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Study on the Pantophthalmidae Family (Diptera: Pantophthalmidae)

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Abstract

There are occurrences of the Pantophthalmidae Family in several Brazilian states, in which observed the habits of these insects. It appears that the larvae are more active at night, live in living or dead trees, and they feed on accumulated organic matter or the products of wood fermentation, on the other hand, adult activities are restricted to reproduction, being cuddles and showing sexual dimorphism. The aim of this paper is to study the biological and taxonomic aspects of the Pantophthalmidae Family. For this, a bibliographic survey of Pantophthalmidae was carried out in the years 1976 to 2022. 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: Academia.edu, Frontiers, Qeios, Pubmed, Biological Abstract, Publons, Dialnet, World, Wide Science, Springer, RefSeek, Microsoft Academic and Scienc.

Keywords: Xylophagous insects; Wood; Fermentation; Sexual dimorphism; Brazil

1 Introduction

Pantophthalmidae is a Family of large and robustas, belonging to the suborder Brachycera, superFamily Stratiomyoidea. They are popularly known as wood flies, and most adults are dark brown to reddish or black in color, with longitudinal stripes in the mesonotum (Figures 1, 2, 3 and 4) [1,2].

Source: Stéphane De Greef

Figure 1 Specimen of Pantophthalmidae Family lateral view

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Source: https://www.biodiversity4all.org/taxa/245352-Pantophthalmidae

Figure 2 Specimen of Pantophthalmidae Family dorsal view

Source: https://v3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=532686

Figure 3 Specimen of Pantophthalmidae Family ventral view

Source: https://www.scielo.br/j/paz/a/nxs94qMNg6xQnjCY9dnVWrw/?lang=en#ModalFigf1

Figure 4 *Pantophthalmus*. (1) Male. (2) Female. Sexual dimorphism

1.1 Description

They are distinct from other basal brachycerans by having large pulvilliform empodia, absence of spurs on the anterior and posterior tibias, and the presence of a distinct tuft of bristles below or close to the posterior spiracle (Figure 5) [3,4,5].

Source: https://www.researchgate.net/figure/Figures-3-6-Pantophthalmus-chuni-Enderlein-1912-3-Dorsal-habitus-4-Lateral-view_fig2_330968809

Figure 5 *Pantophthalmus chuni* (Enderlein, 1912). 3. Dorsal habitus. 4. Lateral view of head. 5. Base of wing. 6. Hind femur

The wings are hyaline, with spots of varied patterns, yellow or brown. The eyes are large and occupy the most of the head. Females are dicoptic and males are holoptic, both with eight segments on the antenna. The larvae have a body with 12 segments, the first segment of the thorax and the last segment of the abdomen are strongly chitinized (Figures 6 and 7) [5,6,7].

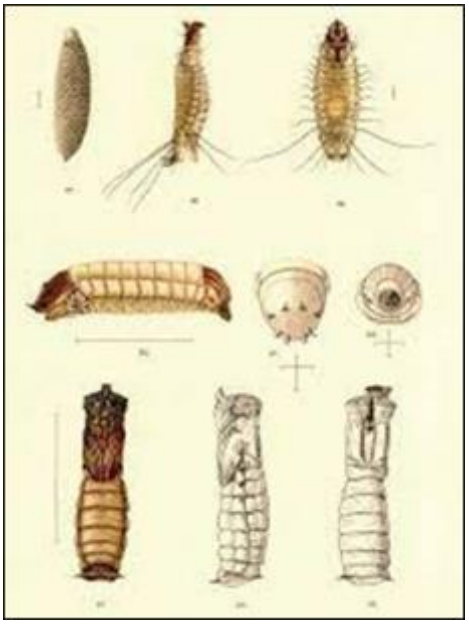
Source: https://www.researchgate.net/figure/Figures-7-10-Pantophthalmus-comptus-Enderlein-1912-7-Dorsal-habitus-8-Lateral-view_fig3_330968809

Figure 6 *Pantophthalmus comptus* Enderlein, 1912. 7. Dorsal habitus. 8. Lateral view of head. 9. Base of wing yellow. 10. Hind femur without ventral spine

Source: After Andrade, 1930

Figure 7 *Pantophthalmus pictus* (Wiedemann, 1821): 1, female; 2, female head; 3, female abdomen; 4, male; 5, male head; 6, left antenna of female, outer side; 7, left antenna of female, inner side; 8, female proboscis; 9, female head, lateral view; 10, facial process of female; 11, male head, dorsal view; 12, apical and preapical articles of female fore tarsus; 13, apical and preapical articles of male fore tarsus; 14, terminal segments of female abdomen, dorsal view; 15, left maxillary palpus of male, ventral view, inner side; 26, left maxillary palpus of female, ventral view, inner side

Larvae are amphipneustic, with a pair of thoracic spiracles and a pair of abdominal spiracles; except in the first instar larva, which has finger-like or flabelliform organs in the ventral part of the abdomen. Their larvae attack and pierce living or dead trees, forming galleries where probably feed on accumulated organic matter or its fermentation (Figure 8) [6,7].

