



The families of the suborder Brachycera Schiner, 1862 (Insecta: Diptera): Part 1

Carlos Henrique Marchiori *

Department of Biological Science, Instituto Federal Goiano, Goias, Brazil.

Open Access Research Journal of Multidisciplinary Studies, 2024, 07(01), 052–069

Publication history: Received on 07 December 2023; revised on 27 January 2024; accepted on 28 January 2024

Article DOI: <https://doi.org/10.53022/oarjms.2024.7.1.0005>

Abstract

Brachycera Schiner, 1862 is distinguished from the mosquitoes suborder Nematocera by their short antennae, with few segments. The antennae are formed by three segments of articles, the last of which ends in a long bristle, the arista, or in a multi-segmented article. The objective is to describe Brachycera families (Insecta Diptera). The methodological basis of the present work consists of bibliographical research of scientific articles published in national and international academic journals classified by the Coordination for the Improvement of Higher Education Personnel (CAPES). Document analysis was used as a data collection method to gather information from theoretical books, banks, university dissertations, scientific journals, documents, and digital platforms: The search criterion for articles was prioritizing articles that dealt with the topic. Document analysis was used as a data collection method to gather information on theoretical books, banks, university dissertations, scientific journals, documents, and websites ResearchGate, HAL, and SSRN.

Keywords: Decomposition; Ectoparasitoids; Parasite; Parasitoids; Predator

1. Introduction

Suborder Brachycera is the group by its short antennae, with few segments Flagellum of the antennae is nearly always fused into a compound 3rd segment, remaining diminutive segments form a stumpy “style” or bristle-like arista; the anal cell of the wing narrowed, nearly always closed on or before wing margin; palpi seldom with more than 3 segments, often 2 or 1, held forward (porrect); larvae usually with well-defined head, mandibles move vertically or parallel, cannot be opposed; adult escapes from pupa by a rectangular slit. [1-2].

Objective

The objective is to describe Brachycera families (Insecta Diptera).

2. Methods

The methodological basis of the present work consists of bibliographical research of scientific articles published in national and international academic journals classified by the Coordination for the Improvement of Higher Education Personnel (CAPES). Document analysis was used as a data collection method to gather information from theoretical books, banks, university dissertations, scientific journals, documents, and digital platforms: The search criterion for articles was to prioritize articles that dealt with the topic. Document analysis was used as a data collection method to gather information from the websites ResearchGate, HAL, and SSRN.

* Corresponding author: Carlos Henrique Marchiori

3. Family Acartophthalmidae

The Acartophthalmidae ((Diptera: Brachycera) are a family of very small, dark flies with a pubescent arista, placed in the order Diptera. All are Holarctic in distribution. Two fossil species are known, with uncertain locations (Figure 1) [3].



<https://en.wikipedia.org/wiki/Acartophthalmus>

Figure 1 *Acartophthalmus nigrinus* (Zetterstedt, 1848)

3.1. Biology

The Acartophthalmidae are known to live in woodland, where they are associated with several decaying substances such as wood, fungi, carrion, and droppings. The larvae are saprophagous, and the immature stages have been described and have been found mostly in forests and have been reared from dead wood and decaying organic material [1-3].

3.2. Systematic

3.2.1. *Acartophthalmus bicolor* Oldenberg, 1910.

Portugal: Aveiro, Estarreja, Canelas, and Fernelã The 2013 specimen was collected with a bottle a few centimeters from a dead rat *Rattus* sp. The two specimens from 2014 were collected in a jar near several dead Louisiana crayfish *Procambarus clarkii* (Girard, 1852), a pest of exotic crustaceans very common in the area. The area is a cattle pasture adjacent to a marsh. Among the most common plant species is *Salix atrocinerea* Brot. (Salicaceae), *Alnus glutinosa* L. (Betulaceae), *Frangula alnus* Mill. (Rhamnaceae), *Rubus* sp., and *Hedera* sp. [1-3].

4. Study Selection

4.1. Study1

The present study sought to carry out an entomological survey at different altitude levels, evaluating its influence on the diversity and spatial distribution of insect populations that inhabit Serra da Engabelada, in the municipality of Congo in the Cariri do Paraibano region, Northeast Brazil. The work was carried out through monthly trips to carry out collections, from July/2013 to December/2013 in the Engabelada mountains. Insects were collected solely and exclusively through passive collections, using pitfall traps.

The order Hymenoptera (ants, ants, wasps, wasps) (78.45%) had the highest frequency among the other orders of insects collected, followed by the order Coleoptera (beetles, wood saws, and others) (6.90 %), Diptera (flies) (6.50%), Trichoptera (phrygans and water flies) (2.99%), Orthoptera (crickets and grasshoppers) (1.85%), Dermaptera (earwigs) (1.39%), Blattodea (cockroaches) (0.77%), Lepidoptera (butterflies and moths) (0.65%), Hemiptera (cicadas) (0.34%), Isoptera (termites) (0.15%) and Phasmatodea (stick insect) (0.03%).

The most abundant families were Formicidae (58.50%) most frequently, followed by the families Mutillidae (15.15%), Vespidae (4.80%), Acartophthalmidae (3.17%), Sarcophagidae (3.14%), Leptoceridae (2.99%), Carabidae (2.74%), Tenebrionidae (1.66%), Gryllidae (1.39%), Curculionidae (1.29%), Labiduridae (0.80%), Pieridae (0.65%) and Carcinophoridae (0.58%). The families Cicadidae, Phasmatidae, Blattidae, Scolytidae, Lepturinae, Neriidae, Termitidae, Nitidulidae, Polyphagidae, and Acrididae account for 3.14% of the individuals collected. There is a great diversity of insect species belonging to the Formicidae family [4].

5. Family Apioceridae

The Apioceridae, or flower-loving flies, are a small family of flies, all in the single genus *Apiocera* Westwood, 1835. They occur mainly in dry, sandy habitats in the deserts of North America, South America, and Australia. Other genera previously placed in Apioceridae are now in Mydidae (Figure 2) [1-5].



Source: Photo 1912601, (c) Jean and Fred and https://www.flickr.com/photos/jean_hort/12215038636/

Figure 2 Flower-loving Flies (Family Apioceridae)

5.1. Description

The members of the Apioceridae family are generally recognized by having two antennal flagellomeres, the first pear-shaped or oval-elongated and the second small and cylindrical, by presenting a line of integumentary weakening at the apex of the labrum, postoccipital suture slightly arched between the foramen and the postoccipital suture, sternums 5 to 7 superimposed on tergi, in the male the aedeagus like needle-like, and the female the sclerotized and elongated sternum [1-5].

Leg empodium is usually setiform or absent; wing with cell cup elongated and vein CuA2 ending freely on the wing margin or meeting with vein A1 at or near the wing margin. The head is at least slightly concave between the eyes and the ocelli, and both sexes are dichoptic, and the males are usually holoptic [1-5].

5.2. Biology

The Apioceridae usually visit flowers to feed, while larvae usually live on a substrate and are predatory. There are exceptions to this rule, such as Bombyliidae larvae are parasitoids of other insects and Asilidae adults are predatory. The greatest diversity of Asiloidea is in arid, sandy habitats. Apioceridae is a family of flies commonly known as flower-loving flies or wader-legged flies. They are important pollinators of flowers and are often found near water sources. The distinctive long legs of Apioceridae help them reach deep into flowers to feed on nectar and pollen [5-9].

5.3. Systematic and Distribution

The subfamily Rhapsiomidinae includes 138 species that are distributed from Argentina and Chile to Canada, Australia, and South Africa. In Mexico, there are 22 known valid species of the *Apiocera* which are presented in the biotics database with their respective synonyms and basic taxonomic [5-9].

