https://doi.org/10.53964/jmab.2023016

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Journal of
Modern Agriculture and Biotechnology

ISSN 2788-810X (Online)

Open Access

MiniReview

Family Perilampidae (Insecta: Hymenoptera) as Parasitoids of Ants (Hymenoptera: Formicidae) and Other Insects

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Received: April 8, 2023 **Revised:** May 15, 2023 **Accepted:** June 21, 2023 **Published:** August 1, 2023

Abstract

Species in the family Perilampidae are parasitoids of Lepidoptera, Diptera (Tachinidae) Coleoptera, Hymenoptera, Neuroptera, Orthoptera and Raphidioptera. Most are primary parasitoids of beetles (Anobiidae and Platypodidae) and ants (Hymenoptera: Formicidae). In some species, the egg is deposited on the foliage and the larva is of the planidium type. It mounts a member of the secondary host species and eventually parasitizes the parasitoid of the larvae. The family has a cosmopolitan distribution, with about 250 described species and 12 genera. In the Neotropical region, there are 4 genera, with about 30 species: *Perilampus* (25 species), *Burksilampus*, *Euperilampus* and *Crysolampus*. The aim of the manuscript is to increase the knowledge of the family Perilampidae (Insecta: Hymenoptera). The bibliographic verification of Perilampidae was carried out from 1978 to 2022. Manuscripts published in scientific journals and digital platforms on the subject were examined. This paper expands the knowledge of the bionomy of Perilampidae.

Keywords: beetles, digital platforms, primary parasitoids, scielo, tachinidae

Citation: Marchiori CH. Family Perilampidae (Insecta: Hymenoptera) as Parasitoids of Ants (Hymenoptera: Formicidae) and Other Insects. *J Mod Agric Biotechnol*, 2023; 2(3): 16. DOI: 10.53964/jmab.2023016.

1 INTRODUCTION

The Perilampidae are a small family within the Chalcidoidea, composed mainly of hyperparasitoids. The family is closely related to the Eucharitidae, and the eucharitids appear to have evolved from within the Perilampidae, making the family paraphyletic (Figure 1A-E)[1].

1.1 Description

Diagnostic characters: Jaws deep and robust, crossed when closed, left with 3 teeth, right with 2 teeth; antenna with 13 articles, 1st ringed flagellomere; clypeus separated from the rest of the rostrum by sutures; compact, short and tall mesosome in lateral view; full noteaulice; triangular metasoma in lateral view, terga 2 and 3 fused dorsally; Ovipositor sheath slightly exposed. They are black or metallic luster and measure from 1.0 to 12.0mm (Figures 2-6)[1-4].

1.2 Biology

Eupelmidae, with approximately 850 species and 45 genera, are ectoparasitoids of larvae or prepupae of insects hidden in plants, which may be endoparasitoids of spider oothecae. Perilampidae share is that the first