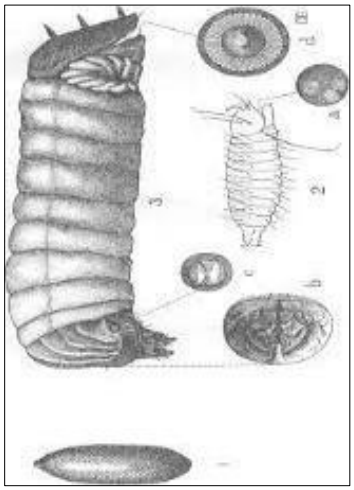


Source: After Andrade, 1930

Figure 8 *Pantophthalmus pictus* (Wiedemann, 1821). 17, egg; 18, newly emerged larva, lateral view; 19, do., lateral view; 20, developed larva, lateral view; 21, last segment of adult larva; 22, cephalic segment and prothorax of larva, frontal view; 23, pupa, ventral view; 24, pupa, lateral view; 25, puparium

Biology, habitat Ecology and Damage

There are occurrences of the Pantophthalmidae Family in several Brazilian states, in which observed the habits of these insects. It appears that the larvae are more active at night, live in living or dead trees, and they feed on accumulated organic matter or the products of wood fermentation, on the other hand, adult activities are restricted to reproduction, being cuddles and showing sexual dimorphism (Figure 9) [8,9].



Source: https://resjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/j.1365-2311.1931.tb00699.x

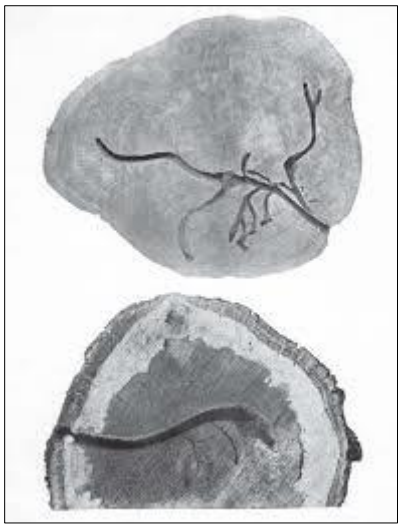
Figure 9 The immature stages of *Pantophthalmus tabaninus* Thunberg, 1819

A phonetic interaction was found between *Semeiochernes armiger* (Balzan, 1892), with *Pantophthalmus tabaninus* Thunberg, 1819, in an Amazon rainforest, although not much is known about the relationship of this insect with the environment and agriculture, it is known that it can be a pest to the attack various cultures, such as angico, bracatinga, yellow cinnamon, Imperial palm, Paraná pine, and others. These larvae usually open cylindrical, horizontal, simple or branched galleries, in the woody region of the wood, making the plant unproductive (Figure 10) [9,10].

Source: https://www.alice.cnptia.embrapa.br/bitstream/doc/1137587/1/moscamadeira.pdf

Figure 10 Paricá trunk attacked by *Pantophthalmus kerteszianus* (Enderlein, 1914).: hanging exuvia in emergency orifice (right), orifice without exuvia (center) and adult (left) Belém, Pará, 2011

Due to the injuries caused to several species of trees, wood flies have great economic importance in the areas of cultivation of forest essences and fruit plants A Family is exclusive to the Neotropical Region (Figure 11) [9,10].



Source: After Andrade, 1930

Figure 11 *Pantophthalmus pictus* (Wiedemann, 1821): 1, galleries open by larvae in a trunk of *Casuarina* (cross-sectional section); 2, gallery in a trunk of *Casuarina* showing at the end the widening made by the larva so it can turn backwards

The larvae of these flies have been recorded on wood from several families of trees such as: Aceraceae, Araucariaceae, Arecaceae, Bombacaceae, Casuarinaceae, Fabaceae, Fagaceae, Juglandaceae, Lauraceae, Magnoliaceae, Moraceae, Myrtaceae, Platanaceae, Rhamnaceae, Rosaceae, Rutaceae, Salicaceae and Sapotaceae (Figure 12) [9,10].

