



Family Ormyridae (Insecta: Hymenoptera) as ectoparasitoid idiobionts of gall inducing, fruit fly and hyperparasitoids of other hymenoptera parasitoids

Carlos Henrique Marchiori

Instituto Federal Goiano, Biological Sciences., Goiânia, Goiás, Brazil.

*Correspondence to: **Carlos Henrique Marchiori**, PhD, Professor, Department of Biological Science, Instituto Federal Goiano, Rua T-65, Setor Bueno, Goiânia, Goiás, 74230120, Brazil;

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ABSTRACT: Most species of Ormyridae, in their larval form, feed solitary as ectoparasitoid idiobionts of various gall-inducing insects or caecids, while in some cases they behave as hyperparasitoids. In the Nearctic and the few known species from the Neotropics. While in other zoogeographic regions, they are also associated with galls of Cecidomyiidae, Agromyzidae and Tephritidae (Diptera), as well as gall inducers of the orders Coleoptera and Thysanoptera species associated with *Ficus*. The objective of this paper was to record the biology, ecology, taxonomy of the Ormyridae Family (Insecta: Sepsidae). The research was carried out in studies related to

quantitative aspects taxonomic and conceptual aspects. A literature search was carried out containing articles published from 1977 to 2022. The mini review was prepared in Goiânia, Goiás, from September to October 2021, through the Biological Abstract, Periodicals CAPES and Scielo.

KEYWORDS: Cynipidae, Larvae, Hyperparasitoids, *Ficus*, Neotropics

1. INTRODUCTION

The Ormyridae (Ormyridae Förster, 1856) represent a small family of insects (Hymenoptera Chalcidoidea) including parasitoid species. The family is little known and studied in the Neotropics (Figures 1, 2 and 3) [1,2].



Figure 1 Specimens of Ormyridae Förster, 1856., Source: <https://bugtracks.wordpress.com/tag/ormyridae/>



Fig 4-5: 4. *Ormyrus orientalis*, female; 5. *Ormyrus orientalis*, male.

Figure 2 *Ormyrus orientalis* Walker, 1871, 4. female; 5. Male. Source: <https://www.semanticscholar.org/paper/Contribution-to-the-knowledge-of-the-Ormyrus-with-Kazmi-Sheela/b21bff2444fe57ecaa85ec2da3699e2443370f72>

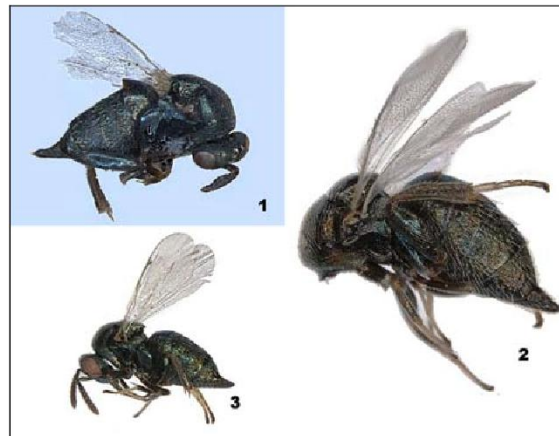


Fig 1 2 3: 1. *Ormyrus longicaudus*, female; 2. *Ormyrus secus*, female;

Figure 3 *Ormyrus longicaudus* Narendran, 1999, female; 2. *Ormyrus secus* Narendran 1999, female; 3. *Ormyrus gopii* Narendran 1999, female. Source: <https://www.semanticscholar.org/paper/Contribution-to-the-knowledge-of-the-Ormyrus-with-Kazmi-Sheela/b21bff2444fe57ecaa85ec2da3699e2443370f72>

