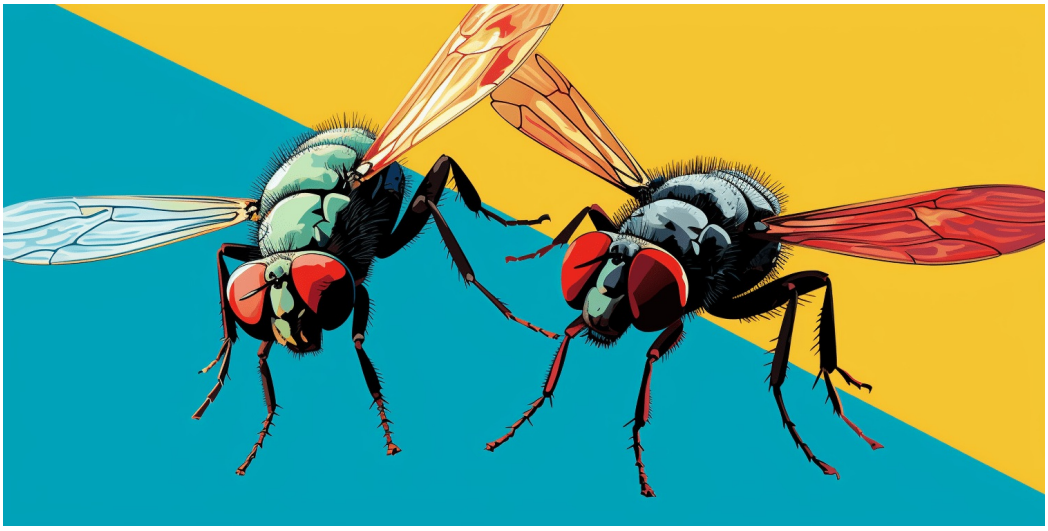

Study of four families of the suborder Brachycera (Insecta: Diptera)

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Abstract

The mini-review aims to verify the themes of the Asteiidae, Lauxiniidae, Mydidae, and Neriidae families such as morphology, biology, and systematics. In terms of the type of research source, we worked with scientific articles published in national and international journals. This modality of production, in addition to being commonly the most valued in the set of bibliographic production, is the most easily accessed. Access to articles was through virtual libraries such as Scielo (http//www.scielo.org), ResearchGate (https://www.researchgate.net/signup.SignUp.html), and SSRN (https://hq.ssrn.com/login/pubsigninjoin.cfm). Considering only this section constitutes a limitation of the study since articles belonging to journals that integrate other sections of the electronic library could also contribute to the discussion of knowledge production and the writing of interpretative syntheses of each theme.

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1. Introduction

Order Diptera are so called because the hind wings are modified in the shape of dumbbells and function only as flight stabilizers. It is a group that is present in most habitats. Diptera are distributed across all continents, including Antarctica, and have successfully colonized practically any type of habitat, especially in aquatic environments, in which the stage occurs larval [1][2].

Diptera larvae can occupy coastal marine areas and estuaries, lakes of all depths, rivers, and streams of all sizes and speeds, stagnant waters, thermal waters, wells of petroleum, and phytotelmas. It can be said that the only unexplored habitat for dipterans is the open sea. Diptera are distributed across all continents, including Antarctica, and have successfully colonized practically any type of habitat, especially in aquatic environments, in which the stage occurs larva [3][4].

They occupy different food niches and can be parasites, hematophagous, and predators, in addition to feeding on leaves, fruits, flowers, nectar, and other sugary substances. Many dipterans play an important ecological role, especially as natural enemies of various organisms. Certain species have great economic, forensic, medical, and veterinary importance [3][4].

1.1. Objective

The mini-review aims to verify the themes of the Asteiidae, Lauxiniidae, Mydidae, and Neriidae families such as morphology, biology, and systematics.

2. Methods

In terms of the type of research source, we worked with scientific articles published in national and international journals. This modality of production, in addition to being commonly the most valued in the set of bibliographic production, is the most easily accessed. Access to articles was through virtual libraries such as Scielo (http//www.scielo.org), ResearchGate ((https://www.researchgate.net/signup.SignUp.html), and SSRN (https://hq.ssrn.com/login/pubsigninjoin.cfm). Considering only this section constitutes a limitation of the study since articles belonging to journals that integrate other sections of the electronic library could also contribute to the discussion of knowledge production and the writing of interpretative syntheses of each theme.

3. Family Asteiidae

This is a worldwide family of approximately 100 described species of very small acalyptrates grouped into 10 genera. A few species have been bred from fungi, and many species are associated with trees; few are collected using generalized methods like Malaise traps. Although all but two of the 10 genera occur in the Indo-Pacific region, Fiji's known fauna has five species of just the genus *Asteia* Meigen, 1830, all but one of which are new[5][6].

3.1. Description

They are very small 2 mm or more and inconspicuous flies with several characteristics, especially in terms of wing venation. Identification of these flies at the family level requires a stereoscope or a good hand lens. The wings are transparent and have only two longitudinal veins 2 and 3 the first vein is very short and bends towards the costal vein. This feature is unique to this family (Figure 1)[7][8].

