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Three new species of *Loneura* (Psocodea:'Psocoptera':Ptiloneuridae) from Gorgona Island, Cauca, Colombia, with a new infrageneric classification

ALFONSO N. GARCÍA ALDRETE[1], RANULFO GONZÁLEZ OBANDO[2] & FABIO A. SARRIA SARRIA[2]

[1]*Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, 04510 México, D. F. MÉXICO. E-mail: anga@ibiologia.unam.mx*

[2]*Departamento de Biología, Facultad de Ciencias Naturales y Exactas, Universidad del Valle, Santiago de Cali, COLOMBIA. E-mail: ranulfog@gmail.com;fabsarria@gmail.com*

Abstract

Three related species of *Loneura* Navás, from Gorgona Island (Cauca, Colombia), are here described and illustrated. The types are deposited in the Entomological Museum of the Universidad del Valle (MUSENUV). A set of infrageneric groups within *Loneura* is proposed based on the structure of the male hypandrium and phallosome. The species of the genus are assigned to the groups recognized in this classification.

Key words: Colombian Pacific, neotropics, psocid fauna, Epipsocetae

Introduction

Sarria (2011) conducted the first systematic study of Psocoptera in Colombia. In that study, 68 species in 37 genera and 21 families were recorded from Gorgona, a small island of 13.8 km^2 in the Colombian Pacific that is separated from the continent by only 35 km (02°47'–3°06'N: 78°6'–78°18'W). That study analyzed samples taken during field work in 2009 and 2010, together with specimens collected by canopy fogging in 2007 (see Pimienta *et al.* 2008). The genus *Loneura* (Ptiloneuridae) was not represented in these samples. However, during field work on Gorgona Island in February, March and May, 2011, by the Biology Department of the Universidad del Valle, three undescribed species of this genus were found.

Loneura Navás is essentially a neotropical genus, whose species extend from southwestern United States (southern Arizona), to southern Brazil (Santa Catarina). At present it includes 17 described species, but 17 further undescribed species are represented in the collection of García Aldrete (Moreira de Castro 2007). Only two species are recorded from Colombia (García Aldrete et al. 2011), but recent collecting in Valle del Cauca has revealed the presence of six additional undescribed species. The megadiverse nature of Colombia suggests that many more species remain to be discovered. The purpose of this paper is to describe from Gorgona Island, as a distinct insular unit, three related species of *Loneura* based on 14 specimens. For the dissecting, mounting and measuring procedures see González et al. (2011). The type series of each species is deposited in the Entomological Museum of the Universidad del Valle, Santiago de Cali, Colombia (coden: 23530-23537 MUSENUV).

Loneura gorgonaensis n. sp. (♂).

(Figs. 1–5)

Diagnosis. Head with a creamy white, oblique band between each compound eye and epistomal suture, enclosing antennal fossae (Fig. 2). Forewing M five branched, M5 distally forked (Fig.1), resulting in six M veins reaching the wing margin; areola postica tall, almost reaching M, 1.23 times as tall as wide. Hindwing M two branched. Hypandrium with side sclerites fused proximally to central piece; this anteriorly convex, with side projections parallel to side sclerites and two stout, distally rounded posterior projections, each bearing an anteapical macrosetae

