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Papaverodinia, a new genus with three new species from the north and northeast of Brazil collected in the canopy (Diptera: Odiniidae)

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Abstract. *Papaverodinia* gen. nov. (Odiniidae: Traginopinae) is described from Brazil, with three new species, *P. chiquinhamum* gen. et sp. nov. (type species) (from Amazonas, Maranhão, Pará and Piauí), *P. canalesi* gen. et sp. nov. (from Ceará and Maranhão) and *P. willkeniae* gen. et sp. nov. (from Amazonas). The genus is characterized by a unique combination of diagnostic features: body predominantly brown to black; lunule arched with central black pubescent spot; scutellum with several marginal setulae; posterior intra-alar setae present; male tergite 6 absent; epandrium about 3.5 × as short as high; inner surstylus thin and positioned below the outer surstylus; outer surstylus enormously dilated at the distal end.

Keywords. Acalyptratae, Amazon Forest, Atlantic Forest, Cerrado Forest, Opomyzoidea.

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Introduction

Despite being a small family, the Odiniidae Hendel, 1920 have been the focus of recent research, especially in the Neotropics. The odiniid fauna has seen a remarkable increase of 30% since the

beginning of the 21st century, with the addition of six genera and almost 30 species. This progress has greatly increased our understanding of the species richness of the family. However, there is still much diversity in this family to be described. Currently, the family comprises 81 valid species distributed in 18 genera and two subfamilies, Odiniinae Hendel, 1920 and Traginopinae Hennig, 1965 (Tôrres *et al.* 2024). The Neotropics have a more remarkable diversity, with 38 species in 12 genera; 33 species in 10 of these genera occurring in South America, and 24 species in nine genera occurring in Brazil (Gaimari & Mathis 2011; Tôrres *et al.* 2024; Limeira-de-Oliveira & Tôrres 2024).

In Brazil, many genera and species of odiniids have been found in the last five years. Some were recently described (e.g., *Inpauema* Limeira-de-Oliveira, Marques, Reis & Rafael, 2017; *Pauximyia* Limeira-de-Oliveira, Marques, Gaimari & Rafael, 2020b), but the majority are currently in the process of being described. Much of the success in collecting new odiniid species resulted from sampling the canopy fauna in Central Amazonia, as described in Rafael *et al.* (2020).

Odiniids have always seemed very rare in nature, as they are not easily collected using traditional methods most frequently used by entomologists, such as entomological nets, Malaise traps (such as the models of Gressitt & Gressitt (1962) and Townes (1972)) and other interception flight traps, suspended traps (Rafael & Gorayeb 1982), light traps, and baits; this explains the fact that they are poorly represented in collections. However, while the absence or low representation of odiniids in collections may result from using the wrong collecting method, the scarcity may also be due to the lack of knowledge of the habitat where they occur in nature. A previously poorly known habitat for odiniids has been found to be the forest canopy, including forests with low trees (such as Caatinga and/or Cerrado) or forests composed of tall trees (such as Amazon Rainforest and/or Gallery Forests). In those habitats, they are only occasionally captured in the forests' lower strata or the understory. In the early 1990s, occasional odiniid records were reported in the forest canopy (Stork 1991; Krüger & McGavin 1998; Tschirnhaus 2008; Barkeley 2009). However, in the last seven years, with the use of different methods (baited traps and Malaise traps (such as model Gressitt & Gressitt 1962, installed in the canopy), odiniids have become well documented in the Neotropical Region. The success in capturing specimens in the canopy appears independent of the supporting tree species (Tôrres *et al.* 2021, 2024); the specific association with any odiniid species with a particular plant species is entirely unknown. Carles-Tolrá (1996) reported the capture of *Odinia* spp. and *Traginops* spp. with baited traps (in most cases, with yeast), Carles-Tolrá *et al.* (1993) also mentioned the capture of *Odinia trinotata* Robineau-Desvoidy, 1830 (as *maculata* (Meigen, 1830)) with traps baited with vinegar in Spain; in recent years Parchami-Araghi *et al.* (2018) collected *Odinia meijerei* Collin, 1952 and *Turanodinia graciosa* Krivosheina & Krivosheina, 1996 using flight interception traps and traps baited with rotting fruit in Iran.

Since then, we have found that at least some odinids swarm in the canopy at different heights or strata of forests; this claim has been supported by numerous collections using appropriate methods, for example, Malaise traps (Limeira-de-Oliveira *et al.* 2020a) and traps baited with vinegar and ethanol solution (80+20%) (Tôrres *et al.* 2021, 2024). In addition to these methods, studies have been carried out in different vertical strata with tremendous success in canopy collecting. In seven years of collections with traps baited with a vinegar+ethanol solution (80+20%) installed 2 m above the ground, only one genus, *Paratraginops* Hendel, 1917, was collected exclusively in the lower stratum of the forest or understory, although at low density. As a result of the combined use of these methods and, in particular, the use of the baited traps with the solution mentioned above, extraordinary results were achieved with around 12000 specimens of various genera and species, currently being more fully analysed and described.

These results suggest that many odiniids are attracted to rotten fruits, yeasts and exudates from the trunks of some botanical species, given that the odors of alcohol and vinegar are typical products of the fermentation process.

The species of the new genus described here are homogeneous in most respects, with differences evident mostly in the male genitalia, particularly in the form of the outer and inner surstyli, subepandrial sclerites, pregonite curvature, and cerci.

Material and methods

This study is based on the examination of specimens from the Brazilian Amazon, Atlantic, Caatinga and Cerrado biomes in the states of Amazonas, Ceará, Pará, Piauí and Maranhão. The specimens were collected with modified fly-trapping bottles baited with about 350 ml of red wine vinegar + ethanol solution, installed in the vegetation canopy. We installed these traps using a 'big shot notch' which allows us to place our vials (traps) in the treetops, regardless of the hight of the tree. They are housed in the Coleção Zoológica do Maranhão, Caxias, Maranhão, Brazil (CZMA), Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil (INPA), Museu Nacional do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ), Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP) and California State Collection of Arthropods, Sacramento, California, USA (CSCA).

In all methods used to capture odiniids (baited traps or Malaise traps), upon the specimens entering the collecting jars, they are preserved in ethanol.

The specimens were dehydrated using the rapid drying method, which consists of using amyl acetate (banana oil) modified by Austin & Dillon (1997), Dal Molin (2018), Pérez Benavides *et al.* (2023) and Rafael *et al.* (2023).

After collection, the specimens are subjected to a dehydration protocol consisting of the following steps: (i) specimens are removed from alcohol and placed on paper towels for a few seconds to remove excess liquid; (ii) specimens are placed in ice cube trays and submerged in amyl acetate (banana oil); (iii) specimens are taken to a bacteriological incubator, previously heated to 45°C (fast process) or they are kept at room temperature (slow process) until they are entirely dehydrated.

Using this method, specimens retain their morphological characteristics without alteration, as if they had been collected and mounted immediately after capture. Once this stage is completed, specimens are point-mounted and labelled. General morphological terminology follows Cumming & Wood (2017). Body length was measured by adding the length of the head (without antennae) through the thorax to the abdominal length, to account for differential curling of the abdomens.

The apex of the abdomen was removed and macerated in hot (150°C) 85% lactic acid for approximately 25 minutes. After maceration, the pieces were rinsed in distilled water, and then further dissected and examined in glycerin in excavated slides. After analysis, the pieces were placed in a microvial containing glycerin, which was fixed on the pin of the corresponding specimen.

Each photograph of external morphology was made using a Zeiss®Discovery V12 stereo microscope, coupled with a 1.4 megapixel AxionCan ICc1 digital camera, and the Zen®2012 program was used to combine serial images to form a single fully focused image. For photographs of the internal morphology, a Zeiss®Scope A1 compound microscope was used with the same camera with the AxioVision program ver. 4.8.2, and the CombineZP program was used to combine serial images into a single image. Plates were assembled in CorelDRAW 2021.

The label data of the material examined are provided "ipsis litteris" in the holotypes and paratypes. Abbreviations and symbols were used in the citation of the material examined and, when the coordinates, locality, altitude, method and / or collectors are coincident, the terms "same data as for holotype" and / or "same data as for preceding" were used. The names of the Brazilian states are written in bold, from west

to east and from north to south, while the municipalities are listed in alphabetical order. Additional data not found on the specimen labels (such as the completion of the abbreviations, for example) are added in square brackets. The "mts" is the height at which the trap was installed in relation to the ground (installed with using a 'big shot notch').The ordering of the label data follows the regulations of this journal. The depository institution of the holotypes and / or paratypes is indicated immediately after the citation of the specimen label data. The abbreviation "FLO" followed by any number means the specimen's registration code (for example, "FLO 0987").

Abbreviations for measurements

a.s.l. = above sea level
FL = frons length, anterior view (distance from the top of ptilinial fissure to the anterior ocellus)
FW = frons width, anterior view (distance between inner margins of compound eyes at the level of the anterior ocellus)
HW = head width, anterior view (distance between outer margins of the compound eyes measured at the widest part)
HH = head height, lateral view (distance from the ventral margin of the gena to the dorsal margin of the head)
HL = head length, lateral view (distance from the lunule to the postcranium)
WL = wing length (distance from the base to the apex)
WW = wing width (distance from costal to anal borders measured at the widest level, generally around the apex vein CuA_1) (Limeira-de-Oliveira *et al.* 2017).

Results

Taxonomy

Phylum Arthropoda Latreille, 1829
Class Insecta Linnaeus, 1758
Order Diptera Linnaeus, 1758
Family Odiniidae Hendel, 1920
Subfamily Traginopinae Hennig, 1965

Genus ***Papaverodinia*** gen. nov.
urn:lsid:zoobank.org:act:47DE34D1-0ED0-4950-8924-99031FCF1B9F
Figs 1–81

Type species

Papaverodinia chiquinhamum gen. et sp. nov., by present designation.

Diagnosis

Body predominantly brown to black; head higher than long and wider than high; gena broad; postocellar setae stout; frons wider than high, with lateral edges slightly converging ventrally and usually converging dorsally; lunule arched with respective spot black pubescent; dorsocentral setae 1 + 3; prescutellar acrostichal seta absent; prescutellum absent; scutellum with 2 to 7 setulae on the posterior margin, between the lateral and apical scutellar macrosetae; wing hyaline, vein *C* extended to vein M_1; costal spinules extended to apex of vein R_{2+3}; tergite 6 absent, sternite 6 present; epandrium very short, about 3.5 × as short as high; inner surstylus thin and positioned under the outer surstylus; outer surstylus enormously dilated at the distal end and gonocoxal apodeme capsulated.

Etymology

Named after the Brazilian dipterist, naturalist and historian, Nelson Papavero, adding the genus name *Odinia*. Gender feminine.

Description

Male

Head (Figs 1–4, 25–28, 48–51). Height 1.6–1.8 × length and 1.2 × as wide as high. Eye slightly longer than high. Postocellar setae strong and long, as strong as but slightly shorter than ocellar setae, divergent. Ocellar triangle dark gray pruinose, setulose, with two rows of slightly stronger setulae, diverging, located between and behind posterior ocelli to postocellar setae; posterior ocelli slightly closer together than distance between anterior and posterior ocelli; ocellar setae stout, originating very close together, in line between anterior and a posterior ocellar seta. Inner and outer vertical setae present, stout. Postcranium slightly concave in dorsal view. Frons 1.3–1.4 × as wide as long. Fronto-orbital plate either entirely yellow or with narrow strip of yellow only along its outer edge; with very short, sparse setulae; with 3 pairs fronto-orbital setae, 1st pair inclinate and 2nd and 3rd pairs reclinate, 1st pair originated at or above dorsal margin of lunule, 2nd pair originated closer to 1st than to 3rd pair, 3rd pair originated below, at or above level of anterior ocellus (*P. canalesi* gen. et sp. nov., *P. chiquinhamum* gen. et sp. nov. and *P. willkeniae* gen. et sp. nov., respectively). All macrosetae with oblong alveolae slightly raised, margins darkened. Lunule 0.1–0.2 mm high, arched; 0.3–0.4 × height or length of frons; yellow to dark yellow, yellowish-gray pruinose except for brown spot. Antenna predominantly brown, except for postpedicel proximal ⅓, sometimes, entirely yellow-orange, arist predominantly dark brown to black; arist progressively feathery, with short rays. Face dark yellow to light brown, yellowish-gray pruinose except in dark brown antennal grooves. Oral vibrissa stout, with 2 subvibrissal setae, externally flanked by several short setulae. Genal groove broad, smooth, reddish-brown. Gena broad, reddish-brown with yellow-orange pruinose, with short brown setae and brown alveolae; with slightly stronger seta facing upturned. Clypeus dark brown to black, subshiny, brownish-gray sparse pruinose. Palpus clavate, predominantly brown except for yellowish proximal and distal ends, brown pruinose, yellowish-gray on proximal and distal ends, brown setae, some slightly longer on ventral surface and distal end. Prementum and labellum light brown to brown, with short, colored setulae.

Thorax (Figs 1–2, 5, 25–26, 29, 48–49, 52). Mesonotum and scutellum predominantly brown to black, pruinose predominantly dark greenish-gray to brown. All macrosetae with alveolae slightly oblong and slightly raised, margins darkened. Chaetotaxy: 1 + 3 dorsocentrals (two posteriormost postsutural dorsocentral setae, strongest), prescutellar acrostical absent, 1 postpronotal (along with a few setulae), 1 presutural intra-alar, 1 postsutural intra-alar, 2 notopleural (anterior setae slightly longer and strongest), 2 supra-alars (longer and stronger posterior, as long and strong as anterior postalar), 2 postalars (longer and strongest anterior setae, as long and strong as posterior postalar setae, and 2 additional minute setulae between them). Prescutellum absent. Scutellum concolorous with scutum, with sparse light brown to dark brown pruinosity; with two pairs of macrosetae, proximal pair slightly shorter and weaker than apical pair; scutellar disc with some small scattered setulae, with cluster of 3 or more setulae located between proximal and apical pairs of scutellar macrosetae. Pleuron light brown to black, with sparse brownish-gray pruinosity, denser on proepisternum and around anterior spiracle; pleura above katepisternum without setae or setulae, except for 1 propleural seta. Katepisternum with 3 stout setae along dorsal edge, in addition to some setulae.

