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Study of the bionomy of the Ephydridae Family (Insecta: Diptera)

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Abstract

The larvae of the Ephydridae family feed on decaying plant material, algae, and other microscopic single-celled organisms and do not feed directly on plant tissue. Therefore, the damage they produce is indirect, since they are not phytophagous; but adults are vectors of bacteria, viruses and fungi which are transmitted on plants by perching and supporting their sucking mouthparts (proboscis). Also the larvae, when feeding, ingest spores of fungi or bacteria that then remain in the oral apparatus of the adult, and these, when flying and perching on the plants, transmit diseases. The high rate of reproduction of shore flies can give rise to a swarm of adults, which devalue the plants commercially. The objective of this paper and study of the bionomy of the Family Ephydridae. For this, a bibliographic survey of Ephydridae was carried out in the years 1926 to 2021. Only complete articles published in scientific journals and expanded abstracts presented in national and international scientific events were considered. Data were also obtained from platforms such as: World and Scielo.

Keywords: Petroleum Oil; Herbivorous; Predator; Damage; Bacterium

1. Introduction

Ephidrid flies (Ephydridae), commonly known as riverbank flies or beach flies, are a family of Brachycera insects of the order Diptera. Ephydridae is one of the most diverse families of the acaliptrate Diptera, with more than 1,500 species in about 110 genera. Shore flies are found near the shoreline of seas or smaller bodies of water such as lakes and ponds. There are about 2,000 described species worldwide (Figure 1) [1,2,3].

Source: https://www.naturalista.mx/observations/60747939

Figure 1 Specimens of Ephydridae Family

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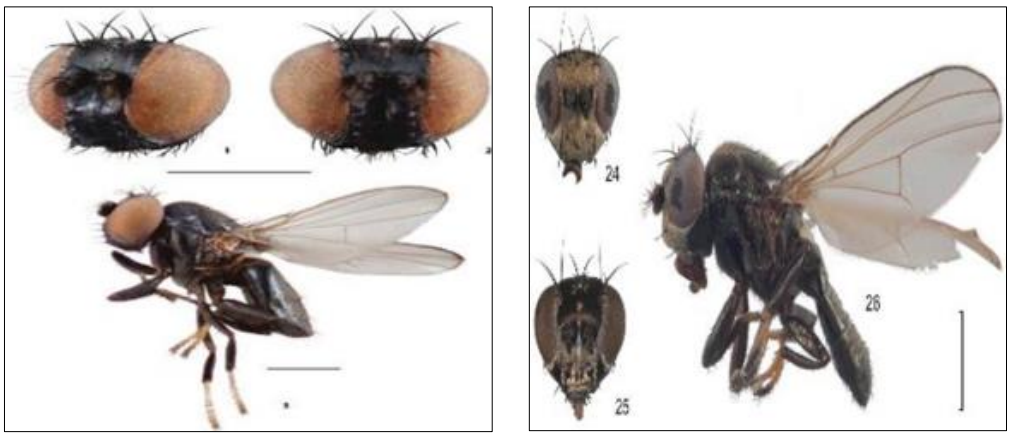
Helaeomyia petrolei (Coquillett, 1899) is the only known insect whose larva lives in natural crude oil. Another notable species is *Ephydra hians* Say, 1830, which lives in large numbers in Mono Lake with its extreme salinity (Figure 2) [2,3].

Source: https://www.naturalista.mx/observations/60747939

Figure 2 *Helaeomyia petrolei* (Coquillett, 1899)

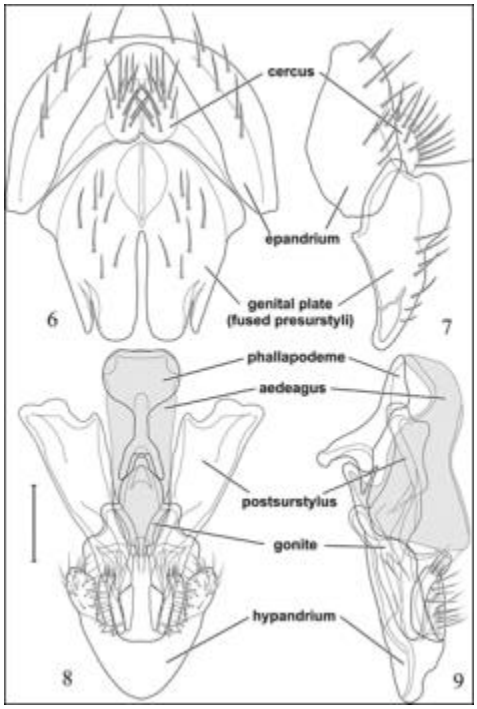
1.1 Description

They are extremely small flies (0.9 to 7.0 mm.), black or gray. The wings sometimes feature a design. The costa has two interruptions, one in the first section (near the transverse humeral vein) and one near the end of vein 1. The second basal cell is not separated from the discal cell. The awn is hairless or hairy only on the upper part (feathery upper part). The mouth opening is very large in some species. Generally, these insects are small in size and the adult color varies from silver gray to jet black, and their wings can vary from completely discolored to mottled gray and brown (Figures 3A and 3B, 3C, 4, 5 and 6A, 6B and 6C) [4,5,6].



Source: https://zookeys.pensoft.net/article/10718/element/7/0/Lamproclasiopa/

Figure 3A Male: (1) head, anterolateral oblique view; (2) same, previous view; (3) habitus, lateral view. Scale bar: 0.5 mm. Figure 3B male paratype head, anterior view 25 female paratype head, anterior view 26 male paratype habitus, lateral view. Scale bar = 0.5 mm

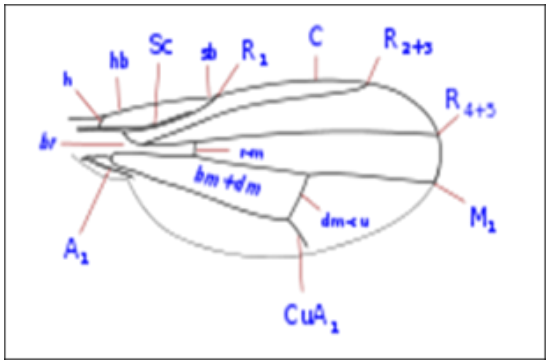


Source: https://diptera.myspecies.info/category/diptera-classification/ephydridae

Figure 3C Female usually larger than male. Pseudopostocellar setae divergent or lacking. Arista bare, pubescent, or pectinate; aristal rays on dorsum only, except in Asmeringa Becker and in some *Ptilomyia* Coquillett.

