The \textit{Sphaeroceridae (Diptera)} of Madeira, with notes on their biogeography

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The \textit{Sphaeroceridae (Diptera)} of Madeira are reviewed with critical re-evaluation of all published records and presentation of recently obtained data. Altogether 43 species are reliably recorded from the island (20 species, including 4 unnamed, for the first time) and general information on their distribution and biology is provided. The biogeography of Madeiran Sphaeroceridae is discussed. All species are classified according to presupposed region of origin, and possible introduction routes are discussed. The majority of species belong to widespread taxa that reached Madeira due to human-assisted dispersal. Of these three species are of Nearctic origin, 2 species are of Afrotropical origin, 1 species is of Neotropical origin and one is an originally Macaronesian species that apparently spread to the European mainland. In contrast to the sphaerocerid fauna of the Canarian archipelago, the number of species of Mediterranean and southern Palaearctic origin is markedly reduced in Madeira. Four unnamed species here considered endemic to Madeira belong to different genera than endemic Canarian species. While the Madeiran and Canarian archipelagos have generally similar communities of coprophagous and synanthropic species, the species assemblages associated with laurisilva ecosystem and with river-bank habitats differ significantly in these areas, the virtual absence of \textit{Aptilotus a Rachispoda} species in Madeira being the most striking phenomenon.

Keywords: Sphaeroceridae, biogeography, faunistics, new records, Madeira

Introduction

The fauna of \textit{Sphaeroceridae (Diptera)} in the Macaronesian subregion received intensified attention during last decade but hitherto only data dealing with the occurrence of the family in the Canary Islands have been elaborated and published (Roháček et al. 2003). In other archipelagos of the subregion the \textit{Sphaeroceridae} remain insufficiently known in spite of papers published on the dipterous fauna of the Azores and Madeira by Frey (1945, 1949). For this reason I took part in a collecting trip to Madeira realized together with Dr. Miloslav Vála (from Olomouc, Czech Republic) in September 2003. Our field work was aimed at the fauna of \textit{Diptera}, acalyptrate families in particular. Because of the recent project to inventory species diversity of the animal kingdom in Madeira (Prof. Dr. P. Borges and co-editors) I was asked by Dr. Carles-Tolrá (Barcelona) who is responsible for coordinating the order \textit{Diptera} to prepare a checklist of Madeiran \textit{Sphaeroceridae}. Knowing that we obtained relatively rich material of the family on this island in 2003 I decided to elaborate and publish our results so that they could be included in the new Madeiran checklist. It was also necessary to critically evaluate the formerly published records of \textit{Sphaeroceridae} from Madeira because several of them are doubtful or based on misidentifications.

The first records of \textit{Sphaeroceridae} from Madeira were published by Becker (1908) who listed 12 species from this island including also descriptions of two new species, viz. \textit{Olina ferruginea}...
Becker, 1908 and *Limosina eximia* Becker, 1908. However, both these taxa were later found to be synonymous with the widespread species *Lotophila atra* (Meigen, 1930) and *Trachyopella atomus* (Rondani, 1880) respectively. Duda (1918) revised Becker’s specimens from Madeira, rectified some of his misidentifications and published additional data on species not recognized by Becker (1908) including the description of *Spinilimosina brevicostata* (Duda, 1918) which is partly based on a specimen (syntype) from Madeira. Some of the latter records were repeated by Duda (1925, 1938) who also synonymized *Olina ferruginea* Becker with *Lotophila atra* (see Duda 1938). Frey (1949) published results of his dipterological expedition to Madeira and listed 22 species including Becker’s (l.c.) records but overlooked those published by Duda (1918). A few further data were added by Roháček (1982, 1983) and Roháček & Marshall (1986), mostly based on revision of Frey’s specimens. *Trachyopella (Nudopella) hem* Roháček & Marshall, 1986 was partly described from Madeiran specimens (paratypes). In summary, 27 valid species have been recorded from Madeira (all are listed in the last catalogs and checklists, viz. Roháček et al. 2001; Carles-Tolrá & Báez 2002; Roháček 2004a) but some of these records are considered doubtful (see Roháček et al. 2001). Four species were previously described from Madeira, of which none are endemic to this island and only two remain valid taxa (*Spinilimosina brevicostata*, *Trachyopella hem*).

All hitherto published records of *Sphaeroceridae* from Madeiran archipelago originate from the island of Madeira (Fig. 1). This is also true for the new records listed in this paper. No member of this family is known from adjoining smaller islands Porto Santo, Desertas and/or Selvagens.

**Material and methods**

A total of 849 specimens of *Sphaeroceridae* were collected during our Madeira collecting trip (2.-14. ix.2003) using the following methods: hand-netting, sweeping vegetation, collecting from various breeding substrates and sifting leaf litter and other detritus (especially for terricolous species). Special attention was dedicated to the fauna of laurel forests. Precise locality data are presented in the list below. Under each species only an abbreviated name of the locality, habitat data and number of specimens examined are given. All specimens are deposited in the Silesian Museum, Opava, Czech Republic (SMOC), unless mentioned otherwise. In the material examined males are coded M, females F.

Literature records are only given if based on original specimen data (mere citations and catalogue records are omitted). Species are listed alphabetically within their subfamilies, providing general information on their distribution according to the system used in the World Catalog of *Sphaeroceridae* (Roháček et al. 2001).

Fig. 1: Satellite photograph of the island of Madeira. Source: http://209.15.138.224/portugal_maps/ s_Ilha_da_Madeira.htm
Fig. 2 (top): Funchal, riverbed inside the town, residential area Monte in background. Fig. 3 (bottom): semi-ruderal vegetation near a spring place in Funchal-Penteada. Photo by J. Roháček, 2003.
List of localities visited

Achadas da Cruz - NW. MADEIRA: Achadas da Cruz 1.5 km S, 32°49'28" N 17°12'34" W, 800 m, 10.9.2003, J. Roháček leg.

Chão da Cancela - N. MADEIRA: Chão da Cancela nr. Seixal, 32°48'10" N 17°06'56" W, 500 m, 3.9.2003, J. Roháček leg. (Fig. 23).

Cumeal - C. MADEIRA: Cumeal nr. Curral das Freiras, 32°43'55" N 16°58'10" W, 600 m, 4.9.2003, J. Roháček leg. (Fig. 7).

Curral des Freiras env. - C. MADEIRA: Curral des Freiras env., 32°43'06" N 16°57'42" W, 600 m, 13.9.2003, J. Roháček leg. (Fig. 8).


Curral dos Romeiros - C. MADEIRA: Curral dos Romeiros nr. Funchal, 32°39'59" N 16°53'28" W, 600 m, 7.9.2003, J. Roháček leg. (Fig. 6).

Eira do Serrado - C. MADEIRA: Eira do Serrado, N. slope, 32°42'59" N 16°57'43" W, 1000 m, 13.9.2003, M. Vála leg. (Fig. 6).

Eira do Serrado 1 km E - C. MADEIRA: Eira do Serrado 1 km E, 32°42'56" N 16°57'43" W, 1100 m, 12.9.2003, M. Vála leg.

