

The hoverflies (Diptera, Syrphidae) of the Madeiran Archipelago, Portugal

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Summary

The syrphid fauna of the Madeiran Archipelago is reviewed, based on revision of collections, review of literature and field study. A new species, *Eumerus hispidus* sp. n., is described from Madeira and its status is discussed in relation to the other Macaronesian *Eumerus* species. *Paragus mundus* Wollaston, 1858 is recognised as a junior synonym of *Paragus coadunatus* Rondani, 1847 syn. n. Argument is presented that *Xylota puella* Becker, 1921 should be regarded as a junior synonym of *Xylota segnis* (Linnaeus, 1758), syn. n. A checklist and distribution maps are provided for the 25 species of hoverfly (Diptera, Syrphidae) reliably recorded from the Madeiran Archipelago. *Eupeodes nuba* (Wiedemann, 1830) is recorded from Madeira for the first time. The presence of *Syrphus torvus* Osten-Sacken, 1875 on the archipelago is confirmed. *Eumerus purpureus* Macquart, 1839 and *Syrphus ribesii* (Linnaeus, 1758) are removed from the Madeiran species list. A provisional key to the identification of Madeira hoverfly species is provided. The species *Eumerus purpurariae* Báez, 1982, recently incorrectly synonymised with *Eumerus etnensis* van der Goot, 1964 (Marcos-García and Pérez-Bañón 2000), is re-instated as a valid species.

Introduction

The aims of the current study are (1) to provide a revision of the nomenclature for the Madeiran hoverfly fauna, seeking to clarify the identity of taxa where there has been confusion in the past, and (2) to draw together location records to provide distribution maps for the reliably recorded species. The maps are intended to provide a baseline against which future observations of Madeiran hoverfly distribution can be compared and this should facilitate understanding of the long-term conservation status of these flies. The study is based on revision of several hoverfly collections both in and outside Madeira, review of literature and field study.

The Madeiran Archipelago

Madeira (33° 10' - 32° 20' N latitude; 16° 10' - 17° 20' W longitude) is the largest island in a small volcanic archipelago that lies approximately 960 km south west of continental Portugal and 560 km west of Rabat on the west coast of Morocco (West Africa). It includes an UNESCO World Heritage Site (the endemic laurel forest or laurisilva; see below) and covers an area of approximately 730 km², rising to its highest point at Pico Ruivo (1861m). Madeira is accompanied by a number of smaller islands, of which the largest is the inhabited Porto Santo (approximately 60 km to the north east of Madeira; highest point Pico do Facho (517m); area approximately 50 km²). To the south are a number of smaller uninhabited islands: (1) Ilhas Desertas (three dry, rocky islands 17.5 km off the south-east coast of Madeira with a total area of less than 15 km²; highest point 442m); (2) Salvages (three small dry islands 300 km south of Madeira with a total area of less than 3 km²; highest point 153m), and a number of associated islets. The age of these oceanic islands has been given various

estimates ranging from 2-70 million years before the present and together with the Azores, Canary Islands, Cape Verde Islands and a small area of the West Coast of Africa make up the geographical region known as Macaronesia. Although these islands were formed by volcanic activity, none of those constituting the Madciran Archipelago now appears to be active.

Climate and vegetation

Unlike the dry, smaller islands in the archipelago, Madeira itself is a lush, wet island. Approximately 38% of its area lies above 1000m and dense coastal fogs develop over its mountainous terrain. Water droplets condense from these fog clouds on the vegetation, collect in streams and eventually flow down to sea level in natural watercourses (ribeiras) or in a network of man-made irrigation channels (levadas). The climate is mild, the air temperature is fairly constant throughout the year, and frost is virtually unknown.

In its pristine state, and before the arrival of the Portuguese in the fifteenth century, Madeira appears to have had four main vegetation zones on the southern side of the island (Press and Short 1994; Capelo *et al.* 1999):

Zone 1: Sea level to 300m: dry herb and scrub plant associations including species such as dragon trees (*Dracaena draco* (L.) L.), and endemic species such as *Echium nervosum* Dryand and *Euphorbia piscatoria* Aiton.

Zone 2: 300m - 700m: dry evergreen forest (dry laurisilva) plant associations characterised by *Apollonias barbujana* (Cav.) Bornm.

Zone 3: 700m - 1200m: humid evergreen forest (humid laurisilva) plant associations characterised by species such as *Persea indica* (L.) Spreng., *Ocotea foetens* (Aiton) Baill., *Laurus azorica* (Seub.) Franco, and *Clethra arborea* Aiton (Fig. 1).

Zone 4: Above 1200m: upland vegetation characterised by plant associations that include species such as *Erica arborea* L. and *Vaccinium padifolium* Sm.

On the northern side of the island, which is generally wetter, humid laurisilva probably extended a further 200m down towards the coast (Zone 1 only occurring in the first 100m above sea level) and about 100m further up the mountains. Since the Portuguese first arrived on Madeira in the fifteenth century, the area of humid laurisilva has been reduced from 60% to less than 16% of the island area, and is now mainly restricted to the northern side of the island (Fig. 1). The native lowland vegetation (Zone 1) and dry laurisilva (Zone 2) have been almost completely replaced by terraced agriculture, forest plantation of *Acacia* spp. and *Eucalyptus* sp., as well as by urban development. Only the mountain slopes on the northern side of Madeira still retain areas of humid laurisilva (Zone 3). Laurisilva is a relict of the subtropical forest that appears to have covered much of southern Europe and northern Africa in the Tertiary Period. Today, it is restricted to Macaronesia, where the oceanic climate and isolation of the islands have allowed it to survive.

Production of the distribution maps

The distribution maps are based on collected specimens, published data and field observations dating back to the 1800s. Altogether data from over 2,250 specimens, much of which has never been published before, are included in the distribution maps. The first author has checked the majority of this material, while revising and extracting data from syrphid collections held in the Insect Collection of the Laboratório Agrícola da Madeira, Camacha (ICLAM), the collection of the Museu Municipal do Funchal (MMF) and the private collection of Isamberto Silva (IS). Additional label data were recorded from the private collections of António M.F. Aguiar (Madeira, Portugal; AMFA), Ulrich Schmid (Stuttgart, Germany; US), Andrew Wakeham-Dawson (London, England; AWD) and John Smit (Utrecht, the Netherlands; JTS).

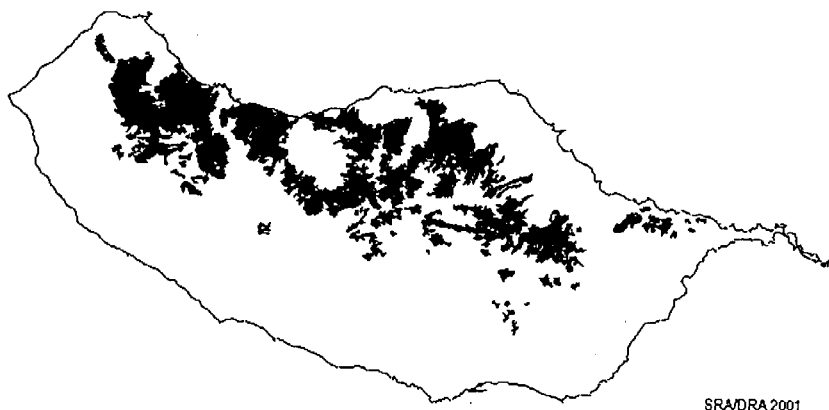


Fig. 1. Distribution of humid laurisilva (shaded areas) on Madeira Island.

The third author extracted data from Madeiran material held in the British Museum (Natural History) (BMNH) (now The Natural History Museum, London). Published data were extracted from Frey (1939, 1949), Gomes and Báez (1990) and Barkemeyer (1999). A.M.F. Aguiar, A. McCullough, B. Roels, J. Smit, J.T. Smit and A. Wakeham-Dawson collected additional new data during various field studies made between 1976 and 2003.

The second author plotted these data on maps based on 1:25000 Madeira Military Maps. The grid on these maps is based on the Universal Transverse Mercator (UTM) projection and the nine sheets that compose Madeira are inside zone 28S (100 km squares BB and CB) of the world grid. This paper provides distribution maps for the species that occur on Madeira Island itself. Each small grid-square represents 1 km². However, no map is provided for *Scaeva albomaculata* (Macquart), which has only been found on Madeira's adjacent islands and not on Madeira Island proper. For the endemic and rare species, the sources of information used to construct the distribution maps are provided in the text. In the cases of the other species, where data sources are too numerous to present easily in the text, the information is summarized only in the maps. A map showing the distribution of endemic humid evergreen forest (laurisilva) (Fig. 1) on Madeira Island is also provided for comparison with the distribution maps.

The hoverflies of Madeira

Until now, a total of 26 hoverfly species has been recorded from the Madeiran Archipelago (Barkemeyer 1999; Becker 1921; Gomes and Báez 1990). The current study has revealed that the actual number of species reliably recorded from the Madeiran Archipelago is 25. This includes four endemic species. In the following checklist, species are presented in alphabetical order. For each species, the name of the genus in which it was first described (if it is different from the current placing), reference to the original description and to previous records in the literature for Madeira,

reference to an illustration, a summary of flight period(s), and the worldwide distribution are provided. The first and third authors have checked the page numbers and publication dates of original species descriptions. Publication dates have also been checked against Evenhuis (1997). Records of the species from the Azores and the Canary Islands are based on Báez (1977), Barkemeyer (2002b) and Rojo *et al.* (1997).

1. *Episyrphus balteatus* (De Geer, 1776) (*Musca*)

Mémoires pour servir à l'histoire des insectes, vol. 6, p. 116

Syrphus balteatus (De Geer): Walker (1849), Osten-Sacken (1884), Schiner (1868), Becker (1908)

Epistrophe balteata (De Geer): Frey (1939, 1949)

Episyrphus balteatus (De Geer): Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Illustrated by Stubbs and Falk 2002 (Plate 3, Fig. 1). This species is common and widely distributed in Madeira Island and Porto Santo Island. It can be found in a wide range of habitats on Madeira, including laurisilva. It has been recorded from Deserta Grande and Selvagem Grande. It has been recorded in all months of the year except December (Fig. 17).