Source: https://www.naturalista.mx/observations/60747939

Figure 4 Wing veins (anterior view)



Source: https://es.wikipedia.org/wiki/Ephydridae

Figures 5 The wings sometimes feature a design. The costa has two interruptions, one in the first section (near the transverse humeral vein) and one near the end of vein 1. The second basal cell is not separated from the discal cell

Source: https://es.wikipedia.org/wiki/Ephydridae

Figure 6A Note wing pattern and feathery ridges

Source: https://bugguide.net/node/view/476402

Figure 6B Left for femur and tibia - posterior (outside) view

Source: Gardens of the Simón Bolívar University campus, Caracas, Venezuela

Figure 6C *Ochthera* sp. (Ephydridae)

1.2 Larva

1.2.1 Helaeomyia petrolei (Coquillett, 1899) larva

In the Notiphilini tribe the head is reduced to the cephalic skeleton. There are no anterior spiracles and the posterior ones extend like spines. The larvae of the other taxa are similar to those of the Sciomyzidae, with the posterior spiracles at the tips of divergent branches with a common base. They can be differentiated by short thoracic segments (like the abdominals) and by the absence of ventral arches connecting the buccal hooks (Figures 7 and 8) [7,8].

Source: https://pt.wikipedia.org/wiki/Helaeomyia_petrolei

Figure 7 *Helaeomyia petrolei* (Coquillett, 1899) larva

Source: https://www.sciencedirect.com/science/article/pii/B9780128042236000433

Figure 8 Larva anterior and posterior view

1.3 Biology

Plants belonging to 13 families were listed that were visited by Ephydridae (such as Polygonaceae and Anacardiaceae), and which have in common the fact of having composite or numerous inflorescences small clustered flowers. The uthors recorded, for example, the species *Allotrichoma abdominalis* (Williston, 1896), which has a long proboscis adapted to feed on nectar. Ephydridae are considered the main pollinators of *Cabomba caroliniana* Gray (Cabombaceae) (Figures 9, 10, 11, 12, 13 and 14) [7,8].

Source: https://www.naturalista.mx/observations/60747939

Figure 9 *Allotrichoma abdominalis* (Williston, 1896), which has a long proboscis adapted to feed on nectar

Source: https://bugguide.net/node/view/1639113/bgpage

Figure 10 Image of a pupa that resulted from some of these larvae held in a petri-dish. Pupae tended to be af varying sizes and shapes. May have been because of poor and artificial rearing conditions

Source: Photograph by Lyle J. Buss, University of Florida

Figure 11 Egg of leaf mining fly *Hydrellia* spp.

Source: Photograph by Lyle J. Buss, University of Florida

Figure 12 Larva of hydrilla leaf mining fly, *Hydrellia* spp.

Source: Photograph by Lyle J. Buss, University of Florida

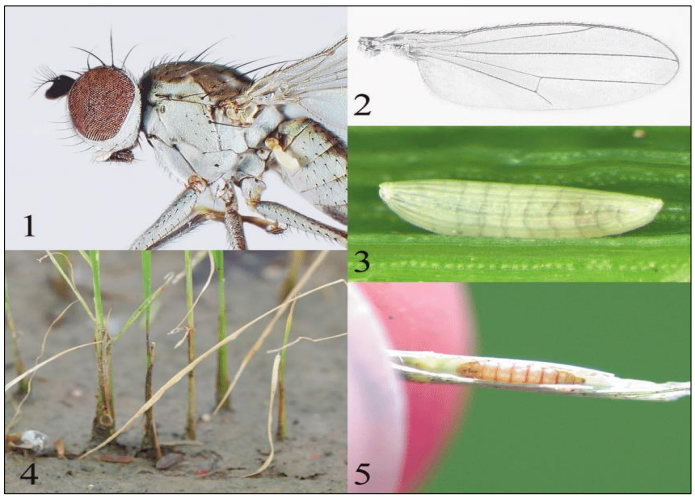
Figure 13 Puparium of hydrilla leaf mining fly, *Hydrellia* spp, left photo puparium containing pupa and right photo empty puparium

Source: Photograph by Lyle J. Buss, University of Florida

Figure 14 Damage to a hydrilla leaf caused by larvae of hydrilla leaf mining fly, *Hydrellia* spp.

1.4 Life cycle

After 3 to 4 days, the larvae hatch from the eggs. The larval stage lasts about two weeks before pupation. Pupae develop within the puparium over a period of 6 to 15 days, and adults live approximately 10 to 20 days (Figure 15A).



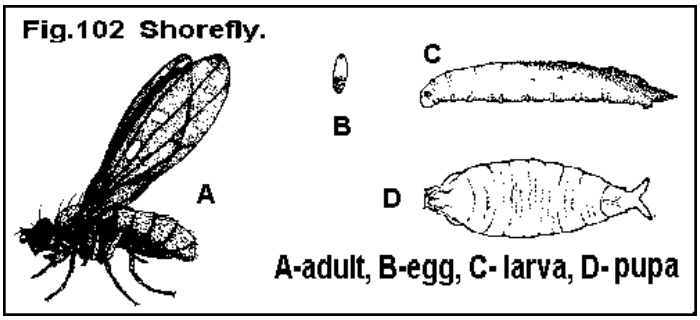
Source: https://diptera.myspecies.info/category/diptera-classification/ephydridae

Figure 15A Life Cycle Specimen of the Ephydridae Family

Ephydrid adults mate within two hours of emergence. The entire life cycle varies from 25 to 30 days. Ephydridae larvae are found near the surface of the water (Figures 15B and 16).

