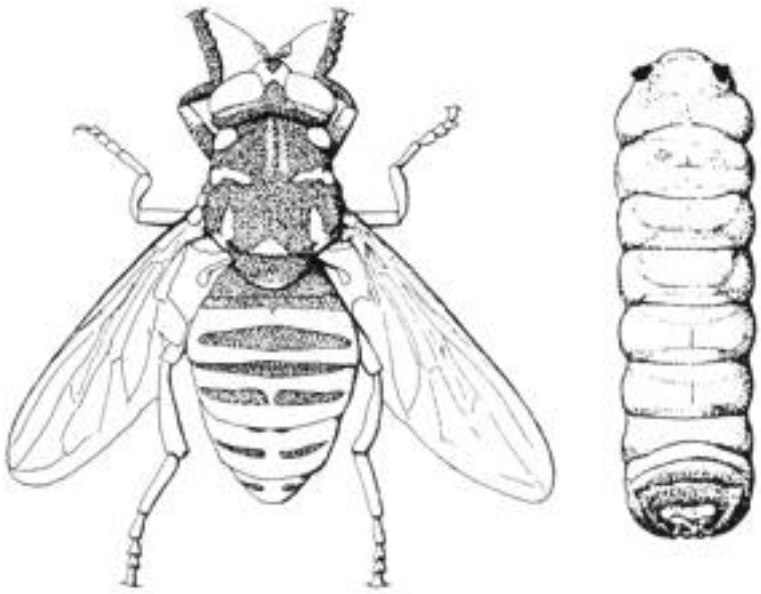
SPECIES ACCOUNTS OF EUROPEAN SYRPHIDAE, 2024

M. C. D. Speight



SYRPH THE NET: THE DATABASE OF EUROPEAN SYRPHIDAE (DIPTERA)

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SPECIES ACCOUNTS OF EUROPEAN SYRPHIDAE 2024

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Chapter 1: INTRODUCTION

The general purpose behind the StN species accounts is to provide an accompaniment to the StN spreadsheet files, for those who receive the database. Here the accounts included in the 2020 version of the StN Species Accounts volume have been updated to cover information (from both published and unpublished sources) which has become available subsequently and further species accounts have been added — accounts are now provided for 1000 species (97%) of the known European syrphid fauna).

Precisely how many syrphid species have been recorded in Europe remains uncertain, because of the doubtful status of a significant number of them. The species listed in the StN spreadsheets comprise a Checklist of European and Turkish Syrphidae. But that Checklist should be regarded as a list of the species names currently in use for European Syrphidae, rather than as a list of valid species. At the time of writing (August, 2024) the coding of taxonomic status (see Range and Status section of spreadsheets) of each of the 1031 nominal species in the Checklist groups them (category definitions provided in the Content and Glossary file) as follows:

taxonomically stable and recognisable: 854
taxonomically unstable: 131
taxonomic status uncertain: 39

A copy of the licence agreement, required to be completed for receipt of the current set of database spreadsheets, is provided at the end of this volume, as Appendix 2.

The species accounts contain a mélange of published and unpublished information. The published component brings together material from widely scattered sources, but some of those sources are themselves compendia of relevant data, prominent among which are Barkemeyer (1994, 1997), Bartsch *et al*. (2009a, 2009b), de Buck (1990), Speight and Lucas (1992), Torp (1994) and Vujić (1996). The unpublished component of the accounts is based on the experience of the author and other European syrphid workers. European syrphid workers have been generous in their help. Indeed, the syrphid database is progressively becoming the intellectual offspring of Europe's syrphid specialists. It has not been possible to refer to each collaborator by name at every point that some piece of information they have provided has been incorporated into the accounts, although many pieces of information are referenced in this way as "pers.comm". Collaborators who have contributed to production of the species accounts and to the information content of other database files are as follows: H.Ahnlund, S.Ball, A. Barendregt, A.Barkalov, H.Bartsch, D.Birtele, R. & R.Blackith, R.Bygbjerg, E.Carrières, E.Castella, P.Cerretti, J.Claude, C.Claussen, M. de Courcy Williams, D.Doczkal, C.Dussaix, F.Dziock, M.J. Ebejer, M.Falck, L. Fisler, J. Fleury, H.-J.Flügel, J.Garrigue, P. Goeldlin de Tiefenau, D. Goy, M. de Groot, A. Haarto, M.Hauser, W.Hurkmans, T.Järveläinen, N.Jones, A.Jukes, K.Kassebeer, C.Kehlmaier, S.Kerppola, M.Kotarac, M.Krivosheina, D.Langlois, L.Larrieu, T, Lebard, D. & T.Levy, M.A. Marcos-García, X.Mengual, L. Mielczarek, T.Moertelmaier, Z. Nedeljković, B.Nelson, T.R.Nielsen, C.Palmer, P.M.Pavett, G. Pennards, G. Pétremand, A.Polevoi, G.Popov, M.Reemer, A.Ricarte Sabater, G.Rotheray, S.Saribiyik, J.-P.Sarthou, V. Sarthou, U.Schmid, J.T.Smit, M. Sörensson, J.-H. Stuke, A.Ssymank, B.Tissot, T. Tot, P. Trzciński, C.Vanappelghem, L.–J. van der Ent, V.S. van der Goot, G. van de Weyer, A. van Eck, P.J. van Helsdingen, W. van Steenis, M. van Veen, L.Verlinden, A.Vujić, B. Wakkie, P. Withers.

Information relating to Alpine species has been provided by P. Goeldlin de Tiefenau, T. Moertelmaier and L.Verlinden, in particular. M. A. Marcos-García and A.Vujič have provided a considerable proportion of the information used for Mediterranean species and the data presented for species from northern Europe are heavily dependent on information provided by A. Haarto, H. Bartsch, S. Kerppola and T. R. Nielsen.

1.1. THE SPECIES COVERED AND THEIR NOMENCLATURE

In principle, the species of Syrphidae incorporated into the database are those that can reasonably be regarded as resident in some part of Europe (plus Cyprus and Turkey) covered by the database. One or two of the species covered, for instance *Ischiodon aegyptius* (Wied.) and *I. scutellaris* (Fab.), are possibly not resident, but repeatedly establish temporary populations that may, or may not, survive from one year to the next in Europe. A species almost certainly only recorded from some part of Europe as a consequence of transport by Man, and with no clear evidence of having established itself there, is not covered by the database, if its origin is outside Europe.

In general, the nomenclature used for both species and genera follows Peck (1988), but many changes have been introduced since Peck's account was completed. Changes introduced since Peck's text was completed are mentioned here where relevant, under the species or genera concerned. Vujić *et al.* (2021a) are followed here, in resolving issues relating to names of a number of the syrphid species occurring in Greece, as referred to in Vujić *et al.* (2020d).

Microdon species are included in the database, but are treated here as representatives of a separate family, the Microdontidae, following the species accounts of Syrphidae. The syrphid species not yet covered by the species accounts are nearly all of them taxa whose identity or taxonomic status remains uncertain, the remainder being species that are reasonably well-defined but for which almost no information exists. The taxa covered by this StN Species Accounts volume are listed in the StN spreadsheets in the Range and Status column headed "Species Account compiled".

The nomenclature of European Syrphidae is by no means static. New European syrphid species are continuing to be described each year. Each year also sees the establishment of additional synonymies and various other nomenclatural changes. Nomenclatural acts (in the sense of the International Code of Zoological Nomenclature) are not initiated in the StN Species Accounts volume. But an attempt is made to up-date nomenclature as changes are carried out elsewhere, citing the sources of the changes introduced. In rare cases where a nomenclatural change is not followed, the reasons for maintaining the *status quo* are given. An attempt is also made to explain existing, unresolved nomenclatural issues that have introduced confusion and contradiction to the literature, highlighting the need for their resolution.

1.1.1 Citation of the authorities for the name of a species, when they are a subset of the authors of a multi-author publication in which the species is described

In recent taxonomic literature on European syrphids a trend has developed for sub-sets of the authors of a multi-authored paper to be cited as the authorities for the names of species described in that paper. The original descriptions of more than 30 European syrphid species, published since the year 2000, are affected by this phenomenon. For instance, in the paper on the group of species related to *Merodon nigricornis*, by Vujić, Radenković, Ståhls, Ačanski, Stefanović, Veselić, Andrić and Hayat (2012) the description of *Merodon gallicus* is ascribed to Vujić and Radenković and the description of *M. nigripodus* to Vujić and Hayat. Citation of *Merodon gallicus* as "*Merodon gallicus* Vujić and Radenković, 2012" and *M. nigripodus* as "*Merodon nigripodus* Vujić and Hayat, 2012" is inadequate, since this fails to indicate where the original descriptions of *M. gallicus* and *M. nigripodus* were published – there is no publication "Vujić and Radenković, 2012", or "Vujić and Hayat, 2012". The conventional approach to dealing with this type of issue would be to cite the authority for and date of publication of the original description of *Merodon gallicus* and *M. nigripodus* as follows:

Merodon gallicus Vujić and Radenković, in Vujić, Radenković, Ståhls, Ačanski, Stefanović, Veselić, Andrić and Hayat, 2012
Merodon nigripodus Vujić and Hayat, in Vujić, Radenković, Ståhls, Ačanski, Stefanović, Veselić, Andrić and Hayat, 2012

In cases where a publication cited has more than two authors a modification of this practice has been adopted in the StN Species Accounts, reducing the above citations to:

Merodon gallicus Vujić and Radenković, in Vujić *et al.*, 2012
Merodon nigripodus Vujić and Hayat, in Vujić *et al.*, 2012

1.1.2 Vernacular names

Skevington *et al*. (2019) have created what they refer to as "common names" for N American syrphids, employing an anglicised quasi-bionomial system, in which the last word of the created name is the same for all the species of a genus. Thus all *Sphaerophoria* species become "globetails" and all *Neocnemodon* become "spikelegs". In Bot and Van de Meutter (2023), the same approach has been adopted, copying many of the names created for genera by Skevington *et al*. (2019), and using English words to construct English-sounding names for species of the syrphid fauna of much of western Europe. Bot and Van de Meutter (2023) also refer to their created names as "common names", although these constructs have been unknown in Europe previously and are not the result of some consensus reached between the authors and potential user groups. The universally available on-line dictionary Wiktionary states that "the common name of a taxon or organism (also known as a vernacular name, English name, colloquial name, country name, popular name, or farmer's name) is a name that is based on the normal language of everyday life". Examples of the created "common names" published in Bot and Van de Meutter (2023), are as follows:

peg-footed roundface, spindly haireye, Olga's smoothtail, red-horned puff-tail, white-bowed smoothwing, stripe-backed brusheye, tubercled flatface, lesser orange-thighed leafwalker, snouted duck fly, hornet plume-horn, four-spotted pithead, greater spotted bristleside, black-ankled stripeback, broad-faced wrinklehead, conifer twinspot sapeater, common batman, crossband dayglower, smudge-winged blacklet, blotch-winged whitebelt, stripe-eyed mucksucker

The reason given in Bot and Van de Meutter (2023), for undertaking the task of constructing English-sounding names for hundreds of hoverflies is given as follows: "It has probably never been more important that hoverflies become popular amongst a wider audience to raise awareness of these flies, and insects in general, and we know common names do help".

Creating English-sounding names for hoverflies does not magically convert those constructs into common names. Indeed, it is arguable that the constructs offered in Bot & Van de Meutter (2023) are the antithesis of common names. Most of them refer to microscopic anatomical features, denying an essential characteristic of common names based on physical attributes, which is that they refer to something visible to the naked eye, thus aiding in recognition. The sample of these constructed names listed above highlights a basic contradiction ignored by their authors – many syrphids are too small for English-sounding names based on anatomy to be meaningful.

Whether based on morphology or other species traits the constructed names proposed at present also suffer from constraints imposed by their authors' attempt to make them reflect generic groupings, with confusing and misleading results. For instance, in both Skevington *et al*. (2019) and Bot and Van de Meutter (2023), *Platycheirus* species are all referred to as sedge-sitters and all *Orthonevra* species become muck-suckers. In consequence *Platycheirus albimanus* is dubbed the grey-spotted sedge sitter, despite the reality that *P. albimanus*, like many other European *Platycheirus* species, has no association with sedges. Introduction of the term muck-suckers in Europe, for *Orthonevra* species, seems to have been based on the term "muck" as used in American English, rather than European English. In common usage, "muck" in European English refers particularly to the combination of bedding materials and faeces accumulated in barns by overwintering livestock – hence the farming terms muck-heap and muck-spreading. European *Orthonevra* species are in no way associated with muck in that interpretation, the larvae of most species being associated with small water-bodies that are not eutrophicated by animal faeces and the adults not being found around muck heaps or where muck has been spread, an example being *O. nobilis*, shown in Figure 1. In N America the term muck is apparently applied more generally, to include water-sodden soils. In European English the term "muck-sucker" would not only be inaccurate to denote *Orthonevra* species. It could also quite reasonably be perceived as vulgar and pejorative.

Except when "force-fed" them, under the guise they are somehow official, who might use the essentially artificial, English-sounding names created in Bot & Van de Meutter (2023)? From discussion with anglophone "citizen scientists" it is the opinion of the present author that they neither need nor want to refer to syrphids, using English-sounding names perceived as linguistically inept, ugly, cumbersome or just silly. But if more acceptable names were available, they might be adopted. In what way are the existing English-sounding names an improvement over the pre-existing scientific names? The scientific names for European syrphids are open to use by anyone, not just specialists, throughout the continent, and already provide a mechanism for communicating information about the same species in the literature of different languages. Use of names constructed in a multiplicity of European languages, for referring to the same syrphid species, can only be expected to create

barriers to communication, not make information more accessible. *Myathropa florea* could now be referred to as Doodskopzweefvlieg (Reemer *et al*., 2009); Dödskallefluga (Bartsch *et al*., 2009b), Mesisurri (Haarto & Kerppola, 2007a), dødningehodeblomsterfluer (Nielsen & Gammelmo, 2017) and Common batman (Bot & Van de Meutter, 2023).

The fact that the Bot & Van de Meutter (2023) initiative introduces English-sounding names not only for British syrphid species, but also for European syrphid species which do not occur in English-speaking parts of the continent, implies that the authors recognise some general need for "official" English names for European syrphid species. The discord and confusion caused by attempts to introduce to different parts of the world vernacular names coined in a language other than the language used locally, are detailed by Jiminéz-Majías *et al*. (2024). They argue forcefully against such initiatives. And if some need for official English language names for European syrphids is identified, which over-rides all other logic, it would be preferable that the names be compiled by consultation between specialists, linguists and potential end-user groups, and adopted by consensus, rather than created by specialists acting alone. It is to be hoped that the product would then also be more fit for purpose. The constructed, English-sounding names for syrphids published in Bot and Van de Meutter (2023) are not used in the StN database, by decision of the StN editors.

Figure 1: The "Atlantic muck-sucker" sensu Bot & Van de Meutter (2023), a.k.a. *Orthonevra nobilis*, ♀

1.2. SPECIES ACCOUNT SUBHEADINGS

The information provided in each species account is partitioned under a series of subheadings. In cases where there is no information available for a species under some particular subheading, this is indicated by the phrase "no data". Some of the species accounts are minimal in their information content. But it has seemed more useful to include species where possible, rather than to leave them out. The basic criterion used to decide whether to code a species in the spreadsheets is whether or no a clear statement can be made concerning its "preferred environment". The subheadings used are as follows:

1.2.1 Preferred environment: an overview of the species' ecological amplitude, which covers much the same material as is presented in coded form in the Macrohabitats file.

1.2.2 Adult habitat and habits: where the adult insect may be found, when, and what it can be expected to be found doing there, for those who might wish to find it.

Flowers visited: a digest of the flower-visiting data available for syrphids known to visit a wide range of flowers (see de Buck, 1960; Nilsson et al, 2012; Ssymank, 2001, for more extended lists of flowers visited by various syrphid species) or all available information for syrphids known to visit the flowers of only a few plants and for syrphids whose flower-visiting habits are poorly known. This section also covers other pollen-gathering activity e.g. collection of pollen accumulated on leaf surfaces by *Xylota* species. Sap-run visiting is referred to under adult habits. Time of day of flower-visiting activities is alluded to under "Adult habitats and habits".

Flight period: an overview of flight period data, with indications on how this varies from one part of the European range to another. This information is presented with greater precision in coded form, for certain parts of Europe, in the Traits spreadsheet.

Developmental stages: the principle published sources of information on the larval and puparial morphology and biology/microhabitat of the species are given, together with a précis of whatever other data, published and unpublished, are available. Larval feeding methods are not mentioned. Comprehensive information on aphid species predated by aphidiphagous syrphid larvae is not provided. A review of the data available on that topic is given by Rojo et al (2003). Keys to determination of larvae are referred to where relevant. Publications providing illustrations of the larva are also cited. Where information is available about the egg of a species, it is also referred to in this section. Diapause/delayed development of the immature stages is referred to for some species, but there is insufficient information on this phenomenon for most European species and it is not coded in the Traits spreadsheet. It is nonetheless potentially an important survival stratagem for many syrphids. Research aimed at obtaining more comprehensive data on which species employ diapause/delayed development, when and for how long it may endure, can be regarded as a priority, in efforts to better understand syrphid life histories. Rotheray and Gilbert (2011) provide instructive overviews of both this topic and larval feeding. The most comprehensive key to the identification of the larvae of European syrphid genera is that of Rotheray and Gilbert (1999), which, despite its title, covers only European genera. An alternative key, to the larvae of genera of European Syrphinae, is provided by Laska *et al*. (2013).

Range: an overview of the geographic range of the species, with greater detail provided for range within Europe. But all the European countries from which a species is known are not listed in its species account, other than in exceptional circumstances e.g. species known from only very few countries, or species for which most existing, published range data are of uncertain value, due to change in the status of the species. Precise listings of all the European countries from which published records of a species are available are provided in the Range and Status spreadsheet. If the species is a known migrant, this is also referred to in the "Range" section of its species account. Some syrphids are highly migratory and can regularly reach offshore islands. Fully one third of the recorded Faroese syrphid fauna is made up of almost-certainly non-resident species (Jensen, 2001).

Determination: keys which may be used for identification of the species are referred for English, French and German language users, citing, where possible, keys which provide pan-European coverage of the species. Keys which cover the widest range of species and which may be used reliably are always cited in preference to those dealing only with local faunas. On occasion, hints are provided on separation of closely similar species, either by comparison of distinguishing features or by provision of short keys. Sources providing published figures of the male terminalia of the species are cited. Publications in which coloured photos are used to illustrate features used in identification keys are now frequent. The abundant illustrations, accompanying the open access key to European syrphid genera provided by Sarthou *et al*. (2023), are nearly all photographic images, obtained by image-stacking technology. A notable example focussed on the British syrphid fauna is Ball and Morris (2013). More comprehensive examples are the regional identification guides of Bot and van de Meutter (2019, 2023), which

contain a wealth of more formal illustration of both morphological features and entire insects. Such literature is mentioned where apposite. This section also refers to nomenclatural change or controversy, which may have affected the species recently, and, in particular, to changes, which have been introduced since Peck (1988). In some instances, reference is made to application of the International Code of Zoological Nomenclature (ICZN). The most recent version of ICZN may now be accessed directly at: http://www.iczn.org/iczn/index.jsp. In reference to morphological features used in determination, simple terms are used when possible. The complex terminology advocated for referring to syrphid morphological features by Van Steenis *et al*. (2023a), is not applied in the StN files.

In the Range and Status spreadsheet the taxonomic status of each species is coded, to indicate which can be regarded as reliably identifiable, and which are of doubtful status. Assessment of the degree to which a species can be reliably identified is based here on the availability of information on diagnostic morphological distinctions, accessible in identification keys which can be employed using a binocular microscope. The increasing availability of genetic data characterising species is not addressed in that assessment. Species only separable genetically are here regarded as unidentifiable for practical purposes. Similarly, procedures for analysis of complex morphometric data (e.g. Ačanski *et al*. 2023), however valuable in the resolution of taxonomic issues, are not tools available for everyday use in syrphid identification. It may well be that use of artificial intelligence to name species from photographic images, based on both morphology and novel techniques, like recognition of species-specific light interference spectra generated by the wings of flying syrphids, and related technologies (Li *et al*., 2023), will in future augment, if not replace, existing taxonomic literature. But that has not yet happened. On-line, multiple entry identification keys are now beginning to appear, using morphological features already employed in existing literature. As such they are susceptible to the same limitations found in the keys in the literature – including linguistic problems in the accuracy of description of morphological features. But, being on-line, theoretically at least they are more easily revised and updated. Even if existing examples are perhaps still to a significant extent experimental, they already represent promising tools in the kit-bag for identification of European syrphids.

Illustrations of the adult insect: sources of coloured illustrations of the entire insect are cited here. The advent of digital photography and the ease with which it can be employed to make coloured "portraits" of small organisms like insects, has led to a dramatic increase in the availability of images of syrphids on open-access websites, where the costs inherent in producing printed publications are non-existent. But many of these images are of syrphids photographed in the field, and not subsequently collected to verify determination. Internet syrphid photo galleries maintained by specialists are, in consequence, more reliable as sources of images of correctly-identified species. For European species the website http://cyrille.dussaix.pagesperso-orange.fr/ can be mentioned. Syrphid species occurring in Britain and Ireland are specifically dealt with at: http://www.flickr.com/photos/63075200@N07/collections/72157629600153789/. The availability of a figure of a species on one or other of these two websites is only mentioned in the following species accounts for species for which the website figure is the only one known. Many species figured elsewhere are also figured on these websites. Example species of nearly all the European syrphid genera are photographed, in colour, in the current issue of the StN Syrphid Portraits volume. Recent, printed regional monographs, like Bot and Van de Meutter (2019, 2023) and Pétremand *et al*. (2022) also demonstrate the advances achieved via the digital photography revolution, and contain an abundance of high resolution, focus-stacked images of European syrphid species.

Readers with additional information (published or personal observation) about any of the species covered are invited to send it to the author at: speightm@gmail.com. The species accounts contain much observational information very difficult to publish elsewhere, and one reason for their compilation has been to try to ensure such information is not lost.

Chapter 2: SPECIES ACCOUNTS, SYRPHIDAE

Here (as in the spreadsheets), the genera and species are treated in alphabetic order. The species accounts pertaining to each genus are preceded by brief notes on the representation of that genus in Europe and the degree of reliability of existing literature for identification of the European species. Papers cited in the species accounts are listed in the bibliography at the end of this volume.

Alphabetic order is used here to present the genera and species because it is universally understandable. The phylogenetic arrangements favoured traditionally require a knowledge of which genera are supposedly most closely related to each other, that most potential users neither have nor require. Further, concepts of the phylogenetic inter-relationships of syrphid genera are extremely volatile, leaving little confidence that they are as yet very meaningful. The number of sub-families, tribes etc that are recognised changes with almost every publication that is produced on the subject. Here, *Microdon* and its allies are not treated as syrphids, but as representatives of a separate family, the Microdontidae. This vision of the relation between microdontids and syrphids was briefly in vogue but has now fallen into disuse, though it unclear why. In general, *Microdon* and its allies appear in recent phylogenetic literature as the most distantly related group among the taxa usually consigned to Syrphidae, as in Reemer and Ståhls (2013) and Pauli *et al.*(2018). But at present it is difficult to take into account features of the developmental stages, due to inadequate information. Hippa and Ståhls (2005), whose synthesis does not take the developmental stages into consideration either, suggest that *Neoascia* and *Sphegina* are more distantly related to syrphids than is *Microdon*, which is a novel proposition. Their account also includes a bibliography of recent papers dealing with syrphid phylogenetic inter-relationships.

ANASIMYIA

The European species of *Anasimyia* were revised by Claussen & Torp (1980). They consign four European species to the genus. More recently a fifth European species, *A. femorata* was described by Simić (1987). *Eurimyia lineata* has frequently been placed in *Anasimyia* in recent literatue, but Skevington et al.(2019) provide a genetic basis for consigning it to its own genus. Various authors, e.g. Peck (1988), van der Goot (1981), have treated *Anasimyia* as a subgenus of *Helophilus*. Some include these species in *Lejops*.

Anasimyia contracta Claussen & Torp, 1980
Preferred environment: wetland/open ground; ponds and ditches with *Typha*, especially in fen. **Adult habitat and habits:** rarely more than a few metres from margins of ponds, where they fly low over the water and settle in the sun, usually on foliage of large-leaved emergent vegetation, such as *Menyanthes*; they also fly in and out of stands of sedges and reeds, making their movements very difficult to follow. **Flowers visited:** white umbellifers; *Myosotis, Potentilla erecta, P.palustris, Ranunculus, Sorbus aucuparia*. **Flight period:** May/June & August/September. **Developmental stages:** larva undescribed, but can be found among debris of dead *Typha* stalks beneath the water surface. **Range:** from Scandinavia southwards to the Mediterranean basin and from Ireland eastwards through central Europe to European parts of Russia and Georgia. **Determination:** Bartsch *et al.* (2009b); Claussen & Torp (1980); Speight (1981b), van der Goot (1981), Verlinden (1994). See Key provided in StN Keys volume. The male terminalia are figured in Claussen & Torp (1980), Torp (1984) and van der Goot (1981). **Illustrations of the adult insect:** The adult insect is figured in colour in Bartsch *et al*. (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Anasimyia femorata Simić, 1987
Preferred environment: wetland; shallow pools with emergent *Nuphar* and *Nymphaea*, in lake-edge marsh (Van Steenis *et al*. 2015). **Adult habitat and habits:** "resting on top of or underneath leaves, mostly 0-25 cm above the water surface, or flying fast within the vegetation" (Van Steenis *et al*, 2015). **Flowers visited:** *Nuphar lutea* (Van Steenis *et al*, 2015). **Flight period:** June/July. **Developmental stages:** not described. **Range:** known only from the type locality in Montenegro. This species should be regarded as threatened at the European level (Vujić *et al*. 2001). **Determination:** See Key provided in StN Keys volume. Simić (1987) describes both sexes of the species and figures the male terminalia. Van Steenis *et al.* (2015) discuss separation of *A. femorata* from *A. transfuga*, the two species being well-nigh identical in general appearance. They indicate that the male of *A. femorata* may be distinguished by the "orange tinge" on tergites 2 – 4, which is absent in *A.*

transfuga. They also point out that the abdominal sternites are more variable in colour than previously indicated, and cannot be used to separate these two species. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided by Vujić *et al.* (2020d).

Anasimyia interpuncta (Harris), 1776
Preferred environment: wetland/open ground; at the edge of, or among the emergent vegetation cover of, standing/slow-moving water in fen, marsh and river floodplains, where it occurs in association with weter-filled ditches, dead arms and ox-bows in floodplain grassland; exhibits an association with beds of *Glyceria maxima* (Ball *et al*, 2011). **Adult habitat and habits:** flies among waterside vegetation or emergent hydrophytes e.g. *Phragmites*. **Flowers visited:** white umbellifers; *Caltha, Euphorbia, Prunus padus, Ranunculus, Salix, Sorbus aucuparia*. **Flight period:** April/May, July. **Developmental stages:** not described. **Range:** Fennoscandia south to northern France; Britain eastwards through central Europe into European parts of Russia. **Determination:** Bartsch *et al.* (2009b); Verlinden (1994). See Key provided in StN Keys volume. The male terminalia are figured in Claussen & Torp (1980), Speight (1981), Torp (1984) and van der Goot (1981). **Illustrations of the adult insect:** the adult insect is figured in colour in Bartsch *et al.* (2009b), Stubbs and Falk (1983) and Torp (1994).

Anasimyia lunulata (Meigen), 1822
Preferred environment: wetland; margins of dystrophic lakes, ponds and pools with amphibious vegetation, e.g. *Menyanthes*, usually in valley bogs and transition mires; taiga wetlands. **Adult habitat and habits:** flies low among vegetation in the immediate vicinity of standing water or out over the water surface among floating vegetation; rarely found more than a few metres from the water's edge; often settles on leaves protruding from the water, such as those of *Menyanthes*, with which this fly is often found; can be abundant on cut-over bogs where the vegetation is now regenerating. **Flowers visited:** white umbels, *Caltha, Menyanthes, Ranunculus*. **Flight period:** mid May/end August, with most records from June/July. **Developmental stages:** the larva requires redescription - Hartley's (1961) account may refer to the larva of *A.interpuncta*, or may be based on both *A.interpuncta* and *A.lunulata*. **Range:** Scandinavia south to north-eastern France (Jura massif); Ireland and Britain; European Russia; range elsewhere requires reconfirmation, due to confusion with *A.interpuncta*. **Determination:** Bartsch et al.(2009b); Verlinden (1994). See Key provided in StN Keys volume. The male terminalia are figured in Claussen & Torp (1980), Speight (1981b), Torp (1984) and van der Goot (1981). **Illustrations of the adult insect:** the adult insect is figured in colour in Bartsch et al.(2009b), Torp (1984, 1994) and van der Goot (1986).

Anasimyia transfuga (L.), 1758
Preferred environment: wetland; margins of mesotrophic pools and lakes with *Scirpus* or *Sparganium*. **Adult habitat and habits:** flies among water-margin vegetation, settling on emergent stems etc., often where the water is up to 1m. deep. **Flowers visited:** white umbellifers, *Caltha palustris, Ranunculus repens, Sonchus arvensis, Sorbus aucuparia, Taraxacum*. **Flight period:** early May/July, with some records into August. **Developmental stages:** it is not known whether the larva ascribed to this species by Hartley (1961) is that of *A. transfuga* or *A.contracta*. **Range:** Southern Sweden south to northern France; Ireland east through mountainous parts of central and southern Europe (the former Yugoslavia, Roumania) into Russia as far as southern parts of central Siberia (Tuva). **Determination:** extremely similar to *A.contracta*, with which it has been confused until recently. These two species may be found on the wing together. See Key provided in StN Keys volume. *A.transfuga* can be distinguished by means of the keys in Bartsch et al.(2009b), Claussen and Torp (1980), Speight (1981), van der Goot (1981b) and Verlinden (1994). The male terminalia are figured in Claussen & Torp (1980), Torp (1984) and van der Goot (1981). **Illustrations of the adult insect:** the adult insect is figured in colour in Bartsch et al.(2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

ARCTOPHILA: see under *Sericomyia*

ARCTOSYRPHUS
This genus has also been regarded as a subgenus of *Lejops*. Its only known species is Holarctic in distribution.

Arctosyrphus willingii (Smith), 1912
Preferred environment: tundra; beside shallow, freshwater pools enriched with organic material and in swampy ground with hummocks (Bagachanova, 1990). **Adult habitat and habits:** no data. **Flowers visited:** *Taraxacum* (Skevington *et al*, 2019). **Flight period:** May/July. **Developmental stages:** the larva is described by Bagachanova (1990), who observed that *A.willingii* oviposits into the ground among grass roots and established that larval development occurs in the spring, in shallow water enriched with organic material and in swamp hummocks. Pupariation occurs under natural conditions in May/June, the species remaining in the puparium for 9-10 days. **Range:** northern parts of European Russia (Arkhangel region and Kola peninsula) and through Siberia to the Pacific; in the Nearctic region through northern Canada and south into the US, in N Dakota. **Determination:** Violovitsh (1986). See StN Keys to genera. This species closely resembles *Helophilus*, but its abdominal tergites are entirely black. **Illustrations of the adult insect:** the male is illustrated in colour by Skevington *et al*. (2019).

ASARKINA

The species of this genus occur almost exclusively in the Afrotropical, Australasian and Oriental Regions, with one or two species also in the Oceanian. One species, *Asarkina fiorii* Bezzi, is still cited as European by various authors such as Peck (1988) and Thompson and Rotheray (1988), on the basis that the female type material is labelled as originating in Italy and cited as such in the original description (Bezzi, 1903). However, Dirickx (1998) points out that this species apparently occurs only in Africa south of the Sahara and that Bezzi (1915) himself subsequently described the male from the Transvaal, in South Africa. Dirickx (1998) goes on to dispute the origin of the type material, stating that it must have been mislabelled. Certainly, there are no records of *A.fiorii* from Italy, other than the type material, and the species is not included in recent Italian species lists of Syrphidae (e.g. Daccordi, 1995; Daccordi and Sommaggio, 2002). Similarly, there have been no citations of the occurrence of any *Asarkina* species from elsewhere in Europe. Without verification of the occurrence of *A.fiorii* in Europe, in the form of material additional to the female type, it seems unjustified to regard either *A.fiorii* or the genus *Asarkina* as European insects and more reasonable to conclude that the original citation of *A.fiorii* from Europe was based on human error, i.e. a mislabelled specimen, as Dirickx (1998) suggests. Here it is assumed that *A.fiorii* was cited from Europe in error. *Asarkina* can be recognised using the keys provided by Thompson and Rotheray (1998). See also the generic Key provided in the StN Keys volume.

BACCHA

Only two European species are recognised in this genus in recent literatureand one of them, *B.obscuripennis* Meigen, is generally regarded as a synonym of the other, *B.elongata* (Fab.). Peck (1988) refers to a third European species, *B.strandi* Duda., which has since been shown to be a species of *Melanostoma* (Doczkal, 1998b). Accounts like that of van der Goot (1981) include keys, which supposedly make it possible to distinguish between *B.elongata* and *B.obscuripennis*, but they are not very convincing.

Baccha elongata (Fabricius), 1775
Preferred environment: forest, both coniferous and deciduous, both young and old; also in scrub woodland, hedgerows and suburban gardens. **Adult habitat and habits:** flies within woodland, usually within 1 - 3 metres of the ground and as much in the shade as in the sun; seldom ventures far into open areas. **Flowers visited:** Compositae, Rosaceae and Umbelliferae, *Hedera* etc. **Flight period:** April/June and July/September or October. **Developmental stages:** eggs described and figured by Chandler (1968); larva and puparium described and figured by Dusek & Laska (1960b) and Goeldlin (1974) and larva figured in colour and differentiated from other related genera in the keys provided by Rotheray (1994); aphid- feeding, on tall herbs, e.g. thistles (*Cirsium*), bushes and trees. Dussaix (2005a) reared the species from larvae found on *Aquilegia, Digitalis, Euphorbia, Hieracium, Hypochaeris, Sambucus nigra* and *Sonchus*. Dussaix (2013) provides coloured photos of the last instar larva and the puparium. The puparial phase lasts approximately 10 days in this species and the larva overwinters (Dussaix, 2013). **Range:** Scandinavia to the Mediterranean; central Spain eastwards to Greece and Ireland eastwards into European parts of Russia and Georgia. This species is also known from the Azores (Rojo *et al*., 1997). **Determination:** van Veen (2004). The male terminalia are figured by Dusek and Laska (1967). There has been considerable uncertainty as to the status of *B.obscuripennis* (Meigen), which is now usually regarded as a junior synonym of *B.elongata*. Features used for

separation of the males of *B.obscuripennis* from those of *B.elongata* are of doubtful value and there are no features (van der Goot, 1982) for separating the females. Here, the case for recognition of *B.obscuripennis* as a separate species is regarded as unproven and it is regarded as a synonym of *B.elongata*. Ssymank and Doczkal (2017) figure an extremely dark-brown winged *Baccha* specimen, to which they apply the name *B.obscuripennis*, stating that this specimen differs from *B. elongata* in features which suggest it is a different species. It is not clear why the name *B. obscuripennis* is used for this specimen however. Ssymank and Doczkal (2017) make no reference to either Meigen's description of *B. obscuripennis*, or to examination of type material, and Meigen's coloured plates of his Diptera, published by Morge (1975) show the wing of *Baccha obscuripennis* as very lightly tinted brown, not almost black as in the specimen photographed by Ssymank and Doczkal (2017). It would be very helpful if a revision of European *Baccha* were undertaken, including re-examination of type material and genetic characterisation of *B. elongata*, to clarify the taxonomic status of specimens like the one illustrated by Ssymank and Doczkal (2017). **Illustrations of the adult insect:** the adult fly is figured in colour by Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986), Kormann (1988) and Pétremand *et al.* (2022).

Baccha obscuripennis Meigen - see under *B.elongata* (Fabricius).

BLERA

Three European species are known in this genus. One of them, *B.fallax* (L.) is treated in most regional accounts. A second, *B.nitens* (Stackelberg), reaches Europe in parts of Russia (Sverdlovsk). The third, *B.eoa* (Stackelberg), was added to the European list by Peterrsson and Bartsch (2001), on the basis of a recent record from Sweden. *Blera eoa* and *B. fallax* are included in Van Veen (2010). All three species are keyed out by Violovitsh (1986) and in the StN Keys to Species volume.

Blera eoa (Stackelberg), 1928
Preferred environment: forest; humid pine forest (*Pinus sylvestris*) (Peterrsson and Bartsch, 2001) with overmature trees; taiga. **Adult habitat and habits:** the male has been collected from resting on the trunk of an old, living *Salix caprea* (Kerppola and Raekunnas, 2012). **Flowers visited:** *Rhododendron aureum* (Gritskevich, 1998); *Rosa acicularis, Potentilla fragarioides, Acer tataricum* (Bartsch et al.(2009b). **Flight period:** June/July. **Developmental stages:** not described. **Range:** northern Sweden; northern Finland; eastern Siberia to the Pacific (Sakhalin). **Determination:** See Key provided in StN Keys volume. In this species the abdominal tergites are entirely black, and the wing veins are yellow toward the wing-base. The male terminalia are figured by Barkalov and Mutin (1991). **Illustrations of the adult insect:** the male is figured in colour by Kerppola and Raekunnas (2012).

Blera fallax (L.), 1758
Preferred environment: humid, ancient coniferous forest containing over-mature and dead trees; found in association with *Picea* or *Pinus*, up to, and including, subalpine *P.uncinata* forest. **Adult habitat and habits**: rests in the sun on the cut ends of the stumps of conifers and on the ground adjacent to felled or fallen trees. Males fly fast and low through the vegetation of forest clearings, particularly in the vicinity of clumps of plants such as *Rubus idaeus* in flower. **Flowers visited**: *Berberis, Parnassia, Prunus, Rosa canina, Rubus idaeus, Valeriana*. **Flight period**: May/July. **Developmental stages:** larva and puparium described and figured by Rotheray and Stuke (1998) from material found in wet, heart-rot trunk cavities in cut stumps of *Pinus sylvestris*. These cavities can evidently persist in stumps for a number of years, in a condition usable by this species (Rotheray and MacGowan, 2000). Rotheray (2013) observed that as water in a rot-hole reaches a temperature at which it freezes, the larva of *B.fallax* emerges from the water and remains on the side of the rot-hole. or on the water surface. Rotheray (2013) also presents evidence that resource partitioning between larvae of *B.fallax, Callicera rufa, Myathropa florea* and *Sphegina clunipes* reduces the likelyhood of competition between them, when they occur in the same rot-hole. Under favourable conditions, Rotheray (2013) found that larvae can complete development within one year, reaching maturity by the onset of winter and then leaving the rot-hole, apparently passing the winter in diapause, to pupate the following spring. Maximum rates of development were found when pine sawdust was added to rot-hole content. This would imply that, under natural conditions, water-filled tree-holes into which comminuted wood fragements are raining down from above, e.g. as a consequence of the activities of the larvae of saproxylic Coleoptera, would provide better conditions for *B.fallax* larvae than rot-holes in stumps remaining from tree-felling activities. Rotheray et al.(2016) show that food resource availability within the tree holes is limiting to larval growth, but that, even when food supply is not limiting, approximately 20% of larvae take 2

years to develop. Larvae of two North American *Blera* species are described and figured by Greene (1923), who also found them (in frass) in rotting stumps. The larva of *B.fallax* has also been found in a water-filled tree-hole by Dusek and Laska (1961). Occurrence of B.*fallax* in *Picea* forest from which *Pinus* is absent, in central Europe, indicates that this syrphid can develop in rot-holes in *Picea*, as well as hol-holes in *Pinus*. **Range**: central and southerm Norway to the Pyrenees and Scotland eastwards through central Europe and Siberia to the Pacific coast (Sakhalin and Japan). The relative biogeographic isolation of the relict population of *B. fallax* in Scotland is apparently reflected in its lower levels of genetic diversity**, as** compared with Scandinavian *B. fallax* (Rotheray et al, 2012). **Determination**: See Key provided in StN Keys volume. The male terminalia are illustrated by Hippa (1978), Barkalov and Mutin (1991) and Violovitsh (1986). **Illustrations of the adult insect:** the adult insect is figured in colour by Bartsch et al.(2009b), Stubbs & Falk (1983), Torp (1984, 1994), van der Goot (1986) and Kormann (1988).

Blera nitens (Stackelberg), 1923
Preferred environment: *Pinus sibiricus* taiga (A. Barkalov, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Rubus sachalinensis* (Barkalov and Mutin, 1991); white umbellifers, *Rosa* (A. Barkalov, pers.comm.).. **Flight period:** July/August (A. Barkalov, pers. comm.). **Developmental stages:** not described. **Range:** parts of European Russia and eastwards through Siberia to the Pacific; Korea. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Barkalov and Mutin (1991). **Illustrations of the adult insect:** none known.

BRACHYOPA

The European species of *Brachyopa* were revised by Thompson (1980), including a key to the adults. Thompson and Torp (1982) subsequently added a further species (*B.obscura*), and Doczkal and Dziock (2004) another two. Since then, Haarto and Kerppola (2009) have added *B. zhelochovtsevi* to the European list and van Steenis and van Steenis (2014) added the North African species *B. atlantea* and the near Eastern *B. quadrimaculosa*, at the same time describing two further European species, *B. cruriscutum* and *B. vernalis*. Pérez-Bañón et al.(2016) described a further species, *B. minima*, bringing the European total to 22 species. The two European species of the closely related genus *Hammerschmidtia* perhaps belong here also.

Brachyopa atlantea Kassebeer, 2000
Preferred environment: no data. **Adult habitat and habits:** Van Steenis *et al*. (2020b) indicate that the only European record of this species was probably from *Quercus ilex/Q. pyrenaica* forest. **Flowers visited:** no data. **Flight period:** March/April. **Developmental stages:** described and figured by Kassebeer (2000), from larvae found in a sap-run on *Populus*. This species apparently has a larval diapause of some 10 months. **Range:** southern Spain (Grenada) and North Africa (Morocco). **Determination:** both sexes of this species are described by Kassebeer (2000), who also figures the male terminalia and compares the species to the rather similar *B. quadrimaculosa*. This is one of a small group of Mediterranean/North African species in which the mesoscutum has three or more pairs of black, shining spots. It is included in the Keys provided in the StN Keys volume and Van Steenis *et al*. (2020b). **Illustrations of the adult insect:** the general appearance of the female can be seen in the coloured photo in Van Steenis *et al*. (2020b).

Brachyopa bicolor (Fallen), 1817
Preferred environment: mature/overmature deciduous forest; *Fagus/Quercus* forest; alluvial hardwood forest; *Ulmus* forest; *Castanea* forest. **Adult habitat and habits**: largely arboreal, but occurs at sap runs on trunks of over-mature and senile *Acer pseudoplatanus*, *Fagus* and *Quercus*, when in the sun (usually around mid-day), zig-zagging down the trunk from high in the tree; males hover close to sap runs and can be found on adjacent foliage; sometimes to be found in dappled sunlight on foliage along small streams in deciduous forest. **Flowers visited:** *Acer* spp., *Crataegus*, *Valeriana* (Van Steenis *et al*. 2020b); *Photinia, Prunus spp.*. **Flight period:** beginning April/beginning July. **Developmental stages:** larva described and figured by Rotheray (1991), Krivosheina (2005) and Pérez-Bañón *et al*. (2016) and figured in colour by Rotheray (1994), from larvae collected from sap runs on the trunks of *Fagus* and *Quercus*. A coloured photo of the puparium is provided by Dussaix (2013). Krivosheina (2005) found the larvae in sap runs on *Ulmus* and *Abies*. The larvae were also recorded from *Populus alba* attacked by *Cossus cossus*, by Torp (1984) and from sap runs on *Aesculus*. Van Steenis *et al*. (2020b) mention an association between *B. bicolor* and the workings of *Hylecoetus* larvae. Nielsen (2005) reports that this species has been

hatched (together with *B.obscura*) from the "bark of a pear (*Pyrus*) tree". Dussaix (2005a) notes that the sap runs on *Populus* from which he reared *B.bicolor* were apparently caused by the bark-damaging activities of deer. This species may also be associated with *Castanea* (Ricarte *et al*, 2014). In addition, Van Steenis *et al*. (2020b) mention *Platanus* and *Salix* as trees on which the larvae of *B. bicolor* have been found. The larva overwinters in this species, with puparial formation occurring February to May and duration of the puparial phase is 3.5 weeks (Dussaix, 2013). **Range:** Sweden and Finland south to southern France; Britain (southern England) east through central Europe (and the former Yugoslavia) into Turkey and European parts of Russia, and on through Siberia to the Pacific. Ricarte *et al*.(2006) show that published citations of this species from Spain were based on misdeterminations. **Determination:** See Key provided in StN Keys volume; Thompson (1980). Van Steenis *et al*. (2020b). The male terminalia are figured by Pellmann (1998). The colour of the scutellum is somewhat variable in this species, from mid-brown to almost black. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*.(2009b) and Torp (1994), and in the StN Syrphid Portraits volume.

Brachyopa bimaculosa Doczkal & Dziock, 2004
Preferred environment: forest; coniferous forest of *Abies* (*A. alba* and *A. cephalonica*) and *Pinus nigra* (Vujić *et al*, 2020b); riparian *Alnus/Acer/Salix* forest, within mixed, humid *Abies/Fagus* forest (Van Steenis *et al*. 2020b). **Adult habitat and habits:** no data. **Flowers visited:** *Aegopodium* (Van Steenis *et al*, 2013); *Salix aurita* (Doczkal and Dziock, 2004); *Acer*, *Bupleurum*, *Prunus* (Vujić *et al*., 2020b). **Flight period:** March/May. **Developmental stages:** no data. **Range:** southern Germany, Greece, Slovenia. **Determination:** See Key provided in StN Keys volume. *B.bimacolosa* was described (Doczkal & Dziock, 2004) from two females (one from Germany, the other from Greece) that show some intraspecific variability in their features. It is redescribed by van Steenis and van Steenis (2014), who provide a description of the male and figure its terminalia. The material from which *B. bimaculosa* was redescribed by Van Steenis and Van Steenis (l. c.) included specimens from Germany and Greece. They do not state whether the terminalia figures they provide are based on a German or Greek specimen. Van Steenis *et al*. (2020b) suggest the central European (Germany) and Balkan populations at present consigned to *B. bimaculosa* are perhaps different species. *Brachyopa stackelbergi*, described from Tajikistan by Krivosheina (2004b), in the same year as *B. bimaculosa*, seems to be a rather similar species with some components of its male terminalia e.g. the surstyli, nearly identical to those of *B. bimaculosa*. But the profile of the head in side view is very different in the females of these two species. Krivosheina (2005) also described and figured the larvae of *B.stackelbergi*, collected from a sap run on *Populus*. *Brachyopa bimaculosa* is very similar to *B. silviae* (see under *B. silviae*). Assuming the figure of the male terminalia provided by Steenis and van Steenis (2014) is based on a specimen from the German population of *B. bimaculosa*, the terminalia of *B. bimalulosa* can be used to separate that species from males of *B.silviae*. However, differences between females of these two species are slight, and there are complications in interpreting the key features used by Van Steenis *et al*. (2020b) to separate them (see species account for *B. silviae*). At present, the only feature which perhaps reliably separates them is not mentioned by Van Steenis *et al*. (2020b), namely the absence, in *B. bimaculosa*, of a pair of small, black, shiny patches on the anterior part of the mesoscutum, just medial to the humeral calli, these black patches being present in *B. silviae*. **Illustrations of the adult insect:** the general appearance of this species can be seen in the coloured photo included in Vujić *et al*.(2020d).

Brachyopa cinerea Wahlberg, 1844
Preferred environment: forest, mature/overmature boreal *Betula* forest, usually with *Alnus incana* and *Salix*, to its northern limits, and taiga (T. Nielsen, pers. comm.). **Adult habitat and habits**: may be found on foliage of shrubs and low-growing trees, in glades and beside tracks; also visits trees in flower. **Flowers visited:** *Anthriscus sylvestris* (Van Steenis *et al*., 2020b); *Ribes rubrum* (Bartsch *et al*. (2009b), male *Salix*. **Flight period**: May/beginning of July. **Developmental stages:** not described. **Range**: northern and southern Norway, northern Sweden, Finland, through most of Siberia to the Russian Far East; Japan. **Determination**: See Key provided in StN Keys volume; Bartsch *et al*. (2009); Thompson (1980); Van Steenis *et al*. (2020b); Violovitsh (1986). **Illustrations of the adult insect:** the dark colouration of this species is apparent from the photograph of the adult insect provided by Haarto & Kerppola (2007). The male is also illustrated in colour by Bartsch *et al*. (2009b).

Brachyopa cruriscutum van Steenis & van Steenis, 2014
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** no data. **Range:** Turkey. **Determination:** See Key provided in StN Keys volume; Van Steenis *et al*. (2020b); both male and female are described by van Steenis & van Steenis (2014), together with figures of the male terminalia. This species belongs to the group with three or more pairs of black, shining marks on the mesoscutum and has more extensive,

black, undusted, shining parts of the surface of the mesoscutum than the others described to-date. **Illustrations of the adult insect:** the general appearance of this species can be seen from the coloured photo of the male included in Van Steenis *et al*. (2020b)..

Brachyopa dorsata Zetterstedt, 1837
Preferred environment: sub-alpine *Betula* forest; swamp forest of *Betula/Pinus/Salix*; montane *Fagus/Picea* forest and *Fraxinus/Ulmus* at lower altitude. **Adult habitat and habits**: may be found settled on trunks of standing trees in patches of sunlight, in the sun on bare ground within woodland or on low foliage of larger-leaved trees along streams; flies around stumps and logs in semi-shade; on hot days comes to wet mud in the shade to drink. Van Steenis et al. (2020b) mention "damaged conifers" as visited by this species. **Flowers visited**: *Acer platanoides, Caltha, Crataegus, Euphorbia, Geranium sylvaticum, Malus sylvestris, Prunus padus, Rubus chamaemorus, Salix* spp. **Flight period**: end of April to mid-June. **Developmental stages:** larva described and figured by Krivosheina (2005) from larvae collected in the bast of *Betula* trunks (many records), from the tunnels of Lymexylonidae in tunks of *Betula* and *Ulmus* and from *Populus*. This species has also been reared from larvae collected from under the bark of a rotting, fungus-infested *Ulmus glabra* stump and from under bark on stumps of other trees, including *Fagus, Picea* and *Quercus*. Larvae have also been found in tunnels of lymexylonid beetles in wood of *Betula* and *Ulmus* by Bagachanova (1990). Mutin (1998b) reared the species from larvae collected under the bark of *Populus* species, including *P.tremula*. Whether these various rearings all relate to *B. dorsata* seems unlikely. For instance *B. dorsata* is not generally an inhabitant of forest types containing *Populus* species, in contrast to the closely similar *B. panzeri*, so rearings from *Populus* would be expected to involve *B. panzeri*. Carstensen (2022) reports multiple rearings of *Brachyopa panzeri* from sappy *Fagus* stumps in humid *Fagus* forest, the identifications being based on the reared adults. From the same stumps, at the same time, a number of *Brachyopa pilosa* were also reared. But none of the reared specimens proved to be *B. dorsata*. Maybe the rearings of *B. dorsata* from *Fagus* stumps reported in the literature actually refer to *B. pamzeri*? According to Shparyk and Zamoroka (2021) the features used for separation of the larvae of *B. dorsata* and *B. panzeri*, in the key provided by Van Steenis *et al*. (2020b), are of questionable value and diagnostic differences between the larvae of these two species cannot be obtained, until the larva of *B. dorsata* is reliably redescribed. **Range:** Fennoscandia south to the Pyrenees; Belgium and the Netherlands eastwards through much of central and northern Europe into European parts of Russia and on across Siberia to the Pacific. **Determination:** See Key provided in StN Keys volume; Bartsch *et al*. (2009b); Thompson (1980). The male terminalia are figured by Pellmann (1998). The size of the antennal pit can be larger in females of *B.dorsata* than in the males, leading to misdetermination as *B.panzeri*. The black bristles on the posterior margin of the scutellum, in *B. dorsata*, vary in length from very distinctively longer than the general hair covering of the dorsal surface of the scutellum to so short as to be hardly distinguishable by length.In this respect, the statement in the key provided in Van Steenis *et al*. (2020b), that these black, bristly hairs on the posterior scutellar margin are "long" is misleading. In *B. panzeri*, these black bristles are entirely absent. Identity of the male in *B. dorsata* can be confirmed by examination of the male terminalia, which are distinctly different from the terminalia of both *B. panzeri* and *B. vittata*, these differences being shown in Pellmann (1998). The females of *B. dorsata* and *B. panzeri* are extremely similar to each other (see also under *B.panzeri*) and can be difficult to separate. **Illustrations of the adult insect:** Bartsch *et al*.(2009b), Haarto & Kerppola (2007) and Torp (1994) illustrate this species in colour.

Brachyopa grunewaldensis Kassebeer, 2000.
Preferred environment: deciduous forest; alluvial hardwood forest and *Quercus/Carpinus* forest; Mediterranean riparian ash woods and *Quercus pyrenaica* forest (Ricarte *et al*, 2013); along seasonal streams with riparian gallery forest of *Platanus*, in Balkanic thermophilous *Quercus* forest. **Adult habitat and habits:** has been found flying around the trunk of mature *Quercus* and at a sap-run on *Castanea* (Doczkal and Dziock, 2004). Females descend in the evening (17.00 - 18.30hrs), on hot days, to drink in the shade on wet mud of stream edges and even from drying puddles in forest tracks. They descend abruptly, and remain almost motionless once they have landed. **Flowers visited:** *Acer* (Kassebeer, 2000); *Crataegus* (Ricarte *et al*, 2013); *Pyrus spinosa* (M. de C. Williams, pers.comm.); *Sorbus torminalis, Tamarix*. **Flight period:** March/mid June. **Developmental stages:** not described, but *B. grunewaldensis* has been collected from emergence traps over trunk cavities in *Fraxinus angustifolia, Quercus faginea* and *Q. pyrenaica* (Ricarte *et al*., 2013). Sánchez-Galván *et al*. (2014) provide information suggesting that a pre-requisite for development of larvae of *B. grunewaldensis* in a trunk cavity may be the presence there of larvae of saproxylic beetles, exemplified by the Iberian cetoniid *Cetonia aurataeformis*, whose faeces are known to be rich in accessible nutrients (Micó *et al*, 2011); females have also been observed flying round the trunk of large *Quercus cerris* inhabited by the trunk-cavity ant *Liometopum microcephalum*.. **Range:** as yet only known from central and

southern Germany, Portugal, Spain, southern France, Switzerland, Austria, Serbia and northen Greece. **Determination:** See Key provided in StN Keys volume. Doczkal and Dziock (2004) provide a key for distingusihing this species from other European members of the *B.insensilis* group. Kassebeer (2000) figures the male terminalia of *B.grunewaldensis*. For a figure of the male terminalia of *B.insensilis* it is necessary to resort to Pellmann (1998), whose figure is difficult to interpret. Suffice it to say that the surstyli appear to be significantly different in shape in these two species, when examined in side view. **Illustrations of the adult insect:** The black, shining stripe between the eyes, across the head posterior to the vertex in the female of *B.grunewaldensis*, is well-illustrated in the coloured illustration provided by Haenni (2010). A coloured photo of the male is provided by Bot and Van de Meutter (2019).

Brachyopa insensilis Collin, 1939

Preferred environment: both conifer and deciduous forest: over mature *Abies*, *Quercus* and *Fagus* forest with senescent trees. May also occur in association with old trees in suburban parks. **Adult habitat and habits:** primarily arboreal, but descends to visit sap runs on various trees within woodland and the flowers of certain trees; normally only visits sap-runs when they are in the sun, which tends to be only around mid-day; flies up and down trunks of standing, live trees with a characteristic, rapid, zigzag flight, rarely descending below 3m from the ground. It may occur in small swarms, flying around close to the trunk and some metres from the ground, immediately in front of a sap run (T.Gittings, pers.comm.) - in which circumstance verifiying identity of the species requires climbing the tree! **Flowers visited:** white umbellifers; *Photinia*, *Prunus padus*, *Sorbus aria*. **Flight period:** beginning of May/end June. **Developmental stages:** larva described and figured by Rotheray (1991) and figured in colour by Rotheray (1994), Schmid (1996) and Bartsch *et al.* (2009a). The latter authors also provide a coloured photo of the puparium. Larvae occur in sap runs, and less frequently in rot-holes (where internal sap-runs are present?) on the trunks of living deciduous and coniferous trees. The species has been reared from larvae in damp tree-humus in a rot-hole in the trunk of a large, live *Acer pseudoplatanus* (MS), from sap-runs and goat moth (*Cossus*) tunnels in *Quercus*, from behind loose bark, in a pocket of sappy water on the trunk of live *Acer monspecellanus* (MS), from sap-runs on *Aesculus* (Sjuts, 2004), *Alnus glutinosa* (van Steenis *et al*., 2001) and *Abies alba* (Schmid and Grossmann, 1996b; Dussaix, 2005a) and *Fagus* (Krivosheina, 2005). Females have also been found ovipositing on the trunk of old *Populus nigra* (Louboutin *et al*., 2023) and visiting sap runs on *Tilia* (Ball and Morris, 2000); T.Gittings, pers.comm.), which probably also provides appropriate conditions for the larvae. Recent literature suggests that *B.insensilis* is also associated with *Ulmus*. This species overwinters as a larva (Dussaix, 2013). It should be noted that observations on rearings of this species, published prior to 2000, could relate to the larva of *B. grunewaldensis*, which was not described until 2000. **Range:** Denmark south to the Pyrenees and central Spain; Ireland east through central Europe into European parts of Russia and southeast to Tajikistan. **Determination:** See Key provided in StN Keys volume; Van Steenis *et al*. (2020b). Kassebeer (2000) does not figure the male terminalia of *B.insensilis*, referring instead to an illustration provided by Pellmann (1998). The latter figure of the male terminalia of *B.insensilis* is unfortunately rather misleading in certain particulars and could itself lead to misdeterminations. It should be noted that Pellmann (1998) was produced prior to description of *B. grunewaldensis*. Van Steenis *et al*. (2020b) cite genetic data which indicate that Greek populations currently consigned to this species may represent a separate tyaxon. **Illustrations of the adult insect:** the general appearance of the adult of *B.insensilis* is shown, in colour, by Ball and Morris (2013) and Torp (1994). The male is figured in colour by Bartsch *et al.* (2009b).

Brachyopa maculipennis Thompson, 1980

Preferred environment: deciduous forest; alluvial hardwood forest of *Quercus/Ulmus/Fraxinus*; alluvial softwood forest of *Salix alba/Populus alba*; alluvial gallery softwood forest of *Salix alba*; riparian gallery forest of *Populus alba/Alnus glutinosa* (Mielczarek *et al.*, 2019) and L. Mielzarek (*pers. comm*.); along streams in humid *Fagus* forest (A.Vujić, pers.comm.), possibly associated with *Alnus cordata*. **Adult habitat and habits:** sits in the sun on the trunks of trees beside streams (A.Vujić, pers. comm.); visits sap runs on *Populus alba* (P. Trzciński, pers. comm.; Van Steenis *et al*, 2019) and *Salix alba* (Mielczarek *et al.*, 2019; Van Steenis *et al.*, 2019). **Flowers visited:** *Rhamnus frangula* (V.Bradescu, pers.comm.); *Prunus padus* (Mielczarek *et al.*, 2019); *Crataegus*, *Malus* (P. Trzciński, pers. comm.). **Flight period:** April/June. **Developmental stages:** not described. Van Steenis *et al.* (2019) report observations of *B. maculipennis* on sap runs on *Populus alba* and *Salix alba*. Large numbers of *B. maculipennis* are also reported on sap runs on *Populus alba* by Mielczarek *et al.*, (2019). A female has been observed ovipositing close to a sap-run on the trunk of an old, living *Populus alba* (P. Trzciński, pers. comm.), showing evidence of *Cossus* infestation. The sesiid moth *Sesia apiformis* was also present at this location. The larvae of both *Sesia apiformis* and *Cossus cossus* tunnel just beneath the bark, in the process damaged the vascular system of the tree, resulting in accumulations of fermenting sap in their workings. If *Brachyopa maculipennis* requires not only sap runs on

old *Populus alba* or *Salix alba*, but also has some dependence on a commensal relationship with *Cossus* and or *Sesia* larvae, to provide sap runs in an appropriate condition for its larvae, that could account for the apparent rarity of *B. maculipennis*. Both *Cossus* and *Sesia* species are regarded as pests of commercial forestry. **Range:** northern Germany; Poland; Czech Republic; Austria; Slovakia; northern Italy; Hungary; Croatia, Roumania; parts of the former Yugoslavia; Ukraine. **Determination:** See Key provided in StN Keys volume; Thompson (1980); Van Steenis *et al*., 2020b); Bradescu (1991). Doczkal and Dziock (2004) also provide a key for distingusihing this species from other European members of the *B.insensilis* group. The male terminalia are figured by Pellmann (1998). This is the only known European *Brachyopa* in which the wings are normally maculated, the area of the r-m cross-vein being distinctly infuscate, as shown by Dziock (1999). However, occasional specimens of *B.panzeri* Goffe may exhibit a similar condition (F.Dziock, pers. comm.). **Illustrations of the adult insect:** the male is illustrated in colour by Prokhorov *et al.* (2018b), showing the small dark markings of the wings that are characterisatic of this species.

Brachyopa minima Vujić & Pérez-Bañón, in Pérez-Bañón *et al*., 2016
Preferred environment: riparian gallery forest *(Populus*). **Adult habitat and habits:** has been seen flying round the trunk of the tree inhabited by its larvae. **Flowers visited:** no data. **Flight period:** April/beginning of May. **Developmental stages:** Pérez-Bañón *et al.* (2016) found the larvae in sap runs on the trunk of a living *Populus nigra* and provide detailed description and photos of the larva. In this species the larva can evidently withstand prolonged dessication (Pérez-Bañón *et al*, 2016). **Range:** Greece (the Aegean island of Lesvos). **Determination:** both sexes of this species are described in Pérez-Bañón *et al.* (2016), together with features distinguishing it from related species and figures of the male terminalia. It is one of the group of *Brachyopa* species with pairs of round, shiny black marks on the mesoscutum. *B. minima* is included in the keys provided in the StN Keys volume and Van Steenis *et al*. (2020b). **Illustrations of the adult insect:** the photo of a male of *B. minima* included in Van Steenis *et al*. (2020b) is very dark and its mesoscutum is to a significant obscured by the pin through the specimen.

Brachyopa obscura Thompson and Torp, 1982
Preferred environment: forest, mature/overmature deciduous forest; along rivers with *Populus nigra*, within deciduous forest (Stuke, 2001); wet woodland of *Alnus/Populus* and *Alnus* forest (Wakkie *et al*, 2011); alluvial *Alnus/Fraxinus* forest. **Adult habitat and habits:** flies low around *Populus tremula* trunks (S.Kerppola, pers.comm.); males have been observed to settle on low-growing vegetation (within 1metre of the ground) close to deciduous trees (*Alnus* and *Populus*) with trunk sap seepages (Wakkie *et al*, 2011). Heimburg *et al*. (2022) record finding this species on the trunk of a live *Populus nigra*. **Flowers visited:** *Acer platanoides* (Nilsson *et al*., 2012), *Aegopodium podagraria* (S.Kerppola, pers.comm.), *Crataegus* (H.Bartsch, pers. comm.), *Filipendula* (Van Steenis *et al*., 2020b); *Prunus padus, P. serotina, P. spinosa* (Van Steenis, 1998b; Van Steenis *et al*., 2020b), *Ribes alpinum* (Bartsch *et al.* (2009b). **Flight period:** May/beginning July. **Developmental stages:** not described. Stuke (2001) suggests this species may be associated with *Populus nigra* and it shows an association with *P.tremula* in Finland and Sweden (S. Kerppola and H. Bartsch, pers.comm.). Nielsen (2005) reports that this species has been hatched from the "bark of a pear (*Pyrus*) tree". Wakkie *et al.* (2011) suggest *B. obscura* is associated with *Populus tremula* and its hybrids. The curiously small number of widely scattered records of this insect south of Scandinavia implies that some factor, other than presence of overmature trees of small *Populus* species within wet woodland, may be required to support it. **Range:** Sweden; southern Norway; southern Finland; northern Germany; Poland; Belgium; Switzerland; Austria; northern parts of European Russia; the Pyrenees (France); Montenegro. **Determination:** See Key provided in StN Keys volume; Bartsch *et al.* (2009b); Thompson and Torp (1982), who figure the male terminalia and suggest that features of the terminalia are the only means of distinguishing this species from *B.testacea* (Fallen). The abdominal tergites of *B.obscura* are a more uniformly brown colour than they usually are in *B.testacea*, and lack the median black stripe normally found in the latter species, but these differences cannot be relied upon. These differences are figured by van Steenis (1998b) and used in the key in Bartsch *et al.*(2009). The surstylus of *B.obscura* referred to in van Veen's (2004) key is in fact the aedeagus and the bristles are non-articulated spikes. The degree of development of these spines at the apex of the surstyli in *B. obscura* and *B. testacea* is rather variable, and does not provide diagnostic differences between the species. There are wing venation features which have also been used to aid in the separation of *B. obscura* from *B. testacea*. But neither the feature introduced by Stuke (2001) nor the one introduced by Bot and Van de Meutter (2019) are sufficiently stable to be useful. Essentially, the shorter aristal hairs found in *B. obscura*, as compared with *B. testacea* (shown for the males in Stuke,

2001), and the proportions of the theca of the hypandrium in the two species (as figured by Thompson and Torp (1982), plus the ribbing on its convex side found in *B. obscura* but absent in *B. testacea,* are the only features currently available for reliable separation of these two species. **Illustrations of the adult insect:** the general appearance of this species is shown in the photographs provided by Haarto & Kerppola (2007). The male is figured in colour by Bartsch *et al.*(2009b) and Bot and Van de Meutter (2019).

Brachyopa panzeri Goffe, 1945

Preferred environment: deciduous forest; humid *Fagus* forest and alluvial gallery forest of *Populus* with overmature trees. **Adult habitat and habits**: stumps etc. in the sun, within forest; sap runs. **Flowers visited**: white umbellifers; *Acer campestre, Crataegus, Prunus padus, P. spinosa, Salix, Sambucus.* **Flight period**: beginning of May/June. **Developmental stages:** This species has been reared from a larva collected from a slime-flux on a *Fagus* stump, by Stuke and Schulz (2001). Krivosheina (2005) describes and figures the larva of a *Brachyopa* believed to be of this species, stating "No adult was reared from larvae of this species. However, as the larvae have been found in a fir stub together with larvae of *B. vittata* Zett., and adults of only these two species have been recorded in the area, I refer these larvae to *B. panzeri*". This species may also be associated with *Castanea* (Ricarte *et al*., 2014) and *Acer campestre* (Merz, 2009). Shparyk and Zamoroka (2021) describe and figure a larva they found in s stump of *Quercus robur* as that of *B. panzeri*, having reared other larvae from this stump and determined the reared adults as *B. panzeri*. They also describe and figure the puparium, from the same origin. They report that duration of the puparial stage is 12 – 17 days. They observe that the number of apical setae on the lateral sensilla in the larvae they identify as of *B. panzeri* is not constant, at two, as stated by Krivosheina (2005), but varies between 2 and 4. They also question the diagnostic value of the pale colour of these setae, as observed by Krivosheina (2005), pointing out that in their larvae these setae were dark coloured and the pale colour of the setae observed by Krivosheina (2005) could be an artefact, since the larva described by Krivosheina (2005) had been stored for 40 years before being described. Further, they point out the weakness of Krivosheina's (2005) logic, that the larvae she identified as belonging to *B. panzeri* had to belong to that species because only *B. panzeri* and *B. vittata* occurred in the area from which her larvae were obtained, and were not the larvae of *B. vittata* – according to Shparyk and Zamoroka (2021) no less rthan six *Brachyopa* species are now known to occur in that area. They go on to dispute the diagnostic value of the features identified by Krivosheina (2005) for separation of the larvae of *B. dorsata* and *B. panzeri*, and repeated in the key provided by Van Steenis *et al*. (2020b), stating that there is need for detailed redescription of the larva of *B. dorsata* before diagnostic features can be identified, for separation of the larvae of *B. dorsata* and *B. panzeri*. The observations of Carstensen (2022) require to be added to those of Krivosheina (2005) and Shparyk and Zamoroka (2021). Carstensen (2022) reports multiple rearings of *Brachyopa panzeri* from sappy *Fagus* stumps in humid *Fagus* forest, the identifications being based on the reared adults. From the same stumps, at the same time, a number of *Brachyopa pilosa* were also reared. Carstensen (2022) describes simple methodology for encouraging use of particular stumps by *B. panzeri*, which also render simple the collection of larvae and puparia. **Range**: Southern Scandinavia to central France (Massif Centrale) and through central Europe to the Czech Republic, Switzerland and Austria; Slovenia; range not yet well known due to the recent date of species redefinition. (Thompson, 1980). The range of this insect may be expanding. **Determination**: See Key provided in StN Keys volume; Bartsch *et al*. (2009b); Thompson (1980); Van Steenis *et al*. (2020b) . The male terminalia are figured by Pellmann (1998). The name *panzeri* was introduced by Goffe (1945), as a new name for *Musca conica* of Panzer, but without any description of the species. Although Thompson (1980) discusses location of type material he does not describe *B.panzeri* either and up until now this species has never been adequately described. It is extremely similar to *B. dorsata* and the size of the antennal pit, that is used to separate *B. dorsata* from *B.panzeri* in keys, is variable, especially in females of *B. dorsata*, where it is also distinctly larger than in males of *B. dorsata*. In consequence, females of *B. dorsata* may easily be misdetermined as *B.panzeri*. One supplementary feature that may aid in identification is that in *B.panzeri* the lower part of the face protrudes in front of the eyes c2.5x as far as the frontal prominence, whereas in *B. dorsata* it protrudes no more than 2x as far as the frontal prominence. This feature is mentioned by Thompson (1980). A second useful feature is that the posterior margin of the scutellum carries bristles in *B. dorsata*, but does not carry bristles in *B. panzeri*. **Illustrations of the adult insect:** Bartsch *et al*. (2009b), Merz (2009) and Torp (1994) illustrate this species in colour.

Brachyopa pilosa Collin, 1939

Preferred environment: forest; deciduous forest with overmature and senescent trees, from *Quercus/Carpinus/Ulmus* to *Fagus*, including alluvial hardwood forest and alluvial softwood forest with overmature *Populus*. **Adult habitat and habits:** may be found in small patches of sunlight on the trunks of overmature trees of *Fagus, Populus* etc., particularly on and in the

immediate vicinity of sap runs; also flies up and down the trunk of such trees and settles on adjacent foliage in the sun. **Flowers visited:** white umbellifers*; Acer platanoides, Allium ursinum, Cardamine, Crataegus, Malus sylvestris, Photinia, Prunus cerasifera, P. padus, P.spinosa*, male *Salix, Viburnum opulus*. **Flight period:** end April/beginning July, with peak end May/beginning June. **Developmental stages:** larva described and figured by Rotheray (1991) from larvae collected from beneath the bark of a rotting stump of *Fagus*. Rotheray (1994) also found the larva of this species in association with sap runs on *Fagus, Populus* and *Quercus*. Krivosheina (2005) describes and figures the larva of this species from larvae collected a fallen trunk of *Populus tremula*, sap in a *Betula* stump and a sap run on *Fagus*. It is figured in colour by Rotheray (1994). Carstensen (2022) reports multiple rearings of *B. pilosa* from larvae collected from sappy *Fagus* stumps. **Range:** Fennoscandia south to central France; Britain (England) east through central Europe (Czech Republic, Switzerland) into European parts of Russia and Georgia. Van Steenis *et al*. (2020b) mention Ireland as part of the range of this species, but without providing substantiation. **Determination:** See Key provided in StN Keys volume; Thompson (1980). Van Steenis *et al*. (2020b). The male terminalia are figured by Pellmann (1998). In both Pérez-Bañón *et al*. (2016) and Van Steenis *et al*. (2020b) mention is made of the larvae of "*Brachyopa* aff *pilosa*" in the text on *B. minima*. But elsewhere, including text on *B. pilosa*, "*Brachyopa* aff *pilosa*" is not mentioned. It is unclear whether these references to "*Brachyopa* aff *pilosa*" are to be taken as an indication that *Brachyopa pilosa* may be a complex of more than one species, as recognised at present. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Torp (1994).

Brachyopa plena Collin, 1939

Preferred environment: thermophilous oak forests of the eastern Mediterranean and deciduous gallery forest along rivers, within *Pinus brutia* forest (pers.comm. M.de C.Williams). **Adult habitat and habits:** no data. **Flowers visited:** *Acer campestre, Crataegus, Pyrus spinosa, Salix* (pers.comm. M.de C.Williams); *Sorbus torminalis*. **Flight period:** April/May. **Developmental stages:** not described. **Range:** the type material is stated by Collin (1939) to be two males from the Kowarz collection, from "Waldegg", a locality he states to be in 'Bohemia'. There may be good reason for Collin's statement that this locality is in 'Bohemia' - he refers to a number of Kowarz specimens from 'Bohemia' in the same paper. But the only "Waldegg" to be found in atlases is in Austria. Vujić (1991) has also referred to occurrence of *B. plena* in parts of the former Yugoslavia. Kočić *et al*. (2023) record *B. plena* for Slovenia. Putative *B. plena* also occurs in Northern Greece (M. de C.Williams, pers.comm.). **Determination:** Collin's description of *B. plena* is based on two males from Bohemia (now in the Czech Republic). His description is very brief - only four lines of text, and does little more than suggest differences between *B. plena* and *B.pilosa*, which are repeated in the key he provides. He lists three features as characterising *B. plena* as different from *B. pilosa*: a larger and more ventral sensory pit on the 3rd antennal segment; a "more extensively dusted" frons and "numerous black hairs on apical half of second abdominal tergite at sides". Collin (1939) described *B. pilosa* in the same paper as he described *B. plena*, and it is apparent that the only material of *B. pilosa* then available to him (i.e. the *B. pilosa* type material) comprised 4 males from Britain and one from 'Bohemia'. Abundant material of *B. pilosa* is now available in collections and intraspecific variability in this species is consequently more easily recognised. The size and location of the pit on the 3rd antennal segment is certainly open to greater variability than Collin suggests, among males that would be consigned to *B. pilosa* on the basis that they have identical terminalia. Similarly, the quantity of black hairs on the second abdominal tergite is more variable in male *B. pilosa* than Collin suggests (he says of *B. pilosa*: "hairs on sidemargin of second abdominal tergite all pale"), though interpretation of what might constitute the "numerous black hairs" of *B. plena* is dependent entirely on personal opinion, and may, or may not be encompassed by the variability of *B. pilosa*. Collin unfortunately does not figure the male terminalia of *B. plena*. But he does figure the antenna, showing a round sensory pit. Vujić (1991) figures the male terminalia of the taxon he recognises as *B. plena*. The taxon depicted as *B. plena* by by Vujić (1991) certainly has terminalia easily distinguished from the terminalia of *B. pilosa*. These specimens also exhibit the features given by Collin (1939), as distinguishing *B. plena* from *B. pilosa*. However, while their terminalia are clearly distinct from those of *B. pilosa*, they are identical to the terminalia of *B. scutellaris*. The only feature described and figured by Collin, that might be used to separate Balkan specimens currently recognised as *B. plena*, from *B. scutellaris*, is the shape of the pit on antennal segment three. This pit is normally c-shaped, or kidney-shaped in *B. scutellaris*, but more-or-less circular in *B. plena*, as described and figured by Collin (1939), and as figured by both Thompson (1980) and Vujić (1991). Neither of these authors, nor others who have subsequently followed their interpretation of *B. plena*, seem to have examined Collin's type material of *B. plena*, and no lectotype would seem to have been designated for *B. plena*, so whether their interpretation of the species is correct cannot be certain. However, the species they recognise as *B. plena* is recognisably distinct from other European *Brachyopa* species, even if very similar to *Brachyopa scutellaris*. Their interpretation of *B. plena* is thus followed here, at least until the identity of the

type material of *B.plena* is established. In this regard it is appropriate to note that the shape of the sensory pit on antennal segment three varies in *B. scutellaris*, and occasional specimens may be found in which it is either oval or round, or of indeterminate shape. At present, *B.scutellaris* is unrecorded from the Balkan peninsula, suggesting that no specimens of *B. plena/scutellaris* have been found there with a kidney-shaped or c-shaped pit on antennal segment three – one of the potential interpretations of Collin's (1939) *B. plena* is that it is *B.scutellaris* with a round pit on antennal segment three. That interpretation seems less likely if no Balkan specimens of *B.plena/scutellaris* occur with a c-shaped, or kidney-shaped sensory pit. In their key, Van Steenis et al. (2020b) allude to an additional feature they indicate can be used to separate *B. plena* and *B. scutellaris*, namely the relative length of the hairs on the mesoscutum in the two species. But they do not illustrate the condition of this feature in either *B. plena* or *B. scutellaris* and, comparing specimens of the two species demonstrates that, if there is a visible difference, it is extremely difficult to discern. A feature they do not mention, and which has not been referred to by other authors, is that when examined from behind, the transverse suture on the mesoscutum appears shining and expands towards its medial extremity, so appearing spatulate, in both male and female of *B. scutellaris*, whereas in the male and female of *B. plena* it remains dull from all angles and does not expand medially. Althought the photo is rather dark, the condition of the transverse suture in *B. scutellaris* can be seen in the photo of the male provided in Van Steenis *et al*. (2020b). It can also be seen, in both the male and female of *B. scutellaris*, in Speight & de Courcy Williams (2021). Neither of these latter publications show the mesoscutum of *B. plena*. *Brachyopa plena* is included in the keys provied in the StN Keys volume, and Van Steenis *et al*. (2020b). **Illustrations of the adult insect:** none known.

Brachyopa quadrimaculosa Thompson, 1981
Preferred environment: forest, river-edge *Platanus orientalis* gallery forest within deciduous forest of *Quercus frainetto/Q.pubescens* (M. de Courcy Williams, pers. comm.); river-edge deciduous forest within *Pinus brutia* forest (M. de C.Williams, pers.comm.); maquis (Kaplan and Thompson, 1981). **Adult habitat and habits:** this species has a rapid, darting flight, within the foliage of trees it visits for flower-feeding (M. de C.Williams, pers.comm.). **Flowers visited:** *Smyrnium olusatrum* (Kaplan and Thompson, 1981); *Pyrus spinosa* (M. de Courcy Williams, pers.comm.). **Flight period:** March/April. **Developmental stages:** not described. In the text on *Brachyopa minima*, in Van Steenis *et al*. (2020b) it is stated that larvae of *B. quadrimaculosa* were found together with larvae of *B. minima*, in sap runs on *Populus nigra*. However, in Pérez-Bañón *et al*. (2016), the origin of the information about larvae of *B. minima*, there is no mention of larvae of *B. quadrimaculosa* beimng found with those of *B. minima*. Further, in the text on *B. quadrimaculosa*, in Van Steenis *et al*. (2020b) there is no mention of the larvae of that species, neither is there mention of *B. quadrimaculosa* larvae in the accompanying key to known *Brachyopa* larvae. Presumably, the mention in Van Steenis *et al*. (2020b), of *B. quadrimaculosa* larvae in their text on *B. minima*, is an error and is to be disregarded. **Range:** Greece; Cyprus; Israel. **Determination:** see key in StN Keys volume. Both male and female are described in Kaplan and Thompson (1981), who also figure the male terminalia. The name of this species is misleading, since it has 6 distinct, black marks on the mesoscutum, rather than 4, a reality only apparent from reading the description. Also, the photographs accompanying the description are difficult to interpret. For instance, the photo of the head shows the anterior part of the frons apparently black and shining. But, according to the description, this part of the frons is "orange medially, brownish-black laterally". *B.quadrimaculosa* is a species of the *insensilis* group, with the sensory pit on the third antennal segment absent in the female and minuscule in the male. The six, shining, roundish black marks on the mesoscutum make this species immediately distinguishable from most other European *Brachyopa*, though the anterior pair are rather variable in size and can be small in some specimens. In the photos of the male and female of this species, in Van Steenis *et al*. (2020b) the pins through the specimens partly obscure the mesoscutum, but, at least in the female, the 6 black marks can more-or-less be seen. **Illustrations of the adult insect:** the general appearance of the male and female can be seen in the coloured photos provided in Van Steenis *et al*. (2020b) .

Brachyopa scutellaris Robineau-Desvoidy, 1844
Preferred environment: forest; deciduous forest, with mature *Acer*, *Alnus* or *Fraxinus*. **Adult habitat and habits:** flies back and forth, pendulum-like, in patches of sunlight beside living trees exhibiting sap-runs, rot-holes or trunk-base rot and standing within woodland; settles frequently on foliage in the immediate vicinity and on the tree trunks themselves, where these are in the sun; when sunlight disappears *B.scutellaris* disappears from the vicinity of these trees, presumably moving up to the canopy; visits flowers of low-growing plants in the shade and the flowers of trees. **Flowers visited:** white umbellifers; *Cardamine*, *Cornus*, *Crataegus*, *Malus*, *Mespilus*, *Photinia*, *Rubus fruticosus* agg., *Sorbus*, *Viburnum opulus*. **Flight period:** mid April/end June. **Developmental stages:** the larva develops in sap-runs on *Acer pseudoplatanus*, *Fraxinus* and *Ulmus glabra* and in sappy, wet-rot situations beneath the bark of *Alnus*, *Fraxinus*, *Populus tremula* etc.; described and figured by

Rotheray (1996). According to Pellmann (1998), *B.scutellaris* has also been reared from *Taxus*. This species has also been found flying in numbers round the trunk base of an oak (*Q.robur*) showing extensive damage by *Cossus*, including weeping bark lesions. This species may also be associated with *Castanea* (Ricarte *et al*, 2014). **Range:** Denmark south to the Pyrenees; Ireland east through central Europe to Hungary. **Determination:** See Keys provided in StN Keys volume; Thompson (1980); Van Steenis *et al*. (2020b) . The male terminalia are figured by Pellmann (1998). In general appearance, very similar to *B. plena* – see *B. plena* species account. **Illustrations of the adult insect:** illustrated in colour by Bartsch *et al*. (2009b); Speight & de Courcy Williams (2021); Torp (1994); Van Steenis *et al*. (2020b); Pétremand *et al*. (2022)..

Brachyopa silviae Doczkal & Dziock, 2004

Preferred environment: forest; deciduous forest of humid *Fagus* and *Quercus/Carpinus*, plus also, probably, alluvial hardwood forest (Doczkal & Dziock, 2004); deciduous gallery forest along rivers. **Adult habitat and habits:** no data. **Flowers visited:** *Crataegus, Pyrus spinosa* (pers. comm. M. de C. Williams); *Acer pseudoplatanus* (Van Steenis *et al*. 2020b). **Flight period:** April/beginning June. **Developmental stages:** undescribed. Van Steenis *et al*. (2019) report this species has been observed close to a sap run on the trunk of *Carpinus betulus*, which suggests it may be associated with this tree. **Range:** central Germany; southern France, Austria, Serbia. **Determination:** Doczkal and Dziock (2004) describe both sexes of this species and figure its male terminalia. *Brachyopa silviae* is one of the group of species with pairs of shining black marks on its mesoscutum. It is included in the Keys provided in StN Keys volume and Van Steenis *et al*. (2020b). In referring to distinctions between *B. silviae* and *B. bimaculosa* in their key, Van Steenis *et al*. (2020b) state that a ventral scutellar fringe is absent in *B. bimaculosa*, but "present" in *B. silviae*. In their description of *B. silviae*, Doczkal & Dziock, (2004) say, of the ventral scutellar fringe in *B. silviae* "A rudimentary ventral scutellar fringe represented by a few hairs at the extremity of its ventro-lateral margin". The key in Van Steenis *et al*. (2020b) also states of *B. silviae* "Scutum with one pair of triangular bare shiny maculae at the transverse suture" referring to their Figure 4B as an illustration of their statement. That figure (a male from Germany) shows a pair of oval black marks in that position, the marks being an entirely different shape from those shown in the photo (Figure 29) of the mesoscutum of *B. silviae* (a female, from Germany) supplied by Doczkal & Dziock, (2004). In reality, these marks are of variable shape in *B. silviae* and while usually angular (rather than round), can appear wider than long or longer than wide. It should also be noted that in *B. silviae* there is not only one pair of bare, shining patches on the mesoscutum, as implied by Van Steenis *et al*. (2020b). There is also a second, smaller bare, shining patch on each side of the mesoscutum anteriorly, just median to the humeral callus. The presence of this pair of black marks is mentioned in the description of *B. silviae* by Doczkal & Dziock, (2004), and stated by them to be absent in *B. bimaculosa*, in their description of that species. **Illustrations of the adult insect:** the coloured photo of the male provided by Bot and Van de Meutter (2019) seems to be the same as the photo of the male in Van Steenis *et al*. (2020b).

Brachyopa testacea (Fallen), 1817

Preferred environment: *Picea* forest. **Adult habitat and habits**: males hover a few inches above ground around recently felled *Picea* stumps and settle on adjacent, low vegetation, often in numbers. **Flowers visited**: white umbellifers, also *Acer pseudoplatanus, Anemone nemorosa, Arabidopsis arenosa, Crataegus, Malus, Meum, Prunus, Ribes alpinum, Saxifraga granulata, Sorbus, Stellaria, Taraxacum, Valeriana, Viburnum opulus*. **Flight period**: April/beginning July. **Developmental stages:** undescribed, but the species has been reared from larvae collected from beneath bark of rotting *Picea* stumps (Nielsen, 1992), in association with Lymexylid beetle workings. **Range**: Scandinavia through to Asiatic parts of Russia and on to the Pacific and Mongolia; western and central Europe. **Determination**: See Keys provided in StN Keys volume and Van Steenis *et al*. (2020b); Thompson (1980) and Thompson and Torp (1982) figure the male terminalia. The male terminalia are also figured by Pellmann (1998). According to Thompson & Torp (1982) this species can only be distinguished from *B. obscura* using features of the male terminalia. However, the key in Van Steenis *et al*. (2020b) distinguishes *B. testacea* from both *B. obscura* and *B. zhelochovtsevi* without resort to genitalic features. *B. obscura* may be recognised immediately in the field from its uniformly brown abdomen, which contrasts with the pale brown tergites with dark posterior margins and a dark mid-line normally found in *B.testacea*. However, these dark markings may be very poorly developed in some females of *B.testacea*. These differences are figured by van Steenis (1998b and again in van Veen (2004). The surstylus of *B. testacea* referred to in van Veen's (2004) key is in fact the aedeagus and the bristles are non-articulated spikes.. Mutin (1998) details distinctions between *B. testacea* and *B. zhelochovtsevi*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Torp (1984, 1994) and van der Goot (1986).

Brachyopa vernalis van Steenis & van Steenis, 2014
Preferred environment: deciduous forest (M. Reemer, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Crataegus* (M. Reemer, pers.comm.); *Prunus* (Van Steenis *et al*. (2020b). **Flight period:** March/beginning of April. **Developmental stages:** no data. **Range:** the island of Crete (Greece). **Determination:** See Key provided in StN Keys volume; described by van Steenis & van Steenis (2014), from a series of males. The female remains unknown. *Brachyopa vernalis* is one of the group of species with pairs of shiny black marks on the mesoscutum. It is included in the key provided by Van Steenis *et al*. (2020b). **Illustrations of the adult insect:** the general appearance of this species can be seen from the coloured photo of the male in Van Steenis *et al*. (2020b).

Brachyopa vittata Zetterstedt, 1843
Preferred environment: *Picea* and *Abies* forest with overmature trees; "mixed swamp forest" (Van Steenis *et al*. (2020b). **Adult habitat and habits:** flies round cut *Picea* logs, settling often on the cut ends and also low down on the foliage of any surrounding plants; characteristically, found on foliage of deciduous shrubs along streams, within *Picea* forest; on hot days comes to wet mud in the shade to drink. **Flowers visited:** *Caltha, Crataegus, Prunus avium, Sambucus, Salix, Sorbus aucuparia, Viburnum* and, under cloudy or shaded conditions, white umbellifers; *Spiraea, Valeriana* (Van Steenis *et al*. (2020b). **Flight period:** mid April/June and July at higher altitudes. **Developmental stages:** larva described and figured by Krivosheina (2005), from larvae found in tunnels of lymexylonid beetles in stumps of *Abies*, and also from under the bark of *Abies* and *Larix* stumps. Kassebeer (1993) also reared the species from *Picea* stumps. **Range:** Scandinavia south to the Pyrenees and east from Belgium/Netherlands through central Europe to European parts of Russia and the former Yugoslavia and on through Siberia to the Pacific. **Determination:** See Key provided in StN Keys volume; Thompson (1980). The male terminalia are figured by Pellmann (1998). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Schmid (1996).

Brachyopa zhelochovtsevi Mutin, 1998
Preferred environment: forest; *Pinus/Betula* swamp forest with overmature and fallen trees (A. Haarto, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Ledum palustre* (A. Haarto, pers.comm.). **Flight period:** June/July. **Developmental stages:** not described. **Range:** Finland; eastern Asiatic Russia (Yakutia). **Determination:** Mutin (1998b) describes both the male and female and figures features of the male terminalia. *B. zhelochovtsevi* is evidently closely similar to *B. testacea* and Mutin (1998) provides features for separation of these two species. Haarto and Kerppola (2009) provide an extension to their earlier (Haarto and Kerppola, 2007) key (in both Finnish and English versions) to Fennoscandian *Brachyopa* species, to include *B. zhelochovtsevi*, and also figure features of the male terminalia. See also Keys provided in StN Keys volume and Van Steenis *et al*. (2020b). **Illustrations of the adult insect:** the general appearance of the male of *B. zhelochovtsevi* is shown in the coloured photo provixed by Van Steenis *et al*. (2020b).

BRACHYPALPOIDES

This genus was first established by Hippa (1978), who placed it on a firmer basis in his later work (Hippa, 1985). Various authors have placed *Brachypalpoides* species in either *Chalcosyrphus* or *Xylota*. Only *B. lentus* is known from Europe, though there are additional species in Eastern parts of the Palaearctic.

Brachypalpoides lentus (Meigen), 1822
Preferred environment: forest with overmature trees; especially *Fagus, Picea* and *Quercus* and including evergreen oak forest. **Adult habitat and habits:** running on foliage of bushes, *Rubus fruticosus* etc. at the edge of forest clearings; also on the ground near fallen and felled trees. **Flowers visited:** umbellifers; *Crataegus, Galium, Mespilus germanica, Rubus idaeus, Sorbus aucuparia*. **Flight period:** April/June plus July at higher altitudes. **Developmental stages:** larva undescribed, but the species has been bred from damp, fungus-riddled rotten wood within the trunk base of an old, living *Fagus* and is included in the keys provided by Rotheray (1994), where it is distinguished from larvae of related genera and its fore body is figured. *B. lentus* larvae have also been found beneath the bark of *Picea*, by Kassebeer (1993). **Range:** Scandinavia to the Pyrenees and central Spain; Ireland through central Europe into European parts of Russia and Georgia; southern Europe eastwards to the former Yugoslavia and Greece and on into Asia Minor. **Determination:** see generic key provided in StN Keys volume. *B.lentus* is superficially very similar in appearance to *Chalcosyrphus piger* (Fab).The male terminalia are figured in Hippa

(1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch et al.(2009b), Colyer and Hammond (1951), Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Kormann (1988).

BRACHYPALPUS

There is some confusion as to how many European species there are in this genus. At least three species, *B.chrysites*, *B.laphriformis* and *B.valgus* are generally recognised. Some authors, e.g. van der Goot (1981), Peck (1988) also recognise *B.meigeni*, which is otherwise taken to be a colour variety of *B.laphriformis*. Van Steenis *et al* (2019) signal the presence of an additional, undescribed species in the Balkan peninsula.

Brachypalpus chrysites Egger 1859
Preferred environment: conifer forest; open *Abies/Picea* forest with overmature trees, from the upper limit of *Fagus, up* to the *Larix/Pinus mugo* zone. **Adult habitat and habits**: flies around shrubs like *Salix* and *Sorbus aucuparia* in flower, but also settles on cut tree trunks of *Larix* and *Picea* and on low-growing vegetation, around the edges of clearings in forest. It is apparently a rather slow-flying, low-flying mimic of *Bombus* - or perhaps *Laphria flava* (Moertelmaier, pers.comm.). **Flowers visited:** *Centaurea, Crataegus, Crocus, Eriophorum vaginatum, Helleborus niger, Petasites albus, Ranunculus, Salix, Sorbus aucuparia, Tussilago*. **Flight period**: April/June, plus July at higher altitudes. **Developmental stages:** larva described and figured by Schmid and Moertelmaier (2007), from larvae reared to last instar in a mixture of damp rotten wood of *Acer, Alnus* and *Picea*, into which a captive female laid eggs. **Range**: mountainous parts of central Europe: Schwarzwald (Germany); Massif Central, Jura and the Vosges (France); Tatra mountains (Poland, Slovakia); through the Alps (France, Germany, Switzerland, Liechtenstein, Austria) eastwards into the former Yugoslavia, Roumania, Ukraine, Turkey; Caucasus mountains (Georgia, Armenia). **Determination**: See Key provided in Speight and Lebard (2022b). The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** the male is illustrated in colour in Speight and de Courcy Williams (2021) and Speight & Lebard (2022b).

Brachypalpus laphriformis (Fallen), 1816
Preferred environment: deciduous forest; over-mature *Fagus* and *Quercus* forest with senescent trees and fallen, rotting timber. **Adult habitat and habits:** males engage in rapid, zigzag flight along the trunks of fallen and felled deciduous trees, in clearings, not infrequently settling on the bark, in the sun; in flight they emit a characteristic, high-pitched buzz; they also settle on the trunks of standing, live trees, in the sun; the female can be found investigating fallen trees, but does not settle on them in the sun - on occasion can be found on the cut end of a felled tree or walking around the periphery of a tree hole, or settled on the foliage of trees at upwards of 2m from the ground; both sexes visit the flowers of certain trees. **Flowers visited:** umbellifers; *Berberis, Crataegus, Photinia, Prunus serotina, Sorbus*. **Flight period:** end May/end June, with a few records for early July. **Developmental stages:** larva described and figured by Rotheray (1991) and illustrated in colour (apparently from a preserved larva) by Rotheray (1994), from a larva collected from exudates of a rot-hole in the trunk of *Taxus* and another from sappy water in a sub-bark cavity on the trunk of a live *Quercus*. From the habits of the adults, it is likely that the larvae of *B. laphriformis* might also be found in association with *Acer, Castanea* and *Prunus*. According to Bartsch *et al.* (2009b), this species may be associated with *Pinus* in Sweden. **Range:** southern Fennoscandia south to the Pyrenees; Ireland east through much of central Europe (and northern Italy) to the former Yugoslavia and European parts of Russia. **Determination:** see key provided in Speight & Lebard (2022b). The male terminalia are figured by Hippa (1978). Andersson (1988) states that the name *valgus* (Panzer) should be applied to this species, rather than to the *Brachypalpus* species to which it is applied by most recent authors. He provides no justification for his statement, which has largely been ignored and is not regarded as proven by the present author. The type material of *valgus* (Panzer) no longer exists and it is difficult to see how Andersson's claim can be justified on the basis of available information. In the interests of nomenclatural stability, it would clearly be preferable if the application of the names *laphriformis* and *valgus* can be maintained as in these species accounts. Considerable confusion will result, if use of the name *valgus* were to be switched to the species currently known as *laphriformis*, analogous to the confusion already evident in respect of use of the name *Chrysotoxum arcuatum* (L.), which has suffered such a switch in application. Unless incontrovertible proof can be provided that *valgus* (Panzer) has to be used for the species referred to here as *laphriformis*, it would seem preferable that present usage be maintained. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.* (2009b); Speight & Lebard (2022b); Stubbs and Falk (1983); Torp (1984, 1994); van der Goot (1986).

Brachypalpus valgus (Panzer), 1798
Preferred environment: Old *Fagus* (both mesophilous and humid *Fagus* forest) and *Quercus* forest (from acidophilous oak forest to thermophilous oak forest and evergreen oak forest of *Q. suber*) with overmature trees; according to Doczkal (pers.comm.) also in old cherry (*Prunus*) orchards with overmature trees, in southern Germany. **Adult habitat and habits**: to a significant extent arboreal, but also visits tree trunks and fallen trees in the sun in glades, etc., flying fast and very close to the surface of the timber; settles on fallen trunks and stumps, or the trunks of living trees, in the sun; the female may be found investigating the trunk-base of old trees and the cut ends of felled timber. When visiting low-growing forest flowers (while the branches of the tree canopy are still bare of leaves), the males may settle on dead leaves in the sun. The male closely resembles a large, fast-flying hive bee (*Apis mellifera*). **Flowers visited**: umbellifers; *Anemone nemorosa*, *Crataegus*, *Euphorbia*, *Prunus mahaleb*, *P.spinosa*, *Ranunculus*, male *Salix*, *Scilla bifolia*, *Sorbus*, *Tussilago*; most frequently visits flowers at some height above the ground (long-handled net advised!). **Flight period**: beginning of April to the beginning of June. **Developmental stages:** larva described and figured by Dusek and Laska (1988), from larvae collected from a wet fissure in the trunk of *Alnus glutinosa*. This species has also been reared from a trunk cavity if *Quercus suber* (J. -P. Sarthou, pers. comm.). **Range**: Southern Sweden and Denmark south to the Pyrenees and central Spain; northern France eastwards through central Europe to European parts of Russia. Localised and decreasing, although probably not yet threatened at European level. **Determination**: see key provided in Speight & Lebard (2022b). This species is very similar to *B.laphriformis*, but usually larger. Males usually have the eyes separated by a distance slightly greater than the diameter of the anterior ocellus (contiguous in *B.laphriformis*), but this is variable and the eyes can almost meet. In females the frons is undusted and brightly shining over most of its width (heavily dusted across entire width in *B.laphriformis*). The male terminalia are figured by Hippa (1978). Andersson (1988) states that the name *valgus* (Panzer) should be applied to the species currently known as *B.laphriformis* (Fallen). But no justification has been provided for this suggested switch in name usage and it has been largely ignored subsequently. In the opinion of the present author the case for use of the name *valgus* (Panzer) for the species referred to in these species accounts as *B.laphriformis* is unproven, and the switch in usage would be unjustified - not to mention extremely confusing for anyone subsequently attempting to use existing literature (see also the species account for *B.laphriformis*). **Illustrations of the adult insect:** the male and female are illustrated in colour in Pétremand *et al*. (2022).

CALIPROBOLA

There is only one *Caliprobola* species recognised as occurring in Europe. A second species, *C.aurea* (Sack) is known from south of the Caucasus mountains in Georgia and also in Azerbaidjan and Iran. There are no other *Caliprobola* species known, either in the Palaearctic or elsewhere.

Caliprobola speciosa (Rossi), 1790
Preferred environment: forest; deciduous forest (*Castanea; Fagus; Quercus pedunculata; Q. pubescens; Quercus/Carpinus/Ulmus*) and evergreen oak forest (especially *Q. suber* forest maintained for cork production) with overmature and senescent trees. **Adult habitat and habits**: males fly around, hover between and settle close to, the roots of senescent *Castanea*, *Fagus* or *Quercus* in the sun, settling on bare ground, on the sawdust of cut stumps, or on vegetation (e.g. *Pteridium*) in the vicinity. Both sexes visit the flowers of small trees and low-growing plants. Can be found away from forests, feeding at flowers growing on exposed riverbed gravels or in adjacent fields, along large rivers with galley forest, in situations with either alluvial softwood, such as *Salix alba* or *Populus*, or with hardwood such as *Fraxinus*/*Carpinus/Quercus*. The species appears to use these riverine biotopes as corridors to move between forests. An alternative explanation would be that one or more of these trees provides an alternative host for the larvae. *C.speciosa* visits the damp mud of drying stream beds or drying puddles on tracks, usually in the shade, on hot afternoons, to drink. **Flowers visited**: white umbellifers; *Caltha*, *Crataegus*, *Mespilus germanica*, *Rorippa*, *Rubus*, *Sorbus aucuparia*, *Tamaris; Cornus sanguinea*, *Frangula alnus* (Dussaix, 2013). **Flight period:** May/mid July, with peak at beginning June. **Developmental stages:** larva described and figured by Rotheray (1991) and illustrated in colour by Rotheray (1994), from larvae collected from wet, decaying roots of *Fagus* stumps. It has also been reared from larvae collected from *Fagus* and *Quercus pedunculata* stumps/roots/rot-holes by other authors. For instance, Dussaix (2005a) reared the species from material in a moist, trunk-base cavity in live *Quercus*. Distinguished from larvae of related genera in the keys provided by Rotheray (1994). A coloured photo of the puparium is provided by Dussaix (2013) who also confirms that overwintering of this species occurs as a larva.

Range: Denmark and Poland south to the Pyrenees and northern Spain; Britain (southern England) east through central Europe (plus northern Italy and northern parts of the former Yugoslavia) into Turkey and European parts of Russia; Georgia and on into Asia as far as Eastern Siberia. This species is regarded as endangered in Spain (Marcos-García, 2006). **Determination:** See generic Key provided in StN Keys to Genera volume. Sack (1928-32) and Mengual *et al.*(2021) provide keys to distinguish *C.speciosa* from *C.aurea* Sack. Mengual *et al.*(2021) also provide coloured illustrations of *C. aurea* and *C. speciosa*. The male Terminalia of *C. speciosa* are figured by Hippa (1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Ball and Morris (2013), Bartsch *et al.* (2009b), Kormann (1988) and Stubbs and Falk (1983).

CALLICERA

The European species have recently been reviewed by Speight (1991b), who recognises 6 as occurring in Europe. However, the status of the additional eastern European species *C.rohdendorfi* Zimina, known from the Crimea and Georgia, is as yet unclear.

Callicera aenea (Fabricius), 1777
Preferred environment: forest; ancient *Fagus/Picea* forest with overmature and senescent trees, toward the upper altitudinal limit of *Fagus, plus Fraxinus* forest in Scandinavia (Bartsch, pers. comm.); in *Quercus robur/Acer platanoides* forest in Ukraine (G. Popov, pers. comm.). **Adult habitat and habits**: primarily arboreal, but males are known to hover at 2-3m from the ground, in clearings and at woodland edge. **Flowers visited**: white umbellifers; *Crataegus, Rhododendron aureum, Rosa canina*. **Flight Period**: May/September, with peak May/June (June/July in Scandinavia), plus April in central Europe. **Developmental stages:** not described, but this species has been seen emerging from a small tree hole in *Acer campestre* (G. Popov, pers. comm.). **Range**: requires reassessment, due to confusion with *C.aurata*; but the species can be confirmed from Norway, Sweden, Poland, Czech Republic, France (Alps, Massif Central, Vosges) and various parts of Germany through central Europe into the Jura, the Alps (Switzerland, Austria) and (according to Zimina, 1986) on into European parts of Russia, south to the Crimea and east into Siberia and on to the Pacific (Sakhalin). **Determination**: see key in StN Keys volume; Speight (1991b); the male terminalia are illustrated by Speight (1991b), where the figures of the male terminalia of *C. aenea* and *C. aurata* have unfortunately been interchanged: the terminalia of *C. aenea* are actually shown in Figure 4b. The relative lengths of antennal segments 1 and 2 are more variable in this species than is indicated by Zimina (1986); some females of *C.aurata* in which the areas of black hair on ventral parts of the thorax are very restricted can be easily mistaken for females of *C.aenea*. **Illustrations of the adult insect:** the male is illustrated in colour by Bartsch et al.(2009b) and Kormann (1988.

Callicera aurata (Rossi), 1790
Preferred environment: deciduous forest; ancient *Fagus/Quercus* forest with overmature and senescent trees, including thermophilous *Quercus* forest. **Adult habitat and habits:** primarily arboreal, descending rarely to feed at flowers or to visit streams to drink; descends to drink in dappled sunlight at the margin of streams within the canopy of old forest; occasionally females can be found at great distance from forest. **Flowers visited**: *Calluna, Dipsacus fullonum, Filipendula, Hedera, Rosa* (including *R.canina* - D.Levy, pers.comm.), *Succisa*; *Crataegus* (Bygebjerg, 2002); *Hypericum, Rubus fruticosus, Verbascum* (Ssymank, 2012). **Flight Period:** end May/mid October, with most records July/September. **Developmental stages:** larva described and figured by Rotheray (1991), from larvae collected from a rot-hole high (18m above ground) in an old *Fagus* in ancient forest. Collected from emergence traps over trunk holes in old, living *Quercus pyrenaica* (Conca-Esquembre, 2024). The general appearance of the larva and puparium is shown in the coloured photos provided by Dussaix (2013). Dussaix (2005a) reared the species from small, water-filled cavities in *Fagus* and *Quercus*. Reared from rot-holes in *Fraxinus angustifolia* by Ricarte (2008). Distinguished from larvae of some related species in the key provided by Rotheray and Perry (1994). Dussaix (2013) records that the puparial phase lasts nearly 3 weeks and confirms that overwintering occurs as a larva. **Range:** can only be stated provisionally, due to confusion with *C.aenea*; confirmed from Norway/Sweden and Britain south to the Mediterranean and central Spain, including most of France; east through central and southern Europe with records from Germany, Switzerland, Italy, the former Yugoslavia, Greece and Turkey; according to Zimina (1986) (as *C. zhelochovtsevi*) from Albania and southern parts of European Russia, the Crimea and Caucasus and on to Azerbaijan. **Determination:** see key in StN Keys volume; Speight (1991b); the relative lengths of antennal segments 1 and 2 are more variable in this species

than is indicated by Zimina (1986); females in which the areas of black hairs on ventral parts of the thorax are very restricted can be difficult to separate from females of *C.aenea*; the male terminalia are shown by Speight (1991b), but there the figures of the male terminalia of *C. aenea* and *C. aurata* have been interchanged: the terminalia of *C. aurata* are actually shown in Figure 4a. **Illustrations of the adult insect:** the male is illustrated in colour by Bartsch *et al*. (2009b), the female by Ball and Morris (2013) and (as *C.aenea*) in Stubbs and Falk (1983). Both male and female are illustrated in colour in Pétremand *et al.* (2022).

Callicera fagesii Guerin-Meneville, 1844
Preferred environment: deciduous forest; ancient *Fagus/Quercus* forest with overmature and senescent trees and alluvial hardwood forest; also along ravines of seasonal streams where *Fraxinus* and old *Acer* are present, within drier types of forest, e.g. Salzmann pine forest. Can be abundant in *Quercus pubescens* forest where old *Acer* are frequent. **Adult habitat and habits:** primarily arboreal, descending to feed at flowers of sub canopy trees and to visit edges of streams in the afternoon/evening - or even the wet mud of a drying stream bed or rain puddle in a track, to drink. During the spring, adults may sometimes be found sun-bathing on the foliage of large-leaved plants, including tall herbs like *Heracleum.* **Flowers visited:** *Hedera; Laserpitium, Quercus ilex; Sorbus aria*. **Flight period:** beginning April/end June, with females on to mid July. **Developmental stages:** larva unknown, but possibly associated with waterside trees like *Alnus, Fraxinus, Populus* or *Salix*. The female of this species has been seen ovipositing on the trunk of a large *Populus* showing lesions on its trunk (W.Renema, pers.comm.) and in small, water-containing rot-holes in the trunk of an old, live, river-edge *Fraxinus ornus* (M. de C. Williams, pers. comm.). **Range:** can be confirmed from the Netherlands, Belgium, France (NW, south to the Mediterranean, inc. the Pyrenees); Germany; Portugal, Spain (Cadiz); Italy (including Sardinia); Greece; Turkey; the former Yugoslavia and Turkmenia (Zimina, 1986). **Determination:** see key in StN Keys volume; Speight (1991b) who figures the male terminalia. **Illustrations of the adult insect:** A coloured photo of the male is provided by Speight and de Courcy Williams (2018) and Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Callicera macquarti Rondani, 1844
Preferred environment: deciduous forest; ancient *Fagus* forest with overmature and senescent trees. **Adult habitat and habits**: primarily arboreal, descending occasionally to feed at flowers or to visit streams to drink; descends to drink in bright sunlight, at spots where woodland streams provide flat patches in the sun at the water's edge and clear flight paths up to the canopy; occasionally females can occur at great distance from forest. Males may sit in the sun on the end of dead branches of trackside trees, at 3m or more from the ground, returning to particular branches repeatedly (M.Hauser, pers.comm.). **Flowers visited**: pink flowered, autumnal *Allium* spp., *Calluna vulgaris, Hedera, Solidago canadensis*. **Flight Period**: September/October. **Developmental stages:** larva not described, but reared from rot-holes in overmature *Quercus rotundifolia* by Ricarte *et al.*(2008). **Range**: due to previous confusion with *C.fagesii* and *C.rufa*, the range information for this species can only be stated provisionally; central and southern France (inc. Pyrenees); south-west Germany (Rhine valley); southern Spain (Barcelona); Switzerland and central and southern Italy; Greece, Turkey and Cyprus. If *C.rohdendorfi* is a synonym of *C. macquartii*, then *C. macquartii* occurs also in the Crimea and the Caucasus. **Determination:** see key in StN Keys volume; Speight (1991b), who figures the male terminalia. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019) and by Van Steenis *et al.* (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Callicera rufa Schummel, 1842
Preferred environment: conifer forest; ancient *Pinus sylvestris* forest with overmature and senescent trees; has also been collected in *P. pinaster* and *Abies alba* forest (J-P.Sarthou, pers.comm.). Whether records of supposedly this species at a great distance from any form of pine forest, on Mediterranean islands (e.g. Van Steenis *et al*, 2021; Vujić *et al*, 2020d) refer to this species, or some other cryptic taxon, requires to be investigated genetically. **Adult habitat and habits:** primarily arboreal, but females descend to visit the freshly cut stumps of old pine trees in the sun in small forest clearings, or to visit rot-holes; males have been observed resting on the trunks and branches of more-or-less isolated pines in the sun, at heights of from 2.5m to 15m above the ground, from where they dashed off to make sorties at passing insects (pers. comm. Nigel Jones). **Flowers visited:** *Ranunculus repens* (Kormann, 1993) *Hedera, Sarrothamnus*. **Flight Period:** mid May/August. **Developmental stages:** larva described and figured by Coe (1938); puparium described by Coe (1939), from larvae collected from deep, standing-water tree-holes in old, living *Pinus sylvestris*. Rotheray (2013) observed that as water in a rot-hole reaches a temperature at which it freezes, the larva of *C. rufa* emerges from the water and remains on the side of the rot-hole. or on the water surface. The larva is illustrated in colour by Rotheray (1994). Development can apparently take 1-3 years. MacGowan

(1994) also reports rearing this species from a standing-water rot-hole in a mature *Larix*, and shows that cutting artificial rot-holes in living *P.sylvestris* can provide sites in which *C. rufa* can develop successfully. Rotheray and McGowan (2000) add that they have found larvae in the wet, decaying heartwood of a *Picea* stump and provide further detail on the larval microhabitat. MacGowan and Rotheray (2007) record use by *C. rufa* of plastic tubs containing pine sawdust and chips, as sites for larval development sites, when these tubs are placed in localities where the species occurs. They also note that rot-holes with a capacity of less than 1 litre are noticeably susceptible to drying out resulting in death of the developmental stages of *C. rufa*, and that rot-holes found to contain larvae in the autumn may be without larvae the following spring, so that finding larvae in a rot-hole in the autumn is not necessarily evidence that development can be completed in that rot hole. Rotheray (2013) observed that *C. rufa* larvae characteristically occur around the mid-depth of a rot-hole's volume and, because they lack an extendable respiratory tube, require to visit the water surface 2 – 3 times each hour for respiratory purposes. When the water in a rot-hole begins to freeze, *Callicera rufa* larvae have been observed to come to the water surface, to rest on the ice, rather than remaining in the frozen water (Rotheray, 2013). The larva of *C. rufa* is distinguished from larvae of some related species in the key provided by Rotheray and Perry (1994). **Range:** older records of this species require reassessment, due to potential confusion with *C. fagesii* and *C. macquartii*. *C. rufa* is known from Atlantic (Scotland, Belgium, Netherlands) central (Germany, Poland, Czech Republic, Hungary) and southern (Balaearic islands, Portugal, Pyrenees, Corsica, Italy, Greece, Roumania) parts of Europe, but not, apparently, from Scandinavia or European Russia and there are no records from more eastern parts of the Palaearctic. **Determination:** see key in StN Keys volume; Speight (1991b); in the male terminalia (figured by Speight, 1991b) the cerci are longer than deep and almost triangular, and the long digitate process of each stylus is almost straight, narrows progressively, but only slightly, from base to tip and is without any obvious apical widening; the claw-like processes on the superior lobe are more widely spaced than in other species. **Illustrations of the adult insect:** the female is illustrated in colour by Ball and Morris (2013) and Stubbs and Falk (1983).

Callicera spinolae Rondani, 1844

Preferred environment: deciduous forest; ancient *Fagus/Quercus* forest with overmature and senescent trees. **Adult habitat and habits:** primarily arboreal, but descends occasionally to feed at flowers or to visit streams to drink; visits streams in bright sunlight, choosing spots where direct sunlight falls on flat patches at the water's edge and there is direct flight path up to the canopy. **Flowers visited**: *Angelica, Hedera, Solidago* sp. **Flight Period:** September/October. **Developmental stages:** larvae of this species have been reared from rot-holes in living *Populus* (Zimina, 1986) and *Fagus* (Rotheray, 1994, Dussaix, 1996). It has also been reared from rot-holes in ancient, living *Fraxinus angustifolia* and *Quercus faginea*, by Ricarte *et al*. (2008). Dussaix (2005a) also reports rearing this species from a small trunk cavity in live *Betula*. Ball *et al*. (2011) cite *Acer campestre* and *Aesculus* as host trees. Further, this species has been reared from a larva collected from a cavity in the trunk of an ancient, live tree of *Quercus suber* (Dussaix, pers.comm.). The larvae usually require more than one year in which to complete development and are known to inhabit the heart-rot of the trunk of living trees, so that they may be located deep within the tree. The larva is described and figured by Rotheray and Perry (1994), who also provide a key distinguishing *C.spinolae* larvae from larvae of some related species. The general appearance of the puparium is shown in the coloured photo provided by Dussaix (2013), who also confirms that the larva overwinters. **Range:** Britain (eastern England) and northern France south to the Pyrenees, Portugal, central Spain and the Mediterranean; Germany; Switzerland, Italy; Roumania; Tajikistan. **Determination**: see key in StN Keys volume; Speight (1991b); Stubbs and Falk (1983) suggest that the femora are "entirely or almost entirely pale" in both sexes of this species, and while this is true for the female, in the male the femora of all legs are black on almost their entire length; in the male terminalia (figured by Speight, 1991b) the cerci are longer than deep and almost triangular, and the digitate process of each stylus lacks the inner flange occurring in other European species, narrows progressively from base to shortly before the apex and then expands noticeably to give a bulbous appearance in side view. **Illustrations of the adult insect:** the female is illustrated in colour by Stubbs and Falk (1983).

CERIANA

Two species of *Ceriana* are recorded from Europe. A third, *C. glaebosa* van Steenis & Ricarte, has recently been described from Cyprus. In earlier literature, species of this genus frequently appeared under the names *Ceria*, and *Ceriodes*. As yet, larvae of neither European species have been described, although those of *C.conopsoides* have been reared. But larvae of N American species have been described and figured by Heiss (1938) and Rotheray *et al*.(1998). Bhatia (1931) describes larvae of Indian species.

Ceriana conopsoides (Linnaeus), 1758
Preferred environment: deciduous forest; riparian *Fraxinus/Populus* forest; *Quercus/Ulmus/Carpinus* forest; thermophilous *Quercus* forest *(Q. pubescens*; *Q. cerris/Q. frainetto*) and evergreen oak (*Q.suber* forest managed for cork production) with overmature trees. **Adult habitat and habits**: fast-flying at up to 3m; settles on path side shrubs. Birtele and Hardersen (2012) provide data from Malaise traps installed at canopy level, that suggest this species is largely arboreal as an adult. Adult females have been found on sap runs on the trunk of old, live *Aesculus* and *Populus*. **Flowers visited**: various umbellifers, *Crataegus, Cirsium, Dianthus, Euonymus, Euphorbia, Ligustrum, Physocarpus, Rubus fruticosus* and *Sorbus aucuparia*. **Flight period**: May to September, but most records are from June/July. **Developmental stages:** larva in sap runs and damp tree-holes of deciduous trees, notably *Populus* and *Ulmus*. The only available description is that of Dufour (1847), who found the larva in sappy exudate on *Ulmus*. Ahnlund (pers.comm.) has captured females of this species in small traps attached to a high stump of *Populus tremula* and to a burnt, but still living *Betula*, suggesting *C.conopsoides* may be associated with these trees. An adult female has also been seen investigating the trunk of an old, lving *Quercus pubescens*, apparently searching for oviposition sites. **Range**: Finland south to the Mediterranean and N Africa; France east through central Europe and on into Asiatic parts of Russia to the Pacific; China. Rare and decreasing in western Europe. Probably present in Britain in the early 19th.cty. (see Verrall, 1901) but not recorded there since. **Determination**: see Key provided in StN Keys volume. Van Steenis *et al.*(2016) show that *Ceriana caucasica* (Paramonov) is a junior synonym of *C. conopsoides*. **Illustrations of the adult insect:** black and white illustrations of the adult fly are provided by van der Goot (1981), Verlinden (1994) and Barkemeyer (1994). The general appearance of the male of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). The male is figured in colour by Bartsch *et al.* (2009b) and Pétremand *et al.* (2022). Both sexes are illustrated in colour by van Steenis *et al.* (2016).

Ceriana glaebosa van Steenis & Ricarte, in van Steenis *et al.*, 2016
Preferred environment: this species has been collected in herb-rich, open land with patches of scrub and scattered *Cupressus* and *Eucalyptus* plantations. **Adult habitat and habits:** no data. **Flowers visited:** white umbellifers (*Ammi majus:* A van Eck, pers. comm.); *Foeniculum*. **Flight period:** early April/mid June and August/October. **Developmental stages:** not described. There is circumstantial evidence to suggest that the developmental stages of this species may be associated with old/storm-damaged *Cupressus sempervirens* (A. van Eck, pers.comm.). **Range:** Cyprus. **Determination:** see Key provided in StN Keys volume. Both sexes of this species are described in Van Steenis *et al.* (2016), who also figure the male terminalia and provide a key to distinguish *C. glaebosa* from other European and also western asiatic *Ceriana* species. This species is very similar in appearance to *C. vespiformis*. **Illustrations of the adult insect:** coloured illustrations are provided by van Steenis *et al.* (2016).

Ceriana vespiformis (Latreille), 1804
Preferred environment: forest; evergreen oak forest of *Quercus suber* and *Q.ilex* with over mature trees; Mediterranean riparian *Fraxinus angustifolia* forest; Mediterranean *Fraxinus angustifolia/Tamarix* forest. The records of this species from the Netherlands (Reemer & van Aartsen, 2000) are difficult to reconcile with what is known of its ecology. If it were to be established that *C.vespiformis* is breeding under natural conditions in the Netherlands, it would have to be doing so in association with some habitat other than evergreen oak forest. **Adult habitat and habits:** flies fast through more open areas of Mediterranean scrub vegetation at up to 1m from the ground, emitting a very audible, high-pitched whine; settles on vegetation or on the bare ground surface; visits the margins of forest streams to drink, in dappled sunlight. Females may be observed investigating open trunk cavities in *Q.suber*, in the sun. **Flowers visited:** umbellifers; *Mentha pulegium, Thapsia villosa* (Marcos-García, 1985a); *Galium* (Louboutin *et al*., 2023); *Centaurea, Hedera*. **Flight period:** end May/mid July; September. **Developmental stages:** larva figured and described by Rotheray et al.(2006), from larvae found in "decaying roots of a live *Fraxinus aungustifolius* tree". Collected from emergence traps over trunk holes in old, living *Quercus pyrenaica* and *Q. rotundifolia* (Conca-Esquembre, 2024). Females have also been seen investigating holes in rotten parts of an ancient, live *Quercus pubescens*, and Sack (1928-32) states, without quoting the reference involved, that Efflatoun found the larvae of this species in a sap-run on *Morus alba*. The female has been observed ovipositing at the edge of a trunk cavity in an ancient *Fraxinus* sp in Portugal, by Van Eck (pers. comm.). **Range:** Spain and round the Mediterranean basin to Albania and Greece; Roumania and Turkey; Lebanon and Israel and in N Africa from Morocco to Egypt; also known from various Mediterranean islands, including Majorca, Corsica, Sardinia, Sicily, Malta, Crete and Rhodes. On Cyprus *C. vespiformis* is apparently replaced by the closely similar *C. glaebosa*. Reemer & van Aartsen (2000) record *C.vespiformis* from the

Netherlands, based on two specimens collected in 1976 and 1978. Theirs are the only records north of the Alps and away from the Mediterranean zone of Europe. Until and unless data become available to indicate that *C.vespiformis* is established in the Netherlands, it would not seem justified to regard the records from the Netherlands as indicating that the natural range of the species extends that far north in Europe. Other potential explanations for those records would seem more likely. **Determination:** See Key provided in StN Keys volume and Bradescu (1991). **Illustrations of the adult insect:** the adult of this species is illustrated in colour by Birtele (2011) and Rotheray and Gilbert (2011). Both sexes are illustrated in colour by van Steenis *et al.*(2016).

CHALCOSYRPHUS

This generic name has been in existence for more than 50 years, but was only recently (Hippa, 1978) applied to species in the European fauna. Since 1978 some European authors have recognised the genus, while others have not, so that European *Chalcosyrphus* species have variously appeared under *Brachypalpus, Xylota, Chalcosyrphus* or under (as in Peck, 1988) what are now regarded as sub generic divisions of *Chalcosyrphus*, such as *Xylotomima*. Thompson and Rotheray (1998) also regard the monotypic eastern European (and Siberian) genus *Spheginoides* as a subgenus of *Chalcosyrphus*, making *C.obscurus* the only *Chalcosyrphus* species in which the cross-vein r-m is located in the basal half of the discal cell.

Chalcosyrphus eumerus (Loew), 1869
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Rosa canina* (Zimina, 1957). **Flight period:** June/July. **Developmental stages:** not described. **Range:** European Russia (Karelia, Moscow region) and throughout Siberia to the Pacific coast. **Determination:** See Key provided in StN Keys volume. Hippa (1968a) figures the male terminalia. This species is noted for the sexual dimorphism it exhibits. **Illustrations of the adult insect:** none known.

Chalcosyrphus eunotus (Loew), 1873
Preferred environment: forest/freshwater; streamside in deciduous (*Carpinus, Fagus, Quercus*) or mixed forest, including *Fraxinus* woodland, alluvial hardwood forest and brook floodplain forest; up to 1000m in the Alps. Although found more often in association with permanently running water, this species can be found along the bed of seasonal forest streams, where these contain fallen timber. Where beavers are present, this species is known to increase (G. :Popov, pers. Comm.). **Adult habitat and habits:** this is a secretive species, rarely seen as an adult. Most specimens have been found closely associated with running water, usually small or very small streams, where they occur on fallen logs and branches resting partly in the water, or on stones projecting from the water, or on the foliage of large-leaved, water-side plants, either over or beside the water, at up to 1.5m above the water, or on moist stream-edge sand. During hot weather the species appears to visit stream edges to drink. The males patrol along streams, stopping at one appropriate resting place after another and visiting the same resting places repeatedly (most of this information was supplied by U.Schmid and E.T.& D.A.Levy). Mating has been observed by Jukes (A Jukes, pers.comm.). It is apparently initiated by a male launching itself into the air at a passing female, from some vantage point. Mating then takes place while on the wing, and only last for some 15 seconds. **Flowers visited**: no data. **Flight period:** April/July. **Developmental stages:** the puparium has been described and figured by Maibach and Goeldlin (1992), from a larva reared from a container of artificial medium (wet sawdust) placed beside a stream in *Fraxinus* woodland. Jukes (A.Jukes, pers.comm. and Jukes, 2010) has observed oviposition on (and in cracks and crannies of) the bark of small *Alnus* and *Betula* logs (c5cm diameter and less than 1m long) in dappled sunlight, partially submerged in water, on the margin of a small stream within riverine gallery woodland. The eggs apparently took 2-4 weeks to hatch. On hatching, the larvae were observed to make their way into the wood of the log, rather than remaining just under the bark, and there they made tunnels in the wood. The wood of the water-sodden *Betula* logs concerned was fibrous and white. Two or three larvae were found aggregated within the same tunnel. No larvae were found in wood submerged in water. **Range:** Britain, Netherlands, Belgium, France, Germany, Czech Republic, Switzerland, Hungary, Poland, Roumania; in southern Europe from northern Spain, southern France, northern parts of the former Yugoslavia, Armenia, the Caucasus and Turkey. **Determination**: Speight (1999b). See Key provided in StN Keys volume. The male terminalia are partially figured (as *Brachypalpus eunotus*) by Coe (1941). They are also figured by Vujić and Milankov (1999). They are similar to those of the Scandinavian/Siberian species *C.jacobsoni* (Stack.), as figured by Violovitsh (1983) (as *Xylota jacobsoni*) and Hippa (1978), which closely resembles *C.eunotus* in appearance. The female of *C.eunotus* is also rather similar to *C.nemorum* in general appearance, but the male perhaps more closely resembles a small *Brachypalpus*. In the field both sexes could be mistaken for

rather large specimens of *C.nemorum*. **Illustrations of the adult insect:** the male is illustrated in colour by Stubbs and Falk (1983). The species is also illustrated in colour by Ball and Morris (2013) and Schmid (1996).

Chalcosyrphus femoratus (L.), 1758 (not aucct.)
Preferred environment: deciduous forest; *Quercus robur* forest with over-mature trees, but may be associated with *Populus alba* within these forests. **Adult habitat and habits**: runs on foliage of bushes and shrubs in the sun, where it resembles, in both appearance and movements, a large ophionid ichneumon; settles on freshly cut trunks. **Flowers visited**: *Ranunculus repens*. **Flight period**: end May/end July. **Developmental stages:** larva undescribed, but found by Krivosheina, M. G. (2001) in "wood dust" in *Betula* and in rotten wood of *Betula*. Krivosheina, N. P. (2020) records the occurrence of larvae of *C. femoratus* with those of a tipulid, *Libnotes longistigma*, again in "humid wood dust" in trunk cavities in *Betula*. Association of *C. femoratus* with stands of *Populus alba* and *P. canescens* (a naturally occurring, fertile hybrid between *P. alba* and *P. tremula*) along rivers and in wet areas within *Quercus robur* forest, suggests *C. femoratus* may also develop in the rotten wood of these poplar species. *Populus canescens* has both a growth form and bark very simlar to *Betula*, making fallen, dead trees of these species difficult to distinguish from one another. **Range**: Poland south to central France; Belgium and northern France east through central Europe into Russia and on through Siberia almost to the Pacific coast. This is today a very local species in much of Europe, but was clearly more frequent in the past. It should probably be regarded as threatened at European level. **Determination**: See Key provided in StN Keys volume. Thompson et al.(1982) point out that when Loew (1854) segregated his *curvipes* from *femoratus* he unfortunately recognised the wrong segregate as *femoratus*, so that *curvipes* of Loew is the Linnaean *femoratus*. Similarly, the name *femoratus* has been wrongly applied subsequent to Loew, *femoratus sensu auct*. now being correctly referred to as *valgus* (Gmelin). At present, some authors are still applying the name *femoratus* sensu Loew, and it is also used incorrectly in Peck (1988), so there is considerable confusion. The male terminalia of *C. femoratus* are figured by Hippa (1968a), as *C.curvipes*. Here the use of the name *femoratus* L. follows Thompson *et al*. (1982). *C. femoratus* and *C. valgus* are extremely similar to both one another and to *C. rufipes* (Loew). **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Chalcosyrphus jacobsoni (Stackelberg), 1921
Preferred environment: forest/wetland; mosaic of boreal *Picea/Pinus/Betula* forest and mires with overmature and senescent trees and plentiful fallen timber in waterlogged conditions (H.Bartsch, pers.comm.), northwards into the taiga. **Adult habitat and habits:** no data. **Flowers visited:** *Salix* (Pestov, 2010). **Flight period:** June/July. **Developmental stages:** no data. **Range:** northern Norway, northern Sweden, northern Finland, northern parts of European Russia and on to eastern Siberia; the Ukraine (Carpathians). **Determination:** See Key provided in StN Keys volume. *C.jacobsoni* is also distinguished from northern European species in the key provided by Andersson (1988), which does not, however, include *C.eunotus* (Loew). The male terminalia are figured by Hippa (1978). In general appearance, *C.jacobsoni* and *C.nigripes* are rather similar. The females of *C.eunotus* and *C.jacobsoni* are also extremely similar in appearance. **Illustrations of the adult insect:** the general appearance of the female of *C.jacobsoni* is shown in the photo provided by Haarto & Kerppola (2007). The male is figured in colour by Bartsch et al.(2009b).

Chalcosyrphus nemorum (Fabricius), 1805
Preferred environment: forest/wetland; *Alnus/Salix* carr; poorly drained deciduous forest and woodland; alluvial gallery forest; beside ponds and along streams in deciduous forest and woodland; along streams and rivers in mesophilous and thermophilous deciduous forest. **Adult habitat and habits:** on sunlit foliage of bushes etc. overhanging the water along streams in woodland; on trunks of fallen and felled trees beside water; also settles on bare, damp mud/sand at the water's edge, to drink. **Flowers visited:** white umbellifers; *Anemone nemorosa, Caltha, Euphorbia amygdaloides, Potentilla erecta, Ranunculus, Rubus idaeus, Sorbus aucuparia, Taraxacum*. **Flight period:** beginning May/end September. **Developmental stages:** larva described and figured by Hartley (1961); occurs beneath bark of water-sodden deciduous timber, stumps and in damp tree rot-holes in deciduous trees, such as *Betula, Fagus, Populus, Quercus, Salix* and *Ulmus*. Also recorded from under the bark of stumps of *Larix* and *Pinus* and from a water-sodden *Larix* trunk lying partly in the water (Bagachanova, 1990). Krivosheina, N. P. (2020) adds *Abies* to the list of trees used by *C. nemorum* larvae. Jukes (A. Jukes, pers. comm.) has observed oviposition on *Salix* and *Betula* logs, in a log-jam of partially submerged timber across a small river in riverine gallery forest. The larva overwinters and the puparial phase lasts 10 days (Dussaix, 2013). **Range:** Fennoscandia south to the Pyrenees; Ireland eastwards through much of northern, central and southern Europe (to southern Italy) into Russia and on to

the Pacific coast (Sakhalin, Japan); in N America from Alaska to Nova Scotia and south to California. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1978) and Vujić & Milankov (1999). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Chalcosyrphus nigripes (Zetterstedt), 1838
Preferred environment: forest; arctic-alpine *Betula* forest and western taiga (H. Bartsch, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end May/beginning July. **Developmental stages:** not described, but the species was reared by Bagachanova (1990), from larvae collected from under the bark of *Larix* stumps and logs. The species evidently overwinters as a larva. **Range:** Sweden, northern Finland, Siberia. **Determination:** See Key provided in StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007). In its overall appearance it is similar to *C.jacobsoni*.

Chalcosyrphus nitidus (Portschinsky), 1879
Preferred environment: forest; deciduous forest of *Quercus/Carpinus/Ulmus* with overmature trees (M. Krivosheina, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Trollius riederanus* (Gritskevich, 1998). **Flight period:** May/July. **Developmental stages:** larva figured and included in the key provided by Krivosheina (2001), who found it always in the galleries of other insects (e.g. *Temnostoma* spp.) in fallen, rotten wood of *Alnus*, *Tilia* and *Ulmus*. By contrast, Bagachanova (1990) reports rearing this species from larvae found in the bast (phloem) of *Pinus* and *Larix* trunks. **Range:** European Russia, Ukraine and on into Siberia to as far as Sakhalin; also northern China. **Determination:** Violovitsh (1986). The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** none known.

Chalcosyrphus obscurus (Szilady), 1939
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Trollius riederanus* (Gritskevich, 1998). **Flight period:** June. **Developmental stages:** not described. **Range:** parts of European Russia, Ukraine and eastwards through most of Siberia. **Determination:** See Key provided in StN Keys volume. This species appears in nearly all recent literature (including generic keys) as the only representative of the genus *Spheginoides*, normally placed within the Spheginina (as in Peck, 1988). The transfer of this species to *Chalcosyrphus*, as initiated by Thompson and Rotheray (1998), results in *C.obscurus* being the only European representative of the Xylotini in which the wing vein r-m is located in the basal half of the discal cell. The male terminalia are figured in van der Goot (1981) and a brief description of the species is provided by Violovitsh (1986). **Illustrations of the adult insect:** none known.

Chalcosyrphus pannonicus (Oldenberg), 1916
Preferred environment: "swamp" (Drensky, 1934); flushes and beside streams in mesophilous *Picea abies* forest (Ssymank, 2012). **Adult habitat and habits:** no data. **Flowers visited:** *Cirsium* (Mielczarek, 2014), *Pastinaca* (Vujić *et al*, 2021); *Verbascum* (Ssymank, 2012). **Flight period:** June/July. **Developmental stages:** not described. **Range:** Poland, Slovakia, Serbia; Bulgaria; Roumania (trés rare: Bradescu, 1991); Greece (Ssymank, 2012); Georgia. This species is regarded as threatened at the European level. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Mielczarek (2014b). **Illustrations of the adult insect:** Ssymank (2012) provides a coloured photo of the female; Mielczarek (2014b) provides coloured photos of the male.

Chalcosyrphus piger (Fabricius), 1794
Preferred environment: Forest; *Picea* or *Pinus* forest with overmature trees, in the Pyrenees up to and including the *P. uncinata* zone; taiga forest (Krivosheina, N. P., 2020). **Adult habitat and habits**: sits on cut trunks and fallen trees in small patches of sunlight, within forest and on the lower leaves of large-leaved, low-growing plants growing beneath shrubs (e.g. *Salix*) in partial sunlight, at the edge of small open areas within forest or at forest edge. The species visits the margins of streams/small rivers in the sun, to drink under hot conditions, choosing locations where the margin is sandy/muddy, rather than with gravel or stones. **Flowers visited**: umbellifers; yellow composites; *Calluna*, *Crataegus*, *Prunus serotina*, *Ranunculus*, *Seseli* (Baugnée, 1998); *Potentilla erecta* (Bartsch *et al*. (2009b), *Solidago canadense*, *Verbascum*. **Flight period**: May/June, to July/August at higher altitude. **Developmental stages:** larva and puparium described by Heiss (1938), from sappy hollows beneath bark of *Pinus*. Both larva and puparium of this species are figured in colour by Bartsch *et al*. (2009a). Perris (1870) records finding the larvae under bark on the trunk of *Pinus pinaster*, in wet tree humus formed from the

frass of *Ips* and *Acanthocinus*. The female has been observed ovipositing in weeping hollows in bark, caused by woodpecker activity, on the lower trunk of moribund *Pinus uncinata*. Krivosheina (2001) reports rearing this species from under the bark of *Larix* and "Siberian cedar". Krivosheina, N. P. (2020) reports that "its larvae were repeatedly recorded in the galleries of various bark beetles, including *Ips subelongatus* Motsch, and *Dryochoetes baicalicus* Rtt". Bagachanova (1990) similarly reports rearing *C. piger* from larvae collected from the bast of stumps and trunks of *Larix* and *Pinus*, in this instance the trunks being of young trees that had fallen and were lying partly in water. Bagachanova (l. c.) adds that the larvae overwinter under the bark and that the species remains in the puparium for approximately two weeks. **Range**: Scandinavia south to the Pyrenees, increasingly montane southwards; eastwards from northern France through central Europe into Asiatic parts of Russia; also in the Nearctic. A particularly enigmatic species, recently thought to be threatened at the European level and approaching extinction in Western Europe, but now increasing. Recently recorded in the Netherlands and Belgium. **Determination**: See Key provided in StN Keys volume. This species has been referred to in recent literature as *C. pigra, a* mis-spelling not mentioned by Peck (1988). In general appearance and coloration *C. piger* closely resembles *Brachypalpoides lentus*. This resemblance can be particularly close in living male specimens of *C. piger*, when the last visible tergite is almost black, as in *B. lentus*. After death this darkness fades in *C. piger*, to leave the all=orange abdomen characterising the male in dry, pinned specimens. The male terminalia are figured by Hippa (1968a) and Vujić & Milankov (1999). The normal colour form of this species, in which the tergites are largely orange/red, is absent from the island of Corsica, where it is replaced by an entirely black form whose abdomen remains that colour after death. This black form is apparently endemic to the island (*C. piger* is not at present recorded for Sardinia, so it is not known whether the black form of *C. piger* also occurs there). No other morphological differences have been found, between the two colour forms. The black form is easily mistaken for *C. nigripes*, but lacks the patch of black, spinose bristles on the posterior surface of the hind coxae, which are found in *C. nigripes*. I**llustrations of the adult insect:** the adult insect is figured in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Torp (1994).The black form apparently endemic to Corsica is illustrated in Cornuel-Willermoz & Lebard (2024).

Chalcosyrphus rufipes (Loew), 1873

Preferred environment: forest; humid deciduous forest of *Fagus* and sometimes *Quercus* (A.Vujić, pers.comm.), alluvial hardwood forest and riparian gallery forest of *Fraxinus* (M. Krivosheina, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Aruncus asiaticus* (Gritskevich, 1998). **Flight period:** May/July. **Developmental stages:** larva described and figured by M. G. Krivosheina (2001), from larvae found in workings of other insects, in rotten wood under the bark of old trunks and in moist tree-holes of *Populus* and *Tilia*. N. P. Krivosheina (2020) also records the larvae from a fallen *Fraxinus* trunk, adding that it occurs in the galleries of an ambrosia beetle, *Xyloporus saxeseni* Ratz **Range:** Sweden and Finland, Poland, Czech Republic, Slovakia, Hungary, parts of the former Yugoslavia, Roumania, Ukraine, Transcaucasus, from western to eastern Siberia, Mongolia. **Determination:** Bradescu (1991). See Key provided in StN Keys volume. The male terminalia are figured by Vujić & Milankov (1999). **Illustrations of the adult insect:** the male is illustrated in colour by Prokhorov *et al*.(2017).

Chalcosyrphus valgus (Gmelin), 1790 *(femoratus* of auct. not L.)

Preferred environment: coniferous forest; old *Fagus/Picea* forest with overmature trees, toward the upper altitudinal limit of the *Fagus* and in old *Pinus* forest, including western taiga; deciduous forest; old *Quercus/Carpinus* forest. **Adult habitat and habits**: on stumps and freshly cut logs of conifers; both in flight and when settled closely resembles in appearance and movements large ophionid ichneumons. From the observations of L. Mielczarek (pers. comm.): "the male of *C. valgus* flies fast just over ground vegetation, close to poplars. When it reaches a tree, it flies spirally round the trunk, upwards to approximately 2.5 m - presumably to find a female. The male then returns to the base of another trunk and repeats this behaviour 3-4 times, systematically moving forward in the forest. Searching flight behaviour also occurs above fallen logs. Females searching for oviposition sites fly close to trees with wounds, sap runs or with activity of ants". **Flowers visited**: *Campanula, Chaerophyllum, Hypericum, Rubus idaeus, Sorbus aucupariae*. **Flight period**: May/July. **Developmental stages:** larva described and figured by Schmid and Moertelmaier (2007), from larvae reared to last instar in a mixture of damp rotten wood of *Acer, Alnus* and *Picea*, to which eggs laid by a captive female were added. There is strong circumstantial evidence to indicate that the larvae of *C. valgus* can develop in damaged trunks of *Populus alba* (L. Mielczarek, pers. comm.). **Range**: Scandinavia south to the Pyrenees; northern France eastwards through central and southern Europe into Asiatic parts of Russia almost as far as the Pacific coast; China. Today very localised within many parts of its European range, but not so evidently under threat as the closely similar *C.femoratus*. **Determination**: See Key provided in StN Keys volume. The male terminalia are figured (as *C. femoratus*) by Hippa (1968a), and by Vujić & Milankov (1999). This insect appears under the

name *C. femoratus* in much recent literature, including Peck (1988). This nomenclatural muddle is detailed in the account of *C. femoratus*. *C.valgus* closely resemble *C.femoratus*. Distinctions between these two species are indicated in the account of *C. femoratus*. **Illustrations of the adult insect:** the adult male of *C. valgus* is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Torp (1994) and Pétremand *et al*. (2022)..

CHAMAESYRPHUS: see under ***PELECOCERA***

CHEILOSIA

Nearly 300 Palaearctic *Cheilosia* species are listed by Peck (1988), 175 of them from Europe. In reality, the taxonomy of European *Cheilosia* species is a swamp of confusion, error and nomenclatural anarchy, different authors having described new species with little or no attempt being made to first examine type material of existing species, or to establish the limits of intra-specific variation in their own species. Further, species descriptions have been all too often inadequate. To a significant extent, Becker's (1894) confused "revision" of the genus is to blame for this situation, in that he obscured the identity of many existing species and gave descriptions of a host of new species, some of which he described more than once under different names, in the same publication. One of them, *Cheilosia metallina* Becker, even appears to have been from N America, rather than Europe as he assumed. It's synonymy with the N American species *C.hoodiana* Bigot was eventually established by Barkalov (1998). Various of Becker's "species" remain to this day quite uninterpretable without access to the type material and many of the types have been lost or destroyed. Even his figures, which on first acquaintance seem clear and precise, are frequently inaccurate and misleading. Claussen and Speight (2007) highlighted this problem, in relation to both Becker and other authors, in the process consigning nearly 40 *Cheilosia* names to either synonymy or *nomen dubium* status. It also needs to be said that two separate nomenclatures have grown up in Europe and eastern parts of the Palaearctic, so that species at the moment known only from one or the other of these two major geographical areas may well, in reality, occur in both, but under different names. Recently, attempts have been made to stabilise the nomenclature of at least the western European *Cheilosia* species, by dealing with small groups of closely related groups of species, one by one. This has resulted in an ever-increasing number of names being used in the same way by different authors and there is hope that this process will accelerate. One useful outcome is the treatment of all the then known European black-legged, bare-eyed *Cheilosia* species in one publication, by Barkalov and Stahls (1997). More recently, nearly all of the northern European *Cheilosia* species have been keyed out together, in both Finnish and English, in the keys provided by Haarto and Kerppola (2007a). However, there is not, as yet, any key with which all European species of *Cheilosia* can be identified and many of the species still have to be taken as individual problems. The species which constitute "Group A" of various authors are in some recent publications (e.g. Barkalov and Ståhls, 1997; Vujić, 1996) mostly consigned to a separate subgenus or genus, known as *Nigrocheilosia* or *Taeniochilosia*. Other subgeneric concepts are also in use and Ståhls et al.(2004) demonstrate that certain of them have some phylogenetic meaning. A review of the data available about *Cheilosia* larvae was published by Stuke (2000).

Cheilosia aerea Dufour, 1848
Preferred environment: forest/open ground; open areas in mesophilous/thermophilous deciduous forest of *Fagus* and *Quercus*; dry scrub and unimproved dry/very dry grassland. **Adult habitat and habits:** clearings and glades; fields adjacent to woodland and open areas in scrubby dry grassland; fast flying; males hover up to 4m in sunlit glades; both sexes settle on foliage of trees and shrubs and on ground vegetation. **Flowers visited:** white umbellifers, *Crataegus*, *Euphorbia*. **Flight period:** April/October, with peaks in May and July/August. **Developmental stages:** larva reared by Dufour (1848) from among decaying leaves of *Verbascum pulverulentum*. Doczkal (1996b) reports specimens bred from *Verbascum nigrum* and females observed ovipositing on *Verbascum densiflorum*. Stuke (2000) provides a detailed description of the larva. **Range:** Poland south to the Mediterranean; from the Netherlands eastwards through much of central and southern Europe into European parts of Russia as far as the Transcaucasus. **Determination:** van Veen (2004). In *C.aerea*, the postero-dorsal rim of the flat part of mesanepisternite 1 is hairy, whereas in other *proxima* group species it is bare. This species was known in recent literature as *C.zetterstedti* Becker, until Claussen and Thompson (1996) established that *zetterstedti* is a junior synonym of *aerea*. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia ahenea (von Roser), 1840
Preferred environment: open ground; permanent, unimproved grassland from throughout the montane zone up to nearly 2000m, in both calcareous and non-calcareous subalpine pasture, in central Europe. At the extreme western edge of its range,

in Ireland, this species occurs on the coast at sea level, in calcareous Machair grassland. **Adult habitat and habits:** flies close to the ground; males hover at 1-5 metres; often settles on bare ground or stones, in the sun. **Flowers visited:** *Antennaria, Dryas, Hieracium, Ranunculus, Taraxacum*. **Flight period:** May/July. **Developmental stages:** undescribed. **Range:** Ireland, Islay (small island off west coast of Scotland), France (Vosges, Alps, Pyrenees), Germany, Czech Republic, Switzerland, Liechtenstein and Austria; also in northern Spain (Cordillera Cantabrica). **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Speight and Claussen (1987); Barkalov and Ståhls, (1997), who figure the male terminalia. **Illustrations of the adult insect:** none known.

Cheilosia alba Vujić & Claussen, 2000
Preferred environment: forest; humid *Fagus/Abies/Picea* forest and alluvial softwood forest with *Salix alba* (Vujić and Claussen, 2000); humid, mesophilous/calciphilous *Picea* forest. **Adult habitat and habits:** along streams in open areas in forest, or beside rivers and lakes (Vujić and Claussen, 2000). **Flowers visited:** male *Salix* (Vujić and Claussen, 2000). **Flight period:** end March/beginning May. **Developmental stages:** undescribed. **Range:** as yet uncertain, but confirmed from Finland, Germany (Baden-Würrtemberg), Switzerland, Montenegro and Serbia. **Determination:** both sexes are described by Vujić and Claussen (2000), who figure the male terminalia and detail differences between this and other species of the *pini* group. This species is included in the keys to northern European *Cheilosia* species in Bartsch *et al*.(2009b) and Haarto and Kerppola (2007a). A key to aid in separation of the female of *C. alba* from females of related central European species is provided in Tissot *et al*.(2019). **Illustrations of the adult insect:** the female is figured in colour by Bartsch *et al*.(2009b).

Cheilosia albipila Meigen, 1838
Preferred environment: wetland/forest; *Alnus/Salix* carr, clearings, tracksides and other open areas in humid forest, both coniferous and deciduous, up to the altitude of *Larix* forest. **Adult habitat and habits:** tracks and clearings in forest and at the edge of woodland; tracks etc. through carr; males hover at 1-3m, beside bushes etc. **Flowers visited:** *Betula, Caltha, Cardamine, Corylus, Prunus spinosa, Ribes uva-crispa, Salix, Taraxacum, Tussilago, Vaccinium*. **Flight period:** end March/end May. **Developmental stages:** larva described and figured by Rotheray (1988a), from specimens collected from *Cirsium palustre* in pastures. The larva is a stem miner and becomes full-grown by the autumn. Stuke (2000) brings together the available data on larval plant hosts, listing various species of *Carduus* and *Cirsium*, plus *Echinops sphaerocephalus*. The larva is shown in colour, within its stem mine, by Bartsch *et al*. (2009a) and Dussaix (2013). This species overwinters as a puparium. The morphology of the chorion of the egg is figured by Kuznetzov (1988). The general appearance of the puparium is shown in the coloured photo provided by Dussaix (2013). **Range:** southern Fennoscandia south to the Pyrenees; Ireland eastwards through parts of northern and central Europe into European Russia and on to central Siberia. **Determination:** van Veen (2004). Although usually orange-brown, the third antennal segment is more variable in colour in this species than is indicated in keys and can be entirely dark, greyish-brown. Specimens with antennae darkened in this way could be confused with *C.alpina*. The surstyli of the male terminalia of *C.albipila* are figured by Stubbs and Falk (2002) and Violovitsh (1986). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Cheilosia albitarsis (Meigen), 1822 sensu Doczkal, 2000
Preferred environment: open ground/forest; agricultural land and forest clearings; montane and subalpine pasture. An anthropophilic species, favoured by present-day farming practises. **Adult habitat and habits:** edges of forest clearings and tracks; along hedges and in pastures in farmland; males hover up to 5 metres; settles on foliage of shrubs or low growing plants. **Flowers visited:** white umbellifers; yellow composites; *Ajuga, Allium ursinum, Caltha, Crataegus, Matricaria, Potentilla, Ranunculus, Sorbus, Stellaria*. **Flight period:** April/June, and July at higher altitudes. **Developmental stages:** larva described and figured by Rotheray (1991), from larvae collected from rootstock of *Ranunculus* (probably *R.repens*: G.Rotheray, pers.comm.) and illustrated in colour by Rotheray (1994). The specimens reared by Rotheray proved all to be females (G. Rotheray, pers.comm.), so it is not certain that the larval description dependent upon them (Rotheray, 1994) is of the larvae of *C.albitarsis*. However, re-examination of all adult material collected, from the Scottish localities where larvae were found, has established that they all belong to *C.albitarsis* (G.Rotheray, pers.comm.), and according to Gibbs and Plant (2001) *C.ranunculi* is not known in Britain from further north than central England, so it remains extremely probable that the larvae described under the name *C.albitarsis* by Rotheray (1994) are indeed the larvae of that species. **Range:** supposedly throughout the Palaearctic (including N Africa) except the far north and in N America, but requires re-appraisal due to confusion with *C.ranunculi*, Doczkal. **Determination**: can be distinguished from other species except *C.ranunculi* using

most recent keys, e.g. van der Goot (1981). Differences between males of *C.albitarsis* and *C.ranunculi* are detailed by Doczkal (2000a). Both of these species are included in the keys provided by van Veen (2004). Females of these two species are at present indistinguishable. Specimens in which the legs are entirely black are not accomodated in existing keys - they can easily be midetermined as *C.vicina*. **Illustrations of the adult insect:** the appearance of the adult insect is shown by coloured illustrations in Stubbs and Falk (1983), Kormann (1988) and Torp (1994).

Cheilosia alpestris Becker, 1894
Preferred environment: forest/open ground; humid grassy areas within the upper levels of the *Picea* zone and on through the *Larix* zone into humid, unimproved, calcareous subalpine grassland, up to 2000m; open, herb-rich areas within *Alnus viridis* thickets. **Adult habitat and habits:** flies at up to 1m among tall herb vegetation along streams etc. **Flowers visited:** *Ranunculus*. **Flight period:** June/beginning August. **Developmental stages:** not described. **Range:** Alps (France, Switzerland, Austria). **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. In general appearance, this species is similar to *C.derasa* Loew and (in the female), to *C.pedemontana* Rondani. Separation of females of *C.alpestris* from those of *C.pedemontana* may easily be achieved from examination of the thoracic metasternum, which is entirely bare in *C.alpestris*, but has long, pale hairs in *C.pedemontana*. **Illustrations of the adult insect:** none known.

Cheilosia alpina (Zetterstedt), 1838
Preferred environment: forest/open ground; open areas in subalpine *Betula* forest and unimproved alpine grassland in northern Europe (H.Bartsch and T.Nielsen, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Alchemilla, Caltha palustris* (Bartsch et al, 2009b), *Ranunculus* (Bartsch et al, 2009b), *Salix* (T.Nielsen, pers.comm.). **Flight period:** early May/July. **Developmental stages:** not described, but Bartsch et al.(299b), provide information suggesting that larval development occurs in *Angelica*. **Range**: supposedly northern Europe and Siberia, from Norway to the Pacific, plus Germany and Mongolia. **Determination:** Claussen (1998), who also figures the male terminalia. This species is also included in the key to Fennoscandian *Cheilosia*, provided by Bartsch et al.(2009b). Intraspecific variability of this species and the closely related *C.montana* Egger results in sufficient overlap in their characteristics to call into question the validity of recognising both taxa as species. The identity of females, in particular, can be very difficult to decide. This species is included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Haarto and Kerppola (2007a). **Illustrations of the adult insect:** none known.

Cheilosia andalusiaca Torp Pedersen, 1971
Preferred environment: sparsely vegetated, open, rocky ground from 900m to above 2300m (Marcos-García, 1987b). **Adult habitat and habits:** sun bathes on rocks in the first hours in the morning (pers.comm. A. -M. Marcos-García). **Flowers visited:** no data. **Flight period:** April/May and June at higher altitudes. **Developmental stages:** undescribed. **Range:** Spain (in mountain ranges from the north to the south of the Iberian peninsula). **Determination:** Torp Pedersen (1971) describes the male of this species. Marcos-García (1987b) describes the female. In Ballester-Torres *et al*. (2024) *C. andalusiaca* is included in a key to Iberian species of the *melanura/vernalis* group and features of its male genitalia are figured. This species is apparently similar in appearance to *C. rhynchops* (C. Claussen, pers. comm.). **Illustrations of the adult insect:** none known.

Cheilosia angustigenis Becker, 1894
Preferred environment: forest; open areas in boreal *Betula* forest (Nielsen, 1980a) and western taiga (Nielsen, 1998). **Adult habitat and habits:** no data. **Flowers visited:** *Acer platanoides, Anemone nemorosa* (Nielsen, 1980a*), Caltha, Crataegus, Viburnum opulus* (Bartsch et al, 2009b), *Prunus padus, Salix* (van Steenis, 1998b). **Flight period:** beginning May/August. **Developmental stages:** not described. **Range:** northern Europe and Siberia, from Norway to the Pacific. **Determination:** this species is included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Bartsch et al.(2009b) and Haarto and Kerppola (2007a). Violovitsh (1986) figures the male terminalia. Claussen (2000) also figures the male terminalia, and points out that *C.angustigenis* exhibits a most unusual feature among *Cheilosia* species, in possessing a complete probasisternal bridge in front of the fore coxae. **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a).

Cheilosia antiqua (Meigen), 1822
Preferred environment: forest/open ground; deciduous forest and unimproved pasture, including montane/subalpine pasture. **Adult habitat and habits:** clearings and beside tracks in woodland; also along old hedgerows; in the open in montane pasture; flies low and settles on low-growing plants and bushes; males hover up to 4 metres. **Flowers visited:** *Caltha, Cardamine, Fragaria, Iris, Ranunculus, Taraxacum* **Flight period:** April/June, with occasional specimens in March and July. **Developmental stages:** described and figured by Rotheray (1991) and illustrated in colour by Rotheray (1994); known to feed within the roots of various *Primula* species, including *P. elatior*. **Range:** Ireland through to central Europe and southern Europe (former Yugoslavia) and on into European parts of Russia. Apparently not recorded from further north than Denmark. **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994).

Cheilosia aristata Barkalov and Ståhls, 1997
Preferred environment: open ground; almost bare, hot and sunny siliceous rocky slopes at 2300m. - 2400m, with *Androsacion alpinae* communities (P.Goeldlin, pers.comm.). **Adult habitat and habits:** males rest on rocks heated by the sun, flattening themselves closely against the rock surface. They do not hover, but dart rapidly at any flying insect that approaches the rock they are resting on, returning almost immediately to the position they vacated. Each male is strongly territorial, chasing away other males that arrive in the vicinity of its chosen rock. The female flies extremely fast and within 2-3 cm of the ground surface (all data pers.comm. P.Goeldlin). **Flowers visited:** *Silene rupestris* (P.Goeldlin, pers.comm.). **Flight period:** mid July/mid August. **Developmental stages:** not described. **Range:** Alps (Switzerland). **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. Barkalov and Ståhls (l.c.) refer to the mesosutal hair covering as predominantly "yellow" in the male of this species, but although the hairs are certainly pale-coloured they are more silver-grey than yellow. In both sexes, the postero-dorsal, triangular extension of mesanepisternite 1 carries long hairs in *C.aristata*, as in *C.ahenea*. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). **Illustrations of the adult insect:** none known.

Cheilosia balkana Vujić, 1994
Preferred environment: forest/open ground; open areas within humid *Fagus* forest and upwards into subalpine grassland to 2000m (Vujić, 1996). **Adult habitat and habits:** in open grassy and rocky ground; males hover at 5-7m (Vujić, 1996). **Flowers visited:** *Alyssum* (Vujić, 1996). **Flight period:** mid June/mid July (Vujić, 1996). **Developmental stages:** undescribed. **Range:** Alps (Italy) and Balkans (Montenegro, Serbia, Slovenia). **Determination:** Vujić (1994). This is a "*proxima* group" species. **Illustrations of the adult insect:** none known.

Cheilosia barbafacies Vujić & Radenković, in Vujić *et al*., 2013b
Preferred environment: forest; deciduous forest (Vujić *et al*., 2013b). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July (Vujić *et al*., 2013b). **Developmental stages:** not described. **Range:** Bosnia-Herzegovina, Montenegro (Vujić *et al*., 2013b). **Determination:** this species is described in Vujić *et al*. (2013b). Both sexes of the species are described, the male terminalia figured and a key is provided, distinguishing *C. barbafacies* from related species. **Illustrations of the adult insect:** none known.

Cheilosia barbata Loew, 1857
Preferred environment: young deciduous woodland and scrub on well-drained soils and dry, unimproved grassland at altitudes up to and including montane pasture; more associated with open areas within forest towards the southern edge of its range. **Adult habitat and habits**: open areas within woodland, especially beside streams; settles on vegetation up to 4 metres; males hover at 4 - 10 metres over tracks etc. **Flowers visited**: *Caltha, Chaerophyllum, Crataegus, Euphorbia, Ranunculus, Sambucus, Taraxacum* and most white umbellifers (list in de Buck, 1990), where it may be found in numbers. **Flight period**: May/August, with a peak in July/beginning of August. **Developmental stages:** undescribed. **Range:** Scandinavia south to central Spain; Britain east through most of central Europe to parts of European Russia; through upland areas of southern Europe to the former Yugoslavia. **Determination:** van der Goot (1981). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia beckeri Strobl, 1910
Preferred environment: open ground, alpine zone. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Developmental stages:** not described. **Range:** Austria. **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; the female lectotype was redescribed by Barkalov and Ståhls (1997) and included in their key, where it keys out next to the Kazak species *bakurianiensis* Kuznetzov, from which it seems to differ in only minor features. Strobl (1910) includes a number of males in his description of this species, but whether they all belong to the same taxon is doubtful. Barkalov and Ståhls (1997) include the male of b*eckeri* in their key, presumably on the basis of Strobl's description, since they state "We do not know the male of this species". **Illustrations of the adult insect:** none known.

Cheilosia bergenstammi Becker, 1894
Preferred environment: open ground; open, grassy areas in coniferous and deciduous forest, up to the upper altitudinal limit of *Picea*; eutrophic dune grassland; unimproved alpine pasture and also sheep pasture in parts of Europe with a moist climate. Being poisonous to cattle and horses, the normal larval food-plant of *C.bergenstammi*, *Senecio jacobaea*, is systematically removed from grassland grazed by these animals, so it is unusual to find this syrphid in pasture grazed by cows or horses. **Adult habitat and habits:** edges of clearings, tracks and fields; males hover at 2-5 metres. **Flowers visited:** *Allium, Caltha, Geranium, Hieracium, Ranunculus, Senecio, Taraxacum,* umbellifers. **Flight period:** April/June and middle July/September. **Developmental stages:** the larva is an internal feeder in stems of *Senecio,* especially *S.jacobaea,* but probably also in other species, e.g. *S.palustris, S.erucifolia*; described and figured by Smith (1979). **Range:** Scandinavia south to the Pyrenees and northern Spain; Ireland east through central Europe to European parts of Russia. **Determination:** van der Goot (1981). Females of *Cheilosia vernalis* with the third antennal segment orange and few black eye hairs can easily be mistaken for small specimens of *C.bergenstammi*. The eye hairs extend almost to the lowest extremity of the eye in *C.vernalis*, but are absent from the ventral third of the eye surface in *C.bergenstammi*. Also, in *C.vernalis* the clypeus is c.1.5x as long as wide, but 2x as long as wide in *C.bergenstammi*. The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994).

Cheilosia brachysoma Egger, 1860
Preferred environment: unimproved/almost unimproved (subject at most to addition of occasional organic fertiliser), humid, oligotrophic/mesotrophic montane grassland (at 800-1000m) with streams and flushes, subject to light/moderate grazing by cows (pers.comm.C.Claussen, D.Doczkal and A.Maibach). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** second half April/beginning June. **Developmental stages:** undescribed. **Range:** Poland, Germany, Switzerland, Austria and Roumania. This species appears to be extremely scarce and should be regarded as threatened. **Determination:** Sack (1928-32). But the female cannot reliably be determined using Sack's (l.c.) keys, since it is keyed out as a species with hairy eyes, although in the female the eye hairs may be virtually non-existent. The male is similar to *C.vernalis* in general appearance and the species has to be regarded as a member of the *vernalis* group, whose component taxa still pose considerable taxonomic problems. Claussen and Vujić (1995) provide means of separating females of *C.brachysoma* from females of *C.clama*. **Illustrations of the adult insect:** none known.

Cheilosia bracusi Vujić & Claussen, 1994
Preferred environment: forest/open ground; open areas along streams, in humid *Fagus* forest upwards into unimproved, subalpine grassland, both calcareous and non-calcareous. **Adult habitat and habits**: flies fast and low, settling on low-growing plants. Males hover at up to 3m. **Flowers visited:** composites, crucifers, umbellifers; *Aposeris foetida, Ranunculus, Telekia speciosa, Trollius*. **Flight period:** end April/July. **Developmental stages:** not described. **Range:** Portugal; Pyrenees (France, Spain); Jura (France, Switzerland); central Germany, Alps (France, Austria, Italy); Apennines (northern Italy); Balkans (Bulgaria, Bosnia, Croatia, Macedonia, Montenegro, Serbia, Slovenia); Caucasus (Georgia). **Determination:** Vujić and Claussen (1994b), who figure the male terminalia. In the field, this species is easily mistaken for either *C.canicularis* (Panz.) or *C.fraterna* (Mg.) and occurs in similar situations. Females of *C.bracusi* and *C.fraterna* are difficult to distinguish. These two species are included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** none known.

Cheilosia brunnipennis Becker, 1894
Preferred environment: forest/freshwater; forest; along streams in thermophilous *Quercus* forest (Vujić (1996); garrigue and maquis. **Adult habitat and habits:** flies fast among waterside shrubs, settling on branches etc. (Vujić (1996); males hover over *Prunus* shrubs in flower, at 2-3m; both sexes have a rapid, darting flight more reminiscent of *Syritta* than a

Cheilosia species. **Flowers visited:** *Petasites, Salix* (Vujić, 1996); *Euphorbia characias* (Ssymank and Ebejer (2009); *Prunus mahaleb, P. spinosa, Pyrus spinosa, Viburnum tinus*. **Flight period:** February/mid May; end March/beginning June in N Africa (Kassebeer, 1998). **Developmental stages:** not described. **Range:** southern France, northern Italy, Balkans (Bosnia, Bulgaria, Croatia, Greece, Macedonia, Montenegro, Serbia), Roumania, southern Russia, Ukraine, Israel and N Africa (Morocco). **Determination:** Bradescu (1991). Vujić (1996) established that *sareptana* Becker is a synonym of *C.brunnipennis*. Kaplan and Thompson (1981) provide a detailed description of the male of *C.brunnipennis* (as *sareptana*) and figure its terminalia. *C.brunnipennis* is very similar in appearance to *C.flavipes* (Panzer). Vujić and Claussen (2000) provide a key separating males of *C.brunnipennis* from those of *C.flavipes*, but their key to females does not include *C.brunnipennis*. In their key to females *C.brunnipennis* would run to the second couplet, but then does not correspond to either option, because it has broad ocular strips (distinguishing it from *C.uviformis*) but most tarsal segments yellow, not entirely black as in the other species with broad ocular strips. **Illustrations of the adult insect:** the general appearance of the male of this insect can be seen from the coloured photo provided by Vujić *et al*.(2020d).

Cheilosia caerulescens (Meigen), 1822

Preferred environment: rocky, unimproved calcareous and non-calcareous subalpine grassland and heath to above 2000m; ornamental gardens at lower altitudes, with *Sempervivum*. All the records from lower altitudes appear to be recent. Whether ths species has recently adapted to use of some low altitude plant species as larval host, or is just using *Sempervivum* in gardens (having been transported to lower altitude by some garden enthusiast who collected *Sempervivum* in the wild?) is unclear. The recent British records are definitely from suburban gardens, one of them of specimens bred from *Sempervivum* imported to Britain from horticultural suppliers in the Netherlands (Collins and Halstead, 2008). **Adult habitat and habits:** fast flying, within 1m of the ground, in rocky grassland; both sexes rest in the sun on the surface of boulders and stones, out of the wind. **Flowers visited:** white umbellifers; yellow composites; *Allium ursinum, Chrysanthemum, Cirsium, Crataegus, Geum, Origanum, Ranunculus, Sempervivum*. **Flight period:** end April/beginning September, with peaks in May and August. **Developmental stages:** d'Aguilar and Coutin (1988) reared the species from larvae found in the fleshy leaves of *Sempervivum*, where they were causing lesions. *C. caerulescens* is apparently becoming a "back garden species" in parts of Atlantic Europe (e.g. in Britain, see Ball and Morris, 2021). Features of the larva are described and figured by Stuke (2000). Now that it is regarded as a "pest" of horticulture and ornamental gardens**,** information about the larva can be gleaned from horticultural websites, according to which *C. caerulescens* is the only leaf miner of *Sempervivum* known in Europe. Larval development can occur (at low altitudes, in gardens and parks) successfully in the leaves of the European houseleeks *Sempervivum arachnoideum, S. grandiflorum, S. montanum* and *S. tectorum*, where the larva makes large, blotchy, irregular mines. Oviposition occurs on the central part of the leaf rosette of the plant and larvae can be found mining leaves between May and September, exiting leaves through a hole made at the leaf base. Pupariation occurs loose in the soil, where the puparium overwinters. It is assumed here that all the information, available from horticultural sources, on the *Cheilosia* mining *Sempervivum* leaves applies to *C. caerulescens*. But, given the prolonged period over which larvae have been observed in the leaves, plus the use of three different *Sempervivum* species, more than one *Chelosia* species may be involved. The larval host plants of the closely-related and very similar *C. laeviventris* and *C. venosa* remain unknown. If either of those subalpine species use the high altitude *Sempervivum montanum* as larval host plant for instance, and have been introduced to low altitude gardens and parks in the same way as *C. caerulescens*, their presence could easily go un-noticed. **Range**: Britain and the Netherlands south to the Pyrenees; France eastwards through central Europe as far as European parts of Russia and southeast to the former Yugoslavia and Roumania. Lowland records in the Atlantic zone of Europe are derived from human introduction of *Sempervivum* carrying *C. caerulescens* larvae to ornamental gardens. The rapid spread of *C. caerulesecens* in Britain, between 2006, when it was first found there, and 2018, is detailed by Ball and Morris (2021), who note that nearly all the records are from photographs originating in suburban gardens and apparently involving the easily recognisable larval mines in the leaves of *Sempervivum*. **Determination:** Ståhls & Barkalov (2017) provide a key for the separation of this species from others of the *caerulescans* group. *Cheilosia caerulescens* is a very variable species, with legs ranging from obviously partly yellow to almost entirely black and with wings from heavily marked with brownish clouds to entirely clear. Dark forms of this species may be mistaken for *C.laeviventris* Loew or *C.venosa* Loew, and the male terminalia of these species are indistinguishable. Colour of the hair covering of the mesoscutum is also variable, as is the extent to which black bristly hairs are intermixed. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Schmid (1996); Bot and Van de Meutter (2019) and Ball and Morris (2013).

Cheilosia candida Vujić & Radenković, in Radenković *et al*. 2020
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** holotype from the Pindos mountains (central Greece). **Determination:** the description of this species is based on a single male collected more than 30 years prior to its description and there is no genetic information available for it. The females is unknown. Features of the male are figured in Radenković *et al*. (2020b), including its terminalia, together with a key to separate *C. candida* from closely-related European *Cheilosia* species. The unknown female of *C. candida* is included in the key, based on presumed morphological features and assumptions on the geographical distribution of the species. *Cheilosia candida* is consigned to the group of species including *C. cumanica, C. hypena* and *C. laticornis* (subgenus *Convocheila*). Disparities between the nomenclature of this species, as referred to in Vujić *et al*. (2020d) and Radenković *et al*. (2020b), are resolved in Vujiç *et al*., (2021a). **Illustrations of the adult insect:** the general appearance of *C. candida* can be seen in the coloured photo of the male in Vujić *et al*. (2020d).

Cheilosia canicularis (Panzer), 1801
Preferred environment: forest/wetland, open areas along streams with marginal tall herb vegetation in humid *Fagus* forest and *Abies* forest, up to the upper limit of *Abies* forest. **Adult habitat and habits:** clearings, tracksides, along streams and in pasture; settles on foliage of bushes and ground flora, especially *Petasites*. **Flowers visited:** umbellifers, yellow composites; *Cirsium arvense*. **Flight period:** end June/September. **Developmental stages:** the larva is undescribed, but has been reared from *Petatites hybridus* (Stuke and Claussen, 2000). It is uncertain whether this species overwinters as larva or puparium. **Range:** requires redefinition, following reinstatement of *C. himantopus* (Stuke & Clausen, 2000), with which *C. canicularis* was previously confused. At present confirmed from Denmark; France (Alpes Maritimes); Germany; Czech Republic; Switzerland (Jura); Austria; Slovakia; Italy (Alps, Apennines); the Balkan peninsula (Greece, Montenegro, N Macedonia, Slovenia, Serbia); Turkey; Caucasus (Georgia). **Determination:** Stuke and Claussen (2000), who provide features for separating this species from the closely similar *C.himantopus* and figure the terminalia of both. Both of these species are also included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b); Bot and Van de Meutter (2019) and Torp (1984).

Cheilosia carbonaria Egger, 1860
Preferred environment: near flushes, springs and seasonal streams in pasture and scrub woodland on well-drained and usually calcareous soils, from alluvial hardwood forests up to within the *Fagus/Picea* forest zone. **Adult habitat and habits:** edges of woodland clearings and tracks; field hedges; usually close to a river or stream; flies low and rather fast. **Flowers visited:** white umbellifers; yellow composites; *Allium ursinum, Caltha, Cirsium, Myosotis, Pulicaria, Ranunculus*. **Flight period:** May/June and July/September. **Developmental stages:** undescribed. **Range:** Scandinavia south to the Pyrenees; southern England eastwards into central Europe, including European parts of Russia, and on into Siberia. **Determination:** there has been confusion between this species and *C.cynocephala* in some accounts. It may be determined using van der Goot (1981). This species is also included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Haarto and Kerppola (2007a). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch et al.(2009b), Kormann (1988) and Torp (1994).

Cheilosia chloris (Meigen), 1822
Preferred environment: forest/open ground, grassy areas within *Fagus/Picea* forest and scrub and old, unimproved pasture, apparently not extending above the upper altitudinal limit of *Fagus*. **Adult habitat and habits:** clearings, tracksides etc.; flies low over ground vegetation. **Flowers visited:** yellow composites; umbellifers; *Allium ursinum, Caltha, Euphorbia, Frangula alnus, Prunus spinosa, Ranunculus, Salix, Sorbus aucuparia.* **Flight period:** April/June. **Developmental stages:** the larva is undescribed, but the female has been observed egg-laying on *Cirsium oleraceum* (Doczkal, 1996b), and the larval association with that plant was confirmed by Stuke (2000). **Range:** Fennoscandia south to the Pyrenees; Belgium east through much of Europe into European parts of Russia and on into Siberia. **Determination:** van der Goot (1981). This species is very similar to *C.fraterna* (Mg.) and *C.bracusi* Vujić and Claussen. Distinctions between *C.chloris* and *C.bracusi* are detailed by Vujić and Claussen (1994). **Illustrations of the adult insect:** this species is illustrated in colour by Kormann (1988) and Torp (1994).

Cheilosia chrysocoma (Meigen), 1822
Preferred environment: wetland/forest: *Alnus-Salix* woodland; fen carr & alluvial softwood forest. **Adult habitat and habits:** tracks and glades, on low-growing vegetation in the sun. **Flowers visited:** *Caltha*, **Crataegus**, *Narcissus, Prunus, Ranunculus, Salix,* inc. *S.viminalis*. **Flight period:** April/June. **Developmental stages:** larva undescribed, but the adult female has repeatedly been observed (Doczkal, 1996b) egg-laying on *Angelica sylvestris*, providing strong evidence that this is a larval host plant. Bagachanova (1990) reports rearing this species from a Chinese umbellifer (*Cnidium*). **Range:** Scandinavia south to northern Spain, Italy and Bulgaria; Ireland eastwards through central Europe to European parts of Russia and on into Siberia. **Determination:** van der Goot (1981). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch et al.(2009b), Stubbs and Falk (1983), Torp (1994) and Kormann (1988).

Cheilosia circassica Ståhls & Barkalov, 2017
Preferred environment: unimproved subalpine grassland (Ståhls & Barkalov, 2017). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** European Russia (northern edge of the Caucasus mountains). **Determination:** the description of this species is based on two males. The female remains unknown. It is consigned to the *caerulescens* group. Ståhls & Barkalov (2017) provide a key for separation of the male from males of other *caerulesens*-group species and figure the male terminalia. **Illustrations of the adult insect:** none known.

Cheilosia clama Claussen & Vujić, 1995
Preferred environment: forest/open ground; humid, open grassy areas in *Fagus/Picea* forest upwards through the *Picea* zone and on into *Pinus cembra* forest and the *Larix* zone. **Adult habitat and habits:** grassy clearings and tracksides, usually close to streams (Vujić, 1996); females fly low and fast, with a rapid, zigzag flight, settling on leaves of low-growing plants (e.g., *Caltha*) in the sun. **Flowers visited:** *Caltha, Salix, Taraxacum, Tussilago*. **Flight period:** beginning May/June. **Developmental stages:** not described. **Range:** uncertain, due to confusion with other species until recently, but confirmed from France, Germany, Switzerland, Serbia and Bosnia. **Determination:** Claussen and Vujić (1995), who figure the male terminalia. The male of this species bears a superficial resemblance to *C.nebulosa* Verrall, while the female resembles *C.psilophthalma*, though its eyes are entirely bare and its claws are paler in colour. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019).

Cheilosia clausseni Barkalov and Ståhls, 1997
Preferred environment: sparsely vegetated, rocky, open ground in the subalpine zone, from 2000 - 2500m. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** beginning July/end August. **Developmental stages:** not described. **Range:** Alps (Austria, northern Italy). **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). Specimens of *C.clausseni* with antennal segment three partly orange/red can easily be mistaken for *C.pilifer*, these two species sharing the feature of long, black hairs on the ventral surface of the hind femora, a condition rare in bare-eyed, black-legged *Cheilosia* species. Further, they both occur in the subalpine zone. *C.clausseni* can also occur with almost entirely black antennae. **Illustrations of the adult insect:** none known.

Cheilosia crassiseta Loew, 1859
Preferred environment: open ground; unimproved, non-calcareous grassland, from within the upper part of the *Abies/Picea* zone upwards into alpine grassland to 2500m. (P.Goeldlin, pers.comm.). **Adult habitat and habits:** flies extremely close to the ground and settles on bare ground or rocks, in the sun (P.Goeldlin, pers.comm.) **Flowers visited:** no data. **Flight period:** June, July at higher altitudes. **Developmental stages:** not described. **Range:** Poland, Alps (Switzerland, Austria, Italy), Slovakia, and Slovenia. **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). Males in which the third antennal segment is entirely dark grey-brown/black and the mesoscutal hairs are entirely pale cannot be correctly determined using Barkalov and Ståhls (1977), where they would run to *C.ahenea*, but in *C.crassiseta* the posterior triangle of the anterior part of the mesopleur (mesoanepisternite 1) is bare of hairs and the third antennal segment is rounded apico-dorsally. **Illustrations of the adult insect:** none known.

Cheilosia cumanica Szilady, 1938
Preferred environment: forest; deciduous forest; herb-rich open areas in thermophilous *Quercus* forest (*Q.cerris/Q.pubescens*). **Adult habitat and habits:** flies low, settling of foliage of large-leaved bushes and umbellifers (Vujić, 1996) and on foliage of trees such as *Tilia*, at up to 2m from the ground (A.Vujić, pers.comm.); males hover at up to 3m (A.Vujić, pers.comm.). **Flowers visited:** *Smirnium* (Vujić, 1996), composites (A.Vujić, pers.comm.). **Flight period:** March/August (Vujić, 1996). **Developmental stages:** not described. **Range:** Balkans (Bosnia-Herzegovina, Macedonia, Montenegro, Serbia); Carpathians (Roumania, Serbia); Caucasus (Georgia); southern parts of European Russia; Iran. **Determination:** Radenković *et al*. (2020b), provide a key separating both sexes of *C. cumanica* from the other European species of this group (subgenus *Convocheila*), like *C. laticornis, C.hypena* etc., including figures of the male terminalia of *C. cumanica*. The female is separated largely on the basis of biogeographical data, rather than morphological data. This species is also included in the keys of Bradescu (1991), who also provides a sketch of the male terminalia. **Illustrations of the adult insect:** none known.

Cheilosia cynocephala Loew, 1840
Preferred environment: Open ground; near rivers, streams or flushes in unimproved grassland, usually on calcareous soils, including unimproved montane pasture. **Adult habitat and habits:** flies among low-growing plants; flight rapid. **Flowers visited:** white umbellifers; *Calluna vulgaris, Cirsium arvense, Parnassia palustris, Pulicaria, Ranunculus, Salix repens, Saxifraga azoides, Scabiosa, Senecio, Sonchus.* **Flight period:** July-October, with peaks in July and September. **Developmental stages:** larva described by Dusek and Laska (1962). It evidently mines the stems of *Carduus nutans*. Ball *et al*. (2011) indicate the species is also associated with *Carduus crispus*. The information brought together by Stuke (2000) shows *Cirsium palustre* and *C. vulgare* can also act as larval plant hosts. **Range:** Fennoscandia south to central France; southern England eastwards through central Europe and on into central Russia; southwards into mountainous parts of northern Italy and the former Yugoslavia. **Determination:** In lowland situations, this species is frequently, and easily, confused with *C.impressa*. In the Alps, dark male specimens of *C.melanura* or *C.vernalis* with a bluish tinge may be mistaken for this species. *C.cynocephala* is more variable in size than many other *Cheilosia* species, from the dimensions of *C.melanura* down to those of *C.vernalis*. Available keys, such as those in van der Goot (1981), will help to distinguish *C.cynocephala* from *C.impressa, but* distinction of the males from *C.melanura* and *C.vernalis* on any basis other than the blue-black colour of *C.cynocephala* can be difficult. The male terminalia of these three species are illustrated by Violovitsh (1986), but his figures are not particularly helpful. The surstyli of the male terminalia are also figured by Stubbs and Falk (2002). Falk (2004) discusses the differences between males of spring and summer populations of *C.cyanocephala* in Britain and how they may be distinguished from *C.vernalis*. **Illustrations of the adult insect:** the male is figured in colour by Bartsch et al.(2009b).

Cheilosia derasa Loew, 1857
Preferred environment: freshwater/open ground; stream margins with *Petasites, toward* the upper limit of *Abies*/*Picea* forest and montane/subalpine, unimproved, calcareous and non-calcareous grassland and grassy clearings with *Adenostyles* or *Petasites*. **Adult habitat and habits:** flying among *Adenostyles* or *Petasites* foliage, or settled on their leaves. **Flowers visited:** *Ranunculus*. **Flight period:** end May/July. **Developmental stages:** undescribed. **Range:** Poland, the Alps (France, southern Germany, northern Italy, Switzerland, Liechtenstein, Austria) Roumania and parts of the former Yugoslavia; also supposedly from northern Spain and the Pyrenees. **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. Sack's (1930-1932) key is misleading in respect of this species, since he indicates that *C.derasa* possesses only 2 bristles on the posterior margin of the scutellum, though up to 6 bristles may be present. A particular feature of *C.derasa* is that in the wing the alula is more than six times as long as its maximum width, appearing strap-like, almost parallel-sided, a condition most unusual among *Cheilosia* species. **Illustrations of the adult insect:** coloured photos of the male and female are provided by Speight and de Courcy Williams (2018).

Cheilosia fasciata Schiner & Egger, 1853
Preferred environment: forest and open ground; humid deciduous forest, including alluvial hardwood forest, usually close to water; unimproved subalpine grassland. **Adult habitat and habits:** normally found flying low among vegetation in the immediate vicinity of the larval food-plant, at the edge of clearings, etc.; males hover low over stands of *Allium ursinum* and both sexes rest on the leaves of this plant. According to Hövemeyer (1992), the adult female shelters from bad weather within the soil litter layer. **Flowers visited:** *Allium ursinum, Chrysosplenium alternifolium, Ranunculus, male Salix, Tussilago*.

Flight period: end March/May, when associated with *Allium ursinum*, but June when associated with *A.victorialis*. Hövermeyer (1992) presents data to show that the sex ratio of the adult flies can be influenced by puparial parasitism, which seemingly reduces the representation of males in the population. **Developmental stages:** the larva mines the leaves of the closely similar *Allium* species *A. ursinum* and *A. victorialis*. The final instar larva may move from one leaf to another if its food supply becomes exhausted; larva figured by Dusek and Laska (1962) and both figured and described by Rotheray (1990). The larva is also illustrated in colour by Schmid (1996); larval biology described by Nielsen (1979). Detailed biological information on the development of this species is provided by Hövemeyer (1992). The egg and larval stages together take 8 weeks, after which pupariation takes place in the soil in the vicinity of the host plant. The species overwinters as a puparium, usually within the top 3cm of the soil. This insect is more easily recorded as a larva than as an adult, the larval mines being very distinctive and obvious when the larvae are maturing in *A. ursinum* leaves in May. Schmid and Grossmann (1998) contrast the life history details of populations associated with *A. ursinum* (low altitude) and *A. victorialis* (high altitude) in central Europe. De Groot and Kogoj (2015) observe that, within the altitudinal range of the *A. ursinum*, maximum densities of *C. fasciata* occurred at the highest altitudes. **Range:** southern Norway; Denmark south to central France; the Alps and northern parts of the Balkans; Bulgaria and Roumania. **Determination:** van der Goot (1981). Both sexes of this species have the central area of the mesoscutal disc entirely undusted and brightly shining black, separating *C. fasciata* from both *C. rhodiolae* and *C. semifasciata*, in which the mesoscutum is uniformly dusted over its entire surface. A key for the separation of these three species is provided in Speight *et al*.(2017). **Illustrations of the adult insect:** the adult insect is illustrated in colour in Kormann (1988), Schmid (1996) and Bartsch et al.(2009b).

Cheilosia faucis Becker, 1894

Preferred environment: open areas in montane *Picea* forest (Vujić, 1996) and upwards into open areas within *Alnus viridis* thickets and on into unimproved, subalpine grassland to 2000m in the Alps. **Adult habitat and habits:** within forest in the montane zone beside streams in open areas, flying up to some metres from the ground round *Salix* etc; males hover in small open areas and settle on foliage of large-leaved shrubs, like *Alnus viridis*. **Flowers visited:** *Ranunculus, male Salix.* **Flight period:** May/June. **Developmental stages:** not described. **Range:** uncertain, due to confusion with other species, but confirmed from the Pyrenees (France, Spain), Massif Central and Jura (France, Switzerland), Alps (France, Germany, Switzerland, Austria, Italy), the Czech Republic, Dinaric mountains (Montenegro) and the Carpathians (Roumania). **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). **Illustrations of the adult insect:** none known.

Cheilosia flavipes (Panzer), 1798

Preferred environment: forest/open ground; small open areas in humid *Fagus* forest upwards through the *Picea* zone and into the subalpine zone. **Adult habitat and habits**: clearings, glades and tracksides etc.; settles on low-growing vegetation **Flowers visited**: *Caltha, Euphorbia, Ranunculus, Salix, Sorbus aucuparia, Taraxacum*. **Flight period**: April/June, and July at higher altitudes. **Developmental stages:** the larva remains undescribed, but the adult female has been observed (Stuke, 1996) egg laying on *Cirsium arvense* and *Taraxacum officinale*. Subsequently, Stuke (2000) lists only *Taraxacum* species as larval plant hosts. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Sweden and Finland southwards, primarily through mountainous regions, to the Pyrenees and the Alpes-Maritimes, throughout the Alps to the former Yugoslavia and Bulgaria; through northern Europe into western parts of Siberia. **Determination**: the female is noticeable on account of its almost entirely yellow legs. The male is more easily misdetermined. In both sexes this species closely resembles another southern European species, *C. brunnipennis* Becker, from which it may be distinguished using the keys provided by Bradescu (1991). This species is included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Haarto and Kerppola (2007a). **Illustrations of the adult insect:** the male of *C. flavipes* is illustrated in colour by Bartsch *et al*. (2009b), the female by Torp (1994) and Francois *et al*. (2019).

Cheilosia flavissima Becker, 1894

Preferred environment: forest; conifer forest. **Adult habitat and habits:** no data. **Flowers visited:** *Solidago virgaurea* (Bartsch et al.(2009b); *Sorbaria sorbifolia* . **Flight period:** June/August (Scandinavia). **Developmental stages:** not described. Stuke (2000) refers to *Suillus* as a larval host. **Range:** Northern Europe (Norway, Sweden, Finland, Russia) and Siberia through to the Pacific and Japan; Poland; Georgia; Mongolia. **Determination:** this species appears in recent European literature under the name *pallipes* (Lw.), now known to be a separate species (Claussen and Stahls, 2007)

apparently confined to N America (from where it was described). Under the name *C.pallipes*, *C.flavissima* is included in the keys of Violovitsh (1986). The latter author also figures the male terminalia. This species is included (as *C.flavissima*) in the keys to northern European *Cheilosia* species in Bartsch *et al*. (2009b) and Haarto and Kerppola (2007a). **Illustrations of the adult insect:** none known.

Cheilosia fraterna (Meigen), 1830
Preferred environment: deciduous forest/freshwater; along streams and rivers with marginal tall herb communities, in open forest (acidiphilous *Quercus*, humid *Fagus*). **Adult habitat and habits:** clearings and tracksides, usually along streams or rivers. **Flowers visited:** *Caltha, Ranunculus, Stellaria, Taraxacum*. **Flight period:** April/June and at higher altitudes July to August/September. **Developmental stages:** larva described and figured by Rotheray (1988a); mines stems and basal rosettes of *Cirsium palustre*; other species of *Carduus* and *Cirsium* are also cited as larval food plants by Stuke (2000) and Reemer *et al*. (2009).. This species overwinters as a puparium. **Range:** Fenno-Scandia south to the Pyrenees, montane in southern parts of its range; Britain eastwards through central Europe into European parts of Russia and on into much of Siberia. **Determination:** van der Goot (1981). This species is very similar to *C.bracusi* Vujić & Claussen. Distinctions between these two species are given by Vujić and Claussen (1994b). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult insect is illustrated in Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994).

Cheilosia frontalis Loew, 1857
Preferred environment: in the vicinity of streams, flushes and areas of poorly drained ground in unimproved montane grassland (including relatively small areas within forest) from the *Picea* zone upwards to 2000m. **Adult habitat and habits**: flies at up to 2m. from the ground, in relatively sheltered situations, often following the edge of streams; settles on vegetation of low-growing plants or shrubs. **Flowers visited**: white umbellifers; *Acer pseudoplatanus, Anemone nemorosa, Cardamine, Salix.* **Flight period**: April/May and June/July at higher altitudes. **Developmental stages:** undescribed. **Range:** Fennoscandia and mountainous parts of Europe south to the Pyrenees and northern Spain; from the Ardennes east to the Alps and on into European parts of Russia. **Determination**: van der Goot (1981). There is confusion in the literature between this species and *C.hypena* (Becker). But the male of *C.hypena* does not have discrete dust markings on the abdominal tergites like those found in males of *C.frontalis*. The male of *C.frontalis* is quite distinctive, with strongly delimited, rather rectangular pale dust patches on the abdominal tergites, reminiscent of *C.fasciata*. *C.frontalis* has a body length of 6-7.5mm, while *C.hypena* has a body length of 8-11mm. The female of *C.frontalis* is less distinctive and may easily be confused with females of *C.hypena* or *C.melanopa*, which can occur in the same localities and at the same time of the year. Verlinden (1999b) details distinctions between *C,frontalis* and *C.hypena*. The keys provided by van Veen (2004) help to distinguish females of *C.frontalis* and *C.melanopa*. This species is included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Haarto and Kerppola (2007a). **Illustrations of the adult insect:** the female of *C.frontalis* is illustrated in colour by Torp (1994).

Cheilosia gagatea Loew, 1857
Preferred environment: open ground; unimproved, calcareous montane and subalpine grassland to above 2000m in the Alps and open areas within *Fagus/Picea* forest. **Adult habitat and habits:** tracksides, clearings and pasturage; adults fast flying, up to 2m from the ground. **Flowers visited:** white umbellifers, *Ranunculus*. **Flight period**: May/July. **Developmental stages:** undescribed. **Range:** Poland, Czech Republic, Alps (France, Switzerland, Austria), northern Italy, the former Yugoslavia, Bulgaria, Roumania; also in northern Spain (Cordillera Cantabrica). **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. The length of the aristal hairs is variable in this species. In populations from the Pyrenees, in particular, the aristal hairs can be short or almost absent, whereas in populations from the Alps they are consistently longer than the maximum diameter of the ariista. It is possible that an additional taxon is invloved, but specimens from the Alps and the Pyrenees appear identical, except in respect of this one feature. **Illustrations of the adult insect:** none known.

Cheilosia gigantea (Zetterstedt), 1838
Preferred environment: open ground, unimproved grassland, usually montane and subalpine (calcareous to neutral) in the Alps, but at low altitude in Scandinavia. **Adult habitat and habits:** males hover at 2-5m. and settle on grass and rocks; both sexes are fast flying, flying low over ground vegetation. **Flowers visited:** white Umbelliferae; *Caltha, Euphorbia, Meum,*

Ranunculus, Sorbus aucuparia, Taraxacum. **Flight period**: May/June (July/beginning August at higher altitudes). **Developmental stages:** reared by Stuke and Carstensen (2002) from larvae in the tap root of *Rumex longifolius* and *Rumex aquaticus*. They observed that the species overwinters as a puparium. The larva was also reported by Bagatshanova (1990), from *Rumex* sp. She found that the larvae overwinter, and pupate in the spring. **Range:** Fennoscandia south to the Alps; Germany eastwards through northern and central Europe (plus northern Italy and the old Yugoslavia) into European parts of Russia and from the Ukraine to the Caucasus (including Georgia); in Siberia from the Urals to the Pacific coast. **Determination:** van der Goot (1981). There are unresolved problems with the identity of this species at present, which will not be solved until a thorough revision of the entire *proxima* group of species can be carried out. Nielsen and Claussen (2001) separate *C.ingerae* from *C.gigantea*, establishing in the process that *C.gracilis* Hellen is a synonym of *C.gigantea*. They also figure the male terminalia of *C.gigantea, C.ingerae* and *C.proxima*. This species is included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Haarto and Kerppola (2007a). **Illustrations of the adult insect:** the male is figured in colour by Bartsch et al.(2009b).

Cheilosia gorodkovi Stackelberg, 1963
Preferred environment: open ground; humid, lowland unimproved grassland (Skufjin, 1977); steppic grassland (Mielczarek, 2013). **Adult habitat and habits:** no data. **Flowers visited:** *Campanula, Fritillaria, Salix, Schivereckia* (Skufjin, 1977). **Flight period:** April/May. **Developmental stages:** not described. **Range:** Poland; southern parts of European Russia; western Siberia to the Far East in Asiatic Russia. **Determination:** this species appears in recent literature under the name *kuznetzovae* Skufjin. Barkalov and Mutin (2018) establish that *kuznetzovae* is a synonym of *gorodkovi*. Claussen (1998), who redescribes the species (under the name *kuznetzovae*), provides a key for separation of both male and female of *C. gorodkovi* from closely related species and also figures the male terminalia. The male terminalia are also figured by Barkalov (2007). **Illustrations of the adult insect:** a coloured photograph of the female is provided by Mielczarek (2013).

Cheilosia griseifacies Vujić, 1994
Preferred environment: forest; deciduous forest, *Quercus/Fraxinus* forest, including alluvial hardwood forest (Vujić, 1994a, 1996). **Adult habitat and habits:** flies among *Salix* branches and settles on large-leaved plants like *Smyrnium* (Vujić, 1996). **Flowers visited:** Rosaceae; *Euphorbia, Plantago, Salix* (Simic *et al.*1994, Vujić, 1996). **Flight period:** mid March/May (Vujić, 1994a, 1996). **Developmental stages:** not described. **Range:** uncertain, due to confusion with *C.canicularis* until recently, but confirmed from: Germany (Rheinland-Palatinate, Bavaria), Hungary, Bosnia, Serbia. **Determination:** Vujić (1994a), who figures the male terminalia and details features for separation of this species from the closely similar *C.canicularis* (Panzer). **Illustrations of the adult insect:** none known.

Cheilosia grisella Becker, 1894
Preferred environment: open ground, unimproved montane/subalpine grassland on calcareous and non-calcareous sites, and sometimes at lower altitudes. **Adult habitat and habits**: flies low over the ground vegetation. **Flowers visited**: *Caltha, Ranunculus*. **Flight period**: June/July, plus August at higher altitudes. **Developmental stages:** undescribed. **Range**: Carpathians ("Silesia") and the Alps (France, Germany, Switzerland, Liechtenstein, Austria and northern Italy) south to the former Yugoslavia and the Transcaucasus. **Determination**: see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. This species is easily misdetermined as *C.impudens*, but the clypeus is only c1.5x as long as wide in *C.grisella*, whereas it is more than 2x as long as wide in *C.impudens*. Also, in the latter species the sternites are shining, only thinly dusted, while in *C.grisella* the sternites are heavily dusted. Further, *C.impudens* is generally slightly larger than *C.grisella*. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia grossa (Fallen), 1817
Preferred environment: deciduous forest/open ground; clearings and tracksides in woodland and scrub; poorly drained pasture. **Adult habitat and habits:** males hover at from 2 - 10 metres, usually beside bushes or hedges in sheltered situations; females fly fast and low over ground vegetation in clearings and along tracks; both sexes visit flowers of low-growing plants and trees, usually towards the middle of the day. Although the known food plant of the larva of this species is typically a pasture plant, most records of the adult insect are from sheltered woodland sites, not open country. The early season at which *C.grossa* is in flight may dictate that this species occurs only where woodland and pasture are closely interdigitated, the larvae requiring the pasture for appropriate host plants, the adults requiring the woodland for its early

flowers. **Flowers visited:** *Anemone nemorosa, Corylus, Prunus spinosa, Ranunculus* spp., male *Salix, Taraxacum, Tussilago*. **Flight period:** March/April, and May at higher altitudes. **Developmental stages:** the larva is described and figured by Rotheray (1988a, 1994). It is a miner in stems of *Cirsium* spp. (Rotheray, l.c.) and *Carduus* spp. (Dusek and Laska, 1962); detailed information about larval biology, based on rearing of *C. grossa* from *Carduus nutans*, is provided by Rizza *et al*. (1988), who use the name *Cheilosia corydon* (Harris) for this species. Stuke (2000) lists seven *Carduus* species, three *Cirsium* species and *Onopordon acanthium* as larval host plants. This species overwinters as a puparium. Dussaix (2013) observes that larval development is of long duration, commencing in April and not completed until September. The appearance of the puparium is shown in the coloured phot provided by Dussaix (2013). **Range:** Fennoscandia south to Spain; Ireland eastwards through northern, central and southern Europe into Asiatic parts of Russia in Siberia. Also recorded from the Oriental region (Uttah Pradesh in northern India) and N Africa (Morocco). **Determination:** Haarto and Kerppola (2007a), van der Goot (1981), Violovitsh (1986). The surstyli of the male terminalia are figured by Stubbs and Falk (2002) and Violovitsh (1986). Some authors, like Rizza et al.(1988) have used the Harris name *corydon* for this species. However, neither figure nor original description of *corydon* can be applied unambiguously to this species, there is no Harris type material of *corydon* in existence and no neotype has been designated. Under these circumstances there is no clear basis for application of the name *corydon* and it is thus not used here. **Illustrations of the adult insect:** The adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983),Torp (1984, 1994) and Pétremand *et al*. (2022).

