



***Desutterella* n. gen., a new genus of Luzarinae (Orthoptera: Grylloidea: Phalangopsidae) and the first report of the Aracambiae group Souza-Dias & Desutter-Grandcolas, 2014 in the Amazon**

PEDRO G. B. SOUZA-DIAS¹, LUCAS DENADAI DE CAMPOS¹
& FRANCISCO DE ASSIS GANEO DE MELLO²

¹Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, rua do Matão, travessa 14, n. 101, 05508-900, Cidade Universitária, São Paulo, SP, Brazil.

²Departamento de Zoologia, Instituto de Biociências de Botucatu, Universidade Estadual Paulista “Júlio de Mesquita Filho” (UNESP), 18618-000, Botucatu, SP, Brazil.

³Corresponding author. E-mail: pedrogdias@gmail.com

Abstract

A new genus and two new species of Luzarinae cricket (Grylloidea, Phalangopsidae) are described from the Amazon Rainforest of Brazil and Colombia. *Desutterella manauara* n. gen. n. sp. and *D. colombiana* n. gen. n. sp. are described based in characters of external morphology and genitalia. The new genus is characterized by the presence of reduced and pubescent male forewings, with stridulatory vein visible but other areas for sound production and propagation absent, and file teeth very reduced, vestigial. Regarding the male genitalia, *Desutterella* n. gen. presents an extra projection in the pseudepiphallic paramere 2, a condition not observed in the Aracambiae until now. Besides the description, we provide morphological evidence for the glandular nature of the metanotum of males through scanning electron microscopy analysis, a discussion about the morphological and genital features of this new genus, and a distribution map of the Aracambiae group.

Key words: cricket, new species, taxonomy, biodiversity, metanotal gland

Resumo

Um novo gênero e duas novas espécies de grilos Luzarinae (Grylloidea, Phalangopsidae) são descritos para a Amazônia do Brasil e Colômbia. *Desutterella manauara* n. gen. n. sp. and *D. colombiana* n. gen. n. sp. são descritos baseados em caracteres de genitalia e morfologia externa. O novo gênero caracterizado pela presença de asas anteriores masculinas reduzidas e pubescentes, com veia estridulatória visível, mas com regiões para produção e propagação de som ausentes, e os dentes da fileira muito reduzidos, vestigiais. Considerando a genitália masculina, *Desutterella* n. gen. apresenta uma projeção extra no parâmero pseudoepifálico 2, uma condição ainda não observada nos Aracambiae at o momento. Além da descrição, nós fornecemos uma evidência morfológica para a natureza glandular do metanoto dos machos através de uma análise de microscopia eletrônica de varredura, uma discussão sobre as características morfológicas e genitais deste novo gênero e um mapa de distribuição do grupo Aracambiae

Palavras-chave: grilo, nova espécie, taxonomia, biodiversidade, glândula metanotal

Introduction

The Amazon is a superlative biome: within its expansive boundaries lies the world’s largest tropical forest, and a mosaic of different Amazonian ecosystems, forming the most species-rich biome in the world (Hoorn *et al.*, 2010). This incredible biodiversity is far from being completely known, with innumerable species, especially for highly diverse groups, such as insects, still undescribed (Wilson, 1992; Peres 2005; Lewisohn *et al.*, 2005; May, 2010)

The majority of the Amazon Rainforest lies inside Brazil's territory, occurs in almost 60% of its area, and reaches eight States (Brazil, 2015, 2016). Consequently, Brazil is considered megadiverse and is the world's most biodiverse country (Brazil, 2015). As in other areas of the Amazon, the biodiversity from the Brazilian Amazon is barely understood, especially considering insects (Peres, 2005). Concerning Orthoptera, two faunal lists have been published for Caelifera from the Brazilian Amazon (Nunes & Braga, 2008; Costa *et al.*, 2015), while there are no inventories for Ensifera.

The Grylloidea of the Amazonian fauna in Brazil is practically unknown. Only 41 species have been recorded in the entire Brazilian Amazon, distributed in the three main families of crickets: Gryllidae (17 spp.), Phalangopsidae (11 spp.), and Trigonidiidae (13 spp.). Almost all of these records are the type localities of the original species description.

Recent studies on Tettigoniidae (Cadena-Castañeda *et al.*, 2016; Mendes *et al.*, 2016; Tavares *et al.*, 2016; Mendes *et al.*, 2017) and Grylloidea (Martins *et al.*, 2013, 2014) in the Brazilian Amazon have shown the great potential for the discovery and description of new Amazonian taxa, primarily for groups that have been historically neglected as crickets.

Souza-Dias & Desutter-Grandcolas (2014) proposed the Aracambiae group to include the genera of Luzarinae characterized by the development of phallic glands within the pseudepiphallic sclerite of male phallic complex associated with a pair of tubular pseudepiphallic arms. Aracambiae includes the following genera and species: *Aracamby* de Mello, 1992 including *A. balneatorius* de Mello, 1992, *A. mucuriensis* de Mello, 1992 (type species), and *A. picinguabensis* de Mello, 1992; *Cacruzia* de Mello, 1992, monotypic, including *C. bahiana* de Mello, 1992; *Izecksohniella* de Mello, 1992 including *I. almeidai* Mews & Mól, 2009, *I. amore* de Mello, 1992 (type species), and *I. puri* Sperber, Rocha, Lopes-Andrade & Mesa, 2003; *Marcgraviella* Souza-Dias & Desutter-Grandcolas, 2014 including *M. christiana* Desutter-Grandcolas & Souza-Dias, 2014, and *M. muriciensis* Souza-Dias, 2014 (type species); *Marliella* Mews & Mol, 2009, monotypic, including *M. titai* Mews & Mól, 2009; and *Vanzoliniella* de Mello, 1994, monotypic, including *V. sambophila* de Mello & Cezar dos Reis, 1994. These genera are found in the Atlantic Forest and Cerrado of Brazil (Fig. 7).

During an expedition for the project "Biota de Orthoptera do Brasil at the "Reserva Florestal Adolpho Ducke (02°55'S, 59°58'W), in Manaus (Amazonas State, Brazil), several specimens of an undescribed species were found. Subsequently, one of us (PGBSD) found more specimens of this species in the collection of the Museu Paraense Emilio Goeldi (MPEG), Belém (state of Pará Brazil), and specimens of a second undescribed species in the collection of the Instituto de Ciencias Naturales (ICN), Universidad Nacional, Bogotá, Colombia. In this paper, we describe a new genus and two new species of the Aracambiae group from the Brazilian and Colombian Amazon, and provide the first record of this group for the Amazon and Colombia.

Material and methods

The male and female habitus photographs (Fig. 1) were taken using a Canon EOS 550D T2i equipped with EF 100mm macro lens and 430EX II flash. The photographs of external morphology (Figs. 2, 4) were taken with specimens immersed in 85% ethanol, using a Leica MZ-16 stereomicroscope attached to a DFC-420 video camera; the same equipment was used to take the photographs of male and female genitalia (Figs. 4, 6).

The specimens were examined, described and compared using a Leica MZ-9.5 stereomicroscope. We used the Leica Application Suite LAS v4.0 software to capture the images, and the digital image processing software Helicon Focus 5.3 to stack them. Subsequently, the images were edited in Adobe Photoshop CS6 and GIMP (GNU Image Manipulation Program) 2.8. The distribution map was built with the software QGIS 2.18. The biomes follow Olson *et al.* (2001).

The male phallic complexes were removed and treated with an aqueous solution of 10% KOH for 24 h to remove muscular tissues, and stored in a small glass vial with 80% ethanol along with the respective specimen. The female copulatory papillae were removed and stored in a small glass vial with 80% ethanol along with the respective specimen. Genitalia terminology follows Desutter (1987), and Desutter-Grandcolas (2003).