Source: https://br.pinterest.com/pin/528469337534035429/

Figure 12 Sawdust accumulated at the base of the host tree from activity larvae of wood fly in an area planted with Paricá. Paragominas, Pará, 2009

1.2 The life Cycle

The egg stages, which have a elliptical, cream colored and covered by small honeycomb-like cells, and are placed on the bark of trees, singly or in groups, with hatching of the larvae after 24 days; followed by the larval stage, which lasts an average of 24 months, in which the development of oral structures, especially the mandible, and the last abdominal segment of the larva is well chitinized, with thorn-like structures, with the probable function of defense. the larvae of *Pantophthalmus* are approximately 4 mm long; in sequence, there is pupal stage, measuring between 40 and 45 mm in length, having a light brown color, with dark and hardened anterior end (Figures 13A and 13B) [10,11].

Source: Photo: Marlus Almeida, 2018 and Photo: Francisco F. Xavier Filho, 2016

Figure 13A Species collection sites of Pantophthalmidae. 1. Serra da Mocidade, Caracaraí, Roraima, Brazil. 2. Serra do Tepequém, Roraima, Brazil. Figure 13B *Antophthalmid* larvae in relation to adult (abdomen shown)

Their formation takes place inside the galleries that. they are opened in the wood by the larvae and reach the adult stage after 30 to 45 days; and in the final stage, adult, the coloration becomes dull, dark brown, with dark yellow wings, and the females become stand out in size in relation to males, in addition, they have a developed abdomen, and the ovipositor is located at its tip (Figure 14) [10,11].

Source: https://naturalhistorymuseum.blog/2015/06/08/big-is-beautiful-in-the-world-of-flies-curator-of-diptera/

Figure 14 Larvae of the Pantophthalmidae Family leaving the trees to form the pupa, causing damage to the plant

There are occurrences of the Pantophthalmidae Family in several Brazilian states, in which observed the habits of these insects. It appears that the larvae are more active at night, live in living or dead trees, and they feed on accumulated organic matter or the products of wood fermentation, on the other hand, adult activities are restricted to reproduction, being cuddles and showing sexual dimorphism (Figure 15) [11,12].

Source: https://naturalhistorymuseum.blog/2015/06/08/big-is-beautiful-in-the-world-of-flies-curator-of-diptera/

Figure 15 The Museum spirit collection of Pantophthalmidae

1.3 Taxonomy and Phylogeny

Aspects of the group's biology were addressed. The Family is exclusive to the Neotropical Region, with 20 species described in two genera: *Pantophthalmus* Thunberg (19 species) and *Opetiops* Enderlein (1 species).

Pantophthalmus Thunberg, 1819, *kerteszianus* Enderlein, 1914. Localidade-tipo: Peru, Mariscal Cáceres, Juanjui. Distribuição: Bolívia, Brasil (Amazonas, Pará, Mato Grosso do Sul), Colômbia (Cochabamba, Santa Cruz), Panamá and Peru.

In Brazil ten species of *Pantophthalmus* occur, in addition to the only species of *Opetiops* did a complete review of the Family studying the taxonomy and the evolution of the group in several aspects.

Pantophthalmidae Bigot, 1886; Genus: *Opetiops* and *Pantophthalmus:*

1.3.1 *Opetiops alienus* (Hermann, 1916) (Santa Catarina, Brazil) (Figure 16).

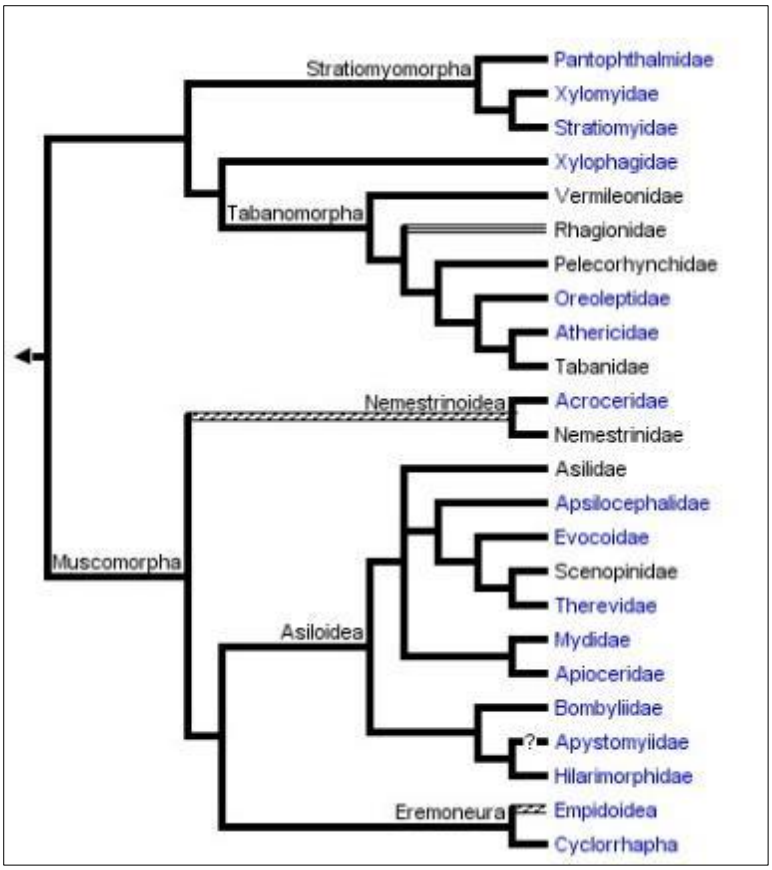
Source: https://naturalhistorymuseum.blog/2015/06/08/big-is-beautiful-in-the-world-of-flies-curator-of-diptera/

