Lucas Denadai de Campos

Estudo taxonômico e filogenético de *Eidmanacris* Chopard, 1956 (Orthoptera; Phalangopsidae; Luzarinae)

Taxonomic and phylogenetic study of Eidmanacris *Chopard, 1956 (Orthoptera; Phalangopsidae; Luzarinae)*

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Dissertação apresentada ao Instituto de Biociências da Universidade de São Paulo, para a obtenção de Título de Mestre em Ciências Biológicas, na Área de Zoologia.

Orientador: Prof. Dr. Silvio Shigueo Nihei

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Prof. Dr. Silvio Shigueo Nihei

Orientador

Aos meus amados e

sempre presentes,

Pai, Mãe e Irmão

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Sumário

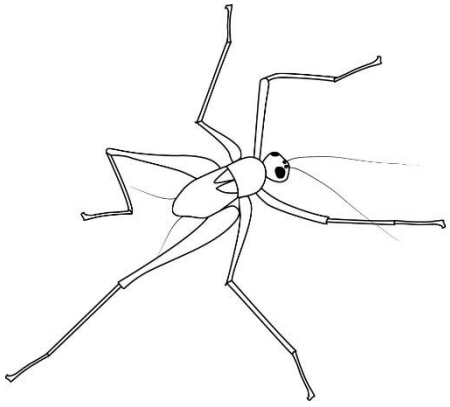
Resumo

Os ortópteros neotropicais, com exceção aos de importância econômica, de maneira geral, são muito pouco conhecidos em relação aos demais ortópteros ao redor do mundo. Isso devido à carência de trabalhos científicos para esse grupo, principalmente os estudos taxonômicos; consequentemente, o número de espécies descritas atualmente é muito subestimado. Não diferente, o gênero *Eidmanacris* Chopard, 1956, possui atualmente 20 espécies descritas, distribuídas nos domínios de Mata Atlântica e Cerrado, que se estendem pelas regiões sul, sudeste e centro-oeste brasileiras, além de também serem encontrados na Bolívia e Paraguai. São grilos ativos no período noturno, habitantes cavidades naturais, como tocas, barrancos, troncos de árvores mortas, fendas de rochas e cavernas. Neste estudo, o gênero foi revisado, incluindo a redescrição de espécies pouco conhecidas, descrição de sete novas espécies (*E. scopula* Campos, **sp. nov.**, *E. gigas* Campos, **sp. nov.**, *E. neomarmorata* Campos, **sp. nov.**, *E. desutterae* Campos, **sp. nov.**, *E. putuhra* Campos, **sp. nov.**, *E. fontanettiae* Nihei & de Mello, **sp. nov.** e *E. melloi* Campos, **sp. nov.**), três novas combinações (*E. speluncae* (Mello-Leitão, 1937) **comb. nov.**, *E. minuta* (de Mello, 1990) **comb. nov.** e *E. endophallica* (de Mello, 1990) **comb. nov.**) e uma sinonímia nova (*E. lencionii* Bolfarini, 2016 = *E. dissimilis* Desutter-Grandcolas, 1995, **syn. nov.**), totalizando 29 espécies para o grupo. Também foram feitos uma chave de identificação para o gênero e mapas de distribuição de suas espécies. Uma análise filogenética é apresentada incluindo 38 terminais, dos quais 12 foram considerados como grupo externo, e 98 caracteres morfológicos. Essa análise suportou a monofilia do gênero, permitiu visualizar seu relacionamento com táxons próximos de Luzarinae e sustenta a proposta de sinonímia de *Endophallusia* de Mello, 1990 com *Eidmanacris* Chopard, 1956, de modo a sua taxonomia refletir a monofilia indicada na análise filogenética.

Abstract

The Neotropical Orthoptera, excluding those with economic importance, are poorly known, in comparison with the orthopterans around the world. The main reason is the lack of scientific studies on this group, mainly taxonomic studies, resulting in a underestimated number of described species. Likewise, *Eidmanacris* Chopard, 1956 comprises 20 described species, and is mostly distributed on Atlantic Forest and Cerrado areas, extending from south, southeast and midwest Brazilian regions, and beyond, reaching Bolivia and Paraguay. *Eidmanacris* species are active at night, and inhabit natural cavities as burrows, bounds, hollow trees trunks, cavities in rocks and caves. In this study, the genus was reviewed, including the redescription of seven new species (*E. scopula* Campos, **sp. nov.**, *E. gigas* Campos, **sp. nov.**, *E. neomarmorata* Campos, **sp. nov.**, *E. desutterae* Campos, **sp. nov.**, *E. putuhra* Campos, **sp. nov.**, *E. fontanettiae* Nihei & de Mello, **sp. nov.** and *E. melloi* Campos, **sp. nov.**), three new combinations (*E. speluncae* (Mello-Leitão, 1937) **comb. nov.**, *E. minuta* (de Mello, 1990) **comb. nov.** and *E. endophallica* (de Mello, 1990) **comb. nov.**) and one synonym (*E. lencionii* Bolfarini, 2016 = *E. dissimilis* Desutter-Grandcolas, 1995, **syn. nov.**), totalizing 29 species in this genus. An identification key for the genus and a distribution map of species were made. A phylogenetic analysis is presented including 38 terminals, 12 of them as outgroup and 98 morphological characters This analysis attested the monophyly of the genus, showed its relationships with another Luzarinae taxa, and supported the proposal of synonymy of *Endophallusia* de Mello, 1990 with *Eidmanacris* Chopard, 1956, so that its taxonomy reflected the monophyly indicated in the phylogenetic analysis.

Introdução Geral



A ordem Orthoptera possui mais de 27.250 espécies válidas e está distribuída em todo o mundo, exceto os polos e grandes altitudes, concentrando-se em regiões tropicais, onde formam importante componente da fauna, sendo considerada a ordem mais diversa dentre os Polyneoptera (Rentz, 2000; Grimaldi, 2005, Sperber *et al.*, 2012; Eades *et al.*, 2016). Fazem parte deste grupo os insetos popularmente conhecidos como grilos, gafanhotos, paquinhas, esperanças, taquarinhas, etc. Os ortópteros são reconhecidos principalmente pelo som que emitem, denominado estridulação, geralmente com função sexual, provocado pelo atrito entre partes das asas ou entre parte das asas com as pernas posteriores.

Diferencia-se das demais ordens de Insecta por apresentarem o fêmur posterior dilatado, tornando as pernas posteriores adaptadas ao salto. Possuem aparelho bucal do tipo mastigador; dois pares de asas (quando presentes), sendo as anteriores denominadas tégminas; pronoto bem desenvolvido e órgãos auditivos (tímpanos) localizados no abdome (gafanhotos) ou nas tíbias anteriores (Rentz, 2000; Nickle & Walker, 2011; Sperber *et al.*, 2012). Com duas subordens monofiléticas, os ortópteros, dividem-se em Ensifera (grilos e esperanças) e Caelifera (gafanhotos) (Gwynne, 1995; Flook & Rowell, 1997; Flook *et al*., 1999; Desutter-Grandcolas, 2003; Jost & Shaw 2006; Legendre *et al*., 2010; Sheffield *et al*., 2010; Zhou *et al*., 2010; Song *et al*., 2015).

Dentro de Ensifera, a superfamília Grylloidea passou por divergências taxonômicas entre diferentes autores. Enquanto alguns consideravam que Grylloidea possuía sete famílias (Eneopteridae, Gryllidae, Oecanthidae, Paragryllidae, Phalangopsidae, Podoscirtidae e Trigonidiidae) (*sensu* Chopard, 1968; Desutter, 1988, 1990; *e.g.* de Mello & de Andrade, 2003; Mews *et al.*, 2010; Bolfarini *et al.*, 2012), outros autores consideravam apenas quatro famílias (Gryllidae, Gryllotalpidae, Mogoplistidae e Myrmecophilidae) (*sensu* Alexander & Otte, 1967; Gorochov, 1986, 1995, 2014; Otte, 1994), alocando as demais famílias da classificação anterior como subfamílias de Gryllidae.

Desutter (1987, 1988) realizou um estudo abrangente da fauna de Grylloidea Neotropical, reconheceu oito famílias para a região com base em estudos de homologia das partes que compõem o complexo fálico e propôs uma terminologia para os elementos da genitália masculina. Posteriormente, Desutter (1990), reduziu o número de famílias neotropicais para sete, as quais estão supracitadas. Em trabalho mais recente (Desutter-Grandcolas, 2003) a autora reviu a nomenclatura das estruturas dos complexos fálicos e substituiu os nomes de alguns elementos em Grylloidea. Essa terminologia, baseada na

homologia dos escleritos fálicos, válida para toda a subordem Ensifera é utilizada atualmente por diversos autores (de Mello & de Andrade, 2003; Mews *et al.*, 2010; Bolfarini *et al.*, 2012; Desutter-Grandcolas & Felix, 2012; Sperber *et al.*, 2012; Zefa *et al.*, 2012; Souza-Dias *et al.*, 2014, 2015; Campos *et al.*, 2015).

Recentemente, uma análise cladística com dados moleculares de três genes mitocondriais e quatro nucleares de 205 terminais de Grylloidea foi proposta. Seus resultados consideram quatro famílias: Gryllidae, Mogoplistidae, Phalangopsidae e Trigonidiidae. Nesse trabalho, Gryllotalpidae e Myrmecophillidae estão situados em Gryllotalpoidea, e que, juntamente com Grylloidea formam a infraordem Gryllidea (Chintauan-Marquier *et al*., 2015, Eades *et al*., 2016).

Em Grylloidea, a família Phalangopsidae, está distribuída nas principais regiões biogeográficas, onde mais de 70% são originados da região Neotropical (Desutter-Grandcolas, 1995b). São conhecidos como "grilos araneiformes" (*spider-like crickets*), devido as suas pernas alongadas em relação ao tamanho do corpo. Ocorrem em sub-bosques florestais e são essencialmente noturnos, permanecendo durante o dia sob cascas soltas de árvores, troncos ocos sobre o solo, em cavidades naturais (como tocas e cavernas) ou entre a serrapilheira (Desutter-Grandcolas, 1995b).

Grilos falangopsídeos são caracterizados por um corpo relativamente delgado; com pernas, antenas e cercos alongados; cabeça pequena, grande desenvolvimento do escapo antenal; tégminas muitas vezes ausentes ou reduzidas (geralmente são braquípteros) e com a asa posterior ausente, exceto em *Lerneca* Walker, 1869 (Desutter-Grandcolas, 1995a; Sperber *et al*., 2012). Atualmente, estão descritos 173 gêneros em todo o mundo e no Brasil, até o momento, 40 gêneros, onde inclui-se *Eidmanacris* Chopard, 1956 (Eades *et al.*, 2016; de Mello *et al*., 2016).

O gênero *Eidmanacris*, até o momento, possui 20 espécies descritas que estão distribuídas pelas regiões sul, sudeste e centro-oeste brasileiras, e também na Bolívia e Paraguai. Esses grilos costumam forragear sobre a serrapilheira durante a noite e escondem-se em cavidades durante o dia, em barrancos, troncos de árvores ocas, fendas em rochas e em cavernas, sendo considerados cavícola-estraminícola (Desutter-Grandcolas, 1995c).

Os objetivos desse trabalho são revisar taxonomicamente o gênero *Eidmanacris*, redescrevendo o gênero e espécies com descrições pouco informativas ou incompletas, descrever novas espécies, e realizar uma análise filogenética do gênero baseada em dados morfológicos.

Essa dissertação está dividida em dois capítulos, os quais serão publicados separadamente. Já estão na língua inglesa, porém as revistas científicas ainda não foram escolhidas para submissão. No primeiro, encontra-se a parte taxonômica desse estudo com a revisão do gênero *Eidmanacris*, chave identificação e considerações sobre as tégminas e glândulas metanotais de suas espécies. O segundo apresenta a análise filogenética do gênero, com comentários sobre os caracteres morfológicos propostos, e discussão baseada nos resultados dos clados que compões o gênero, bem como a sua distribuição. Também são feitas considerações sobre os caracteres genitais desse gênero.

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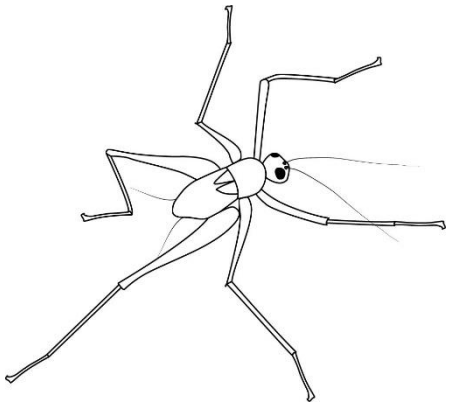
Objetivos



Os objetivos do presente estudo foram:

-Revisar o gênero *Eidmanacris* Chopard, 1956*:*

- Redescrever espécies com descrições pouco informativas ou incompletas (e.g. sem a descrições de machos, fêmeas ou genitália) e padronizar a nomenclatura genital para estes táxons, de acordo com a terminologia adotada neste estudo,
- Descrever novas espécies;

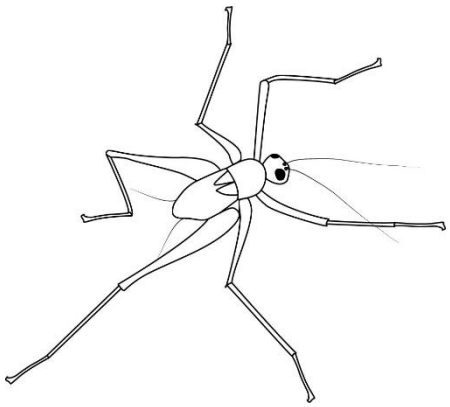
-Confeccionar uma chave de identificação.

-Confeccionar mapas de distribuição das espécies de *Eidmanacris.*

-Realizar análise cladística de *Eidmanacris* com base em caracteres morfológicos.

Chapter 1

Taxonomic study of *Eidmanacris* Chopard, 1956



Resumo

O gênero *Eidmanacris* Chopard, 1956 é revisado com a redescrição do gênero e de 15 espécies. São descritas sete novas espécies da Mata Atlântica e do Cerrado brasileiros (*E. scopula* Campos **sp. nov.**, *E. gigas* Campos **sp. nov.**, *E. neomarmorata* Campos, **sp. nov.**; *E, desutterae* Campos, **sp. nov.**; *E. putuhra* Campos, **sp. nov.**; *E. fontanettiae* Nihei & de Mello, **sp. nov.** e *E. melloi* Campos, **sp. nov.**), utilizando caracteres morfológicos de machos e fêmeas. Além disso, três novas combinações (*E. speluncae* (Mello-Leitão, 1937) **comb. nov.**, *E. minuta* (de Mello, 1990) **comb. nov.** e *E. endophallica* (de Mello, 1990) **comb. nov.**) e uma nova sinonímia (*E. lencionii* Bolfarini, 2016 = *E. dissimilis* Desutter-Grandcolas, 1995, **syn. nov.**) são propostas. Desta forma, o gênero passa a compreender 29 espécies. Uma chave de identificação para o gênero é apresentada juntamente com o mapa de distribuição das espécies. Ao final, são feitas considerações sobre a morfologia e função das tégminas e das estruturas metanotais.

Palavras Chave: região Neotropical, Phalangopsidae, grilos, taxonomia, descrição

Abstract

The genus *Eidmanacris* Chopard, 1956 is reviewed, including the redescription of the genus and 15 species. Seven new species are described from Brazilian Atlantic Forest and (*E. scopula* Campos **sp. nov.**, *E. gigas* Campos **sp. nov.**, *E. neomarmorata* Campos, **sp. nov.**; *E, desutterae* Campos, **sp. nov.**; *E. putuhra* Campos, **sp. nov.**; *E. fontanettiae* Nihei & de Mello, **sp. nov.** and *E. melloi* Campos, **sp. nov.**), based on morphological characters from males and females. Besides, three new combinations (*E. speluncae* (Mello-Leitão, 1937) **comb. nov.**, *E. minuta* (de Mello, 1990) **comb. nov.** and *E. endophallica* (de Mello, 1990) **comb. nov.**) and one new synonym (*E. lencionii* Bolfarini, 2016 = *E. dissimilis* Desutter-Grandcolas, 1995, **syn. nov.**) are proposed. Thus, the genus comprises a total of 29 species. An identification key is presented and a distribution map of the species are also provided. Finally, considerations on morphology and the function of males' forewings and metanotal structures are discussed.

Key words: Neotropical region, Phalangopsidae, crickets, taxonomy, description

1. *Introduction*

Initially described by Chopard in 1938 as *Eidmanniella*, and posteriorly renamed for being preoccupied (Chopard, 1956), the genus *Eidmanacris* originally included the species *E. larvaeformis*, from Mendes municipality (Rio de Janeiro, Brazil).

Mesa & de Mello (1985) described the second species of the genus, *E. bicornis* Mesa & de Mello, 1985, from specimens collected at the entrance of a sandstone cave in Itirapina municipality (São Paulo, Brazil). Later Mesa *et al.* (1998), synonymized this species with *Arachnomimus alboannulatus* Piza, 1960, and proposed the new combination *E. alboannulata* (Piza, 1960).

Desutter-Grandcolas (1995a) revised the genus and described seven new species: *E. dissimilis* (Poços de Caldas, Minas Gerais, Brazil), *E. fusca* (Aratinga, Rio Grande do Sul, Brazil), *E. meridionalis* (Nova Teutônia, Santa Catarina, Brazil), *E. multispinosa* (Santa Teresa, Espírito Santo, Brazil), *E. paramarmorata* (Amambay, Paraguay), *E. septentrionalis* (Linhares, Espírito Santo, Brazil), *E. tridentata* (Santa Teresa, Espírito Santo, Brazil), and transferred the species *Phalangopsis marmoratus* Bruner, 1916, from Bolivia, to the genus, proposing the new combination *E. paramarmorata* (Bruner, 1916). All species were described based on the examination of male and female specimens, including description of their terminalia, excepting the species *E. fusca*, *E. paramarmorata*, *E. multispinosa* and *E. tridentata*. The species *E. fusca* was described based in only one adult male dissected, but with the genitalia lost, while the description of *E. paramarmorata* was based on only one adult female. The remaining species were described based on the examination of adult males.

In that publication, the author mentioned the possibility of two other species (*Arachnopsis fontanettiae* Costa Lima, 1953, and *Phalangopsis speluncae* Mello-Leitão, 1937), described with a single female, belong to *Eidmanacris*. These species were not transferred or synonymized since the original descriptions because those descriptions do not provide enough information for taxonomic changes.

Later, Mesa et al. (1998) described two new species: *E. bidentata* Sperber, 1998 (Viçosa, Minas Gerais, Brazil) and *E. corumbatai* García-Novo, 1998 (Cerrado de Corumbatai, São Paulo, Brazil).

Gorochov (2014) described *E. longa* Gorochov, 2014 (Santa Cruz, Bolivia), and proposed the genus transference from Luzarinae to Phalangopsinae. Therefore,

Eidmanacris was grouped in the subtribe Phalangopsina, together with *Phalangopsis* Serville, 1831 and *Philippopsis* Desutter-Grandcolas, 1992.

Recently, three taxonomic papers (Campos *et al.*, 2015; Souza-Dias *et al.*, 2015; Bolfarini, 2016) added seven new species to the genus: *E. caipira* Souza-Dias, Campos & Nihei, 2015 (Teodoro Sampaio, São Paulo, Brazil), *E. suassunai* Souza-Dias, Campos & Nihei, 2015 (Teodoro Sampaio, São Paulo, Brazil), *E. bernardii* Nihei & de Mello, 2015 (Serra da Mesa, Goiás, Brazil), *E. eliethae* Nihei & de Mello, 2015 (Rio das Ostras, Rio de Janeiro, Brazil), *E. papaveroi* Nihei & de Mello, 2015 (Santa Teresa, Espírito Santo, Brazil), *E. simoesi* Nihei & de Mello, 2015 (Rio das Ostras, Rio de Janeiro, Brazil), and *E. lencionii* Bolfarini, 2016 (Brumadinho, Minas Gerais, Brazil). The latter, *E. lencionii* was found in the entrance of caves, as registered for *E. alboannulata* by Mesa & de Mello (1985). Thus, totalizing 20 species in the genus.

Unlike most of crickets that attract females through stridulation, *Eidmanacris* species do not have stridulatory apparatus on forewings, nor tympana on fore tibia. Therefore, these crickets use other strategies to attract females. The main strategy to attract females consist in offering a nuptial gift (nutritious secretion) from males' metanotal gland, located dorsally on the metanotum, under the forewings. This nuptial gift stimulates female to be in copulatitory position. While the female feeds of this secretion, the male everts its genitalia and attachs its spermatophore to the female copulatory papilla (Prado, 2006). This metanotal gland has specific characters that are widely used in *Eidmanacris* taxonomy (Desutter-Grandcolas, 1995a; Prado & Fontanetti, 2005; Souza-Dias *et* al, 2015; Campos *et* al., 2015; Bolfarini, 2016).

Besides the metanotal gland strategy for the reproductive success, de Mello (2007) described the occurrence of mating plugs in an undescribed species of *Eidmanacris* from southern Brazil. According to the author, this plug is represented by the spermatophore ampulla, which obstructs the female copulatory papilla, avoiding that other males can copulate with the same female.

The species of *Eidmanacris* usually forage on litter during the night, and hide in cavities during the day. These cavities may be burrows in bounds (Fig. 1A), trunks of hollow trees, cracks in rocks or even in caves (Fig. 1B). Regarding the use of habitat, *Eidmanacris* is considered a cavicolous-straminicolous taxon (Desutter-Grandcolas, 1995b).

The genus is distributed through Atlantic Forest and Cerrado domains through South, Southeast and Central regions of Brazil, Bolivia (*E. marmorata* Bruner, 1916 and *E. longa* Gorochov, 2014) and Paraguay (*E. paramarmorata* Desutter-Grandcolas, 1995).

The aim of this chapter is to review the genus *Eidmanacris*, by redescribing species with incomplete descriptions, by standardizing the genital nomenclature for the group, and by describing new species, and to provide an identification key for the species.

Figure 1. A- Male of *E. septentrionalis* in bound. **B**- Female of *E. neomarmorata* **sp. nov.** on the ground in a cave.

2. *Material and Methods*

2.1. *Material of study*

The examined material belongs to the following institutions:

-MNHN – Muséum national d'Histoire naturelle, Paris, France (27 specimens);

-MZSP – Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (65 specimens);

-MZUEFS – Museu de Zoologia da Universidade Estadual de Feira de Santana, Feira de Santana, Brazil (4 specimens);

- Laboratório de Insetos, Departamento de Zoologia, Universidade Estadual Paulista, Botucatu, Brazil (UBTU) (385 specimens);

- Laboratório de Orthopterologia, Universidade Federal de Viçosa, Viçosa, Brazil (55 specimens).

Most of the studied specimens are fixed in 75-80% ethanol, excepting the dry material from MNHN and MZUEFS.

2.2. *Field trips*

The field trips were made in three localities: Chapada dos Guimarães (Mato Grosso State, Brazil), Aquidauana and Porto Murtinho (Mato Grosso do Sul State, Brazil). These collects occurred mainly at night, with headlamp of 225 lumens. The specimens were captured using an aquarium net with 10x9 cm. Each specimen collected was initially transferred to a plastic bag with green branches, collected in the local. This procedure allows the maintenance of high humidity in the bag and provides substrate for the insect fixation.

The collected specimens were fixed in ethanol 80% and kept in glass tubes covered with cotton. Each tube contains a label with coordinates and name of the collected area, date of collect and collector name.

2.3. *Taxonomic study*

Characters of external morphology, including male and female genitalia, were analyzed under stereomicroscope Leica EZ4. Drawings of structures and male genitalia were made under stereomicroscope Leica MZ9.5 coupled with camera lucida. The photographs of morphological characters and genitalia were made under stereomicroscope Leica MZ9.5 with camera Leica DFC420, with the specimen/genitalia immersed in ethanol 80%.

Images were made under different focuses plans and posteriorly processed with *Helicon Focus* 5.3 software. The final images, when necessary, were edited in Adobe Photoshop CS6 software, and final plates were made using Adobe Illustrator CS6 software.

The male genitalia, after dissection, were treated with KOH 10% solution during 24 hours, to remove musculature and membranes. Posteriorly, it was washed with water, neutralized with acetic acid 10 %, and rewashed with water to remove the excess of acid. It has undergone an alcoholic series (50, 70, 80, 90 and 100%) for fixation. All material prepared is kept with the dissected specimen.

The male phallic complexes were drawn with the same magnification, and the sizes of the structures were compared using a 5x5 mm squared tracing paper overlapped to the drawings. Each small square was used as a measurement unit for the structures.

The terminology adopted for the external morphology and the male phallic complex was that of Desutter (1987; 1988, 1990), Desutter-Grandcolas (2003) and Souza-Dias *et al.* (2015). Taxonomic classification follows Desutter (1988) and Chintauan-Marquier *et al.* (2015).

The female copulatory papilla was also dissected, but without treatment, only the mechanical remove of membranes, due to the lower complexity of these structures.

The label data of examined specimens is presented within quotes, comma separates the lines of the label, and semicolons separate each label.

2.4. *Abbreviations*

General Morphology: **I, II, III**- anterior, medium, posterior (legs, tarsomeres); **DD**-dorsal disk of pronotum; **LL**-lateral lobes of pronotum; **FW**- forewing; **iad, iam, iav**-inner apical dorsal, medium and ventral apical spur; **oad, oam, oav-** outer apical dorsal, medium and ventral apical spur.

Measurements (Fig. 2): **BL-** body length; **Hw**– head width; **iod**– intra-ocular distance; **Lpron**– length of pronotum; **awpron**– anterior width of pronotum; **pwpron**– posterior width of pronotum; **wpron**– width of pronotum; **LFW**– length of forewing; **wFW** – width of forewing; **LFIII** – length of hind femur; **wFIII**– width of posterior femur; **LTIII** – length of hind tíbia; **Ltars1-III** – length of basitarsomere III; **OL-** ovipositor length.

Metanotal gland (Fig. 3): **AMC-** anteromedian crest; **MP-** median projection; **LP-** lateral projection.

Male genitalia (Fig. 4): **A-** sclerite A; **A.P.Ps.-** anterior projection of pseudepiphallus; **Arm-** pseudepiphallic arm; **B.Ps.-** base of pseudepiphallic sclerite; **D.P.Ec.-** dorsal projection of ectophallus; **Ect.Ap.-** ectophallic apodeme; **Ect. F.** – ectophallic fold; **End. Ap.-** endophallic apodeme; **End.Sc.-** endophallic sclerite; **L.L.End.-** latero-posterior lobe of endophallic sclerite; **L.P.Ps.-** lateral projection of pseudepiphallus; **M.S.-** membranal sphere; **M.P.End-** medio-posterior projection of endophallic sclerite; **PsP1-** pseudepiphallic paramere 1 (ventral lobe of pseudepiphallic paramere); **PsP2-** pseudepiphallic paramere 2 (dorsal lobe of pseudepiphallic paramere); **V.P.Ec.-** ventro-posterior projection of ectophallic invagination.

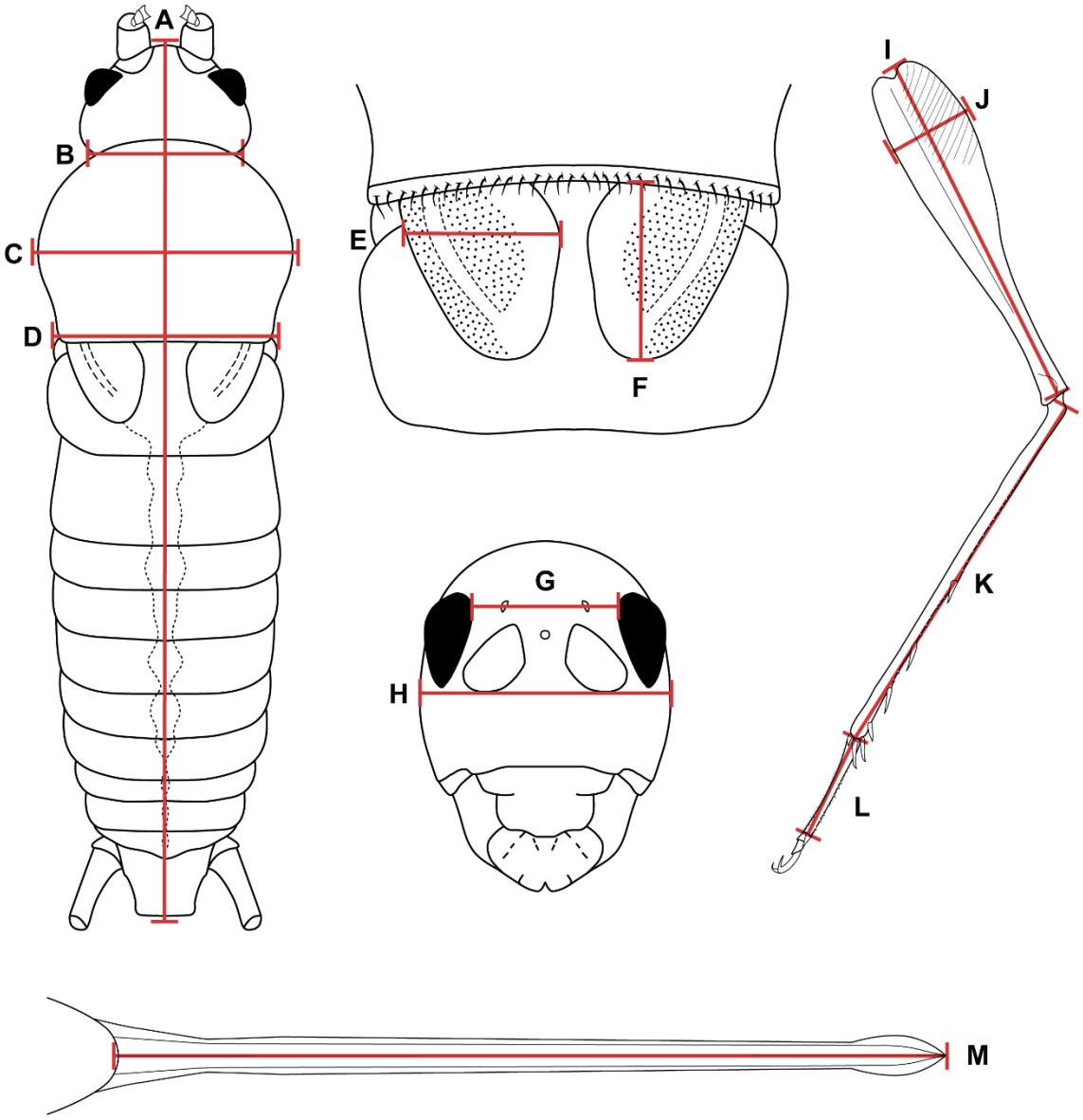


Figure 2. Measurements: **A**- body length (BL); **B**- anterior width of pronotum (awpron); **C**- length of pronotum (Lpron); **D**- posterior width of pronotum (pwpron); **E**- width of forewing (wFW); **F**- length of forewing (LFW); **G**- intra-ocular distance (iod); **H**- head width (Hw); **I**- width of hind femur (wFIII); **J**- length of hind femur (LFIII); **K**- length of hind tibia (LTIII); **L**- length of basitarsomere III (Ltars1-III); **M**- ovipositor length (OL).

2.5. *Scanning Electron Microscopy (S.E.M.)*

The metanotal glands in *Eidmanacris* are an important source of characters, as studied before by Prado & Fontanetti, (2005). In order to investigate these characters, we performed an ultra-morphological study through S.E.M. analysis.

The examined specimens were dissected, by separating for analysis the forewings and the whole thorax. The samples were dehydrated in a graded ethanol series until 100% ethanol, critical point dried using CO_2 as transitional fluid, mounted on stubs and metalized with gold. The samples were analyzed using a Scanning Electron Microscopy Zeiss SIGMA VP at the Instituto de Biociências of Universidade de São Paulo.

2.5. *Distributional data and maps*

The distributional data were obtained from literature (Chopard, 1938; Mesa & de Mello, 1985; Desutter-Grandcolas, 1995; Mesa *et al.* 1998; Gorochov, 2014; Souza-Dias *et al.*, 2015; Campos *et al.*, 2015; Bolfarini, 2016); from labels of examined specimens and collects, and through the catalogue on line *Orthoptera Species File* (Eades *et al.*, 2016).

All collected data were plotted on a map of South America and edited with the software *Quantum-gis* 2.10.

3. *Results*

A total of 481 specimens of *Eidmanacris* obtained in field works and borrowed from national and international collections were studied. Based on the detailed examination of this material, the genus *Eidmanacris* and 15 of its species were redescribed, including three new combinations (*E. speluncae* (Mello-Leitão, 1937) **comb. nov.**; *E. minuta* (de Mello, 1990) **comb. nov.**; *E. endophallica* (de Mello, 1990) **comb. nov.**), one new synonym (*E. lencionii* Bolfarini, 2016 = *E. dissimilis* Desutter-Grandcolas, 1995, **syn. nov.**), and seven new species (*E. scopula* Campos, **sp. nov.**; *E. gigas* Campos, **sp. nov.**; *E. neomarmorata* Campos, **sp. nov.**; E. *desutterae* Campos, **sp. nov.**; *E. putuhra* Campos, **sp. nov.**; *E. fontanettiae* Nihei & de Mello, **sp. nov.**; *E. melloi* Campos, **sp. nov.**). Thus, *Eidmanacris* comprises now 29 species. The descriptions are followed by plates of morphological structures, including male and female genitalia. An identification key and distribution maps are also presented.

Eidmanacris Chopard, 1956

Eidmanniella Chopard, 1938: 159. **Type species,** *Eidmaniella larvaeformis* Chopard, 1938, by original designation. Preocc. *Eidmaniella* Keler, 1938.

Eidmanacris Chopard, 1956: 254 (note, new replacement name); Chopard, 1968: 278 (catalogue); Mesa & de Mello, 1985:199-204 (new species, note) Desutter-Grandcolas, 1987: 233 (note); Desutter-Grandcolas, 1990: 53 (note); de Mello, 1990: 146 (comparison); Trajano & Gnaspini, 1991: 383-404 (biology note); Otte, 1994: 56 (catalogue); Desutter-Grandcolas, 1995: 453-473 (new species, notes and key to species); Mesa *et al.*, 1998: 43-61 (new combination, new species); Prado & Fontanetti, 2005: 83-87 (morphology); Prado, 2006: 452-457 (reproductive behavior) de Mello, 2007: 245-257 (reproductive behavior); Mews & Sperber, 2008: 647-655 (note); de Mello, Horta & Bolfarini, 2013: 88 (note); Gorochov, 2014: 13 (note); Souza-Dias, Campos & Nihei, 2015: 547-555 (new species, notes); Campos, Souza-Dias, Nihei & de Mello, 2015: 228-248 (new species, note); Bolfarini, 2016: 525 (new species, distribution notes).

Species

E. larvaeformis (Chopard, 1938)

E. alboannulata (Piza, 1960)

E. dissimilis Desutter-Grandcolas, 1995

E. fusca Desutter-Grandcolas, 1995

E. marmorata (Bruner, 1916)

E. meridionalis Desutter-Grandcolas, 1995

E. multispinosa, Desutter-Grandcolas, 1995

E. paramarmorata Desutter-Grandcolas, 1995

E. septentrionalis Desutter-Grandcolas, 1995

E. tridentata Desutter-Grandcolas, 1995

E. bidentata Sperber, 1998

E. corumbatai Garcia, 1998

E. longa Gorochov, 2014

E. caipira Souza-Dias, Campos & Nihei, 2015

E. suassunai Souza-Dias, Campos & Nihei, 2015

E. bernardii Nihei & de Mello, 2015

E. eliethae Nihei & de Mello, 2015

E. papaveroi Nihei & de Mello, 2015

E. simoesi Nihei & de Mello, 2015

E. speluncae (Mello-Leitão, 1937) **comb. nov.** (*Phalangopsis*)

E. minuta (de Mello, 1990) **comb. nov.** (*Endophallusia*)

E. endophallica (de Mello, 1990) **comb. nov.** (*Endophallusia*)

E. scopula Campos, **sp. nov.**

E. gigas Campos, **sp. nov.**

E. neomarmorata Campos, **sp. nov.**

E. desutterae Campos, **sp. nov.**

E. putuhra Campos, **sp. nov.**

E. fontanettiae Nihei & de Mello, **sp. nov.**

E. melloi Campos, **sp. nov.**

Diagnosis.

Eidmanacris is a typical Luzarinae cricket, with general coloration in several shades of brown, marbled; adult brachypterous; legs long, annulated, and maxillary palpi elongated. Among Luzarinae, *Eidmanacris* can be recognized by the following characters: medium to large body, pronotum dorsal disc (DD) wider than long, with inflated aspect. Males: forewings (FW) short, coriaceous; stridulatory file or any specialized veins or areas for sound production and propagation absent; glandular thickening present on the ventral side of distal portion of FWs; metanotal gland present, with anteromedian crest forming an inverted triangle; lateral projections short, cylindrical or conical, parallel; supra anal plate with latero-posterior projections; auditory tympanum absent. Phallic complex: pseudepiphallic sclerite bearing an anterior projection; apex of pseudepiphallic arm with three main projections: superior (with bristles), internal and inferior; connection between the ventral lobe (PsP1) and dorsal lobe (PsP2) of pseudepiphallic parameres not sclerotized; ectophallic fold entirely membranous; medio-posterior projection of endophallic sclerite elongate, the apex reaching or surpassing the PsP2; latero-posterior lobes of the endophallic sclerite present. Female: larger than male, general coloration similar, with very small FW, reduced to a small scale.

Redescription.

Head. Occiput and vertex with three vertical lines, in dorsal view. Fastigium with two rows of bristles, slightly longer than wide, slightly narrowed toward the apex, separated from vertex by a line forming a "v". Frons with three vertical bands, two bellow eyes, one above clypeus (except in *E. fusca*). Three ocelli present, well developed, forming an isosceles triangle, the central one flattened at bottom (except in *E. endophallica* **comb. nov.**, *E. minuta* **comb. nov.**, *E. fusca)*, lateral ocelli elliptical or rounded. Eyes with an unpigmented small area on supero-internal angle. Maxillary palpi long and thin, slightly pilose, distal portion of joints whitish; apex of joint 5 upcurved, apex ventrally rounded. Antennae annulated.

Thorax. Pronotum DD wider than long, with sparse dark spots and maculae, slightly pubescent, inflated, divided by a sagittal line; ventro-cephalic angle rounded, ventro-caudal margin gradually ascendant.

Legs. Tibia I (TI) with two same-sized apical spurs; tibia II (TII) with two inner apical spurs and one outer, smaller. Femur III (FIII) with thin stripes on outer face. Tibia III (TIII) subapical spurs 4/4, with serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face: dorsal (iad) and median one (iam) sub-equals,

ventral smallest (iav) (iam>iad>iav) (except in *E. endophallica* **comb. nov.**, *E. minutia* **comb. nov.**); outer apical spurs: median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III with two rolls of spines.

Abdomen. Divided by a whitish sagittal line in dorsal view (except in *E. tridentata*, *E. speluncae* **comb. nov.,** *E. putuhra* **sp. nov.**).

Male. Body size small (*E. fontanettiae* **sp. nov.**) to large, general coloration varying from dark to light brown, marbled. FWs: apex rounded or triangular, in dorsal view; posterior half of inner margin and apex connected to a single vein that divides the external part of FW as a lateral field, glandular thickening present distally (except in *E. endophallica* **comb. nov.**, *E. minuta* **comb. nov.**, *E. fusca, E tridentata, E simoesi, E. eliethae*); FWs covering metanotal gland, surpassing or not the metanotum posterior border. Metanotal gland present (except in *E. endophallica* **comb. nov.** and *E. tridentata*), anteromedian crest forming an inverted triangle, with cluster of bristles; lateral projections short, cylindrical or conical, and parallel (Fig. 3). Supra anal plate slightly pubescent, anterior margin slightly concave, with latero-posterior projections short or long. Subgenital plate longer than wide, with lateral pubescence, anterior margin slightly straight, posterior margin rounded or straight with a small invagination centrally.

Phallic complex (Figs. 4, 5). Pseudepiphallus: central area of the base of pseudepiphallic sclerite narrow, in dorsal view; pseudepiphallic arms sclerotized, hard, upcurved in lateral view; apex of pseudepiphallic arms with bristles on outer face, with three main projections: superior (with bristles), internal and inferior; anterior projection of pseudepiphallic sclerite present, surpassing or not the base of pseudepiphallic sclerite; apex of dorsal lobe of pseudepiphallic paramere (PsP2) pointed in lateral view, with membranous sphere on inner face (except in *E. endophallica* **comb. nov.**, *E. minuta* **comb. nov.**, *E. fusca*); sclerite A connected with base of pseudepiphallic sclerite, articulating with PsP2; connection between PsP2 and ventral lobe of pseudepiphallic paramere (PsP1) not sclerotized. Ectophallic invagination: ectophallic apodeme long, straight (except in *E. spelucae* **comb. nov.** and *E. putuhra* **sp. nov.**); ectophallic arc located posteriorly or below the base of pseudepiphallic sclerite, in dorsal view; ventro-posterior projection elongate; dorsal projections present, well developed; ectophallic fold membranous. Endophallus: medio-posterior projection of the endophallic sclerite

elongated, reaching or surpassing PsP2 apex; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme crest-shaped, elongate.

Female. Larger than male, general coloration similar. Presence of very small FWs, not reaching the metanotum border, almost entirely under the posterior border of pronotum. Posterior border of supra anal plate rounded, without latero-posetrior projections. Subgenital plate wider than long, anterior margin sub-straight, posterior margin with central concavity. Ovipositor apex lateral rounded (drop shaped) in dorsal view.

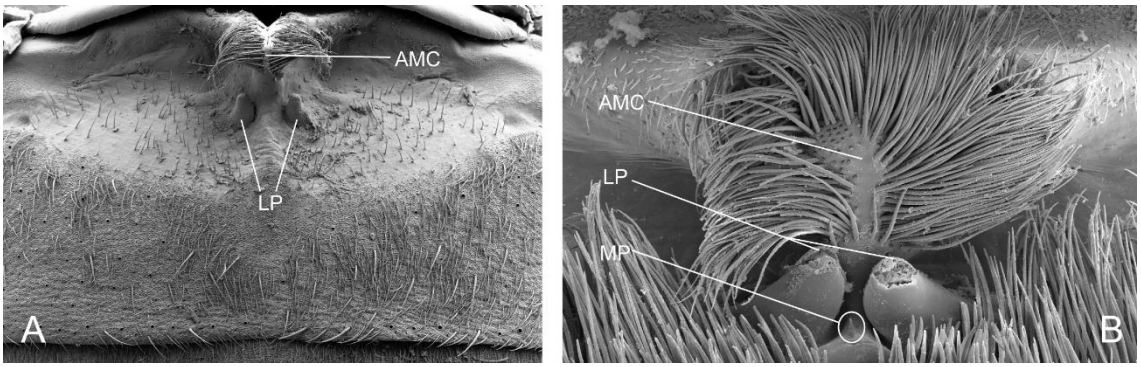


Figure 3. Main structures of metanotal gland in *Eidmanacris*. **A-** *E. fontanettiae* **sp. nov.**; **B**- *E. alboannulata.*

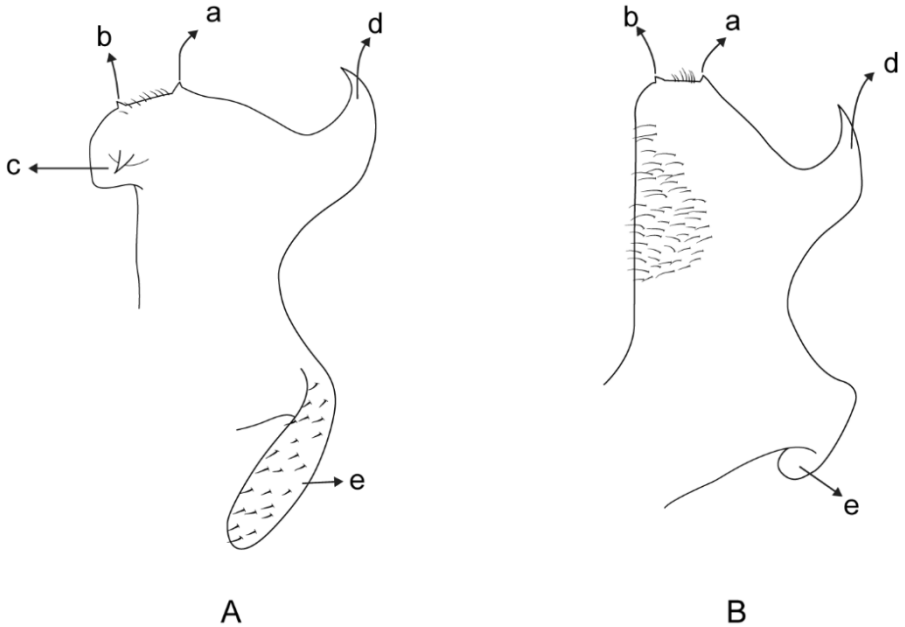


Figure 4. *Eidmanacris corumbatai*. Projections of the apex of pseudepiphallic arm, lateral view: **A-** internal lateral; **B-** external lateral. Projections: **a-** superior; **b-** supero-internal; **c-** infero-internal; **d-** inferior; **e-** ventral.

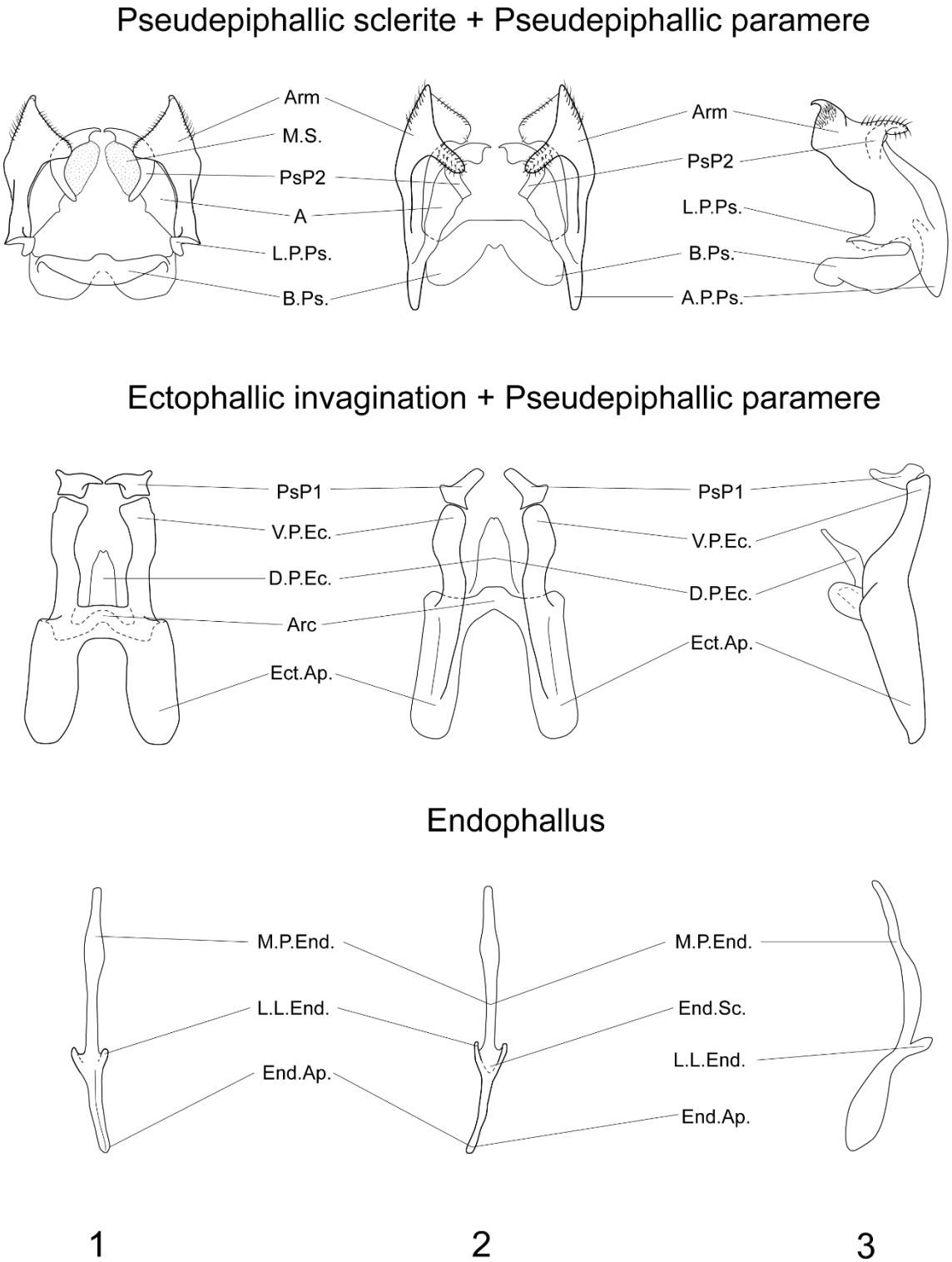


Figure 5. Dismembered male phallic complex of *E. gigas* **sp. nov.** 1- dorsal view, 2-ventral view, 3- lateral view.

Eidmanacris larvaeformis (Chopard, 1938)

(Figs. 6-8)

Eidmanniella larvaeformis Chopard, 1938: 159 (male and female description). Type locality, Brazil, Rio de Janeiro State, Mendes municipality.

Eidmanacris larvaeformis, Chopard, 1956: 254 (new combination); Chopard, 1968: 278 (catalogue); Prado & Fontanetti, 2005: 83-87 (morphology of the metanotal gland); Souza-Dias, Campos & Nihei, 2015: 555 (note).

Type material examined. Holotype male, allotype, 1 male paratype, 1 female paratype (MNHN). Holotype male labeled "Dr. Eidmann legit"; "Mendes, E. d. Rio. Brazilien, IX.IX.1933"; "*Eidmanniella larvaeformis* Chopard det."; "MNHN-EO-ENSIF3925". Allotype labeled "Mendes, Rio de Janeiro, 4.IX-24.X.1933, Eidmann"; "*Eidmanniella larvaeformis* allotype, Chop."; "MNHN-EO-ENSIF3926". Paratype labeled "Dr. Eidmann legit"; "Mendes, E. d. Rio. Brazilien, IX.IX.1933"; "*Eidmanniella larvaeformis* TYPE Chop."; "Elytre droite –Metanotum PHOTOS SEM 20-26/27-34, 54-57". Dry specimens.

Other material examined. Total: 19 males, 14 females and 3 nymphs. 1 male and 1 female labeled: "Brasil, RJ, Nova Friburgo, Macaé de Cima, Pousada Amantes da Natureza, Margem esquerda do Rio Macaé, 23/ix/2015, T.P.L. Pereira col." (MZSP). 6 males and 6 females, labeled: "Brasil, RJ, Rio das Ostras, Distr. Rocha Leão, i-1996 (22 Km NW Casemiro de Abreu), 22°26'86''S//42°03'35''W, F.A.G. Mello – S.S. Nihei leg."; 6 males and 7 females labeled: "Ilha do Araújo, Brasil, Parati – RJ, 15/vi/1996, F.A.G. de Mello &J. Justi Jr. Col."; 9 males and 2 females labeled: "Brasil, Sp, Ubatuba, Picinguaba (mata), 10-11.IX.1985, F.A.G. de Mello – L. Jacomini, *leg.*; "Brasi, RJ, Angra dos Reis, 05-06.x.1996, 23°00'32''S//44°18'46''W, F.A.G. Mello – A.S. Jim, *leg.* Mata"; 1 male and 1 female labeled: "Brasil, RJ, Seropédica, Floresta Nac. "Mário Xavier", 07-09.x.1996 (Mata), 22°44'04''S//43°42'48''W, F.A.G. Mello – A.S. Jim" (UBTU). Specimens preserved in ethanol 80%.

Distribution. Brazil, Rio de Janeiro and São Paulo States.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: first *c.a.* 35 antenomeres dark brown, the remaining whitish; male FWs triangular; lateral projections of metanotal gland cylindrical and parallel; superior

projection of pseudepiphallic arm upcurved, internal projection longer than superior, finger-shaped; inferior projection very short; PsP2 curved outwards, in dorsal view; sclerite A sinuous in dorsal view.

Redescription.

Head. Reddish brown. Occiput reddish brown with central, light brown band, and band light brown going from occiput to margin of each eye; vertex light to medium brown, with three lines light brown, vertical, in dorsal view (Fig. 6C). Fastigium reddish brown, apically dark, with two rows of bristles, slightly longer than wide, slightly narrowed toward the apex, separated from vertex by a line forming a "v" (Fig. 6C). Frons light brown, with three dark brown vertical bands, two bellow eyes, other one above clypeus (Figs. 6A, B). Three ocelli present, well developed, forming an isosceles triangle, central one flattened at bottom, lateral ones elliptical (Figs. 6A, B, C). Eyes with unpigmented small area on supero-internal angle (Fig. 6C). Maxillary palpi medium brown, long and thin, slightly pilose, distal portion of joints whitish; joints 3, 4 and 5 almost same-sized (Fig. 6H); apex of joint 5 upcurved. Gena light brown, posterior margin medium brown in lateral view (Fig. 6B). Frontoclypeal suture dark yellow; clypeus light brown, dark on lateral; labrum whitish, lower portion light brown. Mandible light brown, inner margin medium to dark brown. Antennal scape inner half light brown, outer half dark brown (Fig. 6A); first *c.a.* 35 antenomeres dark brown, posterior antenomeres whitish.

Thorax. Pronotum DD wider than long, reddish to medium brown, with sparse, dark spots and maculae, slightly pubescent, inflated, divideded by a very tiny light brown sagittal line (Fig. 6C); DD cephalic margin sub straight and caudal margin slightly concave (Fig. 6C); ventro-cephalic angle rounded, ventro-caudal margin gradually ascendant (Fig. 6B).

Legs. FI and II dark yellow, annulated with dark brown. TI and II dark yellow, TI with two same-sized apical spurs; TII with two inner apical spurs and one outer, smaller. FIII light yellow, with thin, medium brown stripes on outer face, apical third medium brown (Fig. 6D). TIII yellowish brown; subapical spurs 4/4, with serrulation above and between subapical spurs, except between the two distal ones; apical spurs 3/3, more developed on inner face: dorsal (iad) and median one(iam) sub-equal, ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III yellowish.

Abdomen. Sub-cylindrical in dorsal view, reddish to dark brown, marbled, divided by light brown sagittal line.

Male. Medium to large sized body, general coloration medium brown to dark brown, marbled. FWs medium brown, inner margin light brown, short, apex sub-triangular; posterior part of inner margin and apex whitish, connected to a single vein that divides the external part of FW as a lateral field, glandular thickening present distally (Fig. 6C); inner margins not touching each other; FW covering the metanotal gland, not surpassing metanotum posterior border (Figs. 6B, C). Metanotal gland present, anteromedian crest forming an inverted triangle with cluster of bristles; lateral projections short, cylindrical, parallel (Figs. 6F, G). Supra anal plate medium to dark brown, slightly pubescent; anterior margin slightly concave, latero-posterior projections very short, medium brown; posterior margin sub-straight (Fig. 6I). Subgenital plate longer than wide, with lateral pubescence, laterally medium brown and centrally whitish; anterior margin almost straight, posterior margin rounded with a central invagination small (Fig. 6K).

Phallic complex (Figs. 7A-C; 8A-C). Pseudepiphallus: base of pseudepiphallic sclerite central part slightly narrow, in dorsal view; pseudepiphallic arms sclerotized, hard, upcurved in lateral view; apex of pseudepiphallic arm with bristles, superior projection folded to dorsal; supero-internal projection longer than superior, finger-shaped; inferior projection very short; anterior projection of pseudepiphallic sclerite present, very short, not surpassing the base of pseudepiphallic sclerite; PsP2 hardly sclerotized, surpassing the posterior extremity of pseudepiphallic arms, in dorsal view; apex pointed in lateral view, curved outwards in dorsal view, with membranous sphere on inner face; sclerite A connected with base of pseudepiphallic sclerite, sinuous in dorsal view, articulated with PsP2, no visible connection between them; PsP1 elongate, inner face well sclerotized, in ventral view. Ectophallic invagination: ectophallic apodeme short; ectophallic arc located posteriorly to base of pseudepiphallic sclerite, in dorsal view; ventro-posterior projection elongate; dorsal projections sclerotized, short, laterally rounded, posterior margin forming a central concavity. Endophallus: medio-posterior projection of the endophallic sclerite elongate, not surpassing PsP2 apex; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme not so elongate, as for the genus.

Female. Larger than male, general coloration similar (Fig. 6E). Supra anal plate medium brown, posterior border dark brown, anterior margin concave, posterior margin

slightly rounded with long bristles (Fig. 6J). Subgenital plate light to medium brown, wider than long, anterior margin sub straight, posterior margin with tiny central concavity (Fig. 6L). Ovipositor as in figs. 6M, N.

Copulatory papilla (Figs. 8D-F). Slightly longer than wide, flattened dorso-ventrally in lateral view, anterior margin membranous, posterior margin unpigmented, pointed centrally.

Remarks: A large variation between sizes of specimens from different localities were observed.

Measurements (mm).

Male (n=6): Hw, 3.33 ± 0.08 (3.22-3.41); iod, 1.68 ± 0.06 (1.61-1.8); Lpron, 4.27 ± 0.13 (4.15-4.46); awpron, 3.49 ± 0.17 (3.22-3.66); pwpron, 4.07 ± 0.11 (3.09-4.15); wpron 5.15 ± 0.11 (5.02-5.27); LFW, 2.26 ± 0.25 (1.98-2.54); wFW, 1.56 ± 0.06 (1.49-1.67); LFIII, 17.37 ± 0.52 (16.8-17.85); wFIII, 3.52 ± 0.15 (3.45-3.68); LTIII, 18.78 ± 0.59 (18.15-19.65); Ltars1-III, 5.7 ± 0.35 (5.25-6).

Female (n=7): Hw, 3.39 ± 0.39 (3.22-3.59); iod, 1.61 ± 0.06 (1.48-1.67); Lpron, 3.92 ± 0.23 (3.72-4.27); awpron, 3.48 ± 0.19 (3.22-3.72); pwpron, 4.01 ± 0.2 (3.78-4.27); wpron, 4.88 ± 0.35 (4.4-5.39); LFIII, 16.47 ± 1.13 (15.15-18.3); wFIII, 3.44 ± 0.2 (3.15-3.75); LTIII, 17.63 ± 0.8 (16.8-19.05); Ltars1-III, 4.99 ± 0.29 (4.65-5.4); OL, 13.45 ± 0.88 (12.3–14.4).

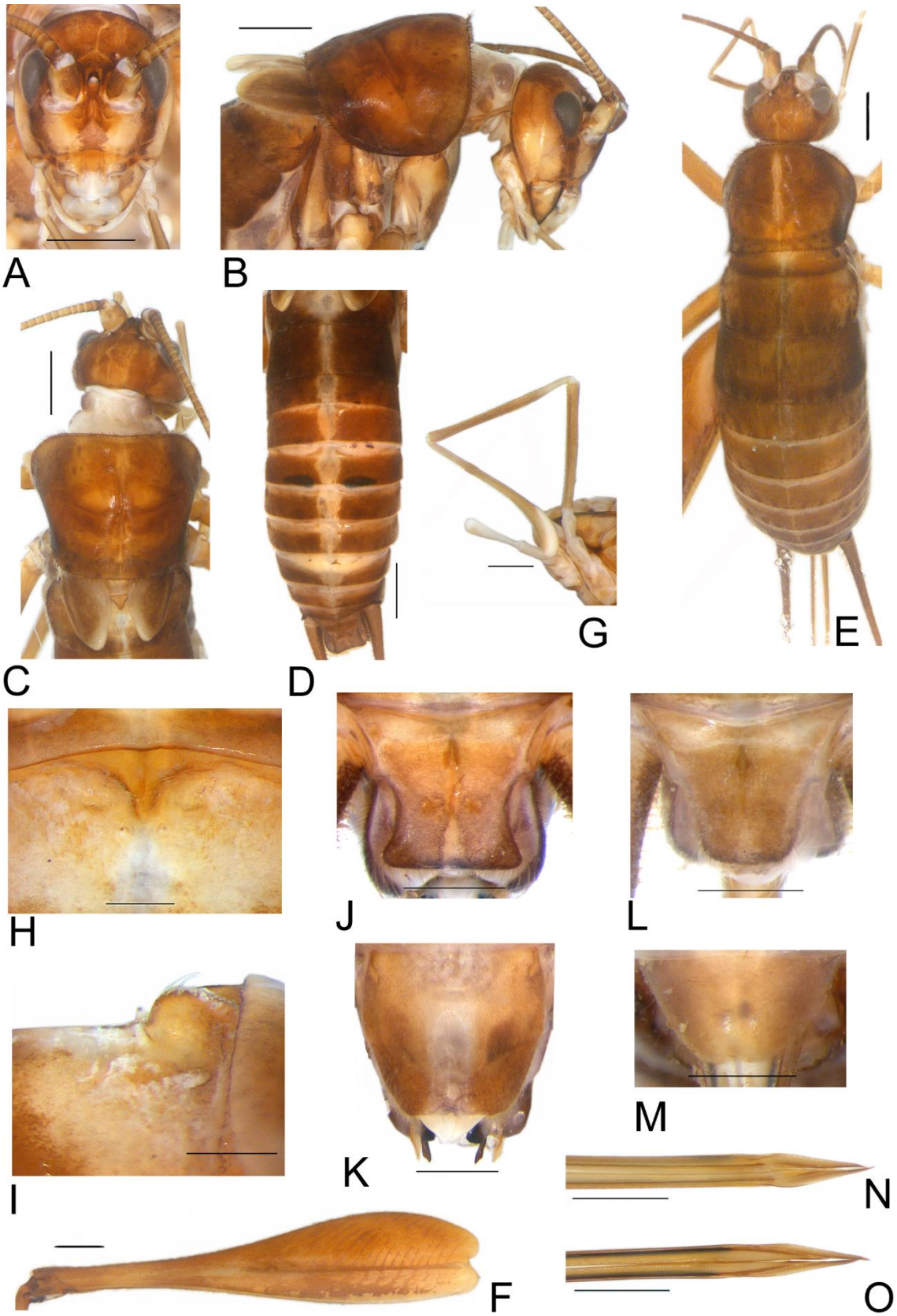


Figure 6. *Eidmanacris larvaeformis* (Chopard). Male and female topotypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor, dorsal; **O**- ovipositor, ventral. Scale bar: A-F: 2mm; G-O: 1mm.

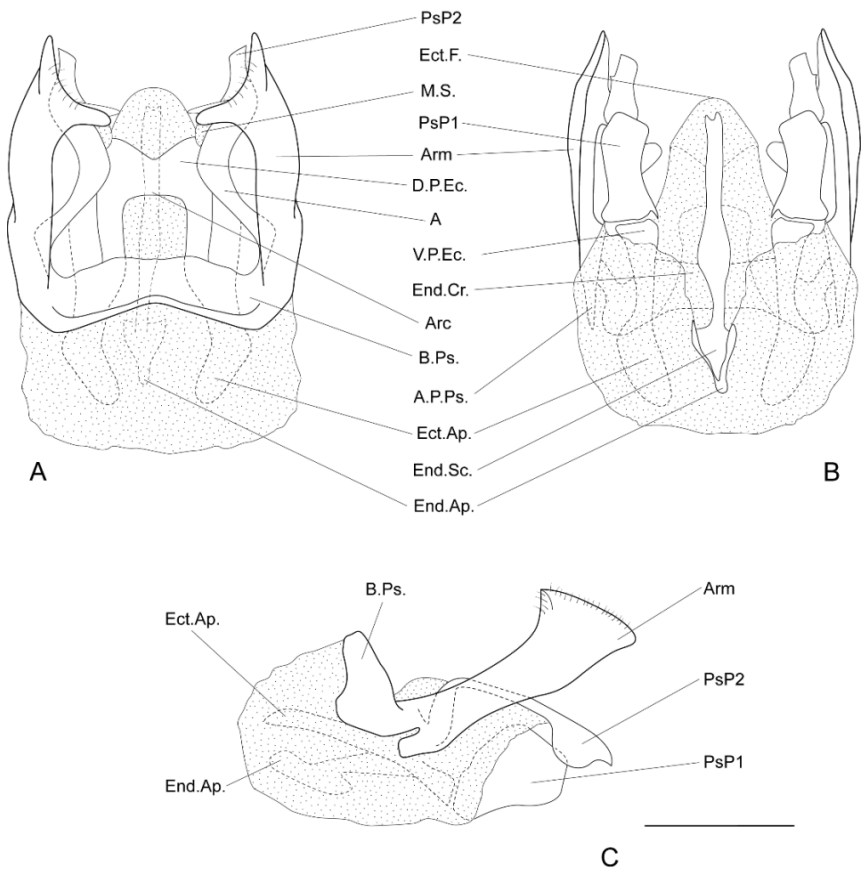


Figure 7. *Eidmanacris larvaeformis* (Chopard). Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

Figure 8. *Eidmanacris larvaeformis* (Chopard). Male and female topotypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris alboannulata (Piza, 1960)

(Figs. 9-11)

Arachnomimus alboannulatus Piza, 1960: 253 (male and female description). Type locality, Brazil, São Paulo state, Piracicaba municipality.

Endecous alboannulatus, Chopard, 1968: 280 (catalogue).

Eidmanacris bicornis Mesa & Mello, 1985: 199-204 (male and female description); Synonymy by Mesa *et al*., 1998: 44.

Arachnominus alboamulatus, Paschoal & Barros, 1997: 242 (misspelling).

Eidmanacris alboannulata, Mesa *et al.*, 1998: 44 (synonymy with *bicornis*); Prado & Fontanetti, 2005: 83-87 (morphology of metanotal gland); Zefa, Fontanetti & Martins, 2010: 53-58; Souza-Dias, Campos & Nihei, 2015: 554 (note).

Type material examined. 1 male paratype, 1 female paratype. Labeled: "*Eidmanacris bicornis* Mesa & Mello"; "Muséum Paris, Brésil, Col. A. Mesa/ F. Mello"; "São Paulo, 10 km NE of Itirapina, Vii-1982"; "PARATYPE"; "MNHN-EO-ENSIF3929" (MNHN). Dry specimens.

Other material examined. Total: 51 males, 74 females. 13 males and 17 females labeled: "Jundiaí, São Paulo, Brasil, Reserva Biológica Serra do Japi, 05-07.xi.2012, Dias, P.G.B.S.; Dios, R. *et* al." (Laboratório de Biogeografia e Sistemática de Insecta, IBUSP). 1 male and 1 female labeled: "Brasil, SP, Piracicaba, Horto Flor. Tupi, xii. 1988, F.A.G. Mello leg. Brasil"; 3 males and 7 females labeled: "SP, Itirapina, Fazenda da Toca (entrada da gruta), xi-1989, F.A.G. Mello, *leg*"; 23 males and 22 females labeled: "Brasil, SP, Botucatu, Fazenda Lageado, Ambiente de mata, 01.xii.1995, F.A.G. Mello – S. Nihei, *leg*"; 9 males and 8 females labeled: "Brasil, SP, S. J. dos Campos, Distr. S. Francisco Xavier, 08-12.xii.2004, *ca.* 1400 m alt., Fazenda Mandala, M. P. Bolfarini *leg.*" (UBTU). Specimens preserved in ethanol 80%.

Distribution. Brazil, São Paulo State.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: antenomeres medium brown, with whitish band composed of *c.a.* 5 antenomeres increasing in number toward the end of antennae; posterior portion of metanotum very pubescent; anterior half of basitarsus light brown, posterior half dark

brown; latero-posterior projections of supra anal plate longer than posterior margin; inferior projection of apex of pseudepiphallic arm hook-shaped, curved inwards.

Redescription.

Head. Medium to dark brown. Occiput with central maculae light brown, band light brown going from occiput to the margin of each eye; vertex medium to dark brown, with three lines light brown, vertical, in dorsal view (Fig. 9C). Fastigium medium to dark brown, with two rows of bristles, slightly longer than wide, narrowed toward the apex, separated from vertex by a line forming a "v" (Fig. 9C). Frons light brown, with three bands dark brown, vertical, two bellow eyes and antennal scape and other above clypeus (Figs. 9A, B). Three ocelli present, well developed, forming an isosceles triangle, the central flattened at bottom, lateral elliptical (Figs. 9A, B, C). Eyes with unpigmented small area on supero-internal angle (Fig. 9C). Maxillary palpi long and thin, slightly pilose, medium brown, distal portion of joints white; joints 3, 4 and 5 almost same-sized (Fig. 9H); apex of joint 5 upcurved. Gena light brown, posterior margin medium to dark brown in lateral view (Fig. 9B). Frontoclypeal suture yellowish brown to pale yellow; clypeus light brown, with band dark brown, central, in upper margin, in frontal view; labrum whitish, lower portion light brown. Mandible light brown, inner margin dark brown. Antennal scape light brown, inner margin dark brown (Fig. 9A); antenomeres medium brown with whitish band composed of *c.a.* 5 antenomeres, increasing in number toward the end of antennae.

Thorax. Pronotum DD wider than long, dark brown, with sparse dark spots and maculae, slightly pubescent, inflated, divided by a very tiny light brown sagittal line (Fig. 9C); DD cephalic margin slightly concave, caudal margin sub straight (Fig. 9C); ventro-cephalic angle rounded, lighter than DD, ventro-caudal margin gradually ascendant (Fig. 9B).

Legs. FI and II yellowish brown to light yellow, annulated with dark brown. TI and II yellowish brown, TI with two same-sized apical spurs; TII with two inner apical spurs and one outer, smaller. FIII yellowish brown, with medium brown thin stripes on outer face, apical third medium brown (Fig. 9D). TIII yellowish brown; subapical spurs 4/4, with serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face: median (iam) longer than dorsal (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III anterior half light brown, posterior half medium to dark brown.

Abdomen. Fusiform in dorsal view, medium to dark brown, divided by light brown sagittal line.

Male. Medium sized body, general coloration dark brown. Male FWs medium to dark brown, inner margin light brown, reticulated, elongated, apex rounded; posterior part of inner margin and apex whitish connected to a single vein that divides the external part of FW as a lateral field, glandular thickening present distally (Fig. 9C); inner margins not touching each other; FWs covering the metanotal gland, surpassing metanotum posterior border (Fig. 9B, C). Metanotal gland present, anteromedian crest forming an inverted triangle with cluster of bristles; lateral projections short, cylindrical, parallel (Figs. 9F, G), posterior portion of metanotum very pubescent. Supra anal plate light brown, anterior margin dark, slightly concave, pubescent; latero-posterior projections longer than posterior margin, light brown; posterior margin somewhat rounded. (Fig. 9I). Subgenital plate longer than wide, with lateral pubescence, laterally medium to dark brown and centrally whitish; anterior margin almost straight, posterior margin straight, with a central, small invagination (Fig. 9K).

Phallic complex (Figs. 10A-C; 11A-C). Pseudepiphallus: central and lateral parts of the base of pseudepiphallic sclerite with same thickness, in dorsal view; pseudepiphallic arms sclerotized, hard, slightly upcurved in lateral view; apex of pseudepiphallic arm with bristles on outer face, superior and supero-internal projections reduced to a spine, inferior projection hook shaped curved inwards; anterior projection of pseudepiphallic sclerite very short, distally pointed; PsP2 hardly sclerotized, not surpassing posterior extremity of pseudepiphallic arms in dorsal view, apex pointed in lateral view, curved inwards in dorsal view, with membranous sphere on inner face; sclerite A connected with base of pseudepiphallic sclerite, straight, articulation with PsP2 visible; PsP1 elongate, inner face well sclerotized in ventral view. Ectophallic invagination: ectophallic apodeme elongated; ectophallic arc located below the base of pseudepiphallic sclerite in dorsal view; ventro-posterior projection elongate; dorsal projection sclerotized, short. Endophallus: median-projection of pseudepiphallic sclerite elongated, not surpassing PsP2 apex, anterior portion wider in ventral view; latero-posterior lobes of the endophallic sclerite elongate; endophallic apodeme elongated, reaching the apex of ectophallic apodeme.

Female. Larger than male, general coloration similar (Fig. 9E). Supra anal plate medium brown, posterior border dark, anterior margin slightly concave, posterior margin

rounded with long bristles (Fig. 9J). Subgenital plate light brown with whitish maculae on anterior margin, wider than long, anterior margin sub straight, posterior margin rounded with central, small concavity (Fig. 9L). Ovipositor as in figs. 9M, N.

Copulatory papilla (Figs. 11D-F). Hard sclerotized, as long as wide, cylindrical, anterior margin membranous, posterior margin somewhat rounded in dorsal and ventral views.

Measurements (mm).

Male (n=10): Hw, 2.77 ± 0.18 (2.48-3.1); iod, 1.3 ± 0.08 (1.12-1.43); Lpron, 2.9 ± 0.19 (2.48-3.16); awpron, 2.87 ± 0.15 (2.67-3.1); pwpron, 3.04 ± 0.24 (2.42-3.35); wpron 3.93 ± 0.3 (3.29-4.4); LFW, 3.78 ± 0.18 (3.47-4.09); wFW, 1.59 ± 0.23 (1.24-1.98); LFIII, 12.46 ± 0.64 (10.95-13.05); wFIII 2.88 ± 0.15 (2.55-3); LTIII, 13.53 ± 0.74 (12-14.55); Ltars1-III, 4.36 ± 0.43 (3.6-5.1).