Cheilosia herculana Bradescu, 1982
Preferred environment: forest/open ground; open, rocky areas in humid *Fagus* forest, upwards to 2000m in the Balkans (Vujić, 1996). **Adult habitat and habits:** flies in open, rocky areas, settling on stones in the sun; males hover at 2-4m (Vujić, 1996). **Flowers visited:** *Alyssum, Ranunculus* (Vujić, 1996). **Flight period:** beginning June/end August. **Developmental stages:** undescribed. **Range:** Carpathians (Roumania) and Balkans (Macedonia, Montenegro). **Determination: :** Ståhls & Barkalov (2017) provide a key for the separation of this species from others of the *caerulescans* group. This species closely resembles *C.caerulescens* (Mg.). Bradescu (1991) treats *C.herculana* as a synonym of *C.kerteszi*, without comment. **Illustrations of the adult insect:** none known.

Cheilosia hercyniae Loew, 1857
Preferred environment: forest/open ground; herb-rich open areas within *Abies/Picea* forest and upwards into calcareous, unimproved subalpine grassland to well above the tree line. **Adult habitat and habits:** flies low over ground vegetation in open grassland, but higher among tall waterside vegetation of streams within the forest zone; males hover at 2-5 m (Vujić, 1996). **Flowers visited:** white umbellifers, *Anemone ranunculoides, Caltha, Helianthemum, Ranunculus, Salix, Senecio, Tanacetum*. **Flight period:** end May/July and on into August at higher altitudes. **Developmental stages:** not described. **Range**: southern Sweden, Poland; Alps (France, Switzerland, Austria, northern Italy); Pyrenees (Spain) and mountainous parts of northwest Spain; Montenegro, Serbia, Bulgaria, Roumania. **Determination:** Ståhls & Barkalov (2017) provide a key for the separation of this species from others of the *caerulescans* group. The female of *C.hercyniae* is distinguished from related species by its possession of a very large, yellow-orange, third antennal segment, with, low down on its internal face, a very distinct, straight, slit-like antennal pit. An additional distinguishing feature of this species is that, in both sexes, the postero-dorsal triangular extension of mesanepisternite 1 carries long hairs. **Illustrations of the adult insect:** the female head and abdomen are figured in colour by Bartsch et al.(2009b).

Cheilosia himantopa (Panzer), 1798
Preferred environment: forest/freshwater; along streams and in open areas in humid *Fagus* forest and upwards through the *Abies/Picea* zone into unimproved, subalpine grassland to 2000m. **Adult habitat and habits:** flies fast and low over ground vegetation and settles on foliage of large-leaved, low-growing plants. **Flowers visited:** yellow composites, umbellifers. **Flight period:** end April/August. **Developmental stages:** the larva is described and figured by Dusek (1962), from larvae collected from *Petasites*, under the name *C. canicularis*. Stuke (2000) cites both *Petasites albus* and *P. hybridus* as larval plant hosts. Stuke and Claussen (2000) provide information on the biology of the larvae, which live in leaf stem-bases and rhizomes of the host plant. This species overwinters as a larva. **Range:** southern Sweden; Germany (Harz, Schwarzwald), France (Vosges); Alps (France, Germany, Switzerland, Liechtenstein, Austria, Italy); Apennines (Italy); Balkan Peninsula (Greece, Montenegro, North Macedonia, Serbia, Slovenia); Bulgaria. **Determination:** Stuke and Claussen (2000), who provide features for separating this species from the closely similar *C.canicularis* and figure the terminalia of both. This

species is also included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia hypena Becker, 1894
Preferred environment: freshwater/open ground; close to streams and pools in unimproved, montane and subalpine grassland, from 400m upward to above 2000m. At lower altitudes, in the vicinity of marshy seepages and streams in open areas or in forest, e.g. *Betula, Quercus, Pinus uncinata.* **Adult habitat and habits:** flies along stream edges and among taller ground vegetation and settles on the foliage of taller herb layer plants, particularly umbellifers. Males hover at 1-2m (Vujić, 1996). **Flowers visited:** umbellifers, *Mentha, Parnassia, Saxifraga, Sisymbrium*. **Flight period:** from the beginning of June to the end of August, plus March/May in the Balkans (Vujić, 1996), where the species is at least bivoltine. **Developmental stages:** not described. **Range:** Portugal, Pyrenees (France, Spain). Alps (France, Switzerland, Austria), northern Italy, Balkans (Slovenia, Croatia, Serbia). **Determination:** Claussen (in Maibach *et al*., 1992) states that *C.capitata* Goeldlin (1974) is a junior synonym of *C.hypena*. Radenković *et al*. (2020b) provide a key separating *C. hypena* from other European species of this group (subgenus *Convocheila*) and include figures of the male terminalia. Verlinden (1999b) redescribes the species, pointing out that the male had never previously been described and providing detailed information on separation of this species from *C. frontalis* Loew. He also figures features of the head of male and female *C.hypena*. Goeldlin (1974) mentions some distinguishing features of *C. hypena* (as *C.capitata*). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia iberica Marcos-García & Claussen, 1989
Preferred environment: open *Quercus* forest, from 600 - 1200m. **Adult habitat and habits:** in flight from early morning (c8.30) to the evening (c 17.30) (pers.comm. M.-A. Marcos-García). **Flowers visited:** white umbellifers; *Chaerophyllum, Doronicum, Halymium, Stellaria* (Marcos-García and Claussen, 1989); *Ranunculus*; *Spiraea; Taraxacum* (Van Eck, 2011). **Flight period:** April/beginning June. **Developmental stages:** undescribed. **Range:** north-eastern Portugal, northern and central Spain. **Determination:** Marcos-García and Claussen, (1989), who describe both sexes of this "*proxima* group" species and figure the male terminalia and the head of the female. **Illustrations of the adult insect:** none known.

Cheilosia illustrata (Harris), 1780
Preferred environment: deciduous forest and hedgerows; pasture and meadows, including montane pasture within sheltering woodland. **Adult habitat and habits:** glades, tracksides and clearings; along hedges; pastures and meadows. **Flowers visited:** a wide range of white Umbelliferae, but very frequent on the flowers of *Heracleum; Matricaria, Prunus, Rubus, Sambucus*. **Flight period:** May/ September. **Developmental stages:** larva and puparium described and figured by Rotheray (1999a). This species has been bred from *Pastinaca sativa* roots (bred specimen in the collections of the National Museum of Ireland) and also from the expanded rootstock of *Heracleum sphondylium* (Rotheray, 1999a). Stuke (2000) gives *Angelica sylvestris* as another larval host plant. The female has been observed egg-laying on *Heracleum*, (Doczkal, 1996b). The species overwinters as a puparium. **Range:** Fenno-scandia south to Spain; Ireland to the Caucasus (Georgia) and western parts of Siberia. **Determination:** van der Goot (1981). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, inluding Bartsch *et al*. (2009b), Colyer and Hammond (1951), Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Kormann (1988).

Cheilosia impressa Loew, 1840
Preferred environment: deciduous forest/wetland: open areas in deciduous forest; montane, unimproved grassland, plus unimproved grassland up to above 2,000m in the alpine zone; fen. **Adult habitat and habits:** clearings, tracksides etc.; males hover at 2 - 5 metres. **Flowers visited:** wide range of white Umbelliferae; Compositae; *Cirsium, Eupatorium, Euphorbia, Filipendula, Geranium, Mentha, Prunus, Ranunculus, Rubus*. **Flight period:** May/July and August/September (with peak in July), but the second generation may be limited or missing. **Developmental stages:** larva described and figured by Schmid (1999a), from larvae found feeding externally on the rootstock and underground stem-bases of *Arctium lappa*. This species very probably has alternative food plants, since it may be abundant where no *Arctium* is present, for instance in subalpine grassland. Stuke (2000) and Doczkal (2002) report egg-laying by this species on *Eupatorium cannabinum* and numbers of teneral specimens have been found drying their wings on large *Rumex*, in grazed subalpine grassland where no other large herbs were present (MS). **Range:** Fennoscandia south to the Pyrenees and north Spain; Ireland east through central Europe to European parts of Russia; Georgia; across Siberia to the Pacific. **Determination:** van der Goot (1981),

Vujić *et al*.(1998). *C. impressa* and its close ally *C. schnabli* Becker are apparently unique among European *Cheilosia* species, in possessing a distinct, knob-like projection baso-laterally, on the external surface of the fore coxae in both sexes (Vujić *et al*, 1998). This remarkably useful feature has been ignored in keys until recently. *C.impressa* and *C.schnabli* are very similar in appearance, but the surface of the mesoscutum is fine-punctured in *C.schnabli*, whereas it is coarse-punctured in *C.impressa*. Additional features are provided by Vujić *et al*.(1998), who also figure the male terminalia of both taxa. *C.schnabli* is so far known only from the Balkans and the Caucasus, but within its range can occur with *C.impressa*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Bartsch et al.(2009b) andTorp (1994).

Cheilosia impudens Becker, 1894
Preferred environment: forest; from *Fagus/Picea* and *Fagus/Abies* forest up into the *Picea* or *Abies* zone and on to its upper edge and the *Larix* zone. **Adult habitat and habits:** clearings and tracksides; flies low and settles on the foliage of low-growing plants in the sun; males hover at 2-3m. **Flowers visited:** *Caltha, Ranunculus*. **Flight period:** April/June. **Developmental stages:** not described. **Range:** Poland, Schwarzwald (Germany), Massif Central (France), the Jura and the Alps (France, Switzerland, Austria), the Pyrenees (Spain); the Balkans (Slovenia, Croatia), Roumania and the Caucasus. **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. This species is easily confused with *C.grisella* (see under *C.grisella*) and *C.vicina*. **Illustrations of the adult insect:** none known.

Cheilosia ingerae Nielsen & Claussen, 2001
Preferred environment: forest/open ground; open areas in taiga forest and field margins (Nielsen and Claussen, 2001). **Adult habitat and habits:** no data. **Flowers visited:** *Anthriscus sylvestris* (Nielsen and Claussen, 2001), *Ranunculus* (Bartsch et al.(2009b). **Flight period:** mid-June/early August. **Developmental stages:** undescribed. **Range:** northern Norway, Sweden and Finland. **Determination:** Nielsen and Claussen (2001), who figure the male terminalia. This species is included in the keys (provided in English) to northern European *Cheilosia* species in Bartsch et al.(2009b) and Haarto and Kerppola (2007a) and in the keys provided by van Veen (2004). It is a "*proxima* group" species apparently very similar to *C. gigantea*. Nielsen and Claussen (2001) detail distinctions between this species and *C. gigantea, C. proxima, C. rufimana* and *C. velutina*. **Illustrations of the adult insect:** the male is figured in colour by Bartsch et al.(2009b).

Cheilosia insignis Loew, 1857
Preferred environment: humid, montane *Fagus* forest and from the upper limit of *Larix* into unimproved, calcareous and non-calcareous, subalpine grassland, and upwards into the rock and scree zone (Vujić, 1996; Verlinden, 2000). **Adult habitat and habits:** flies low over the ground, settling on stones and rocks in the sun, beside streams and snow patches (Vujić, 1996). **Flowers visited:** *Muscari, Salix*. **Flight period:** beginning April/end May (plus June at higher altitudes). **Developmental stages:** not described, but Verlinden (2000) provides evidence suggesting the larvae may be associated with the rhizomes of *Anemone* species. **Range:** through mountainous parts of central Europe from Germany and Poland to Montenegro and Roumania, via France and Switzerland. **Determination**: see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. For separation of *C.insignis* from *C.pedestris* it is necessary to refer either to the StN key or the key provided by Claussen and Van der Weyer (2004). Verlinden (2000) points out problems in the determination of *C.insignis* and provides features that help to identify *C.insignis* with more certainty. **Illustrations of the adult insect:** none known.

Cheilosia katara Claussen & Vujić, 1993
Preferred environment: forest/freshwater; open areas with seepages/flushes in relict montane forest of *Pinus heidreichii*/*P.nigra* ssp.*pallasiana* (Vujić, 1996). **Adult habitat and habits:** " the adult is stocky with short wings, which results in its clumsy and short flight" (Vujić, 1996). **Flowers visited:** *Ranunculus* (Vujić, 1996). **Flight period:** April/May. **Developmental stages:** undescribed. **Range:** northern Greece (Pindos mountains). This species should be regarded as threatened at the European level (Vujić *et al*, 2001). **Determination:** Claussen and Vujić (1993), who figure the male terminalia and provide distinctions from other apparently similar species also with hairy eyes, bare face and scutellar margin without bristles. Vujić and Claussen (2000) provide a key distinguishing this species from others of the *pini* group. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided by Vujić et al.(2020d).

Cheilosia kerteszi Szilady, 1938
Preferred environment: open areas along streams in deciduous forest (Vujić, 1996). **Adult habitat and habits:** males hover at 2-5m (Vujić, 1996). **Flowers visited:** *Ranunculus, Salix* (Vujić, 1996). **Flight period:** April/May. **Developmental stages:** not described. **Range:** Roumania, Bosnia-Herzegovina, Serbia. **Determination:** Ståhls & Barkalov (2017) provide a key for the separation of this species from others of the *caerulescans* group. This species is as yet inadequately differentiated from C.*caerulescens* (Mg.), and specimens of the latter species can be misdetermined as *C.kerteszi*, using Bradescu's key. The situation is further confused by uncertainty over the relationship between *kerteszi* and *herculana* Bradescu. The latter species was synonymised with *kerteszi* by Bradescu (1991), but subsequently treated as a separate taxon by Vujić (1996). **Illustrations of the adult insect:** none known.

Cheilosia laeviseta Claussen, 1987
Preferred environment: open ground; open, grassy areas in the *Larix* zone upwards into unimproved, calcareous and non-calcareous subalpine grassland to above 2000m into the alpine zone, including sparsely vegetated, stony ground and close to snow patches. **Adult habitat and habits:** flies at up to 1m over alpine grassland vegetation; settles on rocks and stones in the sun. **Flowers visited:** white umbellifers; *Ranunculus*. **Flight period:** beginning June/mid August. **Developmental stages:** not described. **Range:** Northern Spain, Pyrenees (France) and Alps (France, Switzerland, Austria, northern Italy); Slovenia; Balkans (Montenegro). **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). The terminalia are also figured by Marcos-García (1989a) (as *C.cantabrica* Marcos-García). This species varies considerably in adult size (L.Verlinden, pers.comm.). **Illustrations of the adult insect:** none known.

Cheilosia laeviventris Loew, 1857
Preferred environment: thinly-vegetated, rocky, unimproved, non-calcareous, subalpine grassland to above 2000m. **Adult habitat and habits:** has a very rapid, darting flight; the males hover at 1-3m in the vicinity of large boulders and both sexes settle on rocks in the sun. **Flowers visited:** no data. **Flight period:** July **Developmental stages:** undescribed; according to Stuke and Carstensen (2002) the larval host plant is *Primula auricula*. **Range:** Alps (France?, Germany, Switzerland, Austria, Italy); the Slovak Republic; Slovenia. **Determination:** Ståhls & Barkalov (2017) provide a key for the separation of this species from others of the *caerulescans* group. Also see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. Ståhls & Barkalov (2017) establish that *Cheilosia primulae* Hering is a synonym of *C. laeviventris*. **Illustrations of the adult insect:** none known.

Cheilosia lasiopa Kowarz, 1885
Preferred environment: forest, both deciduous and coniferous, particularly scrub woodland. **Adult habitat and habits:** clearings, tracksides etc.; flies low and fast; settles on foliage of bushes etc. favouring those with large leaves, e.g. *Arctium*. **Flowers visited:** white Umbelliferae; *Cochlaeria, Crataegus, Euphorbia, Fragaria, Menyanthes, Ranunculus, Salix, Stellaria, Taraxacum, Vaccinium*. **Flight period:** May/June (with occasional specimens into July) and April in southern Europe. **Developmental stages:** larva described and figured by Stuke and Carstensen (2000), from larvae which lived initially in the leaf and stem bases of *Plantago lanceolata* and later in the rootstock of that plant. They also established that this species overwinters as a puparium. **Range:** Fennoscandia south to the Vosges mountains (north-east France); Britain eastwards through mountainous parts of central Europe into the former Yugoslavia and European parts of Russia. **Determination:** Haarto and Kerppola (2007a), van der Goot (1981). This species appears in recent literature as *C. honesta* Rondani. Claussen and Thompson (1996) showed that *honesta* Rondani is a junior synonym of *barbata* Loew and introduced *lasiopa* as a replacement name for *honesta sensu aucct* not Rondani. The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia laticornis Rondani, 1857
Preferred environment: forest/open ground; tall-herb open areas and tracksides within montane, southern European deciduous forest (mesophilous *Fagus, Castanea*) and unimproved, montane grassland. At the northern edge of its range, in southern Sweden, this species appears to be confined to coastal grassland. **Adult habitat and habits:** flies among tall herb vegetation of scrub-invaded grassland, forest tracksides and clearings, settling on foliage. **Flowers visited:** umbellifers;

yellow composites; *Euphorbia*. **Flight period:** end April/June and end July/beginning September. **Developmental stages:** larva not described, but Sörensson (2003) suggests *Peucedanum oreoselinum* may act as one larval host plant for this species. **Range:** southern Sweden, Netherlands, Poland, Czech Republic, southern Germany (Bavaria), France (Pyrenees, Causses, Cevennes, Massif Central, Alps); Switzerland (Swiss plateau, Rhone valley), Austria, Italy (inc. Sardinia and Sicily), Balkans (Bosnia, Croatia, Macedonia, Montenegro, Serbia, Slovenia), Roumania, southern Russia and the Ukraine on to the Transcaucasus and Kirghizistan; Afghanistan; Turkey, Israel and N Africa (Algeria, Libya). In Europe, there are isolated records of this species from the northern edge of its range that suggest it is currently expanding northwards. **Determination:** Radenković *et al*. (2020b) provide a key separating *C. laticornis* from other European species of this group (subgenus *Convocheila*) and include figures of the male terminalia. In the keys provided by van Veen (2004) specimens of *C. uviformis* lacking scutellar marginal bristles could be confused with *C. laticornis*. The male terminalia are figured (as *C. latifacies*) by Marcos García (1987a), in separating this species from the closely similar *C. paralobi* Malski. *C. laticornis* appears in recent literature under the name *latifacies* Loew. The synonymy of *latifacies* of Loew with *laticornis* of Rondani was established by Claussen and Thompson (1996). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia latifrons (Zetterstedt), 1843
Preferred environment: open ground; unimproved, non-calcareous grassland, usually on poorly drained sites; also coastal dune systems. **Adult habitat and habits:** low-flying, at the level of grasses etc., among which it settles. **Flowers visited:** yellow Compositae, especially *Senecio* and *Taraxacum*; *Origanum, Ranunculus;* also anaemophilus flowers such as *Luzula* and *Plantago*. **Flight period:** April (March in southern Europe) to September, with peaks in June/July and September. **Developmental stages:** larva described by Stuke and Carstensen (2002), from larvae found in the tap root of *Leontodon hispidus*. Schmid and Grossmann (1996a) present evidence of egg-laying by *C.latifrons* on *Leontodon autumnalis*, suggesting this may be another larval host plant. Reemer *et al*. (2009) also cite *L.hispidus* as a larval foodplant of this syrphid. In all probability this insect uses a range of different plant species as larval food-plants. **Range:** Fenno-Scandia south to Iberia and from Ireland eastwards through central and southern Europe to Turkey and on into European parts of Russia and western Siberia. Also in N Africa (Kassebeer, 1998). **Determination:** this species is referred to in much recent literature under the name *C.intonsa* Loew. The synonymy of *intonsa* with *latifrons* was established by Speight and Lucas (1992). *C.latifrons* appears to be a polyform species (mediated by use of different host plants in different biotopes/parts of its range??) which has led to attempts (e.g. by Stubbs and Falk, 1983; van Veen, 2004) to subdivide it into two or more taxa, but without convincing result. In southern Europe there is confusion between this species, *C.griseiventris* Loew and *C.marokkana* Becker. *C.griseiventris* may or may not be a variant of *C.latifrons*, but *C.marokkana* has recently been formally synonymised with *C.latifrons* by Kassebeer (1998). As recognised in the present text, *C.latifrons* may be determined using Haarto and Kerppola (2007a) and van der Goot (1981: where it appears as *C.intonsa* Loew). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994).

Cheilosia latigenis Claussen and Kassebeer, 1993
Preferred environment: open ground; beside pools and streams in unimproved, non-calcareous, subalpine grassland. **Adult habitat and habits:** no data. **Flowers visited:** *Caltha palustris, Senecio*. **Flight period:** June. **Developmental stages:** not described. **Range:** Pyrenees (France). **Determination:** Claussen and Kassebeer (1993) provide a key for distinguishing *C.latigenis* from the closely similar species *C.mutabilis* (Fall.), *C.psilophthalma* (Becker) and *C.urbana* (Mg.). Another species in this group, *C.parva* Kassebeer, closely related to *C.latigenis*, has recently been described from N Africa (Kassebeer, 1998) and might be expected to occur in southern Europe - in mountainous parts of Spain, for instance. There is potential for confusion between references to *C.latigenis* and references to the almost-identically-named *C.latigena* Barkalov and Peck. These are, however, two entirely different taxa. *C.latigena* is treated by Barkalov and Stahls (1997). **Illustrations of the adult insect:** none known.

Cheilosia lenis Becker, 1894
Preferred environment: forest; deciduous woodland towards its upper altitudinal limits or otherwise experiencing a somewhat harsh climate e.g., humid *Fagus/Picea* forest and upwards into the subalpine zone. **Adult habitat and habits:** clearings etc., often resting on low-growing vegetation; males hover at 1-3 metres. **Flowers visited:** *Acer platanoides, Alliaria petiolata, Allium ursinum, Anemone nemorosa, Caltha, Cardamine pratensis, Galium, Petasites albus, Prunus, Ranunculus, Salix, Taraxacum, Tussilago*. **Flight period:** April/May and June at higher altitudes. **Developmental stages:** described and figured by Dusek (1962) from larvae collected from *Senecio fuchsii*. The female has also been observed

(Doczkal, 1996b) egg-laying on this ragwort species. Reemer *et al*. (2009) also cite *Senecio nemorensis* as a larval foodplant of this syrphid. **Range:** Germany south to the Pyrenees; Netherlands eastwards through central Europe to European parts of Russia; Italy & the former Yugoslavia; Georgia. **Determination:** Bradescu (1991), van der Goot (1981). Maibach et al, 1992, indicate, as a pers.comm. from Claussen, that *lenis* Becker is a synonym of *omissa* Becker. However, Röder (1998) indicates, also as a pers.comm. from Claussen, that *omissa* is a synonym of *lenis*. Confirmation of this latter synonymy has been received from Claussen (pers.comm.). In which case *C.angustipennis* Becker is apparently yet another synonym of *C.lenis* (Claussen, in Maibach et al, 1992). It can be difficult to separate *C.lenis* from its allies in central Europe. In western Europe, it is probably most easily confused with *C.bergenstammi* Becker. In *C.lenis* the eye hairs are long, vary from black to pale grey and extend to the ventral surface of the eyes. In *C.bergenstammi* they are shorter (especially in the female), pale brown and absent from the ventral quarter of the eye surface. The posterior margin of the scutellum can possess only fine hairs in this species, or fine hairs with some thin, black bristles, or hairs with some well-developed black bristles. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia lenta Becker, 1894
Preferred environment: forest; beside brooks and rivers in humid deciduous forest, from *Quercus/Carpinus* up into the *Fagus* zone to above 1500m in the Balkans (Vujić, 1996 and pers.comm.). **Adult habitat and habits:** flies low over waterside vegetation, settling on leaves (Vujić, 1996). **Flowers visited:** *Caltha, Myosotis, Ranunculus* (Vujić, 1996). **Flight period:** April/June and July at higher altitudes (Vujić, 1996). **Developmental stages:** not described. **Range:** known from Switzerland, Hungary and many parts of the Balkans. **Determination:** the male of this species remains undescribed. *C.lenta* is extremely difficult to separate from *C. rhynchops* (Vujić, pers. comm.) The species referred to as *C.lenta* in Bradescu's (1991) keys would seem to be some other taxon. According to Vujić (1996), *C. drenowskii* Szilady should be regarded as a synonym of *C. lenta*. **Illustrations of the adult insect:** none known.

Cheilosia limbicornis (Strobl), 1909
Preferred environment: forest; open areas within matorral of both *Pinus* and *Quercus* species; and *Q.ilex* maquis (Marcos-García, pers.comm.), up to 1600m. **Adult habitat and habits:** no data. **Flowers visited:** *Prunus spinosus* (Pérez-Bañón *et al*, 1996), *Ranunculus ollissiponensis* (Marcos-García, 1990a). **Flight period:** middle of March/June. **Developmental stages:** not described. **Range:** Spain. **Determination**: the male is re-described by Torp Pedersen (1971). Diagnostic features are mentioned by Pérez-Bañón *et al*., (1996). **Illustrations of the adult insect:** none known.

Cheilosia loewi Becker, 1894
Preferred environment: unimproved montane grassland within the *Picea* zone and upwards into unimproved subalpine grassland to above 2000m, usually in the vicinity of seepages or streamlets. **Adult habitat and habits:** flies among grasses etc. in open areas towards the upper altitudinal limit of *Picea* and upwards. **Flowers visited:** *Euphorbia, Myosotis, Potentilla verna, Ranunculus*. **Flight period:** May/July. **Developmental stages:** undescribed. **Range:** southern Poland, Alps (France, Germany, Switzerland, Liechtenstein, Austria, Italy), Dolomites (Italy), Pyrenees (France), Balkans (Bosnia, Croatia, Montenegro, Serbia, Slovenia) Roumania. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. **Illustrations of the adult insect:** none known.

Cheilosia longula (Zetterstedt), 1838
Preferred environment: forest (deciduous and coniferous) and conifer plantations. **Adult habitat and habits:** glades, clearings, tracksides etc.; adults fly at up to 3m, often settling on low-growing vegetaion in dappled sunlight; more frequent in conifer forest than deciduous forest. **Flowers visited:** white umbellifers; yellow composites; *Achillea, Calluna, Cirsium, Euphorbia, Galium, Potentilla erecta.* **Flight period:** end June/October, with a peak in September. **Developmental stages:** larva described and figured by Rotheray (1990) and illustrated in colour by Rotheray (1994); an internal feeder on the tissues of the fruiting bodies of various large, woodland basidiomycetes, especially *Boletus, Leccinum, Suillus* (Buxton, 1955; Hackman & Meinander, 1979; Rotheray, 1990; Stuke, 2000). Rotheray (1994) found larvae in the autumn, in collapsed fruiting bodies, and observed that this species overwinters as a puparium "in the leaf litter and soil beneath the remains of the fungus". **Range:** Fennoscandia south to the Pyrenees; from Ireland eastwards through Eurasia to eastern Siberia; Italy; the former Yugoslavia. **Determination:** Haarto and Kerppola (2007a) – where this species appears under the name *C. plumulifera*; Bartsch *et al.*(2009b), who point out that in northern parts of Fennoscandia *C.longula* is a complex of two

species, one of which they refer to as *C. longula*, the other being referred to simply as "*Cheilosia* aff. *longula*". These two taxa are differentiated in the keys in Bartsch *et al*.(2009b). The taxon *Cheilosia* aff. *longula* has so far only been found in northern parts of Fennoscandia. A genetic study by Milankov *et al*.(2010) confirms the separate identity of *C. longula* and *C.* aff. *longula*, but did not result in formal description and naming of the latter taxon. *C. longula* may occur together with closely related *C.scutellata*. The surstyli of the male terminalia are figured by Stubbs and Falk (2002). The orbital strip is extremely narrow in this species – no broader than the anterior ocellus. In Haarto and Kerppola (2007a) *C.longula* is given as a synonym of *C.plumulifera*, without explanation. In Peck (1988), *plumulifera* Loew, 1857 is given as a synonym of *longula* (Zett.), 1838. Since the Zetterstedt name would seem to have precedence its use is retained here. **Illustrations of the adult insect:** The adult insect is illustrated in colour by Bartsch et al.(2009b) and Torp (1994).

Cheilosia lucense Ricarte, in Ricarte *et al*, 2014
Preferred environment: calcareous, montane, unimproved grassland (Ricarte et al, 2014). **Adult habitat and habits:** no data. **Flowers visited:** *Chaerophyllum hirsutum* (Ricarte et al, 2014). **Flight period:** May. **Developmental stages:** not described. **Range:** NW Spain (Cantabrian mountains). **Determination:** Ricarte (in Ricarte et al, 2014) describes both the male and female of this species, figures the male terminalia and shows how *C. lucense* can be incorporated into the key to European *alpina* group species provided by Claussen (1998).

Cheilosia luteicornis (Zetterstedt, 1838)
Preferred environment: forest; *Picea* forest and plantations. **Adult habitat and habits:** no data. **Flowers visited:** *Salix, Taraxacum*. **Flight period:** May. **Developmental stages:** larvae are presumed to inhabit resin flows on *Picea*, caused by the activities of scolytid beetles, and the larvae of *C. morio* likewise. But confusion between *C. luteicornis* and *C. morio* has been such that re-appraisal of the larval biology of both species is needed. **Range:** uncertain, due to confusion with *C. morio*, but confirmed from Sweden, Belgium and Netherlands. **Determination:** Bot & Van de Meutter (2023) provide a description of this species and mention distinctions between it and *C. morio*, saying of *C. luteicornis* "Until recently this species was known as *C. morio*, but soon-to-be-published research will show that this name actually belongs to the hairy-faced sister species which until now lacked a widely accepted name. *Cheilosia luteicornis* is the correct name for the here-described bare-faced species". In its bare face and other features *C. luteicornis* of Bot & Van de Meutter (2023) corresponds with *C. morio* A of Bartsch *et al*. (2009b). In an earlier use of the name *C. luteicornis*, Van Steenis (2016), applied it to *C. morio* B of Bartsch *et al*. (2009b). **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured illustration provided by Bot & Van de Meutter (2023).

Cheilosia marginata Becker, 1894
Preferred environment: open ground/forest; open areas within the upper levels of humid *Fagus* forest and upwards through the *Picea* and *Larix* zones and on into humid, unimproved subalpine grassland to above 2000m. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** beginning April to beginning June; plus July at higher altitudes. **Developmental stages:** not described. **Range:** Alps (France, Germany, Switzerland, Austria, Italy), Roumania. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). **Illustrations of the adult insect:** none known.

Cheilosia melanopa (Zetterstedt), 1843
Preferred environment: forest/open ground; along streams in the *Picea* forest zone upwards into unimproved montane and subalpine grassland, from c1400m to above 2000m. **Adult habitat and habits:** in alpine grassland settles on rocks in the sun; males hover at 2-3 metres. Within the *Picea* zone occurs in dappled sunlight near water (L.Verlinden, pers.comm.). **Flowers visited:** *Myosotis, Ranunculus, Salix*. **Flight period:** end May/end July (and August at more northerly latitudes). **Developmental stages:** not described. **Range:** Fennoscandia, the Baltic States and mountainous parts of central Europe south to the Pyrenees (France); Italy, Bulgaria, Roumania and parts of the former Yugoslavia; Caucasus (Georgia). **Determination:** Vujić (1996), who figures the male terminalia and differentiates the Balkan subspecies *C.m.redi*, that is now recognised as a species in its own right, *C.redi* Vujić. *C.melanopa* is also included in the keys provided by van Veen (2004) and Haarto and Kerppola (2007a). **Illustrations of the adult insect:** the male is illustrated in colour by Bartsch et al.(2009b).

Cheilosia melanura Becker, 1894

Preferred environment: open ground; unimproved, calcareous and non-calcareous montane and subalpine grassland, from within the *Picea* zone upwards. **Adult habitat and habits**: fast flying; grassy areas, frequently along streams. **Flowers visited**: white umbellifers; *Caltha, Euphorbia*. **Flight period**: mid May/August. **Developmental stages:** undescribed, but the adult female has been observed egg-laying on *Cirsium spinosissimum* (Doczkal, 1996b). **Range:** Carpathians, Schwarzwald, Alps, Balkans and Caucasus mountains; in western Siberia to Cis-Baikal; Lair *et al*. (2021) record this species from the Pyrenees. **Determination**: van der Goot (1981). Separation of *C.melanura* from related species, like *C.cyanocephala* and *C.vernalis*, can be extremely difficult and it remains uncertain how many species require to be recognised in this complex. Claussen (in Maibach *et al*,, 1992) indicates that *C.plumbella* Becker should be regarded as a synonym of *C.melanura*, while Vujić (1996) recognises a series of named subspecies of *C.melanura*. **Illustrations of the adult insect:** none known.

Cheilosia montana Egger, 1860

Preferred environment: open ground; unimproved, calcareous and non-calcareous subalpine grassland, up to 2000m in the Alps. **Adult habitat and habits:** males hover up to 5m above the ground, in the vicinity of large rocks or other outstanding surface structures. Both sexes rest on rocks and stones in the sun, but out of the wind. **Flowers visited:** no data. **Flight period:** beginning July/end August. **Developmental stages:** not described. **Range:** Poland southwards and eastwards through mountainous parts of central Europe to Bulgaria and Roumania; also in western Siberia. **Determination:** Claussen (1998), who figures the male terminalia. Separation of this species from *C.alpina* (Zett.) remains problematic, especially in the female sex, and whether it is valid to recognise both taxa is still open to question. **Illustrations of the adult insect:** none known.

Cheilosia morio (Zetterstedt), 1838

Preferred environment: forest; conifer forest of *Picea* containing overmature trees, from the *Fagus/Picea* zone upwards. **Adult habitat and habits:** open areas within forest and along streams and rivers in forest. **Flowers visited:** *Ranunculus, Salix, Taraxacum.* **Flight period:** April/May. **Developmental stages:** it is uncertain whether existing larval data recorded under the name *C. morio* refer to this species or to *C. luteicornis*, or to a combination of both. A larva stated to be of *C. morio* is figured in colour by Bartsch *et al*. (2009a). Barkemeyer (1994) provides a comprehensive review of the larval biology of what is presumed to be this species, based on Hellrigl (1992) and Tragardh (1923). Essentially, the larva inhabits resin outflows on the trunk of *Picea*, caused by damage or the activities of scolytid beetles. The species apparently overwinters as a larva and pupates on the trunk, at the edge of the resin flow. Individual resin flows can evidently provide suitable larval habitat for a number of years, indicated by empty puparia trapped in the resin. The extent to which the larva is dependent upon the resin itself, or on micro-organisms associated with resins outflows, as its food source, is obscure. **Range:** supposedly from northern Scandinavia (Lapland) south to northern Germany and Poland; from the Baltic states and northern Germany eastwards through central Europe (Switzerland, Austria) to Bulgaria and Roumania and on into the Ukraine, the Balkans, western Siberia and Mongolia. But given confusion in the literature between *C. morio* A and *C. morio* B of Bartsch *et al*. (2009b) the range of *C. morio* (*C. morio* B of Bartsch *et al*., 2009b) requires reappraisal. **Determination:** Bot & Van de Meutter (2023); Bartsch *et al*. (2009b) as *C. morio* B. Two species have been confused under the name *C. morio* in recent literature. Bartsch *et al*. (2009b) refer to the two as *C. morio* A and *C. morio* B, separated by *C. morio* A having an essentially bare face, whereas the upper part of the face of *C. morio* B is hairy. Van Steenis (2016) uses the name *Cheilosia luteicornis* (Zetterstedt, 1838) for *C. morio* B of Bartsch *et al*. (2009b) without explanation, and refers likewise to *C. morio* A of Bartsch *et al*. (2009b) as *C. morio*. This interpretation of morio A and B is reversed in Bot & Van de Meutter (2023), who refer to their use of the name *luteicornis* as follows: "Until recently this species was known as *C. morio*, but soon-to-be-published research will show that this name actually belongs to the hairy-faced sister species which until now lacked a widely accepted name. *Cheilosia luteicornis* is the correct name for the here-described bare-faced species". That statement is preceded by a brief description of the species to which they apply the name *luteicornis*. Under *Cheilosia morio* they also provide a short description of the species to which they apply the name *C. morio*. **Illustrations of the adult insect:** the general appearance of the taxa confused under the name *C. morio* is shown in the coloured figures shown under the names *C. morio* A and B by Bartsch *et al*. (2009b). The male is illustrated in colour in Bot & Van de Meutter (2023).

Cheilosia mutabilis (Fallen), 1817

Preferred environment: open ground/forest (both coniferous and deciduous), open woodland and scrub on well-drained sites often susceptible to short-duration winter flooding; also in garrigue and heathland. In Sweden, Denmark and along the

northern seaboard of Germany, *C.mutabilis* is primarily a coastal species, occurring in coastal heathland and dune grassland, but it may also occur there in inland, grassland situations that are not obviously well drained (Bartsch, pers.comm.). **Adult habitat and habits:** clearings, tracksides etc.; flies up to 2m from the ground; settles on foliage of bushes etc., a number of specimens often being found within a few metres of each other along a particular stretch of track, or in a particular clearing, though the species is not found elsewhere in the vicinity. **Flowers visited:** white Umbelliferae; *Alisma plantago-aquatica, Cistus, Hieracium, Jasione Montana, Potentilla fruticosa, Sedum acre*. **Flight period:** May/mid August with peak in July. **Developmental stages:** undescribed, but reported by Grosskopf *et al*. (2001) as developing in the above-ground parts of *Hieracium pilosella*. According to Ball *et al*. (2011), the larva of *C. mutabilis* has been found in the roots of *Carduus crispus*. **Range:** Fennoscandia south to Iberia, the Mediterranean and N Africa; from Britain eastwards through much of Europe into Turkey; Georgia; European parts of Russia into western Siberia. **Determination:** Haarto and Kerppola (2007a), van der Goot (1981) and Claussen and Kassebeer (1993), who figure the male terminalia. If the N African species *C.parva* Kassebeer were to occur in Europe it is more likely to be confused with *C.mutabilis* than other European species In the male, *C.mutabilis* is distinguishable from closely related European species by its combination of a distinctly pubescent arista and a mesoscutum that is partly black-haired. Black hairs on the tergites distinguish the female of *C.mutabilis* from these other species. *C.parva*, described from Morocco (Kassebeer, 1998a), is extremely similar to *C.mutabilis*, and in the male has black hairs mixed in on the mesoscutum, but its aristal pubescence is extremely short, shorter than in male *C.mutabilis*. Unfortunately, separation of the females is more difficult, since the aristal hairs are often almost non-existent in female *C.mutabilis*, and in the female of *C.parva* the tergites are partly black-haired. Kassebeer (1998a) does not mention which features of *C.parva* are diagnostic for separation of *C.mutabilis* from *C.parva*, although he states that *C.mutabilis* is the most closely similar European species. Kassebeer (1998a) figures the male terminalia of *C.parva* and his illustrations indicate that there are small differences between the terminalia of *C.mutabilis* and *C.parva*. **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch et al.(2009b), Stubbs and Falk (1983), Torp (1984) and van der Goot (1986).

Cheilosia naruska Haarto & Kerppola, 2007
Preferred environment: open ground; "humid meadows" (Haarto, Kerppola and Ståhls, 2007); edge of humid meadow bordering *Betula/Salix/Populus* forest (Nielsen, 2008). **Adult habitat and habits:** males sit on leaves in the sun and close to the ground, from where they make forays to chase away other males (Haarto, Kerppola and Ståhls, 2007). **Flowers visited:** *Anthriscus sylvestris* (Haarto, Kerppola and Ståhls, 2007). **Flight period:** mid-June/beginning July (Haarto, Kerppola and Ståhls, 2007). **Developmental stages:** not described, but possibly associated with *Anthriscus sylvestris*, with which the adult flies are apparently always found (Haarto, Kerppola and Ståhls, 2007). **Range:** mainly within the Arctic circle, in Finnish Lapland and adjacent parts of European Russia. **Determination:** Haarto, Kerppola and Ståhls (2007), who describe both sexes of this *proxima* group species and figure the male terminalia. The only comprehensive key in which *C.naruska* has so far appeared is that provided by Bartsch *et al*. (2009b). **Illustrations of the adult insect:** Bartsch *et al*. (2009b) illustrate the male in colour.

Cheilosia nasutula Becker: see under *C.vicina* (Zett.)

Cheilosia nebulosa (Verrall), 1871
Preferred environment: wetland/forest; *Alnus/Salix* carr; poorly drained scrub (*Prunus spinosa*) woodland; open areas with flushes in *Picea* forest. **Adult habitat and habits:** clearings and tracksides; males hover up to 7m along tracks and paths, beside *Salix* or *Crataegus* in flower, descending to settle on low-growing plants whenever the sun disappears behind a cloud; females fly low over ground vegetation, settling to rest in the sun on dead grasses (e.g. *Molinia* tussocks) and both sexes visit flowers of trees. **Flowers visited:** *Crataegus, Prunus*, male *Salix, Taraxacum, Tussilago*. **Flight period:** end April/beginning June, and on to the beginning of July at higher altitudes. **Developmental stages:** undescribed, but Doczkal (2002) reports egg-laying by this species on leaves of *Centaurea nigra*. **Range:** Finland south to northern France; from Ireland eastwards through central Europe to Bulgaria and European parts of Russia. **Determination:** Bot & Van de Meutter (2023). Until recently, specimens of this species with unmarked wings have also appeared in literature under the name *langhofferi*, Becker. Such specimens would be liable to misdetermination using the keys provided by van Veen (2004). The male terminalia are figured by Claussen and Speight (1988a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983).

Cheilosia nigripes (Meigen), 1822
Preferred environment: forest/open ground; open grassy areas within *Fagus* forest, usually on well-drained soils, and upwards through (well-drained) *Abies/Picea* forest to the lowest levels of subalpine grassland, both calcareous and non-calcareous. **Adult habitat and habits:** clearings, tracksides etc.; flies low, rarely more than 2m above the ground; settles on the foliage of low-growing plants and bushes. **Flowers visited:** white umbellifers; *Prunus padus, Ranunculus, Rubus idaeus, Taraxacum*. **Flight period:** May/June and on into July/beginning August at higher altitudes. **Developmental stages:** undescribed. **Range:** Fennoscandia south to the Pyrenees and northern Spain; from southern England eastwards through central and southern Europe (northern Italy, the former Yugoslavia) into Turkey and European parts of Russia; through Siberia to the Pacific coast. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. This species is not easy to determine, especially in the female sex, which cannot with confidence be distinguished from the female of *C.vicina* (Zett.), except in the shape of the clypeus, which is less than 1½ x as long as wide in *C.nigripes*, but noticeably longer in *C.vicina*. **Illustrations of the adult insect:** the adult insect is illustrated in colour in Stubbs and Falk (1983) and Torp (1994).

Cheilosia nivalis Becker, 1894
Preferred environment: open ground/freshwater; stony, open areas along rivers, torrents or roads, in unimproved grassland within the upper levels of *Abies/Picea* forest upwards, through the *Pinus cembra/mugo* zone and into unimproved, thinly-vegetated, calcareous and non-calcareous subalpine grassland to above 2000m. **Adult habitat and habits:** sits on the leaves of low-growing, large-leaved herbs in the sun; males hover at 1-2m. **Flowers visited:** *Ranunculus, Sisymbrium*. **Flight period:** mid May/July and on into August at higher altitudes. **Developmental stages:** not described. **Range:** Pyrenees (France), Massif Central (France), Alps (France, Germany, Switzerland, Austria, Italy); also Poland. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. Specimens of *C.nivalis* with mixed black and yellow mesoscutal hairs can be confused with *C.venosa*, but the male terminalia of these two species are reasonably distinctive. A feature not mentioned in Barkalov and Ståhls (1997) is that antennal segment three of the female of *C.nivalis* usually has a very distinct, transverse, slit-like sensory pit on its inner surface, as in *C.hercyniae*. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). **Illustrations of the adult insect:** none known.

Cheilosia omissa: see under *C.lenis* Becker

Cheilosia orthotricha Vujić & Claussen, 1994
Preferred environment: freshwater/forest; along stream margins and trackside with tall herb communities in humid deciduous forest of *Fagus* and *Quercus*. **Adult habitat and habits:** open areas along streams; settles on the ground or on the foliage of large-leaved herb-layer plants e.g. *Petasites*; males hover at 1-3m (Vujić, 1996). **Flowers visited:** *Petasites, Salix, Taraxacum*. **Flight period:** February/May (plus June and July at higher altitudes). **Developmental stages:** not described, but Stuke and Claussen (2000) record finding larvae of this species in *Petasites hybridus*, where they occur in the lower half of the flowering stalks. It is uncertain whether the species overwinters as larva or puparium. **Range**: uncertain, due to confusion with *C.canicularis*, but confirmed from Belgium (Ardennes) and France (Jura) eastwards through central Europe (Germany, Switzerland, Czech Republic, Slovakia, Hungary) to Serbia, Croatia and Bosnia. **Determination:** Vujić & Claussen (1994b), who figure the male terminalia and provide distinctions from *C.canicularis* (Panz.), which is closely similar to *C.orthotricha*. This species is also included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia pagana (Meigen), 1822
Preferred environment: forest/open ground; open areas in coniferous and deciduous forest and humid, unimproved grassland; somewhat anthropochorous, occurring also along hedgerows in farmland and at roadsides. **Adult habitat and habits:** clearings and tracksides in woodland, scrub and carr; fen meadow; along hedgerows and beside streams; adults fly up to 2m, with hovering males up to 4 or 5m; settle on foliage of bushes and low-growing plants. **Flowers visited:** yellow composites; Ranunculaceae; white umbellifers; *Allium ursinum, Anemone nemorosa, Fragaria, Potentilla erecta, Primula, Prunus spinosa, Salix*. **Flight period:** May/June and July/September. In southern Europe, on the wing from mid March. **Developmental stages:** larva described by Rotheray (1990). *Cheilosia pagana* has been reared from larvae collected in the

autumn from rotting "roots" (presumably the tap root) of *Anthriscus sylvestris* (Stubbs, 1980); other recorded larval host plants are *Angelica sylvestris* (Doczkal, 1996b) and *Heracleum sphondylium* (Stuke, 2000). This species has also been collected repeatedly, by emergence traps installed over clumps of *Heracleum* and other emergence traps installed over clumps of *Angelica* (MS), suggesting that both of these large umbellifers can support the larvae of *C.pagana*. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia south to Iberia; from Ireland eastwards through central and southern Europe into Turkey and Russia and on throughout Siberia. **Determination:** van der Goot (1981). Existing diagnostic keys do not sufficiently take into account the variability of this species. In particular, although normally stated to be bare-eyed, its eyes are frequently distinctly hairy. Spring brood specimens tend to be large and brown-haired over the entire body surface, whereas summer brood specimens are frequently smaller and mostly or almost entirely black-haired. The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Pétremand *et al.* (2022),Torp (1984, 1994) and van der Goot (1986).

Cheilosia pallipes (Loew), 1863: see under *C.flavissima*

Cheilosia paralobi Malski, 1962
Preferred environment: forest: broad-leaved evergreen forest; by streams in open *Quercus ilex* forest and, at higher altitudes, in mixed *Q.ilex/Q. pyrenaica/Castanea* forest (Marcos-García, pers.comm.) and in open *Castanea* forest (C.Kehlmaier, pers.comm.); montane grassland with *Castanea* (Ricarte et al, 2014). **Adult habitat and habits:** males hover over ground vegetation in open areas within forest (C.Kehlmaier, pers.comm.). **Flowers visited:** umbellifers; *Foeniculum, Hedera, Leucanthemopsis, Mentha, Oenanthe, Ranunculus, Stellaria, Thapsia* (Marcos-García, 1986c, as *C. latifacies* - Marcos-García, pers. comm.); *Salix* (Van Eck, 2011). **Flight period:** April/November in Spain (Marcos-García (1986c, 1987, 1990a); in N Africa virtually throughout the year, with peaks in March/April and September/ October (Kassebeer, 1998). **Developmental stages:** undescribed. **Range:** Portugal, Spain and N Africa (Morocco, Algeria). **Determination:** Radenković *et al*. (2020b) provide a key separating *C. paraboli* from other European species of this group (subgenus *Convocheila*) and include figures of the male terminalia. This species is closely similar to *C. laticornis* Rondani, from which it may be distinguished by features provided by Marcos García (1987a), who also figures the male terminalia. In the male, the eyes meet on the frons for a distance shorter than the length of the vertex (in *C.laticornis* the eyes meet for a distance greater than the length of the vertex), the posterior margin of abdominal sternite 4 is deeply concave (straight in *C.laticornis*) and the surstyli of the terminalia are more than 7x as long as their basal width (no more than 4x as long as their basal width in *C.laticornis*). The female is described by Torp Pedersen (1971). **Illustrations of the adult insect:** none known.

Cheilosia pascuorum Becker, 1894
Preferred environment: forest; humid deciduous forests of *Quercus* and *Fagus* (Vujić, 1996), upwards into unimproved, non-calcareous subalpine grassland to above 2000m (Goeldlin and Speight, 1997); tall-herb open areass in *Quercus frainetto/Q. pubescens* forest and *Quercus cerris/Q. pubescens* forest. **Adult habitat and habits:** males hover at 2-5m and settle on the ground, or on flowers (Vujić, 1996). **Flowers visited:** *Alyssum, Ficaria* (Vujić, 1996); *Euphorbia*. **Flight period:** April/beginning June and July at higher altitudes (Vujić, 1996). **Developmental stages:** larva not described, but its rearing is reported in Grosskopf *et al*. (2002), who state that it is an internal feeder highly specific to *Cynoglossum officinale*. **Range:** Alps (France, Germany, Switzerland, Austria), the Balkans, Roumania, parts of European Russia, Ukraine. **Determination:** Vujić (1994c), who figures features of the male terminalia and the distinctive venational character (the junction between wing veins M1 and R4+5) which helps to distinguish this species from both *C. balkana* and C. *gigantea*. In general appearance *C. pascuorum* closely resembles *C. gigantea*, but has abdominal tergites that are entirely pale (yellow-brown) haired, whereas in *C. gigantea* black hairs are also present. Where it meets R4+5, vein M1 is curved slightly toward the wing base in *C. pascuorum*. In the other species it either meets R4+5 at a right angle or is pointing more toward the wing apex, in consequence reaching R4+5 at an angle less than 90°. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photos provided by Vujić et al.(2020d) and Prokhorov *et al*.(2020).

Cheilosia pedemontana Rondani, 1857
Preferred environment: conifer forest/open ground: open areas within montane zone *Abies/Picea* forest and upwards into unimproved, calcareous and non-calcareous subalpine grassland to 2000m, in the Alps. **Adult habitat and habits:** males hover at 2-4m in open areas within forest and rest on foliage of shrubs such as *Alnus viridis*. Both sexes rest on rocks or patches of bare ground in the sun, to warm up. **Flowers visited:** umbellifers; *Caltha, Ranunculus*. **Flight period:**

June/September. **Developmental stages:** not described**. Range:** Spain (Pyrenees?), Alps (France, Switzerland, Austria, northern Italy), Roumania. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. The female of this species is remarkably similar to the female of *C.alpestris*, from which it may most easily be distinguished by its hairy metasternum - the metasternum is bare in *C.alpestris*. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia pedestris Becker, 1894
Preferred environment: forest/open areas; unimproved montane/subalpine, calcareous grassland within the *Fagus/Abies* zone, up to 1800m; also in subalpine *Pinus uncinata* forest on karst. **Adult habitat and habits:** flies fast and low over short ground vegetation. Settles on foliage of shrubs etc along woodland edge. **Flowers visited:** no data. **Flight period:** mid May/June. **Developmental stages:** undescribed. **Range:** Alps (Italy, Switzerland) and Jura (Switzerland). **Determination**: see key to males of European *Nigrocheilosia* species in the StN Keys volume; *C.pedestris* was described by Becker (1894), based on a solitary female. The species was redescribed (as *C.romigi*) by Claussen and Van der Weyer (2004). Those authors figure the male terminalia and detail differences between this species, *C.insignis* and *C.marginata*. They also provide a key distinguishing males and females of *C.pedestris* (as *C.romigi*) from other bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae. The synonymy of *C.romigi* with *C.pedestris* was established by Claussen and Speight (2007). **Illustrations of the adult insect:** none known.

Cheilosia personata Loew, 1857
Preferred environment: forest/open ground; open areas in humid *Fagus* forest and upwards through the *Picea* zone into the *Larix/Pinus mugo* or *P. sylvestris*/*P. uncinata* zone; plus unimproved, calcareous and non-calcareous montane grassland. **Adult habitat and habits:** clearings and tracksides within forest and more open grassland; flies fast and low and settles on low growing vegetation. **Flowers visited:** white Umbelliferae; *Adenostyles, Knautia, Saxifraga, Scabiosa*. **Flight period:** June/July and August at higher altitudes. **Developmental stages:** undescribed. **Range**: Poland, the Alps, the Pyrenees, northern Spain and northern parts of the former Yugoslavia (Croatia, Montenegro, Serbia, Slovenia). **Determination**: see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia pictipennis Egger, 1860
Preferred environment: forest; mature *Abies/Picea* forest/unimproved, calcareous montane grassland. **Adult habitat and habits**: flies low in open areas within *Picea* forest or in unimproved grassland at higher altitude, and may settle on the ground. **Flowers visited**: *Ranunculus*, male *Salix, Sorbus aucuparia*. **Flight period**: end May/June and on to July at higher altitudes. **Developmental stages:** undescribed. **Range**: Poland, Germany, France (Vosges, Pyrenees, Alps), Switzerland, Liechtenstein, Austria, Roumania, northern parts of the former Yugoslavia; northern edge of the Caucasus, in Russia. **Determination**: Claussen (1998), who both provides a key distinguishing *C.pictipennis* from closely-related species and figures its male terminalia. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia pilifer Becker, 1894
Preferred environment: open ground; unimproved calcareous and non-calcareous grassland, from the *Larix/Pinus mugo* zone upwards to above 2,500m. **Adult habitat and habits:** flies at up to 1m, in open grassland, settling on vegetation. **Flowers visited:** *Ranunculus*. **Flight period:** beginning June/end July, plus August at higher altitudes. **Developmental stages:** not described. **Range:** Alps (France, Germany, Switzerland, Austria, Italy), Roumania. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Stahls (1997) figure the male terminalia. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). *C.clausseni* is easily mistaken for *C.pilifer* (see under *C.clausseni*). **Illustrations of the adult insect:** none known.

Cheilosia pini Becker, 1894
Preferred environment: forest; humid *Fagus/Picea* forest (Vujić and Claussen, 2000); humid, montane grassland at 1100m (Treiber and Doczkal, 2016). **Adult habitat and habits:** no data. **Flowers visited:** male *Salix, Caltha* (Vujić and Claussen, 2000). **Flight period:** beginning April/beginning July. **Developmental stages:** undescribed. **Range:** France (Vosges), Germany, Poland, Czech Republic, Slovakia, Austria, Bosnia-Herzegovina, and Montenegro. **Determination:** Vujić and

Claussen (2000) redescribe the male and provide a description of the female, together with figures of the male terminalia and a key separating this from other species of the *pini* group. **Illustrations of the adult insect:** none known.

C. praecox (Zetterstedt): see under *C.urbana* (Meigen)

Cheilosia proxima (Zetterstedt), 1843
Preferred environment: forest, both coniferous and deciduous, acidophilous *Quercus* and humid *Fagus/ Picea*; also in scrub and unimproved grassland. **Adult habitat and habits:** clearings, tracksides etc.; may occur in small patches of woodland, among scrub in old pasture and in more open grassland situations; males hover up to 6m beside trees; both sexes rest on foliage of bushes and trees, not infrequently at more than 3m from the ground. **Flowers visited:** white umbellifers; *Crataegus, Euphorbia, Prunus spinosa, Ranunculus, Valeriana dioica*. **Flight period:** April/ September, with peaks in June and July/August. **Developmental stages:** larva described and figured by Rotheray (1988a), collected from rosettes of *Cirsium palustre*, where it is an internal feeder in lateral roots. The species has also been reared from *C.oleraceum* and *C. spinosissimum* (Stuke, 2000). It overwinters as a puparium. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range**: Fennoscandia south to Pyrenees and mountainous parts of Spain; Britain eastwards through much of Europe into Turkey and European parts of Russia; Georgia; in Siberia from the Urals to Kamchatka. **Determination:** van der Goot (1981). This species is extremely similar to *C.aerea* Dufour and *C.gigantea* (Zett.). Nielsen and Claussen (2001) figure the male terminalia of both *C.proxima* and *C.gigantea*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b) and Torp (1994).

Cheilosia psilophthalma Becker, 1894
Preferred environment: open ground/forest: open, grassy areas within sparse woodland and unimproved, montane/subalpine grassland from above 1500m, down to grassy, open areas within karstic *Quercus pubescens* forest. **Adult habitat and habits:** settles on low-growing vegetation, e.g. clumps of dead *Molinia* and visits flowers of shrubs. **Flowers visited:** *Acer platanoides, Anemone nemorosa, Euphorbia, Primula veris, Prunus padus, P.spinosa, Salix* spp., including *S.repens*. **Flight period:** April/May and on to July at higher altitudes. **Developmental stages:** larva not described, but *C. psilophthalma* was reared by Grosskopf *et al*. (2002) from 9 different European *Hieracium* species, the larva developing in the aerial parts of the *plants*. The species evidently overwinters as a puparium, among ground surface litter. **Range:** uncertain, due to confusion until recently with *C.latigenis* and *C.urbana,* but confirmed from southern Norway, Sweden, southern Finland, Ireland, Britain, France (Vosges, Alps, Cevennes), Poland, Switzerland, Greece, Montenegro, Serbia and European Russia. **Determination:** Claussen and Kassebeer (1993) and Speight (1996) distinguish this species from the closely similar *C.latigenis*, *C.mutabilis* (Fallen) and *C.urbana* Meigen. Claussen & Doczkal (1998) provide distinctions from *C.Vujići*; another closely related central European species. Various of these authors figure the surstyli of the male terminalia, as do Stubbs and Falk (2002). In other recent keys this species would usually key out to *C.urbana*, but without certainty, since *C.psilophthalma* can have antennae that are from pale orange to almost black, and the keys do not accommodate this range of variation. The closely-related *C.urbana* often occurs in great numbers, but, inexplicably, only single individuals of *C.psilophthalma* are usually found. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia pubera (Zetterstedt), 1838
Preferred environment: forest/open ground/wetland; unimproved montane pasture and fen carr and beside streams in *Fagus/Picea* forest. **Adult habitat and habits:** adults are low flying, over ground vegetation in grassland and in open areas along streams within forest, settling on the foliage of large-leaved plants. **Flowers visited:** *Acer platanoides, Caltha, Cardamine, Prunus padus, Pulsatilla alpina, Ranunculus, Taraxacum*. **Flight period:** end April/June at lower altitudes, and June/July at higher altitudes/more northerly latitudes. Exceptionally, there appears to be a second generation in Ireland, July/August. **Developmental stages:** the larva is described by Stuke and Carstensen (2002), from larvae found in the leaf-bases and root-stock of *Geum rivale*, between June and September; overwintering occurs as a puparium. *C.pubera* can be found in at least two rather different types of situation. This may be due to the larvae having plant hosts with rather distinctly different ecological requirements. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia, the Ardennes, northern Spain (Cordillera Cantabrica) and the Alps; from Ireland eastwards through northern and central Europe (plus mountainous parts of northern Italy and the former Yugoslavia) into European parts of Russia. Lair *et al*. (2021) record this species from the Pyrenees. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. Females of this species are not satisfactorily

dealt with in keys at present. **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994). *C.pubera* has a quite different appearance in the figures provided by Bartsch et al.(2009b) and Stubbs and Falk (1983).

Cheilosia ranunculi Doczkal, 2000
Preferred environment: open ground; unimproved dry grassland and open, grassy areas within forest, from thermophilous *Quercus* forest up to 1500m in the *Abies* zone in the Jura and Alps. **Adult habitat and habits:** flies at up to 1m through grassland vegetation, settling on flowers or on leaves of low-growing plants. **Flowers visited:** *Caltha, Ranunculus, Senecio*. **Flight period:** end April/beginning June. **Developmental stages:** larva undescribed, but probably associated with *Ranunculus bulbosus* (Doczkal, 2000, 2002), though Gibbs and Plant (2001) report the occurrence of *C.ranunculi* from localities where *R.bulbosus* did not seem to be present. **Range:** uncertain as yet, due to confusion with *C.albitarsis*, but confirmed from Denmark, Britain (southern England), France (Paris basin southwards), Germany, Switzerland, Hungary, Italy (including Sicily), Spain, parts of the former Yugoslavia, Bulgaria, Roumania. **Determination**: Doczkal (2000), who figures the male terminalia and provides features for distinguishing the male of this species from males of the closely-related *C.albitarsis*. Males of *C.albitarsis* and *C.ranunculi* can also be separated using the keys provided by van Veen (2004). Females of these two species cannot be distinguished. *C.ranunculi* and *C.albitarsis* are indistinguishable in the field and may be found in flight in the same place and on the same day, so considerable care is required in determining specimens. **Illustrations of the adult insect:** the general appearance of the adult insect is shown by the coloured illustrations of "*C.albitarsis*" in Stubbs and Falk (1983), Kormann (1988) and Torp (1994). The male of *C.ranunculi* is figured in colour by Bartsch et al.(2009b).

Cheilosia redi Vujić, 1996
Preferred environment: deciduous forest/freshwater; near streams in Balkanic thermophilous *Quercus* forest, *Quercus/Carpinus* forest and mesophilous *Fagus* forest (A.Vujić, pers.comm.). **Adult habitat and habits:** males hover at 2-3m (Vujić, 1996). **Flowers visited:** *Caltha, Salix, Stellaria* (Vujić, 1996). **Flight period:** March/May and July at the northern edge of its range (Vujić, 1996). **Developmental stages:** not described. **Range:** Czech Republic, Slovakia, Hungary, Serbia, Bosnia-Herzegovina, Macedonia, Bulgaria, Greece, Roumania. **Determination:** originally described (Vujić, 1996) as a subspecies of *Cheilosia melanopa*, *C.redi* was raised to species level by Francuski et al.(2009), on the results of a comparative morphometric study of the adult insects involving *C.lasiopa, C.melanopa* and *C.variabilis*. Distinctions between *C.melanopa* and *C.redi* are detailed by Vujić (1996) and Francuski et al.(2009). Vujić (1996) also figures the male terminalia. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided by Vujić et al.(2020d).

Cheilosia reniformis Hellén, 1930
Preferred environment: open ground/freshwater; humid, unimproved grassland along streams and grassy, open areas in forest. **Adult habitat and habits:** males hover at 2-3 metres above the ground (G.Ståhls, pers.comm.). **Flowers visited:** *Caltha* (G.Ståhls, pers.comm.); *Trollius riederanus* (Gritskevich, 1998); *Tussilago* and *Salix caprea* (Bartsch et al, 2009b). **Flight period:** April/June. **Developmental stages:** not described. **Range:** known from Norway (Nielsen & Ødegaard (2013); Finland; the western edege of European Russia and eastern Asiatic Russia (Yakutia); Ukraine. Stahls et al.(2008) refer also to an isolated, montane, Serbian population of what may be this species, pointing out that, while genetically this population is more similar to *C.reniformis* than to other elements of the *C.vernalis* complex, it might equally represent a distinct and as yet unnamed species. **Determination:** this is a species of the *C.vernalis* complex. It is included in the keys of Bartsch *et al.* (2009b) and Haarto and Kerppola, 2007), but for separation of *C. reniformis* from *C. vernalis* these authors depend on the absence of bristles on the posterior margin of the scutellum in *C. reniformis*. Stahls *et al.* (2008) confirm the status of *C. reniformis* as a distinct species but note that this feature is unreliable, i.e. that bristles can also be present on the posterior margin of the scutellum in *C. reniformis*. Stahls *et al*. (l.c.) indicate that differences in the dusting of the abdominal tergites are also useful. In the male, the second and third abdominal tergites are dusted and dull only across the median third/half of the width of the tergite, in *C. reniformis*. This contrasts with the situation in the male of *C. vernalis*, where tergite 2 is dusted and dull across fully five sixths of the width of the tergite and tergite 3 is dusted and dull across the median two thirds of its width. Females of *C. reniformis* with marginal scutellar bristles would be more difficult to distinguish from *C. vernalis*. In the females of both species the abdominal tergites are entirely undusted and brightly shining. However, in the female of *C. reniformis* the eye hairs are sparse and distinctly shorter on the ventral third of the eye surface (where they are so short they are virtually absent) than dorsally, whereas in *C. vernalis* the eye hairs are long over the entire surface of the eye and not

distinctly shorter on the ventral third. These differences are illustrated in colour by Prokhorov *et al.* (2018a), who also list diagnostic features of the female and discuss distinctions between *C. reniformis* and *C. vernalis*. **Illustrations of the adult insect:** a general impression of the appearance of *C.reniformis* can be gained from the coloured figure of the male provided by Bartsch et al.(2009b), but comparison between that figure and the figure provided for *C.vernalis* serves only to suggest the artist used the same illustration for both species. Coloured photos of the female of *C. reniformis* are provided by Prokhorov *et al.*(2018a).

Cheilosia rhodiolae Schmid, 2000
Preferred environment: open ground; non-calcareous cliff, rock and rocky moraine with sparse, alpine heath communities at 2000 - 2400m (Schmid, 2000). **Adult habitat and habits:** Schmid (2000) reports that both sexes feed persistently on flowers of *Rhodiola rosea* and suggests (pers.comm.) that *C.rhodiolae* may be an important pollinator of this plant. Males hover at 3-5 m over plants of *Rhodiola*, and settle almost exclusively on their inflorescences. Females lay their eggs on the undersides and bases of *Rhodiola* leaves, particularly basal leaves of the plant (Schmid, pers.comm.). **Flowers visited:** *Rhodiola rosea* (Schmid, 2000). **Flight period:** mid June/July. **Developmental stages:** larva described and figured by Schmid (2000), who also provides detail of the larval biology. He shows that the larva mines the leaves of roseroot (*Rhodiola*) and that the species overwinters as a puparium. **Range:** so far known only from the Alps (Austria, France) and the Tatra mountains (Poland: Zóralski and Mielczarek, 2021). There is an unverified record from Switzerland (Schmid, 2007). **Determination:** Schmid (2000), figures the male terminalia and provides a key distinguishing this species from *C.fasciata* and *C.semifasciata.* Speight *et al.*(2017) review the features available for separation of *C. rhodiolae* from *C. fasciata* and *C. semifasciata* and provide another key. Lair *et al.* (2021) found no genetic basis for continuing to recognise *C. rhodiolae* as a separate species. **Illustrations of the adult insect:** Schmid (2000) illustrates both male and female in colour.

Cheilosia rhynchops Egger, 1860
Preferred environment: *Fagus/Picea* and *Fagus/Abies* forest, from the upper altitudinal limit of the *Fagus* into the *Abies/Picea* zone and upwards into the *Larix/P.mugo/P.uncinata* zone to 2,000m. **Adult habitat and habits**: clearings, tracksides, beside streams etc., fast-flying through vegetation up to 2m; settles on foliage of bushes, *Petasites* etc.; males hover at up to 5m in open areas within forest. **Flowers visited**: *Caltha, Euphorbia, Ranunculus, Sorbus aucuparia*. **Flight period**: end May/July. **Developmental stages:** undescribed, but the female has been observed (Doczkal, 1996b) ovipositing on *Adenostyles alliariae*, strongly suggesting that this is a larval host plant. Stuke (2000) cites *A. alliariae* as the larval host plant of *C. rhynchops*. **Range**: Poland south to the Alps`and the Pyrenees; northeast France (Vosges) eastwards through central Europe to Austria and northern Italy; parts of the former Yugoslavia; Roumania and Bulgaria; Caucasus (Georgia). **Determination**: Sack (1930-32). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia rodgersi Wainwright, 1911
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April. **Developmental stages:** not described. **Range:** Portugal, southern Spain and N Africa (Morocco). **Determination**: this species is redescribed and its male terminalia figured by Claussen (1989). Vujić and Claussen (2000) provide a key in which the male of *C.rodgersi* is separated from the males of some closely related species. **Illustrations of the adult insect:** none known.

Cheilosia rotundiventris Becker, 1894 and ***C.ruficollis*** Becker, 1984 - see under *C.vernalis*

Cheilosia rufimana Becker, 1894
Preferred environment: deciduous forest; humid *Fagus* forest and in the vicinity of springs and flushes in more open country. **Adult habitat and habits:** clearings/tracksides within forest and in the vicinity of streams and flushes in more open conditions; males hover at 2-6m and settle on low-growing plants and on the ground. **Flowers visited:** white umbellifers; *Anemone nemorosa, Bunias orientalis, Caltha, Crataegus, Euphorbia, Ficaria verna, Geranium sylvaticum, Iris psuedacorus, Prunus padus* and *P.spinosa, Ranunculus, Salix, Stellaria, Taraxacum*. **Flight period:** end April/mid June. **Developmental stages:** not described, but Bothe (1986) has observed the female ovipositing on *Polygonum bistorta*. **Range:** from Finland, Denmark and Belgium eastwards through mountainous parts of central Europe to Bulgaria; Ukraine; Kazakstan; Asiatic Russia. Lair *et al*. (2021) record this species from the Pyrenees (France). **Determination:** Bradescu (1991), Haarto and Kerppola (2007a), van der Goot (1981). Nielsen and Claussen (2001) and Barkalov (2007) figure the male terminalia.

Barkalov (2007) also establishes that *C. subarctica* Hellen is a synonym of this species. Using existing keys the female of *C. rufimana* can be difficult to distinguish from females of *C. lenis*, and females of *C. velutina*. In *C. lenis* the hairs on the lateral margins of tergites 3 and 4 are longer than the maximum depth of a hind femur and sternites 2-4 are brightly shining. In females of both *C. rufimana* and *C. velutina* the hairs on the lateral margins of tergites 3 and 4 are shorter than the maximum depth of a hind femur and the sternites are grey-dusted and dull. In the female of *C. rufimana* the hairs on the disc of the scutellum are upstanding, whereas in *C .velutina* they are adpressed and point toward the mid-line of the scutellum. **Illustrations of the adult insect:** both male and female are illustrated in colour by Torp (1994) and Bot and Van de Meutter (2019). The male is also figured in colour by Bartsch *et al*. (2009b).

Cheilosia sahlbergi Becker, 1894
Preferred environment: near streams and base-rich flushes in moorland/montane heath; unimproved, thinly vegetated, non-calcareous subalpine grassland. **Adult habitat and habits:** flies low and rather rapidly over ground vegetation, emerging immediately following snow-melt; settles on rocks, stones and flowers in sheltered spots. **Flowers visited:** *Caltha palustris, Potentilla erecta, Ranunculus, Saxifraga.* **Flight period:** April/May at lower altitudes and June/beginning July in the alpine zone. **Developmental stages:** larva not described, but, according to Stubbs and Falk (2002), has been observed by Rotheray to feed externally on the rootstock of *Polygonum viviparum* L. **Range:** Fennoscandia south through mountainous parts of Europe to the Alps, the Balkans and the Caucasus; from Britain (Scottish highlands) eastwards through northern Europe to the Baltic states and on to the Kola peninsula. Lair *et al*. (2021) record this species from the Pyrenees (France and Spain). **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. An aadditional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). This species is also included in the key to Fennoscandian *Cheilosia* species, provided by Bartsch *et al*. (2009b). *C. sahlbergi* remains particularly difficult to separate from *C. grisella* Becker, *C. pubera* (Zett.) and *C. vangaveri* (Timon-David). **Illustrations of the adult insect:** none known.

Cheilosia schnabli Becker, 1894
Preferred environment: forest; open areas in thermophilous *Quercus* forest (Vujić, 1996). **Adult habitat and habits:** in open, grassy areas within forest; settles on vegetation and flowers; males hover at 1-3m (Vujić, 1996). **Flowers visited:** *Euphorbia, Ranunculus* (Vujić, 1996). **Flight period:** mid May/beginning July. **Developmental stages:** undescribed. **Range:** Hungary; Roumania**;** Balkans (Bosnia/Herzegovina, Greece, Serbia); southern parts of European Russia and the Caucasus (Dagestan; Georgia); Kazakhstan. **Determination:** redescribed by Vujić et al.(1998), giving a first description of the male and figures of the male terminalia. This species is very similar to *C. impressa* Loew, with which it shares one feature not known in other European *Cheilosia* species - a pronounced, knob-like projection on the antero-lateral surface of the fore coxa. Vujić *et al*. (1998) detail distinctions between this species and *C.impressa*. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia scutellata (Fallen), 1817
Preferred environment: a wide range of types of forest, from northern European conifer forest to Mediterranean maquis, but not apparently associated with *Betula, Fraxinus* or *Picea*. **Adult habitat and habits:** frequently found on low-growing vegetation and bushes within woodland, in the dappled sunlight of small glades etc.; also along tracks and at the edges of clearings. **Flowers visited:** white umbellifers, *Calluna, Chaerophyllum, Cirsium, Cistus, Crataegus, Galium, Hedera, Hieracium, Ranunculus, Sorbus*. **Flight period:** May/September and April/October (or even November) in southern Europe. **Developmental stages:** together with the larva of *C. longula,* the larva is described and figured by Rotheray (1990); well-known as tunnelling the fruiting bodies of various large woodland basidiomycete fungi. The list of larval host fungi brought together by Stuke (2000) comprises *Amanita caesarea, Boletus aestivalis, B. calopus, B. edulis, B. erytropus, B. impolitus, B. luridus, B. pinophilus, B. quéletti, B.regius, Gyroporus castaneus, Lactarius pallidus, Leccinum griseum, L. scabrum, Russula vesca, Suillus grevillea, Xerocomus chrysenteron, X. rubellus* and *X. subtomentosus*. Mature larvae have been found in the autumn and the species presumably overwinters as a puparium. **Range:** Fennoscandia south to Iberia and round the Mediterranean to Greece, Turkey and N Africa; from Ireland eastwards through Eurasia to the Pacific coast. **Determination:** van der Goot (1981). The adult insect is illustrated in colour by Ball and Morris (2013), Bartsch *et al*. (2009b) and Torp (1994). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia semifasciata Becker, 1894

Preferred environment: open ground/forest; stabilised scree slopes, cliffs and rock outcrops in sheltered locations up to 2000m, or within woodland at altitudes up to and including those of *Alnus viridis* scrub; dry-stone walls; also poorly-drained deciduous forest. This species can also occur in urban situations (Barkemeyer, 1997). Schmid (2004b) noted frequent occurrence of *C.semifasciata* in suburban gardens in SW Germany, using *Sedum telephium* as larval host, observing that the larvae could even be found in *Sedum* on traffic islands in the roads and in seedlings on sale in garden supply shops. He concluded the species was self-maintaining in the urban environment there. **Adult habitat and habits:** flies low over ground vegetation and rock, settling on foliage or rock in the sun; males hover up to 3m in woodland glades or sheltered hollows in rocky terrain. The male flies seldom hover far from stands of the larval foodplant and are often no more than a few metres from it. **Flowers visited:** *Alliaria petiolata, Allium ursinum, Anemone nemorosa, Prunus spinosa, Ranunculus, male Salix, Taraxacum, Vaccinium myrtillus*. **Flight period:** end March/end May. **Developmental stages:** larva described and figured by Rotheray (1988c) and illustrated in colour by Rotheray (1994); a miner in the leaves of *Saxifraga, Sedum* and *Umbilicus* (Hering, 1957). The larva is shown within a leaf mine on *Umbilicus*, by Ball and Morris (2013).This species overwinters as a puparium. **Range:** northern Norway and Finland south to the Pyrenees; from Ireland eastwards through mountainous parts of central Europe to Roumania and Bulgaria. **Determination:** Bradescu (1991), Haarto and Kerppola (2007a) and van der Goot (1981) may be used to separate *C.semifasciata* from related species apart from *C.rhodiolae*. To separate *C.semifasciata* and *S.rhodiolae* from one another it is necessary to refer to Schmid (2000). As Schmid (2000) says, high altitude specimens of *C.semifasciata* may have entirely black legs. This, together with the fact that the leg hairs on the mid tibiae in this high altitude form can also be all black, can make the species very difficult to distinguish from *C.rhodiolae* Schmid. The surstyli of the male terminalia are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the coloured figure provided for the male of this species by Bartsch et al.(2009b) is erroneous. It is the same illustration as is provided for *Cheilosia fasciata* and shows the entirely dull tergites found in that species. In males of *C. semifasciata* the hind margins of tergites 2 and 3 are narrowly black, undusted and shining.

Cheilosia sootryeni Nielsen, 1970

Preferred environment: forest; open areas in boreal *Betula* and *Picea* forest (Nielsen, 1970) and western taiga (T.Nielsen, 1998). **Adult habitat and habits:** no data. **Flowers visited:** *Anemone nemorosa, Ranunculus ficaria* Nielsen (1970), *Caltha, Taraxacum* (Bartsch et al.(2009b). **Flight period:** mid May/mid June Nielsen (1970). **Developmental stages:** not described. **Range:** Norway; Finland; northern parts of European Russia; Asiatic Russia. **Determination:** Nielsen (1970) details differences between this species and *C.vernalis* Fall.), and figures the male terminalia. The male terminalia are also figured by Barkalov (2007). This species is included in the keys to northern European *Cheilosia* species in Bartsch et al.(2009b) and Haarto and Kerppola (2007a). It is also included in the keys in Bartsch et al.(2009b). **Illustrations of the adult insect:** Bartsch et al.(2009b) figure the male in colour.

Cheilosia soror (Zetterstedt), 1843

Preferred environment: deciduous forest/evergreen broadleaved forest; mature/overmature *Fagus* and *Quercus* forest, including cork oak (*Q. suber*) forest; alluvial softwood forest of *Salix/Populus*. **Adult habitat and habits:** clearings, tracksides, and hedgerows, usually in partial shade. **Flowers visited:** white umbellifers, *Cirsium, Taraxacum*. **Flight period:** May/September with peak in June/July. **Developmental stages:** larva undescribed, but reported from the fruiting bodies of basidiomycetes, notably *Leccinum* and *Suillus* and also from the ascomycete *Tuber aestivum* (Marino *et al*., 2024). Stuke (2000) cites *Suillus bovinus* as the larval host. **Range:** Fennoscandia south to N Africa; from Britain (southern England) eastwards through most of Europe into Siberia and on to the Pacific coast, including Japan. **Determination:** Bradescu (1991), van der Goot (1981); Bartsch *et al*, (2009b); Bot & Van de Meutter (2019). This species appears in some recent literature under the name *ruffipes* (Preyssler). The wide phenotypic variability found in Iberian populations of *C. soror* was studied genetically by Ballester-Torres *et al*. (2022), who concluded it was not indicative of the presence of unrecognised species. The surstyli of the male terminalia are figured by Stubbs and Falk (2002) and Ballester-Torres *et al*. (2022). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia subpictipennis Claussen, 1998

Preferred environment: open ground/forest; open areas, either grassy or with tall herb vegetation, within the *Abies/Picea* zone and, when along streams, down into the *Fagus* zone; also unimproved, non-calcareous montane grassland up to 1500m; and up to 2000m in unimproved, non-calcareous subalpine grassland in southern parts of the Alps and in the Pyrenees. **Adult**

habitat and habits: flies low among clumps of taller ground vegetation and settles on low-growing plants or on the ground; males hover at 2-3m beside shrubs etc. **Flowers visited:** *Crataegus, Ribes uva-crispa, Salix, Sorbus aucuparia, Vaccinium myrtillus* (Clausen, pers.comm.); *Cotoneaster jurana*. **Flight period:** end April/mid July. **Developmental stages:** not described, but almost certainly associated with *Meum athamanticum*, on which Doczkal has observed oviposition (Claussen, 1998). **Range:** Vosges, Schwarzwald, Massif Central, Jura, Alps (France, Germany, Switzerland, Liechtenstein, Austria, Italy), Pyrenees (France), Hungary, Balkans (Greece, Slovenia, Macedonia); western Siberia. **Determination:** Claussen (1998), who provides a key separating *C.subpictipennis* from other closely similar species and figures the male terminalia. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia sulcifrons Kaplan in Kaplan & Thompson, 1981
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March, May, July. **Developmental stages:** not described. **Range:** Turkey, Israel. **Determination**: Kaplan and Thompson (1981), who figure the male terminalia. **Illustrations of the adult insect:** none known.

Cheilosia thessala Claussen & Ståhls, 2007
Preferred environment: forest; Mediterranean pine forest of *P.pinaster* and *P.halepensis* (Claussen and Ståhls, 2007) and *P.pinea/P.halepensis* (Standfuss and Claussen, 2007); *Pinus brutia/Quercus coccifera* forest (Van Steenis *et al*, 2019). **Adult habitat and habits:** flies along forest edges and tracks within pine forest (Claussen and Ståhls, 2007). **Flowers visited:** *Foeniculum, Hedera pastuchovii* (Van Steenis *et al*, 2019). **Flight period:** September/October (Claussen and Ståhls, 2007). **Developmental stages:** not described, but the larva is probably associated with the large basidiomycetes *Amanita caesarea* and *Suillus granulatus* (Standfuss and Claussen, 2007). **Range:** Croatia, Greece, Cyprus. **Determination:** Claussen and Ståhls (2007) who include a key to separate this species from others in the *C.scutellata* group and also figure the male terminalia. **Illustrations of the adult insect:** none known.

Cheilosia tonsa Sack, 1938
Preferred environment: open ground; sparsely-vegetated, rocky ground in the alpine zone, from 1,800m upwards to above 3,000m. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end July/August. **Developmental stages:** not described. **Range:** Alps (Switzerland, Austria, Italy). **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. **Illustrations of the adult insect:** none known.

Cheilosia triamilia Ballester-Torres, Ricarte & Nedeljković, in Ballester-Torres *et al*., 2024
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus, Salix* (Ballester-Torres *et al*., 2024). **Flight period:** April/June. **Developmental stages:** not described. **Range:** the Sierra Nevada massif of southern Spain. **Determination:** both the male and female are described in Ballester-Torres *et al*. (2024), based on morphological and genetic data separating *C. triamilia* from other species of the *melanura/vernalis* species group. Morphologically, *C. triamilia* and *C. vernalis* are almost identical, except in distribution of the eye hairs – more-or-less uniform in *C. vernalis* but sparcer and shorter on the lower half of the eye in males of *C. triamilia* and almost absent on the lower half of the eye in females of *C. triamilia*. With a body length of 8.5 – 9.00 mm., *C. triamilia* is also slightly larger than *C. vernalis*. Ballester-Torres *et al*. (2024) figure features of the male terminalia of *C. triamilia* and include it in a key to Iberian species of the *Cheilosia melanura/vernalis* group. **Illustrations of the adult insect:** the general appearance of both the male and the female can be seen in the coloured photos provided in Ballester-Torres *et al*. (2024).

Cheilosia urbana (Meigen), 1822
Preferred environment: forest/open ground; open areas in both coniferous and deciduous forest and scrub; unimproved grassland, including semi-arid grassland, dry calcareous grassland and montane/subalpine grassland. **Adult habitat and habits:** clearings, tracksides; flies low, usually within 1m of the ground, and settles on low-growing plants; males hover at 1-2m close to shrubs in flower, or close to rocks. **Flowers visited:** white umbellifers, *Acer pseudoplatanus, Anemone nemorosa, Buxus, Caltha, Euphorbia, Potentilla, Prunus spinosa,* male *Salix, Taraxacum.* **Flight period:** April/June and July at higher altitudes/more northerly latitudes. **Developmental stages:** undescribed, but Claussen (1980) and Doczkal (1996b) found the species egg-laying in the basal leaf rosettes of *Hieracium pilosella*. Grosskopf *et al*. (2002) report that *C.urbana* can develop in both *H. pilosella* and *H. caespitosum*, and other European *Hieracium* species, the young larvae

moving down from the leaf axils in which the eggs are laid, to feed externally on the roots of the plant, in which they make small holes. The species evidently overwinters as a puparium, close to the ground surface, in the soil. Kassebeer (1993) indicates finding females egg-laying on *Filipendula ulmaria*. Grosskopf *et al*. (2002) were not able to rear *C.urbana* on *F. ulmaria*. **Range:** Fennoscandia south to Iberia and the Mediterranean (including the island of Crete); from Britain eastwards through central and southern Europe to the Balkans and Turkey,; Georgia; N Africa. **Determination:** this species appears in most recent literature as *C.praecox* (Zetterstedt). Speight *et al*. (1998) indicate that the correct name for this species is *C.urbana* (Meigen). It is distinguished from the extremely similar *C.latigenis* Claussen & Kassebeer, *C.mutabilis* (Fallen) and *C.psilophthalma* Becker by Claussen & Kassebeer (1993), and Speight (1996). Claussen & Doczkal (1998) provide distinctions from *C.Vujići*, another closely related central European species, and provide figures of the male terminalia. The antennae in this species can be almost black or to various extents paler, the palest having the third antennal segment orange. The specimens with orange antennae cannot be determined easily using existing keys, where *C.urbana* is taken to have brown/black antennae. **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch et al.(2009b), Torp (1984, 1994) and van der Goot (1986).

Cheilosia uviformis Becker, 1894
Preferred environment: deciduous forest and woodland subject to winter flooding; occurs in both alluvial hardwood forest and lake edge swamp woodland of *Alnus/Salix*. **Adult habitat and habits:** females spend much time sunning themselves on low-growing plants in sheltered spots; males hover up to 10 metres from the ground in small glades and along paths, in woodland, descending immediately when the sun disappears behind a cloud; males settle low down on pathside vegetation etc.; both sexes visit male flowers of *Salix*, but leave whenever the sun is obscured. **Flowers visited:** white umbellifers; *Anemone nemorosa, Caltha, Crataegus, Listera ovata, Potentilla tabernaemontani, Prunus padus, Ranunculus*, male *Salix, Vaccinium myrtillus*. **Flight period**: May. **Developmental stages:** undescribed. **Range:** Fennoscandia south to the Pyrenees; from Ireland eastwards through central Europe to the former Yugoslavia; Ukraine. **Determination:** this species is not satisfactorily distinguished in existing keys. It is included in the keys provided by van Veen (2004), but specimens lacking scutellar marginal bristles could be misdetermined as *C .laticornis*, and others with a heavily-dusted face could be identified as *C. rufimana*. It is redescribed and its diagnostic features are detailed by Speight and Claussen (1987), who also figure features of the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Prokhorov *et al*.(2020) and Torp (1994).

Cheilosia vangaveri Timon-David, 1937
Preferred environment: forest/open ground; unimproved, montane grassland and open, grassy areas in the upper parts of the *Abies/Picea* zone and on through the *Larix* zone into unimproved, calcareous and non-calcareous sub-alpine grassland to above 2,500m. **Adult habitat and habits:** very low-flying. **Flowers visited:** white umbellifers; Ranunculaceae; *Potentilla; Thlaspi*. **Flight period:** beginning June/end July, plus August at higher altitudes. **Developmental stages:** not described. **Range:** Jura (France, Switzerland), Alps (France, Switzerland, Austria, Italy); parts of the former Yugoslavia (Montenegro, Serbia, Slovenia). **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. An additional key, for identification of the bare-eyed, black-legged *Cheilosia* species with partly red/orange antennae, is provided by Claussen and Van der Weyer (2004). Both sexes of this species can be easily confused with *C.sahlbergi* Becker and females can easily be confused with *C.pedestris* Becker. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Cheilosia variabilis (Panzer), 1798
Preferred environment: humid/mesophilous deciduous forest, from the *Fagus/Picea* zone to alluvial hardwood forest. **Adult habitat and habits:** tracksides, edges of clearings etc.; settles frequently on the foliage of bushes e.g. *Rubus fruticosus*, shrubs and taller ground vegetation such as *Pteridium*; flight swift and darting, between and round bushes etc. **Flowers visited:** white umbellifers; *Caltha, Cirsium, Euphorbia, Galium, Ranunculus, Rubus, Scrophularia nodosa, Sorbus aucuparia*. **Flight period:** April/September, with apparently one generation June/August towards the northern edge of the range but with two periods of emergence April/June and July/September further south. **Developmental stages:** the larva is described and figured by Dusek (1962) and Rotheray (1990). It mines the rhizomes of *Scrophularia nodosa* and the stems of *S. auriculata* during the autumn. **Range:** southern Fennoscandia south to Iberia; from Ireland eastwards through central and southern Europe (Italy, former Yugoslavia) into Bulgaria; Turkey; Georgia; Russia as far as western Siberia; N. Africa (Morocco). **Determination:** van der Goot (1981). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

Illustrations of the adult insect: the adult insect is illustrated in colour in Stubbs and Falk (1983), Kormann (1988) and Torp (1994).

Cheilosia varnensis Claussen, 2000
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** undescribed. **Range:** Bulgaria. **Determination:** Claussen (2000), who figures the male terminalia and provides features separating this species from the closely related *C.angustigenis*, with which it shares the unusual feature of a complete probasisternal bridge. The female remains unknown. **Illustrations of the adult insect:** none known.

Cheilosia velutina Loew, 1840
Preferred environment: forest/open ground; mesophilous deciduous forest/scrub and unimproved grassland. **Adult habitat and habits:** males hover up to 5m in the vicinity of trees and shrubs, beside streams and tracks; both sexes settle on foliage up to 5m; flight is low, very fast and very direct. **Flowers visited:** white umbellifers, yellow composites; *Achillea, Anemone nemorosa, Anthemis, Bellis, Caltha, Chrysanthemum, Galium, Potentilla erecta, Prunus spinosa, Ranunculus, Rorippa, Ranunculus.* **Flight period:** mid July/late August. **Developmental stages:** the larva remains undescribed, but supposedly mines the stems of *Cirsium palustre* (Rizza *et al*., 1988) and, according to Torp (1984), has been found mining the rhizome of *Scrophularia nodosa.* The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia south to Spain; from Ireland eastwards through much of Europe into Russia and on through Siberia to the Pacific coast. **Determination:** van der Goot (1981). The male terminalia of this species are figured by Nielsen and Claussen (2001). There is confusion concerning the identity of this species. For example, Violovitsh's (1986) figure of the male terminalia does not match exactly with the terminalia of western European "*C.velutina"*. The concept of the species employed here is that of Nielsen and Claussen (2001). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Torp (1994).

Cheilosia venosa Loew, 1857
Preferred environment: thiny-vegetated, rocky, calcareous, subalpine grassland from the upper edges of the *Larix* zone and in karstic *Pinus uncinata* forest and upwards, to above 2400m. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end May/mid August. **Developmental stages:** not described. **Range:** Alps (Germany, France, Switzerland, Austria, Italy), Roumania. **Determination:** Ståhls & Barkalov (2017) provide a key for the separation of this species from others of the *caerulescans* group. See also key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Stahls (1997) figure the male terminalia. This species is inadequately differentiated from *C.caerulescens, C.herculana* and *C.kerteszi* in existing keys. **Illustrations of the adult insect:** none known.

Cheilosia vernalis (Fallen), 1817
Preferred environment: open ground/forest; dune systems, humid, oligotrophic and eutrophic unimproved pasture; *Molinia* grassland of acidic fen subject to seasonal flooding; grassy clearings in deciduous forest and upwards through montane grassland into alpine grassland. **Adult habitat and habits:** low-flying, over ground vegetation; males hover at 1-3m, in small clearings and at sheltered spots. **Flowers visited:** white umbellifers; *Caltha, Cirsium arvense, Leontodon, Leucanthemum, MenCirsium, yanthes, Prunus spinosa, Ranunculus, Salix, Senecio, Taraxacum.* **Flight period:** April/October, with peaks in May/June and August. **Developmental stages:** the larva has not been described, but is known to be an internal feeder in the stems of *Achillea, Cirsium, Matricaria* and *Sonchus oleraceus* (Stuke, 2000) and in the involucre of *Tragopogon* (Bankowska, 1980; Torp, 1984). The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia south to Iberia; from Ireland eastwards through central and southern Europe (Italy, former Yugoslavia) to Turkey, Georgia and European parts of Russia and on through Siberia to the Pacific coast. **Determination:** Bartsch *et al*. (2009a); van der Goot (1981). In recent texts it has more than once been suggested that, as at present recognised, *C.vernalis* comprises more than one species. However, no satisfactory basis for subdividing the species has yet been demonstrated and the male terminalia of the various different variants appear identical. Van Veen (2004) attempts to segregate some elements of the *C. vernalis* complex, such as *C. rotundiventris* Becker and *C. ruficollis* Becker. But Stahls *et al*. (2008) subsequently identified these two taxa as synonyms of *C. vernalis*, from a comparative genetic study. Milankov *et al*. (2002) studied genetically a number of Balkan populations of *C. vernalis* collected in various habitats, but concluded that the variation exhibited was intra-specific, though significant. Spring brood specimens are typically entirely, or predominantly, brown haired and frequently have the third antennal segment orange, while summer specimens tend to be predominantly black-haired,

with the third antennal segment dark brown. The specimens with orange antennae are not possible to determine correctly using existing keys. One species which is extremely similar to *C.vernalis* although differing distinctly in characters of the male terminalia, is *C. sootryeni* Nielsen (1970). This latter species may well have been confused with *C. vernalis* by some authors, since its description seems to have been largely overlooked. *C. sootryeni* is included in the keys provided by Bartsch *et al*. (2009b), Haarto and Kerppola (2007) and van Veen (2004). Another species extremely similar to *C. vernalis*, but nonetheless distinct, according to genetics data presented by Stahls *et al.* (2008), is *C. reniformis* (Hellen). For distinctions between *C. vernalis* and *C. reniformis* see the *C. reniformis* species account. Other species that can be extremely difficult to separate from *C. vernalis* are *C. cynocephala* and *C. melanura*: it can be impossible to decide to which of these three taxa individual specimens belong, using the morphological features currently employed to separate them. An extended discussion of intraspecific variability in adults of *C.vernalis* is provided by Stahls et al.(2008), but their study does not encompass *C.cynocephala* and *C.melanura*. **Illustrations of the adult insect:** the adult of *C.vernalis* is illustrated in colour in Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994).

Cheilosia vicina (Zetterstedt), 1849
Preferred environment: forest/open ground (both coniferous and deciduous forest); clearings and open areas in forest and unimproved grassland from the *Fagus/Picea* zone up to the *Larix* zone and beyond, into subalpine grassland, to above 2,000m in the Alps. **Adult habitat and habits:** clearings, tracksides etc.; usually flies within 2m of the ground; settles on foliage of ferns and bushes etc. **Flowers visited:** *Caltha, Convolvulus, Galium, Potentilla erecta, Prunus spinosa, Ranunculus,Taraxacum.* **Flight period:** May/July and August at higher altitudes/more northerly latitudes. **Developmental stages:** the larva has not been described. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia south to the Pyrenees and northern Spain; from Ireland eastwards through northern, central and southern Europe (northern Italy and the former Yugoslavia) into European parts of Russia and Turkey; in Siberia to Tuva. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. Females of this species cannot be satisfactorily distinguished from females of *C.nigripes* (Mg.) using existing keys. However, they may be distinguished satisfactorily from the shape of the postclypeus, which, in the midline, is less than 1½x as long as its maximum width in *C.nigripes*, but nearly 2x as long as wide in *C.vicina*. This species appears in most recent literature as *C.nasutula* Becker. It was established that *nasutula* of Becker (1894) is a junior synonym of *vicina* (Zett.) by Lucas et al.(1995), who also figure the male terminalia of this species. Barkalov and Ståhls (1997) established that *recens* Becker is also a synonym of this species. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b) and Torp (1994).

Cheilosia vujići Claussen & Doczkal, 1998
Preferred environment: open ground; unimproved, calcareous and non-calcareous montane/subalpine and alpine grassland up to 2500m in the Alps. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end May/end June and on into July at higher altitudes. **Developmental stages:** not described. **Range:** Alps (France, Switzerland, Italy), Montenegro. **Determination:** Claussen and Doczkal (1998), who figure the male terminalia and provide a key distinguishing this species from the closely similar *P. psilophthalma* and *P. urbana* (Mg.). **Illustrations of the adult insect:** none known.

Cheilosia vulpina (Meigen), 1822
Preferred environment: forest/unimproved grassland. **Adult habitat and habits:** open woodland, coniferous and deciduous, where there is herbaceous ground cover; unimproved pasture to above the altitude of *Picea* forest, usually on well-drained sites; males hover up to 15m. **Flowers visited:** white Umbelliferae, especially *Heracleum; Chaerophyllum, Bellis, Galium, Ranunculus*. **Flight period:** April/June and July/September. **Developmental stages:** the larva is described and figured, together with the puparium, by Brunel and Cadou (1990a), who reared the species from the roots of cultivated artichoke (*Cynara scolymus*). These authors (1990b) also demonstrate the occurrence of pupal diapause in *C.vulpina*, triggered by temperatures experienced during the last larval instar. Stuke and Carstensen (2002) reared the species from larvae found in the root-stock of *Arctium lappa* and *Arctium minus*, and redescribe the larva. Doczkal (2002) reports egg-laying behaviour by this species on *Cirsium eriophorum* and Stuke and Carstensen (2002) also refer to various *Cirsium* species as probable larval host plants. The species overwinters as a puparium. **Range:** Denmark to the Pyrenees and northern Spain; from Britain (England) eastwards through central Europe to central and southern parts of Russia as far as western Siberia. **Determination:** van der Goot (1981). It has recently been recognised (Claussen and Speight, 1988) that *C.conops* Loew is a synonym of *C.vulpina*. In van der Goot (1981) *C.conops* is treated as a separate species. The surstyli of the male terminalia

are figured by Stubbs and Falk (2002). **Illustrations of the adult insect:** the adult female is figured in colour by Ball and Morris (2013).

CHRYSOGASTER

Peck (1988) lists 13 European species in this genus. Six of them have since been transferred to *Melanogaster* (Maibach *et al*, 1994a). Two of the remainder, *C.basalis* Lw and *C.musatovi* Stackelberg, are very probably the same species, though they do not seem to have been formally synonymised. One additional species, *C.rondanii*, has been described by Maibach and Goeldlin (1995) and another, *C.mediterraneus*, by Vujić (1999b). A further European species, *Chrysogaster coerulea*, has been re-instated by Ricarte *et al.* (2022). There is no key which includes all the European species.

Chrysogaster basalis Loew, 1857
Preferred environment: freshwater/forest; springs/streams in deciduous forest (acidophilous *Quercus*/thermophilous *Quercus*, including mesophilous *Fagus*). **Adult habitat and habits:** flies with a rapid, darting movement above tall ground vegetation and swings rapidly from side to side as it approaches to settle on flowers. **Flowers visited:** white umbellifers; *Chrysanthemum leucanthemum, Potentilla erecta*. **Flight period:** mid June/August, with apparent peak in July. **Developmental stages:** not described. **Range:** from France and southern Germany south to northern Spain and Portugal and in N Africa; Switzerland; Roumania and much of the Balkan Peninsula (Bosnia-Herzegovina, Croatia, Greece, Macedonia, Serbia). Assuming *musatovi* is the same species as *basalis*, then *C.basalis* also occurs in the Ukraine, the Caucasus (Georgia) and on into Kazakhstan and Tajikistan. Confusion between *C. basalis* and the recently re-described Iberian species *C. coerulea* renders the distribution of *C. basalis* uncertain, at least west of the Alps. **Determination:** the Key provided in the StN Keys volume does not include *C. coerulea*, which is very similar to *C. basalis*. It can be separated from *C. basalis* by features of the male terminalia. The male terminalia of *C. coerulea* are figured by Ricarte *et al.*(2022). The male terminalia of the species currently regarded as *C.basalis* are figured by Claussen & Hauser (1990), Maibach *et al.*(1994a) and Vujić (1999b). None of the authors who have figured the male terminalia of the species they refer to as *C. basalis* in recent literature seem to have examined the type material of this species. It is thus uncertain how solid a basis there is for current interpretations of *C. basalis*. Females of *C.basalis* are very difficult to separate from those of C. *coerulea*, *C.solstitialis* and *C. virescens*. This is probably the same species as *C.musatovi* Stack. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019).

Chrysogaster cemiteriorum (L.), 1758
Preferred environment: wetland; fen and cutover valley bog. **Adult habitat and habits:** flies among and over fen meadow vegetation and is frequent at flowers, including under overcast conditions. **Flowers visited:** white umbellifers; *Sambucus ebulus*. **Flight period:** mid June/mid September. **Developmental stages:** features of the larva and puparium are described and figured by Kuznetzov and Kuznetzova (1994), but without any information on larval biology or habitat. **Range:** Fennoscandia south to N Africa; from Ireland eastwards through most of Europe (though extremely localised in the Alps) into Russia and on to the Pacific coast. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Maibach *et al.*(1994a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.*(2009b), Stubbs and Falk (1983) and Torp (1994).

Chrysogaster coerulea Strobl, in Czerny & Strobl, 1909
Preferred environment: in the vicinity of springs and small streams in mesophilous *Fagus* forest (Speight and Lebard, 2022a) and in more open habitats up to 2000 m altitude. **Adult habitat and habits:** no data. **Flowers visited:** Apiaceae; *Euphorbia*. **Flight period:** June/September. **Developmental stages:** not described. **Range:** as yet uncertain, due to confusion with *C. basalis* until recently. Widely distributed in Spain (Ricarte *et al.*, 2022), and recorded from both southern France and eastern central France (Claude & Speight, 2022; Speight & Lebard, 2022). **Determination:** originally described as a variety of *C. cemiteriorum* this taxon was elevated to species level and redescribed by Ricarte *et al.*(2022), who also figure the male terminalia and provide a key to separate *C. coerulea* from other Spanish *Chrysogaster* species. In addition, they point out that the well-developed facial prominence of the male in *C. caerulea* distinguishes this species from *C. musatovi*, as well as from *C. basalis*. It is in other ways closely similar to *C. basalis*, but can, with confidence, be separated from *C. basalis* by features of the male terminalia. The female is not reliably distinguishable from the female of *C. basalis*.

Illustrations of the adult insect: the general appearance of the male and female is shown in coloured illustrations provided by Ricarte *et al.*(2022) and Speight and Lebard (2022a).

Chrysogaster mediterraneus Vujić, 1999
Preferred environment: forest/freshwater; streams and small marshy areas in thermophilous oak forests of *Q. pubescens* (A.Vujić, pers.comm.); "deciduous forest (mainly *Platanus*) with springs and small streams" (Reemer and Smit, 2007); by stream, open area in *Platanus* orientalis forest (Van Steenis *et al*, 2021). **Adult habitat and habits:** settles on flowers (A.Vujić, pers.comm.). **Flowers visited:** umbellifers; *Ferulago sylvatica*, *Tordylium apulum* (Standfuss and Claussen (2007); *Smirnium perfoliatum* (A.Vujić, pers.comm.); *Foeniculum vulgare* (Van Steenis *et al*, 2021). **Flight period:** beginning May/mid June. **Developmental stages:** not described. **Range:** so far known only from Greece and the Balkans (Macedonia and Montenegro), plus Turkey. **Determination:** See Key provided in StN Keys volume. Vujić (1999b) figures the male terminalia and provides features for distinguishing both sexes of this species from the closely similar *C.solstitialis.* Separation of the females is as yet not always possible. **Illustrations of the adult insect:** none known.

Chrysogaster rondanii Maibach & Goeldlin, 1995.
Preferred environment: groundwater streams in forest; streams fringed by riparian *Fraxinus* gallery forest in *Quercus/Carpinus/Ulmus* forest, humid *Fagus/Picea* and *Fraxinus/Fagus* forest. **Adult habitat and habits:** open areas along small brooks in forest. **Flowers visited:** *Cytisus*, *Ilex* (C.Dussaix, 2005a); *Crataegus*, *Prunus spinosa* (P.Withers, pers.comm.). **Flight period:** April/beginning June. **Developmental stages:** not described. **Range:** as yet uncertain, due to confusion with *C.virescens*. *C.rondanii* is known from the Netherlands, France (Normany to central France), central Germany and Switzerland. **Determination:** the description of this species is based on two males and two females from the Netherlands and four other females from Germany and Switzerland (Maibach and Goeldlin, 1995). In the description it is stated that *C. rondanii* is very closely similar to *C. virescens* and a key fragment is provided to aid in separation of the two species. However, the features mentioned in the key fragment are variable and cannot be relied upon. Further, there is no indication that the type material of *C. virescens* was examined by Maibach and Goeldlin (1995) and no other indication of the basis for their interpretation of *C. virescens*. *Chrysogaster rondanii* has subsequently been included in keys together with *C. virescens* (e.g. Vujić (1999), Speight & Sarthou (2017), Bot and Van de Meutter (2019), Ricarte *et al*. (2022), but not in a context in which the type material of *C. virescens* has been examinecd. It is also clear that different interpretations of *C. virescens* are in use (see under *C. virescens*). To add to the confusion, the type material of another apparently closely similar species, *C. basalis*, has not been examined by recent authors and its relationship to both *C. rondanii* and *C. virescens* remains uncertain. Until the uncertainties surrounding the identity of *C. basalis* and *C. virescens* are resolved, neither the correct name for the taxon described as *C. rondanii*, nor the features which can be used to separate it reliably from these other taxa, can become clear.
Illustrations of the adult insect: the general appearance of the male can be seen from the coloured photo provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Chrysogaster simplex Loew, 1843
Preferred environment: forest; "deciduous forest (mainly *Platanus*) with springs and small streams" (Reemer and Smit, 2007). **Adult habitat and habits:** no data. **Flowers visited:** no data.**Flight period:** May/June. **Developmental stages:** not described. **Range:** Poland?, Greece, Roumania and Turkey. **Determination:** the male of this species has never been described or included in any key. The female of this species is included in the keys provided by Bradescu (1991). **Illustrations of the adult insect:** none known.

Chrysogaster solstitialis (Fallen), 1817
Preferred environment: wetland/deciduous forest, woodland streams and ponds. **Adult habitat and habits:** beside streams and ponds in woodland and scrub, including *Salix* carr; not infrequently, this species may be active under cloudy conditions; visits stream margins to drink during hot weather. **Flowers visited:** white umbellifers; *Cornus*, *Filipendula*, *Galium*, *Sambucus*, *Senecio jacobaea*. **Flight period:** June/September (and May in southern Europe). **Developmental stages:** the aquatic larva is described and figured by Hartley (1961), from larvae collected from pond mud containing much debris of fallen twigs and branches; the larvae may be found on the surface of organically-enriched mud beneath the fallen leaves of trees, in very shallow (1cm) water of seepages and spring-fed pools within deciduous woodland. The larva has been illustrated in colour by Rotheray (1994). **Range:** from Fennoscandia south to Iberia and the Mediterranean, including N Africa; from

Ireland eastwards through much of Europe into European parts of Russia; Ukraine and the Caucasus (Georgia). **Determination:** See Key provided in StN Keys volume. The male terminalia are figured in Speight (1980), Torp (1984) and, most comprehensively, by Maibach et al.(1994a). Females of this species can easily be mistaken for females of *C.basalis* Lw. In females of *C.solstitialis*, the frons is inflated above the antennae and the antennae are inserted at the middle of the head (viewed in profile). In *C.basalis*, the frons is flat and the antennae are inserted below the middle of the head (viewed in profile). Another European species, *C.mediterraneus*, may also easily be confused with *C.solstitialis* and the females cannot always be separated. **Illustrations of the adult insect:** the adult insect is illustrated in colour in Bartsch *et al*. (2009b), Stubbs and Falk (1983), Kormann (1988) and Torp (1994). Both male and female are illustrated in colour by Pétremand *et al.* (2022).

Chrysogaster virescens Loew, 1854
Preferred environment: forest/wetland; fen carr plus small open areas with flushes and streams in deciduous forest. **Adult habitat and habits:** *Alnus/Salix* carr and poorly-drained scrub, streamsides in woodland; settles on foliage of bushes and trees; adults descend to drink from stream margins, in hot weather. **Flowers visited:** white umbellifers, *Filipendula, Ilex, Iris, Ranunculus*. **Flight period:** end April/mid July. **Developmental stages:** undescribed. **Range:** southern Finland, Ireland, Britain and the Atlantic seaboard of Europe from Denmark to the Pyrenees and northern Spain. Also in Switzerland, in central Europe. **Determination:** See Key provided in StN Keys volume. Until recently this species has been confused with the very similar *C.rondanii* Maibach & Goeldlin. The male terminalia are figured by Maibach et al.(1994a) and Maibach and Goeldlin (1995). **Illustrations of the adult insect:** the male is illustrated in colour by Bartsch *et al.* (2009b) andTorp (1994), the female by Speight and de Courcy Williams (2021).

CHRYSOSYRPHUS

This genus appears in earlier European literature as *Helleniola* Kassebeer (1995a) reviews the Palaearctic species, of which he recognises three. Two of these species are known from northern Europe.

Chrysosyrphus nasutus (Zetterstedt), 1838
Preferred environment: wetland/forest; aapamire within boreal *Pinus sylvestris/Betula* forest (H.Bartsch and T.Nielsen, pers.comm.), northwards to taiga wetlands (Nielsen, 1998); palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits**: no data. **Flowers visited:** *Caltha membranacea, Dryas octopetala, Ledum palustre, Rhododendron tomentosum, Rubus chamaemorus*. **Flight period:** mid June/mid July. **Developmental stages:** not described. Van Steenis and Zuidhoff (2013) record observing oviposition in wet moss at the water edge, in a palsa mire. **Range:** northern parts of Norway and Sweden and through northen Siberia to the Pacific. **Determination:** See Key provided in StN Keys volume;Bartsch et al.(2009b); Kassebeer (1995a), who also figures the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b) and Haarto & Kerppola (2007).

Chrysosyrphus nigra (Zetterstedt), 1843
Preferred environment: wetland/forest; aapamire within *Pinus sylvestris* forest and in taiga wetlands (Nielsen, 1998). **Adult habitat and habits:** no data. **Flowers visited:** *Caltha, Cerastium, Ledum, Rubus chamaemorus, Salix, Taraxacum.* **Flight period:** mid June/mid July. **Developmental stages:** not described. **Range:** northern Europe: northern Norway, Sweden and Finland, northern parts of European Russia and across Asia through northern Siberia to Kamchatka. **Determination:** See Key provided in StN Keys volume; Bartsch et al.(2009b); Kassebeer (1995a), who also figures the male terminalia. This species may occur with *C.nasutus* (Zetterstedt). **Illustrations of the adult insect:** the great similarity between *C.nasutus* and *C.nigra* is apparent from the coloured illustrations provided by Bartsch et al.(2009b) and Haarto & Kerppola (2007).

CHRYSOTOXUM

Peck (1988) lists 23 supposedly distinct European *Chrysotoxum* species. There remains great need for comprehensive revision of the European species belonging to this genus. Coe (1953) highlighted the problem when he said of the species *Chrysotoxum latilimbatum* "I am of the opinion that *latilimbatum* is simply a colour variety of *elegans*. The dissected male

genitalia appear identical". The male terminalia of many European "species" of *Chrysotoxum* are equally indistinguishable and whether this means that the male terminalia simply cannot usually be employed to distinguish these species, or some of the species are no more than colour varieties of one another, remains to be resolved. Generally, use of morphological features to characterise the species is very difficult, and all-too-often unconvincing. Molecular taxonomic studies are beginning to impact on this problem. Masetti *et al*. (2006) subjected some Italian species to genetic analysis and suggested they could be divided into groups, genetically. Since then, the results of genetic taxonomic study of *Chrysotoxum festivum* and *C. vernale* in the Balkans have been published (Nedeljković *et al*., 2015), revealing the presence of three cryptic species, one of which (*C. tomentosum*) had previously been confused with *C. festivum* and two others (*C. montanum*, *C. orthostylum*) with *C. vernale*. The results of the study by Nedeljković *et al*. (2015) are a clear demonstration that more comprehensive genetic characterisation of European *Chrysotoxum* is needed, before reliable species concepts can be established in the genus. More recently, a study of Turkish *Chrysotoxum* taxa and adjacent countries (Vujić *et al*., 2017) has been carried out without the benefit of genetic characterisation of the taxa involved. This resulted in recognition of another three species, one (*C. antennalis*) closely similar to *C. gracile*, another (*C. clausseni*) close to *C. vernale* and the third (*C. persicum*) close to *C. elegans* and *C. octomaculatum*. Further species have also been separated from *C. vernale* elsewhere in Europe. But results of molecular taxonomic investigations have also been at odds with attempts to morphologically resolve *Chrysotoxum* taxonomic issues, as demonstrated by Van Steenis *et al*. (2020). Since the various genetic studies have not all been based on the same forms of data analysis, the Van Steenis *et al*. (2022) study demonstrates that it is now an issue whether they are all equally reliable.

Chrysotoxum anatolicum Nedeljković & Vujić, in Nedeljković *et al*., 2020
Preferred environment: open ground; dry, montane steppic grassland at the upper altitudinal fringe of *Pinus brutia/P. nigra* v. *pallasiana* forests, with dwarf shrubs (*Genista*) (Nedeljković *et al*., 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** Turkey. **Determination:** the description of this species is based on two females, the male remains unknown. The female is included in the key to *vernale*-group species provided in Nedeljković *et al*. (2020), where it is separated from *vernale* and most other species by the overall pigmentation of the wing membrane, which is illustrated and said to be confined to the anterior half of the wing in other species. Nedeljković *et al*. (2020) also illustrate the head of *C. anatolicum* in anterior and lateral views and the dorsal surface of its abdomen. **Illustrations of the adult insect:** none known.

Chrysotoxum antennalis Vujić, Nedeljković & Hayat, in Vujić *et al*., 2017
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Turkey, Armenia, Azerbaijan, Iran. **Determination:** both the male and the female of this species are described in Vujić *et al*.(2017), who also figure the male terminalia and various other features. *Chrysotoxum antennalis* is very similar to *C. gracile* and *C. vernale*. Vujić *et al*. (2017) provide a key for distinguishing *C. antennalis* from both these and other other *Chrysotoxum* species recorded from Turkey. Nedeljković *et al*. (2020) include it in a key to European *vernale*-group species. **Illustrations of the adult insect:** the general appearance of both the male and female can be seen from the coloured photos provided in Vujić *et al*.(2017).

Chrysotoxum bicinctum (L.), 1758
Preferred environment: forest/open ground; beside streams (including seasonal streams) in open areas in coniferous and deciduous forest, up to the lower levels of *Abies/Picea* forest; also in fen meadow/unimproved, lowland humid grassland including *Molinia* grassland and along streams and rivers in lowland, improved grassland. **Adult habitat and habits:** among streamside and fen vegetation; flies fast and low; males hover at 2 - 3 m along streams; settles on low-growing vegetation and bushes. **Flowers visited:** white umbellifers; *Achillea ptarmica*, *Alisma plantago-aquatica*, *Carduus*, *Crataegus*, *Hypochoeris*, *Potentilla erecta*, *Ranunculus*, *Rubus*. **Flight period:** end May/September. **Developmental stages:** larva undescribed, but has been reared on a diet of aphids in the laboratory (Rotheray and Gilbert, 1989). **Range:** Fennoscandia south to Iberia and the Mediterranean, including N Africa; through central and southern Europe (Italy, the former Yugoslavia, Bulgaria) into Turkey; Georgia; European parts of Russia; in Asiatic parts of Russia as far as central Siberia. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). Van Steenis *et al*. (2020) provide grounds for concluding that, as recognised in Europe at present - at least in Europe West of the Alps - *C. bicinctum* is a complex of cryptic species. How many European species level taxa are involved, or what their names should be, is less clear (see also under *Chrysotoxum volaticum* sensu Van Steenis *et al*.). Van Steenis *et al*. (2020) were unable to detect

genetic differences between the segregates of *C. bicinctum* they refer to and the morphological differences they allude to overlap to a significant extent. Further, they did not establish which of the segregates they refer to is the *Chrysotoxum bicinctum* of Linnaeus, either by re-examination of the type material of *C. bicintum* or in any other way. They conclude that the closely similar N African species *C. volaticum* is present in southern Europe, but that there is also a *volaticum*-like segregate of *C. bicinctum* present in western and northern parts of the continent, which is not *C. volaticum* but *C. bicinctum*. Until the identity of *C. bicinctum* of Linnaeus itself is reassessed and clarified the taxonomy of other components of the *C. bicinctum* complex in Europe remains uncertain. The descriptions of both *Chrysotoxum tricinctum* Rondani and *C. subbicinctum* Violovitsh predate description of *C. volaticum* and their status in relation to both *C. bicinctum* and *C. volaticum* senus Van Steenis *et al*. (2020) also requires review. Rondani introduced the name *tricinctum* for Italian specimens he concluded were not the same as the earlier-described *C. bicinctum* and the review of Rondani species conducted by Sforzi & Sommaggio (2021) makes no reference to Van Steenis *et al*. (2020) and cites Belcari *et al*. (1995) in regarding *C. tricinctum* as a synonym of *C. bicinctum*. In the key to syrphids of Eastern Asiatic Russia provided by Violovitsh (1986), the species he described as *Chrysotoxum subbicinctum* is separated from *C. bicinctum* using morphological features very reminiscent of those discussed by Van Steenis *et al*. (2020), in attempting to separate from one another the various Western European segregates of C. *bicinctum* they recognise.

Here the name *C. bicinctum* is retained in its previous use, but it should be recognised that, once more comprehensive revisionary work has been carried out to resolve the issues involved, more species-level taxa may be segregated within this concept of *C. bicinctum*. Further, the study by Van Steenis *et al*. (2020) is focussed only on parts of Western and Northern Europe and does not consider material from East of the Alps - Pan-European revision of the *bicinctum* complex is clearly needed. **Illustrations of the adult insect:** the adult insect has been figured in colour by Kormann (1988), Torp (1984, 1994), Stubbs and Falk (1983) and van der Goot (1986).

Chrysotoxum bozdagensis Nedeljković, Vujić & Hayat, in Nedeljković *et al*., 2018
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** Turkey. **Determination:** this species was discovered by genetic analysis (Nedeljković *et al*., 2018b). Morphologically, it is virtually indistinguishable from *C. elegans*. Further, its description is based on a single male and a single female, so nothing is as yet known about intra-specific variability in its morphological features. Nedeljković *et al*. (2018b) include a key fragment purporting to separate *C. bozdagensis* from *C. elegans*. But the variability of *C. elegans* encompasses the differences they allude to and the morphological description of *C. bozdagensis* provides no clear means of separating it from related species, especially *C. elegans*, apart from body length – the male of *C. bozdagensis* is 19 mm long, making it much larger than *C. elegans*. **Illustrations of the adult insect:** the general appearance of *C. bozdagensis* is shown in the coloured photos of the male and female provided in Nedeljković *et al*. (2018b).

Chrysotoxum caucasicum Sack, 1930
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Developmental stages:** not described. **Range:** Ukraine; Georgia; central Asiatic Russia; Afghanistan (Mengual *et al*., 2020). **Determination:** Becker's (1921) original description of this species, as *C. derivatum*, is based on two females. Sack (1928 - 32) subsequently provided the replacement name of *C. caucasicum* for it, pointing out that *derivatum* was a homonym of another, earlier described, *Chrysotoxum* species. The female of *C. caucasicum* is included in the keys to *Chrysotoxum* species provided by Becker (1921) - where it appears as *C. derivatum*, Sack (1928 – 32) and Van der Goot (1981). The male remains undescribed. *Chrysotoxum caucasicum* is one of the species in which article 3 of the antenna is longer than articles 1 and 2 combined and tergites 3 to 5 are rather long-haired, as in *C. fasciatum* and *C. fasciolatum*. But, according to Becker's (1921) description, in *C. caucasicum* the anterior part of the wing is not dark brown as in *C. fasciolatum* and the frons is yellow, with a median black area and the legs are entirely yellow, contrasting with both *C. fasciatum* and *C. fasciolatum*, in which the frons is black and at least the front and mid femora are black basally. **Illustrations of the adult insect:** none known.

Chrysotoxum cautum (Harris), 1778
Preferred environment: deciduous forest and scrub; unimproved grassland and lightly grazed grassland which has not been subject to ploughing or tillage; steppic grassland. **Adult habitat and habits:** open areas in forest or scrub on well-drained sites; clearings, tracksides etc.; usually flies within 2m from the ground; settles on foliage of bushes etc. **Flowers visited:** white umbellifers; yellow composites; *Allium ursinum, Caltha, Cornus, Crataegus, Euonymus, Euphorbia, Frangula alnus,*

Geranium, Linum, Mespilus, Plantago, Pyrocantha, Ranunculus, Rhamnus catharticus, Rubus, Sorbus aucuparia. **Flight period:** May/July, plus April in southern Europe. **Developmental stages:** larva undescribed. Egg: the morphology of the egg of this species is described by Chandler (1968). The morphology of the chorion of the egg is figured by Kuznetzov (1988). The female has been observed ovipositing on roadside grasses by Reemer and Goudsmits (2004) and on grasses and *Galium* at the edge of a *Rubus* thicket by Smith (2004). The eggs are apparently laid singly. **Range:** Finland south to the Pyrenees and Spain; Ireland (extinct?) and Britain (southern England) eastwards through central and southern Europe (Italy, the former Yugoslavia, Bulgaria, Greece) into Turkey; Georgoia; in Russia to as far as the Altai mountains and Mongolia. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). The female of this species is unique among European *Chrysotoxum* in possessing a longitudinal, median, membranous strip on abdominal tergite 6, which effectively divides this tergite into two parts. The male terminalia are illustrated by Lehrer (1971). **Illustrations of the adult insect:** the adult insect is figured in colour by Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Chrysotoxum cisalpinum Rondani, 1845
Preferred environment: unimproved, dry montane grassland in the mesophilous *Fagus* zone of southern European mountain ranges; open, grassy areas along seasonal streams and rivers in karstic, thermophilous *Quercus* forest; thermophilous forest fringes. **Adult habitat and habits:** no data. **Flowers visited:** yellow composites; *Euphorbia, Thapsia*. **Flight period:** May/beginning October. **Developmental stages:** not described. **Range:** France (Paris basin) south to the Mediterranean; from Spain eastwards through southern Europe to the former Yugoslavia and Bulgaria and on to Tajikistan and Uzbekistan. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al.* (2016). **Illustrations of the adult insect:** the female is shown in colour by Speight and Lebard (2022c).

Chrysotoxum clausseni Vujić, Nedeljković & Hayat, in Vujić *et al.*, 2017
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April to September, with most records from July. **Developmental stages:** not described. **Range:** Turkey. **Determination:** this species is extremely similar in appearance to *C. vernale*. Both the male and the female of *Chrysotoxum clausseni* are described in Vujić *et al.*(2017), who also figure the male terminalia and various other features and provide a key for distinguishing *C. clausseni* from other Turkish *Chrysotoxum* species. Nedeljković *et al*. (2020) include it in a key to European *vernale*-group species. **Illustrations of the adult insect:** the general appearance of both the male and female can be seen from the coloured photos provided in Vujić *et al.*(2017).

Chrysotoxum elegans Loew, 1841
Preferred environment: deciduous forest/open ground, mesophilous/thermophilous deciduous forest and dry, unimproved grassland with scrub, on well-drained sites. This species can also be found in some types of heathland. **Adult habitat and habits:** clearings, tracksides etc.; fast flying; flies low over ground vegetation. **Flowers visited:** white umbellifers; *Origanum, Ranunculus*. **Flight period:** May/August, with occasional specimens on into September. **Developmental stages:** larva described and figured by Dusek & Laska (1962), from a full-grown larva found beneath a stone in grassland; almost certainly aphid-feeding, probably on root aphids. **Range:** Fennoscandia south to Iberia and the Mediterranean; through central and southern Europe into European parts of Russia as far as the Caucasus (Georgia); Turkey. This insect seems to be disappearing rapidly from much of its European range, along with its primary habitat, ancient, unimproved pasture with patches of scrub woodland. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). There is uncertainty over the relation between *C.elegans* and some other *Chrysotoxum* species and a great need for better understanding of intra-specific variation in these species. It is to be hoped that *C. elegans* and its allies will be subject to genetic taxonomic study. **Illustrations of the adult insect:** the male of *C.elegans* is figured in colour by Stubbs and Falk (1983) and Ball and Morris (2013). The female is shown in colour in Pétremand *et al*. (2022).

Chrysotoxum fasciatum (Muller), 1764
Preferred environment: wetland/forest, fen carr, edges of raised bogs; along stream edges and in poorly-drained clearings in humid/wet forest (both conifer and deciduous) and conifer plantations; also in the montane/subalpine zone of the Alps and Pyrenees, in unimproved, non-calcareous grassland and heath. **Adult habitat and habits:** woodland clearings and tracksides, in the vicinity of water or poorly-drained ground; also at the edge of bog and acid fen where *Betula/Salix* scrub has developed; flies low among ground vegetation and in a manner resembling the flight of the *Vespula* species it mimics, but its

flight is soundless. **Flowers visited:** yellow composites; **white** umbellifers; *Calluna, Frangula alnus, Hypochoeris, Leontodon, Leucojum aestivum, Ligustrum, Luzula sylvatica, Potentilla erecta, Ranunculus, Rubus fruticosus, R. idaeus, Salix repens, Sorbus aucuparia.* **Flight period:** May/September, with peaks in June and August and occasional specimens on to October. **Developmental stages:** undescribed. **Range:** Fennoscandia south to the Pyrenees and northern Spain; from Ireland eastwards through northern and mountainous parts of central and southern Europe (northern Italy, the former Yugoslavia, Bulgaria) into European parts of Russia; Caucasus (Georgia); through Siberia from the Urals to Kamchatka; Japan. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). Rigid application of the International Code of Zoological Nomenclature once again suggests use of the name *arcuatum* for this species, a name in use over most of Europe for another *Chrysotoxum* species for some 20 years. The narrow terms of reference of the International Commission on Zoological Nomenclature, that permit exclusion from their consideration of anything but strictly nomenclatural issues, would in this instance render European literature references to "*Chrysotoxum arcuatum*" totally unusable, since authors of anything except strictly nomenclatural revisions normally fail to indicate in what sense they are applying species names. Biological species are bundles of attributes, if the term is to have any meaningful application in ecology etc. Names for biological species are only labels and have no other utility, so that when their utility as labels is compromised they become meaningless. The name "*arcuatum* L." has in this way become meaningless, in that the biological species to which it has been applied in the literature (and the literature defines the biological species in human terms) is too often uncertain and open to misinterpretation. The name "*arcuatum* L" is thus no longer used in this database. The International Commission on Zoological Nomenclature requires to ponder the reality that it has itself become the primary source of nomenclatural instability, by producing three successive and conflicting versions of the "International Code" during the last century, resulting in such absurd situations as names validly switching from one species to another and back again. Such International Commissions have no legal status and the success of their regulatory function is dependent upon their credibility. Although it is now arguable that the International Commission on Zoological Nomenclature has become senile and incompetent to such an extent that some of its utterances are better ignored there is unfortunately no authority capable of providing a reputable alternative. Thus, although in the case of some of its recommendations, such as use of the name " *Musca arcuatum* L", it is best ignored, failure to apply the existing version of the International Code of Zoological Nomenclature, when possible, would be to invite nomenclatural anarchy. **Illustrations of the adult insect:** The adult insect has been figured in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Chrysotoxum fasciolatum (de Geer), 1776
Preferred environment: forest; herb-rich open areas within humid *Fagus/Picea* forest and upwards through the *Abies/Picea* zone into unimproved alpine grassland. **Adult habitat and habits:** clearings and tracksides within forest and more open areas at higher altitudes; flies fast at up to 2m from the ground. **Flowers visited:** *Adenostyles, Ranunculus, Rubus idaeus, Taraxacum.* **Flight period:** May/July. **Developmental stages:** not described. **Range:** Fennoscandia, mountain ranges in Poland and Germany south to France (e.g. Vosges, Massif Central), where it reaches almost to the Mediterranean in the Cevennes; eastwards through northern Europe (Baltic States, Russia) into Siberia and on to the Pacific and Japan; from the Vosges eastwards through the Alps (including northern Italy and parts of the former Yugoslavia) and on to Bulgaria, the Ukraine and the Caucasus. Peck (1988) cites N America as part of the range of this species, but Vockeroth (1992) makes no reference to the occurrence of *C. fasciolatum* there. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). This species is a remarkable mimic of the queen (female) caste of *Dolichovespula/Vespula* wasp species. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988); Bartsch *et al*. (2009a), Bot and Van de Meutter (2019) and Speight and de Courcy Williams (2021).

Chrysotoxum festivum (L.), 1758
Preferred environment: forest/open ground, open areas in scrub woodland and deciduous forest; unimproved grassland with scrub. **Adult habitat and habits:** clearings, tracksides etc.; males hover at 2-4m; flies fast through scrub and bushes. **Flowers visited:** white umbellifers; *Calluna, Chaerophyllum, Cirsium arvense, Euphorbia, Galium, Hieracium, Hypochoeris, Mespilus, Narthecium, Origanum, Potentilla erecta, Ranunculus, Rosa rugosa, Rubus idaeus, Sambucus nigra, Senecio, Solidago canadensis, S.virgaurea.* **Flight period:** May/September, with peaks in June and August. **Developmental stages:** larva undescribed; puparium described and figured by Speight (1976), who found the mature larva with the ant *Lasius niger*, beneath a stone in *Corylus/Prunus* scrub on old pasture. **Range:** Fennoscandia south to Iberia and the Mediterranean, including N Africa; from Ireland eastwards through much of Europe into Turkey; Caucaus (Georgia); European parts of

Russia; through Siberia to the Pacific coast; Japan; northern India. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). Separation of *C. festivum* from *C. tomentosum* is discussed under *C. tomentosum*. The confused history of the use of the name *festivum* (L.) has made European literature on this species almost unusable. **Illustrations of the adult insect:** the male is shown in colour by Ball *et al*. (2002), Ball and Morris (2013) and Bartsch *et al*. (2009a).

Chrysotoxum gracile Becker, 1921
Preferred environment: forest; deciduous forest of *Quercus pubescens* and *Q.petraea* up to an altitude of c.1000m.; *Q.pubescens* savanna; often near streams (permanent or seasonal). **Adult habitat and habits:** flies low over ground vegetation and settles on the ground in the sun. **Flowers visited:** *Anthriscus silvestris, Euphorbia* sp. *Pastinaca sativa* (Glumac, 1968); *Potentilla* (A. Vallet, pers.comm.); *Silene rupestris, Thapsia* (Van Steenis *et al*., 2020). **Flight period**: May-September, with a peak in May/June. **Developmental stages:** not described. **Range:** central Spain (Gil-Collado, 1930), Spanish Pyrénees (Leclercq, 1971); Mediterranean and sub-Mediterranean parts of southern France; Balkans (North Macedonia); Turkey. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). Also distinguished from related species in the key provided by Speight *et al*. (2013b) This species is very similar in appearance to *C. festivum*, but is of smaller size (9.5-12mm body length). It may be distinguished from other known European species of *Chrysotoxum* as follows:
<u>Male</u>
Frons black, partly grey-dusted; hairs on upper parts of eyes longer than a posterior ocellus; antennal segments 1 and 2 together longer than segment 3 and first segment longer than second (viewed from above); hairs on scutellar disc longer than half the length of the scutellum; legs entirely yellow, the tibiae slightly paler yellow than the tarsi and the hind femur pale yellow in the basal half and slightly darker yellow in the apical half; wings with a brownish smudge beneath the stigma; yellow marks on the tergites separate from any yellow markings on their lateral margins, the yellow marks on tergite 3 being as deep as those on tergite 4; abdominal sternite 4 less than 3 x as wide as long and surstyli of genitalia symmetrical.
<u>Female</u>
The features of the antennae, legs, wings and abdominal tergites are the same in the female as in the male, but the scutellar hairs are so short as to be virtually absent. **Illustrations of the adult insect:** the female is figured in colour by Speight et al. (2013b).

Chrysotoxum hispanicum Nedeljković, Ricarte & Marcos-Garcia, in Nedeljković *et al*., 2020
Preferred environment: *Quercus rotundifolia* dehesa; riparian gallery forest of *Fraxinus angustifolia*; montane forests of *Quercus faginea* and *Q. pyrenaica* with grassy, open areas; up to above 2000m in the subalpine zone (Nedeljković *et al*., 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/June, with a peak in June. **Developmental stages:** not described. **Range:** Spain. **Determination:** rhe description of this species is based on a large number of both male and female specimens, from various parts of Spain. The genetic analysis carried out shows that *C. hispanicum* is very closely related to *C. vernale*. Morphologically, a primary feature of *C. hispanicum* is stated to be the proportions of the yellow markings on the tergites, described by Nedeljković *et al*. (2020) as follows: T2 yellow fascia about a third as wide as the width of the tergum, T3-T5 yellow fasciae about half as wide as the width of the tergum". From the accompanying illustrations of the dorsal surface of the abdomen, it is apparent that the terms "wide" and "width", as used by the authors, are in this instance erroneous. In fact the length of the markings is being compared with the length of the tergites, measuring length in relation to the longitudinal axis of the abdomen. Nedeljković *et al*. (2020) illustrate the male surstyli and include *C. hispanicum* in their key to European *vernale*-group species. **Illustrations of the adult insect:** none known.

Chrysotoxum intermedium group
Among the European *Chrysotoxum* species, those with the following combination of morphological features comprise what can usefully be termed the *intermedium* group:

> Antennal article 3 (basoflagellomere) longer than antennal articles 1 and 2 combined; hairs on tergites 3 – 5 short, or very short; lateral margins of tergites without sclerotized projections posteriorly; male surstyli symmetrical; tergite 5 in female without median, membranous cleft

Within the *intermedium* group, the species *C. cisalpinum* and *C. triarcuatum* can be separated morphologically from one another and from other species of the group. With *C. cisalpinum* and *C. triarcuatum* removed, the rest of the European *intermedium* group species form a complex of ill-defined taxa until recently referred to in the literature as *Chrysotoxum intermedium*. While it has been recognised for a long time that the "*Chrysotoxum intermedium*" of European authors comprised a complex of two or more species, it is still unclear how many species are involved or what their names should be. A step forward was achieved by Sommaggio (2001), who separated *C. lessonae* Giglio-Tos from the complex, based on re-examination of the type material of *C. lessonae*. Some authors, e.g. Vujić *et al*. (2017) subsequently applied the two names *intermedium* and *lessonae* as referring to individual species, without comment. However, there are at least four synonyms listed for *C. intermedium*, all of them predating description of *C. lessonae*, none of which were investigated by Sommaggio (2001). More recently, Speight & Lebard (2022c) pointed out that, both morphologically and ecologically, there appear to be two variants within *C. lessonae*, as recognised by Sommaggio (2001), requiring resolution as potential species-level taxa. These two variants are detailed here under *Chrysotoxum lessonae* agg., as *lessonae* aggregate form 1 and *lessonae* aggregate form 2.

With the two *lessonae* variants separated from it, the *intermedium* complex is reduced to an entity which may, or may not, still be a combination of cryptic species. Speight & Lebard (2022c) refer to this entity as the *intermedium* aggregate. They point out that, although specimens which would be consigned to it exhibit morphological variability between them, in features which, elsewhere among *Chrysotoxum* species, would be used to characterise species, the *intermedium* aggregate nonetheless defies subdivision into morphologically-definable segregates. That said, if the name *Chrysotoxum intermedium* of Meigen is to be used, the taxon to which it relates still requires re-description and diagnosis. So far, the *intermedium* aggregate has not been subjected to a comprehensive integrative taxonomic investigation, involving not only morphology, but also morphometric and genetic analysis. Perhaps that would provide a basis for meaningful subdivision of the *intermedium* aggregate and definition of *Chrysotoxum intermedium* of Meigen itself. In the interim, the *intermedium* aggregate is regarded here as an amalgam of possible species-level taxa, rather than as a single species, and referred to as the *Chrysotoxum intermedium* aggregate.

Chrysotoxum intermedium aggregate

Preferred environment: forest/open ground; open areas in mesophilous *Fagus* forest; *Quercus pubescens* savanna; open *Q. ilex* forest and maquis; *Pinus salzmannii* forest; olive groves (organic); garrigue; both calcareous and non-calcareous, sub-xeric, unimproved grassland; Mediterranean dune systems. **Adult habitat and habits:** flies fast and low; frequently rests on bare ground; males hover up to 4m. from the ground, along tracks etc. **Flowers visited:** no data. **Flight period**: throughout the year, but with very few records for December and January. **Developmental stages:** not described. **Range:** almost confined to the Mediterranean zone in Europe, from Iberia through southern France to Greece and Turkey; N Africa. **Determination:** separable from the *lessonae* aggregate by the length of its arista, characteristics of the longitudinal stripes of grey dusting on the mesoscutum and length of the mesoscutal hairs: in specimens of the *intermedium* aggregate the arista does not extend beyond the apex of article of the antenna; the longitudinal, mesoscutal dust stripes are either narrower than the distance between them or only slightly wider than the distance between them and, in the female, the mesoscutal hairs are either all short, or mostly short with scattered longer hairs (see figures in Speight & Lebard (2022c). In males of the *intermedium* aggregate the posterior half of the mesoscutum is brightly shining and uneven, with the hair insertions frequently linked into chains and incomplete polygons, by shallow rugulae (see figures in Speight *et al*., 2022c). As recognised here the *intermedium* aggregate includes males in which the dusting on the frons varies from negligible to covering most of its surface, males and females in which the colour of the femora varies from entirely yellow to predominantly black, the longitudinal mesoscutal stripes of dusting extend from the anterior margin of the thorax to the level of the wing bases or are hardly visible and do not extend as far as the transverse suture, and specimens which differ distinctly from one another in the shape of the abdomen. Some of this variability is illustrated in Speight *et al*. (2022c). As yet, consistent combinations of the variants of these features have not been detected. **Illustrations of the adult insect:** none known.

Chrysotoxum lessonae aggregate

Sommaggio (2001) reinstated *Chrysotoxum lessonae* Giglio-Tos, 1890, from examination of the type material, in the process separating it morphologically from other taxa of the *Chrysotoxum intermedium* complex. His work didn't include re-definition of *Chrysotoxum intermedium* itself, or re-examination of the type material of species which had been described earlier than *C. lessonae* and subsequently synonymised with *C. intermedium*. Subsequently, various authors, e.g. Bot & Van

de Meutter (2019), Vujić *et al*. (2017) have adopted use of the name *C. lessonae*, without comment. Speight & Lebard (2022c) point out that, both morphologically and ecologically, there appear to be two variants within *C. lessonae*, as recognised by Sommaggio (2001), requiring resolution as potential species-level taxa. Separation of them is provided for in the key in Speight & Lebard (2022c), but the features employed were not ones referred to by Sommaggio (2001) and Speight & Lebard (2022c) did not re-examine the *lessonae* type material. So, which of these two variants corresponds with *C. lessonae* of Giglio-Tos is not clear, from the available information. Until the status of species synonymised with *C. intermedium* is re-assessed, the identity of *C. intermedium* itself is re-defined and the status of the two variants of *C. lessonae* is clarified, correct use of the name *C. lessonae* remains uncertain. The taxa of the *intermedium/lessonae* complex have yet to be subject to a comprehensive integrative taxonomic study, involving morphometric and genetic analysis, along with traditional morphological investigation. It is to be hoped that such a study would resolve some of these issues. In the interim, the two forms of *C. lessonae* recognised in Speight & Lebard (2022c) are referred to here, as *C. lessonae* aggregate forms 1 and 2.

Chrysotoxum lessonae agg. form 1

Preferred environment: forest; small, herb-rich and grassy open areas in *Quercus/Carpinus* forest, humid *Fagus/Picea* forest, *Abies* forest and humid *Pinus sylvestris* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus*. **Flight period:** mid April/beginning July. **Developmental stages:** not described. **Range:** uncertain, but known from the Pyrenees, western parts of the Alps (France, Germany, Switzerland) and the Massif Central in France. **Determination:** separable from the *intermedium* aggregate by the length of its arista, characteristics of the longitudinal stripes of grey dusting on the mesoscutum , the length of the mesoscutal hairs and the texture of the mesoscutal surface: in *lessonae* agg. form 1 the arista extends beyond the apex of article 3 of the antenna; the longitudinal mesoscutal dust stripes are distinctly wider than the distance between them; both long and short hairs are abundant on the mesoscutum and in the male the posterior half of the surface of the mesoscutum is dull, mostly smooth and almost without rugulae connecting the hair insertions (see figures in Speight *et al*., 2022c). The male of *lessonae* agg. form 1 is distinguishable from the male of *lessonae* agg. form 2 by having the hind femur black or infuscated in the basal half of its length and the laterotergite nearly always dark grey to pale grey, without a yellow mark. The puncturation on the posterior half of the mesoscutum is also less dense in the male of *lessonae* agg. form 1 than in *lessonae* agg. form 2 (see figures in Speight & Lebard, 2022c). In the female of *lessonae* agg. form 1 this feature is more pronounced, with the posterior half of surface of the mesoscutum dull and almost smooth, and very few of the hair insertions linked by rugulae, whereas, in the female of *lessonae* agg. form 2, the posterior half of the surface of the mesoscutum is brightly shining and uneven, with many of the hair insertions linked into transverse chains by shallow rugulae (see figures in Speight & Lebard, 2022c). Also, in the female of *lessonae* agg. form 1 the front and mid femora are black-marked basally, the laterotergite usually lacks a yellow mark and the black hairs on the frons and vertex are long (see figures in Speight & Lebard, 2022c). By contrast, in *lessonae* agg. form 2 all of the femora are usually entirely yellow, the laterotergite is yellow-marked nd the black hairs on the frons and vertex are shorter (figured in Speight & Lebard, 2022). **Illustrations of the adult insect:** the female is illustrated in colour in Speight & Lebard (2022c).

Chrysotoxum lessonae agg. form 2

Preferred environment: forest/open ground; open areas in deciduous forest of low-altitude humid *Fagus*, *Quercus/Carpinus/Ulmus* forest and mesophilus *Fagus* forest and unimproved, mesotrophic, lightly-grazed, well-drained grassland bordering *Quercus/Carpinus/Ulmus* forest. **Adult habitat and habits:** no data. **Flowers visited:** yellow Asteraceae. **Flight period:** June/September. **Developmental stages:** not described. **Range:** uncertain, but known from SW France and foot-hills of the Pyrenees, the French Massif Central, northern Italy and Corsica. **Determination:** separable from the *intermedium* aggregate by the length of its arista, characteristics of the longitudinal stripes of grey dusting on the mesoscutum. the length of the mesoscutal hairs and the texture of the mesoscutal surface: in *lessonae* agg. form 2 the arista extends beyond the apex of article 3 of the antenna, the longitudinal mesoscutal dust stripes are distinctly wider than the distance between them and both long and short hairs are abundant on the mesoscutum, and in the male the posterior half of the surface of the mesoscutum is dull, mostly smooth and almost without rugulae connecting the hair insertions (see figures in Speight *et al*., 2022c). For separation of *lessonae* agg. form 2 from *lessonae* agg. form 1, see under *lessonae* agg. form 1. **Illustrations of the adult insect:** the female is illustrated in colour in Speight & Lebard (2022c).

Chrysotoxum lineare (Zetterstedt), 1819
Preferred environment: open ground; seasonally flooded, humid, unimproved, mesotrophic grassland, in the vicinity of standing-water bodies. **Adult habitat and habits:** flies low over ground vegetation and among taller sedges; settles on sedges and other vegetation (T. & D.Levy, pers.comm.). **Flowers visited:** umbellifers. **Flight period:** May to August, with peak end June/beginning July. **Developmental stages:** not described. **Range:** southern Sweden (extinct?), Poland, Germany, Czech Republic, France, Roumania, Bulgaria, European parts of Russia, Kazakhstan. In western Europe, this species exhibits a relictual distribution pattern, with very few populations, which are widely separated. Van Eck (2011) states that the presence of *C.lineare* in Portugal cannot be verified and that it should be removed from the Portugese list. **Determination:** see key to European species provided in StN Keys volume; Speight *et al*. (2016). Nedeljković *et al*. (2020) include *C. lineare* in a key to European *vernale*-group species. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009a) and Speight and de Courcy Williams (2021).

Chrysotoxum montanum Nedeljković & Vujić, in Nedeljković *et al*, 2015
Preferred environment: montane grassland within conifer forest (Nedeljković *et al*., 2015). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end May/mid August. **Developmental stages:** not described. **Range:** as yet uncertain, but reported from Switzerland, Austria, Bosnia & Herzegovina, North Macedonia, Montenegro and Serbia, Greece. Whether this taxon occurs in western Europe is at present uncertain, because the material examined in the morphometric and genetic studies carried out by Nedeljković *et al.* (2015) did not include specimens from western parts of the Alps. **Determination:** Nedeljković *et al.* (2015) establish the separate identity of this taxon, by use of morphometric and molecular taxonomic studies of *Chrysotoxum vernale* populations derived mostly from the Balkans. Their work confirms the existence of two cryptic species in SE Europe, *C. montanum* and *C. orthostylum*, in addition to *C. vernale*. As yet, few morphological distinctions between *C. montanum, C. orthostylum* and *C. vernale* have been found. In the male of *C. montanum* the mesoscutal hairs, both long and short, are black, whereas in males of the other two taxa the mesoscutal hairs are predominantly yellow. The mesoscutal hairs in the female of *C.montanum* are likewise black, but they can also be almost entirely black in females of *C. vernale*. Nedeljković *et al.* (2015) distinguish females of *C. montanum* from those of *C. vernale* by the shape of the frontal dust spots, triangular in *C. montanum* and rectangular in *C. vernale*. In *C. montanum*, the yellow patch on the sternopleuron (thoracic mesokatepisternum) found in *C. orthostylum* and often in *C. vernale*, is usually absent. Additional distinctions from *C. orthostylum* are mentioned in the species account for *C. orthostylum*. The description of *C. montanum* provided by Nedeljković *et al.* (2015) includes figures of the thoracic pleura, the male terminalia and coloured figures of the dorsum of the male thorax and abdomen. The key to European *Chrysotoxum* species provided in the StN Keys volume includes the male of *C. montanum*. Nedeljković *et al*. (2020) include it in a key to European *vernale*-group species. Recognition of this species remains difficult. Occasional, isolated individuals apparently exhibiting the characteristics of *C. montanum* have been found in western parts of the Alps, and not necessarily from high altitude. But no population has yet been reported. It would be helpful if specimens from the western Alps were subjected to genetic characterisation, to establish whether they exhibit the same differences from *C. vernale* as were found in Balkan populations. **Illustrations of the adult insect:** parts of the male are illustrated in colour by Nedeljković *et al.* (2015).

Chrysotoxum octomaculatum Curtis, 1837
Preferred environment: forest/open ground; dry scrub woodland with open areas (including dune scrub) and open, mature woodland, both deciduous and coniferous. **Adult habitat and habits:** males hover at 3-5 metres and settle on foliage of trees from 2m upwards - very fast flying and elusive; females fly fast and low over low-growing vegetation and bare ground; as easily caught by malaise trap as by net; visits forest stream margins to drink on hot days. **Flowers visited:** white umbellifers; *Erica*. **Flight period:** May/June and September. **Developmental stages:** not described. **Range:** Britain (southern England) and the Netherlands south to the Mediterranean and eastwards through central and southern Europe into southern parts of Russia to as far as Armenia and Kazakhstan. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). Whether *latifasciatum* Becker is simply a large variety of this species or a separate taxon remains unresolved. **Illustrations of the adult insect:** the male is illustrated in colour in Bot and Van de Meutter (2019) and Speight and de Courcy Williams (2021).

Chrysotoxum orthostylum Vujić, in Nedeljković *et al.*, 2015
Preferred environment: montane grassland in conifer forest (Nedeljković et al, 2015); on the edge of mesotrophic flush system, in unimproved montane grassland (at 1700m. alt.) adjacent to *Larix* forest (Lebard, pers. comm.). **Adult habitat and**

habits: settles on low-growing vegetation in the open. **Flowers visited:** white umbellifers. **Flight period:** mid-May/mid-August. **Developmental stages:** not described. **Range:** as yet uncertain, but confirmed from North Macedonia, Montenegro, Serbia, Turkey, Georgia and Kyrgyzstan. **Determination:** the male of this species is included in the key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al.* (2016). The separate identity of this taxon is established in Nedeljković *et al.* (2015) , by use of morphometric and molecular taxonomic studies of *Chrysotoxum vernale* populations derived mostly from the Balkans. Their work confirms the existence of two cryptic species in SE Europe, *C. montanum* and *C. orthostylum*, in addition to *C. vernale*. The description of *C. orthostylum* provided by Nedeljković *et al.* (2015) includes figures of the thoracic pleura, the male terminalia and the dorsum of the male thorax and abdomen. Separation of *C. orthostylum* from *C. montanum* and *C. vernale* using morphological features remains difficult. Separation of *C. orthostylum* from both *C. festivum* and *C. tomentosum* is also an issue, because in *C. orthostylum* the femora can be either entirely yellow as in those two species, or with the fore and mid femora black at the base as in *C. vernale*. A feature not mentioned in the species diagnosis given for *C. orthostylum* by Nedeljković *et al.* (2015), but used as a feature in their key, is that the postero-lateral corners of tergites 3 and 4 in both sexes of this species exhibit a well-developed thorn-like process, which they consider to be absent, or hardly developed, in *C. festivum, C. montanum, C. tomentosum* and *C. vernale*. However, in males of *C. festivum* this thorn-like process can be more developed than is shown by Nedeljković *et al.* (2015) for the male of *C. orthostylum*. The abdomen is rather narrower in *C. orthostylum* than in C. *montanum* and *C. vernale* and the surstyli of *C. orthostylum* are proportionally longer and more slender than in these other two species or in *C. festivum*. Nedeljković *et al*. (2020) include *C. orthostylum* in a key to European *vernale*-group species. **Illustrations of the adult insect:** parts of the male thorax and abdomen are shown in colour by Nedeljković *et al.* (2015).

Chrysotoxum parmense Rondani, 1843

Preferred environment: open ground/forest; sparsely vegetated, dry, unimproved grassland/grazed Mediterranean heat; open areas in heathy *Quercus ilex* forest, matorral/maquis; *Quercus rotundifolia* woodland (M.-A. Marcos-García, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Calamentha, Cistus, Euphorbia, Potentilla, Quercus ilex, Thymus* (see Marcos-García and Isidrio, 1995). **Flight period:** end May/end July. **Developmental stages:** not described. **Range:** southeast Spain, southern France, Italy, Greece (including Crete), Turkey, Lebanon and Israel, Iran and N Africa (Egypt); also recorded from the Transcaucasus. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight et al.(2016). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Chrysotoxum persicum Vujić, Nedeljković & Hayat, in Vujić *et al*, 2017

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Turkey, Azerbaijan, Armenia, Iran. **Determination:** both sexes of this species are described in Vujić *et al.*(2017), together with figures of the male terminalia and other features and a key which distinguishes *C. persicum* from the rest of the *Chrysotoxum* species known in Turkey. This species is extremely similar in appearance to *C. octomaculatum*, with the transverse black band across the anterior margin of tergites 3 and 4 interrupted before it reaches the side margin of the tergite, according to the photos provided in Vujić *et al.*(2017). The morphological differences between *C. octomaculatum* and *C. persicum* alluded to in Vujić *et al.*(2017) are extremely small. **Illustrations of the adult insect:** the general appearance of both the male and female can be seen from the coloured photos provided in Vujić *et al.*(2017).

Chrysotoxum tomentosum Giglio-Tos, 1890

Preferred environment: open areas and unimproved grassland within montane *Fagus/Picea* forest upwards into unimproved subalpine grassland (Nedeljković *et al*, 2013). **Adult habitat and habits:** no data**. Flowers visited:** no data. **Flight period:** end of May to late August, with a peak in July (Z. Nedeljković, pers.comm.). **Developmental stages:** not described. **Range:** Pyrenees (Andorra), France (Alps), Italy, Montenegro, Serbia. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al.*(2016). Nedeljković *et al.*(2013) redefine this taxon, previously regarded as a variety of *C. festivum*, based on morphological, morphometric and genetic features, establishing it as a species separate from *C. festivum*. Morphologically, *C. tomentosum* can be separated from *C. festivum* by the fact that its mouth edge is black (yellow in *C. festivum*) and the hairs on the mesoscutum are predominanly black and of two distinct lengths, the long black hairs being accompanied by short, black setulose hairs across the middle of its surface. In *C. festivum* the mesoscutal hairs are predominantly yellow and short, black setulose hairs are absent. Also, when observed in anterior view, the median, dorso-ventral stripe on the face of the male is broader than the lateral yellow areas in *C. tomentosum*, but narrower than these yellow

areas in *C. festivum*. In the female, the frontal dust spots are triangular, whereas in *C. festivum* they are rectangular. **Illustrations of the adult insect:** none known.

Chrysotoxum triarcuatum Macquart in Webb & Berthelot, 1839
Preferred environment: no data. **Adult habitat and habits:** settles on bare ground and rocks, low-growing vegetation and the trunks of trees. **Flowers visited:** yellow composites and crucifers. **Flight period:** January to October, with peaks in February and June/July. **Developmental stages:** not described. **Range:** endemic to the Canary Isles (Spain). **Determination:** redescribed in detail by Baez (1977); included in the key in Speight and Sarthou (2017). *Chrysotoxum triarcuatum* belongs to the *lessonae* aggregate of the *intermedium* complex and can be distinguished by its almost entirely yellow sternites. **Illustrations of the adult insect:** the general appearane of a dark-coloured female can be seen at: https://observation.org/observation/264095435/. A pale coloured female is likewise shown at: https://observation.org/observation/263019093/.

Chrysotoxum vernale Loew, 1841
Preferred environment: forest; open woodland and scrub on well-drained sites, from *Betula* invaded heathland to *Fagus* woodland to *Genista florida/Quercus pyrenaica* macquis; also in well-drained, unimproved grassland, including montane and alpine grassland up to 2,500m. **Adult habitat and habits:** flies rapidly and low over ground vegetation; the males hover at up to 4m in open forest or grassland. **Flowers visited:** white umbellifers; *Caltha, Crataegus, Euphorbia, Helianthemum, Sorbus, Valeriana*. **Flight period:** May/June; end June/beginning August at higher altitudes. **Developmental stages:** not described, but females have been observed ovipositing around the entrance holes of ants of the *Lasius flavus* group in unimproved grassland (P. Goeldlin, pers. comm.). Females have also been observed egg-laying on grasses along a sandy road verge (Reemer and Goudsmits, 2004). The eggs are apparently laid singly. **Range:** Fennoscandia south to the Pyrenees; from Britain (southern England) eastwards through most of Europe into Asia almost to the Pacific; Iran. How much reliance can now be placed on these European range data is open to question, given discovery of the presence of two cryptic species in SE Europe (Nedeljković *et al.*, 2015), largely indistinguishable from *C. vernale*, and another, *C. hispanicum* from Iberia. **Determination:** Nedeljković *et al*. (2020) include *C. vernale* in their key to European *vernale*-group species. For distinctions from *C. montanum* and *C. orthostylum*, see under their respective species accounts. The species diagnosis given for *C. vernale* by Nedeljković *et al.*(2015) states that the sternopleuron in this species exhibits a yellow patch, referring to the accompanying figure (Figure 9b) as an illustration of this feature. That figure shows no yellow patch on the sternopleuron in *C. vernale* and, elsewhere in their text, Nedeljković *et al.*(2015) remark that the yellow patch on the sternopleuron may be either present or absent in *C. vernale*. The lateral margin of the abdomen in *C. vernale* may be distinctly partly (but narrowly) yellow at the hind margin of each tergite in *C. vernale*, although most existing keys suggest the lateral margin is entirely black. Montane and northern populations tend to have the costal region of the wing membrane heavily infuscated, whereas in lowland and southern populations this infuscation is more limited, frequently appearing as little more than a diffuse spot. **Illustrations of the adult insect:** the species is illustrated in colour by Torp (1994).

Chrysotoxum verralli Collin, 1940
Preferred environment: forest/open ground; deciduous woodland, including alluvial hardwood forest; scrub and old field hedges. **Adult habitat and habits:** usually near standing or slow-moving water, but on well-drained soils; clearings and tracksides in open woodland; hedgerows and old pasture; flies fast at *Pteridium* height; males settle on foliage at up to 3 metres from the ground. **Flowers visited:** white umbellifers, *Caltha, Galium boreale, Ligustrum*. **Flight period:** June/October, with peak in July/August. **Developmental stages:** larva supposedly described and figured by Dixon (1960), from a larva collected in the nest of the ant *Lasius niger*. So many of Dixon's determinations have proved unreliable that the identity of the *Chrysotoxum* species involved requires to be checked before Dixon's description of this larva can be with confidence taken to refer to *C. verralli*. **Range:** Denmark south to central France; Britain (Wales and central/southern England) eastwards through central Europe into European parts of Russia to the Caucasus and on into eastern Siberia. **Determination:** see key to the European *Chrysotoxum* species provided in the StN Keys volume; Speight *et al*. (2016). **Illustrations of the adult insect:** the species is illustrated in colour by Torp (1994) and Ball and Morris (2013)

Chrysotoxum volaticum sensu Van Steenis *et al*. (2020)
Preferred environment: forest; open areas in mesophilous *Fagus* forest, often beside rivers; Mediterranean, riparian *Fraxinus* forest. **Adult habitat and habits:** males hover at up to 3 metres from the ground, in open areas within forest, in

particular in the vicinity of small rivers. Females are low-flying, in the vicinity of small rivers. **Flowers visited:** *Thapsia* (Van Steenis *et al*., 2020). **Flight period:** end May/beginning of September (Iberia, France). **Developmental stages:** not described. **Range:** at present known from Portugal, Spain and southern France (Van Steenis *et al*. (2020). If it is confirmed that this taxon is the *volaticum* of Séguy (1961) then it is also known from N Africa: Morocco (Séguy, 1961) and Algeria (Van Steenis *et al*. (2020). **Determination:** extremely similar in appearance to *C. bicinctum*. Van Steenis *et al*. (2020) provide a table showing features to separate European specimens of these two taxa, but the overlap in species characteristics, and the complication of the existence of a Scandinavian *volaticum*-like variant of *C. bicinctum* recognised by those authors, but consigned by them to *C. bicinctum*, reduce the utility of the listed features. Further, the genetic analysis which accompanies their morphological study demonstrates no support for their contention that the European specimens they consign to *C. volaticum* represent a different, species level taxon from the specimens they consign to *C. bicinctum*. The description of *C. volaticum* (in Séguy, 1961) is based on specimens from N Africa. No North African specimens were included in the genetic analysis conducted by Van Steenis *et al*. (2020). However, one morphological feature explicitly mentioned by Séguy (1961), as distinguishing his *volaticum* from *C. bicinctum* is the colour of the frons – partly or extensively orange in *C. volaticum*, but entirely black in *C. bicinctum*. This feature is also referred to in Van Steenis *et al*. (2020), among the features they use, to distinguish the European specimens they consign to *C. volaticum* from specimens they consign to *C. bicinctum*. This partly orange frons seems to be the only feature common to *volaticum* of Seguy and *volaticum* sensu Van Steenis *et al*. (2020) which is consistently absent from Western European specimens of *C. bicinctum* sensu Van Steenis *et al*. (2020). Following in principle the conclusion that the European material consigned to *C. volaticum* by Van Steenis *et al*. (2020) represents a separate species from *C. bicinctum*, it is referred to here as *C. volaticum* sensu Van Steenis *et al*. (2020), acknowledging the present uncertainty surrounding whether it is the same species as the N African *C. volaticum* of Séguy. In this context it should be pointed out that Van Steenis *et al*. (2020) refers only to the *C. bicinctum* complex in western Europe. Further east in Europe there is also a variant of the *bicinctum/volaticum* complex in which the frons is extensively orange. How many species level taxa await recognition within the *bicinctum/volaticum* complex in Europe in general remains to be established by more comprehensive revision, as does the question of to which of them, if any, the name *volaticum* can be correctly applied. As part of that revision it would be appropriate if European synonyms of C. *bicinctum*, not investigated by Van Steenis *et al*. (2020), were checked, in case any of the synonymised species correspond with the European taxon they regard as C. *volaticum*. For difficulties arising from the uncertain relationship between *C. bicinctum* of Van Steenis *et al*. (2020) and *C. bicinctum* of Linnaeus, see under the species account for *C. bicinctum*. **Illustrations of the adult insect:** the general appearance of this species can be seen in the coloured illustrations provided by Van Steenis *et al*. (2020).

CLAUSSENIA

Based on genetic and morphological features, *Claussenia* was erected by Vujić and Ståhls (2013a) for the European species previously known as *Heringia hispanica* (Strobl).

Claussenia hispanica (Strobl), 1909
Preferred environment: forest; open, scrub/maquis of evergreen oak forest of *Q.ilex* and *Q.suber* and open areas in *Pinus nigra* v.*salzmanni* forest; phrygana. **Adult habitat and habits:** flies through taller ground vegetation with a rapid, zig-zag flight; visits stream edges in the shade, to drink. **Flowers visited:** *Nasturtium officinale* (observed feeding in the evening at the margin of a large spring emerging at the edge of *Quercus ilex* forest: MS). **Flight period:** beginning April/mid May. **Developmental stages:** not described. **Range:** a primarily Mediterranean species, occurring in Spain, the Mediterranean zone of southern France (plus Corsica), northern Italy (and Sardinia), Croatia and Greece (plus Crete). **Determination:** Claussen *et al*. (1994), who figure the male terminalia. Until recently (e.g. Peck, 1988) this species has been regarded as a synonym of *H.heringi* (Zett.). It may be found in flight with *H.heringi* and the two species are virtually indistinguishable in the field, though males of *C.hispanica* are usually slightly larger than those of *H.heringi*. A key distinguishing these two species is provided in the StN Keys volume. *C.hispanica* is unusual in that the wing-vein Sc ends in the costa either opposite or basal to the cross-vein r-m, a feature generally regarded as characteristic of *Pipizella*. One of the features used to characterise *C.hispanica* is the hairs present at the ventral extremity of the median lobe of the lunule. But these can be absent in the female. **Illustrations of the adult insect:** the male is illustrated in colour by Speight and de Courcy Williams (2016).

CONOSYRPHUS: See under *Sericomyia*.

COPESTYLUM

A primarily Neotropical genus with a few species that extend into the Nearctic, *Copestylum* is not indigenous to the Palaearctic. However, one Nearctic species has recently been recorded from the Canary Isles and appears to be well-established there. *Copestylum* is now included in the StN key to European genera. It is related to *Volucella*, from which it may be distinguished by a lack of hairs on the antero-dorsal, flat part of the mesanepisternum.

Copestylum melleum (Jaennicke), 1867
Preferred environment: open ground; grassland, orchards and open areas in *Pinus* plantations (Romig and Hauser, 2004). **Adult habitat and habits:** according to Romig and Hauser (2004) "In the field, the flies are conspicuous, flying rather slowly close to the ground or between vegetation, giving the general impression of oversized *Rhingia*". **Flowers visited:** composites and umbellifers (*Foeniculum*). **Flight period:** probably on the wing throughout the year (Canary Isles). **Developmental stages:** undescribed, but the larvae are assumed to feed in decaying plant material, such as cacti (Romig and Hauser, 2004). **Range:** Canary Isles; Nearctic (Mexico). **Determination:** a summary description of the species, based upon material from the Canary Isles, is provided by Romig and Hauser (2004). **Illustrations of the adult insect:** the female is illustrated in colour in Speight and de Courcy Williams (2021).

CRIORHINA

Some of the European species generally regarded as belonging to this genus have been consigned by Peck (1988) to a separate genus, *Brachymyia*. *Brachymyia* was erected by Williston (1882), for a North American species *lupina*, but has been regarded by most authors, including Wirth *et al*.(1965) and Vockeroth and Thompson (1987), as a synonym of *Criorhina*. Hippa (1978) provides some support for reinstatement of *Brachymyia*, based on features of the male terminalia, but it remains to be seen whether a more adequate basis for re-establishing this genus can be demonstrated. Here, the species consigned by Peck (1988) to *Brachymyia* are included in *Criorhina*, with one exception: following Moran *et al*.(2021) the species erstwhile known as *Criorhina berberina* is transferred to *Matsumyia*, leaving a European *Criorhina* fauna of 5 species, one of which (*C.brevipila* Lw) is known in Europe only from the eastern edge of European Russia. Rotheray and Stuke (1998) provide a key distinguishing last instar larvae of four of the European species keyed out here.

Criorhina asilica (Fallen), 1816
Preferred environment: deciduous forest; mesophilous and humid *Fagus* forest and *Quercus /Carpinus/Ulmus* forest with overmature trees. On occasion, may also occur in association with *Fraxinus* (de Courcy Williams, pers.comm.). **Adult habitat and habits:** arboreal except when visiting flowers; males patrol stands of *Rubus idaeus* etc. in flower, zig-zagging fast through the vegetation. **Flowers visited:** umbellifers; *Allium ursinum, Berberis, Cardamine, Crataegus, Euonymus, Frangula alnus, Hieracium, Ligustrum vulgare, Lonicera xylosteum, Rhamnus catharticus, Ribes, Rubus idaeus, Sorbus aucuparia*. **Flight period:** May/June, July at higher altitudes. **Developmental stages:** undescribed, but the species has been reared by Schuhmacher (1968) from larvae found in tree humus in a trunk cavity in *Fagus*. **Range:** central Norway and southern Sweden south to the Pyrenees and northern Spain; from Britain eastwards through central Europe into European parts of Russia and the Ukraine; Italy, the former Yugoslavia, Bulgaria, Roumania. **Determination:** van der Goot (1981). See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** the adult fly is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Kormann (1988), Torp (1984, 1994), Stubbs and Falk (1983) and van der Goot (1986).

Criorhina brevipila Loew, 1871
Preferred environment: coniferous forest; *Pinus sylvestris*/*P.sibiricus* taiga, with *Abies sibiricus* (A.Barkalov, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Heracleum, Rhododendron aureum, Weigela middendorffiana* (Gritskevich, 1998).; *Berberis, Salix* (A.Barkalov, pers.comm.). **Flight period:** May/August (A.Barkalov, pers.comm.). **Developmental stages:** not described. **Range:** eastern edge of European Russia (Urals) through to eastern Asiatic Russia; Mongolia. **Determination:** see Key provided in StN Keys volume. **Illustrations of the adult insect:** none known.

Criorhina floccosa (Meigen), 1822
Preferred environment: deciduous forest; humid *Fagus* and *Quercus* forest with over-mature and senescent trees, up to the upper altitudinal limit of *Fagus*. **Adult habitat and habits:** to a significant extent arboreal, but descends to visit flowers of various small trees and to rest in the sun on foliage of bushes etc. in the evening; also found flying round the trunk base of large, old deciduous trees, apparently investigating sites of trunk-base rot, and around trunks with rot-holes. **Flowers visited:** white umbellifers; *Cornus sanguinea, Crataegus, Photinia, Prunus spinosa, Ribes alpina, Rubus idaeus, Sorbus aucuparia, S.aria, S. torminalis*. **Flight period:** beginning April/beginning July, with records beyond mid June mostly from higher altitudes. **Developmental stages:** larva described and figured by Rotheray (1991) and figured in colour by Rotheray (1994), from larvae collected from a rot-hole in the trunk of *Ulmus* and wet, decaying roots of *Fagus* stumps; has also been found within the mass of wet tree humus and wood fragments filling a large, winter-flooded rot-hole, within the trunk of a large, live *Acer pseudoplatanus*, at 1.5m from the ground. **Range:** southern Sweden and Denmark south to the Pyrenees; from Ireland eastwards through central Europe (plus northern Italy and the former Yugoslavia) into European parts of Russia as far as the Caucasus. **Determination:** van der Goot (1981). See Key provided in StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Criorhina pachymera (Egger), 1858
Preferred environment: forest; ancient mesophilous *Fagus* forest containing overmature and senescent trees; also alluvial softwood forest with overmature *Populus* (Doczkal, pers.comm.); *Populus/Fraxinus* riparian gallery forest with overmature trees. **Adult habitat and habits:** primarily arboreal, descending to flowering under-storey trees to feed; females may be found investigating insect-bored and rotten parts of the trunks of old, standing, live deciduous trees. **Flowers visited:** *Cornus sanguinea* (Dirickx & Obrecht, 2007); *Crataegus, Photinia, Prunus, Salix, Sorbus*. **Flight period:** April/June. **Developmental stages:** not described. Males have been observed patrolling the trunk bases of old, living *Populus nigra* (G. Pétremand, pers. comm.), adding to the speculation that the larvae of *C. pachmera* may develop in rotting roots of these trees. Collected from emergence traps over trunk holes in old, living *Quercus pyrenaica* (Conca-Esquembre, 2024). **Range:** from Southern Sweden south to northern Spain; Belgium (Ardennes) eastwards through central Europe (Czech Republic, Switzerland, Austria) to Roumania. **Determination**: van der Goot (1981); Bradescu (1991), Verlinden (1994). See Key provided in StN Keys volume. Bisschop *et al*. (2023) highlight the existence of two colour forms of *C. pachymera*, which are largely segregated geographically, and whose distribution corresponds with the distribution of two colour forms of the honey bee (*Apis mellifera*), which *C pachymera* closely resembles. Both forms of *C. pachymera* occur in the Balkanic peninsula. Whether the colour forms have taxonomic significance is as yet unclear. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/. An abundance of coloured images of *C. pachymera* is provided by Bisschop *et al*. (2023).

Criorhina ranunculi (Panzer), 1804
Preferred environment: deciduous forest; *Betula, Fagus* and *Quercus* forest with overmature trees. **Adult habitat and habits**: primarily arboreal, but descends to visit flowering shrubs in sun-lit glades and can be found investigating patches of wet, trunk-base rot (frequently in the shade) or, in the case of the males, hovering adjacent to patches of wet trunk-base rot; flies extremely fast, with a characteristic, high-pitched whine, often zig-zagging between the branches of flowering trees. **Flowers visited:** *Cardamine pratensis, Cornus sanguinea, Crataegus, Photinia, Prunus cerasus, P. spinosa, Rubus,* male *Salix, Smyrnium, Sorbus aucuparia*. **Flight period:** beginning of March/mid May and on to end June at higher altitudes. **Developmental stages:** larva described and figured by Rotheray (1991), from larvae from a stump of *Fagus*; almost certainly occurs in trunk-base, fungus-infested, wet-rot cavities, of *Betula, Fagus, Quercus* and *Ulmus*. **Range:** southern Norway and southern Sweden south to Portugal and central Spain; from Ireland eastwards through central Europe into European parts of Russia. **Determination:** See Key provided in StN Keys volume. As at present recognised, *C. ranunculi* includes at least four visibly distinct forms, of uncertain taxonomic status. Their existence is not accommodated in most existing identification literature and one of them has been mistaken for *C.pachymera* (Egger) by some authors, notably Séguy (1961). The forms occurring in central and northern Europe can be separated from one another, and from *C. pachymera*, by the key provided in Speight *et al*.(2020). The suggestion there, that the form resembling *C. pachymera* might be the same as *C. ranunculi v. hispanica* of Gil Collado, is erroneous (A van Eck, pers. comm.). *Criorhina ranunculi v. hispanica* is still not accommodated in existing keys. **Illustrations of the adult insect:** The more usual colour form of the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Colyer and Hammond (1951) and Stubbs and Falk (1983).Three of the forms of *C. ranunculi* are

shown in colour by Speight *et al.* (2020) and Pétremand *et al.* (2022) illustrate both male and female of the "all brown" variant.

CRYPTOPIPIZA

The single species consigned to this genus was originally described by Violovitsh (1985) under the generic name *Pseudopipiza*. Mutin (1998a) introduced the replacement name *Cryptopipiza* for *Pseudopipiza* of Violovitsh, pointing out that the latter name was a junior homonym of *Pseudopipiza* Hull, erected for certain species of fossil syrphid. *Cryptopipiza* is so far known only from the Palaearctic.

Cryptopipiza notabila (Violovitsh), 1985
Preferred environment: forest/open ground; herb-rich open areas within *Picea* (T.Järveläinen, pers.comm.) and *Pinus* (Van Veen, 2011) forest. **Adult habitat and habits:** no data. **Flowers visited:** *Anthriscus sylvestris* (T.Järveläinen, pers.comm.). **Flight period:** June/July (Ståhls and Vujić, 2009). **Developmental stages:** not described. **Range:** Norway (Nielsen & Ødegaard (2013); Sweden; Finland; western edge of European Russia (Karelia) and the far east of Siberia (Sakhalin). **Determination**: *C.notabila* is the only known European species of this genus and can be separated from other European syrphids using the generic key given in the StN Keys volume. In both sexes, this species bears a strong, general resemblance to *Pipiza lugubris*, with which it is likely to be confused if the barette is not checked for presence of hairs (hairs present in *Cryptopipiza*, absent in *Pipiza*). Violovitsh (1985) figures the male terminalia, which are also shown diagramatically in Haarto & Kerppola (2007). **Illustrations of the adult insect:** the male is illustrated in colour by Haarto & Kerppola (2007).

DASYSYRPHUS

Peck (1988) lists 12 species of *Dasysyrphus* as occurring in Europe, but the European species of this genus are badly in need of revision. Bicik and Laska (1996), Doczkal (1996a) and Soszynski *et al*. (2013) each add a further species. There is confusion both as to how many species can be recognised and what names should be applied to them. The interpretations employed here are explained in the text on the individual species. *Dasysyrphus intermedius* (Becker) was given as a European species by Peck (1988) on the basis of a female cited from Switzerland, by Goeldlin (1974). It has since been removed from the Swiss species list (Maibach et al, 1992, 1998). In the absence of further citations from Europe *D. intermedius* is not regarded as a European species in the present text. It was described from the vicinity of L. Baikal, in Russian central Asia.

Dasysyrphus albostriatus (Fallen), 1817
Preferred environment: forest; most types of coniferous and deciduous forest and conifer plantation, up to the lower limits of the alpine zone. **Adult habitat and habits:** tracksides, clearings etc.; to a significant extent arboreal, but often within 2-3m of the ground; settles on foliage of trees and bushes; may be found sunning itself in the evening, on bushes in sheltered locations. **Flowers visited:** yellow composites; white umbellifers; *Acer pseudoplatanus, Calluna, Crataegus, Euphorbia, Lonicera xylosteum, Papaver, Ranunculus, Rubus, Salix, Sorbus, Stellaria, Succisa pratensis, Viburnum opulus* (for extended list, see de Buck, 1990). **Flight period:** end April (early April in southern Europe) /September, with stragglers into October. **Developmental stages:** larva described and figured by Dusek & Laska (1962), Brauns (1968) and Goeldlin (1974); predominantly aphid-feeding, but apparently predatory on a wide range of soft-bodied insects; according to Goeldlin (1974) the larvae twine around twigs or small branches like an annulus, keeping to the woody parts, where their colouration makes them almost invisible, and remain motionless unless potential prey passes in their immediate vicinity. Kula (1982) reports that in spruce (*Picea)* forest larvae of this species are to be found mostly in the crowns of trees. **Range:** from Fennoscandia south to Iberia; from Ireland eastwards through central and southern Europe (Italy, the former Yugoslavia) to Crete, Turkey and European parts of Russia (from the north to the Crimea and the Caucasus); Georgia; central Asia to Tuva; North Africa; Japan. This species is a confirmed migrator. **Determination:** *D.albostriatus* is one of the better-defined species in the genus and, as interpreted here, may be identified using van der Goot's (1981) keys. It is most similar to *D.eggeri* (Schiner), from which it may be distinguished without difficulty. The male terminalia are figured by Dusek and Laska (1967), Hippa (1968b) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Dasysyrphus corsicanus (Becker), 1921
Definition of taxon inadequate: separate species status not justified, based on existing information.
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Developmental stages:** not described. **Range:** Corsica. **Determination:** the description of this species is based on a solitary male. *D. corsicanus* has not been seen since its description (Cornuel-Willermoz & Lebard, 2024) and the female remains undescribed. It is included in the keys provided by Sack (1928-32). From its description it would seem quite possible that *D. corsicanus* is conspecific with *D. hilaris*. Only a critical revision of European *Dasysyrphus* species (now much required) could resolve these issues. It is quite possible that even critical revision would not help to decide the identity of *D.corsicanus*, because it is known that many of Becker's types have been lost and the type of *D. corsicanus* may no longer be available for examination. On the basis of existing information, whether *D. corsicanus* is a distinct species, or a junior synonym of either *D. hilaris* or some other species cannot be decided. **Illustrations of the adult insect:** none known.

Dasysyrphus eggeri (Schiner), 1862
Preferred environment: forest; *Larix/Pinus mugo* zone in the Alps, but apparently at lower altitudes further east: data deficient. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** mid June/August. **Developmental stages:** not described. **Range:** southern Sweden, Pyrenees (France, Spain), Alps (Switzerland, Austria, northern Italy), Corsica, Greece, Roumania and the Caucasus, also Poland; southwest Asia (Kirghizistan, Tajikistan) and western Siberia; Mongolia. **Determination:** Bradescu (1991). **Illustrations of the adult insect:** Bartsch *et al.*(2009a) figure the adult male, and the female abdomen, in colour; Vujić *et al.* (2020d) provide a coloured photo of the female.

Dasysyrphus friuliensis (van der Goot), 1960
Preferred environment: forest; *Picea* forests and plantations upwards to the *Larix* zone. **Adult habitat and habits**: clearings, tracksides etc.; primarily arboreal, but descends to visit flowers. **Flowers visited**: white Umbelliferae; *Ranunculus, Sambucus ebulus, Sorbus aucuparia, Taraxacum*. **Flight period**: May/June and on into July/beginning of August at higher altitudes. **Developmental stages:** larva described and figured by Goeldlin (1974); aphid feeding; Kula (1982) records larvae of this species overwintering among leaf litter on the floor of spruce (*Picea*) forest. **Range:** Fennoscandia and mountainous parts of Europe south to the Pyrenees; from Britain eastwards through mountainous parts of Europe into European parts of Russia; Georgia; Siberia from the Urals to Kamchatka. **Determination:** neither the nomenclature nor status of this taxon is as yet fully resolved: see Vockeroth (1986) and Speight (1988a). The interpretation employed here is that of Haarto and Kerppola (2007a) and Bartsch *et al.*(2009a). **Illustrations of the adult insect:** Bartsch *et al.*(2009a) provide coloured illustrations of both the male and female of this species.

Dasysyrphus hilaris (Zetterstedt), 1843
Preferred environment: mature conifer forest; humid *Pinus* forest and *Betula/Pinus* swamp forest, *Fagus/Picea* forest up to c.1000m in the Alps and *Pinus* plantations. **Adult habitat and habits:** flies round the foliage of conifers, but descends to visit flowers and settles on foliage of large-leaved deciduous trees, e.g. *Acer*. **Flowers visited:** *Lonicera xylosteum, Ranunculus, Sorbus aucuparia, Taraxacum, Vaccinium myrtilus*. **Flight period:** beginning May/mid June. **Developmental stages:** not described. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** uncertain, due to considerable confusion with related species until recently, but confirmed from Ireland, Great Britain, Norway, France (Vosges, Alps, Pyrenees), Liechtenstein. **Determination:** this species cannot be determined with confidence using existing keys. The concept of *D.hilaris* employed here is that of Doczkal, who has a publication on this species in an advanced stage of preparation (Doczkal, pers.comm.). **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the photo provided by Haarto and Kerppola (2007a). It is not clear which species is illustrated under this name in Bartsch *et al.*(2009a). A coloured photo of the male is provided by Bot and Van de Meutter (2019).

Dasysyrphus lenensis Bagatshanova, 1980
Preferred environment: conifer forest; montane *Abies/Picea* forest to its upper altitudinal limit. **Adult habitat and habits:** no data. **Flowers visited:** *Alnus viridis*, *Caltha palustris*, *Ribes*, male *Salix*. **Flight period:** end April/mid June, plus July at higher altitudes. **Developmental stages:** undescribed. **Range:** Netherlands, France (Vosges, Alps), Germany, Switzerland, Liechtenstein, Austria, Italy (Dolomites) and eastern Siberia. **Determination:** Doczkal (1996a) figures the male terminalia and discusses separation of this species from other closely related European species. Doczkal (l.c.) also figures the female frons and abdomen, both in dorsal view. Reemer (2002) shows the male abdomen in dorsal view, and the female frons.

However, his figure of the male abdomen does not correspond with other figures of the abdomen of this species and it seems possible that the labelling of his figures of the abdomens of *D. lenensis* and *D. pauxillus* have been reversed. Distinctions between *D. lenensis* and both *D. nigricornis* (Verrall) and *D. pinastri* (DeGeer) do not yet seem either clear or reliable. This species is included in the keys provided by van Veen (2004), but without convincing improvement in means of separating it from *D.pinastri*. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Dasysyrphus lunulatus: see under *D.pinastri* (DeGeer) sensu Doczkal

Dasysyrphus neovenustus Soszynski, Mielczarek and Tofilski, 2013
Preferred environment: forest; conifer forest; humid *Pinus sylvestris* forest, Caledonian pine forest; conifer plantations with *Pinus sylvestris*; "alluvial forest" (Prokhorov *et al*., 2023); heathland invaded by *Pinus sylvestris* scrub; sheep-grazed limestone grassland with thickets of *Juniperus* and *Pinus sylvestris* scrub. **Adult habitat and habits:** no data. **Flowers visited:** yellow-flowered composites, white-flowered umbellifers, *Caltha*, *Cardamine*, *Ledum palustre*, *Salix* spp. and *Sorbus aucuparia*. **Flight period:** mid April/end June. **Developmental stages:** not described. **Range:** uncertain, due to confusion with *D. venustus* until recently, but reported from Ireland, Britain, France, the Netherlands, Poland, Switzerland, Ukraine and parts of European Russia. **Determination:** Soszynski *et al*. (2013) describe both sexes of *D. neovenustus*, figure the male terminalia and provide information on separation of this specie from *D. venustus* and *D. hilaris*. Speight and Vanappelghem (2018) provide a key for the separation of these taxa. *D. neovenustus* and *D. venustus* are extremely similar in appearance and post-mortem changes in the colour of the markings on the abdominal sternites can render some specimens unidentifiable. Further, the existence of additional, undescribed species within the *D. venustus* complex in Europe is recognised and cannot easily be taken into consideration. See also the species account for *Dasysyrphus venustus*. Prokhorov *et al*. (2023) provide additional discussion of differences between *D. neovenustus* and *D. venustus*. **llustrations of the adult insect:** coloured photos of this species are provided by Bot and Van de Meutter (2019) and Falk, at https://www.flickr.com/photos/63075200@N07/collections/72157629311220358/.

Dasysyrphus nigricornis (Verrall), 1873
Preferred environment: taiga (Nielsen, 1998); dwarf-shrub tundra. **Adult habitat and habits:** no data. **Flowers visited:** *Caltha*, *Ledum*, *Ranunculus*, *Salix* (Nielsen, 1998); *Rhododendron tomentosum*. **Flight period:** June/July; May/July in the Nearctic. **Larva:** not described. **Range:** uncertain, due to confusion with related species, but confirmed from northern Norway, northern Sweden and Finland and the Kola peninsula in European Russia. Now known also to occur in Greenland; Alaska (USA) and Canada (Locke and Skevington, 2013). Bartsch *et al*. (2009a) suggest this species occurs only north of the Arctic Circle. **Determination:** Bičik and Láska (1996), Bartsch *et al*. (2009a), Locke and Skevington (2013). There has been considerable confusion as to whether this taxon is a distinct species and, if so, what its diagnostic features might be and where it occurs in Europe. This originates from the bizarre situation that, when he introduced the name *nigricornis* to replace the name *obscura* of Zetterstedt, Verrall (1873) proceeded to define *nigricornis* based on material from Scotland, where the Zetterstedt taxon does not occur. Since the Scottish material apparently belonged to the taxon now known as *D. pinastri*, and Verrall (l.c.) was attempting to distinguish *nigricornis* from *pinastri*, the result was a set of totally unreliable distinguishing features. Bičik and Láska (1996) finally redefined *D. nigricornis* based on the original type material of Zetterstedt's *obscura*, at the same time suggesting features to aid in separation of *D. nigricornis* from the very similar species *D. pauxillus* and *D. pinastri*. They unfortunately do not consider how *D. nigricornis* might be separated from *D. lenensis*. Given the uncertainty surrounding the identity of European *D. pauxillus* (see under *D. pauxillus*), the still inadequate differentiation of *D. lenensis* and *D. pinastri* from one another and the absence of means of separation of *D. nigricornis* from *D. lenensis*, correct determination of putative *D. nigricornis* material remains difficult. *D. nigricornis* is included in the keys provided by Bartsch *et al*. (2009a), and Locke and Skevington (2013). Bartsch *et al*. (2009a) provide a reasonably clear basis for separation of this taxon from *D. pinastri*. However, *D. lenensis* (which is not known from Scandinavia) is not included in their keys. **Illustrations of the adult insect:** Bartsch *et al*. (2009a) provide a coloured figure of the male of *D. nigricornis*. Locke and Skevington (2013) figure both the male and female in colour.

Dasysyrphus pauxillus (Williston), 1887
Preferred environment: conifer forest; acidophilous *Picea* forest, *Abies/Picea* forest and upwards into the *Larix*/*Pinus mugo* zone, plus northwards to taiga, in the Palaearctic. **Adult habitat and habits:** males hover at 2-3m in conifer forest

(Reemer et al, 2009). **Flowers visited:** *Acer platanoides, Carex, Crataegus, Ranunculus, Rubus chamaemorus* (Nielsen, 1998); *Ribes alpinum* (Bygebjerg, 2004); umbellifers, *Anemone nemorosa, Barbarea vulgaris, Caltha, Prunus padus* (Bartsch *et al.*, 2009). **Flight period:** end April/mid June, plus July in northern Europe. **Larva:** undescribed. **Range:** northern Norway, Sweden, Finland, Denmark, Britain, Spain (Pyrenees), France (Puy-de-Dôme, Alpes-Maritimes), Switzerland, Austria, Italy (Dolomites); Asiatic Russia and in N America from Alaska to California and across to New York. **Determination:** Doczkal (1996a), who figures the male terminalia and provides distinctions between *D.pinastri*, *D.pauxillus* and *D.lenensis* Bagatshanova. *D. pauxillus* is included in the keys provided by Haarto and Kerppola (2007a) and Bartsch *et al.* (2009a), but not using the same diagnostic features. The male terminalia of Nearctic *D. pauxillus* are figured by Vockeroth (1992). There are noticeable abdominal colour pattern differences between the N American *D. pauxillus*, as illustrated by Vockeroth (1992), and the European material consigned to this species by Bicik and Laska (1996) and Doczkal (1996a). The range of variation indicated for this species by Vockeroth (1992) would imply that more than one taxon was confused under this name by him, and Williston's type material has apparently been lost (Vockeroth, 1986a). This does not provide a good basis for use of the name *pauxillus* for European specimens. Locke and Skevington (2013) do not indicate whether *pauxillus* sensu Vockeroth (1992) included more than one species. Bicik and Laska (1996) provide distinctions between the European taxon they recognise as *D. pauxillus* and the species now known as *D. nigricornis* (Verrall). The taxa figured by Reemer (2002) as *lenensis* and *pauxillus* are difficult to reconcile with these species as recognised by Doczkal (1996a) or Bicik and Laska (1996). Prokhorov *et al.* (2020) remark that the terminalia of the specimen they record (and figure) as *D. pauxillus* from the Ukraine do not co-incide with the figures of this species provided by other authors. Another intrerpretation is provided by the coloured photo of the female given in Haarto and Kerppola (2007a), which seems to be the same taxon as the male figured in colour by Bartsch *et al.* (2009a). A neotype has been designated for *D. pauxillus* by Locke and Skevington (2013), who also redescribe the species. They state the opinion that, in this group of Nearctic *Dasysyrphu*s species (*laticaudus, nigricornis, pacificus, pauxillus),* the only Holarctic one is probably *D. nigricornis*, recommending that all putative *D. pauxillus* material from the Palaearctic be comprehensively re-examined and re-evaluated. **Illustrations of the adult insect:** both male and female of the Nearctic *D. pauxillus* are figured in colour by Locke and Skevington (2013). Publications figuring Palaearctic *D. pauxillus* are referred to above.

Dasysyrphus pinastri (De Geer), 1776 sensu Locke and Skevington (2013)
Preferred environment: conifer forest (*Abies, Picea* and *Pinus*) and conifer plantation, plus montane *Betula* woods. **Adult habitat and habits:** largely arboreal, but descends to visit flowers. **Flowers visited:** *Caltha, Cirsium, Crataegus, Crepis paludosa, Euphorbia, Fragaria, Frangula alnus, Galium, Heracleum, Hieracium, Lonicera xylosteum, Prunus spinosa, Ranunculus, Rosa rugosa, Salix repens, Sorbus aucuparia. Stellaria.* **Flight period:** April/June and July/beginning of August at higher altitudes/more northerly latitudes. **Developmental stages:** larva figured by Nielsen *et al.*(1954) (re-examination of Icelandic specimens demonstrates that the only *lunulatus*-group species present in Iceland is apparently *D pinastri* itself). Rotheray (1987) provides a description of the larva, based on larvae beaten in September from *Acer pseudoplatanus* infested with the aphid *Drepanosiphum platanoides* (Schrank). The larvae overwintered and produced adults in May of the following year. aphid feeding; Kula (1982) records larvae probably of this species as overwintering among leaf litter on the floor of spruce (*Picea*) forest. Egg: Chandler (1968). **Range:** Greenland, Iceland and Fennoscandia south to the Pyrenees; from Ireland eastwards through northern and central Europe (plus mountainous parts of northern Italy and the former Yugoslavia) into Turkey; Georgia; European parts of Russia; through Siberia from the Urals to Yakutia. **Determination:** Doczkal (1996a), as *D. pinastri* (De Geer) - this is the *Dasysyrphus lunulatus* of recent European authors, e.g. Goeldlin (1974), who redefined the species and published the designation of a lectotype for it. However, Vockeroth (1986a, 1992) disputed the identity of the lectotype of *lunulatus*, referring to a manuscript by Thompson and Nielsen in which it is apparently claimed that *lunulatus* is a synonym of *venustus* and suggested that the name *pinastri* (De Geer) should be used for *lunulatus* of Goeldlin and other authors. Unfortunately, no neotype had then been designated for *pinastri* and Vockeroth (1986a) defined his concept of this species only in terms of the definitions provided by Coe (1953) and van der Goot (1981) for *D.lunulatus*, which do not adequately distinguish the taxon from *D. lenensis* (Bag.) or *D. nigricornis* (Verrall). Further, the Thompson and Nielsen paper to which Vockeroth refers has never appeared in published form. More recently, Bicik & Laska (1996) have attempted to define European taxa previously confused with *D. pinastri*, recognising the additional species as *D. nigricornis* (Verrall) *nec aucct* and *D. pauxillus* Williston. Supposed distinctions between these three taxa are provided by Bicik & Laska (1996), though the distinctions given for separating *D. pinastri* from *D. nigricornis* are unconvincing. Doczkal (1996a) provides distinctions between *D. pinastri*, *D. pauxillus* and *D. lenensis* Bagatshanova, recording the latter species for the first time from central Europe. However, there are noticeable differences between the N

American *D. pauxillus*, as redescribed by Vockeroth (1992), and European material supposedly belonging to this same species as defined by Bicik & Laska (1996) and Doczkal (1996a). Further, the distinctions referred to by Doczkal (1996a) for separation of *D. lenensis* and *D. pinastri* do not seem reliable, specimens frequently exhibiting a mixture of the characters of both taxa. A final complication derives from the fact that Thompson & Pont (1994) designated as neotype of *pinastri* de Geer's figure of this species. There is no indication given by Thompson & Pont (l.c.) that they were aware of the presence in Europe of the taxa currently referred to as *D. lenensis* and *D. pauxillus* and they provide no definition of *pinastri* which would help to decide to which species they are applying the name, beyond stating that they are referring to "*lunulatus* of authors". There is no basis for concluding that either the original description or figure of *pinastri* may be used to decide to which species they refer. For authors who wish to apply the name *pinastri* to this taxon, it could be refered to as *pinastri* (de Geer) sensu Doczkal (1996a), since Doczkal linked the neotype designation of *pinastri* to a usable description of a species. Alternatively, the definition of *D. pinastri* provided by Locke & Skevington (2013) could be used in the same way, arriving at *pinastri* (de Geer) sensu Locke & Skevington (2013). Those authors also designate a neotype for *D. pinastri*, on this occasion an actual specimen, rather than a "virtual" neotype as designated by Thompson and Pont (1994). Further, the neotype designated by Locke & Skevington (2013) is backed by genetic data for their interpretation of the species, providing a solid basis for identifying it, whereas the picture designated as neotype by Thompson & Pont (1994) has no such security of identity. The male terminalia of *D. pinastri* have been figured by Doczkal (1996a) and Vockeroth (1992). **Illustrations of the adult insect:** The adult insect is supposedly illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Haarto & Kerppola (2007a) and Bartsch *et al*. (2009a). But whether these various authors are referring to the same taxon under the name *D.pinastri* is not clear.

Dasysyrphus postclaviger (Stys & Moucha), 1962
Preferred environment: forest; conifer forest at the upper altitudinal limit of *Picea* and on through *Larix/Pinus cembra* and *P.uncinata* forest up to its limit (2,200m in the Alps) (P.Goeldlin, pers.comm.). **Adult habitat and habits:** males hover at 1.5 - 5m and settle on the trunks of *Larix* in the sun (P.Goeldlin, pers.comm.). **Flowers visited:** *Veronica, Ranunculus, Rubus idaeus* (Krpač *et al*, 2009); yellow composites; *Crataegus*. **Flight period:** end May/beginning July. **Developmental stages:** not described. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** northern Europe, central parts of the Alps (France, Switzerland, Liechtenstein, Austria) and the Pyrenees. **Determination:** Stys and Moucha (1962); Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). *D. postclaviger* can be separated from the closely similar species *D. friuliensis* (van der Goot) and *D. hilaris* (Zetterstedt), using the keys provided by Haarto and Kerppola (2007a), Bartsch *et al*. (2009a) and Van Veen (2010). **Illustrations of the adult insect:** the adult male is illustrated in colour by Bartsch *et al*. (2009a).