For scanning electron microscopy (SEM) analysis, we dissected a male specimen, and removed its forewings and thorax (including pronotum, mesonotum and metanotum). The sample was dehydrated in a graded ethanol series until ethanol 100%, critical point dried using CO₂ as intermediate, mounted on stubs and coated with gold.

The sample was analyzed using a Scanning Electron Microscope Zeiss SIGMA VP at the Instituto de Biociências da Universidade de São Paulo (Biosciences Institute of the University of São Paulo).

Abbreviations. Male genitalia. **Arm**, pseudepiphallic arm; **EctAp**, ectophallic apodeme; **EctF**, ectophallic fold; **EndAp**, endophallic apodeme; **EndSc**, endophallic sclerite; **Gland**, phallic gland; **PsP1**, pseudepiphallic paramere 1; **PsP2**, pseudepiphallic paramere 2; **R**, ramus.

General morphology. I, II, III, anterior, median, posterior (leg, tarsomere); DD, LL, dorsal disc, lateral lobe of pronotum; FW, forewing; F, femur; T, tibia; iad, iam, iav, respectively, dorsal, median and ventral apical spurs of hind tibia on inner face; oad, oam, oav, dorsal, median and ventral apical spurs of hind tibia on outer face; TIII subapical and apical spurs formula indicated as x/y, for inner/outer spurs respectively.

Measurements (mm). AWP, anterior width of pronotum; HW, head width; IOD, intra-ocular distance; LFIII, length of hind femur; FWL, forewing length; PL, pronotum length; PW, pronotum width (at mid-line); LBt–III, length of basitarsus III; LTIII, length of hind tibia; OL, ovipositor length; PWP, posterior width of pronotum; WFIII, width of hind femur; FWW, forewing width (at mid-line).

Repositories. BOTU, Zoology Department Insect Collection (Coleção de Insetos do Departamento de Zoologia), Instituto de Biociências, Universidade Estadual Paulista, UNESP (São Paulo State University), Botucatu, Brazil. MZSP, Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil.

Institutions. MPEG, Museu Paraense Emilio Goeldi, Belém, Brazil; ICN, Instituto de Ciencias Naturales, Bogotá Colombia.

Results

Desutterella Souza-Dias, Campos & de Mello n. gen.

Etymology. Taxon named after the French Orthopterist Laure Desutter-Grandcolas, for her work on Neotropical Grylloidea.

Type species. *Desutterella manauara* Souza-Dias, Campos & de Mello n. sp.

Species included. *Desutterella manauara* Souza-Dias, Campos & de Mello n. sp., *Desutterella colombiana* Souza-Dias, n. sp.

Distribution. Amazon Forest, in Brazil (Amazonas State), and Colombia (Amazonas Department).

Diagnosis. Size small, slender, as the other genera from Aracambiae group. General coloration light to medium brown. Head, pronotum and legs I and II with sparse, thick setae. Fastigium with double row of thick setae. Three ocelli, large, circular. Maxillary palpi elongated, joints 3–5 whitish, pilose. Legs elongated, not annulated; tympanum on inner face of TI. **Male.** Metanotum with two projections rounded, whitish, glandular. Male FWs short, rounded, membranous; right FW medium brown, apex light brown, pilose; stridulatory file very reduced; veins and areas for sound propagation absent. **Male genitalia.** Male genitalia bearing a pair of genital glands within pseudepiphallic sclerite, connected to tubular pseudepiphallic arms. Pseudepiphallic arms curved outwards. Pseudepiphallic parameres highly sclerotized; PsP2 with two pairs of distinct projections. **Female.** Almost same size as males. Females FWs yellowish brown, transparent, small, reaching first abdominal tergite.

Description. Occiput and vertex with thick setae (Figs. 2 A–D, 5 A–C). Fastigium wider than long, with double row of thick setae, below vertex level and not separated from it by line or furrow (Figs. 2 A–D, G, 5 A–C, F). Three ocelli, large, circular (Figs. 2G, 5F). Antennal scape longer than wide (Figs. 2 A–D, 5 A–C). Maxillary palpi elongated, joints 3–5 elongated, whitish, pilose, joint 4 longest (Figs. 2J, 5E); joint 5 curved, apex rounded (Figs. 2J, 5E). Pronotum DD longer than wide, with thick setae, mainly on cephalic margin (Figs. 2 A–F, 5A, B). Tergites slightly pubescent, without apparent tergal glands (Figs. 2A, B, D, 5A). Legs I and II not annulated, with thick setae. Tympanum on inner face of TI. TIII not annulated. Subapical spurs 4/4, with serrulation between and above them; inner distal subapical spur near upper apical; apical spurs 3/3, more developed on inner face; inner apical spurs: dorsal longest (iad), median slightly shorter (iam), ventral smaller (iav) (iad>iam>iav); outer apical spurs: median longest (oam), dorsal slightly shorter (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus III with double row of spines.

Male. Metanotum with two glandular projections whitish, rounded (Figs. 2D, E, 3 A–B, 5D). Male FWs short, reaching half of abdomen (Figs. 1A, 2A, 5A); right FW medium brown, pilose (Figs. 2A, C, 5 A–C); without specialized veins or areas for sound production and propagation; left FW membranous, transparent, lateral field

medium brown (Fig. 5D). Supra anal plate not constricted medially (Figs. 2H, 5H); distal margin without extended angles (Figs. 2H, 5H). Subgenital plate elongated, pubescent (Figs. 2I, 5G).

Male genitalia. Male genitalia bearing a pair of genital glands within pseudepiphallic sclerite, connected to tubular pseudepiphallic arms (Figs. 4 A–C, 6 A–C). Pseudepiphallus: pseudepiphallic sclerite transverse, (Figs. 4 A–C, 6 A–C); pseudepiphallic arms curved outwards (Figs. 4A, B, 6A, B); apex with opening duct, rounded. Rami elongated, connected to pseudepiphallic sclerite, reaching apex of ectophallic apodemes (Figs. 4A, 6A). Pseudepiphallic parameres (PsP) highly sclerotized (Figs. 4 A–C, 6 A–C); PsP2 with two pairs of distinct projections: one elongated, upcurved, lateral; second small, medial, semicircular, visible in dorsal view (Figs. 4A, 6A); PsP1 elongated (Figs. 4B, 6B). Ectophallic invagination. Ectophallic apodemes elongated, thin (Figs. 4A, 6A). Ectophallic fold sclerotized, surrounding apex of medio-posterior projection of endophallic sclerite (Figs. 4B, 6B). Endophallus. Endophallic sclerite large, flat (Figs. 4B, 6B); latero-posterior projections short; medio-posterior projection elongated (Figs. 4B, 6B). Endophallic apodeme paired, curved outwards, apex pointed (Figs. 4B, 6B).

Female. In comparison with other Luzarinae crickets, females of *Desutterella* Souza-Dias, Campos & de Mello **n. gen.** are almost same-sized as males—in the Aracambiae genera, frequently the females are larger than males. Head, pronotum, abdomen and legs with thick setae (Figs. 1B, 2B). Females FWs small, translucent, reaching half of first tergite (Figs. 2B, F). Supra anal plate pubescent, slightly constricted medially (Figs. 2K). Subgenital plate pubescent, small (Figs. 2L). **Female genitalia**: copulatory papilla small, basis rounded, apex pointed centrally (Figs. 3 D–F).

***Desutterella manauara* Souza-Dias, Campos & de Mello n. sp.**

Figures 1–4

<http://lsid.speciesfile.org/urn:lsid:Orthoptera.speciesfile.org:TaxonName:500285>

Type locality. Brazil, Amazonas State, municipality of Manaus, Reserva Florestal Adolpho Ducke (02°55'S, 59°58'W).