Encumeada - C. MADEIRA: Encumeada 0.5 km SW, 32°45'14" N 17°01'12" W, 950 m, 5.9.2003, J. Roháček leg.

Feiteira do Nuno [1] - N. MADEIRA: Feiteira do Nuno nr. Santana, 32°47'38" N 16°53'08" W, 600 m, 8.9.2003, J. Roháček leg. (Fig. 11).


Feiteira do Nuno 1 km SW - N. MADEIRA: Feiteira do Nuno nr. Santana 1 km SW, 32°47'21" N 16°53'32" W, 700 m, 9.9.2003, J. Roháček leg.

Funchal-Corujeira [1] - S. MADEIRA: Funchal-Corujeira 1 km N, 32°40'39" N 16°54'30" W, 600 m, 11.9.2003, J. Roháček leg. (Fig. 10).


Funchal-Monte 1 km E - S. MADEIRA: Funchal-Monte 1 km E, 32°40'02" N 16°53'42" W, 500 m, 7.9.2003, J. Roháček leg. (Fig. 2).

Funchal-Monte, Ribeira de João Gomes [1] - S. MADEIRA: Funchal-Monte, Ribeira de João Gomes, 32°40'03" N 16°53'37" W, 450 m, 7.9.2003, J. Roháček leg. (Fig. 12).


Funchal-Penteada - S. MADEIRA: Funchal-Penteada, 32°39'30" N 16°55'31" W, 150 m, 6.9.2003, J. Roháček leg. (Fig. 3).

Funchal-Trapiche - S. MADEIRA: Funchal-Trapiche, 32°41'07" N 16°56'45" W, 500 m, 12.9.2003, M. Vála leg.


Maloeira - W. MADEIRA: Maloeira nr. Raposeira do Lugarinho, 32°45'58" N 17°12'40" W, 650 m, 10.9.2003, J. Roháček leg. (Fig. 9).

Passo do Poiso - C. MADEIRA: Passo do Poiso, 32°42'45" N 16°53'34" W, 1400 m, 14.9.2003, J. Roháček leg. (Fig. 24).


Pico do Furão - C. MADEIRA: Pico do Furão nr. Curral das Freiras, 700 m, 32°44'41" N 16°57'59" W, 4.9.2003, J. Roháček leg. (Fig. 5).

Rabaçal env. - C. MADEIRA: Rabaçal env., 32°45'43" N 17°08'01" W, 950 m, 5.9.2003, J. Roháček leg. (Figs 17-19).

Ribeira da Janela 3 km S - N. MADEIRA: Ribeira da Janela 3 km S, 32°49'33" N 17°09'36" W, 850 m, 10.9.2003, J. Roháček leg.

Fig. 4 (top): Funchal-Corujeira, beginning of a river in deep valley. Fig. 5 (bottom): Pico do Furão, rocky valley of a brook. Photo by J. Roháček, 2003.
Synopsis of species

COPROMYZINAE

1. *Copromyza equina* Fallén, 1820

**Literature:** Becker (1908, as *Borborus equinus*: Madeira); Frey (1949: Ribeiro Frio).

**Material examined:** Encumeada, sweeping vegetation along small creek (1F); Feiteira do Nuno 1 km SW, on horse dung (10M 7F); Rabaçal env., on cow excrement (1F); Passo do Poiso, sweeping along creek bed in coniferous forest (2F); Ribeiro Frio [1], on human excrement (1F); Ribeiro Frio 2 km E, sweeping vegetation along levada in laurel forest (2F). – 23 specimens [11M 12F].

**Comments:** A very common, originally Holarctic, coprophagous species spread also to Oceanian, Neotropical and Oriental Regions.

2. *Lotophila atra* (Meigen, 1830)

**Literature:** Becker (1908, as *Olina geniculata* and *Olina ferruginea* n. sp.: Madeira); Frey (1949, as *Borborus ater*: Funchal-Monte, Ribeiro Frio, Poiso, Santo do Serra, Rabaçal).

**Material examined:** Curral des Freiras env., sweeping vegetation along brook (2M 1F); Eira do Serrado, sweeping vegetation along spring (3M 2F); Encumeada, sweeping vegetation along small creek (1F); Feiteira do Nuno 1 km SW, on horse dung (4M 4F); Lombo, on cow dung (4M 2F); Paul da Serra-Ribeiro do Alercim, on cow excrement (2F); Pico do Furão, sweeping vegetation along small creek (1F); Rabaçal env., on cow excrement (4M 2F), sifting leaves in laurel forest (1F), sweeping vegetation along levada (1F); Santana-Fajã do Mar, sweeping over forest margin (1F). – 40 specimens [19M 21F].

**Comments:** A widespread, subcosmopolitan (mainly distributed in the Holarctic Region), coprophagous species.

3. *Norrbomia marginatis* (Adams, 1905)

**Material examined:** Lombo, on cow dung (1F); Maloeira, on human excrement (1F); Santana-Fajã do Mar, sweeping over forest margin (1F); São Jorge-Praia, on cow dung (1M 2F); São Jorge-Praia env. [2], on cow dung (13M 24F). – 43 specimens [14M 29F].

**Comments:** This coprophagous species is widespread in the Old World tropics and Australia, reaching its northern limits in southernmost areas of the Palaearctic Region. It was described from the Canary Is. under the synonym *Borborus marmoratus* Becker, 1908. The specimens recorded here from Madeira represent a new northwestern distribution record for this species.

SPHAEROCERINAE

4. *Ischiolepta pusilla* (Fallén, 1820)

**Literature:** Becker (1908, as *Sphaerocera pusilla*: Madeira).

**Material examined:** Feiteira do Nuno [2], on dung heap (2M 2F). – 4 specimens [2M 2F].

**Comments:** A widespread (mainly Holarctic) polysaprophagous species. *I. pusilla* is the only representative of the Sphaerocerinae on the Canary Is. (Roháček et al. 2003) and seems to be uncommon also in Madeira.
Fig. 6 (top left): Eira do Serrado, viewed from Curral des Freiras. Fig. 7 (top right): Cumeal nr. Curral des Freiras, valley of a river. Fig. 8 (bottom): Deep valley of Curral des Freiras, viewed from Eira do Serrado. Photo by J. Roháček, 2003.
5. Sphaerocera curvipes Latreille, 1805

**Literature:** Frey (1949: Funchal-Monte).

**Material examined:** Chão da Cancela, sweeping riverside vegetation (1M 1F); Encumeada, sweeping vegetation along small creek (1M); Feiteira do Nuno 1 km SW, on horse dung (3M); Lombo, on cow dung (2M 2F); Paúl da Serra-Ribeira do Alecrim, on cow excrement (7M 2F); Rabaçal env., on cow excrement (2M 1F); sifting leaves in laurel forest (1F). – 23 specimens [16M 7F].

**Comments:** For unknown reasons this almost ubiquitous subcosmopolitan species has not been recorded from the Canarian archipelago (Roháček et al. 2003) although it occurs commonly both in Madeira and Azores.

LIMOSININAE

6. Coproica ferruginata (Stenhannmar, 1855)

**Literature:** Becker (1908, as Limosina ferruginata and Limosina littoralis: Madeira), Duda (1918, as Limosina (Coprophila): Madeira, Funchal, Funchal-Monte, Porto Novo, Santo do Serra).