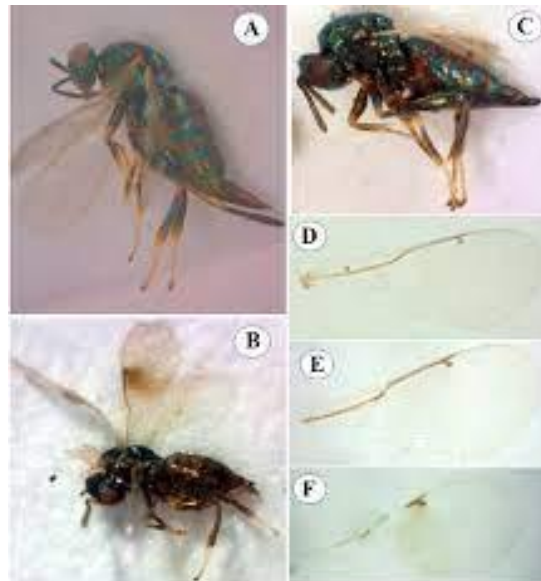


Figure 4 Species of the family Ormyridae identified for Panama. A. *Ormyrus gopii* Narendran 1999. B. *Ormyrus unfasciatipennis* Girault, 1917. C. *Ormyrus venustus* Hanson, 1992. D. Wing of *Ormyrus hegeli* Girault, 1917. Wing of *O. venustus*. F. Wing of *O. unfasciatipennis*. Source: https://www.researchgate.net/figure/Figura-1-Especies-de-la-familia-Ormyridae-identificadas-para-Panama-A-Ormyrus-hegeli_fig1_322164886

The head carries short antennae, the thorax presents sculptures in the form of superficial furrows. The posterior coxae are generally longer than the anterior ones. The wings are similar to those of the

Torimids, with postmarginal vein and stigmale vein sketched and uncus that touches the anterior margin of the wing (Figures 5, 6, 7 and 8) [5,6].



Figure 5 *Ormyrus nkoloensis* Rasplus sp. nov. paratype. Female: (A) head, frontal view; (B) habitus; (C) gaster, dorsal view; (D) head and mesosoma, lateral view; (E) gaster, lateral view; (F) head and mesosoma, dorsal view; (G) right wings. Source: https://www.researchgate.net/figure/Ormyrus-nkoloensis-Rasplus-sp-nov-paratype-FEMALE-A-head-frontal-view-B_fig3_229071967

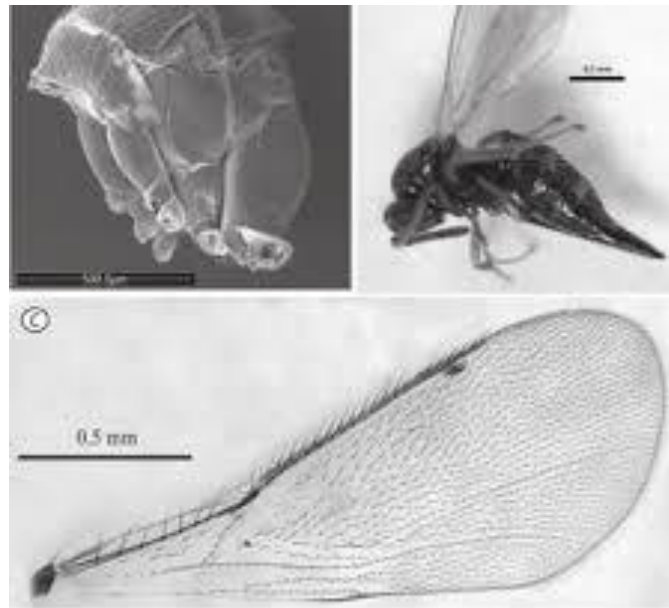


Figure 6 *Ormyrus fernandinus* nov. sp. A) Lateral view of the mesosome (SEM). B) female habitus (LM). C) female forewing (LM). Source: https://www.researchgate.net/figure/Ormyrus-fernandinus-n-sp-A-vista-lateral-del-mesosoma-SEM-B-habitus-de-la-hembra_fig3_44200953



Figure 7 *Ormyrus pallens* sp. n.: (6) female gaster in dorsal view, (7) male gaster in dorsal view, and (8) female gaster in lateral view. Source: <https://www.mindat.org/paleoimg.php?id=922341>



Figure 8 *Ormyrus pallens* sp. n.: (1) female habitus, (2) head and antennae of female in lateral view, (3) head in dorsal view, (4) forewing of female, and (5) male antenna. Source: <https://www.mindat.org/paleoimg.php?id=922340>

The abdomen is subsessile due to the very short petiole and the back of the gaster shows particular sculptures of the tergites. The ovipositor is quite short and typically does not protrude from the abdomen. In the last uritis of the females there is an

elongated sclerite, called epipygium, which protrudes between the cercoids. The female's ovulation tube (ovipositor) is rather short and protrudes little from the hind body (Figures 9A, 9B, 9C, 10A, 10B and 10C) [7,8].

