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An Updated Hoverfly Checklist (Diptera: Syrphidae) of the Mascarene Island of Réunion, France

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ABSTRACT

A commented and updated checklist of the hoverflies from the Mascarene island of Réunion, France, is presented. A total of 22 species are listed. New data on eight species are provided, two of them new to Réunion: *Syritta austeni* Bezzi, 1915 and *Eristalinus madagascariensis* (Hervé-Bazin, 1914). Réunion has 14 species shared with Madagascar and 10 with Mauritius. The present study contributes to better understand the biodiversity of this part of the world.

Key words: Syrphid fauna, first records, Afrotropical region, Mascarene Islands.

INTRODUCTION

Hoverfly adults (Sryphidae) are usually conspicuous, Hymenoptera-mimicking insects, exhibiting an extensive range of shapes, colours and sizes according to species. Ecologically they are important pollinators, especially in islands (Pérez-Bañón *et al*., 2007), and their larvae feed on plants, predate other insects and recycle decomposing material. This is why they live in a wide range of habitats and microhabitats (Rotheray and Gilbert, 2011) and can then be used as bioindicators (e.g. Sommaggio, 1999; Speight and Castella, 2001; Ricarte *et al*., 2011). Although hoverflies are distributed throughout the world, some biogeographical regions such as the Afrotropical are insufficiently studied. This is possibly one of the reasons why the Afrotropical is one of the least diverse regions in terms of hoverflies (Rotheray and Gilbert, 2011).

At the eastern border of the Afrotropical region, the Mascarene Islands (Mascarenhas Archipelago) are situated in the Indian Ocean. These are a group of small islands, Mauritius, Réunion and Rodrigues, sharing a common geologic origin in the volcanism of the Réunion hotspot. This group of islands has a unique flora and fauna undoubtedly linked to those of Madagascar, which lies to the west of this archipelago. The largest Mascarene island is Réunion.

Prior to this study, 20 hoverfly species were recorded from the island of Réunion. In the catalogue by Smith and Vockeroth (1980) five hoverfly species are listed from

Réunion, all of them recorded in earlier studies (Macquart, 1842; Bigot, 1862, 1884; Bezzi, 1908). Kassebeer (2000a) provided data on 19 species, four of which were new to science. Kassebeer (2000b) described *Melanostoma subbituberculatum* and deleted *M. bituberculatum* from the Réunion checklist. Lyneborg and Barkemeyer (2005) added two species to the hoverfly fauna of Réunion.

Species checklists are essential for basic reference in biodiversity and conservation studies, especially for bioindicator organisms such as the Syrphidae. In this paper, we provide new data on the hoverflies of Réunion and compile all the published information. An updated and commented checklist of the hoverflies from this island is presented.

MATERIAL AND METHODS

Réunion

The island of Réunion (French Republic, EU) (Fig. 1) is about 200 km southwest of Mauritius, the nearest island. Réunion, on the so-called volcanic hotspot, is the largest Mascarene island with a size of 2512 km^2 (63 km long and 45 km wide). The highest peaks in the Mascarenes are on Réunion, the tallest being the extinct volcano Piton des Neiges (3070 m a.s.l.). Another notable peak is the eastern Piton de la Fournaise volcano (2631 m a.s.l.) which, in terms of climate and volcanic nature, is very similar to the Hawaiian volcanoes (Reunion Island Tourism Board, 2009). These two Réunion volcanoes are extensively forested and their eastern slopes receive more rain than their western slopes. Réunion has a tropical climate tempered by the breezes from the Indian Ocean, but with sub-zero temperatures at the highest altitudes. Croplands and urban areas are concentrated on the lowlands surrounding the volcanoes.

In the past, the primary vegetation of Réunion was diverse and included coastal wetlands, swamp forests, lowland dry forests, rain forests, palm-tree savanna, montane deciduous forests and, at the highest altitudes, heaths. Nowadays the vegetation consists of remnants of these vegetation types frequently colonized by invasive plant species. Réunion has also been reafforested in the past and trees now cover almost 40% of the island. Palm trees on Réunion are especially notable because of the high number of species and the number of endemic genera on the island.

Hoverfly sampling

Fieldwork took place from March to July 2010. March and April belong to the Austral summer and correspond to the hot and rainy season on the island. The Austral winter, which runs from May to November, is the warmest and driest season. Eight different sites were studied, four on the humid northern area of the island (numbers 1, 2, 3, 7 in Fig. 1), three on the drier southwest (numbers 5, 6 and Malaise trap site in Fig. 1) and a rather central site in the Cirque de Salazie (number 4 in Fig. 1). For each sampling site, the geo-reference, altitude and habitat type were recorded (Table 1). Most of the examined material was collected by hand net at sites 1−7 (Fig. 1) by Neus

Estela. A 500-m transect was followed during two hours each month (March to June) at each of the seven netting sites. Netting took place at the daily pick of insect activity.