Until 1996, the family contained the genera *Apiocera* and *Rhapsiomidas* Osten Sacken, 1877 but the latter was removed from the Apioceridae and placed in Mydidae, since investigating the Apioceridae they found that the family as conceived was paraphyletic concerning Mydidae. In this way, they transferred four genera to Mydidae and placed them in two subfamilies Megascelinae and Rhapsiomidinae, leaving only the genus *Apiocera* in Apioceridae. Despite this, the BDWD catalogs and SIIT (2001) still maintain *Rhapsiomidas* in Apioceridae [5-9].

6. Family Brachystomatidae

6.1. Description

The flies included in this taxonomic group are small, fly quickly, have elongated bodies, and generally have large compound eyes, which sometimes cover almost the entire surface of the head. Many species have a well-developed anal lobe and a small but distinct anal cell. The spindle-shaped larvae sometimes resemble first to second-instar larvae of the family Syrphidae, differing in that the posterior spiracles are not together but are apart along the edges of the last segment (Figure 3) [10-13].



Sources: 08WOLVES-01313 and http://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=456919

Figure 3 Family Brachystomatidae

6.2. Systematic and Phylogeny

The most common families in this grouping are Empididae and Dolichopodidae, both with cosmopolitan occurrence, each of which groups thousands of species. A set of smaller families were integrated into Empididae but were now recognized as autonomous groups with family status. The Brachystomatinae groups in Microphorinae are sometimes elevated to family status, but this would make the Empididae and Dolichopodidae groups paraphyletic, which is why they are generally maintained as subfamilies [10-13].

The current systematic treatment seems to essentially reflect the phylogeny of the group very well, although some of the most basal taxa of each lineage are of more uncertain position in cladistic analyses, at least as an interim solution, the solution of subdividing the group into four families seems adequate. Brachystomatinae was classified as a subfamily within Empididae, at which point a new phylogeny was proposed in which the lineage was raised to family rank, though other contemporaneous studies did not support this conclusion, a new analysis indicated that the treatment of Brachystomatinae as a family rendered Empididae paraphyletic, and restored it to the rank of subfamily [10-13].

6.3. Taxonomy

6.3.1. Superfamily Empidoidea Families

Atelestidae, Brachystomatidae, Dolichopodidae, Empididae, Hybotidae, and Microphoridae [10-13].

6.3.2. Genus

Anomalempis Melander, 1928, *Apalocnemis* Philippi, 1865, *Boreodromia* Coquillett, 1903, *Brachystoma* Meigen, 1822, *Ceratempis* Melander, 1927, *Ceratomerus* Philippi, 1865, *Ephydrempis* Saigusa, 1986, *Gloma* Meigen, 1822, *Glyphidopeza* Sinclair, 1997, *Heleodromia* Haliday, 1833, *Hyperperacera* Collin, 1933, *Niphogenia* Melander, 1928, *Pseudheleodromia* Wagner, 2001, *Rubistella* Garrett-Jones, 1940, *Sabroskyella* Wilder, 1982, *Sematopoda* Collin, 1928, *Sinotrichopeza* Yang, Zhang & Zhang, 2007, *Trichopeza* Rondani, 1856, *Xanthodromia* Saigusa, 1986 and *Zealandicesa* Koçak & Kemal, 2010 [10-13].

6.3.3. Genus

Brachystoma Meigen, 1822:

6.3.4. Some Species

Brachystoma flavicolle Mik, 1887, *Brachystoma fuscipennis* Saigusa, 1963, *Brachystoma jonesi* Smith, 1969, *Brachystoma minuta* (Olivier, 1791), *Brachystoma mite* (Jones, 1940), *Brachystoma montanum* Smith, 1969, *Brachystoma nigrimanum* Loew, 1862, *Brachystoma obscuripes* Loew, 1856 and *Brachystoma occidentale* Melander, 1902 [10-13].

7. Family Chamaemyiidae

7.1. Description

Chamaemyiidae or silver flies are small flies of 1.5 to 4.0 mm, silvery gray to brown, usually velvety, sometimes shiny black, sometimes with brown stripes on the mesonotum and black spots or bands on the abdomen. They have zero to 3 front orbital setae. Internal and external verticals are usually present, sometimes reduced, or absent. On the thorax,

there are 2 to 6 dorso ventral setae. Wings moderately wide, C vein uninterrupted, usually extending to M, SC vein complete, R reaching SC near the apex. Symmetrical male genitalia. The terminalia of the female is slightly sclerotized and tube-shaped [14-16].

7.2. Biology

The larvae of all Chamaemyiidae whose food is known are predators of coccids and aphids. Adults feed on the sugary secretions of larval prey. Generally, the larvae of the most primitive groups feed on coccids that live on stems and roots of cereals, those of slightly more advanced genera feed on coccids on the leaves and branches of various plants, and those of the most advanced groups prey on aphids. Representatives of the more advanced genus *Leucopis* Meigen, 1830, to which almost half of the known species of the family belong, are predators of aphids found in angiosperms (Figures 4A-4B) [16-18].



Sources: Credit: Jack Kelly Clark, UC IPM, <https://ipm.ucanr.edu/natural-enemies/aphid-flies/> and <https://www.mapress.com/zt/article/view/zootaxa.5067.1.1>

Figure 4A Larvae of aphid fly (Chamaemyiidae) feeding on aphids, *Aphis ceanothi* Clarke, 1903, tended by Argentine ants, *Iridomyrmex humilis* (Mayr, 1868)



Sources: Credit: Jack Kelly Clark, UC IPM, <https://ipm.ucanr.edu/natural-enemies/aphid-flies/> and <https://www.mapress.com/zt/article/view/zootaxa.5067.1.1>

Figure 4B Chamaemyiidae (Diptera: Lauxanioidea) predaceous on Adelgidae (Hemiptera)

The spectrum of feeding relationships in this case can range from feeding on one species (monophagy) to several species (broad oligophagy). Numerous species of Chamaemyiidae, along with other entomophagous organisms, can successfully control the abundance of certain pests. Some species of *Leucopis*, and *Neoleucopis* Malloch, 1921, were introduced to North America from Europe to control *Dreyfusia piceae* (Ratzeburg, 1844), and today efforts are also being made to introduce *Leucopis ninae* L., 1758, a predator of the Russian wheat aphid, Kurdjumov 1913 [17-19].

7.3. Systematic

- Subfamily Cremifaniinae: Genus *Cremifania* Czerny, 1904.
- Subfamily Chamaemyiinae: Tribe Chamaemyiini: Some Genus: *Chamaemyia* Meigen, 1803, *Hamecamyia* Gaimari, 2001, *Melanochthiphila* Frey, 1958, *Ortalidina* Blanchard, 1852, *Parapamecia* Cogan, 1978 and *Parochthiphila* Czerny, 1904, *Plunomia* Curran, 1934, *Pseudoleucopis* Malloch, 1925, *Pseudodinia* Coquillett, 1902 [19-22].
- Tribe Leucopini: Genus: *Anchioleucopis* Tanasijtshuk, 1997, *Echinoleucopis* Gaimari & Tanasijtshuk, 2001 and *Leucopis* and Meigen, 1830: *Leucopis* Meigen, 1830, *Leucopomyia* Malloch, 1921, *Neoleucopis* Malloch, 1921,

Xenoleucopis Malloch, 1933. Genus *Leucopomyia* Malloch, 1921, *Lipoleucopis* Meijer, 1928 and Genus *Neoleucopis* Malloch, 1921 [19-22].

A new genus of Chamaemyiidae (Diptera: Lauxanioidea) is described, namely *Leucotaraxis* gen. nov. type species *Leucopis atrifacies* Aldrich; 1925, other included species *Leucotaraxis argenticollis* (Zetterstedt, 2021), comb. nov., *Leucotaraxis piniperda* (Malloch, 2021), comb. nov., and *Leucotaraxis sepiola* sp. nov. These species are predators of *Adelgidae* (Hemiptera) infesting Pinaceae. *Leucotaraxis argenticollis* is Holarctic, while the other three species are Nearctic. In addition, a lectotype is designated for *Leucopis olivacea* Meijere, 1928, and it is synonymized under *Neoleucopis obscura* sp. nov. [19-22].

