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Authors: Souza-Dias, Pedro G. B., De Campos, Lucas Denadai, and Nihei, Silvio Shigueo

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# Two new species of *Eidmanacris* (Orthoptera: Grylloidea: Phalangopsidae) from the Atlantic forest of São Paulo State, Brazil

Pedro G. B. Souza-Dias<sup>1</sup>, Lucas Denadai De Campos, and Silvio Shigueo Nihei

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## Abstract

Two new cricket species, *Eidmanacris caipira* **sp. nov.** and *Eidmanacris suassunai* **sp. nov.** (Orthoptera: Phalangopsidae), are described from the Atlantic Forest of São Paulo State, Brazil, using morphological and genital characters from males and females. The habit of *Eidmanacris*, distribution of its species, and the presence of reduced forewings in females are discussed. The type material is deposited in Museu de Zoologia da Universidade de São Paulo (MZSP).

Key Words: Luzarinae, Neotropical region, new species, taxonomy

## Resumo

Duas novas espécies de grilos, *Eidmanacris caipira* **sp. nov.** e *Eidmanacris suassunai* **sp. nov.** (Orthoptera: Phalangopsidae), são descritas da Floresta Atlântica do estado de São Paulo, Brasil, usando caracteres genitais e de morfologia, de machos e fêmeas. O hábito de *Eidmanacris*, a distribuição de suas espécies e a presença de asas reduzidas em fêmeas são discutidas. O material tipo está depositado no Museu de Zoologia da Universidade de São Paulo (MZSP).

Palavras Chave: Luzarinae, novas espécies, Taxonomia, região Neotropical

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*Eidmaniella* was described by Chopard in 1938 for the species *E. larvaeformis*, from Mendes, Rio de Janeiro State, Brazil. Later, Chopard (1956) renamed *Eidmaniella* (preocc. Keler, 1938) to *Eidmanacris*, which was posteriorly included in his Orthopterorum Catalogus (Chopard, 1968).

A second species, *E. bicornis* Mesa & Mello, 1985, was described from specimens collected in the entrance of a sandstone cave in Itirapina, São Paulo State (Brazil).

Desutter-Grandcolas (1995) revised the genus and described 7 new species: *E. dissimilis* (Poços de Caldas, Minas Gerais State, Brazil); *E. fusca* (Aratinga, Rio Grande do Sul State, Brazil); *E. meridionalis* (Nova Teutônia, Santa Catarina State, Brazil); *E. multispinosa* (Santa Teresa, Espírito Santo State, Brazil); *E. paramarmorata* (Amambay, Paraguay); *E. septentrionalis* (Linhares, Espírito Santo State, Brazil); *E. tridentata* (Santa Teresa, Espírito Santo State, Brazil), and transferred *Phalangopsis marmoratus* Bruner, 1916 (Bolivia) to *Eidmanacris*, proposing the new combination *E. paramarmorata* (Bruner, 1916).

Mesa et al. (1998) described 2 new species, *E. bidentata* (Viçosa, Minas Gerais State, Brazil) and *E. corumbatai* (Cerrado de Corumbatai, São Paulo State, Brazil), synonymized *E. bicornis* with *Arachnomimus alboannulatus* Piza, 1960, and proposed the new combination *E. alboannulata* (Piza, 1960).

Recently, *E. longa* Gorochoy, 2014 was described from Santa Cruz, Bolivia, thus totaling now 13 species known in the genus. *Eidmanacris* is distributed in the Atlantic Forest and Cerrado domains, extending

throughout the south and southeast Brazil, and reaching Bolivia (*E. marmorata* and *E. longa*), and Paraguay (*E. paramarmorata*) (Fig. 8).

Desutter-Grandcolas (1995) presented a discussion on the origin of *Eidmanacris* and proposed 5 putative synapomorphies that support its monophyly: the formation of a median projection and a double row of bristles on the glandular metanotum of males, originating from the anterior border of metanotum (1), and the structure of the cylindrical vertical formations, with open apex (2); the inflated aspect of pronotum, resulting from the swelling of dorsal disc and elevation of lateral lobes (3), and features of the male genitalia structure: pseudepiphallallic arms (referred to as “*épine latérale*”) clearly separated from genitalia, and rather mobile (4), and the ectophallallic arc shifted to the back of the genitalia, reduced and opened. Nevertheless, no phylogenetic analysis was proposed for *Eidmanacris* and its species so far.

The males of *Eidmanacris* species are easily distinguishable using male genitalia characters, unlike the females, which are quite similar (Mesa et al. 1998).

Prado (2006) studied the reproductive behavior of the species *E. corumbatai*, however, the study of sexual behavior of more species is required to reliably propose and code behavioral characters for phylogenetic purposes.

The aim of the present paper is to describe 2 new *Eidmanacris* species from the Atlantic Forest of São Paulo State, Brazil, based on morphological and genital characters, what increases the number of known species to 15.

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Laboratory of Systematics and Biogeography of Insects, Department of Zoology, Institute of Biosciences, University of São Paulo, 05508-900, São Paulo, Brazil

\*Corresponding author; E-mail: pedrogdias@gmail.com

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## Materials and Methods

The specimens were collected at night in the trails of Morro do Diabo State Park, located in the municipality of Teodoro Sampaio, west of São Paulo State (22° 27' to 22° 40' S, 52° 10' to 52° 22' W; 260–599.5 m asl). With 33.845 ha, the park is the largest remnant in São Paulo State (Santos et al, 2009) of Mesophytic Semideciduous Forest, one of the subtypes within the Atlantic Forest Domain (sensu Ab'Saber 1977).

The male habitus photographs (Fig. 1) were taken using a Canon EOS Rebel XSI digital camera. The photographs of general morphology were taken with specimens immersed in 85% ethanol, using a Leica MZ-16 stereomicroscope attached with a DFC-420 video camera. The same procedure was used for the genitalia photographs. The software Leica Application Suite LAS v4.0 was used to capture the images and the digital image processing software Helicon Focus 5.3 was used to stack them. Subsequently, the images were edited in the software Adobe Photoshop CS5.

The male phallic complexes were removed and treated with an aqueous solution of 10% KOH for 24 h to remove muscular tissues, then neutralized with 5% acetic acid, washed and cleared with water, and then stored in 85% ethanol. The female genitalia were removed and stored in 85% ethanol. The genitalia terminology follows Desutter (1987) and Desutter-Grandcolas (2003).

The specimens were examined, described and compared using a Leica MZ-9.5 stereomicroscope. Specimens of *E. caipira* **sp. nov.** and

*E. suassunai* **sp. nov.** were compared to *E. alboannulata*, *E. corumbatai* and *E. dissimilis*, which are the geographically nearest species. The drawings were made under a camera lucida attached to a Leica MZ-9.5 stereomicroscope. Subsequently, the drawings were scanned and then vectored and edited in Adobe Illustrator CS6.