Worldwide distribution: a migrant species whose range includes the Australasian, Oriental and Palaearctic regions. It has also been recorded from the Azores and Canary Islands.

2. *Eristalinus aeneus* (Scopoli, 1763) (*Musca*)

Entomologia carnolica, p. 347

Eristalinus aeneus (Scopoli): Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Illustrated by Stubbs and Falk 2002 (Plate 11, Fig. 9). This species has been recorded in low numbers from only a few locations near the southeast coast of Madeira Island (4 specimens, Caniço, 20.ii.1982, leg. & coll. U. Schmid; 1 ♂, Machiço-Canical, 11.x.1981, Gomes and Báez (1990)) and in Porto Santo Island (2 ♀, Vila Balerira, 23.viii.1989, Gomes and Báez (1990)). Wollaston collected nine specimens between 1847 and 1855, which are now held at BMNH and a specimen is held in the Funchal Museum (collected on 8.v.1980). The species is restricted to the warmer coastal habitats in the south side of Madeira and throughout Porto Santo. It has been recorded in February, May, August and October, with several adults observed feeding at the flowers of some yellow Asteraceae (Fig. 18).

Worldwide distribution: present in all biogeographical regions, except the Neotropical region. It has also been recorded from the Azores and Canary Islands.

3. *Eristalis tenax* (Linnaeus, 1758) (*Musca*)

Systema Naturae, p. 591

Eristalomyia tenax (Linnaeus): Frey (1939, 1949)

Eristalomyia tenax var. *campestris* Meigen: Frey (1939, 1949)

Eristalomyia tenax var. *hortorum* Meigen: Frey (1939, 1949)

Eristalis tenax (Linnaeus): Becker (1908), Osten-Sacken (1884), Schiner (1868), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Eristalis ustus Wollaston, as a synonym of *E. tenax* var. *hortorum* Meigen: Becker (1908) (misidentification)

Illustrated by Stubbs and Falk 2002 (Plate 11, Fig. 1). This species is common and widely distributed in Madeira and Porto Santo Island, and has been recorded from Deserta Grande. On Madeira it can be found in a wide range of habitats including laurisilva. Records have been made in every month except January (Fig. 19).

Worldwide distribution: a cosmopolitan, anthrophile species. It has been recorded from the Azores and Canary Islands.

4. *Eumerus hispidus* sp. n.

Eumerus purpureus Macquart: Becker (1908), Frey (1949), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002) (all misidentifications)

The only species of *Eumerus* previously recorded from Madeira is *E. purpureus* Macquart, 1839. However, this species is endemic to the Canary Islands. Comparison of Madeiran specimens with material collected in the Canary Isles reveals that, although very similar, these specimens clearly belong to two different taxa. The occurrence of *E. purpureus* in Madeira is doubtful and all previous records of *E. purpureus* are probably misidentifications of *E. hispidus* sp. n. All material collected by the three current authors represents this new species (Plate 2, Fig. 1).

The holotype is deposited, together with one ♂ and two ♀ paratypes, in the Zoological Museum Amsterdam, Netherlands (ZMAN). Further paratypes are deposited in the Insect Collection of the Laboratório Agrícola da Madeira, Camacha (ICIAM), The Natural History Museum, London and the private collections of the authors.

Holotype: ♂ **Madeira**: Ribeira Brava, Boa Morte, 5.v.1998, (leg. JTS, coll. ZMAN).

Paratypes:

Madeira: Canhas, Salões, 500m., 1.vi.1999, 1 ♀ (leg. & coll. AMFA); Funchal, Pico dos Barcelos, 7.vii.1997, 1 ♂, 1 ♀ (leg. & coll. JTS); 9.vii.1997, 1 ♂ (leg. & coll. JTS); 13.vii.1997, 1 ♀ (leg. & coll. JTS); Funchal Pico de Santo António, 1.iii.1998, 2 ♂ (leg. & coll. JTS); 11.vi.1998, 1 ♂ (leg. & coll. JTS); Garajau, 8-15.vi.1998, 1 ♂ (leg. & coll. JTS); João Frino, 19.vii.1997, 2 ♀ (leg. & coll. JTS and ZMAN); Loreto, 5.v.1998, 1 ♀ (leg. & coll. JTS); Machico, Pico do Facho, 270m, 14.iv.2003, 1 ♂ (leg. AMFA, coll. ICLAM); 12.vi.2003, 1 ♀, (leg. AMFA, coll. ICLAM); Madalena do Mar, 15.vii.1997, 1 ♀ (leg. & coll. JTS); Monte, 4.iii.1998, 1 ♂, 1 ♀ (leg. & coll. JTS); Palheiro Ferreiro, 19.vii.1997, 1 ♂, 1 ♀ (leg. & coll. JTS); Ponta Delgada, 12.vii.1997, 1 ♂, 1 ♀ (leg. & coll. JTS); Ponta do Pargo, 5.v.1998, 1 ♂ (leg. J. Smit, coll. JTS); 19.v.1998, 5 ♂ (leg. & coll. JTS, 1 ♂ in ZMAN); Ponta do Sol, Lombo de São João, 10.xi.1994, 1 ♀ (leg. & coll. AMFA); Ponta do Sol, Lugar de Baixo, 10-30m, 30.ix.1991, 1 ♀ (leg. & coll. AMFA); Ribeira Brava, 3.iii.1998, 2 ♂, (leg. & coll. JTS); Ribeira Brava, Boa Morte, 5.v.1998, 3 ♂, 1 ♀ (same date as holotype) (leg. & coll. JTS); Ribeira da Janela, 10-17.iv.2003, 2 ♂ (leg. AWD & AMcC, 1 ♂ coll. AWD, 1 ♂ BMNH); Ribeira dos Socorridos, 24.ii.1998, 1 ♀ (leg. & coll. JTS); 3.iv.1998, 1 ♀ (leg. & coll. JTS); 7.vi.1998, 2 ♂, 2 ♀ (leg. & coll. JTS, 1 ♀ in ZMAN); São Gonçalo, 300m, 8-15.vii.2002, on *Aeonium glutinosum*, 1 ♂, 4 ♀ (leg. & coll. AWD, 2 ♀ BMNH); São Vicente, 10-17.iv.2003, 1 ♂, 2 ♀ (leg. AWD & AMcC, coll. AWD); Tabúa, 10-17.iv.2003, in *Euphorbia* scrub, 2 ♂ (leg. AWD & AMcC, coll. AWD).

Porto Santo: Calheta, 10m, 8-15.vii.2002, 2 ♀ (leg. & coll. AWD, 1 ♀ BMNH); Vila Baleira, 19.iv.1998, 7 ♂, 2 ♀ (leg. B. Roels & JTS, coll. JTS).

Additional material:

Madeira: Madeira, without further location, 1847-1855, 4 specimens (leg. T.V. Wollaston, coll. BMNH); Caniço, 5.iii.1982, 1 specimen (leg. & coll. US); Encumeada, 1000m, 23.vii.2000, 1 ♂ (leg. C. & S. Leidenroth, coll. US); Funchal, Botanical Gardens, 18.ii.1977, 1 specimen (leg. A.E. Stubbs, coll. BMNH); Funchal, Pico dos Barcelos, 15.ii.1998, 3 specimens (leg. JTS, coll. MMF); Garajau, Caniço, 27.v.1998, 1 ♀ (leg. JTS, not collected); Pico do Facho, 14.iv.2003, 1 specimen (leg. AWD, not collected); Quinta Reid, 10.viii.1929, 1 specimen (leg. J. Balfour-Browne, coll. BMNH); Ribeira Brava, 3.iii.1998, 1 specimen (leg. JTS, not collected); Ribeira da Janela, 15.iv.2003, 1 specimen (leg. AWD, not collected); Ribeira dos Socorridos, 11.ii.1998, 1 specimen (leg. JTS, coll. MMF); 16.ii.1998, 1 ♀ (leg. JTS, not collected); 24.ii.1998, 1 ♀ (leg. JTS, not collected); 7.vi.1998, 1 ♀ (leg. JTS, not collected); São Vicente, 15.iv.2003, 1 specimen (leg. AWD, released); Tabua, 13.iv.2003, 1 specimen (leg. AWD, released)

Deserta Grande: Deserta Grande, 28.ix.1993, 1 specimen (leg. & coll. IS).

Porto Santo: Ribcira do Zimbral, 14.ii.1963, 2 specimens (leg. E.W. Classey, coll. BMNH).

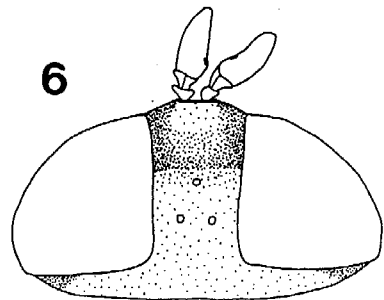
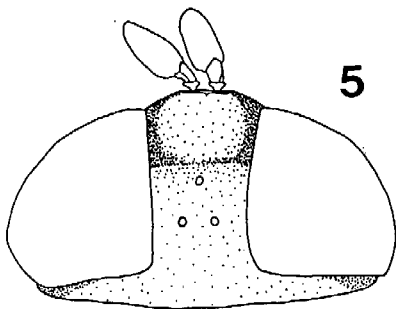
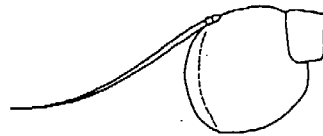
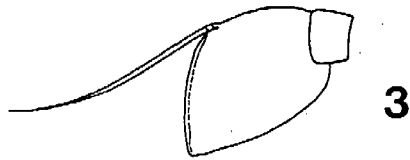
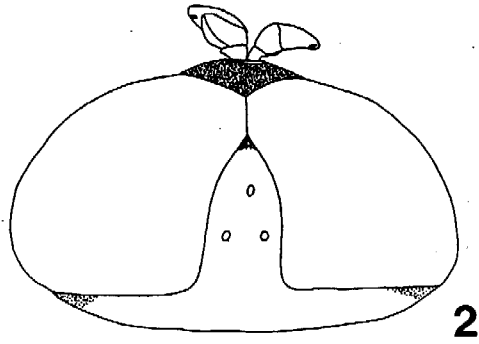
Description

Male:

Head (Fig. 2): face is small, entirely white dusted and completely white haired. Eyes are contiguous over a distance that is more or less equal to the length of the ocellar triangle. Frons is shining black, lightly golden dusted forward from the base of the ocellar triangle; the extreme point of the frontal triangle is heavily white dusted. Frons has black hairs, which are intermixed and eventually replaced by light brown hairs at the hind margin. Occiput: on top of the head shining, at the sides white dusted. Eyes have scattered white hairs. Antennae are dark, the third segment slightly longer than broad, the upper corner rounded, the lower corner pointed, giving it a somewhat elongated shape (Fig. 3).