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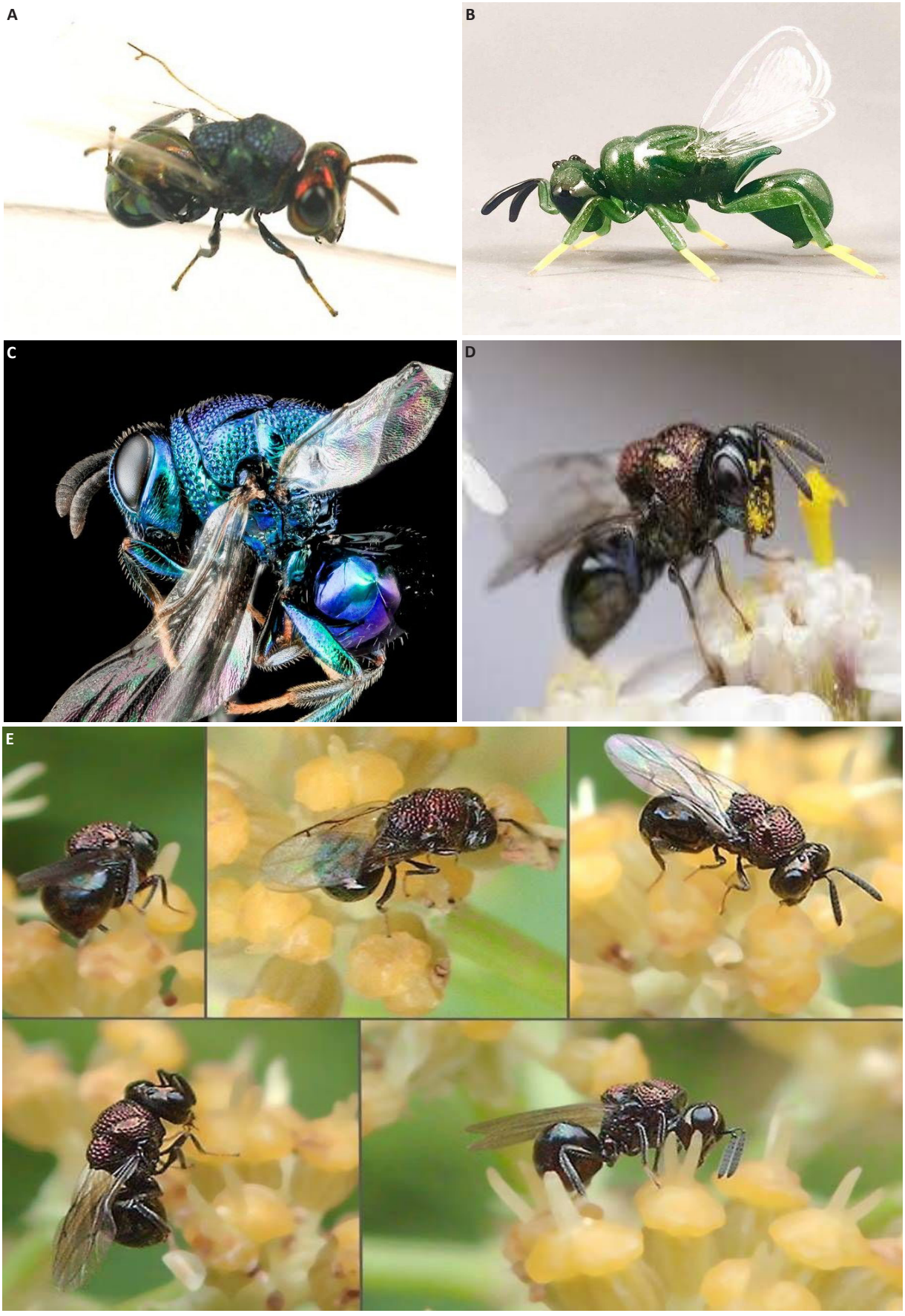

Figure 1. Specimens of Perilampidae family. A: *Perilampus;* B: Perilampidae wasp; C: Perilamids wasp; D: Chalcid wasp; E: A small parasitoid wasp of the genus *Perilampus* feeding and pollinating. Sources: https://bugguide.net/node/view/966335, https://www.picuki.com/tag/perilampidae, https://www.biodiversity4all.org/taxa/203268-Perilampidae, https://alchetron.com/Perilampidae and https://www.biodiversity4all.org/photos/1119729

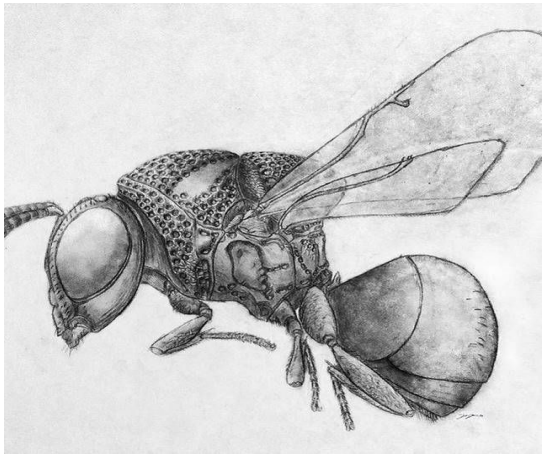

Figure 2. My illustration of *Perilampus* sp. (Perilampidae). Source: https://www.picuki.com/tag/perilampidae

larval stage is a planidium with the function of finding a host to parasitize. That is, they have a complex metamorphosis, called hypermetamorphosis. On the plants in which these individuals occurred, *Myrcia bella* Cambess (Myrtaceae) and *Pera glabrata* (Schott) Poepp. ex bail. (Peraceae) species of Curculionidae (Coleoptera) were also found preying on their seeds and which are probably their hosts. It is a hyperparasitoids of the Braconidae family (Figures 7-12)[4-11].