Figures of this paper are reproduced in color in the online supplementary material available at <http://purl.fcla.edu/fcla/entomologist/browse>. The figures in the supplementary document are referred to in the text below as Suppl. Figs. 1A-B, Suppl. Figs. 2A-P, Suppl. Figs. 3A-F, Suppl. Figs. 5 A-P, and Suppl. Figs 6 A-F.

## ABBREVIATIONS

**Male Genitalia.** Arc, ectophallic arc; Arm, pseudepiphallallic arm; D. P. Ec., dorsal projection of ectophallic invagination; Ect. Ap., ectophallic apodeme; Ect. F., ectophallic fold; End.Ap., endophallic apodeme; End.Cr., endophallic crest; End. Sc., endophallic sclerite; L. P. Ps., lateral projection of pseudepiphallus; M. S., membranous sphere; Ps. Ap., pseudepiphallallic apodeme; PsM, median part of pseudepiphallus; PsP1, pseudepiphallallic paramere 1; PsP2, pseudepiphallallic paramere 2; V. P. Ec., ventral projection of ectophallic invagination; V. P. Ps., ventral projection of pseudepiphallus.

**General Morphology.** I, II, III, anterior, median, posterior (leg, tarsomere); DD, LL, dorsal disc, lateral lobe of pronotum; FW, forewing; F, femur; T, tibia; apical spurs of TIII: iad, iam, iav, inner apical dorsal, medium and ventral; oad, oam, oav, outer apical dorsal, medium and ventral.

**Repositories.** MZSP, Museu de Zoologia da Universidade de São Paulo, São Paulo.

**Measurements** (in mm). awpron, anterior width of pronotum; Hw, head width; iod, intra-ocular distance; LFIII, length of hind femur; LFW, forewing length; Lpron, pronotum length; Ltars1-III, length of basitarsomere III; LTIII, length of hind tibia; OL, ovipositor length; pwpron, posterior width of pronotum; wFIII, width of hind femur; wFW, median forewing width; wpron, pronotum width.

## Results

### *Eidmanacris suassunai* **sp. nov.**

(Figs. 1A; 2 A–P; 3A–F; 4A–C, and Suppl. Figs. 1A, 2 A–P, 3 A–F)

### TYPE LOCALITY

Brazil, São Paulo State, Teodoro Sampaio municipality, Morro do Diabo State Park.

### TYPE MATERIAL

**HOLOTYPE:** BRAZIL, São Paulo State, Teodoro Sampaio, Parque Estadual Morro do Diabo, 11-14.xi.2012, Dias, P. G. B. S.; Dios, R. col., 1 male. **Allotype:** same locality as the holotype, 1 female. **PARATYPES:** same locality as the holotype, 10 males and 10 females.

### MATERIAL EXAMINED

Holotype, Allotype, Paratypes. Non-type material: 5 males, 7 females, same data as holotype and allotype.

### ETYMOLOGY

Species is named in honor of the Brazilian writer Ariano Suassuna (1927–2014).

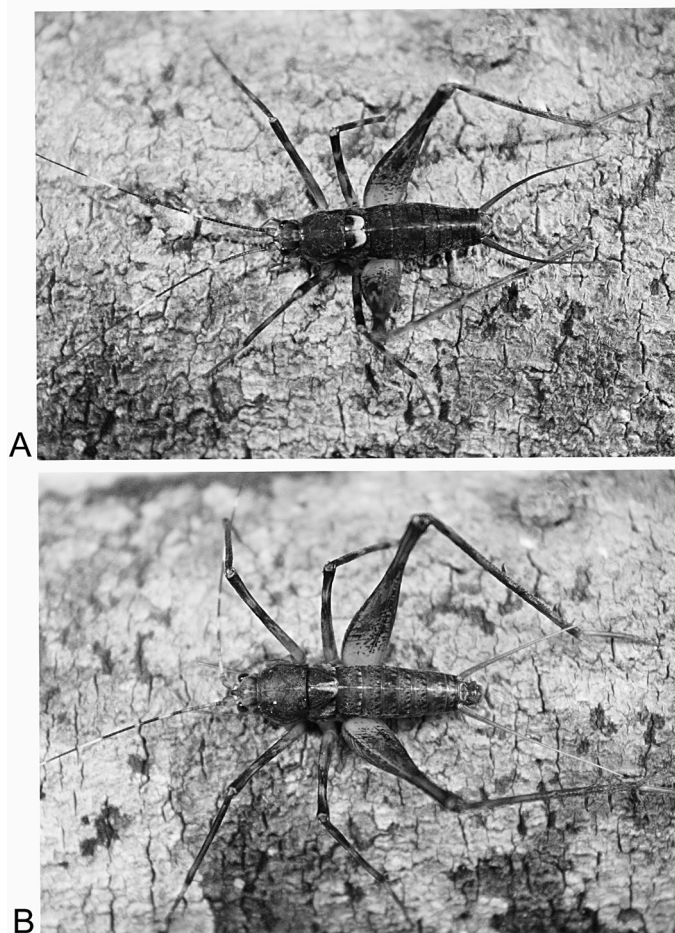
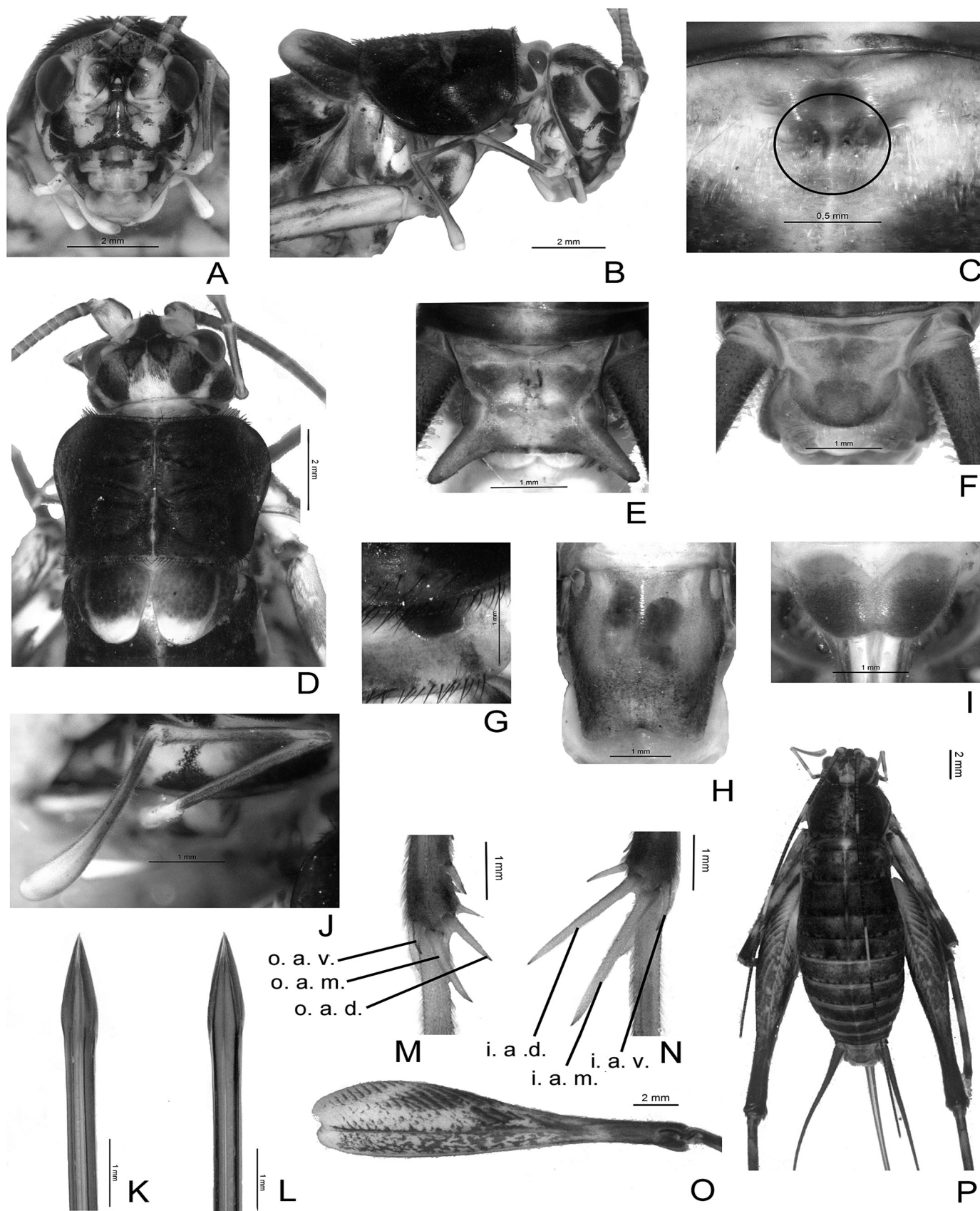
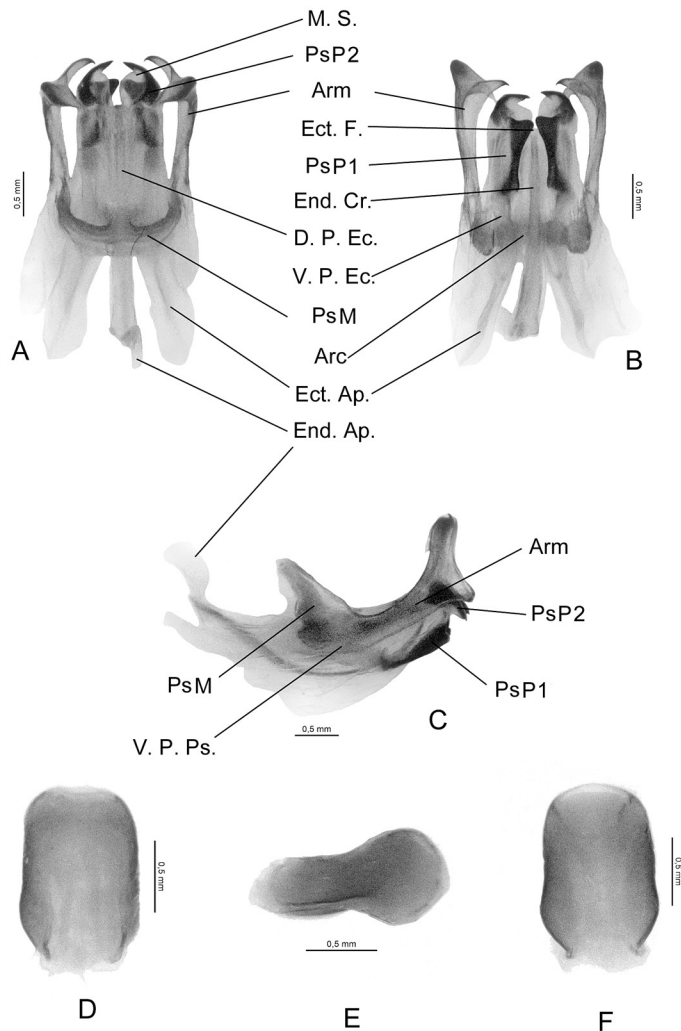