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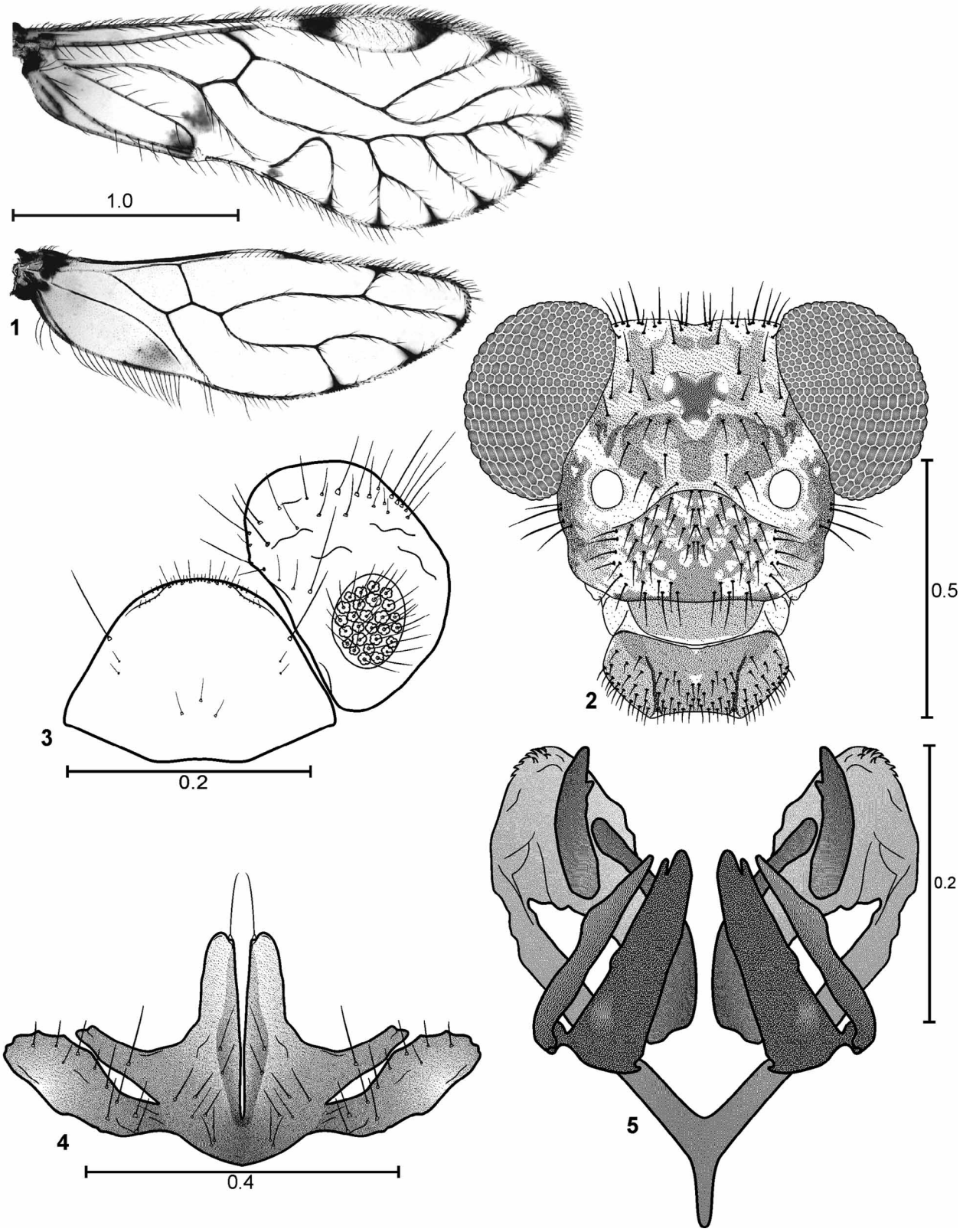
on inner margin (Fig. 4). Phallosome (Fig. 5) with V-shaped side struts, external parameres stout, distally blunt, bearing pores, and two pairs of symmetric phallosome sclerites, a central pair biramous, with outer arm long, acuminate, and inner body stout, wide based, extended posteriorly, distally blunt, and a posterior pair, wide based, distally acuminate, bearing a subterminal tooth on inner margin (Fig. 5).



FIGURES 1–5. ***L****oneura gorgonaensis* **n. sp.** ♂. 1. Forewing and hindwing. 2. Front view of head. 3. Paraproct and epiproct. 4. Hypandrium. 5. Phallosome. Scales in mm.