Female (n=10): Hw, 3.16 ± 0.10 (2.98-3.35); iod, 1.45 ± 0.08 (1.3-1.55); Lpron, 3.45 ± 0.21 (3.1-3.72); awpron, 3.19 ± 0.18 (2.91-3.41); pwpron, 3.54 ± 0.27 (2.98-3.9); wpron, 4.48 ± 0.23 (4.09-4.84); LFIII, 14.92 ± 0.76 (13.35-16.2); wFIII, 3.46 ± 0.14 (3.15-3.6); LTIII, 15.4 ± 0.55 (14.25-16.05); Ltars1-III, 4.3 ± 0.31 (3.75-4.8); OL, 13.74 ± 0.55 (13.05–14.55).

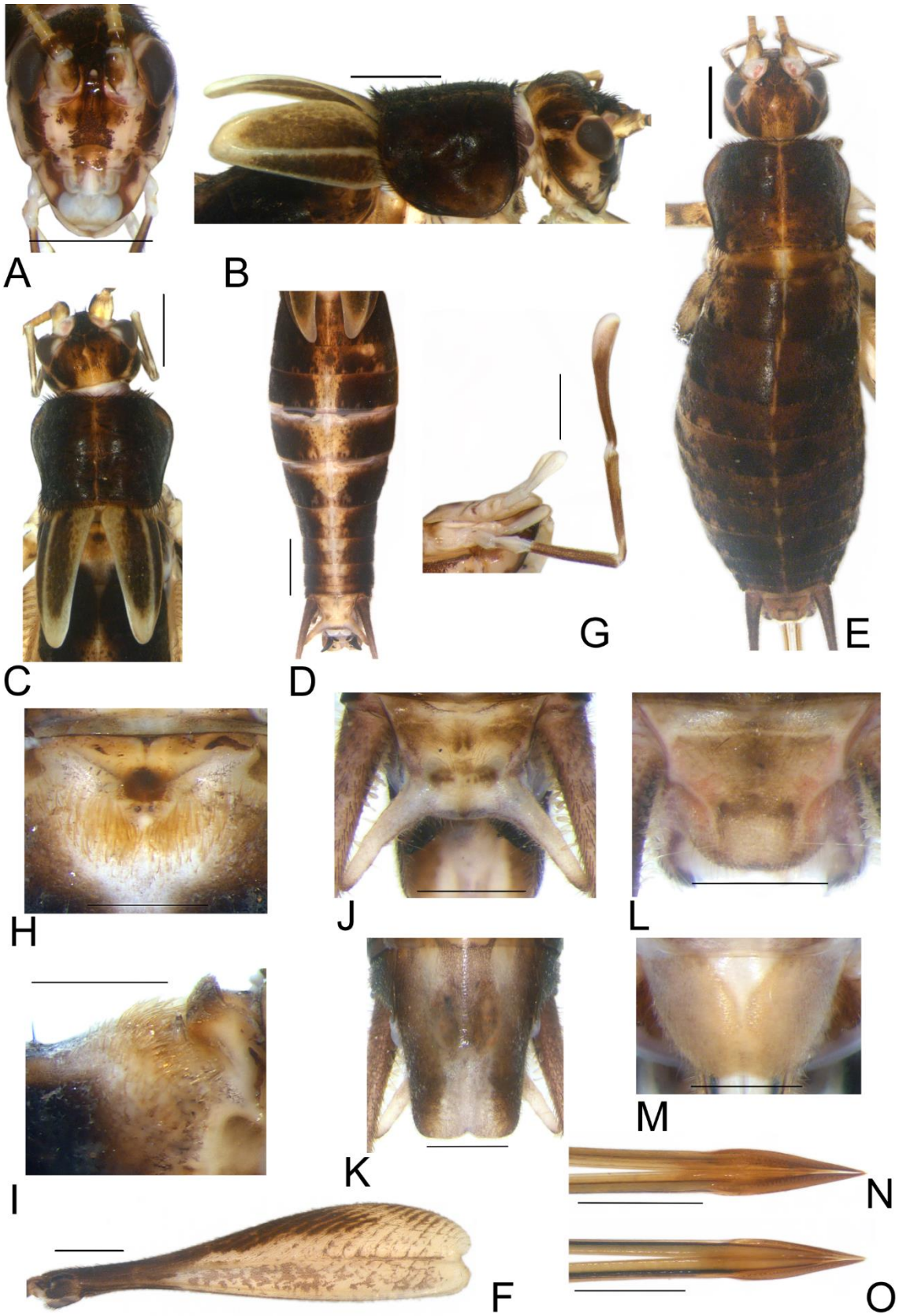


Figure 9. *Eidmanacris alboannulata* (Piza). Male and female topotypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

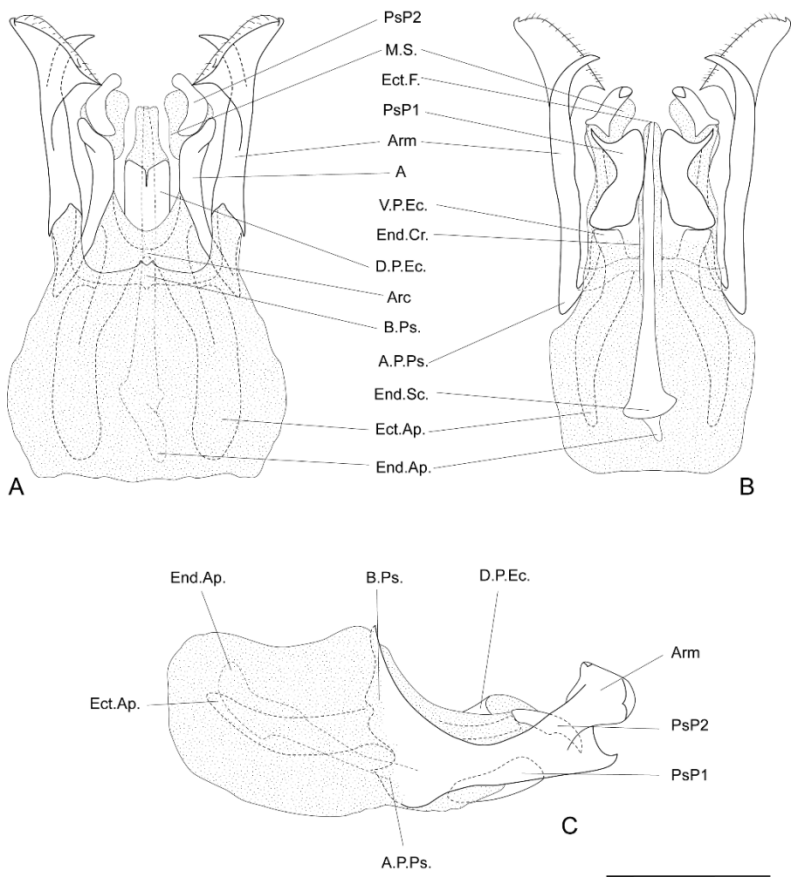


Figure 10. *Eidmanacris alboannulata* (Piza). Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

Figure 11. *Eidmanacris alboannulata* (Piza). Male and female topotype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris dissimilis Desutter-Grandcolas, 1995

(Figs. 12-14)

Eidmanacris dissimilis Desutter-Grandcolas, 1995: 463 (male and female descriptions). Type locality: Brazil, Minas Gerais State, Poços de Caldas municipality.

Eidmanacris dissimilis, Prado & Fontanetti, 2005: 83-87 (morphology of metanotal gland); Souza-Dias, Campos & Nihei, 2015: 555 (note).

Eidmanacris lencionii Bolfarini, 2016: 526-532. Type locality: Brazil, Minas Gerais State, Brumadinho municipality. **Syn. nov.**

Type material examined. Holotype male, allotype, 1 male paratype and 1 female paratype. Holotype labeled: "Brasil, Minas Gerais, Poços de Caldas, Morro do Ferro, 7.IX.1967, J. Becker, O. Roppo, O. Leoncini col."; "*Eidmanacris dissimilis* L. DESUTTER DET."; "HOLOTYPE". Allotype labeled: "Brasil, Minas Gerais, Poços de Caldas, Morro do Ferro, 7.IX.1967, J. Becker, O. Roppo, O. Leoncini col."; "*Eidmanacris dissimilis* L. DESUTTER DET."; "ALLOTYPE"; Paratype male and female labeled: "Brasil, Minas Gerais, Poços de Caldas, Morro do Ferro, 7.IX.1967, J. Becker, O. Roppo, O. Leoncini col."; "L. DESUTTER DET., PARATYPE". Dry specimens (MNHN).

Other material examined. Total: 16 males and 10 females. 2 males and 2 females labeled: "Brasil- Minas Gerais Poços de Caldas, Morro do Ferro, 7.IX.1967, O. Roppa, Q. Leoncini col"; "#37907 MZUEFS"; "#37899 MZUEFS"; "#37905 MZUEFS"; "#37897 MZUEFS" (MZUEFS). 2 males and 2 females labeled: "Brasil (MG) Sul da Matiqueira, Fazenda Saiqui, 20 Km/s NO de Barreira do Piquete, 01-X-83, A. Mesa, O. Cello" (MZSP). 10 males and 4 females labeled: "Gruta, PBR01- Brumadinho, 607744mE/7770546mN SAD' 69, 28.ix-03.x.2009, Bessi *et* al., col"; "Gruta, PBR03- Brumadinho, 607229mE/7770560mN SAD' 69, 28.ix-03.x.2009, Bessi *et* al., col."; "Gruta, PBR04- Brumadinho, 607709mE/7770560mN SAD' 69, 28.ix-03.x.2009, Bessi *et* al., col."; "Gruta, PBR06- Brumadinho, 607708mE/7770581mN SAD' 69, 28.ix-03.x.2009, Bessi *et* al., col."; "Gruta, PBR07- Brumadinho, 607042mE/7770056mN SAD' 69, 28.ix-03.x.2009, Bessi *et* al., col."; "Gruta, PBR16- Brumadinho, 607269mE/7770965mN SAD' 69, 28.ix-03.x.2009, Bessi *et* al., col." (UBTU). Specimens preserved in ethanol 80%.

Distribution. Brazil, Minas Gerais State.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: antennomeres medium to dark brown with whitish bands composed by *c.a.* 20 antennomeres; apex of FWs rounded, slightly curved inwards with ventral bristles; apex of pseudepiphallic arm with superior projection somewhat rounded posteriorly, with bristles, internal projection reduced to a protuberance, inferior projection short, with tip rounded.

Redescription.

Head. Dark to reddish brown. Occiput with central maculae medium brown, band medium brown going from occiput to the margin of each eye; vertex medium to dark brown, with three lines light brown, vertical, in dorsal view (Fig. 12C). Fastigium dark brown, with two rows of bristles, slightly longer than wide, narrowed toward the apex, separated from vertex by a line forming a "v" (Fig. 12C). Frons light brown, with three medium to dark brown vertical bands, two bellow eyes, one above clypeus (Figs. 12A, B). Three ocelli present, well developed, forming an isosceles triangle, central one flattened at bottom, lateral rounded (Figs. 12A, B, C). Eyes with unpigmented small area on supero-internal angle (Fig. 12C). Maxillary palpi long and thin, slightly pilose, medium brown, distal portion of joints white; joints 3 and 4 almost same-sized, joint 5 the longest (Fig. 12H); apex of joint 5 upcurved. Gena light brown, posterior margin medium to dark brown in lateral view (Fig. 12B). Frontoclypeal suture light yellow, clypeus light brown with two bands medium brown, vertical, on upper margin, in frontal view; labrum whitish, lower portion yellowish brown. Mandible medium brown, maculae light brown on inferior margin. Antennal scape medium brown, inner margin dark brown (Fig. 12A); antenomeres medium to dark brown with whitish bands composed of *c.a.* 20 antenomeres.

Thorax. Pronotum DD wider than long, medium to dark brown, slightly pubescent, inflated, divided by very tiny light brown sagittal line (Fig. 12C); DD cephalic margin slightly concave, caudal margin sub straight (Fig. 12C); ventro-cephalic angle rounded, ventro-caudal margin gradually ascendant (Fig. 12B).

Legs. FI and II light to yellowish brown, annulated with dark brown. TI and II yellowish brown, annulated with dark brown, TI with two same-sized apical spurs; TII with two inner apical spurs and one outer, smaller. FIII light to yellowish brown, with thin stripes medium to dark brown on outer face, dorsal margin and apical third dark brown (Fig. 12D).TIII medium brown; subapical spurs 4/4, with serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face: median (iam)

sub-equal in length than dorsal (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III yellow.

Abdomen. Cylindrical in dorsal view, medium to dark brown, with spots and maculae, divided by a light brown, thin sagittal line.

Male. Medium sized body, general coloration medium to reddish brown, with dark spots and maculae. FWs medium to dark brown, elongated, apex rounded, in curved inwards; posterior part of inner margin and apex whitish connected to a single vein that divides the external part of FW as lateral field, glandular thickening present distally, with bristles (Fig. 12C); inner margins overlapped; covering the metanotal gland, surpassing metanotum posterior border (Fig. 12B, C). Metanotal gland present, anteromedian crest forming an inverted triangle with cluster of bristles; lateral projections short, cylindrical, parallel (Figs. 12F, G), posterior portion of metanotum very pubescent. Supra anal plate medium to dark brown, superior margin lighter, anterior margin concave; latero-posterior projections short, dark brown, with long bristles; posterior margin sub-straight (Fig. 12I). Subgenital plate longer than wide, pubescent, medium to dark brown laterally and greyish centrally; anterior margin straight, posterior margin rounded with a small invagination centrally, forming two lobes (Fig. 12K).

Phallic complex (Figs. 13A-C; 14A-C). Pseudepiphallus: base of pseudepiphallic sclerite without depressions in dorsal view; pseudepiphallic arms sclerotized, hard, slightly upcurved in lateral view; apex of pseudepiphallic arm with bristles on outer face, superior projection somewhat rounded posteriorly, with bristles; supero-internal projection reduced to a protuberance, inferior projection short, with tip rounded; anterior projection of pseudepiphallic sclerite present, elongate, surpassing base of pseudepiphallic sclerite; PsP2 short, hardly sclerotized, not reaching posterior extremity of pseudepiphallic arms, in dorsal view; apex pointed in lateral view, curved inwards in dorsal view, with membranous sphere on inner face; sclerite A connected with base of pseudepiphallic sclerite, straight, articulation with PsP2 visible; PsP1 elongated, inner face well sclerotized in ventral view. Ectophallic invagination: ectophallic apodeme elongate; ectophallic arc located below the base of pseudepiphallic sclerite, “v”-shaped in dorsal view; ventro-posterior projection short; dorsal projection sclerotized, straight laterally, posterior margin with central invagination resembling a “v”. Endophallus: medio-posterior projection elongated, surpassing PsP2 apex, anterior portion wider in

ventral view; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme elongate, anterior to ectophallic apodeme.

Female. Larger than male, general coloration similar (Fig. 12E). Supra anal plate medium to dark brown, posterior margin light brown, anterior margin slightly concave, posterior margin rounded with long bristles (Fig. 12J). Subgenital plate light brown with whitish anteromedian maculae, wider than long, anterior margin sub-straight, posterior margin rounded (Fig. 12L). Ovipositor as in figs. 12M, N.

Copulatory papilla (Figs. 14D-F). Sclerotized, longer than wide, cylindrical, anterior margin membranous, posterior margin unpigmented.

Remarks. *E. lencionii* is proposed as junior synonym of *E. dissimilis* because there is no significant morphological differences between them, only color variation. Some specimens from Brumadinho-MG are darker than specimens from Poços de Caldas-MG.

Measurements (mm).

Male (n=8): Hw, 2.97 ± 0.19 (2.54-3.16); iod, 1.48 ± 0.15 (1.24-1.61); Lpron, 3.23 ± 0.23 (2.79-3.53); awpron, 2.96 ± 0.21 (2.72-3.34); pwpron, 3.41 ± 0.13 (3.28-3.72); wpron 4.31 ± 0.2 (4.03-4.65); LFW, 3.28 ± 0.19 (3.03-3.53); wFW, 1.57 ± 0.07 (1.42-1.67); LFIII, 14.76 ± 1.38 (12.15-15.9); wFIII 3 ± 0.12 (2.85-3.15); LTIII, 16.45 ± 1.27 (13.8-17.55); Ltars1-III, 5.03 ± 0.34 (4.5-5,4).

Female (n=3): Hw, 3.36 ± 0.09 (3.28-3.47); iod, 1.55 ± 0.06 (1.48-1.61); Lpron, 3.57 ± 0.14 (3.41-3.65); awpron, 3.2 ± 0.17 (3.1-3.41); pwpron, 4.05 ± 0.25 (3.84-4.34); wpron, 4.79 ± 0.23 (4.52-4.96); LFIII, 16.15 ± 0.6 (15.45-16.5); wFIII, 3.4 ± 0.22 (3.15-3.6); LTIII, 17.7 ± 0.79 (16.8-18.3); Ltars1-III, 4.7 ± 0.22 (4.5-4.95); OL, 17.05 ± 0.99 (16.2–18.15).

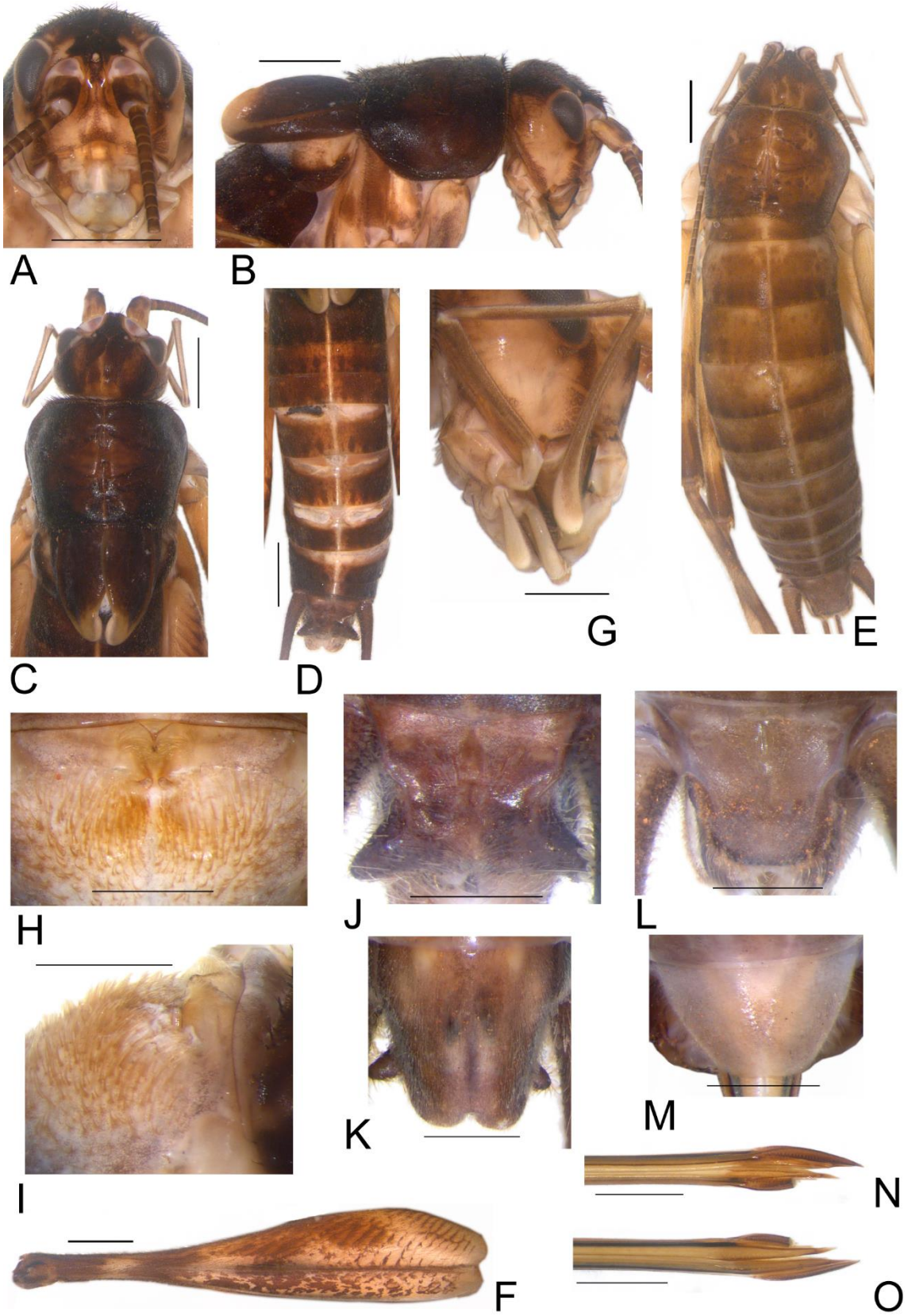


Figure 12. *Eidmanacris dissimilis* Desutter-Grandcolas. Male and female topotypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

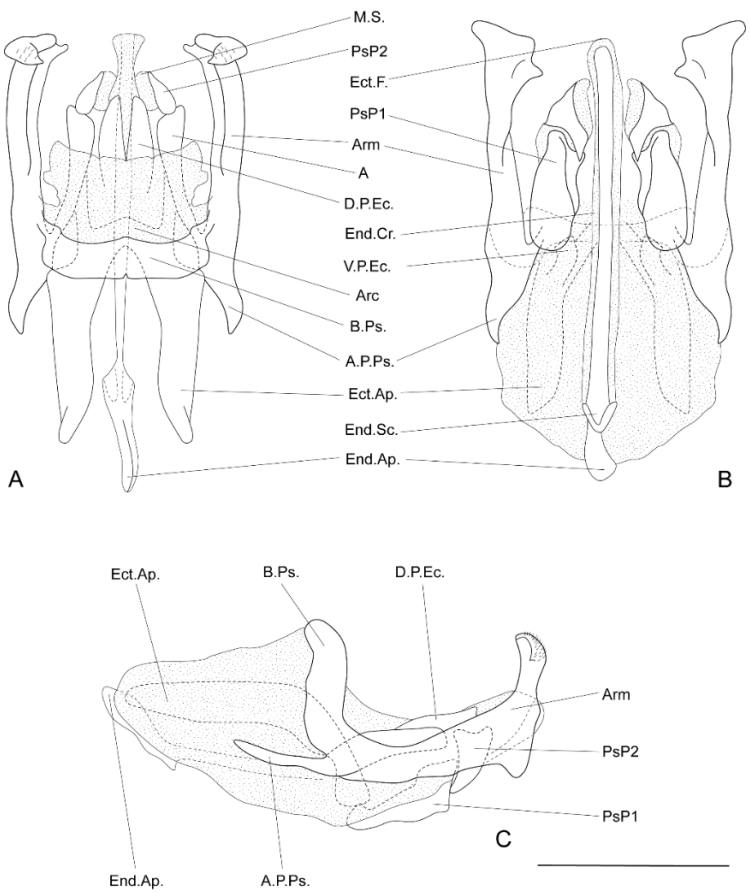


Figure 13. *Eidmanacris dissimilis* Desutter-Grandcolas. Holotype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

Figure 14. *Eidmanacris dissimilis* Desutter-Grandcolas. Male and female topotypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris fusca Desutter-Grandcolas, 1995

(Figs. 15-17)

Eidmanacris fusca Desutter-Grandcolas, 1995: 466 (male description). Type locality: Brazil, Rio Grande do Sul State, Aratinga municipality (Serra Geral).

Material Examined. Total: 22 males and 6 females. 21 males and 5 females labeled: "BR, SC, URUBICI, 02-05.XII.2011, DIAS, P. G. B. S. col." (Laboratório de Sistemática e Biogeografia de Insecta, IBUSP). 1 male and 1 female labeled: "Brasil, Sta Catarina, 20 Km. S.E. de São Bentos do Sul, 31-XII-76, A. Mesa, R. Cohn." (UBTU). All specimens preserved in ethanol 80%.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: general coloration dark brown; metanotal gland absent, with two structures whitish, rounded and inflated; TIII subapical spurs yellowish, with central, dark brown bands; apex of pseudepiphallic rounded distally, superior and supero-internal projections reduced to a spine, inferior projection well developed in lateral view. PsP2 apex trifid, two projections curved inwards, other elongate, down curved and apically pointed in lateral view; PsP1 robust, curved inwards in ventral view, pointed distally, enlarged anteriorly; copulatory papilla rounded laterally, posterior margin rounded with a central concavity well discernible in dorsal and ventral views, large anterior concavity in ventral view.

Redescription

Head. Dark brown (Figs. 15A, B, C). Occiput dark brown with central maculae light brown; vertex with three stripes light brown, longitudinal (Fig. 15C). Fastigium dark brown with two row of bristles, as long as wide, slightly narrowed toward at apex, narrower than scape, separated from vertex by a transverse line almost no discernible (Fig. 15C). Frons dark brown, with central triangle medium to dark brown (Fig. 15A). Three ocelli present, well developed, lateral rounded, central oval (Figs. 15A, B, C); eye with unpigmented area on supero-internal angle (Fig. 15A, C). Maxillary palpi dark brown, long, thin; joints 3, 4 and 5 almost same sized, dark brown, distal portion whitish; apex of joint 5 upcurved (Fig. 15G). In frontal view, gena dark brown (Fig. 15A); in lateral view, gena dark brown, posterior margin light brown (Fig. 15B). Frontoclypeal suture dark yellow. Clypeus upper margin dark brown, lower margin light brown; labrum

whitish, apex light brown (Fig. 15A). Mandible dark brown with light brown maculae. Antennal scape dark brown, light brown longitudinal stripe on outer face (Fig. 15A); antenomeres dark brown, with two whitish bands, the first composed of *c.a.* 11 antenomeres, second larger composed of *c.a.* 20 antenomeres

Thorax Pronotum DD dark brown, wider than long, inflated, slightly pubescent, divided by a thin light brown vertical line; DD cephalic margin slightly concave, caudal margin almost straight (Fig. 15C); ventro-cephalic angle broadly rounded, ventral margin gradually ascendant, (Fig. 15B).

Legs. FI and II dark brown. TI dark brown; TII dark brown, annulated with medium brown. TI with two same-sized apical spurs; TII with two inner same-sized spurs, one outer, smaller. FIII medium to dark brown, with several dark brown stripes, apical part dark brown (Fig. 15F). TIII yellowish brown, apically dark brown; subapical spurs 4/4, spurs yellowish, centrally dark brown banded; apical spurs 3/3, more developed on inner face; inner apical spurs: median (iam) and dorsal almost same sized but slightly bigger (iad), ventral smallest (iav) (iad>iam>iav); outer apical spurs: median (oam) and dorsal almost same sized but larger (oad), ventral smallest (oav) (oad>oam>oav). Basitarsus I, II and III dark yellowish.

Abdomen. Dark brown, sub-cylindrical, pubescent, divided by a thick sagittal line light brown, almost no discernible (Fig. 15D).

Male. Body large, general coloration dark brown. FWs dark brown, short, covering metanotal gland area, not surpassing metanotal posterior margin, outer margins medium brown, apex connected to a single vein that divide outer part of FW as lateral field, reticulated; inner margins touching each other (Fig. 15C). Metanotal gland absent, apparently vestigial, with two structures whitish, rounded and inflated (Figs. 15H, I). Supra anal plate medium brown, posterior margin dark brown; anterior margin slightly concave, posterior margin slightly concave, composed of latero-distal projections very short (Fig. 15J). Subgenital plate dark brown, as long as wide, laterally pubescent, central maculae greyish, anterior margin almost straight, posterior margin with central, small invagination (Fig. 15K).

Phallic complex (Figs. 16A-C; 17A-C). Pseudepiphallus: base of pseudepiphallic sclerite centrally narrow; pseudepiphallic arms sclerotized, hard, apex upcurved; apex of pseudepiphallic arm without bristles, curved inwards (more than 90°), bifid, distally rounded, forming superior and internal projection-like spines; inferior projection well

developed, elongated, apex pointed in lateral view; anterior projection of pseudepiphallic sclerite short, pointed, down curved, not surpassing median part of pseudepiphallus in dorsal and lateral views; PsP2 sclerotized, elongate in lateral view, not surpassing posterior extremity of pseudepiphallic arms; apex trifid, two projections pointed inwards, other long, down curved, pointed apically in lateral view, apparently without membranous sphere on inner face; sclerite A connected in the base of pseudepiphallic arm, straight, articulation with PsP2 visible; PsP1 sclerotized, robust, short, curved inwards in ventral view, distally pointed, anteriorly enlarged. Ectophallic invagination: ectophallic apodeme somewhat long, anteriorly thin, dorso-ventrally flattened in lateral view; ectophallic arc short, located posteriorly to base of pseudepiphallic sclerite in dorsal and ventral views; dorsal projection short, sclerotized, with a posterior concavity, not surpassing PsP2 in dorsal view; ventro-posterior projection not so elongate. Endophallus: medio-posterior projection elongated, apex reaching PsP2 apex; latero-posterior lobes of endophallic sclerite very short; endophallic apodeme laterally flattened, wider than long, upcurved in lateral view, the limits not surpassing ectophallic apodeme.

Female. Larger than male, general coloration dark brown (Fig. 15E). Maxillary palpi dark brown Thorax and abdomen dark brown, with a thin, light brown sagittal line, almost no discernible. Supra anal plate medium brown, anterior margin slightly concave, posterior margin darker, somewhat rounded with not so long bristles (Fig. 15L). Subgenital plate medium to dark brown, anterior margin light brown, posterior margin with central concavity (Fig. 15M). Ovipositor as in figs. 15N and 15O.

Copulatory papilla (Figs 17D-F). Sclerotized, wider than long, laterally rounded, posterior margin rounded with a central, well discernible concavity in dorsal and ventral views, anterior concavity large in ventral view.

Mesurements (mm)

Male (n=10): Hw, 3.41 ± 0.06 (3.28-3.53); iod, 1.69 ± 0.13 (1.48-1.86); Lpron, 3.89 ± 0.18 (3.65-4.15); awpron, 3.45 ± 0.17 (3.22-3.72); pwpron, 3.7 ± 0.22 (3.28-4.03); wpron 5.07 ± 0.2 (4.65-5.33); LFW, 2.02 ± 0.12 (1.86-2.17); wFW, 1.95 ± 0.12 (1.67-2.1); LFIII, 17.13 ± 0.67 (16.5-18.3); wFIII 3.36 ± 0.18 (3-3.6); LTIII, 18,61 ± 0.83 (17.25-19.5); Ltars1-III, 5.02 ± 0.28 (4.35-5,4).

Female (n=5): Hw, 3.42 ± 0.10 (3.28-3.53); iod, 1.66 ± 0.05 (1.61-1.73); Lpron, 3.69 ± 0.09 (3.59-3.84); awpron, 3.31 ± 0.18 (3.1-3.59); pwpron, 3.79 ± 0.11 (3.59-3.9); wpron, 4.87 ± 0.16 (4.71-5.08); LFIII, 16.5 ± 0.63 (15.9-17.4); wFIII, 3.54 ± 0.13 (3.45-3.75); LTIII, 17.43 ± 0.66 (16.8-18.45); Ltars1-III, 4.74 ± 0.17 (4.5-4.95); OL, 18.69 ± 0.88 (18-19.8).

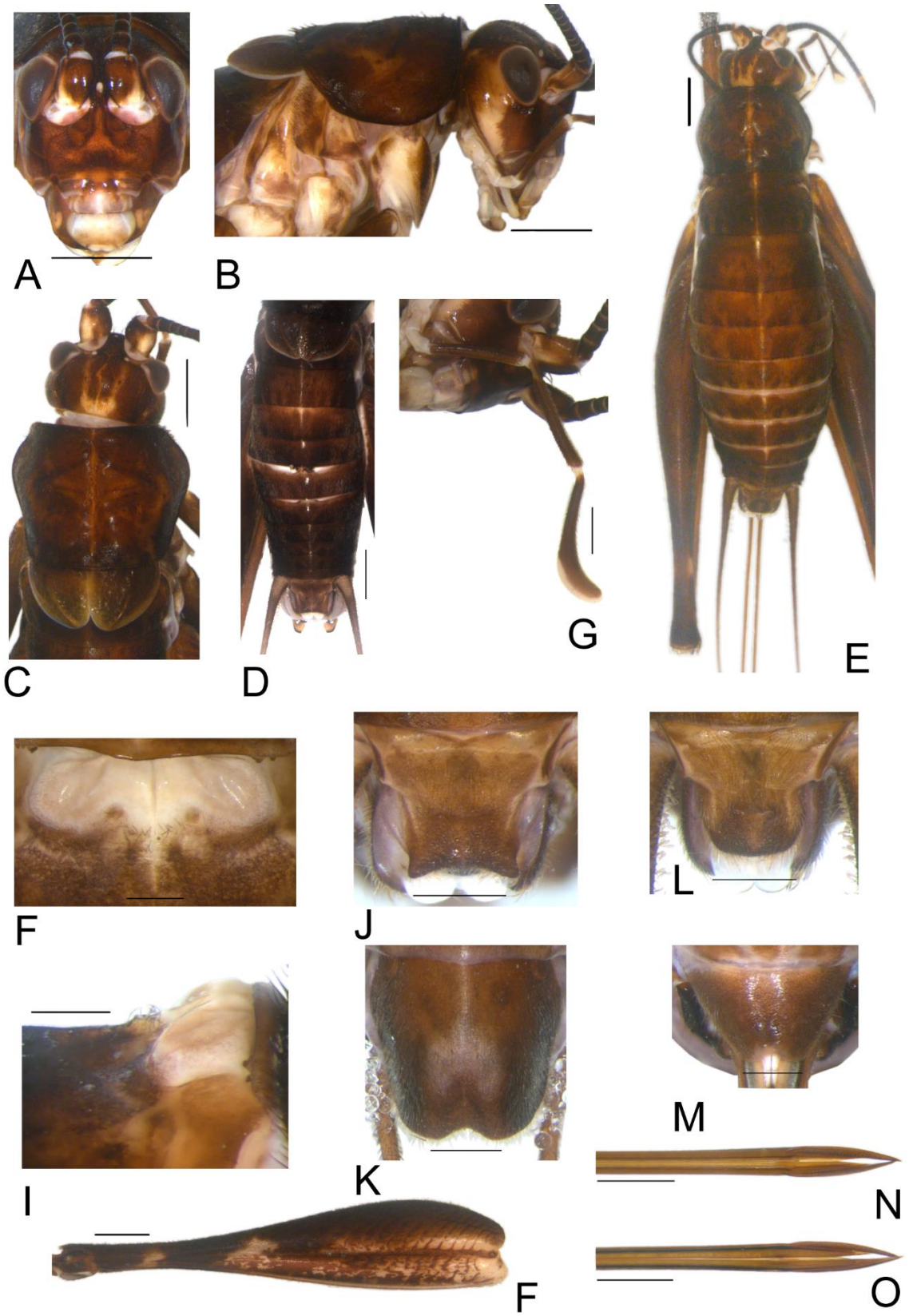


Figure 15. *Eidmanacris fusca* Desutter-Grandcolas. Non-type. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpi; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

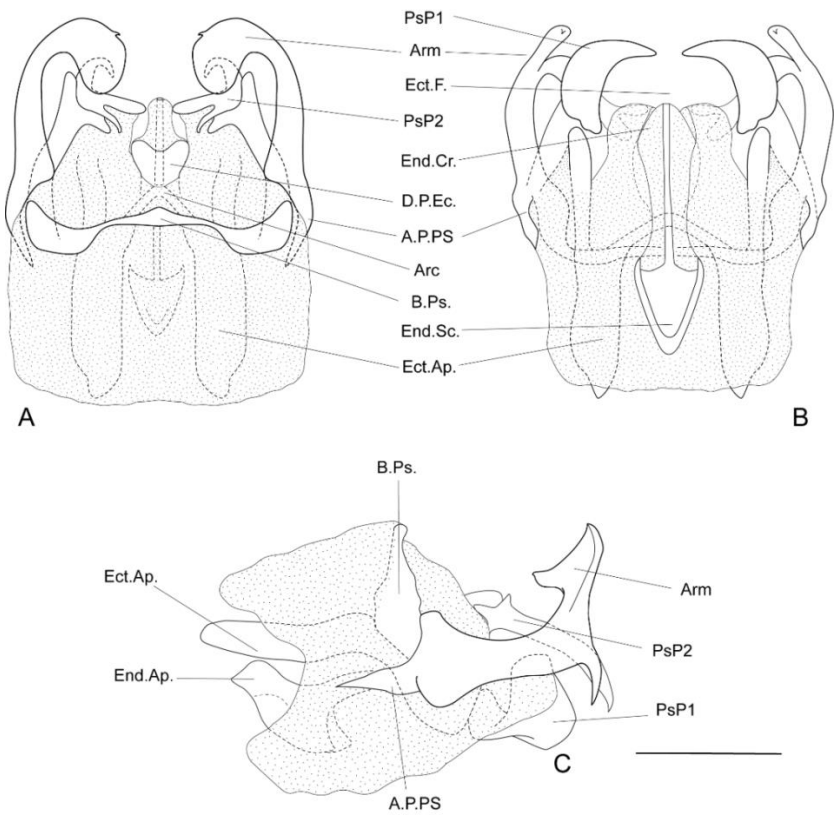


Figure 16. *Eidmanacris fusca* Desutter-Grandcolas. Non-type. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

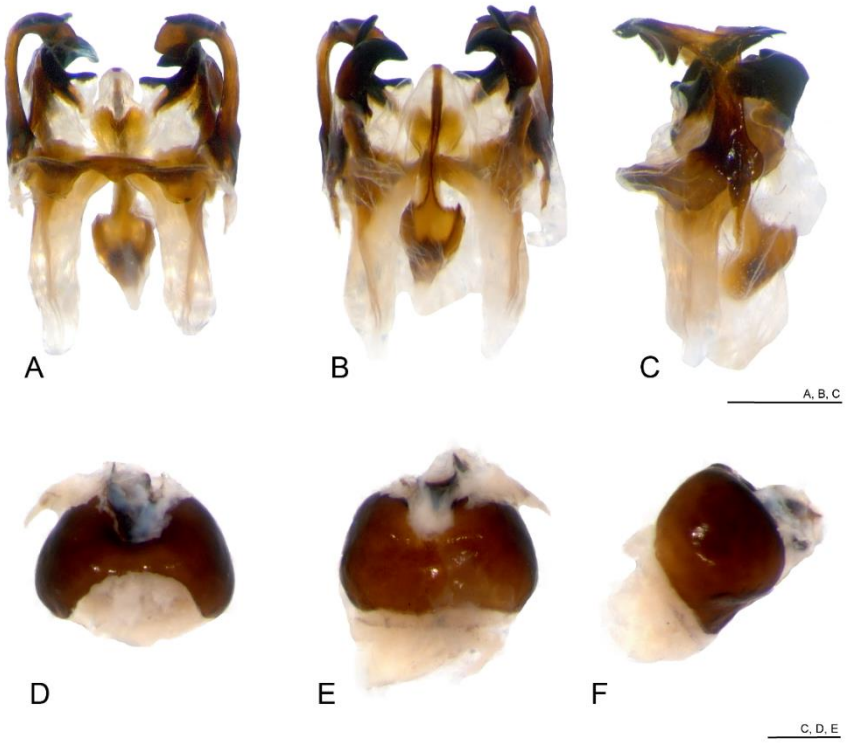


Figure 17. *Eidmanacris fusca* Desutter-Grandcolas. Non-type. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris multispinosa Desutter-Grandcolas, 1995

(Figs. 18-20)

Eidmanacris multispinosa Desutter-Grandcolas, 1995: 463 (male description). Type locality: Brazil, Espírito Santo State, Sante Teresa municipality.

Eidmanacris multispinosa, Souza-Dias, Campos & Nihei, 2015: 554 (note).

Type material examined. Male holotype labeled: "Vitoria, Fundao. Sta Teresa, Réserve biologique de Sta. Lucia, 22-XI-1992, nuit"; "Muséum Paris, BRESIL / Etat de Espirito Santo, L. Desutter-Grandcolas, rec."; "HOLOTYPE" (MNHN). Dry specimen.

Other material examined. 1 male and 3 females, labeled: "Santa Teresa, ES, Brasil, Estação Biológica Santa Lúcia, 19°57'56.0''S 40°32'26.4''W, 16-28.xi.2015, Redü, D.R. *leg*." (Laboratório de Sistemática e Biogeografia de Insecta, IBUSP). 8 females labeled: "Brasil, ES, Sta. Teresa, Reserva Sta. Lúcia, i-96, F.A.G. Mello – S.S. Nihei, *leg*" (UBTU). Specimens preserved in ethanol 80%.

Distribution. Brazil, Espírito Santo State.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: antenomeres anterior half dark brown, posterior half whitish; caudal margin of pronotum light brown contrasting with DD; latero-distal projections of supra anal plate parallel; apex of pseudepiphallic arm with superior projection pointed, posterior face rounded in lateral view, small bristles anteriorly, internal projection with *c.a.* 5-7 small spines, inferior projection with *c.a.* 2-3small spines.

Redescription.

Head. Reddish brown. Occiput reddish brown with central band light brown going from occiput to vertex, other two laterally, shorter; vertex reddish brown (Fig. 18C). Fastigium blackish, with two lines of bristles, longer than wide, separated from vertex by a line forming a "v" (Fig. 18C). Frons light brown, central band dark brown, vertical, two bellow eyes (Fig. 18A). Three ocelli present, well developed, rounded (Figs. 18A, B, C). Eyes with unpigmented small area on supero-internal angle (Fig. 18C). Maxillary palpi medium brown, long, thin; joints 3 and 4 almost same-sized; joint 5 the longest (Fig. 18G), apex upcurved. Gena light brown, posterior margin with dark brown stripe in lateral view (Figs. 18A, B). Frontoclypeal suture dark yellow. Clypeus whitish, with two dark brown vertical bands; labrum whitish, lower portion light brown. Mandible light brown,

inner margin dark brown. Antennal scape light brown, inner face dark brown with row of bristles (Figs. 18A, B, C); antenomeres anterior half dark brown, posterior half whitish.

Thorax. Pronotum DD redidish brown, marbled, posterior margin light brown, wider than long, inflated, divided by a thin vertical line; DD cephalic margin slightly concave, caudal margin almost straight. (Fig. 18C); ventro-cephalic angle light brown, rounded, ventro-caudal margin gradually ascendant (Fig. 18B).

Legs. FI and II yellowish brown, annulated with dark brown. TI and II yellowish brown, annulated with medium to dark brown; TI with two same-sized apical spurs, TII with two inner apical spurs and one outer, smaller. FIII yellowish brown, several thin stripes medium brown on outer face, apical third reddish brown (Fig. 18F). TIII yellowish brown, annulated medium brown; sub apical spurs 4/4, with serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face; inner apical spurs: median longer (iam), dorsal somewhat shorter (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oa v). Basitarsus I, II and III yellowish.

Abdomen. Medium brown, sub-cylindrical, divided by a sagittal, light brown line, posterior margin of tergite I with spots light brown (Fig. 18D).

Male. Large-sized body, general coloration in different shades of brown, with spots and maculaes. FWs medium brown, sub triangular, glandular thickening on inner and posterior borders, with bristles, inner and posterior margin yellowish brown; apex connected to a single vertical vein that divides external part of FW as lateral field (Figs. 18B, C); inner margins not touching each other; FWs covering metanotal gland area, posterior margin surpassing metanotum (Fig. 18C). Metanotal gland present, anteromedian crest triangular with line of bristles; lateral projections short, top rounded; long bristles posteriorly on metanotum (Figs. 18H, I). Supra anal plate light to medium brown, anterior margin sub-straight, posterior margin somewhat concave with long setae; latero-distal projections short and parallel (Fig. 18J). Subgenital plate longer than wide, medium brown, median maculae greyish, anterior margin sub straight, posterior margin concave with invagination almost forming a “v” (Fig. 18K).

Phallic complex (Figs. 19A-C; 20A-C). Pseudepiphallus: base of pseudepiphallic sclerite not depressed; pseudepiphallic arms sclerotized, upcurved; apex of pseudepiphallic arm with bristles on outer face, superior projection pointed, posterior face rounded in lateral view, small bristles anteriorly, supero-internal projection with *c.a.* 5-7

small spines, inferior projection with *c.a.* 2-3 small spines; anterior projection of pseudepiphallic sclerite long, rounded, not surpassing the apex of ectophallic apodeme, in dorsal view; PsP2 elongate, sub-straight, inclined outwards, well sclerotized, apex pointed in lateral view, with membranous sphere on inner face, not surpassing posterior extremity of pseudepiphallic arms; sclerite A slightly sinuous, articulation visible with PsP2 in dorsal view; PsP1 short, wider than long, posteriorly pointed in ventral view, posterior face sclerotized; upcurved in lateral view. Ectophallic invagination: Ectophallic apodeme long, weakly sclerotized, laterally flattened in dorsal view, slightly upcurved in lateral view ectophallic arc short, located anteriorly to the base of pseudepiphallic sclerite in dorsal and ventral views; dorsal projection short, slightly sclerotized; ventro-posterior projection elongate, apical third curved outwards. Endophallus: medio-posterior projection elongated, surpassing PsP2 apex; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme well developed, long, upcurved in lateral view.

Female. Larger than male, general coloration similar (Fig. 18E). Supra anal plate yellowish brown, centrally dark, anterior margin sub-straight, posterior margin somewhat rounded with long bristles (Fig. 18L). Subgenital plate reddish brown medially, lateral and posterior borders medium brown, posterior margin rounded (Fig. 18M). Ovipositor as in figs. 18N and 18O.

Copulatory papilla (Figs 20D, E, F). Longer than wide, dorso-ventrally flatenned in lateral view, posterior margin whitish and rounded in dorsal and ventral views.

Measurements (mm).

Male (n=1): Hw, 3.47; iod, 1.43; Lpron, 3.9; awpron, 3.6; pwpron, 4.34; wpron, 5.08; LFW, 3.16; wFW, 1.98; LFIII, 18.3; wFIII, 3.45; LTIII, 20.1; Ltars1-III, 5.4.

Female (n=2): Hw, 3.78 ± 0.35 (3.53–4.03); iod, 1.64 ± 0.13 (1.55–1.73); Lpron, 3.87 ± 0.39 (3.59–4.15); awpron 3.59 ± 0.08 (3.53–3.65); pwpron, 4.58 ± 0.26 (4.02–4.77); wpron, 5.2 ± 0.43 (4.89–5.51); LFIII, 18.22 ± 0.31 (18–18.45) ; wFIII, 3.9 ± 0.42 (3.6–4.2); LTIII, 21.15 ± 0.84 (20.55–21.75); Ltars1-III, 5.47 ± 0.1 (5.4–5.55); OL, 17.7 ± 0.84 (17.1–18.3).

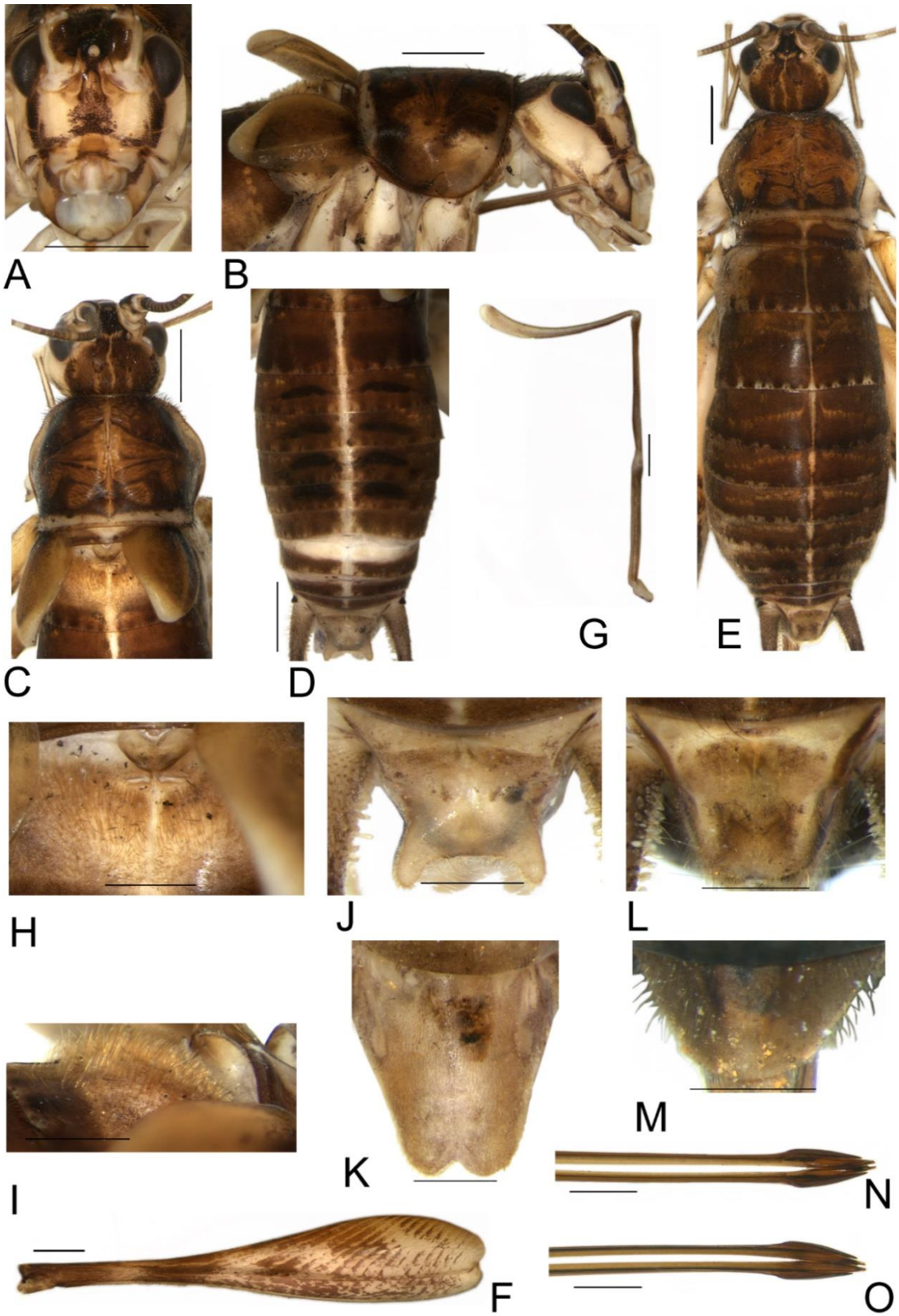


Figure 18. *Eidmanacris multispinosa* Desutter-Grandcolas. Male and female topotypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

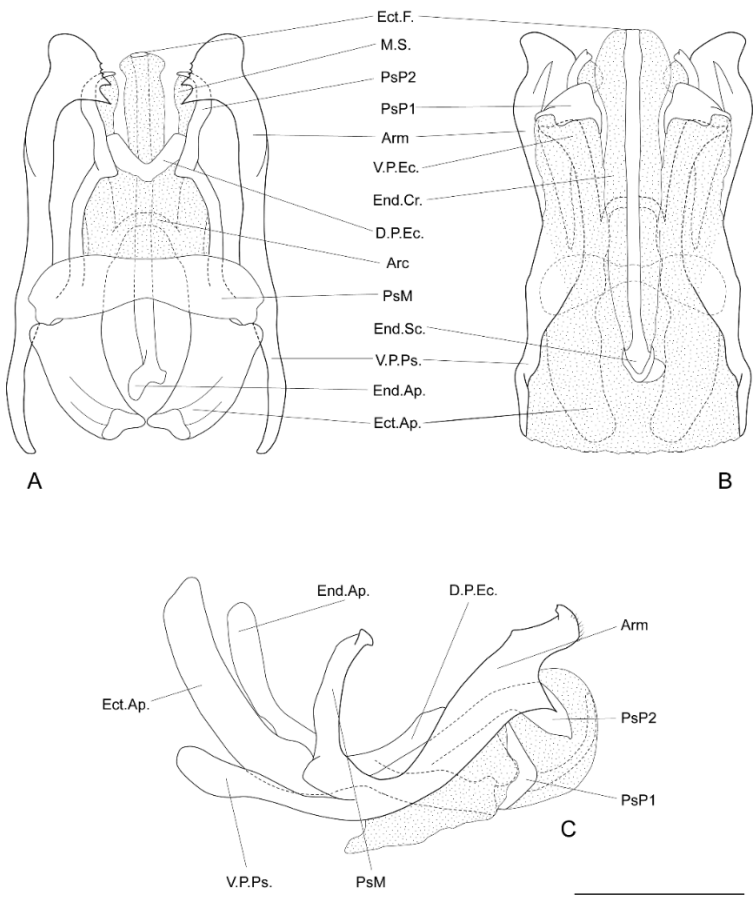


Figure 19. *Eidmanacris multispinosa* Desutter-Grandcolas. Holotype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

Figure 20. *Eidmanacris multispinosa* Desutter-Grandcolas. Male and female topotypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris tridentata Desutter-Grandcolas, 1995

(Figs. 21-23)

Eidmanacris tridentata Desutter-Grandcolas, 1995: 462 (male description). Type locality: Brazil, Espírito Santo State, Santa Teresa municipality.

Eidmanacris tridentata, Souza-Dias, Campos & Nihei, 2015: 554 (note).

Type material examined. Holotype male, 1 paratype male. Holotype male labeled: "Vitoria, Fundao, Sta. Teresa, Réserve biologique de Sta. Lucia, 22-XI-1992, Nuit"; "Muséum Paris, BRESIL/ Etat de Espirito Santo, L. Desutter-Grandcolas, rec."; "*Eidmanacris tridentata,* L. DESUTTER DET."; "HOLOTYPE". Paratype male labeled: "Vitoria, Fundao, Sta. Teresa, Réserve biologique de Sta. Lucia, 22-XI-1992, Nuit"; "Muséum Paris, BRESIL/ Etat de Espirito Santo, L. Desutter-Grandcolas, rec."; "*Eidmanacris tridentata,* L. DESUTTER DET."; "PARATYPE" (MNHN). Dry specimens.

Other material Examined. 25 males and 42 females. 5 males and 1 female labeled: "Brasil, ES, Sta. Teresa, Reserva Sta. Lucia, i-96, F. A. G. De Mello – S. S. Nihei *leg*". 20 males and 29 females labeled: "Reserva. Biol. De Duas Bocas, Brasil, Cariacica-ES, 15-21/vii/2012, F. A. G. De Mello col." (UBTU). The examined types are dry, and all other specimens are preserved in ethanol 80%.

Distribution: Brazil, Espírito Santo State.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: FWs very short, not reaching the posterior border of metanotum; metanotal gland absent; apex of pseudepiphallic arms trifid, forming three projection-like spines: superior, inferior and supero-internal; PsP2 elongate, thin, fused with sclerite A; ventral sclerotization of medio posterior projection of endophallic slcerite only at two anterior thirds; copulatory papilla sclerotized in central area; copulatory papilla anterior portion membranous and larger, posterior portion unpigmented, laterally thinner in dorsal and ventral views.

Redescription.

Head. Light to medium brown, with bands dark brown and sparse bristles. Occiput medium brown, with central maculae medium brown; vertex medium brown, with three central stripes light brown, longitudinal (Fig. 21C). Fastigium anteriorly blackish,

posteriorly light brown, with two row of bristles, longer than wide, slightly narrowed toward the apex, narrow than scape; separated from vertex by transverse line forming a "v" (Fig. 21C). Frons light brown, with central stripe dark brown, two bellow eyes. Three occeli present, well developed, lateral ones elliptical, central flattened at bottom (Figs. 21A, B, C). Eye with unpigmented area on supero-internal angle (Figs. 21A-C). Maxillary palpi medium brown, long, thin, joints 4 and 5 almost same-sized; apex of joint 5 slightly upcurved, distal portion whitish (Fig. 21G). In frontal view, gena light brown; in lateral view, posterior margin medium brown (Figs. 21A, B). Frontoclypeal suture yellowish, centrally dark. Clypeus light brown, central part of upper margin medium to dark brown, lateral border medium brown; lower portion whitish. Labrum whitish, apex light brown (Fig. 21A). Mandible dark brown, with central maculae light brown. Antennal scape medium brown on inner face, light brown on outer face (Fig. 21A). Antenomeres medium brown with whitish bands of two or three antenomeres

Thorax. Pronotum DD medium to dark brown, as long as wide, inflated, slightly pubescent, divided by a thin light brown sagittal line; DD cephalic margin almost straight, caudal margin slightly concave (Fig. 21C). Ventro-cephalic angle broadly rounded, ventral margin gradually ascendant (Fig. 21B).

Legs. FI and II yellowish brown, annulated with dark brown. TI and II medium brown annulated with yellowish brown; TI with two same-sized apical spurs; TII with two inner, same-sized apical spurs, and one outer, smaller. FIII light brown, two bands of several thin stripes dark brown on outer face, apical third dark brown (Fig. 21F); TIII yellowish brown; subapical spurs 4/4, serrulation between and above subapical spurs; apical spurs 3/3, inner face more developed; inner apical spurs: median one longer (iam), dorsal smaller (iad), ventral smaller (iav) (iam>iad>iam); outer apical spurs: median one longer (oam), dorsal smaller (oad), ventral smaller (oav) (oam>oad>oam). Basitarsus I, II and III yellowish.

Abdomen. Pubescent, yellowish, marbled with dark brown, with dark spots and maculae, divided by a thick, light brown sagittal line (Fig. 21D).

Male. Small-sized body (13-14 mm), general coloration of different shades of brown, marbled, with dark spots and maculae. FWs medium brown, very short, not reaching posterior border of metanotum, posterior margin light brown; single vertical vein almost no discernible that divides external part as lateral field; FWs inner margins touching each other (Fig. 21C). Metanotal gland absent. Supra anal plate light to medium

brown, latero-posterior projections short; anterior margin concave, posterior margin almost straight (Fig. 21J). Subgenital plate light brown, posterior border medium brown, as long as wide, slightly pubescent; anterior margin almost straight, posterior margin with small, central invagination (Fig. 21K).

Phallic complex (Figs. 22A-C; 23A-C). Pseudepiphallus: base of pseudepiphallic sclerite centrally narrow, in dorsal view; pseudepiphallic arms sclerotized, straight, hard; apex of pseudepiphallic arms smooth, trifid, forming three projections pointed: superior, inferior and supero-internal; anterior projection of pseudepiphallic sclerite somewhat elongate, surpassing the base of pseudepiphallic sclerite, apex point in lateral view; PsP2 sclerotized, elongate, thin, no visible articulation with sclerite A, apex point downwards, membranous sphere on postero-inner face; PsP1 sclerotized, short, robust, longer than wide, apex almost reaching apex of pseudepiphallic arms in ventral view. Ectophallic invagination: Ectophallic apodeme long, dorso-ventrally flattened; ectophallic arc short, located posteriorly to base of pseudepiphallic sclerite; dorsal projection long, curved; ventro-posterior projection elongate. Endophallus: medio-posterior projection elongated, posterior third not sclerotized; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme elongate, curved upwards, apex not surpassing ectophallic apodeme apex.

Female. Larger than male, general coloration light to medium brown, marbled with dark brown (Fig. 21E). Head light brown, bands and stripes dark brown; maxillary palpi medium brown. Thorax dark brown, marbled; abdomen light brown, marbled with dark brown, with thin sagittal, light brown line well discernible. Supra anal plate light brown, posterior third dark brown, anterior margin sub-straight, posterior margin rounded with not so long bristles (Fig. 21L). Subgenital plate light to medium brown, anterior margin lighter, posterior margin with central concavity (Fig. 21M). Ovipositor as in figs. 21N and 21O.

Copulatory papilla (Figs. 23F-H). Cylindrical, longer than wide, sclerotized on middle part; anterior portion membranous, larger; posterior portion whitish, laterally thinner in dorsal and ventral views.

Measurements (mm).

Male (n=10): Hw, 2.7 ± 0.1 (2.54-2.79); iod, 1.44 ± 0.10 (1.24-1.55); Lpron, 3.03 ± 0.17 (2.72-3.38); awpron, 1.98 ± 0.07 (1.86-2.1); pwpron, 3.13 ± 0.13 (2.85-3.34); wpron 3.79 ± 0.17 (3.79-4.03); LFW, 0.76 ± 0.11 (0.62-0.99); wFW, 1.33 ± 0.13 (0.99-1.48); LFIII, 15.15 ± 0.74 (13.95-16.2); wFIII, 2.8 ± 0.14 (2.55-3); LTIII, 17.26 ± 1.13 (15.45-19.35); Ltars1-III, 4.86 ± 0.34 (4.35-5.4).

Female (n=10): Hw, 3.26 ± 0.29 (2.85-3.72); iod, 1.61 ± 0.12 (1.42-1.79); Lpron, 3.63 ± 0.22 (3.28-3.96); awpron, 2.44 ± 0.25 (2.1-2.85); pwpron, 3.81 ± 0.23 (3.53-4.21); wpron, 4.57 ± 0.32 (4.21-5.08); LFIII, 18.19 ± 1.19 (16.65-19.65); wFIII, 3.37 ± 0.22 (3-3.75); LTIII, 20.62 ± 1.67 (18.3-23.4); Ltars1-III, 5.14 ± 0.45 (4.5-5.7); OL, 15.45 ± 1.10 (13.8-16.95).

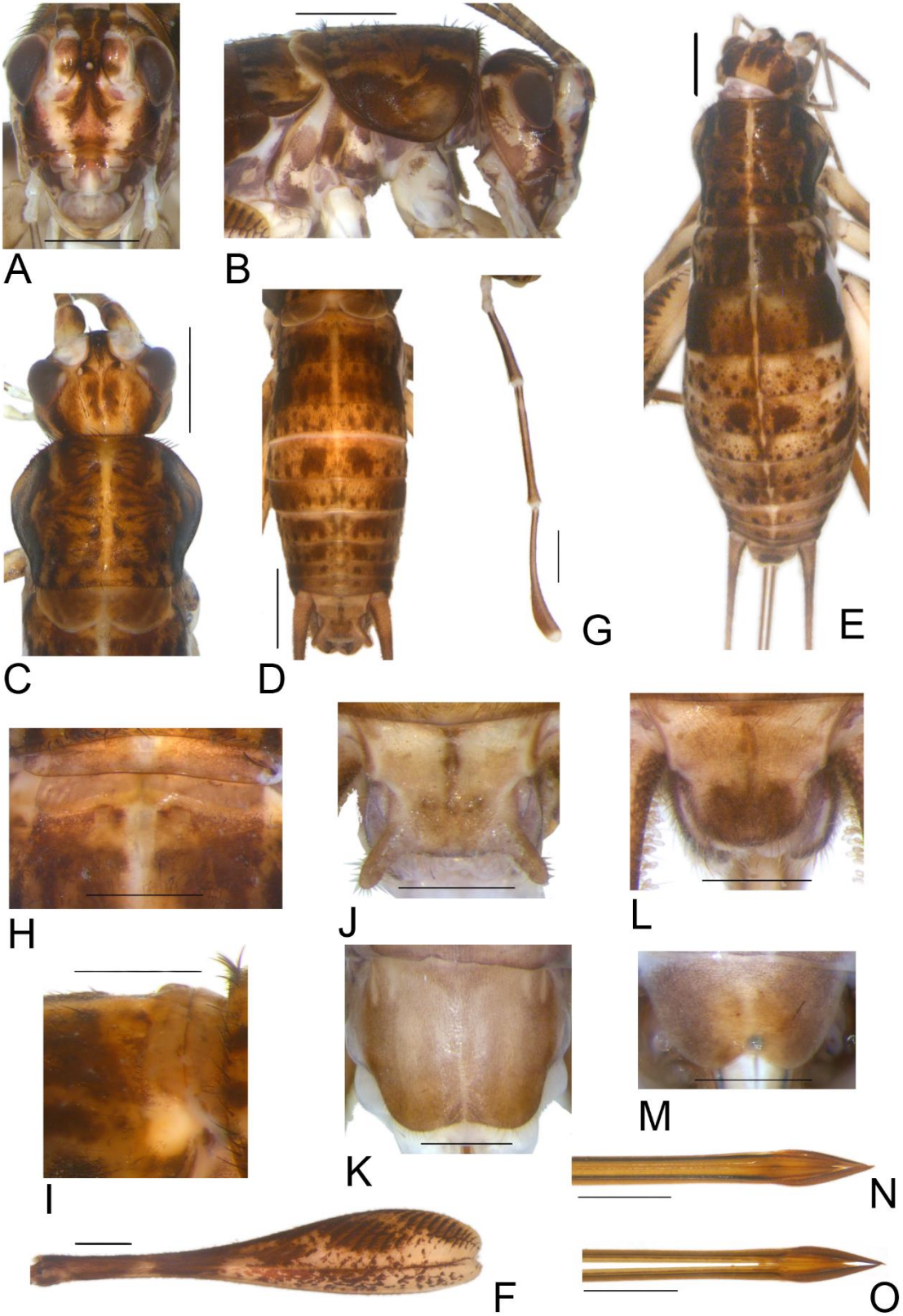


Figure 21. *Eidmanacris tridentata* Desutter-Grandcolas. Male and female topotypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

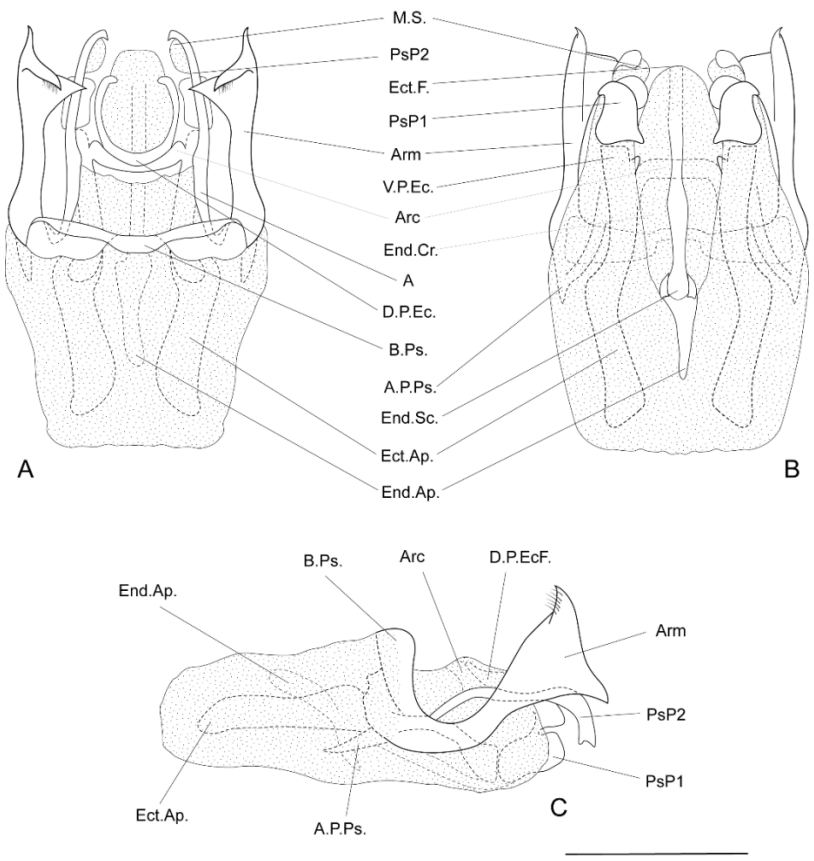


Figure 22. *Eidmanacris tridentata* Desutter-Grandcolas. Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

Figure 23. *Eidmanacris tridentata* Desutter-Grandcolas. Male and female topotypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris bidentata Sperber, 1998

(Figs. 24-26)

Eidmanacris bidentata Sperber, 1998 *in* Mesa, Sperber & Garcia, 1998: 45 (male and female descriptions). Type locality: Brazil, Minas Gerais State, Viçosa municipality.
Eidmanacris bidentata, Zefa, Fontanetti & Martins, 2010: 53-58 (note on cytogenetics).

Type material examined. Holotype male, allotype, 1 male paratype, 2 females paratypes (MZSP). Holotype male labeled: "Brasil (M.G.) Mun. Viçosa, Fragmento Florestal de 70 ha, Mata da Biologia, UFV, trilha VEEC// 8.VII.1996//SPERBER, CF". Allotype labeled: "Brasil (M.G.) Mun. Viçosa, Fragmento Florestal de 70 ha, Mata da Biologia, UFV, trilha VEEC, col. c/ aveia// 11.VII.1996//SPERBER, CF & RIBEIRO, PH". 1 male paratype, 2 females paratypes labeled: "Brasil (M.G.) Mun. Viçosa, Fragmento Florestal de 70 ha, Mata da Biologia, em folhiço, UFV, trilha VEEC, col. c/ aveia// 10.VII.1996//SPERBER, CF & RIBEIRO, PH" (MZSP). Specimens preserved in ethanol 80%.

Other material examined. 2 males labeled: "BRASIL (MG), Viçosa, Fragmento: BIO, Data: 03/VIII/2000, Sperber *leg*"; "Código #6011", "*Eidmanacris bidentata* Sperber, 1998"; "Sperber det. 2004". Specimens preserved in ethanol 80%.

Distribution: Brazil, Minas Gerais State.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: lateral projections of metanotal gland elongate, medially fused, anteriorly curved to pronotum; latero-posterior projections of supra anal plate elongate, curved inwards, finger-shaped; apex of pseudepiphallic arm with superior and inferior projections pointed, internal projection absent.

Redescription.

Head. Medium brown. Occiput light to medium brown with central maculae light brown, diagonal band dark brown going from occiput to margin of each eye; vertex medium brown with three lines light brown, vertical, in dorsal view (Fig. 24C). Fastigium medium brown, apically dark, with two rows of bristles, almost longer than wide, slightly narrowed toward the apex, separated from vertex by a line forming a "v" (Fig. 24C). Frons light brown, with three dark brown vertical bands, two bellow eyes and antennal scape, one above clypeus (Figs. 24A, B). Three ocelli present, well developed, forming

isosceles triangle, central one rounded, lateral elliptical (Figs. 24A, B, C). Eyes with unpigmented very small area on supero-internal angle (Fig. 24C). Maxillary palpi, long, thin, pilose, medium to dark brown, distal portion of joints whitish; joints 3 and 4 almost same-sized, joint 5 little longer (Fig. 24H); apex of joint 5 upcurved. Gena light brown in lateral view, posterior margin medium to dark brown, line medium brown connecting lower margin of eye with posterior border in lateral view (Fig. 24B). Frontoclypeal suture dark yellow; clypeus light brown, lateral part darker, with two vertical, central bands dark brown; labrum whitish, lower portion light brown. Mandible light brown, with inner margin dark brown. Antennal scape light brown, inner margins medium to dark brown (Fig. 24A); antenomeres medium brown interspersed with whitish, isolated antenomeres.

Thorax. Pronotum DD wider than long, medium brown, with sparse dark spots and maculae, slightly pubescent, inflated, dived by an almost no discernible sagittal light brown line (Fig. 24C). DD cephalic margin sub concave, caudal margin slightly concave (Fig. 24C); lateral lobes darker than DD, ventro-cephalic angle rounded, ventro-caudal margin gradually ascendant (Fig. 24B).

Legs. FI, FII, TI and TII yellowish annulated with dark brown; TI with two same-sized apical spurs; TII with two inner apical spurs and one outer, smaller. FIII pale yellow, with thin stripes medium to dark brown on outer face, dorsal margin and apical third medium brown in lateral view (Fig. 24D). TIII yellowish brown; subapical spurs 4/4, with serrulation above and between subapical spurs, except between two distal ones; apical spurs 3/3, more developed on inner face: median (iam) longer than and dorsal one (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III yellowish.

Abdomen. Sub-elliptical in dorsal view, medium to dark brown, marbled, divided by light brown sagittal line, with spots dark brown.

Male. Medium-sized body, general coloration medium brown, with maculae and spots. FWs medium to dark brown, reticulated, short, sub-triangular, without glandular thickening apically, apex connected to a single vein that divides the external part of FW as lateral field (Fig. 24C); inner margins not touching each other; covering the metanotal gland, surpassing metanotum posterior border (Figs. 24B, C). Metanotal gland present, anteromedian crest forming an inverted triangle with cluster of bristles; lateral projections elongate, medially fused, anteriorly curved to pronotum (Figs. 24F, G). Supra anal plate light brown, slightly pubescent; anterior margin sub-straight, latero-posterior projections

elongate, curved inwards, finger-shaped, with long bristles; posterior margin with central invagination (Fig. 24I). Subgenital plate longer than wide, with lateral pubescence, dark brown on lateral part, centrally lighter; anterior margin almost straight, posterior margin rounded with small, central invagination forming two lobes (Fig. 24K).