8. Family Celyphidae

The Celyphidae is a small family in the Muscomorpha, Schizophora, Acalyptratae, and Lauxanioidea characterized by their greatly enlarged scutellum and sharp reductions in the chaetotaxy. commonly known as beetle flies or beetle flies, are a family of flies. About 115 species in about 9 genera are known mainly from eastern biogeographical and Afrotropic regions with a lineage in the New World. They are known to have their diversity in tropical Asia and Southeast Asia, with a smaller number of species in the Afrotropical Region (Figure 5) [23-25].



Source: <https://photog.social/@sohkamyung/111210919534612532>

Figure 5 Beetle Fly, genus *Celyphus* Dalman, 1818, spotted at MacRitchie Reservoir Park, Singapore, on 18 May 2023. A fly that looks like a beetle with that shield over its wings, it is tiny, but recognizable by its strange looks

8.1. Description

Celyphidae are small to medium-sized and easily recognised. The scutellum is enlarged, forming a protective shell over the abdomen, giving them a beetlelike appearance. Also, like many beetles, Celyphidae are often shiny or metallic in color. The wings, when at rest, are folded beneath the scutellar “shell” [25-26].

8.2. Biology

Family Coelopidae the biology of the family is poorly known. The biology of the family is poorly known. Adults are found in along streams and rivers, and in wet grassy areas. Larvae are saprophagous [27-28].

8.3. Sistematic

- **Genus** *Acelyphus* Malloch, 1929- Asia, *Atopocelyphus*, Gaimari, 2017, French Guiana, *Celyphus* Dalman, 1818, Africa and Asia.
- **Subgenus:** *Celyphus* Dalman, 1818, Asia, *Hemiglobus* Frey, 1941 and *Paracelyphus* Bigot, 1859, Asia.
- **Genus:** *Chamaecelyphus* Frey, 1941, Africa, *Idiocelyphus* Malloch, 1929 Asia, *Oocelyphus* Chen, 1949 southern China and *Spaniocelyphus* Hendel, 1914, Africa and Asia.
- **Genus:** *Atopocelyphus* Gaimari, gen. nov.
- **Type species:** *Celyphus ruficollis* Macquart, 1844, by present designation. *Atopocelyphus ruficollis* (Macquart, 1844) and *Celyphus ruficollis* Macquart, 1844 [27-28].

9. Study Selection

9.1. Study 1

Entomofauna associated with *Coffea canephora* Pierre ex A. Froehner of Brazil.

In the order Diptera, 15 families were recorded, with diverse habits including parasitoids and saprophagous that play a fundamental role in coffee agroecosystems. The record of the Celyphidae fly *Spaniocelyphus*. Hendel, 1914, known as “Beetle fly” stands out. Until now there was no record of its occurrence in coffee agroecosystems and in general there is little information about this family. It constitutes a new family record for the present study.

9.2. The family Celyphidae in the New World.

This species, *Celyphus ruficollis* Macquart, 1843, was rarely mentioned in subsequent literature, despite having been the third species of *Celyphus* Dalman, 1818, described. The identity and type locality of this species were verified by examination of Macquart, 1844, work, his type specimen, labels and the 1826–1834 accession book in Museum national d’Histoire naturelle (Paris) and a second specimen recently collected from the same country in the Natural History Museum (London). As the species possesses unique characteristics relative to other Celyphidae genera, indicating a separate lineage from the Old World celyphids, the new genus *Atopocelyphus* Gaimari, 2017, was described.

In addition to this New World genus, the Old-World genera of celyphids are reviewed, including discussion of the synonymy of *Chamaecelyphus* Frey, 1941, under *Spaniocelyphus* Hendel, 1914, and the elevation in rank to genus of *Hemiglobus* Frey, 1914 and *Paracelyphus* Bigot., 1852 [29-30].

10. Family Coelopidae

Coelopidae are small to medium-sized, robust flies, predominantly with a flat body and darkly colored. The Coelopidae belong to the superfamily Sciomyzoidea and Acalyptratae which also includes families: Dryomyzidae, Helcomyzidae, Helosciomyzidae, Heterocheilidae, Huttoninidae, Phaeomyiidae, Ropalomeridae, Sepsidae, Sciomyzidae and Tetanoceridae (Figures 6A-6B) [31-35].



Sources: https://www.zoology.ubc.ca/~biodiv/entomology_archive/Diptera/Coelopidae/ and [https://en.wikipedia.org/wiki/Coelopidae#/media/File:T%C3%A5ngflugor_\(Coelopidae\)_-Ystad-2023.jpg](https://en.wikipedia.org/wiki/Coelopidae#/media/File:T%C3%A5ngflugor_(Coelopidae)_-Ystad-2023.jpg)

Figure 6A *Coelopa* sp. **Figure 6B** Kelp flies on a flatfish

10.1. Biology

Females lay their eggs in small batches on fresh algae beds. Three larval instars occur. The larvae feed in a bacteria-laden mass. Pupation rarely occurs in the algal substrate that soon collapses, but more often in the higher layers of sand. In winter, bacteria increase temperatures so that even the pile is superficially frozen. The larvae are decomposers of organic matter on beaches, being better represented in temperate zones and with greater richness in Australia and New Zealand [31-35].

Coelopidae: Attributes including body: symmetry bilaterally symmetric; it is eaten by *Arenaria melanocephala* (Vigors, 1829) (Aves: Charadrii) preyed upon by *Vespula germanica* (Fabricius 1793) (Hymenoptera: Vespidae) diurnal behavioral; circadian rhythm; multicellular cellularity; holometabolous mode of development; feeding structure sucking mouthparts; temperate habitat; benthic marine habitat; supporting exoskeleton structures and enclosures; type specimen repository Naturalis [31-35].

10.2. Systematic

Subfamily Coelopinae Hendel, 1910: Genus: *Beaopterus* Lamb, 1909, *Coelopella* Malloch, 1933, *Dasycoelopa* Malloch, 1933, *Gluma* McAlpine, 1991, *Icaridion* Lamb, 1909, *Malacomysia* Haliday in Westwood, 1840, *Rhis* McAlpine, 1991, and *This* McAlpine, 1991.

The *Lopa convexa* McAlpine, 1991, is a species of Diptera described by McAlpine in 1991. The *L. convexa* belongs to the genus *Lupa* Leach, 1814, family Coelopidae. Coelopidae *Malacomyia sciomyzina meridionalis* (Rondani, 1868) (Acalyptrate dipterans of Catalonia (Spain) (Diptera, Acalyptrate) [31-35].

Malacomyia sciomyzina (Haliday, 1833)

Pontevedra: Vilanova de Arousa, Island of Arousa, 13.02.2016, 1 male (ABIGA 24602); 13.02.2016, male (ABIGA 24644); 13.02. 2016, 1 male (ABIGA 24650), 13.02.2016, 1 male (ABIGA 24653). All, beach, and 10 m. Previous Spanish dating: Alicante, Asturias, Balearic Islands (Ibiza and Mallorca), Cadiz and Gerona. Gender and species new to Galicia [31-35].

11. Study Selection

11.1. Study 1

The objective of this study was to determine the successional entomofauna present in the corpse of a female canid exposed to the open air and to establish the relative frequency of appearance of the taxa found, with particular interest in the Diptera species. The research was carried out in an area considered tropical dry forest with an average annual temperature of 24 °C, at the biology experimental station at the Universidad del Valle, Santiago de Cali, Colombia. Or a female canid, whose weight was 23 Kg.