Thorax: mesonotum has four white dusted stripes: the two in the middle just reaching the scutellum, the two at the side margins reaching the posterior calli. Hairs black and light (yellowish brown), in the middle predominantly black and present in two lengths, the light hairs are more abundant at the sides. Just before the scutellum and on the scutellum itself, there are short light hairs and longer black hairs. The mesonotum and scutellum are punctuated but shining bronze, in some lights a little purplish shining, more obvious in females and living specimens. The pleura are slightly dusted. The wings are microtrichose, although the base of both basal cells and the alula are bare of microtrichia. The pterostigma is brown, slightly lighter in colour than the veins. Legs are predominantly black. Tibia 1 and 2 orange at the basal third, tibia 3 with the basal quarter orange. The extreme apex of the femora is orange. The first segment of tarsomere 2 is orange; the other segments are dark. The hairs on the legs are predominantly white, turning orange golden on the tarsus. The anterior and dorsal sides of femora 1 and 2 have very short, black hairs. The apical quarter of femur 3 has black hairs of normal length anteriorly and dorsally. Tibia 3 has black hairs intermixed with the white ones at the basal part. Femur 3 is strongly swollen, ventrally with two rows of small spines at the top. Tibia 3 is thickened at the posterior two thirds.

Figs 2-6. *Eumerus* species heads. 2, *E. hispidus*, male head; 3, *E. hispidus*, antenna; 4, *E. purpureus*, antenna; 5, *E. hispidus*, female head; 6, *E. purpureus*, female head.



Abdomen: entirely black with three pairs of white dusted spots on the tergites. The spots on the second and third tergites are situated in a small depression. The tergites are punctuated, shining black with a bluish tinge in the middle, laterally more shiny bronze. Tergite 1 is dusted in the lateral corners. The abdomen is slightly tapering towards the tip. Tergite 3 is clearly less broad than tergite 2. Tergites 2 to 4 have short, adpressed black hairs in the middle, laterally the hairs are longer, lighter and more erect, these light hairs continue over the dust spots. Tergite 2 has the anterior corners covered with the same light hairs. The black hairs on the fourth tergite are longer in the posterior third and on the pregenital segment. Sternites 2 and 3 are small, slightly dusted and entirely white haired. The shape of the fourth sternite is very characteristic, especially the position of the short black bristles (Fig. 7), in contrast to *Eumerus purpureus* (Fig. 10).

Genitalia (Figs 8-9): extremely similar to those of *E. purpureus* (Figs 11-12). The apical extension of the anterior surstyle lobe is forked in *E. hispidus* sp. n., whereas it is simple in *E. purpureus*, viewed from ventral side. Furthermore the dorsal corner of the anterior surstyle lobe, above the membranous part of the surstyle of is more pointed in *E. hispidus* and more rounded in *E. purpureus*.

Length: Body: 9 mm. Wing: 6.5 mm.

Variability observed in the paratype series

The white dust stripes on the thorax may not reach the scutellum and or the posterior calli. Tibia 3 can be nearly entirely black or orange up to the basal quarter. The first segments of all tarsomeres can be orange. The second tarsomere may have the first until the third segment orange.

Length: Body: 6.5 – 10 mm. Wing: 5.5 – 7.5 mm.

Female:

Similar to the male except for the following differences: **Head** (Fig. 5): frons is entirely dusted from the occiput to the base of the antenna, more or less golden, becoming intermixed with white dust from the antennae to just before the frontal ocellus, the white dusting becoming predominant towards the eye margins. The frons is black and light haired, until just under the base of the antennae; the lighter hairs are more or less confined to the middle of the frons between the antennae and the frontal ocellus. The legs may be lighter than in the males, especially tarsomere 2, which is sometimes entirely orange. Sternites 2 and 3 are entirely white haired, whereas sternite 4 can have a few white hairs at the front, but is usually otherwise entirely black haired like sternite 5.

Length: Body: 8.0 – 11.5 mm. Wing: 6.0 – 8.0 mm.

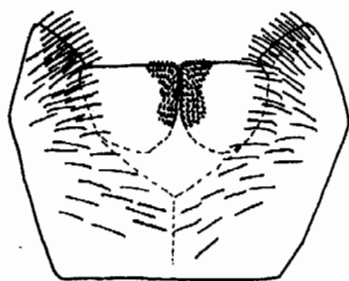
Diagnosis:

Eumerus hispidus is readily recognized within the Macaronesian group of *Eumerus* species by the following combination of characters. The eyes in males are contiguous over a length more or less equal to the length of the ocellar triangle and scattered with white hairs. The third antennal segment is pointed (Fig. 3), the abdomen is entirely dark, with three pairs of dusted white spots and the posterior femur is strongly swollen with two rows of small spines at the top.

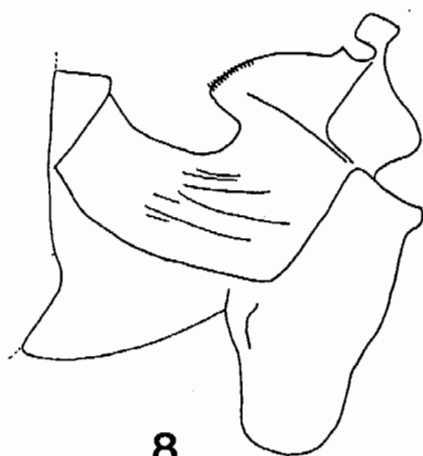
Figs 7-12. *Eumerus* species males. *E. hispidus*: 7, sternite 4; 8, right surstylus in lateral view; 9, apical extension of anterior surstyle lobe, ventral view. *E. purpureus*: 10, sternite 4; 11, right surstylus in lateral view; 12, apical extension of anterior surstyle lobe, ventral view.



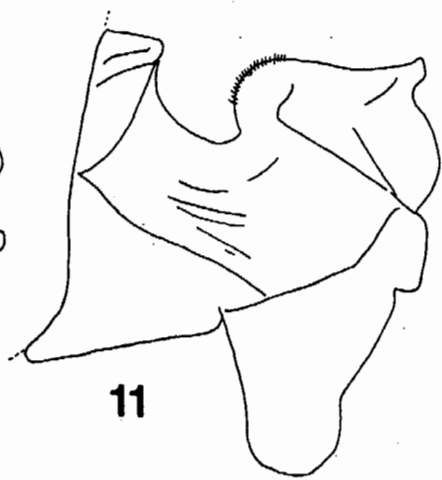
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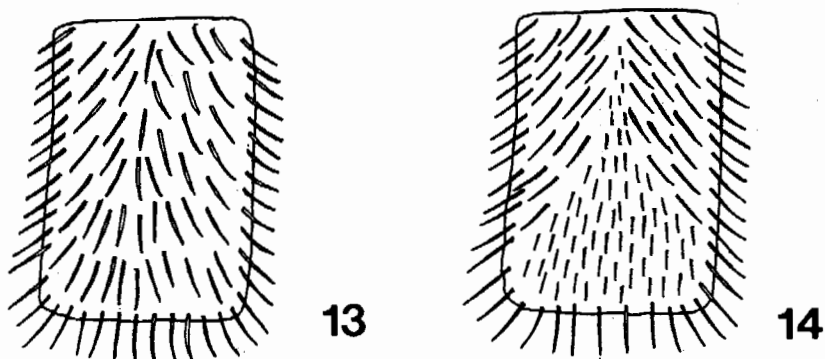
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Figs 13-14. *Eumerus* species, female sternite 3. 13, *E. hispidus*; 14, *E. purpureus*.

Males of *Eumerus hispidus* can be separated easily from *E. purpureus* by the characteristic shape and position of the small black bristles on the fourth sternite and by the apical extension of the anterior surstyle lobe, which is forked in *E. hispidus* sp. n. (Figs 7 and 9). *E. purpureus* always has a few black hairs next to the base of the antenna, but these are absent in *E. hispidus*. In *E. hispidus*, the third antennal segment is slightly longer than broad and somewhat elongated, making it appear less square than in *E. purpureus* (Fig. 4). The frons is partly shining in *E. hispidus*, whereas the entire frons is slightly golden pilose up to the occiput in *E. purpureus*.

Females of *Eumerus hispidus* can be separated from females of *E. purpureus* by the complete lack of black hairs on sternite 3 (Fig. 13). In *E. purpureus* there is a triangle of short black hairs among the white ones on sternite 3, which is more or less continuous to the black hairs on sternite 4 (Fig. 14). The third antennal segment is slightly longer than broad in *E. hispidus*, making it appear more elongated and less square than in *E. purpureus* (Fig. 4). The white dusting on the frons before the ocelli is less extensive in *E. purpureus* (Fig. 5) than in *E. hispidus* (Fig. 6).

Etymology:

Hispidus is Latin for rough, hairy, bristly and prickly and in the current species description refers to the small black bristles on the fourth sternite of the male (Fig. 7). This is the main diagnostic character separating the males of *Eumerus hispidus* sp. n. from the similar species *E. purpureus* Macquart.