1.3 Taxonomy

The family has a cosmopolitan distribution, with about 250 described species and 12 genera. In the Neotropical region, there are 4 genera, with about 30 species: *Perilampus* (25 species), *Burksilampus*, *Euperilampus* and *Crysolampus*.

Subfamilies include Chrysolampinae, Perilampinae and Philomidinae (Figures 13 and 14).

1.4 Some Species

Euperilampus beharae (Risbec, 1952) (Madagascar) and *Euperilampus hymenopterae* (Risbec, 1952) (Madagascar). Biology: Hyperparasitoid through Ichneumonidae. *Krombeinius lerouxi* Rasplus, 1987 (Figures 15-17)[12-19].

1.5 Objective

The aim of the manuscript is to increase the knowledge of the family Perilampidae (Insecta: Hymenoptera).

2 METHODS

To this end, a bibliographic survey of Perilampidae was carried out in the years 1972 to 2022. Only complete articles published in scientific journals and expanded abstracts presented at national and international scientific events. Data were also obtained from platforms such as: Qeios, Pubmed and Scielo (Marchiori, 2021)[18].

Figure 3. Perilampidae wasp borosilicate glass sculpture (A and B). Source: https://www.picuki.com/tag/perilampidae

3 STUDIES

3.1 Study 1

3.1.1 Parasitoids and Other Natural Enemies of Ants

Specimens of the Perilampidae family have between 1 and 12mm in length, with dark that can be metallic to black, and wings with reduced venation, whose marginal vein is large medium. Unlike Eucharitidae, Perilampidae has a greater diversity of hosts, encompassing several insect orders, such as Neuroptera, Coleoptera, Diptera and Hymenoptera (Figure 18).

However, interactions of these parasitoids with poneromorphs have only been recorded so far in southeastern Peru. The emergence of several Perilampidae (about nine individuals of a species that remains