During the process, a total of 3,170 individuals were grouped into 39 families, and 7 orders were collected from the corpse. Three of the 7 orders housed 94.22% of all individuals: Diptera, Hymenoptera and Coleoptera. Apart from Calliphoridae, the families Trixoscelididae, Sarcophagidae, and Coelopidae stood out from the others for their appearance in the Swollen state, particularly the latter Chloropidae, one of the least frequent families [36].

12. Family Chyromyidae

12.1. Description and taxonomy

Chyromyidae is small to very small Cyclorrhapha flies, and Acalyptrates currently classified within Heleomyzoidea by most authors. Most have a pale-yellow integument and bright iridescent green, red, or purple eyes. Adults are xerophilous and are related to flowering plants in Mexico, there is knowledge of one species (Figure 7) [37-39].



Sources: Photo#102702 - Joe, Entomologist (in trainin and <https://bugguide.net/node/view/102702>

Figure 7 *Gymnochiromyia flavella* (Zetterstedt, 1848)

12.2. Biology

Adults are xerophilic and have been collected on flowering plants. There appears to be some association with bird and mammalian nests, though the nature of this association is not clear. Some species have been reared from guano and dung, from debris in trees. The biology of Chyromyidae is poorly known and no life history of any species has been elucidated. Adults are xerophilic and have been collected on flowering plants. There appears to be some association with bird and mammalian nests, though the nature of this association is not clear. Some species have been reared from guano and dung, from debris in tree hollows, and bird and mammalian nests [40-45].

12.3. Distribution

The family is represented in all continents except Antarctica. There are about 150 named species in this family worldwide. There has been no comprehensive taxonomic study to elucidate the generic limits of species in the family. Currently, only four genera are recognised, but ongoing studies of the African species indicate that there are more [45-47].

13. Studies selection

13.1. Chyromyidae (Diptera: Brachycera) for mainland Portugal

Aphaniosoma melitense Ebejer, 1993 Portugal: 1♂, 2♀ Canidelo, Vila Nova de Gaia, 11.IX.2009, captured using sweep netting, leg. R. Andrade; 5♂, 1♀ Canidelo, Vila Nova de Gaia, 22.IX.2009, captured using sweep netting, leg. R. Andrade.

Gymnochiromyia homobifida Carles-Tolrà, 2001 Portugal: 1♂, Arcozelo, Vila Nova de Gaia, 16.VI.2009, captured using yellow water trap, leg. R. Andrade.

Gymnochiromyia inermis Collin, 1933 Portugal: 2♀, Arcozelo, Vila Nova de Gaia, 19.V.2009, captured using yellow water trap, leg. R. Andrade; 1♀, Arcozelo, Vila Nova de Gaia, 22.V.2009, captured using yellow water trap, leg. R. Andrade.

13.2. Acalypterous dipterans from Catalonia (Spain) (Diptera, Calyptratae)

Aphaniosoma propinquans Collin, 1949 B (8).

Chyromya femorella (Fallén, 1820) B (26).

Chyromya flava (Linnaeus, 1758) BT (8, 21).

Gymnochiromyia mihalyii Soós, 1979 B (8).

B = Barcelona, G = Girona, L = Lleida, T = Ta they are known only from dud identifications/genera/species (by family) [48-49].

14. Family Dryomyzidae

Sciomyzoidea is a superfamily of Acalyptratae flies. The families placed here include at least the following: Coelopidae seaweed flies, Dryomyzidae, Helcomyzidae, Helosciomyzidae, Heterocheilidae, Huttoninidae, Natalimyzidae, Phaeomyiidae, Ropalomeridae, Sciomyzidae marsh flies, snail-killing flies (including Huttoninidae).

14.1. Description

The Dryomyzidae are a small family of flies that range from 4 to 18 mm in length, with prominent setae and yellow to brown or rusty yellow coloration. The wings are very big. The subcosta is complete and well separated from the rib. The undercoast is complete and well separated from the nerve (Figures 8A-8B) [51-52].



Sources: <https://en.wikipedia.org/wiki/Dryomyzidae> and Photo#1722001 and <https://bugguide.net/node/view/1722001/bgimage>

Figure 8A Dryomyzid fly - *Dryomyza* sp.



Sources: <https://en.wikipedia.org/wiki/Dryomyzidae> and Photo#1722001 and <https://bugguide.net/node/view/1722001/bgimage>

Figure 8B *Dryomyza anilis* Fallén, 1820

14.2. Biology

The larvae of members of this family feed on decaying organic matter, carrion, dung, and fungi. Most are distributed in the Holarctic region but there are some representatives in the southern hemisphere. Around 22 species from 6 genera have been described. Only one species has been recorded in Mexico [53-54].

14.3. Systematic

Subfamily: Dryomyzinae Schiner, 1862: Genus: *Dryomyza* Fallén, 1820, *Dryomyza ambli* Kurahashi, 1981, *Dryomyza ecalcarata* Kurahashi, 1981, *Dryomyza formosa* (Wiedemann, 1830), *Dryomyza Pakistani* Kurahashi, 1989, *Dryomyza puellaris* Steyskal and *Dryomyza takae* Azuma, 2001. **Genus:** *Dryope* Robineau-Desvoidy, 1830, *Dryope decrepita* (Zetterstedt, 1838), *Dryope flaveola* (Fabricius, 1794), and *Dryope melanderi* (Steyskal, 1957). **Genus:** *Oedoparena* Curran, 1934, and *Oedoparena glauca* (Coquillett, 1900). **Genus:** *Paradryomyza* Ozerov, 1987, *Paradryomyza orientalis* Ozerov & Sueyoshi, 2002, *Paradryomyza setosa* (Bigot, 1886), *Paradryomyza spinigera* Ozerov, 1987 and *Paradryomyza steyskali* Ozerov & Sueyoshi, 2002. **Genus:** *Pseudoneuroctena* Ozerov, 1987 and *Pseudoneuroctena senilis* (Zetterstedt, 1846). **Genus:** *Steyskalomyza* Kurahashi, 1982 and *Steyskalomyza hasegawai* Kurahashi, 1982 [53-55].

Dryomyzidae (=Dryomyzidae) Baumfliegen

Neuroctena anilis Fallén, 1820.

Subspecies: No subspecies are recognized. Synonyms: *Dryomyza anilis* Fallén, 1820. *Neuroctena anilis* (Fallén, 1820).

Type locality: Sweden.

Dryope liturata Robineau-Desvoidy, 1830.

Dryomyza analis auct. (frequent misspelling): =Identification: No information has been entered yet. Distribution: No information has been entered yet. Biology: No information has been entered yet [53-55].

Dryomyzidae of Catalunya (Diptera), Miguel Carles-Tolrà, 2023.

Dryomyza anilis Fallén, 1820 and *Dryope flaveola* (Fabricius, 1794) [54-55].

15. Studies Selections

15.1. Study 1

The present work consisted of an export experiment with 3 rabbits, in which the development of cadaveric fauna was observed, under three different environmental conditions, created in the same location, on the roof of a three-story building.

Each rabbit from the others, one exposed to the sun, another in the shade and the third buried, in climatic conditions during the months of June to August. Observations were made over 90 days, periodic screening of the sand contained

in the boxes that served as support, collection of eggs, larvae, and pupae, for reproduction and observation in the laboratory until birth, after which taxonomic identification, processing and analysis of the data obtained and preparation of tables and graphics.

Eleven (11) species of insects were identified, 8 Diptera from three families of flies and 3 Coleoptera, the three arrived first months, featuring in the first month the arrival of species of flies from the Calliphoridae family, in the second month species of Sarcophagidae and the third month species of small flies from the Dryomyzidae family. The differentiated behavior of species in the created environments and differentiation of the life cycles of the first two families [56].