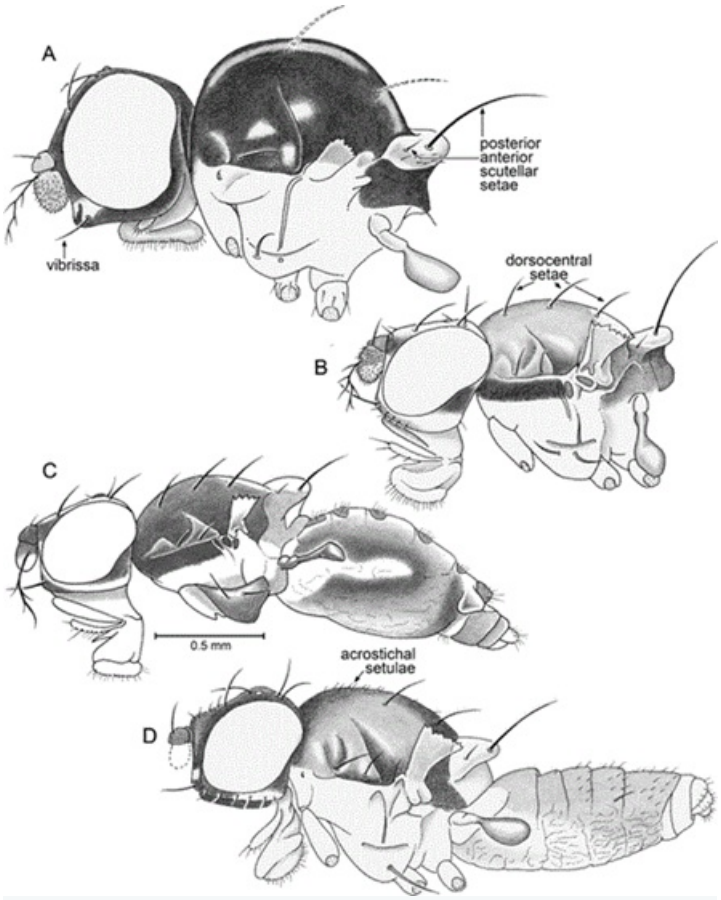

Figure 1. Portions of the left lateral habitus of Fiji *Asteia* (Asteiidae) (to the same scale). **A.***A. rotundiscuta*, n. sp. **B.***A. pleurovitta*, n. sp. **C.***A. pleurovittata*, n. sp. **D.***A. nigriceps* Bezzi.

Sources: *Asteia nigriceps* Bezzi, 1928: 160; Sabrosky, 1957: 37 (discussion), 1989 (catalog) and American Museum Novitates, 2009(3671):1-59 (2009). https://doi.org/10.1206/685.1.

A similar, but not identical, feature is found in some Chloropidae. Other features of members of this family include a thorax that is generally black or light brown and highly polished, and an abdomen with slender, dark-spotted tergites arranged in pairs. Males have headbands across the forehead [7][8].

3.2. Biology

Adults can be captured with Malaise traps set within the forest, but the best way to obtain specimens is when they are found congregating. At these sites, one can easily capture the adults with the vacuum cleaner. Adults are often found on flowers and low vegetation but have been collected from indoor windowsills and tree wounds. In one genus *Leiomyza* Macquart, 1835, adults are found on mushrooms and bracket fungi[7][8].

Adults of the species *Astiosoma rufifrons* Duda, 1927 are attracted to wood ash after bonfires, especially at dusk. The biologies of the larvae are unknown, but adults have been reared from fungi (*Leiomyza*), *Cannabis sativa* L. (Cannabaceae) stems, flower buds, and dried cane stems. The larvae may be scavengers on the excrement of other insects[9][10].

3.3. Taxonomy

There are only 2 genera and 8 species reported for Costa Rica (antenna, expanse, and spinosa). Most of the small groups of calyptrate flies with delicate individuals have been taxonomically neglected, and it is difficult to estimate their true diversity in Costa Rica[9][10][11].

Subfamilies: Asteiinae and Sigaloessinae.

4. Selected Manuscripts

4.1. Study 1

Occurrence of Asteiidae in the Gemer area, in the Muránska Planina National Park in 2013[12][13].

Asteia amoena Meigen, 1830.

Leiomyza dudai Sabrosky, 1956.

Leiomyza scatophagina (Fallén, 1823)

Asteia concinna Meigen, 1830.

Asteia amoena Meigen, 1830[14][15].

4.2. Study 2

A parasitological examination of sturgeons of the family at the external examination of an Amur sturgeon*Acipenser schrenckii* Brandt, 1869 (Pisces: Acipenseriformes; Acipenseridae) with a body length of 40 cm by Smith a small wound closed with skin was found on the ventral side of the body at the base of the 8th scute of the ventral row. After dissecting the wound an imago *Leiomyza scatophagina* (Fallen, 1823) was extracted.

According to unpublished information from ichthyologists and fishermen, juvenile sturgeons, to which this specimen belonged, typically keep in shallow waters, unlike adults. A slight injury of soft tissue was seen at the base of the scute that could allow the fly to put its egg. This is most probably a case of facultative myiasis, a disease caused by the invasion and activity of larval and adult arthropods in the tissues and cavities of human or animal organisms.

