Open Peer Review on Qeios

[Mini Review] The Family Micropezidae (Insecta: Diptera)

Carlos Henrique Marchiori[1]

1 Instituto Federal Goiano

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.

Abstract

Relatively few studies are known about the larval habit of tropical Micropezidae, but it is known that the larvae commonly develop in decomposing plant organic matter and can also be reared in manure. Species of the genus *Mimegralla* Rondani and *Calobata* Meigen can develop on rhizomes and roots of ginger or other plants. Adults are either predatory on small insects or are attracted to excrement or decaying fruit. Adults are found on low herbage, flowers, leaves, rotting fruit, and excrement. The Micropezidae mimic ants; others mimic wasps and are especially similar in appearance to some ichneumonid wasps. The objective of this manuscript is to verify the mimicry behavior of the Family Micropezidae (Insecta: Diptera). The bibliographic search included the Lilacs databases (Latin American and Caribbean Literature in Health Sciences) at: http://www.bireme.br/, in electronic journals available at the Scielo and USP databases: http://www.usp.br/ and in theoretical books, theses banks, university dissertations, national and international scientific articles, scientific journals, documents. The main terms used were: Diptera, flies, and Micropezidae.

Carlos Henrique Marchiori[1,*]

[1] *Department of Biological Science, Instituto Federal Goiano, Goias, Brazil*

[*]**Correspondent Author**

Carlos Henrique Marchiori, PhD, Professor

Department of Biological Science, Instituto Federal Goiano, Rua T-65 No. 1050, Goiânia, Goiás 74230120, Brazil

Email: chmarchiori@yahoo.com.br

Keywords: Decomposition, Mimicry, Larva, Adult, Ant.

1. Introduction

Adults of Micropezidae are distinguishable by medium size (5-17mm) with long, slender legs, in addition to the common

mimetic forms of ants and wasps. Few taxonomic studies in the Neotropical region have been carried out, after the last general review by Willi Hennig in the 30s of the last century. Therefore, the identification of species is still problematic and there is still much to know, especially with regard to Brazilian species. (Figures 1-2) [1][2][3].

Figure 1. *Micropeza bisetosa* Coquillett, 1902

Source: https://elp.tamu.edu/ipm/bugs/order-diptera-flies/family-micropezidae/diptera-micropezidae-micropeza-bisetosa-stilt-legged-flies-c/

Figure 2. *Rainieria antennaepes* (Say 1823)

Source: https://bugguide.net/node/view/1629046

1.2. Description

Diagnostically, they have ocellar bristles and vibrissa is absent, katepisternum with a row of delicate bristles, R4+5 and M veins strongly convergent at the apex of the wing, females with tergite and sternite VII fused forming a rigid ovipositor and males of most species having sternite V with finger-like extensions forming some forceps (Figures 3-6) [4][5][6].

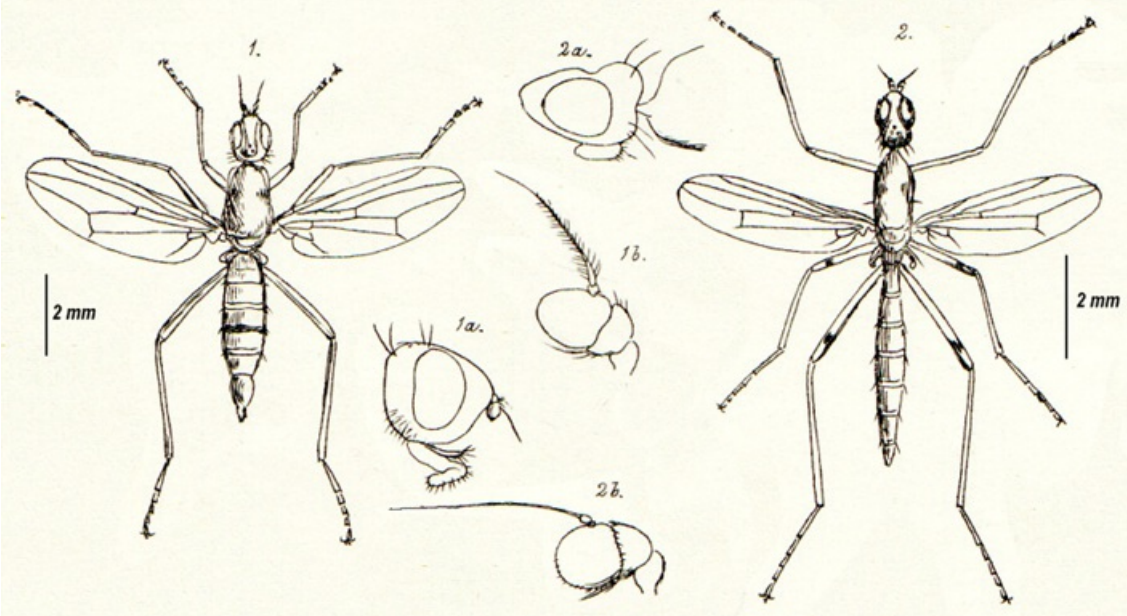

Figure 3. *Calobata petronella* (Linnaeus, 1761), with head from side (1a) and antenna (1b). 2, *Micropeza correctolata* (L., 1758), with head from side (2a) and antenna (2b)