Fig. 1. Life habit. A- *Eidmanacris suassunai* **sp. nov.**; B- *Eidmanacris caipira* **sp. nov.**





**Fig. 2.** *E. suassunai* sp. nov. A- male, head frontal view; B- male, head and pronotum lateral view; C- male, metanotal region; D- male, head and pronotum dorsal view; E- male supra-anal plate; F- female supra-anal plate; G- female wing; H- male, subgenital plate; I- female, subgenital plate; J- male maxillary palpi; K- ovipositor dorsal; L- ovipositor ventral; M- outer apical spurs (o. a. d.- outer apical dorsal; o. a. m.- outer apical median; o. a. v.- outer apical ventral); N- inner apical spurs (i. a. d.- inner apical dorsal; i. a. m.- inner apical medium; i. a. v.- inner apical ventral); O- male femur; P- female, dorsal.



**Fig. 3.** *E. suassunai* sp. nov. Male phallic complex: **A**-dorsal view; **B**- ventral view; **C**-lateral view. Female copulatory papilla: **D**- dorsal view; **E**- lateral view; **F**- ventral view.

Ariano wrote a famous Brazilian play entitled “O Auto da Compadecida”; the main character in this play is named “João Grilo” – “grilo” is the Brazilian common name for cricket.

## DIAGNOSIS

Medium sized body, general coloration of body, head, and legs dark brown, marbled. Male FW short, rounded, dark brown to medium brown towards the internal border, covering metanotal gland area but not exceeding posterior margin of metanotum; apex pale yellow connected to a single vertical vein that divide external part of FW as a lateral field; internal margins touching each other.

## DESCRIPTION, MALE

Medium sized body, general coloration dark brown, marbled. **Head.** Dark to medium brown with pale yellow maculae (Fig. 2A, B, D). Occiput and vertex in different shades of medium brown, with sparse bristles and a light yellow triangular spot in the middle and 2 diagonal lateral yellow stripes (Fig. 2D). Fastigium dark brown, with fine bristles, mainly on its lateral part (Fig. 2D); longer than wide, slightly narrowed toward the apex, and narrower than scape (Fig. 2D); below vertex level,