Source: https://www.naturalista.mx/taxa/84670-Ephydridae/browse_photos

Figure 15B Copulation between adults of the Ephrytidae Family



Source: https://mrec.ifas.ufl.edu/lso/entomol/ncstate/fly5.htm

Figure 16 Full view Shore fly A-adult, B-egg, C-larva, D-pupa

1.5 Habitats

1.5.1 Notihila sp. in flower of Nymphaeaceae

Ephidrid flies occupy a variety of coastal and wetland aquatic habitats including hot springs, oil lagoons, saltwater lagoons, alkaline lakes, and wetlands. Imagos are herbivorous, feeding on microscopic algae and bacteria (*Paracoenia* and *Ephydra*), although some are predatory (Ochthera, Ephydrinae). Most larvae are also phytophagous, grazing aquatic plants (including cultivated rice), others feed on algae or are saprophytic. *Trimerina* larvae are predatory. Some species are an important food source for other animals. Others cause damage to crops (Figure 17).

Source: https://www.naturalista.mx/taxa/84670-Ephydridae/browse_photos

Figure 17 *Helaeomyia petrolei* (Coquillett, 1899) found in oil

These small acaliptrated Diptera normally occur in habitats aquatic and semi-aquatic such as swamps, banks of rivers and lagoons and the marine coast, being thus commonly known as “shore flies” or “brine flies” (Figure 18).

Source: https://www.naturalista.mx/taxa/84670-Ephydridae/browse_photos

Figure 18 Saprophytic Ephydridae Family

The larvae of some ephidrides live in unusual habitats. For example, *Ephydra brucei* (Tullgren 1955) lives in hot springs and geysers where the temperature can exceed 45°C, some *Scatella* live in sulphurous waters; Helaeomyia petrolei develops in puddles of crude oil and *Ephydra cinerea* Jones, 1906 lives in salty lagoons. Some are of public health importance because they live in sewage or septic tanks (Figure 19).

Source: https://canberra.naturemapr.org/species/4831

Figure 19 Saprophytic Ephydridae Family

In Brazil, there are about 80 species distributed in 28 genera and represent a small part of the family diversity in the region (Figures 20, 21, 22, 23 and 24) [9,10].

Source: https://www.naturalista.mx/observations/30950952

Figure 20 Habitats aquatic Ephydridae Family

Source: https://www.naturalista.mx/observations/30950952

Figure 21 This was an unusual sighting, as this species usually occurs near at least pools of water. Although it was wet enough for the moss to be damp, it was still relatively dry here

Source: https://www.naturalista.mx/observations/30950952

Figure 22 Thousands upon thousands of these flies along the causeway to Antelope Island. Wonderful source of food for the many birds

Source: https://www.naturalista.mx/observations/30950952

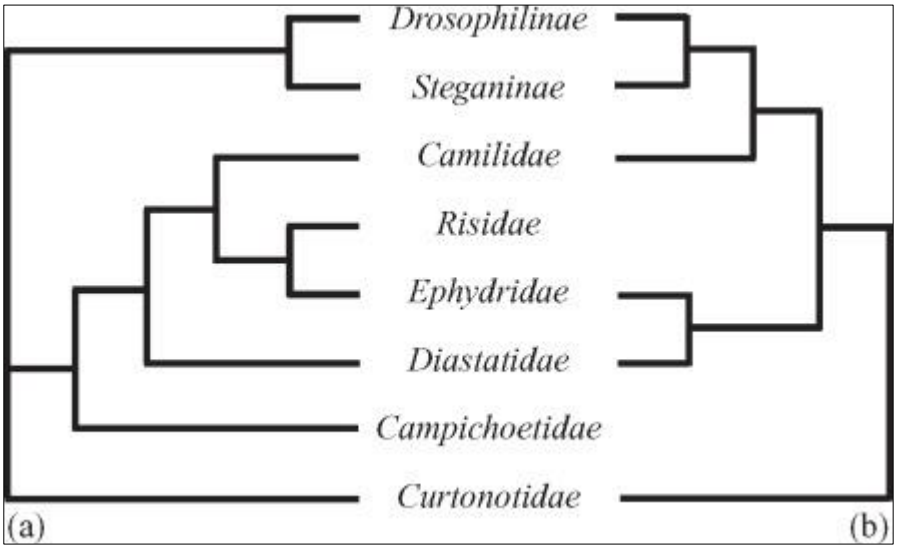
Figure 23 Pollination of species of the Ephydridae family

Source: https://bugguide.net/node/view/1329142/bgpage

Figure 24 Very fun to photograph the larva underwater. Not easy with the salinity layers

1.6 Phylogeny

A phylogenetic study based on characters molecular and morphological, including 149 of the 157 recognized Diptera families. In According to the phylogenetic relationship presented in this study, the Ephydridae family is a monophyletic group included in the Ephydroidea cyanide. This in turn is the sister group of Calyptratae, included in the Schizophor grouping (Figure 25) [11,12, 13,14].



Source: Thorp and Covich's Freshwater Invertebrates (Fourth Edition), 2015

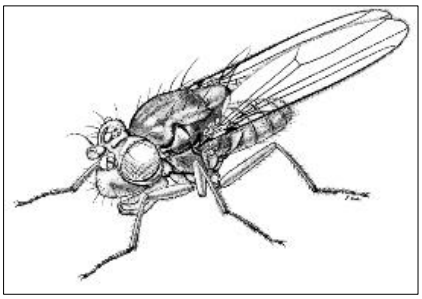
Figure 25 a) Phylogeny of Ephydroidea based on Grimaldi (1990); (b) Phylogeny of Ephydroidea from McAlpine (1989)

1.7 Taxonomia

Superfamily Ephydroidea: Discomyzinae, Ephydrinae, Gymnomyzinae, Hydrelliinae and Hytheinae (Figures 26, 27, 28, 29 and 30) [12,13,14,15,16].