Source: From Walker (1853)

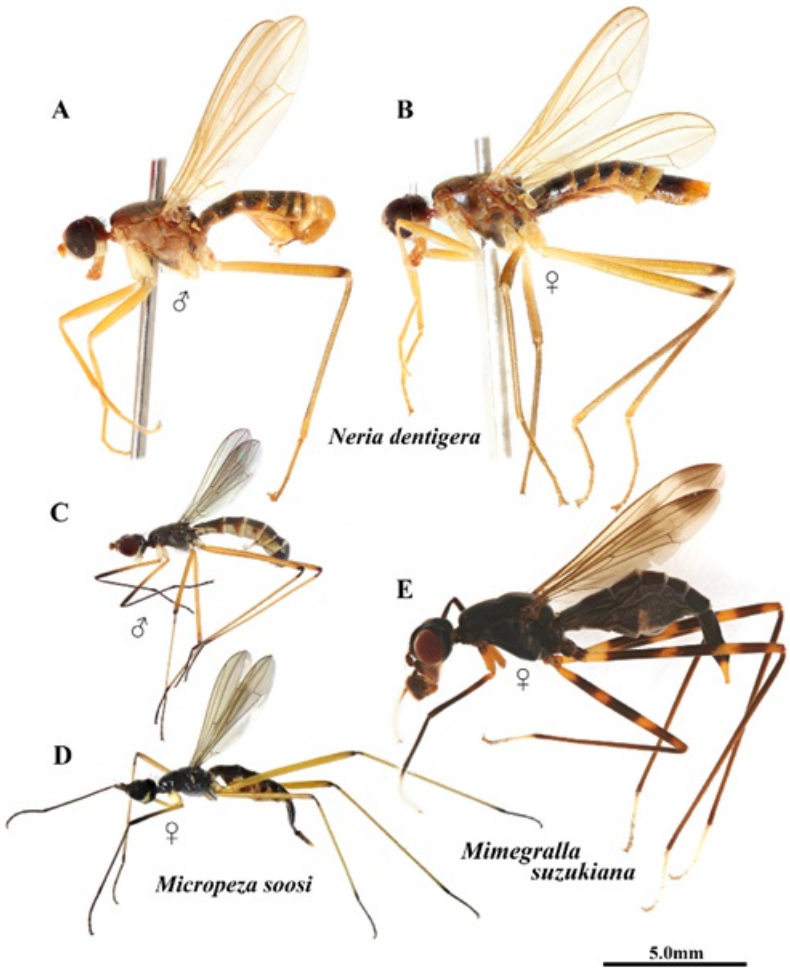

Figure 4. Lateral habitus of Korean Micropezidae species. (A), *Compsobata*

dentigera (Loew, 1854), male; (B), ditto, female; (C), *Micropeza soosi* Ozerov, 2008, male; (D), ditto, female; (E), *Mimegralla suzukiana* Hennig, 1938, female