Phallic complex (Figs. 25A-C; 26A-C). Pseudepiphallus: central portion of base of pseudepiphallic sclerite thinner in dorsal view; pseudepiphallic arms sclerotized, hard, upcurved in lateral view, slightly curved inwards in dorsal view; apex of pseudepiphallic arm with few bristles, superior projection pointed, supero-internal projection absent, inferior projection pointed; anterior projection of pseudepiphallic sclerite elongate, surpassing the base of pseudepiphallic sclerite; PsP2 hardly sclerotized, bifid, surpassing posterior extremity of pseudepiphallic arms in dorsal view, apex pointed in lateral view, with membranous sphere on inner face; sclerite A connected to the base of pseudepiphallic arm, straight, connected and articulated with PsP2; PsP1 short, well sclerotized in ventral view. Ectophallic invagination: ectophallic apodeme elongate; ectophallic arc located posteriorly to the base of pseudepiphallic sclerite in dorsal view; ventro-posterior projection elongate; dorsal projection sclerotized, short, slightly curved outwards. Endophallus: medio-posterior projection of endophallic sclerite elongated, not surpassing PsP2 apex; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme elongate, reaching the apex of ectophallic apodeme.

Female. Larger than male, general coloration similar (Fig. 24E). Supra anal plate light brown, anterior margin concave, posterior margin rounded with long bristles (Fig. 24J). Subgenital plate medium brown, wider than long, anterior margin slightly concave, posterior margin with central invagination (Fig. 24L). Ovipositor as in figs. 24M, N.

Copulatory papilla (Figs. 26D-F). Little longer than wide, cylindrical, anterior margin membranous until median portion in dorsal view, posterior margin unpigmented, centrally pointed.

Measurements (mm).

Male (n=2): Hw, 2.69 ± 0.14 (2.54-2.85); iod, 1.33 ± 0.03 (1.3-1.36); Lpron, 2.72 ± 0.13 (2.54-2.85); awpron, 2.58 ± 0.09 (2.54-2.72); pwpron, 3.11 ± 0.17 (2.91-3.34); wpron 3.64 ± 0.18 (3.41-3.84); LFW, 1.56 ± 0.21 (1.36-1.86); wFW, 1.56 ± 0.06 (1.48-1.67); LFIII, 12.15 ± 0.51 (11.4-12.6); wFIII, 3.03 ± 0.14 (2.85-3.15); LTIII, 12.07 ± 0.37 (11.55-12.45); Ltars1-III, 3.45 ± 0.21 (3.15-3.6).

Female (n=2): Hw, 3.22; iod, 1.59 ± 0.03 (1.55-1.61); Lpron, 3.2 ± 0.09 (3.1-3.28); awpron, 3.18 ± 0.29 (2.85-3.41); pwpron, 3.18 ± 0.18 (3.47-3.84); wpron, 4.38 ± 0.14 (4.21-4.46); LFIII, 14.15 ± 0.17 (13.95-14.25); wFIII, 3.5 ± 0.08 (3.45-3.6); LTIII, 14.7 ± 0.45 (14.25-15.15); Ltars1-III, 3.55 ± 0.08 (3.45-3.6); OL, 13.65 ± 0.15 (13.5–13.8).

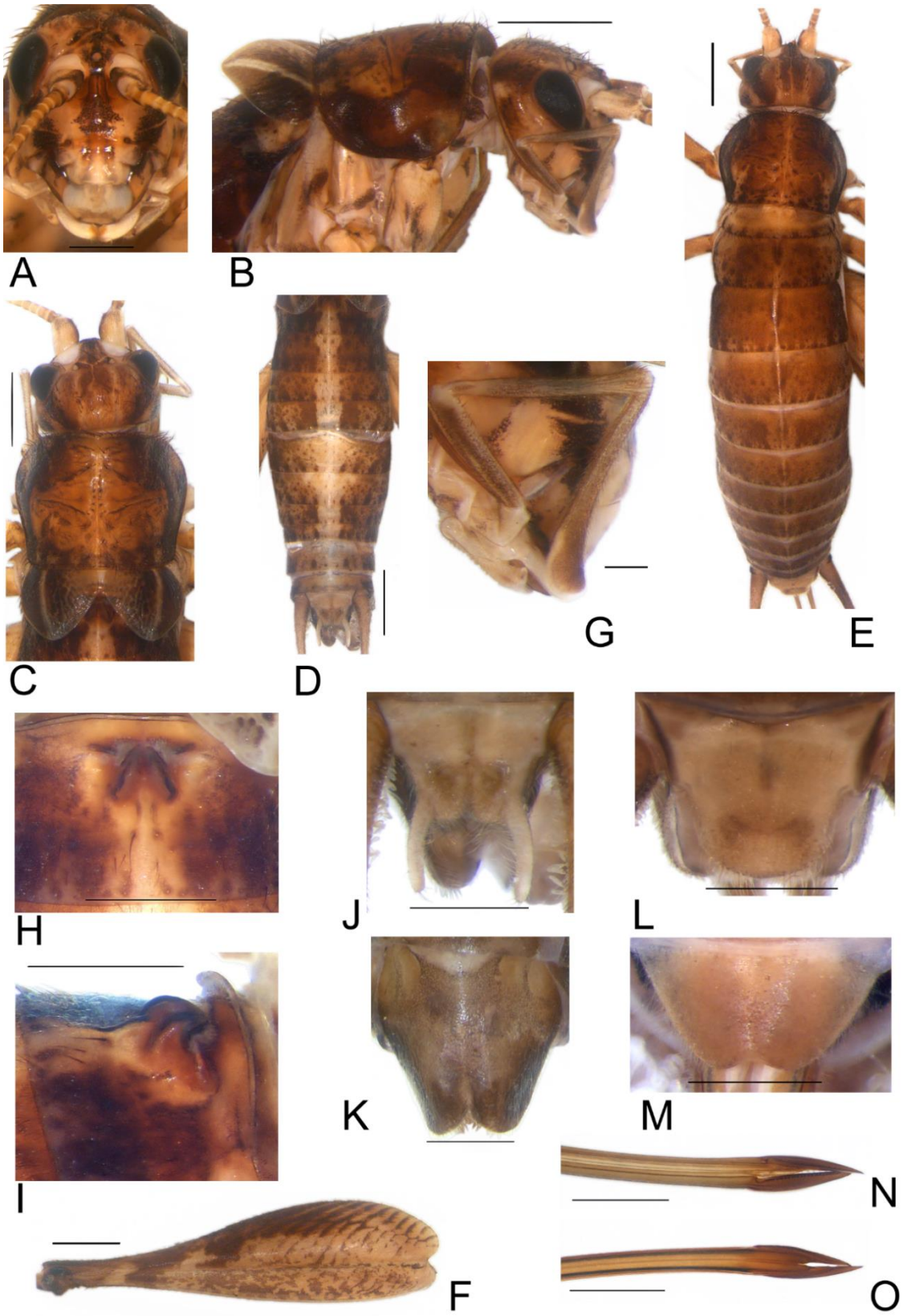


Figure 24. *Eidmanacris bidentata* Sperber. Holotype male and allotype. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

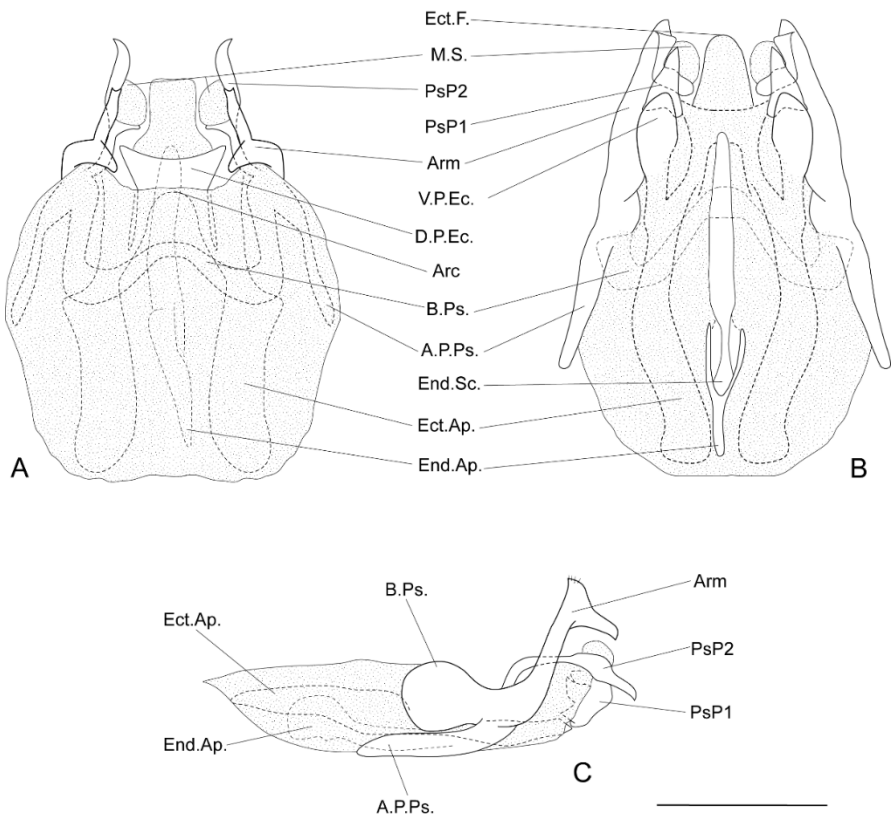


Figure 25. *Eidmanacris bidentata* Sperber. Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

Figure 26. *Eidmanacris bidentata* Sperber. Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris corumbatai Garcia, 1998

(Figs. 27-29)

Eidmanacris corumbatai Garcia, 1998 *in* Mesa, Sperber & Garcia, 1998: 46. Type locality: Brazil, São Paulo State, Cerrado de Corumbataí municipality.

Eidmanacris corumbatai, Prado & Fontanetti, 2005: 83-87 (morphology of metanotal gland); Prado, 2006:452-457 (reproductive behavior); Zefa, Fontanetti & Martins, 2010 (citogenetic note); Souza-Dias, Campos & Nihei, 2015 (note).

Type material examined. Holotype male, allotype. Holotype male labeled: "Brasil (SP), Cerrado de Corumbataí, 30-IX-95/ A. Mesa, P. García, Camila Cherem, Ejemplares fotografados". Allotype labeled: "Brasil (SP), Cerrado de Corumbataí, 10-IX-95, A. Mesa-P. García, C. Cherem" (MZSP). Specimens preserved in ethanol 80%.

Other material examined. 4 males and 5 females labeled: "Brasil, SP, Botucatu, Distrito de Vitoriana, Beira da Estrada no cerrado, 01.xii.1995, F.A.G. Mello – S. Nihei, *leg*" (UBTU). All specimens preserved in ethanol 80%.

Distribution. Brazil, São Paulo State.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: frons with maculae dark brown bellow antennal scape in frontal view; antenomeres medium brown with whitish bands composed of *c.a.* 5 antenomeres, intersected by a single one, whitish; latero-posterior projections of supra anal plate greyish; superior, supero-internal and infero-internal projections of apex of pseudepiphallic arm reduced to a spine, inferior projection hook-shaped, with bristles on inner face, upcurved, ventral projection curved inwards with bristles; dorsal projection of ectophallic invagination posterior half thinner than anterior, poster margin straight.

Redescription.

Head. Medium to reddish brown. Occiput pilose, with central maculae light brown, band light brown going from occiput to margin of each eye; vertex medium brown with three vertical lines light brown in dorsal view (Fig. 27C). Fastigium medium to dark brown, with two rows of bristles, slightly longer than wide, narrowed toward the apex, separated from vertex by a line forming a "v" (Fig. 27C). Frons light brown, with three bands dark brown, vertical, two bellow eyes, one above clypeus; maculae dark brown bellow antennal scape, in frontal view (Figs. 27A, B). Three ocelli present, well

developed, forming isosceles triangle, central one flattened at bottom, lateral ones elliptical (Figs. 27A, B, C). Eyes with an unpigmented small area on supero-internal angle (Fig. 27C). Maxillary palpi, long, thin, pilose, medium brown, distal portion of joints whitish; joints 3, 4 and 5 almost same-sized (Fig. 27G); apex of joint 5 upcurved. Gena light brown, posterior margin dark brown, line dark brown, vertical, connecting to inferior margin of eye in lateral view (Fig. 27B). Frontoclypeal suture dark yellow, clypeus light brown with central band dark brown in upper margin, in frontal view; labrum whitish, lower portion light brown. Mandible light brown, with inner margin dark brown. Antennal scape light brown, inner margin dark brown (Fig. 27A); antenomeres medium brown with whitish bands composed of *c.a.* 5 antenomeres, intersected by one whitish.

Thorax. Pronotum DD reddish brown, wider than long, with sparse dark spots and maculae, slightly pubescent, inflated, divided by a very tiny light brown sagittal line (Fig. 27C); DD cephalic margin slightly concave, caudal margin sub straight (Fig. 27C); lateral lobes dark brown, ventro-cephalic angle rounded, lighter than DD, ventro-caudal margin gradually ascendant (Fig. 27B).

Legs. FI and II yellowish brown, annulated with dark brown. TI and II yellowish brown, TI with two same-sized apical spurs; TII with two inner apical spurs, one outer, smaller. FIII yellowish brown, with thin stripes medium to dark brown on outer face, dorsal margin and apical third dark brown (Fig. 27F). TIII yellowish brown; subapical spurs 4/4, with serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face: median (iam) longer than dorsal (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III dark yellow.

Abdomen. Cylindrical in dorsal view, medium to dark brown, with spots and maculae, divided by a light brown thin sagittal line (Fig. 27D).

Male. Large-sized body, general coloration reddish brown, with dark spots and maculae. FWs medium to dark brown, elongate, triangular, inner margin medium brown; posterior part of inner margin and apex whitish, connected to a single vein that divides external part of FW as lateral field, glandular thickening present distally (Fig. 27C); inner margins not touching each other, covering the metanotal gland, surpassing metanotum posterior border (Figs. 27B, C). Metanotal gland present, anteromedian crest forming an inverted triangle with cluster of bristles; lateral projections short, conical, parallel (Figs. 27H, I), posterior portion of metanotum pubescent. Supra anal plate light to medium

brown, lateral margins dark, anterior margin slightly concave; latero-posterior projections longer than posterior margin, grayish, with long bristles; posterior margin sub-straight (Fig. 27J). Subgenital plate longer than wide, with lateral pubescence, laterally medium to dark brown, centrally greyish; anterior margin straight, posterior margin straight with small invagination centrally (Fig. 27K).

Phallic complex (Figs. 28A-C; 29A-C). Pseudepiphallus: central portion of the base of pseudepiphallic sclerite thinner than lateral portions, in dorsal view; pseudepiphallic arms sclerotized, hard, upcurved forming a 90° angle in lateral view; apex of pseudepiphallic arm with bristles on outer face; superior, supero-internal and infero-internal projections reduced to a spine; inferior projection hook shaped with bristles on inner face, upcurved, ventral projection curved inwards with bristles; lateral projection present, short, apex pointed; anterior projection of pseudepiphallic sclerite short, not surpassing base of pseudepiphallic sclerite; PsP2 elongate, sclerotized, reaching posterior extremity of pseudepiphallic arms in dorsal view, apex pointed in lateral view, curved inwards in dorsal view, with membranous sphere on inner face; sclerite A connected with base of pseudepiphallic sclerite, straight, articulation with PsP2 visible; PsP1 elongate, inner face well sclerotized in ventral view. Ectophallic invagination: ectophallic apodeme elongate; ectophallic arc located below the base of pseudepiphallic sclerite, “v”-shaped in dorsal view; ventro-posterior projection elongate, tip slightly curved inward; dorsal projection sclerotized, fused. Endophallus: medio-posterior projection of endophallic sclerite elongated, not surpassing PsP2 apex, median portion wider in ventral view; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme elongate, anterior to ectophallic apodeme.

Female. Larger than male, general coloration similar (Fig. 27E). Supra anal plate medium brown, posterior margin light brown, anterior margin slightly concave, posterior margin rounded with long bristles (Fig. 27L). Subgenital plate light brown with whitish band medially, wider than long, anterior margin sub straight, posterior margin rounded with central furrow reaching the median area of plate (Fig. 27M). Ovipositor as in figs. 27N, O.

Copulatory papilla (Figs. 29D-F). Sclerotized, wider than long, cylindrical, anterior margin membranous, posterior region with a visible hole, anterior margin rounded.

Measurements (mm).

Male (n=4): Hw, 3.37 ± 0.22 (3.22-3.72); iod, 1.65 ± 0.23 (1.42-1.86); Lpron, 3.85 ± 0.24 (3.59-4.15); awpron, 3.22 ± 0.40 (2.79-3.59); pwpron, 3.95 ± 0.13 (3.78-4.09); wpron 5.13 ± 0.36 (4.71-5.52); LFW, 3.36 ± 0.13 (3.16-3.47); wFW, 1.82 ± 0.15 (1.67-2.05); LFIII, 17.32 ± 0.93 (16.2-18.45); wFIII 3.52 ± 0.19 (3.3-3.75); LTIII, 17.85 ± 1.26 (16.35-18.9); Ltars1-III, 4.8 ± 0.44 (4.35-5,4).

Female (n=5): Hw, 3.67 ± 0.17 (3.47-3.9); iod, 1.71 ± 0.22 (1.48-1.98); Lpron, 4.03 ± 0.21 (3.72-4.21); awpron, 3.72 ± 0.15 (3.53-3.9); pwpron, 4.48 ± 0.14 (4.28-4.65); wpron, 5.44 ± 0.25 (5.08-5.7); LFIII, 18.18 ± 0.72 (17.4-18.9); wFIII, 4.26 ± 0.34 (3.9-4.8); LTIII, 18.09 ± 0.77 (17.25-18.75); Ltars1-III, 4.65 ± 0.3 (4.35-4.95); OL, 10.92 ± 0.55 (10.5–11.85).

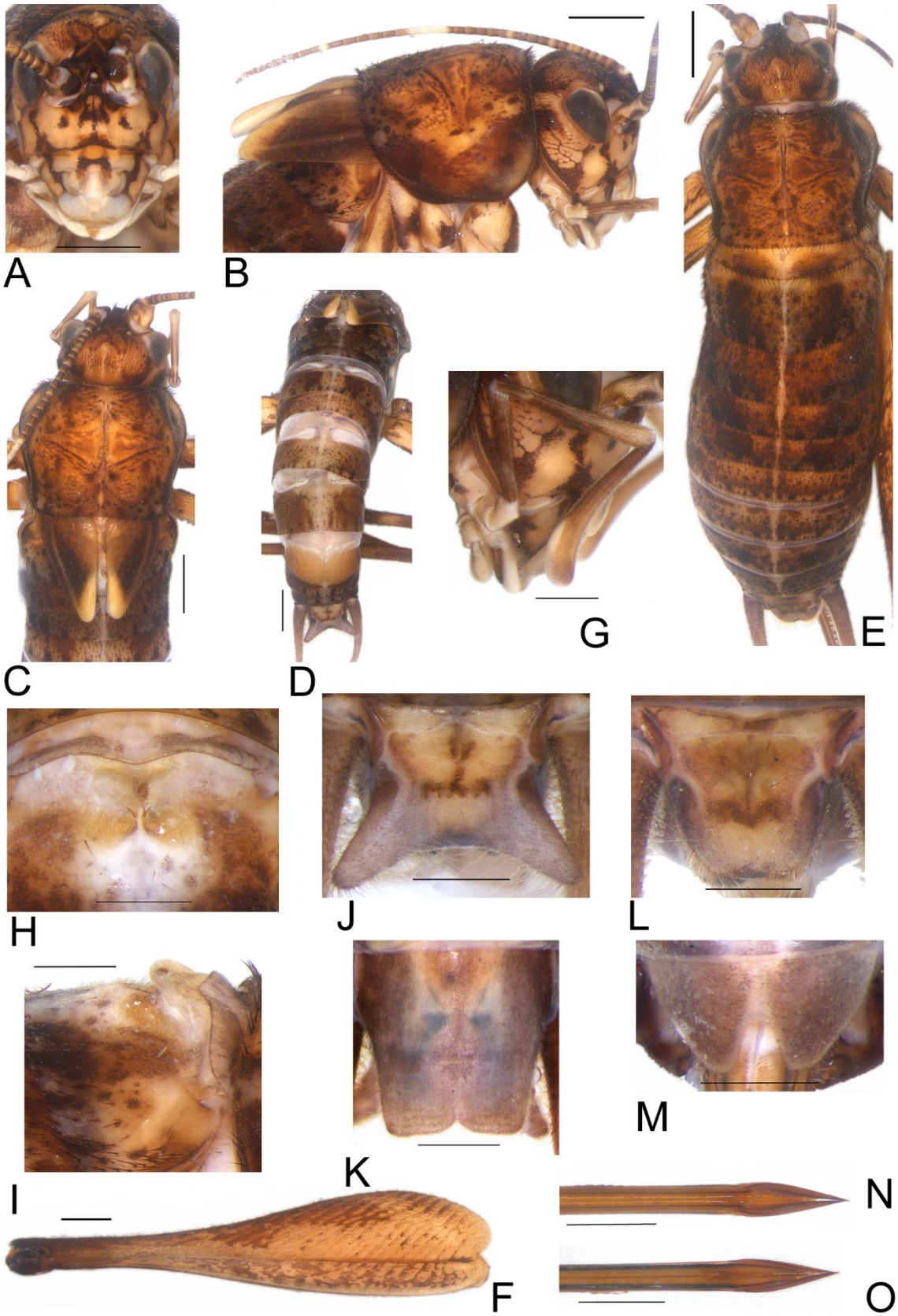


Figure 27. *Eidmanacris corumbatai* Garcia. Holotype and allotype. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen, dorsal; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

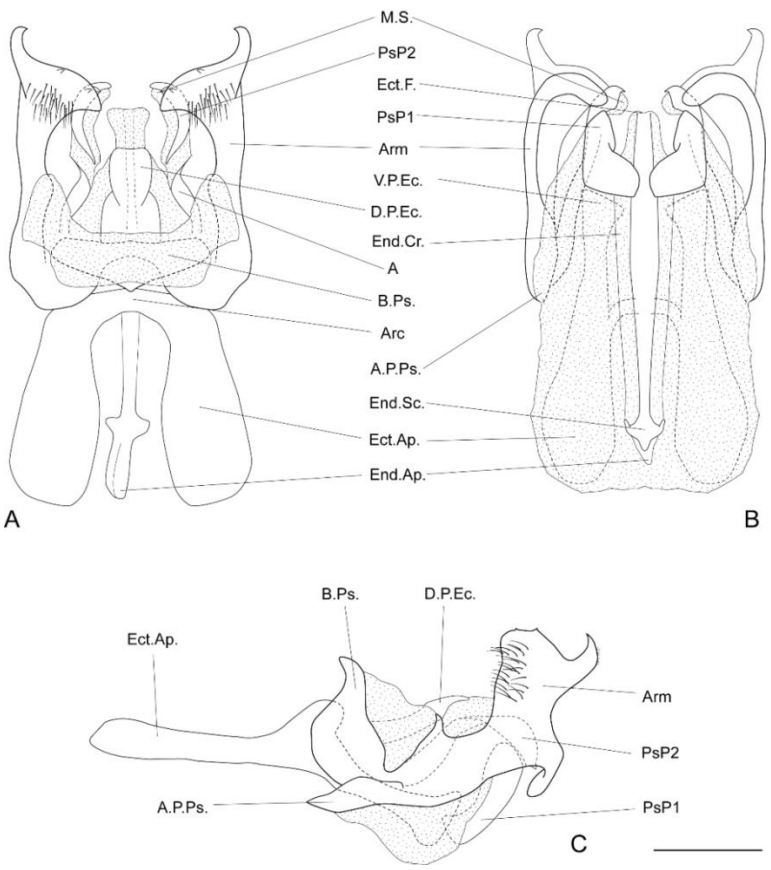


Figure 28. *Eidmanacris corumbatai* Garcia. Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

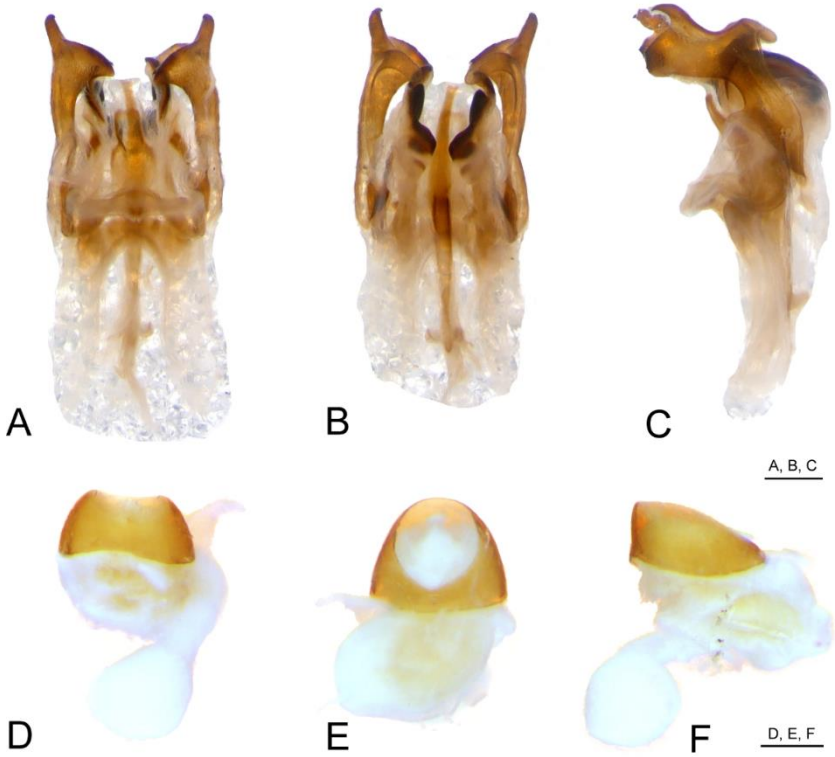


Figure 29. *Eidmanacris corumbatai* Garcia. Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris speluncae (Mello-Leitão, 1937) **comb. nov.**

(Figs. 30-32)

Arachnopsis speluncae Mello-Leitão, 1937: 11 (female description). Type locality: Brazil, Minas Gerais State, Santa Bárbara municipality.

Arachnopsis speluncae, Costa Lima 1940: 44 (note); Costa Lima & Costa Leite, 1953: 169 (note).

Phalangopsis speluncae, Chopard, 1968: 284 (catalogue); Pinto-da-Rocha, 1995: 116 (faunal inventory); Mews & Sperber, 2008: 647-655 (note).

Material examined. Total: 10 males and 4 females. 1 male and 1 female labeled: "Gruta CH-24 Mina Conta História, Mariana-MG, 654822mE/7762702mN SAD' 69, 23-30.ix.08, Pellegatti et *al.* col." 3 males labeled: "Mina Alegria, Mariana-MG, 10.x.2010, Basi et *al.* col. Gruta RF-23 1 male labeled: "Barão dos Cocais-MG, 657243mE/7796388mN SAD' 69, 10-21.iii.09, R. Andrade et *al.*col"1 male and 1 female labeled: "Gruta RF-55 Barão dos Cocais-MG, 654571mE/7794897mN SAD' 69, 22.iv-03.vii.09, R. Bessi et *al.*col." 1 male labeled: "Gruta PBR12- Brumadinho-MG, 607308mE/7770983mN SAD' 69, 28.ix-03.x.2009, Bessi et *al.* col.". 2 males and 1 female labeled: "Gruta AP-57-Santa Bárbara-MG, 0637478mE/7785067mN SAD'69, 13-17.iv.2010, Bessi *et* al. col." 1 male labeled: "Gruta AP-49 – Caeté-MG, 0636873mE/7784042mN SAD' 69, 13-17.iv.2010, Bessi *et* al. col." (UBTU). All specimens preserved in ethanol 80%.

Distribution: Brazil, Minas Gerais State.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: first 40 antenomeres dark brown, followed by whitish antenomeres; pseudepiphallic arm with a line of bristles on outer face; apex of pseudepiphallic arm clavate; superior, inferior and internal projections reduced; PsP2 rounded outside, concave inside, with a small spine pointed anteriorly in ventral view; dorsal projections of ectophallic invagination posteriorly wide, posterior margin concave; posterior apex of ectophallic fold surpassing pseudepiphallic arms apex; copulatory papilla dorso-ventrally flattened, anterior third little wider in dorsal and ventral views, anterior border whitish.

Redescription.

Head. Medium to light brown. Occiput light to medium brown, with maculae yellowish brown, band medium brown going from occiput to margin of each eye (Fig. 30C); vertex with three almost no discernible lines vertical, light brown. Fastigium medium to dark brown, longer than wide, slightly narrowed at apex, narrower than scape; separated from vertex by a straight line forming "v" (Fig. 30C). Frons light to medium brown, with two lateral, dark bands bellow eyes (Figs. 30A, C). Three ocelli present, well developed, lateral elliptical, central flattened at bottom (Figs. 30A, B, C); eyes with unpigmented area on supero-internal angle (Fig. 30C). Maxillary palpi light brown, joints 3 and 4 medium brown, very long, thin, joints 3-5 almost same-sized (Fig. 30G), apex of joint 5 whitish, up-curved. Gena light brown (Figs. 30A, B). Frontoclypeal suture medium brown, centrally dark. Clypeus whitish with central maculae light brown; labrum whitish, lower portion light brown. Mandible dark yellow, inner and lower margins dark. Antennal scape yellowish brown, inner face dark brown (Figs. 30A, B, C); about first 40 antenomeres dark brown, followed by whitish antenomeres.

Thorax. Pronotum DD medium brown, anterior third dark, wider than long, inflated, with sparse dark spots and maculae, divided by a thin, light yellow sagittal line; DD cephalic margin slightly concave, caudal margin almost straight (Fig. 30C); ventro cephalic angle rounded, margin light to medium brown, ventro caudal margin darker, gradually ascendant (Fig. 30B).

Legs. FI and II yellowish, annulated with dark brown. TI and II light yellow, annulated with dark brown; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. FIII yellowish brown, several thin stripes medium brown on outer face, apical third dark brown (Fig. 30F). TIII medium to dark brown, apical third lighter; subapical spurs 4/4, serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face; inner apical spurs: median one longer (iam), dorsal shorter (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oav). Basitarsus I, II and III yellow, elongated.

Abdomen. Sub-cylindrycal, medium brown, marbled, divided by thin sagittal line light brown (Fig. 30D).

Male. Large-sized body, general coloration medium brown, marbled. FWs medium brown, inner margin light brown, less sclerotized, rounded, apex connected to a single

vein medium brown that divides the external part of FW as a lateral field, posterior margin with tiny glandular thickening (Figs. 30B, C); inner margins not touching each other; FWs covering metanotal gland area, posterior margin not surpassing posterior metanotum border (Fig. 30C). Metanotal gland present, with anteromedian crest triangular, a line of bristles vertically divided pointing out; lateral projections cylindrical, short, top rounded, near each other; posteriorly, long bristles pointing anteriorly (Figs. 30H, I). Supra anal plate dark brown, anterior margin slightly concave, posterior margin sub-straight; latero-distal projection very short, similar *E. larvaeformis*, posteriorly with long setae (Fig. 30J). Subgenital plate light brown, lateral borders dark, longer than wide, anterior margin sub straight, posterior margin somewhat rounded (Fig. 30K).

Phallic complex (Figs. 31A-C; 32A-C). Pseudepiphallus: base of pseudepiphallic sclerite weakly sclerotized, median part narrow; pseudepiphallic arms more sclerotized than base of pseudepiphallic sclerite, slender like in *E. meridionalis*, upcurved, slightly curved inwards in dorsal and ventral views, outer face with a line of bristles; apex of pseudepiphallic arm clavate; superior, internal and inferior projections very reduced; anterior projection of pseudepiphallic sclerite long and thin, anteriorly pointed in lateral view, surpassing base of pseudepiphallic sclerite; PsP2 well sclerotized, elongate, not surpassing posterior extremity of pseudepiphallic arms, curved inwards, rounded outwards, concave, with membranous sphere in the concavity; small spine anteriorly pointed in ventral view; articulated with sclerite A laterally; PsP1 short, wider than long in ventral view, pointed posteriorly in ventral view, inner face well sclerotized. Ectophallic invagination: Ectophallic apodeme elongate, slightly upcurved, laterally flattened; ectophallic arc short, located posteriorly to the base of pseudepiphallic sclerite; dorsal projection weakly sclerotized, elongate, curved inwards, reaching apex of PsP2 in dorsal view; ventro-posterior projection sclerotized, not so elongate, curved outwards in ventral view. Endophallus: medio-posterior projection of pseudepiphallic sclerite elongate, surpassing pseudepiphallic arms apex, apex wide in ventral view; latero-posterior lobes of endophallic sclerite somewhat short; endophallic apodeme elongate, upcurved in lateral view, anterior limit almost reaching ectophallic apodeme anterior margin.

Female. Larger than male, general coloration medium brown, marbled (Fig. 30E). Supra anal plate medium to dark brown, posterior lateral margins darker, posterior margin rounded with bristles (Fig. 30L). Subgenital plate light brown, posterior margin concave, with small central concavity (Fig. 30M). Ovipositor as in figs. 30N and 30O.

Copulatory papilla (Figs 32D-F). Dorso-ventrally flattened, longer than wide, anterior third little wider in dorsal and ventral views, posterior margin concave, anterior borders unpigmented.

Remarks. The species was described based on a single female. Females of *Eidmanacris* do not provide informative characters for species delimitation, in comparison to males. Thus, with the description we can properly re-define the species, and transfer it to *Eidmanacris*. This species has all the synapomorphies proposed for *Eidmanacris* in the phylogenetic analysis. The specimens described here were compared with the holotype, through photographs available in the Orthoptera Species File.

Measurements (mm).

Male (n=7): Hw, 3.7 ± 0.32 (3.22-4.09); iod, 1.86 ± 0.08 (1.73-1.98); Lpron, 4 ± 0.59 (3.03-4.71); awpron, 3.25 ± 0.14 (2.97-3.41); pwpron, 3.96 ± 0.56 (3.34-4.52); wpron, 5.19 ± 0.59 (3.34-4.52); LFW, 2.06 ± 0.19 (1.86-2.35); wFW, 1.67 ± 0.24 (1. 3-1.92); LFIII, 18.3 ± 2.08 (16.2-21.15); wFIII, 3.42 ± 0.3 (3.15-3.75); LTIII, 20.28 ± 1.81 (18.6-22.8); Ltars1-III, 5.61 ± 0.73 (4.65-6.6).

Female (n=1): Hw, 4.03; iod, 1.98; Lpron, 4.4; awpron, 3.09; pwpron, 4.89; wpron, 5.83; LFIII, 20.4; wFIII, 3.9; LTIII, 22.65; Ltars1-III, 6; OL, 17.85.

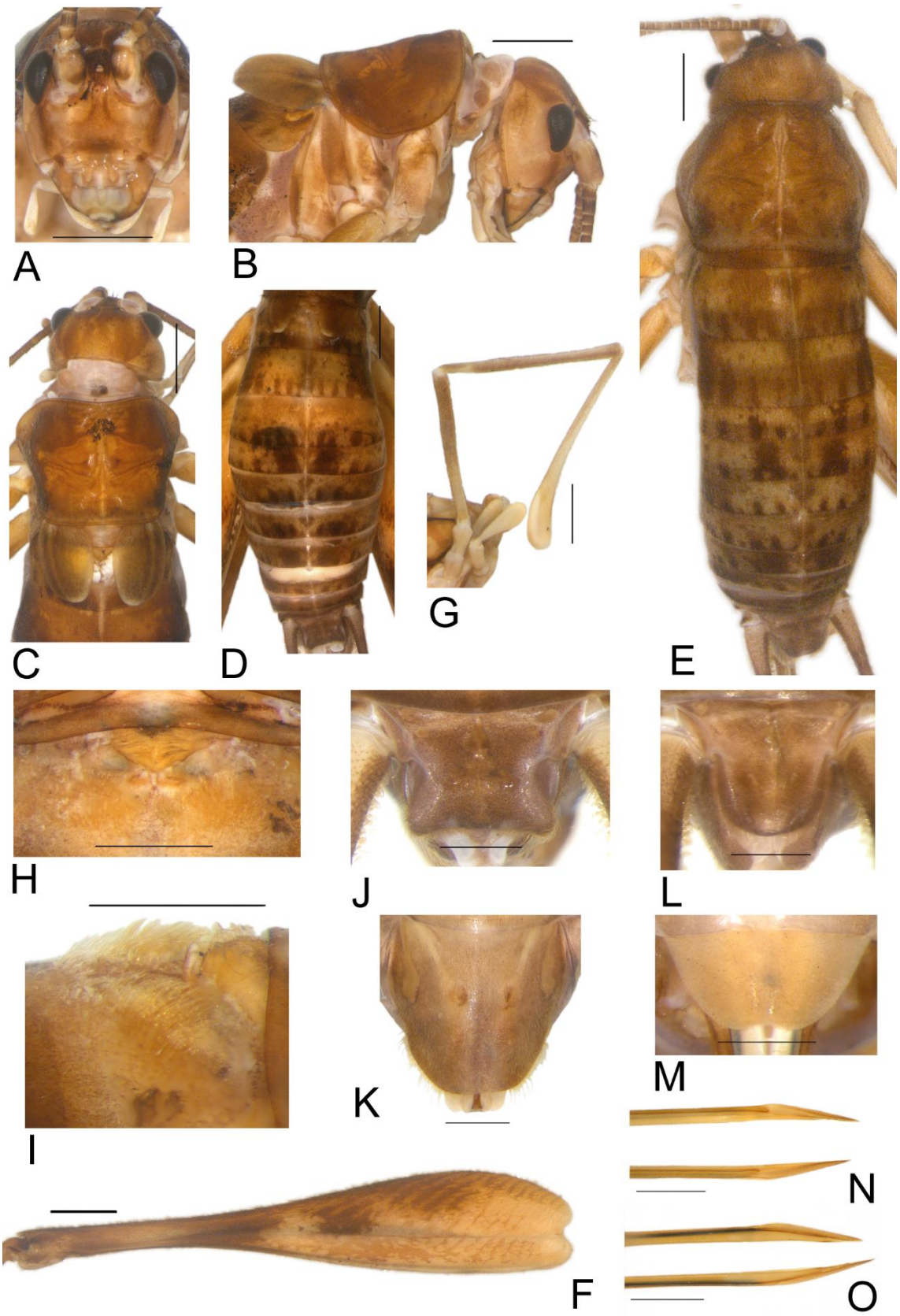


Figure 30. *Eidmanacris speluncae* (Mello-Leitão)**.** Topotypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

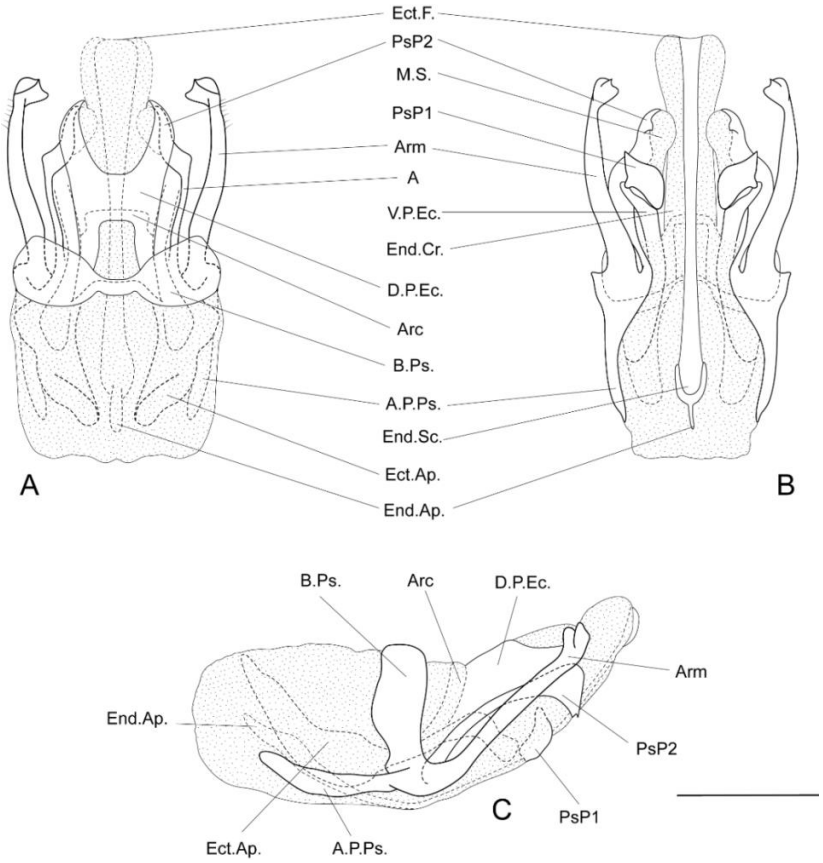


Figure 31. *Eidmanacris speluncae* (Mello-Leitão). Topotypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

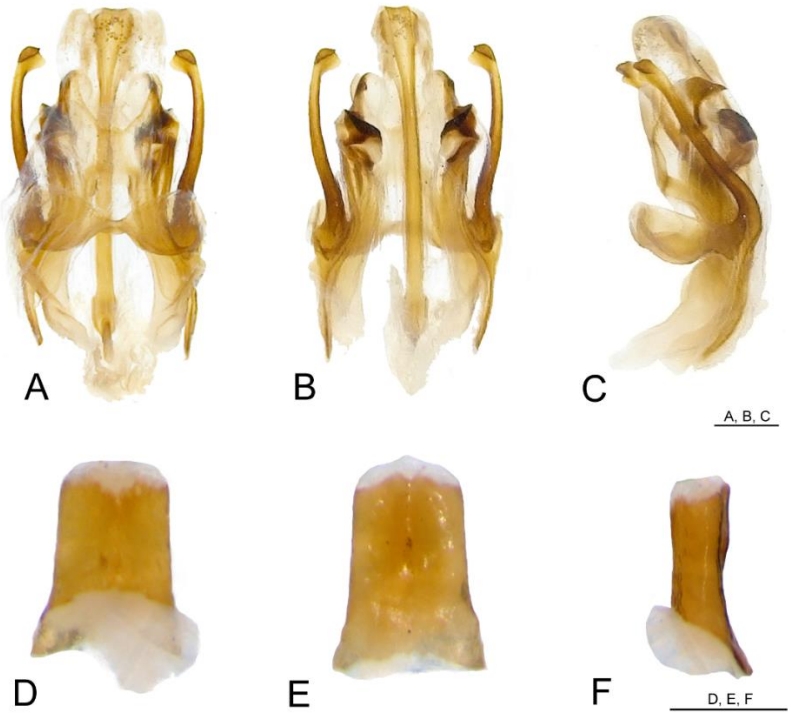


Figure 32. *Eidmanacris speluncae* (Mello-Leitão). Topotypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris minuta (de Mello, 1990) **comb. nov.**

(Figs. 33-35)

Endophallusia minuta de Mello, 1990: 146. Type locality: Brazil, Rio de Janeiro State, Teresópolis municipality.

Endophallusia minuta, De Domenico, 2005: 72 (collection inventory).

Type material examined. 1 male paratype, 1 female paratype, labeled: "BRASIL, RJ, Teresópolis, Faz. Revolta, 01/viii/1989, F.A.G. Mello col." (MZSP). Specimens preserved in ethanol 80%.

Other material examined. 4 males, 2 females, labeled: "BRASIL, RJ, Teresópolis, Faz. Revolta, 01/viii/1989, F.A.G. Mello col." (UBTU). Specimens preserved in ethanol 80%.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: antennae with a median band composed of *c.a.* 6 antenomeres whitish; metanotal gland median crest with cluster of bristles, two latero-posterior projections; lateral projections elongate, cylindrical, slightly curved inwards; PsP2 anterior half bifid, one part curved inwards, other curved outwards, longest.

Redescription.

Head. Light to medium brown. Occiput and vertex medium brown, laterally dark, with three vertical, light brown lines in dorsal view (Fig. 33C). Fastigium light brown, with two rows of bristles, slightly longer than wide, slightly narrowed toward the apex, separated from vertex by a line forming a "v" (Fig. 33C). Frons light to medium brown, with three vertical bands medium brown, two bellow eye, other above clypeus (Figs. 33A, B). Three ocelli present, well developed, forming an isosceles triangle, central flattened at bottom, lateral rounded (Figs. 33A, B, C). Eyes with unpigmented small area on supero-internal angle (Fig. 33C). Maxillary palpi, long, thin, slightly pilose, light brown, distal portion of joints whitish; joints 3-5 almost same-sized (Fig. 33H); apex of joint 5 upcurved. Gena light brown (Fig. 33B). Frontoclypeal suture yellowish brown; clypeus light brown, laterally dark; labrum whitish, lower part yellowish brown. Mandible medium brown. Antennal scape light brown, inner margin medium brown (Fig. 33A); antenomeres medium brown, with median band with *c.a.* 6 antenomeres whitish.

Thorax. Pronotum DD wider than long, medium brown, latero-anterior region with dark spots, slightly pubescent, inflated, divided by a very tiny light brown sagittal line (Fig. 33C); DD cephalic margin sub-straight, caudal margin slightly concave (Fig. 33C); lateral lobes dark brown, ventro-cephalic angle rounded, ventro-caudal margin gradually ascendant (Fig. 33B).

Legs. FI and II dark yellow, annulated with medium brown. TI and II dark yellow, TI with two same-sized apical spurs; TII with two inner apical spurs and one outer, smaller. FIII yellowish brown, with thin stripes light to medium brown on outer face dorsal margin, apical third medium brown (Fig. 33 F). TIII yellowish brown; subapical spurs 4/4, with serrulation above and between subapical spurs, except between two distal ones; apical spurs 3/3, more developed on inner face: dorsal (iad) longer than median (iam), ventral smallest (iav) (iad>iam>iav); outer apical spurs: dorsal one longer (oad), median smaller (oam), ventral smallest (oav) (oad>oam>oav). Basitarsus I, II and III yellow.

Abdomen. Sub-cylindrical in dorsal view, pubescent, medium to dark brown, marbled, divided by a thin light brown sagittal line almost no discernible (Fig. 33D).

Male. Small-sized body, general coloration medium brown, with spots and maculae medium brown. FWs medium brown, apically dark, short, apex rounded; posterior part of inner margin and apex connected to a single vein that divides the external part of FW as a lateral field, glandular thickening absent distally (Fig. 33C); inner margins touching each other; FWs covering the metanotal gland, not surpassing metanotum posterior border (Fig. 33B, C). Metanotal gland present, anteromedian crest with cluster of bristles, two latero-posterior projections; lateral projections elongate, cylindrical, slightly curved inwards; posterior portion of metanotum with bristles (Figs. 33H, I). Supra anal plate light brown, slightly pubescent; anterior margin slightly concave, latero-posterior projections shorter than posterior margin, yellowish, posterior margin sub-straight (Fig. 33J). Subgenital plate longer than wide, with lateral pubescence, laterally medium brown and centrally lighter; anterior margin almost straight, posterior margin rounded (Fig. 33K).

Phallic complex (Figs. 34A-C; 35A-C). Pseudepiphallus: central portion of the base of pseudepiphallic sclerite narrow in dorsal view; pseudepiphallic arms sclerotized, upcurved in lateral view; apex of pseudepiphallic arm with few bristles, curved inwards forming a 90° angle; superior projection sclerotized, tip rounded, internal projection rounded, inferior projection short, apex pointed; anterior projection of pseudepiphallic

sclerite long, surpassing base of pseudepiphallic sclerite in lateral view; PsP2 hardly sclerotized, thin, surpassing posterior extremity of pseudepiphallic arms, anterior half bifid, one part curved inwards, other curved outwards, longer; apex pointed in lateral view, apparently without membranous sphere on inner face; sclerite A connected with base of pseudepiphallic sclerite, curved inwards, articulated with PsP2, without visible connection sclerite A and PsP2; PsP1 short, well sclerotized, apex rounded in ventral view. Ectophallic invagination: ectophallic apodeme longer than pseudepiphallic sclerite; ectophallic arc located posteriorly to the base of pseudepiphallic sclerite in dorsal view; ventro-posterior projection elongate, apex curved outwards; dorsal projections sclerotized, very short; ectophallic fold membranous, sub-apical lateral area inflated. Endophallus: medio-posterior projection of endophallic sclerite elongate, not surpassing PsP2 apex; latero-posterior lobes of the endophallic sclerite short; endophallic apodeme wider than long, flattened laterally, not reaching apex of ectophallic apodeme.

Female. Larger than male, general coloration similar (Fig. 33E). Supra anal plate medium brown, posterior border dark, anterior margin concave, posterior margin rounded with long bristles (Fig. 33L). Subgenital plate light to medium brown, wider than long, anterior margin sub straight, posterior margin rounded (Fig. 33M). Ovipositor as in figs. 33N, O.

Copulatory papilla (Figs. 35D-F). Sub-triangular, dorso-ventrally flattened in lateral view, anterior margin membranous, posterior margin unpigmented.

Remarks. *Endophallusia* de Mello, 1990 was included in the cladistics analysis (Chapter 2) as outgroup of *Eidmanacris*. The results of the phylogenetic analysis of *Eidmanacris* herein shows *Endophallusia* nested within *Eidmanacris*, and based on that result we propose the synonymy of *Endophallusia* with *Eidmanacris* and the transfer of *Endophallusia* species to *Eidmanacris*. This decision is also based on the characters of male genitalia as the presence of anterior projections of pseudepiphallic sclerite (A.P.Ps.), not sclerotized connection between PsP1 and PsP2, the ectophallic fold entirely membranous dorsally, the median-posterior projection of endophallic sclerite long throughout the entire structure, and the presence of latero-posterior lobes on endophallic sclerite. The phylogeny proposed by Souza-Dias (2015) corroborates these nomenclatural acts.

Measurements (mm).

Male (n=1): Hw, 2.17; iod, 1.17; Lpron, 2.04; awpron, 2.23; pwpron, 2.48; wpron 2.79; LFW, 1.24; wFW, 1.17; LFIII, 10.05; wFIII, 2.55; LTIII, 8.85; Ltars1-III, 2.25.

Female (n=1): Hw, 2.41; iod, 1.3; Lpron, 2.29; awpron, 2.97; pwpron, 2.35; wpron, 3.16; LFIII, 9; wFIII, 2.7; LTIII, 8.85; Ltars1-III, 2.25; OL, 8.55.

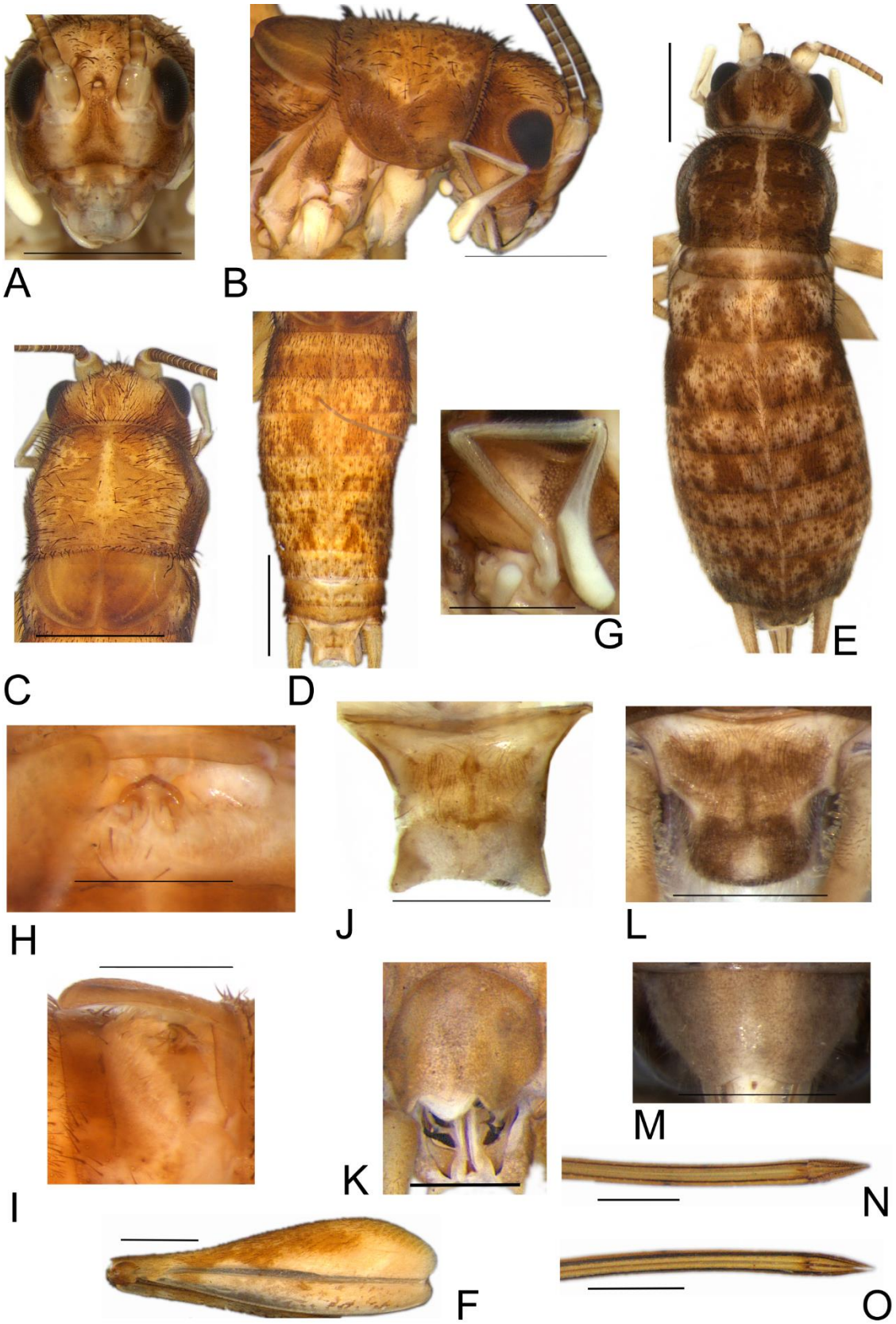


Figure 33. *Eidmanacris minuta* (de Mello). Paratypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

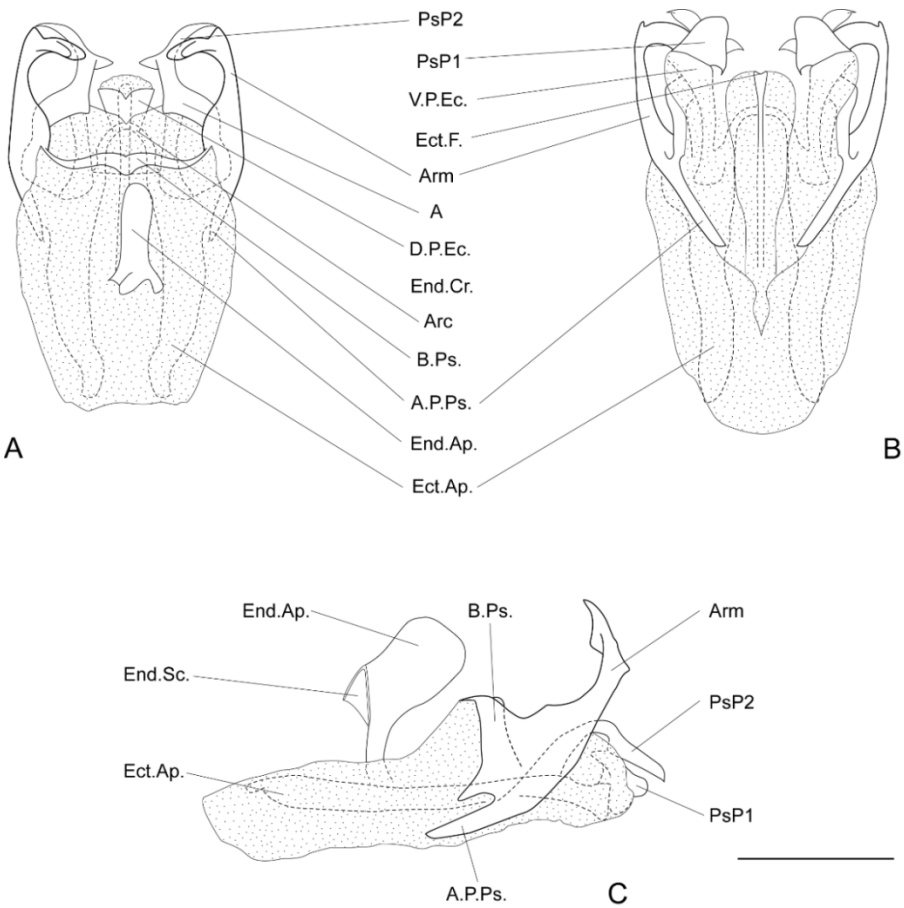


Figure 34. *Eidmanacris minuta* (de Mello). Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

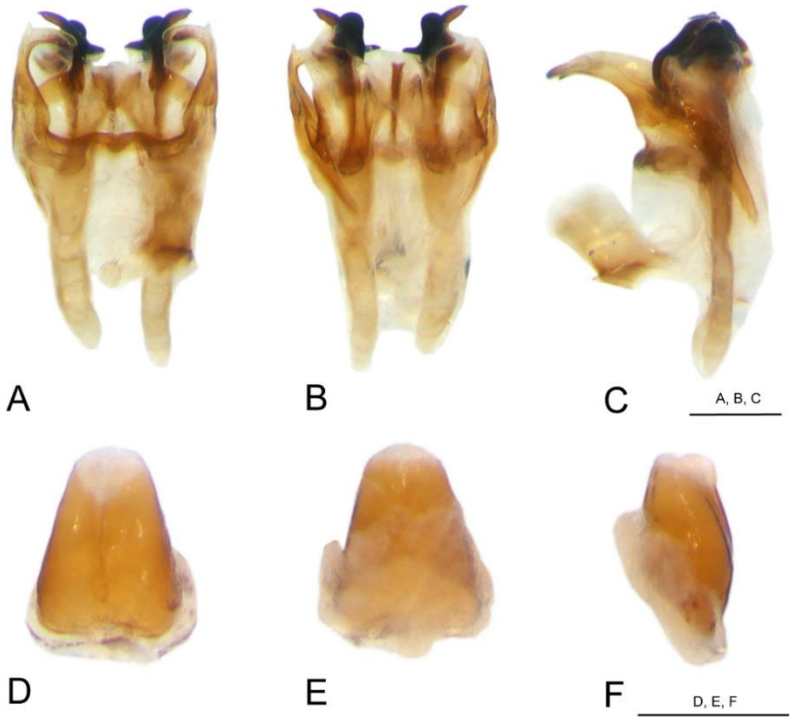


Figure 35. *Eidmanacris minuta* (de Mello). Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris endophallica (de Mello, 1990) **comb. nov.**

(Figs. 36-39)

Endophallusia endophallica de Mello, 1990: 147 (male and female description). Type locality: Brazil, Rio de Janeiro State, Teresópolis municipality.

Endophallusia endophallica, De Domenico, 2005: 72 (collection inventory).

Type material examined. 1 male paratype and 1 female paratype labeled: "BRASIL, RJ, Teresópolis, Faz. Revolta, 01/viii/1989, F.A.G. Mello, col." (MZSP). Specimens preserved in ethanol 80%.

Other material examined. 2 males and 1 female labeled: "Brasil, RJ, Teresópolis, Pq. Nacional Serra dos Órgãos, 22°23'S//42°56'W (Mata), 21-27.ii.1997, F.A.G. Mello – N.D. Jago, *leg*" (UBTU). Specimens preserved in ethanol 80%.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: antenomeres medium brown, with isolated, withish interspersed ones; latero-anterior region of DD with dark brown spots; subgenital plate two times longer than wide; a singular male phallic complex, very elongated; inferior projection of apex of pseudepiphallic arm truncate in lateral view; ectophallic apodeme *c.a.* three times longer than pseudepiphallic sclerite; medio-posterior projection of endophallic sclerite *c.a.* four times longer than pseudepiphallic sclerite; endophallic apodeme as long as wide, laterally flattened.

Redescription.

Head. Dark brown. Occiput and vertex medium to dark brown, with three vertical lines light brown in dorsal view, band light brown going from occiput to margin of each eye; vertex light to medium brown (Fig. 36C). Fastigium dark brown, apically dark, with two rows of bristles, slightly longer than wide, slightly narrowed toward the apex, separated from vertex by a horizontal line light brown (Fig. 36C). Frons light brown, with three vertical bands dark brown, two below eyes, one above clypeus (Figs. 36A, B). Three ocelli present, well developed, rounded, forming isosceles triangle (Figs. 36A, B, C). Eyes without unpigmented small area on supero-internal angle (Fig. 36C). Maxillary palpi, long, thin, pilose, light brown, distal portion of joints whitish; joints 3, 4 and 5 almost same-sized (Fig. 36G); apex of joint 5 upcurved. Gena light brown; in lateral view, posterior margin medium to dark brown (Fig. 36B). Frontoclypeal suture dark yellow;

clypeus light brown, lateral dark, with medium brown band on upper margin; labrum whitish, lower portion light brown. Mandible dark brown, light brown maculae on lower margin. Antennal scape light brown, internal margin medium brown (Fig. 36A); antenomeres medium brown, interspersed by some isolated, whitish.

Thorax. Pronotum DD wider than long, reddish to medium, with sparse dark spots and maculae, pubescent, inflated, divided by a light brown sagittal line, latero-anterior region with dark brown spots (Fig. 36C); DD cephalic margin sub-straight, caudal margin slightly concave (Fig. 36C); lateral lobes darker than DD, ventro-cephalic angle rounded, ventro-caudal margin gradually ascendant (Fig. 36B).

Legs. FI and II yellowish brown, annulated with dark brown. TI and II yellowish brown, annulated with medium brown; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. FIII light yellow, with thin stripes outer face medium brown, apical third dark brown (Fig. 36F). TIII medium brown; sub apical spurs 4/4, with serrulation above and between subapical spurs, base of spines yellowish; apical spurs 3/3, more developed on inner face: dorsal (iad) longer than median (iam), ventral smallest (iav) (iad>iam>iav); outer apical spurs: dorsal one longer (oad), median smaller (oam), ventral smallest (oav) (oad>oam>oav). Basitarsus I, II and III yellow.

Abdomen. Cylindrical in dorsal view, medium brown, with dark brown spots, divided by light brown median band (Fig. 36D).

Male. Large sized body, general coloration medium to reddish brown, with dark brown spots and maculae. FWs medium brown, very short, not surpassing metanotum anterior border, without visible veins, inner margins not touching each other, metanotal gland absent (Figs. 36B, C). Supra anal plate light brown, centrally yellowish, slightly pubescent; anterior margin slightly concave, latero-posterior projections elongate, longer than posterior margin of supra anal plate, with long bristles; posterior margin sub-straight (Fig. 36H). Subgenital plate two times longer than wide, with lateral pubescence, medium brown; anterior margin almost straight, posterior margin rounded (Fig. 36I).

Phallic complex (Figs. 37A, B; 38A-C; 39A-C). Pseudepiphallus: central portion of base of pseudepiphallic sclerite narrow than lateral portions in dorsal view; pseudepiphallic arms sclerotized, hard, slightly upcurved in lateral view; apex of pseudepiphallic arm with few bristles on outer face, curved inwards forming a 90° angle; superior projection with tiny bristles, inferior projection truncate in lateral view; anterior projection of pseudepiphallic sclerite present, elongate, surpassing base of

pseudepiphallic sclerite, apically pointed; PsP2 hardly sclerotized, elongate, thin, not surpassing posterior extremity of pseudepiphallic arms in dorsal view, curved downwards, apex pointed in lateral view, without membranous sphere on inner face; sclerite A connected with base of pseudepiphallic, straight, visible articulation with PsP2; PsP1 short, posterior margin rounded, inner face concave in ventral view. Ectophallic invagination: ectophallic apodeme *c.a.* three times longer than pseudepiphallic sclerite, thin; ectophallic arc located posteriorly base of pseudepiphallic sclerite in dorsal view; dorsal projections not visible; ectophallic fold membranous, apex surpassing pseudepiphallic arms, sub-apical lateral lobes. Endophallus: medio-posterior projection *c.a.* four times longer than pseudepiphallic sclerite; latero-posterior lobes of endophallic sclerite short; endophallic apodeme as long as wide, laterally flattened, surpassing apex of ectophallic apodeme.

Female. Larger than male, general coloration similar (Fig. 36E). Supra anal plate light brown, anterior margin concave, posterior margin slightly rounded, darker, with bristles (Fig. 36J). Subgenital plate medium brown, wider than long, pilose, anterior margin sub straight, posterior margin rounded (Fig. 36K). Ovipositor as in figs. 36L, M.

Copulatory papilla (Figs. 39D-F). Sub-triangular in dorsal and ventral views, dorso-ventrally flattened in lateral view, anterior margin sclerotized, posterior margin unpigmented, rounded.

Remarks. See above the Remarks section under *Eidmanacris minuta*.

Measurements (mm).

Male (=2): Hw, 2.94 ± 0.21 (2.79-3.1); iod, 1.64 ± 0.13 (1.48-1.73); Lpron, 3.25 ± 0.13 (2.97-3.34); awpron, 2.97; pwpron, 3.47 ± 0.26 (3.28-3.65); wpron 4.21 ± 0.26 (4.03-4.4); LFW, 0.21 ± 0.04 (0.18-0.24); wFW, 0.83 ± 0.13 (0.74-0.93); LFIII, 13.42 ± 0.31 (13.2-13.65); wFIII, 3.6; LTIII, 14.32 ± 0.53 (13.95-14.7); Ltars1-III, 4.05 ± 0.21 (3.15-4.2).

Female (n=1): Hw, 3.03; iod, 1.48; Lpron, 3.25; awpron, 2.91; pwpron, 3.53; wpron, 4.03; LFIII, 12.9; wFIII, 3.15; LTIII, 12.45; Ltars1-III, 4.05; OL, 11.25.

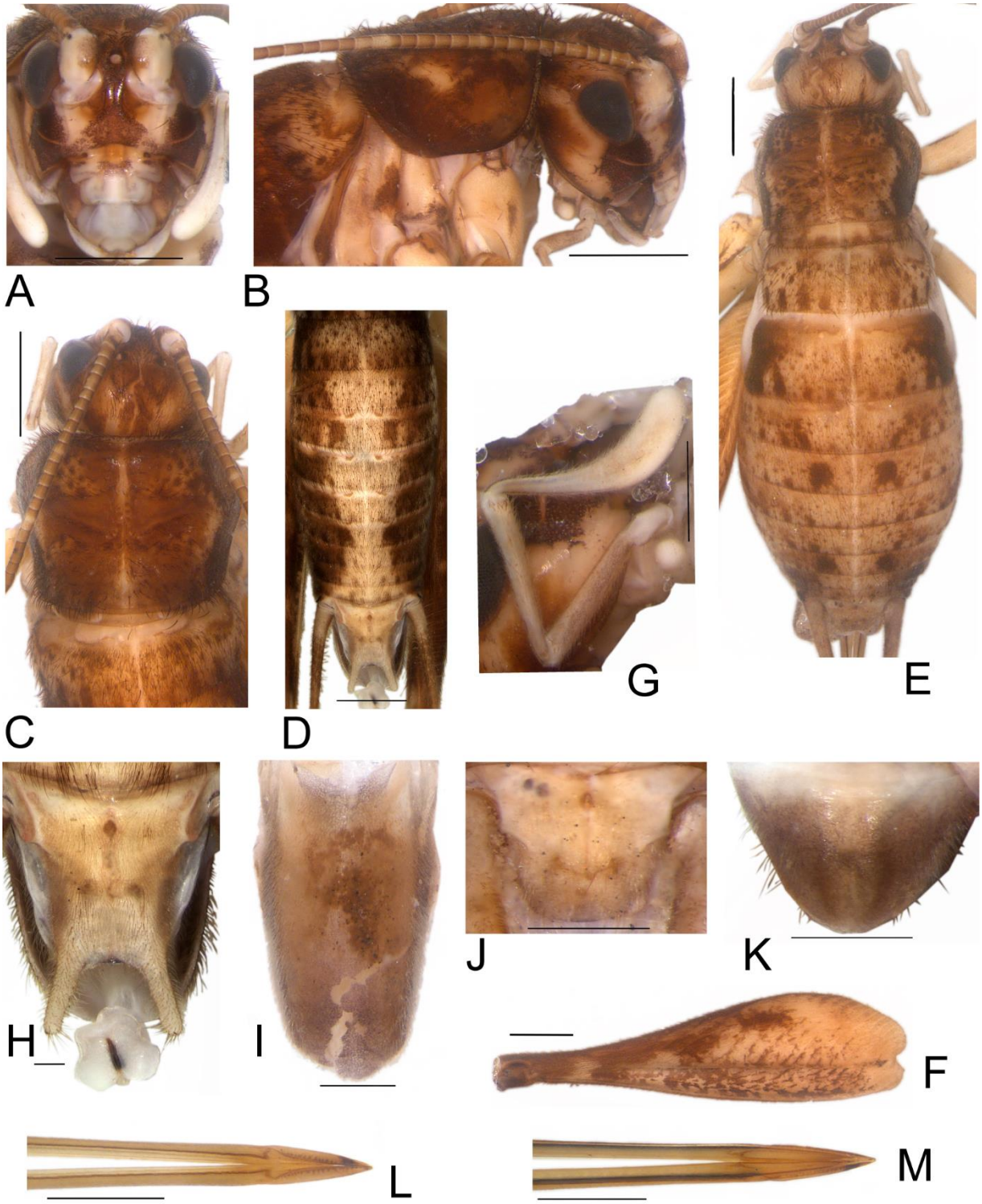


Figure 36. *Eidmanacris endophallica* (de Mello) Paratypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male supra anal plate; **I**- male subgenital plate; **J**- female supra anal plate; **K**- female subgenital plate; **L**- ovipositor dorsal; **M**- ovipositor ventral. Scale bar: A-F: 2mm; G-M: 1mm.

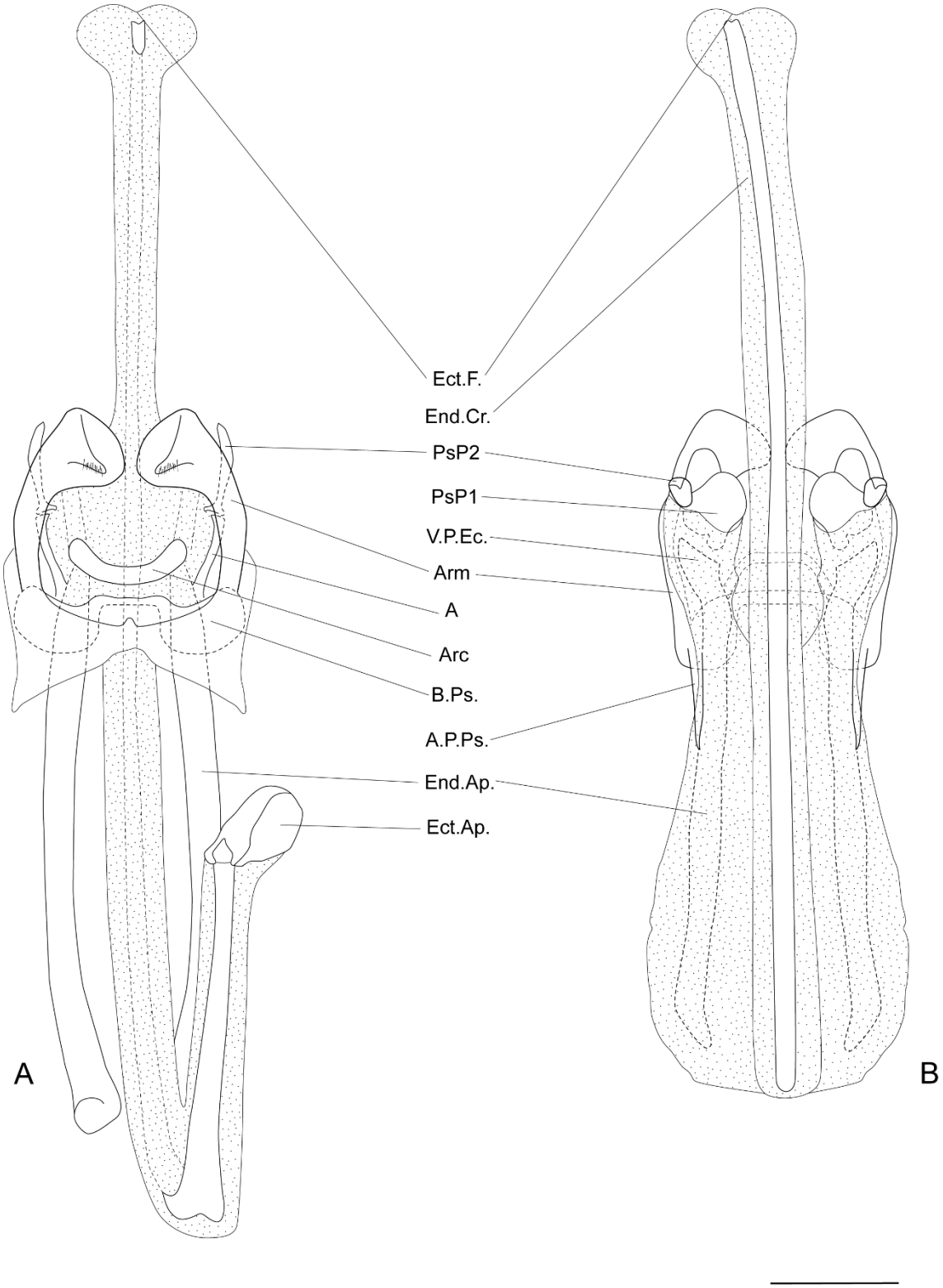


Figure 37. *Eidmanacris endophallica* (de Mello). Paratype. Male phallic complex: **A**- dorsal; **B**- ventral. Scale bar: 0.5 mm.