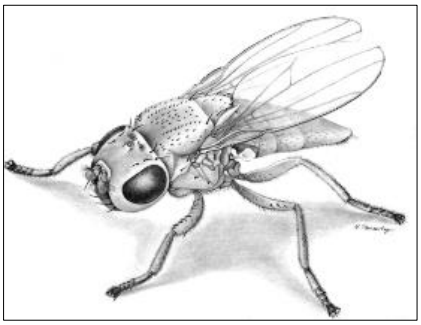
Source: Zatwarnicki T, Cielniak M, Pochrząst K. A Revised Phylogeny of Discocerinini (Diptera: Ephydridae) with an Emphasis on Structures of the Proboscis. Annales Zoologici. 2016 66(1), 1-34

Figure 26 Subfamily Discomyzinae



Source: https://www.semanticscholar.org/paper/Studies-of-Ephydrinae-(Diptera%3A-Ephydridae)%2C-VI%3A-of-Mathis/999d8268fb5afee78e73f297a76e710013e78fcb/figure/0

Figure 27 Subfamily Ephydrinae



Source: https://www.semanticscholar.org/paper/Studies-of-Gymnomyzinae-(Diptera%3A-Ephydridae)%2C-IV%3A-Mathis/bd4d706a4577a3db2483676bf5f4c3c452401c6f/figure/0

Figure 28 Subfamily Gymnomyzinae

Source: https://bioone.org/journals/annales-zoologici/volume-64/issue-3/000345414X684821/Phylogeny-of-Hyadinini-Diptera--Ephydridae-with-an-Emphasis-on/10.3161/000345414X684821.short

Figure 29 Subfamily Hydrelliinae

Source: https://bugguide.net/node/view/866412

Figure 30 Subfamily Hytheinae

Objective

The objective of this manuscript was to carry out an inventory of the Family Ephrytidae (Insecta: Diptera).

2. Methods

The method used to prepare this mini review was Marchiori 2021 methodology [17].

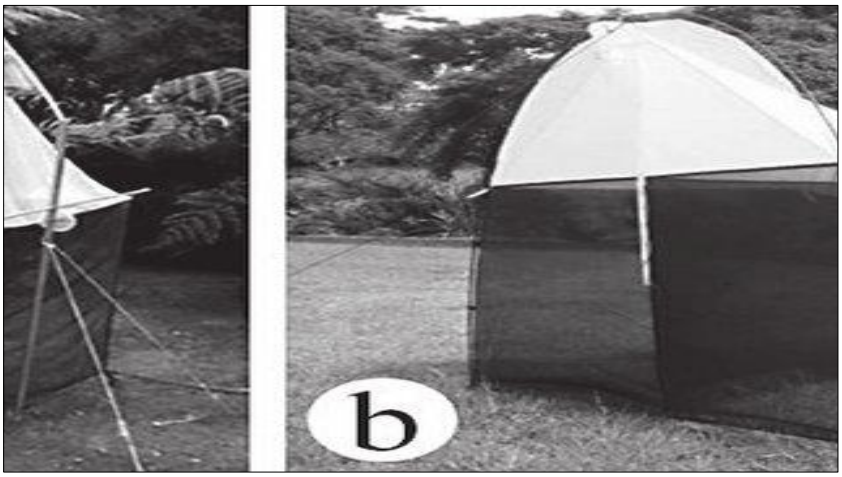
3. Studies conducted and selected

3.1 Study 1

A study of the Diptera population, occurent in Estação Ecológica of Tapacura, PE., has been carried ait for two years. The insects were collected of January 1981 to December 1983. The Tapacura Ecological Station was divided into four subareas, two close to the water collections and the other two in the Mata region. Used to collect the dipterans entomological nets (Figures 31 and 32) [18].

Source: http://www.portal.zoo.bio.br/cat147

Figure 31 Estação Ecológica of Tapacura, PE



Source: https://www.researchgate.net/figure/Figura-2-Redes-entomologicas-a-rede-entomologica-comum-wwwentosuppliescomau-b_fig2_264414345

Figure 32 Entomological Network

During the course of the present work, 1,200 specimens were collected, classified in 18 families. As in each excursion, only small sample, a notification regarding the occurrence of each existing family in the studied area, following the following criteria: abundant: ++++, frequent: ++ +, occasional: ++ and rare: +.

Of the 18 families found, the Chironomidae, Drosophilidae, Tethinidae, Sciaridae, Sepsidae, Micropezidae, Leptoceratidae and Sciamizidae showed very low incidence, not justifying further details about them. The most frequent dipterans were: Muscidae 490, 210 Dolichopodidae, 190 Ephydriidae and 98 Sarcophagidae, with a percentage of 83.9%, leaving only 16.1% for the remaining families (Figure 33).

Source: https://bugguide.net/node/view/1364921

Figure 33 Specimen of Ephydridae Family

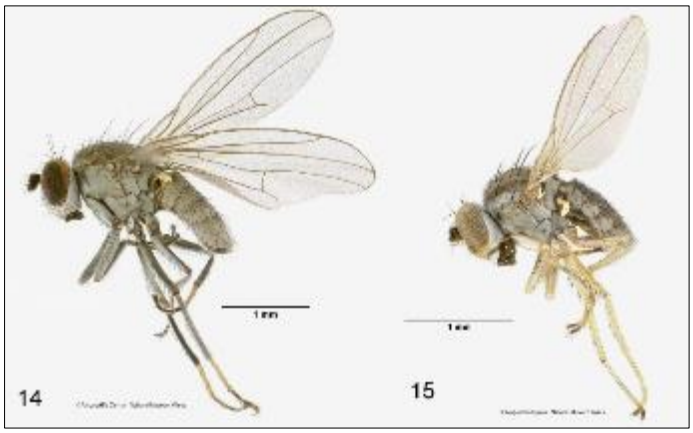
All Ephydridae belong to the genus *Barochotera,* occurring in a relatively large percentage corresponding to 15.8% of the total of dipterans. Chloropidae, Ephydriidae, Micropezidae, Lauxaniidae, Ottidae, always appeared in humid and flooded places (Figure 34). [18].

Source: https://www.naturalista.mx/observations/6806541

Figure 34 Humid and flooded places

3.2 Study 2

Among the Ephydridae (Diptera) family, *Hydrellia* is the genus with the highest number of species described worldwide (more than 200). In addition to the great species richness, *Hydrellia* is also known for its great potential as an agricultural pest, as its larvae form mines in vegetables planted in flooded regions, such as oats, barley and rice (Figure 35, 36 and 37).