Dasysyrphus tricinctus (Fallen), 1817
Preferred environment: deciduous forest, coniferous forest and conifer plantations; in particular *Picea* plantations and areas of scrub *Betula* in sheltered locations (e.g. associated with stands of mature coniferous or deciduous trees), but can occur in a wide range of deciduous woodland situations. **Adult habitat and habits:** tracksides, clearings etc.; predominantly arboreal, but descends to visit flowers of low-growing plants. **Flowers visited:** yellow composites; white umbellifers; *Calluna, Campanula, Convolvulus, Cornus, Euphorbia, Geranium, Parnassia, Plantago, Polygonum, Ranunculus, Sedum, Sorbus, Stellaria, Succisa, Valeriana*. **Flight period:** April/October, with pronounced peaks in April/May (Belgium) or May/June (Ireland) and August/ September and very few records from the intervening period. **Developmental stages:** the larva has been observed predating sawfly larvae on *Picea* and lepidopterous larvae on deciduous trees (Gabler, 1938, Friederichs *et al*, 1940); features of the larva are described and figured by Dixon (1960) and the larva is illustrated in colour by Rotheray (1994). Egg: features described and figured by Chandler (1968). **Range:** Iceland south to the Pyrenees and northern Spain; from Ireland and Fennoscandia eastwards through much of central and northern Europe and Russia to the Pacific coast and Japan; Caucasus (Georgia). **Determination:** van der Goot (1981). The male terminalia are figured by Hippa (1968b) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Dasysyrphus venustus (Meigen), 1822
Preferred environment: forest; humid *Fagus*, acidophilous *Quercus*, *Betula* and wet woodland; alluvial hardwood forest; humid *Pinus*, *Picea/Abies* and conifer plantations. **Adult habitat and habits:** clearings, tracksides etc.; to a significant extent arboreal, but descends to visit flowers and also to sun itself in the evening. **Flowers visited:** white Umbelliferae; *Acer*

platanoides, A.pseudoplatanus, Allium ursinum, Berberis, Caltha, Crataegus, Endymion, Euonymus europaeus, Euphorbia, Frangula alnus, Ilex, Lonicera xylosteum, Potentilla erecta, Prunus cerasus, P. spinosa, Ranunculus, Rubus idaeus, Salix, Sambucus, Sorbus aucuparia, Stellaria, Taraxacum. **Flight period:** April/June and July at higher altitudes/more northerly latitudes. **Developmental stages:** larva described and figured by Dusek and Laska (1962) and Rotheray (1987) and illustrated in colour by Rotheray (1994); aphid-feeding, on trees and shrubs, e.g. *Acer pseudoplatanus*. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia south to the Pyrenees and northern Spain; from Ireland eastwards through northern, central and mountainous parts of southern Europe (Italy, the former Yugoslavia) into European parts of Russia; in Siberia from the Urals to the Pacific coast (Kuril Isles); in N America from Alaska to Quebec and southwards to Oregon. **Determination:** present concepts of this species are confused and its treatment here has to be regarded as provisional in nature. The definition of *D. venustus* employed here is that provided by Locke and Skevington (2013), which is backed by genetic characterisation. It also corresponds well with the definition of *D. venustus* in Soszynski *et al*.(2013), in the paper in which they separate *D. neovenustus* from *D. venustus*, in respect of both male and female features, including the male terminalia. However, these authors did not examine the type material of *D. venustus*. Unpublished revisionary work by. Doczkal (Dieter Doczkal, pers. comm.) suggets that, in Europe, *D. venustus* is a complex of three or more morphologically recognisable taxa, at least one of which still remains undescribed. It is to be hoped that ongoing genetic revisionary work based on European material will fix the status of this taxon and provide a more satisfactory basis for distinguishing it from related species. Male terminalia of *D venustus* as recognised here are illustrated by Locke and Skevington (2013) and Soszynski et al.(2013). The figures of the male terminalia of *D.venustus* provided by Hippa (1968b) and Vockeroth (1969) may refer to other species. **Illustrations of the adult insect:** The general appearance of the adult insect is shown in the coloured illustrations provided by Bartsch et al.(2009a), Kormann (1988), Locke and Skevington (2013) and Stubbs and Falk (1983).

DIDEA

The three European species in this genus are included in the keys provided by various recent authors, including van der Goot (1981), Stubbs and Falk (1983) and Verlinden (1994).

Didea alneti (Fallen), 1817
Preferred environment: forest; humid conifer forest (including western taiga) and conifer plantations. **Adult habitat and habits:** primarily arboreal, but descends to visit flowers at the edges of clearings, along tracks, beside streams etc. Males hover at 3-4m beside trees, or between their branches. In other syrphids, hovering is normally carried out with the long axis of the body more or less parallel to the ground surface, but *D.alneti* can hover at a strongly inclined angle, with its head high. **Flowers visited:** white umbellifers, yellow composites; *Cirsium, Plantago, Potentilla, Rosa, Rubus idaeus, Salix, Sambucus ebulus, Valeriana officinalis, Viburnum opulus.* **Flight period:** mid May/early September. **Developmental stages:** Dusek and Laska (1967) figure features of the arboreal larva. Larvae of this species have been found on *Larix, Prunus, Salix* and *Quercus*. **Range:** northern Fennoscandia south to the Pyrenees; from Ireland eastwards through central Europe and across Russia to the Pacific coast, Japan and Korea; Mongolia; in N America from Alaska south to Colorado. **Determination:** Stubbs and Falk (1983). See Key provided in StN Keys volume. The male terminalia are figured by Dusek and Laska (1967). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Didea fasciata Macquart, 1843
Preferred environment: forest; most types of deciduous and coniferous forest and conifer plantations. **Adult habitat and habits:** tracksides, clearings etc.; fast-flying, frequently flies around tree foliage at some height; males patrol flowering trees, zig-zagging rapidly among the branches. **Flowers visited:** white umbellifers; *Arbutus unedo, Chaerophyllum, Crataegus, Galium, Hedera, Hypochoeris, Polygonum cuspidatum, Rubus fruticosus, R. idaeus, Sambucus, Urtica dioica, Viburnum opulus.* **Flight period:** May/September, with scattered records for October. **Developmental stages:** larva described and figured by Heiss (1938) and illustrated from a preserved specimen in Rotheray (1994); aphidophagous larvae arboreal, on both conifers and deciduous trees; Laska & Stary (1980) provide data on larval biology. **Range:** Fennoscandia south to the Pyrenees and Spain; Italy and Greece; from Ireland eastwards through Eurasia to the Pacific coast; in the Oriental region to N India and Formosa. **Determination:** Stubbs & Falk (1983). See Key provided in StN Keys volume.The male terminalia are

figured by Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Didea intermedia Loew, 1854
Preferred environment: coniferous forest; *Pinus mugo, P.uncinata* and humid *P. sylvestris* forest. **Adult habitat and habits:** flies around the foliage of pines, usually above 2m from the ground; descends to visit flowers. **Flowers visited:** white umbellifers; yellow composites; *Calluna, Crataegus, Cirsium, Ligustrum, Narthecium ossifragum, Potentilla erecta, Ranunculus, Rosa pimpinellifolia, Sambucus ebulus*. **Flight period:** end May/August with occasional specimens on into October. **Developmental stages:** larva aphid-feeding; described by Evenhuis (1978), who found larvae on *Pinus nigra*. **Range:** Fennoscandia south to Iberia; Italy; the former Yugoslavia; from Britain eastwards through central and southern Europe into Russia; Caucasus (Georgia); through Asiatic Russia to the Pacific coast (Kamchatka). **Determination:** Stubbs & Falk (1983). See Key provided in StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984) and van der Goot (1986).

DOROS

The are only two European *Doros* species known. These are reviewed by Speight (1988c).

Doros destillatorius Mik, 1885
Preferred environment: forest; deciduous forest of mesophilous *Fagus* and thermophilous *Quercus* with overmature trees. **Adult habitat and habits:** apparently largely arboreal, but descends from the canopy to visit the margins of forest streams to drink, where these are in sunlight. **Flowers visited:** *Rubus fruticosus* agg. (D.Levy, pers.comm.). **Flight period:** end of June to the beginning of October, with a peak in September. **Developmental stages:** larva not described, but Speight (1988c) describes and figures features of the puparium, which was found among moss at the base of an oak (*Quercus*). Females have been observed apparently searching for oviposition sites, flying slowly, in the shade, close to the trunk (at up to 1m from the ground) of mature, more-or-less isolated *Acer monspesulanum*, in open *Acer*/*Quercus pubescens* forest edging an abandoned almond orchard, from the middle of the day into the afternoon. Females have also been observed (M. de Courcy Williams, pers. comm.) ovipositing repeatedly at the base of large *Quercus ithaburensis* trees inhabited by *Liometobium microcephalum* (Panzer), a saproxylic ant which zealously farms the huge, myrmecophilpous root-collar/trunk aphid, *Stomaphis quercus* (L.). A number of European *Acer* species are known to support ant-maintained populations of another large, subcortical aphid, *Stomaphis graffii* (Cholodkovsky). A large population of *S. graffii* can build up within the bark of a tree trunk, in chambers excavated for them (Depa, 2012, 2013) by the ant host, normally *Lasius brunneus* Lat. Indeed, it seems that a *L. brunneus* colony is, to a significant extent, dependent upon the population of *Stomaphis* living with them within the bark of the trees they inhabit. *Lasius brunneus* is also an inhabitant of the bark of at least the lower parts of the trunks of various European *Quercus* species, including both deciduous species like *Q. robur* and evergreen oaks like *Q. suber* (Loi *et al*, 2012), where it has a similar relationship with *Stomaphis quercus* (L.). Putting together what is known of the habitat and habits of *D. destillatorius* with what is known of the arboreal ants *Lasius brunneus* and *Liometopum microcephalum*, and their commencal *Stomaphis* species, it is but a small step of logic to conclude it is more than possible that the larva of *D.destillatorius* is a specialist predator of *Stomaphis*, within the bark of the trunk bases of *Acer* and *Quercus* species. This would also be in keeping with the larval biology of species of the closely-related syrphid genus *Xanthogramma*. **Range:** round the Mediterranean basin from southern France (including Corsica) through Italy to Greece, Bulgaria and Turkey; also in Roumania and the Crimea; Sardinia. **Determination:** Speight (1988c). **Illustrations of the adult insect:** a coloured photo of the female is provided in Birtele (2011).

Doros profuges (Harris), 1779
Preferred environment: deciduous forest; *Quercus/Fraxinus* (both mature and scrub) and *Corylus* scrub, on well-drained sites which have been forested for a considerable period of time; well-drained, ancient, unimproved pasturage invaded by scrub (including *Rubus* and *Taxus*). **Adult habitat and habits:** may be primarily arboreal, and is certainly elusive where it occurs. In more open situations, adults fly along the edge of scrub, often around *Rubus fruticosus* agg. thickets, on which they settle. Males may hover at 1-2m over tracks. The following account of the behaviour of a male of *Doros profuges* that was caught and then immediately released was supplied by Barry Brigden (pers.comm.): upon release, the male *Doros* flew slowly, in a zig-zag fashion, just above grass height, to a patch of knee-high bramble (*Rubus fruticosus*) where it settled on a

leaf, exposed in full view. There it proceeded to move its abdomen slowly up and down and at one point seemed almost to be standing on its head. It then proceeded to rub its hind legs against its abdomen, and then its hind legs together, presumably a cleaning process. It then continued to wave its abdomen, performed a little dance by moving forward slightly, then backwards and from side to side, followed by turning a complete circle on the spot. It then rubbed its front legs together. This whole process took about a minute. The fly then flew about 10cm to an adjacent bramble leaf and rested for about ten seconds before flying on to another leaf, where it indulged in more abdomen waving, dancing and twirling. This happened six times before it flew from the bramble patch on to a blade of grass about 45cm away where it stayed for a couple of seconds, then back to a leaf of the same bramble patch, the abdomen waving and dancing continuing. Another flight of about 50cm took it to the leaf of a low growing plant (species unknown) where it stayed briefly and, after rubbing its front legs together, again flew back to the bramble patch. On the bramble it again changed leaves a few times with yet more dancing and waving. Suddenly, it flew off to a hazel (*Corylus*) shrub about 3m away and alighted on an exposed leaf, where it once more danced and waved its abdomen. Then, with no warning, it took off at speed, flying low down and in a direct line towards the back of the glade. This flight was in direct contrast to the slow, lazy zig-zag flight observed earlier. **Flowers visited:** umbellifers, *Chrysanthemum leucanthemum, Filipendula, Rubus*. **Flight period:** end May/June, and on into July particularly at higher altitudes. **Developmental stages:** features of the puparium are described and illustrated by Speight (1988c), including distinctions from the puparium of *D.destillatorius* Mik; the larva is believed to be an ant commensal, probably with *Lasius fuliginosus* (Lat.). A female has been observed ovipositing at the base of a *Fraxinus* sapling. **Range:** southern Norway and southern Finland south to central Spain; from Ireland east through most of central and southern Europe and on through Eurasia to the Pacific coast (Japan); also recorded from various parts of China. **Determination:** Speight (1988c); this species appears in most European literature as *D.conopseus* (Fab.). The male terminalia are figured by Vockeroth (1969). Mengual *et al*. (2020) argue that the date of publication of the original description of this species was 1779, not 1780 as cited previously. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Stubbs and Falk (1983) and Torp (1994).

EPISTROPHE

Peck (1988) lists 11 European species of *Epistrophe*. One of these, *E.helvetica* Sack, has recently been shown to be a synonym of *Parasyrphus nigritarsis (Zett.)*. Another, *E.monticola* Becker, has subsequently been synonymised with *Parasyrphus punctulatus* (Verrall). A third species, *E.euchroma*, is frequently treated as belonging to a separate genus, *Epistrophella*, as is the case in the present account. Further, the species *E.leiophthalma* has affinities with both *Epistrophe* and *Leucozona*. Doczkal and Schmid (1994) provide a partial revision of the European *Epistrophe* species, in which they demonstrate that the names *E.melanostomoides* (Strobl) and *E.ochrostoma* (Zetterstedt) have been wrongly applied and describe *E.cryptica* and *E.flava*. More recently *E.olgae* has been added to the European list. There are now 12 *Epistrophe* species known from Europe.

Epistrophe annulitarsis (Stackelberg), 1918
Preferred environment: taiga (A.Barkalov, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** mid-May/end August. **Developmental stages:** not described. **Range:** Finland, Latvia, northern parts of European Russia and eastwards through Siberia to the Pacific coast. **Determination:** see Key provided in StN Keys volume. This species is included in the keys provided by Haarto and Kerppola (2007a), Bartsch *et al*. (2009a) and Violovitsh (1986), but not in the key of Doczkal and Schmid (1994). The male terminalia, head in side view and abdominal tergites are figured by Hippa (1968), who also gives a short redescription of the male. *E.annulitarsis* has yellow antennae and yellow hind tarsi that are distinctively marked with black, dorso-apically, on at least tarsomeres 2-4 (and often on all 5 tarsomeres). The hind basitarsus is also marked with black basally. These features are well shown in the coloured illustration of the male provided by Bartsch *et al*. (2009a). **Illustrations of the adult insect:** Bartsch *et al*. (2009a); the general appearance of the male of this species is also shown in the coloured photograph provided by Haarto and Kerppola (2007a).

Epistrophe cryptica Doczkal and Schmid, 1994
Preferred environment: forest; conifer forest of *Picea*, up to the altitude of *Pinus mugo*. **Adult habitat and habits:** no data. **Flowers visited:** white umbellifers; *Acer platanoides, Crataegus, Cruciata laevipes, Malus, Prunus, Salix*. **Flight period**: April/June **Developmental stages:** larva described and figured by Mazánek *et al*. (2001), from larvae derived from

eggs laid in the laboratory by a wild-caught, gravid female. Mazánek et al.(2001) include this species in t as previously cited.heir key to the third stage larvae of European *Epistrophe*. **Range:** uncertain, due to confusion with other related species until recently. Confirmed from the southern edge of Norway, from Sweden and Finland, Denmark, the Netherlands, Belgium, France, Germany, and Switzerland. **Determination:** see Key provided in StN Keys volume. Doczkal and Schmid (1994) figure the male terminalia. See also Haarto and Kerppola (2007a); Bartsch *et al.*(2009a) and Van Veen (2004). **Illustrations of the adult insect:** the general appearance of the female is shown in the coloured photograph provided by Haarto and Kerppola (2007a). The male is figured in colour by Bartsch *et al.* (2009a) and Bot and Van de Meutter (2019).

Epistrophe diaphana (Zetterstedt), 1843
Preferred environment: wetland/forest; rivers and streams in deciduous woodland, including carr; also in unimproved, montane grassland. **Adult habitat and habits:** stream margins etc., adults fly among thick scrub vegetation and in more open situations; males hover at between 2 and 4 metres in open patches. **Flowers visited:** white umbellifers; *Foeniculum, Senecio*. **Flight period**: May/August (with peak in July) and on into September in southern Europe. **Developmental stages:** larva described and figured by Mazánek *et al*. (2001), from larvae collected on *Cicorium* in the field and then reared in the laboratory. Mazánek *et al*. (2001) include this species in their key to the third stage larvae of European *Epistrophe* and also figure its puparium **Range:** Sweden and Finland south to the Pyrenees and Spain; from Britain (southern England) eastwards through central and southern Europe (Italy, the former Yugoslavia) into European Russia; Georgia; through Asia to the Pacific coast. **Determination:** see Key provided in StN Keys volume and Doczkal and Schmid (1994). The male terminalia are figured in Hippa (1968b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Epistrophe eligans (Harris), 1779
Preferred environment: most types of deciduous forest and scrub; also in suburban ornamental gardens. **Adult habitat and habits:** tracksides, clearings etc.; flies round tree foliage; males hover beneath mature trees, at 2 - 6 metres. **Flowers visited:** white umbellifers, *Acer pseudoplatanus, Cistus, Crataegus, Endymion, Euonymus, Euphorbia, Ilex, Prunus spinosa, Stellaria, Viburnum opulus*. **Flight period:** April/June, plus March in southern Europe and on to the beginning of July at higher altitudes/more northerly latitudes. **Developmental stages:** larva described and figured by Goeldlin (1974) and figured in colour by Rotheray (1994) and Bartsch *et al*. (2009a); egg described and figured by Chandler (1968); the larva is aphid feeding and largely arboreal, on shrubs and trees such as *Euonymus, Malus, Prunus, Quercus* and *Sambucus*, but can occur on bushes e.g. *Rubus fruticosus* (Dussaix, 1997), or herbaceous plants e.g. *Arundo* and some crops, such as *Foeniculum, Vicia*. Chambers *et al*. (1986) refer to having collected larvae of this species from winter wheat crops. Since harvesting of winter wheat would occur before *E. eligans* larvae reached maturity it can only be presumed that such cereal crops represent a drain on the *E. eligans* population. Dussaix (2005a) points out that this species goes through prolonged larval diapause, from spring through to the end of the following winter. Mazánek *et al*. (2001) include this species in their key to the third stage larvae of European *Epistrophe*. Dussaix (2013) provides coloured photos of both the active larva and the diapausing larva, and also a photo of the puparium. The puparial phase lasts only a few weeks (Dussaix, 2013). **Range:** southern Sweden southwards to Iberia; from Ireland eastwards through central and southern Europe into Turkey and European parts of Russia as far as the Caucasus. **Determination:** see Key provided in StN Keys volume. The male terminalia are figured by Dusek and Laska (1967) and (as *E. bifasciata*) in Hippa (1968b). Specimens of var. *trifasciata* Strobl, which has complete yellow bands on tergites 3 and 4, are not infrequent, giving rise to confusion with other *Epistrophe* species because this variety has not been included in keys, apart from the StN key. Van Eck (2011) encountered specimens of this variety of *E . eligans* misdetermined as *E. cryptica, E. flava* and *E. ochrostoma*. On Corsica, all specimens of *E. eligans* that have been observed belong to var. *trifasciata* (T. Lebard, pers. comm.). Mengual *et al*. (2020) argue that the date of publication of the original description of this species was 1779, not 1780 as cited previously. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Epistrophe flava Doczkal and Schmid, 1994
Preferred environment: deciduous forest, from riverine gallery forest of *Populus/Salix alba* to dry *Quercus/Castanea* forest and on to humid *Fagus/Picea* forest. **Adult habitat and habits:** clearings etc., but generally flying rather high. The males hover over tracks and in open patches at from 2-5m above the ground. **Flowers visited:** umbellifers, *Argentina anserina, Berberis vulgaris, Bunias orientalis, Caltha, Chrysanthemum leucanthemum, Crataegus, Euphorbia, Lathyrus japonicus, Ranunculus, Sorbus aucuparia, Tilia cordata*. **Flight period:** May/June, and July at higher altitudes. **Developmental**

stages: larva described and figured (under the name *ochrostoma*) by Goeldlin (1974), from larvae collected from aphid galls on *Malus* in an orchard (Goeldlin, pers.comm.). Mazánek *et al*. (2001) report finding the larvae of this species in the field on *Cichorium* and *Cirsium*. Bartsch *et al*. (2009a) refer to larvae on *Sambucus nigra*. The larva is redescribed, figuring the puparium, by Mazánek *et al*. (2001), who also include this species in their key to the third stage larvae of European *Epistrophe*. **Range:** Scandinavia south to the Pyrenees and from Belgium eastwards through central and southern Europe (Spain, Italy) into European parts of Russia; Georgia; through Siberia to the Pacific coast. **Determination:** see Key provided in StN Keys volume. The keys provided by Doczkal and Schmid (1994), van Veen (2004) and Bartsch *et al*. (2009a) do not take into account the variability in microtrichial coverage on the wing, found in this species. Haarto and Kerppola (2007a) do make allowance for this variability, but do not include *E. eligans* var. *trifasciata* in their key. This is one of the larger *Epistrophe* species, similar in size and colouration to *E. grossulariae*. Its thoracic dorsum is dull, rather than shining as in *E. nitidicollis*, its face and antennae are entirely yellow (contrasting with *E. diaphanus* and *E. grossulariae*) and its scutellar hairs are all yellow. The pale marks on abdominal tergite 2 reach the base of the tergite. Additional useful features are that its metasternum is usually hairy and its hind basitarsi appear black. The male terminalia are figured by Doczkal & Schmid (1994). **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). The male is figured in colour by Bartsch *et al*. (2009a).

Epistrophe grossulariae (Meigen), 1822
Preferred environment: deciduous forest, particularly along rivers and streams, including *Salix* swamp woodland; also alpine grassland. **Adult habitat and habits:** clearings, tracksides and beside streams etc.; adults fly at up to 3m; males hover at 2-5 m over tracks etc. **Flowers visited:** white umbellifers; *Centaurea, Cirsium, Filipendula, Geranium, Knautia, Rhododendron, Rubus, Sambucus nigra, Succisa, Valeriana*. **Flight period:** end June/September, with males predominating in June and females continuing on into September. **Developmental stages:** larva described and figured by Rotheray (1986) and figured in colour by Rotheray (1994), from larvae collected on *Acer pseudoplatanus*; aphid feeding; Dixon's (1960) material identified as *E. grossulariae* was wrongly determined. Chambers *et al*. (1986) refer to having collected larvae of this species from winter wheat crops. Mazánek *et al*. (2001) include this species in their key to the third stage larvae of European *Epistrophe*. **Range:** Fennoscandia south to Spain; from Ireland eastwards through Eurasia to Kamchatka; Italy; the former Yugoslavia and Turkey; Georgia; across N America from Alaska to Quebec and south to California. **Determination:** see Key provided in StN Keys volume and Doczkal and Schmid (1994). The male terminalia are figured in Hippa (1968b) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Epistrophe leiophthalma (Schiner & Egger), 1853
Preferred environment: forest/open ground; open areas and tracksides with tall herbs, within upper levels of the *Fagus* forest zone and upwards to the upper limit of *Picea*; unimproved montane and subalpine grassland. **Adult habitat and habits**: usually near streams in open areas within forest. **Flowers visited**: umbellifers. **Flight period**: June/August. **Developmental stages:** larva described and figured by Goeldlin (1974) from larvae collected on *Cirsium* at 1500m; aphid feeding. Mazánek *et al*. (2001) include this species in their key to the third stage larvae of European *Epistrophe*. **Range**: Ardennes (Belgium), Alps, Haut Languedoc, Pyrenees (France), northern parts of the former Yugoslavia, the Carpathians and the Caucasus (Georgia). **Determination**: see Key provided in StN Keys volume. This species has traditionally been regarded as belonging to *Leucozona* (or *Ischyrosyrphus*, in texts where *Ischyrosyrphus* is recognised as a genus). The adult fly bears a remarkable resemblance to *Leucozona glaucia* (L.), particularly in the field. The most convenient distinguishing feature is that the eyes are bare in *E. leiophthalma*, whereas they are distinctly hairy in *L. glaucia*. Vockeroth (1969) transferred *E. leiophthalma* to *Epistrophe*, on the basis of characters of the male terminalia. Goeldlin (1974) shows that in its larval morphology this species is also closely related to *Epistrophe*. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Epistrophe melanostoma (Zetterstedt), 1843
Preferred environment: deciduous forest; *Fagus* and *Quercus* forest; alluvial softwood and alluvial hardwood forest. **Adult habitat and habits:** clearings etc., the flight is extremely rapid, especially in the case of the males. **Flowers visited:** *Acer platanoides, Caltha, Chelidonium, Euphorbia, Euonymus, Lonicera xylosteum, Prunus spinosus*. **Flight period:** mid April/June and July at higher altitudes. **Developmental stages:** larva described by Mazánek *et al*. (2001), who report finding the larvae of this species in the field on *Carduus, Euonymus* and *Sambucus nigra*. Dussaix (2013) reports observing

oviposition of this species on the foliage of an apple tree. Mazánek *et al*. (2001) include this species in their key to the third stage larvae of European *Epistrophe* and also figure its puparium. **Range:** Scandinavia south to Iberia; Italy, the former Yugoslavia, Bulgaria; from Britain (southern England) through central Europe into Asiatic parts of Russia. The information provided by Verlinden and Decleer (1987) suggests *E.melanostoma* may have spread into Belgium only recently and the presence of this species in Britain was only recognised early in the 1990's. **Determination:** see Key provided in StN Keys volume and Doczkal and Schmid (1994). In size, colour and general appearance *E. melanostoma* is superficially similar to *E. nitidicollis*, but has wings entirely covered in microtrichia and a yellow-haired scutellum, whereas in *E .nitidicollis* there are usually areas of the Ist.basal and other wing cells bare of microtrichia and the scutellum is usually predominantly black haired (see also under *E. nitidicollis*). This species is less easy to distinguish from *E. cryptica, E. flava* and *E. ochrostoma*, and great care has to be taken in its determination. The male terminalia are figured by Doczkal & Schmid (1994). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Torp (1994) and Bartsch *et al*. (2009a).

Epistrophe nitidicollis (Meigen), 1822
Preferred environment: acidophilous *Quercus* forest; *Quercus/Carpinus/Ulmus* forest; alluvial forest; thermophilous *Quercus* forest; humid and mesophilous *Fagus* forest; *Abies* and *Picea* forest; high maquis. **Adult habitat and habits:** largely arboreal, descending to visit flowers. **Flowers visited:** white umbellifers; *Caltha, Cistus, Euphorbia, Prunus, Ranunculus, Rubus, Taraxacum*. **Flight period:** May/June (April in southern Europe) and on into July at higher altitudes/ more northerly latitudes. **Developmental stages:** larva described and figured by Dusek & Laska (1959), Goeldlin (1974) and Mazánek *et al*. (2001); aphid-feeding. The larval biology is described by Laska & Stary (1980), who found larvae on *Euonymus, Malus, Prunus* and *Sambucus nigra*. Mazánek *et al*. (2001) also report finding the larvae on *Acer pseudoplatanus, Cerasus avium, Carduus, Rubus idaeus* and *Spiraea*. Mazánek *et al*. (2001) include this species in their key to the third stage larvae of European *Epistrophe* and also figure its puparium. Dussaix (2013) provides a coloured photo of the puparium, and observes that the puparial phase lasts less than 2 weeks. **Range:** Fennoscandia south to Iberia; from Ireland eastwards through northern, central and southern Europe (Italy, the former Yugoslavia, Bulgaria) into Russia; Georgia; through Siberia to the Pacific coast (Kamchatka, Sakhalin Is.); in N America from Alaska south to California and S Carolina. **Determination:** see Key provided in StN Keys volume. Doczkal and Schmid (1994) can be used to separate *E. nitidicollis* from European *Epistrophe* species other than *E. olgae*. The keys provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a) can be used for separation of *E. nitidicollis* from *E. olgae* (see also under the account for *E. olgae*). Heads of the male and female of this species are illustrated (to show frons and vertex) in colour by Bartsch *et al*. (2009a). This species is also frequently confused with *E. melanostoma* (Zett.) (see Speight, 1988), from which it may usually be distinguished by the extent of the microtrichial coverage of the wings. In *E. nitidicollis*, the 1st.basal cell normally has an area bare of microtrichis at the base, whereas in *E. melanostoma* the wing microtrichial coverage is complete. However, specimens of *E. nitidicollis* can occur in which microtrichial coverage is virtually complete. In such specimens the colour of the scutellar hairs is helpful - all, or almost all yellow in *E. melanostoma*, all, or mostly black in *E. nitidicollis*. In the male the angle between the eyes is slightly less than 90° in *E. nitidicollis*, and slightly greater than 90° in *E. melanostoma*. The male terminalia are figured by Hippa (1968b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Epistrophe obscuripes (Strobl), 1910
Preferred environment: forest; montane conifer forest of *Picea*. **Adult habitat and habits:** largely arboreal, but descends to understorey trees and shrubs in flower. **Flowers visited:** *Crataegus, Sorbus aucuparia;* Bartsch *et al.* (2009a) refer also to this species visiting umbellifers, *Bunias orientalis* and *Salix*. **Flight period**: beginning May/July. **Developmental stages:** not described. **Range:** inadequately known. So far recorded from Norway, Sweden, Finland, the Netherlands, Belgium (Ardennes), France (Vosges), Germany, Switzerland and Austria. **Determination:** see Key provided in StN Keys volume. Doczkal and Schmid (1994) figure the male terminalia (as *similis*); Haarto and Kerppola (2007a); Bartsch *et al.* (2009a). Schmid (1999b) established *obscuripes* (Strobl) as the senior synonym of *similis* (Doczkal & Schmid). This species is also included in the keys provided by van Veen (2004), where additional features helping to separate *E. obscuripes* from *E. cryptica* are included. **Illustrations of the adult insect:** the general appearance of the male of this species is shown in the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al.* (2009a); the female is figured in colour by Prokhorov *et al.* (2020).

Epistrophe ochrostoma (Zetterstedt), 1849
Preferred environment: forest; conifer forest and deciduous forest; western taiga and *Betula /Fraxinus/Salix* (T.Nielsen, H.Bartsch and M. Reemer, pers.comm.). **Adult habitat and habits:** males hover low over ground vegetation. **Flowers visited:** *Salix repens* (Reemer, 1999); *Prunus padus* and *Ranunculus ficaria* (Bartsch *et al*, 2009). **Flight period:** mid April/mid May and on to end June at the northern end of its range (Finnmark). **Developmental stages:** not described. The larva described under this name by Goeldlin (1974) was that of *E. flava* (P.Goeldlin. pers.comm.). **Range:** uncertain, due to confusion with related species until recently; confirmed from northern and southern Norway, Sweden, central and southern Germany and the Netherlands. The record from Gibraltar by Ebejer and Bensusan (2011) is apparently based on misdetermined specimens of *E.eligans* (A. Van Eck, pers.comm.). **Determination:** see Key provided in StN Keys volume and Bartsch et al.(2009a). Doczkal and Schmid (1994) redescribe the species and figure the male terminalia. Using the key provided by Stubbs and Falk (2002) specimens of *E.flava* could be mistaken for *E.ochrostoma*, since the cruciform black mark on the frons, used in that key as diagnostic for *E.flava*, can be missing in *E.flava* (as in *E.ochrostoma*). Specimens of *Epistrophe eligans* with wide bands on the abdominal tergites (a condition not infrequent in Mediterranean parts of Europe) can be mistaken for *E.ochrostoma*. Bartsch (2007) establishes that *Scaeva excisa* of Zetterstedt is a junior synonymn of *E. ochrostoma*. **Illustrations of the adult insect:** the general appearance of the male of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). Bartsch et al.(2009a) provide coloured illustrations of the male and the head of the female. A coloured photo of the male is provided by Bot and Van de Meutter (2019).

Epistrophe olgae Mutin, 1993
Preferred environment: deciduous forest; gallery *Salix/Populus* forest along edges of lakes and pools (H.Bartsch, pers.comm.); alluvial softwood and hardwood forest; *Salix/Alnus* swamp forest (Speight, 2007b). **Adult habitat and habits:** males hover close to *Prunus* in flower (H.Bartsch, pers.comm.). **Flowers visited:** *Crataegus, Prunus padus, P.spinosa, Taraxacum* (Bartsch et al, 2009); *Salix alba*. **Flight period**: May/June. **Developmental stages:** not described, but reported from *Sambucus* spp by Bartsch et al.(2009a). **Range:** as yet uncertain, due to confusion with *E.nitidicollis*, but known from Norway, Sweden, Finland, Netherlands, France (Rhine valley in Alsace), Switzerland, Ukraine and Eastern Siberia, including the Kuril islands. **Determination:** see Key provided in StN Keys volume; Mutin and Barkalov (1999); Haarto and Kerppola (2007a); Bartsch et al.(2009a). This species is very similar to *E.nitidicollis* (Mg), and these two species can be found in flight together (H.Bartsch, pers.comm.). In the male the dusting on the frons, along the eye margins, is more extensive and yellowish-grey, rather than grey as in *E.nitidicollis*. In the female the frons is greyish-dusted across its full width and the vertex is heavily dusted both on and to either side of the vertical triangle, unlike *E.nitidicollis*, in which there are well-defined, separated dust-spots on the frons and the vertex is shining black and undusted. Heads of the male and female of this species are illustrated (to show frons and vertex) in colour by Bartsch et al.(2009a). The areas of the wing bare of microtrichia are smaller than in *E.nitidicollis*. In the male, microtrichial coverage of the 2nd basal cell varies from virtually complete to up to nearly 50% bare. **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). The male is illustrated in colour by Bartsch et al.(2009a) and Bot and Van de Meutter (2019).

E. similis Doczkal & Schmid: see under *E.obscuripes* (Strobl)

EPISTROPHELLA

The genus *Epistrophella* was erected by Dusek and Laska (1967) for the European species previously known as *Syrphus euchromus* Kowarz. *Epistrophella* remained monotypic until Vockeroth (1969) expanded the concept of the genus to include a North American species, *E.emarginata* (Say) and the Oriental *E.horishana* (Matsumura). More recently, Rotheray and Gilbert (1989) provide grounds for consigning *euchroma* to the genus *Meligramma*, a course followed in the present account. Since the type species of *Epistrophella* is now consigned to a different genus, use of the generic name *Epistrophella* for any syrphid species is of questionable validity. But Doczkal and Vujić (1998) have also placed another enigmatic European species, originally described as *Lasiopthicus coronata*, Rondani, in *Epistrophella*, on the basis of the similarity between its male terminalia and those of the then *Epistrophella euchroma*. At the same time Doczkal and Vujić (1998) point out that the combination of features exhibited by *E.coronata* is such that the species cannot with confidence be placed in any existing genus. Even if the generic name *Epistrophella* is retained for the N American *E. emarginata* and/or the Oriental *E.*

horishama, there are sufficient differences between *E. coronata* and these two species to make it doubtful whether there is much validity to consigning *E. coronata* to a redefined *Epistrophella* based on them. Clearly, both use of the generic name *Epistrophella* and the placing of *E. coronata* in that genus have to be regarded as acts only of temporary expediency. In the present account the generic name *Epistrophella* is retained simply to provide a generic placement for *E.coronata*. It is to be hoped that more information (e.g. details of its developmental stages) becomes available about *E. coronata* to allow of a more satisfactory placing of the species.

Epistrophella coronata (Rondani), 1857
Preferred environment: forest; "relict Tertiary polydominant forest communities" (Doczkal and Vujić, 1998); Balkanic thermophilous *Quercus* forest (M. de C.Williams, pers.comm.) **Adult habitat and habits:** on hot days, descends to drink at the wet mud of drying puddles on forest tracks, after rain (M. de C. Williams, pers. comm.). **Flowers visited:** no data. **Flight period:** March/May. **Developmental stages:** undescribed. **Range:** Italy, Serbia and Greece. This species should be regarded as threatened at the European level (Vujić *et al*, 2001). **Determination:** Doczkal and Vujić (1998) redescribe the species, figure the terminalia and list features distinguishing *E.coronata* from *Meligramma euchroma* (as *Epistrophella euchroma*). Doczkal and Vujić (1998) note that one of the features distinguishing *coronata* from *euchroma* is that in *coronata* the "upper and lower katepisternal hair patches (are) joined posteriorly". The fact that these hair patches are widely separated in *euchroma* is one of the features that led to *euchroma* being segregated from *Epistrophe* (in which these hair patches are joined) in a separate genus, *Epistrophella*, so it is incongruous that *E.coronata* should be consigned to *Epistrophella*. Doczkal and Vujić (1998) cite features of the male terminalia as the primary basis for consigning *coronata* to *Epistrophella*, suggesting that there was great similarity between the terminalia of this species and the type species of *Epistrophella*, now regarded as *Meligramma euchroma*. A noticeable difference between *coronata* and European *Epistrophe* species is that the eyes of *coronata* are abundantly hairy, whereas the eyes of European *Epistrophe* species are entirely bare. Vockeroth (1969) refers to only one *Epistrophe* species with hairy eyes, the Oriental *E.hirsuteron* (Curran). It is a moot point whether *coronata* should be consigned to *Epistrophella* or placed elsewhere, as observed by Doczkal and Vujić (1998). With the type species of *Epistrophella* (*E.euchroma*) now consigned to *Meligramma*, it is uncertain whether the generic name *Epistrophella* can validly be used, but *coronata* possesses features that make it inappropriate to consign to *Meligramma*. *E.coronata* is treated as a species of *Epistrophella* here, simply because it would otherwise seem necessary to create a new genus for it, and that nomenclatural procedure is beyond the scope of the present account. In the generic key in the StN Keys volume, *E.coronata* would key out to *Melangyna*, from which it could be distinguished by its lack of a median black stripe on the face, its abundantly hairy eyes and its unicolorous, uniformly grey-dusted, sternites. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by De Courcy Williams *et al*.(2011). Likewise, the female, in Van Steenis *et al*.(2019).

EPISYRPHUS

In most recent literature, only one European species, *E.balteatus*, is consigned to this genus. However, the species treated in the present account as belonging to the genus *Meliscaeva* are sometimes (e.g. by Hippa, 1968b; van Veen, 2004) regarded as species of *Episyrphus*.

Episyrphus balteatus (de Geer), 1776
Preferred environment: highly anthropophilic and almost ubiquitous. **Adult habitat and habits:** usually flies within 2m of the ground; active under cloudy conditions as much as in the sun; highly migratory; males hover both singly and in groups, at up to 4 - 5 m, usually over paths in woodland, or in similar situations. When hovering in groups the individual males maintain a "personal space" around themselves, chasing off other males which intrude into that space, but otherwise do not expend energy on each other. They are evidently aware of each other's position however, since when one changes its orientation while hovering, all other mambers of the hovering group also re-orient themselves to each other (Alderman, 2010, 2012). A hovering male apparently has a visual field of c.320°, in both horizontal and vertical planes (Alderman, 2012). **Flowers visited:** visits a wide range of white and yellow flowers, from trees to low-growing plants and including nectarless flowers like grasses, e.g. *Stipa*; also visits pink flowers such as *Cirsium* and *Succisa* (see de Buck, 1990, for an extended list of plants visited by this species). Early in the year, females emerging from hibernation can be found on flowers like *Petasite fragrans* and *Prunus laurocerasus*. In October/November the species uses flowers of plants such as *Arbutus unedo*, *Hedera* and *Viburnum tinus*. Aspects of the use of flowers by *E.balteatus* are discussed by various authors, e.g. Laubertie *et al*. (2012); Pinheiro *et al*.

(2013); Sutherland *et al.* (1999),. Van Rijn *et al.* (2013) show that aphid honey dew can be a significant additional food source for adults of this syrphid. **Flight period:** February/ November, with a number of overlapping generations; overwinters as an adult and may be found hibernating among ivy, or in caves etc. On exceptionally mild, sunny days in mid-winter this species can sometimes be found in flight - presumably specimens that have been hibernating. In the Mediterranean zone both males and females of *E. balteatus* can be found in flight in mid-winter. Sarthou *et al.*(2005) show that the occurrence of *E.balteatus* adults under these conditions is linked to availability of shelter and potential resting/hibernation sites (in forest), in an agricultural landscape. This species is a pronounced migrant. **Developmental stages:** the larva has been described and figured by various authors, notably by Bhatia (1939). It is incorporated into the keys provided by Rotheray (1994), who also figures the larva in colour. The morphology of the chorion of the egg is figured by Kuznetzov (1988). Egg morphology is described by Chandler (1968), oviposition behaviour by Bargen *et al.*(1998) and Scholz and Poehling (2000) and various aspects of egg development are detailed by Branquart and Hemptinne (2000), who establish that a female of this species can lay between 2000 and 4,500 eggs during its adult life. The larva is predominantly aphidophagous on a wide range of low-growing plants including various crops (e.g. *Beta, Lactuca, Ribes, Solanum, Trifolium* spp., *Triticum*), shrubs (e.g. *Buddleja, Euonymus, Sambucus*), lianas (*Lonicera*) and trees (including apple trees). Gomez-Polo *et al.* (2014) demonstrate that the larvae of *E. balteatus* predate not only aphids, but also a wide range of other arthropods they come across, including larve of other syrphids, spiders, Collembola, caterpillars of micro-Lepidoptera (*Plodia*) and Heteroptera. Kula (1982) records that *E.balteatus* shows a preference for aphid colonies low down among the foliage, when its larvae are found on spruce (*Picea*). Dusek and Laska (1974) and Bargen et al.(1998) describe elements of larval biology and Bombosch (1957) and Tanke (1976) give accounts of laboratory culture of the species. Branquart (1999) shows that development time (from egg-laying to eclosion of adult) in this species can be as little as 3 weeks. The puparial phase lasts for approximately one week. An extensive literature has grown up around this species, because it may be readily cultured under laboratory conditions. It has to be recognised that, although larvae of this species may occur abundantly in crops their presence does not necessarily lead to abundant adults - pesticides used to control aphids can lead to 100% mortality of *E.balteatus* larvae. There can also be sublethal effects of pesticides on the insects, for instance reduction of fecundity, in females that have developed in treated crops (see, for instance, Colignon *et al*, 2003). Barkemeyer (1994) provides an extensive and comprehensive review of the literature concerning this species and its biology. While it has been long recognised that this species can overwinter as an adult, only recently has it been established that it can also overwinter as a larva (Sarthou *et al.*, 2006). Noel *et al.* (2022) show that the development of *Episyrphus balteatus* is adversely affected when larvae are reared at ambient temperatures higher than 23°C, with potential implications to impacts of climatic warming in Atlantic parts of Europe and providing possible explanation for the apparent summer population collapse observed anecdotally in this species recently, in parts of western Europe. **Range:** Fennoscandia to the Mediterranean; Canary Isles, Azores and N Africa; Ireland through Eurasia to the Pacific coast; south through the Oriental region to Sri Lanka. This is an extremely migratory species and records from offshore islands of northern Europe, such as the Faroes (Jensen, 2001) and Iceland are assumed to be due to the occasional arrival of migrant individuals, rather than indicative of the occurrence of resident populations. **Determination:** van der Goot (1981). The male terminalia are figured by Dusek and Laska (1967), Hippa (1968b) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

ERIOZONA

While it is apparent that *Didea, Eriozona* and *Megasyrphus* are closely related there is less agreement on whether the species consigned to these genera should all be grouped under *Didea* or segregated under the three existing genera (see, for example, Vockeroth and Thompson, 1987; Rotheray and Gilbert, 1989; Vockeroth, 1992). However, recognition of *Eriozona* as a separate genus carries with it the implication that *Megasyrphus* should also be regarded as a separate genus, and *vice versa*, to judge from the information now available. This course of action is thus followed here, making *E.syrphoides* the only European species in the genus *Eriozona*.

Eriozona syrphoides (Fallén), 1817

Preferred environment: forest; mature *Picea/Abies* forest and plantations. **Adult habitat and habits:** largely arboreal, descending usually to understorey trees and shrubs in flower, to feed. **Flowers visited:** white umbellifers; *Centaurea, Cirsium, Crataegus, Epilobium, Hypericum, Ranunculus, Sambucus nigra, Sorbus aucuparia, Succisa, Valeriana*. **Flight**

period: May/October, with peaks at end May/mid June and end August/beginning September. **Developmental stages:** larva arboreal, known to feed on aphids on *Picea* (Kula, 1983). Figured in colour and distinguished from larvae of related genera and from the larva of *E. erratica*, in the keys of Rotheray (1994). **Range:** southern Norway, Sweden and Finland south to France (Vosges, Alps, Pyrenees; from Ireland eastwards through central Europe (and northern Italy: Aosta) into European parts of Russia; Georgia; through Siberia to the Pacific coast. **Determination:** van der Goot (1981), Bradescu (1991); Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). The male terminalia are figured by Vockeroth (1969). **Illustrations of the adult insect:** The adult insect is illustrated in colour byBall and Morris (2013), Bartsch *et al*. (2009a), Haarto and Kerppola (2007a) and Torp (1994).

ERISTALINUS

There are five *Eristalinus* species listed for Europe in Peck (1988). Dirickx (1998) points out that European records of one of them (*E.quinquelineatus*, (Fab.)) are erroneous and refer to *E.megacephalus*, thus reducing the European fauna to four species. Two of them do not reach further north than the Mediterranean basin. Two subgenera, *Eristalodes* and *Lathyrophthalmus*, are treated as genera by some authors, but Pérez-Bañón *et al*. (2003) demonstrate that genetic studies provide no support for this segregation.

Eristalinus aeneus (Scopoli), 1763
Preferred environment: freshwater; coastal lagoons, ponds, slow-moving rivers, streams and irrigation ditches, distinctly anthropophilic in southern Europe; towards the northern edge of its range confined to coastal sites. **Adult habitat and habits:** flies very fast and low, over ground vegetation and settles on bare ground and rock, as well as vegetation. In continental Europe *E.aeneus* often occurs away from water, but in northern Europe it is nearly always found on the coast, only a few metres away from the high-tide mark. Further south, it may also be found along the sand and gravel banks edging large rivers. **Flowers visited:** yellow composites, white umbellifers, *Aster, Berteroa incana, Cistus, Origanum, Salix repens, Senecio, Taraxacum*. **Flight period:** April/September and on into October in southern Europe; over-winters as an adult. **Developmental stages:** larva described and figured by Hartley (1961) and by Pérez-Bañón et al.(2003), who also provide a key distinguishing the puparia of this species from the puparia of the other European *Eristalinus*. At the northern edge of its range the larvae of *E.aeneus* occur in freshwater seepages and brackish rock pools on the sea coast, but elsewhere they occur in a variety of inland situations, including in association with animal dung (e.g. from pigs) and in sewage farms. Campoy *et al*.(2019) show that, in a large-scale rearing system, the life cycle of *E. aeneus* is completed in an average of 9 – 10 weeks. **Range:** cosmopolitan; southern Sweden south to N Africa and the Canary Isles; on into the Afrotropical region south to Kenya and Tanzania; from Ireland eastwards through central and southern Europe and on through Russia and China to the Pacific and south into the Oriental region; Mauritius; in N America from Minnesota and Ontario south to California and Texas; Hawaii, Australia and the Gilbert and Ellis islands in Australasia; Bermuda. **Determination:** See Key provided in StN Keys volume. Pérez-Bañón et al.(2003) figure the male terminalia. In specimens from southern Europe, the mesoscutum exhibits distinct longitudinal banding, as in *E.sepulchralis* (L.), particularly in the female. **Illustrations of the adult insect:** the northern form of the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994), Pétremand *et al*. (2022) and van der Goot (1986).

Eristalinus megacephalus (Rossi), 1794
Preferred environment: open ground/freshwater; canal and riverside situations in open country; coastal lagoons. **Adult habitat and habits:** fast-flying around tall waterside vegetation. **Flowers visited:** *Chrysanthemum coronarium, Dittrichia viscosa, Foeniculum, Lotus dorycnium, Picris, Prunus spinosa, Solidago*. **Flight period**: March/April and September/October, but also with some records May/July and as late as November. **Developmental stages:** larval and pupal morphology described and figured by Pérez-Bañón *et al*. (2003), who also provide a key distinguishing the puparia of this species from the puparia of other European *Eristalinus*. The larvae were found in running water contaminated by pig manure. **Range:** southern Spain, Mediterranean coast in France and coastal parts of Italy round the Mediterranean basin (including islands, e.g. Corsica, Malta, Sicily, Crete) to Turkey; Georgia; Egypt and N Africa; southwards through the Afrotropical region to S Africa. **Determination:** See Key provided in StN Keys volume. This species appears in most recent literature (inc. Peck, 1988) under the name *E.quinquelineatus* (Fabricius). Dirickx (1998) reviews its confused nomenclatural history (as *Lathrophthalmus megacephalus*), pointing out that the real *E.quinquelineatus* (as *Eristalodes quinquelineatus*) is an

Afrotropical species unknown from either Europe or N Africa. Pérez-Bañón *et al*. (2003) figure the male terminalia. Differences between *E. megacephalus* and the closely similar *E. taeniops* are detailed and figured (in colour) in Speight and Goy (2016). **Illustrations of the adult insect:** Louboutin *et al*. (2023); http://cyrille.dussaix.pagesperso-orange.fr/

Eristalinus sepulchralis (L.), 1758
Preferred environment: wetland; fen, river and pond margins; significantly anthropophilic, occurring also where domestic stock is pastured, along polluted ditches and in the vicinity of slurry pits and manure heaps. **Adult habitat and habits:** low flying, over ground vegetation; frequently settles on wet mud. **Flowers visited:** white umbellifers; *Achillea millefolium, Allium, Armeria maritima, Bellis perennis, Bidens cernua, Caltha, Cochlearia danica, Crataegus, Euphorbia, Galium, Leontodon, Origanum vulgare, Potentilla erecta, Ranunculus, Rosa, Rubus fruticosus, Salix, Senecio jacobaea, Solidago virgaurea, Sorbus aucuparia, Taraxacum, Tussilago, Valeriana dioica.* **Flight period:** mid April/September (March/ October in southern Europe). **Developmental stages:** larva described and figured by Hartley (1961), from larvae collected in rotting vegetation in a pond. This species has also been collected from emergence traps installed over *Glyceria maxima* beds in a seasonally temporary pool. Larval morphology also described and figured by Pérez-Bañón et al.(2003), who provide a key distinguishing the puparia of this species from the puparia of other European *Eristalinus*. **Range:** Fennoscandia south to Iberia and the Mediterranean, including N Africa; from Ireland through most of Europe into Turkey and European parts of Russia; Caucasus (Georgia); through Siberia to the Pacific coast; Japan; China; India. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured in Kanervo (1938), Pérez-Bañón *et al*. (2003) and van der Goot (1981). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eristalinus taeniops (Wiedemann), 1818
Preferred environment: forest/open ground/freshwater; by streams and seasonal streams in *Quercus ilex* forest and maquis; beside rivers, including seasonal rivers; by temporary pools in dune systems and lagoons in coastal marsh. **Adult habitat and habits:** may come to the edge of small streams to drink, during hot weather. **Flowers visited:** umbellifers; *Calluna vulgaris, Cistus, Daphne, Eryngium, Euphorbia, Hedera, Mentha, Rubus, Senecio, Solidago* (see Marcos-García, 1985a). **Flight period**: April/October, with peaks in May and August. **Developmental stages:** larval morphology described and figured by Pérez-Bañón *et al.* (2003), who provide a key distinguishing the puparia of this species from the puparia of other European *Eristalinus*. The larvae were found in standing water containing decaying plant material (pine needles) or rotting animal carcasses and also in running water contaminated by pig manure. Dutto and Maistrello (2017) report the recovery of *E. taeniops* larvae from various forms of organic waste, produced as by-products on urban industrial premises. **Range:** Portugal, Spain and round the Mediterranean basin (southern France including Corsica, Italy including Sardinia and Sicily, parts of the former Yugoslavia, Albania, Roumania, Cyprus, Greece (including Crete and Rhodes), Turkey, Lebanon, Israel, N Africa (Syria, Egypt, Libya, Tunisia, Morocco), Canary Islands, Caucasus (Georgia); in eastern parts of the Afrotropical region down to South Africa (inclusive) and in Nepal and parts of Pakistan and northern India in the Oriental region. Also present in the Neotropical region, where it has inadvertently been introduced. **Determination:** See Key provided in StN Keys volume and Pérez-Bañón *et al*. (2003). **Illustrations of the adult insect:** The male insect is illustrated in colour by Birtele (2011) and the female by Speight and de Courcy Williams (2021).

ERISTALIS

Peck (1988) lists 22 *Eristalis* species as European, but Hippa *et al*. (2001) show that two of those species, *E.stackelbergi* Dolezil and Rozkosny and *E.vitripennis* Strobl, are junior synonyms of other European species, thereby reducing the number of European species to 20. The description of *E.tecta* (Vujić *et al*., 2004) has subsequently raised the total to 21. Chandler (1998) states that according to decision of the International Commission on Zoological Nomenclature the generic name *Eristalis* is masculine. But Hippa *et al*. (2001) state that by decision of the International Commission on Zoological Nomenclature the generic name *Eristalis* is feminine, without referring to Chandler's (1998) earlier statement. Since the revision of European *Eristalis* species by Hippa *et al*. (2001) is more recent than Chandler's work it is presumed here that Hippa *et al*. (l.c.) should be followed, and species names used here have been amended accordingly. Remarks on determination of some of the more difficult species are included in the species accounts. A key to the *Eristalis* species known from Europe is provided in the StN Keys volume.

Eristalis abusiva Collin, 1931
Preferred environment: wetland; coastal fen and salt-marsh; marsh and fen, raised bog and cutover bog. **Adult habitat and habits:** flies up to 2m from the ground, usually in the vicinity of standing water and where taller and more dense fen or marsh vegetation occurs. **Flowers visited:** yellow composites; white umbellifers; *Calluna vulgaris, Caltha, Cirsium, Erica, Potentilla erecta, Ranunculus, Rubus fruticosus agg. Salix repens, Stellaria, Spartina*. **Flight period:** beginning May/mid October. **Developmental stages:** larva described and figured by Hartley (1961), from specimens collected from mud at the edge of a moorland pond. The species has also been collected from emergence traps installed at the edge of oligotrophic flushes in unimproved grassland. **Range:** Fennoscandia and the Faroes (Jensen, 2001) south to northern France (Yonne); from Ireland eastwards through northern and central Europe (extremely scarce in most of central Europe) into Russia and on through Siberia to the Pacific coast. **Determination:** See Key provided in StN Keys volume and Hippa *et al*. (2001), who also figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch e*t al*. (2009b), Speight and de Courcy Williams (2021), Stubbs and Falk (1983) and Torp (1994).

Eristalis alpina (Panzer), 1798
Preferred environment: margins of streams and rivers, usually in forested situations, including alluvial hardwood forest. **Adult habitat and habits:** reminiscent of *E.pertinax* in flight; visits flowers of waterside shrubs and understorey trees. **Flowers visited: white** umbellifers; *Aruncus asiaticus, Crataegus, Heracleum, Prunus spinosa, Sambucus, Sorbus aucuparia, Trollius riederanus*. **Flight period:** mid May/end August, and June/July at higher altitudes. **Developmental stages:** not described. **Range:** from Denmark, the Netherlands (extinct?) and Belgium (extinct?) eastwards through mountainous parts of central and southern Europe (Italy, former Yugoslavia, Caucasus) into European parts of Russia and Turkey; through Siberia to the Pacific coast; Mongolia. In western and central Europe this species seems to have undegone a steep decline during the last 50 years and there are very few recent records. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who also figure the male terminalia. The male terminalia are also figured in Kanervo (1938). The male is difficult to distinguish from *E.pertinax* in the field. **Illustrations of the adult insect:** *E.alpina* is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Torp (1994).

Eristalis anthophorina (Fallen), 1817
Preferred environment: wetland; acid fen, flushes in open areas in woodland and freshwater bodies in coastal dune systems; taiga wetlands. **Adult habitat and habits:** in the vicinity of groundwater-fed springs and streams or oligotophic/mesotrophic pools. **Flowers visited***: white* umbellifers; *Bellis, Caltha, Cardamine, Cirsium, Crataegus, Lycopus, Menyanthes, Prunus, Ranunculus, Rubus, Salix, Solidago canadensis, Taraxacum, Valeriana.* **Flight period:** mid April/end August. **Developmental stages:** features of the larva and puparium are described and figured by Kuznetzov and Kuznetzova (1994), but without any information on larval biology or habitat. Bagachanova (1990) records rearing the species from swampy ground rich in organic material, and also from swamp hummocks. **Range:** Fennoscandia south to eastern France (Jura); from Denmark and the Netherlands eastwards through central Europe into European parts of Russia; through Siberia to the Pacific coast and Japan; Mongolia; in N America from Alaska southwards through mountainous parts to California and New Mexico. In the Netherlands this species has become much less frequent during the last 50years. There is only one recent record from France (Dirickx *et al*., 1996). **Determination:** See Key provided in StN Keys volume and Hippa *et al*. (2001), who figure the male terminalia; Bartsch *et al*. (2009b). The male terminalia are also figured in Kanervo (1938). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Torp (1994).

Eristalis arbustorum (L.), 1758
Preferred environment: an anthropophilic species, ubiquitous in farmland, urban parks and gardens; also found in a wide range of wetlands and in alluvial softwood forest. **Adult habitat and habits:** flies within 2 - 3m of the ground; settles on low-growing vegetation; males spend considerable time in the vicinity of stands of plants in flower. **Flowers visited:** visits the flowers of a wide range of low-growing plants and shrubs (see de Buck, 1990, for list of plants visited by this species). **Flight period:** April/October (plus March in southern Europe). This species is a pronounced migrant. **Developmental stages:** larva described and figured by Hartley (1961); aquatic/subaquatic, occurring in a wide variety of shallow, standing water situations and in cow-dung, silage pits etc. Dussaix (2005b) reports rearing the species from compost and manure heaps. Dussaix (2013) reports that the puparial phase lasts approximately two weeks, in non-overwintering generations of the species, and provides a coloured photo of the puparium. **Range:** throughout the Palaearctic region, including N Africa; N

America from Wisconsin to Labrador and south to Kansas and South Carolina; reaches the Oriental region in northern India. In western Europe, there has been a noticeable decrease in the abundance of this species during the 1990s, which may be due to the widespread use of Ivermectins and similar compounds as systemic helminthicides. These compounds render cow-dung toxic to a range of dung-feeding insects, but their level of toxicity to *E.arbustorum* remains to be established, so that the extent to which the disappearance of this species is due to the spread of these compounds into general use remains uncertain. **Determination:** See Key provided in StN Keys volume and Hippa *et al*. (2001), who figure the male terminalia. The male terminalia are also figured by Kanervo (1938) and van der Goot (1981). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eristalis cryptarum (Fabricius), 1794
Preferred environment: wetland/freshwater; palsa mires, pools or spring-fed streamlets in tundra, at the edge of raised bogs, in poor fen and marsh (including alpine floodplain marsh) and wet flushes in moorland; taiga wetlands. **Adult habitat and habits:** near oligotrophic and mesotrophic pools and streamlets; flies fast over ground vegetation, zig-zagging around stands of plants in flower. **Flowers visited:** yellow composites and crucifers; *Calluna vulgaris, Caltha, Cardamine, Crataegus, Menyanthes, Potentilla erecta, P.palustris, Ranunculus, Succisa, Sorbus aucuparia, Vaccinium.* Drake (2005), who carried out a study specifically on flower-visiting by *E.cryptarum*, added *Anagallis* and *Narthecium* to the list of flowers at which this hoverfly feeds. **Flight period:** mid May/mid September (Stubbs and Falk, 1983, give March/September), with most records from June. Divoltine in lowland or southern latitudes, but univoltine further north or at higher altitudes, where it is in flight end June/August. Drake and Baldock (2013) provide information suggesting that, in southern England, there are in fact three generations per annum: April/beginning June; mid June/July; August/September. **Developmental stages:** undescribed. According to Stubbs and Falk (2002) the female has been observed ovipositing on and close to very fresh cow dung along oligotrophic seepages in moorland. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** northern Fennoscandia south to the Pyrenees; from Ireland (extinct) through central Europe into Russia and on into central Siberia; Mongolia. Alaska to Nova Scotia in N America. In Europe, very localised through much of its range. Drake and Baldock (2013) show that wet flush populations are apparently small, of less than 100 individuals, but that one of these small populations can persist for a number of years. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who figure the male terminalia. Bartsch et al.(2009b), The male terminalia are figured in Kanervo (1938). Hippa et al.(2001) regard *nigritarsis* Macquart as a junior synonym of this species. **Illustrations of the adult insect:** Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986) illustrate the adult insect in colour.

Eristalis fratercula (Zetterstedt), 1838
Preferred environment: open ground/freshwater; humid, seasonally-flooded grassland with standing water, in tundra; beside rivers in taiga (Nielsen 1998 and pers.comm.). **Adult habitat and habits:** on mud at the edge of pools and sitting in flowers of *Caltha* etc. **Flowers visited:** *Caltha, Matricaria, Ranunculus, Salix*. **Flight period**: June/July. **Developmental stages:** larva described and figured by Campoy *et al*.(2017), from laboratory-reared specimen. A larva from the same source is figured in colour by Nielsen and Svendsen (2014), reared in the lab, in "a plastic dish with a solution of soil, water and cow manure". **Range:** northern Norway, northern Sweden, Finland, northern parts of European Russia and on through Siberia to the Pacific coast; Greenland; Alaska and Canada in N America. **Determination:** See Key provided in StN Keys volume and Nielsen (1995), who figures the male terminalia; Bartsch et al.(2009b). The species that appears under this name in Kanervo (1938) and van der Goot (1981) is apparently *E.gomojunovae* Violovitsch (Nielsen, 1995). This misinterpretation led Kanervo (1938) to treat *fratercula* of Zetterstedt as a new species, *E.vallei*. **Illustrations of the adult insect:** The general appearance of *E.fratercula* is shown in the photograph provided by Haarto & Kerppola (2007). The male is figured in colour by Bartsch et al.(2009b).

Eristalis gomojunovae Violovitsh, 1977
Preferred environment: wetland/freshwater; boggy margins of lakes and along drainage ditches in the open; open boreal *Pinus sylvestris* forest (western taiga) and tundra (T.Nielsen, pers.comm.); palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** rests on mud at the edge of pools and ditches and flies rapidly to and fro close to the water surface (Tore Nielsen, pers.comm.). **Flowers visited:** *Caltha, Ranunculus, Salix* (Bartsch et al.(2009b); *Rubus chamaemorus* (Van Steenis and Zuidhoff, 2013). **Flight period**: June/July. **Developmental stages:** not described. **Range:** northern Norway, northern Sweden and Finland; northern parts of European Russia and on into Siberia; Alaska and northern Canada

in Nearctic. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who figure the male terminalia. Nielsen (1995) also figures the male terminalia. The species that appears under the name *fratercula* in Kanervo (1938) and van der Goot (1981) is *E.gomojunovae, according* to Nielsen (1995). **Illustrations of the adult insect:** the photograph provided by Haarto & Kerppola (2007) shows the general appearance of this species. The male is figured in colour by Bartsch *et al*.(2009b) and Skevington *et al*.(2019). The latter authors also show the female.

Eristalis hirta Loew, 1866
Preferred environment: wetland/open ground; raised bog and aapa mire; ditches and temporary pools in humid, seasonally-flooded, unimproved grassland and tundra and sub-alpine *Betula* forest (H.Bartsch and T.Nielsen, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** yellow composites, umbellifers; *Achillea, Caltha, Galium, Ledum, Matricaria, Ranunculus, Salix, Taraxacum, Valeriana* (T.Nielsen, pers. comm.). **Flight period**: end June//beginning September. **Developmental stages:** not described. **Range:** northern Norway, Sweden and Finland; northern parts of European Russia and on into Siberia; Nearctic. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who figure the male terminalia; Bartsch et al.(2009b). Kanervo (1938) also figures the male terminalia. This species appears in recent literature under the name *E.tundrarum*, which was recognised as a junior synonym of *hirta* by Hippa et al.(2001). **Illustrations of the adult insect:** the male is figured in colour by Bartsch *et al*. (2009b).

Eristalis horticola (De Geer), 1776
Preferred environment: wetland/forest; fen, cut-over valley bog, margins of pools, brooks and rivers, especially brooks in forest (though not entirely beneath the tree canopy), both deciduous and coniferous. **Adult habitat and habits:** usually close to water; flies along stream banks, pond margins, visiting flowers of marginal vegetation and settling on foliage. **Flowers visited:** yellow composites; white umbellifers; Compositae; Ranunculaceae; Umbelliferae; *Calluna vulgaris, Cardamine, Cirsium, Crataegus, Eupatorium, Galium, Jasione, Pyrus communis, Ranunculus, Rubus fruticosus, R.idaeus, Sambucus, Sorbus aucuparia, Stellaria, Succisa, Viburnum opulus.* **Flight period:** end May/mid September, plus April in southern Europe. **Developmental stages:** the larva and puparium are described by Dolezil (1972). **Range:** Fennoscandia south to N Africa; from Ireland eastwards through much of Europe into Russia and on through Siberia to the Pacific coast (Sakhalin); India. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who figure the male terminalia. Van der Goot (1981) also figures the male terminalia. This species has appeared in much recent literature under the name *E.lineata*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eristalis interrupta: see under *E.nemorum*

Eristalis intricaria (L.), 1758
Preferred environment: wetland; raised bog/fen/fen carr/poorly-drained deciduous forest and humid, seasonally-flooded grassland. **Adult habitat and habits:** in early Spring usually in the vicinity of scrub, carr or tall reeds, providing shelter; males hover along paths in carr and woodland at up to 5m; later in the year present in a wide range of wetland types, including boggy pasture; adults visit flowers of both low-growing plants and trees. **Flowers visited:** white umbellifers; yellow composites; Ranunculaceae; Armeria *maritima, Cakile, Calluna vulgaris, Cirsium, Crataegus, Filipendula, Jasione, Ligustrum, Lythrum, Mentha, Polygonum cuspidatum, Prunus spinosa, Pyrus communis, Rhododendron, Rubus, Salix, Succisa.* **Flight period:** mid April/end August. **Developmental stages:** larva described and figured by Hartley (1961), occurs in semi-liquid mud and fen peat beside water, in field drains, slurry and cow dung on water-logged ground. **Range:** Iceland, Fennoscandia and the Faroes (Jensen, 2001) south to central Spain, but increasingly confined to mountainous regions towards the southern limit of its range and absent from much of southern Europe; from Ireland eastwards through much of northern and central Europe (though very localised in the Alps) into Russia as far as eastern Siberia. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who figure the male terminalia. Male terminalia are figured by Kanervo (1938). **Illustrations of the adult insect:** the adult is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Bot and Van de Meutter (2019). Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eristalis jugorum Egger, 1858
Preferred environment: running freshwater/forest; streams within *Fagus/Picea* forest and carr. **Adult habitat and habits:** beside streams, tracksides and clearings close to water; usually flies within 3m of the ground; males frequently patrol stands of waterside plants in flower. **Flowers visited:** white umbellifers; *Chrysanthemum leucanthemum, Euphorbia, Knautia, Polygonum, Rubus idaeus, Scabiosa, Sorbus aucuparia, Succisa*. **Flight period:** May/July (and August at higher altitudes). **Developmental stages:** undescribed. **Range:** Poland south to the Pyrenees and northern Spain; from Belgium (Ardennes) eastwards through central and southern Europe (northern Italy, the former Yugoslavia, Greece) into European parts of Russia and on as far as the Caucasus, Turkey and Iran. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who figure the male terminalia. Males of *E.jugorum* may be distinguished from those of all related species by the extremely dense fringe of thick (usually all-black) hairs entirely covering the postero-lateral surface of the anterior femora. This fringe is noticeably thicker than the fringe on the dorsal surface of the hind femora. In the other species, these two hair fringes are of equivalent density and the hairs are of normal thickness. Further, in these other species (except for *E.rupium*), the fringe on the postero-lateral surface of the fore femora is rarely predominantly black in colour. The female of *E.jugorum* may be distinguished by the fact that the lower part of its face is prolonged to an unusual extent, so that, in lateral view, the shortest line between the eye and the middle of the upper mouth edge is shorter than the shortest line between the eye and the anterior tip of the lateral mouth edge. In females of related species, these two lines are the same length, or that between eye and middle of upper mouth edge is the longer. The male terminalia of *E.jugorum* are figured in Kanervo (1938). **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019) and Speight and de Courcy Williams (2021).

Eristalis lineata: see under *E.horticola*

Eristalis nemorum (L.), 1758
Preferred environment: wetland/forest; river and brook margins, marsh, fen, edges of raised bog and sunlit forest brooks. **Adult habitat and habits:** streamsides, fen meadow and poorly-drained pasture; males circulate fast and noisily through waterside vegetation, in the vicinity of plants in flower. **Flowers visited:** yellow composites; umbellifers; *Cakile, Calluna vulgaris, Caltha, Cardamine, Cirsium, Crataegus, Eupatorium, Euphorbia, Filipendula, Malus, Menyanthes, Mentha, Parnassia, Prunus, Ranunculus, Rubus fruticosus agg. Salix, Sorbus, Succisa*. **Flight period:** April/ September. **Developmental stages:** larva described and figured by Hartley (1961); aquatic/subaquatic in streams and pools; also in cow faeces on water-logged ground. **Range:** northern Fennoscandia south to Iberia; from Ireland eastwards through central Europe into Turkey and Russia and on into Asia over most of Siberia; Italy; the former Yugoslavia; Japan; in N America from Quebec south to Colorado. **Determination:** See Key provided in StN Keys volume and Hippa *et al*. (2001), who figure the male terminalia; Vujić *et al*. (2004). Care is needed in distinguishing this species from closely related species such as *E. alpina, E. horticola, E. jugorum, E. rupium* and *E. tecta*. For separation of *E. nemorum* from *E. tecta* it is necessary to refer to Vujić *et al*. (2004). Kanervo's (1938) figures (repeated in van der Goot, 1981) of the male terminalia of European *Eristalis* species can also be used to help in determination of doubtful specimens of *E.nemorum*. This species has appeared in recent literature under the name *E. interrupta*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Eristalis obscura Loew, 1866
Preferred environment: wetland/freshwater; reed beds, fen, fen carr on alluvial floodplains and fringing lakes. **Adult habitat and habits:** no data. **Flowers visited:** white umbellifers; *Achillea millefolium,* (T. R. Nielsen, pers.comm.), yellow composites, *Caltha, Jasione, Crataegus, Ranunculus, Rosa canina, Rubus plicatus, Saxifraga granulate, Taraxacum, Valeriana* (Bartsch *et al*. (2009b). **Flight period**: May/June plus July in more northerly latitudes. **Developmental stages:** features of the larva and puparium of an *Eristalis* species identified as *E.vitripennis* Strobl are described and figured by Kuznetzov and Kuznetzova (1994), but without any information on larval biology or habitat and no discussion of the basis upon which the species was named as *E.vitripennis*. It should be noted that *vitripennis* of Strobl was recognised as a junior synonym of *rupium* by Hippa *et al*. (2001). There is need for re-examination of the adults of the material upon which Kuznetzov and Kuznetzova (1994) based their description of "*E.vitripennis*" larvae, before it can be decided to which species the description belongs. **Range:** northern Norway, Sweden and Finland south to the Netherlands; central Germany (Rheinland-Palatinate), European parts of Russia and eastwards through most of Siberia; Nearctic. **Determination:** See Key provided in StN Keys volume and Hippa *et al*. (2001), who figure the male terminalia. Also Kanervo (1938), where the

species appears as *E.vitripennis* v *pseudorupium*. Hippa *et al.* (2009) established that the correct name for this species is *E. obscura*, rather than *E.pseudorupium*, showing that the Palaearctic taxon *E.pseudorupium* is conspecific with the earlier-named Nearctic taxon *E.obscura*. They also figure the superior lobe of the male genitalia in a number of Palaearctic and Nearctic specimens of *E. obscura*. Kanervo (l.c.) figures the male terminalia and subsequent authors have reproduced his figures, as depicting the terminalia of *E.vitripennis*. There has been considerable confusion over the identity of this species and published records from further south in Europe than Scandinavia, based on females, cannot be relied upon. This taxon has erroneously been referred to in recent literature as *E.vitripennis* Strobl (Nielsen, 1999). Specimens of *E.nemorum*, *E.jugorum* and *E.picea* are also likely to be found in collections misdetermined as *E.vitripennis*. **Illustrations of the adult insect:** Haarto & Kerppola (2007) provide coloured photographs of the male and female of *E.obscura*. Bartsch *et al.* (2009b) show the male in colour (under the name *E.pseudorupium*).

Eristalis oestracea (L.), 1758

Preferred environment: oligotrophic/mesotrophic water bodies in bog, moor and coastal dune systems. **Adult habitat and habits:** edges of pools and small lakes; fast-flying. **Flowers visited: white** umbellifers; yellow composites; *Caltha, Cardamine, Lythrum, Menyanthes, Prunus spinosa, Salix, Scabiosa, Succisa*. **Flight period:** beginning May/ beginning September. **Developmental stages:** not described. **Range:** from Fennoscandia south to Denmark and northern Germany and eastwards through Poland into European parts of Russia; through Siberia into central Asia; also in mountainous parts of Roumania, the former Yugoslavia and Kazakhstan; in parts of Ontario in N America. Plichta *et al*. (2020) show that, in Europe, there are very few recent records of this species south of Scandinavia. **Determination:** See Key provided in StN Keys volume and Hippa *et al*. (2001), who figure the male terminalia; Bartsch *et al*. (2009b) . The male terminalia are figured in Kanervo (1938). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Torp (1994).

Eristalis pertinax (Scopoli), 1763

Preferred environment: wetland/forest; alluvial forest, fen and woodland streams and ponds; primarily anthropophilic, over much of Europe, occurring in farmland (especially where domestic stock are grazed in fields), suburban gardens and parks etc., but progressively confined to the immediate vicinity of woodland streams toward the southern edge of its range. **Adult habitat and habits:** flies round bushes and shrubs; frequently settles on ground by water, e.g. at the edge of streams, ditches; males hover over paths etc. at 1 - 4m; spends much time on flowers. **Flowers visited:** visits the flowers of a wide range of low-growing plants, bushes, shrubs and trees (see de Buck, 1990, for list of plants visited by this species). **Flight period:** February/November. From the early start to the flight period, this species might be supposed to hibernate as an adult, but there do not seem to be published records of hibernating specimens and Hartley (1961) claims *E.pertinax* over-winters as a larva. **Developmental stages:** larva described and figured by Hartley (1961), from larvae in farm drains, wet manure and decaying vegetable matter in a pond. Dussaix (2005b) also reports rearing the species from a manure heap. His observation of oviposition in *E.pertinax* at the edge of a pond demonstrated that the eggs of this species were laid at the water surface, and float. The puparial phase lasts approximately 4 weeks (Dussaix, 2013). The female of this species has also been frequently observed apparently ovipositing at the edge of a shallow, water-filled cavity in a *Quercus robur* stump. Carstensen (2022) reports rearing *E. pertinax* from a larva in a superficial pool of water on a stump of *Fagus*. **Range:** Fennoscandia south to Iberia and the Mediterranean; from Ireland through much of Europe into European parts of Russia; Georgia; Turkey; apparently not known beyond the Urals. **Determination:** See Key provided in StN Keys volume and Hippa *et al*. (2001), who figure the male terminalia. This species is difficult to segregate from *E.similis* (Fall.) (Speight, 1988). The male terminalia are also figured by Kanervo (1938) and Speight (1988a). **Illustrations of the adult insect:** The adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Eristalis picea (Fallen), 1817

Preferred environment: forest/freshwater; deciduous forest with temporary pools and /or streams, in particular alluvial softwood forest of *Salix/Populus* and alluvial hardwood forest; *Betula/Pinus* swamp forest. Sometimes in association with permanent limnocrene springs. **Adult habitat and habits:** to a significant extent arboreal, but may, on occasion, be found resting on bushes and shrubs, or feeding at flowers of low-growing plants; both sexes can be found flying fast and low around seasonally-flooded hollows and along the channels of small, temporary streams, which are patrolled by the males. **Flowers visited:** umbellifers; *Anemone, Brassica, Caltha, Cardamine, Crataegus, Euonymus, Myosotis, Prunus, Pyrus communis, Ranunculus, Rorippa, Rosa canina, Salix, Scilla verna, Sorbus aucuparia*. **Flight period:** mid April/mid June.

Developmental stages: not described, but probably occurring in bottom deposits of seasonal pools over sands or gravels. **Range:** Fennoscandia south to SW France; from Belgium eastwards into central Europe as far as Switzerland and probably Austria; European Russia; Ukraine. **Determination:** See Key provided in StN Keys volume and Hippa *et al.*(2001), who figure the male terminalia. The male terminalia are also figured in Kanervo (1938) and Torp (1994). In the male sex, this species is only reliably distinguished from *E.rupium* by means of features of the terminalia. The female has a matt, transverse band across the anterior and posterior margins of each tergite, whereas in the female of *E.rupium* the tergites are entirely shining. This species may be found in flight in the company of both *E.nemorum* and *E.rupium*, both of which may be impossible to distinguish from *E.picea* in the field. **Illustrations of the adult insect:** the adult male insect is illustrated in colour by Bartsch *et al.* (2009b) and Torp (1994). Haarto & Kerppola (2007) provide coloured photographs of the male and female of this species.

Eristalis pratorum Meigen, 1822: see under *Eristalis similis*

Eristalis rossica Stackelberg, 1958
Preferred environment: tundra; taiga dominated by *Pinus sylvestris, P.sibiricus* and *Abies sibirica* (A.Barkalov, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Aruncus asiaticus, Heracleum, Rhododendron aureum, Trollius riederanus, Weigela middendorffiana* (Gritskevich, 1998). **Flight period**:June/August. **Developmental stages:** features of the larva and puparium are described and figured by Kuznetzov and Kuznetzova (1994), but without giving any information on larval biology or habitat. According to Bagachanova (1990) the larvae live among the roots of grasses growing in shallow water, but do not occur in swamps. **Range:** parts of European Russia and Siberia eastwards to Sakhalin; Mongolia, China. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who provide a key to separate this species from other European *Eristalis* and figure the male terminalia. *E.rossica* is closely similar to *E.nemorum*. **Illustrations of the adult insect:** none known.

Eristalis rupium Fabricius, 1805
Preferred environment: running freshwater/forest; beside streams in humid deciduous and coniferous forest and montane grassland; up to the *Alnus viridis* zone. **Adult habitat and habits:** stream margins, clearings etc. usually within woodland, but also in more open locations toward the tree-line; apparently dependent upon clean water; absent from lowland situations except where cold, clean spring-water feeds permanent streams; fast-flying, usually close to water. **Flowers visited:** white umbellifers; *Anemone nemorosa, Cardamine, Chrysanthemum leucanthemum, Crepis, Helianthemum nummulinum, Menyanthes, Parnassia, Polygonum, Rubus fruticosus agg., R..idaeus, Sorbus aucuparia, Taraxacum, Valeriana officinalis*. **Flight period:** May/July and August at higher altitudes. **Developmental stages:** aquatic, described and figured by Maibach and Goeldlin (1991b). **Range:** Fennoscandia south to the Pyrenees and northern Spain; from Britain (northern England, Wales, Scotland) eastwards through central Europe into Turkey and Russia and on throughout Siberia; N America from British Columbia south to Colorado and east to New York. **Determination:** See Key provided in StN Keys volume and Hippa *et al.* (2001), who figure the male terminalia. The male terminalia of this species were rather poorly depicted by Kanervo (1938). Kanervo's (l.c.) figures were badly redrawn and reproduced by van der Goot (1981), and copied in their redrawn condition by Torp (1984, 1994). In their redrawn condition these figures bear little resemblance to the terminalia of *E.rupium*. Violovitsh (1986) shows the redrawn version of Kanervo's (1938) figures (fig.162E), but also provides alternative figures of the male terminalia (fig.163A). The latter figures correspond with those of the species recognised as *E.rupium* in this account and in the database files in general. *E.rupium* is a variable species, whose intra-specific variation is not adequately taken into account in existing keys. Males can easily be confused with *E.horticola, E.nemorum, E.obscura or E.picea*. In the females, the tergites are entirely shining in *E.rupium*, but have a matt band anteriorly and posteriorly on each tergite in *E.picea*. Hippa *et al*. (2001) establish that *E. vitripennis* Strobl, 1892, is a synonym of *E. rupium*. **Illustrations of the adult insect:** The adult of *E.rupium* is illustrated in colour by Bartsch *et al*. (2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eristalis similis (Fallen), 1817
Preferred environment: forest; mature/overmature deciduous (*Fagus* and *Quercus*) forest and Mediterranean evergreen forest (*Quercus ilex/Q.suber*); *Pinus/Betula* swamp forest; also in conifer forests (*Abies/Picea, Pinus*), up to the subalpine zone. **Adult habitat and habits**: males hover at 2-4 metres above woodland tracks. Both sexes sit in the sun on the trunks of standing trees. Females can be found investigating puddles and damp mud etc. up against fallen or felled trunks. Females

may also be found along streams in open country, some distance from woodland. Both sexes may come to stream edges to drink, during hot weather. **Flowers visited**: *Angelica, Buxus, Chaerophyllum, Convolvulus, Cornus, Crataegus, Euonymus, Hypericum, Mentha aquatica, Mespilus, Parnassia, Ranunculus, Salix, Sambucus ebulus, Sorbus aria, Tilia*. **Flight period:** mid March/August and February/November in southern Europe. **Developmental stages:** Pérez-Bañón et al.(2013) describe the larva, figuring features in which it differs from the larva of *E. tenax* using photos derived from scanning electron microscopy. They found the larva of *E. similis* "in streams rich in organic matter", the organic matter being, in this case, waste from an olive processing factory. They state that "oviposition took place at the edges of the stream, under and between the stones situated near the water. Eggs were ovoposited in clusters of up to a hundred eggs if several females used the same place. Pupation took place between the vegetation and slightly above the water level". Maibach (1993) has observed oviposition by this species in a shallow, water-filled (5cm. water) depression, containing rotting wood and leaves, in river-margin gallery forest. **Range:** Finland south to the Mediterranean basin (including islands such as Crete); N Africa; from Britain (central England) eastwards through central and southern Europe to the former Yugoslavia and on through Turkey; Georgia; from European Russia into Asia. Malec (1986) presents data suggesting that *E.similis* has become more frequent within the last few years, in northwest Germany. Nielsen (2009) and Nielsen *et al*. (2012) present evidence of migrations of *E.similis* to Norway. **Determination:** See Key provided in StN Keys volume and Hippa et al.(2001), who figure the male terminalia. This species appears in recent literature as *E.pratorum* Meigen. Nielsen (1995) states that.*similis* (Fallen) is a senior synonym of *pratorum* Meigen. The fact that *E.pertinax* and *E.similis* are well nigh identical in appearance can easily lead to specimens of *E.similis* being misdetermined as *E.pertinax*. In *E.pertinax* all the tarsomeres of the fore and mid legs are yellow/orange in both sexes, whereas in *E.similis* at least the last two tarsomeres of the fore and mid legs are black/very dark brown. The male terminalia of *E.pertinax* and *E.similis* are quite distinct in the form of the sclerotised projections on the distal end of the theca. The terminalia of these species are not figured by van der Goot (1981) but are figured by Kanervo (1938) and Speight (1988a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), and Torp (1994).

Eristalis tecta Vujić, Radenkovic, Nielsen & Simic, 2004
Preferred environment: forest/freshwater; mesophilous *Fagus* forest with brooks (Vujić *et al*, 2004). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period**: April/June. **Developmental stages:** not described. **Range:** Macedonia. **Determination:** Vujić *et al.* (2004), who figure the male terminalia and provide distinctions from the closely similar *E.nemorum*. This species is yet to be included in any key. **Illustrations of the adult insect:** none known.

Eristalis tenax (L.), 1758
Preferred environment: anthropophilic and almost ubiquitous. **Adult habitat and habits:** flies up to 5m from ground; spends a considerable amount of time resting on flowers; settles also on foliage, from ground level upwards and in the evenings can be found sunning itself on the foliage of bushes and shrubs. **Flowers visited:** visits a wide range of flowers, including white, yellow, pink and blue blooms (see de Buck, 1990, for list of plants visited by this species). **Flight period:** February to November, the extremely long flight period being due to the fact that this species hibernates as an adult and some individuals become active in fine weather, under all but extremely cold conditions. Hibernating adults can be found in old buildings, in caves and under ivy on trees etc. This species is a pronounced migrant. **Developmental stages:** larva described and figured by Hartley (1961); redescribed by Pérez-Bañón *et al.* (2013); illustrated in colour by Rotheray (1994); aquatic/subaquatic; found in a wide range of aqueous and semi-aqueous, organically rich, rotting materials, including cow-dung, slurry etc. Dussaix (2005b) reared the species from both compost and dung. Laboratory culture of *E. tenax* is described by Dolley *et al*. (1959). Barkemeyer (1994) provides a comprehensive review of the literature on the biology of this species. The puparial phase lasts approximately 10 days (Dussaix, 2013). Using various measures of fitness, Dañková *et al*. (2023) demonstrate that the temperature at which puparia are kept alters the fitness of the adult insect hatching from the puparium, the fittest adults emerging from puparia kept at 17°C. Campoy *et al.*(2019) carried out in depth studies of a large scale rearing system for *E. tenax*, demonstrating that the length of the life cyle can be maintained at approximately 7 weeks. Francuski *et al*. (2014) demonstrate that laboratory-reared *E. tenax* show loss of genetic diversity after 6 – 8 generations. **Range:** highly migratory; cosmopolitan; the most widely distributed syrphid species in the world, known from all regions except the Antarctic; found throughout Europe except in the far north. It occasionally reaches offshore islands of northern Europe, such as the Faroes (Jensen, 2001). Francuski et al.(2013) indicate that the migratory nature of this species has maintained a high degree of genetic homogeneity of populations from different parts of Europe, but also suggest the Balkan populations of this insect are somwehat different genetically, from other European populations. **Determination:** See Key provided in StN Keys

volume and Hippa et al.(2001), who figure the male terminalia. The male terminalia are also figured by Kanervo (1938). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Bot and Van de Meutter (2019), Colyer and Hammond (1951), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

EUMERUS

This is one of the largest syrphid genera in the Palaearctic region, with 140 species listed by Peck (1988). Unfortunately, the taxonomic status of a significant number of the species is uncertain and the nomenclature of others is confused. More than 50 species have been recorded from Europe, most of them from southern parts of the continent. There is no key in which all the known European species are included. The most comprehensive keys are those of Stackelberg (1961), which are now significantly out- of - date nomenclaturally and unreliable. Among more recent keys, the most comprehensive are those in Speight *et al*. (2021).

Eumerus alpinus Rondani, 1857
Preferred environment: well-drained, unimproved, permanent pasture, from montane pasture to sea level and open areas within deciduous (*Fagus* and *Quercus*) forest. **Adult habitat and habits:** open areas with sparse ground vegetation to more or less complete ground cover of grasses and *Pteridium*; flies fast and low, settling in the sun on bare soil, stones and low vegetation. **Flowers visited:** *Potentilla erecta, Ranunculus*, white umbellifers. **Flight season:** May/June and end July to August. **Developmental stages:** puparium described and figured by Souba-Dols *et al.* (2020), who also provide information on separation of the puparia of *E. alpinus* from those of *E. nudus*, which can also be found in tubers of *Asphodelus*. Speight and Garrigue (2014) reared *E. alpinus* (as *E. olivaceus*) from larvae found in tubers of *Asphodelus albus* and *A. ramosus* and provide a coloured photo of the puparium. The apparently mature larvae overwinter in decaying asphodel tubers and duration of the puparial phase is 2 – 4 weeks (Speight and Garrigue, 2014). **Range:** a largely Mediterranean species, which occurs over much of Spain, at up to 1000m in the Pyrenees, through southern France from the Dordogne and the Atlantic coast to Switzerland (Tessin) and Italy (apparently excluding Sicily, where the closely similar, but endemic *E. olivaceus* occurs) and on to parts of the former Yugoslavia, Bulgaria and Roumania. **Determination:** this species appears in recent literature under the name *E. olivaceus*. Grković *et al*. (2016) state that *E. olivaceus* of Loew is endemic to Sicily, and reinstate the name *alpinus* of Rondani for the species known until then elsewhere in Europe under the name *olivaceus*. According to Stackelberg (1961), tergite 4 of the male of *E. alpinus* (referred to in Stackelberg as *E. olivaceus*) is without the white/yellowish-white, transverse band across its posterior margin that is found in males of *E. nudus*. However, this pale band is frequently well-developed in males of *E. alpinus*. *Eumerus nudus* and *E alpinus* are extremely similar in appearance. Features which may be used to separate them are provided by Speight and Garrigue (2014), who also figure sternite 4 of the male of both species. Both species are also included in the keys in Speight *et al*. (2021). The male terminalia (as *E. olivaceus*) are figured by Vujić and Šimic (1999). **Illustrations of the adult insect:** the male (as *E. olivaceus*) is illustrated in colour by Speight and De Courcy Williams (2016) and Speight *et al*. (2021).

Eumerus amoenus Loew, 1848
Preferred environment: forest; thermophilous *Quercus* forest and unimproved, permanent grassland with an overgrowth of taller vegetation such as *Pteridium*; vegetable gardens; hedges and edges of crop fields. **Adult habitat and habits:** A secretive species, that flies among low-growing vegetation at up to 1m from the ground, often in partially-shaded conditions (e.g. hedges, bramble patches, bracken stands. Leaves cover to settle in the sun on pathside vegetation e.g. the main stem of a *Pteridium* frond, or on the ground. On the ground it uses short vegetation rather than bare soil or stones to settle on. **Flowers visited:** *Bupleurum lancifolium* (Ssymank and Ebejer, 2009); *Smirnium olusatrum* (Ssymank (2012); *Hedera*. **Flight period:** June and mid-July/August, with peak in August; March/October in the Mediterranean zone. **Developmental stages:** Efflatoun (1922) records this species as having been reared from *Allium*, potato tubers, water melon, grapes, rotten paw-paw and damaged rhizomes of *Iris germanica*. It has also been reared from *Allium* (shallots) in the vicinity of Bordeaux. **Range**: from northern France (Paris basin) south to Portugal and Spain and round the Mediterranean (including Cyprus, Rhodes and Crete) to Greece and on to Morocco; Canary Isles, Azores; southern Germany and Switzerland in central Europe; the Caucasus; Kazakhstan, Turkestan, Tadjikistan and Mongolia in Asia. **Determination**: to distinguish the male of *E.amoenus* from the males of other species occurring in temperate western Europe and central Europe, the keys in Speight *et al*. (2021)

may be used. The male of this species may also be identified using the keys in Bradescu (1991) or Stackelberg (1961). Abdominal sternite 4 of the male is figured by Stackelberg (1961) and van der Goot (1981). The male terminalia are figured by Vujić and Šimic (1999). The male is relatively easy to distinguish, but the female is extremely difficult to segregate. In Stackelberg's (1961) it is keyed out to a group of species in which the front coxae are predominantly black/darkened. But in females of *E. amoenus* this feature is variable and specimens with entirely yellow front coxae are not infrequent. *E. amoenus* can be found flying at the same time and in the same place as both *E. hungaricus* and *E. uncipes*, and females of these latter two species also have the front coxae almost entirely yellow. *E. amoenus* can also be found in the same localities as *E. clavatus*, another species in which the female has entirely yellow front coxae. Báez and Barkemeyer (2002) demonstrate that *E. terminalis* Santos-Abreu, previously recognised as a species endemic to the Canaries, is a junior synonym of *E. amoenus*. **Illustrations of the adult insect:** Speight *et al*. (2021); http://cyrille.dussaix.pagesperso-orange.fr/

Eumerus anatolicus Grković, Vujić & Radenković, in Chroni *et al*, 2018
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/May. **Developmental stages:** not described. **Range:** Turkey. **Determination:** the male and female are described in Chroni *et al*.(2018). This is one of four cryptic species comprising the *minotaurus* group, as defined by Chroni *et al*.(2018), who figure the male terminalia of *E. anatolicus* and provide morphological features enabling its separation from the other European species of this group. They also detail distinctions between *E. anatolicus* and both *E. crassus* and *E. longicornis*. **Illustrations of the adult insect:** none known.

Eumerus ancylostylus Aguado-Aranda & Ricarte, in Aguado-Aranda *et al*., 2023
Preferred environment: forest/open ground; herb-rich open areas in calcareous *Fagus/Picea* forest; *Quercus ilex* garrigue; dry Mediterranean pine forest (*Pinus salzmanni*); calcareous, unimproved dry grassland/dry scrub. **Adult habitat and habits:** flies fast and very low among open ground vegetation and along paths or over other bare ground, settling on stones or bare ground in the sun. **Flowers visited:** white Apiaceae. **Flight period:** May/August. **Developmental stages:** not described. **Range:** not certain, due to confusion with other closely similar species; described from Spain and subsequently recorded from France. **Determination:** this species is described and characterised genetically from a number of males, in Aguado-Aranda *et al*. (2023). The female remains undescribed, but its recognition is discussed in Speight & Lebard (2024). Aguado-Aranda *et al*. (2023) illustrate the male terminalia and include *E. ancylostylus* in their key to European *tricolor* group species. It is very similar to *E. grandis*, with which it has previously been confused. The male can be separated from *E. grandis* (and *E. lateralis*) by the shape of the third article of the antenna. This is axe-blade-shaped, with a straight anterior margin, in *E. ancylostylus* and *E. hispanicus*, but ovoid, with a very convex, rounded anterior margin in *E. grandis*. The male of *Eumerus ancylostylus* is very difficult to separate from *E. hispanicus*, from which it is separated in Aguado-Aranda *et al*. (2023) using a slight difference in the shape of the surstylus of the male genitalia, which they illustrate. Using the keys in Grković *et al*. (2021) and Speight *et al*. (2021) *E. ancylostylus* would be identified as *E. grandis*. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photos provided in Aguado-Aranda *et al*. (2023). The male and female are shown in colour in Speight & Lebard (2024).

Eumerus angustifrons Loew, 1848
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June. **Developmental stages:** not described. **Range:** Roumania, Turkey. **Determination:** the female of this species is included in the keys provided by Sack (1928-32), Stackelberg (1961) and Bradescu (1991). The male is apparently still undescribed. **Illustrations of the adult insect:** none known.

Eumerus arctus Van Steenis, in Grković *et al*., 2021
Preferred environment: unclear, but has been found in herb-rich, open areas/tracks sides, edging calcareous, closed-canopy, montane mixed forest. **Adult habitat and habits:** no data. **Flowers visited:** white Apiaceae. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Switzerland. **Determination:** the description of this species is based on one male, but according to J. Van Steenis (pers.comm.) is the same as Species A of Speight *et al*. (2021). It is a *tricolor*-group species very similar to *E. grandis*, but can have the tergites either entirely black or with orange markings, whereas *E. grandis* itself and most other tricolor-group species do not have morphs with entirely black tergites. The entirely black holotype of *E. arctus* is illustrated in Grković *et al*. (2021), together with various morphological features, including its genitalia. The female is yet to be described. Grković *et al*. (2021) provide no genetic data on *E. arctus*. *Eumerus arctus* is not included in the keys

provided by Grković *et al*. (2021), but, as Species A, is incorporated into the keys in Speight *et al*. (2021). It is also in the keys to European *tricolor*-group species in Aguado-Aranda *et al*. (2023), where it is accompanied by the two all-black *tricolor*-group species *E. crispus* and *E. larvatus*. One feature used by Aguado-Aranda *et al*. (2023), to separate the male of *E. arctus* from *E. larvatus*, is the shape of the third article of the antenna, which in *E. larvatus* is said to be "square" in Aracil *et al*. (2023), a description repeated in Aguado-Aranda *et al*. (2023). However, the accompanying photos in Aracil *et al*. (2023) do not show the third antennal article of *E. larvatus* to be square. The other feature used in Aguado-Aranda *et al*. (2023), to separate *E. arctus* from *E. larvatus*, is the colour of the ventral hair fringe on the hind femur – white in *E. arctus*, black in *E. larvatus*. Shape of the third antennal article is also used in the diagnosis of *E. arctus* (Grković *et al*., 2021) which states it is "trapezoid" in *E. arctus*, but "rectangular" in *E. crispus*. These terms are also used to define the shape of article 3 of the antenna in separating *E. arctus* from *E. crispus* in the keys in Aguado-Aranda *et al*. (2023). From examination of the photos of the antennae of *E. arctus* and *E. crispus*, provided in Grković *et al*. (2021), it can be seen that article 3 is trapezoid in both species. However, the photo of the antenna of *E. arctus* does not seem to have been taken from the same angle as the photo of the antenna of *E. crispus*, or from the same side of the antenna, making any differences between them difficult to interpret. Other differences referred to in Grković *et al*. (2021), as distinguishing *E. arctus* from *E. crispus*, are also difficult to interpret from the photos provided, leaving the line drawings of the male genitalia as the primary basis for separation of the two species. Reliance upon ill-defined differences in the shape of antennal article 3 to separate *E. arctus* from *E. crispus*, without illustration of the differences, makes the two species very difficult to separate using the keys in Aguado-Aranda *et al*. (2023). In Speight *et al*. (2021), where *E. arctus* is included in the key to males as Species A, it is distinguished by the ventral bulge at the base of the mid femur, which separates it from morphologically similar *tricolor*-group species except *E. crispus*. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photos provided in Speight *et al*. (2021), where it appears as Species A, and in Grković *et al*. (2021).

Eumerus argyropus Loew, 1848

Preferred environment: forest/open ground; dry *Pinus*, *Pinus* matorral and semi-arid, stony, unimproved grassland; hedgehog heath; field margins. **Adult habitat and habits:** low-flying through sparse ground vegetation; settles on stones or bare ground in the sun; males patrol round "territories" at the edge of scrub, settling on the ends of branches at the boundaries of their territories (P.Withers, pers.comm.). **Flowers visited:** *Ranunculus muricatus* (Ssymank and Ebejer, 2009);. **Flight period:** April, June and mid July/September. **Developmental stages:** not described. **Range:** central and southern Spain, Mediterranean/submediterranean parts of France, Switzerland (Rhone valley), Italy (inc. Sardinia), parts of the former Yugoslavia, Greece (inc. Rhodes), Bulgaria, Roumania, Ukraine and the Caucasus mountains, Turkey. **Determination:** Stackelberg (1961); Speight *et al*. (2021) include *E. argyropus* in their keys to males and females of European *flavitarsis*-group species and also include the male in their keys to central European *Eumerus* species. The male terminalia are figured by Vujić and Šimic (1999) and Claussen and Standfuss (2017). Schmid *et al.* (1998) demonstrate that *E. bernhardi* Lindner is a synonym of *E. argyropus*. In dry specimens of this species the only pale markings on the abdominal tergites are bars of silver-grey dusting. However, specimens in alcohol (for instance from Malaise trap catches) show a pair of translucent, yellow marks on tergite 2, located beneath the silver-grey dust bars. In consequence, attempts to identify specimens of *E. argyropus* in alcohol can lead to misdetermination, since existing keys (e.g. Stackelberg, 1961) are based on dry specimens. **Illustrations of the adult insect:** a coloured photo of the male is provided in Vujić *et al.* (2020d); the male and female are illustrated in colour in Speight *et al*. (2021).

Eumerus armatus Ricarte and Rotheray, in Ricarte *et al*, 2012

Preferred environment: rocky, open ground (a quarry) (Ricarte *et al.* 2012); herb-rich open area edging *Pinus halepensis* forest (Van Steenis *et al*., 2021). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/July. **Developmental stages:** not described. **Range:** Greece (Aegean islands); Cyprus; SW Turkey. **Determination:** the description of this species in Ricarte *et al.* (2012) is based on a single male. They figure the male terminalia, antenna and abdominal tergites and provide distinctions between the male of this species and males of *E. rubescens* and *E.urartorum*. The hypandrium of this species carries highly distinctive armature. Grković *et al*. (2021) compare this species with *E. nigrorufus*, based on additional material of *E. armatus*, incuding females. They also figure the male genitalia of *E. armatus* and include the species in their key to *tricolor*-group *Eumerus* species of SE Europe. *Eumerus armatus* is also included in the keys in Aguado-Aranda *et al*. (2023). The females of *E. armatus* and *E. nigrorufus* are apparently indistinguishable morphologically. **Illustrations of the adult insect:** the general appearance of this species can be seen in the coloured photo of the male provided in Vujić *et al.* (2020d).

Eumerus aurofinis Grković, Vujić & Radenković, in Grković *et al*., 2015
Preferred environment: thermophilous *Quercus* forest ; olive orchards; vineyards (Vujić *et al*., 2020d). **Adult habitat and habits:** no data. **Flowers visited:** none known (the list of flowers visited, provided by Vujić *et al*. (2020d) clearly applies to some other species. **Flight period:** March and May/June (Grković *et al*., 2015). **Developmental stages:** not described. **Range:** Aegean islands, Rhodes (Greece); Turkey. **Determination:** the male and female are described in Grković *et al*. (2015), who also figure features of the male terminalia, plus the male and female head in anterior and side view. Grković *et al*. (2015) state that *E. aurofinis* "differs from all the other species of the genus in having very short body hairs, golden reflections and short golden hairs on the top of the abdomen." *Eumerus aurofinis* is included in the keys to *tricolor*-group species of SE Europe, in Grković *et al*. (2021) and in the keys to European *tricolor*-group species in Aguado-Aranda *et al*. (2023). **Illustrations of the adult insect:** the general appearance of this species is shown in coloured photos of the side view of the male and female, in Grković *et al*. (2015).

Eumerus azabense Ricarte & Marcos-García, in Ricarte *et al*,, 2018
Preferred environment: *Quercus pyrenaica/Q. rotundifolia* dehesa with an open grassland ground layer grazed by livestock (Ricarte *et al*., 2018). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/July. **Developmental stages:** not described. **Range:** Portugal, western Spain (Salamanca). **Determination:** both the male and the female of this species are described in Ricarte *et al*. (2018). It is extremely similar in appearance to *E. niveitibia*, and the males of these two species have apparently identical terminalia (*E. niveitibia* terminalia figured by Ricarte *et al*, 2018). Ricarte *et al*. (2018) characterise these two taxa genetically, confirming their separate identity. They also provide features for distinguishing them morphologically. In its description, the dorsal parts of the body surface of *E. azabense* are stated to have "very inconspicuous dark-blue reflections". But the coloured photos of the male accompanying the description show a bright blue insect. In the key in Aguado-Aranda *et al*. (2023) it is stated that in *E. azabense* "terga II – IV do not have a metallic blue shine". Aguado-Aranda *et al*. (2023) also point out that *E. azabense* is very similar in appearance to *E. bayardi*, and discuss the differences between these two species. **Illustrations of the adult insect:** the general appearance of the male and female are shown in the coloured illustrations provided by Ricarte *et al*. (2018), but whether the colour of the male is as depicted is moot (see above).

Eumerus banaticus Nedeljković, Grković & Vujić, in Grković *et al*., 2019
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June and August/September. **Developmental stages:** not described. **Range:** Serbia, Roumania. **Determination:** both the male and female are described in Grković *et al*. (2019), where features of the male terminalia are also illustrated and a key is provided for separation of *E. banaticus* from other known European species of the *bactrianus* sub-group of the *strigatus* group. Grković *et al*. (2019) define the *bactrianus* subgroup on one feature of the male terminalia – possession of a bifurcate surstylus. This provides no mechanism for separating *bactrianus* sub-group females from females of other *strigatus* group species. Whether females of *E. banaticus* can be separated from females of European *strigatus* group species in general is yet to be established. **Illustrations of the adult insect:** The general appearance of the male and female of this species can be seen in the coloured photos provided by Grković *et al*. (2019).

Eumerus barbarus (Coquebert), 1804
Preferred environment: forest/freshwater: along seasonal rivers and streams in open *Cistus florida/Quercus pyrenaica* maquis and lentisc scrub; wetland/open ground: around the edge of wetland (e.g. marsh) in open ground of sparsely-vegetated, unimproved, xeric grassland; forest/open ground: *Olea europaea* maquis with thickets of *Opuntia ficus-indica*. **Adult habitat and habits**: low-flying, over ground vegetation; settles on bare ground. **Flowers visited:** umbellifers; *Chrysanthemum* (Ebejer, 1988), *Euphorbia*, *Hedera*, *Thapsia* (Marcos-García, 1985a); *Isatis tinctoria* (Ssymank and Ebejer (2009); *Foeniculum*. **Flight period**: April/end October, with peaks in May and August/September. **Developmental stages:** undescribed, but the species has supposedly been reared from cultivated *Allium* sp. **Range:** Portugal and Spain, the Mediterranean coast of France and Italy and Mediterranean islands including Majorca, Corsica, Sardinia, Sicily and Malta; N Africa from Morocco to Egypt; Lebanon. **Determination:** the only identification key which covers all of the *barbarus*-group species now known in Europe is to the males only, in Aguado-Aranda *et al*. (2024). Stackelberg's (1961) key is hardly usable for recognition of this species. Van Steenis *et al*. (2017) provide a key for separation of the male and female of *E. barbarus* from the closely similar *E. gibbosus* and *E. sulcitibius* and provide a lengthy diagnosis of the "*barbarus* group" species, which

should help to distinguish them from other European *Eumerus*. They also figure the male terminalia of *E. barbarus*. The male of *Eumerus barbarus* is also included in the keys in Speight *et al*. (2021), which do not, however, include either *E. gibbosus* or *E. sardus*. **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021). The general appearance of *E. barbarus* can be seen from the coloured photos provided in Van Steenis *et al.* (2017).

Eumerus basalis Loew, 1848
Preferred environment: forest; broad-leaved, evergreen forest and high maquis of *Quercus ilex;* Mediterranean shrub formations, evergreen Mediterranean forest with *Laurus nobilis*; thermophilous deciduous forest (A.Vujić, pers.comm.); thermophilous forest fringes. **Adult habitat and habits:** flies very fast through shrub vegetation, along edges of clearings and forest, settling at up to 1.5m on leaves of various plants (e.g. *Laurus nobilis*, *Pistacia* sp) (A.Vujić, pers.comm.). **Flowers visited:** *Pulicaria dysenterica* (Van Steenis *et al.*, 2021); *Smirnium perfoliatum* (A.Vujić, pers.comm.); *Foeniculum* (Van Eck *et al.*, 2020). **Flight period:** May-June and August/October. **Developmental stages:** undescribed. **Range:** Mediterranean parts of Europe, from southern France (plus Corsica) to Greece (including Crete and Rhodes), Croatia, Montenegro and Serbia, plus Bulgaria, Roumania and the Ukraine; Turkey and Iran. **Determination:** Speight *et al*. (2021); Stackelberg (1961). The male terminalia are figured by Vujić & Šimić (1999). **Illustrations of the adult insect:** a coloured photo of the male is provided in Vujić *et al*. (2020d) and Speight *et al*. (2021).

Eumerus bayardi Séguy, 1961
Preferred environment: open ground; unimproved, very dry, unimproved, herb-rich, calcareous grassland, with rocky areas bare of vegetation (A. Van Eck, pers. comm.). **Adult habitat and habits:** males settle on the bare rock of old field walls (A. Van Eck, pers. comm.). **Flowers visited:** no data. **Flight period:** May, October. **Developmental stages:** not described. **Range:** Portugal, Spain and southern France. **Determination:** the original description of this species is based on a single male. The female remains undescribed. Aguado-Aranda *et al*. (2023) characterise the species genetically, figure its male terminalia and include the male in their key to Iberian *tricolor*-group species. They also discuss its separation from the closely similar *E. azabense*. **Illustrations of the adult insect:** the male is illustrated in colour in Aguado-Aranda *et al*. (2023).

Eumerus bicornis Grković, Vujić & Hayat, in Grković *et al*, 2019
Preferred environment: forest/open ground; open areas in Mediterranean *Pinus* forest; *Pinus* matorral and more open, Eastern European, unimproved, semi-arid dry grassland (Vujić et al.(2020d). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July and September. **Developmental stages:** not described. **Range:** Greece, Turkey. **Determination:** both the male and female are described in Grković *et al.*(2019), where features of the male terminalia are also illustrated and a key is provided for separation of *E. bicornis* from other known European species of the *bactrianus* sub-group of the *strigatus* group. Grković *et al.*(2019) define the *bactrianus* subgroup on one feature of the male terminalia – possession of a bifurcate surstylus. This provides no mechanism for separating *bactrianus* sub-group females from females of other *strigatus* group species. Whether females of *E. bicornis* can be separated from females of European *strigatus* group species in general is yet to be established. **Illustrations of the adult insect:** The general appearance of the male and female of this species can be seen in the coloured photos provided by Grković *et al.*(2019).

Eumerus bifurcatus van Steenis & Hauser, in Grković *et al*, 2019
Preferred environment: forest; open Mediterranean pine forest (*P. halepensis* and *P. nigra*) with herb-rich ground vegetation (Grković *et al*, 2019). **Adult habitat and habits:** no data. **Flowers visited:** *Thapsia*. **Flight period:** June. **Developmental stages:** not described. **Range:** Spain. **Determination:** both the male and female are described in Grković *et al.*(2019), where features of the male terminalia are also illustrated and a key is provided for separation of *E. bifurcatus* from other known European species of the *bactrianus* sub-group of the *strigatus* group. Grković *et al.*(2019) define the *bactrianus* subgroup on one feature of the male terminalia – possession of a bifurcate surstylus. This provides no mechanism for separating *bactrianus* sub-group females from females of other *strigatus* group species. Whether females of *E. bifurcatus* can be separated from females of European *strigatus* group species in general is yet to be established. **Illustrations of the adult insect:** none known.

Eumerus caballeroi Gil-Collado, 1929
Preferred environment: forest/scrub; open areas in *Quercus ilex* or *Q.pyrenaica* forest/maquis, *Pinus* matorral (Marcos-García, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August.

Developmental stages: not described. **Range:** central and eastern Spain, N Africa (Morocco). **Determination:** Gil-Collado (1929). The male of this species remains undescribed. **Illustrations of the adult insect:** none known.

Eumerus canariensis Baez, 1982
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** February. **Developmental stages:** not described. **Range:** endemic to the Canary Isles. **Determination:** Baez (1982), who figures the male terminalia and provides a key distinguishing the male of *E.canariensis* from males of the other *Eumerus* species known from the Canary Isles. This species was described from a series of males and females. **Illustrations of the adult insect:** none known.

Eumerus claripennis Coe, 1957
Preferred environment: open areas/scrub along rivers and beside lakes. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers. **Flight period:** June. **Developmental stages:** not described. **Range:** North Macedonia, Greece (Aegean island of Lesvos). **Determination:** this species is not included in existing keys. It was redescribed by Ricarte *et al*. (2012), with figures of the male terminalia, antenna and abdominal tergites, plus a first description of the female and comparison with the related *E.punctifrons*. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided in Vujić *et al*. (2020d).

Eumerus clavatus Becker, 1923
Preferred environment: mesophilous *Fagus* forest. **Adult habitat and habits:** flies low in and around the edges of thickets of *Rubus* in the sun, in clearings and open areas, settling on bare ground or low-growing plants. **Flowers visited:** *Hedera*, *Pulicaria dysenterica* (Van Steenis *et al*., 2021). **Flight period:** June/ September. **Developmental stages:** not described. **Range:** northeast France south to Spain, Germany, Roumania (Danube floodplain), the former Yugoslavia, Ukraine and the Caucasus; N.Africa. **Determination**: the male is included in the keys in Speight *et al*. (2021). This species is extremely similar to *E.uncipes*, in both sexes. The males may be distinguished by the absence of the pointed, narrow, triangular extension apico-ventrally on the hind tibiae, which occurs in *E.uncipes* and by the shape of the distinctive black, median projection at the posterior margin of abdominal sternite 3, which is triangular and very pointed (thorn-shaped) in lateral view, in *E.clavatus*, but irregularly rectangular in *E.uncipes*. There isnokey in which the female can be separated from females of *E.amoenus*, *E. colladoi*, *E.elaverensis* and *E.uncipes*. The male terminalia are figured by Vujić and Šimic (1999). **Illustrations of the adult insect:** none known.

Eumerus colladoi Ricarte & Aguado-Aranda, in Aguado-Aranda *et al*., 2022
Preferred environment: mesophilous *Fagus* forest; *Quercus suber* forest and maquis; garrigue; organic olive orchards. **Adult habitat and habits:** flies close to the ground surface and settles on dead leaves in the sun. **Flowers visited:** *Thapsia* (Aguado-Aranda *et al*., 2022). **Flight period:** end of March/beginning of October. **Developmental stages:** not described. **Range:** Portugal, Spain, southern France. **Determination:** both sexes of this species are described in Aguado-Aranda *et al*. (2022), based on an abundance of material. Aguado-Aranda *et al*. (2022) illustrate the male terminalia and provide a diagnosis for *E. colladoi*, but do not present a key in which it is separated from other species. Both molecular and morphological data suggest *E. colladoi* occupies a relatively isolated position. It can be separated, in both male and female, from superficially similar species by its lack of a defined ridge on the basal half of the ventral surface of the hind tibia. In the keys provided by Speight *et al*. (2021) the male would run to *E. amoenus*, from which it can be distinguished by lack of the ridge on the ventral surface of the hind tibia, which is present in *E. amoenus*. **Illustrations of the adult insect:** the general appearance of the species is shown in coloured photographic images provided in Aguado-Aranda *et al*., 2022.

Eumerus consimilis Šimić & Vujić, 1996
Preferred environment: open ground/forest; open, scrub-invaded areas and tracksides in well-drained, sandy alluvial hardwood forest and thermophilous *Quercus* forest; beside rivers in karstic, *Quercus pubescens* savanna; found in Switzerland in ruderal vegetation between tracks in a railway shunting yard (Fisler *et al*., 2023). **Adult habitat and habits:** "skulks" around the edge of thickets of scrub, remaining motionless on lower leaves or on bare twigs for much of the time, within the hem of the thicket. When it flies, does so fast and low through vegetation along the margin of the thicket, rarely emerging into more open, shorter vegetation; more easily detected by use of a Malaise trap than by direct observation. **Flowers visited:** *Helianthemum*. **Flight period:** May/June and August/September. **Developmental stages:** not described. **Range:** uncertain,

due to confusion with related species until recently, but confirmed from Portugal; Spain; France (from the R.Loire southwards to the Mediterranean coast); Switzerland; Sardinia; Balkan peninsula (Croatia, Greece, Montenegro); Georgia. **Determination:** the male is included in the key provided by Speight *et al*. (2021), which separates the males of *strigatus* group species occurring in western and central Europe. Šimić & Vujić (1996) and Vujić and Šimić (1999) figure the male terminalia. This species is extremely similar to *E. montanum*, *E. sogdianus* and *S. strigatus*, from which it may only be distinguished in the male sex. The female remains undescribed. The cleft found on the posterior margin of abdominal sternite 4 in the male is diamond-shaped, as in *E. sogdianus*, rather than triangular, as in *E. strigatus*, and this sternite is wider than long in *E. consimilis*, whereas in *E. sogdianus* it is longer than wide. In fresh specimens, and specimens in alcohol, sternite 4 appears as figured in Vujić & Simić (1999) and Speight *et al*.(2013). But in dry-pinned specimens, in which the tissues have shrunk, it more frequently appears as figured in Grković *et al*.(2017), who also figure sternite 4 of the Balkan species *E. montanum*. Also, abdominal sternite 4 may be difficult to see in its entirety, making its proportions difficult to interpret. It would also be possible to confuse the male of this species with *E. amoenus*, from which it may be distinguished by its possession of a pale-haired genital capsule - usually black-haired in *E.amoenus*. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Eumerus crassus Grković, Vujić & Radenković, in Grković *et al*, 2015
Preferred environment: forest/open ground; sparsely-vegetated, open areas in Mediterranean scrub and garrigue (Vujić *et al*, 2020d); small, tall-herb open areas in Balkanic thermophilous oak forest (*Quercus frainetto/ Q. cerris*). **Adult habitat and habits:** flies low (and quite slowly) over sparsely-vegetated ground and settles on the ground, or dead leaves, in the sun. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** Greece: Thrace and the Aegean islands of Chios, Lesvos, Samos and Thassos. **Determination:** the description of this species was based on a solitary male. The female remains undescribed. Grković *et al.* (2015) indicate that this species belongs to the "*strigatus* group" and differs from related species in its broad abdomen, features of the male terminalia and the shape of sternite 4, which they figure. Chroni *et al.* (2018) consign *E. crassus* to the *minotaurus* group. Malidzan *et al.* (2022) found no genetic difference between *E. crassus* and *E. niehuisi* and the descriptions of *E. crassus* and *E. niehuisi* do not indicate any morphological differences, so it is unclear on what basis *E. crassus* is regarded as a separate species from *E. niehuisi*. **Illustrations of the adult insect:** the general appearance of the male is shown in the coloured photos of the insect in lateral view and the abdomen in dorsal view, provided by Grković *et al.* (2015).

Eumerus crispus Vujić & Grković, in Grković *et al*., 2021
Preferred environment: unimproved, montane, steppic grassland. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** Serbia. **Determination:** The description of this species is based on 2 males and 1 female. Grković *et al*. (2021) illustrate various morphological features of the species, including the male genitalia, and include it in their key to *tricolor*-group species of SE Europe. *E. crispus* is very similar to *E. grandis*, *E. arctus* and E. *ancylostylus*. What is referred to in Grković *et al*. (2021) as its "twisted"mid femur distinguishes the male from males of *E. ancylostylus* and *E. grandis*, but not from the male of *E. arctus*. Both the descriptions and illustrations of features mentioned in Grković *et al*. (2021) for separating males of *E. arctus* and *E. crispus* are difficult to interpret and is not included in their key. Both known males of *E. crispus* share, with the solitary male described for *E. arctus*, the phenomenon of entirely black tergites. It will not be possible to establish how stable this feature is until more material of both species becomes available. But the only known female of *E. crispus* has orange-marked tergites like other species of the *grandis* complex and it would not be unexpected if the tergites of both *E. arctus* and *E. crispus* prove to vary from entirely black to black with orange markings, in both sexes. **Illustrations of the adult insect:** the general appearanceof both the male and the female of *E. crispus* can be seen from the coloured photos provided by Grković *et al*. (2021)

Eumerus dubius Baez, 1982
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/June. **Developmental stages:** not described. **Range:** endemic to the Canary Isles. **Determination:** Baez (1982), who figures the male terminalia and provides a key distinguishing the male of *E.dubius* from males of the other *Eumerus* species known from the Canary Isles. This species was described from a series of males. The female remains undescribed. **Illustrations of the adult insect:** none known.

Eumerus elaverensis : see under *E. hungaricus*

Eumerus emarginatus Loew, 1848
Preferred environment: forest/open ground; mosaic of thickets of thermophilous *Quercus* matorral and sparsely-vegetated open ground; garrigue (Vujić *et al*., 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia characias, Ranunculus muricatus* (Ssymank and Ebejer, 2009). **Flight period:** April/beginningJuly (Vujić *et al*., 2020). **Developmental stages:** not described. **Range:** Corsica; Italy (Sicily); Greece (Peleponnesos, Aegean islands, including Crete, Rhodes) (Vujić *et al*., 2020). **Determination:** in Chroni *et al*. (2017), *Eumerus emarginatus* is characterised genetically and shown to be closely related to *E. pulchellus*. Both male and female of *E. emarginatus* are included in Stackelberg's (1961) key, but the female of *E. pulchellus* is not. In the absence of an updated key separating it from related species, or an account of its diagnostic features, recognition of *E. emarginatus* remains difficult. The male is not included in the key in Speight *et al*. (2021). There, it would run to couplet 18, where the distinct, but shallow concavity on the ventral surface of the hind tibia would lead to *Eumerus pusillus*. It is a small species, with a body length similar to that of *E. pusillus*. From the available information, the male could be distinguished from the male of *E. pusillus* by its all-black legs and finely punctured mesoscutum and scutellum. In the male of *E. pusillus* the tibiae are distinctly yellow in part and the mesoscutum and scutellum are coarsely punctured. These differences can be seen in the photos of the male of *E. pusillus* in Speight *et al*. (2021) and of *E. emarginatus* in Cornuel-Willermoz *et al*. (2023). The male terminalia of *E. emarginatus* are figured by Claussen and Standfuss (2017), based on a specimen compared with a syntype of *E. emarginatus*. **Illustrations of the adult insect:** the general appearance of the male of this species is indicated in the coloured photos provided by Vujić *et al*. (2020) and Cornuel-Willermoz *et al*. (2023).

Eumerus etnensis van der Goot, 1964
Preferred environment: forest/open ground; open *Castanea* forest; *Olea europaea* maquis with Opuntia *ficus-indica* thickets; sparsely vegetated ground with *Opuntia*. **Adult habitat and habits:** flies around, and settles on, the foliage of large-leaved plants, e.g. *Castanea,* on bare ground and on fallen, decaying pieces of *Opuntia*. **Flowers visited:** *Euphorbia.* **Flight period:** February/June and end July/mid September. **Developmental stages:** the egg, larva and puparium of this species described and figured by Pérez-Bañón and Marcos-García (1998), under the name *E.purpurariae*. The larvae were found mining decaying stems (platyclades) of the introduced cactus *Opuntia*. The puparial phase lasts from two and a half to nearly four weeks. In southern Europe, larvae apparently occur throughout the year, as do puparia. **Range:** Portugal (as *nigrostriatus* - Lucas, 1996), Spain, southern France, Sicily (slopes of Mt.Etna) and Malta; N Africa (Algeria). **Determination:** Speight *et al*. (2021); Lambeck (1973), who figures the male terminalia (under the name *nigrostriatus*, Lambeck). Marcos-García and Pérez-Bañón (2000) synonymised the Canary Isles species *E. purpurariae* Báez with *E. etnensis*, but Smit *et al*.(2004) provide data indicating these taxa are distinct, and re-instate *E. purpurariae* as a separate species. These latter authors figure the male terminalia of both *E.etnensis* and *E. purpurariae*. **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021).

Eumerus excisus van der Goot, 1968
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** Mediterranean zone of France (Bouches-du-Rhône: Speight *et al*., 1998) and Corsica. Cornuel-Willermoz & Lebard (2024) indicate that the identity of the specimen on which the record from Bouches-du-Rhône is based requires re-appraisal. **Determination:** the description of this species is based on a solitary male from Corsica. Van der Goot (1968) illustrates its hind leg and antenna and indicates that this species is very similar to *E. hungaricus*. **Illustrations of the adult insect:** none known.

Eumerus falsus Becker, 1921
Preferred environment: thinly-vegetated, unimproved, subalpine grassland. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** Turkey; Israel; Syria; Iran; Turkmenistan; Tadjikistan. **Determination:** the female was described by Becker (1921), under the name *rubriventris*. The following year Becker (1822) issued a correction, replacing the name *rubriventris* with the name *falsus*. In doing so he cites prior usage of the name *rubriventris* by Macquart. Both the male and the female of *E. falsus* are included in Stackelberg's (1961) key. In describing *Eumerus badkhyziensis*, Mutin (2019) remarks that this species would key out to *E. falsus* in Stackelberg's (1961) key and details how the males of these two species could be separated. *Eumerus falsus* is included in the

key to the males of Iranian *tricolor*-group species in Gilasian *et al*. (2020). **Illustrations of the adult insect:** the male is photographed in colour, in side view, in Gilasian *et al*. (2020).

Eumerus flavitarsis Zetterstedt, 1843

Preferred environment: close to tiny brooklets in deciduous forest, from thermophilous *Quercus* forest up the lower levels of humid *Fagus* forest, including alluvial hardwood (*Quercus*) forest on sands and gravels. **Adult habitat and habits:** the males fly at great speed in and out of tiny patches of sunlight in otherwise shaded situations like narrow woodland paths, at within one metre of the ground surface and displaying their silver hind tarsi, which thus flash in the sunlight. They often settle on low-growing to bush-height vegetation in these tiny glades. Females are more secretive, flying low and settling on foliage along paths or in glades, just at the edge of sunlit patches. The adults are usually very close to water and may settle on emergent vegetation in woodland streams, where sunlight percolates through the canopy. **Flowers visited**: *Potentilla erecta, Veronica chamaedrys* (Bartsch et al, 2009b). **Flight period:** June/August. **Developmental stages:** undescribed. **Range:** from southern Norway, southern Sweden and southern Finland southwards to the Pyrenees and much of Spain; from Netherlands and Belgium eastwards through central and southern Europe (Corsica, Italy, the former Yugoslavia, Roumania); Georgia; into European parts of Russia and on into Asia to the Pacific coast. **Determination:** the male and female can be separated from other European species of the *ornatus* group using the keys in Speight *et al*. (2021). The male terminalia are figured by Vujić and Šimic (1999). This is a particularly distinctive species in the male sex, with spatulate hind tarsomeres covered in long, densely packed, adpressed white hairs, which shine silver-white in direct light. The female is less distinctive and can be difficult to separate from species such as *E. argyropus* and *E. subornatus*. However, in *E. flavitarsis* the hairs on the scutellar disc are longer than one quarter of the length of the scutellum in the mid-line, whereas in females of both *E.argyropus* and *E. subornatus* the hairs on the scutellar disc are no longer than one eigth of the length of the scutellum in the mid-line. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.* (2009b), Haarto & Kerppola (2007) and Torp (1994). The male and females are illustrated in colour in Speight *et al*. (2021).

Eumerus funeralis Meigen, 1822

Preferred environment: open ground, dry grassland and clearings in dry woodland; to a significant extent anthropochorous, occurring also in suburban gardens and land used for horticultural purposes. **Adult habitat and habits:** flies close to the ground in sparsely vegetated grassland and woodland clearings; over flower-beds in gardens etc.; fast-flying, settling often on bare ground or stones. **Flowers visited:** *Convolvulus, Euphorbia, Fragaria, Leucanthemum, Ranunculus.* **Flight period:** end April/September, with peaks in June and August. **Developmental stages:** larva described and with morphological features figured by various authors, including Hodson (1927, 1932a) and illustrated in colour by Rotheray (1994); phytophagous, feeding in damaged bulbs of *Amaryllis, Hyacinthus* and *Narcissus* etc.; classed as a minor pest of horticulture, but larvae are unable to complete their development in the absence of fungi (especially *Fusarium* basal-rot fungus and yeasts, S*accharomyces* spp.) infesting the bulbs (Creager and Spruijt, 1935). Whether the larva of *E.funeralis* carries with it (from hatching) the fungus it requires, enabling it to inoculate with that fungus a healthy bulb it attacks, so as to provide itself with a food supply, has not been established. Experiments carried out by Hodson (1927) indicate the success of freshly-hatched larvae in finding and gaining access to onion corms decreases rapidly with the depth to which the corms are buried, only corms at least slightly exposed at the soil surface being regularly colonised. Bulbs buried 2.5 cm below the soil surface were not colonised. Multiple larvae can inhabit one corm and successfully devcelop in it. This species overwinters as an almost full-grown larva (Hodson, 1927; Brunel and Cadou (1994), and remains more-or-less quiescent during the winter months within the corm in which it has been feeding, until exiting the corm to pupariate, in April/May. The adult insects hatch approximately 2 weeks later. Progeny from the Spring generation of adults may either develop very rapidly (from egg to adult in 6 weeks), to produce a second generation in July, or more slowly, producing adults in August/September, or even more slowly to overwinter and hatch as adults the following Spring. Hodson (1927) found that, in Southern England, the adults hatching in August/September did not seem to initiate another generation, suggesting this as possibly a consequence of the Mediterranean origins of the species, rendering it unable to successfully start its development in the more northerly latitude of Britain that late in the year. **Range:** probably originated in the Mediterranean basin, but the species is becoming cosmopolitan, being known from much of the Palaearctic region and N America, except cold-climate zones, and in S America; also introduced to Australia and New Zealand. **Determination:** Speight *et al.*(2013a, 2021); van der Goot (1981); Bradescu (1991); Doczkal (1996c). This species appears in recent literature as *E. tuberculatus*, Rondani. *E. funeralis* appears in Peck (1988) as a synonym of *E. strigatus* (Fallen), but was reinstated as the correct name for *tuberculatus* Rondani, sensu *aucct*. by Speight *et al.* (1998). The female of *E. funeralis* possesses a unique feature, in the form of a longitudinal ridge along each

lateral margin of abdominal tergite 5 (figured in Speight, 1979, Marcos-García, 1983 and Speight *et al*, 2013). *E.vandenberghei* Doczkal is extremely similar to *E. funeralis* and, although at present known only from Corsica (Doczkal, 1996c), could occur elsewhere. At least in Mediterranean parts of Europe there is thus need to ensure that *E. vandenberghei* is not mistaken for *E. funeralis*. Recent illustrations of the male terminalia of *E. funeralis* are provided by Marcos-García (1983). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Speight *et al*. (2021) and Torp (1994).

Eumerus gibbosus Van Steenis, Hauser & Van Zuijen, 2017
Preferred environment: herb-rich open areas in dry, Mediterranean pine forest (*P. halapensis/P. nigra*) with thickets of Mediterranean scrub, in the vicinity of streams or seasonal water courses. **Adult habitat and habits:** no data. **Flowers visited:** yellow umbels; *Thapsia*. **Flight period:** mid May/June. **Developmental stages:** not described. **Range:** southern Spain and Portugal. **Determination:** the only identification key which covers all of the *barbarus*-group species now known in Europe is to the males only, in Aguado-Aranda *et al*. (2024). Both sexes of this species are described by Van Steenis *et al*.(2017), who also figure the male terminalia and other morphological features, define the "*barbarus* group", to which *E. gibbosus* belongs, and provide a key separating *E. gibbosus* from *E. barbarus, E. sulcitibius* and the N African species *E. schmideggeri* Van Steenis, Hauser & Van Zuijen. **Illustrations of the adult insect:** the general appearance of this species can be seen from the coloutred photos provided by Van Steenis *et al*.(2017).

Eumerus graecus Becker, 1921
Preferred environment: open ground; rocky ground with sparse, xerophytic, garrigue-type vegetation (M.Ebejer, pers.comm.). Can occur only a few metres from the sea shore. **Adult habitat and habits:** flies very close to the ground. **Flowers visited:** *Urginea maritima* (M.Ebejer, pers.comm.). **Flight period:** July/September (M.Ebejer, pers.comm.). **Developmental stages:** not described. **Range:** Malta (M.Ebejer, pers.comm.), Bulgaria, Greece, Turkey (M.Ebejer, pers.comm.), Caucasus mountains. **Determination:** *E.graecus* is difficult to recognise using existing keys. The male of this species is not included in Stackelberg's (1961) key, and the feature he uses to separate the female from other species in his key suggests that *graecus* of Stackelberg is not the species described as *graecus* by Becker. Essentially, Stackelberg states that the female of *graecus* lacks grey dust bars on tergite 4, whereas Becker (1921) states that *graecus* has a pair of dust bars on each of tergites 2 – 4. Becker (1921) also states that in g*raecus* the antennae are entirely yellow, the mesoscutum lacks longitudinal stripes of dusting and the costal wing vein is yellow. None of those features are referred to by Stackelberg (1961) in relation to the female of of the species he recognises as g*raecus*. This combination of entirely yellow antennae, yellow costa and lack of mesoscutal dust stripes separates *E.graecus* from related European species. Stackelberg (1961) had apparently not seen the male of *E.graecus*, but he mentions in a footnote to his key that it apparently belongs to the same group as *E.pulchellus*. In Sack's (1928-32) keys the male of *E.graecus* keys out in the same couplet as the male of *E.pulchellus*. *E.graecus* does not possess the long, white hairs on the extreme lateral edge of tergites 3 and 4, which are found in *E.pulchellus* (M.Ebejer, pers.comm.). Similarly, while the eyes in *E.pulchellus* are rather sparsely covered in moderately long white hairs, in *E.graecus* they are bare. This feature is not mentioned by Sack, but is clear in Becker's (1921) original description of *E.graecus*. **Illustrations of the adult insect:** none known.

Eumerus grallator Smit, in Grković, Smit, Radenković, Vujić & van Steenis, 2019
Preferred environment: *Quercus* dehesa. **Adult habitat and habits:** no data. **Flowers visited:** *Thapsia*. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Spain. **Determination:** Grković *et al*. (2019), who figure the male terminalia and provide a key for separation of this species from the others of the *binominatus* sub-group. *E. grallator* is included in the *E. tricolor* group, separated from most of them by its exceptionally long and spindly legs – the diagnostic feature of the *binominatus* subgroup. Aguado-Aranda *et al*. (2023) include the 2 European *binominatus* sub-group species in their keys and point out that, now that more material of *E. grallator* is available, it is apparent that the relative proportions of the hind femur and tibia are not consistent, and cannot be used to separate the Iberian *E. grallator* from the Balkan (and Turkish) *E. tenuitarsis*. Further, they point out that *E. grallator* is probably a synonym of the N African *E. afrarius* of Séguy (1961), but that they were unable to obtain access to the type material of *E. afrarius* to confirm the synonymy. **Illustrations of the adult insect:** the general appearance of the male can be seen from the photo provided in Grković *et al*. (2019).

Eumerus grandis Meigen, 1822

Preferred environment: according to Grković *et al*. (2021) this species "can be found in dry Pinus forest as well as in herbaceous plant rich open areas in coniferous and deciduous forests". **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** unknown. **Range:** uncertain, due to confusion with other closely similar species until recently. As characterised genetically it is known from Poland, Slovenia, Serbia, Montenegro and Greece. Grković *et al*. (2021) state that the origin of the Meigen type material of *Eumerus grandis* was "Germany". But this is an unverifiable assumption, since the type material is apparently lost and Meigen's (1822) description provides no type locality information. Peck (1988) gives the origin of the type material as "Europe". Prior to description of *E. ancylostylus*, *E.arctus*, and *E. crispus*, *E. grandis* was cited as occurring from southern Finland eastwards through central Europe (Poland, southern Germany, Switzerland, Austria, Italy, Montenegro, Roumania) to the Transcaucasus (Georgia; Armenia), in southern Europe from Spain to Greece and also known supposedly from Mongolia and China. **Determination:** between them, Grković *et al*. (2021) and Aguado-Aranda *et al*. (2023) separate three new European species (*ancylostylus*, *argus* and *crispus*) from *E. grandis* as recognised previously. In addition, Aguado-Aranda *et al*. (2023) re-instate *E. lateralis*, pointing out that, morphologically, it appears to be the same species as *E. grandis*. If *lateralis* of Zetterstedt 1819 is the same species as *grandis* of Meigen,1822 then *lateralis* becomes the correct name for the species. Given that the name *grandis* has for more than 200 years been applied to four morphologically distinct species, there is no argument for retaining use of *grandis* on grounds of maintaining nomenclatural stability – the literature on "*grandis*", from prior to 2023, in now unreliable, because it could relate to more than one of those four species. It is to be hoped that prevarication over application of the name *lateralis* will cease and that the outcome will be confirmation of *lateralis* as senior synonym of *grandis*. Adding to the confusion the type material of *E. grandis* has apparently been lost and no neotype has been designated. Grković *et al*. (2021) characterise their concept of *E. grandis* genetically, based on specimens from the Balkan peninsula and Poland. They also list specimens from various parts of western Europe as material of *E. grandis* they have examined, but do so apparently in ignorance of the existence of *E. ancylostylus* (which was not then described). The features used for separation of *E. grandis*, in the keys provided by Grković *et al*. (2021), would not separate *E. ancylostylus* from *E. grandis* and it is not clear on what morphological basis *E. grandis* has been recognised, in compiling the list of European records of *E. grandis* which they provide. A feature of the male of *E. grandis*, visible in Meigen's illustrations of the species, as reproduced in Morge (1975) is that the anterior margin of the third article of the antenna is very convex, rounded rather than straight, distinguishing it from males of *E. ancylostylus*, *E. argus* and *E. crispus*. This feature it shares with the male of *E. lateralis*, as shown in the photos of the male lectotype of *E. lateralis* provided in Aguado-Aranda *et al*. (2023). The female of *E. grandis* has a yellow mark on the antenna, which is apparently unicolorous dark brown/charcoal grey in the other species. This yellow mark is mentioned in both Aguado-Aranda *et al*. (2023) and Grković *et al*. (2021), both sets of authors stating it is located at the base of the third antennal article. However, neither set of authors illustrate the antenna of the female of *E. grandis*. Aguado-Aranda *et al*. (2023) use its yellow-marked antenna to distinguish the female of *E. grandis* in their key. Also in Aguado-Aranda *et al*. (2023) the antenna of the female of *E. lateralis* is illustrated in colour, showing a yellow mark on the second antennal article, but not on the third. Aguado-Aranda *et al*. (2023) illustrate small differences in the shape of the posterior lobe of the surstylus of the genitalia which separate the male of *E. ancylostylus* from both *E. grandis* as known in the Balkans and *E. lateralis*, The morphology of the posterior lobe of the surstylus is also used by Grković *et al*. (2021), to separate *E. grandis* from *E. arctus* and *E. crispus*, these two species having a wing-like flange extending from the posterior lobe, this flange being undeveloped in *E. grandis*. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photos of what is presumably the morphologically indistinguishable *E. lateralis*, in Bartsch *et al.* (2009b) and Haarto & Kerppola (2007). The species shown as *E. grandis* in Speight *et al*. (2021) subsequently proved to be *E. ancylostylus*.

Eumerus hispanicus van der Goot, 1966

Preferred environment: forest/scrub; *Quercus ilex* forest and maquis*; Q. rotundifolia* woodland (Marcos-García, pers. comm.); montane grassland (van der Goot, 1966). **Adult habitat and habits:** close to streams or drainage ditches; settles on stones (Marcos-García, pers. comm.). **Flowers visited:** *Thapsia*. **Flight period:** May/September. **Developmental stages:** not described. **Range:** central and southern Spain. **Determination:** both the male and the female are included in the keys provided by Aguado-Aranda *et al*. (2023), who also figure the male genitalia. The feature of the colour of the hairs on the vertex, used to separate *E. hispanicus* from *E. ancylostylus* in the key in Aguado-Aranda *et al*. (2023), is of questionable value (Speight & Lebard, 2024), reducing the morphological basis for separation of the males of these two species to detail of the shape of the male surstylus. Separation of the females of *E. ancylostylus* and *E. hispanicus* morphologically cannot be

achieved with certainty (Speight & Lebard, 2024). **Illustrations of the adult insect:** the general appearance of the male is shown in the coloured photos provided by Aguado-Aranda *et al*. (2023).

Eumerus hispidus Smit, Franquinho-Aguiar & Wakeham-Dawson 2004
Preferred environment: open ground; the open, dry, stony, thinly-vegetated Madeiran xerophytic spurge communities up to the lower altitudes of Laurisilva forest (J. T. Smit, pers. comm.); field margins and *Eucalyptus* plantation forest (Barkemeyer, 1999). **Adult habitat and habits:** the adults are usually found on stones, rocks, branches or leaves, in direct sunlight. Very often they are found in (large) numbers around and on *Euphorbia*-bushes (J. T. Smit, pers.comm.). **Flowers visited:** *Crithmum maritimum (*Gomez and Báez, 1990), *Euphorbia* (J. T. Smit, pers. comm.). **Flight period:** February/October (probably present the whole year round) (J. T. Smit, pers. comm.). **Developmental stages:** undescribed, undoubtedly phytophagous, possibly in *Euphorbia*. **Range:** the Madeiran archipelago (including Porto Santo) (Portugal), where it is the only *Eumerus* species known to occur. **Determination:** Smit *et al*. (2004), who provide features to distinguish this species from the closely related *E. purpureus* Macquart, with which *E. hispidus* has been confused in recent literature. These authors also figure the male terminalia and female sternite 3 of both of these species. **Illustrations of the adult insect:** Smit *et al*. (2004); Rego *et al*. (2022).

Eumerus hissaricus Stackelberg, 1949
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Turkey; Armenia; Iran; Tadjikistan. **Determination:** various features of the male, including its terminalia, are illustrated by Gilasian *et al*. (2020), who also include *E. hissaricus* in their key to males of the Iranian *tricolor*-group species. **Illustrations of the adult insect:** a coloured photo of the male, in side view, is shown in Gilasian *et al*. (2020).

Eumerus hungaricus Szilády, 1940
Preferred environment: scrub/open ground; patches of dry deciduous (thermophilous *Quercus: Q.cerris*, *Q.pubescens*) scrub or garrigue in dry, sparsely-vegetated ground (open, xeric, stony, calcareous, unimproved grassland). **Adult habitat and habits:** "skulks" around the edge of thickets of scrub, remaining motionless on lower leaves or on bare twigs for much of the time, within the hem of the thicket. Emerges in the earlier part of the morning to sit on foliage in the sun, at up to 1.5m from the ground. On twigs, it lies parallel with the long axis of the twig, and may do so away from the sun, on the shaded side of a twig. When it flies, does so fast and low through vegetation along the margin of the thicket, rarely emerging into more open, shorter vegetation; more easily detected by use of a Malaise trap than by direct observation. **Flowers visited:** no data. **Flight period:** June/end September. **Developmental stages:** the puparium is described and figured by Ricarte *et al*.(2017), from specimens reared from bulbs of *Narcissus confusus* in Spain. From their data, it is apparent that the larva overwinters in bulbs of the host plant. In France, adults now consigned to *E. hungaricus* have repeatedly been collected from localities where no species of *Narcissus* is present anywhere in the vicinity, suggesting *E. hungaricus* can also use some other plant as larval host. **Range:** from Spain to Turkey and from central France south to the Mediterranean and round the Mediterranean basin into N Africa, as far as Morocco. **Determination:** Szilády's (1940) description of *E. hungaricus* is based on the male only and is accompanied by a figure of its hind leg. Van Doesburg (1960), redescribed *E. hungaricus*, adding a description of the female, but no further illustrations, so the male terminalia were not figured. *Eumerus hungaricus* was also described by Séguy (1961), as a new species, *E. elaverensis*. Under the name *E. elaverensis* the male terminalia and hind leg of *E. hungaricus* were subsequently figured by Vujić and Šimic (1999), based on specimens from the Balkans. *E. hungaricus* is not easy to determine using Stackelberg's (1961) key, particularly in the female. The male is included in the keys in Speight *et al*. (2021). A useful feature present in the male is very long, white, ventrally oriented hairs on the lateral margins of abdominal tergites 3 and 4, figured by Vujić and Šimic, 1999). The hairs on the basal half of the ventral surface of the hind femur are exceptionally long – longer than the femur is deep, as shown by both Szilády (1940) and Vujić and Šimic (1999). The male hind tibia also has a brush of usually black hairs (the hairs can be mostly white), postero-laterally, in the apical half of its length and a deep concavity just distal to the brush of hairs, on the same surface of the tibia. Sternite 4 in the male is usually almost flat, with a bunch of golden hairs on each side, apically, but it can be raised into a shallow, longitudinal ridge medially. This ridge is sometimes well-developed. The fact that the front coxae are entirely yellow in both sexes can result in confusion between females of this species and females of *E.amoenus*, *E.clavatus* and *E.uncipes*. The female of *E. hungaricus* can be distinguished from the female of *E. amoenus* by the number of stout, black spines in the row on the postero-lateral edge of the ventral surface of the hind femur and in the proportions of the second tarsomere of the hind leg. In the female of

E. hungaricus there are 9 – 11 black spines, but in the female of *E. amoenus* there are 12 – 16 black spines; in the female of *E. hungaricus* the second tarsomere of the hind leg is less than twice as long as it is wide but in the female of *E. amoenus* it is more than twice as long as wide. The female of *E. hungarisus* can be separated from females of *E. clavatus* and *E. uncipes* by the eye hairs. In *E. hungaricus* the eyes are distinctly hairy, many of the hairs being as long as a posterior ocellus, whereas in females of *E. clavatus* and *E. uncipes* the eyes are almost bare, the hairs all being much shorter than the length of a posterior ocellus. In the male of *E. hungaricus* the posterior edge of tergite 4 is supposed to be orange, but varies from exhibiting a broad orange patch medially to being entirely dark, and the pale marking is usually very narrow and hardy discernable. In the female there is no pale mark on the posterior margin of tergite 4. The third antennal segment also varies in colour in this species, from partly yellowish (at the base) to entirely dark brown. Ricarte *et al.*(2017) formally synonymise *E. elaverensis* of Séguy (1961) with *E. hungaricus*, in the process pointing out that Van Doseburg's designation of a neotype for *E. hungaricus* was invalid, but they do not themselves designate a neotype for *E. hungaricus* or figure the male terminalia of the species. Assuming the synonymy established by Ricarte *et al.* (2017) is correct, one might expect that the shape of the apical part of the surstylus of *E. hungaricus*, as figured by Vujić and Šimic, 1999), would be the same as can be seen in males of apparently the same taxon in France. But this is not the case. Further, the surstyli of a male corresponding in other respects with *E. hungaricus*, and collected at altitude in the Pyrenees, exhibits a different form both from other French specimens and the figure provided by Vujić and Šimic, 1999). Whether this is simply a consequence of variability in this feature within *E. hungaricus*, and the difficulty of illustrating it, or has some taxonomic significance, remains to be established. **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021).

Eumerus incisus Vujić & Malidžan, in Malidžan *et al.*, 2022
Preferred environment: open ground; dry, unimproved, calcareous montane meadow grassland (Malidžan *et al.*, 2022). **Adult habitat and habits:** flies low among ground vegetation. **Flowers visited:** *Dianthus deltoides* (Malidžan *et al.*, 2022). **Flight period:** August/September. **Developmental stages:** not described. **Range:** Montenegro. **Determination:** both the male and the female are described in Malidžan *et al.* (2022). The authors consign *E. incisus* to the "*torsicus* group", with *Eumerus torsicus*, a recently described species previously regarded as occupying a rather isolated position within the European *Eumerus* fauna. Neither *E. incisus* nor *E. torsicus* have been included in any key to *Eumerus* species. Malidžan *et al.* (2022) detail differences between *E. incisus* and *E. torsicus* and illustrate the male terminalia of both species. **Illustrations of the adult insect:** the general appearance of male and female of *E. incisus* can be seen in the coloured photos provided in Malidžan *et al.* (2022).

Eumerus karyates Chroni, Grković & Vujić, in Chroni *et al.*, 2018
Preferred environment: Eastern Mediterranean maquis; Aegean phrygana (Vujić et al., 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** Greece (Peleponnesos). **Determination:** the male and female are described in Chroni *et al.* (2018). This is one of four cryptic species comprising the *minotaurus* group, as defined by Chroni *et al.* (2018). *E. karyates* is characterised by a combination of genetic and morphometric data, but is otherwise very difficult to distinguish from *E. minotaurus* and *E. phaeacus*. **Illustrations of the adult insect:** none known.

Eumerus larvatus Aracil, Grković & Pérez-Bañón, in Aracil *et al*., 2023
Preferred environment: sandy, semi-arid, unimproved, open grassland/sub-desert. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/June (nearly all data from reared specimens, adults collecrted in the field in March and April). **Developmental stages:** larva and puparium described in detail and comprehensively figured in Aracil *et al*. (2023). During March to May the larva feeds internally, on the tissues of the fleshy stems of the parasitic plant *Cistanche phelypæa, varieties C. phelypæa phelypæa and C. phelypæa lutea* (Aracil *et al.*, 2023), one inhabited stem normally containing more than one *E. larvatus* larva. *Cistanche phelypæa phelypæa* is recognised as specialising on chenopods of the genus *Chenopodium* as its host plants. According to Piwowarczyk *et al*., (2016) plant hosts of *C. phelypæa lutea* in Iberia include *Arthrocaulon macrostachyum* (Amaranthaceae), *Limoniastrum monopetalum* (Plumbaginaceae), *Salsola genistoides* (Chenopodiaceae) and *Salicornia fruticosa* (Amaranthaceae), some of them salt-marsh plants. But Aracil *et al.* (2023) remark that *E. larvatus* has not so far been found in salt-marsh localities. The mature larva leaves its host plant to pupariate just under the soil surface, close to the host plant. Time spent in the puparium was on average

15 days. It is unclear in what form the species survives the period July to January. **Range:** south-east Spain. **Determination:** both male and female of *E. larvatus* are described and figured, and also characterised genetically, in Aracil *et al*. (2023). The male terminalia are also figured. *Eumerus larvatus* is apparently an all-black representative of the *Eumerus tricolor* group. Both the male and the female are included in\the key to Iberian *tricolor*-group species provided by Aguado-Aranda *et al*. (2023). **Illustrations of the adult insect:** Aracil *et al*. (2023).

Eumerus lasiops Rondani, 1857
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Developmental stages:** no data. **Range:** Italy. **Determination:** *E. lasiops* was described from Italy. It has not been included in any key to *Eumerus* species and its original description (Rondani, 1957) is inadequate to permit its recognition. It is categorised as a doubtful species in Peck (1988). Dirickx (1994) also comments that the validity of this taxon requires confirmation. It has been included as a separate species in a recent list of the Syrphidae of Italy (Daccordi and Sommaggio, 2002) but there are no recent citations of occurrence of the species. In their monumental review of Rondani type material, Sforzi & Sommaggio (2021) state that there is no type material of *E. lasiops* in the Rondani collections. Effectively, there is no adequate basis for recognising *E. lasiops* as a separate species, leaving it destined to remain in lists of European syrphids as a sort of "moribund" taxon. **Illustrations of the adult insect:** none known.

Eumerus lateralis (Zetterstedt, 1819)
Preferred environment: calcareous, unimproved, montane grassland with tall herbs (*Laserpitium latifolium).* **Adult habitat and habits:** the male flies fast and very low among open ground vegetation and along paths or over other bare ground, settling on dead vegetation, stones or bare ground in the sun. **Flowers visited:** *Sedum album* (Bartsch *et al*, 2009b). **Flight period:** June/July. **Developmental stages:** not described. The female has been observed ovipositing on the basal leaves of a withered plant of *Laserpitium latifolium* (Sjöberg, 2015). **Range:** Sweden and potentially widely in the Palaeartctic Region, but uncertain at present due to lack of clarity concerning the taxonomic relationship between *E. lateralis* and *E. grandis*. **Determination:** this taxon was regarded as a "doubtful species" by Peck (1998) and not mentioned as a Swedish species by Bartsch *et al*. (2009b). Aguado-Aranda *et al*. (2023) re-instate *E. lateralis*, based on re-examination of a Swedish male and female from Zetterstedt's type series and designate a male as lectotype. They also illustrate the male terminalia of the lectotype, and other morphological features, based on the type material. They demonstrate that *E. lateralis* is apparently morphologically indistinguishable from *E. grandis* and very probably the same species, in which case *grandis* of Meigen 1822 would be a junior synonym of *lateralis* of Zetterstedt 1819. But they cite the lack of relevant molecular data, for *E. lateralis*, as reason for not synonymising *E. grandis* with *E. lateralis,* and continue to use the name *grandis* in their key to European *tricolor*-group species. If *lateralis* of Zetterstedt, 1819 is the same species as *grandis* of Meigen,1922 then it is the valid name for the taxon, and *grandis* is a junior synonym. If *lateralis* of Zetterstedt 1819 is not the same species as *grandis* of Meigen 1822 then it is a valid species in its own right and requires to be treated as such. That is the interim position adopted here. Given that the label *grandis* has been applied to four different taxa for more than 200 years, arguing for retaining its use on grounds of maintaining nomenclatural stability would be absurd. Essentially, all literature on "grandis", written prior to 2023, has now to be regarded as unreliable because of the difficulty of knowing to which species the name has been applied. It has outlived its usefulness, as a label denoting an individual species-level taxon and it is to be hoped that *lateralis* will be confirmed as the senior synonym, removing the ambiguity associated with continued use of the name *grandis*. I**llustrations of the adult insect:** the general appearance of the male and female is shown in the coloured photos provided by Aguado-Aranda *et al*. (2023).

Eumerus latitarsis Macquart in Webb & Berthelot, 1839
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** throughout the year. **Developmental stages:** the larva occurs in decomposing parts of the stem of *Euphorbia canariensis* L. (Báez, 1977). **Range:** Canary Isles. **Determination:** features of the male and its terminalia are figured by Báez (1977, 1982). Baez (1982) provides a key distinguishing the male of *E.latitarsis* from males of the other *Eumerus* species known from the Canary Isles. **Illustrations of the adult insect:** none known.

Eumerus longicornis Loew, 1855

Preferred environment: deciduous forest/open ground; thermophilous forest fringes/mesophilous *Fagus* forest and unimproved dry grassland within open deciduous forest; xeric, open, unimproved, calcareous and non-calcareous grassland (D.Doczkal and A.Ssymank, pers.comm.); steppic grassland (Ssymank & Wolff, 2018). **Adult habitat and habits:** no data. **Flowers visited:** *Asparagus officinalis*. **Flight period:** May/July. **Developmental stages:** undescribed. **Range:** known from southern and central Germany, Slovakia, Hungary and the Caucasus mountains (requires confirmation). There are very few records of this species and it is probably threatened at European level. In Germany it has to be regarded as endangered (D. Doczkal, pers. comm.). **Determination:** Stackelberg (1961). The male is included in the keys in Speight *et al*. (2021), providing for separation of *E. longicornis* from other western and central European *Eumerus* species. Doczkal (1996c) provides features for distinguishing this species from other European *Eumerus* in which antennal article 2 (pedicel) is elongate. Standfuss and Claussen (2007) figure the surstylus and other parts of the male terminalia (the origin of the specimen of *E. longicornis* whose terminalia are figured is not given, but is presumably not from Greece – Standfuss and Claussen do not record *E. longicornis* from Greece), and provide a table of differences between *E. longicornis* and "*E. minotaurus*". It has subsequently been established that, in Greece and its islands, "*E. minotaurus*" is a complex of cryptic species (Chroni *et al*., 2018), and *E. minotaurus* itself is not known from mainland Greece, so the figures and data of Standfuss and Claussen (2007) may still help, in separation of *E. longicornis* from some members of the "*minotaurus* complex", but not necessarily from *E. minotaurus*. **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021).

Eumerus lucidus Loew, 1848

Preferred environment: along streams in *Pinus brutia* forest (Van Steenis *et al*, 2019); ruderal vegetation (Ssymanck, 2012). **Adult habitat and habits:** no data. **Flowers visited:** *Hedera*. **Flight period:** mid August/mid September. **Developmental stages:** not described. **Range:** Greece; Turkey (supplementary data file, Demirözer *et al*, 2022); Yemen; Saudi Arabia; southwestern Asia (Turkmenistan, Uzbekistan, Tajikistan). Published records of *E.lucidus* from France have proven to be based on misdetermined specimens of *E. subornatus*. **Determination**: both male and female are separated from other European species of the *ornatus* group by the keys in Speight *et al*. (2021). This species can be determined, with some difficulty, using Stackelberg (1961). Specimens of *Eumerus subornatus* in alcohol can have the pale markings on tergite 2 appear translucent, as in *E. lucidus*, giving rise to misdeterminations.The male terminalia are figured by Claussen & Standfuss (2017). **Illustrations of the adult insect:** the general appearance of this species can be seen in the coloured photos provided by Smit *et al*. (2017) and Vujić *et al*. (2020d).

Eumerus lunatus (Fabricius), 1794

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Ziziphus lotus* (Leclercq, 1961). **Flight period:** July. **Developmental stages:** not described. **Range:** The occurrence of *E.lunatus* in Europe requires confirmation. It is an African species, known from southern parts (South Africa) of the Afrotropical region northwards to the southern edge of the Palaearctic region, in Morocco, Yemen and Arabia. *E. lunatus* was listed for the former Yugoslavia, but specimens validating that citation have not been found (Vujić and Simić, 1999). At present the only basis for inclusion of this species in the European list is a record by Venturi (1960) from Linosa, a small Italian island comprising, with Lampedusa, the Pelagic Isles (Isole Pelagie), close to the coast of N.Africa. This record was repeated in Belcari *et al*. (1995) as a record for Sicily and its surrounding islands (D. Sommaggio, pers. comm.). Given the changes that have occurred in the taxonomy of European *Eumerus* species since publication of Venturi's (1957) record, including description of similar species, like *E. etnensis*, it would be helpful if the Venturi material on which his record of *E. lunatus* is based could be located and re-examined, to establish whether or no it is indeed *E. lunatus*. **Determination:** both the male and the female of this species are included in Stackelberg's (1961) keys. *E. lunatus* belongs to the small number of *Eumerus* species in which one of the two lines of black spines on the ventral surface of the hind femur is carried on a ridge running along the apical third of the antero-lateral margin of the femur, rather than the spines projecting directly from the surface of the femur. **Illustrations of the adult insect:** none known.

Eumerus minotaurus Claussen & Lucas, 1988

Preferred environment: forest/open ground; evergreen oak (*Quercus coccifera*) garrigue/Phrygana (Claussen and Lucas, 1988). **Adult habitat and habits:** males rest on the foliage of shrubby vegetation, in the sun (Claussen and Lucas, 1988). **Flowers visited:** no data. **Flight period:** April/May. **Developmental stages:** undescribed. **Range:** Greece: Crete, Karpathos (Dodecanese islands). **Determination:** Chroni *et al*.(2018) establish genetically that *E. minotaurus*, as recognised

previously, is a complex of four cryptic species, *E. anatolicus, E. karyates, E. minotaurus* and *E. phaecus*. They also provide morphological features for the separation of *E. minotaurus* from these other taxa. The original description of *E. minotaurus* was provided by Claussen and Lucas (1988), who figure the male terminalia and compare the species with others it might be confused with using the keys in Stackelberg (1961); Doczkal (1996c), who provides features distinguishing this species from *E.niehuisi*. Standfuss and Claussen (2007) figure the surstylus and other parts of the male terminalia, supposedly of *E. minotaurus*, but do not give the origin of the specimen illustrated. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photo provided by Vujić et al.(2020d).

Eumerus montanum Grković, Radenković & Vujić, in Grković *et al*, 2017
Preferred environment: deciduous forest; in the vicinity of streams and other water bodies in *Quercus robur* and mesophilous *Fagus* forest (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August. **Developmental stages:** not described. **Range:** Greece, Montenegro. **Determination:** Both male and female are described in Grković *et al.*(2017), who also figure the male terminalia, sternite 4 of the male abdomen and various other features. *E. montanum* is a *strigatus* group species, very similar to others in the group. The shape of sternite 4 and features of the terminalia in the male are refered to by Grković *et al.*(2017) as the most reliable means of identifying the species. The figures provided by Mutin and Barkalov (2018), of sternite 4 and terminalia, of the species they record from asiatic Russia as *E. montanum*, do not correspond well with the figures of *E. montanum* in Grković *et al.* (2017). In particular, the posterior margin of sternite 4, described in Grković *et al.* (2017) as "with v-shaped shallow notch with two spatulate projections laterally", is shown, and described by Mutin and Barkalov (2018), as "with deep cut" in their species, suggesting it is some other species than *E. montanum*. **Illustrations of the adult insect:** the general appearance of the adult insect can be seen from the coloured photos of the male and female in side view, provided in Grković *et al*. (2017).

Eumerus narcissi Smith, 1928
Preferred environment: forest/open ground; small open areas in evergreen oak maquis; grazed, herb-rich, dry, unimproved grassland with dwarf scrub; bulb farms. **Adult habitat and habits:** flies fast and low through ground vegetation. **Flowers visited:** no data. **Flight period:** March/May and August/October (California); March/June and September/October (Europe); **Developmental stages:** on various occasions reared from bulbs of cultivated *Narcissus*, probably *N.tazetta*, according to Latta and Cole (1933). In N America, the species has also been reared from the indigenous *Hippeastrum* and "onions" (Speight *et al.*, 2013a). Thomas *et al*. (2023) re-enforce the conclusion that this species is associated with *Narcissus tazetta*, in pointing out that the records from Cornwall and the Scilly Isles are from areas which specialise in bulb production, *N. tazertta* varieties being prominent among the bulb crops involved. They also note that *N. tazetta* is known to have been growing wild in the Scilly Isles for more than 150 years, providing *E. narcissi* with the opportunity to establish populations there, independent of the bulb farming activities, assuming it does use *N. tazetta* as a larval host plant. It would seem likely that, if an attempt were made to systematically sample "strigatus group" *Eumerus* in the vicinity of bulb farms growing *N. tazetta*, *Eumerus narcissi* would be recorded from various parts of continental Europe. **Range:** uncertain, due to confusion with related species; confirmed from Corsica and the Mediterranean zone of France; introduced to North America, where it has apparently become naturalised in California. Thomas *et al*. (2023) record *E. narcissi* from Cornwall, in the extreme SW of England and the Scilly Isles, 45km offshore from Cornwall (but administratively part of Cornwall). **Determination:** Smith (1928); *E. narcissi* was redescribed by Speight *et al.* (2013a), who also include it in a key to western European species of the *strigatus* group, and figure parts of the male Terminalia. In the keys in Speight *et al*. (2021) *E. narcissi* is separated from the males of other western and central European species of the *strigatus* group. Thomas *et al*. (2023) figure the terminalia of *E. narcissi* and other *strigatus*-group species, and discuss the identification of *E.narcissi*. **Illustrations of the adult insect:** none known.

Eumerus niehuisi Doczkal, 1996
Preferred environment: no data. **Adult habitat and habits: Flowers visited:** *Euphorbia*. **Flight period:** April/beginning June. **Developmental stages:** not described. **Range:** Corsica. Records of *E. niehuisi* from parts of Greece are apparently based on misdeterminations of *E. crassus*, unless *E. crassus* proves to be the same species as *E. niehuisi*. **Determination:** Speight *et al*. (2021). Doczkal (1996c), who figures the male terminalia and provides features for distinguishing *E.niehuisi* from other European *Eumerus* species then known, in which the second antennal segment (pedicel) is elongate. Chroni *et al.* (2018) did not include *E. niehuisi* in their genetic analyses of the "*minotaurus*" group, although alluding to both *E. longicornis* and *E. niehuisi* as part of this complex. Malidzan *et al.* (2022) show no genetic difference between *E. niehuisi* and *E. crassus* and no morphological differences are known between *E. niehuisi* and *E. crassus*, so the basis for regarding them as

separate taxa is unclear. It would seem that *crassus* is very probably a junior synonym of *niehuisi*. **Illustrations of the adult insect:** none known.

Eumerus nigrorufus Grković & Vujić, in Grković *et al*., 2021
Preferred environment: calcareous montane unimproved grassland and hay meadow (Grković *et al*., 2021). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Montenegro. **Determination:** both the male and the female are described in Grković *et al*. (2021), together with illustrations of various morphological features, including the male terminalia, and a key to separate *E. nigrorufus* from other *tricolor* group species occurring in SE Europe. *Eumerus nigrorufus* is also included in the keys in Aguado-Aranda *et al*. (2023). This species is morphologically very similar to *E. armatus*, from which the female can only be distinguished genetically, or by assuming the range of these two species is sufficiently well-known that they can also be distinguished biogeographically. **Illustrations of the adult insect:** the general appearance of both the male and the female can be seen from the coloured photos provided in Grković *et al*. (2021).

Eumerus nivariae Baez, 1982
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** this species is endemic to the Canary Isles. **Determination:** Baez (1982), who figures the male terminalia and prvides a key in which the male of *E.nivariae* is distinguished from males of the other *Eumerus* species known from the Canary Isles. This species was described from a solitary male. The female remains undescribed. **Illustrations of the adult insect:** none known.

Eumerus niveitibia Becker, 1921
Preferred environment: ruderal vegetation on burnt ground, two years after burning (Standfuss and Claussen, 2007); olive groves (Ricarte *et al.*, 2012); open thermophilous *Quercus*/evergreen oak forest (*Q. frainetto/Q. coccifera/Q. ilex*), with sparsely vegetated open areas; sparsely-vegetated open areas in *Castanea* forest. **Adult habitat and habits:** rests on the ground (Ricarte *et al.*, 2012) and on rocks, tree stumps and fallen dead wood, in the sun; flies extremely rapidly. **Flowers visited:** *Ferulago sylvatica* (Standfuss and Claussen, 2007). **Flight period:** May/July and September.. **Developmental stages:** not described. **Range:** various parts of Greece, including the Aegean island of Lesvos; Bulgaria; Turkey (supplementary data file, Demirözer *et al*, 2022); the Caucasus mountains; Egypt. **Determination:** this species was described from a single male collected in Greece. The female was finally described by Ricarte *et al.* (2018), who also redescribe the male and figure its terminalia. They also provide distinctions from the closely similar *E. azabense*, whose male terminalia are evidently virtually identical to those of *E. niveitibia*. These two species are characterised genetically by Ricarte *et al.* (2018), demonstrating that they are separate taxa. *Eumerus niveitibia* is included in the keys provided by Sack (1928-32) and Stackelberg (1961), but *E. azabense*, of course, is not. According to the original description of *E.niveitibia*, the male has silvery-white hind tibia and tarsi, but this colouration is not evident in the coloured illustrations of the male provided by Ricarte *et al*.(2018). Comparative genetic work carried out by Ricarte *et al.*(2018) shows that *E. niveitibia* is closely related to *E. ovatus* and *E. sinuatus*. It is included in the keys to *tricolor*-group species of SE Europe, in Grković *et al*. (2021) and in the keys to European *tricolor*-group species in Aguado-Aranda *et al*. (2023). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/ and Ricarte *et al*.(2018). In the former, the male appears as a predominantly black insect with deep blue metallic reflections. In the latter, the male is shown as a bright blue insect. The female abdomen, shown in Ricarte *et al*.(2018) appears largely red, as in females of *E. ovatus* and *E. sinuatus*.

Eumerus nudus Loew, 1848
Preferred environment: open ground/forest; open areas in Mediterranean lentisc shrub formations and sparsely vegetated grassland/*Arundo* thickets edging Mediterranean salt-marsh. **Adult habitat and habits:** flies low through sparse, tall ground vegetation, settling on vertical stalks of dry grasses etc., ceases activity before mid-morning. **Flowers visited:** no data. **Flight period:** May/June and September. **Developmental stages:** larva and puparium described and figured by Ricarte *et al*.(2017), from larvae collected from "swollen roots of *Asphodelus cerasiferus*". The species has also been reared from larvae found in tubers of *Asphodelus ramosus* (sometimes regarded as a synonym of *A. cerasiferus*), by Speight and Garrigue (2014), who also provide a photo of the puparium. Ricarte et al.(2017) question the identity of the larval host plant recorded by Speight and Garrigue (2014), stating it must have been *A. cerasiferus*. However, it can be confirmed that the asphodel species refered to as *A. ramosus* by Speight and Garrigue (2014) was indeed that species. *Asphodelus cerasiferus* also occurs in the vicinity of the Jardin Méditerranéen (Banyuls-sur-Mer), from which the larvae were collected, but is a much rarer plant

there (J. Garrigue, pers. comm.) and was not investigated as a potential host plant for *E. nudus*. The larva of *E. nudus* apparently overwinters within decaying asphodel tubers and the duration of the puparial phase is approximately 6 weeks (Speight and Garrigue, 2014). An occupied tuber was usually found to contain more than one *E. nudus* larva and often also larvae of *E. olivaceus* and *E. pulchellus* (Speight and Garrigue, 2014). **Range:** Spain and round the Mediterranean coast through southern France and Italy (plus Sicily) to the former Yugoslavia; Roumania, Turkey; Morocco, Algeria and Tunisia in N Africa. **Determination:** Speight *et al*. (2021) provide a key to separate the male of this species from other western European *Eumerus* species, including *E. alpina*. *Eumerus nudus* is closely similar to *E. alpinus* in size and general appearance. Features which may be used for distinguishing *E. nudus* from *E. alpinus* are provided by Speight and Garrigue (2014), who also figure sternite 4 of the male of both species. **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021).

Eumerus obliquus (Fabricius), 1805

Preferred environment: open ground; thinly vegetated, semi-arid dry grassland, often along the margins of seasonal rivers; also now in almost any Mediterranean-zone habitat where stands of the introduced prickly-pear, *Opuntia ficus-indica*, occur. **Adult habitat and habits:** flies fast and low over thinly-vegetated ground, settling on platyclades of *Opuntia*, bare ground and stones in the sun. This *Eumerus* also feeds/drinks from the juice of ripe, fallen fruits of *Opuntia*, which gives the fly's abdomen a bright pink appearance in lateral view, due to the colour of the *Opuntia* juice (J.Garrigue, pers.comm.). **Flowers visited:** *Euphorbia dendroides* (Ssymank and Ebejer, 2009); *Hedera*. **Flight period:** March/November; almost throughout the year in Malta (M.Ebejer, pers.comm.). **Developmental stages:** larva and puparium described and figured by de Moor (1973) from larvae collected from decaying, liquified tissues of a tropical fruit (Loganiaceae) and from cuttings of *Poinsettia* (Euphorbiaceae) in water. Puparium also described and figured by Ricarte *et al*.(2008), from larvae in decaying *Opuntia* platyclades and fruit. In this species the three pairs of lappets at the posterior end of the abdomen, normally characterising the larvae of *Eumerus* species, seem to be undeveloped. De Moor (1973) records *E. obliquus* as having been reared from the decaying tissues of fruiting bodies, tubers or bulbs of a wide range of plant families: Cruciferae (rotting cabbage), Cucurbitaceae (pumpkin), Liliaceae (Aloe), Rutaceae (grapefruit), Sapindaceae (Lichi), Solanaceae (rotting potatoes). The pupal phase lasts in this species for 2 – 3 weeks (de Moor, 1973). **Range:** this species has been widely distributed by human transport and is now almost cosmopolitan, being known from the Balearics, the Canaries, Corsica, southern France, Italy, Sicily, Greece (Corfu), Malta; N Africa and the Afrotropical region, including the Mascarene islands; the Nearctic and the Neotropical; Yemen, Sokotra; Madagascar; Mauritius; Australia. **Determination:** the male can be separated from other western European *Eumerus* species using the keys in Speight *et al*. (2021). Stackelberg (1961) can be used for separating *E. obliquus* from most other European *Eumerus* species. But only the key in Smit *et al*. (2017) separates *E. obliquus* from the closely similar *E. incilis* and *E. vestitus*. **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021). the general appearance of this insect can be seen from the coloured photo provided by Vujić *et al*. (2020d).

Eumerus olivaceus Loew, 1848

Preferred environment: unimproved, very dry pasture grassland "with isolated old olive trees, abundant *Euphorbia characias* and *Asphodelus ramosus*" (Ssymank and Ebejer, 2009 – assuming *E. alpinus* does not also occur on Sicily). **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia characias* (Ssymank and Ebejer, 2009 – assuming *E. alpinus* does not also occur on Sicily). **Flight period:** March/April (Ssymank and Ebejer, 2009 – assuming *E. alpinus* does not also occur on Sicily). **Developmental stages:** not described. **Range:** Sicily. **Determination:** Grković *et al*. (2016) state that the type material of *E. olivaceus* is "clearly different" from the type material of *E. alpinus*, in examined "morphological features", but do not define these differences or provide a re-description of *E. olivaceus***,** which they regard as endemic to Sicily. For the widely distributed European species previously recognised as *E. olivaceus* they reinstate the name *alpinus*. Whether *E. olivaceus* is indeed endemic to Sicily will not become clear until it is redescribed in sufficient detail to be identifiable and distinguished from both *E. alpinus* and *E. nudus*. It is not clear whether *E. alpinus* also occurs on Sicily. **Illustrations of the adult insect:** none known.

Eumerus ornatus Meigen, 1822

Preferred environment: deciduous forest; humid and mesophilous *Fagus* forest and *Quercus* forest, including thermophilous *Q.pubescens* forest; may be particularly common in coppiced woodland (including truffles oak forest). On occasion, this species is also to be found in mature, urban parkland (see Plant, 2001). **Adult habitat and habits:** edges of clearings, tracks etc. and beside streams; flies fast and low among ground vegetation, settling often on path-side foliage or the

ground; males distinctly territorial. **Flowers visited:** *Convolvulus, Geranium robertianum*. **Flight period:** May/July, plus August/September in southern Europe, with stragglers into November. **Developmental stages:** undescribed. There is some circumstantial evidence to suggest *Allium oleraceum* may be a larval host plant. **Range:** southern Sweden south to the Pyrenees and northern Spain; from Britain (southern England) eastwards through central and southern Europe, including Italy (and Sicily), the former Yugoslavia, Roumania and Turkey, into European parts Russia; N Africa. **Determination:** the male and female can be separated from other European species of the *ornatus* group using the keys in Speight *et al*. (2021). The male terminalia are figured by Vujić and Šimic (1999). See under *E. subornatus* for separation of *E. ornatus* from *E. subornatus*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994). Male and female are illustrated in colour in Speight *et al*. (2021).

Eumerus ovatus Loew, 1848
Preferred environment: open ground; thermophilous forest fringes and herb-rich, dry/semi-arid, open, unimproved, calcareous grassland and scrub/garrigue. **Adult habitat and habits:** over bare ground both sexes fly low and very rapidly, zig-zagging repeatedly. In the morning, males can be encountered flying among tall grasses, at from 50cm to a metre from the ground. They are very difficult to follow, because, as they zig-zag, the silver-white hairs on the abdomen flash silver in the sun at some angles, catching the eye. As soon as the insect alters its line of flight the silver colour disappears and the insect with it, because the human eye tries to follow the silver object which has vanished. In the evening (between 17.00 and 18.00 hours) the males rest in the sun towards the top of grass blades, where the ground is sparsely vegetated and still hot. Males also settle on bare patches of ground. **Flowers visited:** no data. **Flight period:** May/July; September. **Developmental stages:** not described. **Range:** from Lithuania and Poland, southern Germany and the Czech Republic through central Europe (Switzerland, Austria) to Roumania, the Ukraine and the Caucasus mountains; in southern Europe from Spain through southern France and Italy to the former Yugoslavia. **Determination:** Stackelberg (1961); Speight *et al*. (2021); Grković *et al*. (2021); Aguado-Aranda *et al*. (2023). The male terminalia are figured by Vujić and Šimic (1999). The tergites of the male of this species are very distinctive: tergite two is black and orange and the succeeding tergites are densely covered in reclinate, silver-white, metallic hairs. The female, on the other hand, is almost indistinguishable from the females of *E.grandis* and *E. sinuatus*. **Illustrations of the adult insect:** The male is illustrated in colour in Speight *et al*. (2021).

Eumerus pannonicus Ricarte, Vujić & Radenković, in Markov *et al*, 2016
Preferred environment: Pannonian steppe (Markov *et al*., 2016). **Adult habitat and habits:** no data. **Flowers visited:** *Conium maculatum* (Markov *et al*, 2016). **Flight period:** May/June. **Developmental stages:** not described. **Range:** Serbia. **Determination:** the description of this species, in Markov *et al*. (2016), is based on one male and a female. *Eumerus pannonicus* is evidently very similar to the asiatic species *E. bactrianus* Stackelberg. Means of separating these two species are detailed in Markov *et al*.(2016), who also provide figures of the male terminalia and of other features of *E. pannonicus*. This species is also included in the key to European *bactrianus* sub-group species (of the *strigatus* species group) in Grković *et al*. (2019), who also consign *E. pannonicus* to the *bactrianus* sub-group. However, in the figure provided of the genetic relationships established between members of the *strigatus* group Grković *et al*.(2019) show *E. pannonicus* distanced from other members of the *bactrianus* subgroup, and apparaently more closely related to *E. strigatus* itself. Grković *et al*.(2019) define the *bactrianus* subgroup morphologically on one feature of the male terminalia – possession of a bifurcate surstylus. This provides no mechanism for separating *bactrianus* sub-group females from females of other *strigatus* group species. Whether females of *E. pannonicus* can be separated from females of European *strigatus* group species in general is not established. **Illustrations of the adult insect:** the general appearance of the male and female can be seen in the coloured photos provided in Grković *et al*. (2019).

Eumerus pauper Becker, 1921
Preferred environment: beside rivers (Stackelberg, 1961). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June. **Developmental stages:** no data. **Range:** Spain; Greece (Van de Weyer and Dils, 1999); southern parts of European Russia (Stackelberg, 1961). **Determination:** this species was described from two females, originating in Spain (Becker, 1921). Gil Collado (1930) subsequently described what he believed to be the male of the species, also based on Spanish specimens. *E.pauper* is included in the keys provided by Sack (1928-32) and Stackelberg (1961). **Illustrations of the adult insect:** none known.

Eumerus petrarum Aguado-Aranda, Nedeljković & Ricarte, in Aguado-Aranda *et al*., 2023
Preferred environment: unimproved montane and subalpine grassland with rock outcrops; at lower altitude (1400m.) in "*Quercus*" forest (Aguado-Aranda *et al*., 2023). **Adult habitat and habits:** settles on rocks in open ground. **Flowers visited:** no data. **Flight period:** May/June. **Developmental stages:** not described. **Range:** southern Spain. **Determination:** this species is characterised genetically and both the male and the female are described in Aguado-Aranda *et al*. (2023), based on a large number of specimens. Aguado-Aranda *et al*. (2023) figure the male terminalia and include *E. petrarum* in their key to European *tricolor*-group species. Morphologically, this species is extremely similar to *E. sabulonum*, from which the male differs in the shape of the posterior lobe of the surstylus and the proportions of the vertex. The photo of the vertex of the male of *E. petrarum* in Aguado-Aranda *et al*. (2023) shows that it broadens progressively as far as the posterior margin of the eyes. In males of *E. sabulonum* the vertex is parallel-sided from anterior to the ocellar triangle back to the posterior margin of the eyes. Females of *E. petrarum* and *E. sabulonum* are distinguished by the shape of the third article of the antenna, which is essentially angled apicoventrally in *E. petrarum*, but broadly rounded apicoventrally in *E. sabulonum*, and by the vertical triangle, more elevated above the general surface of the vertex in *E. petrarum* than in *E. sabulonum*. This last feature is difficult to interpret from the photos provided in Aguado-Aranda *et al*. (2023). **Illustrations of the adult insect:** the general appearance of the male and female of *E. petrarum* can be seen in the coloured photos provided by Aguado-Aranda *et al*. (2023).

Eumerus phaeacus Chroni, Grković & Vujić, in Chroni *et al*, 2018
Preferred environment: forest; thermophilous *Quercus* forest (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** Greece (Corfu); Montenegro. **Determination:** This is one of four cryptic species comprising the *minotaurus* group, as defined by Chroni *et al*. (2018), who characterise *E. phaeacus* on a combination of genetic and morphometric features, but also detail small morphological differences between it and other species in the group, primarily in the male terminalia. **Illustrations of the adult insect:** none known.

Eumerus pulchellus Loew, 1848
Preferred environment: open, well-drained ground with low vegetation; unimproved, permanent pasture and *Pteridium*-covered terrain. **Adult habitat and habits:** flies low, within 1m of the ground, with a rapid, zigzag flight, through and round ground vegetation at pathsides and in open patches. This species settles in the sun on vegetation (including *Pteridium*) or the ground surface, preferring bare ground or stones if there is a drop in temperature, such as is occasioned by cloud passing in front of the sun. **Flowers visited:** *Euphorbia, Potentilla erecta*, white umbellifers. **Flight period:** May and end July/September, with peak in August. **Developmental stages:** developmental stages described and figured by Ricarte *et al*.(2008), from larvae found in cavities in tubers of the asphodel, *Asphodelus aestivus* and sea squill, *Urginea maritima*. *Asphodelus albus* and *Asphodelus ramosus* have also been identified as plant hosts for the larvae (Speight and Garrigue, 2014). So far, larvae of *E. pulchellus* have been found accompanying larvae of other bulb/tuber inhabiting syrphid larvae and it seems likely that this species is dependent upon larvae of other species to provide the conditions of plant tissue decay under which its own larvae can develop. **Range:** Spain; from the foothills of the Pyrenees on the Atlantic coast of France (Pyrenées-Atlantiques) south to the Mediterranean coast; southern Switzerland (Tichino); round the Mediterranean basin through Italy, the former Yugoslavia, Greece (including Crete and Rhodes); Roumania; Cyprus and Turkey to N Africa. **Determination:** Bradescu (1991). The male can be distinguished from the males of other western European *Eumerus* species using the keys in Speight *et al*. (2021). The long, white, ventrally-directed, hairs on the lateral margins of the abdominal tergites are useful in halping to identify the male of this species. The male terminalia are figured by Vujić and Šimic (1999). Sternite 4 of the male is figured by Speight and Garrigue (2014), who also review diagnostic features of the species. In Stackelberg's (1961) key it is indicated that, in this species, the antennae are partly orange/red and the legs partly yellow. However, both legs and antennae may be entirely black/dark brown in *E. pulchellus*. The female of *E. pulchellus* is omitted from Stackelberg's (1961) key. Because its antennae may be partly orange/red, or entirely charcoal/dark brown, and its tibiae may be mostly yellow or mostly black, the female would key out to four different couplets in Stackelberg's (1961) key. Both sexes of *E. pulchellus* are included in the key to some western European *Eumerus* species provided by Speight *et al*. (2013). **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021).

Eumerus purpurariae Baez, 1982
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** February/May. **Developmental stages:** undescribed. The developmental stages described as those of *E.purpurariae* by Pérez-Bañón and Marcos-García (1998) are those of *E.etnensis* (see Smit et al, 2004). **Range:** this species is endemic to the Canary Isles. **Determination:** Baez (1982), who describes both the male and the female and provides a key in which the male of *E.purpurariae* is distinguished from males of the other *Eumerus* species known from the Canary Isles and Smit et al.(2004), who figure features of the male terminalia and detail distinctions between this species and the closely similar *E.etnensis* van der Goot. **Illustrations of the adult insect:** none known.

Eumerus purpureus Macquart, in Webb & Berthelot, 1839
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** throughout the year. **Developmental stages:** not described. **Range:** this species is endemic to the Canary Isles (Spain). **Determination:** Baez (1982), who provides a key separating males of this species from males of the other *Eumerus* species known from the Canary Isles and Smit et al.(2004), who provide features to distinguish this species from the closely related *E.hispidus* Smit et al, with which *E.purpureus* has been confused in recent literature. These authors also figure the male terminalia and female sternite 3 of both of these species. **Illustrations of the adult insect:** none known.

Eumerus pusillus Loew, 1848
Preferred environment: forest/open ground; open areas in *Castanea* forest (M. Miličić, pers. comm.); *Cistus florida/Quercus pyrenaica* maquis (M.A. Marcos-García, pers.comm.) and more open, semi-arid, almost bare ground; hedgehog heath; Mediterranean dune systems. **Adult habitat and habits:** flies low, settling on stones and bare ground in the sun**. Flowers visited**: umbellifers; *Euphorbia, Foeniculum, Hedera, Mentha, Nasturtium officinale, Solidago, Vinca* (most of information from Marcos-García, 1985a). **Flight period:** April/September, with peaks in April/May and September. **Developmental stages:** larva described and figured by Ricarte *et al*. (2008) from larvae in decaying parts of bulbs of sea squill, *Drimia maritima*. Van Eck (2016a) reports further rearings of *E. pusillus* from *D. maritima* bulbs. **Range:** Portugal, Spain, the Mediterranean zone of France and round the Mediterranean to Greece and Turkey, including islands e.g. Sardinia, Sicily, Malta, Cyprus, Rhodes and Crete, and on to Tunisia and Algeria in N Africa. **Determination**: the male can be separated from the males of other Western European *Eumerus* species using the keys in Speight *et al*. (2021); Stackelberg (1961). The hind tibia of the female is figured by Speight *et al.* (2013a). **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021).

Eumerus richteri Stackelberg, 1960
Preferred environment: forest; Eastern thermophilous *Quercus* forest. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Croatia, NE Greece, Montenegro, Serbia, Turkey and the Transcaucasus (Azerbaijan). **Determination:** Stackelberg (1961); Grković *et al*. (2021). The male terminalia are figured by Vujić & Šimić (1999) and Grković *et al*. (2021). This is a *tricolor*-group species. **Illustrations of the adult insect:** the abdomen of the male and female are shown in colour, in dorsal view, in Grković *et al*. (2021)..

Eumerus rubrum Grković & Vujić, in Grković *et al*, 2017
Preferred environment: herb-rich open areas in Mediterranean *Pinus* forest (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/June. **Developmental stages:** not described. **Range:** Greece. **Determination:** the description of this species is based on a single male and a single female. In Grković *et al.*(2017) figures are provided of the male terminalia and various other features of male and female morphology. *Eumerus rubrum* belongs to the *tricolor* group and has the abdominal tergites extensively red in both sexes. It is included in the keys to *tricolor*-group species of SE Europe, in Grković *et al*. (2021). *Eumerus rubrum* is also included in the keys in Aguado-Aranda *et al*. (2023). See also under *Eumerus tauricus*. **Illustrations of the adult insect:** the male abdomen is shown in colour, in dorsal view, in a photo provided by Grković *et al.*(2017); male shown in colour in lateral view in Vujić et al, 2020).

Eumerus ruficornis Meigen, 1822
Preferred environment: humid, unimproved, lowland grassland at the edge of floodplains; beside flushes/seepages and along river banks where *Scorzonera humilis* is present, in humid, unimproved, lightly-grazed, seasonally-flooded grassland with *Scorzonera humilis*. **Adult habitat and habits:** flies in the open among grasses and low-growing vegetation; settles on taller plants like *Pteridium*, in dappled sunlight. **Flowers visited:** *Potentilla erecta, Ranunculus.* **Flight period:** end

May/beginning July . In southern parts of the range also August/beginning September. **Developmental stages:** Johansson (2011) provides evidence indicating that a larval host plant of *E. ruficornis* is *Scorzonera humilis*. **Range:** from southern Sweden (recently rediscovered: see Johansson, 2011) and Finland south to the Mediterranean; east through the Baltic states and Poland into European parts of Russia; in southern Europe from Spain to the former Yugoslavia; N Africa. This species is extinct in Denmark and has not been recorded recently from Atlantic parts of Europe north of central France. It does not seem to have been recorded from most parts of central Europe. Johansson (2011) links disappearance of *E. ruficornis* to increased intensity of agricultural use of erstwhile humid grassland, causing loss of its putative larval host plant, *Scorzonera humilis*. *Scorzonera hispanica* (black salsify) was, until some 50 years ago, cultivated widely for its root in various parts of Europe, but has more recently gone out of fashion as a vegetable. Whether *E. ruficornis* can use *S. hispanica* as a larval food plant is at present unknown. If it can, diminution in use of this plant as a vegetable could also have led to a reduction in the frequency and range of *E. ruficornis*, since *S. hispanica* can be cultivated outside the natural range of *S. humilis*. **Determination:** the male of *E.ruficornis* can be distinguished from other *Eumerus* species known from Atlantic parts of Europe using the keys in Speight *et al.*(2021). The name of this species is misleading, in that the 3rd. antennal segment varies in colour, from entirely brown to pale orange with the dorsal margin infuscated. This variability is noted for the female, in the key in Speight *et al.*(2013a), but not accomodated in the keys of Bradescu (1991), Stackelberg (1961) and Van Veen (2004). Neither is it noted for the male in Speight *et al.* (2013a). In addition, the number of black spines on the ventral surface of the hind femur is more variable than is indicated for the female, in the key in Speight *et al.* (2013a). There can be 9 or more spines in the anterolateral row and up to 14 in the posterolateral row. In both male and female *E.ruficornis* may be distinguished from various similar species by its lack of pale grey dust spots against the eye margins on the vertex, adjacent to the ocelli. Also, in both sexes, the silver-grey transverse bands of dusting on the tergites narrow progressively towards the mid-line of the tergites, whereas in *strigatus* group species these dust bands expand, or are parallel-sided, within the median half of their length. The male exhibits a feature found in few other European *Eumerus* species, in having a dirty white band across the posterior margin of the fourth tergite. In the females, tergite 5 is almost entirely black haired. **Illustrations of the adult insect:** The adult insect is illustrated in colour by Bartsch *et al.* (2009b), Torp (1994) and Speight *et al*. (2021).

Eumerus rusticus Sack, 1932

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** Roumania, Turkey, Turkmenistan. **Determination:** both sexes are described by Sack (1928 - 32). The species is included in the keys provided by Sack (1928 – 32) , Stackelberg (1961) and Bradescu (1991). **Illustrations of the adult insect:** none known.

Eumerus sabulonum (Fallen), 1817

Preferred environment: open ground; coastal dune systems and low, rocky, coastal undercliffs at the northern edge of its range; dry, sandy areas of alluvial floodplains and dry, open, sandy areas within forest over much of continental Europe; open areas within *Quercus ilex* forest and maquis; in southern Europe also in unimproved, montane grassland. **Adult habitat and habits:** flies fast and very close to the ground surface, settling on bare ground. May visit patches of damp sand at the edge of streams to drink, during hot weather. **Flowers visited:** *Aegopodium podagraria, Euphorbia, Jasione montana, Potentilla erecta, Rosa pimpinellifolia.* **Flight period:** May/August. **Developmental stages:** Munk (2000) observed early instar larvae of apparently this species in cavities they had presumably made in the leaves of *Jasione montana*, on which he had previously observed oviposition by *E. sabulonum*. Unfortunately the larvae were not reared to maturity. Stubbs (1997) also reported a female apparently ovipositing on a rosette of *Jasione montana*. **Range:** from southern Fennoscandia south to N Africa; from Britain (England) eastwards through central and southern Europe into European parts of Russia. **Determination:** both sexes are included in the keys to European *tricolor*-group species in Aguado-Aranda *et al*. (2023) and in the keys to *tricolor*-group species of SE Europe in Groković *et al*. (2021). The male is included in the keys to central European *Eumerus* species in Speight *et al*. (2021). Separation of the female of *E. sabulonum* from females of *E. petrarum*, *E. tarsalis* and *E. tauricus* cannot consistently be achieved. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.* (2009b), Stubbs and Falk (1983), Torp (1994) and Speight *et al*. (2021).

Eumerus santosabreui Baez, 1982

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** throughout the year. **Developmental stages:** not described. **Range:** this species is endemic to the Canary Isles. **Determination:** Baez (1977) redescribes this species, which was then known as *E.auratus* Santos Abreu. Baez (1982) provides a key in which the

male of *E. santosabreui* is distinguished from males of the other *Eumerus* species known from the Canary Isles. **Illustrations of the adult insect:** none known.

Eumerus sardus Aguado-Aranda, Ricarte and Hauser, in Aguado-Aranda *et al*., 2024
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June. **Developmental stages:** not described. **Range:** Sardinia, Corsica. **Determination:** the description of this species is based on 2 males. The female remains undescribed. Discovery of this species resulted from genetic analysis of material of *Eumerus sulsitibius* from various parts of Europe (Aguado-Aranda *et al*., 2024). It is a member of the *barbarus*-groip, morphologically extremely similar to *E. sulsitibius*, from which it is distinguishable by small differences in the form of the surstyli of the male genitalia, illustrated in Aguado-Aranda *et al*. (2024). The only identification key which covers all of the *barbarus*-group species now known in Europe is to the males only, in Aguado-Aranda *et al*. (2024). The two males constituting the type material of *E. sardus* also differ from males of *E. sulcitibius* in having the entire length of the dorsum of the mesoscutum covered in a mixture of black and yellow hairs – in males of *E. sulcitibius* black hairs are absent from the part of the dorsum of the mesoscutum anterior to the transverse suture (Aguado-Aranda *et al*., 2024). Further, the dorsal surface of the hind tibia has abundant black hairs in the *E. sardus* male, but is entirely covered in yellowish-white hairs in *E. sulcitibius* males. Corsican males of *E. sardus* exhibit the same morphological features that distinguish Sardinian males from *E. sulcitibius*. **Illustrations of the adult insect:** an indication of the general appearance of the male is provided by the coloured illustration of one in side view in Aguado-Aranda *et al*. (2024).

Eumerus sicilianus van der Goot, 1964
Preferred environment: the vicinity of springs/streams in xeric, non-calcareous, open ground (van der Goot, 1964). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Developmental stages:** not described. **Range:** Sicily. **Determination:** van der Goot (1964), who figures the hind leg and antenna of the male. The female remains undescribed. **Illustrations of the adult insect:** none known.

Eumerus sinuatus Loew, 1855
Preferred environment: open ground/deciduous forest; dry scrub woodland of *Quercus pubescens* with open areas. **Adult habitat and habits:** males venture out of *Q.pubescens* thickets into adjacent grassland in the morning, flying fast and low, to settle on low-growing vegetation or bare soil, but don't seem to remain in the open once temperatures exceed 20°. **Flowers visited:** no data. **Flight period:** May-beginning July and August. **Developmental stages:** not described. **Range:** central and southern France, Germany, Czech Republic, Switzerland Austria, Serbia, and Roumania. **Determination:** the maled is included in the keys in Speight *et al*. (2021); both the male and the female are keyed out by Grković *et al*. (2021) and Aguado-Aranda *et al*. (2023). The male terminalia are figured by Vujić and Šimic (1999). In life, the thoracic dorsum of the male of this species is a metallic purple. But this colour fades after death, to be replaced by a non-metallic, dark green. **Illustrations of the adult insect:** the male is illustrated in colour in Speight *et al*. (2021), the female in Claude & Speight (2024).

Eumerus sogdianus Stackelberg, 1952
Preferred environment: open ground; dry, unimproved pasture and montane grassland; farmland, particularly potato fields, on sandy soils; fixed dune grassland (grey dunes) and sandy alluvial floodplains, plus humid, unimproved grassland. This species may also occur along the landward edge of *Phragmites* beds, in grassland in southern Europe (D. Sommaggio, pers.comm.). **Adult habitat and habits:** pathsides, hedges, flies close to the ground and settles on low-growing vegetation. **Flowers visited:** white umbellifers; *Sedum acre*. **Flight period:** May/June & end July/August. **Developmental stages:** undescribed, but reared from *Allium* spp., *Daucus carota* and *Solanum tuberosum*. This species overwinters as a larva (Brunel and Cadou (1994). The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Denmark south to southern Spain; from Britain (S England) and Belgium eastwards through central and southern Europe into European parts of Russia and on into central Asia (Kazakhstan, Tajikistan, Uzbekistan, Mongolia); China. The presence of this species in Western Europe has only been recognised recently. **Determination:** the male of *E. sogdianus* may be distinguished from males of other western and central European *E. strigatus* group species using the keys provided by Speight *et al*. (2013a, 2021), where the fourth sternite of the males is also figured. In Speight *et al*. (2013a) the key also attempts to separate females of *E. sogdianus* from females of *E. consimilis* and *E. strigatus*, but the features used have subsequently proven unreliable. The male terminalia are figured by Vujić and Šimic (1999). Verlinden & Decleer (1987) point out that *E. strigatus*,

E. sogdianus and *E. funeralis* can be found flying together. Further south in Europe, *E. consimilis* and *E. sogdianus* can also be found in the same localities. *E. sogdianus* is indistinguishable from other *E. strigatus* group species in the field. **Illustrations of the adult insect:** The adult insect is illustrated in colour by Bartsch *et al*. (2009b), Torp (1994) and Speight *et al*. (2021).

Eumerus strigatus (Fallen), 1817

Preferred environment: wetland/forest/open ground; unimproved, humid, seasonally-flooded grassland, deciduous forest and open, dry unimproved pasture, including dune grassland; to some extent anthropochorous, occurring sometimes in horticultural land and suburban gardens. **Adult habitat and habits:** among thick vegetation of humid grassland, edges of clearings and tracks, etc.; flies low, usually keeping within vegetation; in dry grassland often settles on the ground, on stones etc. **Flowers visited**: umbellifers; *Allium ursinum, Convolvulus, Eschscholzia californica, Euphorbia, Fragaria, Leontodon, Papaver, Potentilla erecta, Ranunculus, Sonchus arvensis, Taraxacum.* **Flight period:** May/September, with peaks in June and August. **Developmental stages:** puparium described and figured by Ricarte *et al.*(2017); larva supposedly described and figured by Heiss (1938); bulb feeder, recorded from Amaryllidaceae, parsnip, carrot, potato, asparagus, artichoke roots (*Cynara scolymus*) and *Iris* rhizomes, plus rotting grapefruit, though how many of these plant host records refer to *strigatus*, rather than closely similar *Eumerus* species, cannot be ascertained. The comparison between larvae of *E. funeralis* (as *tuberculatus*) and "*Eumerus strigatus*", provided by Hodson (1932a), probably highlights larval features which can aid in separating the larvae of *strigatus* group species. But which species were included among the larvae (apparently of horticultural origin and from various parts of Europe) he regarded as those of *E. strigatus* cannot be known, given that subsequently both *E. narcissi* and *E. sogdianus* have been found in Britain, neither of which were recognised in Europe at the time Hodson (1932a) was writing. *Eumerus strigatus* is regarded as a minor pest of horticulture, but apparently only attacks bulbs etc. when they are rotting. This species overwinters as a larva (Brunel and Cadou (1994). **Range:** Fennoscandia south to Iberia and the Mediterranean; much of Europe through into Turkey and Russia; from the Urals to the Pacific coast (Sakhalin); Japan; introduced to the Nearctic and recorded from both Canada and the USA; introduced to the Neotropical (Argentina); introduced to both Australia and New Zealand. **Determination:** the males of *strigatus* group species known in western and central Europe can be distinguished from one another using the key provided by Speight *et al.* (2021). The male terminalia are figured by Vujić and Šimic (1999). The female remains indistinguishable from the females of *E. consimilis* and *E. sogdianus*. **Illustrations of the adult insect:** The adult insect is illustrated in colour by Bartsch *et al.* (2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Speight *et al*. (2021).