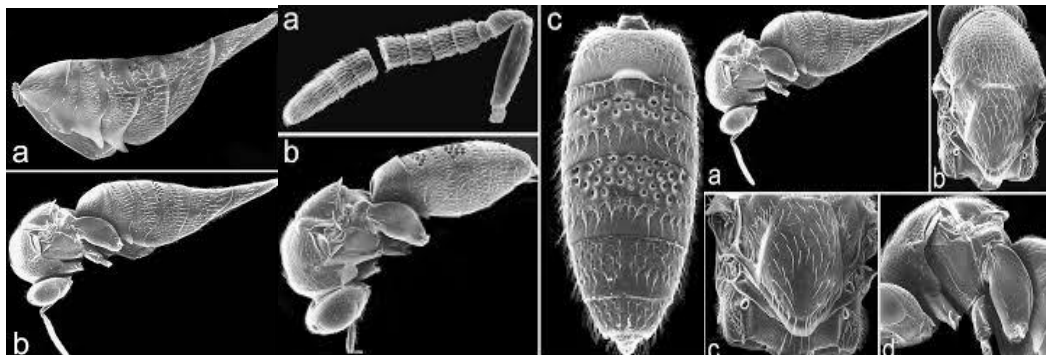


Figure 9A *Ormyrus coccotori* sp. n., female. – a. Gaster, lateral view. – b. Body, lateral view. Figure 9B *O. coccotori* sp. n., male. – a. Antenna. – b. Body, lateral view. – c. Gaster, dorsal view. Figure 9C *O. coccotori* sp. n., female. – a. Body, lateral view. – b. Mesonotum and propodeum, dorsal view. – c. Scutellum and propodeum, dorsal view. – d. Head and mesosoma, lateral view. Source: file:///C:/Users/User/Downloads/84219-Article%20Text-124857-1-10-20190807.pdf



Figure 10A *Ormyrus coccotori* sp. n. Female, front view. Figure 10B *O. coccotori* sp. n. Female, front view. Figure 10C *O. coccotori* sp. n. Female antenna. Source: file:///C:/Users/User/Downloads/84219-Article%20Text-124857-1-10-20190807.pdf



Biology

Most species of Ormyridae, in their larval form, feed solitary as ectoparasitoid idiobionts of various gall-inducing insects or caecids, while in some cases they behave as hyperparasitoids. In the Nearctic and the few known species from the

Neotropics. While in other zoogeographic regions, they are also associated with galls of Cecidomyiidae, Agromyzidae and Tephritidae (Diptera), as well as gall inducers of the orders Coleoptera and Thysanoptera species associated with *Ficus* (Figures 11, 12A and 12B) [9,10,11].



Figure 11 *Ormyrus?* on *Callirhytis quercusventricosa* Bassett, 1864 (Hymenoptera: Cynipidae) galls - *Ormyrus* - Female Head of the Plains, Nantucket, Nantucket County, Massachusetts, USA, 2016. Source: Copyright © 2016 Charley Eiseman



Figure 12A Females walking across knopper galls on oak trees. Source: <http://tristram.squarespace.com/home/2009/9/15/chalcid-wasps.html>