Table 1. Sampling sites where fieldwork took place in the Mascarene island of Réunion, France. In column 1, numbers and the word 'Malaise' in brackets refer to sites (see Figure 1).

Sampling sites	Geo-reference (longitude-latitude)	Altitude (metres)	Habitat type
La Montagne (1)	55º26'00''-20º52'57''	300	Mid-altitude rain forest
Piton Bois de Nèfles, St. Denis (2)	55º28'02''-20º56'10''	850	High-altitude rain forest
Bois de Nèfles, St. Denis (3)	55º28'45''-20º54'35''	330	Grassland
Hell-Bourg, Salazie (4)	55º31'16''-21º04'13''	920	High-altitude rain forest
Les Avirons (5)	55º20'31''-21º15'37''	45	Abandoned crops
L'Étang-Salé 1 (6)	55º20'15''-21º16'04''	2	Grassland
La Possession, Ravine des Lataniers (7)	55º21'54''-20º56'31''	20	Ravine
L'Étang-Salé 2 (Malaise)	55º21'36''-21º16'48''	2	Low-altitude dry forest

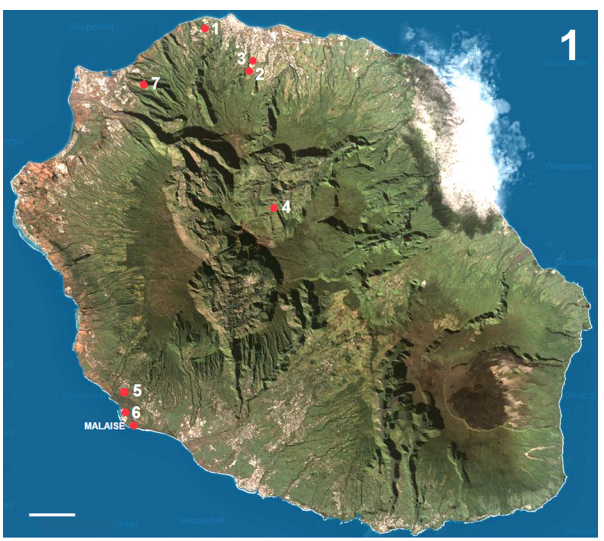

Fig. 1. Map of the Mascarene Island of Réunion, France. The sampling sites, described in Table 1, are indicated with the numbers 1−7 and the word 'Malaise'. Scale bar: 5 km.

Hoverfly identification

Collected specimens were pin-mounted and, when required, male genitalia were examined by relaxing specimens and extracting them by means of a hook-tipped entomological pin. Genitalia were cleared by boiling individually in tubes of KOH solution for 5-7 min. This was followed by brief immersion in acetic acid to neutralize the KOH, immersion in ethanol to remove the acid, and storage in microvials containing glycerine. The following references were used for identification: Bezzi (1915), Curran (1927), Kassebeer (2000a), Kassebeer (2000b) and Lyneborg and Barkemeyer (2005). Species distribution follows Smith and Vockeroth (1980), Lyneborg and Barkemeyer (2005), Pape and Thompson (2010) and Dirickx *et al*. (in press), and Pape and Thompson (2010) was also followed for species nomenclature. Under 'references' for

each species, literature mentioning material or citations from Réunion are provided. To track the recording history of each species from Réunion, Dirickx *et al*. (in press) has been used as a guide. All the collected specimens are deposited in the University of Alicante, Alicante, Spain (CEUA collection at CIBIO). Voucher specimens from the Natural History Museum, London (NHM) were examined for comparison and identifications were made by M. Ángeles Marcos-García and Antonio Ricarte.

RESULTS

In this study, 44 hoverfly specimens of eight species were collected (see material examined in the checklist below). Two of these species, *Syritta austeni* and *Eristalinus madagascariensis*, were new to Réunion.

Hoverfly checklist of Réunion

***Allograpta (Allograpta) borbonica* Kassebeer, 2000**

References. Kassebeer (2000a) (original description).

Distribution. Réunion.

Notes. Only known from Réunion.

***Allograpta (Allograpta) nasuta* (Macquart, 1842)**

References. Smith and Vockeroth (1980) (catalogue citation); Kassebeer (2000a) (additional records).

Distribution. Widespread in the Afrotropics including Mauritius, Réunion, Diego García, Madagascar and Seychelles Islands.

Notes. The type material of *A. nasuta* is from Mauritius and Réunion.