**Material examined:** Feiteira do Nuno [2], on dung heap (3M 3F); Feiteira do Nuno 1 km SW, on horse dung (1M); Funchal-Estrada da Fundoa, sweeping riverside vegetation (1F); Funchal-Penteada, sweeping riverside vegetation (1M); Lombo, on cow dung (3M 1F); São Jorge-Praia, on cow dung (1F); São Jorge-Praia env. [2], on cow dung (4M 3F). – 18 specimens [11M 7F].

**Comments:** A very common cosmopolitan coprophagous species.

7. Coproica hirticula Collin, 1956

**Material examined:** Feiteira do Nuno [2], sweeping over pasture meadow (3M 3F), on dung heap (23M 17F); Funchal-Estrada da Fundoa, sweeping riverside vegetation (1F); Funchal-Penteada, sweeping riverside vegetation (1M); Lombo, on cow dung (3M 1F); São Jorge-Praia, on cow dung (1F); São Jorge-Praia env. [2], on cow dung (2F). – 55 specimens [30M 25F].

**Comments:** A widespread, almost cosmopolitan species, introduced to most parts of the world because of its polysaprophyg and synanthropic association with manure, dump heaps, garden compost and garbage. It seems to have established successful populations also in Madeira (first records).

8. Coproica hirtula (Rondani, 1880)

**Literature:** Duda (1918, as Limosina (Coprophila): Madeira).

**Material examined:** Feiteira do Nuno [2], sweeping over pasture meadow (1M). – 1 specimen [1M].

**Comments:** A cosmopolitan, predominantly coprophagous species. The only previous record from Madeira is confirmed here. Western Palaearctic populations of C. hirtula seem to be on the decline, possibly due to expansion of C. hirticula (personal observation). This may also be true for Madeira.

9. Coproica lugubris (Haliday, 1836)

**Material examined:** Lombo, on cow dung (1F); Maloeira, on human excrement (8M 2F); São Jorge-Praia, on cow dung (10M 7F); São Jorge-Praia env. [2], on cow dung (10M 6F). – 43 specimens [28M 15F].

**Comments:** A widespread (Palaearctic and Oriental Regions) coprophagous species associated with dung in pastures. These records from Madeira represent a new western distribution limit of the species. Hitherto, C. lugubris has not been recorded from Macaronesia.


**Material examined:** Santana-Fajã do Mar, sweeping over forest margin (1M 1F). – 2 specimens [1M 1F].

**Comments:** This is the first record of this species from Madeira. C. rufifrons was originally described from Pakistan (Hayashi, 1991) and was subsequently found to be widespread in tropical and subtropical areas of the world (see Roháček et al. 2001). There are only few records from the Palaearctic Region: Canary Is. (Roháček et al. 2003), Malta (Gatt 2004) and Japan (Roháček et al. 2001).

11. Elachisoma aterrimum (Haliday, 1833)

**Literature:** Frey (1949, as E. aterrima: Funchal-hotel Miramar, Funchal-Monte).

**Material examined:** Fêiteira do Nuno [2], on dung heap (1F); São Jorge-Praia env. [2], on cow dung (1M 3F). – 5 specimens [1M 4F].

**Comments:** A common polysaprophagous species widespread in the Holarctic Region. Confirmed previous records from Madeira.
Fig. 9 (top left): Maloeira nr. Raposeira do Lugarinho, levada in a burnt eucalyptus forest. Fig. 10 (top right): Feiteira do Nuno 1 km SW, an old laurel tree with Tradescantia in undergrowth. Fig. 11 (bottom): Feiteira do Nuno, pasture meadow with a large dung heap. Photo by J. Roháček, 2003.
12. *Elachisoma bajzae* Papp, 1983  
**Material examined:** Curral des Freiras env., sweeping vegetation along brook (1M); Curral des Freiras-Murteiras, sweeping vegetation along small creek (2M 2F); Lombo, on cow dung (1F); São Jorge-Praia env. [1], on decayed grass (1F); São Jorge-Praia env. [2], on cow dung (1M 1F). – 9 specimens [4M 5F].  
**Comments:** A species distributed in southern and central Europe, also recorded from Canary Is. (Roháček et al. 2003). It can be found on decaying straw, hay and various kinds of dung including manure. This first record from Madeira represents a new westernmost distribution limit of the species.

13. *Elachisoma pilosum* (Duda, 1924)  
**Material examined:** São Jorge-Praia env. [2], on cow dung (1M) – 1 specimen [1M].  
**Comments:** A polysaprophagous species widely distributed in the Palaearctic Region and also occurring in the Oriental Region (Java, Malaysia). Hitherto, it has not been found in the Macaronesian subregion. This is the first record from Madeira.

14. *Leptocera caenosa* (Rondani, 1880)  
**Literature:** Becker (1908, as *Limosina fontinalis*: Madeira) ??.  
**Material examined:** Funchal-Levada do Massapez, 450 m, 8.4.2003, C. Castro leg. (1M), deposited in the Dpto. Biologia, Universidade da Madeira, Funchal. – 1 specimen [1M].  
**Comments:** A widespread species known from most biogeographical regions, recently also found in the Canary Is. (Roháček et al. 2003). It can form successful synanthropic populations which favours its spread to new areas. It often lives in caves and other subterranean habitats. *L. caenosa* was not collected found during our field work in Madeira but a single male (collected in a tunnel of a levada) was found in the insect collection of the Funchal University. It is probable that Becker’s (1908) record of *Limosina fontinalis* also belongs to this species.

15. *Leptocera nigra* Olivier, 1813  
**Literature:** Frey (1949, as *Paracollinella curvinervis*: Funchal, Funchal-Lido, Funchal-Monte, Canico, Ribeiro Frio, Poiso, Ribeira Brava, Santo do Serra); Roháček (1982: Madeira, Funchal, Ribeira Brava).  
**Material examined:** Chão da Cancela, sweeping riverside vegetation (4M 5F); Cumeal, sweeping riverside vegetation (8M 2F); Curral des Freiras env., sweeping vegetation along brook (1M 4F); Curral des Freiras-Murteiras, sweeping vegetation along small creek (5M); Eira do Serrado, sweeping vegetation along spring (1M); Encumeada, sweeping vegetation along small creek (1F); Feiteira do Nuno 1 km SW, sweeping undergrowth of mixed forest (1F); Funchal-Corujinha [2], sweeping vegetation along levada (1M); Funchal-Estrada da Funchal, sweeping riverside vegetation (1M); Funchal-Monte 1 km E, sweeping vegetation along brook (1M); Funchal-Trapiche, sweeping vegetation along levada (1M 1F); Lombo, sweeping vegetation along levada (1M 2F); Maloeira, sweeping vegetation along small creek (5M 2F); Paúl da Serra-Ribeira do Alecrim, sweeping vegetation along small creek (2M 3F); Pico do Furão, sweeping vegetation along small creek (5M 2F); Santana-Fajã do Mar, sweeping over forest margin (1M); São Jorge-Praia env. [1], sweeping riverside vegetation (2M). – 62 specimens [39M 23F].  
**Comments:** A common and widespread species in the Palaearctic and Afrotropical Regions. It is also frequent in Madeira. It is rather strange that Becker (1908) did not record it from Madeira.

