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A new genus in the family Ptiloneuridae (Psocodea: ‘Psocoptera’: Psocomorpha: Epipsocetae) from Brazil

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Abstract

A new ptiloneurid genus from Brazil, *Brasineura* n. gen., is described and illustrated. It includes two species, both known only from males, one from the Chapada Diamantina (State of Bahia), and one troglomorphic species from the State of Pará. It differs from all other known ptiloneurid genera, in which the males are known, by the unique structure of the phallosome, and by having a uniquely shaped hypandrium of a single sclerite. An updated identification key to the genera of Ptiloneuridae is presented and the synonymy between *Brisacia* and *Loneura* is proposed.

Key words: taxonomy, Neotropics, Epipsocetae

Introduction

Ptiloneuridae is one of the families in the psocomorphan infraorder Epipsocetae (Yoshizawa 2002). It presently includes the genera *Belicania* García Aldrete, *Euplocania* Enderlein, *Omilneura* García Aldrete, *Perucania* New & Thornton, *Timnewia* García Aldrete, *Triplocania* Roesler, *Willreevesia* García Aldrete, all with the hindwing vein M unbranched, and *Loneura* Navás, *Loneuroides* García Aldrete, *Ptiloneura* Enderlein, and *Ptiloneuropis* Roesler, these last four genera with hindwing vein M having from 2 to 5 branches. As for the forewing venation, the four latter genera have the forewing vein Rs of two branches, and the vein M may have from 3 to 8 branches. Besides the differences in wing venation, the ptiloneurid genera can be separated on the basis of differences on hypandrium and phallosome structures in the males, and on differences on subgenital plate, gonapophyses and ninth sternum in the females, although in general, the males provide more diagnostic characters.

Another gender within Ptiloneuridae would *Brisacia* that was described based on copal but its validity is questionable and this issue will be more specified in the discussion.

Recently, one of us (AMSN) found, in the Brazilian states of Bahia and Pará, three specimens that represent two related species of a ptiloneurid genus not assignable to any of the known genera above. The purpose of this paper is to describe and illustrate the species in the new genus, to present an updated identification key to the genera of Ptiloneuridae, and to discuss the unique structure of the phallosome of the new genus.

Material and methods

Three specimens, all males, from the Brazilian states of Bahia (one specimen) and Pará (two specimens), were available for study. They were dissected in 80% ethanol, and their parts were mounted on slides in Canada balsam. The remains of each specimen, after being dissected and mounted, are preserved in 80% ethanol, and are labeled with the same data as the slides. Standard measurements (in μm), were taken with a filar micrometer. Abbreviations of parts measured are as follows: FW and HW: right fore- and hindwing lengths, F, T, t1, t2 and t3: lengths of

femur, tibia and tarsomeres 1, 2 and 3 of right hind leg, fl...fn: lengths of flagellomeres 1...n of right antenna, Mx4: length of fourth segment of right maxillary palpus, IO: minimum distance between compound eyes in dorsal view of head, D and d: antero-posterior and transverse diameter, respectively, of right compound eye in dorsal view of head, PO: d/D.

The holotypes will be deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil. The paratype from Pará will be deposited in the Scientific Collection of the Laboratório de Estudos Subterrâneos da Universidade Federal de São Carlos (LES/UFSCar), São Carlos, São Paulo, Brazil.

Systematics

Family Ptiloneuridae

Diagnosis. Labral sclerites incomplete, not reaching the proximal end of the labrum with the exception of *Willreevesia*. Three-segmented tarsi. Forewing with two anal veins, forewing M with 3–8 branches and hindwing M with 1–5 branches. Phallosome V- or Y-shaped, complex, open posteriorly, with distinct endophallic sclerites. Hypandrium of one to five sclerites, usually with a large, central sclerite, with posterior projections, with one or two small side sclerites on each side. Ovipositor valvulae with v1 present and v3 a finger-like, setose lobe broadly attached to side of v2 (García Aldrete & Mockford 2012).