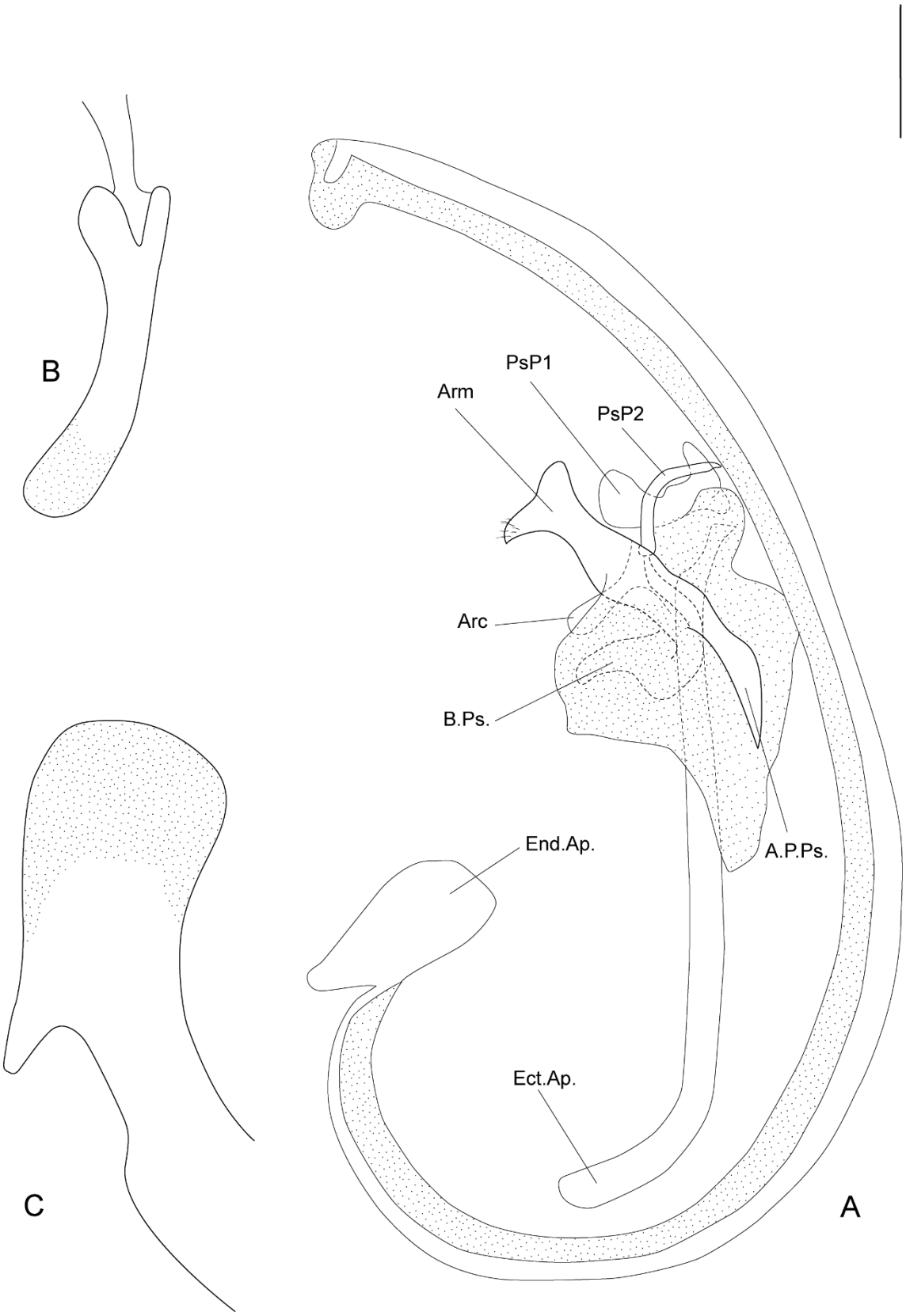


Figure 38. *Eidmanacris endophallica* (de Mello). Paratype. Male phallic complex: **A**- lateral; **B**- endophallic apodeme, ventral; **C**- endophallic apodeme, lateral. Scale bar: 0.5 mm.

Figure 39. *Eidmanacris endophallica* **comb. nov.** Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris scopula **sp. nov.**

(Figs. 40-42)

Type material. Holotype male, allotype and 1 female paratype (MZSP). Holotype male and allotype labeled: "Gruta G. VOZINHA, Dianópolis, TO, Brasil, 04-09.xii.2007, Andrade et *al.* col.". 1 female paratype labeled: "Gruta Onça, Dianópolis, Tocantins, Brasil, 04-09.xii.2007, Andrade et *al.* col.". Specimens preserved in ethanol 80%.

Type locality. Brazil, Tocantins State, Dianópolis municipality.

Distribution. Brazil, Tocantins State.

Etymology. From Latin, *scopul* means "a small broom", referring to the bristles of metanotal gland.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: two thin lines light brown involving median ocellus; antenomeres dark brown interspersed of whitish bands composed of three antenomeres, excepting the first band, composed of only one; pronotum posterior third dark brown; metanotal gland centrally inflated in lateral view, with two horizontal lines of long bristles, one directed anteriorly and other posteriorly; abdominal tergites II and III with two dark spots; apex of pseudepiphallic arm with ventro-posterior hook, upcurved, with a curved line in lateral view; PsP2 inner margin concave in dorsal view, apex pointed in lateral view; copulatory papilla thin in lateral view.

Description.

Head. Medium brown. Occiput light to medium brown with band dark brown going from occiput to margin of each eye; vertex medium brown, with a central line light brown, vertical, until fastigium (Fig. 40C). Band dark brown, lateral, from occiput to clypeus passing through eye in lateral view. Fastigium medium to dark brown, almost without bristles, longer than wide, separated from vertex by a transverse furrow forming "v", two lines light brown, thin, involving median ocellus (Fig. 40C). Frons light to medium brown, with a central band dark brown, vertical (Fig. 40A). Three ocelli present, well developed, lateral ones rounded, central flattened at bottom (Figs. 40A, B, C). Eyes with unpigmented small area on supero-inner angle (Fig. 40C). Maxillary palpi light brown, long and thin, distal portion of joints whitish; joints 3, 4 and 5 almost same-sized (Fig. 40G); apex of joint 5 upcurved. Gena light brown, posterior margin with stripe dark brown in lateral view (Figs. 40A, B). Frontoclypeal suture dark yellow. Clypeus whitish,

with two vertical bands dark brown; labrum whitish, lower portion light brown. Mandible light brown, inner and lower margins dark brown. Antennal scape light to medium brown, inner face darker with row of bristles (Figs. 40A, B, C); antenomeres dark brown interspersed by whitish bands composed of three antenomeres, excepting the first band, with only one.

Thorax. Pronotum DD medium brown, posterior third dark brown, wider than long, inflated, divided by a line dark brown, thin, vertical; cephalic margin slightly concave, caudal margin almost straight (Fig. 40C); ventro-cephalic angle rounded, ventro-caudal margin dark brown, gradually ascendant (Fig. 40B).

Legs. FI and II yellowish brown, annulated with dark brown. TI and II light to medium brown, annulated with medium to dark brown; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. FIII yellowish brown, with several stripes medium brown, thin, on outer face, apical third dark brown (Fig. 40F). TIII dark yellow, apical third lighter; sub apical spurs 4/4, with serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face; inner apical spurs: median longer (iam), dorsal somewhat shorter (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oav). Basitarsus I, II and III yellow.

Abdomen. Sub-cylindrical, medium brown, posteriorly dark, posterior tergites narrower in dorsal view, divided by a sagittal line light brown, with dark brown punctuations, tergites II and III with two dark maculae each (Fig. 40D).

Male. Large-sized body, general coloration in different shades of brown. FWs dark brown, inner and posterior margin medium brown, relatively long, triangular, glandular thickening absent, apex connected to a single vertical vein that divides the external part of FW as lateral field (Figs. 40B, C); inner margins not touching each other, covering metanotal gland area, posterior margin surpassing metanotum (Fig. 40C). Metanotal gland present, anteromedian crest triangular, reduced; apparently lateral projections absent, central region somewhat inflated in lateral view, with two horizontal lines of long bristles, one directed anteriorly, other one posteriorly (Figs. 40H, I). Supra anal plate dark brown, centrally light brown, anterior margin sub-straight, posterior margin somewhat concave; latero-distal projection very long like in *E. alboannulata*, apex light brown with long setae (Fig. 40J). Subgenital plate longer than wide, light brown, with anterior

maculae dark brown , anterior margin sub straight, posterior margin concave with invagination almost forming “v” (Fig. 40K).

Phallic complex (Figs. 41A-C; 42A-C). Pseudepiphallus: base of pseudepiphallic sclerite depressed on median part; pseudepiphallic arms sclerotized, upcurved, hard; apex with bristles on outer face, superior and internal projections reduced, spine-like; inferior projection hook-shaped, upcurved, with a line of bristles on the curvature in lateral view; dorsal border of apex of pseudepiphallic arm sub-concave; lateral projection short, tip pointed in lateral view; anterior projection of pseudepiphallic sclerite short, anteriorly pointed, not surpassing median part of pseudepiphallus in dorsal view; PsP2 short, curved inwards, well sclerotized, inner margin concave in dorsal view, apex pointed in lateral view, with membranous sphere on inner face, not surpassing posterior extremity of pseudepiphallic arms; sclerite A anteriorly curved inwards and articulated with PsP2 in dorsal view; PsP1 short, wider than long, inclined in ventral view, inner face more sclerotized than outer; elongate and upcurved in lateral view. Ectophallic invagination: Ectophallic apodeme somewhat long, weakly sclerotized, anteriorly robust, dorso-ventrally flattened in lateral view; ectophallic arc short, located below the base of pseudepiphallic sclerite in dorsal and ventral views; dorsal projection elongate, well sclerotized, fused, posterior border concave, not surpassing PsP2 posteriorly in dorsal view; ventro-posterior projection elongate, apical third curved inwards. Endophallus: medio-posterior projection of endophallic sclerite elongate, not surpassing PsP2 apex; latero-posterior lobes of the endophallic sclerite somewhat short; endophallic apodeme well developed, somewhat long, upcurved in lateral view, limits not surpassing ectophallic apodeme.

Female. Larger than male, general coloration medium brown (Fig. 40E). Supra anal plate yellowish brown, posterior margin medium to dark brown, somewhat rounded with long bristles (Fig. 40L). Subgenital plate yellowish brown, lateral and posterior borders dark brown, posterior margin with central concavity (Fig. 40M). Ovipositor as in figs. 40N and 40O.

Copulatory papilla (Figs. 42D-F). Little longer than wide, dorso-ventrally thin in lateral view, posterior margin rounded in dorsal and ventral views.

Measurements (mm).

Male (n=1): Hw, 2.48; iod, 1.05; Lpron, 2.6; awpron, 2.98; pwpron, 3.04; wpron, 3.53; LFW, 2.6; wFW, 1.61; LFIII, 15.15; wFIII, 3; LTIII, 17.25; Ltars1-III, 4.95.

Female (n=2): Hw, 3.72 ± 0.35 (3.47–3.96); iod, 1.95 ± 0.13 (1.86–2.04); Lpron, 3.9 ± 0.17 (3.78–4.03); awpron, 4.24 ± 0.13 (4.15–4.34); pwpron, 4.37 ± 0.39 (4.09–4.65); wpron, 5.36 ± 0.48 (5.02–5.70); LFIII, 18.6 ± 0.21 (18.45–18.75); wFIII, 3.97 ± 0.1 (3.9–4.05); LTIII, 21.15 ± 0.21 (21–21.3); Ltars1-III, 5.25 ± 0.21 (5.1–5.4); OL, 18.85 ± 0.84 (14.25–15.45).

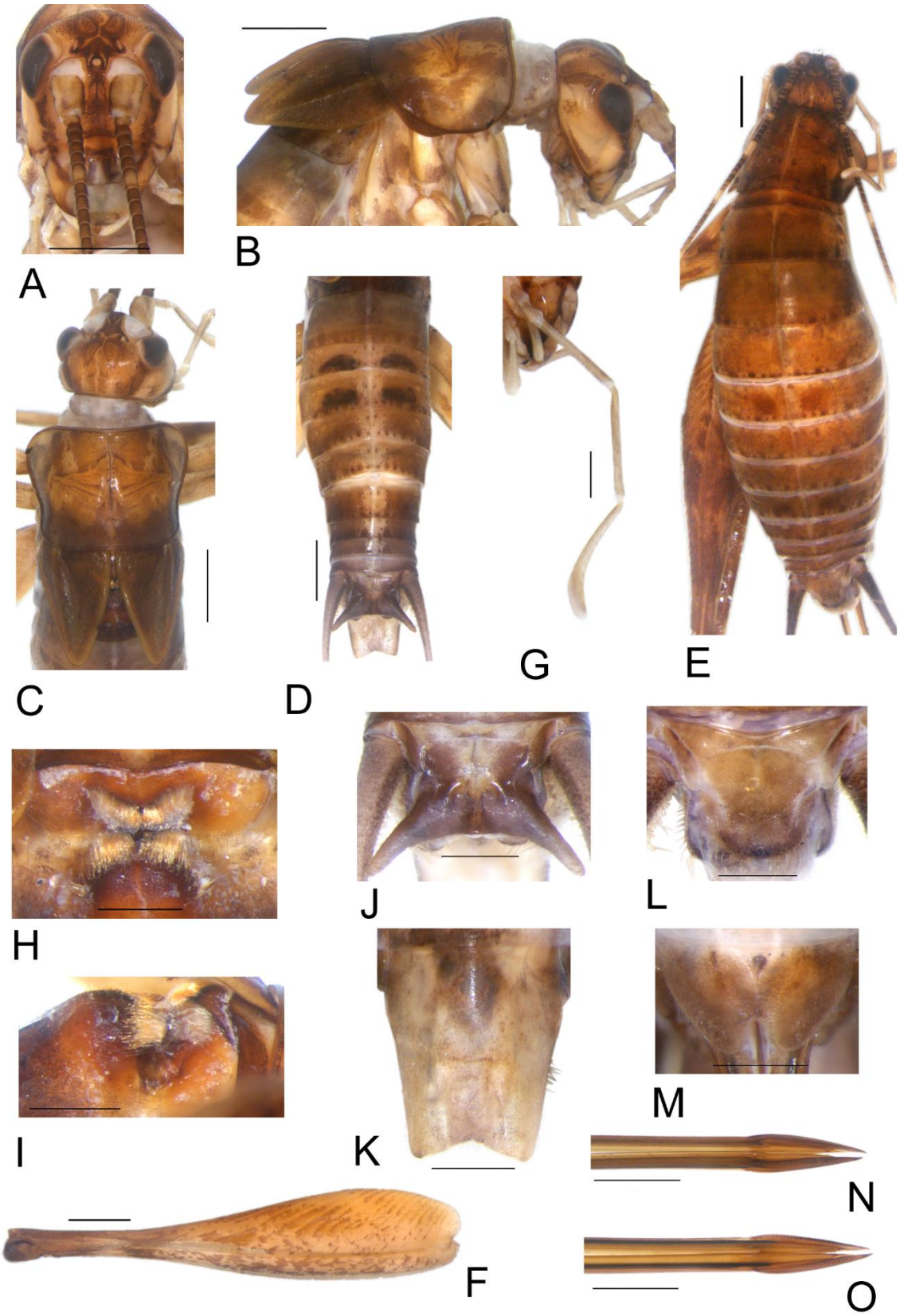


Figure 40. *Eidmanacris scopula* **sp. nov.** Holotype male and allotype. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

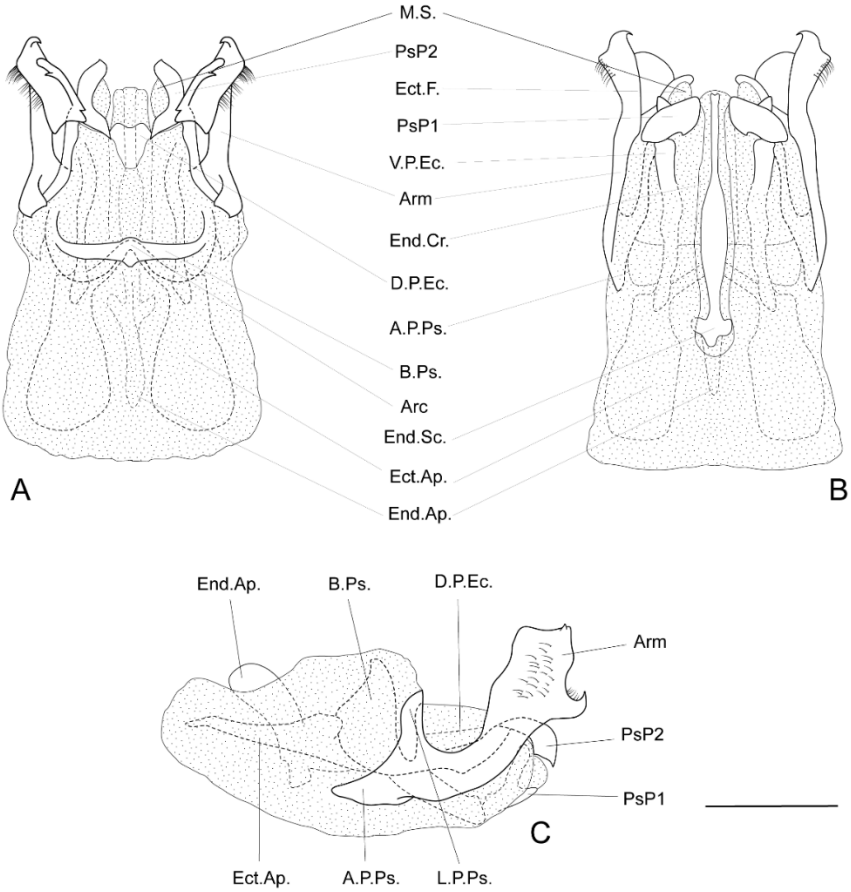


Figure 41. *Eidmanacris scopula* **sp. nov.** Holotype male. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

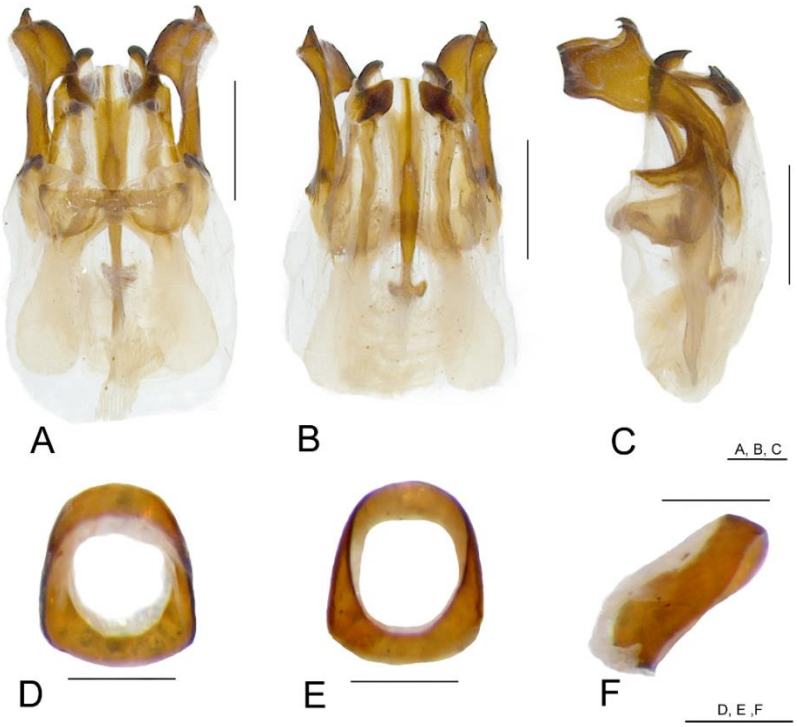


Figure 42. *Eidmanacris scopula* **sp. nov.** Holotype and allotype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris gigas **sp. nov.**

(Figs. 43-45)

Type material. Holotype male, allotype, 4 males paratypes and 2 females paratypes (MZSP). Holotype male, allotype, 3 males paratypes and 2 females paratypes labeled: "BRASIL (GO) Piripiri, 6 km E de Pirenópolis. 15°50'81''S, 48°55'94''W, 12-17/X/97. A. Mesa, P. Garcia. Em mata ciliar. 770m alt.". 1 male paratype labeled: "Brasil (GO) Pirenópolis, Outubro 1984, Alexander Dinif, Coleta Noturna". Specimens preserved in ethanol 80%.

Type locality. Brazil, Goiás State, Pirenópolis municipality.

Distribution: Brazil, Goiás State.

Etymology. Formerly named by Dr. Alejo Mesa (*in memorian*), but not published. *Gigas* means very big, probably this is the largest species of *Eidmanacris* known so far.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: pseudepiphallic arm dorsal margin almost forming 90° angle in lateral view; apex of pseudepiphallic arms with ventral projection curved inwards, finger-shaped, with hard bristles; superior, supero-internal and infero-internal projections reduced to a spine; inferior projection hook-shaped, upcurved; PsP2 curved inwards, pointing anteriorly, pointed on its posterior margin; copulatory papilla anterior half wider than posterior in dorsal and ventral views, dorsal and anterior borders unpigmented in lateral view.

Description.

Head. Dorsum pubescent, in several shades of brown. Occiput dark brown, yellowish brown band going from occiput to margin of each eye (Figs. 43C, B); vertex medium to dark brown, with three almost no discernible lines light brown, vertical (Fig. 43C). Fastigium dark brown, with row of bristles, longer than wide, slightly narrowed toward the apex, narrower than scape; separated from vertex by transverse line forming "v" (Fig. 43C). Frons yellowish brown, with central band dark brown, vertical, two thinner, bellow eyes (Fig. 43A). Three ocelli present, well-developed, lateral rounded, central flattened at bottom (Figs. 43A, B, C). Eyes with unpigmented small area on supero-internal angle (Fig. 43C). Maxillary palpi light brown, long, thin, joints 3, 4 and 5 almost same-sized (Fig. 43G), apex of joint 5 upcurved. Gena yellowish brown, posterior border dark brown in lateral view (Figs. 43A, B). Frontoclypeal suture dark

yellow, centrally darker. Clypeus whitish, upper part with two bands dark brown, short, vertical; labrum whitish, lower portion light brown. Mandible medium brown, inner and low margins darker. Antennal scape light brown, inner face dark brown (Figs. 43A, B, C); antenomeres dark brown with whitish bands composed of three antenomeres and five antenomeres consecutively.

Thorax. Pronotum DD dark brown, posterior third darker, wider than long, inflated, slightly pubescent, divided by slender vertical line medium brown; DD cephalic margin slightly concave, caudal margin almost straight. (Fig. 43C); ventro cephalic angle rounded, margin medium brown, ventro caudal margin dark brown, gradually ascendant (Fig. 43B).

Legs. FI and II yellowish brown, annulated with dark brown. TI and II light to medium brown, annulated with dark brown; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. FIII yellowish brown, two bands of several stripes medium brown, thin, on outer face, apical third dark brown (Fig. 43F). TIII medium to dark brown, clearing at apical third; sub apical spurs 4/4, with serrulation above and between sub apical spurs; apical spurs 3/3, more developed on inner face; inner apical spurs: median one longer (iam), dorsal somewhat shorter (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oav). Basitarsus I, II and III dark yellowish.

Abdomen. Dark brown, sub-cylindrical, posterior tergites narrower in dorsal view, divided by a thick sagittal line light brown (Fig. 43D).

Male. Large-sized body, general coloration reddish brown. FWs dark brown, pubescent, relatively long, sub-triangular, apex connected to a single vertical vein that divides external part of FW as lateral field, inner margin medium brown, posterior part of inner margin with glandular thickening (Figs. 43B, C); inner margins touching each other, covering metanotal gland area, posterior margin reaching posterior border of metanotum (Fig. 43C). Metanotal gland present, lateral projections cylindrical, short, tip rounded, with a spot dark brown; anteromedian crest triangular with long bristles line on posterior borders (Figs. 43H, I). Supra anal plate yellowish brown, anterior margin sub-straight, posterior margin somewhat concave; latero-distal projection greyish, not so long, with long setae (Fig. 43J). Subgenital plate light brown, lateral border darker, longer than wide, anterior margin sub straight, posterior margin concave, central invagination almost forming “v” (Fig. 43K).

Phallic complex (Figs. 44A-C; 45A-C). Pseudepiphallus: base of pseudepiphallic sclerite hard sclerotized; pseudepiphallic arm less sclerotized than base of pseudepiphallic sclertie, upcurved, dorsal margin almost forming 90° angle in lateral view; apex of pseudepiphallic arm with bristles on outer face; superior, supero-internal e infero-internal projections reduced to spine; inferior projection hook shaped, upcurved; ventral projection curved inwards like *E. corumbatai*, finger-shaped with hard bristles; lateral projection short, tip pointed in lateral view; anterior projection of pseudepiphallic sclerite short, thin, anteriorly pointed, not surpassing median part of pseudepiphallus in lateral view; PsP2 elongate, not surpassing posterior extremity of pseudepiphallic arms, completely curved inwards, pointing anteriorly, posterior margin pointed, apparently without membranous sphere; PsP1 short, wider than long in dorsal view, upcurved in ventral view. Ectophallic invagination: ectophallic apodeme long, dorso-ventrally flattened in lateral view; ectophallic arc short, located below the base of pseudepiphallic sclerite in dorsal and ventral views; dorsal projections well sclerotized, fused, not surpassing PsP2 posteriorly in dorsal view, posterior margin with central concavity; ventro-posterior projection well sclerotized, elongate, posteriorly curved inwards. Endophallus: medio-posterior projection of endophallic sclerite elongate, reaching PsP2 apex; latero-posterior lobes of the endophallic sclerite long; endophallic apodeme elongate, upcurved in lateral view, its limits almost reaching ectophallic apodeme anterior margin.

Female. Larger than male, general coloration similar (Fig. 43E). Supra anal plate dark brown, anterior and lateral margins light brown, posterior margin somewhat rounded with long bristles (Fig. 43L). Subgenital plate medium brown, getting lighter anteriorly, posterior margin concave, central concavity rounded (Fig. 43M). Ovipositor as in figs. 43N and 43O.

Copulatory papilla (Figs. 45D-F). Cylindrical, longer than wide, anterior half wider than posterior in dorsal and ventral views, anterior and posterior margins concave, dorsal and anterior borders unpigmented in lateral view.

Measurements (mm).

Male (n=5): Hw, 3.86 ± 0.34 (3.53-4.27); iod, 1.75 ± 0.23 (1.73-1.98); Lpron, 4.04 ± 0.48 (3.53-4.77); awpron, 3.78 ± 0.4 (3.1-4.15); pwpron, 4.28 ± 0.35 (3.96-4.77); wpron, 5.46 ± 0.6 (4.77-6.38); LFW, 2.64 ± 0.44 (2.1-3.28); wFW, 1.79 ± 0.27 (1.48-2.10); LFIII, 14.49 ± 1.79 (15.6-20.25); wFIII, 3.72 ± 0.26 (3.6-4.2); LTIII, 19.38 ± 1.93 (17.25-21.9); Ltars1-III, 5.7 ± 0.96 (4.95-7.2).

Female (n=3): Hw, 3.97 ± 0.06 (3.9–4.03); iod, 1.92 ± 0.06 (1.86–1.98); Lpron, 4.27 ± 0.19 (4.09–4.46); awpron, 4.13 ± 0.14 (3.96–4.21); pwpron, 4.83; wpron, 5.76 ± 0.11 (5.7–5.89); LFIII, 17.7 ± 0.54 (17.25–18.3); wFIII, 4.1 ± 0.17 (3.9-4.2); LTIII, 18.1 ± 0.38 (17.7–18.45); Ltars1-III, 5.05 ± 0.23 (4.8–5.25); OL, 13.1 ± 0.87 (12.45–14.1).

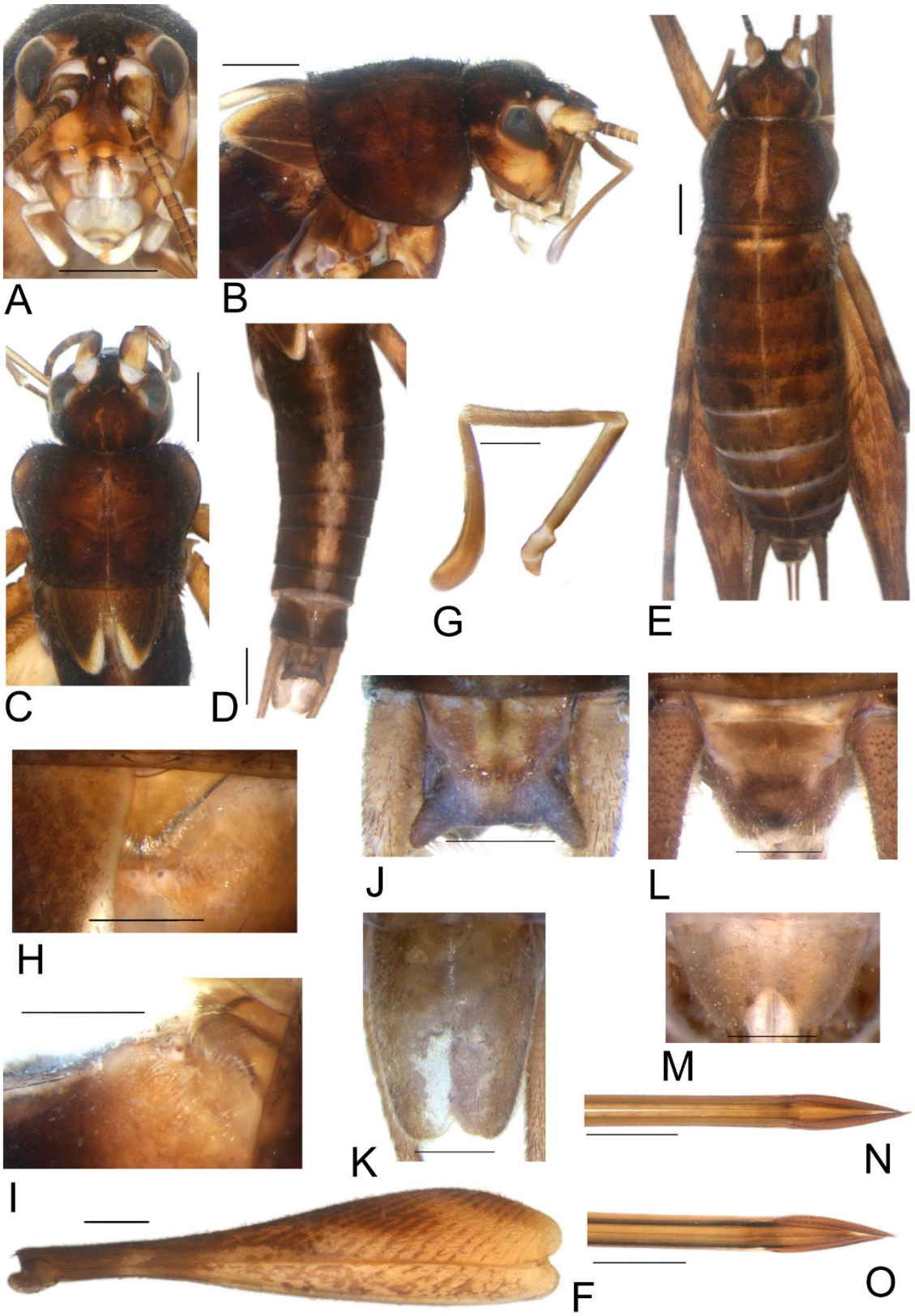


Figure 43. *Eidmanacris gigas* **sp. nov.** Paratypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

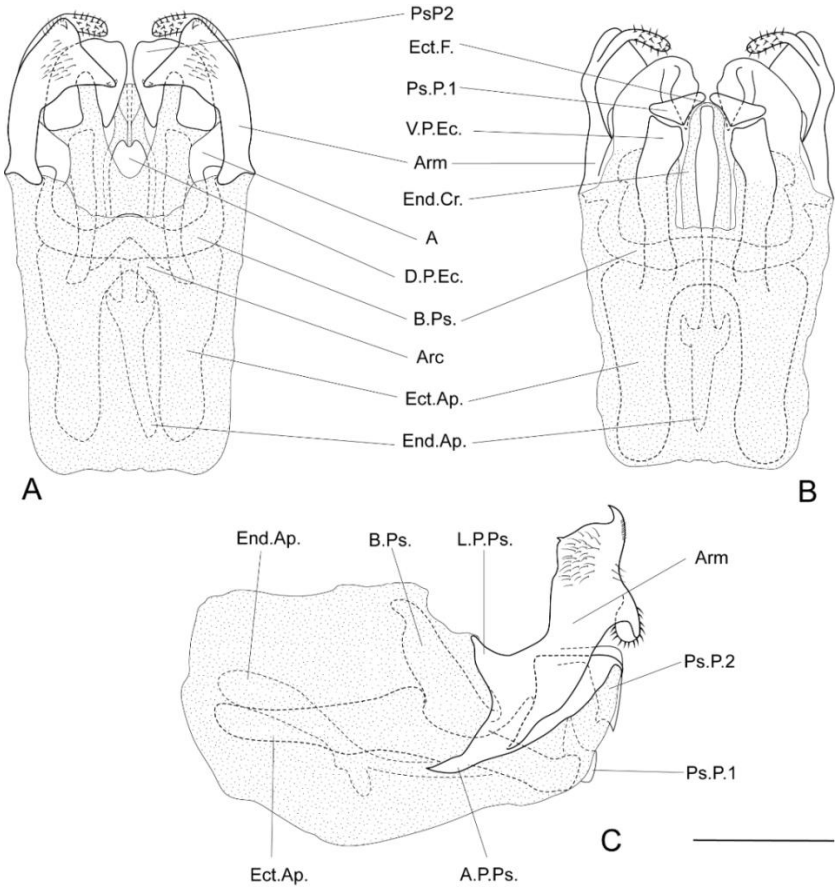


Figure 44. *Eidmanacris gigas* **sp. nov.** Male **p**aratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

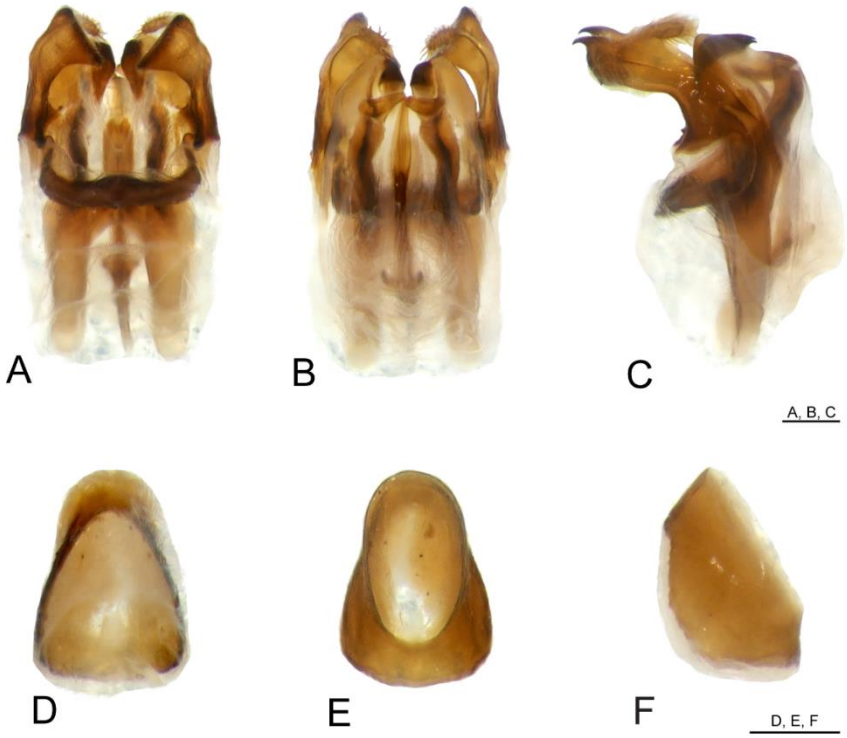


Figure 45. *Eidmanacris gigas* **sp. nov.** Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris neomarmorata **sp. nov.**

(Figs. 46-48)

Type material. Holotype male, allotype, 5 males paratypes and 4 females paratypes (MZSP); 2 males paratypes and 2 females paratypes (UBTU). Labeled: "Gruta Casa de Pedra, Pq. Nacional da Chapada dos Guimarães, Brasil, MT, Chapada dos Guimarães, 15°6'34''S/55°35'51''W, 10-13/xii/2014, L. D. Campos *et al.* col. " Specimens preserved in ethanol 80%.

Type locality. Brazil, Mato Grosso State, Chapada dos Guimarães municipality.

Distribution. Brazil, Mato Grosso State.

Etymology. From latin, *neo* means "new". Named due to the similar coloration with *E. marmorata*.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: antenomeres dark brown interspersed with whitish bands, first band with only one antenomere, other bands increasing in number; apex of pseudepiphallic arm dorsally truncate in lateral view, superior and inferior projections hook shaped, upcurved, supero-internal and inferior projections reduced like spines in dorsal view; PsP2 curved inwards, posterior margin pointed, very sclerotized; dorsal projection of ectophallic invagination well sclerotized, elongate, posterior third thin, posterior margin with small central concavity.

Description.

Head. Light brown, marbled, dorsum pubescent, with dark spots. Occiput centrally light brown, laterally dark brown, with band light brown going from occiput to margin of each eye (Fig. 46C); vertex light brown, with anterior maculae dark. Fastigium dark brown, longer than wide, slightly narrowed at apex, narrower than scape; separated from vertex by transverse line forming "v" (Fig. 46C). In frontal view, frons light brown, with central triangle dark brown, four lateral bands dark brown, two vertical bellow eyes, two diagonal bellow scapes (Fig. 46A). Three ocelli present, well developed, lateral rounded, central flattened at bottom (Figs. 46A, B, C); eyes with unpigmented area on supero-internal angle (Fig. 46C). Maxillary palpi medium to dark brown, long and thin, joints 3, 4 and 5 almost same-sized, apex of joint 5 slightly upcurved, whitish ventrally (Fig. 46G). Gena light brown, dark brown band forming "v" in lateral view (Figs. 46A, B). Frontoclypeal suture yellowish brown, dark brown centrally. Clypeus light brown, with

horizontal, central band dark brown; labrum whitish, lower portion yellowish brown. Mandible light brown, inner margin dark brown. Antennal scape light brown, inner face dark brown (Figs. 46A, B, C); antenomeres dark brown interspersed with whitish bands, first band with only one antenomere, posterior bands increasing in number.

Thorax. Pronotum DD light brown, dark brown, marbled, with dark spots and maculae, wider than long, inflated, divided by light brown sagittal line slender and well discernible; DD cephalic margin slightly concave, caudal margin almost straight. (Fig. 46C); ventro cephalic angle rounded, margin light brown, ventro caudal margin dark brown, gradually ascendant (Fig. 46B).

Legs. FI and II light brown, annulated with dark brown. TI and II light to medium brown, annulated with dark brown; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. FIII light brown, two bands of several stripes dark brown, thin, on outer face, apical third dark brown (Fig. 46F). TIII medium to yellowish brown, annulated with three dark brown bands; subapical spurs 4/4, serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face; inner apical spurs: median one longer (iam), dorsal almost same sized (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oav). Basitarsus I, II and III anteriorly light brown, posteriorly medium brown, pubescent.

Abdomen. Dark brown, marbled, with dark spots and maculae, sub-cylindrical, posterior tergites narrower in dorsal view, divided by thin sagittal line light brown, tergite 7 yellowish (Fig. 46D).

Male. Large-sized body, different shades of brown, marbled, with dark spots and maculae. FWs dark brown, relatively long, triangular, apex connected to single vein that divides external part of FW as lateral field, antero-internal margin yellowish brown, postero-internal margin with glandular thickening (Figs. 46B, C); inner margins touching each other, covering metanotal gland area, posterior margin reaching posterior metanotum border (Fig. 46C). Metanotal gland present, with anteromedian crest triangular, thin line of long bristles on lateral part; lateral projections short, conical, tip rounded; posteriorly with bristles (Figs. 46H, I). Supra anal plate light brown, centrally medium to dark brown, anterior margin sub-straight, posterior margin somewhat concave; antero-lateral borders dark brown, latero-distal projection medium brown, elongate, with long setae (Fig. 46J). Subgenital plate light brown, lateral borders darker, longer than

wide, anterior third wider, anterior margin sub straight, posterior margin almost straight, centrally invaginated (Fig. 46K).

Phallic complex (Figs. 47A-C; 48A-C). Pseudepiphallus: base of pseudepiphallic sclerite narrow at center; pseudepiphallic arm well sclerotized, upcurved, dorsal margin almost forming 90° angle in lateral view, apex dorsally truncate in lateral view; apex of pseudepiphallic arm with bristles on outer face, superior and inferior projection hook shaped, upcurved like *E. marmorata*, although nearest; supero-internal and inferior projections reduced like spine in dorsal view; lateral projection short, pointed in lateral view, posterior margin almost forming 90° angle; anterior projection of pseudepiphallic sclerite elongate, anteriorly pointed, surpassing median part of pseudepiphallus in lateral view; PsP2 elongate, not surpassing posterior extremity of pseudepiphallic arms, curved inwards, posterior margin pointed, very sclerotized, with membranous sphere on inner concavity, laterally articulated with sclerite A; sclerite A straight, connected with base of pseudepiphallic arms; PsP1 sclerotized inwards, short, wider than long in dorsal view, upcurved in ventral view. Ectophallic invagination: ectophallic apodeme long, dorso-ventrally flattened in lateral view; ectophallic arc short, located anteriorly to base of pseudepiphallic sclerite in dorsal and ventral views: dorsal projection well sclerotized, fused, elongate, not surpassing PsP2 in dorsal view, posterior margin with small central concavity; ventro-posterior projection elongate, sclerotized, posteriorly curved inwards. Endophallus: medio-posterior projection of pseudepiphallic sclerite elongate, not reaching PsP2 apex; latero-posterior lobes of endophallic sclerite elongate; endophallic apodeme long, upcurved in lateral view, limits not reaching ectophallic apodeme anterior margin.

Female. Larger than male, general coloration similar (Fig. 46E). Supra anal plate light brown, posterior and lateral margins dark brown, two posteriorly bands dark brown, diagonal, posterior margin somewhat rounded with long bristles (Fig. 46L). Subgenital plate medium brown, getting lighter on central part, posterior margin concave, central concavity rounded (Fig. 46M). Ovipositor as in figs. 46N and 46O.

Copulatory papilla (Figs 48D, E, F). Cylindrical, somewhat longer than wide, anterior half wider than posterior in dorsal and ventral views, anterior and posterior margins concave.

Measurements (mm).

Male (n=8): Hw, 3.47 ± 0.19 (3.1-3.72); iod, 1.48 ± 0.07 (1.36-1.55); Lpron, 3.76 ± 0.25 (3.28-4.03); awpron, 3.44 ± 0.17 (3.1-3.65); pwpron, 4.05 ± 0.2 (3.72-4.34); wpron, 4.91 ± 0.28 (4.34-5.27); LFW, 3.31 ± 0.2 (3.1-3.59); wFW, 1.93 ± 0.17 (1.67-2.17); LFIII, 17.04 ± 1 (15-18.15); wFIII, 3.37 ± 0.19 (3.15-3.6); LTIII, 17.92 ± 1.07 (15.45-19.05); Ltars1-III, 4.91 ± 0.33 (4.2-5.25).

Female (n=7): Hw, 3.69 ± 0.12 (3.47-3.84); iod, 1.57 ± 0.06 (1.48-1.67); Lpron, 3.93 ± 0.17 (3.72-4.21); awpron, 3.54 ± 0.14 (3.34-3.72); pwpron, 4.51 ± 0.23 (4.27-4.89); wpron, 5.14 ± 0.18 (4.89-5.33); LFIII, 18.32 ± 0.64 (17.7– 19.65); wFIII, 3.81 ± 0.14 (3.6-4.05); LTIII, 18.79 ± 0.59 (18.15–19.8); Ltars1-III, 4.91 ± 0.21 (4.5–5.1); OL, 10.82 ± 0.32 (10.5–11.25).

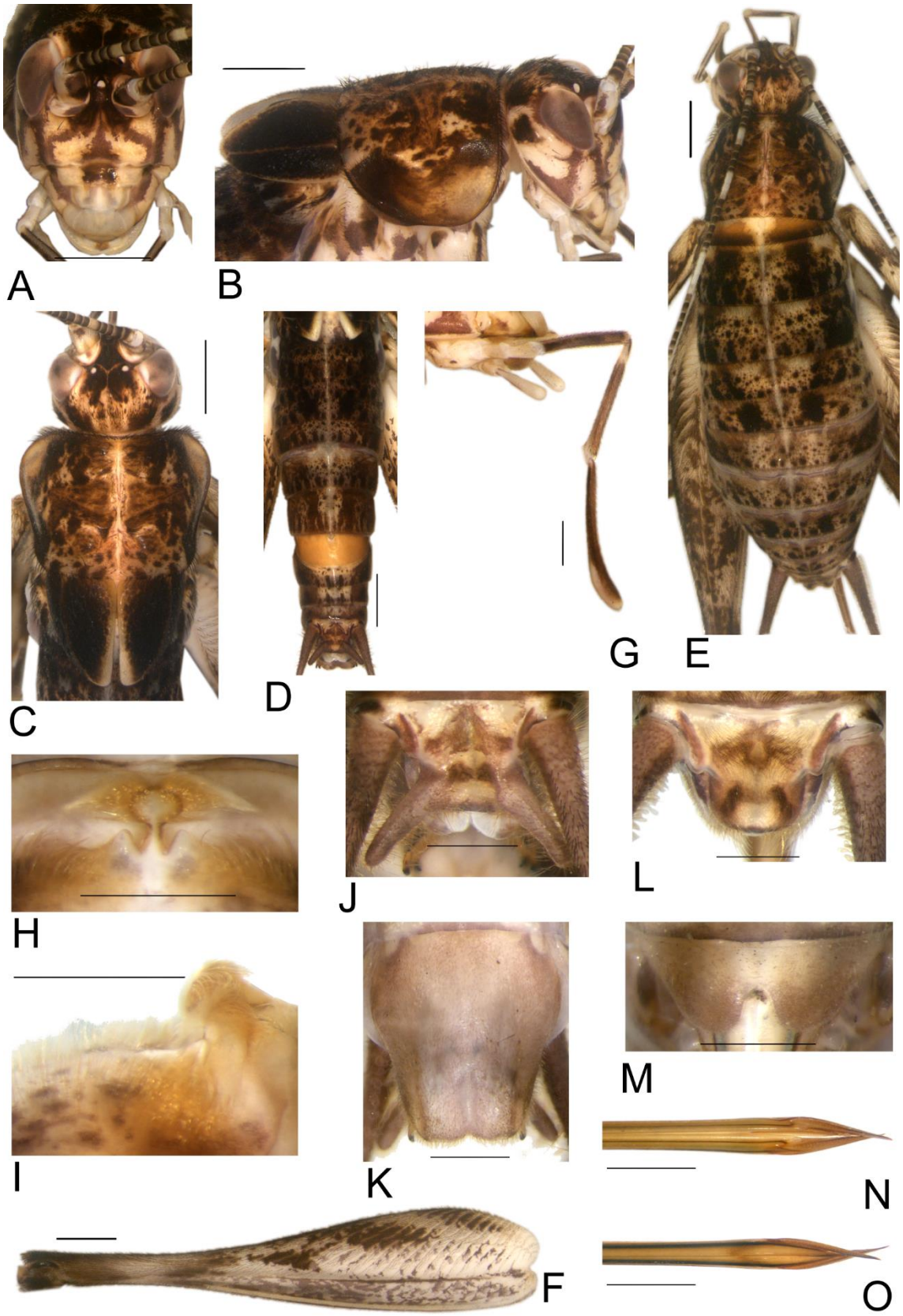


Figure 46. *Eidmanacris neomarmorata* **sp. nov.** Paratypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

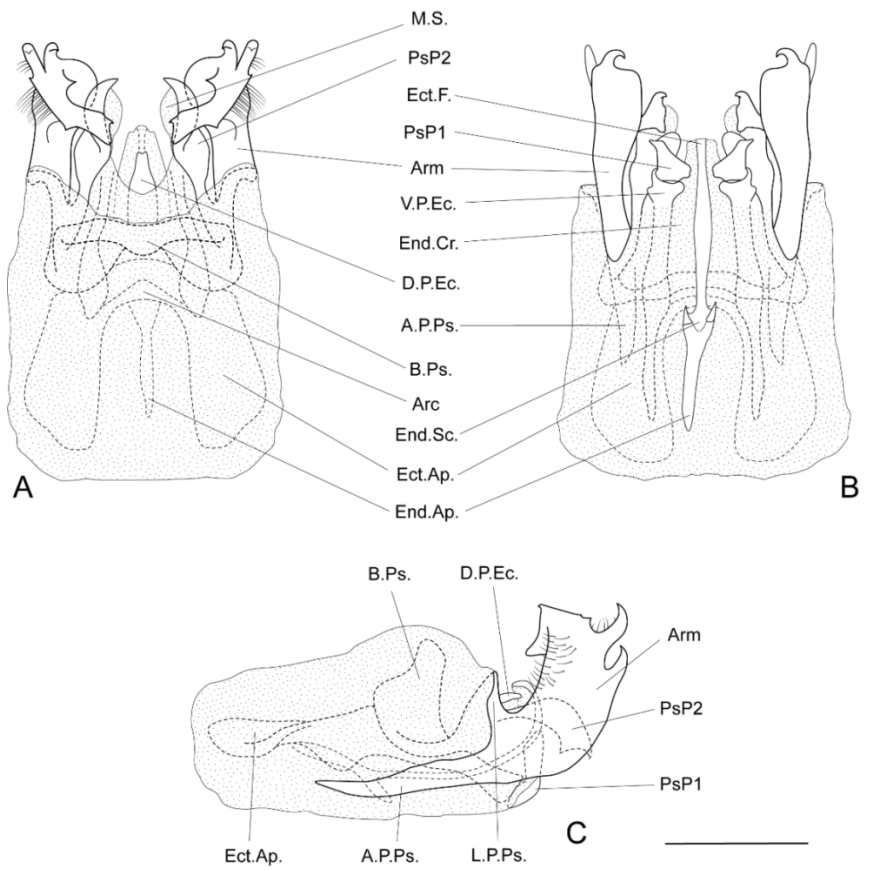


Figure 47. *Eidmanacris neomarmorata* **sp. nov.** Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

Figure 48. *Eidmanacris neomarmorata* **sp. nov.** Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris desutterae **sp. nov.**

(Figs. 49-51)

Type material. Holotype male, allotype and 6 females paratypes (MZSP) labeled: "UEMS, Campus Experimental, Brasil, MS, Aquidauana, 20°27'20''S/55°38'26''W, 14/xii/2014, L. D. Campos *et al*., col.". Specimens preserved in ethanol 80%.

Type locality. Brazil, Mato Grosso do Sul State, Aquidauana municipality.

Distribution. Brazil, Mato Grosso do Sul State.

Etymology. Named after the French orthopterist, Dr. Laure Desutter-Grandcolas.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: metanotal gland with lateral projections inflated, fused medially; supra anal plate antero-lateral borders reddish; apex of pseudepiphallic arm with superior projection, posterior margin convex with line of bristles dorsally, invagination in the central part forming a inferior projection hook-shaped, upcurved; in dorsal view, inner border with internal projection reduced like a spine; in ventral view, ventral projection short; PsP2 inflated, anteriorly convoluted, ventrally pointed.

Description.

Head. Light and dark brown, dorsum pubescent. Occiput dark brown, with a light brown band going from occiput to margin of each eye; vertex dark to medium brown, with three light brown lines, vertical, crossed by two horizontal lines in dorsal view. Fastigium dark brown, longer than wide, slightly narrowed toward the apex, narrower than scape, with two rows of bristles, separated from vertex by thick transverse line forming "v" (Fig. 49C). Frons light brown, with diagonal band dark brown bellow eye; centrally two inverted dark brown triangles, one bellow other, dorsal larger (Fig. 49A). Three ocelli present, well developed, lateral elliptical, central flattened at bottom (Figs. 49A, B, C). Eyes with unpigmented area on supero-internal angle (Fig. 49C). Maxillary palpi joints 1 and 2 whitish, joints 3 to 5 medium brown, long, joint 5 the longest, apex lighter, upcurved (Fig. 49G). Gena light brown, with a band medium brown forming "v" in lateral view (Fig. 49B). Frontoclypeal suture dark yellow. Clypeus whitish with two vertical bands dark brown, central; labrum whitish, lower portion yellowish brown (Fig. 49A). Mandible light brown, inner margin dark brown. Antennal scape light brown, inner face dark brown with row of bristles (Figs. 49A, B, C); antenomeres dark brown with

white bands of two antenomeres and increasing in number until antennae end, one antenomere white separating them.

Thorax. Pronotum DD dark brown, posterior border lighter, wider than long, inflated, divided by thin vertical line medium brown; DD cephalic margin slightly concave, caudal margin almost straight (Fig. 49C); ventro-cephalic angle lighter, rounded, ventro-caudal margin gradually ascendant (Fig. 49B).

Legs. FI and II light brown, annulated with dark brown. TI and II medium brown, annulated with dark brown; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. Basitarsus I and II first half light brown, apical half dark brown. FIII light brown, two dorsal bands of several medium brown thin stripes on outer face, apical third dark brown (Fig. 49F). TIII anterior face dark yellow, posterior face medium brown; subapical spurs 4/4, serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face; inner apical spurs: median one longer (iam), dorsal somewhat shorter (iam), ventral smaller (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oav). Basitarsus I, II and III anteriorly light yellow, posteriorly medium brown.

Abdomen. Dark brown, marbled and punctuated, slightly pubescent, sub-cylindrical, divided by sagittal line light brown, tergite II with two dark maculae (Fig. 49D).

Male. Large-sized body, general coloration dark brown, marbled. FWs dark brown, relatively long, triangular, apex connected to single vertical vein that divides external part of FW as lateral field, glandular thickening absent, margins medium brown (Figs. 49B, C); inner margins touching each other, covering metanotal gland, surpassing metanotum posterior border (Fig. 49C). Metanotal gland present, with anteromedian crest triangular, reduced, line of bristles pointing posteriorly touching lateral projections; lateral projections yellowish, anterior portion whitish, inflated, upcurved, inner margins touching each other (Figs. 49H, I). Supra anal plate light brown, antero-lateral borders reddish, anterior margin slightly concave, posterior margin sub-straight, latero-distal projection greyish, elongate, long bristles on posterior border (Fig. 49J). Subgenital plate longer than wide, light brown, posterior margin dark brown; anterior margin sub straight, posterior margin concave with central invagination rounded in ventral view (Fig. 49K).

Phallic complex (Figs. 50A-C; 51A-C). Pseudepiphallus: base of pseudepiphallic sclerite centrally thin; pseudepiphallic arms sclerotized, hard, upcurved almost forming

90° angle; apex of pseudepiphallic arm with bristles on outer face; in lateral view, dorsal margin sub-straight, with superior projection, posterior margin convex with line of bristles dorsally, invagination in the central part forming inferior projection hook-shaped, upcurved; in dorsal view, inner border with supero-internal projection reduced like a spine; in ventral view, ventral projections short (like *E. corumbatai*, but regressed), curved inwards, apex rounded with hard bristles; lateral projection somewhat long, tip pointed; anterior projection of pseudepiphallic sclerite short, anteriorly rounded, not surpassing base of pseudepiphallic sclerite in lateral and ventral view; PsP2 elongate, sclerotized, inflated, anteriorly convoluted, ventrally pointed in lateral view, with membranous sphere on concavity, not surpassing posterior extremity of pseudepiphallic arms; sclerite A straight, inclined inwards, flattened, visible articulation with PsP2; PsP1 well sclerotized, in lateral view: elongate, upcurved. Ectophallic invagination: ectophallic apodeme somewhat long, robust; ectophallic arc short located anteriorly to base of pseudepiphallic sclerite; dorsal projections elongate, fused, posterior margin concave, not surpassing PsP2 in dorsal view; ventro-posterior projections elongate, posterior third curved inwards. Endophallus: medio-posterior projection of endophallic sclerite elongate, not surpassing PsP2 apex; latero-posterior lobes of endophallic sclerite long; endophallic apodeme well-developed not surpassing ectophallic apodeme.

Female. Larger than male, general coloration dark brown, marbled (Fig. 49E). Supra anal plate yellowish brown, latero-anterior margins reddish, central portion darker and pilose, posterior margin medium to dark brown, somewhat rounded with long bristles (Fig. 49L). Subgenital plate medium brown, centrally lighter, posterior margin rounded with central concavity (Fig. 49M). Ovipositor as in figs. 49N and 49O.

Copulatory papilla (Figs 51D-F). Cylindrical, wider than long, anterior half wider than posterior, anterior margin almost straight in ventral view, posterior margin somewhat concave, border unpigmented in dorsal view.

Measurements (mm).

Male (n=1): Hw, 2.66; iod, 1.36; Lpron, 3.28; awpron, 3.22; pwpron, 3.97; wpron, 4.59; LFW, 2.73; wFW, 1.86; LFIII, 14.85; wFIII, 3.15; LTIII, 15.6; Ltars1-III, 3.9.

Female (n=7): Hw, 3.68 ± 0.15 (3.53–3.84); iod, 1.64 ± 0.09 (1.48–1.73); Lpron, 3.9 ± 0.22 (3.65–4.21); awpron, 3.74 ± 0.22 (3.47–4.03); pwpron, 4.58 ± 0.23 (4.27–4.89); wpron, 5.5 ± 0.22 (5.14–5.76); LFIII, 18.17 ± 0.6 (17.4–19.2) ; wFIII, 4.18 ± 0.16 (3.9–4.35); LTIII, 18.79 ± 0.64 (18–20.1); Ltars1-III, 4.97 ± 0.29 (4.65–5.4); OL, 14.23 ± 0.31 (13.95–14.85).

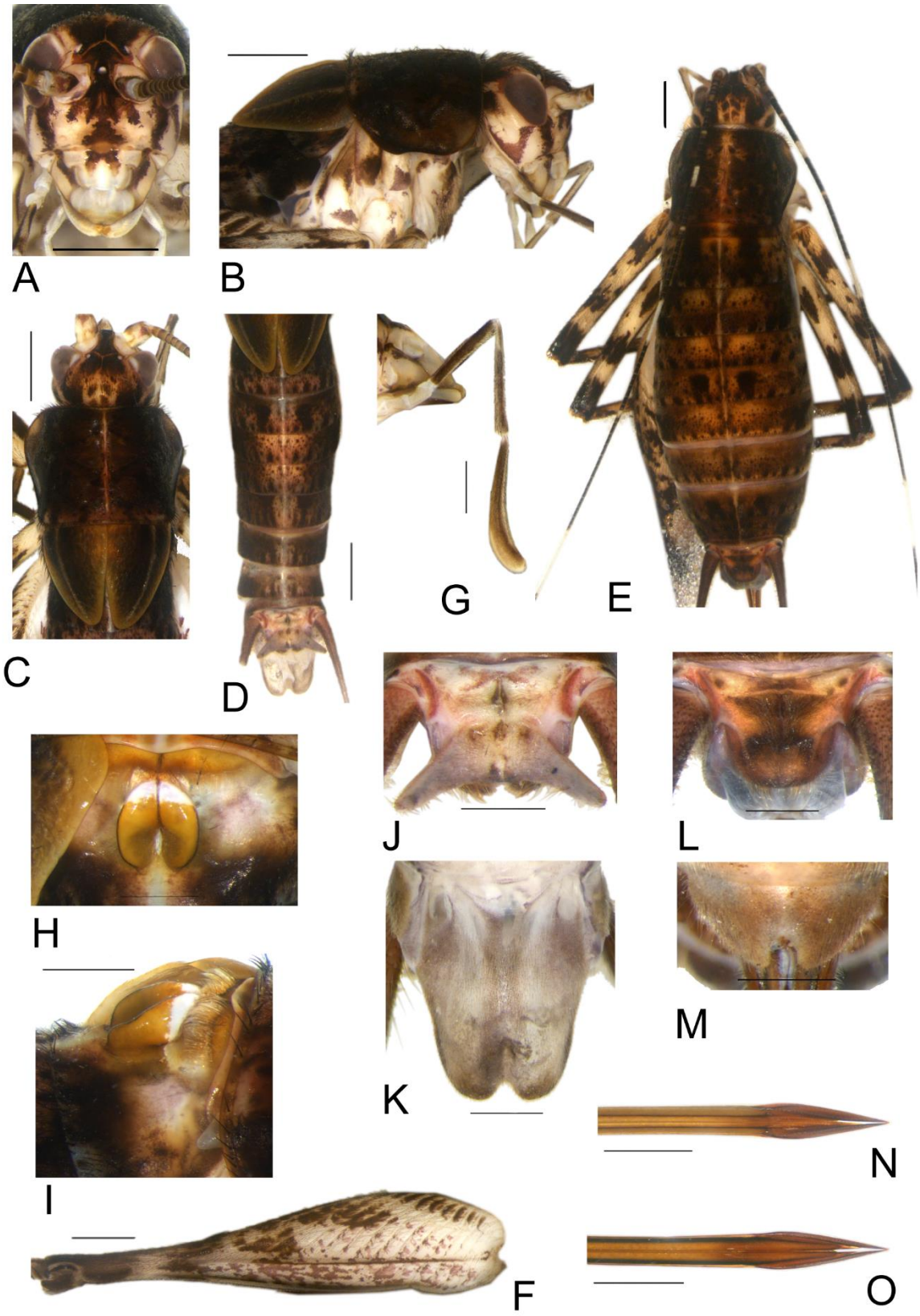


Figure 49. *Eidmanacris desutterae* **sp. nov.** Holotype male and allotype. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

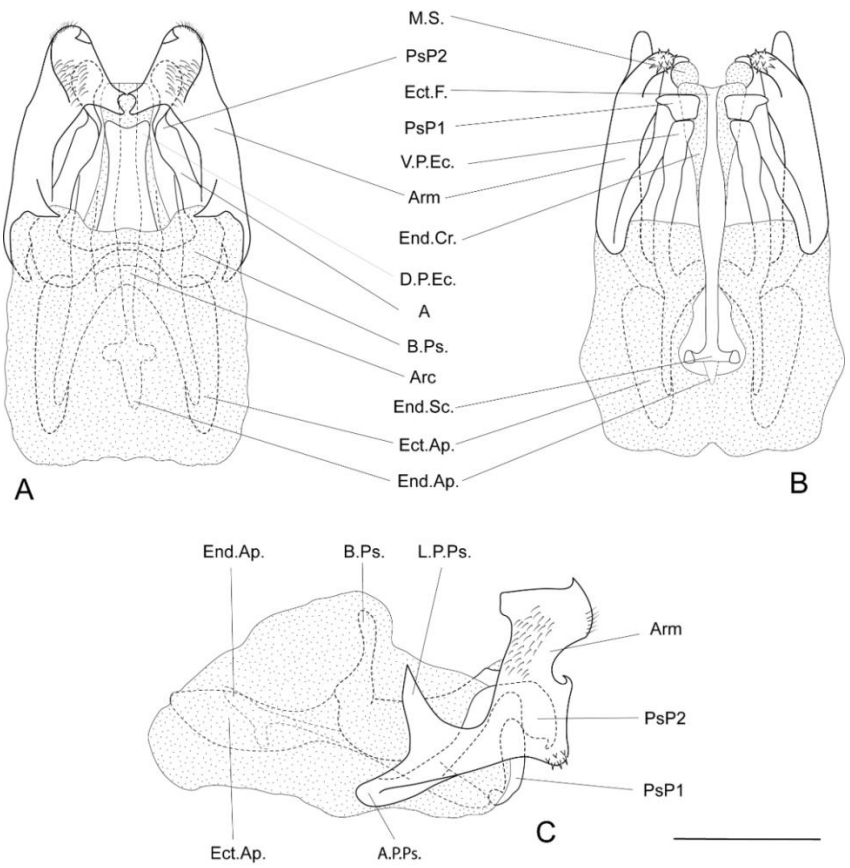


Figure 50. *Eidmanacris desutterae* **sp. nov.** Holotype male. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

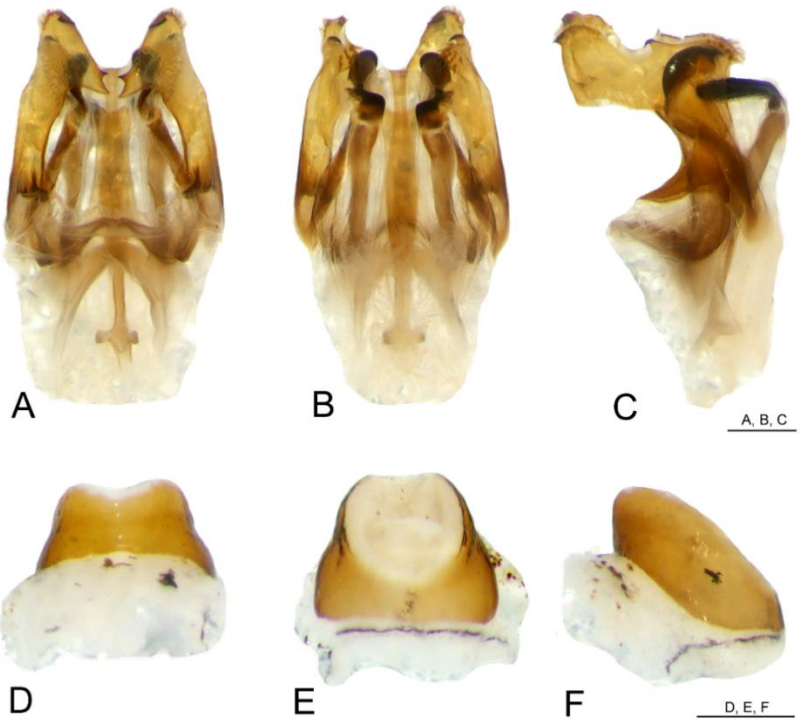


Figure 51. *Eidmanacris desutterae* **sp. nov.** Holotype male and allotype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris putuhra **sp. nov.**

(Figs. 52-54)

Type material. Holotype male, allotype, 4 males paratypes and 6 females paratypes (MZSP); 2 males paratypes and 2 females paratypes (UBTU). Holotype male, allotype, 2 males paratypes and 2 females paratypes labeled: "BRASIL (M.G.) - Mun. Viçosa - Jardim Botânico da UFV- 4.II.97- C. F. Sperber. BRASIL (MG), Viçosa, Fragmento: BIO, Data: 09/iii/2000, Sperber *leg*., Código: #5282". 4 males paratypes and 6 females paratypes labeled: "BRASIL (MG), Viçosa, Fragmento: BIO #6154, Data: 16/iii/2002, Coleta Noturna: C/Aveia, Mendes, M. H. & Rocha A. BRASIL (MG), Viçosa, Fragmento: MBIO, Data: 10/i/2002, Sperber *leg*., Código: Trilha #6031". Specimens preserved in ethanol 80%.

Type locality. Brazil, Minas Gerais State, Viçosa municipality.

Distribution. Brazil, Minas Gerais State.

Etymology. This species was formerly described and named by Dr. Carina Mews in her Master's dissertation, but not published (Mews, 2006). From the language of Brazilian indigenous tribe Puri, *putuhra* means "yellow", referring to the outer coloration of FIII.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: antennae with bands composed of four whitish antenomeres, the following bands increasing in number, interspersed by one whitish antenomere; pseudepiphallic arm slightly curved outwards, apex curved inwards in dorsal and ventral views; anterior projection of pseudepiphallic sclerite curved inwards in dorsal view; PsP2 distal portion convex outside, concave inside, forming posterior spine curved inwards; ectophallic apodeme laterally flattened; endophallic apodeme short; copulatory papilla cylindrical, down curved, more sclerotized ventrally.

Description.

Head. Dorsum pubescent, different shades of brown. Occiput reddish brown, with light brown band going from occiput to margin of each eye (Fig. 52C); vertex reddish brown, with three lines light brown, vertical, well discernible. Fastigium reddish brown, longer than wide, with two rows of bristles, slightly narrowed at apex, narrower than scape; separated from vertex by transverse line forming "v" (Fig. 52C). Frons light brown, two vertical bands dark brown bellow eyes, extending to mandibles, one central, lighter

band (Fig. 52A). Three ocelli present, well developed, rounded (Figs. 52A, B, C); eyes with unpigmented small area on supero-internal angle (Fig. 52C). Maxillary palpi joints 3 and 4 medium to dark brown, joint 5 light to medium brown, long, thin; joints 4 and 5 almost same-sized, apex of joint 5 whitish, slightly upcurved (Fig. 52G). Gena light brown (Figs. 52A, B); frontoclypeal suture medium to dark brown, centrally dark. Clypeus whitish, with two vertical median stripes light brown; labrum whitish, lower portion light brown. Mandible dark brown, posterior margins light brown. Antennal scape light brown, inner face darker (Figs. 52A, B, C); antennae with bands composed of four whitish antenomeres, the following bands increasing in number, interspersed by one whitish antenomere.

Thorax. Pronotum DD reddish brown, wider than long, inflated, divided by vertical line light yellow almost no discernible, and four lateral lines, in dorsal view; cephalic margin slightly concave, caudal margin almost straight (Fig. 52C); ventro cephalic angle rounded, margin light brown, ventro caudal margin darker, gradually ascendant (Fig. 52B).

Legs. FI and II yellowish, annulated with medium brown. TI and II light yellow, annulated with dark brown; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. FIII yellowish brown, dorsally reddish brown, several thin stripes reddish brown on outer face, apical third reddish brown (Fig. 52F). TIII medium to dark brown, lighter at apical third; subapical spurs 4/4, serrulation above and between subapical spurs; apical spurs 3/3, more developed on inner face; inner apical spurs: median one longer (iam), dorsal shorter (iad), ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oav). Basitarsus I, II and III yellowish.

Abdomen. Medium brown, marbled, sub-cylindrical, with several dark spots and dark vertical lines, divided by light brown thin, sagittal line almost no discernible (Fig. 52D).

Male. Small to medium-sized body, general coloration reddish brown, marbled, with dark spots and maculae. FWs medium to dark brown, rounded, reticulated, apex connected to single vein that divide the external part of FW as lateral field, inner and posterior margins light brown, posterior margin without glandular thickening (Figs. 52B, C); inner margins not touching each other, covering metanotal gland area, posterior margin not surpassing posterior metanotum border (Fig. 52C). Metanotal gland present, with anteromedian crest triangular, apex elliptical, line of bristles anteriorly; lateral

projections short, cylindrical, top rounded, close each other; (Figs. 52H, I). Supra anal plate light to medium brown, posterior margin dark brown; anterior margin slightly concave, posterior margin somewhat concave; latero-distal projection elongate, lighter (Fig. 52J). Subgenital plate light brown, lateral and posterior borders darker, longer than wide, anterior margin sub-straight, posterior margin somewhat convex forming "v" centrally (Fig. 52K).

Phallic complex (Figs. 53A-C; 54A-C). Pseudepiphallus: base of pseudepiphallic sclerite weakly sclerotized, dorso-ventrally flattened, centrally narrow, with central concavity posteriorly; pseudepiphallic arm sclerotized, narrow, upcurved, slightly curved outwards, apex curved inwards in dorsal and ventral views, with dorsal line of bristles on dorsal face; apex of pseudepiphallic arm bifid, forming superior and internal projections, pointing posteriorly; inferior projection present, apex pointed in ventral view; anterior projection of pseudepiphallic sclerite elongate, thin, curved inwards in dorsal and ventral views, surpassing median part of pseudepiphallus; PsP2 well sclerotized, elongate, not surpassing posterior extremity of pseudepiphallic arms, distal portion convex outside, concave inside, forming posterior spine curved inwards, with membranous sphere on concavity; PsP1 longer than wide, thin, well sclerotized, posteriorly pointed in ventral view. Ectophallic invagination: Ectophallic apodeme elongate, upcurved, laterally flattened; ectophallic arc short, located posteriorly to base of pseudepiphallic sclerite; dorsal projections well sclerotized, elongate, apex pointed, curved inwards, posterior margin concave almost forming "v", not surpassing PsP2 posteriorly in dorsal view; ventro-posterior projection less sclerotized, not so elongate. Endophallus: medio-posterior projection of pseudepiphallic sclerite elongated, surpassing pseudepiphallic arms apex; latero-posterior lobes of the endophallic sclerite very short; endophallic apodeme relatively short, its limits not surpassing ectophallic apodeme anterior margin.

Female. Larger than male, general coloration medium brown, marmored (Fig. 52E). Supra anal plate yellowish brown, posterior margin dark brown, posterior margin rounded with long bristles (Fig. 52L). Subgenital plate light brown, marbled, posterior margin slightly convex, (Fig. 52M). Ovipositor as in figs. 52N and 52O.