Source: Images: James Turner, NMWC

Figure 35 15. Habitus, side view. 14. *Hydrellia griseola* (Fallén, 1813), female. 15. *Hydrellia latipalpis* Cresson, 1943

Numerous losses have been reported in oat plantations and barley, caused by *Hydrellia griseola* (Fallén, 1813), in the summer of 1860 in Sweden, this was the first record of *Hydrellia* species as an agricultural pest. Since then, other occurrences were reported in several countries, such as Egypt, Japan and the United States. The only species recorded for Brazil is *Hydrellia xanthocera* Cresson, 1938.

Source: Júnior FA, Rodrigues MR, Nielsen W, Souto MC. *Hydrellia* Robineau-Desvoidy (Diptera: Ephydridae) from Brazil with an emphasis on the faunas from the states of Parana and Rio de Janeiro. Zootaxa. 2014; 3753(6): 501-541

Figure 36 (male, profile of thorax and head) from Matinhos, Paraná; 4.2) *Hydrellia calverti* Cresson, 1918 (female, profile) from Matinhos, Paraná; 4.3) *Hydrellia tibialis* Cresson 1917 (male, profile) from Rio de Janeiro; 4.4) *Hydrellia vulgaris* Cresson 1931 (male, profile) from Parque Iguaçú, Paraná; 4.5) *Hydrellia wirthi* Korytkowsky, 1982 (female, profile) from Bocaiúva do Sul, Paraná; 4.6) *Hydrellia xanthocera* Cresson, 1938 (holotype, female), profile

Since then, few taxonomic studies on this genus have been developed in the country. This work aimed to expand the knowledge of *Hydrellia* in Brazil, through new species records. Material was obtained by active collection with an entomological net and sweeping in regions close to water bodies during the period from January to November 2010, in the states of Paraná and Amazonas. A collection was also carried out in the Tijuca National Park in Rio de Janeiro, in October 2011.

Source: Republic of Cuba. Ministry of Informatics and Communications (2017)

Figure 37 Presence of *Hydrellia* sp., on leaves of rice A. Eggs. B. Larva. C. Pupa. D. Adult

The following species were identified: *Hydrellia anthocera* (12 specimens from CEIOC from the city of Rio de Janeiro, from the localities of Grajaú and Jacarepaguá), *H. tibialis* (47 specimens from five locations: Parque Nacional da Tijuca, RJ; Bocaiúva do Sul, Curitiba and Parque Iguaçu, PR and Sítio Vida Tropical, Amazonas) and *H. calverti* (eight specimens from Parque Iguaçu, PR). *Hydrellia tibialis* and *H. calverti* are reported for the first time in Brazil, increasing the number of species recorded in the country from 1 to 3 [19].

3.3 Study 3

The work was developed with the aim of obtaining a updated material related to the characterization of the main pest insects, invertebrates and vertebrates that can affect the cultivation of rice in Ecuador, as well as the damage they cause and measures for their control, through consultation of updated scientific literature, aimed at creation of theoretical bases in farmers, technicians, professionals, students and the population in general, linked to rice production.

3.3.1 Rice leafminer fly

That the fly rice leafminer *Hydrellia wirthi*, Korytkowski, 1982 (Diptera: Ephydridae) is a very harmful that attacks the crop in the early stages of growth. In recent years, the population of This insect has increased steadily, due to inadequate management of insecticides and climatic variations that have favored its development (Figures 38 and 39).

Source: https://repositorio.unc.edu.pe/bitstream/handle

Figure 38 That the fly rice leafminer *Hydrellia wirthi*, Korytkowski, 1982 (Diptera: Ephydridae)

Source: https://www.lsuagcenter.com/topics/crops/rice/insects/presentations/16south-american-rice-miner

Figure 39 Damage: *Hydrellia wirthi*, Korytkowski, 1982 (Diptera: Ephydridae)

3.3.2 Management

Taking into account that *H. wirthi* reaches rice areas unexpectedly, the best method for its control is the use of insecticides, obtaining excellent results. Among the products more efficient is Diazinon in doses of 0.50-0.75 l ha-1, which is very effective. What's more, there are biological controls reported in various rice-growing areas, among which are spiders predators of the adult insect and wasps that parasitize the eggs and larvae of *Hydrellia* such as: *Gerris* sp. (Hemiptera: Gerridae), and *Pirata piraticus* (Clerck, 1757)

is a species of wolf spider in the Lycosidae Family. It is found in North America, Europe, Turkey, the Caucasus, Russia, Central Asia, China and Japan. Wikipedia is a species of wolf spider in the Lycosidae Family. It can be found in North America, Europe, Turkey, the Caucasus, Russia, Central Asia, China and Japan (Figure 39).

Source: https://en.wikipedia.org/wiki/Pirata_piraticus

Figure 39 Predator spider *Pirata piraticus* (Clerck, 1757)

Several Hymenoptera as biological controls of *Hydrellia*. The most effective. They are *Chorebus aquaticus* Muesebeck, 1950 (Hymenoptera; Braconidae) and *Opius hydrelliae* Muesebeck, 1967. East parasitism in the first generation of the pest it is low, although it increases by 70 to 80% on the second and third generation (Figure 40).

Source: https://www.si.edu/object/nmnhentomology_9176180

Figure 40 *Chorebus aquaticus* Muesebeck, 1950. (Hymenoptera; Braconidae)

In the rice zone of Jamundí (Colombia) there are some reports of wasps that parasitize eggs and larvae of *Hydrellia* and *Chorebus aquaticus* Muesebeck, 1950. (Hymenoptera: Braconidae) and *Opius hydrelliae* Muesebeck, 1933 (Hymenoptera: Braconidae) are mentioned (Figure 41).

Source: Photograph by of Florida Jian Li, University

Figure 41 Dorsal view of an adult *Opius* sp. (Hymenoptera: Braconidae), an

3.4 Ethological control

Consists of the use of traps activated with light attractants, visual (colors), food (ferments), sexual (pheromones), which act as stimuli to attract pest insects in order to catch them. Light-based traps attract nocturnal flying insects (butterflies, beetles, flies). By capturing adult insects, the biological cycle of these and the reduction of their populations is achieved (Figure 42).