Larvae's ability to exist in decomposing organic materials predetermined the development of larval parasitism in flies. Many species, for which necrophagy is typical, can use not only meat and corps but also festering wounds on a human or animal's body as a substrate for oviposition. In most cases, larvae do not come out of the boundaries of the wound and do not damage the intact tissues of the host animal.

They consume purulent exudate and dead tissues and do not differ much from their free-living congeners. The Asteiidae Family includes about 100 species of 11 genera described in the world fauna. These are minute to small 1.0-3.0mm, delicate, often weakly sclerotized flies. Three genera and about 10 species are recorded from Russia. Two species of the genus *Asteia* are known from the Russian Far East. Biology is poorly known. The European species of Asteiidae belong to two, ecologically different groups. *Asteia* species are saprophagous as larvae *Leiomyza* spp. have mycetophagous larvae developing in the sporocarps of fungi and occur chiefly in woodland [16][17].

5. Familia Lauxaniidae

The Lauxanioidea are a superfamily of flies that includes the two large families, the Lauxaniidae and Chamaemyiidae, and the small family Celyphidae. Generally, they are small to medium, densely populated, colored flies. The Chamaemyiidae live as parasites on insects. The family Celyphidae looks like beetles. Larvae of most Lauxaniidae and Celyphidae feed on decaying vegetation. Some species of Lauxaniidae only occur in bird nests. Adult lauxaniids may visit flowers. Larvae of all known Chamaemyiidae have a rather different lifestyle: they are predators of aphids and scale insects. The Lauxaniidae constitute one of the largest families of Diptera Schizophora, with worldwide distribution, very abundant in tropical areas, and absent in the Antarctic region [18][19][20].

5.1. Description

Lauxaniids range from small to medium in size, 1.5 to 8.0 mm. Their bodies are variously marked and colored. Varying from pale yellow to brown, gray, or black, sometimes with mingling or dark spots. The wings are usually yellowish, but there may be spots or dark areas. The head is spherical, but very projecting anteriorly in the species of some genera. Some species have impressively colored eyes in life (Figure 2)[21][22][23].

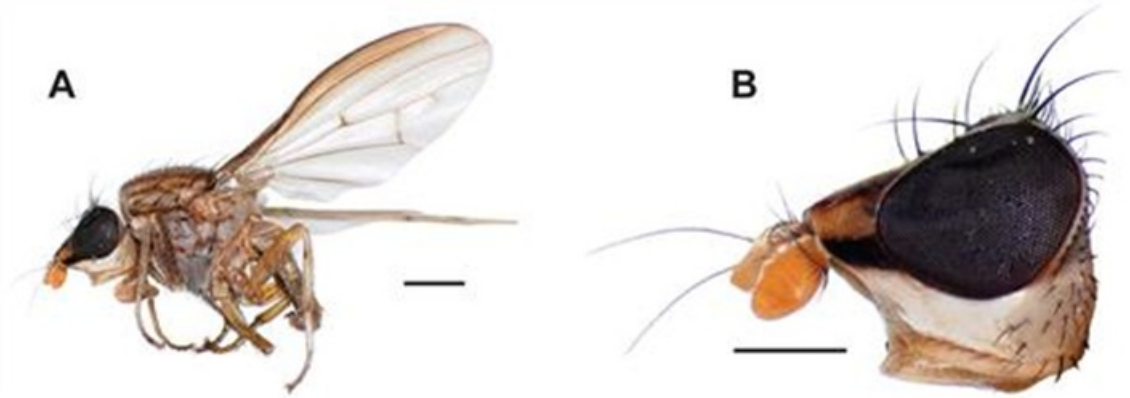

Figure 2. fig. 8 *Proteaphila stuckenbergorum* sp. n., ♂: (A) habitus image showing fumose wings; (B) head, lateral view.
Sources: African Invertebrates, 53(2):615-636 (2012) https://doi.org/10.5733/afin.053.0201

The antennae are normally short, but a group of genera has very long antennae. The thorax is normally matte. The abdomen is ovoid, rarely thin. The family can be recognized by the convergence of the postocellar setae, the presence of 2 front orbital setae, the absence of vibrissae, and wing venation with a complete costal vein, a complete subcostal vein, and a short anal vein, not extending to the wing margin [24][25][26].

5.2. Biology

Adult Lauxiniidae is sedentary and like shaded places. They can be found in a wide variety of environments such as grasses, flowers, compost capitula, and low foliage, mainly in humid forests near streams and swamps. It was observed that they are more active at the end of the afternoon and, therefore, are easier to collect during this period. Many adults are scraper fungi found on leaves [27][28][29].

The larvae of the family feed on decaying plant matter. In the temperate region, larvae of most species are saprophagous, living on fallen leaves and other decaying plant material. There are few records regarding the biology of Neotropical Lauxaniids, and immature stages that have not been described [30][31][32].

Larvae in this family are primarily saprophagous, commonly found in fallen leaves, rotting wood or straw, decaying vegetation, and bird nests. Some species are known to be phytophagous and have been reported on roots, stems, and leaves of clover, on galls on the ovaries of violets, and on pseudo leaves of cacti [33][34][35].