Source: https://www.gbif.org/pt/species/9495/treatments

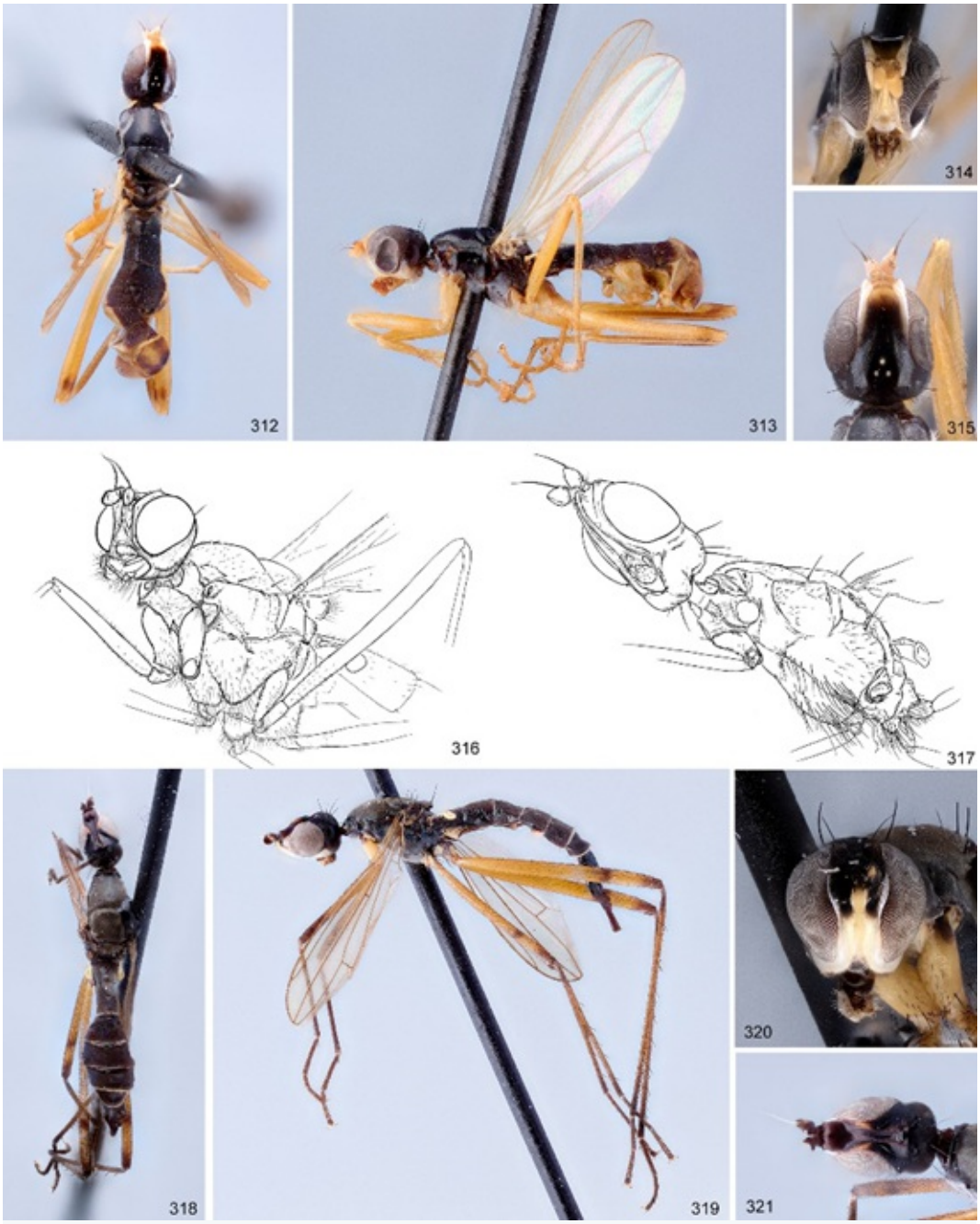

Figure 5. figs. 312-321. Figs 312-315: *Calobata pallipes* Say 1823 (Micropezidae), male; (312): dorsal; (313): side; (314): previous head; (315): head, dorsal. Fig. (316): *Compsobata mima* (Hennig, 1963) (Micropezidae). (Fig. 317): *Micropeza lineata* van Duzee, 1923 (Micropezidae). (Figs 318-321): *Micropeza* sp. (Micropezidae), female; (318): dorsal; (319): side; (320): previous head; (321): dorsal head

Sources: © Lonsdale, Owen and https://www.gbif.org/pt/species/9495/treatments

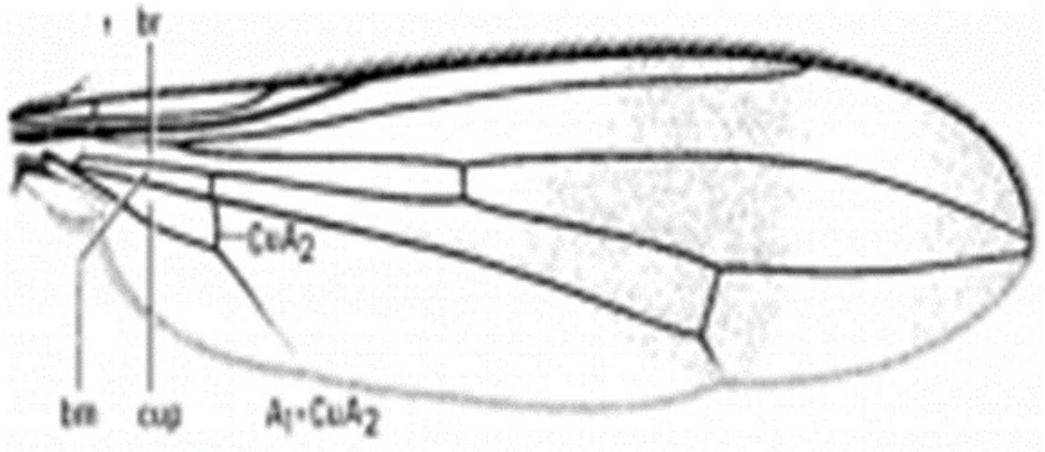

Figure 6 Wing of male of *Rainieria antennaepes (Say, 1823)*

Source: http://www.hr-rna.com/RNA/Other%20insect%20pages/Micropezid%20key.htm

1.3. Bioecology

Relatively few studies are known about the larval habit of tropical Micropezidae, but it is known that the larvae commonly develop in decomposing plant organic matter and can also be reared in manure. Species of the genus *Mimegralla* Rondani and *Calobata* Meigen can develop on rhizomes and roots of ginger or other plants (Figures 7A-7B)[7][8][9].