Copulatory papilla (Figs 54D-F). Cylindrical, longer than wide, down-curved, more sclerotized ventrally, anterior third little wider in dorsal and ventral views, posterior margin rounded.

Measurements (mm).

Male (n=4): Hw, 2.34 ± 0.14 (2.23-2.54); iod, 1.25 ± 0.06 (1.17-1.3); Lpron, 2.4 ± 0.09 (2.35-2.54); awpron, 2.37 ± 0.14 (2.23-2.54); pwpron, 2.76 ± 0.13 (2.6-2.91); wpron, 3.25 ± 0.06 (3.22-3.34); LFW, 1.55 ± 0.11 (1.42-1.67); wFW, 1.58 ± 0.16 (1.36-1.73); LFIII, 12.3 ± 0.5 (11.7-12.9); wFIII, 2.58 ± 0.07 (2.55-2.7); LTIII, 13.42 ± 0.92 (12.3-14.55); Ltars1-III, 3.25 ± 0.24 (3.25-4.05).

Female (n=6): Hw, 2.73 ± 0.12 (2.6-2.91); iod, 1.37 ± 0.07 (1. 3-1.48); Lpron, 2.75 ± 0.07 (2.66-2.85); awpron, 2.55 ± 0.05 (2.48-2.6); pwpron, 3.31 ± 0.12 (3.16-3.47); wpron, 3.72 ± 0.18 (3.53-3.96); LFIII, 14.37 ± 0.9 (13.35–15.75); wFIII, 2.97 ± 0.16 (2.7-3.15); LTIII, 15.09 ± 0.93 (14.4–16.65); Ltars1-III, 4.08 ± 0.16 (3.9–4.2); OL, 15.36 ± 0.5 (14.55–15.9).

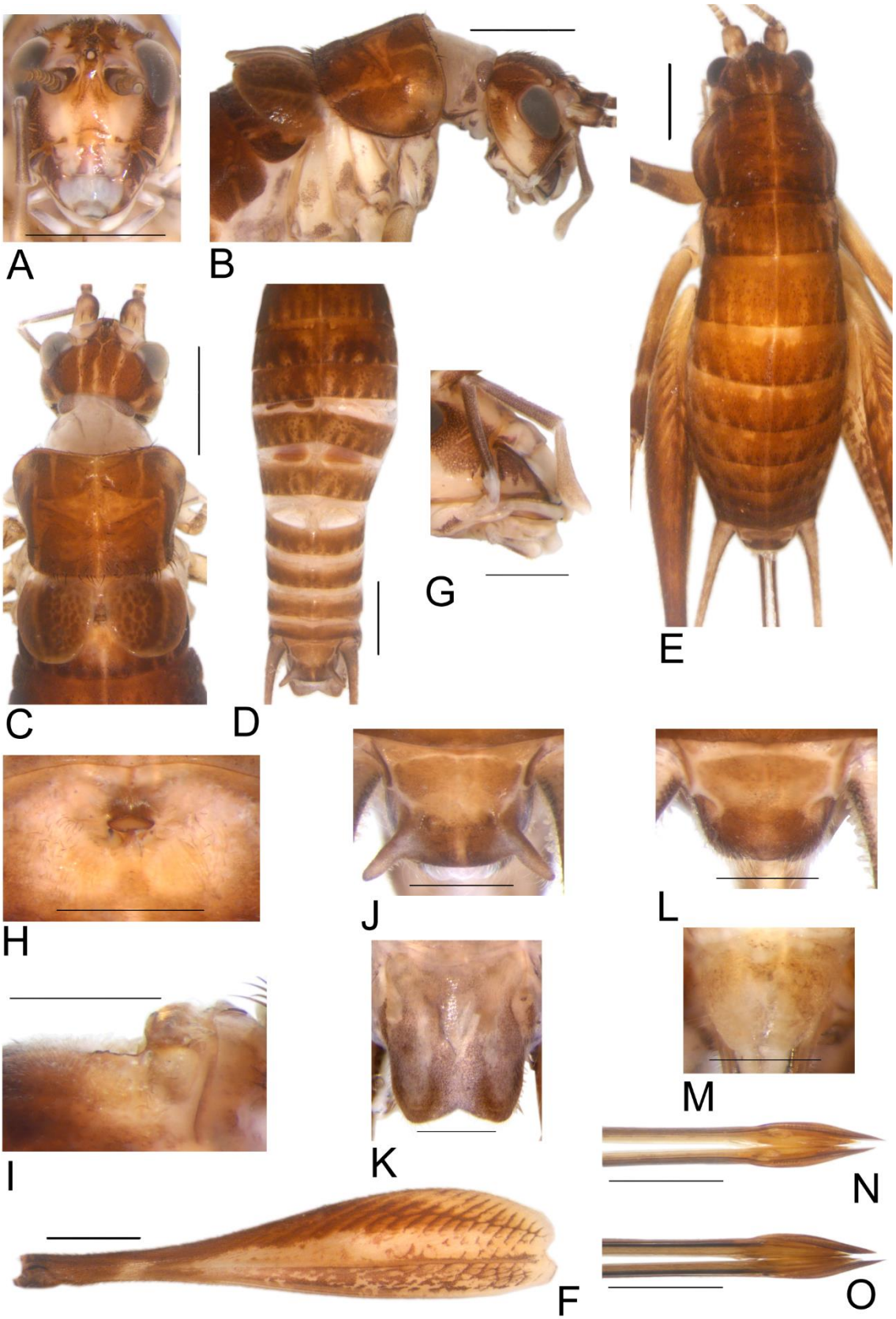


Figure 52. *Eidmanacris putuhra* **sp. nov.** Paratypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

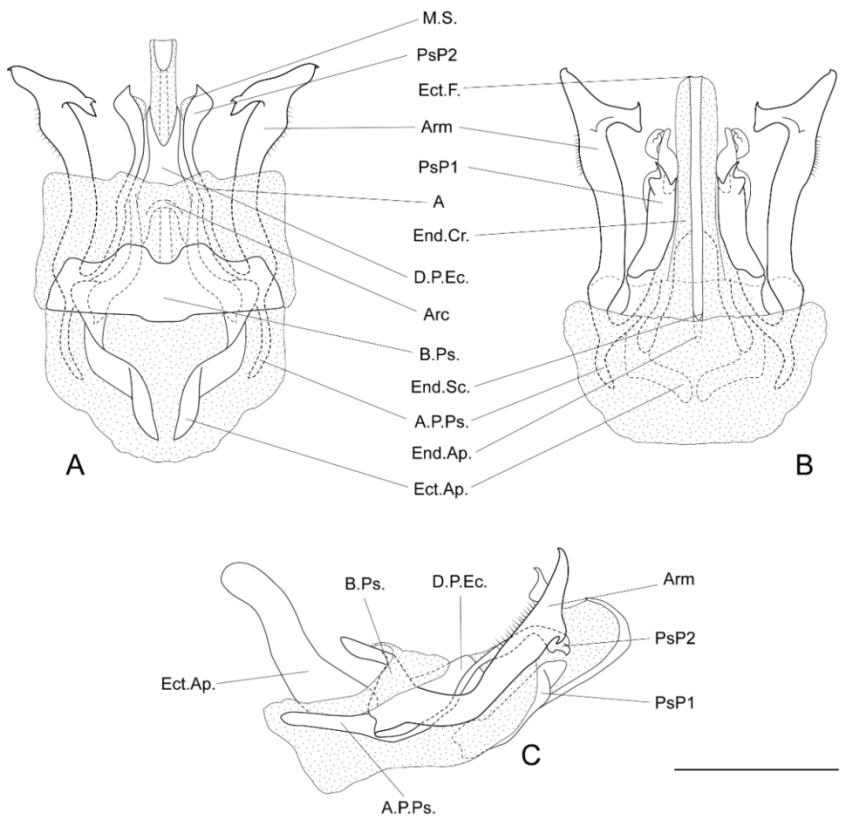


Figure 53. *Eidmanacris putuhra* **sp. nov.** Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

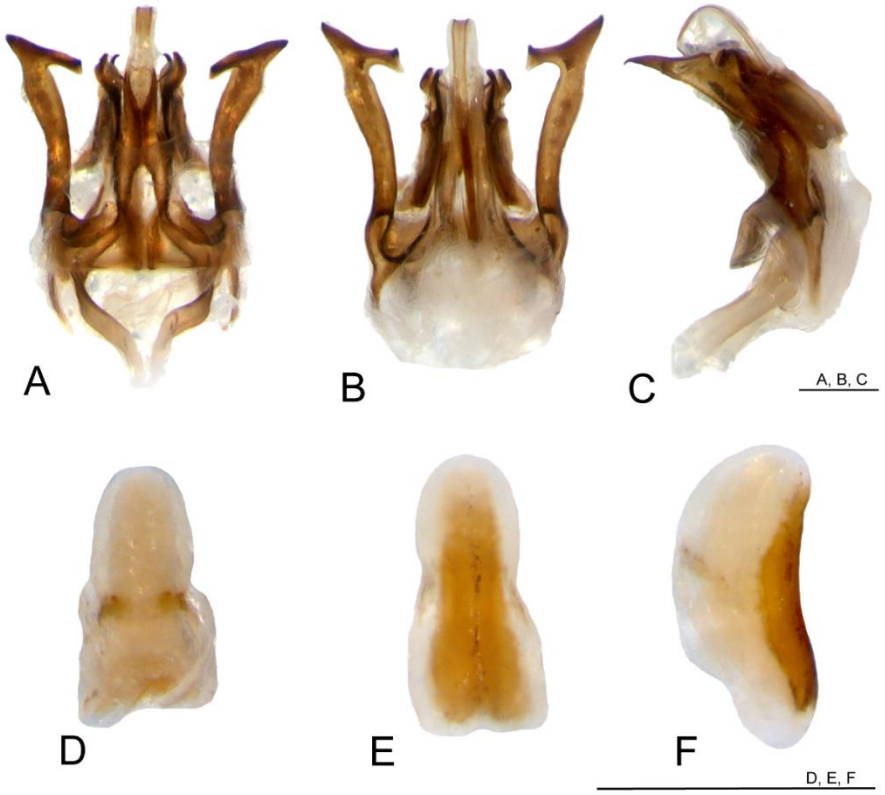


Figure 54. *Eidmanacris putuhra* **sp. nov.** Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris fontanettiae **sp. nov.**

(Figs. 55-57)

Type material. Holotype male, allotype, 6 males paratypes and 1 female paratype (MZSP); 1 male paratype (UBTU). Holotype male, allotype, 6 males paratypes and 1 female paratype, labeled: "Brasil, Espírito Santo, Cariacica, Reserva Biológica de Duas Bocas, vii-2012, F. A. G. Mello *leg*". 1 male paratype, labeled: "Brasil, Espírito Santo, Santa Teresa, Reserva Santa Júlia, vii-1989, F. A. G. Mello *leg*" Specimens preserved in ethanol 80%.

Type locality. Brazil, Espírito Santo State, Cariacica municipality.

Distribution: Brazil, Espírito Santo State.

Etymology. Named after Dr. Carmem Silvia Fontanetti, for her contributions on morphology and cytogenetics of crickets. This species was formerly described by Dr. Silvio Shigueo Nihei in his undergraduate studies, but not published (Nihei, 1997).

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: small-sized body in relation to other species; antenomeres dark brow with bands composed of whitish ones, *c.a*. 18-20; inner margin of male FWs light brown; pseudepiphallic arms slightly sinuous in dorsal view; PsP2 apex pointed in lateral view, curved inwards in dorsal view, apparently without membranous sphere ; endophallic apodeme short; copulatory papilla little longer than wide, dorso-ventrally flattened in lateral view, posterior margin slightly concave, unpigmented in dorsal view.

Description.

Head. Pale yellow to light brown. Occiput medium brown with maculae light brown, band light brown going from occiput to margin of each eye; vertex light to medium brown with three vertical lines, lateral little conspicuous in dorsal view (Fig. 55C). Fastigium medium to dark brown, with two rows of bristles, slightly longer than wide, slightly narrowed toward the apex, separated from vertex by straight line forming "v" (Fig. 55C). Frons medium brown, with three bands dark brown, vertical, two bellow eye and antennal scape, one above clypeus (Figs. 55A, B). Three ocelli present, well developed, forming isosceles triangle, central flattened at bottom, lateral elliptical (Figs. 55A, B, C). Eyes with unpigmented small area on supero-internal angle (Fig. 55C). Maxillary palpi, long, thin, pilose, medium brown, distal portion of joints whitish; joints 3 and 4 almost same-sized (Fig. 55G); apex of joint 5 upcurved. Gena light brown,

posterior medium brown stripe from occiput to mandible in lateral view (Fig. 55B). Frontoclypeal suture yellowish, clypeus light brown, lateral dark; labrum whitish, lower part pale yellow. Mandible light brown, inner margin dark brown. Antennal scape light brown, dark brown on inner face (Fig. 55A); antenomeres dark brow with bands composed of whitish ones, *c.a.* 18-20.

Thorax. Pronotum DD wider than long, medium to dark brown, with sparse dark spots and maculae, slightly pubescent, inflated, divided by light brown to pale yellow sagittal line (Fig. 55C); DD cephalic margin slightly concave, caudal margin sub-straight (Fig. 55C); ventro-cephalic angle rounded, ventro-caudal margin gradually ascendant (Fig. 55B).

Legs. FI and II dark yellow, annulated with dark brown. TI and II dark yellow, annulated with medium brown; TI with two same-sized apical spurs; TII with two inner apical spurs, one outer, smaller. FIII pale yellow, with thin stripes medium brown on outer face, dorsal face and apical third medium brown (Fig. 55F). TIII medium brown, apical third pale yellow; subapical spurs 4/4, with serrulation above and between subapical spurs, except between two distal ones; apical spurs 3/3, more developed on inner face: dorsal (iad) and median one(iam) sub-equals, ventral smallest (iav) (iam>iad>iav); outer apical spurs: median one longer (oam), dorsal sub-equal in length (oad), ventral smaller (oav) (oam>oad>oav). Basitarsus I, II and III yellowish.

Abdomen. Sub-cylindrical, medium to dark brown, marbled, pubescent, divided by thin pale yellow sagittal line.

Male. Small-sized body in relation other species of genus, general coloration medium brow, marbled. FWs dark brown, short, sub-triangular; posterior part of inner margin and apex whitish connected to single vein that divides outer part of FW as lateral field, glandular thickening present distally, but reduced (Fig. 55C); inner margin light brown, inner margins not touching each other; not covering the metanotal gland centrally and not surpassing metanotum posterior border (Fig. 55B, C). Metanotal gland present, anteromedian crest forming an inverted triangle with cluster of bristles; lateral projections short and cylindrical, parallel (Figs. 55H, I). Supra anal plate dark brown, pubescent; anterior margin slightly concave, lateral margins curved inwards, latero-posterior projections very short, medium brown; posterior margin sub-straight (Fig. 55J). Subgenital plate longer than wide, with lateral pubescence, laterally dark brown, centrally

medium to light brown; anterior margin almost straight, posterior margin rounded with small invagination centrally (Fig. 55K).

Phallic complex (Figs. 56A-C; 57A-C). Pseudepiphallus: central portion of base of pseudepiphallic sclerite narrow in dorsal view; pseudepiphallic arms sclerotized, hard, slightly sinuous in dorsal view, upcurved in lateral view; apex of pseudepiphallic arm with bristles, folding itself to dorsal and forming a superior projection; internal projection present, apex rounded; PsP2 hardly sclerotized, surpassing posterior extremity of pseudepiphallic arms, apex pointed in lateral view, curved inwards in dorsal view, membranous sphere apparently absent; sclerite A sinuous, very thin, articulated with PsP2; PsP1 elongate, well sclerotized, rounded at apex, curved inwards. Ectophallic invagination: ectophallic apodeme short, relatively enlarged at anterior third in dorsal view; ectophallic arc located posteriorly to the base of pseudepiphallic sclerite in dorsal view; ventro-posterior projection elongate; dorsal projection sclerotized, apex pointed. Endophallus: medio-posterior projection of pseudepiphallic sclerite elongate, not surpassing PsP2 apex; latero-posterior lobes of the endophallic sclerite elongate; endophallic apodeme not so elongate, not reaching the middle part of pseudepiphallus.

Female. Larger than male, general coloration similar (Fig. 55E). Supra anal plate anteriorly medium brown, posteriorly dark brown, anterior margin slightly concave, posterior margin rounded with relatively long bristles (Fig. 55L). Subgenital plate medium brown, marbled, wider than long, anterior margin slightly concave, posterior margin with central concavity (Fig. 55M). Ovipositor as in figs. 55N, O.

Copulatory papilla (Figs. 57D-F). Little longer than wide, dorso-ventrally flattened in lateral view, anterior margin membranous, posterior margin slightly concave in dorsal view, unpigmented.

Measurements (mm).

Male (n=7): Hw, 2.64 ± 0.18 (2.41-2.85); iod, 1.39 ± 0.11 (1.3-1.55); Lpron, 2.96 ± 0.29 (2.6-3.34); awpron, 2.79 ± 0.25 (2.48-3.16); pwpron, 3 ± 0.17 (2.85-3.22); wpron, 3.82 ± 0.28 (3.41-4.15); LFW, 0.81 ± 0.18 (0.62-1.11); wFW, 1.05 ± 0.07 (0.99-1.17); LFIII, 11.8 ± 0.58 (10.95-12.45); wFIII, 2.56 ± 0.17 (2.4-2.85); LTIII, 12.26 ± 0.97 (11.1-13.65); Ltars1-III, 3.43 ± 0.18 (3.3-3.75).

Female (n=2): Hw, 2.85; iod, 1.36 ± 0.08 (1.3-1.42); Lpron, 2.82 ± 0.13 (2.72-2.91); awpron, 2.69 ± 0.04 (2.66-2.72); pwpron, 3.04 ± 0.17 (2.91-3.16); wpron, 3.72 ± 0.18 (3.53-3.96); LFIII, 11.85 ± 0.42 (11.55–12.15); wFIII, 2.85; LTIII, 12.15 ± 0.21 (12–12.3); Ltars1-III, 3.15; OL, 10.45 ± 0.11 (10.35–10.5).

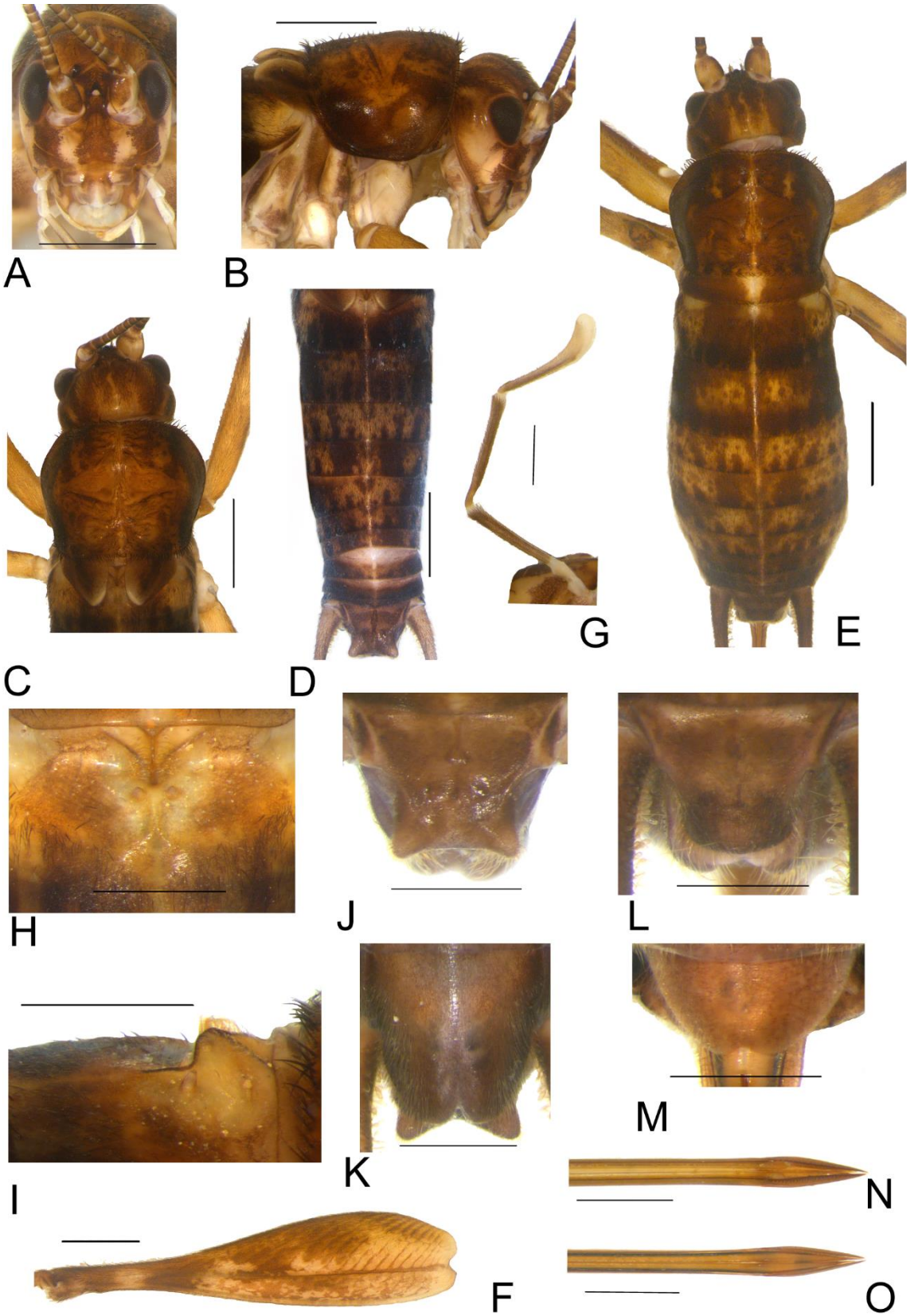


Figure 55. *Eidmanacris fontanettiae* **sp. nov.** Paratypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

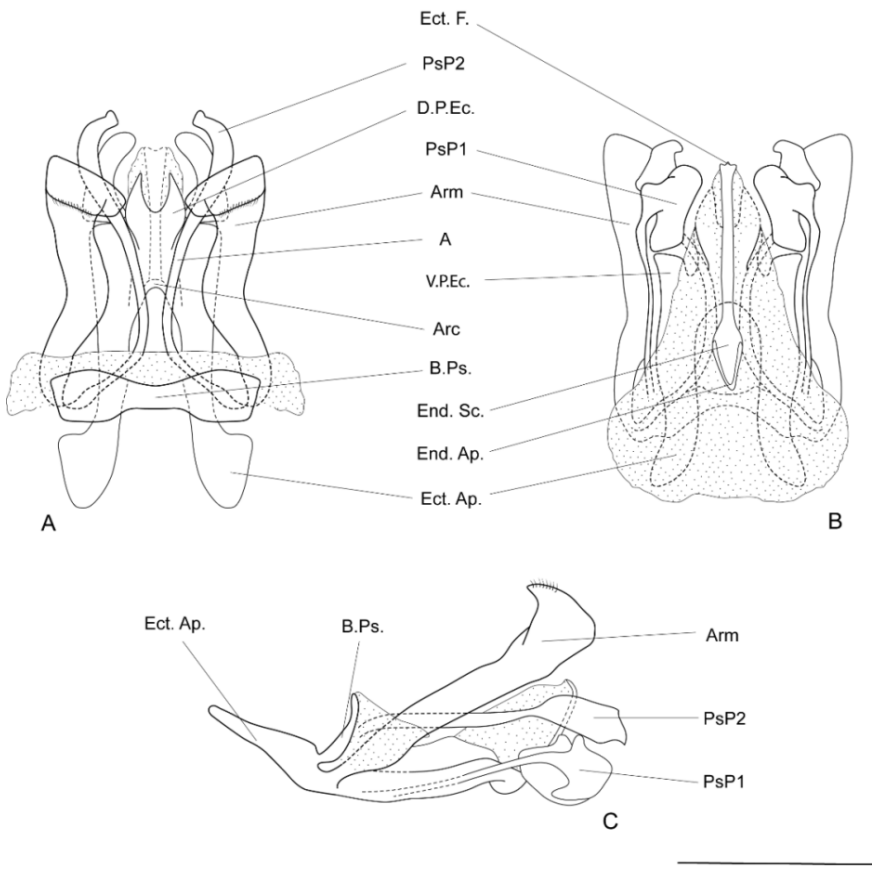


Figure 56. *Eidmanacris fontanettiae* **sp. nov.** Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

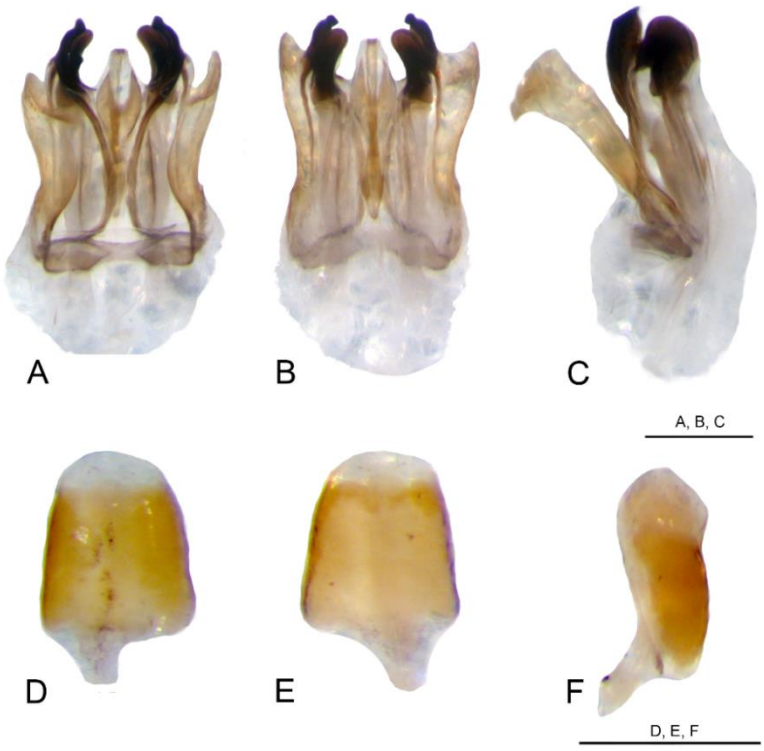


Figure 57. *Eidmanacris fontanettiae* **sp. nov.** Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

Eidmanacris melloi **sp. nov.**

(Figs. 58-60)

Type material. Holotype male, allotype, 6 males paratypes and 2 females paratypes (MZSP), 2 males paratypes and 2 females paratypes (UBTU). Holotype male, allotype, 5 males paratypes and 1 female paratype labeled: "Brasil, SP, São Luiz do Paraitinga (forest), 14.ix.1991, F.A.G. Mello – M.L.F. Camargo, col.". 3 males paratypes and 3 females paratypes labeled: "Brasil, SP, S. J. dos Campos, Distr. S. Francisco Xavier, 10-23.i.2008, *c.a.* 1400 m alt., Fazenda Kolibri, M. P. Bolfarini *leg.*" Specimens preserved in ethanol 80%.

Type locality. Brazil, São Paulo State, São Luiz do Paraitinga municipality.

Distribution. Brazil, São Paulo State.

Etymology. Named after the Brazilian Orthopterist, Dr. Francisco de Assis Ganeo de Mello.

Diagnosis. This species can be distinguished from other *Eidmanacris* by the following characters: presence of median crest between lateral projections of metanotal gland, inflated anteriorly with long bristles pointing outwards; posterior apex of ectophallic fold laterally inflated; anterior half of copulatory papilla thicker than posterior in lateral view.

Description.

Head. Reddish brown, marbled, dorsum pubescent, with dark spots. Occiput centrally reddish brown, laterally dark brown laterally, with band light brown, thin, going from the occiput to margin of each eye (Fig. 58C); vertex light brown, with anterior maculae dark. Fastigium reddish brown, wider than long, wide as antennal scape; separated from vertex by a transverse line vertex forming "v" (Fig. 58C). In frontal view, frons reddish brown, centrally lighter (Fig. 58A). Three ocelli present, well developed, rounded (Figs. 58A, B, C); Maxillary palpi medium brown, elongate, thin, joints 3, 4 and 5 same-sized, apex of joint 5 upcurved, distal half whitish (Fig. 58G). Gena reddish brown, posterior margin lighter in lateral view (Figs. 58A, B). Frontoclypeal suture medium brown, getting darker centrally. Clypeus medium brown; labrum whitish, lower portion yellowish brown. Mandible dark brown, inner margin lighter. Antennal scape light brown, inner face medium brown (Figs. 58A, B, C); antenomeres medium brown

with whitish bands, first band only composed of three antenomeres, posterior bands with five antenomeres.

Thorax. Pronotum DD reddish brown dark brown, marbled, with dark spots and maculae, posterior margin dark brown; wider than long, inflated, divided by a slender, sagittal, line light brown well discernible; DD cephalic margin slightly concave, caudal margin almost straight. (Fig. 58C); ventro-cephalic angle rounded, margin medium to dark brown, ventro-caudal margin dark brown, gradually ascendant (Fig. 58B).

Legs. FI and II yellowish brown, medium to dark brown distally. TI and II yellowish brown, getting darker distally; TI with two same-sized apical spurs, TII with two inner apical spurs, one outer, smaller. FIII light brown, with band of several thin stripes dark brown on outer face, covered by reddish brown, apical third reddish brown, ventrally yellowish brown (Fig. 58F). TIII medium to yellowish brown; sub-apical spurs 4/4, serrulation above and between them; apical spurs 3/3, more developed on inner face; inner apical spurs: dorsal one longer (iad), median smaller (iad), ventral smallest (iav) (iad>iam>iav); outer apical spurs: median one longer (oam), dorsal (oad) little longer than ventral (oav) (oam>oad>oav). Basitarsus I, II and III yellowish, pubescent.

Abdomen. Dark brown, marbled, with dark spots and maculae, sub-cylindrical, divided by thick sagittal band light brown (Fig. 58D).

Male. Medium-sized body, general coloration reddish brown to dark brown, marbled, with dark spots and maculae. FWs medium brown, , apex rounded, apparently without veins (Figs. 58B, C); inner margin light brown, inner margins not touching each other, covering metanotal gland area, posterior margin not surpassing metanotum border (Fig. 58C). Metanotal gland present, lateral projections elongate, curved inwards; median crest between lateral projections, anteriorly inflated with long bristles pointing outwards (Figs. 58H, I). Supra anal plate light brown, laterally darker, anterior margin concave, posterior margin slightly concave; latero-distal projections medium brown, short, with long setae (Fig. 58J). Subgenital plate light brown, lateral borders darker, longer than wide, anterior third wider, anterior margin sub straight, posterior margin almost straight (Fig. 58K).

Phallic complex (Figs. 59A-C; 60A-C). Pseudepiphallus: central part of base of pseudepiphallic sclerite narrow; pseudepiphallic arm well sclerotized, upcurved, somewhat slender, apex curved inwards more than 90° angle in dorsal view; apex of pseudepiphallic arm inner margin bifid, forming superior and inferior projections,

isosceles triangle-form in lateral view, apparently without bristles on outer face; anterior projection of pseudepiphallic sclerite elongate, somewhat curved inwards, thin, anteriorly pointed, surpassing median part of pseudepiphallus in lateral view; PsP2 elongate, surpassing posterior extremity of pseudepiphallic arms, straight in dorsal view, down-curved in lateral view, pointed on posterior margin, very sclerotized; PsP1 very sclerotized inwards, short, longer than wide, inner margin concave. Sclerite A external lateral margin rounded in dorsal view. Ectophallic invagination: ectophallic apodeme long, dorso-ventrally flattened in lateral view; ectophallic arc short, located posteriorly to base of pseudepiphallic sclerite in dorsal and ventral views; dorsal projections well sclerotized, short, curved outwards; ventro-posterior projection elongate, sclerotized, curved outwards posteriorly; ectophallic fold membranous, sub apical margins inflated laterally. Endophallus: medio-posterior projection of endophallic sclerite elongate, apex reaching PsP2 apex; endophallic apodeme as long as wide, laterally flattened, upcurved in lateral view, limits not reaching ectophallic apodeme anterior margin.

Female. Larger than male, general coloration similar (Fig. 58E). Supra anal plate light brown, posterior third darker, posterior margin rounded with long bristles (Fig. 58L). Subgenital plate medium brown, lighter band centrally, posterior margin with central concavity rounded (Fig. 58M). Ovipositor apex laterally flattened as in figs. 58N and 58O.

Copulatory papilla (Figs 60D-F). Dorso-ventrally flattened, somewhat longer than wide, anterior half wider than posterior in dorsal and ventral views. In lateral view, anterior half thicker than posterior. Posterior apex unpigmented.

Remarks. The specimens from district of São Francisco Xavier in São José dos Campos municipality, São Paulo, Brazil, are darker than specimens from São Luiz do Paraitinga municipality, São Paulo, Brazil.

Measurements (mm).

Male (n=9): Hw, 2.33 ± 0.12 (2.17-2.54); iod, 1.2 ± 0.05 (1.11-1.24); Lpron, 2.94 ± 0.16 (1.79-2.35); awpron, 2.21 ± 0.16 (2.04-2.54); pwpron, 2.45 ± 0.21 (2.23-2.73); wpron, 2.94 ± 0.18 (2.72-3.28); LFW, 1.41 ± 0.16 (1.11-1.55); wFW, 1.22 ± 0.16 (0.93-1.42); LFIII, 8.33 ± 0.48 (7.65-9); wFIII, 2.42 ± 0.18 (2.1-2.7); LTIII, 8.43 ± 0.5 (7.65-9); Ltars1-III, 2.03 ± 0.17 (1.8-2.4).

Female (n=5): Hw, 2.62 ± 0.14 (2.48-2.85); iod, 1.35 ± 0.10 (1.24-1.48); Lpron, 2.43 ± 0.12 (2.29-2.6); awpron, 2.68 ± 0.15 (3.34-3.72); pwpron, 3.06 ± 0.22 (2.72-3.28); wpron, 3.48 ± 0.14 (3.34-3.72); LFIII, 9.3 ± 0.46 (9– 10.05); wFIII, 2.67 ± 0.13 (2.55-2.85); LTIII, 9.39 ± 0.48 (8.85–10.05); Ltars1-III, 2.28 ± 0.16 (2.1–2.4); OL, 8.49 ± 0.23 (8.25–8.27).

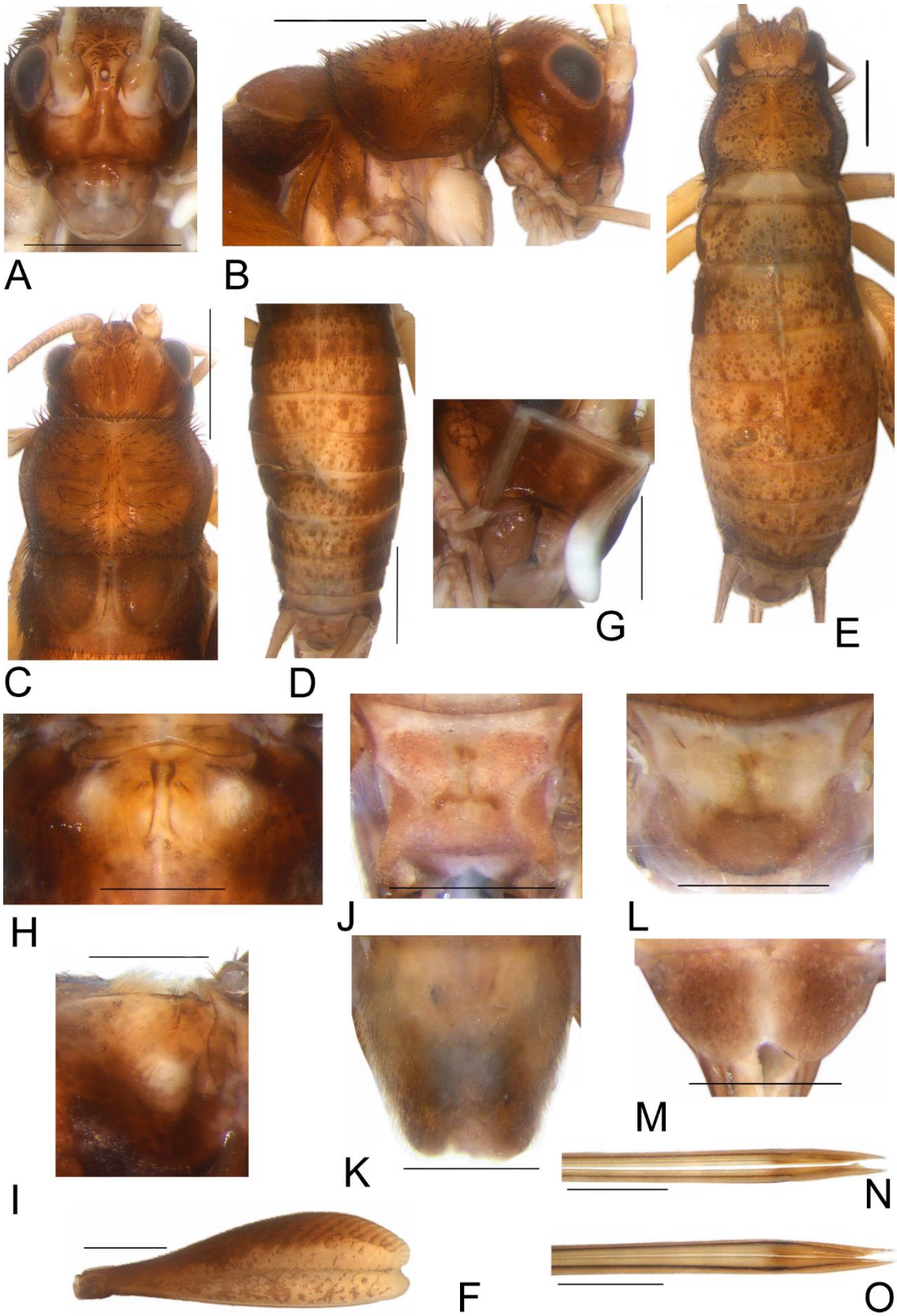


Figure 58. *Eidmanacris melloi* **sp. nov.** Paratypes. **A**- male head, frontal; **B**- male head, pronotum and FW, lateral; **C**- male head, pronotum and FWs, dorsal; **D**- male abdomen; **E**- female habitus; **F**- posterior femur; **G**- maxillary palpus; **H**- male metanotum, dorsal; **I**- male metanotum, lateral; **J**- male supra anal plate; **K**- male subgenital plate; **L**- female supra anal plate; **M**- female subgenital plate; **N** ovipositor dorsal; **O**- ovipositor ventral. Scale bar: A-F: 2mm; G-O: 1mm.

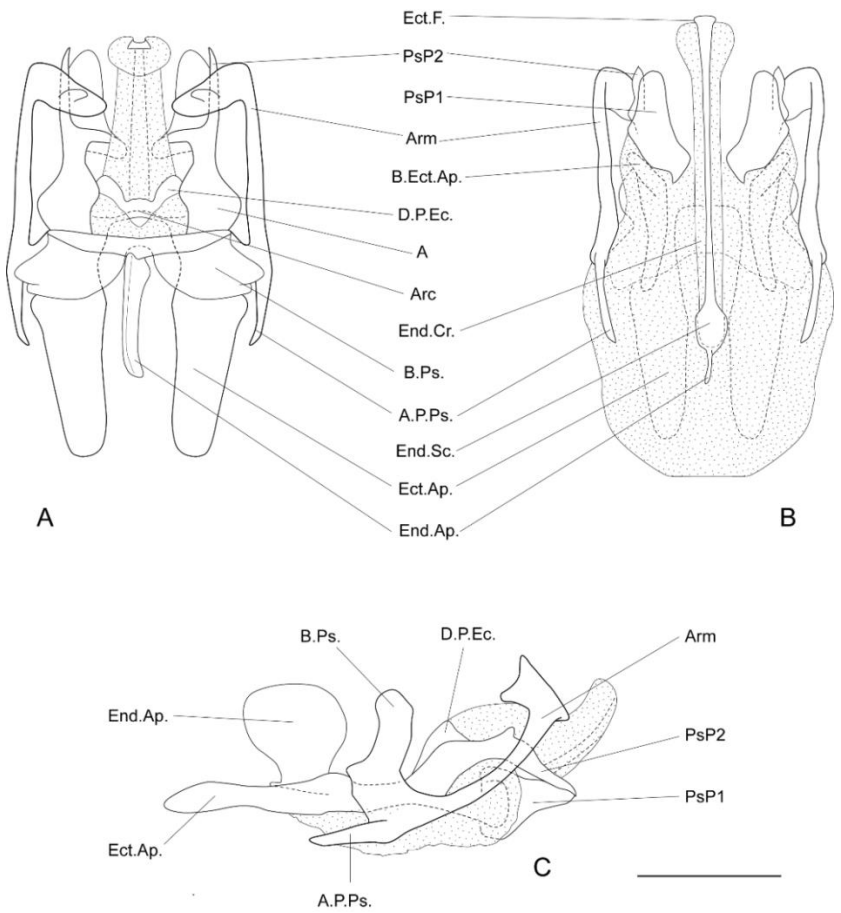


Figure 59. *Eidmanacris melloi* **sp. nov.** Paratype. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Scale bar: 0.5 mm.

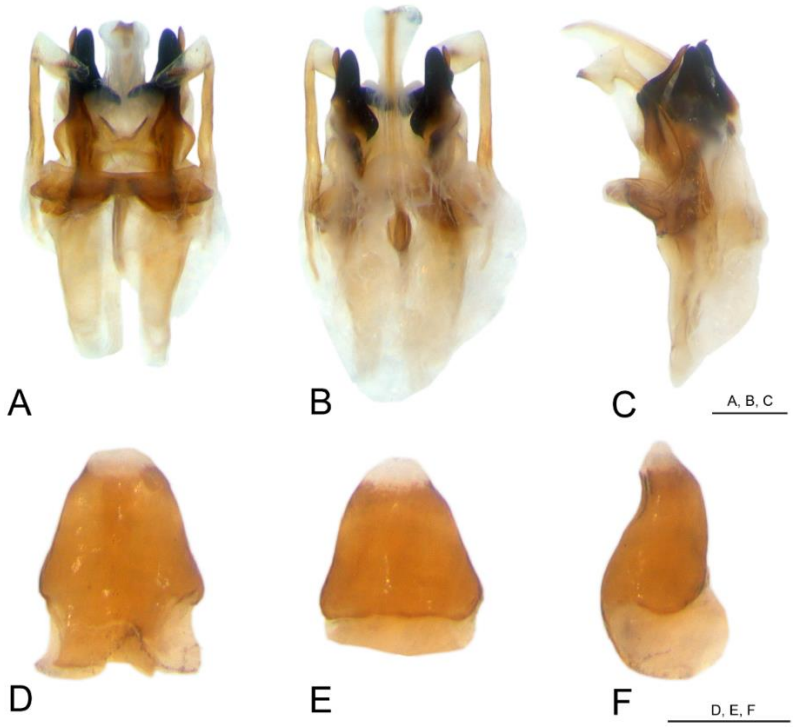


Figure 60. *Eidmanacris melloi* **sp. nov.** Paratypes. Male phallic complex: **A**- dorsal; **B**- ventral; **C**- lateral. Female copulatory papilla: **D**- dorsal; **E**- ventral; **F**- lateral. Scale bar: 0.5 mm.

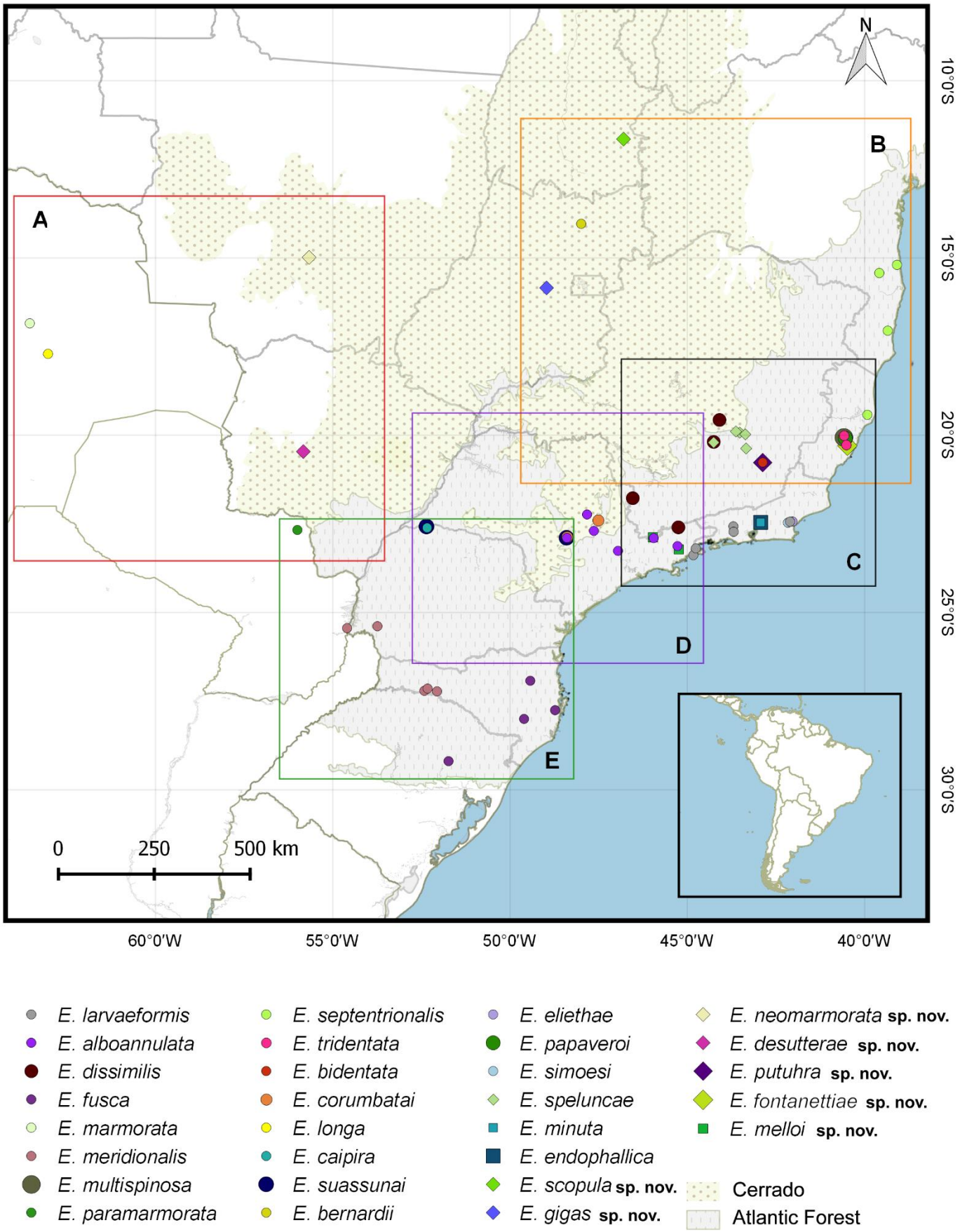


Figure 61. Map of distribution of *Eidmanacris* species.

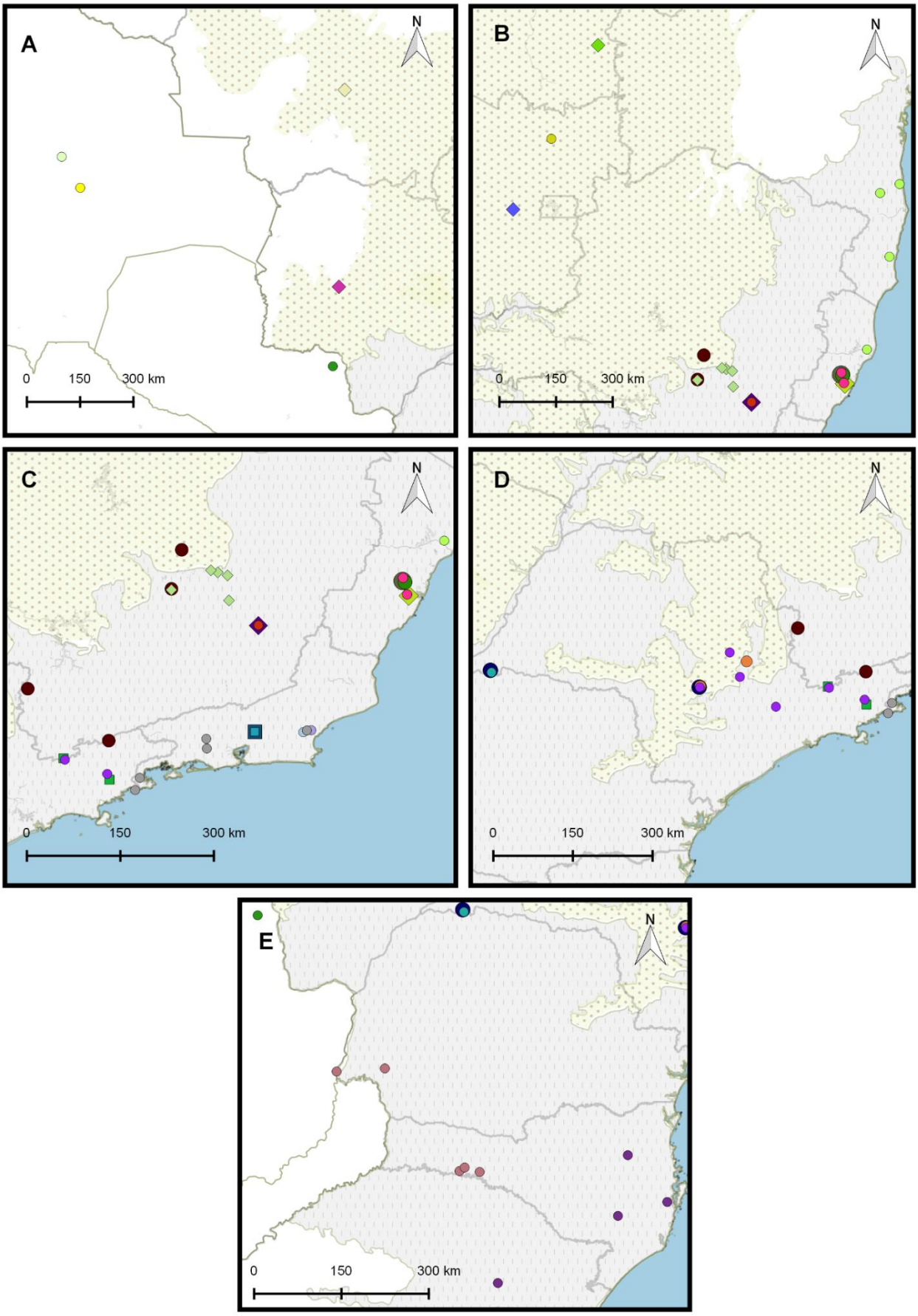


Figure 62. Map of distribution of *Eidmanacris* species.

Key to species of **Eidmanacris** *(except* E. paramarmorata*)*

1. –Posterior border of female subgenital plate with a central furrow, almost reaching the median part of the plate (Fig. 27M); posterior aperture of female copulatory papilla large (Fig. 29E); male genitalia with apex of pseudepiphallic arms upcurved, forming a 90° angle (Fig. 28C); lateral projection of pseudepiphallic sclerite (L.P.Ps) present (Fig. 41C); ventro-posterior projection of ectophallic invagination curved inwards (Fig. 43B)……..…….…….……..**2**

-Posterior border of female subgenital plate with a short or rounded concavity (Fig. 6M); posterior aperture of female copulatory papilla inconspicuous (Fig. 8E); male genitalia with apex of pseudepiphallic arms slightly upcurved (Fig.8C); lateral projection of pseudepiphallic sclerite absent, ventro-posterior projection of ectophallic invagination straight or curved outwards (Figs. 7B; 19B) ……..…….....**9**

2. -Lateral projections of metanotal gland absent or inflated (Figs. 40H, I; 49H, I); supero-internal projection of the apex of the pseudepiphallic arm reduced to a spine (Figs. 42A, 50A)…….……..…...……...…….**3**

-Lateral projections of metanotal gland conical and parallel (Figs. 46H, I); supero-internal projection of the apex of the pseudepiphallic arm not reduced (Fig. 28C)……..…….…..**4**

3. –Lateral projections of metanotal gland absent (Figs. 40H, I); supero-lateral borders of supra anal plate dark brown, latero-posterior projections dark brown (Fig. 40J); posterior border of subgenital plate rounded (Fig. 40K); ventral projection of apex of pseudepiphallic arm absent (Fig. 41C)..…….***E. scopula* sp. nov.**

-Lateral projections of metanotal gland inflated, anteriorly curved, medially fused (Fig. 49H, I); supero-lateral borders of supra anal plate reddish, latero-posterior projections greyish (Fig. 49J); posterior border of subgenital plate rounded (Fig. 49K); ventral projection of apex of pseudepiphallic arm present, very short with hard bristles (Figs. 50B; 51B)……..…….…….….***E. desutterae* sp. nov.**

4. –Ventral projection of apex of pseudepiphallic arm present (Fig. 28B); proximal and distal regions of ectophallic apodeme with same width (Figs. 43A, B)……..…**5**

-Ventral projection of apex of pseudepiphallic arm absent; proximal region of ectophallic apodeme wider than distal region in dorsal view (Fig. 48A)…….……...**6**

5. - 7th abdominal tergite yellowish, contrasting to other tergites (Fig. 27D); posterior border of subgenital plate straight (Fig. 27K); latero-posterior projections of supra anal plate longer than posterior border (Fig. 27J); central portion of base of pseudepiphallic sclerite narrow than lateral portions, in dorsal view (Figs. 28A; 29A); dorsal projection of ectophallic invagination without concavity on posterior border (Fig. 28A; 29A)..…….…***E. corumbatai* Garcia, 1998**

- 7th abdominal tergite with same coloration than other tergites; posterior border of subgenital plate rounded (Fig. 43K); latero-posterior projections of supra anal plate with same length of posterior border (Fig. 43J); central portion of base of pseudepiphallic sclerite same width than lateral portions in dorsal view (Fig, 44A; 45A); dorsal projection of ectophallic invagination with small concavity on posterior border (Fig. 44A)……...…….……***E. gigas* sp. nov.**

6. -Lateral projections of pseudepiphallic sclerite with rounded tip; superior projection of apex of pseudepiphallic reduced, like a spine.……..…..…**7**

-Lateral projections of pseudepiphallic sclerite with pointed tip (Fig. 47C); superior projection of apex of pseudepiphallic hook-shaped, upcurved (Fig. 47C; 48C).....…….……..…….**8**

7. –Apex wider than the base of pseudepiphallic arm in lateral view; inferior projection of apex of pseudepiphallic arm rounded; dorsal projection of ectophallic invagination with median invagination on posterior border…….
.....***E. caipira* Souza-Dias, Campos & Nihei, 2015**

-Apex same width than base of pseudepiphallic arm in lateral view; inferior projection of apex of pseudepiphallic arm hook-shaped, upcurved; dorsal projection of ectophallic invagination with the posterior border straight…….....***E. bernardii* Nihei & de Mello, 2015**

8. –Latero-posterior projections of supra anal plate longer than the posterior border; median fold of anterior border of metanotum with cluster of bristles laterally pointed (Fig. 46H); superior and inferior projections of apex of pseudepiphallic arm hook-shaped, close each other in lateral view; supero-internal and inferior projections present (Figs.47C; 48C)……..…….…***E. neomarmorata* sp. nov.**

-Latero-posterior projections of supra anal plate same-sized than the posterior border; median fold of anterior border of metanotum with cluster of bristles anteriorly pointed; superior and inferior projections of apex of pseudepiphallic arm hook-shaped, distant each other in lateral view; only supero-internal projection present.....***E. marmorata* (Bruner, 1916)**

9. –Abdominal sagittal line occupying more than half of dorsum (Fig. 36D); lateral projections of metanotal gland elongate, slightly curved inwards (Fig. 33H) (except in *E. endophallica* comb. nov. and *E. fusca*); anterior margin of metanotum without crest (Fig. 36H); TIII dorsal apical spur on inner face the longest; apex of pseudepiphallic arm curved inwards forming a 90° angle in dorsal view (Figs. 34A; 35A); apex of ovipositor laterally straight in dorsal view (Fig. 36L)..……..…..…..**10**

- Abdominal sagittal line not occupying more than half of dorsum; lateral projections of metanotal gland cylindrical and parallel (except *E. tridentata*, absent) (Fig. 6H); anterior margin of metanotum with median triangular crest (Fig. 6H); TIII median apical spur on inner face the longest; apex of pseudepiphallic arm not curved (Figs. 10A; 11A); apex of ovipositor laterally rounded, drop shaped in dorsal view (Fig. 9N)…….…….…….……...…...……**13**

10. -Metanotal gland absent (Fig. 36C)…….....……..…**11**

-Metanotal gland present (Fig. 6H)……**12**

11. -Latero-posterior projections of supra anal plate longer than the posterior border (Fig. 36J); inferior projection of apex of pseudepiphallic arms short (Fig.38A); subapical margins of ectophallic fold laterally inflated (Fig. 39B); medio-posterior projection of endophallic sclerite four times longer than pseudepiphallic sclerite; ectophallic arc slightly rounded; ectophallic apodeme three times longer than pseudepiphallic sclerite (Fig. 37A, B; 38A)….....…***E. endophallica* (de Mello, 1990)**

-Latero-posterior projections of supra anal plate very short (Fig. 15J); inferior projection of apex of pseudepiphallic arms long and pointed (Figs. 16C; 17C); medio-posterior projection of endophallic sclerite slightly longer than pseudepiphallic sclerite (Fig. 16A, B, C); subapical margins of ectophallic fold not inflated laterally; ectophallic arc v-shaped; ectophallic apodeme almost same size than pseudepiphallic sclerite…….……..……...…….***E. fusca* Desutter-Grandcolas, 1995**

12. –Inferior margin of median ocellus truncate (Fig. 33A); frons with three vertical bands, one median, two bellow eyes (Fig. 33A); inner margins of males' FWs touching each other (Fig. 33C); median fold of anterior margin of metanotum with two latero-posterior projections (Fig. 33H), sclerite A of pseudepiphallus curved inwards; apex of ectophallic fold not reaching the apex of pseudepiphallic arms (Figs. 34A, B); female subgenital plate with posterior border rounded……..….....…..... ***E. minuta* (de Mello, 1990)**

-Median ocellus spherical (Fig. 58A); frons without vertical bands (Fig. 58A); inner margin of FWs not touching each other (Fig. 58C); median crest of anterior margin of metanotum inflated (Fig. 58H); sclerite A of pseudepiphallus straight; apex of ectophallic fold reaching or surpassing the apex of pseudepiphallic arms (Figs. 59A, B); female subgenital plate with posterior border with central concavity..... ***E. melloi* sp. nov.**

13. -Apex of males' FWs triangular (Fig. 6C)……..……..…..…….....……**14**

-Apex of males' FWs rounded (Fig. 30C)…...…...……...…….……**18**

14. –Sclerite A of pseudepiphallus straight…….....
.....…***E. septentrionalis*** **Desutter-Grandcolas, 1995**
-Sclerite A of pseudepiphallus sinuous (Fig. 7A)…….....…...**15**

15. –Supero-internal projection of apex of pseudepiphallic arm finger-shaped (Figs. 7A; 8A); connection between PsP2 and sclerite A not visible (Fig. 8A); ectophallic apodeme shorter than pseudepiphallic arm; PsP1 longer than wide…….……**16**
-Supero-internal projection of apex of pseudepiphallic arm serrulated (Fig. 19A; 20A); connection between PsP2 and sclerite A visible (Fig. 20A); ectophallic apodeme as long as or longer than pseudepiphallic arm; PsP1 as long as wide.…….……..…...**17**

16. -Body medium to large (longer than 18 mm); posterior margin of male subgenital plate without median invagination (Fig. 6K), anterior projection of pseudepiphallic sclerite present (A.P.Ps.) (Fig. 7C); sclerite A of pseudepiphallus not thin as below; endophallic sclerite anterior to base of pseudepiphallic sclerite……...……. ***E. larvaeformis*** **(Chopard, 1938)**
–Body small (15 mm or smaller); posterior margin of male subgenital plate with median invagination (Fig.55K); anterior projection of pseudepiphallic sclerite absent; sclerite A of pseudepiphallus very thin (Fig. 56A); endophallic sclerite anterior to base of pseudepiphallic sclerite (Fig. 57B)...…….…..… ***E. fontanettiae*** **sp. nov.**

17. –Posterior border of DD whitish in dorsal view (Fig. 18C); lateral projections of metanotal gland not reduced (Fig. 18H); latero-posterior projections of supra anal plate parallel (Fig. 18J); apex of the inferior projection of pseudepiphallic arm serrulated (Fig. 19C); anterior projection of pseudepiphallic sclerite very long, surpassing the base of pseudepiphallic sclerite (Figs. 19A, B)….....***E. multispinosa*** **Desutter-Grandcolas, 1995**

-Posterior border of DD same coloured as the pronotum in dorsal view; lateral projections of metanotal gland very reduced; latero-posterior projections of supra anal plate not parallel; apex of the inferior projection of pseudepiphallic arm very reduced (spine); anterior projection of pseudepiphallic sclerite very short, not surpassing the base of pseudepiphallic sclerite.....…. ***E. papaveroi*** **Nihei & de Mello, 2015**

18. -Ectophallic apodeme curved inwards in dorsal view and upcurved in lateral view (Fig. 31A, C)…….…….…….……..……...…..**19**

-Ectophallic apodeme straight in dorsal and lateral views (Figs. 22A, C)……..…….……..…..**20**

19. –5th joint of maxillary palpus longer than joints 3 and 4 (Fig. 30G); posterior half of antennae whitish; latero-posterior projections of supra anal plate very short, not extended (Fig 30J); posterior border of subgenital plate rounded (Fig. 30K); superior, internal and inferior projections of the apex of pseudepiphallic arm very reduced (apex clavate) (Figs. 32A, B, C); PsP2 short (Figs. 31B, 32B)……...……..….***E. speluncae*** **(Mello-Leitão, 1937)**

-3rd, 4th and 5th Joints of maxillary palpus almost same-sized (Fig. 52G); antennae entirely banded; latero-posterior projections of supra anal plate elongate, extended (Fig.52J); posterior border of subgenital plate with central invagination (52K); superior, internal and inferior projections of the apex of pseudepiphallic arm not reduced, pointed (Figs. 53A, B, C); PsP2 elongate (Figs. 53B, 54B)……...***E. putuhra*** **sp. nov.**

20. –FWs reticulated, apex without glandular thickening..…….....……**21**

-FWs not reticulated, apex with glandular thickening...…..……...…….…..**24**

21. –DD without characteristic lines; lateral projections of metanotal gland elongated, curved to pronotum, inner borders fused (Fig. 24H); internal projection of apex of pseudepiphallic arm absent (Fig. 25A; 26A)……..…***E bidentata*** **Sperber, 1998**

-DD with five longitudinal lines, two latero-anterior, two posterior and one median (Fig. 20C); Lateral projections of metanotal gland absent (Figs. 20H, I) or short, cylindrical, parallel, inner borders not medially fused; internal projection of apex pseudepiphallic arm present, pointed (Fig. 21A; 22A)...……..……**22**

22. –FWs very short, not covering metanotum (Fig. 21C); metanotal gland absent; PsP2 thinner than pseudepiphallic arm in dorsal view (Figs. 22A, 23A)…….....***E. tridentata*** **Desutter-Grandcolas, 1995**

-FWs covering the metanotum; metanotal gland present; PsP2 same width or wider than pseudepiphallic arm in dorsal view……..……..…..**23**

23. -General coloration medium brown, marbled; FWs not surpassing the posterior border of metanotum; abdominal medio-dorsal line well discernible; supra anal plate yellowish brown contrasting with abdomen; PsP1 with a concavity inwards and a anterior, small projection in dorsal view; anterior projection of pseudepiphallus short; copulatory papilla wider than long, somewhat laterally rounded …….……..…….……***E. simoesi*** **Nihei & de Mello, 2015**

-General coloration dark brown, marbled; FWs surpassing the posterior border of metanotum; abdominal medio-dorsal line almost not discernible; supra anal plate dark brown, not contrasting with abdomen; PsP1 with concavity outwards, with pointed projection posteriorly in dorsal view; anterior projection of pseudepiphallus long; copulatory papilla longer than wide, cylindrical……..……..***E. eliethae*** **Nihei & de Mello, 2015**

24. -Inner borders of FWs overlapped (Fig. 12C); latero-posterior projections of supra anal plate shorter than posterior border (Fig. 12J); posterior border of subgenital plate rounded; inferior projection of apex of pseudepiphallic arm not curved inwards…….……..…….……..**25**

-Inner borders of FWs not overlapped (Fig. 9C); latero-posterior projections of supra anal plate same-sized or longer than posterior border (Fig. 9J); posterior border of subgenital plate straight; inferior projection of apex of pseudepiphallic arm curved inwards (Figs. 10B; 11B)…...…..……..…….……..…….**26**

25. –Apex of FWs apex not curved inwards; pseudepiphallic arms thin; supero-internal, and inferior projections of apex of pseudepiphallic arm reduced (as in *E. speluncae*); ectophallic arc posterior to base of pseudepiphallic sclerite; copulatory papilla anterior margin as wide as posterior margin in dorsal and ventral views …….…….***E. meridionalis* Desutter-Grandcolas, 1995**

-Apex of FWs apex curved inwards (Fig. 12C); pseudepiphallic arms robust (Figs 13A, B ,C; 14A, B, C); superior, internal and inferior projections of apex of pseudepiphallic arm not reduced (Figs.13C; 14C); ectophallic arc below base of pseudepiphallic sclerite (Fig. 13A); copulatory papilla anterior margin wider than posterior margin in dorsal and ventral views (Fig. 14D, E)….....***E. dissimilis* Desutter-Grandcolas, 1995**

26. –FWs surpassing the posterior border of metanotum (Fig. 9C); latero-posterior projections of supra anal plate longer than posterior border; internal projection of apex of pseudepiphallic arm reduced, like a spine (Figs. 10A); copulatory papilla cylindrical, wider than long in dorsal and ventral views (Fig. 11D, E)……...***E. alboannulata (*Piza, 1960)**

–FWs not surpassing the posterior border of metanotum; latero-posterior projections of supra anal plate shorter than posterior border; internal projection of apex of pseudepiphallic arm curved inwards, pointed; papilla longer than wide, flattened dorso-ventrally.……***E. suassunai* Souza-Dias, Campos & Nihei, 2015**

4. *Discussion*

Apart of the value of the male forewings and metanotal glands for taxonomic studies as diagnostic characters, the ultramorphological study of these structures herein have revealed their usefulness and potential implications for phylogenetic, behavioural, histochemical, and sexual selection researches. Below, a brief discussion is provided about these structures of the external morphology for some species of *Eidmanacris*.

4.1. *Males' forewings*

The males of *Eidmanacris* species are brachypterous, with reduced, coriaceous forewings, without stridulatory apparatus or any specialized veins or areas for sound production and propagation. Consequently, they use other means to attract females. Apart of visual and mechanical stimulus, as waving the antennae and drumming the substrate with the anterior tibiae (Prado, 2006), *Eidmanacris* also uses chemical stimulus.

The chemical communication relative to sexual behavior of *Eidmanacris* is characterized by the liberation of pheromones from glands, as reported in other groups of crickets (Bell, 1980; Desutter-Grandolas, 1995; Lopes-Andrade & Sperber, 2001; Mews *et al*., 2009; Prado, 2006; Fernandes *et al*., 2015).

Most of the species of *Eidmanacris* have a whitish glandular thickening with bristles on the ventral side of the apex of forewing. During courthip, the male raises his forewings exposing its ventral part and the metanotal gland for the female. These areas are touched by the female, and produce substances that act as a nuptial gift, attracting and maintaining the females during copulation.

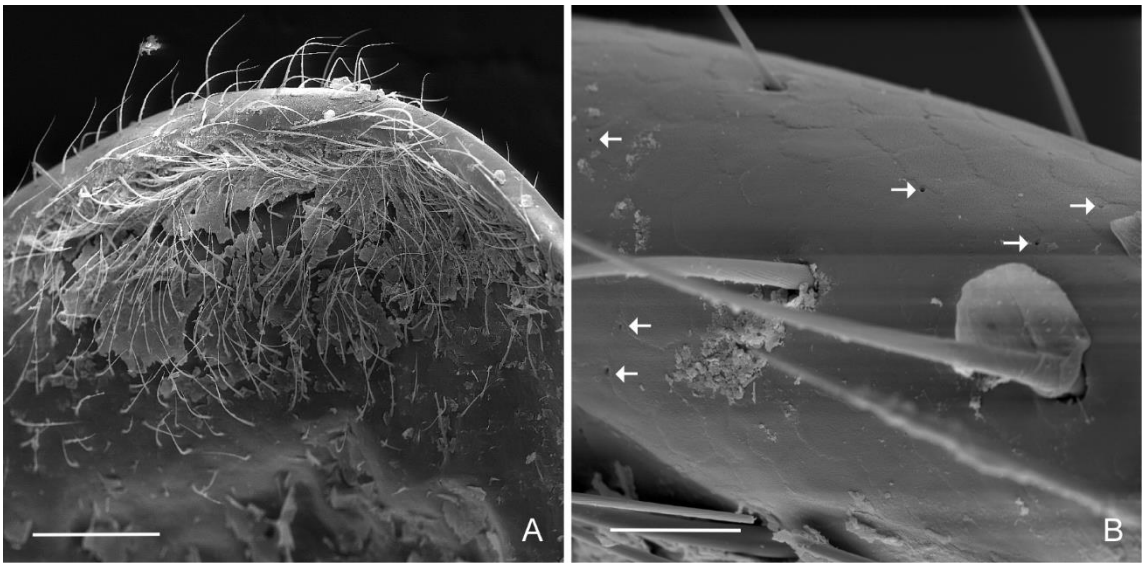


Figure 63. *Eidmanacris meridionalis*. Apex of Left forewing, ventral view. **A-** 100x magnification, scale bar 200µm; **B-** 1000x magnification, White arrows indicates pores, scale bar 20µm.

In Luzarinae, during copulation, the most common position is female-above (Alexander & Otte, 1967), reported in all Brazilian species studied so far (de Mello & dos Reis, 1994; Prado, 2005; Zefa *et al*., 2008; Souza-Dias et al., 2015) and observed by me and several colleagues in field works and laboratory experiments. When males' forewings are raised, this glandular thickening is directed to female and there may be release of pheromones.

The glandular thickening of male forewings were never examined through S.E.M. analysis before. Thus, through examination of this region in the forewings with S.E.M. is possible to recognize some substances retained on the bristles, and pores on the surface (Fig. 63). These structures, mainly the pores, indicate the presence of secretory glands, possibly under the metanotal cuticle.

Other related Luzarinae species also have glandular thickening at the apex of forewings, as *Guabamima saiva* de Mello, 1993 *a*nd *Guabamima lordelloi* de Mello, 1993. However, these species do not have metanotal glands and the forewings are functional for stridulation, usually with presence of stridulatory apparatus.

More studies on the morphology of the glandular thickening of male forewings should be developed, including more *Eidmanacris* species. These will be the first morphological studies regarding these structures, and certainly will produce interesting results.

4.2. *The metanotal glands*

Twenty out of 29 species of *Eidmanacris* were analysed here for the ultramophological study of the metanotal glands: the previously described species *E. alboannulata*, *E. bidentata*, *E. caipira*, *E. corumbatai*, *E. dissimilis*, *E fusca*, *E. larvaeformis*, *E. meridionalis*, *E. papaveroi*, *E. septentrionalis*, *E. simoesi*, *E. suassunai*, *E. tridentata*, and the new or transferred species: *E. gigas* **sp. nov.** *E. putuhra* **sp. nov.**, *E. fontanettiae* **sp. nov.**, *E. melloi* **sp. nov**, *E. minuta* **comb. nov.**, *E. endophallica* **comb. nov.** and *E. speluncae* **comb. nov**.

Due to the reduced number of specimens available, some species could not be analyzed through S.E.M, in order to not compromise the material.

It is a consensus that there is a relation between the metanotal gland and reproductive success in crickets. The metanotal gland is related to female attraction (with pheromones) (Prado, 2006), and provides a nuptial gift as a nutritional secretion which is consumed by the female during and after the copulation (Walker & Gurney, 1967; de Mello, 2007). According to Prado & Fontanetti (2005), the metanotal gland in *Eidmanacris* has an interspecific variation, which was confirmed in this study. In addition to the studied species by Prado & Fontanetti (2005) (*E. corumbatai*, *E alboannulata*, *E. dissimilis*, *E larvaeformis*) other nine species also present differences between each other.

Based on these assumptions, the metanotal glands can be considered the product of sexual selection among crickets. These glands occur in different and distant lineages of Grylloidea, as in the subfamilies Gryllinae, Tafaliscinae, and Oecanthinae of Gryllidae, and the subfamilies Phalangopsinae, Luzarinae, and Homoeogryllinae of Phalangopsidae (Walker & Gurney 1967).