Etymology. The specific epithet is a gentilic adjective that refers to Manaus, type locality of this species.

Distribution. Amazon Forest, in Amazonas State, municipality of Manaus, Reserva Florestal Adolpho Ducke (Adolpho Ducke Forest Reserve), and in Pará State, municipality of Melgaço, Floresta Nacional de Caxiuanã (Caxiuanã National Forest), Estação Científica Ferreira Penna (Ferreira Penna Scientific Station).

Type material. Holotype, 8 males paratypes, 10 females paratypes. **Holotype**: male, with genitalia removed and kept with the specimen, labeled Manaus, AM [Amazonas], Brazil. Reserva 'Adolfo' Ducke. 2°55'47.07"S, 59°58'29.48"W. F.A.G. Mello & equipe // CNPq-SISBIOTA (MZSP). **Paratypes**: 6 males, 8 females, same data as the holotype (MZSP); 1 male, same data as the holotype, labeled "GRYLLO/MAN C2SUP (BOTU)"; 1 male, same data as the holotype, labeled PSD44 (BOTU); 1 female, same data as the holotype, labeled "GRYLLO/MAN H6J3X (BOTU)"; 1 female, same data as the holotype, labeled PSD45 (BOTU).

Diagnosis. Within the genus, *D. manauara* **n. sp.** can be recognized by the following characters: pseudepiphallic parameres (PsP) highly sclerotized; PsP2 with two pairs of distinct projections: one elongated, upcurved, second small, medial, semicircular, visible in dorsal view; PsP1 elongated, outer face of apex pointed, inner face rounded; ectophallic arc curved, below the median part of pseudepiphallic sclerite; ventral projections of the ectophallic invagination bent on the half of its extension, distal half and apex linked to the rest of the projection; ectophallic fold sclerotized, surrounding the apex of medio-posterior projection of endophallic sclerite.

Description. In addition to the characters of the genus:

Head. Occiput and vertex medium brown, almost uniform, with thick setae (Figs. 2 A–D). Fastigium wider than long, medium brown, with double row of thick setae, below vertex level and not separated from it by line or furrow (Figs. 2 A–D, G). Antennal scape longer than wide, scape and pedicel light brown; proximal antennomeres light brown, medial and distal medium brown (Figs. 2 A–D). Frons medium brown (Fig. 2G). In frontal view, gena dark brown (Fig. 2G). In lateral view, gena medium brown, not divided by stripe, with dark brown spots. Mandibles light to medium brown (Fig. 2G). Clypeus medium brown, center light brown; labrum greyish brown (Fig. 2G). Maxillary palpi elongated, joints 3–5 elongated, joint 4 longest; whitish, ventral half light brown (entirely light brown in some specimens); fifth joint whitish, apex light brown (medium brown in some specimens), curved, rounded (Figs. 1 A–B, 2J).



FIGURE 1. *Desutterella manauara* n. gen. n. sp. A, male habitus; B, female habitus.

Thorax. Pronotum DD longer than wide, borders medium to dark brown (except cephalic margin), with thick setae, mainly on cephalic margin (Figs. 2 A–F). DD cephalic margin slightly convex, DD caudal margin sub-straight, LL ventro-cephalic angle curved, ventral margin ascending, ventro-caudal angle gradually ascendant (Figs. 2 A–F). **Remarks.** The holotype lost the setae on pronotum DD.

Legs. Legs I and II light to medium brown, not annulated, pubescent, with thick setae (Figs. 1 A–B, 2 A–B). Tympanum on inner face of TI. TI and TII with two ventral spurs. TII with two ventral spurs, and one dorsal—the outer dorsal is absent. FIII basis inflated; outer face light to medium brown, with dark brown maculae, inner face with same pattern (Figs. 1 A–B). TIII light to medium brown, not annulated. Subapical spurs 4/4, with serrulation between and above them; inner distal subapical spur near upper apical; apical spurs 3/3, more developed on inner face; inner apical spurs: dorsal longest (iad), median slightly shorter (iam), ventral smaller (iav) (iad>iam>iav);

outer apical spurs: median longest (oam), dorsal slightly shorter (oad), ventral smaller (oav) (oam>oad>oav).
 Basitarsus III with double row of spines.

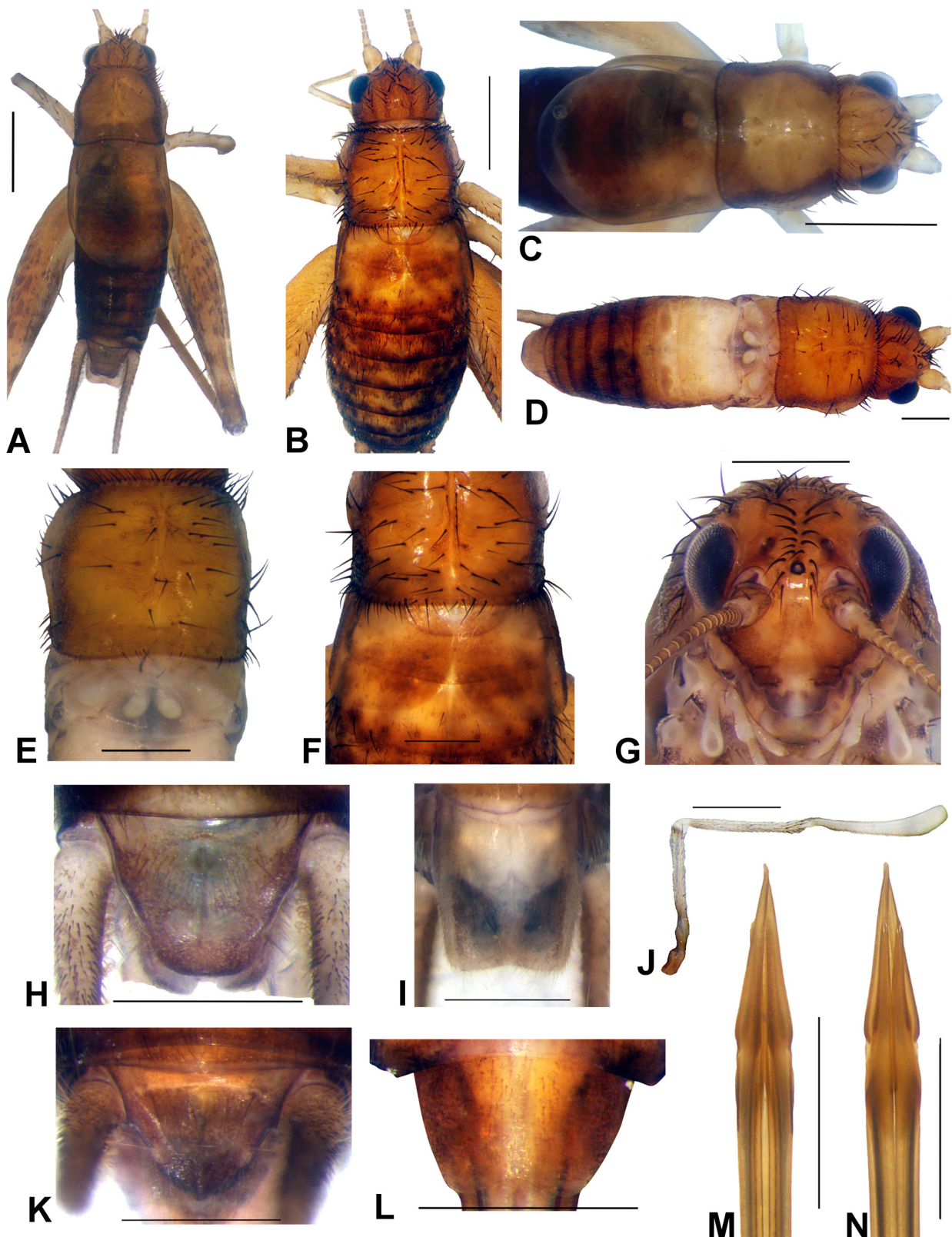


FIGURE 2. *Desutterella manauara* n. gen. n. sp. General morphology. A, male habitus, dorsal; B, female habitus, dorsal; C, male head, pronotum and FW, dorsal; D, male habitus, dorsal (FWs removed); E, male pronotum and metanotum, dorsal; F, female pronotum and FW, dorsal; G, male head, frontal; H, male supra anal plate; I, male subgenital plate; J, male maxillary palpus; K, female supra anal plate; L, female subgenital plate; M, ovipositor, dorsal; N, ovipositor, ventral. Scale bar: A, B, 2mm; C–N, 1 mm..