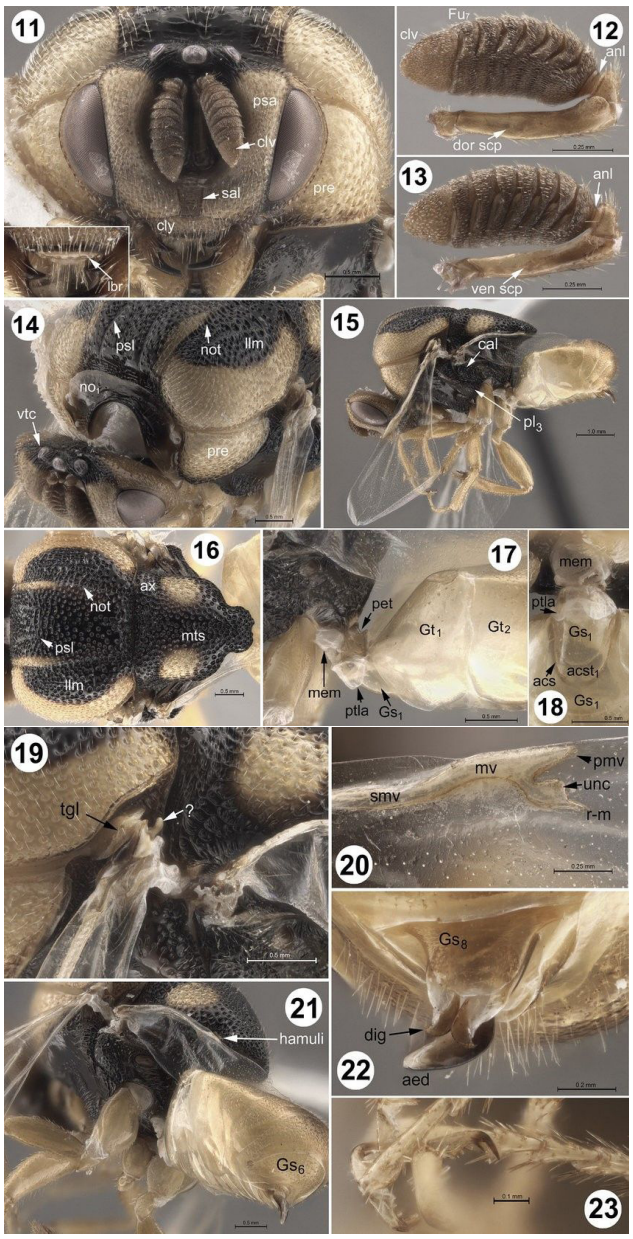

Figure 4. *Philomides hamooniae* Heraty, Derafshan & Ghafouri Moghaddam, 2019, male (holotype; UCRCENT00491418). (11): Head and anterior mesosoma (inset anteroventral view of clypeus and labrum); (12): Right antenna, lateral view; (13): Right antenna, medial view; (14): Head and mesosoma, anterolateral view; (15): Habitus, lateral view; (16): Mesosoma, dorsal view; (17): Mesosoma and gaster, lateral view; (18): Petiole and anterior gaster, ventral view; (19): Mesosoma, lateral view; (20): Fore wing venation, dorsal view; (21): Mesosoma and metasoma, posterolateral view; (22): Apex of gaster and genitalia, subcentral view; (23): Tarsi. Source: https://www.researchgate.net/figure/18-Philomides-hamooniae-male-holotype-UCRCENT00491418-11-head-and-anterior_fig4_333207824

identified) of a single Ponerinae larva *Neoponera luteola (*Roger, 1861), which nests in trunks of *Cecropia membranacea* Trécul (Rosales: Urticaceae).

According to the authors, the nests of *N. luteola* are

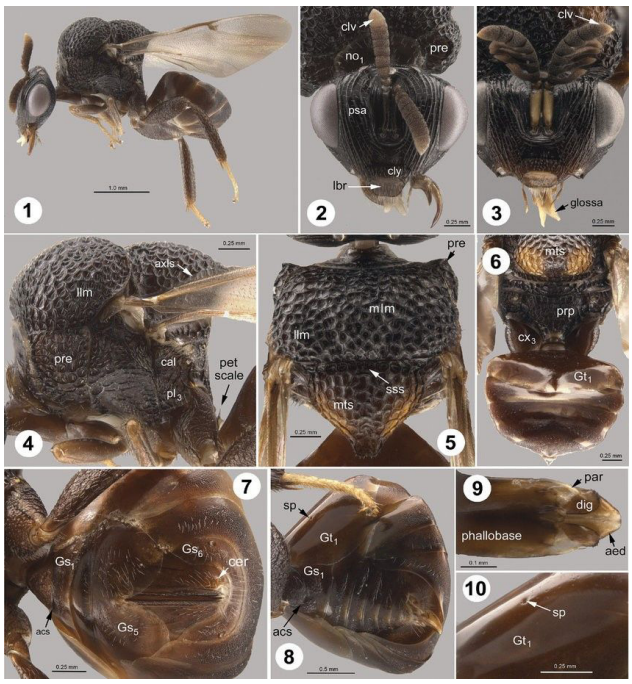

Figure 5. *Aperilampus.* (1): Habitus; (2): Head; (3): Head, frontal view; (4): Mesosoma, lateral view; (5): Mesosoma, dorsal view; (6): Posterior mesosoma and dorsal metasoma; (7): Metasoma, ventral view; (8): Metasoma ventral view; (9): *Aperilampus* sp., male (CASENT022341), genitalia, ventral view; (10): Gastral tergum; (11): lateral view. Source: https://www.researchgate.net/figure/10-Aperilampus-1-2-4-7-A-rabeharisoae-female-holotype-CASENT2212474-1_fig3_333207824

