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Inpauema, a new genus of Odiniidae (Diptera) from Brazil, with description of five new species

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Abstract

A new genus and five new species of odiniids (Odiniidae: Traginopinae) are described from the Brazilian Amazon and Cerrado biomes: *Inpauema mirador* **gen. nov. et sp. nov.** (type species), *I. catarinae* **sp. nov**., *I. gaimarii* **sp. nov**., *I. raimundoluizi* **sp. nov.**, and *I. xavieri* **sp. nov.** The genus is being characterized by a unique combination of diagnostic characters: body predominantly dark brown to black, with silvery-gray pruinose spots on inner margin of eyes, longitudinally along middle of lunule and face, on notopleuron and mesopleuron; postcranium concave from dorsal view; one pair of stout proclinate ocellar setae; postocellar setae absent; lunule shorter than frons; gena lacking upturned seta; antennae separated by a maximum distance of 2X the diameter of a single antennal socket and gonocoxal apodemes directed upward, forming an arch. A key to separate *Helgreelia* Gaimari, 2007 from *Inpauema* **gen. nov.** and for the new species is provided.

Key words: Acalyptratae, Traginopinae, taxonomy, Neotropical, rainforest, Cerrado biome

Introduction

Odiniidae is a family of strongly bristled flies, with body length ranging from 2.5 to 6.0 mm. They are found throughout most parts of the world, including Australia based on unidentified specimens according to Gaimari & Mathis (2011) and to the second author (DWAM) that also found a few specimens from Australia deposited in the Canadian National Collection of Insects, Arachnides and Nematodes (CNC - AgriFood Canada). The family is small currently composed of 65 valid species, distributed in 15 genera and two subfamilies, Odiniinae and Traginopinae (Gaimari & Mathis 2011).

Until the 1960s, the Brazilian fauna of Odiniidae was composed of only five species: *Neotraginops clathratus* (Hendel, 1909), *Odinia brevitibia* Shewell, 1960, *Paratraginops pilicornis* (Cresson, 1912), *P. plaumanni* Shewell, 1960 and *Schildomyia punctifrons* Malloch, 1926.

Prado (1973) added seven species to the Brazilian fauna and described two genera: *Neotraginops* Prado, 1973, to accommodate *Traginops clathratus* Hendel, 1909, and *Lopesiodinia* Prado, 1973, with two species: *L. alvarengai* Prado, 1973 and *L. diversa* Prado, 1973. The other species described by Prado were *Odinia surumuana* Prado, 1973, *Shildomyia flavida* Prado, 1973, *S. goyana* Prado, 1973, *S. lanei* Prado, 1973 and *S. reticulata* Prado, 1973. The most recently described Brazilian species of Odiniidae is *Helgreelia gaimarii* Carvalho-Filho, Esposito & Santos, 2009 (Carvalho-Filho *et al*. 2009).

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Although odiniids occur practically in all zoogeographic regions, they are most numerous in the Neotropical Region: out of the 65 described species in 15 genera around the world, 26 species in nine genera occur in the neotropics (Gaimari & Mathis 2011) and thirteen species in six genera occur in Brazil, namely *Odinia* Robineau-Desvoidy, 1830 (2 species), *Helgreelia* Gaimari (1), *Lopesiodinia* Prado (2), *Neotraginops* Prado (1), *Paratraginops* Prado, 1973 (2) and *Schildomyia* Malloch, 1926 (5) (Prado 1973; Carvalho-Filho *et al.* 2009; Carvalho-Filho 2017). A large number of Neotropical species are awaiting revisionary work and descriptions (Gaimari & Mathis 2011).

Here we describe a new genus and five new species of Odiniidae belonging to the Traginopinae**.**

Material and methods

This study was based on specimens deposited in the Coleção Zoológica do Maranhão, Caxias, Maranhão, Brazil (CZMA) and Coleção de Invertebrados do Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil (INPA). The specimens were collected with interception trap model Gressit & Gressit (= armadilha Malaise in the labels), light trap (= arm. luz, dossel in labels) and suspended trap (= armadilha suspensa in labels). The Malaise trap model Gressit & Gressit (1962) consists of a tent-like structure, made of fine mesh black material about 6 meters long with two collecting jars. The ligth trap consists of a vertical white sheet illuminated by a 250 watts mixed light and black light bulb of 20 watts that was mounted at the canopy level. The suspended trap consists of a suspended pyramidal tent-like structure with a collection jar located in the top and a lower septum that can be made of different materials and colors (Rafael & Gorayeb 1982).

The specimens were collected in Amazonian biome of states of Amazonas and Pará, and Cerrado biome of state of Maranhão.

The Cerrado region is the most biodiverse savannah-like vegetation, which originally covered approximately 25% of the Brazilian territory; is a region characterized by a ground layer of grasses, small palms, shrubs and trees (Miranda *et al.* 2009). This biome is extremely threatened, having lost almost half of its original floral cover and it is being affected by an intense process of fragmentation (Ganem *et al.* 2013).

The Amazon basin includes the largest remaining area of tropical rainforest of the World, but is also covered with several other kinds of vegetation, like open/closed shrublands, savannas, woody savannas, grasslands and croplands (Saatchi *et al.* 2010). According to Figueroa & Nobre (1990) the western and northeastern parts of the Amazon receive more than 2500 mm and the rest of the basin receives around 2100 mm or less per year.

The morphological terminology is based on Cumming & Wood (2009), except for antennal morphology that follows Stuckenberg (1999). The specimen length was measured in lateral view from the frons (excluding antenna) to the apex of the abdomen.

The following measurements are used in the descriptions, illustrated in the Figs 2, 3 and 5.

Head

FL—frons length, anterior view (distance from the top of ptilinial fissure to the anterior ocellus) (Fig. 2).

FW—frons width, anterior view (distance between inner margins of compound eyes at the level of the anterior ocellus) (Fig. 2).

HW—head width, anterior view (distance between outer margins of the compound eyes measured at the widest part) (Fig. 2).

HH—head height, lateral view (distance from the ventral margin of the gena to the dorsal margin of the head) (Fig. 3).

HL—head length, lateral view (distance from the lunule to the postcranium) (Fig. 3).

Wing

WL—wing length (distance from the base to the apex) (Fig. 5).

WW—wing width (distance from costal to anal borders measured at the widest level, generally around the apex of CuA_1 vein) (Fig. 5).

The apex of the abdomen was removed and macerated in hot (150 °C) 85% lactic acid for around 30 minutes, and then it was examined on excavated slides with glycerin. After study and illustration, the dissected abdomen and terminalia of the holotypes (male paratype in *I. mirador* **sp. nov**.) were placed in microvials with glycerin. The left wing of the holotypes (male paratype in *I. mirador* **sp. nov**., female paratype in *I. gaimarii* **sp. nov**.) were mounted between microslides with Canada balsam. After drying, the microslides were glued to the edge of a small piece of thick paper, which was then pinned with the specimen.

Photographs were taken through a Leica DFC500 digital camera fitted on a Leica MZ205 stereomicroscope connected to a computer with the Leica Application Suite software, which includes an Auto-Montage module (Syncroscopy software) (http://www.syncroscopy.com/syncroscopy/) which combines multiple layers of photographs into a single fully focused image.

Results

The Gaimari & Mathis' (2011) key to identify the world genera of odiniids is useful and here we included only a modified dichotomy 13 to separate *Helgreelia* Gaimari from *Inpauema* **gen. nov.** and the species included in the new genus.