Figure 16 *Opetiops alienus* (Hermann, 1916)

Pantophthalmus: *Pantophthalmus argyropastus* (Bigot, 1880), *Pantophthalmus bellardii* (Bigot in Bellardi, 1862), *Pantophthalmus comptus* Enderlein, 1912, *Pantophthalmus engeli* Enderlein 1931, *Pantophthalmus planiventris* Wiedemann, 1821), *Pantophthalmus roseni* (Enderlein 1931), *Pantophthalmus splendidus* Austen, 1923, *Pantophthalmus subsignatus* (Enderlein, 1931) and *Pantophthalmus tabaninus* Thunberg, 1819.

In Brazil: *Pantophthalmus kerteszianus* Enderlein, 1914. Localidade-tipo: Peru, Mariscal Cáceres, Juanjui. Distribuição: Bolívia, Brasil (Amazonas, Pará, Mato Grosso do Sul), Colômbia (Cochabamba, Santa Cruz), Panamá and Peru.

Regarding their phylogeny, the Pantophthalmidae form a monophyletic clade with the Stratiomydae and Xylomydae families, however they share few synapomorphies with the rest, the *Stratiomyomorpha* (Figure 17A) [13,14,15,16,17,18].



Source: https://naturalhistorymuseum.blog/2015/06/08/big-is-beautiful-in-the-world-of-flies-curator-of-diptera/

Figure 17A Tolweb organization of Brachycera

Objective

The aim of this paper is to study the biological and taxonomic aspects of the Pantophthalmidae Family.

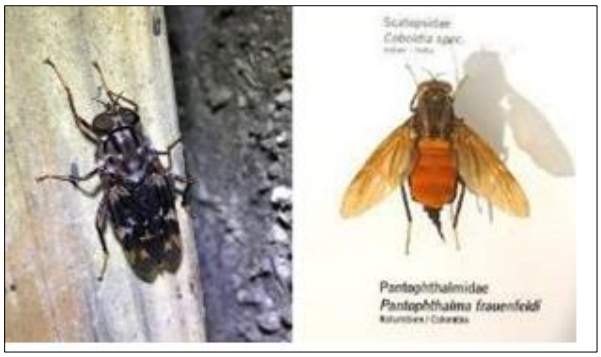
2 Methods

The method used to prepare this mini review was Marchiori 2021 methodology [19].

3 Studies carried out and selected

3.1 Study 1

Pantophthalmidae is a small Family and their larvae live in galleries that excavate in the trunks of living or dead trees. It is composed of two genera, *Opetiops* and *Pantophthalmus*, it has an exclusively Neotropical distribution, from southern Mexico to northern Argentina, and its occurrence is not known in northeastern Brazil or Chile; is composed of twenty species, one of the genera *Opetiops* and nineteen of the genus *Pantophthalmus*, the latter with twelve representatives in Brazil (Figure 17B) [20].



Source: https://inaturalist.ca/taxa/871930-Opetiops and https://en.wikipedia.org/wiki/Pantophthalmus

Figure 17B Genera *Opetiops* and *Pantophthalmus*

Source: https://www.ecoregistros.org/sheet/Pantophthalmus-pictus

Figure 18A *Pantophthalmus pictus* (Wiedemann, 1821)

Source: https://www.jardineiro.net/plantas/casuarina-casuarina-equisetifolia.html