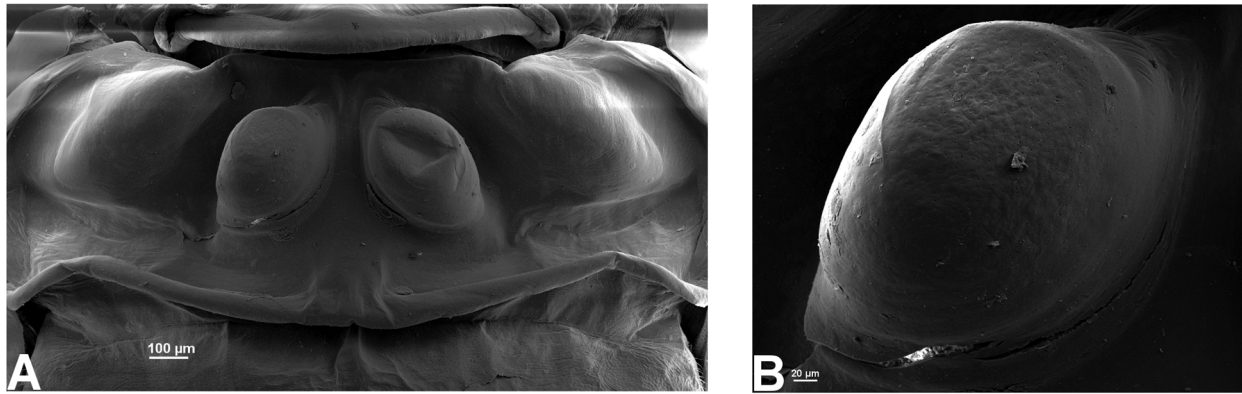


FIGURE 3. *Desutterella manauara* n. gen. n. sp. Male metanotum. A, SEM picture of male metanotum; B, metanotal projection in detail.

Abdomen. Tergites slightly pubescent, without tergal glands; dark brown, coloration almost uniform (Figs. 2A, D). Sternites light to medium brown. Cerci light to medium brown. Supra anal plate light to medium brown, not constricted medially; proximal margin slightly concave; distal margin straight, wide, without extended angles (Fig. 2H). Subgenital plate elongated, light brown, pubescent; proximal margin concave; median portion of distal margin convex, with short angles, resembling an open “w” (Fig. 2I).

Male. Metanotum with two projections whitish, rounded (Figs. 2 D–E, 3 A–B); metanotal projections glandular (Figs. 3A–B). Male FWs short, rounded, reaching half of abdomen (Figs. 1A, 2A); right FW medium brown, distal half with thick setae (Figs. 2A, C); apex light brown (Fig. 1A); stridulatory file vestigial (very reduced, almost indistinguishable); other specialized veins or areas for sound production and propagation absent; left FW membranous, transparent, lateral field medium brown, with sparse setae. **Male genitalia.** Male genitalia bearing a pair of genital glands within pseudepiphallic sclerite, connected to tubular pseudepiphallic arms (Figs. 4 A–C). **Pseudepiphallus:** pseudepiphallic sclerite transverse, with phallic glands connected to two dorsal pseudepiphallic arms tubular (Figs. 4 A–C); pseudepiphallic arms curved outwards (Figs. 4A, B); apex with opening duct, rounded. Rami elongated, connected to pseudepiphallic sclerite, reaching apex of ectophallic apodemes (Fig. 4A). Pseudepiphallic parameres (PsP) highly sclerotized (Figs. 4 A–C); PsP2 with two pairs of distinct projections: one elongated, upcurved; second small, medial, semicircular, visible in dorsal view (Fig. 4A); PsP1 elongated, outer face of apex pointed, inner face rounded (Fig. 4B, C). **Ectophallic invagination.** Ectophallic apodemes elongated, thin (Figs. 4A, B); ectophallic arc curved, below median part of pseudepiphallic sclerite (Figs. 4A, B); dorsal projections of ectophallic invagination absent; ventral projections bent on half of its extension, distal half and apex linked to rest of the projection (Fig. 4B). Ectophallic fold sclerotized, surrounding apex of medio-posterior projection of endophallic sclerite (Fig. 4B). **Endophallus.** Endophallic sclerite large, flat (Figs. 4A, B); latero-posterior projections short, pointed (Fig. 4B); medio-posterior projection elongated (Fig. 4B). Endophallic apodeme paired, curved outwards, apex pointed (Figs. 4A, B).

Female. General coloration: body medium to yellowish brown; head, pronotum, abdomen, and legs with thick setae (Figs. 1B, 2B); abdomen pubescent, medium brown with sparse maculae yellowish brown (Fig. 2B); legs, pronotum, and structures of head same colored as males. Females FWs yellowish brown, translucent, reaching half of first tergite (Figs. 2B, F); inner margins juxtaposed (Fig. 2F). Supra anal plate pubescent, medium brown, medially constricted; proximal margin slightly concave, distal rounded (Fig. 2K). Subgenital plate pubescent, small; proximal margin convex, distal margin medially convex, angles rounded (Fig. 2L). Apex of ovipositor as in Figs. 2M, N. **Female genitalia:** copulatory papilla small, basis rounded, apex pointed centrally, as in Figs. 4 D–F.

Measurements (mm). Males (n=10)—media (range): HW—1.87 (1.7–1.9); IOD—0.94 (0.8–1.1); PL—1.84 (1.7–1.9); AWP—1.80 (1.7–1.9); PWP—2.13 (1.9–2.3); PW—2.24 (2.1–2.2); FWL—3.07 (2.8–3.2); FWW—2.44 (2.2–2.5); LFIII—7.06 (6.7–7.6); WFIII—1.96 (1.8–2.1); LTIII—6.75 (6.3–7.5); LBt-III—2.11 (1.9–2.4).

Females (n=10): HW—2.11 (1.9–2.2); IOD—1.04 (0.9–1.1); PL—2.03 (1.8–2.1); AWP—2.05 (1.9–2.1); PWP—2.43 (2.1–2.6); PW—2.51 (2.2–2.7); LFIII—7.74 (6.6–8.5); WFIII—2.28 (1.9–2.4); LTIII—7.05 (6.1–7.5); LBt-III—1.99 (1.6–2.2); OL—7.50 (6.9–8.4).