Color (in 80 % alcohol). As in diagnosis, plus the following: body creamy white, with ochre spots as indicated below. Compound eyes black, ocelli hyaline, with thick ochre centripetal crescents. Head dark brown in front view, except for the creamy white bands indicated in the diagnosis. Vertex pale brown, with dark brown spots near mesal line, with other small irregular spots; postclypeus with irregular dark brown striae as illustrated. Antennae brown, flagellomeres creamy white at both ends. Mx 2–4 dark brown, Mx1 creamy white. Thorax creamy white with brown irregular spots on pleurae; tergal lobes of meso- and metathorax brown; procoxae pale brown, meso- and metacoxa creamy white; foreleg almost totally brown, femur with extended creamy area between proximal and distal brown areas. Meso- and metathoracic legs brown except for creamy white coxae, trochanter and proximal third of femur.

Forewings almost hyaline; well defined dark brown bands proximally and distally on pterostigma, brown spots distally on veins, and brown areas on cells CuA and CuP, near nodulus. Hindwings almost hyaline, veins brown, with dark spots at wing margin. Abdomen creamy white, with subcuticular, irregular dark brown ochre bands. Clunium and hypandrium dark brown; epiproct creamy white; paraprocts creamy white, with small irregular brown spots laterally.

Morphology. As in diagnosis, plus the following: compound eyes prominent. Outer cusp of lacinial tip broad, with four denticles. Forewing 2.56 times as long as wide, pterostigma elongate, 4.18 times as long as wide. Rs about as long as R2+3; areola postica broad, apically rounded. Hindwing 3.00 times as long as wide. Hypandrium (Fig. 4). Phallosome symmetric, complex (Fig. 5). Paraprocts (Fig. 3) broad, posterior margin rounded with setal field as illustrated, sensory fields with 22 trichobothria in basal rosettes. Epiproct (Fig. 3) broad, trapeziform, with a group of three small setae in the middle, near anterior border; a field of setae on each side, and a field of microsetae and a row of setae along posterior border.

Measurements (in µm). FW: 2875, HW: 2100, F: 730, T: 1230, t1: 560, t2: 60, t3: 100, ctt1: 22, Mx 4: 195, f1: 520, f2: 390, f3: 345, f4: 310, IO: 290, D: 270, d: 380, IO/d: 0.76.