15.2. Study 2

The objective was to survey the urban insect fauna that occurs in the food industry, bakeries, hotels, and recreational clubs.

Collections were carried out from June 2002 to May 2003, in two hotels (R and C), a bakery and a recreational club, located in Curitiba, and a food industry, in the industrial region of São José dos Pinhais (metropolitan region) (PR). Two light traps with "Ultralight" ultraviolet light were used, containing an adhesive refill and an insulated refill. In each of the locations, the traps were installed in the kitchen and sewage (isolated refill), and at the input and output of Excel in the food industry. The refills were placed every 15 days and removed after 24 hours.

Sixteen hundred and forty-four (1,644) insects belonging to the orders Diptera, Hymenoptera, Blattaria, Coleoptera, Lepidoptera, Isoptera, Hemiptera, Dermaptera and Orthoptera were collected. The first three orders together totaled 78.1% and were the most frequent with 42.9%, 21.5% and 13.7%, respectively. Among the Diptera, the Muscidae and Calliphoridae families were the most abundant, representing 19.3% and 17.5%, respectively. The Dryomyzidae family collected 13 specimens and presented a frequency of 1.8% [57].

16. Family Eurychoromyiidae

16.1. Introduction

The Eurychoromyiidae (Superfamily Lauxanioidea and Acalyptratae) are a family of Diptera notable only for their extreme rarity. It consists of a single genus and species, *Eurychoromyiidae mallea* Hendel, 1910 [58-60].

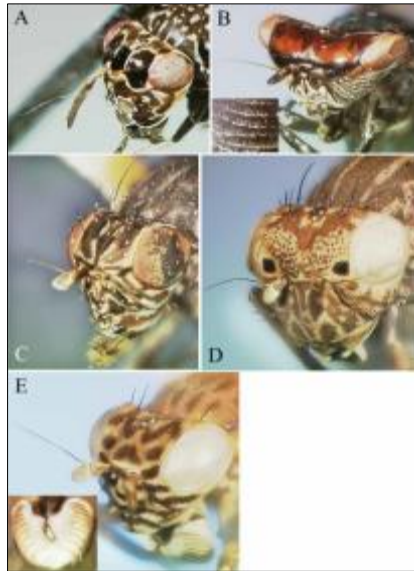
16.2. Phylogeny

The Neotropical genus *Eurychoromyia* Hendel, 1910, was described for the group, classified in its family group coordinated in rank with subfamilies Lauxaniinae (=Lauxanioidea) and Sciomyzinae (=Sciomyzoidea) Hennig was the first to align the family with Lauxanioidea a placement followed by the few subsequent authors dealing with this issue, but being specifically aligned, in turn, with each of the other Lauxanioidea families based an affinity with Chamaemyiidae on the presence of four spermathecae (2+2), while all Lauxaniidae known at the time had three (2+1) placement near Lauxaniidae (or Ropalomeridae, a Ropalomerioidea quickly dismissed), but 20 years later suggested Celyphidae [58-60].

Characteristics used to support Celyphidae + Eurychoromyiidae either represent clear trends towards reduction that have evolved in parallel in several Lauxanioidea lineages, general conditions also found in many Lauxaniidae, widened fronto-orbital plates, elongated scape), and misinterpretations of character states (e.g., convex bulging face, reduced costal setulae). The current study provides evidence for reducing Eurychoromyiidae to a subfamily within Lauxaniidae. *Eurychoromyiidae mallea* Hendel, 1910 (Figure 9) [58-60].

16.3. Biology

Eurychoromyia malea, the broadhead fly, is a species of fly in the Eurychoromyiidae. Sarampuni was collected, in the foothills of the Bolivian Andes, he caught 4 specimens, all females, of a fly with a strange wide and flat head. These were described as a new species *E. mallea*, which classified them as an isolated group of muscids. Their judgment was upheld, and they are now recognized as belonging to a distinct family, Eurychoromyiidae. No other specimens have been identified as belonging to this family. In the Neotropical area, seven genera and nine species are known [58-60].



https://www.researchgate.net/figure/Heads-of-eurychoromyiine-species-oblique-view-A-Choryeuromyia-xenisma-sp-nov-B_fig4_242234554

Figure 9 Heads of Eurychoromyiine species, oblique view. A) *Choryeuromyia xenisma*, sp. nov. B) *Eurychoromyia mallea* Hendel, 1903 (inset, closeup of striped pattern of pale white hairs on gena). C) *Euryhendelimyia schlingeri*, sp. nov. D) *Tauridion shewelli* Papp & Silva, 1995 E) *Roryeuchomyia tigrina*, sp. nov. (inset, close-up of labellum)

16.4. Description

The features used to support Celyphidae + Eurychoromyiidae represent clear reduction trends that have evolved in parallel in several Lauxaniidae lineages e.g., reduction of macrosetae, general conditions also found in many Lauxaniidae e.g., enlarged frontal-orbital plates, elongated scape, and misinterpretations of character states, for example, convex, and protruding face, reduced costal setulas [58-60].

17. Family Fergusoninidae

17.1. Bioecology

All species of Fergusoninidae for which biology is known are gall-feeders in the living tissue of Myrtaceae and are involved in an obligate mutualistic association with nematodes in the genus *Fergusobia* Currie 1937 (Tylenchida: Neotylenchidae). The family is Australasian in distribution, with species known from Australia, India, Papua New Guinea, the Philippines, and New Zealand (Figure 10) [61-63].



Source: <http://treatment.plazi.org/id/BD15296C-6A5F-FFA0-FF1A-FB04DC30A7F2>

Figure 10 figs. 191–194. *Fergusonina* spp. (Fergusoninidae); 191: male dorsal; 192: male lateral; 193: head, anterolateral; 194: female lateral

Fergusonina (Purcell et al., 2016), the only genus in the family Fergusoninidae, are gall-forming flies. There are about 40 species in the genus, all of which produce galls on species of *Eucalyptus* sp., *Melaleuca* sp., *Corymbia* sp. and *Metrosideros* sp. in Australia and New Zealand. Insects are the most frequent gall-inducers, Diptera (Tephritidae, Agromyzidae, Chloropidae, Fergusoninidae) are also known to induce galls on a vast number of host plants. In addition to the gall formers, other insects were also found in the galls. These were classified as parasitoids, inquilines, or predators [64-66].

17.2. Systematic

Order: Diptera: Suborder: Brachycera, Suborder: Muscomorpha, Section: Schizophora, Subsection: Acalyptrata, Superfamily: Opomyzoidea, Family: Fergusoninidae:

Genus: *Fergusonina* Malloch 1924.

Fergusonina Malloch, 1924: 337. Original status: Valid genus.

Type species: *Fergusonina microcera* Malloch, 1924 Fixation: Original designation (p. 338) [and monotypy] ZooBank: EF81B7E6-5FB9-483E-88CE-0033F55964EB [66-69].

18. Study selection

18.1. Study 1

A. Fergusoninidae is a family of Diptera. EOL has data for attributes.

Body symmetry bilaterally symmetric; diurnal behavioral circadian rhythm; multicellular cellularity; holometabolous mode of development; feeding structure; sucking mouthparts.

The galls themselves are induced by endosymbiotic nematodes in the genus *Fergusobia* Currie, 1937 (family Neotylenchidae) which are obligate mutualists of the flies. Females carry the nematode in their hemocoel and transport them to host plants while laying their eggs. Most of the fly species are specific to their tree hosts but a few uses more than one species of host.