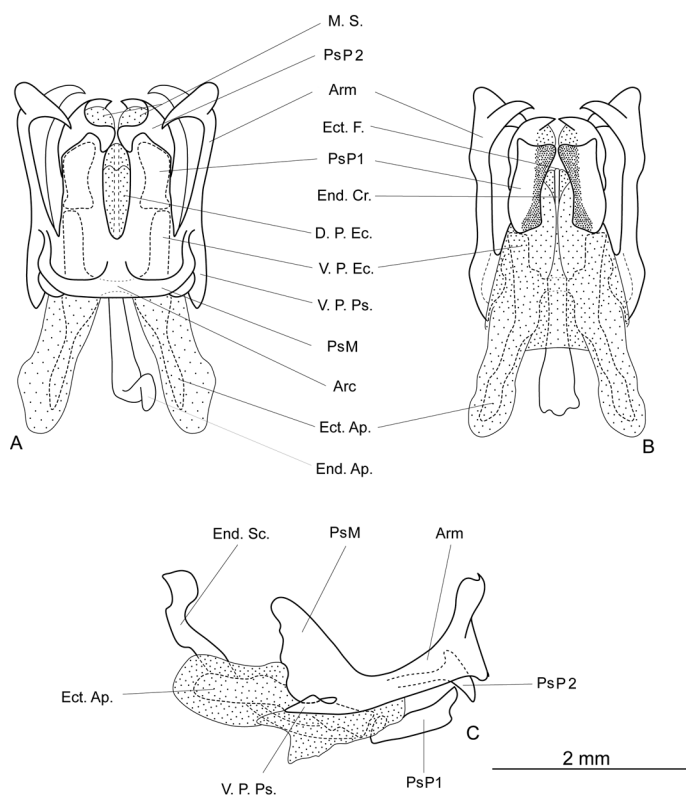
from which it is not separated by a transverse furrow (Fig. 2B). Three ocelli present, well developed (Figs. 2A, B, D); eye with unpigmented area on supero-internal angle (Fig. 2A, D). Maxillary palpus long and thin, specially joints 3 to 5 (Figs. 2B, J); joint 5 the longest (Fig. 2J); joints 3, 4 and 5 medium to light brown at apex, joint 4 the smallest (Figs. 2B, J); apex of joint 5 curved, light brown becoming whitish on distal portion (Fig. 2J). In frontal view, frons with dark brown central stripe between 2 yellowish brown bands going from basis of each antennal scape to the darker frontoclypeal suture, and small dark brown spot in this stripe, below the scapes (Fig. 2A). In frontal view, gena dark brown, with thick yellowish brown transverse stripe (Fig. 2A). In lateral view, gena dark brown on anterior and posterior portion, with central pale yellow maculae divided by a dark brown stripe (Fig. 2B). Frontoclypeal suture dark brown; upper margin of clypeus with central medium brown band between light brown and dark brown bands on each side, lower portion whitish; labrum whitish, its apex light brown (Fig. 2A). Mandible dark brown, with internal margin light brown. Antennal scape whitish, dark brown on inner face (Fig. 2A); antennomeres medium brown with lighter antennomeres.

**Thorax.** Pronotum DD as long as wide, dark brown, inflated, slightly pubescent, divided by thin, light brown vertical line; DD cephalic margin concave and caudal one almost straight (Fig. 2D); ventro-cephalic angle broadly rounded, its ventral margin gradually ascendant caudad to the more rounded ventro-caudal angle (Fig. 2B). Male FW short, rounded, dark brown to medium brown towards internal border, covering metanotal gland area but not exceeding posterior margin of metanotum; apex pale yellow connected to single vertical vein that divide external part of FW as a lateral field (Figs. 2B, D); internal margins touch each other. Posterior margin of metanotum with glandular thickening; metanotal gland present, cluster of bristles seems to form a unique cluster on median region, the projections short (Fig. 2C).

**Legs.** FI and FII yellowish, annulated with brown. TI and II dark brown annulated with yellowish brown; TI with 2 equal-sized apical spurs; TII with 2 inner apical spurs and an outer one, smaller. FIII light brown with several dark brown stripes and spots on inner face, apical part dark brown; outer face light brown with medium brown maculae and stripes, apical part medium brown (Fig. 2O); TIII medium brown annulated with light brown; TIII subapical spurs 4/4; serrulation between and above subapical spurs, except between inner apical dorsal (iad) and first subapical (is1); apical spurs 3/3, more developed on inner face; inner apical spurs (Fig. 2N): median one longer (iam), dorsal sub-equal in length (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs (Fig. 2M): median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III dark yellow, with 2 rows of small spines.

**Abdomen:** Dark brown, marbled, pubescent, divided by thick sagittal light yellow line (Fig. 2A). Supra anal plate medium brown on anterior portion and distal projections, and yellowish brown on center; anterior margin concave on median part, lateral ones constricted on median portion and very extended distal projections (Fig. 2E); posterior margin almost straight. Subgenital plate longer than wide, slightly pubescent, light brown with lateral borders dark brown; anterior margin straight (Fig. 2H); posterior margin with slightly extended distal projections, concave on median part (Fig. 2H).

**Phallic complex.** Pseudepiphallus: median part of pseudepiphallus sclerotized, curved inwards (Figs. 3A, 4A); pseudepiphallal arms sclerotized, straight, hard and broadly bifid at apex (Figs. 3A, B; 4A, B); apex of pseudepiphallal arms smooth, projections same-sized, pointed and sharpened (Figs. 3A, B; 4A, B); pseudepiphallal arms narrower than in *E. caipira* n. sp. in lateral view (Figs. 3C; 4C); lateral projection absent; basal extension of pseudepiphallus short (visible in lateral view) (Figs. 3B). PsP2 short and bifid, with membranous sphere embedded on its



**Fig. 4.** *E. suassunai* **sp. nov.** Male phallic complex: **A**-dorsal view; **B**- ventral view; **C**-lateral view.

concavity (Figs. 3A, 4A); PsP1 elongated, well developed, inner face more sclerotized than outer, laterally connected with PsP2 (Figs. 3B, 4B). Ectophallus: ventro-distal projection shorter than in *E. caipira* **sp. nov.** (Figs. 3B, 4B); ectophallic apodeme elongated and narrow (Figs. 3A, B; 4A, B); ectophallic arc short, located right below median part of pseudepiphallus (Fig. 4A); dorso-distal projections slightly sclerotized and connected near the basis PsP2; ectophallic fold distal, with small sclerotization at apex (Figs. 3B, 4B). Endophallus: endophallic sclerite curved inwards, indistinct, forming a well-developed and dorsally curved endophallic crest (Figs. 3A, B; 4A, B); endophallic apodeme curved, unique, and robust (Figs. 3A, B; 4A, B).

#### DESCRIPTION, FEMALE

Larger than male, general coloration similar (Fig. 2P); presence of very small FW, not reaching metanotum border (Fig. 2G); supra anal plate yellowish brown, with anterior margin slightly concave, lateral ones constricted on median portion and posterior rounded, with thick bristles (Fig. 2F); subgenital plate small, posterior margin bilobate (Fig. 2I); ovipositor as in figs. 2K, L.

*Copulatory papilla*: longer than wide, dorso-ventrally flattened on first ¼, laterally flattened on posterior ¼ (Figs. 3D–F).

#### MEASUREMENTS (MM)

Males (n = 10): Hw,  $3.25 \pm 0.13$  (3.07 – 3.39); iod,  $1.64 \pm 0.16$  (1.45 – 1.91); Lpron,  $3.87 \pm 0.15$  (3.54 – 4.05); awpron,  $5.06 \pm 0.20$  (4.72 – 5.38); pwpron,  $4.14 \pm 0.13$  (4 – 4.35); wpron,  $3.65 \pm 0.19$  (3.45 – 3.9); LFW,  $1.92 \pm 0.15$  (1.7 – 2.13); wFW,  $1.88 \pm 0.14$  (1.51 – 1.98); LFIII, 16.69

$\pm 0.88$  (16.23 – 17.35); wFIII,  $3.44 \pm 0.23$  (3.03 – 3.7); LTIII,  $18.05 \pm 0.99$  (15.51 – 19.11); Ltarsl-III,  $5.32 \pm 0.32$  (4.74 – 5.74).