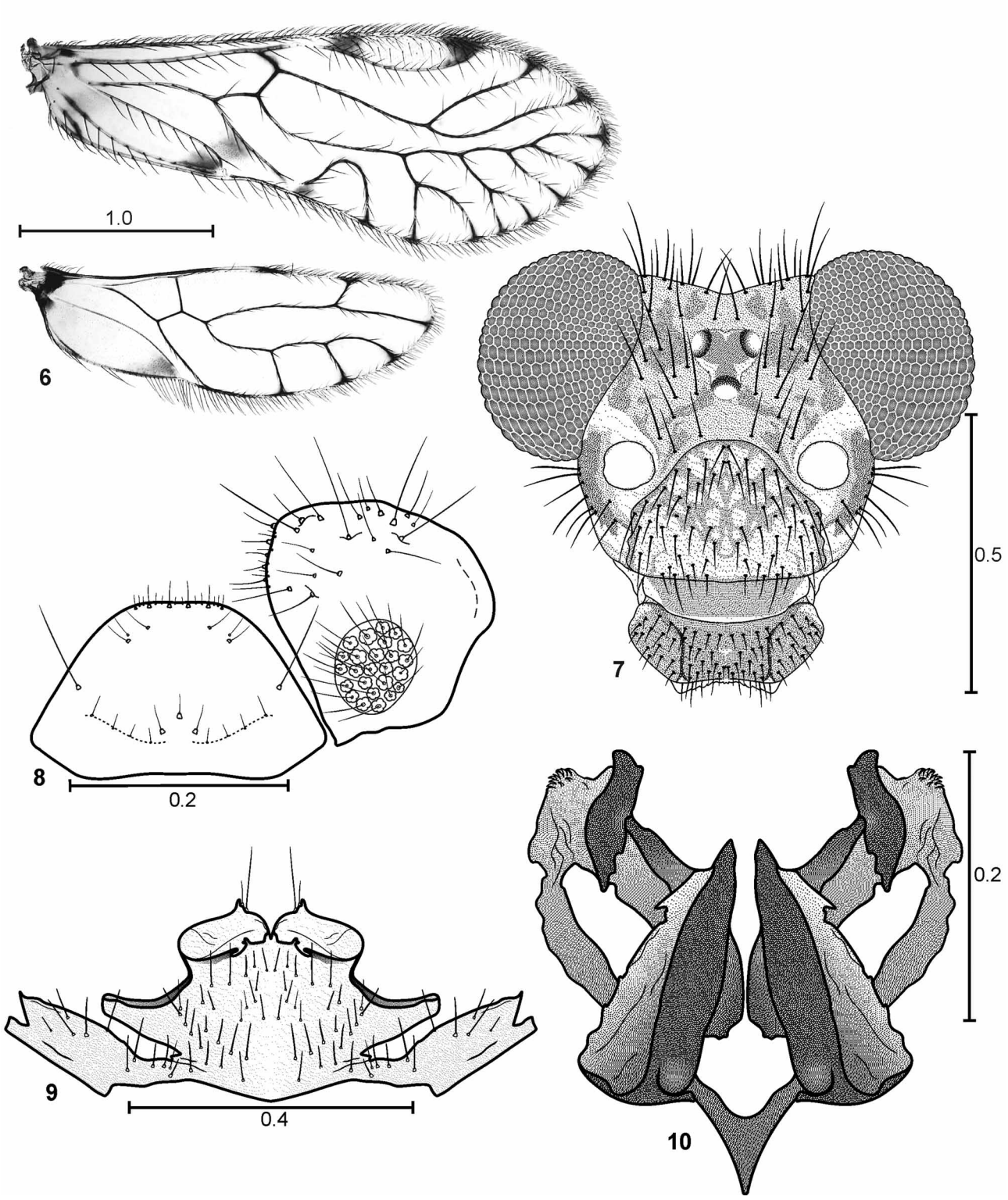
Specimens studied. Holotype male. **COLOMBIA. Cauca**. Guapi. National Natural Park Gorgona Island, Palmeras Beach (02°56’28.6’’N: 78°12’21.4’’W), 28m. 24–25.II.2011. Black light trap. MUSENUV slide cod. 23530. J. Mendívil and R. González. Two male paratypes: 1, same data as holotype, 2, same locality and trap as holotype, 27.II –1.III.2011. MUSENUV cod. 23531. R. González and J. Mendívil.

Etymology. The specific name refers to the origin of this species, in Gorgona Island, Cauca, Colombia.

***Loneura insularis* n. sp. (♂).**
(Figs. 6–10)

Diagnosis. Head mostly dark brown, vertex creamy white; a creamy white, oblique band between each compound eye and epistomal suture, enclosing antennal fossae (Fig.7). Forewing M five branched, M5 two branched, M4 two branched in some specimens, as illustrated (Fig.6), resulting in six or seven M terminals; areola postica tall, broad, rounded apically, 1.55 times as tall as wide. Hindwing M three branched. Side sclerites of hypandrium fused proximally with central piece; this slightly convex anteriorly, with two blunt side projections, parallel to side sclerites, and two broad posterior lobes, each with a small conical projection, next to a macroseta (Fig. 9). Phallosome stout, V-shaped, with distally rounded external parameres, bearing pores; two pairs of phallosome sclerites, the central pair long, triangular, and the posterior pair slender, next each external paramere (Fig. 10).

Color (in 80 % alcohol). As in diagnosis, plus the following: body light brown, with ochre spots as indicated below. Compound eyes black, ocelli hyaline, with thick ochre centripetal crescents. Head (Fig. 7); vertex pale brown, with dark brown spots near mesal line and other small irregular spots; postclypeus with irregular dark brown striae as illustrated. Antennae brown, flagellomeres creamy white on both ends. Mx 3–4 dark brown, Mx 1–2 creamy white. Thorax creamy white, with irregular brown spots on pleurae; tergal lobes of meso- and metathorax brown; procoxae pale brown, meso- and metacoxa creamy white; forelegs almost totally brown, femur with extended creamy area between a proximal and a distal brown area. Meso- and metathoracic legs brown except for creamy white coxae, trochanter and proximal third of femur. Forewings almost hyaline; well-defined dark brown bands proximally and distally on pterostigma; cells CuA and CuP, near nodulus, with dark brown areas; veins brown, with dark spots well-defined at wing margin. Hindwings with veins brown, with dark spots at wing margin. Abdomen creamy white, with subcuticular, irregular dark brown ochre rings. Clunium and hypandrium brown; epiproct creamy white; paraprocts creamy white, with small irregular brown spots on sides.