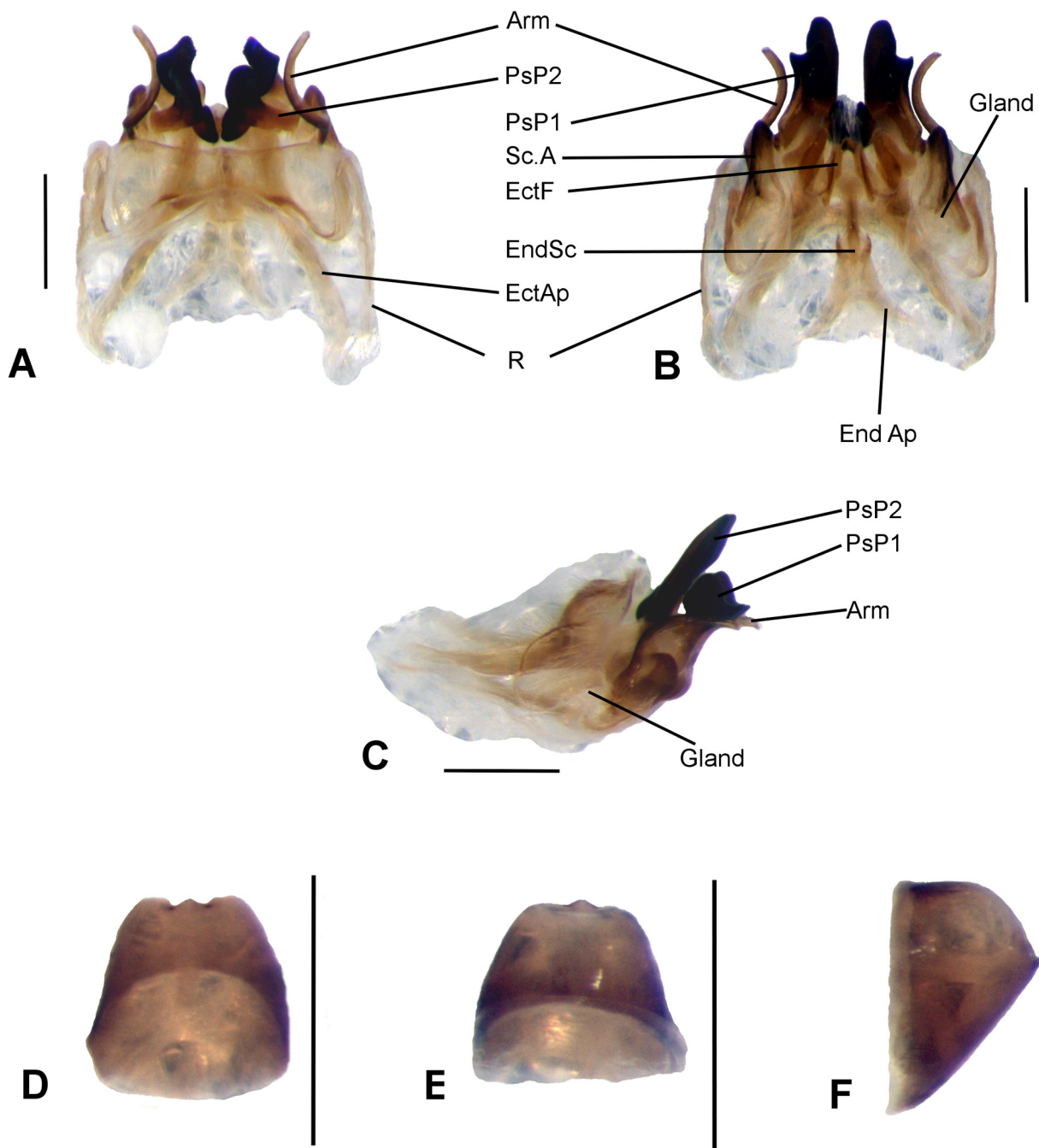


FIGURE 4. *Desutterella manauara* n. gen. n. sp. Male and female genitalia. Male genitalia in dorsal (A), ventral (B) and lateral (C) views. Female copulatory papilla in dorsal (D), ventral (E) and lateral (F) views. Conventions: Arm—pseudepiphallic arm; EctAp—ectophallic apodeme; EctF—ectophallic fold; EndAp—endophallic apodeme; EndSc—endophallic sclerite; Gland—phallic gland; PsP1—pseudepiphallic paramere 1; PsP2—pseudepiphallic paramere 2; R—ramus. Scale bar: 1mm.

***Desutterella colombiana* Souza-Dias n. sp.**

Figures 5–6

<http://lsid.speciesfile.org/urn:lsid:Orthoptera.speciesfile.org:TaxonName:500286>

Type locality. Colombia, Amazonas Department Leticia (4°7'49"S, 69°58'7"W).

Etymology. The specific epithet is a gentilic adjective that refers to Colombia, where this species can be found.

Type material. Holotype male. **Holotype:** Amazonas. Leticia. Km11 via Tarapaca. 26/10/02 alt. 170m. 6.sist.A. 091-059 (MZSP).

Diagnosis. General aspect similar to *D. manauara* n. sp., differing mainly in male genitalia characters. The phallic complex of *D. colombiana* Souza-Dias n. sp. is longer than in *D. manauara* Souza-Dias n. sp.; pseudepiphallallic parameres (PsP) highly sclerotized; PsP2 with two pairs of distinct projections: first projection elongated, upcurved, larger than in *D. manauara* n. sp.; second projection small, medial, semicircular, visible in dorsal view; PsP1 elongated, outer face of apex pointed, inner face broadly rounded; ectophallic arc straight, anterior to median part of pseudepiphallallic sclerite; ventral projections not bent, large, apex wide, curved outwards. Ectophallic fold sclerotized, longer than in *D. manauara* n. sp., surrounding apex of medio-posterior projection of endophallic sclerite.