5.3. Biological cycle

The complete cycle from egg to adult can take from 16 to 96 days in the Nearctic region. Eggs are laid on individual leaves among the fallen leaves of the mulch. The eggs hatch in 2-3 days into first-instar a larva. There are 3 larval instars, and generally, the younger instars penetrate the leaf tissues and burrow as leafminers. The more advanced stages can do the same but are more often found outside the leaves. The formation of the puparium can occur inside the leaf, or the same larva can be covered with a calcareous secretion before forming the puparium; the secretion appears to originate from the tubules [36][37][38].

5.4. Habitat and Distribution Geographic

Adults of most species prefer moist, shady habitats. Many species can be found visiting flowers. They are commonly found on low vegetation and become increasingly active in the late afternoon and early morning. Some species are attracted to light, to baits with decaying fruit or meat. They can be reared using a jar covered with nylon cloth and with honey and brewer's yeast as food for the adults. Leaves from mulch, decaying lettuce, and tree leaves can be used for larvae [39][40][41].

The Lauxiniidae with distribution in all the main biogeographical regions of the world. The neotropical Lauxiniidae ten shared with the Nearctic region, and four are widely distributed and found in other regions. This review of the Neotropical genera indicated the existence of this region [42][43].

5.5. Taxonomy

The family of Acalyptrate dipterans, Lauxaniidae, is one of the largest of the division Schizophora. The Lauxaniidae is composed of about 142 genera and approximately 1550 species, with distribution in all the main biogeographical regions of the world. The neotropical Lauxaniidae is composed of 32 endemic genera, shared with the Nearctic, and four widely distributed found in other regions. The family comprises three subfamilies, Lauxaniinae, Homoneurinae, and Eurychoromyiinae [44][45][46][47].

6. Selected Studies

6.1. Study 1

The objective was to characterize the Diptera fauna in the upland fragment of the 1st Infantry Battalion in the Jungle - Manaus, Amazonas, in the dry and rainy periods.

The collections were made in September and October 2017, comprising the least rainy period in this region, and in February and March 2018, comprising the rainiest period. The specimens were collected in in-flight interception traps (passive collections: two Malaise and two Suspended (1m)) that remained in the field for seven days of each month.

During the dry and rainy season 1379 dipterans of the Brachycera suborder were captured and divided into 28 families, which are: Agromyzidae (1), Calliphoridae (2), Chloropidae (14), Clusiidae (5), Drosophilidae (138), Dolichopodidae (203), Ephydridae (25), Hybotidae (10), Lauxaniidae (32), Lonchaeidae (5), Micropezidae (27), Milichiidae (39), Muscidae (20), Neriidae (3), Periscelididae (10), Phoridae (463), Richardiidae (9), Ropalomeridae (4), Sarcophagidae (45), Sepsidae (8), Syrphidae (11), Sphaeroceridae (175), Stratiomyidae (64), Tabanidae (12), Tachinidae (25), Ulidiidae (26), Xylomyidae (3).

The collections in the dry period were less abundant in relation to the rainy period 455 and 920, respectively, possibly due to the increase in rainfall causing a greater presence of wild fruits in the process of fermentation, with the most abundant families in traps decomposing matter organic as Phoridae, Sphaeroceridae, and Drosophilidae.

Lauxaniidae is one of the largest families of Diptera Schizophora, with a very abundant distribution in tropical areas, and is composed of about 1,550 species, but the Brazilian fauna comprises a smaller number of species, about 106, divided between 39 genus. Adults have a small to relatively large body 2-11 mm, with varying coloration, often with markings, spots, stripes, or reticulated patterns. The larvae of these families are known as saprophagous, feeding on a variety of decaying plant matter and even on flower heads. Adults are leaf fungus scrapers [48][49].

6.2. Study 2

The general objective of this study was to generate scientific knowledge about the pest and beneficial insects associated with guava in Honduras. This information may be used by national producers in the design of a better agronomic and phytosanitary management plan for this crop.

The total abundance of insects in the three sampling methods was 13,568 insects, being the Pitfall trap where was captured with the highest number of insects at 5,670, followed by the McPhail trap with 5,413 insects, and finally the observation method with 2,485 insects. Pitfall and McPhails traps are effective for capturing insects, since a good number of them were caught using this type of trapping; it is reported that visual observation is not as effective for stopping several insects.

Quarantine families were collected of insects associated with guava; in addition, 10 types of feeding habits of insects were reported most abundant families were Muscidae, Lauxaniidae, Tephritidae, Apidae, and Formicidae Shannon-Weaver diversity index, a diverse fauna is considered when it is above an index of 2 upwards with a maximum of 5. In this study, low diversity indices result in an average of 1,061, which indicates that the entomofauna in guava is low [50].

6.3. Study 3

The Acalyptrate Diptera, although they do not form a natural group, share some characteristics, such as the reduction or absence of the calyptra, the absence of the longitudinal suture in the pedicel, and the incomplete suture of the thorax. Within the Muscomorpha, they were once considered a sister group to the Calyptrate however, more recent evidence has indicated their paraphyly.

The “acalyptrates” have a worldwide distribution and a great diversity of habits and forms. The are a total of approximately 80 families in the world, with many species. Some families are very numerous, such as Agromyzidae, Drosophilidae, Chloropidae, Ephydridae, Lauxaniidae, and Tephritidae galleries which together represent more than 50% of the species in this group. The biology and ecology of these dipterans are quite varied and can be miners, aquatic, predators, and saprophagous.