13'. "Only anterior fronto-orbital seta inclinate; scutellar disc bare" 14

14. Face uniformly yellow, lacking mid-longitudinal stripe. Lunule higher than frons. Antennae separated by a distance greater than 3X the diameter of a single antennal socket. M_1 vein becoming distinctly weaker from cross vein dm-cu towards wing margin . . . . . *Helgreelia* Gaimari

\- Face brown to black pruinose with white mid-longitudinal gray pruinose stripe (Figs 2, 16, 28, 47, 58). Lunule shorter than frons. Antennae separated by a maximum distance of 2X the diameter of a single antennal socket. M_1 vein normal, distinctly reaching wing margin (Figs 5, 19, 31, 50, 61) . . . . . *Inpauema* **gen. nov.**...15

15. Mesonotum with a large medial gray stripe intermixed with brown stripes, reaching scutellum (Fig. 30). Cercus with a small pointed projection in the tip (Fig. 37) . . . . . *Inpauema gaimarii* **sp. nov.**

\- Mesonotum dark brown to black with a faint gray pruinose stripe between dorsocentral setae that does not reach base of scutellum (Figs 4, 18, 49, 60), more distinct when seen under anterior incident light. Cercus simple, without projections (Figs 9, 21, 52, 63) 16

16. Mid-longitudinal stripe of lunule with parallel sides, somewhat rectangular (Figs 2, 16, 47). Gena predominantly gray-yellowish pruinose (Figs 3, 17, 48). Tergite 6 symmetrical (Figs 8, 22, 53). Gonocoxal apodemes fused posteriorly when seen from posterior view (Figs 11, 26, 56) 17

\- Mid-longitudinal stripe of lunule with distinct divergent sides ventrally, somewhat triangular (Fig. 58). Gena predominantly brown pruinose (Fig. 59). Tergite 6 asymmetrical, very short, restricted to the right side (Fig. 64). Gonocoxal apodemes not fused posteriorly when seen from posterior view (Fig. 66) . . . . . *Inpauema xavieri* **sp. nov.**

17. Fronto-orbital plate with dark brown pruinosity (Fig. 16). Wing slightly brown infuscated along anterior half (Fig. 19). Tergite 6 almost as long as the syntergosternite 7+8 (Fig. 22). . . . . *Inpauema catarinae* **sp. nov.**

\- Fronto-orbital plate predominantly with gray-yellowish to light brown pruinosity (Figs 2, 47). Wing entirely hyaline (Fig. 50) or slightly brown infuscated only on cell c and beginning of cell r_1 (Fig. 5). Tergite 6 much shorter than syntergosternite 7+8 (Figs 8, 53) 18

18. Frontal pruinosity velvety black (Fig. 2). Coxae and femora brown to dark brown (Fig. 1). Tergite 6 narrow dorsally, about 4X shorter than syntergosternite 7+8 (Fig. 8). Epandrium without spots (Fig. 8) . . . . . *Inpauema mirador* **sp. nov.**

\- Frontal pruinosity velvety brown (Fig. 47). Coxae and femora light brown (Fig. 46). Tergite 6 approximately half the length of syntergosternite 7+8 (Fig. 53). Epandrium with rounded spot medially (Fig. 53).. . . . . *Inpauema raimundoluizi* **sp. nov.**

Taxonomy

Inpauema gen. nov.

Type species. *Inpauema mirador* **sp. nov**., by present designation.

Gender. Feminine.

Etymology. Named in honor of Instituto Nacional de Pesquisas da Amazônia (INPA) and Universidade Estadual do Maranhão (UEMA), two partner institutions in the studies of insect biodiversity along last decades.

Diagnosis. Predominantly dark brown to black, with well-delimited, silvery-gray pruinose spots on inner margin of eyes, narrow on postcranial margin, longitudinally along middle of lunule and face, on notopleuron and

mesopleuron; propleuron light brown pruinose; laterotergite gray pruinose, sparse. Postcranium concave from dorsal view. One pair of stout proclinate ocellar setae. Postocellar setae absent. Frons with 3 fronto-orbital setae: one inclinate anterior seta and two reclinate posterior setae. Lunule shorter than frons. Antennae separated by a maximum distance of 2X diameter of single antennal socket. Gena lacking upturned seta. Scutum with 1+3 dorsocentral setae. Costal vein extending slightly beyond vein R_{4+5}; costal spinules extending to vein R_{2+3}. Gonocoxal apodemes directed upward, not fused or fused posteriorly, forming an arch (Figs 11, 26, 40, 56, 66).

Adults, ♂, ♀. Body length 3.25–5.32 mm.

Head (Figs 1–3, 15–17, 27–29, 46–48, 57–59). Higher than long in lateral view, wider than high in anterior view. Eye slightly higher than long in lateral view. Postcranium concave from dorsal view. One pair of stout proclinate ocellar setae; distance between anterior and posterior ocelli 1.2X the distance between posterior ocelli. Postocellar setae absent. Outer and inner vertical setae stout. Frons 1.4–1.9X wider than long. Frons medially brown to black under certain angle of light incidence, projecting dorsally to lateral side of ocellar triangle; frons with 3 fronto-orbital setae, anterior inclinate and two posterior reclinate; fronto-orbital plate with gray-yellowish to brown pruinosity in frontal view, silvery-gray in ventral view, with few small scattered setulae. Lunule moderately arched, slightly shorter than length of frons. Face concolorous with lunule, with continuous mid-longitudinal gray pruinose stripe through both. Face with deep antennal grooves. Gena lacking upturned setae, with gray-yellowish to brown pruinosity; postgena with dark gray to dark brown pruinosity. Genal groove area (below eye) brown, large, bare (with dark brown spot larger near eye margin in *I. gaimarii* **sp. nov**. and *I. raimundoluizi* **sp. nov**.). Oral vibrissa moderately stout, with 1–2 additional slightly smaller subvibrissal setae below and 1–2 setae above. Antennae moderately separated, with scape and pedicel brown to black, postpedicel dark yellow to black, arista mainly black yellowish at base (except in *I. xavieri* **sp. nov**. arista entirely black; arista lost in *I. catarinae* **sp. nov.**); arista distinctly bristled on both sides, rays on ventral basal half longer. Palpus spatulate; predominantly darkened, from dark yellow to black. Proboscis brown to dark brown, with dark setulae.

Thorax (Figs 4, 1, 30, 49, 60). Chaetotaxy: 1 propleural, 1 stout postpronotal with several additional setulae, acrostichal multiseriated, small, subequal in size or with posterior setula slightly stouter, reaching level or just past level of stout posterior pair of dorsocentral setae, 1+3 dorsocentrals, 1+1 intra-alar, 1 supra-alar postsutural, 2 postalars (anterior stouter), 2 scutellars, 2 notopleurals and 3 katepisternals along dorsal edge. Mesonotum dark brown to black dorsally, with variable intensity of gray pruinosity according to angle of light incidence. Postpronotal lobe with dark brown pruinosity reaching level of stouter seta, remaining gray pruinose, variable according to angle of light incidence. Scutellum concolorous with adjacent scutum, arched, scutellar disc bare. Propleuron brown, with light brown pruinosity less dense than on adjacent mesopleural sclerites, remaining mesopleural sclerites densely silvery-gray pruinose, but laterotergite gray pruinose, sparse. Notopleuron subshiny posteriorly, on the edge.

Wing (Figs 5, 19, 31, 50, 61). Hyaline or slightly brown infuscated along anterior (costal) half (brown infuscated only on cell c and beginning of cell r_1 in *I. mirador* **sp. nov.**). Extreme base light yellow, vein C extending just past vein R_{4+5}; costal spinules extending just past vein R_{2+3}; vein M_1 distinctly reaching wing margin. Halter light yellow. **Legs.** Predominantly brown to dark brown, with femuro-tibial and tibio-tarsal articulation somewhat yellow, setae black. Midtibia with one stout apical spur.

Abdomen (Figs 6, 20, 33, 51, 62). Dark brown to black with lateral silvery gray pruinosity on tergites 1 and 5 and triangular silvery gray pruinosity posterolaterally on tergites 2–4. Tergite 6 narrow; syntergosternite 7+8 symmetrical, bare, more sclerotized anteriorly (on tergite 7) and somewhat weakly sclerotized posteriorly (on tergite 8), only laterally separated. Sternite 1 wider than remaining sternites, without setulae, sternites 2–5 with black stouter setulae along posterior edge. Sternite 6 asymmetrical, thin, sclerotized band present on left side, fused to syntergosternite 7+8 laterally, bare; spiracle six and seven close together, on left side of syntergosternite 7+8.

Male genitalia (Figs 7–12, 21–26, 34–40, 52–56, 63–66). Epandrium with anterior edge directed downward to connect with hypandrium almost ventrally, encompassing the upwardly directed gonocoxal apodeme. Surstylus absent. Cercus well developed, setose. Subepandrial membrane, when distinctly sclerotized, articulated with gonocoxal apodeme. Hypandrium projected anteriorly, concave in dorsal view, extending laterally around phallapodeme; gonocoxal apodemes well developed, not fused or fused posteriorly, forming an arch when seen from posterior view, bearing setulae laterally. Pregonite somewhat fused to hypandrium, somewhat stout (gonocoxal apodeme + pregonite with an open snake mouth appearance in lateral view; with a mesial keel-shaped protuberance with inconspicuous tiny setae; postgonite as a small distal lobe, sometimes inconspicuous (=

articulated lobe of gonopod *sensu* Gaimari 2007), with inconspicuous setae and separated from the apex of pregonite. Ejaculatory apodeme absent. Basiphallus with elongated rod-like phallapodeme, the latter longer than hypandrium; distiphallus labelliform, with the halves somewhat fused.