Legs (Figs 2, 26, 49). Coxae and femora light brown to brown, slightly lighter at distal end of femur. All tibiae predominantly yellow, slightly darker on anterodorsal surface; tarsi yellow to dark yellow, tarsomeres 3–5 slightly darker. Mid tibia with one stout apical spur.

Wing (Figs 1–2, 6, 25–26, 30, 48–49, 53). Length 3.3–4.5 mm; width 1.1–1.7 mm. Vein *C* extended to M_1, with costal spinules extended to apex of vein R_{2+3}. Membrane hyaline, slightly yellowish. Halter dark yellow to brown, with base of stem and knob base slightly darker.

Abdomen (Figs 1, 25, 48). Tergites dark yellow to light brown, subshiny, with sparse yellowish-gray pruinosity; setulae black, tergites 3–5 with long setae on posterior margin and laterally on syntergite 1+2. Tergite 5 with small sublateral shallow concavities.

Male terminalia (Figs 7–18, 31–41, 54–64, 73–81). Tergite 6 absent. Sternite 6 assymmetrical, strongly connected to left of syntergosternite 7+8 and including tracheal opening, and almost reaching right end of syntergosternite 7+8 (Figs 10–11, 34–35, 57–58). Syntergosternite 7+8 symmetrical, strongly fused, strongly sclerotized, except for membranous area on distal margin with two sublateral lobes slightly sclerotized, bare, about 5.0 × as wide as long (Figs 9, 33, 56). Sternite 7 membranous, symmetrical, weakly connected to right lobe of syntergosternite 7+8, with large ventromedial concavity (Figs 10–11, 34–35, 57–58). Epandrium yellow to dark brown, 'saddle-shaped'; with brown to dark brown setulae, more elongated on laterodistal ends, except for triangular areas on anterolateral margins, weakly interconnected anteromedially, glabrous. Cercus yellow, subtriangular, long, as long as length of inner surstylus, medial surface subparallel, setae dark yellow to light brown, medially proclinate and extended slightly beyond cercal opening, thereafter these are slightly reclinate, including those located on medial surface of distal ¼ of cercus (Figs 7–14, 31–38, 54–61, 73, 75, 77). Surstyli, concolorous with epandrium, lobes strongly fused (not articulated) to epandrium. Inner and outer surstyli weakly to strongly fused together at proximal end. Inner surstylus 'rod-shaped' and narrow, slightly narrower than proximal half of outer surstylus, slightly shorter and surrounded by outer surstylus; both surstyli with dense yellowish setae, with fringes of elongated setae on edges of outer surstylus (Figs 8–14; 32–38; 55–61). Outer surstylus with large, clavate distal lobe, densely setulose in distal ¾, glabrous in proximal ¼ (Figs 7–14; 31–38; 54–61). Subepandrial sclerite, 'bra-shaped', strongly sclerotized, weakly articulated with hypandrium and strongly articulated with both surstyli and cerci (Figs 12–13, 36–38, 59–60, 74, 76, 78). Hypandrium, very short, about 3.5 × as wide as long, strongly sclerotized, slightly concave distally in dorsal view; concave in lateral view, extended laterally around base of phallapodeme and phallus. Gonocoxal apodemes, with ventral median U-shaped concavity, distally open; gonocoxal apodeme directed upward, connected at anterior margin by short band, slightly longer than median diameter of phallapodeme, forming case surrounding phallic complex; distal end more broadly open in U-shape. Pregonite robust and strongly connected to gonocoxal apodeme, without any point of weakness between them; pregonite curved ventrodistally, with angle varying among species (between 90° and 150°), articulated subdistally with postgonite; postgonite with short, sparse, almost imperceptible setae (Figs 15–18, 39–41, 62–64, 79–81). Postgonite, long, laminate, bifid distally. Phallapodeme, rod-like, about 1.3–1.5 × as long as length of phallus; 'fork-shaped' phallus in dorsal and ventral views, surrounded by membrane, apparently smooth, bilobed distally in lateral view; distal lobes dark yellow, Y-shaped, with large opening in ventral view.

Female

Similar to male (in external morphology of head, thorax, wings, legs and abdomen).

Terminalia (Figs 19–24, 42–47, 65–72). Tergite 6 dark yellow to brown. Sternite 6 membranous, with anteromedial sclerotization 'top hat-shaped'. Tergite 7 strongly fused to sternite 7. Segment 8 entirely membranous. Epiproct small, plate-like. Cerci dark yellow, setose, separated, elongated and thin. Spermathecae in single pair, each 'mushroom-shaped', light brown to brown.

Remarks

Papaverodinia gen. nov. is similar to the genera *Schildomyia* Malloch, 1926 and *Lopesiodinia* Prado 1973 in that it has a wing with the *C* vein extended to the M_1 vein. However, it is easily separated from *Schildomyia* by having a lunule with a pubescent dark brown to black spot; three fronto-orbital setae almost equidistant, the 1st and 2nd pairs only slightly closer to each other, scutellar disc with 1 to 3 setulae, sometimes glabrous; tergite 6 absent (in *Schlidomyia*, lunule without spot; 1st and 2nd pairs of fronto-orbitals very close to each other, scutellar disc densely setulose, tergite 6 present).

The new genus differs from *Lopesiodinia* in having posterior intra-alar setae, tergite 6 absent (in *Lopesiodinia,* posterior intra-alar setae absent, tergite 6 present).

Key to the species of Traginopinae Hennig, 1965

Key to adults; here, we modify couplet 20 in the key of Tôrres *et al.* (2021) to accommodate the inclusion of *Papaverodinia* gen. nov., and its included species.

20. Scutellar disc and margins with numerous setulae .....***Schildomyia*** Malloch, 1926 (21)
– Scutellum with few (up to 7) marginal setulae 20A

20A. Posterior intra-alar setae present. Tergite 6 in male absent .....***Papaverodinia*** gen. nov. (20B)
– Posterior intra-alar setae absent. Tergite 6 in male present .....***Lopesiodinia*** Prado, 1973 (29)

20B. Frons with lateral margins yellow from 3rd pair fronto-orbital seta and encompassing bases of the 1st and 2nd pairs fronto-orbital setae (Figs 3, 50). Inner surstylus parallel-sided in both anterior and lateral view (Figs 9, 14, 55, 61). Outer surstylus with basal part narrow, less than ¼ of distal lobe height (Figs 14, 61). Angle of pregonite 90–120° or less (Figs 79, 81). Subepandrial sclerite with anteromedial margin in an open U-shaped (Figs 74, 78) 20C
– Frons with lateral margins yellow only along very edge, lateral to bases of fronto-orbital setae (Fig. 27). Inner surstylus expanded and club-like distally in both anterior and lateral views (Figs 36, 38), and distinctly curved following the curvature of the posterior margin of the outer surstylus in lateral view (Fig. 38). Outer surstylus with basal part thick, nearly ½ height of distal lobe (Fig. 38). Angle of pregonite 150° (Fig. 80). Subepandrial sclerite with anteromedial margin in a 'open end wrench-shaped' (Fig. 76) .....***Papaverodinia canalesi*** gen. et sp. nov.

20C. Mesonotum predominantly brown, with narrow brown median vitta, brown at the bases of the 1st and 2nd pairs of dorsocentral setae and laterally, yellow pruinosity at the posterolateral corners (Figs 2, 5). Scutellum entirely light brown with yellow margin (Fig. 5). Middle tibia yellow (Fig. 2). Antenna with pedicel, basal postpedicel and the first two aristal segments predominantly yellow-orange (Figs 3, 4). Epandrium 1.4 × taller than long (Fig. 14) .....
.....***Papaverodinia chiquinhamum*** gen. et sp. nov.
– Mesonotum dark throughout (Figs 49, 52), without vitta. Scutellum entirely dark (Fig. 52). Mid tibia dark, except yellow at distal and proximal tips (Fig. 49). Antenna entirely brown (Figs 50–51). Epandrium length and height subequal (Fig. 61) .....***Papaverodinia willkeniae*** gen. et sp. nov.

Papaverodinia chiquinhamum gen. et sp. nov.
urn:lsid:zoobank.org:act:65A5ADBF-9FBC-47A2-A4F5-3A8841193A00
Figs 1–24, 73–74, 79

Diagnosis

The 3rd pair fronto-orbital setae originated in line with the lower margin of the anterior ocellus. Fronto-orbital plate entirely yellow. Cercus opening with inverted 'arrow' appearance. Inner and outer surstyli weakly fused together at proximal end. Inner surstylus straight in lateral view. Outer surstylus greatly enlarged distally, 'soup ladle-shaped' in lateral view.

Etymology

The specific name is a composition of 'Chiquinho' and 'inhamum'. Chiquinho is the nickname of Mr Francisco dos Reis (in memoriam), who was the park ranger at the Inhamum Ecological Reserve.

Type material examined

Holotype

BRAZIL – **Maranhão [MA]** • ♂ (pinned, good condition); Caxias, Res.[= Reserva] Ecologica do Inhamum, Ramal Sumidouro do Padre; 4°53′22″ S, 43°24′59″ W; 23–31 Jan. 2020; F. Limeira-de-Oliveira, A. Tôrres and I. Cantanhede leg.; PET (Vinagre V. [= Vinho] Tinto+Etanol), alta 20 mts [= metros metre]; CZMA FLO 6088.

Paratypes

BRAZIL – **Maranhão [MA]** • 4 ♂♂; same data as for holotype; MZUSP FLO 6070, MZUSP FLO 6089, INPA FLO 6094, MNRJ FLO 6096 • 3 ♀♀; same data as for holotype; CZMA FLO 5839 to FLO 5841 • 10 ♂♂; same data as for holotype; 15−29 Feb. 2020; CZMA FLO 6080, CZMA FLO 6097, CZMA FLO 6112, CZMA FLO 6186, CZMA FLO 6344, INPA FLO 6346, INPA FLO 6347, INPA FLO 6999 (pinned, terminalia in microvial of plastic), MNRJ FLO 6349, MNRJ FLO 6888 • 3 ♂♂; same data as for holotype; 15−31 May 2020; CZMA FLO 6185, MNRJ FLO 6223, MZUSP FLO 6272 • 1 ♂; same data as for holotype; 15−30 Jun. 2020; CSCA FLO 5866 • 5 ♂♂; same data as for holotype; 15−31 Jul. 2020; INPA FLO 5877, INPA FLO 5886, INPA FLO 5888, INPA FLO 5894, CZMA FLO 5887 • 4 ♂♂; same data as for holotype; 15−31 Aug. 2020; INPA FLO 6064, INPA FLO 6076, MZUSP FLO 6278, MNRJ FLO 6570 • 2 ♂♂; same data as for holotype; 15−30 Sep. 2020; CZMA FLO 5276, CZMA FLO 6065 • 2 ♂♂; same data as for holotype; 15−31 Oct. 2020; CSCA FLO 5820, MNRJ FLO 5947 • 1 ♂; same data as for holotype; 15−30 Nov. 2020; CSCA FLO 6578 • 3 ♂♂; Caxias, Lagoa do Paraná; 4°51′01.2″ S, 43°09′39.4″ W; 11−25 Jan. 2020; F. Limeira-de-Oliveira, A. Tôrres and I. Cantanhede leg.; PET (Vinagre V. [= Vinho] Tinto+Etanol); alta 20 mts [= metros]; CZMA FLO 6071, CZMA FLO 6072, CZMA FLO 6082 • 5 ♂♂; Carolina, PARNA [= Parque Nacional] Chapada das Mesas, RPPN [= Reserva Particular do Patrimônio Natural] Mansinha; 7°18′11.9″ S, 47°26′07″ W; 12−15 Mar. 2023; F. Limeira-de-Oliveira, R. Ale-Rocha and A. Tôrres leg.; PET Vinagre V. [= Vinho] Tinto+Etanol, 20 mts [= metros metre]; CZMA FLO 3738 (pinned, terminalia in microvial of plastic), CZMA FLO 7057, MZUSP FLO 7063, CSCA FLO 7065, MNRJ FLO 7066 • 2 ♂♂; same data as for preceding; São Romão; 7°04′23.2″ S, 47°05′26.2″ W; CZMA FLO 3741 (pinned, terminalia in microvial of plastic), INPA FLO 7061 • 1 ♂; same data as for preceding; Mirador, Parque Estadual do Mirador, Base da Geraldina; 6°37′48″ S, 45°52′49″ W; 20−30 Jun. 2022; PET (Vinagre V. [= Vinho] Tinto+Etanol), alta 20 mts [= metros metre]; CZMA FLO 6334 • 1 ♂; same data as for preceding; 20−31 Jul. 2022; CZMA FLO 6330 • 2 ♂♂; same data as for preceding; 20−31 Aug. 2022; CZMA FLO 6333, INPA FLO 6335 • 2 ♂♂; same data as for preceding; 20−30 Sep. 2022; CZMA FLO 6367, INPA FLO 6368 • 2 ♂♂; same data as for preceding; 10−20 Oct. 2022; CZMA FLO 6336, INPA FLO 6369 • 1 ♂; same data as for preceding; 10−20 Nov. 2022; CZMA FLO 6363 • 2 ♂♂; same data as for preceding; 2−31 Dec. 2022; CZMA FLO 7103, INPA