Source: https://cropwatch.unl.edu/2019/light-trap-data-available-online

Figure 42 Light Trap

3.4.1 Check it out chemical

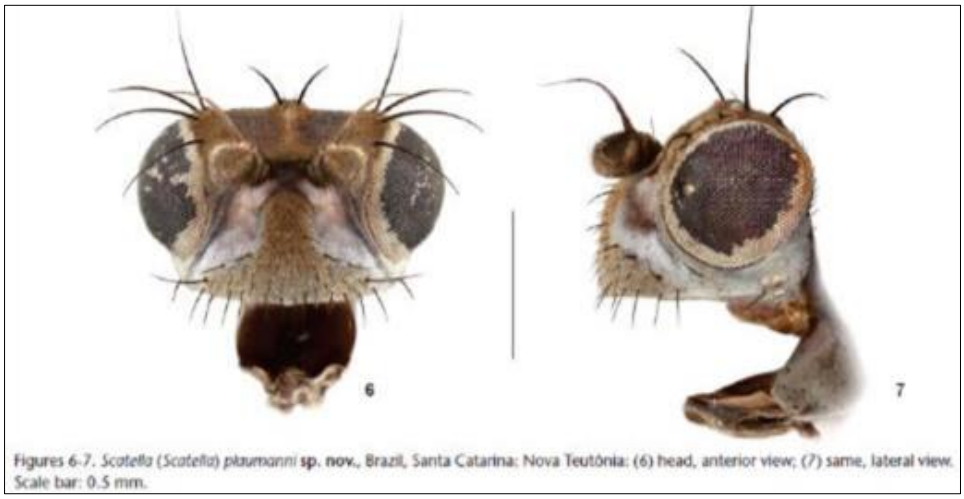
Taking into account that *H. wirthi* reaches rice areas unexpectedly, the best method for its control is the use of insecticides, obtaining excellent results. among the products more efficient is Diazinon in doses of 0.50-0.75 l ha-1, which is very effective [20,21,22].

3.5 Study 4

The identified species was *Scatella* sp. It is an insect belonging to the Diptera order, Ephydridae family, Ephidrinae subfamily, Scatellini tribe.

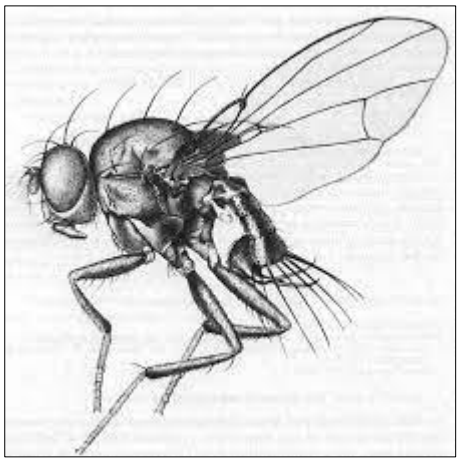
3.5.1 Scatella sp.

Adults are small 2-mm flies with a black body and are characterized by brown spots on their wings. The larvae and Adults are closely related to places where algae develop and the presence of algae and moss in pots, floors and buildings is very favorable for their development (Figures 43 and 44).



Source: https://www.scielo.br/j/zool/a/55dShdpbrfyFpBVBQH6gCsj/?lang=en#ModalFiga05fig06

Figure 43 *Scatella plaumanni* sp. nov., Brazil, Santa Catarina: Nova Teutônia: (6) head, anterior view; (7) same, lateral view



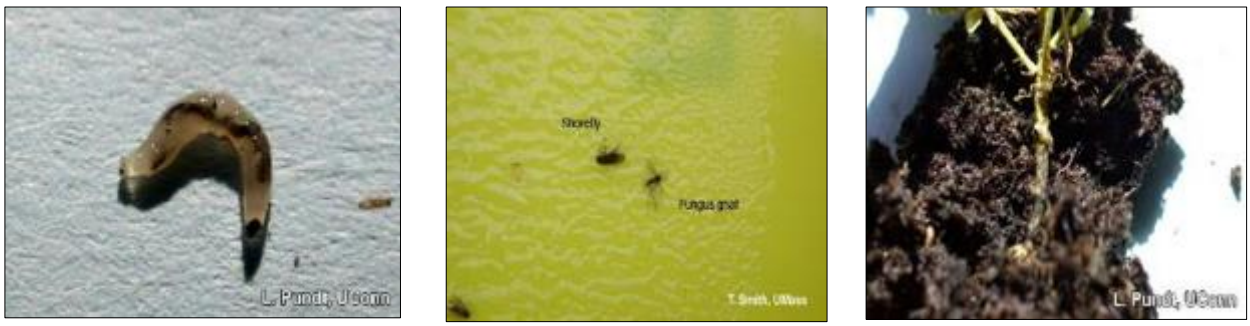
Source: https://www.diptera-in-beeld.nl/Ref-Key%20Ephydridae%20British%20key%20-%20new%20(2006)-C.M.Drake.pdf

Figure 44 *Scatella* sp.

The larvae feed on decaying plant material, algae, and other microscopic single-celled organisms and do not feed directly on plant tissue. Therefore, the damage they produce is indirect, since they are not phytophagous; but adults are vectors of bacteria, viruses and fungi which are transmitted on plants by perching and supporting their sucking mouthparts (proboscis). Also the larvae, when feeding, ingest spores of fungi or bacteria that then remain in the oral apparatus of the adult, and these, when flying and perching on the plants, transmit diseases. The high rate of reproduction of shore flies can give rise to a swarm of adults, which devalue the plants commercially (Figure 45).