Eumerus subornatus Claussen, 1989

Preferred environment: small open areas in *Quercus pyreniaca* forest, thermophilous oak forest of *Q.faginea*, evergreen oak forest of *Q.suber* and Mediterranean scrub (M.-A. Marcos-García & A. Ricarte-Sabater, pers.comm.). **Adult habitat and habits:** flies very close to the ground (M.-A. Marcos-García & A. Ricarte-Sabater, pers.comm.); comes to drink at the edge of springs in hot conditions. **Flowers visited:** yellow composites and *Urginea maritima* (M.-A. Marcos-García & A. Ricarte-Sabater, pers.comm.). **Flight period:** May to October (in the Mediterranean zone of Europe). **Developmental stages:** not described. **Range:** Morocco (Claussen, 1989); Portugal (Van Eck, 2011); "Pyrenees" (Schmid, 1995); Mediterranean zone France (Speight and Ricarte, 2012; Lebard, 2022); Spain (Ricarte Sabater *et al.*, 2008). **Determination:** both male and female of this species can be separated from other European ornatus group species, using the keys in Speight *et al*. (2021). Claussen (1989) who figures the male terminalia and details distinctions from *E.ornatus*. Features for separation of the female from the female of *E.ornatus* are provided by Speight and Ricarte (2012). Tergite 2 may be partly red/orange or entirely black (but still with a pair of silver-grey dust bars) in this species. Specimens appearing entirely black when dry can exhibit a pair of translucent, pale marks on tergite 2 when wet (e.g. in alcohol from Malaise trap catches). In this condition they can be misdetermined as *E.lucidus*, using Stackelberg's (1961) key. The female remains extremely difficult to separate from the females of *E.argyropus*, from which it may be distinguished by the black hairs intermixed with whitish hairs, on the hind tibiae. In females of E.*argyropus* the hairs on the hind tibiae are all pale, and silver-grey. **Illustrations of the adult insect:** the female is illustrated in colour in Speight *et al*. (2021).

Eumerus sulcitibius Rondani, 1868

Preferred environment: open ground; semi-arid, unimproved grassland and open woodland of *Quercus pyrenaica* (Marcos-García, 1985a). Small open areas beside rivers in *Quercus ilex* forest. **Adult habitat and habits:** flies through grassland vegetation, settling on the ground; in woodland, flies low in open, herb-rich glades, in the sun, settling on low tree foliage and

bare twigs. **Flowers visited:** *Ferula* (T. Lebard, pers. comm.), *Thapsia* (Marcos-García, 1985a), *Euphorbia*. **Flight period:** April/September. **Developmental stages:** not described. **Range:** requires re-assesment, due to the recent description of the closely similar European species *E. sardus*. At present *E. sulcitibius* is recognised as occurring in southern Europe from Portugal round the Mediterranean basin to Italy and Montenegro and on to Turkey, including islands e.g. Corsica, Sardinia, Sicily and Crete; Georgia; Azerbaijan. **Determination:** the only identification key which covers all of the *barbarus*-group species now known in Europe is to the males only, in Aguado-Aranda *et al*. (2024). The keys in Speight *et al*. (2021) separate the male of *E. sulcitibius* from the males of most western European *Eumerus* species, but do not include either *E. gibbosus* or *E. sardus*. Van Steenis *et al.* (2017) provide a key in which *E. sulcitibius* is separated from other European "*barbarus* group" species except *E. sardus*, and give a detailed description of the characteristics of the "*barbarus* group". The male terminalia are figured by Vujić and Simic (1999), Van Steenis *et al.* (2017) and Aguado-Aranda *et al*. (2024). For distinctions from *E. sardus* see the *E. sardus* species account. **Illustrations of the adult insect:** the general appearance of this species is shown in the coloured photos provided by Van Steenis *et al.*(2017). The male is illustrated in colour in Speight *et al*. (2021).

Eumerus tarsalis Loew, 1848

Preferred environment: forest/open ground; both coniferous and deciduous forest, including humid *Fagus/Picea* forest and *Fagus/Fraxinus* forest in central Europe; unimproved, alpine pasture up to above 2000m in the Alps; montane *Pinus* forest in southern Europe. **Adult habitat and habits:** flies fast and low over the bare ground of tracksides or other open areas in forest and rocky stream margins, usually in partial shade; settles on bare ground, rocks or fallen branches etc. **Flowers visited:** Apiaceae. **Flight period:** May/July and August at higher altitudes. **Developmental stages:** undescribed. **Range:** from Belgium (extinct) south to N Africa and east through central and southern Europe into Russia and on into eastern Siberia; Mongolia. **Determination:** The long, blunt-ended pegs occurring laterally on each segment of the fore tarsi in both sexes help to distinguish this species. But it nonetheless remains easy to confuse with both *E. sabulonum* and *E. tauricus*, especially in the female. The length of the eye suture, used by Stackelberg (1961) in separation of the male of *E. tarsalis* from the male of *E. sabulonum*, is not very constant, and males of *E. tarsalis* can be found in which the eyes are distinctly, if narrowly, separate. Males of *E. tarsalis* can be separated from males of *E. sabulonum* by the character of the hair fringe on the postero-lateral surface of the middle femur. In *E. tarsalis* (and *E. tauricus*) males these hairs are longer than the femur is wide and are crinkled apically. In *E. sabulonum* they are shorter than the femur is wide and simple apically i.e. without crinkled tips. The male of *E. tarsalis* can be distinguished from males of most Western Europen *Eumerus* species using the keys in Speight *et al*. (2021), the exceptions being some Iberian *tricolor*-group species. Keys to the males and females of European *tricolor*-group species, including *E. tarsalis*, are provided by Aguado-Aranda *et al*. (2023). The male terminalia are figured by Vujić and Šimic (1999) and Grković *et al.* (2017, 2021). Females of *E. sabulonum* and *E. tarsalis* canot always be distinguished. **Illustrations of the adult insect:** the male is illustrated in colour by Speight and De Courcy Williams (2016), Bot and Van de Meutter (2019) and Speight *et al*. (2021).

Eumerus tauricus Stackelberg, 1952

Preferred environment: steppe (Barkalov and Popov, 2000). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/mid July. **Developmental stages:** not described. **Range:** Roumania, Serbia, Ukraine. **Determination:** the female is included in the keys provided by Stackelberg (1961); the male is included in the keys in Speight *et al*. (2021). *E. tauricus* is not included by Grković *et al*. (2021), in their keys to *tricolor*–group species of SE Europe, but both sexes are included in the keys to European *tricolor*-group species in Aguado-Aranda *et al*. (2023). Barkalov (1991), figured the male terminalia of this species under the name *carasukensis*, later synomysed with *E. tauricus* by Barkalov and Popov (2000). Additional information is also provided by Barkalov and Popov (2000), including figures of the hind leg. Those authors detail features for separation of the male of *E.tauricus* from the male of *E.sabulonum.* Grković *et al.* (2017) mention that the male terminalia of *E. tauricus* and *E. rubrum* are indistinguishable, and provide other features for distinguishing the males of these two species. The keys in Speight *et al*. (2021) separate the male of *E. tauricus* from males of central European *Eumerus* species. **Illustrations of the adult insect:** the male is illustrated in colour by Speight *et al*. (2021).

Eumerus tenuitarsis Grković & Vujić, in Grković, Smit, Radenković, Vujić & van Steenis, 2019

Preferred environment: open areas in *Castanea* forest (M. Miličić, pers. comm.); thermophilous *Quercus* forest (Vujić et al, 2020)**Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** NE Greece (female); the Aegean island of Lesvos (male); Turkey (supplementary data file, Demirözer *et al.*, 2022). **Determination:** description of this species is based on a solitary male and a solitary female, from widely separated

locations. Grković *et al.* (2019) do not state on what the basis the male and female are recognised as belonging to the same species. Subsequently, additional females (without accompanying males) have been collected from Turkey. *Eumerus tenuitarsis* is a member of the *binominatus* subgroup of the *tricolor* group of *Eumerus* species. This subgroup is defined by Grković *et al.* (2019). A characteristic feature of the subgroup is extremely long and spindly legs, figured by Grković *et al.* (2019). These authors also figure the male terminalia of *E. tenuitarsis* and include it in a key to the known species of the *binominatus* subgroup. Grković *et al*. (2021) include it in their keys to *tricolor*–group species of SE Europe and Aguado-Aranda *et al*. (2023) include both sexes in their keys to European *tricolor*-group species. **Illustrations of the adult insect:** the general appearance of this species can be seen in the photos of the male holotype provided in Grković *et al.* (2019).

Eumerus torsicus Grković & Vujić, in Grković *et al.*, 2015
Preferred environment: along streams in *Pinus brutia* forest (Van Steenis *et al*, 2019); thermophilous *Quercus* forest (Vujić *et al*, 2020); riparian *Platanus* forest (Van Steenis *et al.*, 2021). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September/November. **Developmental stages:** not described. **Range:** Greece (Aegean islands of Chios and Samos); Cyprus, Turkey, Iran. **Determination:** the male and female are described in Grković *et al.* (2015), who also figure the male terminalia and other features. A diagnostic feature of the male is that the hind tibia is strongly bent, inwards, in the apical fifth of its length. In both sexes the tergites are without pale markings and a pair of silver-grey dust stripes is present on tergites 2 – 4. Grković *et al.* (2015) suggest this species has an isolated position within the genus *Eumerus*. Malidžan *et al.* (2022) indicate that, with *E. incisus*, *E. torsicus* forms a separate group within the genus. **Illustrations of the adult insect:** the general appearance of this species can be seen in the coloured photos of the male and female in side view provided by Grković *et al.* (2015).

Eumerus tricolor (Fabricius), 1798
Preferred environment: scrub, hedgerows, dry, unimproved, permanent pasture, including montane grassland from within the *Fagus/Picea* zone up to the *Abies/Picea* belt. **Adult habitat and habits:** flies low down among sparse pathside vegetation etc.; often settles on bare ground or low-growing vegetation; very fast flying. **Flowers visited:** *Euphorbia*, *Ranunculus*, white umbellifers. **Flight period:** beginning May/July; from beginning April in southern Europe and on to the beginning of August at higher altitudes. **Developmental stages:** larva and puparium described by Arzone (1972). The species has been reared from *Tragopogon* (Loiselle, 1914; Arzone, 1973) and is recognised as a pest of crops of *T. porrifolius* (Arzone, 1972). **Range:** from Netherlands south to the Mediterranean; from Belgium eastwards through central Europe to European parts of Russia; through Siberia to the Pacific coast, including the Sakhalin peninsula. Decreasing over much of Europe and seemingly not associated with any crop vegetables. **Determination:** both sexes are included in the keys to European *tricolor*-group species in Aguado-Aranda (2023) and to *tricolor*-group species of SE Europe in Grković *et al.* (2021). The male can be separated from males of other *Eumerus* species known from Atlantic and central Europe using the keys in Speight *et al*. (2021). The male terminalia are figured by Vujić and Šimic (1999) and Grković *et al.* (2017). Grković *et al.* (2021) confirm that *E. varius* of Meigen is a junior synonym of *E. tricolor*. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019) and Speight *et al*. (2021); http://cyrille.dussaix.pagesperso-orange.fr/

Eumerus truncatus Rondani, 1868
Preferred environment: forest; matorral and garrigue (Vujić *et al*, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Foeniculum* (Van Eck *et al*., 2020). **Flight period:** January/July. **Developmental stages:** not described. **Range:** Portugal; Spain; Corsica (France); Greece (Aegean islands of Crete, Lesvos, Naxos); Italy (Sicily); N Africa (Morocco, Tunisia). **Determination:** the original description is of a solitary male. *E. truncatus* has been regarded as a synonym of *E. barbarus* in recent literature, but was cited by Grković *et al.* (2016) as a separate species, without comment other than that the type material was examined by the authors. Subsequently it was reinstated as a distinct species by Van Steenis *et al.* (2017), who redescribe the male and figure its terminalia and the fourth abdominal sternite. *E. truncatus* is a member of the "*strigatus* group". The female remains unknown. Tbis species is not included in any key and the only information available on its separation from other European species is that in Van Steenis *et al.* (2017). **Illustrations of the adult insect:** the general appearance of this species can be seen from the coloured photos provided by Van Steenis *et al.* (2017) and Vujić *et al.* (2020d).

Eumerus tuberculatus: see under *E.funeralis* Mg.

Eumerus uncipes Rondani, 1850

Preferred environment: deciduous forest; thermophilous *Quercus* forest and scrub. **Adult habitat and habits:** edges of clearings, tracksides etc. within dry, scrub-oak forest, including old, coppiced forest maintained for truffles production; a secretive species that "skulks" around the edge of thickets of scrub, or scrubby forest margins, remaining motionless on lower leaves or on bare twigs for much of the time, within the hem of the thicket. **Flowers visited:** no data. **Flight period:** May/October. **Developmental stages:** not described. **Range:** imperfectly known. France, from the Rhine valley south to the Mediterranean; Germany, northern and central Italy and Roumania. **Determination:** the male can be distinguished from males of other central and western European Eumerus species using the keys in Speight *et al*. (2021). It is extremely similar to the male of *E. clavatus* Becker, from which it may be distinguished by the shape of the black, median projection close to the posterior margin of abdominal sternite 3. In *E. clavatus* this projection is more of less triangular, coming to a pronounced point apically. In *E. uncipes* it is roughly rectangular, with an irregular apical margin, which is more or less parallel to the long axis of the body. Also, in males of *E. uncipes*, there is a short, blade-like projection (difficult to see) at the apex of the hind tibia, absent in *E. clavatus*, *E. colladoi* and *E. hungaricus*. The females of *Eumerus clavatus*, *E. colladoi* and *E. uncipes* are more difficult to separate and the female of *E. uncipes* is also extremely similar to the female of *E. amoenus*. The females of *E. clavatus* and *E. uncipes* have an almost vertical groove within the third article of the antenna, which separates them from the females of these other species. In the female of *E. uncipes* the second segment of the hind tarsus is distinctly less than twice as long as wide, whereas in *E. clavatus* it is at least twice as long as wide. **Illustrations of the adult insect:** the male is illustrated in colour by Speight *et al*. (2021).

Eumerus vandenberghei Doczkal, 1996

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May, September. **Developmental stages:** not described. **Range:** Corsica; Sardinia. **Determination:** the male is included in the keys in Speight *et al*. (2021, providing for separation of the male of *E. vandenberghei* from the males of other *strigatus*-group species known from western and central Europe. Doczkal (1996) figures the male terminalia and provides distinctions from the closely related *E. funeralis*, with which it shares the feature of a bulge, baso-ventrally, on the hind femur. **Illustrations of the adult insect:** none known.

Eumerus vestitus Bezzi, 1912

Preferred environment: semi-arid, sparsely-vegetated, herb-rich, open ground communities beside seasonal water bodies (Van Steenis *et al.*, 2019). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** February/May and November (Arabian peninsula). **Developmental stages:** not described, but larvae were reared by Anooj *et al.* (2020) from tomatoes attacked by the tomato pest *Atherigona orientalis* Schiner (Muscidae). Shaumar and Kamal (1978) also record grapes, peaches, potatoes and water melon as supporting larval development. **Range:** Greece (Santorini); Cyprus; N Africa (Egypt); Arabian Peninsula; Sudan; Afrotropical region (Guinea-Bissau); Oriental region (India). Believed to be transported outside its natural range as larvae in consignments of fruit. The first mention of occurrence of this species in Europe is by Grković *et al.*(2016), who include it in a list of *Eumerus* species from islands of the eastern Mediterranean, without comment, beyond stating "identity confirmed by J. Smith". **Determination:** in Bezzi's (1912) original description of *E. vestitus* both the male and the female are described. Bezzi (1912) also provides a key, in which *E. vestitus* is separated from the closely similar *E. obliquus*. In the keys provided by Stackelberg (1961) the male of *E. vestitus* is included, but not the female. According to Bezzi (1912) in *E. vestitus* there are lunulate stripes of grey dusting only on tergites 2 and 3, whereas in *E. obliquus* a pair of dust stripes is also present on tergite 4. In Smit *et al.* (2017) it is shown that tergite 4 in *E. vestitus* is almost entirely covered in grey dusting. The key provided by Smit *et al.* (2017) separates *E. vestitus* from both *E. obliquus* and the closely similar *E. incilis*, Smit. Smit *et al.* (2017) regard *E. efflatouni* Curran as a synonym of *E. vestitus*. **Illustrations of the adult insect:** the general appearance of the male of this species is shown in the coloured photos provided by Smit *et al.* (2017) and in Vujić *et al*. (2020d). The female is similarly illustrated by Dawah *et al.* (2020).

EUPEODES

Until recently the European species of *Eupeodes* appeared under the generic name *Metasyrphus*, but Vockeroth (1986a) showed that there is no basis for segregating *Eupeodes* and *Metasyrphus* species in separate genera and pointed out that the generic name *Eupeodes* had precedence over *Metasyrphus*. As *Metasyrphus*, the European species of this genus have been

revised by Dusek and Laska (1976). Since then 4 further European species, *E.biciki, E. duseki, E.lucasi* and *E.goeldlini* have been described, by Marcos-García and Laska (1983), Mazánek et al.(1999a) and Nielsen (2003). *E.curtus* (Hine) has been added to the European list (Finland and Iceland) by Vockeroth (1992) and the presence of *E.nigroventris* (Fluke) in Europe (Iceland) has been confirmed by Olafsson (1991). Despite the careful work of Dusek and Laska several European *Eupeodes* species remain difficult to determine and there is clear need for critical comparison between European and N American taxa, especially in the subarctic fauna – it is extremely likely that more of the northern European *Eupeodes* species are holarctic. Mazánek *et al*.(1999b) demonstrate this, in showing that the N American *E.chillcotti* is conspecific with *E.punctifer*.

Eupeodes abiskoensis (Dusek & Laska), 1973
Preferred environment: open ground; dwarf *Betula* scrub and herb-rich, unimproved subalpine grassland and heathland. **Adult habitat and habits:** no data. **Flowers visited:** male *Salix* (Nielsen, pers.comm.); *Bartsia alpina, Pinguicula alpina* (Bartsch et al, 2009). **Flight period:** June/July (Nielsen, pers.comm.). **Developmental stages:** not described. **Range:** northern Fennoscandia (Norway, Sweden, Finland) and the Nearctic (Canada, see Mazánek *et al*, 1999b). **Determination:** Dusek & Laska (1976); Haarto and Kerppola (2007a); Bartsch et al.(2009a). The most comprehensive keys to European *Eupeodes* species incorporating *E.abiskoensis* are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). **Illustrations of the adult insect:** the general appearance of the male of this species is shown in the coloured photographs provided by Haarto and Kerppola (2007a) and Skevington *et al*.(2019). Bartsch et al.(2009a) figure in colour the male and the abdomen of the female.

Eupeodes biciki Nielsen, 2003
Preferred environment: subalpine zone (Nielsen, 2003). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** At present known only from the Norwegian type specimen and a male from Finland. **Determination:** Nielsen's (2003) description of this species is based on a solitary male. The female remains undescribed. Various features of the species are figured, including the male terminalia, as part of the description. Nielsen (l.c.) suggests *E. biciki* is perhaps closest to *E. nielseni*, but provides features for separating these two species. *E. biciki* is included in the keys provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). **Illustrations of the adult insect:** Bartsch *et al*. (2009a) illustrate the male in colour.

Eupeodes borealis (Dusek & Laska), 1973
Preferred environment: tundra; dwarf scrub tundra. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** beginning June/end July. **Developmental stages:** not described. **Range:** Iceland and northern parts of European Russia (Karelia). But apparently absent from Norway, Sweden and Finland. **Determination:** Dusek & Laska (1976). This species is not included in the keys of either Haarto and Kerppola (2007a) or Bartsch et al.(2009a). **Illustrations of the adult insect:** none known.

Eupeodes bucculatus (Rondani), 1857
Preferred environment: riverine gallery forest, alluvial softwood forest of *Populus/Salix* and mature fen carr of *Salix/Betula*. **Adult habitat and habits:** principally arboreal, but descends to visit flowers; in early spring also descends to sun-bathe on clumps of dead grass (e.g. *Molinia*) beside tracks etc. **Flowers visited:** yellow composites; *Euphorbia, Narthecium, Potentilla erecta, Salix, Sorbus aucupariae, Stellaria*. **Flight period:** April/May and July/August. **Developmental stages:** Dixon (1960) provides a description of the larva of what was probably this species. Larvae were found by Laska and Stary (1980) on *Cirsium arvense* in fields. **Range:** from Norway, Sweden and Denmark south to Portugal; from Ireland eastwards through central Europe to Switzerland; Georgia; S Korea. **Determination:** See Key provided in StN Keys volume and Bartsch *et al*. (2009a). This species appeared in recent literature under the name *E. latilunulatus* (Collin). The name *bucculatus* Rondani was reintroduced for the species by Mazánek *et al*. (1998). According to Sforzi & Dommaggio (2021), due to a problem relating to the identity of the lectotype, the name *bucculatus* of Rondani has been wrongly applied. In the supplementary data file associated with Reverté *et al*. (2023) it seems that the name "*frequens*" has been used for *bucculatus* of Mazánek *et al*. (1998) and subsequent European authors. But there is, as yet, no published explanation for that use of the name *frequens*. Here, use of the name *bucculatus* sensu Mazánek *et al*. (1998) is retained, in the absence of a validated alternative. Early spring specimens of *E. bucculatus* are small and extremely similar to the more frequent *E. luniger* (Mg.), whereas summer specimens can be larger and more closely resemble *E. latifasciatus* (Macqt.), but *E. bucculatus* may be separated from these species by careful use of the keys in Dusek and Laska (1976), who also figure the male terminalia (under the name *latilunulatus* Collin). It can be more difficult to separate *E. bucculatus* from *E. nielseni*, especially in the female

sex. Mazánek *et al*. (1998) concern themselves solely with the male of *E. bucculatus* and provide no information of direct aid in determination of the female. Their description of variability in *E. bucculatus* seems to embrace the range of variation within which they subsequently (Mazánek *et al*, 1999a) recognise two new species. But, taking their remarks on variability in *E. bucculatus* at face value, it would seem that this species has "Tergite 5 with black spot at middle but lateral margins of tergite whole pale. Black spot often approximates to lateral margins, rarely lateral margin partially darkened especially anterolateral corner". If so, the spring generation populations of *E. bucculatus* would appear to have the lateral margins of tergite 5 consistently partially (up to more than 50% of its length) black, from their anterior corners posteriorly, in both males and females, the extent of the black margin being greater in the females than the males. This can also be the case in summer generation specimens from higher altitudes. These dark specimens are impossible to identify correctly using the keys provided by Dusek and Laska (1976) or Mazánek *et al*. (1999c). And since subsequent keys to *Eupeodes* species produced by other authors are largely based on these keys, such specimens cannot be correctly determined using more recent keys either. They are most likely to be misdetermined as *E. nitens* (the males) or *E. nielseni* (females). The current confusion surrounding the correct identity of *E. bucculatus* is well illustrated by Ball *et al*. (2002), whose key to *Eupeodes* recognises no less than 4 taxa of uncertain status within the *bucculatus* complex, all of which could be consigned to the *E. bucculatus* of Mazánek *et al*. (1998) on the basis of the features given. One feature not referred to by either Dusek and Laska (1976), Mazánek *et al*. (1998) or Mazánek *et al*. (1999c), in respect of *E. bucculatus* is that its clypeus is 1.25-1.5x as long as wide, as it is in both *E. duseki* and *E. goeldlini* (Mazánek *et al*., 1999a). In *E. nielseni* the clypeus is 1.75-2.0x as long as wide. Males of *E. .bucculatus* may be distinguished from males of *E. nitens* using wing microtrichial coverage: the 2nd basal cell is entirely covered in microtrichia in *E. nitens*, but partially bare (though sometimes by no more than 5%) in *E. bucculatus*. The problems that remain in separation of *E. bucculatus* from *E. duseki* and *E. goeldlini* are discussed under the species accounts for those species. **Illustrations of the adult insect:** The adult insect is illustrated in colour by Torp (1994), Bot and Van de Meutter (2019) and Bartsch *et al*. (2009a).

Eupeodes corollae (Fabricius), 1794

Preferred environment: open ground; grassland, dune systems, dry river beds, garrigue, largely anthropophilic, occurring in most sorts of farmland (including arable crops), suburban gardens, orchards and parks; occurs (at least as an adult) up to altitudes of alpine grassland in the Alps. **Adult habitat and habits:** hedgerows, grassy clearings in woodland, crops, gardens, tracksides, road verges etc.; flies round and over low-growing vegetation; settles on low-growing vegetation; visits the margins of streams, ponds (including garden ponds) and pools to drink, in hot weather. **Flowers visited:** umbellifers; *Achillea millefolium, Campanula rapunculoides, Chrysanthemum, Cirsium, Eschscholzia californica, Galeopsis, Hypericum, Leontodon, Origanum vulgare, Potentilla erecta, Ranunculus, Rubus fruticosus, Salix, Senecio, Tripleurospermum inodoratum, Tussilago*. For an extended list of flowers visited by this species, see de Buck (1990). **Flight period:** May/September, and may persist into November in some years (all the year round in the Mediterranean zone). **Developmental stages:** larva described by Dusek & Laska (1961); larva and puparium photographed in colour by Dussaix (2013); biology detailed by Marcos-García (1981); aphid feeding on various low-growing plants, particularly Leguminosae but also *Euphorbia, Sonchus* etc and including various crop plants (e.g. *Avena, Beta, Cucurbita, Cynara, Lactuca, Triticum, Zea*). Dussaix (2013) also reports larvae on *Acer campestre, Hedera, Laburnum, Malus* and *Rosa*. In Spain, Esquembre & Marcos-Garcia (2022) report rearing *Eupeodes corollae* from larvae on *Nerium oleander*. The larvae are also reported as predators of aphids on apple trees in orchards (Wojciechowicz-Żytko & Wilk, 2023; Stanić, 2024). Li *et al*. (2021) indicate that *E. corollae* larvae can be effective predators of small caterpillars of the army worm, *Spodoptera frugiperda*, on maize, but that the *Spodoptera* larvae become active predators of the larvae of *E. corollae*, once they have become larger than the syrphid larvae. Chambers and Sunderland (1983) record larval densities of up to 46 per m² in crops of winter wheat (*Triticum*). Laboratory culture of this species is described by Bombosch (1957). According to Dusek and Laska (1961), this species overwinters as a puparium, which is most unusual for an aphidiphagous syrphid. Development (from egg-laying to larval maturity) can apparently take as little as 11 days (Chambers, 1991). The puparial phase lasts approximately 8 days (Dussaix (2013). Egg: Chandler (1968). The morphology of the chorion of the egg is figured by Kuznetzov (1988). A comprehensive review of the biology of this species is provided by Barkemeyer (1994). Oystaeyen *et al*. (2022) establish that, in greenhouse strawberry crops, the adult flies of *E. corollae* can be effective pollinators and its larvae effective control agents of the aphid *Chaetosiphon fragaefolii*, reducing populations of the aphid by more than 50%. **Range:** from Iceland, Fennoscandia and the Faroes (Jensen, 2001) south to Iberia, the Mediterranean, Madeira, the Canary Isles and N Africa; coastal States of Africa down to and including S Africa; Mauritius; from Ireland eastwards through most of Europe into European parts of Russia; through Siberia from the Urals to the Pacific coast; Japan; China; Formosa. This is a highly migratory species, frequently

observed using the coastal land/water interface as a migration route. Records from northern European offshore islands such as the Faroes (Jensen, 2001) are almost certainly derived from annual immigration, rather than a resident population. **Determination:** See Key provided in StN Keys volume; van der Goot (1981); Dusek & Laska (1976). The male terminalia are figured by Dusek and Laska (1976). **Illustrations of the adult insect:** The adult insect is illustrated in colour by various authors, including Bot and Van de Meutter (2019), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Eupeodes curtus (Hine), 1922
Preferred environment: forest/open ground; western taiga and tundra (Nielsen, 1998). **Adult habitat and habits:** no data. **Flowers visited:** *Caltha* (Nielsen, 1998); *Chrysanthemum leucanthemum* (Bartsch et al, 2009), *Taraxacum*. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Norway, northern Sweden and Finland; Iceland, Greenland, northern Canada and Alaska. **Determination:** Vockeroth (1992); Mazánek *et al*.(1999c), who distinguish the male of the taxon they recognise as this species from the males of other northern European *Eupeodes* except *E.borealis* (Dusek and Laska). However, it is questionable whether *E.curtus* sensu Mazánek *et al*.(1999c) is the same species as that described as *E.curtus* by Hine, since Vockeroth (1992) states of the male of the N American taxon "cell bm bare on anterobasal one- to two-fifths", whereas the *E.curtus* of Mazánek *et al*.(1999c) has the "second basal cell completely covered in microtrichia" in the male. Further, assuming one can rely on the accuracy of the figures of the hypandrium of *E.curtus* as figured by these different authors it is difficult to accept that the hypandrium figured for *E.curtus* by Mazánek *et al*.(199c) is from the same species as that figured for *E.curtus* by Vockeroth (1992). None of the European authors now using the name *E.curtus* for European material seem to have examined the N American type material of *E.curtus* and there is no indication that Vockeroth (1992) did so either. It should be mentioned that the name *curtus* is an earlier name than *punctifer*, so if these two taxa are synonymised the senior synonym would seem to be *curtus*. There would also seem need for clarification of the taxonomic relationship between *E.curtus* and *E.borealis*, since it would seem possible that they are one and the same species, to judge from the shape of their aedeagi, as figured by Vockeroth (1992) and Dusek and Laska (1976), respectively. The most comprehensive keys to European *Eupeodes* species incorporating *E.curtus* are those of Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a). **Illustrations of the adult insect:** Bartsch *et al*.(2009a) provide illustrations in colour of the male and of the head and abdomen of the female.

Eupeodes duseki Mazanek, Laska & Bicik, 1999
Preferred environment: open ground; dwarf scrub tundra. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers, *Caltha*, *Potentilla crantzi*. **Flight period:** mid-June/July. **Developmental stages:** not described. **Range:** uncertain, due to confusion with related species, but confirmed from Norway and Sweden. **Determination:** Mazanek et al.(1999a), who figure the male terminalia. The only keys to European *Eupeodes* species incorporating *E.duseki* are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). Mazanek et al.(1999a) state that although it is similar to *E.bucculatus* (Rondani), *E.duseki* may be distinguished from that species using non-genitalic characters. However, they give no such characters to use for distinguishing the males of these two species. From the description, it is clear that the angle between the eyes is in male *E.duseki* only 90º at most, whereas in *E.bucculatus*, as recognised here, it is greater than 90º. *E.duseki* is apparently also almost indistinguishable from *E.abiskoensis* (Dusek & Laska) and *E.goeldlini* Mazanek, Laska & Bicik. The features given for distinguishing females of *E.duseki* from these various other taxa are not very convincing and likely to lead to considerable uncertainty as to the identity of specimens. However, both Haarto and Kerppola (2007a) and Bartsch et al.(2009a) provide features for distinguishing *E.duseki* from these various other species. The relationship between this species and previously described N American *Eupeodes* taxa remains to be established. **Illustrations of the adult insect:** Haarto and Kerppola (2007a) provide a coloured photo of the male and Bartsch et al.(2009a), figure in colour the male and the head and abdomen of the female.

Eupeodes flaviceps (Rondani), 1857
Preferred environment: forest/open ground; open areas in *Quercus ilex* and *Q. pubescens* forest and dry scrub; dry/semi-arid, unimproved grassland. **Adult habitat and habits:** males hover low (c. 1m) in dappled sunlight, beneath trees like *Q. ilex*. **Flowers visited:** no data. **Flight period:** June/ September. **Developmental stages:** larva undescribed, but reared by Marcos-García (1985b) from larvae collected on *Thalictrum flavum* among aphids. Further plants on which *E.flaviceps* larvae have been found are listed by Rojo and Marcos-García (1998): *Chaerophyllum*, *Cirsium*, *Eryngium* and *Foeniculum*. The larvae are also reported as predators of aphids on apple trees in orchards (Stanić, 2024). **Range**: from Poland and the former Czechoslovakia through central Europe to Austria; in southern Europe from central and southern Spain through southern

France and Italy to the former Yugoslavia and on to Georgia, Azerbaijan and Armenia. **Determination:** Dusek and Laska (1976). **Illustrations of the adult insect:** none known.

Eupeodes goeldlini Mazanek, Laska & Bicik, 1999
Preferred environment: forest/open ground; tall-herb open areas in alluvial softwood forest, *Alnus incana* alluvial hardwood forest and other types of humid forest where stands of *Salix* scrub are present (Speight et al, 2007). **Adult habitat and habits:** the adult is fast-flying, and flies within 1-2 m of the ground surface. **Flowers visited:** yellow composites: *Leontodon* and *Taraxacum*. **Flight period:** May and July/August. **Developmental stages:** not described. **Range:** uncertain due to confusion with similar species like *E.bucculatus* until recently. Known from Finland, Sweden, Ireland, Britain; central Europe from Poland through Germany and Switzerland to the Czech Republic and Slovakia; European parts of Russia; Georgia. Also recorded from the Pyrenees (France). **Determination:** See Key provided in StN Keys volume and Bartsch et al.(2009a). The description of this species provided by Mazanek *et al*. (1999a) is confined to the male. The female remains undescribed but is included in the keys provided in the StN Keys volume and in the keys provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). The extent of the black area on the frons is rather variable in the female of *E. goeldlini* and specimens can be found in which it extends no more than one third of the length of the frons, as in females of *E. corollae*. But in *E. goeldlini* an undulating yellow band extends across the entire width of tergites 3 and 4, whereas in *E. corollae* these tergites each have a pair of transverse, pale, whitish-yellow marks, separated in the mid-line. Also, in profile, the frons of *E. goeldlini* females is quite flat, while in females of *E. corollae* it is shallowly concave. Mazanek *et al*. (1999a) figure the male terminalia. **Illustrations of the adult insect:** Bartsch *et al*. (2009a) provide coloured illustrations of the male and of the head and abdomen of the female. A coloured photo of the male is provided by Bot and Van de Meutter (2019).

Eupeodes lambecki (Dusek & Laska), 1973
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April. **Developmental stages:** not described. **Range:** Corsica. **Determination:** apparently known only from the male holotype. This male is included in the key provided by Dusek and Laska (1976). Cornuel-Willermoz & Lebard (2024) allude to the collection of additional male specimens potentially belonging to this species, but were unable to confirm their identity. **Illustrations of the adult insect:** none known.

Eupeodes lapponicus: see under *Lapposyrphus*.

Eupeodes latifasciatus (Macquart), 1829
Preferred environment: wetland/open ground; fen, humid, seasonally-flooded/poorly-drained grassland, oligotrophic *Molinia* grassland and along streams in open country, unsown fallow land (including setaside). **Adult habitat and habits:** rarely flies more than 2m above the ground; usually among low growing vegetation in the vicinity of water. **Flowers visited:** white umbellifers; *Caltha, Convolvulus, Euphorbia, Potentilla erecta, Prunus padus, Ranunculus, Salix repens, Taraxacum, Tussilago, Ulex.* **Flight period:** May/September, with peaks in June and August (plus April and October in southern Europe). **Developmental stages:** larva described by Dusek & Laska (1960); aphid feeding, on root-aphids. Egg: Chandler (1968). The morphology of the chorion of the egg is figured by Kuznetzov (1988). This species has been reared in the laboratory on aphids associated with various low-growing plants and shrubs. The available information on rearing in culture is summarised by Barkemeyer (1994). **Range:** from Iceland and Fennoscandia south to Iberia, the Mediterranean, N Africa and Turkey; from Ireland eastwards through most of Europe into European parts of Russia; through Siberia from the Urals to the Pacific coast (Sakhalin and Kuril Isles); India; in N America from Alaska south to California and Texas. **Determination:** See Key provided in StN Keys volume; van der Goot (1981), Dusek & Laska (1976). The male terminalia are figured by Dusek and Laska (1976). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eupeodes latilunulatus: see under *E.bucculatus* (Rondani)

Eupeodes lucasi (Marcos-García & Laska), 1983
Preferred environment: forest/open ground; open areas in mesophilous *Fagus* forest, *Quercus pyrenaica* forest and *Castanea* forest, upwards into *Abies* forest; dehesa of *Quercus rotundifolia*/*Q. pyrenaica* (Ricarte *et al.*, 2018).. **Adult habitat and habits:** males hover over paths and other small, open areas, at 1-3m, in the sun, within forest. **Flowers visited:** *Hedera*, *Linaria*, *Thapsia* (Marcos-García, pers.comm.); *Quercus coccifera* (Ssymank, 2012); *Sorbus*. **Flight period:**

April/October, peaking in June/July (Marcos-García et al, 2000). **Developmental stages:** larva not described, but reared from aphids on *Arctium, Cirsium, Cynara scolymus, Doronicum, Epilobium, Malus, Prunus* and *Vicia* (Rojo and Marcos-García, 1998; Marcos-García et al, 2000). Under laboratory conditions, the period egg/adult is less than 4 weeks, for this species (Marcos-García et al, 2000). **Range:** Portugal, central Spain and the Pyrenees (France), Czech Republic, Alps (Switzerland), Apennines (northern Italy); Hungary, Greece, Balkans (Macedonia, Montenegro, Serbia), Corsica, Sicily. **Determination**: See Key provided in StN Keys volume, Marcos-García and Laska (1983) and Marcos-García et al.(2000), who figure the male terminalia. The male of this species is almost indistinguishable from the male of *E.luniger*. According to Marcos-García et al.(2000), the males of these two species may be distinguished by the darker hind femora (two thirds to three quarters of their length black) and abdominal sternites (st 2 and st3 with large, rectangular, black marks) of *E.lucasi*. However, males of *E.luniger* from more northerly latitudes may have both the hind femora almost entirely black and abdominal sternites with black marks that reach across virtually the entire width of the sternites. Luckily, *E.lucasi* is as yet known no further north in Europe than the Czech Republic and is not known in the Atlantic Region. But, if *E.lucasi* were found to occur further north and west these features would not be very reliable for separating males from *E.luniger*. In the Pyrenees, *E.lucasi* may be found in flight at the same time, and in the same localities, as *E.latifasciatus*, while at higher altitudes it may similarly be found in flight with *E.tirolensis*. The females of all three of these species have no frontal dust spots and can be difficult to distinguish. **Illustrations of the adult insect:** the male and female are illustrated in colour in Speight and de Courcy Williams (2021).

Eupeodes lundbecki (Soot-Ryen), 1946

Preferred environment: forest; grassy open areas in *Betula/Pinus* forest, western taiga, *Picea* forest and conifer plantations (*Abies/Picea/Pinus*). **Adult habitat and habits:** clearings, tracksides, glades etc., in the sun; flies from very close to the ground (30cm.) to several metres above the ground surface, round foliage of low-growing plants, shrubs and trees; flight very reminiscent of *Scaeva*; often settles on foliage in the sun. **Flowers visited:** white umbellifers, *Achillea, Circium, Ranunculus, Sanguisorba, Solidago, Taraxacum*. **Flight period:** mid May/midOctober, with a peak in August/ September. **Developmental stages:** not described, but Bagachanova (1990) records rearing this species from larvae found on *Tanacetum* and *Prunus*. **Range:** Iceland, Finland and Denmark south to the Netherlands (where it is regarded as a vagrant), from Britain (vagrant?) eastwards through Germany, Poland, Ukraine and Russia into Siberia and on to the Pacific; Mongolia. Large-scale movements of this species apparently occur out of Scandinavia in August/September. **Determination**: See Key provided in StN Keys volume, van der Goot (1981) and Dusek & Laska (1976). **Illustrations of the adult insect:** The adult insect is illustrated in colour by Haarto and Kerppola (2007a), Bartsch *et al*. (2009a) and Torp (1994).

Eupeodes luniger (Meigen), 1822

Preferred environment: open ground/forest, dune grassland, grassland and woodland clearings and tracks, strongly anthropophilic, occurring also in many sorts of farmland and orchards, suburban gardens and parks and along the firebreaks and tracks of conifer plantations; may be found up to 2,000m in the Alps. **Adult habitat and habits:** hedges, tracksides, clearings, gardens; fast flying, over ground vegetation and round bushes and shrubs; males hover beside hedges, in sunny patches beneath trees in woodland, etc., up to 4m from the ground. **Flowers visited:** white Umbelliferae; *Calluna, Leontodon, Malus sylvestris, Polygonum cuspidatum, Prunus spinosa, Ranunculus, Rosa rugosa, Senecio, Taraxacum*. For an extended list of flowers visited by this species see de Buck (1990). **Flight period:** April/November, plus March in southern Europe, with peaks in May/June and August. This species is known to hibernate as an adult in central Europe, accounting for early records. **Developmental stages:** larva described and figured by Bhatia (1939) and Rotheray (1994) and illustrated in colour by Rotheray (1994) and Dussaix (2013); puparium shown in colour by Dussaix (2013); biology described by Dusek & Laska (1974) and Marcos-García (1981); aphid feeding on various low-growing plants, including various crops (*Cynara, Lavatera, Vicia, Zea*). Dussaix (2005b) also reports rearing the species from larvae collected on *Hedera*. Dussaix (2013) adds *Urtica* to the list of plants on which larvae of this species have been found, and indicates that duration of the puparial phase is approximately ten days. Apparently this species can overwinter as a puparium. Egg: Chandler (1968). A review of the literature on the biology of this species is provided by Barkemeyer (1994). **Range:** from Fennoscandia south to Iberia, the Mediterranean, Madeira and N Africa; from Ireland eastwards through most of Europe into European parts of Russia and Asia Minor (including Turkey); in Siberia from the Urals to the Pacific coast (Kuril Isles); Japan; N India. This species is highly migratory and immigrants from further south augment populations in many parts of Europe during the summer. **Determination:** See Key provided in StN Keys volume, van der Goot (1981) and Dusek & Laska (1976). Males of this species with predominantly black hind femora can be very difficult to distinguish from males of *E.lucasi*, and, in parts of

Europe where both *E.lucasi* and *E.luniger* occur, separation of the males may not be possible to achieve with confidence. In those circumstances it is more reliable to base determination on the females, since females of these two species are easily distinguished. However, females of this species cannot be satisfactorily distinguished from those of *E.flaviceps* (Rond.), and where both *E.flaviceps* and *E.luniger* occur it is necessary to base separation of these two species on the males. The male terminalia and intra-specific variation in its features are figured by Dusek and Laska (1973). **Illustrations of the adult insect:** The adult insect is illustrated in colour by various authors, including Bot and Van de Meutter (2029), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eupeodes nielseni (Dusek & Laska), 1976
Preferred environment: conifer forest; *Pinus* forest from humid *Pinus sylvestris* up to and including *P. mugo, P.uncinata and* western taiga; also in *P.sylvestris* plantations. **Adult habitat and habits**: largely arboreal, but descends to visit flowers in clearings, tracksides etc. **Flowers visited**: white umbellifers; *Anemone nemorosa, Galium, Helianthemum nummulinum, Potentilla erecta, Ranunculus, Rubus chamaemorus, Salix repens, Sorbus aucuparia.* **Flight period**: May/August, with peak in June. **Developmental stages:** larva described and figured by Rotheray (1988a) and illustrated in colour by Rotheray (1994); apparently a specialist predator of conifer aphids. **Range**: Fennoscandia south to the Pyrenees and Alps; from Britain eastwards through northern and central Europe (and northern Italy) into European parts of Russia. **Determination**: see Key provided in StN Keys volume, Haarto and Kerppola (2007a) and Bartsch et al.(2009a). The male terminalia are figured by Dusek and Laska (1976). The adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994). The male of *Eupeodes biciki* Nielsen is evidently very similar to that of *E.nielseni*, from which it can only be distinguished by its entirely yellow-haired scutellum and yellow-margined tergite 5 (Nielsen, 2003. **Illustrations of the adult insect:** The male of *E.lundbecki* is illustrated in colour by Bartsch *et al*. (2009a).

Eupeodes nigroventris (Fluke), 1933
Preferred environment: tundra. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end June/beginning August. **Developmental stages:** not described, but has been collected on *Salix*, on which both aphids and coccids were present (Vockeroth, 1992). **Range:** arctic Canada, Greenland and Iceland. It is curious that there are no records of this species from the Yukon (USA) or Siberia. **Determination:** Vockeroth (1992); Bartsch *et al*. (2009a). This species appears in much recent literature (e.g. Bartsch *et al.* (2009a) as *E. rufipunctatus*. Skevington *et al*. (2019) give reasons for reverting to use of the name *nigroventris* for this taxon. The female of *E. nigroventris* is frequently entirely without pale markings on the abdomen and pale markings are very restricted in the male (male abdomen figured in black and white by Vockeroth, 1992). Distinctions between *E. nigroventris* (as *E. rufipunctatus*) and another arctic *Eupeodes* recently referred to as *E. vockerothi* (see species account for *E. vockerothi*) are provided in Böcher *et al*. (2015)**Illustrations of the adult insect:** Bartsch *et al*. (2009a) and Skevington *et al.*(2019) provide coloured illustrations of the male and female of this species.

Eupeodes nitens (Zetterstedt), 1843
Preferred environment: mature deciduous forest (*Fagus*); also in unimproved, non-calcareous alpine grassland, from 1700m to 2000m (Goeldlin, pers. comm.). **Adult habitat and habits:** in forested locations largely arboreal, but descends to visit low-growing plants in flower, in clearings, beside tracks etc. **Flowers visited**: yellow composites; umbellifers; *Acer platanoides, Calluna vulgaris, Cirsium arvense, Euphorbia, Galium, Geranium, Inula, Potentilla, Pyrus, Ranunculus, Sambucus, and Taraxacum*. **Flight period**: May/beginning August. **Developmental stages:** larva undescribed, but this species has been reared by Goeldlin (pers.comm.) from larvae collected from *Cirsium* in alpine grassland. Barkemeyer (1994) provides a comprehensive account of the aphid species on which *E.nitens* has been reared under laboratory conditions, citing various authors. Metcalf (1916) described the larva of a North American species he named as *E. nitens*, but *E. nitens* is not known from N America. Bagachanova (1990) reared a species she identified as *E. nitens* from larvae on *Betula, Epilobium, Larix, Rumex, Salix, Spiraea, Tanacetum, Thalitricum, Urtica* and umbellifers. **Range:** Fennoscandia south to the Pyrenees; Britain (southern England) eastwards through central and southern Europe (Italy, the former Yugoslavia) into Siberia and on to the Pacific coast. **Determination**: See Key provided in StN Keys volume, van der Goot (1981) and Dusek and Laska (1976). The male terminalia are figured by Dusek and Laska (1976). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983).

Eupeodes nuba (Wiedemann), 1830
Preferred environment: open ground; sparsely vegetated ground beside dry, seasonal rivers; Mediterranean, riparian *Fraxinus* forest; by seasonal streams in maquis; hedgehog heath; Mediterranean dune scrub; coastal dune systems. **Adult habitat and habits:** flies round and over low-growing vegetation; settles on low-growing plants - as *E.corollae* but rather faster in flight. **Flowers visited:** yellow composites; *Euphorbia*, *Viburnum tinus*. **Flight period:** April/June and August/September. **Developmental stages:** not described. **Range:** Canary Isles, Mediterranean basin, from Portugal to Italy (Sicily) and parts of the former Yugoslavia, Crete, Cyprus, Lebanon, Israel, Egypt and Morocco; Switzerland in central Europe, Roumania; Transcausasus (Georgia) and south-western parts of Asia (Uzbekistan, Kirghizistan, Tajikistan) to Afghanistan and Mongolia. In eastern parts of the Afrotropical region from Ethiopia south to S Africa (inclusive). **Determination:** See Key provided in StN Keys volume and Dusek and Laska (1976), who figure the male terminalia. This species appears in much recent literature as *Metasyrphus interrumpens* (Walker). In the field *E.nuba* is extremely similar to *E.corollae*. **Illustrations of the adult insect:** coloured photos of the male are provided by Smit *et al.* (2004) and Dawah *et al.* (2020).

Eupeodes punctifer (Frey), 1934
Preferred environment: taiga and dwarf-shrub tundra. **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus*, *Tanacetum* (Barkalov, 2012), *Silene acaulis* (T.Nielsen, pers.comm.). **Flight period:** June/July (Nielsen, pers.comm.). **Developmental stages:** not described, but Bagachanova (1990) reared this species from larvae found on *Spiraea*. **Range:** Iceland, Norway, Sweden, Finland, Poland and the Nearctic, where it has been known as *E.chillcotti* until recently (see Mazánek *et al*, 1999a). **Determination:** the most comprehensive keys to European *Eupeodes* species incorporating *E.punctifer* are those of Haarto and Kerppola (2007a) and Bartsch *et al.*(2009a). Dusek and Laska (1976) and Mazánek *et al.*(1999c). Unfortunately, distinctions made between this species and *E.borealis* (Dusek & Laska) at the time of description of *E.borealis* (Dusek and Laska, 1973) were unconvincing and have not been improved since, leaving many specimens impossible to determine and suggesting that the separate identity of these two taxa is very much open to doubt. Which perhaps accounts for the apparent absence of *E.borealis* from Scandinavian countries! Using the key of Mazánek *et al.*(1999c), *E.biciki* Nielsen might be mistaken for *E.punctifer*. But in *E.biciki* the alula is partly bare of microtrichia (Nielsen, 2003), while it is entirely microtrichose in *E.punctifer*. **Illustrations of the adult insect:** the general appearance of the male of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). Bartsch et al.(2009a) provide coloured figures of the male of this species and of the abdomen of the female.

Eupeodes tirolensis (Dusek & Laska), 1973
Preferred environment: open ground; near seepages and streams in unimproved, calcareous and non-calcareous montane and alpine grassland (with *Alnus viridis* and *Salix* scrub) and heath, from 1,200m up to 2,500m in the Alps and Pyrenees and in open taiga in northern Scandinavia (T.Nielsen, pers.comm.). **Adult habitat and habits:** flies fast and low over ground vegetation. The males rest in the sun on large stones or scree, returning repeatedly to the same rock, many of them frequently being found in close proximity, on the same patch of rocks/large stones; they hover at heights from 1 - 5m, in open situations. **Flowers visited:** *Sedum*. **Flight period:** end May/July and August at higher altitudes. **Developmental stages:** not described. **Range:** Northern Norway, Alps (France, Switzerland, Austria, Italy) and Pyrenees (France). **Determination:** See Key provided in StN Keys volume, Dusek and Laska (1973, 1976), who figure the male terminalia; Haarto and Kerppola (2007a), Bartsch et al.(2009a) and Mazánek et al, (1999c). **Illustrations of the adult insect:** Bartsch et al.(2009a) figure in colour the male of this species, plus the head and abdomen of the female.

Eupeodes vandergooti (Dusek & Laska), 1973
Preferred environment: forest; montane black pine forest of *Pinus laricio* (Corsica: van der Goot, 1961; Cornuel-Willermoz & Lebard (2024). **Adult habitat and habits:** no data. **Flowers visited:** *Sedum album* (van der Goot, 1961). **Flight period:** July. **Developmental stages:** not described. **Range:** Corsica and Italy. The occurrence of *E. vandergooti* elsewhere than on Corsica has recently been called into question. The issue is reviewed in detail by Cornuel-Willermoz & Lebard (2024), who conclude that neither the original description, nor subsequent literature, provide an adequate basis for recognition of *E. vandergooti*, rendering all non-Corsican records of the species unreliable. **Determination:** Dusek and Laska (1973) describe the species from a series of males and females collected in Corsica and provide figures of its abdomen and male terminalia. *E.vandergooti* is also included in the key in Dusek and Laska (1976). Based extensive material from Corsica, Cornuel-Willermoz & Lebard (2024) suggest additional features to aid in identification of the species, namely that the clypeus is more

than twice as long as wide and the hairs on the lateral margins of tergite 4 are unusually long. **Illustrations of the adult insect:** none known.

Eupeodes vockerothi (Fluke, 1952) sensu Böcher *et al*., 2015
Preferred environment: tundra. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July (Svalbard); June to August (Canada). **Developmental stages:** not described. **Range:** Svalbard (Spitsbergen islands, Norway) and Greenland. If the interpretation of Böcher *et al*. (2015) proves correct the range also includes the Yukon and northern Canada. **Determination:** as applied in Europe at present, the name *Eupeodes vockerothi* derives from a subspecies of *E. luniger* described by Fluke (1952) from the Nearctic Region. Vockeroth (1992) included it under *E. luniger* and remarked that specimens of *E. luniger* from Greenland have reduced markings on the tergites. Böcher *et al*. (2015) refer to the Greenland species previously regarded as *E. luniger* under the name *E. vockerothi* (Fluke, 1952), without explanation. Skevington *et al*. (2019) make no reference to the occurrence of a species named *Eupeodes vockerothi* in N America and state that Böcher *et al*. (2015) "incorrectly apply the name *E. vockerothi*". On what basis Böcher *et al*. (2015) treat Fluke's (1952) subspecies of *E. luniger* as a species level taxon and apply its name to the Greenland taxon is unclear. Nielsen & Gammelmo (2017) subsequently list a *Eupeodes* from the Svalbard islands as *E. vockerothi*, for the first time applying the name in a European context, but without providing any information about the distinguishing features of the insect. Neither do they justify the use of the epithet *vockerothi* (Fluke, 1952) for the Svalbard species. In Fluke's (1952) description of his *Metasyrphus luniger* subspecies *vockerothi* he states that it differs from typical *E. luniger* (as *Metasyrphus luniger*) in having a more extensively darkened upper mouth edge and legs and, usually, in having black hair along the lateral margins of the mesoscutum. He goes on to say the pale markings on the tergites are narrower than in typical *E. luniger*, and that on tergite 5 the hind margin and lateral margins of the tergite are entirely yellow, the lateral margins only narrowly so (the yellow lateral margins are not visible in the figures of the abdomen provided). Fluke (1952) also states that its eyes are frequently hairy, the hairs often conspicuous in the female. In Böcher *et al*. (2015) it is not indicated whether eye hairs are detecteable in the species to which they apply the name *E. vockerothi* in Greenland. Similarly, it is not stated whether there are black hairs laterally on its mesoscutum, there being mention only of the pale mesoscutal hairs being almost white. Further, it is stated that the Greenland taxon has tergite 5 entirely black, except for its posterior margin, which is narrowly yellow. Other features mentioned for the Greenland taxon are not described in Fluke's (1952) account of his *E. luniger* subspecies *vockerothi*, except for the darkened upper mouth edge and legs common to both the Nearctic and Greenland taxa. The name *E. vockerothi* has most recently been used in a European context applied to a syrphid species categorised as data-deficient, recognised as occurring in Europe by the IUCN, in their Red List project on European syrphids. Since neither Böcher *et al*. (2015), nor Nielsen & Gammelmo (2017), provide either explanation or justification for referring to the Greenland/Svalbard taxon as *E. vockerothi*, its identity can only remain uncertain, given the subsequent denouncement of use of the name *vockerothi* for it, by Skevington *et al*. (2019). It will remain data deficient both taxonomically and in terms of its European status, unless credible data are obtained either justifying application of the name *Eupeodes vockerothi* to the European taxon, or making it possible to assign a new name to it. In the interim, a species account is offered here, to draw attention to the apparent existence of an arctic *Eupeodes* taxon of uncertain status and identity, to which the name *E. vockerothi* has been applied. **Illustrations of the adult insect:** none known.

EURIMYIA

One European species, *E. lineata*, is consigned to this genus. In recent literature it has variously been treated as a species of either *Anasimyia* or *Helophilus*, or placed in its own genus. Skevington et al.(2019) indicate that *Eurimyia* should be recognised as a separate genus on genetic grounds. They also establish that North American material previously consigned to *A. lineata* has to be regarded as a separate species.

Eurimyia lineata (Fabricius), 1787
Preferred environment: wetland; bog, fen and marsh, including pond-side and riverine fen and alluvial wetlands, such as oxbow lakes. **Adult habitat and habits:** flies low over water surface, often within stands of emergent vegetation; frequently settles on emergent vegetation, e.g. *Menyanthes* leaves. **Flowers visited:** *Alisma plantago-aquatica, Anthriscus sylvestris, Caltha, Cardamine pratense, Cicuta virosa, Crataegus, Lychnis flos-cuculi, Lythrum salicaria, Menyanthes trifoliata, Nymphaea alba, Potentilla anserina, Ranunculus, Sorbus aucuparia.* **Flight period:** May to August. **Developmental stages:** larva described and figured by Hartley (1961) and illustrated in colour (apparently from a preserved specimen) in

Rotheray (1994); aquatic, microphagous, in rotting plant debris just below the water surface. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Scandinavia south to the northern edge of the Pyrenees and Ireland east through central Europe into European parts of Russia and Georgia. **Determination:** Bartsch et al.(2009b); Claussen & Torp, 1980; Speight (1981b); van der Goot (1981), Verlinden (1994). **Illustrations of the adult insect:** the adult insect is figured in colour by various authors, including Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

FERDINANDEA

Peck (1988) lists five European species in this genus. The status of two of these, *F.nigrifrons* and *F.sziladyi*, is unclear. A third species, *F.aurea*, is largely confined to southern Europe. The two remaining species are widespread and treated in most regional accounts, including van Veen (2004). Kassebeer (1999b) recently described from N Africa a new species, *F.fumipennis*, which has subsequently been found in Europe.

Ferdinandea aurea Rondani, 1844
Preferred environment: forest; ancient/overmature thermophilous (*Q.pubescens, Q.pyrenaica*) and evergreen oak (*Q.ilex/Q.suber*) forest; oak dehesa; also mesophilous beech (*Fagus*) forest. **Adult habitat and habits:** settles on trunks of trees, among dead leaves on the ground, on stones and the bare ground of forest paths, in the sun. **Flowers visited:** autumnal *Crepis* species; *Aster, Colchicum autumnale*; *Dianthus; Hedera; Hieracium, Scabiosa; Sternbergia lutea*. **Flight period:** occasional specimens from end of July, but a "mass emergence" of males seems to occur in the second half of September, the females then appearing at the beginning of October. Some specimens can persist until mid November. **Developmental stages:** not described, but Ricarte *et al*. (2010) record collection of *F.aurea* in emergence traps covering trunk-base tree cavities ("root-holes") and other trunk tree-holes, in *Quercus faginea* and *Q.pyrenaica*. Also, a female has been observed apparently prospecting the trunk base of an overmature *Q.pubescens* for oviposition purposes. The tree concerned had no extensive areas of trunk-base rot or trunk cavities, but did exhibit a narrow area of *Cerambyx* damage just above the ground surface. On a number of French sites where *F.aurea* is locally common *Cerambyx velutinus* is also abundant and it is possible that the larvae of *F.aurea* inhabit the tunnels made by the larvae of this cerambycid, low down on the trunks (and in trunk cavities) of various *Quercus* species. A dependence upon some other Mediterranean-zone saproxylic insect like *Cerambyx velutinus* would help to explain the restriction of *F.aurea* to the Mediterranean zone and its unusual feature of having an almost entirely autumnal flight period – presumably providing the female with an opportunity to oviposit in trunk cavities that have reached an approprite condition for larval development. Now that it is known that the larvae of *F.aurea* develop in trunk-base tree holes it should be possible to establish exactly where, in those tree holes, the larvae occur and whether other saproxylics are involved in making appropriate larval microhabitat available for *F.aurea*. **Range:** Portugal; central and southern Spain (and Mallorca); southern France, Italy (plus Sardinia) and Greece (plus Crete - Claussen & Lucas, 1988). **Determination:** See Key provided in StN Keys volume. **Illustrations of the adult insect:** a coloured photo of the male is provided by Speight and de Courcy Williams (2018).

Ferdinandea cuprea (Scopoli), 1763
Preferred environment: forest; deciduous forest with mature and over-mature trees, including alluvial softwood forest of *Populus-Salix, Carpinus-Quercus* forest, acidophilus *Quercus* forest, thermophilous *Quercus pubescens* and *Q.pyrenaica* forest and *Betula* forest. **Adult habitat and habits:** usually on the trunks of standing, live trees, or on the cut ends of stacked logs of deciduous trees in the sun, or on the ground among leaves etc., in glades, or at the edge of clearings and along tracks etc., also at sap runs. **Flowers visited:** *Convolvulus, Crataegus, Hieracium, Leontodon, Lonicera, Mentha, Oenothera, Prunus cerasus, Ranunculus, Rosa, Rubus fruticosus agg. Sonchus, Taraxacum, Ulmus.* **Flight period:** April/September (occasional specimens on into October and, in southern Europe, into November), with peaks in June and August/September. **Developmental stages:** larva described by Hartley (1961), who found the larvae in semi-aqueous material associated with tree wounds, in *Cossus*-damaged *Populus*. Illustrated in colour by Rotheray (1994) and Dussaix (2013). Larvae have also been collected from sappy frass or fungus growths in superficial, sub-bark *Cossus* tunnels in *Quercus* (including *Q.pubescens*) and from sap runs on *Quercus* where there was no evidence that *Cossus* was present. Larvae have been found in tree wounds and sap runs on the trunks of living deciduous trees of various sorts, including *Acer, Aesculus, Betula, Malus, Populus, Quercus, Salix* and *Ulmus*. Rotheray (1990a) found larvae in association with wet, decomposing tree

roots of *Quercus* and in the tree humus of large trunk cavities in old *Quercus*. Ricarte *et al*. (2010) report collection of *F. cuprea* in emergence traps covering holes in trunks of *Quercus pyrenaica*. Dussaix (2005b) reports finding puparia at the base of living *Quercus*, where parts of either the trunk-base or roots were rotting. Van Eck and Zwakhals (2015) also mention collection of the puparia of this species in the winter and early spring, from around the base of a large oak carrying sap runs. The puparia can be found by eye, lying free on the ground surface, or among loose, ground surface litter (A. Eck, pers.comm.). Dussaix (2013) reports observing full-grown *F. cuprea* larvae moving down the trunk of an oak, away from the sap-run in which they developed, to pupate among the litter at the trunk base. Brunel and Cadou (1994) show that larval development of *F.cuprea* is not necessarily dependent upon tree exudates, having reared the species successfully and repeatedly from larvae collected in the field from rotting artichoke (*Cynara*) roots, on which the larvae also fed in the laboratory. They suggest that, on both morphological and behavioural grounds, the larva of *F. cuprea* should be regarded more as a phytophage than a saprophage. This species overwinters as a puparium (Cadou, pers. comm. and Dussaix, 2013). But the duration of the puparial phase, for non-overwintering puparia, originating in larvae from the spring generation of adults, is 2 weeks (Dussaix, 2013). The general appearance of the puparium is shown in the coloured photo provided by Dussaix (2013). **Range:** Fennoscandia south to southern Spain and north Africa (Algeria) and round the Mediterranean through southern Europe to Turkey; from Ireland eastwards through central/northern parts of Eurasia to the Pacific coast of Siberia and Japan. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Coe (1953). The male terminalia of the closely related N African species *F.fumipennis* are figures by Kassebeer (1999b). In the male of *F.fumipennis* antennal segment three is deeper than long (as in *F.aurea*), but in the female the shape of this antennal segment is very much as in *F.cuprea*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1981).

Ferdinandea fumipennis Kassebeer, 1999

Preferred environment: forest; deciduous forest; acidophilous oak forest of *Quercus pyrenaica*; riparian *Fraxinus angustifolia* forest (Ricarte and Marcos-García, 2007). **Adult habitat and habits:** males settle on the trunks of trees in the sun, in small open areas in riparian Fraxinus/Alnus forest and also visit sap runs, e.g. on *Quercus pubescens;* females visit trunk base sap runs in semi-shade, e.g. on *Fraxinus* species. **Flowers visited:** *Hypericum, Merendera* (Ricarte and Marcos-García, 2007); *Cistus, Dittrichia viscosa* (Lebard, 2022); *Lonicera* (Louboutin *et al*., 2023); autumnal *Crepis* species. **Flight period:** in Spain March/May, July and September/October (Ricarte and Marcos-García, 2007); in France February/April and September/October; in Sardinia April/June; in N Africa from October to May. This species may be found in flight with *Ferdinandea cuprea*, and both species can be observed on the same tree, at the same time. **Developmental stages:** features of the larva and puparium are described and figured by Ricarte et al.(2007), from material collected from a sap-run on the trunk of live *Quercus pyrenaica*. Ricarte et al.(2010) also report a female of *F.fumipennis* observed ovipositing in a sap-run on *Q.pyrenaica*, in April. **Range:** Portugal; Spain, Balearic islands (Ricarte and Marcos-García, 2007); southern France, including Corsica; Italy (Sardinia); N Africa - Morocco and Tunisia (Kassebeer, 1999). **Determination:** See Key provided in StN Keys volume and Kassebeer (1999), who figures the male terminalia. In its appearance this species is extremely similar to *F.cuprea*. **Illustrations of the adult insect:** the adult female is illustrated in colour by Birtele (2011). Coloured photos of the male are provided by Speight and de Courcy Williams (2021) and Louboutin *et al*. (2023).

Ferdinandea ruficornis (Fabricius), 1775

Preferred environment: forest; deciduous *Quercus* forest and alluvial hardwood forest. **Adult habitat and habits:** insufficient data; probably largely arboreal, but has been found in patches of sunlight, on the trunks of living oaks (*Quercus*) infested with *Cossus*. **Flowers visited:** *Campanula latifolia* (N. Jones, pers.comm.), *Heracleum* (de Buck, 1990). **Flight period:** March (Mediterranean zone) and mid April/beginning September, with peaks at the beginning of May and in August. **Developmental stages:** not described, but has been reared from sappy material in the burrows of *Cossus cossus* caterpillars in *Quercus*. Kruger (1926) found the puparium of this species in soil at the base of a *Populus* attacked by *Cossus* larvae. Ricarte *et al*. (2010) report collection of a number of specimens of *F. ruficornis* in an emergence trap covering a tree hole into which a sap-run was flowing, on the trunk of *Quercus pyrenaica*. Bartsch *et al*. (2009b) refer to the adults as being found on the trunks of *Aesculus, Betula* and *Populus tremula*. **Range:** from Sweden south to Portugal and from Britain (England) eastwards through central (Germany, Poland) and southern Europe (Italy, former Yugoslavia, Roumania) into European Russia and the Caucasus and on through Siberia and Uzbekistan to the Pacific; northern China. In western Europe, at least, the close association apparently existing between this species and the goat moth (*Cossus cossus*) ensures the hoverfly's scarcity, since forestry practice acts to eliminate *Cossus* and the over-mature trees it inhabits. *Cossus* is currently exhibiting a

marked decline in much of western Europe and *F. ruficornis* has to be regarded as threatened over much of its European range. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Coe (1953). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994).

HAMMERSCHMIDTIA

Two European species are consigned to this genus. They may be distinguished by means of the key in Violovitsh (1986). One of them, *H. rufa* (Fallen), is so far known in Europe only from Finland and parts of Russia (St Petersburg). It is questionable whether there is justification in recognising *Hammerschmidtia* as more than a subgenus of *Brachyopa*. It is treated as a subgenus of *Brachyopa* by Vockeroth and Thompson (1987).

Hammerschmidtia ferruginea (Fallen), 1817
Preferred environment: forest, coniferous (*Pinus*) or deciduous (*Betula, Quercus*) forest with overmature *Populus tremula;* western taiga (Van Steenis *et al*. (2020b). **Adult habitat and habits:** the adults may be found sitting on the trunks of *Betula* and old *Populus tremula*, or on logs and stumps in the vicinity of *P.tremula*. According to Rotheray *et al.* (2009) "fallen wood with wet decaying sap is important as an assembly site for mate selection". Males maintain territories on patches of the trunk of fallen, dead *P. tremula* (Rotheray *et al.*, 2014). **Flowers visited:** white umbellifers, *Aruncus dioicus, Crataegus, Malus, Prunus padus, Pyrus communis, Ranunculus, Rosa, Rubus fruticosus*, male *Salix, Sambucus nigra, Sorbus aucuparia, Spiraea, Viburnum opulus*. **Flight period:** mid May/end July. **Developmental stages:** larva described and figured by Rotheray (1991) and figured in colour by Rotheray (1994), from larvae and puparia collected from sappy material under the bark of recently fallen aspen (*Populus tremula*), of more than 25cm diameter. The larva is also figured in colour by Bartsch *et al*. (2009a). The larvae may be distinguished from larvae of some *Brachyopa* species by the key in Rotheray (1994). Krivosheina, M.A. (2003a) provides a key for separation of the larva of *H.ferruginea* from the larva of *H. rufa*. Rotheray and MacGowan (2000) suggest that stands of aspen of less than 5ha extent are unlikely to be able to maintain populations of this species, due to its requirement for a constantly renewed resource of recently-dead trees.That recently-dead trees of *P.tremula* are significant in maintaining *H.ferruginea* populations, is reiterated by Rotheray *et al.*(2009). However, they also indicate that this syrphid can survive at lower populations densities using sap runs on living *P.tremula* as larval microhabitat. **Range:** Fennoscandia south to the Pyrenees (Spain); Great Britain (Scotland) east through northern and central Europe (south as far as Roumania, Slovenia); Georgia; into Siberia and on to the Pacific. This species was previously recognised also as Nearctic, but Skevington *et al*. (2019) indicate that N American records are erroneous, and refer to other species. Local movements of up to 1km from larval development sites are recorded for this species by Rotheray *et al*. (2014), with a maximum recorded distance of 5km. Rotheray *et al*. (2014) also discuss the significance of these results to dispersal by the species and establishement of populations at new sites. **Determination:** see Key provided in StN Keys to species volume and Haarto and Kerppola (2007a). *H. rufa* is now recorded from Finland, as well as European parts of Russia and may occur more widely in Europe. Prokhorov *et al*. (2020b) provide a detailed discussion of distinctions between the two European *Hammerschmidtia* species, accompanied by coloured photos of the features mentioned. The arista is plumose (aristal hairs c 3x as long as the maximum diameter of the arista) in *H. ferruginea* but short haired (aristal hairs distinctly less than 2x as long as the maximum diameter of the arista) in *H. rufa*. Also, *H. rufa*, with a body length of 5.5 - 7.5mm, is noticeably smaller than *H. ferruginea*, which has a body length of 10-15 mm. Violovitsh (1986), figures the male terminalia. The male terminalia are also figured by Krivosheina, M. A. (2003a). *H.ferruginea* closely resembles larger *Brachyopa* species (with which it may be confused in the field). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Stubbs and Falk (1983).

Hammerschmidtia rufa (Fallen) 1817
Preferred environment: forest: deciduous forest; mixed boreal forest. **Adult habitat and habits:** no data. **Flowers visited:** white umbellifers; *Anemone, Physocarpus, Prunus, Rubus* (Skevington *et al*, 2019); *Cornus alba* (Van Steenis *et al*. (2020b). **Flight period:** mid March/beginning July and mid August/mid October. **Developmental stages:** larva described and figured by Krivosheina, M. A. (2003a), who also provides a key to separate the larvae of the two European *Hammerschmidtia* species. Found under the bark of various trees: *Juglans manshurica, Populus* (including *P. tremula*), *Ulmus* and, in Asia *Chosenia* and *Maackia* (M. A. Krivosheina, pers. comm.), plus the Amur Cork tree, *Phellodendron a*murense (N. P. Krivosheina, 2020). . Polevoi *et al*. (2018) report collection of a number of specimens of this species by an emergence trap installed on a broken

trunk of *Populus tremula* in Karelia. Skevington *et al*. (2019) state "larvae have been found under the bark of recently fallen aspen, elm, walnut and willow". **Range:** Finland, European parts of Russia and on through Siberia almost to the Pacific; Nearctic. **Determination:** see Key provided in StN Keys to species volume. The two European *Hammerschmidtia* species can also be separated by the key provided in Haarto and Kerppola (2007a). Prokhorov *et al*. (2020b) provide a detailed discussion of distinctions between the two European *Hammerschmidtia* species, accompanied by coloured photos of the features mentioned. In recent literature *H. rufa* appears under the name *ingrica* Stackelberg, Skevington *et al*. (2019) establish that *ingrica* is a junior synonym of *rufa*, based on genetic data. Violovitsh (1986) figures the male terminalia. **Illustrations of the adult insect:** illustrated in colour by Skevington *et al*. (2019).

HELOPHILUS

Some authors (e.g. Peck, 1988) include *Anasimyia* and *Lejops* as subgenera of *Helophilus*. This practice is not followed here. There are 9 European *Helophilus s.s.* species listed in Peck (1988). A further species, *H. continuus* Lw, was subsequently added to the European list, from Roumania (Bradescu, 1989). Nielsen (1997) notes that two of the species listed by Peck (*l.c.*) (*arcticus* Zetterstedt, *borealis* Staeger) are synonyms of other species and provides an updated key to the 7 European species other than *H. continuus*. Bartsch *et al*. (2009b) provide an alternative key, once again omitting *H. continuus*.

Helophilus affinis Wahlberg, 1844
Preferred environment: wetland; small water bodies in humid, unimproved grassland, acid fen and at the edge of raised bogs. **Adult habitat and habits:** hovers at 1-2 metres over small pools. **Flowers visited:** *Aruncus asiaticus, Cirsium, Parnassia, Ranunculus, Rubus idaeus, Senecio jacobaea, Succisa, Valeriana officinalis* (Nielsen, 1966). **Flight period:** mid May/beginning September. **Developmental stages:** undescribed. **Range:** Scandinavia south to the Netherlands, including Denmark, northern Germany, Poland and Switzerland; through northern Europe into Siberia and on into Asia to Mongolia. Appears to be extending its range southwards. Torp (1984) suggests large migrations are occurring from southern Sweden into Denmark now, though previously only isolated specimens were seen in Denmark. Since 1980 it has been recorded first from N.W.Germany, then from the Netherlands. It has subsequently been recorded from southwest Germany, Switzerland and one of the small islands off the north coast of Scotland. **Determination:** see Key provided in StN Keys volume and Bartsch *et al*. (2009b). Nielsen (1997) figures the male terminalia. Both male and female are illustrated in colour by Torp (1994). **Illustrations of the adult insect:** the male is shown in colour by Bartsch *et al*. (2009b), Bot and Van de Meutter (2019) and Speight and de Courcy Williams (2021).

Helophilus bottnicus Wahlberg, 1844
Preferred environment: forest/freshwater/open ground; seasonally-flooded alluvial grassland on sandy soil (H. Bartsch, pers. comm.) and taiga forest (S. Kerppola, pers.comm.). Habitat associations of this species remain poorly known and difficult to define. **Adult habitat and habits:** no data. **Flowers visited:** *Ribes rubrum, Salix glauca* (pers.comm. H. Bartsch). **Flight period:** June. **Developmental stages:** not described. **Range:** Sweden (extinct?), Poland (extinct?), northern and central Finland, northern Siberia across to the Russian Far East. There are very few European records of this species and it has been listed as extinct in Europe by the IUCN (Vujić *et al*. 2022). It is also present in the Nearctic, with scattered records from central Canada westwards into Alaska. **Determination:** See Key provided in StN Keys volume; Bartsch (1977) and Nielsen (1997), who figures the male terminalia. A coloured photograph of the adult female is provided by Haarto & Kerppola (2007). **Illustrations of the adult insect:** Bartsch *et al*. (2009b) show a coloured figure of the male. Further coloured illustrations of the male can be found in Skevington *et al*. (2019).

Helophilus continuus Loew, 1854
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Roumania (Danube delta); Turkey; Ukraine and the Transcaucasus (Georgia) and on through Asiatic Russia to the Pacific (Kamchatka); Mongolia. **Determination:** See Key provided in StN Keys volume, or Speight & Labatut (2022). This species is not included in the key provided by Nielsen (1997). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Helophilus groenlandicus (Fabricius), 1780
Preferred environment: wetland; palsa mire (Van Steenis and Zuidhoff, 2013); bog, taiga/tundra. **Adult habitat and habits:** no data. **Flowers visited:** *Allium sibiricum, Epilobium angustifolium, Matricaria, Stellaria, Tripleurospermum perforatum, Valeriana*. **Flight period:** end June/mid September. **Developmental stages:** not described. **Range:** the Shetland islands and north-west coast of Scotland (vagrant?), Norway, Sweden, the Baltic (Sweden, Finland, Estonia, Latvia, Lithuania), northern parts of European Russia and northern Siberia through to the Pacific, Greenland, Alaska, Canada and mountainous parts of the USA south to Colorado and New Hampshire. Not known from Iceland. **Determination:** See Key provided in StN Keys volume and Bartsch *et al*. (2009b). Nielsen (1997) figures the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b); Haarto & Kerppola (2007) and Skevinton *et al*. (2019).

Helophilus hybridus Loew, 1846
Preferred environment: wetland/freshwater; non-eutrophic pools both temporary and permanent in fen, poor fen, deciduous woodland and dune slacks; cutover valley bog; fen carr; brooks through woodland. **Adult habitat and habits:** flies up to 2m from the ground, usually close to water and in the vicinity of dense, tall vegetation, e.g. *Iris, Filipendula, Salix* carr; settles on foliage up to 2m. **Flowers visited:** white umbellifers; *Calluna vulgaris, Cirsium, Convolvulus, Crataegus, Echium, Euphorbia, Limonium, Lycopus, Mentha aquatica, Menyanthes, Narthecium, Parnassia palustris, Plantago, Pulicaria, Rosa, Rubus, Salix repens, Salix spp., Senecio, Sorbus, Succisa, Taraxacum, Valeriana.* **Flight period:** beginning May/ beginning September. **Developmental stages:** larva described and figured by Hartley (1961), from larvae collected from decaying rhizomes of *Typha*, in a pond. This species has also been collected in numbers from emergence traps installed over beds of *Glyceria maxima*, in a seasonally temporary pool. **Range:** from Fennoscandia south to SW France (Speight & Labatut, 2022); from Ireland eastwards through much of northern and central Europe (though very localised in the Alps); Balkan peninsula; European Russia and on through Siberia to the Pacific coast; Serbia, Mongolia; in N America from Alaska to Nova Scotia and south to Utah. **Determination:** See Key provided in StN Keys volume. An alternative key (in English and French), separating *H. hybridus* from other central and southern European *Helophilus* species, is provided by Speight and Labatut (2022). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors,including Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Helophilus lapponicus Wahlberg, 1844
Preferred environment: forest/wetland/open ground; fen in boreal *Picea/Pinus/Betula* forest; taiga wetlands, palsa mires in tundra (H. Bartsch and T. Nielsen, pers. comm.); Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** no data. **Flowers visited:** *Achillea, Allium sibiricum, Caltha, Dryas, Matricaria, Ranunculus, Rubus chamaemorus, R. idaeus, Sorbus aucuparia*. **Flight period:** end June/beginning September. **Developmental stages:** not described, but probably in pools and ditches (Nielsen, 1997). **Range:** Norway, Sweden, Finland, Lithuania and northern parts of European Russia and on through Siberia to the Pacific coast; Kyrgyzstan (Ssymank and Nielsen, 2012); Greenland; in N America from Alaska south to Oregon, Colorado and New York State. **Determination:** See Key provided in StN Keys volume and Bartsch *et al*. (2009b). Nielsen (1997) figures the male terminalia. Nielsen (1997) points out that *H. borealis* Staeger is apparently the same species as *H. lapponicus*, but does not accommodate the resultant variability of *H. lapponicus* within his key. Specimens of *H. lapponicus* that would previously have been referred to "*H. borealis*" (e.g. in Violovitsh, 1986) are here keyed out separately, as variety *H. lapponicus* v. *borealis*, in an attempt to overcome this problem. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.* (2009b); Haarto & Kerppola (2007) and Skevington *et al.* (2019)..

Helophilus pendulus (L.), 1758
Preferred environment: freshwater/wetland; an anthropophilic species which has become ubiquitous in some regions of Europe because of its ability to use a wide range of standing water and sub-aqueous habitats for larval development. **Adult habitat and habits:** flies low over and among waterside vegetation; also found away from water along woodland tracks, in suburban gardens, along field hedges, in pasturage etc. **Flowers visited:** Compositae; Rosaceae, including flowering understorey trees; Umbelliferae and a wide range of other white and yellow flowers (see de Buck, 1990), including *Berberis, Menyanthes, Polygonum* and *Salix;* also at pink flowers such as *Cirsium* and *Succisa*. **Flight period:** April/October (March in southern Europe and stragglers on into November). **Developmental stages:** larva described and figured by Hartley (1961) and illustrated in colour (apparently from a preserved specimen) by Rotheray (1994). The living larva and the puparium are shown in colour by Dussaix (2013). Larvae occur in standing water of ponds (including garden ponds), canals, wet ditches,

open tree hollows and garden water butts and in sub-aqueous decaying vegetable matter such as cow-dung, wet compost heaps and slurry pits. Dussaix (2013) observes that the duration of the puparial phase varies with the generation, more than 4 weeks for puparia from overwintering larvae, but less than 2 weeks for puparia from non-overwintering larvae. **Range:** from Iceland, Fennoscandia and the Faroes (Jensen, 2001) south to Iberia; from Ireland eastwards through central and southern Eurasia to the Pacific coast; more localised in southern Europe. **Determination:** See Key provided in StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by v arious authors, including Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Helophilus trivittatus (Fabricius), 1805
Preferred environment: wetland/open ground; river margins, seasonally flooded humid grassland and salt-marsh; becomes to a significant extent anthropophilic in southern Europe, where it frequents irrigation ditches in farmland. **Adult habitat and habits:** flies fast and low among ground vegetation, usually close to slow-moving water and is extremely evasive; occasionally settles on the bare ground of paths; to a significant extent a migratory species, the adult fly not infrequently being found at a great distance from sites appropriate for larval development. **Flowers visited:** umbellifers; yellow composites; *Armeria, Aster, Cakile, Centaurea, Chrysanthemum, Cirsium, Crataegus, Epilobium angustifolium, Eryngium, Eupatorium, Euphorbia, Ligustrum, Lychnis, Lythrum, Mentha, Menyanthes, Origanum, Plumbago, Polygonum persicaria, Potentilla, Ranunculus, Rubus fruticosus agg. Salix, Succisa, Sorbus.* **Flight period:** May/October, with peak in August. **Developmental stages:** apparently still undescribed, although larvae have been reared by Dolezil (1972) from eggs laid on a hay infusion in water. The eggs were laid in batches of 100-150 over a period of a week in September. Some of the larvae kept in the laboratory pupated in November, but the others, kept outdoors until frosts commenced and then in a cool cellar, pupated from 21 April onwards in the next year. The puparial phase lasted 2 weeks. The larva has also been found in liquid mud with a high organic content of animal dung and rotting vegetation. Bagachanova (1990) observed oviposition on plants bordering shallow water enriched by organic material and notes that the eggs of this species float in water. From rearing the species under laboratory conditions she established that *H. trivittatus* overwinters as a larva. **Range:** from Fennoscandia south to the Mediterranean and from Ireland eastwards through Eurasia to the Pacific, including Iran and Afghanistan. This species is regarded as highly migratory and can frequently be found in habitats which cannot support its larvae. Evidence of truly long-distance movements by the species is less easy to come by. Nielsen *et al*. (2010) document one such instance. **Determination:** See Key provided in StN Keys volume. This species appears in some recent literature e.g. Peck (1988) under the name *parallelus* (Harris). But it can be shown that application of the name *parallelus* to this species is unjustified (Speight, 1988). The female closely resembles those of *H. affinis* and *H. hybridus* in the field and these species may be found in flight together. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Bot and Van de Meutter (2019), Kormann (1988), Stubbs and Falk (1983) and Torp (1984, 1994).

HERINGIA

The species of the genus *Neocnemodon* have at various times been consigned to *Heringia*, but recent genetics work argues for separation of *Heringia* from *Neocnemodon* (Vujić *et al*., 2013a), as in Peck (1988). However, of the *Heringia* species listed in Peck (1988) three have been shown by Claussen *et al*. (1994) to be junior synonyms of other syrphids. Claussen *et al*. (1994) also reinstate the Canary Isles endemic, *H. propinquans* (Becker), as an additional *Heringia* species and point out that there are no reliable features for distinguishing *H. senilis* Sack from *H. heringi* (Zett.), so that its status remains uncertain. There are then only 2 certain European *Heringia* species recognised as present.

Heringia adpropinquans (Becker), 1908
Preferred environment: Laurisilva forest (Báez, 1977). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May, July/August. **Developmental stages:** not described. **Range:** Canary Isles. **Determination:** Claussen et al.(1994) provide a key in which this species is distinguished from *H.heringi* and figure the male terminalia. In the male of *H.adpropinquans* the surstylus is noticeably broader in the apical half of its length, whereas in *H.heringi* it is almost parallel-sided, from base almost to apex. **Illustrations of the adult insect:** none known.

Heringia heringi (Zetterstedt), 1843
Preferred environment: forest; deciduous forest (*Fagus, Quercus*), including alluvial hardwood forest, plus broad-leaved evergreen forest (*Q.ilex/Q.suber*), orchards and sometimes suburban gardens (where fruit trees are present). **Adult habitat**

and habits: flies low among the foliage of bushes and within low-growing vegetation, at the edge of clearings or along paths, usually in partial shade; visits flowers in partially shaded situations; comes out into the open to sun-bathe on the foliage of low-growing shrubs in the evening. **Flowers visited:** *Alliaria, Allium ursinum, Anthriscus, Caltha, Cornus sanguinea, Eruca sativa, Hypericum, Prunus spinosa*. **Flight period:** generally end April/July, with occasional specimens in August, but with a second generation in August/September in southern Europe. **Developmental stages:** larva described and figured by Dusek and Laska (1959); larval biology described by Dusek and Kristek (1967), Kurir (1963) and Rojo et al.(1999); the larvae are predators of gall-making or leaf-curling aphids or psyllids on various trees, e.g. *Populus* and *Ulmus*, fruit trees e.g. *Malus*, *Prunus* spp., *Pyrus*, shrubs e.g. *Laurus*, *Pistachio* and live within the aphid galls, one larva per gall being normal. Ball and Morris (2013) provide a coloured illustration of the larva of *H. heringi* with its aphid prey, within a gall on *Populus*. In the case of *Laurus nobilis*, Rojo et al.(1999) observed that it was characteristically the young plants, less than 1m tall, on which *H.heringi* larvae were found. Rojo and Marcos-García (1997) established that from oviposition to production of a puparium takes three weeks and that the adult hatches from the puparium after two weeks, during the summer. The larvae overwinter in diapause, which ends in April/May. **Range:** from southern Norway to southern Spain and the Mediterranean (including Crete); from Ireland eastwards through central and southern Eurasia to Greece, Roumania, Turkey and European parts of Russia; Mongolia. **Determination:** Claussen et al.(1994), who figure the male terminalia. *H.heringi* as recognised here is regarded by some authors as a mixture of two species, *H.heringi* and *H.senilis* Sack. Claussen et al.(1994) were unable to find consistent differences that supported this subdivision and this situation has not changed subsequently. Authors who continue to recognise *H.senilis* as a separate species have failed to provide any additional features to substantiate their action. Jones (2001), for instance, refers to the same features as used by Claussen et al.(1994), but re-interprets them, claiming constancy in differences between *H.heringi* and his "*H.senilis*", in both length of the third antennal segment and shape of a sclerite (post-anal lamella) of the male terminalia. He also regards colour of general body hairs, and in particular the colour of the hairs on the mesonotum (wrongly cited as "dorsum of pronotum" in Jones's key) as diagnostic, *H.senilis* being regarded as white-haired and *H.heringi* "dark" haired. It is not clear how the identity of the many specimens with mixed white and dark hairs, intermediate-length 3rd antennal segment and intermediate post-anal lamellae would be decided. In the present text the case for recognition of *H.senilis* as a separate species is regarded as unproven. *H.heringi* does occur in a wide range of forest types, however, and its larvae live in galls on trees and shrubs of very different type e.g. *Laurus, Pistachio, Populus, Prunus*, so its apparent variability might be indicative of the existence of a number of very similar species (rather than just two) under the same name. *H.heringi* would seem to be an appropriate subject for molecular taxonomic study! **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Bot and Van de Meutter (2019). Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Heringia senilis **-** see under *H.heringi*

ISCHIODON

Between 2006 and 2018 *Ischiodon* species were consigned to the genus *Simosyrphus*, following the work of Laska *et al*. (2006). Mengual *et al*. (2018) re-instated the genus *Ischiodon*, based on a large-scale molecular genetics study of the *Eupeodes-Scaeva* lineage. A small genus, *Ischiodon* is included, under that name, in Vockeroth's (1969) key to European genera of Syrphini. Essentially, it may be distinguished by the following combination of characters: squama without long hairs; anterior, flat portion of mesopleuron bare; hypopleuron bare; mesoscutum with a well-developed, sharply-defined yellow, longitudinal stripe laterally, down each side; abdomen distinctly margined; wings almost bare of micortrichia; males with a digitate or spine-like protuberance on the hind trochanters. In general appearance *Ischiodon* species are reminiscent of rather broad-bodied *Sphaerophoria* with a parallel-sided abdomen. One species, *I. scutellaris* (Fabricius), is more or less cosmopolitan in the Oriental/Oceanic and Australasian regions and reaches the southern Palaearctic in much of Asia, to as far west as NE Greece. A second species, *I. aegyptius* (Wiedemann) occurs throughout Africa and just reaches the Mediterranean coast of Europe in the Iberian peninsula and the Aegean islands (Greece). A key for the separation of these two species is provided in the StN Keys volume. A third species, *I. feae* (Bezzi) is endemic to the Cape Verde islands. Peck (1988) refers to an additional Palaearctic species, *I. libycus* Nayar, described from Libya.

Ischiodon aegyptius (Wiedemann), 1830
Preferred environment: open ground/scrub; scrub-invaded, dry, thinly-vegetated open ground, crops and fallow land; citrus and pomegranete orchards; open areas and tracksides in woodland; landward edges of reed beds. **Adult habitat and habits:** flies low through sparse ground vegetation and settles on flowers of low-growing herbs. **Flowers visited:** *Foeniculum*. **Flight period:** June/October (Madeira), August (southern Spain); throughout the year (Canary Isles, N Africa). **Developmental stages:** the developmental stages are described and figured by Tawfik *et al*. (1974); an aphid predator on low-growing plants, shrubs and small trees, including various crops, e.g. cotton, maize, squashes. Rojo *et al*. (2003) report the larvae as feeding on aleyrodids, larvae of Lepidoptera and thrips (Thysanoptera), as well as on aphids. Marcos-García (pers. comm.) has reared this species from a larva collected on *Euphorbia obtusifolia* in the Canary Isles. Laska *et al*. (2006) provide a key for separation of the last instar larvae and puparia of *I. aegyptius* and *I. scutellaris*, and also describe their diagnostic features. **Range:** throughout the Afrotropical region and through the Sahel (Senegal, Gambia) into N Africa to the coast of the Mediterranean and the Arabian peninsula; Cyprus; southern Spain; the Mediterranean zone of southern France; Corsica; southern Italy; Aegean islands (Greece); the Balearic Islands (Spain); Madeira (Portugal) and the Canaries (Spain). Adults have almost never been seen in continental Europe other than in the summer and autumn, suggesting this species may not be resident, but establishes temporary populations in favourable seasons. However, Vujić & Petrović (2024) report collection of a larva in mid-May (subsequently reared to produce an adult) in Montenegro, pointing out that the early date of collection indicates that the species may be present there throughout the year. **Determination:** See Key provided in StN Keys volume for separation of *I. aegyptius* from *I. scutellaris*. Its terminalia are figured, together with those of *I. feae* (Bezzi), by Claussen and Barkemeyer (1987), and with the terminalia of all other known *Ischiodon* species, by Mengual (2018). **Illustrations of the adult insect:** the male is illustrated in colour in Van Steenis *et al*. (2021); a coloured photo of the female is provided by Smit *et al*. (2004). http://cyrille.dussaix.pagesperso-orange.fr/

Ischiodon scutellaris (Fabricius), 1805
Preferred environment: open ground/freshwater; along the margins of water bodies (including irrigation ditches) and wetlands (permanent or temporary/seasonal), or in oases, in xeric environments (M. Ebejer, pers. comm.); along dry water courses in coastal dry grassland; various crops, including potato (*Solanum tuberosum*), peas (*Pisum sativum*) and mustard (*Sinapis alba*) (Lal and Gupta, 1953). **Adult habitat and habits:** flies low, in a manner reminiscent of *Sphaerophoria* (M.Ebejer, pers.comm.). **Flowers visited:** *Citrullus colocynthis, Diplotaxis harra, Fagonia indica, Reichardia spp.* (M.Ebejer, pers.comm.); *Foeniculum*. **Flight period:** January/April (Turkey) and September. **Developmental stages:** described (as *Sphaerophoria scutellaris*) by Lal and Gupta (1953), who found larvae on various low-growing and tall herbaceous plants, including lianas. They remark that they found larvae frequently on crops of mustard (*Sinapis alba*). Laska *et al*. (2006) provide a key for separation of the last instar larvae and puparia of *I. aegyptius* and *I. scutellaris*, and also describe their diagnostic features. **Range:** NE Greece (De Courcy Williams e*t al*. 2011) and Aegean islands; Turkey; Crimea; southern, Asiatic parts of the Palaearctic from Iran to Japan; Oriental Region; Oceania; Australasian Region. **Determination:** A key for the separation of *I. aegyptius* and *I. scutellaris* is provided in the StN Keys volume. The male terminalia are figured, together with the terminalia of all other known *Ischiodon* species, by Mengual (2018), who also provides a key to known *Ischiodon* species. **Illustrations of the adult insect:** a coloured photo of the male is provided by De Courcy Williams *et al*. (2011) and Van Steenis *et al*. (2021).

ISCHYROPTERA

From the information currently available, this monotypic genus appears to be endemic to central Europe.

Ischyroptera bipilosa Pokorny, 1887
Preferred environment: bare ground; calcareous, rocky moraine and talus slopes from 2400m, with very sparse ground vegetation; has also been collected at 1600m, in montane/subalpine, unimproved, calcareous grassland (pers.comm. G. Van de Weyer). **Adult habitat and habits:** in flight when snow melt has progressed far enough for patches of bare ground to be exposed; males hover at 2-3 m and settle on rocks (P.Goeldlin, pers.comm.). **Flowers visited:** *Potentilla* (pers.comm. G. Van de Weyer). **Flight period:** end May/June. **Developmental stages:** not described. **Range:** Alps (France, Switzerland, Austria, Italy). **Determination:** See generic Key provided in StN Keys volume and Sack (1928-32). **Illustrations of the adult insect:** a coloured photo of the female is provided by Speight and de Courcy Williams (2021).

KATARA

The genus *Katara* was established by Vujić *et al*. (2018b) for the distinctive species *K. connexa*, which is described in the same paper. Their description of the genus is accompanied by a genetic analysis of its phylogenetic relationships, which results in placement of *Katara* within the tribe Rhingiini.

Katara connexa Vujić & Radenković, in Vujić *et al*., 2018
Preferred environment: montane conifer forests of *Pinus heldreichii*/*P. nigra* ssp. *pallasiana* (Vujić *et al*., 2018b). **Adult habitat and habits:** no data. **Flowers visited:** *Carduus* (Vujić *et al*., 2020). **Flight period:** May. **Developmental stages:** not described. **Range:** NW Greece (Pindos mountains). Vujić *et al*. (2018b) conclude that *K. connexa* requires recognition as an endemic glacial relict species requiring conservation measures. **Determination:** both sexes of this species are described by Vujić *et al*. (2018b), who provide figures of various morphological features of both male and female, including the male terminalia. They also provide a key separating *Katara* from related genera. **Illustrations of the adult insect:** the general appearance of the male of *K. connexa* can be seen in the coloured photo included in Vujić *et al*. (2018b). A coloured illustration of the male is provided in Speight and de Courcy Williams (2021).

LAPPOSYRPHUS

Lapposyrphus has generally been treated as a subgenus of *Eupeodes*, e.g. in Peck (1988), Thompson and Rotheray (1998). However, it has progressively becoming apparent that a more realistic arrangement would be to recognise *Lapposyrphus* as a separate genus, a course of action re-enforced by the molecular genetics study of Mengual *et al*. (2018). Only one Palaearctic species is consigned to this genus.

Lapposyrphus lapponicus (Zetterstedt), 1838
Preferred environment: forest, both coniferous (*Picea/Abies*) and deciduous (mesophilous and humid *Fagus*) forest, up to and including the altitude of the *Larix* zone (2,000m in the Alps); also in montane birch (*Betula*) forest of northern Europe and in conifer (*Picea/Abies*) plantations. **Adult habitat and habits:** clearings, tracksides etc.; males hover at 2 - 5m over tracks etc. and also in the shade, beneath large trees, with one male stationed beneath each tree; settles on shrub foliage and tree trunks. It was suggested by Goeldlin (1974) that *L.lapponicus* can overwinter as an adult and large numbers of females of this species have been observed, in the middle of November, investigating cracks in rock faces along a track in *Quercus/Picea* forest. Similarly, Wolff (1990) found females of *L.lapponicus* hibernating in the brickwork of a bridge, in a wooded locality, two years running. But Kula (1982) indicates overwintering occurs as larva or puparium, so it may well be that in this species larvae, puparia and adults can hibernate successfully. **Flowers visited:** *Allium ursinum*, *Caltha*, *Chaerophyllum*, *Chelidonium*, *Crataegus*, *Euphorbia*, *Hieracium*, *Knautia*, *Ligustrum*, *Prunus spinosa*, *Ranunculus*, *Rubus*, *Salix*, *Sorbus*, *Tussilago*. **Flight period:** March/November, but most frequent in the period June/August. This is a highly migratory species (Aubert *et al*., 1976). **Developmental stages:** larva described and figured by Goeldlin (1974). According to Kula (1980) the larvae may be found at all heights above the ground in spruce (*Picea*) trees and can overwinter among litter on the forest floor. Laska and Stary (1980) reared *L.lapponicus* from aphids on *Euonymus* and *Fagus*. According to Skevington *et al*. (2019) the larvae "feed on aphids and adelgids on *Abies*, *Cedrus*, *Euonymus*, *Fagus*, *Gleditsia triacanthos*, *Larix*, *Malus*, *Picea*, *Pinus*, *Prenanthes purpurea* and *Rhododendron*". **Range:** Fennoscandia south to Spain and the Mediterranean (including Crete); from Ireland east through most of Eurasia (including Turkey and the Transcaucasus) to the Pacific coast; Iceland; Greenland; N America from Alaska to California. **Determination:** See Key provided in StN Keys volume, Dusek and Laska (1976) and van der Goot (1981), where *L.lapponicus* appears as *Metasyrphus lapponicus*. Stubbs and Falk (1983) and Ball *et al*. (2002) suggest that two species may be confused under the name *lapponicus*, but do not resolve this issue and their contention is here regarded as unproven. *L. lapponicus* is easily confused with various *Eupeodes* species, such as *E.bucculatus*, *E.luniger* or *E.nielseni*, but may be distinguished from all known European *Eupeodes* by its bare metasternum. This sclerite carries long hairs in *Eupeodes* species. The male terminalia are figured by Dusek and Laska (1976). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988) and Bartsch *et al*. (2009a). The male and female are illustrated in colour by Pétremand *et al*. (2022).

LEJOGASTER

This genus is still regarded as a subgenus of *Chrysogaster* by some authors. Four species are included here by Peck (1988). Maibach et al.(1994a, 1994b) demonstrate that one of them, *L.virgo* Rondani, is a synonym of *L.metallina* and argue that, from its description, the species frequently referred to as *L.nigricans* Stackelberg in recent literature does not belong in *Lejogaster*. Kassebeer (1999) transfers that species to *Melanogaster*. So following their work only 2 European species would be consigned to this genus. The earlier works of both Van der Goot (1981) and Bradescu (1991) include *nigricans* of Stackelberg in their keys to *Lejogaster* species.

Lejogaster metallina (Fabricius), 1781
Preferred environment: freshwater/wetland; transition mire, fen, marsh, pool and lake edge; humid, seasonally flooded grassland, poorly-drained pasture, beside brooks; along brooks and permanently water-filled ditches in open situations and along brooks in *Quercus ilex* forest in southern Europe. **Adult habitat and habits:** flies among low-growing vegetation. **Flowers visited:** Ranunculaceae; white umbellifers; *Cochlearia, Convolvulus, Leontodon, Polygonum, Symphoricarpos, Valeriana.* **Flight period:** May/June (with stragglers in July; also July at higher altitudes) and August/September. **Developmental stages:** larva described and figured by Maibach and Goeldlin (1994) and by Hartley (1961); aquatic, occurring among plant roots just at the level of the water surface, along the edge of slowly running water. **Range:** from northern Fennoscandia and the Faroes (Jensen, 2001) south to Iberia; from Ireland eastwards through Eurasia to the Pacific coast; N Africa. Continuing drainage of farmland and general loss of wetlands is resultingin progressive localisation of this species. It is now regarded as threatened in Poland (Zóralski, 2023). **Determination:** van der Goot (1981). The male terminalia are figured by Maibach *et al*. (1994a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Lejogaster tarsata (Megerle in Meigen), 1822
Preferred environment: freshwater/wetland; clean water streams, springs in fens and spring-fed ponds. **Adult habitat and habits:** margins of streams and pools, flies in a zigzag, darting fashion, among taller vegetation. **Flowers visited:** white umbellifers; *Crataegus, Matricaria, Ranunculus*. **Flight period:** mid May/August, and on to the end of September in southern Europe. **Developmental stages:** larva described and figured by Maibach and Goeldlin (1994) and by Hartley (1961), from larvae found among floating, decaying vegetation in a pond; the larva is figured in colour by Rotheray (1994). **Range:** from Fennoscandia south to the Mediterranean and Mediterranean islands (Corsica, Sicily); from Ireland east through central and southern Europe into European parts of Russia; Iran and Afghanistan and on by way of Uzbekistan, Tajikistan, Kirghizia, Turkmenia and Kazakhstan to Mongolia, south-eastern Siberia and the Pacific coast. **Determination:** van der Goot (1981). The male terminalia are figured by Maibach *et al*. (1994a). This species appears as *L. splendida* (Mg.) in much recent literature, including van der Goot (1981) and Stubbs and Falk (1983). Maibach *et al.* (1994b) reinstate the name *tarsata*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

LEJOPS

As recognised here *Lejops* contains only one species. However, broader concepts of the genus recognise a series of subgenera of *Lejops*, including *Mesembrius*, *Anasimyia* and *Parhelophilus*. Another interpretation is employed by Thompson and Rotheray (1998), who regard *Lejops* as comprising two subgenera, *Lejops* and *Arctosyrphus*, consigning the *Anasimyia* species to subgenus *Lejops*, along with *L.vittata*.

Lejops vittatus (Meigen), 1822
Preferred environment: freshwater; standing and slow-running freshwater bodies supporting stands of *Phragmites, Typha* or *Scirpus*, including coastal lagoons with *S. maritimus* and ox-bows on functional floodplains of large rivers. **Adult habitat and habits:** flies among emergent vegetation of reeds etc. along the edges of freshwater bodies and standing-water ditches, keeping low; settles on reeds, *Typha* etc. Visits the flowers of plants like *Schoenoplectus* early in the morning (06.00 – 08.30, A. van Eck, pers. comm.). Flies above the water in beds of emergent plants and is rarely found elsewhere. **Flowers visited:** *Bolboschoenus maritimus, Phragmites, Schoenoplectus lacustris,* male *Typha*. **Flight period:** mid June/mid August, with the peak in July. **Developmental stages:** Waitzbauer (1976) records that the eggs of this species are laid on the stems and

leaves of emergent plants like *Typha*, the larvae falling into the water once hatched. The larvae apparently remain more-or-less at the water surface, in association with floating plants such as *Lemna*, for most of their development, but by the last instar have moved into the submerged organic ooze/mud at the bottom of the pond or ditch in which they are living. **Range:** from Fennoscandia south to the Mediterranean coast of France, including Corsica; Balearic Islands (Mallorca); from Britain (southern England) eastwards through central Europe (Germany, Poland, Austria, Hungary) and Italy and the former Yugoslavia into Greece, Bulgaria, Roumania and southern parts of European Russia; Turkmenistan, Uzbekistan, Kirghizia, Tajikistan and Kazakhstan into southern parts of Siberia and on to the Pacific. **Determination:** may be determined using the generic key in the StN Keys volume. **Illustrations of the adult insect:** the adult insect is figured in colour by Ball and Morris (2013), Bartsch *et al*. (2009b), Bot and Van de Meutter (2019) and Stubbs and Falk (1983).

LEJOTA

Peck (1988) lists three European species. One of these, *L.beckeri* (Shannon) has not been referred to in literature for many years (including the recent check lists for Germany and the Czech Republic, from where the type material of *L.beckeri* originates), and is given as a junior synonym of *L.ruficornis* (Zetterstedt) in Thompson and Brake (2005), but with no indication of the source of that synonymy. The other two species are differentiated in the keys of van der Goot (1981) and Violovitsh (1986), though *L.korsakovi* (Stackelberg), categorised by Pack (1988) as occurring in the "Central European Territory" of the then USSR, is probably wrongly regarded as a Europen species since it does not seem to have been found West of the Urals. This genus has been synonymised with other genera in the past, for instance appearing as a synonym of *Cheilosia* in Sack (1928-32) and as a synonym of *Myolepta* in Séguy (1961).

Lejota korsakovi (Stackelberg), 1952
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Trollius riederanus, Wiegela middendorffiana* (Gritskevich, 1998). **Flight period:** June. **Developmental stages:** not described. **Range:** the Urals in Russia and eastern Siberia. **Determination:** Violovitsh (1986) provides a key for separation of the males of *L.korsakovi* and *L. ruficornis*. The female of *L.korsakovi* remains undescribed. **Illustrations of the adult insect:** none known.

Lejota ruficornis (Zetterstedt), 1843
Preferred environment: forest/freshwater; boggy stream-sides and pool edges in open forest from the *Picea* forest zone upwards into alpine grassland; flushes with streamlets (slope mires) in *Alnus viridis* scrub. In Sweden this species appears to be associated with open, overmature and senescent mire forest of *Betula* and *Populus tremula*, including areas where forest fires have resulted in the presence of large quantities of dead wood (Bartsch, pers.comm.). **Adult habitat and habits**: usually close to water; settles on low-growing vegetation and on rotten logs: flight reminiscent of *Chrysogaster* species (Moertelmaier, pers.comm.); on flowers runs about like a muscid or a tachinid, or *Xylota* spp. Indeed, given its general body shape and colour *L.ruficornis* is easily mistaken for a tachinid, when feeding at a flower. **Flowers visited**: *Caltha, Prunus avium, Ranunculus*. **Flight period**: end May/end June and July at higher altitudes **Developmental stages:** not described. The larva of a north American *Lejota* species was found by Metcalf (1913), under the bark of a rotten log. From the available data there is a high probability that the larvae of this species are associated with fallen timber (including small branches) of deciduous trees, partially-submerged in shallow water, and with wet wood partially rotted by Polyporaceae. Bartsch et al.(2009b) suggest that, in Scandinavia, the larvae develop in rotting wood of *Populus tremula*. **Range**: Norway, Sweden, Finland, Lithuania, Poland, southern Germany (Alps), France (Alps), Czech Republic, Switzerland (Jura, Alps); Austria (Alps), northern Italy (Dolomites); Montenegro (Durmitor); through Russia into eastern Siberia. **Determination:** this species has a confused nomenclatural history, which renders it difficult to locate in literature. The genus is keyed out by Bradescu (1991), van der Goot (1981), van Veen (2004), Violovitsch (1986) and Vockeroth and Thompson (1987). The male terminalia of *L.ruficornis* are figured by Hippa (1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007).

LEUCOZONA

As recognised in the present account, *Leucozona* comprises 5 European species, if *L.nigripila* Mik is regarded as European, occurring as it does on the very edge of the continent, in the Caucasus mountains. The larvae of three of these species are

distinguished in a key by Rotheray (1988a). Some recent authors (e.g. Peck, 1988) have consigned *L. glaucia* and *L. laternarius* to a separate genus, *Ischyrosyrphus*. For separation of the species in the *L.lucorum* complex Doczkal (2002b) should be consulted.

Leucozona glaucia (L.), 1758
Preferred environment: forest; acidophilus *Quercus* and *Quercus/Carpinus/Ulmus* forest; humid *Fagus* forest; riverine gallery forest of *Fraxinus/Salix*. **Adult habitat and habits:** beside streams, in clearings, along tracks, etc., usually in humid woodland; spends considerable time on flowers. **Flowers visited:** white umbellifers; *Filipendula, Sambucus, Senecio*. **Flight period:** end May/September, with peak in July/August. **Developmental stages:** larva described and figured by Dusek & Laska (1962). **Range:** from Fennoscandia south to the Pyrenees; from Ireland east through mountainous parts of central Europe into Turkey, European parts of Russia and Georgia; throughout Siberia to the tundra zone and on to the Pacific coast (Kuril Islands, Japan). **Determination:** van der Goot (1981). The male terminalia are figured by Dusek and Laska (1967), Hippa (1968b) and Vockeroth (1969). The male and female can differ somewhat in appearance, and this is well shown by Stubbs and Falk (1983). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Leucozona inopinata Doczkal, 2000
Preferred environment: forest; open, non-calcareous areas within sandy *Pinus sylvestris* forest upwards into humid *Fagus* forest. **Adult habitat and habits:** flies in open areas with a rich, tall herb flora and long grasses. **Flowers visited:** umbellifers, *Rubus idaeus*. **Flight period:** May/June, with some individuals occurring later in the year, especially at more northerly latitudes. **Developmental stages:** not described. **Range:** uncertain, due to confusion with related species until recently. Confirmed from Norway, Sweden, Finland, Denmark, Germany, France (Vosges), Switzerland, Austria, Hungary, Ukraine and Japan. **Determination:** Doczkal (2000b), who lists the combination of features which separate this taxon from *L.lucorum* (L.) and *L.nigripila;* Haarto and Kerppola (2007a); Bartsch et al.(2009a). In Doczkal (1998a) this species was confused with *L.nigripila* Mik, the two species subsequently being separated by Doczkal (2000b). The male terminalia of *L.inopinata* are figured by Doczkal (1998a), under the name *L. nigripila*. **Illustrations of the adult insect:** the general appearance of the female of *L.inopinata* is shown in the coloured photograph provided by Haarto and Kerppola (2007a). The male is illustrated in colour by Bartsch *et al*. (2009a). and Bot and Van de Meutter (2019); the female is illustrated in colour by Speight and De Courcy Williams (2021).

Leucozona laternaria (Müller), 1776
Preferred environment: deciduous forest/wetland; poorly drained, humid deciduous forest and along forest streams with *Salix/Alnus* scrub; fen carr. **Adult habitat and habits:** beside woodland streams, tracksides in fen carr and near standing water or wet flushes in forest, nearly always where the ground vegetation is dense and tall; fast flying. **Flowers visited:** white umbellifers; *Cirsium arvense, Convolvulus, Filipendula ulmaria.* **Flight period:** end June/August, with occasional specimens in September. **Developmental stages:** larva described and figured by Rotheray (1988a) from larvae collected on *Angelica* and figured in colour by Rotheray (1994). **Range:** from Fennoscandia south to the Pyrenees; from Ireland east through northern and central Europe into Turkey and European parts of Russia; through Siberia to the Pacific coast (Kuril Isles); Japan. **Determination:** van der Goot (1981). The male terminalia are figured by Hippa (1968b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Leucozona lucorum (L.), 1758
Preferred environment: deciduous forest, including scrub woodland and hedgerows, normally in relatively humid regions and up to the upper altitudinal limit of *Fagus;* unimproved montane grassland. **Adult habitat and habits:** clearings, tracksides etc., flies through bush-level and scrub vegetation. **Flowers visited:** white umbellifers; *Acer pseudoplatanus, Centaurea, Cirsium palustre, Euphorbia, Filipendula, Polygonum cuspidatum, Rubus, Sorbus aucuparia, Taraxacum.* **Flight period:** May/July and on into August in western Europe (stragglers in September). Egg: Chandler (1968). **Developmental stages:** larva described and figured by Dusek & Laska (1967) and figured in colour by Rotheray (1994); aphidophagous. **Range:** from Fennoscandia south to the Pyrenees and northern Spain; from Ireland eastwards through Eurasia to the Pacific coast (Sakhalin and Kuril Islands); Japan. Until recently, *L. lucorum* was also regarded as occurring in N America, but genetic analysis demonstrated that the N American species, now known as *L. americana* Curran, is distinct.

Determination: Doczkal (1998a, 2000b). The male terminalia are figured by Dusek and Laska (1967), Hippa (1968b), Vockeroth (1969) and Doczkal (1998a). Doczkal (2000b) demonstrates that three closely similar species have been confused under the name *lucorum*. One of these, *L.nigripila* Mik, is currently known only from the Caucasus, but the other two species, *L. inopinata* and *L. lucorum*, appear to be widely distributed in Europe and, at least in central Europe, may be found in flight together. A simple, but not entirely reliable, method for distinguishing *L. lucorum* from *L. inopinata* is that in both sexes the hairs on abdominal tergite 4 are predominantly white in *L. lucorum*, whereas they are all black in *L. inopinata*. This feature is used by van Veen (2004), in separation of *L. inopinata* and *L. lucorum*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Colyer and Hammond (1951), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) van der Goot (1986) and Bartsch *et al*. (2009a).

Leucozona nigripila Mik, 1888
Preferred environment: collected from a mosaic of montane/subalpine tall-herb stands and grassland within areas of both deciduous and coniferous forest (Doczkal, 2000b)**. Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August. **Developmental stages:** not described. **Range:** known from Northern parts of the Caucasus mountains, along the southern frontier of European Russia and in Georgia and Azerbaijan. **Determination:** for a long time regarded as a synonym of *L. lucorum*, *L. nigripila* was re-instated and redescribed by Doczkal (2000b), who also lists features that aid in separating both males and females of *L. nigripila* from other European *Leucozona* species. **Illustrations of the adult insect:** none known.

LIOCHRYSOGASTER

Stackelberg (1924) introduced the name *Liochrysogaster przewalskii* for a syrphid collected in the "Oasis Nia", in the Taklamakan desert (Xinjiang Province, China). Until recently, *Liochrysogaster* has remained a monospecific genus known only from the type material of *L. przewalskii*. Bradescu and Parvu (2002) reported the occurrence of *L. przewalskii* in Roumania, based on a solitary male, figuring various parts of the specimen. They do not state on what basis they recognise their specimen as *L. przewalskii*, or provide any descriptive detail of its morphology. Their figures show that their specimen had eyes meeting on the frons for only an extremely short distance – a distance shorter than the length of the anterior ocellus. Indeed, their figure could be interpreted as showing an insect narrowly dichoptic in the male. Photographs of the male type material of *Liochrysogaster przewalskii* are available at:
http://syrphidae.myspecies.info/taxonomy/term/639/media
Those photos clearly show that in the male of *L. przewalskii* the eyes meet on the frons for a distance greater than the maximum width of the vertex, demonstrating that, whatever the species was that Bradescu and Parvu (2002) illustrated from Roumania, it is not *L. przewalskii*. The Roumanian record (Bradescu and Parvu, 2002; Stanescu and Parvu, 2005) is the only published reference to the occurrence of *Liochrysogaster* in western parts of the Palaearctic. So, since that record is evidently erroneous, there is no basis for regarding *Liochrysogaster przewalskii* as a European insect.

MALLOTA

Peck (1988) lists 8 *Mallota* species as occurring in Europe. *M.auricoma* Sack, has subsequently been synonymised (Kassebeer, 1996) with *M.rossica*. Two of the European species (*M.rossica* Portschinsky, *M.eurasiatica* Stackelberg) have so far only been recorded in Europe from European parts of Russia/Belarus/Ukraine. One European species, *M.dusmeti* Andréu, has so far been recorded only from Spain.

Mallota cimbiciformis (Fallen), 1817
Preferred environment: forest; deciduous forest of *Fagus* and *Quercus* with overmature and senescent trees, including thermophilous oak forest (*Q. pubescens; Q. cerris/Q. frainetto*), plus evergreen oak forest of *Q.suber* and *Q.ilex*. **Adult habitat and habits:** largely arboreal, but descends to flowering bushes and shrubs in glades and more open areas; flies between flowering bushes extremely rapidly, with a zigzag flight. Males can be found sitting on vegetation adjacent to rot-holes or patches of humid trunk rot (e.g. at the base of the tree) apparently awaiting the appearance of females. Females may be observed prospecting rot-holes, round the entrance to which they first hover. **Flowers visited:** white umbels; *Cistus, Cornus sanguineus, Crataegus, Euonymus, Euphorbia, Rosa canina, Rubus, Sambucus ebulus, Sarothamnus scoparius.*

Flight period: June/August. **Developmental stages:** larva described and figured by Maibach and Goeldlin (1989), who summarise data available on larval biology. The larva is also illustrated in colour by Rotheray (1994). Dussaix (2013) provides a coloured photo of the puparium. The rat-tailed larva is saprophagous, living in standing-water tree-holes in deciduous trees, e.g. *Acer*, *Aesculus*, *Fagus*, *Populus*, *Quercus*, *Ulmus*, usually at some metres from the ground. Adults have been collected from emergence traps over trunk holes in old, living *Fraxinus angustifolia*, *Quercus pyrenaica* and *Q. rotundifolia* (Conca-Esquembre, 2024). The species apparently shows preference for cavities with narrow entrance holes. These holes can provide entry to central trunk cavities of considerable proportions. *Mallota* larvae have been found in these large cavities, when they are part filled with water, for instance by Dussaix (2005b). The larva of this species over-winters. Duration of the puparial phase is approximately 3 weeks (Dussaix, 2013). **Range:** Southern Fennoscandia south to the Pyrenees and central Spain and on into N. Africa; Britain east through most of Europe to central Siberia; northern Iran. **Determination:** See Key provided in StN Keys volume and van der Goot (1981); Bradescu (1991), Marcos-García (1982). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Mallota dusmeti Andréu, 1926

Preferred environment: forest/open ground; arborescent matorral of evergreen oak (*Quercus rotundifolia*) forest (M.-A. Marcos-García pers.comm.); *Quercus suber* forest (Claussen and Hauser, 1990). **Adult habitat and habits:** no data. **Flowers visited:** *Cistus ladaniferus* (Marcos-García, 1985); *Foeniculum* (Carles-Tolrá, 2006); *Euphorbia; Oenanthe*. **Flight period:** March/July. **Developmental stages:** larva reared (Marcos-García, 2006) from rot-holes in *Fraxinus angustifolius* and *Quercus faginea;* Micó *et al*. (2010) add *Q. pyrenaica* and *Q. rotundifolia* to the list of trees hosting larvae, adding that rot-holes containing larvae were at heights of 1-2.5m from the ground. Lauriaut and Lair (2018) provide an account of rearing *M. dusmeti* from a deep, water-containing rot-hole in the trunk of an ancient, living *Quercus suber*. Larval and puparial features are described and figured by Ricarte *et al*. (2007). **Range:** Portugal, central Spain and N Africa (Tunisia: Claussen & Hauser, 1990). This is one of the few European syrphid species to be included on a National "Red List". It appears on the Spanish Red List as "vulnerable" (Marcos-García, 2006). **Determination:** See Key provided in StN Keys volume and Marcos-García (1982), who provides a key to distinguish this species from *M.cimbiciformis*. In this species the eyes are bare and the abdominal hair covering is short, as in *M.cimbiciformis*. In the male, the eyes are in approximation on the frons only at a point (also as in *M.cimbiciformis*). *M.dusmeti* may be distinguished from *M.cimbiciformis* through possession of black hairs mixed in on the mesoscutum and scutellum (all brown-haired in *M.cimbiciformis*). Also, in *M.dusmeti* all three pairs of legs have the femora and tibiae largely brown, whereas they are mostly/almost entirely black in *M.cimbiciformis*. Andréu (1926) provides a comprehensive description of both the male and the female of this species. There seems to be little difference between this species and *M.eurasiatica*. **Illustrations of the adult insect:** the female is illustrated in colour by Marcos-García (2006). Coloured photos of both male and the female are provided by Louboutin *et al*. (2023).

Mallota eurasiatica Stackelberg, 1950

Preferred environment: forest; deciduous forest with overmature trees; *Betula* forest; suburban parks with overmature deciduous trees (*Populus*, *Ulmus*, *Quercus* etc.) (G.V.Popov, pers.comm.); Eastern thermophilous *Quercus* (*Q.cerris/Q.frainetto*) forest. **Adult habitat and habits:** both males and females rest on trunks of deciduous trees, by tree holes, sap-runs and patches of humid, rotting wood, especially toward the trunk base, and can also be found hovering around trees with trunk cavities or sap-runs (G.V.Popov, pers.comm.). **Flowers visited:** Umbellifers; *Berberis*, *Euphorbia virgata*, *Filipendula vulgaris*, *Rosa*, *Spirea crenata* (A.Barkalov, pers.comm.); *Acer ginnala* (Mutin, 1983); *Crataegus*. **Flight period:** April/July. **Developmental stages:** features of the larva and puparium are described by Kuznetzov and Kuznetzov (1995), based on puparia collected from rot-holes in *Betula*. Sivova & Mutin (2000) also found the larva of this species among wet material in a rot-hole on a young birch (*Betula platyphylla* Sukacz.). N. P. Krivosheina (2020) reports the larva from a water-filled rot-hole in the fallen trunk of the willow *Chosenia arbutifolia*. Svivova *et al*. (1999) both describe and figure features of the larva and briefly describe the puparium, having reared the species from wet, sappy material under the bark of old, live *Ulmus pumila*. They state the species overwinters as a larva and that the insect remains in the puparium for 12-14 days. Features of the larva and puparium are again described and figured by Krivosheina (2002), from larvae collected in sap-run and wet rot-hole material on the trunk of a living tree of *Ulmus propinqua* Koidz**. Range:** Ukraine (Popov *et al*., 2002). European parts of Russia and eastwards through much of Siberia to Kunashir. **Determination:** See Key provided in StN Keys volume and Violovitsh (1986). This species is very similar in appearance to *M.dusmeti*. **Illustrations of the adult insect:** a coloured photo of the male is provided by Speight and De Courcy Williams (2021).

Mallota fuciformis (Fabricius), 1794
Preferred environment: forest; deciduous forest (*Fagus/Quercus*) with over-mature trees; *Quercus/Carpinus/Ulmus* forest with rivers and streams; thermophilous *Quercus* forest (*Q .pubescens*) with gallery forest of *Populus/Salix* along rivers/in wet areas; *Q. cerris/Q. frainetto* forest; ancient cork oak groves.. **Adult habitat and habits:** largely arboreal, but descends to bushes and shrubs to feed. **Flowers visited**: *Crataegus*, *Malus*, *Prunus*. **Flight period:** mid March/beginning May. **Developmental stages:** undescribed, but bred from basal rot-holes containing wet tree humus in trunks of *Quercus suber* (C. Lauriaut, pers.comm.) and trunk rot-holes in *Acer platanoides* (Zóralski *et al*., 2022); also observed egg-laying in a trunk hole in *Aesculus hippocastanum* (Zóralski *et al*., 2022). Maritano *et al*. (2024) demonstrate that, in the flood plain of the R.Po, the presence of *M. fuciformis* is associated with large *Quercus/Carpinus* forest remnants containing overmature oaks (species not specified, but presumably *Q. robur*). **Range:** Germany and Poland south through France to Portugal and Spain; from Brittany (north-west France) eastwards through central Europe to European parts of Russia. In southern Europe from Spain to the former Yugoslavia and on to northern Iran. Evidently much scarcer towards the end of the 20th century than previously, but apparently showing recent range expansion. **Determination:** See Key provided in StN Keys volume and van der Goot (1981), Bradescu (1991), van Veen (2004). *M. fuciformis* is totally unlike *M. cimbiciformis* in appearance, being an almost perfect mimic of a worker of certain *Bombus* species. In this it closely resembles *M. tricolor*, from which it can be separated by its hairy eyes. Its early flight season must militate against capture. **Illustrations of the adult insect:** a coloured photo of the male is provided by Speight and de Courcy Williams (2021).

Mallota megilliformis (Fallén), 1817
Preferred environment: deciduous forest; Falck (1996) has found this species in alluvial hardwood forest (*Fraxinus/Acer*) with overmature trees. The species has also been found in *Quercus/Carpinus* forest adjacent to seasonally flooded ground, but in forest which itself is apparently only rarely (if ever) flooded (M. Reemer, pers.comm.); alluvial forest with ancient *Populus* and *Ulmus* (Zóralski *et al*., 2022). **Adult habitat and habits:** largely arboreal, descending to visit the upper flowering branches of small trees like *Crataegus* and *Salix*, where it is difficult to distinguish from the accompanying *Bombus* spp. (Bartsch, pers.comm.). Males may patrol trackside *Rubus* thickets, at 1-2m, settling on the foliage (M. Reemer, pers.comm.). **Flowers visited:** *Crataegus* (Falck, 1996); *Anthriscus*, *Salix*, *Spiraea salicifolia* (Bartsch, pers.comm.); *Sambucus nigra* (Zóralski *et al*., 2022). **Flight period:** May/July. **Developmental stages:** not described, but this species is closely associated with old trees of *Populus* and *Ulmus* damaged by *Cossus* (G. Popov, pers. comm.). **Range:** Latvia and southern parts of Fennoscandia south to Germany (extinct?); from Poland (endangered) eastwards (including the Czech Republic and Slovakia) into European parts of Russia and the Ukraine and on into Siberia to Khabarovsk. European records of this species are extremely few from the 20th century and it must be regarded as threatened at European level. **Determination:** See Key provided in StN Keys volume and Bradescu (1991); van Veen (2004). **Illustrations of the adult insect:** the adult male is illustrated in colour by Bartsch *et al*. (2009b); Haarto & Kerppola (2007) and Zóralski *et al*., (2022).

Mallota rossica Portschinsky, 1877
Preferred environment: forest; conifer forest and mixed coniferous/deciduous forest (A. Barkalov, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers (A. Barkalov, pers.comm.). **Flight period:** mid May/mid August (A. Barkalov, pers.comm.). **Developmental stages:** not described. **Range:** central parts of European Russia; Iran; Kyrgyzstan; through Asiatic Russia to Sakhalin; Mongolia; China; Korea. **Determination:** see Key provided in StN Keys volume. *M. aino* Violovitsh and *M. auricoma* Sack were synonymised with this species by Kassebeer (1996). Suk *et al*. (2015) list features which distinguish this species from other Palaearctic *Mallota* species. **Illustrations of the adult insect:** Coloured photos of the male and female are provided in Suk *et al*. (2015). A coloured photo of the male is also provided by Speight and De Courcy Williams (2021).

Mallota tricolor Loew, 1871
Preferred environment: steppic grassland with scattered deciduous scrub (G. Popov, pers. comm.); steppic grassland with clumps of scrub *Populus tremula* (Axel Ssymank, pers.comm.) deciduous forest; overmature alluvial hardwood forest (*Quercus*, with *Populus* and *Salix* intermixed) with frequent dead trees and fallen timber (M. Reemer, pers. comm. and 2000b); ancient, living trees of *Acer platanoides* and *Ulmus minor* in parks and at roadsides in farmland (Zóralski *et al*., 2022). These highly contrasting habitat data suggest either that two different taxa are involved or that this species occurs in both semi-arid (steppic) and humid (alluvial forest) habitats. **Adult habitat and habits:** males can be found flying round dead, standing oaks at 2-4m, close to the trunk (M. Reemer, pers.comm. and 2000b) - searching for freshly-emerged females??

Flowers visited: *Euphorbia*. **Flight period:** end April/beginning June. **Developmental stages:** not described. **Range:** Finland (endangered), Latvia, Lithuania, Poland (endangered), Germany (extinct?), Belarus, European parts of Russia and on into Asia through Siberia to Kamchatka. European populations of this species are now residual, except perhaps in Belarus and European Russia. **Determination**: See Key provided in StN Keys volume and Bradescu (1991); van Veen (2004). This species closely resembles *M. fuciformis*, but has bare eyes. **Illustrations of the adult insect:** coloured photos of the male are provided by Zóralski *et al*. (2022).

MATSUMYIA

Known primarily from the Oriental Region, *Matsumyia* species include one from Europe, *M. berberina*, until recently regarded as a species of *Criorhina*. This transfer was effected by Moran *et al.* (2021), on the basis of a wide-ranging and comprehensive genetic study of syrphid genera and species.

Matsumyia berberina (Fabricius), 1805
Preferred environment: forest with overmature trees; most categories of both coniferous and deciduous forest. **Adult habitat and habits:** to a significant extent arboreal, descending to feed at flowers or oviposit; males also "patrol" stands of certain flowers (e.g. *Rubus idaeus*) or trees (e.g. *Crataegus*) in bloom, on the look-out for females; females may also be found flying in the shade, investigating the trunks and roots of old trees for possible oviposition sites; both sexes may be found "sun-bathing" in the evening, on the foliage of shrubs and bushes, in sheltered spots. **Flowers visited:** white umbellifers; *Allium ursinum, Cornus sanguinea, Crataegus, Euonymus, Filipendula, Frangula alnus, Hypericum, Lonicera xylosteum, Mespilus, Photinia, Ranunculus, Rhamnus catharticus, Rhododendron, Rosa, Rubus idaeus, Salix, Sorbus, Taraxacum, Viburnum opulus*. **Flight period:** May/July and on into August at higher altitudes. **Developmental stages:** larva described and figured by Hartley (1961) and Rotheray (1991, 1994), from the rotten wood of a recently fallen *Betula* and from rotten roots of a *Fagus* stump. The larvae probably occur in association with rotten roots of a wide range of trees, including *Abies* and *Picea*. Rotheray (1994) mentions *Betula*, Fagus and *Fraxinus* for this species and reviews its larval biology. **Range:** Fennoscandia south to the Pyrenees and northen Spain; from Ireland eastwards through central Europe to European parts of Russia; Georgia and Turkey; Italy; the former Yugoslavia, Roumania. **Determination:** See Key provided in StN Keys volume, where this species is keyed out in the genus *Criorhina*. Some recent literature still refers to a colour variety of *M. berberina*, *M.berberina v.oxyacanthae*, as a separate species. *Criorhina graeca* of Schirmer, included by Peck (1988) as a separate species, is now recognised as a synonym of *M.berberina*. *Matsumyia berberina* does not exhibit the morphological distinctions currently used to separate *Matsumyia* from *Criorhina* and Moran *et al.*(2021) do not provide any morphological basis for the transfer of *C. berberina* to *Matsumyia*. **Illustrations of the adult insect:** both colour varieties of *M. berberina* are illustrated by Stubbs and Falk (1983) and Pétremand *et al*. (2022). *M. berberina v.oxyacanthae* is also figured in colour by Bartsch *et al.* (2009b), Kormann (1988), Schmid (1996), Torp (1984, 1994) and van der Goot (1986).

MEGASYRPHUS

In recent literature *Megasyrphus* species have variously been regarded as species of *Didea*, species of *Eriozona* or as belonging to a genus in their own right. As a separate genus, *Megasyrphus* has only one species known from the Holarctic and another in Asiatic parts of the Palaearctic.

Megasyrphus erraticus (L.), 1758
Preferred environment: conifer forest (*Abies, Picea*, humid *Pinus*) and plantations. **Adult habitat and habits:** clearings and tracksides etc. from the altitude of *Fagus/Picea* forest upwards into the conifer forest zone; males hover at 3 - 5m in dappled sunlight beneath the canopy in conifer forest; females are apparently primarily arboreal, descending to visit flowers. **Flowers visited:** yellow composites; **white** umbellifers; *Bellis, Calluna vulgaris, Cardamine pratense, Cirsium vulgare, Crataegus, Epilobium angustifolium, Euphorbia hyberna, Geranium, Lonicera periclymenum, Prunus spinosa, Ranunculus, Rubus idaeus, R. fruticosus agg. Salix, Sorbus aucuparia, Stellaria, Veronica, Viburnum.* **Flight period:** May/July, with occasional specimens on through August into September, particularly at more northertly latitudes. **Developmental stages:** larva described and figured by Dusek & Laska (1967) and Goeldlin (1974); recorded by Kula (1982) as overwintering among leaf litter on the floor of spruce (*Picea*) forest. **Range:** Fennoscandia south to the Pyrenees (becomes increasingly montane

toward southern parts of its range); from Ireland eastwards through central Europe and the Alps (plus Apennines in Italy; northern parts of the former Yugoslavia) into European Russia and on through Siberia to the Pacific coast (Sakhalin and Kunashir islands); the Himalayas (Nepal, see Claussen and Weipert, 2003); in N America from Alaska to Mexico. **Determination:** see StN Keys volume; van Veen (2004); Bartsch *et al*. (2009a). The male terminalia, as *M. annulipes*, are figured by Dusek and Laska (1967) and Vockeroth (1969) and, as *Syrphoides annulipes*, by Hippa (1968b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

MELANGYNA

In the present text, *Melangyna* is restricted to the species of *Melangyna* subgenus *Melangyna* of some other authors, who regard *Meligramma* as a second subgenus of *Melangyna*. Some of the European *Melangyna* species have never been included in any key. The most comprehensive keys to European species are those of Haarto and Kerppola (2007a), Bartsch *et al*. (2009a) and Byjebjerg (2011).

Melangyna arctica (Zetterstedt), 1838
Preferred environment: forest; both coniferous forest (*Abies/Picea*, *Pinus*) and plantations and wet deciduous woodland (*Alnus/Betula/Salix*) up to the altitude *of Larix* forest; Alnus *viridis* scrub. **Adult habitat and habits:** largely arboreal, but descends to visit flowers. **Flowers visited:** *Acer pseudoplatanus, Galium, Ilex, Prunus spinosa, Ranunculus, Salix, Stellaria, Taraxacum.* **Flight period:** April/June (and July/August at higher altitudes). **Developmental stages:** larva described and figured by Rotheray (1988a) from larvae collected on *Alnus*, and figured in colour and separated from larvae of some other *Melangyna* species in the keys of Rotheray (1994). **Range:** Fennoscandia, Britain and Ireland (where it is generally distributed), Schwarzwald (Germany), the Czech Republic, France (Pyrenees and Alps), Switzerland, Liechtenstein. It is also known from much of northern and central Siberia, through to Kamchatka. In N America it is known from Alaska and Canada, and down through the Rocky mountains to as far as Colorado. **Determination:** see key provided in StN Keys volume; Speight (1988a); Bartsch *et al*. (2009a). The male terminalia are figured by Hippa (1978). For additional features useful in separation of males of *M. arctica* and *M. barbifrons*, see under *M. barbifrons*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Haarto and Kerppola (2007a), Stubbs and Falk (1983) and Bartsch *et al*. (2009a).

Melangyna barbifrons (Fallen), 1817
Preferred environment: forest; acidophilous *Quercus* forest. **Adult habitat and habits:** largely arboreal, descending to understorey trees and shrubs in flower. **Flowers visited:** *Alnus, Anemone nemorosa, Corylus, Hamamelis mollis, Prunus*, male *Salix, Tussilago*. **Flight period:** February/early April. **Developmental stages:** not described. **Range:** Fennoscandia south to Belgium; from Britain eastwards through central Europe into European parts of Russia and on through Siberia to the Pacific. **Determination:** see key provided in StN Keys volume; Speight (1988a); Bartsch *et al*. (2009a). In Northern Europe, males of *M. arctica* can occur without pale marks on tergite 2, in which condition, they can all too easily be mistaken for males of *M. barbifrons.* But the angle between the eyes in males of *M. barbifrons* is 100° or more, whereas it is 95-100° in *M. arctica* and both the occiput and sternites 1 and 2 are almost entirely black-haired in males of *M. barbifrons*, whereas they are mostly/entirely black-haired in *M. arctica* males (T. R. Nielsen, pers.comm.). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983) and Bartsch *et al*. (2009a).

Melangyna coei Nielsen, 1971
Preferred environment: taiga (Nielsen, 1998), subalpine *Betula* forest (Bartsch et al, 2009). **Adult habitat and habits:** no data. **Flowers visited:** *Trollius riederanus* (Gritskevich, 1998), umbellifers, *Dasiphora fruticosa, Potentilla erecta, Saxifraga aizoides, Taraxacum* (Bartsch *et al*., 2009). **Flight period:** June/July. **Developmental stages:** larva not described, but found on umbellifers (Bartsch *et al*., 2009). **Range:** in Europe, this species appears only to be reported from Scandinavia (Finland, Norway, Sweden), where it ranges from the far north to the southern tip of Norway (Nielsen, 1999); also Asiatic Russia (where it was known as *M. stackelbergi* Violovitsh, until Barkalov and Mutin (2018) pointed out that *M. stackelbergi* is a synonym of *M. coei*). According to Vockeroth (1992) this species is widely distributed in Canada and the USA. However, Vockeroth (*loc.cit*.) says it is distinguishable from *M.compositarum* only "in the presence of abundant and very distinct eye hairs", which raises the question of whether the Nearctic *coei* sensu Vockeroth is the same taxon as *coei* Nielsen.

Determination: see key provided in StN Keys volume; Haarto and Kerppola (2007a), Nielsen (1971a); Speight (1988d); Vockeroth (1992); Bartsch *et al*. (2009a). It remains difficult to separate this species from all other European species in the genus. **Illustrations of the adult insect:** the general appearance of the male of *M.coei* is shown in the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a).

Melangyna compositarum (Verrall), 1873
Preferred environment: conifer forest (*Abies Larix, Pinus*) and conifer plantations, up to (and including) the *Larix* zone. **Adult habitat and habits:** largely arboreal, but descends to visit flowers (usually small trees in bloom); males hover from 2m upwards, at the edge of stands of trees. **Flowers visited:** white Umbelliferae; *Galium, Sorbus aucuparia.* **Flight period:** end May/September (July/September at higher altitudes). **Developmental stages:** undescribed. **Range:** from Fennoscandia south to the Pyrenees and northern Spain; from Ireland eastwards through northern and central Europe (plus northern Italy and the former Yugoslavia) into European parts of Russia; in Siberia from the Urals to the Pacific coast (Kuril Islands); in N America from Alaska south through the Rocky mountains to New Mexico. **Determination:** see key provided in StN Keys volume; Speight (1988a). The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988) and Torp (1994).

Melangyna ericarum (Collin), 1946
Preferred environment: forest: conifer forest; humid *Pinus* forest (*P.sylvestris)* and, occasionally, *P. sylvestris* plantations; along the tree line from 1,700m upwards in the Alps found with Pinus *mugo* and *Larix*. **Adult habitat and habits:** flies fast and low over sparsely-vegetated ground, settling on flowers. **Flowers visited:** white umbellifers, yellow composites, *Ranunculus, Saxifraga paniculata*. **Flight period:** July/August. **Developmental stages:** not described. **Range:** Britain (Scottish highlands), Germany, Czech Republic, France, Switzerland, Italy (Aosta). **Determination:** see key provided in StN Keys volume; Speight (1988a). The black, bristly hairs on the male coxae, referred to by Speight (1988a), may be absent in this species. It may be characterised by the following combination of characters: face with black hairs mixed in laterally, from the level of the antennae downwards; extensive area of microtrichia missing on the second basal cell of the wings: black hairs mixed in, laterally on the mesoscutum: pale spots on abdominal tergites 2-4, those on abdominal tergite two not reaching the margins of the tergite. In the female, the frons has a distinct band of dusting and the pale spots on abdominal tergite 2 are set back from the anterior margin of the tergite for a noticeable distance. This latter feature is mentioned by Collin (1946) as one of the diagnostic features distinguishing the female from those of other species, including *M. umbellatarum*. From the information provided by Vockeroth (1992), it seems probable that *M. ericarum* occurs in N America under the name *M. umbellatarum* (Fab.) at present. If this proves correct, a name change will probably be required for the species known in Europe as *ericarum* at present, since there are at least 5 synonyms of the N. American "*umbellatarum*" which predate Collin's (1946) publication of the description of *ericarum*. **Illustrations of the adult insect:** the male is illustrated in colour by Bartsch *et al*. (2009a).

Melangyna lasiophthalma (Zetterstedt), 1843
Preferred environment: forest; acidiophilous *Quercus* forest; Fraxinus/*Salix* gallery woods along rivers; wet forest of *Alnus*/*Salix*; Betula/*Salix* forest; coniferous forest (*Abies/Picea*) and conifer plantations, plus Atlantic scrub, hedgerows, suburban gardens and orchards. **Adult habitat and habits:** edges of clearings, tracksides etc.; largely arboreal, females flying round tree foliage from 2m upwards; descends to visit flowers and frequently settles on the trunks of standing trees, in the sun; males hover over tracks, in glades etc., from 2m upwards. **Flowers visited:** *Acer pseudoplatanus, Alnus glutinosa, Anemone nemorosa, Anthriscus, Caltha, Chrysosplenium oppositifolium, Corylus avellana, Euphorbia, Ilex, Lonicera xylosteum, Narcissus, Oxalis, Prunus laurocerasus, P.spinosa, Ranunculus, Salix, Sambucus, Sorbus aucuparia, Taraxacum, Tussilago, Ulex.* **Flight period:** March/June and on into July at higher altitudes/more northerly latitudes. **Developmental stages:** larva described and figured by Goeldlin (1974), who found larvae on yellow gentian; aphid-feeding. Figured in colour and separated from larvae of some other *Melangyna* species in the keys of Rotheray (1994). Egg: Chandler (1968). **Range:** from Iceland and Fennoscandia south to the Pyrenees and mountainous parts of Spain; from Ireland eastwards through northern Europe and mountainous parts of central Europe into European parts of Russia; through much of Siberia. In the Nearctic from Alaska south to Colorado and Maryland. **Determination:** see key provided in StN Keys volume; Speight (1988a). The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Torp (1994) and Bartsch *et al.* (2009a). Coloured photos of both male and female are provided by Pétremand *et al*. (2022).

Melangyna lucifera Nielsen, 1980
Preferred environment: forest; *Betula/Pinus/Salix* forest, boreal pine forest. **Adult habitat and habits:** no data. **Flowers visited:** *Acer platanoides, Crocus vernus* (Nilsson *et al*, 2012), male *Salix*. **Flight period:** beginning March/mid May. **Developmental stages:** not described. **Range:** southern Norway, Finland, Denmark, Netherlands, France, Germany, Czech Republic, parts of European Russia and Siberia. **Determination:** see key provided in StN Keys volume; Haarto and Kerppola (2007a), Nielsen (1980). Haarto and Kerppola (2007a), The most comprehensive keys to European *Melangyna* species incorporating *M.lucifera* are those provided by Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a). **Illustrations of the adult insect:** Torp (1994), Bartsch *et al*.(2009a) and Bot and Van de Meutter (2019) illustrate the male in colour.

Melangyna pavlovskyi Violovitsh, 1956
Preferred environment: forest; humid *Pinus/Betula* forest/acidophilous *Picea* forest; mixed coniferous and deciduous forest (Bygebjerg, 2011). **Adult habitat and habits:** no data. **Flowers visited:** *Prunus, Salix* (Bygebjerg, 2011); *Corylus avellana* (Van de Meutter *et al*, 2015). **Flight period:** end March/beginning May (Denmark). **Developmental stages:** not described. **Range:** since first recorded in Europe from Denmark, in 2005, this species has been found in various parts of Northern, Atlantic and central regions of the continent (Austria, Belgium, Czech Republic, Denmark, France, Germany, Netherlands, Norway, Poland, Slovakia, Sweden, Switzerland). Van de Meutter *et al.* (2015) consider the records of this species in western Europe, pointing out that recognition of the presence of *M. pavlovskyi* in Europe has not resulted in discovery of earlier specimens in collections: there is no evidence to suggest the recent European records area are a consequence of anything other than a rapid, recent and considerable expansion of the range of this species. In the eastern Palaearctic it is known from the Pacific coast of Asiatic Russia (Sakhalin) and Japan. The IUCN categorize the status of this species as "Not applicable", in this instance stated to mean that "it has not arrived in Europe by natural expansion from its original area of distribution". *M. pavlovskyi* is one of only two syrphid species occurring in Europe to be consigned by IUCN to the "Not applicable" category (Vujić *et al*., 2022c). There is no scientific data provided in support of this categorisation of *M. pavlovskyi*. Indeed, it is indicated that it is based on surmise. Neither is there any indication of what form of "un-natural expansion" is deemed to explain the recent appearance of this species in Europe. **Determination:** see key provided in StN Keys volume; Bygebjerg (2011); Bot and Van de Meutter (2019). *M. pavlovskyi* is also keyed out by Violovitsh (1986). It is one of the species with an all-black face and the male is closely similar to the male of *M. quadrimaculata*, which can be found in flight together with *M. pavlovskyi* (Bygebjerg, 2011). The female has pale marks on the tergites and could easily be confused with *M. lasiophthalma*, from which its all-black face helps to distinguish it. **Illustrations of the adult insect:** both male and female are illustrated in colour by Bygebjerg (2011). The male is also figured in colour by Bot and Van de Meutter (2019).

Melangyna quadrimaculata (Verrall), 1873
Preferred environment: old deciduous forest, humid *Fagus* and *Quercus*, in particular. Can also occur in extensive urban/suburban parks in which overmature/mature trees have been retained. **Adult habitat and habits:** primarily arboreal, but descends to visit trees and shrubs in flower, usually at sheltered locations within woodland; normally uses taller trees in flower, when these are available. **Flowers visited:** *Alnus, Anemone nemorosa, Carpinus, Chrysosplenium oppositifolium, Corylus, Hamamelis mollis, Lonicera xylosteum, Populus tremula, Pyrus communis, Salix, Sambucus, Tussilago.* **Flight period:** end February/end April. **Developmental stages:** larva described and figured by Rotheray (1988a), from larvae collected on *Abies alba*, and figured in colour and separated from larvae of some other *Melangyna* species in the keys of Rotheray (1994). This species apparently overwinters as a puparium. **Range:** southern Norway, Sweden, Finland and Denmark south to Belgium; from Ireland eastwards through central Europe into European parts of Russia and on through Siberia to the Pacific coast (Sakhalin). **Determination:** see key provided in StN Keys volume; Speight (1988a); Bartsch *et al*.(2009a). Melanic females of *M. lasiophthalma* (Zett.) are frequently misidentified as females of *M.quadrimaculata*. These two species can be found in flight together. The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and Bartsch *et al*.(2009a). The femaleis shown in colour by Pétremand *et al*. (2022).

Melangyna umbellatarum (Fabricius), 1794
Preferred environment: forest/wetland; forest streams with *Salix; Salix* carr; beside streams and rivers fringed by *Salix*. **Adult habitat and habits:** flies from 1 - 5m above ground, around shrubs and bushes; males hover over paths etc., at 2 - 5m. to a significant extent arboreal, rarely settling on low-growing plants except when visiting flowers. **Flowers visited:** white umbellifers and *Foeniculum; Euphorbia, Filipendula ulmaria, Sorbus.* **Flight period:** May/September, with peaks in June

and August. **Developmental stages:** larva described and figured by Dusek & Laska (1967); aphid feeding. Figured in colour and separated from larvae of some other *Melangyna* species in the keys of Rotheray (1994). The larvae have been found on large umbellifers, *Rumex* and *Betula* (Bagachanova, 1990). Egg: Chandler (1968). The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia south to Iberia; from Ireland eastwards through northern, central and southern Europe (Italy, the former Yugoslavia, Roumania, Bulgaria) into European parts of Russia; through mountainous parts of Siberia to Kamchatka; in N America from Alaska to Arizona. **Determination:** see key provided in StN Keys volume; Speight (1988a), Bartsch et al.(2009a). The male terminalia are figured by Hippa (1978). The male of this species is extremely difficult to separate from *M.ericarum* (Coll.). But, as explicitly stated by Collin (1946), in his description of *M.ericarum*, the female of that species is easily distinguished from the female of *M.umbellatarum* by the fact that the pale marks on abdominal tergite 2 reach the base of the tergite in *M.umbellatarum*, while they are widely set back from it in *M.ericarum*. Assuming Collin's (l.c.) interpretation of *M.umbellatarum* is correct (and there is no evidence that he examined the type material of the species), the N American species which is referred to by this name in Vockeroth (1992) cannot be *M.umbellatarum*, but is more likely to prove con-specific with *M.ericarum*. If *M.umbellatarum* does occur in N America, it would seem to be the species at present known there as *M.fisherii* (Walton). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Bartsch *et al.* (2009a).

MELANOGASTER

This genus was only recently reinstated (Maibach *et al*, 1994a). Most of its species were earlier included in *Chrysogaster*. Ten European species of *Melanogaster* are now recognised, but two of them, *M.inornata* Lw and *M.tumescens* Lw, are not referred to in recent literature and are of uncertain status. There is no key that deals with them all.

Melanogaster aerosa (Loew), 1843
Preferred environment: wetland; acid fen and valley bog lagg, and flushes, pools and small streams in moorland. **Adult habitat and habits:** flies among dense fen vegetation, usually close to water. **Flowers visited:** white umbellifers; *Cirsium, Hieracium, Leontodon.* **Flight period:** May to September, with peaks in June and August. **Developmental stages:** larva described and figured by Maibach and Goeldlin (1994), who also provide means of distinguishing this larva from that of *M.hirtella*; to be found close to water, beneath the surface of semi-liquid mud heavily enriched by peat, in the vicinity of plant roots, where there is almost no water movement. **Range:** not as yet certain, due to confusion with *M. baetica* and *M. parumplicata*, but confirmed from Scandinavia (Norway and Sweden), Ireland and Britain, Poland, Germany, Switzerland and Liechtenstein, plus Montenegro in the Balkans (Vujić, 1999b). **Determination:** Bartsch *et al.* (2009b); Maibach *et al.* (1994b); Ricarte & Nedeljković (2022). This species appears in recent literature under the name *Chrysogaster macquarti* Loew, which has proved to be a composite taxon in which *M.aerosa* and *M.parumplicata* were confused. The most reliable way to distinguish these two species is by means of features of the male terminalia, as figured in Maibach *et al.* (1994b). Bartsch *et al.* (2009b) introduce additional key features for the separation of females of *M.aerosa* and *M.parumplicata*. This species is included in the key to males of the European *Melanogaster* species provided by Prokhorov *et al*. (2020b). **Illustrations of the adult insect:** *M.aerosa* is illustrated in colour by Bartsch *et al.* (2009b) and Haarto & Kerppola (2007).

Melanogaster baetica Ricarte & Nedeljković, in Ricarte *et al.*, 2022
Preferred environment: at 1600 – 1900 m altitude, "near streams" (Ricarte *et al.*, 2022). **Adult habitat and habits:** no data. **Flowers visited:** *Cistus, Euphorbia* (Ricarte *et al.*, 2022). **Flight period:** mid-April/end June. **Developmental stages:** not described. **Range:** southern Spain. **Determination:** both male and female are described in Ricarte & Nedeljković (2022), who provide both morphological and genetic data distinguishing the species. Ricarte *et al.* (2022) also figure the male terminalia and provide a key distinguishing *M. baetica* from other Spanish *Melanogaster* species. Their key does not include *M. parumplicata*, one of the European species closely similar to *M. baetica*. But in their diagnosis of *M. baetica*, Ricarte *et al.* (2022) indicate that, in both sexes, the pale, brownish-yellow hair covering of the mesoscutum in *M. baetica* separates it from *M. parumplicata* (in which the mesoscutal hairs are dark brown/almost black) and that the male can be separated from the male of *M. parumplicata* by subtle differences in the shape of the surstyli. In the female of *M. baetica* the hairs along the dorsal rim of the occiput are all white, whereas in *M. parumplicata* black hairs are also present. Also, in both sexes of *M. baetica* the central area of the wing is more strongly infuscated than it is in *M. parumplicata*. **Illustrations of the adult**

insect: the general appearance of both sexes of *M. baetica* can be seen in the coloured photos provided in Ricarte *et al.*, (2022).

Melanogaster curvistylus Vujić & Stuke, 1998
Preferred environment: deciduous forest/wetland; from information provided by Vujić & Stuke (1998) and Stuke (pers.comm.) it can be deduced that this species has been found close to standing/slow-flowing water bodies in humid river floodplain forest. Mielczarek (2010) records the species from marsh/ seasonally-flooded grassland, close to a seasonally-flooded pool, not far from stream bordered by river on an alluvial floodplain. Heimburg *et al*. (2022) provide a contrasting observation, having found *M.curvistylus* close to a seasonally-flooded pool, not far from a stream bordered by *Alnus/Salix* gallery forest. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end April/beginning June (Vujić & Stuke (1998). **Developmental stages:** not described. **Range:** unknown at present, due to confusion with related species until recently. *M. curvistylus* was described from Germany and Serbia and has subsequently been recorded from Austria and Poland.. **Determination:** Vujić & Stuke (1998), who figure the male terminalia. The female of this species remains undescribed. From the description, this species could be confused with *M.hirtella* or *M.stackelbergi*, in both general appearance and shape of the male surstyli. However, in the male it may easily be distinguished from other known European species by its extremely narrow face - in anterior view the head at the level of the antennae is more than twice the width of the face at the same level. This feature is illustrated by Vujić & Stuke (1998), who also detail other distinguishing features. This species is also included in the keys provided by van Veen (2004). This species is included in the key to males of the European *Melanogaster* species provided by Prokhorov *et al*. (2020b). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Melanogaster hirtella (Loew), 1843
Preferred environment: wetland, fen, marsh, poorly-drained pasture and a wide range of waterside situations, such as along woodland streams or field drains, beside lakes, ponds and rivers, up to the altitude of *Picea* forest. **Adult habitat and habits:** usually in the vicinity of standing or running water, flying among field-layer vegetation and settling on leaves or flowers. **Flowers visited:** white umbellifers; *Caltha, Euphorbia, Iris pseudacorus, Menyanthes, Mimulus guttatus, Potentilla erecta, Pyrus communis, Ranunculus, Sorbus aucuparia, Taraxacum, Viburnum opulus.* **Flight period:** end April/July and on into August at higher altitudes. **Developmental stages:** larva described and figured by Hartley (1961); aquatic, associated with various aquatic plants, including *Glyceria* and *Typha*, whose aerenchyma is tapped by the larvae to provide their air supply; the larvae are to be found among plant roots, usually at the edge of running water, in the angle where the bank begins to rise away from the water level. **Range:** Denmark south to the Pyrenees and Portugal; Ireland eastwards to the Alps (Switzerland, Liechtenstein). This is very much an "Atlantic" species, very widespread and abundant along the western seaboard of the continent from Denmark to Brittany, but otherwise rather localised and increasingly scarce as one progresses into central and southern Europe. **Determination:** Speight (1980), Bartsch *et al.* (2009b), The male terminalia are figured in Speight (1980), Torp (1984) and Maibach *et al.* (1994a). This species is included in the key to males of the European *Melanogaster* species provided by Prokhorov *et al*. (2020b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.* (2009b), Stubbs and Falk (1983) and Torp (1994).

Melanogaster jaroslavensis (Stackelberg), 1922
Preferred environment: humid, alluvial grassland near rivers, beside alluvial hardwood forest of *Alnus glutinosa* (Popov *et al*, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Barbarea, Caltha, Lupinus, Ranunculus* (Popov *et al.*, 2020). **Flight period:** May/June. **Developmental stages:** not described. **Range:** central parts of European Russia; northern Ukraine. **Determination:** towards the wing-base, the wing veins of this species are bright yellow, distinguishing it from other European *Melanogaster* species. This feature is illustrated by Popov *et al.* (2020), who redescribe *M. jaroslavensis*, figure its male terminalia and provide a key to separate it from other (Asiatic) *Melanogaster* species in which the wing-base is bright yellow. This species is included in the key to males of the European *Melanogaster* species provided by Prokhorov *et al*. (2020b). **Illustrations of the adult insect:** coloured photos of the male and female are given in Popov *et al.* (2020)..

Melanogaster nigricans (Stackelberg), 1922
Preferred environment: wetland/freshwater: beside both standing and running water bodies (pools, lakes, streams, rivers), in humid grassland, marsh and fen (G. Popov, pers. comm.). **Adult habitat and habits:** flies among waterside vegetation, on which it also settles (G. Popov, pers. comm.). **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not

described. **Range:** Albania, Bulgaria, Greece, Roumania, parts of European Russia, Ukraine. **Determination:** this species has until recently been consigned (e.g. by Peck, 1988) to the genus *Lejogaster*. Maibach *et al.* (1994a) pointed out that it did not seem to be correctly placed in *Lejogaster* and Kassebeer subsequently (1999a) transferred *L.nigricans* to *Melanogaster*, redescribing the male of the species and figuring its terminalia at the same time. *L. nigricans* is unique among *Melanogaster* species in that the eyes of the male do not meet above the antennae. This species is included in the key to males of the European *Melanogaster* species provided by Prokhorov *et al*. (2020b). **Illustrations of the adult insect:** none known.

Melanogaster nuda (Macquart), 1829
Preferred environment: calcium-rich fens and marshes, also pond and stream-side vegetation in calcareous regions. **Adult habitat and habits**: flies within a metre or so of the ground, through and over fen and wet meadow/pasture vegetation in the vicinity of standing water; easily swept on dull days. **Flowers visited:** *Caltha, Carex, Chaerophyllum, Crataegus, and Ranunculus*. **Flight period:** May/June and July/August at higher altitudes. **Developmental stages:** larva described and figured by Hennig (1952) and Maibach and Goeldlin (1994); the larvae are to be found among plant roots, usually at the edge of running water, where the bank begins to rise above the water level. **Range:** Sweden and Finland south to central Spain; from northern France and Belgium eastwards through central Europe into European Russia; south-east into southern Turkey; Georgia; Syria. **Determination:** Speight (1980), van der Goot (1981). This species is included in the key to males of the European *Melanogaster* species provided by Prokhorov *et al*. (2020b). This is the *Chrysogaster viduata* (L.) of various authors. The species has also appeared in recent literature as *Chrysogaster lucida* (Scopoli). Maibach *et al.*(1994b) established that the name *lucida* was wrongly applied to this species and introduced *nuda* as replacement name. It would be all-too-easy to dismiss a specimen of *M.nuda* as belonging to *M.hirtella* and these species are frequently confused in collections. Traditionally, keys seek to distinguish *M.nuda* from *M.hirtella* by referring to the brown blotch often present on the middle of the wing of *M.nuda*, stating that while present in *M.nuda*, this blotch is absent in *M.hirtella*. However, *M.nuda* can occur without any discernable wing blotch and *M.hirtella* can possess wings quite heavily infuscate in the anterior half. The male terminalia are figured in Speight (1980), Torp (1984) and Maibach *et al.* (1994a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.* (2009b), Torp (1984, 1994) and van der Goot (1986).

Melanogaster parumplicata (Loew), 1840
Preferred environment: open ground/forest/freshwater; close to water-bodies in river-floodplain grassland (P.Goeldlin, pers.comm.) and alluvial forest. Found by Dziock (pers.comm.) close to a stream in a nutrient rich marsh with a vegetation of *Urtica*, the marsh apparently fed by groundwater seepage and also along a seasonally-flooded ditch leading to a permanent pond; also found along ground-water fed spring streamlets edging mesotrophic grassland/raised bog interface. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers, *Achillea millefolium, Caltha, Crataegus, Prunus spinosa, Ranunculus, Rhamnus cathartica, Taraxacum*. **Flight period:** mid May/mid August, with peak in June. **Developmental stages:** undescribed. **Range:** uncertain at present, due to confusion with *M.aerosa* (Lw.) and *M. baetica* until recently, but known from Norway, Sweden, southern Finland, Poland, northern, central and south-west Germany, the French and Swiss Jura, the Alps (France) and the Balkans (Bosnia-Herzegovina, Montenegro, Serbia). **Determination:** Bartsch *et al.* (2009b); Maibach *et al.* (1994b) and Vujić (1999b), who figure the male terminalia. This species is included in the key to males of the European *Melanogaster* species provided by Prokhorov *et al*. (2020b). This species is closely similar to *M.aerosa* and *M. baetica* in both sexes. Bartsch *et al.* (2009b) introduce additional key features for the separation of females of *M.aerosa* and *M. parumplicata*. See under *M. baetica* for distinctions between that species and *M.parumplicata*. **Illustrations of the adult insect:** *M. parumplicata* is figured in colour by Bartsch *et al.* (2009b) and Bot and Van de Meutter (2019).

MELANOSTOMA

Six species of *Melanostoma* are now known from Europe. Two of them are very widely distributed in the continent, two others are montane and subalpine and the remaining two are apparently endemic to different parts of the Macaronesian zone. Unfortunately, it is very doubtful whether present species concepts provide an accurate reflection of the number of *Melanostoma* species in the continent. Haarto and Ståhls (2014) provide a genetic basis for recognition of the four Fennoscandian species, but more comprehensive molecular taxonomic studies will be required before the status of dissimilar phenotypes occurring in various parts of Europe can be understood.

Melanostoma certum Haarto & Ståhls, 2014
Preferred environment: open ground; unimproved, humid montane and alpine grassland and moor; palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** sheltered spots, such as beside streams; low-flying, through grasses etc. **Flowers visited:** *Carex* spp., *Potentilla erecta, Ranunculus.* **Flight period:** June/July and August at higher altitudes. **Developmental stages:** undescribed. **Range:** at present presumed to be from Fennoscandia south to the Pyrenees; from Britain (Scotland) eastwards through northern Europe and mountainous parts of central Europe into European parts of Russia and on through Siberia to Yakutia. But there is no certainty that the recently re-instated *M. certum* now recognised as the valid name for the species previously known as *M. dubium* in Scandinavia is the same taxon recorded as *M. dubium* outside Scandinavia. **Determination:** see key provided in StN Keys to Species volume. Haarto and Ståhls (2014) establish that *dubium* of Zetterstedt is a synonym of *M. mellinum*, but that the Scandinavian *dubium* of authors is a separate species, to which they give the name *certum*, also redescribing the species and figuring its male terminalia. In deriving these conclusions they characterise genetically *certum* and the other *Melanostoma* species known from Fennoscandia. However, no material of *dubium* sensu aucct from other parts of Europe was includced in the genetic analysis and populations from the Alps exhibit at least one feature in the female, namely the proportions of the 4th. sternite, in which they differ from *certum* as described by Haarto and Ståhls (2014). Until more comprehensive genetic studies have been undertaken it will remain unclear whether or no *dubium* sensu aucct from the Pyrenees, Alps, Balkans etc. is the same taxon as the Fennoscandian *certum*. But, in the interim, the name *certum* is used here for these various populations. **Illustrations of the adult insect:** the general appearance of the male and female of this species can be seen from the coloured photos provided by Haarto and Kerppola (2007a).

Melanostoma mellarium (Meigen), 1822
Preferred environment: forest/open ground; humid, unimproved, montane grassland (including karst limestone grassland) and open, grassy areas within humid *Fagus/Picea* forest and upwards through *Abies* and *Picea* forest (both acidophile and calcareous) to *Larix* forest and on, into grazed, unimproved grassland and heath (where it occurs along streams) in the subalpine zone; above the tree line in Scandinavia (Haarto and Ståhls, 2014); at low altitude in the Atlantic zone, where it can occur along streams in moorland and blanket bog. **Adult habitat and habits:** flies within the ground vegetation of sparsely-vegetated ground. **Flowers visited:** *Euphorbia, Ranunculus*. **Flight period:** June/July over most of its range, but earlier (April) in southern parts of the Atlantic zone (N Spain). **Developmental stages:** not described. **Range**: uncertain at present due to confusion with other species until recently, but confirmed from Norway, Finland, Luxembourg, France and Austria. There are as yet unpublished records from various parts of the Alps, the Pyrenees and the British Isles. **Determination:** see key provided in the StN Keys to species volume. In its general appearance, this species closely resembles *M. scalare*. Haarto and Ståhls (2014) provide a genetic basis to the recognition of *M. mellarium* as a separate species, redescribe it, figure its male terminalia and include it in their key to Fennoscandian *Melanostoma* species. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); the abdomen of the female is illustrated in colour, in dorsal view, by Haarto and Ståhls (2014).

Melanostoma mellinum (L.) 1758
Preferred environment: open country, grassland and heathland, plus grassy clearings and tracksides in woodland, predominantly anthropophilic, occurring also in most types of farmland, including arable crops and "improved" pasture, in suburban gardens and parks and along firebreaks and tracks in conifer plantations. **Adult habitat and habits:** within grassland and heathland, flying low among the vegetation; frequently active under overcast conditions; as easily detected by means of a sweep net as by direct observation. **Flowers visited:** Graminae; Cyperaceae; white Umbelliferae; *Allium ursinum, Bellis perennis, Caltha, Eschscholzia californica, Euphorbia, Leontodon, Luzula, Plantago, Potentilla erecta, Ranunculus, Salix repens, Stellaria holostea, Succisa, Taraxacum.* **Flight period:** April/October. **Developmental stages:** larva described and figured by Dusek & Laska (1960a); aphid-feeding, on a wide range of low-growing plants, including grasses. Dunn (1960) has been quoted as observing *M. mellinum* larvae predating the aphid *Pemphigus bursarius* on the roots of lettuce *(Lactuca*). But his paper only notes the presence of *M. mellinum* larvae on lettuce foliage in August/September, from which he infers that *M. mellinum* could predate *P. bursarius*. Discovery that larvae of *M. scalare* predate the larvae of other Diptera in woodland leaf litter (Wilkinson & Rotheray, 2017) suggests that larvae of *M. mellinum* might well do likewise in open ground habitats like grassland. Dziock (2002) reported that under laboratory conditions development (from egg-laying to hatching of adult) can take as little as 5-6 weeks in *M. mellinum*. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** from Iceland and Fennoscandia south to Iberia, the Mediterranean and N Africa; from Ireland eastwards

through most of Europe into European parts of Russia; Siberia from the Urals to the Pacific coast; N America from Alaska to Quebec and south to Washington. **Determination:** see key provided in StN Keys to species volume. As at present recognised, European populations of *M. mellinum* exhibit great phenotypic variability and ecological amplitude, potentially indicating that it is a complex of more than one species. However, Haarto and Ståhls (2014) have brought the techniques of molecular taxonomy to bear on Fennoscandian populations, and conclude they all represent one species. But the taxonomic status of *M. mellinum* populations elsewhere in Europe is likely to remain uncertain in the absence of a similar, geographically more broadly based study. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994).

Melanostoma scalare (Fabricius), 1794
Preferred environment: most types of humid/mesophilous forest (both coniferous and deciduous), but also occurring in more open situations in parts of Europe with an Atlantic climate; a largely anthropophilic species, occurring along hedges in various sorts of farmland and in gardens, parks and along tracksides in conifer plantations. **Adult habitat and habits:** tracksides, clearings, hedges, gardens, especially along streams or in poorly-drained locations; flies low over ground vegetation and bushes; males hover beside bushes in flower, in the shade beneath trees etc., at up to 3m from the ground. **Flowers visited:** Graminae; umbellifers; *Allium ursinum, Arbutus unedo, Caltha, Cosmos, Euphorbia, Ilex, Leontodon, Plantago, Prunus spinosa, Ranunculus, Rosa, Salix repens, Taraxacum, Verbascum, Veronica*. **Flight period:** March/ September. **Developmental stages:** larva described and figured by Dusek & Laska (1959), from a full-grown larva found on the trunk of an apricot tree; larvae seem to occur mostly in the litter layer or tussocks of grasses such as *Dactylis*. Wilkinson and Rotheray (2017) extracted *M. scalare* larvae from woodland leaf litter and demonstrate they can predate co-occurring larvae of other Diptera (Lonchopteridae, Lauxaniidae, Limoniidae) and are not obligate aphid feeders. Dziock (2005) notes that, in captive rearing experiments, *M. scalare* larvae choose to feed on aphid species which, in nature, would normally be tended by ants. Dziock (2002) reports that under laboratory conditions development (from egg-laying to hatching of adult) can take as little as 5-6 weeks in this species. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** from Iceland and Fennoscandia south to Iberia, the Mediterranean and N Africa; from Ireland eastwards through most of Europe into European parts of Russia; in Siberia from the Urals to the Pacific coast (Kuril Isles); in eastern parts of the Afrotropical region south to Zimbabwe; throughout the Oriental region to New Guinea. **Determination:** see key provided in StN Keys to Species volume. The male terminalia are figured by Dusek and Laska (1967) and Haarto and Ståhls (2014). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Melanostoma wollastoni Wakeham-Dawson, Franquinho-Aguiar, Smit, McCullough and Wyatt, 2004
Preferred environment: forest; *Acacia*/*Eucalyptus* plantation forests, Laurisilva (*Deschampsietum argenteae* association) and Cloud heath-forest (*Vaccinio - Sibthorpietum* association) (J.T.Smit, pers.comm.; Wakeham-Dawson et al, 2004). **Adult habitat and habits:** the adults can be found at forest-edges and in open spots in forest. They can often be found visiting flowers or sitting on leaves up to three metres from the ground, rarely in the direct sunlight (J.T.Smit, pers.comm.). **Flowers visited:** Apiacaea, Asteraceae, Ranunculaceae (J.T.Smit, pers.comm.). **Flight period:** March/October (probably present the whole year round) (J.T.Smit, pers.comm.). **Developmental stages:** undescribed. **Range:** endemic to Madeira (Portugal). **Determination:** Sack (1928-1932). This species is also distinguished from *M.mellinum* in the key provided by Smit *et al*.(2004). This species has erroneously been referred to as *M.babyssa* (Walker), in recent literature (Wakeham-Dawson *et al*, 2004). **Illustrations of the adult insect:** a coloured photo of the female is provided by Smit *et al*. (2004).

MELIGRAMMA

Three of the European species of *Meligramma* are widespread in Europe and treated in most regional accounts. *M. cingulata* has until recently been regarded as a species of *Melanostoma*. *M. euchroma* has usually been treated as belonging to a separate genus, *Epistrophella* (see under *M. euchroma*). *Meligramma* itself has by some authors been treated as a subgenus of *Melangyna* and appears in Dusek and Laska's (1967) major work as *Fagisyrphus*.

Meligramma cincta (Fallen), 1817
Preferred environment: forest; deciduous forest of *Fagus* and *Quercus* forest, including acidophilous *Quercus* and *Quercus/Carpinus/Ulmus;* alluvial hardwood forest. **Adult habitat and habits:** primarily arboreal, but descends to visit flowers; edges of clearings, tracksides etc.; males hover over tracks or in woodland glades, from 3m upwards. **Flowers visited:** white umbellifers; *Acer pseudoplatanus, Crataegus, Ligustrum, Malus sylvestris, Prunus spinosa, Rubus idaeus, Salix, Sambucus nigra, Sorbus aucupariae, Urtica dioica, Viburnus opulus.* **Flight period:** April/June and July/beginning September. **Developmental stages:** larva described and figured by Dusek & Laska (1962) from larvae on *Fagus;* aphid-feeding; egg described by Chandler (1968). Figured in colour (as *Melangyna cincta*) and separated from larvae of some other *Meligramma* species in the keys of Rotheray (1994). **Range:** Fennoscandia south to Iberia and the Mediterranean; from Ireland eastwards through much of Europe into the Ukaine and European parts of Russia; Georgia; Turkey. According to Vockeroth (1980) N American records of this species are erroneous. **Determination:** see key in StN keys volume; van der Goot (1981). In recent literature, this syrphid is often treated as a species of *Melangyna*. The male terminalia are figured in Dusek and Laska (1967) (as *Fagisyrphus cinctus*) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) (as *Fagisyrphus*) and van der Goot (1986).

Meligramma cingulata (Egger), 1860
Preferred environment: *Abies*/*Picea* forest. **Adult habitat and habits**: flies round foliage of conifers, usually at some metres above ground. Males hover along tracks etc., at heights of 3-4m or more. **Flowers visited**: *Allium ursinum, Crataegus, Genista, Photinia, Ranunculus, Sorbus aucuparia, Ulex, Viburnum opulus*. **Flight period**: end May/June plus July at higher altitudes. **Developmental stages:** undescribed. **Range**: from northern France (Vosges), Poland and the Czech Republic through the Alps (Switzerland, Austria) and on into the former Yugoslavia and parts of European Russia; also in Portugal, the Pyrenees and central Spain; Asiatic Russia; South Korea. In the Atlantic zone of western France (Sarthe: Dussaix, pers.comm.). Lack of records from the Ardennes is surprising. *M.cingulata* is regarded as a threatened species in Spain (Marcos-García, 2006). **Determination:** see key in StN keys volume. Until recently consigned to *Melanostoma*, *M.cingulata* was recognised as belonging in *Meligramma* by Goeldlin (1974). This species bears superficial resemblance to *Melanostoma*. It would run to *Melanostoma* in the keys of Coe (1953), Stubbs & Falk (1983) and van der Goot (1981), because its face is entirely, or almost entirely, black and shining and its scutellum is black and shining (the scutellum may be yellowish toward the hind margin, especially in the female). *M.cingulatum* may be distinguished from *Melanostoma* by the character of its abdominal markings, which widen progressively towards the lateral margins of the tergites, meeting the lateral margins at full width. The second tergite bears a pair of narrow, transverse, whitish yellow bars, which come to a point towards the mid-line, while tergites three and four each exhibit either a pair of bars or a narrow, transverse band, of the same colour as the markings on tergite two. The male terminalia are figured by Goeldlin (1974). **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019) and Speight and de Courcy Williams (2021); Marcos-García (2006) provides a coloured photo of the female.

Meligramma euchroma (Kowarz), 1885
Preferred environment: forest; taiga (Nielsen, 1998); mature deciduous forest (humid and mesophilous *Fagus; Quercus/Carpinus/Ulmus*; thermophilous *Quercus*); alluvial hardwood forest; apple (*Malus*) orchards. **Adult habitat and habits:** apparently largely arboreal, but descends to visit flowers, when it may be found in clearings etc. Males can be found hovering in the sun, 2-5m above the ground, at the edge of small glades in forest. **Flowers visited:** white umbellifers; *Acer pseudoplatanus, Euphorbia, Prunus, Salix*. **Flight period:** April/June and on into July at higher altitudes/more northerly latitudes. **Developmental stages:** larva described and figured by Dusek & Laska (1959) and Goeldlin (1974); separated from related species in the keys of Rotheray (1994); aphid- feeding on trees and shrubs (e.g. *Euonymus, Prunus*), including fruit trees in orchards. **Range:** northern Fennoscandia south to the Pyrenees and central Spain; from Britain (southern England) eastwards through central Europe into Russia, reaching the Caucasus in the south and eastern Siberia (Yakut) in Asia. **Determination:** see key in StN keys volume. This species has been variously placed either in its own genus, in *Meligramma* or in *Epistrophe*. Its differences from *Epistrophe* species prompted Dusek and Laska (1967) to establish a monotypic genus for it, *Epistrophella*. Vockeroth (1969) reduced *Epistrophella* to subgeneric status, under *Epistrophe*, at the same time broadening the concept of *Epistrophella* to contain non-European species rather different from *euchroma*. This had the unfortunate effect of introducing *Epistrophella* to generic keys of N American Diptera (Vockeroth and Thompson, 1987) based on the features of these non-European species, rendering *euchroma* unrecognisable as a species of *Epistrophella* in

those keys. This situation did not change with transfer of those keys to the Palaearctic Manual of Diptera (Thompson and Rotheray, 1998), where *euchroma* keys out as a species of *Meligramma*. A year later Rotheray and Gilbert (1989) provided new grounds for consigning *euchroma* to *Meligramma* and since then no good case has been made to support segregation of *euchroma* from *Meligramma*. Since *euchroma* was the type species of the genus *Epistrophella*, and the only species consigned to the genus by Dusek and Laska (1967), there would seem little justification for continued use of the generic name *Epistrophella* for the species subsequently consigned to it by other authors, if *euchroma* is to be regarded as a species of *Meligramma*. The male terminalia are figured by Dusek and Laska (1967) and (as *Meligramma* s.g. *Zimaera euchroma*) in Hippa (1968b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Meligramma guttata (Fallen), 1817
Preferred environment: humid deciduous forest, particularly along rivers; field hedges with mature *Fraxinus;* mature *Salix/Alnus* carr; alluvial hardwood forest. **Adult habitat and habits:** primarily arboreal, but descends to visit flowers. **Flowers visited:** white umbellifers; *Epilobium angustifolium, Euonymus, Filipendula, Frangula alnus, Galium, Solidago*. **Flight period:** mid June/mid August. **Developmental stages:** larva described and figured by Dixon (1960), from larvae collected on *Acer pseudoplatanus*. Separated from larvae of some other *Meligramma* species in the keys of Rotheray (1994). Vockeroth (1980) provides a key for distinguishing the puparia of *M.guttata* and *M.triangulifera*. **Range:** Fennoscandia south to the Pyrenees; from Ireland eastwards through much of northern and central Europe into Russia and on through Siberia to the Pacific coast (Sakhalin); Georgia; in N America from Alaska to Arizona. **Determination:** see key in StN keys volume. In recent literature, this syrphid is often treated as a species of *Melangyna*. The male terminalia are figured by Hippa (1968b). In the field, the male of this species appears almost identical to males of the common and widespread *Platycheirus* species, *P.albimanus* (Fab.) and *P.scutatus* (Mg.), and is probably frequently overlooked for this reason. **Illustrations of the adult insect:** The adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Bartsch *et al*. (2009a).

Meligramma triangulifera (Zetterstedt), 1843
Preferred environment: forest; humid deciduous forest, including alluvial hardwood forest; also from river-margin tree fringes too sparse to be considered alluvial gallery forest. This species has also been recorded from mature urban parks and gardens (see Plant, 2001). **Adult habitat and habits**: primarily arboreal, but descends to visit flowers. **Flowers visited**: white umbellifers; *Acer platanoides, Anemone nemorosa, Bunias orientalis, Galium, Ligustrum, Lonicera, Prunus, Ranunculus, Ribes, Salix, Tilia cordata*. **Flight period**: end April/mid August. **Developmental stages:** larva figured in colour and separated from larvae of *M.cincta* and *M.guttata* in the keys of Rotheray (1994). The larva is also figured in colour by Bartsch *et al*. (2009a) and Dussaix (2013). Vockeroth (1980) provides a key for distinguishing the puparia of *M.guttata* and *M.triangulifera*. Larvae are aphidophagous on tall herbs, deciduous shrubs and trees (Heiss, 1938, as *Epistrophe cincta* and *E.triangulifera*, according to Vockeroth, 1992), e.g. *Betula, Cirsium, Prunus, Ribes, Rubus, Sambucus*. Dussaix (2005b) reports rearing the species from larvae found on *Frangula alnus, Hydrangium* and *Sonchus*. Dussaix (2013) provides a coloured photo of the puparium, and reports that duration of the puparial phase is approximately 10 days. **Range:** Fennoscandia south to central France; from Britain east through northern and central parts of Eurasia to the Pacific; in N America from the Yukon to Minnesota, Massachusetts and New York. **Determination:** see key in StN keys volume. In recent literature, this syrphid is often treated as a species of *Melangyna*. The male of this species is easily mistaken for *M.auricollis*, which often is in flight in the same localities. The male terminalia are figured by Hippa (1968b). **Illustrations of the adult insect:** both male and female are illustrated in colour by Stubbs and Falk (1983). The male is also figured by Ball and Morris (2013).

MELISCAEVA

The two European species of *Meliscaeva* are widely distributed and treated in most accounts. By some authors *Meliscaeva* species have been included in the genus *Episyrphus*.

Meliscaeva auricollis (Meigen), 1822

Preferred environment: many types of forest (both deciduous, broad-leaved evergreen and coniferous) and conifer plantations. **Adult habitat and habits:** trackside and clearings etc.; flies around tree foliage; males hover over tracks etc. at 2 - 5 m. **Flowers visited:** white umbellifers; *Arbutus unedo, Chaerophyllum, Daphne bholua, Euonymus, Euphorbia, Filipendula, Hedera, Pistacia terebinthus, Rosmarinus officinalis, Rubus, Salix, Sarrothamnus, Sorbus, Viburnum opulus*. An extended list of flowers visited may be found in de Buck (1990). **Flight period:** March/October (plus February and November in southern Europe). This species overwinters as an adult and has been found hibernating beneath ivy (*Hedera*) on the walls of an old house (P.Goeldlin, pers.comm.). In southern Europe, adults can be found on the wing during mid-winter, in sheltered spots on days of sunshine. Recently, it has become possible to find *M. auricollis* in flight before the end of February as far north as Dublin (Ireland). Presence of clearly teneral specimens, and both males and females, indicates that these are not overwintering individuals but freshly emerged i.e. the species can pass most of the winter as a larva, then pupating to produce early-flying adults. **Developmental stages:** the larva and puparium are shown in colour by Dussaix (2013). Some of the literature references to description of the larva of this species are confused. According to Rotheray (1994) the larva of *M.auricollis* has a posterior respiratory process with a basal, sclerotised ring, which distinguishes it from the larva of *M. cinctellus*, where this ring is absent. However, according to Dixon (1960) it is the larva of *M.cinctellus* that has a basal, sclerotised ring to its posterior respiratory process, distinguishing it from the larva of *M. auricollis*, in which this ring is absent. Here, it is assumed that the determinations of Rotheray (1994) are correct and those of Dixon (1960) are incorrect, in which case the posterior respiratory process of the larva of *M. auricollis* is figured, in lateral view, by Dixon (1960), under the name *M. cinstellus*. Rotheray (1994) does not seem to have been aware of the contradictions between the descriptions of the larva of *M. auricollis* provided by himself and Dixon (1960), because he quotes Dixon (1960) as the source of the information that *M. auricollis* has been reared from among aphids found on *Sarrothamnus*, which must relate to *M. cinctellus* if his definition of the larva of *M. auricollis* is correct. The larva of *M. auricollis* is aphid-feeding on trees (e.g. *Castanea, Crataegus, Fagus*), shrubs (e.g.*Viburnum*), lianas (e.g. *Hedera*) and tall herbaceous plants, including some crop species (*Nicotiana, Triticum*). The larva is also a predator of aphids on apple trees in orchards (Stanić, 2024). In addition, it has been found feeding on psyllids (Aphalaridae: Homoptera) on olive trees (*Olea*) by Rojo *et al*. (1999), where larval development can take only 2 weeks and the adult hatches after a puparial phase lasting only 8-9 days. Dussaix (2013) reports puparial duration as 17 days. Jones (2001) reports rearing *M. auricollis* from *Pemphigus* (Aphididae) galls on *Populus*. The larva of this species may be separated from the larva of *M. cinctella* in the keys provided by Rotheray (1994). Kula (1982) records larvae of this species as overwintering among leaf litter on the floor of spruce (*Picea)* forest. Egg: Chandler (1968). **Range:** Fennoscandia and the Faroes (Jensen, 2001) south to Iberia, the Mediterranean (including Cyprus, Malta and Crete), Canary Isles, N Africa, Turkey and Israel; Ireland eastwards through most of Europe into European parts of Russia; Georgia. **Determination:** van der Goot (1981). The male terminalia are figured by Dusek and Laska (1967) and Hippa (1968b) (as *Episyrphus*). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), whose figures show the range of variation exhibited by the abdominal markings in this species. Other coloured figures of the adult insect appear in Torp (1984, 1994) and van der Goot (1986).

Meliscaeva cinctella (Zetterstedt), 1843

Preferred environment: forest and scrub, both deciduous and coniferous and conifer plantations; to a significant extent anthropophilic, occurring also in hedgerows and suburban gardens and parks. **Adult habitat and habits:** clearings, tracksides, flower beds etc.; flies around foliage of low-growing plants, bushes, shrubs and trees; males hover over paths etc. at 3 - 5m. **Flowers visited:** white umbellifers; *Acer pseudoplatanus, Crataegus, Euphorbia, Ilex, Juncus, Ligustrum, Lonicera periclymenum Origanum vulgare, Oxalis, Polygonum cuspidatum, Potentilla erecta, Prunus spinosa, Ranunculus, Rhododendron, Rubus fruticosus, R.idaeus, Salix, Sambucus, Senecio jacobaea, Solidago virgaurea, Sorbus aucupareia, Taraxacum.* **Flight period:** April/September, with peaks in May/June and August and occasional specimens on into October. **Developmental stages:** assuming that the definitions of the larvae of *Meliscaeva* species incorporated into Rotheray's (1994) keys are correct, the description of the larva of this species provided by Dixon (1960) relates to *M. auricollis*, and her description of the larva of *M. auricollis* relates to *M. cinctella* (see also notes relating to the larva of *M. auricollis*, in the account of that species). Branquart (1999) provides extensive information on the developmental stages of this species under laboratory conditions, and shows that development time (from egg-laying to eclosion of adult) can be as little as 4 weeks. The larva is aphid feeding, on bushes, shrubs, for example *Sarrothamnus* - Dixon (1960) as *M. auricollis* - and trees, e.g. *Fagus*; Kula (1982) records larvae of this species as overwintering among leaf litter on the floor of spruce (*Picea*) forest. **Range:** from Fennoscandia south to Iberia, the Mediterranean and N Africa; from Ireland eastwards through most of Europe into

Turkey and European parts of Russia; Siberia from the Urals to the Pacific coast (Kuril Isles); N America from Alaska south to California and Colorado. **Determination:** van der Goot (1981). The male terminalia are figured by Dusek and Laska (1967) (as *Episyrphus*), Hippa (1968b) (as *Episyrphus)* and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

MERODON

With more than 140 species known from the continent and more being described annually, *Merodon* is now the largest European genus of Syrphidae. A majority of the species are southern European and many are poorly known and inadequately treated in identification keys. Marcos-García *et al.*(2007) provide a key to separate the Iberian species and Speight and Langlois (2020a, 2020b) provide keys for separation of the males of French species, but there is no key which deals with all the European species. Hurkmans (1993) carried out a partial revision of the nomenclature and status of the European species, but his work was never completed. The *Merodon* fauna of the Balkan peninsula and Turkey is now becoming progressively better known as a consequence of the series of papers published by Vujić and his co-workers, who have also provided a first key to *Merodon* species groups of the world (Vujić *et al*, 2021). The recent revisionary work has demonstrated the existence of a number of cryptic species, characterised genetically but without reliable morphological distinctions. Where possible, means of determining individual *Merodon* species are dealt with here in their species accounts. A species account is included for *M.caudatus*, though it is unclear whether this species occurs in Europe.

Merodon aberrans Egger, 1860
Preferred environment: unimproved, calcareous montane grassland and patchily-vegetated, herb-rich open areas within the *Abies* forest zone, in the Alps and Pyrenees; forest edge of *Quercus/Carpinus* forest with unimproved grassland; Balkanic thermophilous *Quercus* forest, in South East Europe. **Adult habitat and habits:** males rest on patches of bare ground (e.g. along paths), darting away fast and low over the surrounding vegetation, to chase away other males or in pursuit of females. Females fly largely within the vegetation cover, in tall-herb-rich clearings etc. Adult behaviour is reported in more detail by Hurkmans & Hayat (1997). **Flowers visited:** *Galium, Tanacetum, Tilia* (Vujić *et al*. (2022b); Umbelliferae; *Cirsium, Rosa canina*. **Flight period:** May/July and August at higher altitudes. **Developmental stages:** not described. In Vujić *et al*. (2022b) it is stated that "in laboratory conditions the larvae of the species feed on *Leopoldia comosa* bulbs (Popov, unpubl. data)." **Range:** through central Europe from Germany, the Czech Republic and the Alps (France, Switzerland, Austria) to Hungary and Roumania and on to the Ukraine, southern Russia and Georgia; in southern Europe from mountainous parts of Portugal and Spain eastwards to Italy, Albania, Slovenia, the former Yugoslavia and Greece, including Mediterranean islands e.g. Crete; Turkey. According to Vujić *et al*. (2022b) literature records from Lebanon refer to a different species and the only records from N Africa (Morocco) are unsure and require confirmation. **Determination:** Vujić *et al*. (2022b) redescribe the species, figure its male terminalia and provide a key in which *M. aberrans* is distinguished from other known species of the *aberrans* group, among which *M. aberrans* is the only species known to occur west of the Balkan peninsula, in Europe. Hurkmans (1993) also igures the male terminalia and provides a detailed re-description of the species. **Illustrations of the adult insect:** Speight and Langlois (2020a, 2020b); Vujić *et al*. (2022b).

Merodon abruzzensis (van der Goot), 1969
Preferred environment: open ground; heavily-grazed, unimproved, subalpine, dry grassland. **Adult habitat and habits:** found flying among stands of tall *Scrophularia* that is unpalatable to cattle (V.S. van der Goot, pers.comm.). **Flowers visited:** no data. **Flight period:** July/beginning August **Developmental stages:** undescribed. **Range:** Italy. **Determination:** Vujić et al.(2012), who redefine the species, figure its male terminalia and provide a key to separate it from other known European species of the *ruficornis* group. **Illustrations of the adult insect:** none known.

Merodon adriaticus Veselić, Vujić & Radenković, 2017
Preferred environment: forest; evergreen adriatic *Quercus* forest and Mediterranean scrub (Veselić *et al*., 2017). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Developmental stages:** not described. **Range:** Croatia, Montenegro. **Determination:** the description of this species provided by Veselić *et al*. (2017) is based on two males. The female is at present unknown. *M. adriaticus* is a member of the *bessarabicus* sub-group of the *aureus/aureus* complex and is included in the key to males of the *bessarabicus* group in Veselić *et al*. (2017). **Illustrations of the adult**

insect: a coloured photograph of the male in dorsal view is given in Veselić *et al*. 2017), together with photos of other views of various parts of the male, including its head and legs.

Merodon aerarius Rondani, 1857
Preferred environment: occurs in a wide range of herb-rich open ground habitats and open areas within forest of *Pinus laricio, Fagus, Quercus ilex, Q. pubescens* and *Castanea* on Corsica (T. Lebard, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August/September. **Developmental stages:** not described. **Range:** uncertain, due to confusion with other species, but confirmed from Corsica, Italy, Slovenia, Serbia. **Determination:** *Merodon aerarius* has long been regarded as a synonym of *M. aureus*, but Kočić *et al*. (2023) say of it "*Merodon aerarius* is a valid species belonging to the *cinereus* sub-group of *aureus* lineage".This is "species C" of the *aureus* clade key to males of French *Merodon* species, in Speight & Langlois (2020a, 2020b) (A. Vujić, pers. comm.). Separation of the female from related species is not at present possible, and until more comprehensive keys are available, identification of the male in Italy or the Balkan peninsula also remains unreliable. **Illustrations of the adult insect:** none known.

Merodon alagoezicus Paramonov, 1925
Preferred environment: open ground; wet, unimproved, montane grassland (mostly above 1500m). **Adult habitat and habits:** flies round stands of umbellifers and settles on low-growing vegetation, often in partial shade (Hurkmans and Hayat, 1997). **Flowers visited:** Umbelliferae. **Flight period:** June/August. **Developmental stages:** not described. **Range:** Greece, Turkey and Armenia. **Determination:** Vujić *et al.* (2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia; Hurkmans (1993) also figures the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). Both the male and the female are included in the keys in Hayat *et al*. (2024), but the feature used to distinguish the female, "top of hind tibia broadened", is not illustrated and open to misinterpretation.**Illustrations of the adult insect:** none known.

Merodon albidus Šašić Zorić, Ačanski & Vujić, in Vujić *et al.*, 2020b
Preferred environment: montane zone species, has been collected along streams (Vujić *et al.*, 2020b). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** western Turkey. **Determination:** in Vujić *et al.* (2020b) it is stated that this species only differs from *M. pumilus* genetically and in its wing morphometrics. **Illustrations of the adult insect:** none known.

Merodon albifasciatus Macquart, 1842
Preferred environment: Eastern Mediterranean maquis with *Drimia* (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Carlina, Dittrichia viscosa* (Vujić *et al.*, 2018a), Dreimia. **Flight period:** April/May and September/October. **Developmental stages:** not described. **Range:** Greece, including Peloponnesos and some Aegean islands (Cyclades). **Determination:** this *Merodon geniculatus* group species is re-instated and redescribed by Vujić *et al.* (2018a). The original description is based on a solitary female of disputed provenance. It belongs to a group of species in which the females can only be separated genetically. In associating the putative holotype with the male of an otherwise un-named European species in the redescription, Vujić *et al.* (2018a) state that they seek to fix the identity of *M. albifasciatus*. They provide figures of the male terminalia and a key to separate the male from males of the other *Merodon geniculatus* group species occurring in eastern parts of the Mediterranean region. **Illustrations of the adult insect:** none known.

Merodon albifrons Meigen, 1822
Preferred environment: open ground; stony, unimproved, non-calcareous dry grassland and open, tall-herb areas in *Quercus pubescens* and *Q.ilex* forest on calcareous substrates. **Adult habitat and habits:** flies fast and low over sparsely-vegetated, dry, open ground; settles on bare ground; frequently encountered in numbers over a rather restricted area (2-300 m.sq.). **Flowers visited:** *Urginea maritima* (Standfuss and Claussen, 2007), *Chrysanthemum, Euphorbia, Helianthemum, Ranunculus, Scabiosa, Senecio, Thymus*. **Flight period:** May/June and August/September. Milankov *et al*. (2013) present genetic information indicating that, in some populations of this species, the progeny of the spring generation produce adults next spring and the autumnal generation produces the autumnal generation of the following year. **Developmental stages:** not described. **Range:** from central France south to the Mediterranean and N Africa; from western Spain eastwards through central (Switzerland, Austria) and southern Europe (Corsica, Sardinia, Sicily, Italy, former Yugoslavia, Greece, Bulgaria,

Roumania) to the Crimea and the Transcaucasus (Georgia, Azerbaijan. **Determination:** Marcos-García et al.(2007), who include this species in their keys and figure the male terminalia. Marcos-García eta al (2007) establish that *M.grossus* Gil Collado (described by Gil Collado as a variety of *M. spinipes*) is a junior synonym of *M. albifrons*. For separation of *M. albifrons* from *M. parietum*, see under *M. parietum*. There is considerable variation in the extent of the pale (yellow, orange or red) markings on the tergites of this species. The summer generation can have the tergites predominantly pale orange/yellow, especially in Mediterranean zone populations, whereas in spring generation specimens the tergites can be almost entirely dark brown, with only a vestige of a reddish mark on each side of tergite 2. **Illustrations of the adult insect:** the male is illustrated in colour by Speight and Langlois (2020a, 2020b); both male and female are illustrated in colour by Pétremand *et al*. (2022).

Merodon alexandri Popov, 2010
Preferred environment: forest/open ground; small open areas in humid *Quercus robur* forest and alluvial hardwood forest with *Q.robur* (Popov, 2010). **Adult habitat and habits:** flies low over ground vegetation; males exhibit territorial behaviour (Popov, 2010). **Flowers visited:** *Crataegus, Euphorbia, Fragaria, Ornithogalum fischeranum, Stellaria holostea* (Popov, 2010). **Flight period:** May/June. **Developmental stages:** not described, but evidently bulb-feeding in Hyacinthaceae (Popov, 2010). **Range:** Ukraine and SE parts of European Russia. **Determination:** both sexes of this species are described by Popov (2010), from series of specimens collected in the Ukraine and Russia. Vujić et al.(2012) redefine the species, figure its male terminalia and provide a key to separate it from other known European species of the *ruficornis* group. Popov (2010) also figures the male terminalia and includes a key to distinguish both sexes of *M.alexandri* from other species of the *M.ruficornis* group occurring in the Ukraine. **Illustrations of the adult insect:** none known.