FIGURES 6–10. *Loneura insularis* **n. sp.** ♂. 6. Forewing and hindwing. 7. Front view of head. 8. Paraproct and epiproct. 9. Hypandrium. 10. Phallosome. Scales in mm.

Morphology. As in diagnosis, plus the following: compound eyes prominent. Outer cusp of lacinial tip broad, with four denticles. Forewing 2.75 times as long as wide; pterostigma elongate, 4.75 times as long as wide. Rs about as long as R2+3, M5 forked, some specimens with M4 also forked. Areola postica (Fig. 6). Hindwing (Fig. 6) 3.14 times as long as wide, with M three branched in both wings, but sometimes (paratype) one of the wings four branched. Hypandrium (Fig. 9). Phallosome symmetric, complex (Fig. 10). Paraprocts (Fig. 8) broad, with setae as

illustrated, sensory fields with 24 trichobothria in basal rosettes. Epiproct (Fig.8) broad, trapeziform, with a group of three small setae in the middle, a row of setae near anterior border, and one macrosetae on each side; a field of microsetae and a row of setae along posterior border.

Measurements (in µm). FW: 3025, HW: 2200, F: 795, T: 1390, t1: 600, t2: 60, t3: 100, ctt1: 22, Mx 4: 218, f1: 520, f2: 410, f3: 350, f4: IO: 320, D: 300, d: 400, IO/d: 0.78.

Specimens studied. Holotype male. **COLOMBIA. Cauca.** Guapi. National Natural Park Gorgona Island. Palmeras Beach (02°56'28.6''N: 78°12'21.4''W) 28m. 22–23.II.2011. Black light trap. MUSENUV slide cod. 23532. R. González and J. Mendívil. Three paratypes male, same locality as holotype, 24.II.2011, curtain light trap. MUSENUV cod. 23533. R. González and J. Mendívil. One paratype male, N N P Gorgona Island, ca. Yundigua (02°58'4.8''N: 78°10'05.3''W) 41m. 27.II–1.IV.2011. Black light trap. MUSENUV cod. 23534. J. Mendívil.

Etymology. The specific name refers to the insular nature of this species, so far only known in Gorgona Island, Cauca, Colombia.

***Loneura monticola* n. sp. (♂).**
(Figs. 11–15)

Diagnosis. Head dark brown, with a creamy white, oblique band between each compound eye and epistomal suture, enclosing antennal fossae (Fig 12). Forewing M five branched, M5 two branched (Fig. 11), resulting in six M terminals; areola postica broadly triangular, with apex rounded, 1.36 times as tall as wide. Hindwing M two branched. Hypandrium with side sclerites fused proximally to central piece, this wide, almost straight anteriorly, with acute side projections, parallel to side sclerites, and two posterior projections, each with an acute, side apophysis, and distal end rounded, with a macrosetae at apex (Fig. 14). Phallosome stout, V-shaped, external parameres short, distally rounded, bearing pores; two pairs of symmetrical phallosome sclerites, the central pair, stout, broadly triangular, and the posterior pair with basal arms elongate, and distal arms curved, stout, terminally truncate (Fig. 15).