FLO 7104 • 1 ♂; same data as for preceding; 20−31 Jan. 2023; CZMA FLO 7106 • 1 ♂; same data as for preceding; 20−28 Feb. 2023; CZMA FLO 7107 • 1 ♂; same data as for preceding; 10−20 Mar. 2023; CZMA FLO 7110. – **Pará [PA]** • 1 ♂; same data as for holotype; Belterra, Flona Tapajós; 2°36′15″ S, 54°56′25″ W; 100 m a.s.l.; 16 Apr. 2018; J.A. Rafael and F.F. Xavier leg.; Atrativo Luz; CZMA FLO 1322. – **Piauí [PI]** • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for holotype; Altos, Floresta Nacional de Palmares; 5°03′24.5″ S, 42°35′35.6″ W; 1−15 Dec. 2022; F. Limeira-de-Oliveira, A. Tôrres and G.A. Reis leg., PROTAX [project]; PET (Vinagre V. [= Vinho] Tinto + Etanol), alta 30 mts [= metros]; CZMA FLO 6236 • 2 ♂♂; same data as for preceding; 1−15 Jan. 2023; CZMA FLO 6318, INPA FLO 6320 • 1 ♂; same data as for preceding; 1−14 Feb. 2023; CZMA FLO 7117 • 2 ♀♀; same data as for holotype; Altos, Floresta Nacional de Palmares; 5°03′24.5″ S, 42°35′35.6″ W; 1−15 Nov. 2022; F. Limeira-de-Oliveira, A. Tôrres and G.A. Reis leg., PROTAX [project]; PET (Vinagre V. [= Vinho] Tinto + Etanol), alta 30 mts [= metros]; CZMA FLO 6252, INPA FLO 6255 • 1 ♀ (pinned, terminalia in microvial of plastic); same data as for preceding; 1−15 Dec. 2022; INPA FLO 6245 • 2 ♀♀; same data as for preceding; 1−15 Jan. 2023; CZMA FLO 6311 • 1 ♀; same data as for preceding; INPA FLO 6313 • 6 ♀♀; same data as for holotype; Altos, Floresta Nacional de Palmares; 5°03′24.5″ S, 42°35′35.6″ W; 1−15 Dec. 2022; F. Limeira-de-Oliveira, A. Tôrres and G.A. Reis leg., PROTAX [project]; PET (Vinagre V. [= Vinho] Tinto + Etanol), alta 30 mts [= metros]; CZMA FLO 6239 to CZMA FLO 6244. – **Amazonas [AM]** • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for holotype; Manaus, BR 174, ZF-2, km 14; 2°35′21″ S, 60°06′55.6″ W; 15−28 Feb. 2019; J.A. Rafael leg., Rede BIA [project]; baited with vinegar, 22 m; CZMA FLO 1332 • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for preceding; 29 Mar.−12 Apr. 2019; CZMA FLO 1334 • 6 ♀♀; same data as for holotype; 15−29 Feb. 2020; CZMA FLO 5838, CZMA FLO 5843, INPA FLO 5844, MZUSP FLO 5846, MNRJ FLO 5849, CSCA FLO 5847 • 3 ♀♀; same data as for holotype; 15−30 Apr. 2020; INPA FLO 5830, MZUSP FLO 5848, MNRJ FLO 6137 (pinned, terminalia in microvial of plastic) • 1 ♀; same data as for holotype; 15−31 May 2020; CZMA FLO 6480 • 1 ♀; same data as for holotype; 15−30 Jun. 2020; CZMA FLO 6000 • 2 ♀♀; same data as for holotype; 15−31 Jul. 2020; MNRJ FLO 6158, MZUSP FLO 6159 • 3 ♀♀; same data as for holotype; 15−31 Aug. 2020; CZMA FLO 5965, CSCA FLO 6484, MZUSP FLO 6513 • 3 ♀♀; same data as for holotype; 15−30 Sep. 2020; MZUSP FLO 6160, CSCA FLO 6411, MNRJ FLO 6418 • 1 ♀; same data as for holotype; 15−31 Oct. 2020; MZUSP FLO 6532 • 2 ♀♀; same data as for holotype; 15−30 Nov. 2020; MZUSP FLO 6026, CSCA FLO 6504 • 1 ♀; same data as for holotype; Mirador, Parque Estadual do Mirador, Base da Geraldina; 6°37′48″ S, 45°52′49″ W; 20−31 Jul. 2022; CZMA FLO 63022 • 1 ♀; same data as for holotype; Manaus, BR 174, ZF-2, km14; 2°35′21″ S, 60°06′55.6″ W; 14 Jun.−3 Jul. 2018; J.A. Rafael leg., Rede BIA [project]; 16 mts [= metros] alt. [= altura], nascente [= sunrise], Malaise gde [= grande]; CZMA FLO 1342 • 1 ♀ (pinned, terminalia in microvial of plastic); same data as for preceding; 17−31 Aug. 2018; baited with vinegar; 28 mts [= metros]; CZMA FLO 1344 • 1 ♀; same data as for preceding; 6−16 Nov. 2018; vinagre e fermento [= vinegar and yeast], 40 mts [= metros]; CZMA FLO 1345 • 1 ♀; Manaus, Rod. [= Rodovia] AM-010, km 35, Ramal Água Branca II, Sítio Vida Tropical; 2°51′53″ S, 59°56′00″ W; 26−30 Jun. 2018; J.A. Rafael and F. Limeira-de-Oliveira leg., Rede BIA [project]; 12 mts [= metros], baited with vinegar; CZMA FLO 1335 • 1 ♀; same data as for preceding; 13−26 Sep. 2018; J.A. Rafael leg., Rede BIA [project]; baited with vinegar, 20 mts [= metros]; CZMA FLO 1339 • 1 ♀ (pinned, terminalia in microvial of plastic); same data as for preceding; 3−10 Mar. 2019; baited with vinegar, 15 mts [= metros]; CZMA FLO 1336 • 71 ♂♂; same data as for holotype; 14−20 Dec. 2019; F.Limeira-de-Oliveira, J.C. Oliveira, J.M. Oliveira and I. Cantanhede leg; PET (Vinagre V. [= Vinho] Tinto + Ferm. [= Fermento] Bio. [= Biológico] + Etanol), 20 mts [= metros]; MNRJ FLO 1506 to FLO 1518, MNRJ FLO 1522 to MNRJ FLO 1546, INPA FLO 1573 to INPA FLO 1577, CZMA FLO 6198 to CZMA FLO 6203, CZMA FLO 6205 to CZMA FLO 6225, CZMA FLO 6908 to CZMA FLO 6910 • 10 ♂♂; same data as for holotype; 15−31 Mar. 2020; CZMA FLO 6039 to CZMA FLO 6044, INPA FLO 6894 to INPA FLO 6897 • 3 ♂♂; same data as for holotype; 15−30 Apr. 2020; INPA FLO 6056 to INPA FLO 6058 • 8 ♂♂; same data as for holotype; 15−31 May 2020; INPA FLO 6212 to INPA FLO 6216, CSCA FLO 6219 to CSCA FLO 6221 • 5 ♂♂;

same data as for holotype; 15−30 Jun. 2020; INPA FLO 5889 to INPA FLO 5893 • 6 ♂♂; same data as for holotype; 15−31 Jul. 2020; CSCA FLO 5896 to CSCA FLO 5898, MNRJ FLO 6077 to MNRJ FLO 6079 • 6 ♂♂; same data as for holotype; 15−31 Aug. 2020; CSCA FLO 6273 to CSCA FLO 6275, CZMA FLO 6551 to CZMA FLO 6553 • 4 ♂♂; same data as for holotype; 15−30 Sep. 2020; INPA FLO 6659 to INPA FLO 6662 • 8 ♂♂; same data as for holotype; 15−31 Oct. 2020; CZMA FLO 5796 to CZMA FLO 5798, INPA FLO 5811 to INPA FLO 5815 • 18 ♂♂; same data as for holotype; 15−30 Nov. 2020; CZMA FLO 6114 to CZMA FLO 6121, INPA FLO 6562 to INPA FLO 6566, MZUSP FLO 6571 to MZUSP FLO 6575 • 26 ♀♀; same data as for holotype; 14−20 Dec. 2019; F. Limeira-de-Oliveira, J.C. Oliveira, J.M. Oliveira and I. Cantanhede leg.; PET (Vinagre V.[= Vinho] Tinto + Ferm. [= Fermento] Bio.[=Biológico] + Etanol), 20 mts [= metros]; INPA FLO 1732 to INPA FLO 1739, CZMA FLO 1741 to CZMA FLO 1759 • 3 ♀♀; same data as for holotype; 15−31 Mar. 2020; CZMA FLO 5990 to CZMA FLO 5992 • 5 ♀♀; same data as for holotype; 15−30 Apr. 2020; CZMA FLO 5824 to CZMA FLO 5828 • 3 ♀♀; same data as for holotype; 15−30 Jun. 2020; INPA FLO 6141 to INPA FLO 6143 • 3 ♀♀; same data as for holotype; 15−31 Jul. 2020; INPA FLO 5981 to INPA FLO 5983 • 10 ♀♀; same data as for holotype; 15−31 Aug. 2020; INPA FLO 6488 to INPA FLO 6493, MNRJ FLO 6537 to MNRJ FLO 6540 • 7 ♀♀; same data as for holotype; 15−30 Sep. 2020; CZMA FLO 5961 to CZMA FLO 5964, INPA FLO 6138 to INPA FLO 6140 • 16 ♀♀; same data as for holotype; 15−31 Oct. 2020; CZMA FLO 5911 to CZMA FLO 5915, INPA FLO 5942 to INPA FLO 5946, MNRJ FLO 6474 to MNRJ FLO 6479 • 18 ♀♀; same data as for holotype; 15−30 Nov. 2020; MNRJ FLO 6008 to MNRJ FLO 6010, INPA FLO 6011 to INPA FLO 6015, CZMA FLO 6016 to CZMA FLO 6025 • 17 ♀♀; Carolina, PARNA [= Parque Nacional] Chapada das Mesas, RPPN [= Reserva Particular do Patrimônio Natural] Mansinha; 7°18′11.9″ S, 47°26′07″ W; 12−15 Mar. 2023; F. Limeira-de-Oliveira, R. Ale-Rocha and A. Tôrres leg.; PET (Vinagre V. [= Vinho] Tinto + Etanol), alta 20 mts [= metros]); INPA FLO 7067 to INPA FLO 7084.

Description

Measurements (Figs 1–8). Body: length 4.8 mm; wing: length 0.4 mm, width 0.6 mm.

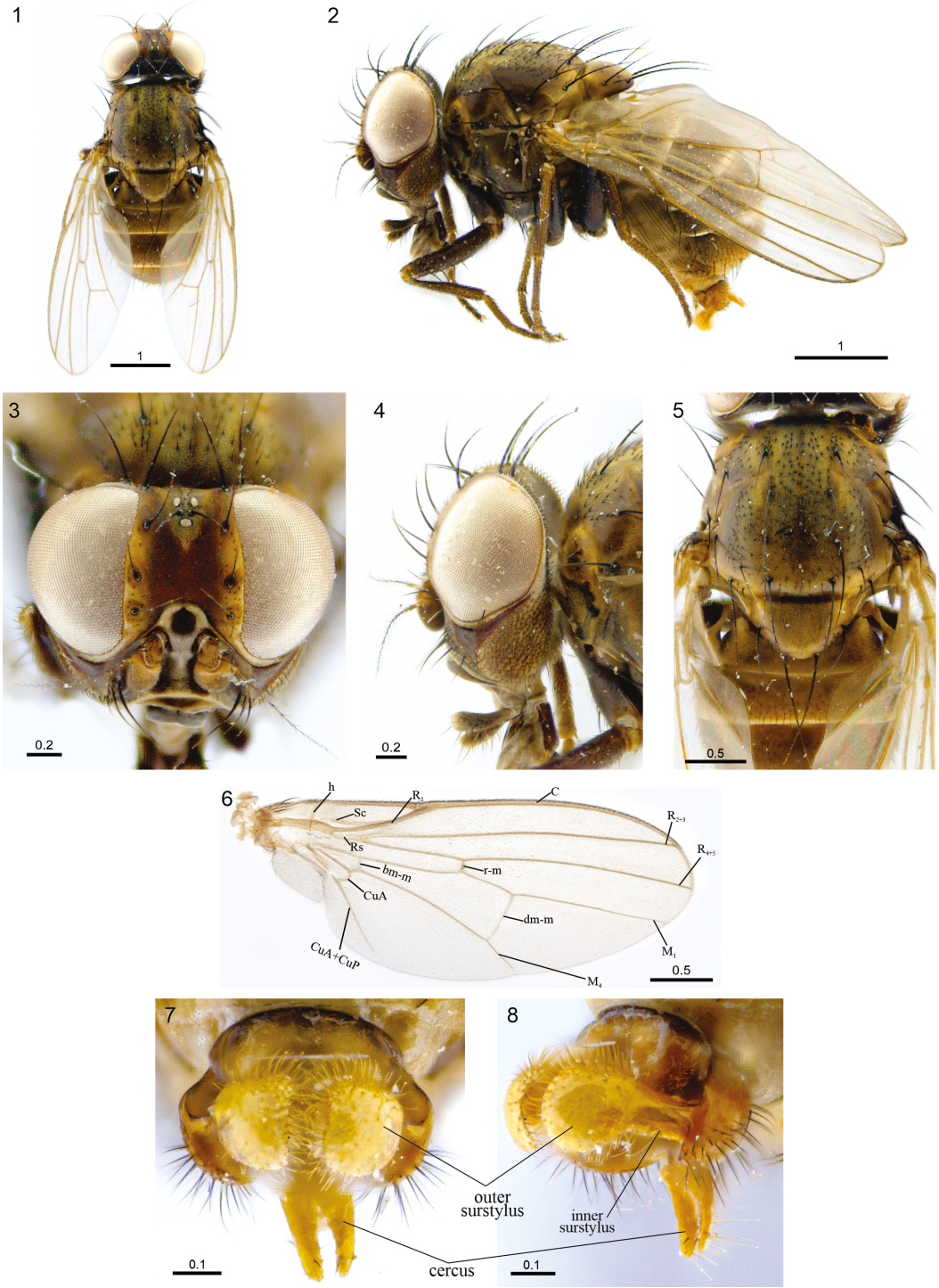
Male

Head (Figs 1–4). 1.8 × as high as long and 1.2 × as wide as high. Frons 1.4 × as wide as long, with lateral margins yellow from 3rd pair fronto-orbital seta and encompassing bases of 1st and 2nd pairs fronto-orbital setae; 3rd pair fronto-orbital setae originated in line with lower margin of anterior ocellus; fronto-orbital plate either entirely yellow (Fig. 3). Lunule 0.2 mm high; 0.4 × height or length of frons. Antenna predominantly yellow-orange, including first two aristal segments, except for small dark spots on median surface of scape and pedicel and distal ¾ of postpedicel, including remaining aristal segments, brown (Figs 3–4).