As a result, a total of 10 families were found, with the following diversity: Agromyzidae, Chloropidae, Drosophilidae, Ephydridae, Lauxaniidae, Neriidae, Milichiidae, Sepsidae, Chyromyidae, and Sphaeroceridae. The most numerous in terms of the number of specimens collected were and Drosophilidae. Some families collected have great economic, agricultural, medical, and veterinary importance.

The Agromyzidae, for example, for having the biology of their immature phase related to plants, being miners of leaves, stems, and fruits, are considered pests, since they interfere with the development of the plant, compromising its commercial interest. The larvae of most species of Chloropidae feed on grass stems and are serious pests of cereals. Some chloropids, which grow in decaying vegetation and droppings, are attracted to animal secretions, particularly the eyes. That's why they are called "eye-lickers". They can act as vectors of yaws and conjunctivitis.

Drosophilidae is known as vinegar flies and are often domestic pests on fruit present, and some species are ectoparasites. The Ephydridae has aquatic or semiaquatic habits they are found in rivers, water collections, and seas. The Lauxaniidae have saprophagous larvae and are possible consumers of microorganisms, fungi, bacteria, and yeasts. About the Neriidae family, there is no knowledge of the immature stage it is only known that the adults feed on tree excrement and rotten fruits.

The Milichiidae have some species that are kleptoparasites and therefore steal food captured by other animals. Sepsidae is called "black cleaner flies" and some species can be found on the face of mammals; the larvae feed on various decaying materials. Chyronomyidae larvae are apparently saprophagous, occurring in a series of substrates. They are found in vegetation of saline areas, mainly beaches. The larvae of the Sphaeroceridae family are microbial herbivores, found in environments rich in bacteria [51].

7. Family Mydidae

Mydidae is a relatively small group of Asiloidea (Diptera) that comprise the largest flies in the world, and little is known about the nature of adults; males visit flowers occasionally and females are unlikely to feed. The Mydidae constitute a family of orthorrhaph flies, which includes the largest known dipterans. These are dipterans medium to large size 9 – 60 mm. Its orange, black, and white colors shimmered in the rays of sunlight [52][53].

7.1. Description

The Mydidae family presents the following apomorphic characters: simple subgenera or with a wide median projection, maxillary palp with a segment, commonly reduced and without pit, which differs from *Anomalomydas* Papavero & Wilcox,1974, proprecoxal bridge present, reduced macrosetae on the shield and escutcheon or absent, males with tergum 8 with deeply (Figure 3).

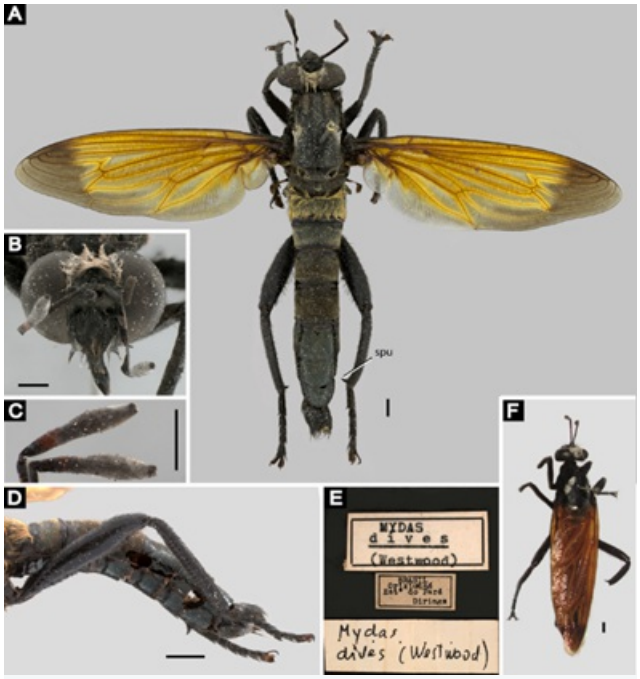

Figure 3. *Gauromydas papaveroi* sp. nov. A–E: male holotype (MZUSP). A dorsal habitus; B, head, frontal view; C, antennae, inner surface; D, hind leg; E, labels. F, female paratype, dorsal habitus (INPA).

Source: https://www.researchgate.net/figure/Gauromydas-papaveroi-sp-nov-A-E-male-holotype-MZUSP-A-dorsal-habitus-B-head_fig3_284748600

concave posterior margin (except in *Syllegomydas* Becker, 1906), hypandrium fused to the gonocoxytes or absent, gonostyles absent, aedeagal apodemes absent, and tergum 9 of females extending ventrally to the middle of the acanthophorites.

The proboscis is little developed or even vestigial and the antennae are long, ending in the shape of a club. They have an elongated body, sparsely hairy, generally dark, dull, brown to blackish in color. The bristles are developed only on the paws. In the wings, the veins end before reaching the tip, with which, in general, the posterior alar margin does not or almost does not present veins [54][55][56][57].

7.2. Biology

Larvae of several species of Mydidae feed on immatures of Coleoptera and can be found in nests of *Atta* spp. (Zikán, 1942) and *Acromyrmex* spp. ants. Adults are suggested as being flower visitors, but the biology of most species is still unknown. *Gauromydas heros* (Perty, 1833) males visit flowers, but adult females were not recorded visiting flowers and might not feed. Mydidae species are rarely sampled and seen in the field [58][59][60][61].