**Material examined:** São Jorge-Praia env. [2], on cow dung (1M 1F). – 2 specimens [1M 1F].  
**Comments:** This is a surprising discovery (no *Allolimosina* species is known from the whole of the Macaronesian subregion) probably representing an unnamed species.

17. *Minilimosina (Minilimosina) fungicola* (Haliday, 1836)  
**Literature:** Frey (1949, as *Limosina exigua*: Ribeiro Frio).  
**Material examined:** Eira do Serrado, sweeping vegetation along spring (1M); Lombo, on cow dung (1M); Paúl da Serra-Ribeira do Alecrim, on cow excrement (1M 5F); Ribeiro Frio [2], on refuse heap (1F); Santana-Fajã do Mar, sweeping over forest margin (1M). – 10 specimens [4M 6F].  
**Comments:** A polysaprophagous species, widespread in the Holarctic Region. The former record (somewhat doubtful – see Roháček et al. 2001) from Madeira is confirmed here by records from 4 localities.

18. *Minilimosina (Minilimosina) parvula* (Stenhammar, 1855)  
**Material examined:** Rabaçal env., sifting leaves in laurel forest (1M); Ribeiro Frio [2], on refuse heap (1F). – 2 specimens [1M 1F].
Fig. 12 (top left): Funchal-Monte, Ribeira de João Gomes, upper part of the river valley. Fig. 13 (top right): northern coast of Madeira viewed from Fajã do Mar near Santana. Fig. 14 (bottom): Ribeira da Janela, mouth of the river. Photo by J. Roháček, 2003.
Comments: A polysaprophagous Holarctic species, mainly developing in carrion and decaying fungi. Recently, it has been also recorded from the Canary Is. (Roháček et al. 2003). These are the first records from Madeira.

19. *Minilimosina* (*Svarciella*) *vitripennis* (Zetterstedt, 1847)

**Material examined:** Curral des Freiras env., sweeping vegetation along brook (1F); Funchal-Monte 1 km E, sweeping vegetation along brook (1F). – 2 specimens [2F].

**Comments:** This species is widespread in the Holarctic Region. In Macaronesia it is only known from the Canary Is. (Roháček et al. 2003). This is a new addition to the *Diptera* fauna of Madeira.

20. *Opacifrons coxata* (Stenhammar, 1855)

**Literature:** Becker (1908, as *Limosina pusio*: Madeira).

**Material examined:** Chão da Cancela, sweeping riverside vegetation (1F); Cumeal, sweeping riverside vegetation (2M 1F); Curral des Freiras-Murteiras, sweeping vegetation along small creek (3M 2F); Feiteira do Nuno [1], sweeping vegetation along small creek (1M); Funchal-Corujeira [1], sweeping riverside vegetation (2M 1F), sweeping over mud (1M 1F); Funchal-Estrada da Fundoa, sweeping riverside vegetation (1M); Funchal-Monte 1 km E, sweeping vegetation along brook (3M 3F); Funchal-Monte, Ribeira de João Gomes [1], sweeping over mud (4M); Funchal-Monte, Ribeira de João Gomes [2], sweeping over mud (10M 3F); Lombo, sweeping vegetation alonglevada (1M); Maloeira, sweeping vegetation along small creek (6M 5F); Paúl da Serra-Ribeira do Alercrim, sweeping vegetation along small creek (1M 2F); Pico do Furão, sweeping vegetation along small creek (6M 3F). – 63 specimens [41M 22F].

**Comments:** This species is associated with muddy habitats. It is widespread throughout the western Palaearctic (Afrotropical records need verification) and also in the Canaries (Roháček et al. 2003). Interestingly, Frey (1949) did not find it in Madeira but it was recorded from the island already by Becker (1908). The latter record is confirmed here by a number of additional findings.

21. *Opalimosina* (*Opalimosina*) *mirabilis* (Collín, 1902)

**Literature:** Frey (1949, as *Limosina*: Funchal, Funchal-Lido, Funchal-Monte, Ribeiro Frio, Poiso, Porto Novo).

**Comments:** A subcosmopolitan coprophagous species. Although the above records by Frey (1949) are not confirmed by recent collections they are reliable because the species is unmistakable.

22. *Opalimosina* (*Pappiella*) *liliputana* (Rondani, 1880)

**Material examined:** Ribeiro Frio [1], on human excrement (1F); Ribeiro Frio [2], on refuse heap (5M 6F). – 12 specimens [5M 7F].

**Comments:** A Holarctic species, widespread in Europe but hitherto unrecorded from the Macaronesian subregion. This is a polysaprophagous species with a tendency to form synanthropic populations near human settlements, and is here newly recorded from Madeira.

23. *Phthitia* (*Kimosina*) *plumosula* (Rondani, 1880)

**Literature:** Becker (1908, as *Limosina*: Madeira); Duda (1918, as *Limosina* (*Scotophilella*): Madeira); Frey (1949, as *Limosina*: Funchal-Monte, Ribeiro Frio, Porto Novo, Santo do Serra).

**Material examined:** Cumeal, sweeping riverside vegetation (2M 1F); Curral des Freiras env., sweeping vegetation along brook (2M 2F); Curral des Freiras-Murteiras, sweeping vegetation along small creek (1M); Encumeada, sweeping vegetation along small creek (1M 2F); Feiteira do Nuno [1], sweeping vegetation along small creek (4F); Feiteira do Nuno 1 km SW, sweeping undergrowth of mixed forest (1M); Funchal-Corujeira [1], sweeping over mud (8M 16F); Funchal-Monte, Ribeira de João Gomes [1], sweeping over mud (31M 19F); Funchal-Monte, Ribeira de João Gomes [2], sweeping over mud (7M 18F); Passo do Poiso, sweeping along creek bed in coniferous forest (14M 8F); Paúl da Serra-Ribeira do Alercrim, sweeping vegetation along small creek (3M 2F); Pico do Furão, sweeping vegetation along small creek (2F); Rabaçal env., sweeping vegetation along small creek (1M); Ribeiro Frio [2], sweeping vegetation along brook (6M 2F). – 153 specimens [77M 76F].

**Comments:** The species is widespread in the Holarctic Region but occurs also in the Neotropical Region and has apparently been introduced to Gough I. in the southern Atlantic (Roháček et al. 2001). It is common in Madeira, particularly along brooks and rivers, often living in muddy habitats normally associated with species of the genus *Rachispora*, which are virtually absent in this island.
Fig. 15 (top): São Jorge-Praia env., river (Ribeira Bonita) 0.3 km in front of its mouth. Fig. 16 (bottom): São Jorge-Praia, seashore. Photo by J. Roháček, 2003.
24. *Phthitia (Kimosina) sp.*
**Material examined:** Passo do Poiso, sweeping along creek bed in coniferous forest (1M). – 1 specimen [1M].
**Comments:** The above male apparently represents an unnamed species characterised by large size and darkened wings. It was captured together with a series of *Phthitia plumosula*.