Merodon alexeji Paramonov sensu Hurkmans (1993): see under *M.serrulatus* Wiedemann

Merodon ambiguus Bradescu, 1986
Preferred environment: forest; deciduous forest; tracksides and tall-herb open areas in Eastern thermophilous *Quercus* forest. **Adult habitat and habits:** an extremely fast-flying and wary species very difficult to catch with a hand net, *M.ambiguus* frequents open areas and tracksides, where it flies mostly within 1m of the ground surface, around and through tall-herb vegetation and the foliage of the lowest branches of trees; it rests in the sun on foliage of low branches or large-leaved herbs within 1m of the ground, or on the ground; it appears soon after the sun reaches tracksides etc. in the morning and disappears before mid-day. **Flowers visited:** *Polygonum*. **Flight period:** September/October. **Developmental stages:** not described. **Range:** Serbia, Greece, Roumania. **Determination:** *M. ambiguus* is included in Bradescu's (1991) keys, but there the features provided for separation of *M. ambiguus* from *M. bessarabicus* are too imprecise to be reliable. Those two species are extremely similar to one another and can be found on the wing at the same time, in the same locality. Males of *M. ambiguus* can be separated from males of *M. bessarabicus* by the brightly metallic, brassy area of the mesoscutum immediately anterior to the scutellum present in *M. ambiguus*. In *M. bessarabicus* this part of the mesoscutum is unmetallic, shining black. **Illustrations of the adult insect:** the male is illustrated in colour by Speight and De Courcy Williams (2016).

Merodon analis Meigen, 1822
Preferred environment: forest/open ground; open grassy areas in/adjacent to alluvial hardwood forest or *Quercus/Carpinus* forest. **Adult habitat and habits:** flies fast and low over and among ground vegetation; settles close to the ground on foliage of large-leaved plants (e.g. umbellifers). **Flowers visited:** white umbellifers; *Eryngium, Scabiosa*. **Flight period:** June/September**. Developmental stages:** in the "supplementary data" accompanying Vujić *et al.*(2020a) a record quoted as originating from the British Museum (Natural History) is given as "ex *Galanthus*, imported. Tours, France". At that point in time (2020), the only *constans*-group species recognised as occurring in France was *M. analis*. Langlois and Speight (2022) detail the rearing of the French species from bulbs of *Leucojum vernum* in Eastern France, where *Galanthus* is viriually absent, observing that in the Loire valley, from which there were a number of records of *M. analis*, *Galanthus* is present, but *Leucojum* is absent. Orengo-Green *et al*. (2024) describe the larva of the taxon reared from *Leucojum* in Eastern France, but regard the species involved as *M. constans* (see below, under determination). **Range:** uncertain, due to confusion with related species until recently, but recognised from Austria, Bosnia-Herzegovina, Croatia, Czech Republic, France, Germany, Hungary, Italy, Serbia, Slovenia. **Determination:** Vujić *et al.* (2020a) reinstate this species, which had been until then universally confused with *M. constans*. Separation of *M. analis* and *M. constans* remains contentious. Genetically (Vujić *et al.*, 2020a; Ricarte *et al*., 2022c), no basis has been found for separating *M. analis* from *M. constans.* The females cannot be separated

morphologically and separation of the males is dependent on slight differences in the male terminalia, essentially differences in the shape of the posterior lobe of the surstylus (Vujić *et al.*, 2020a). These are minimal and inconsistent within populations. Vujić *et al*. (2020a) illustrate three variants in the shape of the posterior lobe in *M. constans*, but provide only one figure of the posterior lobe in *M. analis*. Although Vujić *et al*. (2020a) allude to examination of specimens from west of the Alps which they consign to *M. analis*, for both *M. analis* and *M. constans* their illustrations of male genitalia are derived from specimens originating in the Balkans. Vujić *et al*. (2020a) were able to confirm the presence of *M. constans* only East of the Alps, with *M. analis* as the only *constans*-group species found West (or North) of the Alps, with records from France and Germany. More recently, Ricarte *et al*. (2022c) record *M. constans* from Spain, illustrating the posterior lobe of the surstylus of a Spanish specimen. The shape of the posterior lobe shown for the Spanish specimen is not consistent with the range of shapes shown for the posterior lobe of *M. constans* by Vujić *et al*. (2020a). Neither does it coincide with the shape of the posterior lobe of *M. analis*, as shown by Vujić *et al*. (2020a). Its shape is essentislly intermediate between the shapes illustrated for *M. analis* and *M. constans*. Subsequently, Orengo-Green *et al*. (2024) have re-identified French populations consigned to *M. analis* by Vujić *et al*. (2020a) and Speight & Langlois (2020c) as *Merodon constans*. Orengo-Green *et al*. (2024) illustrate the posterior lobe of 7 different French specimens they consign to *M. constans*. The illustrations show the same shape as illustrated for the posterior lobe *M. constans* in Spain, in Ricarte *et al*. (2022c), and none of them co-incide well with the figures of the posterior lobe of Balkan *M. constans* provided by Vujić *et al*. (2020a). Orengo-Green *et al*. (2024) do not illustrate the posterior lobe of Balkan *M. constans* as shown by Vujić *et al*. (2020a), or discuss differences between those illustrations and the posterior lobe of Spanish specimens they consign to *M. constans.* Discussion of the identity of the French specimens in Orengo-Green *et al*. (2024) voices a hypopthesis offered by Vujić, that the French populations represent a recombinant swarm of hybridised *M. analis* and *M. constans*. An alternative interpretation would be that West of the Alps neither *M. analis* nor *M. constans* occur, the *constans*-group being represented there by what is simply another, as yet unrecognised, closely similar species, so far indistinguishable genetically, and with some populations using *Gallanthus* as larval host plant and others likewise using *Leucojum*. If the hybrid swarm hypothesis is adopted it is difficult to see what basis remains for recognising *analis* and *constans* as separate species – they interbreed to provide fertile offspring, there are no undisputable morphological distinctions between them and they cannot be separated genetically. It is to be hoped that re-appraisal of the taxonomic status of these two taxa, both genetically and morphometrically, can be carried out to clarify this confused situation. Vujić *et al.*(2020a) synonymise *M. haemorrhoidalis* of Sack with *M. analis*. The dense covering of distinctly golden-yellow, longish hairs present on tergites 3 and 4 in *constans*-group species help to distinguish *M. analis* from a range of other *Merodon* species, including *M. albifrons* and *M. parietum* (which are of approximately the same size and shape as *M. analis*). **Illustrations of the adult insect:** the general appearance of the abdomen of *M. analis* can be seen from the coloured photographs provided by Vujić *et al.* (2020a). The male isillustrated in colour by Speight and Langlois (2020a, 2020b).

Merodon andriotes : see under *Merodon luteomaculatus* complex

Merodon annulatus : see under *Merodon natans*

Merodon antonioi Marcos-García, Vujíc & Mengual, 2007
Preferred environment: forest/open ground/freshwater; open areas in riparian *Fraxinus angustifolia* forest along seasonal rivers (Marcos-García *et al*., 2007); open areas in Pinus pinea forest (Van Eck, 2016). **Adult habitat and habits:** the adults have been collected resting on the rocks of a dry river bed (Marcos-García et al, 2007). **Flowers visited:** *Dianthus broteri* (Van Eck, 2016). **Flight period:** September/October. **Developmental stages:** not described. **Range:** Portugal; central Spain. **Determination:** Marcos-García *et al*. (2007), who describe the species and figure the antennae, cerci and parts of its male terminalia. This species is also included in the keys they provide. *M.antonioi* is part of the *M.geniculatus* complex and quite difficult to separate from related species. **Illustrations of the adult insect:** none known.

Merodon armipes Rondani, 1843
Preferred environment: open ground/forest; thermophilous *Quercus* forest; thermophilous forest fringes; open areas within dry scrub and dry/semi-arid, closed, unimproved grassland. **Adult habitat and habits:** flies fast and low over grassland vegetation, settling on foliage of low-growing plants and on stones, in the sun. **Flowers visited:** *Helianthemum, Ornithogalum umbellatum*; *Ranunculus bulbosus* (G. Pétremand, pers. comm.); *Saxifraga urbium* (Ssymank & Doczkal, 2017). **Flight period:** end April/end June. **Developmental stages:** not described. This species is apparently associated with

the tassel hyacinth, *Muscari* (Liliaceae) in southern Germany (D. Doczkal, pers. comm.). *Ornithogalum* is almost certainly an alternative host. **Range:** from north-east France (Rhine valley in Alsace) and adjacent parts of Germany, through central Europe (Switzerland) and mountainous parts of northern Italy into the former Yugoslavia and on to Bulgaria, Roumania and the Crimea; Greece, Iran, Israel, N Africa. **Determination:** Vujić *et al.* (2012) provide a key to separate *M. armipes* from other known European species of the *ruficornis* group, but do not figure the male terminalia of this species. Using that key, some males of *M.trebevicensis* could be misidentified as *M.armipes*. Separation of the males of these two species is considered here in the *M.trebevicensis* species account. **Illustrations of the adult insect:** The male is illustrated in colour in Speight and Langlois (2020a, 2020b).

Merodon arundanus Marcos-García, Vujíc & Mengual, 2007
Preferred environment: forest/open ground; open areas at the upper altitudinal limit of *Abies pinsapo* forest (c.1350m). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April. **Developmental stages:** not described. **Range:** apparently a localised endemic species, known only from a small area in southern Spain. **Determination:** Marcos-García *et al.* (2007), who describe the species, figure its male terminalia and include it in their identification keys. *M.arundanus* was described from three male specimens and the female remains unknown. **Illustrations of the adult insect:** none known.

Merodon atratus (Oldenberg), 1919
Preferred environment: unimproved montane and subalpine, non-calcareous grassland to above 3000m alt. **Adult habitat and habits:** flies fast and low through ground vegetation, settling on either large leaves in the sun, or on bare ground. **Flowers visited:** yellow composites; *Achilea, Potentilla, Senecio* (A Vujić, pers. comm.). **Flight period:** mid June/mid August. **Developmental stages:** not described. **Range:** Alps: France, Switzerland, Austria, Italy. **Determination:** originally described from 3 males, as a variety of *M. cinereus*, and later as "*M. cinereus* B" (Milankov *et al*., 2008) confused with the cryptic species *M. virgatus*. *Merodon atratus* is redescribed by Šašić *et al*. (2016). It is a member of the *cinereus* subgroup of the *aureus* group, separated from *M. cinereus* in the male by having tergite 3 either entirely black haired or with stripes of black hair. It is one of a trio of cryptic species separated in this way from *M. cinereus*. The other two cryptic species, *M. balkanicus* and *M. virgatus*, appear to be endemic to the Balkan peninsula. For discussion of how these three cryptic taxa may be distinguished, see Šašić *et al.* (2016), who also figure the male terminalia of *M. atratus*. **Illustrations of the adult insect:** the male abdomen is shown in colour, in dorsal view, by Šašić *et al.* (2016). A coloured photo of the male, in dorsal view, together with *M. cinereus*, is given in Speight and Castella (2017).

Merodon atricapillatus Šašić, Ačanski & Vujić, in Šašić *et al*, 2018
Preferred environment: phrygana (Claussen and Lucas, 1988 – as *caerulescens*); Mediterranean scrub (Šašić *et al*, 2018). **Adult habitat and habits:** no data. **Flowers visited:** *Anthemis chia* (Claussen and Lucas, 1988 - as *caerulescens*); *Ornithogalum* (Vujić et al, 2020). **Flight period:** March/April and October. **Developmental stages:** undescribed. **Range:** the Aegean island of Crete (Greece). **Determination:** Both male anf female of this species are described in Šašić, *et al*.(2018). This is an *aureus* group species indistinguishable morphologically from *M. caerulescens*, with which it forms the *caerulescens* complex of Šašić, *et al*.(2018). In Šašić *et al*.(2016) the species of the *caerulescens* complex are distinguished from other sub-groupings of the *aureus* group by their "strong blue body lustre", a distinction also referred to in Šašić *et al*.(2018). However, photographs provided in Veselić *et al*.(2017), of *Merodon adriaticus* and *Merodon rufipes*, indicate that both of these *aureus* group species also have a distinctly blue body lustre, at least in the male. **Illustrations of the adult insect:** the general appearance of the male and female can be seen from the coloured photos provided by Sasic *et al*.(2018).

Merodon aureus Fabricius, 1805
Preferred environment: open ground; unimproved, calcareous montane grassland. **Adult habitat and habits:** flies fast and low over ground vegetation in open situations; settles on vegetation, bare ground and stones in the sun. **Flowers visited:** umbellifers*; Anthericum ramosum, Chrysanthemum leucanthemum, Mentha, Ranunculus, Solidago, Taraxacum.* **Flight period:** end May/August. At higher altitudes the peak is in July/August. **Developmental stages:** not described. The puparium described and figured as that of *M. aureus*, by Preradovic *et al.* (2018), proved subsequently to be the puparium of *M. calidus* (Vujić *et al.*, 2020b). Association between the larva of *Merodon aureus* and *Ornithogalum* has been mooted, but *M. aureus* is frequently found in localities where *Ornithogalum* is absent, but where other geophytes are present. **Range:** confirmed from Belgium, Poland and the Alps (Germany, France, Switzerland, Austria), Italy (Apennines), northern parts of the Balkans

(Croatia, Bosnis-Herzegovina, Serbia, Slovenia) and Bulgaria. Literature records from Hungary, Latvia, Roumania, Slovakia and N Africa require confirmation. **Determination:** with the redescription of *M. aureus* by Vujić *et al.* (2020b) and associated designation of a neotype for M. *aeneus* of Megerle in Meigen, which confirms *aeneus* as a junior synonym of *M. aureus*, the confusion over which name should be used for this taxon has been resolved. Sack (1928-32) and Bradescu (1991) provide for separation of *M.aureus* (as *aeneus*) from species recognised at that time, but not for separation of *M.aureus* from species more recently segregated in the *aureus* group. For identification of *aureus*-group species occurring in the Pyrenees and the Iberian peninsula Marcos-García *et al.* (2007) may be used. They show that *M.aureus* itself does not occur in that part of Europe, the previous Spanish records mostly now being referred to *M.unicolor*, though other taxa are also involved (see Marcos-García *et al*, 2007). Further east in Europe the *aureus* group becomes increasing diverse in species. Its various sub-groups may be separated by the key in Veselić *et al.* (2017). The species complexes recognised in the *aureus* subgroup can be distinguished from each other by the key provided in Vujić *et al.* (2020b). Of the three species recognised within the *aureus* complex, only *M. aureus* has been found west of the Balkans (Vujić *et al.*, 2020b). The other two species, *M. calidus* and *M. ortus*, can only be separated from *M. aureus* genetically. **Illustrations of the adult insect:** the male is illustrated in colour in Speight and Langlois (2020a, 2020b).

Merodon aurifer Loew, 1862

Preferred environment: Aegean phrygana; herb-rich, semi-arid, open, unimproved grassland; open, riparian *Fraxinus angustifolia* forest (Ricarte *et al*, 2008). **Adult habitat and habits:** flies fast and low and settles on low-growing vegetation. **Flowers visited:** *Ferula, Foeniculum.* **Flight period:** July/October. Nearly all records are from August/September, with a few for July and October. In addition, there are one or two records from May/June, which, assuming they are correct, seem exceptional. **Developmental stages:** not described. **Range:** Spain; Mediterranean zone of France (Pétremand *et al*., 2020, suggest this species may be extinct in Frane); Italy (including Sicily); parts of the former Yugoslavia; Greece, including Aegean islands; Armenia; Turkey; Azerbaijan.. West of the Alps, there are very few recent records of this species. This species has been recorded frpm N Africa (e.g. Claussen, 1989), but in their revision of *aurifer*-group species, Vujic *et al*. (2021c) make no mention of those records or allude to examination of any N African specimens which had previously been determined as *M. aurifer* (or as *M. distinctus*). Similarly, in the review of world-wide *Merodon* groups by Vujic *et al*. (2021b), there is no mention of the occurrence of any *aurifer*-group species in N Africa. The status of *M. aurifer* in N Africa has thus become unclear and the records of *M. aurifer* for Morocco, given in Kettani *et al*. (2022), require confirmation. **Determination:** variously referred to as *aurifera* or *auriferus*, for almost 100 years this species has been regarded as a junior synonymn of "*Merodon spinipes*". Likov *et al*.(2019) refer to it as a distinct species, belonging to a small group they call the *aurifer* group, close to *M. clunipes***.** The *aurifer*-group is comprehensively defined in Vujic *et al*.(2021c). In an appendix, Vujić *et al*.(2020d) give *M. distinctus* Palma as a synonym of *M. aurifer*. As *Merodon distinctus*, the male terminalia of *M. aurifer* are figured by Marcos-García *et al.* (2011). Also as *Merodon distinctus*, the male of *M. aurifer* is included in the keys in Speight and Langlois (2020a, 2020b). The identity of the species whose terminalia are figured as those of "*M. distinctus*", by Hurkmans (1993), is unclear, but it does not seem to be *M.aurifer*. Vujić *et al*.(2021c) point out that Hurkmans' (1993) designation of a lectotype for *aurifer* was invalid and designate a lectotype themselves. In the same paper they describe a new *aurifer*-group species from Turkey (and Azerbaijan), *M. nudicorpus*. *Merodon aurifer* and *M. nudicorpus* can be distinguished from each other on leg colour: in *M. aurifer* all tibiae and tarsi are reddish yellow, as are the hind femora in the female, whereas in *M. nudicorpus* the tarsi are black dorsally, the tibiae have a black ring and the hind femora in the female are black. From the figures provided by Vujić *et al*.(2021c) the male terminalia of these two species appear to be very similar. **Illustrations of the adult insect:** the general appearance of the male of this species can be seen from the coloured photos provided in Likov *et al.* (2019), Speight and Langlois (2020a, 2020b) and Vujić *et al.* (2020d).

Merodon auripes Sack, 1913

Preferred environment: *Castanea* forest (M. Miličić, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus* (Vujić *et al*., 2020). **Flight period:** April/May. **Developmental stages:** not described. **Range:** Switzerland, Italy, the Balkans, Bulgaria, Roumania and the Ukraine. **Determination:** Vujić *et al.* (2012) redefine the species, figure its male terminalia and provide a key to separate it from other known European species of the *ruficornis* group. They also comment that this species has been overlooked almost since its description. Milankov *et al.* (2008a) point out that *M. ruficornis* sensu Milankove *et al.* (2002) is in fact *M.auripes*. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photos provided by Vujić *et al.* (2020d) and Speight and Langlois (2020a, 2020b)..

Merodon auronitens Hurkmans, 1993
Preferred environment: conifer forest; grassy areas in *Pinus* forest (Vujić *et al*., 2011). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March, June. **Developmental stages:** not described. **Range:** Turkey; Israel. **Determination:** Hurkmans (1993), who figures the highly distinctive male terminalia. The hind basitarsus is also distinctive in the male of this species. The female of *M.auronitens* is as yet undescribed. However, both the male and female of *M. auronitens* are identified to species in the key to "species groups and unplaced species of the *avidus-nigritarsis* lineage" in Vujic *et al.* (2021b). **Illustrations of the adult insect:** the general appearance of the male of this species can be seen in the coloured photo provided (Figures 10d) in the supplementary data accompanying Vujić *et al.* (2021b).

Merodon avidus
For some years after Milankov *et al.* (2001) presented genetic data demonstrating that *M. avidus* as recognised by Hurkmans (1993) is a complex of two cryptic species with apparently identical male terminalia, which they referred to as referred to as *M. avidus* A and B. Subsequently, Milankov *et al.* (2009) concluded that, on the Iberian peninsula, a third cryptic taxon is present, morphologically indistinguishable from *M. avidus* B, and subsequently described by Popović *et al.* (2015) as *M. ibericus*. Over most of Europe *M. avidus* A is now recognised as *M. avidus* of Rossi, and *M. avidus* B as *M. moenium*. But in Vujić *et al*. (2024a) both *M. avidus* and *M. moenium* are stated to be absent from Spain, so that both *M. avidus* A and B sensu Marcos-Garcia *et al.* (2007) are now consigned to *M. ibericus*. Three more species have recently been described within the *avidus* complex, *M. magnus, M. megavidus* and *M. pseudomoenium*, all from SE Europe (Ačanski *et al.*, (2016); Vujić *et al*. (2024a).

Merodon avidus (Rossi), 1790 : *M. avidus* Taxon A sensu Milankov *et al*. (2001)
Preferred environment: forest/open ground; tracksides etc in thermophilous *Quercus* (*Q.pubescens, Q.frainetto/Q.cerris*) forest, evergreen oak (*Q.ilex, Q.suber*) forest, Salzmann's pine forest and *Pinus halapensis* forest (including planted *P.halapensis*); old olive orchards. **Adult habitat and habits:** adults fly very fast and low through vegetation and settle most often on the ground, on bare patches of soil on woodland paths, or at the edge of tracks. The presence of this species is as easily detected by the high-pitched buzz it emits during flight as by direct observation. The males may return repeatedly to particular resting positions among ground vegetation, usually at slightly higher levels than the general, surrounding vegetation, and patrol "territories" surrounding these resting points. **Flowers visited:** *Euphorbia*. **Flight period:** May/June and September. **Developmental stages:** the larva is described by Andrić *et al*. (2014), who collected it from bulbs of *Ornithogalum umbellatum* and identified it using molecular taxonomic techniques, without rearing, using genetic data from adults of *M. avidus*. A more detailed description, again from larvae and puparia associated with *Ornithogalum umbellatum*, is provided by Preradovic *et al.* (2018). **Range:** Mediterranean zone of Europe, from southern France to Italy; southern Switzerland (Tichino); the Balkan Peninsula and Roumania (and probably further south round the Mediterranean basin). Apparently abesmnt from the Iberian peninsula. **Determination:** the key in Likov *et al.* (2019) includes the males of all known European members of the *avidus* group of species. Popović *et al*. (2015) affirm the existence of three cryptic species within *M. avidus* as earlier recognised, using molecular taxonomic and morphometric techniques, *M. avidus* (Rossi) being one of them. They redefine *M. avidus*, which unfortunately remains morphologically almost indistinguishable from the other two species, *M. moenium* and *M. ibericus*, including in its male terminalia. The statements in Vujić *et al*. (2024b), on the overlap between *M. avidus, M. ibericus* and *M. moenium*, in leg colouration, extent of orange markings on the tergites and presence or absence of patches of grey dusting on tergite 2 amplify the unreliability of these features as means of distinguishing between these three species. Nonetheless, they are used in the key provided. It should be emphasised that the key is entitled "Key for typical morpho forms of species from *Merodon avidus* complex", and, as such, does not take into account the morphological variability alluded to in the accompanying text. Essentially, the text indicates that the key cannot be relied upon to distinguish *M. avidus* from *M. moenium* (and hence *M. ibericus*). For further discussion of identification of *M. avidus*, Popović *et al.* (2015) should be consulted. Recently, additional cryptic species in this complex, *M. magnus, M. megavidus* and *M. pseudomoenium* have been recognised (see under their species accounts). **Illustrations of the adult insect:** coloured figures of the abdomen of the male and female of this species are provided by Popović *et al*. (2015). the male is illustrated in colour by Speight and De Courcy Williams (2016).

Merodon balkanicus Šašić, Ačanski & Vujić, in Šašić *et al.*, 2016
Preferred environment: montane/subalpine unimproved grassland, from 1400 - 2000m alt. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** Bulgaria, Serbia.

Determination: *M. balkanicus* is a cryptic species of the *cinereus* sub-group of the *Merodon aureus* group, virtually indistinguishjable from *M. atratus* and *M. virgatus*. It is defined genetically and morphometrically in Šašić *et al.* (2016). **Illustrations of the adult insect:** none known.

Merodon bessarabicus Paramonov, 1924
Preferred environment: conifer forest; grassy areas in *Abies* forest (Vujić *et al.*, 2011); glades in Eastern thermophilous *Quercus* forest and mesophilous *Fagus*/*Q.frainetto* forest (M. de C.Williams, pers.comm.). **Adult habitat and habits:** flies fast and low over ground vegetation in sun-lit glades within forest, settling on the ground, or on low-growing vegetation in the sun; around the middle of the day visits stream margins to drink, alighting under concealing vegetation or jumbles of interlacing, fallen branches or twigs; the female investigates white hand-nets and can be collected easily while so doing. **Flowers visited:** *Euphorbia* spp. (Vujić *et al*., 2011); yellow composites; *Polygonum*. **Flight period:** September. **Developmental stages:** not described. **Range:** Slovenia; Balkan peninsula; Moldova; Turkey. **Determination:** Paramonov (1924); Sack (1928-32); Bradescu (1991). *M. bessarabicus* is not adequately separated from related species in existing keys. It is extremely similar to *M. ambiguus* (see under *M. ambiguus*) and these two species can be found in flight at the same time and on the same site. *M. bessarabicus* is included in the keys in Hayat *et al*. (2024), but *M. ambiguus* is not. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photo provided by Vujić *et al.* (2020d).

Merodon brevis Paramonov, 1926
Preferred environment: open areas in montane *Quercus*/*Fagus*/*Acer* forest; herb-rich, unimproved, montane/subalpine grassland and ruderal communities up to 2000m altitude (Vujić *et al*., 2022b). **Adult habitat and habits:** rests on stones in the sun. **Flowers visited:** no data. **Flight period:** end June/July. **Developmental stages:** not described. **Range:** Turkey; Armenia; Iran. **Determination:** the original description of this species was based on a solitary male. Based on an abundance of new material, Vujić *et al*. (2022b) redescribe the male, describe the female, figure the male terminalia and provide a key in which *M. brevis* is distinguished from other known species of the *aberrans* group. **Illustrations of the adult insect:** coloured photos of the male and female are provided by Vujić *et al*. (2022b).

Merodon cabanerensis Marcos-García, Vujíc & Mengual, 2007
Preferred environment: forest; open areas in thermophilous *Quercus* forest (*Q.faginea*) and riparian *Fraxinus angustifolia* forest (Marcos-García *et al*, 2007). **Adult habitat and habits:** the adults are low-flying and rest on the bare ground (Marcos-García *et al*, 2007). **Flowers visited:** no data. **Flight period:** March (Marcos-García *et al*, 2007). **Developmental stages:** not described. **Range:** central Spain; Morocco. **Determination:** Marcos-García *et al*.(2007), who describe the species, figure its male terminalia and include it in their keys; Vujić *et al*.(2018c) provide a key separating *M. cabanerensis* from other members of the *M. desuturinus* group. **Illustrations of the adult insect:** none known.

Merodon caerulescens Loew, 1869
Preferred environment: Mediterranean scrub; open *Pinus brutia* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Anthemis chia* (Vujić *et al*, 2020). **Flight period:** March/April. **Developmental stages:** undescribed. **Range:** the Aegean island of Rhodes (Greece). According to Dirickx (1994), there is no basis for the repeated references to occurrence of this species in North Africa. Šašić Zorić *et al*.(2018) state that *M. caerulescens* is endemic to Rhodes. **Determination:** Sack (1928-32) provides a key to separate *M. caerulescens* from other European *Merodon* species then known. But so many European *Merodon* species have subsequently been described that Sack's key cannot be regarded as reliable. *M. caerulescens* is a member of the *aureus* group, in which there are a number of cryptic species only separable genetically. Šašić Zorić *et al*.(2018) state that *M. caerulescens* cannot be separated from *M. atricapillatus* morphologically, and refer to these two species together as the "*caerulescens* complex", repeating an earlier statement, from Šašić Zorić *et al*.(2016), that the distinguishing characteristic of the *caerulescens* complex (segregating its species from other sub-groups and species complexes within the *aureus* group) is that its species have a "strong blue body lustre". However, photographs provided in Veselić *et al*.(2017), of *Merodon adriaticus* and *Merodon rufipes*, indicate that both of these *aureus* group species also have a distinctly blue body lustre, at least in the male. **Illustrations of the adult insect:** the general appearance of the *M. caerulescens* male can be seen in the coloured photo provided by Vujić *et al.* (2020d).

Merodon calcaratus (Fabricius), 1794
Preferred environment: semi-arid, sandy calcareous grassland with scattered *Pinus pinea* (Van Eck, 2016); semi-arid, unimproved, open, calcareous grassland (Van Eck *et al*., 2020); "*Pinus* forest on low mountains" (Vujić *et al*., 2021d). **Adult habitat and habits:** no data. **Flowers visited:** *Drimia maritima* (Van Eck, 2016); *Prospero autumnalis* (Vujić *et al*., 2021d). **Flight period:** March/April and end of September/November. **Developmental stages:** not described, but Van Eck (2016a) provides circumstantial evidence suggesting the larval host plant could be *Scilla autumnalis*. Vujić *et al*. (2021d) similarly suggest *Prospero autumnalis*. **Range:** Portugal; southern Spain; N. Africa (Morocco, Algeria, Tunisia, Libya). **Determination:** both the male and female of *M. calcaratus* are redescribed by Vujić *et al*. (2021d), together with figures of the male terminalia and a key to separate this species from others of the *Merodon natans* group. A photograph of the male Terminalia of *M. calcaratus* is provided by Van Eck (2016a). **Illustrations of the adult insect:** the adult male, in side view, is illustrated in colour by Van Eck (2016a).

Merodon calidus Šašić Zorić, Ačanski & Vujić, in Vujić *et al*, 2020b
Preferred environment: forest; open areas along rivers in mesophilous *Fagus* forest; unimproved, calcareous, montane grassland (Vujić *et al*, 2020d), up to 1550m altitude. **Adult habitat and habits:** no data. **Flowers visited:** Apiaceae; *Anthericum, Leucanthemum, Mentha, Ranunculus, Solidago, Taraxacum* **Flight period:** April/June, plus July at higher elevations**. Developmental stages:** the puparium of *M. calidus* is described by Preradovic *et al*.(2018) under the name *M. aureus*, from two puparia found loose in the soil (one in May, the other in August), in the vicinity of bulbs of *Ornithogalum umbellatum*, but where bulbs of *Muscari* and *Gagea* species and corms of *Crocus*, were also present. Identification of the puparia was achieved genetically and they were recognised as belonging to *M. calidus* in Vujić *et al*.(2020b), where *M. calidus* is described. The assertion made in Vujić *et al*, (2020d), that " the larva is undescribed but has been found in association with *Ornithogalum*" requires substantiation, in that it is not clear which of various geophytes found in the soil where the puparia were collected hosted the larva of *M. calidus*. **Range:** various parts of the Balkan peninsula (Albania, Bulgaria, Greece, N Macedonia, Serbia) and the islands of Corfu, Crete and Euboea. **Determination:** as an adult, this species is morphologically indistinguishable from other *aureus* complex species, and only recognisable from a combination of genetic and morphometric characteristics. Whether this is also true of the developmental stages is not yet known. **Illustrations of the adult insect:** the general appearance of *M. calidus* can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Merodon caucasicus Portschinsky, 1877
Preferred environment: Forest; open areas in montane *Fagus* forest, from 1000m to almost 2000m. altitude (Vujić *et al*., 2020a). **Adult habitat and habits:** no data. **Flowers visited:** *Leontodon* (Vujić *et al*., 2020a). **Flight period:** July/October. **Developmental stages:** not described. **Range:** Georgia; Turkey; Russian Caucasus. Live specimens believed to have been introduced with bulbs have on two occasions been found in the Netherlands (Smit & Langefeld, 2018). **Determination:** Diagnostic features of the male of this species are detailed in Vujić *et al*. (2020a), who also figure features of the male terminalia and provide a key for the separation of the male of *M. caucasicus* from the males of other European *constans*-group species. Separation of the male of *M. caucasicus* from the male of *M. triangulum* is dependent upon features of the terminalia. Features used to separate the female of *M. caucasicus* from females of other *constans*-group species, in the key provided by Vujić *et al*. (2020a), are not very precise and whether they could lead to reliable determination is debatable. Vujić *et al*. (2020a) establish that *batumicus* Paramonov is a junior synonym of *caucasicus* Portschinsky. **Illustrations of the adult insect:** the female is illustrated in colour by Smit and Langefeld (2018).

Merodon caudatus Sack, 1913
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March. **Developmental stages:** not described. **Range:** Israel, Palestine. Hurkmans (1993) cites Israeli and Palestinian records of this species but erroneously refers to the type locality as located in Turkey. The description of *M.caudatus* was based on a single male from Jaffa, in Israel. Vujić *et al*.(2011) and Saribiyik (2014) also list *M.caudatus* as occurring in Turkey, but without citation of any Turkish records of the species. At present, there do not apear to be any confirmed records of this species from Turkey. **Determination:** Hurkmans (1993), who redescribes the species and figures the male terminalia. Both the male and female are identified to species in the key to "species groups and unplaced species of the *avidus-nigritarsis* lineage" in Vujic *et al*.(2021b). **Illustrations of the adult insect:** the general appearance of the male of this species can be seen in the coloured photos provided (Figure 11c, 11d) in the supplementary data accompanying Vujić *et al*.(2021b).

Merodon chalybeatus Sack, 1913
Preferred environment: forest/open ground; alongside seasonal river beds in rocky, dry, unimproved grassland and grassy, open areas in *Abies* forest, thermophilous *Quercus* forest and mixed deciduous forest (*Syringo-Carpinetum orientalis* forest: A.Vujić, pers.comm.). **Adult habitat and habits:** flies fast and low, within tall ground vegetation, settles on stones in the sun when it is hot (A.Vujić, pers.comm.). **Flowers visited:** yellow composites (*Taraxacum* spp.) (A.Vujić, pers.comm.); *Euphorbia, Ranunculus* (Vujić *et al.*, 2011); *Cichorium intybus, Crepis capillaris* (Ssymank, 2012). **Flight period:** April and August/September. **Developmental stages:** undescribed. **Range:** Croatia, Cyprus, North Macedonia, Greece, Montenegro, Roumania, Serbia, Slovenia, Turkey. Vujić *et al.* (2001) suggest this species should be regarded as threatened at the European level. **Determination:** Vujić *et al.* (1996), who figure the male terminalia (as *M. albonigrum*). *M. chalybeatus* is apparently a member of the *Merodon geniculatus* complex, but distinguishable from other species in this group by the transverse band of black hairs across the mesoscutum. This species is apparently closely similar to *M. escorialensis*. Distinguishing features are described by Vujić *et al.* (1996) and a diagnosis of *M. chalybeatus* is provided by Vujić *et al.* (2018a). A key separating *M. chalybeatus* from other eastern Mediterranean *geniculatus* group species is provided by Vujić *et al.* (2018a). Vujić *et al* .(2011) established that *M. albonigrum* Vujić *et al.* (1996) is a junior synonym of *M. chalybeatus*. **Illustrations of the adult insect:** a coloured photo of the male is provided by Vujić *et al.* (2018a).

Merodon chalybeus Wiedemann in Meigen, 1822
Preferred environment: forest/open ground; open areas in evergreen oak maquis and more open, almost bare ground in semi-arid conditions (Marcos-García *et al.*, 2007); fixed dune grassland in Mediterranean dune systems. **Adult habitat and habits:** low-flying, with a rapid, zig-zag flight; settles on bare ground in the sun, where its dark colouration makes it difficult to see. **Flowers visited:** no data. **Flight period:** March to beginning of July and end of September to beginning of November. **Developmental stages:** not described. **Range:** Portugal; Spain; S France and N Africa. Records of this species from Mediterranean islands (including Corsica), the Balkan peninsula and Greece have proven to be based on misdeterminations. **Determination:** Marcos-García *et al.*(2007) redefine the species and include it in their keys and figure the male terminalia. They also figure the head and tergites of this species, but the figure numbers given (61-68) are incorrect. The figures concerned are actually numbers 47-56. This species appears in much previous literature under the name *spicatus* Becker, shown by Marcos-García *et al.*(2007) to be a junior synonym of *chalybeus* Wiedemann. Together with two other European species, *M. minutus* and *M. robustus*, *M. chalybeus* is consigned to a named subgroup of the *M. aureus* clade, the *chalybeus* subgroup, by Ačanski *et al.* (2022). They also provide a key to the *chalybeus* subgroup species. An error in the key makes it difficult to use. In couplet 8, part of the mesoscutum of *M. chalybeus* is stated to be "pollinose", in contradistinction to the condition in *M. minutus*, where this "pollinosity" is said to be lacking. Pollinosity is entirely absent from that part of the mesoscutum in both of these species. But in *M. chalybeus* a patch of hairs is present on this part of the mesoscutum, but absent in *M. minutus*. These hairs can be seen in the coloured photo of this feature in *M. chalybeus*, provided by Ačanski *et al.*(2022). **Illustrations of the adult insect:** Speight & Garrigue (2016), Speight and Langlois (2020a, 2020b).

Merodon chrysotrichos Vujić, Radenković & Likov in Vujić *et al*, 2020a
Preferred environment: forest; open areas in riparian *Platanus orientalis* forest; open areas by streams in Eastern thermophilous *Quercus* forest and Mediterranean *Pinus* forest (Vujić *et al.*(2020a). **Adult habitat and habits:** flies in open areas, where it settles on vegetation, and in patches of sunlight within *Platanus* forest. **Flowers visited:** *Oxalis corniculata* (Vujić *et al.*(2020a). **Flight period:** end March/end July. **Developmental stages:** not described. **Range:** NE Greece and Aegean islands (including Lesvos); Turkey. **Determination:** Vujić *et al.*(2020a) describe both the male and female, figure the male terminalia and include *M. chrysotrichos* in the key they provide to the males of European *constans*-group species. The male of *M. chrysotrichos* can only be separated from males of *M. chrysurus* and *M. mishustini* using small features of the terminalia. The female of *M. chrysotrichos* cannot reliably be separated from that of *M. chrysurus*, either morphologically or genetically. **Illustrations of the adult insect:** the adult female is illustrated in colour in Vujić *et al.* (2020d).

Merodon chrysurus Hurkmans & Vujić, in Vujić *et al*, 2020a
Preferred environment: open ground; open areas along streams, with thickets of *Pinus*, from 1500m to 1800m (Vujić *et al*, 2020a). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Developmental stages:** not described. **Range:** southern Turkey. **Determination:** both male and female are described by Vujić *et al*, 2020a, who also figure features of the male terminalia and provide a key separating the male of *M. chrysurus* from the males of other *constans*-group species. The key to females of the *constans* group in Vujić *et al.* (2020a) includes *M. chrysurus*, but its recognition

depends upon rather imprecise characters, which are not illustrated. In the key to *Merodon* species in Hayat *et al*. (2024) there is apparently an error in couplet 48, where the female of *M. chrysurus* is separated from the females of *M. loewi* and *M. papillus* – both parts of the couplet refer to "species with reddish-yellow hairs on top of abdomen". Reddish yellow hairs are present on some of the tergites in the female of *M. chrysurus* (Vujić *et al*., 2020a), but are not mentioned for the tergites of the other two species in the review of the *ruficornis* group by Vujić *et al*. (2012), and the second half of couplet 48 in Hayat *et al*. (2024) is presumably intended to refer to species *without* "reddish-yellow hairs on top of abdomen". **Illustrations of the adult insect:** none known.

Merodon cinereus (Fabricius), 1794
Preferred environment: open ground; from the *Picea* zone up to 2500m, in unimproved, calcareous and non-calcareous montane and alpine grassland. **Adult habitat and habits:** grassy areas within forest and unimproved alpine grassland; flies fast and low (within 1m of the ground surface) through and round ground vegetation; settles on ground vegetation. **Flowers visited**: white Umbelliferae; Compositae, *Euphrasia, Thymus*. **Flight period:** June/August. **Developmental stages:** undescribed, but very probably associated with spring-flowering *Crocus*. **Range**: Massif Central? (France), Alps (confirmed from France, Switzerland), Apennines? (Italy). **Determination:**. Since Milankov *et al.*(2008) concluded that, in the Balkans, 3 or more cryptic taxa were confused under the name *M.cinereus*, it has become conjectural which of them is *M. cinereus*, where *M. cinereus* occurs and how it can be distinguished from these other species. It is also clear that identification of *M. cinereus* using the keys provided in regional monographs like Bradescu (1991), Sack (1930-32) or van der Goot (1981) is no longer reliable. It is now apparent that *M. cinereus* does not occur in the Balkans (Šašić *et al*, 2016). In the Alps it can be found in flight together with another species of the *cinereus* complex that occurs there, *M. atratus* (A. Vujić, pers.comm.). The females of *M. atratus* and *M. cinereus* cannot be distinguished, but the males can: see under *M. atratus*. **Illustrations of the adult insect:** The general appearance of the adult insect can be seen in the photographs provided by Speight & Castella (2017).

Merodon clavipes (Fabricius), 1781
Preferred environment: open ground; sparsely-vegetated, semi-arid, unimproved, stony pasturage and open, grassy areas within thermophilous *Quercus* forest. **Adult habitat and habits:** Hurkmans (1985) describes territorial behaviour in the males. "The females fly close to the soil and through the vegetation" (Hurkmans, 1993). **Flowers visited:** Umbellifers; *Euphorbia, Leontodon* and *Solidago*. **Flight period:** May/August. **Developmental stages:** apparently undescribed. **Range:** from northern France to the Mediterranean (including Corsica, Sardinia, Sicily and Crete); from S France through central and southern Europe to Greece, Roumania, Ukraine and Turkey. **Determination:** *Merodon clavipes* males may be distinguished from the males of other French *Merodon* species using the keys in Speight & Langlois (2020a, 2020b). It may be separated from other European *clavipes*-group species by the keys provided in Vujić *et al*. (2024), who also review the various named colour varieties of this species. In previous literature *M. clavipes* has been recorded from Portugal and N Africa, but Vujić *et al*. (2024b) make no reference to the occurrence this species in either Portugal or N Africa. They do, however, describe a new species, *M. latens*, based on Spanish material previously consigned to *M. clavipes*. Since they also refer to no Spanish specimens of *M. clavipes*, it would appear that *M. latens* replaces *M. clavipes* there. They also state that *M. latens* is endemic to Spain. Whether records of Portugese and N African specimens previously identified as *M. clavipes* refer to *M. clavipes*, *M. latens* or some other species remains to be clarified. Vujić *et al*. (2024b) indicate that *M. splendens* Hurkmans is a junior synonym of *M. clavipes*. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/. The male is illustrated in colour by Speight and Langlois (2020a, 2020b) and Speight and De Courcy Williams (2021).

Merodon clunipes Sack, 1913
Preferred environment: forest; coniferous and deciduous forest; *Pinus* forest; open areas in mesophilous *Fagus* and Eastern thermophilous oak forest (A.Vujić, pers.comm.); *Castanea* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Ferula, Foeniculum, Smyrnium* (Vujić *et al*, 2020). **Flight period:** June/July. **Developmental stages:** not described. **Range:** so far confirmed from southern France, Switzerland, Austria, Hungary, Italy (and Sicily), parts of the former Yugoslavia, Greece, Bulgaria,Turkey and the Lebanon. **Determination:** Hurkmans (1993), who figures the male terminalia; Ståhls *et al.*(2019), who include this species in their key to the *Merodon* species of Lesvos, and figure the surstylus of the male terminalia. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photos of the female provided in Vujić *et al.*(2020d) and the male illustrated in Speight and Langlois (2020a, 2020b). The coloured photos of a male (Figures 12a, 12b), provided in the supplementary data accompanying Vujić *et al.*(2021b) do not seem to be

of the same species, because they show a species in which the tergites are extensively pale-marked, in addition to the bars of grey dusting, whereas in *M. clunipes* the tergites are entirely back, apart from pale-grey bars of dusting

Merodon confinius Sašić Zorić & Vujić, in Vujić *et al.*, 2020a
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August/September. **Developmental stages:** not described. **Range:** central Greece (Peloponnesos). **Determination:** Vujić *et al.*(2020a) base the description of this cryptic species on two females, which were detected as a distinct taxon by genetic analysis and cannot be separated morphologically from some (*M.constans*, *M. spineus*) other of the species of the *constans*-group. The male remains unknown. Vujić *et al.*(2021c) correct the name of this species, from its original form, *confinium*, to *confinius*. **Illustrations of the adult insect:** the general appearance of the female can be seen from the coloured photo provided in Vujić *et al.*(2020d).

Merodon confusus Marcos-García, Vujić, Ricarte & Ståhls, 2011
Preferred environment: forest; open areas along seasonal streams with a riparian forest of *Fraxinus angustifolia*, within *Q.pyrenaica* forest; open patches in Mediterranean shrub formations (Marcos-García et al, 2011); open *Quercus suber/Phillyrea* maquis; open, grassy or herb-rich, areas along rivers, streams and seasonal water-courses in karstic *Q.pubescens* savanna and *Pinus salzmanni* forest (such rivers and seasonal rivers are usually lined by a riparian forest of *Fraxinus/Populus*). **Adult habitat and habits:** flies fast and low (with a flight more rapid than that of M.equestris) over the bare ground of paths etc, settling on bare ground or stones in the sun. Visits flowers in the morning, this activity starting with the arrival of the sun and stopping between 09.30 and 10.00am. **Flowers visited:** *Potentilla*, *Cistus*. **Flight period:** March/June, with peak in May. **Developmental stages:** not described. **Range:** Portugal, Spain, southern France. **Determination:** both sexes of this cyrptic species are described by Marcos-García et al.(2011). It is morphologically extremely difficult to distinguish from *M.equestris* and its identity as a separate taxon was validated by DNA sequencing. Marcos-García et al.(2011) point out that there is signifcant overlap between the morphology of *M.confusus* and *M.equestris*, leaving a proportion of specimens unidentifiable using morphological features. However, the female of *M.confusus* is consistently smaller than is normal for *M.equestris* and its perhaps most frequent colour morph has no black hairs on the mesoscutum but tergites 3-5 predominantly black-haired, with the hairs mostly short and recumbent. In *M.equestris* females the hair covering of tergites 4 and 5 is predominantly pale (yellowish-whitish or orange) and long, with only tergite 3 frequently predominantly black-haired. In some circumstances the habitat preferences of the two taxa can aid in their identification, since *M.equestris* does not seem to occur in the strictly Mediterranean, dry, savanna-type, open forests where *M.confusus* can be found (usually along seasonal water-courses). **Illustrations of the adult insect:** the male is illustrated in colour by Speight and Langlois (2020a, 2020b).

Merodon constans (Rossi), 1794
Preferred environment: forest, mesophilous *Fagus* forest; eastern thermophilous *Quercus* forest and evergreen *Q. ilex* forest, plus along streams in Mediterrenean *Pinus* forest (Vujić *et al.*, 2020a). **Adult habitat and habits:** flies fast and low over and among ground vegetation. **Flowers visited:** no data. **Flight period:** July/beginning October. **Developmental stages:** the developmental stages described and figured by Ricarte *et al*. (2008) as those of *M. constans* are shown by Andric *et al*. (2014) to belong to the N African species *M. hurkmansi*. Hurkmans and de Goffau (1995) report emergence of "*Merodon constans*" from bulbs of *Galanthus* imported to the Netherlands. The *constans* complex taxon involved has not been established, either by Vujić *et al.* (2020a), or subsequent authors. Orengo-Green *et al*. (2024) describe the larva of a species identified by them as *M. constans*, from material reared from *Leucojum vernum* in Eastern France. Identified as *Merodon analis*. the rearing of these specimens was previously described by Langlois and Speight (2022): the larvae feed actively within *Leucojum* bulbs in February and March, pupariate either within the remains of the bulb in which they have been feeding, or in the surrounding soil, to hatch in the summer of the same year. Whether overwintering occurs as an egg or first instar larva is not established. **Range:** occurrence confirmed from Italy (Apennines) and the Balkans (Croatia, Greece, Montenegro, North Macedonia, Serbia), but elsewhere uncertain, due to confusion until recently (Vujić *et al.*, 2020a) with other, previously undefined or unrecognised species belonging to the *constans* group. For instance, a species named as *M. constans* by Bradescu (1993) is known from Roumania, but it's identity requires to be established – Vujić *et al.* (2020a) record no species of the *M. constans* group from Roumania. **Determination:** in the revision of the *M. constans* group by Vujić *et al.* (2020a) *M. constans* is redefined and a lectotype is designated for the species, together with figures of the male terminalia based on specimens from the Balkans and a key to separate the male of *M. constans* from other western Palaearctic *constans* group species. Vujić *et al.*

(2020a) also establish that *M. montanus* of Rondani is a synonymn of *M. constans*. Most of the species included in the revision by Vujić *et al.* (2020a) are described there for the first time. Some of them are cryptic and can only be recognised genetically, so that recognition of *constans* group taxa is now very challenging! *Merodon analis* and *M. constans* cannot be reliably separated either morphologically or genetically and the identity of the taxon occurring west of the Alps, previously recognised as *M. analis*, has become particularly problematic. Most recently reconsigned to *M. constans* (see under *M. analis*), these French and Spanish populations could be as easily be regarded as neither *M. analis* nor *M. constans*, but as another, as yet unrecognised species, very similar to both *M. analis* and *M. constans*. **Illustrations of the adult insect:** the general appearance of the abdomen of *M. constans* can be seen from the coloured photographs provided by Vujić *et al.* (2020a, 2021b).

Merodon crassifemoris Paramonov, 1925
Preferred environment: beside permanent and seasonal water courses with a riparian forest vegetation of *Populus* and *Salix*, within thermophilous oak scrub (*Quercus iberica*) and a more steppe vegetation of *Tamarix* etc (Hauser, 1998). **Adult habitat and habits:** no data. **Flowers visited:** *Ferula, Mentha* (Vujić *et al*, 2020). **Flight period:** June/July. **Developmental stages:** not described. **Range:** southern France, parts of the former Yugoslavia, Greece, Turkey, Ukraine, Azerbaijan. **Determination:** *M. crassifemoris*, originally described as a variety of "*M. spinipes*", was established as a separate species by Hurkmans (1993). He redescribes the male and figures its terminalia, stating the female to be "unknown". The female remains undescribed and there is no published information available about its diagnostic features. Vujić *et al.*(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group, figure features of the male terminalia and provide a figure of the male head in side view, showing the bulge on the face, just beneath the antennae, which is diagnostic for the male. This feature is also shown in a coloured illustration in the supplementray data accompanying Vujić *et al.*(2021b). This species is also included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al.* (2019) and the keys to French *Merodon* species provided by Speight and Langlois (2020a, 2020b). **Illustrations of the adult insect:** the appearance of this insect can be seen from the coloured photo provided by Vujić *et al.* (2020d, 2021b).

Merodon crymensis: see under *M. trebevicensis*

Merodon crypticus Marcos-García, Vujíc & Mengual, 2007
Preferred environment: open ground; non-calcareous, unimproved montane/subalpine grassland (M.-A. Marcos-García, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Merendera montana*. **Flight period:** July-September (Marcos-García *et al*, 2007). **Developmental stages:** not described. **Range:** Portugal, northern Spain (Cantabria) and the Spanish Pyrenees (Marcos-García *et al*, 2007); Portugal (Ricarte *et al*, 2009). **Determination:** Marcos-García *et al.*(2007), who describe the species, figure its male terminalia and include it in their keys. This is a species of the *geniculatus* complex. **Illustrations of the adult insect:** none known.

Merodon cupreus Hurkmans, 1993
Preferred environment: montane steppic oak forest (Vujić *et al*., 2024b). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993), who describes both the male and the female and figures the male terminalia. Merodon cupreus is consigned to the *pruni* species group in Vujić *et al*. (2024b), where the male genitalia are figured and a key is provided, separating *M. cupreus* from other members of the group. **Illustrations of the adult insect:** the general appearance of the male in shown in the coloured photo provided by Vujić *et al*. (2024b).

Merodon defectus Vujić, Likov & Radenković, in Vujić *et al*, 2020c
Preferred environment: forest/open ground; open areas in Eastern thermophilous *Quercus* forest, evergreen oak forest and *Castanea* forest; beside a stream in dry *Pinus* forest (Vujić *et al.*, 2020c). **Adult habitat and habits:** no data. **Flowers visited:** *Ornithogalum, Potentilla, Thymus* (Vujić *et al.*, 2020c). **Flight period:** May/July. **Developmental stages:** not described. **Range:** western Turkey. **Determination:** (Vujić *et al.*, 2020c). the male and female of *M. defectus* are described in Vujić *et al.* (2020c), where the male terminalia are also figured and keys are provided to separate this species from other western Palaearctic species of the *serrulatus*-group. Separation of the male of *M. defectus* from the male of *M. serrulatus* is dependent on small features of the male terminalia. The female can only be separated from females of *M. serrulatus* and the N.

African *M. sophron* genetically. The female of *M. defectus* is separated from the females of other *Merodon* species known from central Turkey in the keys in Hayat *et al*. (2024). *M. serrulatus* is not included in those keys. **Illustrations of the adult insect:** none known.

Merodon desuturinus Vujić, Simić, & Radenković, 1995
Preferred environment: forest/open ground; open, dry, grassy areas within humid *Fagus/Picea/Abies* forest (Vujić *et al*, 1995). **Adult habitat and habits:** settles on vegetation in the sun (Vujić *et al*, 1995). **Flowers visited:** *Ranunculus* (Vujić *et al*, 1995). **Flight period:** May/June. **Developmental stages:** not described. **Range:** Montenegro; Serbia. This species should be regarded as threatened at the European level (Vujić *et al*, 2001). **Determination:** Vujić *et al*.(1995), who figure the male terminalia; Vujić *et al*.(2018c) provide a key separating this species from other members of the *M. desuturinus* group and also define the *desuturinus* group. **Illustrations of the adult insect:** none known.

Merodon distinctus: see under *M. aurifer*

Merodon dobrogensis Bradescu, 1982
Preferred environment: forest; small, open areas maintained by goat-grazing, in evergreen oak mattoral of *Quercus coccinea* on limestone (M. de C.Williams, pers.comm). **Adult habitat and habits:** very low-flying, over short ground vegetation (M. de C.Williams, pers.comm). **Flowers visited:** *Prospero autumnale* (= *Scilla autumnalis*) (M. de C.Williams, pers.comm.). **Flight period:** August/October. **Developmental stages:** not described. This species seems to have a close relationship with *Prospero autumnale*, with which its larvae may be associated. **Range:** NE Greece; Roumania. **Determination:** *M.dobrogensis* is included in the keys of Bradescu (1991), but does not seem to have been referred to subsequently, until Vujić et al.(2011) described a closely-related and almost identical "cryptic" taxon, *M.puniceus*, from the Aegean island of Lesvos. *Merodon puniceus* can be distinguished genetically and morphometrically from *M.dobrogensis*, but not otherwise. These two taxa, together with a third cryptic species, *M. rojoi* - which is known from western and southern parts of the Greek mainland - form a highly distinctive sub-group within the *aureus* group, with lightly, but distinctly infuscated wings, tergites 2-4 each with orange markings, which take up almost all of the surface of the tergite, and very short (yellow and black), recumbent hairs on the tergites. **Illustrations of the adult insect:** Vujić et al.(2011) provide a coloured illustration of the male of *M.puniceus*, which gives a very good impression of the general appearance of *M.dobrogensis*. The female of *M. dobrogensis* is illustrated in colour in Speight and de Courcy Williams (2021).

Merodon dzhalitae Paramonov, 1926
Preferred environment: open ground; semi-arid steppic grassland – "grassland and steppe-like areas among ravine woods" (Vujić *et al*, 2020a) and shyblyak (thickets of prickly Mediterranean scrub formations of evergreen oaks, *Arbutus*, *Pistacia*, *Laurus*). **Adult habitat and habits:** no data. **Flowers visited:** *Mentha longifolia*, *Limonium platyphyllum* (Vujić *et al*, 2020a). **Flight period:** May/August. **Developmental stages:** not described. **Range:** apparently endemic to the Crimea. **Determination:** diagnostic characters of this species are detailed by Vujić *et al*.(2020a), who also figure features of the male terminalia and provide a key to the males of European *constans*-group species, including the male of *M. dzalitae*. However, in the key the male of *M. dzalitae* is separated from the males of *M. constans* and *M. spineus* only on geographic range, the only reliable basis for separation being genetic characterisation. **Illustrations of the adult insect:** none known.

Merodon elegans: see under *M. femoratus*

Merodon eques (Fabricius), 1805
Preferred environment: areas of rocky, sub-xeric, calcareous grassland in mattoral of *Olea europea*, *Osyris quadripartita*, *Rhamnus alaternus*, *Pistacia lentiscus* and *Pistacia terebinthus* (Ebejer and Bensusan, 2011); ruderal vegetation along the margins of seasonal rivers. **Adult habitat and habits:** rests on bare ground in the sun. **Flowers visited:** umbels (*Foeniculum*), composites (*Dittrichia viscosa)* and with a particular preference for *Urginea* (Hyacinthaceae) (Ebejer and Bensusan, 2011). **Flight period:** September/October. **Developmental stages:** not described, but supposedly reared from *Narcissus* collected in Turkey, by Pehlivan and Akbulut (1991). Turkish material of the *geniculatus*-group species *M. neofasciatus* is listed in Vujić *et al*.(2018) as having been misdetermined by Hurkmans as *M. eques*. The same authors establish that *M. neofasciatus* has been reared from *Narcissus* in Turkey. However, they neither refer to the paper by Pehlivan and Akbulut (1991), nor to the material reared by Pehlivan and Akbulut (1991), so the identity of the species reared

by Pehlivan and Akbulut is not known. However, Vujić *et al.* (2018) include *M. eques* within their tree of genetic relationships within the "*M. albofasciatus* complex", which also includes *M. neofasciatus*, whilst synchronously excluding *M. eques* from the eastern Mediterranean species of that complex. In these circumstances, it can be concluded that, whatever species was reared by Pehlivan and Akbulut (1991), it cannot be the species recognised as *M. eques* by Vujić *et al.* (2018). **Range:** Portugal; Gibraltar; France; Italy (Sardinia, Sicily); N Africa (?). Vujić *et al.* (2011), list *M. eques* as a Turkish species, but Vujić *et al.*(2018) do not include it as an eastern Mediterranean species or indicate the identity of the species listed as *M. eques* in the Turkish list in Vujić *et al.* (2011). Nonetheless, it has to be assumed that literature references to the occurrence of *M. eques* in Turkey are to be regarded as erroneous. **Determination:** Ebejer and Bensusan (2011) point out that there is some doubt concerning correct application of the name *eques* of Fabricius. Here, the concept of this taxon follows Ebejer and Bensusan (2011), who figure the male terminalia. This species is also referred to in recent literature as *M. arrasus* Becker. The large, baso-ventral flange on the hind basitarsus of the male is highly distinctive and, coupled with the other features shown by Ebejer and Bensusan (2011), should make the identity of their taxon clear, should nomenclatural change become necessary. In general appearance, *M. eques* (sensu Ebejer and Bensusan, 2011) is closely similar to *M.geniculatus*, but noticebaly larger. The male terminalia of these two species are also very similar. However, in the male of *M. geniculatus* the hind basitarsus is simple - the baso-ventral flange found in *M. eques* is lacking. **Illustrations of the adult insect:** Ebejer and Bensusan (2011) provide coloured figures of the adult male and its hind leg. The male is also illustrated in colour by Speight and Langlois (2020a, 2020b).

Merodon equestris (Fabricius), 1794

Preferred environment: deciduous forest/open ground; open areas in humid deciduous forest and at higher altitudes, up into the subalpine zone; significantly anthropophilic, occurring also in suburban gardens and on horticultural land. **Adult habitat and habits:** flies low, with a rapid zig-zag flight, among ground vegetation beside tracks, in clearings, over flower beds; frequently settles on bare ground. **Flowers visited:** umbellifers; *Ajuga, Aster, Cirsium, Crepis, Eschscholzia californica, Hieracium, Knautia arvensis, Meconopsis cambrica, Papaver, Ranunculus, Rubus idaeus, Scabiosa, Senecio, Thymus.* **Flight period:** May/July (plus April in southern Europe and August at higher altitudes/more northerly latitudes). **Developmental stages:** larva described and figured by Hodson (1932b) and Heiss (1938) and illustrated in colour by Rotheray (1994); internal feeder in tissues of bulbs of Amaryllidaceae; regarded as a minor pest of horticulture e.g.in the culture of *Narcissus*. A comprehensive survey of the literature on the biology of *M.equestris* is provided by Barkemeyer (1994). From laboratory studies Hodson (1932b) provides some information on longevity in the adult insect, males living on average 11 days, females 17 days. The female is recorded as laying a total of 60 – 100 eggs. Characteristically, eggs are laid on a *Narcissus* bulb, just below ground surface, in the central cavity remaining between dying back flower stem and leaves and visible from above-ground, the fly backing down to lay in this position. Normally, only one egg is laid per bulb and eggs hatch between 10 and 16 days after laying. The newly hatched larva is very active and makes its way down the bulb, to make an entry hole at the junction between bracts and root- bases. The larva then proceeds to spend the first weeks of its existence tunnelling in the base plate of the bulb, after which it tunnels upwards in the flesh of the bulb itself, on a roughly spiral trajectory, to the growing point of the bulb, which is consumed next. Thereafter it tunnels through the bulb and, when approaching maturity, makes a large hole through the wall of the bulb, towards its base, through which the posterior end of the larva, bearing the respiratory process, is visible. Larvae overwinter in the bulb in which they have developed, exiting the bulb during the period February to April, through the large hole already made. The larva then tunnels upwards through the soil to transform into the puparium just below the soil surface. The anterior spiracular processes are not protruded through the puparium until 8 days after puparium formation. The puparial stage lasts 35 – 40 days. **Range:** Fennoscandia south to Iberia and the Mediterranean, including N Africa; from Ireland eastwards through much of Europe into European parts of Russia; also in Japan; in N America from British Colombia south to California. Man's activities have resulted in introduction of this species to parts of the world outside its natural range, including New Zealand. Within Europe its range has almost certainly been expanded due to human activity - it is doubtful, for instance, that this species reached either Britain or Ireland unaided by man. **Determination:** van der Goot (1981), Bradescu (1991). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al.* (2009b), Haarto & Kerppola (2007), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986), who all show a range of the colour varieties of this very variable bumble bee mimic.

Merodon erivanicus Paramonov, 1925
Preferred environment: open ground; beside seasonal water-courses with a riparian forest strip of *Populus* and *Salix* scrub within otherwise open steppe (Hauser, 1998); alongside rivers, in various habitats, including olive orchards and *Castanea* forest (Ricerte *et al*., 2012); phrygana (Petanidou *et al*., 2011). **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia* (Vujić *et al*, 2011); yellow umbellifers (Ricarte *et al*., 2012); *Foeniculum* (Van Steenis *et al*., 2021). **Flight period:** end May/July and September. **Developmental stages:** not described. **Range:** parts of the former Yugoslavia (Croatia, Macedonia), Greece, Caucasus (Armenia), Turkey, Israel, Azerbaijan. **Determination:** Ståhls *et al.* (2009) include this species in their key to the *Merodon* species of Lesvos and figure the surstylus of the male terminalia. Hurkmans (1993) describes the male and figures its terminalia under the name *M. kaloceros*, Hurkmans. He also redescribes the female both under the name *M. erivanicus* and under the name *M. kaloceros*. Vujić *et al.* (2011) established the synonymy of *kaloceros* with *erivanicus*. The female of *M. erivanicus* is separated from the females of various other *nigritarsis* group species in the keys of Hayet *et al*. (2024). **Illustrations of the adult insect:** the appearance of this insect can be seen from the coloured photo provided in Vujić *et al*.(2020d).

Merodon erymanthius: see under *Merodon luteomaculatus* complex

Merodon escorialensis Strobl, 1909
Preferred environment: open ground; unimproved, non-calcareous, montane grassland and heath, from the level of *Castanea* forest up to 1800m (Marcos-García, 1989b); open *Quercus rotundifolia* woodland. **Adult habitat and habits:** no data. **Flowers visited:** yellow composites; *Calluna, Lavandula, Mentha, Succisa* (Marcos-García, 1989b). **Flight period:** March/October. **Developmental stages:** undescribed. **Range:** Spain (from Cantabria southwards into much of central Spain). **Determination:** this species is extremely similar to *M. geniculatus* and was described as a variety of that species. It was first recognised as a separte species by Marcos-García (1989). Distinctions between this species, *M. chalybeatus* (under the name *M.albonigrum*) and *M.geniculatus* are detailed by Vujić *et al*.(1996), who also figure the male terminalia of *M.escorialensis* and illustrate differences between the hind legs of the males of *M. escorialensis* and *M. geniculatus*. In *M. escorialensis* the ventral surface of the hind femur is flat, whereas in *M. geniculatus* it has a wide, but shallow, bulge, mostly within the basal half of the length of the femur. This bulge is clearly shown in Marcos-García (1989) and Vujić *et al*.(1996), but cannot be seen in the figure of *M. geniculatus* provided in Marcos-García (2007). The apex of the hind tibia in *M. escorialensis* does not have the well-developed, mid-ventral, sharply-pointed extension found in *M. geniculatus*, but does have a smaller, more posterior, pointed extension, which is hardly visible when the leg is examined in lateral view. These differences are also figured in Marcos-García (1989), Marcos-García *et al*.(2007) and Vujić *et al*.(1996). *Merodon escorialensis* is redefined and included in the keys provided by Marcos-García et al.(2007). **Illustrations of the adult insect:** none known.

***Merodon euri*:** see under *Merodon luteomaculatus* complex

Merodon femoratoides Paramonov, 1925
Preferred environment: sparsely-vegetated, dry grassland. **Adult habitat and habits:** no data. **Flowers visited:** *Mentha* (Vujić et al, 2020). **Flight period:** May/July. **Developmental stages:** not described. **Range:** Greece, Ukraine (Crimea), parts of European Russia, Turkey, N Africa (Algeria). **Determination:** Hurkmans (1993) redescribes both sexes of this taxon and figures the male terminalia. It was previously regarded as a variety of "*M. spinipes*". Radenković *et al.* (2011) provide features for the separation of *M. femoratoides* from the closely similar *M. latifemoris* and *M.nigritarsis*. They also figure the hind legs and parts of the male terminalia of these species and *M. femoratoides*. Ståhls *et al.* (2009) include this species in their key to the *Merodon* species of Lesvos, and figure the surstylus of the male terminalia. Vujić *et al.* (2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is also included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). The female of *M. femoratoides* is separated from the females of *M. latefemoris* and *M. nigritarsis* in the keys in Hayat *et al*. (2024). **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photo provided by Vujić *et al.* (2020d).

Merodon femoratus Sack, 1913
Preferred environment: scrub/open ground. This species has been found on low-lying, sandy, herb-rich grassland containing abundant wild onion flowers (*Allium* sp.), scattered clumps of sedge and occasional stems of *Arundo*, at the edge of

Mediterranean salt-marsh, where the fluctuating ground-water levels would, during the winter, bring the water level very close to the ground surface. It has also been found in open, dry *Pinus* forest (*P.halepensis*) on largely bare, stony ground and in open areas within *Q.ilex* forest and *Castanea* forest, garrigue and matorral; hedgehog heath; phrygana. **Adult habitat and habits:** flies extremely rapidly and very low over and through ground vegetation. The males return repeatedly to particular resting sites, settling on patches of reclining grass stems, or other low-growing vegetation, or on small patches of bare ground. According to Hurkmans and Hayat (1997) the flight pattern of this species (as *M. biarcuatus*) "is similar to that of asilids: a short, somewhat erratic flight, interrupted by seemingly random landings among the vegetation". **Flowers visited:** *Calystegia, Cistus, Eryngium*. **Flight period:** April/September (Marcos-García, pers.comm.), with peaks in June and end August/beginning September. **Developmental stages:** not described. **Range:** Portugal; Spain; southern France (and Corsica); southern Italy (plus Sardinia and Sicily); Turkey; N Africa (Algeria, Morocco). **Determination:** this species appears in recent literature under the names *biarcuatus* Curran and *elegans* Hurkmans, as well as under the name *M. femoratus*. Likov *et al*. (2019) establish the synonymy of both *biarcuatus* and *elegans* with *femoratus*, designate a lectotype for *femoratus* and provide a key to males of the species of the *Merodon avidus* and *nigritarsis* groups, including *M. femoratus*. Hurkmans (1993) figures the male terminalia (as *M. elegans*) and redescribes the female (as *M. biarcuatus*). This species is indistinguishable from *M.avidus* and *M.nigritarsis* in the field. Both sexes of *M. femoratus* can be distinguished from *M.avidus* agg. by the hair fringes on the ventral surface of the hind femora. In *M. femoratus* the hairs in both the anterolateral and posterolateral fringes are longer than one third of the maximum depth of the hind femur. In *M.avidus* agg the hairs in the posterolateral fringe are extremely short, no more than one tenth as long as the maximum depth of the femur, contrasting with the hairs in the anteroventral fringe, which are much longer. *M.nigritarsis* can be distinguished from both *M.avidus* agg and *M. femoratus* by the colour of its hind tarsi. Tarsomeres 1 – 3 (at least) of the hind leg are dorsally dark brown/black in *M.nigritarsis*, and the dorsal surface is covered almost entirely by procumbent black hairs (some yellowish hairs are mixed in). In *M.avidus* agg and *M. femoratus* the dorsal surface of tarsomeres 1 – 3 of the hind leg is yellow/pale brown and covered predominantly in procumbent yellow hairs. **Illustrations of the adult insect:** the male is illustrated in colour in Speight and Langlois (2020a, 2020b).

Merodon flavicornis (Macquart), 1842
Preferred environment: forest; western thermophilous *Quercus* forest (Veselić *et al*., 2017). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September/October. **Developmental stages:** not described. **Range:** southern France. **Determination:** Veselić *et al*. (2017) redescribe this species, based on 3 males and 2 females and include it in the key they provide to European species of the *bessarabicus* subgroup of the *aureus* group. **Illustrations of the adult insect:** coloured photos of the male and female in dorsal view are presented in Veselić *et al*. (2017), together with photos of the head and the hind leg of the male.

Merodon flavitibius Paramonov, 1926
Preferred environment: open areas in montane *Quercus/Fagus/Acer* forest and herb-rich unimproved montane and subalpine grassland up to 2100m altitude (Vujić *et al*., 2022b). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Turkey; Armenia; Georgia, Azerbaijan; the southern edge of European Russia; Iran. **Determination:** Vujić *et al*. (2022b) redescribe both the male and the female, figure its male terminalia and provide a key in which both the male and female of *M. flavitibius* are distinguished from other known species of the *aberrans* group. **Illustrations of the adult insect:** none known.

Merodon flavus Sack, 1913
Preferred environment: open ground; unimproved montane grassland with stands of wild *Narcissus*. **Adult habitat and habits:** flies low (up to 0.5m) through and just above ground vegetation, with a rapid zig-zagging pattern, closely resembling that of *M.equestris*. **Flowers visited:** no data. **Flight period:** end May/end July. **Developmental stages:** not described, but very probably associated with *Narcissus*. **Range:** Czech Republic; Spain, Causses (France), Alps (France, Switzerland, Italy); Hungary, Bulgaria. **Determination:** Bradescu (1991). This species is extremely similar in appearance to *M.equestris* (Fab.), with which it may be found in flight. The male is reasonably easy to distinguish from *M.equestris* under the microscope, using features of the leg armature, but the female is much less easy to distinguish. It is advisable to collect a series of specimens from localities at which the presence of *M.flavus* is suspected, to ensure both males and females are obtained, from among the usually more frequent *M.equestris*. **Illustrations of the adult insect:** the male is illustrated in colour by Speight and Langlois (2020a, 2020b).

Merodon funestus (Fabricius), 1794
Preferred environment: forest/open ground; open areas in evergreen oak forest of *Quercus ilex* and *Q.coccinea/ Q.macrolepis*; by rivers and seasonal streams in Balkanic thermophilous *Quercus* forest (*Q. cerris/Q. frainetto*); tall-herb ruderal communities on sparsely-vegetated open ground, close to seasonal rivers and streams, or drainage ditches. **Adult habitat and habits:** closely resembles the honey bee (*Apis*) and spends much time sitting on flowers; also settles on stones (Marcos-García, pers.comm.); flies low through and over ground vegetation. **Flowers visited:** tall, yellow composites; *Adonis, Anacyclus, Ranunculus* (Marcos-García, pers.comm.). **Flight period:** May/June and end August/September. **Developmental stages:** not described. **Range:** most of southern and central Spain and round the Mediterranean basin through southern France, the length of Italy (inc.Sicily), parts of the former Yugoslavia, Albania and Turkey to Israel and Libya; known also from Bulgaria and Roumania and, apparently, from Poland. **Determination:** Sack (1928-32), Bradescu (1991), Speight and Langlois (2020a, 2020b). **Illustrations of the adult insect:** Two males of contrasting appearance are illustrated in colour by Speight and Langlois (2020a, 2020b). The female is illustrated in colour by Speight and De Courcy Williams (2021).

Merodon gallicus Vujić & Radenković, in Vujić *et al.*, 2012
Preferred environment: open ground/deciduous forest, open grassy and tall-herb areas in *Quercus/Fraxinus* forest, *Quercus/Carpinus* forest and western thermophilous *Quercus* (*Q. pubsecens*) forest. **Adult habitat and habits:** flies fast through and at the tops of, tall herb and long grass vegetation and also at greater heights above the ground round the foliage of shrubs. **Flowers visited:** no data. **Flight period:** May/end June. **Developmental stages:** not described. **Range:** eastern France, from Lorraine south to the Alpes-Maritimes, and Haut-Languedoc in south-west France; Switzerland (including records from Tichino, on the southern side of the Alps). **Determination:** In Vujić *et al.*(2012) both sexes of the species are described, the male terminalia are figured and a key is provided to separate *M.gallicus* from other species of the *ruficornis* group. Additional features which might aid in the separation of the females of *M. gallicus* and *M. ruficornis* are discussed and illustrated in Pétremand *et al.* (2021). **Illustrations of the adult insect:** the male is shown in colour in Speight and Langlois (2020a, 2020b) and the female in Speight and de Courcy Williams (2021).

Merodon geniculatus Strobl, 1909
Preferred environment: forest/open ground; unimproved montane grassland in southern Europe and open areas in mesophilous *Fagus* forest and *Quercus ilex* forest. **Adult habitat and habits:** flies rapidly and extremely close to the ground, settling on small patches of bare surface among low-growing vegetation. **Flowers visited:** *Calluna vulgaris, Chrysanthemum coronarium, Hedera, Rosmarinus officinalis*. **Flight period:** March/April (Malta) and July to September, with a peak at end August/beginning September. **Developmental stages:** the puparium is described and figured by Ricarte *et al*. (2017), who reared a series of specimens from bulbs of various species of *Narcissus*: *N. dubius, N. rupicola, N. tazetta* and *N. triandrus* ssp. *pallidulu*s, all of which were collected from the field. Circumstantial evidence suggests one potential plant host for the larva of this species is the yellow autumn crocus *Sternbergia lutea*. **Range:** southern France, Portugal, Spain, Italy, southern parts of the former Yugoslavia, Greece, Bulgaria, Turkey, Israel and N Africa (Algeria, Morocco); Mediterranean islands - Balearics, Corsica, Malta, Sardinia. **Determination:** Vujić *et al.*(1996), and Marcos-García *et al.*(2007) who also figure the male terminalia of this and related species, include *M.escorialensis* Strobl as a separate species, which is listed as a synonym of *M.geniculatus* by Peck (1988). *M. geniculatus* is included in the keys provided by Marcos-García *et al.*(2007). *M. fractipes* Paramonov is listed as a synonym of *M. geniculatus* by Vujić *et al.*(2011), but in Vujić *et al.* (2018) it is reduced to the status of nomen dubium. **Illustrations of the adult insect:** the male is shown in colour in Speight and Langlois (2020a, 2020b).

Merodon hakkariensis Vujić & Radenković, in Vujić et al, 2013c
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** the description of this species is given in Vujić *et al*. (2013c). It is based on males only. The female remains undescribed. In Vujić *et al.*(2013c) it is pointed out that Hurkmans' (1993) description of *M.lucasi* is based on a mixed series of *M.lucasi* and *M.hakkariensis*. Indeed the specimen they select as holotype of *M.hakkariensis* was a paratype of *M.lucasi*. They provide a key to separate the male of this species from males of other European members of the *nigritarsis* group, including *M.lucasi*, and figure features of the male

terminalia. This species is also included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*.(2019). **Illustrations of the adult insect:** none known.

Merodon hamifer Sack, 1913
Preferred environment: thermophilous *Quercus* forest; also in introduced forest of *Castanea*. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers (*Ferrula, Foeniculum*). **Flight period:** May/July. **Developmental stages:** not described. **Range:** Greece (Aegean islands of Chios, Lesvos and Samos); Turkey. **Determination:** Vujić *et al*. (2022b) redescribe the species, figure its male terminalia and provide a key in which both the male and female of *M. hamifer* are distinguished from other known species of the *aberrans* group. A diagnostic feature of the male, figured by Vujić *et al*. (2022b), is the bright yellow, very much broadened and flattened segments of the front tarsus. In the female this same feature occurs, but is less marked (Vujić *et al*., 2022b). Hurkmans (1993) also figures the male terminalia. Ståhls *et al*.(2009) include this species in their key to the *Merodon* species of Lesvos. Hayat *et al*. (2024) also include *M. hamifer* in their keys. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photo provided by Vujić *et al*.(2020d).

Merodon hayati Hurkmans in Hurkmans & Hayat, 1997
Preferred environment: open ground; thinly-vegetated, open, montane talus slopes beside torrents, within open woodland (Hurkmans and Hayat, 1997). **Adult habitat and habits:** flies low over bare, stony ground. **Flowers visited:** no data. **Flight period:** June/August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans & Hayat (1997), who figure the male terminalia. **Illustrations of the adult insect:** none known.

Merodon hikmeti Hurkmans in Hurkmans & Hayat, 1997
Preferred environment: forest/open ground; open areas in *Quercus* forest (Vujić *et al*, 2011) and humid, montane, unimproved grassland (Hurkmans and Hayat, 1997). **Adult habitat and habits:** males apparently fly in the late afternoon and rest on umbellifers, e.g. *Pimpinella saxifraga* (Hurkmans and Hayat, 1997). **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans & Hayat (1997), who figure the male terminalia. **Illustrations of the adult insect:** none known.

Merodon hirsutus Sack, 1913
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/April, June. **Developmental stages:** not described. **Range:** SE Turkey, Israel, Syria. **Determination:** the male and female of this *serrulatus*-group species are redescribed in Vujić *et al*.(2020c), together with figures of the male terminalia and keys to separate *M. hirsutus* from the other western Palaearctic species of the group. **Illustrations of the adult insect:** the general appearance of the abdomen in dorsal and lateral views can be seen in the coloured photos provided in Vujić *et al*. (2020c).

Merodon hirtus (Sack, 1932)
Preferred environment: open ground; herb-rich unimproved very dry grassland with patches of scrub. **Adult habitat and habits:** no data. **Flowers visited:** *Calendula, Crataegus* (E. Van Eck, pers. comm.). **Flight period:** March/April and September/October. **Developmental stages:** not described. **Range:** Cyprus (widespread and abundant: A. Van Eck, pers. comm.), Turkey, Iran, Israel, Palestine, Jordan, Syria. **Determination:** according to Vujić *et al*. (2021b) *M. hirtus* occupies an isolated position within the *avidus* lineage. The male is included in the keys to *Merodon* groups and species provided in Vujić *et al*. (2021b), together with notes on some of the morphological features of both sexes. Figures of its male genitalia are shown in the supplementary data file 2 associated with that publication. Another source of information on morphological features of *M. hirtus* is the detailed original description of both male and female provided by Sack (1932). **Illustrations of the adult insect:** none known.

Merodon hoplitis Hurkmans, in Vujić *et al.*, 2012
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June. **Developmental stages:** not described. **Range:** Croatia and Montenegro. **Determination:** this species is described in Vujić *et al*. (2012), based on both males and females. There the male terminalia are figured and a key is provided to separate *M. hoplitis* from other *ruficornis* group species known from Europe. **Illustrations of the adult insect:** none known.

Merodon hypochrysos Hurkmans, 1993
Preferred environment: in the western part of its range this species is associated with steppic evergreen oak/pine forest and maquis of *Quercus infectoria/Pinus halepensis/P. brutia*. Further east it inhabits other steppe forest associations, steppic grassland and scrub and less arid forest of *Quercus petraea/Carpinus betulus/Cornus mas* (Vujić *et al*. 2023a). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Turkey; Iran; Israel. **Determination:** Hurkmans (1993) describes this species from a series of male specimens and figures its terminalia. A diagnosis of the female is provided by Vujić *et al*. (2023a), together with a key to the males and females of the *tarsatus* group, the group within the *avidus/nigritarsis* clade to which they consign *M. hypochrysos*. **Illustrations of the adult insect:** none known.

Merodon ibericus Vujíc, in Popović *et al*., 2015
Preferred environment: *Quercus pyreniaca* dehesa (A. Ricarte, pers. comm.); *Quercus pyrenaica/Q. rotundifolia* dehesa (Ricarte *et al*., 2018) ; unimproved, montane dry grassland with scattered *Q. pyrenaica* scrub (Lorenzo *et al*., 2020); olive groves (Ortega *et al*., 2023). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Portugal; Spain; N Africa (Morocco). **Determination:** originally described as variety *bicolor* of *Merodon spinipes*, this taxon was raised to species level status, as *Merodon bicolor*, Gil Collado, by Milankov *et al*. (2009), based on genetic and morphological re-assessment. Vujíc (in Popović *et al*, 2015), pointed out that a new name was required for the taxon, renaming it as *M. ibericus*. In Marcos-García *et al*. (2007) *M. ibericus* was presumed to be *Merodon avidus* B, of Milankov *et al*. (2001). Occurrence of *M. ibericus* is at present recognised only genetically, demonstrating it occurs in the Iberian peninsula, from which specimens with genetics corresponding to *M. avidus* and *M. moenium* have not been found. In consequence *M. ibericus* can be separated from other Iberian *Merodon* species (as bogth *Merodon avidus* A and *M. avidus* B) using the key provided by Marcos-García *et al*. (2007), on the assumption that neither *M. avidus* nor *M. moenium* occur West of the Pyrenees. In its adult morphology *M. ibericus* overlaps with both *M. avidus* and *M. moenium* (Vujić *et al*., 2024a), and to a lesser extent also with *M. pseudomoenium*. In *M. pseudomoenium* the bars of dusting on tergite 4 occupy one third of the length of the tergite, but in *M. ibericus* they are narrower. *M. ibericus* was included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019), but not in the more recent key to *avidus* group species in Vujić *et al*., (2024a). **Illustrations of the adult insect:** none known.

Merodon ilgazense Vujić, Marcos-García, Saribiyik & Ricarte, 2011
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus* (Vujić *et al*, 2011). **Flight period:** June. **Developmental stages:** not described. **Range:** Turkey. **Determination:** the description of this species is based on a single male. The female is as yet unknown. It is a member of the *armipes/ruficornis* group and similar to both *M.armipes* and *M.trebevicensis*. Vujić *et al*.(2011) figure the male terminalia and Vujić *et al*.(2012) provide a key in which the male of *M.ilgazense* can be separated from other species of the *ruficornis* group known in Europe. **Illustrations of the adult insect:** none known.

Merodon italicus Rondani, 1845
Preferred environment: open ground/freshwater; open ground/cultures; stony river banks, dry grassland and orchards; phrygana (Petanidou *et al*, 2011). **Adult habitat and habits:** settles low down, on foliage of large-leaved shrubs/bushes (M.Reemer, pers.comm.); males rest on the bare ground of paths and tracks, in the sun, in the evening (M. de Courcy Williams, pers.comm.). **Flowers visited:** *Foeniculum vulgare* (Standfuss and Claussen (2007); *Euphorbia* (Zimina,1960); *Paliura spinosa* (M. de Courcy Williams, pers.comm.); *Daucus* (Ssymank, 2012). **Flight period:** May/August. **Developmental stages:** not described. **Range:** Spain (where this species was earlier known under the name *affinis* Gil Collado: see Marco-García *et al*., 2007); former Yugoslavia; Greece, Turkey; Ukraine; southern Russia; Lebanon; N Africa (Claussen & Hauser, 1990: as *M. longicornis*). **Determination:** This species appears in recent literature under the name *longicornis* Sack. As *longicornis*, it was redescribed by Hurkmans (1993) and its male terminalia were figured by Marco-García *et al*. (2007). Vujić *et al*. (2011) established the synonymy of *M. longicornis* with *M. italicus*. Ståhls *et al*.(2009) include this species in their key to the *Merodon* species of Lesvos. The male is included in the keys to French *Merodon* species provided by Speight and Langlois (2020a. 2020b). In its general appearance, *M. longicornis* more closely resembles *Eumerus* species, than other *Merodon*, especially when it is without orange markings on its abdomen. **Illustrations of the**

adult insect: the male is shown in colour in Speight and Langlois (2020a, 2020b). Coloured phots of the male and female are provided in Speight and de Courcy Williams (2021).

Merodon kopensis Vujìc & Hayat, 2015
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Vujić *et al*.(2015) figure the male terminalia and provide a key distinguishing the male from males of four other species of the *M. nanus* group. The female remains undescribed. **Illustrations of the adult insect:** none known.

Merodon kozufensis Radenković & Vujić, in Radenković *et al*., 2020
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September. **Developmental stages:** not described. **Range:** Greece (Pindus mountains) and N Macedonia (Kozuf mountain). **Determination:** description of this species is based on 3 males and 2 females (Radenković *et al*, 2020). It is closely similar in appearance to other *rufus*-group species, from which the male may be distinguished morphologically by small, but distinct, genitalic differences. These are incorporated into the key to the males of European *rufus*-group species provided by Radenković *et al*.(2020a). Morphologically, separation of the female is more difficult, and a key to the *rufus*-group females is not given in Radenković *et al*.(2020a). Recognition of the female is dependent primarily on genetic characterisation. **Illustrations of the adult insect:** none known.

Merodon lamellatus Vujić & Radenković, in Vujić *et al*., 2012
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/June. **Developmental stages:** not described. **Range:** Anatolian zone of Turkey. **Determination:** both sexes of this species are described in Vujić *et al*. (2012), together with figures of the male terminalia and a key for the separation of *M. lamellatus* from other *ruficornis* group species known in Europe. **Illustrations of the adult insect:** none known.

Merodon latens Vujić, Radenković & Likov, in Vujić *et al*., 2024
Preferred environment: "open, sparsely-vegetated, semi-arid, stony pasturage and open, grassy areas within thermophilous *Quercus* forest" (Vujić *et al*., 2024b). **Adult habitat and habits:** flies close to the ground and through ground vegetation; both sexes exhibit territorial behaviour (Vujić *et al*., 2024b). **Flowers visited:** umbellifers and *Euphorbia* (Vujić *et al*., 2024b). **Flight period:** April/June. **Developmental stages:** not described. **Range:** Spain - at the end of the species diagnosis for *M. latens* in Vujić *et al*. (2024b) it is stated "*Merodon latens* sp. nov. is an Iberian endemic". But in the key in Vujić *et al*. (2024b) the distribution of *M. latens* is stated to be "Iberian peninsula and south-western France (Fig.13)". The figure reference is to a map showing the known distribution of *M. latens* in Europe. The map shows no records of *M. latens* in France. No French specimens of *M. latens* are mentioned elsewhere in the text, either under the material examined section of the description of *M. latens*, or in the supplementary data file 2, which lists all other specimens examined. Here it is concluded that addition of *M. latens* to the French list would be premature based on existing information and awaits the publication of verified French records. **Determination:** this species is extremely similar in appearance to *M. clavipes*, with which it has been confused until recently. Both the male and the female of *M. latens* are described in Vujić *et al*. (2024b), together with figures of parts of the male genitalia and photos of the hind leg of the male of *M. clavipes* and *M. latens*, to show the slight differences between them, in the shape of the hind femur. In referring to differences between *M. clavipes* and *M. latus*, the key to *clavipes*-group species in Vujić *et al*. (2024b) provides features to separate the males, but not the females. **Illustrations of the adult insect:** the general appearance of the male of *M. latens* is shown in the coloured photo provided in Vujić *et al*. (2024b).

Merodon latifemoris Radenković & Vujić, in Radenković *et al*., 2011
Preferred environment: olive groves (Ricarte *et al*., 2012); *Castanea* forest. **Adult habitat and habits:** no data. **Flowers visited:** yellow umbellifers (Ricarte *et al*., 2012); *Trifolium*. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Greece; Turkey (supplementary data file, Demirözer *et al*., 2022; Hayat *et al*., 2024). **Determination:** both sexes of this species are described in Radenković *et al*. (2011), together with figures of the male terminalia, and differences between this species and the closely-related *M. femoratoides* and *M. nigritarsis*. Vujić *et al*. (2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. *M. latefemoris* and *M. nigritarsis* can only be separated using features of the male terminalia. This species is included in the key

to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). Both males and females of *M. latefemoris* and *M. nigritarsis* are included in the keys in Hayat *et al*. (2024). **Illustrations of the adult insect:** the appearance of this insect can be seen from the coloured photo provided by Vujić *et al*. (2020d).

Merodon legionensis Marcos-García, Vujíc & Mengual, 2007
Preferred environment: open ground; unimproved, montane grassland, including open, grassy areas in pine forest or Mediterranean scrub; *Quercus rotundifolia* woodland (M.-A. Marcos-García, pers.comm.); broad-leaved evergreen matorral (Louboutin & Speight (2021). **Adult habitat and habits:** no data. **Flowers visited:** white Apiaceae; yellow composites; *Merendera montana*. **Flight period:** September. **Developmental stages:** undescribed. **Range:** Portugal; northern (Cantabria), eastern Spain and the Mediterranean zone of France. **Determination:** Marcos-García *et al*.(2007), who describe the species, figure its male terminalia and include it in their keys. This is a species of the *aureus* group and in general appearance rather similar to *M. flavicornis*. Its separation from *M. flavicornis* is discussed in Louboutin & Speight (2021). The male is included in the keys provided by Speight and Langlois (2020a, 2020b). **Illustrations of the adult insect:** a coloured photo of the male is provided in Speight and Langlois (2020a, 2020b).

Merodon loewi van der Goot, 1964
Preferred environment: forest; polydominant deciduous forest (A.Vujić, pers.comm.); open thermophilous *Quercus* (*Q.cerris/Q.frainetto*) forest*;* evergreen oak (*Q.ilex*) and Mediterranean pine (*P.halepensis, P.pallasiana*) forest subject to periodic burning and/or clearance of ground vegetation (especially woody shrubs) to avoid burning; garrigue. **Adult habitat and habits:** males exhibit territorial behaviour, and fly close to the ground, patrolling the boundaries of their territories. They emit an audible buzz in flight, and the flight is a rapid zig-zag. They settle both on the ground and on vegetation (Hurkmans, 1988). Females settle low on the upright stems of plants such as *Gladiolus*, and on dead leaves on the ground. **Flowers visited:** *Aphylanthes monspeliensis, Muscari, Ornithogalum.* **Flight period:** April/beginning June. **Developmental stages:** not described, but probably associated with *Ornithogalum* (Hurkmans, 1988) or Hyacinthaceae (Popov, 2009). **Range:** Italy, Bulgaria, Montenegro, Serbia, North Macedonia, Greece, Moldova, Ukraine, southern parts of European Russia, Turkey, Armenia, Israel. **Determination:** Vujić *et al*.(2012) redefine the species, figure its male terminalia and provide a key to separate it from other known European species of the *ruficornis* group. The male terminalia are also figured by Popov (2010). In Sack (1928-32) this species appears as *graecus*, Loew. **Illustrations of the adult insect:** a coloured photo of the male isprovided in Speight and Langlois (2020a, 2020b).

Merodon longicornis Sack, 1913: see under *M.italicus*.

Merodon longisetus Vujić, Radenković & Likov, in Likov *et al*, 2019
Preferred environment: Eastern Mediterranean maquis; phrygana (Vujić *et al*., 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Foeniculum*. **Flight period:** May/July and September. **Developmental stages:** not described. **Range:** Greece (Aegean island of Chios); Turkey. **Determination:** both male and female are described in Likov *et al*. (2019), who also illustrate various morphological features of the species, including the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). It is a species of the *nigritarsis* group, apparently morphologically indistinguishable from *M. toscanus*, except in features of the male terminalia. The male is also included in the keys in Hayat *et al*. (2024), but the female is not. **Illustrations of the adult insect:** the appearance of this insect can be seen from the coloured photo provided by Vujić *et al*. (2020d).

Merodon longispinus Marcos-García, Vujíc & Mengual, 2007
Preferred environment: has been collected from montane, sparsely-vegetated ground beside a river (Marcos-García et al, 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Lavandula latifolia* (Marcos-García et al, 2007). **Flight period:** September. **Developmental stages:** not described. **Range:** appears to be a localised endemic of the Sierra de Cazorla, in southern Spain. **Determination:** (Marcos-García et al, 2007), who describe this distinctive species, figure the hind leg and the terminalia of the male and include the species in their keys. *M.longispinus* is at present known only from the unique male holotype. The female is undescribed. **Illustrations of the adult insect:** none known.

Merodon lucasi Hurkmans, 1993
Preferred environment: open grassy areas beside streams in montane scrub (Hurkmans and Hayat, 1997). **Adult habitat and habits:** apparently flies in the shade (Hurkmans and Hayat, 1997). **Flowers visited:** *Pimpinella saxifraga, Ranunculus* (Hurkmans and Hayat, 1997). **Flight period:** June/August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes the male of this species, based on a series of specimens. He also figures the male terminalia. The female remains unknown. Vujić et al.(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. They also point out that Hurkmans (1993) had two species confused under the name *lucasi*, when he described the species. They describe the second species, as *hakkariensis*. Given that none of the type material of *M.hakkariensis* is from the localities where Hurkmans and Hayat (1997) gathered their observational data on *M.lucasi*, it is presumed here that they were observing *M.lucasi* and not *M.hakkariensis*. However, whether *M.hakkariensis* and *M.lucasi* occur in the same habitat remains unknown, since no ecological information is provided by Vujić et al.(2013c), with their description of *M.hakkariensis*. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov et al.(2019). **Illustrations of the adult insect:** none known.

Merodon luteihumerus Marcos-García, Vujíc & Mengual, 2007
Preferred environment: forest/open ground; open areas in evergreen oak forest (*Q.ilex* and *Q.suber*) with thickets of Mediterranean scrub on stony ground (Marcos-García et al, 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Urginea maritima* (Marcos-García et al, 2007). **Flight period:** September. **Developmental stages:** developmental stages described and figured by Ricarte et al.(2008), from larvae collected in healthy bulbs of sea squill, *Urginea maritima* – the larvae of this species are apparently phytophagous, rather than saprophagous. **Range:** known from central Spain (Cabañeros National Park), Gibraltar, Portugal and Algeria. **Determination:** (Marcos-García et al, 2007), who describe this large species, figure the hind leg and the terminalia of the male and include the species in their keys. *M.luteihumerus* is very similar in general appearance to *M.clavipes* and *M.pruni*. **Illustrations of the adult insect:** the general appearance of the male of this species can be seen in the coloured photos provided (Figures 4a, 4b) in the supplementary data accompanying Vujić *et al*.(2021b).

Merodon luteofasciatus Vujić, Radenković & Ståhls, in Vujić *et al*, 2018
Preferred environment: Eastern Mediterranean maquis; Aegean phrygana with *Drimia* (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Drimia* (Vujić et al, 2020). **Flight period:** June, September/October. **Developmental stages:** not described, but larva reared from "*Amaryllis"* (Vujić *et al*, 2018a). **Range:** Greece (Aegean islands: Crete, Lesvos, Samos); Turkey. **Determination:** an abbreviated description of the male of this cryptic *Merodon geniculatus* group species is provided in Vujić *et al*.(2018a), who also figure features of the male terminalia, upon which recognition of the species is largely dependent. The female is morphologically indistinguishable from females of other Mediterranean *Merodon geniculatus* group species, although distinct genetically. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photo provided by Vujić et al.(2020d).

Merodon luteomaculatus complex, Radenković *et al*, 2018
In Radenković *et al*.(2018) *Merodon luteomaculatus* is the taxon which gives its name to a complex of six cryptic species only distinguishable from one another using combinations of genetic and morphometric characteristics. The six taxa of the *M. luteomaculatus* complex are cited in Radenković *et al*.(2018) as *M. andriotes* sp.n., *M. euri* sp.n., *M. erymanthius* sp.n., *M. luteomaculatus* sp.n., *M. naxius* sp.n. and *M. peleponnesius* sp.n. But the descriptions of these taxa are given in a Word file of "supporting information", which has to be downloaded separately. The status of this file as an integral part of the paper is open to question, since the journal states "The publisher is not responsible for the content or functionality of any supporting information supplied by the authors". Here, it is taken that, despite the apparent dissociation between the paper and its supporting information, and differences between the way in which the taxa are cited in the main body of the paper and in its supporting information, the descriptions of the *M. luteomaculatus* complex species have been validly published and the citations of the authorities for them, provided in the supporting information, can be applied to the taxa cited in the main body of the paper. This interpretation will be maintained until and unless it is shown that this practice is nomenclaturally unsound.
The *Merodon luteomaculatus* complex is a component of the *bessarabicus* sub-group of the *aureus* clade, the largest of the subdivisions of *Merodon* in Europe. It is included, as the l*uteomaculatus* complex, in the key to species complexes of the *bessarabicus* sub-group provided by Veselić *et al*.(2017).

Morphological features characteristic of the *Merodon luteomaculatus* species complex are referred to by Radenković *et al.*(2018), at the beginning of the results section of their text. There it is mentioned that the *luteomaculatus* group taxa differ from other species of the *bessarabicus* subgroup "in having yellow spots on tergites 2 and 3". Photos of the dorsal surface of the abdomen of *M. luteomaculatus*, in one of the files of supplementary information associated with Radenković *et al.*(2018), are cited as examples. But in those photos yellow marks are not visible on any tergite. The unique combination of genetic and morphometric characteristics diagnostic in separation of each of the l*uteomaculatus* complex taxa from the others is to be found in Appendix 2 of the supplementary information associated with Radenković *et al.*(2018). So far, none of these taxa have been found flying together with one another. But, together, their known range spans parts of the Balkans, Greece and islands of the Aegean. Unfortunately, without access to the technology of molecular taxonomy and morphometric techniques, the identity of *luteomaculatus* complex specimens collected from new locations cannot be established.

Species accounts for the cryptic taxa comprising the *luteomaculatus* complex are provided below, in alphabetical order.

Merodon andriotes Vujić, Radenković & Šašić, in Radenković *et al*, 2018

Preferred environment: Eastern Mediterranean maquis (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Dittrichia viscosa*. **Flight period:** August/October. **Developmental stages:** not described. **Range:** Aegean island of Andros (Greece). **Determination:** cannot reliably be distinguished morphologically from other taxa of the *luteomaculatus* complex. The combination of genetic and morphometric characteristics diagnostic for this taxon is given in appendix two of the supplementary information associated with Radenković *et al.*(2018), together with information on variability in the general appearance of the insect. **Illustrations of the adult insect:** none known.

Merodon erymanthius Vujić, Ačanski & Šašić, in Radenković *et al*, 2018

Preferred environment: Mediterranean *Pinus* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Mentha*. **Flight period:** August/September. **Developmental stages:** not described. **Range:** Mount Erymanthos (Peloponnesos, Greece). **Determination:** cannot reliably be distinguished morphologically from other taxa of the *luteomaculatus* complex. The combination of genetic and morphometric characteristics diagnostic for this taxon is given in appendix two of the supplementary information associated with Radenković *et al.*(2018), together with information on variability in the general appearance of the insect. **Illustrations of the adult insect:** none known.

Merodon euri Vujić & Radenković, in Radenković *et al*, 2018

Preferred environment: open Eastern thermophilous *Quercus* forest (M. de C. Williams, pers. comm.); garrigue (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April and August/October. **Developmental stages:** not described. **Range:** Bulgaria, Greece, Serbia. **Determination:** cannot reliably be distinguished morphologically from other taxa of the *luteomaculatus* complex. The combination of genetic and morphometric characteristics diagnostic for this taxon is given in appendix two of the supplementary information associated with Radenković *et al.*(2018), together with information on variability in the general appearance of the insect. **Illustrations of the adult insect:** none known.

Merodon luteomaculatus Vujić, Ačanski & Šašić, in Radenković *et al*, 2018

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August/September. **Developmental stages:** not described. **Range:** Bosnia and Herzegovina, Montenegro. **Determination:** cannot reliably be distinguished morphologically from other taxa of the *luteomaculatus* complex. The combination of genetic and morphometric characteristics diagnostic for this taxon is given in appendix two of the supplementary information associated with Radenković *et al.*(2018), together with information on variability in the general appearance of the insect. **Illustrations of the adult insect:** the general appearance of the male and female of *M. luteomaculatus* can be seen from the coloured figures provided in supplementary information files associated with Radenković *et al.*(2018).

Merodon naxius Vujić & Šašić, in Radenković *et al*, 2018

Preferred environment: Eastern Mediterranean maquis (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Dittrichia*. **Flight period:** October. **Developmental stages:** not described. **Range:** the Aegean island of Naxos (Cyclades, Greece). **Determination:** cannot reliably be distinguished morphologically from other taxa of the *luteomaculatus* complex. The combination of genetic and morphometric characteristics diagnostic for this taxon is given in appendix two of the supplementary information associated with Radenković *et al.*(2018), together with information on variability in the general appearance of the insect. This is the least well known taxon of this complex, described on the basis of 2 males and 1 female. **Illustrations of the adult insect:** none known.

Merodon peloponnesius Vujić, Radenković, Ačanski & Šašić, in Radenković *et al*, 2018

Preferred environment: Eastern Mediterranean maquis (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June-July, October. **Developmental stages:** not described. **Range:** southern parts of Peleponnesos (Greece). **Determination:** cannot reliably be distinguished morphologically from other taxa of the *luteomaculatus* complex. The combination of genetic and morphometric characteristics diagnostic for this taxon is given in appendix two of the supplementary information associated with Radenković *et al.*(2018), together with information on variability in the general appearance of the insect. **Illustrations of the adult insect:** none known.

Merodon magnus Vujić, Tubić & Ačanski, in Vujić *et al*., 2024

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** the Aegean island of Samos (Greece). **Determination:** the male and female are described in Vujić *et al*. (2024a) and included in the key to *avidus*-group species provided there. This is large species (body length 15 – 17mm) apparently almost indistinguishable morphologically from *M. megavidus*, but genetically distinct. **Illustrations of the adult insect:** the male abdomen is shown in colour in (Vujić *et al*., 2024).

Merodon makrisi Vujić, Radenković & Tot, in Vujić *et al*., 2021

Preferred environment: calcareous, rocky, semi-arid, herb-rich but largely unvegetated ground and unimproved open grassland, with or without scattered patches of Mediterranean scrub and *Pinus brutia* (André van Eck, pers. comm. and Vujić *et al*., 2021d). **Adult habitat and habits:** flight rapid and close to the ground; often rests on the ground surface, or low-hanging leaves. **Flowers visited:** *Prospero autumnale* (= *Scilla autumnalis*). **Flight period:** October/November. **Developmental stages:** reared by Van Eck *et al*. (2020) from a last instar larva found in a bulb of *Prospero autumnale* in February. The larva evidently pupates in the bulb, remaining there until hatching in the following autumn. The puparium from this specimen is figured and described by Vujić *et al*. (2021d). **Range:** Cyprus; may also occur in Israel and Somalia (Vujić *et al*., 2021d) but the taxonomic status of those populations is unclear. **Determination:** the male and female are described in Vujić *et al*. (2021d), together with a key to provide for separation of *M. makrisi* from the other European species of the *Merodon natans* group. But the key relies on imprecise features of the antennae and diagrammatic approximations of the surstyli of the male terminalia, which are difficult to interpret or equate with what can be seen microscopically, eroding confidence that they depict meaningful morphological differences between *M. makrisi* and *M. pulveris*. **Illustrations of the adult insect:** coloured photos of the male and female are provided by Vujić *et al*. (2021d).

Merodon medius Vujić, Likov & Radenković, in Vujić *et al.*, 2020c

Preferred environment: forest/open ground; open areas in evergreen oak forest, *Pinus brutia* forest and Mediterranean shrub formations. **Adult habitat and habits:** no data. **Flowers visited:** *Ornithogalum, Potentilla, Thymus*. **Flight period:** May. **Developmental stages:** not described. **Range:** apparently endemic to the island of Crete (Greece). **Determination:** The male and female of *M. medius* are described in Vujić *et al.*(2020c), together with figures of the male terminalia and keys for the separation of this species from others of the *serrulatus*-group known from the western Palaearctic. However, although the male of *M. medius* is refered to in the keys, the female seems to have been inadvertently omitted. Vujić *et al.*(2020c) provide no comment on its omission. For recognition of the female it is necessary to rely on the species diagnosis provided for *M. medius*, plus the coloured photo of the dorsal view of the female abdomen. *Merodon medius* is the only *serrulatus*-group species that has been found on Crete. Vujić *et al.*(2021c) correct the spelling of the name of this species to *medius*, from the original *medium*. **Illustrations of the adult insect:** dorsal views of the abdomen of the male and female are provided in Vujić *et al.*(2020c).

Merodon megavidus Vujić & Radenković, in Ačanski *et al.*, 2016

Preferred environment: *Castanea* forest; maquis. **Adult habitat and habits:** no data. **Flowers visited:** *Convolvulus* (Vujić *et al*, 2020). **Flight period:** April/July. **Developmental stages:** not described. **Range:** the Aegean island of Lesvos (Greece) and Turkey. **Determination:** both male and female are described and defined genetically in Ačanski *et al.*(2016). *Merodon megavidus* is a species of the *avidus* group, distinguished from related species by its "larger size, golden body pile, bright orange colour of the pale parts of legs, and extremely short pile on hind femur" (Ačanski *et al*, 2016). Features of its male terminalia are figured in Ačanski *et al.*(2016). This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al.*(2019). It is morphologically almost indistinguishable from *M. magnus*, from which it is nonetheless genetically distinct (Vujić *et al*., 2024a). **Illustrations of the adult insect:** coloured photos of the male and

female abdomen, in dorsal view, are provided in Ačanski *et al.* (2016). The appearance of this insect can be seen from the coloured photo provided by Vujić *et al.*(2020d).

Merodon minutus Strobl, 1893
Preferred environment: forest/open ground; open areas in evergreen oak maquis; semi-arid, open, unimproved grassland. **Adult habitat and habits:** flies extremely low and fast over thinly vegetated ground, settling on the ground and visiting the flowers of low-growing herbs. **Flowers visited:** *Scilla autumnalis* (Standfuss and Claussen (2007). **Flight period:** April to beginning of June and September/October. **Developmental stages:** not described. **Range:** the Mediterranean islands of Corsica, Sicily and Sardinia; the Balkan peninsula and Greece, including Ionian and Aegean islands and Crete. Records from N Africa have proven to be based on misdeterminations (Ačanski *et al.*, 2022), and inclusion of this species in the list for Morocco (Kettani *et al*., 2022) has to be regarded as requiring verification. **Determination:** *Merodon minutus* is a species of the *M. aureus* clade, consigned to the *chalybeus* subgroup by Ačanski *et al.*(2022), who both define the subgroup and provide a key to its 3 European species. *Merodon minutus* is extremely similar to *M. chalybeus*. An error in the key provided by Ačanski *et al.*(2022) makes it difficult to use for recognition of *M.minutus*, as explained in the species account for *M. chalybeus*. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photos provided by Vujić *et al.*(2020d) and Ačanski *et al.*(2022).

Merodon mishustini Popov, in Vujić *et al*, 2020a
Preferred environment: Forest; at 150 - 500m altitude in "*Quercus* sp. forest" (Vujić *et al*, 2020a), interpreted here to imply Eastern thermophilous *Quercus* forest. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/July. **Developmental stages:** not described. **Range:** Turkey. **Determination:** both the male and female of this species are described in Vujić *et al.*(2020a), where features of the male terminalia are also figured. *M. mishustini* can be distinguished morphologically from the other European species of the *constans* group and is included in the keys provided in Vujić *et al.*(2020a). **Illustrations of the adult insect:** none known.

Merodon moenium (Wiedemann in Meigen), 1822: *M. avidus* Taxon B sensu Milankov *et al.* (2001)
Preferred environment: forest/open ground; humid *Fagus/Picea* forest; mesophilous *Fagus* forest; thermophilous *Quercus* forest; dry, unimproved, lowland grassland; old almond and cherry orchards, vineyards with ground vegetation. **Adult habitat and habits:** adults fly very fast and low through vegetation and settle most often on the ground, on bare patches of soil on woodland paths, or at the edge of tracks. The presence of this species is as easily detected by the high-pitched buzz it emits during flight as by direct observation. The males may return repeatedly to particular resting positions among ground vegetation, usually at slightly higher levels than the general, surrounding vegetation, and patrol "territories" surrounding these resting points. **Flowers visited:** umbellifers; *Achillea* and *Euphorbia*. **Flight period:** May/July. **Developmental stages:** undescribed, but seemingly with a number of alternative plant hosts occurring in different biotopes. Reemer and Goudsmits (2004) observed a female of "*M.avida"* ovipositing on the leaves of a flowering plant of *Muscari*, which could be one host plant. **Range:** probably from southern Sweden south to the Mediterranean and N.Africa; from France through most of central and southern Europe to Turkey, European parts of Russia and Georgia. But occurrence of this taxon in various parts of Europe still requires confirmation, due to confusion with *M. avidus* and *M. ibericus*. Whether *M. moenium* or the Iberian *M. ibericus*, or both taxa, are present in the Pyrenees and western France is uncertain, because genetics data are not available for populations from those parts of Europe and there are no morphological features by which these two taxa may be separated. The presence of *M. moenium* in the Iberian peninsula has not been confirmed. **Determination:** *M. moenium* is one of five cryptic species now recognised within the *M. avidus* complex. Identification of species in the *M. avidus* complex remains very difficult. For further discussion of this issue see Popović *et al.*(2015). *M. moenium* remains morphologically indistinguishable from *M. ibericus* and almost indistinguishable from *M. pseudomoenium*. Both *Merodon moenium* and *M. ibericus* are included in the keys to males of *avidus* group and *nigritarsis* group species provided by Likov *et al.* (2019), but the reliability of features used there to separate *M. moenium* from the other species is questionable. Cavaillès and Bouteloup (2019) found specimens from the north of France, where ecologically *M. avidus* is extremely unlikely to occur, with a mixture of the features used to separate *M. avidus* and *M. moenium*, notably some with patches of dusting on tergite 2, a condition supposedly not occurring in *M. moenium*. The features used to separate *M. moenium* from *M. avidus* in the key in Vujić *et al.* (2024a) only relate to "typical morpho-forms", essentially rendering it unusable. *M. ibericus* is not included in that key, nor is its absence from the key referred to. Lack of genetics data for *M. avidus/M.ibericus/M. moenium* populations for any part of France except Corsica and the extreme SE (Vujić *et al*., 2024a) makes identification of French specimens of *M. moenium*

more an act of faith than of science. The map showing the distribution of *M. ibericus* and *M. moenium* in Europe, provided by Vujić *et al*., does not inspire confidence in this respect. *M. ibericus* is shown occurring in Iberia eastwards right up to the Spanish/French frontier and *M. moenium* is shown occurring in France from up against the Spanish/French frontier across to the Alps and beyond. Given that *M. ibericus* and *M. moenium* can only reliably be distinguished genetically, and there are no published genetic data from anywhere in western France, for specimens which morphologically correspond with *ibericus/moenium*, the French distribution shown for *M. moenium* in that map would seem to be almost entirely conjectural. Until genetic data are available for populations of *M. ibericus/moenium* in western France the distribution of *M. moenium* there is likely to remain conjectural. The wing morphometrics study, conducted by Vujić *et al*. (2024a), gives some hope that an alternative to genetic studies might become available to decide the identity of *ibericus/moenium* in western France, since it demonstrated the existence of significant differences between the wings of *M. ibericus* and *M. moenium*. But, as with genetic studies, wing morphometric analysis has yet to be carried out on French *ibericus/moenium* specimens. **Illustrations of the adult insect:** the general appearance of *M. moenium* is shown in the coloured figure of *M. avidus* provided by Bartsch *et al*. (2009b) and Torp (1994). Popović *et al*.(2015) provide coloured figures of the abdomen of both sexes of *M. moenium*. A coloured photo of the male is provided by Speight and de Courcy Williams (2018) and Bot and Van de Meutter (2019).

Merodon nanus (Sack), 1931

Preferred environment: unimproved, humid, montane grassland (Vujić *et al*, 2020d); olive groves (Ricarte *et al*, 1012). **Adult habitat and habits:** flies very low through ground vegetation. **Flowers visited:** composites; umbellifers; *Euphorbia; Ornithogalum* (Vujić *et al*, 2020d); *Malus* (Vujić *et al*, 2011). **Flight period:** February/July. **Developmental stages:** not described. **Range:** uncertain, due to confusion with related species until recently, but confirmed from Armenia, Greece, Iran, Israel, Lebanon, Palestine, Syria, Turkey, **Determination:** Vujić *et al*.(2015) figure the male terminalia and provide a key distinguishing the male from males of four other species of the *M. nanus* group. Ståhls *et al*.(2009) include this species in their key to the *Merodon* species of Lesvos. The female remains undescribed. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photos provided by Vujić *et al*. (2020d, 2021b).

Merodon natans (Fabricius), 1794

Preferred environment: forest/open ground; herb-rich open areas in thermophilous *Quercus* forest. The habitat range of this species in Europe requires re-assessment, due to previous confusion between *M. natans* and other closely related *Merodon* species. **Adult habitat and habits**: open areas with tall herbs and scrub, within dry woodland; a secretive species, as easily collected by use of Malaise trap as by direct observation. **Flowers visited:** *Mentha; Prospero autumnale* (Vujić *et al*., 2021d). **Flight period:** April and September/October (Vujić *et al*., 2021d). **Developmental stages:** the larva is undescribed, but Vujić *et al*. (2021d) provide photos of a puparium from which a specimen of *M. natans* was hatched. The puparium was found in a bulb of *Prospero automnale* in September, and hatched a few days later. **Range:**. The distribution of this species in Europe requires re-appraisal, due to confusion until recently with other closely similar species of the *Merodon natans* group whose presence was not previously recognised. Vujić *et al*. (2021d) give the range of *M. natans* as: Spain; France; Italy (including Sardinia); Croatia; Montenegro and Serbia; North Macedonia; Greece (including Crete); Bulgaria. **Determination:** Vujić *et al*. (2021d) designate a neotype for *Merodon natans* and redescribe the species, illustrating the male terminalia and other features and including it in a key to the European species of the *Merodon natans* group. The key brings together species which have not previously been treated in the same key. The concepts of *Merodon natans* group species employed by Vujić *et al*. (2021d) are based on both genetic and morphometric data. But this does not necessarily lead to availability of morphological features convenient for use in keys. In the key provided by Vujić *et al*. (2021d). recognition of *M. natans* is dependent upon imprecise features of the antennae and diagrammatic approximaions of the surstyli of the male terminalia, both of which are difficult to interpret, resulting in need for great care in identification of the species. Specimens from the spring generation of *M. natans* can be almost devoid of any yellowish or reddish markings on the tergites, but the September generation more often have both the lateral margins of the abdomen, and the posterior margin of tergites 3 and 4, largely yellowish. At present, further west in Europe than the islands of the Aegean sea, the only *Merodon natans* group species known are *M. calcaratus* and *M. natans*, which can reasonably easily be separated from one another in the shape of the third antennal segment (see figures in Vujić *et al*., 2021d). However, to rely on these biographical data for *Merodon natans* recognition it would be necessary to assume the existence of more comprehensive knowledge of the genetics of European populations than is currently available – for example, genetic data for populations of *M. natans* from west of the Alps. Vujić *et al*. (2021d**)** synonymise *Merodon annulatus* (Fabricius) with *M. natans*. **llustrations of the adult insect:** coloured photos of the male and female are provided by Vujić *et al*. (2021d).

***Merodon naxius*:** see under *Merodon luteomaculatus* complex

Merodon neofasciatus Ståhls & Vujić, in Vujić *et al.*, 2018
Preferred environment: Eastern Mediterranean maquis with *Drimia* (Vujić *et al.*, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Crithmum maritimum, Drimia, Dittrichia viscosa, Inula, Senecio iopensis*. **Flight period:** February/June and August/October. **Developmental stages:** not described, but reared from bulbs of *Narcissus* species and probably *Sternbergia* species (as *"Amaryllis"*) (Vujić *et al.*, 2018a). **Range:** Greece (Aegean islands including Rhodes, Cyclades), Cyprus, Turkey, Palestine, Israel. **Determination:** an abbreviated description of this cryptic *Merodon geniculatus* group species is provided in Vujić *et al.* (2018a), together with figures of features of the male terminalia, upon which separation of *M. neofasciatus* from related species depends. The female is indistinguishable, morphologically, from both *M. albifasciatus* and *M. luteofasciatus*, although distinct genetically. **Illustrations of the adult insect:** none known.

Merodon neolydicus Vujić, in Vujić, Radenković & Likov, 2018
Preferred environment: Eastern Mediterranean maquis (Vujić *et al.*, 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Ornithogalum*. **Flight period:** January/June, with a peak in March. **Developmental stages:** not described. **Range:** the Aegean island of Chios (Greece); Turkey; Lebanon; Israel; Syria; Iran. **Determination:** both male and female are described in Vujić *et al.*(2018c), who also provide figures of the antennae, coloured figures of the abdomen in dorsal view, figures of the male terminalia and a key to separate *M. neolydicus* from other members of the *M. desuturinus* group. The name *neolydicus* is introduced by Vujić *et al.* (2018c) as a replacement name for the manuscript name *lydicus*, referred to in previous publications without an associated description and in consequence relegated to the status of nomen nudum by Vujić *et al.* (2018c). **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Merodon neonanus Vujić & Taylor, in Vujić *et al*, 2015
Preferred environment: small, open, herb-rich areas within Balkanic mesophilous beech forest; along the edge of riparian *Platanus* forest; unimproved, montane grassland (Vujić *et al*, 2015); olive groves. Nakas *et al*. 2023) provide data showing that this species can become more abundant is areas which were burned the previous year. **Adult habitat and habits:** no data. **Flowers visited:** yellow composites (*Leontodon*); *Ornithogalum; Trifolium*. **Flight period:** March/July and October. **Developmental stages:** not described. **Range:** North Macedonia, Greece, Turkey. **Determination:** in Vujić *et al*. (2015) the male terminalia are figured and a key is provided, distinguishing the male of *M. neonanus* from males of four other species of the *M. nanus* group. The female remains undescribed, but is included in the keys in Hayat *et al*. (2024). **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Merodon nigripodus Vujić & Hayat, in Vujić *et al.*, 2012
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** Turkey. **Determination:** this species is described in Vujić *et al*. (2012), where parts of the male terminalia are figured and the male is also included in a key to species of the *ruficornis* group known in Europe. The description is based on a single male. The female remains unknown. **Illustrations of the adult insect:** none known.

Merodon nigritarsis Rondani, 1845
Preferred environment: forest/open ground; herb-rich, dry/semi-arid, unimproved grassland and open areas in thermophilous oak forest and evergreen *Q. ilex* and *Q. suber* forest/maquis; vineyards; *Pinus* matorral and Mediterranean scrub; what appears to be the same species also occurs in open, calcareous, montane grassland and hedgehog heath. **Adult habitat and habits:** flies fast and low through sparse ground vegetation, settling in the open on bare ground. **Flowers visited:** *Rosmarinus officinalis* (H.Kaplan, pers.comm.); *Euphorbia, Tordylium apulum*. **Flight period:** May/August. **Developmental stages:** not described, but reared from the steppe hyacinth *Hyacinthella pallasiana* by Stepanenko and Popov (1997). The larva is strictly phytophagous (i.e. it feeds on healthy bulbs), apparently requires only one bulb to complete its development and overwinters as a larva, free in the soil. There is circumstantial evidence to suggest that *Muscari racemosum* can also act as a larval host for this species. **Range:** uncertain, due to confusion until recently with related species of the *avidus* group, but can be recorded from Austria, southern France, Greece, Hungary, Italy, former Yugoslavia, Poland, Spain, Switzerland,

Turkey. **Determination:** this species was re-instated by Hurkmans (1993), who figures the male terminalia and provides a detailed re-description and notes on the differences between *M. nigritarsis* and related species. In general appearance it is closely similar to *M. avidus* (Rossi). *Merodon nigritarsis* is included in the key to males of French *Merodon* species in Speight & Langlois (2020a, 2020b) and the keys to Iberian *Merodon* species in Marcos-Garcia *et al*. (2007). Useful comparative figures of the male terminalia of *M. avidus* and *M. nigritarsis* are provided by Vujić *et al*. (1998). In *M. nigritarsis* the wings are entirely covered in microtrichia and the plumule is pale/mid brown, whereas in *M. avidus* there are extensive areas bare of microtrichia on the second basal and anal wing cells and the plumule is black. Also, in *M. nigritarsis* the hairs in the postero-lateral fringe, on the ventral surface of the hind femur, are (though rather sparse) approximately one fifth as long as the maximum depth of the femur, whereas in *M. avidus* this posterolateral hair fringe is very short, its hairs being no longer than one tenth of the maximum depth of the hind femur (se also under *M. elegans*). Vujić *et al*. (2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. *M. nigritarsis* can only be separated from *M. latefemoris* by features of the male terminslia. Both species are included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). **Illustrations of the adult insect:** coloured photos of the male are provided in Speight and Langlois (2020a, 2020b) and Pétremand *et al*. (2022).

Merodon nisi Veselić, Vujić & Radenković, 2017
Preferred environment: open aress in dry *Pinus* forest and Mediterranean scrub (Veselić *et al*, 2017). **Adult habitat and habits:** no data. **Flowers visited:** *Drimia* (Vujić et al, 2020). **Flight period:** October. **Developmental stages:** no data. **Range:** the island of Rhodes. **Determination:** this species is described on the basis of two males and a female. *M. nisi* is included in the key to sub-groups of the *aureus* complex provided by Veselić *et al*.(2017). Its relatively isolated position within the complex results in it being keyed out by itself, rather than as a member of any of the subgroups. **Illustrations of the adult insect:** coloured photos of both the male and the female, in dorsal view, are provided by Veselić *et al*.(2017), together with other photos of various parts of the body, including the head and the hind leg of the male.

Merodon nitens Hurkmans & Vujić, in Vujić *et al*, 2020a
Preferred environment: forest; open areas by seasonal streams, within mixed forest, high maquis, Mediterranean shrub formations (Vujić *et al*, 2020a). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/beginning August. **Developmental stages:** not described. **Range:** so far as is known, this species is endemic to Sicily (Italy). **Determination:** in Vujić *et al*.(2020a) both male and female of *M. nitens* are described, together with figures of features of the male terminalia and keys to separate both sexes from other European *constans*-group species. **Illustrations of the adult insect:** none known.

Merodon nitidifrons Hurkmans, 1993
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) figures the male terminalia. The female of this species remains unknown. Vujić *et al*. (2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). **Illustrations of the adult insect:** none known.

Merodon nudicorpus Vujić & Radenković, in Vujić *et al.*, 2021
Preferred environment: collected in a wadi, beside seasonal streams with a riparian gallery forest of *Populus, Salix* and *Tamarix*, on a sparsely-vegetated slope with *Euphorbia* and *Paliurus spina-christi* (Vujic *et al.*, 2021c). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** Eastern Turkey; Azerbaijan. **Determination:** described, based on both males and females, in Vujić *et al*. (2021c), who figure the male terminalia and provide features for separation of *M. nudicorpus* from the closely similar *M. aurifer* – see also species account for *M. aurifer*. Whether *M. nudicorpus* is of a similar size to *M. aurifer* is not indicated in the description of *M. nudicorpus*. **Illustrations of the adult insect:** parts of the thorax and abdomen of both the male and the female are illustrated in colour by Vujić *et al*. (2021c).

Merodon obscuritarsis Stroblin Czerny, 1909
Preferred environment: evergreen oak (*Q.ilex*) forest and montane, dry pine forest (Marcos-García et al, 2007); montane heath (Ricarte *et al*., 2014); Mediterranean riparian ash forest (Ricarte-Sabater *et al*., 2008). **Adult habitat and habits:** no data. **Flowers visited:** Apiaceae; *Caralluma burchardii, Euphorbia, Genista, Opuntia, Thapsia* (Marcos-García et al, 2007). **Flight period:** April/May and July/September. **Developmental stages:** undescribed. **Range:** Spain including the Canary Isles; France (Pyrenees). If, as suggested by Marcos-García *et al.*, 2007, *M. tricinctus* proves to be the same species as *M.obscuritarsis*, then the range of *M. obscuritarsis* is much wider (see under *M.tricinctus*), including parts of N. Africa. **Determination:** Marcos-García *et al*. (2007), who figure the antennae (both sexes), plus the male abdominal tergites and terminalia and include this species in their keys. They establish that *fuerteventurensis* Barkemeyer is a junior synonym of *obscuritarsis* Strobl and suggest very strongly that *tricinctus* Sack will also prove to be a synonym of *obscuritarsis*, though they do not formally establish that synonymy. **Illustrations of the adult insect:** the male is shown in colour by Speight and Langlois (2020a, 2020b).

Merodon obstipus Vujić, Radenković & Likov, in Likov *et al.*, 2019
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Turkey. **Determination:** both male and female are described in Likov *et al*. (2019), who also illustrate various morphological features of the species, including the male terminalia. It is a member of the *nigritarsis* group apparently indistinguishable, morphologically, from related species, except for in features of the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). Both sexes of *M. obstipus* are included in the keys in Hayat *et al*. (2024), but the distinctions referred to for separating the female from the female of *M. femoratoides* (hind femur "less broad" in *M. obstipus*, "broad" in *M. femoratoides*) are not illustrated and thus largely uninterpretable. **Illustrations of the adult insect:** none known.

Merodon oidipous Hurkmans, 1993
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993), who figures the male terminalia. The female of this species remains unknown. **Illustrations of the adult insect:** none known.

Merodon olympius Vujić & Radenković, in Radenković *et al*, 2020
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September. **Developmental stages:** not described. **Range:** central Greece (Mt. Olympus). **Determination:** description of this species is based on 3 males and 5 females (Radenković *et al*, 2020). It is closely similar in appearance to other *rufus*-group species, from which the male may be distinguished by small, but distinct, genitalic differences. These are incorporated into the key to the males of European *rufus*-group species provided by Radenković *et al*.(2020a). Morphologically, separation of the female is more difficult, and a key to the *rufus*-group females is not given in Radenković *et al*.(2020a). Recognition of the female is dependent primarily on genetic characterisation. **Illustrations of the adult insect:** none known.

Merodon opacus Vujić, Likov & Radenković, in Vujić *et al*, 2020c
Preferred environment: forest; open, Eastern thermophilous *Quercus* forest, *Quercus ilex/Q. coccifera* forest and *Castanea* forest; *Pinus brutia* forest (Vujić *et al*.(2020c). **Adult habitat and habits:** no data. **Flowers visited:** *Ornithogalum, Potentilla*. **Flight period:** April/June. **Developmental stages:** larval host plant unknown, but puparium described and figured in Vujić *et al*.(2020c), from a larva found free in the superficial layer of the soil of a *Castanea* forest on 2nd March, 2006. The larva formed a puparium on 4th March, from which an adult hatched on 21st March of the same year. **Range:** Aegean island of Lesvos (Greece) and western Turkey. **Determination:** the male and female of *M. opacus* are described in Vujić *et al*.(2020c), together with figures of the male terminalia and keys to separate the species from others of the s*errulatus*-group known from western parts of the Palaearctic. Males *of M. serrulatus* with the mesoscutum entirely pale-haired could be misidentified as *M.opacus* using the key, unless features of the male terminalia are also checked. **Illustrations of the adult insect:** dorsal and lateral views of the abdomen of both sexes are illustrated in coloured photos in Vujić *et al*.(2020c).

Merodon orjensis Radenković & Vujić, in Radenković *et al*, 2020
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Developmental stages:** not described. **Range:** Montenegro. **Determination:** description of this species is based on a solitary

male (Radenković *et al*, 2020). It is closely similar in appearance to other *rufus*-group species, from which it may be distinguished morphologically by small, but distinct, genitalic differences. These are incorporated into the key to the males of European *rufus*-group species provided by Radenković *et al.*(2020a). It is also genetically distinct. The female is unknown. **Illustrations of the adult insect:** none known.

Merodon ottomanus Hurkmans, 1993
Preferred environment: forest/open ground; open areas in *Quercus ilex/Pinus halepensis* forest and lentisc scrub (Marcos-García *et al*, 2007); *Q.rotundifolia* woodland (M.-A. Marcos-García, pers.comm.); unimproved, montane grassland (Hurkmans and Hayat (1997). Occurs at 2000m in Turkey (Hurkmans, 1993). **Adult habitat and habits:** flies along the margin of stands of taller herbs (Hurkmans and Hayat (1997). **Flowers visited:** umbellifers, *Ornithogalum*. **Flight period:** May/June. **Developmental stages:** not described. **Range:** as at present recognised, *M. ottomanus* exhibits a disjunct distribution, being known from Spain, Greece, Turkey and Iran (Vujić *et al*, 2021). But its range ihas to be regarded as uncertain, due to confusion with other species. **Determination:** this species is included in the keys provided by Marcos-García *et al.*(2007); Speight & Langlois (2020) and Vujić *et al.*(2021). Its male terminalia are figured by Hurkmans (1993) and Marcos-García *et al.*(2007). The terminalia figures shown for this species in Marcos-García *et al.*(2007) are based on Spanish material. The same figures are reproduced in Vujić *et al.*(2021), as the terminalia of *M. ottomanus*. Vujić *et al.*(2021) regard *M. ottomanus* as occupying a rather isolated position within the *Merodon avidus/nigritarsis* clade and do not consign it to any named species group. By commenting that it requires revision, they also imply that, as recognised at present, it is a species complex, rather than a single species. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photos provided in Likov *et al.*(2019), Speight & Langlois (2020) and Vujić *et al.*(2021b).

Merodon ovaloides Vujić & Radenković, in Vujić *et al.*, 2012
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Turkey. **Determination:** the description of this species in Vujić *et al.* (2012) is based on both sexes. Vujić *et al.* (2012) also figure parts of the male terminalia and include *M. ovaloides* in a key to the *ruficornis* group species known from Europe. **Illustrations of the adult insect:** none known.

Merodon papillus Vujić, Radenković and Pérez-Bañon, in Vujić *et al.*, 2007
Preferred environment: forest; thermophilous oak forest of Q.*pubescens/Q.cerris* etc; evergreen oak forest of *Q.ilex* and maquis of *Q.coccifera/Pistacia/Olea*; phrygana of *Cistus/Thymus capitatus*; olive (*Olea*) groves (habitat data from Vujić *et al*., 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Ornithogalum* (Vujić *et al*., 2020). **Flight period:** April/May. **Developmental stages:** not described. **Range:** so far known only from Lesvos (Greece), and Turkey. **Determination:** in Vujić *et al.* (2007) both sexes of the species are described and the male terminalia and other features of the male and female morphology are figured. *M. papillus* is a member of the *ruficornis* group, in the male distinguished from all other member of this group by possessing a pair of sclerotised papillae at the posterior margin of abdominal sternite 4. Vujić *et al.* (2012) provide a key for separation of *M. papillus* from other *ruficornis* group species known in Europe. **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Merodon parietum Wiedemann in Meigen, 1822
Preferred environment: forest/open ground; open areas in thermophilous *Quercus* forest and well-drained, unimproved, non-calcareous grassland. **Adult habitat and habits:** flies low through tall ground vegetation, settling on patches of bare ground. **Flowers visited:** *Chrysanthemum leucanthemum, Myosotis, Ranunculus, Scilla momophyllos, Stellaria.* **Flight period:** end May/June. **Developmental stages:** not described. **Range:** Portugal, Spain, southern France (north to the Dordogne); Greece?. **Determination:** Sack (1930-32). The third antennal segment is very short in this species - shorter than the combined length of segments 1 + 2 together. Also, the clypeus is parallel-sided and approximately 4x as long as its maximum width. *M. parietum* is very similar in general appearance to some forms of *M. albifrons*. The male of *M. parietum* can be distinguished from the male of *M. albifrons* by the shape of the apex of the hind tibia. *In M. parietum* it is very rounded, but in *M. albifrons* it has a sharp angle, antero-ventrally, between its long axis and its apical margin. The females are more difficult to distinguish, but the third antennal segment is longer in *M. albifrons* than in *M. parietum*. Also, in *M. parietum* the eye hairs are all straight, whereas in *M. albifrons* there is nearly always a patch of strongly curved eye hairs, toward the anterior margin of the eye, at the level of the antennal insertions. This patch of curved eye hairs is also present in

the male of *M. albifrons*. **Illustrations of the adult insect:** the male is shown in colour by Speight and Langlois (2020a, 2020b).

***Merodon peloponnesius*:** see under *Merodon luteomaculatus* complex

Merodon petiolatus Vujić, Radenković & Rojo, in Vujić *et al*., 2022
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** central Turkey. **Determination:** the description of this species, provided in Vujić *et al*. (2022b), is based on a solitary male. It is accompanied by figures of the male terminalia and a key to the known species of the *aberrans* group, including the male of *M. petiolatus*. The female is unknown. **Illustrations of the adult insect:** a coloured photo of the male is provided in Vujić *et al*. (2022b).

Merodon planiceps Loew, 1862
Preferred environment: open ground; unimproved, humid, montane grassland (Hurkmans, 1988). **Adult habitat and habits:** flies fast and very low through/over short ground vegetation (Hurkmans, 1988). **Flowers visited:** *Euphorbia* (Hurkmans and Hayat, 1997). **Flight period:** April/July. **Developmental stages:** not described. **Range:** Italy, Greece (Rhodes) and Turkey. **Determination:** Sack (1928-32). Vujić *et al*.(2012) figure the male terminalia and provide a key for the separation of *M.planiceps* from other *ruficornis* group species known in Europe. **Illustrations of the adult insect:** Vujić et al.(2020d), provide a coloured photo of the male of this species.

Merodon ponticus Vujić & Radenković, in Vujić *et al*., 2012
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end of June/July. **Developmental stages:** not described. **Range:** Turkey, Azerbaijan. **Determination:** both sexes of this species are described in Vujić *et al*. (2012), who also figure the male terminalia and provide a key for separation of *M. ponticus* from other *ruficornis* group species known in Europe. **Illustrations of the adult insect:** none known.

Merodon portschinskyi Stackelberg, 1924
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** at present known only from the Caucausus, at the southern edge of European Russia and in Georgia. **Determination:** Vujić *et al*. (2012) redefine the species, figure its male terminalia and include it in the key they provide to species of the *ruficornis* group known in Europe. Vujić *et al*. (2022) describe the female and include both male and female in an updated key to *ruficornius*-group species. **Illustrations of the adult insect:** none known.

Merodon pruni (Rossi), 1790
Preferred environment: open ground; sparsely vegetated, dry/semi-arid grassland with scattered tall herbs; open areas in low-altitude *Abies cephalonica* forest on limestone; *Castanea* forest; open *Pinus halepensis* forest. **Adult habitat and habits:** Hurkmans (1985) provides some information on territorial behaviour by the males; females fly fast and very close to the ground, and are much less noticeable than the males. Both sexes fly silently. **Flowers visited:** *Ferula, Foeniculum*. **Flight period:** May/September, with peaks in May and September. **Developmental stages:** not described. **Range:** southern France (extinct?), Italy, Austria, former Yugoslavia, Greece, Malta, Cyprus, Crete, Turkey, N Africa, Arabia. **Determination:** Hurkmans (1993), who figures the male terminalia. This species is included in the key provided by Ståhls et al.(2009), to the *Merodon* species of Lesvos. **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photos provided by Speight & Langlois (2020b) and Vujić *et al*. (2020d).

Merodon pseudomoenium Vujić, Tubić & Ačanski, in Vujić *et al*., 2024
Preferred environment: "open grassland areas surrounded by maquis and Mediterranean *Quercus* forest" (Vujić *et al*., 2024a). **Adult habitat and habits:** flies along forest margins, mostly in the shade and settles on leaves (Vujić *et al*., 2024). **Flowers visited:** no data. **Flight period:** May/June. **Developmental stages:** not described. **Range:** Corfu, in the Ionian Sea, and the Pelopponese (Greece). **Determination:** the male and female are described in Vujić *et al*. (2024a) and included in the key to *avidus*-group species provided there. As its name suggests, *M. pseudomoenium* is very similar to *M. moenium*, with which it would have been confused previously. Separation of *M. pseudomoenium* from *M. moenium* is discussed in Vujić *et al*. (2024a). **Illustrations of the adult insect:** the male abdomen is shown in colour in (Vujić *et al*., 2024a).

Merodon pulveris Vujić & Radenković, in Radenković *et al.*, 2011
Preferred environment: open areas in Eastern European maquis (Radenković *et al*., 2011); semi-arid, calcareous, rocky, patchily-vegetated, herb-rich open ground (Vujić *et al*., 2021d). **Adult habitat and habits:** no data. **Flowers visited:** *Foeniculum, Prospero autumnale* (Van Steenis *et al*., 2019); *Drimia*. **Flight period:** April and late September/mid October. **Developmental stages:** the larva is described and figured by Vujić *et al*. (2021d), from a last instar larva found in a bulb of *Prospero autumnale* in April, on the Aegean island of Lesvos. **Range:** Aegean islands of Lesvos, Samos and Rhodes (Greece); Cyprus; Turkey. **Determination:** in Radenković *et al*.(2011) both sexes of the species are described and its male terminalia are figured. Morphological differences between *M. pulveris* and *M. natans* are small, but in Radenković *et al*. (2011) the separate identity of these two species is clear genetically. A subsequent morphometric study (Arok *et al*., 2019) further substantiates the validity of *M. pulveris* as a separate species-level taxon. Vujić *et al*. (2021d) provide a key to separate the European *Merodon natans* group species, including *M. pulveris*. The diagrammatic approximations of features of the surstyli of the male terminalia accompanying the key are difficult to interpret or equate with what can be seen under a microscope, eroding confidence that they depict meaningful differences between *M. pulveris* and other *natans*-group species. Recognition of *M. pulveris* using morphological features remains difficult. **Illustrations of the adult insect:** the general appearance of the male and female can be seen in the coloured photos provided by Vujić *et al*. (2020d) and Vujić *et al*. (2021d). A coloured photo of the female is shown in Speight and de Courcy Williams (2021).

Merodon pumilus Macquart in Lucas, 1849
Preferred environment: forest/open ground; open areas in thermophilous *Quercus* forest and evergreen oak forest; maquis and matorral; xeric grassland (Marcos-García *et al*, 2007). **Adult habitat and habits:** no data. **Flowers visited:** Apiaceae; *Anthericum ramosum, Chrysanthemum leucanthemum, Mentha, Ranunculus, Solidago, Taraxacum.* **Flight period:** April/June. **Developmental stages:** not described. **Range:** Portugal and Spain to the Pyrenees; N Africa (Morocco, Algeria, Tunisia). **Determination:** Marcos-García *et al*.(2007), who redefine the species, figure its male terminalia and include it in their keys. *Merodon pumilus* is a species of the *aureus* group. It can be distinguished from the two other *aureus*-group species known to occur west of the Alps in Europe (*M. aureus* and *M. unicolor*) using the key in Vujić *et al*.(2020b). **Illustrations of the adult insect:** none known.

Merodon puniceus Vujić, Radenković & Péres-Bañón, in Radenković *et al*., 2011
Preferred environment: Eastern Mediterranean maquis (Radenković *et al*, 2011); open areas of sparsely-vegetated, sub-arid, goat-grazed, herb-rich calcareous grassland, with thickets of evergreen oak (*Q. coccifera/Q.ilex*) scrub. **Adult habitat and habits:** no data. **Flowers visited:** *Dittrichia viscosa* (Vujić et al, 2020). **Flight period:** August/October. **Developmental stages:** not described. **Range:** Greece (Levos); Turkey. **Determination:** in Radenković *et al*.(2011) both sexes of the species are described and its male terminalia are figured. Morphologically, *M.puniceus* is extremely similar to *M.dobrogensis*, which occurs in North-east Greece, not so far from the island of Lesvos, and *M. rojoi*, known from western and southern parts of mainland Greece. **Illustrations of the adult insect:** Radenković *et al*.(2011) figure both male and female in colour.

Merodon quadraticus Vujić & Radenković, in Vujić *et al*., 2013c
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Turkey; Iran; Turkmenistan. **Determination:** the description of this species is based on males only. The female remains undescribed. Vujić *et al*.(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*. (2019). **Illustrations of the adult insect:** none known.

Merodon quadrinotatus (Sack), 1931
Preferred environment: sparsely-vegetated open ground in steppic forest of *Quercus brantii* and semi-steppic grassland and scrub (Vujić *et al*., 2024b). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June; August. **Developmental stages:** not described. **Range:** Turkey, Iran, Iraq. **Determination:** Sack (1928-32). Hurkmans (1993) provides information on the distinctions between the female of this species and the female of *M. clavipes*. The male of *M. quadrinotatus* remained unknown for nearly a century, until described by Vijić *et al*. (2024b), who also figure the male genitalia and include *M. quadrinotatus* in their key to *clavipes*-group species. **Illustrations of the adult insect:** none known.

Merodon quercetorum Marcos-García, Vujíc & Mengual, 2007
Preferred environment: forest/open ground; open areas in thermophilous *Quercus* (*Q.faginea*, *Q.pyrenaica*) and evergreen oak (*Q. rotundifolia*) forest and open ground at higher altitudes, up to 2200m (Marcos-García *et al*., 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Crocus salzmannii* (Marcos-García *et al*., 2007). **Flight period:** August-September. **Developmental stages:** not described. **Range:** northern Spain (Cantabria) and some montane localities in south-eastern Spain. **Determination:** (Marcos-García *et al.* (2007), who describe the species, figure its male terminalia and include it in their keys. This is another species of the *aureus* group, closely similar to *M. cinereus*. **Illustrations of the adult insect:** none known.

Merodon rasicus Vujić & Radenković, in Vujić *et al.*, 2015
Preferred environment: grassy, open areas in Eastern thermophilous oak forest (*Quercus frainetto*); unimproved, subalpine grassland. **Adult habitat and habits:** flies low and settles on low-growing vegetation (M. de Courcy Williama, pers.comm.). **Flowers visited:** *Achillea* (Vujić *et al.*, 2020). **Flight period:** April/July. **Developmental stages:** not described. **Range:** Greece, Poland, Serbia, Turkey, Ukraine; also in Aserbaijan and Iran. **Determination:** Vujić *et al.* (2015) figure the male terminalia and provide a key distinguishing the male from males of four other species of the *M. nanus* group. Morphologically, the female cannot be distinguished from females of other *nanus*-group species. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić *et al*.(2020d).

Merodon robustus Veselić, Vujić & Radenković, 2017
Preferred environment: forest; open areas in evergreen oak forest and maquis (Veselić *et al*, 2017). **Adult habitat and habits:** no data. **Flowers visited:** *Smyrnium perfoliatum* (Vujić *et al*, 2020). **Flight period:** April/May. **Developmental stages:** not described. **Range:** Aegean island of Samos (Greece); Cyprus; Turkey; Israel. **Determination:** Both the male and the female are described by Veselić *et al*.(2017). This species is included in the key to sub-groups of the *aureus* complex provided by Veselić *et al*.(2017), where it is keyed out separately from all named sub-groups. In Ačanski *et al*.(2022) *M. robustus* is recognised as belonging to the *chalybeus* subgroup of the *aureus* complex and included in the key to *chalybeus* subgroup species. **Illustrations of the adult insect:** Veselić *et al*.(2017) provide coloured photos of the male and female in dorsal view, together with photos of other parts of the species, including the head, the abdomen in side view and the hind leg of the male.

Merodon rojoi Radenković & Vujić, in Šašić *et al.*, 2019
Preferred environment: forest; herb-rich open areas in evergreen oak forest and "*Pinus* forests" (Šašić *et al*.(2019). **Adult habitat and habits:** no data. **Flowers visited:** *Prospero autumnale*. **Flight period:** September. **Developmental stages:** not described. **Range:** central and southern Greece. **Determination:** *Merodon rojoi* is one of three cryptic species making up the highly distinctive *dobrogensis* complex (see under *M. dobrogensis*) within the *aureus* group. *Merodon rojoi* is defined genetically and morphometrically in Šašić *et al*, 2019), but segregating it morphologically from the other two *dobrogensis* taxa is extremely difficult (see in Šašić *et al*, 2019). **Illustrations of the adult insect:** the coloured photos in Šašić *et al.* (2019) give a good impression of the appearance of the species of the *dobrogensis* complex.

Merodon rubidiventris Costa, 1884
Preferred environment: small open areas along seasonal streams and rivers in thermophilous *Quercus* forest (Vujić *et al*, 2020a). **Adult habitat and habits:** no data. **Flowers visited:** *Helichrysum.* **Flight period:** May/October. **Developmental stages:** not described. **Range:** believed to be endemic to Corsica and Sardinia (Vujić *et al*, 2020a), earlier records from Greece and Sicily being regarded as erroneous. These erroneous records include a specimen collected by Hurkmans, labelled as collected from Delphi, in central Greece. Vujić *et al.* (2020a) conclude the labelling is in error. It should be noted that in the "Supplementary Material" to their paper, which has to be downloaded separately, the Hurkmans' record is cited for Greece without comment. This species is not listed for Greece in Vujić *et al.* (2020d). **Determination:** under the name *mariae* Hurkmans (1993) describes both sexes of this species and figures the male terminalia. Vujić *et al.* (2020a) establish that *mariae* is a junior synonym of *rubidiventris*, figure its terminalia and provide a key to European species of the *constans* group, including *M. rubidiventris*. **Illustrations of the adult insect:** a coloured photo of the male is provided by Speight & Langlois (2020b).

Merodon ruficornis Meigen, 1822
Preferred environment: forest; alluvial hardwood forest; thermophilous *Quercus* forest. **Adult habitat and habits:** small open areas with dense ground vegetation, within forest; flies fast and low over and among ground vegetation, settling on low-growing plants in the sun. **Flowers visited:** *Allium ursinum, Ranunculus, Taraxacum.* **Flight period:** mid April/mid June. **Developmental stages:** not described. At a calcareous ancient grassland and open *Quercus pubescens* forest site in southern France, with a strong population of *M. ruficornis,* apart from various orchids the only visible geophyte occurring with *M. ruficornis* is the tulip, *Tulipa sylvestris*, which is present there in considerable numbers. The plant occurs in dense clumps of close-packed bulbs, providing what would appear to be ideal conditions for a *Merodon* larva requiring to move from one bulb to another in order to complete its development. No opportunity has been available for digging up *T. sylvestris* bulb clumps at that site in the period January/March, to search for larvae in the bulbs, and no definite association between *M. ruficornis* and this tulip species has been established. Nonetheless, the circumstantial evidence suggests that *Tulipa sylvestris* is worthy of investigation as a potential larval host plant for *M. ruficornis*. **Range**: requires reappraisal, due to recent descriptions of closely similar species, but supposedly known from Belgium south to the Mediterranean and N Africa and eastwards through central and southern Europe to the Caucasus. Vujić *et al.* (2012) confirm the occurrence of *M. ruficornis* in France, Germany, Switzerland, Slovakia, Austria, Hungary, Italy, Serbia, Montenegro, Croatia, Bosnia-Herzegovina, Roumania and the Ukraine. **Determination:** Vujić *et al.* (2012) redefine the species, figure its male terminalia and include it in the key they provide to species of the *ruficornis* group known in Europe. Radenkovic *et al.*(2004) established that *M.recurvus* of Milankov *et al.*(2002) is a junior synonym of *M.ruficornis*. Milankov *et al.*(2008a) point out that *M.ruficornis* sensu Milankov *et al.*(2002) is in fact *M.auripes*. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019), Speight and Langlois (2020a, 2020b) and Pétremand *et al*. (2022).

Merodon rufipes Sack, 1913
Preferred environment: Eastern thermophilous *Quercus* forest; mesophilous *Fagus* forest (Veselić *et al*, 2017). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August/September. **Developmental stages:** not described. **Range:** Bulgaria, Ukraine. **Determination:** Veselić *et al.*(2017) redescribe the species and include it in their key to *bessarabicus* sub-group species of *aureus* group. **Illustrations of the adult insect:** coloured photos are given of the male and female in dorsal view, together with photos of head and male hind leg, in Veselić *et al.*(2017).

Merodon rufus Meigen, 1838
Preferred environment: forest/open ground; open areas within dry forest, both deciduous (mesophilous *Fagus*, thermophilous *Quercus* and evergreen *Q. ilex* forest) and coniferous (dry *Pinus*); up to 1400m in unimproved montane grassland in the Alps, for example on grass-covered scree/talus slopes. **Adult habitat and habits:** flies very fast and low over thinly vegetated ground; settles on bare ground in the sun; females are more often within woodland, in dappled sunlight. **Flowers visited:** composites; *Anthericum, Geranium, Helianthemum, Paradisia, Stellaria, Taraxacum*. According to Peterson *et al.*(2008), *M. rufus* is a specialist pollinator of *Anthericum liliago* (Anthericaceae). It has also been observed feeding on flowers of *Pinus sylvestris* (G. Pétremand, pers.comm.). **Flight period:** mid May/July. **Developmental stages:** a puparium without associated plant host data, but with the male insect that emerged from it, preserved in the collections of the Bavarian State Museum, in Munich, forms the basis of a description and figures of the puparium of this species, in Preradović *et al.* (2018). This species is frequently found in association with *Anthericum* (both *A. liliago* and *A. ramosum*: Asparagaceae), which are regarded as probable host plants. Peterson *et al.*(2008) observed that *M. rufus* was always present with large populations (more than 10, 000 individuals) of *A. liliago*, often absent from medium-sized populations of the plant and always absent from small populations. It can also occur abundantly where *Anthericum* is absent and attempts to find the larva with this plant have been unsuccessful (D Langlois, pers. comm.). **Range:** from Belgium south to the Pyrenees, the Mediterranean and N Africa; through central and southern Europe into European parts of Russia and on to Kazakhstan. **Determination:** Bradescu (1991); Marcos-García *et al.* (2007); Speight and Langlois (2020a, 2020b). The revisionary work of Radenković *et al.* (2020a) converted *M. rufus* into a group of four closely similar species, three of which are endemic to individual mountain massifs on the Balkan peninsula. *M. rufus* itself is separable from these other species by extensive brown dusting on the lower part of the face - the face in the other species is entirely undusted and shining. *M.rufus* does not exhibit the white bands of dusting on its tergites mentioned by van der Goot (1981). As illustrated by Marcos-Garcia *et al*. (2011), the cercus of the male terminalia is flat-ended, and pointed on the side closer to the posterior lobe of the surstylus, unlike the illustration provided by Radenković *et al.* (2020a), where the cercus is shown irregularly round-ended. **Illustrations of the**

adult insect: a coloured photo of the male is provided by Bot and Van de Meutter (2019) and Speight and Langlois (2020a, 2020b).

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Merodon sacki (Paramonov), 1936

Preferred environment: forest/open ground; open areas in evergreen oak forest of *Quercus ilex* and *Q. suber*, and in Mediterranean scrub. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/July**. Developmental stages:** not described. **Range:** known only from a restricted part of the province of Cádiz, in Spain. **Determination:** the original description of *M. sacki* is based on a solitary male. Vujić *et al*.(2020c) redescribe the male, based on the holotype and three additional males collected more than 100 years later. The female remains unknown.Vujić *et al*.(2020c) also figure the male terminalia and include a key, which provides for separation of the male of *M. sacki* from the males of other *serrulatus*-group species known from the western Palaearctic. The deeply curved hind femur helps to distinguish the male of this species. **Illustrations of the adult insect:** none known.

Merodon sapphous Vujić, Pérez-Bañon and Radenković, in Vujić *et al*, 2007

Preferred environment: forest; dry deciduous forest of *Castanea* (Vujić *et al*., 2007); open, herb-rich areas in *Pinus halepensis* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Foeniculum* (Vujić *et al*., 2020). **Flight period:** September/October (Vujić *et al*., 2007). **Developmental stages:** not described. **Range:** Lesvos (Greece), where it occurs in the island's only chestnut forest (Vujić *et al*., 2007); Turkey (supplementary data file, Demirözer *et al*, 2022; Hayat *et al*., 2024). **Determination:** both sexes of the species are described in Vujić *et al*. (2007), together with figures of the male terminalia and some features of the morphology of the female. *M. sapphous* is evidently a species of the "aureus" group, very similar in appearance to *M. legionensis* and *M. quercetorum*. Ståhls *et al*. (2009) include this species in their key to the *Merodon* species of Lesvos. Both sexes of *M. sapphous* are included in the keys in Hayat *et al*. (2024). **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić et al.(2020d).

Merodon satdagensis Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes both the male and the female of this species. He also figures the male terminalia. Vujić *et al*.(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*.(2019). **Illustrations of the adult insect:** none known.

Merodon schachti Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes the male of this species, based on a series of specimens. He also figures the male terminalia. The female of this species remains unknown. Vujić *et al*.(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*.(2019). **Illustrations of the adult insect:** none known.

Merodon segetum (Fabricius), 1794

Preferred environment: open rocky areas of sub-xeric calcareous grassland in Mattoral of *Olea europea*, *Osyris quadripartita*, *Rhamnus alaternus*, *Pistacia lentiscus* and *Pistacia terebinthus* (Ebejer and Bensusan, 2011). **Adult habitat and habits:** settles on bare ground of paths and on low-growing vegetation; flight rapid and noisy (Ebejer and Bensusan, 2011). **Flowers visited:** *Scilla peruviana* (Ebejer and Bensusan, 2011). **Flight period:** March/beginning May. **Developmental stages:** not described. **Range:** Spain; Gibraltar; North Macedonia; Crete, N Africa. **Determination:** included in the key to Iberian *Merodon* species by Marcos-García *et al*. (2007), who also figure the male terminalia. In Vujić *et al*. (2021b) *M. segetum* is treated as a species of the *natans*-lineage and keyed to species in the *natans*-lineage key. In Vujić *et al*. (2021d) it is included in a key to European *Merodon natans* lineage species. **Illustrations of the adult insect:** the general appearance of the male of this species can be seen in the coloured illustration (Figure 15B) in the supplementary data accompanying Vujić *et al*.(2021b).

Merodon serrulatus Wiedemann in Meigen, 1822
Preferred environment: forest/open ground; thermophilous *Quercus* forest; *Castanea* forest (Stahls et al, 2009), evergreen oak forest (*Quercus ilex* and *Q.suber*), dry *Pinus* forest; lentisc scrub; dry, well-vegetated, calcareous and non-calcareous, unimproved grassland and tracksides; hedgehog heath. **Adult habitat and habits:** flies low and very fast, zig-zagging through grasses and tall, herb-rich ground vegetation of tracksides, paths and grassland, emitting a very audible, high-pitched, whining buzz. In grassland, the species flies at the level of the tips of the grass shoots, but in herb-rich track edges it may fly within the vegetation, emerging only briefly and occasionally. It settles on low-growing ground vegetation, often on dead shoots. **Flowers visited:** Umbelliferae; *Cirsium*, *Helianthemum*, *Potentilla*, *Rosa*, *Thapsia*, *Thymus*. **Flight period:** April/ August. **Developmental stages:** not described. **Range:** Portugal and Spain through Mediterranean parts of Europe to Greece and Turkey. Records from elsewhere round the Mediterranean, including N Africa, are now refered to other species of the *serrulatus* group (Vujić *et al*, 2020c). *Merodon serrulatus* is also known from the Ukraine, Kazakhstan and various parts of Russia to as far east as central Siberia. Records in the literature for Roumania require verification. **Determination:** revision of the *serrulatus*-group by Vujić *et al*.(2020c) resulted in description of three new species occurring within Europe and re-instatement of two other European species, all of which had until then been confused under the name *Merodon serrulatus*. One consequence is that identification literature, including keys, predating the Vujić *et al*.(2020c) revision, cannot be relied upon to correctly identify *Merodon serrulatus*. It should be noted that an error in one of the couplets (couplet 14) leading towards *M. serrulatus*, in the key in Vujić *et al*.(2020c), makes it misleading: in the second half of the couplet it is stated "metafemur less incrassate and with almost straight lateral margin". It is the ventral margin of the hind femur which is being referred to, not its lateral margin. The keys provided in Vujić *et al*.(2020c) demonstrate that, in parts of SE Europe, *Merodon serrulatus* cannot always be separated from some of these other taxa, except genetically, unless reliance is put upon knowledge of their biogeographic range as a basis for separating them from *M. serrulatus*, i.e. making an assumption that species which, on existing information, are island endemics will not be found elsewhere. This problem relates to recognition of both males and females of *M. serrulatus*, and differences in the male terminalia, which, while helpful in separating *M. serrulatus*, are subtle and difficult to interpret. Variability in the terminalia of *M.serrulatus* is unwittingly illustrated by Hurkmans (1993), in his figures of the male terminalia of *alexeji* Paramonov and *altinosus* Hurkmans, both subsequently synonymised with *M.serrulatus* by Vujić *et al*.(2011). In addition, Marcos-García *et al*.(2007) establish that *lusitanicus* Hurkmans is a junior synonym of *serrulatus* and Vujić *et al*.(2020c) establish that *tener* of Sack is also a junior synonym of *M. serrulatus*. Conversely, *hirsutus* Sack, synonymised with *serrulatus* by Vujić *et al*.(2011), is re-instated as a separate species by Vujić *et al*.(2020c). **Illustrations of the adult insect:** the male and female are illustrated in colour in Lebard & Speight (2019).

Merodon spineus Vujić, Sašić Zorić & Likov, in Vujić *et al*., 2020a
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August/September. **Developmental stages:** not described. **Range:** apparently endemic to the Ionian island of Corfu (Greece). **Determination:** both male and female of this species are described in Vujić *et al*.(2020a). But *M. spineus* is not distinguishable morphologically from some of the other European *constans* group species and can only be identified genetically. **Illustrations of the adult insect:** none known.

Merodon spinitarsis Paramonov, 1929
Preferred environment: forest; grassy open areas in *Pinus* forest (Vujić *et al*.(2011) and thermophilous deciduous forest; *Castanea* forest (Ricarte *et al*, 2012; Stahls *et al*, 2009). **Adult habitat and habits:** no data. **Flowers visited:** *Anthemis* sp., *Euphorbia* spp., white umbellifers (Vujić *et al*, 2011). **Flight period:** April/July. **Developmental stages:** not described. **Range:** Greece, Roumania, Turkey. **Determination:** Paramonov (1929); Bradescu (1991); Ståhls *et al*.(2009), who include this species in their key to the *Merodon* species of Lesvos. Vujić *et al*. (2021b) indicate that this species occupies a somewhat isolated position and key out *M. spinitarsis* as a separate group, within the *aureus* clade. The male of this species has a diagnostic, thorn-like projection at the base of the hind basitarsus. Both the male and the female are included in the keys in Hayat *et al*. (2024). **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d); http://cyrille.dussaix.pagesperso-orange.fr/

Merodon spinosus Vujić, Radenković & Likov, in Vujić *et al*., 2020a
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** eastern Turkey. **Determination:** both the male and female of *M. spinosus* are

described in Vujić *et al.* (2020a), who also figure features of the male terminalia and provide keys in which the male and female of *M. spinosus* can be distinguished from other European *constans*-group species. However, the female cannot be distinguished morphologically from the female of the Caucasian species, *M. gudaurensis*. **Illustrations of the adult insect:** coloured photos of the abdomen of the male and female of this species are provided by Vujić *et al.* (2020a).

Merodon taniniensis Hurkmans, 1993
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes this species from a series of male specimens and figures the male terminalia. The female remains unknown. Vujić *et al.*(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al.*(2019). **Illustrations of the adult insect:** none known.

Merodon telmateia Hurkmans, 1987
Preferred environment: open ground/freshwater; unimproved, montane/subalpine grassland with seasonal flushes/wet areas according to Hurkmans, (1988). But, from the information provided by Vujić *et al.*(2015) it seems likely Hurkmans' observations were based on both *M. kopensis* and *M. telmateia*. **Adult habitat and habits:** females fly very close (c 10cm) to the ground (Hurkmans, 1988), males somewhat higher. **Flowers visited:** *Euphorbia, Ornithogalum*. **Flight period:** March/August. **Developmental stages:** not described. **Range:** Greece, Israel, European Russia,Turkey and Pakistan. **Determination:** Hurkmans (1987) describes both sexes of the species, figures the male terminalia.and discusses distinctions between *M. telmateia* and *M. aureus, M. fulcratus, M. minutus, M. nanus, M. spinitarsis* and *M. syriacus*. Vujić *et al.* (2015) figure the male terminalia and provide a key distinguishing the male from males of four other species of the *M. nanus* group. In Tubić *et al.* (2018) three named varieties of *M. telmateia* are recognised, one of them occurring only on the Aegean island of Samos (Greece), the other two in western Turkey and Eastern Turkey (plus Israel) respectively. The keys in Hayat *et al*. (2024), on the syrphid fauna of parts of central Turkey, include both the male and female of *M. telmateia*. **Illustrations of the adult insect:** the general appearance of this species can be seen in the coloured photos of the male provided by Tubić et al.(2018).

Merodon teruelensis (van der Goot), 1966
Preferred environment: forest/open ground; small, marshy, open areas in evergreen oak maquis, garrigue and scrub-invaded grassland (V.S. van der Goot, pers.comm.), also wet meadows (M.-A. Marcos-García, pers.comm.); in France around the margins of poor fen. **Adult habitat and habits:** flies fast and low through ground vegetation. **Flowers visited:** *Senecio* sp. **Flight period:** May, July/beginning August. **Developmental stages:** not described. **Range:** northern and central Spain and southern France (Speight & Descaves, 2015). **Determination:** Marcos-García *et al.*(2007), who redefine the species, figure its male terminalia and include it in their keys. **Illustrations of the adult insect:** the male is shown in colour in Speight and Langlois (2020a, 2020b).

Merodon testaceus Sack, 1913
Preferred environment: forest; thermophilous deciduous forest; *Castanea* forest (Ricarte *et al*, 2012; Ståhls *et al*, 2009); sub-arid, open, unimproved grassland; Aegean phrygana. **Adult habitat and habits:** settles on stoney bare ground. **Flowers visited:** *Ferula, Foeniculum*. **Flight period:** May, August/September. **Developmental stages:** not described. **Range:** Italy (Burgio *et al*, 2015); North Macedonia; Serbia; Greece; Turkey. **Determination:** included in the keys provided by Sack (1928-32). Hurkmans (1993) redescribes both male and female of this species and figures the male terminalia. Ståhls *et al.*(2009) include this species in their key to the *Merodon* species of Lesvos, and figure the surstylus of the male terminalia. Vujić *et al.*(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is also included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al.*(2019). Vujić *et al.*(2021c) establish that both *Merodon manicatus* of Sack and *M. testaceoides* of Hurkmans (treated in Vujić *et al*, 2021c, as *testacoides*) are synonyms of *M. testaceus*. **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photo provided by Vujić *et al.* (2020d) and Speight and Langlois (2020a, 2020b).

Merodon toscanus Hurkmans, 1993
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** Italy. **Determination:** Hurkmans' (1993) description of this species is based on a solitary male. He provides a figure of the male terminalia. The female remains unknown. Vujić *et al*.(2013c) provide a key to separate the male of this species from males of other European members of the *nigritarsis* group and figure features of the male terminalia. This species is included in the key to males of *avidus* group and *nigritarsis* group species provided by Likov *et al*.(2019). **Illustrations of the adult insect:** none known.

Merodon trebevicensis Strobl, 1900
Preferred environment: open ground/forest, open grassy and tall-herb areas in montane, mesophilous *Fagus* forest and *Castanea* forest of southern Europe. **Adult habitat and habits:** flies fast through and at the tops of, tall herb and long grass vegetation and also at greater heights above the ground round the foliage of shrubs. **Flowers visited:** yellow umbellifers; yellow composites; *Aegopodium*, *Ranunculus*. **Flight period:** May/end June. **Developmental stages:** not described. **Range:** Slovakia, Switzerland (?), Austria, Italy, Bulgaria, Roumania, the Balkans, the Crimea and Turkey. **Determination:** Vujić *et al*.(2012), who redefine the species, figure its male terminalia and provide a key in which *M.trebevicensis* is separated from other *ruficornis* group species known in Europe. Until recently, this species has appeared in literature under the name *M.crymensis*. Radenkovic *et al*.(2004) established that *crymensis* Paramonov is a junior synonym of *trebevicensis*. Vujić *et al*.(2012) demonstrate that another species, which they describe as *M.gallicus*, had until then been confused with *M.trebevicensis*. Theirs is currently the only key including all known European species of the *ruficornis* group, and thus the only key which may be used to separate *M.trebevicensis* from the other species of this group. However, their key to males includes an anomaly, placing *M.trebicensis* in the section of the key in which the protuberance on the ventral surface of the hind femur is "as long as or longer than" the process on the hind trochanter, although in a subsequent couplet in the same key *trebevicensis* is stated to exhibit a protuberance on the ventral surface of the hind femur "shorter or the same length as" the process on the hind trochanter. The effect of this anomaly is that males of *trebevicenis* in which the protuberance on the ventral surface of the hind femur is shorter than that on the hind trochanter, would actually run to *M.armipes* in the key. Such males may in fact be distinguished from *M.armipes* males by the character of the protuberance on the hind trochanter. In *M.armipes* this protuberance takes the form of an unusually large, pointed spike, making the length of the hind trochanter, from its base to the apex of the spike, greater than the depth of the hind femur. In *M.trebevicensis* the protuberance on the hind trochanter is also pointed, but much shorter, so that the trochanter, from its base to the tip of the protuberance, is shorter than the depth of the hind femur. **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photo provided by Vujić *et al*.(2020d).

Merodon triangulum Vujić, Radenković & Hurkmans, in Vujić *et al*, 2020a
Preferred environment: forest; open areas within mesophilous *Fagus* forest and eastern thermophilous *Quercus* forest (Vujić *et al*, 2020a); seasonally-flooded grassland; humid (seasonally-flooded?), open, grassy areas within *Salix* forest (Van Steenis *et al*, 2015). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** the larva and puparium are described and figured by Aracil *et al*. (2024), based on mature larvae found feeding within bulbs of *Leucojum vernum* in March, reared to produce adults in June and July. **Range:** the eastern extremity of Italy (Trieste); eastern Austria; Hungary; parts of the Balkan peninsula (Croatia, Montenegro, N Macedonia, Serbia, Slovenia). **Determination:** both male and female of this constans-group species are described in Vujić *et al*.(2020a), who also figure features of the male terminalia and provide keys separating *M. triangulum* from the other European species of this group. Vujić *et al*.(2020a) also point out that *M. triangulum* is the *M. haemorrhoidalis* of Van Steenis *et al*.(2015). **Illustrations of the adult insect:** none known.

Merodon tricinctus Sack, 1913
Preferred environment: forest; evergreen oak forest (*Q.ilex*) and montane, dry *Pinus* forest. **Adult habitat and habits:** flies fast and low over patchily-vegetated ground in open areas within dry forest, settling on bare ground. **Flowers visited:** umbellifers; Genista, *Thapsia*. **Flight period:** April/May and July/September. **Developmental stages:** not described. **Range:** from central France (Massif Central) south to the Mediterranean (including Sardinia, Sicily) and N Africa; from Spain eastwards through southern Europe to Greece, Bulgaria, Ukraine (Crimea), Turkey and the Caucasus; also in Israel; in Switzerland in central Europe. **Determination:** Sack (1928-32). This species appears in much recent literature under the name *monticola* Villeneuve. Popov (2000) figures the male terminalia of *M.tricinctus* and demonstrates that *M.karadaghensis*

is a synonym of *M.tricinctus*. Marcos-García *et al*. (2007) suggest very strongly that *tricinctus* Sack will prove to be a junior synonym of *obscuritarsis* Strobl, but they do not formally establish that synonymy. The male terminalia of the species recognised here as *M. tricinctus* correspond with those of *M. obscuritarsis*, as figured by Marcos-Garciia et al.(2007). **Illustrations of the adult insect:** none known.

Merodon trispinus Vujić & Radenković, in Vujić *et al*., 2022
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end May/beginning July. **Developmental stages:** not described. **Range:** SW Turkey**. Determination:** both male and female of this species are described in Vujić *et al*. (2022), where the male terminalia and various other morphological features are illustrated and *M. trispinus* is also included in an updated key to the species of the *ruficornis* species group. Vujić *et al*. (2022) demonstrate that, genetically, *M. trispinus* is closely similar to *M. hoplitis*. **Illustrations of the adult insect:** none known.

Merodon trochantericus Costa, 1884
Preferred environment: forest/open ground: thermophilous *Quercus* and evergreen oak (*Q.suber*) forest, maquis, thermophilous forest fringes: unimproved, calcareous, coastal grassland and heath at the northern edge of its range. **Adult habitat and habits:** open areas in dry, deciduous and evergreen forest. Flies fast and low through tall ground vegetation. **Flowers visited:** *Cistus, Euphorbia, Quercus coccifera, Scilla autumnalis*. **Flight period:** May/June and mid July/September. **Developmental stages:** undescribed. It has been postulated that one of the larval host plants of this species is *Scilla autumnalis*. **Range:** from the Channel Isles and northern France south to Spain and the Mediterranean; Corsica, Sardinia, Italy; Algeria in N Africa. **Determination:** Sack (1928-32). In its general appearance, the female of *M.trochantericus* resembles the female of *M.albifrons*, but has a small (nonetheless distinct), pointed, lamellate projection on the tip of the hind trochanter, distinguishing it from both the female of *M.albifrons* and the females of many other Merodon species. The ornamentation of the male hind leg is shown in colour by Ransom (2016). **Illustrations of the adult insect:** the appearance of the female can be seen in the coloured photo provided by Vujić *et al*. (2020d). A coloured photo of the male is provided in Speight and Langlois (2020a, 2020b).

Merodon turcicus Vujić & Hayat, in Vujić *et al*., 2012
Preferred environment: this is a montane/subalpine species. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/beginning of August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** the description of this species is presented in Vujić *et al*. (2012). Both sexes of *M. turcicus* are described, the male terminalia are figured and the species is included in the key provided, to *ruficornis* group species known in Europe. **Illustrations of the adult insect:** none known.

Merodon unguicornis Strobl in Czerny & Strobl, 1909
Preferred environment: forest/scrub; open *Quercus ilex* forest and maquis (Marcos-García *et al*, 2007); *Q.rotundifolia* woodland (M.-A. Marcos-García pers.comm.); unimproved, montane dry grassland with *Q. pyrenaica* scrub (Lorenzo *et al*, 2020); hedgehog heath (M.-A. Marcos-García, pers.comm.). Adult **habitat and habits:** flies at up to 1m from the ground, through low shrub vegetation (Marcos-García, pers.comm.). **Flowers visited:** *Brachypodium, Cistus, Erinacia anthyllis, Euphorbia, Helianthemum, Sedum, Thymus* (Marcos-García *et al*, 2007). **Flight period:** April/July. **Developmental stages:** not described. **Range:** Spain (from northern parts to the Mediterranean); N Africa (Morocco). Withers (2017) alludes to an unsubstantiated record of this species from France. **Determination:** this species is included in the keys provided by Marcos-García *et al*. (2007), who figure the male terminalia. These authors also establish that *andalusiacus* Paramonov, *bolivari* Gil Collado and *hispanicus* Sack are all junior synonyms of *unguicornis* Strobl. Sasić *et al*. (2016) indicate that *M. unguicornis* occupies a rather isolated position, within the *aureus* group, and is keyed out separately from all the sub-groups of the *aureus* group in the key provided by Veselić *et al*. (2017). **Illustrations of the adult insect:** none known.

Merodon unicolor Strobl in Czerny & Strobl, 1909
Preferred environment: forest/open ground; well-drained, non-calcareous, montane and sub-alpine unimproved grassland (Marcos-García *et al*., 2007); hedgehog heath (M.-A. Marcos-García, pers.comm.); unimproved, dry, montane grassland with scattered *Quercus pyrenaica* scrub (Lorenzo *et al*., 2020); open, grassy areas in montane *Betula* and *Pinus* forest, up to and including *P. uncinata* forest in the Pyrenees. **Adult habitat and habits:** fast-flying, at up to 1.5m from the ground, through

and around tall ground vegetation. **Flowers visited:** *Anthemis mixta* (Marcos-García *et al*., 2007). **Flight period:** April/September. **Developmental stages:** not described. **Range:** mountainous parts of northern and central Spain; Pyrenees (Andorra, France) and Haute-Languedoc (Hérault) in SW France; northern Italy mountain ranges in NW Africa. **Determination:** Marcos-García *et al*. (2007), who redefine the species figure its male terminalia and include it in their keys. This is a species of the *aureus* group that closely resembles *M. aureus* and *M. pumilus*, other than in that the eyes are entirely pale-haired (black over dorsal half in *M. aureus* and *M. pumilus*). It is distinguished from *M. aureus* and *M. pumilus* in a key included in Vujić *et al*. (2020b). **Illustrations of the adult insect:** none known.

Merodon vandergooti Hurkmans, 1993
Preferred environment: maquis and Eastern Mediterranean pine/thermophilous oak forest of *Quercus libani/Q. infectoria*, with *Juniperus* and *Acer monspessulanum* in Israel (Vujić *et al*., 2024b). **Adult habitat and habits:** no data. **Flowers visited:** white umbellifers (Vujić *et al*. (2011). **Flight period:** April/July. **Developmental stages:** not described. **Range:** Turkey, Israel, Syria. **Determination:** Hurkmans (1993) bases the description of this species on a series of males and figures the male terminalia. Hurkmans (1993) described the female of *M. vandergooti* under the name *M. aureotibia*. Vujić *et al*. (2011) established the synonymy of *aureotibia* with *vandergooti*. *Merodon vandergooti* is a member of the *clavipes* species group and included in the key provided by Vujić *et al*. (2024b), together with figures of the male genitalia and coloured photos of the male and female abdomen in dorsal view. **Illustrations of the adult insect:** none known.

Merodon velox Loew, 1869
Preferred environment: forest/open ground; semi-arid, stony, thinly-vegetated, unimproved grassland and open areas in *Abies* forest; *Castanea* forest. **Adult habitat and habits:** this species apparently resembles a small *Xylocopa* in the field and continues in flight at temperatures above 35°. Males are strongly territorial and both sexes fly low and fast through ground vegetation (data from Hurkmans and Hayat (1997). The species has been found drinking at the edge of a small stream, in the evening of a hot day (Reemer and Smit, 2007). **Flowers visited:** umbellifers; *Euphorbia* (Hurkmans and Hayat (1997). **Flight period:** May/August. **Developmental stages:** not described. **Range:** Italy, Greece, Turkey, Armenia, Georgia, Azerbaijan. **Determination:** Hurkmans (1993), who figures the male terminalia. Ståhls *et al*. (2009) include this species in their key to the *Merodon* species of Lesvos. In Vujić *et al*. (2024b), *M. velox* is consigned to the *clavipes* species group and included in the key to the species of this group, together with figures of the male genitalia and coloured photos of various other parts of the insect. **Illustrations of the adult insect:** a coloured photo of the male is provided in Speight and Langlois (2020a, 2020b).

Merodon virgatus Vujić & Radenković, in Šašić *et al*, 2016
Preferred environment: unimproved, montane and subalpine grassland up to 2000m alt. **Adult habitat and habits:** no data. **Flowers visited:** *Thymus/Thymbra* (Vujić *et al*., 2020). **Flight period:** July. **Developmental stages:** not described. **Range:** Balkanic peninsula: Bosnia Herzegovina, Croatia, North Macedonia, Greece, Montenegro, Serbia. **Determination:** a cryptic species of the *cinereus* sub-group of the *Merodon aureus* group, morphologically virtually indistinguishable from *M. atratus* and *M. balkanicus*, and defined genetically and morphometrically in Šašić *et al*.(2016). **Illustrations of the adult insect:** the appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Merodon vladimiri Vujić & Tubić, in Tubić *et al*., 2018
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** North Macedonia. **Determination:** this species is described from a solitary male, in Tubić *et al*. (2018). The female is unknown. *M. vladimiri* is a member of the *Merodon nanus* group, dependent on features of the male terminalia for morphological separation from other members of the group, but also genetically distinct (Tubić et al., 2018). **Illustrations of the adult insect:** The coloured photo of the male provided by Tubić *et al*.(2018), shows the general appearance of the species.

Merodon warnckei Hurkmans, 1993
Preferred environment: subalpine zone. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes both sexes of this species and figures the male terminalia. Vujić *et al*. (2022b) redescribe the species, figure its male terminalia and provide a key in which both the male and female of *M. warnchei* are distinguished from other known species of the *aberrans* group.

Illustrations of the adult insect: separate photos of the head, thorax and abdomen are provided, in colour, by Vujić *et al*. (2022b).

MESEMBRIUS
There is only one *Mesembrius* species known in Europe.

Mesembrius peregrinus (Loew), 1846
Preferred environment: wetland/freshwater; temporary pools in humid, seasonally-flooded, unimproved grassland and on alluvial floodplains in general, including slightly brackish waters. **Adult habitat and habits**: tall, waterside vegetation. **Flowers visited**: umbellifers; *Euphorbia* (Kormann, 1993); *Paliurus spina-christi* (M. de C. Williams, pers.comm.); *Rubus* (Maritano, 2021); *Brassica, Lepidium draba, Prunus spinosa* (Gonier, 2024). **Flight period**: May/September. **Developmental stages:** not described. **Range**: from southern Germany south to the Mediterranean; through parts of central Europe (Switzerland, Austria, Hungary) and southern Europe (Italy, former Yugoslavia, Bulgaria, Roumania) to Israel; from the Ukraine and the Caucasus (Georgia) eastwards through southern parts of the Palaearctic to the Pacific and northern China. **Determination:** Bradescu (1991). In its general appearance, *M. peregrinus* could be mistaken for a species of *Parhelophilus*. Further, it has, in the male, a tuft of black, bristly hairs towards the base of the hind femora, ventrally. However, in *M. peregrinus*, the hind tibiae have a uniformly dense and long thick, posteroventral fringe of black hairs for almost their entire length and the tarsal segments of the front legs are flattened and expanded into a leaf-like form reminiscent of males of *Platycheirus* species. In some females, the pale markings on the abdomen can be represented only by grey patches of dusting, giving the abdominal dorsum a sombre appearance, more similar to the situation found in some *Anasimyia* species. However, female specimens in alcohol can reveal the presence of a pair of pale markings on tergites 2 and 3. The hind tibiae also have a posteroventral fringe of black hairs in the female, but more irregular in both density and length, so that it is sparse in the basal third and with a few noticeably longer hairs scattered in from about the mid-point of the tibial length. **Illustrations of the adult insect:** The male is illustrated in colour by Kormann (1988). The male and female and illustrated in colour by Speight and De Courcy Williams (2021), Pétremand *et al*. (2022) and Louboutin *et al*. (2023).

***MICRODON*:** see under Microdontidae, following the species accounts of Syrphidae.

MILESIA

Hippa (1990) provides a world revision of the genus, including identification keys. The two European species he recognises are listed by Peck (1988). Since then the Cretan endemic species, *M. cretica*, has been described. *Milesia* reaches its greatest diversity in the Oriental region, but also occurs in the Palaearctic, the Nearctic and the Afrotropical.

Milesia crabroniformis (Fabricius), 1775
Preferred environment: evergreen oak (*Q. ilex/Q. suber*) forest and deciduous forest (mesophilous *Fagus*, acidophilous *Quercus*, thermophilous *Quercus, Castanea*) with over-mature trees; organic olive orchards with overmature trees. **Adult habitat and habits:** within forest, the adults tend to fly high among trees, descending only to feed, drink or oviposit. Flowers visited are usually tall herbs, for example, *Sambucus ebulus* is particularly frequented. The adult fly is as often met with in the vicinity of streams as elsewhere. It settles in patches of sun at the stream edge to drink, toward the middle of the day and in early afternoon. It is not restricted to forests with permanent streams, but can occur where standing or running water are almost entirely absent (except after rain) during the adult flight period. Visually a very convincing mimic of the hornet, *Vespa crabro*, *M.crabroniformis* also flies in a manner very reminiscent of this large wasp, and the buzzing sound it emits in flight is very close to that made by the hornet. Both of these insects are on the wing at the same time of the year, and in the same forest biotopes. *M. crabriformis* exhibits a distinct tendency to follow streams away from the forest biotope, so that the fly can be found feeding at streamside flowers in open country, some kilometres from the nearest potential larval habitat. **Flowers visited:** white umbellifers; *Cirsium* spp., *Fallopia japonica, Hedera, Lythrum salicaria, Mentha aquatica, Sambucus ebulus, Scabiosa*. **Flight period:** July/October, peak at end August/beginning September. **Developmental stages:** Matile and Leclercq (1992) described what they believed to be the puparium of this species, collected from tree hole debris in an old *Fagus*. Orengo-Green *et al*. (2023) confirm that the larval mouth-parts and puparium figured by Matile and Leclercq (1992) are correctly referred to *M. crabroniformis*, not to some other syrphid as previously suggested. Orengo-Green *et al*.

(2023) describe and figure in detail the larva and puparium of *M. crabroniformis*, reared from "rot-holes filled with water and debris" between the mature stems of ancient, living coppice stools of *Castanea*. Larval development apparently takes 2 years. They also mention collection of *M. crabroniformis* in emergence traps over trunk rot-holes in *Fraxinus angustior*.The female of *M.crabroniformis* has also been seen ovipositing in the bark at the base of an old, living *Quercus* that was largely hollow and filled with a metre of tree humus and (T. Lebard, pers. comm.) within the entrance to a trunk rot-hole in an old, living olive tree, in an organic olive orchard with abundant *M. crabroniformis*. **Range:** from northern France (Brittany) south to central Spain and round the Mediterranean, including islands, to the former Yugoslavia, Greece and Turkey; Georgia; also in N Africa. There are some records from central Europe (Switzerland). This species is not known from Russia. It is now very localised in parts of its range and apparently retreating at the northern edge of its range, though there are indications that recently it may have become established in Britain, where sightings of the species in SW England in 2006 and 2007 have been announced (Gainey, 2008;Tremewan, 2008). Given the large size and unmistakable appearance of *M. crabroniformis*, it would be surprising if those sightings were erroneous. But until a specimen has been more securely recorded it would be premature to cite Britain as part of the range of this species. **Determination:** Bot *et al*. (2022). The key provided in the StN Keys volume can be used for separation of *M. crabroniformis* and *M. semiluctifera*. The male terminalia are figured by Hippa (1978). *M.crabroniformis* can also be distinguished from the other European *Milesia, M. semiluctifera* (Villiers), using Séguy (1961), or Hippa (1990). **Illustrations of the adult insect:** the adult insect is figured in black and white by Matile & Leclercq (1992). A coloured photo of the female is provided by Smit *et al*. (2004). The male is illustrated in colour by Speight and De Courcy Williams (2016). The male and female are illustrated in colour together, in Pétremand *et al*. (2022).

Milesia cretica Bot & Van Steenis, in Bot *et al*., 2022
Preferred environment: riparian *Platanus orientalis* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Hedera helix*. **Flight period:** June, October/November. **Developmental stages:** developmental stages not known, but a female has been observed apparently ovipositing in rotten wood at the trunk base of a living *Platanus orientalis* (Bot *et al*., 2022). **Range:** apparently endemic to the Mediterranean island of Crete (Greece). **Determination:** both the male and female of this species are described in Bot *et al*. (2022). The description is accompanied by a figure of the male terminalia and a key providing for the separation of *M. cretica* from the other two *Milesia* species known in Europe. **Illustrations of the adult insect:** the male and female are illustrated in colour by Bot *et al*. (2022).

Milesia semiluctifera (Villers), 1789
Preferred environment: forest; thermophilous and evergreen *Quercus* forest with overmature trees; *Castanea* forest. **Adult habitat and habits**: flight strong and direct, at levels from the canopy of evergreen oak forest to close to the ground; feeds at the flowers of low-growing plants in the morning (c.9.00a.m.-10.30a.m.), where it bears a close resemblance to large scoliid wasps (*Scolia* spp.) which may be found on the same flowers; settles on fallen timber; visits forest stream margins to drink during the afternoon, settling on mud in shaded spots adjacent to patches of sunlight. **Flowers visited**: white umbellifers; *Bupleurum, Eryngium, Euphorbia, Hedera, Scabiosa, Sedum*. **Flight period**: July/August. **Developmental stages:** not described. **Range**: Mediterranean basin, from central Spain through southern France to Italy (plus Sicily) and on to the former Yugoslavia, Greece and Bulgaria; Israel and Syria; in central Europe from south-east Switzerland; Roumania and the Ukraine to the Caucasus and on to as far as Turkmenistan in Asia. **Determination**: Bot *et al*. (2022). The keys provided in StN Keys volume, Séguy (1961) and Hippa (1990) can be used for separation of *M. crabroniformis* from *M. semiluctifera*. **Illustrations of the adult insect:** The adult insect is figured in black and white by Matile & Leclercq (1992) and in colour by Rotheray and Gilbert (2011). The male is illustrated in colour by Speight and De Courcy Williams (2016).

MYATHROPA

M. florea is the only species of *Myathropa* currently recognised as occurring in Europe, except for on the Madeiran islands, to which a second species, *M. usta*, is endemic.

Myathropa florea (L.), 1758
Preferred environment: most types of deciduous forest; also in fen carr; to some extent anthropophilic, occurring in humid pasturage and suburban gardens. **Adult habitat and habits:** clearings, tracksides, hedgerows; flies fast, usually at 2m upwards in height; males circulate at speed, making a highly audible, high-pitched buzzing, among the branches of trees in bloom; both sexes fly along the margins of woodland streams, settling on stones etc. at the water's edge, often in order to

drink; females often frequent puddles of water beside fallen or felled trees. **Flowers visited:** white umbellifers; *Castanea, Convolvulus, Crataegus, Chaerophyllum, Euonymus, Filipendula, Hedera, Rhododendron, Rubus, Sambucus, Solidago, Sorbus, Viburnum opulus*. **Flight period:** May/October, with peaks in June and August. **Developmental stages:** larva described and figured by Hartley (1961) and Rotheray (1994) and illustrated in colour by Rotheray (1994); puparium illustrated in colour by Dussaix (2013); larva aquatic, frequent in standing-water rot-holes and in water-filled hollows among tree-roots, on tree stumps or at the junction between major branches and trunk, from ground level to high in the tree (at least 10m). The larva has been found in association with various deciduous trees, including *Alnus, Betula, Castanea, Fagus, Populus* and *Quercus*, and especially with *Fagus*, but also with conifers, e.g. *Pinus sylvestris* (Dussaix, 2005b). Larvae can also develop in wet cow dung and compost heaps. Whether the species can also use silage effluent and/or manure heaps is uncertain. Although larval development can be rapid (some months only) it may take two or more years. Larval biology of this species is reviewed by Rotheray (1994). Greig (1989) provides details of overwintering by *Myathropa* larvae, suggesting their main cause of mortality is the drying-up of many rot-holes toward the end of the winter. Dussaix (2013) observes that duration of the puparial phase is more than 3 weeks, for puparia derived from overwintering larvae, but 2 weeks for puparia from non-overwintering larvae. Sánchez-Galván *et al*. (2014) show that successful development of larvae of *M. florea* in a trunk cavity can be enhanced by the presence there of the faeces of saproxylic Coleoptera. **Range:** from Fennoscandia south to Iberia and the Mediterranean, the Canary Isles and N.Africa; from Ireland eastwards through Eurasia to the Pacific coast. **Determination:** van der Goot (1981). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Myathropa usta (Wollaston), 1858
Preferred environment: forest; Madeiran Laurisilva (*Deschampsietum argenteae* association) and Cloud heath-forest (*Vaccinio - Sibthorpietum* association) (J. T. Smit, pers. comm.). **Adult habitat and habits:** insufficient data, but has been found at tracksides and forest-edges, feeding at flowers or sitting on leaves (J. T. Smit, pers. comm.). **Flowers visited:** *Ranunculus arvensis, R. cortusifolius, R. muricatus, R. repens, Tolpis succulenta, T. macrorhiza* (J. T. Smit, pers. comm.), *Hydrangea* (Barkemeyer, 1999). **Flight period:** March/September (probably present the whole year round), with a peak in July (J. T. Smit, pers. comm.). **Developmental stages:** undescribed, but most probably like *M. florea*, aquatic in standing-water, rot-holes and in water-filled hollows among tree roots (J. T. Smit, pers. comm.). **Range:** endemic to Madeira (Portugal), where it is the only *Myathropa* species known to occur. **Determination:** Frey (1939). This species has been included in *Eristalis* in recent literature (e.g. Peck, 1988). Barkemeyer (1999) established that *mallotiformis* of Frey is a junior synonym of *usta* of Wollaston, at the same time transferring *usta* to *Myathropa*. **Illustrations of the adult insect:** Smit *et al*. (2004) and Rego *et al*. (2022) each provide a coloured figure of *M. usta*.

MYOLEPTA

Peck (1988) lists seven European species of *Myolepta*. In the revision of Reemer et al.(2005) one of them, *M.helvetica* (Wainwright) is shown to be a synonym of *M.vara*. In the same publication *M.trojana* is described from south-western parts of Turkey.

Myolepta difformis Strobl in Czerny & Strobl, 1909
Preferred environment: forest; riparian *Fraxinus angustifolia* forest within thermophilous *Quercus* forest. **Adult habitat and habits**: no data. **Flowers visited**: white umbelifers (Carles-Tolrá, 2006). **Flight period**: mid-April to mid-July. **Developmental stages:** larval and puparial features are described and figured by Ricarte et al.(2007), from material collected from water-containing rot-holes in the trunk of ancient, live *Fraxinus angustifolia* along the edge of a river within *Quercus pyrenaica* forest. Adults have been collected from emergence traps over trunk holes in old, living *Fraxinus angustifolia*, *Quercus pyrenaica* and *Q. rotundifolia* (Conca-Esquembre, 2024). Sánchez-Galván et al.(2014) provide information suggesting that a pre-requisite for development of larvae of *M. difformis* in a trunk cavity may be the presence there of larvae of saproxylic beetles, citing the Iberian saproxylic cetoniid *Cetonia aurataeformis*, whose faeces are known to be rich in accessible nutrients (Micó et al, 2011). **Range**: published European records for this species are only from Portugal and Spain, where the species seems to be extremely infrequent. It should probably be regarded as threatened at European level. *M.difformis* is also known from N Africa (Algeria, Morocco, and Tunisia). **Determination:** Reemer *et al*. (2005). The red-brown post-alar calli of this species serve to distinguish it from other known European *Myolepta* species. In the male, tergite 2

is largely pale, with an abbreviated black mark, medially, that fades out toward the posterior margin of the tergite. The other tergites are entirely black. The female may have an abdomen that is entirely dark, as in *M.vara*, but tergite 2 can be paler, orange-brown darkened along the mid-line, to give a vague, median black stripe. Reemer et al.(2005) conclude that *M.philonis* Séguy, described from N Africa, is a junior synonym of *M.difformis*. **Illustrations of the adult insect:** none known.

Myolepta dubia (Fabricius), 1805

Preferred environment: deciduous and evergreen forest; alluvial hardwood forest, mesophilous *Fagus;* acidophilous *Quercus;* thermophilous *Quercus* forest; *Q.suber* forest maintained for cork production; maquis of evergreen *Q.ilex/Q.suber*, with overmature and senescent trees and sometimes old orchards with ancient trees. **Adult habitat and habits**: to a significant extent arboreal, but visits low-growing plants in flower, usually in dappled sunlight at the edge of woodland paths or in small glades; also to be found in dappled sunlight on the foliage of *Rubus* etc., along streams in woodland; females may be found inspecting tree wounds and patches of rot on the trunk of living trees, especially *Quercus* species. **Flowers visited:** white umbellifers; *Cistus, Crataegus, Potentilla erecta, Prunus* and *Rubus*. **Flight period:** mid May/August with the peak in June. **Developmental stages:** larva described and figured by Dusek and Laska (1960), based on larvae from a wet tree hole in *Populus italica*; described and figured by Hartley (1961) from larvae collected in a small, wet rot hole in the trunk of an overmature *Fagus*; also reared from a water-filled rot-hole in the trunk of a live *Fagus* by Dussaix (1997a). Adults have been collected from emergence traps over trunk holes in old, living *Quercus pyrenaica* (Conca-Esquembre, 2024). The larva is illustrated in colour by Rotheray (1994); puparium shown in colour by Dussaix (2013). Larvae have also been found May in a water-filled cavity beneath the bark of the trunk of a mature *Acer*, larvae of three distinct sizes being found together, indicating that this species requires more than one year to complete its development. This species overwinters as a larva. Dussaix (2013) reports that duration of the puparial phase is two and a half weeks. **Range:** from southern Sweden south to Spain and the Mediterranean; from Britain (southern England) eastwards through central and southern Europe (Italy, former Yugoslavia) into European parts of Russia. **Determination:** Reemer et al.(2005). In most recent literature this species appears as *M.luteola* (Gmelin). Thomson and Pont (1994) demonstrate that the name *luteola* is not available for this species and introduce *dubia* of Fabricius as the valid replacement. Chandler (1998) erroneously refers to "*Musca dubia* Fabricius" as the origin of the name. But Fabricius described no species under the name *Musca dubia*. The name *dubia* now used for *M.luteola* comes from "*Thereva dubia*" of Fabricius. However, Zimsen (1964) points out that there is no type material of "*Thereva dubia*" of Fabricius in existence and Thompson and Pont (1994) fail to designate a neotype for their interpretation of this species, fail to provide a redescription of it and fail to indicate any source of published description of a *Myolepta* species that they regard as referable to their interpretation of *Myolepta dubia*. Subsequently, Reemer et al.(2005) have redescribed the species and designated a neotype. The hypandrium of the male terminalia of this species is supposedly figured by Reemer et al.(2004), but the figure (12c, p.576) would seem either to be inaccurate or to depict a different species. In contrast, the hypandrium illustrated in the corresponding figure (12h, p.576) for the extremely similar *M.trojana*, appears identical to the hypandria of *M.dubia* males examined by the author and originating in various parts of Europe. It would seem possible that these two figures have been mislabelled, with the figure for *M.dubia* appearing under the name *M.trojana*, and vice versa. The only other potential interpretation would be that the figure for *M.dubia* (12c, p.576) shows an as yet undescribed species and that the hypandria of *M.dubia* and *M.trojana* are identical, which would call into question both the validity of *M.trojana* as a distinct species and the identity of *M.dubia* as defined by Reemer et al.(2005), if their figure (12c, p.576) is based on the neotype of *M.dubia* designated by them (the text does not indicate what specimen that figure is based on). These issues clearly require clarification. The female of this species remains extremely difficult to distinguish from the female of *M.potens*. **Illustrations of the adult insect:** The adult insect is illustrated (as *M.luteola*) in colour by Stubbs and Falk (1983) , Torp (1994) and (as *M.dubia*) by Bartsch et al.(2009b).