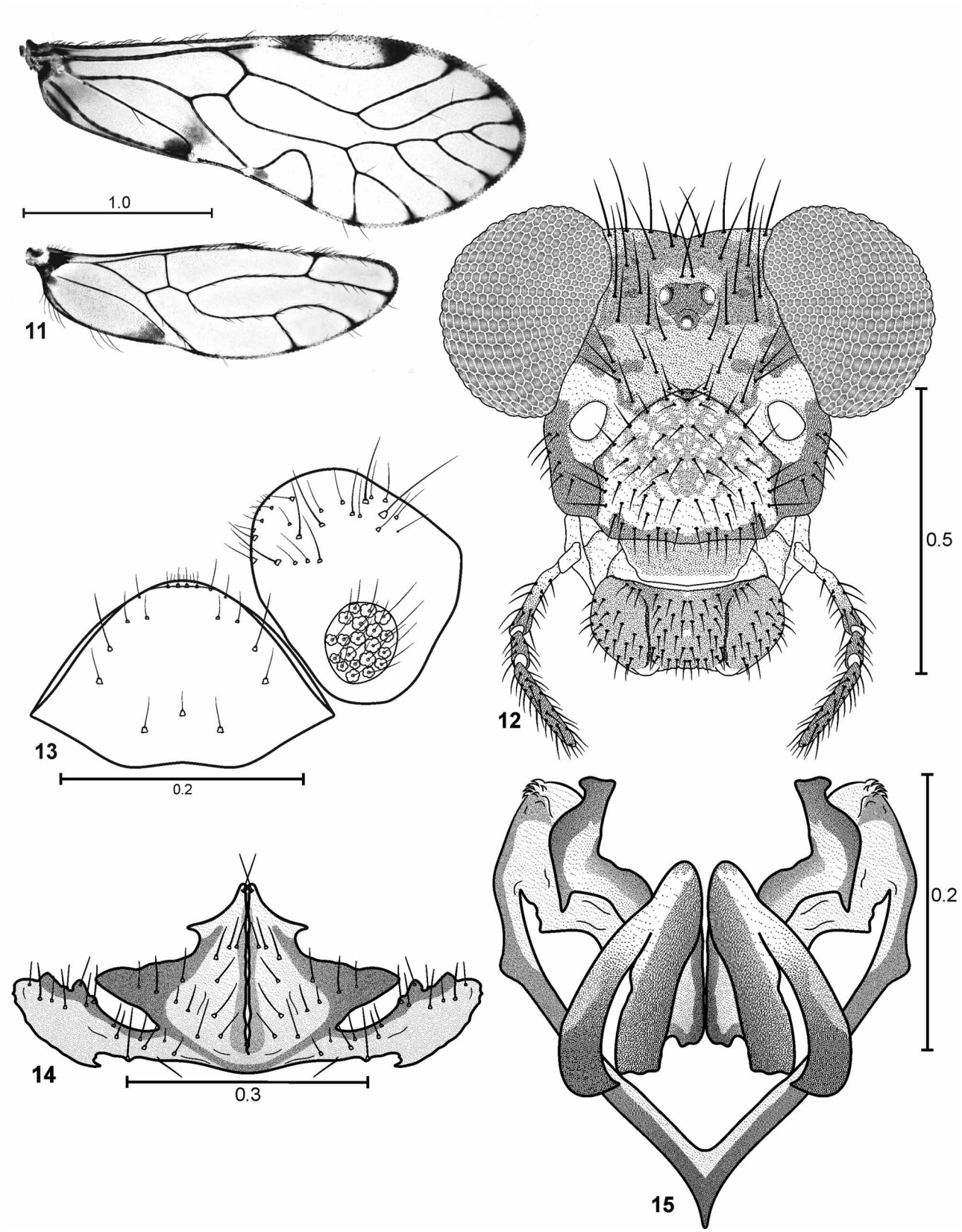
Color (in 80 % alcohol). As in diagnosis, plus the following: body light brown, with ochre spots as indicated below. Compound eyes black, ocelli hyaline, with thick ochre centripetal crescents. Head (Fig. 12): Vertex pale brown, with dark brown spots near mesal line and other small irregular spots; postclypeus with irregular dark brown striae, as illustrated. Antennae brown, flagellomeres creamy white on both ends. Mx 2–4 brown, Mx1 creamy white. Thorax brown with pale brown spots. Legs almost entirely dark brown; trochanter, femur, both ends of tibia of middle and hind legs creamy white. Coxae with brown basal spots. Forewings almost hyaline, with well-defined dark brown bands on proximal and distal ends of pterostigma; cells CuA and CuP, near nodulus, with brown spots; veins brown, with dark, well defined spots at wing margin. Hindwings with brown veins, with dark spots at wing margin. Abdomen creamy white, with subcuticular, dark brown, transverse rings, less pigmented ventrally. Clunium and hypandrium brown; epiproct and paraprocts pale brown.