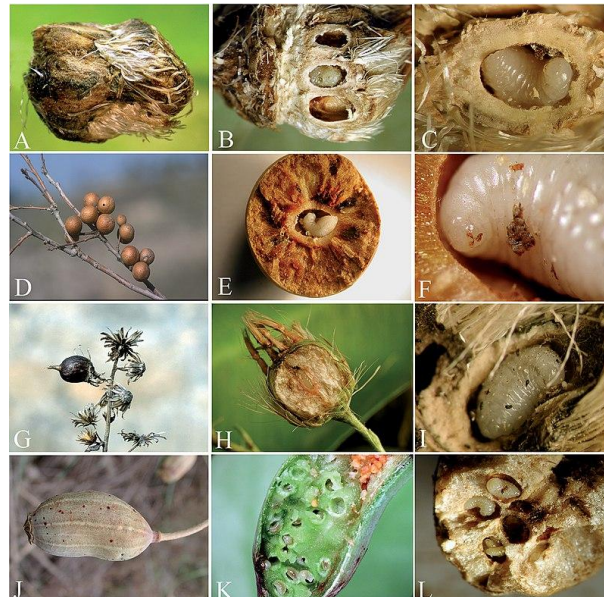


Figure 12B Fully (A) and dissected (B) galls of *Isocolus scabiosae* (Giraud, 1859) (Hymenoptera: Cynipidae) in achenes of heads of *Centaurea scabiosa* L., (Asteraceae), C detail of larvae of *Ormyrus gratiosus* (Förster, 1860) inside cells of *I. scabiosae* gall D galls of *Andricus hispanicus* (Hartig 1856) (Hymenoptera: Cynipidae) on *Quercus pyrenaica* Will. (Fagaceae) E cross-section of gall of *Andricus hispanicus* (Hartig, 1856) (Hymenoptera: Cynipidae) with larvae of *Ormyrus nitidulus* (Fabricius, 1804) within gall cell F detail of head and thorax in anterior view of larvae of *O. nitidulus* within gall cell of *A. hispanicus* G gall of *Myopites limbardae* Schiner, 1863 (Diptera: Tephritidae) on *Inula viscosa* L., (Asteraceae) H cross-section of gall of *M. limbardae* on *I. viscosa* I detail of larva of *Ormyrus orientalis* Walker, 1871 within gall cell of Tephritidae on *Microlonchus salmanticus* (L.) (Asteraceae) J galls of *Aylax papaveris* (Perris, 1839) (Hymenoptera: Cynipidae) on poppy heads K cross-section of poppy head shown cells of galls of *A. papaveris* L larvae of *Ormyrus papaveris* (Perris, 1840) with debris of dead host within gall cells of *A. papaveris*. Source: Gómez JF, Nieves MH, Gayubo SF, Nieves-Aldrey JL Terminal-instar larval systematics and biology of west European species of Ormyridae associated with insect galls (Hymenoptera, Chalcidoidea). 2017; ZooKeys 644: 51-88.

They are parasitoids or hyperparasitoids of gall-forming insects, especially wasps of the family Cynipidae and flies of the family Tephritidae. The larvae of said species are associated with bile-

forming insects, most commonly bile wasps. It is often unclear whether they are primary parasitoids, which attack the bile duct, or hyperparasitoids, which attack other parasitoids (Figures 13 and 14) [9,10,11].



Figure 13 This figures because *Ormyrus* sp. lay their eggs on the larvae of *Andricus quercuscalicis* (Burgsdorff, 1783), the cynipid wasp that causes knopper galls. Source: <http://tristram.squarespace.com/home/2009/9/15/chalcid-wasps.html>



Figure 14 *Andricus quercuscalicis* (Burgsdorff, 1783), the cynipid wasp that causes knopper galls. Source: <http://tristram.squarespace.com/home/2009/9/15/chalcid-wasps.html>

Distribution

Malaysia, India, America, which includes North America, Costa Rica, Colombia, Brazil and now Panama one species each (monotypic), with a cosmopolitan distribution, has the other described species [11,12].

Systematics and phylogeny

Tree list, order varicose veins, Hymenoptera, the group of wasps, Apocrite, the *Proctotrupomorpha* group the group Chalcidoidea, the family Ormyridae, *Eubeckerella* Narendran, 1999, *Ormyrus* Bouček, 1986 *Ormyrus* Westwood, 1832, includes most species, only genus found in Europe where 25 species are recorded (Figure 15).



Figure 15 *Ormyrus* Westwood, 1832. Source: Photo 55761086, (c) Sally Adam

The family includes about 120 species divided into three genera. Ormyridae is a small family of

parasitic wasps in the superfamily Chalcidoidea (Figure 16).