18.2. Taxonomy

Type genus: *Fergusonina* Malloch, 1924: 337, by Tonnoir (1937: 129) [as subfamily "Fergusoninae"]. Type species of the genus: *Fergusonina microcera* Malloch, 1924: 338, by original designation. Some species: *Fergusonina atricornis* Malloch, 1925, *Fergusonina brimblecombi* Tonnoir, 1937, *Fergusonina centeri* Taylor, 2004, *Fergusonina curriei* Tonnoir, 1937, *Fergusonina davidsoni* Tonnoir, 1937, *Fergusonina eucalypti* Malloch, 1932, *Fergusonina goolsbyi* Taylor, 2004, *Fergusonina lockharti* Tonnoir, 1937, *Fergusonina morgani* Tonnoir, 1937, *Fergusonina nicholsoni* Tonnoir, 1937, *Fergusonina purcelli* Taylor, 2004, *Fergusonina scutellata* Malloch, 1925 and *Fergusonina syzygii* Harris, 1982 [69-74].

19. Family Heleomyzidae



Source: Determined by Chris Angell

Figure 11 Diptera-Heleomyzidae-*Pseudoleria*-Sun Flies

The Heleomyzidae is a small family of true flies in the insect order Diptera. Around 650 species of heleomyzids are known worldwide, classified into 80 genera and 22 tribes, which together are distributed throughout the world, but with greater richness in the Holarctic region. The larvae are saprophagous of organic plant and animal matter and others

are mycophagous. In Mexico, 10 valid species are known belonging to five genera of four tribes and one subfamily (Figure 11) [75-78].

19.1. Description

Heleomyzids are small to medium-sized flies which vary in color from yellow to reddish yellow or reddish brown to black. The wings often have small but distinctly longer, well-spaced spines mixed with the shorter spines along the leading edge, and the cross veins are often clouded [75-78].

19.2. Biology

The Heleomyzidae adults are attracted to carcasses and feces. Larvae feed on decaying plant and animal matter, mushrooms, and various fungi. The larvae of the Holarctic occur principally in fungi. Larvae live in borer tunnels in trees [75-78].

19.3. Systematic

The group is composed of 22 tribes, of which Rhinotorini and Diaciini are the only tribes recorded from Brazil. Rhinotorini are represented in Brazil by three genera: *Neorhinоторa* Lopes, 1934, with four species, *Rhinotoroides* Lopes, 1934, with a single species and *Rhinоторa* Schiner, 1868, with six species.

19.3.1. List of species in the State of Mato Grosso do Sul.

Neorhinоторaaristalis (Fisher, 1932).

Distribution: Brazil (Amazon, Mato Grosso do Sul, Minas Gerais, Rio de Janeiro, São Paulo). Type-locality: "Fazenda Murtinho" [Male holotype deposited at the Museum of Zoology of the University of São Paulo, MZSP].

The following species of Rhinotorini are known from adjacent Brazilian states, and may be found in the Brazilian state of Mato Grosso do Sul:

Neorhinоторa mutica (Schiner, 1868); *Neorhinоторa fonsecai* (Lopes, 1934); *Rhinоторa diversipennis* Lopes, 1936; *Rhinoceros lopesi* Guimaraes & Papavero, 1966; *Rhinоторa pluricellata* Schiner, 1868; *Salesopolitan rhinoceros* Guimaraes & Papavero, 1966; *Rhinоторa spilopectera* Guimaraes & Papavero, 1966; *Rhinоторa travassosi* Lopes, 1934; *Rhinotoroides bifurcata* Lopes, 1934 [79].

20. Studies selections

20.1. Study 1

UEMA researchers discover a new species of fly in Maranhão discover yet another new species of fly in the periurban area of the municipality of Caxias-MA.

According to researchers, the new species was named *Neorhinоторa fapema* sp. nov., this new species of fly from the Heleomyzidae family has never had contact with the human species, since the species in this group live in the canopy or canopy of vegetation, generally the approximately 30 meters high about the ground.

According to the researchers developing research, there is the opportunity to collect several other groups of insects that naturally live in the canopy, around 20 and 30 meters high, bringing unprecedented data to science and consequently to humanity. This allows us to elucidate and bring light to society in several aspects, through the discovery of these new species of flies [80-81].

21. Conclusion

This group is distinguished from mosquitoes (suborder Nematocera) by their short antennae, with few segments. The antennae are formed by three segments (the articles), the last of which ends in a long bristle, the arista, or in a multi-segmented article.

References

- [1] Tremblay E. Applied entomology. 1st ed. Naples: Liguori Editore. 1985.
- [2] Ozerov AL. Review of the family Acartophthalmidae (Diptera) with description of a new species. Zoological Journal. 1986; 65: 807–809.
- [3] Kahanpää J. Checklist of the Diptera families Acartophthalmidae, Canacidae (including Tethinidae), Carnidae and Milichiidae of Finland (Insecta). Zookeys. 2014; 19(441): 305-359.
- [4] Shtakelberg AA. Family Acartophthalmidae. Keys to the insects of the European part of the Diptera and Siphonaptera. Part 2. 1st ed. Washington: Smithsonian Institution Libraries & National Science Foundation. 1988.
- [5] Carvalho CJB, et al. Diptera Linnaeus, 1758. In: Rafael JA, Melo GAR. Carvalho CJB, Casari S, Constantino R, eds. Insects from Brazil: Diversity and Taxonomy. 2nd ed. Manaus: Institute National Amazon Research Institute; 2024. p. 783-831.
- [6] Carvalho CJB, et al. Diptera Linnaeus, 1758. In: Rafael JA, Melo GAR. Carvalho CJB, Casari S, Constantino R, eds. Insects from Brazil: Diversity and Taxonomy. 2nd ed. Manaus: Institute
- [7] National Amazon Research Institute; 2024. p. 783-831. Trautwein MD, Wiegmann BM, Yeates DK. A multigene phylogeny of the fly superfamily Asiloidea (Insecta): Taxon sampling and additional genes reveal the sister group to all higher flies (Cyclorrhapha). Molecular Phylogenetics and Evolution. 2010; 56(3): 918–930.
- [8] Yeates DK. The cladistics and classification of the Bombyliidae (Diptera: Asiloidea). Bulletin of the American Museum of Natural History. 1994; 219: 1–191.
- [9] Winterton SL, Ware JL. Phylogeny, divergence times, and biogeography of window flies (Scenopinidae) and the therevoid clade (Diptera: Asiloidea): Therevoid clade phylogeny. Systematic Entomology. 2015; 40(3): 491–519.
- [10] Yeates DK. Revision of African Apiocera (Diptera: Apioceridae). Annals of the Natal Museum. 1994; 35(1): 123–131.
- [11] Moulton JK, Wiegmann BM. The phylogenetic relationships of flies in the superfamily Empidoidea (Insecta: Diptera). Molecular Phylogenetics and Evolution. 2007; 43(3): 701-713.
- [12] Sinclair BJ, Cumming JM. The morphology, higher-level phylogeny, and classification of the Empidoidea (Diptera). Zootaxa. 2006; 1180: 1-172.
- [13] Wahlberg E, Johanson KA. Molecular phylogenetics reveals novel relationships within Empidoidea (Diptera). Systematic Entomology. 2018; 43(4): 619–636.
- [14] Sinclair B. Review of three little-known monotypic empidoid genera (Diptera: Empidoidea: Brachystomatidae), assigned to Trichopezinae. Zootaxa. 2008; 1754: 52–62.
- [15] Raspi A, Benelli G. On the identity of *Leucopis* (Diptera Chamaemyiidae) described by Camillo Rondani: a revision of eight silver fly species. Bulletin of Insectology. 2016; 69(2): 199–219.
- [16] Ebejer MJ. A conspectus of the silver-flies (Diptera Chamaemyiidae) of the Middle East with descriptions of new species of *Chamaemyia* Meigen and *Melanochthiphila* Frey, from the Arabian Peninsula. Zootaxa. 2017; 4319(3): 461–482.
- [17] Solís A. The National Biodiversity Institute, Costa Rica [Internet]. San José: 1994. INBio; @1997 [cited 2024 Jan 05]. Available from <http://www.inbio.ac.cr/papers/insectoscr/Texto406.html>.
- [18] Gaimari SD, Tanasijtshuk VN. A new *Leucopine* genus (Diptera: Chamaemyiidae) with species attacking *Ceroplastes* wax scales (Hemiptera: Coccidae) in South America. Systematic Entomology. 2001; 26(3): 311–328.
- [19] Gaimari SD. A new Afrotropical genus of Chamaemyiidae (Diptera: Lauxanioidea). African Invertebrates. 2012; 53(1): 157–168.
- [20] Tanasijtshuk VN. Morphological differences and phyletic relations between the genera of Chamaemyiidae flies (Diptera: Chamaemyiidae). Entomology Cheskie Obozrenie. 1992; 71(1): 199–230.
- [21] Gaimari SD. A new genus and species of Chamaemyiidae (Diptera: Lauxanioidea) from South America feeding on *Ceroplastes* wax scales (Hemiptera: Coccidae), and status of the genus *Ortalidina* as a chamaemyiid. Zootaxa. 2012; 3342: 39–50.