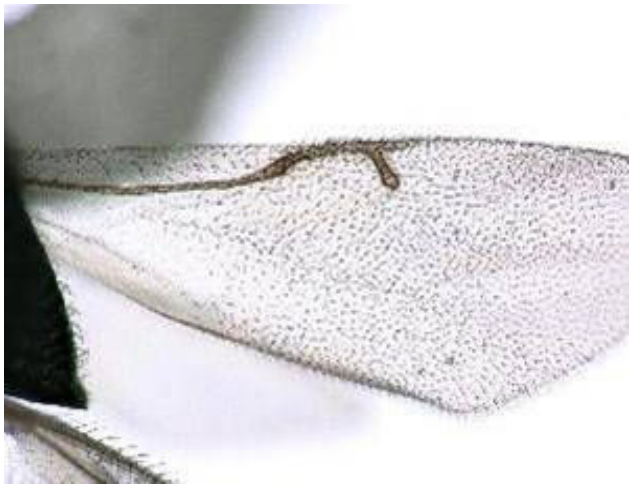

Figure 6. Wing of Perilampidae. Source: https://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=989269

particularly easy targets for parasitoids because access to the nest is wide and it's open for the ant queen can collect the Müllerian corpuscles. Further details of the biology and behavior of these parasitoids have not been detailed so far, but the literature describes these interactions with other organisms noting that behavioral and biological characteristics of Perilampidae resemble those of its sister group, the Eucharitidae (Figure 19).

https://doi.org/10.53964/jmab.2023016

Figure 7. Perilampidae larvae surrounded by *Aphis nerii* Boyer de Fonscolombe, 1841 (Hemiptera: Aphididae) on *Asclepias syriaca* L. (Apocynaceae). Source: https://en.wikipedia.org/wiki/Perilampidae

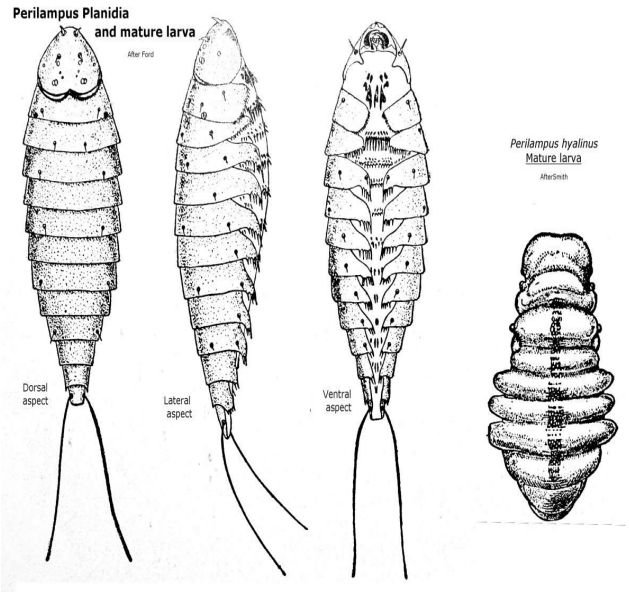

Figure 8. Planidia and larva of a parasitoid wasp of the Perilampidae. Source: https://en.wikipedia.org/wiki/Planidium

Figure 9. Planidia (larva) of a parasitoid wasp of the Perilampidae. Source: https://bugguide.net/node/view/746626/bgimage

Figure 10. Larva of a parasitoid wasp of the Perilampidae. Source: Photo by Charleey Eiseman

Figure 11. Prepupae - *Perilampus platigaster* Say, 1836, done feeding and ready to burrow down and spin cocoons. The prepupa of this species looks much like the feeding-stage larva but its head is no longer red. Source: https://bugtracks.wordpress.com/tag/perilampidae

Figure 12. *Perilampus platigaster* Say, 1836 (hyperparasitoids) emerged from cocoons of braconid (Hymenoptera: Braconidae) wasp larvae that emerged from a few caterpillars that remain unidentified because all of them were parasitized. Source: Photo by Charleey Eiseman

