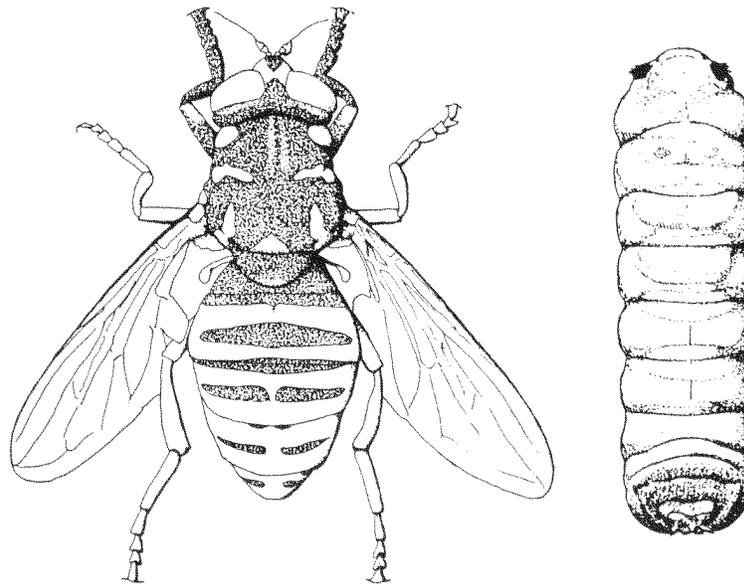


SPECIES ACCOUNTS OF EUROPEAN SYRPHIDAE (DIPTERA), GLASGOW 2011

M.C.D.Speight



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

Volume 65

Series Editors:

Martin C.D.Speight, Emmanuel Castella, Jean-Pierre Sarthou & Claude
Monteil

**SPECIES ACCOUNTS OF EUROPEAN SYRPHIDAE (DIPTERA),
GLASGOW 2011**

**M.C.D.Speight
Dept. of Zoology, Trinity College,
Dublin 2, Ireland**

**A special issue of the Species Accounts
to commemorate the occasion of the
6th International Symposium on the Syrphidae,
University of Glasgow, 2011**

**Syrph the Net: the database of European Syrphidae (Diptera)
Volume 65
Speight, M.C.D., Castella, E., Sarthou, J.-P. and Monteil, C. (eds.)**

compilation of this database initially received funding from:
contract STEP/CT90/0084 (Science and Technology for Environmental Protection),
European Commission

this publication may be referred to as:

Speight, M.C.D. (2011) Species accounts of European Syrphidae (Diptera), Glasgow
2011. *Syrph the Net, the database of European Syrphidae*, vol. 65, 285 pp., Syrph
the Net publications, Dublin.

ISSN 1393-4546 (Series)

Syrph the Net Publications
Dublin
2011

© M.C.D.Speight 2011

**SPECIES ACCOUNTS OF EUROPEAN SYRPHIDAE (DIPTERA),
GLASGOW 2011**

CONTENTS

Chapter 1: INTRODUCTION

- 1.1. Parts of Europe covered by the database**
- 1.2. The species covered and their nomenclature**
- 1.3. Species account subheadings**

Chapter 2: SPECIES ACCOUNTS, SYRPHIDAE

Chapter 3: SPECIES ACCOUNTS, MICRODONTIDAE

REFERENCES

Appendix 1: publications in which use is made of the StN database

Appendix 2: StN licence agreement

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, but accounts are also given for species additional to those covered by the spreadsheets (see below). Here the accounts included in the 2010 edition of the database have been up-dated to cover information (from both published and unpublished sources) which has become available subsequently and further species accounts have been added — species accounts are now provided for more than 800 species (more than 90% 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. A Checklist of European and Turkish Syrphidae is provided in the StN Range and Status file. 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. The coding of taxonomic status (see Range and Status file) of each of the nominal species in the Checklist groups them (category definitions provided in the Range and Status file) as follows:

taxonomically stable and recognisable: 725

taxonomically unstable: 76

taxonomic status uncertain: 87

Publications exemplifying different ways in which the StN database – including the Species Accounts - can be used are listed in Appendix 1 to this volume. A copy of the licence agreement, required to be completed for receipt of the current set of database files, has also been included, 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 Vujic (1996). The unpublished component of the accounts is based primarily on the experience of the author, gathered over more than 30 years of observation on European syrphids, but has been significantly augmented by information from other European syrphid workers, who 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, H.Bartsch, D.Birtele, R. & R.Blackith, R.Bygbjerg, E.Carrières, E.Castella, P.Cerretti, C.Claussen, M. de Courcy Williams, D.Doczkal, C.Dussaix, F.Dziock, M.J. Ebejer, M.Falck, H.-J.Flügel, P. Goeldlin de Tiefenau, M. de Groot, A. Haarto, M.Hauser, W.Hurkmans, T.Järveläinen, A.Jukes, K.Kassebeer, C.Kehlmaier, S.Kerppola, M.Kotarac, M.Krivosheina, L.Larrieu, D. & T.Levy, M.A. Marcos-Garcia, X.Mengual, T.Moertelmaier, B.Nelson, T.R.Nielsen, C.Palmer, P.M.Pavett, M.Reemer, A.Ricarte Sabater, G.Rotheray, S.Saribiyik, J.-P.Sarthou, U.Schmid, J.T.Smit, M. Sörensson, J.-H. Stuke, A.Ssymank, V.S. van der Goot, G. Van de Weyer, P.J. van Helsdingen, W. van Steenis, M. van Veen, L.Verlinden, A.Vujic, 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-Garcia 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. PARTS OF EUROPE COVERED BY THE DATABASE

The various "Biogeographical Regions" of Europe, as defined by the EU (earlier called "biogeographical zones"), are used here as a means of defining the geographic coverage provided by each version of the database, and for purposes of subdividing Europe into working units. They are referred to here simply as "regions" of Europe. Certain modifications have been made to the subdivision of northern Europe, aimed at simplifying the task. This results in those parts of Scandinavia that are consigned by the EU to the Alpine and Boreal regions being treated together here (together with Iceland and Norway), as the Northern region. The Alpine region, as recognised here, consequently excludes those parts of Scandinavia included in it by the EU. In summary, the subdivisions of Europe treated in whole or in part in the syrphid database are as follows:

- Alpine region (including Switzerland)
- Atlantic region
- Continental region (including Czech and Slovak Republics)
- Macaronesian region
- Mediterranean region
- Northern region (including Iceland and Norway)

A second set of subdivisions of the EU, recognised more recently, are the "ecological regions", whose present boundaries have little relation to those of the "biogeographical regions". The boundaries of these "ecological regions" are apparently not as yet finalised. The most recent available map (September, 1997) of these "ecological regions" shows a multiplicity of units, whose limits are defined by variations in vegetation type. Since these "ecological regions" do not correspond with administrative, political or other boundaries found on existing maps of Europe, they cannot be employed for subdividing the continent into broad, precisely defined geographical units, recognisable by anyone wishing to use the syrphid database. Equally, any correspondence these "ecological regions" may have with meaningful faunistic subdivisions of the continent remains conjectural. They are thus not used in the syrphid database.

The database now covers almost all the syrphid species that are known from the Atlantic, Continental and Northern zones of the EU (plus Iceland, Norway and the Czech and Slovak Republics), together with most of the species known from the Alpine region (including Liechtenstein and Switzerland) and many of the species that are exclusively Mediterranean in their European range. The Mediterranean species included are largely species that occur on the western edge of the Mediterranean basin. Dirickx (1994) provides an overview of current knowledge on the Mediterranean syrphid fauna, but the fauna of this zone remains the least well-known element of syrphid fauna of the EU in general, and considerable work needs to be done on both habitat associations of the species and compilation of species lists, before satisfactory coverage could be achieved. For instance, there is no comprehensive species list for Greece and no obvious initiative currently in place to compile such a list. Similarly, there are no published data on the syrphids associated with phrygana habitats.

In terms of coverage of the faunas of different countries or other recognisable entities, with the exception of doubtful taxa listed below, the database includes all the species currently known from:

- Belgium,
- Britain (the island)
- Denmark
- Finland
- Iceland
- Ireland (the island)
- Liechtenstein
- Luxembourg

Malta
Netherlands
Norway
Slovenia
Sweden
United Kingdom
Atlantic and Continental parts of France
Atlantic parts of Spain and Portugal
northern Germany (the Länder of Bremen, Mecklenburg-Vorpommern, Niedersachsen, and Schleswig-Holstein)
southern Germany (the Länder of Baden-Württemberg and Bayern).

Although the database now covers nearly all the syrphid species known from Poland, the Czech Republic, France, Germany, Hungary, the Slovak Republic and Switzerland, it has not yet proved possible to complete coverage for these countries. The Austrian fauna is covered to the extent that this is possible, in the absence of a taxonomically revised species list for that country.

1.2. 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 covered by the database. One or two of the species covered, for instance *Simosyrphus aegyptius* (Wied.), 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 part of Europe covered by the database 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 those parts of Europe that are covered by the database. An example is the Georgian species *Merodon batumicus* Paramonov, a live specimen of which was found recently in the Netherlands (Delfos and van Helsdingen, 2000) having apparently arrived there in a consignment of bulbs. *M.batumicus* is neither covered by the database nor listed in it as a species occurring in the Netherlands.

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 Range and Status column headed "Species Account compiled".

1.3. SPECIES ACCOUNT SUBHEADINGS

The information provided in each species account is partitioned under a series of subheadings, as follows:

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.

Adult habitat and habits: where the adult insect may be found 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 species known to visit a wide range of flowers, or all available information for species known to visit the flowers of only a few plants/species whose flower-visiting habits are poorly known. This section also covers other pollen-gathering activity e.g. by *Xylota* species. Sap-run visiting is referred to under adult 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.

Larva: 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. Keys to determination of larvae are referred to where relevant. Publications providing illustrations of the larva are also cited. 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.

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, as are sources of coloured illustrations of the entire insect. 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 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.

In cases where there is no information available for a species under some particular subheading, this is indicated by the phrase "no data". Lack of information is most frequent in relation to "adult habitat and habits" and "flowers visited". 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".

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

In the species accounts (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. References are given in a bibliography following the species accounts. 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, not least because the cut-off point for literature considered by Peck was 1982, even though her account was not published until 1988. Changes introduced since Peck's text was completed are mentioned here where relevant, under the species or genera concerned.

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. But this seems to depend to a significant extent on whether or no features of the developmental stages are included in phylogenetic analyses. Hippa and Ståhls (2005), whose synthesis does not take the developmental stages into consideration, 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 this genus were revised by Claussen & Torp (1980). They consign four European species to the genus, but exclude *A. lineata*, which, like some other authors, they regard as belonging to a separate genus, *Eurimyia*. Other authors, including Peck (1988), include *A. lineata* in *Anasimyia*. Various authors, e.g. Peck (1988), van der Goot (1981), treat *Anasimyia* as a subgenus of *Helophilus*. Some include these species in *Lejops*.

Anasimyia contracta Claussen & Torp, 1980

Preferred environment: wetland; ponds 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 palustris*, *Ranunculus*, *Sorbus aucuparia*. **Flight period:** May/June & August/September. **Larva:** undescribed, but can be found among debris of dead *Typha* stalks beneath the water surface. **Range:** Scandinavia south to the Mediterranean basin and from Ireland eastwards through central Europe to European parts of Russia. **Determination:** Bartsch et al (2009b); Claussen & Torp (1980); Speight (1981b), van der Goot (1981), Verlinden (1991). See Key provided in StN Keys volume. The male terminalia are figured in Claussen & Torp (1980), Torp (1984) and van der Goot (1981). 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: open ground/freshwater; by water bodies in humid, seasonally flooded grassland. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Larva:**

not described. **Range:** Montenegro. This species should be regarded as threatened at the European level (Vujic *et al.*, 2001). **Determination:** See Key provided in StN Keys volume. Simić (1987) describes both sexes of the species and figures the male terminalia.

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 and river floodplains, where it occurs in association with dead arms and ox-bows in floodplain grassland. **Adult habitat and habits:** flies among waterside vegetation or emergent hydrophytes e.g. *Phragmites*. **Flowers visited:** white umbellifers; *Caltha*, *Euphorbia*, *Ranunculus*, *Salix*, *Sorbus aucuparia*. **Flight period:** May, July. **Larva:** not described. **Range:** Fennoscandia south to northern France; Britain eastwards through central Europe into European parts of Russia. **Determination:** Bartsch *et al.* (2009b); Verlinden (1991). 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). The adult insect is figured in colour in Bartsch *et al.* (2009b), Stubbs and Falk (1983) and Torp (1994).

Anasimyia 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. **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 Kuznetsov (1988). **Range:** Scandinavia south to the northern edge of the Pyrenees and Ireland east through central Europe into European parts of Russia; through Siberia to the Pacific coast (Sakhalin). **Determination:** Bartsch *et al.* (2009b); Claussen & Torp, 1980; Speight (1981b); van der Goot (1981), Verlinden (1991). See Key provided in StN Keys volume. The adult insect is figured in colour in Bartsch *et al.* (2009b), Haarto & Kerppola (2007), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

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. **Larva:** aquatic; 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 northern France (Haute Saone); Ireland and Britain; European Russia; range elsewhere requires reconfirmation, due to confusion with *A.interpuncta*. **Determination:** Bartsch *et al.* (2009b); Verlinden (1991). 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). 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. **Larva:** not distinguished from that of *A.contracta*, but see Hartley (1961). **Range:** Southern Sweden south to northern France (Paris basin); 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 (1991). The male terminalia are figured in Claussen & Torp (1980), Torp (1984) and van der Goot (1981). 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

The three European species belonging to this genus are all included in the keys in van der Goot (1981) and Bradescu (1991) and in the key below. One of them, *A.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. The other two species are dealt with in most regional accounts.

Arctophila bequaerti Hervé-Bazin, 1913

Preferred environment: open ground; subalpine zone. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June (Hervé-Bazin, 1913), August (Zimina, 1960). **Larva:** not described. **Range:** Albania, parts of the former Yugoslavia, Bulgaria, Greece, Turkey, southern Russia, Ukraine, Armenia. **Determination:** See Key provided in StN Keys volume. Hervé-Bazin (1913) describes the species and figures the male terminalia.

Arctophila 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*. **Flight period:** May/August (June/July at high altitudes). **Larva:** undescribed. **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:** van der Goot (1981). See Key provided in StN Keys volume. The adult insect resembles bumblebees of the *Bombus lucorum* group. The adult insect is figured in colour in Bartsch et al (2009b), Torp (1984, 1994) and van der Goot (1986).

Arctophila 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 (*Picea*) 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. **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 Decler, 1987) and Denmark (Torp, 1984). **Determination:** van der Goot (1981). 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.) and this form of the adult insect is figured in colour in Bartsch et al (2009b),

Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). 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.).

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:** no data. **Flight period:** May/July. **Larva:** 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 Generic Key provided in StN Keys volume.

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 literature and 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. **Larva:** 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*. **Range:** Scandinavia to the Mediterranean; central Spain eastwards to Greece and Ireland eastwards into European parts of Russia. 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). The adult fly is figured in colour by Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Kormann (1988). 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*.

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, including van Veen (2004). 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. All three species are keyed out by Violovitsh (1986).

Blera eoa (Stackelberg), 1928

Preferred environment: forest; humid pine forest (*Pinus sylvestris*) (Peterrsson and Bartsch, 2001) with overmature trees. **Adult habitat and habits:** no data. **Flowers visited:** *Rhododendron aureum* (Gritskevich, 1998); *Rosa acicularis*, *Potentilla fragarioides*, *Acer tataricum* (Bartsch et al (2009b)). **Flight period:** June/July. **Larva:** not described. **Range:** northern Sweden, eastern Siberia to the Pacific (Sakhalin). **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Barkalov and Mutin (1991).

Blera fallax (L.), 1758

Preferred environment: ancient conifer 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. **Larva:** 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). 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 been found in a water-filled tree-hole by Dusek and Laska (1961). **Range:** central and southern Norway to the Pyrenees and Scotland eastwards through central Europe and Siberia to the Pacific coast (Sakhalin and Japan). **Determination:** See Key provided in StN Keys volume. The male terminalia are illustrated by Hippa (1978), Barkalov and Mutin (1991) and Violovitsh (1986). 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: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Rubus sachalinensis* (Barkalov and Mutin, 1991). **Flight period:** no data. **Larva:** 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).

BRACHYOPA

A revision of the European species of *Brachyopa* is provided 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, bringing the known European fauna to 14 species. The two European species of the closely related genus *Hammerschmidtia* perhaps belong here also.

Brachyopa bicolor (Fallen), 1817

Preferred environment: mature/overmature deciduous forest; *Fagus/Quercus* forest, alluvial hardwood forest, *Ulmus* forest and *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:** *Photinia*. **Flight period:** beginning April/beginning July. **Larva:** described and figured by Rotheray (1991) and Krivosheina (2005) and figured in colour by Rotheray (1994), from larvae collected from sap runs on the trunks of *Fagus* and *Quercus*. 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*. 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. **Range:** Sweden and Finland south to southern France; Britain (southern England) east through central Europe (and the former Yugoslavia) into 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). The male terminalia are figured by Pellmann (1998). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994). The colour of the scutellum is somewhat variable in this species, from mid-brown to almost black.

Brachyopa bimaculosa Doczkal & Dziock, 2004

Preferred environment: inadequately known; forest; deciduous forest. **Adult habitat and habits:** no data. **Flowers visited:** *Salix aurita* (Doczkal and Dziock, 2004). **Flight period:** March/May. **Larva:** no data. **Range:** southern Germany, Greece. **Determination:** See Key provided in StN Keys volume. Doczkal and Dziock (2004) provide a key for distinguishing the female of this species from other European members of the *B. insensilis* group. The male is as yet undescribed. *B. bimaculosa* is as yet known from only two females that show some intraspecific variability in their features, assuming they do, indeed, belong to the same species. They are also closely similar to the female of *B. quadrimaculosa* Thompson (described from Israel) and there must remain some doubt as to whether *B. bimaculosa* and *B. quadrimaculosa* are distinct species. The male terminalia of *B. quadrimaculosa* are figured by Thompson and Kaplan (1981). Krivosheina (2004b) described (figuring the terminalia of the male) another species (*B. stackelbergi*) in this group from Tajikistan, later (Krivosheina, 2005) also describing and figuring its larvae, collected from a sap run on *Populus*. Until the male of *B. bimaculosa* has been found and described and the female is more certainly defined, it will remain an open question whether this species is distinct from *B. quadrimaculosa* and *B. stackelbergi*.

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:** *Ribes rubrum* (Bartsch et al (2009b), male *Salix*. **Flight period:** June/July. **Larva:** not described. **Range:** northern and southern Norway, northern Sweden, Finland, through most of Siberia.

Determination: See Key provided in StN Keys volume; Bartsch et al (2009); Thompson (1980); Violovitsh (1986). 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 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. **Flowers visited:** *Caltha*, *Salix* spp. **Flight period:** end of April to mid-June. **Larva:** described and figured by Krivosheina (2005) from larvae collected in the bast of *Betula* trunks (many records), from the tunnels of Lymexylonidae in trunks 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* 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* (Bagachanova, 1990; M.Krivosheina, pers.comm.). Mutin (1998b) reared the species from larvae collected under the bark of *Populus* species, including *P.tremula*. **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). Bartsch et al (2009b), Haarto & Kerppola (2007) and Torp (1994) illustrate this species in colour. The size of the antennal pit can be larger in females of *B.dorsata* than in the males, leading to misdetermination as *B.panzeri*. These two species are extremely similar to each other (see also under *B.panzeri*).

Brachyopa grunewaldensis Kassebeer, 2000.

Preferred environment: deciduous forest; alluvial hardwood forest and *Quercus/Carpinus* forest; can also occur along seasonal streams in *Quercus pubescens* forest where old *Acer* are present; 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). **Flight period:** April/May. **Larva:** not described. **Range:** as yet only known from central and southern Germany, southern France, Switzerland and northern Greece. **Determination:** See Key provided in StN Keys volume. Doczkal and Dziock (2004) provide a key for distinguishing 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. 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).

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 verifying identity of the species requires climbing the tree! **Flowers visited:** white umbellifers; *Photinia*, *Prunus padus*, *Sorbus aria*. **Flight period:** beginning of May/end June. **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). Adults have also been found 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*. **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. 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. The appearance of the adult of *B.insensilis* is shown, in colour, by Torp (1994). The male is figured in colour by Bartsch et al (2009b).

Brachyopa maculipennis Thompson, 1980

Preferred environment: deciduous forest; alluvial hardwood forest; along streams in humid *Fagus* forest (A.Vujic, pers.comm.). **Adult habitat and habits:** sits in the sun on the trunks of trees beside streams (A.Vujic, pers.comm.). **Flowers visited:** *Rhamnus frangula* (V.Bradescu, pers.comm.). **Flight period:** May/June. **Larva:** not described. **Range:** northern Germany, Czech Republic, Austria, Slovakia, northern Italy, Hungary, Roumania, parts of the former Yugoslavia. **Determination:** See Key provided in StN Keys volume; Thompson (1980); Bradescu (1991). Doczkal and Dziock (2004) also provide a key for distinguishing 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.).

Brachyopa obscura Thompson and Torp, 1982

Preferred environment: forest, mature/overmature deciduous forest; along rivers with *Populus nigra*, within deciduous forest (Stuke, 2001). **Adult habitat and habits:** flies low around *Populus tremula* trunks (S.Kerppola, pers.comm.). **Flowers visited:** *Aegopodium podagraria* (S.Kerppola, pers.comm.), *Crataegus* (H.Bartsch, pers.comm.), *Prunus padus* (van Steenis, 1998b), *Ribes alpinum* (Bartsch et al (2009b)). **Flight period:** May/beginning July. **Larva:** 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". **Range:** Sweden, southern Norway, southern Finland, northern parts of European Russia. **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). However, the abdominal tergites of *B.obscura* are a more uniformly brown colour than those of *B.testacea*, and lack the median black stripe normally found in the latter species. 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 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).

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:** *Prunus spinosa*, *Salix*. **Flight period:** beginning of May/June. **Larva:** undescribed. 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* species 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 adult of only these two species have been recorded in the area, I refer these larvae to *B.panzeri*". **Range:** Southern Scandinavia to central France (Massif Centrale) and through central Europe to the Czech Republic, Switzerland and Austria; 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). The male terminalia are figured by Pellmann (1998). Bartsch et al (2009b) and Torp (1994) illustrate this species in colour. 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*.

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; *Allium ursinum*, *Cardamine*, *Photinia*, *Prunus cerasifera*, *P. padus*, *P.spinosa*, male *Salix*, *Viburnum opulus*. **Flight period:** end April/beginning July, with peak end May/beginning June. **Larva:** described and figured by Rotheray (1991) from larvae collected from beneath the bark of a rotting stump of *Fagus*. Rotheray (1994) has 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). **Range:** Fennoscandia south to central France; Britain (England) east through central Europe (Czech Republic, Switzerland) into European parts of Russia. **Determination:** See Key provided in StN Keys volume; Thompson (1980). The male terminalia are figured by Pellmann (1998). The adult insect is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007) and Torp (1994).

Brachyopa plena Collin, 1939

Definition of taxon inadequate: status uncertain, based on existing information.

Preferred environment: thermophilous oak forests of the eastern Mediterranean (pers.comm. M.de C.Williams). **Adult habitat and habits:** no data. **Flowers visited:** *Acer campestre*, *Salix* (pers.comm. M.de C.Williams). **Flight period:** April/May. **Larva:** 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. Vujic (1991) has also referred to occurrence of *B.plena* in parts of the former Yugoslavia. Putative *B.plena* also occurs in Northern Greece (M. de C.Williams, pers.comm.).

Determination: Collin's description of *B.plena* is very brief - only four lines of text, and does little more than suggest differences between *B.plena* and *B.pilosa*, of which he lists three: 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. Collin unfortunately does not figure the male terminalia of *B.plena*. Vujic (1991) does figure the male terminalia of the taxon he recognises as *B.plena*. Other specimens from the Balkans, with the same genitalic features as shown by Vujic (1991) for *B.plena*, certainly have terminalia easily distinguished from the terminalia of *B.pilosa*. These specimens also exhibit the features given by Collin (1939), as distinguishing *B.plena*. However, while their terminalia are clearly distinct from those of *B.pilosa*, they are identical to the terminalia of *B.scutellaris*. Indeed, the only feature that might be used to separate these specimens 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 Vujic (1991). But the shape of this pit varies, and occasional specimens may be found, among series of specimens of *B.scutellaris* from western Europe, in which this pit 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. Collin's (1939) *B.plena* could be *B.scutellaris* with a round pit on antennal segment three. The Balkanic taxon referred to by Vujic (1991) as *B.plena* could be either Collin's *B.plena* or some other closely-related taxon that replaces *B.scutellaris* in the Balkan peninsula, usually distinguishable morphologically from *B.scutellaris* by the shape of the pit on antennal segment three. Whether the type material of *B.plena* has ever been examined subsequent to description of the species is unclear. Certainly, there is no published figure of the male terminalia of any of the type material and no lectotype would seem to have been designated. Until and unless re-examination of Collin's type material (currently in the Hope Dept Museum of the University of Oxford, England) demonstrates that the male terminalia of *B.plena* are distinct from those of *B.scutellaris*, or reveals other features that are more convincingly diagnostic for *B.plena* than those identified by Collin, the status of *B.plena* must remain uncertain. Other approaches would be to carry out chemotaxonomic studies on putative *B.plena* material from the Balkans and Western European *B.scutellaris* material, or to locate the larvae of the Balkanic taxon, for comparison with those of *B.scutellaris*. Given the association between *B.scutellaris* and sap-runs on *Fraxinus excelsior*, perhaps a starting point would be to search sap-runs on *Fraxinus ornus*, the largely Eastern European tree occurring scattered through thermophilous oak forests in the Balkans, where putative *B.plena* have been found. For now, this enigmatic taxon cannot be dismissed as a synonym of *B.scutellaris* (or *B.pilosa*) but requires to be treated as a separate species until more substantive taxonomic work can be carried out to establish its correct designation.

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*, *Photinia*, *Rubus fruticosus* agg., *Sorbus*, *Viburnum opulus*. **Flight period:** mid April/end June. **Larva:** develops in sap-runs on *Acer pseudoplatanus*, *Fraxinus* and *Ulmus glabra* and in sappy, wet-rot situations beneath the bark of *Alnus*, *Fraxinus* etc.; described and figured by Rotheray (1996). According to Pellmann (1998), *B.scutellaris* has also been reared from *Taxus* and *Ulmus*. 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. **Range:** Denmark

south to the Pyrenees; Ireland east through central Europe to Switzerland. **Determination:** See Key provided in StN Keys volume; Thompson (1980). The male terminalia are figured by Pellmann (1998). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

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). **Adult habitat and habits:** no data (to date, all known specimens have been collected by Malaise trap). **Flowers visited:** no data. **Flight period:** end April/beginning June. **Larva:** undescribed. **Range:** central Germany. **Determination:** See Key provided in StN Keys volume. Doczkal and Dziock (2004) figure the male terminalia of this species and also provide a key to distinguish both male and female from other European members of the *B. insensilis* group.

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*, *Crataegus*, *Malus*, *Meum*, *Prunus*, *Sorbus*, *Viburnum opulus*. **Flight period:** May/beginning July. **Larva:** undescribed, but the species has been reared from larvae collected from beneath bark of rotting *Picea* stumps (Nielsen, 1992). **Range:** Scandinavia through to Asiatic parts of Russia and on to the Pacific and Mongolia; western and central Europe. This species would seem likely to spread to wherever *Picea* plantations are established. **Determination:** See Key provided in StN Keys volume; Thompson (1980) and Thompson and Torp (1982) figure the male terminalia. The male terminalia are also figured by Pellmann (1998). The adult insect is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007), Torp (1984, 1994) and van der Goot (1986). According to Thompson & Torp (1982) this species can only be distinguished from *B. obscura* using features of the male terminalia. However, *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.

Brachyopa vittata (Zetterstedt), 1843

Preferred environment: *Picea* and *Abies* forest with overmature trees. **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. **Flight period:** May/June and July at higher altitudes. **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). 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. **Larva:** 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.

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*, *Rubus idaeus*, *Sorbus aucuparia*. **Flight period:** April/June plus July at higher altitudes. **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. lenta* 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; southern Europe eastwards to the former Yugoslavia and Greece and on into Asia Minor. **Determination:** Speight (1999b). The male terminalia are figured in Hippa (1978). 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). *B. lentus* is superficially very similar in appearance to *Chalcosyrphus piger* (Fab): see Key provided in StN Keys volume.

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*.

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. **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:** Scandinavia and mountainous parts of Europe south to the Pyrenees; Tatra mountains, Schwarzwald, through the Alps (France, Germany, Switzerland, Liechtenstein, Austria) eastwards into the former Yugoslavia, Roumania, Turkey and European parts of Russia. **Determination:** Speight (1999b). See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1978).

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. **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:** Speight (1999b). See Key provided in StN Keys volume. The male terminalia are figured by Hippa (1978) and the adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs, and Falk (1983), Torp (1984, 1994) and van der Goot (1986). 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 is the opinion of the present author that present usage should be maintained.

***Brachypalpus valgus* (Panzer), 1798**

Preferred environment: Old *Fagus* and *Quercus* forest 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*, *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. **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 of *Quercus suber* (J. -P. Sarthou, pers.comm.). **Range:** 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:** Speight (1999b). See Key provided in StN Keys volume. This species is very similar to *B.laphriformis*, but usually larger. Males have the eyes separated by a distance slightly greater than the diameter of the anterior ocellus (contiguous in *B.laphriformis*). 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*).

CALIPROBOLA

There is only one *Caliprobola* species generally recognised as occurring in Europe. A second species, *C.aurea* (Sack) is known from south of the Caucasus mountains in Georgia.

***Caliprobola speciosa* (Rossi), 1790**

Preferred environment: forest; deciduous forest (*Castanea*, *Fagus*, *Quercus pedunculata*, *Q.pubescens*) 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, but there is so far no evidence for this and the adults cannot be found investigating trunk bases of these trees as they do *Castanea* and *Fagus*. *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*, *Rorippa*, *Rubus*, *Sorbus aucuparia*, *Tamarix*. **Flight period:** May/mid July, with peak at beginning June. **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 *Quercus*. Distinguished from larvae of related genera in the keys provided by Rotheray (1994). **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 and on into Asia as far as Eastern Siberia. This species is regarded as endangered in Spain (Marcos-Garcia, 2006). **Determination:** See generic Key provided in StN Keys volume. Sack (1928-32) provides a key to distinguish *C.speciosa* from *C.aurea* Sack. The male terminalia are figured by Hippa (1978). The adult insect is illustrated in colour by 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.). **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:** *Rhododendron aureum*, *Rosa canina*. **Flight Period:** May/September, with peak May/June (June/July in Scandinavia). **Larva:** unknown. **Range:** requires reassessment, due to confusion with *C.aurata*; but the species can be confirmed from Norway, Sweden, Poland, Czech Republic, France (Vosges) and various parts of Germany through central Europe into 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:** Speight (1991b); 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*; the male is illustrated in colour by Bartsch et al (2009b) and Kormann (1988); the male terminalia are illustrated by Speight (1991b), Thompson (1980) and Zimina (1986).

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:** *Crataegus* (Bygebjerg, 2002), *Dipsacus fullonum*, *Filipendula*, *Rosa* (including *R. canina* - D.Levy, pers.comm.), *Rubus fruticosus*. **Flight Period:** end May/mid October, with most records July/September. **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. Dussaix (2005a) reared the species from small, water-filled cavities in *Fagus* and *Quercus*. Reared from rot-holes in *Fraxinus angustifolia* by Ricarte et al (2008). Distinguished from larvae of some related species in the key provided by Rotheray and Perry (1994). **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, including the Crimea and Caucasus and on to Azerbaijan. **Determination:** 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); the male is illustrated in colour by Bartsch et al (2009b), the female (as *C. aenea*) by Stubbs and Falk (1983).

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. Salzman 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:** *Sorbus aria*. **Flight period:** beginning April/end June, with females on to mid July. **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.). **Range:** can be confirmed from the Netherlands, Belgium, France (NW, south to the Mediterranean, inc. the Pyrenees); Germany, Spain (Cadiz); Greece, Turkey; Sardinea; probably also from Italy (Rondani specimens), the former Yugoslavia and Turkmenia (Zimina, 1986). **Determination:** Speight (1991b) who figures the male terminalia.

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. **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); 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 Caucasus. **Determination:** Speight (1991b), who figures the male terminalia.

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.). **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. **Flowers visited:** *Ranunculus repens* (Kormann, 1993). **Flight Period:** mid May/August. **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*. 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. 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, Hungary) and southern (Balearic islands, 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:** 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; the female is illustrated in colour by 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. **Larva:** 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 reared this species from a small trunk cavity in live *Betula*. They usually require more than one year in which to complete development. 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. **Range:** Britain (eastern England) and northern France south to the Pyrenees, central Spain and the Mediterranean; Germany; Italy; Roumania; Tajikistan. **Determination:** 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; the female is illustrated in colour by Stubbs and Falk (1983).

CERIANA

Two species of *Ceriana* are recorded from Europe. They may be distinguished using the keys in Seguy (1961) and by means of the Key provided in StN Keys volume. A third Palearctic species, *C. caucasica* (Paramonov) reaches Armenia. 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; deciduous forest (*Fagus/Quercus*) 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. **Flowers visited:** various umbellifers, *Cirsium*, *Dianthus*, *Euonymus*, *Euphorbia*, *Physocarpus*, *Rubus fruticosus* and *Sorbus aucuparia*. **Flight period:** May to September, but most records are from June/July. **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. **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.cy. (see Verrall, 1901) but not recorded there since. **Determination:** Seguy (1961). See Key provided in StN Keys volume. Black and white illustrations of the adult fly are provided by van der Goot (1981), Verlinden (1991) 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).

***Ceriana vespiformis* (Latreille), 1804**

Preferred environment: forest; evergreen oak forest of *Quercus suber* and *Q. ilex* with over mature trees. 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-Garcia, 1985a). **Flight period:** end May/mid July. (and September in southern Spain: Marcos-Garcia, pers.comm.). **Larva:** figured and described by Rotheray et al (2006), from larvae found in "decaying roots of a live *Fraxinus aungustifolius* tree". 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*. **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, Cyprus, Crete and Rhodes. 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). The adult of this species is illustrated in colour by Rotheray and Gilbert (2011).

CHALCOSYRPHUS

This generic name has been in existence for more than 50 years, but was only recently (Hippra, 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. **Larva:** no described. **Range:** European Russia (Karelia, Moscow region) and throughout Siberia to the Pacific coast. **Determination:** See Key provided in StN Keys volume. Hippra (1968a) figures the male terminalia. This species is noted for the sexual dimorphism it exhibits.

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. **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. **Larva:** 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 Hippra (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*. The male is illustrated in colour by Stubbs and Falk (1983). The species is also illustrated in colour by Schmid (1996), with its habitat.

Chalcosyrphus femoratus (L.), 1758 (not auct.)

Preferred environment: deciduous forest; *Quercus* forest with over-mature trees. **Adult habitat and habits:** runs on foliage of bushes and shrubs in the sun and settles on freshly cut trunks. **Flowers visited:** *Ranunculus repens*. **Flight period:** end May/end July. **Larva:** undescribed, but found by Krivosheina (2001) in "wood dust" in *Betula* and in rotten wood of *Betula*. **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). These species may be distinguished from one another using the key provided above.

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:** no data. **Flight period:** June/July. **Larva:** not described. **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. 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. **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. **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). 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. **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 Vujic & Milankov (1999). 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. **Larva:** not described, but 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. 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. **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).

Chalcosyrphus obscurus (Szilady), 1939

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Trollius riederanus* (Gritskevich, 1998). **Flight period:** June. **Larva:** 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).

Chalcosyrphus pannonicus (Oldenberg), 1916

Preferred environment: "swamp" (Drensky, 1934). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Larva:** not described. **Range:** parts of the former Yugoslavia (no records for more than 100 years: extinct?), Bulgaria, Roumania (trés rare: Bradescu, 1991). This species should be regarded as threatened at the European level. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Vujić & Milankov (1999).

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. **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:** *Ranunculus*, *Seseli* (Baugnée, 1998); *Potentilla erecta* (Bartsch et al (2009b)). **Flight period:** May/June, to July/August at higher altitude. **Larva:** 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". 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, now threatened at the European level and approaching extinction in Western Europe. It is already believed to be extinct in the Netherlands. **Determination:** See Key provided in StN Keys volume. This species is often mistakenly 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 lenta*. Distinctions between these two species are given here in the species account for *B.lenta*. The male terminalia are figured by Hippa (1968a) and Vujic & Milankov (1999). The adult insect is figured in colour by Bartsch et al (2009b), Haarto & Kerppola (2007) and Torp (1994).

Chalcosyrphus rufipes (Loew), 1873

Preferred environment: forest; humid deciduous forest of *Fagus* and sometimes *Quercus* (A.Vujic, pers.comm.), alluvial hardwood forest and riparian gallery forest (M.Krivosheina, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Aruncus asiaticus* (Gritskevich, 1998). **Flight period:** May/July. **Larva:** described and figured by 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*. **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 Vujic & Milankov (1999).

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. **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. **Flowers visited:** *Campanula*, *Chaerophyllum*, *Hypericum*, *Rubus idaeus*, *Sorbus aucupariae*. **Flight period:** May/July. **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. **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. Very probably now threatened with extinction at European level - there are few published 20th.cty. European records. **Determination:** See Key provided in StN Keys volume. 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*. Although in general a very distinctive species, unlikely to be confused with most other European *Chalcosyrphus* species except *C.femoratus (curvipes)* of auct.), unfortunately, *C.valgus* also closely resemble *C.femoratus*. Distinctions between these two species are indicated in the account of *C.femoratus*. The adult male of *C.valgus* is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007) and Torp (1994). The male terminalia are figured (as *C.femoratus*) by Hippa (1968a), and by Vujic & Milankov (1999).

CHAMAESYRPHUS: see under **PELECOCERA**

CHEILOSIA

Nearly 300 Palearctic *Cheilisia* species are listed by Peck (1988), 175 of them from Europe. In reality, the taxonomy of European *Cheilisia* 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 Ståhls (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; Vujic, 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 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. **Larva:** undescribed, but 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*. **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*.

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. **Larva:** 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.

Cheilosia alba Vujic & Claussen, 2000

Preferred environment: forest; humid *Fagus/Abies/Picea* forest and alluvial softwood forest with *Salix alba* (Vujic and Claussen, 2000); also edges of bogs with *Pinus cembra*. **Adult habitat and habits:** along streams in open areas in forest, or beside rivers and lakes (Vujic and Claussen, 2000). **Flowers visited:** male *Salix* (Vujic and Claussen, 2000). **Flight period:** end March/beginning May. **Larva:** undescribed. **Range:** as yet uncertain, but confirmed from Finland, Germany (Baden-Württemberg), Switzerland, Montenegro and Serbia. **Determination:** both sexes are described by Vujic 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 *Cheilisia* species in Bartsch et al (2009b) and Haarto and Kerppola (2007a). The female is figured in colour by Bartsch et al (2009b).

Cheilisia 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. **Larva:** described and figured by Rotheray (1988a), from specimens collected from *Cirsium palustre* in pastures. The larva is a stem miner in *Carduus* and *Cirsium palustre*. It is shown in colour, within its stem mine, by Bartsch et al (2009a). This species overwinters as a puparium. The morphology of the chorion of the egg is figured by Kuznetsov (1988). **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). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Cheilisia 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. **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. The appearance of the adult insect is shown by coloured illustrations in Stubbs and Falk (1983), Kormann (1988) and Torp (1994). Specimens in which the legs are entirely black are not accommodated in existing keys - they can easily be misdetermined as *C.vicina*.

Cheilisia 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. **Larva:** 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*.

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. **Larva:** not described, but Bartsch et al (2009b), 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).

Cheilosia andalusiaca Torp Pedersen, 1971

Preferred environment: sparsely vegetated, open, rocky ground from 900m to above 2300m (Marcos-Garcia, 1987b). **Adult habitat and habits:** sun bathes on rocks in the first hours in the morning (pers.comm. A. -M. Marcos-Garcia). **Flowers visited:** no data. **Flight period:** April/May and June at higher altitudes. **Larva:** 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-Garcia (1987b) describes the female. This species is apparently similar to *C.rhynchops* (C.Claussen, pers.comm.).

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:** *Anemone nemorosa* (Nielsen, 1980a), *Caltha*, *Crataegus*, *Viburnum opulus* (Bartsch et al, 2009b), *Prunus padus* (van Steenis, 1998b). **Flight period:** beginning May/late June. **Larva:** 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. 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. **Larva:** described and figured by Rotheray (1991) and illustrated in colour by Rotheray (1994); known to feed within the

roots of various *Primula* species. **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 and not known from the Pyrenees, though it is recorded from Spain. **Determination:** see key to males of European *Nigrocheilosia* species in StN Keys volume; Barkalov and Ståhls (1997) figure the male terminalia. 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. **Larva:** 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).

Cheilosia balkana Vujic, 1994

Preferred environment: forest/open ground; open areas within humid *Fagus* forest and upwards into subalpine grassland to 2000m (Vujic, 1996). **Adult habitat and habits:** in open grassy and rocky ground; males hover at 5-7m (Vujic, 1996). **Flowers visited:** *Alyssum* (Vujic, 1996). **Flight period:** mid June/mid July (Vujic, 1996). **Larva:** undescribed. **Range:** Alps (Italy) and Balkans (Montenegro, Serbia, Slovenia). **Determination:** Vujic (1994). This is a "proxima group" species.

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. **Larva:** 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).

Cheilosia beckeri Strobl, 1910

Preferred environment: open ground, alpine zone. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Larva:** 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* Kuznetsov, 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 *beckeri* in their key, presumably on the basis of Strobl's description, since they state "We do not know the male of this species".

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. **Larva:** 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). The adult insect is illustrated in colour in Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

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. **Larva:** 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 Vujic (1995) provide means of separating females of *C.brachysoma* from females of *C.clama*.

Cheilosia bracus Vujic & 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. **Larva:** not described. **Range:** Pyrenees (France, Spain), **Jura** (France, Switzerland), central Germany, Alps (France, Austria, Italy), Apennines (northern Italy), Balkans (Bulgaria, Bosnia, Croatia, Macedonia, Montenegro, Serbia, Slovenia). **Determination:** Vujic 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).

Cheilosia brunnipennis Becker, 1894

Preferred environment: forest/freshwater; forest; along streams in thermophilous *Quercus* forest (Vujic (1996); garrigue and maquis. **Adult habitat and habits:** flies fast among waterside shrubs, settling on branches etc. (Vujic (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* (Vujic, 1996); *Prunus mahaleb*, *P.spinosa*, *Viburnum tinus*. **Flight period:** February/mid May; end March/beginning June in N Africa (Kassebeer, 1998). **Larva:** not described. **Range:** southern France, northern Italy, Balkans (Bosnia, Bulgaria, Croatia, Greece, Macedonia, Montenegro, Serbia), Roumania, southern Russia, Israel and N Africa (Morocco). **Determination:** Bradescu (1991). Vujic (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). Vujic and Claussen (2000) provide a key separating males of *C.brunnipennis* from those of *C.flavipes*.

Cheilisia caerulea (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 this 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. **Larva:** undescribed, but d'Aguilar and Coutin (1988) reared the species from larvae found in the fleshy leaves of *Sempervivum*, where they were causing lesions. **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. **Determination:** 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. At present, there is no way in which this species can with confidence be separated from *C.herculana*, *C.kerteszi*, *C.laeviventris* or *C.venosa* and until and unless reliable means of distinguishing these taxa can be found their identity as separate species must remain open to question. The adult insect is illustrated in colour by Schmid (1996).

Cheilisia 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. **Larva:** apparently undescribed, but reared from *Petastites hybridus* (Stuke and Claussen, 2000). It is uncertain whether this species overwinters as larva or puparium. **Range:** requires redefinition, following reinstatement of *C.himantopus*, with which *C.canicularis* was confused until recently. At present confirmed from Denmark, France (Alpes Maritimes), Germany, Czech Republic, Switzerland (Jura), Austria, Slovakia, Italy (Alps, Apennines) and Turkey. **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). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1984).

Cheilisia 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. **Larva:** 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 *Cheilisia* species in Haarto and Kerppola (2007a). The adult insect is illustrated in colour in Bartsch et al (2009b), Kormann (1988) and Torp (1994). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

Cheilisia 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. **Larva:** undescribed, but the female has been observed egg-laying on *Cirsium oleraceum* (Doczkal, 1996b), and the larval association with that plant is 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* Vujic and Claussen. Distinctions between *C.chloris* and *C.bracusi* are detailed by Vujic and Claussen (1994). The male and female of *C.chloris* are figured in colour by Torp (1994). This species is also illustrated in colour by Kormann (1988).

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. **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 adult insect is illustrated in colour in Bartsch et al (2009b), Stubbs and Falk (1983), Torp (1994) and Kormann (1988). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

Cheilosia clama Claussen & Vujic, 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 (Vujic, 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. **Larva:** not described. **Range:** uncertain, due to confusion with other species until recently, but confirmed from France, Germany, Switzerland, Serbia and Bosnia. **Determination:** Claussen and Vujic (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.

Cheilosia clauseni Barkalov and Ståhls, 1997

Preferred environment: sparsely vegetated, rocky, open ground in the alpine zone, from 2000 - 2500m. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** beginning July/end August. **Larva:** 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).

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. **Larva:** 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.

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 (Vujic, 1996) and on foliage of trees such as *Tilia*, at up to 2m from the ground (A.Vujic, pers.comm.); males hover at up to 3m (A.Vujic, pers.comm.). **Flowers visited:** *Smiranium* (Vujic, 1996), composites (A.Vujic, pers.comm.). **Flight period:** March/August (Vujic, 1996). **Larva:** not described. **Range:** Balkans (Bosnia-Herzegovina, Macedonia, Montenegro, Serbia) and Carpathians (Roumania, Serbia); Iran. **Determination:** this species is included in the keys of Bradescu (1991), who also provides a sketch of the male terminalia.

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. **Larva:** described by Dusek and Laska (1962), mines the stems of *Carduus nutans*. **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. cynocephala* in Britain and how they may be distinguished from *C. vernalis*. 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. **Larva:** 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.

Cheilosia fasciata Schiner & Egger, 1853

Preferred environment: forest and open ground; humid deciduous forest, including alluvial hardwood forest, usually close to water and 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.victoralis*. Hövemeyer (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. **Larva:** mines the leaves of *Allium ursinum* and *A.victoralis*. 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 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.victoralis* (high altitude) in central Europe. **Range:** southern Norway; Netherlands south to northeast France; the Alps and northern parts of the former Yugoslavia, Bulgaria and Roumania. **Determination:** van der Goot (1981). The adult insect is illustrated in colour in Bartsch et al (2009b), Kormann (1988) and Schmid (1996).

Cheilosia faucis Becker, 1894

Preferred environment: open areas in montane *Picea* forest (Vujic, 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. **Larva:** 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).

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. **Larva:** undescribed, but the adult female has been observed (Stuke, 1996) egg laying on *Cirsium arvense* and *Taraxacum officinale*. 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). The male of *C.flavipes* is illustrated in colour by Bartsch et al (2009b), the female by Torp (1994). This species is included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Haarto and Kerppola (2007a).

Cheilosia flavissima Becker, 1894

Preferred environment: forest; conifer forest. **Adult habitat and habits:** no data. **Flowers visited:** *Solidago virgaurea* (Bartsch et al (2009b)). **Flight period:** June/August (Scandinavia). **Larva:** not described. **Range:** Northern Europe (Norway, Sweden, Finland, Russia) and Siberia through to the Pacific and Japan; Poland; 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 Van Veen (2004) and 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).

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. **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 foodplants by 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). The adult insect is illustrated in Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994). This species is very similar to *C.bracusi* Vujic & Claussen. Distinctions between these two species are given by Vujic and Claussen (1994b). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

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. **Larva:** 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*. The female of *C.frontalis* is illustrated in colour by Torp (1994). This species is included in the keys (provided in both Finnish and English) to northern European *Cheilosia* species in Haarto and Kerppola (2007a).

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. **Larva:** 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 arisal hairs is variable in this species. In populations from the Pyrenees, in particular, the arisal 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 involved, but specimens from the Alps and the Pyrenees appear identical, except in respect of this one feature.

Cheilisia 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). **Larva:** undescribed, but reported by Bagatshanova (1990), from *Rumex* sp. She notes 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; 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 *Cheilisia* species in Haarto and Kerppola (2007a). The male is figured in colour by Bartsch et al (2009b).

Cheilisia griseifacies Vujic, 1994

Preferred environment: forest; deciduous forest, *Quercus/Fraxinus* forest, including alluvial hardwood forest (Vujic, 1994a, 1996). **Adult habitat and habits:** flies among *Salix* branches and settles on large-leaved plants like *Smyrnum* (Vujic, 1996). **Flowers visited:** Rosaceae; *Euphorbia*, *Plantago*, *Salix* (Simic et al 1994, Vujic, 1996). **Flight period:** mid March/May (Vujic, 1994a, 1996). **Larva:** not described. **Range:** uncertain, due to confusion with *C.canicularis* until recently, but confirmed from: Germany (Rheinland-Palatinate, Bavaria), Hungary, Bosnia, Serbia. **Determination:** Vujic (1994a), who figures the male terminalia and details features for separation of this species from the closely similar *C.canicularis* (Panzer).

Cheilisia 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. **Larva:** 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*.

Cheilisia 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. **Larva:** described and figured by Rotheray (1988a, 1994), miner in stems of *Cirsium* spp. (Rotheray, l.c.) and *Carduus* spp. (Dusek and Laska, 1962); detailed information about larval biology is provided by Rizza et al (1988), who use the name *C.corydon* (Harris) for this species. This species

overwinters as a puparium. **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). The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1984, 1994). 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.

Cheilisia herculana Bradescu, 1982

Preferred environment: forest/open ground; open, rocky areas in humid *Fagus* forest, upwards to 2000m in the Balkans (Vujic, 1996). **Adult habitat and habits:** flies in open, rocky areas, settling on stones in the sun; males hover at 2-4m (Vujic, 1996). **Flowers visited:** *Alyssum*, *Ranunculus* (Vujic, 1996). **Flight period:** beginning June/end August. **Larva:** undescribed. **Range:** Carpathians (Roumania) and Balkans (Macedonia, Montenegro). **Determination:** Bradescu (1991), where the species is included under *C.kerteszi* (Szil.). This species closely resembles *C.caerulescens* (Mg.). Bradescu (1991) gives *C.herculana* as a synonym of *C.kerteszi*, without comment. But Vujic (1996) treats *C.herculana* and *C.kerteszi* as separate species, without comment on Bradescu's (1991) treatment.

Cheilisia 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 (Vujic, 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. **Larva:** 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:** Bradescu (1991). 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. The female head and abdomen are figured in colour by Bartsch et al (2009b).

Cheilisia himantopus (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. **Larva:** described and figured by Dusek (1962), from larvae collected from *Petasites*, under the name *C.canicularis*. 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) and Apennines (Italy); Bulgaria, former Yugoslavia. **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).

Cheilisia 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 (Vujic, 1996). **Flowers visited:** umbellifers, *Mentha*, *Parnassia*, *Sisymbrium*. **Flight period:** from the beginning of June to the end of August, plus March/May in the Balkans (Vujic, 1996), where the species is at least bivoltine. **Larva:** not described. **Range:** 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*. There is no key in which *C.hypena* is adequately distinguished from related species. 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*).

Cheilosia iberica Marcos-Garcia & 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-Garcia). **Flowers visited:** *Chaerophyllum*, *Doronicum*, *Halymium*, *Stellaria* (Marcos-Garcia and Claussen, 1989). **Flight period:** April/beginning June. **Larva:** undescribed. **Range:** northern and central Spain. **Determination:** Marcos-Garcia and Claussen, (1989), who describe both sexes of this "*proxima* group" species and figure the male terminalia and the head of the female.

Cheilosia illustrata (Harris), 1776

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. **Larva:** 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* (Rotheray, 1999a). The female has been observed egg-laying on *Heracleum*, (Doczkal, 1996b). The species overwinters as a puparium. **Range:** Fenno-scandia to Spain and Ireland to western parts of Siberia. **Determination:** van der Goot (1981). 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). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

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*, *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. **Larva:** described and figured by Schmid (1999a), from larvae found feeding externally on the rootstock and underground stem-bases of *Arctium*. This species very probably has alternative food plants, since it may be abundant where no *Arctium* is present, for instance in alpine 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 alpine 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 and on across Siberia to the Pacific. **Determination:** van der Goot (1981), Vujic et al (1998). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994). *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 (Vujic et al, 1998). This remarkably useful feature has been ignored in keys (e.g. Ball et al, 2002; van Veen, 2004), except for those of Bartsch et al (2009b),

where it is also figured. *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 Vujic 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*.

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. **Larva:** 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*.

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. **Larva:** 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*. 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 (Vujic, 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 (Vujic, 1996). **Flowers visited:** *Muscari*, *Salix*. **Flight period:** beginning April/end May (plus June at higher altitudes). **Larva:** 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.

Cheilosia katara Claussen & Vujic, 1993

Preferred environment: forest/freshwater; open areas with seepages/flushes in relict montane forest of *Pinus heidreichii/P. nigra ssp. pallasiana* (Vujic, 1996). **Adult habitat and habits:** "the adult is stocky with short wings, which results in its clumsy and short flight" (Vujic, 1996). **Flowers visited:** *Ranunculus* (Vujic, 1996). **Flight period:** April/May. **Larva:** undescribed. **Range:** northern Greece (Pindos mountains). This species should be regarded as threatened at the European level (Vujic et al, 2001). **Determination:** Claussen and Vujic (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. Vujic and Claussen (2000) provide a key distinguishing this species from others of the *pini* group.

Cheilosia kerteszi Szilady, 1938

Preferred environment: open areas along streams in deciduous forest (Vujic, 1996). **Adult habitat and habits:** males hover at 2-5m (Vujic, 1996). **Flowers visited:** *Ranunculus*, *Salix* (Vujic, 1996). **Flight period:** April/May. **Larva:** not described. **Range:** Roumania, Bosnia-Herzegovina, Serbia. **Determination:** Bradescu (1991). 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 Vujic (1996).

Cheilosia kuznetzovae Skufjin, 1977

Preferred environment: open ground; humid, lowland unimproved grassland (Skufjin, 1977). **Adult habitat and habits:** no data. **Flowers visited:** *Campanula*, *Fritillaria*, *Salix*, *Schivereckia* (Skufjin, 1977). **Flight period:** May. **Larva:** not described. **Range:** southern parts of European Russia; western Siberia in Asiatic Russia. **Determination:** Claussen (1998), who redescribes the species, provides a key for separation of *C.kuznetzovae* from closely related species and also figures the male terminalia. The male terminalia are also figured by Barkalov (2007).

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. **Larva:** not described. **Range:** Northern Spain, Pyrenees (France) and Alps (France, Switzerland, Austria, northern Italy); 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-Garcia (1989a) (as *C.cantabrica* Marcos-Garcia). This species varies considerably in adult size (L.Verlinden, pers.comm.).

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. **Larva:** undescribed. **Range:** Alps (Germany, Switzerland, Austria, Italy) and the Slovak Republic. **Determination:** see key to males of European *Nigrocheilosia* species in the StN Keys volume; Barkalov and Ståhls, (1997) figure the male terminalia. Existing keys do not satisfactorily distinguish this species from *C.caerulescens* or *C.kerteszi*.

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. **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 auct* not Rondani. The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

Cheilisia 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. **Flight period:** end April/June and end July/beginning September. **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. 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:** Bradescu (1991). In the keys provided by van Veen (2004) specimens of *C.uviformis* lacking scutellar marginal bristles could be confused with it. The male terminalia are figured (as *C.latifacies*) by Marcos Garcia (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).

Cheilisia 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. **Larva:** undescribed; in all probability, this insect uses a range of different plant species as larval food-plants. Schmid and Grossmann (1996a) present evidence of egg-laying by *C.latifrons* on *Leontodon autumnalis*, suggesting this may be one larval host plant. Reemer et al (2009) also cite *L.hispidus* as a larval foodplant of this syrphid. **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 adult insect is illustrated in colour by Torp (1994). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

Cheilisia 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. **Larva:** 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).

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. **Larva:** described and figured by Dusek (1962) from larvae collected from *Senecio fuchssi*. 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. **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.

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 (Vujic, 1996 and pers.comm.). **Adult habitat and habits:** flies low over waterside vegetation, settling on leaves (Vujic, 1996). **Flowers visited:** *Caltha*, *Myosotis*, *Ranunculus* (Vujic, 1996). **Flight period:** April/June and July at higher altitudes (Vujic, 1996). **Larva:** 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* (Vujic, pers.comm.) The species referred to as *C.lenta* in Bradescu's (1991) keys would seem to be some other taxon. According to Vujic (1996), *C.drenowskii* Szilady should be regarded as a synonym of *C.lenta*.

Cheilosia limbicornis Strobl, 1909

Preferred environment: forest; open areas within matorral of both *Pinus* and *Quercus* species; and *Q.ilex* maquis (Marcos-Garcia, 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. **Larva:** not described. **Range:** Spain. **Determination:** the male is described by Torp Pedersen (1971). Diagnostic features are mentioned by Pérez-Bañón et al, (1996).

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. **Larva:** 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 Stähls (1997) figure the male terminalia.

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 vegetation 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. **Larva:** described and figured by Rotheray (1990) and illustrated in colour by Rotheray (1994); an internal feeder on the tissues of various large, woodland basidiomycetes, especially *Boletus*, *Leccinum*, *Suillus* (Buxton, 1955 and Hackman & Meinander, 1979). This species overwinters as a puparium. **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 is as yet to be described. *C.longula* may occur together with closely related *C.scutellata*. The adult insect is illustrated in colour by Bartsch et al (2009b), Torp (1994). The surstyli of the male terminalia are figured by Stubbs and Falk (2002). 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.

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. **Larva:** 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).

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). **Larva:** not described. **Range:** Fennoscandia, the Baltic States and mountainous parts of central Europe south to Italy, Bulgaria, Roumania and parts of the former Yugoslavia; Pyrenees. **Determination:** Vujic (1996), who figures the male terminalia and differentiates the Balkan subspecies *C.m.redei*, that is now recognised as a species in its own right, *C.redei* Vujic. *C.melanopa* is also included in the keys provided by van Veen (2004) and Haarto and Kerppola (2007a). 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. **Larva:** 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. **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 Vujic (1996) recognises as series of named subspecies of *C.melanura*.

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. **Larva:** 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.

Cheilisia 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*. **Flight period:** April/May. **Larva:** figured in colour by Bartsch et al (2009a). Barkemeyer (1994) provides a comprehensive review of the larval biology of 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:** 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. **Determination:** van der Goot (1981). This is probably the *C.scanica* of van Veen (2004), but the identity of *C.morio* as recognised by van Veen is less certain. Haarto and Kerppola (2007a) given *C.scanica* as a synonym of *C.morio*, but on what basis is unclear – two different taxa are clearly involved in this confused situation, but their correct names remain to be established.

Cheilisia 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. **Larva:** undescribed, but reported by Grosskopf et al (2001) as developing in the above-ground parts of *Hieracium pilosella*. **Range:** Fennoscandia south to Iberia, the Mediterranean and N Africa; from Britain eastwards through much of Europe into Turkey and 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. The adult insect is illustrated in colour in Bartsch et al (2009b), Stubbs and Falk (1983), Torp (1984) and van der Goot (1986). 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 arista pubescence is extremely short, shorter than in male *C.mutabilis*. Unfortunately, separation of the females is more difficult, since the arista 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*.

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). **Larva:** 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), who also illustrate the male in colour.

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

Cheilosia nebulosa Verrall, 1871

Preferred environment: wetland/forest; *Alnus/Salix* carr and poorly drained scrub (*Prunus spinosa*) woodland. **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. **Larva:** 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:** van der Goot (1981). 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). 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. **Larva:** 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*. 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. **Larva:** 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).

Cheilosia omissa: see under *C.lenis* Becker

Cheilosia orthotricha Vujic & 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 (Vujic, 1996). **Flowers visited:** *Petasites*, *Salix*, *Taraxacum*. **Flight period:** February/May (plus June and July at higher altitudes). **Larva:** not described, but Stuke and Claussen (2000) record larvae of this species as found 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:** Vujic & 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).

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. **Larva:** undescribed, but has been reared from rotting roots of *Anthriscus sylvestris* (Stubbs, 1980) and *Angelica sylvestris* (Doczkal, 1996b). 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 adult insect is illustrated in colour in Bartsch et al (2009b), Torp (1984, 1994) and van der Goot (1986). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

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-Garcia, pers.comm.) and in open *Castanea* forest (C.Kehlmaier, pers.comm.). **Adult habitat and habits:** males hover over ground vegetation in open areas within forest (C.Kehlmaier, pers.comm.). **Flowers visited:** umbellifers; *Hedera*, *Leucanthemopsis*, *Mentha*, *Oenanthe*, *Ranunculus*, *Stellaria*, *Thapsia* (Marcos-Garcia, 1986c, as *C.latifacies* - Marcos-Garcia, pers. comm.). **Flight period:** April/November in Spain (Marcos-Garcia (1986c, 1987, 1990a); in N Africa virtually throughout the year, with peaks in March/April and September/ October (Kassebeer, 1998). **Larva:** undescribed. **Range:** Spain and N Africa (Morocco, Algeria). **Determination:** closely similar to *C.laticornis* Rondani, from which it may be distinguished by features provided by Marcos Garcia (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).