Myolepta nigritarsis Coe, 1957

Preferred environment: forest; overmature and senescent evergreen oak forest of *Q.ilex* and *Q.suber*; also recorded from thermophilous *Q.pubescens* forest; Balkanic thermophilous oak forest of *Quercus frainetto/Q. cerris*. **Adult habitat and habits**: flies rapidly at 1-2 metres from the ground, among tall herb and low shrub vegetation, in the sun. Females have been observed ovipositing at sap runs on *Q.suber*. This species also visits the edge of seepages and small streams in order to drink, when it is hot. **Flowers visited**: *Cistus monspeliensis, Crataegus, Euphorbia, Orlaya grandiflora*. **Flight period**: beginning of May to mid July. **Developmental stages:** not described; the female has been observed investigating a small sap run on the trunk of *Quercus ithaburensis.* **Range**: southern France, Italy, Austria, Hungary, Roumania, Greece, Crete and parts of the former Yugoslavia (Croatia, North Macedonia, Serbia); southern parts of European Russia and on into Turkey, Azerbaijan

and Armenia. **Determination:** Reemer et al.(2005). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/. The female is illustrated in colour by Speight and De Courcy Williams (2016).

Myolepta obscura Becher, 1882
Preferred environment: forest; alluvial softwood forest with overmature and senescent *Populus* and riparian *Fraxinus* forest, including along temporary streams; *Quercus/Carpinus/Ulmus* forest; thermophilous *Quercus* forest, both Western and Balkanic. **Adult habitat and habits**: on hot days both sexes visit damp sand at the edge of forest streams, to drink, in dappled sunlight; has also been observed on a sap run on the trunk of an old *Populus nigra* (Louboutin *et al*., 2023). **Flowers visited**: *Anthriscus*, *Photinia*, *Sorbus torminalis*. **Flight period**: end of April to end of May. **Developmental stages:** described (and compared with the larva of probably *M.dubia*), from a larva collected in a wet tree hole in *Populus*, by Becher (1882); larval and puparial features redescribed and figured by Ricarte *et al*. (2007), from material reared from a water-filled rot-hole in the trunk of an ancient, live *Fraxinus angustifolia*. **Range:** from northern France through Germany to Switzerland (extinct?) and on into northern Italy, southern Austria, Roumania and the Caucasus (Azerbaijan); Portugal. **Determination:** Reemer *et al*. (2005). *M.obscura* may be distinguished from all other European *Myolepta* by the fact that its thoracic metasternum is bare, this sclerite being hairy in the other species. However, this feature can be difficult to see and both sexes are very similar, in general appearance, to the more frequent *M.vara*, especially in the field, where both species can be found together in the same habitat and on the same day. Additional features that aid in the separation of these two species are: the mesoscutal hair is long, woolly and upstanding in *M.obscura*, but shorter, more-or-less straight and rather reclinate in *M.vara*; the mesothoracic epimeron is dusted grey and dull over almost its entire surface in *M.obscura*, but mostly brightly shining, black and undusted, in *M.vara*; the hairs on the antero-lateral surface of the hind tibiae include many that are clearly longer than the maximum width of the tibia in dorsal view, in *M.obscura*, but all shorter than the width of the tibia in *M.vara*. In addition, the median, dorso-ventral, black stripe on the face of the male is simple in *M.obscura*, hardly extending laterally further than to include the facial prominence, whereas in the male of M.vara this stripe has on each side a diagonal arm extending away from the facial prominence, to give a pronounced V-shape. **Illustrations of the adult insect:** a coloured photo of the male isprovided by Louboutin *et al*. (2023).

Myolepta potens (Harris), 1776
Preferred environment: forest; mesophilous *Fagus*, thermophilous *Quercus* (*Q.pubescens* and *Q. cerris/ Q. frainetto*) and *Q.suber* forest containing overmature/senescent trees; also alluvial forest with ancient *Populus*. **Adult habitat and habits:** Males can be found on the ground at the foot of overmature oaks with trunk cavities, or sitting on the adjacent bark, apparently awaiting females. Both sexes visit sap runs. Females can be found walking over the surface of the bark at the edge of trunk cavities and sap runs, or over the exposed wood. **Flowers visited:** *Cistus*, *Cornus sanguinea*, *Crataegus*. **Flight period:** mid May/beginning July. **Developmental stages:** described and figured by Rotheray (1991), from larvae collected from a rot-hole at the base of *Fagus*. **Range:** imperfectly known. Britain (southern England) through France south to the Mediterranean and in Germany (Rhine valley), Hungary, Roumania, Serbia, Turkey and the Transcaucasus. **Determination:** Reemer et al.(2005). The female of this species is still not adequately distinguished from *M.dubia* in keys. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983).

Myolepta trojana Reemer, Hauser and Speight, 2005
Preferred environment: forest; deciduous forest of *Quercus petraea* and *Fagus orientalis*; *Liquidamber* forest (Reemer *et al*., 2005); thermophilous oak forest (Ricarte *et al*., 2012). **Adult habitat and habits**: no data. **Flowers visited**: "various yellow flowers" (Reemer *et al*., 2005); *Euphorbia* (M. de C. Williams, pers. comm.). **Flight period**: mid April/July. **Developmental stages:** not described. **Range**: Greece (Aegean island of Lesvos); Turkey; Transcaucasus (Georgia, Azerbaijan); Iran. **Determination:** Reemer *et al*. (2005). This species is very similar to both *M.dubia* and *M.potens*. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Myolepta vara (Panzer), 1798
Preferred environment: forest; acidophilous and thermophilous *Quercus* forest with over-mature trees. **Adult habitat and habits**: adults very secretive; settle in patches of sunlight on tree trunks and on bare ground of paths etc. in the sun; also on bare earth of stream edges (where they land to drink on hot afternoons, usually in the shade) or on cow dung in forest clearings. Their cryptic colouration makes them well-nigh invisible in all these situations and has probably resulted in under-

recording of this species. **Flowers visited**: *Crataegus, Euphorbia, Salix, Sorbus* and other small trees and shrubs. **Flight period**: May/June. **Developmental stages:** larval features are described and figured by Svivova *et al*. (1999), who reared *M. vara* from wet rot-holes in old, live *Ulmus pumila*. The species has also been reared from a tree-humous filled cavity in the trunk of a recently-felled *Quercus* by Dussaix (1997b), who illustrates the puparium. **Range**: the Netherlands south through Belgium (extinct?) and France south to the Mediterranean and central Spain; through central and South Europe to Switzerland, Austria and Roumania and on to the Balkans and the Caucasus (Azerbaijan). Also, supposedly, from the Pacific coastal region of Asiatic Russia. This species appears to be scarce over most of its European range. **Determination:** Reemer *et al*. (2005). Reemer *et al*. (2005) establish that *M. helvetica* (Wainwright) is a junior synonym of this species. **Illustrations of the adult insect:** The male is illustrated in colour by Speight and De Courcy Williams (2016). The male and female are illustrated in colour, together, in Pétremand *et al*. (2022).

NEOASCIA

With the exception of the northern species *N. subchalybea* Curran, the Caucasian *N. pavlovskii* and the Mediterranean species *N. balearensis* Kassebeer (2002), the European *Neoascia* species are all keyed out by Barkemeyer and Claussen (1986). *N. subchalybea* is included in the key to Fennoscandian *Neoascia* species provided by Bartsch *et al*. (2009b).

Neoascia annexa (Muller), 1776
Preferred environment: forest/freshwater; usually, but not exclusively, along streams in *Fagus/Picea* forest. **Adult habitat and habits**: streamsides; flies among streamside vegetation and along stream margins. **Flowers visited**: umbellifers; Ajuga, *Caltha, Galium, Potentilla, Ranunculus*. **Flight period**: May/June and July/August at higher altitudes. **Developmental stages:** larva described and figured by Maibach and Goeldlin (1993), from larvae and puparia collected from water-sodden vegetable debris beside streams in *Fagus/Picea* forest. **Range**: from southern Sweden south to the Pyrenees and northern Spain; from Belgium eastwards through mountainous parts of central and Southern Europe (Italy, Yugoslavia) into European parts of Russia; the Caucasus (Georgia). **Determination**: The most recent and comprehensive key to European *Neoascia* species is that of Barkemeyer and Claussen (1986). *N.annexa* may also be determined using van der Goot (1981), where it appears as *N.floralis* (Mg.). Distinctions from the closely-related, Turkish species *N.subannexa* are provided by Claussen and Hayat (1997b). The male terminalia are figured by Barkemeyer and Claussen (1986). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Torp (1994).

Neoascia balearensis Kassebeer, 2002
Preferred environment: freshwater; marsh, *Phragmites* beds, around small reservoirs and seepages/springs. **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia, Ranunculus* (Riddiford and Ebejer, 2006). **Flight period:** known from March/April to October (Kassebeer, 2002; Riddiford and Ebejer, 2006). **Developmental stages:** not described. **Range:** Balearic Islands (Mallorca, Menorca). **Determination:** Kassebeer (2002), who figures the male terminalia and discusses differences between this species and the closely-related *N.clausseni* and *N.podagrica*. **Illustrations of the adult insect:** none known.

Neoascia geniculata (Meigen), 1822
Preferred environment: wetland; by pools, streams, springs and flushes in acid fen, calcareous fen and aapamire and round the edge of raised bog. **Adult habitat and habits:** flies low among fen vegetation and is as easy to detect by sweeping as by direct observation. **Flowers visited:** white umbellifers, *Alisma plantago-aquatica, Baldellia ranunculoides, Caltha palustris, Potentilla erecta, Ranunculus*. **Flight period:** May/September, with most records from May and mid-July/mid-August. **Developmental stages:** larva and puparium apparently described and figured by Lundbeck (1916), but redescription is required, in comparison with the developmental stages of other *Neoascia* species. **Range:** from northern Fennoscandia south to central France; from Ireland eastwards through northern and mountainous parts of central Europe; into Russia to eastern Siberia; Nearctic Region. **Determination:** Barkemeyer & Claussen (1986), van der Goot (1981), who figure the male terminalia. *N. geniculata* is indistinguishable from *N. tenur* in the field and often found in flight with that species. The N American species *N. guttata* and *N. willistoni* are shown by Skevington *et al*. (2023) to be synomyms of *N. geniculata*. At one point in their text Skevington *et al*. (2023) erroneously refer to synonymising *N. unifasciata* of Strobl with *N. geniculata*. Elsewhere in their text it is clear they are referring to *N. unifasciata* of Curran as a synonym of *N. geniculata*. They make the situation more complicated by first pointing out that *N. unifasciata* of Curran is a junior homonym of *N. unifasciata* of Strobl,

then providing the name *willistoni* as a replacement name for *N. unifasciata* of Curran and then synonymising *willistoni* with *geniculata*. **llustrations of the adult insect:** the species is illustrated in colour by Bartsch *et al*. (2009b) andTorp (1994).

Neoascia interrupta (Meigen), 1822
Preferred environment: becomes increasingly coastal towards the northern edge of its range in western Europe, where it occurs primarily in association with coastal lagoons containing beds of reeds or *Typha*; further south and in central Europe the species occurs round the edges of permanent standing-water bodies from small ponds up to the scale of large lakes; also along the margins of the potomal stretches of major rivers, where stands of reeds or tall sedges occur, or along standing-water ditches with abundant emergent vegetation of, for example, *Apium*. **Adult habitat and habits**: flies along the edge of emergent *Phragmites* and *Typha* stands, on their water side (as opposed to the land side). **Flowers visited:** umbellifers; *Alisma plantago-aquatica, Bellis, Myosotis palustris, Ranunculus, Rubus, Stachys, Stellaria, and Taraxacum (*see Duty, 1995). **Flight period:** beginning May/September, with a peak in June. **Developmental stages:** features of the larva and puparium are described and figured by Kuznetzov and Kuznetzova (1994), but without any information on larval biology or habitat. **Range:** from Fennoscandia south to central France; from Britain (southern England) eastwards through central Europe (and the former Yugoslavia) into European parts of Russia and the Caucasus and on into western Siberia. **Determination**: Barkemeyer & Claussen (1986) and van der Goot (1981), who figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b) andTorp (1994).

Neoascia meticulosa (Scopoli), 1763
Preferred environment: wetland; fen, plus pond and stream margins in the open, with sedge or tall herb communities. **Adult habitat and habits**: flies low through tall fen vegetation e.g. Cyperaceae, and is more easily detected by sweeping than by direct observation. **Flowers visited**: white umbellifers; *Anemone nemorosa, Caltha, Cardamine, Ficaria verna, Galium, Prunus avium, Ranunculus, Salix, Sorbus aucuparia, Taraxacum.* **Flight period**: end April/June. In some years, there is an apparent partial second generation in July/August. **Developmental stages:** larvae and puparia described and figured by Hartley (1961) and Maibach and Goeldlin (1993); aquatic; may be found beneath the outer leaves of rotting *Typha* stems, below the water surface. **Range**: from Fennoscandia south to northern Spain, the Alps and the former Yugoslavia; from Ireland eastwards through northern and central Europe into European parts of Russia; the Caucasus; through Siberia to as far as Cis-Baikal. **Determination**: van der Goot (1981) and Barkemeyer & Claussen (1986), who figure the male terminalia. **Illustrations of the adult insect:** the species is illustrated in colour by Bartsch et al.(2009b), Haarto & Kerppola (2007) and Torp (1994).

Neoascia obliqua Coe, 1940
Preferred environment: wetland/forest; streamsides within forest, from humid *Fagus/Picea* forest and higher altitudes, into the *Picea* zone and on to its upper limits; lake-side fen, stream-sides (brook floodplains) with tall herb communities, at sheltered locations. **Adult habitat and habits:** lush streamside vegetation; flies through and settles on vegetation along the water's edge. **Flowers visited**: white umbellifers; *Galium, Ranunculus, Taraxacum*. **Flight period**: end April/beginning August. **Developmental stages:** undescribed, but Reemer et al.(2009) report that larvae of *N.obliqua* have been found in stems of *Petasites hybridus*, in tunnels made by larvae of another syrphid, *Cheilosia canicularis*. **Range:** from southern Sweden south to the Pyrenees; from Ireland eastwards through central Europe to European parts of Russia; the former Yugoslavia; the Caucasus. Birtele (2011) lists many records of this species from Sardinia, which would not be expected from what is know of the occurrence of this species elsewhere. **Determination:** Barkemeyer and Claussen (1986). Distinctions from other members of *podagrica* group in Speight (1988b). Both Barkemeyer and Claussen (1986) and Speight (1988b) figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994).

Neoascia pavlovskii Stackelberg, 1955
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Developmental stages:** not described. **Range:** Turkey, Caucasus (Russian federation: Dagestan), Tajikistan and Afghanistan. **Determination:** Stackelberg (1965); van der Goot (1981). *N.pavlovskii* has a complete postmetacoxal bridge but no infuscation on the wings and abdominal markings that narrow greatly towards the lateral margins of the tergites, or do not reach the lateral margins at all (the abdomen may also be entirely without pale marks). As such, it can be easily confused with *N.tenur*. Males of *N.pavlovskii* and *N.tenur* can apparently be distinguished by their differently-shaped surstyli (figured by

van der Goot, 1981) and by the colour of the hairs on the hypopygium – black in *N.pavlovskii* and white in *N.tenur*. The females of these two species are more difficult to separate. **Illustrations of the adult insect:** none known.

Neoascia podagrica (Fabricius), 1775
Preferred environment: forest/wetland; alluvial forest plus pond margins and fen; now primarily anthropophilic, found in humid pasturage, along wet ditches, around farmyards and in other situations where organic refuse is present, including canal banks, suburban gardens, rubbish dumps and parks. **Adult habitat and habits**: flies low among waterside vegetation; males hover among vegetation, frequently close to flowers in bloom. **Flowers visited**: white umbellifers; *Achillea millefolium, Allium ursinum, Caltha, Chelidonium, Convolvulus, Crataegus, Euphorbia, Leontodon, Menyanthes, Plantago, Potentilla erecta, Ranunculus, Salix repens, Senecio jacobaea, Taraxacum.* For an extended list of flowers visited, see de Buck (1990). **Flight period**: April/October (plus March in southern Europe). **Developmental stages:** larva figured in colour by Bartsch et al.(2009a) and Dussaix (2013); described and figured by Hartley (1961) and Maibach and Goeldlin (1993) from larvae in cow dung and compost; sub-aquatic, occurring in cow-dung, slurry and dung-enriched mud etc; recorded by Dusek and Laska (1962) living with larvae of *Cheilosia canicularis* in roots of *Petasites* species, though there must be some doubt as to whether this records refers to *N.obliqua* (see under *N.obliqua*). Puparium shown in colour by Dussaix (2013), who also notes that the puparial phase lasts for 1-2 weeks. **Range**: from Fennoscandia south to Iberia and the Mediterranean, including Madeira, Cyprus and Crete; N Africa; from Ireland eastwards through northern, central and southern Europe (Italy, the former Yugoslavia, Greece) to Turkey and Israel; European parts of Russia and on into western Siberia as far as Cis-Baikal. **Determination**: Barkemeyer & Claussen (1986). Separation from other members of the *podagrica* group except *N. balearensis* in Speight (1988a). Both Barkemeyer and Claussen (1986) and Speight (1988b) figure the male terminalia. Kassebeer (2002) details differences between *N.podagrica* and the closely-related *N.balearensis*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Neoascia subannexa Claussen & Hayat, 1997
Preferred environment: forest; humid conifer forest/*Picea* plantation (Claussen and Hayat, 1997b), with a rich herb-layer vegetation. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July and October/November. **Developmental stages:** not described. **Range:** Turkey; Georgia. **Determination:** Claussen and Hayat (1997b), who figure the male terminalia and provide a key to separate this species from the closely similar *N.annexa* (Muller). **Illustrations of the adult insect:** none known.

Neoascia subchalybea Curran, 1925
Preferred environment: taiga wetlands (Nielsen, 1998). **Adult habitat and habits:** no data. **Flowers visited:** *Caltha* (Nielsen, 1998), *Stachys* (Bartsch *et al*., 2009b). **Flight period:** mid May/early July. **Developmental stages:** not described. **Range:** northern Norway, Sweden, Finland, the Kola Peninsula and Sverdlovsk (Russia) and on into Siberia; Canada in N America. **Determination:** Bartsch *et al*. (2009b); Kanervo (1934), Andersson (1966), Hippa (1967), as *N. petsamoensis* Kanervo. The male terminalia are figured by Hippa (1967). Nielsen (1999) lists *petsamoensis* as a junior synonym of *subchalybea* Curran. *N. subchalybea* is included in the keys provided by Bartsch *et al*. (2009b). The only other recent key to European *Neoascia* in which a taxon named as *N. subchalybea* is included is that of Violovitsh (1986). According to Violovitsh (l.c.) *N. subchalybea* possesses a complete metapleural bridge posterior to the hind coxae, wings entirely unmarked by infuscation and an elongated facial region which extends anteriorly for a distance equal to the width of an eye. According to Skevington *et al*. (2019, in the N American *N. subchalybea* (its description by Curran is based on N American material) there is no metapleural bridge between the hind coxae, so it has to be presumed that *N. subchalybea* of Violovitsh is a different species. Hippa (1967) states clearly that there is no post-metacoxal bridge present in the lectotype of *N. petsamoensis* and Tore Nielsen (pers. comm.) concurs, supporting the synonymy of *petsamoensis* with *subchalybea*. Bartsch *et al*. (2009b) also state that there is no post-metacoxal bridge in *N. subchalybea*. A further complication is provided by Peck (1988), who lists *N. petsamoensis* among the group of *Neoascia* species in which there is no metapleural bridge posterior to the hind coxae, but consigns *N. subchalybea* to the other subgenus, where the post-metacoxal bridge is present. So Peck's placement of *N. subchalybea* is clearly incorrect. The anteriorly elongated lower face of *N. subchalybea* is illustrated in Bartsch *et al*. (2009b) and Skevington *et al*. (2019) and provides a means of separating the female from the female of *N. meticulosa*. Both Andersson (1966) and Hippa (1967) show that the third antennal article is elongate in *N. subchalybea*, approximately twice as long as its maximum depth, separating it from *N. geniculata*, in which the third article of the antenna

is short, less than 1.5 times as long as deep. In both sexes, pale marks on the abdominal tergites are apparently absent in *N. subchalybea*. Hippa (1967) states that the hind femora are pale only at the base in the male, but may be pale at both base and apex in the female. The male genitalia of these two species are distinct. The male terminalia of *N. subchalybea* are figured by Skevington *et al*. (2019). **Illustrations of the adult insect:** *N. subchalybea* is figured in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Skevington *et al*. (2019).

Neoascia tenur (Harris), 1779
Preferred environment: wetland; flushes and streams in blanket bog, around the periphery of raised bogs, acid and rich fen, humid, oligotrophic grassland, pond and lake margins and along brooks. **Adult habitat and habits**: flies low among and settles within, dense vegetation, usually close to water and as a result its presence is more easily recognised by sweeping than by direct observation. **Flowers visited**: *Caltha, Carex, Cicuta virosa, Filipendula ulmaria, Potentilla erecta, Ranunculus, Salix repens*. **Flight period**: end April/September, with peak June/July. **Developmental stages:** larvae and puparia described and figured by Maibach and Goeldlin (1993), from puparia collected at around the level of the water-surface, within stem sheaths of dead *Typha*, in a slow-moving stream. **Range**: from Iceland, Fennoscandia and the Faroes (Jensen, 2001) south to Iberia and the Mediterranean; from Ireland eastwards through most of Europe into Turkey; European parts of Russia; Georgia; through most of Siberia. **Determination**: Barkemeyer & Claussen (1986), who figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Neoascia unifasciata (Strobl), 1898
Preferred environment: wetland; beside streams in unimproved, humid pastures; open areas by stream, in brook-alluvial gallery forest of *Salix/Alnus* or *Picea* forest; montane calcareous fen. **Adult habitat and habits:** flies among tall-herb vegetation, usually in the vicinity of *Petasites* and close to streams. The habitat of this species is described in detail by Treiber (1991). **Flowers visited:** white umbellifers; *Caltha, Euphorbia cyparissias, Stellaria*. **Flight period:** end May/July. **Developmental stages:** undescribed. **Range:** yet to be established; known at present from Germany, the Netherlands, Belgium, France (Moselle, Jura), Switzerland, Austria and North Macedonia. **Determination:** Re-instated as a separate species by Barkemeyer & Claussen (1986) and may be determined using their key. May be distinguished from other *podagrica* group species using the key in Speight (1988b). Resembles *N.podagrica* but without pale marks on abdominal tergite 2. However, these marks may, on occasion, be absent in *N.podagrica* or present in *N.unifasciata*. Can be found in flight together with *N.annexa* and *N.obliqua*. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

NEOCNEMODON

Since Goffe (1944) introduced the generic name *Neocnemodon* for the species standing under that name here, *Neocnemodon* has in most accounts been regarded as a subgenus of *Heringia*. However, the genetic data provided by Vujić et al.(2013a) demonstrate the validity of recognising *Neocnemodon* as a separate genus. Seven European species are consigned to the genus at present. The males of all European *Neocnemodon* species are included in the keys provided by Bartsch et al.(2009b). Currently, the females cannot be determined with confidence.

Neocnemodon brevidens (Egger), 1865
Preferred environment: forest; alluvial softwood forest with *Populus* including gallery forest, also small water bodies with a *Populus/Salix* fringe in various types of forest. **Adult habitat and habits:** primarily arboreal, but descends to visit the flowers of low-growing plants, and both males and females can be found flying over path-side vegetation in the sun, and settling on the leaves within 30cm of the ground. Both sexes have a rapid, zig-zag flight. Flowers **visited:** *Caltha palustris, Nasturtium officinale, Rubus fruticosus* agg. **Flight period:** mid May/beginning September. **Developmental stages:** undescribed. **Range:** from Latvia and the Netherlands south to France; from Britain (England) eastwards through central Europe (Germany, Switzerland, Austria, Czech Republic) to Roumania, the Ukraine and European parts of Russia; across Siberia to the Pacific. **Determination:** Bartsch et al.(2009b). Delucchi and Pschorn-Walcher (1955), Bradescu (1991), Verlinden (1994) all figure the male terminalia. Verlinden (1994) provides the most comprehensive illustrations of male leg characters. The female of *N. brevidens* is more easily distinguished than are the females of most other *Neocemodon* species. In *N. brevidens* there is a pair of distinct dust spots against the eyes, on the frons, that are twice as wide as the strip of dusting running along the eye margins. In females of other European species frontal dust spots are either absent or hardly detectable.

Illustrations of the adult insect: the male is figured in colour by Bartsch et al.(2009b). The male and female are illustrated in colour by Speight and De Courcy Williams (2021).

Neocnemodon fulvimanus (Zetterstedt), 1843
Preferred environment: forest; conifer forest of *Abies/Picea*, at 1300-1800m in the Alps (Claus Claussen, pers.comm.); taiga forest and subalpine *Betula* forest (Hans Bartsch, pers.comm.). **Adult habitat and habits:** flies in tall-herb open areas within or at the edge of, conifer forest (Claus Claussen, pers.comm.). **Flowers visited:** *Taraxacum* (Bartsch et al.(2009b). **Flight period:** May/June and August. **Developmental stages:** undescribed. **Range:** uncertain, due to persistent misdetermination of *N. pubescens* and *N. vitripennis* as *N. fulvimanus*, but confirmed from Norway, Sweden, Finland and the Alps (Austria, Italy). This species may occur through Siberia to the Pacific, as indicated in Peck (1988). But this requires confirmation. **Determination:** Bartsch et al.(2009b). Delucchi and Pschorn-Walcher (1955) figure the male terminalia. The description and figures provided by those authors are based only on the male lectotype of the species. They were unable to locate further material of this species, pointing out that the large numbers of specimens they had seen named as *N. fulvimanus* in collections were all misdetermined. The female of *N. fulvimanus* is included in the keys of Bartsch et al.(2009b). **Illustrations of the adult insect:** the male of *H.fulvimanus* is figured in colour by Bartsch et al.(2009b).

Neocnemodon larusi (Vujić), 1999
Preferred environment: forest; along streams in open, montane *Picea/Abies/Fagus* forest, up to 1800m (Vujić, 1999a). **Adult habitat and habits:** flies low around and within bushes and low-growing vegetation beside streams; settles on leaves in patches of sunlight along streams (A.Vujić, pers.comm.). **Flowers visited:** *Caltha* spp., *Ranunculus* spp. (A.Vujić, pers.comm.), *Prunus padus* (Bartsch *et al*. (2009b). **Flight period:** mid May/beginning July. **Developmental stages:** undescribed. **Range:** Sweden, Finland, Italy and Serbia. **Determination:** Bartsch *et al*. (2009b). Vujić (1999a) figures the male terminalia and discusses distinctions between this species and the closely similar *N. pubescens* and *N. vitripennis*. According to Vujić (1999a) the body length of *N. larusi* is 7-8.5 mm. The body length given for *N. larusi* by Bartsch *et al*. (2009b) is 4-6 mm, exactly the same as given by those authors for *N. pubescens*. Delucchi and Pschorn-Walcher (1955) give the body length for *N. pubescens* as 5.5-6.5 mm. Whether the small size of the Scandinavian *N. larusi* specimens indicates a regional size difference or confusion with *N. pubescens* is a moot point. Certainly, it seems odd that *N. larusi* should be recorded for the Balkans and Scandinavia, but not, apparently, from any points in between. Re-appraisal of central European *N. pubescens* material would seem worthwhile! **Illustrations of the adult insect:** the appearance of the adult of the Scandinavian *N. larusi* is shown in the photograph provided by Haarto & Kerppola (2007) and the coloured figure given in Bartsch et al.(2009b).

Neocnemodon latitarsis (Egger), 1865
Preferred environment: forest; mature mixed, coniferous (*Abies*), deciduous (acidophilus *Quercus*, thermophilous *Quercus)* and evergreen (*Q.ilex*) forest. **Adult habitat and habits:** apparently largely arboreal, but descends to visit flowers; sunbathes on the foliage of low-growing shrubs in the evening, in sunlit glades. Can also be found flying in a rapid, zigzag manner, around the foliage of large-leaved, low-growing plants at the edge of woodland, and settling briefly on their foliage. Both sexes may visit sandy/gravely edges of woodland streams to drink, in dappled sunlight, in hot weather. **Flowers visited:** white umbellifers; *Campanula rotundifolia, Crataegus, Origanum, Prunus serotina, Rosa rugosa, Rubus, Vaccinium uliginosus*. **Flight period:** end May/June and August/September (July/September at higher altitudes). **Developmental stages:** larva described and figured by Dusek and Laska (1960); found by Laska and Stary (1980) feeding on aphids on *Abies*, *Malus*, *Populus* and *Ulmus*. **Range:** southern Finland south to the Pyrenees; from Britain eastwards through central and southern Europe (former Yugoslavia) into European parts of Russia and on as far as the Caucasus mountains; introduced to N America. **Determination:** Bartsch *et al*.(2009b). Delucchi and Pschorn-Walcher (1955), Bradescu (1991), Verlinden (1991 all figure the male terminalia. Verlinden (1994) provides the most comprehensive illustrations of male leg characters. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*.(2009b) and Torp (1994).

Neocnemodon pubescens (Delucchi & Pschorn-Walcher), 1955
Preferred environment: forest; various types of deciduous and coniferous forest, from *Quercus/Carpinus* to *Fagus/Picea* and *Abies/Picea*. **Adult habitat and habits:** largely arboreal, but also flies round tree foliage within 2m of the ground and visits the flowers of low-growing plants, in clearings etc. **Flowers visited:** *Anemone nemorosa, Bellis perennis, Caltha, Mercurialis perennis, Prunus cerasus, P.spinosa, Ranunculus, Ribes, Stellaria, Taraxacum, Veronica*. **Flight period:** end April/July. **Developmental stages:** undescribed, but Kula (1980) records the larva of this species as overwintering on the

forest floor in *Picea* forest. **Range:** Fennoscandia south to the Alps; from Britain eastwards through central Europe into European parts of Russia. **Determination:** Bartsch *et al*. (2009b). Delucchi and Pschorn-Walcher (1955), Bradescu (1990) and Verlinden (1994) may be used to distinguish this species from other European species of *Neocnemodon*, except for *N. larusi*. The only keys in which *N. larusi* is included are those of Bartsch *et al*. (2009b) and Vujić (1999a). Most of these authors figure the male terminalia. Verlinden (1994) provides the most comprehensive illustrations of male leg characters. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Torp (1994).

Neocnemodon verrucula (Collin), 1931
Preferred environment: forest; humid *Pinus sylvestris* and *Quercus/Carpinus/Ulmus*; small open areas with flushes in mixed forest and alluvial hardwood forest (Prokhorov *et al*., 2023). **Adult habitat and habits:** flies close to the ground, with a rapid, zigzag motion, among vegetation and along the edges of paths etc., in the open. **Flowers visited:** *Acer, Potentilla erecta,* male *Salix.* **Flight period:** end April/end June. **Developmental stages:** not described. **Range:** Norway, Sweden, southern Finland, Denmark, Britain, Netherlands, Germany, Ukraine, European parts of Russia; through Siberia to the Pacific; Mongolia. **Determination:** Bartsch *et al*. (2009b), Delucchi and Pschorn-Walcher (1955), Bradescu (1991), Verlinden (1994). The male terminalia are figured by all of these authors. Verlinden (1994) provides the most comprehensive illustrations of male leg characters. Prokhorov *et al*. (2023) provide a photographic image of the ventral surface of the abdomen of the male, including the median projection on sternite 4. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Torp (1994).

Neocnemodon vitripennis (Meigen), 1822
Preferred environment: forest; conifer forest and plantation; deciduous forest (*Quercus/ Carpinus/Ulmus*), suburban parks and gardens. **Adult habitat and habits:** largely arboreal; males hover at 3m upwards, descending to settle on foliage of trees and shrubs. **Flowers visited:** white umbellifers; *Euphorbia, Potentilla, Prunus serotina, Rosa, Rubus fruticosus agg. Salix.* **Flight period:** mid May/mid September. **Developmental stages:** larva predatory on adelgid plant bugs; described and figured by Delucchi *et al*. (1957), from larvae collected on *Abies*. The species has also been reared from larvae found feeding on coccids on *Populus* and aphids on *Malus* (Evenhuis, 1959). According to Bergh *et al*. (2023) the larvae are specialised predators of the commercially significant wooly apple aphid *Eriosoma lanigerum*. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** known from southern Sweden southwards to central France and from Ireland eastwards through northern and central Europe into Russia and on through Siberia to the Pacific coast. **Determination:** Bartsch *et al*. (2009b). Delucchi and Pschorn-Walcher (1955), Bradescu (1991) and Verlinden (1994) figure the male terminalia. Verlinden (1994) provides the most comprehensive illustrations of male leg characters. Females of this species cannot be reliably distinguished from those of related species. Information published on *N. vitripennis* prior to the revision by Delucchi and Pschorn-Walcher (1955) cannot be relied upon, due to possibility of confusion with *N. pubescens* (D. & P. - W.). Because of confusion over the identity of the Meigen type of *N. vitripennis*, Delucchi and Pschorn-Walcher (l.c.) described this species under a new name, *dreyfusiae*, but Collin (1960) reinstated the name *vitripennis* for it. Subsequently, Thompson (1988) has validated Collin's action, by noting that the type material of *N. vitripennis* is not in Paris, as had been assumed by Delucchi and Pschorn-Walcher (l.c.), but is in Vienna and that the two males concerned are *N. vitripennis* sensu Collin - these males had in fact been examined by Delucchi and Pschorn-Walcher and included by them as paratypes of their species *N. dreyfusiae*. The male of *N. vitripennis* is extremely similar in appearance to the male of *N. larusi*. The key provided by Bartsch *et al*. (2009b) can be used to separate the males of these two species. *Neocnemodon vitripennis* is also morphologically almost identical to *N. calcarata* (Loew), whose larvae feed on the wooly apple aphid in N. America. Separation of *N. calcarata* from *N. vitripennis* is reviewed by Bergh *et al*. (2023), who also figure the male genitalia of both species. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Olbiosyrphus laetus: see under *Xanthogramma laetum* (Fab.)

ORTHONEVRA

There is need for revision of the European species belonging to this genus. Maibach *et al*. (1994a) consign certain European species previously included in *Orthonevra* to a separate genus, *Riponnensia*. There is no key to all of the European

Orthonevra species . The key in van Veen (2004) does not include the species *O. arcana*, *O. atlantica*, *O. gemmula*, *O. auritarsis*, *O. shusteri* or *O. montana*. The key in Bartsch *et al*. (2009b) does not include southern European species. The Bot & Van de Meutter key (2023) does not include E European species, *O. atlantica* or *O. plumbago* and the key in Zóralski *et al*., (2024) excludes the species with partly yellow legs. The identity of a number of species, particularly *O. plumbago* and *O. tristis*, requires clarification.

Orthonevra arcana Ricarte & Nedeljković, 2022, in Ricarte *et al*., 2022
Preferred environment: "near small rivers" (Ricarte *et al*, 2022). **Adult habitat and habits:** no data. **Flowers visited:** *Crataegus, Prunus spinosa, Pyrus, Salix* (Ricarte *et al*., 2022). **Flight period:** February/May. **Developmental stages:** not described. **Range:** central/southern Spain and Belgium. Van de Meutter *et al*. (2023), suggest the French specimens recorded as males of *O. plumbago* in Speight & Castella (2011) belong to *O. arcana*, because of the illustrated shape of their surstyli. But re-examination of those specimens indicates they do not correspond with the description of *O. arcana* in Ricarte *et al*. (2022). **Determination:** both sexes of this species are described by Ricarte *et al*. (2022). The male genitalia and the apical abdominal tergites of the female are figured in Ricarte *et al*. (2022), who also provide a key distinguishing this species from other Spanish *Orthonevra* species, plus *O. incisa* and *O. plumbago*. From the information supplied by Ricarte *et al*. (2022), it is apparent that *Orthonevra arcana* is almost identical to *O. plumbago*, but can be separated from *O. plumbago* by its short-haired eyes (bare in *O. plumbago*) and distinctly dusted abdominal sternite 1 (undusted and shiny in *O. plumbago*). However, according to Van de Meutter *et al*. (2024) "Identification of the male of *O. arcana* is only possible when opening the genital capsule", implying reservations about the other features used to characterise the species in the key in Ricarte *et al*. (2022). The dusted sternite 1 would help to separate *O. arcana* from other *Orthonevra* species known from West of the Balkan peninsula, except *O. incisa*, in which sternite 1 is also mostly dusted. It would also help to distinguish *O. arcana* from *O. brevicornis*, which has sternite 1 brightly shining. In the male, there are small differences in features of the epandrium which appear to distinguish *O. arcana* from *O. plumbago*, but the surstyli of the two species are very similar in shape. The surstyli of *O. plumbago* are illustrated in Speight & Castella (2011). In the female of *O. arcana* the posterior margin of tergite 5 has a median, semi-circular concavity, contrasting with the condition in *O. incisa* and *O. plumbago*, where tergite five has a very narrow, triangular, median cleft in its posterior margin, though the form of tergite 5 is stated to be variable, in Ricarte *et al*. (2022). The presence of an additional hair-patch, between the upper and lower hairs patches on the katepisternum of the thoracic pleura, is referred to by Ricarte *et al*. (2022) as a means of separating the female of *O. arcana* from that of *O. incisa*. **Illustrations of the adult insect:** the general appearance of both sexes of this species can be seen in the coloured photos provided in Ricarte *et al*. (2022).

Orthonevra atlantica Zóralski & Van de Meutter, in Zóralski *et al*., 2024
Preferred environment: forest; close to flushes, springs and clean-water streams in acidophilous *Quercus* forest, *Quercus/Carpinus/Ulmus* forest; *Alnus/Fraxinus* brook floodplain forest and *Alnus glutinosa* swamp. **Adult habitat and habits:** settles on foliage of bushes in dappled sunlight and on bare ground of paths within woodland; visits flowers in sunlit glades within woodland, usually close to pools or brooks. **Flowers visited:** white umbels; *Crataegus, Malus, Pyrus, Ranunculus*. **Flight period:** April/June. **Developmental stages:** the larva of "*Orthonevra brevicornis*" illustrated in colour (apparently from a preserved specimen) by Rotheray (1994) presumably belongs to this species, assuming that *O. brevicornis* itself is absent from Britain, which at present appears to be the case. **Range:** as yet uncertain**,** due to confusion until recently with *O. brevicornis*, but in western Europe confirmed from Denmark south to central France plus Britain and central Spain; Germany, Poland, the Czech Republic and Switzerland in central Europe; Serbia. **Determination:** the description of this species, in Zóralski *et al*. (2024), is based on a long series of both males and females. They separate this species from the morphologically extremely similar *O. breviicornis*, with which it had previously been confused. Zóralski *et al*. (2024), provide illustrations of the male terminalia and a key separating *O. atlantica* from other European *Orthonevra* species. In addition to its genitalic differences, in the male of *O. atlantica* the thoracic dorsum carries a mixture of black and yellow-brown hairs, contrasting with the thoracic dorsum of *O. brevicornis*, where only yellow-brown hairs are present. Separation of the females of these two species is more difficult. Tergite 5, which exhibits diagnostic features in a number of European *Orthonevra* speies, is simple and the same in both *O. atlantica* and *O. brevicornis*. Zóralski *et al*. (2024) separate the females of these two species using small differences in antennal colour and wing venation. **Illustrations of the adult insect:** photographs of the male and female in side view are provided in Zóralski *et al*. (2024).

Orthonevra auritarsis Bradescu, 1992
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** undescribed. **Range:** Romania. **Determination:** Bradescu (1992), who figures the male terminalia. *O.auritarsis* seems similar in appearance to *O.intermedia* and *O.nobilis*. This species does not seem to have been recorded since description of the male holotype, and the female remains unknown. **Illustrations of the adult insect:** none known.

Orthonevra brevicornis (Loew, 1843)
Preferred environment: flushes in alluvial marshes; *Alnus incana* brook floodplain forest; calcareous alluvial grassland. **Adult habitat and habits:** no data. **Flowers visited:** *Acer, Crataegus, Photinia, Prunus avium, Salix, Sorbus*. **Flight period:** April/June. **Developmental stages:** references to the developmental stages of this species, published prior to 2024, cannot be relied upon, due to potential confusion with *O. atlantica*. **Range:** uncertain at present, due to confusion with *O. atlantica*. Most confirmed records are from central Europe: Germany, Poland, Czech Republic, Switzerland and Hungary, but the species is also recorded from Belgium, Greece and Georgia. **Determination:** the only key which can be used for separation of *O. brevicornis* from other European *Orthonevra* species including *O. atlantica* is that provided by Zóralski *et al*. (2024). They also redescribe and redefine *Orthonevra brevicornis*, in the context of discovery that, as recognised previously, two morphologically very similar species were confused under that name. Genetic analysis accompanying the redescription demonstrates the same thing. They designate a neotype for *O. brevicornis* and name the second species involved as *O. atlantica*. They figure differences between the male genitalia of the two species and provide other morphological distinctions for separating both males and females of the two species. A feature of the wing venation they introduce – and figure - is rather subtle, and difficult to interpret when only one specimen is available for examination. However, with series of specimens and males and females of both species available, the small, but consistent venational difference involved can be recognised. A second feature, the more extensively orange-marked third article of the antenna in *O. brevicornis*, is less reliable than indicated. In the male of *O. atlantica* the third antennal article can be entirely orange. The males of *O. atlantica* and *O. brevicornis* can be separated using both the features of the male genitalia alluded to in Zóralski *et al*. (2024), and the colour of the hairs on the thoracic dorsum – all yellow-brown in *O. brevicornis*, but mixed black and pale brown in *O. atlantica*. But separation of the females of these two species is less certain, and not aided by an absence of differences in the morphology of tergite 5, which provides diagnostic features in some other European *Orthonevra* species. **Illustrations of the adult insect:** photographs of the male and female in side view are provided in Zóralski *et al*. (2024).

Orthonevra elegans (Wiedemann in Meigen), 1822
Preferred environment: wetland; springs in fens and along brooks in meadows (brook floodplains). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Berula, Filipendula, Saxifraga hirculus, Viburnum opulus*. **Flight period:** end June/August. **Developmental stages:** undescribed. **Range:** from southern Finland south through Denmark and Belgium (extinct) to northern France (Paris basin) extinct?; from northern Germany eastwards through central Europe (Poland, Switzerland, Austria) to Bulgaria, Romania and European parts of Russia and on through Siberia; Mongolia; China. The fate of springs in grassland has been such throughout Western Europe that if *O.elegans* is indeed dependent on such a habitat its disappearance is more or less guaranteed. This wetland syrphid is almost certainly under threat throughout the European Union area, if not in Europe in general. **Determination:** Bartsch *et al*. (2009b); van Veen (2004); van der Goot (1981), Bradescu (1991). The male terminalia are figured by Maibach *et al*. (1994a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Torp (1994).

Orthonevra erythrogona (Malm), 1863
Preferred environment: wetland, pool edge in fen/fen carr. **Adult habitat and habits:** no data. **Flowers visited**: *Caltha, Leontodon, Ranunculus acris, R.repens, Taraxacum*. **Flight period**: mid May/beginning July. **Developmental stages:** larva not described, but has been found in wet mud containing a high proportion of dung and plant remains. **Range**: Fennoscandia and Latvia, Denmark, northern Germany; Ukraine; Siberia to Kamchatka; Mongolia. **Determination:** Bartsch *et al*. (2009b); van Veen (2004); van der Goot (1981) figures the male terminalia; van Veen (2004). Prokhorov *et al*. (2020b) point out that this species is distinguished from other European *Orthonevra* species by its combination of tibiae yellow only at the base and antennae in which the third segment is only twice as long as high. **Illustrations of the adult insect:** Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Prokhorov *et al*. (2020b) and Torp (1994) illustrate this species in colour.

Orthonevra frontalis (Loew), 1843
Preferred environment: wetland/forest: flushes and spring-fed brooks on the floodplains of major rivers; brooks in thermophilous *Quercus* forest and *Q. ilex* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Crataegus, Euphorbia, and Ranunculus*. **Flight period:** May/June. **Developmental stages:** not described. **Range:** Poland south to Spain and the Mediterranean; from central France eastwards through central and southern Europe (Italy, former Yugoslavia) into Turkey, Iran and European parts of Russia and on through Siberia to the Pacific (Kamchatka); Mongolia. **Determination:** van Veen (2004); Bradescu (1991). The male terminalia are figured by Maibach et al.(1994a) and Vujić (1999a). **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić et al.(2020d).

Orthonevra gemmula Violovitsh, 1979
Preferred environment: small, open areas with oligotrophic/mesotrophic flushes/*Juncus* marsh in thermophilous *Quercus* (*Q.cerris, Q.pubescens*) forest (A.Vujić, pers.comm.); flushes in steppe (Reemer & Turnhout, 2015). **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia*. **Flight period:** April. **Developmental stages:** not described. **Range:** so far known only from western Siberia, Serbia and Hungary. **Determination:** Vujić (1999b) who figures the male terminalia. The male terminalia are also figured by Reemer & Turnhout, 2015), who, in addition provide features for separation of the female from females of *O. intermedia* and *O. stackelbergi*. **Illustrations of the adult insect:** none known.

Orthonevra geniculata (Meigen, 1830)
Preferred environment: wetland/forest; beside springs, flushes and brooks in wet acidophilous *Quercus* forest, wet woodland of *Alnus/ Salix, Alnus/Salix* carr, fen, transition mire and the margins of raised bog. **Adult habitat and habits:** in the immediate vicinity of spring-fed ponds and flushes and beside streams; flies within 2 m of the ground and settles on foliage, including dead *Phragmites* stalks; also settles in the sun on the trunks of standing trees. **Flowers visited:** *Anemone nemorosa, Bellis, Caltha, Cardamine, Malus sylvestris, Menyanthes, Prunus spinosa, Ranunculus*, male flowers of *Salix* species, including *S.repens*. **Flight period:** mid April/mid May, plus June in Scandinavia and at higher altitudes. **Developmental stages:** larva not described, but almost certainly associated with springs and wet flushes. **Range:** from northern Norway south to SW France; from Ireland eastwards through northern and central Europe (plus parts of northern Italy) into Russia and on as far as eastern Siberia and Mongolia. **Determination:** Bartsch *et al*.(2009b); van Veen (2004); van der Goot (1981), Bradescu (1991). Maibach *et al*.(1994a) figure the male terminalia. The figures of the male terminalia of *O.intermedia* provided by van der Goot (1981) also appear to be those of *O.geniculata*, and are certainly not the terminalia of *O.intermedia*. **Illustrations of the adult insect:** the adult of *O.geniculata* is illustrated in colour by Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994).

Orthonevra incisa (Loew, 1843)
Preferred environment: small open areas with flushes, in mixed forest (Prokhorov *et al*., 2023). **Adult habitat and habits:** no data. **Flowers visited:** *Caltha palustris* (Prokhorov *et al*., 2023). **Flight period:** May. **Developmental stages:** not described. **Range:** known from Poland, northern Germany, Ukraine and Moldova, but range uncertain, due to confusion with other species until recently. **Determination:** *Orthonevra incisa* was described more than 150 years ago (Loew, 1843) based on a solitary female. Its identity, and in particular the identity of the male of *O. incisa*, has been uncertain until recently. Ricarte *et al.* (2022) redescribe the female, based on examination of the holotype, and follow the interpretation of the male offered by Stackelberg (1953). While it may require genetic data to confirm that interpretation, there is circumstantial evidence to support it and it is followed here. As defined in Ricarte *et al.* (2022) *O. incisa* differs from other closely similar European *Orthonevra* species in both sexes, in having abdominal sternite 1 extensively dusted. In other species, except *O. arcana*, it is entirely undusted and shiny, as are sternites 2-4. *Orthonevra arcana* is unusual in that it has short-haired eyes. The eyes in *O.incisa* are bare. See the *O. arcana* species account for other distinctions from that species. The female of *O. incisa* shares with the females of *O. arcana* and *O. plumbago* the feature of a median cleft in the posterior margin of tergite 5. The cleft varies in its expression in these three species and its appearance does not seem to be entirely constant intra-specifically. Essentially, it divides tergite 5 into two shallow lobes, posteriorly, but may be marked, more anteriorly, as a narrow, membranous strip extending for a variable distance toward the anterior margin of the tergite. A feature of the outer surface of the theca of the male terminalia of *O. incisa* distinguishes it from *O. plumbago*. Basal to the "large, hook-like process of the apico-dorsal lobe of the aedeagus" as defined in Ricarte *et al.* (2022), on the outer surface of the epandrium, there is a row of three robust, thorn-like projections, which are absent in *O. plumbago*. These are well-illustrated in photos of

the male terminalia of *O. incisa* provided in Ricarte *et al*. (2020). In the key to Spanish *Orthonevra* species Ricarte *et al*. (2022) also include both *O. incisa* and *O. plumbago*. The interpretation of *O. incisa* provided by Ricarte *et al*. (2022) is followed by Prokhorov *et al*. (2023), who provide a photo of the posterior part of the abdomen of the female of *O. incisa*, in dorsal view, including tergite 5. **Illustrations of the adult insect:** coloured photos of the *O. incisa* holotype are provided by Ricarte *et al*. (2022). The male and female of *O. incisa* are illustrated in colour in Prokhorov *et al*. (2023).

Orthonevra intermedia Lundbeck, 1916
Preferred environment: wetland/freshwater; neutral/calcareous springs and flushes (A. Ssymank, pers.comm.) in various situations, e.g. the lagg edge of raised bogs, poor and rich (mesotrophic) fen and humid, unimproved grassland subject to seasonal flooding; also in association with slow-moving streams (e.g. on functional floodplains of large rivers) on river floodplains. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Crataegus, Frangula alnus, Knautia, Potentilla, Prunus, Ranunculus, Rosa rugosa, Sorbus aucuparia, Viburnum opulus*. **Flight period:** mid April/beginning August; mid June/end July at higher altitudes/more northerly latitudes. **Developmental stages:** not described. **Range:** from southern Norway (Nielsen, 1989) through Denmark and the Netherlands to Belgium (extinct?); from NE England and Belgium eastwards through northern and central (northern Germany, Poland, Switzerland, Hungary) Europe to European parts of Russia; through Siberia to the Pacific (Kamchatka, Sakhalin). **Determination:** Bartsch et al.(2009b) provide the only key in which both males and females of *O.intermedia* and *O.stackelbergi* can be separated using non-genitalic features. Thompson and Torp (1982) figure the male terminalia of both this species and *O.stackelbergi* (Thompson & Torp), and point out that Stackelberg's *O.rossica* was, in fact *O.intermedia*. The figures of the male terminalia of *O.intermedia* provided by van der Goot (1981) do not depict that species, but appear to be the terminalia of *O.geniculata*, and the surstylus of *O.rossica* figured by van der Goot is the surstylus of *O.intermedia*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Haarto & Kerppola (2007) and Torp (1994).

Orthonevra montana Vujić, 1999
Preferred environment: forest/freshwater; by flushes and close to brooks above 1000m in open *Picea*/*Pinus* forest (in the Balkans - Vujić (1999b). **Adult habitat and habits:** flies low among vegetation in the immediate vicinity of standing water or settles on leaves protruding from the water, such as those of *Petasites* (A.Vujić, pers.comm.). **Flowers visited:** white umbellifers, *Ranunculus* (Vujić, 1999b); *Trollius* (Van Steenis *et al*., 2015). **Flight period:** mid May/end July (Vujić, 1999b). **Developmental stages:** not described. **Range:** Balkans (Bosnia-Herzegovina, Greece, North Macedonia, Montenegro, Serbia). There is also a record from the Czech Republic (Bartak and Vujič, 2004). **Determination:** in describing this species, Vujić (1999b) points out that the female cannot be distinguished from the female of the species he recognises as *O. tristis* (*O. onytes* Séguy of the present text). In the male, separation of these two taxa is largely dependent upon the terminalia. Vujić (1999b) figures the male terminalia of both. Unfortunately, the male terminalia of the type material of *O. tristis* seem never to have been figured or examined and the type locality of *O. tristis* is in SE Austria, within the known geographic range of *O. montana*. So, at present, it is uncertain whether *O. tristis* is the same species as *O. montana* or *O. onytes*. A more detailed account of the confusion surrounding the taxonomic status of these taxa is provided in Speight *et al*.(2018). **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Orthonevra nobilis (Fallen), 1817
Preferred environment: freshwater/wetland/forest; springs and flushes in fen, raised bog, riparian gallery forest and humid *Fagus*. May on occasion also occur in association with springs in humid grassland. **Adult habitat and habits:** flies among ground vegetation, usually close to water. **Flowers visited:** white umbellifers; *Fragaria, Galium, Potentilla erecta, Ranunculus*. **Flight period:** May/August, plus April in southern Europe. **Developmental stages:** larva described and figured by Maibach and Goeldlin (1994), associated with springs and flushes, where it occurs in wet, organically-enriched mud. **Range:** from central Norway south to the Pyrenees, Portugal and central Spain; from Ireland eastwards through northern and central Europe into European parts of Russia; also in mountainous parts of Italy, the former Yugoslavia, Greece and Turkey; the Caucasus (Georgia); through Siberia to the far east; China. **Determination:** Bartsch et al.(2009b); van Veen (2004); van der Goot (1981) figures the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various aiuthors, including Bartsch *et al*. (2009b), Stubbs and Falk (1983), Pétremand *et al*. (2022) and Torp (1994).

Orthonevra onytes (Séguy), 1961

Preferred environment: wetland, seepages and springs in unimproved montane/alpine grassland, from the altitude of the upper limit of *Fagus*, upwards, including open areas within forest. **Adult habitat and habits**: close to seepages, springs and small streams in unimproved grassland; adults fly low, settling on vegetation or rocks beside seepages etc., although the males may hover in the vicinity of large boulders or bushes, at 1-3 metres above the ground. **Flowers visited**: *Ranunculus*. **Flight period**: June/August (May in southern Europe). **Developmental stages:** larva described and figured by Maibach and Goeldlin (1994); found among plant roots beside seepages in unimproved alpine grassland. **Range:** Massif Central (France), Alps (Switzerland, Liechtenstein, Austria, Italy), Pyrenees (France, Spain), plus Cantabrian mountains (northern Spain) and Sierra de Gredos (central Spain). **Determination:** van Veen (2004); Séguy (1961). This is quite possibly the same species as *O.tristis* Loew, which has been largely ignored in the literature, since being wrongly synonymised by Becker (1921). However, until examination of the type material of *O.tristis* clarifies its identity, it is appropriate to retain use of *onytes*, since it is just as possible that *O. tristis* is the same species as *O. montana* (see under *O. montana*), rather than *O. onytes*. Séguy's (1961) key is not very satisfactory for identifying *O.onytes*, which can, however, be distinguished from related species (except *O. montana*) through its possession of the following combination of features: antennal segment 3 less than twice as long as deep; antennae entirely black; wing with vein R3+4 reaching wing margin before the actual wing tip; male with face quite flat and at upper mouth edge almost one and a half times as wide as at level of antennal insertions and eyes touching on frons for a distance equal in length to that of the ocellar triangle; female with mesoscutum and scutellum covered in very short, adpressed, backward-pointing hairs. Vujić (1999b) provides figures of the male terminalia of both the species he interprets as *O.tristis* and the closely-related *O. montana* and gives other, non-genitalic features for separating them. He remarks that the females of these two taxa cannot be reliably distinguished. **Illustrations of the adult insect:** the female is illustrated in colour by Speight and De Courcy Williams (2021).

Orthonevra plumbago (Loew), 1840

Preferred environment: wetland; springs/flushes in seasonally-flooded, oligotrophic/ mesotrophic, herb-rich, harvested *Phragmites* marsh, on freely-draining sandy soil; small, open areas with flushes in *Alnus incana* forest. **Adult habitat and habits:** in the immediate vicinity of spring-fed streamlets/flushes; adults fly within 2m of the ground. **Flowers visited:** no data. **Flight period:** end April/mid May. **Developmental stages:** not described. **Range:** requires revision, following redescription of the female lectotype by Ricarte *et al.*(2022), which suggests that more than one species may be confused under the name *O. plumbago* in recent literature. In recent literature *O. plumbago* has been reported from southern Finland, Latvia, Lithuania, Poland, Germany, France (Alps), Czech Republic, Switzerland, Slovakia, Italy, Hungary, Roumania, Bulgaria, Moldova and European Russia. **Determination:** Ricarte *et al.*(2022) redescribe the female of *O. plumbago*, based on the lectotype they designate. They also allude to variability in the characteristics of *O. plumbago* as interpreted in recent literature, remarking that "Given the confusion found in the literature with this species, females of *O. plumbago* identified in Europe and the European parts of Russia should be now revised by comparison with the featured lectotype and reported variability in certain features (e. g. length of the posterior incision in tergum V of female). Regarding males sensu Stackelberg (1953), further morphological and molecular analyses should be undertaken to confirm whether those of *O. plumbago* are conspecific with the lectotype-like females". Unfortunately, no genetic data are provided for *O. plumbago*, by Ricarte *et al*. (2024), and they do not provide a figure of the male genitalia of the taxon they refer to as *O. plumbago* sensu Stackelberg.

Whether the variability in *O. plumbago* alluded to by Ricarte *et al.*(2022) is due to the presence of more than one species confused under the name *plumbago*, it remains necessary to consider how to separate *O. plumbago*, as currently recognised, from other European *Orthonevra* species. In the key provided by Ricarte *et al.* (2022) separation of *Orthonevra arcana* from *O. plumbago* is dependent upon sternite 1 – said to be "densely pollinose" in *O. arcana*, but "shiny or slightly pollinose" in *O. plumbago*. As currently recognised, the female of *O. plumbago* varies in the extent of the median cleft on the posterior margin of tergite 5 and in whether or no there is a "small elevation on the posterior margin of tergite IV" (Ricarte *et al.*, 2022). The posterior margin of tergite 4 can be entirely flat, uninterrupted medially by any prominence or elevation. Given that there is no male definitely associated with the lectotype female, establishing the identity of the male of *O. plumbago* may well depend on genetic data, as suggested by Ricarte *et al.* (2022). But, as figured by Stackelberg (1953) the male terminalia of *O. plumbago* are distinct from those of other European *Orthonevra* species, in respect of the aedeagal armature and projections of the theca. Stackelberg's (1953) interpretation of the male of *O. plumbago* is followed here. Males with terminalia corresponding with the Stackelberg (l. c.) figure have sternite 1 entirely shining, separating them from males of *O. incisa* (sternite 1 extensively dusted) and bare eyes, which would separate them from *O. arcana*, assuming eye hairs can always be detected in *O. arcana*. Van de Meutter *et al*. (2023) suggest that the similarity between the male genitalia of *O. plumbago*, as

figured in Speight and Castella (2011), with the male genitalia of *O. arcana*, suggests that the *O. plumbago* of Speight and Castella, 2011) is actually *O. arcana*. But Van de Meutter *et al*. (2023) do not compare the Belgian specimens they consign to *O. arcana* with any specimens they recognise as *O. plumbago*. Neither do they either allude to, or figure, differences between the male genitalia of *O. arcana* and what they would regard as *O. plumbago*. Genetic data from central European and/or Russian populations of *O. plumbago* are much needed, to aid in deciding whether the existing, ambivalent morphological definitions of *O. arcana* and *O. plumbago* refer to one, two or more species-level taxa. *Orthonevra plumbago* as recognised here is also very similar to *O. brevicornis*. In the male the surstyli are almost symmetrical, whereas in *O. brevicornis* (as figured by Speight and Castella, 2011) the surstyli are extremely asymmetrical. Another small difference is in the character of the mesoscutal hair covering. In the male of *O. plumbago* the mesoscutal hairs are silver-grey, no longer than twice the length of a posterior ocellus and many of them have recurved tips. In the male of *O. brevicornis* the mesoscutal hairs are dark grey (almost black) and yellowish, distinctly longer than twice the length of a posterior ocellus and upstanding, straight. In the female, the median, longitudinal cleft in tergite 5 of *O. plumbago* separates it from the female of *O.brevicornis*, where this cleft is absent. **Illustrations of the adult insect:** none known.

Orthonevra shusteri Bradescu, 1993
Preferred environment: along streamlets (Bradescu, 1993). **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus* (Bradescu, 1993). **Flight period:** April. **Developmental stages:** not described. **Range:** Roumania. **Determination:** Bradescu (1993) describes this species based on a solitary male. The female is undescribed. Bradescu (1993) figures the male terminalia and the antenna. Antennal segment 3 is in this species very square-ended. Bradescu (1993) does not discuss differences between this species and *O. frontalis*, which it evidently closely resembles in both shape of antennal segment 3 and the form of the male terminalia. **Illustrations of the adult insect:** none known.

Orthonevra stackelbergi Thompson & Torp, 1982
Preferred environment: : wetland/forest, wet clearings/open areas in deciduous forest and mixed boreal forest (H.Bartsch and T.R.Nielsen, pers.comm.); areas subject to seasonal flooding (Bartsch *et al*.(2009b). **Adult habitat and habits:** rests on foliage and small twigs of shrubs; flight rapid and at up to at least 3m (H.Bartsch, pers.comm.). **Flowers visited:** *Aruncus asiaticus, Heracleum* (Gritskevich, 1998); *Sambucus nigra, Viburnum opulus* (H.Bartsch, pers.comm.); *Frangula alnus* (Tolsgaard and Bygebjerg, 2006); white umbellifers, *Caltha, Crepis, Rosa canina* (Bartsch *et al*.(2009b); *Crataegus, Ranunculus* (Nilsson *et al*, 2012). **Flight period:** mid June/July. **Developmental stages:** undescribed. **Range:** Fennoscandia (southern Norway, southern and more northern coastal parts of Sweden and southern Finland, eastern Denmark); the Baltic States and Poland; European parts of Russia and on through Siberia to the Pacific. **Determination:** Bartsch *et al*.(2009b). Thompson and Torp (1982) figure the male terminalia of both this species and the closely similar *O.intermedia*. **Illustrations of the adult insect:** the male is illustrated in colour by Bartsch *et al.*(2009b) and Haarto & Kerppola (2007).

Orthonevra tristis - see under *O. montana* Vujić and *O. onytes* Séguy.

PALUMBIA

A small genus comprising two sub-genera (*Palumbia* and *Korinchia*), one of which (*Palumbia*) occurs in Europe. Only three species are known in the subgenus *Palumbia*, two of them Palaearctic and one of them Nearctic. The two Palaearctic species both occur in southern Europe and are keyed out by Thompson (1975). The other subgenus, *Korinchia*, is mostly found in the Oriental Region, though one species reaches the Palaearctic in China.

Palumbia bellieri (Bigot), 1860
Preferred environment: no data. **Adult habitat and habits**: no data. **Flowers visited:** *Euphorbia*. **Flight period:** June. **Developmental stages:** not described. **Range:** described from the Italian island of Sicily. **Determination:** Thompson (1975), who redescribes the species and provides a key distinguishing it from *P. eristaloides*. Thompson (1975) suggests that *P. bellieri* and *P. eristaloides* may well be colour forms of the same species, in which case the name *bellieri* presumably takes precedence. The synonymy *of P. eristaloides* with *bellieri* seems to have been assumed in Vujić *et al*. (2020d), but without comment. **Illustrations of the adult insect:** the male of *P. bellieri* is figured in colour by Speight and de Courcy Williams (2021).

Palumbia eristaloides (Portschinsky), 1887
Preferred environment: forest/open ground; along streams in open, montane conifer forest of *Pinus/Cedrus* (P.M.Pavett, pers.comm.) and marshy, unimproved, montane grassland and streamsides partially overshadowed by trees or shrubs (Hurkmans and Hayat, 1997). **Adult habitat and habits**: according to Hurkmans and Hayat (1997) this species (as *P.flavipes*) flies in the shade around mid-day, but in the open in the evening. In the open it apparently flies rather slowly, low over herb-layer vegetation. Has also been found flying round seasonal pools edging a small stream (P.M.Pavett, pers.comm.). **Flowers visited:** umbellifers; *Euphorbia* (Zimina, 1960). **Flight period:** March, plus June/July. **Developmental stages:** not described. **Range:** Transcaucasus (Armenia), northern Turkey and the Lebanon. **Determination:** according to Thompson (1975) and Peck (1988), *flavipes* is a synonym of *eristaloides* (Portschinsky), and is treated as such here. Thompson (l.c.) redescribes *P.eristaloides* and figures the male terminalia. Although he provides a key to separate them, Thompson (1975) states that *P.bellieri* (known only from Sicily) and *P.eristaloides* have identical male terminalia and suggests they may well be no more than colour varieties of one species. **Illustrations of the adult insect:** *P.bellieri* is figured in colour at: http://cyrille.dussaix.pagesperso-orange.fr/

PARAGUS

Identification of the European *Paragus* species was virtually impossible until Goeldlin's (1976) revision appeared. Claussen (1989), Goeldlin and Lucas (1981), Kaplan and Thompson (1981), Marcos-García (1986), Marcos-García & Rojo (1994), Simic (1986), Stanescu (1977, 1981, 1991, 1992) and Vujić *et al*. (1999) subsequently added a further thirteen species to the European list. There is still no key which deals with all the European species and identification is at present dependent primarily on features of the male terminalia - females of some of the species cannot be satisfactorily separated. Some species are still of uncertain status, particularly in the *bicolor* and *majoranae/hermonensis* complexes, and in the subgenus *Pandasyophthalmus* e.g. *P. albipes*, and further European species await description. It remains necessary to approach identification of *Paragus* specimens with great care! Recently, Rojo *et al*. (2006) stated that "based on both morphological and molecular evidence, *Paragus haemorrhous* Meigen 1822, *Paragus coadunatus* (Rondani, 1847) and *Paragus ascoensis* Goeldlin de Tiefenau & Lucas, 1981 appear to be synonyms of *Paragus tibialis* (Fallén, 1817)". It is unfortunate that their study incorporates no consideration of the differing ecologies of the taxa they claim to synonymise and contains no data from captive breeding experiments to back-up their perception of what constitutes intra-specific variability among these *Paragus* s.g. *Pandasyophthalmus* taxa. It would seem that conclusions based on mitochondrial DNA require to be regarded with the same degree of healthy scepticism by morphologists and ecologists as they themselves employ, in their appraisal of the results they obtained from their examination of the morphology of adult flies and developmental stages! Vujić *et al*. (2008), in their genetic re-appraisal of the species of the tribe Paragini, effectively reverse the conclusions of the earlier genetic study by Rojo *et al*. (2006), reinstating *P. ascoensis*, *P. mundus* (as *coadunatus*) and *P. haemorrhous*, in their World list of *Paragus* species, at the same time redefining *Pandasyophthalmus* as a subgenus of *Paragus*.

Key to subgenera of *Paragus* known in Europe and Turkey

1 Eye hairs arranged in 3 more or less vertical stripes of contrasting colour; scutellum usually partly yellow or reddish at apex ……... **2**
----- eye hairs of nearly uniform colour, not forming stripes of contrasting colour; scutellum entirely black ..... ……... ***P. Pandasyopthalmus*** Stuckenberg

2 Posterior margin of scutellum almost smooth ……..... ***P. Paragus*** Latreille
----- entire posterior margin of scutellum with a row of long, digitate projections …….. ***P. Serratoparagus*** Vujić *et al*.

Paragus abrogans Goeldlin, 1971
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/beginning August (females July/August: pers. comm. C. Claussen) and September. **Developmental stages:** not described. **Range:** Greece (?); Turkey; Iran; Saudi Arabia; Kyrgyzstan; Turkmenistan. Probably also known from Tajikistan

and Uzbekistan, having been recorded there under the name "*P. albipes*" by Peck (1988). **Determination:** the key provided by Claussen and Weipert (2004) is the most comprehensive and reliable for separating this species from other European *Paragus* s.g. *Pandasyophthalmus* species. Vujić *et al*. (1998) and Claussen and Weipert (2004) also provide figures of the male terminalia. This species was erroneously synonymised with *P. rufocinctus* (Brunetti), by Thompson and Ghorpadé (1992). Its separate identity was re-established by Claussen and Weipert (2004), who also figure the male terminalia of *P. rufocinctus*. Peck (1988) gives *P. abrogans* as a synonym of *P. albipes* Gimmerthal (described from Estonia and Latvia and not subsequently cited from elsewhere: see under *P.albipes*), but without explanation or justification. This synonymy is disregarded here, as requiring substantiation. **Illustrations of the adult insect:** none known.

Paragus absidatus Goeldlin, 1971
Preferred environment: open ground; unimproved, calcareous and non-calcareous alpine/subalpine grassland, subalpine heath and moraine, up to 2100m; also occasionally in unimproved montane grassland within the *Picea* zone, down to 1300m. **Adult habitat and habits:** flies low among/over ground vegetation and is as easily swept as found by direct observation. **Flowers visited:** *Potentilla erecta* (P. Goeldlin, pers.comm.); *Saxifraga paniculata* (Lair *et al*., 2021). **Flight period:** mid June/end July. **Developmental stages:** both larva and puparium are described – the larva is also figured - by Rotheray and Sarthou (2007), from larvae found on *Gentiana punctata* in subalpine grassland. This species has also been reared from larvae found on *Epilobium* and *Cirsium* in subalpine grassland (P.Goeldlin, pers.comm.). **Range:** France (Pyrenees, Alps), Switzerland and Turkey; Eastern Siberia and the Far East, in Asiatic Russia. **Determination:** Goeldlin (1976), who figures the male terminalia. **Illustrations of the adult insect:** none known.

Paragus albifrons (Fallen), 1817
Preferred environment: forest/scrub; thermophilous *Quercus* forest, dry *Pinus* forest, dry scrub and dune scrub and ancient, unimproved dry grassland; usually close to damper spots or stream margins. **Adult habitat and habits:** a secretive species, as easily collected by Malaise trap or sweeping as by direct observation; in flight only early in the morning and late in the evening, under warm conditions; flies within stands of taller grasses etc. along the edges of paths and small, open areas in forest or dune scrub. **Flowers visited:** umbellifers; *Eryngium, Euphorbia; Ranunculus, Sambucus ebulus, Veronica*. **Flight period:** June/October, with a peak in September. **Developmental stages:** larva described and figured by Goeldlin (1974) from larvae collected on *Cirsium arvense*; also found on *Carduus* and *Onopordon* by Marcos-García (1981, 1985). Torp (1994) mentions *Ononis repens* as another plant on which *P.albifrons* larvae have been found. In the list provided by Rojo and Marcos-García (1998) *Daucus* and *Tragopogon* are also given. **Range**: from southern Sweden and Denmark south to the Mediterranean; from Britain (southern England) eastwards through central and southern Europe (Italy, the former Yugoslavia, Bulgaria) into European parts of Russia and the Caucasus (Georgia) and on to the Pacific; Iran, Afghanistan and Mongolia. **Determination:** Goeldlin (1976), Bradescu (1991) who figure the male terminalia. The female of this species cannot be reliably determined because the females of various recently-described, related, European species remain unknown. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Paragus albipes Gimmerthal, 1842
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Developmental stages:** not described. **Range:** described from Estonia and Latvia and still referred to as occurring in those countries (Kuznetzov, 1993), but not cited as occurring elsewhere other than by Peck (1988). **Determination:** the identity of this species is uncertain. Its description is undiagnostic, its male terminalia have never been figured and the type material does not seem to have been re-examined since the species was described. For unknown reasons, Peck (1988) gives *P.abrogans*, a species described from Iran, as a synonym of *P. albipes*. This presumed synonymy is probably the explanation for Peck's (1988) citation of *P. albipes* from Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Here, these citations are regarded as requiring confirmation, as is the synonymy of *P. abrogans* with *P. albipes*. It would seem more likely that *P. constrictus* is a junior synonym of *P. albipes*. There is clear need for the type material of *P. albipes* to be re-examined in order to clarify the identity of this taxon, given that its description is unhelpful in this regard. **Illustrations of the adult insect:** none known.

Paragus altomontanus Van de Weyer, 2010
Preferred environment: open, unimproved, calcareous, goat-grazed, dry grassland at 1700 – 1900m (J.Dils & J. Faes, pers.comm.) . **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end of June/beginning of August.

Developmental stages: no data. **Range:** Turkey. **Determination:** described from the male only, the female remains unknown. Van de Weyer (2010) provides figures of the male terminalia, which can be used to separate *P. altomontanus* from other species and figures the markings on the tergites, in which *P. altomontanus* parallels the range of variability found in *P. bicolor*.

Paragus ascoensis Goeldlin & Lucas, 1982
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia*. **Flight period:** end March/beginning October. **Developmental stages:** not described. **Range:** Corsica and Sardinia. **Determination:** only the male of this species can reliably be recognised, using features of the male terminalia, as figured by Goeldlin and Lucas (1982) and Vujić *et al*. (1998). **Illustrations of the adult insect:** none known.

Paragus atlasi Claussen, 1989
Preferred environment: open ground; semi-arid, open, unimproved grassland. **Adult habitat and habits:** flies low among ground vegetation. **Flowers visited:** no data. **Flight period:** May/end June. **Developmental stages:** not described. **Range:** At present, *P.atlasi* has only been recorded from southern France and N Africa (Morocco). **Determination:** the description of this species is based on a single male (Claussen, 1989), lacking bars of dusting on the tergites. The male terminalia are figured by Claussen (1989) and are evidently very similar to the terminalia of *P. bradescui*, but differ in the shape of the lingula. A specimen from France, confirmed as *P. atlasi* by Claussen (pers. comm.) conforms with the holotype in its terminalia but has bars of silver-grey dusting on the tergites. Whether bars of dusting are present or absent on the tergites is constant in some *Paragus* species but variable in others. It is concluded here that in *P.atlasi* dust bars on the tergites may be present or absent. Assuming this conclusion is correct *P. atlasi* and *P. bradescui* can at present only be distinguished by subtle differences in their male terminalia. The female of *P. atlasi* remains undescribed and may be indistinguishable from the female of *P. bradsescui*. **Illustrations of the adult insect:** none known.

Paragus azureus Hull, 1949
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** January/beginning of May and October/November (Arabian peninsula); July (Turkey). **Developmental stages:** no data. **Range:** Turkey (*P.azureus* ssp. s*crupens* Stuckenberg: see Hayat and Claussen, 1997), Armenia, Israel, Egypt, Arabian peninsula and eastern parts of the Afrotropical region. **Determination:** Stuckenberg (1954) redescribes the species and figures the male terminalia. *P.azureus* is a member of the subgenus *Serratoparagus*, and as such has deep serrations along the posterior margin of the scutellum. It is closely similar to *P. crenulatus* Thomson, which is not known in Europe or Turkey, but which does reach the south-western edge of Asia. *P.crenulatus* is not differentiated from *P.azureus* in any key. Stuckenberg (1954) figures the male terminalia of *P.crenulatus*. *Paragus faesi* van de Weyer, is another member of the *P.serratus* group known from Turkey (see under *P. faesi*). **Illustrations of the adult insect:** the general appearance of the male of this species can be seen in the coloured photos provided by Smit *et al.* (2017) and Dawah *et al.* (2020).

Paragus bicolor (Fabricius), 1794
Preferred environment: open ground; dry, unimproved, sparsely-vegetated grassland and open areas in *Quercus ilex* forest and maquis. **Adult habitat and habits:** flies low among ground vegetation, settling on either bare ground or low plants; as easily detected by sweeping, or Malaise traps, as by direct observation. **Flowers visited:** *Euphorbia, Herniaria glabra, Potentilla, Sedum, Scleranthus, Solidago*. **Flight period:** May/July; July/August at higher altitudes. **Developmental stages:** larva not described, but apparently reared from among aphids on *Rumex* (Gomes, 1981). **Range:** from southern Sweden and Denmark (extinct in Belgium) south to the Mediterranean and N Africa; from France eastwards through central and southern Europe to Mongolia; Iran and Afghanistan. **Determination:** Goeldlin (1976), Bradescu (1991), who figure the male terminalia. Hayat *et al*. (2024) illustrate the differences in shape of the surstyli in *P. bicolor* and *P. testaceus*, which provide the only convenient way of separating these morphologically nearly identical species. Existing keys do not differentiate *P.bicolor* from the full range of known, related, European species. At present, identification can only be reliably carried out using features of the male terminalia. The females cannot be identified with certainty, due to the potential for confusion with females of related species, for some of which females are yet to be described. **Illustrations of the adult insect:** Bartsch *et al*. (2009a) provide a coloured illustration of the adult male. The male and female are illustrated in colour by Speight and De Courcy Williams (2021).

Paragus bradescui Stanescu, 1981.
Preferred environment: forest/open ground; open areas in thermophilous *Quercus* forest; thermophilous forest fringes and open ground; stony, dry, sparsely-vegetated, unimproved grassland. **Adult habitat and habits:** no information, but almost certainly low-flying, among ground-vegetation. **Flowers visited:** *Foeniculum vulgare* (Lebard, 2022). **Flight period:** May to September, with peaks in May, July and September. **Developmental stages:** not described. **Range:** southern France, the former Yugoslavia, Roumania; Israel; asiatic Russia; Kyrgyzstan; Turkmenistan; Tajikistan. **Determination:** Stanescu (1992), Vujić *et al*. (1999), who figure the male terminalia. In Peck (1988) this species is erroneously synonymised with *P.hermonensis* Kaplan. Stanescu (1991a), in re-instating *P.bradescui*, points out that Kaplan illustrates the terminalia of two different species under the name *P.hermonensis*, and that he clearly indicates that the species illustrated in his Fig.7 is the species he recognises as *P.hermonensis*, while stating that the identity of the other, shown in his Fig.8, was to him uncertain. From Stanescu's figures of the male terminalia of *P.bradescui* (e.g. in Stanescu, 1992) it is evident that, as she (1991a) states herself, Kaplan's uncertain specimen is the same species as *P.bradescui*, while *P.hermonensis* is just as clearly a different species. *P.bradescui* can only be reliably distinguished from other, related, European *Paragus* species in the male sex, using characteristics of the terminalia. Stanescu's (1992) key provides the most comprehensive basis for distinguishing *P.bradescui* and includes figures of the terminalia of that species, together with figures of the male terminalia of *P.oltenicus* Stanescu and *P.romanicus* Stanescu. Unfortunately, there remains considerable possibility for misdetermination of *P.bradescui* and for confusion of other related species with it. Vujić et al.(1999) attempt to consolidate the status of these various species, but fail to adequately include *P.majoranae* among their comparisons and segregate *P.atlasi* using features which appear to be partly in conflict with the original description of that species. They do establish that *P.antoinettae* is a synonym of *P.bradescui*. But the status of *P.atlasi* remains unclear. Considerable caution requires to be exercised in attempting to decide the identity of specimens belonging to the *P.hermonensis* group. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić et al.(2020d).

Paragus cinctus Schiner & Egger, 1853
Preferred environment: forest; evergreen oak (*Q.ilex/Q.suber*) forest with a scrub layer of *Cistus* and *Sarrothamnus* and more open patches with sparse vegetation of grasses and *Sedum*.. **Adult habitat and habits:** flies slowly through sparse, tall ground vegetation of grasses and scattered bushes, at c1m from the ground, during the earlier part of the morning (disappears by 10.00a.m.). **Flowers visited:** *Foeniculum vulgare, Scabiosa*. **Flight period:** May/August. **Developmental stages:** undescribed. **Range:** Spain, southern France, Italy, Austria, Hungary, parts of the former Yugoslavia; Roumania, parts of southern Russia, the Ukraine and on into Asia toTadjikistan and Turkmenia; N Africa (Morocco). **Determination:** Goeldlin (1976), Bradescu (1991), who figure the male terminalia. The parameres in this species are easily visible and diagnostic. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Paragus coadunatus: see under *P. mundus*

Paragus compeditus Wiedemann, 1830
Preferred environment: open ground; dune slacks with chenopods etc. in coastal dune systems and at the edge of marsh and other humid situations in inland dune systems and other arid habitats (M.Ebejer, pers.comm.). **Adult habitat and habits:** flies among vegetation in humid situations. **Flowers visited:** *Cachrys crassiloba, Foeniculum, Mentha longifolia, Polygonum equisetiforme* (Van Steenis *et al.*, 2019). **Flight period:** January (Arabian peninsula); April; October (Cyprus). **Developmental stages:** not described, but Van Eck *et al.* (2020) report rearing *P. compeditus* from larvae feeding on the aphid *Hyalopterus pruni*, on the leaves of *Phragmites*. **Range:** Italy, the Ukraine, Cyprus, Turkey and on to N Africa; Arabian peninsula and the Afrotropical region, including the Mascarene islands; asiatic Russia; Iran; Kazakstan; Uzbekistan; Kyrgyzstan; Tajikistan; China. **Determination:** Goeldlin (1976), who figures the male terminalia. **Illustrations of the adult insect:** the general appearance of this species can be seen in the coloured photo provided by Smit *et al*. (2017).

Paragus constrictus Simic, 1986
Preferred environment: open ground; has been found on thinly vegetated limestone karst and bouldery, calcareous alluvial deposits/river margins; also in unimproved, alpine pasture and inland and coastal dune systems. **Adult habitat and habits:** flies within 1m of the ground, over bare rock and through ground vegetation, settling on foliage; as easily detected by sweeping as by direct observation. **Flowers visited:** white umbellifers; *Crithmum maritimum, Dasiphora fruticosa,*

Potentilla erecta, P.fruticosa, Ranunculus . **Flight period:** May and July/August. **Developmental stages:** undescribed, but has been found on *Hypochoeris radicata* (Bartsch *et al*., 2009). **Range:** as yet uncertain, due to confusion with other species, particularly *P.tibialis* (Fall.). So far, known from southern Sweden and Denmark (where it is almost entirely coastal in distribution: Bygebjerg, 2004), Ireland, Spain, Germany, the French Alps, Switzerland, Austria, Italy, the former Yugoslavia and Turkey; Georgia; asiatic Russia. **Determination:** Simic (1986), Speight and Chandler (1995), Vujić *et al*. (1998). In both sexes *P. constrictus* shares with *P.tibialis* the feature of having entirely pale-haired abdominal tergites, so it is immediately distinguishable from *P.haemorrhous* Mg. The male is only distinguishable from *P. tibialis* in the shape of the parameres. These are illustrated by Simic (1986), Speight and Chandler (1995), Doczkal (1996a) and Vujić *et al*. (1998). Haarto (2014b) provides photos showing differences in pilosity of the tergites of *P. constrictus* and *P. tibialis* females, which aid in their separation. In particular, on tergite 4 the pilosity is recumbent in females of *P. constrictus* but upstanding in *P. tibialis* females. The relationship between this species and the enigmatic *P. albipes* Gimmerthal remains to be established. The type material of *P. albipes* (assuming it exists) does not seem to have been examined by any recent author, including Simic (1986). **Illustrations of the adult insect:** the general appearance of the male of *P. constrictus* is shown in colour by Bartsch *et al*. (2009a). The same illustration is also used by those authors to illustrate the male of *P. haemorrhous* and *P. tibialis*. A coloured photo of the male is provided by Bot and Van de Meutter (2019).

Paragus faesi Van de Weyer, 2000
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September. **Developmental stages:** not described. **Range:** Turkey. **Determination:** Van de Weyer (2000), who figures the male terminalia. This species is known only from the male holotype. It is a member of the *Paragus serratus* group, as defined by Stuckenberg (1954), recognised as a subgenus, *Paragus Serratoparagus*, by Vujć *et al*. (2008), that is primarily Afrotropical and Oriental in distribution. As such, it has deep serrations along the posterior margin of the scutellum, distinguishing it from all non-*serratus* group *Paragus* species known from Europe. The only other *serratus* group species whose range extends to the edges of Europe is *P.azureus* Hull, ssp *scrupeus* Stuckenberg, which is also known from Turkey. Van de Weyer lists features separating *P. faesi* from both *P. azureus* and *P. pusillus*, the latter an Afrotropical species whose range extends to the Arabian peninsula and with male terminalia closely similar to those of *P.faesi*. **Illustrations of the adult insect:** none known.

Paragus finitimus Goeldlin, 1971
Preferred environment: montane and subalpine unimproved, usually calcareous, lightly-grazed (sheep, cows) grassland; closed, dry, unimproved, lightly-grazed calcareous, lowland pasture; at the northern edge of its range this species occurs at sea level, in more-or-less calcareous, fixed-dune grassland. **Adult habitat and habits:** among the thin vegetation cover of cropped grassland; flies low and settles on foliage as well as feeding at flowers. **Flowers visited:** *Galium* spp., *Origanum, Potentilla erecta, Pimpinella, Rosa pimpinellifolia, Sedum*. **Flight period:** end of May/August, with peak in July. **Developmental stages:** undescribed. **Range:** in Europe known from southern Norway, Sweden and Finland, Denmark, Belgium, France (Paris basin, Rhine valley), southern Germany, Switzerland and Spain; in the Eastern Palaearctic from Asiatic Russia, Kyrgystan, Kazakstan and Mongolia. **Determination:** Goeldlin (1976), Bradescu (1991), who figure the male terminalia. Can only be determined reliably by examination of the male terminalia. **Illustrations of the adult insect:** the adult insect (male and female) is illustrated in colour by Torp (1994). Bartsch *et al*. (2009a) have used the same coloured illustration of a male *Paragus* for both *P.bicolor* and *P.finitimus*.

Paragus flammeus Goeldlin, 1971
Preferred environment: thermophilous forest fringes and dry/semi-arid, unimproved grassland. **Adult habitat and habits:** flies low among sparse ground vegetation in unimproved dry grassland and in open areas around and within thermophilous *Quercus* forest. **Flowers visited:** *Scabiosa* (Baugnée (1998). **Flight period:** end May/end August. **Developmental stages:** not described. **Range:** from Belgium south through France to central Spain and eastwards through central (Germany, Switzerland, Austria) Europe to the Ukraine and through southern Europe to Greece; and the Caucasus mountains and on into Kazakhstan and Tajikistan; Crete, Iran, N Africa (Morocco). **Determination:** Goeldlin (1971), who figures the male terminalia. This species may only be distinguished from *P.glumaci* using features of the male terminalia (Vujić et al, 1999b). **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Paragus glumaci Vujić, Simic & Radenkovic, 1999
Preferred environment: open ground/wetland; wetlands and seasonally-flooded coastal grassland and submediterranean lake shores, near thermophilous *Quercus* forest and Eastern Mediterranean maquis (A.Vujić, pers.comm...). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** North Macedonia, Montenegro. This species should be regarded as threatened at the European level (Vujić *et al*, 2001). **Determination:** Vujić et al.(1999b), who figure the male terminalia. The female of this species has not yet been described. *P.glumaci* is very similar to *P.flammeus*, from which it may only easily be distinguished by characters of the male terminalia. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić et al.(2020d).

Paragus haemorrhous Meigen, 1822
Preferred environment: forest/open ground/wetland; unimproved grassland (calcareous and non-calcareous), heathland, including montane/subalpine heath, garrigue, dune grassland, open areas and pathsides in forest up to the *Larix*/*Pinus uncinata* zone, fen meadow. **Adult habitat and habits:** flies low through ground vegetation, with an erratic, darting, weaving flight; males hover close to the ground or close to the foliage of low-growing plants and patrol stands of low-growing plants in flower; settles on foliage or the ground. **Flowers visited:** umbellifers; *Calluna, Jasione montana, Matricaria, Origanum, Polygonum, Potentilla anserina, P.erecta, P.fruticosa, Solidago, Stellaria.* **Flight period:** May/September, with peaks in June and August (plus March/April and October in southern Europe). **Developmental stages:** larva aphid feeding on *Rubus* and various herbaceous plants, e.g. *Calendula*, *Digitalis* and *Sonchus* (Dussaix, 2013) plus some crops (at least in southern Europe), such as *Beta*, *Cynara* and *Vicia* species (Rojo and Marcos-García, 1998); described and figured by Goeldlin (1974), from a larva collected on *Knautia*. The larva is of this species is also illustrated in colour (from a preserved specimen) by Rotheray (1994) and (from living material) by Bartsch et al.(2009a) and Dussaix (2013). The larva described by Dixon (1960) as that of *P.tibialis* (Fall.) is the larva of *P.haemorrhous*. The puparium is shown in colour by Dussaix (2013), who also reports that duration of the puparial phase is 10 days. Mizuno et al.(1997) present data showing that *P. haemorrhous* larvae specialise in predation of aphids that are protected by ants (*Lasius niger)*, which deter more generalist aphidophagous syrphid larvae. **Range:** from northern Norway south to Iberia and the Mediterranean (including Sicily and Malta); N Africa, Israel and Turkey; also in the Afrotropical region; from Ireland eastwards through central and southern Europe (Italy, the former Yugoslavia) into European parts of Russia; in N America from the Yukon south to Costa Rica. **Determination:** Goeldlin (1976), Speight and Chandler (1995), Simic (1986) and Vujić *et al*. (1998), who figure the male terminalia of this and related species. Speight and Chandler (1995) also distinguish both sexes of *P. haemorrhous* from *P. constrictus* and *P.tibialis*. Haarto (2014b) provides photos showing differences in pilosity of the tergites of *P. constrictus* and *P. tibialis* females, which aid in their separation. Sforzi & Dommaggio (2021) synonymise *P. coadunatus* of Rondani with *P. haemorrhous*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994).

Paragus hyalopteri Marcos-García & Rojo, 1994
Preferred environment: wetland; marsh or ditches with *Arundo* or *Phragmites*, but better known in association with orchards of fruit trees: almond, apricot, peach, and plum. **Adult habitat and habits:** no data - almost all known specimens derived from rearing of larvae. **Flowers visited:** no data. **Flight period:** end May/October, with a peak in July. **Developmental stages:** larval biology indicated by Marcos-García and Rojo (1994) and Rojo and Marcos-García (1998); feeds on the aphid *Hyalopterus pruni* on fruit trees of the genus *Prunus* and on *Arundo* and *Phragmites*. The larval morphology is described and illustrated in detail by Orengo-Green *et al*. 2024c), based on larvae collected from *Phragmites* foliage in June, some of which were reared to maturity. **Range:** Spain; France (Corsica); Italy (Sommaggio and Corazza, 2006); Serbia, Kyrgyzstan; Tajikistan; Uzbekistan. **Determination:** Marcos-García and Rojo (1994), who detail distinctions between this species, *P.quadrifasciatus* Mg. and *P.compeditus* Wied.; Sorokina (2009), who figures the male terminalia and includes *P.hyalopteri* in a key which includes many European *Paragus* species. In general appearance, *P.hyalopteri* is very similar to *P.quadrifasciatus*. **Illustrations of the adult insect:** none known.

Paragus kopdagensis Hayat & Claussen, 1997
Preferred environment: humid, grazed, subalpine grassland (and meadows). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end of June/August. **Developmental stages:** not described. **Range:** Turkey; European Russia (Caucasus); Georgia. **Determination:** Hayat & Claussen (1997), who figure the male terminalia and demonstrate how this

species may be distinguished from *P.punctulatus* Zett. and *P.absidatus* Goeldlin. **Illustrations of the adult insect:** none known.

Paragus majoranae Rondani, 1857
Preferred environment: forest/open ground; open grassy areas, both humid and semi-arid, along brooks and rivers in thermophilous *Quercus* forest and upwards through *Fagus* forest into the *Picea* zone to 1500m (in the Balkans); largely confined to relict areas of unmodified forest (A.Vujić, pers. comm.). **Adult habitat and habits:** flies among low-growing plants (A.Vujić, pers. comm.). **Flowers visited:** no data. **Flight period:** April/May and July/August. **Developmental stages:** not described. **Range:** France, Germany, Switzedrland, Italy, Greece, Montenegro, Serbia, North Macedonia. **Determination:** Vujić *et al*. (1999), who figure the male terminalia under the name *P.gorgus*; Sommaggio (2002). Sommaggio (2002) demonstrates that the name *majoranae* had been until then wrongly applied, to the species now referred to as *M.pecchiolii*. *P.majoranae* is closely similar to *P.hermonensis* and *M.pecchiolii*, from which the female cannot reliably be separated. Determination is largely dependent upon features of the male terminalia. Considerable caution requires to be exercised in attempting to decide the identity of specimens belonging to the *P.hermonensis* group, including *P.majoranae*. **Illustrations of the adult insect:** none known.

Paragus medeae Stanescu, 1991
Preferred environment: inland/estuarine sand dunes (Stanescu, 1992): Pannonian steppic grassland (Tot *et al*., 2024). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/September **Developmental stages:** not described. **Range:** Hungary, Roumania, Serbia. **Determination:** male terminalia figured by Stanescu (1992), who also provides a key distinguishing the male of this species from males of other Roumanian *Paragus* species. **Illustrations of the adult insect:** none known.

Paragus mundus Wollaston, 1858
Preferred environment: open ground; thinly vegetated dry grassland and field margins; gardens; beside streams in *Pinus brutia* forest; in the Madeiran archipelago a ”coastal species” (Smit *et al.*, 2004). **Adult habitat and habits:** no data. **Flowers visited:** *Crithmum maritimum* (Gomez and Baéz, 1990), *Euphorbia, Foeniculum, Ferula* (M. J. Ebejer, pers.comm.), *Frankenia, Malva, Solidago*. **Flight period:** April/October. **Developmental stages:** not described. **Range:** Madeiran archipelago (Portugal); Balearic Islands and Canary Islands (Spain); Sicily; Malta; Greece; Turkey (Hayat & Claussen, 1997), N Africa (Morocco: Claussen & Hauser, 1990). **Determination:** appears in recent literature as *P. coadunatus*. Based on examination of Rondani’s type material of *coadunatus*, Sforzi & Dommaggio (2021) synonymise *coadunatus* of Rondani with *haemorrhous* of Meigen, proposing use of the name *mundus* Wollaston for the *coadunatus* of Goeldlin (1971, 1976) and subsequent authors. Goeldlin (1976) and Vujić *et al*. (1998) figure the male genitalia, as *P. coadunatus*. Females of this species remain indistinguishable from those of related species. A coloured photo of the male is provided by Smit *et al*. (2004). **Illustrations of the adult insect:** the general appearance of the male (as *P. coadunatus*) can be seen in the coloured photos provided by Smit *et al*. (2004) and V ujić *et al*. (2020d); under the name *P. mundus* coloured photos are provided in Rego *et al*. (2022).

Paragus oltenicus Stanescu, 1977
Preferred environment: inland/estuarine sand dunes (Stanescu, 1992); tall-herb areas with scattered *Lavandula* in open *Quercus pubescens* forest; xeric, karstic, unimproved, open grassland and pavement with scattered thickets of scrub *Q.pubescens*. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/August. **Developmental stages:** not described. **Range:** southern France, Greece, Roumania, Turkey, Ukraine; Asiatic Russia, Kazakstan, Kyrgyzstan, Uzbekistan, China. **Determination:** male terminalia figured by Stanescu (1992), who also provides a key distinguishing males of this species from males of other Roumanian *Paragus* species. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photo provided by Vujić et al.(2020d).

Paragus pecchiolii Rondani, 1857
Preferred environment: occurs in a wide range of biotopes; most frequently in deciduous woodland; occurs also in overgrown dune slacks, the edges of marshes and, further south, in garrigue, *Quercus ilex* forest and dry grassland; may also occur in vegetable gardens. **Adult habitat and habits**: low down among vegetation beside woodland paths etc., flight quite rapid; in the heat of summer seems to fly in the sun in the morning and evening only. **Flowers visited:** umbellifers; *Euphorbia, Galium, Hedera, Matricaria, Potentilla erecta, Stellaria, Thymus, Trientalis, Veronica*. **Flight period:** May to

September and end March/October in southern Europe. **Developmental stages:** larva described and figured (under the name *P. majoranae)* by Goeldlin (1974), who found larvae on legumes, *Hedera* and *Prunus*. Rojo and Marcos-García (1998) record the rearing this species (as *P. majoranae*) from larvae collected among aphids on various crops (*Beta, Cynara, Vicia, Zea mays*) and on *Carduus*, *Lavatera* and *Rumex*. Dussaix (2013) records rearing the species from larvae found on *Viola* and *Symphytum* and provides coloured photos of both larva and puparium. Duration of the puparial phase is 8 days (Dussaix (2013). **Range:** from southern Norway and Denmark south to Spain, most of the Mediterranean islands and N Africa; from northern France (Brittany) eastwards through central Europe (Germany, Czech Republic, Switzerland, Liechtenstein and Austria) to the former Yugoslavia, Roumania and European parts of Russia; Turkey; Georgia. **Determination:** this species has appeared in recent literature under the name *P.majoranae*. But Sommaggio (2002) demonstrates that the name *majoranae* Rondani had been until then wrongly applied and that the correct name for *majoranae* of authors is *pecchiolii* Rondani. Determination may be achieved only from examination of the male terminalia, which are figured by Goeldlin (1976), under the name *P.majoranae*. Colour characters of the adults are unreliable. In particular, *P.bradescui, P.majoranae* and dark forms of *P.bicolor* resemble *P.pecchiolii*. Separation of *P.pecchiolii* from *P.majoranae* is particularly difficult, because features of the male terminalia can overlap with the intraspecific variability of *P.majoranae*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994) (as *P.majoranae*), Bartsch *et al*. (2009a) and Pétremand *et al*. (2022).

Paragus punctulatus (Zetterstedt), 1838
Preferred environment: open ground; montane and alpine *Juniperus/Rhododendron*/ *Vaccinium* heath at from 1200m - 2500m in the Alps; *Calluna/Vaccinium* heath and unimproved montane grassland in northern Europe (Norway: T.Nielsen, pers.comm.). **Adult habitat and habits:** flies extremely low and quite rapidly over the ground surface and among sparse vegetation. **Flowers visited:** *Calluna, Potentilla crantzi***,** *Rhododendron, Saxifraga, and Vaccinium*. **Flight period:** mid-June/July and on into August at higher altitudes/more northerly latitudes. **Developmental stages:** not described, but quite possibly associated with dwarf shrubs, to judge from the habits of the adult flies. **Range**: Fennoscandia; Alps (France, Germany, Switzerland, Italy, Austria); Pyrenees (France, Spain) and other mountain ranges in Spain; northern, mountainous parts of the former Yugoslavia; Carpathians (Roumania). **Determination:** Bradescu (1991), Goeldlin (1976), who figures the male terminalia. This is one of the more distinctive European species of *Paragus*, due to its noticeably forwardly-extended face. **Illustrations of the adult insect:** the adult male is illustrated in colour by Bartsch et al.(2009a).

Paragus quadrifasciatus Meigen, 1822
Preferred environment: open ground/forest; dry, unimproved, sparsely-vegetated grassland, with or without dry scrub; open evergreen oak (*Q.ilex/Q.suber*) forest. *P.quadrifasciatus* may also occur in various cultivated situations, including cabbage crops, waste ground, hedge margins and suburban gardens; has been collected by emergence trap installed on an urban "green roof" (Passaseo *et al*, 2020). **Adult habitat and habits:** flies low among ground vegetation; as easy to detect by sweeping as by direct observation. **Flowers visited:** yellow composites, umbellifers. **Flight period**: May/September. **Developmental stages:** larva described and figured by Goeldlin (1974); recorded from among aphids on various, mostly low-growing, plants: *Centaurea, Cichorium, Leontodon autumnalis, Onopordon,* but also from *Rubus* and *Sonchus*. According to Marcos-García (1983), development from the time an egg is laid to hatching of the puparium takes only 4 weeks in this species. Dussaix (2013) records duration of the puparial phase as between 8 and 20 days, the shorter puparial phase being exhibited by puparia from summer larvae. Dussaix (2005b) observed that the larva can overwinter. **Range:** from Belgium south to the Mediterranean and N.Africa; from Portugal eastwards through southern and central Europe to Roumania, Greece (including Crete and Rhodes), Turkey, Iran and the Caucasus (Georgia); European parts of Russia eastwards through Kazakhstan, Tajikistan etc.to the far east; northern China, Korea, Japan. Its range has expanded recently to include much of Belgium (Bot & Van de Meutter, 2023). **Determination:** Goeldlin (1976), who figures the male terminalia, plus Marcos-García & Rojo (1994). This species is extremely similar to *P.hyalopteri*, Marcos-García & Rojo, at least in the female sex. It also bears a general resemblance to *P.cinctus* Schiner & Egger. In the male it may be easily distinguished from both of these species in that the hind margin of the fourth visible abdominal sternite (the last entire sternite) has a distinct, broadly-rounded median projection, flanked on each side by a broadly-rounded excavation. In the other two species the posterior margin of this sternite is simply straight in the male. In the female, the two protuberances on the seventh tergite distinguish females of *P.quadristriatus* from females of other species. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Paragus romanicus : see under *P. testaceus*

Paragus sexarcuatus Bigot, 1862
Preferred environment: open ground; sparsely-vegetated, semi-arid ground vegetated mostly by low-growing ruderals (P.Goeldlin, pers.comm.), at between 600m and 1100m (Corsica). **Adult habitat and habits:** flies low through sparse ground vegetation (P.Goeldlin, pers.comm.). **Flowers visited:** no data. **Flight period:** mid April/end July. **Developmental stages:** not described. **Range:** Corsica, Sardinia, Sicily. **Determination:** Goeldlin & Lucas (1981) and Vujić *et al*. (1999). The male terminalia are figured in both of these publications, but this species has yet to be included in any key. Vujić *et al*. (1999) provide a table in which this species is compared with others in the *P.hermonensis* group. But considerable caution remains necessary in attempting to decide the identity of specimens belonging to the *P.hermonensis* group, including *P.sexarcuatus*. **Illustrations of the adult insect:** none known.

Paragus strigatus Meigen, 1822
Preferred environment: open ground/scrub/cultures; hedgehog heath; small, open areas in maquis/along the edges of fields and olive orchards. **Adult habitat and habits:** flies among and through tall ground vegetation. **Flowers visited:** *Chamaemelum, Leucanthemopsis, Rubus* (Marcos-García, 1983); umbellifers (Carles-Tolrá, 2006); *Euphorbia*. **Flight period:** April/September. **Developmental stages:** not described. **Range**: Mediterranean basin, from Portugal round to Morocco (Spain; southern France; Italy, Sicily, Sardinia; parts of the former Yugoslavia; Egypt; Algeria), Bulgaria, Roumania, Ukraine and on through southern parts of Russia to Kirghizia, Tajikistan and Mongolia. **Determination:** Bradescu (1991), **Goeldlin** (1976), who figure the male terminalia. **Illustrations of the adult insect:** none known.

Paragus testaceus Meigen, 1822
Preferred environment: open ground/forest; herb-rich, small open areas in thermophilous *Quercus* and *Fagus* forest; thermophilous forest fringes and vert dry, open, unimproved grassland; fixed dune grassland (grey dunes) at the northen edge of its range. **Adult habitat and habits:** low flying, through sparce ground vegetation. **Flowers visited:** *Helianthemum*. **Flight period:** May/June. July at higher altitudes. **Developmental stages:** no data. **Range:** from northern France through central Europe (Alps) to Roumania and south to the Mediterranean, Sardinia and Turkey. **Determination:** this is the *P. romanicus* of recent authors, *romanicus* of Stanescu 1992 apparently being a synonym of *P. bicolor* (Kočić *et al*., 2023). In the male *P. testaceus* may be distinguished from *P. bicolor* by the surstyli, which are distinctly longer than broad in *P. bicolor*, but approximately as broad as long in *P. testaceus*. These differences are illustrated in Hayat *et al*. (2024). The female is difficult to separate from other *bicolor*-group species, but may be separated from the female of *P. bicolor* itself by the absence of the raised annulus across tergite 7, which is present in *P. bicolor*. *Paragus testaceus* and *P. bicolor* may be found in flight together, in the same habitat, at the same time. **Illustrations of the adult insect:** none known.

Paragus thracusi Likov & Vujić, in Radenković *et al*. 2020
Preferred environment: open areas with scrub-invaded, unimproved grassland, in open, thermophilous *Quercus* forest (Vujić *et al*. 2020d). **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia* (Vujić *et al*. 2020d). **Flight period:** May. **Developmental stages:** not described. **Range:** holotype from the Rhodope mountains, in NE Greece. **Determination:** the description of this species is based on a single male, collected twenty years prior to its description - there are no genetic data for the species and the female is unknown. Separation of this species from other European *Paragus* species is primarily dependent on its uniquely-shaped lingula, in the male genitalia, which is figured in Radenković *et al*. (2020b). Other distinctions between the male of *P. thracusi* and the male of *P. oltenicus* are also referred to in Radenković *et al*. (2020b). Disparities between the nomenclature of this species, as in Vujić *et al*. (2020d) and Radenković *et al*. (2020b) are resolved in Vujić *et al*. (2021a). **Illustrations of the adult insect:** the general appearance of the holotype can be seen in the coloured photo provided in Vujić *et al*. (2020d).

Paragus tibialis (Fallen), 1817
Preferred environment: open ground; unimproved dry pasturage, dry heathland, garrigue, glades in dry *P.sylvestris* forest and dune grassland. **Adult habitat and habits:** zig-zags in and out of low-growing plants in open grassland and heathland etc., and beside tracks in open woodland, flying rapidly; also visits flowers in these situations. **Flowers visited:** *Iberis, Jasione montana, Potentilla, Salix repens, Thymus*. **Flight period:** early May/August, and from April to the end of

September in southern Europe. **Developmental stages:** larva not described, but information on the biology of the aphid-feeding larva is provided by Marcos-García (1981), who reared the species from eggs and larvae collected from *Carduus* and *Onorpodon*. Torp (1984) also reports finding larvae on *Hypochoeris*. Esquembre & Marcos-Garcia (2022) record rearing *P. tibialis* from larvae collected on *Chrysanthemum coronarium* and *Sonchus tenerrimus*. Rojo and Marcos-García (1998) report rearing the species from larvae collected among aphids on crops of *Foeniculum vulgare*, *Glycyrrhiza glabra* and *Medicago sativa*. Generation time in southern Europe is only 3 weeks (Marcos-García, 1981). **Range:** uncertain at present, due to confusion with other species until recently; apparently occurs from southern Norway, Sweden and Denmark south to the Mediterranean coast of Europe, N Africa and the Canary Isles; from Britain (southern England) eastwards through central and southern Europe to the former Yugoslavia, Turkey and Israel; records from N America are apparently erroneous and relate to *P.haemorrhous* (Mg.), according to Vockeroth (1986b). The more northerly European records are now suspect because of the possibility of confusion with *P.constrictus* Simic. **Determination:** females of this species cannot be distinguished from those of P.constrictus or most other European s.g. *Pandasyopthalmus* species. Males may be identified using Simic (1986), Speight and Chandler (1995), Doczkal (1996a) or Vujić *et al*. (1998), who figure the male terminalia and provide distinctions from males of *P. constrictus*. Both sexes may be distinguished from *P. haemorrhous* by the key provided in Speight and Chandler (1995). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1984, 1994), van der Goot (1986) and Speight and de Courcy Williams (2021).

Paragus vandergooti Marcos-García, 1986
Preferred environment: forest/scrub; tall-herb open areas in *Quercus ilex* forest, *Q.rotundifolia* woodland and *Cistus florida/Quercus pyrenaica* maquis (Mª-A. Marcos-García and A.Ricarte, pers.comm.); Mediterranean riparian ash forest (Ricarte-Sabater et al, 2008). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Thapsia villosa* (Carles-Tolrá, 2006). **Flight period:** May/September. **Developmental stages:** not described. **Range:** southern France, Portugal, central Spain; N Africa (Morocco). **Determination**: the male and female are described by Marcos-García (1986); Claussen (1989) figures the male terminalia. **Illustrations of the adult insect:** none known.

PARASYRPHUS

This genus has appeared under various names in recent literature: *Mesosyrphus* (Dusek and Laska, 1967, Hippa, 1968) and *Phalacrodira* (Vockeroth, 1969). Peck (1988) lists 11 *Parasyrphus* species as European. Mutin (1990) reviewed the Palaearctic species, and added *P.kirgizorum* (Peck) to the European list (from the Alps) in the process. Two species *(relictus* Zetterstedt and *unifasciatus* Zetterstedt) referred to *Parasyrphus* by Peck (1988) are excluded from the genus by Mutin (1990). Nielsen (1999) lists the additional species *P.groenlandicus* (Nielsen) and *P.proximus* Mutin for the Norwegian fauna, bringing to 12 the number of *Parasyrphus* species known from Europe.

Parasyrphus annulatus (Zetterstedt), 1838
Preferred environment: forest; various types of coniferous forest up to the level (inclusively) of *Larix* forest, plus conifer plantations and, occasionally, acidophilous *Quercus* forest. **Adult habitat and habits:** to a significant extent arboreal, but descending to visit flowers. **Flowers visited:** white umbellifers; *Allium, Caltha, Cardamine, Euphorbia, Galium, Inula, Ligustrum, Meum, Prunus spinosa, Pyrus communis, Ranunculus, Rubus idaeus, Sambucus nigra, Sorbus aucuparia, Viburnum opulus*. **Flight period:** May/beginning August, with occasional specimens on into September. **Developmental stages:** larva not described, but reported by Bartsch et al.(2009a) as found feeding on aphids on *Abies* spp. Curiously, Kula (1982) records larvae of *P.annulatus* as hibernating in the leaf litter of spruce (*Picea*) forest, though he reports no records of the larvae of this species among syrphid larvae collected from spruce foliage, which he investigated in another part of this same study. Bastian (1986) also records larvae from *Picea*. **Range:** from northern Fennoscandia south to southern France (Alpes Maritimes); from Ireland eastwards through northern and central Europe (and mountainous parts of Italy and the former Yugoslavia) into European parts of Russia and on to the Caucasus (Georgia); through Siberia to the Pacific coast (Kuril Isles). **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1968b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Parasyrphus groenlandicus (Nielsen), 1910
Preferred environment: forest/open ground; western taiga and tundra (T.Nielsen, pers.comm...). **Adult habitat and habits:** no data. **Flowers visited:** *Dryas, Rubus chamaemorus* (T. Nielsen, pers. comm.), *Salix lapponum* (Bartsch *et al*., 2009). **Flight period:** June/July. **Developmental stages:** not described. **Range:** northern Norway, Finland, Greenland, arctic Alaska and Canada. **Determination:** See Key provided in StN Keys volume; Bartsch *et al*. (2009a). Vockeroth (1992) figures the head of the male of this species and that of *P. tarsatus*. Vockeroth (1992) remarks that the male terminalia of this species are indistinguishable from those of *P. tarsatus*. **Illustrations of the adult insect:** the male of this species is illustrated in colour by Bartsch *et al*. (2009a). Its general appearance is also shown in the coloured photograph provided by Haarto and Kerppola (2007a).

Parasyrphus kirgizorum (Peck), 1969
Preferred environment: forest/open ground; conifer forest, from upper levels of *Abies/Picea* into the *Larix/Pinus mugo* zone and beyond up into unimproved, alpine grassland to 2400m. **Adult habitat and habits:** males hover at 2-4 metres, settling on the bare ground of paths and on stones and rocks in the sun (P.Goeldlin, pers.comm.); flies low over sparsely-vegetated tracksides etc. **Flowers visited:** *Ranunculus*, male *Salix*, and Taraxacum. **Flight period:** end May/June. **Developmental stages:** not described. **Range:** uncertain, due to confusion with *P.tarsatus*, but confirmed from the Alps (France, Switzerland) the Jura (Switzerland), Kirghizia (Kyrgyzstan), central Asiatic Russia (Altai) and the Himalayas (Nepal, see Claussen and Weipert, 2003). **Determination:** See Key provided in StN Keys volume. This species is extremely similar to *P.tarsatus*, but is generally (body length greater than 10 mm) rather larger. Mutin (1990) and Claussen and Weipert (2003) figure the male terminalia. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Parasyrphus lineolus (Zetterstedt), 1843
Preferred environment: forest; **conifer** forest (*Abies, Picea, humid Pinus*) and conifer plantation. **Adult habitat and habits:** largely arboreal; descends to visit flowers. **Flowers visited:** yellow composites; white umbellifers: *Acer platanoides, Achilea, Alchemilla, Anemone nemorosa, Calluna vulgaris, Caltha, Cardaminopsis, Galium, Inula, Meum, Petasites albus, Potentilla erecta, P.avium, P.cerasus, P. laurocerasus, P.spinosa, Ranunculus, Rubus fruticosus, Salix, Sambucus nigra, Sorbus aucuparia, Taraxacum, Triplospermum inodorum, Valeriana officinalis, Veronica, Viburnum.* **Flight period:** end April/July, and July/August at higher altitudes. **Developmental stages:** larva described and figured by Goeldlin (1974); aphid feeding; Kula (1982) has established that the larvae of this species occur in the crowns of spruce (Picea) and that a proportion overwinter on the forest floor, among leaf litter. **Range:** from Fennoscandia south to the Pyrenees; from Ireland eastwards through central and southern Europe (northern Italy, Balkans) into Russia; from the Urals through Siberia to the Pacific coast (Kamchatka, Sakhalin Is.); N America from Alaska to Quebec and south to Colorado and New Mexico. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1968b) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994) and Bartsch et al.(2009a).

Parasyrphus macularis (Zetterstedt), 1843
Preferred environment: *Picea/Abies* forest. **Adult habitat and habits:** flight from 2-3 metres upwards above ground, especially around *Picea* and *Abies*; males hover at 3-4 metres in sunlit glades. **Flowers visited:** umbellifers; *Acer platanoides, Adoxa moschatellina, Anemone nemorosa, Caltha, Crataegus, Meum, Petasites albus, Prunus spinosus, Salix, Sambucus nigra, Sorbus aucuparia, Viburnum opulus* **Flight period:** end April /July. **Developmental stages:** not described. **Range:** Scandinavia south to France (Vosges, Alps) and Belgium eastwards through mountainous parts of central Europe; northern parts of European Russia; in the Nearctic from Alaska south to Oregon. **Determination:** See Key provided in StN Keys volume. There is considerable confusion about this species in the literature. Van der Goot (1981) refers to a "*Melangyna macularis* (Zett.)", following Stackelberg, but comments that this should perhaps be regarded as a *Parasyrphus*. *P.macularis* is extremely similar to *P.punctulatus*. It should be noted that *P.punctulatus*, at least, may exist in a melanic intersex form in which the abdomen is entirely unmarked, so that the specimens bear a close resemblance, superficially, to females of *Melangyna quadrimaculata*. Melanic intersex specimens of *P.macularis* may exist also. The male terminalia are figured by Hippa (1968b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994), Bartsch et al.(2009a) and Bot and Van de Meutter (2019).

Parasyrphus malinellus (Collin), 1952
Preferred environment: forest; **conifer** forest (*Abies, Picea, humid Pinus*) and conifer plantation. **Adult habitat and habits:** tracksides, clearings etc., largely arboreal, but descends to visit flowers; females can be found flying round foliage of conifers, from 2m upwards. **Flowers visited:** white umbellifers; *Anemone nemorosa, Barbarea, Cardamine flexuosa, Crataegus, Meum, Prunus cerasus, P.spinosa, Petasites albus, Ranunculus, Rubus fruticosus agg., Salix, Sorbus aucuparia, Stellaria, Taraxacum, Vaccinium myrtillus*.. **Flight period:** April/July. **Developmental stages:** not described. **Range:** from Fennoscandia south to the Ardennes and the Alps; from Ireland eastwards through northern and central Europe into European parts of Russia; through Siberia to Yakutia. **Determination:** See Key provided in StN Keys volume. This species closely resembles *P.proximus* Mutin. The male terminalia are figured by Hippa (1968b). **Illustrations of the adult insect:** the species is illustrated in colour by Torp (1994) and Bartsch *et al*. (2009a).

Parasyrphus nigritarsis (Zetterstedt), 1843
Preferred environment: wetland/wet woods; Alnus/*Salix/Populus tremula* woodland and *Alnus viridis* scrub up to 2000m in the Alps. **Adult habitat and habits:** males hover at from 5m upwards, beside the canopy of trees edging open spaces within woodland, usually close to water, descending precipitously to settle on trackside foliage of trees and shrubs down to within 1m of the ground, the instant the sun disappears behind a cloud; females may be found resting in similar situations or flying around trackside shrubs. In the Alps, males descend to rest on rocks in the sun and both sexes may seek damp mud/sand for drinking purposes, on hot afternoons. **Flowers visited:** *Anemone nemorosa, Potentilla erecta, Prunus cerasus, P.spinosus, Ranunculus, Rhododendron aureum, Rubus idaeus, Salix*. **Flight period:** end May/end June. **Developmental stages:** larva described and figured by Schneider (1953) and illustrated in colour by Rotheray (1994); predatory on the larvae of chrysomelid beetles on trees and shrubs. The species has also been reared from larvae collected with *Gastrophysa viridula* on *Rumex*, in farmland (Rotheray and Hewitt, 1999). But it is a moot point whether *P.nigritarsis* larvae in such a location would under normal conditions ever complete their development – the farming practice of topping grassland to prevent seeding of aggressive weeds like *Rumex* would be expected to convert a *Rumex* stand into a population sink for syrphids like *P.nigritarsis*. Distinguished from larvae of related genera and some other (unspecified) *Parasyrphus* species in the keys provided by Rotheray (1994). **Range:** Norway, Sweden and Finland south to Belgium and also in northern Spain (Cordillera Cantabria); from Ireland eastwards through central Europe into Russia and on to the Pacific coast, including Japan; in N America from Alaska to Quebec and south to Washington and Idaho. **Determination:** See Key provided in StN Keys volume. The adult insect bears a striking resemblance to *Epistrophe* or *Syrphus* species and can be mistaken for these much more widespread insects in the field. The male terminalia are figured by Hippa (1968b) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Parasyrphus proximus Mutin, 1990
Preferred environment: forest; mixed boreal forest (H.Bartsch, pers.comm.); *Alnus glutinosa* forest (A.Harrto, pers.comm.). **Adult habitat and habits:** along forest tracks and edges, and in adjacent fields (H.Bartsch, pers.comm.). **Flowers visited:** umbellifers, *Filipendula* (van Steenis *et al*., 2001), *Caltha, Prunus padus, Ribes alpinum, Rosa canina* (Bartsch *et al*., 2009); *Salix* (Van Steenis, 2011). **Flight period:** mid May (peak) to July. **Developmental stages:** not described. **Range:** central and northern parts of Fennoscandia (Norway, Sweden, Finland) eastwards into European parts of Russia and on through Siberia to the Pacific; reported from southern Germany by Ssymank and Doczkal (2017). **Determination:** See key provided in StN Keys volume. Mutin (1990) figures the male terminalia. This species closely resembles *P.malinellus*. **Illustrations of the adult insect:** the male of this species is illustrated in colour by Bartsch *et al*. (2009a). Its general appearance is also shown in the coloured photograph provided by Haarto and Kerppola (2007a).

Parasyrphus punctulatus (Verrall), 1873
Preferred environment: forest; deciduous and coniferous forest and conifer plantation; *Quercus/Fraxinus* and *Betula/Salix/Alnus* forest and woodland and forest and plantation of Pinaceae or *Larix*; plus suburban gardens and orchards with mature trees; thermophilous *Quercus* forest. **Adult habitat and habits:** largely arboreal but descends to visit flowers; also flies around foliage of conifers and deciduous trees at 2m upwards, frequently settling on the foliage; males hover close to trees, in clearings, along tracks etc., at 2m upwards. **Flowers visited:** white umbellifers; *Acer pseudoplatanus, Aliaria, Anemone nemorosa, Caltha, Cardamine, Crataegus, Euphorbia, Ilex, Ligustrum, Meum, Oxalis, Prunus cerasus, P.laurocerasus, P.spinosa, Ranunculus,* male *Salix, Sambucus racemosa, Sorbus aucuparia, Taraxacum, Tussilago, Ulex,*

Viburnum opulus. **Flight period:** mid March/mid June and on to mid July at higher altitudes. **Developmental stages:** larva described, with its posterior spiracular processes illustrated, by Rotheray (1987), who collected larvae in December, from leaf litter beneath *Acer pseudoplatanus*. The larvae overwintered and produced adults in May of the following year. Rotheray (1987) also records finding larvae on *Rosa* sp. The larva is illustrated in colour by Rotheray (1994). Chandler (1968) describes the egg. According to Barkemeyer (1994), this species overwinters as a puparium. **Range:** from Fennoscandia south toPortugal and the Pyrenees; from Ireland eastwards through northern and central Europe (plus northern Italy) into European parts of Russia and the Caucasus and on through Siberia to the Pacific coast (Japan); Himalayas (Nepal, see Claussen and Weipert, 2003). **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1968b). **Illustrations of the adult insect:** The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994), Pétremand *et al*. (2022) and van der Goot (1986).

Parasyrphus relictus (Zetterstedt), 1836

Preferred environment: "scrub and marsh" (Skevington *et al.*, 2019). **Adult habitat and habits:** no data. **Flowers visited:** the Nearctic taxon refered to as *P. relictus* has been recorded from flowers of umbellifers, composites, *Rhododendron* and *Sambucus* (Skevington *et al.* (2019). **Flight period:** no data. **Developmental stages:** not described. Larvae of the N American taxon recognised as *P. relictus* "have been recorded feeding on aphids and adelgids from trees" (Skevington *et al*, 2019). **Range:** the type material of this species is from Sweden. In his recent review of Swedish Syrphidae Bartsch (2001) says "I am unable to establish the identity of the taxon referred to in literature as *P.relictus* (Zett.). I have included Zetterstedt's type-record and another record from the literature (in italic) on a provisional basis. However the situation of this taxon in Sweden cannot be clarified until the European *Parasyrphus* species have been revised". *P.relictus* is not listed as occurring in Sweden by Bartsch *et al*. (2009a). According to Mutin (1990) the species previously recorded from Russia as *P.relictus* does not belong to the genus *Parasyrphus*. Haarto and Kerppola (2004) state that they are listing *P.relictus* as a Finnish species "based on the figures of genitalia drawn of a specimen collected in Ab: Turku, Finland (Hippa, 1968)". They add that "all other reported [Finnish] specimens of *P.relictus* have been proved to be misdeterminations of other *Parasyrphus* species". Vockeroth (1992) identifies as *P.relictus* a Nearctic *Parasyrphus* species that occurs from Alaska to California and Colorado. **Determination:** no accord on the identity of this taxon is evident in the literature. From the present situation it is even unclear whether Zetterstedt's *relictus* is a species of *Parasyrphus*. If it is, whether or no it is a distinct species or a synonym of some other European *Parasyrphus* is impossible to decide. Both Hippa (1968b) and Vockeroth (1992) provide figures of the male terminalia of taxa they recognise as *P.relictus*, but whether the figures relate to the same species is a matter for conjecture, due to differences in the features illustrated and the angles from which they are drawn. Similarly, there is no basis for deciding whether either author is figuring the taxon described by Zetterstedt under the name *relictus*, since neither Hippa nor Vockeroth seem to have examined Zetterstedt's type material. Vockeroth's recognition of *relictus* as a Nearctic species was apparently based on information received from Thompson (Thompson pers.comm. in Vockeroth, 1992). Hippa (1968b) both describes and figures the taxon he identifies as *P.relictus*, but without indicating why he uses the name *relictus* for it. Van Veen (2004) follows Bartsch (2001) in listing *P.relictus* for Sweden, but makes no reference to the species in his keys. Bartsch (2001) states that he was unable to examine the type material of *relictus* because it was on loan (to person or persons unspecified). If, in reality, the type material of *relictus* is now lost, the identity of this taxon can never be decided, other than by redefining and redescribing it and designating a neotype for it. **Illustrations of the adult insect:** N American material consigned to this taxon is figured in colour by Skevington *et al.* (2019)..

Parasyrphus tarsatus (Zetterstedt), 1838

Preferred environment: forest/open ground; deciduous forest and conifer forest, subalpine *Betula/Pinus* forest, western taiga and dwarf *Betula/Salix* scrub tundra (T. Nielsen, 1998 and pers.comm.) and *Larix* forest. **Adult habitat and habits:** males hover at 1-2m and settle on bare ground, stones or rocks in the sun; both sexes are often found sun-bathing on foliage of *Betula* in the morning (T.Nielsen, pers. comm.). **Flowers visited:** white umbellifers; *Barbarea, Caltha, Ledum palustre, Papaver nudicaule, Potentilla cranzti, Ranunculus, Rhododendron tomentosum, Rubus chamaemorus, Salix, Saxifraga azoides, Taraxacum* (Nielsen, 1998 and pers.comm.). **Flight period:** end May/mid August. **Developmental stages:** not described, but larvae have been found feeding on aphids on both *Betula* and *Salix* (Skevington *et al.*, 2019). . **Range:** this species is found in the Alps (France, Switzerland), but its distribution in much of central Europe is uncertain due to confusion with *P. kirghizorum*. It is confirmed from most of Scandinavia and from parts of European Russia; in the Nearctic from Greenland (Haarto and Koponen, 2003) and Alaska south to mountainous parts of Colorado and New Hampshire (Vockeroth, 1992; Skevington *et al.*, 2019). **Determination:** See Key provided in StN Keys volume; Bartsch *et al.* (2009a). Mutin (1990)

figures the male terminalia, but the features he uses in his key, to characterise *P. tarsatus*, are at odds with the features used by Bartsch *et al*. (2009a), raising the question of whether *P. tarsatus* as recognised in Scandinavia is the same species. This species closely resembles *P. kirgizorum* but is generally rather smaller (body length less than 10 mm). Vockeroth (1992) indicates that the taxon recognised as *P. tarsatus* in N America varies in body length from 7-11mm and records that it is extremely variable in appearance, leading Thompson to subdivide the N American material into 4 different morphs, all of which, however, they both agree belong to *P. tarsatus*. **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). The male is illustrated in colour by Bartsch *et al*. (2009a).

Parasyrphus vittiger (Zetterstedt), 1843
Preferred environment: conifer forest (*Abies, Picea*, humid *Pinus*), but also, occasionally, in deciduous forest (humid *Fagus*). **Adult habitat and habits:** largely arboreal, but descends to visit flowers. **Flowers visited:** *Alchemilla, Alisma plantago-aquatica, Ranunculus vicaria, Buxus, Galium, Hypochoeris, Potentilla erecta, Ranunculus, Salix, Sorbus aucuparia, Taraxacum.* **Flight period:** April/September, with peaks in May/June and July/August at lower altitudes. At higher altitudes/more northerly latitudes the flight period is more restricted and there is one peak in July/August. **Developmental stages:** larva described and figured by Goeldlin (1974) and illustrated in colour by Rotheray (1994); aphid feeding; Kula (1982) records larvae of this species as found hibernating in leaf litter in spruce (*Picea*) forest. Larvae have been found on *Abies, Fagus, Picea and Pinus*. **Range:** from Fennoscandia south to the Pyrenees and central Spain; from Ireland eastwards through most of Europe into European parts of Russia and the Caucasus; from the Urals to central Siberia (Cis-Baikal, Yakutia). **Determination:** See Key provided in StN Keys volume. The adults of *P.lineola* and *P vittiger* are so similar to each other that it has been suggested these two are variants of the same species, but Goeldlin's (1974) work on the larvae demonstrates their larvae are distinct. The male terminalia are figured by Dusek and Laska (1967) and Hippa (1968b). **Illustrations of the adult insect:** the species is illustrated in colour by Ball and Morris (2013), Bartsch *et al*. (2009a), Speight and de Courcy Williams (2021) and Torp (1994).

PARHELOPHILUS

This genus is frequently regarded as a subgenus of *Helophilus*, as in Peck (1988). The three European species consigned to *Parhelophilus* in most recent literature are treated by van der Goot (1981), Bradescu (1991) and various other authors. Thompson (1997) shows that *Pleskeola* is a synonym of *Parhelophilus*, which results in transfer of the Siberian *P.sibiricus* (Stackelberg) to *Parhelophilus*. Thompson (1997) also includes a key to the *Parhelophilus* species then known in the Holarctic. More recently, Reemer (2000a) has described *P.crococoronatus* Reemer, from southern Europe.

Parhelophilus consimilis (Malm), 1863
Preferred environment: wetland; pools in fen, transition mire, the lagg edge of raised bog and abandoned, cut-over bog. **Adult habitat and habits:** flies at great speed within stands of tall waterside vegetation, or along the margin of small, standing-water bodies containing emergent vegetation; settles on foliage of emergent plants like *Menyanthes;* rarely strays more than a few metres from standing water. **Flowers visited:** white umbellifers; *Bidens cernua, Menyanthes, Potentilla palustris, Ranunculus*. **Flight period:** mid June/beginning August. **Developmental stages:** undescribed. **Range:** from Fennoscandia south to Belgium (extinct?) and north-east France (Haute Saône); from Ireland eastwards through Britain, Denmark, Poland and northern Europe into Russia to as far as eastern Siberia. This insect does not seem to have been recorded from the Alps, other than Switzerland (Maibach et al, 1992). Re-examination of the material concerned shows that the record of *P.consimilis* from Mallorca, in Riddiford & Ebejer (2006), was based on misdetermined specimens of *P.versicolor*. **Determination:** See Key provided in StN Keys volume; Bartsch et al.(2009b) and Thompson (1997). Reemer (2000a) figures the male terminalia. The male terminalia are figured by Reemer (2000a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Stubbs and Falk (1983) and Torp (1994).

Parhelophilus crococoronatus Reemer, 2000
Preferred environment: freshwater/open ground: pools with *Phragmites*, in more-or-less open conditions (M.Reemer, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Cistus* (M.Reemer, pers.comm.; Lebard, 2022). **Flight**

period: April, June. **Developmental stages:** undescribed. **Range:** Portugal, Spain, southern France. **Determination:** See Key provided in StN Keys volume and Reemer (2000), who figures features of the male terminalia and provides a key distinguishing this species from *P.consimilis*, *P.frutetorum* and *P.versicolor*. *P.crococoronatus* apparently resembles *P.frutetorum* very closely, and may be found in flight with *P.versicolor*. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Parhelophilus frutetorum (Fabricius), 1775
Preferred environment: wetland/forest; pools in alluvial softwood forest, fen carr and fen. **Adult habitat and habits:** flies in open areas in wet woodland and fen carr, including small glades, usually beside standing water; flies from 1-4m from the ground, settling on low-growing plants, bushes and shrubs; males hover at 2-4m, in open spaces, settling on tree and shrub foliage; both sexes visit trees in flower. **Flowers visited:** yellow composites, white umbellifers; *Cornus*, *Crataegus*, *Filipendula*, *Frangula alnus*, *Ranunculus*, *Rubus*, *Sambucus*, *Viburnum opulus*. **Flight period:** end May-July, with peak in June. **Developmental stages:** the larva and puparium are described and figured by Hartley (1961), from material collected from organic mud in a woodland pond. **Range:** Southern Sweden south to the Mediterranean and eastwards through central Europe and parts of southern Europe into Russia, the Caucasus and on as far as eastern Siberia. **Determination:** See Key provided in StN Keys volume; Bartsch et al.(2009b); Thompson (1997) and Reemer (2000a), who figures the male terminalia. According to Reemer (2000a), *P.frutetorum* is extremely similar to *P.crococoronatus*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Bartsch *et al*. (2009b), Bot and Van de Meutter (2019) and Torp (1994).

Parhelophilus sibiricus (Stackelberg), 1924
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** European Russia (Karelia) to eastern Siberia. **Determination:** See Key provided in StN Keys volume. The female of this species remains unknown. The male was comprehensively redescribed by Thompson (1997), who figures its male terminalia. **Illustrations of the adult insect:** Thompson (1997) provides a black and white illustration of the adult insect.

Parhelophilus versicolor (Fabricius), 1794
Preferred environment: wetland/freshwater; fen, marsh and reed beds with patches of standing water, also along canals and water-filled ditches. **Adult habitat and habits:** flies very fast, with a characteristic, high-pitched whine and a zig-zag flight, within stands of tall vegetation (e.g. *Scirpus*, *Phragmites*) bordering fen pools etc.; males hover at 1 - 2m over animal tracks etc. in reed beds; settles on emergent vegetation, e.g. *Menyanthes*, *Typha*. **Flowers visited:** white umbellifers; *Aegopodium podagraria*, *Cardamine*, *Cistus*, *Crataegus*, *Euphorbia*, *Filipendula ulmaria*, *Galium*, *Leontodon*, *Lychnis*, *Scirpus sylvaticus*, *Sorbus aucuparia*. **Flight period:** May/August (plus April and September in southern Europe), with peak in June/July. **Developmental stages:** larva described and figured by Hartley (1961), from larvae collected from decaying rhizomes of *Typha*, in a pond; aquatic. **Range:** from southern Fennoscandia south to Iberia, the Mediterranean and N Africa; from Ireland eastwards through most of Europe into Turkey and European parts of Russia; in Siberia from the Urals to the R.Ob. **Determination:** See Key provided in StN Keys volume, also Bartsch et al.(2009b), Thompson (1997) and Reemer (2000a), who figures the male terminalia. The colour of the fore tibiae is usually used as a diagnostic feature for separation of males of this species from males of *P.consimilis*. However, although usually entirely yellow in males of *P.versicolor*, the front femora may be marked with black antero-laterally in this species, as in *P.consimilis*. Females of this species can be difficult to distinguish from females of both *P.frutetorum* and *P.crococoronatus*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) Bot and Van de Meutter (2019) and Torp (1994).

PELECOCERA

There are three European species of *Pelecocera* recognised in Peck (1988). Since then, the practice of regarding *Chamaesyrphus* as a subgenus of *Pelecocera* has been introduced. This practice was followed by Thompson and Rotheray (1998) and has been supported by Ståhls *et al*. (2004). Indeed, recognition of *Chamaesyrphus* as a separate genus seems to have little justification or utility. Its European species are thus included here under *Pelecocera*. Since Peck (1988) two Mediterranean zone *Pelecocera* species have been described, *P. garrigae* and *P. hederae*, the former from Spain and southern

France, the latter from Cyprus. Vujić *et al*. (2018) transfer *Pelecocera latifrons* to a separate genus, *Pseudopelecocera*. In general, the European species of *Pelecocera* (including *Chamaesyrphus*) remain in need of revision, despite the advances made by Lair *et al*. (2022) and Van Eck & Mengual (2021), with the status of various taxa requiring clarification. Introduction of molecular taxonomy, as a tool for clarifying relationships between *Pelecocera* taxa, is proving revelatory, but insufficient data are yet available and the uselesslessness of ancient type specimens as a source of genetic data is all too apparent.

Pelecocera and its allies have until very recently been rather mysterious syrphids, since the developmental stages of none of the species had been discovered. The puzzle of the larval biology of *Pelecocera* at last gained partial resolution through the observations of Okada *et al*. (2021), who reared a number of larvae of the Oriental species *Pelecocera* (*Chamaesyrphus*) *japonicus*, from the fruiting bodies of the small hypogeous, ectomycorrhizal basidiomycete fungus *Rhizopogon*, often referred to as false truffles, most of which are associated with species of *Pinus*. This was followed by the work of Ståhls (2024), who reared both *Pelecocera caledonica* and *P. tricincta* from the fruiting bodies of *Rhizopogon luteolus* associated with *Pinus*, collected from the same locality, at the same time. Orengo-Green *et al*. (2024b), likewise report finding the larvae of *Pelecocera lugubris/lusitanica* and *P. tricincta* at the same time and from the same localities, also from the fruiting bodies of *R. luteolus* associated with *Pinus*. The implication is that *Pelecocera* larvae will all prove to be mycophagous, on semi-subterranean/subterranean fruiting bodies of mycorrhizal fungi associated with trees. The genus *Rhizopogon* itself has a number of European species. In Europe *Rhizopogon luteolus* is one of the most widely distributed species (also occurring elsewhere in the Palaearctic and in the Nearctic) and is associated not only with various species of *Pinus*, but also with *Quercus ilex* and *Q. suber* (Paz-Martin, 1996). Production of its fruiting bodies is also much less confined to some specific season than is the case for most European *Rhizopogon* species. That being so, and given the rearing data now available, why are *P. caledonica, P. lugubris/lusitanica* and *P. tricincta* not usually observed together and why do they not show the same distribution patterns? Also, why are they not more generally distributed, given the extensive plantings of *Pinus* species as commercial tree crops over much of lowland Europe. Doubtless, the presence of pine trees doesn't automatically result in the presence of *Rhizopogon luteolus*, and the presence of *R. luteolus* doesn't automatically result in the presence of particular *Pelecocera* species. To determine how the developmental biology of a *Pelecocera* species interacts with both habitat conditions and its fungal food supply, to explain the distribution of the insect, would present more than one challenging research issue requiring a number of years to resolve. For the time being, *Pelecocera* species remain enigmatic, both taxonomically and biologically.

Pelecocera caledonica (Collin), 1940

Preferred environment: forest; humid conifer forest of *Pinus sylvestris* and western taiga forest; coastal dune systems, in the grey dunes/fixed dune grassland, where some shelter is provided by scrub or planted conifers; and open, heathy areas in humid *Pinus sylvestris* forest; *Pinus heldreichii/nigra* forest (Vujić *et al.*, 2020); unimproved, montane dry grassland with scattered *Quercus pyrenaica* scrub (Lorenzo *et al.*, 2020); open *Quercus suber* forest with ericaceous herb layer; garrigue (calcareous) with thickets of *Q. pubescens* scrub and *Juniperus*. **Adult habitat and habits**: no data. **Flowers visited:** *Calluna vulgaris, Mentha, Saxifraga, Solidago virgaurea*. **Flight period:** July/August and on to October toward the southern end of its range/at lower altitudes. **Developmental stages:** the larva was found by Ståhls (2024) in September/October, feeding internally on the semi-subterranean fruiting bodies of the hypogoeus mycorrhizal fungus *Rhizopogon luteolus* in southern Finland. The larvae were determined both genetically and by identification of reared adults. Larvae of *P. tricincta* were found associated with the fruiting bodies of the same fungus, also in September/October, and at the same location. The full-grown larva of *P. caledonica* was observed to leave the fungus, to pupariate in the litter layer/grass-root zone, the puparial phase occupying from 4 to 8 weeks under laboratory conditions. Ståhls (2024) provides a photo of the puparium. It would appear that, under natural conditions, the species probably overwinters as a puparium. But this is not yet certain. *Rhizopogon luteolus* is associated with various species of *Pinus*, and also with *Quercus ilex* and *Q. suber*, which potentially explains records of *P. caledonica* from *Q. ilex* scrub and *Q. suber* forest. **Range:** northern and central Norway; Sweden; northern, central and southern Finland; Britain (northern Scotland); Portugal; Northern Spain; Andorra; France; European Russia (St.Petersbourg region); Germany (Bavaria). **Determination**: Van Eck and Mengual (2021) and Lair *et al*. (2022). From the genetic analysis provided by Van Eck and Mengual (2021) it can be concluded that genetic data from more geographically dispersed populations of this widespread species are required (the available data are all from specimens collected in Finland) to consolidate its taxonomic integrity. Separation of *P. caledonica* morphologically remains dependent on a few small features which can be difficult to observe or interpret. **Illustrations of the adult insect:** Stubbs and Falk (1983) illustrate the adult male and female in colour. The male is figured in colour by Bartsch *et al*. (2009b).

Pelecocera garrigae Lair & Nève, in Lair *et al*., 2022

Preferred environment: open ground/scrub; open, calcareous, heavily grazed *Quercus ilex* garrigue. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/May. **Developmental stages:** not described. **Range:** uncertain, due to confusion, until very recently, between this and other *Pelecocera* species, but confirmed from Southern France and Spain. **Determination:** both the male and the female are described in Lair *et al*. (2022), who also include photos of the male terminalia and a key separating *P. garrigae* from other *Pelecocera* species recorded from France. They also provide genetic data, demonstrating a genetic distance of *P. garrigae* from other European *Pelecocera* species, consistent with the view that it is a distinct species-level taxon. Lair *et al*. (2022) point out that *P. garrigae* has previously been confused with *P. lusitanica*. In their key, *P. garrigae* is separated from *P. lusitanica* (as *P. lugubris*) by its undusted, shiny lunule, the lunule being entirely dusted in *P. lusitanica*. This same feature is used to separate *P. lusitanica* from *P. garrigae* (as Lair & Nève spec. nov.) in the key to European *Pelecocera* species in Van Eck & Mengual (2021). *P. garrigae* shares with *P. lusitanica* the presence of some long, white hairs on the upper part of the anterior mesanepisternite. But in *P. garrigae* these hairs may be shorter and less distinguishable than in *P. lusitanica*.This condition is accommodated for in the key by Van Eck & Mengual (2021), by keying out *P. garrigae* also in the section of the key dealing with *Pelecocera* species in which long hairs are absent from the anterior mesanepisternite. In *P. garrigae* tergites 1 and 2 are black, but tergites 3 – 5 can be either entirely black or with paired reddish-brown marks. Among the 8 males included in the type material of *P. garrigae* no more than 2 pairs of pale marks were observed on the tergites. Assuming that, as more males of *P. garrigae* become available none are found to possess more than two pairs of pale marks on the tergites, this feature might provide a distinction from the male of *P. lusitanica*, which, in Mik (1898), was described as possessing three pairs of pale marks on its tergites. Both Van Eck & Mengual (2021) and Lair *et al*. (2022) assume a particular identity for *P. lusitanica*, based on genetic characterisation. But neither sets of authors include the type material of *P. lusitanica* among the material examined. While the identity of *P. lusitanica* remains uncertain, use of the name *garrigae* remains insecure. The type material of *P. lusitanica* originates from Portugal. It could prove to correspond with *P. garrigae* rather than with *P. lusitanica* of Van Eck & Mengual (2021) or *P. lugubris* of Lair *et al*. (2022). The complexities of this issue are also discussed under the species accounts for *P. lugubris* and *P. lusitanica*. **Illustrations of the adult insect:** the general appearance of the male can be seen in the coloured photos provided in Lair *et al*. (2022).

Pelecocera hederae Van Eck, in Van Eck & Mengual, 2021

Preferred environment: forest; coniferous forest of *Pinus brutia* (Van Eck, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Alnus orientalis, Hedera pastuchovii* (Van Eck and Mengual, 2021). **Flight period:** October/ November. **Developmental stages:** not described. The apparent association of *P. hederae* with *Pinus brutia* forest would be in keeping with the association of most European *Pelecocera* species with forest of one or another *Pinus* species (an association of N American *Pelecocera* species with coniferous forest has also been noted – J. Skevington, pers. comm.). The only known larval host of *Pelecocera* species is the hypogeous fungus *Rhizopogon* (Okada *et al*., 2021; Orengo-Green *et al*., 2024; Ståhls, 2024). Nearly all European *Rhizopogon* species are associated with species of *Pinus*. None have been noted explicitly as associated with *Pinus brutia* (Paz-Martin, 1996), though one of the most widespread European species, *Rhizopogon roseolus,* is apparently frequent in "pine forests" on Cyrpus. Noted explicitly as having been found with *Pinus brutia,* in Greece, are other hypogoeus fungi, *Elaphomyces muricatus*, *Tuber aestivum* and *T. borchii*. *Elaphomyces muricatus* produces its fruiting bodies in the autumn, which would be an appropriate timing for producing adults of *P. hederae* in October/November. The fruiting bodies of *Rhizopogon roseolus* can be found throughout the year in southern Europe (Paz-Martin, 1996). *Tuber aestivum*, as its name suggests, produces fruiting bodies May/June, while *T. borchii* has it fruiting bodies December/June. So, there are various hypogoeus fungal hosts for *P. hederae* larvae, available within *Pinus brutia* forests in Cyprus. But from the timing of production of its fruiting bodies, *Elaphomyces muricatus* would seem particularly worthy of investigation as a potential larval host of *P. hederae*. **Range:** Cyprus. **Determination:** the male and female of this species are described from long series of specimens in Van Eck and Mengual (2021) and the morphological description is accompanied by genetic characterisation. Morphologically, *P. hederae* is closely similar to *P. caledonica* and *P. scaevoides*. Genetically, its status as a separate species is well supported, but without indication of close links to *P. scaevoides*. Van Eck and Mengual (2021) figure the male terminalia of *P. hederae*, pointing out that they are sufficiently distinctive to separate the species from other European *Pelecocera*. They also provide a key to European species, which includes both *P. hederae* and *P. garrigae* (as "*Pelecocera* Lair & Nève spec. nov."). **Illustrations of the adult insect:** the male and female are illustrated in colour in Van Eck and Mengual (2021).

Pelecocera lugubris Perris 1839

Preferred environment: not known. **Adult habitat and habits:** no data. **Flowers visited:** *Potentilla montana* (Perris, 1839). **Flight period:** a spring species (Perris, 1839). **Developmental stages:** see under *P. lusitanica*. **Range:** at present only known certainly from the department of Landes, in SW France, where the type material originates. **Determination:** the description of this species is based on a series of females in which the tergites are entirely black. The male was not described. Lair *et al*. (2022) re-instate *P. lugubris* as a valid species occurring in France, based on re-examination of the Perris type series. However, they do not provide a redescription of the species, either based on the type material, or otherwise. The original description provided by Perris (1839) is brief and apart from stating that the insect is black does not refer to many useful features. Further, the illustrations (reproduced in Lair *et al*., 2022) accompanying the original description are inaccurate, depicting an insect with a wing venation not found in Syrphidae and an antenna showing article 3 sharply angled apico-dorsally and with an apical arista. Photographs provided by Lair *et al*., (2022) of a specimen in the type series show a wing venation typical for *Pelecocera*. However, they do not provide a clear illustration of the shape of the antenna found in the type series, showing the proportions of article 3 or the insertion of the arista. Lair *et al*. (2022) state that *P. lugubris* is very probably the same species as *P. lusitanica*, in which case *lusitanica* would be a junior synonym of *lugubris*. However, they did not examine the type material of *P. lusitanica* or have genetic data for specimens from southern France they recognise as *P. lugubris*, leaving the relation between the French taxon *P. lugubris* and *P. lusitanica* uncertain. Further, in the same publication they describe a new *Pelecocera* species, *P. garrigae*, which they show had previously been confused with *P. lusitanica*. *Pelecocera garrigae* shares with *P. lusitanica* the feature of long hairs on the anterior mesanepisternite, which are absent from other European *Pelecocera* species. It is unclear whether these hairs are present in the *P. lugubris* type material. The only relevant statement in Lair *et al*. (2022) comes in the following sentence: "This hair-like arista is consistent with Perris' drawing of *P. lugubris*, and with known characters of *P. lusitanicus* such as the notably hairy anterior anepisternum, convex frons, and the shape of the lunule". In its description, the female of *P. garrigae* is stated to be unique among European *Pelecocera* species, in having an almost entirely undusted frons. *Pelecocera lugubris* is not explicitly mentioned in the diagnosis or description of *P. garrigae*. Similarly, *P. garrigae* is not mentioned in the taxonomic notes provided in Lair *et al*. (2022) about *P. lugubris.* In the key provided in Lair *et al*. (2022) *P. lugubris* is separated from *P. garrigae* by its entirely grey-dusted lunule, stated to be "brownish or blackish, slightly polished and not polinose" in *P. garrigae* and also by "paraface wider than diameter of anterior ocellus", contrasting with the condition in *P. garrigae*, described as "paraface as wide as diameter of anterior ocellus". Lair *et al*. (2022) present no data or argument to indicate that *lugubris*, rather than *garrigae*, is the species which was described as *lusitanica* by Mik. Mik's (1898) description of l*usitanica* is based on one male and one female. Mik's (1898) description of the female of *P. lusitanica* does not refer to the polinosity of the lunule, or to the "paraface", or to the polinosity of the frons. It does state "auf dem Abdomen dürfte es 4 gelbe Flecken-parre", indicating the tergites were not entirely black. With the diagnostic characteristics of the *P. lusitanica* type material remaining unknown it is uncertain whether *P. garrigae, P. lugubris* and *P. lusitanica* are three separate species – with *P. lugubris* a localised Mediterranean zone species at present known only from part of southern France – or two species, with one of the three names involved becoming a synonym. If only two species are involved, it is as yet unclear whether *garrigae* is a junior synonym of *lusitanica*, or *lusitanica* is a junior synonym of *lugubris*. **Illustrations of the adult insect:** the general appearance of the female in shown in the coloured photos of the lectotype provided by Lair *et al*. (2022) and Lair & Nève (2023).

Pelecocera lusitanica (Mik), 1898

Preferred environment: coastal dune systems in western Europe, at the transition between *Ammophila* dunes and grey dunes/dune scrub, or where *Pinus* has been planted in dunes; according to Reemer *et al.* (2009) in sandy heathland/pine forest. Johansson (2012) records the species from inland sandy locations, including sandy roadsides and sandpits, in southern Sweden. Habitat in central Europe unknown - continental dunes? **Adult habitat and habits:** flies low among vegetation, and appears to be in flight only early in the morning. **Flowers visited:** white umbellifers; *Cakile maritima, Calluna vulgaris, Galium, Hieracium umbellatarum, Hypochoeris radicata, Pimpinella saxifraga, Salix repens.* **Flight period:** May/June and July/October, with a peak in September. **Developmental stages:** larva and puparium apparently described by Orengo-Green *et al*. (2024b) (under the name *P. lugubris*), from material collected in Denmark in September, within or under the semi-subterranean fruiting bodies of the hypogeal mycorrhizal basidiomycete *Rhizopogon luteolus*, at coastal localities where the fungus was associated with young *Pinus* plantations on sandy soil. Identification of *P. lusitanica* (as *P. lugubris*) was based on specimens reared from some of the collected larvae, using the key in Lair *et al*. (2022). Genetic analysis of the larvae or reared adults was not carried out. *P. tricincta* was reared from larvae collected at the same time of the year, from the same

locations, also from the fruiting bodies of *R. luteolus*. These observations are remarkably similar to those of Stahls (2024), who found *P. caledonica* larvae in the fruiting bodies of *R. luteolus* in southern Finland, alongside *P. tricincta* larvae in the same fungus. Stahls (2024) reports that the identity of the *Pelecocera* species found was confirmed genetically. If the larvae of *P. caledonica* and *P. tricincta* can occur at the same time, in the same place, associated with *Rhizopogon luteolus*, and the larvae of *P. lugubris/lusitanica* and *P. tricincta* can apparently do likewise, why do these three species show such different distributions? An issue complicating interpretation of the existing data is the identity of the fungi with which *Pelecocera* larvae have been found. Orengo-Green *et al*. (2024b) do not indicate how they identified the Danish *Rhizopogon* hosting the *Pelecocera* larvae they studied. Both *Rhizopogon* species known to host *Pelecocera* larvae, *R. luteolus* and *R. roseolus*, are widespread in Scandinavia and by no means restricted to coastal localities, and other *Rhizopogon* species occur there as well (Paz-Martin, 1996). From the similarity between them, there would appear to be ample opportunity for confusion between the fruiting bodies of the various *Rhizopogon* species. The identification key included in Paz-Martin (1996) involves both macroscopic and microscopic features of the fruiting bodies and suggests that separation of even the two widespread species, *R. luteolus* and *R. roseolus*, would require resort to use of a microscope. Was the *Rhizopogon luteolus* of Ståhls (2024) the same species as the *Rhizopogon luteolus* of Orengo-Green *et al*. (2024b)? Was there more than 1 *Rhizopogon* species present where the *Pelecocera* larvae were found, with *P. tricincta* larvae in the fruiting bodies of one *Rhizopogon* species and larvae of other *Pelecocera* species in the fruiting bodies of different *Rhizopogon*? More extensive use of genetic analysis on populations of *Pelecocera* larvae found in *Rhizopogon* fruiting bodies could determine whether larvae of more than 1 *Pelecocera* species can occur together within one individual fruiting body and also whether mixed populations of *P. caledonica* and *P. lugubris/lusitanica* can occur in association with the same *Rhizopogon* species. But this would also depend on great rigour in determining which species of *Rhizopogon* are present. The morphology of the chorion of the egg of what may be *P. lusitanica* is figured by Kuznetzov (1988). **Range:** southern Fennoscandia south to the Mediterranean; Iberia east through parts of central and southern Europe into European parts of Russia. **Determination:** Van Eck and Mengual (2021) and Lair *et al*. (2022). There has been considerable confusion concerning the identity of southern European species related to *C. lusitanica*. Van Eck and Mengual (2021) point out that the lack of genetic data from southern European populations, consigned morphologically to *P. lusitanica*, limits understanding of their relationship with other populations also consigned to this species. This is particularly an issue since the type material of *P. lusitanica* is from Portugal. The only southern European specimen consigned morphologically to *P. lusitanica*, and for which published genetic data are available, is from Corsica (Van Eck and Mengual 2021), and appears genetically somewhat removed from central and Northern European populations. Also, Lair *et al*. (2022), who reinstate *P. lugubis* (original description based on a series of all-black females from SW France) as a valid species, based on morphological data, did not examine the type material of *P. lusitanica* or provide genetic data for southern French material they recognise as *P. lugubris*. Further, they describe a new species, *P. garrigae*, which is morphologically very similar to *P. lusitanica* as recognised in recent literature. Until the type material of *P. lusitanica* is re-examined and it can be established whether morphologically it corresponds with *P. garrigae* or *P. lugubris*, it will remain uncertain whether *garrigae* is a synonym of *lusitanica* of Mik, or *lusitanica* of Mik is a synonyn of *lugubris*. If examination of the *P. lusitanica* type material demonstrates that morphologically *P. lugubris* and *P. lusitanica* of Mik cannot be distinguished, genetic data for *Pelecocera* specimens identifying as *P. lugubr*is, and collected from the vicinity of the type locality of that taxon, should indicate whether *P. lugubris* is the same species as the Scandinavian taxon currently characterising *P. lusitanica* genetically. It follows that if it is not demonstrated that *P. lugubris* is a genetically distinct taxon there is no basis for considering that the names *P. garrigae, P. lugubris* and *P. lusitanica* represent three distinct taxa. A consequence of that conclusion is that, whether the type material of *P. lusitanica* of Mik corresponds with *P. garrigae* or with *P. lugubris*, the *P. lusitanica* of authors, as characterised genetically in Lair *et al*. (2022), would become a synonym of *P. lugubris*. Since the data necessary to resolve these issues are not available, the interim solution adopted here is to retain the name *Pelecocera lusitanica* for the taxon characterised genetically as *P. lusitanica* in Lair *et al*. (2022) and treat *P. garrigae* and *P. lugubris* as two additional, separate taxa. **Illustrations of the adult insect:** Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Torp (1994) provide coloured illustrations showing the general appearance of *C.lusitanicus*.

Pelecocera nigricornis (Santos Abreu), 1924

Preferred environment: forest; *Pinus* forest and Laurisilva forest (Baez, 1977). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August/February. **Developmental stages:** not described. **Range:** this species is endemic to the Canary Isles. **Determination:** this species was redescribed by Baez (1977), under the name *Chamaesyrphus lusitanicus* Mik, but subsequently reinstated as a separate species in the list of Spanish Syrphidae (Marcos-García *et al*,, 1998), without comment. Inclusion of *Pelecocera nigricornis* material in genetic analyses of *Pelecocera* species carried out by Van Eck and

Mengual (2021) produced results which do not conflict with the recognition of *P. nigricornis* as a separate species level taxon. Van Eck and Mengual (2021) include *P. nigricornis* in the key they provide to the identification of European *Pelecocera* species. **Illustrations of the adult insect:** none known.

Pelecocera pruinosomaculata Strobl, 1906
Preferred environment: open ground/forest; Mediterranean coastal dunes and heath with scrub *Pinus*; *Pinus salzmanni* forest; open *Quercus pubescens* forest on limestone karst plateau (at 730m), with *Buxus* shrub layer and sparse, unimproved dry grassland; phrygana. **Adult habitat and habits:** apparently only in flight early in the morning (before 08.30) to judge from Malaise trap catches (Malaise trap emptied after dark and visited again early in the morning). **Flowers visited:** yellow Cruciferae (MS); *Erica manipuliflora* (Standfuss and Claussen, 2007), *Hedera, Lecokia cretica, Polygonum equisetiforme, Smyrnium, Zosima absinthiifolia* (Van Eck and Mengual, 2021). **Flight period:** April/May and September/November. **Developmental stages:** not described, but larvae probably feeding in the subterranean fruiting bodies of species of the mycorrhizal basidiomycete *Rhizopogon*, associated with *Pinus nigra s.l*. **Range:** uncertain due to confusion with related species, but known from Portugal, Spain, southern France, southern Italy, Greece and Cyprus. **Determination:** Van Eck and Mengual (2021) and Lair *et al*. (2022). The morphological interpretation of this species used here has been confirmed by Dieter Doczkal, who has examined the type material of *P.pruinosomaculata* (D. Doczkal, pers. comm.). Genetic analysis carried out by Van Eck and Mengual (2021) revealed taxonomic issues in the relation between populations consigned morphologically to *P. pruinosomaculata* and other populations similarly consigned to *P. scaevoides*. They point out that more comprehensive genetic analysis (i.e.involving more geographically dispersed populations of these widespread taxa) will be required before taxonomic relationships in the *pruinosomaculata/scaevoides* complex can be resolved. As recognised at present, *P. pruinosomaculata* varies from having entirely black tergites to showing a pair of yellow or greyish-white marks on most tergites. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Pelecocera scaevoides (Fallen), 1817
Preferred environment: coniferous forest, especially *Pinus*. **Adult habitat and habits:** low-flying among ground vegetation in open woodland, clearings etc. **Flowers visited:** *Cerastium, Myosotis, Potentilla erecta*. **Flight period:** June/September. **Developmental stages:** undescribed, but presumably mycophagous, probably on the largely subterranean fruiting bodies ofone or more species of *Rhizopogon*. Given the frequent association of *P. scaevoides* with humid *Pinus sylvestris* forest, *Rhizopogon luteolus* would be the most likely larval host. **Range:** northern Norway and Sweden, Finland, Britain (Scottish highlands), Belgium (extinct), France (Aude, Hautes Alpes), Germany, Poland, Czech Republic, Switzerland, Liechtenstein, Italy, Greece, parts of European Russia and the Caucasus mountains; Lebanon; Mongolia. **Determination:** See keys provided in StN Keys volume, Bartsch *et al*. (2009b), Van Eck and Mengual (2021) and Lair *et al*. (2022). Separation of this species from *P. pruinosomaculata* is extremely difficult. Genetic analysis carried out by Van Eck and Mengual (2021) revealed taxonomic issues in the relation between populations consigned morphologically to *P. pruinosomaculata* and other populations similarly consigned to *P. scaevoides*. They point out that more comprehensive genetic analysis (i.e.involving more geographically dispersed populations of these widespread taxa) will be required before taxonomic relationships in the *pruinosomaculata/scaevoides* complex can be resolved. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Stubbs and Falk (1983).

Pelecocera tricincta Meigen, 1822
Preferred environment: conifer forest/open ground, dry *Pinus* forest and heathland; also in open areas within *Castanea* forest. **Adult habitat and habits:** flies low among ground vegetation of tracksides, clearings, etc. and in ericaceous heathland; as easily detected by use of the sweep net as by direct observation. **Flowers visited:** *Calluna vulgaris, Cichorium intybus, Cirsium palustre, Hieracium, Hypochoeris, Leontodon, Narthecium, Potentilla erecta, Ranunculus, Sedum acre, Teucrium*. **Flight period:** June/September, plus April/May in southern Europe. **Developmental stages:** the larva was found by Ståhls (2024) in September/October, feeding internally on the semi-subterranean fruiting bodies of the hypogoeus mycorrhizal fungus *Rhizopogon luteolus*. The larvae were determined both genetically and by identification of reared adults. The full-grown larva was observed to leave the fungus, to pupariate in the litter layer/grass-root zone, the puparial phase occupying from 4 – 8 weeks under laboratory conditions. Ståhls (2024) provides a photo of the puparium. It would appear that, under natural conditions, the species probably overwinters as a puparium. But this is not yet certain. Orengo-Green *et al*. (2024b) describe the larva and puparium of *P. tricincta* from material collected under very similar conditions to those described by Ståhls (2024), again from larvae found in fruiting bodies of *Rhizopogon luteolus*. Determination of *P. tricincta* was in this case based on morphological features of reared adults.The morphology of the chorion of the egg is figured by

Kuznetzov (1988). **Range:** from Fennoscandia south to Iberia; from Britain (southern England) eastwards through much of Europe (including Italy, northern parts of the Balkans, northen Greece) into European parts of Russia and the Caucasus; through Siberia to Cis-Baikal. **Determination:** See keys provided in StN Keys volume, Bartsch *et al*. (2009b),Van Eck and Mengual (2021) and Lair *et al*. (2022). *Pelecocera tricincta* is the most easily separated of the European *Pelecocera* species, both morphologically and genetically. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). Speight and de Courcy Wolliams (2021) similarly illustrate the female.

PIPIZA

The European species of the genus *Pipiza* have for a long time been badly in need of revision - arguably more so than the species of any other syrphid genus. Vujić *et al*. (2013a) conducted a comprehensive revision, involving both genetic and morphometric analyses, in addition to use of traditional features of the external morphology. This has resulted in recognition of 11 European species, including one previously unknown, plus many new synonyms. Unfortunately, separation of some of these species using features of external morphology remains extremely difficult, with much reliance upon small differences in the male terminalia (see Vujić *et al*,, 2013a). Concepts of *Pipiza* species enshrined in the literature prior to the revision by Vujić *et al*. (2013a) cannot be relied upon, necessitating a re-working of material in collections and re-appraisal of range and distribution data.

Pipiza accola Violovitsh, 1985
Preferred environment: forest; deciduous forest, along streams with *Alnus* and *Fraxinus* in *Quercus/Carpinus/Ulmus* forest (Wolff, 1998); in association with *Prunus padus* close to water (T.Järveläinen, pers.comm.); alluvial hardwood forest. **Adult habitat and habits:** no data. **Flowers visited:** *Prunus padus, Salix* (Mutin, 2002); *Prunus spinosa, Salix caprea* (Bartsch et al.(2009b). **Flight period:** end April/June. **Developmental stages:** not described. In Fennoscandia this species seems to be closely associated with *Prunus padus*. **Range:** southern Norway, Sweden and Finland; Germany (Nieder Sachsen, Baden-Würrtemberg), Netherlands, eastern France (Haute-Savoie); Switzerland; Ukraine; asiatic Russia (Siberia). **Determination:** Vujić *et al*. (2013a); Vujić *et al*. (2008) provide a key distinguishing *P.accola* from other known European species of the *luteitarsis* group and also figure the male terminalia. Wolff (1998) figures the male terminalia of both this species and *P.luteitarsis;* Bartsch *et al*. (2009b) include *P.accola* in their key. Separation of the 4 European *luteitarsis* group species is also provided for in the key by Speight and Lebard (2020b). *P.accola* is very similar to both *P. luteibarba* and *P.luteitarsis* and in the male can only reliably be identified by means of features of the terminalia. In the female, abdominal sternite 5 is noticeably wider than long in both *P. accola* and *P.luteibarba*, whereas it is longer than wide in *P.luteitarsis*. The female of *P. accola* can be distinguished from the female of *P.luteibarba* using the proportions of the third antennal segment, which is almost round in *P. accola* but distinctly elongate in *P. lueiibarba*. These features are shown in Vujić *et al*. (2008). Bartsch *et al*. (2009b) and Speight and Lebard (2020b). Wolff (1998) illustrates the female abdomen of *P. accola* and *P. luteitarsis*. The male terminalia are also figured by Mutin (2002). **Illustrations of the adult insect:** the male and female of *P.accola* are figured in colour by Bartsch et al.(2009b) and Prokhorov et al.(2018b).

Pipiza austriaca Meigen, 1822
Preferred environment: forest/open ground; tall herbs and shrubs (e.g. thickets of *Rubus fruticosus*) at edges of open areas and tracks in deciduous (acidophilous *Quercus*) forest, conifer plantations and Atlantic scrub (including *Corylus* scrub on limestone pavement); tall herb vegetation edging fen and reed beds, pools and lakes; along hedges with an associated tall-herb, field-margin zone, in farmland; crops of *Solanum tuberosum*. **Adult habitat and habits:** flies through tall-herb ground vegetation and around shrubs. **Flowers visited:** umbellifers; *Euphorbia, Ranunculus*. **Flight period:** mid-June/end August. **Developmental stages:** larva and puparium figured in colour by Dussaix (2013); larva described and figured by Goeldlin (1974), from larvae collected on yellow gentian. Dussaix (2013) found the larvae of this species on *Rumex*, and observes that, at maturation, they go into a diapause for some weeks, before puparial formation. He records duration of the puparial phase as 8-9 days. **Range:** uncertain, due to confusion with related species, but as interpreted here in much of the Atlantic zone and southern parts of Scandinavia. **Determination:** Vujić et al.(2013a), who include *P. austriaca* in their key to European *Pipiza* species; Bartsch et al.(2009b). **Illustrations of the adult insect:** the species is shown in colour by Ball and Morris (2013). Bartsch et al.(2009b) figure the male.

Pipiza carbonaria Meigen, 1822
Preferred environment: forest; forest margins and track-sides in *Quercus* forest (Vujić *et al*, 2013a). **Adult habitat and habits:** flies through ground vegetation (Vujić *et al*, 2013a). **Flowers visited:** *Smyrnium, Stellaria* (Vujić et al, 2013a). **Flight period:** May/beginning June. **Developmental stages:** not described. **Range:** Switzerland; Austria; "Balkan peninsula" (Vujić *et al*, 2013a). **Determination:** Goeldlin (1997) consigned this species to *Pipiza* (it had previously been regarded as a species of *Trichopsomyia*) and figured its male terminalia. Vujić *et al*.(2013a), in their revision of European *Pipiza*, were unable to locate the type of *P. carbonaria*, but followed Goeldlin's (1997) interpretation of the species, based on his figure of its apparently diagnostic terminalia. They include both the male and the female of *P. carbonaria* in their key and state that it is an overlooked taxon very similar to *P. laurusi* and *P. lugubris*. **Illustrations of the adult insect:** none known.

Pipiza fasciata Meigen, 1822
Preferred environment: margins of and tracksides in acidophilous *Quercus* forest, *Quercus/Ulmus/Carpinus* forest, humid *Fagus* forest and *Picea* forest. **Adult habitat and habits:** flies through tall herb vegetation and around shrubs (Vujić *et al*., 2013a). **Flowers visited:** umbellifers; *Stellaria, Ranunculus* (Vujić *et al*., 2013a). **Flight period:** April/August. **Developmental Stages:** not described. **Range:** "from Fennoscandia south to France; from Germany eastwards through central Europe to the Balkan Peninsula" (Vujić *et al*., 2013a). **Determination:** Vujić *et al.* (2013a) establish that this is the species which has generally been known as "*Pipiza fenestrata*", but that *fenestrata* of Meigen is not this species. They also provide a key to European *Pipiza* species, including *P. fasciata*. However, since Vujić *et al.* (2013a) also show that the only way to separate the male morphologically from a number of related species is apparently by reference to features of the terminalia, whereas previous keys have not been based on terminalia, but on general morphology, it is difficult to conclude other than that specimens standing under "*Pipiza fenestrata*" in collections could include a mixture of five or more different species. Separation of the females of this species is at least equally difficult. **Illustrations of the adult insect:** a "typical" male, with pale marks on both second and third tergites, is shown in colour by Bartsch *et al*. (2009b).

Pipiza festiva Meigen, 1822
Preferred environment: forest; alluvial forest and orchards. **Adult habitat and habits:** fast-flying, up to 3-4m from the ground, round trees and shrubs. **Flowers visited:** *Hedera*. **Flight period:** April/June and August/October. **Developmental stages:** larva described and figured by Dusek and Laska (1959), from larvae found feeding on gall-making aphids of the genus *Pemphigus*, on *Populus*; also found with gall-making aphids on *Populus* by Dussaix (2013). The larval biology is described by Rojo and Marcos-García (1997), who found larvae on *Populus*, fruit trees (*Prunus* spp., *Pyrus*) and shrubs (*Pistachio* spp.). From oviposition to emergence of adults, development takes approximately 1.5 months, but may be interrupted by larval diapause. Overwintering also occurs in larval diapause. Dussaix (2013) records duration of the puparial phase as 2-3 weeks. **Range:** from Belgium and the Netherlands south to the Mediterranean; from Spain eastwards through southern and central Europe to the Caucasus and on into Asiatic parts of Russia to as far as the Pacific (Sakhalin). **Determination:** Vujić *et al*. (2013a). A significant feature of this species is that the tarsal segments of all legs are entirely yellow. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007).

Pipiza laurusi Vujić & Ståhls, in Vujić *et al*, 2013a
Preferred environment: *Laurus nobilis* forest (Vujić et al, 2013a); "deciduous and coniferous forest" (Vujić *et al*., 2020). **Adult habitat and habits:** no data. **Flowers visited:** *Smyrnium perfoliatum* (Vujić et al, 2020). **Flight period:** April/May; July (Vujić *et al*., 2013a). **Developmental stages:** not described. **Range:** uncertain, due to potential confusion with *P.lugubris*, but known from Montenegro; North Macedonia and Greece (Vujić *et al*., 2013a). **Determination:** in Vujić *et al.* (2013a) this taxon is recognised as a separate species almost entirely on genetic and morphometric data. It is well-nigh identical to *P. lugubris* in its general morphology. The morphometric data detected significant differences in wing shape, between *P. laurusi* and *P. lugubris*, but whether these differences can be detected by eye is not clear. The key to European *Pipiza* species provided by Vujić *et al*., (2013a) cites no morphological differences between *P. laurusi* and *P. lugubris*, in either the male or the female. At the moment, the best indicators of species identity are ecological: *P. laurusi* is evidently an inhabitant of Mediterranean laurel forests, where *P. lugubris* apparently does not occur and *P. lugubris* inhabits Atlantic zone

and central European oak forest, where *P. laurusi* apparently doesn't occur. **Illustrations of the adult insect:** the general appearance of the female can be seen in the coloured photo provided by Vujić *et al*. (2020d).

Pipiza lugubris Fabricius, 1775
Preferred environment: tall-herb tracksides and open areas in acidophilous *Quercus* and *Quercus/Ulmus/Carpinus* forest. **Adult habitat and habits:** males hover in small groups at 2-3 m above the ground, in small open areass in oak forest, settling on foliage of trees in the sun. **Flowers visited:** white umbellifers; *Crataegus, Euphorbia, Filipendula, Leontodon, Mentha, Potentilla erecta, Ranunculus, Rosa rugosus, Rubus, Stellaria*. **Flight period:** June and August/September, rarely seen in July; at the northern edge of its range in flight only in July/August. **Developmental stages:** not described. **Range:** Fennoscandia, Poland, from England and Wales through France (south to the Dordogne) and across central Europe to Austria; Italy in southern Europe. Whether Ssymank's (2012) record of *P.lugubris* from montane spruce forest in the Rhodope mountains of NE Greece is based on *P.lugubris* or *P.laurusi* requires to be established. Since *P.laurusi* is apparently an inhabitant of Mediterranean laurel forest Ssymank's (2013a) record may well refer to *P.lugubris*. **Determination:** Vujić et al.(2013a), whose key does not separate this species from *P. laurusi*, which at present seems to be morphologically identical to *P. lugubris* (see under *P. laurusi*). However, *P. laurusi* appears to be a strictly Mediterranean-zone species, whereas *P. lugubris* is found in more northerly parts of Europe. According to Vujić *et al*. (2013a) the Meigen *Pipiza* species *funebris, geniculata* and *signata* are all synonyms of *P. lugubris*. **Illustrations of the adult insect:** Bartsch *et al*. (2009b) figure the male and female in colour.

Pipiza luteibarba Vujić, Radenković & Polić, 2008
Preferred environment: forest/freshwater; deciduous forest; tall-herb open areas along rivers in Balkanic thermophilous *Quercus* forest of *Q. pubescens/Q. cerris/ Q. frainetto* and in alluvial hardwood forest (Vujić *et al*., 2008); *Quercus/Carpinus/Ulmus* forest (Prokhorov *et al*., 2023). **Adult habitat and habits:** no data. **Flowers visited:** *Smyrnium perfoliatum* (Vujić *et al*., 2020). **Flight period:** April. **Developmental stages:** not described. **Range:** known from Sweden, northern France, Austria, Serbia, Greece (Lesvos), Ukraine and Israel. **Determination:** Vujić *et al.* (2013a); Vujić *et al.* (2008) and Speight and Lebard (2020b) provide figures of the male terminalia and a key distinguishing *P.luteibarba* from other European members of the *luteitarsis* group. The *luteitarsis* group of species may be distinguished from other European *Pipiza* by the lack of apicoventral ridges on the hind femora. For distinctions between *P. accola, P. luteibarba* and *P. luteitarsis*, see under *Pipiza accola*. **Illustrations of the adult insect:** none known.

Pipiza luteitarsis Zetterstedt, 1843
Preferred environment: forest: deciduous forest; mature humid *Fagus* and acidophilous *Quercus* forest and woodland; thermophilous *Quercus* forest; also in mature suburban gardens. **Adult habitat and habits:** to a significant extent arboreal, flying at up to 5m from the ground round the foliage of mature trees and shrubs; settles on foliage of the lower branches of oak and beech at the edge of clearings and paths etc., and on bushes, e.g. *Rubus fruticosus*. **Flowers visited:** *Acer platanoides, Crataegus, Euphorbia, Malus, Prunus spp., Ranunculus, Tussilago.* **Flight period:** mid April/end May, with occasional later records. **Developmental stages:** larva described, with various features figured, by Rotheray (1987), who found larvae on a number of occasions in June, in colonies of the leaf-curl aphid *Schizoneura ulmi* (L.), in leaf-curl galls on *Ulmus glabra*. Rotheray (2014) again records finding *P. luteitarsis* larvae with the same leaf-curl aphid on *Ulmus glabra* in 2010, remarking that the larva of this species "appears to develop exclusively on the aphid *Schizoneura ulmi*, on its primary host, the foliage of elms, *Ulmus* species". Rotheray (1987) observed that the larvae went into diapause in July, overwintered as larvae, pupated in the following April and May and hatched as adults in May-June. The larva is illustrated in colour by Rotheray (1994). **Range:** from Fennoscandia south to Belgium and France; from Ireland eastwards through central Europe (Alps) into European parts of Russia. **Determination:** Vujić *et al*. (2013a). Vujić *et al*. (2008) and Speight and Lebard (2020b) provide keys distinguishing *P. luteitarsis* from other known European species of the *luteitarsis* group and also figure the male terminalia. Species of the *luteitarsis* group can be separated from other European *Pipiza* species by the lack of a pair of apico-ventral ridges on the hind femora, which are present in the other species. In males of *P. quadrimaculata* the hairs on the thoracic pleura and abdomen are almost entirely black, whereas they are pale whitish-yellow in *P. luteitarsis*. Wolff (1998) provides features distinguishing *P. accola* from *P. luteitarsis* in both sexes, but does not refer to the lack of the apico-ventral ridges on the hind femora in *P. accola*. Males of *P. luteitarsis* can only be reliably distinguished from *P. accola* and *P. luteibarba* by features of the terminalia. **Illustrations of the adult insect:** the adult of *P. luteitarsis* is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Pipiza noctiluca (L.), 1758
Preferred environment: forest/water-edge ecotones; edges of open areas and tracksides in Atlantic scrub, conifer forest, conifer plantations, *Salix* forest and *Quercus* forest; tall herb formations along streams in deciduous forest, around fens and at pool or lake edges in open country; suburban gardens and along hedges in farmland. **Adult habitat and habits:** flies among tall ground vegetation and within edges of thickets of *Rubus* etc., along hedges, tracks within woodland and in open areas in deciduous woodland and scrub and among tall herb vegetation of humid grassland. **Flowers visited:** umbellifers; C*rataegus, Filipendula, Ranunculus, Rosa, Stellaria, Taraxacum*. **Flight period:** May/beginning July and end July/beginning September, with peaks in June and August. **Developmental stages:** larva aphid-feeding on tall herbs, bushes and shrubs up to 3m from the ground. Dussaix (2013) notes that, in what is probably this species, the mature larva undergoes a diapause of some weeks before formation of the puparium, and that duration of the puparial phase is approximately 2 weeks. **Range:** uncertain, due to confusion with other species but, according to Vujić *et al.*(2013a), probably "all Europe, Russia and Turkey". Skevington *et al.*(2019) suggest this species may also occur in the Nearctic. **Determination:** Vujić *et al.*(2013a). *P.noctiluca* still cannot be reliably distinguished from related species over much of Europe. The differences in the male terminalia, used by Vujić *et al.*(2013a) to separate the male of *P. noctiluca* from the males of other species, are minuscule and very difficult to interpret consistently. In literature prior to Vujić *et al.*(2013a) interpretations of *P. noctiluca* vary from author to author, a phenomenon which seems likely to continue. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007). The male and female are illustrated in colour together in Pétremand *et al*. (2022).

Pipiza notata Meigen, 1822
Preferred environment: forest; track-sides and tall herb open areas in acidophilous *Quercus* forest. **Adult habitat and habits:** flies around and through forest margin vegetation of shrubs and bushes, settling on foliage at 1-3m. **Flowers visited:** *Ranunculus*. **Flight period:** May/June. **Developmental stages:** undescribed, but Dussaix (2005b) reports rearing what may be this species from larvae collected on *Prunus avium*, with a leaf-rolling aphid. **Range:** uncertain, due to confusion with other species, but known from Sweden, Denmark, various parts of the Atlantic zone, including Britain and Ireland, Germany, France and "central Europe (Alps) into European parts of Russia and until south-east Greece" (Vujić *et al*, 2013a). **Determination:** this species appears in recent literature (including the StN database files) under the name *P.bimaculata*. The synonymy of both *bimaculata* Meigen and *morionellus* Zetterstedt, with *notata*, was established by Vujić *et al.*(2013a), who also redefine the species, figure its terminalia and provide a key for separating it from other European *Pipiza* species. Unfortunately, although the validity of recognising this species as a separate taxon has now been verified genetically, identification of *P.notata* using features of its external morphology remains extremely difficult. **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019).

Pipiza quadrimaculata (Panzer), 1802
Preferred environment: forest; conifer forest from the *Fagus/Picea* zone up into *Picea* forest; on occasion also in humid *Fagus* forest. **Adult habitat and habits:** tracksides, clearings and open, mature forest. **Flowers visited:** yellow composites; umbellifers; *Alliaria, Allium ursinum, Caltha, Cardamine, Cornus, Euphorbia, Fragaria, Malus, Meum, Potentilla, Ranunculus, Rubus, Salix, Sambucus, Sorbus aucuparia*. **Flight period**: end May/July, with occasional later specimens, especially at higher altitudes. **Developmental stages:** not described, but Kula (1982) records larvae as overwintering among leaf litter on the floor of spruce (*Picea*) forest. The morphology of the chorion of the egg is figured by Kuznetzov (1988). According to Skevington *et al.*(2019) the larvae are predators of *Cynara* (Aphididae). **Range**: from Finland south. to the Pyrenees, Bulgaria and the former Yugoslavia; through northern and central Europe into Russia as far as the Pacific (Sakhalin). This species also occurs in north America (Skevington *et al*, 2019). **Determination**: Vujić *et al.* (2013a). Vujić *et al.* (2008) and Speight and Lebard (2020b) provide keys distinguishing *P.quadrimaculata* from other known European species of the *luteitarsis* group and also figure the male terminalia. *P.quadrimaculata* closely resembles *Trichopsomyia flavitarse* in general appearance, but usually has a pair of pale marks on both the second and third abdominal tergites and the anterior, flat part of the mesopleur immediately posterior to the prothoracic spiracle is bare. The male of *P.quadrimaculata* may be distinguished from males of other European *Pipiza*, except for *P.accola, P.luteibarba* and *P.luteitarsis* (Zett.), in that its hind femora do not carry a pair of ventral, longitudinal ridges at the distal end. In the male of *P.luteitarsis* the thoracic pleura and the abdomen are almost entirely pale haired, while in the male of *P.quadrimaculata* these areas are almost entirely

black haired. In the female, *P. quadrimaculata* lacks the frontal dust spots found in females of other European *Pipiza* species without apico-ventral ridges on the hind femur and also has the tergites predominantly black-haired. In the other three species the tergites are entirely pale-haired. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Kormann (1988), Torp (1984) and van der Goot (1986).

PIPIZELLA

Until recently, there has been great confusion as to how many species of *Pipizella* there are in Europe and what their correct names should be. A significant improvement in the situation was achieved when Lucas (1977) provided a series of species redefinitions with accompanying figures of male terminalia. Since then various authors have described additional species, but usually without reference to sufficient of the existing species to make reliable determination possible. Verlinden (1999a) made the first recent attempt to provide a comprehensive key to the European *Pipizella*, but, as he states himself, his key omits several southern European species, and it only treats the males. Van Steenis and Lucas (2011) include all known European *Pipizella* species in their revision and provide a key to the males. The status of three further species, *P. beckeri* Bradescu, *P. fumida* Goeldlin and *P. sacculata* Becker, remains confused.

Pipizella annulata (Macquart), 1829
Preferred environment: deciduous forest; *Quercus/Carpinus/Ulmus* forest; mesophilous and humid *Fagus* forest and *Castanea* forest; also unimproved, subalpine grassland up to 2,000m; can occur in unimproved grassland at lower altitudes (Doczkal, pers. comm.). **Adult habitat and habits:** thick vegetation beside tracks, at the edge of clearings or along old hedges; adults fly low in dappled sun and shade and frequently within vegetation such as bramble bushes; settles on low-growing plants in patches of sun; among taller vegetation beside brooks, in alpine grassland. **Flowers visited:** umbellifers; *Chaerophyllum, Galium.* **Flight period:** end May/September, with peak June/July; only July/August at higher altitudes/more northerly latitudes. **Developmental stages:** undescribed, but larva found by Dussaix (1997a) at the root collar level of *Heracleum stems*, with aphids tended by ants. Dussaix (2013) provides more detail on the rearing of this species and coloured photos of both larva and puparium. He notes that all the larvae he found were on leaves of, or at the stem-base of, *Heracleum* plants, where both aphids and ants (genus not specified) were present. Puparial formation occurred at the stem-base. Larvae reaching maturity in the autumn remained at the stem-base, in diapause, throughout the winter. Dussaix (2013) records duration of the puparial phase as 12 days. **Range:** from Finland south to southern Portugal and east through central Europe to Hungary and round the Mediterranean to the former Yugoslavia. Records of *P. annulata* from Turkey require re-appraisal: according to Van Steenis and Lucas (2011) they probably refer to *P. orientalis*. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a) who figures the male terminalia. In both sexes of *P.annulata* the hairs on the hind tibiae are long, though not as long as in *P.virens*, but the basitarsi of both the fore and mid legs are bright yellow, whereas in *P.virens*, and *P.viduata*, the basitarsi of at least the fore legs are dusky brown/dark brown. Maibach et al.(1992) established the synonymy of *flavescens* (Goeldlin) with this species. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994).

Pipizella antennata Violovitsh, 1981
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Developmental stages:** no data. **Range:** Turkey: the southern Pacific coastal region (South Primorye, in the Primorskiy-Kray) of the Russian Far East. **Determination:** Van Steenis and Lucas (2011), who redescribe both sexes, provide a key to separate the male from males of other *Pipizella* species and figure the male terminalia. In this species the third antennal segment is nearly 4x as long as its maximum depth. **Illustrations of the adult insect:** none known.

Pipizella bayburtica Claussen & Hayat, 1997
Preferred environment: open ground; unimproved montane grassland at 1700-1800m in Turkey (Claussen and Hayat, 1997a). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** north-east Turkey. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Claussen and Hayat (1997a), who figure the male terminalia. In this species, the tarsi of the female are entirely yellow. **Illustrations of the adult insect:** none known.

Pipizella beckeri Bradescu, 1986
Definition of taxon inadequate: separate species status not justified, based on existing information
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** Roumania. **Determination:** Bradescu (1986). This species is known only from the female holotype, comprehensively described by Bradescu (1986). In his preamble to description of this species Bradescu (1986) remarks that Becker (1921) named a variety of *P.virens* based on a solitary female with the third antennal segment of a distinctive shape, which he named v.*sacculata*. Bradescu then goes on to say that a second female with this same feature has now been found, adding that "Cet exemplaire présente une identité complète avec la description de Becker". Becker's (1921) description is confined entirely to a remark about the shape of the third antennal segment, which he figures. Bradescu (1986) finishes his preamble by stating "nous présentons ici la description de notre exemplaire, tout à fait différente de celle de *Pipizella virens* (F.)". He then describes the specimen he designates as what he refers to as the "Holotype" of *P.beckeri*. From the fact that he states *P.beckeri* is clearly not *P.virens*, and through his designation of a holotype for *P.beckeri*, it is clear that Bradescu was *NOT* redescribing *P.virens* v.*sacculata*, as mistakenly suggested by Verlinden (1999). Indeed, whatever *P.beckeri* might be it is unlikely to be the same taxon as *P.virens* v.*sacculata*, since the latter belongs to some subalpine species, whereas the holotype of *P.beckeri* was found at 350m in Roumania. Given that females of *Pipizella* species cannot at present be adequately distinguished from one another, and that there is sufficient variability in the shape of the third antennal segment (basoflagellomere) that its shape in *P.beckeri* is not reliably diagnostic, it is not at present possible to decide whether or no *P.beckeri* is a distinct species. Van Steenis and Lucas (2011) refer to *P.beckeri* as a synonym of "*Pipizella virens* var *sacculata* Becker", but state that they come to no conclusion as to the identity of *P.virens* var. *sacculata*. **Illustrations of the adult insect:** none known.

Pipizella bispina Simic, 1987
Preferred environment: forest/open ground; unimproved grassy, open areas and heath within the upper levels of acidophilous *Picea* forest. **Adult habitat and habits:** flies low among and over short ground-vegetation in dappled sun and shade; settles on low-growing plants in patches of sun, and on low foliage of deciduous trees in small, sunny, open areas in forest. **Flowers visited:** white umbellifers (A.Vujić, pers.comm.). **Flight period:** June/July. **Developmental stages:** not described. **Range:** Austria, Belgium, France (Pyrenees, Alps), Italy, Montenegro, Serbia, Slovenia, Switzerland. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a). The male terminalia are figured by Vujić (1997) and Verlinden (1999a). The female of this species is described by Vujić (1997). **Illustrations of the adult insect:** none known.

Pipizella brevis Lucas, 1977
Preferred environment: open ground/forest; open heathy areas in the Pyrenees, within the upper levels of *Fagus/Picea* forest upwards to the tree line in *Pinus uncinata/ Rhododendron* forest and on into the alpine zone in thinly-vegetated heath and acid grassland, with such low-growing plants as *Potentilla montana* and *Thymus serpyllum* and patches of *Polystichum filix-mas* and *Vaccinium myrtillus*, or *Carex* spp., *Nardus* and *Sphagnum* on wetter sites, to above 2000m (data from M.A. Marcos-García and J.-P. Sarthou). **Adult habitat and habits:** flies extremely close to the ground surface, with a zig-zag flight, settling on the bare ground of paths (J.-P.Sarthou, pers.comm.). **Flowers visited:** no data. **Flight period:** July/August. **Developmental stages:** not described. **Range:** Spain and the Pyrenees (Spain, France). Records of this species from northern Europe (Finland, Siberia) are now consigned to *P.certa*, Violovitsh. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Lucas (1977), who figures the male terminalia. **Illustrations of the adult insect:** none known.

Pipizella calabra (Goeldlin), 1974
Preferred environment: open ground/scrub; dry, open grassy areas with scattered deciduous scrub in the *Picea/Larix* zone and upwards into unimproved, calcareous alpine grassland to 2000m; often near streamlets or alongside the summer-dry channels of torrents (L.Verlinden, pers.comm.). **Adult habitat and habits:** low-flying, among and over low ground-vegetation. **Flowers visited:** *Potentilla tabernaemontana* (L.Verlinden, pers.comm.). **Flight period:** end May/end July. **Developmental stages:** not described. **Range:** France (Alps) and central (Apennines) and southern Italy. **Determination:** essentially, the species can only be distinguished from other similar *Pipizella* species by features of the male genitalia. The male genitalia are illustrated by Lucas (1976), under the name *macrobasalis*, synonymised with *calabra* in an addendum to the publication. Subsequently, Verlinden (1999a) also figured the male terminalia of *P. calabra*, the illustrations closely

matching those of Lucas (1976). In Van Steenis and Lucas (2011), where the genitalia are again figured, it is stated "No type material of *P. calabra* was studied" and the figures of the genitalia are given as based on a paratype of *macrobasalis*. In their figure showing the genitalia in dorsal view (Figure 67), the shape of the surstyli does not correspond with the shape of the surstyli shown in Lucas (1976) and Verlinden (1999a). Here it is assumed that the genitalia figures of Lucas (1976) and Verlinden (1999a) are correct and the interpretation of *P. calabra* used is based on them. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Pipizella cantabrica Claussen, 1991
Preferred environment: open ground; dry, unimproved grassland. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers. **Flight period:** May/June. **Developmental stages:** not described. **Range:** northern Spain, northern Italy. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a) who figures the male terminalia. **Illustrations of the adult insect:** none known.

Pipizella caucasica Skufjin, 1976
Preferred environment: open ground; from the tree-line into subalpine grassland (Skufjin, 1976); at 1700-2500m in Turkey, where it has also been found in suburban parkland (Claussen and Hayat, 1997). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end June/beginning August (Turkey). **Developmental stages:** not described. **Range:** Caucasus (Georgia) and north-east Turkey. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Claussen and Hayat (1997) who figure the male terminalia and detail differences between the males of this species and the closely related *P.elegantissima* Lucas. Dirickx (1994) wrongly synonymised these two species. The female of *P.caucasica* cannot yet be separated from females of related species. **Illustrations of the adult insect:** none known.

Pipizella certa Violovitsch, 1981
Preferred environment: humid, grassy, open areas in calciphile deciduous forest with *Tilia* (A.Haarto, pers.comm.); tall-herb vegetation bordering *Larix/Taxus* forest (van Steenis, 2011). **Adult habitat and habits:** settles on foliage of low-growing plants, in the sun (A.Haarto, pers.comm.). **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** southern Sweden, southern Finland and western Siberia (Altai). **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; included in the keys provided by Violovitsh (1986), who also figures the male terminalia. This species is also keyed out by Bartsch et al.(2009b). **Illustrations of the adult insect:** the general appearance of this species is shown in the photograph provided by Haarto & Kerppola (2007) and in the coloured figure given by Bartsch et al.(2009b).

Pipizella curvitibia Stackelberg, 1960
Preferred environment: no data. This species occurs at altitudes of 1700-2000m in north-east Turkey (Claussen and Hayat, 1997). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** north-east Turkey and the Transcaucasus (Azerbaijan, Armenia). **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Claussen and Hayat (1997), who figure the male terminalia and note that this species is distinctive in the male, through possession of expanded front tarsal segments and mid tibiae which are expanded apically. The mid-tibiae are expanded in the apical half in both the male and the female of this species, as figured by Van Steenis and Lucas (2011). **Illustrations of the adult insect:** none known.

Pipizella divicoi (Goeldlin), 1974
Preferred environment: open ground/scrub; well-drained, dry, unimproved grassland with scrub; montane, unimproved grassland with *Castanea* (Ricarte et al.(2014); tall-herb open areas within thermophilous oak forest of *Q. cerris/ Q. frainetto;* unimproved, dry montane pasture and garrigue; sheep-grazed, unimproved, dry grassland with low, scattered, grazed scrub of *Prunus spinosa*, *Crataegus* or *Rosa* spp. Occurs up to 2300m in the Alps (Verlinden, 1999). **Adult habitat and habits:** flies fast and very close to the ground in sparsely vegetated, open areas where there is some scrub invasion and in garrigue, visiting the flowers of low-growing plants. **Flowers visited:** *Aegopodium podagraria, Euphorbia, Mercurialis, Thymus.* **Flight period:** beginning May/June and July at higher altitudes. **Developmental stages:** undescribed. **Range:** from the Netherlands

south to the Mediterranean coast of Spain; from Belgium and northern France (Rhine valley) eastwards through central and southern Europe (Italy, the former Yugoslavia) to Turkey, European parts of Russia, the Caucasus (Georgia) and through Siberia to the Pacific coast; Mongolia. This species disappears with introduction of irrigation to its dry grassland habitat. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. Males of *P.divicoi* may be distinguished from males of other *Pipizella* species by their possession of an extremely narrow abdominal sternite 3, which is more than 3x as wide as its median length. **Illustrations of the adult insect:**
http://cyrille.dussaix.pagesperso-orange.fr/

Pipizella elegantissima Lucas, 1976
Preferred environment: deciduous forest; open areas within *Fagus* forest. **Adult habitat and habits:** well-drained clearings and tracksides with thick, low-growing vegetation; flies fast and low through ground vegetation, settling on foliage. **Flowers visited:** white umbellifers; *Stellaria*. **Flight period:** end May/beginning July. **Developmental stages:** not described. **Range:** France (Alps), Italy (Apennines). **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. This species appears in most recent literature under the name *elegantissima* Lucas, but Dirickx (1994) synonymised *P.elegantissima* with *P.caucasica* Skufjin. Claussen and Hayat (1997a) reinstate *elegantissima* as a distinct species, demonstrating clear differences between the male terminalia of this taxon and *P.caucasica*. The male terminalia are also figured by Lucas (1977) and by Claussen and Hayat (1997a). The latter authors also figure the terminalia of the closely similar *P.caucasica*. **Illustrations of the adult insect:** none known.

Pipizella kuznetzovi Van Steenis & Lucas, 2011
Preferred environment: In Turkey, this species occurs at altitudes of 1700-2300m (Van Steenis and Lucas, 2011). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** mid July/August. **Developmental stages:** no data. **Range:** Turkey. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia. This species is described from a series of males. The female remains unknown. **Illustrations of the adult insect:** none known.

Pipizella lyneborgi Torp Pedersen, 1971
Preferred environment: forest; deciduous forest; thermophilous *Quercus* forest at 850-1300m (M.-A. Marcos-García, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Diplotaxis erucoides*, *Quercus rotundifolia*, *Rhamnus*, *Viburnum tinus* (Pérez-Bañón et al, 1996, Rojo & Marcos-García, 1997); *Euphorbia* (Van Eck, 2011). **Flight period:** beginning of April/mid May. **Developmental stages:** not described. **Range:** Portugal and southern Spain. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Torp Pedersen (1971), who figures the male terminalia and Nielsen & Torp (1973), who provide a table of comparison between the males of this and related *Pipizella* species. **Illustrations of the adult insect:** the general appearance of the male is shown in the coloured photo provided by Van Eck (2011).

Pipizella maculipennis (Meigen), 1822
Preferred environment: forest/open ground; dry, unimproved, grassy areas within dry scrub or *Fagus/Pinus* forest. **Adult habitat and habits:** small groups of mles can occur on the foliage of low branches of trees (e.g. *Quercus*), in the sun, at the edge of woodland.. **Flowers visited:** *Cirsium*. **Flight period:** end May/August. **Developmental stages:** not described. **Range:** uncertain, due to confusion with *P.zennegenensis* until recently; known from Britain (southern England), Belgium, France, Switzerland, Italy, Slovenia, Bosnia, Croatia, North Macedonia, Montenegro, Serbia, Roumania and Turkey. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. Males of *P.maculipennis* may be distinguished from males of other *Pipizella* species by their possession of an extremely convex third abdominal sternite, which does not occur in other species. **Illustrations of the adult insect:** none known.

Pipizella mongolorum Stackelberg, 1952
Preferred environment: wetland; calcareous fen, transition mire and edges of raised bog, up to 1300m in the Alps (C.Claussen, pers.comm.). **Adult habitat and habits**: flies low, with a zig-zag flight, through the upper edge of tall-herb fen

vegetation, settling on the foliage of large-leaved plants such as *Caltha*. **Flowers visited**: *Potentilla erecta* (B. Tissot, pers.comm.), yellow composites, *Caltha*. **Flight period**: late May/July. **Developmental stages:** not described. **Range**: France (Jura), southern Germany; Czech Republic, central and eastern Siberia; Mongolia. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. This species may be found in flight with *P.viduata*. Females of *P.mongolorum* may be distinguished from those of *P.viduata* by the large dust spots on the frons (no dust spots on the frons in *P.viduata*) and the length of the hairs on the antero-lateral surface of the hind tibia, which are longer than the maximum width of the tibia in dorsal view (shorter than the maximum width of the hind tibia in *P.viduata*). Also, in the female of *P.mongolorum* the face is lightly, but distinctly, dusted in the midline, making a broad, dorso-ventral stripe of dusting from the antennal insertions to the upper mouth edge (entirely shining and undusted in females of *P.viduata*). The combination of frontal dust spots and long hairs on the antero-lateral surface of the hind tibia distinguishes the female of *P. mongolorum* from the females of most other European *Pipizella* species. Frontal dust spots are present in females of *P. annulata*, but in *P. annulata* the hairs on the antero-lateral surface of the hind tibiae are no longer than the maximum width of the tibia and the hairs on the scutellar disc are no longer than one fifth of the median length of the scutellum, whereas in females of *P. mongolorum* the hairs on the scutellar disc include many longer than half of the median length of the scutellum. Further, in *P. annulata* females the hairs along the lateral margins of tergites 2 and 3 are shorter than the maximum width of a mid femur in dorsal view, but, in *P.mongolorum* females, the hairs along the lateral margins of these tergites are longer than the maximum width of a mid femur in dorsal view. In females of *P. elegantissima* and *P. virens* the hairs on the antero-lateral surface of the hind tibia are as long as (or longer than) the hairs on the same part of the hind tibia in *P.mongolorum*, but the frons lacks dust spots. **Illustrations of the adult insect:** none known.