Figure 16 India (Andhra Pradesh, Karnataka, Uttar Pradesh) Biology: Host: *Procontarinia matteiana* Kieffer & Cecconi, 1906 (Cecidomyiidae). Source: Aisha Mayekiso

The Ormyridae are phylogenetically and morphologically similar to the Torymidae, from which they are distinguished by some

morphological details such as the stockier body, the short ovipositor, the more superficial notauli on the mesoscutum, the greater development of the epipygium (Figure 17).

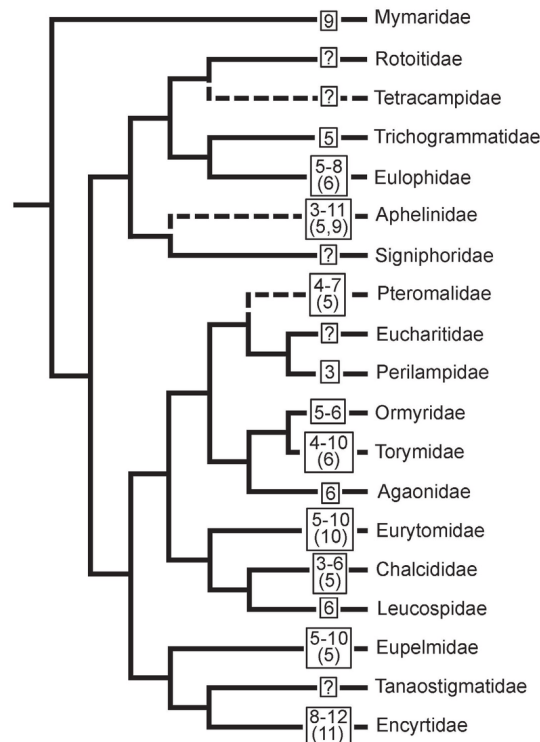


Figure 17 Phylogenetic tree of chalcid families (based on Noyes, 1990; see the text for further explanations) with ranges of haploid chromosome numbers superimposed onto it (based on data from Gokhman, 2009 and recent updates by the first author). Most frequent "n" values are given in brackets. Source: https://www.researchgate.net/figure/Phylogenetic-tree-of-chalcid-families-based-on-Noyes-1990-see-the-text-for-further_fig2_247905145

Genus *Ormyrus* Westwood, 1832; Genus *Avrasyamyris* Doganlar, 1991 accepted as *Ormyrus* Westwood, 1832; Genus *Chrysoideus* Stefani, 1898 accepted as *Ormyrus* Westwood, 1832; Genus *Monobaeus* Forster, 1860 accepted as *Ormyrus* Westwood, 1832; Genus *Pericyphus* Agassiz, 1845 accepted as *Ormyrus* Westwood, 1832; Genus *Periglyphus* Boheman, 1834 accepted as *Ormyrus* Westwood, 1832; Genus *Percyphus* Blanchard, 1840 accepted as *Ormyrus* Westwood, 1832; Genus *Percyphus* Westwood, 1840 accepted as *Ormyrus* Westwood, 1832; Genus *Siphonura* Nees, 1834 accepted as *Ormyrus* Westwood, 1832; Genus *Tribaeus* Forster, 1860 accepted as *Ormyrus* Westwood, 1832; Genus *Wania* Risbec, 1951 accepted as *Ormyrus* Westwood, 1832; Genus *Eubeckerella* Narendran, 1999 (uncertain, unassessed); Genus *Ormyrus* Boucek, 1986 (uncertain, unassessed); Genus *Cyrtosoma* Perris, 1840 accepted as *Ormyrus* Westwood, 1832 (unaccepted > junior subjective synonym) [13,14,15,16,17].

1.1. Objective

The objective of this paper was to record the biology, ecology, taxonomy of the Ormyridae Family (Insecta: Sepsidae).

II. METHODS

The research was carried out in studies related to quantitative aspects taxonomic and conceptual aspects. A literature search was carried out containing articles published from 1977 to 2022. The mini review was prepared in Goiânia, Goiás, from September to October 2021, through the Biological Abstract, Periodicals CAPES and Scielo.

III. STUDIES CONDUCTED AND SELECTED

3.1. Study 1

1-*Ormyrus hegeli* (Girault, 1917)

Diagnosis

This species, and *Ormyrus crassus* Hanson 1992, are the only species of the genus identified from the Nearctic that have only one ring-shaped joint on the antennae. In *O. hegeli* the forewings have bristles



on the basal cell while in *O. crassus* the basal cell is glabrous.