- [22] Santos-Neto LG. *Mallochianamyia*, a new name for *Gayomyia* Malloch (Diptera, Chamaemyiidae). *Brazilian Zoology Journal*; 1996; 13(1): 91-92.
- [23] Gaimari SD, Nathan PH. A new genus of Chamaemyiidae (Diptera: Lauxanioidea) predaceous on Adelgidae (Hemiptera), with a key to chamaemyiid species associated with Pinaceae-feeding *Sternorrhyncha*. *Zootaxa*. 2021; 5067(1): 1–39.
- [24] Tenorio JM. A revision of the Celyphidae (Diptera) of the Oriental Region. *Transactions of the Royal Entomological Society of London*. 2009; 123(4): 359–453.
- [25] Xuankun L, et al, Mitochondrial genomes provide insights into the phylogeny of Lauxanioidea (Diptera: Cyclorrhapha). *International Journal of Molecular Sciences*. 2017; 18(4): 773.
- [26] Gaimari SD. The dipteran family Celyphidae in the New World, with discussion of and key to world genera (Insecta, Diptera). *ZooKeys*. 2017; 711: 113–130.
- [27] Tenorio JM. A revision of the Celyphidae (Diptera) of the Oriental Region. *Transactions of the Entomological Society of London*. 1972; 123(4): 359–453.
- [28] Paap L. Celyphidae. In: Soós Á, Paap L, eds. *Catalogue of Palaearctic Diptera 9*. 1st ed. Budapest: Akadémiai Kiadó Elsevier; 1992. p. 63-66.
- [29] Shi LZY, Xue W, Yang C. Celyphidae of China (Diptera). In: Xue W, Chao C, eds. *Flies of China*. 1st ed. Shenyang: Liaoning Science & Technology Press; 1988. p. 234–261.
- [30] Lopez JLB. Entomofauna associated with agroecosystems of *Coffea conilon* (*Coffea canephora* Pierre ex A. Froehner) in the State of Espírito Santo, Brazil. Master's dissertation. Federal University of Viçosa; @2016 [cited 2024 Jan 05]. Available from <https://www.locus.ufv.br/bitstream/123456789/28525/1/texto%20complete.pdf>.
- [31] Gaimari SD. The family Celyphidae in the New World and remarks on the world genera [Internet]. Windhoek: 9th International Congress of Dipterology; @2018 [cited 2024 Jan 05]. Available from https://nucleus.iaea.org/sites/naipc/twd/Documents/Abstract_booklet_circular_ICD9_2018.PDF.
- [32] Mathis WN, McAlpine DK. A Catalog and conspectus on the family Coelopidae (Diptera: Schizophora). *Myia*. 2011; 12: 171–205.
- [33] McAlpine DK. Review of the Australian kelp flies (Diptera: Coelopidae). *Systematic Entomology*. 1991; 16: 29–84.
- [34] McAlpine DK. Family Coelopidae. In: Papp L, Darvas B, eds. *Contributions to a manual of Palaearctic Diptera*. 3rd ed. Budapest: Science Herald; 1998. p. 335–340.
- [35] Bisby FA, et al. *Species 2000 & ITIS catalog of Life: 2011 Annual Checklist*. 1st ed. London: Species 2000. 2012.
- [36] Carles-Tolrá M. Two new species for Spain and faunal novelties for Galicia (Spain) (Diptera: Blephariceridae, Thaumaleidae, Atelestidae, Athericidae, Mythicomyiidae, Opetiidae, Platypezidae, Canacidae, Chloropidae and Coelopidae). *Entomologic Archives*. 2020; 22: 105-108.
- [37] Masmela LAO. Successional entomofauna in the corpse of a canid in field conditions at the Universidad del Valle (Cali-Colombia). *Forensic Medicine Notebooks*. 2001; 23: 1-15.
- [38] Wheeler TA, Sinclair BJ. Chyromyidae (Diptera) from the Galapagos Islands, Ecuador: three new species of *Aphaniosoma* Becker. *Proceedings of the Entomological Society of Washington*. 1994; 96(3): 440–453.
- [39] Smith KGV. An introduction to the immature stages of British flies. *Handbooks for the Identification of British Insects*. 10th ed. London: Royal Entomological Society of London. 1989.
- [40] Ebejer MJ. Chyromyidae (Diptera: Schizophora) from the Arabian Peninsula with descriptions of twelve new species. *Fauna of Saudi Arabia*. 1996; 15: 280–299.
- [41] Ferrar P. A guide to the breeding habits and immature stages of Diptera Cyclorrhapha. *Entomonograph*. 1987; 8(1-2): 1–907.
- [42] Ebejer MJ. The Moroccan species of Chyromyidae (Diptera) with descriptions of five new species of *Aphaniosoma* Becker. *Zootaxa*. 2016; 4208(3): 221–236.
- [43] Ebejer MJ, Barták M. Chyromyidae (Diptera, Acalyptrata) of Turkey. *Zookeys*. 2019; 872: 69–79.
- [44] Ebejer MJ. Chyromyidae (Diptera: Heleomyzoidea). In: Kirk-Spriggs AH, Marais E, eds. *Biodiversity of the Brandberg Massif, Namibia*. 1st ed. Massif. Cimbebasia Memory; 2000. p. 261–264.