When described the metanotal gland in *Eidmanacris*, Prado & Fontanneti (2005) suggested that the secretions were released only by the lateral projections, when female removed the apical part of the structure through bites of a virgin male. However, with the analyses using S.E.M, it is possible to observe pores throughout several regions of the metanotum, including the surface of the lateral projections, most of them with traces of secretion (Fig. 64).

This indicates that not only the lateral projections have secretory glands, but the entire metanotum dorsal region, which is covered by tiny pores. The region with bristles (*i.e.*, median crest of anterior border of metanotum, and posterior region of metanotum)

holds a considerable amount of secretions, and may act facilitating the access by the female.

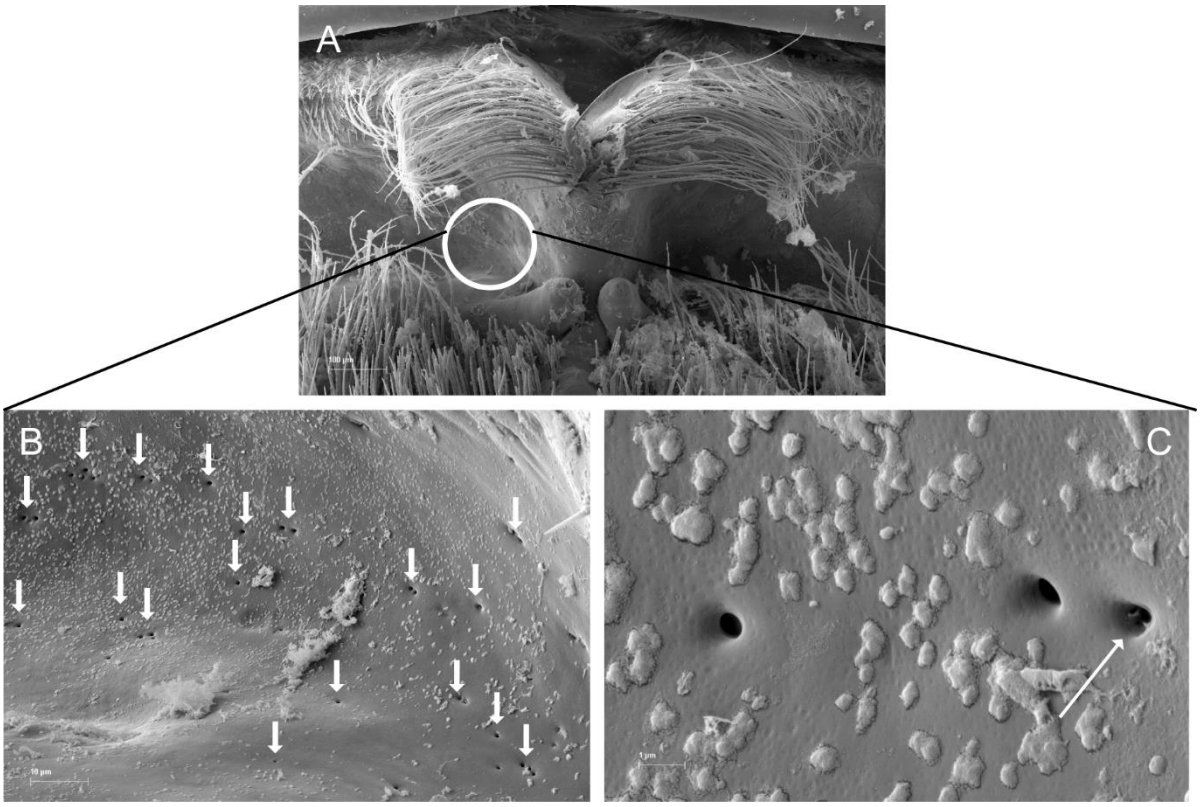


Figure 64. *Eidmanacris dissimilis*. Metanotal gland: **A-** 272x magnification; **B-** white circle region from A magnified 2680x, white arrows indicate pores; **C-** white circle region magnified 21470x, white arrow indicates pore with intern secretion.

Here we present S.E.M. photographs of several *Eidmanacris* species (Fig. 65). Based on this study, a set of characters is proposed and used in the cladistic analysis (Chapter 2), including new interpretations on the morphology of metanotal glands, differing from the previous study of Prado & Fontanetti (2005) (Figs. 66-69).

The description of the metanotal glands of all *Eidmanacris* species studied will be presented in a separate publication. Moreover, studies on sexual behavior can help us to understand the role of these structures on males' reproductive success. Furthermore, additional histological and histochemical studies will provide informations on the morphology of the tissue and the nature of the secretions.

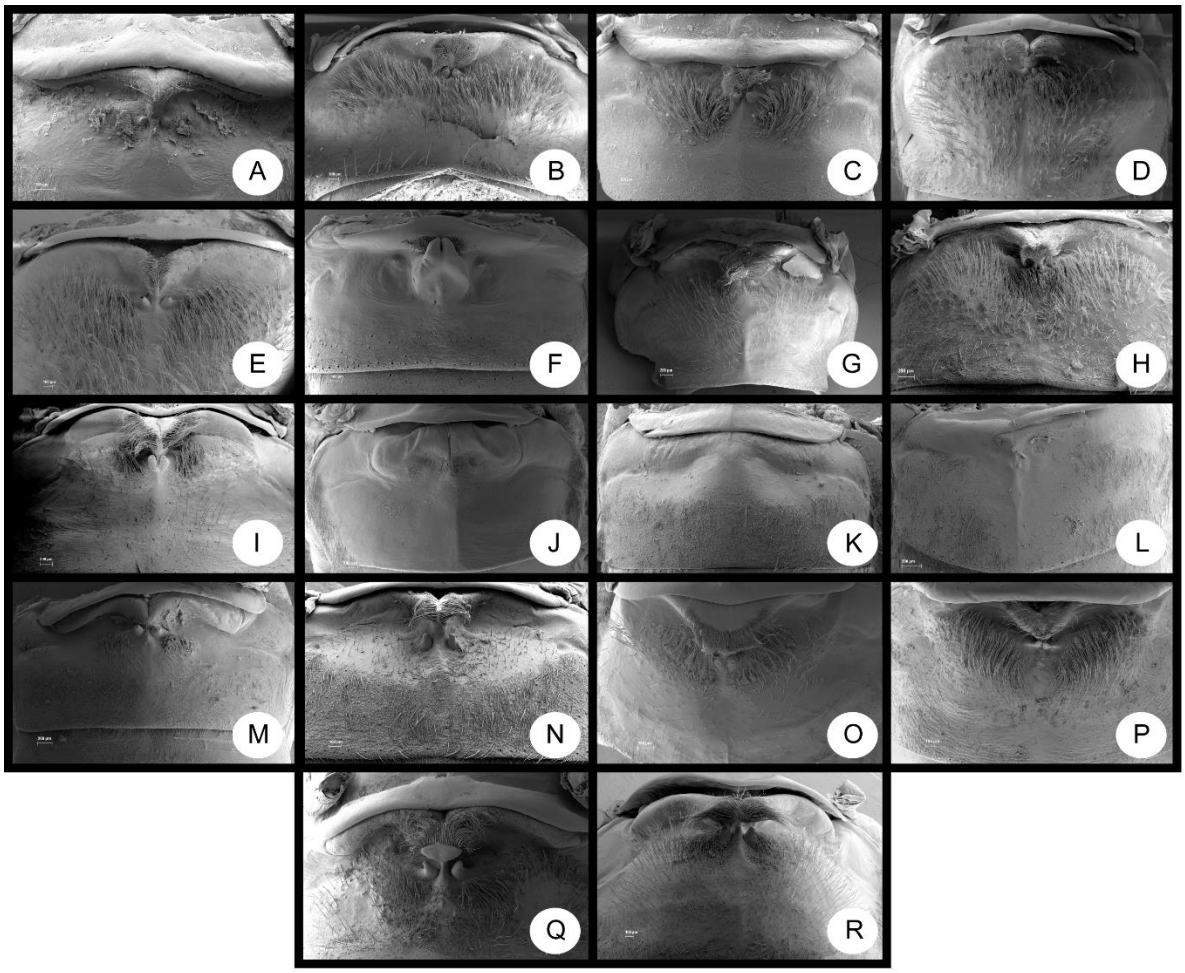


Figure 65. Metanotal gland in dorsal view: **A-** *E. larvaeformis*, **B-** *E. alboannulata*, **C-** *E. septentrionalis*, **D-** *E. dissimilis*, **E-** *E. meridionalis*, **F-** *E. bidentata*, **G-** *E. corumbatai*, **H-** *E. suassunai*, **I-** *E. caipira*, **J-** *E. fusca*, **K-** *E. tridentata*, **L-** *E. papaveroi*, **M-** *E. simoesi*, **N-** *E. fontanettiae* **sp. nov.**, **O-** *E. gigas* **sp. nov.**, **P-** *E. speluncae* **comb. nov.**, **Q-** *E. putuhra* **sp. nov.**, **R-** *E. neomarmorata* **sp. nov.**

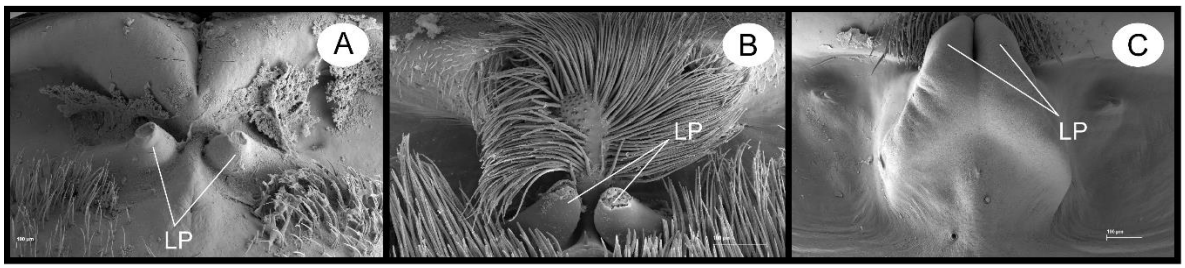


Figure 66. Lateral projections of metanotal gland: **A-** *E. simioesi*, *E. alboannulata*, **C-** *E. bidentata*. LP: lateral projections

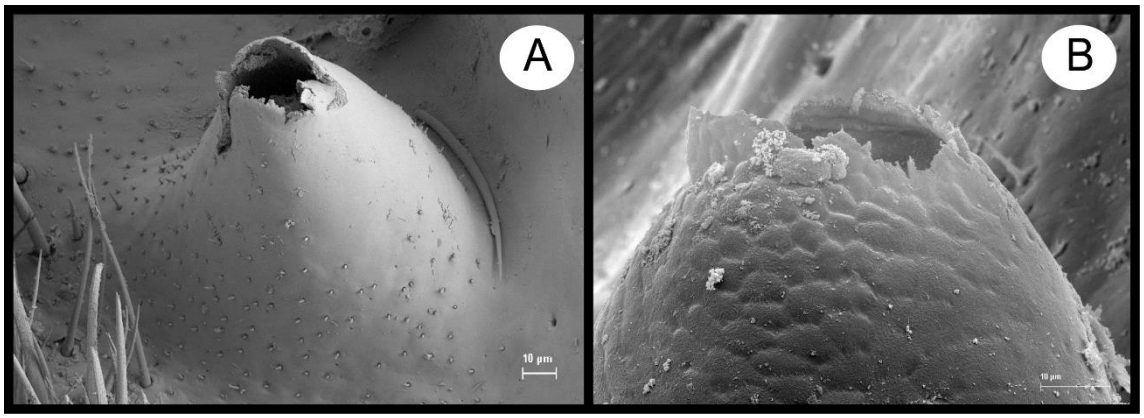


Figure 67. Surace of lateral projections: **A-** *E. meridionalis*, smooth; **B-** *E. sepetentrionalis*, striated.

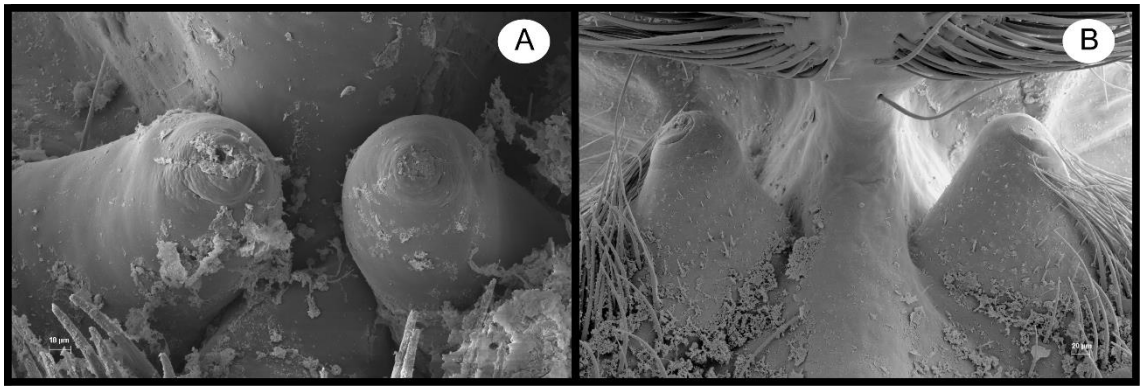


Figure 68. Shape of lateral projections: **A-** *E. dissimilis*, cylindrical; **B-** *E. neomarmorata* **sp. nov.**, conical.

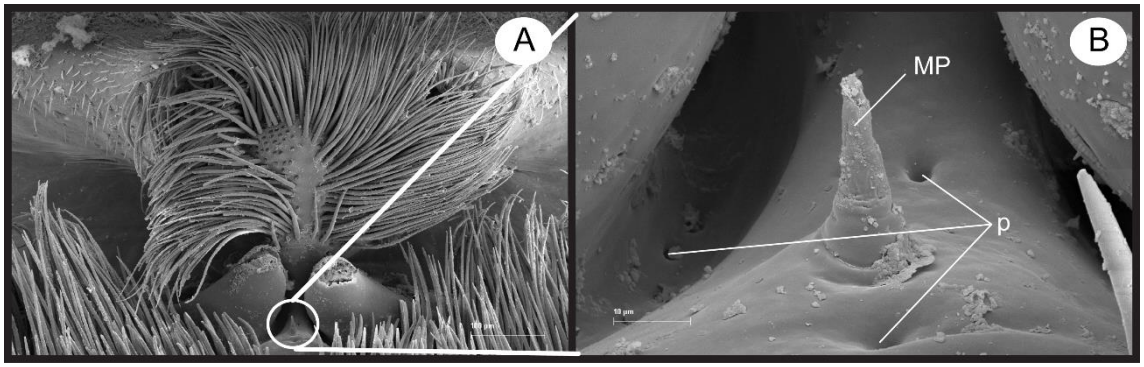


Figure 69. Median projection of metanotal gland, *E. alboannulata*: **A-** Lateral and median projections; **B-** Median projection (MP); p- pores.

5. *Conclusions*

The genus *Eidmanacris* is the most diverse within the South-American Luzarinae, with 29 species. The genus is widely distributed, occurring in Chaco, Cerrado and Atlantic Forest, but not reaching the Amazon Forest.

Three nomenclatural acts are proposed here:

- *Endophallusia* de Mello, 1990 is a junior synonym of *Eidmanacris* Chopard, 1956;
- *Eidmanacris lencionii* Bolfarini, 2016 is a junior synonym of *Eidmancris dissimilis* Desutter-Grandcollas, 1995;
- *Phalangopsis speluncae* (Mello-Leitão, 1937) is transferred to *Eidmanacris*.

Seven new species are described from the Atlantic Forest and Cerrado: *E. scopula* Campos, **sp. nov.**, *E. gigas* Campos, **sp. nov.**, *E. neomarmorata* Campos, **sp. nov.**, *E. desutterae* Campos, **sp. nov.**, *E. putuhra* Campos, **sp. nov.**, *E. fontanettiae* Nihei & de Mello, **sp. nov.** and *E. melloi* Campos, **sp. nov.**

The species *Eidmanacris longa* and *Eidmanacris marmorata* require more studies, once it was not possible to analyze these species in the present revision.

The description of the male of *Eidmanacris paramarmorata* is important for data complementation, since in Grylloidea the males are more informative than females for diagnostic characters and species delimitation.

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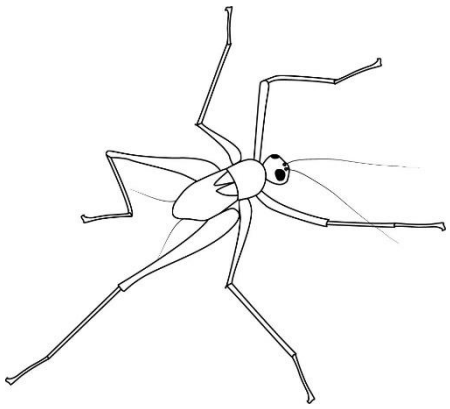
Chapter 2

Phylogenetic Analysis of *Eidmanacris*



Resumo

O conhecimento sistemático da superfamília Grylloidea tem passado por várias divergências ao longo dos anos, possivelmente devido à falta de estudos científicos para o grupo, principalmente os taxonômicos e sistemáticos. As primeiras filogenias propostas para grilos foram baseadas em modelos de especiação, comunicação acústica e diversificação do aparato estridulatório. Recentemente, filogenias de Orthoptera, Ensifera e Grylloidea, começaram a clarear seus relacionamentos. Assim, novos estudos filogenéticos de táxons menos abrangentes podem contribuir para o esclarecimento das relações nesses grandes grupos. Uma análise filogenética de *Eidmanacris* Chopard, 1956, gênero neotropical com 29 espécies, é apresentada aqui com 38 terminais, dos quais 12 fazem parte do grupo externo. Foram construídos 98 caracteres morfológicos, e as buscas utilizando a parcimônia como critério de otimização encontraram 11 árvores mais parcimoniosas. Uma segunda análise foi feita excluindo *E. paramarmorata* (94% de dados ausentes) e apenas uma árvore mais parcimoniosa foi encontrada. Os resultados das duas análises foram similares, tanto para os caracteres como para a topologia, exceto por uma politomia apresentada na árvore de consenso da primeira análise. Ambas as análises demonstraram *Eidmanacris* como um táxon monofilético incluindo o gênero *Endophallusia* de Mello, 1990, suportado por sete sinapomorfias e dividido em cinco clados principais. Mapas de distribuição desses clados também são apresentados aqui.

Palavras-chave: filogenia, grilo, *Eidmanacris*

Abstract

The systematic knowledge of the superfamily Grylloidea has experienced several divergences over the years, possibly due the lack of scientific studies on this group, mainly taxonomic and systematics. The first phylogenies proposed for crickets were based on models of speciation, acoustic communication and diversification of stridulatory apparatus. Recently, phylogenies of Orthoptera, Ensifera and Grylloidea, started to clarify their relationships. Thus, new phylogenetic studies of less inclusive taxa may contribute to clarify large groups. A phylogenetic analysis of *Eidmanacris* Chopard, 1956, is presented here with 38 terminals, 12 as outgroup. 98 morphological characters were constructed, with searches using parsimony as optimization criteria, obtaining 11 most parsimonious trees. A second analysis was performed excluding *E. paramarmorata* (94% of missing data), and only one most parsimonious tree was found. The results of the two analyses were similar, for the characters and for the topology, excluding one polytomy presented in the consensus tree of the first analysis. Both analyses showed *Eidmanacris* as a monophyletic taxon including the genus *Endophallusia* de Mello, 1990, with seven synapomorphies and five main clades. Distribution maps of these clades are also presented here.

Key-words: phylogeny, cricket, *Eidmanacris*

1. *Introduction*

The first phylogenies of crickets were based on groups used as models of speciation, acoustic communication and diversification of stridulatory apparatus (Huang *et al.*, 2000; Shaw, 2002; Desutter-Grandcolas, 2003; Robillard & Desutter-Grandcolas, 2004; Oneal *et al.*, 2010). Despite the phylogenies proposed by Desutter (1987, 1990) for the Neotropical Grylloidea, none of these phylogenies, aimed to a broad understanding about the relationships in Grylloidea.

Recently, Chintauan-Marquier *et al.* (2015) carried out a molecular phylogenetic analysis for this superfamily, establishing the relationships of its main lineages and proposing four monophyletic families in Grylloidea: Gryllidae, Mogoplistidae, Trigonidiidae and Phalangopsidae. The latter, wherein is allocated the genus *Eidmanacris* Chopard, 1956, was considered a subfamily of Gryllidae in the catalogue *Orthoptera Species Files* (Eades *et al.*, 2016).

Some phylogenetic studies have been performed for Phalangopsidae taxa. In the early 90's , Desutter-Grandcolas (1993a) described three genera (*Allochrates* Desutter-Grandcolas, 1993; *Ochraperites* Desutter-Grandcolas, 1993; *Tetragonia* Desutter-Grandcolas, 1993) and together with six other genera (*Acantoluzarida*, Deustter-Grandcolas, 1992; *Luzarida* Herbard, 1928; *Luzaridella* Desutter-Grandcolas, 1992; *Melanotes* Desutter-Grandcolas, 1993; *Palpigera* Herbard, 1928; *Stenotes* Desutter-Grandcolas, 1992) carried out a phylogenetic analysis for these taxa, which formed a monophyletic group.

In the same year, the author studied the cave fauna of Grylloidea from Chiapas (Mexico), and performed, for the first time, a phylogenetic analysis for the genus-group Amphiacustae (Desutter-Grandcolas, 1993b). In that study, she included in the analyses the genus *Amphiacusta* Sassure, 1874 and six new genera described in that paper, and also discussed about adaptation of these taxa in the cave environment.

Later, Desutter-Grandcolas (1997) proposed a new phylogenetic analysis with emphasis in the evolution of stridulatory apparatus, using only characters of forewings of two phalangopsid groups: the Amphiacustae and *Luzarida* group. The results revealed an unexpected complexity of acoustic communication for these crickets.

Souza-Dias (2015), in a recent phylogenetic analysis of Phalangopsidae, using 142 morphological characters and 55 terminals, corroborated the proposal of Desutter (1990),

in which *Eidmanacris* is grouped within Luzarinae. In that study, the author attested the monophyly of *Eidmanacris* supported by six synapomorphies from male genitalia, namely: 1- pseudepiphallic arm with basal projection; 2- ectophallic fold membranous; 3- medio-posterior projections of endophallic sclerite very elongate; 4- presence of a membrane between the median part of pseudepiphallus and the pseudepiphallic parameres; 5- endophallic sclerite flattened; 6- endophallic sclerite located anteriorly to the base of pseudepiphallic sclerite. *Eidmanacris* composed a monophyletic clade together with *Ottedana*, *Strinatia Adenopygus* Bolfarini & de Mello, 2012, *Bambuina* de Mello, Horta & Bolfarini, 2013 and *Endecous* Saussure, 1878.

Eidmanacris Chopard, 1956 comprises 27 described species, and is mostly distributed on Atlantic Forest and Cerrado areas, extending from south, southeast and midwest Brazilian regions, and beyond, reaching Bolivia and Paraguay. *Eidmanacris* species are active at night, and inhabit natural cavities as burrows, bounds, hollow trees trunks, cavities in rocks and caves.

According to Desutter-Grandcolas (1995a), the genus *Eidmanacris* presents five putative synapomorphies that possibly support its monophyly: 1- area of metanotal gland with a double row of bristles, and with a median projection on the anterior border of metanotum; 2- glandular area of metanotum with a pair of cylindrical vertical structures with open apex – character confirmed by images of scanning electron microscopy by Prado & Fontanetti (2005); 3- the inflated aspect of pronotum, resulting from the swelling of dorsal disc and elevation of lateral lobes; 4- pseudepiphallic arm clearly separated from the genitalia, very mobile; 5- ectophallic arc shifted to the back of the genitalia, reduced and opened. According to Mesa *et al.* (1998) species of *Eidmanacris* can be easily recognized from the male genitalia characters, although it is hard to identify them from female characters.

As reported by Desutter-Grandcolas (1995a), *Eidmanacris* can be related to the following genera based on features of the male phallic complex: *Aracamby* de Mello, 1992; *Cacruzia* de Mello, 1992; *Cophella* Herbard, 1928; *Koilenoma* Desutter-Grandcolas, 1993; *Lerneca* Walker, 1869*; Tairona*, Herbard, 1928; *Microlerneca* de Mello, 1995; *Prosthacusta* Saussure, 1974; *Grandcolasia* Koçak & Kemal, 2010 (=*Smicrotes* Desutter-Grandcolas, 1991); *Strinatia* Chopard, 1970. Posteriorly, de Mello & de Andrade (2003) complemented this information with other five Brazilian genera: *Endophallusia* de Mello, 1990; *Lernecopsis* de Mello, 1995; *Izecksohniella* de Mello, 1992; *Guabamima* de Mello, 1992; and *Ottedana* de Mello & de Andrade, 2003.

Although some studies have included *Eidmanacris* in higher level phylogenetic analysis or discussed its systematic placement and even its putative, no phylogenetic analysis has been carried out focusing the genus so far.

The aim of this chapter is to perform a phylogenetic analysis of the genus *Eidmanacris* based on morphological characters.

2. *Material and Methods*

2.1. *Examined material and ingroup selection*

The examined material belongs to the following institutions:

-MNHN – Muséum national d'Histoire naturelle, Paris, France. Curator, Dr. Laure Desutter-Grandcolas.

-MZSP – Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil. Curator, Dr. Eliana Marques Cancello.

-MZUEFS – Museu de Zoologia da Universidade Estadual de Feira de Santana, Bahia, Brazil. Curator, Dr. Freddy Bravo.

-Laboratório de Insetos do Departamento de Zoologia da UNESP de Botucatu, São Paulo, Brasil (UBTU). Curator, Dr. Francisco de Assis Ganeo de Mello.

-Laboratório de Orthopterologia da Universidade de Viçosa, Minas Gerais, Brazil (UFV). Curator, Dr. Carlos Frankl Sperber.

For the ingroup (Table 1), we included 27 species of *Eidmanacris* described until now, but excluding *Eidmanacris lencionii* Bolfarini, 2016, which was synonymized with *E. dissimilis* Desutter-Grandcolas, 1995 in the taxonomical revision of the genus, presented in the Chapter 1.

Due to the unavailability of material for *E. marmorata* (Bruner, 1916), *E. paramarmorata* Desutter-Grandcolas, 1995 and *E. longa* Gorochov, 2014, data were obtained from previous publications dealing with these species. High resolutions images of the holotypes of *E. paramarmorata* and *E. speluncae* (Mello-Leitão, 1937), available in the catalogue *Orthoptera Species Files* (Eades *et al.*, 2016) were used. The male genitalia drawings of *E. marmorata*, deposited in the collection of the Academy of Natural Sciences of Philadelphia (ANSP), was kindly provided by Dr. Francisco de Assis Ganeo de Mello.

The species *E. longa* has description and illustrations very similar to *E. marmorata* and these two species are from proximal localities. However, we consider premature to propose any nomenclatural act without reviewing the type material of these species. For this reason, both species were included in the phylogenetic analysis.

2.2. *Outgroup and rooting*

The tree rooting and character polarization were made through the outgroup method (Nixon & Carpenter, 1993).

The choice for the outgroup taxa were based on the phylogeny of Souza-Dias (2015), in which *Eidmanacris* was grouped in the subfamily Luzarinae. Four species of *Eidmanacris* were included in that phylogeny: *E. alboannulata* (Piza, 1960), *E. caipira* Souza-Dias, Campos & Nihei, 2015, *E. meridionalis* Desutter-Grandcolas, 1995 and *E. suassunai* Souza-Dias, Campos & Nihei, 2015. The outgroup taxa were selected from its sister-group clade*: Adenopygus heikoi* Bolfarini & de Mello, 2012; *Bambuina bambui*; *Guabamima lordelloi* de Mello, 1993; *Guabamima saiva*, 1993; *Melanotes ornata* Desutter-Grandcolas, 1993; *Ottedana cercalis*; *Strinatia brevipennis*; *Strinatia teresopolis* Mesa, 1999. All these taxa occur in the Atlantic Forest. We also include one taxon from Amazon Forest, an undescribed species of *Modestozara* (Table 2).

Melanotes ornata was used to root the trees. This choice is questionable and subject to discussion, since the relationships among Neotropical phalangopsids is still unknown. Excepting the recent phylogeny of Phalangopsidae, with emphasis on Luzarinae, and used as reference in this study (Souza-Dias, 2015), other recent analyses (Robillard & Desutter-Grandcolas, 2004; Chintauan-Marquier *et al.*, 2016), considered few taxa of Phalangopsidae from Neotropical region.

Table 1. Material examined for the ingroup taxa included in the phylogenetic analysis.

Taxon	**Analyzed material**	**Locality**
Eidmanacris larvaeformis (Chopard, 1938)	Type material MNHN	BR, Rio de Janeiro, Mendes
Eidmanacris alboannulata (Piza, 1960)	Type material MNHN and UBTU	BR, São Paulo, Itirapina, Fazenda da Toca
Eidmanacris dissimilis Desutter-Grandcolas, 1995	Type material MNHN; topotypes MZUEFS	BR, Minas Gerais, Poços de Caldas, Morro do Ferro
Eidmanacris fusca Desutter-Grandcolas, 1995	Not deposited material*	BR, Santa Catarina, Urubici; BR, Santa Catarina, São Bento do Sul
Eidmanacris meridionalis Desutter-Grandcolas, 1995	Type material MNHN; topotypes*	BR, Santa Catarina, Nova Teutônia
Eidmanacris multispinosa Desutter-Grandcolas, 1995	Type material MNHN; topotypes*	BR, Espírito Santo, Santa Teresa, Reserva Santa Lúcia
Eidmanacris septentrionalis Desutter-Grandcolas, 1995	Type material MNHN; topotypes UBTU	BR, Espírito Santo, Linhares, Reserva Natural Vale
Eidmanacris tridentata Desutter-Grandcolas, 1995	Type material MNHN; topotypes UBTU	BR, Espirito Santo, Santa Teresa, Reserva Santa Lúcia
Eidmanacris bidentata Sperber, 1998	Type material MZSP	BR, Minas Gerais, Viçosa, Mata da Biologia, UFV
Eidmanacris corumbatai Garcia, 1998	Type material MZSP	BR, São Paulo, Cerrado de Corumbatai
Eidmanacris bernardii Nihei & de Mello, 2015	Type material MZSP	BR, Goiás, Serra da Mesa
Eidmanacris caipira Souza-Dias, Campos & Nihei, 2015	Type material MZSP	BR, São Paulo, Teodoro Sampaio, Parque Estadual Morro do Diabo
Eidmanacris eliethae Nihei & de Mello, 2015	Type material MZSP and UBTU	BR, Rio de Janeiro, Rio das Ostras
Eidmanacris papaveroi Nihei & de Mello, 2015	Type material MZSP and UBTU	BR, Espirito Santo, Santa Teresa, Reserva Santa Lúcia

Eidmanacris simoesi Nihei & de Mello, 2015	Type material MZSP and UBTU	BR, Rio de Janeiro, Rio das Ostras
Eidmanacris suassunai Souza-Dias, Campos & Nihei, 2015	Type material MZSP	BR, São Paulo, Teodoro Sampaio, Parque Estadual Morro do Diabo
Eidmanacris speluncae (Mello-Leitão, 1937)	UBTU	BR, Minas Gerais, Santa Barbara
Eidmanacris scopula	UBTU	BR, Tocantins, Dianópolis
Eidmanacris gigas	MZSP	BR, Goiás, Pirenópolis
Eidmanacris neomarmorata	Not deposited material*	BR, Mato Grosso, Chapada dos Guimarães
Eidmanacris desutterae	Not deposited material*	BR, Mato Grosso do Sul, Aquidauna, Fazenda experimental da UEMS
Eidmanacris putuhra	MZSP e UBTU	BR, Minas Gerais, Viçosa
Eidmanacris fontanettiae	UBTU	BR, Espirito Santo, Santa Teresa
Eidmanacris melloi	UBTU	BR, São Paulo, São Luiz do Paraitinga

* Collected material previously deposited in the Laboratório de Sistemática e Biogeografia de Insecta. After the publication of these results, the material will be forwarded to the designated repositories.

Table 2. Material examined for outgroup taxa included in the phylogenetic analysis.

Taxon	**Analyzed material**	**Locality**
Melanotes ornata Desutter-Grandcolas, 1993	Type material MNHN and topotype	BR, Espírito Santo, Santa Teresa, Reserva Santa Lúcia.
Guabamima lordelloi de Mello, 1993	UBTU and not deposited material	BR, Bahia, Porto Seguro, Mata da CEPLAC; BR, Bahia, Una, Reserva Biológica de Una
Guabamima saiva de Mello, 1993	Type material MZSP	BR, Rio de Janeiro, Rezende, distrito de Penedo
Modestozara sp.	MNHN	Equador, Aguyacu; Equador, Fatima
Adenopygus heikoi Bolfarini & de Mello, 2012	Type material MZSP	BR, São Paulo, São José dos Campos, dist. São Francisco Xavier
Bambuina bambui de Mello, Horta & Bolfarini, 2013	Type material MZSP and UBTU	BR, Minas Gerais, Mariana, Gruta do Centenário
Ottedana cercalis de Mello & Andrade, 2003	Type material MZSP and UBTU	BR, São Paulo, Campos do Jordão
Strinatia brevipennis Chopard, 1970	Type material MNHN	BR, São Paulo, Iporanga, Gruta das Areias
Strinatia teresopolis, Mesa, 1999	Type material MZSP	BR, Rio de Janeiro, Teresópolis
Endophallusia minuta de Mello, 1990	Type material MZSP and UBTU	BR, Rio de Janeiro, Teresópolis
Endophallusia endophallica de Mello, 1990	Type material MZSP and UBTU	BR, Rio de Janeiro, Teresópolis

* Collected material previously deposited in the Laboratório de Sistemática e Biogeografia de Insecta. After the publication of these results, the material will be forwarded to the designated repositories.

2.3. *Characters and data matrix*

This study was based on external morphological characters of adult males and females, including genitalia. Autapomorphies were not considered because they are uninformative.

The criteria of homology adopted were the primary and secondary homology (De Pinna, 1991). Thus, the primary homology is based on similarity, in which the corresponding parts can be detected by a combination of observed similarities. The secondary homology is a result of the analysis, confirming or not the initial propositions of primary homologies.

Some of the constructed characters were based on previous studies (Desutter-Grandcolas, 1992, 1993; Robillard & Desutter-Grandcolas, 2004, Souza-Dias, 2015). In these cases, such characters were properly referenced to the original source. However, most characters were proposed for the first time due to the low number of cladistic studies in Phalangopsidae at the species level. The morphological terminology adopted, including the male phallic complex, follows Desutter (1987, 1990), Desutter-Grandcolas (2003) and Souza-Dias (2015).

The formulation of the characters follows Sereno (2007), with a logical structure composed by primary and secondary finders and its variables.

The data matrix (Table 5, appendix) was constructed with software *Mesquite* 3.04 (build 725) (Maddison & Maddison, 2015). Inapplicable characters were coded as "-" and not observed ones as "?".

2.3.1. Ultra-morphology of metanotal gland

The metanotal gland in *Eidmanacris* is an important source of characters (Prado & Fontanetti, 2005; Chapter 1) especially when using scanning electron microscopy (S.E.M.) for searching and analyzing these characters.

The sampled species of *Eidmanacris* for SEM analyses were: *E. alboannulata*, *E. bidentata*, *E. caipira*, *E. corumbatai*, *E. dissimilis*, *E fusca*, *E. larvaeformis*, *E. meridionalis*, *E. papaveroi*, *E. septentrionalis*, *E. simoesi*, *E. suassunai*, *E. tridentata*, *E. minuta*, *E. endophallica*, *E. speluncae*, *E. gigas*, *E. putuhra*, *E. fontanettiae* and *E. melloi*.

In addition, other species of closely related genera were sampled: *Adenopygus heikoi*, *Bambuina bambui*, *Guabamima lordelloi*, *Ottedana cercalis*, *Strinatia brevipennis*, *Strinatia teresopolis*. Due to reduced number of specimens, some species

were not analyzed through S.E.M. to not compromising the state of material. Thus, totalizing 26 species analyzed.

For scanning electron microscopy (SEM) analysis, a male specimen was dissected, having its forewing and thorax (including pronotum, mesonotum and metanotum) removed. 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).

2.4. *Data analysis*

Two data matrices were constructed, one with all the 38 terminals, and another one excluding the species *E. paramarmorata.* This species is known only by the female, and its inclusion in the analysis generated a large amount of missing data (94%), since the males provide the majority of characters.

The criterion used for the phylogenetic inference was the Fitch parsimony (1971), considering all the characters as unordered and with equal weights.

The software *TNT* 1.1 (Goloboff *et al.*, 2008) was used for the tree searches. The searches were made using the New Technologies, with 1000 replications, holding 100 trees by replicate, and using the followings searches algorithms: *Drift,* 200 substitutions per cycle; Tree-Fusing, 10 rounds; and Ratchet, 200 substitutions. The algorithm TBR (Tree Bisection Reconnection) was also initially used for searches with the new technologies.

After the analyses, the strict consensus tree was obtained in *TNT*, whenever the analyses found more than one most parsimonious tree.

The resulting trees and characters were visualized in the software *Winclada* (Nixon, 1994-2004), in which the consistency index (*ci*) (Kluge & Farris, 1969) and retention index (*ri*) (Farris, 1989) were calculated.

Ambiguous characters were optimized through the algorithms ACCTRAN (accelerated transformation optimization) (Farris, 1970), which attributes changes earlier on the tree, close to the root, to maximize homoplastic reversions, and DELTRAN (delayed transformation optimization) (Swafford & Maddison, 1987), which attributes changes away from the tree root, maximizing homoplasies explained by parallelisms.

However, as discussed in Agnarson (2004) and Agnarson & Miller (2008), these optimizations are used to describe the preferences of secondary gains or losses, although ACCTRAN will not necessarily result in secondary losses and DELTRAN in secondary gains. For that reason, in this study both optimizations were applied individually for each character.

The branch support was obtained through Bremer support (Bremer, 1994), which considers the number of extra steps necessary to collapse a particular branch of the consensus tree. The calculations were performed in *TNT*.

The obtained topologies were exported in vectorial format and edited in the software *Adobe Illustrator CS6*.

2.5. *Distributional data and maps*

All collected data were plotted on a map of South America and edited in the software *Quantum-gis* 2.10.

The distribution data of species were obtained from the literature (Chopard, 1938; Mesa & de Mello, 1985; Desutter-Grandcolas, 1995; Mesa *et al.* 1998; Gorochov, 2014; Souza-Dias *et al.*, 2015; Campos *et al.*, 2015; Bolfarini, 2016), from labels of studied specimens, and from the catalogue *Orthoptera Species File* (Eades *et al.*, 2016).

The biogeographical provinces proposed by Morrone (2014) were used to verify the pattern of distribution of the species. The shapefiles were provided by Löwenberg-Neto (2014).

3. *Results*

3.1. *Characters*

Ninety-eight (98) characters of external morphology were constructed, six from head, 22 from thorax (including forewings and metanotal gland), six from abdomen, four from legs, 54 from male genitalia and six exclusive from female (including copulatory papilla).

The list of characters, with their states and comments, when necessary, is presented below.

General Morphology

Head:

1 –Head, central ocellus, shape (Fig. 1A):

0- Elliptical;

1- Spherical;

2- Truncated inferiorly.

Character proposed by Robillard & Desutter-Grandcolas (2004) for the states "spherical" and "elliptical". Here we propose the state "truncated inferiorly", for the cases when the inferior border is broader than superior, resulting in a triangular ocellus.

2 – Head, frons, median vertical band (Fig. 1B):

0- Absent;

1- Present

Initially considered by Nihei (1997) as three-state character. Here, it was considered as different characters (characters 2 and 3).

3 – Head, frons, vertical bands below the eyes (Fig. 1B):

0- Absent;

1- Present.

4 – Head, antenna:

0- Not annulated;

1- Annulated;

2- Posterior half unpigmented (whitish)

This character is ambiguous to state 2, using ACCTRAN, antenna with posterior half unpigmented appears as a synapomorphy in the clade C, with reversion to state 1 in *E. septentrionalis*.

5 – Head, maxillary palpus, article 5, dorsal curvature (Fig. 1C):

0- Slightly curved;

1- Not curved;

2- Sharply curved.

The curvature degree of the fifth article differentiates the states “slightly curved” and “sharply curved” (see Fig. 1C).

6 – Head, maxillary palpus, article 5, area of sensillas, shape (Fig. 1C):

0- Rounded;

1- Truncated.

Ambiguous synapomorphy to state 1 (ACCTRAN).

Thorax:

7 – Thorax, pronotum, dorsal disk, lateral lobes:

0- Same color as dorsal face;

1- Different color of dorsal face.

Ambiguous synapomorphy for state 1. Through ACCTRAN optimization, the synapomorphy for state 1 indicates only one appearance of this feature and at least four reversions to state 0.

8 – Male, thorax, forewings, stridulatory file:

0- Present;

1- Absent.

9 – Male, thorax, forewings, constitution:

0- Pergameneous;

1- Coriaceous.

In addition to its constitution, the evident veins can identify the state pergaminous forewings, as in species of *Guabamima* and *Melanotes ornata*. The coriaceous forewings have a maximum of one evident vein separating dorsal field from a rudimentary lateral field and absence of stridulatory file, as in *Eidmanacris* species. Souza-Dias (2015) proposed this character.

10 – If 9(1), male, thorax, forewings, shape of apex in dorsal view (Fig. 1D):

0- Rounded;
1- Squared;
2- Triangular.

In dorsal view, the state "squared" occurs with the ventral convolution of apex of forewing, as in *Bambuina bambui*.

11 – Male, thorax, forewings, length related to posterior border of metanotum:

0- Reaching or surpassing;
1- Not reaching.

12 – Male, thorax, forewings, internal borders:

0- Overlapping internally;
1- Not overlapping;
2- Overlapping partially.

The state 0 occurs when the right forewing covers completely the left forewing as in *Melanotes ornata*, *Guabamima saiva* and *Guabamima lordelloi*.

13 – Male, thorax, forewings, ventral, apex, bristles:

0- Absent;
1- Present.

14 – Male, thorax, forewing, developed lateral field:

0- Present;
1- Absent.

15 – Male, thorax, metanotum, glandular area, lateral projection:

0- Absent;

1- Present (Fig. 1E).

Prado & Fontanetti (2005) initially proposed this character named as “median projections”. However, in the S.E.M. images obtained here, was possible to identify new projections located between them. I propose here to name the “median projections” of Prado and Fontanetti (2005) as “lateral projections”. Therefore, it can be possible to name this central projection as “median projection” (character 21).

16 – If 15(1), male, thorax, metanotum, glandular area, lateral projection, surface (Fig. 2A):

0- Smooth;

1- Striated;

Character confirmed by S.E.M. This character appears as ambiguous in the clade *E. caipira* + *E. bernardii* because there is missing data in *E. bernardii*. It is suggested here the emergence of “striated” condition only in *E. caipira* (DELTRAN). However, it is not possible to confirm that *E. bernardii* has the same condition without examining with S.E.M. (feature shared between these two terminals if optimization was using ACCTRAN).

17 – If 15(1), male, thorax, metanotum, glandular area, lateral projections, shape:

0- Longer than wide (Fig. 2Da);

1- As long as wide (Fig. 2Ba).

This character presents a synapomorphy for the state 1 and ambiguity for the state 0 in the clade *E. scopula* + *E. desutterae*. Here, using DELTRAN occurs a second emergence of state 0 only in *E. desutterae*, since *E. scopula* does not present lateral projections.

18 – If 15(1) and 17(1), male, thorax, metanotum, glandular area, median projections as long as wide, shape:

0- Cylindrical;
1- Conical.

As the clade *E. scopula* + *E. desutterae* has not the condition “as long as wide” of character 17, it generates an ambiguity to clade E not sharing state 1. In this situation was adopted DELTRAN that suggests the emergence of this condition in the clade posteriorly.

19 – If 15(1), male, thorax, metanotum, glandular area, lateral projections, position:

0- Directed to pronotum (Fig. 2Bb);
1- Convergent (Fig. 2Db);
2- Parallel to each other (Fig. 2Ba).

Ambiguous character to state 0 in the clade *E. scopula* +*E. desutterae*. As *E. scopula* do not has lateral projections (inapplicable character) the secondary emergence for this condition is only to *E. desutterae* (DELTRAN).

20 – If 15(1), male, thorax, metanotum, glandular area, lateral projections, internal lateral latero-internal borders (Fig. 2B):

0- Not fused;
1- Partially or completely fused.

Here occurs the same situation of the previous character. The absence of lateral projections in *E. scopula* generates ambiguity for state 1 in the clade *E. scopula* + *E. desutterae*. The emergence occurs only in *E. desutterae* (DELTRAN).

21 – If 15(1) and 20(0), male, thorax, metanotum, glandular area, median projection:

0- Absent;
1- Present (Figs 2C, D).

This character is ambiguous in the clade A. As neither *E. fusca* nor *Endophallusia endophallica* have metanotal structures, this condition appears after *E. fusca* in clade A

(DELTRAN). The presence of median projection occurs once more in the clade D but very reduced, as explicit in the next character (character 22).

22 – If 15(1), 20(0) and 21(1), male, thorax, metanotum, glandular area, median projection, development related to lateral projections:

0- Same-sized or bigger than lateral projections (Fig. 2D);
1- Very reduced, visible only with S.E.M. (Fig. 2C).

As many terminals do not present median projection, this character is ambiguous. Here it is preferable to consider the state 1 as synapomorphy of clade D (DELTRAN), than his previous appearance (ACCTRAN) in taxa without median projection.

23 –If 15(1), 20(0), 21(1) and 22(0), male, thorax, metanotum, glandular area, glandular area, median projection not reduced, shape (Fig. 2D):

0- Elongated;
1- Longitudinal crest.

The situation is the same as the previous character, however, occurs in the clade A. So, the state 1 is considered as a synapomorphy for the clade A except for *E. fusca* and *Endophallusia endophallica* because these terminals do not have metanotal structures (DELTRAN).

24 – Male, thorax, metanotum, glandular area, anterior border, median crest pronounced:

0- Absent;
1- Present (Fig. 1E).

The fold of the anterior border of metanotum contributes to the formation of this crest.

25 – If 24(1), male, thorax, metanotum, glandular area, anterior border, median crest pronounced, bristles:

0- Present (Fig. 1Ea);
1- Absent (Fig. 1Eb).

In many situations, was possible to observe adhered secretions in these bristles. Together with the metanotum bristles (character 27), they apparently have the function of retaining the secretions released in the median crest.

26 – If 24(1) and 25(0), male, thorax, metanotum, glandular area, anterior border, median crest pronounced, bristles, direction:

0- Antero-posterior (Fig. 3A);
1- Lateral (Fig. 1Ea).

This character was proposed by Prado & Fontanetti (2005).

27 – Male, thorax, metanotum, glandular area, bristles:

0- Absent;
1- Present (Fig. 2D).

This character appears as synapomorphy before *Ottedana cercalis* for state 0 through ACCTRAN. The loss of bristles in the metanotum happened six times: *Strinatia teresopolis, E. fusca, Endophallusia endophallica, E. tridentata, E. bidentata* and in the clade *E. scopula* + *E. desutterae*. The loss of these bristles could be associated to a little or no use of the secretions liberated in the metanotal region, not requiring the retention of these secretions.

28 – If 27(1), male, thorax, metanotum, glandular area, bristles, quantity:

0- Occupying the anterior half of metanotum;
1- Occupying all the metanotum.

As in the previous character, it can be a relation between the bristles in the metanotum and the amount of secretion released there. We suppose that the greater the amount of bristles, the greater the retention and availability of substances to female during copulation as nuptial gift. Thus, extending the time for the transference of sperma through spermatophore, and increasing their reproductive success.

Abdomen:

29 – Male, abdomen, dorsum, sagittal line:

0- Absent;

1- Present (Fig. 3B).

30 – If 29(1), male, abdomen, dorsum, sagittal line, width:

0- Not occupying more than half of dorsal region

1- Occupying more than half of dorsal region (Fig. 3B).

As *E. fusca* does not has a visible sagittal line, the appearance of condition 1 as synapomorphy for the clade *E. melloi* + *Endophallusia endophallica* + *Endophallusia minuta* through DELTRAN, is better explained than if it appears to all the clade A (ACCTRAN).

31 – Male, abdomen, supra anal plate, median constriction (Fig. 3C):

0- Absent;

1- Present.

32- Male, abdomen, supra anal plate, latero-posterior projections:

0- Absent;

1- Present (Fig. 3C).

33 – If 32(1), male, abdomen, supra anal plate, latero-posterior projections, length related to posterior border of the plate (Fig. 3C):

0- Shorter;

1- Same size or longer.

34 – Male, abdomen, subgenital plate, posterior border (Fig. 3D):

0- Bilobated;

1- Straight.

Legs:

35 – Tibia I, external auditory tympanum:

0- Present;

1- Absent.

36 – Tibia II, dorsal apical spurs, outer:

0- Present (Fig. 3E);

1- Absent.

The loss of the outer apical spur of tibia II is considered as a synapomorphy, through ACCTRAN before *Guabamima* species. The emergence of this spur occurs two times, in *Adenopygus heikoi* and *Ottedana cercalis*.

37 – Tibia II, dorsal apical spur, inner:

0- Present (Fig. 3E);

1- Absent.

38 – Tibia III, inner apical spurs, length (Fig. 3F):

0- Dorsal longer than median;

1- Median clearly longer than dorsal;

2- Median and dorsal almost same-sized.

Although the outer apical spurs of tibia III are reduced in relation to the internal, they show the same morphological pattern of size mentioned in this character in all the analyzed terminals in this study. Therefore, we believe that the development of inner and outer spurs of tibia III should be related. Thus, we decided not to propose other character for the outer apical spurs of tibia III. This character was proposed by Robillard & Desutter-Grandcolas (2004).

The state 0 appears only one time through ACCTRAN, and state 1 three times. If the state 0 appears twice (DELTRAN), the state 1 would appear at least four times, which we consider to be less probably than the first option.

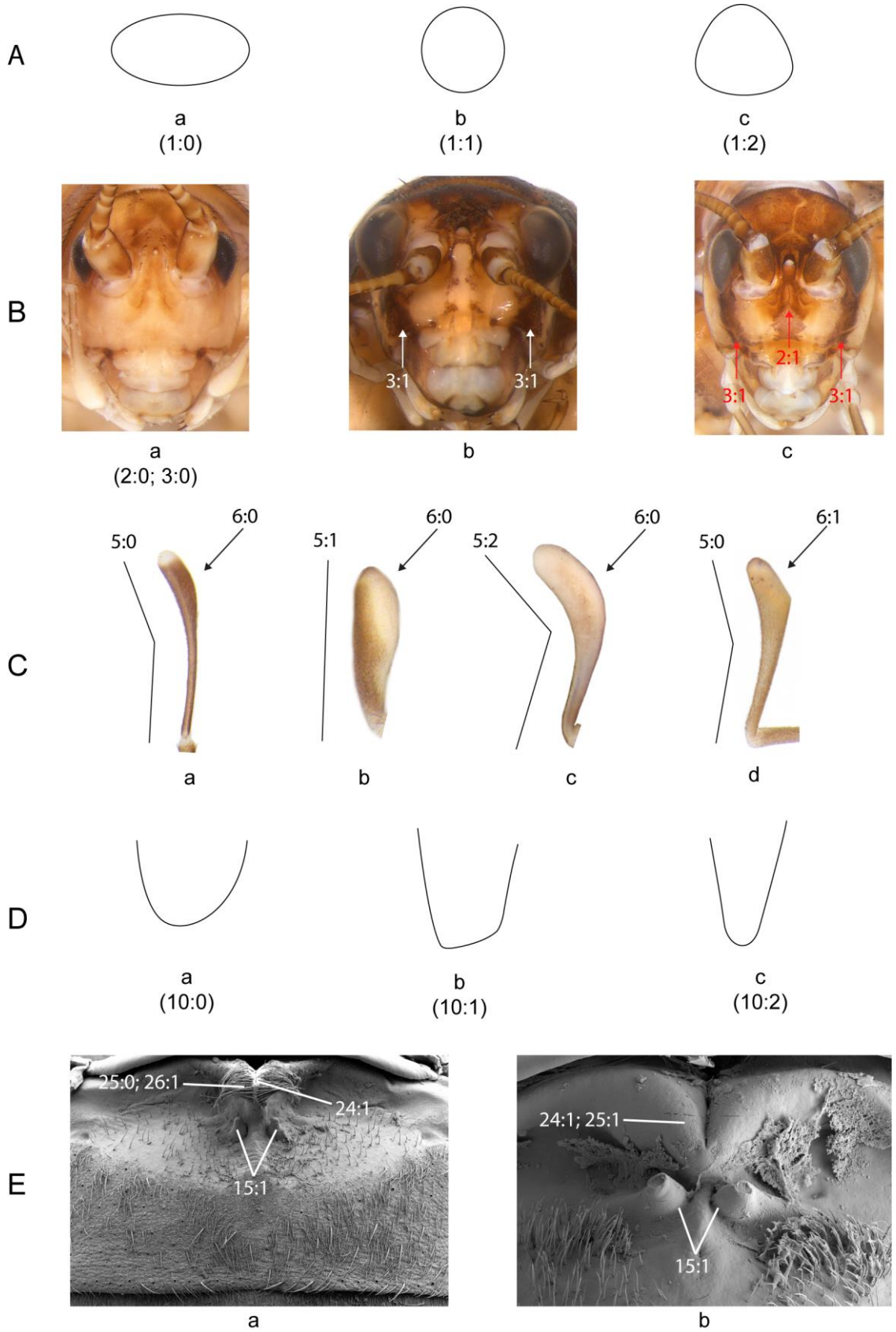


Figure 1. A- Shape of median ocellus in frontal view: **a**- elliptical, **b**- spherical, **c**- inferiorly truncated; **B**- Frontal head: **a**-*Strinatia teresopolis*, **b**-*Guabamima lordelloi*, **c**-*Eidmanacris larvaeformis*; **C**- Palpus, 5th article: **a**-*Eidmanacris meridionalis*, **b**-*Adenopygus heikoi*, **c**-*Endophallusia endophallica*, **d**-*Strinatia teresopolis*; **D**- Apex of forewings, in dorsal view: **a**-rounded, **b**-squared, **c**-triangular; **E**- Male metanotum, dorsal: **a**-*Eidmanacris larvaeformis*, **b**-*Eidmanacris simoesi*.

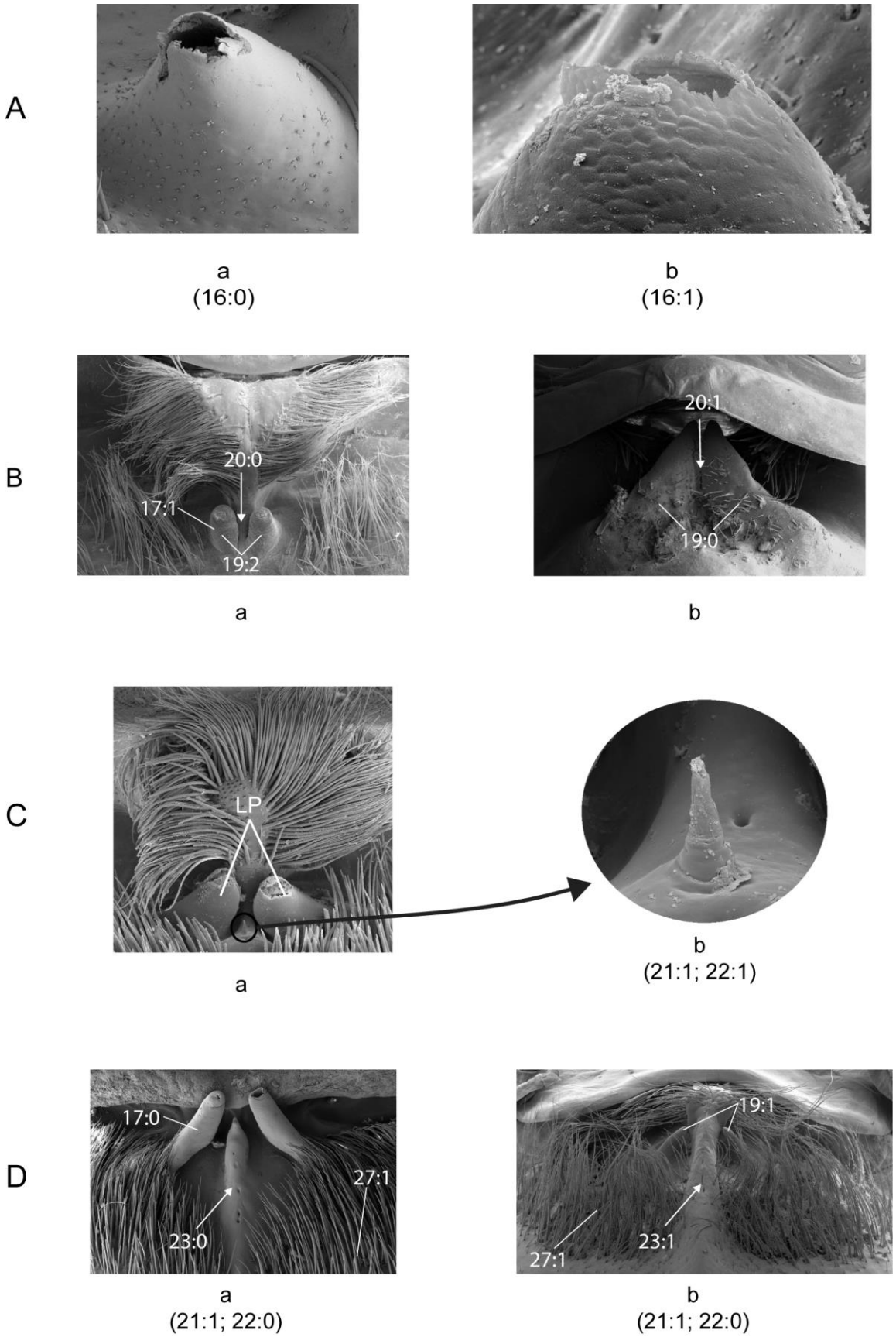


Figure 2. A- Lateral projections of males' metanotal gland: **a**-*Eidmanacris meridionalis*, **b**-*Eidmanacris septentrionalis*; **B**-Metanotum, dorsal **a**-*Eidmanacris caipira*, **b**-*Adenopygus heikoi*; **C**-*Eidmanacris meridionalis*: **a**-antero-median crest and lateral projections, **b**-median projection; **D**- Metanotum, dorsal: **a**-*Strinatia brevipennis*, **b**-*Eidmanacris melloi*

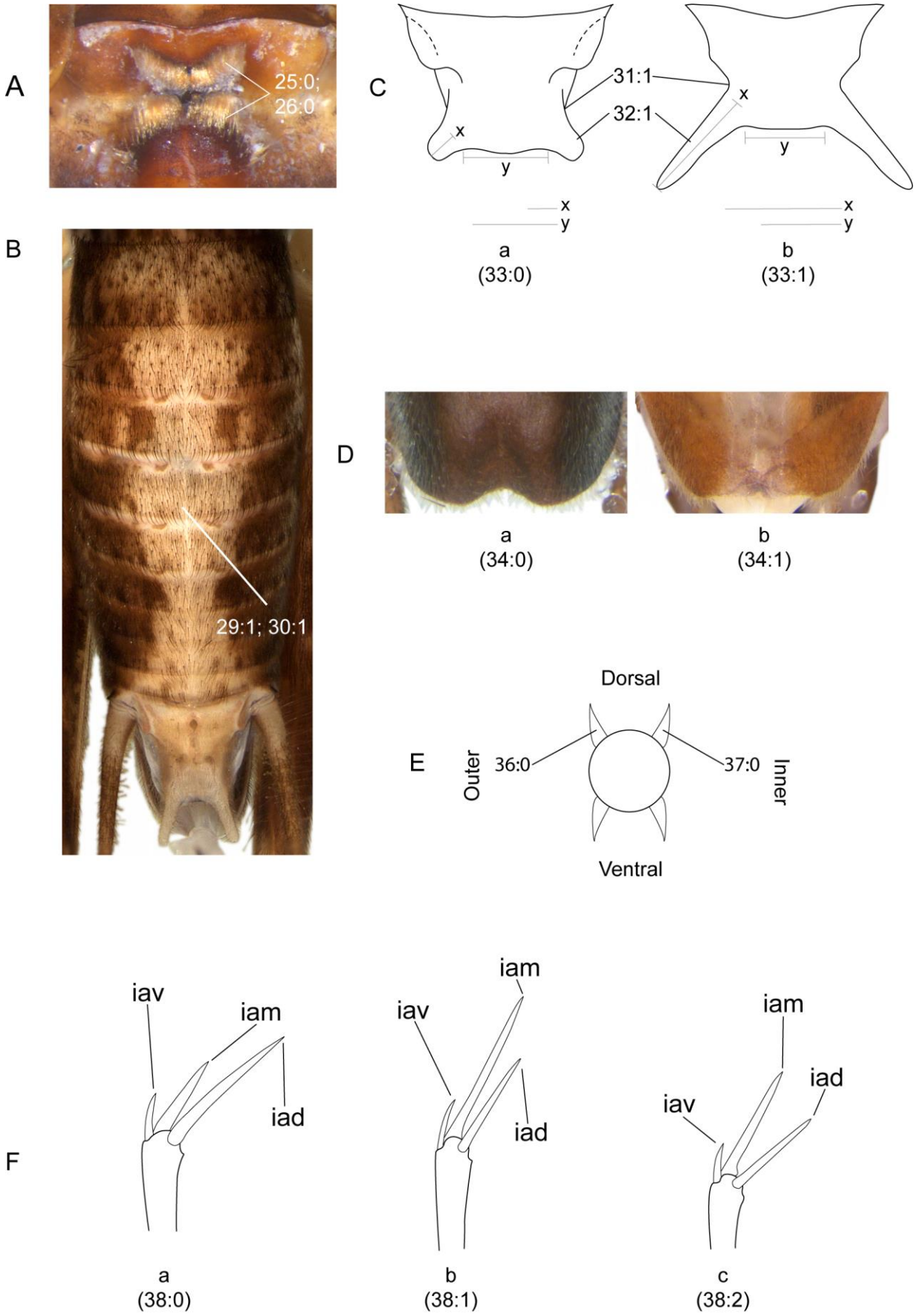


Figure 3. A- *Eidmanacris scopula*, males' metanotum dorsal; **B**- *Endophallusia endophallica*, abdomen dorsal; **C**- Supra anal plate: **a**-*Eidmanacris dissimilis*, **b**-*Eidmanacris alboannulata;* **D**- Subgenital plate, posterior border: **a**-*Eidmanacris fusca*, **b**-*Eidmanacris larvaeformis*; **E**- Apical spurs of tibia II; **F**- Apical spurs of tibia III: **a**- dorsal longer than median, **b**-median longer than median, **c**- dorsal and median sub-equals.

Female exclusive characters

39 – Female, thorax, wings (Fig. 4A):

0- Visible;

1- Under the posterior border of pronotum, very reduced.

The species that presents the state 1 were described initially without wings in females. However, as mentioned by Souza-Dias *et al*. (2015), the wings are present in females of *Eidmanacris* species in a very reduced form. They are located under the posterior border of the pronotum. Except in *Melanotes ornata*, *Guabamima saiva* and *Guabamima lordelloi*, the other species of subfamily Luzarinae analyzed in this study have the same condition.

40 – Female, abdomen, subgenital plate, posterior border, central invagination:

0- Present (Fig. 4B);

1- Absent.

41 – If 40(0), female, abdomen, subgenital plate, posterior border, central invagination in relation to median region of the plate (Fig. 4B):

0- Only at the posterior border;

1- Close or reaching the median part.

42 – Female, abdomen, ovipositor, apex in dorsal view (Fig. 4C):

0- Pointed, arrow shaped;

1- Straight;

2- Curved.

43 – Female, copulatory papilla, posterior aperture (Fig. 4D):

0- Inconspicuous;

1- Large.

44 – Female, copulatory papilla, dorsal, median furrow:

0- Absent;

1- Present (Fig. 4E).

The presence of median furrow appears once through ACCTRAN, supporting the loss of this condition in the genus *Eidmanacris*.

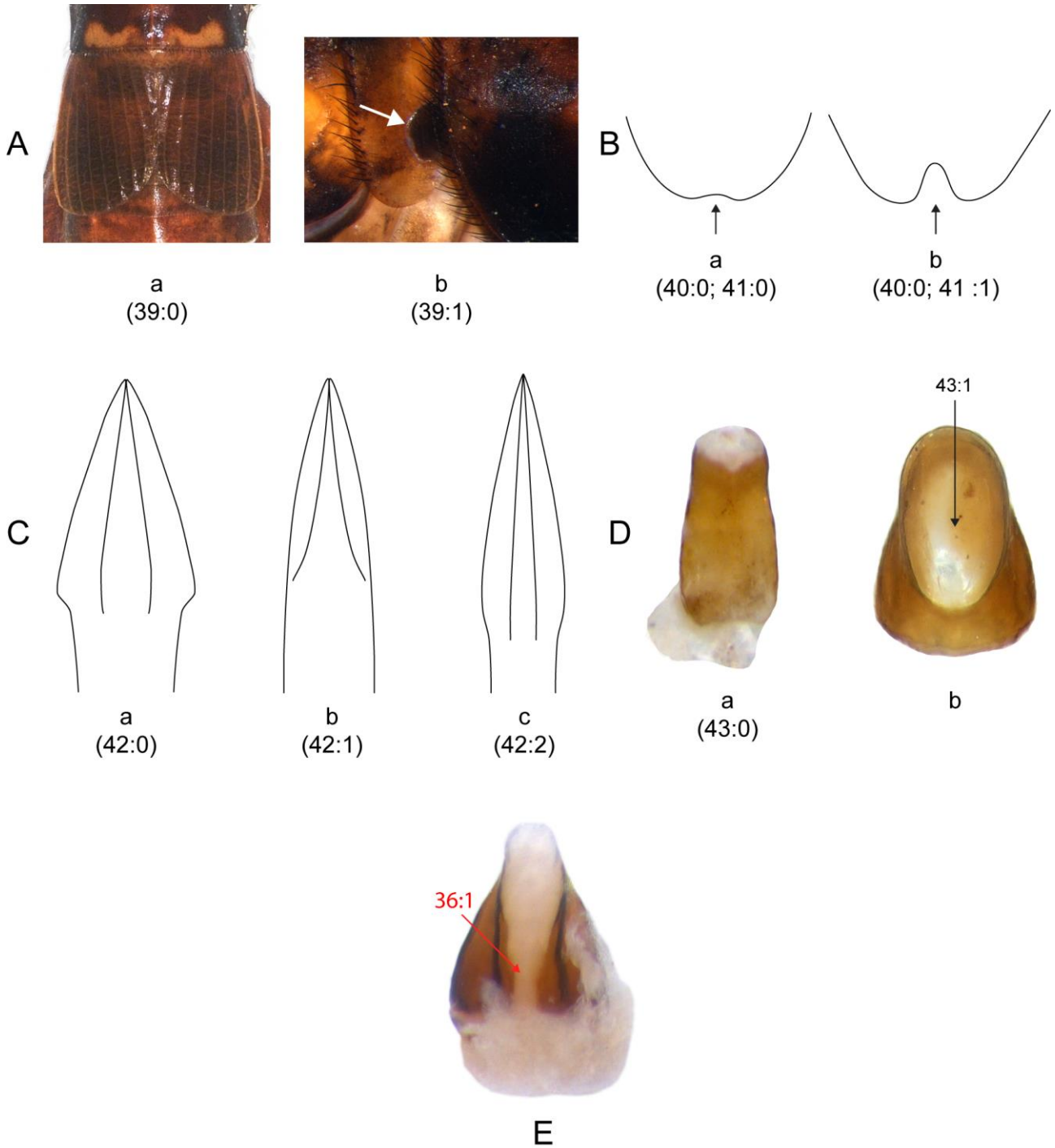


Figure 4. A- Female, tegmina: **a**-*Melanotes ornata*, **b**-*Eidmanacris suassunai*; **B**- Female, median invagination of subgenital plate: **a**-only at the posterior border, **b**-close or reaching the median part; **C**-Apex of ovipositor: **a**- pointed, **b**- straight, **c**- curved; **D**- Copulatory papilla, dorsal: **a**-*Eidmanacris septentrionalis*, **b**-*Eidmanacris gigas*; **E**- *Strinatia teresopolis*, copulatory papilla, dorsal.

.

Male genitalia

45 – Male, phallic complex, pseudepiphallus, rami:

0- Present (Fig. 5A);

1- Absent.

46 – Male, phallic complex, pseudepiphallus, base of pseudepiphallic sclerite, median third related to lateral thirds (Fig. 5B):

0- Same width;

1- Narrower.

The condition 1 of this character refers to the depression that occurs in the median part of the base of pseudepiphallic sclerite.

47 – Male, phallic complex, pseudepiphallus, pseudepiphallic arm, position related to the base of pseudepiphallic sclerite, in lateral view (Fig. 5C):

0- Slightly upcurved;

1- Straight;

2- Upcurved, forming a 90° angle.

48 – Male, phallic complex, pseudepiphallus, pseudepiphallic arm, position related to pseudepiphallic parameres, in dorsal view:

0- Ventral (Fig. 5A);

1- Lateral (Fig. 5D);

2- Dorsal (Fig. 5E).

State 0 appears as an autapomorphy for *Melanotes ornata* through ACCTRAN.

49 – Male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, curvature in dorsal view (Fig. 5D):

0- Not curved inwards;

1- Curved inwards.

The State 1, curved inwards, refers to the apex with an internal 90° angle or less curvature. This state is one of the synapomorphies that supports the clade A.

50 – Male, phallic complex, pseudepiphallic arm, apex, width related to the base of the arm, in lateral view (Fig. 5F):

0- Narrow or same width;

1- Wider.

51- Male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, bristles:

0- Absent;

1- Present.

52 – Male, phallic complex, pseudepiphallic arm, apex, superior projection:

0- Absent;

1- Present (Fig. 6A).

The superior projection of the apex of pseudepiphallic arm is located through its characteristic bristles. From this projection is possible to determine the remain projections (Figs. 10-18). This projection is present in all studied taxa, except in *Melanotes ornata*, *Guabamima lordelloi* and *Guabamima saiva*.

53 – If 52(1), male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, superior projection, shape:

0- Not modified (Fig. 10A1);

1- Reduced to a spine (Fig. 6A);

2- Upcurved hook (Figs. 16A1-D1).

The reduction of the superior projection to a spine (state 1) appears as a synapomorphy through ACCTRAN for the clades D + E, with two reversions for *E. dissimilis* + *E. meridionalis*, and other to *E. desutterae*. If this condition appeared posteriorly, it emerged three times (DELTRAN).

54 – Male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, supero internal projection:

0- Absent;
1- Present (Fig. 6A).

This is the projection of the apex of pseudepiphallic arm internal to the superior projection (character 52). We named “supero-internal” because in some taxa occurs two internal projections: supero-internal and infero-internal (character 56).

The supero-internal projection appears twice (ACCTRAN) with two reversions in *Endophallusia endophallica* and *E. bidentata*.

55 – If 54(1), male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, supero-internal projection, form:

0- Not modified;
1- Serrulated (Figs. 6Cb; 11A2, D2);
2- Reduced to a spine (Fig. 6A).

56 – Male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, infero-internal projection:

0- Absent;
1- Present (Fig. 6A).

This projection is located inferiorly to the supero-internal projection (character 54).

57 – Male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, inferior projection:

0- Absent;
1- Present (Fig. 6A).

As the name suggests, this projection is inferior to the superior projection. It can be determined in lateral view.

58 – If 57(1), male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, inferior projection, curvature:

0- Not curved;

1- Upcurved hook (Fig. 6A).

59 – If 57(1), male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, inferior projection, position in ventral view:

0- Straight;

1- Curved inwards (Fig. 7A, B; 10H4).

60 – Male, phallic complex, pseudepiphallus, pseudepiphallic arm, apex, ventral projection:

0- Absent;

1- Present (Fig. 6A).

This projection appears in three taxa: *E. corumbatai*, *E. gigas* and *E. desutterae*. It is a characteristic structure anterior to the inferior projection (character 57) and curved internally. It is better observed in ventral view.

61 – If 60(1), male, phallic complex, pseudepiphallus, pseudepiphallic arms, apex, ventral projection, length in lateral view:

0- Almost the same width of pseudepiphallic arm (Fig. 15D5);

1- Reaches median region of the phallic complex (Fig. 12H5).

Only the taxa *E. corumbatai*, *E. gigas* and *E. desutterae* have this ventral projection, as commented in the previous character (character 60). Therefore, these taxa generate ambiguity in this character. If the state 1 appears before in the cladogram (ACCTRAN) is considered to *E. corumbatai*, *E. gigas*, *E. caipira*, *E. bernardii*, *E. marmorata*, *E. longa* and *E. neomarmorata*. However, only *E. corumbatai* and *E. gigas* have ventral projection. It is preferable that condition 1 appears just to these two taxa as a synapomorphy (DELTRAN).

62 – Male, phallic complex, pseudepiphallus, lateral projection of pseudepiphallic sclerite:

0- Absent;

1- Present (Fig. 5C).

The presence of this character is one of the synapomorphies that sustains the clade E as monophyletic. This is a very characteristic structure, located in the delimitation between the base of pseudepiphallic sclerite and pseudepiphallic arm. Visible in lateral view.