Figure 7A. *Badisis ambulans* McAlpine, 1990 (Micropezidae), commensal in *Cephalotus* sp. plants

Sources: © Jiri lochmann and https://www.researchgate.net/figure/Badisis-ambulans-McAlpine-Micropezidae-commensal-in-Cephalotus-pitcher-plants-C_fig3_287084994

Figure 7B. Stilt-legged fly, family Micropezidae (Diptera) *Cliobata* sp. fed on organic matter

Source: https://www.pinterest.ca/pin/stiltlegged-fly-family-micropezidae-diptera-cliobata-sp-possibly-cliobata-eques--163537030197536558/

Adults, on the other hand, feed on plant exudates, but are also attracted to human feces. Some representatives of the subfamily Calobatinae may exhibit predatory habits in extreme cases; however, this is a Holarctic distribution group some species develop in rotting wood and is found in old forests [10][11][12].

Adults are either predatory on small insects or are attracted to excrement or decaying fruit. Adults are found on low herbage, flowers, leaves, rotting fruit, and excrement. The Micropezidae mimic ants; others mimic wasps and are especially similar in appearance to some ichneumonid wasps [13][14][15].

Larvae and pupae. The terrestrial larvae; saprophagous (in decaying wood and vegetable matter); app. The pupae enclosed within a puparium. Comments: extraordinarily long and thin, narrow-winged flies of streamlined appearance (Figure 8) [14][15].

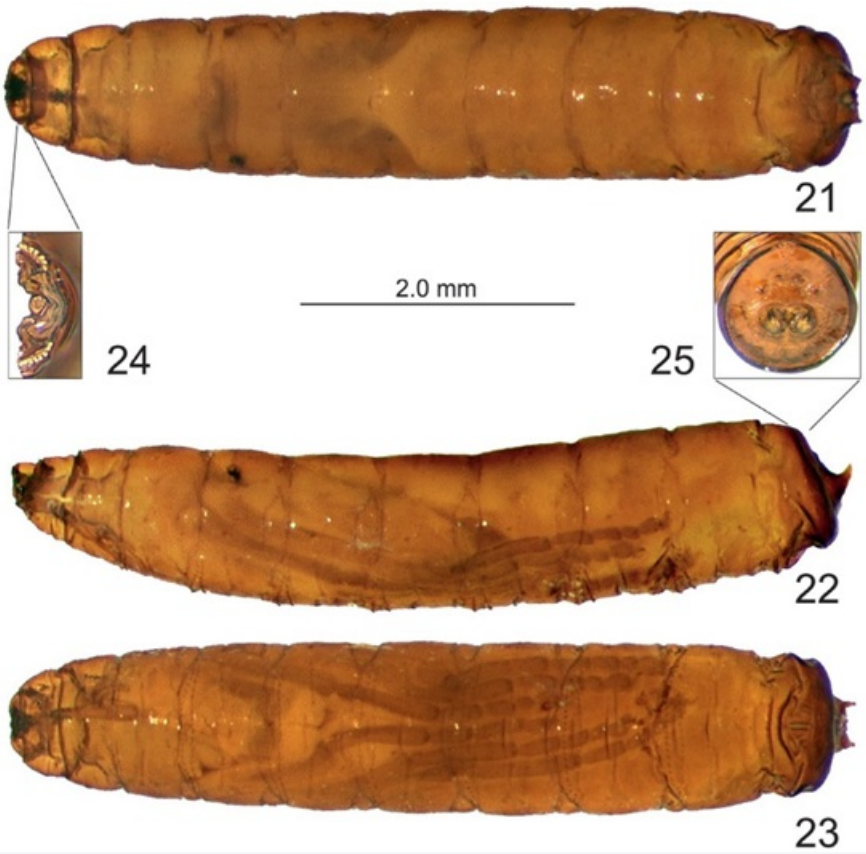

Figure 8. figs. Larvae; (21, 22, 23); Formation of Spiracles of each larval and Spiracles of each larval 24-25)

Source: https://bioone.org/journals/proceedings-of-the-entomological-society-of-washington/volume-117/issue-4/0013-8797.117.4.421/Biology-and-Immature-Stages-of-Compsobata-univitta-Walker-1849-Diptera/10.4289/0013-8797.117.4.421.short

1.4. Taxonomy

Micropezidae comprises a family of cosmopolitan flies, with a predominance of species in tropical regions with almost 700 species in about 60 genera, the family is currently divided into five subfamilies [16][17]

Subfamilies: Calycopteriginae, Calobatinae, Eurybatinae, Micropezinae and Taeniapterinae. Species among 20 genera are found in the Neotropics (Figures 9-15) [18][19][20].