- [45] Ebejer MJ. A new species of *Gymnochiromyia* Hendel (Diptera: Chyromyidae) from the Mediterranean, with notes, lectotype designations, and a key to the species from the West Palaearctic. *Studia Dipterologica*. 1998; 5(1): 19–29.
- [46] Ebejer MJ. New Species of *Gymnochiromyia* Hendel, 1933 (Diptera: Schizophora: Chyromyidae) from Southern Africa. *African Invertebrates*. 2008; 49(1): 77–108.
- [47] Ebejer M. A revision of Afrotropical Chyromyidae (Excluding *Gymnochiromyia* Hendel) (Diptera: Schizophora), with the recognition of two subfamilies and the description of new genera. *African Invertebrates*. 2009; 50(2): 321–434.
- [48] Ebejer MJ. A review of the Palaearctic species of *Aphaniosoma* Becker (Diptera: Chyromyidae) with descriptions of new species and a key for the identification of adults. *German Entomological Journal*. 1998; 45: 191–230.
- [49] Andrade R, Almeida J. New records of the family Chyromyidae (Diptera: Brachycera) for mainland Portugal. *Bulletin of the Aragonese Entomological Society*. 2010; 46: 146.
- [50] Carles-Tolrà M. Preliminary list of 34 families of acalypterous dipterans from Catalonia (Spain) (Diptera, Calyptrata) [Internet]. Barcelona: VIII Joint Session of Entomology; @1994 [cited 2024 Jan 05]. Available from <https://core.ac.uk/download/pdf/39032422.pdf>.
- [51] Iberfauna. Family Dryomyzidae. The Iberian fauna data bank [Internet]. Madrid: National Museum of Sciences Naturales (CSIC); @2005 [cited 2024 Jan 05]. Available from <http://iberfauna.mncn.csic.es/showficha.aspx?rank=&idtax=3741>.
- [52] Sciomyzidae. New Zealand organisms register (FOR). [Internet]. Wellington: National Biodiversity Network (NBN); @2023 [cited 2024 Jan 05]. Available from <https://www.nzor.org.nz/>.
- [53] Burger JF, Anderson JR, Knudsen MF. The habits and life history of *Oedoparena glauca* (Diptera: Dryomyzidae), a predator of arnacles. *Proceedings of the Entomological Society of Washington*. 1980; 82: 360–377.
- [54] Suwa M. Description of a new Japanese species of *Oedoparena*, an Asian-American dipterous genus (Dryomyzidae). *Insecta Matsumurana*. 1st ed. Hokkaido: Hokkaido University. 1981.
- [55] Mathis WN, Steyskal GC. A revision of the genus *Oedoparena* Curran (Diptera: Dryomyzidae; Dryomyzinae). *Proceedings of the Entomological Society of Washington*. 1980; 82: 349–359.
- [56] Prpic-Schäper NM. Family Dryomyzidae [Internet]. Giessen: Justus-Liebig University of Giessen; @2017 [cited 2024 Jan 05]. Available from <https://www.user.gwdg.de/~nprpic/webrepository/about/contact.html>.
- [57] Shovel REC. Human corpse fauna and estimation methodology of time of death. [Ph.D. dissertation]. Callao; National University of Callao Postgraduate School; 2005.
- [58] Mise KM, Souza AL, Almeida LM, Bichon CL. Survey of the insects with light and sticky traps in companies of Curitiba and the metropolitan region, Paraná State, Brazil. *Arquivos do Instituto Biológico*. 2009; 76(1): 127–130.
- [59] Thompson FC, Crosskey RW, Norrbom AL, Pape T. Family-Group names in Diptera and bibliography. Family-Group names in Diptera. 10th ed. Leiden: North American Dipterists Society by Backhuys Publishers. 1999.
- [60] Gaimari SD. One less over-the-top family? The status of *Eurychoromyia* [Internet]. Fukuoka: 6th International Congress of Dipterology; @2006 [cited 2024 Jan 05]. Available from <https://www.uoguelph.ca/nadsfly/ICD/AbstractsICD6.pdf>.
- [61] Cumming JM, Borkent A. Fly times [Internet]. Sacramento: Directory of North American Dipterists; @2001 [cited 2024 Jan 25]. Available from <https://www.uoguelph.ca/nadsfly/News/FlyTimes/issue26.pdf>.
- [62] Evenhuis NL, Pape T. Fergusoninidae. *Systema Dipteroorum*. 1st ed. Copenhagen: Natural History Museum of Denmark. 2023.
- [63] Fernandes W, Neto ET, Martin SRP. Occurrence and characterization of entomogenic galls in vegetation on the Pampulha campus of the Federal University of Minas Gerais. *Brazilian Journal of Zoology*. 1988; 5: 11–29.
- [64] Gagné RJ. The plant-feeding gall midges of North America. 1st ed. Ithaca: Cornell University Press. 1989.
- [65] Gagné RJ. The gall midges of the Neotropical Region. 1st ed. Ithaca: Cornell University Press. 1994.
- [66] Head E. Ecology of the *Fergusonina* fly and *Fergusobia* nematode gall association in South Australia [Internet]. Adelaide: University of Adelaide; @2008 [cited 2024 Jan 05]. Available from <https://digital.library.adelaide.edu.au/dspace/bitstream/2440/48390/8/02whole.pdf>.

- [67] Maia VC, Fernandes GW. Insect galls from Serra of São José (Tiradentes, MG, Brazil). *Brazilian Journal of Biology*. 2004; 64(3A): 423-445.
- [68] Taylor G, Davies K, Martin N, Crosby T. First record of *Fergusonina* (Diptera) and associated *Fergusobia* (Tylenchida: Neotylenchidae) forming galls on *Metrosideros* (Myrtaceae) from New Zealand. *Systematic Entomology*. 2007; 32(3): 548–557.
- [69] Taylor GS. Revision of *Fergusonina* Malloch gall flies (Diptera: Fergusoninidae) from *Melaleuca* (Myrtaceae). *Invertebrate Systematics*. 2004; 18(3): 251-290.
- [70] Nelson LA, et al. An emerging example of tritrophic coevolution between flies (Diptera: Fergusoninidae) and nematodes (Nematoda: Neotylenchidae) on Myrtaceae host plants. *Biological Journal of the Linnean Society*. 2014; 111(4): 699–718.
- [71] Evenhuis NL. *Catalog of the Diptera of the Australian and Oceanic Regions*. Bishop Museum Special Publication 86. 1st ed. Honolulu: Bishop Museum Press and Brill. 1989.
- [72] Scheffer SJ, et al. Phylogenetics of Australasian gall flies (Diptera: Fergusoninidae): Evolutionary patterns of host-shifting and gall morphology. *Molecular Phylogenetics and Evolution*. 2017; 115: 140–160.
- [73] Purcell MFE. Phylogeny and host relationships of the Australian gall-inducing fly *Fergusonina* Malloch (Diptera: Fergusoninidae). [Ph.D. dissertation]. Canberra: Australian National University; 2017.
- [74] Nelson LA, et al. An emerging example of tritrophic coevolution between flies (Diptera: Fergusoninidae) and nematodes (Nematoda: Neotylenchidae) on Myrtaceae host plants. *Biological Journal of the Linnean Society*. 2014; 111(4): 699–718.
- [75] Scheffer SJ, et al. Phylogenetics of Australasian gall flies (Diptera: Fergusoninidae): Evolutionary patterns of host-shifting and gall morphology. *Molecular Phylogenetics and Evolution*. 2017; 115: 140–160.
- [76] Almeida JC, et al. Taxonomic review of *Neorhinotora* Lopes 1934 (Diptera, Heleomyzidae). *Zootaxa*. 2008; 1936: 40-58.
- [77] Carvalho CJB, et al. Main Brazilian collections of Diptera: historical and current situation. In: Costa C, Vanin SA, Wolf JM, Melic A, eds. *Ibero-American Network for Systematic Biogeography and Entomology (PrIBES) Project. Monographs Third Millennium*. 2nd ed. Zaragoza: Aragonese Society of Entomology (SEA); 2002. p. 37-52.
- [78] McAlpine DK. The Australian genera of Heleomyzidae (Diptera: Schizophora) and a reclassification of the family into tribes. *Records of the Australian Museum*. 1985; 36(5): 203-251.
- [79] Oliveira FR, Geniana RG, Torres RA., Barros A. Researchers discover new species of fly in Maranhão [Internet]. Caxias: State University of Maranhão (Uema); @2023 [cited 2024 Jan 05]. Available from <https://www.uema.br/2023/10/pesquisadores-da-uema-descobrem-nova-especie-de-mosca-no-maranhao-e-homenageiam-a-fapema/>.
- [80] Calhau J, et al. Checklist of the Heleomyzidae, Neriidae and Oestridae (Insecta, Diptera) in the State of Mato Grosso do Sul, Brazil. *Iheringia, Zoology Series*. 2017; 107: e2017143.
- [81] Tepedino KP, Rung A, Kosmann C, Pujol-Luz JR. Diversity of Families of Acalyptratae (Hexapoda: Diptera) attracted by decomposing animal organic matter in the Federal District [Internet. Salvador: XXIX Brazilian Zoology Congress; @2012 [cited 2024 Jan 05]. Available from https://seb.org.br/anais2012/trabalhos/1819/1819_1.pdf.