Cheilosia pascuorum Becker, 1894

Preferred environment: forest; humid deciduous forests of *Quercus* and *Fagus* (Vujic, 1996), upwards into unimproved, non-calcareous subalpine grassland to above 2000m (Goeldlin and Speight, 1997). **Adult habitat and habits:** males hover at 2-5m and settle on the ground, or on flowers (Vujic, 1996). **Flowers visited:** *Alyssum*, *Ficaria* (Vujic, 1996). **Flight period:** April/beginning June and July at higher altitudes (Vujic, 1996). **Larva:** not described, but known to be an internal feeder in *Cynoglossum officinale* (Vujic, 1996). **Range:** Alps (France, Germany, Switzerland, Austria), Roumania, parts of European Russia, the Balkans. **Determination:** Vujic (1994c). This species is extremely similar to *C.proxima* (Zetterstedt) and *C.velutina* Loew.

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. **Larva:** 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 Stähls, (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*.

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. **Larva:** 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).

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. **Larva:** 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.

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*, *Sorbus aucuparia*. **Flight period:** end May/June and on to July at higher altitudes. **Larva:** unknown. **Range:** Poland, Germany, France (Vosges, Pyrenees, Alps), Switzerland, Liechtenstein, Austria, Roumania, northern parts of the former Yugoslavia; European parts of Russia and on into Siberia. **Determination:** Claussen (1998), who both provides a key distinguishing *C.pictipennis* from closely-related species and figures its male terminalia.

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. **Larva:** 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).

Cheilosia pini Becker, 1894

Preferred environment: forest; humid *Fagus/Picea* forest (Vujic and Claussen, 2000). **Adult habitat and habits:** no data. **Flowers visited:** male *Salix*, *Caltha* (Vujic and Claussen, 2000). **Flight period:** beginning April/beginning July. **Larva:** undescribed. **Range:** Poland, Czech Republic, Slovakia, Austria, Bosnia-Herzegovina, and Montenegro. **Determination:** Vujic 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.

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. **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*. It overwinters as a puparium. The morphology of the chorion of the egg is figured by Kuznetsov (1988). **Range:** Fennoscandia south to Pyrenees and mountainous parts of Spain; Britain eastwards through much of Europe into Turkey and European parts of Russia; in Siberia from the Urals to Kamchatka.

Determination: van der Goot (1981). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994). 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*.

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*, *Primula veris*, *Prunus spinosa*, *Salix* spp., including *S.repens*. **Flight period:** April/May and on to July at higher altitudes. **Larva:** not described, but reported by Grosskopf et al (2001) as developing in the aerial parts of *Hieracium pilosella* and *H.caespitosum*. 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.vujici*; 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.

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. **Larva:** undescribed. This species occurs 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. **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. 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, 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. **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. 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* Vujic, 1996**

Preferred environment: deciduous forest/freshwater; near streams in Balkanic thermophilous *Quercus* forest, *Quercus/Carpinus* forest and mesophilous *Fagus* forest (A.Vujic, pers.comm.). **Adult habitat and habits:** males hover at 2-3m (Vujic, 1996). **Flowers visited:** *Caltha*, *Salix*, *Stellaria* (Vujic, 1996). **Flight period:** March/May and July at the northern edge of its range (Vujic, 1996). **Larva:** not described. **Range:** Czech Republic, Slovakia, Hungary, Serbia, Bosnia-Herzegovina, Macedonia, Bulgaria, Greece, Roumania. **Determination:** originally described (Vujic, 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 Vujic (1996) and Francuski et al (2009). Vujic (1996) also figures the male terminalia.

***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. **Larva:** not described. **Range:** known from Finland, the western edge of European Russia and eastern Asiatic Russia (Yakutia). Ståhls 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*. Ståhls 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*. Ståhls 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. 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.

***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* 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. **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). **Determination:** Schmid (2000), who figures the male terminalia, provides a key distinguishing this species from *C.fasciata* and *C.semifasciata* and also 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. **Larva:** undescribed, but the female has been observed (Doczkal, 1996b) ovipositing on *Adenostyles alliariae*, strongly suggesting that this is a larval host plant. **Range:** Poland south to the Alps; northeast France (Vosges) eastwards through central Europe to Austria and northern Italy, the former Yugoslavia, Roumania and Bulgaria. **Determination:** Sack (1930-32).

Cheilosia rogersi Wainwright, 1911

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April. **Larva:** not described. **Range:** southern Spain and N Africa (Morocco). **Determination:** this species is redescribed and its male terminalia figured by Claussen (1989). Vujic and Claussen (2000) provide a key in which the male of *C.rodgersi* is separated from the males of some closely related species.

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. **Larva:** 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. **Determination:** Bradescu (1991), Haarto and Kerppola (2007a), van der Goot (1981). 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. Both male and female are illustrated in colour by Torp (1994). The male is also figured in colour by Bartsch et al (2009b). Nielsen and Claussen (2001) and Barkalov (2007) figure the male terminalia of *C.rufimana* and establish that *C.subarctica* Hellen is a synonym of this species.

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. **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. **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). 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).

Cheilosia schnabli Becker, 1894

Preferred environment: forest; open areas in thermophilous *Quercus* forest (Vujic, 1996). **Adult habitat and habits:** in open, grassy areas within forest; settles on vegetation and flowers; males hover at 1-3m (Vujic, 1996). **Flowers visited:** *Euphorbia*, *Ranunculus* (Vujic, 1996). **Flight period:** mid May/beginning July. **Larva:** undescribed. **Range:** Hungary, Roumania, Balkans (Bosnia/Herzegovina, Greece, Serbia) and Caucasus (Dagestan). **Determination:** redescribed by Vujic 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. Vujic et al (1998) detail distinctions between this species and *C.impressa*.

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, *Chaerophyllum*, *Cirsium*, *Cistus*, *Crataegus*, *Galium*, *Hedera*, *Hieracium*, *Ranunculus*, *Sorbus*. **Flight period:** May/September and April/October (or even November) in southern Europe. **Larva:** described and figured by Rotheray (1990); well-known as tunnelling the tissues of various large woodland basidiomycete fungi, especially *Boletus* and *Suillus* (Dely-Draskovits, 1972). **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 Bartsch et al (2009b) and Torp (1994). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

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. **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). This species overwinters as a puparium. **Range:** northern Norway and Finland south to northern France; 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). The male is figured in colour by Bartsch et al (2009b).

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). **Larva:** 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), who also 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. **Larva:** undescribed, but reported as having been found in basidiomycetes, notably truffles. **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). This species frequently appears in recent literature under the name *ruffipes* (Preyssler). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

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.). **Flight period:** end April/mid July. **Larva:** 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.

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. **Larva:** not described. **Range:** Turkey, Israel. **Determination:** Kaplan and Thompson (1981), who figure the male terminalia.

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). **Adult habitat and habits:** flies along forest edges and tracks within pine forest (Claussen and Ståhls, 2007). **Flowers visited:** no data. **Flight period:** September/October (Claussen and Ståhls, 2007). **Larva:** not described, but probably associated with the large basidiomycetes *Amanita caesarea* and *Suillus granulatus* (Standfuss and

Claussen, 2007). **Range:** Greece. **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.

Cheilisia 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. **Larva:** 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.

Cheilisia 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. **Larva:** undescribed, but Claussen (1980) and Doczkal (1996b) found the species egg-laying in the basal leaf rosettes of *Hieracium pilosella*. Grosskopf et al (2001) report that *C. urbana* can develop in both *H. pilosella* and *H. caespitosum*, 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*. **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, and in 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. vujici*, 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. The adult insect is illustrated in colour in Bartsch et al (2009b), Torp (1984, 1994) and van der Goot (1986).

Cheilisia 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. **Larva:** undescribed. **Range:** Fennoscandia south to the Pyrenees; from Ireland eastwards through central Europe to the former Yugoslavia. **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. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Cheilisia vangaveri Timon-David, 1937

Preferred environment: forest/open ground; open areas in the upper parts of the *Abies/Picea* zone and on through the *Larix* zone into unimproved, calcareous and non-calcareous alpine grassland to above 2,500m. **Adult habitat and habits:** very low-flying. **Flowers visited:** Ranunculaceae; *Potentilla*. **Flight period:** beginning June/end July, plus August at higher altitudes. **Larva:** 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.

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. **Larva:** described and figured by Dusek (1962); mines the roots of *Scrophularia nodosa*. **Range:** southern Fennoscandia south to Iberia; from Ireland eastwards through central and southern Europe (Italy, former Yugoslavia) into Bulgaria, Turkey and Russia as far as western Siberia. Also in N Africa (Morocco). **Determination:** van der Goot (1981). The adult insect is illustrated in colour in Stubbs and Falk (1983), Kormann (1988) and Torp (1994). The surstyli of the male terminalia are figured by Stubbs and Falk (2002).

Cheilosia varnensis Claussen, 2000

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** 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.

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. **Larva:** undescribed, but 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 Kuznetsov (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). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Cheilosia venosa Loew, 1857

Preferred environment: thin-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. **Larva:** not described. **Range:** Alps (Germany, France, 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. This species is inadequately differentiated from *C.caerulescens*, *C.herculana* and *C.kerteszi* in existing keys.

Cheilisia 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*, *Menyanthes*, *Prunus spinosa*, *Ranunculus*, *Salix*, *Senecio*, *Taraxacum*. **Flight period:** April/October, with peaks in May/June and August. **Larva:** undescribed, but known to be an internal feeder in the stems of *Achillea*, *Matricaria* and *Sonchus oleraceus* 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 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*. The adult of *C.vernalis* is illustrated in colour in Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994).

Cheilisia 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. **Larva:** undescribed. 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. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Cheilosia vujici 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. **Larva:** not described. **Range:** Alps (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.).

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. **Larva:** 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. The species overwinters as a puparium. That this syrphid must have other plant hosts than *Cynara* is evident from its occurrence where no *Cynara* is present. Doczkal (2002) reports egg-laying behaviour by this species on *Cirsium eriophorum*. **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).

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 Vujic (1999b). There is no key, which includes all the European species. The most comprehensive is that of van der Goot (1981). *C.simplex* Lw is included in the keys provided by Bradescu (1991).

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. **Larva:** not described. **Range:** from northern France and southern Germany south to 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 and on into Kazakhstan and Tajikistan. **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Claussen & Hauser (1990) and Maibach et al (1994a).

Females of *C.basalis* and *C.solstitialis* are very difficult to separate. This is probably the same species as *C.musatovi* Stack.

Chrysogaster coemiteriorum (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. **Larva:** features of the larva and puparium are described and figured by Kuznetsov 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). The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994).

Chrysogaster mediterraneus Vujic, 1999

Preferred environment: forest/freshwater; streams and small marshy areas in thermophilous oak forests of *Q. pubescens* (A.Vujic, pers.comm.); “deciduous forest (mainly *Platanus*) with springs and small streams” (Reemer and Smit, 2007). **Adult habitat and habits:** settles on flowers (A.Vujic, pers.comm.). **Flowers visited:** umbellifers; *Ferulago sylvatica*, *Tordylium apulum* (Standfuss and Claussen (2007); *Smiranium perfoliatum* (A.Vujic, pers.comm.). **Flight period:** beginning May/mid June. **Larva:** 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. Vujic (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.

Chrysogaster rondanii Maibach & Goeldlin, 1995.

Preferred environment: groundwater streams in forest; in 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. **Larva:** 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:** See Key provided in StN Keys volume. Maibach and Goeldlin (1995) figure the male terminalia. This species is very similar to *C.virescens*, with which it has been confused until recently. In the male, the distance between the lower edge of the lunule and the upper mouth edge is, in the midline, actually shorter than the width of the face at the level of the antennal insertions, contrasting with the situation in *C.virescens*, where the distance between lunule and upper mouth edge is longer than the width of the face at the level of the antennal insertions. But these differences are small and not easy to gauge by eye.

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. **Larva:** 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).

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). **Larva:** aquatic; 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 as far as the Ukraine and the Caucasus mountains. **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). The adult insect is illustrated in colour in Bartsch et al (2009b), Stubbs and Falk (1983), Kormann (1988) and Torp (1994). 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.

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. **Larva:** 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). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

CHRYSOSYRPHUS

This genus appears in earlier European literature as *Helleniola* Kassebeer (1995) 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). **Adult habitat and habits:** no data. **Flowers visited:** *Dryas octopetala*, *Ledum palustre*, *Rhododendron tomentosum*, *Rubus chamaemorus*. **Flight period:** mid June/mid July. **Larva:** not described. **Range:** northern parts of Norway and Sweden. **Determination:** See Key provided in StN Keys volume; Bartsch et al (2009b); Kassebeer (1995), who also figures the male terminalia. 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*, *Rubus chamaemorus*, *Salix*. **Flight period:** mid June/mid July. **Larva:** 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 (1995), who also figures the male terminalia. This species may occur with *C.nasutus* (Zetterstedt). 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

There is currently great need for a 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 be employed to distinguish these species, or that they are all no more than colour varieties of one species, remains to be resolved. The generally accepted species concepts operating at present are reflected by the work of van der Goot (1981), which has been followed here. Peck (1988) lists 23 supposedly distinct European species.

***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. **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 and European parts of Russia; in Asiatic parts of Russia as far as central Siberia. **Determination:** van der Goot (1981). The adult insect has been figured in colour by Kormann (1988), Torp (1984, 1994), Stubbs and Falk (1983) and van der Goot (1986).

***Chrysotoxum cautum* (Harris), 1776**

Preferred environment: deciduous forest and scrub; unimproved grassland and lightly grazed grassland which has not been subject to ploughing or tillage. **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*, *Euphorbia*, *Geranium*, *Plantago*, *Ranunculus*, *Rhamnus catharticus*, *Rubus*, *Sorbus aucuparia*. **Flight period:** May/July, plus April in southern Europe. **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 Kuznetsov (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 and Russia as far as the Altai mountains (Mongolia). **Determination:** van der Goot (1981). 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). 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:** no data. **Flight period:** end June/end September. **Larva:** 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:** this species is not satisfactorily distinguished in existing keys. It is included in the keys in Séguy (1961).

***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. **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 Mountains and into 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:** van der Goot (1981). There is uncertainty over the relation between *C.elegans* and some other *Chrysotoxum* species, which is reflected in both keys and distribution data. There is great need for better data on the range of intra-specific variation that can be found in these species. Such data could probably best be derived from captive breeding programmes. But the species involved are all now very localised and none of them has yet been reared in captivity. *C.elegans* has been figured in colour by Stubbs and Falk (1983).

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 subalpine zone, in unimproved 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. **Larva:** 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; through Siberia from the Urals to Kamchatka; Japan. **Determination:** van der Goot (1981). The adult insect has been figured in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). Ill-conceived application of the so-called International Code of Zoological Nomenclature once again suggests use of the name *arcuatum* for this species, for the last 20 years used over most of Europe for another *Chrysotoxum* species. 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.

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. **Larva:** not described. **Range:** Fennoscandia, mountain ranges in Poland and Germany south to France (e.g. Vosges, Massif Central); and 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:** van der Goot (1981). This species is a remarkable mimic of the queen (female) caste of *Dolichovespula/Vespula* wasp species. The adult insect is illustrated in colour by Kormann (1988) and Bartsch et al (2009a).

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*, *Nartheicum*, *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. **Larva:** 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 and European parts of Russia; through Siberia to the Pacific coast; Japan; northern India. **Determination:** van der Goot (1981). The confused history of the use of the name *festivum* (L.) has made European literature on this species almost unusable.

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. **Larva:** not described. **Range:** southern Sweden (extinct?), Poland, Germany, Czech Republic, France, Portugal, 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. **Determination:** van der Goot (1981), Bradescu (1991), Bartsch et al (2009a). The adult insect is illustrated in colour by Bartsch et al (2009a).

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. **Larva:** 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:** van der Goot (1981). There is disagreement as to whether *latifasciatum* Becker is simply a large variety of this species or a separate taxon.

Chrysotoxum parmense Rondani, 1843

Preferred environment: open ground/forest; sparsely vegetated, dry, unimproved grassland/grazed Mediterranean heath and open areas in heathy *Quercus ilex* forest, matorral/maquis. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Calamentha*, *Cistus*, *Euphorbia*, *Potentilla*, *Quercus ilex*, *Thymus* (see Marcos-Garcia and Isidrio, 1995). **Flight period:** end May/end July. **Larva:** 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:** inadequately differentiated in existing keys.

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* maquis; 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. **Larva:** 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. **Determination:** van der Goot (1981). The species is illustrated in colour by Torp (1994). The lateral margin of the abdomen may be distinctly partly (but narrowly) yellow at the hind margin of each tergite, although 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.

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. **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 assumed 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:** van der Goot (1981). The species is illustrated in colour by Torp (1994).

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 not currently included in keys 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 (Jaenicke), 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). **Larva:** undescribed, but 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).

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*. Hipa (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*. But *C.graeca* is now regarded as a synonym of *C.berberina*, giving a European fauna of 6 species, one of which (*C.brevipila* Lw) is known in Europe only from the eastern edge of European Russia. Van der Goot (1981) includes all of the European *Criorhina* species in his keys. 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. **Larva:** 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 Hipa (1978). The adult fly is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007), Kormann (1988), Torp (1984, 1994), Stubbs and Falk (1983) and van der Goot (1986).

***Criorhina 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*, *Photinia*, *Ranunculus*, *Rhamnus catharticus*, *Rhododendron*, *Rosa*, *Rubus idaeus*, *Salix*, *Sorbus*, *Taraxacum*, *Viburnum opulus*. **Flight period:** May/July and on into August at higher altitudes. **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 northern Spain; from Ireland eastwards through central Europe to European parts of Russia and Turkey; Italy; the former Yugoslavia, Roumania. **Determination:** van der Goot (1981). See Key provided in StN Keys volume. Peck (1988) consigns this species to the genus *Brachymyia*, which was set

up during the last century for the N American species *lupina* Williston. In recent literature on the North American syrphid fauna, e.g. Vockeroth and Thompson (1987), *Brachymyia* does not appear and in Stone et al (1965) it is given as a synonym of *Criorhina*. The only mention of *Brachymyia* in European literature is a passing reference in Hippa (1978), where no European species are consigned to the genus, so the basis for Peck's (1988) action is obscure. Some recent literature still refers to a colour variety of *C.berberina*, *C.berberina v.oxycanthae*, as a separate species. Both colour varieties of *C.berberina* are illustrated by Stubbs and Falk (1983). *C.berberina v.oxycanthae* is also figured in colour by Bartsch et al (2009b), Kormann (1988), Schmid (1996), Torp (1984, 1994) and van der Goot (1986). *C.graeca* Schirmer, included by Peck (1988) as a separate species, is now recognised as a synonym of *C.berberina*.

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*. **Flight period:** beginning April/beginning July, with records beyond mid June mostly from higher altitudes. **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. The adult insect is illustrated in colour by 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.). **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 trees. **Flowers visited:** *Crataegus*, *Photinia*, *Prunus*, *Salix*, *Sorbus*. **Flight period:** May/June. **Larva:** not described. **Range:** Netherlands south to northern Spain; Belgium (Ardennes) eastwards through central Europe (Czech Republic, Austria) to Roumania. **Determination:** van der Goot (1981); Bradescu (1991), Verlinden (1991). See Key provided in StN Keys volume.

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*, *Sorbus aucuparia*. **Flight period:** beginning of March/mid May and on to end June at higher altitudes. **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 central Spain; from Ireland eastwards through central Europe into European parts of Russia. **Determination:** van der Goot (1981). See Key provided in StN Keys volume. 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). The variety *ruficauda* (Meigen) is entirely rufous-haired and has been mistaken for *C.pachymera* (Egger) by some authors, notably Seguy (1961).

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 conifer (*Picea*) forest (T.Järveläinen, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Anthriscus sylvestris* (T.Järveläinen, pers.comm.). **Flight period:** June/July (Ståhls and Vujić, 2009). **Larva:** not described. **Range:** 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 males can be separated from other European syrphids using the generic key given in the StN Keys volume. However, available information is insufficient to provide for separation of females of *C.notabila* from females of *Heringia* s.g. *Neocnemodon*, other than by reference to the wing blotch present in *C.notabila* females. In both sexes, this species bears a strong, general resemblance to *Pipiza lugubris*, with which it is likely to be confused if the barett is not checked for presence of hairs (hairs present in *Cryptopipiza*, absent in *Pipiza*). The male is illustrated in colour by Haarto & Kerppola (2007), who also provide a diagrammatic representation of the male terminalia.

DASYSYRPHUS

Peck (1988) lists 8 species of *Dasysyrphus* as occurring in Europe, but the European species of this genus are badly in need of revision. Bicik and Laska (1996) and Doczkal (1996a) 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. **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); into 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). 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. **Larva:** not described. **Range:** Corsica. **Determination:** the description of this species is based on a solitary male. *D.corsicanus* does not seem to have been seen since its description 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.

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. **Larva:** not described. **Range:** southern Sweden, Pyrenees (France, Spain), Alps (Switzerland, Austria, northern Italy), Corsica, Roumania and the Caucasus, also Poland; southwest Asia (Kirghizistan, Tajikistan) and western Siberia; Mongolia. **Determination:** Bradescu (1991); Bartsch et al (2009a), who figure the adult male, and the female abdomen, in colour.

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*, *Sorbus aucuparia*, *Taraxacum*. **Flight period:** May/June and on into July/beginning of August at higher altitudes. **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; 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). The latter authors 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 myrtillus*. **Flight period:** beginning May/mid June. **Larva:** 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.). 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).

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. **Larva:** 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.pinastris* (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.pinastris*.

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

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. **Larva:** not described. **Range:** uncertain, due to confusion with related species, but confirmed from northern Norway, northern Sweden and Finland. Bartsch et al (2009a) suggest this species occurs only north of the Arctic Circle. **Determination:** Bičík and Láška (1996), Bartsch et al (2009a). 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.pinastris*, and Verrall (l.c.) was attempting to distinguish *nigricornis* from *pinastris*, the result was a set of totally unreliable distinguishing features. Bičík and Láška (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.pinastris*. 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.pinastris* 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), who provide a reasonably clear basis for separation of this taxon from *D.pinastris* and a coloured figure of the male of *D.nigricornis*. However, *D.lenensis* (which is not known from Scandinavia) is not included in their keys.

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. **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, France (Puy-de-Dôme, Alpes-Maritimes), Switzerland, Austria, Italy (Dolomites) 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.pinastris*, *D.pauxillus* and *D.lenensis* Bagatshanova. However, 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 Bičík and Láška (1996) and Doczkal (1996a). The range of variation indicated for this species by Vockeroth (1992) would imply that more than one taxon may be confused under this name in N America, but Williston's type material has apparently been lost (Vockeroth, 1986a) and no neotype has been designated. This does not provide a good basis for use of the name *pauxillus* for European specimens. Bičík and Láška (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). Another interpretation 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). *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 *D.pauxillus* are figured by Vockeroth (1992).

Dasysyrphus pinastri (DeGeer), 1776 sensu Doczkal (1996a)

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*, *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. **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); 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 and European parts of Russia; through Siberia from the Urals to Yakutia. **Determination:** Doczkal (1996a), as *D.pinastri* (DeG.) - 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 and Laska (1996) have attempted to define European taxa previously confused with *D.pinastri*, recognising the additional species as *D.nigricornis* (Verrall) *nec auccet* and *D.pauxillus* Williston. Supposed distinctions between these three taxa are provided by Bicik and 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 and 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 and Pont (1994) designated as neotype of *pinastri* de Geer's figure of this species. There is no indication given by Thompson and 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 those authors who wish to apply the name *pinastri* to this taxon, the only way to do so would seem to be to refer to it as *pinastri* (DeGeer) sensu Doczkal (1996a), since Doczkal is the only author to link the neotype designation of *pinastri* to any usable description of a species. The male terminalia of *D.pinastri* have been figured by Doczkal (1996a) and Vockeroth (1992). The adult insect is supposedly illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Haarto and 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* (Krpáč et al, 2009); yellow composites; *Crataegus*. **Flight period:** end May/beginning July. **Larva:** not described. The morphology of the chorion of the egg is figured by Kuznetsov (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) and Bartsch et al (2009a). *D.postclaviger* is not included in the keys provided by van Veen (2004), where it would run down to *D.friuliensis*. 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. **Larva:** has been observed predated 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. **Determination:** van der Goot (1981). The male terminalia are figured by Hippa (1968b) and Vockeroth (1969). 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*, *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. **Larva:** described and figured by Dusek and Laska (1962) and illustrated in colour by Rotheray (1994); aphid-feeding, on trees and shrubs. The morphology of the chorion of the egg is figured by Kuznetsov (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. It is hoped that revisionary work currently underway (Doczkal, pers.comm.) will clarify the status of this taxon and provide a more satisfactory basis for distinguishing it from related species, some of which are currently unrecognised in existing literature. The male terminalia of *D.venustus* (as *D.arcuratus*, Fallen) are figured by Hippa (1968b) and Vockeroth (1969). The adult insect is supposedly illustrated in colour by Kormann (1988), Stubbs and Falk (1983) Torp (1994) and Bartsch et al (2009a).

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 (1991).

Didea alneti (Fallen), 1817

Preferred environment: forest; conifer forest (including western taiga) and plantation; acidophilous *Quercus*. **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. **Larva:** 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 northern France; 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). 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. **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 N America from British Columbia south to New Mexico and east to New York; 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). 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*, *Nartheicum ossifragum*, *Potentilla erecta*, *Ranunculus*, *Rosa pimpinellifolia*, *Sambucus ebulus*. **Flight period:** end May/August with occasional specimens on into October. **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 and on to the Pacific coast (Kamchatka). **Determination:** Stubbs & Falk (1983). See Key provided in StN Keys volume. 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. 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. **Flowers visited:** no data. **Flight period:** end of June to the beginning of October, with a peak in September. **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*). **Range:** round the Mediterranean basin from southern France through Italy to Greece and Turkey; also in Roumania. **Determination:** Speight (1988c).

Doros profuges (Harris), 1780

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 an, 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. **Larva:** 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). The adult insect is illustrated in colour by 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 nigratarsis* (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. They also describe additional species. European *Epistrophe* species recognised currently can be determined using the keys in Doczkal and Schmid (1994). An alternative key (omitting *E.annulitarsis*) is provided by van Veen (2004).

Epistrophe annulitarsis (Stackelberg), 1918

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Larva:** not described. **Range:** Finland, northern parts of European Russia and eastwards through Siberia to the Pacific coast. **Determination:** 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). 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:** *Crataegus*, *Prunus*, *Salix*. **Flight period:** June. **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 their 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, Germany, and Switzerland. **Determination:** Doczkal and Schmid (1994), who figure the male terminalia; Haarto and Kerppola (2007a); Bartsch et al (2009a). This species is also included in the keys provided by van Veen (2004), where additional features helping to separate *E.cryptica* from *E.obscuripes* are included. 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 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. **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 Russia and on through Asia to the Pacific coast. **Determination:** Doczkal and Schmid (1994). The male terminalia are figured in Hippa (1968b). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Epistrophe eligans (Harris), 1780

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. **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. 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*. **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:** Doczkal and Schmid (1994). The male terminalia are figured by Dusek and Laska (1967) and (as *E.bifasciata*) in Hippa (1968b). 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. **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; through Siberia to the Pacific coast. **Determination:** Doczkal and Schmid (1994); van Veen (2004); Bartsch et al (2009a). 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 are black. The male terminalia are figured by Hippa (1968b). 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. **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; across N America from Alaska to Quebec and south to California. **Determination:** Doczkal and Schmid (1994). The male terminalia are figured in Hippa (1968b) and Vockeroth (1969). The adult insect is illustrated in colour by 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 alpine

grassland. **Adult habitat and habits:** usually near streams in open areas within forest. **Flowers visited:** umbellifers. **Flight period:** June/August. **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 Transcaucasus. **Determination:** van der Goot (1981), Bradescu (1991), Doczkal & Schmid (1994), Verlinden (1991); van Veen (2004). 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 glauca* (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.glauca*. 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*.

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. **Larva:** described by Mazánek et al (2001), who report finding the larvae of this species in the field on *Carduus*, *Dactynotus*, *Euonymus* and *Sambucus nigra*. 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 Decler (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. Vockeroth (1992) points out that the N American species *E.terminalis* (Curran) might well be a synonym of *E.melanostoma*, but was unable to confirm this synonymy because the identity of *E.melanostoma* was then in doubt - at that time the revision of Doczkal and Schmid (1994) was not available. From the information provided by Vockeroth (1992) and Doczkal and Schmid (1994) it would seem almost certain that *E.terminalis* is, indeed, a junior synonym of *E.melanostoma*, and is treated as such here. This interpretation results in a Nearctic range for *E.melanostoma*, from Alaska through Canada to Maine and Ontario. **Determination:** Doczkal and Schmid (1994); van Veen (2004); Bartsch et al (2009a). 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 1st.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* and *E.ochrostoma*, and great care has to be taken in its determination. The male terminalia are figured by Doczkal & Schmid (1994). The adult insect is illustrated in colour by Kormann (1988), Torp (1994) and Bartsch (2009).

Epistrophe nitidicollis (Meigen), 1822

Preferred environment: deciduous forest, scrub and macquis. **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. **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 *Spirea*. Mazánek et al (2001) include this species in their key to the third stage larvae of European *Epistrophe* and also figure its puparium. **Range:** Fennoscandia south to Iberia; from Ireland eastwards through northern, central and southern Europe (Italy, the former Yugoslavia, Bulgaria) into Russia; through Siberia to the Pacific coast (Kamchatka, Sakhalin Is.); in N America from Alaska south to California and S Carolina. **Determination:** 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). 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. **Larva:** not described. **Range:** inadequately known. So far recorded from Norway, Sweden, Finland, the Netherlands, Belgium (Ardenne), France (Vosges), Germany and Austria. **Determination:** Doczkal and Schmid (1994), who 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. 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).

***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). **Larva:** 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. Reported from Gibraltar by Ebejer and Bensusan (2011). **Determination:** Doczkal and Schmid (1994), who redescribe the species and figure the male terminalia; Bartsch et al (2009a). 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*). This species is also included in the keys provided by van Veen (2004). 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.

***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:** *Prunus padus*, *P.spinosa*, *Taraxacum* (Bartsch et al, 2009); *Salix alba*. **Flight period:** May/June. **Larva:** 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, France (Rhine valley in Alsace), Switzerland and Eastern Siberia, including the Kuril islands. **Determination:** 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. 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).

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 *Lasiophthicus 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 (pers.comm., M. de C.Williams). **Flowers visited:** no data. **Flight period:** March/May. **Larva:** undescribed. **Range:** Italy and Serbia. This species should be regarded as threatened at the European level (Vujić *et al*, 2001). **Determination:** Doczkal and Vujic (1998) redescribe the species, figure the terminalia and list features distinguishing *E.coronata* from *Meligramma euchroma* (as *Epistrophella euchroma*). Doczkal and Vujic (1998) note that one of the features distinguishing *coronata* from *euchroma* is that in *coronata* the "upper and lower katapisternal 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 Vujic (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 Vujic (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 and its abundantly hairy eyes.

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 *Episyrrhus*.

***Episyrrhus 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 up to 4 - 5 m, usually over paths in woodland, or similar situations. **Flowers visited:** visits a wide range of white and yellow flowers, from trees to low-growing plants and including nectarless flowers; also visits pink flowers such as *Cirsium* and *Succisa* (see de Buck, 1990, for an extended list of plants visited by this species). 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. Sutherland et al (1999). **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. Sarthou et al (2006) 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. **Larva:** 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 Kuznetsov (1988). Egg morphology is described by Chandler (1968), oviposition behaviour by Barga 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 aphidophagous on a wide range of low-growing plants including various crops (e.g. *Beta*, *Lactuca*, *Solanum*, *Trifolium* spp., *Triticum*), shrubs (e.g. *Buddleja*, *Euonymus*, *Sambucus*) and trees; 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 Barga et al (1998) describe elements of larval biology and Bomboš (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. 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). **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; Australia. This is an extremely migratory species and records from offshore islands of northern Europe, such as the Faroes (Jensen, 2001) are assumed to be due to annual immigration, 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). 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 (Fallen), 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. **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 and on 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). The adult insect is illustrated in colour by Haarto and Kerppola (2007a), Bartsch et al (2009a) 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. Three of them do not reach further north than the Mediterranean basin. The two more generally distributed species are included in the keys of van der Goot (1981), Stubbs and Falk (1983) and Verlinden (1991). 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*, *Taraxacum*. **Flight period:** April/September and on into October in southern Europe; overwinters as an adult. **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. **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. 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) and van der Goot (1986). In specimens from southern Europe, the mesoscutum exhibits distinct longitudinal banding, as in *E.sepulchralis* (L.), particularly in the female.

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:** *Solidago*. **Flight period:** March/April and September/October, but also with some records May/July and as late as November. **Larva:** 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 and coastal parts of Italy round the Mediterranean basin (including islands, e.g. Corsica, Malta, Sicily, Crete) to Turkey and on into 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.

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. **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). **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; 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). 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).

Eristalinus taeniops (Wiedemann), 1818

Preferred environment: forest/open ground/freshwater; by 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*, *Hedera*, *Mentha*, *Rubus*, *Senecio*, *Solidago* (see Marcos-García, 1985a). **Flight period:** April/October, with peaks in May and August. **Larva:** 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. **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, Transcaucasus; 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. **Determination:** See Key provided in StN Keys volume and Pérez-Bañón et al (2003).

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* (Vujic 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. **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. The adult insect is illustrated in colour by Bartsch et al (2009b), 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. **Larva:** not described. **Range:** from Denmark and the Netherlands 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. **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. *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 oligotrophic/mesotrophic pools. **Flowers visited:** white umbellifers; *Bellis*, *Caltha*, *Cardamine*, *Cirsium*, *Crataegus*, *Lycopus*, *Menyanthes*, *Ranunculus*, *Rubus*, *Salix*, *Taraxacum*, *Valeriana*.

Flight period: mid April/end August. **Larva:** features of the larva and puparium are described and figured by Kuznetsov 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 western Europe the range of this species seems to have contracted during the present century, leaving relictual populations at isolated localities in France, Belgium and the Netherlands. 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). 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. **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 reared the species from compost and manure heaps. **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). 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*, *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. **Larva:** 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 Kuznetsov (1988). **Range:** northern Fennoscandia south to the Pyrenees; from Ireland (extinct) through central Europe into Russia and on into central Siberia; Mongolia. **Determination:** See Key provided in StN Keys volume and Hippa et al (2001), who figure the male terminalia. Bartsch et al (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986) illustrate the adult insect in colour. The male terminalia are figured in Kanervo (1938). Hippa et al (2001) regard *nigritarsis* Macquart as a junior synonym of this species.

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. **Larva:** not described. **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* Violovitsh (Nielsen, 1995). This misinterpretation led Kanervo (1938) to treat *fratercula* of Zetterstedt as a new species, *E.vallei*. 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.). **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)). **Flight period:** June/July. **Larva:** not described. **Range:** northern Norway, northern Sweden and Finland; northern parts of European Russia and on into Siberia. **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). 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).

Eristalis hirta Loew, 1932

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*, *Valeriana* (T.Nielsen, pers. comm.). **Flight period:** end June/beginning September. **Larva:** not described. **Range:** northern Norway, Sweden and Finland; northern parts of European Russia and on into Siberia. **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). 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. **Larva:** 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. The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983),

Torp (1984, 1994) and van der Goot (1986). This species has appeared in much recent literature under the name *E.lineata*.

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. **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). The adult is illustrated in colour by Bartsch et al (2009b), 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*, *Knautia*, *Polygonum*, *Rubus idaeus*, *Scabiosa*, *Sorbus aucuparia*, *Succisa*. **Flight period:** May/July (and August at higher altitudes). **Larva:** 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).

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. **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; Vujic *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 Vujic *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*. The adult insect is illustrated in colour by Bartsch *et al* (2009b), Stubbs and Falk (1983) and Torp (1994). This species has appeared in recent literature under the name *E.interrupta*.

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 granulata*, *Taraxacum*, *Valeriana* (Bartsch *et al* (2009b). **Flight period:** May/June plus July in more northerly latitudes. **Larva:** features of the larva and puparium of an *Eristalis* species identified as *E.vitripennis* Strobl are described and figured by Kuznetsov 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 Kuznetsov 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*. 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. Although this taxon is *E.vitripennis* Strobl *sensu* *auct.* (Nielsen, 1999), *E.nemorum*, *E.jugorum* and *E.picea* are also likely to be found in collections misdetermined as *E.vitripennis*. 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*, *Succisa*. **Flight period:** beginning May/ beginning September. **Larva:** 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. **Determination:** See Key provided in StN Keys volume and Hippa *et al* (2001), who figure the male terminalia; Bartsch *et al* (2009b). The adult insect is illustrated in colour by Bartsch *et al* (2009b), Haarto & Kerppola (2007) and Torp (1994). The male terminalia are figured in Kanervo (1938).

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. **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 reared 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. **Range:** Fennoscandia south to Iberia and the Mediterranean; from Ireland through much of Europe into European parts of Russia and 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). The adult insect is illustrated in colour by 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. Sometimes in association with permanent limnocene 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*, *Myosotis*, *Prunus*, *Pyrus communis*, *Ranunculus*, *Rorippa*, *Rosa canina*, *Salix*, *Sorbus aucuparia*. **Flight period:** mid April/mid June. **Larva:** not described, but probably occurring in bottom deposits of seasonal pools over sands or gravels. **Range:** Fennoscandia south to central France; from Belgium eastwards into central Europe as far as Switzerland and probably Austria. **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). 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. 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.

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

Eristalis rossica Stackelberg, 1958

Preferred environment: tundra and unspecified types of forest. **Adult habitat and habits:** no data. **Flowers visited:** *Aruncus asiaticus*, *Heracleum*, *Rhododendron aureum*, *Trollius riederanus*, *Weigela middendorffiana* (Gritskevich, 1998). **Flight period:** June/July. **Larva:** 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; 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*.

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. **Larva:** 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 Hipa 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*. 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*); also in conifer forests (*Abies/Picea, Pinus*). **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*, *Crataegus*, *Euonymus*, *Hypericum*, *Mentha aquatica*, *Parnassia*, *Ranunculus*, *Salix*, *Sambucus ebulus*, *Sorbus aria*, *Tilia*. **Flight period:** mid March/August and February/November in southern Europe. **Larva:** undescribed, but 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 and European Russia into Asia. Malec (1986) presents data suggesting that *E.similis* has become more frequent within the last few years, in northwest Germany. **Determination:** See Key provided in StN Keys volume and Hipa 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). The adult insect is illustrated in colour by Bartsch et al (2009b), and Torp (1994).

Eristalis tecta Vujic, Radenkovic, Nielsen & Simic, 2004

Preferred environment: forest/freshwater; mesophilous *Fagus* forest with brooks (Vujic et al, 2004). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June. **Larva:** not

described. **Range:** Macedonia. **Determination:** Vujic et al, who figure the male terminalia and provide distinctions from the closely similar *E.nemorum*. This species is yet to be included in any key.

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. **Larva:** described and figured by Hartley (1961) and 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. **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). **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). The adult insect is illustrated in colour by Bartsch et al (2009b), 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 and the keys, which do exist, do not inspire confidence. The most comprehensive keys are those of Stackelberg (1961).

Eumerus amoenus Loew, 1848

Preferred environment: forest; thermophilous *Quercus* forest and unimproved, permanent grassland with an overgrowth of taller vegetation such as *Pteridium*; hedges and edges of crop fields and vegetable gardens in southern Europe **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:** no data. **Flight period:** June and mid-July/August, with peak in August. **Larva:** 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 central France 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 *E.amoenus* from the other species occurring in temperate western Europe, the keys in van der Goot (1981) 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 Vujic 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. elaverensis* 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*.

Eumerus angustifrons Loew, 1848

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June. **Larva:** 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.

Eumerus argyropus Loew, 1848

Preferred environment: forest/open ground; dry *Pinus*, *Pinus* matorral and semi-arid, stony, unimproved grassland; field margins. **Adult habitat and habits:** low-flying through sparse ground vegetation; settles on stones or bare ground in the sun. **Flowers visited:** no data. **Flight period:** April, June and mid July/September. **Larva:** not described. **Range:** central and southern Spain, southwest France, Switzerland (Rhône valley), Italy (inc. Sardinia), parts of the former Yugoslavia, Greece (inc. Rhodes), Bulgaria, Roumania, Ukraine and the Caucasus mountains, Turkey. **Determination:** Stackelberg (1961). The male terminalia are figured by Vujic and Šimic (1999). 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.

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. **Adult habitat and habits:** low-flying, over ground vegetation; settles on bare ground. **Flowers visited:** umbellifers; *Chrysanthemum* (Ebejer, 1988), *Hedera*, *Thapsia* (Marcos-Garcia, 1985a). **Flight period:** April/end October, with peaks in May and August/September. **Larva:** undescribed, but has 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:** Stackelberg (1961).

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.Vujic, 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.Vujic, pers.comm.). **Flowers visited:** *Smiranium perfoliatum* (A.Vujic, pers.comm.). **Flight period:** May-June and August/October. **Larva:** 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:** Stackelberg (1961). The male terminalia are figured by Vujic & Šimic (1999).

Eumerus caballeroi Gil-Collado, 1929

Preferred environment: forest/scrub; open areas in *Quercus ilex* or *Q. pyrenaica* forest/maquis, *Pinus* matorral (Marcos-Garcia, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data.

Flight period: June/August. **Larva:** not described. **Range:** central and eastern Spain, N Africa (Morocco). **Determination:** Gil-Collado (1929). The male of this species remains undescribed.

Eumerus canariensis Baez, 1982

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** February. **Larva:** 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.

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:** no data. **Flight period:** June/ September. **Larva:** not described. **Range:** northeast France south to Spain, Germany, Roumania (Danube floodplain), the former Yugoslavia, Ukraine and the Caucasus; N.Africa. **Determination:** Bradescu (1991). 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*. The female can easily be confused with females of *E.amoenus*, *E.elaverensis* and *E.uncipes* (see provisional key under *E.amoenus*). The male terminalia are figured by Vujic and Šimić (1999).

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. **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. **Larva:** not described. **Range:** unknown, due to confusion with related species until recently, but confirmed from Croatia and France, from the R.Loire southwards to the Mediterranean coast. **Determination:** Šimić & Vujić (1996) and Vujić and Šimić (1999) who figure the male terminalia. This species is extremely similar to both *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, whereas in *E.sogdianus* it is longer than wide. However, 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 pale-haired pre-genital segments - these sclerites are black-haired in *E.amoenus*.

Eumerus dubius Baez, 1982

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/June. **Larva:** 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.

Eumerus elaverensis Séguy, 1961

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. **Larva:** not described. **Range:** France, Switzerland, Italy, and Macedonia. **Determination:** Séguy (1961). This species is not easy to determine using existing literature, particularly in the female. The male terminalia and hind leg are figured by Vujic and Šimic (1999). 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 Vujic and Šimic, 1999). 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* (see provisional key under *E.amoenus*).

Eumerus etnensis van der Goot, 1964

Preferred environment: forest/open ground; known from open *Castanea* forest and 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. **Larva:** 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. **Determination:** van der Goot (1964), Lambeck (1973), who figures the male terminalia (under the name *nigrostriatus*, Lambeck). Recently (Marcos-García and Pérez-Bañón, 2000), the Canary Isles species *E.purpurariae* Báez was synonymised with *E.etnensis*, but Smit et al (2004) provide data suggesting 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*.

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. **Larva:** 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) into European parts of Russia and on into Asia to the Pacific coast. **Determination:** van der Goot (1981), Bradescu (1991). The male terminalia are figured by Vujic 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.lucidus*. 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.lucidus* the hairs on the scutellar disc are no longer than one eighth of the length of the scutellum in the mid-line. The adult insect is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007) and Torp (1994).

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:** *Euphorbia*, *Fragaria*, *Leucanthemum*, *Ranunculus*. **Flight period:** end April/September, with peaks in June and August. **Larva:** described and 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 is apparently more or less confined to bulbs already damaged by other agents. This species overwinters as a larva (Brunel and Cadou (1994)). **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:** 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 *aucc.* 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 and Marcos-Garcia, 1983). *E.vandenberghiei* 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.vandenberghiei* is not mistaken for *E.funeralis*. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994). Recent illustrations of the male terminalia of *E.funeralis* are provided by Marcos-Garcia (1983) and Doczkal (1996c).

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.). **Larva:** 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 *graecus* 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 the species he recognises as *graecus*. 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*.

Eumerus grandis Meigen, 1822

Preferred environment: forest; herb-rich open areas in *Abies/Fagus* forest and *Pinus/Fagus* forest, up into the *Pinus uncinata* zone in the Pyrenees. **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:** *Sedum album* (Bartsch et al, 2009b). **Flight period:** beginning June/mid August. **Larva:** not described. **Range:** from southern Finland eastwards through central Europe (Poland, southern Germany, Switzerland, Austria, Italy, Montenegro, Roumania) to the Transcaucasus (Armenia);

also known supposedly from Mongolia and China; in France known from the Alps, the Cevennes and the Pyrenees; mountainous parts of northern Spain. **Determination:** Bradescu (1991). The male terminalia are figured by Vujic and Šimic (1999). This species appears in much recent literature under the name *annulatus* (Panz.). The female is very similar to that of *E.ovatus*, but in *E.ovatus* the distance between the hind ocelli is equal to their distance from the posterior margin of the head, whereas in *E.grandis* their distance from the hind margin of the head is more than 1.5x of the distance between them. Stackelberg's (1961) key suggests that the mesoscutal hairs in females of *E.grandis* are more reclinate than in *E.ovatus*. However, there is little difference between these species in this character. The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

Eumerus hispanicus van der Goot, 1966

Preferred environment: forest/scrub; *Quercus ilex* forest and maquis (Marcos-Garcia, pers.comm.). **Adult habitat and habits:** close to streams or drainage ditches; settles on stones (Marcos-Garcia, pers.comm.). **Flowers visited:** no data. **Flight period:** June/September. **Larva:** not described. **Range:** Spain. **Determination:** Van der Goot (1966).

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.). **Larva:** undescribed, undoubtedly phytophagous, possibly in *Euphorbia*. **Range:** the Madeiran archipelago (including Porto Santo) (Portugal). **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, and provide a colour photograph of the female of *E.hispidus*.

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. **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.

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.). **Adult habitat and habits:** no data. **Flowers visited:** *Asparagus officinalis*. **Flight period:** May/July. **Larva:** 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). Doczkal (1996c) provides features for distinguishing this species from other European *Eumerus* in which antennal segment 2 (pedicel) is elongate. Doczkal (l.c.) also points out that in the male, the eyes of this species are normally "contiguous for a considerable distance, only exceptionally separated", in contrast to what is said of *E.longicornis* by both Sack (1928-32) and Stackelberg (1961). Standfuss and Claussen (2007) figure the surstylus and other parts of the male terminalia.

Eumerus lucidus Loew, 1848

Preferred environment: forest/scrub; *Quercus ilex/Q.suber* matorral/maquis. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** mid August/mid September. **Larva:** not described. **Range:** southwest France, Greece; southwestern Asia (Turkmenistan, Uzbekistan, Tajikistan). **Determination:** this species can be determined, with some difficulty, using Stackelberg (1961).

Eumerus lunatus (Fabricius), 1794

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Ziziphus lotus* (Leclercq, 1961). **Flight period:** July. **Larva:** 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.

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. **Larva:** undescribed. **Range:** Crete, Greece (Thessaly) and the former Yugoslavia. **Determination:** 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.

Eumerus niehuisi Doczkal, 1996

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/beginning June. **Larva:** not described. **Range:** Corsica. **Determination:** Doczkal (1996c), who figures the male terminalia and provides features for distinguishing *E.niehuisi* from other European *Eumerus* species in which the second antennal segment (pedicel) is elongate.

Eumerus nivariae Baez, 1982

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** not described. **Range:** this species is endemic to the Canary Isles. **Determination:** Baez (1982), who figures the male terminalia and provides 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.

Eumerus niveitibia Becker, 1921

Preferred environment: ruderal vegetation on burnt ground, two years after burning (Standfuss and Claussen, 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Ferulago sylvatica* (Standfuss and Claussen, 2007). **Flight period:** no data. **Larva:** not described. **Range:** Greece and the Caucasus mountains. **Determination:** this species was described from a single male collected in Greece. According

to Peck (1988) it has subsequently been found in the Caucasus. It is included in the keys provided by Sack (1928-32) and Stackelberg (1961). The female apparently remains undescribed.

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. **Larva:** not described. **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:** Stackelberg (1961).

Eumerus obliquus (Fabricius), 1805

Preferred environment: open ground; thinly vegetated, semi-arid dry grassland, often along the margins of seasonal rivers. **Adult habitat and habits:** flies fast and low over thinly-vegetated ground, settling on bare ground and stones in the sun. **Flowers visited:** no data. **Flight period:** September/October. **Larva:** described and figured by Ricarte et al (2008), from larvae in decaying *Opuntia* platyclades and fruit. **Range:** the Balearics, the Canaries, Corsica, Italy, Sicily, Malta; N Africa and the Afrotropical region. **Determination:** Stackelberg (1961).

Eumerus olivaceus Loew, 1848

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:** *Ranunculus*, white umbellifers. **Flight season:** June and end July to August. **Larva:** no data. **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 and on (including Sicily) to the former Yugoslavia, Bulgaria and Roumania. **Determination:** Bradescu (1991). The male terminalia are figured by Vujic and Šimic (1999).

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. **Larva:** undescribed. **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:** van der Goot (1981). Bradescu (1991). The male terminalia are figured by Vujic and Šimic (1999). The adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994).

Eumerus ovatus Loew, 1848

Preferred environment: open ground; thermophilous forest fringes and herb-rich, dry/semi-arid, unimproved, calcareous grassland and scrub/garrigue. **Adult habitat and habits:** flies low and very rapidly, settling on bare patches of ground. **Flowers visited:** no data. **Flight period:** June/July. **Larva:** 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). The male terminalia are figured by Vujic and Šimic (1999). The abdomen of the

male of this species is very distinctively covered in silver-white, metallic hairs. The female, on the other hand, is almost indistinguishable from the female of *E. grandis*.

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:** *Potentilla erecta*, white umbellifers. **Flight period:** end July/September, with peak in August. **Larva:** developmental stages described and figured by Ricarte et al (2008), from larvae found in cavities in bulbs of the asphodel, *Asphodelus aestivus*. **Range:** foothills of the Pyrenees on the Atlantic coast of France (Pyrenées-Atlantiques) to the Mediterranean (Inc. Cyprus, Rhodes and Crete), round the Mediterranean basin through Italy, the former Yugoslavia, Greece, Roumania and Turkey to N Africa. **Determination:** Bradescu (1991). The long, white, ventrally-directed, hairs on the lateral margins of the abdominal tergites are a very useful identification feature in this species. The male terminalia are figured by Vujic and Šimic (1999).

Eumerus purpurariae Baez, 1982

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** February/May. **Larva:** undescribed. The developmental stages described as those of *E. purpurariae* by Pérez-Bañón and Marcos-Garcia (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.

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. **Larva:** 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.

Eumerus pusillus Loew, 1848

Preferred environment: forest/open ground; *Cistus florida/Quercus pyrenaica* maquis (M.A. Marcos-Garcia, pers.comm.) and more open, semi-arid, almost bare ground; Mediterranean dune systems. **Adult habitat and habits:** flies low, settling on stones and bare ground in the sun. **Flowers visited:** umbellifers; *Euphorbia*, *Hedera*, *Mentha*, *Solidago*, *Vinca* (most of information from Marcos-Garcia, 1985a). **Flight period:** April/September, with peaks in April/May and September. **Larva:** described and figured by Ricarte et al (2008) from larvae in decaying parts of bulbs of sea squill, *Urginea maritima*. **Range:** Portugal and Spain round the Mediterranean to Greece and Turkey, including islands e.g. Corsica, Sicily, Malta, Cyprus, Rhodes and Crete, and on to Tunisia and Algeria in N Africa. **Determination:** Stackelberg (1961).

Eumerus richteri Stackelberg, 1960

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Larva:** not described. **Range:** Croatia, Greece, Montenegro, Serbia and the Transcaucasus (Azerbaijan). **Determination:** Stackelberg (1961). The male terminalia are figured by Vujčić & Šimić (1999).

Eumerus ruficornis Meigen, 1822

Preferred environment: flushes/seepages in well-drained, unimproved grassland and along riverbanks with some scrub/scattered trees. **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:** *Ranunculus*. **Flight period:** end May/beginning August. **Larva:** unknown. **Range:** from southern Sweden (extinct?) 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. **Determination:** Bradescu (1991), Stackelberg (1961). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Eumerus rusticus Sack, 1932

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Larva:** not described. **Range:** Roumania, Turkey, Turkmenistan. **Determination:** included in the keys provided by Stackelberg (1961) and Bradescu (1991).

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 padagraria*, *Euphorbia*, *Jasione montana*, *Potentilla erecta*, *Rosa pimpinellifolia*. **Flight period:** May/August. **Larva:** Munk (2000) established that a larval host plant of this species is *Jasione montana*. 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:** Bradescu (1991). The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994).

Eumerus santosabreui Baez, 1982

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** throughout the year. **Larva:** 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.

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. **Larva:** not described. **Range:** Sicily. **Determination:** van der Goot (1964), who figures the hind leg and antenna of the male. The female remains undescribed.

Eumerus sinuatus Loew, 1855

Preferred environment: open ground/deciduous forest; dry scrub woodland of *Quercus pubescens* with open areas. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May-beginning July and August. **Larva:** not described. **Range:** central and southern France, Germany, Czech Republic, Austria, Serbia, and Roumania. **Determination:** Bradescu (1991); van Veen (2004). The male terminalia are figured by Vujic and Šimic (1999).

Eumerus sogdianus Stackelberg, 1952

Preferred environment: open ground; dry, unimproved pasture and montane grassland; farmland, particularly potato fields, on sandy soils, especially in coastal dune systems, 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. **Larva:** 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 Kuznetsov (1988). **Range:** Denmark south to southern Spain; from 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:** In the male sex *S.sogdianus* may be distinguished from *E.strigatus* group species other than *E.consimilis* using the key in Bradescu (1990), backed up by the figures of male terminalia. For separating *E.sogdianus* from *E.consimilis* see under the species account for the latter species. But there is no reliable means of distinguishing females of *E.sogdianus* from females of *E.consimilis* and *E.strigatus*. Verlinden & Decleer (1987) point out that *E.strigatus*, *E.sogdianus* and *E.funeralis* can be found flying together. *E.sogdianus* is indistinguishable from other *E.strigatus* group species in the field. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

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. **Larva:** described and figured by Heiss (1938); bulb feeder, recorded from Liliaceae, parsnip, carrot, potato, asparagus, artichoke roots (*Cynara scolymus*) and also from rotting grapefruit; 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 N America and recorded from both Canada and the USA; introduced to both Australia and New Zealand. **Determination:** van der Goot (1981), Bradescu (1991). 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).

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). **Larva:** not described. **Range:** Morocco (Claussen, 1989); "Pyrenees" (Schmid, 1995), Spain (Ricarte Sabater et al, 2008). **Determination:** Claussen (1989) who figures the male terminalia and details distinctions from *E.ornatus*. The female of *E.subornatus* remains undescribed.

Eumerus sulcitibius Rondani, 1868

Preferred environment: open ground; semi-arid, unimproved grassland and open woodland of *Quercus pyrenaica* (Marcos-García, 1985a). **Adult habitat and habits:** flies through grassland vegetation, settling on the ground. **Flowers visited:** *Thapsia* (Marcos-García, 1985a). **Flight period:** April/September. **Larva:** not described. **Range:** southern Europe from Spain round the Mediterranean

basin to Italy and Montenegro and on to Turkey, including islands e.g. Corsica, Sardinia, Sicily and Crete, and into Asia to Azerbaijan. **Determination:** Stackelberg (1961). The male terminalia are figured by Vujic and Simic (1999).

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. **Larva:** 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:** Bradescu (1991). The long, blunt-ended pegs occurring laterally on each segment of the fore tarsi in both sexes help to distinguish this species. The male terminalia are figured by Vujic and Šimic (1999).

Eumerus tauricus (Stackelberg), 1952

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Roumania, Serbia, Ukraine. **Determination:** the female is included in the keys provided by Stackelberg (1961) and Bradescu (1991). The male of this species remains unknown.

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. **Larva:** undescribed, but the species has been reared from *Tragopogon* (Loiselle, 1914; Arzone, 1973) and 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:** van der Goot (1981), Bradescu (1991). The male terminalia are figured by Vujic and Šimic (1999).

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

Eumerus unciipes 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. **Larva:** not described. **Range:** imperfectly known. France, from the Rhine valley south to the Mediterranean; Germany, northern and central Italy and Roumania. **Determination:** extremely similar to *E.clavatus* Becker, from which *E.unciipes* may be distinguished in the male by the shape of the black projection at the distal margin of abdominal sternite 3. In *E.clavatus* this projection is more or less triangular, coming to a pronounced point at its distal extremity. In *E.unciipes* this projection is roughly rectangular, with an irregular distal margin, which is more or less parallel to the long axis of the body. The females of these two species are more difficult to separate and the female of *E.unciipes* is also extremely similar to those of both *E.amoenus* and *E.elaverensis* (see provisional key under *E.amoenus*).

Eumerus vandenberghaei Doczkal, 1996

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** not described. **Range:** Corsica. **Determination:** Doczkal (1996), who figures the male terminalia and provides distinctions from the closely related *E.funeralis*.

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-Garcia 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.). **Larva:** 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). 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) 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. **Larva:** 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.nielsenii*, 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). The latter authors 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. **Larva:** 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).

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*, *Salix*, *Sorbus aucupariae*, *Stellaria*. **Flight period:**

April/May and July/August. **Larva:** 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. **Determination:** See Key provided in StN Keys volume and Bartsch et al (2009a). This species appears in recent literature under the name *E.latilunulatus* (Collin). The name *bucculatus* Rondani was reintroduced for the species by Mazánek et al (1998). 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 (assuming the concept of *E.bucculatus* employed here is correct), 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. The adult insect is illustrated in colour by Torp (1994) 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 inodorum*, *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 southern Europe). **Larva:** described by Dusek & Laska (1961); biology detailed by Marcos-Garcia (1981); aphid feeding on various low-growing plants, particularly Leguminosae and including various crop plants (e.g. *Avena*, *Beta*, *Cucurbita*, *Lactuca*, *Triticum*, *Zea*). 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). Egg: Chandler (1968). The morphology of the chorion of the egg is figured by Kuznetsov (1988). A comprehensive review of the biology of this species is provided by Barkemeyer (1994). **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). The adult insect is illustrated in colour by 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). **Flight period:** June/July. **Larva:** 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 (1999c) 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. 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). The latter authors 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 crantzii*. **Flight period:** mid-June/July. **Larva:** 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-genital 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 90° at most, whereas in *E.bucculatus*, as recognised here, it is greater than 90°. *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. 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. The relationship between this species and previously described N American *Eupeodes* taxa remains to be established.

Eupeodes flaviceps (Rondani), 1857

Preferred environment: open ground; dry/semi-arid, unimproved grassland. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/ September. **Larva:** undescribed, but reared by Marcos-Garcia (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-Garcia (1998): *Chaerophyllum*, *Cirsium*, *Eryngium* and *Foeniculum*. **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).

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. **Larva:** not described. **Range:** uncertain due to confusion with similar species like *E. bucculatus* until recently. Known from Finland, Sweden, Ireland, Britain and central Europe from Poland through Germany and Switzerland to the Czech Republic and Slovakia and on into European parts of Russia. 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). Mazanek et al (1999a) figure the male terminalia. Bartsch et al (2009a) provide coloured illustrations of the male and of the head and abdomen of the female.

Eupeodes lambecki (Dusek & Laska), 1973

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April. **Larva:** 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).

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*, *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). **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 Kuznetsov (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 (including Cyprus), 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). 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-Garcia & Laska), 1983

Preferred environment: forest/open ground; open areas in mesophilous *Fagus* forest, *Quercus pyrenaica* forest and *Castanea* forest, upwards into *Abies* forest. **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-Garcia, pers.comm.), *Sorbus*. **Flight period:** April/October, peaking in June/July (Marcos-Garcia et al, 2000). **Larva:** not described, but reared from aphids on *Arctium*, *Cirsium*, *Cynara scolymus*, *Doronicum*, *Epilobium*, *Malus*, *Prunus* and *Vicia* (Rojo and Marcos-Garcia, 1998; Marcos-Garcia et al, 2000). Under laboratory conditions, the period egg/adult is less than 4 weeks, for this species (Marcos-Garcia 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-Garcia and Laska (1983) and Marcos-Garcia 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-Garcia 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.

