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Family Odinnidae (Insects: Diptera) associated with beetles that feed on wood.

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The family Odoniidae (Insecta: Diptera) belongs to the Subsection Acalyptratae, which is made up of flies that do not have the calyptra that covers the rockers or dumbbells. They are small structures present on the sides of the thorax of insects from the orders Diptera and Strepsiptera. These winged insects are distinguished from others because most of their species have only one pair of wings in Diptera, and in Strepsiptera, the anterior or posterior pair has atrophied and transformed (Figure 1) [1-4].

Figure 1.*Odinia conspicua* Sabrosky, 1959. Sources: Photo #1894679 and UTK Biology Research Station, Sevier County, Tennessee, USA, June 22, 2019.

The color of Odonidae varies between gray, yellowish, brownish, or black; the wings are usually hyaline or even stained dark; the head is wider than long; the forehead is generally as wide as long in both sexes; divergent postocellar bristles or absent; internal vertical bristles generally stronger than the external ones, strong oral vibrissa, adjacent setae progressively decrease in size (Figure 2) [1-4].

Figure 2. figs. 3–8. *Umbodinia bella*, sp. nov., Holotype ♂. 3, habitus, lateral view; 4, head, frontal view; 5, head, lateral view; 6, head and thorax, dorsal view; 7, wing; 8, abdomen, dorsal view. Source: 10.11646/zootaxa.4801.1.8file:///C:/Users/USUARIO/Downloads/LimeiraMarquesGaimariRafael2020-Umbodinia.pdf.

The Odiniidae family, however, is little known despite occurring in all zoogeographic areas, including Australia. Odinids are small, robust flies characterized by the presence of strong setae, mainly on the head and thorax, whose body varies from 2.5 to 6 mm in length. The family has 81 valid species in 18 genera and two subfamilies Odiniinae and Traginopinae [4-6].

Eggs and larvae of unknown first and second instars. Third-instar larvae of the typical type of Schizophora; body essentially naked except for a small fringe of setules anterior to the oral opening and paired creeping welts anteroventrally on abdominal segments 2–7. Barrel-shaped pupae tapered anteriorly and posteriorly; characteristics described largely as for the third instar. Pupae present in Afrotropical species as the *Afrodinia* d'Abrera, 2009 (Figure 3) [5-8].

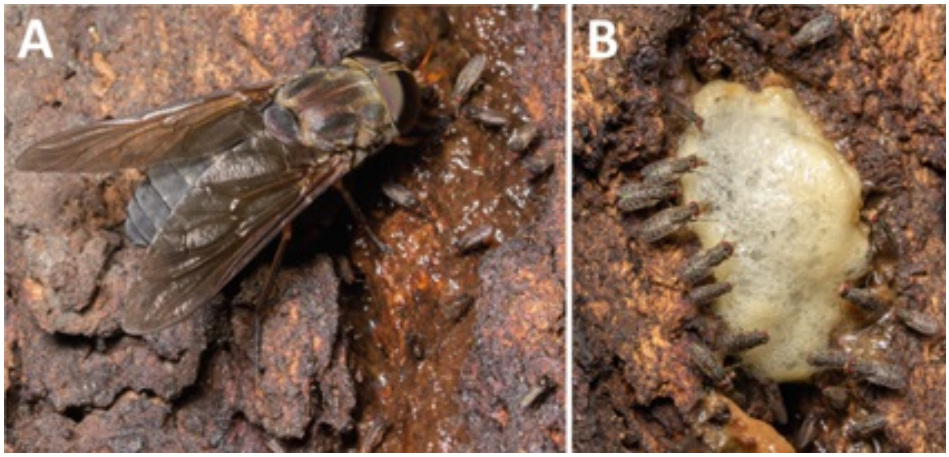

Figure 3. Odoniidae was saprophagous. Source: https://link.springer.com/chapter/10.1007/978-3-319-75937-15.

Adults are closely associated with trees, especially those infested with other insects, rot, fungus, or oozing sap. Some species are known to feed on polyporous fungi on trees, such as *Piptoporus betulinus* (Karsten 1881). Palearctic species of *Odinia* Robineau-Desvoidy, 1830, were created associated with beetles that feed on wood or trees attacked by these Coleoptera, and less commonly on larvae of Cossidae and other moths. They are generally associated with galleries of wood-boring beetles, with different life history possibilities. Those with known larvae or pupae are associated with trees, such as those that attract adults through saprophagy for predation [8-12].

Genus *Odinia* found that oviposition of 15 to 20 eggs occurred at the entrance to a cerambycid beetle tunnel, with the larvae devouring the beetle's excrement, crawling toward the beetle's pupal chamber, which they then attacked externally or bored internally, also exhibiting cannibalism. The full development of the Odoniidae does not depend on predation on the beetle pupa. Larvae take 39 to 46 days to develop before pupation. Adults emerge in 17 to 22 days [13-14].