Thorax (Figs 1–2, 5). Mesonotum and scutellum predominantly brown; mesonotum with anterior half light brown, posterior half dark yellow, including transverse band anterior region in mesonotum, interconnected to postpronotal lobes, just above pronotum, and sublateral region of transverse suture and anterolateral region of scutellum, dark yellow; mesonotum more intensely yellowish in region surrounding postalar seta or in posterolateral corners, dark gray pruinose, except for yellow pruinose, sparse in posterolateral corners, yellowish near dorsocentral setae, sparsely in prescutellar region from 3rd pair of dorsocentral setae to scutellum (subshiny in some specimens, sparse yellow pruinose) (Figs 2, 5). Scutellum with pruinosity entirely yellow or brown with margin yellow (Fig. 5). Pleuron light brown (Fig. 2).

Legs (Fig. 2). Mid tibia predominantly yellow.

Wing (Figs 2, 6). Length 4.0 mm and width 1.5 mm (= 2.7 × as long as wide); veins yellow (Fig. 6), paler in basal parts of veins (Fig. 2).



Figs 1–8. *Papaverodinia chiquinhamum* gen. et sp. nov., holotype, ♂ (CZMA FLO 6088). **1**. Habitus, dorsal view. **2**. Habitus, lateral view. **3**. Head, frontal view. **4**. Head, lateral view. **5**. Thorax, dorsal view. **6**, wing. **7**. Terminalia, dorsal view. **8**. Terminalia, lateral view. Scale bars in mm. Abbreviations: *bm–m* = basal medial crossvein; *C* = costal vein; *CuA* = anterior branch of cubital vein; *CuA+CuP* = anterior branch of cubital vein + posterior branch of cubital vein; *dm–m* = discal medial crossvein; *h* = humeral crossvein; M_1 = first branch of media; M_4 = fourth branch of media; R_1 = anterior branch of radius; R_{2+3} = second branch of radius; R_{4+5} = third branch of radius; *r–m* = radial–medial crossvein; *Rs* = radial sector; *Sc* – subcostal vein. Scale bars in mm.

Abdomen (Fig. 1). Tergites dark yellow to light brown.

Male terminalia (Figs 7–18, 73–74, 79). Epandrium and surstylus yellowish; about 1.4 × as high as long (Fig. 11). Cercus opening with inverted 'arrow' appearance, semihyaline medial membrane extended to ½ of its length, or to proximal end of cercal opening (Figs 7–14, 73). Inner and outer surstyli weakly fused at proximal end. Inner surstylus parallel-sided and straight in both anterior and lateral view (Figs 12, 14). Outer surstylus with basal part narrow, less than ¼ of distal lobe height in lateral view and greatly enlarged distally, 'soup ladle-shaped' in lateral view (Fig. 14). Subepandrial sclerite with an anteromedial margin in an open U-shaped, and with lightly arched posterior margin with angle of approximately 180° (Fig. 74). Angle of pregonite 90° (Fig. 79).

Female

Similar to male (in external morphology of head, thorax, wings, legs and abdomen), except as noted below:

Terminalia (Figs 19–24). Tergite 6 dark yellow to light brown, except for a small rectangular area slightly lighter on mediodistal margin, proximal ⅔ glabrous, distal ⅓ with long, strong setae, spiracle close to anteroventral margin with area of membranous insertion. Sternite 6 membranous, with anteromedial sclerotization 'top hat-shaped', quadrangular lateromedian area, posterior margin with row of 8 setae (1 pair median, 1 pair submedian, 2 lateral pairs), subequal in length and diameter, except for slightly weaker submedian pair. Tergite 7 strongly fused to sternite 7; tergite 7 almost entirely membranous, except for strongly sclerotized subproximal band extending ventrally forming ring with dorsomedial constriction, slightly more pronounced at posterodistal margin; sternite 7 with large concavity on posteroventral margin, with short and sparse setulae.

Variation

Male (n = 10): body length 3.8−5.6 mm, mean 4.7 mm; wing length 3.3−4.5 mm, mean 3.9 mm; wing width 1.1−1.7 mm, mean 1.4 mm. Female (n = 10): body length 3.3−6.2 mm, mean 4.6 mm; wing length 2.7−4.1 mm, mean 3.5 mm; wing width 1.0−1.6 mm, mean 1.4 mm. Thorax: the specimens collected at FLONA of Palmares, state of Piauí, have a mesonotum and scutellum predominantly brown to dark brown.

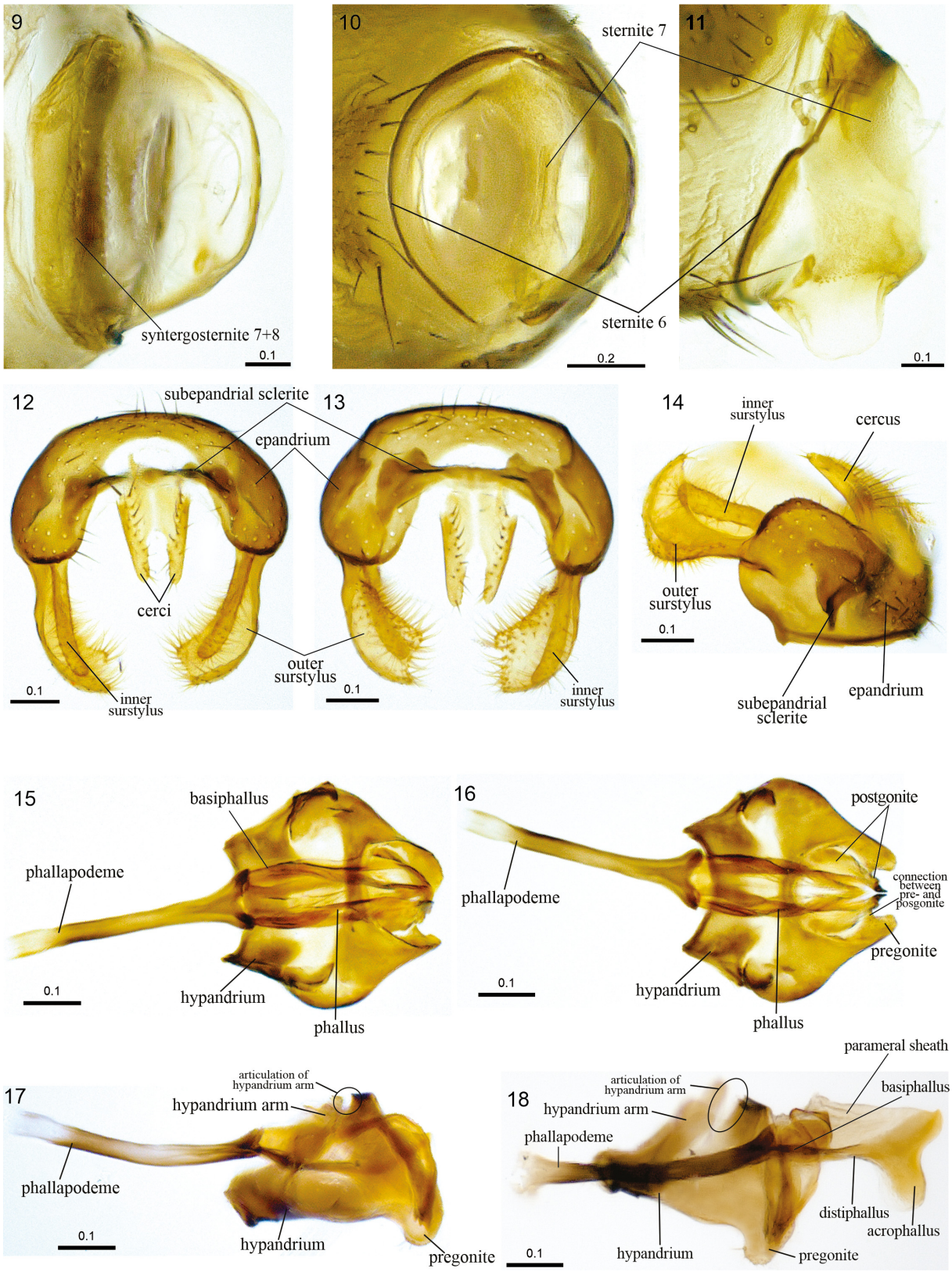
Geographical record

Brazil: Amazonas (Manaus), Maranhão (Carolina, Caxias, Mirador), Pará (Belterra), Piauí (Altos).

Habitat

Canopy between 15 to 40 meters high in the Amazon forest, around Manaus, Amazonas and in the riparian forest at Cerrado, in the states of Maranhão and Piauí.

Figs 9–18 (next page). *Papaverodinia chiquinhamum* gen. et sp. nov., paratypes, ♂♂, terminalia. **9–10**. CZMA FLO 6291. **9**. Syntergosternite 7+8, dorsal view. **10**. Sternite 6 and 7, ventral view. **11–17**. CZMA FLO 1392. **11**. Sternite 6 and 7, lateral view. **12**. Epandrium, cerci, outer and inner surstylus and subepandrial sclerite, anterior view. **13**. epandrium, outer and inner surstylus and subepandrial sclerite, posterior view. **14**. Epandrium, cercus and outer and inner surstylus, lateral view. **15**. Phallapodeme, hypandrium, basiphallus and phallus, dorsal view. **16**. Phallapodeme, hypandrium, phallus, postgonite, connection between pre- and postgonite and pregonite, ventral view. **17**. Phallapodeme, hypandrium, hypandrium arm, gonocoxal apodeme and articulation of hypandrium arm with subepandrial sclerite and pregonite, lateral view. **18**. CZMA FLO 6887, phallapodeme, hypandrium, hypandrium arm, articulation of hypandrium arm with subepandrial sclerite, pregonite, basiphallus, parameral sheath, distiphallus and acrophallus, lateral view. Scale bars in mm.


9
syntergosternite 7+8
0.1
10
sternite 7
sternite 6
0.2
11
0.1
12
subepandrial sclerite
epandrium
cerci
outer surstylus
inner surstylus
0.1
13
0.1
inner surstylus
14
inner surstylus
cercus
outer surstylus
0.1
subepandrial sclerite
epandrium
15
basiphallus
phallapodeme
0.1
hypandrium
phallus
16
postgonite
phallapodeme
connection between pre- and posgonite
pregonite
0.1
hypandrium
phallus
17
articulation of hypandrium arm
hypandrium arm
phallapodeme
0.1
hypandrium
pregonite
18
parameral sheath
articulation of hypandrium arm
basiphallus
hypandrium arm
phallapodeme
distiphallus
acrophallus
hypandrium
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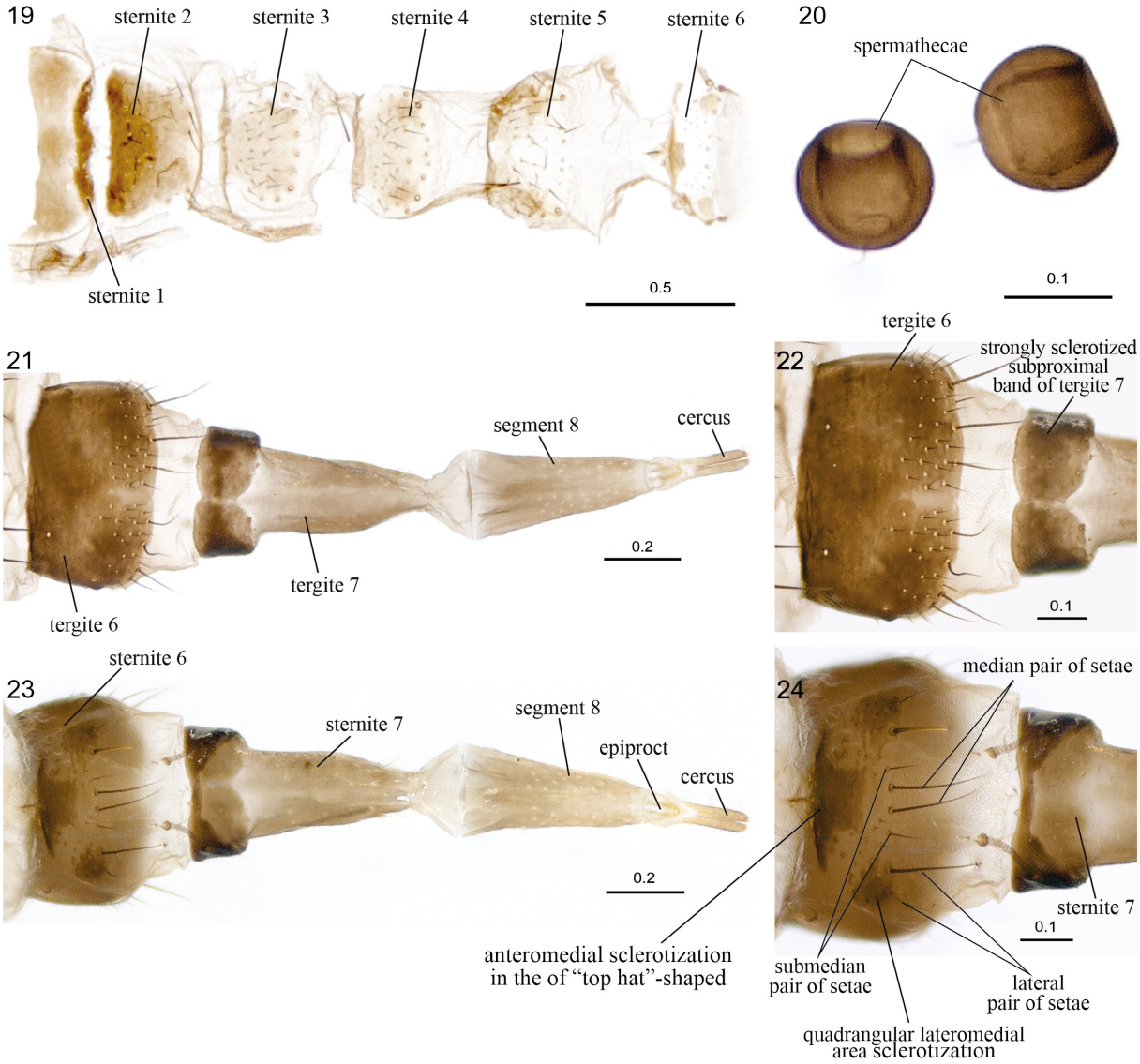