Key to the genera of Ptiloneuridae

(Modified from García Aldrete 2006)

1. Hindwing M one-branched 2
- Hindwing M two to five-branched 8
2. Forewing 2A joining wing margin; no crossveins between 2A and wing margin 3
- Forewing 2A joining 1A; one crossvein between 2A and wing margin; two crossveins between 1A and wing margin *Timnewia* García Aldrete
3. Forewing areola postica high, with apex rounded 4
- Forewing areola postica low, very long *Perucania* New & Thornton
4. Labral sclerites incomplete, not reaching anterior margin of labrum 5
- Labral sclerites complete, reaching anterior margin of labrum *Willreevesia* García Aldrete
5. Forewing M three-branched, occasionally M₃ forked 6
- Forewing M more than three-branched 7
6. Hypandrium formed by a central sclerite, which may bear central or lateral apophyses, with one or two smaller sclerites on each side *Triplocania* Roesler
- Hypandrium formed by a single sclerite, with postero-lateral, slender projections *Belicania* García Aldrete
7. Forewing M four-branched *Euplocania* Enderlein
- Forewing M six-branched *Omilneura* García Aldrete
8. Forewing areola postica free, high, with apex rounded 9
- Forewing areola postica high, rigidly triangular, joined to M by a crossvein *Ptiloneuropsis* Roesler
9. Forewing 2A simple, pterostigma long, smooth 10
- Forewing 2A with one crossvein to wing margin, pterostigma long, distinctly spurred *Loneuroides* García Aldrete
10. Forewing M five to seven-branched; hindwing M two to five-branched 11
- Forewing M eight-branched; hindwing M five-branched; hypandrium a broad sclerite projected posteriorly to form a wide, almost rectangular lobe, with a dense field of setae on each postero-lateral corner; a dense field of setae on each side of central projection *Ptiloneura* Enderlein
11. Forewing M five to seven-branched; hindwing M two to five-branched; hypandrium a central sclerite with one or two smaller ones on each side; central sclerite with one central or with two lateral posterior projections; phallosome V- or Y-shaped *Loneura* Navás (= *Brisacia* Azar, Nel & Waller **n. syn.**; see discussion)
- Forewing M five to six-branched; hindwing M two to four-branched; hypandrium of one sclerite, without projections. Phallosome closed anteriorly, rounded, U-shaped, with lateral extensions of the phallobase, posterior pair of endophallic sclerites basally fused to form a V-shaped structure, each arm of the V distally forked or rounded, enclosing a membrane with numerous pores *Brasineura* **n. gen.**

***Brasineura* n. gen.**

Diagnosis. Five distal labral sensilla, one central placoid, flanked at a distance by a pair trichoid-placoid. Forewing M 5–6 branched, the branch next areola postica forked; hindwing M 2–4 branched. Hypandrium of one sclerite, broadly triangular, setose, anteriorly concave, with anterior border strongly sclerotized. Phallosome closed anteriorly, rounded, U-shaped, with distinct lateral extensions of the phallobase; side struts anterior, fused to external parameres, these elongate, distally pointed; two pairs of endophallic sclerites; anterior pair elongate, lacking a basal bridge, each sclerite independent; posterior pair basally fused to form a V-shaped structure, each arm of the V distally forked or rounded, enclosing a membrane with numerous pores. Female not known.

Type species. *Brasineura diamantina* n. sp.

Etymology. The generic name is a compound name, formed with the root of Brasil, from where the new genus is so far endemic, plus “neura”, a common epithet in Ptiloneuridae, as in *Loneura*, *Omilneura*, *Ptiloneura*.

***Brasineura diamantina* n. sp. Male**

(Figs 1–7)

Color (in 80 % ethanol). Body pale yellow, with brown and pale brown areas as indicated below. Compound eyes black, ocelli hyaline, with ochre centripetal crescents; head pattern (Fig. 1); a brown band on vertex, from each compound eye to upper part of ocellar group, also, a brown irregular band between compound eyes, limited posteriorly by the postclypeus; each gena with a brown band from lower compound eye to subgenal sulcus. Antennae and maxillary palps pale yellow, Mx4 more pigmented distally. Tergal lobes of meso- and metathorax brown; thoracic pleura with an irregular pale brown band above the level of the coxae. Legs with coxae, trochanters and femora creamy white, tibiae and tarsomeres pale yellow. Forewings almost hyaline, as illustrated (Fig. 2); a brown spot on confluence of Cu2–1A; veins brown. Hindwing (Fig. 3), almost hyaline throughout, veins brown.