Most adults live in open, generally hot, arid, sandy habitats. The measured ones move quickly over the sand, running backward so easily like forwards, and they are fast fliers. The males feed on nectar, while the females, it seems. They

feed on body reserves. The belief that they are predators does not seem to be true since the mouthparts seem to be indicated to suck nectar from flowers and not for predation. The larvae, meanwhile, are predators of beetle (Coleoptera) larvae in stumps and ants (Hymenoptera)[61][62][63].

Floral-visiting Diptera family and food adaptations. The proboscis structure is short and thick, some stunted and others elongated. Adult feeding: Most of them feed obligatorily on flowers. Feeding of the larvae: predators of the soil [61][62][63].

7.3. Habitat and Geographic Distribution

They are found in desert or semi-desert areas, with some species in forests being richest in Afrotropical species, followed by Nearctic, Neotropical, Palearctic, Australian, and Eastern, in that order of richness. Cuba, Venezuela, Colombia, Chile, Argentina, Brazil, Mexico, North Africa, specifically from Morocco, Algeria, Tunisia, Egypt, and Europe [64][65][66].

7.4. Taxonomy

With more than 360 species, this family is known from all biogeographical regions, South Africa and South America being the areas with greater diversity. As for Europe, until now, only six species were known, of which two have been cited from the Iberian Peninsula, specifically two from Spain and one from Portugal. Mydidae is divided into nine subfamilies, three of them occurring in Brazil: Apiophorinae, Rhopaliinae, and Mydinae [67][68][69].

Familia Mydidae: Subfamilia Leptomydinae and Syllegomydinae[70][71][72][73].

8. The following study were selected

8.1. Study 1

Biology of the Family Mydidae

Little is known about their biology, although Zikan reported that *Gauromydas heros* (Perty, 1833) larvae live in subterranean "trays" of *Atta* sp. ant detritus in southern Brazil, where they appear to feed on detritivorous larvae of Dynastinae (*Coelosis* spp.). In the United States, *Mydas brunneus* Johnson, 1926, *Mydas clavatus* (Drury, 1773), and *Mydas tibialis* Wiedemann, 1831, larvae are predators of beetle larvae (*Osmoderma* spp.) which feed on dead wood and can be found on standing and fallen trees with extensive heart rot. Others *Mydas maculiventris* (Westwood, 1835) are subterranean and feed on "white grubs" Scarabaeidae: genus *Phyllophaga* Harris 1827), that attack grass roots and could be potential biological control agents for white grubs in turf production areas).

The larvae usually take two to three years to mature. Adults of several species are avid visitors to flowers and act as pollinators. Rattlesnake master *Eryngium yuccifolium* (Rattlesnake Master) (Apiaceae) is a favorite nectar source in the Midwest. They are found infrequently as the adult life expectancy can be quite short [74].

8.2. Study 2

Mydidae Family

The larvae usually live in loose, dry soil, sometimes in decaying wood, and develop by attacking juvenile stages of other insects, usually beetles. Pupation takes place below the surface of the soil, and at the end of the nymph stage, the adult, in the farata phase, emerges to the surface to seek the warmest hours. Adult males are glyciphagous and feed by sucking nectar from flowers, or do not feed due to atrophy of the mouthparts. Females do not feed and, to perform reproductive functions, exploit the adipose reserves accumulated in the abdomen during post-embryonic development. The typical habitat is represented by open ecosystems with a hot and arid climate, therefore, Mydidae are mainly found in the deserts and steppes of tropical and subtropical regions. Several species have adapted in every way to colonize wetter environments, such as the rainforest [75][76].

Pharate phase

Stage of post-embryonic development between molt and cuticle detachment. The individual in the farata form has already completed its development but remains within the cuticle of the previous stage. In Diptera, there are pharate forms:

1. The first-age larva during the end of incubation, surrounded by the embryonic cuticle.
2. The larvae of the penultimate and last stage, surrounded by the cuticle of the previous stages.
3. In Cyclorrhapha, the pupa, enclosed in the puparium, formed by the sclerification of the cuticle of the last larval stage.
4. In some primitive groups, the adult during the completion of the pupal phase, surrounded by the pupal cuticle.

Note: Pharate phase , which is a kind of “mobile pupa” it and, after exiting the cocoon, attaches to the substrate and performs the last ecdysis, giving rise to the adult insect [75][76].

9. Family Neriidae

9.1. Nerioidea is a superfamily of Acalyptratae flies

As flies, Nerioidea undergo complete metamorphosis with the four life stages of egg, larva, pupa, and adult. The adult stage has three body segments head, thorax, and abdomen three pairs of legs, and one pair of wings.

Some features that distinguish adult Nerioidea from other flies are a face that's usually weakly sclerotized (except in Fergusoninidae), antenna usually porrect or slightly deflexed (elbowed in Tanypezidae), wing veins R2+3 and R4+5 usually convergent, and the wing anal cell usually much smaller than the subcostal cell.

Most Nerioidea is associated with dead and decaying organic matter such as dead wood, rotting fruit, and bat dung. On the other hand, Fergusoninidae form galls in plants of the family Myrtaceae, and some Micropezidae have larvae that are predatory or agricultural pests [77][78][79].