Figs 19–24. *Papaverodinia chiquinhamum* gen. et sp. nov., paratypes, ♀♀. **19**. Sternites 1–6, ventral view (CZMA FLO 6137). **20**. Spermathecae (CZMA FLO 6245). **21–24**. Terminalia (CZMA FLO 6714). **21**. Tergites 6 and 7, segment 8 and cercus, dorsal view. **22**. Tergite 6 and strongly sclerotized subproximal band on tergite 7, dorsal view. **23**. Sternites 6 and 7, segment 8, epiproct and cercus, ventral view. **24**. Sternite 6, anteromedial sclerotization 'top hat-shaped', quadrangular lateromedial area sclerotization and setae (median, submedian and lateral), ventral view. Scale bars in mm.

Papaverodinia canalesi gen. et sp. nov.
urn:lsid:zoobank.org:act:8E07D516-1B4B-4980-8A43-2CE703627094
Figs 25–47, 75–76, 80

Diagnosis

The 3rd pair of fronto-orbital setae originated just below the lower margin of the anterior ocellus. Fronto-orbital plate with narrow strip of yellow only along its outer edge. Mesonotum black. Cercus with opening in inverted U-shaped. Inner and outer surstyli strongly fused at proximal end. Inner surstylus

with distal ⅓ strongly curved backward in lateral view following the curvature of the outer surstylus. Outer surstylus, widened and strongly backward curved distally, 'golf club-shaped' in lateral view.

Etymology

Named in honor to Prof. Walter Canales Santana, current Rector of the State University of Maranhão, for all the support offered during his tenure at UEMA, previously as Vice-Rector.

Type material examined

Holotype

BRAZIL – **Maranhão [MA]** • ♂ (pinned, good condition); Mirador, Parque Estadual do Mirador, Base da Geraldina; 8°37′48″ S, 45°52′49″ W; 20–31 Aug. 2022; F. Limeira-de-Oliveira, A. Tôrres and M.O. Braga leg.; PET (Vinagre V. [= Vinho] Tinto + Etanol), alta 20 mts [= metros]; CZMA FLO 6327.

Paratypes

BRAZIL – **Maranhão [MA]** • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for holotype; 10−20 Aug. 2022; CZMA FLO 6308 • 1 ♂; same data as for holotype; 20−30 Sep. 2022; MZUSP FLO 6331 • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for holotype; 1−10 Jan. 2023; CZMA FLO 6886 • 1 ♂; same data as for holotype; 10−20 Mar. 2023; INPA FLO 6920 • 1 ♂; C. [= Candido] Mendes, Fazenda 7 Irmãos; 1°52′06″ S, 45°45′59.7″ W; 1−5 Nov. 2019; F. Limeira-de-Oliveira, A. Tôrres, D. Limeira and I. Cantanhede leg.; PET (Vinagre V. [= Vinho] Tinto + Fermento Biológico + Etanol), 30 mts [= metros]; CZMA FLO 1347 (pinned, terminalia in microvial of plastic) • 1 ♂; same data as for preceding; INPA FLO 1351 • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for preceding; PET (Vinagre V. [= Vinho] Tinto + Fermento Biológico), 30 mts [= metros]; CZMA FLO 1346. – **Ceará [CE]** • 1 ♂; same data as for holotype; Ubajara, Parque Nacional de Ubajara, Teleférico; 3°50′16.2″ S, 40°53′52.1″ W; 20−31 May 2022; F. Limeira-de-Oliveira and A. Tôrres leg.; PET (Vinagre V. [= Vinho] Tinto + Etanol), alta 30 mts [= metros]; INPA FLO 6391 • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for preceding; 10−20 Jun. 2022; CZMA FLO 6922 • 3 ♂♂; same data as for preceding; 10−20 Jul. 2022; CZMA FLO 6251, INPA FLO 6383, MZUSP FLO 6392 • 2 ♂♂; same data as for preceding; 20−31 Oct. 2022; CZMA FLO 6385, MNRJ FLO 6386 • 4 ♂♂; same data as for preceding; 10−20 Nov. 2022; CZMA FLO 6387 (pinned, terminalia in microvial of plastic), CZMA FLO 6382, CSCA FLO 6384, MNRJ FLO 6388, INPA FLO 6389 (pinned, terminalia in microvial of plastic) • 1 ♀; same data as for holotype; 15−31 May 2022; MNRJ FLO 6298 • 3 ♀♀; same data as for holotype; 20−30 Jun. 2022; CSCA FLO 6295, CZMA FLO 6299, INPA FLO 6300 • 1 ♀; same data as for holotype; 10−20 Jul. 2022; MZUSP FLO 6296 • 1 ♀ (pinned, terminalia in microvial of plastic); C. [= Candido] Mendes, Fazenda 7 Irmãos; 1°52′06″ S, 45°45′59.7″ W; 1−5 Nov. 2019; F. Limeira-de-Oliveira, A. Tôrres, D. Limeira and I. Cantanhede leg.; PET (Vinagre V. [= Vinho] Tinto + Fermento Biológico); CZMA FLO 1348 • 1 ♀; same data as for preceding; PET (Vinagre Arroz + Fermento Biológico + Etanol); INPA FLO 1349 • 1 ♀ (pinned, terminalia in microvial of plastic); Ubajara, Parque Nacional de Ubajara, Teleférico; 3°50′16.2″ S, 40°53′52.1″ W; 20−31 May 2022; F. Limeira-de-Oliveira and A. Tôrres leg.; PET (Vinagre V. [=Vinho] Tinto + Etanol), alta 30 mts [= metros]; CZMA FLO 6393.

Description

Measurements (Figs 25–32). Body length 5.0 mm; wing: length 0.4 mm, width 0.6 mm.

Male

Head (Figs 25–28). Height 1.6 × length and 1.2 × as wide as high. Frons 1.3 × as wide as long, with lateral margins yellow only along very edge, lateral to bases of fronto-orbital setae, 3rd pair of fronto-orbital setae originated just below lower margin of anterior ocellus, whose distance between imaginary

line and margin of anterior ocellus equivalent to diameter of said ocellus; fronto-orbital plate with narrow strip of yellow only along its outer edge (Fig. 27). Lunule 0.1 mm high; 0.3 × height or length of frons. Antenna (Figs 27–28), predominantly light brown, except for scape and proximal region of postpedicel, including first two basal segments of arista, yellow-orange.

Thorax (Figs 25–26, 29). Mesonotum and scutellum black, with dark brown pruinosity (Figs 26, 29). Pleuron black (Fig. 26).

Legs (Fig. 26). Mid tibia predominantly dark, except yellow at distal and proximal tips.

Wing (Fig. 30). Length 3.9 mm and width 1.5 mm (= 2.6 × as long as wide); veins brown.

Abdomen (Fig. 25). Tergites brown to dark brown.

Male terminalia (Figs 31–41, 75–76, 80). Epandrium dark brown, surstylus brown; length and height subequal (Fig. 38). Cercus about 2.0 × as long as wide, light yellow, with opening in inverted U-shaped, medial membrane wide (Figs 31–38, 75). Inner and outer surstyli strongly fused at proximal end. Inner surstylus expanded and club-like distally in both anterior and lateral views (Figs 36, 38), and distinctly curved following curvature of posterior margin of outer surstylus in lateral view (Fig. 38). Outer surstylus with basal part thick, nearly ½ of height of distal lobe (Fig. 38), 'golf club-shape' in lateral view (Figs 32, 38). Subepandrial sclerite with anteromedial margin in 'open-end wrench-shaped', and with lightly arched posterior margin with angle of approximately 180° (Fig. 76). Angle of pregonite 150° (Fig. 80).

Female

Similar to male (in external morphology of head, thorax, wings, legs and abdomen), except as noted below:

Terminalia (Figs 42–47). Tergite 6 entirely brown, proximal ⅔ glabrous, distal ⅓ with long, strong setae, spiracle on anteroventral margin with area of membranous insertion. Sternite 6 membranous, with anteromedial sclerotization 'top hat-shaped', quadrangular lateromedial area, posterior margin with row of 8 setae (1 pair median, 1 pair submedian, 2 lateral pairs), subequal in length and diameter, except for very short and weak submedian setae. Tergite 7 strongly fused to sternite 7; tergite 7 almost entirely membranous, except for strongly sclerotized subproximal band extending ventrally to form ring,latter slightly concave on posterodorsal margin; sternite 7 concave on posteroventral margin, with short, sparse setae.

Variation

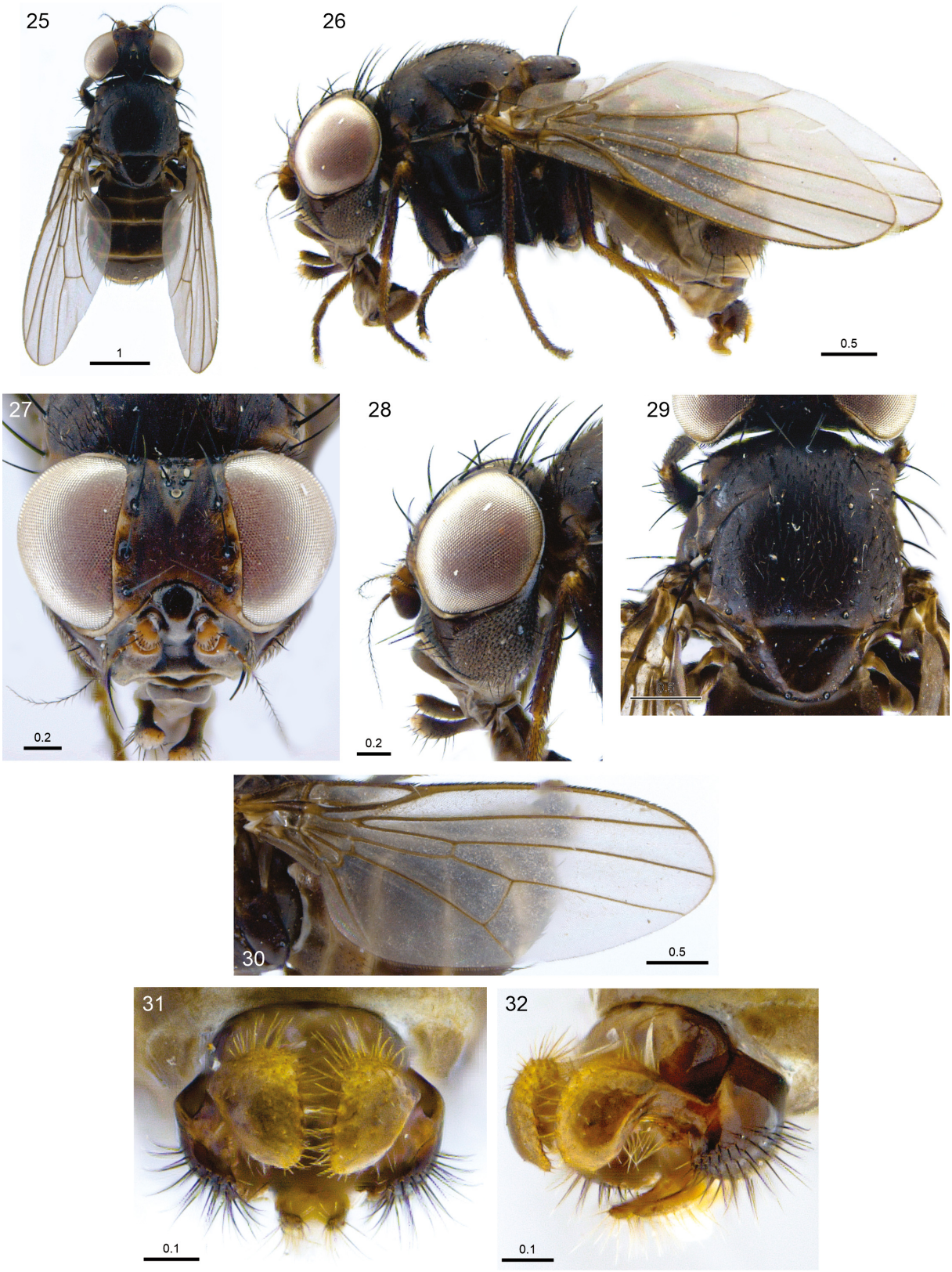
Male (n = 10): body length 4.0−5.3 mm, mean 4.6 mm; wing length 3.3−4.5 mm, mean 3.9 mm; wing width 1.2−1.6 mm, mean 1.4 mm. Female (n = 10): body length 4.5−5.4 mm, mean 4.9 mm; wing length 3.3−4.5 mm, mean 3.9 mm; wing width 1.2−1.7 mm, mean 1.5 mm.