Structural characters. Compound eyes with interommatidial setae. Outer cusp of lacinial tip broad, with four denticles (Fig. 4). Forewing pterostigma elongate, constricted proximally. Areola postica tall, wide basally, apex round. Rs almost straight, slightly shorter than R_{4+5} , this and R_{2+3} slightly sinuous. M stem slightly concave proximally, then almost straight. M5 branched, with M_5 forked as illustrated. Hindwing Rs-M fused for a distance, Rs and M of two branches. Paraprocts (Fig. 5) stout, broad, wide proximally, narrowing to round apex; sensory fields with 33–34 trichobothria on basal rosettes; setae as illustrated. Epiproct (Fig. 5) almost straight basally, with one concave area on each antero-lateral corner; sides converging to round posterior border; a pair of long lateral setae in basal half, other setae as illustrated. Hypandrium of one sclerite, anteriorly concave with border strongly sclerotized and triangular distally, with setae as illustrated (Fig. 6). Phallosome (Fig. 7) with side struts continuous with each external paramere, these long, slender, distally pointed, bearing a row of small spines as illustrated. Two pairs of endophallic sclerites; anterior pair elongate, lacking a basal bridge, each sclerite independent, touching inner edge of corresponding side strut; each sclerite broad and almost straight proximally, narrowing to the middle and then curving distally to a pointed apex, as illustrated; posterior pair fused to form a V-shaped structure, each arm of the V distally rounded, ending in a sclerotized ring enclosing a membrane with numerous pores.

Measurements (in mm). FW: 4620, HW: 3178, F: 1192, T: 2108, t1: 862, t2: 81, t3: 153, f1: 970, f2: 990, f3: 870, Mx4: 304, IO: 320, D: 486, d: 378, IO/d: 0.84, PO: 0.77.

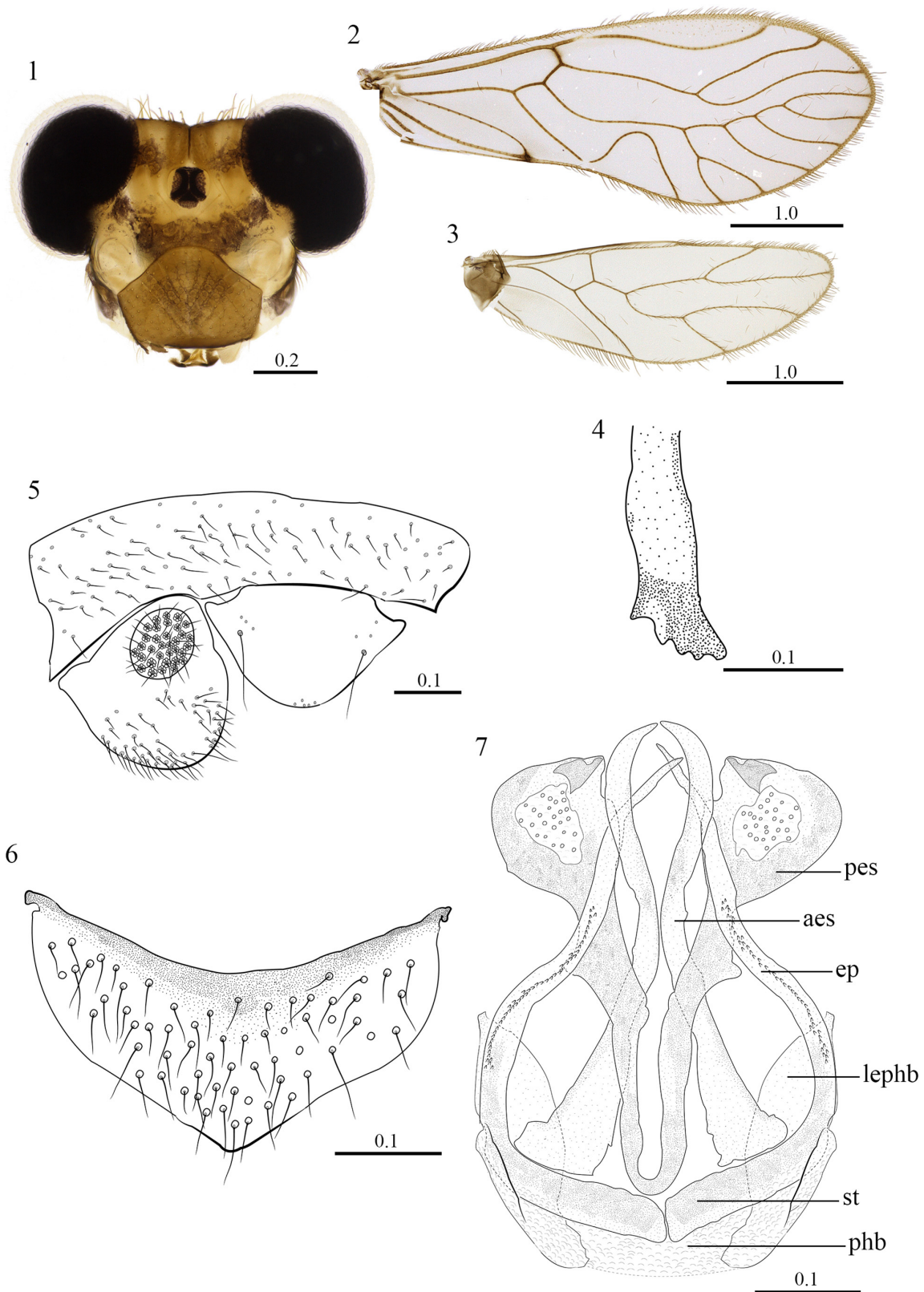
Etymology. The specific name refers to the Chapada Diamantina, in the state of Bahia, Brazil, where the holotype was found.