Ecology

Adult *Eumerus hispidus* can be found in vegetation Zones 1 and 2 (up to about 1000m; see above in 'climate and vegetation section'), especially in thinly vegetated Madeiran xerophytic spurge communities near the coast. This species cannot be found in laurisilva. The adults fly low above the ground and are frequently found sitting on bare ground, stones and rocks, occasionally on leaves and

branches, at field margins and forest edges. Often they are found in quite large numbers on and around *Euphorbia piscatoria*-bushes. They also feed at the flowers of *Aeonium glutinosum*. The immature stages of this species have not been described. Records have been made in all months except January and December (Fig. 20).

Worldwide distribution: an endemic species of the Madeiran Archipelago, found in Madeira, Porto Santo and Deserta Grande.

5. *Eupeodes corollae* (Fabricius, 1794) (*Syrphus*)

Entomologia systematica, vol. 4, p. 306

Eupeodes corollae (Fabricius): Barkemeyer (1999), Carles-Tolra (2002)

Metasyrphus corollae (Fabricius): Gomes and Báez (1990)

Syrphus corollae Fabricius: Becker (1908), Schiner (1868), Osten-Sacken (1884), Frey (1939, 1949)

Illustrated by Stubbs and Falk 2002 (Plate 2, Fig. 12). This species is relatively scarce on Madeira Island, with a concentration of records around Funchal and Ribeiro Frio. It has also been recorded from Porto Santo Island and Deserta Grande. This species can be found in the more open habitats, it has not yet been recorded in laurisilva. Oromí (1983) recorded this species from the Selvagens Archipelago. Records have been made in all months except January, September, November and December (Fig. 21).

Worldwide distribution: Afrotropical, Oriental and Palaearctic. It has also been recorded from the Azores and the Canary Islands.

6. *Eupeodes luniger* (Meigen, 1822) (*Syrphus*)

Systematische Beschreibung, vol. 3, p. 300

Eupeodes luniger (Meigen): Barkemeyer (1999), Carles-Tolra (2002)

Metasyrphus luniger (Meigen): Gomes and Báez (1990)

Syrphus luniger Meigen: Frey (1939, 1949)

Illustrated by Stubbs and Falk 2002 (Plate 2, Fig. 14). In the Madeiran Archipelago, this species appears to be relatively scarce; most records come from the centre and southern side of Madeira Island and it has also been recorded from Porto Santo and Deserta Grande. It can be found in the more open habitats up to the secondary forests, there are only a few records from laurisilva. It has been recorded in all months except January, November and December (Fig. 22).

Worldwide distribution: Palaearctic. It has also been recorded from the Canary Islands.

7. *Eupeodes nuba* (Wiedemann, 1830) (*Syrphus*)

Aussereuropäische zweiflügelige Insecten, vol. 2, p. 136.

This is the first record of this species from the Madeiran Archipelago, where it has been recorded in only one location: an area of waste ground near Ribeira Brava (3 ♂, 2 ♀, 1-21.v.1998, leg. & coll. JTS; 2 ♂, 1 ♀, 11.iii.2001, leg. & coll. AWD) on the south coast of Madeira Island. According to Speight (2003), this species is mainly found on open or sparsely vegetated ground beside dry, seasonal rivers. The records from Madeira are from an area of waste ground next to a small stream.

This site has since been disturbed by a road-building project. The species is illustrated in Plate 1, Fig. 1. Records were made in March and May (Fig. 23)

Worldwide distribution: the Mediterranean part of the Palearctic region, including north Africa, south-western part of Asia and the eastern part of the Afrotropical region. This species has also been recorded from the Canary Islands.

8. *Ischiodon aegyptius* (Wiedemann, 1830) (*Syrphus*)

Aussereuropäische zweiflügelige Insecten, vol. 2, p. 133

Ischiodon aegyptium (Wiedemann): Frey (1949)

Ischiodon aegyptius (Wiedemann): Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Ischiodon scutellaris (Fabricius): Frey (1939) (misidentification)

Syrphus aegyptius (Wiedemann): Loew (1860), Osten-Sacken (1884)

Syrphus brachypterus Thomson: Thomson (1869), Osten-Sacken (1884) (synonym)

Syrphus brachypterus Thomson as synonym of *Ischiodon aegyptium* (Wiedemann): Frey (1949)

Syrphus scutellaris (Fabricius) [*Milithreptus*]: Becker (1908) (misidentification and misspelling of *Milithreptus* (= synonym of *Sphaerophoria*))

Illustrated in Plate 1, Fig. 2. On Madeira Island this species is mainly restricted to coastal regions, especially on the southern side of the island. It has also been recorded from Porto Santo Island and Deserta Grande. It has been recorded in all months except January and November (Fig. 24).

Worldwide distribution: Africa, including the Mediterranean part and the Arabian peninsula, recorded as far north as the Balearic Islands and southern Spain, and eastwards to Iran (coll. JTS). It has also been recorded from the Canary Islands.

9. *Melanostoma mellinum* (Linnaeus, 1758) (*Musca*)

Systema Naturae, Ed. 10, p. 594

Melanostoma mellinum (Linnaeus): Becker (1908), Frey (1949), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Illustrated by Stubbs and Falk 2002 (Plate 1, Fig. 3). This species is widespread in Madeira Island and also present on Porto Santo. It can be found in all habitats on Madeira, including laurisilva, though *M. wollastoni* is more abundant in the forested habitats. This species has been recorded in all months, except December (Fig. 26).

Worldwide distribution: Holarctic. It has also been recorded from the Azores and the Canary Islands.

10. *Melanostoma wollastoni* Wakeham-Dawson, Aguiar, Smit, McCullough and Wyatt, 2004

Dipterists Digest (Second Series), Vol. 10, p. 90

Melanostoma babyssa (Walker) [*Syrphus*]: Becker (1908) (misidentification)

Melanostoma babyssa (Walker): Frey (1939, 1949), Gomes and Báez (1990), Barkemeyer (1999) (misidentification)

Historically, this species has been mistakenly referred to as *Melanostoma babyssa* (Walker, 1849) (see Wakeham-Dawson *et al.* 2004, for details). It is generally restricted to forested areas in the centre of the island, mainly the endemic laurisilva and *Erica* forests and, to a lesser degree,

Acacia/Eucalyptus plantations. Recorded from March to October (Fig. 25). See Wakeham-Dawson *et al.* (2004) for detailed distribution data. Illustrated in Plate 1, Fig. 5

Worldwide distribution: Endemic to Madeira Island.

11. *Meliscaeva auricollis* (Meigen, 1822) (*Syrphus*)

Systematische Beschreibung, vol. 3, p. 318

Syrphus maculicornis (Zetterstedt): Becker (1908) (synonym)

Syrphus docorus (Meigen): Becker (1908) (synonym and misspelling of *decorus* Meigen)

Epistrophe auricollis (Meigen) (= *maculicornis* Zetterstedt): Frey (1939)

Epistrophe auricollis (Meigen): Frey (1949)

Meliscaeva auricollis (Meigen): Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Illustrated by Stubbs and Falk 2002 (Plate 3, Fig. 2). On Madeira Island, this species is generally restricted to forested areas, including all types of forest, secondary as well as laurisilva. Recorded in all months except January, June, November and December (Fig. 27).

Worldwide distribution: Western Palaearctic. It has also been recorded from the Azores and the Canary Islands.

12. *Milesia crabroniformis* (Fabricius, 1775) (*Syrphus*)

Systema Entomologiae, p. 768

Milesia crabroniformis (Fabricius): Walker (1849), Osten-Sacken (1884), Becker (1908), Frey (1939, 1949), Gomes and Báez (1990), Carles-Tolra (2002)

This species (illustrated in Plate 1, Fig. 3) appears to be rare on Madeira, where it has been recorded infrequently in humid laurisilva and coastal areas during May and in July–October (Fig. 28); 1 specimen, Camacha, 20.ix.1951, leg. M. Câmara, coll. MMF; 1 specimen, Caniçal, 8.viii.1963, leg. Weinreich, coll. MMF; 1 specimen, Funchal, 22.vii.1990, leg. T. Maul, coll. MMF; 1 specimen, captured in MMF laboratory, Funchal, 3.x.1985; 1 specimen, Funchal, 31.x.1951, leg. M. England, coll. MMF; 1 ♀, Lombada dos Marinheiros, 650m, 15.viii.1993, leg. & coll. S. Roberts; 1 ♂, Madalena do Mar, 15.vii.1997, leg. & coll. JTS; 1 specimen, Pico das Pedras, 22.viii.1976, coll. ICIAM; 1 specimen, Ribeira da Janela, 14.x.1989, leg. F. Zino, coll. MMF; 1 specimen, Santo da Serra, ix.1962, coll. MMF; 1 ♀, Socorridos Valley, 28.v.1998, leg. & coll. JTS; 1 specimen, Vale Formoso, 15.viii.1987, leg. Ameias, coll. MMF; 1 ♀, Corujeira, Funchal, 600m, 9.x.2001, leg. & coll. AWD; 3 specimens, Madeira, 1847–1855, leg. T.V. Wollaston, coll. BMNH; 1 ♀, Terreiro da Luta, Funchal, 4.x.1981, Gomes and Báez (1990); 1 ♂, Funchal, 24.viii, Frey (1939); 1 ♀, Pico das Pedras, (Parque Florestal), 900m, 22.viii.1976, leg. & coll. AMFA (no. 4); 1 ♀, Folhadal, 23.viii.2001, leg. AMFA, coll. ICIAM (no. 0829); 1 specimen observed, Levada Nova, 700m, 11.ix.2001, AMFA.

According to Rotheray (1993), *Milesia* larvae live in decaying heartwood and rot-holes in deciduous trees. Spcight (2003) stated that the adults tend to fly high among trees, descending only to feed, drink or oviposit. As a result, it is possible that this species is less rare than indicated by the relatively small number of specimens present in collections.

Worldwide distribution: Western Palaearctic, where it is mainly restricted to the Mediterranean region.