Morphology. As in diagnosis, plus the following: compound eyes prominent. Outer cusp of lacinial tip broad, with four denticles. Forewing 2.58 times as long as wide, pterostigma elongate, 4.12 times as long as wide. Rs about as long as R2+3; areola postica (Fig. 11). Hindwing (Fig.11). Hypandrium (Fig. 14). Phallosome symmetric, complex (Fig. 15). Paraprocts (Fig. 13) broad, with hind margin rounded with setal field as illustrated, sensory fields with 22 trichobothria in basal rosettes. Epiproct (Fig. 13) broad, trapeziform, with a group of three small setae in the middle, near anterior border, a field of setae on each side, and a field of microsetae and a row of setae along posterior border.

Measurements (in µm). FW: 2900, HW: 2087, F: 740, T: 1250, t1: 560, t2: 260, t3:105, ctt1: 25, Mx 4: 200, f1: 520, f2: 420, f3: 380, IO: 270, D: 290, d: 385, IO/d: 0.70.

Specimens studied. Holotype male. **COLOMBIA. Cauca.** Guapi. National Natural Park Gorgona Island. El Mirador (02°57'9''N: 78°11'03.6''W), 241m. 24–25.V.2011. Black light trap. MUSENUV slide cod. 23535. J. Mendívil and F. Sarria. Four male paratypes, same data as the holotype, MUSENUV cod. 23536. One male paratype, same data as holotype, Chorro del Cura (02°58'2.3''N: 78°10' 9''W), 90m. 27.II–1.III.2011. Black light trap. MUSENUV slide cod. 23537. J. Mendívil and R. González.

Etymology. The specific name refers to the mountainous nature of the type locality, in Gorgona Island.



FIGURES 11–15. *Loneura monticola* **n. sp.** ♂. 11. Forewing and hindwing. 12. Front view of head. 13. Paraproct and epiproct. 14. Hypandrium. 15. Phallosome. Scales in mm.

Discussion

The three species described herein, together with *L. amazonica* (New), from the Brazilian state of Amazonas, *L. erwini* (New & Thornton), from the Río Tambopata Reserved Zone, Madre de Dios, Peru, and a pair of undescribed sister species, one from Valle Del Cauca, Colombia, and the other from Amazonas, Brazil, constitute a distinct group of species that differ from all the other species presently included in the genus. This group of species is characterized by having a hypandrium of a single piece, with the side sclerites fused at their proximal ends to the central sclerite, this bears two posterior projections, either medially or on the sides; the phallosome is V-shaped, symmetric and complex, with two pairs of endophallic sclerites. Within this group, *L. amazonica* stands apart, on account of the widely separated projections of the hypandrium. *L. erwini* and the pair of undescribed species from Amazonas and Valle Del Cauca constitute a distinct assemblage, grouped by the similarity of the posterior projections of the hypandrium. *L. gorgonaensis* approaches this group, and *L. insularis* and *L. monticola* are closer among themselves, also approaching the group above on the basis of the same character.

According to the ground plan of the male hypandrium and phallosome, we propose the following infrageneric groups within *Loneura*:

Group I. Hypandrium consisting of three sclerites, two small, elongate side sclerites flanking a large, central sclerite.

Subgroup IA. Central sclerite with one median posterior projection. Phallosome with external parameres robust, with outer borders straight, rounded posteriorly; posterior pair of endophallic sclerites of medium length, curved outward, acuminate. Species included: *L. crenata* Navás (Mexico, Costa Rica); *L. leonilae* García Aldrete (Mexico); *L. mombachensis* García Aldrete (Nicaragua).