Geographical record

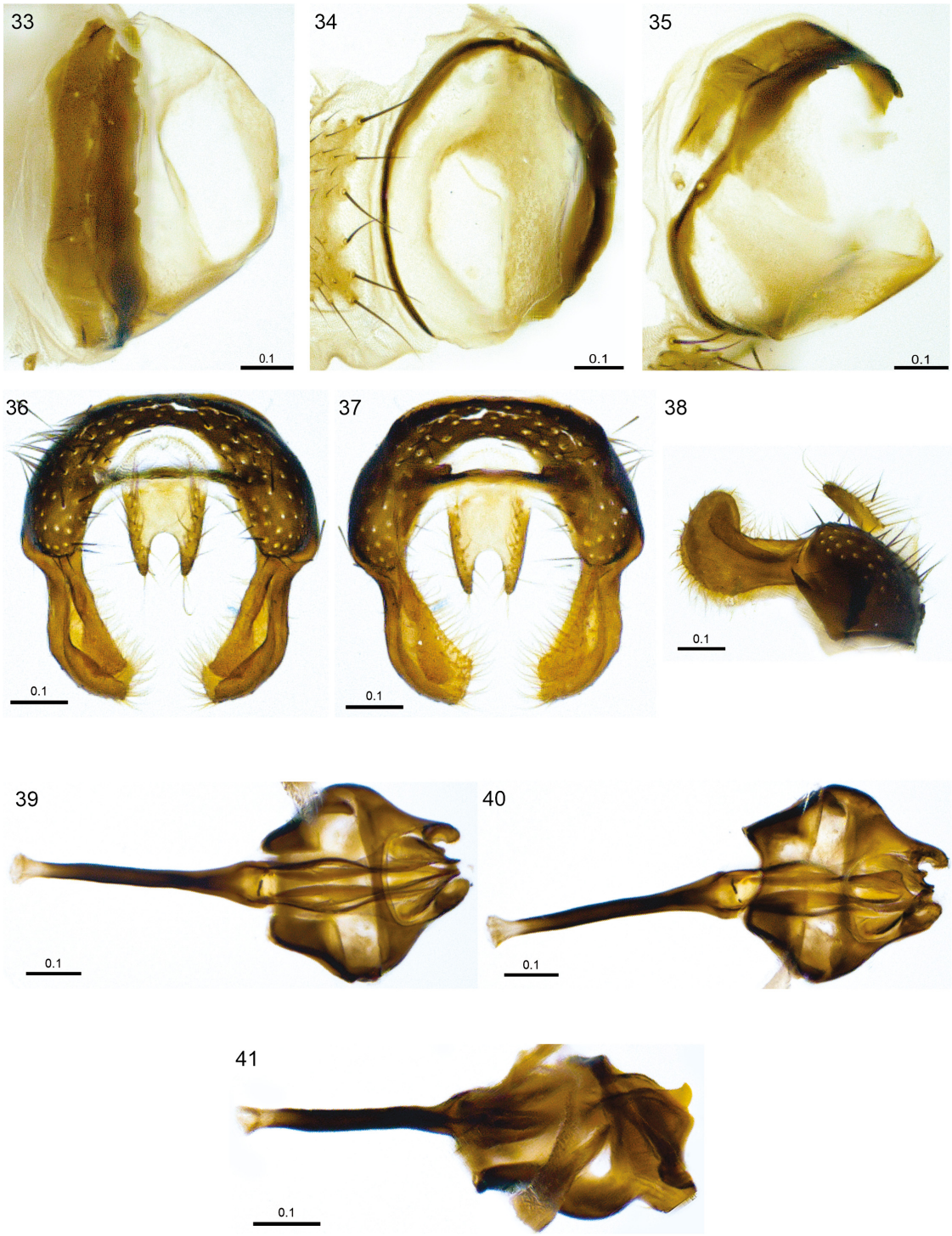
Brazil: Ceará (Ubajara), Maranhão (Candido Mendes, Mirador).

Habitat

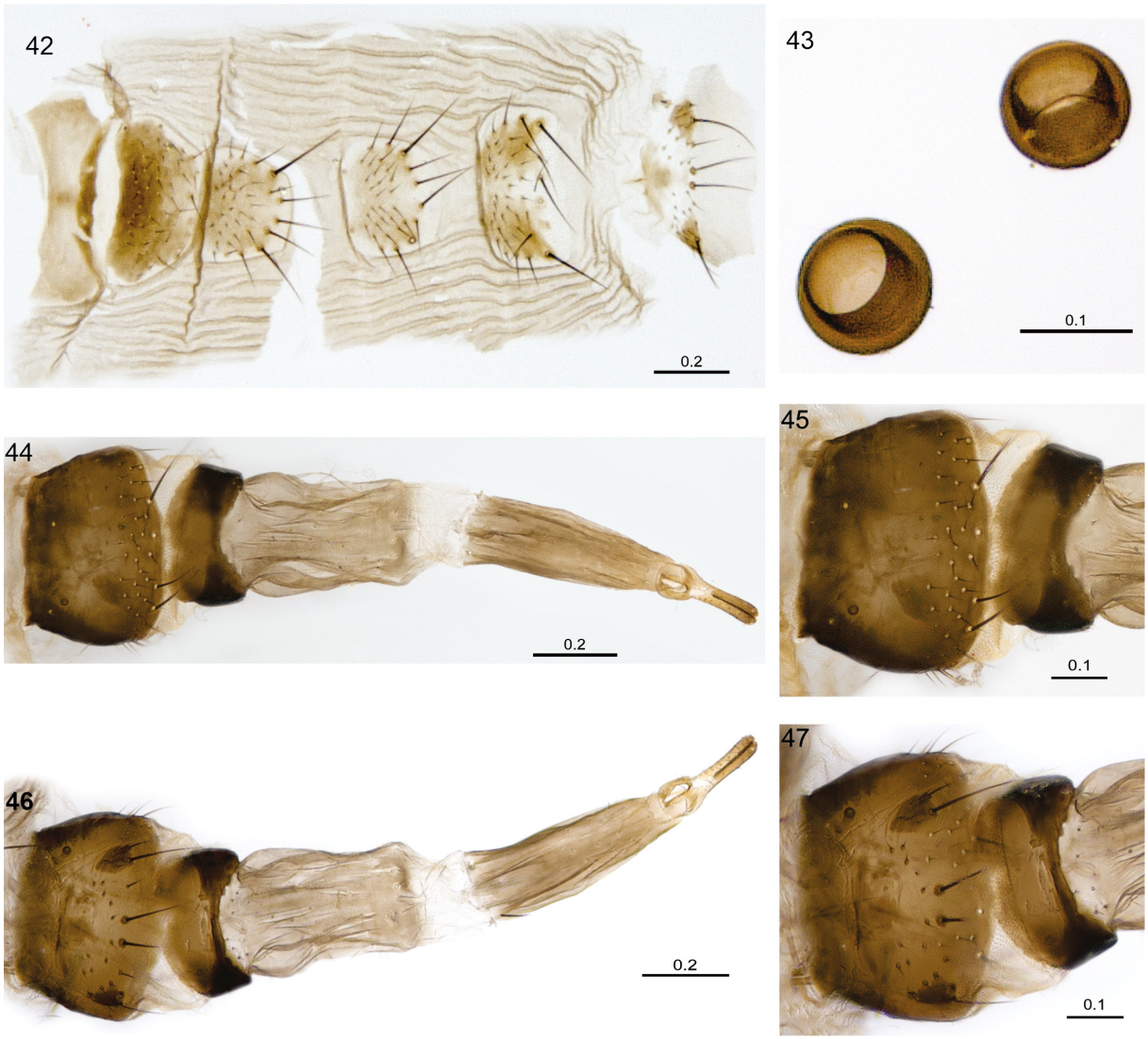
Canopy in the enclave of Atlantic Forest in the Serra de Ibiapaba, Ceará and in areas with Amazon Forest, and in Cerrado Forest, a somewhat Riparian Forest in the state of Maranhão).



Figs 25–32. *Papaverodinia canalesi* gen. et sp. nov., holotype, ♂ (CZMA FLO 6327). **25**. Habitus, dorsal view. **26**. Habitus, lateral view. **27**. Head, frontal view. **28**. Head, lateral view. **29**. Thorax, dorsal view. **30**. Wing. **31**. Terminalia, dorsal view. **32**. Terminalia, lateral view. Scale bars in mm.



Figs 33–41. *Papaverodinia canalesi* gen. et sp. nov., paratype, ♂. **33–41**. CZMA FLO 1346, terminalia. **33**. Syntergosternite 7+8, dorsal view. **34**. Sternite 6 and 7, ventral view. **35**. Sternite 6 and 7, lateral view. **36**. Epandrium, cerci, outer and inner surstylus and subepandrial sclerite, anterior view. **37**. Epandrium, outer and inner surstylus and subepandrial sclerite, posterior view. **38**. Epandrium, cercus and outer and inner surstylus, lateral view. **39**. Phallapodeme, hypandrium, basiphallus and phallus, dorsal view. **40**. Phallapodeme, hypandrium, phallus, postgonite, connection between pre- and postgonite and pregonite, ventral view. **41**. Phallapodeme, hypandrium, hypandrium arm, gonocoxal apodeme and articulation of hypandrium arm with subepandrial sclerite and pregonite, lateral view. Scale bars in mm.



Figs 42–47. *Papaverodinia canalesi* gen. et sp. nov., paratypes, ♀♀. **42**. Sternites 1–6, ventral view (CZMA FLO 1348). **43**. Spermathecae (INPA FLO 6395). **44–47**. Terminalia (INPA FLO 6395). **44**. Tergites 6 and 7, segment 8 and cercus, dorsal view. **45**. Tergite 6 and band of tergite 7, dorsal view. **46**. Sternites 6 and 7, segment 8, epiproct and cercus, ventral view. **47**. Sternites 6 and band of 7, ventral view. Scale bars in mm.

Papaverodinia willkeniae gen. et sp. nov.
urn:lsid:zoobank.org:act:D1B5CFAB-3CFA-454B-9CB5-E6EB120A744B
Figs 48–72, 77–78, 81

Diagnosis

The 3rd pair of fronto-orbital setae originated at the level or above of the anterior ocellus. Fronto-orbital plate entirely yellow. Cercus with opening in inverted V-shape. Inner and outer surstyli weakly fused at proximal end. Inner surstylus, slightly backward curved following curvature of the anterior margin of the outer surstylus, in lateral view. Outer surstylus enlarged distally, 'ice cream ladle-shaped' in lateral view.

Etymology

Named in honor of Dr Dayse Willkenia Almeida Marques, for all her contributions to the organization of part of the biological material used in this work.

Type material

Holotype

BRAZIL – **Amazonas [AM]** • ♂ (pinned, good condition); Manaus, Rod [= Rodovia] AM 010, km 35, Ramal Água Branca II, Sítio Vida Tropical; 2°51′53″ S, 59°56′00″ W; 7–21 Oct. 2018; J.A. Rafael leg., Rede BIA [project]; vinagre [= vinegar], 15 mts [= metros]; CZMA FLO 1323.

Paratypes

BRAZIL – **Amazonas [AM]** • 1 ♂; same data as for holotype; 1−12 Aug. 2018; CZMA FLO 1325 • 1 ♂; same data as for holotype; 28 Feb.−2 Mar. 2018; baited with vinegar; MNRJ FLO 1324 • 1 ♂; same data as for holotype; 23−30 Mar. 2019; MZUSP FLO 1326 • 1 ♂ (pinned, terminalia in microvial of plastic); Manaus, ZF2, km 14; 2°35′21″ S, 60°06′55″ W; 1−16 Jun. 2018; J.A. Rafael and F. Limeira-de-Oliveira leg.; baited with vinegar, 20 mts [= metros] angelim; INPA FLO 1328 • 1 ♂ (pinned, terminalia in microvial of plastic); same data as for holotype; CZMA FLO 1329 • 1 ♂ (pinned, terminalia in microvial of plastic); Manaus, BR 174, ZF-2; 15−28 Feb. 2019; J.A. Rafael leg., Rede BIA [project]; baited with vinegar, 2 mts [= metros]; CZMA FLO 1331 • 1 ♀ (pinned, terminalia in microvial of plastic); same data as for holotype; 5−18 Nov. 2018; INPA FLO 1340 • 1 ♀ (pinned, terminalia in microvial of plastic); same data as for holotype; vinagre [= vinegar], 8 mts [= metros]; CZMA FLO 1341.

Description

Measurements (Figs 48–55). Body length 4.6 mm; wing: length 0.4 mm, width 0.5 mm.

Male

Head (Figs 48–51). Height 1.6 × length and 1.2 × as wide as high. Frons 1.4 × as wide as long, with lateral margins yellow from 3rd pair fronto-orbital seta and encompassing bases of 1st and 2nd pair fronto-orbital setae, 3rd pair of fronto-orbital setae originated at level or above of anterior ocellus; fronto-orbital plate either entirely yellow (Fig. 50). Lunule 0.2 mm high; 0.4 × height or length of frons. Antenna entirely brown except for yellow-orange proximal region (Figs 50–51).