Figure 18B Casuarina equisetifolia L

They are rare insects in Entomological Collections. There are records of *Panthophthalmus heydeni* (Wiedemann, 1828) attacking cajazeiro, imbirussú and jackfruit, in Bahia; *Panthophthalmus vittatus* (Wiedemann, 1828), attacking cajazeiro, jackfruit and imbirussú, in Amazonas, Bahia and São Paulo; *Pantophthalmus pictus* (Wiedemann, 1821) (wood fly) attacking mulberry, angico, battle, bracatinga, maple, black box, yellow cinnamon, cinnamon sassafras or cinnamon-parda, canelão, canelinha, canelinha-brigada, oak- americanus, casuarinas, *Casuarina Cunninghamiana* Miq., *Casuarina equisetifolia* L., *Casuarina gaauca* L., *Casuarina tenuissima* Sieber ex Spreng., *Casuarina torulosa* Miq. (Casuarinaceae), *Casuarina nasturtium* L., guapuruvu, guaratá, toad, imbiruçu, jackfruit, magnolia, pear, massaranduva, loquat, imperial palm, pecan, parana pine, *Platanus orientalis* L. (Platanaceae), saguaragi, suinan, tamarind tree, taiúva and tulip tree in

the states of Amazonas, Minas Gerais, Pará, Rio de Janeiro, Rio Grande do Sul, Santa Catherine and São Paulo. *Pantophthalmus pictus* infestation was observed in a stand of *Liriodendron tulipiferae* L. (Magnoliaceae), in São Paulo (Serra da Cantareira) with high tree mortality, and *Pantophthalmus kerteszianus* (Enderlein, 1914) attacking *Croton lanjowvensis* Jablonsk (Euphorbiaceae) in Manaus (AM) (Figures 18A 18B and 18C) [20].

The objective of this work is to know the probable agents responsible for the mortality of trees in Mata de Santa Geneva, located in the district of Barão Geraldo, Campinas SP. The tree species that showed symptoms of attack, in 3 sampled border areas measuring 50x30 m, were plated, identified and, to obtain the adults, plastic bottle traps (PET) with the bottom coated with filo were installed in the holes; in the laboratory, pieces of trunk were kept in iron cages (50x50x50 cm) lined with nylon (Figure 18C) [20].

Source: https://stringfixer.com/pt/Platanaceae

Figure 18C *Platanus orientalis* L. (Platanaceae)

The attack of Pantophthalmidae (pupal exuvia) was observed on *Croton floribundus* Spreng. (Euphorbiaceae), *Cordia ecalyculata* vell. (Boraginaceae) and *Zantoxylum* sp.; adults of *P. pictus* were obtained in the laboratory on *C. floribundus*. In addition to the Diptera collected, the occurrence of beetles (Platypodidae, Scolytidae, Curculionidae) was also recorded. Symptom of Pantophthalmidae was recorded in galleries produced by Platypodidae (Figure 19) [20].

Source: https://www.agrolink.com.br/problemas/mosca-da-madeira_2344.html

Figure 19 *Pantophthalmus pictus* (Wiedemann, 1821)

3.2 Study 2

Only five of the 20 valid species of this Family have their immature forms - larvae and pupae/pupae formally described. A-*Pantophthalmus frauenfeldi* (Brauer, 1883: larva); B) *Pantophthalmus pictus* (Fiebrig, 1906): larva, as *Acanthomera teretruncum*); Hempel, 1911); larva, pupa); C) *Pantophthalmus planiventris* (Rapp, 2007): egg, 1st instar larva, last instar larva and pupa); D) *Pantophthalmus tabaninus* (Thunberg, 1819); larva; larva; larvae, pupae; habitus and anatomy; larva); and E) *Pantophthalmus vittatus* (Bondar, 1938) larva and pupa). Tree species (native and exotic species) attacked by larvae of six (6) species of pantophthalmids, as follows:

- *Pantophthalmus bellardi*i (Bigot in Bellardi, 1862) – Sterculiaceae: Theobroma cation (Campos, 1952 [cocoa], Ecuador).
- *Pantophthalmus kerteszianus* (Enderlein, 1914) – Euphorbiaceae: *Croton matarensis* Besch (Abreu & Rocha, 2003 (as Croton lanjowvensis Jabl. [sic]), Brazil).
- *Pantophthalmus pictus* - Araucariaceae: *Araucaria angustifolia* (Bertol).
- *Pantophthalmus roseni* (Enderlein, 1931) - Fagaceae: *Quercus germana* Schltdl. & Cham.
- *Pantophthalmus tabaninus* - Anacardiaceae: *Mombin spondias* L.
- *Pantophthalmus* vittatus - Anacardiaceae: *M. spondias* (Figures 20 and 21).