Females (n = 10): Hw,  $3.67 \pm 0.18$  (3.4 – 3.93); iod,  $1.74 \pm 0.10$  (1.61 – 1.89); Lpron,  $3.85 \pm 0.21$  (3.41 – 4.16); awpron,  $5.32 \pm 0.20$  (5.01 – 5.59); pwpron,  $4.45 \pm 0.29$  (4.01 – 4.77); wpron,  $3.92 \pm 0.15$  (3.75 – 4.2); LFIII,  $17.2 \pm 0.60$  (16.41 – 18.09); wFIII,  $3.96 \pm 0.57$  (3.83 – 4.12); LTIII,  $18.63 \pm 0.28$  (17.76 – 19.66); Ltarsl-III,  $5.46 \pm 0.28$  (4.89 – 5.75); OL,  $17.53 \pm 0.78$  (16.52 – 18.46).

#### *Eidmanacris caipira* **sp. nov.**

(Figs. 1B, 5 A–P, 6A–F, 7A–C, and Suppl. Figs. 1B, 5 A–P, 6 A–F)

#### TYPE LOCALITY

Brazil, São Paulo State, Teodoro Sampaio municipality, Morro do Diabo State Park.

#### TYPE MATERIAL

**HOLOTYPE**: BRAZIL, São Paulo State, Teodoro Sampaio, Parque Estadual Morro do Diabo, 11-14.xi.2012, Dias, P. G. B. S.; Dios, R. col., 1 male. **Allotype**: same locality as the holotype, 1 female. **PARATYPES**: same locality as the holotype, 2 males and 3 females.

#### MATERIAL EXAMINED

Holotype, Allotype and Paratypes.

#### ETYMOLOGY

“Caipira” is a Brazilian common name originated from Tupi language (probably *ka’a pora*, which means “forest inhabitant”). Caipira is a term used to refer to people who live in the countryside, generally villages and small cities, of Brazil, mainly in the states of São Paulo, Paraná, Minas Gerais and Goiás.

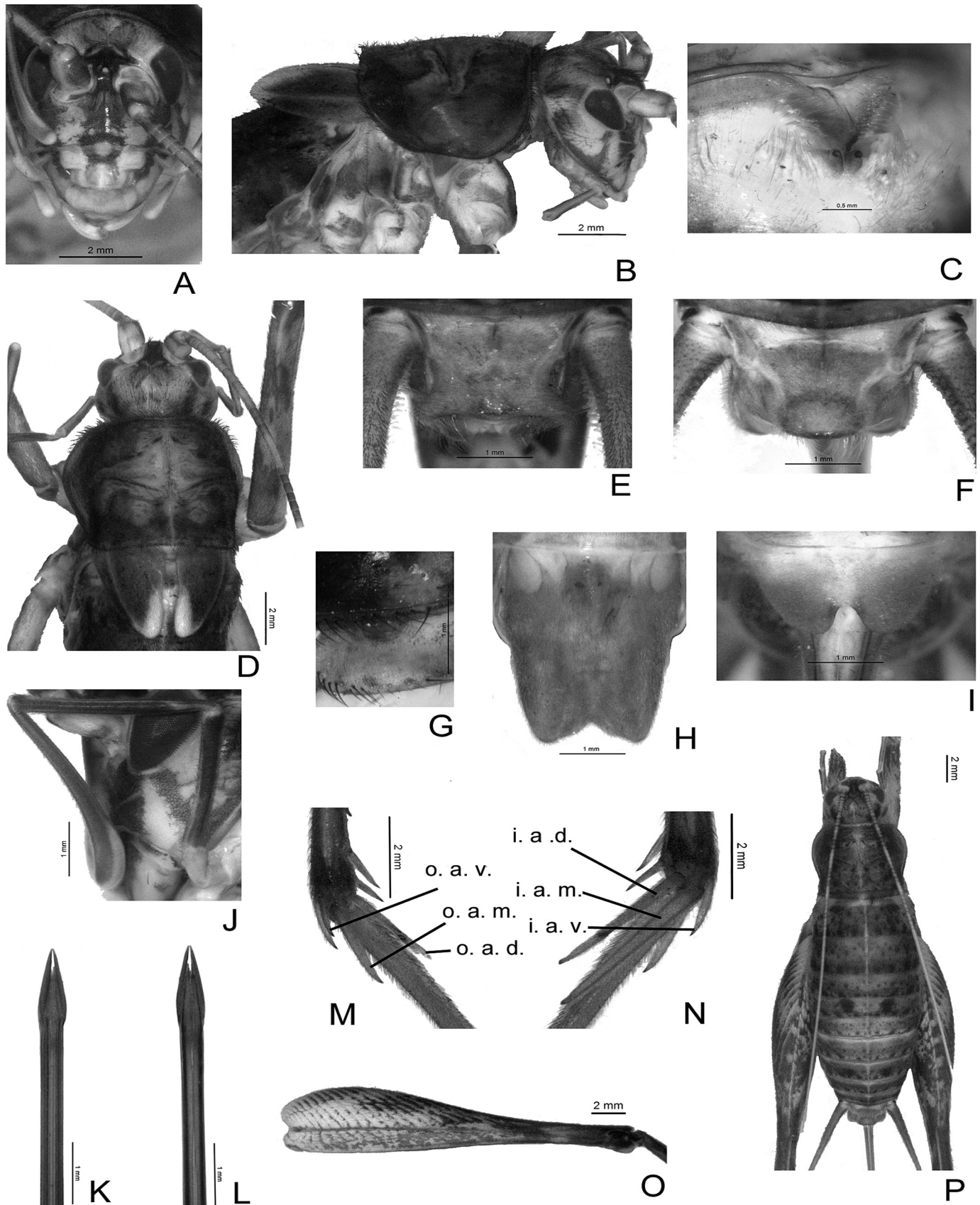
#### DIAGNOSIS

Species large, general coloration of body, head, and legs reddish brown, marbled with dark brown spots. Male FW short, but longer than in *E. suassunai* **sp. nov.**, triangular, with different shades of reddish brown, covering metanotal gland area and exceeding the posterior margin of metanotum; posterior part of internal margin and apex pale yellow connected to a single vertical vein that divide the external part of FW as a lateral field; internal margins separated.