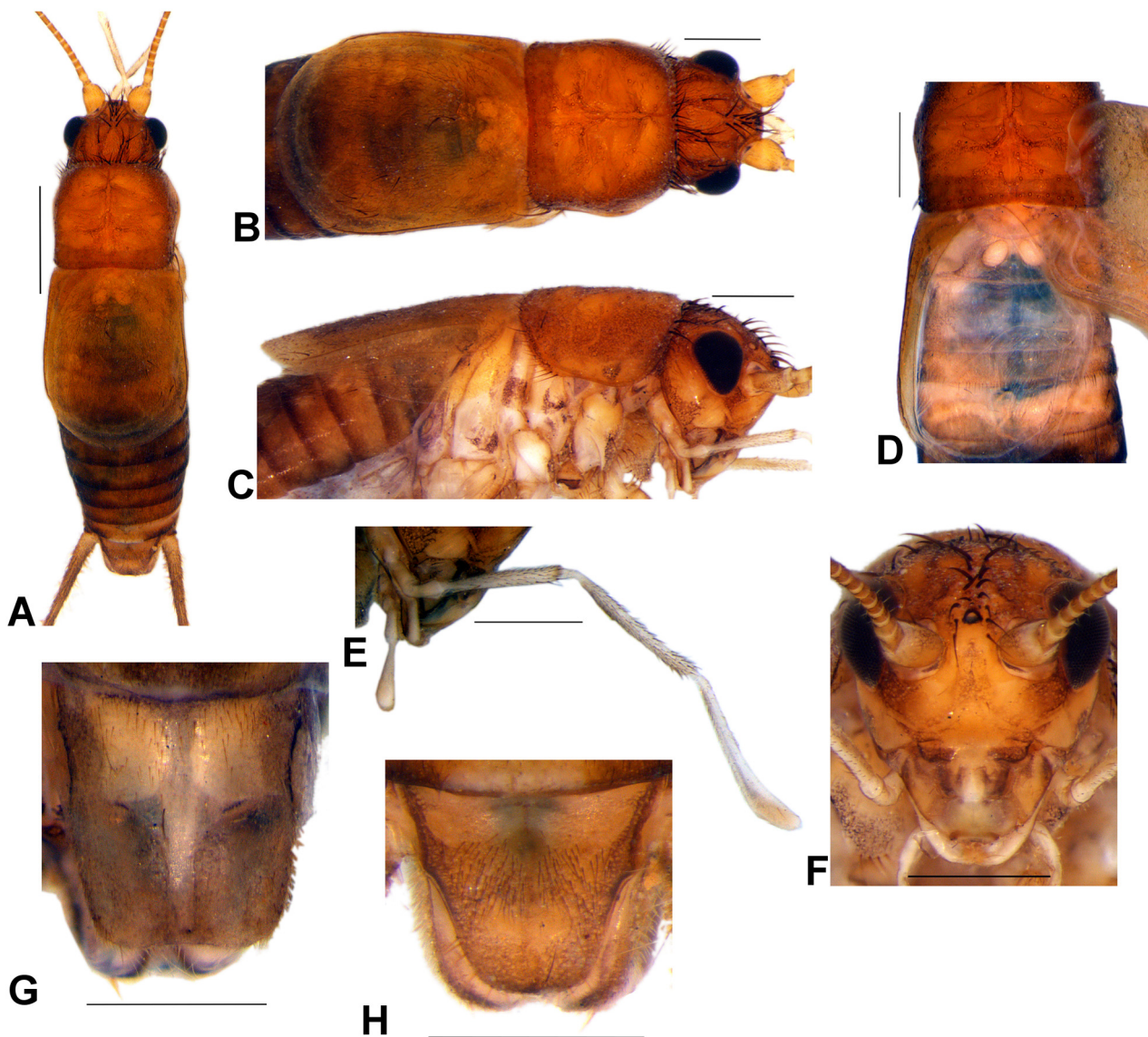


FIGURE 5. *Desutterella colombiana* n. gen. n. sp. General morphology. A, male habitus, dorsal; B, male head, pronotum and FW, dorsal; C, male head, pronotum and FW, lateral; D, male left FW, dorsal; E, male maxillary palpus; F, male head, frontal; G, male subgenital plate; H, male supra anal plate. Scale bar: A, 2mm; B–H, 1 mm.

Description. In addition to the characters of the genus:

Head. Occiput and vertex coloration medium brown, almost uniform, with thick setae (Figs. 5 A–C). Fastigium wider than long, medium brown, with double row of thick setae, below vertex level and not separated from it by line or furrow (Figs. 5 A–C, F). Antennal scape longer than wide, scape and pedicel yellowish brown (Figs. 5A, B); proximal antennomeres yellowish brown, medial and distal medium brown (Figs. 5A, F). Frons yellowish brown (Fig. 5F). In frontal view, gena medium brown (Fig. 5F). In lateral view, gena yellowish brown

divided by incomplete dark brown stripe, with dark brown spots (Fig. 5C). Mandibles light to medium brown (Fig. 5F). Clypeus medium brown, central portion light brown; labrum greyish brown (Fig. 5F). Maxillary palpi elongated, joints 3–5 elongated, pilose, joint 5 longest (Fig. 5E); whitish, ventral half light brown (Fig. 5E); fifth joint whitish, apex light brown, curved, rounded (Fig. 5E).

Thorax. Pronotum DD longer than wide, medium brown, borders darker than central part, cephalic margin with bristles (Figs. 5 A–C). DD cephalic margin slightly convex, DD caudal margin sub-straight, LL ventro-cephalic angle curved, ventro-caudal angle oblique (Figs. 5 A–C).

Legs. Legs I and II light to medium brown, not annulated, pubescent, with thick setae. Tympanum on inner face of TI. TI and TII with two ventral spurs. TII with two ventral spurs, one dorsal—the outer dorsal is absent. FIII basis inflated; outer face light to medium brown, with dark brown maculae inner face with same pattern. TIII light to medium brown, not annulated. Subapical spurs 4/4, with serrulation between and above them; inner distal subapical spur near upper apical; apical spurs 3/3, more developed on inner face; inner apical spurs: dorsal longest (iad), median slightly shorter (iam), ventral smaller (iav) (iad>iam>iav); outer apical spurs: median longest (oam), dorsal slightly shorter (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus III with double row of spines.