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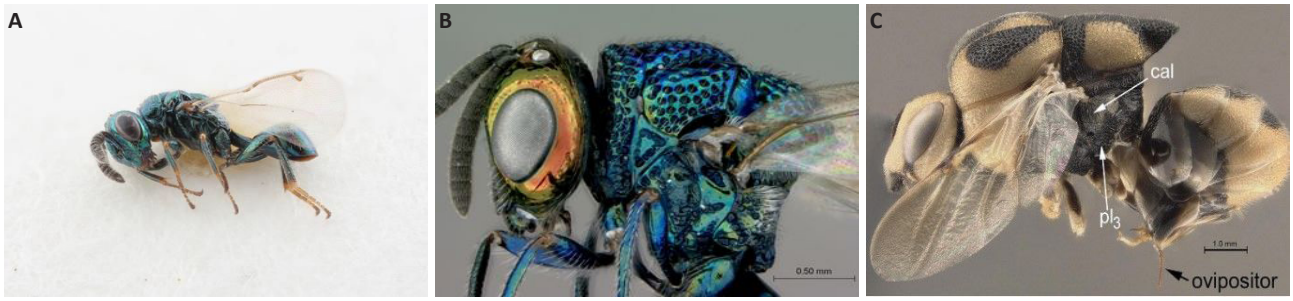

Figure 13. Subfamilies. A: Subfamily Chrysolampinae; B: Subfamily Perilampinae; C: Subfamily Philomidinae. Sources: https://ukhymenoptera.myspecies.info/taxonomy/term/7765, http://www.waspweb.org/chalcidoidea/Perilampidae/Perilampinae/Perilampus/Perilampus_species.htm, and http://www.waspweb.org/Chalcidoidea/Chrysolampidae/Philomidinae/index.htm

Figure 14. Genus. A: Genus *Perilampus* perilampid specimen; B: Genus *Burksilampus*; C: Genus *Euperilampus*. Source: https://www.picuki.com/tag/perilampidae, https://www.gbif.org/tools/zoom/simple.html?src=//api.gbif.org/v1/image/unsafe/http%3A%2F%2Fn2t.net%2Fark%3A%2F65665%2Fm3fa704b38-54c0-4e1b-a725-3f538aa91d96 and https://en.wikipedia.org/wiki/Euperilampus

Figure 15. An entomologist examining wasp specimens in fossilized amber from the Eocene (34-55 million years ago) has identified them as a new species, *Brachyelatus marthae* sp. nov. and the first fossil specimens from the chalcid wasp subfamily Chrysolampinae. Source: https://entomologytoday.org/2020/02/03/previously-unknown-wasps-found-prehistoric-amber-chrysolampinae-brachyelatus-marthae

Figure 16. Rare Perilampidae wasp Chalcidoidea fossil genuine Baltic AMBER 3094. Source: https://www.ambertreasure4u.com/index.php?route=product/product&product_id=3989

Among the characteristics shared by these two families are the larval morphology of the planid type and oviposition behaviors females. An adult female lay about 500 eggs in the vicinity of the host from which it emerged (Figure 20).

She uses her ovipositor to insert eggs inside of plant tissue, mainly in leaves and fruits, and the first stage, the planidium, is quite sclerotized and active, locating the host and adhering to him. In many cases, the planid does not feed until the host begins its pupal stage. The literature points out that only one planidium will develop in each ant larva in the observed several Perilampidae emerging from a single host.