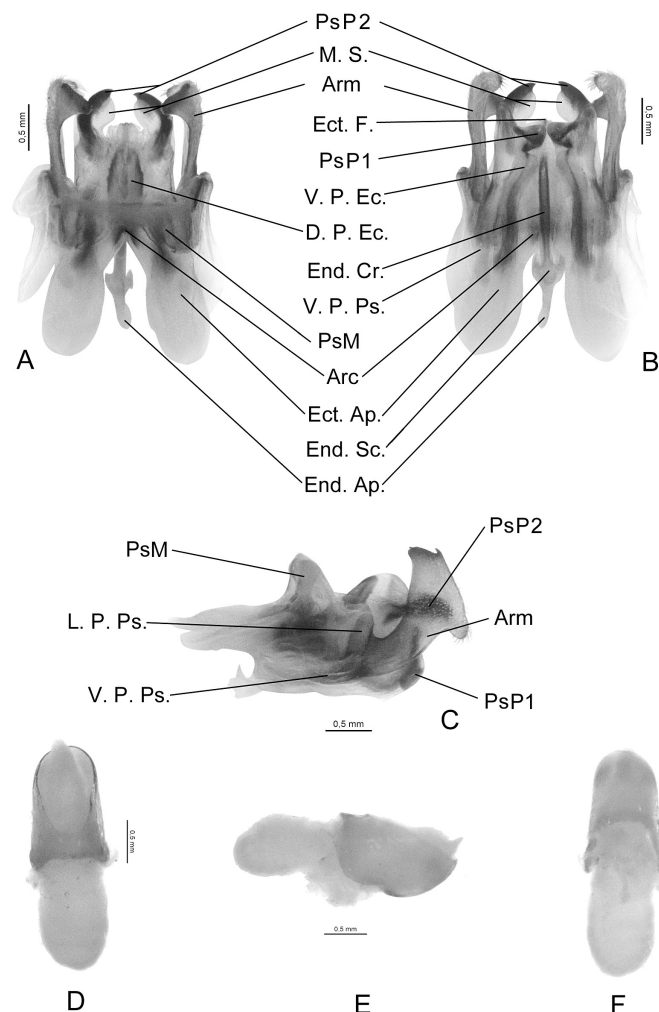
#### DESCRIPTION, MALE

Body large, general coloration reddish brown, marbled with dark brown spots (Fig. 5B). *Head*. Dorsum pubescent, yellowish brown with reddish brown maculae and spots (Fig. 5A, B, D); occiput yellowish brown, with sparse dark brown spots and one reddish dark brown band going from the occiput to the margin of each eye (Fig. 5D); vertex yellowish brown with two medium brown stripes, surrounded by reddish dark brown thick stripes, and descending towards the fastigium (Fig. 5A, D). Fastigium dark brown, with fine bristles (Fig. 5 B, D); longer than wide, slightly narrowed toward the apex, and narrower than scape (Fig. 5D); below vertex level, from which it is not separated by a transverse furrow (Fig. 5B). Three circular large ocelli present (Figs. 5A, B, D); eyes with unpigmented area on supero-internal angle (Fig. 5A, D). Maxillary palpi long and thin, specially joints 3 to 5 (Figs. 5J); joints 4 and 5 the longest, same sized (Fig. 5J); joints 3, 4 and 5 dark





**Fig. 5.** *E. caipira* sp. nov. A- male, head frontal view; B- male, head and pronotum lateral view; C- male, metanotal region; D- male, head and pronotum dorsal view; E- male supra-anal plate; F- female supra-anal plate; G- female wing; H- male, subgenital plate; I- female, subgenital plate; J- male maxillary palpi; K- ovipositor dorsal; L- ovipositor ventral; M- outer apical spurs (o. a. d.- outer apical dorsal; o. a. m.- outer apical median; o. a. v.- outer apical ventral); N- inner apical spurs (i. a. d.- inner apical dorsal; i. a. m.- inner apical medium; i. a. v.- inner apical ventral); O- male femur; P- female, dorsal.



**Fig. 6.** *E. caipira* sp. nov. Male phallic complex: **A**-dorsal view; **B**-ventral view; **C**-lateral view. Female copulatory papilla: **D**-dorsal view; **E**-lateral view; **F**-ventral view.

reddish brown, joint 3 the smallest (Figs. 5J); apex of 5 joint curved, dark reddish brown, apex whitish (Fig. 5J). In frontal view, frons with a reddish brown central stripe between two yellowish brown bands going from the basis of each antennal scape to frontoclypeal suture, with sparse small reddish brown spots in this stripe, below the scapes (Fig. 5A). In lateral view, gena light brown, divided by a diagonal reddish dark brown stripe that goes to the posterior part, and ascends towards the top of head, with several thick dark stripes (Fig. 5B). Frontoclypeal suture light to medium brown; upper margin of clypeus whitish, with a central semi-circular reddish dark brown band, lower portion whitish; labrum whitish, its apex light brown (Fig. 5A). Mandibles pale yellow, with internal margin dark brown (Fig. 5A). Antennal scape whitish, reddish brown on inner face (Fig. 5A); antennomeres medium brown with light antennomeres.

**Thorax.** Pronotum DD as long as wide, reddish brown on the borders and yellowish brown in the center, inflated, slightly pubescent, divided by a thin, medium brown vertical line (Fig. 5D); DD cephalic margin slightly concave and caudal slightly convex (Fig. 5D); lateral lobes reddish brown, ventro-cephalic angle broadly rounded, its ventral margin gradually ascendant caudad to more rounded ventro-caudal angle (Fig. 5B). Male FW short, but longer than in *E. suassunai* sp. nov., triangular, with different shades of reddish brown, covering

metanotal gland area and exceeding the posterior margin of metanotum; posterior part of internal margin and apex pale yellow connected to single vertical vein that divide external part of FW as a lateral field (Figs. 5B, D); internal margins separated. Posterior margin of metanotum with glandular thickening; metanotal gland present, cluster of bristles separated in median region, projections higher than in *E. suassunai* sp. nov. (Fig. 5C). **Legs.** FI and FII yellowish, annulated with medium brown; TI and II reddish brown annulated with yellowish brown; TI with two same-sized apical spurs; TII with two inner apical spurs and one outer, same-sized; FIII light brown with several dark and reddish brown stripes and spots on inner face, apical part dark brown; outer face light brown with medium brown maculae and several diagonal stripes, apical part medium brown (Fig. 5O); TIII dark brown annulated with medium brown; TIII subapical spurs 4/4; serrulation between and above subapical spurs, except between inner apical dorsal (iad) and first subapical (is1); apical spurs 3/3, more developed on inner face; inner apical spurs (Fig. 5N): median one longer (iam), dorsal sub-equal in length (iad), ventral smaller (iav) (iam>iad>iav); outer apical spurs (Fig. 5M): median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III dark yellow, with two row of spines.

**Abdomen.** Reddish brown, marbled, pubescent, divided by thick sagittal light brown line (Fig. 5B). Supra anal plate reddish brown, posterior portion pubescent; anterior margin slightly concave, lateral ones constricted on median portion and not so elongated distal projections (Fig. 5E); posterior margin almost concave, rounded (Fig. 5E). Subgenital plate longer than wide, slightly pubescent, medium brown with lateral borders yellowish brown; anterior margin almost straight (Fig. 5H); posterior margin with distal projections and very concave on median part (Fig. 5H).