13. *Myathropa usta* (Wollaston, 1858) (*Eristalis*)

Annals and Magazine of Natural History, series 3, vol. 1, p. 115

Eristalis ustus Wollaston: Wollaston (1858), Osten-Sacken (1884)

Myiatropa mallotiformis Frey: Frey (1939, 1949) (synonym and misspelling of *Myathropa*)

Myathropa mallotiformis Frey: Gomes and Báez (1990) (synonym)

Myathropa mallotiformis Frey as synonym of *M. usta*: Barkemeyer (1999), Carles-Tolra (2002)

Myathropa usta (Wollaston): Barkemeyer (1999), Carles-Tolra (2002)

This species (illustrated in Plate 1, Fig. 4) is restricted to the areas of humid laurisilva and *Erica* forests in the centre of the island where it has been recorded in March, May and July-September (Fig. 29). It is sometimes abundant, feeding at flowers including several *Ranunculus* species, *Tolpis macrorhiza*, *T. succulenta*, and *Pericallis aurita*. Specimens are variable in colour, with some examples much darker than others.

Type material examined: Holotype ♀, Madeira, 1847-1855, leg. T.V. Wollaston, coll. BMNH.

Other material: 1 ♂, Chão da Ribeira, 23.v.1998, leg. & coll. JTS; 1 ♂, 1 ♀, Encumeada-Paul da Serra, 1300m, 25.vii.1997, leg. & coll. IS; 1 ♂, Fajã da Nogueira, 480m, 14.ix.1996, leg. & coll. IS; 1 ♀, Fajã da Nogueira, 10.iii.1998, leg. & coll. JTS; 3 ♀, Perto do Fanal, 1100m, 19.vii.1992, leg. & coll. IS; 1 ♀, Perto do Lomho, 640m, 18.vi.1992, leg. & coll. IS; 1 ♂, Portela, 31.vii.1998, leg. AWD, coll. JTS; 7 ♂, 2 ♀, Rabaçal, 20.vii.1997, leg. & coll. JTS; 1 ♀, Ribeiro do Alecrim, 1430m, 4.v.1997, leg. & coll. IS; 4 ♂, 1 ♀ captured, many others seen on flowers, Rabaçal, 8-15.vii.2002, leg. & coll. AWD; 10 ♂, 2 ♀, Rabaçal, 17.vii.1935, Frey (1939); 1 ♂, 1 ♀, Rabaçal, 8-15.vii.2002, leg. AWD, coll. AMFA (no. 1275); 1 specimen, Rabaçal, 6.v.1938, Frey (1949)).

Worldwide distribution: endemic to Madeira Island.

14. *Neosascia podagrica* (Fabricius, 1775) (*Syrphus*)

Systema Entomologiae, p. 768

Ascia podagrica (Fabricius): Becker (1908)

Neosascia podagrica (Fabricius): Frey (1949), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Illustrated by Stubbs and Falk 2002 (Plate 7, Fig. 14). This small species is present on Madeira Island. It can be found in a wide range of habitats, except for the very dry and open habitats. It has not been recorded from Porto Santo or the Desertas. It has been recorded in all months except January, November and December (Fig. 30).

Worldwide distribution: Palearctic.

15. *Paragus coadunatus* Rondani, 1847

Nuovi Annali delle scienze naturali [Bologna], series 2, vol. 8, p. 346.

Paragus coadunatus Rondani: Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Paragus mundus Wollaston: Wollaston, 1858, Osten-Sacken (1884) (synonym.)

Paragus mundus Wollaston as synonym of *P. tibialis* (Fallén): Becker (1908), Frey (1949) (misidentification)

Paragus tibialis (Fallén): Osten-Sacken (1884), Becker (1908), Frey (1939, 1949) (misidentification)

Paragus tibialis var. *coadunatus* Rondani: Schiner (1868)

Paragus tibialis var. *meridionalis* Becker: Frey (1939, 1949) (misidentification.)

The number of names mentioned above reflects the difficulties associated with identifying species of this genus. Báez (1978) clarified this problem for the Canary Islands, where both *P. coadunatus* and *P. tibialis* (Fallén) are present. Later Gomes and Báez (1990) checked material from Madeira, which revealed that only *P. coadunatus* is present. Gomes and Báez (1990) listed all names that have previously been applied to the *Paragus* species from Madeira, also mentioning that Becker (1908) placed *P. mundus* Wollaston as a junior synonym of *P. tibialis*. However, as Wollaston's *P. mundus* specimens (nine syntypes are held in BMNH) originated from Madeira and Porto Santo, *Paragus mundus* Wollaston, 1858 is a junior subjective synonym of *P. coadunatus* Rondani, 1847, **new synonymy**, rather than a junior synonym of *P. tibialis* (Fallén).

Illustrated in Plate 1, Fig. 6. In some specimens the abdomen is black, while in others it is red or partially red. In the Madeiran Archipelago, this is largely a coastal species inhabiting the southern side of Madeira Island, avoiding the forested habitats. It is also present on Porto Santo. The species has been recorded in all months except January and December (Fig. 31).

Worldwide distribution: Western Mediterranean. It is also recorded from the Canary Islands.

16. *Scaeva albomaculata* (Macquart, 1842) (*Syrphus*)

Diptères exotiques nouveaux ou peu connus, vol. 2, pt. 2, p. 86; tab. 15, fig. 6

Lasiophthicus albomaculatus (McGicn): Becker (1908) (misspelling of *Lasiophthicus* and wrong author)

Scaeva albomaculata (Macquart): Gomes and Báez (1990), Carles-Tolra (2002)

Syrphus gemellarii (Rondani): Schiner (1868), Osten-Sacken (1884) (synonym)

Illustrated by Stubbs and Falk 2002 (Plate 3, Fig. 13). This migrant species has only been recorded within the Madeiran Archipelago from Porto Santo (1 specimen, 21-28.ii.1963, leg. E.W. Classey, coll. BMNH) and Deserta Grande (2 ♀, 10.v.1992, leg. & coll. IS) and not from Madeira itself. It is unlikely that this species will be found in the humid laurisilva biome.

Worldwide distribution: Eurasian, mainly restricted to the Mediterranean in the European region, but highly migratory. It has also been recorded from the Canary Islands.

17. *Scaeva pyrastris* (Linnaeus, 1758) (*Musca*)

Systema Naturae, p. 594

Catabomba [*Lasiophthicus* Rondani] *pyrastris* (Linnaeus): Becker (1908) (misspelling of *Lasiophthicus*)

Lasiophthicus pyrastris (Linnaeus): Frey (1939) (misspelling of *Lasiophthicus*)

Scaeva pyrastris (Linnaeus): Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Syrphus pyrastris (Linnaeus): Schiner (1868), Osten-Sacken (1884)

Illustrated by Stubbs and Falk 2002 (Plate 3, Fig. 11). This species is widespread but infrequent on Madeira Island (where it occurs mainly on the southern side), Porto Santo Island and Deserta Grande. There are only a few records of this species from the laurisilva. It has been recorded in all months except January, November and December (Fig. 32).

Worldwide distribution: Holarctic.

18. *Scaeva selenitica* (Meigen, 1822) (*Syrphus*)

Systematische Beschreibung, vol. 3, p. 304, Tab. 30, fig. 21

Lasiophthicus seleniticus (Meigen): Becker (1908) (misspelling of *Lasiophthicus*)

Scaeva cf. *selenitica* (Meigen): Gomes and Báez (1990)

Scaeva selenitica (Meigen): Barkemeyer (1999), Carles-Tolra (2002),

Syrphus seleniticus (Meigen): Schiner (1868), Osten-Sacken (1884)

Illustrated by Stubbs and Falk 2002 (Plate 3, Fig. 12). This species is relatively rare on Madeira and has not been recorded on any of the adjacent islands. It has been recorded in February, April, May, July and October (Fig. 33); 1 specimen, Madeira, coll. ICLAM; 1 ♀, Canhas, 10.iv.1998; 1 ♀, Montado do Barreiro, 20.v.1998; 1 ♂, P. dos Barcelos, 22.ii.1998; 1 ♂, 6 ♀, Ponta de São Lourenço, 27.ii.1998, coll. MMF; 1 ♀, Rabaçal, 20.vii.1997; 1 specimen, São Martinho, 2.v.1997, coll. ICLAM; 1 ♀, Socorridos Valley, 11.ii.1998; all leg. & coll. JTS, unless otherwise stated; 1 ♀, Fajã da Nogueira, 600-800m, 19.iv.1993, leg. & coll. AMFA (no. 785); 1 ♀, Jardim da Serra, 1030m, 22.x.1998, leg. & coll. AMFA (no. 1278)).

Worldwide distribution: Palaearctic and Oriental. It has also been recorded from the Canary Islands.

19. *Sphaerophoria rueppellii* (Wiedemann, 1830) (*Syrphus*)

Aussereuropäische zweiflügelige Insecten, vol. 2, p. 141.

Sphaerophoria rueppellii (Wiedemann): Barkemeyer (1999)

Illustrated by Stubbs and Falk 2002 (Plate 4, Fig. 20). This is a rare species on Madeira (Fig. 34), where it is only known from one coastal site near Machico (the mouth of the Ribeira de Machico, where it has been recorded in February, April, May and July; 1 ♀, coll. MMF, 27.ii.1998 (location unknown); 7 ♂ (2 in coll. Pierre Goeldlin de Tiefenau), 1 ♀, 19.vii.1997; 2 ♀, coll. MMF, 5.v.1998; all leg. JTS, all coll. JTS, unless otherwise stated). On Porto Santo, it appears to be more abundant (Barkemeyer 1999). The first author of the current paper collected 14 ♂ and 2 ♀, 18-20.iv.1998 near Vila Baleira, Porto Santo Island (all coll. JTS). In continental Europe, this species is mainly found in places with disturbed vegetation. Speight (2003) mentioned wetland and open ground as preferred environment, especially exposed vegetated sand and the gravel banks of major rivers. In southern Europe, the preferred habitat is irrigation ditches and dry riverbeds that are seasonally flooded. In the Madeiran Archipelago, Porto Santo's dry, sandy conditions and intermittent seasonal streams appear to suit this species better than the continuously wetter conditions of Madeira Island.