63 – If 62(1), male, phallic complex, pseudepiphallus, lateral projection of pseudepiphallic sclerite, apex (Fig. 5C):

0- Pointed;

1- Rounded.

64 – Male, phallic complex, pseudepiphallus, anterior projection of pseudepiphallic sclerite:

0- Absent;

1- Present (Figs. 5B, E).

Named as “ventral projection of pseudepiphallic sclerite” by Souza-Dias (2015), we consider this structure as “anterior”. It is the first part of the pseudepiphallic sclerite, in some situations with the base. We do not consider as a ventral structure because in some situations it is centralized in lateral view, as in *E. larvaeformis*.

Although occupy a similar place than rami, this structures are not homologue. The anterior projections are integral structures of the pseudepiphallic sclerite.

This character is one of the mains synapomorphies of *Eidmanacris* contributing to the genus monophyly.

65 – Male, phallic complex, pseudepiphallus, sclerite A, size related to pseudepiphallic arm in dorsal view:

0- Shorter than half;

1- Longer than half.

The ambiguity of this character is solved through ACCTRAN, that becomes the state 1 in a synapomorphy. The State 0 appears a second time in *Ottedana cercalis*.

66 – Male, phallic complex, pseudepiphallus, sclerite A, connection with dorsal lobe of pseudepiphallic paramere (PsP2) (Fig. 6B):

0- Not continuous;

1- Continuous.

Although the state 1 appears as synapomorphy using DELTRAN, in this situation we choose ACCTRAN, considering both states as homoplasies. In the first situation, the character 0 appears six times while in the second, just five. In the clade D that had the ambiguity, the state 1 appear just once through ACCTRAN.

67 – Male, phallic complex, pseudepiphallus, pseudepiphallic parameres, dorsal and ventral lobes (PsP2 and PsP1, respectively), connection:

0- Sclerotized;

1- Not sclerotized.

The pseudepiphallic parameres are highly variable structures, and the main clasping devices among Grylloidea. In Phalangopsidae, mainly in Luzarinae, each pseudepiphallic paramere is divided in two lobes (or projections), one pair usually ventrally visible (PsP1), while the other are apical, dorsally visible (PsP2).

In this study, only *Eidmanacris* and *Endophallusia* species have a membranous connection between these two lobes.

For more information about the pseudepiphallic parameres in Grylloidea and in Phalangopsidae see Souza-Dias *et al.* (2015) and references therein.

68 – Male, phallic complex, pseudepiphallus, pseudepiphallic parameres, dorsal lobe (PsP2), shape (Fig. 6C):

0- Rounded;

1- Elongate.

The state “rounded” refers to the apical region of the pseudepiphallic paramere. This occurs in *Guabamima lordelloi*, *Guabamima saiva*, *Modestozara* sp. and *Melanotes ornata*.

69 – Male, phallic complex, pseudepiphallus, pseudepiphallic parameres, dorsal lobe (PsP2), apex in lateral view:

0- Not pointed;
1- Pointed (Fig. 5C).

70 – If 69(1), male, phallic complex, pseudepiphallus, pseudepiphallic parameres, dorsal lobe (PsP2), pointed apex in lateral view:

0- Single;
1- Bifid.

71 - Male, phallic complex, pseudepiphallus, pseudepiphallic parameres, dorsal lobe (PsP2), inner face, membranous spheres:

0- Absent;
1- Present (Fig. 6B).

These spheres are recognizable because they are punctuated. They are located on the inner face of PsP2. According to de Mello & Andrade (2003) these spheres may function as claspers, holding the female copulatory papilla by hydraulic pressure. There is a brief discussion about this structure on the item **4.3**.

72 – Male, phallic complex, pseudepiphallus, pseudepiphallic parameres, ventral lobe (PsP1), length related to ectophallic apodeme (Fig. 6D):

0- Shorter;
1- Same size or longer.

73 – Male, phallic complex, pseudepiphallus, pseudepiphallic parameres, ventral lobe (PsP1), accentuated sclerotization (Fig. 7A):

0- Complete or almost complete;
1- Only on the inner margin.

74 – Male, phallic complex, pseudepiphallus, pseudepiphallic parameres, ventral lobe (PsP1), up curvature in lateral view (Fig. 7B):

0- Forming an angle greater than 90°;
1- Forming a 90° angle.

75 – Male, phallic complex, ectophallic invagination, ectophallic arc, position in dorsal view (Fig. 7C):

0- Anterior or below the base of pseudepiphallic sclerite;
1- Posterior to the base of pseudepiphallic sclerite.

Ambiguous character to the clade of *Eidmanacris* through ACCTRAN. This character was proposed in other phylogenetic studies in Grylloidea (Desutter-Grandcolas, 1993a; Nihei, 1997; Robillard & Desutter-Grandcolas,1993, Souza-Dias, 2015).

76 – If 75(1), male, phallic complex, ectophallic invagination, ectophallic arc, posterior to the base of pseudepiphallic sclerite in dorsal view (Fig. 7C):

0- Not surpassing the anterior half of pseudepiphallic arm;
1- Surpassing the anterior half of pseudepiphallic arm.

77 – Male, phallic complex, ectophallic invagination, ectophallic arc, shape in dorsal view (Fig. 7C):

0- Convex;
1- “V” shaped;
2- Straight.

78 – Male, phallic complex, ectophallic invagination, ectophallic apodeme, length related to pseudepiphallic arm in dorsal view (Fig. 7D):

0- Shorter;
1- Same size or longer.

79 – Male, phallic complex, ectophallic invagination, ectophallic apodeme, shape:

0- Not flattened;
1- Flattened.

80 – If 79(1), Male, phallic complex, ectophallic invagination, ectophallic apodeme, orientation:

0- Not curved;
1- Curved (Fig. 7Ca).

The state “curved” refers the torsion of the apodeme. It is better visible in lateral view.

81 – If 79(1) and 80(0), Male, phallic complex, ectophallic invagination, ectophallic apodeme, proximal region in dorsal view:

0- Not enlarged;
1- Enlarged (Fig. 8A).

82 – Male, phallic complex, ectophallic invagination, ectophallic apodeme, apex orientation:

0- Divergent (Fig. 7Da)
1- Straight (Fig 7Db);
2- Convergent (Fig. 7Ca);

83 – Male, phallic complex, ectophallic invagination, ventral posterior projection, orientation (Fig. 8C):

0- Straight;
1- Curved externally;
2- Curved internally.

Through the determination of this structure is possible to locate the pseudepiphallic paramere, since they are closely related.

84 – Male, phallic complex, ectophallic fold:

0- Not entirely membranous;
1- Membranous.

85 – If 84(1), male, phallic complex, ectophallic fold, subapical margins laterally inflated:

0- Absent;

1- Present (Fig. 8B).

86 – Male, phallic complex, ectophallic invagination, sclerotized dorsal projection:

0- Present (Fig. 8A);

1- Absent.

This structure is posterior to the ectophallic arc. It is also visible in *Modestozara* sp. but not coded here because it is a membranous structure (autapomorphy for *Modestozara* sp.). This structure is visible in other Luzarinae genera, as *Endecous*.

87 – If 86(0), male, phallic complex, ectophallic invagination, sclerotized dorsal projection, size:

0- Longer than wide, or as long as wide;

1- Wider than long.

88 – If 86(0), male, phallic complex, ectophallic invagination, sclerotized dorsal projection, posterior border concavity (Fig. 8D):

0- Present;

1- Absent.

89 – If 86(0) and 88(0), male, phallic complex, ectophallic invagination, sclerotized dorsal projection, posterior border concavity (Fig. 8D):

0- Only on posterior border;

1- Reaching the median region of the structure.

90 – Male, phallic complex, endophallus, endophallic apodeme, form:

0- Lamellar (Fig. 9B);

1- Crest (Fig. 9A).

Despite state 1 appears as a synapomorphy for *Eidmanacris* in our analysis, it is not exclusive of this genus. This character also appears in Eneopterinae taxa (Robillard & Desutter-Grandcolas, 2004).

91 – If 90(0), male, phallic complex, endophallus, endophallic apodeme, lamellar:

0- Paired (Fig. 9B);

1- Single.

92 – If 90(1), male, phallic complex, endophallus, endophallic apodeme, crest, form:

0- Flattened (Fig. 9A; 9C).

1- Not Flattened.

93 – If 90(1), male, phallic complex, endophallus, endophallic apodeme, crest, size:

0- Longer than wide (Fig. 9A);

1- As long as wide (Fig. 9C).

This character is not applied on outgroup taxa, there is an ambiguity because of this. State 1 appears as synapomorphy for the clade A (ACCTRAN).

94 – Male, phallic complex, endophallic sclerite, median posterior projection:

0- Absent;

1- Present (Fig. 9A).

95 – If 94(1), male, phallic complex, endophallic sclerite, median posterior projection, size:

0- Short, not surpassing half of ectophallic fold (Fig. 6Db);

1- Long, through all ectophallic fold (Fig. 9A).

State 1 is characteristic to *Eidmanacris* and E*ndophallusia*. There is a hyper development of this structure along with ectophallic fold in *Endophallusia endophallica*. This character was proposed by Souza-Dias (2015).

96 – If 94(1) and 95(1), male, phallic complex, endophallic sclerite, median posterior projection, lateral thickening:

0- Absent (Fig 9Da);

1- Present (Fig. 9A, Db, Dc).

97 – If 94(1), 95(1) and 96(1), male, phallic complex, endophallic sclerite, median posterior projection, lateral thickening, position (Fig. 9D):

0- Anterior;

1- Median.

This character appears as ambiguous because it is present only in clades D and E, becoming inapplicable for the other terminals. The median lateral thickening is a synapomorphy for clade E (ACCTRAN).

98 – Male, phallic complex, endophallic sclerite, latero-posterior lobes (Fig. 9A):

0- Absent;

1- Present.

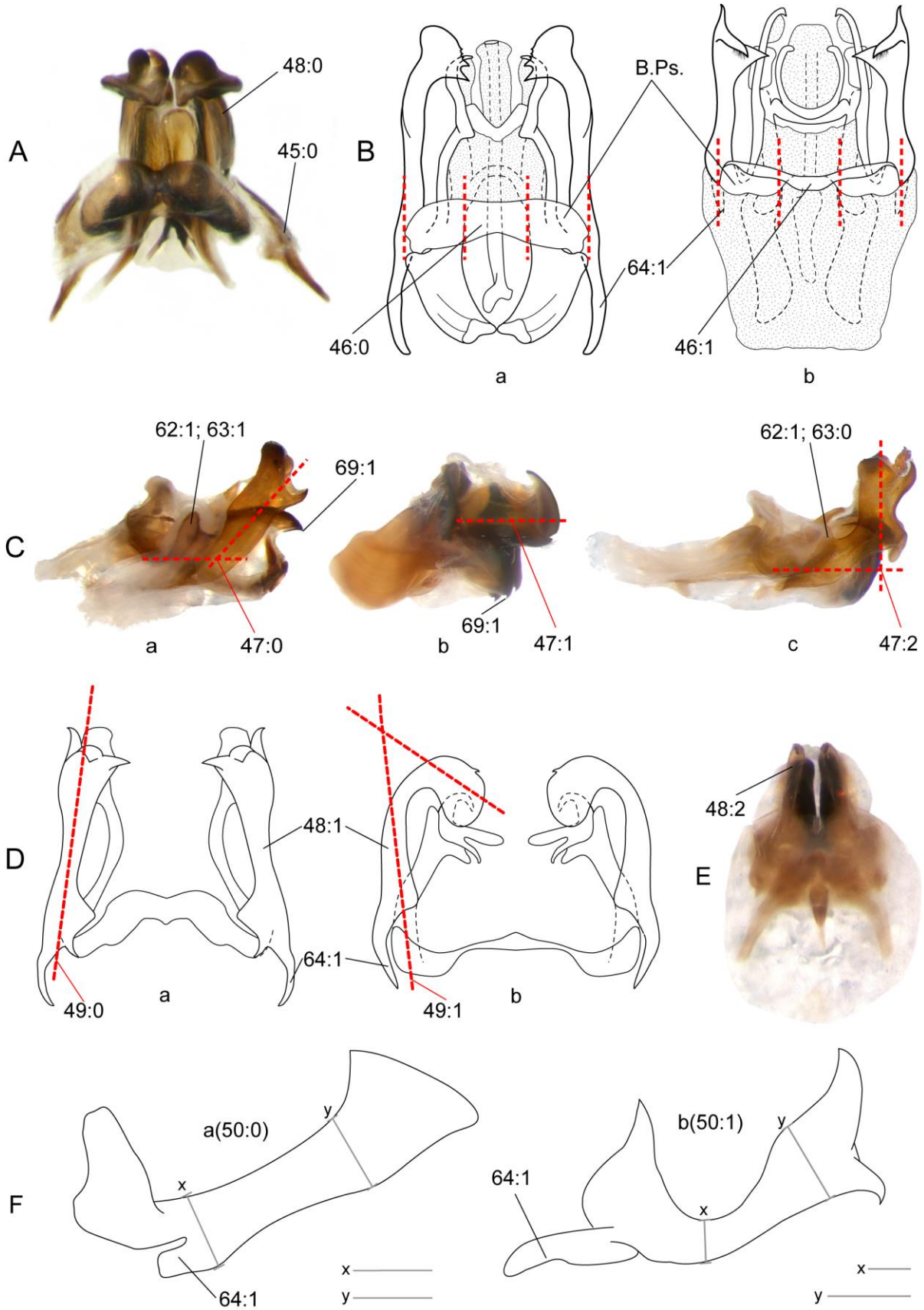


Figure 5. A- *Melanotes ornata*, phallic complex dorsal; **B-** Phallic complex, dorsal: **a-***Eidmanacris multispinosa*, **b-***Eidmanacris tridentata*; **C-** Phallic complex, lateral: **a-** *Eidmanacris bernardii*, **b-***Ottedana cercalis*, **c-***Eidmanacris corumbatai*; **D-** Pseudepiphallic sclerite, dorsal: **a-***Eidmanacris simoesi*, **b-***Eidmanacris fusca*; **E-***Adenopygus heikoi*, dorsal phallic complex; **F-**Pseudepiphallic sclerite, lateral: **a-** *Eidmanacris larvaeformis*, **b-***Eidmanacris simoesi*.

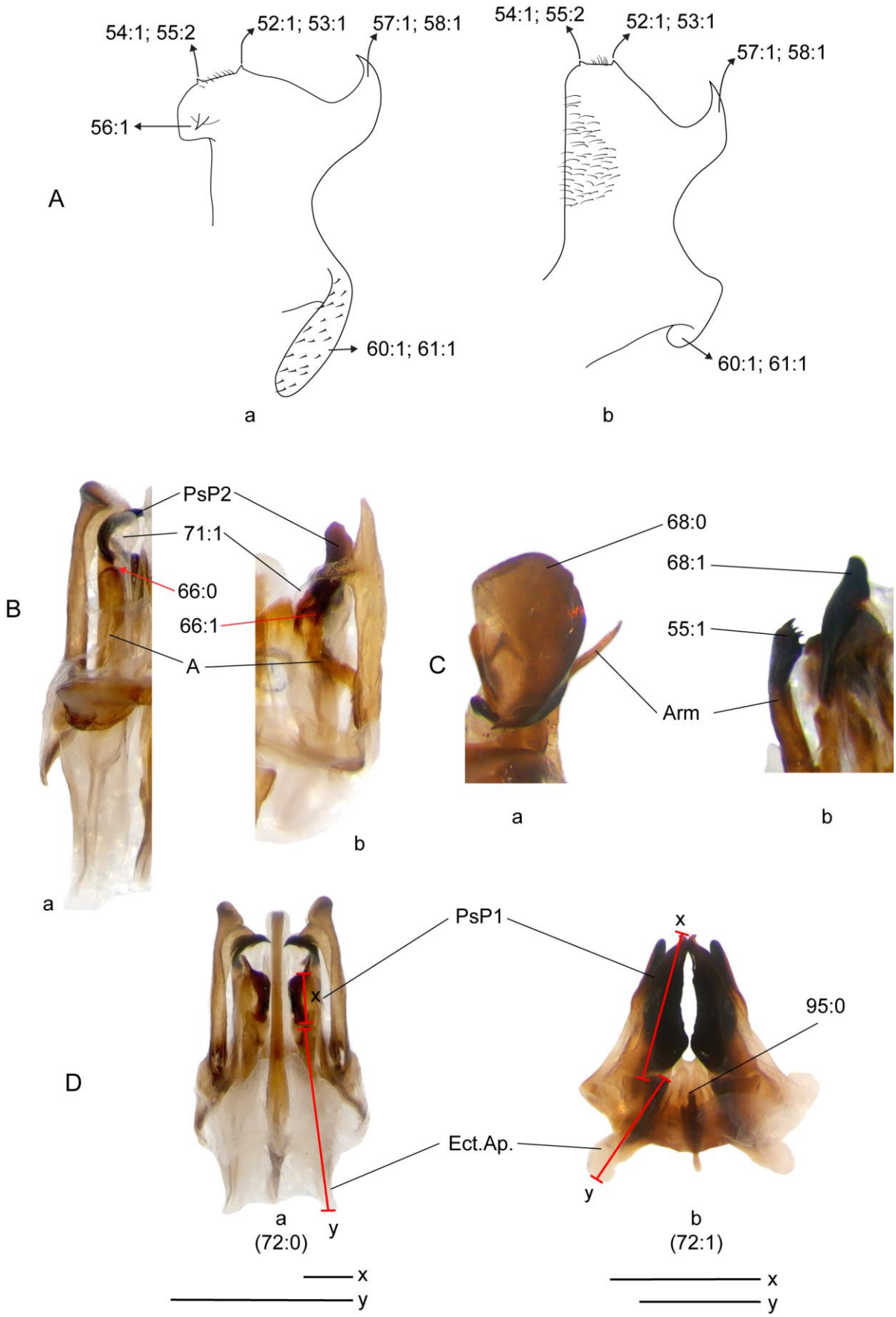


Figure 6. A- *Eidmanacris corumbatai*, apex of pseudepiphallic arm: **a**- inner side, **b**-outer side; **B**- Phallic complex dorsal: **a**-*Eidmanacris dissimilis*, **b**-*Eidmanacris larvaeformis*; **C**- PsP2 and pseudepiphallic arms, dorsal: **a**-*Guabamima saiva*, **b**-*Eidmanacris papaveroi*; **D**- Phallic complex, ventral: **a**-*Eidmanacris dissimilis*, **b**- *Bambuina bambui*.

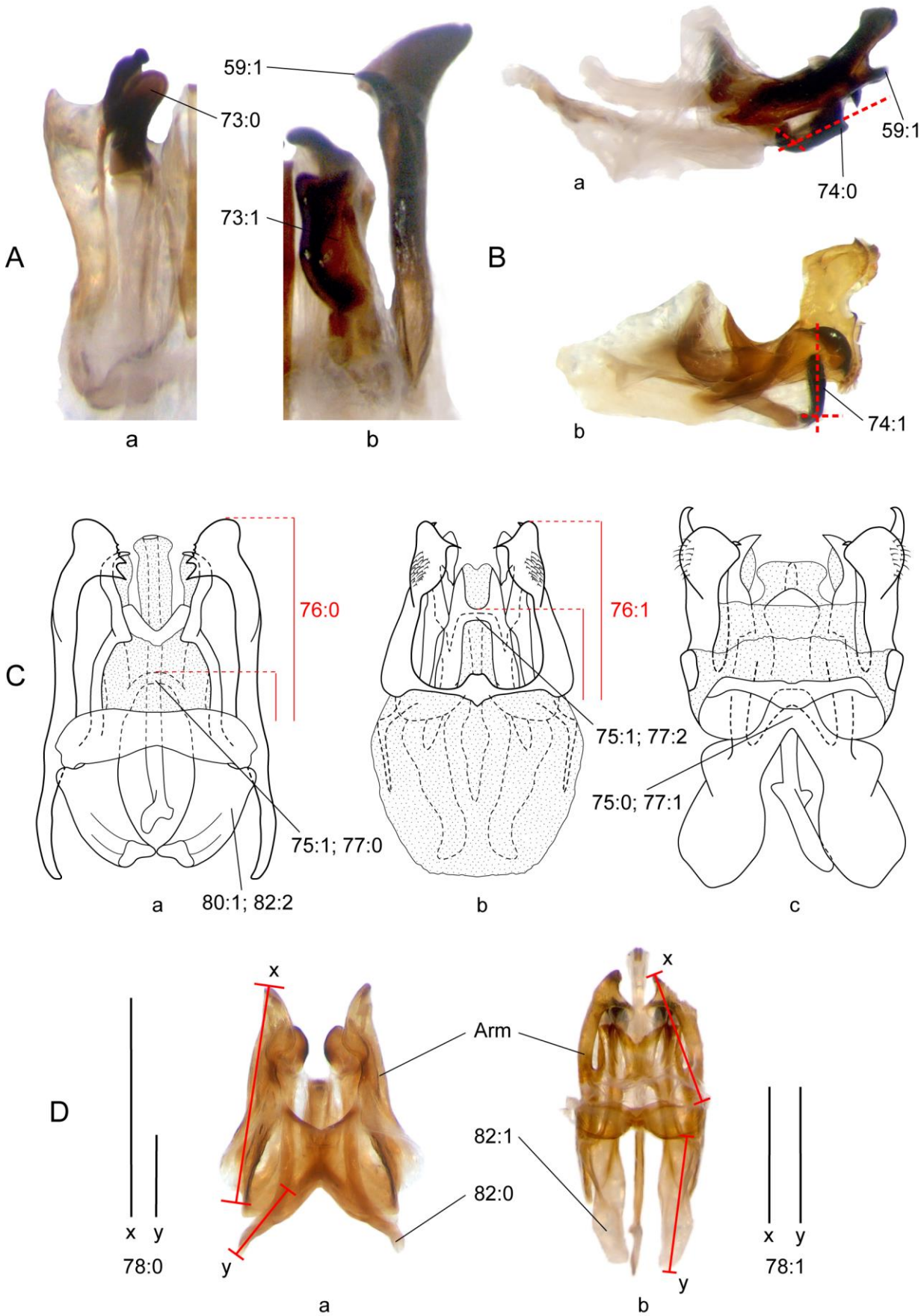


Figure 7. A- Phallic complex ventral: **a**-*Eidmanacris fontanettiae*, **b**-*Eidmanacris alboannulata*; **B-** Phallic complex, lateral: a-*Eidmanacris alboannulata*, **b**-*Eidmanacris desutterae*; **C-** Phallic complex, dorsal: **a**-*Eidmanacris multispinosa*, **b**-*Eidmanacris eliethae*, **c**-*Eidmanacris bernardii*; **D-** Phallic complex, dorsal: **a**-*Strinatia brevipennis*, **b**-*Eidmanacris septentrionalis*.

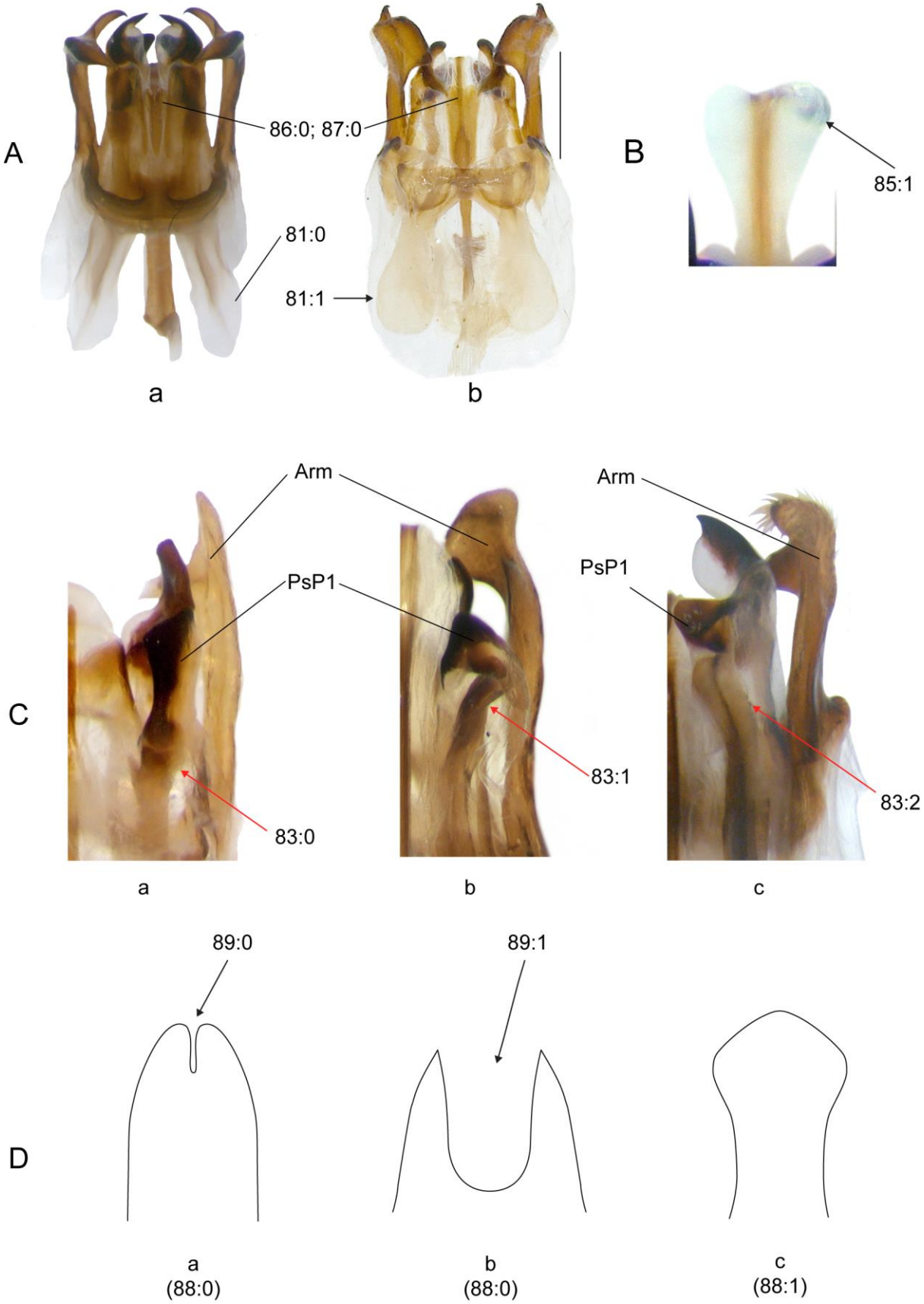


Figure 8. A- Phallic complex, dorsal: **a**-*Eidmanacris suassunai*, **b**-*Eidmanacris scopula*.; **B**-*Eidmanacris melloi*, subapical margins of ectophallic fold; **C-** Phallic complex, ventral: **a**-*Eidmanacris larvaeformis*, **b**-*Eidmanacris multispinosa*, **c**-*Eidmanacris caipira*; **D-** Dorsal projection of ectophallic invagination, posterior border: **a-** only on posterior border, **b**-reaching median region, **c**-no concavity.

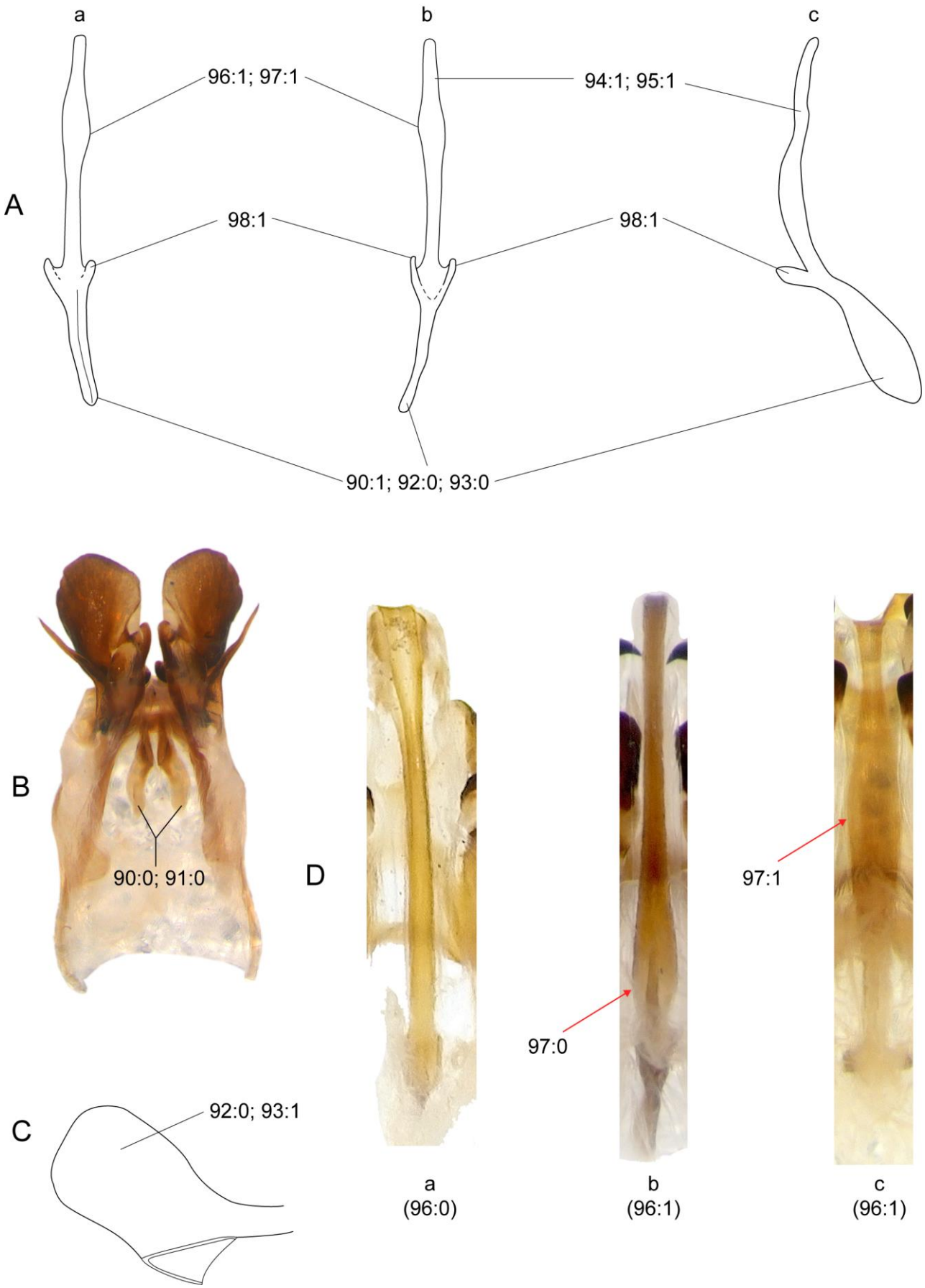


Figure 9. A- *Eidmanacris gigas*, endophallus: **a**-dorsal, **b**-ventral, **c**-lateral; **B**- *Guabamima lordelloi*, phallic complex ventral; **C**- *Endophallusia minuta*, endophallic apodeme lateral; **D**- Endophallus, ventral: **a**-*Eidmanacris speluncae*, **b**-*Eidmanacris alboannulata*, **c**-*Eidmanacris meridionalis*.

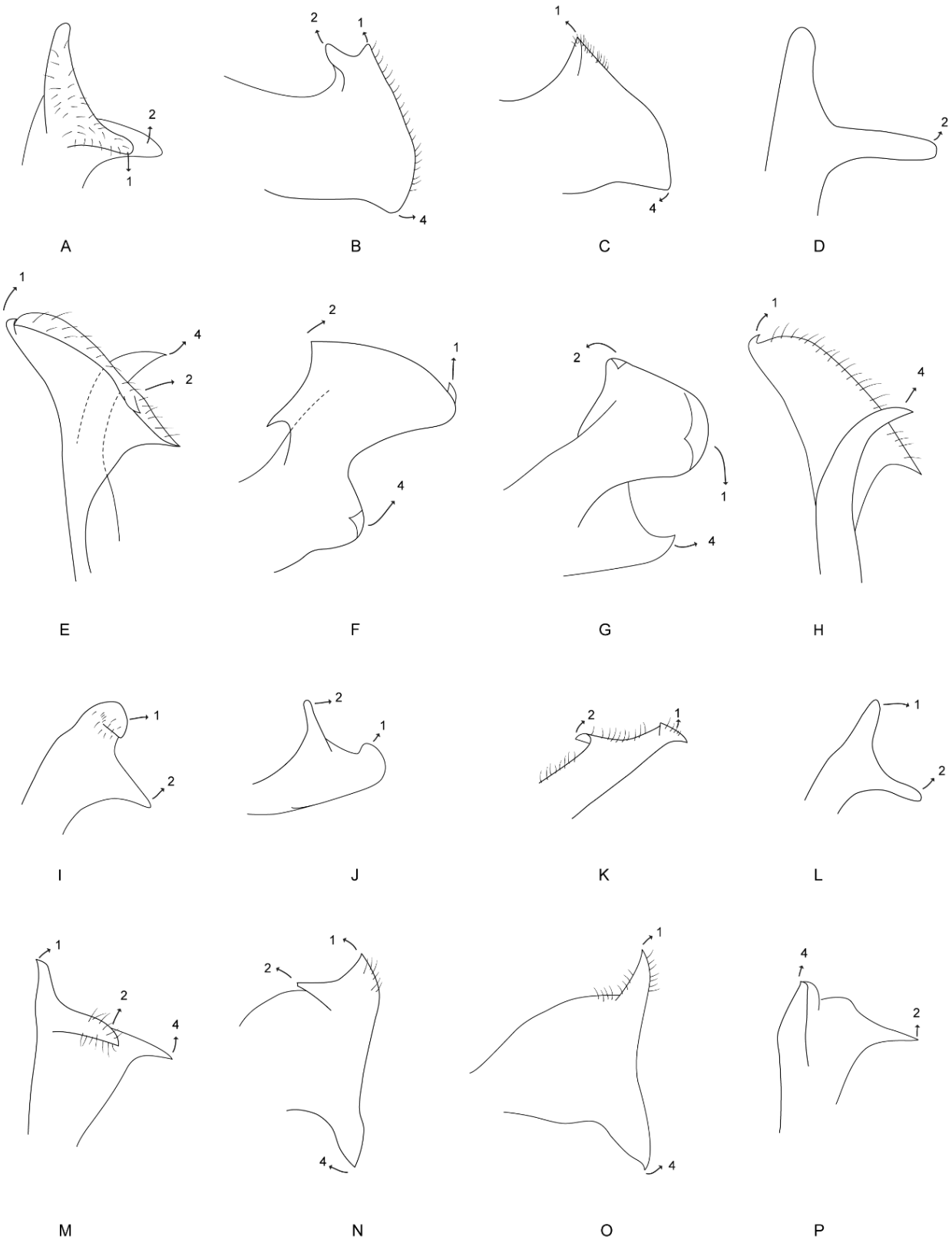


Figure 10. Projections of apex of pseudepiphallic arm. *E. larvaeformis*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. alboannulata*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *E. septentrionalis*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral; *E. tridentata*: **M**- dorsal, **N**- inner side, **O**- outer side, **P**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior. Scale bar: 1 mm.

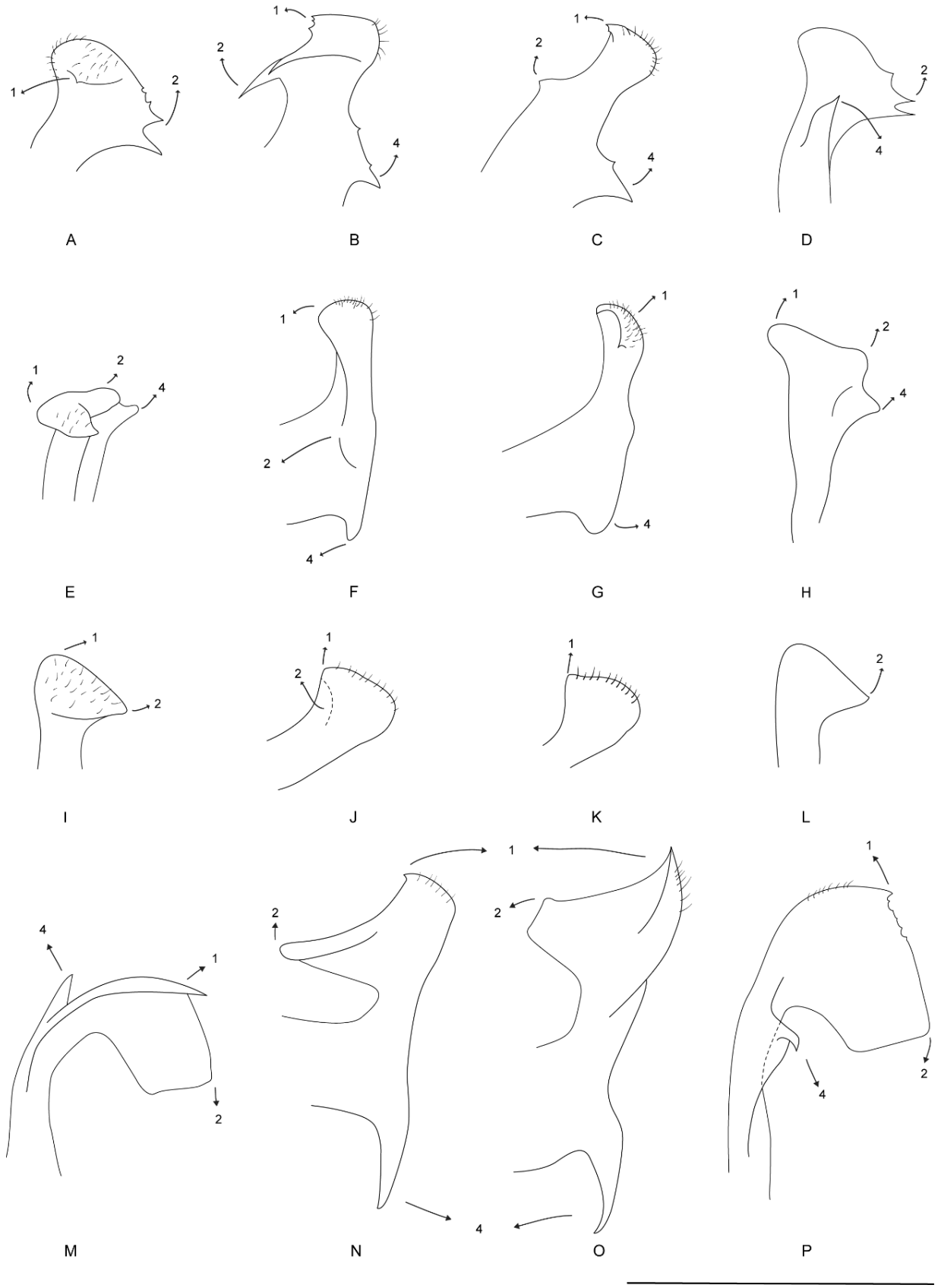


Figure 11. Projections of apex of pseudepiphallic arm. *E. multispinosa*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. dissimilis*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *E. meridionalis*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral; *E. fusca*: **M**- dorsal, **N**- inner side, **O**- outer side, **P**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior. Scale bar: 1 mm.

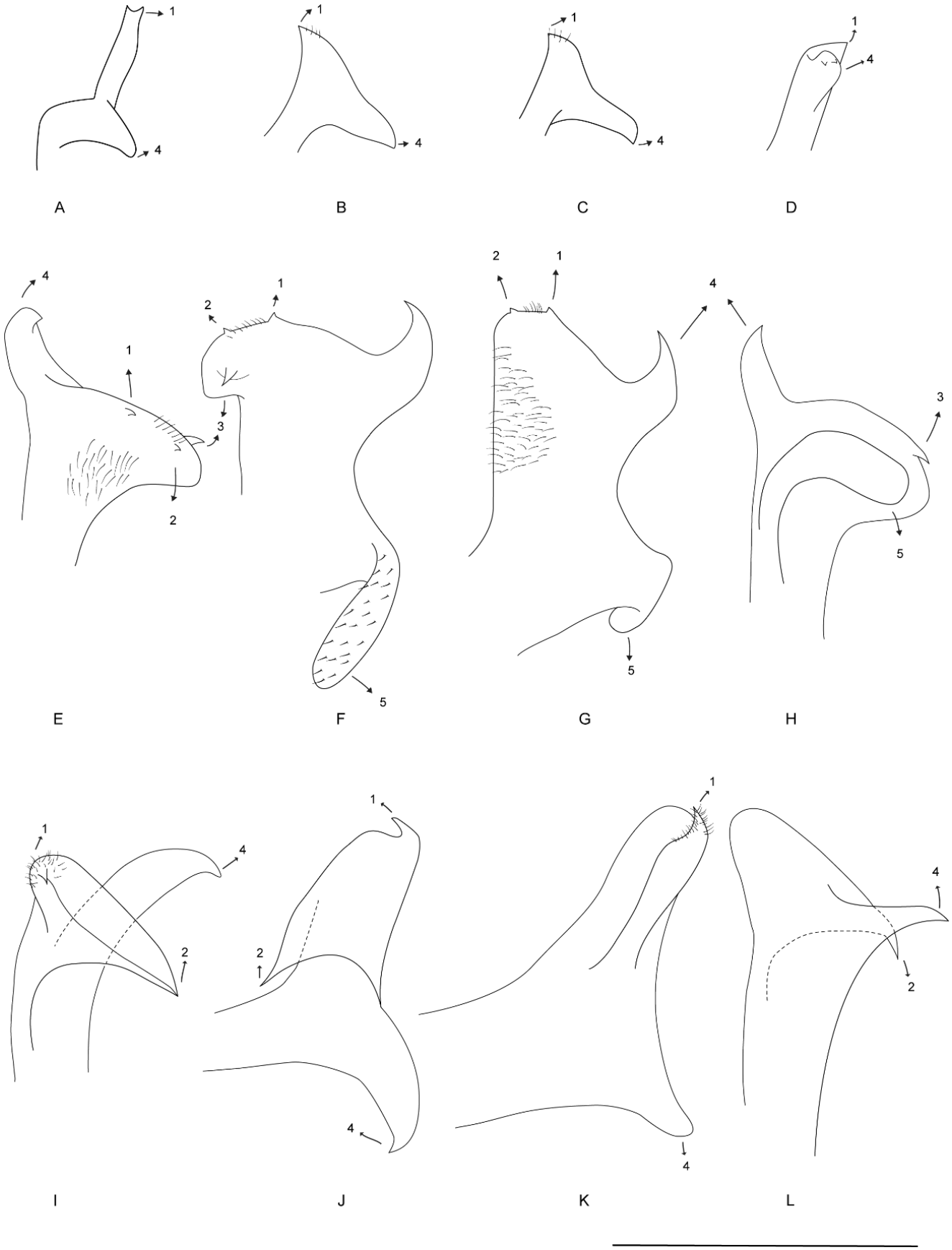


Figure 12. Projections of apex of pseudepiphallic arm. *E. bidentata*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. corumbatai*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *E. suassunai*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior, 5- ventral. Scale bar: 1 mm.

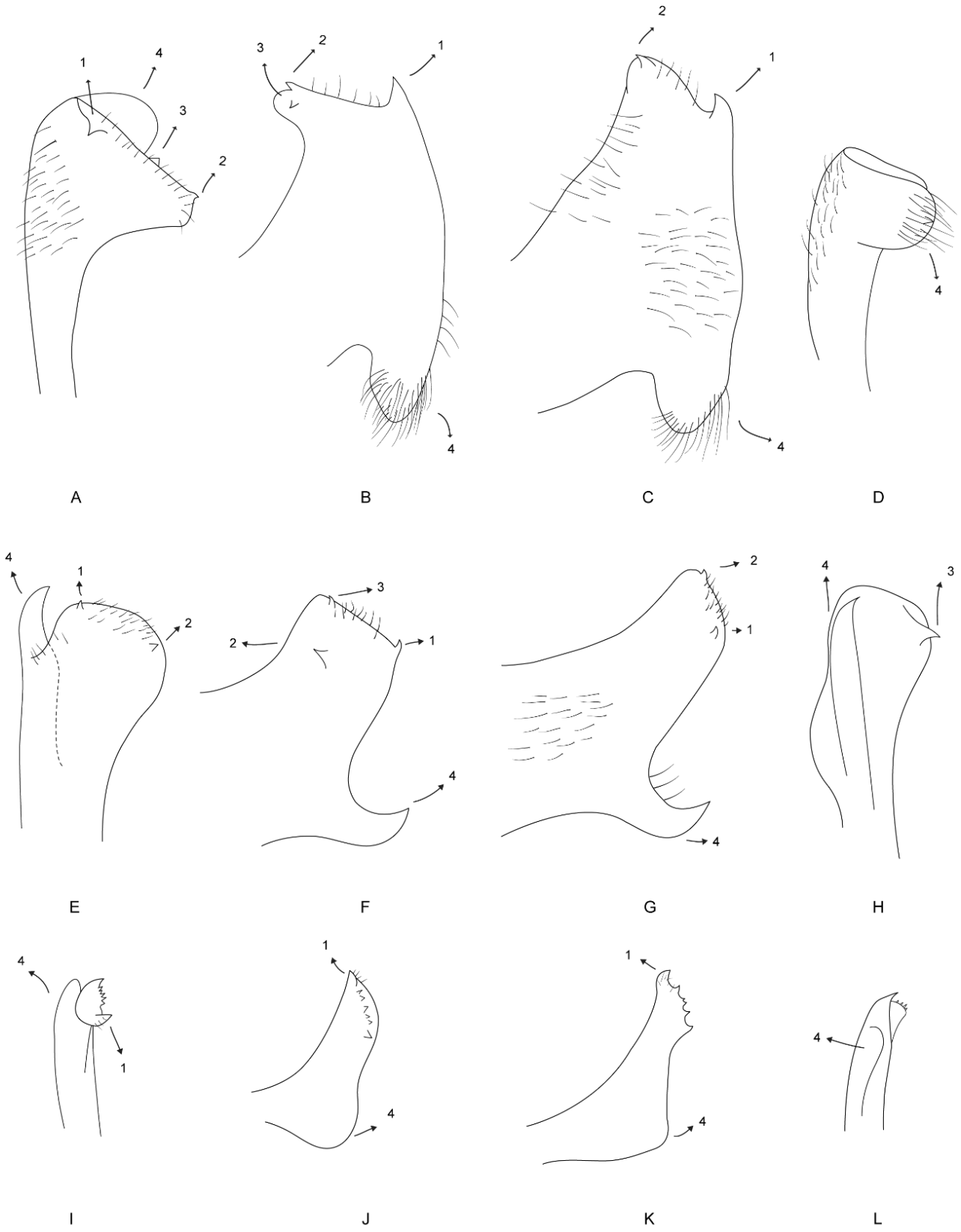


Figure 13. Projections of apex of pseudepiphallic arm. *E. caipira*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. bernardii*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *E. papaveroi*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior. Scale bar: 1 mm.

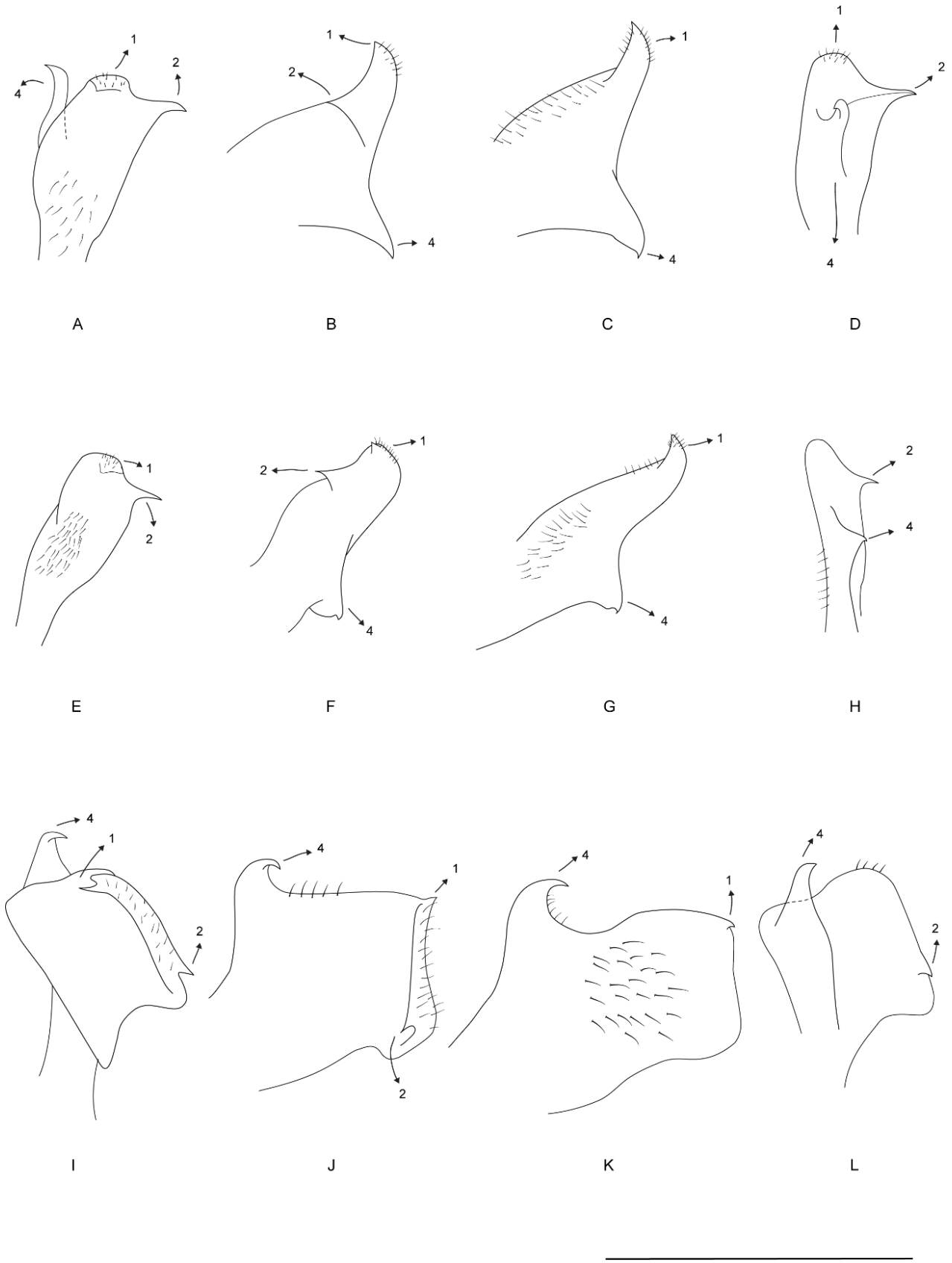


Figure 14. Projections of apex of pseudepiphallic arm. *E. simoesi*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. eliethae*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *E. scopula*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior. Scale bar: 1 mm.

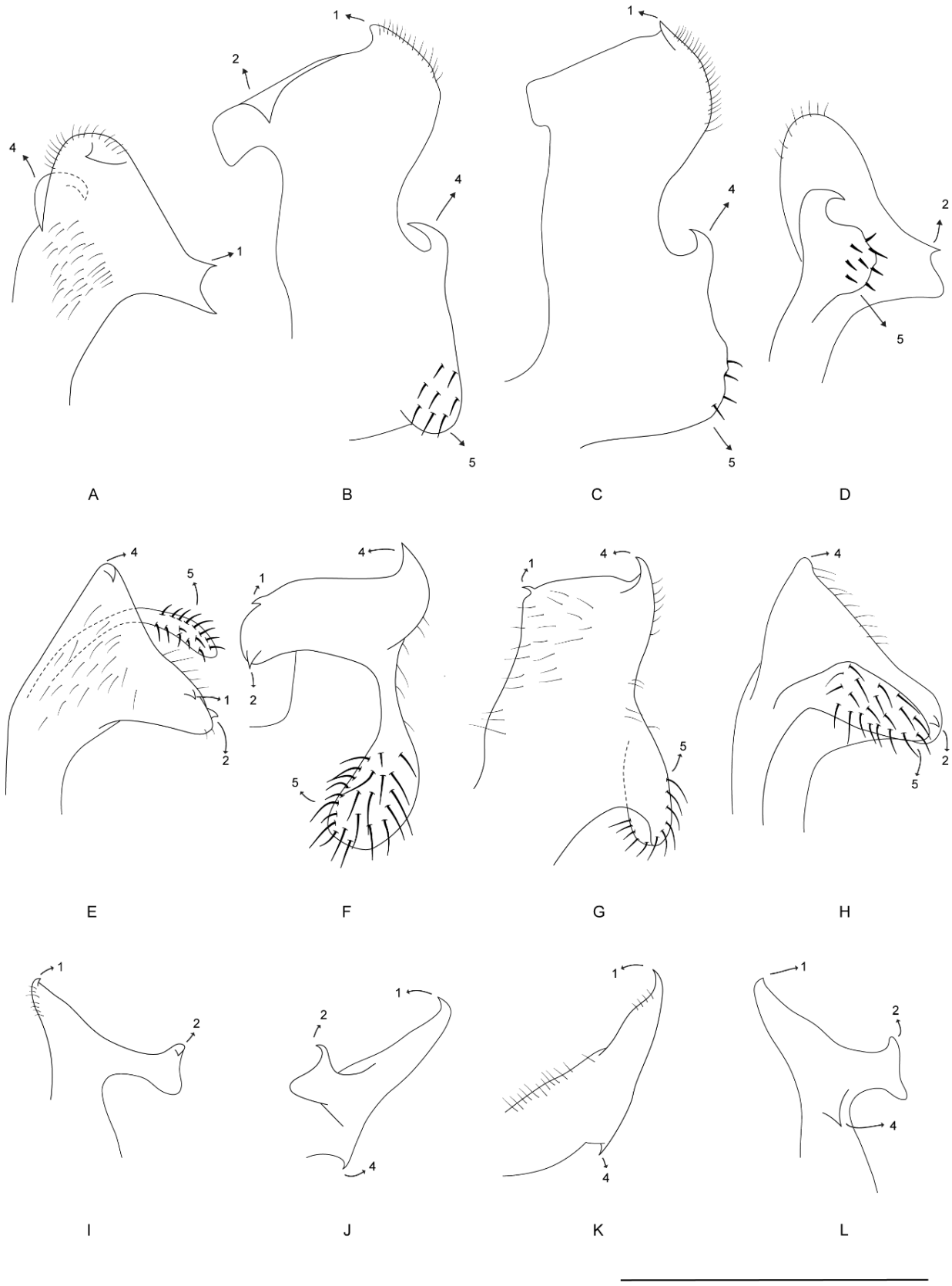


Figure 15. Projections of apex of pseudepiphallic arm. *E. desutterae*.: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. gigas*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *E. putuhra*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior, 5- ventral. Scale bar: 1 mm.

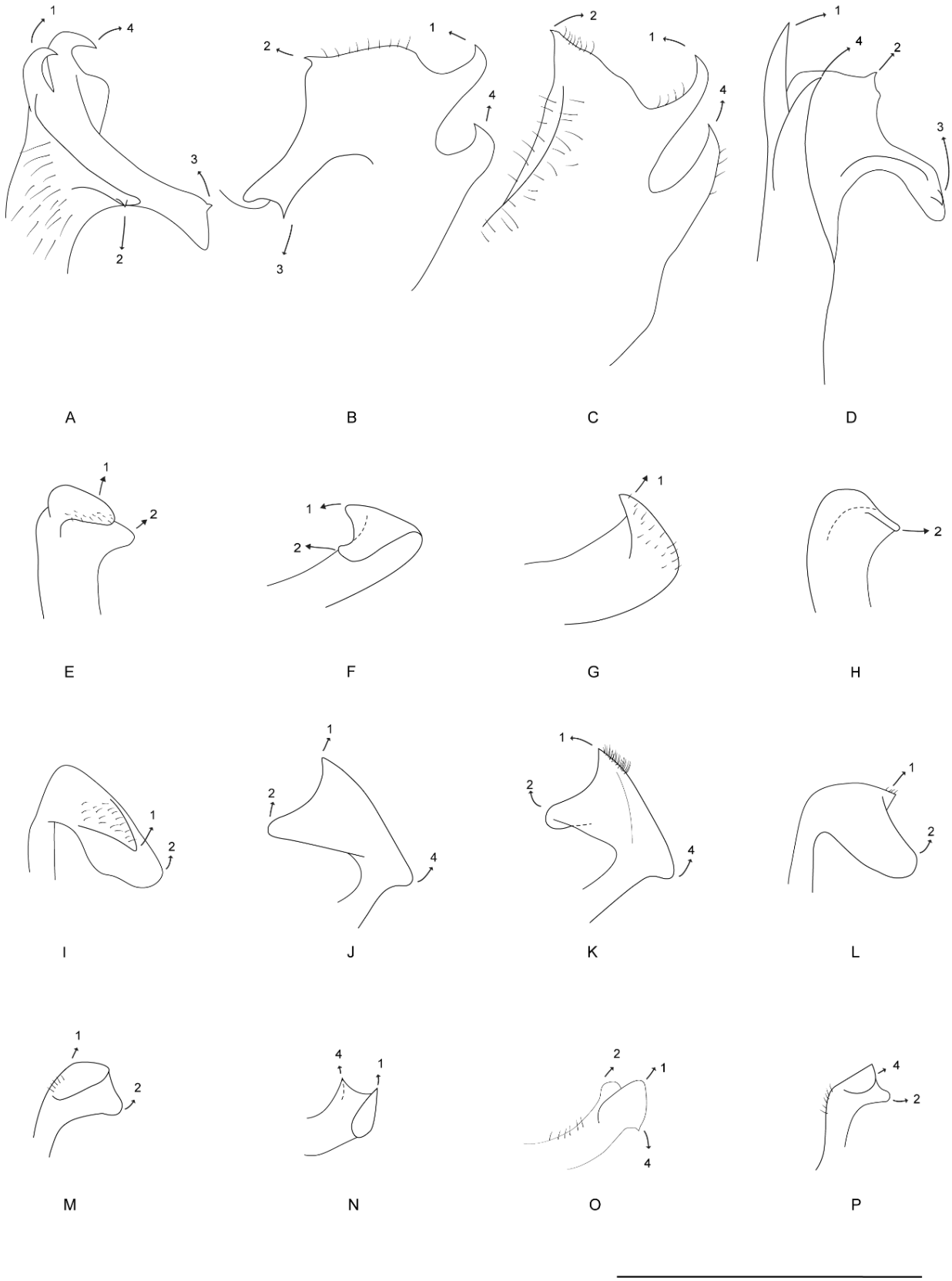


Figure 16. Projections of apex of pseudepiphallic arm. *E. neomarmorata*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. fontanettiae*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *E. melloi*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral; *E. speluncae*: **M**- dorsal, **N**- inner side, **O**- outer side, **P**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior. Scale bar: 1 mm.

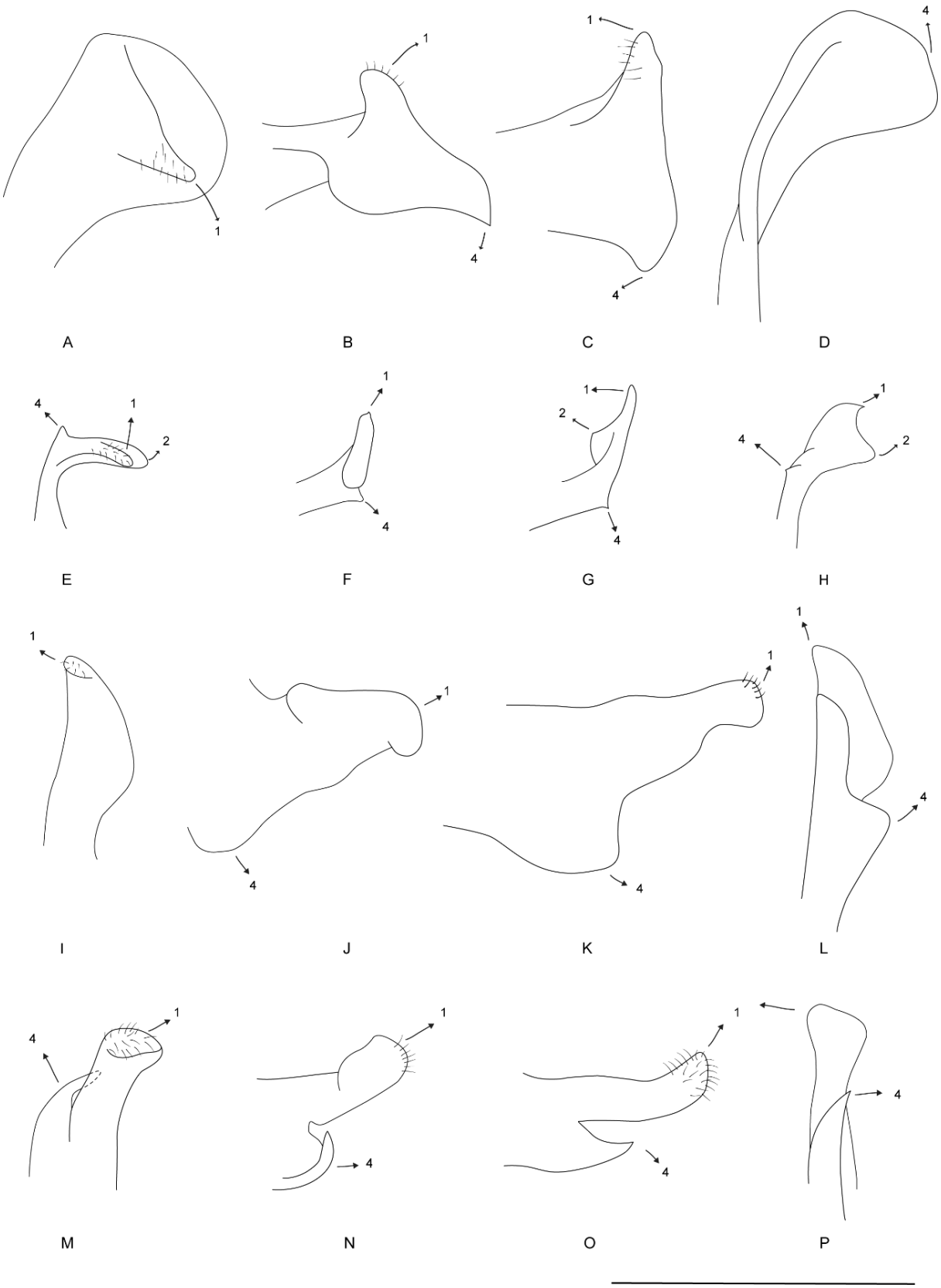


Figure 17. Projections of apex of pseudepiphallic arm. *E. endophallica*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *E. minuta*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *Strinatia brevipennis*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral; *Strinatia teresopolis*: **M**- dorsal, **N**- inner side, **O**- outer side, **P**- ventral. Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior. Scale bar: 1 mm.

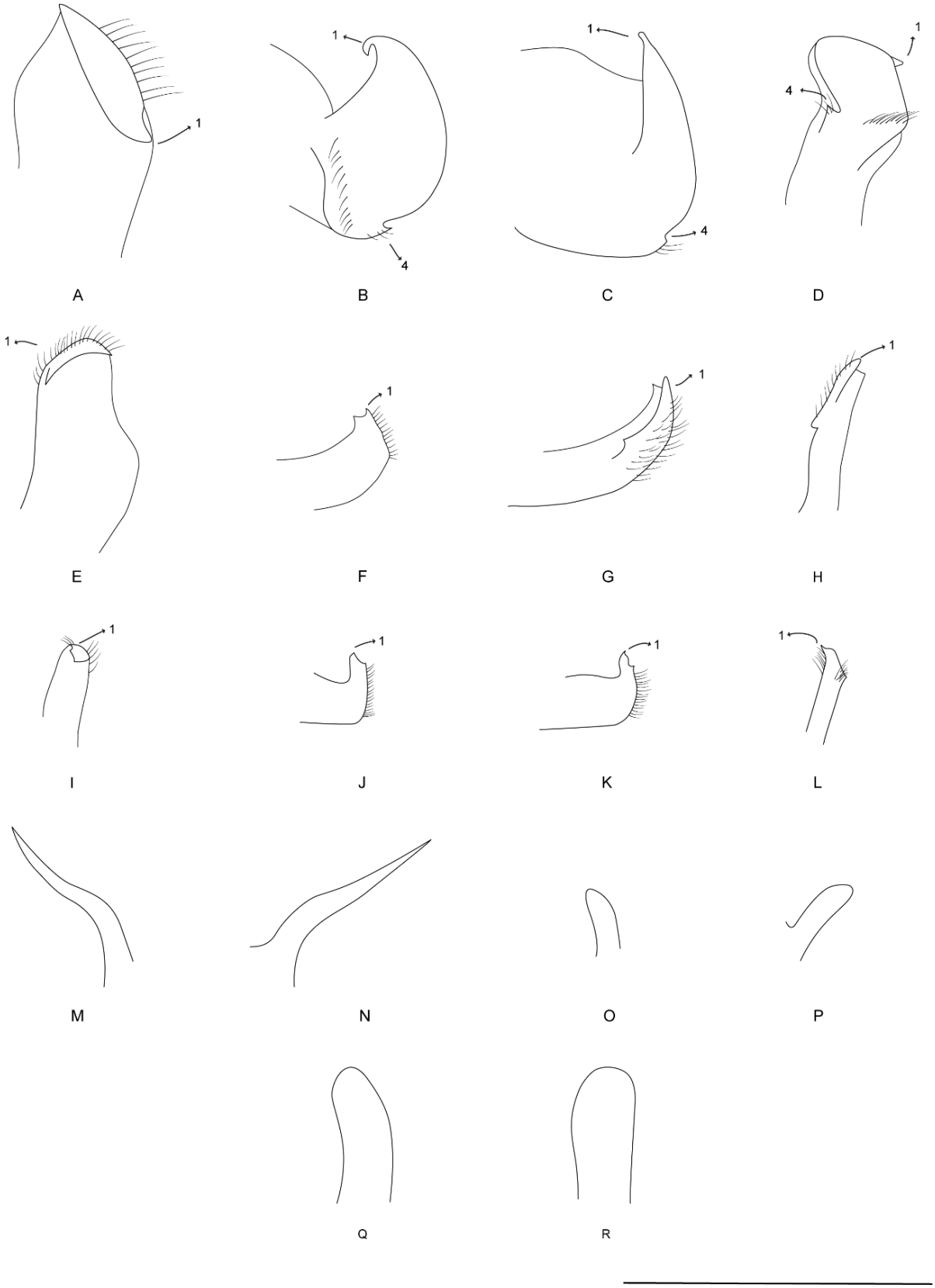


Figure 18. Projections of apex of pseudepiphallic arm. *Ottedana cercalis*: **A**- dorsal, **B**- inner side, **C**- outer side, **D**- ventral; *Bambuina bambui*: **E**- dorsal, **F**- inner side, **G**- outer side, **H**- ventral; *Adenopygus heikoi*: **I**- dorsal, **J**- inner side, **K**- outer side, **L**- ventral; *Guabamima lordelloi*: **M**- dorsal, **N**- ventral; *Guabamima saiva*: **O**- dorsal, **P**- ventral; *Melanotes ornata:* **Q**- dorsal, **R**- Projections: 1- superior, 2- supero-internal, 3- infero-internal, 4- inferior. Scale bar: 1 mm.

3.2. *Analysis*

Two analyses were performed in this study: one including all the 38 terminals studied (analysis 1); the second, with 37 terminals (analysis 2), excluded *E. paramarmorata* due the large amount of missing data (94%). This taxon was not included because its description was based only on females.

Nixon & Wheeler (1992) name this as "wildcard", when a terminal with a large amount of missing data (as in *E. paramarmorata*) appears related to different terminals in the most parsimonious trees found. Consequently, the consensus tree generates a large polytomy.

3.2.1. Analysis 1 – 38 terminals

In this analysis, 11 most parsimonious trees were generated, with 240 steps, consistency index (ci) 0.47 and retention index (ri) 0.78. Then, a strict consensus tree was obtained (Fig. 19), the ambiguous characters were optimized, and Bremer support was calculated (Fig. 20)

The results show *Eidmanacris* paraphyletic, since the two known species of *Endophallusia* are nested in the clade A of *Eidmanacris.* As the clade of *Eidmanacris* species plus *Endophallusia* species is well supported (Bremer support = 11), the genus *Endophallusia* must be transferred to *Eidmanacris*. This will be discussed below.

The species *E. paramarmorata* performed as a wildcard (Figs. 19, 20) only in the clade E, defined by the character 43(1) "posterior aperture of copulatory papilla large". It appears on each resulting tree grouped with a different terminal, although it does not group with terminals from the other clades.

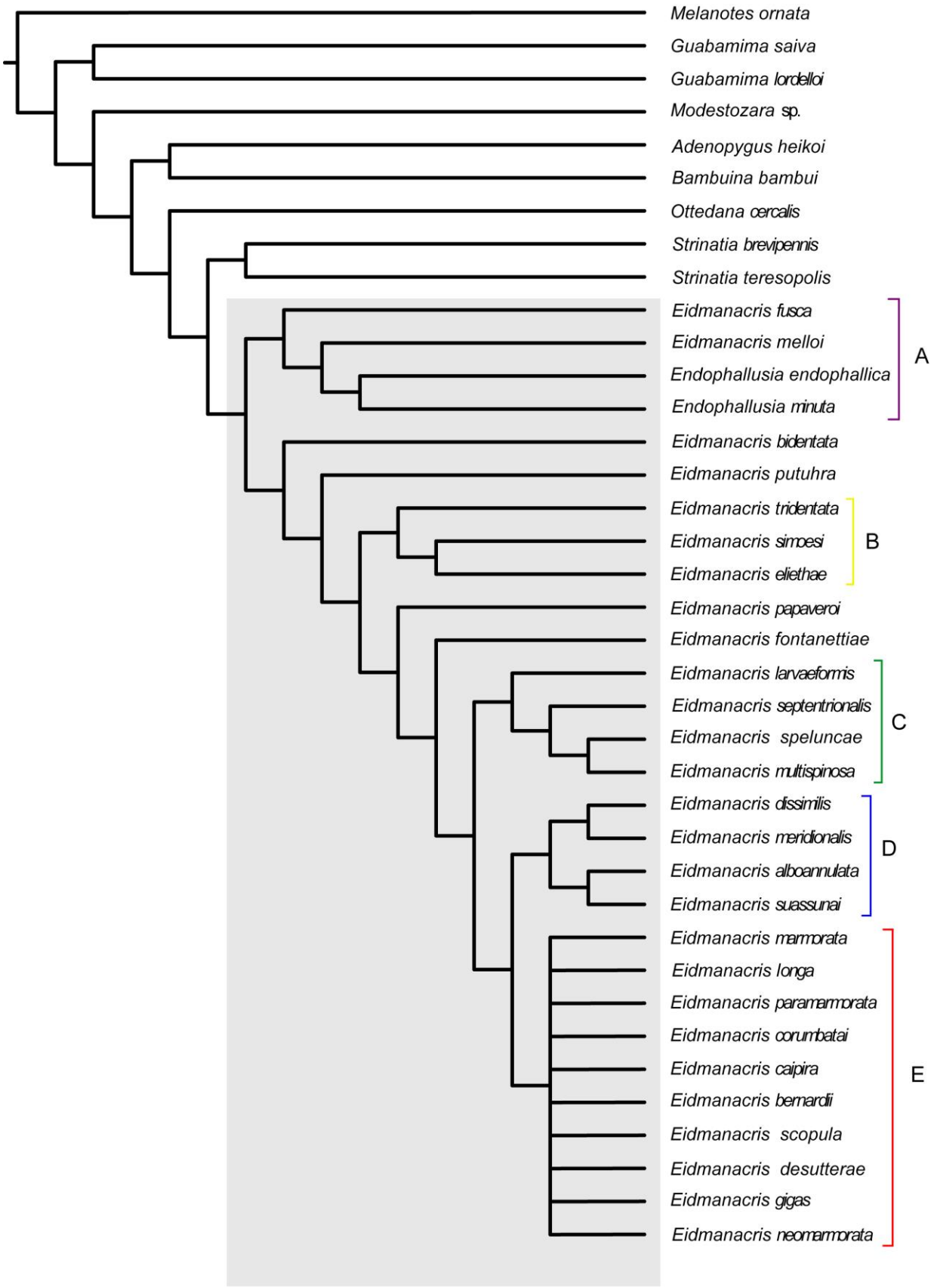


Figure 19. Strict consensus tree of 11 most parsimonious trees of 38 terminals and 98 characters. The grey rectangle indicates the clade of the genus *Eidmanacris*.