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*, *Cirsium*, *Ranunculus*, *Sanguisorba*, *Solidago*, *Taraxacum*. **Flight period:** mid May/midOctober, with a peak in August/ September. **Larva:** 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, from Britain (vagrant?) eastwards through Germany, Poland 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). 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. **Larva:** described and figured by Bhatia (1939) and Rotheray (1994) and illustrated in colour by Rotheray (1994); biology described by Dusek & Laska (1974) and Marcos-Garcia (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*. 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). The adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Eupeodes nielsenii (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. **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.nielsenii*, from which it can only be distinguished by its entirely yellow-haired scutellum and yellow-margined tergite 5 (Nielsen, 2003). The male of *E.lundbeckii* is illustrated in colour by Bartsch et al (2009a).

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; *Cirsium arvense*, *Euphorbia*, *Galium*, *Geranium*, *Inula*, *Potentilla*, *Pyrus*, *Ranunculus*, *Sambucus*, and *Taraxacum*. **Flight period:** May/beginning August. **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) and 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 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; *Viburnum tinus*. **Flight period:** April/June and August/September. **Larva:** not described. **Range:** Canary Isles, Mediterranean basin, from southern France to Italy (Sicily) and parts of the former Yugoslavia, Crete, Cyprus, Lebanon, Israel, Egypt and Morocco; Switzerland in central Europe, Roumania; Transcaucasus 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). A coloured photo of the male is provided by Smit et al (2004). In the field *E.nuba* is extremely similar to *E.corollae*.

Eupeodes punctifer (Frey), 1934

Preferred environment: taiga and dwarf-shrub tundra. **Adult habitat and habits:** no data. **Flowers visited:** *Silene acaulis* (T.Nielsen, pers.comm.). **Flight period:** June/July (Nielsen, pers.comm.). **Larva:** 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*. 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 rufipunctatus (Curran), 1925

Preferred environment: tundra. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end June/beginning August. **Larva:** 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 Siberia. **Determination:** Vockeroth (1992); Bartsch et al (2009a). This species appears in recent literature as *E.nigroventris* (Fluke). Bartsch et al (2009a) treat *nigroventris* (Fluke) as a synonym of *rufipunctatus* (Curran), without explanation. Their practice has been followed here. The female of *E.rufipunctatus* 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). Bartsch et al (2009a) provide a coloured illustration of the male of this species.

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. **Larva:** 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). 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; black pine forest of *Pinus laricio* (Corsica: van der Goot, 1961). **Adult habitat and habits:** no data. **Flowers visited:** *Sedum album* (van der Goot, 1961). **Flight period:** July. **Larva:** not described. **Range:** Corsica and Italy. **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).

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.

Ferdinanda aurea Rondani, 1844

Preferred environment: forest; ancient/overmature thermophilous (*Q.pubescens*, *Q.pyrenaica*) and evergreen oak (*Q.ilex/Q.suber*) forest; 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:** *Dianthus*, *Hedera*. **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. **Larva:** 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 appropriate 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:** central and southern Spain (and Mallorca), southern France, Italy and Greece (plus Crete - Claussen & Lucas, 1988). **Determination:** See Key provided in StN Keys volume.

Ferdinanda cuprea (Scopoli), 1763

Preferred environment: forest; deciduous forest with mature and over-mature trees, including alluvial softwood forest of *Populus-Salix*, *Carpinus-Quercus* forest, acidophilous *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. **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). 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. 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.). **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 adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1981). 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*.

Ferdinandea fumipennis Kassebeer, 1999

Preferred environment: forest; deciduous forest; acidophilous oak forest of *Quercus pyrenaica*; riparian *Fraxinus angustifolia* forest (Ricarte and Marcos-Garcia, 2007). **Adult habitat and habits:** no data.

Flowers visited: *Hypericum*, *Merendera* (Ricarte and Marcos-Garcia, 2007). **Flight period:** in Spain: March/May, July and September/October (Ricarte and Marcos-Garcia, 2007). In N Africa this species has been found on the wing from October to May. **Larva:** 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:** Spain, Balearic islands (Ricarte and Marcos-Garcia, 2007) and 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*.

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:** *Heracleum* (de Buck, 1990). **Flight period:** March (Mediterranean zone) and mid April/beginning September, with peaks at the beginning of May and in August. **Larva:** 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 Denmark (extinct?) south to France (Paris basin) 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). 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.ingrica* Stackelberg, is so far known in Europe only from 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*. **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*. **Flowers visited:** white umbellifers, *Crataegus*, *Ranunculus*, male *Salix*. **Flight period:** end May/end July. **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*). The larva is also figured in colour by Bartsch et al (2009a). They 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.ingrica*. 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. **Range:** Fennoscandia south to northern France; Great Britain (Scotland) east through northern and central Europe (south as far as Roumania) into Siberia and on to the Pacific. In North America this species is known from Alaska south to Arizona. **Determination:** *H.ferruginea* is the only *Hammerschmidtia* species known to occur over most of Europe, and it can be recognised using various keys, such as those in Bradescu (1991) or van der Goot (1981). However, the closely similar *H.ingrica* is also recorded from European parts of Russia and may occur more widely in Europe. The arista is plumose in *H.ferruginea* but short haired in *H.ingrica*. These two species may be distinguished using the keys in Violovitsh (1986), who also figures their 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). The adult insect is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007) and Stubbs and Falk (1983).

***Hammerschmidtia ingrlica* Stackelberg, 1952**

Preferred environment: forest: deciduous forest. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** mid March/beginning July and mid August/mid October. **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* (inc.*P.tremula*), *Ulmus* and, in Asia *Chosenia* and *Maackia* (M.A.Krivosheina, pers.comm.). **Range:** European parts of Russia and on through Siberia almost to the Pacific. **Determination:** Violovitsh (1986), who also figures the male terminalia.

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. **Larva:** undescribed. **Range:** Scandinavia south to the Netherlands, including Denmark, and northern Germany; through northern Europe into Siberia and on into Asia; Poland. 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). The male is shown in colour by Bartsch et al (2009b).

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. **Larva:** not described. **Range:** Sweden (extinct?), northern and central Finland, northern Siberia. There are very few European records of this Siberian species. **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). Bartsch et al (2009b) show a coloured figure of the male.

Helophilus continuus Loew, 1854

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Larva:** not described. **Range:** Roumania (Danube delta), the Transcaucasus region and through Asiatic Russia to the Pacific (Kamchatka). **Determination:** See Key provided in StN Keys volume. This species is not included in the key provided by Nielsen (1997).

Helophilus groenlandicus (Fabricius), 1780

Preferred environment: wetland; 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. **Larva:** 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. The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

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. **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 northern France; from Ireland eastwards through much of northern and

central Europe (though very localised in the Alps) into 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. The adult insect is illustrated in colour by 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.). **Adult habitat and habits:** no data. **Flowers visited:** *Achillea*, *Allium sibiricum*, *Caltha*, *Matricaria*, *Ranunculus*, *Rubus chamaemorus*, *R. idaeus*, *Sorbus aucuparia*. **Flight period:** end June/beginning September. **Larva:** 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; 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. The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

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). **Larva:** described and figured by Hartley (1961) and illustrated in colour (apparently from a preserved specimen) by Rotheray (1994). 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. **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. The adult insect is illustrated in colour by 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*, *Sorbus*. **Flight period:** May/October, with peak in August. **Larva:** 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. **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. The adult insect is illustrated in colour by Bartsch et al (2009b), Kormann (1988), Stubbs and Falk (1983) and Torp (1984, 1994).

HERINGIA

There has been considerable confusion as to how to distinguish females of *Heringia* from females of *Neocnemodon*. Vockeroth and Thompson (1987) have taken the logical step of combining the two genera, under the earlier name *Heringia*, a practice followed here. Combining the names listed in Peck (1988) for European *Heringia* and *Neocnemodon* species gives a nominal European fauna of 12. Since then, Claussen *et al* (1994) have shown that two of these are junior synonyms of species in other genera and that a third is a synonym of another *Heringia* species. Further, they point out that there are no reliable features for distinguishing *H. senilis* Sack, so that its status remains uncertain. They also established that *H. hispanica* (Strobl) and *H. adpropinquans* (Becker) are additional European species belonging to *Heringia*. Since then, Vujic (1999a) has described a further European species, *H. larusi*. These adjustments leave 11 European species consigned to *Heringia*.

At present, only the males of European *Heringia* species (including s.g. *Neocnemodon*) can be determined with confidence. The males of all European *Heringia* s.g. *Heringia* species are included in the key provided by Claussen *et al* (1994). The males of all European *Heringia* s.g. *Neocnemodon* species are included in the keys provided by Bartsch *et al* (2009b).

Key to subgenera of *Heringia*

A Male coxae and trochanters without spurs; female antennal segment 3 (basoflagellomere) much longer than wide; lateral dust spots on frons conspicuous ***H. Heringia*** Rondani

B Male coxae and trochanters with spurs; female antennal segment 3 (basoflagellomere) much longer than wide; dust spots on frons small and inconspicuous or absent ***H. Neocnemodon*** Goffe

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. **Larva:** not described. **Range:** Canary Isles. **Determination:** Claussen *et al* (1994) provide a key distinguishing this species from other known European *Heringia* s.s. species, and figure the male terminalia.

Heringia 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; **Flowers visited:** *Caltha palustris*, *Nasturtium officinale*, *Rubus fruticosus* agg. **Flight period:** mid May/beginning September. **Larva:** 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 (1991) all figure the male terminalia.

Verlinden (1991) provides the most comprehensive illustrations of male leg characters. The male is figured in colour by Bartsch et al (2009b).

Heringia 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. **Larva:** undescribed. **Range:** uncertain, due to persistent misdetermination of *H.pubescens* and *H.vitripennis* as *H.fulvimanus*, but confirmed from 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 *H.fulvimanus* in collections were all misdetermined. The female of *H.fulvimanus* is included in the keys of Bartsch et al (2009b). The male of *H.fulvimanus* is figured in colour by Bartsch et al (2009b).

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, Hypericum, Prunus spinosa*. **Flight period:** end April/July, with occasional specimens in August. **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. 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-Garcia (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. The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). *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! For distinctions from *H.hispanica*, see under *H.hispanica*.

Heringia 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. **Larva:** not described. **Range:** a primarily Mediterranean species, occurring in Spain, southern France (plus Corsica), northern Italy, 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 *H.hispanica* are usually slightly larger than those of *H.heringi*. A key distinguishing these two species is provided in the StN Keys volume. *H.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 not found in other *Heringia* species and generally regarded as characteristic of *Pipizella*.

Heringia larusi Vujic, 1999

Preferred environment: forest; along streams in open, montane *Picea/Abies/Fagus* forest, up to 1800m (Vujic, 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.Vujic, pers.comm.). **Flowers visited:** *Caltha* spp., *Ranunculus* spp. (A.Vujic, pers.comm.), *Prunus padus* (Bartsch et al (2009b)). **Flight period:** mid May/beginning July. **Larva:** undescribed. **Range:** Sweden, Finland, Italy and Serbia. **Determination:** Bartsch et al (2009b). Vujic (1999a) figures the male terminalia and discusses distinctions between this species and the closely similar *H.pubescens* and *H.vitripennis*. The appearance of the adult insect is shown in the photograph provided by Haarto & Kerppola (2007) and the coloured figure given in Bartsch et al (2009b).

Heringia 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/gravelly edges of woodland streams to drink, in dappled sunlight, in hot weather. **Flowers visited:** white umbellifers; *Origanum*, *Prunus serotina*, *Rosa rugosa*, *Rubus*, *Vaccinium uliginosus*. **Flight period:** end May/June and August/September (July/September at higher altitudes). **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 (1991) provides the most comprehensive illustrations of male leg characters. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Heringia 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. **Larva:** 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 (1991) may be used to distinguish this species from other European species of the sub-genus *Neocnemodon*, except for *H.larusi*. The only keys in which *H.larusi* is included are those of Bartsch et al (2009b) and Vujic (1999a). Most of these authors figure the male terminalia. Verlinden (1991) provides the most comprehensive illustrations of male leg characters. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Heringia senilis - see under *H.heringi*

Heringia verrucula (Collin), 1931

Preferred environment: forest; humid *Pinus sylvestris* and *Quercus/Carpinus/Ulmus*. **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. **Larva:** not described. **Range:** Norway, Sweden, southern Finland, Denmark, Britain, Netherlands, Germany, European parts of Russia; through Siberia to the Pacific; Mongolia. **Determination:** Bartsch et al (2009b), Delucchi and Pschorn-Walcher (1955), Bradescu (1991), Verlinden (1991). The male terminalia are figured by all of these authors. Verlinden (1991) provides the most comprehensive illustrations of male leg characters. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Heringia 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. **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). The morphology of the chorion of the egg is figured by Kuznetsov (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 (1991) figure the male terminalia. Verlinden (1991) provides the most comprehensive illustrations of male leg characters. This species appears under *Neocnemodon* in most recent literature. The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994). Females of this species cannot be reliably distinguished from those of related species. Information published on *H.vitripennis* prior to the revision by Delucchi and Pschorn-Walcher (1955) cannot be relied upon, due to possibility of confusion with *H.pubescens* (D. & P. -W.). Because of confusion over the identity of the Meigen type of *H.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 *H.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 *H.vitripennis* sensu Collin - these males had in fact been examined by Delucchi and Pschorn-Walcher and included by them as paratypes of their species *H.dreyfusiae*! The male of *H.vitripennis* is extremely similar in appearance to the male of *H.larusi*. The key provided by Bartsch et al (2009b) can be used to separate the males of these two species.

ISCHIODON: see under **SIMOSYRPHUS**

ISCHYROPTERA

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

Ischyroptera bipilosa Pokorný, 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. **Larva:** not described. **Range:** Alps (France, Switzerland, Italy). **Determination:** See generic Key provided in StN Keys volume and Sack (1928-32).

LAPPOSYRPHUS

Lapposyrphus has generally been treated as a subgenus of *Eupeodes*, e.g. in Peck (1988), Thompson and Rotheray (1998). However, it is progressively becoming apparent that a more realistic arrangement would be to recognise *Lapposyrphus* as a separate genus, a course of action followed here. 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 these species larvae, puparia and adults can hibernate successfully. **Flowers visited:** *Caltha*, *Chaerophyllum*, *Chelidonium*, *Crataegus*, *Euphorbia*, *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). **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*. **Range:** Fennoscandia south to Spain and the Mediterranean (including Crete); from Ireland east through most of Eurasia (including Turkey) 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.nielsenii*, 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). The adult insect is illustrated in colour by Kormann (1988).

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. They are both treated by van der Goot (1981) and Bradescu (1991), both of whom also include *nigricans* of Stackelberg in their keys to *Lejogaster* species.

***Lejogaster metallina* (Fabricius), 1776**

Preferred environment: freshwater/wetland; transition mire, fen, marsh, pool and lake edge; along brooks and permanently water-filled ditches in open situations and along brooks in *Quercus ilex* forest in southern Europe. **Adult habitat and habits:** humid, seasonally flooded grassland, poorly-drained pasture, beside brooks; 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. **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. **Determination:** van der Goot (1981). The male terminalia are figured by Maibach et al (1994a). The adult insect is illustrated in colour by 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; *Matricaria*, *Ranunculus*. **Flight period:** mid May/August, and on to the end of September in southern Europe. **Larva:** described and figured by Maibach and Goeldlin (1994) and by Hartley (1961), from larvae found among floating, decaying vegetation in a pond and 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). The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994). This species appears as *L.splendida* (Mg.) in most recent literature, including van der Goot (1981) and Stubbs and Falk (1983). Maibach et al (1994b) reinstate the name *tarsata*.

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 vittata (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. **Flowers visited:** *Phragmites*, *Scirpus maritimus*, male *Typha*. **Flight period:** mid June/mid August, with the peak in July. **Larva:** 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 central France; Balearic Islands (Mallorca); from Britain (southern England) eastwards through central Europe (Germany, Poland, Austria, Hungary) and Italy and the former Yugoslavia into 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. The adult insect is figured in colour by Bartsch et al (2009b) 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 European 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. **Larva:** not described. **Range:** parts of European 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.

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: 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 **Larva:** 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). 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 glauca (L.), 1758

Preferred environment: forest; acidophilus *Quercus* forest and humid *Fagus* forest; riverine gallery forest of *Fraxinus/Salix*. **Adult habitat and habits:** beside streams, in clearings, along tracks, etc.,

usually in humid woodland; to a significant extent arboreal, but spends considerable time on flowers. **Flowers visited:** white umbellifers; *Filipendula*, *Sambucus*, *Senecio*. **Flight period:** end May/September, with peak in July/August. **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 and European parts of Russia; 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 adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1994) and Bartsch et al (2009a). The male and female can differ somewhat in appearance, and this is well shown by Stubbs and Falk (1983).

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. **Larva:** not described. **Range:** uncertain, due to confusion with related species until recently. Confirmed from Norway, Sweden, Finland, Denmark, Germany, France (Vosges), Switzerland, Austria, Hungary 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*. 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).

Leucozona laternaria (Mueller), 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; to some extent arboreal, but descends to visit flowers; fast flying. **Flowers visited:** white umbellifers; *Cirsium arvense*, *Convolvulus*, *Filipendula ulmaria*. **Flight period:** end June/August, with occasional specimens in September. **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). The adult insect is illustrated in colour by 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). **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; in N.America, from Alaska south to Oregon and New York. **Determination:** Doczkal (1998a, 2000b). The male terminalia are figured by Dusek and Laska (1967), Hippa (1968b), Vockeroth (1969) and Doczkal (1998a). The adult insect is illustrated in colour by Colyer and Hammond (1951), Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) van der Goot (1986) and Bartsch et al (2009a). 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*.

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:** July. **Larva:** not described. **Range:** known from Northern parts of the Caucasus mountains, along the southern frontier of European Russia. **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.

MALLOTA

Peck (1988) lists 8 *Mallota* species as occurring in Europe, three of which (*M.auricomma* Sack, *M.eurasiatica* Stackelberg, *M.rossica* Portschinsky) 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, and 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*, *Rosa canina*, *Rubus*, *Sambucus ebulus*, *Sarothamnus scoparius*. **Flight period:** June/August. **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). 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; 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. **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-Garcia (1982). 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-Garcia pers.comm.); *Quercus suber* forest (Claussen and Hauser, 1990). **Adult habitat and habits:** no data. **Flowers visited:** *Cistus ladaniferus* (Marcos-García, 1985). **Flight period:** March/July. **Larva:** reared (Marcos-Garcia, 2006) from rot-holes in *Fraxinus angustifolius* and *Quercus faginea*; larval and puparial features are described and figured by Ricarte et al (2007). **Range:** 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-Garcia, 2006). **Determination:** See Key provided in StN Keys volume and Marcos-Garcia (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*.

Mallota eurasiatica Stackelberg, 1950

Preferred environment: forest; *Betula* forest. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** mid May/June. **Larva:** features of the larva and puparium are described by Kuznetsov and Kuznetsov (1995), based on puparia collected from rot-holes in *Betula*. Svivova et al (1999) both describe and figure features of the larva, 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. **Range:** European parts of Russia and eastwards through much of Siberia. **Determination:** See Key provided in StN Keys volume and Violovitsh (1986). This species seems to be very similar to *M.dusmeti*.

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. **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. **Larva:** undescribed. **Range:** Germany and Poland south through France to Spain and 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 now than previously and probably threatened at European level, though not yet regarded as extinct in any European state. **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.

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.). **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.). **Flight period:** end May/June. **Larva:** not described. **Range:** southern parts of Fennoscandia south to Germany (extinct?); from Poland 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). The adult male is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

Mallota tricolor Loew, 1871

Preferred environment: 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). **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. **Larva:** not described. **Range:** Lithuania, Poland, Germany (extinct?), Belarus, European parts of Russia and on into Asia through Siberia to Kamchatka. **Determination:** See Key provided in StN Keys volume and Bradescu (1991); van Veen (2004). This species closely resembles *M.fuciformis*, but has bare eyes.

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 northerly latitudes. **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). The adult insect is illustrated in colour by 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 Speight (1988a), Haarto and Kerppola (2007a) and Bartsch et al (2009a).

***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). **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:** Speight (1988a); Bartsch et al (2009a). The male terminalia are figured by Hippa (1978). 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. **Larva:** 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:** Speight (1988a); Bartsch et al (2009a). 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. **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). 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:** 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. 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 (*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). **Larva:** 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:** Speight (1988a). The male terminalia are figured by Hippa (1978). 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*. **Flight period:** July/August. **Larva:** not described. **Range:** Britain (Scottish highlands), Denmark, Netherlands, Germany, Czech Republic, France, Switzerland, Italy (Aosta). **Determination:** 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 margin 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*. The adult female is illustrated in colour by Torp (1994). 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*.

Melangyna lasiophthalma (Zetterstedt), 1843

Preferred environment: forest; acidophilous *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. **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:** Speight (1988a). The male terminalia are figured by Hippa (1978). The adult insect is illustrated in colour by Kormann (1988), Torp (1994) and Bartsch et al (2009a).

Melangyna lucifera Nielsen, 1980

Preferred environment: forest; *Betula/Pinus/Salix* forest, boreal pine forest. **Adult habitat and habits:** no data. **Flowers visited:** male *Salix*. **Flight period:** beginning March/mid May. **Larva:** not described. **Range:** southern Norway, Finland, Denmark, France, Germany, Czech Republic, and Siberia. **Determination:** Haarto and Kerppola (2007a), Nielsen (1980). Haarto and Kerppola (2007a), Torp (1994) and Bartsch et al (2009a) illustrate the male in colour. The most comprehensive keys to European *Melangyna* species incorporating *M.lucifera* are those provided by Haarto and Kerppola (2007a) and Bartsch et al (2009a).

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*, *Salix*, *Sambucus*, *Tussilago*. **Flight period:** end February/end April. **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:** 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). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and Bartsch et al (2009a).

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. **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 Kuznetsov (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:** Speight (1988a), Bartsch et al (2009a). The male terminalia are figured by Hippa (1978). 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). 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).

MELANOASTER

This genus was only recently reinstated (Maibach et al, 1994a). Most of its species were earlier included in *Chrysogaster*. Including the recently-described *M.curvistylus* Vujic & Stuke (1998), nine 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. **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.parumplicata* Loew, but confirmed from Scandinavia (Norway and Sweden), Ireland and Britain, Poland, Germany, Switzerland and Liechtenstein, plus Montenegro in the Balkans (Vujic, 1999b). **Determination:** Bartsch et al (2009b); Maibach et al (1994b). 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*. *M.aerosa* is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

***Melanogaster curvistylus* Vujic & Stuke, 1998**

Preferred environment: deciduous forest/wetland; from information provided by Vujic & 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, but until data are available from a greater number of localities, conclusions about the habitat of *M.curvistylus* must remain tentative. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** end April/beginning June (Vujic & Stuke (1998)). **Larva:** not described. **Range:** unknown at present, due to confusion with related species until recently. Described from Germany and Serbia. **Determination:** Vujic & 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 Vujčić & Stuke (1998), who also detail other distinguishing features. This species is also included in the keys provided by van Veen (2004).

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. **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), van der Goot (1981). The male terminalia are figured in Speight (1980), Torp (1984) and Maibach et al (1994a). The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994).

Melanogaster nigricans (Stackelberg), 1922

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/June. **Larva:** not described. **Range:** Bulgaria, Albania, Greece, 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) transferred *L.nigricans* to *Melanogaster*. Kassebeer (1999a) redescribes the male of this species and figures its terminalia. *L.nigricans* is unique among *Melanogaster* species in that the eyes of the male do not meet above the antennae.

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. **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 and Syria. **Determination:** Speight (1980), van der Goot (1981). 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). 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, *Caltha*, *Crataegus*, *Prunus spinosa*, *Ranunculus*, *Rhamnus cathartica*, *Taraxacum*. **Flight period:** mid May/mid August, with peak in June. **Larva:** undescribed. **Range:** uncertain at present, due to confusion with *M.aerosa* (Lw.) 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 and Montenegro). **Determination:** Bartsch et al (2009b); Maibach et al (1994b) and Vujic (1999b), who figure the male terminalia. This species is closely similar to *M.aerosa* in both sexes. Bartsch et al (2009b) introduce additional key features for the separation of females of *M.aerosa* and *M.parumplicata*. *M.parumplicata* is figured in colour by Bartsch et al (2009b).

MELANOSTOMA

Three species of *Melanostoma* are recognised as widely distributed in Europe - they may be recognised using van der Goot's (1981) keys. A fourth European species has been described from the Canary Isles. Unfortunately, it is very doubtful whether present species concepts provide an accurate reflection of the number of *Melanostoma* species in the continent. This far from satisfactory situation remains to be resolved. In the present account, the *Melanostoma* species referred to are as defined by the keys in van der Goot (1981).

***Melanostoma dubium* (Zetterstedt), 1838**

Preferred environment: open ground; unimproved montane and alpine grassland and moor. **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. **Larva:** undescribed. **Range:** 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. **Determination:** van der Goot (1981). Males still cannot be easily distinguished from those of other *Melanostoma* species. 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 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*, *Ranunculus*, *Salix repens*, *Stellaria holostea*, *Succisa*, *Taraxacum*. **Flight period:** April/October. **Larva:** described and figured by Dusek & Laska (1960a); aphid-feeding, on a wide range of low-growing plants. 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. The morphology of the chorion of the egg is figured by Kuznetsov (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:** van der Goot (1981). There is uncertainty as to the number of *Melanostoma* species occurring in Europe and, as recognised at present, *M.mellinum* may prove to be a complex of more than one species. 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*, *Euphorbia*, *Ilex*, *Leontodon*, *Plantago*, *Prunus spinosa*, *Ranunculus*, *Salix repens*, *Taraxacum*, *Veronica*. **Flight period:** March/ September. **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*. Dziocik (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. 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:** van der Goot (1981). The male terminalia are figured by Dusek and Laska (1967). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). The European *Melanostoma* species are not well understood at present.

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:** Apiaceae, Asteraceae, Ranunculaceae (J.T.Smit, pers.comm.). **Flight period:** March/October (probably present the whole year round) (J.T.Smit, pers.comm.). **Larva:** 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). 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* and does not yet appear in any key to *Meligramma* species. *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 *Fagisyrrhus*.

Meligramma cincta (Fallen), 1817

Preferred environment: forest; deciduous forest (*Fagus/Quercus*). **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. **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 European parts of Russia and on to the Crimea and 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 *Fagisyrrhus cinctus*) and Vockeroth (1969). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) (as *Fagisyrrhus*) 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:** *Crataegus*, *Genista*, *Photinia*, *Ranunculus*, *Sorbus aucuparia*, *Ulex*, *Viburnum opulus*. **Flight period:** end May/June plus July at higher altitudes. **Larva:** undescribed. **Range:** from northern France (Vosges), Poland and the Czech Republic through the Alps (Switzerland, Austria) and on into the former Yugoslavia; also in the Pyrenees and central Spain. 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-Garcia, 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).

Meligramma euchroma (Kowarz), 1885

Preferred environment: forest; taiga (Nielsen, 1998); mature deciduous forest (*Fagus/Quercus*); 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. **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 Palearctic 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). 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. **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); 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 Hipa (1968b). The adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994), van der Goot (1986) and Bartsch et al (2009a). 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.

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. **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). 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*. **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. Both male and female are illustrated in colour by Stubbs and Falk (1983). The male terminalia are figured by Hipa (1968b).

MELISCAEVA

The two European species of *Meliscaeva* are widely distributed and treated in most accounts, including van der Goot (1981). 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*, *Euonymus*, *Euphorbia*, *Filipendula*, *Hedera*, *Rubus*, *Salix*, *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. **Larva:** 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 be 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*). It has also 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. 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. **Determination:** van der Goot (1981). The male terminalia are figured by Dusek and Laska (1967) and Hippa (1968b) (as *Episyrphus*). 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*, *Ligustrum*, *Lonicera periclymenum* *Origanum vulgare*, *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. **Larva:** 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.cinctellus* (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; 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 (Kurul 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). 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 50 species known from the continent, *Merodon* is the second-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-Garcia et al (2007) provide a key to separate the Iberian 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. Means of determining individual *Merodon* species are dealt with here in their species accounts.

Merodon aberrans Egger, 1860

Preferred environment: unimproved, calcareous montane grassland and patchily-vegetated, herb-rich open areas within the *Abies* forest zone. **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:** Umbelliferae. **Flight period:** May/July and August at higher altitudes. **Larva:** not described. **Range:** through central Europe from Germany, the Czech Republic and the Alps (France, Switzerland, Austria) to Hungary and Roumania and on to the Ukraine and southern Russia; in southern Europe from mountainous parts of Portugal and Spain eastwards to Italy, Albania, the former Yugoslavia and Greece and on to Turkey and round the Mediterranean (Lebanon) into N Africa (Morocco), including Mediterranean islands e.g. Crete. **Determination:** Sack (1930-1932), Bradescu (1991). Hurkmans (1993) figures the male terminalia and provides a detailed re-description of the species.

Merodon abruzzensis (van der Goot), 1969

Preferred environment: open ground; heavily-grazed, unimproved, alpine, 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 **Larva:** undescribed. **Range:** Italy. **Determination:** van der Goot (1969). This species is apparently very closely similar to *M.ruficornis*, with which it is compared by van der Goot (1969).

Merodon aeneus Megerle in Meigen, 1822

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. **Larva:** not described. **Range:** from Belgium eastwards through central (Germany, Poland, Switzerland, Austria) and probably southern Europe (all material requires to be re-examined, due to possibilities of confusion with other recently segregated *aeneus*-complex species). **Determination:** Sack (1928-32) and Bradescu (1991) provide for separation of *M.aeneus* from species recognised at that time, but not for separation of *M.aeneus* from species more recently segregated from the *aeneus* complex. For identification of *aeneus*-complex species occurring in the Pyrenees and the Iberian peninsula Marcos-Garcia et al (2007) may be used. They show that *M.aeneus* 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-Garcia et al, 2007). In the Biosystematics Database of World Diptera (Thompson and Blake, 2005), *Merodon aeneus* is given as a synonym of *M.aureus* Fabricius, but without providing any justification for this supposed synonymy, and Marcos-Garcia et al (2007) follow this lead. Unfortunately, since Fabricius' description of *M.aureus* is inadequate to decide the identity of the species to which it applies and the type material of *M.aureus* is reduced to a remnant comprising, according to Zimsen (1964), "only wings", there is no basis for establishing this synonymy, unless a neotype can be designated for *M.aureus* (assuming this would be a valid act in the circumstance that there remains a fragment of the original type material, however useless) and a redefinition of *M.aureus* can be provided, that permits its separation from the other *Merodon* taxa to which it is closely related and which have recently been either re-established as species or described as new species (see Marcos-Garcia et al, 2007). No such actions have been taken in any publication produced to date and, until and unless some meaningful basis is established for the claim that *M.aeneus* is a synonym of *M.aureus*, that synonymy is here regarded as unproven. These problems are confounded by the reality that the description of *M.aeneus* cannot be used to separate it from other segregates of the *aeneus* complex now recognised as distinct species and the type material of *M.aeneus* cannot be found. Further, comparative genetic study of the

M.aeneus complex in the Balkans (Milankov et al, 2008) suggests it contains three cryptic taxa, raising the question of how many cryptic taxa may be confused under the name *M.aeneus* in Europe in general. In practical terms this means that neither *aureus* of Fabricius nor *aeneus* of Megerle are usable names, since there is no basis for deciding to which species they apply. For convenience, the name *aeneus* is used here, since it has been in use for so long and has been universally applied to a species of the *aeneus* complex. In order to clarify the concept of *M.aeneus* employed here the following diagnosis of the male is provided, which should help to segregate it from males of some of the other taxa of the complex:

upper third to half of eyes black-haired; antennae with segment 1 black, segment 2 very dark brown and segment 3 red-brown/brown; mesoscutum entirely covered in dense, long, orange-yellow hairs and metallic, brassy-green in colour; femora black except for very narrowly at apex; postero-lateral surface (and often antero-lateral surface) of hind femora with black, bristly hairs on apical half; tibiae black except at base, where narrowly brownish; tarsi black (mid basitarsus may be yellowish at base, dorsally).

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. **Larva:** not described. **Range:** Greece, Turkey and Armenia. **Determination:** Hurkmans (1993), who figures the male terminalia.

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*, *Senecio*. **Flight period:** May/June. **Larva:** 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 Azerbaijan. **Determination:** Marcos-Garcia et al (2007), who include this species in their keys and figure the male terminalia. Marcos-Garcia et 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*.

Merodon albonigrum Vujic, Radenkovic & Simic, 1996

Preferred environment: forest/open ground; alongside seasonal river beds in rocky, dry, unimproved grassland and grassy, open areas in thermophilous *Quercus* forest and mixed deciduous forest (type locality: *Syringo-Carpinetum orientalis* forest) (A.Vujic, 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.Vujic, pers.comm.). **Flowers visited:** yellow composites (*Taraxacum* spp.) (A.Vujic, pers.comm.). **Flight period:** August. **Larva:** undescribed. **Range:** Croatia, Macedonia, Serbia. This species should be regarded as threatened at the European level (Vujic et al, 2001). **Determination:** Vujic et al (1996), who figure the male terminalia. This species is apparently closely similar to *M.geniculatus* and *M.escorialensis*, and distinguishing features are described by Vujic et al (1996).

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

Merodon altinosus Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes this species based on a solitary male. He also figures its terminalia. The female remains unknown.

Merodon annulatus (Fabricius), 1794

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June and September/beginning November. **Larva:** not described. **Range:** original description based on material from France; known more recently from Italy and Greece, including Crete and Rhodes. **Determination:** included in the keys provided by Sack (1928-32).

Merodon antonioi Marcos-García, Vujčić & Mengual, 2007

Preferred environment: forest/open ground/freshwater; open areas in riparian *Fraxinus angustifolia* forest along seasonal rivers (Marcos-García et al, 2007). **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:** no data. **Flight period:** September. **Larva:** not described. **Range:** 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.

Merodon armipes Rondani, 1843

Preferred environment: open ground; 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:** *Ornithogalum umbellatum*. **Flight period:** end April/end June. **Larva:** not described. This species is apparently associated with the tassel hyacinth, Muscari (Liliaceae) in southern Germany (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:** Sack (1928-32), Bradescu (1991). This species can be separated from others of the *ruficornis* group using the key provided by Milankov et al (2002). The female of *M.armipes* very closely resembles that of *M. trebevicensis*, from which it may however be distinguished through its possession of a distinct, projecting, median point on the posterior margin of abdominal sternite 4, which is straight and simple in the female of *M. trebevicensis*, and by the fact that the basal half of the surface of abd.st.4 is at a distinct angle to the distal half and bears a low, antero-lateral bulge on each side, whereas in *M. trebevicensis* females this sternite is flat.

Merodon arundanus Marcos-García, Vujčić & 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. **Larva:** 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.

Merodon aureotibia Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) description is based on a series of females. The male of this species remains unknown.

Merodon avidus (Rossi), 1790

As recognised at present *M.avidus* is the most frequent and widely distributed of a group of closely related species. This group has been recently revised by Hurkmans (1993), who figures the male terminalia of *M.avidus*. However, Milankov et al (2001) present genetic data demonstrating that *M.avidus* as recognised by Hurkmans (1993) is still a complex of two cryptic species, that they designate only as A and B. They provide morphological data to separate these two taxa (that cannot be distinguished on features of the male terminalia) and show that on the Balkan peninsula species A occurs in the Mediterranean zone whereas species B is more montane, there being only one locality where they found both A and B

occurring together. Similar genetic treatment of *M.avidus* populations elsewhere in Europe has yet to be carried out and there can be no certainty that there are only two cryptic taxa confused under the name *avidus*. However, in the Iberian peninsula Marcos-Garcia et al (2007) report species B as occurring widely but very few occurrences of species A. On the assumption that only species A and species B are confused under the name *avidus*, material available to the present author suggests that species B is wide ranging in the continental zone of Europe and occurs at least as far north as northern France, whereas species A appears to be more-or-less confined to the Mediterranean zone of southern France and other parts of the European Mediterranean zone, through Italy to Roumania. It remains unclear which of these two taxa is correctly referred to as *M.avidus* and the interim practice of referring to both taxa under the umbrella name of *avidus* is adhered to here, but with information being provided for each taxon separately, under the appellations A and B, as defined by Milankov et al (2001). It remains to be seen whether these taxa will be further subdivided, if and when the genetics of European *M.avidus* populations are studied more comprehensively.

Taxon A sensu Milankov et al (2001)

Preferred environment: forest/open ground; tracksides etc in thermophilous *Quercus* (*Q.pubescens*) 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:** no data. **Flight period:** May/June and September. **Larva:** not described. **Range:** Mediterranean zone of Europe, from Spain through southern France to Italy, the Balkan Peninsula and Roumania (and probably further south round the Mediterranean basin). **Determination:** there is no key in which all known European members of the *avidus* group of species are included and females, in particular, can be extremely difficult to separate. The most secure means of identifying males is through examination of the terminalia, in conjunction with Hurkman's (1993) figures. *M.avidus* (A + B) has been referred to as *M.spinipes* (Fab.) in some recent literature. The adult insect is illustrated in colour by Torp (1994). For separation of *M.avidus* taxon A from *M.avidus* taxon B Milankov et al (2001) and Marcos-Garcia et al (2007) should be consulted.

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. **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. **Larva:** 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 is presumably one host plant. **Range:** probably from southern Sweden south to the Mediterranean and N.Africa; from Spain through most of central and southern Europe to Turkey and European parts of Russia (occurrence of this taxon in various parts of Europe still requires confirmation, due to confusion with taxon A). **Determination:** there is no key in which all known European members of the *avidus* group of species are included and females, in particular, can be extremely difficult to separate. The most secure means of identifying males is through examination of the terminalia, in conjunction with Hurkman's (1993) figures. *M.avidus* (A + B) has been referred to as *M.spinipes* (Fab.) in some recent literature. The adult insect is illustrated in colour by Torp (1994). For separation of *M.avidus* taxon A from *M.avidus* taxon B Milankov et al (2001) and Marcos-Garcia et al (2007) should be consulted. The general appearance of this taxon is shown in the coloured figure of *M.avidus* provided by Bartsch et al (2009b).

Merodon biarcuatus Curran, 1939

Preferred environment: unimproved, humid, montane grassland. **Adult habitat and habits:** according to Hurkmans and Hayat (1997) the flight pattern of this species “is similar to that of asilids: a short, somewhat erratic flight, interrupted by seemingly random landings among the vegetation”. Apparently, the insects fly over ground vegetation, rather than within it. **Flowers visited:** no data. **Flight period:** May/August. **Larva:** not described. **Range:** southern France, Italy, Greece, Turkey and North Africa (Morocco). **Determination:** Hurkmans (1993) redescribes the female of this species, and Hurkmans and Hayat (1997) describe the previously unknown male, figuring the male terminalia. In the field, *M. biarcuatus* resembles *M. clavipes* in both size and colour (Hurkmans and Hayat, 1997).

Merodon caerulescens Loew, 1869

Preferred environment: phrygana (Claussen and Lucas, 1988). **Adult habitat and habits:** no data. **Flowers visited:** *Anthemis chia* (Claussen and Lucas, 1988). **Flight period:** March/April. **Larva:** undescribed. **Range:** southern Bulgaria and Greece, including Crete and Rhodes. According to Dirickx (1994), there is no basis for the repeated references to occurrence of this species in North Africa. **Determination:** Sack (1928-32).

Merodon cabanerensis Marcos-García, Vujic & 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). **Larva:** not described. **Range:** apparently a localised endemic, known only from one restricted area in central Spain. **Determination:** Marcos-García et al (2007), who describe the species, figure its male terminalia and include it in their keys.

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). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/September. **Larva:** not described. **Range:** Portugal, Spain and southern France round the Mediterranean to parts of the former Yugoslavia and in N Africa (Morocco). **Determination:** Marcos-García et al (2007), who redefine the species, 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.

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. **Larva:** undescribed, but very probably associated with spring-flowering *Crocus*. **Range:** Massif Central (France), Alps, Apennines (Italy), the former Yugoslavia; southern parts of Russia, the Ukraine and northern Turkey. **Determination:** Sack (1930-32), van der Goot (1981). In the area between the wing-bases, females of *M. cinereus* normally have black hairs intermingled among the yellow-brown hairs covering the mesoscutum. But specimens occur in which these black hairs are entirely lacking, and such females cannot be reliably distinguished from females of other taxa in the *M. aeneus* complex. Milankov et al (2008) conclude that, in the Balkans, two cryptic taxa are confused under the name *M. cinereus*. How many cryptic taxa are confused under this name in Europe in general awaits elucidation.

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. **Larva:** apparently undescribed. **Range:** from northern France to the Mediterranean (including Corsica, Sardinia, Sicily and Crete) and N.Africa; from Portugal and Spain through central and southern Europe to Greece, Roumania, Ukraine and Turkey. **Determination:** Bradescu (1991). *M.clavipes* is not mentioned in van der Goot (1981). The male of *M.clavipes* is a bumble bee mimic. The male terminalia are figured by Hurkmans (1993).

Merodon clunipes Sack, 1913

Preferred environment: deciduous forest; *Fagus* and thermophilous oak forest (A.Vujic, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Larva:** not described. **Range:** so far confirmed from southern France, Switzerland, Austria, Hungary, Italy (and Sicily), parts of the former Yugoslavia, Greece, Bulgaria, Cyprus, Turkey and the Lebanon. **Determination:** Hurkmans (1993), who figures the male terminalia.

Merodon constans (Rossi), 1794

Preferred environment: forest/open ground; open grassy areas in/adjacent to alluvial hardwood forest or *Quercus/Carpinus* forest and grassy open areas within humid *Fagus/Abies* 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:** July/August. **Larva:** developmental stages described and figured by Ricarte et al (2008), from larvae in bulbs of grape hyacinth, *Muscari comosum*; probably also associated with *Colchicum*. **Range:** Poland and Czechoslovakia; central France, Switzerland, Austria, Hungary, Roumania and Bulgaria; Italy, the former Yugoslavia, Greece and the Crimea. **Determination:** Sack (1928-32), Bradescu (1991). This species is not satisfactorily differentiated in existing keys.

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:** no data. **Flight period:** June/July. **Larva:** 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 this taxon and figures the male terminalia.

Merodon crymensis: see under *M.trebevicensis*

Merodon crypticus Marcos-García, Vujic & 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:** no data. **Flight period:** July-September (Marcos-García et al, 2007). **Larva:** not described. **Range:** 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.

Merodon cupreus Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993), who describes both males and females and figures the male terminalia.

Merodon desuturinus Vujic, Simic, & Radenkovic, 1995

Preferred environment: forest/open ground; open, dry, grassy areas within humid *Fagus/Picea/Abies* forest (Vujic et al, 1995). **Adult habitat and habits:** settles on vegetation in the sun (Vujic et al, 1995). **Flowers visited:** *Ranunculus* (Vujic et al, 1995). **Flight period:** May. **Larva:** not described. **Range:** Serbia. This species should be regarded as threatened at the European level (Vujic et al, 2001). **Determination:** Vujic et al (1995), who figure the male terminalia.

Merodon distinctus Palma, 1863

Preferred environment: humid tracksides and meadows (Standfuss and Claussen, 2007); open, riparian *Fraxinus angustifolia* forest (Ricarte Sabater et al, 2008). **Adult habitat and habits:** no data. **Flowers visited:** *Foeniculum vulgare* (Standfuss and Claussen, 2007). **Flight period:** May/June and August/September. **Larva:** not described. **Range:** Spain, Mediterranean zone of France, Italy (Sicily), parts of the former Yugoslavia, Greece, Turkey. **Determination:** Hurkmans (1993), who describes the species (both the male and the female) and figures the male terminalia.

Merodon dobrogensis Bradescu, 1982

Preferred environment: forest; small, open areas maintained by goat-grazing, in evergreen oak maquis 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:** *Scilla autumnalis* (M. de C.Williams, pers.comm.). **Flight period:** August/October. **Larva:** not described. This species seems to have a close relationship with *Scilla autumnalis*, with which its larvae may be associated. **Range:** Roumania, Greece. **Determination:** *M.dobrogensis* is included in the keys of Bradescu (1991), but does not seem to have been otherwise referred to until recently, when Vujić et al (2011) described a closely-related “cryptic” taxon, *M.puniceus*, from the Aegean island of Lesvos. However, genetic information is not available for *M.dobrogensis* and, until it is, there must remain doubt concerning the taxonomic status of *M.puniceus*. 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*.

Merodon dzhalitae Paramonov, 1927

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Larva:** not described. **Range:** Ukraine (Crimea). **Determination:** Hurkmans (1993) provides information about both sexes of this species derived from other authors, without apparently having seen the species himself. *M.dzhalitae* is included in the keys given by Sack (1928-32).

Merodon elegans Hurkmans, 1993

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, garrigue and matorral. **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. **Flowers visited:** *Calystegia*, *Cistus*. **Flight period:** April/September (Marcos-Garcia, pers.comm.), with peaks in June and end August/beginning September. **Larva:** not described. **Range:** Spain, southern France (and Corsica), southern Italy (and Sicily); N Africa (Algeria, Morocco). **Determination:** Hurkmans (1993), who figures the male terminalia. This species is indistinguishable from *M.avidus* and *M.nigritarsis* in the field. Both sexes of *M.elegans* can be distinguished from *M.avidus* agg. by the hair fringes on the ventral surface of the hind femora. In *M.elegans* 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.elegans* 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.elegans* the dorsal surface of tarsomeres 1 – 3 of the hind leg is yellow/pale brown and covered predominantly in procumbent yellow hairs.

Merodon eques (Fabricius), 1805

Preferred environment: areas of rocky, sub-xeric, calcareous grassland in tall Mediterranean scrub 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. **Larva:** not described, but reared from *Narcissus* by Hurkmans and De Goffau (1995) and Pehlivan and Akbulut (1991). **Range:** Gibraltar; France; Italy (Sardinia, Sicily); Turkey; N Africa. **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 provide coloured figures of the adult male and its hind leg and also figure the male terminalia. 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 noticeably 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.

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*, *Senecio*. **Flight period:** May/July (plus April in southern Europe and August at higher altitudes). **Larva:** described and figured by Hodson (1932b) and Heiss (1938) and illustrated in colour by Rotheray (1994); internal feeder in tissues of bulbs of Liliaceae; 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). **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 Columbia 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). 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), 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). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July and September. **Larva:** not described. **Range:** Greece, parts of the former Yugoslavia, Caucasus (Armenia), Turkey, Israel, Azerbaijan. **Determination:** Hurkmans (1993). The male of this species apparently remains undescribed.

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-Garcia, 1989b). **Adult habitat and habits:** no data.

Flowers visited: yellow composites; *Calluna*, *Lavandula*, *Mentha*, *Succisa* (Marcos-Garcia, 1989b). **Flight period:** March/October. **Larva:** undescribed. **Range:** Spain (from Cantabria southwards into much of central Spain). **Determination:** distinctions between this species, *M.albonigrum* and *M.geniculatus* are detailed by Vujic, Radenkovic and Simic (1996), who also figure the male terminalia of *M.escorialensis*. This species is redefined and included in the keys provided by Marcos-Garcia et al (2007).

Merodon femoratoides Paramonov, 1925

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Larva:** 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*".

Merodon femoratus Sack, 1913

Preferred environment: phrygana (Petanidou, 1991). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/August. **Larva:** not described. **Range:** Greece, Cyprus, Turkey. **Determination:** Hurkmans (1993), who figures the male terminalia.

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. **Larva:** 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*.

Merodon funestus (Fabricius), 1794

Preferred environment: forest/open ground; open areas in evergreen oak forest of *Quercus ilex* and *Q.coccinea/Q.macrolepis*; by seasonal streams in Balkanic thermophilous *Quercus* forest; 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-Garcia, pers.comm.) **Flowers visited:** tall, yellow composites; *Adonis*, *Anacyclus*, *Ranunculus* (Marcos-Garcia, pers.comm.). **Flight period:** May/June and end August/September. **Larva:** 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).

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*. **Flight period:** March/April (Malta) and July to September, with a peak at end August/beginning September. **Larva:** not described. **Range:** southern France, Portugal, Spain, Italy, southern parts of the former Yugoslavia, Bulgaria, Turkey, Israel and N Africa (Algeria, Morocco); Mediterranean islands - Balearics, Corsica, Malta. **Determination:** Vujic et al (1996), and Marcos-Garcia 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-Garcia et al (2007).

Merodon hamifer Sack, 1913

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Greece, Turkey. **Determination:** Sack (1928-32). Hurkmans (1993) remarks that this species is very similar in appearance to *M.aberrans*. He also figures the male terminalia.

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. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans & Hayat (1997), who figure the male terminalia.

Merodon hikmeti Hurkmans in Hurkmans & Hayat, 1997

Preferred environment: open ground; 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. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans & Hayat (1997), who figure the male terminalia.

Merodon hirsutus Sack, 1913

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March/June. **Larva:** not described. **Range:** Turkey, Israel, Jordan, Syria. **Determination:** this species is included in the keys provided by Sack (1928-32). Hurkmans (1993) redescribes both sexes of the species and figures the male terminalia.

Merodon hypochrysos Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes the male of this species from a series of specimens and figures its terminalia. The female remains undescribed.

Merodon kaloceros Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** parts of the former Yugoslavia (Croatia, Macedonia), Greece, Turkey. **Determination:** Hurkmans (1993) describes both sexes of this species and figures the male terminalia.

Merodon karadaghensis Zimina, 1989

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September. **Larva:** not described. **Range:** Ukraine (Crimea). **Determination:** Hurkmans (1993) provides some comment on the distinguishing features of this species, based on the original description of the male holotype. The female remains unknown.

Merodon latifemoris Radenković & Vujić, 2011

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Trifolium*. **Flight period:** June/July. **Larva:** not described. **Range:** Greece. **Determination:** Vujić et al (2011), who describe both sexes of the species and figure its male terminalia, detailing differences between this species and the closely-related *M.femoratoides* and *M.nigritarsis*.

Merodon legionensis Marcos-García, Vujčić & Mengual, 2007

Preferred environment: open ground; unimproved, montane grassland, including open, grassy areas in pine forest or Mediterranean scrub. **Adult habitat and habits:** no data. **Flowers visited:** white Apiaceae; yellow composites; *Merendera montana*. **Flight period:** September. **Larva:** undescribed. **Range:** northern (Cantabria) and eastern Spain and southern Italy (Calabria). **Determination:** Marcos-Garcia et al (2007), who describe the species, figure its male terminalia and include it in their keys. This is a species of the *aeneus* group and is very similar in appearance to *M.aeneus*, *M.pumilus* and *M.unicolor*.

Merodon loewi van der Goot, 1964

Preferred environment: forest; polydominant deciduous forest (A.Vujic, pers.comm.); open thermophilous *Quercus* (*Q.cerris*); 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 settle both on the ground and on vegetation (Hurkmans, 1988). Females settle low on the upright stems of plants such as *Gladiolus*. **Flowers visited:** *Aphylanthes monspeliensis*, *Ornithogalum*. **Flight period:** end April/beginning June. **Larva:** not described, but probably associated with *Ornithogalum* (Hurkmans, 1988). **Range:** Bulgaria, Montenegro, Serbia, Greece, Moldova, Ukraine, Turkey and Armenia. **Determination:** Milankov et al (2002). In Sack (1928-32) this species appears as *graecus*, Loew. This is a species of the *ruficornis* group.

Merodon longicornis Sack, 1913

Preferred environment: open ground/cultures; dry grassland and orchards. **Adult habitat and habits:** settles low down, on foliage of large-leaved shrubs/bushes (M.Reemer, pers.comm.). **Flowers visited:** *Foeniculum vulgare* (Standfuss and Claussen (2007); *Euphorbia* (Zimina,1960). **Flight period:** May/August. **Larva:** not described. **Range:** Spain (where this species has been known under the name *affinis* Gil Collado, now recognised as a junior synonym of *longicornis*: see Marco-Garcia et al, 2007) former Yugoslavia, Greece, Turkey, Ukraine, southern Russia, Lebanon, N Africa (Claussen & Hauser, 1990). **Determination:** Hurkmans (1993), Marco-Garcia et al (2007), who figure the male terminalia. Marcos-Garcia et al (2007) include this species in their keys.

Merodon longispinus Marcos-García, Vujic & Mengual, 2007

Preferred environment: has been collected from montane, sparsely-vegetated ground beside a river (Marcos-Garcia et al, 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Lavandula latifolia* (Marcos-Garcia et al, 2007). **Flight period:** September. **Larva:** not described. **Range:** appears to be a localised endemic of the Sierra de Cazorla, in southern Spain. **Determination:** (Marcos-Garcia 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.

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. **Larva:** 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.

Merodon luteihumerus Marcos-García, Vujic & 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-Garcia et al, 2007). **Adult habitat and habits:** no data. **Flowers visited:** *Urginea maritima* (Marcos-Garcia et al, 2007). **Flight period:** September. **Larva:** 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 and Algeria. **Determination:** (Marcos-Garcia 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 evidently very similar in general appearance to *M.clavipes* and *M.pruni*.

Merodon manicatus (Sack), 1938

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** not described. **Range:** Macedonia. This species should be regarded as threatened at the European level (Vujic *et al*, 2001). **Determination:** Hurkmans (1993) redescribes the male and female of this species and figures the male terminalia.

Merodon mariae Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** *Helichrysum*. **Flight period:** May/October. **Larva:** not described. **Range:** Corsica, Sardinia, Sicily, Greece. **Determination:** Hurkmans (1993) describes both sexes of this species and figures the male terminalia.

Merodon minutus Strobl, 1893

Preferred environment: forest/open ground; open areas in evergreen oak maquis and more open, almost bare ground in semi-arid conditions. **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. **Larva:** not described. **Range:** Spain and southern France round the Mediterranean to parts of the former Yugoslavia and on to N Africa (Morocco). **Determination:** Sack (1928-32).

Merodon nanus (Sack), 1931

Preferred environment: open ground; unimproved, humid, montane grassland (Hurkmans and Hayat (1997); sparsely-vegetated, tall-herb open areas in mesophilous *Fagus* forest (pers.comm.M.de C.Williams). **Adult habitat and habits:** flies very low through ground vegetation. **Flowers visited:** composites, umbellifers; *Euphorbia*, *Ornithogalum* (Hurkmans and Hayat (1997); small *Trifolium* spp. (pers.comm. M. de C. Williams). **Flight period:** June. **Larva:** not described. **Range:** Bulgaria (?), Caucasus (Georgia, Armenia), Turkey, Iran, Iraq. **Determination:** included in the keys provided by Sack (1928-32).

Merodon natans (Fabricius), 1794

Preferred environment: forest/open ground; herb-rich open areas in thermophilous *Quercus* forest and phrygana with *Cistus* scrub (W.Hurkmans, pers.comm.); also in orchards in southern Europe. **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:** umbellifers (*Foeniculum*); *Solidago*, *Urginea*. **Flight period:** April/May and end August/beginning October. **Larva:** not described. **Range:** Spain, France (from Paris basin south), Italy, former Yugoslavia, Greece (inc. Rhodes), Cyprus, Bulgaria, Israel and the Caucasus mountains. **Determination:** Sack (1928-32).

Merodon nigratarsis Rondani, 1845

Preferred environment: forest/open ground; herb-rich, dry/semi-arid, unimproved grassland and open areas in evergreen *Q.ilex* and *Q.suber* forest/maquis, Pinus matorral and Mediterranean scrub. **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.); *Tordylium apulum*. **Flight period:** May/August. **Larva:** not described, but reared from the steppe hyacinth *Hyacinthella pallasiana* by Stepanenko and Popov (1997). **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.nigratarsis* and related species. In general appearance it is closely similar to *M.avidus* (Rossi). Useful comparative figures of the male terminalia of *M.avidus*

and *M.nigritarsis* are provided by Vujic 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 (see also under *M.elegans*).

Merodon nitidifrons Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993), who figures the male terminalia. The female of this species remains unknown.

Merodon obscuritarsis Strobl, 1909

Preferred environment: evergreen oak (*Q.ilex*) forest and montane, dry pine forest (Marcos-Garcia et al, 2007); 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-Garcia et al, 2007). **Flight period:** April/May and July/September. **Larva:** undescribed. **Range:** Spain and the Canary Isles (if, as suggested by Marcos-Garcia 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*). **Determination:** Marcos-Garcia 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.

Merodon oidipous Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993), who figures the male terminalia. The female of this species remains unknown.

Merodon ottomanus Hurkmans, 1993

Preferred environment: forest/open ground; open areas in *Quercus ilex/Pinus halepensis* forest and lentisc scrub (Marcos-Garcia et al, 2007); 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. **Larva:** not described. **Range:** a Mediterranean basin species described from Turkey, but whose range is as yet uncertain due to confusion with related species. **Determination:** Marcos-Garcia et al (2007); Hurkmans (1993), who figures the male terminalia.

Merodon papillus Vujić, Radenković and Pérez-Bañon 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:** no data. **Flight period:** April/May. **Larva:** not described. **Range:** so far known only from Lesvos (Greece), but postulated (Vujić et al, 2007) to also occur in neighbouring parts of Turkey. **Determination:** Vujić et al (2007) who describe both sexes of the species and figure both the male terminalia and other features of the male and female morphology. *M.papillus* is evidently a member of the “ruficornis” group of species, 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 (2007) indicate that the female of *M.papillus* is closely similar to that of *M.planiceps* and provide features for separation of the females of these two species.

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*, *Stellaria*. **Flight period:** end May/June. **Larva:** 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.

Merodon planiceps Loew, 1862

Preferred environment: open ground; unimproved 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:** June/July. **Larva:** not described. **Range:** Greece, Turkey. **Determination:** Sack (1928-32).

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. **Adult habitat and habits:** females fly very close to the ground and are much less noticed than the males. **Flowers visited:** no data. **Flight period:** May/August. **Larva:** not described. **Range:** southern France, Italy, Austria, former Yugoslavia, Greece, Malta, Cyprus, Crete, Turkey, N Africa, Arabia. **Determination:** Hurkmans (1993), who figures the male terminalia.

Merodon pulveris Vujić & Radenković, 2011

Preferred environment: Maquis (Vujić et al, 2011). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April and late September/mid October. **Larva:** not described. **Range:** Greece (Lesvos) and Turkey. **Determination:** Vujić et al (2011), who describe both sexes of the species and figure its male terminalia, detailing differences between this species and the closely-related *M.natans* and the N.African *M.calcaratus* (Fab.).

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-Garcia et al, 2007). **Adult habitat and habits:** no data. **Flowers visited:** Apiaceae; *Anthericum ramosum*, *Chrysanthemum leucanthemum*, *Mentha*, *Ranunculus*, *Solidago*, *Taraxacum*. **Flight period:** April/June. **Larva:** not described. **Range:** southern Spain and N Africa (Algeria). **Determination:** Marcos-Garcia et al, who redefine the species, figure its male terminalia and include it in their keys. This is a species of the *aeneus* group that would appear to be very difficult to distinguish from *M.aeneus* itself, to judge from the information in Marcos-Garcia et al (2007). Unfortunately, *M.aeneus* is not included in the keys provided by Marcos-Garcia et al (2007) and no features distinguishing *M.pumilus* from *M.aeneus* are given in the diagnosis they provide for *M.pumilus*.

Merodon puniceus Vujić, Radenković & Péres-Bañón, 2011

Preferred environment: Maquis (Vujić et al, 2011). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August and October. **Larva:** not described. **Range:** Greece (Levos). **Determination:** Vujić et al (2011), who describe both sexes of the species and figure its male terminalia, detailing differences between this species and the closely-related *M.dobrogensis*.

Merodon quadrinotatus (Sack), 1931

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Larva:** not described. **Range:** Turkey, 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* remains unknown.

Merodon quercetorum Marcos-García, Vujčić & 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. **Larva:** 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 *aeneus* group, closely similar to *M.coerulescens*.

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*. **Flight period:** end April/mid June. **Larva:** not described. **Range:** from Belgium south to the Mediterranean and N Africa and eastwards through central (Germany, Switzerland, Austria) and southern Europe to Greece, Roumania, the Caucasus and Armenia. **Determination:** Sack (1928-32), Bradescu (1991). According to Radenkovic et al (2004) *M.ruficornis* sensu Milankov et al (2002) is an undescribed species and *M.recurvus* of Milankov et al (2002) is *M.ruficornis*.

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*, and *Paradisica*. According to Peterson et al (2008), *M.rufus* is a specialist pollinator of *Anthericum liliago* (Anthericaceae). **Flight period:** mid May/July. **Larva:** undescribed. This species is apparently closely associated with *Anthericum* (Liliaceae) in parts of its range (Doczkal, pers.comm.). **Range:** from the Netherlands 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). *M.rufus* Meigen does not exhibit the white bands of dusting on its tergites mentioned by van der Goot (1981).

Merodon sapphous Vujčić, Pérez-Bañón and Radenković, 2007

Preferred environment: forest; dry deciduous forest of *Castanea* (Vujčić et al, 2007). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September/October (Vujčić et al, 2007). **Larva:** not described. **Range:** so far as is known endemic to Lesbos (Greece), where it occurs in the island's only chestnut forest (Vujčić et al, 2007). **Determination:** Vujčić et al (2007), who describe both sexes of the species, figure the male terminalia and also figure some features of the morphology of the female. *M.sapphous* is evidently a species of the "aeneus" group, very similar in appearance to *M.legionensis* and *M.quercetorum*.

Merodon satdagensis Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes both the male and the female of this species. He also figures the male terminalia.