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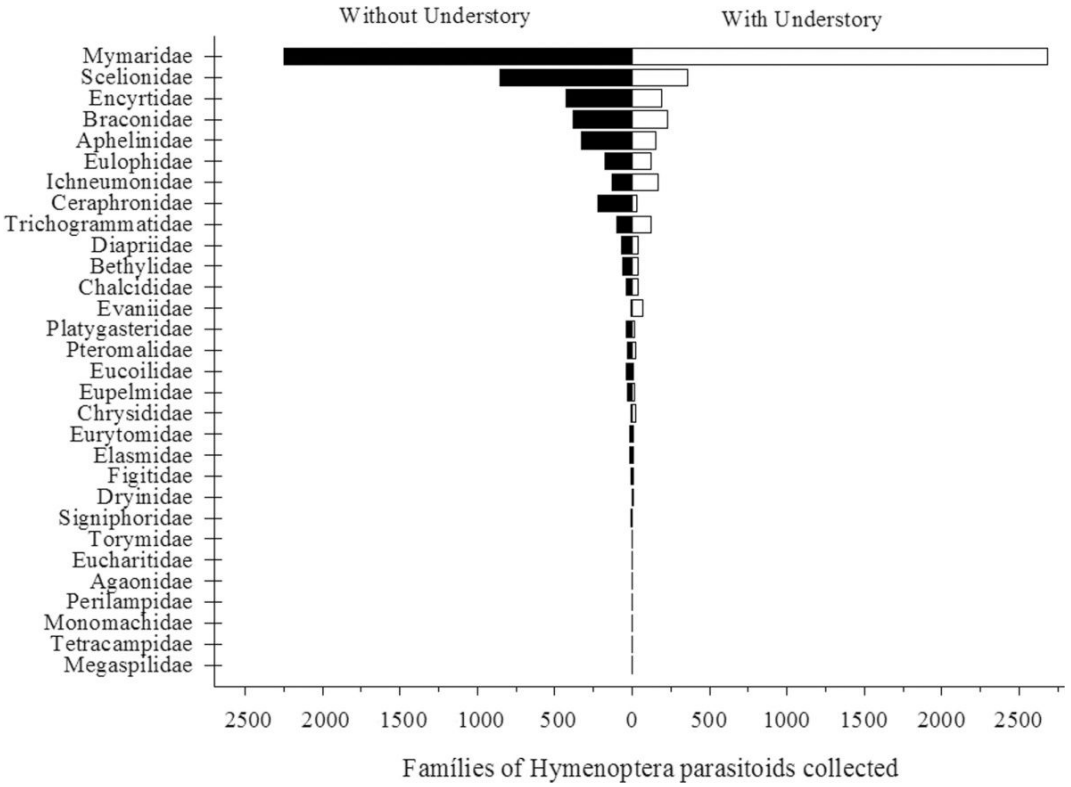

Figure 17. Abundance of Hymenoptera parasitoid individuals collected with Malaise traps in *Eucalyptus grandis* W. Hill ex Maiden., (Myrtaceae) stands without and with understory and total number of individuals collected, Municipality of Belo Oriente, Minas Gerais, Brazil. Source: https://journals.plos.org/plosone/article/figures?id=10.1371/journal.pone.0151165

Figure 18. *Perilampus* sp. Source: https://www.picuki.com/tag/perilampidae

Figure 19. *Neoponera luteola* (Roger, 1861). Source: https://www.antwiki.org/wiki/Neoponera_luteola

The first and second in stars of the larva they develop as typical ectoparasites in the posterior ventral thoracic region of the host pupa. The later stages of the larva, however, they can be secondarily endoparasitoids or hyperparasitoids. Various species of the Perilampinae subfamily are hyperparasitoids, developing in Tachinidae (Diptera) and Ichneumonidae (Hymenoptera). Some species may be obligate hyperparasitoids, while others are facultative.

All Perilampidae complete their development after four instars and are koinobiont. When become adults, they can be observed feeding on flowers (mainly species of the subfamily Perilampinae), but some also feed on honeydew. One female *Perilampus aeneus* (Rossius, 1790) was observed piercing the epidermis of a leaf to feed on exudate (Figure 21)[20-26].