Worldwide distribution: Palaearctic, Oriental and the eastern part of the Afrotropical region. It has also been recorded from the Azores and the Canary Islands.

20. *Sphaerophoria scripta* (Linnaeus, 1758) (*Musca*)

Systema Naturae, p. 594

Melithreptus scriptus (Linnaeus) = *strigatus* Staeger: Becker (1908)

Melithreptus strigatus (Staeger): Schiner (1868) (synonym)

Sphaerophoria scripta (Linnaeus): Frey (1939, 1949), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Sphaerophoria strigata (Staeger) (*Melithreptus*): Osten-Sacken (1884) (synonym)

Illustrated by Stubbs and Falk 2002 (Plate 4, Fig. 16). This species is widespread on the islands of Madeira and Porto Santo. It can be found in a wide range of habitats including laurisilva, though it is more common in the coastal areas. It has been recorded in all months except January, November and December (Fig. 35).

Worldwide distribution: Holarctic and Oriental. It has also been recorded from the Azores and Canary Islands.

21. *Syritta pipiens* (Linnaeus, 1758) (*Musca*)

Systema Naturae, p. 594

Syritta pipiens (Linnaeus): Schiner (1868), Osten-Sacken (1884), Becker (1908), Frey (1949), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Illustrated by Stubbs and Falk 2002 (Plate 10, Fig. 8). This species is widespread and especially common in coastal areas on Madeira and Porto Santo Islands, but has also been found in the laurisilva. It has been recorded in all months except January (Fig. 36).

Worldwide distribution: Holarctic and Oriental. It has also been recorded from the Azores and Canary Islands.

22. *Syrphus torvus* Osten-Sacken, 1875

Proceedings of the Boston Society of Natural History, vol. 18, p. 139

Syrphus ribesii (Linnaeus): Gomes and Báez (1990) (misidentification)

Syrphus cf. *torvus* Osten-Sacken: Gomes and Báez (1990)

Syrphus torvus Osten-Sacken: Barkemeyer (1999), Carles-Tolra (2002),

This species (illustrated by Torp 1994: Plate 2, Fig. 49) is rare on Madeira and generally found in forested areas, including laurisilva in March-May, July-August, October and December (Fig. 37); 1 ♀, Chão da Ribeira, 450m, 19.v.1998; 2 ♂, Loreto, 5.v.1998; 1 ♂, Pico do Arieiro, 1800m, 16.viii.1989, leg. & coll. M. Báez; 3 specimens, Pico das Torres, 1500m, 6.xii.1992 (leg. & coll. IS); 2 ♂, 6 ♀, Rabaçal, 1150m, 20.vii.1997, leg. & coll. JTS (2 ♂, 2 ♀ in coll. Goeldlin de Tiefenau); 1 ♂, Ribeira Brava, 3.iii.1998; 1 ♂, São Jorge, 4.v.1998; 1 ♀, Socorridos Valley, 3.iv.1998; all leg. & coll. JTS, unless otherwise stated; 2 specimens, 55.7 on the data label, Madeira, 1847-1855, leg. T.V. Wollaston, coll. BMNII; 1 ♀, Rabaçal, 8-15.vii.2002, leg. & coll. AWD; 1 ♂ on *Quercus robur* with aphids, Ponta do Sol-Paul da Serra-Fanal, 10.x.1981, Gomes and Báez (1990); 1 ♀, Santa Cruz-Poiso, 9.x.1981, Gomes and Báez (1990).

Gomes and Báez (1990) recorded *Syrphus ribesii* (Linnaeus, 1758) from Madeira (1 ♂, Pico do Arieiro, 16.viii.1989, leg. & coll. M. Báez). However, re-examination by the current paper's first author of the specimen on loan from Marcos Báez revealed that it is also a specimen of *S. torvus*. The specimens from Madeira tend to be much bigger and darker, especially in the wings, than the continental specimens of *S. torvus*. This is perhaps why Gomes and Báez (1990) recorded this species as comparable to, but not exactly the same as, *S. torvus* (i.e. *S. cf. torvus*). Careful examination of the Madeiran specimens reveals no morphological differences with the continental ones, either externally or in the genitalia. Four specimens were sent to Dr. Goeldlin de Tiefenau for examination and he confirmed that, although they are darker in colour, no morphological differences could be found between Madeiran specimens and a series of continental specimens.

Worldwide distribution: Holarctic and Oriental.

23. *Syrphus vitripennis* Meigen, 1822

Systematische Beschreibung, p. 308

Syrphus vitripennis Meigen: Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002),

Illustrated by Stubbs and Falk 2002 (Plate 2, Fig. 1). This species is widespread in Madeira Island, but especially common around Funchal and Ribeiro Frio. It is found in a wide range of habitats, including laurisilva. It has been recorded in all months except January and December (Fig. 38).

Worldwide distribution: Holarctic.

24. *Xanthandrus babyssa* (Walker, 1849) (*Syrphus*)

List of the specimens of the dipterous insects in the collection of the British Museum, pt. 3, p. 584

Syrphus babyssa Walker: Walker (1849), Osten-Sacken (1884)

Xanthandrus babyssa (Walker): Carles-Tolra (2002), Wakeham-Dawson *et al.* (2004)

Xanthandrus parhyalinatus (Bigot): Bigot (1884), Becker (1908), Frey (1939, 1949), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002) (synonym)

This species has previously been recorded as *Xanthandrus parhyalinatus* (Bigot, 1884), which is a junior synonym of *X. babyssa* (Walker, 1849) (see Wakeham-Dawson *et al.* 2004). Illustrated in black and white by Barkemeyer (1999, Fig. 1, p. 126) and here in colour: Plate 2, Figs 2 and 3. It is widespread in areas of endemic laurisilva, and to a much lesser extent in other forested areas (Fig. 39). It has been recorded in all months except January and June.

Type material examined: Holotype ♀, Madeira (Walker 1849)

Other material: 1 ♂, 3 ♀, Barreira, 900m, 19.ii.1998; 4 ♀, Chão da Ribeira, 19.v.1998; 1 ♀, Chão da Ribeira, 20.iii.1998; 1 ♀, Encumeada, 12.vii.1997; 1 specimen, Encumeada, 12.ix.1996, coll. ICLAM; 2 ♀, Fajã da Nogueira, 10.iii.1998; 1 ♀, Fontes, 16.vii.1997; 1 ♀, Jardim Botânico, Funchal, 11.iv.1998; 4 specimens, Pico dos Barcelos, 355m, 7.ii.1998; 1 ♀, Lombada dos Marinheiros, 15.vii.1997; 3 ♀, Pico dos Barcelos, 21.ii.1998; 1 ♀, Poço da Neve, 11.vii.1997; 2 ♀, Ponta de São Lourenço, <100m, 27.ii.1998; 1 ♀, Portela, 31.vii.1998, leg. AWD, coll. JTS; 1 specimen, Terreiro-Portela (after Pico do Suna), 11.xii.1988, leg. & coll. AMFA; 1 ♂, R. Brava, Boa Morte, 5.v.1998; 1 ♀, R. Sta Luzia, Corujeira, 24.v.1998; 7 ♂, 11 ♀, Rabaçal, 20.vii.1997; 1 ♀, Rabaçal, 3.iii.1998; 1 ♀, Ribeira Brava, 3.iii.1998; 1 ♂, Ribeiro Frio, 500m, 21.vii.2000, leg. C. & S. Lei, coll. US; 6 ♂, Ribeiro Frio, 17.vii.1997; 1 specimen, Santana, Queimadas, 22.viii.1976, coll. ICLAM; 1 ♀, Serra da Fira da Laje, 5.iv.1998; 7 ♂, 5 ♀ (2 of these in coll. MMF), Socorridos Valley, 11.ii-24.iv.1998; all specimens leg. & coll. JTS unless otherwise stated; 2 ♂, Encumeada, 800m, 10.iii.2001; 1 ♂, Chão da Ribeira, 2.iii.2000, 1 ♀, Montado do Sabugal, 10.xii.2000, leg. AMFA, coll. AWD; 1 ♀, Encumeada, 800m, 12.x.2001; 7 ♂, Encumeada, 800m, 8.x.2001, all leg. & coll. AWD, unless otherwise stated; 8 specimens, Madeira, leg. T.V. Wollaston, coll. BMNH; 3 specimens, Ribeiro Frio, 3.viii.1962 (2 specimens det. R.L. Coe, puparium case, ex *Myrica fayu* fruit material), xi.1960 (1 specimen), leg. N.L.H. Krauss, coll. BMNH; 3 ♂, Calheta, Parque do Rabaçal, 14.ix.1980, Gomes and Báez (1990); 1 ♀, Terreiro da Luta, Funchal, 4.x.1981, Gomes and Báez (1990); 1 ♀, Ponta do Sol-Paul da Serra-Fanal, 10.x.1981, Gomes and Báez (1990); 1 ♀, Santana-Queimadas, 10.ix.1980, Gomes and Báez (1990); 1 ♂, 5 ♀, Santana-Queimadas, 2.x.1981, Gomes

and Báez (1990); 7 ♂, 6 ♀, Encumcada, 800m, 20.viii.1989, Gomes and Báez (1990); 1 ♂, Ribeiro Frio, 27.viii.1989, Gomes and Báez (1990); 2 ♂, 2 ♀, Rabaçal, 17.vii-4.viii, Frey (1939); 2 ♂, 11 ♀, Caramujo, 6.viii-14.viii, Frey (1939), 1 ♂, Rabaçal, 8-15.vii.2002, leg. & coll. AWD; 2 ♂, Ribeiro Frio - Portela, 8-15.vii.2002, leg. & coll. AWD; 1 ♂, Queimadas, Santana, 880m, 22.viii.1976, leg. & coll. AMFA (no. 66); 1 ♂, Terreiro-Portela (after Pico do Suna), 11.xii.1988, leg. & coll. AMFA (n° 286), 1 ♀, Montado do Sabugal, 10.ii.2000, leg. & coll. AMFA (no. 1287); 1 ♀, Folhadal, 23.viii.2001, leg. & coll. AMFA (no. 1288); 1 ♂, Chão da Ribeira, 28.vii.1998, leg. AMFA, coll. ICLAM (no. 0846); 1 ♀, Folhadal, 23.viii.2001, leg. AMFA, coll. ICIAM (no. 0847); 1 ♀, Entrosa, Boa Ventura, 20-185m, 14.ii.2001, leg. AMFA, coll. ICLAM (no. 0848); 1 specimen, Ribeiro Frio, 920m, 11.iv.2003, leg. AMcC & AWD; 1 specimen, Ribeira da Janela, 50-400m, 15.iv.2003, leg. AMcC & AWD; 1 ♂, Montado do Sabugal, 960m, 12.viii.2003, leg. AMFA & Jesus, coll. ICLAM (no. 0886).