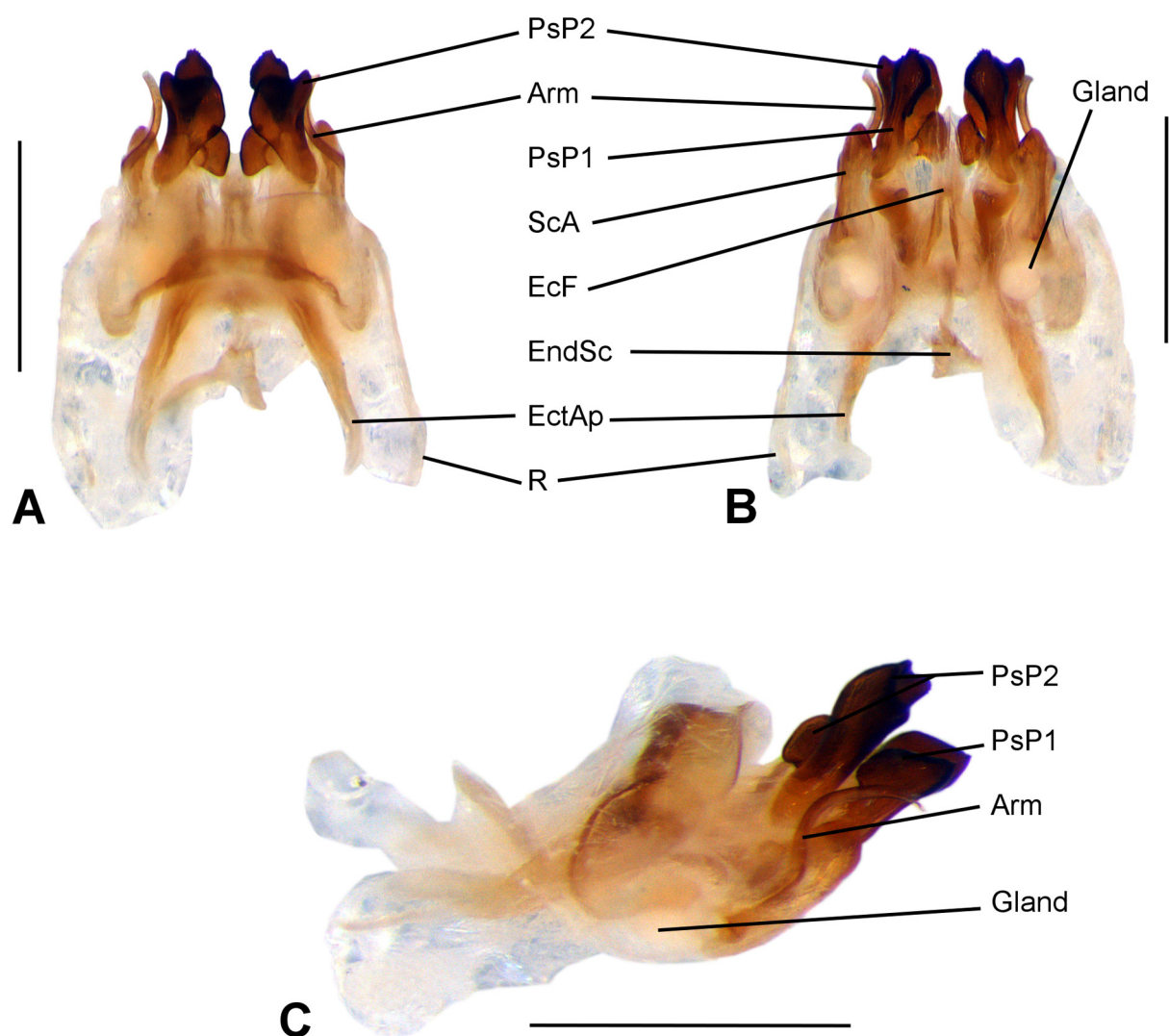
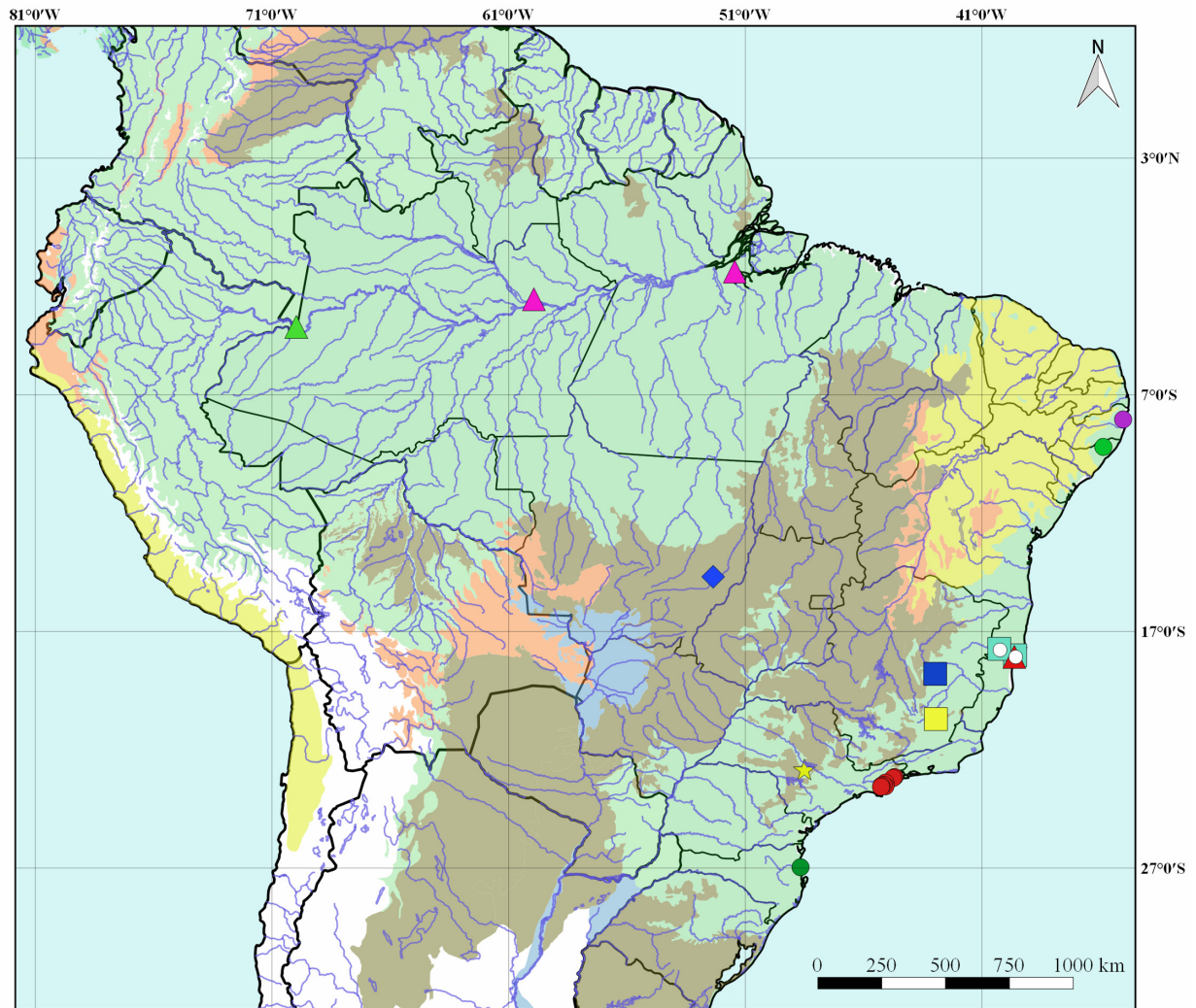


FIGURE 6. *Desutterella colombiana* n. gen. n. sp. Male and female genitalia. Male genitalia in dorsal (A), ventral (B) and lateral (C) views. Conventions: Arm—pseudepiphallic arm; EctAp—ectophallic apodeme; EctF—ectophallic fold; EndAp—endophallic apodeme; EndSc—endophallic sclerite; Gland—phallic gland; PsP1—pseudepiphallic paramere 1; PsP2—pseudepiphallic paramere 2; R—ramus. Scale bar: 1mm.



- | | |
|---|---|
| ● <i>Aracamby balneatorius</i> | ■ Tropical and Subtropical Moist Broadleaf Forests |
| ○ <i>Aracamby mucuriensis</i> | ■ Tropical and Subtropical Dry Broadleaf Forests |
| ● <i>Aracamby pinguabensis</i> | ■ Tropical and Subtropical Grasslands, Savannas, and Shrublands |
| ▲ <i>Cacuzia bahiana</i> | ■ Flooded Grasslands and Savannas |
| ▲ <i>Desutterella colombiana n. gen. n. sp.</i> | ■ Deserts and Xeric Shrublands |
| ▲ <i>Desutterella manauara n. gen. n. sp.</i> | |
| ■ <i>Izecksohniella aimore</i> | |
| ■ <i>Izecksohniella almeidai</i> | |
| ■ <i>Izecksohniella puri</i> | |
| ● <i>Marcgraviella christiana</i> | |
| ● <i>Marcgraviella muriciensis</i> | |
| ◆ <i>Marliella titai</i> | |
| ★ <i>Vanzoliniella sambophila</i> | |

FIGURE 7. Distribution map of the Aracambiae group.

Abdomen. Tergites slightly pubescent, without tergal glands (Fig. 5A); dark brown, coloration almost uniform (Fig. 5A). Sternites light to medium brown. Cerci medium brown. Supra anal plate light to medium brown, pubescent, not constricted medially (Fig. 5H); proximal margin slightly concave, distal margin straight, wide, without extended angles (Fig. 5H). Subgenital plate elongated, light brown, pubescent (Fig. 5G); proximal margin concave, median portion of distal margin almost straight (Fig. 5G).

Male. Male FWs short, rounded, reaching half of abdomen (Fig. 5A); right FW medium brown (Figs. 5A, B), pilose, apex light brown; without specialized veins or areas for sound production and propagation; left FW membranous, translucent, lateral field medium brown, with sparse setae (Fig. 5D). **Male genitalia.** Male genitalia longer than *D. manauara n. sp.*, bearing a pair of genital glands within pseudepiphallic sclerite, connected to tubular pseudepiphallic arms (Figs. 6 A–C). **Pseudepiphallus:** pseudepiphallic sclerite transverse, with phallic glands connected to two dorsal pseudepiphallic arms tubular (Figs. 6 A–C); pseudepiphallic arms curved outwards (Figs. 6A, B); apex with opening duct, rounded. Rami elongated, reaching apex of ectophallic apodemes (Fig. 6A). Pseudepiphallic parameres (PsP) highly sclerotized (Figs. 6 A–C); PsP2 with two pairs of distinct projections: one elongated, upcurved, larger than in *D. manauara n. sp.*, second small, medial, semicircular, visible in dorsal view (Fig. 6A); PsP1 elongated, outer face of apex pointed, inner face broadly rounded (Figs. 6B, C). **Ectophallic invagination.** Ectophallic apodemes elongated, thin (Figs. 6A, B); ectophallic arc straight, anterior to median part of pseudepiphallic sclerite (Fig. 6A); dorsal projections of ectophallic invagination absent; ventral projections large, apex wide, curved outwards (Fig. 6B). Ectophallic fold sclerotized, longer than in *D. manauara n. sp.*, surrounding the apex of medio-posterior projection of endophallic sclerite (Figs. 6A, B). **Endophallus.** Endophallic sclerite large, flat (Figs. 6A, B); latero-posterior projections shorter than in *D. manauara n. sp.*; medio-posterior projection elongated (Figs. 6A, B). Endophallic apodeme paired, curved outwards.