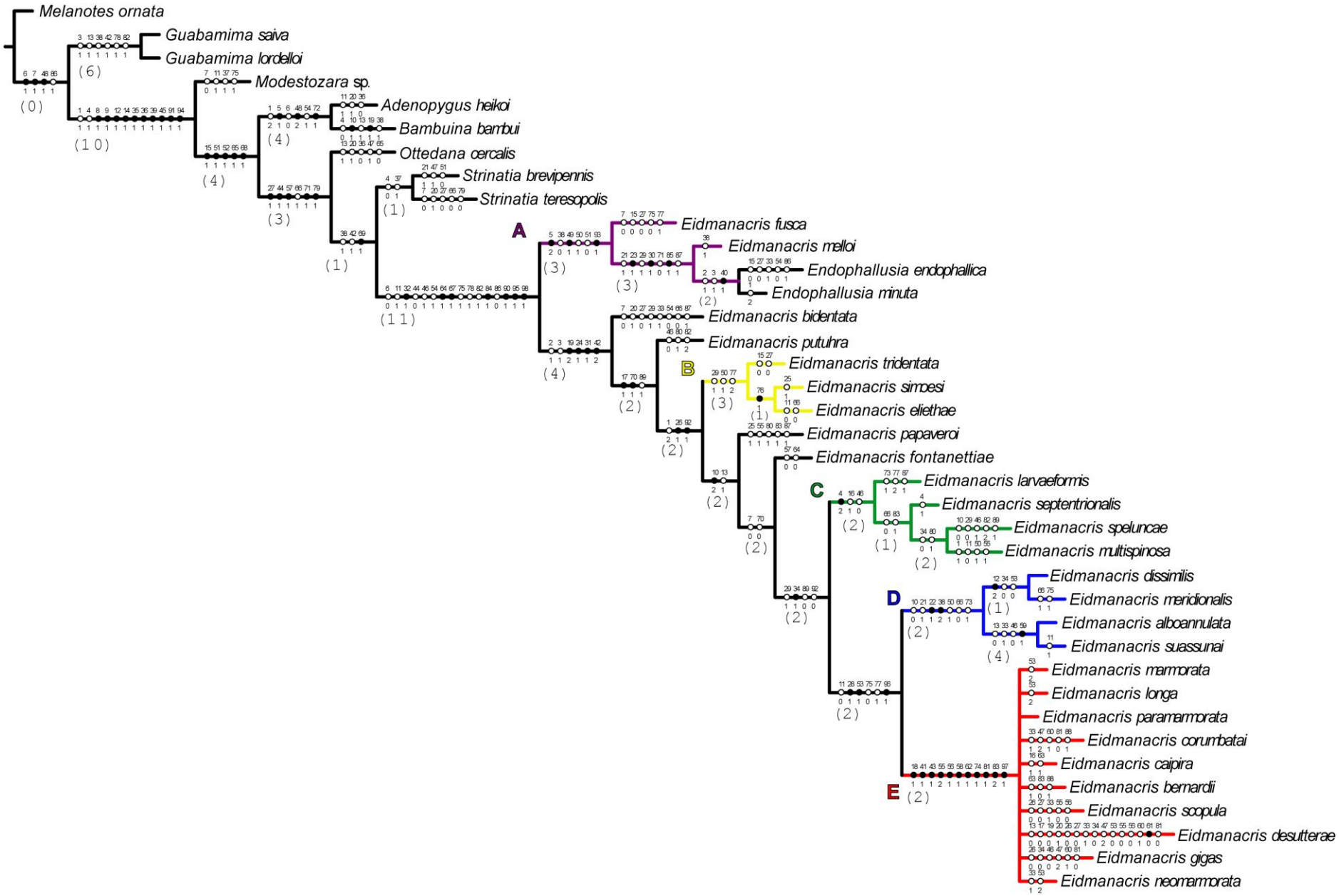


Figure 20. Strict consensus tree of 11 most parsimonious trees with characters optimized and branch support values. White circles indicate homoplastic synapomorphies, black circles exclusive synapomorphies. Number above circle indicates the characters, above the states. Bremer support are in parentheses.

3.2.2. Analysis 2 – 37 terminals

In the analysis with 37 terminals (excluding *E. paramarmorata*) only one most parsimonious tree with 240 steps was found (Fig. 21), with consistency index (ci) 0.47 and retention index (ri) 0.78. A tree showing the Bremer support is also presented (Fig. 22).

The clade *Eidmanacris* remains paraphyletic, including the genus *Endophallusia*. However, unlike the previous analysis (with *E. paramarmorata*), the clade E resulted well supported and nearly completely resolved (only a polytomy with *E. longa*, *E. marmorata* and *E. neomarmorata*), and with higher support (Bremer support = 6).

This tree (Figs. 21 and 22) will be discussed ahead.

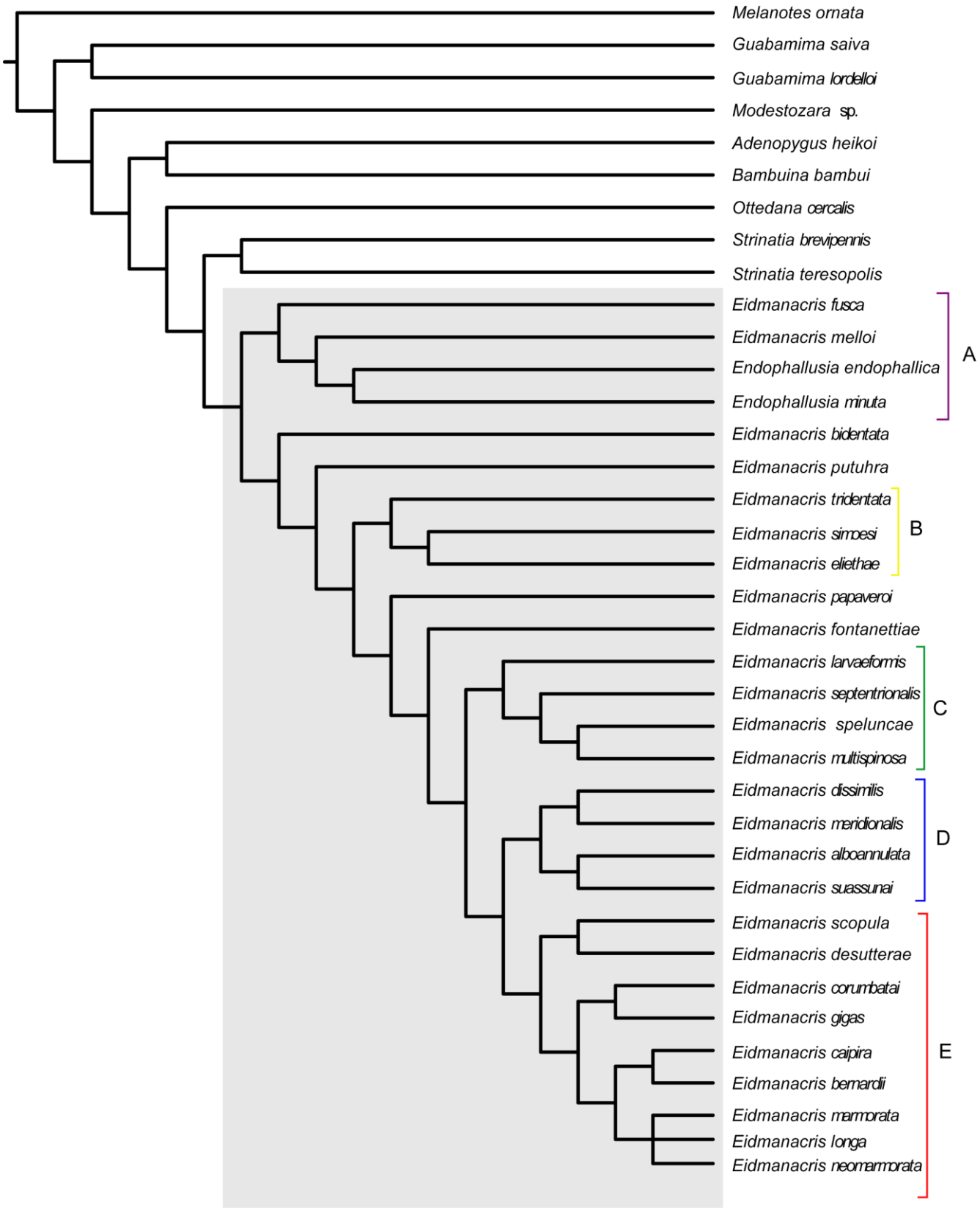


Figure 21. Most parsimonious tree for 37 terminals and 98 characters. Grey rectangle indicates the clades of the genus *Eidmanacris*.

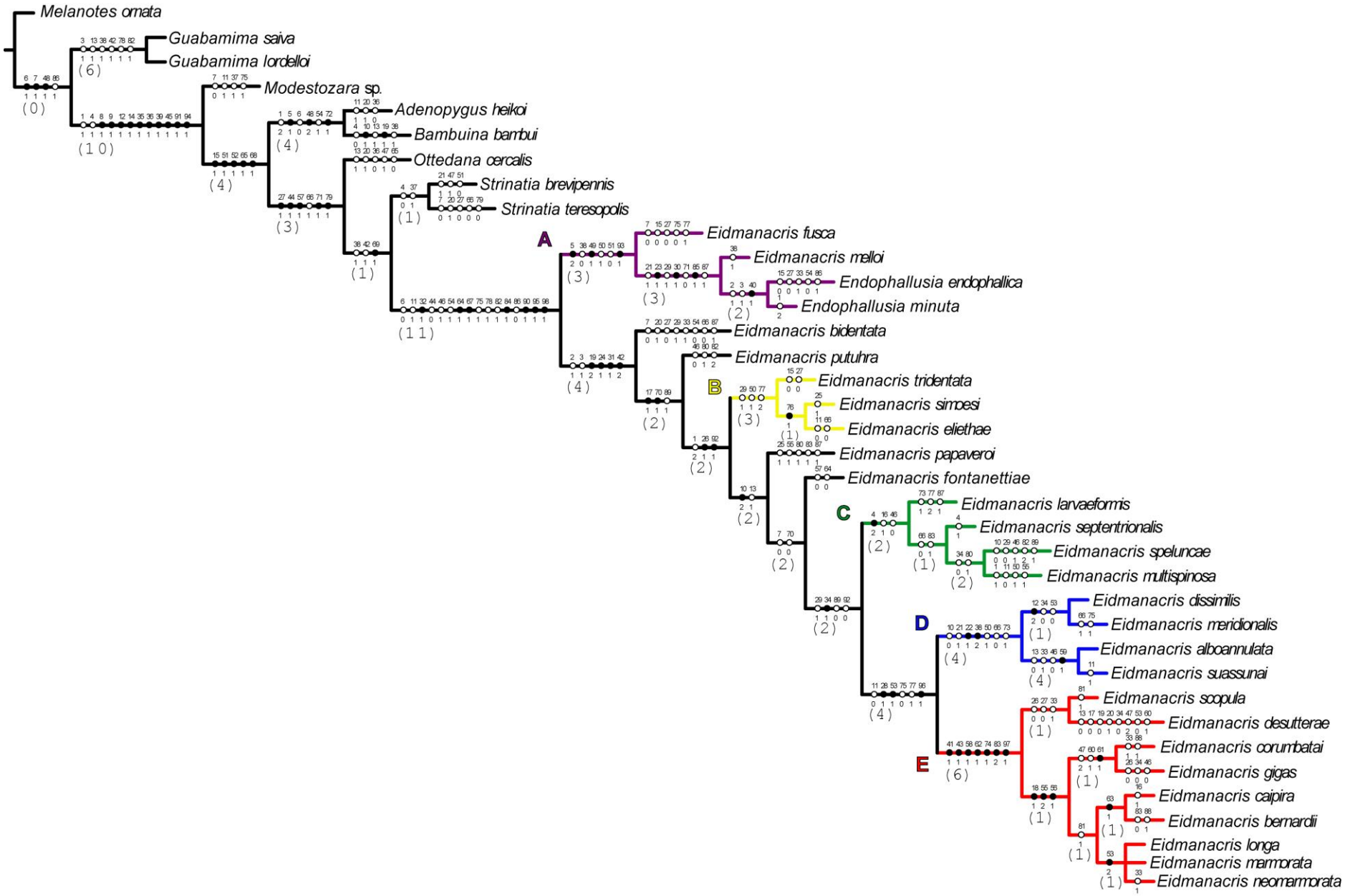


Figure 22. Most parsimonious tree without *E. paramarmorata* with characters optimized and branch support values. White circles indicate homoplastic synapomorphies, black circles exclusive synapomorphies. Number above circle indicates the characters, above the states. Bremer support are in parentheses.

4. *Discussion*

Due to the great similarity of the results between both analyses, the discussion will be based mostly on the results of analysis 2 (Figs. 21 e 22).

4.1. Clade *Eidmanacris*

In the analyses performed, the genus *Eidmanacris* was composed by 29 (including *E. paramarmorata*) and 28 terminals, including the species *Endophallusia endophallica* and *Endophallusia minuta*. This clade is well supported (Bremer support = 11) and sustained by seven exclusive synapomorphies in both analyses (Table 3).

Table 3. Exclusive synapomorphies for the clade *Eidmanacris*.

Character	Character description
32(1)	Presence of latero-posterior projections of the supra anal plate of male
64(1)	Presence of anterior projection of the pseudepiphallic sclerite
67(1)	No sclerotized connection between the PsP1 and PsP2
84(1)	Ectophallic fold membranous
90(1)	Endophallic apodeme crest-shaped
95(1)	Medio-posterior projection of the endophallic sclerite elongate, through all the ectophallic fold
98(1)	Presence of latero-posterior lobes of endophallic sclerite

It is important to notice that some of these synapomorphies appear in other Luzarinae taxa not sampled here as seen in Robillard & Desutter-Grandcolas, 2005 and Souza-Dias, 2015. Therefore, the characters that seem to be exclusive of *Eidmanacris* are: presence of anterior projection of pseudepiphallic sclerite [64(1)], no sclerotized connection between PsP1 and PsP2 [67(1)] and medio-posterior projection of endophallic sclerite elongate, through the ectophallic fold [95(1)].

Homoplastic synapomorphies that are shared by *Eidmanacris* clade are nine (Table 4).

Table 4. Homoplastic synapomorphies of *Eidmanacris*.

Character	Optimization	Character description
6(0)	ACCTRAN	Sensillas region of maxillary palpus rounded
11(1)	Not ambiguous	Apex of forewings not reaching posterior border of metanotum
44(1)	ACCTRAN	Dorsal median furrow of copulatory papilla absent
46(1)	Not ambiguous	Median third of base of pseudepiphallic sclerite narrower than lateral thirds in dorsal view
54(1)	ACCTRAN	Presence of supero-internal projection of apex of pseudepiphallic arm
75(1)	ACCTRAN	Ectophallic arc posterior to the base of pseudepiphallic sclerite
78(1)	Not ambiguous	Ectophallic apodeme with same size or longer than pseudepiphallic arm in dorsal view
82(1)	Not ambiguous	Apex of ectophallic apodeme straight
86(0)	Not ambiguous	Presence of dorsal projection of ectophallic invagination

-Clade A

Clade A is composed of *E. fusca*, *Endophallusia endophallica*, *Endophallusia minuta* and *E. melloi*. The inclusion of *Endophallusia* species in this clade results in the paraphyly of *Eidmanacris*. However, all synapomorphies of *Eidmanacris* mentioned above are also present in this clade, therefore the genus *Endophallusia* must be combined with *Eidmanacris.*

De Mello (1990) suggested a close relationship between these two genera. The author grouped *Eidmanacris* and *Endophallusia* by the following characters: **1-** velvety body; **2-** covered by micropiles; **3-** maxillary palpus long and thin; **4-** very long legs; **5-** median apical spur of tibia III longer in both sides; **6-** endophallus not so long as in *Endophallusia*, **7-** distal extremity of endophallic sclerite beyond of distal extremity of pseudepiphallic parameres. All this characters were examined and tested as hypotheses in the analyses presented here. None of them were phylogenetically informative to separate these two genera.

The synapomorphies of clade A are: **1-** fifth article of maxillary palpus sharply upcurved [character 5(2)]; **2-** apex of pseudepiphallic arm curved inwards [character 49(1)]; **3-** endophallic apodeme laterally flattened, as long as wide [character 93(1)].

-Clade B

The clade B is composed only of three species: *E. eliethae*, *E. simoesi* and *E. tridentata*. It is not sustained by any exclusive synapomorphies, only of three unambiguous homoplastic synapomorphies: **1-** presence of sagittal line in dorsum of abdomen [character 29(1)]; **2-** apex of pseudepiphallic arm wider than the base [character 50(1)]; **3-** ectophallic arc straight in dorsal view [character 77(2)]. The disposition of projections of the apex of pseudepiphallic arm are characteristic for this clade.

-Clade C

With the species *E. multispinosa*, *E. larvaeformis*, *E. septentrionalis* and *E. speluncae*, this clade is sustained only by one exclusive synapomorphy: posterior half of antenna unpigmented [character 4(2)]. And two homoplastic synapomorphies: **1-** surface of lateral projections of metanotum striated [character 16(1), DELTRAN]; **2-** median third and lateral thirds of base of pseudepiphallic sclerite with same width, in dorsal view [character 46(0), not ambiguous].

-Clade D

This clade is supported by seven characters, which five are homoplastic synapomorphies and two are exclusives: **1-** median projection of metanotum very reduced, only visible through S.E.M. [character 22(1)]; **2-** internal apical dorsal and median spurs of tibia III same-sized [character 38(2)]. The terminals that compounds this clade are: *E. alboannulata*, *E. dissimilis*, *E. meridionalis* and *E. suassunai*.

The character 22(1) (presence of median projection of metanotum very reduced) can indicates a regression of this projection in *Eidmanacris*, once it appears developed only in two species, *E. melloi* and *Endophallusia minuta*. It is absent in all other species of the genus.

-Clade E

Within the genus *Eidmanacris* this clade has higher support (Bremer support = 6 in analysis 2), and is sustained by seven exclusive synapomorphies: **1-** median furrow of subgenital plate of female reaching half of the structure [character 41(1)]; **2-** posterior aperture of copulatory papilla large [character 43(1)]; **3-** inferior projection of apex of pseudepiphallic arm hook-shaped, upcurved [character 58(1)]; **4-** presence of lateral projection of the pseudepiphallic sclerite [character 62(1)]; **5-** PsP1 upcurved, forming a 90° in lateral view [character 74(1)]; **6-** ventral posterior projection of ectophallic invagination internally curved [character 83(2)]; **7-** median thickening of median posterior projection of endophallic sclerite [character 97(1)].

Clade E is sustained by higher number of exclusive synapomorphies than the other clades of *Eidmanacris*. These characters are mainly related to male and female genitalia, and the possible reasons to this significant large amount of modifications are discussed ahead (item **4.4**).

4.2. *Analysis 1 polytomy*

The clade E in the analysis 1, as mentioned before, had no stable relationships between its terminals (Figs. 19 e 20). However, after the removal of *E. paramarmorata* in the analysis 2, the polytomy is not maintained. This polytomy was due to the great number of missing data of this terminal.

These missing data contributes for the increase of ambiguity in the possible allocations of the terminals in the nodes, generating a large number of most parsimonious trees (Huelselbeck, 1991). According to Wiens (1998; 2003), the number of missing data in a matrix not necessarily will result in a bad resolved tree. The resolution depends on the characters distribution through terminals along the matrix.

In this study, a large concentration of missing data occurred in *E. paramarmorata*, making this terminal act as wildcard in the clade E.

According to Kearney (2002), in the cases when there is one taxon with large number of missing data, a lot of initial trees are generated (corresponding to all the possible positions that this taxon could occupy). Consequently, a strict consensus tree can be poorly resolved.

This fact was already described by other authors (*e.g.* Huelselbeck, 1991; Wiens, 1998). However, Kearney (2002) also concluded that every taxon, not matters how

incomplete it is, has the potential to solve relationships or even decrease the ambiguity of a character. This occurred with *E. paramarmorata* in the analysis 1, due to the character 43(1) (large posterior aperture of copulatory papilla). This terminal did not collapse all the cladogram because this character is present only on clade E, keeping the other relationships between the other taxa in the tree well supported.

4.3. *The phallic complex in* Eidmanacris

The plasticity of phallic complex in *Eidmanacris* is remarkable, mainly the structures of pseudepiphallic sclerite, which are very developed in relation to other Luzarinae taxa.

The major example is the pseudepiphallic arm. Besides being the most conspicuous structure of the pseudepiphallus in Luzarinae, in *Eidmanacris* it has at least three different types of projections on the apex, reaching up to five in some species.

In this study these five projections were named as: **1**- superior projection [character 52(1)], **2**- supero-internal projection [character 54(1)], **3**- infero-internal projection [character 56(1)], **4**- inferior projection [character 57(1)] and **5**- ventral projection [character 60(1)]. Only two of them appear in the other Luzarinae genera examined here (excluding *Melanotes ornata*, *Guabamima lordelloi*, *Guabamima saiva* and *Modestozara* sp.) (Figs 10-18). These projections can be reduced or not, or have different shapes, like small spines, hooks or serrulated.

Some structures of the pseudepiphallic sclerite are exclusive to *Eidmanacris* species, as the “lateral projection”, present as an exclusive synapomorphy in the clade E [character 62(1)], and the “anterior projection” an exclusive synapomorphy of *Eidmanacris*. Probably these structures must have some kind of musculature associated, since some genital components of these crickets are considerably mobile.

There is a relation between this mobility and the fixation of the male with female genitalia during the copulation. It is possible to note a “key lock” pattern between the pseudepiphallic paramere and the copulatory papilla (Fig. 23). Besides this mobility for the transference of the spermatophore, de Mello & Andrade (2003) reported the presence of a membranal sphere (M.S.) in PsP2 [character 71(1)]. According to the authors, this membrane apparently works through hydraulic pressure, acting as a cushion in the clasping function of the PsP2.

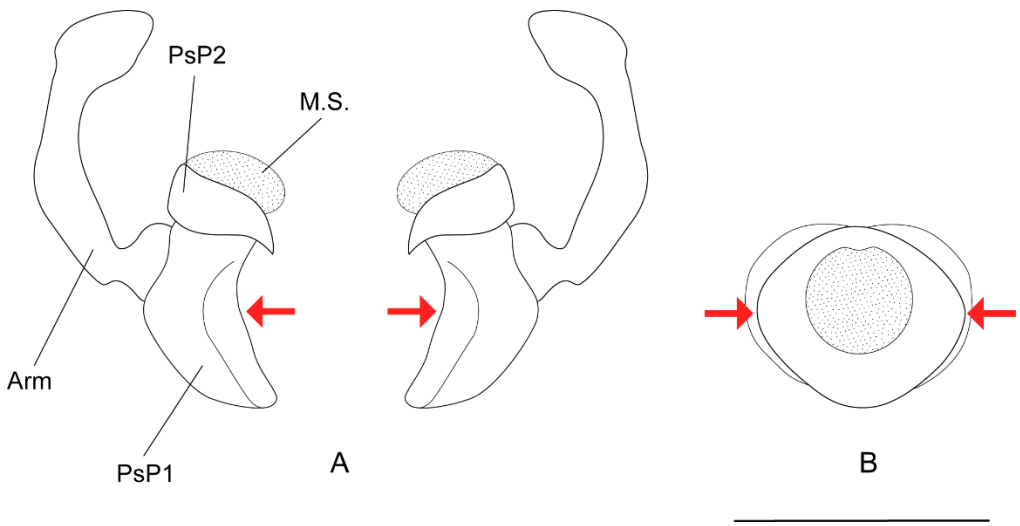


Figure 23. *Eidmanacris meridionalis:* Posterior view: **A-** male genitalia; **B-** copulatory papilla. Red arrows indicate the relation "key lock" between PsP2 and the copulatory papilla. Scale bar: 0.5 mm.

One of the synapomorphies of *Eidmanacris*, the non-sclerotized connection between the lobes of pseudepiphallic paramere [character 67(1)], indicates a possible separation of these lobes over time. The PsP2 is also linked, and sometimes fixed to the sclerite A of the pseudepiphallus.

Another interesting structure is the medio-posterior projection of endophallic sclerite. In *Eidmanacris* it is elongated [character 95(1)], passing through the entire genitalia and surrounded by the membranous ectophallic fold [character 84(1)]. In *Endophallusia endophallica* there is a hyper development of these structures together with the ectophallic invagination. This makes this structure four times longer than the pseudepiphallic sclerite.

This group shows clearly evidences of sexual selection. The genitalia, with the well-developed and conspicuous pseudepiphallic sclerite and its many projections, together with the male metanotal glands demonstrate that the sexual behavior can provide important information for a better understanding of the evolution of these crickets.

4.4. *Geographic distribution and habitat*

The species of *Eidmanacris* are distributed through South-American regions of different compositions of Atlantic Forest (dense rain forest, mixed rain forest, semi deciduous forest), Cerrado and Chaco. They do not occur in the Amazon Forest, so far is known.

The genus is defined by Desutter-Grandcolas (1995b) as cavicolous-straminiculous and recently as occasional cavernicolous by Bolfarini (2016). It is possible to find *Eidmanacris* in natural cavities as burrows on the ground or in bounds, in rock crevices, and in the entrance of caves (Mesa & de Mello, 1985; Bolfarini, 2016).

According to Souza-Dias *et al.* (2015), the species of *Eidmanacris* found in caves can divide the space with other species of crickets. *Eidmanacris* crickets was observed in the entrance of a cave, while *Endecous* crickets were found at the interior of the same cave. *Eidmanacris* was also observed in a co-occurrence with *Strinatia* in photic areas of a cave. These observations indicate that these species are not competitors in large cavities.

When *Eidmanacris* is found in the entrance of cave, there is a population of that species occurring around the cave (Bolfarini, 2016). Five out of 29 species of *Eidmanacris* are registered in caves (Mesa & de Mello, 1985; Bolfarini, 2016; Chapter 1 of this study): *E. alboannulata*, *E. dissimilis*, *E. neomarmorata*, *E. scopula* and *E. speluncae*.

Considering the biogeographic regionalization of Neotropical region of Morrone (2014), the *Eidmanacris* species are distributed over five different provinces: Atlantic (AP), Parana Forest (PF), Araucaria Forest (AFP), Cerrado (CP) and Rondonia (RP) (Figs. 24 e 25).

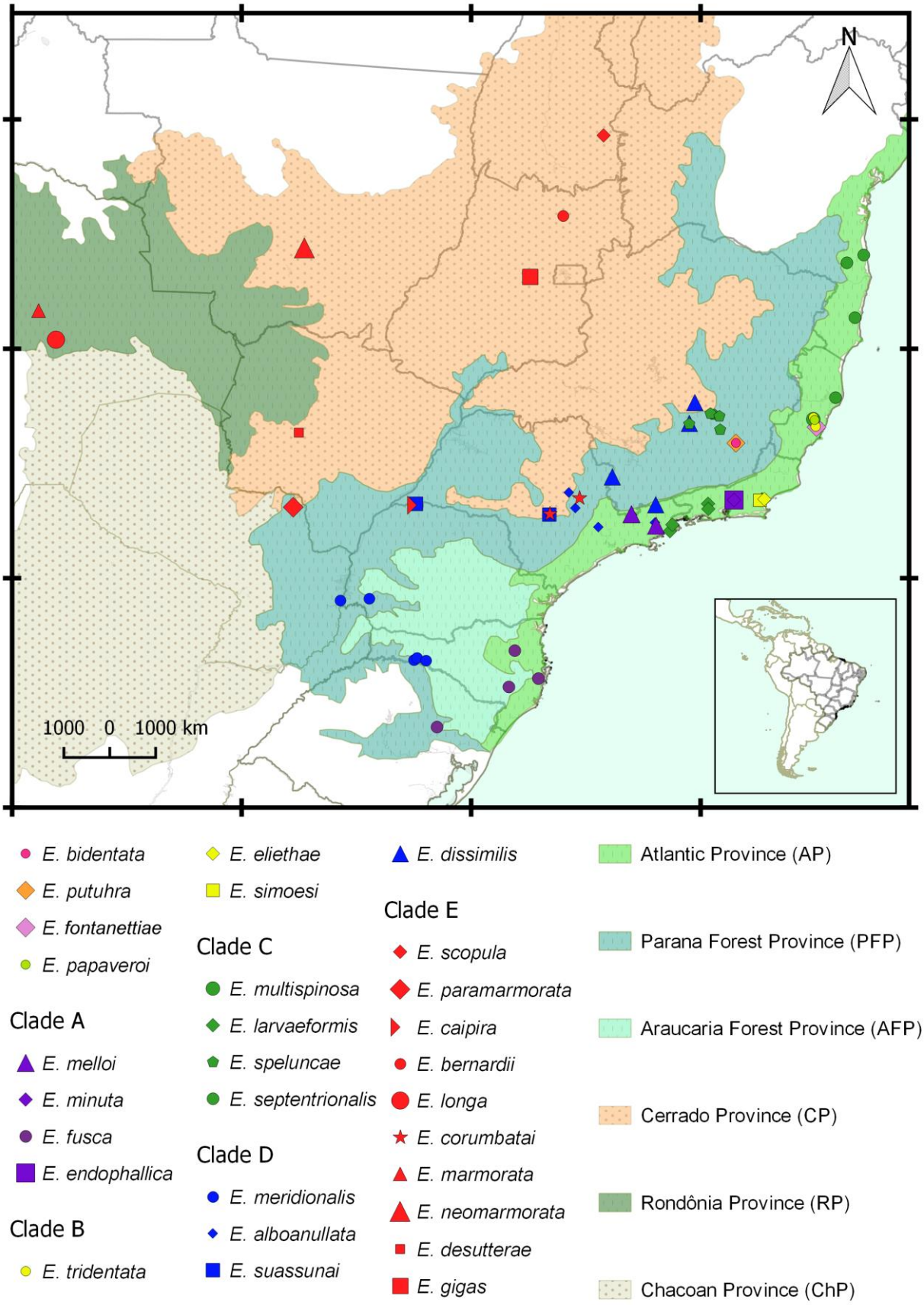


Figure 24. Distribution map of *Eidmanacris* species.

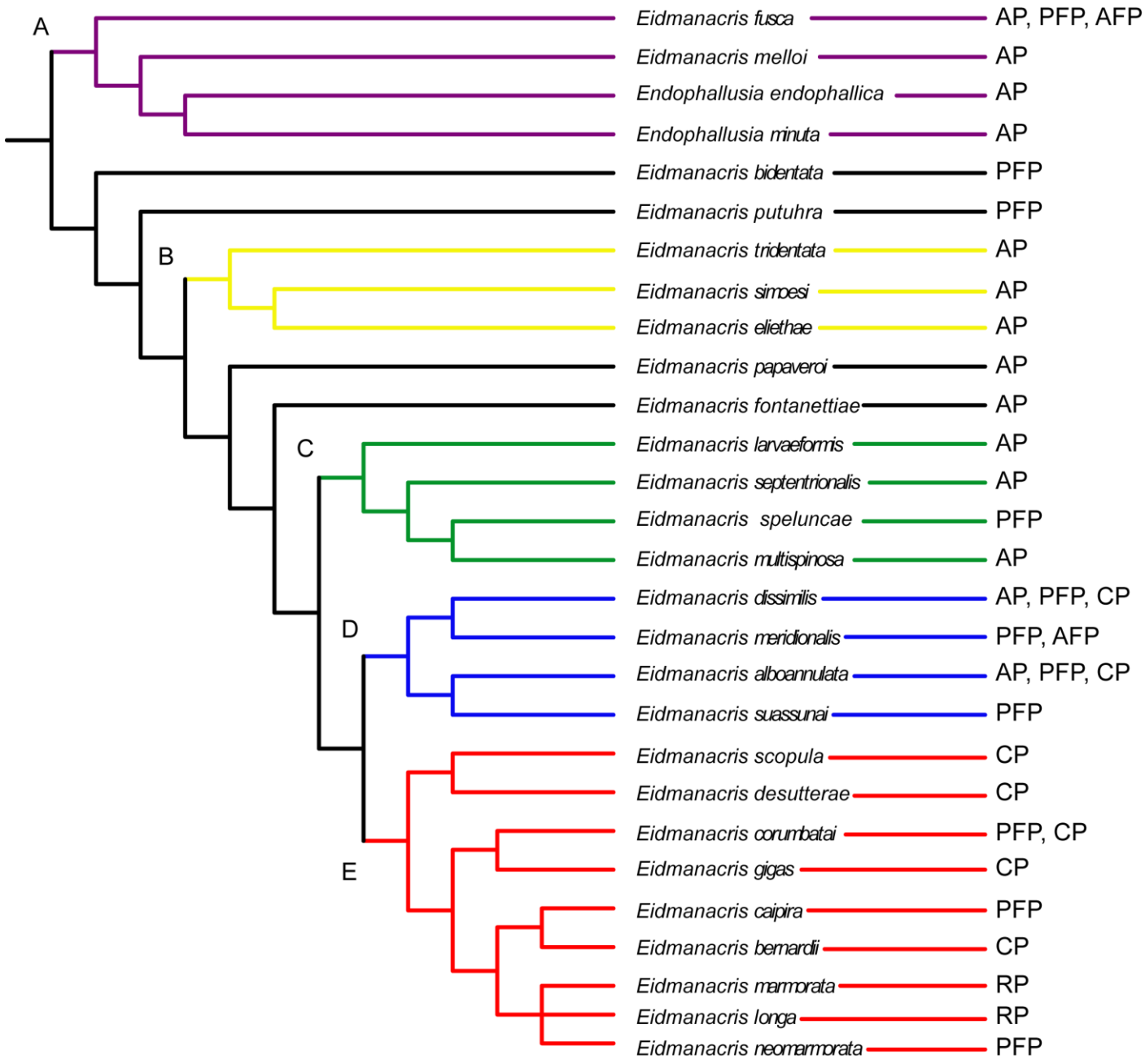


Figure 25. Clade of *Eidmanacris* species of analysis 2 and its distribution in the biogeographical provinces of Morrone (2014). (For abbreviations, please see Figure 24).

All the species that compound clade A are found in mountain ranges. *Endophallusia endophallica* and *Endophallusia minuta* in Serra dos Orgãos (Teresópolis, Rio de Janeiro State); *E.* melloi in Serra da Mantiqueira and Serra do Mar (São Francisco Xavier and São Luiz do Paraitinga in São Paulo State, respectively); and *E. fusca* in Serra Geral, a mountain range covered of Atlantic Forest that extends from northeast of Rio Grande do Sul State until the southeast of Santa Catarina State (Fig. 26). All species occur in the Atlantic Province, except for *E. fusca*, which is 'widespread' over three provinces, Parana Forest, Araucaria Forest and Atlantic.

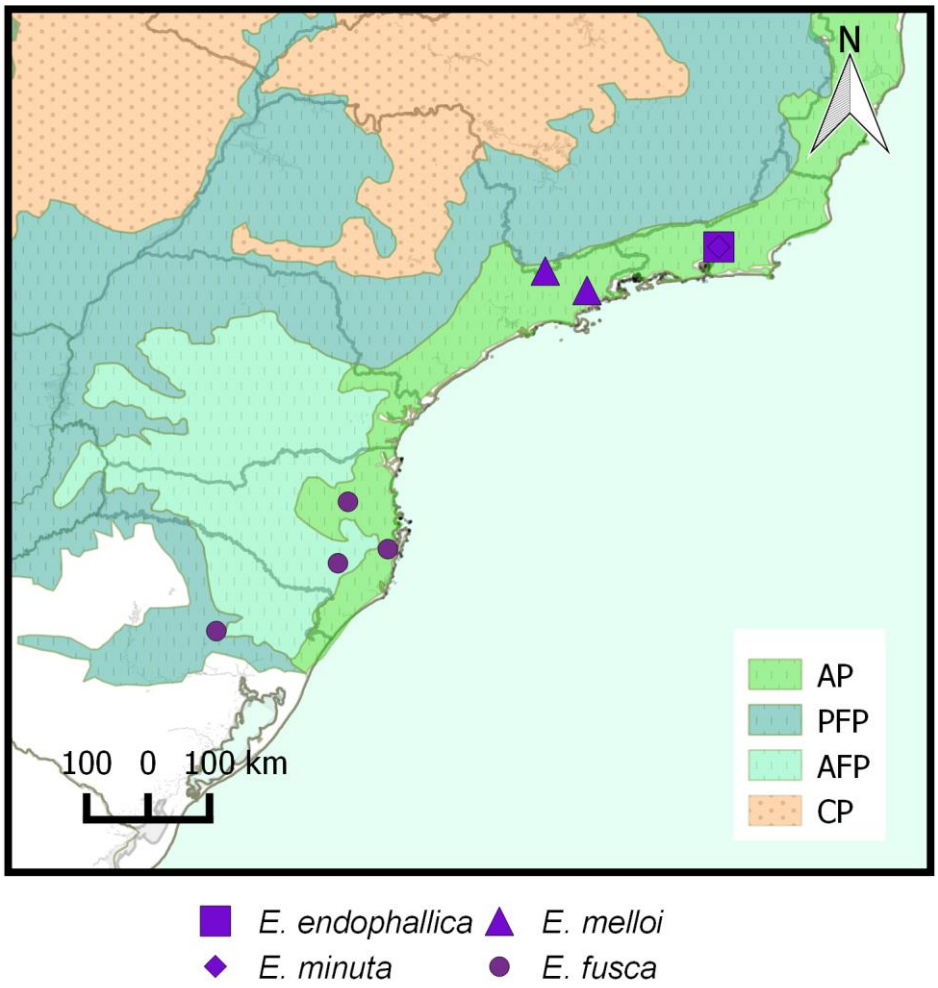


Figure 26. Distribution map of *Eidmanacris* species of clade A.

The species of clade B, *E. eliethae* and *E. simoesi*, are sympatric in Rio das Ostras, Rio de Janeiro State. *Eidmanacris tridentata* is located further north in Cariacica and Santa Teresa in Espírito Santo State. This clade occurs exclusively in the Atlantic Province (Fig. 27)

Clade C, composed of *E. larvaeformis*, *E. multispinosa*, *E. septentrionalis* and *E. speluncae*. is distributed through Atlantic Province, excepting *E. speluncae* that is located in Parana province. Interestingly, all records of *E. speluncae* are in caves (Fig. 28).

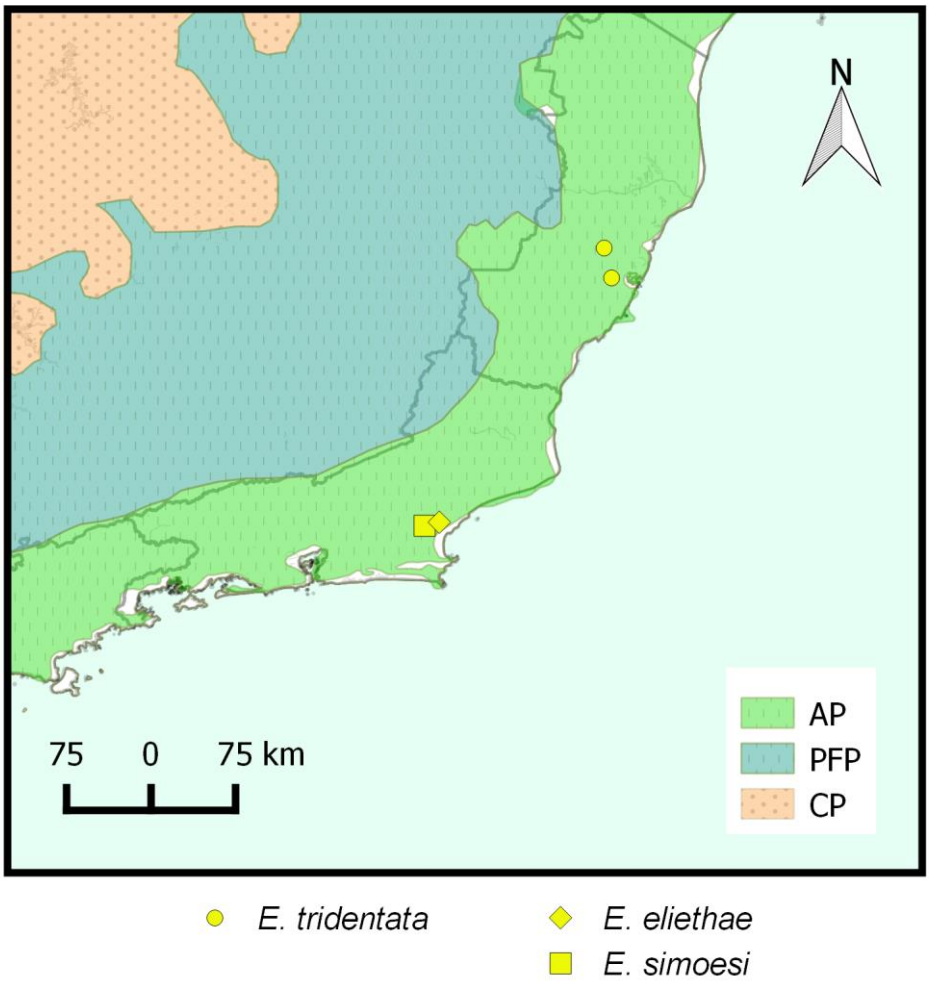


Figure 27. Distribution map of *Eidmanacris* species of clade B.

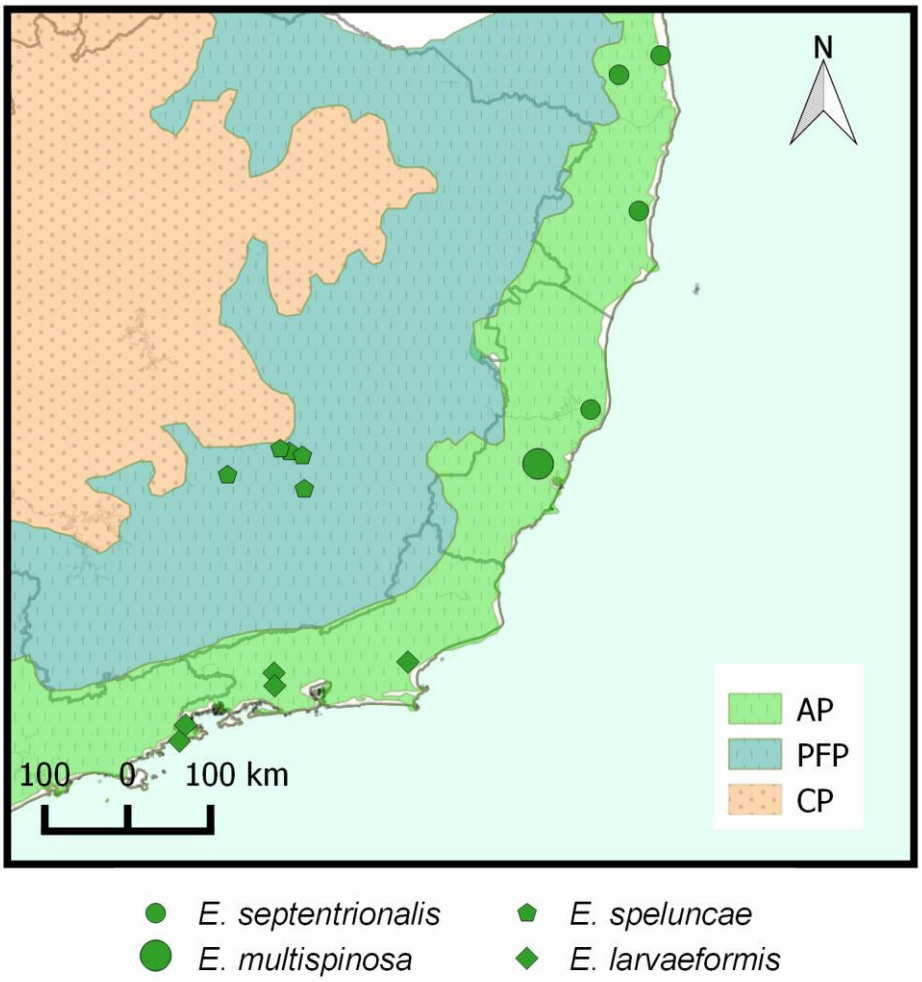


Figure 28. Distribution map of *Eidmanacris* species of clade C.

In clade D, except for *E. meridionalis*, that is distributed over Parana Province and Araucaria Forest Province, the other three species are distributed in transition borders of the Atlantic and Parana Forest Provinces with the Cerrado Province (Fig. 29).

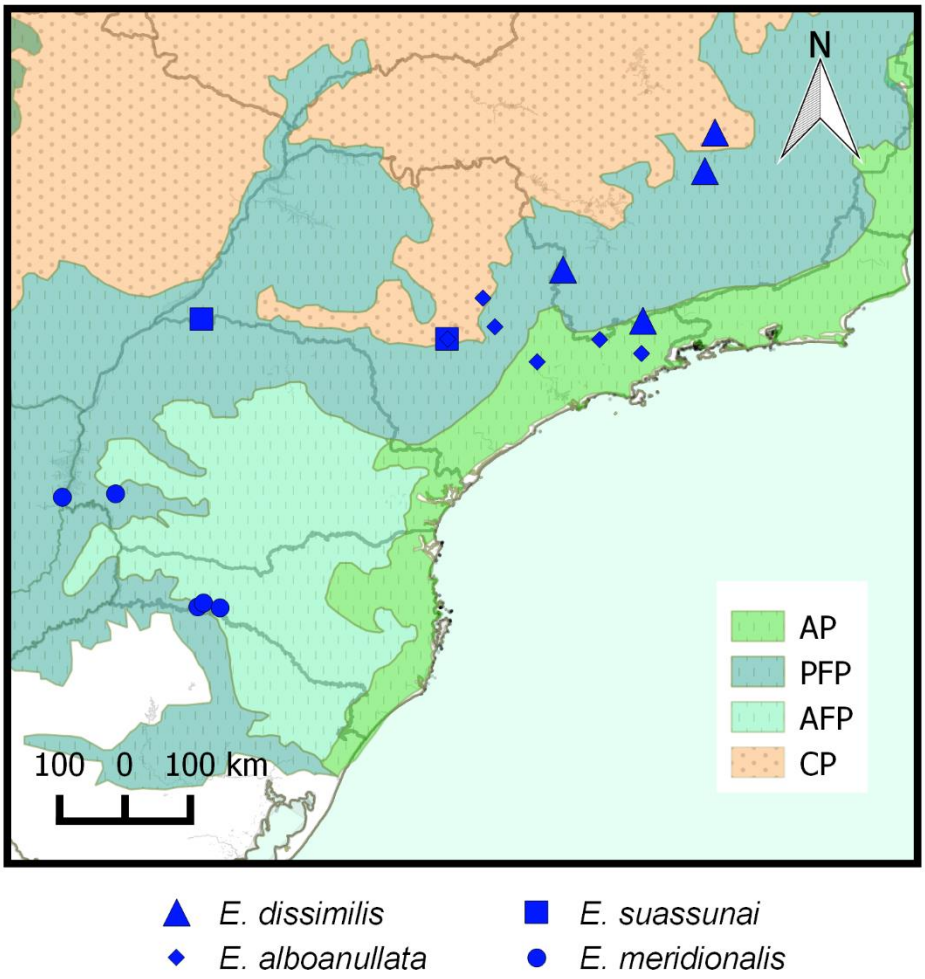


Figure 29. Distribution map of *Eidmanacris* species of clade D.

Besides inhabiting humid forests regions, some species of *Eidmanacris* occur in drier regions as previously noted by Desutter-Grandcolas (1995a), and interestingly, all species of *Eidmanacris* inhabiting those drier regions resulted composing a single clade, clade E. These species are located in the following provinces: Cerrado, Rondonia and Parana Forest (Semi-deciduous Forest) (Fig. 30). The species present in Rondonia and Parana Forest Provinces are in the transition zone with Cerrado and Chacoan Provinces.

Although these species are in dry regions, they are found mostly in shelters that retains humidity (burrows in rock crevices, caves and holes in bounds) and associated with gallery forests that pass through these regions and contributes to their distribution over these drier environments. And these dry regions could contribute to a selective pressure on this group, as a possible explanation for the large number of morphological modifications in the species of this clade, as discussed above, with a greater number of exclusive features (Fig. 22).

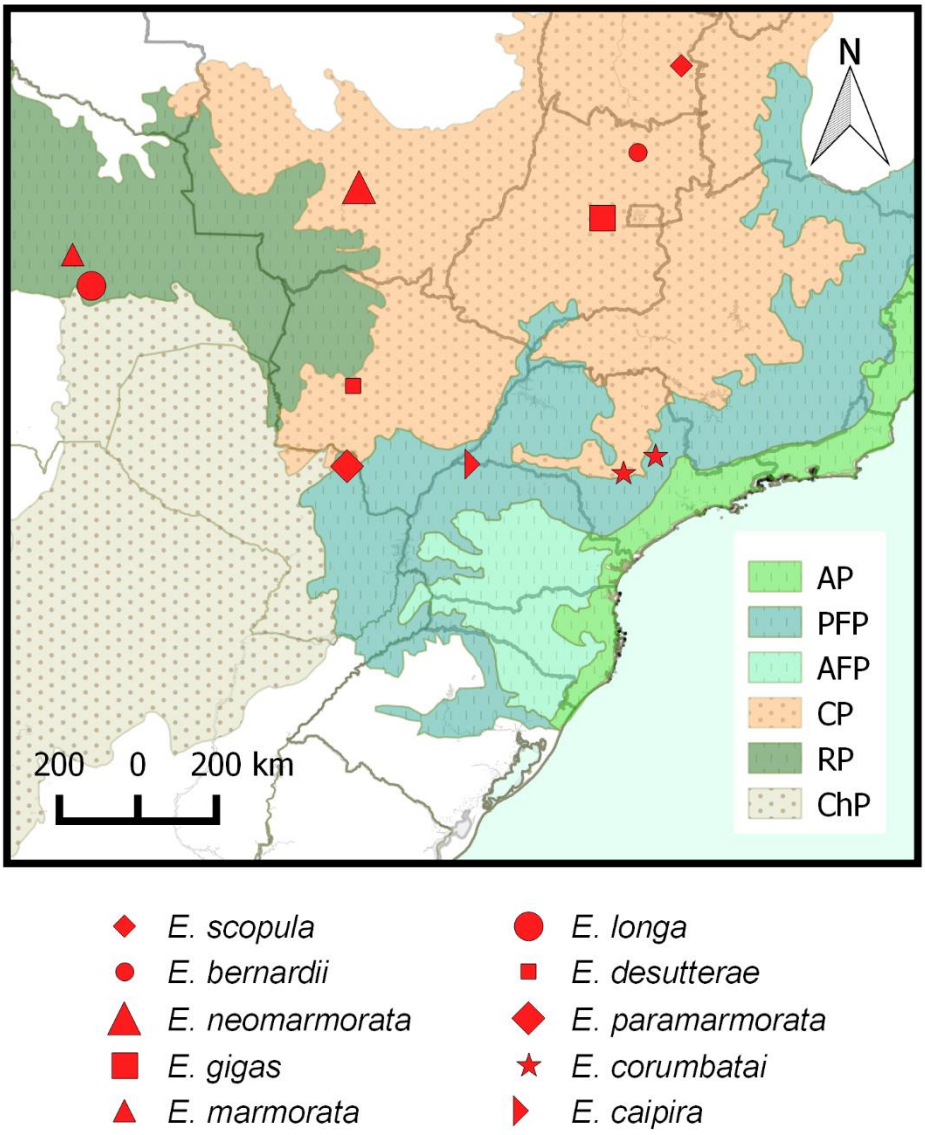


Figure 30. Distribution map of *Eidmanacris* species of clade E.

5. *Conclusions*

Eidmanacris was indicated as a monophyletic genus in the present cladistic analysis, by including the species of *Endophallusia*. The nomenclatural acts (synonymies of *Endophallusia minuta*, *Endophallusia endophallica* and *Phalangopsis speluncae*) proposed in the chapter 1 of this study were corroborated here.

Although not including a complete morphological analysis of *E. marmorata, E. longa* and *E. paramarmorata*, the resolution of the most parsimonious tree of analysis 2 is nearly resolved, and the inclusion of males of *E. paramarmorata* may improve the tree resolution (mainly in analysis 1), and change some relationships in the clade E.

Eidmanacris is mostly diversified over humid areas of the Atlantic Forest, but clade E, that includes *E. marmorata, E. paramarmorata, E corumbatai, E. longa, E. caipira, E. bernardii, E. scopula, E. neomarmorata, E. gigas, E. desutterae,* is an exceptional case, as is distributed through drier areas as Cerrado and Chaco or in transitional areas.

Based on the abovementioned, *Eidmanacris* is certainly a good model organism for future biogeographical, evolutionary and behavioral studies.

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Appendix

Table 5. Data matrix: terminals and characters.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Melanotes ornata	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	-	-	-	-	-	0	-	-	0	-	-	0	-	0	-	0	0	-
Gubamima lordelloi	0	0	1	0	0	1	1	0	0	-	0	0	1	0	0	-	-	-	-	-	0	-	-	0	-	-	0	-	0	-	0	0	-
Guabamima saiva	0	0	1	0	0	1	1	0	0	-	0	0	1	0	0	-	-	-	-	-	0	-	-	0	-	-	0	-	0	-	0	0	-
Modestozara sp.	1	0	0	1	0	1	0	1	1	0	1	1	0	1	0	-	-	-	-	-	0	-	-	0	-	-	0	-	0	-	0	0	-
Ottedana cercalis	1	0	0	1	0	1	1	1	1	0	0	1	1	1	1	0	0	-	0	1	-	-	-	0	-	-	1	0	0	-	0	0	-
Adenopygus heikoi	2	0	0	1	1	0	1	1	1	0	1	1	0	1	1	0	0	-	0	1	-	-	-	0	-	-	0	-	0	-	0	0	-
Bambuina bambui	2	0	0	0	1	0	1	1	1	1	0	1	1	1	1	0	0	-	1	0	0	-	-	0	-	-	0	-	0	-	0	0	-
Strinatia brevipennis	1	0	0	0	0	1	1	1	1	0	0	1	0	1	1	0	0	-	0	0	1	0	0	0	-	-	1	0	0	-	0	0	-
Strinatia teresopolis	1	0	0	0	0	1	0	1	1	0	0	1	0	1	1	0	0	-	0	1	-	-	-	0	-	-	0	-	0	-	0	0	-
Endophallusia minuta	2	1	1	1	2	0	1	1	1	0	1	1	0	1	1	0	0	-	0	0	1	0	1	0	-	-	1	0	1	1	0	1	0
Endophallusia endophallica	1	1	1	1	2	0	1	1	1	0	1	1	0	1	0	-	-	-	-	-	-	-	-	0	-	-	0	-	1	1	0	1	1
Eidmanacris tridentata	2	1	1	1	0	0	1	1	1	0	1	1	0	1	0	-	-	-	-	-	-	-	-	-	-	-	0	-	1	0	1	1	0
Eidmanacris simoesi	2	1	1	1	0	0	1	1	1	0	1	1	0	1	1	0	1	0	2	0	0	-	-	1	1	-	1	0	1	0	1	1	0
Eidmanacris eliethae	2	1	1	1	0	0	1	1	1	0	0	1	0	1	1	?	1	0	2	0	?	?	?	1	0	1	1	0	1	0	1	1	0
Eidmanacris papaveroi	2	1	1	1	0	0	1	1	1	2	1	1	1	1	1	0	1	0	2	0	0	-	-	1	1	-	1	0	0	-	1	1	0
Eidmanacris bidentata	1	1	1	1	0	0	0	1	1	0	1	1	0	1	1	0	0	0	2	1	-	-	-	1	0	0	0	-	1	0	1	1	1
Eidmanacris putuhra	1	1	1	1	0	0	1	1	1	0	1	1	0	1	1	0	1	0	2	0	0	-	-	1	0	0	1	0	0	0	1	1	0
Eidmanacris speluncae	2	1	1	2	0	0	0	1	1	0	1	1	1	1	1	1	1	0	2	0	0	-	-	1	0	1	1	0	0	-	1	1	0
Eidmanacris fontanettiae	2	1	1	1	0	0	0	1	1	2	1	1	1	1	1	0	1	0	2	0	0	-	-	1	0	1	1	0	0	-	1	1	0
Eidmanacris larvaeformis	2	1	1	2	0	0	0	1	1	2	1	1	1	1	1	1	1	0	2	0	0	-	-	1	0	1	1	0	1	0	1	1	0
Eidmanacris septentrionalis	2	1	1	1	0	0	0	1	1	2	1	1	1	1	1	1	1	0	2	0	0	-	-	1	0	1	1	0	1	0	1	1	0
Eidmanacris multispinosa	1	1	1	2	0	0	0	1	1	2	0	1	1	1	1	?	1	0	2	0	?	?	?	1	0	1	1	0	1	0	1	1	0
Eidmanacris alboannulata	2	1	1	1	0	0	0	1	1	0	0	1	0	1	1	0	1	0	2	0	1	1	-	1	0	1	1	1	1	0	1	1	1
Eidmanacris suassunai	2	1	1	1	0	0	0	1	1	0	1	1	0	1	1	0	1	0	2	0	1	1	-	1	0	1	1	1	1	0	1	1	1
Eidmanacris dissimilis	2	1	1	1	0	0	0	1	1	0	0	2	1	1	1	0	1	0	2	0	1	1	-	1	0	1	1	1	1	0	1	1	0
Eidmanacris meridionalis	2	1	1	1	0	0	0	1	1	0	0	2	1	1	1	0	1	0	2	0	1	1	-	1	0	1	1	1	1	0	1	1	0
Eidmanacris marmorata	2	1	1	1	0	0	0	1	1	2	0	1	?	1	1	?	1	1	2	0	?	?	?	1	0	1	1	?	1	0	1	1	0
Eidmanacris longa	?	1	1	1	0	0	0	1	1	2	0	1	?	1	1	?	1	1	2	0	?	?	?	1	0	1	1	?	1	0	1	1	0
Eidmanacris paramarmorata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eidmanacris corumbatai	2	1	1	1	0	0	0	1	1	2	0	1	1	1	1	0	1	1	2	0	0	-	-	1	0	1	1	1	1	0	1	1	1
Eidmanacris caipira	2	1	1	1	0	0	0	1	1	2	0	1	1	1	1	1	1	1	2	0	0	-	-	1	0	1	1	1	1	0	1	1	0
Eidmanacris bernardii	2	1	1	1	0	0	0	1	1	2	0	1	1	1	1	?	1	1	2	0	?	?	?	1	0	1	1	1	1	0	1	1	0
Eidmanacris scopula	2	1	1	1	0	0	0	1	1	2	0	1	1	1	?	?	?	?	?	?	?	?	?	1	0	0	0	-	1	0	1	1	1
Eidmanacris desutterae	2	1	1	1	0	0	0	1	1	2	0	1	0	1	1	?	0	-	0	1	-	-	-	1	0	0	0	-	1	0	1	1	1
Eidmanacris gigas	2	1	1	1	0	0	0	1	1	2	0	1	1	1	1	0	1	1	2	0	0	-	-	1	0	0	1	1	1	0	1	1	0
Eidmanacris neomarmorata	2	1	1	1	0	0	0	1	1	2	0	1	1	1	1	0	1	1	2	0	0	-	-	1	0	1	1	1	1	0	1	1	1
Eidmanacris fusca	1	0	0	1	2	0	0	1	1	0	1	1	0	1	0	-	-	-	-	-	-	-	-	0	-	-	0	-	0	-	0	1	0
Eidmanacris melloi	1	0	0	1	2	0	1	1	1	0	1	1	0	1	1	0	0	-	0	0	1	0	1	0	-	-	1	0	1	1	0	1	0

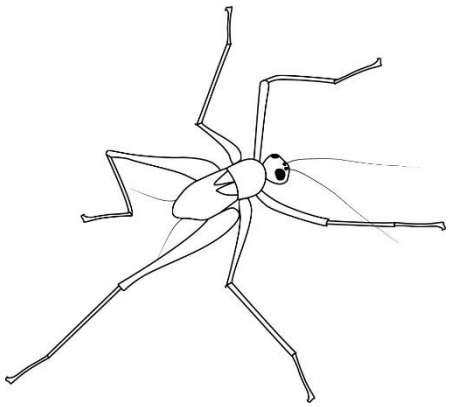
Table 5. Continuation.

	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
Melanotes ornata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	-	0	0	-	-	0	-	0	-	0	0	0
Gubamima lordelloi	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	-	0	-	0	0	-	-	0	-	0	-	0	0	0
Guabamima saiva	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	-	0	-	0	0	-	-	0	-	0	-	0	0	0
Modestozara sp.	0	1	1	1	0	1	0	0	0	?	?	1	0	0	1	0	0	0	0	-	0	-	0	0	-	-	0	-	0	-	0	0	0
Ottedana cercalis	0	1	0	0	0	1	0	0	0	0	1	1	0	1	1	0	0	1	1	0	0	-	0	1	0	0	0	-	0	-	0	0	1
Adenopygus heikoi	0	1	0	0	0	1	0	0	0	0	0	1	0	0	2	0	0	1	1	0	1	0	0	0	-	-	0	-	0	-	0	1	0
Bambuina bambui	0	1	1	0	1	1	0	0	0	0	0	1	0	0	2	0	0	1	1	0	1	0	0	0	-	-	0	-	0	-	0	1	0
Strinatia brevipennis	0	1	1	1	1	1	0	0	1	0	1	1	0	1	1	0	0	0	1	0	0	-	0	1	0	0	0	-	0	-	0	1	1
Strinatia teresopolis	0	1	1	1	1	1	0	0	1	0	1	1	0	0	1	0	0	1	1	0	0	-	0	1	0	0	0	-	0	-	0	1	0
Endophallusia minuta	0	1	1	0	0	1	1	-	1	0	0	1	1	0	1	1	1	0	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1
Endophallusia endophallica	0	1	1	0	0	1	1	-	1	0	0	1	1	0	1	1	1	0	1	0	0	-	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris tridentata	0	1	1	0	1	1	0	0	2	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris simoesi	0	1	1	0	1	1	0	0	2	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris eliethae	0	1	1	0	1	1	0	0	2	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	0
Eidmanacris papaveroi	0	1	1	0	1	1	0	0	2	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris bidentata	0	1	1	0	1	1	0	0	2	0	0	1	1	0	1	0	0	1	1	0	0	-	0	1	0	0	0	-	0	-	1	1	0
Eidmanacris putuhra	0	1	1	0	1	1	0	0	2	0	0	1	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris speluncae	0	1	1	0	1	1	0	0	2	0	0	1	1	0	1	0	0	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	0
Eidmanacris fontanettiae	0	1	1	0	1	1	0	0	2	0	0	1	1	0	1	0	0	1	1	0	1	0	0	0	-	-	0	-	0	-	0	1	1
Eidmanacris larvaeformis	1	1	1	0	1	1	0	0	2	0	0	1	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris septentrionalis	1	1	1	0	1	1	0	0	2	0	0	1	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	0
Eidmanacris multispinosa	0	1	1	0	1	1	0	0	2	0	0	1	0	0	1	0	1	1	1	0	1	1	0	1	0	0	0	-	0	-	1	1	0
Eidmanacris alboannulata	1	1	1	0	2	1	0	0	2	0	0	1	0	0	1	0	1	1	1	1	1	0	0	1	0	1	0	-	0	-	1	1	0
Eidmanacris suassunai	1	1	1	0	2	1	0	0	2	0	0	1	0	0	1	0	1	1	1	1	1	0	0	1	0	1	0	-	0	-	1	1	0
Eidmanacris dissimilis	0	1	1	0	2	1	0	0	2	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	0
Eidmanacris meridionalis	0	1	1	0	2	1	0	0	2	0	0	1	1	0	1	0	1	1	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris marmorata	?	1	1	0	1	1	0	1	?	1	0	1	1	0	1	0	0	1	1	2	1	2	1	1	1	0	0	-	1	0	1	1	1
Eidmanacris longa	?	1	?	0	1	1	0	1	2	1	0	1	1	0	1	0	0	1	1	2	1	2	1	1	1	0	0	-	1	0	1	1	1
Eidmanacris paramarmorata	?	?	?	?	?	?	0	1	2	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eidmanacris corumbatai	1	1	1	0	1	1	0	1	2	1	0	1	1	2	1	0	0	1	1	1	1	2	1	1	1	0	1	1	1	0	1	1	1
Eidmanacris caipira	1	1	1	0	1	1	0	1	2	1	0	1	1	0	1	0	0	1	1	1	1	2	1	1	1	0	0	-	1	1	1	1	1
Eidmanacris bernardii	1	1	1	0	1	1	?	?	?	?	?	1	1	0	1	0	0	1	1	1	1	2	1	1	1	0	0	-	1	1	1	1	1
Eidmanacris scopula	1	1	1	0	1	1	0	1	2	1	0	1	1	0	1	0	0	1	1	1	1	0	0	1	1	0	0	-	1	0	1	1	1
Eidmanacris desutterae	0	1	1	0	1	1	0	1	2	1	0	1	1	2	1	0	0	1	1	0	1	0	0	1	1	0	1	0	1	0	1	1	1
Eidmanacris gigas	0	1	1	0	1	1	0	1	2	1	0	1	0	2	1	0	0	1	1	1	1	2	1	1	1	0	1	1	1	0	1	1	1
Eidmanacris neomarmorata	1	1	1	0	1	1	0	1	2	1	0	1	1	0	1	0	0	1	1	2	1	2	1	1	1	0	0	-	1	0	1	1	1
Eidmanacris fusca	0	1	1	0	0	1	0	0	1	0	0	1	1	0	1	1	1	0	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1
Eidmanacris melloi	0	1	1	0	1	1	0	0	1	0	0	1	1	0	1	1	1	0	1	0	1	0	0	1	0	0	0	-	0	-	1	1	1

Table 5. Continuation.

	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
Melanotes ornata	0	0	0	-	0	0	0	0	0	-	0	0	0	-	-	0	0	0	-	0	0	0	0	0	0	-	-	0	-	-	-	0
Gubamima lordelloi	0	0	0	-	0	0	0	0	0	-	0	1	0	-	-	1	0	0	-	1	-	-	-	0	0	-	-	0	-	-	-	0
Guabamima saiva	0	0	0	-	0	0	0	0	0	-	0	1	0	-	-	1	0	0	-	1	-	-	-	0	0	-	-	0	-	-	-	0
Modestozara sp.	0	0	0	-	0	0	0	0	1	0	0	0	0	-	-	0	0	0	-	1	-	-	-	0	1	-	-	1	0	-	-	0
Ottedana cercalis	0	1	0	-	1	0	0	0	0	-	0	0	1	0	0	0	0	0	-	1	-	-	-	0	1	-	-	1	0	-	-	0
Adenopygus heikoi	0	1	0	-	0	1	0	0	0	-	0	0	0	-	-	0	0	0	-	1	-	-	-	0	1	-	-	1	0	-	-	0
Bambuina bambui	0	1	0	-	0	1	0	0	0	-	0	0	0	-	-	0	0	0	-	1	-	-	-	0	1	-	-	1	0	-	-	0
Strinatia brevipennis	0	1	1	0	1	0	0	0	0	-	0	0	1	0	0	0	0	0	-	1	-	-	-	0	1	-	-	1	0	-	-	0
Strinatia teresopolis	0	1	1	0	1	0	0	0	0	-	0	0	0	-	-	0	0	0	-	1	-	-	-	0	1	-	-	1	0	-	-	0
Endophallusia minuta	1	1	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	1	0	0	1	-	0	1	1	1	0	-	1
Endophallusia endophallica	1	1	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	1	-	-	-	1	-	0	1	1	1	0	-	1
Eidmanacris tridentata	1	1	1	1	1	0	0	0	1	0	2	1	1	0	0	1	0	1	0	0	0	-	-	1	-	1	0	1	1	0	-	1
Eidmanacris simoesi	1	1	1	1	1	0	0	0	1	1	2	1	1	0	0	1	0	1	0	0	0	0	1	1	-	1	0	1	1	0	-	1
Eidmanacris eliethae	1	1	1	1	1	0	0	0	1	1	2	1	1	0	0	1	0	1	0	0	0	0	1	1	-	1	0	1	1	0	-	1
Eidmanacris papaveroi	1	1	1	1	1	0	0	0	1	0	0	1	1	1	-	1	1	1	0	0	1	0	1	1	-	1	0	1	1	0	-	1
Eidmanacris bidentata	1	1	1	0	1	0	0	0	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	-	0	0	1	1	0	-	1
Eidmanacris putuhra	1	1	1	1	1	0	0	0	1	0	0	1	1	1	-	2	0	1	0	0	0	0	1	1	-	0	0	1	1	0	-	1
Eidmanacris speluncae	1	1	1	0	1	0	0	0	1	0	0	1	1	1	-	2	1	1	0	0	0	0	1	1	-	0	0	1	1	0	-	1
Eidmanacris fontanettiae	1	1	1	0	1	0	0	0	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	-	1	0	1	1	0	-	1
Eidmanacris larvaeformis	1	1	1	0	1	0	1	0	1	0	2	1	1	0	0	1	0	1	0	0	1	0	0	1	-	0	0	1	1	0	-	1
Eidmanacris septentrionalis	1	1	1	0	1	0	0	0	1	0	0	1	1	0	0	1	1	1	0	0	0	0	0	1	-	0	0	1	1	0	-	1
Eidmanacris multispinosa	1	1	1	0	1	0	0	0	1	0	0	1	1	1	-	1	1	1	0	0	0	0	0	1	-	0	0	1	1	0	-	1
Eidmanacris alboannulata	1	1	1	0	1	0	1	0	0	-	1	1	1	0	0	1	0	1	0	0	0	0	0	1	-	0	0	1	1	1	0	1
Eidmanacris suassunai	1	1	1	0	1	0	1	0	0	-	1	1	1	0	0	1	0	1	0	0	0	0	0	?	-	0	0	1	1	1	0	1
Eidmanacris dissimilis	1	1	1	0	1	0	1	0	0	-	1	1	1	0	0	1	0	1	0	0	0	0	0	1	-	0	0	1	1	1	0	1
Eidmanacris meridionalis	1	1	1	0	1	0	1	0	1	0	1	1	1	0	0	1	0	1	0	0	0	0	0	1	-	0	0	1	1	1	0	1
Eidmanacris marmorata	1	1	1	0	1	0	0	1	0	-	1	1	1	0	1	1	?	1	0	0	0	0	0	1	-	0	0	1	1	1	1	1
Eidmanacris longa	1	1	1	0	1	0	0	1	0	-	1	1	1	0	1	1	2	1	0	0	0	0	0	1	-	0	0	1	1	1	1	1
Eidmanacris paramarmorata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Eidmanacris corumbatai	1	1	1	0	1	0	0	1	0	-	1	1	1	0	0	1	2	1	0	0	0	1	-	1	-	0	0	1	1	1	1	1
Eidmanacris caipira	1	1	1	0	1	0	0	1	0	-	1	1	1	0	1	1	2	1	0	0	0	0	0	1	-	0	0	1	1	1	1	1
Eidmanacris bernardii	1	1	1	0	1	0	0	1	0	-	1	1	1	0	1	1	0	1	0	0	0	1	-	1	-	0	0	1	1	1	1	1
Eidmanacris scopula	1	1	1	0	1	0	0	1	0	-	1	1	1	0	1	1	2	1	0	0	0	0	0	1	-	0	0	1	1	1	1	1
Eidmanacris desutterae	1	1	1	0	1	0	0	1	0	-	1	1	1	0	0	1	2	1	0	0	0	0	0	1	-	0	0	1	1	1	1	1
Eidmanacris gigas	1	1	1	0	1	0	0	1	0	-	1	1	1	0	0	1	2	1	0	0	0	0	0	1	-	0	0	1	1	1	1	1
Eidmanacris neomarmorata	1	1	1	0	1	0	0	1	0	-	1	1	1	0	1	1	2	1	0	0	0	0	0	1	-	0	0	1	1	1	1	1
Eidmanacris fusca	1	1	1	0	1	0	0	0	0	-	1	1	1	0	0	1	0	1	0	0	0	0	0	1	-	0	1	1	1	0	-	1
Eidmanacris melloi	1	1	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	1	0	0	1	-	0	1	1	1	0	-	1

Conclusões Gerais



Com 29 espécies, o gênero *Eidmanacris* é o mais diverso dentre os Luzarinae Neotropicais. Com ampla distribuição, ocorre nos Chacos, Cerrado e Mata Atlântica, porém não ocorre na floresta Amazônica.

Com base nos resultados são propostas as seguintes modificações taxonômicas:

- O gênero *Endophallusia* é sinônimo júnior de *Eidmanacris.*
- *Eidmanacris lencionii* é sinônimo júnior de *Eidmanacris dissimilis*;
- A espécie *Phalangopsis speluncae* é sinônimo de *Eidmanacris.*

As espécies *Eidmanacris longa* e *Eidmanacris marmorata* necessitam de estudos mais aprofundados, já que não foi possível analisar o material nesse trabalho. A inclusão desses dados pode melhorar a resolução da árvore da análise 1 e modificar alguns relacionamentos no clado E na análise 2 aqui realizadas.

A descrição do macho de *Eidmanacris paramarmorata* é importante para complementação dos dados, uma vez que, em Grylloidea, os machos costumam ser mais informativos do que as fêmeas, no que diz respeitos a caracteres morfológicos.

O clado E, que inclui *E. marmorata, E. paramarmorata, E corumbatai, E. longa, E. caipira, E. bernardii, E. scopula, E. neomarmorata, E. gigas, E. desutterae,* é um clado bem sustentado, e que, diferente das outras espécies do gênero, estão distribuídos em áreas com características mais secas como o Cerrado e o Chaco ou na transição para elas.

Além da Biogeografia, dentre as considerações feitas acima, estudos comportamentais e moleculares (nunca feitos até o momento), tornariam as espécies de *Eidmanacris* em bons modelos para estudos evolutivos.