**Literature:** Becker (1908, as *Limosina pumilio*: Madeira) ??
**Material examined:** Chão da Cancela, sweeping riverside vegetation (1M 2F); Cumeal, sweeping riverside vegetation (1F); Curral des Freiras-Murteiras, sweeping vegetation along small creek (1M); Funchal-Corujeira [1], sweeping over mud (2M 1F); Funchal-Monte 1 km E, sweeping vegetation along brook (1M 1F); Funchal-Monte, Ribeira de João Gomes [1], sweeping over mud (4M 2F); Funchal-Monte, Ribeira de João Gomes [2], sweeping over mud (2M 2F); Passo do Poiso, sweeping along creek bed in coniferous forest (2F); Pico do Furão, sweeping vegetation along small creek (1M 1F); Ribeiro Frio [2], sweeping vegetation along brook (2M). – 26 specimens [14M 12F].
**Comments:** This species was formerly confused with the common Palaearctic *Pseudocollinella humida* (Haliday, 1836). This is obviously true for all previous records of *P. humida* from the Canaries and Azores (see Roháček et al. 2003). The doubtful Becker’s (1908) record of “*Limosina pumilio*” from Madeira may also deal with *P. jorlii*; this possibility is, however, diminished by the fact that Duda (1918) did not record *L. humida* from Madeira when he revised Becker’s collection. *P. jorlii* has formerly been known in the Mediterranean subregion (Algeria, Cyprus, Italy incl. Sardinia and Sicily, Malta, Morocco, Portugal, Spain) but has also been found in England and Slovakia (cf. Roháček 2004a,b).

26. *Pteremis fenestralis* (Fallén, 1820)
**Material examined:** Achadas da Cruz, sifting leaves in laurel forest (4M 6F); Cumeal, sweeping riverside vegetation (2F); Curral des Freiras env., sweeping vegetation along brook (1F); Curral des Freiras-Murteiras, sweeping vegetation along small creek (1M 1F); Eira do Serrado, sweeping vegetation along spring (6M 4F); Eira do Serrado 1 km E, sweeping vegetation along levada (1F); Funchal-Corujeira [1], sweeping riverside vegetation (1M); Funchal-Monte, Ribeira de João Gomes [1], sweeping over mud (1M); Rabaçal env., sifting leaves in laurel forest (5M); Ribeira da Janela 3 km S, sweeping vegetation along levada (1F); Terreiro da Luta, sweeping vegetation along levada (1M). – 35 specimens [19M 15F].
**Comments:** This is another surprising finding in Madeira. *P. fenestralis* is a terricolous species living in moss and woodland debris throughout Europe, but it has been unknown in the Macaronesian subregion up to now. It was probably introduced to Madeira quite recently because no differences between Madeiran and European specimens were noticed. It is possible that this introduced species is competing with native terricolous endemic species living in leaves in laurel forests (viz. *Pullimosina* sp., *Spelobia* sp.) which are now probably restricted to a few well-preserved localities.

27. *Pullimosina (Pullimosina) heteroneura* (Haliday, 1836)
**Literature:** Becker (1908, as *Limosina*: Madeira); Duda (1918, as *Limosina (Scotophilella)*: Madeira); Frey (1949, as *Limosina*: Funchal-Lido, Funchal-Monte, Poiso)
**Material examined:** Curral des Freiras env., sweeping vegetation along brook (2M 2F); Curral des Freiras-Murteiras, sweeping vegetation along small creek (1F); Feiteira do Nuno [2], on dung heap (2F), sweeping over pasture meadow (1M 1F); Paúl da Serra-Ribeira do Alecrim, on cow excrement (1F); São Jorge-Praia env. [1], on decayed grass (12M 15F). – 37 specimens [15M 22F].
**Comments:** A polysaprophagous, widespread, now almost cosmopolitan species previously recorded from Madeira.

**Material examined:** Curral des Freiras env., sweeping vegetation along brook (10M 3F); Curral des Freiras-Murteiras, sweeping vegetation along small creek (8M 11F); Feiteira do Nuno 1 km SW, sweeping undergrowth of mixed forest (2M); Funchal-Estrada da Fundoa, sweeping riverside vegetation (1F); Funchal-Corujeira [2], sweeping vegetation along levada (2M 1F); Pico do Furão, sweeping vegetation along small creek (3M); Ribeiro Frio [2], on refuse heap (3F). – 44 specimens [25M 19F].
**Comments:** A phytosaprophagous species, widespread and common in Europe. It has not been confirmed in the Canaries (Roháček et al. 2003) and the records from Azores (Frey 1945) also remain doubtful. However, the above new records demonstrate that it is relatively frequent in Madeira.
Fig. 17 (top left): Rabaçal env., levada in laurel forest. Fig. 18 (top right): same, an old track in laurel forest, habitat of *Pullimosina* sp. and *Spelobia* sp. Fig. 19 (bottom): Valley of the Ribeira da Janela river near Rabaçal. Photo by J. Roháček, 2003.
29. **Pullimosina (Pullimosina) zayensis** Marshall, 1986

**Material examined:** Curral des Freiras env., sweeping vegetation along brook (3M); Curral des Freiras-Murteiras, sweeping vegetation along small creek (2M); São Jorge-Praia env. [1], on decayed grass (5M 4F), sweeping riverside vegetation (3M). – 17 specimens [13M 4F].

**Comments:** The species appears to be widespread in the southeastern Nearctic and the Neotropical Regions and was probably only recently introduced to the southwestern Palearctic area (Canary Is., Spain, Portugal, Malta, Cyprus, Egypt - see Roháček et al. 2003, Roháček 2004b). Consequently, the above (first) records from Madeira are not very surprising.

30. **Pullimosina (Pullimosina) sp.**

**Material examined:** Funchal-Monte, Ribeira de João Gomes [1], under stones in mixed forest (1F); Rabaçal env., sifting leaves in laurel forest (24M 20F); Ribeiro Frio [2], sifting leaves in laurel forest (1M 1F). – 47 specimens [25M 22F].

**Comments:** The above specimens belong to an undescribed species externally similar to *P. pullula* (Zetterstedt, 1847) but markedly differing by large size (resembling *Spelobia* species) and genital armature. It is believed it is an endemic species restricted to leaf litter of native laurel forests in Madeira.

31. **Spelobia (Bifronsina) bifrons** (Stenhammar, 1855)

**Literature:** Frey (1949, as Limosina: Funchal, Poiso)

**Material examined:** Cumeal, sweeping riverside vegetation (1M); Curral dos Romeiros, sweeping ruderal vegetation along spring (1M); Lombo, on cow dung (1M); São Jorge-Praia, on cow dung (1M); São Jorge-Praia env. [1], on decayed grass (2M 6F), sweeping riverside vegetation (3M). – 15 specimens [9M 6F].

**Comments:** An almost cosmopolitan, phytosaprophagous to coprophagous species.

32. **Spelobia (Spelobia) luteilabris** (Rondani, 1880)

**Literature:** Frey (1949, as Limosina ciliata: Ribeiro Frio); Roháček (1983: Ribeiro Frio, revised Frey’s record of “L. ciliata”).