Merodon schachtii Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Larva:** 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.

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. **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*, *Thapsia*, *Thymus*. **Flight period:** April/ August. **Larva:** not described. **Range:** Portugal, Spain, southern France; Italy, southern parts of the former Yugoslavia, Greece, Roumania, the Ukraine eastwards into western Siberia and Mongolia; Algeria and Morocco in North Africa. **Determination:** this is the species recognised as *M.alexexi* Paramonov, by Hurkmans (1993) who gives a summary redescription of the species. If *alexexi* Paramonov is the same species as *alexexi* sensu Hurkmans then it is a junior synonym of *M.serrulatus*. But this synonymy has not been formally established, and Hurkmans' (1993) interpretation of *alexexi* was based on the description of that species, there being no type material available. *M.serrulatus* is rather more variable than Hurkmans (1993) suggests. In particular, the abdomen can be entirely without pale (orange) markings on tergite 2. The mesoscutum may be entirely pale-haired or with patches of black hairs between the wings, or with a broad band of black hairs across its entire width. The figure of the male terminalia provided by Hurkmans (1993) is also misleading, in that the anterior surstylar lobe is usually more expanded distally than as shown. Clearer and more diagnostic figures of the male terminalia are provided by Marcos-Garcia et al (2007). The male terminalia of the same species, as *M.unguicornis* (Marcos-Garcia, pers.comm.), are figured by Marcos-Garcia (1990b). The shape of the third antennal segment is noticeably variable in this species, its dorsal margin varying from almost straight to deeply concave. The characters identified as diagnostic for *M.sophron* Hurkmans (Hurkmans, 1993) would seem to be encompassed within the variability of *M.serrulatus*, suggesting there is need for further investigation of the status of these two taxa. Marcos-Garcia et al (2007) establish that *lusitanicus* Hurkmans is a junior synonym of *serrulatus*.

Merodon segetum (Fabricius), 1794

Preferred environment: open rocky areas of sub-xeric calcareous grassland in tall Mediterranean scrub 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. **Larva:** not described. **Range:** Spain; Gibraltar; Macedonia; Crete. **Determination:** included in the key to Iberian *Merodon* species by Marcos-Garcia et al (2007), who also figure the male terminalia.

Merodon splendens Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** not described. **Range:** Sardinia. **Determination:** Hurkmans (1993) describes this species on the basis of a solitary male specimen. He also figures the male terminalia. The female remains unknown.

Merodon taniniensis Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** 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.

Merodon telmateia Hurkmans, 1987

Preferred environment: open ground/freshwater; unimproved, montane grassland with seasonal flushes/wet areas (Hurkmans, 1988). **Adult habitat and habits:** females fly very close (c 10cm) to the

ground (Hurkmans, 1988), males somewhat higher. **Flowers visited:** *Ornithogalum*. **Flight period:** June/August. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1987), who describes both sexes of the species and figures the male terminalia. He also discusses distinctions between *M.telmateia* and *M.aeneus*, *M.fulcratus*, *M.minutus*, *M.nanus*, *M.spinitarsis* and *M.syriacus*, suggesting that in general appearance *M.telmateia* is probably most similar to *M.aeneus*.

Merodon tener Sack, 1913

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** extreme south of European Russia. **Determination:** Hurkmans (1993) redescribes this species, based on the two females comprising the type material. The male remains unknown.

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-Garcia, pers.comm.). **Adult habitat and habits:** flies fast and low through ground vegetation. **Flowers visited:** *Senecio* sp. **Flight period:** May, July/beginning August. **Larva:** not described. **Range:** northern and central Spain. **Determination:** Marcos-Garcia et al (2007), who redefine the species, figure its male terminalia and include it in their keys.

Merodon testaceoides Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Larva:** not described. **Range:** Macedonia. This species should be regarded as threatened at the European level (Vujic *et al*, 2001). **Determination:** Hurkmans (1993) describes this species based on a single male and female. He also figures the male terminalia.

Merodon testaceus Sack, 1913

Preferred environment: forest; thermophilous deciduous forest; *Castanea* forest (Ståhls et al, 2009). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** not described. **Range:** 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.

Merodon toscanus Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** 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.

Merodon trebevicensis Strobl, 1900

Preferred environment: open ground/forest, open grassy and tall-herb areas in *Quercus/Fraxinus* forest and 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. **Larva:** not described. **Range:** southern (Haut Languedoc) and eastern (Jura) France; Switzerland (?), Bulgaria, Roumania, the Crimea and Turkey. **Determination:** Bradescu (1991), Sack (1928-32). 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*. The female of this species closely resembles the female of *M.armipes* Rondani (distinguishing features are given in the *M.armipes* species account).

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. **Larva:** 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, the Crimea, Turkey and the Caucasus; also in Israel; in Switzerland and Austria 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-Garcia 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.

Merodon trochantericus Costa, 1884

Preferred environment: forest/open ground: thermophilous *Quercus* and evergreen oak (*Q. suber*) forest, maquis, thermophilous forest fringes. **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*. **Flight period:** May/June and mid July/September. **Larva:** not described. **Range:** from northern France south to Spain and the Mediterranean; Corsica, Sardinia, Italy. **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.

Merodon unguicornis Strobl in Czerny and Strobl, 1909

Preferred environment: forest/scrub; open *Quercus ilex* forest and maquis (Marcos-Garcia et al, 2007) **Adult habitat and habits:** flies at up to 1m from the ground, through low shrub vegetation (Marcos-Garcia, pers.comm.). **Flowers visited:** *Brachypodium*, *Cistus*, *Erinacia anthyllis*, *Euphorbia*, *Helianthemum*, *Sedum*, *Thymus* (Marcos-Garcia et al, 2007). **Flight period:** April/July. **Larva:** not described. **Range:** Spain (from northern parts to the Mediterranean). **Determination:** this species is included in the keys provided by Marcos-Garcia 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.

Merodon unicolor Strobl in Czerny & Strobl, 1909

Preferred environment: forest/open ground; well-drained, non-calcareous, montane and sub-alpine unimproved grassland (Marcos-Garcia et al, 2007); 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-Garcia et al, 2007). **Flight period:** April/September. **Larva:** not described. **Range:** mountainous parts of northern and central Spain; Pyrenees (France) and Haute-Languedoc (Hérault) in SW France; mountain ranges in NW Africa. **Determination:** Marcos-Garcia et al (2007), who redefine the species figure its male terminalia and include it in their keys. This is a species of the *aeneus* group that closely resembles *M. aeneus* and *M. pumilus*, other than in that the eyes are entirely pale-haired (black over dorsal half in *M. aeneus* and *M. pumilus*).

Merodon vandergooti Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) bases the description of this species on a series of males. He figures the male terminalia. The female remains unknown.

Merodon velox Loew, 1869

Preferred environment: open ground; semi-arid, stony, thinly-vegetated, unimproved grassland **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. **Larva:** not described. **Range:** parts of the former Yugoslavia, Greece, Turkey. **Determination:** Hurkmans (1993), who figures the male terminalia.

Merodon warnckeii Hurkmans, 1993

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June, August. **Larva:** not described. **Range:** Turkey. **Determination:** Hurkmans (1993) describes both sexes of this species and figures the male terminalia.

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). **Flight period:** May/September. **Larva:** not described. **Range:** from southern Germany south to the Mediterranean; through parts of central Europe (Austria, Hungary) and southern Europe (Italy, former Yugoslavia, Bulgaria, Roumania) to Israel; from the Ukraine and the Caucasus eastwards through southern parts of the Palaearctic to the Pacific and northern China. **Determination:** Bradescu (1991). The male is illustrated in colour by Kormann (1988). 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 the female, pale markings on the abdomen are represented only by grey patches of dusting, giving the abdominal dorsum a sombre appearance, more similar to the situation found in some *Anasimyia* species. 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.

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) and keyed out by Séguy (1961). *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*) and deciduous forest (mesophilous *Fagus*, acidophilous *Quercus*, thermophilous *Quercus*) with over-mature 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. crabroniformis* also 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., *Hedera*, *Lythrum salicaria*, *Mentha aquatica*, *Sambucus ebulus*, *Scabiosa*. **Flight period:** July/October, peak at end August/beginning September. **Larva:** Matile and Leclercq (1992) described what they believed to be the puparium of this species, collected from debris in an old *Fagus*. However, Maibach (pers. comm.) has pointed out that the puparium they figure appears to be that of a species of Eristalini. Indeed, it resembles the puparium of *Mallota cimbiciformis*. Certainly, its characteristics do not conform to those of the larva of another *Milesia* species, *M. virginensis*, as figured in colour by Rotheray (1994). The female of *M. crabroniformis* has 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. **Range:** from northern France (Brittany) south to central Spain and round the Mediterranean, including islands, to the former Yugoslavia, Greece and Turkey; 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:** See Key provided in StN Keys volume. The male terminalia are figured by Hipa (1978). *M. crabroniformis* can be distinguished from the other European *Milesia*, *M. semiluctifera* (Villiers), using Seguy (1961), or Hipa (1990). 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).

Milesia semiluctifera (Villers), 1789

Preferred environment: forest; thermophilous and evergreen *Quercus* forest with overmature trees. **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*, *Scabiosa*, *Sedum*. **Flight period:** July/August. **Larva:** 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:** See Key provided in StN Keys volume, Seguy (1961) and Hipa (1990). The adult insect is figured in black and white by Matile & Leclercq (1992) and in colour by Rotheray and Gilbert (2011).

MYATHROPA

M. florea is the only species of *Myathropa* known from Europe, except for on the Madeiran islands, to which a second species, *M. usta*, is endemic. *M. florea* is treated in most accounts, including van der Goot (1981).

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. **Larva:** described and figured by Hartley (1961) and Rotheray (1994) and illustrated in colour by Rotheray (1994); 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). It 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. **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). 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), 1859

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.). **Larva:** 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). **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*. Smit et al (2004) 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.helveticus* (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:** no data. **Flight period:** mid-April to mid-July. **Larva:** 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. **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*.

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. **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); illustrated in colour by Rotheray (1994); 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. **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*. 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 nigratarsis Coe, 1957

Preferred environment: forest; overmature and senescent evergreen oak forest of *Q.ilex* and *Q.suber*; also recorded from thermophilous *Q.pubescens* forest. **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*, *Euphorbia*. **Flight period:** beginning of May to mid July. **Larva:** not described. **Range:** southern France, Italy, Austria, Hungary, Roumania, Greece, Crete and parts of the former Yugoslavia (Croatia, Macedonia, Serbia); southern parts of European Russia and on into Turkey, Azerbaijan and Armenia. **Determination:** Reemer et al (2005).

Myolepta obscura Becher, 1882

Preferred environment: forest; alluvial softwood forest with overmature and senescent *Populus* and riparian *Fraxinus* forest, including along temporary streams. **Adult habitat and habits:** on hot days both sexes visit damp sand at the edge of forest streams, to drink, in dappled sunlight. **Flowers visited:** *Photinia*, *Sorbus torminalis*. **Flight period:** end of April to end of May. **Larva:** 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). This species should be regarded as threatened at European level. **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.

Myolepta potens (Harris), 1780

Preferred environment: forest; mesophilous *Fagus*, thermophilous *Quercus* (*Q.pubescens*) 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*. **Flight period:** mid May/beginning July. **Larva:** 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. 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). **Adult habitat and habits:** no data. **Flowers visited:** "various yellow flowers" (Reemer et al, 2005). **Flight period:** May/June. **Larva:** not described. **Range:** Turkey, Azerbaijan, Iran. **Determination:** Reemer et al (2005). This species is very similar to both *M.dubia* and *M.potens*.

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. **Larva:** 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.

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. **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 and on to the Caucasus. **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). 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). **Larva:** 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*.

***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. **Larva:** 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. **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 species is illustrated in colour by Bartsch et al (2009b) and Torp (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 bank side). **Flowers visited:** umbellifers; *Alisma plantago-aquatica*, *Myosotis palustris*, *Ranunculus*, *Rubus*, *Stachys*, *Stellaria*, and *Taraxacum* (see Duty, 1995). **Flight period:** beginning May/September, with a peak in June. **Larva:** features of the larva and puparium are described and figured by Kuznetsov 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. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (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. **Larva:** 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. 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 the upper zone of *Fagus/Picea* 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. **Larva:** 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. **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. 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. **Larva:** 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.

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). **Larva:** figured in colour by Bartsch et al (2009a); 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*). **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. The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). Kassebeer (2002) details differences between *N.podagrica* and the closely-related *N.balearensis*.

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. **Larva:** not described. **Range:** Turkey. **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).

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. **Larva:** 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. However, the figure of the facial profile of the lectotype of *N.petsamoensis*, provided by Andersson (1966), does not accord with this description. In that figure the face of *N.petsamoensis* projects no more than does the face of *N.tenur*. Andersson (l.c.) provides no information on whether there is a post-metacoxal bridge present. However, Hippa (1967) states clearly that there is no post-metacoxal bridge present in this specimen and Tore Nielsen (pers.comm.) concurs. Bartsch et al (2009) also state that there is no post-metacoxal bridge in *N.chalybea*. It has to be concluded that *N.subchalybea* of Violovitsh (1986) is not the same species as *N.subchalybea* Curran. 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. Additional features of *N.subchalybea* mentioned by Andersson (1966) are that the frons of the (female) lectotype is very broad (his figure shows that it is noticeably wider than the maximum width of an eye, from above) and both he and Hippa (1967) show that the third antennal segment is elongate, approximately twice as long as its maximum depth. In both sexes, pale marks on

the abdominal tergites are apparently absent. Hippa (1967) states that the hind femora are pale only at the base in the male, but may be pale at both base and tip in the female. With this combination of characteristics, the female of *N.subchalybea* would seem most likely to be confused with that of *N.meticulosa* (Scop.), among European species. The wider frons of *N.subchalybea* should help to separate them. The males of *N.subchalybea* could probably be most easily confused with males of *N.geniculata* (Mg.). The terminalia of these two species are rather similar, but nonetheless distinct. *N.subchalybea* is figured in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

Neoscia tenur (Harris), 1780

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*, *Cicuta virosa*, *Filipendula ulmaria*, *Potentilla erecta*, *Ranunculus*, *Salix repens*. **Flight period:** end April/September, with peak June/July. **Larva:** 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 and European parts of Russia and on through most of Siberia. **Determination:** Barkemeyer & Claussen (1986), who figure the male terminalia. The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994).

Neoscia unifasciata (Strobl), 1898

Preferred environment: wetland; beside streams in unimproved, humid pastures and clearings, 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. **Larva:** undescribed. **Range:** yet to be established; known at present from Germany, the Netherlands, Belgium, France (Jura), Switzerland, Austria and 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*.

NEOCNEMODON: see *HERINGIA*

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*. The most comprehensive of existing keys to European *Orthonevra* species is that of van Veen (2004), which, however, does not include the species *O.gemmula* Virolvitsh, the two species *O.auritarsis* and *O.shusteri* described by Bradescu (1992, 1993) and *O.montana* described by Vujic (1999b).

Orthonevra auritarsis Bradescu, 1992

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** 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.

Orthonevra brevicornis (Loew), 1843

Preferred environment: forest/wet woodland; standing-water bodies and flushes within acidophilus *Quercus* forest, humid *Pinus sylvestris* forest and wet *Salix* woodland; occasionally in spring and flush areas in heath or unimproved grassland. **Adult habitat and habits:** small open areas within forest; **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:** umbellifers; *Cornus*, *Crateagus*, *Malus*, *Pyrus communis*, *Ranunculus*, *Rorippa*, *Salix*. **Flight period:** May/beginning July, with peak at the beginning of June. **Larva:** described and figured by Maibach and Goeldlin (1994); illustrated in colour (apparently from a preserved specimen) by Rotheray (1994). Nötzold (2000) records collection of an individual of this species from an emergence trap installed in a reed bed. **Range:** southern Finland and Denmark south to northern France (Brittany); from Britain (England) eastwards through parts of central Europe (Netherlands, Belgium, Germany, Poland) into European parts of Russia, the Caucasus and western Siberia. **Determination:** Bartsch et al (2009b); van Veen (2004); van der Goot (1981) figures the male terminalia. There is a long, recurving, fragile, bristle-like process tipping the aedeagus in this and some other *Orthonevra* species. This is easily broken off and is missing from van der Goot's (1981) illustration of the male terminalia. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994). This insect is inadequately differentiated from related species in existing keys. Van Veen's (2004) key is confusing in respect of this species, describing its third antennal segment as "circular, as long as wide", while figuring this feature once (l.c. Fig. 520) as more-or-less circular and once (l.c. Fig. 523) as longer than wide (i.e. deep). The latter figure (l.c. 523) provides a truer representation of the correct shape of the third antennal segment of *O. brevicornis*. The male of *O. brevicornis* is virtually indistinguishable from the males of *O. incisa* and *O. plumbago*, except in features of the male terminalia. *O. brevicornis* and *O. plumbago* can be found in flight together, in the field. For separation of the males, see *O. plumbago* species account.

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. **Larva:** 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). The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

Orthonevra erythrogonia (Malm), 1863

Preferred environment: wetland, pool edge fen/fen carr. **Adult habitat and habits:** no data. **Flowers visited:** *Caltha*, *Ranunculus acris*, *R. repens*, *Taraxacum*. **Flight period:** mid May/beginning July. **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; Siberia to Kamchatka; Mongolia. **Determination:** Bartsch et al (2009b); van Veen (2004); van der Goot (1981) figures the male terminalia; van Veen (2004). Bartsch et al (2009b), Haarto & Kerppola (2007) 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. **Larva:** 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).

Orthonevra gemmula Violovitsh, 1979

Preferred environment: small, open areas with oligotrophic/mesotrophic flushes/*Juncus* marsh in thermophilous *Quercus* (*Q.cerris*, *Q.pubescens*) forest (A.Vujic, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Larva:** not described. **Range:** so far known only from western Siberia and Serbia. **Determination:** Vujic (1999b) who figures the male terminalia.

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 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. **Larva:** not described, but almost certainly associated with springs and wet flushes. **Range:** from northern Norway south to Belgium; 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*. The adult of *O.geniculata* is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994).

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; *Frangula alnus*, *Potentilla*, *Prunus*, *Ranunculus*, *Rosa rugosa*, *Sorbus aucuparia*. **Flight period:** mid April/beginning August; mid June/end July at higher altitudes/more northerly latitudes. **Larva:** 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-genital 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*. The adult insect is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007) and Torp (1994).

Orthonevra montana Vujic, 1999

Preferred environment: forest/freshwater; by flushes and close to brooks above 1000m in open *Picea/Pinus* forest (in the Balkans - Vujic, 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.Vujic, pers.comm.). **Flowers visited:** white umbellifers, *Ranunculus* (Vujic, 1999b). **Flight period:** mid May/end July (Vujic, 1999b). **Larva:** not described. **Range:** Balkans (Bosnia-Herzegovina, Greece, Macedonia, Montenegro, Serbia). There is also a record from the Czech Republic

(Bartak and Vujić, 2004). **Determination:** Vujic (1999b), who figures the male terminalia and provides features for distinguishing the male of this species from the closely similar *O.onytes* (as *O.tristis*).

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. **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 Pyrenees 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; through Siberia to the far east; China. **Determination:** Bartsch et al (2009b); van Veen (2004); van der Goot (1981) figures the male terminalia. The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) 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). **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); Seguy (1961). This is probably the same species as *O.tristis* Loew, which has been largely ignored in the literature, since being wrongly synonymised by Becker (1921). However, until and unless examination of the type material of *O.tristis* confirms the synonymy of *O.onytes*, it is appropriate to retain use of *onytes*, since the concept of that taxon, as employed here, is based on type examination. Seguy'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. Vujic (1999b) provides figures of the male terminalia of this species (as *O.tristis*) and the closely-related *O. montana* and gives other, non-genitalic features for separating them. The females of these two species cannot be reliably distinguished at present.

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. **Larva:** not described. **Range:** southern Finland, Latvia, Lithuania, Poland, Germany, Czech Republic, Switzerland, Slovakia, Italy, Hungary, Roumania, Bulgaria, Moldova, European Russia. **Determination:** van der Goot (1981), who follows Stackelberg's (1953) interpretation of this species and reproduces Stackelberg's (1953) figure of the male terminalia. The male of *O.plumbago* is almost indistinguishable from the male of *O.brevicornis*, except in features of the terminalia, and these two species can occur in flight together. There is a small difference in the character of the mesoscutal hair covering in the males of these two species, which can be used to help separate them. 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. According to Bartsch et al (2009b), in the female of *O.plumbago* “the hind margin of tergite 5 is with a sharp-edged ridge”. Tergite 5 in *O.plumbago* is also almost divided into two halves by a narrow median incision, extending from the hind margin for more than 50% of the median length of the tergite, judging from the figure provided by Haarto and Kerppola (2007). In the latter feature, the female of *O.plumbago* would seem to closely resemble the female of *O.incisa*, but differs from the female of *O.frontalis*, in which the hind margin of tergite 5 is shallowly concave, the concavity taking the shape of a wide, inverted V. In *O.brevicornis* the posterior margin of tergite 5 is shallowly curved, almost straight.

Orthonevra shusteri Bradescu, 1993

Preferred environment: along streamlets (Bradescu, 1993). **Adult habitat and habits:** no data. **Flowers visited:** *Ranunculus* (Bradescu, 1993). **Flight period:** April. **Larva:** not described. **Range:** Roumania. **Determination:** Bradescu (1993), who figures the male terminalia. Antennal segment 3 is in this species very square-ended. The female remains undescribed.

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); *Scambus nigra*, *Viburnum opulus* (H.Bartsch, pers.comm.); *Frangula alnus* (Tolsgaard and Bygebjerg, 2006); white umbellifers, *Caltha*, *Crepis*, *Rosa canina* (Bartsch et al (2009b)). **Flight period:** mid June/July. **Larva:** 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*. The male is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

Orthonevra tristis - see under *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 eristoloides (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. **Larva:** not described. **Range:** Transcaucasus (Armenia), northern Turkey and the Lebanon. **Determination:** according to Thompson (1975) and Peck (1988), *flavipes* is a synonym of *eristoloides* (Portschinsky), and is treated as such here. Thompson (l.c.) redescribes *P.eristoloides* 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.eristoloides* have identical male terminalia and suggests they may well be no more than colour varieties of one species.

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-Garcia (1986), Marcos-Garcia & Rojo (1994), Simic (1986), Stanescu (1977, 1981, 1991, 1992) and Vujic 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! Vujic 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.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*

A Eye hairs arranged in 3 more or less vertical stripes of contrasting colour; scutellum usually partly yellow or reddish at apex *P. Paragus* Latreille

B Eye hairs of nearly uniform colour, not forming stripes of contrasting colour; scutellum entirely black *P. Pandasyophthalmus* Stuckenberg

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. **Larva:** not described. **Range:** Greece (?), Turkey, Iran, . 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. Vujic 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.

Paragus absidatus Goeldlin, 1971

Preferred environment: open ground; unimproved, calcareous and non-calcareous alpine/subalpine grassland 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.). **Flight period:** mid June/end July. **Larva:** 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.

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; *Ranunculus*, *Sambucus ebulus*, *Veronica*. **Flight period:** June/October, with a peak in September. **Larva:** described and figured by Goeldlin (1974) from larvae collected on *Cirsium arvense*; also found on *Carduus* and *Onopordon* by Marcos-Garcia (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-Garcia (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 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. 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. **Larva:** 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.

Paragus ascoensis Goeldlin & Lucas, 1981

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/May and July/August. **Larva:** 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 (1981) and Vujic et al (1998).

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. **Larva:** not described. **Range:** the identity of European specimens referred to this species is uncertain and the occurrence of *P.atlasi* in Europe requires confirmation. At present, *P.atlasi* is only certainly known from N Africa (Morocco). **Determination:** Claussen (1989), who figures the male terminalia.

Paragus azureus Hull, 1949

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** February/March (Aden); July (Turkey). **Larva:** no data. **Range:** Turkey (*P.azureus* ssp. *scrupens* Stuckenberg: see Hayat and Claussen, 1997), Armenia, Israel, Egypt, Aden 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 *P.serratus* group, and as such has deep serrations along the posterior margin of the scutellum. It is closely similar to *P.crenulatus* Thomson, which also reaches the south-western edge of Asia, but which is not differentiated from *P.azureus* in any key. Stuckenberg (1954) figures the male terminalia of *P.crenulatus*. *P.faesi* van de Weyer, described from Greece, is the only member of the *P.serratus* group known from continental Europe (see under *P.faesi*).

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. **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; N America. **Determination:** Goeldlin (1976), Bradescu (1991), who figure the male terminalia. 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. Bartsch et al (2009a) provide a coloured illustration of the adult male.

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:** no data. **Flight period:** May to September, with peaks in May, July and September. **Larva:** not described. **Range:** southern France, the former Yugoslavia, Roumania; Israel; asiatic Russia; Kyrgyzstan; Turkmenistan; Tajikistan. **Determination:** Stanescu (1992), Vujic 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. Vujic 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.antionettae* 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

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:** *Scabiosa*. **Flight period:** May/August. **Larva:** undescribed. **Range:** Spain, southern France, Italy, Austria, Hungary, parts of the former Yugoslavia; Roumania, parts of southern Russia, the Ukraine and on into Asia to Tadjikistan 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.

Paragus coadunatus Rondani, 1847

Preferred environment: open ground; thinly vegetated dry grassland and field margins; gardens. **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. **Larva:** not described. **Range:** Balearic Is, Canary Is Sicily, Malta, Madeira, Turkey (Hayat & Claussen, 1997), N Africa (Morocco: Claussen & Hauser, 1990). **Determination:** Vujic et al (1998), who figure the male terminalia. Females of this species remain indistinguishable from those of related species. A coloured photo of the male is provided by Smit et al (2004).

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:** no data. **Flight period:** April. **Larva:** not described. **Range:** Italy, the Ukraine, Cyprus, Turkey and on to N Africa and the Afrotropical region; asiatic Russia; Iran; Kazakstan; Uzbekistan; Kyrgyzstan; Tajikistan; China. **Determination:** Goeldlin (1976), who figures the male terminalia.

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. **Larva:** 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; asiatic Russia. **Determination:** Simic (1986), Speight and Chandler (1995), Vujic et al (1998). As yet, this species may only be distinguished from *P.tibialis* in the male sex. In both sexes it shares with *P.tibialis* the feature of having entirely pale-haired abdominal tergites, so it is immediately distinguishable from *P.haemorrhous* Mg. However, it 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 Vujic et al (1998). The latter authors provide the most complete set of figures. 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). 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*.

Paragus faesi Van de Weyer, 2000

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** September. **Larva:** 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), 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 with male terminalia closely similar to those of *P.faesi*.

Paragus finitimus Goeldlin, 1971

Preferred environment: dune grassland and dry, unimproved, permanent pasture. **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. **Larva:** undescribed. **Range:** in Europe known from southern Norway, Sweden and Finland, Denmark, Netherlands, 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. 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* (Bagnée (1998)). **Flight period:** end May/end August. **Larva:** 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 (Vujic et al, 1999b).

Paragus glumaci Vujic, Simic & Radenkovic, 1999

Preferred environment: open ground/wetland; wetlands and seasonally-flooded coastal grassland and submediterranean lake shores, near thermophilous *Quercus* forest and maquis (A.Vujic, pers.comm...). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Macedonia, Montenegro. This species should be regarded as threatened at the European level (Vujic et al, 2001). **Determination:** Vujic 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.

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). **Larva:** aphid feeding on various herbaceous plants, including some crops (at least in southern Europe), such as *Beta*, *Cynara* and *Vicia* species (Rojo and Marcos-Garcia, 1998); described and figured by Goeldlin (1974), from a larva collected on *Knautia*. The larva of this species is also illustrated in colour (from a preserved specimen) by Rotheray (1994) and (from living material) by Bartsch et al (2009a)... The larva described by Dixon (1960) as that of *P.tibialis* (Fall.) is the larva of *P.haemorrhous*. **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 Vujic 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*. The adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994).

Paragus hyalopteri Marcos-Garcia & 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. **Larva:** larval biology indicated by Marcos-Garcia and Rojo (1994) and Rojo and Marcos-Garcia (1998); feeds on aphids on fruit trees of the genus *Prunus* and on *Arundo* and *Phragmites*. **Range:** Spain; Kyrgyzstan; Tajikistan; Uzbekistan. **Determination:** Marcos-Garcia 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*.

Paragus kopardagensis 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. **Larva:** not described. **Range:** Turkey; European Russia (Caucasus). **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.

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. **Larva:** not described. **Range:** Germany, Italy, Greece, Montenegro, Serbia, Macedonia. **Determination:** Vujic 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*.

Paragus medeae Stanescu, 1991

Preferred environment: inland/estuarine sand dunes (Stanescu, 1992). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/September. **Larva:** not described. **Range:** Roumania. **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.

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/July. **Larva:** 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.

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*, *Matricaria*, *Potentilla erecta*, *Stellaria*, *Thymus*, *Trientalis*, *Veronica*. **Flight period:** May to September and end March/October in southern Europe. **Larva:** described and figured (under the name *P.majoranae*) by Goeldlin (1974), who found larvae on legumes, *Hedera* and *Prunus*. Rojo and Marcos-Garcia (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*. **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 and southeast to Turkey. **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*. The adult insect is illustrated in colour by Torp (1994) (as *P.majoranae*) and Bartsch et al (2009a).

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 crantzii*, *Rhododendron*, *Saxifraga*, and *Vaccinium*. **Flight period:** mid-June/July and on into August at higher altitudes/more northerly latitudes. **Larva:** 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. The adult male is illustrated in colour by Bartsch et al (2009a)

Paragus quadrfasciatus Meigen, 1822

Preferred environment: open ground/forest; dry, unimproved, sparsely-vegetated grassland, with or without dry scrub and open evergreen oak (*Q.ilex/Q.suber*) forest. *P.quadrfasciatus* may also occur in various cultivated situations, including cabbage crops, waste ground, hedge margins and suburban gardens. **Adult habitat and habits:** flies low among ground vegetation; as easy to detect by sweeping as by direct observation. **Flowers visited:** yellow composites. **Flight period:** May/September. **Larva:** described and figured by Goeldlin (1974); recorded from among aphids on various, mostly low-growing, plants: *Centaurea*, *Cichorium*, *Leontodon autumnalis*, *Onopordon*, *Rubus* and *Sonchus*. According to Marcos-Garcia (1983), development from the time an egg is laid to hatching of the puparium takes only 4 weeks in this species. Dussaix (2005b) observed that the larva can overwinter. **Range:** from northern France (Brittany) 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; European parts of Russia eastwards through Kazakhstan, Tajikistan etc.to the far east; northern China, Korea, Japan. **Determination:** Goeldlin (1976), who figures the male terminalia, plus Marcos-Garcia & Rojo (1994). This species is extremely similar to *P.hyalopteri*, Marcos-Garcia & 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.

Paragus romanicus Stanescu 1992

Preferred environment: open ground/forest; herb-rich temporary clearings in thermophilous *Quercus* and *Fagus* forest; thermophilous forest fringes and dry, open, unimproved grassland. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/June. July at higher altitudes. **Larva:** no data. **Range:** from central France (Vendée) through central Europe (Alps) to Roumania and south, in mountain ranges, to the Mediterranean, Sardinia and Turkey. **Determination:** Stanescu (1992), who figures the male terminalia. The female of this species is as yet undescribed. The male can only be satisfactorily distinguished from other members of the *bicolor* group by features of the male terminalia.

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. **Larva:** not described. **Range:** Corsica, Sardinia, Sicily. **Determination:** Goeldlin & Lucas (1981) and Vujic et al (1999). The male terminalia are figured in both of these publications, but this species has yet to be included in any key. Vujic 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*.

Paragus strigatus Meigen, 1822

Preferred environment: open ground/scrub/cultures; 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-Garcia, 1983). **Flight period:** April/September. **Larva:** not described. **Range:** Mediterranean basin, from Portugal round to Morocco (Spain, southern France, Italy, Sicily, 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.

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:** *Jasione montana*, *Potentilla*, *Salix repens*. **Flight period:** early May/August, and from April to the end of September in southern Europe. **Larva:** not described, but information on the biology of the aphid-feeding larva is provided by Marcos-Garcia (1981), who reared the species from eggs and larvae collected from *Carduus* and *Onoropodon*. Torp (1984) also reports finding larvae on *Hypochoeris*. Rojo and Marcos-Garcia (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-Garcia, 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 Vujic 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). The adult insect is illustrated in colour by Torp (1984, 1994) and van der Goot (1986).

Paragus vandergooti Marcos-Garcia, 1986

Preferred environment: forest/scrub; tall-herb open areas in *Quercus ilex* forest and *Cistus florida/Quercus pyrenaica* maquis (M^a-A. Marcos-Garcia and A.Ricarte, pers.comm.); Mediterranean riparian ash forest (Ricarte-Sabater et al, 2008). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/September. **Larva:** not described. **Range:** southern France, Portugal, central Spain; N Africa (Morocco). **Determination:** described by Marcos-Garcia (1986); Claussen (1989) figures the male terminalia.

PARASYRPHUS

This genus has appeared under various names in recent literature: *Mesosyrphus* (Dusek and Laska, 1967, Hipa, 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. **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; through Siberia to the Pacific coast (Kuril Isles). **Determination:** See Key provided in StN Keys volume. The male terminalia are figured by Hipa (1968b). 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:** *Rubus chamaemorus* (T. Nielsen, pers.comm.), *Salix lapponum* (Bartsch et al, 2009). **Flight period:** June/July. **Larva:** 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*. 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. **Larva:** not described. **Range:** uncertain, due to confusion with *P.tarsatus*, but confirmed from the Alps (France, Switzerland) the Jura (Switzerland), Kirghizia 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 100mm) rather larger. Mutin (19990) figures the male terminalia.

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*, *Achillea*, *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. **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). The adult insect is illustrated in colour by Torp (1994).

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. **Larva:** 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). The adult insect is illustrated in colour by Torp (1994).

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. **Larva:** 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). The species is illustrated in colour by Torp (1994).

Parasyrphus nigratarsis (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. **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.nigratarsis* 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.nigratarsis*. 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 Hipa (1968b) and Vockeroth (1969). The adult insect is illustrated in colour by 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.Harsto, 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). **Flight period:** mid May (peak) to July. **Larva:** 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. **Determination:** See key provided in StN Keys volume. Mutin (1990) figures the male terminalia. This species closely resembles *P.malinellus*. 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 April/mid June and on to mid July at higher altitudes. **Larva:** undescribed, but 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 to 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). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

Parasyrphus relictus (Zetterstedt), 1836

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Larva:** not described. **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.

Parasyrphus tarsatus (Zetterstedt), 1836

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. **Larva:** not described. **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 occurs in the Nearctic from Greenland (Haarto and Koponen, 2003) and Alaska south to mountainous parts of Colorado and New Hampshire (Vockeroth, 1992). **Determination:** See Key provided in StN Keys volume; Bartsch et al (2009a). Mutin (1990) figures the male terminalia. This species closely resembles *P.kirghizorum* but is generally rather smaller (body length less than 10mm). 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*. 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*, *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. **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). The species is illustrated in colour by 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. **Larva:** 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 adult insect is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007), Stubbs and Falk (1983) and Torp (1994). The male terminalia are figured by Reemer (2000a).

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.). **Flight period:** April, June. **Larva:** undescribed. **Range:** Portugal, 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*.

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. **Larva:** 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. The adult insect is illustrated in colour by Bartsch et al (2009b), Torp (1994). According to Reemer (2000a), *P.frutetorum* is extremely similar to *P.crococoronatus*.

Parhelophilus sibiricus (Stackelberg), 1924

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May. **Larva:** 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 provides a black and white illustration of the adult insect and figures its terminalia.

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*, *Sorbus aucuparia*. **Flight period:** May/August (plus April and September in southern Europe), with peak in June/July. **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*. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

PELECOCERA

There are three European species of *Pelecocera* recognised in Peck (1988). Since then, the practice of regarding *Chamaesyrrhus* 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 *Chamaesyrrhus* as a separate genus seems to have little justification or utility. Its European species are thus included here under *Pelecocera*. Ståhls et al (2004) also conclude that one European species until now consigned to *Pelecocera*, *P.latifrons* Loew, does not belong to the genus *Pelecocera*. However, they neither consign it elsewhere nor erect a new genus to contain it, so it is listed here as a *Pelecocera* species. In general, the European species of *Pelecocera* (including *Chamaesyrrhus*) are greatly in need of revision, with the status of various taxa being at present uncertain.

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. **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. **Larva:** not described, but apparently phytophagous. **Range:** northern and central Norway; Sweden, northern, central and southern Finland, Britain (northern Scotland), Northern France, European Russia (St.Petersbourg region), Germany (Bavaria). **Determination:** Bartsch et al (2009b). Stubbs and Falk (1983) illustrate the adult male and female in colour. The male is figured in colour by Bartsch et al (2009b).

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. 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. **Larva:** not described, but apparently phytophagous. The morphology of the chorion of the egg is figured by Kuznetsov (1988). **Range:** southern Fennoscandia south to the Mediterranean; Spain (inc. Canary Isles) east through parts of central and southern Europe into European parts of Russia. **Determination:** Bartsch et al (2009b). There is considerable confusion concerning the identity of southern European species related to *C.lusitanicus*, and this species has certainly been confused with others. There is need for a European revision of the genus. Bartsch et al (2009b), Haarto & Kerppola (2007) and Torp (1994) provide coloured illustrations of the adult 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. **Larva:** not described. **Range:** this species is endemic to the Canary Isles. **Determination:** this species was redescribed by Baez (1977), under the name *Chamaesyrrhus lusitanicus* Mik, but subsequently reinstated as a separate species in the list of Spanish Syrphidae (Marcos-Garcia et al, 1998), without comment.

Pelecocera pruinosomaculata Strobl, 1906

Preferred environment: open ground/forest; Mediterranean coastal dunes and heath with scrub *Pinus*; 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). **Flight period:** April/May and September. **Larva:** not described. **Range:** uncertain due to confusion with related species, but known from Spain, southern France, southern Italy and Greece. **Determination:** Sack (1928-32). The 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.).

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. **Larva:** undescribed, but apparently phytophagous. **Range:** northern Norway and Sweden, Finland, Britain (Scottish highlands), Belgium (extinct), France (Aude, Hautes Alpes), Germany, Poland, Czech Republic, Switzerland, Liechtenstein, Italy, parts of European Russia and the Caucasus mountains. **Determination:** Bartsch et al (2009b). 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*, *Cirsium palustre*, *Hieracium*, *Hypochoeris*, *Leontodon*, *Narthecium*, *Potentilla erecta*, *Ranunculus*, *Sedum acre*, *Teucrium*. **Flight period:** June/September, plus April/May in southern Europe. **Larva:** not described. The morphology of the chorion of the egg is figured by Kuznetsov (1988). **Range:** from Fennoscandia south to Iberia; from Britain (southern England) eastwards through much of Europe (including Italy, northern parts of the Balkans) into European parts of Russia and the Caucasus; through Siberia to Cis-Baikal. **Determination:** Bartsch et al (2009b). The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

PIPIZA

The European species of the genus *Pipiza* are badly in need of revision - arguably more so than the species of any other syrphid genus. At present species concepts in this genus are uncertain and the number of European species cannot be decided, so there is no way in which a stable nomenclature can be established, even if the human and financial resources were available to conduct a revision of the large number of types in existence. For these reasons, most of the European *Pipiza* "species" referred to in recent literature are not covered here. The species interpretations used here follow van der Goot (1981) and Speight (2002b).

Pipiza accola Virolvitsh, 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.). **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. **Larva:** not described. In Fennoscandia this species seems to be closely associated with *Prunus padus*. **Range:** southern Norway, Sweden and Finland; Germany (Nieder Sachsen, Baden-Württemberg) and Siberia. **Determination:** 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. *P. accola* is very similar to *P. luteitarsis*. In the male of *P. accola* the face is almost parallel-sided from the level of the antennae down to the ventral extremity of the eyes (in anterior view), whereas in the male of *P. luteitarsis* it widens distinctly, downwards. In the female, abdominal sternite 5 is noticeably wider than long, whereas it is longer than wide in *P. luteitarsis*. These features of the female abdomen are figured by Bartsch et al (2009b) and Wolff (1998). The male terminalia are also figured by Mutin (2002). The male and female of *P. accola* are figured in colour by Bartsch et al (2009b).

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. **Larva:** described and figured by Goeldlin (1974), from larvae collected on yellow gentian... **Range:** uncertain, due to confusion with related species, but as interpreted here in much of the Atlantic zone and southern parts of Scandinavia. **Determination:** Bartsch et al (2009b). At present, *P. austriaca* cannot be reliably distinguished from related species in much of Europe. The limited interpretation of this species adopted here is based on Speight (2002b).

Pipiza bimaculata 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. **Larva:** undescribed, but Dussaix (2005b) reports rearing this species from larvae collected on *Prunus avium*, with a leaf-rolling aphid. **Range:** uncertain, due to confusion with other species, but known from various parts of the Atlantic zone, including Britain and Ireland and probably occurs more widely. **Determination:** in the restricted sense that this name is applied here, females of *P. bimaculata* can be determined using the key provided by Speight (2002). Identification of males is more problematic.

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. **Larva:** described and figured by Dusek and Laska (1959), from larvae found feeding on gall-making aphids of the genus *Pemphigus*, on *Populus*. The larval biology is described by Rojo and Marcos-Garcia (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. **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:** specimens in which the tarsomeres are entirely yellow may be separated from other *Pipiza* species using the keys in Verlinden (1994). However, specimens in which the tarsi are partially darkened cannot be reliably separated from other species, especially the taxon usually referred to as *P. noctiluca* (L.), using existing keys. The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

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). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April. **Larva:** not described. **Range:** Serbia. The information supplied by Vujić et al (2008) suggest that this European localised endemic has to be regarded as a threatened species. **Determination:** Vujić et al (2008), who 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.

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:** *Euphorbia*, *Prunus* spp., *Ranunculus*, *Tussilago*. **Flight period:** mid April/end May, with occasional later records. **Larva:** undescribed, but 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 (2008) provide a key distinguishing *P. luteitarsis* from other known European species of the *luteitarsis* group and also figure the male terminalia. This species can be separated from others occurring in western Europe by the lack of a pair of apico-ventral ridges on the hind femora, which are present in the other species, except for *P. accola*, *P. luteibarba* and *P. quadrimaculata* (Panz.). 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. luteiventris* 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* may be reliably distinguished from *P. accola* and *P. luteibarba* by features of the terminalia.

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; *Crataegus*, *Filipendula*, *Ranunculus*, *Rosa*, *Stellaria*, *Taraxacum*. **Flight period:** May/beginning July and end July/beginning September, with peaks in June and August. **Larva:** aphid-feeding on bushes and shrubs up to 3m from the ground. **Range:** uncertain, due to confusion with other species but, as interpreted here, known from much of the Atlantic zone and Scandinavia. **Determination:** at present, *P.noctiluca* cannot be reliably distinguished from related species in much of Europe. The limited interpretation of this species adopted here is that of Speight (2002b), who distinguishes it from the other *Pipiza* species occurring in Ireland. It remains uncertain to which taxon this name should be applied and interpretations vary from author to author. The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

***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. **Larva:** 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 Kuznetsov (1988). **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). Also, this species supposedly occurs in north America. **Determination:** Vujić et al (2008) provide a key 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. The female of *P.quadrimaculata* is more difficult to determine, but has an unusually short and broad abdomen - tergite 4 is fully 3x as wide as long. 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) has 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. *P.bayburtica* Claussen & Hayat, *P.brevis* Lucas, *P. caucasica* Skufjin, *P.curvitibia* Stackelberg, *P.lyneborgi* Torp, *P.siciliana* Nielsen & Torp and

P.zloti Vujic are all recorded either from southern Europe or its periphery, and are missing from Verlinden's (1999) key. 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; mesophilous and humid *Fagus* forest and *Castanea* forest; also unimproved, alpine 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. **Larva:** undescribed, but found by Dussaix (1997a) among the roots of *Heracleum*, with aphids tended by ants. **Range:** from Finland south to southern Portugal and east through central Europe to Hungary and round the Mediterranean to the former Yugoslavia and Turkey. **Determination:** 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. The adult insect is illustrated in colour by Torp (1994). Maibach et al (1992) established the synonymy of *flavescens* (Goeldlin) with this species.

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. **Larva:** not described. **Range:** north-east Turkey. **Determination:** Claussen and Hayat (1997a), who figure the male terminalia. In this species, the tarsi of the female are entirely yellow.

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. **Larva:** 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.

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. **Flowers visited:**

white umbellifers (A.Vujic, pers.comm.). **Flight period:** June/July. **Larva:** not described. **Range:** Austria, Belgium, Montenegro, Serbia, Slovenia, Switzerland. **Determination:** Verlinden (1999a). The male terminalia are figured by Vujic (1997) and Verlinden (1999a). The female of this species is described by Vujic (1997).

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-Garcia 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. **Larva:** 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:** Lucas (1977), who figures the male terminalia.

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. **Larva:** not described. **Range:** France (Alps) and central (Apennines) and southern Italy. **Determination:** Verlinden (1999a), who figures the male terminalia.

Pipizella cantabrica Claussen, 1991

Preferred environment: open ground; dry, unimproved grassland. **Adult habitat and habits:** no data. **Flowers visited:** umbellifers. **Flight period:** May/June. **Larva:** not described. **Range:** northern Spain, northern Italy. **Determination:** Verlinden (1999a) who figures the male terminalia.

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). **Larva:** not described. **Range:** Caucasus (Georgia) and north-east Turkey. **Determination:** 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.

Pipizella certa Violovitsch, 1981

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Larva:** not described. **Range:** Sweden, Finland and western Siberia (Altai). **Determination:** 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). 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 curvibibia 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. **Larva:** not described. **Range:** north-east Turkey and the Transcaucasus (Azerbaijan, Armenia). **Determination:** 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.

Pipizella divicoi (Goeldlin), 1974

Preferred environment: open ground/scrub; well-drained, dry, unimproved grassland with scrub; unimproved, dry montane pasture and garrigue. Sheep-grazed, unimproved, dry grassland with low, scattered, grazed scrub of *Prunus spinosa*, *Crataegus* or *Rosa* spp. is characteristic for this species. 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:** May/June and July at higher altitudes. **Larva:** 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 and European parts of Russia and on through Siberia to the Pacific coast; Mongolia. This species disappears with introduction of irrigation to its dry grassland habitat. **Determination:** 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.

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. **Larva:** not described. **Range:** France (Alps), Italy (Apennines). **Determination:** 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* Skuffin. 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*.

Pipizella lyneborgi Torp Pedersen, 1971

Preferred environment: forest; deciduous forest; thermophilous *Quercus* forest at 850-1300m (M.-A. Marcos-Garcia, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Diploaxis erucoides*, *Quercus rotundifolia*, *Rhamnus*, *Viburnum tinus* (Pérez-Bañón et al, 1996, Rojo & Marcos-Garcia, 1997). **Flight period:** beginning of April/mid May. **Larva:** not described. **Range:** southern Spain. **Determination:** 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.

Pipizella maculipennis (Meigen), 1822

Preferred environment: forest/open ground; dry, unimproved, grassy areas within dry scrub or *Fagus/Pinus* forest. **Adult habitat and habits:** no data. **Flowers visited:** *Cirsium*. **Flight period:** end May/August. **Larva:** not described. **Range:** uncertain, due to confusion with *P.zennegenensis* until recently; known from Britain (southern England), Belgium, France, Switzerland, Italy, Bosnia, Croatia, Macedonia, Montenegro, Serbia, Roumania and Turkey. **Determination:** 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.

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:** no data. **Flowers visited:** no data.

Flight period: June/July. **Larva:** not described. **Range:** southern Germany; Czech Republic, central and eastern Siberia; Mongolia. **Determination:** Verlinden (1999a), who figures the male terminalia.

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. **Larva:** 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). **Determination:** 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.

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 **Larva:** undescribed. **Range:** Netherlands, Belgium, France, Spain (Pyrenees), southern Germany, Switzerland, Austria, Serbia, Roumania. **Determination:** 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-Garcia (1985c) established the synonymy of *microapicalis* Lucas with this species.

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. **Larva:** 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 here 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*.

Pipizella siciliana Nielsen & Torp, 1973

Preferred environment: open ground/cultures; thinly vegetated grassland and orchards (Nielsen & Torp, 1973). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/beginning May (Nielsen & Torp, 1973). **Larva:** not described. **Range:** Portugal and Sicily. According to Vujic (1997), the citation of *P.siciliana* from Roumania by Bradescu (1991) should be referred to *P.zloti*. **Determination:** Nielsen & Torp (1973) and Vujic (1997), who figure the male terminalia. The male terminalia are also figured by Vujic (1997).

Pipizella speighti Verlinden, 1999

Preferred environment: forest/open ground; grassy clearings in montane *Fagus* and *Abies/Picea* forest (A.Vujic 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.Vujic and S.Radenkovic, pers.comm.). **Flight period:** May-July. **Larva:** not described. **Range:** Alps (France, Switzerland, Italy); Balkan high mountains (Serbia, Montenegro) (Radenković *et al*, in prep.). **Determination:** Verlinden (1999), who figures the terminalia and provides diagnostic features and a key distinguishing this species from the closely related *P.viduata*.

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. **Larva:** 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. **Determination:** 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), which detail further species related to *P.viduata*. 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) and Verlinden (1991). 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. **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:** the most comprehensive key including this species is provided by Verlinden (1999a), who figures the male terminalia. 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 alpine zone in the Pyrenees and southern parts of the Alps. **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*. **Flight period:** mid May/end July, with peak in June. **Larva:** not described. **Range:** not yet well-known. From the Netherlands south to northern Spain; from France eastwards into central Europe to Switzerland and Austria. This species disappears with introduction of irrigation to its dry grassland habitat. **Determination:** 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* and by the fact that the abdominal tergites are entirely pale-haired, whereas in *P.maculipennis* they are noticeably partly black-haired.

Pipizella zloti Vujic, 1997

Preferred environment: deciduous forest; open areas within mesophilous *Fagus* forest at 600-800m and thermophilous oak forest (A.Vujic, pers.comm.). **Adult habitat and habits:** settling on leaves and flowers of *Smiranium perfoliatum* in dappled sunlight; flies low among vegetation. **Flowers visited:** yellow umbellifers (*Smiranium perfoliatum*) (Vujic, 1997). **Flight period:** April/May (Vujic, 1997). **Larva:** not described. **Range:** Montenegro, Serbia, Greece, Roumania. **Determination:** Vujic (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.

PLATYCHEIRUS

Peck (1988) lists 36 European species in this genus, and a further 15 species have been added subsequently, making *Platycheirus* one of the largest genera in the continent. 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 three further species, keyed out together by Doczkal et al (2002). 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.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.claussenii*, *P. goeldlini*, *P. meridimontanus* and *P. subambiguus*). Vockeroth and Thompson (1987) indicate that the species previously separated from *Platycheirus* in the genus *Pyrophaena* should be consigned to *Platycheirus*, a practice which has been followed here. Thompson and Rotheray (1998) also regard *Rohdendorfia*, *Spazigaster* and *Syrphocheilosia* as subgenera of *Platycheirus*. The most comprehensive key to determination of European *Platycheirus* species is that provided by van Veen (2004), which appeared prior to publication of Nielsen's (2004) account of *ambiguus*-group species and thus omits the species described by Nielsen (l.c.).

Key to subgenera of *Platycheirus*

1. Wing shorter than abdomen; abdomen broad, or mostly red, or black with 2 pale marks on tergite 3
..... *P. Pyrophaena* Schiner
----- wing longer than abdomen; abdomen narrow, not with such abdominal pattern 2
2. Apical half or more of male front femur with a row of stiff, straight black setae postero-laterally, with the most apical seta longer and strongly curled at its tip *P. Pachysphyria* Enderlein
----- male front femora with different arrangement of setae postero-laterally *P. Platycheirus* Lepelletier and Serville

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. **Larva:** not described. **Range:** Jura (Switzerland), Alps (Switzerland), Apennines (Italy); middle and far-east Asian parts of Russia (Barkalov and Nielsen, 2009). **Determination:** Nielsen (2004), who 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).

Platycheirus aeratus Coquillet, 1900

Preferred environment: open ground; tundra with dwarf *Salix* scrub (Nielsen, 1974). **Adult habitat and habits:** no data. **Flowers visited:** *Carex*, *Eriophorum* (van Steenis, 1998b). **Flight period:** end June/July. **Larva:** 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). The latter authors provide a coloured figure of the adult insect. This species appears in recent European literature as *P.angustitarsis* Kanervo. This synonymy was established by Nielsen (1999).

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 & Decler (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. **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 and European parts of Russia; 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.). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983) and Torp (1994). This species is extremely similar in appearance to the southern European *P.muelleri* and the northern European *P.nigrofemoratus* and *P.urakawensis*. *P.albimanus* can be found on the wing with these species.

Platycheirus altomontis Merlin & 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). **Larva:** undescribed. **Range:** Alps (Italy). **Determination:** Nielsen (2004), who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. The female is undescribed.

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. **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:** Nielsen (2004), who 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). 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 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*, *Taraxacum*. **Flight period:** June/July with records into August. **Larva:** 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 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). 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). 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)**

***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. **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 adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) van der Goot (1986) and Bartsch et al (2009a). The male terminalia are figured by Goeldlin et al (1990).

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. **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). **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*.

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. **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. **Larva:** 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 of the other European species of the *scutatus* group, *P.scutatus*, *P.speighti* and *P.splendidus*. 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). All four *scutatus* group species can be found in flight in montane localities in central Europe, at the same time, and at lower altitudes three of them (i.e. excluding *P.speighti*) can also 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*. 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 brunneifrons Nielsen, 2004

Preferred environment: forest; upper levels of humid *Fagus* forest into the *Picea/Abies* belt and up into unimproved, non-calcareous, alpine grassland; humid *Pinus sylvestris* forest; *Quercus pyrenaica* forest in Iberia (Nielsen, 2004). **Adult habitat and habits:** **Flowers visited:** *Calluna vulgaris* (Hellqvist, 2009).

Flight period: mid June/October (Nielsen, 2004). **Larva:** undescribed. **Range:** Finland, Spain (including the Pyrenees), France (Alps), Switzerland, Austria, Macedonia; in Asia in Magadan and Yakutia etc (Russia); Nearctic (Alaska). **Determination:** Nielsen (2004), who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group; Haarto and Kerppola (2007a), Bartsch et al (2009a). The latter authors provide an illustration of the male in colour.

Platycheirus caesius Nielsen & Stuke, 2004

Preferred environment: open ground; calcareous and non-calcareous, unimproved alpine 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). **Larva:** undescribed. **Range:** mountainous parts of northern Spain; Alps (Switzerland). **Determination:** Nielsen (2004), who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group.

Platycheirus carinatus (Curran), 1927

Preferred environment: open ground; arctic-alpine tundra (T.Nielsen, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Dryas octopetala*. **Flight period:** June/July. **Larva:** not described. **Range:** Lapland (northern Norway, northern Sweden and northern Finland) and high alpine areas in southern Norway; through northern Russia into Siberia; Greenland; in N America from Yukon and northern Canada. **Determination:** Vockeroth (1992), van Veen (2004), Bartsch et al (2009a). In Fennoscandia this species was previously known under the name *P.hirtipes* (see under *P.hirtipes*). 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 cintoensis van der Goot, 1961

Preferred environment: forest; conifer forest; open *Abies* forest with scrub, at c.1600m (van der Goot, 1961). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Larva:** not described. **Range:** Corsica. **Determination:** Dusek and Laska (1982), who provide a key distinguishing this species from others of the *manicatus* group. Van der Goot (1961) provides a black and white photograph of the general appearance of this insect, from above.

Platycheirus claussenii 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). **Larva:** undescribed. **Range:** Alps (France, Switzerland, Austria, Italy); Altai mountains (SE Siberia). **Determination:** Nielsen (2004), who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group.

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; white Umbelliferae; *Caltha*, *Luzula*, *Plantago*, *Polygonum cuspidatum*, *Ranunculus*, *Salix*, *Senecio jacobaea*, *Vaccinium myrtillus*. **Flight period:** April/September. **Larva:** supposedly described and figured by Dixon (1960). Dziocik (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 adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). The male terminalia are figured by Goeldlin et al (1990).

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. **Larva:** not described. **Range:** Germany, the Czech Republic, France (Alps), Switzerland, Northern Italy (Dolomites), 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). 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*.

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. **Larva:** 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*. 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, *Ranunculus*, *Taraxacum*. **Flight period:** May/August, peak in June. **Larva:** 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; 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*. The species is illustrated in colour by Torp (1994).

Platycheirus fasciculatus Loew, 1856

Preferred environment: open ground; sparsely-vegetated, unimproved, non-calcareous subalpine grassland and moraine, from 1800m to above 2000m. (C.Claussen, pers.comm.). **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. **Larva:** not described. **Range:** Alps (Austria, 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.

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, *Plantago*. **Flight period:** May/August with occasional specimens into September, and March/October in southern Europe. **Larva:** described and figured by Rotheray and Dobson (1987) and illustrated in colour by Rotheray (1994), aphid-feeding, on *Carex*, *Phragmites* 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. **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. **Determination:** Speight and Goeldlin (1990). 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 alpine grassland to 2,400m. **Adult habitat and habits:** no data. **Flowers visited:** *Salix* (Nielsen, 2004). **Flight period:** beginning July/beginning August (Nielsen, 2004). **Larva:** no data. **Range:** Finland, Alps (France, Switzerland, Italy); central-asian parts of Russia (Barkalov and Nielsen, 2009); Altai mountains (SE Siberia). **Determination:** Nielsen (2004), who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group; Haarto and Kerppola (2007a), Bartsch et al (2009a). The latter authors provide an illustration of the male in colour.

Platycheirus granditarsus (Foerster), 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*, *Ranunculus*, *Senecio jacobaea*. **Flight period:** end of May/September and occasional specimens in October. **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:** van der Goot (1981). Until recently, this species has been consigned to the genus *Pyrophaena*, which Vockeroth (1990) argues should be included in *Platycheirus*. The adult insect is illustrated in colour by Colyer and Hammond (1951), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

***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. **Adult habitat and habits:** low-flying, among dwarf shrubs and other ground vegetation. **Flowers visited:** *Ranunculus*, *Salix*, *Sedum* (Nielsen, 1972); *Rhodiola rosea* (Bartsch et al, 2009). **Flight period:** end June/mid August. **Larva:** 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). 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*. 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 hirtipes* (Kanervo), 1938**

Preferred environment: arctic-alpine tundra. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Larva:** not described. **Range:** northern parts of European Russia and eastwards through northern Siberia to the Pacific. **Determination:** included in the keys provided by Violovitsh (1986), who also figures features of the male terminalia. It is very probable that *P.hirtipes* is a junior synonym of *P.carinatus* (Curran), but this synonymy does not seem to have been formally established in any publication. *P.hirtipes* records published from northern Norway, Sweden and Finland are now consigned to *P.carinatus*.

***Platycheirus holarcticus* Vockeroth, 1990**

Preferred environment: open ground/forest; taiga, sub-alpine *Betula* forest and dwarf scrub tundra (H.Bartsch and T.Nielsen, pers.comm.). **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). **Flight period:** June/August. **Larva:** 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:** Vockeroth (1992); Bartsch et al (2009a). Van Steenis and Goeldlin (1998) provide a key separating the female from females of other European *peltatus*-group species. This species is also included in the keys provided by van Veen (2004). 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 hyperboreus* (Staeger), 1845**

Preferred environment: wetland; marsh (Vockeroth, 1992). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers (H.Bartsch, pers.comm.), *Ranunculus* (Nielsen, 1998), *Carex* (van Steenis, 1998b). **Flight period:** April/August (N America); June/July (Scandinavia). **Larva:** 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.). 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). It is included in the keys provided by van Veen (2004).

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:** *Crataegus*, *Euphorbia*, *Salix* spp., *Sorbus aucuparia*. **Flight period:** end April/end June. **Larva:** 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) and Turkey; 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).

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. **Larva:** 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). The species is illustrated in colour by Torp (1994). This species is almost indistinguishable from *P.perpallidus* (see under *P.perpallidus*).

Platycheirus islandicus Ringdahl, 1930

Preferred environment: forest; arctic *Betula* forest. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June. **Larva:** not described. **Range:** Iceland. **Determination:** van Steenis and Goeldlin (1998) who redescribe and reinstate the species, which was previously regarded as a synonym of *P.peltatus* (Mg.). *P.peltatus* also occurs in Iceland. *P.islandicus* is included in the keys provided by van Veen (2004) and Bartsch et al (2009a). The latter authors also provide coloured illustrations of the abdomen of the male and female of this species.