Pipizella nataliae Kuznetzov, 1990
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** no data. **Range:** Turkey; the southern edge of European Russia (Northern Ossetia); Georgia. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the male terminalia. The male terminalia of this species could easily be confused with the male terminalia of *P.viduata*.The female remains unknown. **Illustrations of the adult insect:** none known.

Pipizella nigriana (Séguy), 1961
Preferred environment: open areas within *Larix/Pinus mugo* forest and scrub and unimproved, non-calcareous alpine grassland and heath up to 2500m. **Adult habitat and habits**: very low-flying among grasses and over sparsely-vegetated ground etc. Settles on low-growing vegetation or the ground surface. **Flowers visited**: *Potentilla, Ranunculus, Saxifraga, and Sedum*. **Flight period**: June/August. **Developmental stages:** undescribed, but quite possibly associated with dwarf shrubs, to judge from the habits of the adult flies... **Range**: Alps (known from France, Germany, Switzerland, Liechtenstein and Austria); Slovenia. **Determination**: Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. Like *P.annulata, P.nigriana* has yellow basitarsi. It may be determined with certainty from features of the male terminalia that are figured by Lucas (1977). The male is apparently almost unique among European *Pipizella* species in that the eyes do not quite meet above the antennae. The only other European species sharing this feature are *P.brevis* Lucas and *P.mongolorum* Stack. **Illustrations of the adult insect:** none known.

Pipizella obscura Van Steenis & Lucas, 2011
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/beginning August. **Developmental stages:** no data. **Range:** Finland; Sweden. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the male terminalia, which are very similar to the male terminalia of *P.viduata*. **Illustrations of the adult insect:** none known.

Pipizella ochreobasalis Van Steenis & Lucas, 2011
Preferred environment: occurs at altitudes of 1400-2200m (Van Steenis and Lucas, 2011). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April and June/July. **Developmental stages:** no data. **Range:** Turkey; southern Iran. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the male terminalia. The description of this species is based on a series of males and

females. In both sexes, *P.ochreobasalis* possesses the distinctive feature of bright yellow wing-veins in the basal part of the wing. **Illustrations of the adult insect:** none known.

Pipizella orientalis Van Steenis & Lucas, 2011
Preferred environment: occurs at 1200-2300m altitude. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July/beginning of August. **Developmental stages:** no data. **Range:** Turkey; Georgia. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the male terminalia. As figured by Van Steenis and Lucas (2011) the male terminalia of this species are almost exactly the same as the male terminalia of *P.annulata*. The only clear distinction between *P.orientalis* and *P.annulata* is that in the former the wing veins are yellow in the basal part of the wing, whereas in *P.annulata* the wing veins are dark brown throughout. *P.orientalis* is described from a series of males. The female remains unknown. **Illustrations of the adult insect:** none known.

Pipizella pennina (Goeldlin), 1974
Preferred environment: forest/open ground; clearings in *Fagus/Picea* forest in the montane zone, and on up to the upper limits of *Picea* forest in the Alps. **Adult habitat and habits:** flies along the edge of clearings etc., around bushes and shrubs, at up to 1m from the ground. **Flowers visited:** white umbellifers; *Potentilla erecta*. **Flight period:** mid June/July **Developmental stages:** undescribed. **Range:** Netherlands, Belgium, France, Spain (Pyrenees), southern Germany, Switzerland, Austria, Serbia, Roumania. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. Males of *P.pennina* may be distinguished from males of other *Pipizella* species by their possession of a pair or shallow, denticulate projections close to the posterior margin of abdominal sternite 4. Marcos-García (1985c) established the synonymy of *microapicalis* Lucas with this species. **Illustrations of the adult insect:** none known.

Pipizella sacculata Becker, 1921
Definition of taxon inadequate: separate species status not justified, based on existing information.
Preferred environment: subalpine zone. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Developmental stages:** not described. **Range:** Switzerland (Zermatt). **Determination:** the description of this species is based on a solitary female, published (Becker, 1921) as a named variety, v.*sacculata*, of *Pipizella virens*. The identity of this taxon is dependent totally on the shape of the third antennal segment, regarded as diagnostic by Becker (1921) and figured by him. No information is provided by Becker on any other features of the specimen. Sack (1928-32) regarded the shape of the antenna in v.*sacculata* as a morphological anomaly. According to Verlinden (1999), Bradescu (1986) raised v.*sacculata* to species level. However, careful reading of Bradescu's paper does not support that statement, or Verlinden's contention that Bradescu redescribed *P.sacculata* under the name *P.beckeri* (see under *P.beckeri*). Indeed, *P.sacculata* does not seem to have been referred to as a distinct species prior to Verlinden's use of the name as a species-level taxon, unless Peck's (1988) reference to *sacculata* Becker as a junior synonym of *P.virens* constitutes such an occurrence. But, whether or not there are prior references to *P.sacculata* as a distinct species, Verlinden (1999) does refer to the taxon in this way, albeit stating that at present "*sacculata* must remain a doubtful taxon". Given that the shape of the third antennal segment (basoflagellomere) is of doubtful reliability as a unique diagnostic feature, that Becker (1921) provides no information about *sacculata* other than the shape of the third antennal segment and that females of most *Pipizella* species cannot at present be distinguished from one another, the status of *P.sacculata* is at present indeterminate. It is nonetheless highly unlikely that *P.sacculata* is a synonym of *P.virens*, since *P.virens* is a low-altitude inhabitant of various types of deciduous forest and Becker's sole specimen of *P.sacculata* originated from c18000 metres in the Swiss Alps. At that altitude the only frequent *Pipizella* species is *P.nigriana* (unknown when Becker described his v.*sacculata*), in which variation in the shape of the third antennal segment of the female does encompass shapes reminiscent of the third antennal segment in *P.sacculata*. Van Steenis and Lucas (2011) draw no conclusion concerning the identity of *P.sacculata*. **Illustrations of the adult insect:** none known.

Pipizella siciliana Nielsen & Torp, 1973
Preferred environment: open ground/cultures; thinly vegetated grassland and orchards (Nielsen & Torp, 1973); montane, unimproved grassland with *Castanea* woodland (Ricarte et al, 2014); montane, sheep-grazed, unimproved, calcareous grassland with thickets of Rosa, *Prunus spinosa* and *Juniperus*. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/beginning May (Nielsen & Torp, 1973). **Developmental stages:** not described. **Range:** Sicily; southern France; NW Spain. According to Vujić (1997), the citation of *P.siciliana* from Roumania by Bradescu (1991)

should be referred to *P.zloti*. According to Van Eck (2011), Portugese records of *P.siciliana* all refer to *P.thapsiana*. **Determination:** the question of how to separate this species from the closely similar *P. thapsiana* and *P. zloti* is discussed by Speight and Lebard (2014). The only characters separating *P. siciliana* from *P. zloti* are essentially trivial features of the male terminalia. Van Steenis and Lucas (2011) include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia. Nielsen & Torp (1973) and Vujić (1997) also figure the male terminalia. Problems in the interpretation of figures of the terminalia of this species are reviewed by Speight and Lebard (2014), who provide further figures. **Illustrations of the adult insect:** none known.

Pipizella speighti Verlinden, 1999
Preferred environment: forest/open ground; grassy clearings in montane *Fagus* and *Abies/Picea* forest (A.Vujić and S.Radenkovic, pers.comm.), up into alpine scrub of *Pinus mugo* and *Alnus viridis*. **Adult habitat and habits:** flies through tall ground vegetation, settling on foliage of large-leaved plants like *Alnus viridis* and other shrubs (*Juniperus*, *Pinus mugo*). **Flowers visited:** white Apiaceae (A.Vujić and S.Radenkovic, pers.comm.). **Flight period:** May-July. **Developmental stages:** not described. **Range:** Pyrenees (France); Alps (France, Switzerland, Italy); Slovenia; Balkan peninsula (Serbia, Montenegro). **Determination:** Verlinden (1999), who describes the male based on material from the Alps, and figures its genitalia. Van Steenis & Lucas (2011), subsequently include this species in their key to the males of West Palaearctic *Pipizella* species and also supposedly figure its genitalia, based on a specimen from the Pyrenees. However, there are sufficient differences between the illustrations of the male genitalia provided by Verlinden (1999) and Van Steenis & Lucas (2011) to make it questionable whether the Alpine and Pyreneean populations are the same species. The revision of *Pipizella* species by Van Steenis & Lucas (2011) was carried out without the benefit of either morphometric or genetic data with which to compare the conclusions drawn from the traditional morphological methods used. At this juncture review of the identity of *P. speighti* and its separation from *P. viduata*, using morphometric and genetic analysis, would seem necessary. **Illustrations of the adult insect:** none known.

Pipizella thapsiana Kassebeer, 1995
Preferred environment: closed, unimproved, lightly-grazed, calcareous, Mediterranean tall-grass grassland (at 200-300m) with thickets of *Crataegus*, *Prunus spinosa*, *Rubus*, etc (A van Eck, pers.comm.); humid grassland at 1000m in the Atlas mountains (Kassebeer, 1995b); very dry, unimproved, calcareous, sheep-grazed grassland with thickets of *Juniperus*, *Prunus spinosa* and *Rosa*. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers**,** including *Thapsia* (Kassebeer, 1995b). **Flight period:** April. **Developmental stages:** not described. **Range:** Portugal; N Africa (Morocco). **Determination:** Van Steenis and Lucas (2011) include this species in their key to the males of West Palaearctic *Pipizella* species. Kassebeer (1995b) describes both male and female and figures the male terminalia. Van Steenis and Lucas (2011) redescribe the male and figure it's terminalia. However, the terminalia figures attributed to *P.thapsiana* in Van Steenis and Lucas (2011) show the terminalia of a different species, necessitating publication of a correction to the text subsequently (Chandler, 2012), in which the correct figures are provided. The male terminalia of *P.thapsiana* are extremely similar to those of P.*annulata* and *P.orientalis*, but can easily be distinguished by the shape of the sclerite referred to by Van Steenis and Lucas (2011) as the "post-anal hood". **Illustrations of the adult insect:** none known.

Pipizella vandergooti Van Steenis & Lucas, 2011
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July/August. **Developmental stages:** no data. **Range:** Turkey; Georgia. **Determination:**Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the male terminalia. The male terminalia are extremely similar to the male terminalia of *P.viduata*, and the only clear difference between *P.vandergooti* and *P.viduata* is that, in *P.vandergooti*, the body is almost entirely covered in pale yellow hair, whereas in *P.viduata* the hair covering is yellow-brown and black. The description of *P.vandergooti* is based on a single male. The female is unknown. **Illustrations of the adult insect:** none known.

Pipizella viduata (L.), 1758
Preferred environment: forest/open ground; dune grassland, heathland (and partly-drained bog dominated by ericaceous scrub), unimproved pasture, grassy clearings in woodland, especially scrub woodland; in southern Europe, apparently mostly a woodland species; alluvial hardwood forest. **Adult habitat and habits:** flies in and out of low-growing vegetation, rarely at more than 1m from the ground; as easily detected by use of a sweep net as by direct observation; however, in woodland situations often frequents the vicinity of pathside *Rubus fruticosus* bushes. **Flowers visited:** umbellifers; *Euphorbia*, *Galium*,

Potentilla erecta. For an extended list of flowers visited by this species, see de Buck (1990). **Flight period:** mid April/beginning October, with peaks in May/June and mid July. **Developmental stages:** the larva is aphid-feeding, on root aphids of low-growing plants (e.g. umbellifers) and was probably that described by Dixon (1960) under the name *P.varipes*. The larva may be a quasi-commensal of ants, which tend root aphids. Egg: Chandler (1968). **Range:** from Fennoscandia south to Iberia and the Mediterranean; from Ireland eastwards through most of Europe into European parts of Russia and the Caucasus; Western Siberia**.** According to Van Steenis & Lucas (2011) *P.viduata* does not seem to occur in Turkey. **Determination:** Van Steenis & Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. The revision by Lucas (1977) demonstrates that earlier references to this species must be treated with caution, due to confusion with closely related species. This reality is reinforced by Verlinden (1991, 1999) and Van Steenis & Lucas (2011), who detail further species related to *P.viduata*. But all of these revisionary works were undertaken without the benefit of either genetic or morphometric data with which to compare the conclusions drawn from the traditional morphological methods used. Further, ecological data have not been taken into account in considering the morphological variability exhibited by *Pipizella viduata*. The variability in form of the male genitalia illustrated for this species, by Van Steenis & Lucas (2011), is greater than that illustrated for other *Pipizella* species. And there is a very wide range of habitats in which *P. viduata*, as recognised at present, can be found. In these circumstances is more realistic to regard the present concept of *P. viduata* as probably encompassing a complex of closely similar species. Comprehensive morphometric and genetic analysis of the genitalic morphs consigned to *Pipizella viduata* is much needed. The female of *P. viduata* still cannot be distinguished with confidence from the females of various other European *Pipizella* species. *P. viduata* appears in much recent literature under the name *P. varipes*. The male terminalia are figured by Lucas (1977), van der Goot (1981), Verlinden (1994) and Van Steenis and Lucas (2011). The latter authors figure some of the variability in the male terminalia, among specimens they consign to *P.viduata*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Pipizella virens (Fabricius), 1805

Preferred environment: forest; dry deciduous forest (mesophilous *Fagus*, mesophilous *Quercus*) and Atlantic scrub. **Adult habitat and habits:** flies low through *Rubus* bushes and other tall ground vegetation beside tracks and at the margin of clearings etc., often in dappled sunlight, showing high fidelity for particular patches of ground of only a few square metres in extent, away from which it does not occur. **Flowers visited:** umbellifers; *Euphorbia*, *Rubus idaeus*. **Flight period:** end May/beginning July, with peak in June. **Developmental stages:** larva not described, but believed to be a predator of root aphids on umbellifers. **Range:** southern Sweden south to northern Spain; Britain (southern England) eastwards through central and southern Europe (southern France, Italy, the former Yugoslavia) into Iran and European parts of Russia and on through Siberia to the Pacific coast; Mongolia. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. **Illustrations of the adult insect:** Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994) illustrate the adult insect in colour.

Pipizella zeneggenensis (Goeldlin), 1974

Preferred environment: forest/open ground; open areas in dry scrub, Mediterranean scrub, *Quercus ilex* forest and maquis and mesophilous *Fagus* forest; dry, stony, unimproved grassland (both calcareous and non-calcareous) and heath up into the subalpine zone in the Pyrenees and southern parts of the Alps; grey dunes of coastal dune systems at the northen edge of its European range, in N France (X. Lair, pers.comm.). **Adult habitat and habits:** flies fast and very low, over sparsely-vegetated open areas within scrub or garrigue and in more open dry grassland. **Flowers visited:** *Euphorbia*, *Myrrhis*, *Potentilla erecta*, *Viburnum lantana*. **Flight period:** mid May/end July, with peak in June. **Developmental stages:** not described. **Range:** not yet well-known. From the Netherlands south to Portugal, northern Spain, Andorra and south-west France; from France eastwards into central Europe to Switzerland and Austria. This species disappears with introduction of irrigation to its dry grassland habitat. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Verlinden (1999a), who figures the male terminalia. Males are extremely similar to males of *P.maculipennis* (Mg.), from which they may be distinguished by the absence of the extremely convex abdominal sternite 3 found in *P.maculipennis*. Also, in *P.maculipennis* the wings often have an area of infuscation but are clear in *P.zeneggenensis* Further, the abdominal tergites can be entirely pale-haired in *P.zeneggenensis*, whereas in *P.maculipennis* they are noticeably partly black-haired. However, this feature is variable in *P.zeneggenensis* males

and individuals with a transverse band of black hairs across the posterior margin of tergites 2 and 3 are not infrequent. In extreme cases a band of black hairs may also be found across the the anterior margin of tergite 4. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Pipizella zloti Vujić, 1997
Preferred environment: deciduous forest; open areas within thermophilous *Quercus* forest and mesophilous *Fagus* forest at 600-800m (A.Vujić, pers.comm.); montane, calcareous grassland. **Adult habitat and habits:** settling on leaves and flowers of *Smirnium perfoliatum* in dappled sunlight; flies low among vegetation. **Flowers visited:** yellow umbellifers (*Smirnium perfoliatum)* (Vujić, 1997). **Flight period:** April/May (Vujić, 1997). **Developmental stages:** not described. **Range:** Montenegro, Serbia, Slovenia, Greece, Roumania. **Determination:** Van Steenis and Lucas (2011), who include this species in their key to the males of West Palaearctic *Pipizella* species and figure the terminalia; Vujić (1997), who figures the male terminalia and points out that this species is closely similar to *P.siciliana* and the N African *P. thapsiana* Kassebeer. **Illustrations of the adult insect:** none known.

PLATYCHEIRUS

Peck (1988) lists 36 European species in this genus. A number of species have been added subsequently, and now *Platycheirus* is one of the largest syrphid genera in the continent, containing more than 50 species. Goeldlin *et al*. (1990) added three species. Vockeroth (1990) added two more. Since then, the *Platycheirus scutatus* group has also been revised, resulting in a total of four further species. A number of additional taxa have been added to the northern European *Platycheirus* fauna, in some instances involving reinstatement of species e.g. *P. nigrofemoratus*, in others discovery in Europe of species described elsewhere e.g. *P. magadanensis, P. sigiktae, P. torei, P. troll, P.urakawensis*. Nielsen's (2004) revision of the *Platycheirus ambiguus* species group added another seven species to the European fauna (*P. altomontis, P. brunnifrons, P. caesius, P. clausseni, P. goeldlini, P. meridimontanus* and *P. subambiguus).*
Various subgenera have been recognised within *Platycheirus*. Certain of these have been regarded as separate genera by some authors. One of them, *Pyrophaena*, has switched from being regarded as a genus, to being regarded as a subgenus (Vockeroth and Thompson, 1987) and then, once again as a separate genus (Young, 2012). Thompson and Rotheray (1998) also regard *Rohdendorfia*, *Spazigaster* and *Syrphocheilosia* as subgenera of *Platycheirus*, but Thompson and Skevington (2014) treat them once again as distinct genera. The most comprehensive keys to determination of European *Platycheirus* species are those provided by Bartsch *et al.* (2009a), Bot and Van de Meutter (2019) and van Veen (2010).

Platycheirus abruzzensis (van der Goot), 1969
Preferred environment: open ground/forest; open areas in conifer forest of *Abies/Picea* and upwards through the *Larix* zone into unimproved, calcareous and non-calcareous alpine grassland to above 2000m (pers.comm. P.Goeldlin). **Adult habitat and habits:** males hover low over the bare ground of paths etc, at 50-100cm. (Goeldlin, pers.comm.). **Flowers visited:** no data. **Flight period:** May and July/August. **Developmental stages:** not described. **Range:** Germany, Jura (Switzerland), Alps (Switzerland), Apennines (Italy); middle and far-east Asian parts of Russia (Barkalov and Nielsen, 2009); Armenia (Nielsen, 2014). **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. Nielsen (2004) provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. Van der Goot (1969) consigned this species to the genus *Melanostoma* and it has been treated as belonging to *Melanostoma* in much recent literature (e.g. Peck, 1988; Belcari et al, 1995). **Illustrations of the adult insect:** a coloured photograph of the male is provided by Nielsen (2014a)..

Platycheirus aeratus Coquillet, 1900
Preferred environment: open ground; tundra with dwarf *Salix* scrub (Nielsen, 1974); palsa mire (Van Steenis, 2022); salt marsh; lake edge marsh. **Adult habitat and habits:** no data. **Flowers visited:** *Carex, Eriophorum* (van Steenis, 1998b). **Flight period:** end June/July. **Developmental stages:** not described. **Range:** northern Europe, from Norway into Karelian Russia and on into Asia to eastern Siberia; in N America from Alaska south to California and Colorado (where it occurs at 3-4000m). **Determination:** Vockeroth (1992), van Veen (2004), Haarto and Kerppola (2007a), Bartsch *et al.* (2009a); Young *et al.* (2016a). This species appears in recent European literature as *P.angustitarsis* Kanervo. This synonymy was established

by Nielsen (1999). **Illustrations of the adult insect:** coloured illustrations of the male and female are provided by Bartsch *et al*. (2009a) and Young *et al*. (2016a).

Platycheirus albimanus (Fabricius), 1781
Preferred environment: deciduous forest, but this is an extremely anthropophilic species occurring in most sorts of farmland, suburban gardens and parks. It may also be found along fire-breaks and tracks in conifer plantations. In southern Europe, it seems to be largely confined to woodland and other more humid situations. **Adult habitat and habits:** clearings, tracksides, gardens, hedgerows; flies among bushes and shrubs and over low-growing vegetation of clearings etc.; males hover at 1 - 3m beneath trees etc. **Flowers visited:** visits a wide range of mostly yellow or white flowers: see list in de Buck (1990). **Flight period:** April/October (March/November in southern Europe). Verlinden & Decleer (1987) detect four peaks for this species in Belgium, suggesting four generations per year there. Elsewhere in Europe either more or less generations might be expected, according to local conditions. **Developmental stages:** larva described and figured by Dixon (1960); aphid feeding, on various low-growing plants and bushes. Larvae have also been found on trees, such as *Abies* and *Malus*. Larvae were found by Maibach (1993) on *Phragmites*, where they rested aligned with the long axis of the stem. Egg: Chandler (1968). **Range:** Greenland, Iceland, the Faroes (Jensen, 2001) and Fennoscandia south to Iberia and the Mediterranean; from Ireland eastwards through most of Europe into Turkey, European parts of Russia and Georgia; in Siberia from the Urals to the Pacific coast (Kuril Isles); Philippines; in N America from Alaska south into Canada and western parts of the USA. **Determination:** van der Goot (1981). In some recent literature, this species has been referred to as *P.cyaneus* (Muller). Vockeroth (1990), provides convincing argument as to why the name should revert to *albimanus* (Fab.). This species is extremely similar in appearance to the southern European *P. ciliatus, P. marokkanus* and *P. muelleri* and the northern European *P.nigrofemoratus* and *P.urakawensis*. *P.albimanus* can be found on the wing with these species. Females of *P.sticticus* are easily confused with females *P.albimanus*, though smaller than *P.albimanus* females usually are. Separation of the females of these two species is considered under *P.sticticus*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009a), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Platycheirus altomontis Merlin & Nielsen, in Nielsen, 2004
Preferred environment: open ground; sparsely-vegetated, rocky talus slopes at above 3,000m in the Alps (Nielsen, 2004). **Adult habitat and habits:** males rest in the sun, in sheltered spots between rocks (Nielsen, 2004). **Flowers visited:** no data. **Flight period:** July (Nielsen, 2004). **Developmental stages:** undescribed. **Range:** Alps (France; Switzerland; Italy). **Determination:** the male is included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. Nielsen (2004), provides a key distinguishing the male of this species from other European members of the *Platycheirus ambiguus* group. The female is described by Van de Meutter (2022). **Illustrations of the adult insect:** a coloured photograph of the male is provided by Nielsen (2014a) and Van de Meutter (2022).

Platycheirus ambiguus (Fallen), 1817
Preferred environment: deciduous forest; scrub-invaded clearings in woodland and forest, scrub-edged tracks in woodland etc., garrigue, hedgerows and gardens. **Adult habitat and habits:** flies only in the immediate vicinity of scrub; the males hover beside *Crataegus, Prunus spinosa* or *Salix* in flower, often actually among the branches; the females visit the flowers of these trees. **Flowers visited:** *Acer pseudoplatanus, Crataegus, Prunus mahaleb, P.spinosa, Pyrus communis*, male flowers of *Salix* spp. (including *S.repens*), *Sorbus aucuparia*, *Viburnum*. **Flight period:** beginning April/end May. **Developmental stages:** larva described and figured by Dusek and Laska (1959) and Goeldlin (1974), aphidophagous on trees and shrubs, e.g. *Malus, Prunus, Ribes;* may be abundant on *Prunus spinosa* in hedges (Pollard *et al*., 1974). **Range:** uncertain, due to confusion with other species, but supposedly from Fennoscandia south to central Spain; from Ireland eastwards through most of Europe into Russia and on to the Pacific coast, including Japan. **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. Nielsen (2004), provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group; Haarto and Kerppola (2007a), Bartsch et al.(2009a). *P.ambiguus* has appeared in some recent accounts under the generic names *Melanostoma* or *Pachysphyria*. The adult insect is extremely similar to the Scandinavian species *P.lundbecki* (Collin) and *P.hirtipes* Kanervo: see Nielsen (1974). From these species, the male of *P.ambiguus* may be distinguished by its possession of predominantly pale front femora (black except at tip in the other two species), while in the female the third antennal segment is partly pale beneath (entirely black in the other two species). Features of the male terminalia are figured by Dusek and Laska (1967). **Illustrations of the adult insect:** the

adult insect is illustrated in colour by various authors, including Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986), Bartsch *et al*. (2009a) and Nielsen (2014a).

Platycheirus amplus Curran, 1927
Preferred environment: wetland; fen and poor fen; flushes and brooks in moor and bog. **Adult habitat and habits:** flies among sedges and similar tall ground vegetation, especially in the vicinity of standing water or brooks; males hover within 1m of the ground, in open patches and along animal paths, within tall ground vegetation. **Flowers visited:** umbellifers, *Polygonum bistorta, Ranunculus, Salix, Taraxacum*. **Flight period:** June/July with records into August. **Developmental stages:** not described. **Range:** European range as yet imperfectly known, due to confusion with *P.peltatus* (Mg.) until recently; at present known in Europe from Iceland, Norway, northern Sweden, Finland, Ireland, Scotland, Belgium (Ardennes), Germany, the French and Swiss Jura and the central Alps (Austria); Altai mountains (SE Siberia); in N America known from Alaska, Western Canada and the Rocky Mountains south to Colorado (USA). **Determination:** this species is included in the keys provided by van Veen (2004), Haarto and Kerppola (2007a) and Bartsch et al.(2009a). Distinguishing features are detailed and figured by Speight and Vockeroth (1988) and included in the keys to N American species by Vockeroth (1990). Van Steenis and Goeldlin (1998) provide a key separating the female from females of other European *peltatus*-group species, but do not include *P.scutatus* (Mg.) in that group. The females of *P.amplus* and *P.scutatus* may be distinguished as follows:

A. Frons dusted yellow-brown and only vaguely shining, from the posterior margin of the lunule to the anterior ocellus; mid-tibiae, in dorsal view, virtually straight ..... ***amplus*** Curran
B. Frons with a pair of large, silver-grey dust spots, which may be narrowly joined in the mid-line, but which are separated from both the lunule and the anterior ocellus by black, shining, undusted areas reaching across almost the entire width of the frons; mid-tibiae, in dorsal view, curved anteriorly at about the median third of their length ..... ***scutatus*** (Meigen)

Illustrations of the adult insect: the general appearance of the male and female of this species can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a).

Platycheirus angustatus (Zetterstedt), 1843
Preferred environment: wetland; fen, rich fen and marsh, humid, unimproved grassland subject to seasonal flooding. **Adult habitat and habits:** flies among dense, tall vegetation of fenland, e.g. Cyperaceae; males hover within 2m of the ground, over paths etc.; more easily detected by use of a sweep net, than by direct observation. **Flowers visited:** Cyperaceae; Graminae; *Aegopodium, Leontodon, Lycopus europaeus, Polygonum cuspidatum, Ranunculus, Rubus fruticosus*. **Flight period:** May/September. **Developmental stages:** larva described and figured by Rotheray (1988a), from herb layer plants. Chambers *et al*.(1986) refer to having collected larvae of this species from crops of winter wheat. **Range:** Fennoscandia south to northern Spain; from Ireland eastwards through northern and central Europe into European parts of Russia; through Siberia from the Urals to the Pacific coast (Sakhalin Is.); in N America from Alaska to Quebec and south to Washington. **Determination:** Speight and Goeldlin (1990); Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). The male terminalia are figured by Goeldlin *et al*.(1990). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) van der Goot (1986) and Bartsch *et al*. (2009a).

Platycheirus angustipes Goeldlin, 1974
Preferred environment: wetland; fen and marsh; beside streams and lakes in montane grassland or open forest, from 1000m upwards into the alpine grassland zone, where it occurs in very wet sites, but not necessarily beside water, e.g. on glacier floodplains. **Adult habitat and habits:** flies low among water-edge sedges etc., and is as easily detected by use of a sweep net as by direct observation. **Flowers visited:** *Caltha palustris*, in particular. **Flight period:** June/August, with peak in July. **Developmental stages:** larva described and figured by Goeldlin (1974), from larvae collected from emergent *Carex* and *Phragmites* around the edge of a small lake (P.Goeldlin, pers.comm.). **Range**: as yet inadequately known, but recorded from the Alps (France, Switzerland, Liechtenstein, and Austria), the Swiss Jura, the Apennines (Italy) and the Pyrenees (Hautes Pyrenees: France); Georgia (Mengual *et al*., 2020). **Determination:** except in that it consistently has more extensively dark fore and mid legs, in its general appearance this species is difficult to distinguish *from P.angustatus, P.clypeatus, P.europaeus* and *P.occultus*. *P.angustipes* may be distinguished from these other species by means of the keys in Speight and Goeldlin (1990). This species is included in the keys provided by van Veen (2004). The generally dark colour of the legs in

this species does tend to render it immediately recognisable, but there are few structural characters which help to confirm identity. In the male, features of the terminalia, figured by Goeldlin et al.(1990), are characteristic and help to separate it from *P.clypeatus* and *P.occultus*, in particular. Occasional females of *P.podagratus*, in which the dusting on the abdominal tergites is unusually well-developed, can be difficult to separate from those of *P.angustipes*. It is not unusual to find *P.angustipes* on the wing in the company of *P.podagratus*. **Illustrations of the adult insect:** none known.

Platycheirus aurolateralis Stubbs, 2002
Preferred environment: forest; deciduous scrub, both Atlantic (*Corylus*) and Alpine (*Corylus/Alnus viridis*). But this species has also been found in mature, urban/suburban parkland (Speight *et al*., 2004) and suburban gardens (Speight, 2005). It occurs in the Alps from 1500-1800m alt. **Adult habitat and habits:** males hover at 1m and upwards, over ground vegetation within mosaics of scrub thicket and herb-rich, unimproved grassland; flight rapid and darting, around the edge of tall ground vegetation. **Flowers visited:** *Anthriscus, Euphorbia amygdaloides, Myosotis, Saxifraga x urbium, Thesium bavaricum, Viburnum*. **Flight period:** April/beginning June and end July/September at lower altitudes and July/mid August in the Alpine zone. **Developmental stages:** not described. Doczkal *et al*. (2002) refer to a puparium, noting that it "has no conspicuous dark markings dorsally as is described for *P. splendidus"*. **Range:** uncertain at present, due to confusion with other members of the *scutatus* group. Known from Ireland and Britain (southern England) eastwards through Germany to the Alps (Austria, France, Switzerland, Italy) and on to Slovenia and Turkey, plus northwards to central Norway and Sweden. **Determination:** Doczkal *et al*. (2002) provide a key distinguishing the male of this species from males other European species of the *scutatus* group (*P.scutatus, P.speighti* and *P.splendidus*), except *P.sibiricus*. The female of this species cannot at present be separated from the other species of this group. This species is also included in the keys provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). Apart from *P. sibiricus*, the European *scutatus* group species can be found in flight in montane localities in central Europe, at the same time. At lower altitudes three of them (*aurolateralis*, *scutatus* and *splendidus*) can occur together in various parts of Europe. In the field *P.aurolateralis* can closely resemble a small specimen of the much more frequent *P.albimanus*, as much as a *P.scutatus* group species. It can also occur in the company of *P.albimanus*. **Illustrations of the adult insect:** the adult male is figured in colour by Bartsch *et al*. (2009a), and the general appearance of the male of this species can be seen from the coloured photo provided by Haarto and Kerppola (2007a).

Platycheirus brunnifrons Nielsen, 2004
Preferred environment: forest; upper levels of humid *Fagus* forest into the *Picea/Abies* belt and up into *Larix/Pinus cembra* forest and on into unimproved, non-calcareous, subalpine grassland; humid *Pinus sylvestris* forest; *Quercus pyrenaica* forest in Iberia (Nielsen, 2004). **Adult habitat and habits: Flowers visited:** *Calluna vulgaris* (Hellqvist, 2009); *Tripleurospermum hookeri* (Barkalov, 2012); *Salix* (Van de Meutter, 2022). **Flight period:** mid June/October (Nielsen, 2004). **Developmental stages:** undescribed. **Range:** Finland; Portugal; Spain (including the Pyrenees); France (Alps); Switzerland; Austria; North Macedonia; in Asia in Magadan and Yakutia etc (Russia); Nearctic (Alaska). **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. Nielsen (2004), provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group; Haarto and Kerppola (2007a), Bartsch et al.(2009a). **Illustrations of the adult insect:** Bartsch *et al*. (2009a) and Nielsen (2014a) provide illustrations of the male in colour. Nielsen (2014a) also provides a coloured photograph of the female.

Platycheirus caesius Nielsen & Stuke, in Nielsen, 2004
Preferred environment: open ground; calcareous and non-calcareous, unimproved subalpine grassland from 2000m (Nielsen, 2004). **Adult habitat and habits:** males hover round outstanding groups of rocks etc, at heights of 2-5m, descending to settle on the ground as soon as the sun disappears behind a cloud (MS). **Flowers visited:** no data. **Flight period:** June/July (Nielsen, 2004). **Developmental stages:** undescribed. **Range:** mountainous parts of northern Spain; Alps (Switzerland). **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. Nielsen (2004) provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. **Illustrations of the adult insect:** Nielsen (2014a) provides a coloured photograph of the male..

Platycheirus chilosia (Curran), 1922
Preferred environment: open ground; arctic-alpine tundra (T. Nielsen, pers.comm.); "high, barren mountain slopes" (Vockeroth, 1990). **Adult habitat and habits:** no data. **Flowers visited:** *Dryas octopetala*. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Lapland (northern Norway, northern Sweden and northern Finland) and high

alpine areas in southern Norway; in central Europe at high altitude (3000m) in the Alps of eastern Switzerland (Fisler & Speight, 2020); through northern Russia into Siberia; Greenland; in N America from Yukon and northern Canada. **Determination:** Vockeroth (1992), van Veen (2004), Bartsch *et al*. (2009a), as *P. carinatus*. The shape and ciliation of the front basitarsis of the male are very distinctive (see figure in Bartsch *et al*., 2009a). Young (2012) gives *P. carinatus* as a synonym of *P. chilosia*, without comment. Young (2012) includes *P. chilosia* in his key to the Nearctic *Platycheirus* species and also redescribes *P. chilosia*. References to *P. chilosia* in Young (2012) are confusing, since, in all the tables and much of the body of the text, it is referred to as *P. carinatus*, but in the key, the figures and redescription as *P. chilosia*. In Finland this species was earlier known under the name *P. hirtipes* Kanervo, which was described from Eastern Siberia. *P. hirtipes* is given as a synonym of *P. carinatus* in Bartsch *et al*. (2009a). But the status of *P. hirtipes* is uncertain. The type material of *P. hirtipes* cannot be located and has probably been destroyed (Nielsen, 1999) and " in his description of *hirtipes* Kanervo does not show the long, curved setae which are characteristic for the *chilosia* fore basitarsus" (T. Nielsen, pers. comm.). It thus remains possible that *P. hirtipes* is a separate taxon. However, specimens corresponding to the *P. hirtipes* description (i.e. without the long, curved setae on the fore basitarsus in the male, that characterise *P. chilosia*) do not seem to have been found in Europe. So, unless that situation changes, there is no basis for regarding *P. hirtipes* as a European insect, if it is, indeed, a separate species. **Illustrations of the adult insect:** the general appearance of the male of this species, as *P. carinatus*, can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch et al.(2009a). Young (2012) provides coloured photos of the male, the female and the fore and mid legs of the male. The photo showing the diagnostic arrangement of setae on the fore tarsus of the male is also shown in Fisler & Speight (2020).

Platycheirus ciliatus Bigot, 1884

Preferred environment: forest/open ground; open *Pinus uncinata* forest with *Rhododendron* thickets to 2000m. alt. ; open, montane *Pinus/Abies/Larix* forest; open areas in evergreen oak (*Q. coccifera*) matorral. **Adult habitat and habits:** flies around scrub at up to 2m from the ground. **Flowers visited:** *Quercus coccifera*. **Flight period:** April/early May. **Developmental stages:** not described. **Range:** European range at present unclear, due to confusion with related species; confirmed from southern France (Provence) (Ssymank and Lair, 2015); in the Nearctic known from western coastal states of Canada and the USA, from Alaska to California. **Determination:** Young (2012) gives diagnostic features for the male, includes it in hs key to N American *Platycheirus* species and figures the fore leg of the male in colour. The female remains undescribed. This species is extremely similar in appearance to *P. albimanus* and *P. marokkanus*, from which it is at present separated by features of the front tibia and tarsus of the male. There is some doubt about the identityof European specimens consigned to *P. ciliatus* (Sander Bot, pers. comm.). **Illustrations of the adult insect:** the general appearance of the male of this species can be seen from the coloured illustrations provided by Young (2012) and Young *et al*. (2016a).

Platycheirus cintoensis van der Goot, 1961

Preferred environment: forest; conifer forest; open *Pinus laricio* forest with scrub, at c.1600m (T. Lebard, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** Corsica. Despite the extensive surveys of Corsican syrphids carried out recently no material of this species has been found since collection of the unique holotype nearly 75 years ago. The IUCN Red List project drew no conclusions on the status of this species, catogorising it as "data deficient". But at the time the IUCN categorisation of *P. cintoensis* was carried out the results of the recent syrphid surveys on Corsica were not available. It is one of very few Corsican syrphids not recorded in the recent surveys. The extent to which the type locality has changed since Van der Goot found *P. cintoensis* in 1956 is unclear. Cornuel-Willermoz & Lebard (2024) indicate that the area has been affected by its recent use for skiing. Whether the unmanaged grazing by livestock, to which the area is also subject, has changed in its intensity since 1956, is unknown. But it is apparent that the *Pinus laricio* forest there shows little sign of regeneration and there is almost no ground vegetation. Put together, these various elements suggest that *P. cintoensis* would be more accurately regarded as extinct, than "data deficient". If further survey on Corsica – or perhaps Sardinia – proves this conclusion wrong, *P. cintoensis* seems likely to nonetheless remain an extremely threatened species. **Determination:** this species is still known only from the male holotype. Dusek and Laska (1982) provide a key distinguishing this species from others of the *manicatus* group. **Illustrations of the adult insect:** Van der Goot (1961) provides a black and white photograph of the general appearance of this insect, from above..

Platycheirus clausseni Nielsen, 2004
Preferred environment: open ground; calcareous and non-calcareous, unimproved subalpine grassland, at 1800-2000m (Nielsen, 2004). **Adult habitat and habits:** found in flight close to streams with tall herb vegetation (*Adenostyles*). **Flowers visited:** *Silene rupestris* (Nielsen, 2004). **Flight period:** July/August (Nielsen, 2004). **Developmental stages:** undescribed. **Range:** Alps (France, Switzerland, Austria, Italy); Altai mountains (SE Siberia); Nearctic. **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguu*s-group. Nielsen (2004) provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. **Illustrations of the adult insect:** none known.

Platycheirus clypeatus (Meigen), 1822
Preferred environment: open ground/wetland; humid grassland and fen, plus the margins of ponds, streams, bogs and lakes; to some extent anthropophilic, occurring also along wet ditches and canals. **Adult habitat and habits:** flies among the dense, tall vegetation of fens, fen meadows and waterside situations, e.g. Cyperaceae, *Juncus*. **Flowers visited:** Cyperaceae; Graminae (e.g. *Holcus mollis*); white Umbelliferae; *Caltha, Luzula, Plantago, Polygonum cuspidatum, Ranunculus, Salix, Senecio jacobaea, Vaccinium myrtillus*. **Flight period:** April/September. **Developmental stages:** larva supposedly described and figured by Dixon (1960). Dziock (2002) reported that under laboratory conditions development (from egg-laying to hatching of adult) can take as little as 5-6 weeks in this species. Maibach (1993) found larvae of this species on foliage of *Carex* and *Typha*. Egg: Chandler (1968). **Range:** from Iceland, the Faroes (Jensen, 2001) and Fennoscandia south to Iberia and the Mediterranean; from Ireland eastwards through most of Europe into Turkey and European parts of Russia; from the Urals to central Siberia; in N America from Alaska to Ontario and south to California. **Determination:** Speight and Goeldlin (1990). Males of this species from the northern edge of its range may be noticeably melanic and Icelandic specimens can be virtually without pale abdominal markings and with predominantly blackish femora. However, in such specimens the anterolateral surface of the fore femora remains pale, distinguishing them from *P.angustipes* Goeldlin (which, in any case, has different features on the ventral surface of the fore basitarsus). Females of this species are extremely difficult to separate from females of *P.occultus* Goeldlin, Maibach and Speight, *P.immarginatus* (Zett.) and *P.ramsarensis* Goeldlin, Maibach and Speight. In both sexes *P.clypeatus* is extremely difficult to separate from *P.hyperboreus* (Staeger). The male terminalia are figured by Goeldlin et al.(1990). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Platycheirus complicatus (Becker), 1889
Preferred environment: forest and wet, unimproved, montane meadows; humid, open areas in *Fagus/Picea* forest upwards into calcareous and non-calcareous, unimproved subalpine grassland; also subalpine *Betula* and *Larix* forest. **Adult habitat and habits**: males hover at 1-2m and settle on both bare, rocky ground and low-growing vegetation (Barkalov and Nielsen, 2007). **Flowers visited**: *Allium ursinum, Caltha, Geranium sylvaticum, Lamium album, Meum athamanticum, Ranunculus, Rhododendron aureum, Salix, Sorbus aucuparia, Tussilago*. **Flight period**: mid May/end July, with the peak in June. **Developmental stages:** not described. **Range**: Belgium, Germany; the Czech Republic; France (Alps), Switzerland; Northern Italy (Dolomites); Georgia; western Siberia, Japan. **Determination**: Dusek and Laska (1982), who illustrate the male terminalia and provide a key distinguishing this species from others of the *manicatus* group. This species is included in the keys provided by van Veen (2004) and Barkalov (2013). Nielsen (pers. comm.) suggests that the relationship between this species and *P. kittilaensis* Dusek and Laska probably requires further investigation. Records of *P. complicatus* from Scandinavia are now referred to *P. kittilaensis*. **Illustrations of the adult insect:** Bot & Van de Meutter (2019) provide a coloured photo of the male.

Platycheirus discimanus Loew, 1871
Preferred environment: forest; deciduous forest and scrub; scrub-invaded grassland. **Adult habitat and habits:** occurs in the immediate vicinity of scrub, where it flies at 2m upwards among the branches of shrubs such as *Prunus spinosa*, descending to rest on low-growing plants, e.g. tussocks of dead *Molinia;* visits flowers of taller shrubs and small trees. **Flowers visited:** *Prunus spinosa*, male *Salix* spp. **Flight period:** mid April/end May. **Developmental stages:** undescribed. **Range:** from southern Norway south to Belgium and France (Alps); from Ireland eastwards through central Europe into Russia and on through Siberia to the Pacific coast (Sakhalin); also in Afghanistan, Mongolia and China; in N America known from central Canada and Pennsylvania. **Determination:** Violovitsh (1986), plus Nielsen (1972, 1981) and Vockeroth (1992); Haarto and Kerppola (2007a), Bartsch et al.(2009a). Violovitsh's indication that the dorsum of the male mesoscutum

is entirely pale haired in *P.discimanus* is erroneous. Black hairs may also be present across the middle. This insect is extremely similar to the northern European *P.groenlandicus* Curran. It may be distinguished from these two species in the male sex by the fact that the two basal segments of the mid tarsi are yellow in *P.discimanus*, while they are entirely black in males of the other species. The recently-described Georgian species, *P.migriaulii*, Stuke and Nielsen, also belongs in this group. Stuke and Nielsen (2002) provide a key for distinguishing that species from *P.discimanus*. **Illustrations of the adult insect:** the adult of *P.discimanus* is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Platycheirus europaeus Goeldlin, Maibach & Speight, 1990
Preferred environment: wetland/open ground; in particular, brook floodplains and wet flushes in montane grassland, grassy glades beside streams or flushes in forest in the *Carpinus/Quercus* zone up into the *Fagus/Picea* zone (including humid *Pinus*) and in humid unimproved grassland. This is perhaps by origin a species of wet, open places within forest, which has come to use certain sorts of grassland when these have been introduced within its altitudinal range. In Scotland the *Pinus sylvestris* woods occupy what elsewhere would be the *Fagus/Picea* zone, so the low altitude records of *P.europaeus* in the Scottish highlands are probably equivalent to records from the upper limit of the altitudinal range of *P.europaeus* on the continent. **Adult habitat and habits:** flies among grasses etc., where it is easily detected by direct observation. **Flowers visited:** Graminae and Cyperaceae; *Plantago; Cardamine*; *Ranunculus*; *Taraxacum*. **Flight period:** May/August, peak in June. **Developmental stages:** not described. **Range:** as yet inadequately known, but recorded from Sweden; Finland; Denmark; Britain, Germany, Netherlands, Belgium, France (the Cote d'Or, Vosges, Alps and Pyrenees), Czech Republic, Hungary, the Swiss Plateau (low altitude plains between the Jura and the Alps), Austria, Spain, Italy and Serbia; Ukraine, eastern Asiatic Russia. **Determination:** Speight and Goeldlin (1990); Bartsch *et al*. (2009a), who also provide a figure of the adult insect in colour. Until recently, this species has been confused with *P.angustatus, P.clypeatus, P.occultus* and *P.ramsarensis*. The male terminalia are figured by Goeldlin *et al*. (1990). This species is included in the keys provided by van Veen (2004). Although part of the second basal cell of the wing is usually distinctly bare of microtrichia in this species, occasional male specimens can be found in which the microtrichial coverage is virtually complete. It is not unusual to find *P.europaeus* on the wing in the company of *P.angustatus*, *P.clypeatus* and *P.occultus*.
Mutin (2022) states that "*Platycheirus motodomariensis* (Matsumura, 1919)" is the same species as *Platycheirus europaeus* and thus *europaeus* is a synonym of *motodomariensis*. It should be noted that Matsumura and Adachi published two papers, both of which are entitled "Synopsis of the Economic Syrphidae of Japan (Pt. III)" and with the publication date of 1917 (see Matsumura and Adachi, 1917a, 1917b). The specific epithet "*motodomariense*" is used for a new species described in each of them, one of which (in Matsumura and Adachi, 1917a) was consigned to the genus *Syrphus*, the other (in Matsumura and Adachi, 1917b, page 133) to *Melanostoma*. It is *Melanostoma motodomariensis* of Matsumura which Mutin (2022) refers to as the senior synponym of *P. europaeus*. Confusingly, Matsumura and Adachi (1917b) is erroneously cited in the bibliography of Mutin (2022) as Part IV of the Synopsis of Economic Syrphidae of Japan, with a publication date given as 1919. Matsumura and Adachi (1917b) describe *Melanostoma motodomariense* from a solitary female collected in Sakhalin. The description states "Abdomen black, scarcely broader than the thorax, nearly twice as long as the thorax, with three pairs of yellowish spots, those of the 3rd. and 4th. being quadrate, somewhat rounded at the inner sides, of the 5th. smaller and at the lateral sides much broader. Venter fuscous, with yellowish spots as above". The accompanying figure (in Plate 1, at the end of the publication) shows the three pairs of spots on the tergites clearly, together with the fact that in *Melanostoma motodomariensis* tergite 2 is without pale spots. In the female of *Platycheirus europaeus* tergite 2 exhibits a pair of pale spots, a feature alluded to in the description of the species (see Goeldlin *et al*., 1990). These spots are sometimes small, but usually extend over more than half the length of the tergite. Further, the abdominal sternites are a uniform yellow brown colour in *P. europaeus*, with no indication of either paler or darker markings. This is a feature not only of *P. europaeus*, but also of other related European *Platycheirus* species. Distinct pale marks on the sternites, surrounded by darker, brown to black margins, are in general a feature of *Melanostoma* species rather than *Platycheirus* species. Together, the pale markings on the tergites and sternites of the type of *Melanostoma motodomariensis* differ significantly from what is found in *P. europaeus* females and no basis is given by Mutin (2022) for his opinion that *Melanostoma motodomariense* and *Platycheirus europaeus* are the same species. There is no indication that Mutin (2022) examined the type material of either *Melanostoma motodomariense* or *Platycheirus europaeus*. Neither is the concept of *Platycheirus europaeus* adopted by Mutin (2022) either illustrated or described. In these circumstances it is concluded that no scientific basis has been established to support the contention that *europaeus* of Goeldlin *et al*. (1990) is a junior synonym of *Melanostoma motodomariense* of Matsumura (1917b), so use of the name *europaeus* is retained here. This would also be in keeping with the principle of maintaining nomenclatural stability adopted by the International Commission for Zoological Nomenclature,

since the name *Platycheirus europaeus* has been in use now for more than 30 years, without interruption. **Illustrations of the adult insect:** the species is illustrated in colour by Bartsch *et al*. (2009a) and Torp (1994).

Platycheirus fasciculatus Loew, 1856
Preferred environment: open ground; sparsely-vegetated, unimproved, non-calcareous subalpine grassland and moraine, from 1800 m. to above 3000 m. (C. Claussen, pers.comm.; Van de Meutter, 2022). **Adult habitat and habits:** flies close to the ground, with a rapid, darting flight when disturbed; settles on stones in the sun (C. Claussen, pers.comm.). **Flowers visited:** *Silene rupestris* (C.Claussen, pers.comm.). **Flight period:** mid July/end August. **Developmental stages:** not described. **Range:** Pyrenees (France); Alps (Austria, France, Germany, Switzerland), Dolomites (Italy). **Determination:** the male of this species may be determined using the key provided by Dusek and Laska (1982). The female still remains undescribed. **Illustrations of the adult insect:** the male is illustrated in colour in Van de Meutter (2022).

Platycheirus fimbriatus (Loew, 1871)
Preferred environment: open *Fagus* forest (Nielsen, 2014). **Adult habitat and habits:** no data. **Flowers visited:** *Salix* (Nielsen, 2014). **Flight period:** May/June; April in Hungary (Nielsen, 2014). **Developmental stages:** not described. **Range:** Hungary; various parts of central and Eastern Asiatic Russia; Mongolia. **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. **Illustrations of the adult insect:** the male is illustrated in colour by Nielsen (2014a).

Platycheirus fulviventris (Macquart), 1829
Preferred environment: wetland; marsh, fen, margins of rivers and irrigation ditches in farmland. **Adult habitat and habits:** flies among fen and waterside vegetation, on the water side (rather than the bank side) of reed beds, frequent where *Phragmites* and Cyperaceae predominate; settles on stems of Cyperaceae, Juncaceae etc. **Flowers visited:** Cyperaceae; Graminae, *Juncus*, *Plantago*. **Flight period:** May/August with occasional specimens into September, and March/October in southern Europe. **Developmental stages:** larva described and figured by Rotheray and Dobson (1987) and illustrated in colour by Rotheray (1994); coloured photo of the puparium in Dussaix (2013). Larva aphid-feeding, on *Carex*, P*hragmites* and *Typha*. Dziock (2002) reported that under laboratory conditions development (from egg-laying to hatching of adult) can take as little as 7 weeks in this species. Dussaix recordes duration of the puparial phase as 1 week. **Range:** from southern Fennoscandia south to Iberia and the Mediterranean; through lowland areas of central Europe and southern Europe into Turkey and European parts of Russia and on to the Pacific coast; N Africa (Morocco). **Determination:** Speight and Goeldlin (1990). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986), Bartsch et al.(2009a).

Platycheirus goeldlini Nielsen, 2004
Preferred environment: open ground; unimproved, calcareous, montane and subalpine grassland to 2,400m. **Adult habitat and habits:** no data. **Flowers visited:** *Juniperus* (Van Eck *et al*., 2020); *Salix* (Nielsen, 2004). **Flight period:** beginning July/beginning August (Nielsen, 2004); May (Van Eck *et al*., 2020). **Developmental stages:** no data. **Range:** Finland, Alps (France, Switzerland, Italy); central-asian parts of Russia (Barkalov and Nielsen, 2009); Altai mountains (SE Siberia); Portugal **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. Nielsen (2004) provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group; Haarto and Kerppola (2007a), Bartsch et al.(2009a). **Illustrations of the adult insect:** Bartsch et al.(2009a) provide an illustration of the male in colour.

Platycheirus groenlandicus Curran, 1927
Preferred environment: forest/open ground; sub-alpine *Betula* forest and dwarf *Betula/Salix* scrub tundra (Nielsen, 1972) and open areas in taiga; palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** low-flying, among dwarf shrubs and other ground vegetation. **Flowers visited:** *Dryas*, *Sanguisorba* (Barkalov, 2012); *Ranunculus*, *Salix*, *Sedum* (Nielsen, 1972); *Rhodiola rosea* (Bartsch et al, 2009); *Rubus chamaemorus* (Van Steenis and Zuidhoff, 2013). **Flight period:** end June/mid August. **Developmental stages:** not described. **Range:** northern Europe; northern Norway, Sweden and Finland and sub-alpine/alpine parts of southern Norway; through northern Russia into Asia to eastern Siberia; Greenland; in N America from Alaska and northern and western Canada. **Determination:** Vockeroth (1992); Violovitsh (1986); Nielsen (1972); van Veen (2004); Haarto and Kerppola (2007a); Bartsch *et al.* (2009a); Barkalov & Nielsen (2012); Barkalov (2013).

Until recently, this species has appeared in European literature under the name *boreomontanus* Nielsen. It is very similar in appearance to *P. discimanus* Lw. The recently-described Georgian species, *P. migriaulii*, Stuke and Nielsen, also belongs in this group. Stuke and Nielsen (2002) provide a key for distinguishing that species from *P.groenlandicus*. **Illustrations of the adult insect:** the general appearance of the male of this species can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a).

Platycheirus hyperboreus (Staeger), 1845
Preferred environment: wetland; marsh (Vockeroth, 1992); palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers (H.Bartsch, pers.comm.), *Ranunculus* (Nielsen, 1998), *Carex* (van Steenis, 1998b); *Parnassia palustris* (Van Steenis and Zuidhoff, 2013). **Flight period:** April/August (N America); June/July (Scandinavia). **Developmental stages:** according to Vockeroth (1992), the larvae of this species have been recorded as important predator of alfalfa and pea aphids in N America - this seems sufficiently unlikely to suggest that the N American and European material referred to this species may include more than one taxon. **Range:** northern Europe: Norway, Finland, northern Russia (Kola peninsula) and on into northern Siberia; Greenland; in N America from Alaska and Canada south through mountain chains to California and Colorado. **Determination:** Violovitsh (1986), Vockeroth (1992), Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). The latter authors provide a coloured illustration of the adult insect. American material of this species is extremely similar to *P. clypeatus* (Mg.). *P. hyperboreus* is also included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** the general appearance of the male and female of the European species can be seen from the coloured photos provided by Haarto and Kerppola (2007a).

Platycheirus immaculatus Ôhara, 1980.
Preferred environment: forest; humid *Fagus/Picea* forest upwards into the *Abies/Picea* zone. **Adult habitat and habits:** visits understorey trees in flower, but can also be found flying among herb layer vegetation in the shade, within forest (Nielsen, 2004), under which conditions it is difficult to detect. **Flowers visited:** white umbellifers; *Crataegus, Euphorbia*, *Salix* spp., *Sorbus aucuparia*. **Flight period:** end April/end June. **Developmental stages:** not described. **Range:** from Norway south to central France (Massif Central) and eastwards through central Germany to the Alps (Switzerland, Italy), the Balkans (Greece and parts of the former Yugoslavia); Turkey; Georgia; Nepal; the Pacific coast of Russia and Japan. **Determination:** Ohara (1980); Nielsen (2004) who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. Doczkal (1996a) also points out that the male may be mistaken for *P.ambiguus* and the female for *P.sticticus*. The female, with its unmarked abdomen, could be mistaken for a melanic specimen of various *Platycheirus* species. This species is included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Platycheirus immarginatus (Zetterstedt), 1849
Preferred environment: wetland; in atlantic parts of Europe particularly in freshwater coastal marshes; fen and flush systems in blanket bog; cut-over raised bog; taiga wetlands. **Adult habitat and habits:** flies among tall waterside vegetation; as easily detected by use of a sweep net as by direct observation. **Flowers visited:** *Scirpus maritimus*. **Flight period:** end May/beginning September. **Developmental stages:** not described. **Range:** uncertain, due to confusion with other species, until recently; in Britain present from the Scottish Highlands to the south coast of England, where it is not infrequent in coastal localities; from various coastal sites in Ireland; its presence cannot yet be confirmed for France or central Europe, but it occurs in Sweden, Denmark, the Netherlands and Belgium. From the information and figures provided by Vockeroth (1990) this species would seem to also occur in N America, from Alaska south to southern California. **Determination:** Speight and Goeldlin (1990), Vockeroth (1990). This species is almost indistinguishable from *P.perpallidus* (see under *P.perpallidus*). **Illustrations of the adult insect:** The species is illustrated in colour by Bartsch et al.(2009a) and Torp (1994).

Platycheirus islandicus Ringdahl, 1930
Preferred environment: forest; arctic *Betula* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Angelica archangelica, Epilobium latifolium, Geranium sylvaticum, Ranunculus* (Van Steenis *et al*., 2023b). **Flight period:** end of May/beginning of August. **Developmental stages:** not described. **Range:** known only from Iceland, where it is apparently common and widespread (Bartsch *et al*., 2009a). **Determination:** van Steenis and Goeldlin (1998) redescribe and reinstate the species, which was previously regarded as a synonym of *P. peltatus* (Mg.). Van Steenis *et al*. (2023b) discuss

identification of *P. islandicus* and provide another redescription of it, together with photos of various morphological features. *P.islandicus* is included in the keys provided by van Veen (2004) and Bartsch *et al*. (2009a). **Illustrations of the adult insect:** Bartsch *et al*. (2009a) provide coloured illustrations of the abdomen of the male and female of this species. Van Steenis *et al*. (2023b) provide coloured photos of the male and the female.

Platycheirus jaerensis Nielsen, 1971
Preferred environment: wetland/forest; raised bog with *Vaccinium* species, especially *V.uliginosus* or *V.myrtillus*, and sometimes with *Betula/Salix* scrub, within boreal *Pinus* forest or *Picea/Pinus/Betula* forest; humid grassy areas within *Picea* forest. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Geranium sylvaticum*, *Ranunculus*, *Taraxacum*, *Vaccinium uliginosum*. **Flight period:** end May/mid June; July/August in Finnmark. **Developmental stages:** larva not described, but Nielsen (pers.comm.) has observed the female ovipositing on the underside of leaves of *Vaccinium uliginosus* and has been able to rear the larvae through early instars using aphids as food. **Range:** Norway, Sweden, Finland, Estonia, Latvia, Germany, France (Jura), Switzerland (Jura); Alaska and Canada in N America. **Determination:** Nielsen (1971a), who figures the male terminalia, together with the abdomen of both sexes in dorsal view and the male front leg. This *peltatus* group species is included in the keys provided by van Veen (2004), Haarto and Kerppola (2007a) and Bartsch et al.(2009a). The keys of Vockeroth (1992) may be used to aid in separating males of *P. jaerensis* from those of *P. amplus*, *P. naso*, *P. nielseni* and. *P. parmatus*. Van Steenis and Goeldlin (1998) provide a key separating the female from females of other European *peltatus*-group species. **Illustrations of the adult insect:** the general appearance of the male and female of this species can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch et al.(2009a).

Platycheirus kittilaensis Dusek & Láska, 1982
Preferred environment: subarctic *Betula* forest, dwarf scrub (*Salix*) tundra and western taiga forest (Nielsen, 1981, 1998); palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** no data. **Flowers visited:** *Geranium silvaticum* (Nielsen, 1981); *Caltha*, *Potentilla erecta* (Bartsch *et al*., 2009); *Ranunculus*, *Rubus chamaemorus*, *Viola biflora* (Van Steenis and Zuidhoff, 2013). **Flight period:** June/July. **Developmental stages:** not described. **Range:** northern Europe: Norway, Sweden, Finland and into northern parts of European (Kola peninsula) Russia and in Asiatic Russia (Altai). **Determination:** Dusek and Láska (1982); van Veen (2004); Haarto and Kerppola (2007a); Bartsch *et al*. (2009a); Barkalov & Nielsen (2012). Nielsen (1998) indicates that Norwegian records previously consigned to *P. complicatus* (Becker) refer to this species. **Illustrations of the adult insect:** the general appearance of the male and female of this species can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a).

Platycheirus laskai Nielsen, 1999
Preferred environment: forest; open areas in deciduous forest of *Betula/Salix* (T.Nielsen, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Crepis* (Bartsch *et al*, 2009), *Geranium sylvaticum* (Nielsen, 1999). **Flight period:** mid June/end July. **Developmental stages:** not described. **Range:** uncertain, due to confusion with *P.sticticus* (Mg.), but confirmed from Norway, Sweden, Finland, Germany, Czech Republic, Austria, N Italy. **Determination:** Nielsen (1999), who provides features for separating the male of this species from the male of the closely similar *P.sticticus*. Both male and female of *P.laskai* are included in the keys provided by Bartsch *et al*.(2009a). **Illustrations of the adult insect:** Bartsch *et al*.(2009a) figure the male and female in colour.

Platycheirus latimanus (Wahlberg), 1845
Preferred environment: forest; boreal *Betula* forest (Nielsen, 1981) northwards through sub-arctic *Betula* forest into taiga and dwarf *Betula/Salix* scrub tundra (H. Bartsch and T. R. Nielsen pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Geranium sylvaticum* (Nielsen, 1981). **Flight period:** end June/mid August. **Developmental stages:** not described. **Range:** northern Europe: Lapland (northern Norway, northern Sweden, northern Finland) into northern Russia and on into Asia through Siberia to the Pacific and Japan (Hokkaido); Mongolia. **Determination:** Nielsen (1981); Violovitsh (1986); van Veen (2004); Haarto and Kerppola (2007a); Bartsch *et al*. (2009a); Barkalov (2013). **Illustrations of the adult insect:** the general appearance of the male and female of this species can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a).

Platycheirus lundbecki (Collin), 1931
Preferred environment: forest/open ground; beside lakes in taiga and in arctic-alpine tundra (Nielsen, 1974). **Adult habitat and habits:** no data. **Flowers visited:** *Salix* (Nielsen, 1974); *Carex* (Bartsch *et al*, 2009); Dryas (Böcher *et al*., 2015). **Flight period:** end June/beginning August. **Developmental stages:** not described. **Range:** northern Europe: Norway, Sweden, Finland, Siberia; Greenland; in N America from Alaska and northern Canada. **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group; Nielsen (1974) and Violovitsh (1986) (as *P. fjellbergi*), plus Vockeroth (1992); Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). This species appears in recent European literature as *P. fjellbergi* Nielsen. The synonymy of *fjellbergi* with *lundbecki* appears to have been established by Vockeroth (1992). This species is included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** the general appearance of the female of this species can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). Nielsen (2014a) provides a coloured photograph of the male.

Platycheirus magadanensis Mutin, in Mutin & Barkalov, 1999
Preferred environment: has been collected from *Carex* beds standing in a shallow, seasonal pool in boreal marsh, within the subalpine *Betula* forest zone (A.Haarto, pers.comm.); "rich flooded meadow" (Haarto, 2023). **Adult habitat and habits:** has been swept from *Carex* standing in shallow water (A.Haarto, pers. comm.) **Flowers visited:** no data. **Flight period:** July. **Developmental stages:** not described. **Range:** Finland and eastern Siberia. **Determination:** the summary description of this species incorporated into the keys in Mutin and Barkalov (1999) is based on the male only, for which the front tibia and tarsus are figured in ventral view, accompanied by a figure of the hind leg. Subsequently, the male of this species has been included in the keys in Haarto and Kerppola (2007a), who show a diagrammatic representation of the fore leg. Bartsch *et al*. (2009a) also figure the ventral surface of the fore basitarsus of the male and include the species in their keys. Haarto (2023) provides an extended diagnosis of the male, together with a detailed, illustrated description of a specimen he identifies as the female of *P. magadenensis*, also listing the unusual combination of features common to the males of *P. magadenensis* and this female. It is not clear whether this female was collected from a site where males of *P. magadenensis* had also been found. Haarto (2023) includes an addendum to the key in Haarto (2015), to incorporate the female of *P.magadanensis*. **Illustrations of the adult insect:** Bartsch *et al*. (2009a) and Haarto and Kerppola (2007a) provide coloured illustrations of the male. Haarto (2023) illustrates in colour the specimen described as the female of *P. magadanensis*.

Platycheirus manicatus (Meigen), 1822
Preferred environment: wetland/open ground; fen, humid, unimproved grassland, unimproved montane and alpine grassland (to above 2000m in the Alps); beside streams and rivers in open country (including moorland) and taiga. **Adult habitat and habits:** along brooks, by flushes and in open pasture and meadow; flies low, among and over ground vegetation. **Flowers visited:** white umbellifers; *Allium schoenoprasum, Caltha, Campanula rapunculoides, Cardamine, Chrysanthemum, Cirsium, Filipendula, Glechoma hederacea, Leontodon, Lychnis, Origanum, Ranunculus, Rosa rugosa, Senecio, Stellaria, Succisa, Taraxacum, Veronica*. **Flight period:** May/September, with peaks in June and August. **Developmental stages:** larva described and figured by Goeldlin (1974); aphid feeding, on low-growing plants and bushes. **Range:** from Iceland, the Faroes (Jensen, 2001) and Fennoscandia south to Iberia, the Mediterranean and N Africa; from Ireland eastwards through most of Europe into Turkey; European parts of Russia; Georgia; in Siberia from the Urals to the Altai; Alaska in N America; Greenland. **Determination:** Dusek & Laska (1982), van Veen (2004), Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Platycheirus marokkanus Kassebeer, 1998
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Saxifraga* (Van Eck, 2016); *Thapsia* (Van Steenis *et al*., 2020). **Flight period:** March/July (Portugal: Van Eck, 2016a); February/November (Morocco: Kassebeer, 1998). **Developmental stages:** not described. **Range:** Portugal; southern Spain; N Africa (Morocco). According to Kassebeer (1998) this species is widespread in Morocco, but *P. albimanus* is absent there, previous records all referring to *P. marokkanus*. **Determination:** Kassebeer (1998) describes both the male and the female. Males may be distinguished by features of the front leg, but females are more difficult to separate from related species. *Platycheirus marokannus* is a species of the *P. albimanus* group, very similar to other species of this group also occurring in southern Europe, namely *P. albimanus*, *P. ciliatus* and *P. muelleri*. The front leg of the male of *P. marokkanus* is figured by Kassebeer (1998). Van Eck (2016a) reiterates additional features mentioned by Kassebeer (1998) in separating the males of *P. marokkanus* and *P. albimanus*.

Platycheirus albimanus and *P. marokkanus* can be found in flight together (Van Eck, 2016a). Van Steenis *et al*., (2020) provide useful discussion of separation of the male of this species from the males of other European *albimanus*-group species. **Illustrations of the adult insect:** none known.

Platycheirus melanopsis Loew, 1856
Preferred environment: unimproved, montane grassland on calcareous rock, usually within open forest or scrub (*Picea, Betula, Juniperus, Pinus mugo*) and in open, unimproved, subalpine grassland up to 2,700m (Alps). **Adult habitat and habits:** beside brooks, or in other sheltered spots; flies low over grasses etc. **Flowers visited:** *Androsace, Bellidiastrum, Calamintha, Cerastium, Cirsium, Convolvulus, Crepis, Gypsophila, Helianthemum, Hornungia, Minuarta, Pinguicula, Potentilla erecta, Ranunculus, Rhododendron ferrugineum*. **Flight period:** June/July and July/August in higher altitudes. **Developmental stages:** larva found by Goeldlin (pers.comm.) among aphid colonies on *Cirsium* in alpine grassland; larva and puparium described and figured by Rotheray (1997), from specimens found on *Vaccinium* and *Blechnum*. **Range:** Britain (northern Scotland, northern England), the Alps and the Pyrenees; eastwards through northern Europe and the Alps into European parts of Russia and on into eastern Siberia. Scandinavian records of this species are now all referred to *P. kittilaensis*. **Determination**: van der Goot (1981), Dusek and Laska (1982). The female of *P. melanopsis* can be difficult to separate from the female of *P. tatricus*. But, in *P. melanopsis* females the inner (postero-lateral) half of the apical margin of the fore basitarsus (in dorsal view) is extended into a flat, sharply-pointed, triangular projection, as long as half of the maximum width of the basitarsus, whereas in females of *P. tatricus* the apical margin of the fore basitarsus is straight, with no projection. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983).

Platycheirus meridimontanus Nielsen, 2004
Preferred environment: inadequately known; montane zone. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end May/mid June. **Developmental stages:** undescribed. **Range:** North Macedonia; Lebanon. **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguu*s-group. Nielsen (2004) provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. The female of this species remains unknown. **Illustrations of the adult insect:** Nielsen (2014a) provides a coloured photograph of the male.

Platycheirus modestus Ide, 1926
Preferred environment: "marshes, fens, and other low, wet areas" in the Nearctic (Young, 2012). No information has been recorded about the habitat of this species in Finland. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August. **Developmental stages:** undescribed. **Range:** northen Finland; Nearctic, with scattered records from Alaska, and through much of Canada south to Maine and New Hampshire in the USA. **Determination:** both male and female of this species are included in the key to Nearctic *Platycheirus* species provided by Young (2012), who also redescribes the male and describes the female. *P.modestus* is a species of the *Platycheirus clypeatus* group, very similar in appearance to *P. scambus*, and sharing with *P. scambus* the feature of a lack of an outstanding white hair postero-laterally, at the base of the front femur. This feature is used almost universally in European keys, to separate *P. scambus* from other similar species. *P. scambus* also occurs in the Nearctic, and so is included in Young's (2012) key. In the male, the tergites are almost entirely orange in *P. modestus*, as shown in the coloured photo provided by Haarto (2014a), but with a distinct, median, longitudinal black stripe in *P. scambus*. However, there is some variability in this feature and discoloured specimens are unlikely to be identified using it. Males of *P. modestus* and *P. scambus* can probably be more consistently separated by the presence in *P. modestus* of a loose clump of black hairs, more than 3x as long as the tibia is deep, mostly on the basal half of the ventral surface of the mid-tibia. In the male of *P. scambus* all the hairs on the ventral surface of the mid tibia are shorter than the depth of the tibia. These differences are illustrated in colour by Young (2012). Separation of the females of *P. modestus* and *P. scambus* remains difficult, as Young's (2012) key shows. **Illustrations of the adult insect:** both the male and the female of this species are illustrated in coloure by Young (2012). The male is also figured in colour by Haarto (2014a).

Platycheirus muelleri Marcuzzi, 1941
Preferred environment: forest; mesophilous *Fagus* forest, and in the Pyrenees upwards through the *Picea/Abies* zone to the *Pinus uncinata* zone. **Adult habitat and habits:** males hover at 2-3m over tracks or other open areas in woodland and settle on foliage of low-growing, trackside plants. **Flowers visited:** *Hypericum, Sorbus*. **Flight period:** May/June and August/September. **Developmental stages:** not described. **Range:** southern France (Pyrenees) and Corsica, northern Italy.

Determination: this species does not appear in any identification key at present. It resembles *P.albimanus* (Fab.) in the field and may be found in flight with that species. The angle between the eyes is approximately 120° in males of *P.muelleri*, whereas in *P.albimanus* males it is 90°. Females of these two species remain indistinguishable. **Illustrations of the adult insect:** none known.

Platycheirus naso (Walker) 1849
Preferred environment: open ground/forest; taiga, sub-alpine *Betula* forest and dwarf scrub tundra (H.Bartsch and T.Nielsen, pers.comm.); palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** no data. **Flowers visited:** *Geranium sylvaticum* and *Rubus chamaemorus* (Nielsen, 1998), *Ranunculus acris* (Nielsen, pers.comm.); *Epilobium angustifolium*, umbellifers, *Taraxacum* (Bartsch et al, 2009); *Tanacetum* (Barkalov, 2012). **Flight period:** June/August. **Developmental stages:** not described. **Range:** northern Europe: Norway, Sweden, Finland; Altai mountains (SE Siberia); in N America from Alaska south through mountain chains to Colorado (where it occurs at 3-4,000m). **Determination:** this species appears in recent literature as *Platycheirus holarcticus*. Young *et al*. (2016a) establish the synonymy of *P. holarcticus* of Vockeroth with *P. naso* of Walker. *Platycheirus naso* appears in the keys of Vockeroth (1992) and Bartsch et al.(2009a) as *P. holarcticus;* Young *et al*. (2016a) include the species in their key to N American Platycheirus species, and figure the legs of the male. Van Steenis and Goeldlin (1998) provide a key separating the female (as *P. holarcticus)* from females of other European *peltatus*-group species. This species is also included in the keys provided by van Veen (2004), as *P. holarcticus*. **Illustrations of the adult insect:** the general appearance of the male and female of this species can be seen from the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch et al.(2009a), under the name *P.holarcticus*. It is also figured in colour by Young *et al*. (2016a).

Platycheirus nielseni Vockeroth, 1990
Preferred environment: forest/open ground; along brooks in open conifer forest (humid *Pinus, Abies,* Picea) and *Betula* woodland. **Adult habitat and habits:** clearings and tracksides, usually along brooks; beside scrub-fringed streams in montane/alpine pasture up to 2,000m (Alps); males hover at 1 - 2m in clearings etc, within one small area often occurring together in large numbers (S Ball, pers.comm.). **Flowers visited:** *Aegopodium, Anthriscus, Barbarea vulgaris, Caltha palustris, Cirsium arvense, Geranium sylviaticum, Geum rivale, Ranunculus, Senecio*. **Flight period:** June/September. **Developmental stages:** undescribed. **Range:** Fennoscandia south to northern France (Vosges); from Ireland eastwards through northern and central Europe (including northern Italy), where it is frequent in the central Alps, into European parts of Russia; Ukraine; Georgia; Siberia; scattered records from N America from Alaska through much of Canada and south through the Rocky mountains to Colorado. **Determination:** Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). Differences between the legs of male *P. nielseni* and male *P. peltatus* may be seen from comparison of the figures in Vockeroth (1990) and Speight and Vockeroth (1988). Van Steenis and Goeldlin (1998) provide a key separating the female from females of other European *peltatus*-group species. But care has to be exercised in employing the feature relating to relative widths of the terminal tergites used in the last couplet of their key, since the condition described for *P. peltatus* (Mg.) may also occur in *P. nielseni*. **Illustrations of the adult insect:** the adult male is shown in colour by Bartsch *et al*. (2009a).

Platycheirus nigrofemoratus Kanervo, 1934
Preferred environment: open ground; along river banks in tundra (Nielsen, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Caltha palustris, Ranunculus* (Nielsen, pers.comm.). **Flight period:** June/July. **Developmental stages:** not described. **Range:** northern Europe: northern Norway, northern Sweden, northern Finland, northern Russia (Karelia); Altai mountains (SE Siberia); Alaska and northern Canada in N America. **Determination:** Vockeroth (1992); van Veen (2004), Haarto and Kerppola (2007a), Bartsch et al.(2009a). This species has been regarded as a variety of *P.albimanus* (Fab.) in recent European literature. The female of *P.nigrofemoratus* can be distinguished from that of *P.albimanus* using the keys of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). In both sexes *P.nigrofenmoratus* is very similar to *P.urakawensis*. **Illustrations of the adult insect:** the male is shown in colour by Haarto and Kerppola (2007a) and Bartsch et al.(2009a).

Platycheirus occultus Goeldlin, Maibach and Speight, 1990
Preferred environment: wetland; fen and the periphery of raised bog, coastal marsh and dune slacks, humid, seasonally-flooded, unimproved grassland, moorland. In the Alps, apparently only in wetlands with *Phragmites*, below 1000m, but in Scandinavia occurs to as far north as taiga wetlands (Nielsen, 1998). **Adult habitat and habits:** flies among thick, tall

vegetation and is as easily located by use of a sweep net as by direct observation. **Flowers visited:** white umbels, *Carex* spp., Salix *repens*. **Flight period:** April to September, with peaks in May/mid-June and mid-July/August. **Developmental stages:** not described. **Range:** Norway, Sweden, Finland, the Faroes (Jensen, 2001), Denmark, Ireland, Britain, northern Germany, France (various parts, including the Paris basin, the Alps, Pyrenees, Massif Central and the Vosges), lowland parts of Switzerland, Liechtenstein (the Rhine valley), Spain and northern Italy (Apennines), Serbia, Ukraine, Turkey, Iran and Azerbaidjan. **Determination:** *P.occultus* is extremely similar to P.angustatus, *P.clypeatus*, *P.europaeus* and *P.ramsarensis*, from which in nearly all cases it may be distinguished using the keys in Speight and Goeldlin (1990). The features used for separation of *P.occultus* males from males of *P.clypeatus* in Stubbs (1996) are also helpful. This species is included in the keys provided by van Veen (2004), Haarto and Kerppola (2007a) and Bartsch *et al.* (2009a). The male terminalia are figured by Goeldlin *et al*. (1990). Although the wing membrane is normally entirely covered in microtrichia in *P. occultus*, in some females a small bare area may be present on the base of the second basal cell. At present it is not always possible to decide whether a female should be consigned to *P. occultus* or *P. clypeatus* and additional key characters for separating the females of these two species would be extremely useful. *P. occultus* is often found on the wing as an adult in the company of *P. clypeatus* - there are verified records of *P. clypeatus* from nearly all localities from which *P. occultus* has been collected in Ireland and Switzerland. **Illustrations of the adult insect:** Bartsch *et al.* (2009a) and Torp (1994) provide coloured figures of the adult insect.

Platycheirus parmatus Rondani, 1857
Preferred environment: forest; from *Fagus*/*Abies* forest up to the upper limits of *Picea* and on into the *P.mugo* zone. **Adult habitat and habits:** tracksides, clearings etc.; males hover at 3 metres or more, in glades. **Flowers visited:** *Alliaria petiolata, Allium ursinum, Anemone nemorosa, Ranunculus, Salix, Stellaria, and Vaccinium*. **Flight period:** April/June, July at higher altitudes. **Developmental stages:** larva described and figured by Goeldlin (1974). **Range:** Norway, Sweden and Finland southwards to the Ardennes and the Vosges; through the Alps in central Europe to the former Yugoslavia and European parts of Russia; Siberia; Alaska and northern Canada in N America. This species has been extending its range westwards for the last 20 or more years. **Determination:** van der Goot (1981), Vockeroth (1992); Haarto and Kerppola (2007a), Bartsch *et al.* (2009a). This is a *peltatus* group species, easily distinguished in the male by an absence of the large, bristle-rimmed crater on the ventral surface of the mid femora, which characterises other *peltatus* group species, though otherwise it is extremely similar to *P. peltatus*. Van Steenis and Goeldlin (1998) provide a key separating the female from females of other European *peltatus*-group species. **Illustrations of the adult insect:** the adult male is illustrated in colour by Bartsch *et al*.(2009a) and Bot and Van de Meutter (2019).

Platycheirus peltatus (Meigen), 1822
Preferred environment: wetland; fen and humid, unimproved grassland, along rivers and streams in grassland and heathland and in association with tall herb vegetation of flushes in grassland; in the Alps also in open areas in humid *Fagus/Abies* forest. **Adult habitat and habits:** among dense waterside and fen vegetation; males hover within 1m of the ground in spots of less dense vegetation; settles on foliage. **Flowers visited:** white umbellifers; *Allium ursinum, Berteroa incana, Epilobium, Eupatorium, Euphorbia, Galium, Papaver, Ranunculus*. **Flight period:** May/August, with a peak in June/July and occasional specimens on into September. **Developmental stages:** available larval descriptions are unreliable, due to doubt about identity of the species involved. The larva is supposedly illustrated in colour by Rotheray (1994). **Range:** uncertain, due to confusion with other species until recently, but presence confirmed in Iceland, Norway, Sweden, Finland, Denmark, Ireland, Britain, Germany, the Netherlands, the Ardennes and Vosges mountains, the R. Loire floodplain, the Rhine valley, the Pyrenees and the Alps (Switzerland, Liechtenstein, Austria), the former Yugoslavia; Georgia; Altai mountains (SE Siberia); Japan. According to Vockeroth (1990), records of this species from N America are erroneous. **Determination:** Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). Van Steenis and Goeldlin (1998) provide a key separating the female from females of other European *peltatus*-group species (see also under *P.nielseni* Vockeroth). **Illustrations of the adult insect:** the male is illustrated in colour by Torp (1994) and Bartsch *et al*. (2009a). A coloured photo of the female is provided by Speight and de Courcy Williams (2021).

Platycheirus perpallidus Verrall, 1901
Preferred environment: wetland/freshwater; water-margin tall sedge and reed beds in fen and transition mire and along rivers or the edge of lakes; palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** flies among taller waterside vegetation or among emergent vegetation over water and among taller vegetation on scraw; as easily detected by use

of a sweep net as by direct observation, but often to a significant extent inaccessible, due to the danger of approaching sufficiently close to its preferred haunts. **Flowers visited:** *Rubus chamaemorus* (Nielsen, 1998); Cyperaceae; *Juncus, Salix repens*. **Flight period:** beginning April/beginning September, but almost no records for July. **Developmental stages:** larva aphidophagous; described and figured by Maibach and Goeldlin (1991a); occurs on water's edge plants such as *Typha* and *Carex rostrata*; overwinters on the lower parts of its plant host under water and may even be found beneath ice (A.Maibach, pers. comm.) when the surface water freezes. **Range**: from Norway and Finland south to northern France; from Ireland eastwards through northern and central Europe into European parts of Russia and on through Siberia to the Pacific coast; in N America from Alaska to New Brunswick and south to Utah. **Determination:** Speight and Goeldlin (1990), Haarto and Kerppola (2007a), Bartsch *et al.*(2009a). In the male, this species is almost indistinguishable from *P. immarginatus*. It can exhibit a row of five or six, long bristly (black, or yellowish, or some of each) hairs, postero-dorsally, on the front femora, as in *P.immarginatus*. But, in *P.perpallidus* these bristly hairs each have a diameter distinctly less than the basal width of the clump of tangled white hairs that occurs at the base of the femur, postero-dorsally. In *P.immarginatus* each of the long, black, bristly hairs present on the postero-dorsal edge of the front femur has a diameter even greater than the basal width of that clump of tangled white hairs. The female of *P.perpallidus* is most easily distinguished from that of *P.immarginatus* in having an almost continuously pale lateral margin to the abdominal tergites (this may be darkened by post-mortem discolouration), whereas in *P.immarginatus* the lateral abdominal margin is almost continuously (and widely) black. Young *et al.*(2016) show that, genetically, *P. perpallidus*, as recognised previously in N America, comprises two species. They recognise one of them as *P. perpallidus* and describe the other under the name *P. neoperpallidus*, Young. The European specimens they examined genetically all correspond with *P. neoperpallidus*. All European specimens of *P. perpallidus* characterised genetically so far (from Great Britain Ireland, the Netherlands and Finland) correspond with *P. neoperpallidus*. Unless European specimens with the genotype of N American *P. perpallidus* are found it has to be concluded that the N American taxon recognised as *P. perpallidus* is not that species, since the original description of *P. perpallidus* is based on specimens from Europe (Great Britain). The N American taxon which does correspond genetically with European *P. perpallidus*, described in Young *et al.*(2016) as *P. neoperpallidus*, would then appear to be a junior synonym of the European *P. perpallidus*. Genetic data are needed for more European *P. perpallidus* populations before it can be concluded with confidence that the N American taxon recognised as *P. perpallidus* is not the species described from Europe as *P. perpallidus*. The case for recognising the presence of *P. neoperpallidus* in Europe, as a taxon distinct from the species described as *P. perpallidus* in Europe, is similarly unproven. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch et al.(2009a).

Platycheirus podagratus (Zetterstedt), 1838

Preferred environment: wetland/open ground; acid fen, margins of oligotrophic lakes, rivers and brooks in unimproved grassland, taiga and moor; unimproved montane and subalpine grassland; palsa mire (Van Steenis and Zuidhoff, 2013); tundra. **Adult habitat and habits:** flies low among ground vegetation of *Briza, Carex, Juncus* etc., usually close to water; as easily detected by use of a sweep net as by direct observation. **Flowers visited:** Cyperaceae. **Flight period:** end May/mid July and on to mid August at higher altitudes. **Developmental stages:** larva not described, but illustrated in colour by Rotheray (1994). **Range:** from the Faroes (Jensen, 2001) and Fennoscandia south to the Pyrenees; from Ireland eastwards through northern Europe and mountainous parts of central Europe into European Russia;Georgia; through asiatic Russia to SE Siberia; in N America from Alberta and Ontario. **Determination:** Speight and Goeldlin (1990), Haarto and Kerppola (2007a), Bartsch et al.(2009a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch et al.(2009a).

Platycheirus ramsarensis Goeldlin, Maibach & Speight, 1990

Preferred environment: wetland/open ground; tundra, transition mires, flushes in blanket bog, lakeside vegetation round oligotrophic lakes and with tall, marginal vegetation along brooks in moorland and oligotrophic, unimproved, montane grassland on non-calcareous soils. **Adult habitat and habits:** flies among *Juncus* etc. and is as easily detected by use of a sweep net as by direct observation. **Flowers visited:** *Caltha palustris*; probably also Graminae and Cyperaceae. **Flight period:** end of June/mid August, with peak in mid-July. Males have so far only been collected in the period June/ beginning July. **Developmental stages:** not described. **Range:** as yet known only from the Faroes (Jensen, 2001), Scandinavia (northern Norway to the southern tip of Norway, northen Sweden, Finland), Ireland, the Outer Hebrides and Britain (Scottish Highlands south to Yorkshire). **Determination:** males of *P.ramsarensis* are less easily recognised than the females, a situation unusual among *Platycheirus* species. Males of *P.angustatus* in which microtrichial coverage of the wings is

complete are particularly easy to confuse with *P.ramsarensis.* The male terminalia are figured by Goeldlin et al.(1990). In its general appearance, the female can easily be mistaken for *P.clypeatus*, *P.immarginatus* or *P.occultus*. *P.ramsarensis* may be distinguished from these other species by means of the keys given in Speight and Goeldlin (1990), Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). However, the facial shape has proved to be more variable in male *P.ramsarensis* than is indicated in the key provided by Speight and Goeldlin (1990) and cannot be used to distinguish this species. The front leg features referred to by Stubbs (1996) are easier to use for separation of males of *P.ramsarensis*. It is not unusual to find *P.ramsarensis* on the wing in the company of *P.angustatus, P.occultus, P.clypeatus* and *P.scambus*. This species is also included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009a) and Speight and de Courcy Williams (2021).

Platycheirus scambus (Staeger), 1843

Preferred environment: wetland; fen, including coastal fen and river margins; salt-marsh. **Adult habitat and habits:** flies among tall emergent and water margin vegetation, characteristically within a few metres of standing or slow-moving oligotrophic or mesotrophic water; males hover up to 3m, beside *Salix* bushes etc. close to water. **Flowers visited:** *Carex, Ranunculus, Schoenoplectus, Scirpus lacustris, Spartina, Urtica dioica*. **Flight period:** end May/mid July and August/September. **Developmental stages:** larva described and figured by Rotheray (1988a). **Range:** from Fennoscandia south to central France; from Ireland eastwards through northern and central Europe to European parts of Russia and on to the Pacific coast (Sakhalin); in N America from Alaska to Quebec and south to California. **Determination:** Speight and Goeldlin (1990), Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). None of these keys provide for the separation of *P. scambus* from the closely similar *P. modestus*, a Nearctic species now known also to occur in Europe. Separation of *P. scambus* from *P. modestus* is considered in the species account for *P. modestus*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Bartsch *et al*. (2009a).

Platycheirus scutatus (Meigen), 1822

Preferred environment: forest; most types of deciduous forest, especially scrub woodland; anthropophilic, occurring also along field hedges, in fruit and olive orchards, in suburban gardens and parks and in young conifer plantations. **Adult habitat and habits:** clearings, tracksides, hedges etc.; flies up to 3m from ground, the males hovering at from 1 - 3m, beside hedges, in woodland glades etc. **Flowers visited:** white umbellifers; *Achillea millefolium, Aster, Berberis, Campanula rapunculoides, Euphorbia, Geranium robertianum, Leontodon, Ranunculus, Rosa, Salix repens, Silene dioica, Stellaria, Taraxacum, Tripleurospermum inodorum*. **Flight period:** April/October, with peaks in June and August and occasional specimens on into November. **Developmental stages:** the larva was supposedly described and figured by Bhatia (1939), who also describes the egg; the larva is also supposedly illustrated in colour by Rotheray (1994). Subsequent description of three more European species in the *scutatus* group renders these larval descriptions insecure. Similarly, the larval biology described by Dusek & Laska (1974) may not refer to *P. scutatus*, but to some other *scutatus* group species. Nonetheless, it seems sure that the larva is aphid feeding, on herbaceous plants, bushes, shrubs and small trees. Dussaix (2013), who reared the species from larvae found on *Rumex*, records a prolonged aestival diapause, of nearly three months, in larvae of this species which matured in June, followed by a puparial phase of 1 week. Dussaix (2013) provides a coloured photo of the puparium. **Range:** requires review due to potential for confusion of this species with the recently-described *scutatus* group species, but supposedly widespread, from Iceland, the Faroes (Jensen, 2001) and Fennoscandia south to Iberia and the Mediterranean; from Ireland eastwards through northern, central and southern Europe (Italy, the former Yugoslavia, Greece) into Turkey and European parts of Russia; Afghanistan; through Siberia to the Pacific coast (Sakhalin Is., Japan); in N America from Alaska south to Colorado. **Determination:** Doczkal *et al*. (2002) provide a key distinguishing the male of this species from males of three of the other European species of the *scutatus* group, *P.aurolateralis, P.speighti* and *P.splendidus*. *Platycheirus sibiricus* has not yet been included in any key with all of the other European members of this group. The female of *P. scutatus* cannot at present be separated from the other species of this group. A further potential complication is *P.atlasi* Kassebeer, recently described from N Africa (Kassebeer, 1998), which might occur in Mediterranean parts of Europe. All five European *scutatus* group species are very similar to each other and most of them occur may be found together in flight in the field. The key provided by Bartsch *et al*. (2009a) does not include *P. sibiricus*. **Illustrations of the adult insect:** the general appearance of *P.scutatus* is shown by coloured illustrations in Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Bartsch *et al*. (2009a).

Platycheirus sibiricus Barkalov & Nielsen, 2007
Preferred environment: dwarf heath tundra/arctic-alpine tundra. In Finland, it has been found in a grassy, open area along a stream, within *Picea* forest (A. Haarto, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Finland, Sweden (Haarto, 2022); Tadjikistan; Magadanskaya Oblast, Yakutia (eastern Siberia in Asiatic Russia). **Determination:** the description of this species, provided by Barkalov & Nielsen (2007), is based on a number of males. The female remains unknown. Barkalov & Nielsen (2007) indicate that *P. sibiricus* is a member of the *P. scutatus* group, closely similar to *P. aurolateralis*. Their description does not state the colour of the frons or frontal dusting, but says that the facial hairs are black in *P. sibiricus*, a feature which distinguishes it from *P. scutatus*. The differences between *P. sibiricus* and other *scutatus*-group species given by Barkalov & Nielsen (2007) are mostly in the shape and pilosity of the middle tibia, which they figure from one angle. In addition, the median, undusted facial stripe is apparently very narrow in *P. sibiricus*, no wider than one fifth of the width of the face, helping to distinguish it from *P. aurolateralis*, where the median facial stripe is wider. *Platycheirus sibiricus* has not yet been included in any key with the other European *scutatus* group species. **Illustrations of the adult insect:** none known.

Platycheirus sigiktae Mutin, in Mutin & Barkalov, 1999
Preferred environment: dwarf *Betula/Salix* scrub tundra (A. Haarto, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July/August. **Developmental stages:** not described. **Range:** Finland (Haarto, 2022); Amur Oblast (a southern part of Asiatic Russia, in the Russian Far East). **Determination:** the brief description of the male and female this species is provided within the key by Mutin & Barkalov (1999), to syrphids of the Russian Far East. In the unpublished translation of their work, later provided by the authors (Barkalov, pers. comm.) the description reads as follows:
"Abdomen black, with bronze maculae. Proleg – fig. 230, 4, 5. Females: abdomen black, with brightly shining leaden-grey maculae; legs mainly brownish–yellow, except coxae, trochanters, metafemur for most part, metatibia on the middle, basotarsomere and apex of metatarsus black".
The leg illustrations referred to figure the left front tibia and basitarsus of the male, in ventral view, and the left front femur of the male, also in ventral view. *Platycheirus sigiktae* evidently belongs within the *clypeatus* group. The sensory pit on the ventral surface of the front basitarsus is small, located more-or-less in the centre of the basitarsus (as in *P. occultus*) and marked by a simple black dot. In the ciliation of the posterolateral surface of the front femur, the male of *P. sigiktae*, as illustrated, is not dissimilar to *P. clypeatus*, but with the long hairs almost straight and the apical half of the femur almost bare. **Illustrations of the adult insect:** none known.

Platycheirus speighti Doczkal, Stuke & Goeldlin, 2002
Preferred environment: unimproved, non-calcareous, montane/subalpine grassland from 1,500m to above 2,000m in the Alps (Doczkal *et al*., 2002). **Adult habitat and habits:** no data. **Flowers visited:** *Myosotis alpestris* (Doczkal *et al*., 2002). **Flight period:** end May/mid July. **Developmental stages:** not described. **Range:** the Alps (Austria, France, Italy, and Switzerland); Nearctic. **Determination:** Doczkal *et al*. (2002) provide a key distinguishing the male of this species from males of the other European species of the *scutatus* group, *P.aurolateralis*, *P.scutatus* and *P.splendidus*. The female of this species cannot at present be separated from the other species of this group. All four *scutatus* group species can be found in flight in the same locality, at the same time. **Illustrations of the adult insect:** none known.

Platycheirus splendidus Rotheray, 1998
Preferred environment: forest/hedgerows; deciduous forest of *Quercus/Ulmus* with clearings and other open areas upwards to the upper limit of the *Picea/Abies* forest zone and on to 2000m in the Alps, where it may be found in association with *Alnus viridis* thickets. Hedges containing *Ulmus glabra* (G.Rotheray, pers.comm.); also, suburban gardens (Speight, 2005). **Adult habitat and habits:** females fly at up to 3m, around the foliage of *U.glabra* (G.Rotheray, pers.comm.). Males of this species make a habit of sitting in the sun, in the evening, in sheltered spots, on the foliage of shrubs, at heights of around 2m from the ground. **Flowers visited:** *Anthriscus* (Bartsch et al, 2005), *Heracleum* (Doczkal et al, 2002), *Silene dioica* (G.Rotheray, pers.comm.), yellow *Crassula*. **Flight period:** April/beginning June and end June/August; possibly only one generation (mid-April/beginning July) in Britain, Ireland and Scandinavia. **Developmental stages:** the larva and puparium are described and figured by Rotheray (1998), from leaf-curl galls of the aphid *Schizoneura ulmi* (L.) on *Ulmus glabra*, and from aphid colonies on *Silene dioica*. **Range:** uncertain, due to confusion until recently with other members of the *scutatus* group, but confirmed from Ireland, Britain (Scotland southwards) and Scandinavia (Norway, Sweden, Finland), through Belgium and

Germany to the Alps (Austria, France, Germany, Italy, Switzerland) and from the Nearctic. **Determination:** Doczkal *et al.* (2002) provide a key distinguishing the male of this species from males of the other central European species of the *scutatus* group, *P.aurolateralis*, *P.scutatus* and *P.speighti*. The female of this species cannot at present be separated from the other species of this group. Rotheray (1998) figures the male terminalia and provides features distinguishing this species from *P.scutatus*. *P.albimanus*, *P.aurolateralis*. *Platycheirus splendidus* and *P.scutatus* may be found in flight together (and with *P.speighti*, in the Alps), and can be difficult to separate from one another in the field. There is greater variability in the colour of the pale abdominal markings in *P.splendidus* than is suggested in existing literature. Far from resembling *P.scutatus*, dark forms of *P.splendidus* can be indistinguishable from the almost ubiquitous *P.albimanus* in the field, though *P.splendidus* is usually rather larger than *P.albimanus*. There is particular difficulty in the recognition of specimens of *P.splendidus* in alcohol or other preservative, because the colour of the frontal dusting and the abdominal markings become difficult to interpret in both this and related species. An attempt to overcome these latter problems is made in the key by Speight *et al.* (2004), which does not, however, include either *P. sibiricus* or *P.speighti*. The keys in Bartsch *et al.* (2009a) does not include *P. sibiricus*. **Illustrations of the adult insect:** the general appearance of the female is shown in the coloured photo provided by Haarto and Kerppola (2007a). The male is well shown in the coloured illustration provided by Bartsch *et al*. (2009a).

Platycheirus sticticus (Meigen), 1822

Preferred environment: forest; conifer plantation (*Picea/Pinus*) and acidophilous *Quercus* woodland. **Adult habitat and habits:** clearings and tracksides; largely arboreal, but descends to visit flowers of low-growing plants. **Flowers visited:** *Cardamine, Euphorbia, Ranunculus, and Stellaria*. **Flight period:** mid May/August and on into September at higher altitudes. **Developmental stages:** not described. **Range:** from southern Sweden and Denmark south to the Pyrenees and northern Spain; from Ireland eastwards through central Europe (plus northern Italy and the former Yugoslavia) into Ukraine, Russia and on to eastern Siberia (Tuva). **Determination:** van der Goot (1981) and Verlinden (1994), plus Nielsen (1999). The only keys to distinguish *P. sticticus* from the extremely similar *P.laskai* are those of Nielsen (1999), Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). The female of *P.sticticus* can be distinguished from the female of *P.laskai* using the keys provided by Bartsch *et al*. (2009a). *P.sticticus* females are very easily misidentified as small females of *P.albimanus*. But in *P.sticticus* the width of the posterior margin of tergite 5 in the female is distinctly less than 2x the median length of that tergite, whereas in females of *P.albimanus* the width of the posterior margin of tergite 5 is distinctly greater than 2x the median length of that tergite. Also, in females of *P.sticticus* the wing membrane is entirely covered in microtrichia, while in females of *P.albimanus* the 2nd basal wing cell is usually c.20% bare of microtrichia, towards the base of the cell, though microtrichial coverage is rather variable in *P.albimanus*. Prokhorov *et al*. (2023) provide extensive discussion of separation of *P. sticticus* from *P. albimanus*, accompanied by photos of various of the morphological features they mention. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Platycheirus subambiguus Nielsen, 2004

Preferred environment: inadequately known; rocky, calcareous open ground; probably beside rivers and brooks in stony, calcareous grassland (Descaves and Speight, 2017).. **Adult habitat and habits:** no data. **Flowers visited:** *Salvia pratensis* (Nielsen, 2004); *Laserpitium siler* (Descaves and Speight, 2017). **Flight period:** May (Nielsen, 2004); June (Descaves and Speight, 2017). **Developmental stages:** undescribed. **Range:** northern Italy, Croatia and Hungary (Nielsen, 2004); southern France (Descaves and Speight, 2017). **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group. Nielsen (2004) provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. The female of this species remains unknown. **Illustrations of the adult insect:** none known.

Platycheirus subordinatus (Becker), 1915

Preferred environment: open ground; *arctic*-alpine tundra and dwarf *Betula/Salix* shrub tundra (Nielsen, pers.comm); palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** flies low though dwarf scrub and ground vegetation; rests in the sun on the foliage of broad-leaved plants (e.g. *Alchemilla*). **Flowers visited:** *Cerastium alpinum, Parnassia palustris, Potentilla crantzii, Ranunculus, Salix* (Nielsen, pers.comm.); *Caltha palustris, Rubus chamaemoru, Viola biflora* (Van Steenis and Zuidhoff, 2013). **Flight period:** end June/beginning August. **Developmental stages:** not described. **Range:** northern Europe: Lapland (northern Norway, northern Sweden, northern Finland) and high alpine areas in southern Norway; through northern Russia into Siberia; in N America from Yukon and Alaska. **Determination:** Nielsen (1981); Violovitsh (1986); Vockeroth (1992); van Veen (2004); Haarto and Kerppola (2007a); Bartsch *et al.* (2009a); Barkalov &

Nielsen (2012). **Illustrations of the adult insect:** the general appearance of the species is shown in the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a).

Platycheirus tarsalis (Schummel), 1836
Preferred environment: forest; small open areas within humid *Fagus*, *Carpinus/Quercus* and acidophilous *Quercus* forest, with tall herb communities. **Adult habitat and habits:** flies along tracksides etc., among tall herbaceous vegetation. **Flowers visited:** *Euphorbia, Geranium, Myosotis, Frangula alnus, Potentilla, Primula, Ranunculus, Senecio, Stellaria, Verbascum, Viola*. **Flight period:** beginning May/beginning July, with peak end May/beginning June. **Developmental stages:** not described. **Range:** from Britain and Finland eastwards through central and southern Europe into European Russia; Georgia; into Asia to as far as eastern Siberia. The reference to occurrence of *P. tarsalis* in N America, given in Peck (1988), is presumably erroneous, since the species is not recognised as Nearctic by Vockeroth (1990). **Determination:** van Veen (2004), Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). The female of *P. parmatus* can easily be mistaken for *P. tarsalis*, but in the female of *P. tarsalis* the mouth edge projects anteriorly beyond the facial prominence, the antennae are entirely black and the frontal dust spots meet on the frons, often for most of their length. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a) and Bot and Van de Meutter (2019).

Platycheirus tatricus Dusek & Laska, 1982
Preferred environment: open ground; from the *Larix* zone upwards, in thinly-vegetated, unimproved, calcareous and non-calcareous, subalpine grassland, up to 2000m, particularly along the edges of torrents (L.Verlinden, pers.comm.); open, heathy areas in upper parts of the *Larix* and *Pinus uncinata* forest zone. **Adult habitat and habits**: flies very low over the sparse alpine ground vegetation, just at the time of melting of the last snow patches. **Flowers visited**: *Potentilla, Ranunculus, Salix*. **Flight period**: end of May/July. **Developmental stages:** undescribed. **Range:** Tatra mountains (Slovakia); Pyrenees (France); the Alps (France, Switzerland, Liechtenstein, Austria) and the Dolomites (northern Italy). **Determination:** Dusek & Laska (1982), who figure the male terminalia. This species is included in the keys provided by van Veen (2004). For separation of females of this species from females of *P. melanopsis*, see under *P. melanopsis*. **Illustrations of the adult insect:** none known.

Platycheirus torei Barkalov, 2013
Preferred environment: dwarf shrub tundra beside a river (Barkalov, 2013); palsa mire (Van Steenis, 2022). **Adult habitat and habits:** no data. **Flowers visited:** *Chamaemorus* (Van Steenis, 2022); *Dryas punctata* (Barkalov, 2013). **Flight period:** June/July. **Developmental stages:** not described. **Range:** northern Sweden; northern Siberia, in central Asiatic Russia. **Determination:** the description of this species is based on six males. The female remains unknown. Barkalov (2013) consigns *P. torei* to the *manicatus* species group and indicates how it would fit into the key to Holarctic tundra *manicatus* group species provided in Barkalov and Nielsen (2012), where it would run to *P. groenlandicus*. Barkalov (2013) also indicates that *P. torei* would run to *P. groenlandicus* in the key to Siberian *Platycheirus* species in Mutin & Barkalov (1999) and provides a revision of that part of the key, to incorporate the male of *P. torei*. Further, Barkalov (2013) provides figures of the head and legs of *P. torei*, essentially illustrating its diagnostic features, together with leg and head figures for 8 other closely similar Siberian species (most of them also present in Europe). Equivalent leg figures for other tundra *Platycheirus manicatus*-group species are found in Barkalov & Nielsen (2012). In photographic form, the legs and head of *P. torei, P. groenlandicus* and *P. subordinatus* are illustrated in Van Steenis (2022), who also discusses the distinctions between the males of these three species. **Illustrations of the adult insect:** the general appearance of the male of *P. torei* can be seen in the coloured photographs provided by Barkalov (2013) and Van Steenis (2022).

Platycheirus transfugus (Zetterstedt), 1838
Preferred environment: forest; open areas in *Picea/Pinus* forest and deciduous forest (Nielsen, 2004). **Adult habitat and habits:** no data. **Flowers visited:** *Chrysanthemum fruticosa***,** *Potentilla fragiformis* (Nielsen, 2004); *Allium schoenoprasum, Potentilla crantzii, Ribes alpinum, Saxifraga granulata* (Bartsch *et al*, 2009). **Flight period:** mid May/beginning August, with peak in June. **Developmental stages:** undescribed. **Range:** in Norway from the southern tip of the country to as far north as the arctic; Sweden, southern Finland, Denmark; southern Germany (Baden-Württemberg); France (Vosges, Alps); Switzerland; Kazakhstan, Kyrgyzstan, Mongolia; Altai mountains (SE Siberia). **Determination:** included in the key provided by Nielsen (2014a), to the World species of the *Platycheirus ambiguus*-group; Haarto and Kerppola (2007a); Bartsch et al.(2009a). Nielsen (2004) describes the female and provides a key distinguishing the male of this species from other

European members of the *Platycheirus ambiguus* group. **Illustrations of the adult insect:** the general appearance of the male is shown in the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a). Nielsen (2014a) provides coloured photographs of the male and female.

Platycheirus troll Mutin, in Mutin & Barkalov, 1999
Preferred environment: in Finland found among pool edge *Menyanthes* and *Eriophorum*, in a mosaic of poor fen and acid bog, with stands of *Pinus sylvestris* and *Picea* (Haarto *et al*, 2019 and A. Haarto, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Developmental stages:** not described. **Range:** Finland; Eastern Siberia (Sakhalin). **Determination:** only a summary description of this species is provided (in Russian) by Mutin, incorporated into the key to *Platycheirus* species in Mutin and Barkalov (1999), and based on 2 males and 2 females. It is accompanied by an illustration of the front leg of the male. An English translation of Mutin's description (kindly provided by A Haarto and G. Ståhls) is provided below. A comprehensive description of the female was subsequently provided by Haarto (2015), accompanied by a provisional key to the females of *Platycheirus clypeatus*-group species known from northern parts of the Palaearctic, and illustrations of the head, legs *etc* of the *P. troll* female. *Platycheirus troll* is a member of the *clypeatus* group in which all femora and tibiae are almost entirely yellow throughout (hind femur vaguely darkened ventrally) and tergites 2 – 4 have large yellow markings reaching the side margin of the tergite for their entire length. Also, at the base of the femur of the front leg there is a long, isolated pale hair in the male, represented in the female as a small group of white hairs (distinguishing the species from *P. scambus*, which lacks these hairs). This combination of features distinguishes *P. troll* from other European c*lypeatus* group species except for *P. fulviventris*, *P. immarginatus* and *P. perpallidus*. Features for separation of the female of *P. troll* from the females of these three species are provided by Haarto (2015). The male of *P. troll* can be separated from the male *of P. fulviventris* by the shape of the front tibia. In *P. troll* it reaches its maximum width apically, whereas it reaches its maximum width at about the middle of its length in *P. fulviventris*. The male of *P. troll* can be separated from the males of both *P. immarginatus* and P. *perpallidus* by the bristles/bristly hairs on the posterolateral surface of the front femur. In *P. troll* the apical half of the length of the front femur is almost devoid of bristly hairs (i.e. with no bristles or hairs as long as half the width of the femur) and with fewer than 10 bristles longer than half the width of the femur in the basal half of its length. The male of *P. immarginatus* has a line of 5 or 6 bristles/bristly hairs posterolaterally, all longer than the femur is wide and spaced along almost the entire length of the femur (these long hairs are accompanied by a dense fringe of short bristly hairs which continues from the base of the femur to its apex). In the male of *P. perpallidus* there is a dense fringe of bristly hairs posterolaterally, from the base to the apex of the front femur, that are longer than half the width of the femur for most of its length (these bristly hairs continue almost to the apex of the femur, but become progressively shorter towards its apex). **llustrations of the adult insect:** coloured photos of the female in dorsal and lateral views are provided by Haarto, 2015.
Translation of the description of *P. troll* in Mutin & Barkalov (1999):
Metatarsus with yellow middle tarsomeres and with black basotarsomere and two apical tarsomeres; basotarsomere evenly thickened. Metafemur yellow, weakly darkened ventrally near middle. Protibia moderately broadened toward apex, posteroapical lobe pointed. Third and fourth tergites with rather large maculae reaching the lateral margin for their entire length; second tergite with relatively large subtriangular yellow maculae; fifth tergum dark except anterior corners yellow. 6.5mm.

Platycheirus urakawensis (Matsumura), 1919
Preferred environment: forest/open ground; tall-herb, open areas within *Picea* forest in northern Europe (Sörensson, 2001); tundra with dwarf *Betula* scrub (T. Nielsen, pers.comm.). **Adult habitat and habits:** flies low through tall-herb vegetation (Sörensson, 2001). **Flowers visited:** *Aruncus asiaticus, Chamerion angustifolium* (Gritskevich, 1998); *Geranium sylvaticum, Ranunculus, Rubus idaeus* (Sörensson, 2001). **Flight period:** June/July in northern Europe (Nielsen ns Svendsen, 2014; Sörensson, 2001); July/mid August in eastern Asiatic Russia (Gritskevich, 1998); June in N America (Vockeroth, 1992). **Developmental stages:** not described, but apparently associated with aphids of herbaceous plants (Vockeroth, 1990). **Range:** a holarctic species known from northern Sweden, Finland, the Himalayas (N India, Bhutan, eastern Siberia and Japan; in the Nearctic from Greenland, Alaska and scattered localities in Canada and the United States south to Colorado and Maine. **Determination:** Vockeroth (1992) provides a key in which the male is distinguished from related species, including *P.albimanus* and *P.nigrofemoratus*. Sörensson (2001) provides features to separate the females of this species from those of *P.albimanus*. The male terminalia are figured by Ôhara (1980). The front leg of the male is figured by Nielsen (2016). This species is extremely similar to *P.albimanus*, with which it can be confused in the field. Sörensson (2001) relates finding these two species on the wing together, in the same locality. The keys provided by Bartsch et al.(2009a), may be used to distinguish

both male and female of this species from the closely-related species *P.albimanus* and *P.nigrofemoratus*. **Illustrations of the adult insect:** . Bartsch et al.(2009a) provide a coloured figure of the male of *P.urakawensis*.

Platycheirus varipes Curran, 1923
Preferred environment: forest; boreal/sub-arctic *Betula* forest (T. Nielsen, pers. comm.) and tundra (Barkalov and Nielsen, 2008); palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** no data. **Flowers visited:** small, white Cruciferae (H. Bartsch, pers. comm.) and *Ranunculus* (Nielsen, 1998). **Flight period:** June/July. **Developmental stages:** not described. **Range:** northern Europe: Norway, Sweden, Finland; Greenland; central Asiatic Russia; in N America from Alaska and Canada south to Colorado, via mountain chains. **Determination:** Vockeroth (1992); van Veen (2004), Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). **Illustrations of the adult insect:** the general appearance of the male is shown in the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a).

PLATYNOCHAETUS

Three southern European species are known in this genus. Two occur in Europe only on Mediterranean islands, Sicily *(P. macquarti* Loew) and Malta (*P. rufus* Macquart). All three are included in the keys of Sack (1928-1932).

Platynochaetus rufus Macquart, 1835
Preferred environment: scrub/open ground; calcicolous *Erica/Euphorbia* garrigue with patchy vegetation, areas of bare ground and bare rock (M. Ebejer, pers.comm.). **Adult habitat and habits:** flies low over the ground surface and frequently settles on bare ground, paths or rocks. A very good mimic of the mason bee *Chalicodoma sicula* with which it shares both habitat and flight period (M. Ebejer, pers. comm.). **Flowers visited:** *Chrysanthemum coronarium*, *Oxalis pes-caprae* (M. Ebejer, pers. comm.); *Euphorbia dendroides*, *E. rigida* (Ssymank and Ebejer, 2009). **Flight period:** end March/beginning June (Malta). **Developmental stages:** undescribed. **Range:** Sicily, Maltese islands, N Africa (Algeria). **Determination:** Sack (1928-1932). This species varies in colouration from bright, rust-red to almost black, the different colour forms being otherwise apparently identical (M. Ebejer, pers.comm.). **Illustrations of the adult insect:** a coloured illustration of the male is provided by Speight & de Courcy Williams (2016).

Platynochaetus setosus (Fabricius), 1794
Preferred environment: forest; open areas in evergreen oak forest of *Quercus ilex*; *Q.ilex maquis*. **Adult habitat and habits:** males fly extremely rapidly, zig-zagging round and through shrubby vegetation and hover at up to 3m; settles on bare ground and on branches of dead shrubs. **Flowers visited:** *Viburnum tinus; Vella lucertina* (Lorenzo *et al*., 2019); *Chrysanthemum coronarium*, *Euphorbia dendroides* (Ssymank and Ebejer, 2009). **Flight period:** March/May. **Developmental stages:** not described. **Range:** Portugal, Spain, Mediterranean zone of France, Corsica, southern Italy and Sicily; N Africa (Tunisia, Algeria, Morocco). **Determination:** Sack (1928-1932). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

POCOTA

Only one *Pocota* species is known in Europe.

Pocota personata (Harris), 1779
Preferred environment: *Fagus* and *Quercus/Carpinus/Ulmus* forest, containing overmature and senescent trees. **Adult habitat and habits:** largely arboreal, descending only to visit flowers of understorey trees and shrubs; males sit on the trunks of trees near the entrance to rot-holes, quite high up the trunk – presumably awaiting the emergence of females. Mating has been observed on the trunk of beech trees. **Flowers visited:** *Cornus sanguinea*, *Crataegus*, *Prunus*, *Sorbus aucuparia*, *S. aria*. **Flight period:** mid April/beginning July. **Developmental stages:** larva described and figured by Rotheray (1991), from larvae collected from rot-holes in live *Fagus*. This species has also been reared from larvae collected in a standing-water rot-hole in *Populus*, by Becher (1882), and from a rot-hole in *Populus tremula* (Ahnlund, pers.comm.); also from *Quercus*. Alexander (2005) concludes that there may be some dependence of the larvae of this species upon white-rot-fungi, suggesting that the presence of such fungi in a rot-hole may be of more significance to *Pocota* than whether or no the rot-hole contains

standing water. He also substantiates suggestions that this species uses trunk rot-holes 1m or more above the ground. Larvae of *P. personata* may be distinguished from larvae of related genera by the keys in Rotheray (1994), who also provides a coloured illustration of the larva, apparently from a preserved specimen. *P. personata* overwinters as a larva. **Range:** from southern Sweden south to the Pyrenees; from Britain eastwards through central and southern Europe (Italy, the former Yugoslavia) into European parts of Russia and on to the Caucasus (Georgia); Ukraine. **Determination:** see generic key in the StN Keys volume. The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Bartsch *et al*. (2009b), Stubbs and Falk (1983), Torp (1994) and Pétremand *et al*. (2022).

PORTEVINIA

The single European species of *Portevinia* was until recently usually consigned to *Cheilosia*. It is treated in most accounts, including van der Goot (1981).

Portevinia maculata (Fallen), 1817
Preferred environment: forest; alluvial hardwood forest and humid *Fagus* or *Quercus* forest; also unimproved subalpine grassland. **Adult habitat and habits:** areas of the woodland floor with dappled sunlight and plants of *Allium ursinum* or (less frequently) *A.triquetrum*; edges of clearings, beside brooks and along tracks with either of these *Allium* species; adults fly low around and among stands of *Allium*, often settling on the leaves of this plant, or on adjacent vegetation; rarely found away from the immediate vicinity of *A.ursinum* plants. Where it has been naturalised in parkland etc, *A.triquetrum* may occur in dense stands like *A.ursinum*, and then provides an alternative foodplant for *Portevinia*. **Flowers visited:** *Allium ursinum, Ranunculus, Rubus idaeus*. **Flight period:** end April/June and July at higher altitudes. **Developmental stages:** larva described and figured by Speight (1986b) and illustrated in colour by Rotheray (1994). The larva is phytophagous, mining firstly the stem-base and later the corms of *Allium ursinum* (or *A. triquetrum*). It passes the winter as a larva and becomes a puparium in early spring. The puparial phase lasts approximately three weeks. In the literature *P. maculata* is frequently referred to, erroneously, as mining the *leaves* of *A. ursinum*. In subalpine grassland, *P. maculata* presumably uses a different *Allium* species as foodplant, as is the case in *Cheilosia fasciata* (see species account for that species), though which *Allium* is involved (probably *A. victorialis*: U.Schmid, pers.comm.) does not seem to have been established for *P. maculata*. The larva may be distinguished from the larvae of related genera by the keys incorporated into Rotheray (1994). **Range:** from southern Norway south to north Spain; from Ireland eastwards into central Europe as far as Liechtenstein, Austria and northern Italy. **Determination:** see generic key in the StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

PRIMOCERIOIDES

There is one known European species in this genus. A second species, *P. petri* (Hervé-Bazin) occurs in eastern asiatic parts of the Palaearctic region and a third species, *P. yoshikawai* (Sasakawa), has been described from the Oriental region.

Primocerioides regale Violovitsh, 1985
Preferred environment: gallery forest of *Carpinus/Quercus*, along seasonal stream in *Quercus frainetto/Q.pubescens* forest (M. de Courcy Williams, pers.comm.); beside stream along the edge of an olive orchard (G. Hancock, pers.comm.). **Adult habitat and habits:** males visit trees of *Pyrus* in flower in the evening (17.30 – 18.30) , to both feed and find females; a mating pair has been observed on the trunk of the tree (M. de Courcy Williams, pers.comm.); the male has also been seen making short circular flights at about 2m from the ground, to and from a shrub of *Cornus mas* in flower, and settling on bare branches (*C.mas* comes into flower before its leaves open), in a small glade in the sun, at the edge of a track (M. de Courcy Williams, pers.comm.). **Flowers visited:** *Pyrus* (M. de Courcy Williams, pers.comm.). **Flight period:** end of February/beginning of May. **Developmental stages:** not described. **Range:** Serbia, north-eastern Greece (including the island of Lesvos) and Cyprus. **Determination:** see StN Keys to Genera volume. This species is comprehensively redescribed by van Steenis et al.(2016), who also show that *Sphiximorpha hiemalis* of Ricarte, Nedeljković and Hancock (2012) is a junior synonym of *P. regale* and provide keys for the separation of *P. regale* from other European Ceriodini. **Illustrations of the**

adult insect: Ricarte et al.(2012), as *Sphiximorpha hiemalis*; van Steenis et al.(2016). The male is illustrated in colour by Speight and De Courcy Williams (2021).

PSARUS

Psarus in a monotypic genus confined to Europe.

Psarus abdominalis (Fabricius), 1794
Preferred environment: well-drained *Quercus* forest, including Eastern, thermophillous oak forest of *Q. frainetto* and *Q. cerris;* it has also been found in ancient olive groves (used for organic olive oil production) with an understorey of thickets of *Quercus coccifera* maquis. **Adult habitat and habits:** flies fast and very low, zig-zagging in a manner reminiscent of *Pipizella* species, along woodland paths and at the edge of woodland. Males have been seen sitting in the sun on the end of dead branches of trackside trees, at 2m or more from the ground, returning to particular branches repeatedly (M.Hauser, pers.comm.) and, in the morning, in the sun on the large leaves of coppised *Quercus frainetto*, within 1m of the ground surface, in small clearings within *Q. frainetto* forest. On hot days, after rain, this species visits temporary puddles of water on forest tracks, to drink (M. de C.Williams, pers.comm.). **Flowers visited**: yellow crucifers; *Anthemis, Geranium sanguineum, Veronica*. **Flight period:** most records from the end of March to the beginning July, with a peak in early May. But Kulijer *et al.* (2023) point out that in the Balkans there are also records from August, and one from the beginning of September. **Developmental stages:** unknown. This insect seems always to be associated with forest, and nearly always with oak forest, especially at this point in time with thermophilous oak forests of the Mediterranean zone, including coppiced forest managed for firewood production. But it can evidently occur with or without the presence of old trees or a diverse ground flora. Kulijer *et al*. (2023) point out that, despite vague suggestions in the literature that *Psarus* is in some way associated with *Geranium sanguineum*, its repeated occurrence where the plant is absent indicates that any dependence on *G. sanguineum* is most unlikely. It is tempting to suggest its larvae may be in some way dependent on new trunk-base regrowth of shoots on oak trees after coppicing or fire, or on some other organism which exploits such new growth. It may be no co-incidence that Psarus vanished from various different parts of Europe at the time coppicing for firewood went out of use, resulting in conversion of firewood forests to high-stem forest or conifer production, or loss of forest altogether. Wherever the larvae are they do not seem accessible to casual searching activity, or associated with any forest microhabitat normally the subject of human interst, either economic or culinary. **Range:** from southern Sweden (extinct?) south through the Netherlands (extinct?) and Belgium (extinct?) to central France (recent records from Rhine valley and Paris basin); from Brittany eastwards through central Europe (Germany - Rhine valley, Switzerland - extinct) to Roumania and the Ukraine; Italy, a number of the Balkan states and northern Greece; Turkey. Threatened at the European level. This is one of the first species of Diptera included on any continental European "Red List": see Andersson *et al*. (1987). Not only is this species evidently a victim of forest clearance and forest management throughout Western Europe, it is such an unmistakeable insect it is highly unlikely that its presence would go undetected. The fact that it is the only species in its genus (and Tribe) and is virtually endemic to Europe makes its status of greater significance. If ever there were a syrphid which required special protection measures to be taken to ensure its survival in Europe then *P. abdominalis* is it. Mengual and Ssymank (2015) review the distribution data for this species. More recently, Kulijer *et al*. (2023) have reviewed its status in the Balkan peninsula. **Determination:** see generic key in the StN Keys volume. *Psarus* is a monotypic genus and *P.abdominalis* is a highly distinctive insect. The only other European syrphid it resembles even remotely is the male of *Pyrophaena granditarsa*, which has likewise a bright orange-red abdomen. **Illustrations of the adult insect:** A coloured photo of the adult fly is provided by Reemer et al.(2009) and the male is figured in colour by Bartsch *et al*. (2009b). The female is illustrated in colour by Speight and De Courcy Williams (2018).

PSEUDODOROS

Pseudodoros is a genus of three described species, one of which, *P. nigricollis* Becker, has recently been recorded from Cyprus (Van Eck and Makris, 2016). The other two *Pseudodoros* species occur in the Nearctic/Neotropical regions.

Pseudodoros nigricollis Becker, 1903
Preferred environment: reed beds (*Phragmites*) (Van Eck and Makris, 2016). **Adult habitat and habits:** low-flying and rests on low-growing vegetation (Van Eck and Makris, 2016). **Flowers visited:** *Mercurialis annua* (Van Eck and Makris,

2016). **Flight period**: has only been found on the wing in Cyprus in November (Van Eck and Makris, 2016), but elsewhere adults have also been seen in April/June and September. **Developmental stages:** not described, but reared from larvae on an unidentified species of reed, and on a banana plant. From the close association of the localised population of *P. nigricollis* on Cyprus with a *Phragmites* bed, Van Eck and Makris (2016) postulate that there its larvae were predating the aphid *Hyalopterus pruni*. **Range:** Cyprus, Israel, Palestine, Egypt; Arabian peninsula; Afrotropical region south to S Africa; Madagascar. **Determination:** *P.nigricollis* is redescribed by Van Eck and Makris (2016). A key separating it from the other two *Pseudodoros* species is provided by Kassebeer (2000b), who also figures its male terminalia. **Illustrations of the adult insect:** Van Eck and Makris (2016) and Speight and de Courcy Williams (2021) illustrate the species in colour.

PSEUDOPELECOCERA

The need for introduction of a new genus, to recognise taxonomically a small group of species sufficiently genetically distant from others consigned to *Pelecocera* that they warranted separate identity, was signalled by Ståhls *et al.*(2004). The new genus was subsequently described by Vujić *et al.* (2018b), as *Pseudopelecocera*. They consigned two species to the genus, one of which, *P. latifrons*, is known from Europe. In some of the figures in Vujić *et al.* (2018d) this species appears under the name *Pokornyia*, without comment.

Pseudopelecocera latifrons (Loew), 1856
Preferred environment: steppic grassland (G. Popov, pers. com.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April. **Developmental stages:** not described. **Range:** this species was described from specimens collected in the Lebanon. In their redescription of the species (as *Pelecocera latifrons*), Mengual *et al*.(2015) cite specimens examined from southern European Russia and Hungary. According to Peck (1988) *P. latifrons* has also been recorded from Germany, the Czech Republic, France, Roumania and the former Yugoslavia. It is not currently included on the species lists for France or Germany, but is listed for Austria (Heimburg *et al*., 2022) and Serbia Vujić *et al.* (2018d). **Determination**: See StN Key to Genera volume. Mengual *et al*. (2015) redescribe *P. latifrons*, provide figures of various parts of the species and include it in a key in which it is separated from *P. tricincta*. *Pseudopelecocera latifrons* can be distinguished from all known European *Pelecocera* species by the width of its face which, at the level of the antennal insertions, is wider than an eye at the same level, in both male and female. **Illustrations of the adult insect:** both the male and the female are illustrated in colour by Mengual *et al*. (2015).

PSILOTA

Four European *Psilota* species are listed by Peck (1988). Smit and Vujič (2008) subsequently recognised one of them, *P. rotundicornis* Strobl, as a synonym of *Pipiza quadrimaculata* (Pz). Smit and Vujič (l.c.) also described two additional species, *P.exilistyla* and *P.nana*, to which Radenković *et al*. (2020b) add *P.aegeae*, bringing the European *Psilota* fauna to a total of six species.

Psilota aegeae Vujić, Ståhls & Smit, in Radenković *et al*., 2020
Preferred environment: *Pinus brutia* forest (Radenković *et al*., 2020b). **Adult habitat and habits:** no data. **Flowers visited:** *Smyrnium perfoliatum* (Radenković *et al*., 2020b). **Flight period:** April/beginning May. **Developmental stages:** not described. **Range:** known only from the Aegean island of Lesvos (Greece). **Determination:** both the male and the female of this species are described in Radenković *et al*. (2020b), together with figures of the male terminalia and a key to separate *P. aegeae* from other European *Psilota* species. Recognition of the male is based primarily on small features of the terminalia. The white-haired mesoscutum of the female helps to separate it from related species. Both its considerable morphological similarity to *P. atra* and genetic data place this species within the *P. atra* group. Disparities between the nomenclature of this species, as referred to in Vujić *et al*. (2020d) and Radenković *et al*. (2020b), are resolved in Vujić *et al*. (2021a). **Illustrations of the adult insect:** the genera lappearance of *P. aegeae* can be seen in the coloured photos provided in Radenković *et al*. (2020b) and Vujić *et al*. (2020d).

Psilota anthracina Meigen, 1822

Preferred environment: deciduous forest; *Quercus/Carpinus/Ulmus* forest and old orchards of *Malus* and *Prunus* (*P. avium, P. cerasus, P. dulcis*). **Adult habitat and habits:** apparently largely arboreal; may be found in small glades within forest; females can be found investigating tree trunks in the shade. **Flowers visited:** white umbellifers; *Acer campestre, Crataegus; Photinia; Rhamnus frangula; Prunus avium,* male *Salix, Sorbus aucuparia*. Van de Meutter and Reemer (2012) record this species as visiting the flowers of *Gleditsia triacanthos*. **Flight period**: May/June. **Developmental stages:** Kassebeer *et al.* (1998) describe and figure the larva and puparium supposedly of this species, but based on material from *Picea* and *Pinus*, which suggests the species bred may have been *P. atra* (from *Pinus*) and *P. exilistyla* (from *Picea*). The female of *P.anthracina* has been seen investigating the damaged trunk of an ancient almond tree (*Prunus dulcis*). **Range:** requires re-appraisal, due to confusion with *P. atra* and *P. exilistyla*, but known from Britain, the Netherlands, Belgium, Germany, France, Switzerland, Austria, Spain, Italy, Montenegro, Croatia and Greece. **Determination:** Smit and Vujić (2008) figure the male terminalia, but the figure of the male epandrium of *P. anthracina* "in dorsal view" provided by them differs significantly from the figure of the male epandrium of the same species "in dorsal view" provided by Smit and Zeegers (2005). This confusion is resolved by the updated figures of male terminalia provided in Radenković *et al*. (2020b), who present a revised key to all known European *Psilota* species. But for separation of females of *P. anthracina*, *P. atra* and *P. exilistyla* it is heavily reliant upon the colour of hairs on parts of the thoracis pleura, a feature sufficiently unreliable that it requires to be treated with great caution. Females of *P. exilistyla* can be separated from females of these other two species by their possession of hairs of uniform length on tergite 4, the hairs being noticeably longer along the posterior margin of the tergite in females of *P. anthracina* and *P. atra*. When two or more specimens apparently belonging to either *P. anthracina* or *P. atra* are found together on the same day, for instance on the flowers of some shrub like *Photinia*, it cannot be assumed that they all belong to the same species – the two species can occur together in various combinations, so males of the one can accompany females of the other. **Illustrations of the adult insect:** the general appearance of the adult of *P.anthracina* is shown in the coloured illustrations provided by Ball and Morris (2013), Ball *et al.* (2002) and Stubbs and Falk (1983).

Psilota atra (Fallen), 1817

Preferred environment: forest; coniferous forest of *Pinus* spp, thermophilous *Quercus* (*Q. pubescens* and *Q. cerris/Q. frainetto*) forest and *Quercus/Carpinus* forest; also organic olive orchards (Lebard and Canut, 2022). **Adult habitat and habits:** fast flying; apparently largely arboreal; adults descend to drink at damp mud in hot weather. Females can be found investigating tree trunks in the shade. Birtele and Hardersen (2012) provide data from Malaise traps installed at canopy level, supporting the perception of this species as largely arboreal as an adult. **Flowers visited:** *Acer pseudoplatanus, Aegopodium, Cornus, Crataegus, Salix* (Smit & Zeegers, 2005); *Cotoneaster, Photinia, Pyrocantha*. **Flight period:** April/June. **Developmental stages:** it seems likely that the description of larvae and puparium of *P. anthracina* provided by Kassebeer *et al.* (1998) is composite, involving material of both *P. anthracina* and *P. atra*. But the larvae they mention from an internal pocket of decay, containing rotten wood, sap and water, in the trunk of a living *Pinus* split by storm damage, probably belonged to *P. atra*. The female of probably this species has been observed ovipositing in the exit hole of a *Cerambyx cerdo* burrow, in an ancient, living *Quercus* in parkland (Doczkal, pers.comm.) and in the bark of the trunk of an old olive tree (Lebard & Canut, 2022). **Range:** uncertain at present, due to confusion with *P. anthracina* and *P. exilistyla*, but known from Norway, lowland Sweden, Lithuania (records based on females only: Lutovinosas and Pútys, 2022), Denmark and low-lying continental parts of the Atlantic zone (e.g. Netherlands), through France to Spain and the Mediterranean, and in central Europe to Switzerland and northern Italy, Montenegro, Serbia, Greece (including Crete), Roumania and Cyprus; N Africa (Morocco). **Determination:** the identity of this species has been fixed by redescription and neotype designation by Smit and Zeegers (2005), who figure the male terminalia. Smit and Vujič (2008) point out that the *P. atra* of van Veen (2004) is *P. anthracina*, and vice versa. Radenković *et al*. (2020b) provide a key to the European *Psilota* species, which includes updated figures of the male terminalia, but for separation of females of *P. anthracina*, *P. atra* and *P. exilistyla* it is heavily reliant upon the colour of hairs on parts of the thoracis pleura, a feature sufficiently unreliable that it requires to be treated with great caution. For separation of the female of *P. exilistyla*, see the *P. exilistyla* species account. **Illustrations of the adult insect:** Smit and Zeegers (2005) illustrate *P. atra* in colour. The male of *P. atra* is figured in colour by Bartsch *et al*. (2009b), Speight and de Courcy Williams (2018) and Bot and Van de Meutter (2019).

Psilota exilistyla Smit & Vujić, 2008

Preferred environment: forest, humid *Fagus* forest upwards into *Picea* forest. **Adult habitat and habits:** both sexes visit margins of streams to drink, in hot conditions. **Flowers visited:** white umbellifers; *Acer campestre* (van de Meutter and

Reemer, 2012). **Flight period:** end April/mid July. **Developmental stages:** not described, unless the *Psilota* larvae referred to by Kassebeer *et al*.(1998), as reared from accumulations of decaying sap under *Picea* bark, were actually those of *P. exilistyla*. **Range:** uncertain, due to confusion until recently with *P.anthracina* and *P.atra*, but reported from the Netherlands, Belgium, France (Alps, Jura, Pyrenees), Switzerland (Jura), Austria and Greece. **Determination:** Smit and Vujić (2008) describe both sexes of *P. exilistyla* and figure the male terminalia, with their distinctively long surstyli. This species is difficult to distinguish from *P.anthracina*, except in features of the male terminalia. Bot and van de Meutter (2019) introduce a feature which helps to separate the female of *P. exilistyla* from the female of *P. anthracina*: in *P. exilistyla* tergite 4 of the female is evenly covered in hairs of closely similar length, including those on the posterior margin of the tergite, whereas in *P. anthracina* the hairs on tergite 4 of the female are more scattered and of more varied length, with noticeably longer hairs scattered along the posterior margin of the tergite. Tergite 4 of the female of *P. atra* also has longer hairs along its posterior margin. Radenković *et al*. (2020b) provide a key to the European *Psilota* species, but for separation of females of *P. anthracina*, *P. atra* and *P. exilistyla* it is heavily reliant upon the colour of hairs on parts of the thoracis pleura, a feature sufficiently unreliable that it requires to be treated with great caution. **Illustrations of the adult insect:** the male is shown in colour by Smit *et al*.(2015) and Bot and Van de Meutter (2019).

Psilota innupta Rondani, 1857
Preferred environment: forest; Balkanic thermophilous *Quercus* forest (*Q.pubescens/Q.frainetto/Q.cerris*) and evergreen oak maquis (M.de C.Williams, pers.comm.); *Quercus robur/Pinus sylvestris* forest in Ukraine (G. Popov, pers. comm.). **Adult habitat and habits:** forest tracksides (H.-J.Flügel, pers.comm.); on hot days visits the damp mud of drying puddles on forest tracks, after rain (M.de C.Williams, pers.comm.). **Flowers visited:** *Potentilla neumanniana* (H.-J.Flügel, pers.comm.); *Pyrus spinosa* (M. de C. Williams, pers.comm.). **Flight period:** April/August. **Developmental stages:** not described, but female has been observed apparently attempting oviposition in the bark of a rotted patch on the trunk of an old, living *Quercus frainetto*. **Range:** Sweden (extinct) central Germany, Czech Republic, Slovakia, Austria, Hungary, Spain, Italy, Serbia, Croatia, Greece, Roumania, southern parts of European Russia and Siberia to Sakhalin; N Africa (Algeria). **Determination:** see key provided by Radenković *et al*. (2020b), who figure updated figures of the male terminalia of all known European species of *Psilota*. **Illustrations of the adult insect:** none known.

Psilota nana Smit & Vujić, 2008
Preferred environment: forest; thermophilous deciduous and broad-leaved evergreen; *Castanea sativa* with *Laurus nobilis* understorey; *Quercus ilex* forest and Balkanic white-oak forest (A.Vujić, pers.comm.); thermophilous oak forest of *Q. cerris*/ *Q. frainetto*. **Adult habitat and habits:** males hover in the sun (A.Vujić, pers.comm.). **Flowers visited:** *Smirnium perfoliatum* (A.Vujić, pers.comm.); umbellifers (Van Steenis *et al*, 2015); *Euphorbia*. **Flight period:** May. **Developmental stages:** not described; females have been observed flying up and down the trunk of a large *Quercus frainetto*, inhabited by the trunk cavity ant *Liometopum microcephalum*, and attempting oviposition on the bark. **Range:** Montenegro, Serbia. **Determination:** see key provided by Radenković *et al*. (2020b), who figure updated figures of the male terminalia of all known European species of *Psilota*. **Illustrations of the adult insect:** the general appearance of this insect can be seen from the coloured photo provided by Vujić et al.(2020d).

PYROPHAENA

There are two European species consigned to this genus. *Pyrophaena* has variously been considered as a subgenus of *Platycheirus*, or as a separate genus, in recent literature. Despite the minimal morphological differences between *Pyrophaena* and *Platycheirus* species (see Vockeroth, 1990), Young (2012) established a convincing genetic basis for recognising *Pyrophaena* as a genus in its own right.

Pyrophaena granditarsis (Forster), 1771
Preferred environment: open ground/wetland; humid, unimproved grassland subject to flooding or not, including oligotrophic *Molinia* grassland, marsh, fen, edges of raised bogs. **Adult habitat and habits:** flies among tall (1m or more) ground vegetation; settles on stems of *Juncus*, *Phragmites* etc.; males hover at up to 2m in more open spots within humid grassland etc. **Flowers visited:** white umbellifers; *Alisma plantago-aquatica, Bidens cernua, Leontodon, Lycopus europaeus, Polygonum cuspidatum, Potentilla erecta, Ranunculus, Senecio jacobaea.* **Flight period:** end of May/September

and occasional specimens in October. **Developmental stages:** larva undescribed, but this species has been collected in numbers from emergence traps installed over the taller patches of grass that develop around cow pats, in a cattle-grazed, humid grassland and from emergence traps installed over setaside vegetation. Barkemeyer's (1994) reference to occurrence of larvae of this species in cereal crops seems to be in error, since the source he quotes (Chambers *et al*, 1986) makes no mention whatever of *Platycheirus granditarsus*. **Range:** from Iceland and Fennoscandia south to northern France and the Alps; from Ireland eastwards through northern and central (very localised in the Alps) Europe into European parts of Russia; across Siberia to the Pacific coast (Kuril Isles); in N America from Alaska to Quebec and south to Colorado. **Determination:** see Key provided in StN Keys volume. *P. granditarsus* has frequently been regarded as a species of *Platycheirus* in recent literature. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Colyer and Hammond (1951), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986), etc.

Pyrophaena rosarum (Fabricius), 1787
Preferred environment: wetland/freshwater; pond, stream and river margins with tall herb vegetation and fen, around the periphery of raised bogs, Salix swamp, also humid, seasonally-flooded, unimproved grassland. **Adult habitat and habits:** flies among tall waterside and fen vegetation; males hover within 2m of the ground in sparsely vegetated patches. **Flowers visited:** *Caltha, Knautia, Lythrum, Potentilla erecta, Ranunculus*. **Flight period:** May/September. **Developmental stages:** not described. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** from Fennoscandia south to Iberia and the Mediterranean; from Ireland eastwards through most of Europe (extremely localised in the Alps) into European parts of Russia; in Siberia from the Urals to the Altai; in N America from Alaska to Nova Scotia and south to New Jersey. **Determination:** see Key provided in StN Keys volume. In recent literature this species has frequently been consigned to the genus *Platycheirus*. The male terminalia are figured by Dusek and Laska (1967). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

RHINGIA

Three *Rhingia* species are recognised as occurring in Europe.

Rhingia borealis Ringdahl, 1928
Preferred environment: forest; **humid** *Fagus/Picea* forest and upwards into the *Abies/Picea* zone; also sometimes in alluvial hardwood forest. Usually in the montane zone but occasionally at lower altitudes, for example on the flood plains of major rivers. **Adult habitat and habits:** clearings and tracksides, also small glades in semi-shade; flies among ground vegetation and bushes; males hover in glades etc. at 3 - 5m. **Flowers visited:** white umbellifers; *Allium ursinum, Geranium robertianum, Glechoma hederacea, Lonicera xylosteum, Lychnis flos-cuculi, Saxifraga.* **Flight period:** May/June; July/August at higher altitudes in the Alps and in northern Europe. In the Pyrenees, this species occurs within the *Fagus* zone in both May/June and August, indicating the occurrence of two generations (T.Zeegers, pers.comm.). **Developmental stages:** undescribed. **Range:** Fennoscandia south, through mountain ranges, to the Pyrenees; northern France (Vosges) eastwards through central Europe into Russia and on into Asia as far as central Siberia. **Determination:** See Key provided in StN Keys volume; also van Steenis (1998a). This species appears under the name *R.austriaca* Meigen in recent literature. Speight and Lucas (1992) established the relevant synonymy. Features of the terminalia are figured by Barkemeyer (1986). **Illustrations of the adult insect:** the male is figured in colour by Bartsch *et al*.(2009b) and Bot and Van de Meutter (2019).

Rhingia campestris Meigen, 1822
Preferred environment: forest/wetland and anthropochorous, occurring most frequently on land where cows are grazed, whether in the open or in woodland; otherwise in alluvial forest and beside streams and rivers in forest up to the *Fagus/Picea* zone. **Adult habitat and habits:** hedgerows, clearings, tracksides etc.; flies up to 2m from the ground; settles frequently on foliage; active under overcast conditions. **Flowers visited:** visits a wide range of flowers, including many pink flowers which have concealed nectar sources, making them unusable by other flies with less attenuated mouthparts. **Flight period:** May/September (plus April and October in southern Europe), with peaks in June and August. In drier parts of Europe the August generation may be extremely localised. **Developmental stages:** the subaquatic larva was described and figured by Coe (1942), from larvae reared from moist cow-dung. It is illustrated in colour by Rotheray (1994). The species is today

closely associated with cattle over most of its European range, but can occur where cows are absent, e.g. alluvial forest, and the larvae can be presumed to develop also in rich, moist accumulations of rotting foliage other than cow dung. **Range**: from northern Fennoscandia south to the Pyrenees, northern Spain and the Mediterranean; from Ireland eastwards through most of Europe into European parts of Russia and the Caucasus; throughout Siberia to the Pacific coast; Mongolia. The practice of keeping cattle penned in cow-houses and feeding them cut grass etc., throughout the summer, is now spreading in Europe and *R.campestris* is all but absent from regions (e.g. much of northern France and northern Italy) where this regime now predominates. Similarly, the use of the systemic pesticides, the Ivermectins, in cattle, appears to be causing a decrease in the frequency of *R.campestris* at present, though there is as yet no experimental work on the degree of toxicity of these chemicals to *Rhingia* larvae - Ivermectins excreted in cow-dung are known to be lethal to dung beetles (Aphodiidae etc.). **Determination:** See key provided in StN Keys volume; also van Steenis (1998a). Features of the male terminalia are figured by Barkemeyer (1986). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986), Bot and Van de Meutter (2019)and Pétremand *et al*. (2022).

Rhingia rostrata (L.), 1758

Preferred environment: forest; deciduous forest (*Quercus, Fraxinus/Fagus*) and scrub with a rich, tall-herb ground flora. **Adult habitat and habits:** flies within woodland, visiting flowers in small glades and dappled sunlight; settles on foliage of large-leaved plants, e.g. *Arctium* (Kormann, 1993). **Flowers visited:** *Centaurea, Cirsium spp. (C.eriophorum, C.palustre - D.Levy, pers.comm.), Geranium robertianum, Hypericum, Succisa, and Veronica*. **Flight period:** beginning May/July and mid August/ beginning October. **Developmental stages:** according to Grunin (1939) the eggs of *R.rostrata* are laid on the underside of the leaves of trees such as *Fagus,* where there is dung of large mammals on the ground below, the female fly first locating dung in an appropriate condition and then flying up to lay eggs on leaves suspended over the dung. He noted that eggs can be very frequent on grasses in the immediate vicinity of dung, but observed that females never lay their eggs in dung itself. Grunin's (1939) additional observation that when the larvae hatch they drop onto dry dung does not co-incide with the information provided by Rotheray and Rotheray (2021), who reared *R. rostrata* from a semi-aqueous mass of compacted, rotting grass. They provide detailed descriptions of the puparia of both *R. campestris* and *R. rostrata* and compare the one with the other. They conclude from the morphology of the R. rostrata larva that it is a saprohagous filter feeder living in soft, freshly decaying vegetable matter. Grunin (1939) suggests that under natural conditions the dung of large ungulates is used by *R. rostrata* and reports once finding larvae in horse dung (noting that horses were then frequent in the forests of the Caucasus), but says that the larvae can be reared on human dung. Although noting that *R. rostrata* larvae may well make particular use of microbe communities "associated almost exclusively with the early stages of decay in green plant material", they do not remark on the role of the dropping of large herbivores, as concentrations of decaying vegetation in potentially exactly the right condition. According to Grunin (1939) the eggs take 5-6 days to hatch, the larvae take approximately two weeks to become fully-grown and they then pupate on the ground. Rotheray and Rotheray (2021) note that the puparia are entirely covered in adhering detritus, observing that this represents good camouflage when they are inert among leaf litter. Confusingly, Grunin's (1939) detailed account of the life history of *R.rostrata* does not accord with the known habitats of *R.rostrata*, that are essentially humid forest, normally on a heavy, clay soil. *R.rostrata* is not a species characteristic of dry forest grazed by livestock and, indeed, is most repeatedly found in forests where ungulate numbers are low – typically confined to wild pig (*Sus scrofa*) and/or roe deer (*Capreolus*). Grunin's (1939) reference to once finding *R. rostrata* larvae in horse dung bears some consideration. In western Europe, *R. rostrata* seems to have been more frequent previously than now. its disappearance more-or-less co-inciding with the period of replacement of horses by mechanised vehicles. Given that *R. rostrata* is a forest insect, it is more than possible that cessation of the use of horses and mules to drag out, or carry out (in the case of firewood) timber from forests caused a considerable decrease in *R. rostrata* numbers. **Range:** from southern Finland and Denmark (extinct?) south to northern Spain; from Britain (Wales, southern England) eastwards through central Europe into European parts of Russia, the Caucasus and western Siberia. Although frequent during the 19th century, this species has all-but-disappeared from most parts of Europe during the 20th century and it should probably be regarded as threatened at European level. Its disappearance co-incided with that of the horse from the European countryside, and it is tempting to speculate that *R.rostrata* was largely dependent on dry horse dung as a larval microhabitat. But horses are not necessarily a feature of the localities from which *R.rostrata* is found today (see above). **Determination:** See Key provided in StN Keys volume; also van Steenis (1998). Features of the male terminalia are figured by Barkemeyer (1986). **Illustrations of the adult insect:** The adult insect is illustrated in colour by Ball and Morris (2013), Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994).

RIPONNENSIA

This genus was established by Maibach *et al*. (1994a), for a group of 4 Palaearctic species erstwhile consigned to *Orthonevra*. Two of them, *R.insignis* (Loew) and *R.longicornis* (Loew) are essentially Mediterranean species, but *R.splendens* (Meigen) is known to occur in most parts of Europe, while the fourth, *R.daccordii* (Claussen) is described from Corsica. Since then, Vujić (1999b) has described a further European species, *R..morini*, from the Balkans.

Riponnensia daccordii (Claussen), 1991
Preferred environment: springs and small flushes in both deciduous (*Alnus, Betulus, Fagus, Quercus*) and coniferous (*Picea*) forest (Cornuel-Willermoz & Lebard, 2024). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Developmental stages:** not described. **Range:** Corsica, Sardinia. **Determination:** Claussen (1991b) who figures the male terminalia. Bot *et al*., (2023) provide a key for the separation of this species from the other four European species of *Riponnensia*, and figure the male genitalia. One of the features used to separate *R. daccordii* from the others is that it has the mesoscutum covered in black hairs, which Bot *et al*. (2023) illustrate in the male. In the female, which is not illustrated, the mesoscutal hairs are also mostly black, but very much shorter, and of a more even length, than in the male. **Illustrations of the adult insect:** none known.

Riponnensia insignis (Loew), 1843
Preferred environment: marshy grassland with small streams at the edge of a *Liquidamber orientalis* forest (Reemer and Smit, 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia* (Reemer and Smit, 2007); *Foeniculum, Hedera* (Bot *et al.*, 2023). **Flight period:** May/June, September. **Developmental stages:** not described. **Range:** Greece (the Aegean island of Lesvos) (Bot *et al*., 2023); Turkey (Reemer and Smit, 2007). **Determination:** the description of this species is based on a solitary male. Maibach *et al*.(1994a) figure the male terminalia, based on the holotype. The terminalia are very similar to those of *R. morini*, as figured by Vujić (1999b). Bot *et al*., (2023) provide a key for the separation of this species from the other four European species, and figure the male genitalia, at the same time redescribing both sexes of *R. insignis*. **Illustrations of the adult insect:** Bot *et al*. (2023).

Riponnensia longicornis (Loew), 1843
Preferred environment: freshwater/forest; seasonal flushes/seepages in open scrub; marshy grassland with small streams at the edge of a *Liquidamber orientalis* forest (Reemer and Smit, 2007); the outflow area of streams and winter-flooded torrents just above the beach (beyond the splash zone), where the torrent bed has become flat and sandy. **Adult habitat and habits:** no data. **Flowers visited:** Asteraceae; *Foeniculum, Tamaris*. **Flight period:** June/July; September. **Developmental stages:** not described. **Range:** Portugal, Spain, southern France (plus Corsica), Sardinia, Sicily, Rhodes, Greece, Bulgaria, Turkey, Israel and N Africa (Algeria, Morocco). **Determination:** Bot *et al*. (2023) provide a key for the separation of this species from the other four European *Riponnensia* species, and figure the male genitalia of all species except *R. longicornis*. The male terminalia of *R. longicornis* are figured by Maibach *et al.* (1994a). However, the illustrations of the head of *R. longicornis* in side view, in Maibach *et al*. (1994a) and Bot *et al*. (2023) do not seem to be of the same species. *R. longicornis* in Bot *et al*. (2023) is distinguished from other *Riponnensia* species through its possession of all-black antennae with article 3 more than 4 times as long as its maximum depth. The illustration in Maibach *et al*. (1994a) shows article 3 less than 4 times as long as deep. The original description of *R. longicornis* is based on specimens from Greece. The male illustrated by Bot *et al*. is also from Greece. The origin of the male illustrated in Maibach *et al*. (1994a) is not indicated. In the key to Spanish *Riponnensia* species in Ricarte *et al*. (2022) reference is made to an accompanying figure 18d, purporting to show the male genitalia of *R. longicornis***.** However, that figure does not exist. The Figure 18 provided relates to molecular data. **Illustrations of the adult insect:** a male from the Aegean island of Lesvos is illustrated in colour in Speight and de Courcy Williams (2021).

Riponnensia morini Vujić, 1999
Preferred environment: forest/freshwater; near limnocren springs/small streams or small marshy areas in humid secondary forests of *Castanea sativa* with *Laurus nobilis* (A.Vujić, pers.comm.) and evergreen oak (*Q.ilex*) forest. **Adult habitat and**

habits: settle in the sun, usually on foliage of large-leaved emergent vegetation and flowers of *Smirnium perfoliatum*; very fast flying (A.Vujić, pers.comm..). **Flowers visited:** *Hedera, Smirnium perfoliatum, Tamarix*. **Flight period:** May, September/November. **Developmental stages:** not described. **Range:** Greece and the Balkans (Montenegro, Serbia); Cyprus; Georgia. This species should be regarded as threatened at the European level (Vujić *et al*, 2001). **Determination:** Bot *et al*., (2023) provide a key for the separation of this species from the other four European *Riponnensia* species, and figure the male genitalia. Vujić (1999b) also figures the male terminalia and provides features for distinguishing both sexes of this species from the closely related *R.dacccordi* and *R.splendens*. **Illustrations of the adult insect:** none known.

Riponnensia splendens (Meigen), 1822
Preferred environment: wetland/forest; fen, also streams, springs and seepages in deciduous forest and scrub, or along hedged, canalised streams in farmland. **Adult habitat and habits:** usually close to slow-moving water; along the margins of forest streams flies in a zig-zag fashion in dappled sunlight, settling on fallen branches and twigs in the sun; in general, flies up to 3m from the ground, but usually within 1m of the ground surface, settling on foliage of bushes or shrubs and frequently visits flowers. **Flowers visited:** yellow composites; white umbellifers; *Lepidium draba, Matricaria, Ranunculus*. **Flight period:** mid June/beginning September. **Developmental stages:** larva described and figured by Maibach and Goeldlin (1994) and Hartley (1961). Hartley's (l.c.) larvae were found in pond mud containing lots of pieces of twig and wood; larvae occur in very shallow, slow-moving water with woody debris, including seepages and ditches. **Range:** from the Netherlands south to N Africa, including Mediterranean islands, e.g. Crete; from Ireland eastwards through much of central and southern Europe into Greece, Turkey, the Crimea and the Caucasus mountains; extremely localised in central Europe. **Determination:** van der Goot (1981); Claussen (1991b); Vujić (1999b); Bot *et al*., (2023) provide a key for the separation of this species from the other four European *Riponnensia* species, and figure the male genitalia. The male terminalia are also figured by Claussen (1991b) and Maibach *et al*. (1994a). In recent literature this species has been referred to the genus *Orthonevra*. In southern Europe, the closely similar *R.daccordii* and *R.morini* could easily be mistaken for *R.splendens*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Stubbs and Falk (1983) and Torp (1994). The male and female are illustrated together, in colour in Pétremand *et al*. (2022).

ROHDENDORFIA

Rohdendorfia is a Palaearctic genus until recently regarded as comprising four species, one of them European. But the revision of the genus by Nielsen and Barkalov (2010) shows that the Asiatic species *R.bactriana* Violovitsh is a synonym of *R.dimorpha*, reducing the known species to three. Thompson and Rotheray (1998) regard *Rohdendorfia* as a subgenus of *Platycheirus*.

Rohdendorfia alpina Sack, 1938
Preferred environment: open ground; alpine rocky moraine and scree slopes, often close to running water (Goeldlin, pers.comm.), or close to glaciers (C.Claussen, pers.comm.) at altitudes from 2500-2800m. **Adult habitat and habits:** rests in the sun on rock-scree and moraine; flies fast and low with a darting flight and settles on rocks immediately the sun is obscured by cloud (C.Claussen, pers.comm.), frequently disappearing into crevices between them (P. Goeldlin, pers.comm.). **Flowers visited:** *Cerastium, Leucanthemopsis alpina, Sedum* (C.Claussen, pers.comm.). **Flight period:** end of June/mid August. **Developmental stages:** larva not described, but incorporated into the keys provided by Rotheray (1994), where it is distinguished from larvae of related genera, based on material collected by Claussen from undersides of morainic rocks (C.Claussen, pers.comm.), where, it seems, the puparia are formed. Claussen (pers.comm.) has also observed oviposition in this species. The female searches for a flat stone that has been grown around by a cushion plant, e.g. *Cerastium*, and then oviposits on the underside of such stones, often disappearing under the stone to do so. **Range:** Alps (France, Switzerland, Austria, Italy); northern edge of the Caucasus mountains and Siberia through to the Far East (Altai), in Russia; Georgia. **Determination:** See generic Key provided in StN Keys volume. Nielsen and Barkalov (2010) provide a key distinguishing *R.alpina* from the other *Rohdendorfia* species and figure the male terminalia. Claussen (1988) also figures the male terminalia. In the same paper he establishes that the taxon referred to as *R.hedickei* Reinig, by Peck (1988), is a junior synonym of *Spazigaster ambulans* (Fabricius). **Illustrations of the adult insect:** the male anared female illustrated in colour by Speight and de Courcy Williams (2021) and Van de Meutter (2022).

SCAEVA

The European species of *Scaeva* have recently been revised by Dusek and Laska (1985). This has resulted in recognition of the fact that, in much of Europe, two species have been confused under the name *S.selenitica* (Mg.). The five European species currently recognised may be identified using the keys of Dusek and Laska (1985) and Speight et al.(1986). Kuznetsov (1985) also purports to provide a revision of Palaearctic *Scaeva*. Because his text does not refer to that of Dusek and Laska (1985), or vice versa, and very different species concepts are employed in the two papers, there is potential confusion over which species concepts to use. The species name *montana* Violovitsh, used by Kuznetsov (1985), is shown by Dusek and Laska (1985) to be a synonym of *latimaculata* (Brunetti). Further, Dusek and Laska (l.c.) show that the extent of pale abdominal markings in *S.selenitica* is controlled by the temperature at which the larvae develop, making Kuznetsov's new European species *baltica* and *rossica* seem to be no more than temperature-controlled variants of *S.selenitica*. The status of *caucasica*, the other new European species described by Kuznetsov (1985) is less clear. In this account the species concepts of Dusek and Laska (1985) are followed.

Scaeva albomaculata (Macquart), 1842
Preferred environment: open ground; hedgehog heath; xeric/semi-arid grassland. **Adult habitat and habits:** no data. **Flowers visited**: *Quercus coccifera* (Ssymank, 2012); *Cynodon dactylon* (Esquembre & Marcos-Garcia, 2022), *Cytisus, Senecio, Thapsia*. **Flight period:** mid June/beginning September (throughout the year in the Canary Isles). **Developmental stages:** puparium described by Kuznetzov and Daminova (1994). Diagnostic features of the last instar larva and puparium are given by Laska *et al*. (2006), who also provide a key separating both larvae and puparia of this species from those of the other *Scaeva* species known from Europe. Rojo and Marcos-García (1998) found the larva among aphids on various herbaceous plants (*Anacyclus, Andryala, Hirschfeldia, Ligusticum, Onopordon)* including crop species of *Beta* and *Vicia*. According to Nourbakhsh *et al*. (2008) the larva forms its puparium in the soil, at a depth of 3-5cm. **Range:** Iberian peninsula and round the Mediterranean basin to Morocco and Egypt; Canary Islands; eastward through southern Russia, the Caucasus and southern Siberia to the far east and northern China; Arabian peninsula; Afghanistan, Mongolia; highly migratory and occasionally reaches as far north as Britain, from which there are two records, from southern England (Palmer, 1996). But such records, like those from most of central Europe, cannot be regarded as indicative of the presence of resident populations. **Determination:** See key provided in StN Keys volume; Dusek & Laska (1985) and Speight et al.(1986). Dusek and Laska (1985) figure the male terminalia. **Illustrations of the adult insect:** Stubbs and Falk (1983) illustrate the adult insect in colour.

Scaeva dignota (Rondani), 1857
Preferred environment: forest; *Pinus* forest, up to the altitude of *P.uncinata* in the Pyrenees, thermophilous *Quercus* (plus evergreen oak forest and maquis, of *Q.ilex* and *Q.suber*), garrigue and mesophilous *Fagus* forest. May also occur in mature, suburban gardens. This species appears to have an affinity for *Buxus* thickets. **Adult habitat and habits:** fast-flying**,** at 1-3 m in open areas and along tracks in forest and garrigue; males hover at up to 5m along tracks etc., in the sun; settles on low-growing plants in the evening, to sun-bathe. **Flowers visited:** white umbellifers and yellow composites; *Euphorbia*, *Prunus padus*. **Flight period:** May to July and beginning August/September in southern Europe. **Developmental stages:** described and figured by Laska *et al*. (2006), who report the larva occurring in the field on fruit trees (*Prunus domestica*, *Prunus dulcis*) and shrubs (*Sambucus nigra*) and also on bean crops (*Vicia fabae*). Esquembre & Marcos-Garcia (2022) record rearing *S. dignota* from larvae on *Euphorbia serrata*. Diagnostic features of the last instar larva and puparium are also given by Laska *et al.*(2006), who provide a key separating both larvae and puparia of this species from those of the other *Scaeva* species known from Europe. However, Laska *et al.*(2006) state that, in respect of *S. dignota* and *S. selenitica*, "except for size differences of microtrichia of the posterior fold, we have been unable to find informative characters to distinguish larvae or pupae of these species". **Range:** there is one record of this species from southern Sweden and another from Denmark. Otherwise it occurs from southern Ireland and Belgium, France (from Brittany southwards) and the Czech Republic south to the Mediterranean (including Crete); from Portugal and Spain eastwards through central (Germany, Switzerland, Austria) and southern Europe to the former Yugoslavia; Greece, Turkey and Georgia; N Africa; Canary Isles. **Determination:** See key provided in StN Keys volume; Dusek & Laska (1985) and Speight *et al.*(1986). Dusek and Laska (1985) figure the male terminalia. **Illustrations of the adult insect:** Torp (1994) and Bartsch *et al.* (2009a) illustrate the male in colour. The male and female are illustratedin colour together in Speight and de Courcy Williams (2021)

Scaeva mecogramma (Bigot), 1860

Preferred environment: *Quercus ilex/Q.suber* forest; *Q.rotundifolia* woodland; western Mediterranean high maquis; olive (*Olea*) and citrus orchards. **Adult habitat and habits:** males hover at 3-6m among open woodland, close to the canopy of an adjacent tree; females fly in dappled sunlight along the edge of evergreen oak forest/maquis, at 2 – 3 metres from the ground. **Flowers visited:** yellow composites. **Flight period:** May/June and August/September. This species can be migratory, occasional specimens occurring far outside its breeding range (e.g. in Scotland). **Developmental stages:** diagnostic features of the last instar larva and puparium are given by Laska *et al.* (2006), who also provide a key separating both larvae and puparia of this species from those of the other *Scaeva* species known from Europe. The larval biology is detailed by Rojo *et al*. (1999), who observed that the larvae are predators of the psyllid *Euphyllura olivina* (Costa) (Aphalaridae: Homoptera) on olive trees (*Olea*). Psyllid numbers peak in spring and autumn and *S. mecogramma* larvae are present within the psyllid colonies during both periods. The larvae become totally covered in the waxy secretions of the psyllids. Larval development is very rapid, taking only 2 weeks and the adult fly emerges after a further two weeks in the puparium. Females of *S. mecogramma* have been observed searching among the foliage of *Phillyrea latifolia* (a Mediterranean understorey tree also of the same plant family as the olive), though oviposition was not confirmed. The psyllid *E. olivina* also lives on *Phillyrea latifolia* and *S. mecogramma* larvae may do likewise. Indeed, there are three *Euphyllura* psyllids on olive trees, *E. olivina, E. phillyreae* Foerster and *E. straminea* Loginova. As its name suggests, one of the hosts of *E. phillyreae* is also *Phillyrea*. Given the heavy, repeated, insecticidal treatments to which commercial olive orchards are subjected, in attempts to prevent infestation of olives by the olive fly (*Bactrocera oleae* (Rossi)), it is perhaps unsurprising that *Scaeva mecogramma* is not today an abundant insect in olive-growing regions. It may depend more on organic olive orchards and *Phillyrea* scrub for its survival. **Range:** Spain, southern France, Corsica, Italy, Switzerland. **Determination:** see StN Key to Genera and the key to *Scaeva* species provided in the StN Keys volume. Dusek and Laska (1985) figure the male terminalia. Vockeroth (1969) remarks of this species that it "is unknown to me", adding that he could not "definitely place" it, and suggesting "it may be a species of *Metasyrphus* with haired eyes". In the keys to Syrphini in Vockeroth (1969), *Scaeva mecogramma* does not key out to *Scaeva.* Separation of *Scaeva* species from those of other genera of Syrphini in Vockeroth and Thompson (1987) and Thompson and Rotheray (1998) is based on the same features as those used in Vockeroth (1969), so in the latter two sets of keys *Scaeva mecogramm*a does not key out to *Scaeva*, or to any other genus. *Scaeva mecogramma* could not be keyed satisfactorily to any genus in earlier versions of the StN Key to Genera either, since it is based primarily on Thompson and Rotheray (1998). It is now keyed out separately in the StN Key to Genera, under its own name. Since Vockeroth (1969) remarked on the uncertain affinities of *S. mecogramma,* this issue seems to have been ignored. Genetic characterisation of the species could be expected to help in defining its relationships. But it does not seem to have been included in any molecular taxonomic works, such as that of Ståhls et al.(2003). Laska et al.(2006) discuss relationships between some other European *Scaeva* species, based on genetic information, but not *S. mecogramma*. Indeed, they make no comment whatever on the affinities of *S. mecogramma*. Dusek and Laska (1985) select the postero-lateral continuity between the upper and lower hair patches on the sternopleuron (first referred to by Vockeroth, 1969) as the sole feature diagnostic of *Scaeva*, and it is only in this feature that *S.mecogramma* more closely resembles *Scaeva* than *Betasyrphus*. That is not to say that continuity between the sternopleural hair patches is unique to *Scaeva*. This feature also occurs in other genera, such as *Dasysyrphus.* In its densely pruinose (and entire) pale bands on tergites 3 and 4 of the abdomen, and in the dense microtrichial coverage of the apical half of the wing, *S.mecogramma* more closely resembles *Betasyrphus* than *Scaeva*. Further, the male of *S.mecogramma* lacks an area of larger ommatidia on the compound eyes, as do *Betasyrphus* species, in contrast to *Scaeva* species, in which a well-differentiated area of enlarged ommatidia is present. Indeed, the male of *S.mecogramma* is so similar to that of *Betasyrphus serarius* (Wiedemann) that the two are difficult to distinguish. It remains to be seen what genetic investigation of *S.mecogramma* might reveal. If *S.mecogramma* were to be consigned to *Betasyrphus* it would be the only European species in that genus, although two other *Betasyrphus* species occur in the Mediterranean basin, and a third (*B.serarius*) occurs in eastern parts of the Palaearctic. **Illustrations of the adult insect:** Stubbs and Falk (1983) illustrate the adult insect in colour. The female isillustrated in colour by Speight and de Courcy Williams (2021).

Scaeva pyrastri (L.), 1758

Preferred environment: it is not possible to define preferences for this highly mobile species, which seems to exploit concentrations of aphids wherever it finds them. It is to a significant extent anthropophilic, occurring in arable crops, hedgerows, orchards, gardens and conifer plantations. **Adult habitat and habits:** clearings, tracksides, hedgerows, gardens etc. etc.; fast flying, usually within 3m of the ground; frequently encountered flying round bushes and shrubs, in a slow and purposeful manner, only to speed away after 30 seconds or so. **Flowers visited:** Umbelliferae; *Calluna, Campanula*

rapunculoides, Cirsium, Convolvulus, Eschscholzia californica, Euphorbia, Hamamelis, Leontodon, Ligustrum, Lycium chinense, Parnassia, Pulicaria disenterica, Rubus fruticosus, R.idaeus, Senecio, Solidago virgaurea, Tripleurospermum inodorum, Ulmus (see extended list in de Buck, 1990). **Flight period:** February/November in most of continental Europe. Females are known to overwinter in central Europe, but there is little evidence for this in Atlantic parts of Western Europe, where the annual occurrence of *S.pyrastri* may well be totally dependent upon annual immigration from elsewhere and records of the adult insect are almost entirely confined to the period June/September. **Developmental stages:** larva described and figured by various authors, e.g. Bhatia (1939), who also describes the egg. Diagnostic features of the last instar larva and puparium are given by Laska *et al*. (2006), who also provide a key separating both larvae and puparia of this species from those of the other *Scaeva* species known from Europe. The larva is aphid feeding on a wide range of aphids on low-growing plants, bushes and shrubs, including various ruderals and many crops. The larvae are also reported as predators of aphids on apple trees in orchards (Stanić, 2024). Rojo and Marcos-García (1998) list herbaceous plant genera on which larvae of this species have been found in Portugal and/or Spain. Rotheray (1994) and Dussaix (2013) illustrate the larva in colour. Overwintering in this species apparently occurs as a puparium (Kantyerina, 1979) in the grass-root zone or on trees. In non-overwintering puparia, Dussaix (2013) reports that duration of the puparial phase is 10 days and shows the puparium in colour. Barkemeyer (1994) reviewed what was then known of the biology of this species. In an extensive study of *S. pyrastri* under laboratory conditions Palial *et al*. (2022) report larval development taking 9 days on a diet of cabbage aphids (*Brevicoryne brassicae*), during which a larva consumed more than 370 aphids, the puparial phase lasting 19 days, the adult female living for an average of 19 days, and the male 15 days. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** Fennoscandia south to Iberia, the Mediterranean, Canary Isles and N Africa; from Ireland east through much of Europe and Asia Minor into European Russia; through Siberia from the Urals to the Pacific coast (Kuril Isles); India; China. This is an extremely migratory species, and occasional records from offshore islands of northern Europe, such as the Faroes (Jensen, 2001) are almost certainly derived from seasonal immigration, rather than a resident population. **Determination:** See key provided in StN Keys volume; Dusek & Laska (1985), Speight *et al*. (1986). The male terminalia are figured by Dusek and Laska (1985), Hippa (1968b) and Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Colyer and Hammond (1951), Kormann (1988), Stubbs and Falk (1983) and Torp (1994) etc.

Scaeva selenitica (Meigen), 1822

Preferred environment: forest; montane *Picea* forest; most types of deciduous forest, including scrub woodland and orchards, plus evergreen *Quercus ilex* forest in southern Europe. **Adult habitat and habits:** clearings, tracksides etc.; fast-flying, making a distinctive, high-pitched whine while investigating flowers etc.; usually flies within 3m of ground; settles on foliage of bushes and shrubs in the evening, to sun itself; males hover at 2 - 4m in clearings. **Flowers visited:** white umbellifers; *Buxus, Erica, Hamamelis, Leontodon, Ligustrum, Origanum, Polygonum, Ranunculus, Salix, Sarrothamnus, Taraxacum, Tussilago, Viburnum opulus*. **Flight period:** March/September over much of Europe, but June/September in montane regions and cooler climatic zones. In central Europe, adults have been reported feeding at flowers in February (e.g. Schedl, 1992), and although there do not seem to be unequivocal reports of adult flies of *S.selenitica* found hibernating it is almost certain that they do hibernate, probably at some height above the ground in chinks and crevices in bark of standing trees and in splits and cracks in broken branch ends attached to trees or similar splits and cracks in wooden beams of old farm out-buildings. **Developmental stages:** the existing descriptions of the larva of this species all predate reinstatement of the closely similar *S. dignota* as a distinct (and widely distributed) European species, and could thus be based on either *S. dignota* or *S. selenitica*. But the description provided by Dixon (1960) has the virtue that it is based on material from part of Europe (Britain) where *S. dignota* did not at the time seem to occur and can thus be presumed to refer to *S. selenitica*. Even though diagnostic features of the last instar larva and puparium of this species have more recently been given and figured by Laska *et al*. (2006), who also provide a key separating both its larvae and puparia from those of the other *Scaeva* species known from Europe, it is apparent that the developmental stages of *S. dignota* and *S. selenitica* remain virtually indistinguishable (see under *S. dignota*). Speight *et al*. (1986) also figure features of the puparium. The larva is aphid feeding, on shrubs and trees; Kula (1982) reports larvae of this species as overwintering among leaf litter of the floor of spruce (*Picea*) forest. **Range:** from Fennoscandia and the Faroes (Jensen, 2001) south to Iberia and the Mediterranean, including N Africa; from Ireland eastwards through much of Europe into Turkey and European parts of Russia; from the Urals through Siberia to Cis-Baikal and on to Sakhalin and the Kuril Isles. **Determination:** See key provided in StN Keys volume; Dusek & Laska (1985); Speight *et al*. (1986). Until recently, this species has been confused with *S. dignota* (Rond.) in southern Europe and Asia. The male terminalia are figured by Dusek and Laska (1985). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994).

SERICOMYIA

In much recent literature, including earlier versions of the StN Species Accounts, *Arctophila Conosyrphus* and *Sericomyia* have been treated as separate genera. In Meigen's original concept of *Sericomyia*, European species subsequently segregated in *Arctophila* were included. Esentially, the only difference between *Arctophila* species and *Sericomyia* species is that the former are *Bombus* mimics, while many of the latter are generalised wasp mimics. Hull (1949) seems to have been the first author to regard *Conosyrphus* as a subgenus of *Sericomyia*. The only difference cited by authors, as a means of separating *Conosyrphus* from *Sericomyia*, is the extent to which the face extends antero-ventrally. *Arctophila* and *Conosyrphus* were finally, formally synonymised under *Sericomyia* by Skevington and Thompson (2012). There are three known *Sericomyia* (*Arctophila*) species. One of them, *S.bequaerti* (Herve-Bazin), is so far known in Europe only from the south east (Balkans, Caucasus and Turkey) and is omitted from mention in nearly all European literature. Only two *Sericomyia* (*Conosyrphus*) species have been described, both of them Palaearctic. Five of the European *Sericomyia (Sericomyia)* species are treated by Nielsen (1997) and Bartsch et al.(2009b). Two additional species, *S.hispanica* Peris Torres and *S.undulans* (Gaunitz), are referred to by Peck (1988). Torp (1994) established that *undulans* is a synonym of *lappona*. The European *Sericomyia* species, including those previously referred to *Arctophila* and *Conosyrphus*, may be separated using the key provided in the StN Keys volume.

Sericomyia arctica Schirmer, 1913.
Preferred environment: forest/wetland; beside pools in humid *P.sylvestris* forest/taiga and forested bog and in tundra. **Adult habitat and habits:** no data. **Flowers visited:** *Achillea millefolium, Rubus chamaemorus* (Tore Nielsen, pers.comm.). **Flight period:** end June/July. **Developmental stages:** undescribed, but probably associated with small pools. **Range:** a circumpolar species from northern parts of Fennoscandia, Siberia and N America (Yukon). **Determination:** See key provided in StN Keys volume; Nielsen (1997) and Skevington and Thompson (2012) figure the male terminalia; Bartsch et al.(2009b). **Illustrations of the adult insect:** The adult insect is illustrated in colour by Bartsch et al.(2009b); Haarto & Kerppola (2007) and Skevington *et al.* (2019).

Sericomyia bequaerti (Hervé-Bazin), 1913
Preferred environment: open ground; subalpine zone; margin of high-altitude *Betula/Picea* forest (Vujić, M. *et al.*, 2016). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June **(**Hervé-Bazin, 1913), August (Zimina, 1960), October (Vujić, M. *et al.*, 2016). **Developmental stages:** not described. **Range:** Albania, parts of the former Jugoslavia, Bulgaria, Greece, Turkey, Armenia, Ukraine, Georgia. **Determination:** See Key provided in StN Keys volume. Hervé-Bazin (1913) describes the species and figures the male terminalia. **Illustrations of the adult insect:** a photo in colour, of the male, is provided by Vujić, M. *et al.* (2016).

Sericomyia bombiforme (Fallén), 1810
Preferred environment: forest/freshwater; close to streams (including temporary streams) or flushes in *Fagus/Picea* forest and upwards into subalpine grassland. **Adult habitat and habits**: clearings, tracks, streamsides. **Flowers visited**: yellow composites; umbellifers; *Carduus, Cirsium, Echium vulgare, Knautia, Succisa, Trifolium, Verbascum*. **Flight period**: May/August (June/July at high altitudes). **Developmental stages:** undescribed. A female has been observed egg-laying in moss at the margin of a forest stream (Van Steenis et al., 2013). **Range**: Scandinavia plus mountainous parts of much of Europe, including the Pyrenees, the Alps, Apennines and Balkans and various mountain ranges in Spain. Also known from Crete and Turkey. **Determination**: See Key provided in StN Keys volume. The adult insect resembles bumblebees of the *Bombus lucorum* group. **Illustrations of the adult insect:** the male is figured in colour (as *Arctophila bombiforme)* in Bartsch *et al.* (2009b), Torp (1984, 1994) and van der Goot (1986). As *Sericomyia bombiforme* the female is illustrated in colour by Speight and de Courcy Williams (2021).

Sericomyia hispanica Peris Torres, 1962
Preferred environment: forest; deciduous forest; open areas with streams and flushes in humid *Fagus* forest; *Pinus sylvestris* forest in north Spain (S. Rojo, *pers. comm.*). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March-July. **Developmental stages:** not described. **Range: Portugal,** Spain, France (Pyrenees - see Speight,

2007a). **Determination:** See key provided in StN Keys volume. In the key provided by Nielsen (1997) *S. hispanica* would key out as *S. lappona*, but in general appearance looks almost exactly like *S. silentis*, with which it would be confused in the field. It may be separated from that species by the black tip to the abdomen (the hypopygium is black in the male, tergite 5 is black in the female) - in *S. silentis* the tip of the abdomen is consistently yellow. *S. hispanica* differs from *S. lappona* in having entirely yellow front femora - in *S. lappona* the front femora are black-marked, especially on the postero-lateral surface, and may even be almost entirely black. The pale marks on the tergites also occupy a greater proportion of the length of each tergite in *S. hispanica* than in *S. lappona*. At a point half way between the mid-line and the lateral margin of the tergite, the pale marks on tergite 3 occupy more than one third of the length of the tergite in *S. hispanica*, whereas in *S. lappona* they occupy less than one third of the length of the tergite. There are differences in the male terminalia, figured for the surstyli by Peris (1962). In the female, the median black mark on the face is (at its maximum width) less than one third of the width of the face (between the eyes), whereas in *S. lappona* this stripe is more than one third of the width of the face. *S. hispanica* may be separated from both *S. lappona* and *S. silentis* using the key provided in the StN Keys volume. **Illustrations of the adult insect:** a coloured photo of *S. hispanica* is provided by Van Eck (2011).

Sericomyia jakutica (Stackelberg), 1927
Preferred environment: tundra; palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Developmental stages:** not described. **Range:** Norway; Sweden; northern Finland; Siberia; Alaska (USA) and Canada in the Nearctic. **Determination:** See key provided in StN Keys volume; Nielsen (1997) and Skevington and Thompson (2012) figure the male terminalia; Bartsch et al.(2009b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b); Haarto & Kerppola (2007) and Skevington *et al*.(2019).

Sericomyia lappona (L.), 1758
Preferred environment: wetland/forest; fen, bog and boggy stream margins within acidophilous *Quercus* forest, Salix carr, swamp *Betula/Pinus* forest and moor. **Adult habitat and habits:** clearings, tracksides, streamsides; flies at up to 3m from the ground. **Flowers visited:** *Caltha, Cardamine, Cirsium, Crataegus, Ligustrum, Ranunculus, Rubus fruticosus, Sorbus aucuparia, Taraxacum, Vaccinium myrtillus.* **Flight period:** May/September, with peak in May/June (June/July at higher altitudes/more northerly latitudes). **Developmental stages: larva** described and figured by Hartley (1961) and illustrated in colour (from a preserved specimen) by Rotheray (1994); aquatic. **Range:** from Iceland, Fennoscandia and the Faroes (Jensen, 2001) south to the Pyrenees; from Ireland eastwards through northern, central and southern Europe (northern Italy, the former Yugoslavia) into European parts of Russia; through Siberia to the Pacific coast (Sakhalin Is.). **Determination:** See key provided in StN Keys volume. Nielsen and Vockeroth (2000) provide a figure of the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Sericomyia nigra Portschinsky, 1873
Preferred environment: forest/wetland; humid, open areas within boreal coniferous and deciduous forest, plus western taiga; humid, seasonally-flooded grassland (H.Bartsch and T.R.Nielsen, pers.comm.). **Adult habitat and habits:** in clearings and along tracks in woodland; settles on low-growing vegetation and the foliage of shrubs and small trees, at up to 3m from the ground (H.Bartsch pers.comm.). **Flowers visited:** umbellifers; *Achillea, Malus, Pyrus, Rosa, Rubus idaeus, Taraxacum, Tilia, Valeriana sambucifolia* (pers.comm. H.Bartsch and T.R.Nielsen); umbellifers, *Crataegus, Prunus padus, Vaccinium* (Nilsson *et al*, 2012). **Flight period:** beginning June/mid August. **Developmental stages:** not described. **Range:** from northern Norway south to southern parts of Norway, Sweden and Finland; northern parts of European Russia and on into Siberia; Alaska and Cananda in the Nearctic. **Determination:** See key provided in StN Keys volume; Nielsen (1997); Bartsch et al.(2009b). The male terminalia are figured by Skevington and Thompson (2012). This species is also included in the keys provided by van Veen (2004). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*.(2009b); Haarto & Kerppola (2007) and Skevington *et al*.(2019).

Sericomyia silentis (Harris), 1778
Preferred environment: wetland/forest; wet moorland, valley bog, fen and *Alnus/Salix* carr; along streams in humid coniferous and deciduous forest; palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** flies within 3m of the ground, tracksides and along streams in woodland; in moorland or heath may be found far from water; often settles on

foliage of low-growing plants or bushes, and on the ground in the vicinity of water. **Flowers visited:** yellow composites; white umbellifers; *Calluna, Filipendula, Knautia, Ligustrum, Polygonum cuspidatum, Ranunculus, Rubus fruticosus agg., Salix repens, Sorbus aucuparia, Succisa,* etc. **Flight period:** end May/beginning October. **Developmental stages:** larva not described, but has been found in old, wet bark and wood fragments and saw-dust on an old forest sawmill site and from humus-rich mud in an acid fen flush. Also found by Bloomfield (1897) in the bottom of a water-filled ditch draining an exploited peat bog. The morphology of the chorion of the egg is figured by Kuznetzov (1988). **Range:** from Fennoscandia south through mountainous regions to Portugal, Spain and the Pyrenees; from Ireland eastwards through northern Europe and mountainous parts of central Europe (this species is very local in the Alps) into Russia (and the Caucasus) and on to the Pacific coast and Japan. **Determination:** see key provided in StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Sericomyia superbiens (Muller), 1776
Preferred environment: wetland/forest; near springs, wet flushes and streams, usually in poorly-drained deciduous (*Alnus/Salix/Quercus* or *Salix/Betula*) or coniferous (*Pice*a) woodland, e.g. Alnus/*Salix* woods along streams, but can be found by wet flushes and along streams in subalpine grassland. **Adult habitat and habits:** flies at all heights between tree canopy and ground level; settles on the foliage of trees and bushes, often at some metres from the ground; visits low-growing flowers beside woodland paths and alongside streams etc., but rarely in open ground; shows some preference for pink flowers. **Flowers visited:** white umbellifers; yellow composites; Centaurea, *Cirsium vulgare, Mentha aquatica, Ranunculus, Rubus, Scabiosa, Succisa pratensis, Sonchus.* **Flight period:** end July/October with peak in August; essentially a late summer/autumn insect. **Developmental stages: larva** undescribed, but almost certainly aquatic/subaquatic among organic debris in semi-liquid mud close to streams and springs. Stubbs and Falk (1983) report that "A female was seen ovipositing in deep, water-filled hoof prints along a shaded muddy path by a stream". **Range:** Scandinavia south to the Pyrenees; Ireland east through central and southern Europe (northern Italy) into European parts of Russia; south of northern France largely confined to mountain ranges. A rapid decline of this species has been noted since 1950 in Belgium (Verlinden and Decleer, 1987) and Denmark (Torp, 1984). **Determination:** see Key provided in StN Keys volume. In Scandinavia, the British Isles and France to as far south as the Massif Centrale, this species resembles *Bombus pascuorum* (Scop.). In the Pyrenees and Alps occurs a form in which the hair covering of the head, thorax and abdomen is bright ginger, more closely resembling some varieties of *Bombus muscorum* (L.). **Illustrations of the adult insect:** the form of the adult insect mimicking *Bombus pascuorum* is figured in colour in Bartsch et al.(2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Sericomyia tolli (Frey), 1915
Preferred environment: open ground/wetland: tundra/bog. **Adult habitat and habits:** no data. **Flowers visited:** *Pachypleurum alpinum, Valeriana capitata* (Barkalov, 2012). **Flight period:** July. **Developmental stages:** features of the larva and puparium are illustrated and described by Kuznetzov and Kuznetzova (1995), from material collected from a peat bog hummock. **Range:** Siberia, including, supposedly, northern parts of European Russia, but not listed for European Russia by Barkalov and Mutin (2018). **Determination:** see key provided in StN Keys volume. In most recent literature this species has been treated as a member of a separate genus, *Conosyrphus*. This species is sexually dimorphic. **Illustrations of the adult insect:** Skevington and Thompson (2012) provide a coloured illustration of the male and female.

Sericomyia volucellina Portschinsky, 1881
Preferred environment: montane/subalpine species, occuring at 1700 – 2000m. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/August. **Developmental stages:** not described. **Range:** Georgia, Armenia, Turkey. **Determination:** see key provided in the StN Keys volume. In most recent literature this species has been treated as a member of a separate genus, *Conosyrphus*. **Illustrations of the adult insect:** none known.

SIMOSYRPHUS: see under ***ISCHIODON***

SPAZIGASTER

There is only one European species in this genus. The genus is not mentioned in the keys in van der Goot (1981), but is keyed out by Sack (1930-32). Claussen (1987) provides a key to separate *Spazigaster* from related genera. Thompson and Rotheray (1998) regard *Spazigaster* as a subgenus of *Platycheirus*.

Spazigaster ambulans (Fabricius), 1798
Preferred environment: scrub/freshwater edge; *Alnus viridis* thickets in particular, along seepages and streams in poorly-drained, unimproved, calcareous and non-calcareous subalpine and montane grassland to above 2500m: alpine glacier floodplains; can occur in riverside/streamside situations at lower altitudes in the Alps, down to 450m. **Adult habitat and habits**: usually along streams. Both sexes fly low with a curious zig-zag flight reminiscent of certain ichneumonids, and on landing run in a hesitant way as do many ichneumons. The males hover at 1-3 metres and descend to rest on foliage of large-leaved bushes (e.g. *Alnus viridis*) or umbels. Males tend to fly around the edge of stands of bushes, while the female is more secretive, flying within the vegetation. **Flowers visited**: Umbelliferae; *Galium, Parnassia, Salvia, Sambucus ebulus, Saxifraga aizoides.* **Flight period**: end June/mid August. **Developmental stages:** undescribed. The marked association between this insect and thickets of low, water-side shrubs is a strong indication that *Spazigaster* larvae inhabit these thickets. It is to be expected that they predate plant bugs, or similar insects, living somewhere in these thickets. However, the larvae could be located mostly on twigs or other woody parts rather than on the foliage and may well have some particular relationship which results in the observed restriction of *S.ambulans* to higher altitudes/colder locations, within its geographic range. **Range**: Schwarzwald (Germany), Alps, Apennines, Hungary, northern parts of the former Yugoslavia, the Carpathians, the Caucasus and Turkey (where it is widespread and abundant in the mountain ranges: J.A.W.Lucas, pers.comm.). **Determination**: See generic Key provided in StN Keys volume, Sack (1930-32), Bradescu (1991) and Claussen (1987). In life, the abdomen of both the male and female may be orange, dull in the male, but shining in the female. The male may also be almost entirely black in life. Once dead, the orange colouration fades almost completely in the male, which then always appears unicolourous black, while the female retains its orange abdomen. The male terminalia are figured by Dusek and Laska (1967). **Illustrations of the adult insect:** the male is illustrated in Speight and Lucas (1992) and in colour by Speight and De Courcy Williams (2016, 2021). A colour photo of the female, in vivo, can be seen at https://www.inaturalist.org/observations/132992768.

SPHAEROPHORIA

There are 20 species of *Sphaerophoria* listed from Europe in Peck (1988) and a further 7 species have been added subsequently. The identity of one of the European species, *S.pictipes*, Boheman, which was described from a melanoid intersex specimen (Bartsch et al, 2009) may never be established. Most of the European species can only be determined with certainty in the male sex, from examination of the male terminalia. The most comprehensive keys to males of European *Sphaerophoria* species (based very largely on features of the terminalia) are those provided by Haarto and Kerppola (2007a), Bartsch et al.(2009a) and van Veen (2004).

Sphaerophoria abbreviata Zetterstedt, 1859
Preferred environment: forest/open ground; grassy open areas in western taiga forest. and dwarf-scrub tundra. **Adult habitat and habits:** no data. **Flowers visited:** *Rubus chamaemorus* (Nielsen, 1998); *Caltha, Ranunculus, Taraxacum* (Bartsch et al.(2009a). **Flight period:** mid June/July. **Developmental stages:** not described, but according to Skevington *et al.*(2019), larvae have been found feeding on aphids on rye (*Secale cereale*). **Range:** Greenland (Haarto and Koponen, 2003), northern Norway, Sweden and Finland; Asiatic Russia; Nearctic. **Determination:** Goeldlin (1989) re-describes the species and figures the male terminalia. The male terminalia are also figured by Haarto and Kerppola (2007a) and Bartsch et al.(2009a). The only keys in which *S.abbreviata* appears are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). References to *S.abbreviata* from prior to 1989 must be regarded as suspect, due to potential confusion with other, then undescribed species. **Illustrations of the adult insect:** Bartsch *et al*. (2009a) provide illustrations in colour of the male and of the female abdomen.

Sphaerophoria bankowskae Goeldlin, 1989
Preferred environment: forest/open ground; herb-rich, ephemeral open areas (small, clear-felled areas of c. 0.5 ha within forest, colonised by tall ruderal vegetation) within *Fagus/Picea* forest and upwards through the *Picea* belt to nearly 2000m in unimproved, non-calcareous, alpine grassland, plus taiga in northern Europe. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers, *Hypericum*, *Lactuca*, *Prunella*, *Potentilla*, and *Ranunculus*. **Flight period:** end May/August. **Developmental stages:** not described. **Range:** northern Norway, Sweden, Finland, Denmark, Britain (southern England), France, Germany, Switzerland, Italy; Asiatic Russia to the Pacific coast. **Determination**: Goeldlin (1989), Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a) figure the male terminalia. The species is included in the keys provided by Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994) and Bot and Van de Meutter (2019). Bartsch *et al*. (2009a) provide coloured illustrations of the male and of the female abdomen.

Sphaerophoria batava Goeldlin, 1974
Preferred environment: forest; open areas in humid *Pinus* forest and scrub, up to and including *P.uncinata* forest in the Pyrenees; *Myrica* scrub and mesophilous *Fagus* forest. **Adult habitat and habits:** clearings, tracksides etc., usually in the vicinity of wet flushes etc., but can occur in apparently dry clearings; flies fast through vegetation, within 1m of the ground; settles on foliage. **Flowers visited:** *Calluna vulgaris*, *Euphorbia*, *Pimpinella saxifraga*, *Potentilla erecta*, *Ranunculu*, *Veronicas*. **Flight period:** May/September. **Developmental stages:** not described. **Range:** as yet uncertain, due to confusion with related species until recently, but recorded from Fennoscandia south to the Pyrenees and from Ireland eastwards through central Europe to the Alps (Switzerland, Liechtenstein, Austria). **Determination:** van der Goot (1981) who figures the male terminalia; Speight (1988a). The most comprehensive keys to *Sphaerophoria* species in which *S.batava* is included are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). A useful feature in the identification of the male of this species is that the long hairs on the yellow lateral margins of abdominal tergites 3 and 4 are all, or predominantly black, whereas these hairs are all, or nearly all yellow in the male of *S.taeniata* (this distinction cannot be used for the females). **Illustrations of the adult insect:** the male is illustrated in colour by Haarto and Kerppola (2007a), Bartsch *et al*. (2009a) and Torp (1994). Bartsch *et al*. (2009a) also provide a coloured illustration of the female abdomen.

Sphaerophoria bengalensis Macquart, 1842
Preferred environment: vegetated inland dune systems and the herb-rich vegetation of dry channels of seasonal rivers (M.Ebejer, pers.comm.); semi-arid, herb-rich, sparsely vegetated open ground beside seasonal waterway (Van Steenis *et al*., 2019). **Adult habitat and habits:** flies rather slowly and close to the ground (M.Ebejer, pers.comm.). **Flowers visited:** *Foeniculum*. **Flight period:** April/August; October (Cyprus) (plus January/March in southern parts of its range). **Developmental stages:** undescribed. Rojo *et al*. (2003) report that the larvae are predatory on aphids, psyllids and leidopterous larvae. **Range:** Cyprus; Turkey; southern parts of European Russia to the Caucasus (Georgia, Armenia and Azerbaijan); parts of Asiatic Russia; Iran; Arabian peninsula (Oman, Saudi Arabia),Turkmenistan; Kazakhstan; Pakistan and northern India. **Determination:** Bankowska (1964), where the species is described as *S. turkmenica*, and the male terminalia are figured. *S. bengalensis* appears in recent literature under the name *S. turkmenica*. Ghorphade (2009) established that *turkmenica* is a synonym of *bengalensis*. This species has complete yellow bands across the tergites (including tergite 2) in the male and its terminalia are perhaps most similar to those of *S. potentillae* Claussen, though none-the-less distinctive. This species is not mentioned by either Goeldlin (1989) or Claussen (1984). **Illustrations of the adult insect:** the general appearance of the male of this species can be seen in the coloured photo provided by Smit *et al*. (2017)..

Sphaerophoria boreoalpina Goeldlin, 1989
Preferred environment: open ground; sparsely-vegetated, rocky ground and largely unvegetated moraine in non-calcareous areas, from 2000m upwards in the Alps (P.Goeldlin, pers.comm.); montane tundra and open, sub-alpine *Betula* forest and patchy dwarf *Betula* scrib in Scandinavia; palsa mire (Van Steenis and Zuidhoff, 2013). **Adult habitat and habits:** flies extremely close to the ground (within 5 cm.), in sparsely vegetated terrain (P.Goeldlin, pers.comm.). **Flowers visited:** *Polygonum*, *Rubus chamaemorus* (van Steenis (1998b), *Ranunculus nivalis*, *Trifolium* sp. (P. Goeldlin, pers.comm.), *Bistorta vivipara* (Bartsch *et al*. (2009a); *Sanguisorba*, *Tanacetum* (Barkalov, 2012). **Flight period:** mid June/end August. **Developmental stages:** not described. **Range:** northern Norway, northern Sweden, northern Finland; Alps (France, Switzerland); Georgia; Asiatic Russia (Altai). **Determination:** Goeldlin (1989) figures the male terminalia. The most comprehensive keys to *Sphaerophoria* species in which *S. boreoalpina* is included are those of Haarto and Kerppola (2007a)

and Bartsch *et al*. (2009a). **Illustrations of the adult insect:** Bartsch et al.(2009a) provide coloured illustrations of the male and of the female abdomen.

Sphaerophoria chongjini Bankowska, 1964
Preferred environment: forest/open ground; lowland unimproved dry grassland/scrub and areas of ruderals on well-drained soils in various situations, including at edges of tracks in humid deciduous woodland. **Adult habitat and habits:** flies low among sparse vegetation. **Flowers visited:** umbellifers, *Potentilla, Prunus spinosa*. **Flight period:** mid April/July. **Developmental stages:** not described. **Range:** European range poorly known as yet, but confirmed from Norway, Sweden and Finland and from the Netherlands and Belgium southwards to central France; also central Europe (Germany, Switzerland); Ukraine; Georgia and Asiatic parts of Russia to the Pacific; Japan. **Determination:** the most comprehensive keys to *Sphaerophoria* species in which *S. chongjini* is included are those of Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). These authors also figure the male terminalia. **Illustrations of the adult insect:** Bartsch *et al*. (2009a) provide illustrations in colour of the male and of the female abdomen. A coloured photo of the male is provided by Bot and Van de Meutter (2019).