Figure 9. Subfamily Calobatinae

https://uk.inaturalist.org/taxa/1151434-Calobatinae

Figure 10. Subfamily Eurybatinae

Source: http://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=748404

Figure 11. subfamily, Micropezinae

Source: https://commons.wikimedia.org/wiki/File:Micropeza_corrigiolata_%28Micropezidae%29_-_%28imago%29,_Elst_%28Gld%29,_the_Netherlands_-_2.jpg

Figure 12. Subfamily Taeniapterinae. These flies, also known as stilt flies, have the habit of raising their legs in front of

their heads so that they are confused with the long antennae of ants and some species imitate wasps – in particular, those of the Ichneumonidae family.

Source: https://www.flickr.com/photos/brunogarciapic/27945012938

Figure 13. *Micropeza grallatrix* Loew, 1868

Source: https://naturdata.com/especies-portugal/taxon/0@1-animalia:arthropoda:insecta:diptera:micropezidae/

Figure 14. *Micropeza lateralis* Meigen, 1826

Source: https://naturdata.com/especies-portugal/taxon/0@1-animalia:arthropoda:insecta:diptera:micropezidae/

Figure 15. *Neria cibaria* (Linnaeus, 1758)

Source: https://naturdata.com/especies-portugal/taxon/0@1-animalia:arthropoda:insecta:diptera:micropezidae/

1.5. Objective

The objective of this manuscript is to verify the mimicry behavior of ants and wasps in the Family Micropezidae (Insecta: Diptera).

2. Methods

The bibliographic search included the Lilacs databases (Latin American and Caribbean Literature in Health Sciences) at: http://www.bireme.br/, in electronic journals available at the Scielo and USP databases: http://www.usp.br/ and in theoretical books, theses banks, university dissertations, national and international scientific articles, scientific journals, documents. The main terms used were: Diptera, flies and Micropezidae.

3. Manuscript selection

3.1. Study 1

Insects in this family are commonly called stilt-legged flies, after their characteristically long legs. The forelegs are markedly smaller than the other pairs. Mostly they are long-bodied, often black flies, usually with infuscated (darkened) wings. Wings are reduced in the genera *Calycopteryx* and entirely absent in the ant-like *Badisis ambulans* McAlpine, 1990 [21].

Some species, much the same as in the strongylophthalmyiid genus, *Strongylophthalmyia*, mimic ants; others mimic wasps and are especially similar in appearance to some ichneumonid wasps. Species of the genus *Anaeropsis* have stalked eyes (Figure 16) [21].

Figure 16. Stilt-legged fly Micropezidae

Source: https://www.projectnoah.org/spottings/121276073/fullscreen

Little is known about the larval habits, but they are probably phytophagous or saprophagous in decayed vegetation, old manure, or fungi. Larvae of certain *Mimegralla* species have been found to live in the roots of ginger and other plants, under the bark of dead trees or in other decaying material (Figure 17) [21].

Figure 17. Stilt-legged fly Micropezidae

Source: https://www.projectnoah.org/spottings/121276073/fullscreen

Species of *Micropeza* have phytophagous larvae feeding in the root nodules of leguminous plants in open habitats. The species of *Rainieria* develop in rotting wood and are found in old forests. Adults are either predaceous on small insects (for example *Calobata* in Britain) or are attracted to excrement or decaying fruit. Adults are found on low herbage, flowers, leaves, rotting fruit and excrement [21].

Many species (for example those of genus *Mimegralla*) are known for their habit of standing motionless while waving their prominently marked front legs in front of their head, a behavior which contributes to their mimicry of wasps. At least one species of *Metopochetus curvus* McAlpine, 1998, was observed to wave its hindlegs instead, though these are not conspicuously colored (Figure 18) [21].

Figure 18. Some species of Micropezidae imitate wasps those of the Ichneumonidae family

Sources: https://www.shutterstock.com/pt/search/stilt-legged-fly and https://alchetron.com/Micropezidae

3.2. Study 2

The species of this genus *Taeniaptera* provide important ecosystem services by participating in the decomposition process of organic matter and in the biological control of insects. However, little is known about the feeding habits of larvae and adults of stilt-legged flies [22].

Larvae of *Taeniaptera annulata* (Fabricius, 1787) have been reported in decaying banana stumps, in rotted roots of cassava, in decomposed fruit, in roots of fig trees, and in decaying sugarcane cuttings. Adults of *Taeniaptera lasciva* (Fabricius, 1798) have been recorded as predators of sugarcane borer *Diatraea saccharalis* (Fabricius, 1794) (Lepidoptera: Crambidae) in Barbados (Figure 19) [22].