Odiniidae are most commonly found in forested ecosystems, where their biological activities occur. Specimens are most commonly collected in Malaise traps or associated with tree trunks, sap flows, or beetle galleries. Some species of *Odinia* have been collected in McPhail traps baited with vinegar, or various yeast mixtures. Interestingly, odiniids are abundant in forest canopies Senegalia and Vachellia as *Acacia* Martius (1829) (Fabaceae) in Tanzania [15-16].

The Odiniidae is composed of 64 species belonging to 15 genera and two subfamilies Odiniinae and Traginopinae present in all zoogeographic regions. The Neotropical fauna is made up of nine genera and 26 species, which shows that they are little known in this region. The greatest richness of species is the Neotropical Region, with 10 genera and 31 species [17-18].

Subfamily Odiniinae: *Afrodinia* Cogan, 1975, *Neoalticomerus* Hendel, 1903, *Odinia*, *Turanodynia* Stackelberg, 1944.

Subfamily Traginopinae: *Coganodynia* Gaimari & Mathis, 2008, *Helgreelia* Gaimari, 2007, *Lopesiodinia* Prado, 1973, *Neoschildomyia* Gaimari, 2007, *Neotraginops* Prado, 1973, *Paratraginops* Hendel, 1917, *Pradomyia* Gaimari, 2007, *Schildomyia* Malloch, 1926, *Shewellia* Hennig, 1969 and *Traginops* Coquillett, 1900 (Figure 4) [19-20].

Figure 4.*Schildomyia yushimai* Kato, 1952. Source: Foto 72576297, (c) Wonwoong Kim.

Six genera are known for Brazil: *Helgreelia, Lopesiodinia, Neotraginops, Odinia*, *Paratraginops* and *Schildomyia*, and has only three known species: *Helgreelia albeto* Gaimari, 2007, *Helgreeli parkeri* Gaimari, 2007 and *Helgreeli gaimari* Carvalho-Filho, Esposito & Santos, 2009 (Figure 5) [21-23].

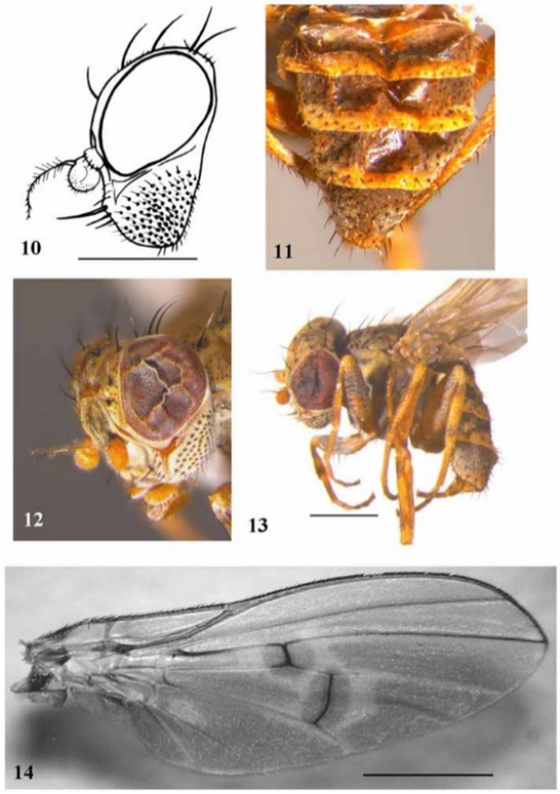

Figure 5. figs. 10 – 14. *Helgreelia gaimarii* n. sp. 10. Head, lateral view. 11. Abdomen, dorsal view. 12. Head, oblique lateral view. 13. Lateral habitus of female. 14. Wing. Sources: https://doi.org/10.5281/zenodo.6212902 and https://treatment.plazi.org/id/FA3987D6-257A-FF95-FF5A-2330FC442AF0.

References

[1] Junqueira AC, Azeredo-Espin AM, Paulo DF, Marinho MA, Tomsho LP, Drautz-Moses DI, Purbojati RW, Ratan A, Schuster SC. Large-scale mitogenomics enables insights into Schizophora (Diptera) radiation and population diversity. Scientific Reports. 2016; 25(6): 217-262.

[2] Pape T, Blagoderov V, Mostovski MB. Order Diptera Linnaeus, 1758. Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. Zootaxa: 2011; 3148: 1-237.

[3] Carvalho CJB. Diptera Linnaeus, 1758. In: Rafael JA, eds. Insects of Brazil: Diversity and taxonomy. 1st ed. Ribeirão Preto: Holos; 2012. p.701 - 735.

[4] Papp L. Odiniidae In: Dély-Draskovits Á, Papp L, eds Budapest: Odiniidae – Chloropidae. Akademiai Kiadó, Budapest. 1978. p. 1-202.