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. **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, 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.holarcticus*, *P.nielsenii* and *P.parmatus*. Van Steenis and Goeldlin (1998) provide a key separating the female from females of other European *peltatus*-group species. 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). **Adult habitat and habits:** no data. **Flowers visited:** *Geranium sylvaticum* (Nielsen, 1981); *Caltha*, *Potentilla erecta* (Bartsch et al, 2009). **Flight period:** June/July. **Larva:** not described. **Range:** northern Europe: Norway, Sweden, Finland and into northern Russia (Kola peninsula). **Determination:** Dusek and Láska (1982), van Veen (2004), Haarto and Kerppola (2007a), Bartsch et al (2009a). Nielsen (1998) indicates that Norwegian records previously consigned to *P.complicatus* (Becker) refer to this species. 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. **Larva:** not described. **Range:** uncertain, due to confusion with *P.sticticus* (Mg.), but confirmed from Norway, Finland, Germany, Czech Republic, 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), who also 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.Nielsen pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Geranium sylvaticum* (Nielsen, 1981). **Flight period:** end June/mid August. **Larva:** 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). 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). **Flight period:** end June/beginning August. **Larva:** not described. **Range:** northern Europe: Norway, Sweden, Finland, Siberia; Greenland; in N America from Alaska and northern Canada. **Determination:** 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). 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).

Platycheirus magadanensis Mutin, 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.). **Adult habitat and habits:**

has been swept from *Carex* standing in shallow water (A.Haarto, pers.comm.) **Flowers visited:** no data. **Flight period:** July. **Larva:** not described. **Range:** Finland and eastern Siberia. **Determination:** this species is included in the keys in Haarto and Kerppola (2007a), who also show a diagrammatic representation of the fore leg. The general appearance of the male is shown in the coloured photo provided by those authors. Bartsch et al (2009a) provide a coloured illustration of the adult insect, figure the ventral surface of the fore basitarsus of the male and include the species in their keys.

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*, *Origanum*, *Ranunculus*, *Rosa rugosa*, *Senecio*, *Stellaria*, *Succisa*, *Taraxacum*, *Veronica*. **Flight period:** May/September, with peaks in June and August. **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 and European parts of Russia; 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). The adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch et al (2009a).

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, alpine 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*, *Minuartia*, *Pinguicula*, *Potentilla erecta*, *Ranunculus*, *Rhododendron ferrugineum*. **Flight period:** June/July and July/August in higher altitudes. **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:** Sweden, Finland and 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. **Determination:** van der Goot (1981), Dusek and Laska (1982). 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. **Larva:** undescribed. **Range:** Macedonia; Lebanon. **Determination:** Nielsen (2004), who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. The female of this species remains unknown.

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. **Larva:** 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.

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 sylvaticum*, *Geum rivale*, *Ranunculus*, *Senecio*. **Flight period:** June/September. **Larva:** 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; 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.nielsenii* 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.nielsenii*. 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. **Larva:** 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.nigrofemoratus* is very similar to *P.urakawensis*. 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. **Larva:** not described. **Range:** not yet adequately known, but now recorded from 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, Turkey. **Determination:** *P.occultus* is extremely similar to *P.angustatus*, *P.clypeatus*, *P.europaicus* 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 latter authors also provide coloured figures of the adult insect (male and female). 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. The species is illustrated in colour by Torp (1994).

Platycheirus parmatus Romani, 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. **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. The adult male is illustrated in colour by Bartsch et al (2009a).

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. **Larva:** available 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; 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). The species is illustrated in colour by Torp (1994) and 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.nielsenii* Vockeroth).

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. **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. **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). The adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and 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.

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 alpine grassland. **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. **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 Russia and on to SE Siberia; in N America from Alberta and Ontario. **Determination:** Speight and Goeldlin (1990), Haarto and Kerppola (2007a), Bartsch et al (2009a). 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. **Larva:** not described. **Range:** as yet known only from the Faroes (Jensen, 2001), Scandinavia (northern Norway to the southern tip of Norway, 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). The adult insect is illustrated in colour by 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).

Platycheirus 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. **Larva:** 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:** van der Goot (1981). Until recently, this species was consigned to a separate genus, *Pyrophaena*. Vockeroth (1990) argues convincingly that *Pyrophaena* should be synonymised with *Platycheirus*. The male terminalia are figured by Dusek and Laska (1967).

The adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

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. **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). 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. **Larva:** described and figured by Bhatia (1939), who also describes the egg; the larva is illustrated in colour by Rotheray (1994); larval biology described by Dusek & Laska (1974); aphid feeding, on low-growing plants, bushes, shrubs and small trees. **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 the other European species of the *scutatus* group, *P.aurolateralis*, *P.speighti* and *P.splendidus*. The female of this species 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. 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). All four European *scutatus* group species are very similar to each other and at localities where they occur may be found together in flight in the field. The key provided by Bartsch et al (2009a) can be used to identify this species where *P.speighti* does not occur.

Platycheirus speighti Doczkal, Stuke & Goeldlin, 2002

Preferred environment: unimproved, non-calcareous, montane/alpine 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. **Larva:** not described. **Range:** so far known only from the Alps (Austria, France, Italy, and Switzerland) **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.

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. **Larva:** larva described and puparium described and figured by Rotheray (1998) from aphid galls on *Ulmus glabra* and 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). **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. 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*, *P. 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 *P. speighti*. 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), whose keys can be used to identify this species where *P. speighti* does not occur.

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. **Larva:** 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 Russia and on to eastern Siberia (Tuva). **Determination:** van der Goot (1981) and Verlinden (1991), plus Nielsen (1999). The adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch et al (2009a). 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).

Platycheirus subambiguus Nielsen, 2004

Preferred environment: inadequately known; open ground; probably beside rivers and brooks in stony, calcareous grassland. **Adult habitat and habits:** no data. **Flowers visited:** *Salvia pratensis* (Nielsen, 2004). **Flight period:** May (Nielsen, 2004). **Larva:** undescribed. **Range:** northern Italy, Croatia and Hungary (Nielsen, 2004). **Determination:** Nielsen (2004), who provides a key distinguishing this species from other European members of the *Platycheirus ambiguus* group. The female of this species remains unknown.

Platycheirus subordinatus Becker, 1915

Preferred environment: open ground; *arctic*-alpine tundra and dwarf *Betula/Salix* shrub tundra (Nielsen, pers.comm.). **Adult habitat and habits:** flies low through 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.). **Flight period:** end June/beginning August. **Larva:** 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). 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. **Larva:** not described. **Range:** from Britain and Finland eastwards through central and southern Europe into Russia and on 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 adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1994) and Bartsch et al (2009a).

Platycheirus tatricus Dusek & Laska, 1982

Preferred environment: open ground; from the *Larix* zone upwards, in thinly-vegetated, unimproved, calcareous and non-calcareous, alpine grassland, up to 2000m, particularly along the edges of torrents (L.Verlinden, pers.comm.); open, heathy areas in *Pinus uncinata* forest. **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. **Larva:** undescribed. **Range:** so far known from the Tatra mountains (Czech Republic), 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).

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 fruticosum*, *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. **Larva:** 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); Kazakhstan, Kirgizstan, Mongolia; Altai mountains (SE Siberia). **Determination:** 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. The general appearance of the male is shown in the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch et al (2009a).

Platycheirus urakawensis (Matsumura), 1919

Preferred environment: forest/open ground; tall-herb, open areas within *Picea* forest in northern Europe (Sörensson, 2001). **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:** July in northern Europe (Sörensson, 2001); July/mid August in eastern Asiatic Russia (Gritskevich, 1998); June in N America (Vockeroth, 1992). **Larva:** not described, but apparently associated with aphids of herbaceous plants (Vockeroth, 1990). **Range:** a holarctic species known from northern Sweden, Finland, 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). 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*. Those authors also 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). **Adult habitat and habits:** no data. **Flowers visited:** small, white Cruciferae (H.Bartsch, pers.comm.) and *Ranunculus* (Nielsen, 1998). **Flight period:** June/July. **Larva:** 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). The general appearance of the male is shown in the coloured illustrations provided by Haarto and Kerppola (2007a) and Bartsch et al (2009a).

PLATYNCHAETUS

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.). **Flight period:** end March/beginning June (Malta). **Larva:** undescribed. **Range:** 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.).

***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*. **Flight period:** March/May. **Larva:** not described. **Range:** Portugal, Spain, Mediterranean zone of France, Corsica, Sicily and N Africa (Tunisia, Algeria, Morocco). **Determination:** Sack (1928-1932).

POCOTA

Only one *Pocota* species is known in Europe.

***Pocota personata* (Harris), 1780**

Preferred environment: *Fagus* forest containing overmature and senescent trees. **Adult habitat and habits:** largely arboreal, descending only to visit flowers of understory trees and shrubs; may occasionally be found sitting on the trunks of trees near the entrance to rot-holes. **Flowers visited:** *Crataegus*, *Prunus*, *Sorbus aucuparia*. **Flight period:** beginning May/beginning July. **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.). 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. **Determination:** van Veen (2004). The male terminalia are figured by Hippa (1978). The adult insect is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994).

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 alpine 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. **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 *A.ursinum* (or *A.triquetrum*). In the literature it is frequently referred to, erroneously, as mining the leaves of *A.ursinum*. In alpine 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.victoralis*: 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:** van der Goot (1981). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

PSARUS

Psarus in a monotypic genus confined to Europe.

***Psarus abdominalis* (Fabricius), 1794**

Preferred environment: well-drained *Quercus* forest with mature/overmature trees and a diverse ground flora. **Adult habitat and habits:** flies 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.). 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:** *Geranium sanguineum*. **Flight period:** end May/July. **Larva:** not described. **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 European parts of Russia; Italy and the former Yugoslavia. Threatened at the European level. This is one of the few species

of Diptera so far 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 unmistakable 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 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. **Determination:** see generic key in the StN Keys volume. 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). *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.

PSILOTA

Four European *Psilota* species are listed by Peck (1988). Smit and Vujić (2008) subsequently recognised one of them, *P.rotundicornis* Strobl, as a synonym of *Pipiza quadrimaculata* (Pz). Smit and Vujić (l.c.) also describe two additional species, *P.exilistyla* and *P.nana*, bringing the total number of European *Psilota* to five. Problems persist concerning the identity of *P.anthracina* (see *P.anthracina* species account) and the probable existence of additional, unrecognised European species.

***Psilota anthracina* Meigen, 1822**

Preferred environment: forest; humid *Fagus* forest and *Fagus/Picea* forest, up into the *Picea* zone.

Adult habitat and habits: apparently largely arboreal; may be found in small glades within forest; adults descend to drink at stream margins in hot weather; females can be found investigating tree trunks in the shade.

Flowers visited: white umbellifers; *Crataegus*, male *Salix*. **Flight period:** May/June. **Larva:** Kassebeer et al (1998) describe and figure the larva and puparium supposedly of this species, but based on material from both *Picea* and *Pinus*, suggesting that both *P.anthracina* and *P.atra* may have been involved. The larvae they mention from accumulations of decaying sap under *Picea* bark are presumably those of *P.anthracina* as interpreted here. The female of *P.anthracina* has been seen investigating the damaged trunk-base of a living *Picea*. **Range:** requires re-appraisal, due to confusion with *P.atra* and *P.exilistyla*, but known from Britain, the Netherlands, Belgium, Germany, the Alps (France, Switzerland, Liechtenstein, Austria), the Pyrenees (France), Spain, Italy, Montenegro, Croatia and Greece.

Determination: See Key provided in StN Keys volume. Smit and Vujić (2008) figure the male terminalia of all known European species of *Psilota*, 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). The distal margin of the epandrium is shown as almost straight in Smit and Vujić (2008), but as deeply notched in Smit and Zeegers (2005). Also, the cerci are figured as reaching far beyond the point of bifurcation of the surstyli, in Smit and Vujić (2008), but only as far as this bifurcation in Smit and Zeegers (2005). No reference is made to these differences in the more recent publication (Smit and Vujić, 2008). Males from Britain, the Pyrenees and the Alps, that would in other respects identify as *P.anthracina*, exhibit the form of the epandrium figured by Smit and Zeegers (2005). While it might be assumed that the differences between the epandrium, as shown in Smit and Zeegers (2005) and Smit and Vujić (2008), are due to the terminalia of the same species being drawn from different angles, this does not seem to be the case. Alternative explanations would be either that the figure in Smit and Vujić (2008) is less accurate, or that two species remain confused under the name *P.anthracina* sensu Smit and Vujić (2008). Smit and Zeegers (2005) and Smit and Vujić (2008) do not indicate the geographical origins of the specimens they figure as *P.anthracina*. However, according to Smit (pers.comm.) the male figured in the 2005 paper was from Britain, while the male figured in the 2008 paper was from Montenegro. Females that would be consigned to *P.anthracina* using the key provided by Smit and Vujić (2008) also show variability, which might indicate that more than one taxon remains confused under the name *P.anthracina*. The key to *Psilota* species incorporated into the StN Keys volume (Speight and Sarthou, 2010) takes these problems into account. The concept of *P.anthracina* employed in the StN files is based on males showing the form of the epandrium figured in Smit and Zeegers (2005). Smit and Vujić (2008) point out that the *P.anthracina* of Van Veen (2004) is *P.atra*. The

general appearance of the adult of *P.anthracina* is shown in the coloured illustrations provided by Stubbs and Falk (1983) and Ball et al (2002).

Psilota atra (Fallen), 1817

Preferred environment: forest; coniferous forest of *Pinus* spp, thermophilous *Quercus* (*Q.pubescens*) forest and *Quercus/Carpinus* forest. **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. **Flowers visited:** *Aegopodium*, *Crataegus*, *Salix* (Smit & Zeegers, 2005); *Photinia*. **Flight period:** May/June. **Larva:** 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.). **Range:** uncertain at present, due to confusion with *P.anthracina* and *P.exilistyla*, but known from Norway, lowland Sweden, 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 northern Italy, Montenegro, Greece (including Crete), Roumania and Cyprus; N Africa (Morocco). **Determination:** see Key provided in StN Keys volume; Smit and Vujić (2008), who figure the male terminalia of all known European species of *Psilota*. The identity of this species has been fixed by redescription and neotype designation by Smit and Zeegers (2005), who figure the male terminalia. They also illustrate *P.atra* in colour. The male of *P.atra* is figured in colour by Bartsch et al (2009b). Smit and Vujić (2008) point out that the *P.atra* of van Veen (2004) is *P.anthracina*, and vice versa.

Psilota exilistyla Smit & Vujić, 2008

Preferred environment: forest, deciduous forest, humid *Fagus* forest. **Adult habitat and habits:** both sexes visit margins of streams to drink, in hot conditions. **Flowers visited:** no data. **Flight period:** end April/beginning July. **Larva:** not described. **Range:** uncertain, due to confusion until recently with *P.anthracina* and *P.atra*, but confirmed from France (Pyrenees) and Greece. **Determination:** see Key provided in StN Keys volume; Smit and Vujić (2008), who figure the male terminalia of all known European species of *Psilota*. This species is difficult to distinguish from *P.anthracina*, except in features of the male terminalia.

Psilota innupta Rondani, 1857

Preferred environment: forest; dry *Pinus sylvestris* forest with overmature/damaged trees (H.-J.Flügel, pers.comm.); Balkanic thermophilous *Quercus* forest (*Q.pubescens/Q.frainetto/Q.cerris*) (M.de C.Williams, 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.). **Flight period:** April/August. **Larva:** not described. **Range:** Sweden, central Germany, Slovakia, Austria, Hungary, Spain, Italy, Serbia, Croatia, Roumania, southern parts of European Russia and Siberia to Sakhalin; N Africa (Algeria). **Determination:** see Key provided in StN Keys volume; Smit and Vujić (2008), who figure the male terminalia of all known European species of *Psilota*.

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.). **Adult habitat and habits:** males hover in the sun (A.Vujić, pers.comm.). **Flowers visited:** *Smiranium perfoliatum* (A.Vujić, pers.comm.). **Flight period:** May. **Larva:** not described. **Range:** Montenegro, Serbia. **Determination:** see Key provided in StN Keys volume; Smit and Vujić (2008), who describe the species and figure the male terminalia of all known European species of *Psilota*.

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; *Geranium robertianum*, *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.). **Larva:** 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).

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. **Larva:** 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). The adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986).

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. **Larva:** 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 also notes that eggs can be very frequent on grasses in the immediate vicinity of dung. He

observed that females never lay their eggs in dung itself. He says that the larvae hatching from eggs laid on the leaves of trees drop onto the dung, at a stage when the dung is already dry and most of the activity of dung-inhabiting organisms has already ceased. He postulates that *R.rostrata* larvae require dung “empty” of other dung-using organisms. He suggests that under natural conditions the dung of large ungulates is used 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. Evidently 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. 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*). It would be very helpful if the life history of this species could be re-investigated, somewhere where it is still frequent, for example in forests of the foothills of the Pyrenees, to establish whether Grunin’s (1939) observations can be repeated, or whether a rather different picture of *R.rostrata*’s development emerges. **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-incident 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). The adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994). Features of the male terminalia are figured by Barkemeyer (1986).

RIPONNENSIA

This genus was established by Maibach et al (1994a), for a group of 4 Palearctic 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, Vujic (1999b) has described a further European species, *R.morini*, from the Balkans.

***Riponnensia daccordii* (Claussen), 1991**

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** August. **Larva:** not described. **Range:** Corsica. **Determination:** Claussen (1991b) and Vujic (1999b), who figure the male terminalia. Vujic (l.c.) also provides a key for the separation of both sexes of this species from the closely-related *R.morini* and *R.splendens*.

***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). **Flight period:** no data. **Larva:** not described. **Range:** no data: Loew’s the type material was of unknown origin, but is assumed (Peck, 1988) to derive from central Europe. **Determination:** the description of this species is based on the male and the female remains unknown. *R.insignis* is included (as *Chrysogaster insignis*) in the keys provided by Sack (1928-32), who also redescribes it. But no occurrences of this species seem to have been reported since its description.

***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). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers. **Flight period:** June/July. **Larva:** not described. **Range:** Portugal, Spain, southern France (plus Corsica), Sardinia, Sicily, Rhodes, Greece,

Bulgaria, Turkey, Israel and N Africa (Algeria, Morocco). **Determination:** Sack (1928-1932). *R.longicornis* may be distinguished from other *Riponnensia* species through its possession of all-black antennae in which the third segment is more than 4x as long as its maximum depth.

Riponnensia morini Vujic, 1999

Preferred environment: forest/freshwater; near limnocran springs/small streams or small marshy areas in humid secondary forests of *Castanea sativa* with *Laurus nobilis* (A.Vujic, 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.Vujic, pers.comm.). **Flowers visited:** *Smirnium perfoliatum*. **Flight period:** May. **Larva:** not described. **Range:** Greece and the Balkans (Montenegro, Serbia). This species should be regarded as threatened at the European level (Vujic *et al.*, 2001). **Determination:** Vujic (1999b), who figures the male terminalia and provides features for distinguishing both sexes of this species from the closely related *R.daccordi* and *R.splendens*.

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; *Matricaria*, *Ranunculus*. **Flight period:** mid June/beginning September. **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), Vujic (1999b). The male terminalia are figured by Claussen (1991b) and Maibach *et al.* (1994a). The adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994). In nearly all recent literature this species is referred to the genus *Orthonevra*. In southern Europe, the closely similar *R.daccordii* and *R.morini* could easily be mistaken for *R.splendens*. Features distinguishing this species are provided by Claussen (1991b) and Vujic (1999b) respectively. Vujic (l.c.) provides a key for separating both sexes of *R.splendens* from these other two species.

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-scrree 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. **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 (Switzerland, Austria, Italy);

southern edge of European Russia(northern edge of the Caucasus mountains) and Georgia; eastern Asiatic Russia (Altai mountains). **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).

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; dry grassland. **Adult habitat and habits:** no data. **Flowers visited:** *Cytisus*, *Senecio*, *Thapsia*. **Flight period:** mid June/beginning September (throughout the year in the Canary Isles). **Larva:** puparium described by Kuznetsov 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-Garcia (1998) found the larva among aphids on various herbaceous plants (*Anacyclus*, *Andryala*, *Hirschfeldia*, *Ligusticum*, *Onopordon*) including crop species of *Beta* and *Vicia*. **Range:** Iberian peninsula and round the Mediterranean basin to Morocco; Canary Islands; eastward through southern Russia, the Caucasus and southern Siberia to the far east and northern China; 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. 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; *Prunus padus*. **Flight period:** May to July and beginning August/September in southern Europe. **Larva:** described and figured by Laska et al (2006), who report the larva occurring in the field on fruit trees (*Prunus domestica*) and other understory trees (*Prunus communis*) and shrubs (*Sambucus nigra*) and also on bean crops (*Vicia fabae*). 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 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 and Turkey; N.Africa. **Determination:** See key provided in StN Keys volume; Dusek & Laska (1985) and Speight et al (1986). Dusek and Laska (1985) figure the male terminalia. Torp (1994) and Bartsch et al (2009a) illustrate the adult insect in colour.

Scaeva mecogramma (Bigot), 1860

Preferred environment: *Quercus ilex/Q.suber* forest; 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. **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). **Larva:** 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 detailed by Rojo et al (1999). The larvae are predaceous on the psyllid *Euphyllura olivina* (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. **Range:** Spain, southern France, Corsica, Italy, Switzerland. **Determination:** See key provided in StN Keys volume; Dusek & Laska (1985) and Speight et al (1986). Dusek and Laska (1985) figure the male terminalia. Stubbs and Falk (1983) illustrate the adult insect in colour. In its adult morphology, this species is intermediate between *Betasyrphus* and *Scaeva*. Indeed, the male of *S.mecogramma* is so similar to that of *Betasyrphus serarius* (Wiedemann) that the two are difficult to distinguish. 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*. Thus, in its densely pruinose (and entire) pale bands on tergites 3 and 4 of the abdomen *S.mecogramma* more closely resembles *Betasyrphus* than *Scaeva*. Similarly, in the dense microtrichial coverage of the wing (especially its distal half), seen in *S.mecogramma*, this species more closely resembles *Betasyrphus* than *Scaeva*. Finally, the male of *S.mecogramma* lacks an area of larger ommatidia on the compound eyes, as do *Betasyrphus* species, in comparison with *Scaeva* species, in which a well-differentiated area of enlarged ommatidia is present. This combination of features ensures that *S.mecogramma* does not run to *Scaeva* in the generic keys of Dusek and Laska (1967), Vockeroth (1969) or Bradescu (1991). Of these keys, Vockeroth's is the only set to include *Betasyrphus*, and there *S.mecogramma* runs to the couplet where *Betasyrphus* is keyed out. At that point, however, *S.mecogramma* does not run to *Betasyrphus*, because of the break between upper and lower sternopleural hair patches used to differentiate *Betasyrphus*. It remains to be seen whether *S.mecogramma* more closely resembles *Betasyrphus* than *Scaeva*, in its larval morphology. 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, in N Africa, and a third (*B.serarius*) occurs in eastern parts of the Palaearctic.

Scaeva pyrastris (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.pyrastris* 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. **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 many crops. Rojo and Marcos-Garcia (1998) list herbaceous plant genera on which larvae of this species have been found in Portugal and/or Spain. Rotheray (1994) illustrates the larva in colour. Overwintering in this species apparently occurs as a puparium (Kantyerina, 1979) in the grass-root zone or on trees. Barkemeyer (1994) provides a comprehensive literature review of what is known of the biology of this species. 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; N America from Alaska to California and New Mexico. 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:** D See key provided in StN Keys volume; usek & Laska (1985), Speight et al (1986). The male terminalia are figured by Dusek and Laska (1985), Hippa (1968b) and Vockeroth (1969). The adult insect is illustrated in colour by Colyer and Hammond (1951), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

Scaeva selenitica (Meigen), 1822

Preferred environment: 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*, *Sarothamnus*, *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. **Larva:** 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* does not 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). The adult insect is illustrated in colour by Stubbs and Falk (1983) and Torp (1994).

SERICOMYIA

In much recent literature, including previous versions of the StN Species Accounts, *Conosyrphus* and *Sericomyia* have been treated as separate genera. Hull (1949) seems to have been the first author to regard *Conosyrphus* as a subgenus of *Sericomyia*, a practice subsequently followed by Coe (1966). The only difference cited by authors, as a means of separating *Conosyrphus* from *Sericomyia*, is the extent to which the face extends antero-ventrally. *Conosyrphus* species otherwise closely resemble *Sericomyia* species and there seems little merit in maintaining the separate status of *Conosyrphus* based on that one feature. Here, *Conosyrphus* is thus treated as a subgenus of *Sericomyia*, with the other *Sericomyia* species in the subgenus *Sericomyia*. Only two *Sericomyia* (*Conosyrphus*) species have been described, both of them Palaearctic. Sack (1928-32) provides a key for their separation. Coe (1966) alludes to the existence of a third, undescribed species, from the Himalayas (NE India: Sikkim). The described *Sericomyia* (*Conosyrphus*) species are primarily Asiatic, but one of them is known from European Russia, and the other reaches Turkey. 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 of both subgenera may be separated using the key provided in the StN Keys volume. Recently, some authors have suggested that *Arctophila* should be regarded as a subgenus of *Sericomyia*. Here, *Arctophila* is retained as a separate genus.

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. **Larva:** 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) figures the male terminalia; Bartsch et al (2009b). The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

Sericomyia hispanica Peris, 1962

Preferred environment: forest; deciduous forest; open areas with streams and flushes in humid *Fagus* forest. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** March-July. **Larva:** not described. **Range:** 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.

Sericomyia jakutica (Stackelberg), 1927

Preferred environment: tundra. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/July. **Larva:** not described. **Range:** Norway, Sweden, northern Finland, Siberia. **Determination:** See key provided in StN Keys volume; Nielsen (1997) figures the male terminalia;

Bartsch et al (2009b). The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

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). **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. 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). Nielsen and Vockeroth (2000) provide a figure of the male terminalia.

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). **Flight period:** beginning June/mid August. **Larva:** not described. **Range:** from northern Norway south to southern parts of Norway, Sweden and Finland; northern parts of European Russia and on into Siberia. **Determination:** See key provided in StN Keys volume; Nielsen (1997); Bartsch et al (2009b). This species is also included in the keys provided by van Veen (2004). The adult insect is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007).

Sericomyia silentis (Harris), 1776

Preferred environment: wetland/forest; wet moorland, valley bog, fen and *Alnus/Salix* carr; along streams in humid coniferous and deciduous forest. **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. **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 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. 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 tolli (Frey), 1915

Preferred environment: open ground/wetland: tundra/bog. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** July. **Larva:** 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 northern parts of European Russia). **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*.

Sericomyia volucellinus Portschinsky, 1881

Preferred environment: montane/subalpine species, occurring at 1700 – 2000m. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** May/July. **Larva:** 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*.

SIMOSYRPHUS

A small genus, the European species of which were until very recently referred to as *Ischiodon*. As *Ischiodon* it is included 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 micotrichia; males with a digitate or spine-like protuberance on the hind trochanters. In general appearance *Simosyrphus* species are reminiscent of rather broad-bodied *Sphaerophoria* with a parallel-sided abdomen. The synonymy of *Ischiodon* with *Simosyrphus* was established by Laska et al (2006). One species, *S.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 the Transcaucasus. A second species, *S.aegyptius* (Wiedemann) occurs throughout Africa and just reaches the Mediterranean coast of Europe. A key for the separation of these two species is provided in the StN Keys volume. A third species, *S.faeae* (Bezzi) is endemic to the Cape Verde islands. Peck (1988) refers to an additional Palaearctic species, *S.libycus* (Nayar), described from Libya. The only other known *Simosyrphus* species, *S.grandicornis* Macquart, is known from Australasia and Oceania.

Simosyrphus aegyptius (Wiedemann), 1830

Preferred environment: open ground/scrub; scrub-invaded, dry, thinly-vegetated open ground, crops and fallow land; 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:** no data. **Flight period:** June/October (Madeira), August (southern Spain); throughout the year (Canary Isles, N Africa). **Larva:** developmental stages described and figured by Tawfik et al (1974); an aphid predator on low-growing plants and shrubs, including various crops, e.g. cotton, maize, squashes. Marcos-Garcia (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 *S.aegyptius* and *S.scutellaris*, and also describe their diagnostic features. **Range:** throughout the Afrotropical region and into N Africa to the coast of the Mediterranean and Yemen; southern Spain, southern Italy, the Balearic Islands and the Canaries. The fact that adults have been seen in southern Europe only during the summer suggests this species may not be resident there, but establishes temporary populations in favourable seasons. **Determination:** See Key provided in StN Keys volume for separation of *S.aegyptius* from *S.scutellaris*. Its terminalia are figured, together with those of *S.faeae* (Bezzi), by Claussen and Barkemeyer (1987). A coloured photo of the female is provided by Smit et al (2004).

Simosyrphus 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.). **Flight period:** January/April (Turkey) and September. **Larva:** 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 *S.aegyptius* and *S.scutellaris*, and also describe their diagnostic features. **Range:** Turkey; southern, Asiatic parts of the Palaearctic from Iran to Japan; Oriental Region; Oceania; Australasian Region. **Determination:** A key for the separation of *S.aegyptius* and *S.scutellaris* is provided in the StN Keys volume.

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 alpine 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; *Salvia*, *Saxifraga aizoides*. **Flight period:** end June/mid August. **Larva:** 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). The male is illustrated in Speight and Lucas (1992).

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. **Larva:** not described. **Range:** Greenland (Haarto and Koponen, 2003), northern Norway, Sweden and Finland. **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. Bartsch et al (2009a) provide illustrations in colour of the male and of the female abdomen.

Sphaerophoria bankowskiae 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. **Larva:** not described. **Range:** northern Norway, Sweden, Finland, Denmark, Britain (southern England), France, Germany, Switzerland, Italy. **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). The adult insect is illustrated in colour by Torp (1994). 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*, *Ranunculus*. **Flight period:** May/September. **Larva:** 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). 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. 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).

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* scrub in Scandinavia. **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). **Flight period:** mid June/end August. **Larva:** not described. **Range:** northern Norway, northern Sweden, northern Finland; Alps (France, Switzerland). **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). The latter authors 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. **Larva:** 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 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. Bartsch et al (2009a) provide illustrations in colour of the male and of the female abdomen.

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. **Larva:** 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.

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. **Larva:** 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). 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. **Larva:** undescribed. **Range:** Germany (Harz), north-east France (Vosges), Czech Republic (Moravia), Alps (including Switzerland, Liechtenstein, Austria, Italy), Pyrenees. **Determination:** Goeldlin (1989), who figures the male terminalia. Indistinguishable from other *interrupta* group species in the field.

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*, *Ranunculus*, *Senecio jacobaea*, *Stellaria*, *Taraxacum*. **Flight period:** May/September (plus April in southern Europe), with peaks in June and end July/August. **Larva:** not described, but illustrated in colour by Rotheray (1994). The morphology of the chorion of the egg is figured by Kuznetzov (1988). **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 (1991) figure the male terminalia. 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. **Larva:** 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*. 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. **Larva:** not described. **Range:** arctic Norway and Sweden, Finland, the Alps (France, Switzerland, Italy) and the Pyrenees (France). **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. 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. **Flowers visited:** white umbellifers; *Butomus*, *Eupatorium*, *Filipendula*, *Lythrum*, *Persicaria*, *Ranunculus*, *Schoenoplectus*, *Scirpus*, *Triglochin*. **Flight period:** beginning June/August, and September in southern Europe. **Larva:** 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 parts of Russia; Kazakhstan, Tajikistan etc. through to Mongolia. **Determination:** the most comprehensive keys to *Sphaerophoria* species in which *S.laurae* is included are those of Haarto and Kerppola (2007a) and Bartsch et al (2009a). The male terminalia are figured by Ball et al (2002). 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). **Larva:** 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).

Sphaerophoria pallidula Mutin, in Mutin and 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. **Larva:** not described. **Range:** northern Sweden and

eastern Finland; eastern parts of Siberia. **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 in their keys, figure its male terminalia and provide a coloured illustration of the male and of the female abdomen.

Sphaerophoria philantha (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. **Larva:** 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.philantha* 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.philantha* 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.philantha* in Europe. Bagachanova (1990) records rearing *S.philantha* 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.philantha* 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. *S.philantha* is illustrated in colour by Torp (1994), Haarto and Kerppola (2007a) and Bartsch et al (2009a). 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. 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. **Larva:** 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 be 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*.

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. **Larva:** 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. infusata* (D.Sommaggio, pers.comm.).

Determination: Claussen (1984) and Speight (1988a) figure the male terminalia, as do Haarto and Kerppola (2007) and Bartsch et al (2009a). Both sexes of *S. potentillae* are included in the keys provided by Haarto and Kerppola (2007) and Bartsch et al (2009a). 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. This small species is indistinguishable from others in the field.

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*, *Limonium*, *Matricaria*, *Polygonum*, *Ranunculus*, *Rumex*, *Sinapis*, *Tamarix*. **Flight period:** April/October in southern Europe, with most records elsewhere from July/August. **Larva:** described and figured by Bhatia (1939); biology detailed by Dusek and Laska (1974) and Marcos-Garcia (1981). The larvae are aphid-feeding on herbaceous plants, and have been recorded on *Brassica*, *Chenopodium*, *Nicotiana*, *Onopordon* and *Sonchus*. **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 alpine 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). The adult male is illustrated in colour by 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. **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 inodorum*, *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). **Larva:** described and figured by Goeldlin (1974); aphid-feeding on herbaceous plants, including various crop plants e.g. *Avena*, *Brassica*, *Cichorium*, *Lactuca*, *Triticum*, *Vicia*. 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 Kuznetsov (1988). **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). 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. **Larva:** undescribed. **Range:** north-east France (Vosges); Belgium (Ardennes); Czech Republic; central and southern Germany (Baden-Württemberg, Bavaria); Switzerland; 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.

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. **Larva:** 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 (1991), 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 (1991). 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. Bartsch et al (2009a) provide coloured illustrations of the male and of the female abdomen.

Sphaerophoria turkmenica Bankowska, 1964

Preferred environment: vegetated inland dune systems and the herb-rich vegetation of dry channels of seasonal rivers (M.Ebejer, pers.comm.). **Adult habitat and habits:** flies rather slowly and close to the ground (M.Ebejer, pers.comm.). **Flowers visited:** no data. **Flight period:** April/July (plus January/March in southern parts of its range). **Larva:** undescribed. **Range:** parts of European Russia; the Caucasus (Armenia, Azerbaijan); Iran; Arabian peninsula (Oman), Turkmenistan; Kazakhstan. **Determination:** Bankowska (1964), who figures the male terminalia. 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. *S.turkmenica* is not mentioned by either Goeldlin (1989) or Claussen (1984).

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. **Larva:** 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. 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. 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 *S.vittata* (Wied.) may be erroneous, in which case *S.vespiforme* (Gorski) would be the only European species in this genus.

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. **Larva:** 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.vespiforme* 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. *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:** August. **Larva:** not described. **Range:** Turkey; Northern edge of the Caucasus, in European Russia. **Determination:** See Key provided in StN Keys volume. Hayat (1997), describes the species and figures the male terminalia. Mutin (2001b) established that *S.pontica* Mutin is a junior synonym of *S.alaoglui*.

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. **Larva:** undescribed. **Range:** Pyrenees (France, Spain). **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*.

Sphegina clavata (Scopoli), 1763

Preferred environment: mature deciduous forest; humid *Fagus* forest, up to well within the *Fagus/Picea* zone; also *Alnus/Populus* forest, according to Reemer et al (2009), where this species appears under the name *S.nigra*. **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. **Larva:** not described. **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 & Decler (1987) and *S.miciki* of Vujic (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.

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. **Larva:** 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 and Thompson & Torp (1986), who figure the male terminalia. 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 alpine 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. **Larva:** not described. **Range:** Alps (France, Germany, Switzerland, Liechtenstein, Austria, N Italy - Aosta). **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*

Vujic and *S.varifacies* Kassebeer, is provided by Doczkal (1995). 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. **Larva:** 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.

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. **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. 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. **Larva:** 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* Vujic and *S.varifacies* Kassebeer. Vujic (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.

Sphegina limbipennis Strobl, 1909

Preferred environment: deciduous forest; humid *Fagus* forest with overmature trees. **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:** *Sorbus*. **Flight period:** mid May/October. **Larva:** not described. **Range:** Pyrenees (France and Spain) and

northern Spain. **Determination:** See Key to males provided in StN Keys volume and Thompson & Torp (1986), who figure the male terminalia.

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. **Larva:** 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.violovitshi* as possessing the same terminalia as *S.montana* sensu Thompson and Torp.

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. **Larva:** 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.sphinginea* 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.

Sphegina obscurifacies Stackelberg, 1956

Preferred environment: forest; southern taiga (Mutin, 2001). **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** June/August (Mutin, 2001). **Larva:** 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:** 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 Palearctic *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.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*).

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. **Larva:** 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.

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. **Larva:** 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 central 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. **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. Photographs of the orange and black forms are shown in Bartsch et al (2009b). 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). The adult male is illustrated in colour by Haarto & Kerppola (2007).

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. **Larva:** 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 an alternative key for distinguishing the females of European *Sphegina* species. The species is shown in colour by Bartsch et al (2009b).

Sphegina sublatifrons Vujic, 1990

Preferred environment: forest/freshwater; along streams in *Picea/Abies* forest above 1200m (Vujic, 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.Vujic, pers.comm.). **Flowers visited:** *Caltha* spp., *Ranunculus* spp. (A.Vujic, pers.comm.). **Flight period:** May/June. **Larva:** not described. **Range:** Slovenia, Macedonia, Serbia. **Determination:** See Key to males provided in StN Keys volume. Vujic (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*.

Sphegina varifacies Kassebeer, 1991

Preferred environment: freshwater/forest; springs and streams within the humid *Fagus* forest zone. **Adult habitat and habits:** streamside, settles on large-leaved shrubs etc in the vicinity of springs and streams. **Flowers visited:** *Caltha*, *Ranunculus*. **Flight period:** June. **Larva:** has 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* Vujic and *S.varifacies*, which are very similar to one another.

Sphagina 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. **Larva:** described and figured by Hartley (1961), who found larvae in sap run exudate on *Ulmus*. **Range:** Britain, Denmark, Germany, Czechoslovakia, northern France, Switzerland, Liechtenstein, northern Italy. **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. The adult insect is illustrated in colour by Bartsch et al (2009b) and Torp (1994).

SPHIXIMORPHA

Five European *Sphiximorpha* species are listed by Peck (1988). Bradescu's keys (1991) distinguish three of them. The other two species are of uncertain status. A key to distinguish *S.subsessilis* from the two European *Ceriana* species is included here in the text on the genus *Ceriana*.

Sphiximorpha binominata (Verrall), 1901

Preferred environment: forest; thermophilous deciduous forest of *Quercus pubescens* with overmature trees and *Quercus suber* forest with overmature trees. **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* (pers.comm. M. de C.Williams). **Flight period:** May/July. **Larva:** undescribed, but quite possibly associated with subcortical sap seepages caused by the tunnelling activities of larvae of saproxylic cetonids, which inhabit the trunk wood of old, living *Quercus*. **Range:** known from southern France, Italy, Hungary, Bulgaria and Roumania, plus parts of the former Yugoslavia. This insect has been very sparsely recorded and is probably threatened at European level. **Determination:** Sack (1928-32). This species can be found with *S.subsessilis*, adults of both species even being observed on the trunk of the same tree at the same time.

Sphiximorpha petronillae Rondani, 1850

Preferred environment: forest; overmature thermophilous *Quercus* (*Q.cerris*) forest (P.Cerretti, pers.comm.); humid *Castanea/Quercus/Laurus* forest (A.Vujic, pers.comm.). **Adult habitat and habits:** no data. **Flowers visited:** *Euphorbia* (Rondani, 1850), *Pyracantha coccinea* (P.Cerretti, pers.comm.), *Smyrnum* (A.Vujic, pers.comm.). **Flight period:** April. **Larva:** not described. **Range:** there are three specimens known from Italy, two of them from the Rondani type material on which the species is based and one more recent specimen. One specimen has also been collected in Montenegro (A.Vujic, pers.comm.). These four specimens, all of them female, and collected over a period of 150 years, comprise the total known, European, material of *S.petronillae*. The male remains undescribed. 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:** Sack (1928-32), who figures the unique pattern of markings on the abdominal tergites.

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. Dzioc (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. **Larva:** described and figured by Rotheray et al (2006), from larvae collected from "exuding sap at the base of an *Abies alba* tree". This species almost certainly also 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 Sabater and Marcos-Garcia (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. **Range:** from the Netherlands 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. Localised and decreasing; probably threatened at European level. **Determination:** Bradescu (1991). The adult insect is illustrated in colour by Schmid (1996). This species can be found with *S.binominata*, adults of both species even being observed on the trunk of the same tree at the same time.

SPILOMYIA

The European *Spilomyia* species have been revised recently, by van Steenis (2000), who records seven species from the continent, one of which (*S.graciosa* Violovitsh), is at present known only from eastern Europe (Greece, Turkey). Van Steenis also shows that one of the European species (*S.boschmai*, Lucas) listed by Peck (1988) is a synonym of *S.manicata* (Rondani).

***Spilomyia digitata* (Rondani), 1865**

Preferred environment: deciduous forest; thermophilous *Quercus* forest (*Q.pyrenaica*) and evergreen *Q.illex* forest, containing overmature and senescent trees; Mediterranean riparian ash forest (Ricarte Sabater et al, 2008). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Thapsia*. **Flight period:** mid-June/September. **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*. **Range:** parts of central Europe (southern Germany extinct?, Switzerland - extinct?) and the Mediterranean basin, from Spain round to Italy. Literature records from eastern parts of Europe probably refer to other species (van Steenis, 2000). **Determination:** van Steenis (2000), who figures features of the male terminalia. The adult insect is illustrated in colour by Rotheray and Gilbert (2011).

***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*. **Flight period:** end June/end August. **Larva:** undescribed. **Range:** southern Norway, Sweden, Finland, Germany (Bavaria), Czech Republic, France (extinct?), 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. It is probably endangered at the European level. **Determination:** van Steenis

(2000), who figures features of the male terminalia. 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). **Flight period:** July/beginning September. **Larva:** not described. **Range:** Greece, Turkey and Iraq. **Determination:** van Steenis (2000).

Spilomyia longicornis Loew, 1872

Preferred environment: forest; deciduous forest of *Quercus* spp. (N America). **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:** August/September (N America). **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. **Determination:** van Steenis (2000).

Spilomyia manicata (Rondani), 1865

Preferred environment: deciduous forest; *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. **Larva:** 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* (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. There are very few recent records of this species from most parts of its range. It is probably threatened over much, if not all, of Europe. **Determination:** van Steenis (2000), who figures features of the male terminalia. 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) and Bygebjerg (2007).

Spilomyia maxima Sack, 1910

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** no data. **Larva:** not described. **Range:** northern parts of European Russia and eastwards through Siberia to the Pacific. **Determination:** Stackelberg (1958), Violovitsh (1986).

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*, *Scabiosa*, *Solidago*. **Flight period:** June/September, with the peak in August and some records on into October. **Larva:** not described. **Range:** from central France south to the Mediterranean; from Spain round the Mediterranean to the former Yugoslavia, Turkey and the Caucasus. 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:** 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).

Spilomyia triangulata van Steenis, 2000

Preferred environment: forest; conifer forest of *Abies/Picea* (France). **Adult habitat and habits:** visits flower-rich grassland to feed and settles on low-growing vegetation (van Steenis, 2000). **Flowers visited:** no data. **Flight period:** beginning June/end August. **Larva:** not described. **Range:** Alps (France), mountain ranges in Greece and Turkey. **Determination:** van Steenis (2000).

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. **Flight period:** April/October with peaks in May and September. **Larva:** described and figured by Perez-Banon and Marcos-Garcia (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; in eastern parts of the Afrotropical region to the southern tip of Africa and in Madagascar. 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).

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. **Larva:** described and figured by Heiss (1938) and Hartley (1961) and illustrated in colour by Rotheray (1994) and Bartsch et al (2009a); an inhabitant of various types of moist, decaying, vegetable matter, including cow dung and garden compost heaps. **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). 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).

Syrpitta vittata Portschinsky, 1875

Preferred environment: no data. **Adult habitat and habits:** no data. **Flowers visited:** no data. **Flight period:** April/June. **Larva:** 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.

SYRPHOCHEILOSIA

This genus is monotypic. The relationships of the single European species have only recently 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), 1910

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 2000m. **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. **Larva:** undescribed. **Range:** Alps (France, Germany, Switzerland, Liechtenstein, Austria, northern Italy); northern Turkey; Armenia and the Caucasus. **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). The adult insect is illustrated in black and white by Speight (1988a).

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. **Larva:** not described. **Range:** as yet uncertain, due to confusion with related species until recently, but confirmed from Norway, Sweden and Finland. **Determination:** See Key provided in StN Keys volume; Goeldlin (1996), Haarto and Kerppola (2007a), Bartsch et al (2009a). 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.). **Larva:** not described. **Range:** Norway, Sweden, Finland, 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. 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, calcareous and non-calcareous alpine 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. **Larva:** not described. **Range:** Alps (Germany, Switzerland). **Determination:** See Key provided in StN Keys volume; Goeldlin (1996). Features of the male head and abdomen are figured by Schmid (1999c).

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. **Larva:** not described. **Range:** from north-west Germany south to the Pyrenees; from Britain (S England), 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). 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.

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). **Larva:** 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).

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. **Larva:** described and figured by Dusek & Laska (1964); aphid feeding on various herbaceous plants (e.g. *Carduus*, *Eryngium*, *Sonchus*, umbellifers), including some crops (*Beta*, *Triticum*, *Vicia*, *Zea*), bushes (e.g. *Rubus* spp.) and shrubs. 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). Egg: Chandler (1968). The morphology of the chorion of the egg is figured by Kuznetzov (1988). Laboratory culture detailed by Bombosch (1957). **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). 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. **Larva:** 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). 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. **Larva:** not described. **Range:** northern parts of European Russia. **Determination:** See Key provided in StN Keys volume; included in the keys provided by Goeldlin (1996). Kuznetzov (1990) figures the male terminalia.

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*, *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. **Larva:** described and figured by Dusek and Laska (1964); aphid feeding; occurs on trees, bushes and shrubs. 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). 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. **Larva:** described and figured by various authors, e.g. Dusek & Laska (1964); 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*). Kula (1982) records larvae overwintering among leaf litter on the floor of a spruce (*Picea*) forest; laboratory culture detailed by Bombosch (1957). Egg: Chandler (1968). **Range:** throughout most of the Palearctic 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 adult insect is illustrated in colour by Kormann (1988), Stubbs and Falk (1983) and Torp (1994). 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*).

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 species. 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 Palearctic *Temnostoma* species.

***Temnostoma angustistriatum* Krivosheina, 2002**

Preferred environment: forest; mixed forest and deciduous forest; taiga forest with *Betula* (S.Kerppola, pers.comm.), 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). **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. 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, *Geum*, *Matricaria inodora*, *Potentilla*, *Ranunculus*, *Rubus idaeus*, *Sorbus aucuparia*, *Trientalis*. **Flight period:** June/end July, and on into August at higher altitudes/more northerly latitudes. **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); 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 its European range 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 adult of *T.apiforme* is illustrated in colour by Bartsch et al (2009b) and Torp (1994). 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*.

Temnostoma bombylans (Fabricius), 1805

Preferred environment: *Fagus* forest with over-mature trees, up to its upper altitudinal limits 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. **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 northern France through northern and central Europe into Asiatic parts of Russia as far as the Pacific coast and Japan; Korea. In Europe, 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*. The adult insect is illustrated in colour by Bartsch et al (2009b), Kormann (1988), Torp (1984, 1994) and van der Goot (1986).

Temnostoma carens Gaunitz, 1936

Preferred environment: forest: deciduous forest; *Alnus* forest with flushes (this habitat information is based on data kindly provided by T.Järveläinen, relating to a specimen collected by him. Since only one specimen is involved rearing data or more substantial habitat association data are required before a relationship between this rarely-seen species and *Alnus* forest can be confirmed). **Adult habitat and habits:** the female flies low among vegetation (T.Järveläinen, pers.comm.). **Flowers visited:** no data. **Flight period:** mid June/end July. **Larva:** not described. **Range:** northern Sweden and Finland. **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. It is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

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. **Flowers visited:** *Cornus sanguinea*. **Flight period:** beginning May/beginning July. **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:** Finland, Estonia, Latvia, Denmark, Germany, Luxembourg, central and south-west France (including the Pyrenees), the Czech Republic, 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. *T. meridionale* is figured in colour by Bartsch et al (2009b).

Temnostoma sericomylaeforme (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.). **Adult habitat and habits:** no data. **Flowers visited:** umbellifers; *Rubus idaeus* (Bartsch et al, 2009b). **Flight period:** mid June/July. **Larva:** 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, Denmark and the Ukraine. **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. sericomylaeforme* and *T. vespiforme*. The adult male of *T. sericomylaeforme* is illustrated in colour by Bartsch et al (2009b), Haarto & Kerppola (2007) and Bygebjerg (2007).

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*, *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. **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. sericomylaeforme*, but probably from central Sweden south to northern Spain; from northern France (Brittany) eastwards through most of Europe and on through Asiatic parts of Russia to the Pacific coast and Japan; the Caucasus; also in the Nearctic from Alaska south to New Mexico and east to Quebec. 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. The adult insect is illustrated in colour by Bartsch et al (2009b), Kormann (1988), Torp (1984, 1994) and van der Goot (1986). *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.sericomylaeforme* 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 *T.sericomylaeforme* is 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.

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:** *Berberoa incana*, *Frangula alnus*, *Narthecium*, *Potentilla*, and *Ranunculus*. **Flight period:** May/July, with some specimens into August, especially at higher altitudes. **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 (1991) 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 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). The male terminalia are figured by van der Goot (1981), Verlinden (1991) and Goeldlin (1997).

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.Dzioc, pers.comm.). **Flowers visited:** umbellifers. **Flight period:** end May/July. **Larva:** not described. **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 in southern Europe: 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 (1991), where it appears under the name *carbonaria*, and by the key in Goeldlin (1997), who illustrates the male terminalia. The general appearance of the adult male is shown by the photograph provided by Haarto & Kerppola (2007). The male is also illustrated in colour by Bartsch et al (2009b).

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 10.00a.m.) but not later. **Flowers visited:** *Rubus fruticosus* agg.; *Verbascum*. **Flight period:** end May/June & mid July/August. **Larva:** not described. **Range:** southern England, Germany, Belgium, the Netherlands, France, central Spain, Switzerland and Turkey. **Determination:** see key provided in StN Keys volume, plus Verlinden (1991) and Goeldlin (1997), who illustrates the male terminalia.

TRIGLYPHUS

Peck (1988) lists only one European species in this genus. Since then, Vujic (1994b) has recorded *T.escalerai* Gil Collado from southern Europe.

Triglyphus escalerai Gil Collado, 1929

Preferred environment: forest; thermophilous oak forest of *Q.pubescens* with *Carpinus orientalis* and *Ruscus*, evergreen oak forest and maquis of *Q.ilex* with *Ostrya* and more humid secondary forests of *Castanea sativa* with *Laurus nobilis* (Vujić, 1994b and pers.comm.). **Adult habitat and habits:** settles on the foliage of bushes and shrubs (Vujić, 1994b). **Flowers visited:** umbellifers (Vujić, 1994b). **Flight period:** end April/mid June. **Larva:** not described. **Range:** Croatia, Montenegro and North Africa (Morocco). This species should be regarded as threatened at the European level (Vujic *et al*, 2001). **Determination:** Vujić (1994b) who figures the male terminalia and mentions distinctions from *T.primus*.

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. **Larva:** found by Leclercq (1944) and Sedlag (1967) in aphid galls on *Artemisia vulgaris*, but as yet undescribed. **Range:** from southern Norway south to southern France and 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:** van der Goot (1981), Bradescu (1991). The male is figured in colour by Bartsch et al (2009b).

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*, and *Ranunculus*. **Flight period:** June-September. **Larva:** 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. The adult insect is illustrated in colour by Haarto & Kerppola (2007).

***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*, *Myosotis*, *Potentilla erecta*, *Ranunculus*, *Rubus*, *Sorbus aucuparia*, *Symphytum*, *Vaccinium*, *Valeriana*. **Flight period:** May/ August, with occasional specimens on into September. **Larva:** puparium figured and described by Decler 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 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). The male terminalia are figured by Hippa (1978).

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. **Larva:** the final instar larva and puparium are described and figured by Rotheray (1999b). The morphology of the chorion of the egg is figured by Kuznetsov (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. 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, plus maquis of *Cistus/Quercus pyrenaica* (A.-M. Marcos-Garcia, pers.comm.); Mediterranean riparian ash forest (Ricarte-Sabater et al, 2008). **Adult habitat and habits:** no data. **Flowers visited:** *Carduus*, *Cirsium arvense*, *Crataegus*, *Diplotaxis erucooides*, *Euphorbia nicaensis*, *Hedera*, *Mentha*, *Rubus*, *Thapsia villosa* (A.-M. Marcos-Garcia, pers.comm.). **Flight period:** May/October, with peak in July/August. **Larva:** not described. **Range:** Portugal, Spain and Corsica. **Determination:** see key provided in the StN Keys volume. *V. elegans* is superficially very similar to both *V. inanis* and *V. zonaria*.

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*, *Thymus*, *Valeriana*. **Flight period:** beginning July/end September. **Larva:** larval morphology described by Hartley (1981); larva illustrated in colour (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 and on through Siberia to the Pacific; Afghanistan, Mongolia, China. This is a strongly migrational species. **Determination:** see key provided in the StN Keys volume. 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. **Flowers visited:** umbellifers; *Cornus*, *Crataegus*, *Euonymus*, *Frangula*, *Ligustrum*, *Rubus*, *Sambucus*, *Viburnum*. **Flight period:** May/July. **Larva:** 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. This fly is now very local over much of its European range. **Determination:** See key provided in the StN Keys volume and van Veen (2004). The adult insect is illustrated in colour by 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. **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. 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. **Larva:** 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 Britain (southern England) eastwards through central and southern Europe (Italy, the former Yugoslavia, Greece) into Turkey and European parts of Russia and on through Siberia to the Pacific; Iran; Mongolia. This species is strongly migratory. **Determination:** See key provided in the StN Keys volume. The adult insect is illustrated in colour by Stubbs and Falk (1983). 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 would include all Corsican material examined.

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). **Larva:** 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).

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.). **Larva:** 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) who also provide coloured photographs of the male and female of *X.babyssa*, although they do not provide any information on how to separate this species from either *X.azorensis* or *X.comtus*.

Xanthandrus comtus (Harris), 1776

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*, *Filipendula*, *Juncus*, *Leontodon*, *Lonicera*, *Mentha aquatica*, *Rosa*, *Rubus*, *Succisa*. **Flight period:** May/October (April to November in southern Europe), with no clear period of peak occurrence. **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). The larvae are known to predate aphids and the caterpillars of various small moths (e.g. Tortricidae), both on trees and low-growing plants. They are also recognised predators 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 adult insect is illustrated in colour by Stubbs and Falk (1983), Torp (1984, 1994) and van der Goot (1986). 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.

XANTHOGRAMMA

The European species of *Xanthogramma* are in need of revision. Kassebeer (pers.comm.) initiated such a revision in 1991, but there has been no published result from that work, and, unfortunately, it now seems unlikely that there will be. 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-Garcia (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 recently been cited from various European countries (see species account for *X.stackelbergi*) having earlier been ignored. An additional European *Xanthogramma*, *X.dives* Rondani, is also recognised here as a distinct species (see Speight and Sommaggio, in press). In Peck (1988) *X.dives* is given as a synonym of *X.pedissequum*. Finally, recognising that the European species of *Xanthogramma* require comprehensive revision, it has to be said that it would not be surprising if the European fauna proves to include further, undescribed species in this genus.

***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*, *Scabiosa*, *Taraxacum*. **Flight period:** May/June, with a second peak in August in southern Europe. **Larva:** 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. *X.citrofasciatum* is illustrated in colour by Torp (1994) and Bartsch et al (2009a). It has been referred to in much recent literature as *X.festivum* (L).

***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 or permanent

streams; 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 or permanent streams in Mediterranean pine forest; has also been found in olive orchards. **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:** no data. **Flight period:** May/mid June and July/beginning September. **Larva:** not described. **Range:** at present uncertain, due to confusion until recently with both *X.pedissequum* and *X.stackelbergi*, but known from Spain, France (from the Mediterranean to as far north as the Paris basin), central Germany, Switzerland and northern Italy. **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).

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 *Dasyrphus* 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. **Flowers visited:** *Allium ursinum*, *Crataegus*, *Glechoma*, *Phyteuma spicatum*, *Ranunculus*. **Flight period:** May/September, with a peak in August. **Larva:** not described. Fetzner (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 (1991) and Marcos-Garcia (1998). Marcos-Garcia (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 (1991).

Xanthogramma marginale (Loew), 1854

Preferred environment: forest/open ground; open maquis of *Q.ilex* and *Q.pyrenaica* and 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. **Flight period:** April/beginning June. **Larva:** 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.

Xanthogramma pedissequum (Harris), 1780

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*, *Euphorbia*, *Lamium*, *Ligustrum*, *Potentilla erecta*, *Pulicaria*, *Ranunculus*, *Rosa*, *Rubus*, *Sambucus nigra*, *Stellaria*, *Ulmus*. **Flight period:** May/September, with a peak in July. **Larva:** features of the larva are described and figured by Rotheray and Gilbert (1989); Speight (1990) distinguishes the puparium from that of *X.citrofasciatum*. The larval biology has been documented by Pontin (1960). The larvae are predators of the "herds" of root aphids tended by ants of the genus *Lasius*. **Range:** uncertain, due to confusion until recently with both *X.dives* and *X.stackelbergi*, but known from Britain and Atlantic seaboard countries south to central 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. The adult insect is illustrated in colour by 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 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:** *Stellaria* (Bartsch et al, 2009); white umbellifers. **Flight period:** mid May/mid August. **Larva:** not described. **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; Denmark; southern Germany (Ssyanck (2002); Switzerland and France, south to the Mediterranean; Italy. **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 and both sexes of this species are included in their keys (which do not, however, include *X dives*). The male of this species is extremely difficult to separate from the male of *X dives*. The female is illustrated in colour by Haarto and Kerppola (2007b) and Bartsch et al (2009a). Violovitsh (1975) figures the male terminalia.

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; Vujic 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. **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 Hippar (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*. *X.abiens* is illustrated in colour by Bartsch et al (2009b) and Stubbs and Falk (1983) and Torp (1994). 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*.

Xylota caeruleiventris (Zetterstedt), 1838

Preferred environment: forest; taiga/humid *Pinus sylvestris* forest (including western taiga) and mixed boreal forest; relict sub-boreal transition mire and bog with *Pinus sylvestris* in central Europe. **Adult habitat and habits:** males sit on the trunks of freshly-fallen (leaves still green) *Pinus sylvestris* 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. **Larva:** not described, but probably under the bark of water-logged, fallen trunks of recently-fallen *Pinus sylvestris* in, or at the edge of, bog and transition mire. **Range:** northern and central Fennoscandia (Norway, Sweden, Finland) and through Siberia to the Pacific coast; Germany (Doczkal, 2004) 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). 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. 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-floodplain 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. **Larva:** 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*. 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*. 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. **Larva:** not described. **Range:** from Fennoscandia south to central Spain; Netherlands and the Ardennes through central Europe to European Russia; in southern Europe to Yugoslavia, Greece and Turkey; 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). The adult insect is illustrated in colour by Bartsch et al (2009b) and Haarto & Kerppola (2007).

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.Vujic, 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. **Larva:** 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 (1991) 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 they are. The adult of *X.jakutorum* (as *X.coeruleiventris*) is illustrated in colour by Bartsch et al (2009b), Kormann (1988), Stubbs and Falk (1983) and Torp (1994).

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. **Larva:** 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*. **Range:** from southern Sweden and Finland south to northern France (Paris basin); from Belgium eastwards through northern and parts of central (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). Hipps (1968a) figures the male terminalia. Bartsch et al (2009b), Torp (1994) and Haarto & Kerppola (2007) illustrate the adult insect in colour.

Xylota segnis (L.), 1758

Preferred 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. **Flight period:** May/September, with peak in June; occasionally in April (March/April in southern Europe) and may persist to November. **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. Rotheray (1994) illustrates the larva in colour. **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 Hipps (1968a). 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. **Larva:** 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 Hipps (1968a). 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. **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*. **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 Hipps (1968a). The adult insect is illustrated in colour by 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:** *Potentilla*, *Sambucus*. **Flight period:** May/August, with a peak at the beginning of July. **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* from *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 Hipps (1968a). The adult insect is illustrated in colour by Bartsch et al (2009b), 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. **Larva:** unknown. **Range:** Lapland south to southern Norway and Sweden; Alps (France, Germany, 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). 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 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. **Larva:** described and 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*. **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 (1991); Bradescu (1991). The male terminalia are figured by Hipps (1968a). 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 species listing provided by 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.

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) achieve a clearer demonstration of the distance between microdontids and syrphids than has been made previously, concluding that the microdontids represent "the basal lineage", in all respects sharing less 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) retain what they refer to as "the traditional classification" of *Microdon* and its allies within the Syrphidae, as the subfamily Microdontinae. 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 *Quercus* 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. **Larva:** 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*. Available information suggests that when *M.analis* occurs in nests of ants of the genus *Lasius*, it may only occur with *L.platythorax*, a recently-recognised segregate of *L.niger*, an ant that normally nests in rotten wood (and hence occurs in forested locations). 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, at least. 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 adult of *M.analis/M.major* is illustrated in colour by Bartsch et al (2009b), Stubbs and Falk (1983) and Torp (1994). 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.