Biology:The best documented records in the Nearctic were in tuberous galls of the species *Andricus ruginosus* Bassett, 1890. (Hymenoptera: Cynipidae)Bassett and *A. wheeleri* Beutenmüller;

both galls are large and form on tree branches. In Panama the species was obtained from galls induced by *Disholcaspis bisethiae* Medianero & Nieves-Aldrey, 2011 (Hymenoptera: Cynipidae) on *Quercus lancifolia* Schltld. & Cham (Fagaceae) (Figure 18).

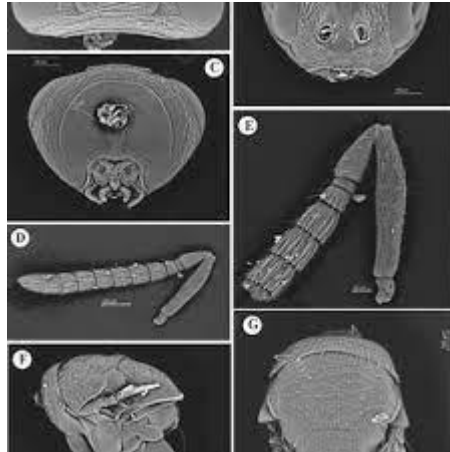


Figure 18 *Ormyrus hegeli* (Girault, 1917). A. Dorsal view of the head. B. Anterior view of the head. C. Dorsal view of the mesosoma. D. Lateral view of the mesosoma. E. Dorsal view of the mesosoma. F. Scutellum. G. Lateral view of the metasoma. Source: https://www.researchgate.net/figure/Figura-2-Ormyrus-hegeli-A-Vista-dorsal-de-la-cabeza-B-Vista-anterior-de-la-cabeza_fig2_322164886

Distribution: Eastern US states (Connecticut and Florida to Michigan and Missouri), southwestern states, California and Mexico (south of Oaxaca). Most records are from the southwestern states and

Mexico. With this study, this species is cited for the first time for the Neotropical region. 2-*Ormyrus unifasciatipennis* Girault, 1917 (Figure 19).

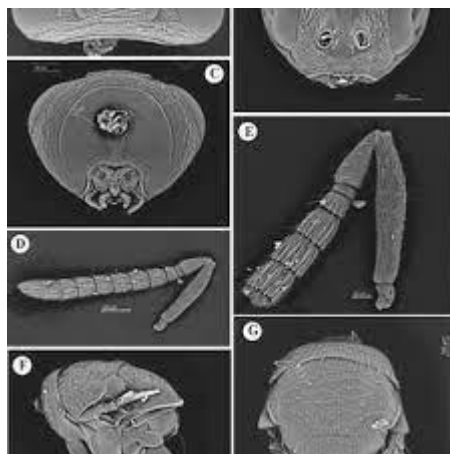


Figure 19 *Ormyrus unifasciatipennis* Girault, 1917. A. Dorsal view of the mesosoma. B. Posterior view of the scutellum and propodeum. C. Lateral view of the female metasoma. D. Dorsal view of female metasoma. E. Dorsal view of the metasoma of the male. F. Hind leg. Source: https://www.researchgate.net/figure/Figura-3-Ormyrus-hegeli-A-Vista-dorsal-de-la-cabeza-B-Vista-anterior-de-la-cabeza_fig2_322164886

Diagnosis

Like *O. unimaculatipennis* Girault, 1916, this species has a reticulate hind leg, forewings with



infused spots and a row of setae in the costal cell; however, *O. unifasciatipennis* has a bluish-green rather than orange-yellow hind femur, and the T7 curves upwards.

Biology: There are few known hosts for this species, including shoot and leaf galls. There are also records of gall emergence of unidentified species that form on acorns, buds and branches of *Quercus prinoides* Raf. (Fagaceae), *Quercus lobata* Née (Fagaceae) and *Quercus alba* (White Oak) (Fagaceae), respectively. In Panama, this species was collected in the district of birth at 1,270 meters above sea level. It emerged from galls

induced by *Disholcaspis bisethiae* Medianero & Nieves-Aldrey, 2011 (Hymenoptera: Cynipidae: Cynipini), *Neuroterus* sp.3 (Cynipidae) and an unidentified inducer.