Figure 19. *Taeniaptera annulata* (Fabricius, 1787)

Sources: Rodrigo Fernandez PH and http://www.fotonat.org/details.php?image_id=97477

The objective of this study was to compare the distribution of*Taeniaptera* species among different farmland habitats, namely, vegetable crops, fallow areas, agroforestry, and native vegetation, and to determine their abundance throughout the year. Four organic farms that produce vegetables were selected for this study. One Malaise trap was installed in each habitat (Figure 20) [22].

Figure 20. *Taeniaptera lasciva* (Fabricius, 1798)

Source: https://www.insects.ch/art/taeniaptera-lasciva

In total, 486 individuals representing 3 species of *Taeniaptera* were collected – *T. lasciva, T. annulata*, and *Taeniaptera* sp. on farms during this study. Among *Taeniaptera* species, *T. lasciva* was more abundant than *T. annulata* and *Taeniaptera* sp, representing about 90% of the total sample population. Even with the predominance of a single species, all occurred in different localities in the Federal District (Figure 21) [22].

Figure 21. *Taeniaptera* sp.

Sources: Bruno Garcia Alvares and https://www.flickr.com/photos/brunogarciapic/27945012938

The sex ratio of *T. lasciva* was 53:47, with a balanced proportion between males and females. The other species,*T. annulata* (5:95) and *Taeniaptera* sp. (11:89) were predominately females. The monthly abundance of*Taeniaptera* was higher in vegetable crops than in fallow, agroforestry, and native vegetation. The mean abundance of *Taeniaptera* did not differ among the months. *Taeniaptera lasciva* and *T. annulata* were collected [22].

3.3. Study 3

Carry out an entomological record of Parque dos Bilhares, located in the city of Manaus, Amazonas, Brazil. Methodological procedure: The records of the insects in the Parque dos Bilhares were observed and photographed for 12 months, at least twice a month during the daytime between the hours 08:00-11:30, and the observations were recorded on camera [23].

During the twelve months of observations, 55 insects of 8 Orders were registered and identified: Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Odonata, Orthoptera, and Mantodea, and 14 Families: Scarabaeidae, Micropezidae, Syrphidae, Coreidae, Pentatomidae, Pseudococcidae, Ichneumonidae, Apidae, Vespidae, Hesperiidae, Nymphalidae, Noctuidae, Tettigonidae, and Hymenopodidae. Of these, only the Hemiptera family was more abundant in Parque dos Bilhares, with four distinct species (Figure 22) [23].

Figure 22. Pair of *Scipopus diversus* (Schiner, 1868) (Micropezidae) in Parque dos Bilhares

Source: https://docplayer.com.br/66145892-Gustavo-borges-ferro-micropezidae-diptera-do-brasil-taxonomia-e-distribuicao-geografica.html

3.4. Study 4

Thus, the objective of this work was to identify the diversity and abundance of insects captured in “flycatcher” traps in the guava culture variety. Fifteen traps made of pet bottles were installed following the Embrapa methodology. The period of insect collection was understood from the emergence of flower buds until the end of flowering, due to the greater occurrence of insects due to the greater availability of pollen and nectar (Figure 23) [24].

Figure 23. “flycatcher” traps

Source: https://www.magazineluiza.com.br/armadilha-para-mosca-com-atrativo-papa-mosca-royal/p/cj22j5347e/me/armi/

The evaluation was carried out weekly and the traps were taken to the laboratory to perform the counting and identification of insects at the order and family level. A total of 6,941 insects distributed in seven orders were captured: Hymenoptera (n=3,366, 48.5%) distributed in the families Apidae, Formicidae, Vespidae, Ichneumonidae, Braconidae and Chalcididae. The Apidae family comprises several bees that pollinate the guava tree. The last four are important natural enemies Vespidae (predator) and the others (parasitoids) (Figure 24) [24].