**Phallic complex:** Pseudepiphallus: median part of pseudepiphallus less esclerotized than pseudepiphallic arms (Figs. 6A, 7A); pseudepiphallic arms esclerotized, straight, hard and broadly bifid at apex (Figs. 6A, B; 7A, B); apex of pseudepiphallic arms with several hard bristles, projections same-sized, broadly rounded (Figs. 6A, B; 7A, B); dorsal projection of pseudepiphallic arms bearing a small spine on apex, and other one larger on dorsum (Figs. 7A, C); pseudepiphallic arms laterally widened, mainly in apex, curved, pubescent, with several sparse thick bristles on outer face, tuft of bristles on ventral part, and two spines on dorsal part (Figs. 6C, 7C); lateral projection present (Figs. 6C, 7C); basal extension of pseudepiphallus longer than in *E. suassunai* sp. nov. (Figs. 6B, 7A–C). PsP2 curved and pointed, with membranous sphere below apex (Figs. 6A, 7A); PsP1 small and laterally curved, internally connected with PsP2 by membranous bridge (Figs. 6B, 7B). Ectophallus: ventro-distal projection weakly sclerotized and longer than in *E. suassunai* sp. nov. (Figs. 6B, 7B); ectophallic apodeme short and robust, weakly sclerotized (Figs. 6A, B; 7A, B); ectophallic arc short, located right below median part of pseudepiphallus (Fig. 4A); dorso-distal projections sclerotized and connected on median part of phallic complex, between basis of PsP2 and median part of pseudepiphallic sclerite (Figs. 6A, 7A); ectophallic fold distal, with small sclerotization on apex (Figs. 6B, 7B). Endophallus: endophallic sclerite elongated (Figs. 36, B; 7A, B); endophallic apodeme well developed, crest-shaped (Figs. 6A, B; 7A, B).

## DESCRIPTION, FEMALE

Larger than male, general coloration similar (Fig. 5P); presence of very small FW, not reaching metanotum border (Fig. 5G) and smaller than in *E. suassunai* sp. nov.; supra anal plate pale yellow, with anterior margin slightly concave, lateral ones constricted on median portion and posterior rounded, with thick bristles (Fig. 5F); subgenital plate reddish brown, small, posterior margin bilobate (Fig. 5I); ovipositor as in Figs. 5K, L.



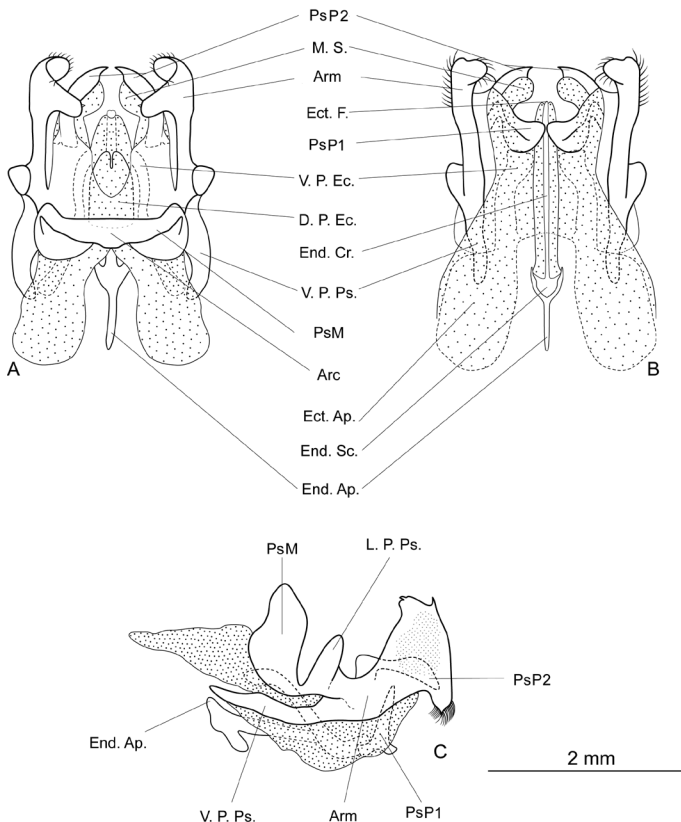


Fig. 7. *E. caipira* sp. nov. Male phallic complex: A-dorsal view; B- ventral view; C-lateral view.

**Copulatory papilla:** longer than wide, cylindrical, with a concavity on posterior margin that occupies  $\frac{3}{4}$  of dorsal portion and other that occupies proximal third on ventral face (Figs. 3D–F).

#### MEASUREMENTS (MM)

Males ( $n = 3$ ): Hw,  $4.02 \pm 0.17$  (3.91 – 4.22); iod,  $2.14 \pm 0.06$  (2.10 – 2.21); Lpron,  $5.10 \pm 0.28$  (4.90 – 5.42); awpron,  $4.75 \pm 0.23$  (4.5 – 4.95); pwpron,  $5.19 \pm 0.19$  (5.02 – 5.39); wpron,  $6.57 \pm 0.27$  (6.26 – 6.75); LFW,  $3.14 \pm 0.30$  (2.81 – 3.39); wFW,  $2.24 \pm 0.16$  (2.08 – 2.40); LFIII,  $21.45 \pm 0.35$  (21.05 – 21.70); wFIII,  $4.48 \pm 0.09$  (4.38 – 4.57); LTIII,  $23.07 \pm 1.12$  (22.14 – 24.33); Ltarsl-III,  $6.49 \pm 0.35$  (6.10 – 6.79).

Females ( $n = 4$ ): Hw,  $4.11 \pm 0.45$  (3.55 – 4.63); iod,  $2.06 \pm 0.08$  (1.98 – 2.16); Lpron,  $4.77 \pm 0.67$  (4.1 – 5.49); awpron,  $4.46 \pm 0.23$  (4.35 – 4.8); pwpron,  $5.36 \pm 0.07$  (5.27 – 5.45); wpron,  $6.09 \pm 0.19$  (5.99 – 6.38); LFIII,  $20.52 \pm 0.93$  (19.56 – 21.76); wFIII,  $4.61 \pm 0.13$  (4.51 – 4.79); LTIII,  $20.86 \pm 1.07$  (19.79 – 22.17); Ltarsl-III,  $5.43 \pm 0.19$  (5.23 – 5.61); OL,  $15.49 \pm 0.78$  (14.29 – 15.38).

#### Discussion

The genus *Eidmanacris* has a wide distribution, with species recorded from Brazil, Bolivia and Paraguay (Mesa & Mello 1985; Desutter-Grandcolas 1995; Mesa et al. 1998; Gorochoy, 2014). In Brazil, it occurs in 2 large biomes, the Atlantic Forest and Cerrado (Fig. 8). Its species are found in forests, even secondary forests and open areas, associated to the litter or natural cavities, as burrows, bounds, dead trees on ground level, rock gullies and crevices. The habit of the genus is defined as straminicolous (active in the litter) and cavicolous (takes refuge in natural cavities) (Desutter-Grandcolas 1995).