Source: https://chrisraper.org.uk/blog/some-more-photos-of-pantophthalmids/

Figure 20 *Pantophthalmus planiventris* (Rapp, 2007), *Pantophthalmus tabaninus* (Thunberg, 1819) and *Pantophthalmus vittatus* (Bondar, 1938)

Source: https://naturalhistorymuseum.blog/tag/pantophthalmus-bellardii/ and https://www.biodiversity4all.org/taxa/259721-Pantophthalmus-roseni

Figure 21 *Pantophthalmus bellardii* (Bigot in Bellardi, 1862) and *Pantophthalmus roseni* (Enderlein, 1931)

Abreu RLS, Rocha RA. Occurrence of *P. kerteszianus* on *C. lanjowvensis* Jabl. [sic] (Euphorbiaceae) in Manaus, state of Amazonas, Neotropical Entomology. 2003; 32(2): 361-362 Bondarb G. Entomological notes from Bahia. II. Entomology Journal. 1938: 8(1-2): 1-24. Andrade EN. The wood fly. Quinta Farm. 1929; 40(6): 595-597, Bondar G. Another pest of forestry. Fifth Farm. 1938; 57 (5): 762.

Andrade EN. Research on the biology of the wood fly, *P. pictus*. Archives of the Biological Institute. 1930; 3: 249-286. Sousa DB, Carvalho GS, Ramos EJA. *Schizolobium amazonicum* Huber ex Ducke. Technical Information Amazon Seeds Networ. 2005; 2(13): 1-2., Rapp M. The immature stages of *P. planiventris*. Dipterological study. 2007; 14(1): 27-36. Hennig W. The larval forms of the Diptera. 1th ed. Berlin: Akademie Verlag. 1952 [21, 22, 23, 24, 25, 26, 27, 28, 29, 30]

3.3 Study 3

Pantophthalmus Thunberg, 1919. *Pantophthalmus zoos* (Enderlein, 1931) Type locality: Mexico, Oaxaca.

3.3.1 Hosts

Celastrus vulcanicolus Donn.Sm. (Calastraceae), *Cornus excelsa* Kunth (Cornaceae), *Quercus* spp. (Fagaceae) (white oak, oaks among others) Ibáñez and Reyes (2017). Distribution: Oaxaca, Oaxaca and Veracruz, Jalapa, Papavero (2009a); Ibáñez and Reyes (2017) [31].

Vegetation. In the northern region of the state of Morelos, a community of pine-oak forest thrives, nine species of oaks such as *Quercus candicans* Née., *Quercus castanea* Née., *Quercus crassipes* Bonpl., *Quercus frutex* Trel., *Quercus glabrescens* Seem, *Quercus glaucoides* M. Martens & Galeotti, *Quercus laurina* Bonpl., *Quercus obtusata* Bonpl., *Quercus rugosa* Née. (Cerros, pers.com), the foregoing is for the purpose of providing information by inferring possible hosts of this species of borer fly, likewise, resinous exudations characteristic of borer larvae were observed in the northern region in Santa María Ahuacatilán, Cuernavaca Material examined: Mexico: Morelos, Cuernavaca, Chamilpa Campus, UAEM, 07-04-2019, 1910 m, Col. A. Burgos, AB-2747 (1♂). Remarks: The examined specimen is collected on the ground and attracted to mercurial light, located on the university campus (Figure 22) [31].

Source: https://ceb.wikipedia.org/wiki/Quercus_glabrescens

Figure 22 Species of the genus *Quercus*

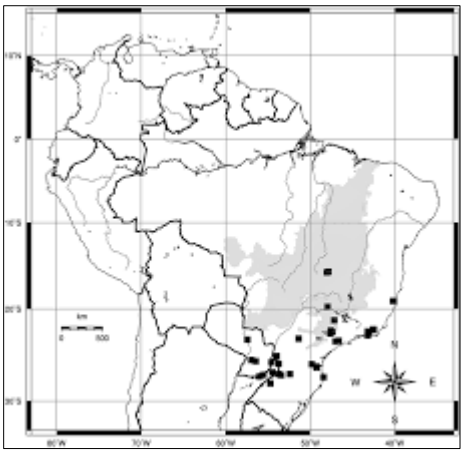
3.4 Study 4

The objective of this paper is to report the first occurrence of *Pantophthalmus pictus* (Wiedemann, 1821) in the Cerrado vegetation of central Brazil (Figure 23) [32,33,34].