3.2 Study 2

3.2.1 Genus *Burksilampus* (Hymenoptera: Perilampidae) (Figure 22)

Five attributes include:

Figure 20. ***Cecropia membranacea*** **Trécul (Rosales: Urticaceae).** Source: https://plantidtools.fieldmuseum.org/pt/nlp/catalogue/3661543

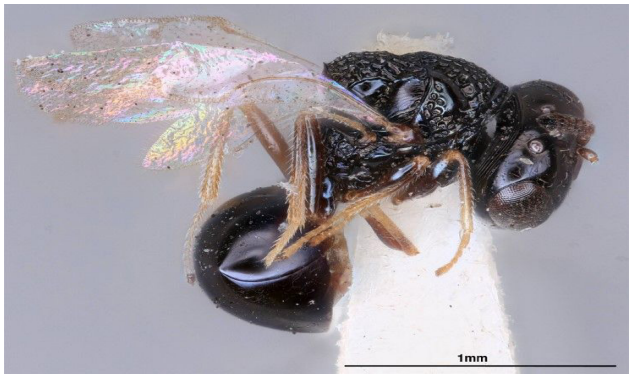

Figure 22. Genus ***Burksilampus***. Source: https://eol.org/pages/86817

Figure 24. Malaise trap. Source: https://simonleather.wordpress.com/2014/10/05/entomological-classics-the-malaise-trap

1-Body symmetry: Bilaterally symmetric.
2-Behavioral circadian rhythm diurnal.
3-Developmental mode holometabolous.
4-Visual system: ocelli.
5-Wing morphology has wings.

Burksilampus includes 1 child: *Burksilampus anobii* (Burks, 1969) [27].

Figure 21. ***Perilampus aeneus*** **(Rossius, 1790)**. Source: http://insecta.pro/taxonomy/530401

Figure 23. The Serra do Japi Forest Reserve. Source: https://www.dreampass.com.br/experiencias/travessia-da-serra-do-japi-jundiai-x-cabreuva-jundiai-sp

Figure 25. Moericke trap. Source: https://www.qeios.com/read/641572

3.3 Study

The Serra do Japi Forest Reserve covers areas of the municipalities of Jundiaí, Cabreúva and Cajamar, in the state of São Paulo, Brazil (Figure 23).

The collections were carried out during five days, between 5 and February 9, 2011 (Figure 24).

The relative abundance of the eight superfamilies of parasitoid Hymenoptera collected in this study (Figure 25).

Figure 26. Vegetation sweep. Source: https://www.eiscolabs.com/products/bi0146sn

Figure 27. FRFt: Parasitoids hymenopterans. A: Perilampidae family. Source: https://twitter.com/hashtag/Perilampidae?src=hash; B: *Steffanolampus salicetum* (Steffan, 1952). Source: https://www.naturalista.mx/observations/83638379; C: *Perilampus hyalinus* Say, 1829. Source: https://www.naturalista.mx/observations/13375763; D: *Perilampus aeneus* (Rossius, 1790). Source: https://www.naturalista.mx/observations/57181550; E: *Euperilampus triangularis* (Say, 1829). Source: https://www.naturalista.mx/observations/108185110; F: *Perilampus maurus* Walker, 1852. Source: https://www.naturalista.mx/observations/90727200; G: *Perilampus minutalis* Steffan, 1952. Source: https://www.naturalista.mx/observations/99322244; H: *Perilampus tristis* (Mayr, 1905). Source: https://www.naturalista.mx/observations/89573290; I: *Perilampus auratus* (Panzer, 1798). Source: https://www.naturalista.mx/observations/6700411; J: *Perilampus stygicus* Provancher 1888. Source: https://bugguide.net/node/view/1146121/bgpage

The presence of Perilampidae (0.62%) was recorded and Pelecinidae (0.15%), families that are not frequent in scientific collections and in samples of parasitoid fauna. Some researchers classified as rare and indicative of conserved areas (Figure 26).

3.3.1 Perilampidae Family

Total: 8 specimens; FRSt; relative frequency of parasitoid (0.62); FRFt: Parasitoids hymenopterans (7.2) (Figure 27)[28-30].

4 CONCLUSION

The species of the Perilampidae family are parasitoids of Lepidoptera, Diptera (Tachinidae) Coleoptera, Hymenoptera, Neuroptera, Orthoptera, Raphidioptera and Anobiidae and Platypodidae beetles.

Acknowledgements

Not applicable.

Conflicts of Interest

The author declared no conflict of interest.

Author Contribution

Marchiori CH contributed to the manuscript and approved the final version.

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