Female genitalia (Figs 13–14, 41–45). Description based on two species (*I. mirador* **sp. nov.** and *I. gaimarii* **sp. nov.**). Tergite 6 the same color of abdomen; large and strongly convex, saddle-shaped, extending laterally around to venter. Tergite 6 with inverted triangle of setae on posterior margin. Sternite 6 with long setae along posterior margin and sparse scattered setulae in middle. Tergite 7 light brown to brown; anterior fourth sclerotized, ring-like, bare; posterior ¾ not sclerotized. Sternite 7 small, with 7th spiracle embedded in cuticle anterolaterally. Segment 8 about 4X longer than wide. Epiproct and hypoproct small, plate-like. Cerci brown setulose, separated, elongated and thin. With 2 brown, mushroom-like spermathecae (Figs 43, 45).

Discussion. *Inpauema* **gen. nov.** is similar to *Shewellia* Hennig and *Helgreelia* by lacking genal seta, costal vein extended to vein R_{4+5} or slightly beyond; postocellar seta absent and postcranium concave from dorsal view. *Inpauema* **gen. nov.** differs from *Shewellia* by having only one anterior fronto-orbital seta inclinate (several anterior fronto-orbital seta inclinate in *Shewellia*); scutellar disc bare (scutellar disc setulose in *Shewellia*). *Inpauema* **gen. nov.** differs from *Helgreelia* by having face and lunule dark brown with gray pruinose stripe through both (face uniformly yellow, lacking mid-longitudinal stripe in *Helgreelia*); antennae separated by at most 2X the diameter of a single antennal socket (antennae separated by a distance greater than 3X diameter of single antennal socket in *Helgreelia*); vein M_1 distinctly reaching wing margin (M_1 vein evanescent after crossvein dm-cu in *Helgreelia*); gonocoxal apodemes well developed, directed upward, forming an arch (gonocoxal apodemes short, not forming an arch in *Helgrellia*); distiphallus labelliform, with the halves somewhat fused, not distinctly separated in ventral view (distiphallus not labelliform, with distict left and right halves in *Helgrellia*).

Inpauema mirador, sp. nov.

(Figs 1–14)

Etymology. The noun in apposition refers to the place where the specimens were collected, Parque Estadual do Mirador, Maranhão state, Brazil.

Holotype ♂. Body length: 4.4 mm.

Diagnosis. Frontal pruinosity velvety black. Palpus light brown to brown, orange on distal half. Tergite 6 about 4X shorter than syntergosternite 7+8, longer laterally.

Head (Figs 1–3). Frontal pruinosity velvety black, with evanescent dorsal vitta projecting laterally to ocellar triangle (Fig. 2). Height 1.66X the length; width 1.5X the height. Frons 1.8X wider than long. Fronto-orbital plate with gray-yellowish pruinosity in frontal view (Fig. 2). Genal groove area brown, large, bare; gena predominantly gray pruinose; postgena with brown pruinosity (Fig. 3). Antenna with arista yellowish at base (Fig. 3). Palpus light brown to brown, orange on distal half.

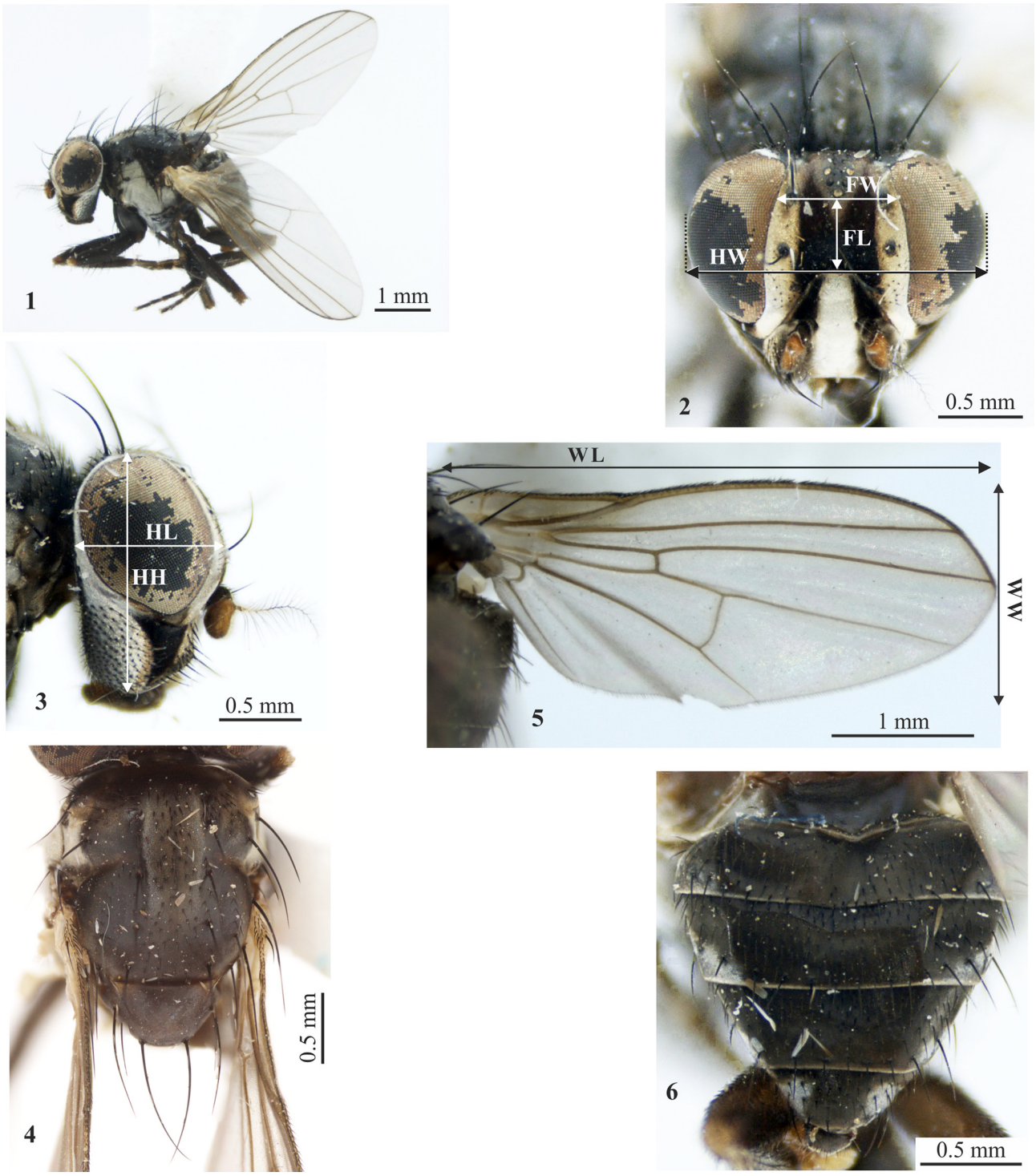
Thorax. Mesonotum dark brown to black; when seen from dorsal view and with lateral and dorsal incident light with dense gray pruinose stripe between dorsocentral setae, reaching third dorsocentral setae pair (Fig. 4); when seen with anterior incident light also with distinct gray pruinosity on posterior margin. Scutellum dark brown to black; in dorsal view with distinct gray pruinosity when seen under anterior incident light. **Legs** (Fig. 1). Coxae and femora brown to dark brown. Tibiae light brown, yellowish on proximal ¼. Tarsi dark yellow to light brown. **Wing** (Fig. 5). Mainly hyaline, slightly brown infuscated on cell c and beginning of cell r_1. Length 3.5 mm, width 1.3 mm, 2.7X longer than wide.

Abdomen (Fig. 6). **Male terminalia**. Tergite 6 narrow dorsally, about 4X shorter than syntergosternite 7+8, longer laterally (Figs 7–8). Epandrium with scattered setae on posterior half. Cercus (Figs 7–9) longer than mid-longitudinal line of epandrium, divergent distally, with sparse setae on anterior margin and outer surface. Hypandrium 3X longer than epandrium (Figs 9–10). Phallapodeme 2.23X longer than hypandrium (Fig. 9). Basiphallus almost as long as distiphallus (Figs 7, 9). Distiphallus suboval and slightly bilobate distally in ventral view (Figs 8, 10, 12). In ventral view, pregonite with distal mesial keel with margin nearly truncate; postgonite subtriangular (Fig. 10). Gonocoxal apodemes upward directed, apparently loosely fused when seen from posterior view (Fig. 11).