***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. **Larva:** described and figured by Rotheray (1991) and puparium figured in colour by Rotheray (1994), from larvae collected from nests of the ant *Lasius flavus*. 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). The adult is figured in colour by Bartsch et al (2009b).

***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.). **Larva:** 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*. 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 till now been regarded as a form of *M. analis*.

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. **Larva:** 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 (Ardenne), 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. 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 pasture and grassy clearings in forest, where long-established ants' nests are present. **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. **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). 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 ants of the genera *Formica* and *Lasius*. Barr (1995) notes that the larvae feed mostly at night, while the ants are inactive. The larva of *M. mutabilis* is distinguished from the larvae of *M. analis* and *M. devius* by the keys provided in Rotheray (1994). Doczkal & Schmid (1999) provide, in addition, distinctions from the larvae and puparia of *M. miki*. 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*. Adults emerging from puparia collected from nests of *Formica* species are generally larger than adults emerging from puparia collected from nests of *Lasius* species. **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 that were determined prior to description of *M.myrmicae*. The only records of *Microdon mutabilis* sensu Schönrogge et al (2002a, b) given by those authors are from Britain and Ireland. Re-appraisal of the range of *M.mutabilis* is now required, based on bred material for which diagnostic puparial features can be examined. 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. 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).

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:** males 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. **Flowers visited:** not known to visit flowers. **Flight period:** May/June. **Larva:** larval and puparial features are figured by Schönrogge et al (2002a). Gammelmo and Aarvik (2007) provide high quality coloured photographs of the larva, the puparium and the anterior spiracular processes of the puparium. See also the key provided in this volume. 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 - especially once data are available from parts of continental Europe). The developmental stages of *M.myrmicae* have been found with this ant in tussocks of grasses, moss (including *Sphagnum*) and sedge. A coloured photo of typical *M.myrmicae* habitat is provided by Gammelmo and Aarvik (2007). It is not yet known whether *M.myrmicae* can occur with *Myrmica vandeli* Bondroit, which is apparently 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). However, Stankiewicz (2003) confirms the occurrence of *M.myrmicae* with species of *Myrmica* other than *M.scabrinodis*, namely *M.gallienii* and *M.rubra*. 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. **Range:** uncertain, due to confusion with *M.mutabilis*. At present, the presence of this species is confirmed from Ireland, Great Britain, the Netherlands, Germany, France, Norway, Poland and parts of European Russia (Karelia). Confirmation of the presence of this species is dependent upon availability of determined larval or puparial material. **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 Schönrogge 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. The general appearance of *M.myrmicae* is shown in the coloured figure provided by Bartsch et al (2009b).

REFERENCES

- Alexander, K.N.A. (2005) Observations on the larval habitat of *Pocota personata* (Harris) (Diptera: Syrphidae). *Dipterists Digest*, 12: 147-148.
- Andersson, H. (1966) The Swedish species of *Neoascia* and *Sphegina* (Dipt., Syrphidae), with lectotype designations. *Opusc.Ent.*, 31: 178-182.
- Andersson, H. (1988) De svenska Xylotini-arterna (Diptera, Syrphidae). *Ent.Tidskr.*, 109: 129-137.
- Andréu, J. (1926) Notas Diptérológicas. I. Una lista de Sirfidos para contribuir al conocimiento de los Dipteros de España. *Boletín de la Sociedad entomológica de España*, 9: 98-126.
- Andries, M. (1912) Zur Systematik, Biologie und Entwicklung von *Microdon* Meigen. *Z.wiss.Zool.*, 103: 300-361.
- Arzone A (1972) Riperti biologici su *Eumerus tricolor* Meigen, nocivo alle coltivazione di *Tragopogon porrifolius* L. in Piemonte (Dipt., Syrphidae). *Annali della Facolta di Scienze Agrarie della Universita degli Studi di Torino*, 7: 17-52.
- Arzone A (1973) *Tragopogon porrifolius* L., ospite naturale di *Eumerus tricolor* Meigen (Diptera, Syrphidae). *Annali della Facolta di Scienze Agrarie della Universita degli Studi di Torino*, 8: 55-66.
- Aubert, J., Aubert, J.-J. & Goeldlin, P. (1976) Douze ans de captures systématiques de Syrphidae (Diptères) au Col de Bretolet (Alpes valaisannes). *Bull.Soc.ent. Suisse*, 49: 115-142.
- Báez, M. (1977) Los Sirfidos de las Islas Canarias. Instituto de Estudios Canarios (Universidad de la Laguna, Monografías; Sección IV (XV): 143 pp.
- Báez, M. (1982) Nuevas especies del genero *Eumerus* en las Islas Canarias (Diptera, Syrphidae). *Annali Mus.civ.Stor.na Giacomo Doria*, 84: 41-51.
- Báez, M. & Barkemeyer, W. (2002) The identity of *Eumerus terminalis* Santos-Abreu, 1924 (Diptera: Syrphidae). *Studia Dipterologica*, 9: 518.
- Bagatshanova, A.K. (1990) Fauna i ekologiya mukh-zhurchalok (Diptera, Syrphidae) Yakutii. *Yakutsk Nauchnye Tsentr*, 1-164.
- Ball, S.G. & Morris, R.K.A. (2000) *Provisional atlas of British hoverflies* (Diptera, Syrphidae). 167pp. Biological Records Centre, Huntingdon.
- Ball, S.G., Stubbs, A.E., McClean, I.F.G., Morris, R.K.A., Falk, S.J. & Hawkins, R.D. (2002) *British Hoverflies: an illustrated identification guide, 2nd edition*, 469pp. British Entomological and Natural History Society.
- Bankowska, R. (1964) Studien über die paläarktischen Arten der Gattung *Sphaerophoria* St.Farg. et Serv. (Diptera, Syrphidae). *Annales Zoologici, Warsz.*, 22: 285-353.
- Bankowska, R. (1980) Fly communities of the family Syrphidae in natural and anthropophilic habitats of Poland. *Memorabilia Zool.*, 33: 1-94.
- Bargen, H., Sauthof, K. & Poehling, H.-M. (1998) Prey finding by larvae and adult females of *Episyrphus balteatus*. *Entomologia Experimentalis et Applicata*, 87: 245-254.
- Barkalov, A.V. (1991) Genitalia construction in the genus *Temnostoma* Lep. et Serv. (Diptera, Syrphidae) of the Soviet Union fauna. *Izv.Sib.Otd.Akad.Nauk. SSSR, Sib.Biol.Zh.*, 5: 59-66.
- Barkalov, A.V. (1998) Changes and additions to the Catalogue of Palaearctic Syrphidae. Genus *Cheilosia* Meigen, 1822. *International Journal of Dipterological Research*, 9: 69-77.
- Barkalov, A.V. & Mutin, V.A. (1991) Revision of Hover-flies of the Genus *Blera* Bilberg, 1820 (Diptera, Syrphidae), II. (In Russian). *Ent.Obozr.*, 1991: 737-749.
- Barkalov, A.V. (2007) A new species, a new synonym and new records of the hoverfly genus *Cheilosia* Meigen (Diptera, Syrphidae). *Entomological Review*, 87: 368-375.
- Barkalov, A.V. & Nielsen, T. (2007) *Platycheirus* species (Diptera, Syrphidae) from Yakutia, Eastern Siberia, with description of two new species. *Volucella*, 8: 87-94.
- Barkalov, A.V. & Nielsen, T. (2008) *Platycheirus* species (Diptera, Syrphidae) from the Altai Mountains, SE Siberia, with description of five new species. *Norw. J. Entomol.*, 55: 91-104.
- Barkalov, A. V. & Nielsen, T. R. 2009. New material of Central Palaearctic *Platycheirus* (Diptera, Syrphidae) with description of three new species. *Norw. J. Entomol.*, 56: 1-8.

- Barkalov, A.V. & Ståhls, G. (1997) Revision of the Palaearctic bare-eyed and black-legged species of the genus *Cheilisia* Meigen (Diptera, Syrphidae). *Acta Zool. Fennica*, 208: 1-74.
- Barkemeyer, W. (1986) Zum Vorkommen seltener und bemerkenswerter Schwebfliegen in Niedersachsen (Diptera, Syrphidae). *Drosera*, '86(2): 79-88.
- Barkemeyer, W. (1994) Untersuchung zum Vorkommen der Schwebfliegen in Niedersachsen und Bremen (Diptera: Syrphidae). *Naturschutz und Landschaftspflege in Niedersachsen*, 31: 1-514.
- Barkemeyer, W. (1997) Zur Ökologie der Schwebfliegen und anderer Fliegen urbaner Bereiche (Insecta: Diptera). *Archiv zoologischer Publikationen*, 3, 187pp. Martina-Galunder-Verlag, Wiehl.
- Barkemeyer, W. (1999) Zur Kenntnis der Syrphidenfauna des Madeira-Archipels. *TenDenZen*, 1999: 115-134.
- Barkemeyer, W. & Claussen, C. (1986) Zur Identität von *Neoascia unifasciata* (Strobl 1898): mit einem Schlüssel für die in der Bundesrepublik Deutschland nachgewiesenen Arten der Gattung *Neoascia* Williston 1886 (Diptera: Syrphidae). *Bonn.zool.Beitr.*, 37: 229-239.
- Barr, B. (1995) Feeding behaviour and mouthpart structure of larvae of *Microdon eggeri* and *Microdon mutabilis* (Diptera, Syrphidae). *Dipt.Digest*, 2: 31-36.
- Bartak, M. & Vujič, A. (2004) The species of the family Syrphidae (Diptera) of the Rokytecka, Novohurecka and Zhurske peat-bogs in the Sumava Mts (Czech Republic). *Folia Fac. Sci. Nat. Univ. Masaryk. Brun., Biologia* 109: 17-35.
- Bartsch, H. (1997) Efterlysta, ovanliga, föbisedda och några andra intressanta norrländska blomflugor (Diptera, Syrphidae). *Natur i Norr*, 16: 69-94.
- Bartsch, H. (2001) Swedish Province Catalogue for hoverflies (Diptera, Syrphidae). *Entomologisk Tidskrift*, 122: 189-215.
- Bartsch, H. (2008) Polarsländfluga *Sphaerophoria pallidula* Mutin, 1999 (Diptera, Syrphidae) – ny för Europa. *Natur i Norr, Umeå*, 27: 97-101.
- Bartsch, H., Binkiewicz, E., Rådén, A. & Nasibov, E. (2009a) Blomflugor: Syrphinae. *Nationalnyckeln till Sveriges flora och fauna*, DH53a. Artdatabanken, SLU, Uppsala. 406 pp.
- Bartsch, H., Binkiewicz, E., Klintbjer, A., Rådén, A. & Nasibov, E. (2009b) Blomflugor: Eristalinae & Microdontinae. *Nationalnyckeln till Sveriges flora och fauna*, DH 53b. Artdatabanken, SLU, Uppsala. 478pp.
- Bartsch, H., Hellqvist, S. & Lundberg, S. (2005) Fem för Sverige nya blomflugor (Diptera: Syrphidae) varav två först identifierade från Norrland. *Årgång*, 24: 61-66.
- Bartsch, H., Hellqvist, S. & Sörensson, M. (1998) Nya fynd av getinglik blomfluga *Sphecomyia vespiformis* (Diptera, Syrphidae), tidigare anedd som utdöd. *Natur i Norr, Umeå*, 17: 53-60.
- Bartsch, H., Nielsen, T.R. & Speight, M.C.D. (2002) Reappraisal of *Xylota caeruleiventris* Zetterstedt, 1838, with remarks on the distribution of this species and *X.jakutorum* Bagatshanova, 1980 in Europe. *Volucella*, 6: 69-80.
- Bastian, O. (1986) Schwebfliegen (Syrphidae). A. Ziemsen Verlag, Wittenberg, 168pp.
- Baugnée, J.-Y. (1998) Observation récente de *Paragus flammeus* Goeldlin, 1971 et de quelques autres syrphespeu connus en Belgique (Diptera, Syrphidae). Soumis à *Lambillionea*, 1998, 1-7.
- Becher, E. (1882) Ueber die ersten Stände einiger Syrphiden und eine neue *Myiolepta* Art. *Weiner Entomol.Zeit.*, 1: 249-254.
- Becker, T. (1894) Revision der Gattung *Chilosia* Meigen. *Nova Acta der Ksl.Leop.-Carol., Deutschen Akademie der Naturforscher*, 62(3): 194-522.
- Becker, T. (1921) Neue Dipteren meiner Sammlung. *Mitt.zool.Mus.Berl.*, 10: 1-93.
- Belcari, A., Daccordi, M., Kozanek, M., Munari, L. Raspi, A. & Rivosecchi, L. (1995). Diptera Platypezoidea, Syrphoidea. In: Minelli, A., Ruffio, S. & La Posta, S. (eds.) *Checklist delle Specie della Fauna Italiana*. Pt. 70, 25pp. Calderini, Bologna.
- Bezzi, M. (1903) Di una specie inedita di Ditteri italiani appartenante ad un genere nuovo per la fauna Europea. *Bolletino della Società Entomologica Italiana*, 33: 3-19.
- Bezzi, M. (1915) The Syrphidae of the Ethiopian Region. Natural History Museum, London, 146pp.
- Bhatia, M.L. (1931) Life histories of Indian Syrphidae. *Ind.J.Ag.Sci.*, 1: 503.
- Bhatia, M.L. (1939) Biology, morphology and anatomy of aphidophagous syrphid larvae. *Parasitol.*, 31: 78-129.

- Bičík and Láska, P. (1996) Revision of type material of *Scaeva obscura* Zetterstedt, 1838 (Diptera, Syrphidae). *Acta Univ.Palacki, Olomouc, Fac.rer.nat. Biol.*, 33 (1993-95): 7-14.
- Bloomfield, E.N. (1897) Habits of *Sericomyia borealis*, Fall. *Ent.mon.Mag.*, 33: 222-223.
- Boheman, C.H. (1863) Entomologiska anteckningar under en resa i norra Skåne och södra Halland år 1862. *Öfvers.K.Vetensk.Akad.Förh.*, 20: 57-85.
- Bombosch, S. (1957) Erfahrungen über laboratoriums-zuchten aphidivorer Schwebfliegen. g. Wanderversammlung Deutsch. *Akad.Landwirt., Wiss.*, 11:160-162.
- Bothe, G. (1986) Schwebfliegen 1984/85. *Naturkundliche Beiträge der DJN*, 17: 13-32.
- Boyes, J.W., van Brink, J.M. & Boyes, B.C. (1971) Chromosomes of Syrphinae (Diptera: Syrphidae). *Misc.Pub.Genet.Soc.Can.* 1-158.
- Brădescu, V. (1982) Deux espèces nouvelles du genre *Cheilosia* Meigen et *Merodon* Meigen (Diptera: Syrphidae). *Revue.roum.Biol., Ser.Biol.anim.*, 27: 11-15.
- Brădescu, V. (1986) Etudes diptérologiques (Syrphidae) dans la réserve naturelle Domogled-vallée de la Cerna. *Trav.Mus.Hist. nat. Grigore Antipa*, 28: 121-131.
- Brădescu, V. (1989) Les Syrphides de Roumanie (Diptera, Syrphidae). *Trav.Mus.Hist. nat. Grigore Antipa*, 30, 7-19.
- Brădescu, V. (1991) Les Syrphides de Roumanie (Diptera, Syrphidae), Clés de détermination et répartition. *Trav.Mus.Hist. nat. Grigore Antipa*, 31: 7-83.
- Brădescu, V. (1992) *Orthonevra auritarsis* n.sp. (Diptera, Syrphidae). *Trav.Mus.Hist. nat. Grigore Antipa*, 32: 13-16.
- Brădescu, V. (1993) *Orthonevra shusteri* sp.n. et deux espèces signalées pour la première fois dans la faune de Roumanie (Diptera, Syrphidae). *Trav.Mus.Hist.nat.Grigore Antipa*, 33: 7-10.
- Branquart, E. (1999) Life history strategies of hoverflies with predacious larvae (Diptera: Syrphinae). Doctoral thesis, Faculté Universitaire des Sciences Agronomiques de Gembloux. 150pp.
- Branquart, E. and Hemptinne, J.-L. (2000) Development of ovaries, allometry of reproductive traits and fecundity of *Episyrphus balteatus* (Diptera: Syrphidae). *Eur.J.Entomol.*, 97: 165-170.
- Brauns, A. von (1968) Beiträge zur Ökologie und wirtschaftlichen Bedeutung der aphidivoren Syrphidenarten. *Beitr.zur Ent.*, B, 3: 278-303.
- Brunel, E et Cadou, D. (1990a) Description de la larve et de la puppe de *Cheilosia vulpina* Meigen (1822), mineuse de racine d'Artichaut (*Cynara scolymus* L.) en Bretagne. *Bull.Soc.ent.Fr.*, 95(3-4): 121-129.
- Brunel, E et Cadou, D. (1990b) Mise en évidence d'une diapause nymphale chez *Cheilosia vulpina* Meigen (Diptère, Syrphides) ravageur de l'artichaut. In: INRA (ed.) Regulation des cycles saisonniers chez les invertébrés. Les Colloques de l'INRA, no. 52: 47-50.
- Brunel, E. & Cadou, D. (1994) Syrphid larvae (Diptera: Syrphidae) mining the roots of artichoke (*Cynara scolymus*, L.) in Brittany. *Dipt.Digest*, 1: 69-71.
- Bruns, D. (1984) Insect mycology in the Boletales: fungivore diversity and the mushroom habitat/Fungus insect relationships; Perspectives in ecology and evolution. 91-129.
- Buxton, P.A. (1955) British Diptera associated with fungi, III. *Entomol.Mon.Mag.*, 96: 61-94.
- Bygebjerg, R. (2002) Svirrefluer *Callicera aurata* (Rossi, 1790) ny for Danmark (Diptera, Syrphidae). *Ent.Meddr.*, 70: 47-50.
- Bygebjerg, R. (2004) Fund af svirrefleur i Danmark i perioden 2000-2003 (Diptera, Syrphidae). *Ent.Meddr.*, 72, 81-100.
- Bygebjerg, R. (2007) Vedsvirrefluer i Danmark (Diptera: Syrphidae; *Temnostoma* & *Spilomyia*) – med lidt om mimicry og artenes potentielle anvendelse som indikatorer i skov. *Ent.Meddr.*, 75: 45-52.
- Chambers, R.J. (1991) Oviposition by aphidophagous hoverflies (Diptera: Syrphidae) in relation to aphid density and distribution in winter wheat. In: Polgár, L., Chambers, R.J., Dixon, A.F.G. and Hodek, I. (eds) Behaviour and impact of Aphidophages, 115-121. Academic Publishing, The Hague.
- Chambers, R.J. & Sunderland, K.D. (1983) The abundance and effectiveness of natural enemies of cereal aphids on two farms in southern England. In: Cavalloro, R. (ed.) *Aphid antagonists*, 83-87. A.A.Balkema, Amsterdam.

- Chambers, R.J., Sunderland, K.D., Stacey, D.L. & Wyatt, I.J. (1986) Control of cereal aphids in winter wheat by natural enemies: aphid-specific predators, parasitoids and pathogenic fungi. *Ann. appl. Biol.* 108: 219-231.
- Chandler, A.E.F. (1968) A preliminary key to the eggs of some of the commoner aphidophagous Syrphidae (Diptera) occurring in Britain. *Trans.R.Ent.Soc., London*, 85: 131-139.
- Chandler, P. J. (1998) Diptera. Checklists of insects of the British Isles (NS), Pt.1, 1-234. Royal entomological Society, London.
- Claussen, C. (1980) Die Schwebfliegenfauna des Landesteils Schleswig in Schleswig-Holstein (Diptera, Syrphidae). *Faun.Okol.Mitt., Kiel*, suppl.1: 3-79.
- Claussen, C. (1984) *Sphaerophoria potentillae* n.sp. - eine neue Syrphiden-Art aus Nordwestdeutschland (Diptera: Syrphidae). *Ent.Zeitschrift*, 94: 245-250.
- Claussen, C. (1987) *Syrphocheilosia claviventris* (Strobl, 1910) und *Cheilosia laeviseta* nom.n. (Diptera: Syrphidae), mit taxonomischen Anmerkungen und neuen Nachweisen aus den Alpen. *Ent.Z.*, 97(23): 337-352.
- Claussen, C. (1988) Zur Kenntnis der Gattung *Rohdendorfia* Smirnov 1924 in Europa (Diptera: Syrphidae). *Ent.Z.*, 98: 113-128.
- Claussen, C. (1989) Syrphiden aus Marokko (Diptera, Syrphidae). *Zeit.fur Ent., Linz*, 10: 357-375.
- Claussen, C. (1991a) Zur Kenntnis europäischer *Pipizella*-Arten (Diptera: Syrphidae). *Entomol.Z.*, 101: 153-172.
- Claussen, C. (1991b) Eine neue *Orthonevra* von Korsica. *Zeit.Ent.*, 12: 205-212.
- Claussen, C. (1998) Die europäischen Arten der *Cheilosia alpina*-Gruppe (Diptera, Syrphidae). *Bonn.zool.Beitr.*, 47: 381-410.
- Claussen, C. (2000) Eine neue Art der Gattung *Cheilosia* Meigen, 1822 (Diptera, Syrphidae) aus Bulgarien und ihre Verwandtschaftsbeziehungen. *Volucella*, 5: 1-14.
- Claussen, C. & Barkemeyer, W. (1987) Zur syrphidenfauna der Kapverden (Insecta: Diptera: Syrphidae). *Cour.Forsch.-Inst.Senckenberg*, 95: 71-86.
- Claussen, C. & Doczkal, D. (1998) Eine neue Art der Gattung *Cheilosia* Meigen, 1822 (Diptera, Syrphidae) aus der Zentralalpen. *Volucella*, 3: 1-13.
- Claussen, C. & Hauser M. (1990) Neue Syrphidenvorkommen aus Marokko und Tunesien (Diptera, Syrphidae). *Entomofauna*, 11 (25): 433-440.
- Claussen, C. & Hayat, R. (1997a) A new species and new records of the genus *Pipizella* Rondani, 1856 (Diptera, Syrphidae) from Turkey. *Studia dipterologica*, 4: 447-452.
- Claussen, C. & Hayat, R. (1997b) A new species of the genus *Neoascia* Williston, 1886 (Diptera, Syrphidae) from North-East Turkey. *Studia dipterologica*, 4: 215-218.
- Claussen, C. & Kassebeer, C. (1993) Eine neue Art der Gattung *Cheilosia* Meigen 1822 aus den Pyrenäen (Diptera: Syrphidae). *Entomol.Z.*, 103: 409-428.
- Claussen, C. & Lucas, J.A.W. (1988) Zur Kenntnis der Schwebfliegenfauna der Insel Kreta mit der Beschreibung von *Eumerus minotaurus* sp.n. *Zeit.Ent.* 9: 133-168.
- Claussen, C. & Speight, M.C.D. (1988) Zur Kenntnis von *Cheilosia vulpina* (Meigen, 1822) and *Cheilosia nebulosa* Verrall, 1871 (Diptera, Syrphidae). *Bonn.zool. Beitr.*, 39(1): 19-28.
- Claussen, C. & Speight, M.C.D. (2007) Names of uncertain application and some previously unpublished synonymms, in the European *Cheilosia* fauna (Diptera, Syrphidae). *Volucella*, 8: 73-86.
- Claussen, C. & Stähls, G. (2007) A new species of *Cheilosia* Meigen from Thessaly/Greece, and its phylogenetic position ((Diptera, Syrphidae). *Volucella*, 8: 45-62.
- Claussen, C. & Thompson, C. (1996) Zur Identität und Synonymie der von Camillo Rondani beschriebenen *Cheilosia*-Arten (Diptera, Syrphidae). *Studia dipterologica*, 3: 275-281.
- Claussen, C. & Torp, E. (1980) Untersuchungen über vier europäische Arten der Gattung *Anasimyia* Schiner, 1864 (Insecta, Diptera, Syrphidae). *Mitt.Zool.Mus.Univ.Kiel*, 1(4): 1-16.
- Claussen, C. & Van de Weyer, G. (2004) A new species of the genus *Cheilosia* Meigen (Diptera, Syrphidae) from the Southern Alps. *Volucella*, 7: 61-74.
- Claussen, C. & Vujic, A. (1993) *Cheilosia katara* n.sp. aus Zentralgriechenland (Diptera: Syrphidae). *Entomol.Z.*, 103: 341-356.
- Claussen, C. & Vujic, A. (1995) Eine neue Art der Gattung *Cheilosia* Meigen aus Mitteleuropa (Diptera: Syrphidae). *Entomol.Z.*, 105: 77-85.

- Claussen, C. & Weipert, J. (2003) Zur Schwebfliegenfauna Nepals (Insecta: Diptera: Syrphidae) unter besonderer Berücksichtigung Westnepals. In: Hartmann, M. & Baumbach, H. (eds.) *Biodiversität und Naturausstattung im Himalaya. Erfurt* (Ferein der Freunde und Förderer der Naturkundemuseums Erfurt e.V.), 343-380.
- Claussen, C. & Weipert, J. (2004) Notes on the subgenus *Paragus* (*Pandasyophthalmus*) (Diptera, Syrphidae) from Nepal, with the description of a new species. *Volucella*, 7: 75-88.
- Claussen, C., Goeldlin de Tiefenau, P. & Lucas, J.A.W. (1994) Zur Identität von *Pipizella heringii* (Zetterstedt) var. *hispanica* Strobl, 1909 - mit Typenrevision der paläarktischen Arten der Gattung *Heringia* Rondani, 1856, *sensu stricto* (Diptera: Syrphidae). *Bull.Soc.ent.Suisse*, 67: 309-326.
- Coe, R.L. (1938) Rediscovery of *Callicera yerburyi*, Verrall (Diptera, Syrphidae): its breeding habits, with a description of the larva. *Entomologist*, 71: 97-102.
- Coe, R.L. (1939) *Callicera yerburyi* Verrall (Diptera: Syrphidae) a synonym of *C.rufa* Schummel; further details of its life history, with a description of the puparium. *Entomologist*, 72: 228-231.
- Coe, R.L. (1941) *Brachypalpus eunotus* Loew Dipt., Syrphidae) new to Britain, its distinctions from *B.bimaculatus* Macquart and notes on synonymy in the genus. *Ent.Mon.Mag.*, 77: 193-197.
- Coe, R.L. (1942) *Rhingia campestris* Mg. (Dipt., Syrphidae), an account of its life history and descriptions of the early stages. *Entomol.mon.Mag.*, 78: 121-130.
- Coe, R.L. (1953) Diptera: Syrphidae. *Handbks.ident.Br.insects*, 10(1): 1-98. R.ent.Soc.London.
- Colignon, P., Haubruge, E., Gaspar, C. & Francis, F. (2003) Effets de la réduction de doses de formulations d'insecticides et de fongicides sur l'insecte auxiliaire non ciblé *Episyrphus balteatus* (Diptera: Syrphidae). *Phytoprotection*, 84: 141-148.
- Collin, J.E. (1939) Notes on Syrphidae (Diptera) III. *Entomol.Mon.Mag.*, 75: 104-109.
- Collin, J.E. (1946) *Syrphus ericarum* sp.n., male, female (Diptera, Syrphidae). *Ent.Rec.*, 58: 117-119.
- Collin, J.E. (1960) A fourth species of *Cnemodon* (Diptera, Syrphidae) in Britain. *Entomologist*, 93: 144-145.
- Collins, G.A. & Halstead, A.J. (2008) *Cheilosia caerulescens* (Meigen, 1822) Diptera, Syrphidae) new to Britain. *Dipt.Digest*, 15: 23-26.
- Colyer, C.N. & Hammond, C.O. (1951) Flies of the British Isles. Frederick Warne, London. 383pp.
- Curran, C.H. (1925) Revision of the genus *Neoascia* Williston (Diptera: Syrphidae) *Ent.Soc.Wash. Proc.*, 27: 51-62.
- Daccordi, M. (1995) Famiglia Syrphidae. In: Minelli, A., Ruffo, S. & La Posta, S. (eds.) *Checklist delle specie delle Fauna Italiana*, 70: 6-19.
- Daccordi, M. & Sommaggio, D. (2002) Fascicolo 70, Syrphidae. In: Aggiornamenti alla Checklist delle specie della fauna italiana, VII Contributo, a cura di F. Stoch & S. Zoia. *Boll. Soc. entomol. ital.*, 134: 84-90.
- d'Aguilar, J. & Coutin, R. (1988) *Cheilosia caerulescens* Meigen, ravageur des Joubarbes (Dipt. Syrphidae). *Bull.Soc.ent.Fr.*, 92(9-10): 307-309.
- de Buck, N. (1985) Waarnemingen over het voedsel van twee *Xylota*-species (Diptera, Syrphidae). *Bull.Annl.Soc.r.belge.Ent.*, 121: 385-390.
- de Buck, N. (1990) Bloembezoek en bestuivingsecologie van Zweefvliegen (Diptera, Syrphidae) in het bijzonder voor België. Doc.Trav. IRSNB, no.60, 1-167.
- Decler, K. (1989) *Sphaerophoria chongjini* Bankowska, 1964 (Diptera, Syrphidae) recorded for the first time in Belgium and its distribution in Europe. *Bull.Annl.Soc.r.belge Ent.*, 125: 152-155.
- Decler, K. & Rotheray, G.E. (1990) The puparium and larval habitat of the hoverfly *Tropidia scita* (Diptera: Syrphidae). *Ent.Gaz.*, 41: 157-160.
- Delforge, P. (1994) Guide des Orchidées d'Europe, d'Afrique du Nord et du Proche-Orient. Delachaux et Niestlé, Lausanne.
- Delfos, J. & van Helsdingen, P. (2000) *Merodon batumicus*, een zweefvlieg nieuw voor de Nederlandse fauna (Diptera: Syrphidae) *Nederlandse Faunistische Mededelingen, Leiden*, 11: 148-157.
- Delmastro, G.B. & Sommaggio, D. (2003) Contributo alla conoscenza dei Sirfidi (Diptera: Syrphidae) del Piemonte Occidentale. *Boll. Mus. reg. Sci. nat. Torino*, 20: 231-268.
- Delucchi, V. & Pschorn-Walcher, H. (1955) Les especes du genre *Cnemodon* Egger (Diptera, Syrphidae) predatrices de *Dreyfusia* (*Adelges piceae* Ratz., Hem. Adelgidae). 1. Revision systematique et repartition géographique des especes du genre *Cnemodon* Egger. *Z.angew.Ent.*, 37: 492-506.

- Delucchi, V., Pschorn-Walcher, H. & Zwolfer, H. (1957) Ibid. 2. Morphologie und Biologie von *Cnemodon dreyfusiae* D. & P.W. nebst Beobachtungen über *C.latitarsis* Egger. *Z.angew.Ent.*, 41: 246-259.
- Dely-Drascovits, A. (1972) Systematische und Ökologische Untersuchungen an den in Ungarn als Schädlinge der Hutpilze auftretenden Fliegen I. Limoniidae, Syrphidae, Platypezidae, Chloropidae (Dipt.). *Acta zool.hung.*, 18: 7-21.
- Derksen, W. (1941) Die Succession der pterygoten Insekten im abgestorben Buchenholz. *Z.Morph.Okol.der Tiere*, 37: 683 - 734.
- Dirickx, H.G. (1994) Atlas des Diptères syrphides de la région méditerranéenne. *Doc.de Travail, Inst.roy.Sci.nat.Belg.*, no.75: 1-314.
- Dirickx, H.G. (1998) Catalogue synonymique et géographique des Syrphidae (Diptera) de la Région Afrotropicale. *Instrumenta Biodiversitatis*, II, 1-187. Mus.d'hist.nat. Genève.
- Dirickx, H.G., Hamon, J. & Steffen, J. (1996) Contribution à l'étude des Syrphidae (Diptera) de la Région Rhône-Alpes. *L'Entomologiste*, 52: 63-79.
- Dixon, T.J. (1960) Key to and descriptions of the third instar larvae of some species of Syrphidae (Dipt.) occurring in Britain. *Trans.R.ent.Soc., London*, 112: 345-379
- Doczkal, D. (1995) Bestimmungsschlüssel für die Weibchen der deutschen *Sphegina*-Arten (Diptera, Syrphidae). *Volucella*, 1: 3-19.
- Doczkal, D. (1996a) Schwebfliegen aus Deutschland: Erstnachweise und wenig bekannte Arten (Diptera, Syrphidae). *Volucella*, 2: 36-62.
- Doczkal, D. (1996b) Observations on host plants and behaviour of egg-laying females of *Cheilosia* Meigen (Diptera, Syrphidae) in central Europe. *Volucella*, 2: 77-85.
- Doczkal, D. (1996c) Description of two new species of the genus *Eumerus* (Diptera, Syrphidae) from Corsica. *Volucella*, 2: 3-19.
- Doczkal, D. (1998a) *Leucozona lucorum* (Linnaeus) - a species complex? (Diptera, Syrphidae). *Volucella*, 3: 27-49.
- Doczkal, D. (1998b) On the identity of *Baccha strandi* Duda, 1940 (Diptera, Syrphidae). *Volucella*, 3: 85-86.
- Doczkal, D. (2000a) Description of *Cheilosia ranunculi* spec.nov. from Europe, a sibling species of *C.albitarsis* Meigen (Diptera, Syrphidae). *Volucella*, 5: 63-78.
- Doczkal, D. (2000b) Redescription of *Leucozona nigripila* Mik and description of *Leucozona inopinata* spec.nov. (Diptera, Syrphidae). *Volucella*, 5: 115-127.
- Doczkal, D. (2002) Further presumed host plant relationships of *Cheilosia* Meigen (Diptera, Syrphidae) obtained from observing egg-laying females. *Volucella*, 6: 163-166.
- Doczkal, D. (2004) *Xylota caeruleiventris* Zetterstedt, 1838 (Diptera, Syrphidae) found in central Europe, with remarks on identification of the female. *Volucella*, 7: 193-200.
- Doczkal, D. & Dziöck, F. (2004) Two new species of *Brachyopa* Meigen from Germany, with notes on *B. grunewaldensis* Kassebeer (Diptera, Syrphidae). *Volucella*, 7: 35-59.
- Doczkal, D. & Schmid, U. (1994) Drei neue Arten der Gattung *Epistrophe* (Diptera: Syrphidae), mit einem Bestimmungsschlüssel für die deutschen Arten. *Stuttgarter Beitr.Naturk.*, A, no.507: 1-32.
- Doczkal, D. & Schmid, U. (1999) Revision der mitteleuropäischen Arten der Gattung *Microdon* Meigen (Diptera, Syrphidae). *Volucella*, 4: 45-68.
- Doczkal, D. & Vujic, A. (1998) Redescription of *Epistrophella coronata* (Rondani, 1857), stat.rest., comb.nov., with first description of the male and notes on the generic assignment. *Volucella*, 3: 51-62.
- Doczkal, D., Stuke, J.-H. & Goeldlin de Tiefenau, P. (2002) The species of the *Platycheirus scutatus* (Meigen) complex in central Europe, with description of *Platycheirus speighti* spec.nov. from the Alps (Diptera, Syrphidae). *Volucella*, 6: 23-40.
- Dolezal, Z. & Romig, T. (2004) *Xylota caeruleiventris* Zetterstedt (Diptera, Syrphidae) is present in central Europe. *Volucella*, 7: 201-203.
- Dolezil, Z. (1972) Developmental stages of the tribe Eristalini (Diptera, Syrphidae) *Acta Entomol. Bohemoslov.*, 69: 339-350.

- Dolley, W.L., Hassett, C.C. & Bowen, W.B. (1959) Culture of the drone fly, *Eristalis tenax*. In: Lutz, F.E., Welch, P.S., Galstoff, P.S. & Needham, J.G. (eds.) Culture methods for invertebrate animals, 410-411.
- Drake, C.M. (2005) Flower visiting by the rare hoverfly *Eristalis cryptarum* (Fabricius, 1794) (Diptera, Syrphidae). *Dipterists Digest*, 12: 101-105.
- Drees, M. (1999) Erfahrungen mit der Aufzucht von *Temnostoma bombylans* (Fabricius, 1805) und *T. vespiforme* (Linnaeus, 1758) aus den Larven (Diptera, Syrphidae). *Volucella*, 4: 121-126.
- Drensky, P. (1934) Die Fliegen der Familie Syrphidae (Diptera) in Bulgarien. *Mitt. bulg. ent. Ges.*, 9: 237-256.
- Dufour, L. (1847) Histoire des métamorphoses de la *Ceria conopsoides*. *Ann. Soc. nat. 3e Sér. Zool.*, 9: 199-209.
- Dufour, L. (1848): Histoire des métamorphoses du *Cheilosia aerea*. – *Annales des Sciences naturelles, Sér. Zoologie* 3, 9: 205-209, 1 pl. Paris.
- Dusek, J. (1962) Beitrag zur Kenntnis von Larven der Gattung *Cheilosia* Mg. (Diptera, Syrphidae). *Acta Soc. Ent. Cechoslov.* 59(1): 68-72.
- Dusek, J. & Kristek, J. (1967) Zur Kenntnis der Schwebfliegenlarven (Diptera, Syrphidae) in der Galen der Pappelblattlaus (Homoptera, Pemphigidae). *Z. ang. Ent.*, 60: 124-136.
- Dusek, J. & Laska, P. (1959) Beitrag zur Kenntnis einiger unbekannter aphidophager syrphiden-larven (Dipt., Syrphidae). *Acta Soc. ent. Cechoslov.*, 57(3): 279-292.
- Dusek, J. & Laska P. (1960a) Beitrag zur Kenntnis der Schwebfliegen-Larven II. *Prirod. cas. slezsky*, 21: 299-320.
- Dusek, J. & Laska, P. (1960b) Weitere unbekannte Syrphidenlarven (Diptera, Syrphidae). *Acta Soc. ent. Cechosloveniae*, 57: 371-388.
- Dusek, J. & Laska, P. (1961) Beitrag zur Kenntnis der Schwebfliegen-Larven III (Syrphidae, Diptera). *Prirod. cas. slezsky*, 22: 513-541.
- Dusek, J. & Laska, P. (1962) Beitrag zur Kenntnis einiger Syrphiden-larven (Diptera, Syrphidae). *Acta Soc. Ent. Cechosloveniae*, 59: 348-356.
- Dusek, J. & Laska, P. (1964) A contribution to distinguishing the European species of the subgenus *Syrphus* Fab. (Diptera, Syrphidae) according to the male genitalia and larvae. *Acta Soc. Ent. Cechoslov.*, 61(1): 58-69.
- Dusek, J. & Laska, P. (1967) Versuch zum aufbau eines natürlichen Systems mitteleuropäischer Arten der Unterfamilie Syrphinae (Diptera). *Acta sc. nat. Brno*, 1: 349-390.
- Dusek J. & Laska P. (1973) Descriptions of five new European species of the genus *Metasyrphus* (Diptera: Syrphidae), with notes on variation within the species. *Acta ent. bohemoslov.*, 70(6): 415-426
- Dusek, J. & Laska, P. (1974) Overwintering and Spring emergence of some common species of aphidophagous syrphids (Syrphidae, Diptera). *Fac. Sci. Nat. Univ. Purkynianae, Brno*, 15(1): 71-75.
- Dusek, J. & Laska, P. (1976) European species of *Metasyrphus*: key, descriptions and notes. *Acta ent. bohemoslov.*, 73: 263 - 282
- Dusek, J. & Laska, P. (1982) European species related to *Platycheirus manicatus*, with descriptions of two new species (Diptera, Syrphidae). *Acta ent. bohemoslov.*, 79: 377-392.
- Dusek, J. & Laska, P. (1985) A review of the genus *Scaeva* (Fabricius) (Diptera, Syrphidae) with the description of a new species from Chile. *Acta ent. bohemoslov.*, 82: 206-228.
- Dusek, J. & Laska, P. (1988) Saprophage Larven von *Ferdinandea cuprea* und *Brachypalpus valgus* (Diptera, Syrphidae). *Acta entomol. Bohemoslov.*, 85: 307-312.
- Dussaix, C. (1996) *Callicera spinolae* (Diptera, Syrphidae) reared in France, *Dipt. Digest*, 3: 44.
- Dussaix, C. (1997a) Liste provisoire des Syrphes du département de la Sarthe (France), suivie de notes sur les stades immatures de quelques espèces (Diptera, Syrphidae). *Bull. Soc. ent. Fr.*, 102: 159-169.
- Dussaix, C. (1997b) *Myolepta vara* (Diptera, Syrphidae) reared in France (Dép. Sarthe). *Dipterists Digest*, 4: 18-19.
- Dussaix (2005a) Liste provisoire des syrphes (Diptera, Syrphidae) du département de la Sarthe (72-France). Période 1990-2004. (1re actualisation). *L'Entomologiste*, 61: 159-178.
- Dussaix (2005b) Liste provisoire des syrphes (Diptera, Syrphidae) du département de la Sarthe (72-France). Période 1990-2004. (1re actualisation). *L'Entomologiste*, 61: 207-226.

- Dussaix, C., Stallegger, P. & Livory, A. (2007) *Microdon major* Andries, 1912, nouvelle espèce pour la faune de France (Diptera, Syrphidae). *L'Entomologiste*, 63 : 265-269.
- Duty, I. (1995) Zum Blütenbesuch von *Neoascia interrupta* (Mg., 1822) (Diptera, Syrphidae). *Studia dipterologica*, 2: 172.
- Dziock, F. (1999) Historische Belege von *Brachyopa maculipennis* Thompson, 1980 (Diptera, Syrphidae) aus Brandenburg. *Volucella*, 4: 157-160.
- Dziock, F. (2002) Überlebensstrategien und Nahrungsspezialisierung bei räuberischen Schwebfliegen (Diptera, Syrphidae). *UFZ-Bericht, Leipzig-Halle*, 10/2002: 1-131.
- Ebejer, M.J. (1988) Some records of hoverflies (Diptera: Syrphidae) from Malta. *Entomol. Gaz.*, 39: 160-164.
- Ebejer, M.J. & Bensusan, K. (2011) Hoverflies (Diptera, Syrphidae) recently encountered on Gibraltar, with two species new for Iberia. *Dipterists Digest*, 17: 123-139.
- Efflatoun, H.C. (1922) A monograph of Egyptian Diptera, Pt.1: Syrphidae. *Mem.Soc. Ent.d'Egypte*, 2(1): 1 - 123
- Elmes, G.W., Radchenko, A.G. & Thomas, J.A. (2003) First records of *Myrmica vandeli* Bondroit (Hymenoptera, Formicidae) for Britain. *Br.J.ent.Nat.Hist.*, 16: 145-152.
- Evenhuis, H.H. (1959) *Cnemodon vitripennis* (Meig.) als roofvijand van de Appelbloedluis, *Eriosoma lonigerum* (Hausm.). *Ent.Ber.Amst.*, 19: 238-240.
- Evenhuis, H.H. (1978) *Didea intermedia* (Dipt., Syrphidae) als predator van *Schizolachnus pineti* (Hemipt., Aphididae) en over prooispecialisatie van andere bladluisvretende zweefvliegjarven. *Ent.Ber.*, Amst., 38: 129-131.
- Falck, M. (1996) *Mallota megilliformis* (Fallén, 1817) and *Chrysotoxum cautum* (Harris, 1776) (Diptera: Syrphidae) new to Norway. *Fauna norv.*, Ser.B, 43: 58-60.
- Falk, S. (2004) Brood dimorphism in male *Cheilosia cyanocephala* Loew (Diptera, Syrphidae) and separation of the first generation from *C.vernalis* (Fallén). *Dipterists Digest*, 11: 123-126.
- Fetzer, C. (1937) Eine seltene Schwebfliege (*Syrphus*). *Jb.nassau.Ver.Naturk.*, 84: 41-43.
- Flügel, H.-J. (2004) *Triglyphus primus* Loew, 1840 (Diptera, Syrphidae), eine eigenwillige Zwerg-Schwebfliege. *Philippia*, 11:235-238.
- Francuski, L., Vujic, A. Kovacevic, A., Ludoski, J. & Milankov, V. (2009). Identification of the species of the *Cheilosia variabilis* group (Diptera, Syrphidae) from the Balkan Peninsula using wing geometric morphometrics, with the revision of status of *C. melanopa redi* Vujic, 1996. *Contributions to Zoology*. 78(3):129-140.
- Fraser, F.C. (1946) *Volucella* (Dipt., Syrphidae) larvae breeding in a nest of *Vespula vulgaris* L. (Hym., Vespidae). *Entomol.Mon.Mag.*, 82: 55-57.
- Friederichs, K., Schaerffenberg, B. & Sturm, H. (1940) Über die Feinde des Kiefernspanners mit Berücksichtigung des Mischwaldes. *Z.angew.Ent.* 27: 621-641.
- Gabler, H. (1938) Die Bedeutung der Larven von *Syrphus tricinctus* Fall. für die Vernichtung von Raupen und Afterraupen. *Tharandt.forstl.Jb.*, 90: 69-74.
- Gainey, P. (2008) A further possible sighting of *Milesia crabroniformis* (Fabricius, 1775) (Diptera: Syrphidae) in West Cornwall (V.C.1). *Entomologist's Gazette*, 59: 250.
- Gammelmo, Ø. & Aarvik, L. (2007) The myrmecophilous fly *Microdon myrmicae* Schönrogge et al., 2002 (Diptera, Syrphidae) in Norway. *Norw. J. Entomol.*, 54: 43-48.
- Gaunitz, S. (1936) Om tre syrphidarter. *Entomologisk Tidskrift*, 57: 6-9.
- Gibbs, D. & Plant, C.W. (2001) *Cheilosia ranunculi* Doczkal (Dip.: Syrphidae) in Britain. *Ent.Record*, 113: 65-68.
- Gil-Collado, J. (1929) Sirfidios de Marruecos del Museo de Madrid (Diptera, Syrphidae) *Mems R.Soc.esp.Hist.Nat.*, 12: 403-415.
- Gil-Collado, J. (1930) Monografía de los Sirfidios de España. *Trab.mus.nac.Cienc.nat.*, Madr., 1930: 1-376.
- Goeldlin de Tiefenau, P. (1971) Quatre espèces nouvelles de *Paragus* (Dipt. Syrphidae) de la région paléarctique occidentale. *Bull.Soc.ent.Suisse*, 43: 272-278.
- Goeldlin de Tiefenau, P. (1974) Contribution a l'étude systématique et écologique des Syrphidae (Dipt.) de la Suisse occidentale. *Bull.Soc.ent.Suisse*, 47: 151 - 252.

- Goeldlin de Tiefenau P. (1976) Revision du genre *Paragus* (Dipt., Syrphidae) de la region palearctique occidentale. *Bull.Soc.Ent.Suisse*, 49: 79-108.
- Goeldlin de Tiefenau, P. (1989) Sur plusieurs espèces de *Sphaerophoria* (Dipt., Syrphidae) nouvelles ou méconnues des régions paléarctique et néarctique. *Bull.Soc.ent.Suisse*, 62: 41-66.
- Goeldlin, P. de Tiefenau (1991) *Sphaerophoria estebani*, une nouvelle espèce européenne du groupe *rueppelli* (Diptera, Syrphidae). *Bull.Soc.ent.Suisse*, 64:331-339.
- Goeldlin de Tiefenau, P. (1996) Sur plusieurs nouvelles espèces européennes de *Syrphus* (Diptera, Syrphidae) et clé des espèces paléarctiques du genre. *Bull.Soc.ent.Suisse*, 69: 157-171.
- Goeldlin de Tiefenau, P. (1997) Le genre *Trichopsomyia* Williston, 1888 (Diptera: Syrphidae) in Europe avec description d'une nouvelle espèce, connue depuis longtemps. *Bull.Soc.Ent.Suisse*, 70: 191-201.
- Goeldlin de Tiefenau, P. & Lucas, J.A.W. (1981) *Paragus* (Dipt., Syrphidae) de Corse et de Sardaigne. *Bull.Soc.Ent.Suisse*, 54: 389-397.
- Goeldlin de Tiefenau, P., Maibach, A. & Speight, M.C.D. (1990) Sur quelques especes de *Platycheirus* (Diptera, Syrphidae) nouvelles ou meconnues. *Dipterists Digest*, 5: 19-44.
- Goeldlin de Tiefenau, P. & Speight, M.C.D. (1997) Complément à la liste faunistique des Syrphidae (Diptera) de Suisse: synthèse des espèces nouvelles et méconnues. *Bull.Soc.ent.Suisse*, 70: 299-309.
- Goffe, E.R. (1945) Notes on the type-species of some genera of Syrphidae (Diptera). *J.Soc.Br.Ent.*, 276-279.
- Gomes, A. (1981) Sirfideos colhidos em Portugal durante 1977 (Diptera, Syrphidae). *Agron.lusit.*, 41: 5-24.
- Gomez, A. & Báez, M. (1990) Contribución al conocimiento de los Sírfidos del archipiélago de Madeira (Diptera, Syrphidae). *Vieraea*, 19: 339-345.
- Greene, C.T. (1923) A contribution to the biology of North American Diptera. *Proc.Ent.Soc.Wash.*, 25(4): 82-89.
- Greig, C. (1989) Overwintering behaviour of the larva of *Myathropa florea* (L.) (Diptera: Syrphidae). *Dipterists Digest*, 2: 11-16.
- Gritskevich, D.I. (1998) Hover-flies (Diptera: Syrphidae) in anthophilous complexes of plants of Myaochan Range, Khabarovskii Krai. *Far Eastern Entomologist*, No.65: 10-14.
- Groot, M. de & Govedič, M. (2008) Checklist of the hoverflies (Diptera: Syrphidae) of Slovenia. *Acta entomologica slovenica*, 16: 67-87.
- Grunin, K. (1939) Oviposition and the development of the larvae of *Rhingia rostrata* L. (Diptera: Syrphidae). *Byull. Obshch. Estest. voronezh. gosud. Univ.*, 3: 69-62.
- Grosskopf, G., Smith, L.A. & Syrett, P. (2001) Host range of *Cheilosia urbana* (Meigen) and *Cheilosia psilophthalma* (Becker) (Diptera: Syrphidae), candidates for the biological control of invasive alien hawkweeds (*Hieracium* spp., Asteraceae) in New Zealand. *Biological Control*, 24: 7-19.
- Haarto, A. & Kerppola, S. (2004) Checklist of Finnish Hoverflies (Diptera, Syrphidae). *Sahlbergia*, 9: 147-164.
- Haarto, A. & Kerppola, S. (2007a) Finnish hoverflies and some species in adjacent countries. Otavan Kirjapaino Oy, Keuruu. 647pp.
- Haarto, A. & Kerppola, S. (2007b) Muutoksia Suomen kukkakärpäsfaunaan (Diptera, Syrphidae). *Sahlbergia*, 13: 34-40.
- Haarto, A. & Kerppola, S. (2009) *Brachyopa zhelochovtsevi* Mutin, 1998 Euroopasts ja muita lisäyksiä Suomen kukkakärpäsfaunaan (Diptera, Syrphidae) *W-Album*, 7: 3-11.
- Haarto, A. & Koponen, S. (2003) Syrphid flies from southern Greenland. *Ent.Meddr.*, 71: 163.
- Haarto, A., Kerppola, S. & Ståhls, G. (2007) Description of *Cheilosia naruska* Haarto & Kerppola spec.nov. from northern Europe (Diptera, Syrphidae). *Volucella*, 8: 63-72.
- Hackman, W. & Meinander, M. (1979) Diptera feeding as larvae on macrofungi in Finland. *Annlz.zool.fenn.*, 16: 50-83.
- Haenni, J.-P. (2010) *Brachyopa grunewaldensis* Kassebeer, 2000, *Ferdinandea ruficornis* (Fabricius, 1775) et quelques autres Syrphides saproxyliques intéressants capturés à Neuchâtel (Diptera, Syrphidae). *Entomo Helvetica* 3 : 65-70.

- Harris, M. (1776-1780) An exposition of English insects, with certain observations and remarks, wherein each insect is particularly described; its parts and properties considered; the different sexes distinguished, and the natural history faithfully related. Privately published, London. 166pp.
- Hartley, J.C. (1961) A taxonomic account of the larvae of some British Syrphidae. *Proc.zool.Soc.Lond.*, 136: 505-573.
- Hartmann, K. & Duelli, P. (1988) Flächenbezogene Angaben zur Erfassung der Produktion (Schlüpfrate) von adulten Aphidophagen in naturnahen Gebeiten. *Mitteilungen der deutschen Gesellschaft für allgemeine und angewandte Entomologie*, 6: 182-187.
- Hauser, M. (1998) Zur Schwebfliegenfauna (Diptera, Syrphidae) Aserbaidshans, mit der Beschreibung von zwei neuen Arten. *Volucella*, 3: 15-26.
- Hayat, R. (1997). *Sphegina (Sphegina) alaoglu*, a new hover-fly from north-eastern Turkey (Diptera: Syrphidae). *Zoology in the Middle East*, 14: 109-113.
- Hayat, R. & Claussen, C. (1997) A new species and new records of the genus *Paragus*, Latreille, 1804 from Turkey (Diptera: Syrphidae). *Zoology in the Middle East*, 14: 99-108.
- Heiss, E.M. (1938) A classification of the larvae and puparia of the Syrphidae of Illinois exclusive of aquatic forms. *Univ.Illinois Bull.*, 36: 1-142.
- Hellqvist, S. (2009) Intressanta blomflugor från norra Sverige med en för Sverige ny art. *Skörvnöpparn* 1: 4-8.
- Hellrigl, K. (1992) Die Fichtenharzfliege *Cheilisia morio* Zett. (Dipt., Syrphidae) als physiologischer Schädling an Fichten in Südtirol. *Anz.Schädlingsk. Pflanzenschutz; Umweltschutz*, 65: 33-36.
- Hennig, W. (1952) Die Larvenformen der Dipteren, 3. Akademie-Verlag, Berlin, 159-190.
- Heqvist, K.-J. (1957) Über die Larve von *Temnostoma apiforme* Fab. (Diptera, Syrphidae). *Entom.Ts.Arg.*, 78: 29 - 31.
- Hering, E.M. (1957) Bestimmungstabellen der Blattminen von Europa einschliesslich des Mittelmeerbeckens und der Kanarischen Inseln, 1: 1-648, 2: 649-1185, 3: 1-221. Gravenhage.
- Hervé-Bazin, J. (1913) Description d'un nouveau Syrphide européen (Dipt.). *Bull.Soc.ent.Fr.* 1913: 135-136.
- Hippa, H. (1967) The male of *Neoascia petsamoensis* Kanervo (Dipt., Syrphidae) with remarks on the females and the distribution of the species. *Ann .Ent. Fenn.*, 33: 256-260.
- Hippa, H. (1968a) Classification of the palaeartic species of the genera *Xylota* Meigen and *Xylotomima* Shannon (Dipt., Syrphidae). *Ann.Ent.Fenn.*, 34: 179-197.
- Hippa, H. (1968b) A generic revision of the genus *Syrphus* and allied genera (Diptera: Syrphidae) in the Palearctic region, with descriptions of the male genitalia. *Acta Ent.Fenn.*, 25: 1-94.
- Hippa, H. (1978) Classification of *Xylotini* (Diptera, Syrphidae). *Acta Zool.Fenn.*, no.156: 1-153.
- Hippa, H. (1985) Infrageneric classification and revision of the Oriental species of the genus *Brachypalpoides* Hippa (Diptera, Syrphidae). *Acta Ent.Fenn.*, 45: 1-20.
- Hippa, H. (1990) The genus *Milesia* Latreille (Diptera, Syrphidae). *Acta Zool.Fenn.*, 187: 1-226.
- Hippa, H. & Ståhls, G. (2005) Morphological characters of adult Syrphidae: descriptions and phylogenetic utility. *Acta Zoologica Fennica*, no.215: 1-72.
- Hippa, H., Nielsen, T.R. & Thompson, F.C. (2009) *Eristalis obscura* (Loew) (Diptera, Syrphidae): synonyms and morphological variation in the Holarctic region. *Norw. J. Entomol.* 56: 32–36.
- Hippa, H., Nielsen, T.R. & van Steenis, J. (2001) The west Palaeartic species of the genus *Eristalis* Latreille (Diptera, Syrphidae). *Norw.J.Entomol.*, 48: 289-327.
- Hodson, W.E.H. (1927) The bionomics of the lesser bulb flies, *Eumerus strigatus*, Flin and *E.tuberculatus* Rond., in South-West England. *Bull.Ent.Res.*, 17: 373-384.
- Hodson, W.E.H. (1932a) A comparison of the larvae of *Eumerus strigatus* Fal. and *E.tuberculatus* Rond. (Syrphidae). *Bul.Ent.Res.*, 23(2): 247-249.
- Hodson, W.E.H. (1932b) The large narcissus fly, *Merodon equestris*, Fab. (Syrphidae). *Bull.Ent.Res.*, 23: 429-448.
- Holldobler, K. (1929) Über die Entwicklung der Schwierfleige *Xanthogramma citrofasciatum* im Neste von *Lasius alienus* und *niger*. *Zool. Anzeig.*, 82: 171-176.
- Hövmeyer, K. (1992) Population studies of *Cheilisia fasciata* (Diptera: Syrphidae), a leaf miner of *Allium ursinum*. *Ecol.Ent.*, 17: 331-337.

- Hull, F.M. (1949) The Morphology and Inter-relationships of the Genera of Syrphid Flies, Recent and Fossil. *Trans.zool.soc.Lond.*, 26: 257-408.
- Hurkmans, W. (1985) Territorial behaviour of two *Merodon* species (Diptera: Syrphidae). *Entomologische Berichten*, Amsterdam, 45: 69-70.
- Hurkmans, W. (1987) *Merodon telmateia*, a new hoverfly from Turkey (Diptera: Syrphidae). *Entomol.Ber. (Amst)*, 47: 119-121.
- Hurkmans, W. (1988) Ethology and ecology of *Merodon* in Turkey. (Diptera: Syrphidae). *Entomologische Berichten*, Amsterdam, 48: 107-114.
- Hurkmans, W. (1993) A Monograph of *Merodon* (Diptera: Syrphidae). Pt.1. *Tijdschr. Ent.*, 136: 147-234.
- Hurkmans, W. & Hayat, R. (1997) Ethology and ecology of *Merodon* (Diptera, Syrphidae) in Turkey II: descriptions of new species and notes on other syrphid flies. *Dipt.Digest*, 3: 62-79.
- Jensen, J.-K. (2001) Faroese Hoverflies (Diptera: Syrphidae): checklist to the year 2000. *Fróðskaparrit*, 48: 125-133.
- Jones, R.A. (2001) *Heringia senilis* Sack (Diptera: Syrphidae): a hoverfly new to Britain. *Br.J.Ent.Nat.Hist.*, 14: 185-194.
- Jukes, A. (2010) *Chalcosyrphus eunotus* (Loew, 1873) (Diptera, Syrphidae): its status, distribution, ecology and conservation. *Dipterists Digest*, 17: 31-42.
- Kanervo, E. (1934) Einige neue Syrphiden aus Petsamo. *Ann.Soc.Zool.-Bot.Fenn.* "Vanamo", 14: 115-135.
- Kanervo, E. (1938) Zur systematik und Phylogenie der westpalaarktischen *Eristalis*-Arten (Dipt.Syrphidae) mit einer Revision derjenigen Finnlands. *Ann.Univ. Turkuensis*, ser.A, 6: 1-54.
- Kantyerina, N.F. (1979) [Biological characteristics of syrphid flies (Diptera, Syrphidae) in the Orlovski Region]. *Byull Nauchno-Tekhn Inf Vses Nauchno-Issled Instit zernobobovykh i Krupianykh Kul'tur* 24: 37-40. (In Russian)
- Kaplan, M. and Thompson, F.C. (1981) New Syrphidae from Israel. *Proc.ent.Soc.Wash.*, 83(2): 185-197.
- Kassebeer, C.F. (1991) Eine neue Art der Gattung *Sphagina* Meigen 1822 aus Europa (Diptera: Syrphidae). *Ent.Zeitschrift*, 101: 441-446.
- Kassebeer, C.F. (1993) Die Schwebfliegen (Diptera: Syrphidae) des Lopautals bei Amelinghausen. *Drosera*, 93: 81-100.
- Kassebeer, C.F. (1995) Revision der paläarktischen Arten der Gattung *Chrysosyrphus* Sedman, 1965 (Diptera, Syrphidae). *Studia dipterologica*, 2: 283-295.
- Kassebeer, C.F. (1998a) Die marokkanischen Arten der Gattung *Cheilosia* Meigen, 1822 (Diptera, Syrphidae). *Dipteron*, 1: 57-68. Kiel.
- Kassebeer, C.F. (1998b) Die marokkanischen Arten der Gattung *Platycheirus* Le Peletier & Serville, 1828 (Diptera, Syrphidae). *Dipteron* 1 (2), 25-36. Kiel.
- Kassebeer, C.F. (1999a) Eine neue Gattung der Brachyopini (Diptera: Syrphidae) aus dem Mittleren Atlas. *Dipteron*, 2: 11-24.
- Kassebeer, C.F. (1999b) Eine neue Art der Gattung *Ferdinandea* Rondani, 1844 (Diptera: Syrphidae) aus Nordafrika. *Dipteron*, 2: 153-162.
- Kassebeer, C.F. (2000) Eine neue *Brachyopa* Meigen, 1822 (Diptera, Syrphidae) aus dem Grunewald. *Dipteron*, 3: 7-12.
- Kassebeer, C.F. (2002) Zur Schwebfliegenfauna (Diptera, Syrphidae) der Balearen. *Dipteron*, 4: 131-156.
- Kassebeer, C., Maibach, A. & Rotheray, G.E. (1998) The third (final) stage larva of *Psilota anthracina* Meigen and *Psilota decessa* (Hutton) (Dipt., Syrphidae). *Entomol.Mon.Mag.*, 134: 39-43.
- Kormann, K. (1988) Schwebfliegen Mitteleuropas: Vorkommen, Bestimmung, Beschreibung. Ecomed, Munchen, 1-176.
- Kormann, K. (1993) Schwebfliegen aus der Umgebung von Karlsruhe. *Zeit.Ent.*, 14: 33-56.
- Krivosheina, M.G. (2001) Notes on the biology of palaeartic flies of the genera *Chalcosyrphus* Curran and *Xylota* Meigen (Diptera, Syrphidae), with the description of immature stages of *Xylota atricoloris* Mutin, 1987. *Int.J.Dipterol.Res.*, 12: 165-172.
- Krivosheina, M.G. (2003a) To biology of flower flies of the genus *Temnostoma* (Diptera, Syrphidae) with description of larvae in four species. *Zoolichesky Zhurnal*, 82: 44-51.