Subgroup IB. Central sclerite with two lateral posterior projections. External parameres of phallosome stout, distally rounded, pre-apically dilated in one species. Posterior pair of endophallic sclerites long, slender, apically blunt. Species included: *L. boliviana* Williner (Argentina, Bolivia); *L. colombiana* García Aldrete, González & Carrejo (Colombia); *L. maracaensis* García Aldrete (Brazil); *L. raramuri* García Aldrete (Mexico); *L. splendida* Mockford (Mexico, Guatemala).

Group II. Hypandrium consisting of five sclerites, two anterior side sclerites, and two posterior, wide based, distally acuminate sclerites, the two pairs flanking a larger, central sclerite, this with a median posterior projection flanked by a tuft of macrosetae. Phallosome with external parameres stout, distinctly curved, spoon-shaped; posterior pair of endophallic sclerites curved, acuminate; anterior pair of endophallic sclerites with proximal half slender, curved, distal half stout, cuadrangular, with a row of blunt teeth along inner edge. Species included: *L. jinotegaensis* García Aldrete (Nicaragua); *L. mirandaensis* García Aldrete (Venezuela).

Group III. Hypandrium consisting of one sclerite, resulting from the fusion of the proximal ends of the side sclerites to the central sclerite, this extended mesally on each side, and with two posterior projections in the middle, variously shaped, each bearing a macrosetae apically or subapically. Phallosome robust, with stout external parameres distally rounded; anterior pair of endophallic sclerites large, stout, broadly triangular, of two pieces; posterior pair of endophallic sclerites elongate, distally rounded or truncate. Species included: *L. gorgonaensis* **n. sp.** (Colombia); *L. insularis* **n. sp.** (Colombia); *L. monticola* **n. sp.** (Colombia); *L. amazonica* (New) (Brazil); *L. erwini* (New & Thornton) (Peru); also the pair of undescribed sister species from Amazonas, Brazil and from Valle del Cauca, Colombia.

Males are not known for *L. brasiliensis* Roesler (Brazil), *L. lienhardi* García Aldrete (Venezuela), and *L. maesi* García Aldrete (Nicaragua), so these are not assignable to any of the groups. The original description of *L. quinaria* Navás (Bolivia) is insufficient for recognition.

Key to males of *Loneura* Group III species

1. Hindwing M 2-branched 2
-. Hindwing M 3-branched 3
2. Posterior projections of hypandrium stout, columnar, distally rounded; posterior pair of endophallic sclerites pointed, with a small preapical tooth on inner edge. . . . . *L. gorgonaensis* **n. sp.**
-. Posterior projections of hypandrium not columnar, each with an acute mesal extension on outer side, apex slender, rounded; posterior pair of endophallic sclerites distally wide, straight . . . . . *L. monticola* **n. sp.**
3. Forewing with cells R4+5-M, each with a pigmented crescent near margin, forming a slender submarginal band 4

-. Forewing hyaline on distal half 6
4. Posterior projections of hypandrium close together, curved outwards 5
-. Posterior projections of hypandrium widely separated, projected from postero-lateral corners of hypandrium, not curved outwards . . . . . .*L. amazonica* (New)
5. Posterior projections of hypandrium with a distinct, almost round pigmented area mesally on outer border, distal thirds decidedly narrower; anterior endophallic sclerites wide based, sides converging to a point . . . . . .*Loneura* **n. sp.** (Amazonas, Brazil) (*Loneura* **sp. n.** 2, in Moreira de Castro 2007)
-. Posterior projections of hypandrium not as above, wide based, narrowing distally; anterior endophallic sclerites broad, with small conical projection medially on posterior border . . . . . *L. erwini* (New & Thornton)
6. Posterior projections of hypandrium slender, distal third narrower, apex blunt; posterior pair of endophallic sclerites distally pointed. . . . . .*Loneura* **n. sp.** (Valle del Cauca, Colombia)
-. Posterior projections of hypandrium wide, almost oval, with apical, small conical extension; posterior pair of endophallic sclerites almost straight distally . . . . . *L. insularis* **n. sp.**

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