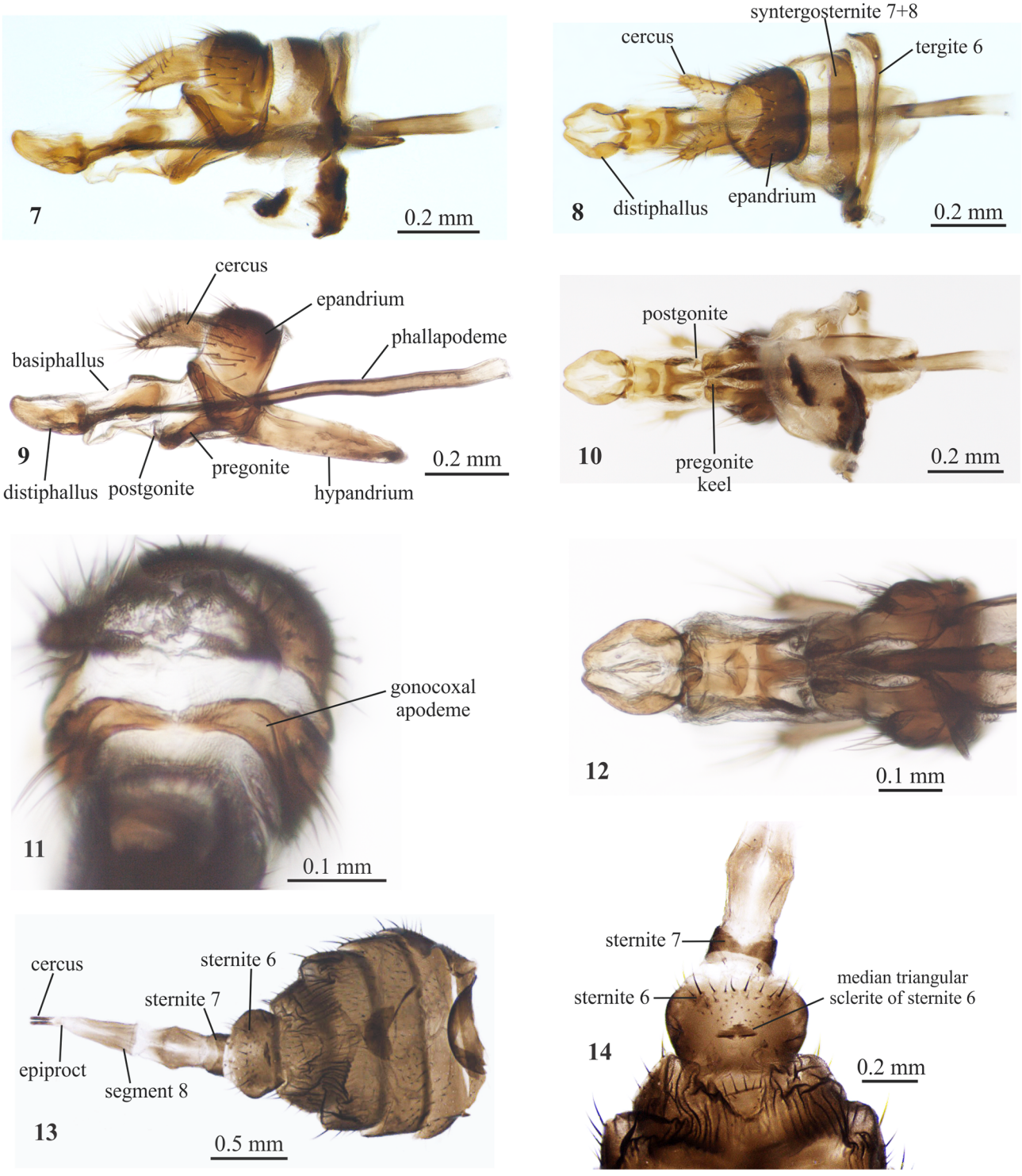
Female similar to male. **Terminalia** (Figs 13–14). Tergite 6 as in the male. Sternite 6 with small median

triangular sclerite, with the point directed posteriorly, bare; with two posterolateral small sclerites, weakly sclerotized. Tergite 7 strongly fused with sternite 7; posterior ¾ with long, thin and sparse setae. Epiproct small, plate-like. Cerci brown setose, separated, elongated and thin.

Variations. Male (n = 4). Body length 3.62−5.32, mean 4.75 mm; Wing length 3.22−4.74, mean 4.19 mm; wing width 1.09−2.50, mean 1.69 mm. Female (n = 4). Body length 3.25−4.67, mean 4.16 mm; wing length 3.38−4.51, mean 3.97 mm; wing width 1.14−1.49, mean 1.34 mm.



FIGURES 1–6. *Inpauema mirador* **sp. nov.**, **Figs 1–3, 5, 6,** Holotype male. **Fig 4,** Paratype female. **1**, habitus, lateral view; **2**, head, frontal view; **3**, head, lateral view; **4**, thorax, dorsal view; **5**, wing; **6**, abdomen, dorsal view.



FIGURES 7–14. *Inpauema mirador* **sp. nov.**, **Figs 7–12**, Paratype male. **Figs 13, 14**, Paratype female; **7**, terminalia, phallapodeme, hypandrium, pregonite, postgonite and phallus, lateral view; **8**, terminalia, epandrium, cercus and phallus, dorsal view; **9**, terminalia, lateral view; **10**, terminalia, ventral view; **11**, cercus and gonocoxal apodeme, posterior view; **12**, pregonite, postgonite and phallus, ventral view; **13**, abdomen and terminalia, ventral view; **14**, sternites 6 and 7, ventral view.

Type material. Holotype ♂ (pinned, very good condition), deposited in CZMA: "Brasil, MA[ranhão], Mirador, Parque Est.[adual] Mirador, Base da Geraldina, 419 m, 06°37'25"S, 45°52'08"W, Armadilha suspensa, 15–30.ix.2014, F. Limeira-de-Oliveira, L. L. M. Santos & L. S. Santos". Paratypes: same data as holotype (1 ♂ CZMA); *idem*, 402 m, 06°35'58"S, 45°50'49"W, 02–12.viii.2013 (2 ♂, 2 ♀ CZMA); *idem*, Armadilha de Malaise (1 ♀ CZMA); *idem*, 01–15.ix.2013 (1 ♀ INPA); *idem*, 15–30.ix.2013 (1 ♂ CZMA); *idem*, 416 m, 06°37'48"S,

45°52'49"W, Armadilha Suspensa, 10–20.xii.2013, F. Limeira-de-Oliveira, L. L. M. Santos & T. L. Rocha (1 ♂ INPA); *idem*, 01–10.xii.2013 (1 ♂ CZMA); *idem*, 419 m, 06°37'25"S, 45°52'08"W (1 ♀ INPA); *idem*, F. Limeira-de-Oliveira, L. L. M. Santos & L. S. Santos (1 ♀ CZMA); *idem*, 14–18.viii.2012, F. Limeira-de-Oliveira, J. S. Pinto Júnior & D. W. A. Marques (2 ♂, 2 ♀ CZMA); *idem*, Armadilha de Malaise (1 ♂, 1 ♀ INPA, 2 ♀ CZMA); *idem*, 411 m, 06°37'06"S, 45°51'51"W, Armadilha suspensa, 02–12.viii.2013, F. Limeira-de-Oliveira, L. L. M. Santos & L. S. Santos (1 ♀ CZMA).

Geographical record. Brazil (Maranhão).

***Inpauema catarinae*, sp. nov.**
(Figs 15–26)

Etymology. The species epithet is in honor of Catarina da Silva Motta (*in memoriam*), a lepidopterist who was a dear friend of the first and last authors.

Holotype ♂. **Body length** 4.5 mm.

Diagnosis. Fronto-orbital plate with dark brown pruinosity. Palpus dark brown to brown, orange at extreme distal tip. Tergite 6 almost as long as syntergosternite 7+8, narrowed medially. Epandrium with V-shaped spot anteromedially.

Head (Figs 15–17). Frontal pruinosity velvety dark brown, with distinct dorsal vitta projecting laterally to ocellar triangle reaching vertex area (Fig. 16). Height 1.4X the length; width 1.2X the height. Frons 1.7X wider than long. Fronto-orbital plate with dark brown pruinosity in frontal view (Fig. 16). Genal groove area reddish brown, large, bare; gena predominantly with gray-yellowish pruinosity; postgena dark brown pruinose (Fig. 17). Palpus brown to dark brown, orange at extreme distal tip.

Thorax (Fig. 18). Mesonotum dark brown to black with a faint gray pruinose stripe between dorsocentral setae, almost reaching third dorsocentral setae pair, more distinct when seen under anterior incident light. Scutellum dark brown to black; in dorsal view with somewhat inconspicuous gray pruinosity when seen under anterior incident light. **Legs** (Fig. 15). Coxae and femora brown to dark brown. Tibiae brown, yellowish on basal half. Tarsi light brown. **Wing** (Fig. 19). Slightly browner infuscated along anterior (costal) half. Length 4.5 mm, width 1.5 mm, 3X longer than wide.