- Krivosheina, M.G. (2003b) A review of flower-flies of the genus *Hammerschmidtia* in Russia with description of *H.ingrica* larva (Diptera: Syrphidae). *Zoolichesky Zhurnal*, 82: 687-693. (In Russian).
- Krivosheina, M.G. (2005) Contributions to the Biology of Flower Flies of the Genus *Brachyopa* (Diptera, Syrphidae). *Entomological Review*, 85: 569-585.
- Krivosheina, N.P. (2002) Morphological and faunistic study of xylophagous flower-flies of the *bombylans* group of the genus *Temnostoma* (Diptera, Syrphidae). *Zool.zhurn.*, 81: 958-969. (In Russian).
- Krivosheina, N.P. (2003) Morphology of species of the genus *Temnostoma* from *apiforme* and *vespiforme* groups, 1. *Zoolichesky Zhurnal*, 82: 1475-1486. (In Russian).
- Krivosheina, N.P. (2004a) Morphology of the species of the genus *Temnostoma* from *apiforme* and *vespiforme* groups, 2. *Zoolichesky Zhurnal*, 83: 75-92. (In Russian).
- Krivosheina, N.P. (2004b) A review of the species of the genus *Brachyopa* (Diptera, Syrphidae) from Russia with description of new species from Tajikistan. *Zoologičeskij žurnal*, 83: 597-603. (In Russian).
- Krivosheina, N.P. & Mamayev, B.M. (1962) Larvae of the European species of the genus *Temnostoma* (Diptera, Syrphidae). *Entomological Review*, 41: 570-575.
- Krivosheina, N.P. & Ståhls, G. (2003) Taxonomy and distribution of *Temnostoma bombylans* (Fabricius) and *T.angustistriatum* Krivosheina (Diptera, Syrphidae) in northern Europe. *Sahlbergia*, 8: 96-99.
- Krpač, V., Vujić, A., Šimić, S., Radenković, S., Lazarevska, S (2009). Revision of the Genus *Dasysyrphus* Enderlein, 1938 (Diptera: Syrphidae) in the Fauna of Macedonia, *Kragujevac* 1. Sci. 31: 103-108.
- Kruger, F. (1926) Biologie und Morphologie einiger Syrphidenlarven. *Z.Morph.Okol.*, 6: 83-149.
- Kula, E. (1980) Pestrenky (Diptera, Syrphidae) zimující v hrabance smrkových porostu na Moravě. *Cas.slez.Muz.Opava* (A), 29: 269-281.
- Kula, E. (1982) The syrphid flies (Syrphidae, Diptera) of spruce forest. *Fol.Fac.Sci.Nat.Univ. Purkynianae Brunensis*, 23 (Biologia 74, no.7): 61-64.
- Kula, E. (1983) The larva and puparium of *Eriozona syrphiodes* (Fallén) (Diptera, Syrphidae). *Acta ent.Bohemoslovaca*, 80: 71-73.
- Kurir, A. (1963) Zur biologie zweier aphidophager Schwebfliegen (Dipt., Syrphidae): *Heringia heringi* Zetterstedt und *Pipiza festiva* Meigen in den Gallen der späten Blattstieldrehgallen-Pappelblattlaus (*Pemphigus spirothecae* Passerini) auf der Pyramidenpappel (*Populus nigra* var. *pyramidalis* Spach). *Z.ang.Ent.*, 52: 61-83.
- Kuznetsov, S.Yu. (1985) Palaearctic species of *Scaeva* Fabricius (Diptera, Syrphidae). *Ent.Oboz.*, no.2, 398-418.
- Kuznetsov, S.Yu. (1988) Morphology of the eggs of hoverflies (Diptera, Syrphidae). *Rev.Ent.URSS*, 67: 741-753.
- Kuznetsov, S.Yu. (1990) A new European species of *Syrphus* F. (Diptera, Syrphidae). *Dipterological Research*, 1: 19-21.
- Kuznetsov, S.Yu. (1993) A checklist of Latvian, Lithuanian and Estonian hover flies (Diptera, Syrphidae). *Dipterological Research*, 4: 35-47.
- Kuznetsov, S.Yu & Daminova, D. (1994) A description of the puparium of *Scaeva albomaculata* Mcq. (Diptera, Syrphidae). *Dipt.Res. (Riga)*, 5: 101-104.
- Kuznetsov, S.Yu & Kuznetsova, N.V. (1994) Descriptions of the unknown larvae and puparia of some aquatic Syrphidae (Diptera) species from the genera *Neoascia*, *Chrysogaster*, *Orthonevra* and *Eristalis*. *Dipt.Res.*, 5: 271-287.
- Kuznetsov, S.Yu & Kuznetzova N.V. (1995) Descriptions of the unknown larvae and puparia of some aquatic Syrphidae (Diptera) species from the genera *Conosyrphus*, *Mallota* and *Myathropa*. *Dipt.Res.*, 6: 135-141.
- Lal, R. & Gupta, S.B.L. (1953) Morphology of the immature stages of *Sphaerophoria scutellaris* (Fabr.) - Syrphidae: Diptera) with notes on its biology. *Indian J.Ent.*, 15: 207-218.
- Lambeck, H.J.P. (1973) *Eumerus nigrostriatus* sp.n. and its karyotype (Diptera: Syrphidae). *Genen Phaenen*, 16: 27-34.
- Laska, P. & Bicik, V. (1996) On the problems of the species *Dasysyrphus venustus* (Meigen) and *D.hilaris* (Zetterstedt) (Dipt., Syrphidae). *Ent. Mon. Mag.*, 132: 305-310.

- Laska, P. & Stary, P. (1980) Prey records of aphidophagous syrphid flies from Czechoslovakia (Diptera, Syrphidae). *Acta ent.Bohemoslov.*, 77: 228-235.
- Laska, P., Perez-Banon, C., Mazanek, L., Rojo, S., Stahls, G., Marcos-Garcia, M.-A., Bicik, V. & Dusek, J. (2006) Taxonomy of the genera *Scaeva*, *Simosyrphus* and *Ischiodon* (Diptera: Syrphidae): descriptions of immature stages and status of taxa. *Eur.J.Entomol.*, 103: 637-655.
- Leclercq, M. (1944) Notes sur les Diptères des environs de Liège. *Bull.Soc.R.Sc. Liège*, 13: 34-44.
- Lehrer, A.Z. (1971) Valeur morphologique des sclerites abdominaux et homologie des terminalia males des Dipteres Cyclorrhapha. 1. Fam.Syrphidae. *Bull.Soc. Ent. Mulhouse*, Jan-fev. 1971: 1-18.
- Loew, H. (1854). Neue Beiträge zur Kenntnis der Dipteren, Zweiter Beitrag. *Programm K. Realschule zu Meseritz*, 1854: 1-56.
- Loiselle, M. (1914) L'*Eumerus tricolor* Mg. parasite des Salsifis (*Tragopogon porrifolium* L.). *Feuille J.Natur.*, 44: 174.
- Lucas, J.A.W. (1977) New species of the genus *Pipizella* Rondani, 1856 (Diptera, Syrphidae). *Publ.nat.hist.Genootschap Limb.*, 26(1976): 5 - 13.
- Lucas, J.A.W. (1996) Notes on syrphid flies of Portugal (Diptera, Syrphidae). *Agronomia Lusitana*, 45: 317-326.
- Lucas, J.A.W., Nielsen, T.R. & Stahls, G. (1995) The identity of the *Cheilosia* complex *vicina* (Zetterstedt, 1849) - *nigripes* (Meigen, 1822) (Diptera, Syrphidae). *Int.J.Dipt.Res.*, 6: 3-7.
- Lundbeck, W. (1916) *Diptera Danica*, 5 (Lonchopteridae, Syrphidae). 1-591. Copenhagen.
- Lyneborg, L. & Barkemeyer, W. (2005) The genus *Syrirta*: a World revision of the genus *Syrirta* Le Peletier & Serville, 1828 (Diptera: Syrphidae). 224pp. Apollo Books, Stenstrup, Denmark.
- MacGowan, I. (1994) Creating breeding sites for *Callicera rufa* Schummel (Diptera,Syrphidae) and a further host tree. *Dipterists Digest* (N.S.) 1: 6-8.
- MacGowan, I. & Rotheray, G.E. (2007) *Callicera rufa* Schummel (Diptera, Syrphidae) status and trends: an update. *Dipterists Digest*, 13: 113-118.
- Maibach, A. (1993) Contribution à l'étude des Syrphidae aquatiques de Suisse occidentale (Insecta; Diptera). Doctoral thesis of the University of Lausanne, Switzerland. 642pp.
- Maibach, A. & Goeldlin, P. de Tiefenau (1989) *Mallota cimbiciformis* (Fallen) nouvelle pour la faune de Suisse: morphologie du dernier stade larvaire, de la puppe et notes biologiques (Diptera, Syrphidae). *Bull.Soc.Ent.Suisse*, 62: 67-78.
- Maibach, A. & Goeldlin de Tiefenau, P. (1991a) *Platycheirus perpallidus* Verrall (Diptera, Syrphidae) nouveau pour la faune de Suisse: morphologie des stades immatures et description du cycle de développement. *Bull. Soc.Vaud. Sci.Nat.*, 80(3): 341-356.
- Maibach, A. & Goeldlin de Tiefenau, P. (1991b) Note biologique et description des larve et puppe d'*Eristalis (Eoseristalis) rupium* F. (Diptera, Syrphidae). *Bull.Soc.ent. Suisse*, 64: 321-330
- Maibach, A. & Goeldlin de Tiefenau, P. (1992) Description de la puppe de *Chalcosyrphus (Xylotodes) eunotus* (Loew) et synthese des caracteristiques morphologiques des stades immatures de plusieurs genres de la tribu des Xylotini (Diptera, Syrphidae). *Bull. Soc. ent.Suisse*, 65: 165-175.
- Maibach, A. & Goeldlin de Tiefenau, P. (1993) Description et clé de détermination des stades immatures de plusieurs espèces du genre *Neoascia* Williston de la région paléarctique occidentale (Diptera, Syrphidae). *Bull.Soc.ent.Suisse*, 66: 337-257.
- Maibach, A. & Goeldlin de Tiefenau, P. (1994) Limites génériques et caractéristiques taxonomiques de plusieurs genres de la Tribu des Chrysogasterini (Diptera: Syrphidae) III. Descriptions des stades immatures de plusieurs espèces ouest-paléarctiques. *Rev.suisse Zool.*, 101: 369-411.
- Maibach, A. & Goeldlin de Tiefenau, P. (1995) *Chrysogaster rondanii* sp.n. from Western and Central Europe (Diptera: Syrphidae). *Bull.Soc.entomol.Suisse*, 68: 459-464.
- Maibach, A., Goeldlin de Tiefenau, P. & Dirickx, H.G. (1992) Liste faunistique des Syrphidae de Suisse (Diptera). *Misc.Faun.Helvetiae*, 1: 1-51. Centre suisse de cartographie de la faune, Neuchatel.
- Maibach, A., Goeldlin de Tiefenau, P. & Dirickx, H.G. (1998) Syrphidae. In: Merz, B., Bächli, G., Haenni, J.-P. & Gonseth, Y. (eds.) *Fauna Helvetica 1: Diptera - Checklist*, 211-224. SEG/CSCF, Neuchatel.
- Maibach, A., Goeldlin de Tiefenau, P. & Speight, M.C.D. (1994a) Limites génériques et caractéristiques taxonomiques de plusieurs genres de la Tribu des Chrysogasterini (Diptera: Syrphidae) 1.

- Diagnoses génériques et description de *Riponnensia* gen.nov. *Ann.Soc.Entomol.Fr.* (N.S.), 30: 217-247.
- Maibach, A., Goeldlin de Tiefenau, P. & Speight, M.C.D. (1994b) Limites génériques et caractéristiques taxonomiques de plusieurs genres de la Tribu des Chrysogasterini (Diptera: Syrphidae) 2. Statut taxonomique de plusieurs des espèces étudiées et analyse du complexe *Melanogaster macquarti* (Loew). *Ann.Soc.Entomol.Fr.* (N.S.), 30: 253-271.
- Maier, C.T. (1978) The immature stages and biology of *Mallota posticata* (Fabricius) (Diptera: Syrphidae). *Proc.entomol.Soc.Wash.*, 80: 424-440.
- Maier, C.T. (1982) Larval habitats and mate-seeking sites of flower flies (Diptera: Syrphidae, Eristalinae). *Proc.entomol.Soc.Wash.*, 84: 603-609.
- Maier, C.T. and Waldbauer, G.P. (1979) Dual mate-seeking strategies in male syrphid flies (Diptera: Syrphidae). *Ann.Entomol.Soc.Am.*, 72: 54-61.
- Malec, F. (1986) *Eoseristalis pratorum* (Meigen, 1822) (Diptera, Syrphidae) in der Umgebung Kassels. Festschr. 150 Jahre Phillipi-Ges. 1836-1986: 78-81.
- Marcos-García, M^a A. (1981) Contribucion al conocimiento de los Syrphidae (Dipt.) de la zona noreste de la provincia de Salamanca. *Bol.Asoc.esp.Entom.*, 4: 157-171.
- Marcos-García, M^a A. (1982) Dos nuevas especies de sirfidos para la fauna de la Peninsula Iberica. *Nouv.Rev.Ent.*, 12: 115-118.
- Marcos-García, M^a A. (1983) *Eumerus tuberculatus* Rondani, 1857 y *Dasysyrphus lunulatus* (Meigen, 1822), (Dip.Syrphidae), especies nuevas para la fauna de la Península ibérica. *Boletin Asoc.esp.Entom.*, 7: 147-150.
- Marcos-García, M^a A. (1985a) Los Syrphidae (Diptera) de las sierras occidentales del Sistema Central español. Subfamilias: Eristalinae, Lampetiinae, Microdontinae, Milesiinae y Cerianinae. *Bol. Assoc.española Ent.*, 9: 187-210.
- Marcos-García, M^a A. (1985b) Sirfidofauna de las Sierras de Béjar, La Alberca y Gata. subfamilia Syrphinae (Syrphidae, Diptera). *Salamanca Revista Provincial Estudios*, No.16-17, 389-419.
- Marcos-García, M^a A. (1985c) Contribucion al conocimiento de la sirfidofauna del Pirineo del Alto Aragon. 1 (Diptera, Syrphidae). Actas do II congresso iberico de entomologia. *Bol.Soc.Port.ent.*, 1: 511-520.
- Marcos-García, M^a A. (1986) Citas de interes del genero *Paragus* Latreille, 1804 en la Peninsula Iberica y descripcion de *Paragus vandergooti* sp.nov. (Diptera, Syrphidae). *Actas de las VIII Jornadas A e E*, 765-772.
- Marcos-García, M^a A. (1987a) Sobre la presencia de *Cheilosia paralobi* Malski, 1962 y *C.latifacies* Loew, 1857 en la peninsula Iberica (Diptera, Syrphidae). *Anales de Biologia*, 11 (Biologia Animal 3): 99-101.
- Marcos-García, M^a A. (1987b) Descripción de la hembra de *Cheilosia andalusiaca* Pedersen,1971 (Diptera, Syrphidae). *Mediterránea (Ser. Biol.)* 9, 1987: 57-61.
- Marcos-García, M^a A. (1989a) *Cheilosia cantabrica* n.sp. de la peninsula iberica (Diptera, Syrphidae). *Nouv.Revue Ent.*, (N.S.), 6: 343-346.
- Marcos-García, M^a A. (1989b) *Merodon escorialensis* Strobl, 1909, *stat.nov.* (Diptera, Syrphidae). *Annl.Soc.ent.Fr.* (N.S.), 25: 243-247.
- Marcos-García, M^a A. (1990a) El género *Cheilosia* Meigen, 1822, en la Cordillera Cantábrica (Diptera, Syrphidae). *Mediterránea Ser. Biol.*, 12: 113-138.
- Marcos-García, M^a A. (1990b) Nuevos datos sobre especies Ibéricas del género *Merodon* Meigen, 1822 y descripción de la genitalia de *Merodon unguicornis* Strobl, 1909 (Diptera, Syrphidae). *Annales de Biologia*, 16: 49-51.
- Marcos-García, M^a A. (1998) Contribución al estudio del genero *Xanthogramma*: *Xanthogramma laetum* (Fabricius, 1794) = (*Xanthogramma catalanicum* Andreu, 1926), *syn.nov.* (Diptera, Syrphidae). *Nouv. Rev Ent.*, 15: 179-282.
- Marcos-García, M^a A. (2006) *Caliprobola speciosa* (Rossi, 1790); *Mallota dusmeti* Andréu, 1926; *Meligramma cingulata* (Egger, 1860). In: Verdú, J.R. & Galante, E. (eds.) *Libro Rojo de los Invertebrados de España*, 173-176. Dirección General para le Biodiversidad, Ministerio e Medio Ambiente, Madrid.

- Marcos-García, M^a A. & Claussen, C. (1989) Description of *Cheilosia iberica*, new species, from the Iberian peninsula (Diptera, Syrphidae). *Bonn.zool.Beitr.*, 40: 57-62.
- Marcos-García, M^a A. & Isidro, P.M. (1995) Prima cita ibérica de *Brachypalpus valgus* (Panzer, 1798) y *Chrysotoxum parmense* Rondani, 1845 (Diptera: Syrphidae): caracterización polínica de su dieta. *Boln.Assoc.esp.Ent.*, 19: 141-147.
- Marcos-García, M^a A. & Laska, P. (1983) Description of *Metasyrphus lucasi* sp.n. (Diptera, Syrphidae). *Nouv.Rev.Ent.*, 13(1): 113-116.
- Marcos-García, M.A. and Pérez-Bañón, C. (2000) *Eumerus etnensis* van der Goot, 1964 (= *Eumerus purpurariae* Báez, 1982), syn.nov. (Diptera, Syrphidae). *Nouvelle Revue d'Entomologie* (N.S.), 17: 336.
- Marcos-García, M.A. & Rojo, S. (1994) *Paragus hyalopteri* n.sp. an aphidophagous hoverfly (Dipt.: Syrphidae) attacking the mealy plum aphid (Hom.: Aphididae). *Entomophaga*, 39: 99-106.
- Marcos-García, M.-A., Isidrio, P.M., Rojo, S. & Pérez-Bañón, C. (1998) Catálogo y distribución geográfica de los sírfidos iberobaleares (Diptera, Syrphidae), I - Syrphinae y Microdontinae. *Boln.Assoc.esp.Ent.*, 22: 37-61.
- Marcos-García, M.A., Mazánek, L., Láska, P., Bičík, V. & Rojo, S. (2000) Description of the male of *Eupeodes lucasi* (Marcos-García & Láska, 1983) and biological data on the species (Diptera, Syrphidae). *Volucella*, 5: 129-138.
- Marcos-García, M.A., Rojo, S. & Pérez-Bañón, C. (2002a) Family Syrphidae. In: Catálogo de los Dípteros de España, Portugal y Andorra (Insecta). Monografías SEA (ed.), 8: 132-136.
- Marcos-García, M.A., Pérez-Bañón, C. & Rojo, S. (2002b) Nuevas especies de *Paragus* Latreille, 1804 para la Península Ibérica (Diptera, Syrphidae). *Boln.Assoc.esp.Ent.*, 26: 201-203.
- Marcos-García, M.A., Vujić, A. & Mengual, X. (2007) Revision of Iberian species of the genus *Merodon* (Diptera: Syrphidae). *Eur.J.Entomol.*, 104: 531-572.
- Matile, L. & Leclercq, M. (1992) Repartition en France de *Milesia crabroniformis* (F.) et *M.semiluctifera* (Villers) et description de la puppe et des pieces buccales larvaires de *M.crabroniformis* (Dipt.Syrphidae Milesiinae). *Ent.gall.*, 3: 101-105.
- Mazánek, L., Bičík, V. & Láska, P. (1998) Redescription and reinstatement of *Eupeodes bucculatus* (Rondani, 1857) and its synonymy (Dipt., Syrphidae). *Acta Univ.Palacki. Olomuc. Fac. rer. nat., Biol.* 36: 27-38.
- Mazánek, L., Láska, P. & Bicik, V. (1999a) Two new Palaearctic species of *Eupeodes* similar to *E.bucculatus* (Diptera, Syrphidae). *Volucella*, 4: 1-9.
- Mazánek, L., Láska, P. & Bičík, V. (1999b) Revision of type material of *Metasyrphus chillcotti* (Diptera: Syrphidae). *Dipterologica bohemoslovaca*, 9: 139-142.
- Mazánek, L., Láska, P., Bičík, V. & Nielsen, T.R. (1999c) Key to males of Norwegian species of *Eupeodes* (Diptera: Syrphidae). *Dipterologica bohemoslovaca*, 9: 141-152.
- Mazánek, L., Láska, P., Bičík, V. & Novotný, R. (2001) Descriptions with key to the third larval stage and puparia of the genus *Epistrophe* s.str. (Diptera: Syrphidae). *Acta Universitatis Carolinae, Biologica*, 45: 115-128.
- Metcalf, C.L. (1913) The Syrphidae of Ohio. *Ohio Biological Survey Bulletin*, 1: 1-317.
- Metcalf, C.L. (1916) Syrphidae of Maine. *Maine Agr.Exp.st.*, 253: 193-264.
- Metcalf, C.L. (1933) An obscure *Temnostoma* differentiated by its larval characters. *Ann.Ent.Soc.Amer.*, 26: 1-8.
- Milankov, V., Stamenkovic, J., Vujic, A. & Simic, S. (2002) Geographic variation of *Cheilosia vernalis* (Fallen, 1817) (Diptera: Syrphidae). *Acta Zoologica Academiae Scientiarum Hungaricae*, 48: 255-267.
- Milankov, V., Vujic, A. & Ludoski, J. (2001) Genetic divergence among cryptic taxa of *Merodon avidus* (Rossi, 1790) (Diptera: Syrphidae). *International Journal of Dipterological Research*, 12: 15-24.
- Milankov, V., Vujic, A. & Simic, S. (2002) Identifying the species of the *ruficornis* group of the genus *Merodon* Meigen (Diptera: Syrphidae) using morphological and genetic markers. *Studia dipterologica*, 9: 319-326.
- Milankov, V., Ståhls, G., Stamenković, J. & Vujić, A. (2008). Genetic diversity of populations of *Merodon aureus* and *M.cinereus* species complexes (Diptera, Syrphidae): integrative taxonomy and

- implications for conservation priorities on the Balkan Peninsula. *Conservation Genetics*. 9: 1125-1137.
- Morris, R.K.A. & Ball, S.G. (2004) Sixty years of *Volucella zonaria* (Poda) (Diptera: Syrphidae) in Britain. *Br.J.ent.nat.hist.*, 17: 217-27.
- Munk, T. (2000) Svirrefluen *Eumerus sabulorum* (Fallén, 1817) (Syrphidae, Diptera) yngler i blomunke (*Jasione montana* L.). *Flora og Fauna*, 106: 19-22.
- Mutin, V.A. (1990) Obeor palaerkticheskikh vidov mukh-zhurchalok roda *Parasyrphus* Matsumura, 1917 (Diptera, Syrphidae). *Nov.Maloizvestiye Vidy Fauny Sib.*, 22: 129-153.
- Mutin, V.A. (1998a) *Cryptopipiza* nom.n., new name for the genus *Pseudopipiza* Violovitsh (Diptera, Syrphidae). *Int.J.Dipterol.Res.*, 9: 13.
- Mutin, V.A. (1998b) New data on the genus *Brachyopa* Meigen, 1822 (Diptera, Syrphidae) from Russian far east. *Far Eastern Entomologist*, No.65: 1-9.
- Mutin, V.A. (2001a) Review of *Sphegina claviventris* species-group (Diptera, Syrphidae) with description of a new species from Japan. *Far Eastern Entomologist*, No.107: 1-8.
- Mutin, V.A. (2001b) New data on the taxonomy of the Palaearctic hover-flies (Diptera, Syrphidae). - *Far Eastern Entomologist*, 2001: 19-20.
- Mutin, V.A. (2002) Review of the far eastern species of the genus *Pipiza* Fallen, 1810 (Diptera, Syrphidae). *Far Eastern Entomologist*, No.121: 1-16.
- Mutin, V. & Gilbert, F. (1999) Phylogeny of the genus *Xylota* Meigen, 1822 (Diptera, Syrphidae), with descriptions of new taxa. *Dipteron*, 2: 45-68.
- Nielsen, P., Ringdahl, O. & Tuxen, S.L. (1954) Family Syrphidae. *Zoology of Iceland*, 3(48a): 60-74.
- Nielsen, T. R. (1966) Species of the genus *Helophilus* (Dipt., Syrphidae) found on Jaeren, Rogaland. *Norsk ent.Tidsskr.*, 4: 427 - 439.
- Nielsen, T. R. (1970) *Cheilosia sootryeni* nov.sp. (Dipt., Syrphidae), a Norwegian species resembling *Ch.vernalis* Fallen. *Norsk Ent.Tidsskr.*, 17(2): 115-118.
- Nielsen, T.R. (1971a) Syrphidae (Dipt.,) from Jaeren, Norway, 1. with description of two new species. *Norsk.ent.Tidsskr.*, 18: 73-73.
- Nielsen, T.R. (1971b) Description of the female *Syrphus pilisquamis* Ringd., and a comparison with female *S.ribesii* L. (Dipt., Syrphidae). *Norsk.ent.Tidsskr.*, 18: 41-44.
- Nielsen, T.R. (1972) *Platycheirus monticolus* nov.sp., a Northern species confused with *P.discimanus* Loew (Dipt., Syrphidae). *Norsk.ent.Tidsskr.*, 19: 91-98.
- Nielsen, T.R. (1974) Notes on two northern species of the genus *Platycheirus* St.-Farg. et Serv. (Dipt., Syrphidae). *Norsk.ent.Tidsskr.*, 21: 167-172.
- Nielsen, T.R. (1979) Hoverflies (Diptera, Syrphidae) associated with Ramsons, *Allium ursinum* L. *Fauna Norv.*, Ser.B, 26: 21-23.
- Nielsen, T.R. (1980) *Melangyna lucifera* n.sp. from southern Norway (Diptera: Syrphidae). *Ent.Scand.*, 11: 310-312.
- Nielsen, T.R. (1980a) *Cheilosia angustigena* Becker, 1894 (Dipt., Syrphidae) in Norway. *Fauna norv.*, Ser.B., 27: 79-80.
- Nielsen, T.R. (1981) Studies on *Platycheirus* Lepeletier & Serville: *P.complicatus* Becker, *P.latimanus* (Wahlberg) and *P.boreomontanus* nom.nov. (Diptera: Syrphidae). *Ent.Scand.*, 12: 99-102.
- Nielsen, T.R. (1989) A survey of some Norwegian hoverfly genera. *Årg.*, 99: 81-100.
- Nielsen, T.R. (1992) On the syrphid genera *Brachyopa* Meigen and *Hammerschmidtia* Schummel (Diptera) in Norway. *Fauna norv.Ser.B*, 39: 39-43.
- Nielsen, T.R. (1995) Studies on some northern *Eristalis* species (Diptera, Syrphidae). *Dipterological Research*, 6: 129-133.
- Nielsen, T.R. (1997) The hoverfly genera *Anasimyia* Schiner, *Helophilus* Meigen, *Parhelophilus* Gerschner and *Sericomyia* Meigen in Norway (Diptera, Syrphidae). *Fauna norv.* Ser.B 44: 107-122.
- Nielsen, T.R. (1998) Hoverflies (Dipt., Syrphidae) in the arctic Pasvik valley, Norway. *Fauna norv.*, Ser.B, 45: 83-92.
- Nielsen, T.R. (1999) Check-list and distribution maps of Norwegian Hoverflies, with description of *Platycheirus laskai* nov.sp. (Diptera, Syrphidae). *NNA Fagrapport*, No.35: 1-99.

- Nielsen, T.R. (2003) Description of *Eupeodes biciki* spec.nov. (Diptera, Syrphidae) from northern Norway. *Norw.J.Entomol.*, 50: 99-103.
- Nielsen, T.R. (2004) European species of the *Platycheirus ambiguus* group (Diptera, Syrphidae), with description of new species. *Volucella*, 7: 1-30.
- Nielsen, T.R. (2005) Additions and corrections to the Norwegian list of hoverflies. *Norw.J.Entomol.*, 52: 139-144.
- Nielsen, T.R. & Claussen, C. (2001) On *Cheilosia ingerae* spec.nov. (Diptera, Syrphidae) from northern Fennoscandia. *Dipteron*, 4: 43-56.
- Nielsen, T.R. & Torp, E. (1973) Syrphidae (Diptera) from Sicily, with a description of a new *Pipizella* species. *Norsk.ent.Tidsskr.*, 20: 295-299.
- Nielsen, T.R. & Vockeroth, J.R. (2000) Description of a new Nearctic *Sericomyia* Meigen, 1803 (Diptera, Syrphidae). *Dipteron*, 3: 137-140.
- Nötzold, R. (2000) Kleinräumige Dispersionsmuster zoophager Fliegen (Diptera: Syrphidae, Empidoidea) im Agrarwirtschaftsraum und ihre Bedeutung für das Naturschutzmanagement. *Verlag Agrarökologie*, No.39, 158pp. Bern-Hannover.
- Ôhara, A. (1980) The genus *Platycheirus* Lepeletier and Serville, 1828 (Diptera, Syrphidae) of Japan, with description of three new species. *Esakia*, 15, 97-142.
- Gammelmo, Ø. & Nielsen, T.R. (2008) Further records of hoverfly species (Diptera, Syrphidae) in Norway. *Norw. J. Entomol.*, 55: 19-23.
- Olafsson, E. (1991) Islenskt skordýratal. *Fjölrit Náttúrufræðistofnunar*, 17: 1-69.
- Palmer, C. (1996) A further record of *Scaeva albomaculata* in Britain and a note on the K.G.Blair collection of British Diptera. *Dipt.Digest*, 2: 97-99.
- Parmenter, L. (1956) On *Syrirta pipiens* L. (Syrphidae) and its habits. *Ent.Rec.J.Var.*, 68: 211-214.
- Peck, L.V. (1988) Syrphidae. In: Soos, A. & Papp, L. (eds.) Catalogue of Palaearctic Diptera, 8: 11-230. Akad.Kiado, Budapest.
- Pellmann, H. (1998) Die Gattung *Brachyopa* Meigen, 1822 (Insecta, Diptera, Syrphidae) in entomologischen Sammlungen sächsischer Museen und die Möglichkeit der Artunterscheidung anhand der Genitalien der Männchen. *Studia dipterologica*, 5: 95-112.
- Pérez-Bañón, C. & Marcos-García, M. A. (1998) Life history and description of the immature stages of *Eumerus purpurariae* (Diptera: Syrphidae) developing in *Opuntia maxima*. *Eur.J.Entomol.*, 95: 373-382.
- Pérez-Bañón, C. & Marcos-García, M^a A. (2000) Description of the immature stages of *Syrirta flaviventris* (Diptera: Syrphidae) and new data about the life history of European species of *Syrirta* on *Opuntia maxima*. *Eur.J.Entomol.*, 97: 131-136.
- Pérez-Bañón, C., Isidro, P.M., Rojo, S. & Marcos-García, M^a A. (1996) Primeros datos sobre la dieta polínica de sírfidos de interés en la Península Ibérica y nuevas aportaciones sobre su corología. *Fragmenta Entomologica*, Roma, 28 (2): 307-320.
- Pérez-Bañón, C., Rojo, S., Ståhls, G. & Marcos-García, M^a A. (2003) Taxonomy of European *Eristalinus* (Diptera: Syrphidae) based on larval morphology and molecular data. *Eur.J.Entomol.*, 100: 417-428.
- Peris, S.V. (1962) Los Sericomyiinae de España con descripción de una nueva especie de *Sericomyia* (Dipt. Syrphidae). *Bol.R.Soc.Esp.Hist.Nat.* (B), 60: 55-60.
- Perris, E. (1870) Histoire des insectes du pin maritime. *Annls.Soc.ent.Fr.*, 4, Série 10: 135-232, 321-366.
- Petanidou, T. (1991) Pollinating fauna of a phrygantic ecosystem: species list. *Verlagen en Technische Gegevens*, No 59: 11pp.
- Peterson, A., Bartish, R.V. & Peterson, J. (2008) Effects of population size on genetic diversity, fitness and pollinator community composition in fragmented populations of *Anthericum liliago* L. *Plant Ecol.*, 198: 101-110.
- Pettersson, R.B. & Bartsch, H.D. (2001) *Blera eoa* (Stackelberg, 1928) en ny stubb-blomfluga för Europa (Diptera: Syrphidae). *Natur. i Norr.*, 20: 91-96.
- Plant, C.W. (2001) Hoverflies (Diptera: Syrphidae) in Buckingham Palace Garden. In: Plant, C.W. (ed.) The Natural History of Buckingham Palace Garden, London, Pt.2, 259-268. *The London Naturalist*, No.80, Supplement.

- Pollard, E., Hooper, M.D. & Moore, N.W. (1974) Hedges. *New Naturalist* no 58, 256pp. Collins, London.
- Pontin, A.J. (1960) Some records of predators and parasites adapted to attack aphids attended as ants. *Entomol. Mon. Mag.*, 95: 154-155.
- Popov, G.V. (2000) A new synonym of *Merodon tricinctus* (Diptera, Syrphidae). *Vestnik Zoology*, 34: 99–102.
- Radenković, S., Vujić, A. & Simić, S. (2004) On the identity and synonymy of two species from *Merodon ruficornis* Meigen group (Diptera: Syrphidae). *Acta entomologica serbica* 2002, 7: 51-57.
- Radenković, S., Vujić, A., Ståhls, G., Pérez-bañón, C., Rojo, S., Petanidou, T. & Simić, S. (2011) Three new cryptic species of the genus *Merodon* Meigen (Diptera: Syrphidae) from the island of Lesvos (Greece). *Zootaxa*, 2735: 35–56.
- Reemer, M. (1999) Faunistiek en ecologie van het zweefvliegengenus *Epistrophe* in Nederland (Diptera: Syrphidae). *Nederlandse Faunistische Mededelingen*, 9: 33-65.
- Reemer, M. (2000a) A new species of *Parhelophilus* Girschner, 1897 (Diptera, Syrphidae) from southwestern Europe. *Dipteron*, 3: 1-6.
- Reemer, M. (2000b) Hoverflies in the Pripyatskij National Park in southern Belarus (Diptera, Syrphidae). *Volucella*, 5: 139-147.
- Reemer, M. (2002) Lena's wimperzweefvlieg *Dasysyrphus lenensis* in Nederland (Diptera: Syrphidae). *Nederlandse Faunistische Mededelingen*, 17: 13-18.
- Reemer, M. & Smit, J.T. (2007) Some hoverfly records from Turkey (Diptera, Syrphidae). *Volucella*, 8: 135-146.
- Reemer, M. & van Aartsen B. (2000) *Ceriana vespiformis*, een nieuwe zweefvlieg voor de Nederlandse fauna (Diptera: Syrphidae). *Nederlandse faunistische Mededelingen*, 2:133-136.
- Reemer, M. & Goudsmits, K. (2004) Oviposition observed in *Chrysotoxum cautum*, *C. vernale* and *Merodon avidus* (Diptera, Syrphidae). *Volucella*, 7: 217-218.
- Reemer, M., Hauser, M. & Speight, M.C.D. (2005) The genus *Myolepta* Newman in the West-Palaearctic region (Diptera, Syrphidae). *Studia dipterologica*, 11: 553-580.
- Reemer, M., Renema, W., Van Steenis, W., Zeegers, T., Barendregt, A., Smit, J.T., Van Veen, M.P., Van Steenis, J. & Van der Leij, L.J.J.M. (2009) De Nederlandse Zweefvliegen (Diptera: Syrphidae). *Nederlandse Fauna* 8, 442pp. NNMN/KNNV/EIS Nederland.
- Ricarte Sabater, A. & Marcos-García, M.-A. (2007) *Ferdinandea fumipennis* Kassebeer, 1999 (Diptera: Syrphidae), nueva especie para el continente europeo. *Boln. Asoc. esp. Ent.*, 31:205-208.
- Ricarte Sabater, A. & Marcos García, M.-A. (2008) Los sírfidos (Diptera: Syrphidae) del Parque Nacional de Cabañeros (España): una herramienta para la gestión. *Boln. Asoc. esp. Ent.*, 32 (1-2): 19-32.
- Ricarte Sabater, A. & Marcos García, M.-A. (2010) first record of the rare european endemic *Sphiximorpha binominata* (Verrall) (Diptera: Syrphidae) for the Iberian Peninsula. *Arch. Biol. Sci.*, Belgrade, 62: 1215-1217
- Ricarte Sabater, A., Amorós-Jiménez, R. & Marcos-García, M^a A. (2009) New records to the hoverfly (Diptera: Syrphidae) fauna of Portugal. *Boln. Asoc. esp. Ent.*, 33: 255-257.
- Ricarte Sabater, A., Jover, T., Marcos-García, M^a A., Micó, E. & Brustel, H. (2009) Saproxylic beetles (Coleoptera) and hoverflies (Diptera: Syrphidae) from a Mediterranean forest: towards a better understanding of their biology for species conservation. *Journal of Natural History*, 43: 583-607
- Ricarte Sabater, A., Kehlmaier, C. & Marcos-García, M^a A. (2006) El género *Brachyopa* Meigen, 1822 (Diptera, Syrphidae) en la Península Ibérica. *Nouv. Revue Ent.*, (N.S.), 23 : 55-56.
- Ricarte Sabater, A., Marcos-García, M^a A., Pérez-Bañón, C. & Rotheray, G.E. (2007) The early stages and breeding sites of four rare saproxylic hoverflies (Diptera: Syrphidae) from Spain. *Journal of Natural History*, 41: 1717-1730.
- Ricarte Sabater, A., Marcos-García, M^a A. & Rotheray, G.E. (2008) The early stages and life histories of three *Eumerus* and two *Merodon* species (Diptera : Syrphidae) from the Mediterranean region. *Entomologica Fennica*, 19: 129-141.

- Ricarte Sabater, A., Nedeljković, Z., Quinto, J. and Marcos-García, M.-A. (2010) The genus *Ferdinandea* Rondani, 1844 (Diptera, Syrphidae) in the Iberian Peninsula: first records and new breeding sites. *J. Entomol. Res. Soc.*, 12: 57-69.
- Riddiford, N.J. & Ebejer, M.J. (2006) Some hoverflies (Diptera, Syrphidae) from Mallorca (Balearic Islands, Spain) with special reference to the habitats in the Parc Naturel de s'Albufera de Mallorca *Boll.Soc.Hist.Nat.Balears*, 49: 185-197.
- Rizza, A., Campobasso, G., Dunn, P.H. & Stazi, M. (1988) *Cheilosia corydon* (Diptera: Syrphidae), a candidate for the biological control of musk thistle in North America. *Ann.Entomol.Soc.Am.*, 81(2): 225-232.
- Röder, G. (1998) Schwebfliegen Bayerns, mit Gefährdungsstufen der Roten Liste. 136pp. Goecke & Evers, Keltern.
- Rojo, S. & Marcos-García, M.A. (1997) Syrphid predators (Dipt.: Syrphidae) of gall forming aphids (Hom.: Aphididae) in Mediterranean areas; implications for biological control of fruit tree pests. *Entomophaga*, 42: 269-276.
- Rojo, S. & Marcos-García, M.A. (1998) Catálogo de los sirfidos (Diptera Syrphidae) aphidófagos (Homoptera Aphididae) presentes en cultivos y plantas herbáceas de España y Portugal. *Boll.Zool.agr.Bacghic.*, Ser.II, 30: 39-54.
- Rojo, S., Isidrio, P.M., Perez-Bañón, C. & Marcos-García, M.A. (1997) Revision of the hoverflies (Diptera: Syrphidae) from the Azores archipelago with notes on Macaronesian syrphid fauna. *Arquipélago, Bulletin of the University of the Azores, Life and Marine Sciences*, 15A: 65-82.
- Rojo, S., Pérez-Bañón, C. & Marcos-García, M.A. (1999) First observations on the biology of *Scaeva mecogramma* (Bigot, 1860) (Diptera, Syrphidae) and notes on some other syrphids preying on psyllids (Hemiptera, Aphalaridae and Triozidae). *Volucella*, 4: 105-111.
- Rojo, S., Ståhls, G., Pérez-Bañón, C. & Marcos-García, M.-Á. (2006) Testing molecular barcodes: invariant mitochondrial DNA sequences vs the larval and adult morphology of West Palaearctic *Pandasyophthalmus* species (Diptera: Syrphidae: Paragini). *Eur.J.Entomol.*, 103: 443-458.
- Romig, T. & Hauser, M. (2004) *Copestylum melleum* (Jaenicke, 1867) (Diptera, Syrphidae) is an established neozoon on the Canary Islands. *Volucella*, 7: 185-191.
- Rotheray, G.E. (1986) The larvae and puparium of *Epistrophe grossulariae* (Meigen) (Dipt., Syrphidae) with a note on overwintering behaviour. *Entomologists Mon.Mag.*, 122: 215-218.
- Rotheray, G.E. (1988a) Larval morphology and feeding patterns of four *Cheilosia* species (Diptera: Syrphidae) associated with *Cirsium palustre* L. Scopoli (Compositae in Scotland. *J.Nat.Hist.*, 22: 17-25.
- Rotheray, G.E. (1988b) Third stage larvae of six species of aphidophagous Syrphidae (Diptera). *Ent.Gaz.*, 39: 153-159.
- Rotheray, G.E. (1988c) Morphology and feeding behaviour of the leaf-mining larva of *Cheilosia semifasciata* (Diptera: Syrphidae). *J.Nat.Hist.*, 22: 865-873.
- Rotheray, G.E. (1990) The relationship between feeding mode and morphology in *Cheilosia* larvae (Diptera, Syrphidae). *J.Nat.Hist.*, 24: 7-19.
- Rotheray, G.E. (1990a) Larval and puparial records of some hoverflies associated with dead wood (Diptera, Syrphidae) *Dipterists Digest*, No.7: 2-7.
- Rotheray, G.E. (1991) Larval stages of 17 rare and poorly known British hoverflies (Diptera: Syrphidae). *J.Nat.Hist.*, 25: 945-969.
- Rotheray, G.E. (1994) Colour guide to hoverfly larvae (Diptera, Syrphidae) in Britain and Europe. *Dipterists Digest*, (1993), No.9: 1-156.
- Rotheray, G.E. (1996) The larva of *Brachyopa scutellaris* Robineau-Desvoidy (Diptera: Syrphidae) with a key to and notes on the larvae of British *Brachyopa* species. *Ent.Gaz.*, 47: 199-205.
- Rotheray, G. E. (1997) Larval stages of the predatory hoverflies *Trichopsomyia flavitarsis* (Meigen), *Platycheirus melanopsis* Loew and *Parasyrphus nigratarsis* (Zetterstedt) (Diptera: Syrphidae). *Ent.Gaz.*, 48: 127-134.
- Rotheray, G. E. (1998) *Platycheirus splendidus* sp.n. from Britain formerly confused with *Platycheirus scutatus* (Diptera: Syrphidae). *Ent.Gaz.*, 49: 271-276.

- Rotheray, G.E. (1999a) The early stages of *Cheilosia illustrata* (Harris) (Diptera, Syrphidae). *Dipterists Digest*, 6: 107-111.
- Rotheray, G.E. (1999b) Descriptions and a key to the larval and puparial stages of north-west European *Volucella* (Diptera, Syrphidae). *Studia dipterologica*, 6: 103-116.
- Rotheray, G.E. (2004) The early stages of *Xylota abiens* Meigen, with a key to the larvae and puparia of British *Xylota* species (Diptera, Syrphidae). *Dipterists Digest*, 11: 83-97.
- Rotheray, G.E. & Dobson, J. (1987) Aphidophagy and the larval and pupal stages of the syrphid *Platycheirus fulviventris* (Macquart). *Ent.Gaz.*, 38: 245-251.
- Rotheray, G.E. & Gilbert, F.S. (1989) The phylogeny and systematics of European predaceous Syrphidae (Diptera) based on larval and puparial stages. *Zool.J. Linn.Soc.*, 95: 29-70.
- Rotheray, G.E. & Gilbert, F.S. (2011). *The Natural History of Hoverflies*. 333pp. Forrest Text, Cardigan.
- Rotheray, G.E. & Hewitt, S.M. (1999) Northern records of *Parasyrphus nigratarsis* (Zetterstedt) (Syrphidae). *Dipterists Digest, second series*, 6: 106.
- Rotheray, G.E. & MacGowan, I. (2000) Status and breeding sites of three presumed endangered Scottish saproxylic syrphids (Diptera, Syrphidae) *J.Ins.Conservation*, 4: 215-223.
- Rotheray, G.E. & Perry, I. (1994) The larva of *Callicera spinolae* with a key to the larvae of British *Callicera* species (Diptera, Syrphidae). *Entomologist*, 113: 205-210.
- Rotheray, G.E. & Sarthou, J.-P. (2007) Description of the larva and puparium of *Paragus absidatus* Goeldlin de Tiefenau, 1971 (Diptera, Syrphidae). *Volucella*, 8: 103-108.
- Rotheray, G.E. & Stuke, J.-H. (1998) Third stage larvae of four species of saproxylic Syrphidae (Diptera), with a key to the larvae of British *Criorhina* species. *Ent.Gaz.*, 49: 209-217.
- Rotheray, G.E., Dussaix, C., Marcos-García, M.-A. & Pérez-Bañón, C. (2006) The early stages of three Palaearctic species of saproxylic hoverflies (Diptera, Syrphidae). *Micron*, 37: 73-80.
- Rotheray, G.E., Hancock, G. & Maier, C.T. (1998) The larvae of two *Ceriana* species (Diptera, Syrphidae) breeding in exuded tree sap. *Entomol.Mon.Mag.*, 134: 223-228
- Rupp, L. (1989) Die mitteleuropäischen Arten der Gattung *Volucella* (Diptera, Syrphidae) als Kommensalen und Parasitoiden in den Nesten von Hummeln und sozialen Wespen. Untersuchungen zur Wirhfindung, Larvalbiologie und Mimikry. Diss., Albert-Ludwigs-Universität Freiburg i.Br., 208pp.
- Sack, P. (1928-32) Die Fliegen der Palaerktischen Region, 31. Syrphidae. Stuttgart (Schweizerbart), 1-451.
- Sarthou, J.-P., Ouin, A., Arrignon, F., Barreau, G. & Bouyjou, B. (2006) Landscape parameters explain the distribution and abundance of *Episyrphus balteatus* (Diptera: Syrphidae). *Eur.J.Entomol.*, 102: 539-545.
- Schedl, W. (1992) Blütenökologische Beobachtungen an der Chinesischen Zaubernuss (*Hamamelis mollis* Oliv., Hamamelidaceae) im Botanischen Garten in Innsbruck (Österreich). *Ber.nat.-med. Verein Innsbruck*, 79: 145-152.
- Schmid, U. (1992) Zur Taxonomie und Verbreitung von *Sphaerophoria shirchan* (Diptera: Syrphidae) in Südwestdeutschland. *Stuttgarter Beitr.Naturk.*, A, No.480: 1-6.
- Schmid, U. (1993) Schwebfliegen (Diptera, Syrphidae) aus dem Rosensteinpark in Stuttgart. *Jh.Ges. Naturkde. Württemberg*, 148: 193-208.
- Schmid, U. (1995) New Palaearctic hoverfly species (Diptera, Syrphidae) and new synonyms: a survey. *Volucella*, 1: 29-44.
- Schmid, U. (1996) Auf gläsernen Schwingen: Schwebfliegen. *Stuttgarter Beit.z.Naturkunde*, Ser.C., No.40: 1-80. Staatlichen Mus.f. Naturkunde, Stuttgart.
- Schmid, U. (1999a) Die Larve von *Cheilosia impressa* (Diptera: Syrphidae). *Volucella*, 4: 113-119.
- Schmid, U. (1999b) *Syrphus obscuripes* Strobl, 1910: ein älteres Synonym von *Epistrophe similis* Doczkal & Schmid, 1994 (Diptera, Syrphidae). *Volucella*, 4: 103-104.
- Schmid, U. (1999c) Schwebfliegen-Nachweise (Diptera, Syrphidae) aus Deutschland: *Cheilosia laeviseta* Claussen, 1987; *Merodon aeneus* Meigen, 1822 und *Syrphus auberti* Goeldlin de Tiefenau, 1996. *Volucella*, 4: 161-165.
- Schmid, U. (2000). *Cheilosia rhodiolae* spec.nov. - Taxonomie und Ökologie einer alpinen Schwebfliege (Diptera, Syrphidae) aus der *Cheilosia fasciata*-Gruppe. *Volucella*, 5: 15-50.

- Schmid, U. (2004a) *Microdon rhenanus* and *Microdon eggeri* var. *major* (Diptera, Syrphidae) revisited. *Volucella*, 7: 111-124.
- Schmid, U. (2004b) *Cheilosia semifasciata* Becker, 1894 (Diptera, Syrphidae) a synanthropic species? *Volucella*, 7: 219-222.
- Schmid, U. & Grossmann, A. (1996a) Eiablage von *Cheilosia latifrons* (Zetterstedt, 1843) on *Leontodon autumnalis* L. *Volucella*, 2: 86-87.
- Schmid, U. and Grossmann, A. (1996b) *Brachyopa insensilis* Collin, 1939 (Diptera, Syrphidae) am Schleimfluss der Weissstanne *Abies alba* Mill. *Volucella*, 2: 98-100.
- Schmid, U. & Grossmann, A. (1998) Larven der Schwebfliege *Cheilosia fasciata* Schiner & Egger, 1853 (Diptera, Syrphidae) in Allermannsharnisch (*Allium victorialis* L.). *Volucella*, 3: 157-160.
- Schmid, U. & Moertelmaier, T. (2007) The larvae of *Brachypalpus chrysites* Egger, 1859 and *Chalcosyrphus valgus* (Gmelin, 1790) (Diptera, Syrphidae). *Volucella*, 8: 109-120.
- Schneider, F. (1953) *Syrphus nigratarsis* Zett., ein ei-und larvenrauber von *Melasoma* (Chrysomel. Col.). *Tijdschr.Plzikt.*, 59: 192-194.
- Scholz, D. & Poehling, H.-M. (2000) Oviposition site selection of *Episyrphus balteatus*. *Experimentalis et Applicata*, 94: 149-158.
- Schönrogge, K., Barr, B., Wardlaw, J.C., Napper, E., Gardner, M.G., Breen, J., Elmes, G.W. & Thomas, J.A. (2002a) When rare species become endangered: cryptic speciation in myrmecophilous hoverflies. *Biological J.Linn.Soc.*, 75: 291-300.
- Schönrogge, K., Barr, B., Wardlaw, J.C., Napper, E., Gardner, M.G., Breen, J., Elmes, G.W. & Thomas, J.A. (2002b) Addendum: When rare species become endangered: cryptic speciation in myrmecophilous hoverflies. *Biological J.Linn.Soc.*, 76: 315.
- Schuhmacher, H. (1968) Die Schwebfliegenfauna im Raum Heidelberg (Ein Beitrag zur Fauna des Landes Baden-Württemberg). *Beitr. naturk. Forsch. SüdWdtl*, 27: 101-108.
- Sedlag, U. (1967) *Triglyphus primus*, eine weitgehend ubersehene Syrphidae (Dipt., Syrphidae). *Ent.Ber.*, Berlin, 1966(2): 88-90.
- Séguy, E. (1961) Dipteres Syrphides de l'Europe occidentale. *Mem.Mus.Nat.Hist.Nat., Nouv.Ser., A, Zoologie*, 23: 248pp.
- Shiraki, T. (1968) Syrphidae (Insecta: Diptera). Fauna Japonica, II: 1-272, III: 1-243. Biogeographical Society of Japan, Tokyo.
- Short, B.D. & Bergh, J.C. (2005) Separation of three common hover fly predators of wooly apple aphid based on the exochorionic sculpturing of the eggs. *Can. Entomol.*, 137: 67-70.
- Simic, S. (1983). *Syrirta flaviventris* Macquart, 1841 (Diptera, Syrphidae) New species for Yugoslavia. *Glas. Republ. Zadova Zast. Prirode*, 16: 129-133.
- Simic, S. (1986) *Paragus constrictus* sp.n. and other related species of the genus *Paragus* Latreille, 1804 (Diptera: Syrphidae) in Yugoslavia. *Acta entomol.Yugosl.*, 22: 5-10.
- Simic, S. (1987) The fauna of Dormitor Mountain. Syrphidae (Insecta: Diptera). A biogeographical and ecological analysis of the hoverflies of Dormitor with a survey of the hover-flies of Montenegro. *Tsrnogorska Akad.Nauka Umjet Posebna Izd.*, 13: 11-154.
- Simic, S., Radosic, P. & Vujic, A. (1994) Some zoological and ecological characteristics of the species *Cheilosia griseifacies* Vujic (Diptera: Syrphidae). *Bios* (Macedonia, Greece), 2: 257-262.
- Simic, S. & Vujic, A. (1996) A new species of the genus *Eumerus* Meigen, 1822 (Diptera: Syrphidae). *Acta entomologica serbica*, 1: 1-4.
- Sjuts, B. (2004) The occurrence of *Brachyopa insensilis* Collin, 1939 (Diptera, Syrphidae) at *Aesculus hippocastanum* L. (Sapindales, Hippocastanaceae) in the city of Leer. *Volucella*, 7: 211-215.
- Skuffjin, K.V. (1976) New species of hover-flies (Diptera, Syrphidae) from the Northern Caucasus. *Ent.Obozr.*, 55: 931-933. (In Russian).
- Skuffjin, K.V. (1977) New species and subspecies of the genus *Cheilosia* Mg. (Diptera, Syrphidae) from the Galichya gora (Lipetsk Region). *Novye maloizvestnye vidy nasekomykh Evropeiskoi chasti SSSR, Leningrad*, 57: 57-60. (Russian, with English summary).
- Smit, J. & Vujić, A. (2008) The Palaearctic species of the genus *Psilota* Meigen (Diptera, Syrphidae) with the description of two new species. *Studia dipterologica*, 14: 345-364.

- Smit, J. & Zeegers, T. (2005) Overzicht van het zweefvliegengenus *Psilota* in Nederland (Diptera: Syrphidae). *Nederlandse faunistische Mededelingen*, 22: 113-120.
- Smit, J., Franquinho-Aguiar, A.M. & Wakeham-Dawson, A. (2004) The hoverflies (Diptera, Syrphidae) of the Madeiran Archipelago, Portugal. *Dipterists Digest* (2nd Series), 11: 47-82.
- Smith, K.G.V. (1955) Notes on the egg and first instar larva of *Volucella bombylans* L. (Dipt., Syrphidae). *Entomol.Mon.Mag.*, 91: 52-54.
- Smith, K.G.V. (1979) The larva and puparium of *Cheilosia bergenstammi* Becker (Diptera: Syrphidae) with a summary of the known biology of the genus in Europe. *Ent.Rec.J.Var.*, 91: 190-194.
- Smith, M.N. (2004) Oviposition by *Chrysotoxum cautum* (Harris, 1776) (Diptera, Syrphidae). *Dipterists Digest*, (2nd series), 11: 23.
- Sommaggio, D. (2002) *Paragus gorgus* Vujic & Radenkovic, 1999: a junior synonym of *P.majoranae* Rondani, 1857 and reinstatement of *P.pecchiolii* Rondani, 1857 (Diptera, Syrphidae). *Volucella*, 6: 53-56.
- Sörensson, M. (2001) *Platycheirus urakawensis* (Matsumura), a hoverfly new to Europe (Diptera: Syrphidae). *Entomologisk Tidskrift*, 122: 169-172.
- Sörensson, M. (2003) Faunistiskt nytt om sydsvenska blomflugor (Diptera: Syrphidae). *Occ Pap Insect Faunistics & Systematics in Sweden*, No.1: 1-12.
- Speight, M.C.D. (1976) The puparium of *Chrysotoxum festivum* (L.) (Dipt., Syrphidae). *Ent.Rec.J.Var.*, 88: 51-52.
- Speight, M.C.D. (1979) *Eumerus tuberculatus*, *Geomyza majuscula* and *Pteromicra leucopeza*: insects new to Ireland, including a key to British Isles *Eumerus* species. *Ir.Nat.J.*, 19: 397-399.
- Speight, M.C.D. (1980) The *Chrysogaster* species (Dipt.Syrphidae) known in Great Britain and Ireland. *Ent.Rec.J.Var.*, 92: 145-150.
- Speight, M.C.D. (1981a) A key to the Xylotini (sensu Hipparia) known in Great Britain and Ireland, plus *Xylota ignava* (Dipt., Syrphidae). *Ent.Rec.J.Var.*, 93(2): 25-27.
- Speight, M.C.D. (1981b) The Irish *Anasimyia* species, including a key and first records of *A.contracta* (Diptera, Syrphidae). *Ir.Nat.J.*, 20(6): 229-234.
- Speight, M.C.D. (1986b) *Portevinia maculata* (Fal.): last instar larva and puparium, with notes on the relationship between this hoverfly and its larval host-plant, *Allium ursinum* (Dipt., Syrphidae). *Nouv.Rev.Ent.*, 3: 37 - 43.
- Speight, M.C.D. (1987) External morphology of adult Syrphidae (Diptera). *Tijds.Ent.*, 130: 141-175.
- Speight, M.C.D. (1988a) Some observations on the Liechtenstein insect fauna and its conservation, with particular reference to the Diptera. *Ber.Bot.-Zool.Ges. Liechtenstein- Sargans-Werdenberg*, 17: 55-66.
- Speight, M.C.D. (1988b) *Neoascia podagrica* (Diptera: Syrphidae) in Ireland, with a key to distinguish it from related European species. *Ir.nat.J.*, 2(10): 447-452.
- Speight, M.C.D. (1988c) *Doros destillatorius*, espèce nouvelle pour la France, avec désignation des types des deux espèces européennes du genre *Doros*, description de leurs pupes et clés de détermination des adultes et des pupes. *Bull.Soc.ent. Fr.*, 92(5-6): 193- 200.
- Speight, M.C.D. (1988d) Syrphidae known from temperate Western Europe: potential additions to the fauna of Great Britain and Ireland and a provisional species list for N.France. *Dipterists Digest*, No.1: 2-35.
- Speight, M.C.D. (1990) The puparia of *Xanthogramma festivum* and *X.pedissequum* (Syrphidae) *Dipterists Digest*, 6: 29-31.
- Speight, M.C.D. (1991a) A key to W European *Parasyrphus* species (Syrphidae). *Dipterists Digest*, No.8: 3-5.
- Speight, M.C.D. (1991b) *Callicera aenea*, *C.aurata*, *C.fagesii* and *C.macquartii* redefined, with a key to and notes on the European *Callicera* species (Diptera: Syrphidae). *Dipterists Digest*, 10: 1-25.
- Speight, M.C.D. (1994) Révision des syrphes de la faune de France: II - Les Microdontidae et les Syrphidae Milesiinae (in part.) (Diptera, Syrphoidea). *Bull.Soc.ent.Fr.*, 99: 181-190.
- Speight, M.C.D. (1996) *Cheilosia psilophthalma* and *Odinia boletina*: insects new to Ireland and *Sapromyza sexpunctata* confirmed as an Irish species (Diptera: Syrphidae, Odiniidae and Lauxaniidae). *Ir.nat.J.*, 25: 178-182.