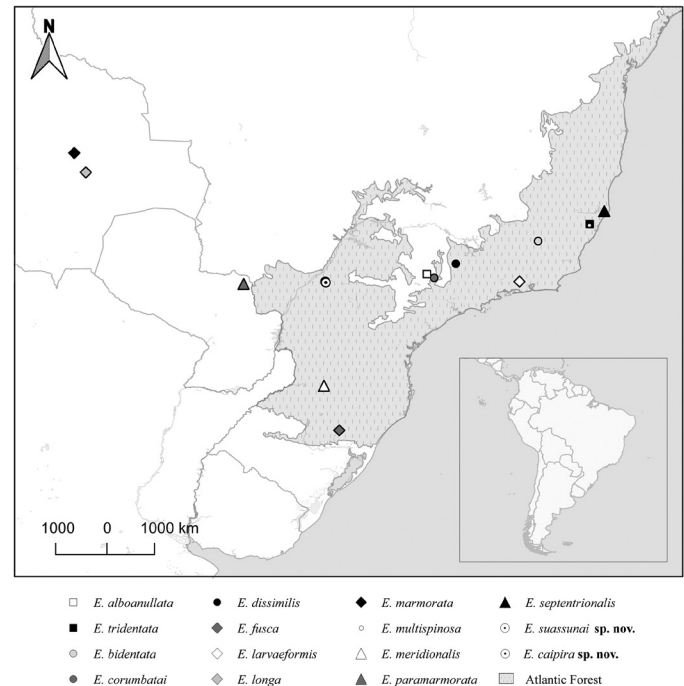


Fig. 8. South America map with *Eidmanacris* species distribution (only type locality), including the new species.

*Eidmanacris* are also found in caves, and together with *Bambuina* de Mello, Horta & Bolfarini, 2013, *Endecous* Saussure, 1878, and *Strinatia* Chopard, 1970, comprises the Luzarinae genera that occur inside caves in Brazil (de Mello et al. 2013). Although *Endecous* can colonize the interior of caves in all the Brazilian territory and has at least one troglotic species (Souza-Dias et al. 2014), *Eidmanacris* species are found in the entrance and the surroundings of the cavities. Mesa & de Mello (1985) reported that individuals of *E. alboannulata* found in the entrance of the cave “Caverna da Toca” (Itirapina, São Paulo State) were not found beyond 50 m inside the cavity. In that cave, *Endecous itatibensis* Rehn, 1918 are also found. In some caves, individuals of *Eidmanacris* were observed only in the entrance, while the interior were occupied by *Endecous* individuals (Bolfarini & Souza-Dias, personal observation).

The distribution of *Eidmanacris* species is shown in Fig. 8. In the Atlantic Forest of Espírito Santo State, *E. tridentata* and *E. multispinosa* are sympatric and known from its type locality, Santa Lucia Reserve, Santa Teresa municipality. *Eidmanacris septentrionalis* is found 100km north from the type locality of *E. tridentata* and *E. multispinosa* and reaches the south of Bahia State. In São Paulo State, although described originally from different localities, *E. alboannulata* and *E. corumbata* are probably sympatric and are found in a transition zone between the Atlantic Forest and Cerrado. *Eidmanacris caipira* sp. nov. and *E. suassunai* sp. nov. are also sympatric. Thus, the distributional pattern of *Eidmanacris* species has an interesting and valuable potential to further biogeographical analyses, although more field works are necessary in order to increase and improve the distributional data of the genus.

Desutter-Grandcolas (1995) described the male metanotal glands of *Eidmanacris* and discussed their importance to the taxonomy of the genus. These structures are present in all species, except *E. fusca* and *E. tridentata*. According to the author, the metanotum of males bears 2 large plates covered with short bristles, a median projection and 2 cone-shaped formations. This was considered a putative synapomor-

phy and was recognized as the main character to delimitate species, together with characters of male genitalia.

Prado & Fontanetti (2005) published a comparative study on the morphology of metanotal glands, using scanning electronic microscope analysis, of 5 species of *Eidmanacris*: *E. alboannulata*, *E. corumbatai*, *E. dissimilis*, *E. larvaeformis*, and an undescribed species, referred to as *Eidmanacris* sp. According to their observation, the metanotal glands of the studied species show a general pattern, comprised by 2 median projections and a cluster of bristles located immediately ahead of the projections. Moreover, the study pointed out that the arrangement of structures is species-specific, confirming thus its importance in the taxonomy of the genus.

The metanotal gland of *Eidmanacris* was also analyzed in a behavioral framework by Prado (2006), focusing on the species *E. corumbatai*. Since this gland works as a nuptial gift, releasing secretions directed to females through the open apex of the median projections, this structure plays an important role in the reproductive behavior of *Eidmanacris*. To date in this genus, a description of the sexual behavior of only *E. corumbatai* has been published. De Mello (2007) reported the occurrence and effect of mating plugs on the reproductive behavior of an undescribed species from Southern Brazil that lacks metanotal glands; this species' males produce a modified spermatophore, which acts as a mating plug.

In all the descriptions of *Eidmanacris* species, including the revision of the genus provided by Desutter-Grandcolas (1995), the females are reported to be apterous. Indeed Figs. 2G/Suppl. 2G and 5G/Suppl. 5G show the very reduced female forewings of the species *E. suassunai* sp. nov. and *E. caipira* sp. nov., respectively; detailed observations of topotypes of the species occurring in Brazil have revealed the presence of very reduced forewings in all females specimens. The senior author (PSD), studying other Luzarinae genera, observed that in *Cacruzia* de Mello, 1992, *Izechsohniella* de Mello, 1992 and *Vanzoliniella* de Mello, 1994, the females also have a very reduced FW; this character was not reported in the original descriptions of these taxa.

The pseudepiphallallic parameres, the main clasper devices in crickets, are remarkable in Luzarinae and usually divided in a pair of dorsal sclerites (pseudepiphallallic parameres, 2 – PsP2) and a ventral one (pseudepiphallallic parameres, 1 – PsP1). De Mello & de Andrade (2003) reported the occurrence of membranous spheres in the PsP2 of *Eidmanacris* (without mentioning the species) and *Ottedana* de Mello & de Andrade, 2003. According to the authors, these structures seem to work by hydraulic pressure, acting like a cushion and improving the PsP2's clasper function (De Mello & de Andrade 2004). Regarding the Luzarinae, the pseudepiphallallic parameres of the Aracambiae Group Souza-Dias, 2014 are also modified, being partly membranous, which probably increases its clasping function (see Discussion in Souza-Dias & Desutter-Grandcolas, in press).

With regard to its distribution, habit, and reproductive behavior, mainly the role of nuptial gifts and chemical communication, we consider *Eidmanacris* to be a subject of considerable interest to biogeography, natural history, behavioral ecology and sexual selection studies. Its taxonomy is not fully understood, for there is a large number of undescribed species in collections, and there are no systematic studies using cladistic methods. A systematic study of *Eidmanacris* and its species is in progress.

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