Abdomen (Fig. 20). **Male terminalia**. Tergite 6 almost as long as syntergosternite 7+8, narrowed medially (Figs 21–22). Epandrium with scattered setae on posterior edge, with a whitish V-shaped spot anteromedially (Fig. 22). Cercus as long as epandrium, with sparse setae on anterior margin and outer surface (Fig. 21). Hypandrium 3.2X longer than epandrium (Figs 21–23, 25). Phallapodeme 2.8X longer than hypandrium (phallapodeme lost after description). Basiphallus almost as long as distiphallus (Figs 21, 24). Distiphallus suboval in ventral view, with small and indistinct fissure distally (Figs 23, 25). In ventral view, pregonite with distal mesial keel subrounded (Figs 23, 25); postgonite as a small thin sclerite (Fig. 24). Gonocoxal apodemes upward directed, distinctly fused when seen from posterior view (Fig. 26).

Female. Unknown.

Type material. Holotype ♂ (pinned, terminalia in microvial of glass), deposited in INPA: "Brasil, AM[azonas], Manaus, Rod.[ovia] AM 010 (*sic*), BR–174, Km 50, ZF–2, Km 14, Torre, 02°35'21"S, 60°06'55"W, 4.iii.2011, 00–03:00h, Arm.[adilha] luz dossel, 40 m de altura, F.F. Xavier Filho, J.T. Câmara, P. Dias leg".

Geographical record. Brazil (Amazonas state).

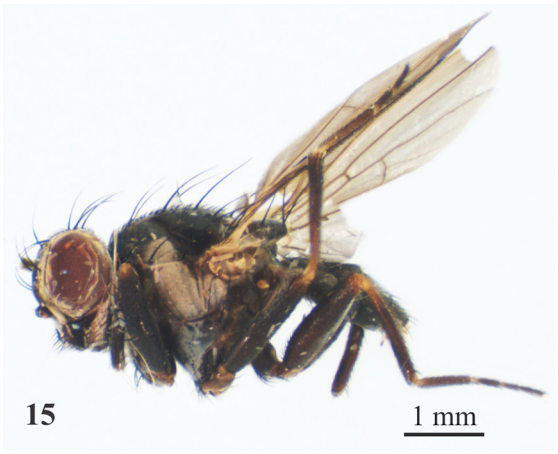
***Inpauema gaimarii*, sp. nov.**
(Figs 27–45)

Etymology. The species epithet is in honor of Dr. Stephen D. Gaimari, who has contributed substantially to the study of Diptera.

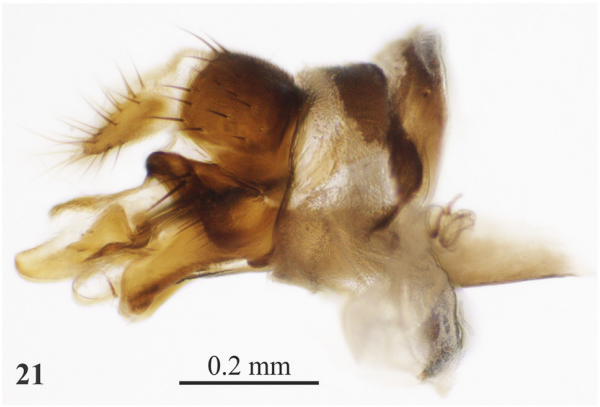
Description. Holotype ♂. **Body length** 4.98 mm.

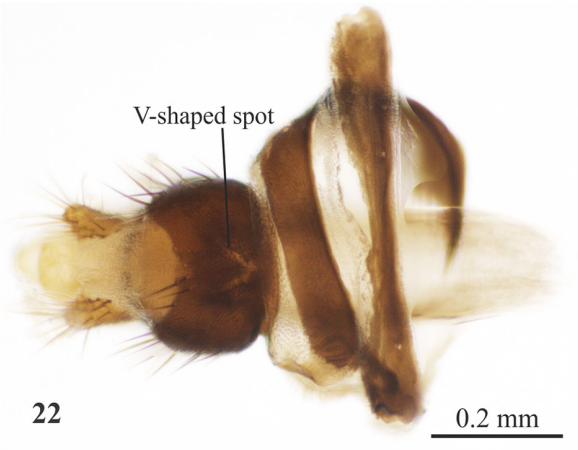
Diagnosis. Palpus mainly dark yellow, brown medially. Alar membrane brown infuscated, denser on cells c, r_1 and r_{2+3}. Tergite 6 about 4X shorter than syntergosternite 7+8, longer laterally. Cercus with a small pointed projection in the tip.

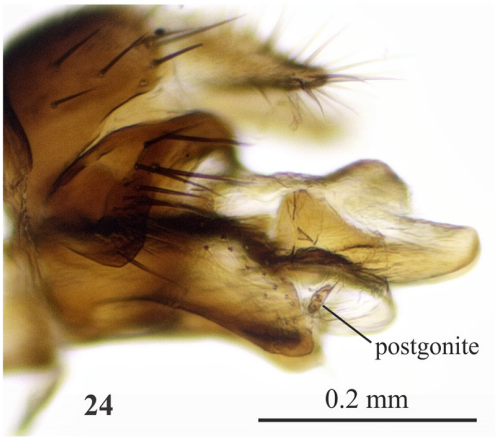
Head (Figs 27–29). Frontal pruinosity velvety dark brown, with distinct dorsal vitta projecting laterally to ocellar triangle reaching vertex area (Fig. 28). Height 1.5X the length; width 1.3X the height. Frons 1.9X wider than long. Fronto-orbital plate with gray-yellowish pruinosity in frontal view (Fig. 28). Antenna with arista brownish on basal half (Fig. 27). Genal groove area brown, large, bare, with dark brown spot, larger near eye margin; gena predominantly gray pruinose; postgena with dark gray to brown pruinosity (Fig. 29). Palpus mainly dark yellow, brown medially.



FIGURES 15–20. *Inpauema catarinae* **sp. nov.**, Holotype male. **15,** habitus, lateral view; **16**, head, frontal view; **17**, head, lateral view; **18**, thorax, dorsal view; **19**, wing; **20**, abdomen, dorsal view.