Source: https://www.waterbugkey.vcsu.edu/php/genuskey.php?idnum=7&o=Ephydridae1L&type=genus

Figure 45 *Scatella* larvae



A **B** **C**

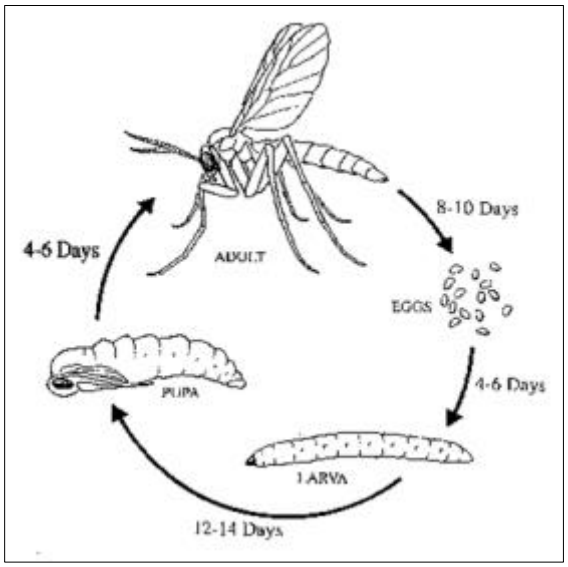
Source: https://ag.umass.edu/greenhouse-floriculture/fact-sheets/fungus-gnats-shore-flies

Figure 46 Fungus gnats and shore flies: fungus gnat larvae (A); adult fungus gnat (B); and Fungus gnat larvae (C)

The adults leave their droppings on the foliage of the plants, decreasing the value aesthetic. High numbers of adult edge flies can become a significant nuisance to workers in greenhouses. The adults They feed on bacteria and yeasts that

grow on the surface of the soil. *Scatella stagnalis* Fallen, 1813 (Diptera: Ephydridae) adults are capable of transmitting *Pythium aphanidermatum* and *Fusarium oxysporum* f. sp. *lycopersici* in greenhouses (Figures 46).

The presence of ephedrine flies, algae growth and root diseases in seedlings are common in situations of high ambient humidity. In the case of the lettuce seedlings observed in the Horticultural Region of Rosario, they could not found pathogenic fungi associated with the roots. However, it was observed that algae developed in the root ball and the seedlings showed loss of turgor and yellow leaves, symptoms associated with the destruction of roots, the roots were necrotic with growth of secondary roots associated with loss of the root apex (Figure 47).



https://ag.umass.edu/greenhouse-floriculture/fact-sheets/fungus-gnats-shore-flies

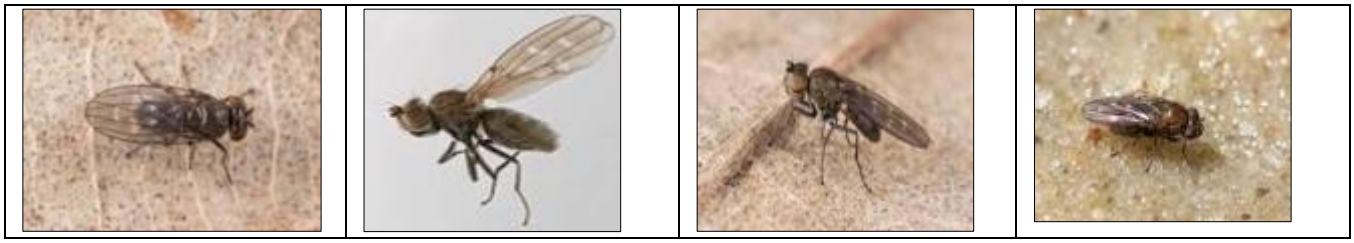
Figure 47 *Scatella* life cycle (UMass Extension Greenhouse Crops and Floriculture Program)

3.5.2 Their life cycle

Includes the egg stage, three larval stages, the pupal stage, and the adult stage. The females lay eggs singly on the soil surface. The larvae are found within the algal crust and below the soil surface in the first few layers. The fully developed larva can be up to 0.5 mm in length. The larva pupates within the integument of the last larval stage. forming a puparium on or very close to the soil surface. The duration of the different stages of *Scatella tenuicosta* Collin, 1930, reared on algae between 20°C and 28.5°C is shown in. The development time for the different stages and the total time required to develop from egg to hatching. adult decreases with increasing temperature. The development from egg to adult lasts between 7 and 14 days between 20°C and 28.5°C of temperature (Figure 48A and 48B)

https://ag.umass.edu/greenhouse-floriculture/fact-sheets/fungus-gnats-shore-flies

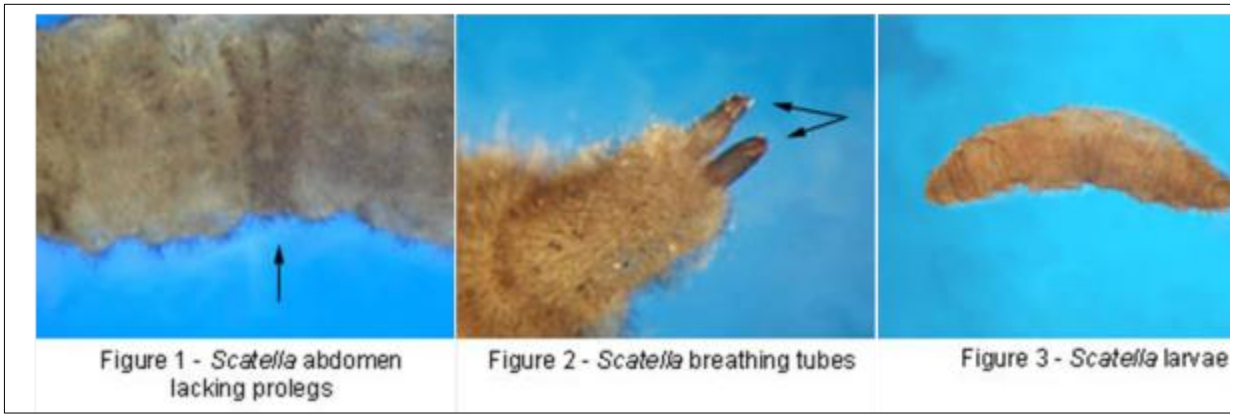
Figure 48A Another type of shore fly (Ephydridae sp.) from the seashore. Adult fungus gnat (*Bradysia* sp.). Adult shore fly (Scatella obscura). Fungus gnat adult on the left and an adult shore fly (*Scatella tenuicosta* Collin, 1930) on the right. Figure 48B Adults of *Scatella tenuicosta* Collin, 1930



Source:https://www.google.com/search?q=Scatella+tenuicosta&oq=Scatella+tenuicosta&aqs=chrome.0.69i59.1497j0j7&sourceid=chrome&ie=UTF-8

Figure 48B Adults of *Scatella tenuicosta* Collin, 1930

The larvae feed on decaying plant material, algae, and other microscopic single-celled organisms and do not feed directly on plant tissue. Therefore, the damage they produce is indirect, since they are not phytophagous; but adults are vectors of bacteria, viruses and fungi which are transmitted on plants by perching and supporting their sucking mouthparts (proboscis). Also the larvae, when feeding, ingest spores of fungi or bacteria that then remain in the oral apparatus of the adult, and these, when flying and perching on the plants, transmit diseases (Figure 49).