**Material examined:** Lombo, on cow dung (1M); Ribeiro Frio [1], on human excrement (4F); Ribeiro Frio [2], on refuse heap (3M 8F). – 16 specimens [4M 12F].

**Comments:** A widespread, often synanthropic, Holarctic species introduced to New Zealand and Macaronesia (Canary Is., Madeira, Azores).

33. **Spelobia (Spelobia) parapusio** (Dahl, 1909)

**Literature:** Duda (1918, as Limosina (Scotophilella): Madeira, based on a specimen collected by T. Becker)

**Material examined:** Ribeiro Frio [3], sweeping vegetation along levada in laurel forest (1F). – 1 specimen [1F].

**Comments:** Duda’s (1918) reliable record of this fungivorous species from Madeira (confirmed here by a newly collected specimen) was the first discovery of the species in the Macaronesian subregion; in the Canary Is. it was found only recently (Roháček et al. 2003). *S. parapusio* is widespread in Europe and was also recorded from Tunisia. It has recently been introduced to Gough I. in the southern Atlantic (Roháček et al. 2001).

34. **Spelobia (Spelobia) pseudosetaria** (Duda, 1918)

**Literature:** Frey (1949, as Limosina penetralis: Funchal-Monte, in Curral).

**Comments:** A widespread, Holarctic, partly synanthropic, species. Although the Frey’s (1949) record may also refer to a misidentified female *S. luteilabris*, it is considered reliable pending revision of the voucher specimen.

35. **Spelobia (Spelobia) sp.**

**Material examined:** Rabaçal env., sifting leaves in laurel forest (1M); Ribeiro Frio [2], sifting leaves in laurel forest (2F). – 3 specimens [1M 2F].

**Comments:** The above recorded specimens belong to an unnamed brachypterous species of *Spelobia* living in leaf litter in laurel forests. It is considered endemic to Madeira.

36. **Spinilimosina brevicostata** (Duda, 1918)

**Literature:** Duda (1918, as Limosina (Scotophilella): syntype from Madeira); Frey (1949, as Limosina: Funchal, Ribeira Brava); Roháček (1983: Ribeira Brava).

**Material examined:** Funchal-Penteada, sweeping riverside vegetation (1M); Maloeira, on human excrement (1M); Santana-Fajã do Mar, sweeping over forest margin (7M 2F); São Jorge-Praia env. [1], on decayed grass
Fig. 20 (top left): Ribeiro Frio, lower part. Fig. 21 (top right): Ribeiro Frio-Balcões. Fig. 22 (bottom): Ribeiro Frio env., interior of laurel forest. Photo by J. Roháček, 2003.
37. *Thoracochaeta brachystoma* (Stenhammar, 1855)

**Literature:** Frey (1949: Funchal).

**Comments:** A thermophilous species widespread in tropical and subtropical regions around the world, northwards reaching temperate areas of the Palaearctic Region.


**Literature:** Frey (1949: as *Trachyopella leucoptera*: Funchal-Lido); Roháček & Marshall (1986: Funchal = 2 paratypes based on specimens recorded by Frey l.c.).

**Material examined:** São Jorge-Praia env. [1], sweeping riverside vegetation (1M). – 1 specimen [1M].

**Comments:** Although *T. hem* was originally described from Atlantic islands (Canary Is., Azores, Madeira) it was later also recorded from continental Europe (Portugal, Czech Republic) and Cyprus (Gatt 2004; Roháček 2004b). This is an additional record of this rare species from Madeira.

39. *Thoracochaeta (Nudopella) leucoptera* (Haliday, 1836)

**Material examined:** Feiteira do Nuno [2], on dung heap (1M), sweeping over pasture meadow (1M 1F). – 3 specimens [2M 1F].

**Comments:** A widespread subcosmopolitan species. Within the Macaronesian area it was formerly recorded from the Canary Is. and Azores (Roháček et al. 2003). This is a new addition to the fauna of Madeira.

40. *Trachyopella (Trachyopella) atomus* (Rondani, 1880)

**Literature:** Becker (1908, as *Limosina eximia*, holotype female: Madeira); Duda (1918, as *Limosina (Trachyopella) atoma*: same, Becker’s holotype revised); Roháček & Marshall (1986: same, holotype revised).

**Comments:** The species is widespread in the Palaearctic Region and was also introduced to Oceania. In Europe it is apparently becoming rarer due to competition with the closely allied *T. lineafrons* introduced from the Nearctic Region. Apart from the female holotype of *L. eximia* Becker there is no other record from Madeira.

41. *Trachyopella (Trachyopella) lineafrons* (Spuler, 1925)

**Material examined:** Curral des Freiras-Murteiras, sweeping vegetation along small creek (1M). – 1 specimen [1M].

**Comments:** A widespread, probably originally Nearctic species, now widespread in the northern hemisphere but also known from Argentina and New Zealand. It was recorded from the Canary Is. by Roháček et al. (2003) but this is the first record from Madeira.

42. *Trachyopella (Trachyopella) nuda* Roháček & Marshall, 1986

**Material examined:** São Jorge-Praia env. [1], on decayed grass (1M). – 1 specimen [1M].

**Comments:** This species lives in various kinds of decaying vegetation. It is native to the Nearctic Region but also known from Hawaii, Bermuda, Spain and Canary Is.-Tenerife (Roháček et al. 2003). The records from Spain and Tenerife and the new record from Madeira probably reflect recent introductions.


**Material examined:** Feiteira do Nuno [2], on dung heap (6M 7F); Maloeira, sweeping vegetation along small creek (1F). – 14 specimens [6M 8F].

**Comments:** *T. straminea* was probably introduced to southern and central Europe from the Nearctic Region. It has been recorded from the Canary Is. by Roháček et al. (2003) so its finding in Madeira is not surprising. The species could have been introduced to Madeira from Europe (and Canary Is.) and/or directly from N. America.

**EXCLUDENDA:**

The following species should be deleted from the list of Madeiran *Diptera*

*Coproica acutangula* (Zetterstedt, 1847).

Duda (1925) mistakenly refers to Becker’s record of *Sphaerocera pusilla* from Madeira as being *Coproica* (his *Coprophila pusilla = C. acutangula*). However, this record (Becker 1908) deals in fact with *Ischiolepta pusilla*
Fig. 23 (top): Chão da Cancela nr. Seixal, margin of laurel forest on a river bank. Fig. 24 (bottom): Passo do Poiso, montane coniferous forest with a small creek, habitat of *Phthitiia (Kimosina)* sp. Photo by J. Roháček, 2003.
(see above). Unfortunately, Duda’s (1925) error was transferred to subsequent catalogs (Papp 1984; Roháček et al. 2001) and Fauna Europaea (Roháček 2004a).

*Coproica vagans* (Haliday, 1833).
Frey (1949: 36) listed this species from Madeira on the basis of Becker’s (1908) record of „Limosina littoralis“. However, the latter record refers to *Coproica ferruginata* as Duda (1918) recognized during revision of Becker’s specimens. Frey’s erroneous record was also transferred to World Catalog of *Sphaeroceridae* (Roháček et al. 2001) and Fauna Europaea (Roháček 2004a).