9.2. Description

Morphologically, the Neriidae are medium to large-sized flies 5-20 mm with a peculiar appearance. They can be distinguished from others the head flattened dorso-ventrally, generally longer than wide; anteriorly projected forehead and face; absence of ocellar bristles; absence or reduction of vibrissa; antenna extended forward; pedicel (Figure 4)[80][81][82][83][84].

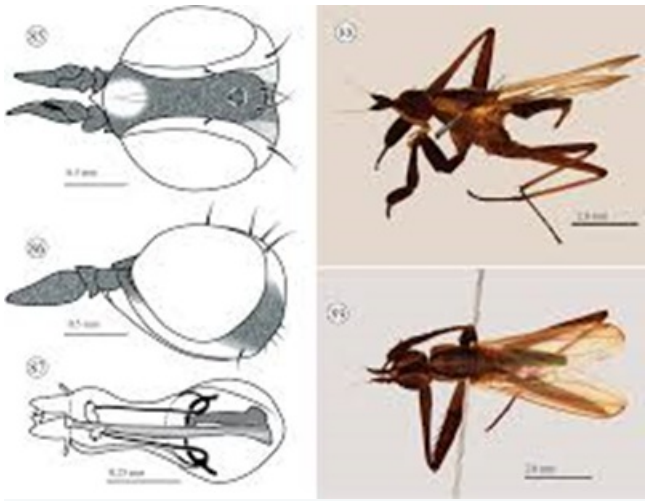

Figure 4. figs 11–17. Morphology of *Telostylus babiensis* Meijere, 1916. 11–14 – specimen NHMUK #1958, female: 11 – head laterodorsal; 12 – head lateral; 13 – thorax lateral; 14 – thorax dorsal. 15–17 – male ectotype (photographs of Pasquale Ciliberti, RMNH): 15 – habitus dorsal; 16 – habituslateral; 17 – labels. Sources: doi: 10.14411/eje.2019.032 and https://www.eje.cz/pdfs/eje/2019/01/32.pdf

with a finger-like process on the inner face, extending through the flagellum; apical or dorso-apical arista; reduced thoracic chaetotaxy and bristles, when present, always short except for some Old-World genera and wing elongated, with R4+5 and M converging; legs long and thin, commonly with rigid bristly spines on the ventral region of the femur and epandrium elongated and flexed under the abdomen [85][86][87][88].

9.3. Biology

The biology of the Neriidae Family is little known, but it occurs in arid areas of the Nearctic and Neotropical regions being adults and larvae commonly found in cacti of various genera and species hence deriving the popular name 'cactus flies. The larvae develop in the necrotic tissues of cacti, probably feeding on fungi responsible for organic decomposition.

Larvae reared in nutrient-rich substrates exhibit greater body size as adults, and males have more elongated bodies, compared to flies reared in nutrient-poor substrates. The expression of male secondary sexual traits is particularly sensitive to the protein content of the larval.

All other Neriidae probably feed on other decaying plant organic tissues, such as plant resins and fruit secretions, and more rarely on animal manure and organic matter. Some species were observed on freshly felled trunks and branches, in galleries of wood saw beetles (Coleoptera, Cerambycidae), while others may be associated with human crops, such as squash, cotton, banana, gourd, and papaya. Some species have high rates of synanthropy, being attracted by cooking odors and becoming common inside homes. Some species are used for behavioral and sexual selection studies [89][90][91][92].

Males of some species engage in spectacular fights over territory or access to females. Rivals raise their bodies to an almost vertical posture and hit each other with the ventral surfaces of their heads, hit each other with their front paws, or attempt to get each other into a headlock.

Males of *Derocephalus angusticollis* Enderlein, 1922, participate in fights over territories and females and guard favorable locations for oviposition and with females laying eggs. Adult neriids try to stay close to plants constantly, avoiding open places. Are reluctant to fly, preferring to run with their long legs through the expanses of vegetation in which they shelter. Observed specimens of *Odontoloxozus longicornis* (Coquillett, 1904) in phoretic association with pseudoscorpion they common in cacti [93][94][95][96]

9.4. Taxonomy

Neriidae comprises 106 species distributed in 19 genus, distributed throughout all tropical regions of the world, with few exceptions.

The subfamilies: Gymnonerinae and Neriinae.

Tribes: Indonesicesini, Paranerini, Telostylini, and Neriini.

Genus: *Cerantichir* Enderlein, 1922, *Derocephalus* Enderlein, 1922*, Glyphidops* Enderlein, 1922, *Nerius* Fabricius, 1805*, Odontoloxozus* Enderlein, 1922, and *Telostylinus* Enderlein, 1922 [97][98].

Species of Neriidae: *Glyphidops filosus* (Fabricius, 1805); *Glyphidops ocherus* Henning, 1937; *Glyphidops etele* Aczél, 1961; *Glyphidops carrerai* Aczél, 1961; *Glyphidops dubia* Henning, 1937; *Glyphidops limbata* (Enderlein, 1922); *Glyphidops neutra* Henning, 1937; *Glyphidops dura* (Cresson, 1926); *Glyphidops falvifrons* (Bigot, 1886); *Nerius czernyi* Aczél, 1961; *Nerius wool* Aczél, 1961; *Nerius pilifer* Fabricius, 1805 [99][100][101].