[5] Cogan BH. New taxa in two families previously unrecorded from the Ethiopian region (Diptera, Odiniidae, and Diastatidae). Annals of the Natal Museum. 1975; 22(2): 471-488.

[6] Wiegmann BM, et al. Episodic radiations in the fly tree of life. Proceedings of the National Academy of Sciences United States. 2011; 108: 5690–5695.

[7] Gaimari SD. Three new Neotropical genera of Odiniidae (Diptera: Acalyptratae). Zootaxa. 2007; 1443: 1–16.

[8] Limeira-De-Oliveira F, Marques DWA, Gaimarl SD, Rafael JA. A new genus and species of odiniids (Diptera: Odiniidae) from the canopy of the Brazilian Amazon rainforest. Zootaxa. 2020; 4801(1): 164–170.

[9] Limeira-De-Oliveira F, Marques WAD, Reis GA, Rafael JA, *Inpauema*, a new genus of Odiniidae (Diptera) from Brazil, with description of five new species. Zootaxa. 2017; 4362(4): 517-534.

[10] Ulyshen M. Saproxylic insects. 1st ed. Cham: Zoological Monographs; Springer. 2018.

[11] Tôrres A, Rafael JA, Gaimarl SD, Limeira-De-Oliveira F. Revision of the genus*Lopesiodinia* Prado, 1973 (Diptera: Odiniidae) with description of three new species, and a key to the extant Neotropical genera and species of Traginopinae. Zootaxa. 2021: 5052(3): 332–352.

[12] Gaimari SD, Mathis WN. World catalog and conspectus on the family Odiniidae (Diptera: Schizophora). Myia. 2011; 12: 291–339.

[13] Filho FDC, Esposito MCS, Oliveira RS. A new species of Helgreelia Gaimari (Diptera: Odiniidae) from Brazil, with a key to the Neotropical species of Odiniidae. Zootaxa.2009; 2219: 61-68.

[13] Parchami-Araghi M, Majnon-Jahromi B, Gilasian E, Withers P, Gaimari SD, Fallahzadeh M. First Iranian record of the family Odiniidae (Diptera: Opomyzoidea), including two species new to the Middle East region. Zootaxa. 2018; 4471(3): 580–584.

[14] Gaimari SD. Odiniidae. In: Brown BV, Borkent A, Cumming JM, Wood D, Woodley NE, Zumbado M, eds: Manual of Central American Diptera. 2st. Ottawa: National Research Council Press; 2010. p. 1049-1055.

[15] Scudder GGE, Cannings RA. The Diptera families of British Columbia. 1st ed. Columbia: University of Columbia. 2006.

[16] Santos RCO. A new species of *Helgreelia Gaimari* (Diptera: Odiniidae) from Brazil, with a key to the Neotropical species of Odiniidae. Zootaxa. 2009; 2219: 61–68.

[17] Braga MO, Tôrres A, Oliveira FLO. Taxonomic Study Of Odinids (Diptera, Odiniidae) with emphasis on the fauna of the states of Maranhão and Piauí [Internet]. Belém: Proceedings of the 2nd Brazilian Congress on Biodiversity and Biotechnology in the Amazon; @2020 [cited 2023 Oct 10]. Available fromfile:///C:/Users/Lenovo/Downloads/galoa-proceedings--cbbba-2022--151707.pdf.

[18] Kahanpää J. Checklist of the smaller families of Opomyzoidea, Anthomyzidae, Asteiidae, Aulacigastridae, Clusiidae, Odiniidae, Opomyzidae and Periscelididae (Diptera) of Finland. Zookeys. 2014; 441: 285-290.

[19] Withers P, Papp L. The Palaearctic species of Neoalticomerus Hendel (Diptera, Odiniidae). Dipterists Digest. 2012; 19: 53-63.

[20] Carvalho CJB, Rafael JA, Couri MS, Silva VC. Diptera. In: Rafael JA, Melo GAR, Carvalho CJB, Constantino CSA. Insects from Brazil: diversity and taxonomy. 1st ed. Ribeirão Preto: Holos Editora; 2012. p. 702-743.

[21] Stephen D. Gaimari SD. Manual of Afrotropical Diptera. In: Kirk-Spriggs AH, Sinclair Bradley J, eds. Brachycera. Cyclorrhapha, excluding Calyptratae. 3st. Pretoria: Editora Suricata. South African National Biodiversity Institute; 2021. p. 1885–1901.

[22] Limeira-De-Oliveira F, Marques WDA, Gaimari SD, Rafael JA. *Pauximyia*, a new genus of Odiniidae (Diptera: Acalyptratae) with the description of two new species from Brazil. Zootaxa. 2020; 4728(2): 227–236.

[23] Flores HF, Pirani G, Gaimari SD, Amorim DS. Two new species of*Neotraginops* Prado from Costa Rica and Brazil (Diptera: Odiniidae: Traginopinae). Zootaxa. 2021; 5048 (2): 176–190.