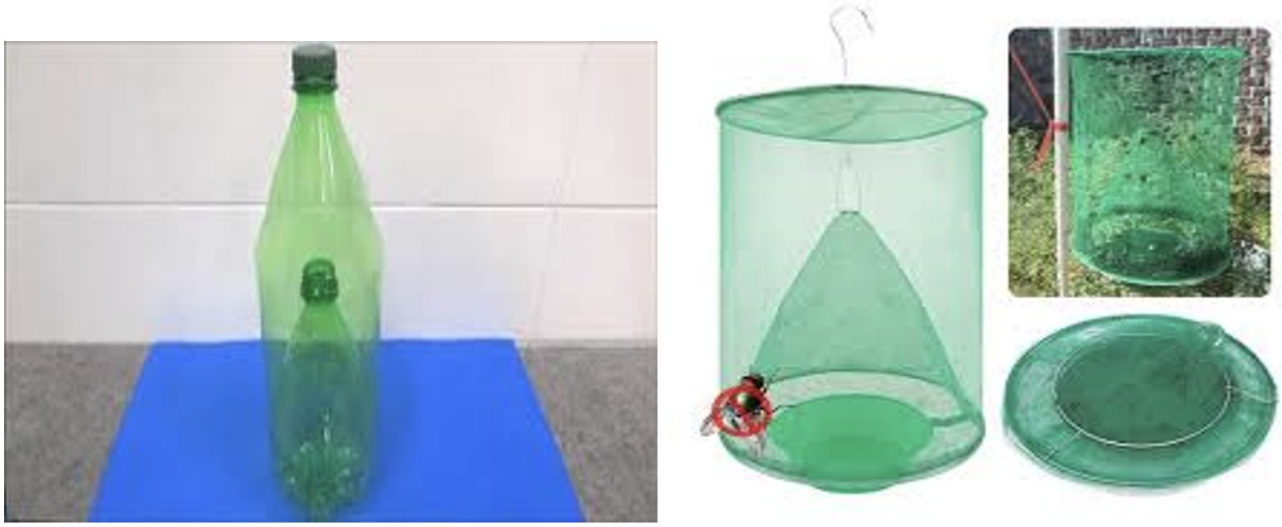

Figure 24. handmade “flycatcher” traps

Source: https://www.magazineluiza.com.br/armadilha-para-mosca-com-atrativo-papa-mosca-royal/p/cj22j5347e/me/armi/

Diptera (n=2,914, 42%) distributed in the families Muscidae, Drosophilidae, Tephritidae, Micropezidae, and Bibionidae. Tephritids are fruit flies that are pests of the crop, however, their occurrence was considered low with 3.8% of the flies collected. The orders Lepidoptera (n=407, 5.9%); Coleoptera (n=125, 1.8%); Neuroptera (n=71, 1.02%); Blattodea (n=55, 0.8%) and Hemiptera (n=3, 0.03%) occurred in smaller numbers, but it should be noted that in the Neuroptera order, all collected insects belong to the Chrysopidae family, important predators of the Psyllid of the guava key crop pest [24].

The orders Hymenoptera and Diptera were the most abundant and together they corresponded to 90.5%. However, the traps capture beneficial insects such as predators, parasitoids and pollinators, which shows the need for research aimed at changing the traps and/or removing them at the time of flowering when the greatest number of these beneficial insects [24].

3.5. Study 5

Fly Trap with Flycatcher

The ecological and definitive solution against flies.

Works on the basis of a non-toxic organic attractant and for this reason, do not harm you or the environment. Try this innovative solution and surprise yourself with the results. Ideal for tanneries, slaughterhouses, restaurants and guesthouses [25].

Characteristics:

1. Quickly attracts and eliminates stress and drowning flies;
2. Captures more than 500/g of flies per day;
3. Reduces more than 90% of the fly population in the area;
4. Eco-friendly product, safe, non-toxic;
5. Economical and practical;
6. Increases the health of the premises and the animal;
7. Promotes ecological, human and animal comfort;
8. Authorization for use by the Ministry of Agriculture (AUP) (Figure 26).

Figure 25. Armadilha Ferreira 1978 or fly trap

Source: http://www.biologico.sp.gov.br/uploads/docs/bio/v78_1/marchiori.pdf

Where to use:

1-Sites, farms and farms. 2-Hotels 3-Poultry farms. 4-Cattle. 5-Wood distribution center. 6-Tanning. 7-Fishing companies. 8-Industries in general of edible products. 9-Dairy products. 10-Dumps. 11-Pig farms. 12-Garbage recycling plant. 13-

Installation and Instructions for Use:

The biological traps must be installed at a distance of 10 to 12 meters from each other, moving them 5 to 10 meters away from the place to be controlled. Add 1 liter of product to the trap and strain the “Papa Mosca” solution every 3 days [25].

Bury the captured flies in a hole with a depth of more than 40 cm, to prevent the larvae from turning into flies and infesting the place again. Another option is to burn the captured flies.

Note: in the first 7 days, it is recommended to strain once a day[25].

4. Conclusion

Relatively few studies are known about the larval habit of tropical Micropezidae, but it is known that the larvae commonly develop in decomposing plant organic matter and can also be reared in manure. Species of the genus *Mimegralla* Rondani and *Calobata* Meigen can develop on rhizomes and roots of ginger or other plants.