Female. Unknown.

Measurements (mm). Males (n=1): HW—2.12 ; IOD—1.06; PL—2.1; AWP—2.12; PWP—2.49; PW—2.6; FWL—3.29; FWW—2.56; LFIII—7.6; WFIII—2.1; LTIII—7; LBt-III—2.1.

Discussion

The specimens of *Desutterella manauara n. gen. n. sp.* and *D. colombiana n. gen. n. sp.* were compared to the entire Aracambiae group genera described until now.

The main character of the Aracambiae group is the occurrence of phallic glands within the pseudepiphallic sclerite and the development of tubular pseudepiphallic arms associated with these glands. Regarding the morphology, the Aracambiae group shares a small and slender body, great enlargement of the legs (mainly the posterior) in comparison to the body size, and the reduction of male FWs. The stridulatory vein is present in *Aracambya*, *Cacruzia*, *Vanzoliniella*, and *Marcgraviella*, and absent in *Izecksohniella* and *Marliella*. For *Desutterella n. gen.* the stridulatory vein was observed in two species described here, but only in *D. manauara n. sp.* could the male FWs be removed. In this species the stridulatory vein is visible, but the file teeth are few, sparse, very small, and irregular, and probably non-functional for acoustic communication. The absence of information about the acoustic behavior, and the fact that probably all Aracambiae lost their calling song and produce only courtship songs (de Mello & Cezar dos Reis, 1994; de Mello, 2007), makes this a promising group for bioacoustic studies, both ecologically and evolutionarily.

The pseudepiphallic arms in *Desutterella n. gen.* are lateral and curved outwards. In *Aracambya* the pseudepiphallic arms are lateral, but straight, with bifid apex—in *Desutterella n. gen.* the apex is simple, rounded. In the remaining genera of the Aracambiae group the pseudepiphallic arms are curved, crossing each other on the median part of the pseudepiphallic sclerite (Souza-Dias & Desutter-Grandcolas, 2014).

An important feature of this group is the growth and great sclerotization of the pseudepiphallic parameres. These structures are the main clasper devices in the male genitalia of crickets, and in Luzarinae they present a wide variation (Souza-Dias & Desutter-Grandcolas, 2014; Souza-Dias *et al.*, 2015). In the Aracambiae, the pseudepiphallic parameres are large, highly variable, well sclerotized, and may have inflatable areas, as in *Cacruzia*, *Izecksohniella*, *Marcgraviella* and *Marliella* (Souza-Dias & Desutter-Grandcolas, 2014). In *Desutterella n. gen.* the pseudepiphallic parameres have unique morphology, with three distinct parts, with the pseudepiphallic paramere 2 divided in two lobes (Fig.), a condition that was not observed in the remaining Aracambiae, as well as in other Luzarinae genera, as *Eidmanacris* Chopard, *Endecous* Saussure, *Guabamima* de Mello, *Pizacris* Souza-Dias & Desutter-Grandcolas, and *Sishiniheia* de Mello & Souza-Dias. This character may be a putative synapomorphy for this genus. For more information on the pseudepiphallic parameres of phalangopsid crickets see Souza-Dias *et al.* (2015) and references therein.

Furthermore, another important feature of the male genitalia, in Luzarinae, concerns the phallic glands.

Although internal spherical formations are reported for several genera, only in Aracambiae are these structures developed as phallic glands associated with pseudepiphallid tubular arms (Souza-Dias & Desutter-Grandcolas, 2014). However, the role of these glands in the sexual behavior of this group of crickets is not fully understood (de Mello, 2007; Souza-Dias & Desutter-Grandcolas, 2014). In Aracambiae, de Mello (2007) reported the phallic glands releasing secretions that act as mating plugs in *Aracamby*, hardening the flexible membrane of the female copulatory papilla and preventing the females from copulating more than once. In the remaining genera and species of Aracambiae the role of the phallic glands, as well as the nature of its products, are still unknown, although de Mello (2007) proposed some hypothesis. Regarding the Luzarinae genera with spherical formations not associated with tubular pseudepiphallid arms, the role of these formations is also unknown—the truly glandular nature of these formations are not confirmed for the majority of the genera. For more information on phallic glands of Luzarinae, mainly in the Aracambiae, see de Mello (2007) and Souza-Dias & Desutter-Grandcolas (2014), and references therein.

Another significant feature of the sexual behavior of crickets is the presence of glands on the dorsum of the metanotum of adult males, and their role in male's courtship, producing secretions that attract conspecific females and act as a nuptial gift (Hancock, 1905; Walker & Gurney, 1967; Prado & Fontanetti, 2005; Prado, 2006; de Mello, 2007; Gwynne, 2008). The morphology of the metanotal glands varies among the Luzarinae, and the composition of its secretions remains unknown. Currently, only a few Luzarinae species had their metanotal glands studied under a morphological framework through SEM analysis (Lopes-Andrade & Sperber, 2001; Prado & Fontanetti, 2005; Souza-Dias *et al.*, 2016; Campos *et al.*, 2017). These authors have observed the metanotal glands associated with metanotal structures, as projections, humps, fossa, and bristles. The diversity of the morphological pattern of these structures in Grylloidea, mainly in Luzarinae, highlights the need for a more detailed study of the metanotal glands, including histological and histochemical techniques.

Metanotal structures are observed in all Aracambiae genera, and here we present morphological evidence for the glandular nature of the male metanotum in *Desutterella* **n. gen.** In this new genus the metanotal structures are composed of a pair of rounded projections with tiny pores throughout their surface (Fig. 3B). This pattern was observed in the closely related genus *Vanzoliniella* sp. (Aracambiae) by Lopes-Andrade & Sperber (2001), and in the more distant *Sishiniheia diamantina* de Mello & Souza-Dias, 2016 by Souza-Dias *et al.* (2016). However, in *Vanzoliniella* sp. of Lopes-Andrade & Sperber (2001) the projections and the meso and metanotum present many glandular pores, while in *Desutterella* **n. gen.** the pores are tiny and more concentrated on the projections, sparse on the mesonotum, and absent on the metanotum.

Metanotal glands also provide useful morphological characters for taxonomic and systematic studies, as demonstrated in taxonomic studies of *Eidmanacris* (Desutter-Grandcolas, 1995; Prado & Fontanetti, 2005; Campos *et al.*, 2017). Thus, in order to propose homologies and a new set of morphological characters for phylogenetic studies, a large comparative study on the morphology of the metanotal structures in Luzarinae is also needed.

Desutterella **n. gen.** is the 7th genus of Aracambiae, and the first described for the Amazon. Figure 7 shows the distribution of the Aracambiae in Brazil, and of *Desutterella* **n. gen.** in the Amazon. Although *Desutterella* **n. gen.** crickets are small in size, they are widely distributed, from the state of Pará in Brazil to the Amazonas Department in Colombia (1,123 kilometers). The species *D. manauara* **n. sp.** also presents a wide distribution, from Manaus, Amazonas State to Caxiuanã, Pará State, in Brazil (950 kilometers). This wide distribution may indicate that more species of *Desutterella* **n. gen.** could be found with further studies in areas of the Amazon, with great potential for discovering new taxa in the Amazon.

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