Material examined. Holotype male (INPA). Brazil. Bahia. Chapada Diamantina. Palmeiras. village of Lavrinha (12°35'04"S, 41°34'32"W) 15–30.viii.2013. Malaise trap. A. M. Silva-Neto, T. R. Barreto and M. Santos.

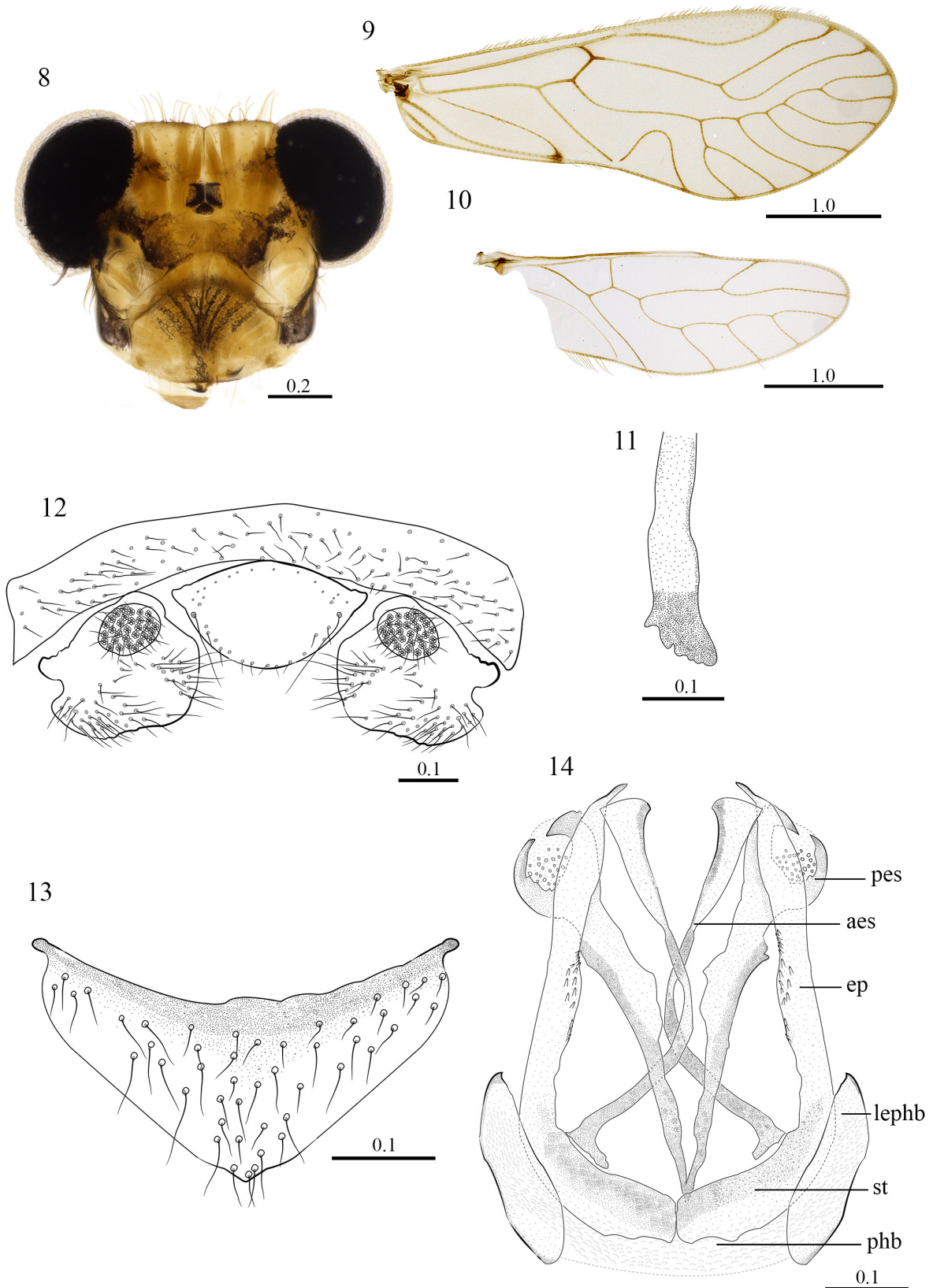
***Brasineura troglophilica* n. sp.**

(Figs 8–14)

Color. Body pale yellow, with brown and pale brown areas as indicated below. Compound eyes black, ocelli hyaline, with ochre centripetal crescents; head pattern (Fig. 8); a brown area on vertex, close to each compound



FIGURES 1–7. *Brasineura diamantina* n. sp. (Holotype male). 1. Front view of head. 2. Forewing. 3. Hindwing. 4. Lacinial tip. 5. Clunium, paraproct and epiproct. 6. Hypandrium. 7. Phallosome. Scales in mm. (Abbreviations: pes, posterior endophallic sclerites; aes, anterior endophallic sclerites; ep, external parameres; lephb, lateral extensions of the phallobase; st, side struts; phb, phallobase).



FIGURES 8–14. *Brasineura trogliphilica* n. sp. (Holotype male). 8. Front view of head. 9. Forewing. 10. Hindwing. 11. Lacinial tip. 12. Clunium, paraprocts and epiproct. 13. Hypandrium. 14. Phallosome. Scales in mm. (Abbreviations: pes, posterior endophallic sclerites; aes, anterior endophallic sclerites; ep, external parameres; lephb, lateral extensions of the phallobase; st, side struts; phb, phallobase).

eye, as illustrated, also a brown band between compound eyes, below the level of the ocellar group, limited posteriorly by the postclypeus; a brown band on each gena, from lower compound eye to subgenal sulcus. Antennae and maxillary palps pale yellow, Mx4 more pigmented distally. Tergal lobes of meso- and metathorax brown; thoracic pleura with an irregular pale brown band above the level of the coxae. Legs with coxae, trochanters and femora creamy white, tibiae and tarsomeres pale yellow. Forewings almost hyaline, as illustrated (Fig. 9); a brown spot on confluence of Cu2–1A; veins brown. Hindwing (Fig. 10), almost hyaline throughout, veins brown.