10. Manuscript Selected

10.1. Study 1

Neriidae species are known in Australia.

Telostylinus angusticollis Enderlein, 1922 also known as *Derocephalus angusticollis* Enderlein, 1922 [102][103].

Telostylinus angusticollis individuals that are reared on a nutrient-poor larval diet develop into adults with little or no sexual dimorphism in body size or shape. [104][105].

Neriidae species are known in Brazil.

For the Northeast region, two species were recorded, one for the Caatinga of Bahia and another for Alagoas (Maceió) and Bahia.

Glyphidops Enderlein, 1922.

Distribution. **Some countries and areas**: Argentina (Tucumán), Brazil (Acre, Amapá, Amazonas, Bahia, Espírito Santo, Mato Grosso, Minas Gerais, Pará, Paraíba, Paraná, Rio de Janeiro, Rondônia, Roraima, Santa Catarina, São Paulo), [106][107].

Glyphidops carrerai Aczél, 1961

Distribution. Brazil (Amazonas, São Paulo, Pará, Paraíba), Colombia, and Guyana.

Glyphidops filosus (Fabricius, 1805)

Distribution. Argentina (Chaco, Corrientes, Jujuy, La Rioja) and Brazil (Bahia, Paraíba).

Nerius Fabricius, 1805.

Distribution. Some countries and areas: Argentina, Bolivia, Brazil (Acre, Amazonas, Bahia, Goiás, Mato Grosso, Pará, Paraíba, Rio Grande do Sul, Rondônia, São Paulo, Tocantins), Colombia, Costa Rica, El.

Nerius pilifer Fabricius, 1805

Distribution. Some countries and areas: Argentina (Chaco, Corrientes, Jujuy, Misiones, Tucumán), Bolivia, Brazil (Acre, Amazonas, Bahia, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, [108][109][110][111].

10.2. Study 2

Update of the species present in the state of Chiapas-Colombia.

Four of the species represent new records for the state of Chiapas, while two species are recorded for the first time in Mexico.

Cerantichir enderleini Henning, 1937

Distribution: Costa Rica. It is registered for the first time in Mexico.

Glyphidops filosus (Fabricius, 1805)

Distribution: Guatemala, Honduras, Costa Rica, Panama, Colombia, Venezuela, Guyana, Suriname, Ecuador, Peru, Brazil, Bolivia, Montserrat, Trinidad. It is registered for the first time in Mexico [109][110].

Glyphidops flavifrons (Bigot,1886)

Distribution: United States, Mexico (Baja California, Sonora, Tabasco, Veracruz), Honduras, Nicaragua, Costa Rica, Panama, Trinidad and Tobago, Colombia, Guyana, Ecuador, Brazil, and Bolivia. It is reported for the first time in the state of Chiapas[109][110].

Nerius pilifer Fabricius, 1805

Distribution: Mexico (Tabasco), Nicaragua, Costa Rica, Panama, Guyana, Suriname, Haiti, Colombia, Venezuela, Ecuador, Paraguay, Peru, Bolivia, Brazil and Argentina. It is reported for the first time in the state of Chiapas.

Nerius plurivittatus Bigot, 1886

Distribution: Mexico (Veracruz), El Salvador, Panama, the Dominican Republic, Trinidad, Guyana, Venezuela, Colombia, Brazil, Peru, Bolivia, and Argentina. It is reported for the first time in the state of Chiapas.

Odontoloxozus longicornis (Coquillet, 1904)

Distribution: United States, Mexico (Baja California, Baja California Sur, Guanajuato, Morelos, Oaxaca, Puebla, Querétaro, San Luis Potosí, Sinaloa, Sonora and Costa Rica. It is reported for the first time in the state of Chiapa [111].

10.3. Study 3

Entomology Forensic

In this paper, we report four families of Diptera (Micropezidae, Neriidae, Sepsidae, and Ulidiidae) and one family of Coleoptera (Hydrophilidae) as insects associated with pig carcasses for the first time in Peninsular Malaysia.

A total of three pig carcasses, weighing about 10kg each were used in simulating different manners of death, including burnt, hanged, and placed on the ground (as control). The first day of placement was counted as Day 1, and the observation was continued until Day 14. Along the decomposition process, we counted and collected some dipterans in the family Micropezidae, *Mimegralla albimana* Doleschall, 1856; Neriidae, *Telostylinus lineolatus* (Wiedemann, 1830); Sepsidae, *Allosepsis indica* Wiedemann, 1824; and Ulidiidae (*Physiphora* sp.).

The Neriidae adults are usually found on certain cacti, flowers, and rotting vegetables, and the larvae breed in decaying cacti or fruits. In our study, *T. lineolatus* was found on decaying pig carrions and the population increased during the early decay stage and the dry stage of decomposition [112][113][114][115].

11. Conclusion

The families Asteiidae, Lauxaniidae, Mydidae and Neriidae fell into the group of adventurers, as they arrived at the carcasses as visitors and fed on the dripping fluid. In this work we highlight the presence of opportunistic insects associated with pig carcasses. Insects associated with corpses are divided into four categories: scavengers, predators, omnivores and adventurers.

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