Source: https://www.waterbugkey.vcsu.edu/php/genuskey.php?idnum=7&o=Ephydridae1L&type=genus

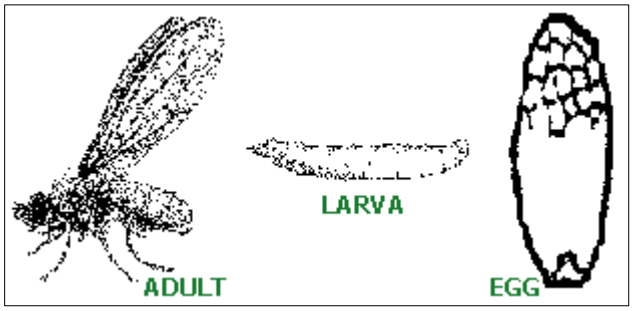
Figure 49 Prolegs are found on the abdominal segments (Fig. 4). Spiracles are elevated on sharply pointed spines on the last body segment (Fig. 5). The overall body looks like Figure 6

The high rate of reproduction of shore flies can give rise to a swarm of adults, which devalue the plants commercially. The adults leave their droppings on the foliage of the plants, decreasing the value aesthetic. High numbers of adult edge flies can become a significant nuisance to workers in greenhouses. The adults feed on bacteria and yeasts that grow on the surface of the soil.

Source:
https://www.google.com/search?q=Scatella+stagmalis+Fallen%2C+1813&oq=Scatella+stagmalis+Fallen%2C+1813&aqs=chrome..69i57.48620j0j7&sourceid=chrome&ie=UTF-8

Figure 50 *Scatella stagmalis* Fallen, 1813

Scatella stagmalis Fallen, 1813 adults are capable of transmitting *Pythium aphanidermatum* and *Fusarium oxysporum* f.sp. *lycopersici* in greenhouses. The presence of ephedrine flies, algae growth and root diseases in seedlings are common in situations of high ambient humidity. In the case of the lettuce seedlings observed in the (Figure 50).Horticultural Region of Rosario, they could not found pathogenic fungi associated with the roots. However, it was observed that algae developed in the root ball and the seedlings showed loss of turgor and yellow leaves, symptoms associated with the destruction of roots, the roots were necrotic with growth of secondary roots associated with loss of the root apex (Figure 51).

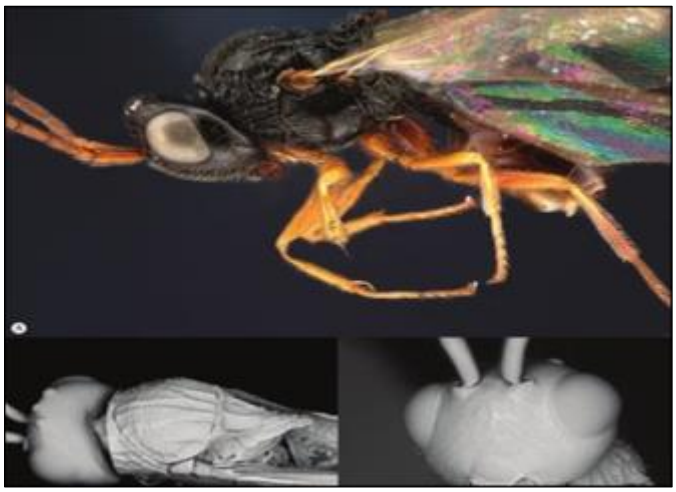


Source: From: NC Extension

Figure 51 Their life cycle includes the egg stage, three larval stages, the pupal stage, and the adult stage

Their life cycle includes the egg stage, three larval stages, the pupal stage, and the adult stage. The females lay eggs singly on the soil surface. The larvae are found within the algal crust and below the soil surface in the first few layers. The fully developed larva can be up to 0.5 mm in length. The larva pupates within the integument of the last larval stage forming a puparium on or very close to the soil surface. The duration of the different stages of *S. tenuicosta* reared on algae between 20°C and 28.5°C is shown in. The development time for the different stages and the total time required to develop from egg to hatching. adult decreases with increasing temperature. The development from egg to adult lasts between 7 and 14 days between 20°C and 28.5°C of temperature.

Parasitoids. Microhymenoptera emerged from *Scatella* pupae found in the root ball of lettuce seedlings in the Horticultural Region of Rosario. parasitoids belonging to the genus *Hexacola*, within the subfamily Eucoilinae, family Figitidae. This genus of Figitidae has been previously cited as parasitoid of *Scatella* in the city of Buenos Aires (Figures 52 and 53) [23].



Source: https://www.researchgate.net/figure/Aegilips-species-Kenya-A-habitus-lateral-view-B-head-and-mesosoma-dorsolateral-view_fig5_274380368

Figure 52 Genus *Hexacola*

Source: https://www.researchgate.net/figure/Aegilips-species-Kenya-A-habitus-lateral-view-B-head-and-mesosoma-dorsolateral-view_fig5_274380368

Figure 53 Figitidae Family

4. Conclusion

Ephidrid flies occupy a variety of coastal and wetland aquatic habitats including hot springs, oil lagoons, saltwater lagoons, alkaline lakes, and wetlands. Imagos are herbivorous, feeding on microscopic algae and bacteria (Paracoenia, *Ephydra*), although some are predatory (Ochthera, Ephydrinae). Most larvae are also phytophagous, grazing aquatic plants (including cultivated rice), others feed on algae or are saprophytic. *Trimerina* larvae are predatory. Some species are an important food source for other animals and others cause damage to crops.

Compliance with ethical standards

Disclosure of conflict of interest

The author has no conflict of interest.

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