*Leptiocera fontinalis* (Fallén, 1826).
Only Becker (1908, as *Limosina fontinalis*) recorded this species from Madeira. Because *L. fontinalis* is not known from any of the Macaronesian islands, nor from subsequent collections from Madeira it is probable that Becker (l.c.) misidentified *L. caenosa* as *L. fontinalis* (see above). Roháček et al. (2001) listed the Madeiran record of *L. fontinalis* as doubtful.

*Phthitia (Kimosina) ciliata* (Duda, 1918).
Frey (1949) recorded this species (as *Limosina ciliata*) from Ribeiro Frio. Roháček et al. (2001) considered the Madeiran record of this species doubtful. The male specimen of *Spelobia (S.) luteilabris* on which this record is based was examined by Roháček (1983) but was not recognized to represent Frey’s record of „*L. ciliata*“ at that time (see also above). It is here confirmed that Frey’s (1949) record of *P. ciliata* is based on a misidentified *S. luteilabris*.

**Discussion**

Of the 27 species previously recorded from Madeira 23 are confirmed here. Only four of these species (*Opalimosina mirabilis*, *Spelobia pseudosetaria*, *Thoracochaeta brachystoma* and *Trachyopella atomus*) were not found during recent collecting. On the contrary 20 additional species, including 4 apparently unnamed species, were found during our field research. The Madeiran fauna thus now includes 43 species of *Sphaeroceridae*. As expected this fauna is poorer in species than that of the Canary Is. (where 59 species were found – Roháček et al. 2003), obviously due to greater distance of Madeira from continents (both Europe and Africa). However, this difference is not so apparent when the number of Madeiran *Sphaeroceridae* is compared to that of single island of the Canarian archipelago where the highest species number was found on Tenerife (49 species).

On the other hand the qualitative composition of these two faunas differ significantly as follows: (1) No *Aptilotus* species occurs in Madeira while in Canary Is. 7 endemic terricolous species are known. (2) No species of paludicolous *Rachispoda* has been found in Madeira while 11 species occur in the Canaries including one endemic species, *R. freyi* (Hackman, 1958). (3) Undescribed species considered probable endemics to Madeira belong to genera *Minilimosina*, *Phthitia*, *Pullimosina* and *Spelobia*, which lack endemic species in the Canarian archipelago. Although some of the synanthropic species occurring in Madeira (e.g. *Sphaerocera curvisipes*, *Coproica lugubris*, *Elachisoma pilosum*, *Opalimosina liliputana*, *Spelobia pseudosetaria*, *Trachyopella atomus*) have not been found in the Canary Is. (see Roháček et al. 2003) this mainly coprophagous and/or polysaprophagous community seems to be similar in both archipelagos. It is expected that in future the above-mentioned species will also be found in the Canaries and, vice-versa, species like *Norrbomia sordida* (Zetterstedt, 1847), *Coproica digitata* (Duda, 1918), *C. rohaceki* Carles-Tolrá, 1990, *C. vagans* (Haliday, 1833), *Telomerina flavipes* (Meigen, 1830) will be introduced to Madeira because of their close association with hoofed animals or debris of human settlements.

**Biogeography of the Madeiran Sphaeroceridae**

As is true for the fauna of the Canaries (see Roháček et al. 2003) the fauna of *Sphaeroceridae* in Madeira includes species of various origin. The colonization of Madeira lasted a long time and is continuing up to the present. Several colonization routes from Europe, Africa and America were suggested for the introduction of sphaerocerids to the Canary Is. (see Roháček et al. 2003). Similar
Fig. 25 (top): Plateau Paúl da Serra with eastern montane ranges in background. Fig. 26 (bottom): Paúl da Serra, upstream of the Ribeira do Alecrim. Photo by J. Roháček, 2003.
scenarios can be assumed for Madeira (Fig. 27), including also a possibility of faunal exchange with the Canary Islands. The earliest introductions leading to the evolution of endemic taxa were not influenced by man’s activities. These endemic species (all currently unnamed) seem to have survived as a component of the terricolous fauna of virgin laurel forests. On the other hand, the majority of species of *Sphaeroceridae* in Madeira are obviously relatively recent introductions, do not differ from continental populations, and are mostly widely distributed species spread around the world by human traffic.

The species known from Madeira are classified according to their probable origin (= genoelement sensu Walter 1954; de Lattin 1967) below.

1. **Cosmopolitan or subcosmopolitan species of unknown origin:**
   - *Coproica ferruginata* (Stenhammar, 1855)
   - *Coproica hirticula* Collin, 1956
   - *Coproica hirtula* (Rondani, 1880)
   - *Coproica rufifrons* Hayashi, 1991
   - *Sphaerocera curvipes* Latreille, 1805

2. **Species of Holarctic origin:**
   - *Copromyza equina* Fallén, 1820
   - *Lotophila atra* (Meigen, 1830)
   - *Ischiolepta pusilla* (Fallén, 1820)
   - *Leptocera caenosa* (Rondani, 1880)
   - *Minilimosina (Minilimosina) parvula* (Stenhammar, 1855)
   - *Minilimosina (Minilimosina) fungicola* (Haliday, 1836)
   - *Minilimosina (Svarciella) vitripennis* (Zetterstedt, 1847)
   - *Opalimosina (Pappiella) liliputana* (Rondani, 1880)
   - *Phthitia (Kimosina) plumosula* (Rondani, 1880)

   Most species of two above groups are synanthropic or symbovilous and have probably been introduced from the nearest continents to Madeira with man’s activities, i.e. from northwestern Africa and western Europe (from the Iberian Peninsula in particular). All species, except *Minilimosina fungicola*, *Opalimosina liliputana* and *Sphaerocera curvipes*, are also known from the Canary Is. (Roháček et al. 2003). *Coproica rufifrons*, a predominantly tropical species, could have reached Madeira from tropical Africa, tropical America or from the Canary Is.

3. **Species of Palaearctic origin:**
   - *Coproica lugubris* (Haliday, 1836)
   - *Elachisoma aterrimum* (Haliday, 1833)
   - *Elachisoma pilosum* (Duda, 1924)
   - *Leptocera nigra* Olivier, 1813
   - *Opalimosina (Opalimosina) mirabilis* (Collin, 1902)
   - *Pullimosina (Pullimosina) heteroneura* (Haliday, 1836)
   - *Spelobia (Bifronsina) bifrons* (Stenhammar, 1855)
   - *Spelobia (Spelobia) luteilabris* (Rondani, 1880)
   - *Spelobia (Spelobia) pseudosetaria* (Duda, 1918)
   - *Trachyopella (Trachyopella) atomus* (Rondani, 1880)
   - *Trachyopella (Nudopella) leucoptera* (Haliday, 1836)

   Although these species are considered to be of Palaearctic origin their present distributions generally include two or more continents. They probably reached Madeira essentially via the same routes as those of the two above categories. Apart from *Coproica lugubris*, *Elachisoma pilosum*,

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Spelobia pseudosetaria and Trachyopella atomus they are also found in the Canary Is. (Roháček et al. 2003).