Distribution: Canada (Quebec), United States (Florida, Oregon and California), Mexico and Costa Rica (Hanson, 1992). The collection of this species represents the first date for Panama.

3-Ormyrus venustus Hanson, 1992

Diagnosis

The forewing has two or three bristles at the apex of the basal cell and a full row of bristles on the underside of the costal cell (Figure 20).

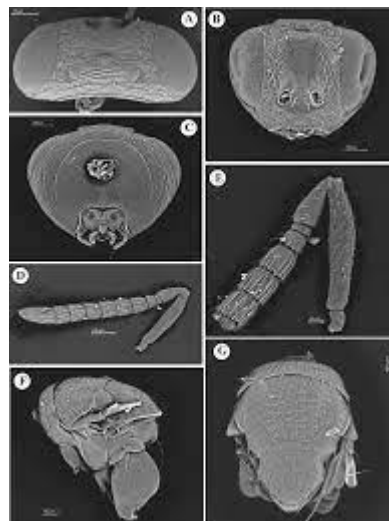


Figure 20 *Ormyrus venustus* Hanson, 1992. A. Dorsal view of the head. B. Anterior view of the head. C. Posterior view of the head. D and E. Antenna. F. Mesosome lateral view. G. Mesosoma dorsal view. Source: https://www.researchgate.net/figure/Figura-5-Ormyrus-venustus-A-Vista-dorsal-de-la-cabeza-B-Vista-anterior-de-la-cabeza_fig5_322164886

Biology: In the Nearctic collected in a variety of Cynipidae galls on *Quercus*, especially shoot galls, catkins and leaves (also on acorns and twigs). There are many other records from Mexico, but the identities of the Cynipidae and *Quercus* are questionable. In Panama it was recovered from galls of different genera of Cynipidae.

Distribution: Canada (Ontario) and the United States (Washington) and Costa Rica. In Panama it is the most common species, and was collected in different sites: Boquete, Renaissance, Volcán Barú, between 1200 and 2070 meters above sea level. It represents the first report for Panama. [18,19,20, 21,22,23,24,25] (Figure 21 and 22).



Figure 21 Specimens of Cynipidae Family. Source: <https://www.thoughtco.com/gall-wasps-family-cynipidae-1968088>



Figure 22 *Quercus* (Fagaceae) oak. Source: <https://pt.wikipedia.org/wiki/Carvalho>

3.2. Study 2

Ormyrus Westwood 1832 Afrotropical species

1-*Ormyrus flavipes* Bouček 1981 (Figure 23).



Figure 23 *Ormyrus flavipes* Bouček 1981

Biology: Parasitoid of *Syceurytoma ficus* Bouček, 1981 (Hymenoptera: Eurytomidae) breeding in *Ficus burkei* (Miq.) Miq. 1867 (Moraceae). Source: Simon van Noort (Iziko South African Museum)

Distribution: Zimbabwe

2-*Ormyrus langlandi* Girault 1920

Biology: Host: *Aulacidea subterminalis* Niblett 1946 (Cynipidae)

Distribution: Madagascar (Afrotropical region); also, Palearctic, Oriental and Australasian regions (Figure 24).



Figure 24 *Ormyrus langlandi* Girault 1920. Source: Simon van Noort (Iziko South African Museum)



3-*Ormyrus nkoloensis* Rasplus, 2011

Biology: Either a parasitoid or an inquiline of the leaf gall former *Gallastichus mutuus* Rasplus & LaSalle gen. nov. (Hymenoptera: Eulophidae) on *Bikinia letestui* (Pellegr.) *Wieringa* subsp. *letestui* (Fabaceae: Caesalpinioideae)

Distribution: Cameroon. The host, *Bikinia letestui*, a canopy tree of primary and older secondary rainforest, is known from the coastal region of Cameroon, Equatorial Guinea and Gabon. If *O. nkoloensis* is only associated with *Gallastichus* galls on this tree species then its distribution would be expected to follow that of its host (Figure 25).