Structural characters. Compound eyes with interommatidial setae. Outer cusp of lacinial tip broad, with five denticles (Fig. 11). Forewing pterostigma elongate, constricted proximally. Areola postica tall, wide basally, with apex rounded. Rs almost straight, slightly shorter than R_{4+5} , this, and R_{2+3} slightly sinuous. M stem slightly concave proximally, then almost straight. M 6 branched, with M_6 forked, as illustrated. Hindwing Rs-M joined for a distance, Rs 2-branched, M 4-branched. Paraprocts (Fig. 12) stout, broad, irregularly shaped, sensory fields with 32–33 trichobothria on basal rosettes; setae as illustrated. Epiproct (Fig. 12) anteriorly convex, posteriorly rounded, with a field of setae along margin and a pair of large lateral setae in basal half. Hypandrium of one sclerite, anteriorly concave, with anterior border strongly sclerotized, and triangular distally, setae as illustrated (Fig. 13). Phallosome (Fig. 14) with side struts continuous with external parameres, these stout, posteriorly directed, distally pointed, bearing mesally a field of spines near inner edge, as illustrated. Two pairs of endophallic sclerites; anterior pair elongate, lacking a basal bridge, each sclerite independent, slender, bow-shaped, dilated distally; posterior pair basally fused to form a V-shaped structure, each arm of the V proximally slender, widening posteriorly, distally forked; this sclerotized fork forming an almost closed ring, enclosing a membrane with numerous pores.