Worldwide distribution: Endemic to Madeira Island.

25. *Xylota segnis* (Linnaeus, 1758) (*Musca*)

Systema Naturae, p. 595

Xylota segnis (Linnaeus): Becker (1908), Frey (1939, 1949), Gomes and Báez (1990), Barkemeyer (1999), Carles-Tolra (2002)

Xylota puella Becker: Becker (1921) (synonym)

Illustrated by Stubbs and Falk 2002 (Plate 9, Fig. 6). This species is widespread but infrequent on Madeira Island, where it is often associated with *Hydrangea macrophylla* plants. It can be found in all forested areas, including laurisilva. It has been recorded in all months except January, September, October and December (Fig. 40).

Worldwide distribution: Holarctic, also recorded from the Azores and Canary Islands.

Becker (1921) described the species *Xylota puella* from Madeira based on a single female. The description suggests that this is an intersex specimen of *Xylota segnis* (Linnaeus, 1758). Unfortunately the holotype, held in the Museum für Naturkunde in Berlin (ZMIIU), is lost (J. Ziegler *pers. comm.*). Only a bare pin remains; this still holds the original labels, one of which records the catalog number (50991) mentioned in the description. Becker (1921) stated that *X. puella* is closely related to *X. segnis*, but is immediately separated from this and all other known *Xylota* species by the aberrant form and colouring of the frons. In *X. puella* the frons is described as triangular and is, at its narrowest point, only as broad as one third of the length of the third antennal segment. In addition, the frons of *X. puella* is described as dull black and the dust spots, which are less well developed than in *X. segnis*, are restricted to the eye margins. In *X. segnis*, the frons is shining black and the two distinct dust spots are frequently connected on the frons. Comparable aberrations can be observed in intersex specimens of the genus *Platycheirus*, where intersex specimens are more frequently encountered than in the genus *Xylota*. The antennal coloration of *X. puella* (brown-black with the first two segments red) and abdominal markings (yellow) may also be dependent on the freshness of the specimen. In *X. segnis*, the *X. puella* coloration can be observed in specimens that have just emerged from the puparium. As a result, we regard the nominal species *Xylota puella* Becker, 1921 to be an intersex (or immature form) of *X. segnis* (Linnaeus, 1758), and thus the name *Xylota puella* to be a junior subjective synonym of *Xylota segnis*, **new synonymy**. It should be noted that this is

not the first aberrant specimen that Becker described as a separate species (Báez *et al.* 1986; Smit and Zeegers 2002).

Discussion:

Origin and zoogeography of Madeira's syrphid fauna

As Madeira is an oceanic island formed by volcanic activity from the seabed, there has probably never been a land bridge between it and a continental landmass. As a result, hoverfly species have probably arrived on the island as migrating adults, although immature stages may have been imported to the region in plant material. The migratory capabilities of some hoverfly species have been documented (e.g. Williams 1958; Speight 1996; Gatter and Schmid 1990; Schmid 1999; Kehlmaier 2002). In their extensive survey, Gatter and Schmid (1990) revealed that the majority of the migratory hoverflies are those that have zoophagous, and to a lesser extent, aquatic saprophagous larvae. For Madeira, these two ecological groups account for 84% of the species (respectively 17 and 4 species). However, adults may also be blown unintentionally between locations. The 'Leste', a very strong wind originating in the African desert, has been shown to blow Lepidoptera (Classey 1966) and one Odonata species (Smit 1998) from Africa to Madeira. This wind probably blows hoverflies from Africa to Madeira or from the Canary Islands to Madeira.

The Azores anticyclone is another probable factor in the migration and unintentional movement of insect species to Madeira. This anticyclone has a strong influence on the climate of Madeira (Stauder 1990; Press and Short 1994) and causes a predominant wind to blow from continental Western Europe (and to a lesser degree from the Mediterranean) towards Madeira, allowing insects to be blown from Europe to Madeira. The zoogeographical affinities between the various syrphid faunas in the Macaronesian region support the view that these weather systems are influential in the movement of hoverflies between mainland and the archipelagos (Table 1).

The same can be observed in dragonflies (Odonata), tachinid flies (Diptera: Tachinidae) and wasps (Hymenoptera: Vespoidea) (Smit 1998; Smit 2000; Smit and Zeegers 2002). The zoogeographical affinities of these groups match those of most of the terrestrial faunistic groups present in Madeira (Báez 1993): i.e. a strong affinity with central Europe, a weak affinity with the Mediterranean region and a very weak affinity with the Afrotropical region.

Table 1. The differences in syrphid zoogeographical affinity among the four north-eastern Atlantic archipelagos (Macaronesian region), showing a shift from mainly Palaearctic to a more Mediterranean and Afrotropical affinity from north to south. The species numbers are based on Barkemeyer 2002b (Azores), Báez 1977, 1978, 1982 (Canary Islands) and Barkemeyer 2002a (Cape Verde Islands). Note that the Mediterranean fauna is a sub-set of the Palaearctic fauna. Similarly the endemic fauna is a sub-set of the species totals for each archipelago.

Affinity	Azores furthest north	Madeira	Canary Isles	Cape Verde furthest south
Holarctic	5	9	5	2
Palaearctic	17	14	24	3
(Mediterranean)	(2)	(3)	(12)	(1)
Afrotropical		2	4	10
(Endemic)	(2)	(4)	(12)	(2)
Total number	22	25	33	15

Comments on the *Eumerus* species of the Macaronesian Islands

Much has recently been published on the *Eumerus* species of the Macaronesian archipelagos, including description of new species and proposed new synonymies (e.g. Báez 1982; Marcos-García and Pérez-Bañón 2000; Barkemeyer 2002a and 2002b; Haeseler *et al.* 2002; Báez and Barkemeyer 2002). However, knowledge of the Macaronesian syrphids in general and the genus *Eumerus* in particular is still limited, as illustrated by the previous confusion over the true identity of *Eumerus hispidus*. This reflects the incomplete understanding of the taxonomy of this genus in the Western Palaearctic as a whole, where there are over 100 described species.

Within Macaronesia, the genus *Eumerus* has been under-surveyed (both in terms of island area and time of year). Most surveys have taken place for short periods of time and, with the exception of Barkemeyer (2002a, 2002b), rarely compare results between archipelagos. To date, the most detailed studies have been carried out in the Canary Islands. In his monograph, Santos-Abreu (1924) recorded five species of *Eumerus* from the Canary Islands. In his 1982 revision, Báez recorded a total of nine species from this archipelago, four of which were described as new species. More recently, two of the previously recorded species, *Eumerus purpurariae* Báez, 1982 and *E. terminalis* Santos-Abreu, 1924, have been synonymised with continental European species (Báez and Barkemeyer 2002; Marcos-García and Pérez-Bañón 2000) and yet another species *Eumerus obliquus* (Fabricius, 1805) has been added to the list (Haeseler *et al.* 2002). In addition to this, the first author of the current paper has a single female specimen of a yet unidentified species from Tenerife. This specimen is clearly different from all the other species currently known from this archipelago. However, this specimen can only be identified with certainty if a matching male is found. Barkemeyer (2002a) experienced a similar problem with a *Eumerus* taxon from the Cape Verde Islands.

The synonymisation of *Eumerus purpurariae* Báez, 1982 with *E. etnensis* van der Goot, 1964 proposed by Marcos-García and Pérez-Bañón (2000) seems incorrect. Comparison of specimens from the Canary Isles (Fuerteventura) with specimens taken from France, Gibraltar, Portugal and Spain, reveals that there are consistent, albeit slight, differences in sternite 4, in metatarsus 3 and in the male terminalia (Figs 15 and 16) between the mainland and the Canary Islands specimens (Table 2). Examination of the holotype of *Eumerus etnensis* van der Goot, 1964 confirms the difference between the two taxa. The above-mentioned continental specimens are conspecific with this holotype. Therefore we hereby re-instate the species *Eumerus purpurariae* Báez, 1982, which is an endemic species of the Canary Islands (Fuerteventura and Lanzarote).

Material examined:

***Eumerus etnensis* van der Goot, 1964** (a continental species, not occurring on any island in the Macaronesian region); 15 specimens: 12 ♂ and 3 ♀ examined:

Type material: Holotype ♂, Italy, Sicily, Etna, Rif. Filicium, 1400-1500 m, 22-28. vii. 1961 (leg. V.S. van der Goot, coll. RMNH)

Other material: France: Pyrénées Orientales, Perpignan, Terreilles Plage, 21.vii.1999, 1 ♂ (leg. J. Smit, coll. JTS); Gibraltar: Upper Rock Nature Reserve, 16.x.2001, 7 ♂, 2 ♀ (leg. & coll. JTS);

Portugal: Algarve, 6-27.iv.1998, 1 ♂ (leg. W. Fliervoet, coll. JTS); Spain: Andalucía, Cádiz, Conil de la Frontera, 15.x.2001, 1 ♂ (leg. & coll. JTS); Alicante, Javea, L. Del Descubridor, 29.iv.1994, 1 ♂ (leg. C. Pérez-Bañón, coll. JTS); Alicante, Isla Nueva Tabarca, 20.iv.1994, 1 ♀ (leg. C. Pérez-Bañón, coll. JTS).