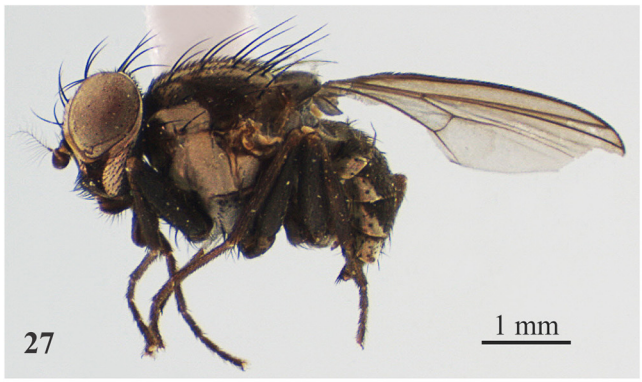


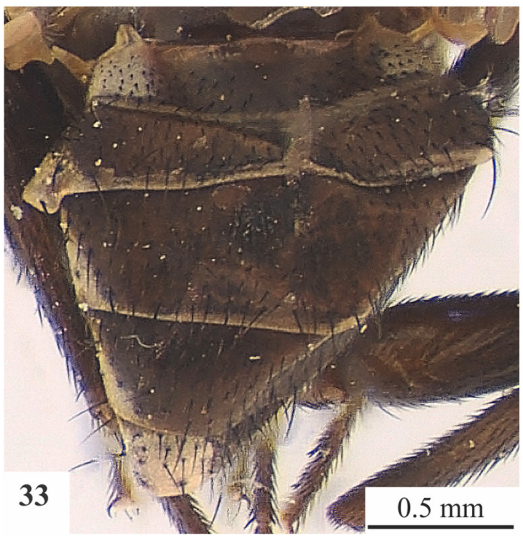




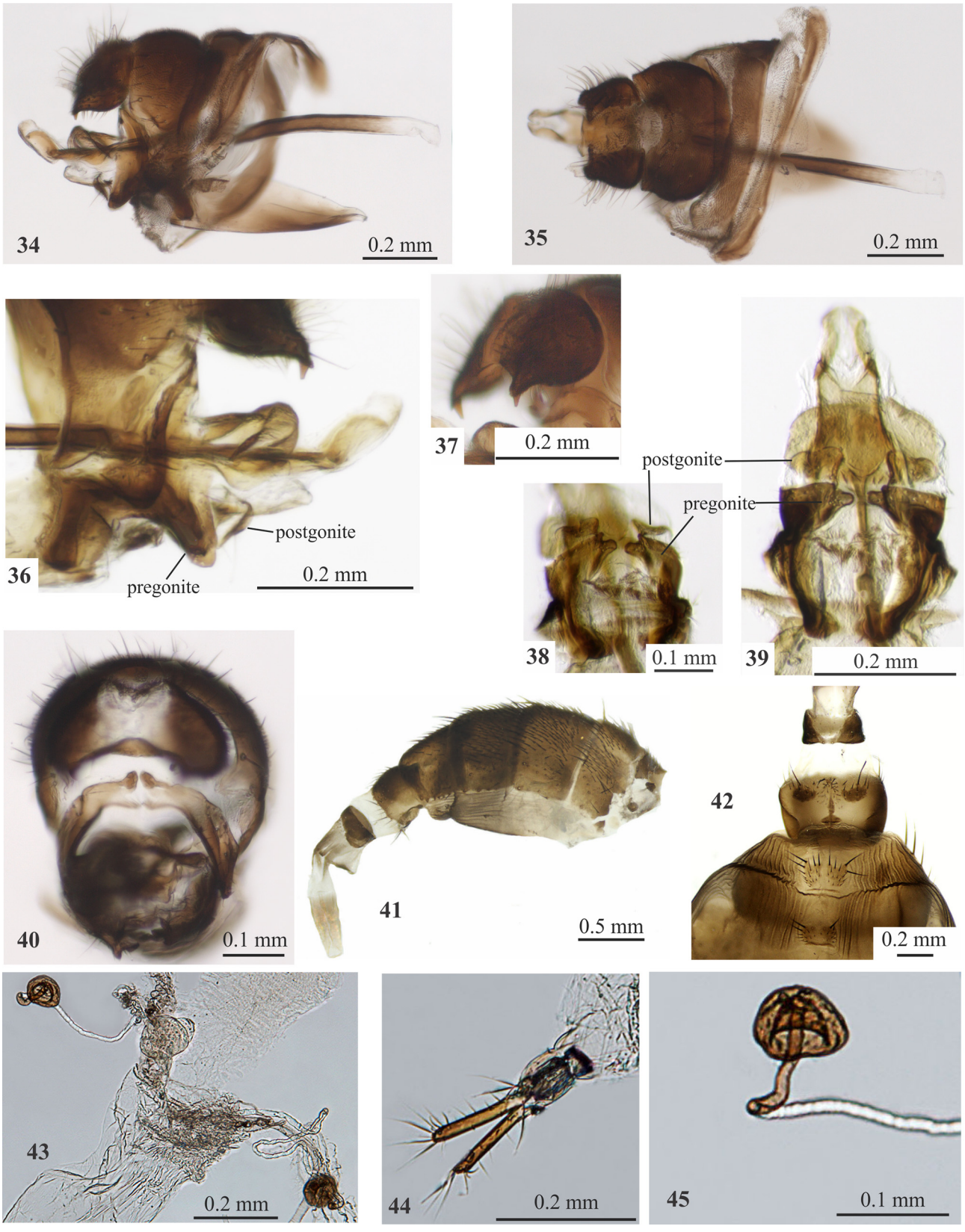
FIGURES 21–26. *Inpauema catarinae* **sp. nov.**, Holotype male. **21**, terminalia, hypandrium, pregonite, postgonite and phallus lateral view; **22**, terminalia, epandrium and cercus, dorsal view; **23**, terminalia, ventral view; **24**, gonocoxal apodeme, pregonite, postgonite and phallus, lateral view; **25**, hypandrium, pregonite, postgonite and phallus, ventral view; **26**, cercus and gonocoxal apodeme, posterior view.

Thorax (Fig. 30). Mesonotum dark brown to black; when seen from dorsal view and with dorsal, lateral and anterior incident light with large medial gray stripe intermixed with brown stripes, reaching scutellum. Scutellum dark brown to black with gray pruinosity. **Legs** (Fig. 27). Coxae, femora and tibiae brown to dark brown. Tarsi light brown. **Wing** (Fig. 31). Slightly light brown infuscated along anterior (costal) half. Length 4.3 mm, width 1.4 mm, 3X longer than wide.





FIGURES 27–33. *Inpauema gaimarii* **sp. nov.**, **Figs 27–31, 33,** Holotype male; **Fig. 32,** Paratype female. **27**, habitus, lateral view; **28**, head, frontal view; **29**, head, lateral view; **30**, thorax, dorsal view; **31**, wing; **32**, female wing; **33**, abdomen, dorsal view.



FIGURES 34–45. *Inpauema gaimarii* **sp. nov.**, **Figs 34–40,** Holotype male; **Figs 41–45,** Paratype female. **34**, terminalia, phallapodeme, hypandrium, pregonite, postgonite and phallus, lateral view; **35**, terminalia, epandrium and cercus, dorsal view; **36**, gonocoxal apodeme, pregonite, postgonite and phallus, lateral view; **37**, cercus, lateral view; **38**, pregonite and postgonite, ventral view; **39**, pregonite, postgonite and phallus, ventral view; **40**, cercus and gonocoxal apodeme, posterior view; **41**, abdomen and terminalia, lateral view; **42**, abdomen, ventral view; **43**, duct and capsule of spermatheca; **44**, cercus, dorsal view; **45**, capsule of spermatheca.

Abdomen (Fig. 33). **Male terminalia**. Tergite 6 thin, about 4X shorter than syntergosternite 7+8, longer laterally (Figs 34–35). Epandrium with scattered setae on posterior half; posterior margin with medial reentrance (Fig. 35). Cercus almost as wide as long, longer than epandrium, somewhat horizontally directed with a small pointed projection in the tip (Figs 34–37). Hypandrium 2.4X longer than epandrium (Fig. 34). Phallapodeme 1.6X longer than hypandrium (Figs 34–35). Basiphallus as long as distiphallus (Figs 34, 36). Distiphallus subrectangular in ventral view, with two small projections basally (Fig. 39). In ventral view, pregonite with distal mesial keel pointed and bifid when seen in ventral view (Figs 38–39); postgonite wide, slightly bilobate (Figs 36, 39). Gonocoxal apodemes upward directed, somewhat sinuous in lateral view (Fig. 36), distinctly fused and with a small dorsal lobe when seen from posterior view (Fig. 40).

Female similar to male, except wing distinctly darker, dark brown on cells c, r_1 and r_{2+3} (Fig. 32). Female (n = 2). Body length 4.36−4.41, mean 4.38 mm; wing length 3.53−3.77, mean 3.65 mm; wing width 1.06−1.36, mean 1.21 mm. **Terminalia** (Figs 41–45). Sternite 6 with small sclerite on anterior margin, roughly diamond in shape, bare; and two sublateral small sclerites on posterior margin, strongly sclerotized (Fig. 42). Tergite 7 weakly fused with the sternite 7 dorsally with short and sparse setae on posterior ¾, which are long and thin distally. Epiproct and hypoproct small, plate-like. Cerci brown setose, separated, elongated and thin (Fig. 44).

Type material. Holotype ♂ (pinned, terminalia in microvial of glass, good condition), deposited in INPA: "Brasil, PA[rá], Belterra, Flona Tapajós, 100 m, 02°36'15"S, 54°56'25"W, 16.iv.2008, arm.[adilha] Luz, J.A. Rafael & F.F. Xavier F." Paratypes: *idem*, MA[ranhão], Carolina, PARNA [Parque Nacional] Chapada das Mesas, Riacho Sucuruiu, 240 m, 07°07'06"S, 47°18'32"W, Armadilha de Malaise, 01–10.i.2014, J.A. Rafael, F. Limeira-de-Oliveira, T. L. Rocha & S. Pereira, cols.[collectors] (1 ♀ CZMA); *idem*, Água Fria, 212 m, 07°04'14"S, 47°17'16"W, [Armadilha] Suspensa simples (5 m), 10–20.viii.2014, J. A. Rafael, F. Limeira-de-Oliveira, T. L. Rocha & G. A. Reis, cols. (1 ♀ INPA).

Geographical records. Brazil (Pará, Maranhão).

***Inpauema raimundoluizi,* sp. nov.**
(Figs 46–56)

Etymology. The specific epithet is in honor of Raimundo Luiz Ferreira de Almeida, a professor at the UEMA and great friend of the first author.

Description. Holotype ♂. **Body length** 4.2 mm.

Diagnosis. Palpus brown on basal half, dark yellow on distal half. Tergite 6 approximately half length of syntergosternite 7+8; syntergosternite 7+8 with whitish rounded spot without sclerotization. Epandrium with subrounded slightly darker area medially.