***Allobaccha (Allobaccha) sapphirina* (Wiedemann, 1830)**

References. Kassebeer (2000a) (first records).

Distribution. Widespread in the Oriental and Afrotropical regions including Réunion.

Notes. Larvae of this species are known to predate the African psyllid *Trioza erytreae* (Del Guercio, 1918), a serious citrus pest (Quilici *et al*., 1988).

***Episyrphus insularis* Kassebeer, 2000**

References. Kassebeer (2000a) (original description).

Distribution. Madagascar and Réunion.

Material examined. Réunion: 2♀♀, Hell-Bourg, 04/VI/2010 (CEUA).

Notes. Species not recorded in mainland Africa; restricted to Madagascar and the Mascarenes.

***Eristalinus (Eristalodes) cressoni* (Hull, 1941)**

References. Kassebeer (2000a) (first records).

Distribution. Madagascar, Mauritius and Réunion.

Notes. Species not recorded in mainland Africa; restricted to Madagascar and the Mascarenes.

***Eristalinus (Lathyrophthalmus) arvorum* (Fabricius, 1787)**

References. Kassebeer (2000a) (first records).

Distribution. Southeast of Asia, Australia, Hawaii, Marianas, Micronesia and Réunion.

Notes. In the Afrotropical region, only known from Réunion.

***Eristalinus (Lathyrophthalmus) madagascariensis* (Hervé-Bazin, 1914)**

New to Réunion

Distribution. Madagascar and Réunion.

Material examined. Réunion: 1 ♀, Hell-Bourg, 04/VI/2010 (CEUA); Madagascar: Mahatsinjo, nr. Isoavinandrina, 4.750 feet, 1 ♂ and 1 ♀, 21/08/1913, R. Beck, leg. (1913.550 Natural History Museum in loan) (NHM).

Notes. The studied specimen from Réunion was collected in an upland forest.

Fig. 2. *Eristalinus (Lathyrophthalmus) madagascariensis* (Hervé-Bazin, 1914), overall appearance, lateral view. Specimen collected on Réunion, France. Scale bar: 2 mm.

***Eristalis tenax* (Linnaeus, 1758)**

Distribution. Palaearctic, Nearctic, Neotropical, Afrotropical, Oriental, Australian regions, Hawaii and New Zealand.

References. Kassebeer (2000a) (first records).

Notes. A cosmopolitan and abundant species.

***Eumerus cilaosiacus* Kassebeer, 2000**

References. Kassebeer (2000a) (original description).

Distribution. Madagascar and Réunion.

Notes. Species not recorded in mainland Africa; restricted to Madagascar and the Mascarenes.

***Eumerus obliquus* (Fabricius, 1805)**

References. Kassebeer (2000a) (first records).

Distribution. Europe, widespread in the Afrotropics including Madagascar, Mauritius and Réunion.

Material examined. Réunion: 1 ♀, Les Avirons, 24/VI/2010 (CEUA).

***Eumerus varipennis* (Curran, 1938)**

References. Kassebeer (2000a) (first records).

Distribution. Mozambique, Madagascar, Réunion and Uganda.

***Eupeodes ohmi* Kassebeer, 2000**

References. Kassebeer (2000a) (original description).

Distribution. Mauritius, Réunion.

***Ischiodon aegyptius* (Wiedemann, 1830)**

References. Bigot (1884) (first records, as *Sphaerophoria borbonica* sp. nov.); Smith and Vockeroth (1980) (catalogue citation); Kassebeer (2000a) (additional records).

Distribution. Widespread in the Afrotropics, Canary and Balearic Islands (Spain), mainland Spain and Madeira Island.

Material examined. Réunion: 1 ♂, L'Étang-Salé, 17/VI/2010 (CEUA).

***Melanostoma annulipes* (Macquart, 1842)**

References. Macquart (1842) (original description, as *Syrphus annulipes*); Smith and Vockeroth (1980) (catalogue citation); Kassebeer (2000a) (additional records).

Distribution. Réunion, Ghana, Guinea-Bissau, Kenya, Liberia, Mauritius, Nigeria, Sierra Leone and Tanzania.

Material examined. Réunion: 1 ♀, Hell-Bourg, 02/VI/2010; 7 ♀♀, La Possession, 04/VI/2010; 2 ♂♂, La Possession, 17/VI/2010; 1 ♀, St. Denis, 31/V/2010; 1 ♂, St. Denis, 19/III/2010; 2 ♀♀, L'Étang-Salé, 27/VI/2010 to 15/VII/2010, Malaise Trap (CEUA).

Notes. The type locality of *M. annulipes* is Réunion.

***Melanostoma subbituberculatum* Kassebeer, 2000**

References. Kassebeer (2000b) (original description).