Character	<i>Eumerus purpurariae</i> (n = 15)	<i>Eumerus etnensis</i> (n = 15)
Males		
Metatarsus 3	Clearly broadened at the base, at most 1½ times as long as broad at the base.	Not broadened, about twice as long as broad at the base.
Sternite 4	The black bristles on the posterior part, somewhat shorter and finer.	The black bristles on the posterior part, longer and thicker.
	Posterior margin, between the lateral corners and the incision in the middle, slightly concave.	Posterior margin straight between the lateral corners and the incision in the middle.
Genitalia	Fig. 15, tip of posterior surstyle lobe round.	Fig. 16, tip of posterior surstyle lobe concave dorsally.
Males and females		
Mesonotum	Brightly shining, only faintly dusted, with 2-5 indistinct dusted stripes.	Heavily dusted, with four darker stripes that are less dusted but not shining.
Scutellum	Brightly shining, not dusted.	Entirely dusted, only weakly shining.

Table 2. The main differences between *Eumerus purpurariae* and *E. etnensis* (n = number of specimens examined).

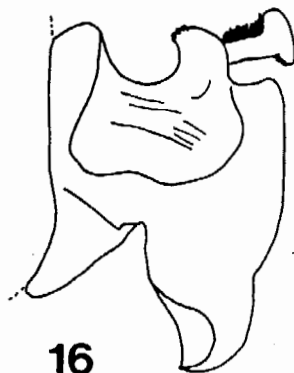
Eumerus purpurariae Báez, 1982 (an endemic species of the Canary Islands, occurring only on Fuerteventura and Lanzarote); 15 specimens: 8 ♂ and 7 ♀ have been examined from the following locations: Spain: Islas Canarias, Fuerteventura, Betancuria, 7.v.2002, 7 ♂, 3 ♀ (leg. & coll. JTS); Vega de Rio Palmas, 7.v.2002, 1 ♂, 4 ♀ (leg. & coll. JTS).

Summary of revisions

This study has established the true identities of a number of nominal taxa. The records of *Eumerus purpureus* from Madeira are misidentifications of *E. hispidus* sp. n. The records of *Melanostoma babyssa* of all authors other than Walker (1849) are misidentifications of *M. wollastoni* (see Wakeham-Dawson *et al.* 2004 for details). The record of *Syrphus ribesii* (Gomes and Báez 1990) is a misidentification of *S. torvus*. *Paragus mundus* Wollaston, 1858 is a junior subjective synonym of *P. coadunatus* Rondani, 1847, **new synonymy**. *Xanthandrus parhyalinatus* (Bigot, 1884) is a junior subjective synonym of *X. babyssa* (Walker, 1849) (see Wakeham-Dawson *et al.* 2004, for details). *Xylota puella* Becker, 1921 is a junior subjective synonym of *X. segnis* (Linnaeus, 1758), **new synonymy**. The species *Eumerus purpurariae* Báez, 1982, recently incorrectly synonymised with *E. etnensis* van der Goot, 1964 (Marcos-García and Pérez-Bañón 2000), is **re-instated** as a discrete species.



15



16

Figs 15-16. *Eumerus* species male genitalia, right surstyle in lateral view. 15, *Eumerus purpurariae*; 16, *E. etnensis*.

Provisional key to the hoverfly species of the Madeiran Archipelago

- | | | |
|---|---|---------------------------------|
| 1 | Wing: inner cross-vein (r-m) before the middle of the discal cell. | 2 |
| - | Wing: inner cross-vein (r-m) at or beyond the middle of the discal cell. | 19 |
| 2 | Scutellum more brightly coloured than thorax, often clear yellow, sometimes brown. Face always partly yellow. | 3 |
| - | Scutellum with the same colour as the thorax, dark, often metallic shining. Face entirely black, except in <i>Paragus</i> . | 15 |
| 3 | Thoracic pleura with clear yellow markings, mesoscutum laterally always with a clear yellow band along the sides. | 4 |
| - | Thoracic pleura without clear yellow marking, mesoscutum laterally sometimes with a faint yellow band along the sides. | 6 |
| 4 | Abdomen distinctly margined. | <i>Ischiodon aegyptius</i> |
| - | Abdomen unmargined. | 5 |
| 5 | The yellow band alongside the mesoscutum interrupted above the wing base. Abdomen slightly constricted. Smaller species. | <i>Sphaerophoria rueppellii</i> |
| - | The yellow band alongside the mesoscutum continuous. Larger species. | <i>Sphaerophoria scripta</i> |

- 6 Eyes distinctly hairy. Frons inflated. Abdomen with yellow spots or completely black, never with yellow bands. 7
- Eyes bare, if some hairs present (*Syrphus torvus*) then abdomen with yellow bands. Frons never inflated. 9
- 7 Abdomen: tergites 3 and 4 with broad oblique bars. *Scaeva albomaculata*
- Abdomen: tergites 3 and 4 with less broad oblique bars, more comma-like markings, or completely black. 8
- 8 Abdomen: Tergites 3 and 4 with hooked bars of almost equal width at each end and with the inner end reaching further forward than the outer end, or abdomen completely black (var. *unicolor*). *Scaeva pyrastris*
- Abdomen: Tergites 3 and 4 with comma-like markings with both ends of equal distance from the anterior edge of the segment. *Scaeva selenitica*
- 9 Mesoscutum dull. Squama with long hairs on the dorsal surface. 10
- Mesoscutum metallic shining. Squama without such hairs. 11
- 10 Eyes hairy, less distinct in females. Wing: basal cell entirely covered with microtrichia. *Syrphus torvus*
- Eyes entirely bare. Wing: basal cell at the base with a patch bare of microtrichia. *Syrphus vitripennis*
- 11 Abdomen: tergites 3 and 4 with double bands. *Episyrphus balteatus*
- Abdomen: tergites 3 and 4 with spots, which might be connected into a single yellow band. 12
- 12 Abdomen: tergites 3 and 4 with the hind margin of the oblique spots (var. *maculicornis*), which might be connected (var. *auricollis*), straight, more or less V-shaped. *Meliscaeva auricollis*
- Abdomen: tergites 3 and 4 with the hind margin of the spots, or bands, curved. 13
- 13 Femora entirely yellow, face small. *Eupeodes nuba*
- Femora black at the base, face broader. 14
- 14 Females: black markings on the frons with a Y-shaped extension forwards. Males: genitalia small, not reaching the fourth sternite, hind margin of sternite 5 more or less straight. *Eupeodes luniger*
- Females: black markings on the frons without a Y-shaped extension. Males: genitalia large, nearly reaching the fourth sternite, hind margin of sternite 5 convex. *Eupeodes corollae*

Plate 1. Fig. 1, *Eupeodes nuba* (♂); 2, *Ischiodon aegyptius* (♀); 3, *Milesia crabroniformis* (♀); 4, *Myathropa usta* (♂); 5, *Melanostoma wollastoni* (♀); 6, *Paragus coadunatus* (♂).





1



2



3

- 15 Face yellow. Abdomen entirely black or partly red, without clear spots on the tergites. *Paragus coadunatus*
 - Face black. Abdomen entirely black or with spots. 16
- 16 Abdomen petiolate. Abdomen: tergites 2 and 3 with a yellow band or with yellow spots. Wing: marginal cross-veins infuscated. *Neosasia podagrira*
 - Abdomen with parallel side margins or broad in width, never petiolate. 17
- 17 Abdomen broad, never with parallel side margins. Female: abdomen entirely black or with small yellow rounded spots. Male: abdomen with pairs of broad yellow spots on tergites 3 and 4; pairs of spots sometimes connected. *Xanthandrus babyssa*
 - Abdomen with parallel side margins, with or without spots. 18
- 18 Abdomen entirely black. Larger species. *Melanostoma wollastoni*
 - Abdomen with clear orange markings, triangular on the third and fourth tergite in females, rectangular in males. *Melanostoma mellinum*
- 19 Wing: third longitudinal vein more or less straight. 20
 - Wing: third longitudinal vein strongly curved downwards. Bee or wasp (hornet) mimics or abdomen entirely metallic green. 22
- 20 Abdomen with a broad orange/red band. *Xylota segnis*
 - Abdomen without an orange/red band, with pale yellow spots or with white dust spots. 21
- 21 Abdomen more or less parallel sided, with pale yellow spots. Smaller species, hind femur swollen. *Syritta pipiens*
 - Abdomen broader, with spots of white dusting. Broader species. *Eumerus hispidus*
- 22 Abdomen entirely metallic green. *Eristalinus aeneus*
 - Abdomen dark with lighter markings, never metallic green. 23
- 23 Thorax and abdomen with bright yellow and orange/red markings. Face entirely yellow. Hornet mimic. Very large species. *Milesia crabroniformis*
 - Thorax and abdomen with yellow brown markings. Face with a black stripe in the middle. Bee-like species. 24
- 24 Wing: cell I open. Tibia 3 with basal half yellow. *Myathropa usta*
 - Wing: cell I closed. Tibia 3 entirely black or dark brown. *Eristalis tenax*

Plate 2. Fig. 1, *Eumerus hispidus* (♀); 2, *Xanthandrus babyssa* (♂); 3, *Xanthandrus babyssa* (♀).

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Figs 17-40. Distribution of species of Syrphidae on Madeira Island. 17, *Episyrphus balteatus*; 18, *Eristalinus aeneus*; 19, *Eristalis tenax*; 20, *Eumerus hispidus*; 21, *Eupeodes corollae*; 22, *Eupeodes luniger*; 23, *Eupeodes nuba*; 24, *Ischiodon aegyptius*; 25, *Melanostoma wollastoni*; 26, *Melanostoma mellinum*; 27, *Meliscaeva auricollis*; 28, *Milesia crabroniformis*; 29, *Myathropa usta*; 30, *Neoascia podagrica*; 31, *Paragus coadunatus*; 32, *Scaeva pyrastris*; 33, *Scaeva selenitica*; 34, *Sphaerophoria rueppellii*; 35, *Sphaerophoria scripta*; 36, *Syrirta pipiens*; 37, *Syrphus torvus*; 38, *Syrphus vitripennis*; 39, *Xanthandrus babyssa*; 40, *Xylota segnis*.