Sphaerophoria estebani Goeldlin, 1991
Preferred environment: open ground; sparsely-vegetated, non-calcareous boulder fields in the alpine zone, non-calcareous torrent outwash talus in the alpine zone and non-calcareous gravelly/stony areas beside alpine rivers, where *Rumex scutatus* is to be found, from 1700m to above 2000m. **Adult habitat and habits:** flies close to the ground, usually in the immediate vicinity of, or actually within, clumps of *Rumex scutatus*. **Flowers visited:**. *Rumex scutatus*. **Flight period:** July/August. **Developmental stages:** not known. **Range:** Pyrenees (France), Alps (France, Germany, Switzerland). **Determination:** Goeldlin (1991), who figures the male terminalia and provides features distinguishing this species from the closely-related *S.rueppelli* Wied. **Illustrations of the adult insect:** none known.

Sphaerophoria fatarum Goeldlin, 1989
Preferred environment: open ground; ericaceous heath, moor and blanket bog; oligotrophic *Molinia* grassland; unimproved, montane and alpine grassland, plus open areas in western taiga. **Adult habitat and habits:** flies low over ground vegetation and among taller grasses. **Flowers visited:** *Euphorbia hibernica, Potentilla erecta, Ranunculus*, male flowers of *Salix, Sorbus aucuparia, Taraxacum*. **Flight period:** may/June and August/September. **Developmental stages:** not described. **Range:** not yet established, but known from Iceland, Scandinavia and the Faroes (Jensen, 2001) south to Belgium and France (Alps); from Ireland eastwards through central Europe to Switzerland and northern Italy. **Determination:** this species appears under the name *S.abbreviata* (Zett.) in much recent literature. Goeldlin (1989) has shown that *S.abbreviata* is confined to Lapland and that a closely related group of three additional species have been confused with *S.abbreviata*. the most comprehensive keys to *Sphaerophoria* species in which *S.fatarum* is included are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). *S.fatarum* can only with confidence be separated from related species by examination of male terminalia. Figures of the male terminalia are provided by Goeldlin (1989), Haarto and Kerppola (2007a) and Bartsch et al.(2009a). **Illustrations of the adult insect:** the species is illustrated in colour by Torp (1994), Haarto and Kerppola (2007a) and Bartsch *et al*. (2009a). The latter authors also provide a coloured illustration of the abdomen of the female.

Sphaerophoria infuscata Goeldlin, 1974
Preferred environment: open ground; open areas of montane heath and grassland within *Picea/Abies* forest toward its upper limit and on upwards into unimproved, non-calcareous and calcareous alpine grassland. **Adult habitat and habits**: flies fast and low among grasses and ericaceous shrubs etc.. **Flowers visited:** *Asperula, Galium, Meum athamanticum, Potentilla erecta, Stellaria*. **Flight period**: June/July. **Developmental stages:** undescribed. **Range**: Germany (Harz), north-east France (Vosges), Czech Republic (Moravia), Alps (including Switzerland, Liechtenstein, Austria, Italy), Pyrenees; Caucasus (Georgia). **Determination:** Goeldlin (1989), who figures the male terminalia. Indistinguishable from other *interrupta* group species in the field. **Illustrations of the adult insect:** none known.

Sphaerophoria interrupta (Fabricius), 1805
Preferred environment: open ground/wetland; fen, humid, unimproved grassland and grassy woodland clearings; from coastal dune systems to montane *Vaccinium* heath and unimproved alpine grassland in central Europe. **Adult habitat and habits:** flies low through stands of grasses etc. **Flowers visited:** *Achillea millefolium, Meum, Potentilla erecta, Ranunculus*,

Senecio jacobaea, Stellaria, Taraxacum. **Flight period:** May/September (plus April in southern Europe), with peaks in June and end July/August. **Developmental stages:** larva described and its posterior respiratory processes figured, by Rotheray (1987), who found larvae on *Hieracium pilosella* in June and on *Silene dioica* in May. The larva is illustrated in colour by Rotheray (1994). The morphology of the chorion of the egg is figured by Kuznetzov (1988). According to Stubbs (1996) larvae have also been found with aphids on the ruderal *Cerastium fontanum*. **Range:** from northern Fennoscandia south to Iberia and the Mediterranean; from Ireland eastwards through much of Europe into European parts of Russia and the Caucasus; through Siberia to Cis-Baikal. **Determination:** this species is usually referred to in recent literature as *S.menthastri* (L.). Goeldlin (1989) points out that the Linnaean type of *menthastri* cannot belong to the species to which that name has been applied and reinstated the name *interrupta* for *menthastri* sensu auctores nec L. , based on examination of the Fabrician type material of *S.interrupta*. Van der Goot (1981) and Verlinden (1994) figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Bartsch *et al*. (2009a).

Sphaerophoria kaa Violovitsh, 1960
Preferred environment: taiga and open, subalpine birch forest (Bartsch et al, 2009). **Adult habitat and habits:** no data. **Flowers visited:** *Potentilla* (Bartsch et al, 2009). **Flight period:** beginning June/July. **Developmental stages:** not described. **Range:** northern Sweden and Finland, Mongolia and eastern Siberia (Sakhalin, Kamchatka, Kuril islands). **Determination:** this species is included in the keys provided by Haarto and Kerppola (2007a), Bartsch et al.(2009a) and Violovitsh (1986) and its male terminalia are figured by Goeldlin (1989), Haarto and Kerppola (2007a) and Bartsch et al.(2009a). *S.kaa* is a species of the *abbreviata* group, quite closely similar to *S.fatarum*. Goeldlin (1989) details differences between the terminalia of *S.kaa* and *S.fatarum*. **Illustrations of the adult insect:** Bartsch et al.(2009a) provide coloured illustrations of the male and of the female abdomen.

Sphaerophoria laurae Goeldlin, 1989
Preferred environment: open ground; humid, sparsely-vegetated, unimproved, calcareous and non-calcareous alpine grassland from 2000m upwards in the Alps and sparsely-vegetated montane tundra in arctic Scandinavia. **Adult habitat and habits:** flies extremely close to the ground surface (within 5 cm) (P.Goeldlin, pers.comm.). **Flowers visited:** *Nigritella rubra, Potentilla, Ranunculus* (P.Goeldlin, and L.Verlinden, pers.comm.). **Flight period:** July/August. **Developmental stages:** not described. **Range:** arctic Norway and Sweden, Finland, the Alps (France, Switzerland, Italy) and the Pyrenees (France); Caucasus; Russian Far East (Altai). **Determination:** Goeldlin (1989) figures the male terminalia. The most comprehensive keys to *Sphaerophoria* species in which *S.fatarum* is included are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). The female of this species remains difficult to distinguish from females of related species. **Illustrations of the adult insect:** Bartsch et al.(2009a) provide coloured illustrations of the male and of the female abdomen.

Sphaerophoria loewi Zetterstedt, 1843
Preferred environment: coastal lagoons with *Scirpus maritimus* and freshwater lakes with *S.lacustris*; also occasional records from lacustrine *Phragmites* beds. **Adult habitat and habits:** flies within large stands of *Scirpus* in shallow water, which it leaves to visit flowers. It is on the wing early in the morning (from 06.00am) when the *Scirpus* flowers are producing pollen, presumably because the pollen is only available early in the day. **Flowers visited:** white umbellifers; *Butomus, Eupatorium, Filipendula, Lythrum, Persicaria, Ranunculus, Schoenoplectus, Scirpus, Triglochin*. **Flight period:** beginning June/August, and September in southern Europe. **Developmental stages:** not described, but reported by Bartsch et al.(2009a) as having been found on *Phragmites*. **Range:** from Scandinavia south to the Mediterranean (Camargue); from Ireland eastwards through central Europe into European and Asiatic parts of Russia; Kazakhstan, Tajikistan etc. through to Mongolia. **Determination:** the most comprehensive keys to *Sphaerophoria* species in which *S.loewi* is included are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). The male terminalia are figured by Ball et al.(2002). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Torp (1994) and Bartsch et al.(2009a).

Sphaerophoria nigra Frey, 1945
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/September (Rojo et al, 1997). **Developmental stages:** undescribed. **Range:** endemic to the Azores. **Determination:** this species is apparently entirely black, except for the scutellum, which is yellow (Rojo *et al*., 1997). The male terminalia are figured by Vockeroth (1971). **Illustrations of the adult insect:** none known.

Sphaerophoria pallidula Mutin, in Mutin & Barkalov, 1999
Preferred environment: wetland; northern European mire systems within *Picea/Betula* forest (H.Bartsch, pers.comm.); mires with *Caltha palustris* in *Pinus/Betula* swamp forest (A. Haarto, pers.comm.). **Adult habitat and habits:** flies among vegetation at the edges of mires and water bodies (H. Bartsch, pers.comm.). **Flowers visited:** *Cicuta virosa* (H. Bartsch, pers. comm.), *Ledum palustre* (A. Haarto, pers.comm.). **Flight period:** June/July. **Developmental stages:** not described. **Range:** northern Sweden and eastern Finland; throughout Siberia to the Russian Far East. **Determination:** Bartsch (2008) figures the male terminalia and discusses other features separating this species from related species of *Sphaerophoria*. *S. pallidula* is evidently closely similar to *S. taeniata*. Haarto and Kerppola (2009) also figure the male terminalia and provide an extension of their earlier (Haarto and Kerppola, 2007) key to males of Fennoscandian *Sphaerophoria* species, to include *S.pallidula*. Bartsch *et al*. (2009a) include this species is their keys, figure its male terminalia **Illustrations of the adult insect:** Bartsch *et al*. (2009a) provide a coloured illustration of the male and of the female abdomen.

Sphaerophoria philanthus (Meigen), 1822
Preferred environment: open ground; ericaceous heath and moor, oligotrophic *Molinia* grassland, especially in montane situations, partly-drained valley and blanket bog, dune grassland; also western taiga (Nielsen, 1998). **Adult habitat and habits:** flies low over ground vegetation. **Flowers visited:** *Calluna vulgaris, Galium, Hypochoeris, Potentilla erecta, Ranunculus, Salix repens*. **Flight period:** May/September, with peaks in June/July and August. **Developmental stages:** the larva of this species has not been described from European material. However, if it can be established that the N American species currently regarded as *S.philanthus* is indeed con-specific with its European counterpart, then descriptions and information about larval biology are available from N American literature. That literature is summarised by Barkemeyer (1994). The larvae of the N.American *S.philanthus* are aphid predators on crops like *Zea mais* and *Brassica* species - crops whose European distribution does not co-incide at all with the known distribution of *S.philanthus* in Europe. Bagachanova (1990) records rearing *S.philanthus* from larvae collected on *Artemisia* and *Potentilla fruticosa*. She also notes that this species overwinters both as larva and puparium. **Range:** requires to be reinterpreted following description of *S.boreoalpina* (see below). At present, this species is only definitely known from parts of northern, Atlantic and central Europe, from northern Norway south to Germany and from Ireland eastwards to Austria. But it probably ranges through northern parts of the Palaearctic outside Europe and occurs also in the Nearctic. **Determination:** Goeldlin (1989) has shown that, in central Europe, *S.philanthus* is replaced at higher altitudes by a closely similar species, *S.boreoalpina* Goeldlin, and that these two species overlap in their altitudinal range. At present, these two species remain very difficult to separate, except by reference to the male terminalia that are figured by Goeldlin (1989), Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a). However, the keys of Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a) purport to provide for separation of the females. In Fennoscandian populations the pale markings on each tergite (including tergite 2) are evidently normally in the form of an uninterrupted yellow band in the male, whereas in Atlantic Europe it is more usual for each tergite to exhibit a pair of distinctly separated yellow marks. **Illustrations of the adult insect:** *S.philanthus* is illustrated in colour by Torp (1994), Haarto and Kerppola (2007a) and Bartsch *et al*.(2009a). The Fennoscandian form is well shown in the coloured illustrations provided by Bartsch *et al*.(2009a), and the Atlantic form is clearly shown in the coloured figure provided by Ball et al.(2002).

Sphaerophoria pictipes Boheman, 1863
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Developmental stages:** not described. **Range:** Sweden (type specimen) and eastern Siberia (Peck, 1988), but not included as a Siberian species by Violovitsh (1986). **Determination:** the single Swedish specimen on which Boheman (1863) based his description of *S.pictipes* is apparently a melanic intersex specimen, according to Bartsch et al.(2009a), rendering it at present impossible to decide whether or not *pictipes* Boheman is a synonym of some other *Sphaerophoria* name. Under these circumstances the solitary type specimen is the only certain representative of *S.pictipes* that is known – subsequent records of the taxon cannot be relied upon until and unless its separate identity from other *Sphaerophoria* species can established. Bartsch *et al*.(2009a) do not list *S.pictipes* as a Swedish species, effectively relegating *pictipes* Boheman to a status analogous to *nomen dubium*. **Illustrations of the adult insect:** none known.

Sphaerophoria potentillae Claussen, 1984
Preferred environment: wetland/open ground; lagg-edge of low-altitude raised bogs and seasonally-flooded, humid grassland (C.Claussen and S.Ball, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited**: umbellifers; *Achillea*,

Potentilla erecta, Ranunculus. **Flight period:** end May/beginning September. **Developmental stages:** not described. **Range:** Norway (one record), Denmark, the Netherlands, Britain (southern England), northern France (Normandy) and northern Germany. The record for Italy (Delmastro and Sommaggio, 2003) is erroneous, and should be referred to *S.infuscata* (D.Sommaggio, pers.comm.). **Determination:** Claussen (1984) and Speight (1988a) figure the male terminalia, as do Harrto and Kerppola (2007) and Bartsch *et al.*(2009a). Both sexes of *S.potentillae* are included in the keys provided by Harrto and Kerppola (2007) and Bartsch *et al.*(2009a). This small species is indistinguishable from others in the field. **Illustrations of the adult insect:** the adult male is shown in colour by Torp (1994). Bartsch *et al.*(2009a) provide coloured illustrations of the male and of the female abdomen.

Sphaerophoria rueppelli (Wiedemann), 1830

Preferred environment: wetland/open ground; salt-marsh meadow on the Atlantic and Fennoscandian fringes of its range; exposed, vegetated, sand and gravel banks of major rivers; irrigation ditches and dry beds of seasonal rivers (torrents) in southern Europe; cruciferous crops over much of Europe and a wide variety of crops in the Mediterranean basin. **Adult habitat and habits:** flies within 1m of the ground, among low-growing vegetation, especially along the edges of ditches and water courses; in shorter vegetation types (e.g. *Limonium*) this species flies lower, so that it remains within the vegetation cover; as easily detected by use of a sweep net as by direct observation. **Flowers visited:** yellow composites; *Asparagus, Aster, Buxus, Limonium, Matricaria, Polygonum, Ranunculus, Rumex, Sinapis, Tamarix*. **Flight period:** April/October in southern Europe, with most records elsewhere from July/August. **Developmental stages:** larva described and figured by Bhatia (1939); biology detailed by Dusek and Laska (1974) and Marcos-García (1981). A detailed redescription is provided by Orengo-Green *et al*., (2022b), who describe and figure egg, all larval instars and puparium, employing images produced by scanning electron microscope. The larvae are aphid-feeding on herbaceous plants. They have been recorded on commercial crops like *Brassica, Capsicum, Fragaria* and *Nicotiana* and are recognised as biocontrol agents of aphids, in various situations. A list of plants on which *S. rueppellii* larvae have been found in the wild is furnished by Rojo *et al.*(2003). The list includes various tall composites and umbellifers, plus some shrubs (*Cistus, Prunus spinosa*). Esquembre & Marcos-Garcia (2022) record rearing this species from larvae collected on *Nerium oleander*. Amorós-Jiménez *et al.*(2012) provide extensive information on the developmental biology of this species, showing that it can complete a generation (from egg-laying to eclosion of the adult) within 2 weeks, under laboratory conditions. They advocate use of *S. rueppellii* as a biocontrol agent of Mediterranean greenhouse-crop pest aphids. Lloret Climent *et al.* (2014) regard *S. rueppellii* as "the main predatory syrphid in Mediterranean greenhouse crops". Amorós-Jiménez *et al.* (2014) provide information on captive breeding of *S. rueppellii* and show that the types of flower visited for food, by the females of one generation, affect the survival capabilities of the next generation. Orengo-Green *et al.* (2022) show that, over a range of temperatures likely to be experienced under natural conditions, higher temperatures shorten the longevity of the adult insects but increase the number of eggs the female is able to lay per day. **Range:** from southern Norway and Sweden south to N Africa and the Canary Isles; from Ireland east through central and southern Europe, including Greece, Turkey and Mediterranean islands into Asia Minor, Russia and Afghanistan and on to the Pacific coast, China and Korea; in eastern parts of the Afrotropical region south to Kenya. **Determination:** Goeldlin (1992) who figures the male terminalia; Speight (1988a). Discovery by Goeldlin (1992) of the subalpine species *S.estebani*, which is extremely similar to *S.rueppelli* and has been confused with that species in the past, leaves records of *S.rueppelli* from cooler parts of the Alps and the Pyrenees (*S.estebani* has not been found in Northern Europe) open to question. These two species may be separated using the key provided by Goeldlin (1992), but care is required, since the abdomen of *S.rueppelli* is more variable in overall shape than is indicated, so that, in males in particular, the more typical clavate form can be absent. The male terminalia of both *S.rueppelli* and *S.estebani* are figured by Goeldlin (1992). The most comprehensive keys to European *Sphaerophoria* species that include *S.rueppelli* are those of Haarto and Kerppola (2007a) and Bartsch et al.(2009a). **Illustrations of the adult insect:** the adult male is illustrated in colour by Ball and Morris (2013), Stubbs and Falk (1983), Torp (1994) and Bartsch *et al.* (2009a). The latter authors also provide a coloured figure of the abdomen of the female.

Sphaerophoria scripta (L.), 1758

Preferred environment: open ground; grassland up to and including the alpine grassland zone; grassy clearings in dry woodland; heath, garrigue and suburban gardens; salt-marsh; predominantly coastal at the northern edge of its range; further south distinctly anthropophilic, occurring with various crops and along hedges and roadside verges and also collected by emergence traps installed on urban "green roofs" (Passaseo *et al*, 2020). **Adult habitat and habits:** flies low through grasses etc.; settles on vegetation, including grass stems. **Flowers visited:** white umbellifers; *Achillea, Campanula*

rapunculoides, Cirsium arvense, Crataegus, Erigeron, Eschscholzia californica, Euphorbia, Leontodon, Origanum vulgare, Prunus spinosa, Ranunculus, Tripleurospermum inodoratum, Tussilago (see extended list in de Buck, 1990). **Flight period:** April to beginning November (May/September in more northerly latitudes/higher altitudes and probably all the year round in southern Europe). **Developmental stages:** larva described and figured by Goeldlin (1974); aphid-feeding on herbaceous plants, including various crop plants e.g. *Avena, Brassica, Cichorium, Lactuca, Triticum, Vicia*. The larvae are also reported as predators of aphids on apple trees in orchards (Wojciechowicz-Żytko & Wilk, 2023). Overwintering in this species apparently occurs as a puparium (Kantyerina (1979) in the grass-root zone. Barkemeyer (1994) provides a survey of the literature on the biology of this species. The morphology of the chorion of the egg is figured by Kuznetzov (1988). Coloured photos of larva and puparium are provided by Dussaix (2013), who also reports that duration of the puparial phase in this species is 1 week. **Range:** a highly migratory species; southwest Greenland, Iceland and Fennoscandia south to the Mediterranean, the Canary Isles and N Africa; from Ireland eastwards through much of the Palaearctic to the Pacific coast of Asia; Kashmir and Nepal. **Determination:** Haarto and Kerppola (2007a), Bartsch et al.(2009a), whose keys cover both males and females of *Sphaerophoria* species. The male terminalia are figured by various authors, including Vockeroth (1969). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1994) and Bartsch *et al*. (2009a).

Sphaerophoria shirchan Violovitsh, 1957

Preferred environment: open ground/forest; sparsely-vegetated tracksides in *Fagus/Picea* forest upwards into the *Picea* zone. **Adult habitat and habits**: flies low among sparse ground vegetation of tracksides and other open areas within forest. **Flowers visited**: no data. **Flight period**: May/June. **Developmental stages:** undescribed. **Range**: north-east France (Vosges); Belgium (Ardennes); Czech Republic; central and southern Germany (Baden-Wurttemberg, Bavaria); Switzerland; Austria; Ukraine; eastern Siberia, including the Sakhalin peninsula and Kunashir Is. **Determination**: Goeldlin (1991) provides a key to the males and females of *S.rueppelli* group species occurring in Europe, including *S.shirchan*. This species is included in the keys provided by van Veen (2004). Schmid (1992) figures the male abdomen and terminalia of *S.shirchan* and a figure of a surstylus of *S.shirchan* is also provided by Speight (1988a). Until recently, it has been reasonable to assume that the only *rueppelli* group species in Western Europe was *S.rueppelli*. Recognition of the presence of *S.shirchan* and *S.estebani* Goeldlin changes this situation. There are additional *rueppelli* group species known in the eastern Palaearctic. Surstyli of all four Asiatic species are figured (rather crudely) in Violovitsh (1986). *S.shirchan* is a small, dark species, indistinguishable from *interrupta* group species in the field. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019). .

Sphaerophoria taeniata (Meigen), 1822

Preferred environment: forest/open ground; open areas in humid *Fagus* and *Quercus* forest, including scrub and alluvial softwood gallery forest; unimproved humid grassland, especially eutrophic, humid grassland on river floodplains. **Adult habitat and habits:** open areas in woodland, clearings, tracksides etc.; flies low in and out of long grass, sedges etc. **Flowers visited:** yellow composites; white umbellifers; *Circaea, Cochlearia danica, Eupatorium, Galium, Origanum, Potentilla erecta, Ranunculus, Rosa rugosa, Sedum acre*. **Flight period:** May/September, but most records are from June/July. **Developmental stages:** not described, but Hartmann and Duelli (1988) apparently hatched the species from a larva or puparium collected from *Phragmites*. **Range:** most of Fennoscandia south to central France; Britain eastwards through central Europe into Russia and on through Siberia to the Pacific coast (Sakhalin). **Determination:** figures of the male terminalia are provided by various authors, but there is inconsistency in these figures - see, for instance Torp (1994) and Verlinden (1994), whose figures of *S.taeniata* terminalia appear to be drawn from different species. For distinguishing *S.taeniata* from *S.batava* Goeldlin and *S.interrupta* (Fab.), the clearest figures are probably those provided by Bartsch et al.(2009a), van der Goot (1981) and Verlinden (1994). A useful, additional feature is that the long hairs on the yellow lateral margins of abdominal tergites 3 and 4 are all, or predominantly yellow in the male of *S.taeniata*, while in the male of *S.batava* they are all, or nearly all, black (this distinction cannot be used for the females). The keys provided by Haarto and Kerppola (2007a) and Bartsch et al.(2009a) are the most comprehensive including *S.taeniata* and cover both the males and the females. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019). Bartsch *et al*. (2009a) provide coloured illustrations of the male and of the female abdomen.

Sphaerophoria virgata Goeldlin, 1974
Preferred environment: open ground, *Molinia*-heath and moorland, plus heathy open areas within humid forest (*Fagus/Picea* and *Pinus*), up to and including montane heath. **Adult habitat and habits:** sheltered spots beside brooks and standing water, in open areas within forest; flies low among grasses etc. **Flowers visited:** yellow composites; umbellifers; *Calluna vulgaris, Caltha, Filipendula, Fragaria, Galium, Geranium sylvaticum, Meum, Myrrhis, Potentilla erecta, Prunus padus, Rubus chamaemorus, Salix repens, Stellaria, Taraxacum, Tussilago*. **Flight period:** mid May/mid September. **Developmental stages:** not described. **Range:** most of Fennoscandia south to Spain; from Britain eastwards through most of central Europe (including Germany, the Czech Republic, Slovakia, Switzerland, Liechtenstein, Austria) to Roumania; across asiatic Russia to the Russian Far East (Yakutia). The range of this species is not yet adequately known. **Determination:** Haarto and Kerppola (2007a) and Bartsch et al.(2009a), whose keys include figures of the male terminalia and cover both males and females. **Illustrations of the adult insect:** the adult insect is shown in colour by Torp (1994) and Bartsch et al.(2009a). The latter authors figure both the male and the abdomen of the female, in colour.

SPHECOMYIA

Two European species are listed in Peck (1988), both of them occurring primarily in forested northern parts of the continent. Bartsch *et al*. (1998) indicate that European records of one of them, *S. vittata* (Wied.), may be erroneous. The revision of *Sphecomyia* by Moran and Skevington (2019) establishes that *S. vittata* is not known outside the Nearctic region, leaving *S. vespiformis* as the only European *Sphecomyia* species.

Sphecomyia vespiformis (Gorski), 1852
Preferred environment: forest/freshwater; along rivers/streams in *Betula/Pinus* forest (Tore Nielsen, pers.comm.) **Adult habitat and habits:** copulation has been observed on the trunk of *Populus tremula*. **Flowers visited:** *Berberis vulgaris, Hesperis matronalis, Rubus idaeus and Sorbus aucuparia* (Bartsch et al, 1998); *Pimpinella saxifraga, Spirea salicifolia* (Bartsch et al, 2009b). **Flight period:** June/July. **Developmental stages:** not described, but according to Bartsch (1997) probably associated with sap-runs/lesions in the trunk of *Populus tremula*. **Range:** southern Norway to northern Sweden, Finland and Russian Karelia, the Baltic States, Poland and on into Siberia. **Determination:** See generic Key provided in StN Keys volume. Violovitsh (1986) figures the male terminalia and provides a brief account of external morphological features of *S.vespiformis*, but does not distinguish this species from the other supposedly European species, *S.vittata* (Wiedemann). Bartsch et al.(1998) provide a basis for distinguishing between *S.vespiformis* and *S.vittata*. They re-examined all available European material of *Sphecomyia*, and established that all specimens belong to *S.vespiformis*, throwing considerable doubt on the occurrence of the N American *S.vittata* in Europe. **Illustrations of the adult insect:** *S.vespiformis* is illustrated in colour by Bartsch et al.(2009b) and Haarto & Kerppola (2007).

SPHEGINA

The review of European *Sphegina* species provided by Thompson and Torp (1986) was not taken into consideration by Peck (1988), whose literature survey was apparently terminated in 1982, so that the *Sphegina* entries in Peck's volume should be treated with caution. There are now 14 *Sphegina* species known from Europe, plus *S.alaoglui* Hayat, described from Turkey.

Sphegina alaoglui Hayat, 1997
Preferred environment: forest, montane *Picea* forest (Hayat, 1997). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August. **Developmental stages:** not described. **Range:** Turkey; European Russia (Northern edge of the Caucasus); Georgia. **Determination:** see Key to males provided in StN Keys volume. Hayat (1997) describes the species, based on a single male, and figures its terminalia. Mutin (2001b) established that *S.pontica* Mutin is a junior synonym of *S.alaoglui*. Mutin's (1998c) description of *S.pontica* includes figures of the male terminalia, and a summary description of the female. In its general appearance *S.alaoglui* is very similar to *S.elegans*. **Illustrations of the adult insect:** none known.

Sphegina atrolutea Lucas in Thompson & Torp, 1986

Preferred environment: forest/freshwater; close to streams and flushes in humid *Fagus* forest, up to its upper limit, at c1800m, in the Pyrenees (Thompson and Torp, 1986; D. and T.Levy, pers.comm.; J.-P.Sarthou, pers.comm.). **Adult habitat and habits**: can be found flying low, along the edge of small streams (J.-P. Sarthou, pers.comm.), which it seems it may follow for some distance into the open, away from forest. **Flowers visited:** white umbellifers; *Crataegus* (D.Levy, pers.comm.). **Flight period**: June/July. **Developmental stages:** undescribed. **Range:** Pyrenees (France, Spain); also listed for Roumania by Stanescu and Parvu (2005). **Determination:** See Key to males provided in StN Keys volume and Thompson and Torp (1986), who figure the male terminalia. An additional feature of *S.atrolutea*, that can help in determination, is that, in the mid-line, its clypeus is distinctly more than 2x as long as its maximum width, whereas in *S.clunipes* the clypeus is distinctly less than 2x as long as its maximum width. This species is extremely similar in appearance to *S.clunipes*, which may occur in flight with *S.atrolutea*. **Illustrations of the adult insect:** none known.

Sphegina calthae Mutin, 1984

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Caltha palustris var. membranacea* (Mutin *et al*, 2009). **Flight period:** May. **Developmental stages:** not described. **Range:** European Russia and the Russian Far East. **Determination:** see StN key to the males of European *Sphegina* species. Both male and female of this species are described by Mutin (1984), who figures features of the male terminalia. *Sphegina calthae* is also included in the keys in Mutin and Barkalov (1999), where the same figures of its terminalia are reproduced. From an English translation of the original description of *S. calthae* kindly provided by F. Gilbert, based on an editable version of the original Russian kindly provided by V. A. Mutin, an English language version of the original description of *Sphegina calthae* is presented below. Essentially, *S. calthae* is extremely similar to *S. spheginea*, but with much of the sternopleuron undusted and shining, giving it an appearance intermediate between *S. montana* and *S. spheginea*. The face of *Sphegina calthae* is black. Sternite 1 of *S. calthae* is fully sclerotized and sternite 3 of the male is entirely flat, without projections. The male has upstanding black, bristly hairs on the frons, and is without a pointed, apicoventral projection on the hind tibia. Tergite 2 is less than 3 times as long as its maximum width in *S. calthae*, but more than 3 times as long as its maximum width in S. *montana*. Tergite 3 is of different proportions in the males of *S. calthae* and *S. spheginea*. In the male of *S. calthae* tergite three is slightly wider than long, but in males of *S. spheginea* it is longer than wide. Parts of the male terminalia of *S. calthae* are also differently shaped from those of *S. montana* and *S. spheginea*. The female of *S. calthae* is more difficult to recognise. **Illustrations of the adult insect:** none known.

In translation (pers.comm. F. Gilbert and V. A. Mutin) the original description (Mutin, 1984) of *Sphegina calthae* is as follows:

<u>Male</u>

Body length 6 mm, wing length 5 mm. **Head:** the face is black, in light pollen, its width at the level of the antennal socket is 1/5 of the width of the head. The frons and occiput are black, with rather long protruding black hairs, the frons slightly pollinose, its width 1/5 of the width of the head; occiput shiny. The antennae are black, the arista is shortly pubescent. **Thorax:** the mesoscutum is brilliantly black, with thick black dense short semi-adjacent and rare long protruding hairs. Scutellum with long black setae at the rear edge. Pleurites are brilliant black, meso and pteropleura with pale hairs. Wings transparent, the pterostigma light brown, *rm* is located at the level of the end of *sc*, the upper section of *m* flows into *r4 + 5* at an acute angle. Calypters greyish, halteres yellowish. Legs black, except basal part of all femora, and the apex of the front and middle femora, the basal 1/3 and the apex of all the tibiae, are yellow. Hind femur moderately thickened. **Abdomen:** the abdomen is shiny black with reddish bases of tergites III or II, III, sometimes the abdomen is completely black, with short semi-adjacent light and black hairs, with rare long light-coloured hairs on the sides of tergites II and III. Tergite II almost rectangular, its length twice its width; tergite III trapezoidal, width of its posterior margin slightly greater than its length.

<u>Female</u>

Body length 6.5 mm, wing length 6 mm. Face black, with light-coloured pollen. **Head:** frons black, with gray pollen and short light-coloured hairs; its width in relation to the width of the head in the ratio 1: 3.5. Occiput brilliant black, with short light-coloured hairs. Antennae black, arista dark brown, with short hairs. **Thorax:** mesoscutum and scutellum brilliant black, with short adjacent yellow hairs. Scutellum with several black or yellow bristles at the rear edge. Pleurites brilliant black, meso- and pteropleura with short yellow hairs. Wings transparent, pterostigma yellowish-brown, veins in the main part of the wing yellowish. Calypters white, halteres light yellow. The front and middle legs are mostly yellowish-brown with wide dark-brown rings in the middle of the femur and tibia. Hind femur black, with yellow base; base of hind tibia yellow. **Abdomen:**

Abdomen brilliant black, with short adjacent, mainly light-coloured hairs. Tergites II – IV are usually more or less reddish brown at the base. The length of tergite II in relation to the width of its posterior edge in the ratio 3: 4. Width of tergite III at posterior margin twice its length.
Holotype: ♂, Khabarovsk Territory, Pivan, on the flowers of *Caltha membranacea*, 24.V 1979 (Mutin). Paratypes: ibid., 20–28.V 1979, 48♂, 16 ♀.

Sphegina clavata (Scopoli), 1763
Preferred environment: mature deciduous forest/freshwater; along streams in humid *Fagus* forest, up to well within the *Fagus/Picea* zone; riparian *Fraxinus/Alnus/Populus* gallery forest within *Fraxinus/Q.robur* forest; also *Alnus/Populus* forest (Reemer *et al*, 2009). **Adult habitat and habits:** flies along edge of paths/tracks etc., in dappled sunlight, within 1 - 2 metres of ground, often in rather dry woodland. **Flowers visited:** white umbellifers, *Alliaria, Viburnum opulus*. **Flight period:** June. **Developmental stages:** not described, but this species has been reared from larvae found under the bark of a fallen branch of a deciduous shrub (probably *Corylus*) partly submerged in a small woodland stream, together with larvae of *S. verecunda* (van Eck, 2016b). Van Eck's (2016) observations demonstrate that this species overwinters as a larva. **Range:** Netherlands, Belgium, France (Paris basin, Vosges, Alps); the Pyrenees and mountainous parts of central Europe; Italy, Montenegro, Serbia, Slovenia, Greece. **Determination:** See Key to males provided in StN Keys volume. This is the *S.nigra* of Verlinden & Decleer (1987), Reemer *et al*.(2009) and Bot and Van de Meutter (2019) and the *S.miciki* of Vujić (1987). Van der Goot (1981, 1986) did not separate *S.clavata* from *S.verecunda* Collin. Males of *S.clavata* may be distinguished from those of *S.verecunda* using the terminalia figures provided by Thompson & Torp (1986). Although in *S.clavata* the antennae are usually bright orange, contrasting greatly with the brown/black antennae of *S.verecunda*, this feature is not entirely reliable. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided by Vujić et al.(2020d).

Sphegina clunipes (Fallen), 1816
Preferred environment: forest; most types of humid coniferous and deciduous forest. **Adult habitat and habits:** flies up to 2m from ground within woodland, rarely coming out into direct sunlight; can be found in dappled sunlight at the edge of clearings, in glades, along tracks, beside streams etc.; usually near water; visits flowers in the shade, as much as in sunlight. **Flowers visited:** white umbellifers; *Cardamine pratense, Crataegus, Euphorbia, Geranium pratense, G.robertianum, Potentilla erecta, Prunus spinosa, Ranunculus, Rubus fruticosus, Sanicula, Stachys, Veronica.* **Flight period:** May/September, with peaks in May/June and August. **Developmental stages:** described and figured by Hartley (1961), from larvae found in wet, sappy material beneath a patch of wet bark on a living *Ulmus*. Larvae have also been found under the bark of water-logged branches of various deciduous trees and in sap runs on *Quercus*, e.g. by Rotheray (1990a), indicating that this species is not dependent upon sap-runs for larval development. *S.clunipes* has also been collected in emergence traps installed over flushes under the tree canopy of an *Alnus* wood. Rotheray (1994) illustrates the larva in colour. **Range:** from Fennoscandia south to Iberia; from Ireland eastwards through most of Europe into European parts of Russia and the Caucasus; through Siberia to the Pacific coast; Japan. **Determination:** See Key to males provided in StN Keys volume andThompson & Torp (1986), who figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Stubbs and Falk (1983) and Torp (1994).

Sphegina cornifera Becker, 1921
Preferred environment: forest/freshwater: springs and small streams in conifer forest of *Abies/Picea* and upwards into the *Pinus mugo/Alnus viridis* zone and on into subalpine grassland up to 2000m. **Adult habitat and habits**: flies low within streamside vegetation in dappled sunlight, from within *Abies/Picea* forest up into open grassland. In association with streams in open grassland, flies within stands of water's edge *Caltha* etc., especially where an almost complete canopy over the water is provided by such plants. **Flowers visited**: *Myosotis*. **Flight period**: June/July and August at higher altitudes. **Developmental stages:** not described. **Range**: Alps (France, Germany, Switzerland, Liechtenstein, Austria, N Italy - Aosta). Lair *et al*. (2021) record this species from the Spanish Pyrenees. **Determination**: See Key to males provided in StN Keys volume.Thompson and Torp (1986), who figure the male terminalia, but their key does not adequately distinguish the female from that of *S.latifrons*. Separation of the females of these two species, together with females of the closely-related *S.sublatifrons* Vujić and *S.varifacies* Kassebeer, is provided by Doczkal (1995). **Illustrations of the adult insect:** the adult male is figured in black and white by Speight (1988a).

Sphegina dogieli Stackelberg, 1953
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Developmental stages:** not described. **Range:** southern edge of European Russia, on the northern fringe of the Caucasus mountains. **Determination:** Thompson and Torp (1986). This species is known only from the male holotype. **Illustrations of the adult insect:** none known.

Sphegina elegans Schummel, 1843
Preferred environment: humid deciduous forest (*Fagus* and *Quercus*). **Adult habitat and habits:** usually flies in partial shade and near water, beside streams etc.; flies at from ground level up to 3m. **Flowers visited:** white umbellifers; *Crataegus, Ranunculus, Sanicula, Stachys, Valeriana, Viburnum opulus*. **Flight period:** end May/July and August/September, plus April in southern Europe. **Developmental stages:** larva described and figured by Hartley (1961), who found larvae in a sap run on the trunk of a living *Ulmus*. However, whether the sap-run microhabitat is typical or unusual for this species is uncertain. *S.elegans* has also been collected from emergence traps located in the bottom of a ditch containing only bare clay and small woody debris from overhanging trees (*Fagus*), and channelling a winter-flowing temporary stream. **Range:** from Fennoscandia south to the Pyrenees and Spain; from Ireland eastwards through central and southern Europe (northern Italy, the former Yugoslavia, northern Greece) into European parts of Russia to the Caucasus mountains. Also known from Samos island, in the Mediterranean near the coast of Turkey. **Determination:** See Key to males provided in StN Keys volume and Thompson & Torp (1986), who figure the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour, by Bartsch *et al*. (2009b), Torp (1984, 1994) and van der Goot (1986).

Sphegina latifrons Egger, 1865
Preferred environment: forest/freshwater; close to small streams in *Fagus/Picea* forest and upwards through *Abies/Picea* forest into alpine grassland; according to Maibach (1993) as frequently found associated with streams in open areas as within forest and also to be found along drainage ditches associated with wet areas in montane grassland. **Adult habitat and habits:** flies low among streamside vegetation; males can be found flying round fallen trees/logs close to, or partly in, the water. **Flowers visited**: white umbellifers; *Caltha, Chaerophyllum*. **Flight period**: beginning May/end July, with the peak in June; small numbers captured in September/October suggest a partial second generation. **Developmental stages:** not described. **Range:** from Poland south through mountainous parts of Germany and France (Vosges, Massif Central, Alps) to northern Spain; from France eastwards through central Europe (Germany, France, Switzerland, Austria, Czech Republic) to Hungary, Bulgaria and Roumania and on to the Ukraine (Carpathians); also northern Italy and parts of the former Yugoslavia. **Determination:** See Key to males provided in StN Keys volume. Thompson and Torp (1986) figure the male terminalia. However, their key does not satisfactorily deal with the females and two additional European species have been segregated from *S.latifrons* since it was produced: *S.sublatifrons* Vujić and *S.varifacies* Kassebeer. Vujić (1990) details differences between both sexes of *S.latifrons* and *S.sublatifrons* and figures the male terminalia of both species. Kassebeer (1991) does the same for *S.latifrons* and *S.varifacies*, figuring the male terminalia of both. However, the male terminalia of these species are not as diagnostic as one might hope: those of *S.latifrons* and *S.varifacies* can appear well-nigh identical in illustrations. Doczkal (1995) provides a table summarising the distinctions between the females of these three species and *S.cornifera* Becker. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided by Vujić et al.(2020d).**;** http://cyrille.dussaix.pagesperso-orange.fr/

Sphegina limbipennis Strobl, 1909
Preferred environment: deciduous forest; riparian *Fraxinus/Alnus* forest in mesophilous *Fagus* forest. **Adult habitat and habits:** close to streams within forest; flies up to some metres from the ground and visits flowering shrubs and understorey trees to feed; also visits wet rock surfaces to drink. **Flowers visited:** *Euphorbia, Ranunculus ficaria* (Cavailles *et al*, 2019); *Sorbus, Anthriscus*. **Flight period:** mid May/October. **Developmental stages:** not described. **Range:** Portugal; Pyrenees (France and Spain) and northern Spain; mountainous parts of southern France to the Alps and in Brittany. This species seems to be experiencing a sudden expansion of its range: in northern France, where it had never been previously recorded, there is a series of records since 2015 (Cavailles *et al*, 2019). In the south of France, where until recently it was known only from the Pyrenees, it is now known from the Alps (Speight & Lebard, 2020). **Determination:** See Key to males provided in StN Keys volume and Thompson & Torp (1986), who figure the male terminalia. **Illustrations of the adult insect:** the male is illustrated in colour in Speight and Lebard (2018) and a coloured photo of the female in provided in Speight and de Courcy Williams (2021).

Sphegina montana Becker, 1921
Preferred environment: *Fagus/Picea* forest, alluvial hardwood forest and riverine *Fraxinus* forest in the Alps. **Adult habitat and habits:** beside streams and tracks, in semi-shade; flies among low-growing vegetation, up to 2m. **Flowers visited:** yellow composites, white umbellifers; *Fragaria*, *Ranunculus*. **Flight period:** May/June, with peak in June and some females lingering into July. **Developmental stages:** not described. **Range:** Finland, Poland, Germany, Czech Republic, Switzerland, Liechtenstein, Austria, Italy, parts of the former Yugoslavia, Roumania. **Determination:** See Key to males provided in StN Keys volume and Thompson & Torp (1986). The identity of *S.montana*, described by Becker from a female, is not yet certainly decided. The interpretation employed here is that of Thompson and Torp (1986) because their definition of the species is at least precise. Thompson and Torp (l.c.) argue that this is the same species as *S.eoa* Stackelberg, rather than *S.violovitshi* Stackelberg. Stackelberg himself apparently regarded *S.violovitshi* as a synonym of *S.montana*. The situation is further complicated by the fact that the figures of male terminalia provided by Violovitsh (1986) show *S.violivitshi* as possessing the same terminalia as *S.montana* sensu Thompson and Torp. Leg colouration is more variable in this species than is indicated in Thompson and Torp (1986). Essentially, the tibiae and tarsi of the front and mid legs can be almost entirely yellow, as shown in Bot and Van de Meutter (2019). **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019).

Sphegina negrobovi Skufjin, 1976
Preferred environment: open ground/freshwater; beside river in subalpine grassland (Skufjin, 1976). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** southern edge of European Russia, on the northern fringe of the Caucasus mountains. **Determination**: See Key to males provided in StN Keys volume and Thompson and Torp (1986). Skufjin (1976) figures the male terminalia. According to Thompson and Torp (1986) the differences in facial profile and leg colouration alluded to by Skufjin (1976) to separate *S.negrobovi* from *S.spheginea* are not reliable. However, the males of these two species may be separated without difficulty using features of the terminalia. This species is known only from the male holotype. **Illustrations of the adult insect:** none known.

Sphegina obscurifacies Stackelberg, 1956
Preferred environment: forest; southern taiga (Mutin, 2001a). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August (Mutin, 2001a). **Developmental stages:** Mutin (2001) states: "Larvae are found in decayed cambium of trunks and branches of *Alnobetula hirsuta* and *Betula platyphylla*, fallen in the water of forest streams". He also says that they are usually found in small groups, that they overwinter as larvae and that the puparial phase lasts about a week. **Range:** Latvia (published as *S.claviventris*); Lithuania (published as *S.claviventris*); parts of European Russia and the Caucasus; Siberia, Korea. **Determination:** See Key to males provided in StN Keys volume. Both males and females of this species may be distinguished from other members of the Palaearctic *claviventris* group using the key provided by Mutin (2001a), who also figures the male terminalia and points out that in both Thompson and Torp (1986) and Violovitsh (1986) *S.obscurifacies* appears under the name *claviventris* Stackelberg. *S.claviventris* was described from Sakhalin island, on the Pacific coast of Asiatic Russia and is also known from the south-east Pacific coastal region of Russia, in South Primorye (Primorskiy-Kray). Here, it is assumed that any record of *S.clavive*ntris, published for a European locality prior to Mutin's (2001a) paper, is suspect, and probably refers to *S.obscurifacies*. There are no confirmed records of *S.claviventris* from Europe. *S.obscurifacies* sensu Violovitsh (1986) is clearly some other species, though it is not apparent which species it is. The male terminalia of *S.obscurifacies* are figured by Thompson and Torp (1986) (as *S.claviventris*). **Illustrations of the adult insect:** none known.

Sphegina platychira Szilady, 1937
Preferred environment: freshwater/conifer forest; close to flushes and other wet patches in *Abies/Picea* forest from c1000m up into the *Pinus mugo* zone, apparently in non-calcareous areas. **Adult habitat and habits:** flies in and out of the tall ground vegetation of peaty hollows, in open woodland towards the tree line (Maibach, 1993). **Flowers visited:** *Caltha palustris*, *Sorbus aucuparia*. **Flight period:** June/July. **Developmental stages:** not described, but adults have been collected from emergence traps placed in montane flushes (L.Verlinden, pers.comm.). **Range:** Vosges and Massif Central (France), Schwarzwald and Allgauer Alps (Germany), Alps (Switzerland, Austria, Italy); Roumania, Ukraine. **Determination:** See Key to males provided in StN Keys volume, Thompson & Torp (1986), Bradescu (1991). The male of this species is

unusual among European *Sphegina* species in possessing fore tarsi with flattened, expanded segments. **Illustrations of the adult insect:** none known.

Sphegina sibirica Stackelberg, 1953
Preferred environment: forest; *Picea* forest and plantations. **Adult habitat and habits:** in flight along streams and hovering round fresh-cut logs of *Picea*. **Flowers visited:** umbellifers, *Crataegus, Mentha aquatica, Photinia, Potentilla, Ranunculus, Sambucus, Sorbus, Viburnum opulus.* **Flight period:** May/June and July at higher altitudes/more northerly latitudes. **Developmental stages:** not described; females have been seen ovipositing on a cut *Picea* trunk lying across a stream, oviposition occurring toward the underside of the log, where it reached the stream-bank. **Range:** from northern Fennoscandia south to the Pyrenaean foothills (France); from Ireland (where it was first recorded in 2008) eastwards through central Europe and European parts of Russia to the Caucasus and into Siberia as far as Kamchatka and Khabarovsk. *S. sibirica* has spread rapidly through western Europe during the last quarter of the 20th century. In Britain, where the earliest collected specimen dates from 1976, the spread of the species up to 2018 is charted by Ball and Morris (2021), who show that it is now very frequent in western Scotland, with scattered records, mostly in western parts of the island, down to S Wales. **Determination:** See Key to males provided in StN Keys volume; Thompson & Torp (1986), Bartsch *et al*. (2009b). *S sibirica* has been placed in a separate sub-genus by most recent authors, on the basis that it lacks a second abdominal sternite. However, although this sclerite is not visible in many specimens of *S.sibirica* it is recognisable, although poorly sclerotised, in others, a fact which requires to be born in mind when using the keys in van der Goot (1981) and Thompson & Torp (1986). This species varies from all black (with an entirely black face) to entirely orange (with a yellow/orange face), with a range of intermediates between the two. In some intermediates there is a general infuscation of the body surface, with ill-defined darker patches, in others a pattern of sharply black patches is found on an otherwise orange insect. The male terminalia are figured by Thompson and Torp (1986). **Illustrations of the adult insect:** coloured photographs of the orange and black forms of this species are shown in Bartsch *et al*. (2009b). The adult male is also illustrated in colour by Bot and Van de Meutter (2019), Haarto & Kerppola (2007) and Speight and de Courcy Williams (2021).

Sphegina spheginea (Zetterstedt), 1838
Preferred environment: conifer and deciduous forest/freshwater; western taiga; cold, humid *Pinus sylvestris* forest; cold, humid *Abies/Picea* forest and humid *Fagus* forest. **Adult habitat and habits:** flies low among tall, herb-layer vegetation in dappled sunlight under the tree canopy, beside streams or in association with flushes. **Flowers visited:** *Caltha, Potentilla erecta, Rubus chamaemorus*. **Flight period:** May/June and on to mid July in Scandinavia. **Developmental stages:** not described. **Range:** northern Sweden south through Fennoscandia to Poland and eastwards through mountainous parts of central Europe (Germany, Switzerland, Austria) to Roumania; through northern Europe from the Baltic states into Russia and on through Siberia to Kamchatka; Mongolia. **Determination:** See Key to males provided in StN Keys volume and Thompson and Torp (1986), who also figure the male terminalia. Doczkal (1995) provides a key for distinguishing the females of most European *Sphegina* species. Although the male terminalia figured for this species in Bartsch *et al.*(2009b) correspond with the figures for *S. spheginea* terminalia in Thompson and Torp (1986) and Mutin and Barkalov (1999), in the coloured illustration of the male of *S. spheginea* provided in Bartsch *et al.* (2009b) the proportions of the abdominal tergites are entirely wrong for this species – the figure appears to be of *S. montana*. **Illustrations of the adult insect:** the species is shown in colour by Bot and Van de Meutter (2019).

Sphegina sublatifrons Vujić, 1990
Preferred environment: forest/freshwater; along streams in *Picea/Abies* forest above 1200m (Vujić, 1990). **Adult habitat and habits:** flies low within streamside vegetation, e.g. stands of water's edge *Caltha*; settles on large-leaved shrubs in the vicinity of springs and streams (A.Vujić, pers.comm..). **Flowers visited:** *Caltha* spp., *Ranunculus* spp. (A.Vujić, pers.comm.). **Flight period:** May/June. **Developmental stages:** not described. **Range:** North Macedonia, Serbia; previously listed for Slovenia, but Kočić *et al*. (2023) removed it from the Slovenian list because no specimen could be found to validate the existing record. **Determination:** See Key to males provided in StN Keys volume. Vujić (1990) figures the male terminalia and provides features for distinguishing both males and females of this species from the closely similar *S.latifrons*. Doczkal (1995) details differences between the female of *S.cornifera* and the female of *S.sublatifrons*. **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided by Vujić *et al*. (2020d).

Sphegina varifacies Kassebeer, 1991
Preferred environment: freshwater/forest; springs and streams within the humid *Fagus* forest zone. **Adult habitat and habits:** streamsides, settles on large-leaved shrubs etc in the vicinity of springs and streams. **Flowers visited:** *Caltha*, *Ranunculus*. **Flight period:** June. **Developmental stages:** adults have been collected from emergence traps sited over wet mud and plant debris bordering springs (J.-J.Bignon, pers.comm.). **Range:** central France (Massif Central) and both French and Spanish parts of the Pyrenees, down to the coast in the Basque country. **Determination:** See Key to males provided in StN Keys volume. Kassebeer (1991) figures the male terminalia and provides features for distinguishing this species from *S.latifrons*. Doczkal (1995) provides a key for distinguishing the females of European *Sphegina* species, and provides a table for distinguishing the females of *S.cornifera* Becker, *S.latifrons* Egger, *S.sublatifrons* Vujić and *S.varifacies*, which are very similar to one another. **Illustrations of the adult insect:** none known.

Sphegina verecunda Collin, 1937
Preferred environment: various types of humid deciduous forest (*Fagus* and *Quercus*). **Adult habitat and habits**: tracksides, edges of clearings etc. close to brooks and along brooks in woodland; adults fly in the shade (at 1 - 2 m from the ground) and visit flowers in partial shade. **Flowers visited**: umbellifers; *Photinia*, *Sanicula*. **Flight period**: end May/July. **Developmental stages:** larva described and figured by Hartley (1961), who found larvae in sap run exudate on *Ulmus*. Also reared by van Eck (2016b), from larvae found under the bark of a fallen branch, probably of *Corylus*, partly submerged in a small, woodland stream. Van Eck's (2016) observations demonstrate that this species overwinters as a larva. **Range**: Britain, Denmark, Germany, Czechoslovakia, northern France, Switzerland, Liechtenstein, northern Italy; Azerbaidjan. **Determination**: See Key to males provided in StN Keys volume. Thompson & Torp (1986) figure the terminalia. For determination of the female, the key by Doczkal (1995) is more reliable. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) andTorp (1994).

SPHIXIMORPHA

Four European *Sphiximorpha* species are known.

Sphiximorpha euprosopa (Loew), 1869
Preferred environment: forest; thermophilous oak forest of *Quercus frainetto/Q. cerris*; evergreen oak forest of *Q. coccifera*. **Adult habitat and habits:** after rain, on hot days has been observed drinking at puddles on forest tracks (M de C Williams, pers. comm.). **Flowers visited:** *Crataegus*, *Pyrus spinosa*. **Flight period:** March/April. **Developmental stages:** not described. **Range:** NE Greece; Turkey. **Determination:** see key provided in StN Keys volume. The male of *S. euprosopa* is redescribed, from the holotype, by van Steenis *et al.* (2016), who also figure the male terminalia. The female remains undescribed. In its general appearance *S. euprosopa* is very similar to both *S. garibaldii* and *S. subsessilis*, but is smaller. It is the smallest *Sphiximorpha* species currently known in Europe, with a maximum body length of 12mm. **Illustrations of the adult insect:** van Steenis *et al.* (2016).

Sphiximorpha garibaldii Rondani, 1860
Preferred environment: forest; thermophilous deciduous forest of *Quercus pubescens* with overmature trees and *Quercus suber* forest with overmature trees; alluvial hardwood forest with many overmature trees of *Quercus robur* (Prokhorov *et al*., 2020b). **Adult habitat and habits:** flies around trunks of live, overmature *Quercus* spp, settling at 1-3m on the bark. Females investigate large trunk cavities and oviposit there. They fly or walk into cavities with only narrow openings. Males sit on the bark of overmature trees in the sun, in the evening, apparently awaiting the arrival of females. This species may be caught in beer traps at c 2m from the ground (pers.comm. H.Brustel). After rain, visits the damp mud of drying puddles on forest tracks to drink (M.de C.Williams, pers.comm). **Flowers visited:** *Crataegus*, *Pyrus* (pers.comm. M. de C.Williams), *Tilia* (pers. comm. G. Pennards); *Filipendula ulmaria* (Prokhorov *et al*., 2020b); *Euphorbia*. **Flight period:** May/July. **Developmental stages:** undescribed, but quite possibly associated with subcortical sap seepages caused by the tunnelling activities of larvae of saproxylic cetoniids, which inhabit the trunk wood of old, living *Quercus*. In N America, puparia of the closely similar species *S. willistoni* have been found under the bark of *Juglans nigra* (Skevington *et al*, 2019). **Range:** known from Germany (extinct), Spain, southern France, Italy, Hungary, Bulgaria and Roumania, plus parts of the former Yugoslavia, northern Greece and Turkey. This insect has been very sparsely recorded and is probably threatened at European level. **Determination:** see key provided in StN Keys volume. *Sphiximorpha garibaldii* appears in recent literature under the name

S. binominata (Verrall). Van Steenis *et al.*(2016) redescribe the species and show that both *binominata* and *worelli* Bradescu are junior synonyms of *garibaldii*. The North American species, *S. willistoni* Kahl, bears a striking resemblance to *S. garibaldii* (see Skevington *et al*, 2019) and could prove to be the same species. *Sphiximorpha garibaldii* can be found together with *S.subsessilis*, adults of both species even being observed on the trunk of the same tree at the same time. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Sphiximorpha petronillae Rondani, 1850
Preferred environment: forest; overmature thermophilous *Quercus* (*Q.cerris*) forest (P.Cerretti. pers.comm.); thermophilous *Q. frainetto/Q. cerris* forest (M. de Courcy Williams, pers.comm.); humid *Castanea/Quercus/Laurus* forest (A.Vujić, pers.comm.). **Adult habitat and habits:** for extended periods males rest motionless at 1-5m on the trunk of old *Q. cerris*, awaiting the arrival of females; trees frequented almost exclusively harbour colonies of the saproxylic ant *Liometopum microcephalum*, whose presence is indicative of a hollow trunk; males can be found in this situation from morning to evening, on still, sunny days (M. de C. Williams, pers.comm.). **Flowers visited:** *Euphorbia* (Rondani, 1850), *Pyracantha coccinea* (P.Cerretti, pers.comm.), *Smyrnium* (A.Vujić, pers.comm.). **Flight period:** April/May. **Developmental stages:** not described; females have been observed laying eggs in the bark of old, living *Querus cerris* inhabitied by colonies of the saproxylic ant *Liometopum microcephalum*, the presence of which indicates that the trunk is hollow. **Range:** Italy, Montenegro, Serbia NE Greece. This spectacular insect has been so infrequently seen that it has to be regarded as one of the rarest of European Syrphidae and is a candidate for inclusion on any list of threatened European Diptera. **Determination:** see key provided in StN Keys volume. The female is redescribed by van Steenis *et al.* (2016). The male remains undescribed. **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/; van Steenis *et al.* (2016). The unique pattern of markings on the abdominal tergites is shown in black and white by Sack (1928 – 32). This insect is a convincing mimic of wasps of the genus *Polistes* (Vespidae). The male is illustrated in colour by Speight and De Courcy Williams (2016, 2021).

Sphiximorpha subsessilis (Illiger in Rossi), 1807
Preferred environment: alluvial softwood and hardwood forest, with over-mature trees of *Populus*; gallery *Alnus/Salix* forest along rivers, within other forest types *(Fagus/Quercus)* and old parks with ancient *Populus; Quercus suber* forest with mature/overmature trees, maintained for cork production, in southern Europe. Bark-stripping of *Q.suber* can cause tree wounds that develop large, semi-permanent sap-runs. This oak is one of the few trees from which a crop (bark) may be as easily harvested from large, overmature trees as from younger trees. *Q.suber* forest maintained for cork production can thus contain more ancient trees than most types of commercially-managed forest. **Adult habitat and habits:** largely arboreal, but adults of both sexes come to sap runs on trunks in dappled sunlight, near streams etc, and visit flowering shrubs and understorey trees to feed. Dziock (pers. comm.) observed a male to remain motionless at the edge of a large sap-run on the trunk of an old *Aesculus* for 3 entire days, after which it was found flying round the trunk and walking about on the tree for a further 2 days before disappearing. Prolonged bouts of motionless waiting have also been noted for this species by other observers. **Flowers visited:** *Crataegus*, *Sorbus*. **Flight period:** April/June. **Developmental stages:** described and figured by Rotheray *et al*. (2006), from larvae collected from "exuding sap at the base of an *Abies alba* tree". This species uses sap runs/wet, under-bark cavities on the trunks of both old deciduous trees (e.g. *Populus*, *Alnus*, *Salix*) and old evergreen oak (*Q. suber*) as larval microhabitat. Ricarte and Marcos-García (2010) report emergence of this species from a trunk cavity in an old, live tree of *Fraxinus angustifolia*. Doczkal (pers.comm.) has observed oviposition of this species in cracks in the bark immediately above a sap run in a live *Ulmus laevis*. Schmid (1993) observed oviposition along the edge of a sap-run on the trunk of *Aesculus hippocastanum*, a process which took several hours. Dussaix (2013) confirms that the larva overwinters in this species, reports that the puparial phase lasts 3 weeks and provides a coloured photo of larvae in situ and also a photo of the puparium. **Range:** from southern Sweden south to the Pyrenees; the Czech Republic, through central Europe to Roumania and European parts of Russia; through Southern Europe from the Pyrenees to the former Yugoslavia and on to the Caucasus. **Determination:** see key provided in StN Keys volume. This species can be found with *S. garibaldii*, adults of both species even being observed on the trunk of the same tree at the same time. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Louboutin *et al*. (2023), Pétremand *et al*. (2022), Schmid (1996) and van Steenis *et al.* (2016).

SPILOMYIA

The revision of European *Spilomyia* species by van Steenis (2000) records eight species from the continent, one of which (*S. graciosa* Violovitsh), is at present known only from eastern Europe (Greece, Turkey), while another (*S. maxima* Sack) only reaches Europe in part of European Russia.

Spilomyia digitata (Rondani), 1865
Preferred environment: deciduous forest; thermophilous *Quercus* forest (*Q.pyrenaica*) and evergreen *Q.ilex* forest, containing overmature and senescent trees; Mediterranean riparian ash forest (Ricarte *et al*, 2008; dehesa (Grković *et al*., 2019). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Hedera* (T. Lebard, pers. comm.); *Hypericum; Thapsia*. **Flight period:** mid-June/September. **Developmental stages:** larva described and figured by Rotheray *et al*. (2006), from larvae collected from rot-holes at the roots of live *Fraxinus angustifolius*, *Quercus faginea* and *Q.pyrenaica*. Sánchez-Galván *et al*.(2014) provide information suggesting that a pre-requisite for development of larvae of *S. digitata* in a trunk cavity may be the presence there of the faeces of saproxylic beetle larvae. Their work on the relationships between trunk-cavity inhabiting syrphids and saproxylic beetles was focussed on the Iberian chafer *Cetonia aurataeformis*, whose larval faeces are known to be rich in accessible nutrients (Micó *et al*., 2011). **Range:** parts of central Europe (southern Germany - extinct?, Switzerland - extinct?, Austria – extinct?) and the Mediterranean basin, from Portugal and Spain round to Italy. Literature records from eastern parts of Europe probably refer to other species (van Steenis, 2000). **Determination:** Speight & Pétremand (2024); van Steenis (2000), who figures features of the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Rotheray and Gilbert (2011) and Pétremand *et al*. (2022).

Spilomyia diophthalma (L.), 1758
Preferred environment: forest; conifer and deciduous forest; *Tilia/Quercus/Fraxinus* forest and *Abies/Picea* forest, with over-mature trees, up to the upper limit of *Picea*. **Adult habitat and habits:** settles on foliage and tree trunks. Males exhibit territorial behaviour when visiting flowers, even chasing away *Vespula* species. Females have been caught in traps on dead *Populus tremula* (all data from van Steenis, 2000). **Flowers visited:** umbellifers; *Cirsium, Crataegus, Euonymus, Knautia, Solidago virgaurea*. **Flight period:** end June/end August. **Developmental stages:** undescribed, but probably in rot holes in *Populus tremula* (Bartsch *et al*., 2009b); the female has been photographed ovipositing in the bark of a living *Acer platanoides* (Łukasz Mielczarek, pers. comm.). **Range:** southern Norway, Sweden, Finland, Latvia, Poland, Germany (Bavaria), Czech Republic, Switzerland, northern Italy, European parts of Russia, Turkey and the Caucasus and on through Siberia to Sakhalin. The European range of this species is now apparently discontinuous. **Determination**: Speight & Pétremand (2024); van Steenis (2000), who figures features of the male terminalia. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007).

Spilomyia graciosa Violovitsh, 1985
Preferred environment: ancient Balkanic thermophilous *Quercus* forest of *Q.pubescens/Q.cerris/ Q.frainetto* (pers.comm., M. de C.Williams). **Adult habitat and habits:** in flight through the middle of the day, at the hottest time of the year (M. de C. Williams, pers.comm.); visits the stony edges of streams to drink, after landing walking under overhanging, low-growing vegetation before drinking. **Flowers visited:** yellow composites; *Scabiosa* (pers.comm., M.de C.Williams); *Plumbago europaea*; *Sambucus ebulus*. **Flight period:** July/beginning September. **Developmental stages:** not described. **Range:** Greece, Turkey and Iraq. **Determination:** Speight & Pétremand (2024); van Steenis (2000). **Illustrations of the adult insect:** illustrated in colour by Speight and De Courcy Williams (2016).

Spilomyia longicornis Loew, 1872
Preferred environment: forest; deciduous forest of *Quercus* spp. (N America). No European habitat data available. **Adult habitat and habits:** males exhibit territoriality at flowers, which they patrol in search of females (Maier and Waldbauer (1979). **Flowers visited:** *Aster, Solidago*. **Flight period:** late May/October (N America); no European flight period data available. **Developmental stages:** larva reared in N America by Maier (1978, 1982) from "wet detritus along wall of treeholes in live *Quercus*", together with larvae of *Mallota* and *Somula* species. These tree holes are described as holding more than 3 litres of debris and containing standing water for more than 2 months of the year (Maier, 1978). **Range:** Hungary, USA, Canada. The solitary record of this species from the Palaearctic Region seems increasingly likely to have been based on mislabelled specimens (Speight & Pétremand, 2024) from N America. **Determination:** Speight & Pétremand (2024); van Steenis (2000). **Illustrations of the adult insect:** coloured photos of the male and female are provided by Skevington *et al*.(2019).

Spilomyia manicata (Rondani), 1865
Preferred environment: deciduous forest; *Carpinus* and *Fagus* forest with over-mature trees. **Adult habitat and habits:** apparently largely arboreal, but descends to visit flowers or drink; in flight a disconcertingly exact mimic of *Polistes* wasps; descends to drink from stream margins etc. around the middle of the day. **Flowers visited:** umbellifers; *Filipendula, Succisa*, pink *Allium*. **Flight period:** mid June/September, with peak July/August. **Developmental stages:** not described; Ahnlund (pers.comm.) has collected females of this species from a small trap attached close to rot-holes on the trunk of live *Populus tremula*. This species has also been hatched from a puparium found in a rot-hole in *Acer platanoides* (van Steenis, 2000). **Range:** from Norway, Denmark and northern France south to central Spain and eastwards through central Europe to European parts of Russia; through mountainous parts of southern Europe (and Corsica) to the former Yugoslavia and Greece; Roumania; the Caucasus (Georgia). This species is also known from Afghanistan and N India (Wachkoo *et al.*, 2019). There are very few recent records of this species from most parts of its European range. It is probably threatened over much, if not all, of Europe. **Determination**: Speight & Pétremand (2024); Van Steenis (2000), who figures features of the male terminalia. Van Steenis also shows that one of the European species (*S. boschmai*, Lucas) listed by Peck (1988) is a synonym of *S. manicata* (Rondani). **Illustrations of the adult insect:** illustrated in colour by Torp (1994) under the name *S.saltuum*, according to van Steenis (2000). The male is also figured in colour by Bartsch *et al*. (2009b), Bygebjerg (2007), Nielsen (2014b) and Pétremand et al. (2022).

Spilomyia maxima Sack, 1910
Preferred environment: forest; coniferous and deciduous forest (A.Barkalov, pers.comm.); *Larix sibirica/Pinus sibirica* forest with *Betula* (A. van Eck/G. Pennards, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** Umbellifers; *Spirea* (A.Barkalov, pers.comm.). **Flight period:** mid June/beginning September (A.Barkalov, pers.comm.). **Developmental stages:** not described. **Range:** northern parts of European Russia and eastwards through Siberia to the Pacific. **Determination:** Speight & Pétremand (2024); Stackelberg (1958), Violovitsh (1986). **Illustrations of the adult insect:** both sexes are illustrated in colour by Speight & Pétremand (2024).

Spilomyia saltuum (Fabricius), 1794
Preferred environment: thermophilous (*Q.pubescens*) and evergreen *Quercus* forest with over-mature trees, but primarily with *Q.ilex/Q.suber*. **Adult habitat and habits:** largely arboreal, but descends to flowers to feed (during the earlier part of the morning) and also to drink at the margins of forest brooks, where these are in direct sunlight; males can be found engaged in shorts bursts of hovering at 1-3m, interspersed with very fast direct flight, at the edge of large open areas within forest, where patches of shorter ground vegetation are intermixed with scrub and regenerating forest trees. **Flowers visited:** umbellifers; *Eryngium, Sambucus ebulus, Scabiosa, Solidago, Succisa*. **Flight period:** June/September, with the peak in August and some records on into October. **Developmental stages:** not described. **Range:** from central France south to the Mediterranean; from Spain round the Mediterranean to the former Yugoslavia, Turkey and the Caucasus (Georgia). Through central Europe from southern Germany, Switzerland and Austria to Hungary, Roumania and southern parts of Russia. Records from more northerly parts of Europe are apparently nearly all erroneous, due to confusion with *S.manicata* (Rondani), and there are very few recent records from north of the Alps. As with the other *Spilomyia* species known in Europe, the decrease in ancient forest has taken a toll of *S.saltuum* and it has to be regarded as under threat over much of its range. **Determination:** Speight & Pétremand (2024); van Steenis (2000), who figures features of the male terminalia. The specimen illustrated in colour by Torp (1994) as *S.saltuum* belongs to *S.manicata*, according to van Steenis (2000). **Illustrations of the adult insect:** a coloured photo of the male is provided by Bot and Van de Meutter (2019); http://cyrille.dussaix.pagesperso-orange.fr/

Spilomyia triangulata van Steenis, 2000
Preferred environment: forest; humid, montane forest of *Abies/Picea* (France and mountain ranges in Greece). The low altitude record apparently from Lesvos (Greece), associated with evergreen oak forest, suggests some other taxon may be involved and requires further investigation. **Adult habitat and habits:** visits flower-rich grassland to feed and settles on low-growing vegetation (van Steenis, 2000). **Flowers visited:** umbellifers (Vujić *et al.*, 2020d). **Flight period:** beginning June/end August. **Developmental stages:** not described. **Range:** Alps (France); Sicily; mountain ranges in North Macedonia, Greece and Turkey; Georgia. **Determination:** Speight & Pétremand (2024); both sexes of this species are described by van Steenis (2000) and included in the key provided, but the male terminalia are not figured. *Spilomyia triangulata* and *S. digitata*

are extremely similar in appearance. **Illustrations of the adult insect:** the coloured photo of *S. triangulata* provided by Vujić *et al*. (2020d) appears to be a specimen of *S. saltuum*. The male is illustrated in colour in Speight & Pétremand (2024).

SYRITTA

One *Syritta* species (*S.pipiens*) occurs almost throughout Europe. A second (*S.flaviventris*) is Mediterranean in distribution and a third (*S.vittata*) reaches the south-east edge of Europe, in the Caucasus. The primarily African species *S. fasciata* reaches as close to Europe as Lebanon and Iran. There are additional Palaearctic species in Asia. The genus has been revised by Lyneborg and Barkemeyer (2005).

Syritta flaviventris Macquart, 1842
Preferred environment: freshwater/wetland/open ground; seasonal rivers, coastal lagoons, dune slacks and temporary pools in marsh. **Adult habitat and habits:** flies low among sparse vegetation beside water (or over dried pools), settling on stones or dried mud. **Flowers visited:** yellow composites; *Lotus dorycnium*. **Flight period:** April/October with peaks in May and September. **Developmental stages:** larva described and figured by Perez-Banon and Marcos-García (2000), from material collected in the field from decaying vegetable matter - *Opuntia* platyclades. Larvae were found in decaying platyclades both on the ground and still attached to the cactus. Pupariation occurred within the tissues of the platyclades. **Range:** Portugal, Spain and round the Mediterranean from the southern coast of France to Turkey and on to north Africa; also from Tichino, on the southern edge of Switzerland; in eastern parts of the Afrotropical region to the southern tip of Africa and in Madagascar and the Mascarene islands; Nearctic. Known from various Mediterranean islands: Corsica, Sardinia, Sicily, Crete, plus Cape Verde. Also cited from Argentina, Brazil and Chile in the Neotropical region, Mexico and Texas (USA) in the Nearctic and Easter Island in Oceania (to which it has supposedly been introduced). **Determination:** See Key provided in StN Keys volume; Séguy (1961), Lyneborg and Barkemeyer (2005). The male terminalia are figured by Simic (1983) and Lyneborg and Barkemeyer (2005). **Illustrations of the adult insect:** the general appearance of the male can be seen from the coloured photo provided by Vujić *et al*. (2020d) and the female likewise in Dawah *et al*. (2020); http://cyrille.dussaix.pagesperso-orange.fr/

Syritta pipiens (L.), 1758
Preferred environment: wetland; fen, edges of bogs and along the margin of almost any freshwater body, including lakes, ponds, ditches, canals, brooks and rivers; anthropophilic, occurring in most sorts of farmland, suburban gardens and urban parks. **Adult habitat and habits:** low-flying, rarely more than 1m from the ground; settles on vegetation; males patrol stands of low-growing plants in bloom (see Parmenter, 1956). **Flowers visited:** white umbellifers; *Achillea, Allium, Aster, Calluna, Cardamine, Cirsium palustre, Convolvulus, Crataegus, Epilobium, Euphorbia, Galium, Jasione montana, Leontodon, Polygonum cuspidatum, Potentilla erecta, Prunus laurocerasus, Ranunculus, Rosa canina, Senecia jacobaea, Sorbus aucuparia, Tussilago*. See also the extended list in de Buck (1990). **Flight period:** March/November, and in southern Europe probably all the year round, but most records are from May/October. **Developmental stages:** larva described and figured by Heiss (1938) and Hartley (1961) and illustrated in colour by Rotheray (1994), Bartsch et al.(2009a) and Dussaix (2013); an inhabitant of various types of moist, decaying, vegetable matter, including cow dung and garden compost heaps. Under some conditions, the larva can apparently also develop successfully in mammalian corpses (Magni et al, 2013). Dussaix (2013) confirms the larva overwinters, shows a puparium in colour and reports the puparial phase as lasting for 3 weeks. **Range:** becoming cosmopolitan; known from most of the Palaearctic, including North Africa, most of N America, S America and the Oriental region. But records from the Afrotropical region are apparently erroneous. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1978) and Lyneborg and Barkemeyer (2005). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Syritta vittata Portschinsky, 1875
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Ferula* (A. Barkalov, pers.comm.). **Flight period:** April/June. **Developmental stages:** not described. **Range:** southern parts of European and Asiatic Russia; Iran, Pakistan. **Determination:** See Key provided in StN Keys volume. This species is redescribed by Lyneborg & Barkemeyer (2005), who also figure the male terminalia. **Illustrations of the adult insect:** none known.

SYRPHOCHEILOSIA

This genus is monotypic. The relationships of the single European species have only recently been been established. *S.claviventris* is treated in most European literature as a species of *Cheilosia*. *Syrphocheilosia* may be separated from related genera using Claussen (1987). Thompson and Rotheray (1998) regard *Syrphocheilosia* as a subgenus of *Platycheirus*.

Syrphocheilosia claviventris (Strobl), 1909
Preferred environment: freshwater/open ground; close to flushes and streamlets in unimproved, calcareous and non-calcareous montane and alpine grassland, from the top of the *Picea* zone to above 2500m. **Adult habitat and habits**: flies low among grasses etc., in a manner reminiscent of *Cheilosia* species. **Flowers visited**: *Anemone ranunculoides, Caltha, Cardamine, Potentilla verna, and Ranunculus*. **Flight period**: end May/mid August. **Developmental stages:** undescribed. **Range**: Alps (France, Germany, Switzerland, Liechtenstein, Austria, northern Italy); northern Turkey; Caucasus (Armenia, Georgia). **Determination**: see generic key provided in StN Keys volume and Claussen (1987). This insect appears in most literature as *Cheilosia claviventris*. It is now placed in the subfamily Syrphinae, as a member of the tribe Melanostomini. The male terminalia are figured by Claussen (1987). **Illustrations of the adult insect:** the adult insect is illustrated in black and white by Speight (1988a) and in colour by Speight and De Courcy Williams (2016).

SYRPHUS

The nine *Syrphus* species known from Europe are keyed out by Goeldlin (1996). Until recently, many species now consigned to other genera were included under the name *Syrphus*, making earlier accounts rather confusing. To establish in which genus such species are now placed Peck (1988) should be consulted.

Syrphus admirandus Goeldlin, 1996
Preferred environment: coniferous forest; western taiga (P. Goeldlin, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Campanula cervicaria, Crataegus laevigata, Taraxacum* (Bartsch *et al*. (2009a). **Flight period:** mid May/beginning August. **Developmental stages:** not described. **Range:** as yet uncertain, due to confusion with related species until recently, but confirmed from Norway, Sweden and Finland; parts of Asiatic Russia. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Haarto and Kerppola (2007a), Bartsch et al.(2009a). **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). Bartsch et al.(2009a) provide a coloured illustration of the male.

Syrphus attenuatus Hine, 1922
Preferred environment: forest; subalpine *Betula* forest (Nielsen, 1971b) and dwarf-shrub tundra (Nielsen, pers. comm.). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Papaver sibiricum*, *Salix*, *Taraxacum* (Nielsen, pers. comm.); *Carex* (van Steenis, 1998b). **Flight period:** end June/beginning August (T. Nielsen, pers. comm.). **Developmental stages:** not described, but the larvae are known to feed on adelgids (Skevington *et al*, 2019). **Range:** Norway, Sweden, Finland, Latvia, northern parts of European Russia and on into Siberia; in the Nearctic from Alaska south to Wisconsin, Colorado and Pennsylvania. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). This species has appeared in much recent European literature under the name *S. pilisquamis* Ringdahl. **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). Bartsch *et al*. (2009a) provide a coloured illustration of the male.

Syrphus auberti Goeldlin, 1996
Preferred environment: open ground; unimproved, humid, calcareous and non-calcareous, montane and subalpine grassland (hay meadow, up to 2500m (Merz, pers.comm.); flushes in subalpine heath. **Adult habitat and habits:** males engage in "hill-topping" (Merz, pers.comm.). **Flowers visited:** no data. **Flight period:** July/August. **Developmental stages:** not described. **Range:** Pyrenees (France); Alps (France, Germany, Switzerland). **Determination:** See Key provided in StN Keys volume; Goeldlin (1996). Features of the male head and abdomen are figured by Schmid (1999c). **Illustrations of the adult insect:** http://cyrille.dussaix.pagesperso-orange.fr/

Syrphus nitidifrons Becker, 1921
Preferred environment: conifer forest (*Abies*, *Picea*, humid *Pinus*). **Adult habitat and habits:** clearings, tracksides etc. **Flowers visited:** *Amelanchier, Lychnis, Prunus serotina, Ranunculus repens, Salix, Sorbus aucupariae*. **Flight period:** April/June. **Developmental stages:** not described. **Range:** from north-west Germany south to the Pyrenees; from Britain (S England), mountainous parts of France from the Vosges to the Pyrenees; Belgium and the Netherlands through central Europe (Czechoslovakia, Switzerland) to the former Yugoslavia. *S. nitidifrons* appears to be spreading rapidly through Atlantic parts of Europe at present. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996); Barendregt (1983). The male is in size, shape and general appearance, extremely similar to *Melangyna lasiophthalma*. Since in *S. nitidifrons* the long hairs on the squamae used to characterise *Syrphus* species in keys may be missing, males of *S. nitidifrons* are all-too-easy to misdetermine. The female is more similar in appearance to females of other *Syrphus* species. In both sexes, *S. nitidifrons* has a pair of pale marks on abdominal tergites 2-4, rendering it distinguishable from typical specimens of the three common European *Syrphus* species, *S. ribesii*, *S. torvus* and *S. vitripennis*. However, specimens of each of these latter three species do occur in which the yellow bands normally present on tergites 3 and 4 are reduced to a pair of transverse pale bars. Barendregt (1983) provides a detailed description and various figures of this species. **Illustrations of the adult insect:** the male is figured in colour by Bot and Van de Meutter (2019) and Speight and de Courcy Williams (2021).

Syrphus rectus (Osten-Sacken), 1877
Preferred environment: forest/open ground/cultures; patchy deciduous scrub and grassland, crops. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July/August (Europe); May/October (N America). **Developmental stages:** not described. Short and Bergh (20005) illustrate the eggs of N American *S.rectus*, where the larva of this species is apparently a significant predator of the aphids on fruit trees, including the woolly apple aphid (*Eriosoma lanigerum*). **Range:** uncertain, due to confusion until recently with other European *Syrphus* species; its presence is so far confirmed from Finland, Denmark, Ireland, Luxembourg, Germany, France/Switzerland (Col de Bretolet). In N America it is known from southern Canada south to Colorado. This species may be to a significant extent migratory. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Vockeroth (1992). There is considerable uncertainty over the status of European specimens referable to this taxon. Goeldlin (1996) drew attention to the occurrence of specimens of apparently this N American species in Europe. In N America it is known only from the female, the male being virtually indistinguishable from *S.vitripennis*, according to Vockeroth (1992). The female specimens consigned to this species by Goeldlin (1996) were regarded as sufficiently different to warrant designation as a separate subspecies, *S.rectus bretolensis*. His key separates these European specimens from the other *Syrphus* species known in Europe, but it has to be recognised that, even if the N American material consigned to this taxon represents a separate species, there is no certainty that European specimens consigned to *S.rectus* either belong to that species or to any discrete taxon. The female looks superficially like *S.ribesii*, in its possession of almost entirely yellow legs, but may be distinguished from that species through possession of wings with extensive areas bare of microtrichia. In these characters it resembles *S.sexmaculatus*, from which it may be distinguished by having black peg-like bristles beneath the mid-tarsi and a more extensively yellow frons. Ssymank et al.(1999) tentatively synonymise *S.rectus bretolensis* with *S.vitripennis*, but without explanation. There is clear need for the correct taxonomic status of European *S.rectus*-type females to be established. Until a satisfactory basis exists for decision, it is practical to give separate identity to this taxon, so that the frequency and geographic extent of its occurrence can be better documented. For further discussion of this enigmatic taxon, see Speight (1999a). **Illustrations of the adult insect:** none known.

Syrphus ribesii (L.), 1758
Preferred environment: anthropophilic, occurring in farmland, orchards, horticultural land, suburban gardens and parks, conifer plantations; also in most types of deciduous and coniferous forest. **Adult habitat and habits:** gardens, tracksides, clearings, hedgerows etc.; flies up to 5m from ground; males hover at 2-5m. **Flowers visited:** visits a wide range of yellow, white, pink and blue flowers, including composites and umbellifers and the flowers of many trees and shrubs (see extended list in de Buck, 1990). **Flight period:** April/mid November (plus March in southern Europe), with peaks in May and August. **Developmental stages:** larva described and figured by Dusek & Laska (1964); aphid feeding on various herbaceous plants (e.g. *Carduus, Eryngium, Sonchus*, umbellifers), including some crops (*Beta, Solanum, Triticum, Vicia, Zea*), bushes (e.g. *Rubus* spp.), shrubs and trees. It is reported as a predator of aphids on apple trees in orchards (Stanić, 2024).The larva of this species apparently occurs in a number of distinct colour forms, as illustrated in colour by Rotheray (1994) and Bartsch *et al*. (2009a). A coloured photo of the puparium is provided by Dussaix (2013). Egg: Chandler (1968). The morphology of the chorion of the egg is figured by Kuznetzov (1988). Laboratory culture detailed by Bombosch (1957). It is unclear whether

this species overwinters as a larva or a puparium. According to Dussaix (2013), summer larvae give rise to puparia which hatch after 10 days to 2 weeks. **Range:** from Iceland and Fennoscandia south to Iberia and the Mediterranean; Canary Isles; from Ireland eastwards through most of Europe into Turkey, European parts of Russia and Afghanistan; from the Urals to the Pacific coast (Kuril Isles); Japan; N America from Alaska south to central parts of the USA. This species is highly migratory. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). Whether the enigmatic, European, female specimens referable to *S. rectus* O.S. represent a distinct species or a variant of *S.vitripennis* is as yet unclear, but whatever they represent, using existing keys except those of Speight (1988a) and Goeldlin (1996) such specimens would be misdetermined as *S.ribesii*, since their legs are yellow as in female *S.ribesii*. They may easily be distinguished by the large areas bare of microtrichia on their wings, which are entirely covered in microtrichia in *S.ribesii*. Boyes *et al*. (1971) show that over much of Europe there are two chromosome races of *S. ribesii*, as currently defined, one with 2n = 8, the other with 2n = 10. It is not known if these races have any taxonomic significance. The male terminalia are figured by Dusek and Laska (1964). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Colyer and Hammond (1951), Kormann (1988), Stubbs and Falk (1983), Torp (1994) and Bartsch et al.(2009a).

Syrphus sexmaculatus (Zetterstedt), 1838
Preferred environment: forest/open ground; taiga (Nielsen, 1998), dwarf scrub tundra and subalpine *Betula* forest (Bartsch, pers.comm.); subalpine heath (Bartsch et al, 2009). **Adult habitat and habits:** no data. **Flowers visited:** *Matricaria, Ranunculus* (Nielsen, 1998); *Bistorta vivipara, Geranium sylvaticum, Leucanthemum vulgare, Taraxacum* (Bartsch et al, 2009). **Flight period:** June/July and August at more northerly latitudes/higher altitudes. **Developmental stages:** not described. **Range:** Norway, Sweden and Finland and northern Russia through Siberia to the Pacific; known in the Nearctic from Alaska and Canada. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Haarto and Kerppola (2007a), Bartsch et al.(2009a). **Illustrations of the adult insect:** the general appearance of the female of this species is shown in the coloured photograph provided by Haarto and Kerppola (2007a). Bartsch et al.(2009a) provide a coloured illustration of the male.

Syrphus stackelbergi Kuznetzov, 1990
Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Developmental stages:** not described. **Range:** northern parts of European and Asiatic Russia. **Determination:** See Key provided in StN Keys volume; included in the keys provided by Goeldlin (1996). Kuznetzov (1990) figures the male terminalia. **Illustrations of the adult insect:** none known.

Syrphus torvus Osten-Sacken, 1875
Preferred environment: forest; humid conifer forest (*Abies*, *Picea* and humid *Pinus*) and conifer plantations (including exotic genera and species), deciduous forest (*Betula, Fagus* and acidophilous *Quercus*) and dwarf-shrub tundra; to some extent anthropophilic, occurring also in suburban gardens with mature trees and in urban parks. **Adult habitat and habits:** forest clearings, tracksides etc.; males hover at 2-5m, over tracks, beneath trees etc. **Flowers visited:** umbellifers; *Allium ursinum, Aster, Bellis perennis, Brassica rapa, Buxus, Caltha, Cirsium arvense, Crataegus, Euphorbia, Frangula alnus, Glaux maritima, Hedera, Hieracium, Oxalis, Plantago, Prunus spinosa, Ranunculus, Rosa, Rubus fruticosus, R.idaeus, Salix, Senecio jacobaea, Sorbus, Taraxacum, Tussilago.* **Flight period:** March/October, with peaks in mid April/ beginning June and August/September. **Developmental stages:** larva described and figured by Dusek and Laska (1964); aphid feeding; occurs on trees, bushes and shrubs. The larvae are reported as predators of aphids on apple trees in orchards (Wojciechowicz-Żytko & Wilk, 2023). Kula (1982) found larvae of *S. torvus* at all heights on spruce (*Picea*) trees in spruce forest and records the larvae as overwintering among leaf litter on the forest floor. **Range:** from Greenland, Iceland, the Faroes (Jensen, 2001) and Fennoscandia south to Iberia and the Mediterranean; through most of Europe into Turkey and European parts of Russia; from the Urals through Siberia to the Pacific coast (Kuril Isles); Japan; Formosa; northern India, Nepal, Thailand; in N America from Alaska south to New Mexico. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Haarto and Kerppola (2007a), Bartsch *et al*. (2009a). This species has frequently been confused with *S. ribesii* and *S. vitripennis*, in European collections. The male terminalia are figured by Dusek and Laska (1964). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Kormann (1988), Torp (1984, 1994), van der Goot (1986) and Bartsch *et al*. (2009a).

Syrphus vitripennis Meigen, 1822
Preferred environment: forest; most types of deciduous and coniferous forest and conifer plantations; significantly anthropophilic, occurring along field hedges, in suburban gardens and parks. **Adult habitat and habits:** tracksides, clearings etc.; males hover at 2 - 5 m beside trees and shrubs. **Flowers visited:** white umbellifers; *Achillea millefolium, Brassica rapa, Campanula rapunculoides, Cirsium, Convolvulus, Crataegus, Euphorbia, Leontodon, Origanum vulgare, Ranunculus, Rosa, Rubus fruticosus*. **Flight period:** end April/October (plus March in southern Europe), with peaks May/June and August. **Developmental stages:** larva described and figured by various authors, e.g. Dusek & Laska (1964); puparium figured in colour by Dussaix (2013). The larva is aphid-feeding, on a range of trees, bushes, shrubs (e.g. *Alnus, Betula, Prunus, Viburnum*), lianas (*Humulus*) and taller herbaceous plants (e.g. *Cirsium, Nicotiana, Sonchus tenerrimus*). It is a predator of aphids on apple trees in orchards (Wojciechowicz-Żytko & Wilk, 2023; Stanić, 2024). Kula (1982) records larvae overwintering among leaf litter on the floor of a spruce (*Picea*) forest; laboratory culture detailed by Bombosch (1957). The puparial phase lasts for 10 – 14 days (Dussaix, 2013). Egg: Chandler (1968). **Range:** throughout most of the Palaearctic region, including north Africa; in N America from Alaska to California; Formosa. This species is highly migratory. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Haarto and Kerppola (2007a), Bartsch et al.(2009a). The male terminalia are figured by Dusek and Laska (1964). The European female specimens referable to *S.rectus* may represent a variant of *S.vitripennis*, but would be misdetermined as *S.ribesii* using most available keys (see under *Syrphus rectus*). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009a), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

TEMNOSTOMA

Peck (1988) lists four European species of *Temnostoma*. More recently, Krivosheina and Ståhls (2003) have recorded *T. angustistriatum* from northern Europe and Krivosheina, N.P. (2003, 2004) has reinstated *T. carens* and *T. sericomyiaeforme* as distinct species, both of which are also northern European syrphids. Keys to the European *Temnostoma* species are provided in the StN Keys volume and by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007). Krivosheina (2004a) provides a key to the Palaearctic *Temnostoma* species. The dead-wood inhabiting larvae of *Temnostoma* are unusual among syrphid larvae in that they bore their own tunnels in the rotting wood they inhabit, using a pair of heavily sclerotised, saw-like outgrowths from the thoracic region of the body.

Temnostoma angustistriatum Krivosheina, 2002
Preferred environment: forest; mixed forest and deciduous forest; taiga forest with *Betula* (S. Kerppola, pers. comm.), *Alnus incana* forest (Mielczarek, 2014b); alluvial hardwood forest, *Quercus/Carpinus/Ulmus* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Anthriscus sylvestris* (S. Kerppola, pers. comm.). **Flight period:** end April/August (Krivosheina, 2002). **Developmental stages:** larva described and figured by Krivosheina, M. G. (2003b), who also provides distinctions from the larvae of *T.bombylans*. The larva occurs in wood of *Alnus, Betula, Fraxinus, Populus tremula, Prunus avium, Quercus, Tilia* and *Ulmus* (M. Krivosheina, pers.comm.). **Range:** Norway, Finland, European Russia (Karelia); Siberia to the Pacific coast region. **Determination:** see key provided in StN keys volume; Bartsch *et al*. (2009b); Haarto & Kerppola (2007). Krivosheina and Ståhls (2003) detail features separating this species from *T. bombylans*, and figure components of the aedeagal complex of those two species. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007).

Temnostoma apiforme (Fabricius), 1794
Preferred environment: forest; areas subject to temporary flooding in humid deciduous forest, from northern *Betula* forest to the upper levels of *Fagus/Picea* forest and down to the alluvial hardwood forest of major rivers. **Adult habitat and habits:** clearings, tracksides, meadows adjacent to forest; although a forest insect, can be found flying close to the ground and visits the flowers of low-growing plants. **Flowers visited:** white umbellifers, *Crataegus, Geum, Lysimachia,Matricaria inodora, Potentilla, Ranunculus, Rubus idaeus, Sorbus aucuparia*. **Flight period:** June/end July, and on into August at higher altitudes/more northerly latitudes. **Developmental stages:** larva wood-boring, in solid wood within part-rotted stumps and logs; described and figured by Heqvist (1957), based on larvae collected from a rotten *Betula* stump. According to Bartsch *et al*. (2009b), this species shows a preference for birch logs "in very humid situations, especially logs that periodically become partly submerged". Krivosheina and Mamayev (1962) also figure and describe the larva of this species, from material collected from stumps of *Tilia*. These latter authors provide a key distinguishing *T. apiforme* larvae from those of the other

European *Temnostoma* species. **Range:** requires reassessment, due to confusion with *T. carens*, but probably from Lapland south to northern France (Ardennes, Vosges, Jura); from eastern Belgium through northern and central Europe into European parts of Russia and on through Siberia to the Pacific coast and Japan. Although this species has a wide geographic range, it has a relictual distribution pattern over much of Europe and is probably now under threat at European level. **Determination**: see key provided in StN keys volume; Bartsch *et al*. (2009b); Haarto & Kerppola (2007). *T.carens* was originally described (Gaunitz, 1936) as a variety of *T. apiforme*, but has been recently reinstated as a distinct species (see under *T. carens*) by Krivosheina, N.P. (2003). *T. apiforme* and *T. carens* are both included in the key provided by Haarto & Kerppola (2007). The male and female terminalia of *T. apiforme* are figured by Barkalov (1991). This species has a strong general resemblance to *T.carens*, *T. meridionale* and *T. vespiforme*. **Illustrations of the adult insect:** the adult of *T. apiforme* is illustrated in colour by Bartsch *et al*. (2009b) and Torp (1994).

Temnostoma bombylans (Fabricius), 1805

Preferred environment: *Fagus* forest with over-mature trees, up to its upper altitudinal limits; *Quercus/Carpinus/Ulmus* forest and old alluvial hardwood forest. **Adult habitat and habits:** clearings and tracksides etc.; flies 1- 2 metres from ground; settles on low-growing vegetation. **Flowers visited:** umbellifers; *Cornus, Hypericum, Ranunculus, Rubus, Sambucus nigra, Sorbus aucuparia, Viburnum opulus*. **Flight period:** May/June and July at higher altitudes. **Developmental stages:** larva described and figured by Krivosheina and Mamayev (1962); wood-boring, in solid wood within part-rotted stumps and logs; reared from stumps and logs of *Acer, Fagus, Quercus, Salix* and *Tilia*; Krivosheina, N.P. (pers.comm.) has also reared this species from stumps and fallen timber of *Alnus* and *Betula*. Derksen (1941) indicates metamorphosis takes 2 years and the larvae inhabit stumps of trees felled 7 - 8 years previously. The larvae described and figured, with puparium, by Heiss (1938) and Metcalf (1933) as those of *T. bombylans* were probably those of *T. balyras* (Walker). *T. bombylans* is not known to occur in N America. Krivosheina and Mamayev (1962) provide a key distinguishing *T. bombylans* larvae from those of the other European *Temnostoma* species. **Range:** requires re-assessment, due to confusion between *T. bombylans* and *T. angustistriatum*, but probably from southern Sweden and Denmark south to the Pyrenees and North Africa; the former Yugoslavia; eastwards from central France through northern and central Europe into parts of European Russia. It has been recorded in Eurasia as far East as Japan and Korea, but, according to Barkalov & Mutin (2018), in Russia it is "unknown East of the Urals". In Europe, *T. bombylans* is probably the most frequently met with *Temnostoma* species, but nonetheless very local. **Determination:** see key provided in StN keys volume; Bartsch et al.(2009b); Haarto & Kerppola (2007). Krivosheina and Ståhls (2003) provide additional information on separation of *T.bombylans* from the closely similar *T. angustistriatum*. In *T.angustistriatum* the hind tibiae are black for one third or more of their length, whereas in *T.bombylans* the hind tibiae are either entirely yellow or with a vague black streak in the apical half. The male terminalia of supposedly this species are figured by Hippa (1978) and Barkalov (1991), but more comprehensive, comparative figures of the male terminalia of *T.angustistriatum* and *T.bombylans* are required before the identity of the species figured by Barkalov (1991) and Hippa (1978) can be confirmed. Krivosheina and Ståhls (2003) figure the aedeagal complex of *T. angustistriatum* and *T.bombylans*. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Bot and Van de Meutter (2019), Kormann (1988), Pétremand *et al*. (2022), Speight and de Courcy Williams (2021), Torp (1984, 1994) and van der Goot (1986).

Temnostoma carens Gaunitz, 1936

Preferred environment: forest: deciduous forest; *Alnus* forest with flushes (T. Järveläinen, pers. comm.). Lutovinovas & Kinduris (2015) found this species in swampy *Betula* forest with old and dead trees and scattered *Picea abies, Populus tremula* and *Quercus robur*. Zoralski & Mielczarek (2018) record *T. carens* from old *Quercus/Carpinus/Tilia* forest with *Pinus* and *Populus tremula*, in Poland. **Adult habitat and habits:** the female flies low among vegetation (T. Järveläinen, pers.comm.). **Flowers visited:** white umbellifers; *Crataegus*. **Flight period:** mid June/end July. **Developmental stages:** not described. **Range:** northern Sweden and Finland; Lithuania, Poland; northern parts of European Russia. **Determination:** see key provided in StN keys volume; Bartsch *et al*. (2009b); Haarto & Kerppola (2007). This species was described by Gaunitz (1936) as a variety of *T. apiforme*, based on a solitary female. Krivosheina, N.P. (2003) recognised it as a distinct species. The markings of the female tergites are figured by Krivosheina, N. P. (2003) and Haarto & Kerppola (2007). In both sexes, this species has the posterior margins of the tergites black, distinguishing it from *T.apiforme*, with which it could otherwise be confused. **Illustrations of the adult insect:** *T. carens* is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Lutovinovas & Kinduris (2015).

Temnostoma meridionale Krivosheina & Mamayev, 1962
Preferred environment: *Fagus* and thermophilous *Quercus* (*Q. pubescens*) forest containing overmature and fallen trees. **Adult habitat and habits:** sunlit forest, where the species flies between the trees, the males hovering at 3 metres or higher; settles on low-growing vegetation. Males have been seen hovering in small groups, close to the trunk of large trees at the edge of a track. In these circumstances they not only hover but also fly rapidly both up and down and from side to side, within a space of 2-3m diameter, buzzing noisily. Their resemblance to a cloud of hornets disturbed at the entrance to their nest hole is alarming! **Flowers visited:** *Cornus sanguinea, Photinia*. **Flight period:** beginning May/beginning July. **Developmental stages:** larva wood-boring, in solid wood within part-rotted stumps and logs; described and figured by Krivosheina and Mamayev (1962), from larvae collected from a *Fagus* log. These authors also provide a key distinguishing *T. meridionale* larvae from those of the other European *Temnostoma* species. **Range:** Sweden, Finland, Estonia, Latvia, Denmark, Poland, Germany, Luxembourg, central and south-west France (including the Pyrenees), the Czech Republic, Austria, Slovenia, Roumania, the Ukraine, European parts of Russia and the Caucasus. **Determination:** see key provided in StN keys volume; Bartsch *et al*. (2009b); Haarto & Kerppola (2007). The male terminalia are figured by Barkalov (1991), Speight & Sarthou (1997) and Doczkal (1996a). Barkalov also figures the female terminalia. The statement by Speight and Sarthou (1997) that Hippa (1978) figures part of the male terminalia of *T. meridionale* under the name *T. vespiforme*, is incorrect. Krivosheina & Mamayev (1962) had no access to the Linnaean material of *T. vespiforme* and were unaware that their new species occurred in Scandinavia. Whether their concept of *T. vespiforme* corresponds with that of Linnaeus is therefore unknown. Re-examination of the Linnaean type of *T. vespiforme* is necessary to establish which species should carry that name. **Illustrations of the adult insect:** *T. meridionale* is figured in colour by Bartsch *et al*. (2009b).

Temnostoma sericomyiaeforme (Portschinsky), 1886
Preferred environment: forest; deciduous forest, *Alnus* swamp forest with *Salix*, *Populus tremula* and *Betula* (S. Kerppola, pers.comm.) and with overmature and fallen trees; *Alnus* forest with *Betula, Prunus padus* and *Populus tremula* (T. Nielsen, pers.comm.); swampy *Alnus incana* forest (Lutovinovas & Kinduris, 2013). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Crataegus* (Lutovinovas & Kinduris, 2013); *Rubus idaeus* (Bartsch *et al*, 2009b). **Flight period:** mid June/July. **Developmental stages:** not described, but stated to develop in partly-rotten stumps and logs of *Betula* in wet situations (Bartsch *et al.*, 2009b). **Range:** uncertain, due to confusion with *T.vespiforme* until recently, but confirmed from Norway, Sweden, Finland, Lithuania, Denmark, Poland, the Ukraine and parts of European Russia. **Determination:** see key provided in StN keys volume; Bartsch *et al*.(2009b); Haarto & Kerppola (2007). Nielsen (2005) and Haarto & Kerppola (2007) figure the dorsum of the abdomen for both *T. sericomyiaeforme* and *T.vespiforme*. **Illustrations of the adult insect:** The adult male of *T. sericomyiaeforme* is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007), Bygebjerg (2007) and Lutovinovas & Kinduris (2013).

Temnostoma vespiforme (L.), 1758
Preferred environment: deciduous forest containing over-mature and fallen trees, especially riverine alluvial gallery forest. **Adult habitat and habits:** open forest, especially near brooks and rivers; males hover at 3 metres and higher; both sexes frequently visit flowers (often visiting pasturage and meadows for the purpose) and settle on shrub foliage etc.; in flight an exact mimic of *Vespula*; when settled this insect carries its black fore tarsi as though they were antennae, resembling exactly black *Vespula* antennae and vibrates them as *Vespula* does its antennae. **Flowers visited:** umbellifers; *Clematis, Cornus, Crataegus, Euphorbia, Lonicera xylosteum, Papaver nudicaule, Ranunculus, Rubus idaeus, Sambucus, Senecio, Sorbus.* **Flight period:** May/June and on into July/August at higher altitudes/more northerly latitudes. **Developmental stages:** larva wood-boring, in solid wood within part-rotted stumps and logs; according to Drees (1999) larval development takes 2 years; larva described and figured by Stammer (1933) and Krivosheina and Mamayev (1962); illustrated in colour by Rotheray (1994); distinctions from the larva of *T. apiforme* (Fab.) are detailed in Heqvist (1957). Krivosheina and Mamayev (1962) provide a key distinguishing *T. vespiforme* larvae from those of the other European *Temnostoma* species known at that time. This species has been bred from *Acer, Alnus, Betula, Fagus, Populus tremula, Quercus, Salix* and *Tilia*. **Range:** requires reassessment, due to confusion with both *T. meridionale* and *T. sericomyiaeforme*, but probably from central Sweden south to northern Spain; from most parts of France eastwards through most of Europe and on through Asiatic parts of Russia to the Pacific coast and Japan; the Caucasus. However, *T. vespiforme* specimens from eastern parts of Asiatic Russia may represent a separate species (Barkalov & Mutin, 2018). Until recently, *T. vespiforme* was also regarded as occurring in the Nearctic, from Alaska south to New Mexico and east to Quebec. But genetic analysis has shown that the species does not occur in the Nearctic, N American specimens previously consigned to *T. vespiforme* now being recognised as belonging to a separate

species, *T. excentrica* (Harris). *Temnostoma vespiforme* is now rather localised over much of its European range. **Determination:** see key provided in StN keys volume; Bartsch *et al*. (2009b); Haarto & Kerppola (2007). Bradescu (1991). The male terminalia of supposedly *T. vespiforme* are figured by Barkalov (1991), Doczkal (1996a), Hippa (1978) and Speight & Sarthou (1997). Barkalov also figures the female terminalia. Barkalov's (1991) figure of the male terminalia of *T. vespiforme* shows features which do not correspond with the figures of the terminalia of this species by other authors. *T. meridionale* Krivosheina & Mamaev is extremely similar to *T. vespiforme.* The two species are almost indistinguishable in the field and occur in the same habitats. Care is needed to ensure correct identification of these two species, given that *T. meridionale* is now known to occupy much the same European range as *T. vespiforme*. Neither *T. meridionale* nor *T. sericomyiaeforme* were taken into account in the review of Linnaean types of Syrphidae conducted by Thompson *et al*. (1982). Since it is now known that *T. meridionale* occurs over such a wide range in Europe, and both *T. carens* and *T. sericomyiaeforme* are known to be present in Fennoscandia, it cannot be assumed that *vespiforme* of Linnaeus is the species currently bearing this name, since the Linnaean type has not been examined more recently than by Thompson *et al*. (1982). However, until and unless the identity of the Linnaean type is checked it is reasonable to assume current interpretations of *T. vespiforme* are correct. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al*. (2009b), Kormann (1988), Torp (1984, 1994) and van der Goot (1986).

TRICHOPSOMYIA

There are three European species consigned to this genus. The species were reviewed by Goeldlin (1997), who provides a revised key for their identification. Alternative keys are provided by van Veen (2002) and in the StN Keys volume. *Trichopsomyia* appears as *Parapenium* in much recent European literature.

Trichopsomyia flavitarsis (Meigen), 1822
Preferred environment: wetland; rich and acid fen, marsh, boggy moorland, including *Myrica* stands; oligotrophic *Molinia* grassland (formed by invasion of old peat cuttings); brook floodplains; tall herb open areas in *Alnus incana* alluvial forest; humid, unimproved grassland with flushes in montane and subalpine pasture and *Pinus mugo ssp. uncinata* forest; towards the southern fringe of its range also in humid deciduous forests. **Adult habitat and habits:** flies low among dense vegetation; males hover in groups within 2m of the ground, beside small bushes, rocks etc. This species is as easily located by use of a sweep net as by direct observation. **Flowers visited:** *Berteroa incana, Frangula alnus, Narthecium, Potentilla, and Ranunculus*. **Flight period:** May/July, with some specimens into August, especially at higher altitudes. **Developmental stages:** larva described by Rotheray (1997) and incorporated into the keys provided by Rotheray (1994), where it is distinguished from larvae of related genera; a predator of a gall-making psyllid (Homoptera) on the stems of a *Juncus* species. **Range:** from Fennoscandia south to the Pyrenees and northern Spain; from Ireland eastwards through northern Europe and mountainous parts of central Europe into European parts of Russia and on to the Pacific coast; also in the former Yugoslavia. **Determination:** See key provided in StN Keys volume, plus Verlinden (1994) and Goeldlin (1997). Care is still needed to distinguish the adults of this species from those of *T.lucida*, and it is doubtful that these two species could be effectively separated until Verlinden's (1991) keys appeared. The male terminalia are figured by van der Goot (1981), Verlinden (1994) and Goeldlin (1997). **Illustrations of the adult insect:** the adult of *T.flavitarsis* is illustrated in colour by Bartsch *et al.* (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Trichopsomyia joratensis (Goeldlin), 1997
Preferred environment: forest; humid *Fagus/Picea* forest from 700m to 1500m (in the Alps), in the vicinity of streams or flushes. **Adult habitat and habits:** the adult insect flies very low among ground vegetation, near streams or flushes in forest glades (or other small, open areas, such as beside paths) and is reminiscent of a *Pipizella* in its flight characteristics (P. Goeldlin, pers.comm.); settles on tall, pathside vegetation such as *Urtica* (F.Dziock, pers.comm.). **Flowers visited:** umbellifers. **Flight period:** end May/July. **Developmental stages:** features of the puparium are described and figured by Van Steenis *et al*. (2018) from the puparium of a reared specimen. The puparium was found in sap on "*Abies*". **Range:** Norway, Sweden and southern Finland southwards through Denmark and the Netherlands to Belgium and France; from Germany and Poland eastwards through central Europe (Czech Republic, Switzerland, Austria, Slovakia, Bulgaria) to Roumania and Ukraine; Italy. **Determination:** See key provided in StN Keys volume. This species appears in most recent literature under the name *carbonaria* (Mg.). Goeldlin (1997) showed that the name *carbonaria* was unavailable for this species and introduced *joratensis* as a valid replacement name. The species may be identified using the keys provided by Bradescu (1991) and Verlinden (1994), where it appears under the name *carbonaria*, and by the key in Goeldlin (1997), who illustrates the

male terminalia. **Illustrations of the adult insect:** the general appearance of the adult male is shown by the photograph provided by Haarto & Kerppola (2007) and Van Steenis *et al*. (2018). The male is also illustrated in colour by Bartsch *et al*. (2009b), Bot and Van de Meutter (2019) and Prokhorov *et al*. (2023).

Trichopsomyia lucida (Meigen), 1822
Preferred environment: forest; open areas with tall herbs in mature, thermophilous *Quercus* forest and sandy, alluvial hardwood forest; also around patchy stands of *Arundo*. This species may also occur in urban/suburban situations, on well-drained sites where a facsimile of deciduous forest margin tall-herb vegetation occurs and ground-water is close to the ground surface during the winter (Speight, 2006). **Adult habitat and habits:** flies through tall ground vegetation at 1-2m from the ground, along path edges, etc.; seemingly active in the earlier part of the morning (to c 10.00 a.m.) but not later. **Flowers visited:** *Rubus fruticosus* agg.; *Verbascum*. **Flight period:** end May/June & mid July/August. **Developmental stages:** not described, unless the rearing data provided by Van Steenis *et al*. (2018) apply to *T. lucida* because *ochrozona* proves to be a variant of *T. lucida*. The larvae of *T. ochrozona*, as defined by Van Steenis *et al*. (2018), predate the psyllid bug *Camarotoscena hoberlandti*, which produces leaf-roll galls on *Populus nigra*. That psyllid apparently does not occur in Europe, so European populations of *T. lucida* would presumably use some equivalent species. Van Steenis *et al*. (2018) describe and figure both larva and puparium of *T. ochrozona*. **Range:** southern England, Germany, Belgium, the Netherlands, Poland, France, central Spain, Switzerland, Austria, Hungary, Slovenia, parts of the Balkan peninsula, Ukraine and Turkey. **Determination:** see key provided in StN Keys volume, plus Verlinden (1994) and Goeldlin (1997), who illustrates the male terminalia. Van Steenis *et al*. (2018) reinstate the name *ochrozona* (Stackelberg) for Iranian populations of what would previously have been regarded as *T. lucida*: Goeldlin (1997) synonymised *ochrozona* with *lucida*. But none of the morphological features used by Van Steenis *et al*. (2018) as diagnostic for *ochrozona* provide for reliable separation from *lucida* and, as the authors suggest, until these taxa have been subjected to genetic characterisation, the status of *ochrozona* as a separate species must remain in doubt. **Illustrations of the adult insect:** the general appearance of the male and female is shown in photographs provided by Van Steenis *et al*. (2018). a coloured photo of the male is provided by Bot and Van de Meutter (2019); the female is shown in colour in Prokhorov *et al*. (2023).

TRIGLYPHUS

Peck (1988) lists only one European species in this genus. Since then, *T. escalerai* Gil Collado, which was described from N Africa, has been found Iberia, the Balkan peninsula and Turkey.

Triglyphus escalerai Gil Collado, 1929
Preferred environment: forest; thermophilous oak forest of *Q.pubescens* with *Carpinus orientalis* and *Ruscus*, evergreen oak forest and Eastern Mediterranean maquis of *Q.ilex* with *Ostrya* and more humid secondary forests of *Castanea sativa* with *Laurus nobilis* (Vujić, 1994b and pers.comm.); riparian *Platanus* forest with *Laurus nobilis* (Van Steenis *et al*., 2021); humid grassland (Van Eck, 2016); remnant *Laurus nobilis* forest (Van Eck *et al*., 2020b). **Adult habitat and habits:** settles on the foliage of bushes and shrubs (Vujić, 1994b); settles on the foliage of *Laurus nobilis* (Van Eck *et al*., 2020). **Flowers visited:** umbellifers (Vujić, 1994b); *Ranunculus* (Van Steenis *et al*., 2015). **Flight period:** end April/mid June; September. **Developmental stages:** not described. **Range:** Portugal, Croatia, Montenegro, Turkey and North Africa (Morocco). Vujić *et al*. (2001) suggest this species should be regarded as threatened at the European level. **Determination:** see key provided in StN Keys volume. Vujić (1994b) figures the male terminalia and discusses distinctions from *T.primus*. Van Eck (2016a) alludes to differences between Portugese and Balkan populations of this species, suggesting they might be different taxa. **Illustrations of the adult insect:** none known.

Triglyphus primus Loew, 1840
Preferred environment: open ground, waste ground (including road verges, railway embankments and quarries), thermophilous forest fringes and gardens. The list of situations in which this species was found by Flügel (2004) provides an overview of the range of (largely man-made) habitats it occupies. **Adult habitat and habits:** flies among tall ground vegetation. **Flowers visited:** umbellifers; *Alliaria, Euphorbia, Ligustrum, Prunus, Solidago, Sorbus aucuparia*. An extended list of flowers visited by *T. primus* is provided by Flügel (2004). **Flight period:** Mid-May to June and July to beginning September, with a peak in August. **Developmental stages:** larva found by Leclercq (1944) and Sedlag (1967) in aphid (*Cryptosiphum artemisiae* Buckton) galls on *Artemisia vulgaris*, but as yet undescribed. **Range:** from southern Norway

south to southern France, northen Spain and Andorra; round the Mediterranean to Italy, the former Yugoslavia and Israel; from Britain (southern England) eastwards through central Europe to Roumania and the Ukraine; from the Caucasus on through Asia to Sakhalin and Korea. **Determination:** see key provided in StN Keys volume. An illustration of the male terminalia is provided by Ricarte and Nedeljković (2020). **Illustrations of the adult insect:** the male is figured in colour by Bartsch *et al*. (2009b) and Pétremand *et al*. (2022) , the female by Ball and Morris (2013).

TROPIDIA

Two *Tropidia* species are known from Europe.

Tropidia fasciata Meigen, 1822
Preferred environment: wetland; bog-fringed pools in humid deciduous forest, edges of raised bogs with *Betula/Pinus mugo* scrub; acid fen; oligotrophic flushes with small *Carex* species and *Juncus* and streamlets in unimproved, acidophilous grassland. **Adult habitat and habits:** flies fast and low through and over ground vegetation, in a fashion very reminiscent of *Merodon* species, but usually very close to streamlets or over the surface of flushes. Settles on low-growing vegetation, including short grass. The males zig-zag fast through the vegetation emitting an audible whine. The female has been seen ovipositing in wet mud containing much organic debris, beneath small *Salix* at the edge of a slow-moving stream. **Flowers visited:** *Chrysanthemum leucanthemum, Daucus, Euphorbia, Mentha, Ranunculus, Scorzonera humilis*. **Flight period:** June-September. **Developmental stages:** not described. **Range:** from southern Finland southwards to the Pyrenees; Belgium, Luxembourg, Germany and Poland and on through the Czech Republic to Slovakia, Austria and Hungary; apparently absent from the Alps and European Russia but also known from eastern Siberia. France, from the Ardennes to the Pyrenees, seems to be the only part of Europe in which *T.fasciata* has been collected frequently. **Determination:** See key provided in StN Keys volume. **Illustrations of the adult insect:** the male is illustrated in colour by Haarto & Kerppola (2007) and Speight and de Courcy Williams (2021).

Tropidia scita (Harris), 1776
Preferred environment: wetland/freshwater; reed beds, marsh, fen with pools; along poorly maintained drainage ditches and canals, beside slow-flowing rivers, with flushes and springs in humid, unimproved grassland. This species can also occur in association with coastal lagoons, where freshwater marsh is present around the edge of the lagoon. **Adult habitat and habits:** found among waterside vegetation, where it darts erratically between stems and settles on foliage; males often hover persistently within 20 cms of some particular leaf. **Flowers visited:** Ranunculaceae; Umbelliferae; *Cardamine, Corydalis, Euphorbia, Galium, Iris pseudacorus, Lepidium draba, Myosotis, Potentilla erecta, Ranunculus, Rubus, Sorbus aucuparia, Symphytum, Tamarix gallica, Vaccinium, Valeriana*. **Flight period:** May/ August, with occasional specimens on into September. **Developmental stages:** puparium figured and described by Decleer and Rotheray (1990), from a specimen collected as a larva between basal sheathing leaves of *Typha*. They suggest *T.scita* larvae probably inhabit the rotting water's edge plant debris occurring in reed beds etc. of fens. Nötzold (2000) records collection of an individual of this species from an emergence trap installed in a reed bed. **Range:** from Fennoscandia south to central France; from Ireland eastwards through central Europe and on through Russia to the Caucasus and in Asia as far as the Pacific coast and Japan. **Determination:** See key provided in the StN Keys volume. The male terminalia are figured by Hippa (1978). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al.*(2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

VOLUCELLA

There are six *Volucella* species known from Europe. They are all included in the key in the StN Keys volume. The keys provided by van Veen (2004) deal with the species other than *V.elegans*.

Volucella bombylans (L.), 1758
Preferred environment: forest/wetland; open areas in most types of deciduous forest and humid *Pinus* forest, edges of fens and raised bogs; along hedges in farmland; in evergreen oak forest (*Q.ilex)* in southern Europe. **Adult habitat and habits:** clearings, tracksides etc., in scrub as well as mature woodland; also in humid grassland and along field hedges; usually flies

within 2m of the ground; settles on low-growing vegetation and bushes. **Flowers visited:** visits a wide range of flowers, including many different composites and umbellifers and trees in bloom. De Buck (1990) provides a comprehensive list of flowers visited. **Flight period:** May/August, plus September at higher altitudes/more northerly latitudes. **Developmental stages:** the final instar larva and puparium are described and figured by Rotheray (1999b). The morphology of the chorion of the egg is figured by Kuznetzov (1988). Smith (1955) describes the egg and first instar larva; the larvae are known to be detritivores/larval predators in nests of bumble bees (*Bombus* species), where they occur in the floor of the nest cavity, as shown diagrammatically by Schmid (1996). Barkemeyer (1994) lists the *Bombus* species with which larvae of this syrphid have been found, pointing out that there are also records from nests of *Vespula* species. Rotheray (1999b) provides a key to the determination of the larvae and puparia of European *Volucella* species, other than *V.elegans*. **Range:** from northern Fennoscandia south to Iberia; from Ireland eastwards through central and southern Europe into Russia and the Caucasus and on to the Pacific coast and Japan; in N America from Alaska to Newfoundland and south to California and Georgia. **Determination:** See key provided in the StN Keys volume. Two colour morphs of *V. bombylans*, mimicing diffetrent groups of *Bombus* species, are widely distributed in Europe and have been illustrated by various authors. Edmunds and Reader (2014) provide evidence to show that the frequency of these two morphs is correlated with the abundance of their models. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Kormann, Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Volucella elegans Loew, 1862

Preferred environment: forest; broadleaved evergreen forest; *Quercus ilex* forest and maquis; *Q.rotundifolia* woodland and matorral; maquis of *Cistus/Quercus pyrenaica* (A.-M. Marcos-García, pers.comm.); Mediterranean riparian ash forest (Ricarte-Sabater *et al*., 2008). **Adult habitat and habits:** no data. **Flowers visited**: *Carduus, Cirsium arvense, Crataegus, Diplotaxis erucoides, Euphorbia nicaensis, Hedera, Mentha, Rubus, Thapsia villosa* (A.-M.Marcos-García, pers.comm.). **Flight period:** May/October, with peak in July/August. **Developmental stages:** not described. **Range:** Portugal and Spain. Literature references to the occurrence of *V. elegans* in Corsica have proven erroneous. **Determination:** see key provided in the StN Keys volume. *V. elegans* is superficially very similar to both *V. inanis* and *V. zonaria*. **Illustrations of the adult insect:** the male and female are illustrated in colour in Speight (2024).

Volucella inanis (L.), 1758

Preferred environment: forest; open areas in various types of deciduous forest. **Adult habitat and habits:** apparently largely arboreal except when flower-visiting, but can occur in many different situations during the course of migration. **Flowers visited:** yellow composites; umbellifers; *Achillea, Allium, Buddleja, Cirsium, Epilobium, Eupatorium, Hedera, Knautia, Mentha, Sambucus, Scabiosa, Solidago, Succisa, Thymus, Valeriana*. **Flight period:** beginning July/end September. **Developmental stages:** larval morphology described by Hartley (1981); larva illustrated in colour by Ball and Morris (2013) and (apparently from a preserved specimen) by Rotheray (1994) and redescribed and refigured by Rotheray (1999b); in its morphology, the larva of this species differs somewhat from the larvae of other known European *Volucella* species. According to Rupp (1989) the 1st and 2nd instars are parasitic in wasps' nests, on larvae of *Vespula germanica* and *V.vulgaris*, while the 3rd instar is more parasitoid. *V.inanis* seems to prefer wasps' nests at some height above ground, for example in the attics of houses (such situations are more frequently used by *Vespula germanica* than *V.vulgaris*). Rotheray (1999b) provides a key to the determination of the larvae and puparia of European *Volucella* species, other than *V.elegans*. **Range:** from southern Fennoscandia south to Spain and the Mediterranean (including islands, e.g. Crete), North Africa and Asia Minor (Syria); from Britain (southern England) eastwards through central and southern Europe into Turkey and European parts of Russia; Georgia; on through Siberia to the Pacific; Afghanistan, Mongolia, China. This is a strongly migrational species. **Determination:** see key provided in the StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Volucella inflata (Fabricius), 1794

Preferred environment: forest; deciduous forest with overmature trees, including alluvial softwood and hardwood forest and thermophilous *Quercus*. **Adult habitat and habits:** largely arboreal; adults descend to visit flowers and sap runs on tree trunks within woodland; sap runs are only visited when the sunlight shines directly on them. On hot days, this species has been repeatedly observed settled on the neck of horses, apparently to drink the horse'e sweat (E. Dunne, pers. comm.). **Flowers visited:** umbellifers; *Cornus, Crataegus, Euonymus, Eupatorium, Frangula, Ligustrum, Mespilus germanica, Rubus, Sambucus, Viburnum*. **Flight period:** May/July. **Developmental stages:** the final instar larva and puparium are

described and figured by Rotheray (1999b), from larvae collected from debris from *Cossus* tunnels in *Quercus*. The female has been seen ovipositing in a sap-run, according to Stubbs and Falk (1983). Females have also been observed ovipositing in cracks in the bark of ancient *Populus* and *Quercus* showing sap seepage and patches of trunk rot. There are early references to probably this species being reared from tree humus from cavities in deciduous trees and to an association with the wet sappy frass which accumulates in the workings of *Cossus* larvae, summarised by Barkemeyer (1994). The accumulated information all points to the larvae of *V. inflata* being inhabitants of insect-workings in which sap and insect faeces/tree humus provide a sub-aqueous mix. According to Rotheray (1999b) their mouthparts indicate they are saprophages of some description, rather than predatory, and records observing the larva feeding on tree sap. Rotheray (l.c.) provides a key to the determination of the larvae and puparia of European *Volucella* species, other than *V. elegans*. **Range:** from Sweden and northern Germany south to the Pyrenees and northern Spain; from Britain (England, Wales) eastwards through central Europe into European parts of Russia and on into the Caucasus; the former Yugoslavia; Bulgaria. **Determination:** See key provided in the StN Keys volume and van Veen (2004). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013), Kormann (1988) and Stubbs and Falk (1983).

Volucella pellucens (L.), 1758
Preferred environment: deciduous forest; mesophilous *Fagus*, acidophilous and thermophilous *Quercus*; scrub and (on occasion) hedgerows. **Adult habitat and habits:** clearings, tracksides etc., in a wide variety of wooded situations, including scrub woodland and hedgerows; adults fly at 1 - 3 metres, the males often hovering rather higher, at up to 7m, over tracks etc. **Flowers visited:** visits the flowers of a wide range of low-growing plants, bushes and trees. De Buck (1990) provides a comprehensive list of flowers visited. **Flight period:** May/October. **Developmental stages:** larva described and figured by Hartley (1961) and illustrated in colour by Rotheray (1994); redescribed and refigured by Rotheray (1999b). The larvae are scavengers/larval predators in nests of wasps (*Vespula*), where they occur in the floor of the nest cavity, as shown diagrammatically by Schmid (1996). Barkemeyer (1994), provides a comprehensive précis of available literature on the biology of this species. Rotheray (1999b) provides a key to the determination of the larvae and puparia of European *Volucella* species, other than *V. elegans*. **Range:** from Fennoscandia south to Iberia; from Ireland eastwards through Eurasia to Japan; India and Malaya in the Oriental region; the Caucasus. **Determination:** see key provided in the StN Keys volume. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b), Kormann, Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Volucella zonaria (Poda), 1761
Preferred environment: forest/open ground; mesophilous *Fagus* and thermophilous *Quercus* forest, scrub, suburban gardens and parks. **Adult habitat and habits:** open areas in forest and scrub; males hover at 2-5m above the ground along forest tracks, in clearings etc.; both sexes visit flowering shrubs and are not infrequently recorded from *Buddleja*. The adult insect occurs in a wide range of different situations on migration, and has been noted resting on ships e.g. cross-channel ferries between France and Britain. **Flowers visited:** umbellifers; *Achillea, Allium, Buddleja, Carduus, Centaurea, Cirsium, Clematis, Eryngium campestre, Eupatorium, Hedera, Hydrangea, Knautia, Ligustrum, Mentha, Ranunculus, Rosa canina, Rubus, Sambucus, Scabiosa, Sedum, Solidago, Succisa* and *Thymus*. Morris and Ball (2004) provide a list of flowers which *V. zonaria* has been found visiting in Britain. **Flight period:** mid June/November. **Developmental stages:** the final instar larva and puparium are described and figured by Rotheray (1999b). The entire third stage larva is figured by Fraser (1946), who also provides some information on its biology. It is known to be associated with *Vespa crabro* and *Vespula* species, acting as a scavenger (and larval predator) in the nests of these wasps. Morris and Ball (2004) conclude that, in Britain, *V. zonaria* is associated largely with the ground-nesting *Vespula vulgaris* and that *Vespa crabro* plays no role in supporting this syrphid. An extensive account of available literature on the biology of this species is provided by Barkemeyer (1994). Rotheray (1999b) provides a key to the determination of the larvae and puparia of European *Volucella* species, other than *V. elegans*. **Range:** from Poland south to the Mediterranean (including islands, e.g. Crete) and N Africa; from Ireland eastwards through central and southern Europe (Italy, the former Yugoslavia, Greece) into Turkey and European parts of Russia; Georgia; and on through Siberia to the Pacific; Iran; Mongolia. This species is strongly migratory. **Determination:** See key provided in the StN Keys volume. Usually, the thoracic dorsum is brown in this species, with a paler longitudinal stripe along the lateral margins, and the pleura are extensively brown-marked. Also, there is usually a complete, transverse, pale band across the anterior half of tergite 3 and a pair of large, pale, lateral marks on sternite 3. However, the thoracic dorsum and pleura may be entirely black (except for the humeri), the pale markings on tergite 3 may be reduced to two small, lateral spots and sternite 3 can be all-black. These darker coloured specimens may occur in various parts of Europe, but are characteristic of Corsican

material examined. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Ball and Morris (2013) and Stubbs and Falk (1983).

XANTHANDRUS

One species of *Xanthandrus* occurs on Madeira, a second on the Azores and a third over much of Europe. There is currently no key that can be used to separate these three species from one another.

Xanthandrus azorensis Frey, 1945
Preferred environment: peaty wetland (Rojo *et al.*, 1997). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/September (Rojo *et al.*, 1997). **Developmental stages:** not described. **Range:** Azores. **Determination:** the male of this species may supposedly be distinguished from males of both *X. babyssa* and *X. comtus* through its lack of pale markings on tergite 2. But these markings may also be lacking in males of *X. babyssa*, as shown in the black and white illustration provided by Barkemeyer (1999). **Illustrations of the adult insect:** none known.

Xanthandrus babyssa (Walker), 1849
Preferred environment: forest; Laurisilva forest in particular, but, less frequently, also in *Acacia*/ *Eucalyptus* plantation forests. This species can be found in low numbers in more open areas, even cultivated land, but whether this is due to movement by the adults away from breeding sites in forest is unclear. It can be numerous in association with Laurisilva (Smit *et al*, 2004). **Adult habitat and habits:** the adults can be found in sheltered spots, like forest edges, where they can be found visiting flowers or sitting on leaves (J. T. Smit, pers. comm.). **Flowers visited:** Apiaceae, Asteraceae and Euphorbiaceae (J. T. Smit, pers. comm.). **Flight period:** March/October (probably present the whole year round) (J. T. Smit, pers. comm.). **Developmental stages:** undescribed, but probably carnivorous on larvae of Lepidoptera and Symphyta. **Range:** endemic to the island of Madeira (Portugal). **Determination:** Sack (1928-1932) provides a key supposedly distinguishing this species (as *X. parahyalinatus*) from *X.comtus*. However, the features used in the key are not convincing and variability in *X. comtus* seems to encompass the differences alluded to. This species appears in recent literature as *X. parahyalinatus* Bigot. The synonymy of *parahyalinatus* with *babyssa* was established by Smit *et al.* (2004). But they do not provide any information on how to separate this species from either *X. azorensis* or *X. comtus*. **Illustrations of the adult insect:** Smit *et al.* (2004) and Rego *et al*. (2022) provide coloured photographs of the male and female of *X. babyssa*.

Xanthandrus comtus (Harris), 1780
Preferred environment: forest, deciduous, broad-leaved evergreen and coniferous; *Fagus*, *Quercus*, and *Pinus* forest and scrub. **Adult habitat and habits:** clearings, tracksides etc., especially where there is a thick understorey of shrubs and young trees; settles on foliage of shrubs etc.; males hover at 3 - 5 metres. **Flowers visited:** umbellifers; *Arbutus unedo*, *Cornus*, *Crataegus*, *Filipendula*, *Hedera*, *Juncus*, *Leontodon*, *Lonicera*, *Mentha aquatica*, *Mewspilus*, *Rosa*, *Rubus*, *Succisa*, *Viburnum tinus*. **Flight period:** May/October (April to November in southern Europe), with no clear period of peak occurrence. **Developmental stages:** larva described and figured by Dusek and Laska (1967) and illustrated in colour and distinguished from larvae of related genera in the keys provided by Rotheray (1994). Black and white photos of the larva and puparium are provided by Belcari and Raspi (1989). A coloured photo of the larva is given in Carstensen (2016). The larva is known to predate aphids and the caterpillars of various small moths (e.g. Noctuidae, Tortricidae), both on trees and low-growing plants. It is recorded by Belcari and Raspi (1989) as a predator of the caterpillars of the tortricid *Lobesia botrana* (Denn. & Schiff.), a pest of grape vines. The rapidity with which *Xanthandrus* arrives to oviposit on infested vines suggests plant info chemicals are broadcast by the plant, to signal the onset of an infestation to predators of the caterpillar. Santolamazza *et al.* (2011) record it as a predator of larvae of the noctuid *Mamestra brassicae* in a cabbage crop. Carstensen (2016) reports it as a predator of the larvae of the leaf beetles *Agelastica alni* (L.) and *Plagiosterna aenea* (L.) (Col.: Chrysomelidae) on *Alnus*. It is also recognised as a predator of the caterpillars of the pine processionary moths (*Thaumetopoea pinivora* and *T. pityocampa*). **Range:** from the Faroes (Jensen, 2001) and southern Norway south to Iberia; from Ireland eastwards through central and southern Europe to Russia and the Caucasus and on to the Pacific coast; Japan; Formosa. **Determination:** The male terminalia are figured by Dusek and Laska (1967). The basis for separation of this species from both *X. azorensis* and *X. babyssa* is unclear. According to Sack (1928-32) the legs are more extensively darkened in *X. comtus* than in *X. babyssa*, but the difference would seem to be more that in *X. comtus* the pale parts of the legs are usually a dusky, yellow-brown, whereas in *X. babyssa* the pale parts of the legs are usually yellow. Given that the pale parts of

the legs are more yellow in some specimens of *X. comtus* than in others, and darker in some specimens of *X. babyssa* than in others (see coloured photo of male and female *X. babyssa* provided by Smit *et al*., 2004) using leg colouration to separate these two taxa does not seem very reliable. Sack (1928-32) does not include *X. azorensis* in his key. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009a), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

XANTHOGRAMMA

Peck (1988) lists eight European *Xanthogramma* species. One of them, *X. laetum*, has frequently been consigned to a separate genus, *Olbiosyrphus*, in recent literature. Another, *X. catalonicum* Andreu, has since been established as a junior synonym of *X. laetum*, by Marcos-García (1998). According to Kassebeer (pers.comm.) a third species listed by Peck (l.c.), *X. flavomarginatum* Strobl, is an unpublished synonym of *Scaeva mecogramma*. It is doubtful whether *X. maculipenne* Mik, listed for Europe by Peck (1988) from the former Yugoslavia, is a European syrphid. Certainly, it remains unmentioned in recent lists published for parts of the former Yugoslavia. It is not regarded as a European species here. *X. stackelbergi* Violovitsh, described from northern parts of European Russia, and not known elsewhere when Peck's (1988) catalogue was published, has subsequently been cited from various European countries (see species account for *X. stackelbergi*). An additional species, *X. dives* Rondani, is also now known to be widespread in Europe. In Peck (1988) *X. dives* is given as a synonym of *X. pedissequum*. More recently, Nedeljković *et al.*(2018a) have described two *Xanthogramma* species from Greece, *X. aeginae* Ricarte, Nedeljokvić & Vujić and *X. pilosum* Nedeljokvić, Ricarte & Vujić.
Evenhuis (2018) indicates that it would be valid to discard the name *Xanthogramma* in favour of *Philhelius* Stephens, but demonstrates no benefit, scientific or otherwise, that would be gained from doing so, making the name *Philhelius* of historic interest only. Indeed, the only obvious impact of introducing use of the name *Philhelius* would be negative – introduction of confusion, since the name *Philhelius* has not been used for more than 100 years. In the StN database the opportunity to replace the name *Xanthogramma* is declined, to maintain nomenclatural stability, a principle advocated by ICZN to avoid un-necessary name changes. Introduction of unnecessary nomenclatural change undermines the credibility of ICZN.

Xanthogramma aeginae Ricarte, Nedeljokvić & Vujić, in Nedeljković *et al.*2018
Preferred environment: "xeric grassland near the sea shore" (Vujić et al, 2020). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/May. **Developmental stages:** not described. **Range**: Greece - the Aegean islands of Chios and Lesvos. **Determination:** both male and female are described by Nedeljković *et al.*(2018a), who also figure the male terminalia and provide a key to distinguish *X. aeginae* from other European *Xanthogramma* species. An alternative key is provided in the StN Keys volume. The male is very similar in appearance to *X. citrofasciatum.* The female is difficult to separate from *X. pilosum*. **Illustrations of the adult insect:** the coloured photos in Nedeljković *et al.*(2018a) provide an indication of the general appearance of the male and female of this species.

Xanthogramma citrofasciatum (de Geer), 1776
Preferred environment: open ground; usually well-drained, unimproved, calcareous/mesophilous grassland, from xeric grassland up to and including grassland in the montane zone. **Adult habitat and habits:** flies low through grasses etc., often settles on the nest mounds of ants of the genus *Lasius*. **Flowers visited:** *Convolvulus, Euphorbia, Lepidium draba, Scabiosa, Taraxacum*. **Flight period:** May/June, with a second peak in August in southern Europe. **Developmental stages:** features of the puparium are detailed by Speight (1990), who distinguishes the puparium of this species from that of *X.pedissequum* (Harris) and an account of the larval biology is provided by Holldobler (1929). Larvae live in the nests of *Lasius* species, where they predate aphids tended by the ants. Egg: Chandler (1968). **Range:** from southern Norway south to Iberia; from Ireland eastwards through central and southern Europe into European Russia and the former Yugoslavia; the Caucasus; western Siberia. This species is noticeably in decline in parts of western Europe. **Determination:** see key provided in the StN Keys volume. This species has been referred to in much recent literature as *X.festivum* (L). **Illustrations of the adult insect:** the male of *X. citrofasciatum* is illustrated in colour by Torp (1994), Bartsch *et al*. (2009a), Bot and Van de Meutter and Speight and de Courcy Williams (2021).

Xanthogramma dives (Rondani), 1857
Preferred environment: forest, both deciduous and coniferous and in broad-leaved evergreen forest; mesophilous *Fagus* and thermophilous *Quercus*, especially in the vicinity of temporary streams; Mediterranean riparian *Fraxinus* forest; in the vicinity of temporary streams in evergreen oak forest of *Q.ilex* and *Q.suber*; garrigue; *Abies* forest, dry *Pinus sylvestris* forest and near temporary streams in Mediterranean pine forest; has also been found in olive orchards. In lowland parts of central Europe *X. dives* can occur in suburban gardens and hay meadows (Pétremand *et al*. (2022). **Adult habitat and habits:** males hover at up to 2m, in the shade, in sparsely-vegetated areas beneath trees. Females fly through sparse ground vegetation, at up to 1m. **Flowers visited:** *Chaerophyllum hirsutum* (Ricarte et al, 2014).. **Flight period:** May/mid June and July/beginning September. **Developmental stages:** not described. **Range:** at present uncertain, due to confusion until recently with both *X.pedissequuum* and *X.stackelbergi*, but known from Spain, France (from the Mediterranean to the north coast), the Netherlands, central Germany, Switzerland, Austria and northern Italy; Van Steenis (2011) records *X.dives* from Norway; Turkey; Caucasus (Georgia); N Africa (Morocco). **Determination:** see key provided in the StN Keys volume. The name *dives* (Rondani) appears in Peck (1988) as a synonym of *X.pedissequum*. Its use here follows the re-definition of the species provided by Speight and Sommaggio (2010). Mengual *et al*. (2020), point out that *X. maculipenne* Mik, 1887, described from the Transcaucasus, has been ignored in recent literature, but may be a synonym of *X. dives*. **Illustrations of the adult insect:** A coloured photo of the male is provided by Speight and de Courcy Williams (2018) and Bot and Van de Meutter (2019). The female is illustrated in colour by Speight and de Courcy Wiilliams (2021)

Xanthogramma laetum (Fabricius), 1794
Preferred environment: forest; close to brooks and flushes in conifer forest (*Abies/Picea* and *Pinus, including* dry *Pinus*); *Alnus incana* alluvial forest. **Adult habitat and habits:** appears to be largely arboreal, but descends to feed at flowers and the female also wanders from the forest biotope, to be found in various other situations. The male is fast-flying and reminiscent of a *Dasysyrphus* species in flight. The female, when flower-visiting, is reminiscent of other *Xanthogramma* species, but flies rather higher, at 1-2m from the ground. Both sexes, and particularly the female, frequently fly in the shade, along stream edges and tracks. The males can be found hovering in the shade, at 2-3m above the ground (J.-P.Sarthou, pers.comm.). **Flowers visited:** *Allium ursinum, Crataegus, Glecoma, Phyteuma spicatum, Ranunculus*. **Flight period:** May/September, with a peak in August. **Developmental stages:** not described. Fetzer (1937) provides an enigmatic account of an attempt to rear this species. On several occasions he observed females laying eggs on the moss-covered (*Peritrichium formosum*) roots of *Fagus* stumps. Apparently neither stumps of recently-felled trees (i.e. one-year-old stumps) nor well-rotted stumps were chosen by the fly, which attempted repeatedly to go down into the moss. A female kept in captivity laid 100 eggs over a period of three days, singly, on the moss leaflets. Within three days these eggs hatched and the larvae were offered plenty of aphids, but had all died two days later. **Range:** from northern Germany south to south-west France (Pyrenées-Atlantiques); from Belgium eastwards through central and southern Europe (Italy, the former Yugoslavia) to Roumania and European parts of Russia. **Determination:** see key provided in the StN Keys volume; van der Goot (1981), Bradescu (1991), Verlinden (1994) and Marcos-García (1998). Marcos-García (l.c.) figures the male terminalia. *X.laetum* appears in much recent literature as *Olbiosyrphus laetus*. The adult insect is illustrated in black and white by Verlinden (1994). **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019); the female is figured in colour by Speight and de Courcy Williams (2018).

Xanthogramma marginale (Loew), 1854
Preferred environment: forest/open ground; open maquis of *Q.ilex* and *Q.pyrenaica;* dehesa of *Quercus rotundifolia/Q. pyrenaica* (Ricarte *et al.*, 2018); dry, unimproved grassland; Mediterranean riparian ash woods (Ricarte Sabater *et al*., 2008). **Adult habitat and habits:** males hover at c 1m, usually alongside markers of some sort, like *Rubus* thickets. **Flowers visited:** yellow composites; umbellifers; *Tamarix canariensis*. **Flight period:** April/beginning June. **Developmental stages:** not described. **Range:** Portugal, central and southern Spain, southern France, Italy and north Africa (Morocco, Algeria). **Determination:** see key provided in the StN Keys volume. **Illustrations of the adult insect:** the male is illustrated in colour by Van Eck and Carles - Tolrá (2023).

Xanthogramma pedissequum (Harris), 1778
Preferred environment: open ground; unimproved montane grassland and unimproved, lowland humid grassland and open areas along streams in thermophilous *Quercus* forest and mesophilous *Fagus* forest; occasionally along grassy road verges or canal banks, or in suburban parks and gardens. This species is almost invariably in well-drained situations, even when close

to water. **Adult habitat and habits:** flies low among tall grass etc. and settles on foliage of low-growing plants. **Flowers visited:** umbellifers, yellow composites; *Berberis, Caltha, Crataegus, Erigeron annuus, Euphorbia, Lamium, Ligustrum, Potentilla erecta, Pulicaria, Ranunculus, Rosa, Rubus, Sambucus nigra, Stellaria, Ulmus*. **Flight period:** May/September, with a peak in July. **Developmental stages:** features of a larva probably of this species are described and figured by Rotheray and Gilbert (1989); Speight (1990) distinguishes the puparium of a *pedissequum* group species from that of *X.citrofasciatum*. The larval biology has probably (*X.pedissequum* being the commonest species in the *pedissequum* group known in Britain) been documented by Pontin (1960). The larvae are predators of the "herds" of root aphids tended by ants of the genus *Lasius*. *Xanthogramma pedissequum* has been collected in emergence traps installed in vineyards, where ground cover of ruderals and grasses had been established (Pétremand et al, 2017). **Range**: uncertain, due to confusion until recently with both *X.dives* and *X.stackelbergi*, but known from Britain and Atlantic seaboard countries south to southern France and into central Europe to the Alps (France, Switzerland). It seems that in the Mediterranean zone *X.pedissequum* is largely replaced by *X.dives* and *X.stackelbergi* and the southern European distribution of *X.pedissequum* is particularly in need of review. **Determination**: see key provided in the StN Keys volume. This species is included in various recent keys e.g. van Veen (2004). But keys in which both *X. dives* and *X. stackelbergi* are not also included cannot be relied upon. **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Colyer and Hammond (1951), Haarto and Kerppola (2007a), Kormann, Stubbs and Falk (1983), Torp (1984, 1994), Bartsch *et al*. (2009a) and van der Goot (1986).

Xanthogramma pilosum Nedeljković, Ricarte & Vujić, in Nedeljković *et al*.2018
Preferred environment: close to temporary streams in evergreen oak (*Q. coccinea*) matorral and organic olive orchards. **Adult habitat and habits:** fast-flying, through tall-herb vegetation; males hover in partial shade, at 1 – 3 m. **Flowers visited:** *Euphorbia*. **Flight period:** April. **Developmental stages:** not described. **Range:** Greece (Thrace) and the Aegean island of Lesvos**. Determination:** both male and female are described by Nedeljković *et al*.(2018a), who also figure the male terminalia and provide a key to distinguish *X. pilosum* from other European *Xanthogramma* species. An alternative key is provided in the StN Keys volume. The male of *X. pilosum* has densely hairy eyes, the hairs sufficiently long to distinguish this species from all other European *Xanthogramma* except *X. laetum*. The eye hairs in the female are less dense and much shorter – sufficiently short to be difficult to distinguish from the condition in females of other *Xanthogramm*a species. **Illustrations of the adult insect:** the coloured photos in Nedeljković *et al*. (2018a) provide an indication of the general appearance of the male and female of this species.

Xanthogramma stackelbergi Violovitsh, 1975
Preferred environment: forest/open ground; open areas in deciduous and broad-leaved evergreen forest on well-drained soils, including mesophilous *Fagus* forest, thermophilous *Quercus* forest of *Q. pubescens*, gallery forest of *Alnus incana* and evergreen oak forest of *Quercus suber*; closed, semi-arid, unimproved, calcareous grassland with dry scrub; riparian *Fraxinus angustior* gallery forest. **Adult habitat and habits:** males hover at 1-3 metres, along the edges of paths and beneath trees (often in the shade) where there is no undergrowth; females visit spring edges to drink and tend to fly within shade. **Flowers visited:** *Sambucus ebulus* (Ssymank, 2012); *Stellaria* (Bartsch *et al*., 2009); white umbellifers; tall *Euphorbia* (in late afternoon/evening). **Flight period:** mid May/September. **Developmental stages:** not described. Females have been observed repeatedly ovipositing on low-growing vegetation around the entrance to the nest of a *Lasius niger* group ant (M de Courcy Williams, pers. comm.). **Range:** not yet well defined, due to confusion with *X. dives* and *X.pedissequum*, but known from Norway (Gammelmo and Nielsen, 2008); Sweden (Bartsch et al.(2009a); Finland (Haarto and Kerppola, 2007b); parts of European Russia and the Crimea; England; Denmark; southern Germany (Ssymanck (2002); Switzerland; Austria; France, south to the Mediterranean; Italy; Greece; Georgia. **Determination:** see key in StN Keys volume. The description of this species is based on a solitary male from the St Petersburg region of European Russia (Violovitsh, 1975). The female is described (in Swedish) by Bartsch *et al*. (2009a) and both sexes of this species are included in their keys (which do not, however, include *X. dives*). The male of this species can be extremely difficult to separate from the male of *X. dives*. Violovitsh (1975) figures the male terminalia. Females from the summer (August) generation of this species in sub-Mediterranean parts of Europe can have a median yellowish mark on tergite 3, or a more extensive yellowish stripe, medially, on tergites 3 and 4. In these specimens the usual yellow marks on the tergites are also more extensive. **Illustrations of the adult insect:** A coloured photo of the male is provided by Bot and Van de Meutter (2019) and Speight and de Courcy Williams (2021). The female is illustrated in colour by Harrto and Kerppola (2007b) and Bartsch *et al*. (2009a).

XYLOTA

Until recently, species now consigned to the genera *Brachypalpoides* and *Chalcosyrphus* were included in *Xylota* and many accounts (including van der Goot, 1981) exhibit this more traditional practice. Eleven European *Xylota* species are recognised by Peck (1988). *X. jakutorum* Bagatshanova has since been added to the European list (Mutin and Gilbert, 1999; Vujić and Milankov, 1999) having previously been confused with *X. caeruleiventris* (Zetterstedt), thus bringing the total number of known European species to twelve. All of the European species are keyed out in the StN Keys volume, by Bartsch *et al*. (2009b) and Haarto and Kerppola (2007a). Rotheray (2004) provides a key to the determination of puparia and last instar larvae of the *Xylota* species known from Britain.

Xylota abiens Meigen, 1822
Preferred environment: forest; overmature deciduous forest of humid *Quercus* and *Carpinus/Quercus/ Ulmus*, also alluvial hardwood forest. This species seems to frequent sites where seasonal fluctuations in water levels occur, such that during the winter months water levels are either at, or slightly above, the ground surface. **Adult habitat and habits:** runs about and sun bathes on felled and fallen trunks and on stumps in the sun, in glades, small clearings and beside tracks and on foliage of bushes and shrubs in similar situations, at up to 1.5m from the ground. This species can also be found on stumps in partial shade/dappled sunlight. **Flowers visited:** umbellifers; *Ilex, Ranunculus, Rubus idaeus, Sambucus*. **Flight period:** mid June/July. **Developmental stages:** larva described and figured by Rotheray (2004), from larvae collected from decaying sap under the bark of moribund pines (*Pinus sylvestris*) sinking into a mire of man-made origin. Under more natural conditions the larva has been found in wet, decaying roots of *Fagus* stumps. **Range:** from Denmark south to the Pyrenees; from Ireland eastwards through central Europe (and northern Italy and northern parts of the former Yugoslavia) into Russia and the Caucasus and on as far as the Pacific coast (Sakhalin). **Determination:** see key provided in the StN Keys volume; Bartsch et al.(2009b). The male terminalia are figured by Hippa (1968a). In both sexes, the adults of this insect are very similar to *X.meigeniana* Stack., but may be distinguished in that the antero-dorsal sclerite of the mesopleur (mesoanepisternite 1) is almost entirely dull and grey dusted in *X.abiens*, whereas in *X.meigeniana* it is almost entirely undusted and shining black. In the male of *X.meigeniana* abdominal tergite two is longer than wide, whereas its basal width is greater than its length in male *X.abiens*. The practice of using the name *semulatra* for this species, adopted by more than one author recently, is simply bad science. Harris's (1776 - 1780) description of his species *semulatra* is inadequate to identify it as a *Xylota*, his figure could be any one of a number of species, there is no type material of *semulatra* in existence and no author using the name *semulatra* has yet designated a neotype for the taxon. It thus remains a *nomen dubium*. **Illustrations of the adult insect:** *X.abiens* is illustrated in colour by Bartsch et al.(2009b) and Stubbs and Falk (1983) and Torp (1994).

Xylota caeruleiventris (Zetterstedt), 1838
Preferred environment: forest; taiga/humid *Pinus sylvestris* forest (including western taiga) and mixed boreal forest; relict sub-boreal transition mire with *Pinus sylvestris* or *P. uncinata* and bog with *Pinus sylvestris* in central Europe. **Adult habitat and habits:** males sit on the trunks of freshly-fallen (leaves still green) *Pinus* within/at the edge of bog/transition mire. **Flowers visited:** umbellifers; *Rhododendron tomentosum* (Bartsch et al.(2009b). **Flight period:** end May/mid July in central Europe; mid June to second half of August in N Europe. **Developmental stages:** larva not described, but probably under the bark of water-logged, fallen trunks of recently-fallen *Pinus* in, or at the edge of, bog and transition mire. N. P. Krivosheina (2020) states that the larvae "develop on fir trees, in sap-filled tunnels of *Hylobius arietis*" occurring "usually under the thick bark in the basal parts of the Scots and Siberian pine trunks". **Range:** northern and central Fennoscandia (Norway, Sweden, Finland) and through Siberia to the Pacific coast; Germany (Doczkal, 2004), Switzerland (Fisler *et al*., 2023) and Czech Republic (Dolezal and Romig, 2004) in central Europe, plus Slovenia (Groot and Govedič, 2008). Literature references to the occurrence of *X. caeruleiventris* prior to 2002 cannot be relied upon, due to confusion with *X.jakutorum*. **Determination:** see key provided in the StN Keys volume; Bartsch et al.(2009b). In recent European literature this species has been totally confused with *X. jakutorum*, which was consistently referred to as *Xylota* "*coeruleiventris*", an incorrect spelling of the name *X. caeruleiventris*. The male terminalia of *X. caeruleiventris* and the closely similar *X. jakutorum* are figured by Bartsch *et al*. (2002). The proportions of the surstyli are different in these two species. In *X. caeruleiventris* the finger-like lobe of the surstylus is almost 5x as long as its basal width (where it joins with its almost circular basal lobe. In *X. jakutorum* it is less tha 4x as long as its basal width. Bartsch et al.(2009) use the abdominal markings to separate the males of these two species. In *X. jakutorum* tergites 2 and 3 each have a pair of pale marks, whereas in *X. caeruleiventris* these marks are usually lacking. However, central European males of *X. caeruleiventris* can have vestigial pale marks on the tergites. An

additional feature which can help to separate the males is that in *X. caeruleiventris* the clypeus is less than 1.5 x as long as wide, while in *X. jakutorum* it is distinctly more than 1.5 x as long as wide. In the females the proportios of the clypeus are more similar. Doczkal (2004) discusses separation of the females of *X.caeruleiventris* from *X.jakutorum.* Unmarked females of *X.jakutorum* remain difficult to distinguish from females of *X.caeruleiventris*. Dolezal and Romig (2004) point out that if *X.pseudoignava* Mutin (an eastern Palaearctic species) were to occur in Europe, it would be confused with *X.caeruleiventris* in existing keys. They also observe that there do not seem to be reliable features to use for distinguishing these two species. **Illustrations of the adult insect:** a coloured photograph of the male of *X.caeruleiventris* is provided by Haarto & Kerppola (2007). The male is also figured in colour by Bartsch et al.(2009b).

Xylota florum (Fabricius), 1805
Preferred environment: deciduous forest; alluvial hardwood forest with over-mature trees (especially *Populus*) and brook-on its anterlateral surfacefloodplain forest. **Adult habitat and habits:** on trunks and stumps of fallen and felled trees in the sun, in clearings and at tracksides; also on streamside and trackside vegetation in the sun, within woodland. **Flowers visited:** white umbellifers; *Rubus fruticosus*. **Flight period:** end May/end July, with most records from June. **Developmental stages:** Dusek and Laska (1960b) described the larva of *X. florum* from hole-holes in *Populus*. Their description has been validated as relating to *X. florum* by Rotheray (2004), who redescribes the developmental stages. Assuming that early records do relate to *X. florum*, the species has been reared more than once from trunk cavities in *Populus nigra*. N.P. Krivosheina (2020) mentions that the larvae develop "in sap accumulations in trunk cracks" on aspen (*Populus tremula*). But *X. florum* can occur in deciduous forest where no species of *Populus* is present, so development must also occur in other trees. Krivosheina (2001) reports rearing this species from a fallen trunk of *Picea*. **Range:** from Scandinavia south to central France; from Ireland eastwards through much of Europe into European parts of Russia and the Caucasus and on as far as eastern Siberia. **Determination:** see key provided in the StN Keys volume; Bartsch *et al*. (2009b). The male terminalia are figured by Hippa (1968a). *X. florum* is extremely similar to *X. meigeniana* Stack, but in both sexes the antero-dorsal sclerite of the mesopleur (mesoanepisternite 1) is predominantly dull and grey-dusted in *X. florum*, whereas it is almost entirely undusted and shining black in *X. meigeniana*. The hypopygium of the male of *X. florum* is black-haired and the apical margin of the cercus is deeply concave, while in *X. meigeniana* the hypopygium is predominantly white-haired and the apical margin of the cercus is convex. Also in the male, the hind femora in *X. florum* carry hairs longer than half the maximum depth of the femur, on the antero-dorsal surface, whereas in *X. meigeniana* none of the hairs on this part of the hind femora are as long as half the maximum depth of the femur. The females of these two species are more difficult to separate - the infuscation of the wing referred to by some authors, as distinguishing the female of *X. meigeniana*, can also occur in females of *X. florum*. Males of *X. florum* can usually be separated from males of *X. jakutorum* by the proportions of the second tergite – longer than wide in *X. florum*, wider than long in *X. jakutorum*. In ambivalent cases, the distribution of hairs longer than half the depth of the hind femur, on its anterodorsal surface, can aid in determination. In *X. florum* males these longer hairs are distributed over the basal half or more of the length of the femur, whereas in *X. jakutorum* males these longer hairs are only present on the basal quarter of the length of the femur. **Illustrations of the adult insect:** Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994) figure the adult insect in colour.

Xylota ignava (Panzer), 1798
Preferred environment: forest; conifer forest of *Picea*, down to the altitude of mixed *Fagus/Picea* forest. **Adult habitat and habits:** on logs and fallen trunks in the sun, or on ground beside them; often in abundance at *Picea* debarking stations. **Flowers visited*:*** *Aegopodium, Crataegus, Galium, Ranunculus, Rosa canina, Sambucus.* **Flight period:** end May/July and August at higher altitudes. **Developmental stages:** not described. **Range**: from Fennoscandia south to central Spain; Netherlands and the Ardennes through central Europe to European Russia; in southern Europe to parts of the former Yugoslavia, Greece and Turkey; Caucasus (Georgia); also through Asiatic Russia to the Pacific; Mongolia, China, Korea, Japan. **Determination**: see key provided in the StN Keys volume; Bartsch et al.(2009b). The male terminalia are figured by Hippa (1968a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Haarto & Kerppola (2007) and Pétremand *et al*. (2022).

Xylota jakutorum Bagatshanova, 1980
Preferred environment: conifer forest, with mature and overmature trees; partially anthropophilic, extending its range into commercial conifer plantations in parts of Europe previously covered in deciduous woodland; found with *Abies*, *Picea* and *Pinus*. In south-east Europe, apparently also in montane deciduous forest (A.Vujić, pers.comm.). **Adult habitat and habits:**

running on the foliage of bushes and shrubs at tracksides and edges of clearings etc.; frequently in the sun on fallen or felled timber and tree stumps or on the ground in the vicinity of old trees. **Flowers visited:** umbellifers; *Potentilla erecta, Ranunculus, Rosa rugosa, Rubus idaeus, Sorbus aucuparia*. **Flight period:** May/August, with peak in June/July and occasional specimens into September. **Developmental stages:** Rotheray (1994) established that the larva of this species (under the name *X. coeruleiventris*) occurs in sap runs on *Abies*, caused by the weevil *Hylobius abietus.* The larva is described and figured (as the larva of *X. caeruleiventris*) by Rotheray and Stuke (1998), from larvae collected from sap-filled borings of *Hylobius* beneath the bark of *Pinus sylvestris* stumps. **Range:** from Fennoscandia south to the Pyrenees; Italy; from Ireland eastwards through central Europe to European parts of Russia and on into Asia through much of Siberia. **Determination:** see key provided in the StN Keys volume; Bartsch *et al*. (2009b). Bartsch *et al*. (2002) figure the male terminalia of *X. jakutorum* and the closely similar *X. caeruleiventris*. *X. jakutorum* appears in most recent European literature, including the keys of Speight (1999b), Verlinden (1994) and Bradescu (1991), under the name X. *coeruleiventris*, a mis-spelling of the name *caeruleiventris*. *X. jakutorum* was confused with *X. caeruleiventris* in European literature for many years. In the female, the presence or absence of pale markings on the abdominal tergites is unreliable (Bartsch *et al*., 2002) as a basis for separating *X. caeruleiventris* and *X. jakutorum*, since pale abdominal markings may be entirely absent in females of both species (it is suspected they are always absent in *X. caeruleiventris* females). Bartsch *et al*. (2002) figure the male terminalia of both species - these figures show how closely similar the terminalia are. **Illustrations of the adult insect:** the adult of *X. jakutorum* (as *X. coeruleiventris*) is illustrated in colour by (Kormann (1988), Stubbs and Falk (1983) and Torp (1994). As *X. jakutorum* it is figured in colour by Bartsch *et al*. (2009b).

Xylota meigeniana Stackelberg, 1964
Preferred environment: forest/freshwater; along streams in deciduous forest with overmature trees; *Carpinus/Quercus/ Ulmus* forest, alluvial hardwood forest; brook floodplain forest with *Populus tremula*. **Adult habitat and habits:** in Sweden "typically found sitting in sunlit patches on 1-2 year-old windfalls of aspen in part-shaded deciduous or mixed forest glades" (Bartsch *et al*., 2009b). **Flowers visited:** umbellifers (Bartsch *et al*., 2009b). **Flight period:** beginning June/ September. **Developmental stages:** not described, but this species has been collected in an emergence trap installed on a groundwater seepage system (helocren) with a mosaic of fen vegetation and small species of *Salix*, e.g. *S.capraea* (E.Carrières, pers.comm.). Krivosheina (2001) reports rearing this species from larvae found in rotten wood under the bark of humid, fallen trunks of *Populus tremula*, with *Hammerschmidtia ferruginea* larvae. **Range:** from southern Sweden and Finland south to northern France (Paris basin); from Belgium eastwards through northern and parts of central (Switzerland, Roumania) Europe into European parts of Russia and the Ukraine and on through Siberia to the Pacific; Japan. **Determination:** see key provided in the StN Keys volume; Bartsch *et al*. (2009b). Hippa (1968a) figures the male terminalia. **Illustrations of the adult insect:** Bartsch *et al*. (2009b), Torp (1994) and Haarto & Kerppola (2007) illustrate the adult insect in colour.

Xylota segnis (L.), 1758
P**referred environment:** forest; most types of coniferous and deciduous forest; an anthropophilic species, also found away from woodland in hedgerows and suburban gardens. **Adult habitat and habits:** running on foliage of bushes and shrubs; on ground beside logs and tree stumps; on felled or fallen trunks and on stumps of both deciduous and coniferous trees. **Flowers visited:** umbellifers; *Corylus, Crataegus, Hedera, Heracleum, Solidago virgaurea, Sorbus aucuparia, Tilia, Viburnum opulus.* De Buck (1985) has established that *X. segnis* collects appreciable quantities of pollen from the surfaces of leaves and may also ingest pollen grains from the faeces of other syrphids. The detailed observations made by Rotheray (2019), of the actions of specimens of *X. segnis* whilst on the flowers of a *Ranunculus* species, indicated that the insect was collecting pollen grains from the surface of the petals, but not from the stamens, and that the nectaries were ignored. **Flight period:** May/September, with peak in June; occasionally in April (March/April in southern Europe) and may persist to November. **Developmental stages:** larva described and figured by Hartley, (1961); may be found under bark of rotten stumps, trunks and logs of both deciduous trees and conifers, in damp rot-holes and sap-runs on living trees and in various rotting plant debris e.g. wet, decomposing silage, wet, rotting sawdust, rotting potatoes. It would appear that the larvae of *X. segnis* can also, on occasion, make use of the remains of rotting mammalian cadavers as food (Moffat, 2013). Rotheray (1994) illustrates the larva in colour. A coloured photo of the puparium is given in Dussaix (2013), who confirms that the larva overwinters and reports 20 days as the duration of the puparial phase.. **Range:** throughout Europe except for the extreme north; North Africa; the Caucasus; through Eurasia to the Pacific coast and Japan; eastern parts of N America. **Determination:** see key provided in the StN Keys volume; Bartsch *et al*. (2009b). The male terminalia are figured by Hippa (1968a). **Illustrations of the adult**

insect: the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Xylota suecica (Ringdahl), 1943
Preferred environment: conifer forest; *Pinus sylvestris* taiga and mosaic boreal *Picea/Pinus/Betula* forest and aapa mire with overmature trees (H. Bartsch and T. Nielsen, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus, Rubus chamaemorus*. **Flight period:** mid June/mid July. **Developmental stages:** not described. **Range:** arctic Norway, northern Sweden and Finland eastwards through northern Russia and on to eastern Siberia. **Determination:** see key provided in the StN Keys volume; Bartsch *et al*. (2009b). The male terminalia are figured by Hippa (1968a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007).

Xylota sylvarum (L.), 1758
Preferred environment: forest; most types of humid deciduous and coniferous forest with mature and over-mature trees and along streams in broad-leaved evergreen oak forest (*Quercus ilex*). **Adult habitat and habits:** tracksides and edges of clearings, running on foliage of bushes, *Pteridium* and low-growing vegetation; sometimes on tree stumps. **Flowers visited:** *Ranunculus, Rubus idaeus.* De Buck (1985) has established that *X.sylvarum* can obtain much or all of its pollen intake from ingestion of the pollen grains it finds on the surface of leaves, and may augment this with pollen taken from the faeces of other syrphids. **Flight period:** end May/September, with peak in July. **Developmental stages:** larva described and figured by Hartley (1961) and illustrated in colour by Rotheray (1994), who also redescribes the larva in a more recent publication (Rotheray, 2004); larvae have been found in damp, fungus-ridden decaying wood of *Abies, Fagus* and *Quercus* trunks and stumps, usually beneath the bark. Rotheray (1990a) suggests decaying tree roots are probably a major larval habitat for this species and Rotheray (1994) mentions both *Abies* and *Fagus* roots as locations where larvae have been found. Krivosheina (2001) adds *Pinus* to the list of tree genera from which the larvae of this species have been reared, commenting that the larvae occur under the same circumstances as those of *Myathropa*. Rotheray (2004) extends the list of trees from which this species has been reared to include *Fraxinus, Picea, Populus tremula* and *Pseudotsuga.* Dussaix (2013) provides a coloured photo of the puparium, indicates that the larva overwinters and records that the puparial phase lasts for 4 weeks. **Range:** from Fennoscandia south to Iberia; from Ireland eastwards through much of northern and central Eurasia to the Pacific coast; known in southern Europe from Italy, the former Yugoslavia, Greece and Turkey. **Determination:** see key provided in the StN Keys volume; Bartsch et al.(2009b). The male terminalia are figured by Hippa (1968a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors,including Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Xylota tarda Meigen, 1822
Preferred environment: deciduous forest, *Quercus* forests (including thermophilous *Quercus* forest of *Q.pubescens*), alluvial forest with overmature *Populus*, brook-floodplain forest and other riparian forests with *Populus tremula* and *Populus* plantations. **Adult habitat and habits:** usually in scrub woodland, or open forest with patches of dense scrub, but nearly always on old forest sites; running on foliage of bushes, *Rubus* etc. at tracksides and edges of clearings and on bare ground; flies through scrub vegetation at 1 - 3 metres from ground. **Flowers visited:** *Calluna vulgaris, Leontodon, Potentilla, Ranunculus, Sambucus.* **Flight period:** May/August, with a peak at the beginning of July. **Developmental stages:** larva described and figured by Rotheray (1991), from larvae collected from a sap run at the base of the trunk of *Populus tremula.* Rotheray (1994) illustrates the larva in colour. Krivosheina records rearing of this species from larvae collected in rotting wood of *Fagus*. **Range:** from northern Fennoscandia south to Spain; from northern Italy (Apennines) and the former Yugoslavia (Slovenia); from Ireland eastwards through central Europe into European parts of Russia; the Caucasus; through Asia to the Pacific coast (Kuril islands). **Determination:** see key provided in the StN Keys volume; Bartsch et al.(2009b). This species is nearly always found in localities where *X. segnis* also occurs and is very difficult to distinguish from *X. segnis* in the field. It is usually seen in much smaller numbers than *X. segnis*, because of its more secretive behaviour. Despite what is suggested in keys such as those of van der Goot (1981) and Stubbs and Falk (1983), abdominal markings are entirely unreliable as a means of distinguishing *X. tarda f*rom *X. segnis*. The presence of dusting on the anterior parts of the mesopleur and a row of black spines beneath the hind tibiae are diagnostic of *X. segnis:* these features are absent in *X.tarda*. The male terminalia are figured by Hippa (1968a). **Illustrations of the adult insect:** the adult insect is illustrated in colour by various authors, including Bartsch *et al.* (2009b), Pétremand *et al*. (2022), Stubbs and Falk (1983) and Torp (1994).

Xylota triangularis Zetterstedt, 1838

Preferred environment: conifer forest; overmature conifer forest with old trees, from the upper limits of *Picea* into old *Larix*/*Pinus cembra/P.mugo* forest (in the Alps); *Pinus/Betula* swamp forest; western taiga. **Adult habitat and habits**: flies in the dappled sunlight of small glades along streams within forest, among tall ground vegetation, on which it settles; also rests on fallen trunks of *Pinus* (C.Claussen, A.Haarto, T.Moertelmaier and L.Verlinden, pers.comm.); also along streams in the more open forest occurring towards the tree line. **Flowers visited:** *Rhododendron tomentosum* (Bartsch et al, 2009b), *Ledum palustre, Rubus chamaemorus, Stellaria*. **Flight period**: May/June and July/August in more northerly latitudes/higher altitudes. **Developmental stages:** unknown. **Range**: Lapland south to southern Norway and Sweden; Alps (France, Switzerland, Liechtenstein, Austria); European parts of Russia and on into Asia throughout Siberia; also known from Mongolia. **Determination**: see key provided in the StN Keys volume; Bartsch et al.(2009b). **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b) and Haarto & Kerppola (2007).

Xylota xanthocnema Collin, 1939

Preferred environment: forest; well-drained deciduous forest, from the lower levels of *Fagus/Picea* forest down to thermophiles *Quercus* forest, *Castanea* forest and alluvial hardwood forest still subject to seasonal flooding, on sites with a well-drained soil. **Adult habitat and habits:** tracksides and clearings, usually found running on foliage of bushes, e.g. *Rubus*, and shrubs, or on large-leaved lower-growing plants e.g. *Petasites* in the sun; also on trunks of standing trees and on logs in clearings etc. **Flowers visited:** there are no records of flower visiting by this species. It is likely it obtains its pollen and sugar intake in the same fashion as *X. sylvarum* i.e. from the surface of leaves. **Flight period:** end May/September, with peak in July. **Developmental stages:** larva described and its posterior spiracular processes figured by Hartley (1961), who stated he had only found *X. xanthocnema* larvae "in the exudate and rot-holes of yews" (*Taxus*). Krivosheina (2001) records rearing this species from larvae in a standing-water rot-hole in *Abies* and Rotheray (2004) also records the larva from a rot-hole in *Quercus*. The larval microhabitat recorded for this species by N. P. Krivosheina (2020) is “holes in fir and pine trunks filled with water and sap”. **Range:** from Denmark south to the Pyrenees; from Britain (England) eastwards through central Europe, plus Italy and the former Yugoslavia in southern Europe, into European parts of Russia and on into the Caucasus mountains. **Determination:** see key provided in the StN Keys volume; Speight (1999b); Verlinden (1994); Bradescu (1991). The male terminalia are figured by Hippa (1968a). Mengual *et al*. (2020) report Caucasian specimens of *X. xanthocnema*, whose identity was checked genetically and from the male terminalia, possessing black marked hind tibiae. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch *et al*. (2009b), Stubbs and Falk (1983) and Torp (1994).

Chapter 3: SPECIES ACCOUNTS, MICRODONTIDAE

MICRODON

The listing of European species in Peck (1988) is now out-of-date. Doczkal & Schmid (1999) provide a review of the genus *Microdon* in Europe. They present a key to the adults and puparia of the four European species they recognise. More recently, Schönrogge et al.(2002a, 2002b) have described the cryptic species *M.myrmicae* (cryptic in the sense that it is distinguishable in its developmental stages, but not as the adult insect). Their work suggests there may be more cryptic European *Microdon* species awaiting description, since the inference to be drawn from their findings is that any of the existing *Microdon* species known to use more than one ant genus as host could be a species complex, with a different cryptic species associated with each of the ants involved. Following from their work var. *major* of "*M.eggeri*", described by Andries (1912), has also been elevated to species level as *M.major*, another cryptic species (Schmid, 2004), on the basis of distinctions observed in the developmental stages. This increases to six the number of *Microdon* species now known from Europe, and more might be expected if information on ant hosts is gathered more systematically and associated *Microdon* puparia are retained for comparison.

The impact of a population of *Microdon* larvae on the viability of an ants' nest seems hardly to have been studied. However, observation of ant colonies harbouring *Microdon* larvae would lead one to the conclusion that the ant population can become greatly reduced, leading to a situation where the nest is vulnerable to being taken over by an ant of a different species, or fails altogether – presumably to the detriment of the *Microdon* population. Clearly, there is need for better understanding of the population dynamics of ant/*Microdon* larvae, within a nest. Hovestadt et al.(2012) use a modelling approach to demonstrate that the impact on ant reproduction can be sufficient to stimulate production of more reproductive individuals (gynes) in the ant population, once *Microdon* larvae are established in a nest. Schönrogge et al.(2006) reach a similar conclusion, based on experimentation with ant colonies and *Microdon mutabilis* larvae. Both sets of authors suggest this effect is a survival stratagem, on the part of *Microdon* species, "aimed at" increasing the likelyhood of establishment of further ant nests susceptible to (i.e. with the appropriate chemo-sensory signature) supporting *Microdon* larvae. Such a thesis presupposes an availability of unoccupied territory in which the ant can establish new nests. The negative impact of a switch to production of gynes is that this also leads to production of fewer worker ants to feed the ant larvae in, and ensure survival of, the nest already containing *Microdon* larvae. So, as both Hovestadt et al.(2012) and Schönrogge et al.(2006) suggest, the infestation of an ants' nest by generations of *Microdon* larvae would seem to lead, progressively, toward destruction of the ant population of that nest and hence loss of that nest as a resource for use by the *Microdon* population, unless ant worker numbers can be made up by worker transfer from adjacent nests. This latter process evidently can occur in mega-populations of ant species like *Formica lemani*, a known host of *Microdon mutabilis*, where nests are closely related to one another. In the case of *M. myrmicae*, the *Microdon* larvae can be found in the same *Myrmica* nest as another brood predator, the caterpillars of *Maculinea* species (Lepidoptera: Lycaenidae), which would seem to inevitably hasten the depletion of the ant population, even if predation by *Maculinea* and *Microdon* larvae does occur at different times of the year (see under *M. myrmicae*). Clearly, understanding of the dynamics of ant population/*Microdon* larval population interactions, within ants' nests, would benefit from further study. The questions of how, without being torn to pieces by the ants, a *Microdon* female can lay its eggs close enough to an ants' nest for its larvae to gain access to the nest's tunnels, or how *Microdon* larvae can live unmolested within an ants' nest, have received attention. The chemosensory signature of the ant is evidently copied by the *Microdon*, the egg-laying female *Microdon* using the signature it gained as a larva to gain access to the nest and the larva first ingesting ant faeces to obtain the ant's chemosensory signature and then manufacturing the chemosensory signature of the ant larvae once it has reached a brood chamber and started to eat them. Scarparo *et al.*(2019) establish that it is the chemosensory signature of the ant larvae with which the *Microdon* larva protects itself, not that of the adult ants, and that "the responsible cuticular hydrocarbons are not passively acquired but synthesised by the fly larvae". However, in a subsequent paper Scarparo *et al.*(2021) observe that both ants and *Microdon* larvae have bacteris living within them that produce compounds "commonly involved in ant communication".

Microdon and its allies have usually been regarded as comprising a subfamily of the Syrphidae by recent authors, but Speight (1987) suggested it would be more realistic to segregate these insects in a separate family, the Microdontidae, and has subsequently (Speight, 1994) treated them as such. Ståhls *et al.*(2003) achieved a clearer demonstration of the distance between microdontids and syrphids than had been made previously, concluding that the microdontids represent "the basal

lineage", in all respects sharing fewer features with the eristaline and syrphine subfamilies than those two groups share with each other. This more-or-less reduces the issue of the correct placement of *Microdon* and allied genera to a matter of personal preference. An author wishing to highlight differences between these flies and syrphids is justified in regarding *Microdon* as belonging to a separate family. An author wishing to highlight the closer relationship that exists between syrphids and *Microdon*, than between *Microdon* and other families of Diptera, like the pipunculids or platypezids, is justified in regarding *Microdon* and allied genera as a subfamily of the Syrphidae. Ståhls *et al*.(2003) retained what they refer to as "the traditional classification" of *Microdon* and its allies within the Syrphidae, as the subfamily Microdontinae. In a more recent, and very extensive work, looking primarily at the relationships between microdontid/microdontine genera, as manifested in characters of adult morphology and molecular characters, Reemer and Ståhls (2013) again opted for retention of the microdontids in the family Syrphidae, commenting that, since "available evidence does not demand that the classification be changed, a conservative attitude is preferable". Whether this stance remains tenable once sufficient information is available about the larvae of a range of microdontid genera, remains to be seen! As more and more genetic data become available for an increasing diversity of syrphids, further attempts are made to produce a definitive phylogeny for syrphids and related Diptera. In Young *et al*.(2016b), Moran *et al*.(2021) and Wong *et al*. (2023) the microdontid genera are again shown as more distant from all the syrphid subfamilies than those subfamilies are from one another, but microdontids are still included as a subfamily of the Syrphidae, without reasoned argument for the practice. Here the view is taken that there is nothing gained by submerging the separate identity of *Microdon* and its allies within the Syrphidae and the "less traditional" classification of them as a separate family is thus continued.

Microdon analis (Macquart), 1842

Preferred environment: forest; overmature deciduous and coniferous forest with fallen timber left in situ, from upper altitudinal limit of *Fagus*, in *Fagus/Picea* forest and humid *P.sylvestris* forest, to acidophilous Q*uercus* and *Betula/Pinus* forest. **Adult habitat and habits:** clearings and tracksides in woodland; flies within 2m of the ground around low-growing plants and bushes/shrubs; settling on foliage or on the ground. **Flowers visited:** adults are not known to visit flowers for feeding purposes. **Flight period:** beginning May/beginning July. **Developmental stages:** the larval hosts of this species have until recently been given as ants of the genera *Formica* and *Lasius*. However, Schmid (2004a) points out that two cryptic *Microdon* species have been confused under the name *M.analis*, one (*M.major*) apparently associated with ants of the genus *Formica*, the other (*M.analis*) with *Lasius* species. In the detailed description of the larva and puparium of "*M.eggeri"* provided by Hartley (1961) there is no reference to the ants with which the described *Microdon* developmental stages occurred. However, from the information supplied by Schmid (2004a) it can be concluded that Hartley's (1961) description is not based on *M.major*. Barr (1995) explicitly states that his observations of "*M.eggeri*" larvae were based on nests of *Formica lemani*. But re-examination of Barr's *Microdon* material shows that, whatever it is, it is not *M.major*. *M.analis* certainly occurs in nests of ants of the genus *Lasius*. It can occur with *L.platythorax*, an ant that normally nests in rotten wood (and hence occurs in forested locations), and has more recently been found with *L. emarginatus* (Scarparo *et al*, 2019). The mature larva, which occurs superficially in ants' nests just prior to pupariation in April, is more easily found than the adult insect. Similarly, the presence of this species can be detected by locating empty puparia in ants' nests. These empty puparia can persist for some months, or even up to a year, in an identifiable condition. Larvae of *M.analis* can be distinguished from larvae of the other known European species, except *M.major*, by the keys in Doczkal & Schmid (1999). Developmental stages of *M.analis* and *M.major* can be distinguished using the features detailed by Schmid (2004a) and the key presented in the StN Keys volume may be used to separate the puparia of these two species. **Range:** requires confirmation, due to confusion with *M.major*, but probably from Scandinavia south to the Mediterranean and northern Africa; from Ireland eastwards through most of Europe into Russia and on to the Pacific coast; Mongolia. Based on larval host information the presence of *M.analis* can be confirmed from Ireland, Great Britain, France, Germany, Austria and Spain. **Determination:** see keys provided in the StN Keys volume. Doczkal & Schmid (1999), who figure the male terminalia, can be used to separate adults of this species from known European *Microdon* species other than *M. major*. At present, the adults of *M. analis* and *M. major* cannot reliably be distinguished, though Schmid points out that *M. major* is typically larger (body length 10-13mm) than *M. analis* (body length < 10mm). The concept of *M. analis* employed here is that of Schmid (2004a), who essentially confines use of the name *analis* to a taxon whose larvae are associated with ants of the genus *Lasius*. Since the Macquart type of *analis* is an adult, with no associated information on the ant species with which it developed, whether this application of the name *analis* is correct may be impossible to establish. There are also various synonyms of *M. analis* that possibly require re-investigation (see Doczkal and Schmid, 1999). All together, it would seem that the taxonomic status of *M. analis* is far from certain. **Illustrations of the**

adult insect: the adult of *M. analis/M. major* is illustrated in colour by Bartsch *et al.*(2009b), Stubbs and Falk (1983) and Torp (1994). The female is illustrated in colour in Pétremand *et al.* (2022).

Microdon devius (L.), 1761
Preferred environment: open ground; ancient pasture and other forms of unimproved grassland on well-insolated, freely-draining sites, including sandy river floodplains. **Adult habitat and habits:** flies low through grasses etc., settling on vegetation or the ground. **Flowers visited:** there are no definite sightings of this species feeding at flowers. **Flight period:** end May/beginning July. **Developmental stages:** larva described and figured by Rotheray (1991) and puparium figured in colour by Rotheray (1994), from larvae collected from nests of an ant then identified as *Lasius flavus*. Scarparo *et al.*(2019) record *M. devius* with a closely-related *Lasius* species, *L. distinguendus*. The larva of *M. devius* is distinguished from larvae of the other 3 European species by the keys in Doczkal & Schmid (1999). **Range:** from Fennoscandia south to Spain; from Britain (southern England) eastwards through central and southern Europe (the former Yugoslavia, Turkey) into European parts of Russia and on as far as central Siberia. **Determination:** See keys provided in the StN Keys volume and Doczkal & Schmid (1999). **Illustrations of the adult insect:** the adult is figured in colour by Ball and Morris (2013), Bartsch *et al*. (2009b) and Pétremand *et al*. (2022)..

Microdon major Andries, 1912
Preferred environment: forest/open ground; open grassy areas in humid coniferous and deciduous forest and more open and drier situations, including thermophilous forest fringes, dry, sub-Mediterranean, scrub-invaded ancient grassland and garrigue. **Adult habitat and habits:** no data. **Flowers visited:** the observation of Delforge (1994), that the flowers of the orchid *Ophrys fuciflora* are known to be visited by "*M.latifrons*", may relate to male flies of *M.major* attempting copulation (*Ophrys fuciflora* does not occur in the habitat of *M.analis*, but is found in scrub-invaded, dry calcareous grassland where *M.major* can occur), since the flowers have a strong resemblance to *Microdon* species and various species of the genus *Ophrys* employ the technique of attracting particular insects to attempt copulation, as a mechanism for ensuring pollination, the pollinia becoming attached to the insect during its exertions and then getting transferred to another flower in subsequent false-mating attempts. **Flight period:** May (U.Schmid, pers.comm.). **Developmental stages:** the information currently available (see Schmid, 2004) suggests that the larva of *M.major* occurs with ants of the genera *Formica* and *Lasius*. Schmid (2004) confirmed occurrence with the "red" *Formica rufa* group species *F.exsecta*, *F.rufa* and *F.sanguinea* and also with the "black" species *F.fusca*. In contrast, the closely-related *M.analis* appears to be associated primarily with *Lasius* species, notably *L.platythorax*. The differences between *M.analis* and *M.major* puparia, although small, are distinct, and can be recognised in *Microdon* puparia that have been collected complete with their posterior spiracular processes. Re-examination of such puparia, with which specimens of the associated ant host have been maintained, demonstrates clearly that *M.major*-type puparia can be found with *Formica fusca* and *F.sanguinea*, whereas *M.analis*-type puparia are found with *L.platythorax*. Witek *et al.*(2011) report finding empty puparia (i.e. without anterior respiratory processes) and small larvae of *M. major* in nests of *Formica fusca* and *F. lemani*. But the authors provide no clear evidence to support their identification of these developmental stages as belonging to *M. major*. The habitat range of *M.major* must remain poorly defined until more bred material is available. Dussaix *et al.*(2007) record empty puparia of *M.major* from an abandoned ants' nest in a tree stump (tree species unknown) in a large area of acidic flush vegetation being invaded by conifers. Features distinguishing the developmental stages of *M.major* and *M.analis* are detailed by Schmid (2004a). The general appearance of *M.analis/M.major* larvae is shown in the coloured illustration (as *M.eggeri*) provided by Rotheray (1994). Photographs of the puparia of *M.analis* and *M.major* are provided by Dussaix et al.(2007). **Range:** due to confusion with *M.analis*, the range of this species is at present uncertain. It can be confirmed from France and Germany. Given that the open country *Formica rufa* group ant species have become much less frequent during the 20th century, because of intensification of farming, it would be expected that *M.major* is itself becoming a threatened species. **Determination:** See keys provided in the StN Keys volume. This is the *M.eggeri* v.*major* of Andries (1912), recognised as a species in its own right by Schmid (2004a). Morphologically, *M.major* can as yet only be separated from *M.analis* using features of its developmental stages, as detailed by Schmid (2004a) and in the key in the StN Keys volume. However, Schmid (l.c.) does point out that adults of *M.major* are usually larger (body length 10-13mm) than adults of *M.analis* (body length <10mm). Application of the name *major* to this taxon has probably to be regarded as provisional, since there are various other *Microdon* names currently synonymised under *M.analis* (see Doczkal and Schmid, 1999) that predate *major* and now potentially require re-consideration, since *M.major* has itself been regarded as a form of *M.analis*. **Illustrations of the adult insect:** none known.

Microdon miki Doczkal & Schmid, 1999

Preferred environment: : forest; open areas within *Pinus sylvestris* forest and *Picea* forest. **Adult habitat and habits**: no data. **Flowers visited**: no data. **Flight period**: April/May. **Developmental stages:** larval mouthparts and puparium described and figured by Doczkal & Schmid (1999). The larva has been found in association with mound-building ants of the *Formica rufa* group (probably *F.lugubris*). Distinguished from larvae of the other 3 European species by the keys in Doczkal & Schmid (1999). **Range**: Norway, Sweden and Finland; Poland, Belgium (Ardennes), Germany, Czech Republic, Switzerland, northern Italy, Austria, Hungary, parts of the former Yugoslavia, Roumania, the Ukraine and European parts of Russia and on through Siberia to the Pacific coast. **Determination:** See keys provided in the StN Keys volume and Doczkal & Schmid (1999), who figure the male terminalia. This species has been referred to in most recent literature under the name *latifrons* Loew. Doczkal & Schmid (1999) establish that *latifrons* Loew is a junior synonym of *analis* (Macquart) and introduce *miki* as a replacement name for *latifrons* of authors. **Illustrations of the adult insect:** the adult insect is illustrated in colour by Bartsch et al.(2009b) and Haarto & Kerppola (2007).

Microdon mutabilis (L.), 1758

Preferred environment: open ground; sparsely-vegetated, dry, rocky ground with loose stones appropriate for ants nests; heathland; ancient, unimproved montane pasture and grassy clearings in forest, where long-established ants' nests are present; lowland, unimproved grassland on calcareous substrates or sandy alluvium. Recent work by Schönrogge *et al.*(2002a) implies close ties between this *Microdon* and the ant *Formica lemani*. But *M.mutabilis* also occurs in ancient, low-altitude, dry/sub-xeric, calcareous grassland in central Europe where *F.lemani* does not occur. These low-altitude occurrences very probably relate to use of *Formica cunicularia* or *F. cinerea* as larval hosts, both of which are known to support *M. mutabilis*, but could also involve other *Formica* species that *M. mutabilis* is not yet known to exploit. **Adult habitat and habits:** usually flies low over ground vegetation, in woodland clearings and along woodland paths, or out in open pasture; males hover at 1 - 3m in clearings etc.; frequently settles on stones or bare ground. **Flowers visited:** there are no definite records of this insect visiting flowers for feeding purposes, but Delforge (1994) states that the flowers of the orchid *Ophrys fuciflora* are known to be visited by this species, presumably by male flies attempting copulation, since the flowers have a strong resemblance to *Microdon* species and various species of the genus *Ophrys* employ the technique of attracting particular insects to attempt copulation, as a mechanism for ensuring pollination, the pollinia becoming attached to the insect during its exertions and then getting transferred to another flower in subsequent false-mating attempts. **Flight period:** May/July. **Developmental stages:** larva described and figured by Andries (1912)*;* some features redefined by Schönrogge *et al.*(2002a); mouthparts figured by Barr (1995) and Doczkal & Schmid (1999); general form of the puparium shown in colour by Rotheray (1994). Many beautiful illustrations of the morphology of the developmental stages of *M. mutabilis* are provided by Scarparo *et al.* (2017, 2020). Dixon's (1960) description and figures of *M.mutabilis* developmental stages are erroneous. The larva lives as a predator of ant larvae in nests of *Formica lemani* (Schönrogge *et al.*(2002a), *Formica cunicularia* (Van de Meutter, 2015; Scarparo *et al*, 2017) and *Formica cinerea* (Speight *et al*, 2019). Also, *M. mutabilis* probably lives with *Lasius niger*, though the latter ant host requires confirmation. Barr (1995) notes that the larvae feed mostly at night, while the ants are inactive. Schönrogge *et al.*(2006) establish that, under laboratory conditions, the larvae of *M. mutabilis* feed preferentially on the eggs and small larvae of their host ant and take 2 years to complete larval development. The keys to larvae of *Microdon* species provided in Rotheray (1994) and Doczkal & Schmid (1999) were produced prior to recognition of the cryptic species *M. myrmicae.* Schönrogge *et al.*(2002a) provide features distinguishing the larva and puparium of *M.mutabilis* sensu Schönrogge et al.(2002a,b) from larvae and puparia of *M.myrmicae*. The StN Keys to Species volume includes a key to the puparia of European *Microdon* species, including *M. myrmicae*. **Range:** supposedly occurring from Fennoscandia south to Iberia and the Mediterranean; from Ireland east through most of Europe, into European parts of Russia; through Siberia to the Pacific coast. But existing range data for this taxon must now be regarded as unreliable, since they are based almost exclusively on specimens collected as adults. The only populations of *Microdon mutabilis* sensu Schönrogge et al.(2002a, b) studied by those authors were from Britain and Ireland. The presence of the species has subsequently been confirmed by examination of developmental stages in Sweden (Bartsch et al, 2009b), Belgium (Van de Meutter, 2015) Italy (Scarparo *et al*, 2017) and Switzerland (Speight *et al*, 2019). Beuker (2004) and Reemer et al.(2009) no longer regard *M.mutabilis* as present in the Netherlands. **Determination:** See keys provided in the StN Keys volume. This species may be distinguished from other European species except *M.myrmicae* using the keys provided by Doczkal & Schmid (1999). At present *M.mutabilis* is only reliably distinguished from *M.myrmicae* by features of the puparium. Schönrogge et al.(2002a) confine application of the name *mutabilis* to specimens bred from nests of the ant *Formica lemani* on well-drained (i.e. non-wetland) sites. Since there is no way to know which ant host was used by specimens of *M.mutabilis* collected as adults, this restriction of the name renders

such specimens unidentifiable, unless they have a body length greater than 10mm, that being the greatest size known to be reached by *M.myrmicae*. The orange colour of the scutellum, often found in *M.mutabilis*, has been referred to in keys as diagnostic, the scutellum being black/bronze in the other European species. Unfortunately, this is not a reliable feature and specimens of *M.mutabilis* (and *M.myrmicae*) can be found in which the scutellum is entirely bronze, with no trace of orange colouration. This is particularly true of *M.mutabilis* specimens reared from nests of *Formica lemani*. Speight (2003b) points out that the morphology of the larval mouthparts suggests that *M.rhenanus* Andries, synonymised with *M.mutabilis* (L.) by Doczkal & Schmid (1999), may well not be the same species as *M.mutabilis* sensu Schönrogge et al.and requires reassessment **Illustrations of the adult insect:** the appearance of the adult insect is indicated by the coloured figures of "*M.mutabilis*" in Bartsch *et al*. (2009b), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). Photos of the male and female, in colour, from bred specimens, are shown in Speight and sde Courcy Williams (2021).

Microdon myrmicae Schönrogge, Barr, Wardlaw, Napper, Gardner, Breen, Elmes & Thomas, 2002
Preferred environment: wetland/open ground and *Betula/Pinus* swamp forest; characteristic of the ecotone between wetland (raised bog and fen) and humid grassland or heath; under certain conditions may also occur within wetland (where the host ant can establish long-lived colonies in tussocks that remain above the level of seasonal flooding, e.g. around bog woodland), or unimproved, humid grassland, for instance along the edge of brook floodplain systems. **Adult habitat and habits**: a detailed account of adult behaviour is provided by Wolton (2011, 2012). On low vegetation in the immediate vicinity of *M.scabrinodis* nests, a male will wait for long periods, flying up to grapple with a female that emerges from the nest. Males also hover at 1-2m above the vegetation surface, within a few metres of host ant colonies. Both sexes fly low over and settle on fen and bog vegetation. Females walk into nests of the host ant in order to lay their eggs, which are deposited in small clusters close to ant-brood chambers. Adult males can apparently live for two and a half weeks and the females for slightly longer. **Flowers visited**: not known to feed at flowers. **Flight period**: May/June. **Developmental stages:** larval and puparial features are figured by Schönrogge *et al*. (2002a). Gammelmo and Aarvik (2007) provide high quality coloured photographs of the last instar larva, the puparium and the anterior spiracular processes of the puparium. Wolton (2011) similarly provides photographs of the egg, first instar larva and second instar larva. Scarparo *et al*. (2020) go into considerable detail, describing and illustrating all larval instars and the puparium. See StN Keys volume, Scarparo et al. (2020) and Bot & Van de Meutter (2023) for keys separating the puparium of *M. myrmicae* from the puparia of other European *Microdon* species. Schönrogge *et al*. (2002a) established that *M. myrmicae* lives in nests of the ant *Myrmica scabrinodis*, in wet situations (available information suggests that the ant occurs in a much wider range of habitats than *M. myrmicae*, though this situation could change as *M. myrmicae* becomes better known). The developmental stages of *M. myrmicae* have been found with this ant in tussocks of grasses (*Molinia*), moss (including *Sphagnum*), rush (*Juncus*) and sedge (*Carex*). A coloured photo of typical *M. myrmicae* habitat is provided by Gammelmo and Aarvik (2007). Apparently (Bonelli *et al*, 2011) *M.myrmicae* can occur with *Myrmica vandeli* Bondroit, which is parasitic upon *M.scabrinodis* and replaces it, such that erstwhile *M.scabrinodis* nests in wetland can quite rapidly become *M.vandeli* nests (Elmes *et al*, 2003). Stankiewicz (2003) confirms the occurrence of *M.myrmicae* with species of *Myrmica* other than *M.scabrinodis*, namely *M.gallienii* and *M. rubra*. Wolton (2011) also found *M.myrmicae* larvae in nests of *Myrmica ruginodis*. To this host list Tartally et al.(2013) add *Myrmica aloba* Forel. Bonelli *et al*. (2011) found that *M.myrmicae* can be equally abundant in nests of *Myrmica gallienii* and *M.scabrinodis* at localities where both ants occur. The second and third instar larvae are clearly predators of ant larvae (they evidently ignore eggs and pupae). But Wolton (2011) successfully fed first instar larvae on debris from within nest tunnels of *M.scabrinodis*, in the absence of ant brood, rearing one through to the second instar. The first instar *M.myrmicae* larvae were observed to ignore ant larvae. The puparia of *M.myrmicae* tend to be found in the uppermost galleries of the ant in the highest part of the nest, just below to outer layer of vegetation roofing the nest. The same *Myrmica* species used as hosts by *Microdon myrmicae* are used as hosts by the larvae of *Maculinea* (Lycaenidae: Lepidoptera) species. Witek *et al*. (2013) demonstrate that co-habitation in *Myrmica* nests by *Microdon* and *Maculinea* larvae can occur without detriment to either brood predator, apparently because their larvae are exploiting the resources of the ants' nest at different times of the year. Scarparo *et al*. (2021a) found that females of *M. myrmicae* move long distances, frequently oviposit at other ants' nests than the natal nest, and that an individual ants'nest can harbour *M. myrmicae* larvae resulting from females of different origins. They contrast this behaviour with that of *M. mutabilis*, which, in the colonies studied so far, returns year after year to oviposit in the same ant nest. **Range**: uncertain, due to confusion with *M.mutabilis*. At present, the presence of this species is confirmed from France, Germany, Great Britain, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Roumania, parts of European Russia (Karelia), Slovakia, Spain, Switzerland and the Ukraine. Confirmation of the presence of this species is largely dependent upon availability of determined larval or puparial material, although the habitat in which the adult insect is found can also be diagnostic.

Determination: See keys provided in the StN Keys volume. *M. myrmicae* was described by Schönrogge *et al*. (2002a, 2002b) from the developmental stages, used by those authors to distinguish this taxon from other European *Microdon* species. Speight (2002a) provides an additional feature for distinguishing *M. myrmicae* from *M. mutabilis* L sensu Schonrögge *et al*., based on the larval mouthparts. *M. myrmicae* would be keyed out as *M. mutabilis* in Doczkal and Schmid (1999). The adult fly may be distinguished from other European *Microdon* species except *M.mutabilis*, using the keys provided by Doczkal & Schmid (1999). Separation of the adults of *M. mutabilis* and *M. myrmicae* cannot be carried out with confidence at present, but these species do exhibit reliable morphological differences in at least the puparium. The adult of *M. myrmicae* is of somewhat smaller size than the average *M. mutabilis* specimen, though small specimens of *M. mutabilis* are similar in size to *M. myrmicae*. Its close similarity to *M.mutabilis* can be seen from the coloured photo provided by Gammelmo and Aarvik (2007). Until and unless more precise features can be defined for separation of the adults of these species, their ecology may remain the best guide to which is present in a locality - a record from dry grassland suggests *M. mutabilis*, whereas one from wetland suggests *M. myrmicae*. But to confirm the presence of the species would at present necessitate search for larvae or puparia in nests of the appropriate ant species, at an appropriate time of the year, which can be a laborious and destructive process. **Illustrations of the adult insect:** The general appearance of *M.myrmicae* is shown in the coloured figure provided by Bartsch *et al*. (2009b).

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