Source: https://www.shutterstock.com/pt/search/pantophthalmus

Figure 23 *Pantophthalmus pictus* (Wiedemann, 1821)

The larvae of *P. pictus* were recorded using a large number of native species (Araucariaceae, Bombacaceae, Fabaceae, Lauraceae, Moraceae, Rhamnaceae, Rutaceae, Sapotaceae) and exotics. (Aceraceae, Arecaceae, Casuarinaceae, Fabaceae, Fagaceae, Juglandaceae, Magnoliaceae, Moraceae, Myrtaceae, Platanaceae, Rosaceae and Salicaceae) (Figure 24) [32, 33, 34].



Source: https://repositorio.unb.br/bitstream/10482/33294/1/ARTIGO_NewRecordPantophthalmus.pdf

Figure 24 *Pantophthalmus pictus* (Wiedemann, 1821). Records of geographical distribution (Argentina, Brazil and Paraguay). Cerrado biome (grey area)

Despite the wide distribution of *Pantophthalmus* in Brazil (Val, 1976; Papavero, 2009a), only two species were recorded in the Cerrado vegetation: *Pantophthalmus planiventris* (Wiedemann, 1821) in the city of Anápolis, Goiás, and *Pantophthalmus vittatus* (Wiedemann, 1828) in the city of Cuiabá, Mato Grosso. Except for a single record in the city of Uberaba, state of Minas Gerais, the geographic distribution of *P. pictus* is restricted to the south and southeast from Brazil, Paraguay and Argentina (Figure 25) [32, 33, 34].

Source: https://pbase.com/splluk/image/131103872

Figure 25 *Pantophthalmus planiventris* (Wiedemann, 1821)

The new occurrence of *P. pictus* in the area of the Cerrado Biome reported here increases the geographic distribution of this fly to the Brazilian central plateau [32,33,34].

3.5 Study 5

Biology and developmental stages have been little studied so far and studies on larvae do not always cover the pupal stage, and when they do, little information is addressed. These flies can cause damage in plantations of various forest essences. Works on the recognition and identification of species are of paramount importance in adding information about this Family (Figure 26).

The material of *Pantophthalmus pictus* (Wiedemann, 1821) (Diptera: Pantophthalmidae) was obtained from the Barbiellini collection, and those of *Pantophthalmus kerteszianus* (Enderlein, 1914) were obtained from Embrapa Amazônia Oriental, collected in a Paricá plantation in the city of Paragominas-PA. The specimens are deposited in the Entomological Collection of the Zoology Department of the University of Brasília. The work proposes an external morphology of pupae as a way of helping to distinguish the two species of the genus *Pantophthalmus* (Figure 27).

Source: https://www.alice.cnptia.embrapa.br/bitstream/doc/1137587/1/moscamadeira.pdf

Figure 26 Damage caused by the wood flies *Pantophthalmus* spp. Thunberg, 1819 (Diptera: Pantophthalmidae)

Source: https://www.researchgate.net/figure/Figures-1-2-Pantophthalmus-pictus-Wiedemann-1-female-Male-total-length-33-mm_fig1_325979323

Figure 27 *Pantophthalmus pictus* (Wiedemann, 1821) (Diptera: Pantophthalmidae)

The puparium of *P. pictus* is yellowish, "horn" with straight apical region, first row of tubercles larger, the following rows gradually decrease in size and are well defined up to the middle portion of the capsule, two pairs of long bristles in the frontal region, fifth abdominal segment with long dorsal fringe and shield of the last abdominal segment with a single central ridge, smooth elevations with few or no tips. *P. kerteszianus* is reddish-brown, "horn" with apical region facing upwards, first row of tubercles and the following rows smaller and less defined, a pair of short bristles in the frontal region, fifth abdominal segment with short dorsal fringe and shield of the last abdominal segment with a single central ridge, well-marked elevations and pointed apices. (Figure 28) [35].

Source: http://www.arboreo.net/2012/12/parica-schizolobium-amazonicum.html

Figure 28 *Schizolobium amazonicum* Huber ex Ducke. Family: Leguminosae – Caesalpinoideae Common Names: Paricá, cuiabano pine, white cuiabano pine, pink cuiabano pine, bandarra, faveira and white

3.6 Study 6

Some more *Pantophthalmus* from French Guiana (Figures 29, 30, 31, 32, 33, 34, 35, 36, 37 and 38) [36].