Measurements (in mm). FW: 4510, HW: 3038, F: 1164, T: 2028, t1: 892, t2: 102, t3: 137, f1: 915, f2: 966, Mx4: 280, IO: 402, D: 498, d: 351, IO/d: 1.14, PO: 0.70.

Etymology. The specific name refers to the troglomorphic nature of this species.

Material examined. Holotype male (INPA). Brazil. Pará. Altamira. Caverna Abrigo do Sismógrafo (03°17'18"S, 52°13'28"W). 09.iv.2009. Bichuette, M. E., Pedroso, D. R., Pellegatti, F. F. & Scatolini, T. L. C. 1 male paratype (LES/UFSCar). Brazil. Pará. Altamira. Caverna do Abrigo do Paratizinho (03°16'35"S, 52°05'27"W) xii.2010. Bichuette, M. E., Gallão, J. E. & Monteiro-Neto, D.

Discussion

Of the genera of Ptiloneuridae known to date, only *Loneura*, *Loneuroides*, *Ptiloneura*, and *Ptiloneuropsis*, have the hindwing vein M with more than one branch. *Brasineura* is not assignable to *Ptiloneura* because the latter has the hindwing M 5-branched, the forewing M is 8 branched, the hypandrium is of three sclerites, with the central sclerite bilobed, each lobe bearing a field of long setae, and the phallosome is Y-shaped, with the anterior and posterior pairs of endophallic sclerites independent. It is also not assignable to *Ptiloneuropsis*, as this one has a triangular areola postica, joined to M by a crossvein; besides, the hypandrium is of a single broadly trapeziform sclerite, and the phallosome is Y-shaped. Similarly, *Brasineura* cannot be assigned to *Loneuroides*, because in the latter, the forewing pterostigma is projected toward Rs and there is a crossvein between A2 and wing margin.

Brasineura cannot either be assigned to *Loneura*, because in the latter the central sclerite of the hypandrium has one or two distinct posterior projections, the phallosome is V- or Y-shaped, and the posterior endophallic sclerites are either independent or basally joined.

Azar *et al.* (2009), erected the genus *Brisacia*, from Colombian Quaternary copal, of age undetermined, probably from Santander, Colombia, and noted its proximity with *Loneura*, but did not assign it to the latter genus, on the basis of a single character: hindwing vein M 2-branched in *Brisacia*, and 3–5 branched in *Loneura*, pointing out that all the species included in *Loneura* have the hindwing M of 3 to 5 branches. Upon examination of *Loneura* specimens in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA, Manaus, Amazonas, Brazil), and in the Mexican National Insect Collection (Instituto de Biología, UNAM, México City, México), we found one female of *L. amazonica* New, from the locality Vida Tropical, near Manaus, one female of *L. erwini* New & Thornton, from the Waorani Ethnic Reserve, in Napo, Ecuador (0°39'10"S, 76°26'00"W), and one female each of two undescribed species, one from about 80 km E Iquitos, Loreto Province, Peru, and the other from 8 km S San Isidro, San José Province, Costa Rica, that have the hindwing M 2-branched. Besides, García Aldrete *et al.* (2011), described *L. gorgonaensis* and *L. monticola*, from Gorgona Island, Cauca, Colombia, in

which also, the hindwing M is 2-branched. The above indicates that the separation between *Brisacia* and *Loneura* cannot be maintained, and that the former must go in the synonymy of the latter.

All of the above justifies the creation of *Brasineura* as a distinct ptiloneurid genus, whose phallosome is unique in the family, strongly apomorphic, as follows: it is distinctly closed, rounded anteriorly, U-shaped, with the side struts in reality anterior and fused to the external parameres, that bear rows or fields of spines; it is the only genus having well developed lateral extensions of the phallobase, the anterior endophallic sclerites are widely separated, independent, and the posterior endophallic sclerites form a V-shaped structure, each arm of the V ending in an open or closed ring-like structure enclosing a membrane with pores. The central sclerite of the hypandrium is simple, approximately triangular, having a strongly sclerotized band along anterior border.

By the branching of the hindwing M, *Brasineura* belongs in the cluster *Ptiloneura-Ptiloneuropsis-Loneuroides-Loneura*, in which, by wing venation and hypandrium structure, it appears to be close to the latter. Synapomorphies with *Loneura* would be the branching of the hindwing M, and the branching of the forewing M.

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