4. Species of Nearctic origin:
Trachyopella (Trachyopella) lineafrons (Spuler, 1925)
Trachyopella (Trachyopella) nuda Roháček & Marshall, 1986
Trachyopella (Trachyopella) straminea Roháček & Marshall, 1986

All these species seem to be introduced to the W. Palaearctic area in the second half of 20th century (Roháček et al. 2003). Of these, *T. lineafrons* reached the area before 1950 but the two other species were probably introduced quite recently. Inasmuch as they were recorded from Europe (Spain and other countries) and the Canary Is. before they were found in Madeira it cannot be determined whether these species reached this island directly from North America or via Western Europe (or Canary Is.).
5. Species of Afrotropical origin:
Norrbomia marginatis (Adams, 1905)
Spinilimosina brevicostata (Duda, 1918)

These two species might have been introduced to Madeira directly from tropical Africa and/or from the Canary Is. Spinilimosina brevicostata could also have arrived from the Iberian Peninsula or from northern Africa. The Afrotropical element is distinctly less represented in Madeira than in the Canary Is. where 5 species of Afrotropical origin became established. This reflects the greater distance of Madeira from Africa.

6. Species of Neotropical origin:
Pullimosina (Pullimosina) zayensis Marshall, 1986

This species was recently introduced from the New World to the western Palaearctic (including also Morocco, Portugal, Spain, Canary Is.) and might have also come to Madeira from these countries. The other Neotropical species known from the Canary Is., viz. Chespiritos pervadens Roháček & Buck, 2003, has not been found in Madeira.

7. Species of Australasian origin:
Thoracochaeta brachystoma (Stenhammar, 1855)

T. brachystoma is considered to be of Australasian origin (Roháček et al. 2003). Because this coastal species is now cosmopolitan and inhabits also Atlantic coasts of Europe it is probable that it reached Madeira from Europe or the Canary Is.

8. Species of Southern Palaearctic origin:
Four species of this faunal element (genoelement) were recorded from the Canary Is. (Roháček et al. 2003) but none of them was found in Madeira. The absence of any species of Rachispoda in Madeira is particularly striking compared to situation in the Canaries where 9 species of this genus (including two belonging to above category and one endemic species) were recorded.

9. Species of Western Palaearctic origin:
Opacifrons coxata (Stenhammar, 1855)
Pteremis fenestralis (Fallén, 1820)
Pullimosina (Pullimosina) vulgesta Roháček, 2001
Spelobia (Spelobia) parapusio (Dahl, 1909)

Species of this genoelement were likely introduced to Madeira from the western Mediterranean and/or Canary Is. but some might have reached the island also from more northern areas of Europe, e.g. the woodland species Pullimosina fenestralis and Spelobia parapusio. So far Pteremis fenestralis and Pullimosina vulgesta have not been found in the Canary Is. They were probably introduced to Madeira directly from the Iberian Peninsula. The occurrence of P. fenestralis is particularly noteworthy because of its terricolous life-habits.

10. Species of Mediterranean origin:
Elachisoma bajzae Papp, 1983
Pseudocollinella jorlii (Carles-Tolrá, 1990)

The Mediterranean insect fauna is closely related to that of the Macaronesia. In Sphaeroceridae, this is apparent for the Canary Is. where 5 originally Mediterranean species were found (see Roháček et al. 2003) but less so for Madeira where only 2 Mediterranean species occur. The absence of Spelobia baezi (Papp, 1977) in Madeira is particularly unexpected because the condi-
tions are suitable for this species.

**11. Species of Macaronesian origin:**
*Trachyopella (Nudopella) hem* Roháček & Marshall, 1986

The species was described from the Macaronesian region (Canary Is., Azores and Madeira). Recent records from Portugal, central Europe and Cyprus (Gatt 2004; Roháček 2004b) indicate that this species may be spreading to the Mediterranean as well as mainland Europe.

**12. Madeiran endemics:**
*Minilimosina (Allolimosina) sp.*
*Phthitia (Kimosina) sp.*
*Pullimosina (Pullimosina) sp.*
*Spelobia (Spelobia) sp.*

No endemic species of *Sphaeroceridae* is yet described from Madeira (see Duda 1918; Frey 1949; Roháček et al. 2001). This fact is in great contrast to the situation in the Canary Is. where 11 endemics, including 7 species of *Aptilotus* Mik, 1898, are known (Roháček et al. 2003). Searching for endemic species was therefore one of main aims during our collecting trip to Madeira. Four apparently undescribed species (see above) were found which seem to be restricted to Madeira, two of them being almost certainly endemics to this island. Very surprisingly all these species proved to belong to genera distinct from those including endemic species in the Canaries – indicating a different origin from Canarian endemics. There is no distinct affinity between these species and Mediterranean taxa as is the case in some Canarian species; moreover, no species of *Aptilotus* was found in Madeira. On the contrary, the terricolous species *Pullimosina* sp. and *Spelobia* sp. inhabiting leaf litter in Madeiran laurel forest seem to have their closest relatives among species of these genera living in broadleaved forests of the W. Palaearctic area. The affinity of the new *Phthitia* and *Minilimosina (Allolimosina)* species remain unknown pending careful comparison with all described species. The undescribed species from Madeira will be dealt with in a subsequent paper.

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**References**


Druhy čeledi Sphaeroceridae (Diptera) na ostrově Madeira, s poznámkami k jejich biogeografii

Na základě kritického přehodnocení dosud publikovaných nálezů a zpracování nově získaného materiálu (z terénního výzkumu provedeného v r. 2003) je prezentován nový přehled druhů čeledi Sphaeroceridae ostrova Madeira. Na Madeire bylo zaregistrováno celkem 43 druhů této čeledi (z toho je 20 druhů, včetně 4 dosud nepopsaných, uváděno z tohoto ostrova poprvé), jejichž výčet je doplněn přehledem dosud publikovaných údajů, studovaného materiálu a informacemi o celkovém rozšíření a bionomii. Kromě toho je diskutována jejich biogeografie: všechny druhy jsou zatíženy do genoelementů podle předpokládané oblasti jejich původu a vytyčovány pravděpodobné cesty jejich introdukcí na Madeiru. Převážná většina zjištěných druhů patří k široce rozšířeným taxonům, které se dostaly na Madeire za pomoci lidské činnosti. Z těchto druhů je nejzajímavější výskyt 3 druhů Nearktického původu, 2 druhů Afrotropického původu, 1 druhu Neotropického původu a 1 původně Makaronézského druhu, který se zřejmě recentně rozšířil na evropský kontinent. Na rozdíl od fauny čeledi Sphaeroceridae na Kanárských ostrovech (viz. Roháček et al. 2003) je na ostrově Madeira silně redukován počet druhů Mediteránního a jižní Palearktického původu. Čtyři dosud nepojmenované druhy, které jsou pravděpodobně madeirskými endemity, náleží ke zcela jiným rodům než endemické druhy na Kanárských ostrovech. Zatímco Madeira a Kanárské souostroví mají celkově dosti podobná společenstva koprofágních a synantropních druhů, druhou složení synuží vázaných na ekosystém vavřínových lesů (laurisilva) a na pobřežní biotopy řek a potoků se v obou těchto oblastech liší velmi podstatně, přičemž nejznámkovějším jevem je úplná absence druhů rodů Aiptilotes a Rachispoda na ostrově Madeira.

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