Figure 25 *Ormyrus nkoloensis* Rasplus, 2011. Source: Simon van Noort (Iziko South African Museum)

4-*Ormyrus orientalis* Walker 1871

Biology: Hosts: *Diastrophus rubi* Hartig 1840; *Eurytoma serratulae* (Fabricius 1798); *Isocolus rogenhoferi* (Wachtl 1880); *Lasioptera eryngii*(Vallot); *Neuroterus quercusbaccaru*

(Linnaeus 1758); *Melanagromyza obtusa* (Malloch 1914).

Distribution: Canary Islands; also, Palearctic and Oriental regions (Figure 26).



Figure 26 *Ormyrus orientalis* Walker 1871. Source: Simon van Noort (Iziko South African Museum)

5- *Ormyrus striatus* Cameron, 1907

Biology: Associated with *Eurytoma oleae* Silvestri 1915

Distribution: Eritrea, South Africa (Figure 27).



Figure 27 *Ormyrus striatus* Cameron, 1907. Source: Simon van Noort (Iziko South African Museum)

6- *Ormyrus subconicus* Bouček 1981

Distribution: Zimbabwe, South Africa (Host fig) distribution in lighter colours).

Biology: Host fig: *F. burkei* (Figure 28A and 28B).



Figure 28A *Ormyrus subconicus* Bouček 1981. Source: Simon van Noort (Iziko South African Museum)

7- *Ormyrus watshami* Bouček 1981

Biology: Host fig: *F. burkei*.

Distribution: Zimbabwe (Distribution of host fig in lighter colours) (Figure 28C).



Figure 28C *Ormyrus watshami* Bouček 1981. Source: Simon van Noort (Iziko South African Museum)

8: Other Species: *Ormyrus australis* Risbec, 1957,
Ormyrus chevalieri (Risbec, 1955);
Ormyrus fernandinus Nieves-Aldrey

Hernández & Gómez, 2007; *Ormyrus eugeniae*
Risbec, 1956; *Ormyrus harongae* (Risbec, 1952);
Ormyrus ornatus (Risbec, 1951) and *Ormyrus*



sculptilis Crosby, 1909. Source: Photographs © Simon van Noort (Iziko Museums of South Africa)

Key to the differentiation of *Ormyrus* species from Panama

- 1- Antennal flagellum with a ring-shaped knuckle; predominant color bronze-violet; in females T4 to T6 with dotted posterior margin
.....
..... *Ormyrus hegeli*
- 2- Antennal flagellum with two or more ring knuckles; predominant color blue or green; T4 to T6 with distinctive apex, posteriorly imbricated
.....
.....
- 3- Forewing with dark spots below stigmal vein, costal cell with incomplete row of setae on inner side; posterior margin of scutellum not exceeding metanotum; anterior area of the vertex, between the median ocellus and the dorsal margin of the scrobal depression, with Slightly marked transverse strigosa

IV. CONCLUSION

Most species of Ormyridae, in their larval form, feed solitary as ectoparasitoid idiobionts of various gall-inducing insects or caecids, while in some cases they behave as hyperparasitoids. In the Nearctic and the few known species from the Neotropics. While in other zoogeographic regions, they are also associated with galls of Cecidomyiidae, Agromyzidae and Tephritidae (Diptera), as well as gall inducers of the orders Coleoptera and Thysanoptera species associated with *Ficus*.

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[26,27].

sculpture.....

Ormyrus unifasciatipennis

- 4- Forewing hyaline, without dark spots, costal cell usually with a complete row of setae on inner side; posterior margin of scutellum in lateral view clearly surpassing the metanotum; anterior area of the vertex, between the median ocellus and the dorsal margin of the escrobal depression, with transverse sculpture strigosa well marked

..... *Ormyrus venustus*

[31,32].

Source: Sánchez V, Paniagua M, Hanson P, Nieves-Aldrey, JL, Medianero E. Ormyridae (Hymenoptera, Chalcidoidea) from Panama associated with galls of cynipids (Hymenoptera, Cynipidae) on *Quercus* species (Fagaceae). *Colombian Journal of Entomology*. 2017; 43(2): 2012; 338:1481-1484. DOI: 10.1126/science.1226727).

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