Head (Figs 46–48). Frontal pruinosity velvety brown, with somewhat evanescent dorsal vitta projecting laterally to ocellar triangle reaching vertex area (Fig. 47). Height 1.8X the length; width 1.27X the height. Frons 1.4 wider than long. Fronto-orbital plate with gray-yellowish pruinosity in frontal view (Fig. 47). Antenna with arista yellowish on basal half (Fig. 48). Genal groove area brown to dark yellow, bare, large; gena predominantly gray-yellowish pruinose; postgena brown pruinose (Fig. 48) with dark brown spot near eye margin. Palpus brown on basal half, dark yellow on distal half.

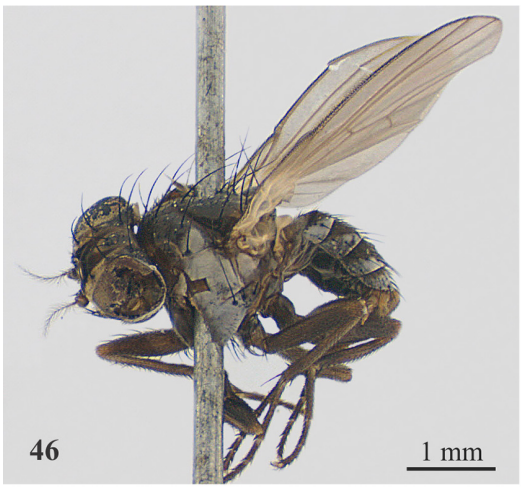
Thorax (Fig. 49). Mesonotum dark brown to black with a faint gray pruinose stripe between dorsocentral setae, almost reaching third dorsocentral setae pair, more distinct when seen under anterior incident light. Scutellum dark brown; in dorsal view with inconspicuous gray pruinosity when seen under anterior incident light. **Legs** (Fig. 46). Coxae and femora light brown. Tibiae and tarsi dark yellow to light brown. **Wing** (Fig. 50). Hyaline; length 3.8 mm, width 1.4 mm, 2.7X longer than wide.

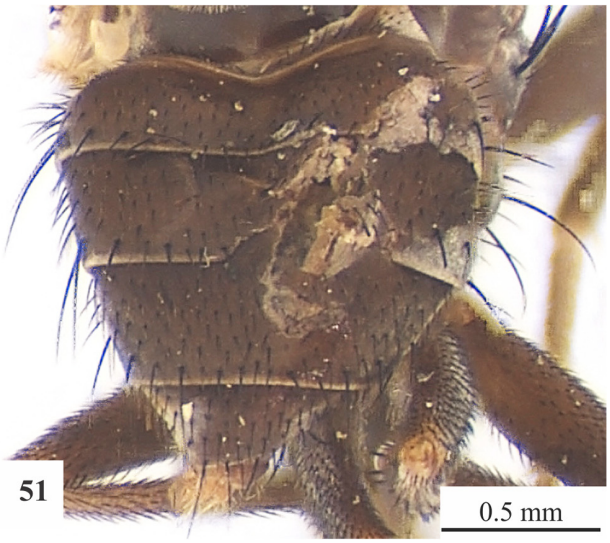
Abdomen (Fig. 51). **Male terminalia**. Tergite 6 approximately half length of syntergosternite 7+8 (Figs 52–53); syntergosternite 7+8 with whitish rounded spot. Epandrium with scattered setae on posterior half; with subrounded dark area medially (Fig. 53). Cercus apparently shorter than epandrium, with sparse setae on anterior margin and outer surface (Fig. 52–53). Hypandrium 3X longer than epandrium (Figs 52, 54). Phallapodeme 2.33X longer than hypandrium (Figs 52–54). Basiphallus with about half length of distiphallus (Figs 52–54). Distiphallus suboval in ventral view, somewhat truncate distally (Figs 53–55). In ventral view pregonite with distal mesial keel subrounded; postgonite as a small thin sclerite (Figs 54–55). Gonocoxal apodemes upward directed, distinctly downcurved at fusion area when seen from posterior view (Fig. 56).

Female. Unknown

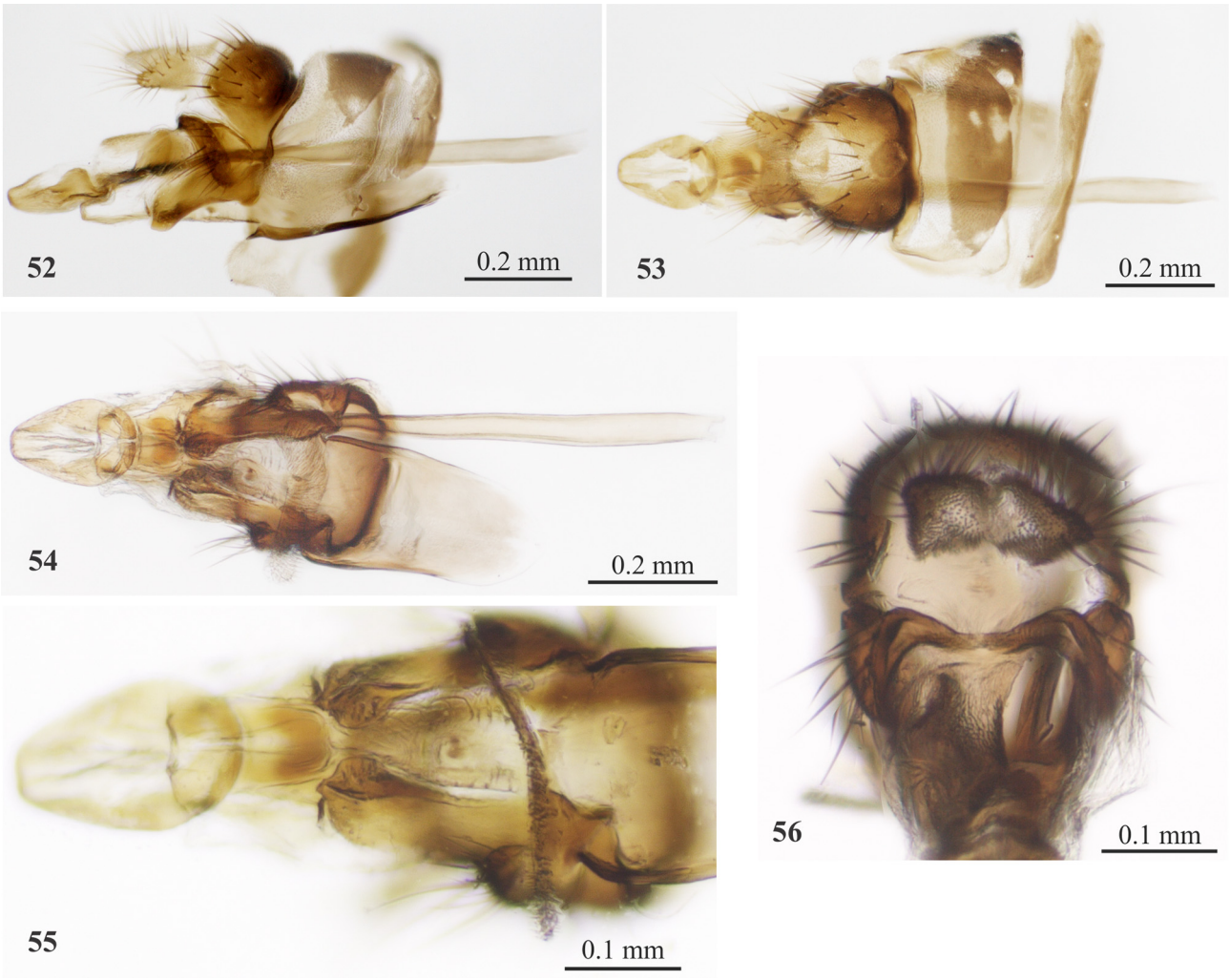
Type material. Holotype ♂ (pinned, terminalia in microvial of glass, good condition; left eye apparently eaten by insects), deposited in INPA: "Brazil, Pará, Óbidos, 01°47'03"S, 55°07'05"W, 29.viii–08.ix.2001, [Armadilha] Suspensa alta, J.A. Rafael & J.F. Vidal".

Geographical record. Brazil (Pará state).





FIGURES 46–51. *Inpauema raimundoluizi* **sp. nov.**, Holotype male. **46,** habitus, lateral view; **47**, head, frontal view; **48**, head, lateral view; **49**, thorax, dorsal view; **50**, wing; **51**, abdomen, dorsal view.