Distribution. Tropical and subtropical forests of West Africa (Ivory Coast and Zaire) and Malagasy regions (Comoros, Madagascar, Réunion).

Notes. In Kassebeer (2000a) this species is recorded from Réunion as *Melanostoma bituberculatum* Loew, 1858. The type locality is Ivory Coast.

***Ornidia obesa* (Fabricius, 1775)**

References. Bigot (1862) (first records, as *Volucella obesa*); Smith and Vockeroth (1980) (catalogue citation); Kassebeer (2000a) (additional records).

Distribution. Neotropical, Afrotropical, Australasian, Neartic and Oriental regions including Madagascar, Muritius, Réunion and Seychelles.

Material examined. Réunion: 1 ♀, Hell-Bourg, 04/VI/2010 (CEUA).

***Paragus (Paragus) borbonicus* Macquart, 1842**

References. Macquart (1842) (original description); Bigot (1862) (additional records); Smith and Vockeroth (1980) (catalogue citation); Kassebeer (1999) (catalogue citation); Kassebeer (2000a) (additional records).

Distribution. Afrotropical (widespread).

Material examined. 5 ♂♂, Les Avirons, 24/VI/2010; 1 ♂ and 1 ♀, La Montagne, 15/V/2010; 4 ♂♂, St. Denis, 09/VI/2010; 3 ♂♂, St. Denis, 19/III/2010; 1 ♂, St. Denis, 15/V/2010; 1 ♂, St. Denis, 02/III/2010; 1 ♂, St. Denis, 31/V/2010; 1 ♂, L'Étang-Salé, 25/VI/2010; 2 ♀♀, 27/VI/2010 to 15/VII/2010 Malaise Trap (CEUA).

Notes. The type locality of *P. borbonicus* is Mauritius and Réunion.

***Paragus (Paragus) compeditus* Wiedemann, 1830**

References. Goeldlin (1976) (first records); Kassebeer (2000a) (additional records).

Distribution. Widespread in the Afrotropics including Madagascar, Principe, Mauritius and Réunion.

***Syritta austeni* Bezzi, 1915** Fig. 3

New to Réunion

Distribution. Northern and central parts of the Afrotropical region and Madagascar.

Material examined. Réunion: 2m, L'Étang-Salé, 25/VI/2010 (CEUA).

Notes. Widely distributed in Africa; also found in urban areas. The collected specimens were caught flying in an open area with cattle. Larvae of other *Syritta* species are saprophagous and human activity (e.g., farming of animals) can provide breeding sites suitable for larvae of these species.

***Syritta decora* Walker, 1849**

References. Kassebeer (2000a) (first records); Lyneborg and Barkemeyer (2005) (additional records and re-description of male).

Distribution. Mauritius and Réunion.

Notes. This rare species is only found in the high-altitude scrublands and woodlands in the Mascarene Islands (Lyneborg and Barkemeyer 2005).

Fig. 3. *Syritta austeni* Bezzi, 1915, overall appearance, lateral view. Specimen collected on Réunion, France. Scale bar: 2 mm.

***Syritta flaviventris* Macquart, 1842**

References. Kassebeer (2000a) (first records).

Distribution. Widespread in the Afrotropics and in southern Europe. Introduced in the Neotropics.

***Syritta nigrifemorata* Macquart, 1842**

References. Kassebeer (2000a) (first records); Lyneborg and Barkemeyer (2005) (additional records and male re-description).

Distribution. Aldabra (Indian Ocean), Mauritius and Réunion.

Notes. This species together with *S. austeni* and *S. leucopleura* Bigot, 1859 form a subgroup of closely related Afrotropical species. *Syritta nigrifemorata* is found in various habitats and it is not restricted to primary biotopes (Lyneborg and Barkemeyer, 2005)

DISCUSSION

In this study, eight hoverfly species were collected, two of which were new to Réunion. The hoverfly checklist of Réunion is the result of sporadic and incomplete samplings and a few more-detailed studies (see Introducion). Of the 22 species recorded from Réunion 14 are also found in Madagascar (Dirickx *et al*., in press). Four of these species are currently only known from Réunion and Madagascar. Two species, *Allograpta borbonica* and *Eupeodes ohmi*, have only been found on Réunion, which was formed some two million years ago: it is possible that these species are recently evolved. Réunion has 10 hoverfly species shared with Mauritius, but only one of them, *Syritta nigrifemorata*, is exclusively found in the Mascarene Islands; the

other nine species are widespread in the Afrotropical region or the world (Dirickx *et al*., in press). Clearly further long-term studies of the Réunion fauna are necessary both to understand the species biology and potential conservation needs, as well as to investigate the origin of the native fauna.

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