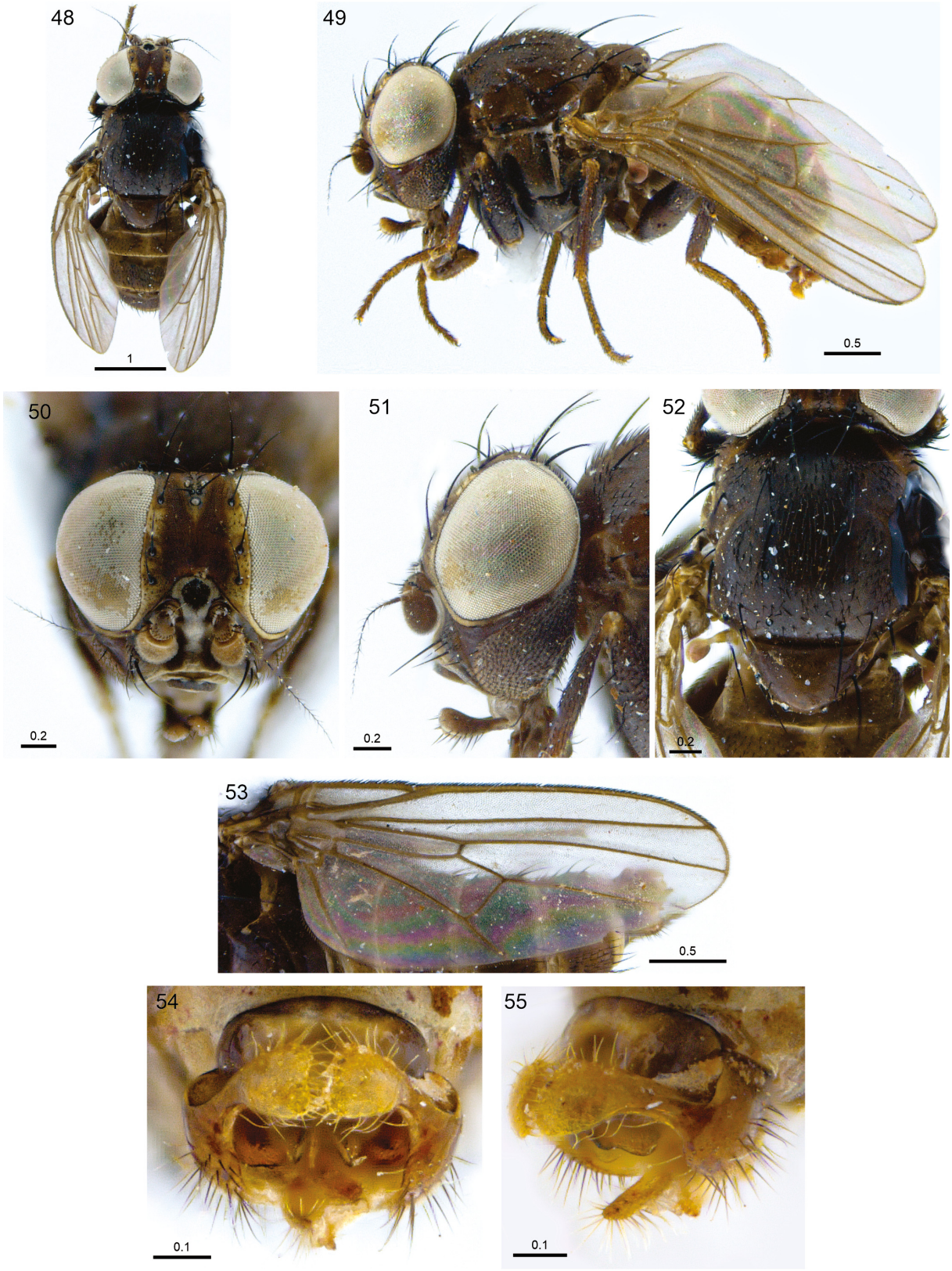
Thorax (Figs 48–49, 52). Mesonotum and scutellum brown, with dark brown pruinosity (Figs 49, 52). Pleuron light brown (Fig. 49).

Legs (Fig. 49). Tibia predominantly dark, except yellow at distal and proximal tips.

Wing (Fig. 53). Length 3.3 mm and width 1.2 mm (= 2.7 × as long as wide); veins brown.

Abdomen (Fig. 48). Tergites brown.

Male terminalia (Figs 54–64, 77–78, 81). Epandrium brown, length and height subequal; surstylus dark yellow to light brown (Fig. 61). Cercus with opening in inverted V-shape, medial membrane slightly infuscated yellow, extended up to ½ its length, or to proximal end of cercal opening (Figs 54–61, 77). Inner and outer surstyli weakly fused at proximal end. Inner surstylus, slightly backward curved following curvature of anterior margin of outer surstylus, in lateral view (Figs 55, 61). Outer surstylus with basal part narrow, less than ¼ of distal lobe height, enlarged distally, ‘ice cream ladle-shaped’ in lateral view (Figs 55, 61). Subepandrial sclerite with anteromedial margin in open U-shape, and posterior margin in inverted V-shape, with an angle of approximately 94° (Fig. 78). Angle of pregonite 120° (Fig. 81).



Figs 48–55. *Papaverodinia willkeniae* gen. et sp. nov., holotype, ♂ (CZMA FLO 1323). **48**. Habitus, dorsal view. **49**. Habitus, lateral view. **50**. Head, frontal view. **51**. Head, lateral view. **52**. Thorax, dorsal view. **53**. Wing. **54**. Terminalia, dorsal view. **55**. Terminalia, lateral view. Scale bars in mm.

Female

Similar to male (in external morphology of head, thorax, wings, legs and abdomen), except as noted below:

Terminalia (Figs 65–72). Tergite 6 entirely brown, proximal ⅔ glabrous, distal ⅓ with long and strong setae, spiracle slightly away from anteroventral margin with area of membranous insertion. Sternite 6 membranous, with anteromedial sclerotization 'top hat-shaped', lateromedian area subquadrangular, posterior margin with row of 9 setae (3 median, 1 pair submedian, 2 lateral pairs), subequal in length and diameter, except very short and weak submedian setae. Tergite 7 strongly fused to sternite 7; tergite 7 almost entirely membranous, except for strongly sclerotized subproximal band extending ventrally forming ring, straight on posterodorsal margin; sternite 7 concave on posteroventral margin, with short, sparse setae.

Variation

Male (n = 4): body length 4.0−5.3 mm, mean 4.6 mm; wing length 3.3−4.5 mm, mean 3.9 mm; wing width 1.2−1.6 mm, mean 1.4 mm. Female (n = 2): body length 4.0−4.7 mm, mean 4.4 mm; wing length 3.3−4.1 mm, mean 3.9 mm; wing width 1.2−1.4 mm, mean 1.3 mm. Head: antenna of some specimens have the postpedicel entirely orange.

Geographical record

Brazil: Amazonas (Manaus).

Habitat

Canopy between 8 to 20 meters high in the Amazon Forest, Amazonas.

Discussion

The results obtained for Odiniidae suggest the observations made by the American naturalist Beebe (1917) were accurate when he claimed to have found a "new continent". This statement was based on his observations of how much life was teeming up to about 40 meters or more above ground level. Years later, from the 1970s onwards, several scholars confirmed the accuracy of this statement, such as Erwin (1983), Stork *et al.* (1997), Basset *et al.* (2003) and Amorim *et al.* (2022). Ribeiro and Corbara (2005), in line with what was being discovered in the upper strata of vegetation, asked the following question: "... where is the greatest diversity of species in a forest, on the ground or in the canopy?...". For the family Odiniidae, the answer is that odiniids do indeed inhabit the canopy with great diversity.

Figs 56–64 (next page). *Papaverodinia willkeniae* gen. et sp. nov., paratype, ♂ (CZMA FLO 1331). **56–64**. Terminalia. **56**. Syntergosternite 7+8, dorsal view. **57**. Sternite 6 and 7, ventral view. **58**. Sternite 6 and 7, lateral view. **59**. Epandrium, cerci, outer and inner surstylus and subepandrial sclerite, anterior view. **60**. Epandrium, outer and inner surstylus and subepandrial sclerite, posterior view. **61**. Epandrium, cercus and outer and inner surstylus, lateral view. **62**. Phallapodeme, hypandrium, basiphallus and phallus, dorsal view. **63**. Phallapodeme, hypandrium, phallus, postgonite, connection between pre- and postgonite and pregonite, ventral view. **64**. Phallapodeme, hypandrium, hypandrium arm, gonocoxal apodeme and articulation of hypandrium arm with subepandrial sclerite and pregonite, lateral view. Scale bars in mm.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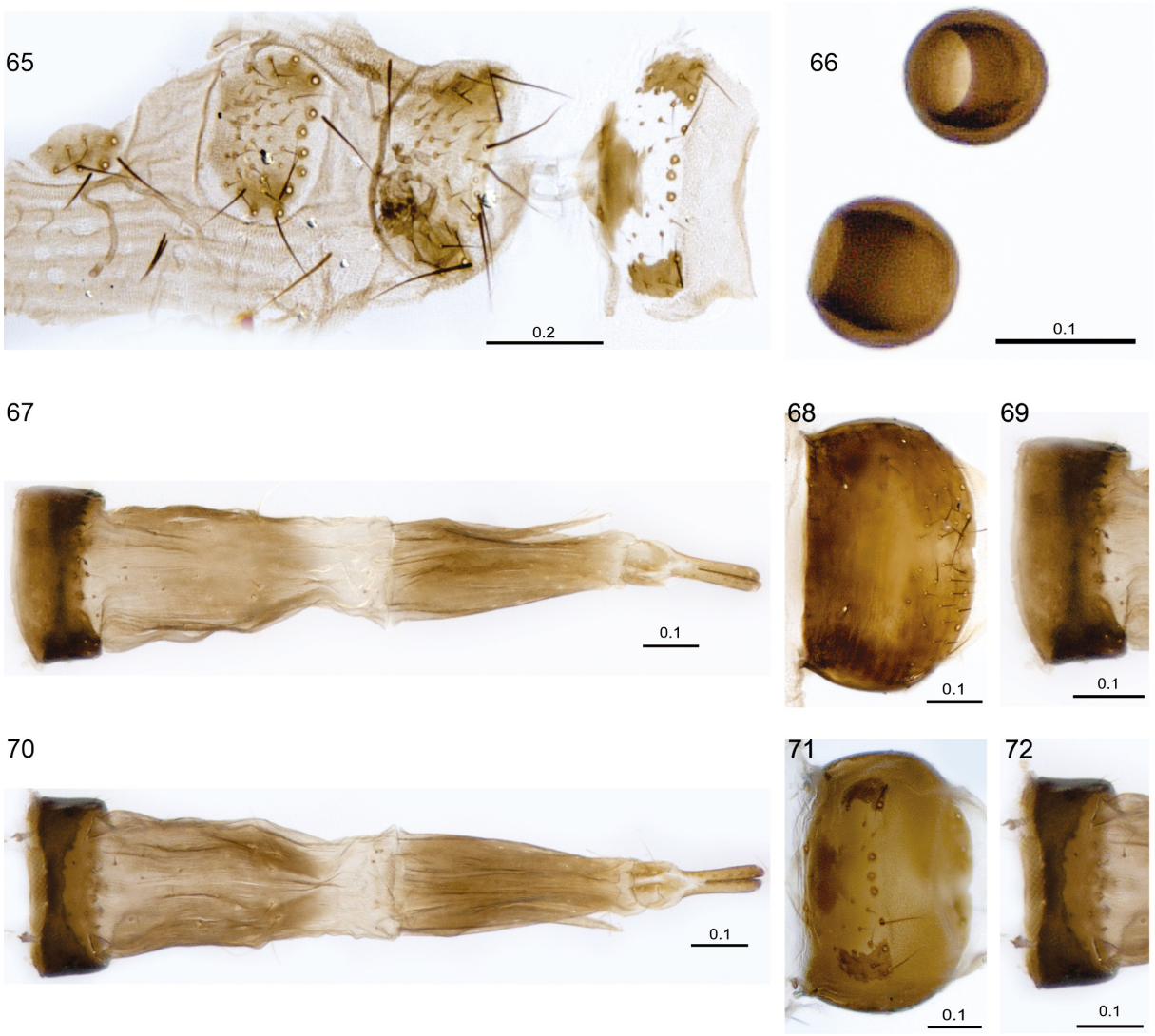

Figs 65–72. *Papaverodinia willkeniae* gen. et sp. nov., paratype, ♀ (INPA FLO 1340). **65**. Sternite 1–6, ventral view. **66.** Spermathecae. **67–72**.Terminalia. **67**. Tergites 6 and 7, segment 8 and cercus, dorsal view. **68**. Tergite 6, dorsal view. **69**. Band of tergite 7, dorsal view. **70**. Sternites 6 and 7, segment 8, epiproct and cercus, ventral view. **71**. Sternite 6, ventral view. **72**. Band of sternite 7, ventral view. Scale bars in mm.