FIGURES 52–56. *Inpauema raimundoluizi* **sp. nov.**, Holotype male. **52**, terminalia, phallapodeme, hypandrium, pregonite, postgonite and phallus, lateral view; **53**, terminalia, epandrium, cercus and phallus, dorsal view; **54**, terminalia, ventral view; **55**, pregonite, postgonite and phallus, ventral view; **56**, cercus and gonocoxal apodeme, posterior view.

***Inpauema xavieri*, sp. nov.**
(Figs 57–66)

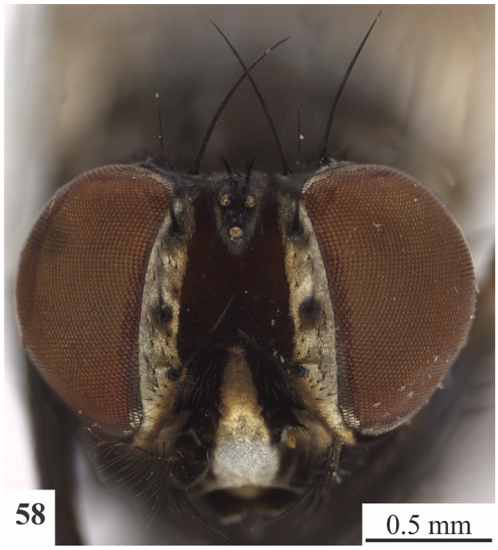
Etymology. Named in honor to the collector of the specimen, Francisco Felipe Xavier Filho (INPA, Brazil).

Description. Holotype ♂. **Body length** 4.85 mm.

Diagnosis. Antenna entirely black, including arista. Gena brown pruinose. Palpus dark brown to black, brown at extreme distal tip. Tergite 6 asymmetrical, restricted to the right side, very short, inconspicuous medially.

Head (Figs 57–59). Frontal pruinosity velvety dark brown, with distinct dorsal vitta projecting laterally to ocellar triangle reaching vertex area (Fig. 58). Height 1.33X the length; width 1.2X the height. Frons 1.5 wider than long. Fronto-orbital plate with gray-yellowish pruinosity in frontal view (Fig. 58). Genal groove area brown, large, bare; gena brown pruinose; postgena with brown to dark brown pruinosity (Fig. 59). Antenna entirely black, including arista (Fig. 57). Palpus dark brown to black, brown at extreme distal tip.

Thorax (Fig. 60). Mesonotum dark brown to black with a faint gray pruinose stripe between dorsocentral setae, reaching third dorsocentral setae pair, more distinct when seen under anterior incident light. Scutellum dark brown to black; in dorsal view with conspicuous gray pruinosity when seen under anterior incident light. **Legs** (Fig. 57). Coxae and femora brown to dark brown. Tibiae mainly brown somewhat yellowish medially. Tarsi brown. **Wing** (Fig. 61). Hyaline. Length 4.4 mm, width 1.5 mm, 2.9X longer than wide.



FIGURES 57–62. *Inpauema xavieri* **sp. nov.**, Holotype male. **57,** habitus, lateral view; **58**, head, frontal view; **59**, head, lateral view; **60**, thorax, dorsal view; **61**, wing; **62**, abdomen, dorsal view.

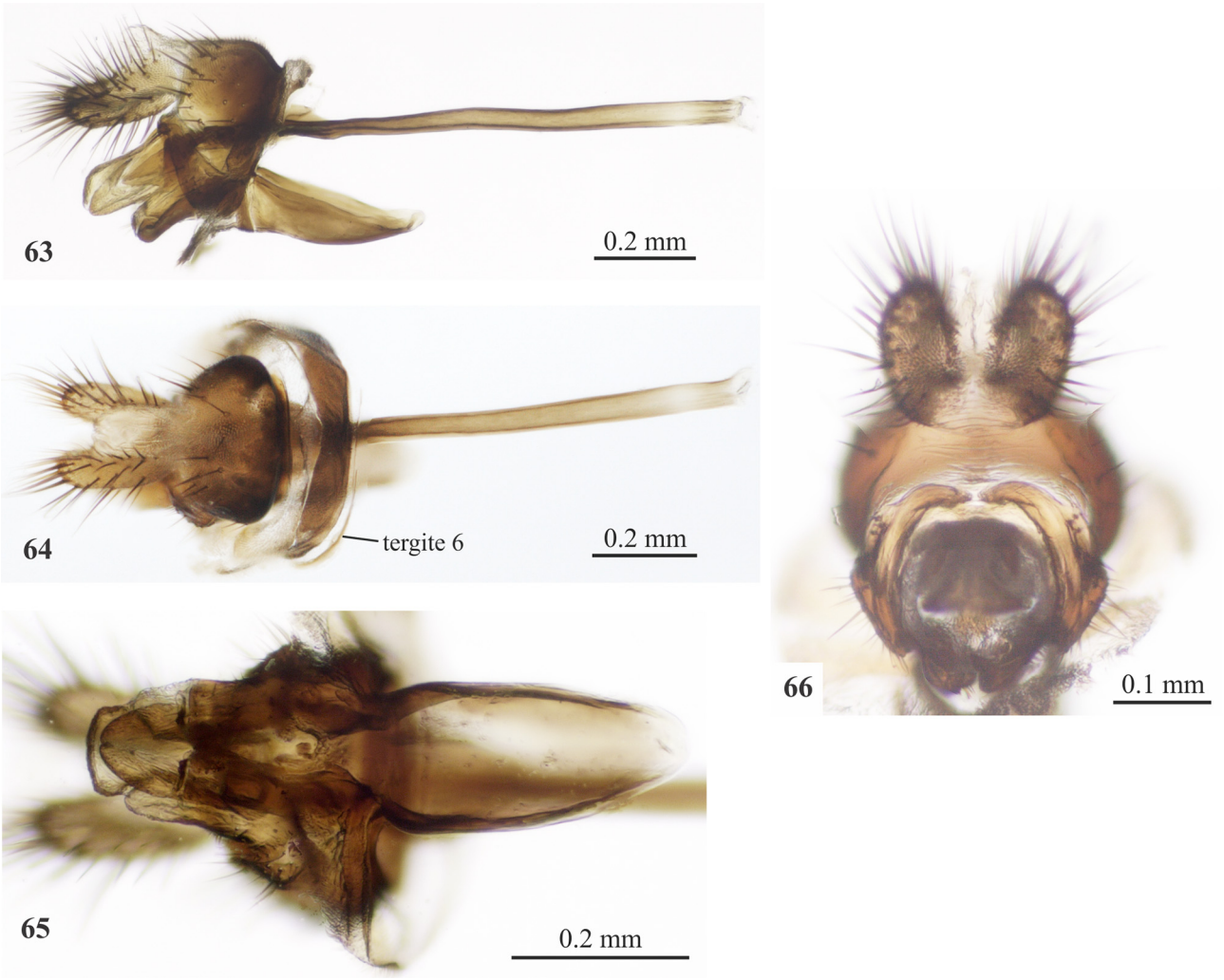
Abdomen (Fig. 62). **Male terminalia**. Tergite 6 asymmetrical, restricted to right side, very thin and short, inconspicuous medially (Fig. 64); syntergosternite 7+8 largely fused. Epandrium with some scattered setae and a single row on posterior edge (Figs 63–64). Cercus almost 3X longer than wide, slightly shorter than epandrium, setose (Figs 63–64). Hypandrium 1.8X longer than epandrium (Figs 63, 65). Phallapodeme 2.4X longer than hypandrium (Figs 63–64). Basiphallus as long as distiphallus (Fig. 63). Distiphallus subhemispherical in ventral view, with a small fissure distally (Fig. 65). In ventral view pregonite with distal mesial keel subrounded;

postgonite as a small thin sclerite (Fig. 65). Gonocoxal apodemes upward directed, apparently not fused when seen from posterior view (Fig. 66).

Female. Unknown.

Type material. Holotype ♂ (pinned, terminalia in microvial of glass; good condition), deposited in INPA: "Brasil, AM[azonas], Manaus, Rod.[ovia] AM 010 (*sic*), BR-174, Km 50, ZF-2, Km 27, próximo entrada LBA, 02°35'S, 60°06'W. 6.iii.2011. 03–06:00h. Arm.[adilha] luz dossel, 35 m. F.F. Xavier; R. Freitas".

Geographical record. Brazil (Amazonas).



FIGURES 63–66. *Inpauema xavieri* **sp. nov.**, Holotype male. **63**, terminalia, phallapodeme, hypandrium, pregonite, postgonite and phallus, lateral view; **64**, terminalia, epandrium and cercus, dorsal view; **65**, hypandrium, pregonite, postgonite and phallus,ventral view; **66**, cercus and gonocoxal apodeme, posterior view.

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