References

1. ^*Mello RL. The Diptera described by Martín L. Aczel. Study Dipterologica. 2010; 17: 223-236.*
2. ^*Owen L. Family groups of Diopsoidea and Nerioidea (Diptera: Schizophora)—Definition, History and relationships. Zootaxa. 2020; 4735(1): 1–177.*
3. ^*Bonduriansky R. The evolution of condition-dependent sexual dimorphism. The American Naturalist. 2007; 16: 9–19.*
4. ^*Tatsuta H, Takahashi KH, Sakamaki Y. Geometric morphometrics in Entomology: basis and applications. Entomological Science. 2018; 21: 164-184.*
5. ^*Marshall S. Micropezidae. In: Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado MA, eds. Manual of Central American Diptera. 2nd ed. Ottawa: NRC Research Press; 2010. p. 805–813.*
6. ^*Amorim DS, Silva VC, Balbi MIPA. State of knowledge of Neotropical Diptera. In: Costa C, Vanin SA, Lobo J, Melic A, eds. Red Iberoamericana de Biogeografía y Entomología Sistemática PrIBES. 2nd ed. Zaragoza: Tercer Milenio; 2002; p. 1- 329.*
7. ^*Cumming JM, Wood DM. Morphology and terminology. In: Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado MA, eds. Manual of Central American Diptera 1st ed. Ottawa NRC Research Press; 2009. p. 9– 50.*
8. ^*Albuquerque LP. Taeniapterinae from Maracá Island and from a locality in Pacaraima, Roraima Brazil. Acta Amazonica. 1991; 21: 3–13.*
9. ^*Shtakel'berg AA. Family Micropezidae. In: Bei-Bienko G, Ya G, eds. Keys to the insects of the Europeans. 5th ed: Moscow: Keys to Palaearctic species. 1988.*
10. ^*McAlpine DK. Review of the Australian stilt flies (Diptera: Micropezidae) with a phylogenetic analysis of the family. Invertebrate Taxonomy. 1998; 12:55–134.*
11. ^*Sandhya PT, Subramanian M, Ghorpadé K. Biology of ginger rhizome fly, Mimegralla sp. near coeruleifrons (Diptera:*

Micropezidae). Entomology. 2016; 41(3): 177–182.

12. ^*Mitra B, Mazumder A, Chakraborti U, Iman I, Roy S. A Review on Indian Stilt-legged Flies (Insecta: Diptera: Micropezidae). The Journal of Zoology Studies. 2015; 2(5): 1–5.*
13. ^*Albuquerque LP. Studies of micropezids from the Amazon Basin. 1 – Contribution to the systematics of Micropezidae and study of the genus Taeniaptera Macquart, 1835 (Diptera – Acalyptratae). Acta Amazonica. 1980; 10: 659–670.*
14. a, b*Albuquerque LP. Study of the micropezids of the Amazon Basin. 2 – Redescription of three species and knowledge of two new species for Taeniaptera science Macquart, 1835 (Diptera – Micropezidae). Acta Amazonica. 1980; 10: 863–881.*
15. a, b*Brown BV, et al. Manual of Central American Diptera. 2nd ed. Ottawa: NRC Research Press. 2010.*
16. ^*Marques DWA, Rafael JA. Latheticomyia Wheeler (Diptera: Pseudopomyzidae) from Peru: new species, description of the male of L. longiterebra Hennig and a key to species. Zootaxa. 2016; 4093(3): 424–434. 85.*
17. ^*Ferro GB, Carvalho CJB. A pictorial key and diagnosis of the Brazilian genera of Micropezidae (Diptera, Nerioidea): Revista Brasileira de Entomologia. 2014; 58(1):52-62.*
18. ^*Marshall. SA. Micropezidae (Insecta, Diptera, Acalyptratae) of Madagascar and a revision of the genus Paramimegralla Hennig. 2017; Zootaxa. 4290(2): 244–280.*
19. ^*McAlpine DK. Review of the Australian stilt flies (Diptera: Micropezidae) with a phylogenetic analysis of the family. Invertebrate Taxonomy. 1998; 12: 55–134.*
20. ^*Bonduriansky R. Convergent evolution of sexual shape dimorphism in Diptera. Journal of Morphology. 2006; 267: 602–611.*
21. a, b, c, d, e*Project Noah. Stilt-legged fly [Internet]. Recife: Project Noah Nature © 2020 [cited 2023 Feb 06]. Available from https://www.projectnoah.org/spottings/121276073.*
22. a, b, c, d, e*Harterreiten-Souza ES, Pujol-Luz JR, Sujii ER. Influence of various farmland habitats on abundance of Taeniaptera (Diptera: Micropezidae). Florida Entomologist. 2016; 99(4): 740-743.*
23. a, b*Ferreira LV [Internet]. Manaus: Universidade do Estado Do Amazonas-UEA© 2017 [cited 2023 Feb 06]. Available from http://repositorioinstitucional.uea.edu.br/bitstream/riuea/1470/1/R.*
24. a, b, c, d*Feitosa KF. Beneficial entomofauna captured in flytraps in guava culture [Internet]. Recife: Universidade Federal Rural de Pernambuco, XVI JEPEX; @ 2016 [cited 2023 Feb 06]. Available from http://www.eventosufrpe.com.br/2016/anais/resumos/R1186-1.html*
25. a, b, c*Guimaraes RR. Traps used for collecting muscoid (Diptera). Bulletin of the Aragonese Entomological Society. 2003; 33: 281-283.*