- Speight, M.C.D. (1999a) *Syrphus rectus* Osten Sacken and its potential implications to the recording of *Syrphus* species. *Dipterists Digest* 6: 85-91.
- Speight, M.C.D. (1999b) A key to European Xylotini (Dip.: Syrphidae). *Ent.Rec.*, 111: 211-217.
- Speight, M.C.D. (2002a) The last instar larval mouthparts of *Microdon mutabilis* and *M.myrmicae* (Diptera: Syrphidae). *Ent.Rec.J.Var.*, 114: 203-205.
- Speight, M.C.D. (2002b) Two controversial additions to the Irish insect list: *Microdon myrmicae* Schönrogge et al and *Pipiza festiva* Meigen (Diptera: Syrphidae) *Bull.Ir. Biogeog.Soc.*, 26: 143-153.
- Speight, M.C.D. (2003a) Species accounts of European Syrphidae (Diptera): special commemorative issue, Second International Workshop on the Syrphidae, Alicante, June 2003 . In: Speight, M.C.D., Castella, E., Obrdlik, P. and Ball, S. (eds.) *Syrph the Net, the database of European Syrphidae* , vol.38, 231 pp., *Syrph the Net publications*, Dublin
- Speight, M.C.D. (2003b) *Microdon myrmicae* Schönrogge et al 2002, (Dipt. Microdontidae): presence in Ireland confirmed. *Ent.Rec.*, 115: 155-157.
- Speight, M.C.D. (2005) *Platycheirus aurolateralis*, *P.scutatus* and *P.splendidus* (Diptera: Syrphidae) in a Co.Dublin garden, Ireland. *Bull.Ir.biogeog.Soc.*, 29: 258-261.
- Speight, M.C.D. (2006) *Trichopsomyia lucida* (Diptera:Syrphidae): an addition to the British list, and its segregation from related species. *Entomologists Record*, 118: 203-206.
- Speight, M.C.D. (2007a) *Sericomyia hispanica*, a little-known European hoverfly (Diptera: Syrphidae) recorded for the first time from the French Pyrenees. *Entomologists Rec. J. Var.*, 119: 109 - 111.
- Speight, M.C.D. (2007b) *Epistrophe olgae* Mutin 1999 (Diptera: Syrphidae) une nouvelle espèce pour la Suisse et la France. *Bull.Romand d'Entomologie*, 24 : 41-42.
- Speight, M.C.D. & Chandler, P.J. (1995) *Paragus constrictus*, *Pteromicra pectorosa* and *Stegana similis*: insects new to Ireland and *Stegana coleoprata*, presence in Ireland confirmed (Diptera). *Ir.Nat.J.*, 25: 28-32.
- Speight, M.C.D. & Claussen, C. (1987) Redefinition of *Cheilosia ahenea* and *C.argentifrons* with records extending the known range of these species in Western Europe (Diptera, Syrphidae). *Annl.Soc.ent.Fr.* (N.S.), 23(3): 299-308.
- Speight, M.C.D. & Sommaggio, D. (in press) On the presence in Switzerland of *Microdon myrmicae* Schönrogge et al, 2002; *Xanthogramma dives* (Rondani), 1857 and *X.stackelbergi* Violovitsh, 1975 (Diptera: Syrphidae). *Entomo Helvetica*, No.3
- Speight, M.C.D., Brown, M.J.F. & Stout, J.C. (2004) *Platycheirus aurolateralis* and *P.splendidus* (Diptera: Syrphidae) new to Ireland and their separation from related species. *Ir.Nat.J.*, 27: 413-417.
- Speight, M.C.D., Castella, E. & Obrdlik, P. (2000) Use of the Syrph the Net database 2000. In: Speight, M.C.D., Castella, E., Obrdlik, P. and Ball, S. (eds.) *Syrph the Net, the database of European Syrphidae*, vol.25, 99 pp., *Syrph the Net publications*, Dublin
- Speight, M.C.D., Claussen, C. & Hurkmans, W. (1998) Révision des syrphes de la faune de France: III - Liste alphabétique des espèces des genres *Cheilosia*, *Eumerus* et *Merodon* et Supplément (Diptera, Syrphidae). *Bull.Soc.ent.Fr.*, 103: 403-414.
- Speight, M.C.D. & Goeldlin de Tiefenau, P. (1990) Keys to distinguish *Platycheirus angustipes*, *P.europaeus*, *P.occultus* and *P.ramsarensis* (Dipt., Syrphidae) from other *clypeatus* group species known in Europe. *Dipterists Digest*, 5: 5-18.
- Speight, M.C.D. & Lucas, J.A.W. (1992) Liechtenstein Syrphidae (Diptera). *Ber.Bot.-Zool.Ges. Liechtenstein-Sargans-Werdenberg*, 19: 327-463.
- Speight, M.C.D. & Sarthou, J.-P. (1997) The European *Temnostoma* species (Dip.: Syrphidae). *Ent.Rec.*, 109: 127-132.
- Speight, M.C.D. & Sommaggio, D. (2010) On the presence in Switzerland of *Microdon myrmicae* Schönrogge et al., 2002, *Xanthogramma dives* (Rondani, 1857) and *X.stackelbergi* Violovitsh, 1975 (Diptera: Syrphidae). *Entomo Helvetica*, 3: 139-145.
- Speight, M.C.D. & Vockeroth, J.R. (1988) *Platycheirus amplus*: an insect new to Ireland not previously recorded from Europe. (Dipt.: Syrphidae). *Ir.Nat.J.*, 22(12): 518-521.

- Speight, M.C.D., Williams, M. de C. & Legrand, J. (1986) *Scaeva dignota* et *S.mecogramma* nouveaux pour la France et cle de determination des especes du genre (Diptera, Syrphidae). *L'Entomologiste*, 42(6): 359-364.
- Ssyman, A. (2002) Patterns of habitat use by Syrphidae (Diptera) in the valley of the river Strom in north-east Brandenburg. *Volucella*, 6: 81-124.
- Ssyman, A., Barkemeyer, W., Claussen, C., Löhr, P.-W. & Scholz, A. (1999) Syrphidae. In: Schumann, H., Bährmann, R. & Stark, A. (eds.) Checkliste der Dipteren Deutschlands, 195-203. Entomofauna Germanica 2, Studia dipterologica Supplement 2.
- Stackelberg, A.A. (1953) Palearkticheskie vidy roda *Orthoneura* Macq. (Diptera, Syrphidae). *Ent.Obozr.*, 33: 342-357 (In Russian).
- Stackelberg, A.A. (1958) The palaeartic species of the genus *Spilomyia* Mg.(Diptera, Syrphidae). *Ent.Obozr.*, 37: 759-768.
- Stackelberg, A.A. (1961) Palaeartic species of the genus *Eumerus* Mg. (Diptera, Syrphidae). *Trudy vses.ent., Obshch.*, 48: 181- 229.
- Stackelberg, A.A. (1965) New data on the taxonomy of Palaeartic hover flies (Diptera, Syrphidae). *Ent.Obozr.*, 44: 907-926 (In Russian; republished in English in: *Ent.Soc.Amer.Scripta Tech.*, Washinton, 4: 528-537).
- Ståhls, G. & Vujić, A. (2009) *Cryptopipiza notabila* (Violovitsh, 1985) (Diptera, Syrphidae) in Finland. *Sahlbergia*, 15 : 1-2.
- Ståhls, G., Hippa, H., Rotheray, G., Muona, J. & Gilbert, F. (2003) Phylogeny of Syrphidae (Diptera) inferred from combined analysis of molecular and morphological characters. *Systematic Entomology*, 28: 433-450.
- Ståhls, G., Stuke, J.-H., Vujic, A., Doczkal, D. & Muona, J. (2004) Phylogenetic relationships of the genus *Cheilosia* and the tribe Rhingiini (Diptera, Syrphidae) based on morphological and molecular characters. *Cladistics*, 20: 105-122.
- Ståhls, G., Vujić, A. & Milankov, V. (2008). *Cheilosia vemalis* (Diptera, Syrphidae) complex: molecular and morphological variability. *Annales Zoologici Fennici*. 45: 149-159.
- Ståhls, G., Vujić, A., Pérez-Bañón, C., Radenković, S., Rojo, S. & Petanidou, T. (2009). COI barcodes for identification of *Merodon* hoverflies (Diptera, Syrphidae) of Lesvos Island, Greece. *Molecular Ecology Resources*. 9: 1431-1438.
- Stammer, H.J. (1933) Die metamorphose der Syrphide *Temnostoma vespiforme* (L.) und die eigenartigen Anpassungen der Larve dieses Tieres an das Bohren im Holz (Dipt.). *Z.f.Morph.Okol.Tiere*, 26: 437 - 446.
- Standfuss, K. & Claussen, C. (2007) Zum aktuellen Artenbestand der Schwebfliegen (Diptera, Syrphidae) in der Ölbaumzone SO-Thessaliens/Griechenland. *Volucella*, 8: 147-164.
- Stanescu, C. (1977) *Paragus oltenicus* n.sp. (Diptera, Syrphidae) aus Rumänien. *Stud.Comun.Muz.Brukenthal, St.nat.*, 21: 287-290.
- Stanescu, C. (1981) *Paragus bradescui* sp.n. et *Paragus majoranae* Rond. 1857 (Diptera, Syrphidae) dans la faune de Roumanie. *Trav.Mus.Hist.nat. "Grigore Antipa"*, 23: 149-153.
- Stanescu, C. (1991) *Paragus medeae* n.sp. (Diptera, Syrphidae) dans la faune de Roumanie. *Trav.Mus.Hist.nat. "Grigore Antipa"*, 31: 259-264.
- Stanescu, C. (1992) Sur le genre *Paragus* Latreille, 1804 (Diptera, Syrphidae) en Roumanie. *Trav.Mus.Hist.nat. "Grigore Antipa"*, 32: 197-209.
- Stankiewicz, A. (2003) Hoverfly *Microdon myrmicae* Schönrogge et al, 2002 (Diptera: Syrphidae) in Poland. *Polish Journal of Entomology*, 72: 145-151.
- Stepanenko, O.V. & Popov, G.V. (1997) On the immature stages biology of *Merodon nigratarsis* Rondani, 1845 (Diptera: Syrphidae). *The Karkov Ent.Soc.Gazette*, 5: 40-43.
- Stone, A., Sabrosky, C.W., Wirth, W.W., Foote, R.M. & Coulson, J.R. (1965) A catalog of the Diptera of America north of Mexico. 1696pp. Agricultural Handbook, no.276. USDA, Washington.
- Strobl, P.G. (1910) Die Dipteren von steiermark. *Mitt.Naturw.Ver.Steierm.*, 46: 100-105.
- Stubbs, A.E. (1980) The rearing of *Cheilosia paganus* and *C.fraterna* *Ent.Rec.J.Var.*, 92: 114-117.
- Stubbs, A.E. (1996) British Hoverflies: second supplement. 55pp. BENHS, Reading.

- Stubbs, A.E. & Falk, S.J. (1983) *British hoverflies: an illustrated identification guide*. Br.Ent.Nat.Hist.Soc., London, 253pp.
- Stubbs, A.E. (1997) Observations on the ecology and oviposition of *Eumerus sabulorum* (Syrphidae) and *Acrosanthe annulata* (Therevidae) (Diptera). *Dipterists Digest*, 3: 54-55.
- Stubbs, A.E. & Falk, S.J.(2002) *British hoverflies: an illustrated identification guide, 2nd edition*. Br.Ent.Nat.Hist.Soc., London, 469pp.
- Stuckenberg, B.R. (1954) The *Paragus serratus* complex, with descriptions of new species (Doptera: Syrphidae). *Trans.R.ent.Soc.London*, 105: 393-422.
- Stuke, J.-H. (1996) Hinweise sur Biologie von *Cheilosia flavipes* (Panzer, 1798) (Diptera, Syrphidae). *Volucella*, 2: 88-90.
- Stuke, J.-H. (2000) Phylogenetische Rekonstruktion der Verwandtschaftsbeziehungen innerhalb der Gattung *Cheilosia* Meigen, 1822 anhand der Larvenstadien (Diptera: Syrphidae). *Studia Dipterologica*, Suppl., 8: 1-118.
- Stuke, J.-H. (2001) *Brachyopa obscura* Thompson & Torp, 1982 - neu für Deutschland (Diptera: Syrphidae). *Studia dipterologica*, 8: 257-260.
- Stuke, J.-H. & Carstensen, L.-B. (2000) Biologie und Morphologie des dritten Larvenstadium von *Cheilosia lasiopa* Kowarz, 1885 (Diptera, Syrphidae). *Volucella*, 5: 95 - 101.
- Stuke, J.-H. & Claussen, C. (2000) *Cheilosia canicularis* auctt. - ein Artenkomplex. *Volucella*, 5: 79 - 94.
- Stuke, J.-H. & Schulz, W. (2001) Bemerkenswerte Schwebfliegenbeobachtungen (Diptera: Syrphidae) aus Niedersachsen 4. *Brunschweiger Naturkundliche Schriften*, 6: 333-346.
- Stuke, J.-H. & Nielsen, T. (2002) A new species of *Platycheirus* from the central Caucasus (Diptera, Syrphidae). *Norw.J.Entomol.*, 49: 109-113.
- Stys, P. & Moucha, J. (1962) Neue Beobachtungen und taxonomische Bemerkungen zur Syrphidenfauna des Tatra-Nationalparks (Diptera, Syrphidae). *Acta Univ.Carol., Biol., Suppl.*, 55-72.
- Sutherland, J.P., Sullivan, M.S. & Poppy, G.M. (1999) The influence of floral character on the foraging behaviour of the hoverfly, *Episyrphus balteatus*. *Entomologia Experimentalis et Applicata*, 93: 157-164.
- Svivova, A.V., Mutin, V.A. & Gritskevich, D.I. (1999) Syrphid larvae (Diptera: Syrphidae) living in *Ulmus pumila* L. In Komsomolsk-on-Amur. *Far Eastern Entomologist*, 71: 1-8.
- Tanke, W. (1976) Bemerkungen zur Dauerzucht von *Epistrophe balteata* DeG. (Dipt.Syrphidae). *Nachrichtenbl.Deut.Pflanzenschutzd.(Braunschweig)*, 28(4): 55-56.
- Tawfik, M.F.S., Azab, A.K. & Awadallah, K.T. (1974) Studies on the life-history and description of the immature forms of the Egyptian aphidophagous syrphids. III. *Xanthogramma aegyptium* Wied. *Bull.Soc.Ent.Egypte*, 58: 73-83.
- Thompson, F.C. (1975) The genus *Palumbia* Rondani (Diptera: Syrphidae). *Proc.entomol.Soc.Wash.*, 77: 194-211.
- Thompson, F.C. (1980) The problem of old names as illustrated by *Brachyopa conica* Panzer", with a synopsis of Palaearctic *Brachyopa* Meigen (Diptera: Syrphidae). *Ent. scand.*, 11: 209 - 216.
- Thompson, F.C. (1988) Syrphidae (Diptera) described from unknown localities. *J.New York Entomol.Soc.*, 96: 200-226.
- Thompson, F.C. (1997) The genus *Pleskeola* Stackelberg (Diptera: Syrphidae) a junior synonym of *Parhelophilus* Girschner. *Proc.entomol.Soc.Wash.*, 99: 628-640.
- Thompson, F.C. & Ghorpadé, K. (1992) a new coffee aphid predator, with notes on other Oriental species of *Paragus* (Diptera: Syrphidae). *Colemania*, 5: 1-24.
- Thompson, F.C. & Brake, I. (2005) Biosystematic Database of World Diptera. <http://www.sel.barc.usda.gov/Diptera/biosys.htm>
- Thompson, F.C. & Ghorpadé, K. (1988) A new coffee aphid predator, with notes on other Oriental species of *Paragus* (Diptera: Syrphidae). *Colemania*, 5: 1-24.
- Thompson, F.C. & Pont, A.C. (1994) Systematic Database of *Musca* names (Diptera). *Theses Zoologicae*, 20: 1-219. Koeltz Scientific Books, Germany and USA.
- Thompson, F.C. & Rotheray, G. (1998) Family Syrphidae. In: Papp, L. & Darvas, B. (eds.) *Contributions to a Manual of Palaearctic Diptera*, 3: 81-139. Budapest.

- Thompson, F.C. & Torp, E. (1982) Two new palaeartic Syrphidae (Diptera). *Ent.Scand.*, 13: 441 - 444.
- Thompson, F.C. & Torp, E. (1986) Synopsis of the European species of *Sphegina* Meigen (Diptera: Syrphidae). *Ent.scand.*, 17: 235 - 268.
- Thompson, F.C., Vockeroth, J.R. & Speight, M.C.D. (1982) The Linnaean species of flower flies (Diptera: Syrphidae). *Mem.Entomol.Soc.Wash.*, 10: 150-165.
- Tolsgaard, S. & Bygebjerg, R. (2006) Svirrefluer (Diptera: Syrphidae) fra Ulvshale, Oversigt med to nye arter for Danmark. *Ent.Meddr.* 74: 151-163.
- Torp, E. (1984) De danske svirrefleur (Diptera: Syrphidae), Kendeteg, levevis og udbredelse. Danmarks Dyreliv, 1: 1-300. Fauna Boger, Kobenhavn.
- Torp, E. (1994) Danmarks Svirrefluer (Diptera: Syrphidae). Danmarks Dyreliv, 6: 1-490. Apollo books, Stenstrup.
- Torp Pedersen, E. (1971) Some Syrphidae from Spain, with descriptions of two new species (Diptera, Diptera). *Steenstrupia*, 1: 229-245.
- Tragardh, I. (1923) Skogsentomologiska bidrag II. *Meddn. St. Skogsfors Anst.*, 20: 401-424.
- Treiber, R. (1991) Die Schwebfliege *Neoascia unifasciata* (Strobl, 1898) in Pestwurzfluren Baden-Württembergs. *NachrBl.bayer.Ent.*, 40: 87-92.
- Tremewan, W.G. (2008) A suspected sighting of *Milesia crabroniformis* (Fabricius, 1775) (Diptera: Syrphidae) in West Cornwall (V.C.1). *Entomologist's Gazette*, 59: 126-127.
- Van der Goot, V.S. (1961) Zweefvliegenvangst op Corsica. *Entomologische Berichten, Deel*, 21: 219-223.
- Van der Goot, V.S. (1964) Summer records of Syrphidae (Diptera) from Sicily, with field notes and descriptions of new species. *Zoöl.Meded.*, 39: 414-432.
- Van der Goot, V.S. (1966) Two new species of Syrphidae (Dipt.) from Spain. *Ent.Ber., Amst.*, 26: 179-183.
- Van der Goot, V.S. (1969) Italian Syrphidae (Diptera). *Ent.Ber., Amst.*, 29: 89-96.
- Van der Goot, V.S. (1981) *De zweefvliegen van Noordwest - Europa en Europees Rusland, in het bijzonder van de Benelux*. KNNV, Uitgave no.32: 275pp. Amsterdam.
- Van der Goot, V.S. (1982) Het determinatiekenmerk voor de wijfjes van de twee Nederlandse *Baccha*-soorten onbetrouwbaar? (Diptera: Syrphidae). *Entomologische Berichten*, 42: 17-19.
- Van der Goot, V.S. (1986) Zweefvliegen in kleur. KNNV, Uitgave 32a: 1-17.
- Van de Weyer, G. (2000) A new syrphid fly species of the *Paragus serratus* complex from Turkey (Diptera: Syrphidae). *Phegea*, 28: 149-152.
- Van Steenis, J. (1998a) *Rhingia borealis* nieuw voor Nederland en België, met een tabel tot de Europese Rhingia-soorten (Diptera: Syrphidae). *Ent.Ber., Amst.*, 58: 73-77.
- Van Steenis, J. (1998b) Some rare hoverflies in Sweden (Diptera: Syrphidae). *Ent.Tidskr.*, 110: 83-88.
- Van Steenis, J. (2000) The West-Palaeartic species of *Spilomyia* Meigen (Diptera, Syrphidae). *Bull.Soc.Ent.Suisse*, 73: 143-168.
- Van Steenis, J. & Goeldlin de Tiefenau, P. (1998) Description of and key to the European females of the *Platycheirus peltatus* sub-group (Diptera, Syrphidae), with a description of the male and female of *P.islandicus* Ringdahl, 1930, stat.n. *Bull.Soc.ent.Suisse*, 71: 187-199.
- Van Steenis, J., van Steenis, W. & Wakkie, B. (2001) Hoverflies in southern Skåne, Sweden (Diptera: Syrphidae). *Ent.Tidskr.*, 122: 15-27.
- Van Veen, M. (2004) *Hoverflies of Northwest Europe: identification keys to the Syrphidae*. 256pp. KNNV Publishing, Utrecht.
- Venturi, F. (1960) Diptera. In: Biogeografia della Isole Pelagie. *Rendiconti Accademia Nazionale dei XL*, 11: 342-349.
- Verlinden, L. (1991) Fauna van België: Zweefvliegen (Syrphidae). 1-298. Inst.Roy.Sci.Nat.Belg., Brussels.
- Verlinden, L. (1999a) A new *Pipizella* (Diptera, Syrphidae) from the French and Italian Alps, with a key to the *Pipizella* species of Central and Western Europe. *Volucella*, 4: 11-27.
- Verlinden, L. (1999b) *Cheilosia hypena* Becker, 1894 (Diptera, Syrphidae) - description of the male, redescription of the female and its separation from *Cheilosia frontalis* Loew, 1857. *Volucella*, 4: 85-92.
- Verlinden, L. (2000) Some notes on the variability of *Cheilosia insignis* Loew, 1857 (Diptera, Syrphidae) with suggestions for adapting existing keys. *Volucella*, 5: 103-113

- Verlinden, L. & Decler, K. (1987) The hoverflies (Diptera, Syrphidae) of Belgium and their faunistics: frequency, distribution, phenology. *Inst.Roy. Sci.Nat.Belg., Documents de Travail*, no.39: 1-170.
- Verrall, G.H. (1873) Additions and corrections to the list of British Syrphidae. *Entomologists' mon.Mag.*, 15: 251-256; 281-286.
- Verrall, G.H. (1901) Platypezidae, Pipunculidae and Syrphidae of Great Britain. 8: 691pp. In Verrall, G.H. (ed.) *British Flies*, London.
- Violovitsh, N.A. (1975) Brief survey of palaeartic species of the genus *Xanthogramma* Schiner (Diptera, Syrphidae) (In Russian). *Taksonomiya i ekologiya zivotnykh Sibiri. Novye i maloizvestnye vidy fauny Sibiri, Novosibirsk*, 9: 90-106.
- Violovitsh N.A. (1985) New flower flies (Diptera, Syrphidae) of the Palaearctic fauna. *Systematics and Biology of arthropods and helminths. New and little-known species of the Siberian fauna*, 18: 80-96. Novosibirsk (In Russian, with an English summary).
- Violovitsh, N.A. (1986) Siberian Syrphidae (Diptera). Translation by van der Goot, V.S. & Verlinden, L. *Inst.Taxon.Zool. (Zool.Mus.)*, Amsterdam, Verslagen en Technische Gegevens, No.43: 1-228.
- Vockeroth, J.R. (1969) A revision of the genera of the Syrphini (Diptera: Syrphidae). *Mem.ent.Soc.Can.*, No.62: 1-176.
- Vockeroth, J.R. (1971) The identity of some holarctic and old world species of *Sphaerophoria* (Diptera: Syrphidae). *Can.Ent.*, 103: 1627-1634.
- Vockeroth, J.R. (1980) A review of the Nearctic species of *Melangyna (Meligramma)* Frey (Diptera: Syrphidae). *Can.Ent.*, 122: 775-778.
- Vockeroth, J.R. (1986a) Nomenclatural notes on Nearctic *Eupeodes* (including *Metasyrphus*) and *Dasysyrphus* (Diptera: Syrphidae). *Can.Ent.*, 118: 199-204.
- Vockeroth, J.R. (1986b) Revision of the New World species of *Paragus* Latreille (Diptera: Syrphidae). *Can.Ent.*, 118(3): 183-198.
- Vockeroth, J.R. (1990) Revision of the Nearctic species of *Platycheirus* (Diptera, Syrphidae). *Can.Ent.*, 122: 659-766.
- Vockeroth, J.R. (1992) The flower flies of the Subfamily Syrphinae of Canada, Alaska and Greenland (Diptera, Syrphidae). *The insects and arachnids of Canada*, Pt.18, 1-456. Agriculture, Canada.
- Vockeroth, J.R. & Thompson, F.C. (1987) Syrphidae. In: McAlpine, J.F. (ed.) *Manual of Nearctic Diptera*, 2: 713-743. Agriculture Canada, Ottawa.
- Vujic, A. (1987) New species of genus *Sphegina* Meigen 1822 (Diptera, Syrphidae). *Glasnik Prirodnjackog muzeja, Beograd*, B42: 79-83.
- Vujic, A. (1990) Genera *Neoascia* Williston 1886 and *Sphegina* Meigen 1822 (Diptera: Syrphidae) in Yugoslavia and description of species *Sphegina sublatifrons* sp.nova. *Bull Nat Hist Mus., Belgrade*, B45: 78-93.
- Vujić, A. (1991) Species of genus *Brachyopa* Meigen 1822 (Diptera: Syrphidae) in Yugoslavia. *Glasnik prirodnjackog Muzeja u Beogradu*, B46: 141-150.
- Vujic, A. (1994a) *Cheilosia griseifacies*, eine neue Fliegen-Art aus Mitteleuropa. (Diptera, Syrphidae). *Entomofauna*, 15: 337-344.
- Vujic, A. (1994b) Description of male of species *Triglyphus escalerei* Gil Collado, 1929 (Diptera: Syrphidae). *Graellsia*, 50: 21-24.
- Vujic, A. (1994c) *Cheilosia balkana* sp.nov., new species of "proximagroup (Diptera, Syrphidae). *Entomofauna*, 15: 445-456.
- Vujic, A. (1996) Genus *Cheilosia* Meigen and related genera (Diptera: Syrphidae) on the Balkan peninsula. *Mon.Dept Nat.Sci.Matica srpska*, 194pp. Novi Sad.
- Vujic, A. (1997) The genus *Pipizella* (Diptera, Syrphidae) on the Balkan Peninsula and description of *Pipizella zloti* sp.n. *Dipterists Digest*, 4: 51-60.
- Vujic, A. (1999a) The subgenus *Neocnemodon* Goffe, 1944 (Diptera, Syrphidae) on the Balkan Peninsula and description of *Heringia (Neocnemodon) larusi* spec.nov. *Dipteron*, 2: 133-142.
- Vujic, A. (1999b) The tribe Chrysogasterini (Diptera: Syrphidae) in the Balkan Peninsula, with the description of three new species. *Studia dipterologica*, 6: 405-423.
- Vujic, A. & Claussen, C. (1994a) *Cheilosia orthotricha*, spec.nov., eine weitere Art aus der Verwandtschaft von *Cheilosia canicularis* aus Mitteleuropa (Insecta, Diptera, Syrphidae). *Spixiana*, 17: 261-267.

- Vujic, A. & Claussen, C. (1994b) *Cheilosia bracusii*, a new hoverfly from the mountains of central and southern Europe (Diptera: Syrphidae). *Bonn zool. Beitr.*, 45: 137-146.
- Vujic, A. & Claussen, C. (2000) *Cheilosia alba* spec.nov. and first description of the female of *C.pini* Becker, 1894 (Diptera, Syrphidae). *Volucella*, 5: 51-62.
- Vujic, A. & Milankov, V. (1999) New data for the tribes Milesiini and Xylotini (Diptera, Syrphidae) on the Balkan Peninsula. *Dipteron*, 2: 113-132.
- Vujic, A. & Simic, S. (1999) Genus *Eumerus* Meigen 1822 (Diptera: Syrphidae) in area of former Yugoslavia. *Glasn. Prir. Muz. u Beogradu*, B 49-50 (1995-1998): 173-190.
- Vujic, A. & Stuke, J.-H. (1998) A new hoverfly species of the genus *Melanogaster* from central Europe (Diptera, Syrphidae). *Studia dipterologica*, 5: 343-347.
- Vujić, A., Pérez-Bañón, C., Radenković, S., Ståhls, G., Rojo, S., Petanidou, T. & Simić, S. (2007) Two new species of the genus *Merodon* Meigen 1803 (Diptera: Syrphidae) from the island of Lesbos (Greece), in the eastern Mediterranean. *Ann.soc.entomol. Fr. (n.s.)*, 43: 319-326.
- Vujić, A., Radenković, S., & Polić, D. (2008). A review of the *luteitarsis* group of the genus *Pipiza* Fallen (Diptera: Syrphidae) with description of a new species from the Balkan Peninsula. *Zootaxa*. 1845: 33-46.
- Vujić, A., Radenković, S. & Simić, S. (1996) *Merodon albonigrum*, a new European species related to *Merodon geniculatus* Strobl 1909 (Diptera, Syrphidae). *Dipterists Digest*, 2: 72-79.
- Vujić, A., Radenkovic, S. & Stanescu, C. (1998) New data on hoverflies (Diptera, Syrphidae) in Romania. *Volucella*, 3: 63-74.
- Vujic, A., Radenković, S., Nielsen, T.R. & Simić, S. (2004) A new species of genus *Eristalis* Latreille, 1804 (Diptera: Syrphidae) *Entomologica Fennica*, 15: 119-123.
- Vujic, A., Simic, S. & Radenkovic, S. (1999) Mediterranean species related to *Paragus hermonensis* Kaplan, 1981, with the description of *Paragus gorgus* spec.nov. (Diptera, Syrphidae). *Volucella*, 4: 20-44.
- Vujic, A., Simic, S. & Radenkovic, S. (1999b) Two related species of *Paragus* (Diptera: Syrphidae) one from the Nearctic and one from the Palaearctic. *Canadian Entomologist*, 131: 203-209.
- Vujic, A., Simic, S. & Radenkovic, S. (2001) Endangered species of hoverflies (Diptera: Syrphidae) on the Balkan peninsula. *Acta entomologica serbica*, 5: 93-105.
- Vujić, A., Stahls, G., Rojo, S., Radenković, S., Šimić, S. (2008): Systematics and phylogeny of the tribe Paragini based on molecular and morphological characters. *Zoological Journal of the Linnean Society*. 152: 507- 536.
- Waitzbauer, W. (1976) Die Insektenfauna männlicher Blütenstände von *Typha angustifolia*. *Zool. Anzeiger (Jena)*, 196: 9-15.
- Wakeham-Dawson, A., Franquinho-Aguiar, A.M., Smit, J., McCullough, A. and Wyatt, N. (2004) *Melanostoma wollastoni* sp.n. (Diptera, Syrphidae) from Madeira, Portugal. *Dipterists Digest* (2nd series), 10: 89-94.
- Williston, S.W. (1882) New or little known genera of North American Syrphidae. *Can.Ent.*, 14: 77-80.
- Wirth, W.W., Sedman, Y.S. and Weems, H.V. (1965) Family Syrphidae. In: Stone, A., Sabrosky, C.W., Wirth, W.W., Foote, R.H. and Coulson, J.R. (eds.) A catalog of the Diptera of America North of Mexico. *Agric.Handbk No.276*: 557-625. *Ag.Res.Serv., USDA*.
- Wolff, D. (1990) Überwinternde Schwebfliegen (Diptera, Syrphidae) bei Ebstorf. *Drosera*, '90 (1-2): 123-125.
- Wolff, D. (1998) *Pipiza accola* Violovitsh, 1985 (Diptera, Syrphidae) - Erstnachweis für Deutschland. *Drosera*, 1998: 123-126.
- Zimina, L.V. (1957) New data on the ecology and faunistics of hover-flies (Diptera, Syrphidae) in Moscow region. *Byull.Mosk.Obshch.Ispyt.Prirod., Otdel.Biol.*, 62: 51-62.(Russian, with English summary).
- Zimina, L.V. (1960) [On the fauna of hoverflies (Diptera, Syrphidae) of Transcaucasus.] *Entomol.Obozr.* 39: 661-665.[In Russian]
- Zimina, L.V. (1986) A review of palaeartic hoverflies of the genus *Callicera* Panzer (Diptera, Syrphidae). *USSR Review of Entomology*, 65: 633-638.
- Zimsen, E. (1964) *The type material of I.C.Fabricius*. Munksgaard, Copenhagen. 508pp.

Appendix 1: publications in which use is made of the StN database

- ALEXANDER, K.N.A. (2005) *Osmoderma eremita* (Coleoptera: Scarabaeidae) y otros insectos saproxilicos en La Liébana, Cantabrica occidental (Insecta: Coleoptera y Diptera). *Boletín Sociedad Entomológica Aragonesa*, no.37: 317-318.
- ANDERSON R., SIMMS M. & NELSON B. (2000) A review of lowland wood pasture and parkland in Northern Ireland. A desk study conducted for Environment and Heritage Service, April 2000. <http://www.ehsni.gov.uk/pubs/publications/pastureparkland.pdf>
- ANDERSON R. SIMMS M. & NELSON B. (2006) A review of ancient tree flora and faunal communities in Northern Ireland. Environment and Heritage Service Research and Development Series N° 06/02.
- ARRIGNON F. (2006) HOVER-WINTER : un modèle multi-agent pour simuler la dynamique hivernale d'un insecte auxiliaire des cultures (*Episyrphus balteatus*, Diptera: Syrphidae) dans un paysage hétérogène. Thèse de Doctorat. Institut National Polytechnique de Toulouse.222p.
- BALL, S.G., STUBBS, A.E., MCCLEAN, I.F.G., MORRIS, R.K.A., FALK, S.J. & HAWKINS, R.D. (2002) *British Hoverflies: an illustrated identification guide, 2nd edition*, 469pp. British Entomological and Natural History Society.
- BARTSCH H., HELLOVIST S. & LUNDBERG S. (2005) Fem för Sverige nya blomflugor (Diptera: Syrphidae), varav två först identifierade från Norrland. *Natur i Norr*. Umeå. 24 (2): 61-66.
- BIESMEIJER J. C., ROBERTS S. P. M., REEMER M., OHLEMÜLLER R., EDWARDS M., PEETERS T., SCHAFFERS A. P., POTTS S. G., KLEUKERS R., THOMAS C. D., SETTELE J., KUNIN W. E. (2006) Parallel Declines in Pollinators and Insect-Pollinated Plants in Britain and the Netherlands. *Science*.313: 351-354.
- BOLU, H. & HAYAT R. (2008). A new host [*Parthenolecanium persicae* (Homoptera : Coccidae)] record for *Eupeodes corollae* (Fabricius) (Diptera : Syrphidae) from Turkey. *Turkish Journal of Zoology*. 32(1): 79-84.
- BOUGET, C; BRUSTEL, H; ZAGATTI, P. (2008). The French information system on saproxylic beetle ecology (FRISBEE) : an ecological and taxonomical database to help with the assessment of forest conservation status. *Revue d'Ecologie. La Terre et la Vie. Suppl.* 10 : 33-36.
- BRANQUART E & HEMPTINNE J.L. (2000) Selectivity in the exploitation of floral resources by hoverflies (Diptera : Syrphinae). *Ecography* 23: 732-742.
- BRANQUART E. & LIEGEOIS S. (Coord.) (not dated) Normes de gestion pour favoriser la biodiversité dans les bois soumis au régime forestier. complément à la circulaire n° 2619 du 22 septembre 1997. Ministère de la Région wallonne. Direction générale des Ressources naturelles et de l'Environnement. 84p.
- BURGIO G. (2007) The role of ecological compensation areas in conservation biological control. PhD thesis. University of Wageningen. 154p.
- BURGIO, G. & SOMMAGGIO, D. (2002) Diptera Syrphidae caught by Malaise trap in Bologna province and new record of *Neoascia interrupta* in Italy. *Bulletin of Insectology* 55: 43-47.
- BURGIO G., SOMMAGGIO D. (2007). Syrphids as landscape bioindicators in Italian agroecosystems. *Agriculture, Ecosystems and Environment* 120: 416-422.
- CARRIERES, E. (2001) Note diptérologique: mise à jour de la liste faunistique des syrphes (Diptera, Syrphidae) du Luxembourg. *Bull.Soc.Nat.Luxemb.*, 101: 99-110.
- CARRIERES E. (2003) Espèces nouvelles et remarquables de syrphes (Diptera, Syrphidae) au Luxembourg. *Bull. Soc. Nat. luxemb.* 103: 79-82.
- CASTELLA, E. & SPEIGHT, M. D. S. (1996) Knowledge representation using fuzzy coded variables: an example based on the use of Syrphidae (Insecta, Diptera) in the assessment of riverine wetlands. *Ecological modelling*. 85: 13-25.
- CASTELLA, E., SPEIGHT, M. & SARTHOU, J.-P. (2008) L'envol des syrphes. *Espaces Naturels*, 21: 22-23.
- CASTELLA, E., SPEIGHT, M., OBRDLIK, P., SCHNEIDER, E. & LAVERY, T. (1994) A methodological approach to the use of invertebrates for the assessment of alluvial wetlands. *Wetlands Ecology and Management*. 3: 17-36.

- DIRICKX H.G. & OBRECHT E. (2007) Découverte de *Criorhina pachymera* (Egger, 1858) (Diptera, Syrphidae) en Suisse. *Bulletin de la Société Entomologique Suisse*. 80: 223-229.
- DOCZKAL, D. & DZIOCK, F. (2004) Two new species of *Brachyopa* Meigen from Germany, with notes on *B. grunewaldensis* Kassebeer (Diptera, Syrphidae). *Volucella*, 7: 35-59.
- DRAKE, C.M. (2007) *Orthonevra intermedia* Lundbeck, 1916 (Diptera, Syrphidae) new to Britain. *Dipterists Digest*, 13: 87-91.
- DZIOCK F. (2006). Life-History Data in Bioindication Procedures, Using the Example of Hoverflies (Diptera, Syrphidae) in the Elbe Floodplain *Internat. Rev. Hydrobiol.* 91 (4): 341–363
- DZIOCK F., FOECKLER F., FOLLNER K. & SCHOLZ M. (2006). Biological Indicator Systems in Floodplains – a Review. *Internat. Rev. Hydrobiol.* 91 (4). 271–291
- FALKNER G., OBRDLIK P., CASTELLA E., SPEIGHT M.C.D. (2001) *Shelled Gastropoda of Western Europe*. Verlag der Friedrich-Held-Gesellschaft. München. 267p.
- FAYT P., DUFRENE, M., BRANQUART, E., HASTIR, P., PONTEGNIE, C., HENIN, J.-M. & VERSTEIRT, V. (2006) Contrasting Responses of Saproxyllic Insects to Focal Habitat Resources: The Example of Longhorn Beetles and Hoverflies in Belgian Deciduous Forests. *Journal of Insect Conservation*, 10, 129-150.
- FRANCUSKI, Lj.; VUJIC, A.; KOVACEVIC, A.; LUDOSKI, J.; MILANKOV, V.(2009). Identification of the species of the *Cheilosia variabilis* group (Diptera, Syrphidae) from the Balkan Peninsula using wing geometric morphometrics, with the revision of status of *C. melanopa redi* Vujic, 1996. *Contributions to Zoology*. 78(3):129-140.
- GITTINGS, T., O'HALLORAN, J., KELLY, T. & GILLER, P.S. (2006) The contribution of open spaces to the maintenance of hoverfly (Diptera, Syrphidae) biodiversity in Irish plantation forests. *Forest Ecology & Management*, 237: 290-300.
- GOELDLIN, P., DELARZE, R., CASTELLA, E. & SPEIGHT M.C.D. (2003) Ecological reference-state studies for forest reserve management in Montricher (Vaud, Jura, Switzerland). Insects as bioindicators. *Mém.Soc.vaud.Sc.nat*, 20: 159-267.
- HAARTO, A. & KERPPOLA, S. (2004) Checklist of Finnish Hoverflies (Diptera, Syrphidae). *Sahlbergia*, 9: 147-164.
- HASLETT J.R. (2008) European Strategy for the conservation of invertebrates. *Nature and environment*, No. 145. 91p.
- HENLE K., DZIOCK F., FOECKLER F., FOLLNER K., HÜSING V., HETTRICH A., RINK M., STAB S. & SCHOLZ M (2006). Study Design for Assessing Species Environment Relationships and Developing Indicator Systems for Ecological Changes in Floodplains – The Approach of the RIVA Project *Internat. Rev. Hydrobiol.* 91 (4): 292–313
- JAUKER F & WOLTERS V. (2008). Hover flies are efficient pollinators of oilseed rape. *Oecologia*. 156(4): 819-823.
- JAUKER, F. DIEKÖTTER, T. SCHWARZBACH, F. & WOLTERS, V. (2009) Pollinator dispersal in an agricultural matrix: opposing responses of wild bees and hoverflies to landscape structure and distance from main habitat. *Landscape Ecology*, 24:547–555.
- KEIL P., DZIOCK F. & STORCH D. (2008). Geographical patterns of hoverfly (Diptera, Syrphidae) functional groups in Europe: inconsistency in environmental correlates and latitudinal trends. *Ecological Entomology*. 33 : 748–757
- KÖSTERMEYER, H. (2004) Die Schwebfliegen (Diptera: Syrphidae) des Schmandberges bei Bellerssen. *Ein Beitrag zur Schwebfliegenfauna des Kreises Höxter – Egge-Weser*, 16: 59-76.
- KOTTHOF, U. & SCHMID, U. (2005) A new fossil hoverfly (Insecta, Diptera : Syrphidae) from the Randeck Maar (Early Miocene, south-west Germany). *Paleontology* 48: 1091-1096.
- KRALIKOVA, A. (2002) Hoverflies (Diptera, Syrphidae) in Javorina (Belianske Tatry Mts) and seasonal dynamics of some species. *Biologia* 57: 235-241.
- KRIVOSHEINA, M. G. & STÄHLS, G. (2003) Taxonomy and distribution of *Temnostoma bombylans* (Fabricius) and *T.angustistriatum* Krivosheina (Diptera, Syrphidae) in northern Europe. *Sahlbergia*, 8: 96-99.
- KRPAC, V., VUJIC, A., SIMIC, S. & RADENKOVIC, S. (2001) Contribution to the knowledge of hoverflies (Diptera: Syrphidae) of Macedonia. *Acta Entomologica Slovenica*, 9: 169-174.

- LASKA P., PEREZ-BANON C, MAZANEK L., ROJO S., STAHL S., M. MARCOS-GARCIA MA, BIK V. and DUSEK J. (2006). Taxonomy of the genera *Scaeva*, *Simosyrphus* and *Ischiodon* (Diptera: Syrphidae): Descriptions of immature stages and status of taxa. *Eur. J. Entomol.* 103: 637–655.
- LUDOSKI J, FRANCUSKI L, VUJIC A & MILANKOV V. (2008). The *Cheilosia canicularis* group (Diptera :Syrphidae): species delimitation and evolutionary relationships based on wing geometric morphometrics. *Zootaxa.* 1825: 40-50.
- MACGOWAN, I. & ROTHERAY, G.E. (2007) *Callicera rufa* Schummel (Diptera, Syrphidae) status and trends: an update. *Dipterists Digest*, 13: 113-118.
- MARCOS-GARCIA M.A. & LOUIS, M. (2001) Revision de las colecciones de Sirfidos (Diptera, Syrphidae) de la coleccion J. Andreu. *Anales de Biología.* 23 (Biología animal, 12): (1998) 2001: 49-62.
- MASETTI A, LUCHETTI A, SOMMAGGIO D, BURGIO G. & MANTOVANI B. (2006). Phylogeny of *Chrysotoxum* species (Diptera: Syrphidae) inferred from morphological and molecular characters. *European Journal of Entomology* 103 (2): 459-467.
- MEYER B., JAUKER F. & STEFFAN-DEWENTER I. (2009). Contrasting resource-dependent responses of hoverfly richness and density to landscape structure. *Basic and Applied Ecology.* 10: 178-186.
- MILANKOV, V., LUDOSKI, J., STAHL S., STAMENKOVIC, J. & VUJIC, A. (2009). High molecular and phenotypic diversity in the *Merodon avidus* complex (Diptera, Syrphidae): cryptic speciation in a diverse insect taxon. *Zoological Journal of the Linnean Society.* 155(4) : 819-833.
- MILANKOV V., STAHL S. & VUJIC A. (2008). Molecular diversity of populations of the *Merodon ruficornis* group (Diptera, Syrphidae) on the Balkan Peninsula. *J Zool Syst Evol Res* 46(2) : 143–152.
- MILANKOV, V., STAHL S., STAMENKOVIC, J. & VUJIC, A. (2008). Genetic diversity of populations of *Merodon aureus* and *M.cinereus* species complexes (Diptera, Syrphidae): integrative taxonomy and implications for conservation priorities on the Balkan Peninsula. *Conservation Genetics.* 9(5) : 1125-1137.
- MILANKOV, V., STAMENKOVIC, J., LUDOSKI, J., STAHL S., G. & VUJIC, A. (2005) Diagnostic molecular markers and the genetic relationships among three species of the *Cheilosia canicularis* group (Diptera : Syrphidae). *European Journal of Entomology* 102(2): 125-131.
- MILANKOV V.R., STAMENKOVIC J.S. & VUJIC A. (2005) Genetic equilibrium in *Cheilosia vernalis* populations (Diptera: Syrphidae). *Proc. Nat. Sci. Matica Srpska Novi Sad.* 109: 21-27.
- MILANKOV V., STAMENKOVIC J & VUJIC A. (2007) Genetic differentiation and linkage disequilibrium in a spatially fragmented population of *Cheilosia vernalis* (Diptera: Syrphidae) from the Balkan Peninsula. *Acta Zoologica Academiae Scientiarum Hungaricae.* 53(2): 193-201.
- MURPHY K., CASTELLA E., CLÉMENT B., HILLS J., OBRDLIK P., PULFORD I., SCHNEIDER E., SPEIGHT M.C.D. (1994) Biotic indicators of riverine wetland ecosystem functioning. In (W.J. MITSCH Ed.) *Global Wetlands: Old World and New.* Elsevier Science B.V., Amsterdam. 659-682.
- NAMAGHI, HS & HUSSEINI, M. (2009). The Effects of Collection Methods on Species Diversity of Family Syrphidae (Diptera) in Neyshabur, Iran. *J. of Agrucultural Science and Technology.* 11(5), Suppl. S : 521-526.
- NEDELJKOVIC Z., VUJIC A., RADENKOVIC & SIMIC S. (2003). The genus *Volucella* Geoffroy, 1764 (Diptera: Syrphidae) on the Balkan peninsula. *Acta entomologica serbica.* 8(1/2): 41-55.
- NEDELJKOVIC, Z; VUJIC, A; SIMIC, S; RADENKOVIC, S. (2009). The fauna of hoverflies (Diptera : Syrphidae) of Vojvodina province, Serbia. *Archives of Biological Sciences.* 61(1) : 147-154.
- NEW T.R. (2007) Broadening benefits to insects from wider conservation agendas. In Stewart A.J.A., New T.R. & Lewis O.T. (eds) *Insect Conservation Biology*, 301-321. The Royal Entomological Society. CABI.
- QUIN A, SARTHOU JP, BOUYJOU B, DECONCHAT M., Lacombe J.P., MONTEIL C. (2006). The species-area relationship in the hoverfly (Diptera, Syrphidae) communities of forest fragments in southern France. *Ecography* 29 (2): 183-190.
- PEREZ-BANON, C., ROJO, S., STAHL S., G. & MARCOS-GARCIA, M.A. (2003) Taxonomy of European *Eristalinus* (Diptera : Syrphidae) based on larval morphology and molecular data. *European Journal of Entomology* 100: 417-428.

- PINEDA A. & MARCOS-GARCÍA M.A. (2008). Seasonal abundance of aphidophagous hoverflies (Diptera: Syrphidae) and their population levels in and outside Mediterranean sweet pepper greenhouses. *Annals of the Entomological Society of America* 101 (2): 384-391.
- REEMER, M. (2005) Saproxylic hoverflies benefit by modern forest management (Diptera: Syrphidae). *Journal of Insect Conservation*. 9:49–59
- REEMER, M. & GOUDSMITS, K. (2004) Oviposition observed in *Chrysotoxum cautum*, *C. vernale* and *Merodon avidus* (Diptera, Syrphidae). *Volucella*, 7: 217-218. Stuttgart.
- RICARTE SABATER, A., MARCOS-GARCIA, M^a A. & ROTHERAY, G.E. (2008) The early stages and life histories of three *Eumerus* and two *Merodon* species (Diptera : Syrphidae) from the Mediterranean region. *Entomologica Fennica*, 19: 129-141.
- RICARTE, A, JOVER, T., MARCOS-GARCIA, M.-A., MICO, E. and BRUSTEL, H. (2009) Saproxylic beetles (Coleoptera) and hoverflies (Diptera: Syrphidae) from a Mediterranean forest: towards a better understanding of their biology for species conservation. *Journal of Natural History*, 43: 583-607.
- ROJO S, STAHL S, PEREZ-BANON C, MARCOS-GARCIA MA (2006). Testing molecular barcodes: Invariant mitochondrial DNA sequences vs the larval and adult morphology of West Palaearctic *Pandasyopthalmus* species (Diptera : Syrphidae : Paragini) *European Journal of Entomology* 103 (2): 443-458.
- ROSSI J., GAMBA U., PINNA M., SPAGNOLO S., VISENTIN C. & ALMA A. (2006) Hoverflies in organic apple orchards in north-western Italy. *Bulletin of Insectology* 59(2): 111-114.
- ROTHERAY, G.E. (2004) The early stages of *Xylota abiens* Meigen, with a key to the larvae and puparia of British *Xylota* species (Diptera, Syrphidae). *Dipterists Digest*, 11: 83-97.
- SABATER, A.R. & MARCOS GARCÍA, M.A. (2008) Los sírfidos (Diptera: Syrphidae) del Parque Nacional de Cabañeros (España): una herramienta para la gestión. *Boln. Asoc. esp. Ent.*, 32 : 19-32.
- SAGOT, P., LIVORY, A., LAIR, X. & CHEVIN, H. (2004) Enquête syrphes: bilan 2004. *L'Argiope*, No.46: 35-44.
- SARIBIYIK, S. (2008). Contributions to the syrphidae fauna of Turkey (Diptera : Syrphidae). *Entomological News*. 119(5) : 501-508.
- SARIBIYIK, S. (2009). Several Rarely Found New Records for the Turkish Syrphidae Fauna (Diptera: Syrphidae). *J. of the Entomological Research Society*. 11(3):37-40.
- SARTHO, V. & SARTHO J.-P. (2010) Evaluation écologique d'écosystèmes forestiers de Réserves Naturelles de Haute-Savoie à l'aide des Diptères Syrphidés. *Syrph the Net, the database of European Syrphidae*, Vol. 62, 131 pp, Syrph the Net publications, Dublin.
- SARTHO, J.-P., DEHONDT, F., DUSSAIX, C., LIBERT, P.-N., VANAPPELGHEIM, C. & VAN DE WEYER, G. (2004) Contribution à la connaissance des Syrphes de 27 départements français; deux espèces nouvelles pour la France (Diptera, Syrphidae et Microdontidae). *Bull.Soc.ent.Fr*, 109: 169-174.
- SARTHO, J.P., QUIN, A., ARRIGNON, F., BARREAU, G. & BOUYJOU, B. (2005) Landscape parameters explain the distribution and abundance of *Episyrphus balteatus* (Diptera : Syrphidae). *European Journal of Entomology* 102(3): 539-545.
- SCHMID, U. (2004) *Microdon rhenanus* and *Microdon eggeri* var. *major* (Diptera, Syrphidae) revisited. *Volucella*, 7: 111-124. Stuttgart.
- SCHWEIGER, O., MUSCHE, M., BAILEY, D., BILLETER, R., DIEKÖTTER, T., HENDRICKX, F., HERZOG, F., LIIRA J., MAELFAIT J.P., SPEELMANS, M. and DZIOCK F. (2007) Functional richness of local hoverfly communities (Diptera, Syrphidae) in response to land use across temperate Europe. *Oikos* 116: 461-472.
- SMIT, J., REEMER, M. & RENEMA, W. (2001) Vijf soorten van het Zweefvliegengenus *Cheilosia* nieuw voor Nederland (Diptera: Syrphidae) *Nederlandse Faunistische Mededelingen* 15: 123-140.
- SMIT J., RENEMA W. & VAN AARTSEN B. (2001) De Zweefvliegen *Chrysotoxum intermedium* en *C. fasciolatum* nieuw voor de nederlandse fauna (Diptera: Syrphidae). *Nederlandse Faunistische Medelingen*. 15.
- SMITH G.F., GITTINGS T., WILSON M., FRENCH L., OXBROUGH A., O'DONOGHUE S., O'HALLORAN J., KELLY D.L., MITCHELL F.J.G., KELLY T., IREMONGER S. MCKEE A.M. & GILLER P. (2008). Identifying practical indicators of biodiversity for stand-level management of plantation forests. *Biodiversity & Conservation*. 17: 991–1015.

- SPEIGHT, M.C.D. (1996) Syrphidae (Diptera) of Central France. *Volucella*, 2: 20-34.
- SPEIGHT, M.C.D. (1997) Invertebrate species lists as management tools: an example using databased information about Syrphidae (Diptera). Proc.Colloq. conservation, management and restoration of habitats for invertebrates: enhancing biological diversity. Environmental Encounters Series, 33: 74-83. Council of Europe, Strasbourg.
- SPEIGHT, M.C.D. (1999) Syrph the Net: a database of biological information about European Syrphidae (Diptera) and its use in relation to conservation of biodiversity. In: RUSHTON, B. (ed.) Biodiversity: the Irish Dimension, 156-171. Royal Irish Academy, Dublin.
- SPEIGHT, M.C.D. (2000) Some thoughts on corridors and invertebrates: the hoverfly (Diptera: Syrphidae) fauna of *Abies/Picea* forests in temperate west/central Europe. Proc. Workshop on ecological corridors for invertebrates: strategies for dispersal and recolonisation in today's agricultural and forestry landscapes. Neuchatel, May 2000, 129-135. Environmental Encounters, no.45. Council of Europe, Strasbourg.
- SPEIGHT, M.C.D. (2001) Farms as biogeographical units: 2. The potential role of different parts of the case study farm in maintaining its present fauna of Sciomyzidae and Syrphidae (Diptera). *Bull.Ir.biogeog.Soc.*, 25: 248-278.
- SPEIGHT, M.C.D. (2002) An annotated list of the Syrphidae (Diptera) of Pollardstown Fen, Co.Kildare, Ireland. *Bull.Ir.Biogeog.Soc.*, 26: 196-210.
- SPEIGHT, M.C.D. (2004) Towards an understanding of the development and constitution of the Irish post-glacial syrphid fauna (Diptera: Syrphidae). *Volucella*, 7: 125-155.
- SPEIGHT, M.C.D. (2004) Predicting impacts of changes in farm management on sciomyzids (Diptera, Sciomyzidae): a biodiversity case study from southern Ireland. *Dipterists Digest*, 11: 147-166.
- SPEIGHT, M.C.D. (2004) Insect records from the Connemara (Co. Galway) and Mayo (Co. Mayo) National Parks (Southern Ireland). *Bull Ir biogeog Soc.* 28 31-60.
- SPEIGHT, M.C.D. (2005) An "expert system" approach to development of decision tools for use in maintenance of invertebrate biodiversity in forests. *Pan-European Ecological Network in forests: Conservation of biodiversity and sustainable management. Proc.5th Internat. Symposium, Pan-European Ecological Network. Environmental Encounters No.57*, 133-141. Council of Europe, Strasbourg.
- SPEIGHT, M. C. D. & CASTELLA, E. (1995) Bugs in the system: relationships between distribution data, habitat and site evaluation in development of an environmental assessment procedure based on invertebrates. In "Threatened species and bioindicators at the pan-European level". Proc. 9th Int.Collq EIS: 1-9. Helsinki.
- SPEIGHT, M. C. D. & CASTELLA, E. (2001) An approach to interpretation of lists of insects using digitised biological information about the species. *Journal of Insect Conservation*. 5: 131-139.
- SPEIGHT, M. C. D. & CASTELLA, E. (2005) Assessment of subalpine grassland and heath sites in Haute-Savoie using Syrphidae (Diptera). In: Speight, M.C.D., Castella, E., Sarthou, J.-P. and Monteil, C. (eds.) *Syrph the Net, the database of European Syrphidae*, vol. 46, 37 pp., Syrph the Net publications, Dublin.
- SPEIGHT, M. C. D. & CASTELLA, E. (2005) Diagnostic de pelouses et landes subalpine, à l'aide des Diptères Syrphidae. In: Speight, M.C.D., Castella, E., Sarthou, J.-P. and Monteil, C. (eds.) *Syrph the Net, the database of European Syrphidae*, vol. 47, 57 pp., Syrph the Net publications, Dublin.
- SPEIGHT, M.C.D. & CASTELLA, E. (2010) Diagnostic de quelques habitats des Hauts de Chartreuse (Isère, France) à l'aide des Syrphidés (Diptères). *Syrph the Net, the database of European Syrphidae*, Vol. 63, 36 pp, Syrph the Net publications, Dublin.
- SPEIGHT, M.C.D. & GOOD, J.A. (2001) Farms as biogeographical units: 3. The potential of natural/semi-natural habitat on a farm to maintain its syrphid fauna under various management regimes. *Bull.Ir.biogeog.Soc.*, 25: 248-278.
- SPEIGHT, M.C.D. & GOOD, J.A. (2003) Development of eco-friendly forestry practices in Europe and the maintenance of saproxylic biodiversity. In: Mason, F., Nardi, G. & Tisato, M. (eds.) Proc. Internat.Symposium "Legno Morto: una chiave per la biodiversità", Mantova, May 2003, *Sherwood*, 95, Suppl.2, 73-77.

- SPEIGHT, M. C. D., CASTELLA, E., OBRDLÍK, P. & SCHNEIDER, E. (1997) Are CORINE habitats invertebrate habitats? In: SCHREIBER, H. (ed.): The importance of chorology to invertebrates. Proc. 10th Int. Collq. EIS: 193-200, Saarbrücken.
- SPEIGHT M.C.D., GOOD, J.A. & CASTELLA, E. (2002) Predicting the changes in farm syrphid faunas that could be caused by changes in farm management regimes (Diptera: Syrphidae). *Volucella*, 6: 125-137.
- SPEIGHT M.C.D., SARTHOU, V., SARTHOU, J.P. & CASTELLA, E. (2007) . Le syrpe, l'ordinateur et la gestion de la biodiversité. 58pp. ASTERS, Conservatoire des espaces naturels de Haute-Savoie, Sallanches, France.
- SSYMANK, A. (2001) Vegetation und blütenbesuchende Insekten in der Kulturlandschaft. Schriftenreihe für Landschaftspflege und Naturschutz. Heft 64. Bundesamt für Naturschutz, Bonn. 513p.
- SSYMANK, A. (2004) Hoverfly communities (Diptera, Syrphidae) in vegetation complexes of river valleys near Bonn (Germany). *Volucella*, 7: 157-183. Stuttgart.
- STAHL G, VUJIC A. & MILANKOV V. (2008). *Cheilosia vemalis* (Diptera, Syrphidae) complex: molecular and morphological variability . *Annales Zoologici Fennici*. 45(2): 149-159.
- STAHL, G; VUJIC, A; PEREZ-BANON, C; RADENKOVIC, S; ROJO, S; PETANIDOU, T. (2009). COI barcodes for identification of *Merodon* hoverflies (Diptera, Syrphidae) of Lesvos Island, Greece. *Molecular Ecology Resources*. 9(6) : 1431-1438.
- VAN VEEN, M. (2004) *Hoverflies of Northwest Europe: identification keys to the Syrphidae*. 256pp. KNNV Publishing, Utrecht.
- VUJIC A, RADENKOVIC S & POLIC D. (2008).A review of the *luteitarsis* group of the genus *Pipiza* Fallen (Diptera: Syrphidae) with description of a new species from the Balkan Peninsula. *Zootaxa*. 1845: 33-46.
- VUJIC, A., SIMIC, S. & RADENKOVIC, S. (2001) Endangered species of hoverflies (Diptera: Syrphidae) on the Balkan peninsula. *Acta entomologica serbica*, 5: 93-105.
- VUJIC, A., SIMIC, S. & RADENKOVIC, S. (2002) New data on hoverflies diversity (Insecta: Diptera: Syrphidae) on the Fruska Gora mountain (Serbia). *Proceedings for Natural Sciences, Matica Srpska Novi Sad*, No 103: 91-106.
- VUJIC A, STAHL G, ROJO S., RADENKOVI S. & SIMIC S. (2008). Systematics and phylogeny of the tribe Paragini (Diptera: Syrphidae) based on molecular and morphological characters. *Zoological Journal of the Linnean Society*. 152(3): 507-536.

Appendix 2

LICENCE AGREEMENT

I,
.....,
wish to receive copies of the Syrph the Net files and agree to

- use the files on a single computer at one time,
- not to copy the files and accompanying materials except for backup purposes in support of using the files on a single machine at one time,
- not to make copies of the files for sale or distribution,
- on termination of this licence to destroy the files together with all copies of the files.

I understand that this licence is effective until terminated, may be terminated at any time by destroying the files and all copies of them and will also be terminated if I fail to comply with any condition or term on this agreement.

Warranty: these files are provided "as is" without warranty of any kind, either expressed or implied, including warranty of merchantability or fitness for a particular purpose. In no event shall Martin C. D. Speight, the editors or Syrph the Net publications be held liable for any loss of profits, special, incidental, consequential, or other similar claims.

I agree _____
Signature of applicant, date

Name (in capital letters)

E-mail address to which you wish the database files to be sent:

.....

(Please give your name where indicated, at the beginning of the agreement, sign it where indicated at the end and send the completed agreement to me by post, at the following address: Dr.M.C.D.Speight, 49 Mount Eagle View, Leopardstown Heights, Dublin 18, Ireland)

N.B. the syrph the net files are sent free of charge.