Source: Published by Chris R: these photos are of specimens on loan courtesy of the British Museum (Natural History), London

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana/

Figure 29 *Pantophthalmus batesi* Austen, 1923 (female) – note the dark wing bases

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 30 *Pantophthalmus batesi* Austen, 1923 (female) – note the large outer spot and smaller inner spot on the suture

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 31 *Pantophthalmus batesi* Austen, 1923 (female) – note the sharp, pointed "nose"

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 32 *Pantophthalmus tabaninus* (Thunberg, 1819) (female) – note the dark wing bases

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 33 *Pantophthalmus tabaninus* (Thunberg, 1819) (female) – note the rounded "nose"

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 34 *Pantophthalmus tabaninus* (Thunberg, 1819) (female) – note the absence of dark spots

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 35 *Pantophthalmus tabaninus* (Thunberg, 1819) (female, typical) – note the dark wing bases

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 36 *Pantophthalmus vittatus* (Wiedemann, 1828) (female) – note the dark wing bases

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 37 *Pantophthalmus vittatus* (Wiedemann, 1828) (female) – note the large outer spot and missing inner spot

Source: https://chrisraper.org.uk/blog/some-more-pantophthalmus-from-french-guiana

Figure 38 *Pantophthalmus vittatus* (Wiedemann, 1828) (female) – note the rounded "nose"

3.7 Study 7

Source: https://sites.unicentro.br/wp/manejoflorestal/11782-2/

Figure 39 Pantophthalmidae larva attacking cashew tree trunk

The larvae Pantophthalmidae are xylophagous. Empupation occurs at the entrance of the galleries with the anterior portion of the pupa appearing outside. Their larvae attack and pierce living or dead trees, forming galleries where they probably feed on the accumulated organic matter or its fermentation (Figure 39).

Species of the Pantophthalmidae Family found in cajazeira (Anacardiaceae): The larvae are xylophagous. Empupation occurs at the entrance of the galleries with the anterior portion of the pupa appearing outside. Their larvae attack and pierce living or dead trees, forming galleries where they probably feed on the accumulated organic matter or its fermentation (Figure 40).

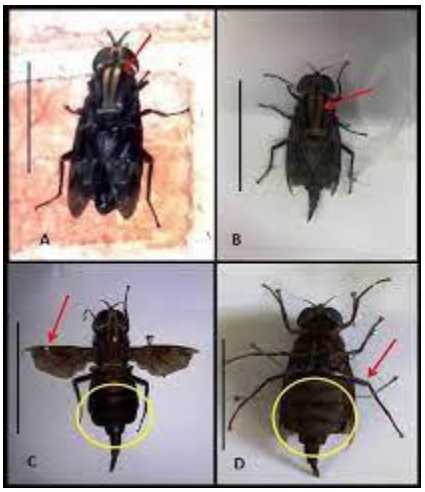
Source: https://pt.wikipedia.org/wiki/Spondias

Figure 40 *Spondias* spp. (Anacardiaceae)

4 *Pantophthalmus tabaninus* (Thunberg, 1819) /*Pantophthalmus heydeni* (Wiedemann, 1828)

Glabrous eyes; external apex of the posterior femur with a thorn 1992). Female: Mesonotum with the region between the stripes lighter than the sides; abdomen completely pollinated, with dark and ferruginous edges. Male:

Mesonotum with the region between the lighter lateral stripes; abdomen with lateral margins without conspicuous stripes in contrast to the central ferruginous region There are records of *P. heydeni* attacking cashew tree, imbirussú and jackfruit, in Bahia (Figure 41).



Source: https://www.brazilianjournals.com/index.php/BJAER/article/viewFile/21726/17324

Figure 41 Images (A) and (B), are indicated by the arrow → the mesothorax region of the insect, brown in color and 02 stripes yellow interspersed with 01 black stripe. Images (C) and (D) have yellow circles in the abdominal regions with tergites

5 *Pantophthalmus vittatus* (Wiedemann, 1821)

Female: Prealar callus with a dark, rounded spot; side stripes of mesonotum with a characteristic sinuosity, mainly due to a constriction behind the transverse suture. Male: Mesonotum with rounded spots on the callus pre-wing; abdomen with dark, oval or rounded spots on the lateral margins and over the ventral region of the tergites. *Panthophthalmus*, attacking cajazeira, jackfruit and imbirussú, in Amazonas, Bahia and São Paulo.

As a combat measure, it is advisable to block the galleries by means of wooden caps. The liquids that overflow flood the galleries, killing the larvae. by drowning. Species of the Pantophthalmidae Family found in cashew tree: Pantophthalmidae: *P. heydeni*, *Pantophthalmus gigas* (Enderlein, 1912) *P. tabaninus* and *P. vittatus*: Attacked part: Trunk [37, 38, 39].

6 Conclusion

There are occurrences of the Pantophthalmidae Family in several Brazilian states, in which observed the habits of these insects. It appears that the larvae are more active at night, live in living or dead trees, and they feed on accumulated organic matter or the products of wood fermentation, on the other hand, adult activities are restricted to reproduction, being cuddles and showing sexual dimorphism.

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