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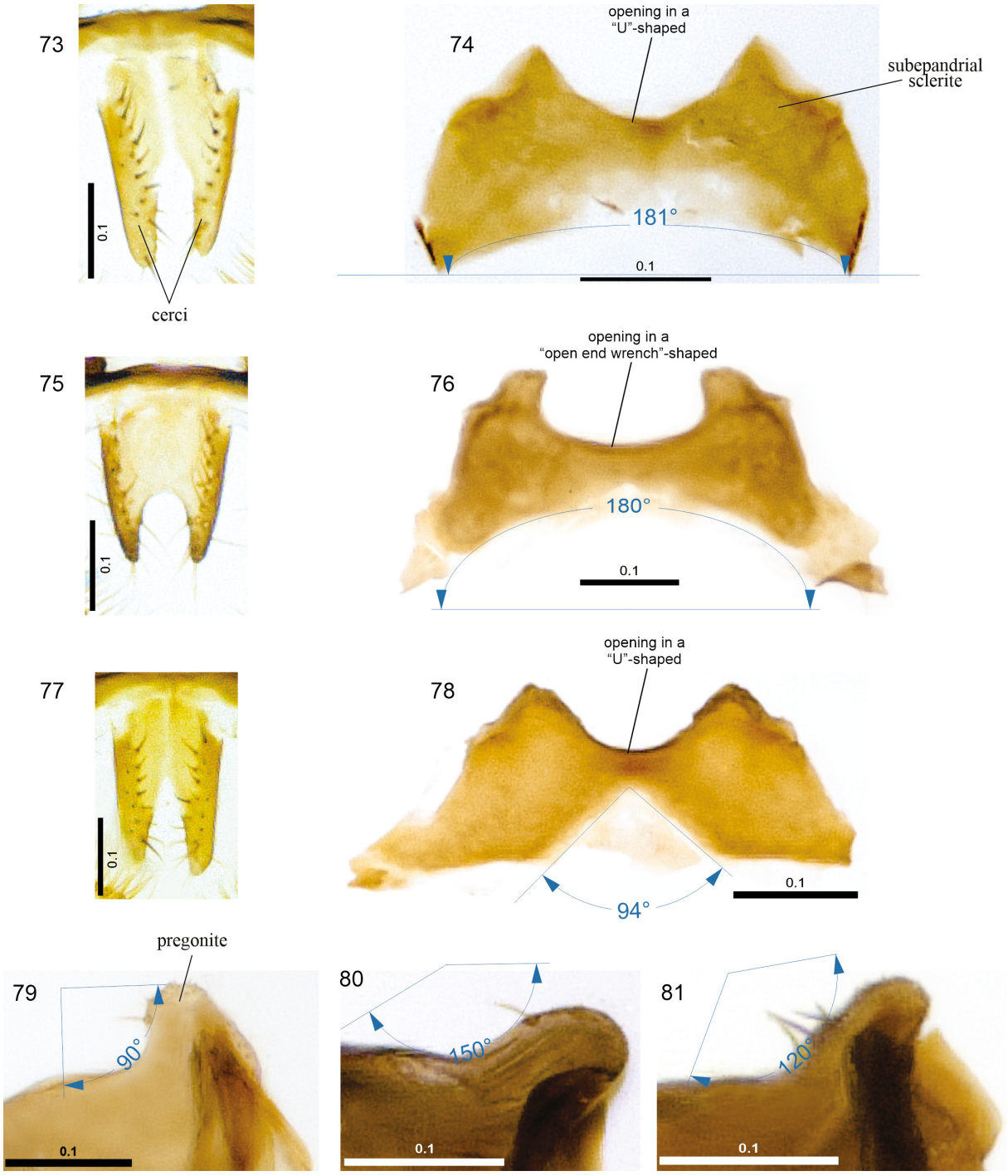

Figs 73–81. *Papaverodinia* gen. nov., paratypes, ♂♂, terminalia. **73–74**. *P. chiquinhamum* gen. et sp. nov. **73**. Cercus, dorsal view (CZMA FLO 1392). **74**. Subepandrial sclerite, dorsal view (CZMA FLO 6291). **75–76**. *P. canalesi* gen. et sp. nov. (CZMA FLO 6389). **75**. Cercus, dorsal view. **76**. Subepandrial sclerite, dorsal view. **77–78**. *P. willkeniae* gen. et sp. nov. (CZMA FLO 1331). **77**. Cercus, dorsal view. **78**. Subepandrial sclerite, dorsal view. **79–81**. Pregonites, lateral view. **79**. *P. chiquinhamum* gen. et sp. nov. (CZMA FLO 6887). **80**. *P. canalesi* gen. et sp. nov. (CZMA FLO 1346). **81**. *P. willkeniae* gen. et sp. nov. (CZMA FLO 1331). Scale bars in mm.

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Author contributions

Alice Tôrres (analyzed, described and illustrated the species, added data and wrote the manuscript), José Albertino Rafael (revised and described species, added data), Stephen D. Gaimari (revised and described species, added data) and Francisco Limeira-de-Oliveira (analyzed and described species, added data and wrote the manuscript).

References

Amorim D.S., Brown B.V., Boscolo D., Ale-Rocha R., Alvarez-Garcia D.M., Balbi N.I.P.A., Barbosa A.M., Capellari R.S., Carvalho C.J.B., Couri M.S., Dios R.V.P., Fachin D.A., Ferro G.B., Flores H.F., Frare L.M., Gudin F.M., Hauser M., Lamas C.J.E., Lindsay K.G., ... & Rafael J.A. 2022. Vertical stratification of insect abundance and species richness in an Amazonian tropical forest. *Scientific Reports* 12: 1734. https://doi.org/10.1038/s41598-022-05677-y

Austin A.D. & Dillon N. 1997. Extraction and PCR of DNA from parasitoid wasps that have been chemically dried. *Australian Journal of Entomology* 36: 241–244. https://doi.org/10.1111/j.1440-6055.1997.tb01461.x

Barkeley E.P. 2009. *Insect Communities and Multicohort Stand Structure in Boreal Mixedwood Forests of Northeastern Ontario*. Master of Science in Forestry, Faculty of Forestry, University of Toronto.

Basset Y., Novotny V., Miller S.E. & Kitching R.L. 2003. Arthropods of tropical forests: Spatio-temporal dynamics and resource use in the canopy. *European Journal of Entomology* 103: 253–254.

Beebe W. 1917. *Tropical Wild Life in British Guiana*. Vol. 1: Zoological Contributions from the Tropical Research Station of the New York Zoological Society. The New York Zoological Society, New York City.

Carles-Tolrá M. 1996. *Odinia trifida* sp.n., a new odiniid species from Spain (Diptera: Odiniidae). *Stuttgarter Beiträge Naturkunde Serie A [Biologie]* 545: 1–3.

Carles-Tolrá M., Garanto O. & Checa J.I. 1993. Nuevas citas y datos de dipteros acalipteros para España (Diptera: Acalyptrata). *Sessió Conjunta d'Entomologia ICHNSCL* 7: 83–89.

Collin J.E. 1952. On the European species of the genus *Odinia* R.-D. (Diptera: Odiniidae). *Proceedings of the Royal Entomological Society of London*, *Series B* 21 (7–8): 110–116. https://doi.org/10.1111/j.1365-3113.1952.tb01063.x

Cumming J.M. & Wood M.D. 2017. 3 Adult morphology and terminology. *In*: KirkSpriggs A.H. & Sinclair B.J. (eds) *Manual of Afrotropical Diptera. Volume 1. Introductory Chapters and Keys to Diptera Families*: 89–133. South African National Biodiversity Institute, Pretoria.

Dal Molin A. 2018. Secagem química de pequenos artrópodes (PT-BR). *Protocols.io – Part of Springer Nature,* 4: 1–4. https://doi.org/10.17504/protocols.io.s9aeh2e

Erwin T.L. 1983. Tropical forest canopies: the last biotic frontier. *Bulletin of the Entomological Society of America* 29 (1): 14–20. https://doi.org/10.1093/besa/29.1.14

Flores H.F., Pirani G., Gaimari S.D. & Amorim DS. 2021. Two new species of *Neotraginops* Prado from Costa Rica and Brazil (Diptera: Odiniidae: Traginopinae). *Zootaxa* 5048 (2): 176–190. https://doi.org/10.11646/zootaxa.5048.2.2

Gaimari S.D. & Mathis W.N. 2011. World catalog and conspectus on the family Odiniidae (Diptera: Schizophora). *Myia* 12: 291–339.

Gaimari S.D. 2007. Three new Neotropical genera of Odiniidae (Diptera: Acalyptratae). *Zootaxa* 1443 (1): 1–16. http://doi.org/10.5281/zenodo.176054

Gressitt J.L. & Gressitt M.K. 1962. An improved Malaise trap. *Pacific Insects* 4 (1): 87–90.

Hendel F. 1917. Beiträge zur Kenntnis der acalyptraten Musciden. *Deutsche entomologische Zeitschrift* 1917: 33–47.

Krivosheina N.P. & Krivosheina M.G. 1996. New data on the taxonomy and biology of the flies from the genus *Turanodinia* Stackelberg (Diptera, Odiniidae). *Dipterological Research* 7 (2): 141–146.

Krüger O. & McGavin G.C. 1998. Insect diversity of *Acacia* canopies in Mkomazi game reserve, north-east Tanzania. *Ecography* 21: 261–268. https://doi.org/10.1111/j.1600-0587.1998.tb00563.x

Limeira-de-Oliveira F. & Tôrres A. 2024. Odiniidae. *In*: Catálogo Taxonômico da Fauna do Brasil. Available from http://fauna.jbrj.gov.br/fauna/faunadobrasil/1213 [accessed 30 Nov. 2024].

Limeira-de-Oliveira F., Marques D.W.A., Reis G.A. & Rafael J.A. 2017. *Inpauema*, a new genus of Odiniidae (Diptera) from Brazil, with description of five new species. *Zootaxa* 4362: 517–534. https://doi.org/10.11646/zootaxa.4362.4.3

Limeira-de-Oliveira F., Marques D.W.A., Gaimari S.D. & Rafael J.A. 2020a. A new genus and species of odiniids (Diptera:Odiniidae) from the canopy of the Brazilian Amazon rainforest. *Zootaxa* 4801 (1): 164–170. https://doi.org/10.11646/zootaxa.4801.1.8

Limeira-de-Oliveira F., Marques D.W.A., Gaimari S.D. & Rafael J.A. 2020b. *Pauximyia*, a new genus of Odiniidae (Diptera: Acalyptratae) with description of two new species from Brazil. *Zootaxa* 4728 (2): 227–236. https://doi.org/10.11646/zootaxa.4728.2.4

Malloch J.R. 1926. New genera and species of acalyptrate flies in the United States National Museum. *Proceedings of the United States National Museum* 68: 1–35. https://doi.org/10.5479/si.00963801.68-2622.1

Meigen J.W. 1830. *Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten*. Sechster Theil. Schulz, Hamm.

Parchami-Araghi M., Majnon-Jahromi B., Gilasian E., Withers P., Gaimari S.D. & Fallahzadeh M. 2018. First Iranian record of the family Odiniidae (Diptera: Opomyzoidea), including two species new to the Middle East region. *Zootaxa* 4471 (3): 580–584. https://doi.org/10.11646/zootaxa.4471.3.9

Prado A.P. 1973. Contribuição ao conhecimento da família Odiniidae (Diptera, Acalyptratae). *Studia Entomologica* 16: 481–510.

Pérez-Benavides A.L., Ospina-Peñuela E., Gamboa J. & Duran-Bautista E.H. 2023. Amyl acetate: an alternative technique to dry mount Chalcidoidea (Hymenoptera) from alcohol, faster and inexpensively. *Journal of Insect Science* 23 (2): 1–6. https://doi.org/10.1093/jisesa/iead010

Rafael J.A. & Gorayeb I.S. 1982. Tabanidae (Diptera) da Amazônia, I - Uma nova armadilha suspensa e primeiros registros de mutucas de copas de árvores. *Acta Amazonica* 12 (1): 232–236. https://doi.org/10.1590/1809-43921982121232

Rafael J.A., Marques D.W.A. & Limeira-de-Oliveira F. 2020. *Atriadops macula* (Wiedemann) inhabiting the canopy: the first record of Nemestrinidae (Diptera) in the Amazon Basin. *Zootaxa* 4722 (5): 486–490. https://doi.org/10.11646/zootaxa.4722.5.7

Rafael J.A., Marques D.W.A. & Limeira-de-Oliveira F. 2023. Insect (Hexapoda) diversity in the oceanic archipelago of Fernando de Noronha, Brazil: Clusiidae (Diptera). *Zootaxa* 5353 (4): 332–350. https://doi.org/10.11646/zootaxa.5353.4.2

Ribeiro S.P. & Corbara B. 2005. Dossel florestal: fronteira desconhecida. *Ciência Hoje* 37 (217): 54–58.

Robineau-Desvoidy J.B. 1830. Essai sur les Myodaires. *Mémoires Présentés par Divers Savans à l'Académie Royale des Sciences de l'Institut de France, et Imprimés par son Ordre. Sciences Mathématiques et Physiques* 2 (2): 1–813.

Stork N.E. 1991. The composition of the arthropod fauna of Bornean lowland rain forest trees. *Journal of Tropical Ecology* 7 (2): 161–180. https://doi.org/10.1017/S0266467400005319

Stork N.E., Adis J. & Digham R.K. 1997. *Canopy Arthropods*. Chapman & Hall, London.

Tôrres A., Rafael J.A., Gaimari S.D. & Limeira-de-Oliveira F. 2021. Revision of the genus *Lopesiodinia* Prado, 1973 (Diptera: Odiniidae) with description of three new species. *Zootaxa* 5052 (3): 332–352. https://doi.org/10.11646/zootaxa.5052.3.2

Tôrres A., Rafael J.A., Gaimari S.D. & Limeira-de-Oliveira F. 2024. *Lopesiodinia alvarengai* Prado, 1973 (Odiniidae: Traginopinae) with the first description of the male and the neotype designation. *Zootaxa* 5405 (3): 433–440. https://doi.org/10.11646/zootaxa.5405.3.6

Townes H.K. 1972. A light-weight Malaise trap. *Entomological News* 83: 239–247.

Tschirnhaus M.V. 2008. Diptera Stelviana, [Chapter] 4.3.01 Acartophthalmidae, Borboropsidae, Chyromyidae, Micropezidae, Odiniidae, Opetiidae, Periscelididae, Pseudopomyzidae, and Tanypezidae. *Studia Dipterologica – Supplement* 16: 65–97. http://dx.doi.org/10.13140/2.1.4759.0723

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