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Revisão e análise cladística de Arthrosolaenomeridini Hoffman, 1976 (Diplopoda: Polydesmida: Chelodesmidae)

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ADVERTÊNCIA

Esta dissertação não é uma publicação conforme descrito no Código de Nomenclatura Zoológica. Portanto, nomes novos e mudanças taxonômicas aqui propostas não tem validade para fins de nomenclatura ou prioridade.

WARNING

This thesis is not a publication as described by the International Code of Zoological Nomenclature. Therefore, new names and taxonomic changes here proposed are not valid for nomenclatural or priority purposes.

EPÍGRAFE

“Remember not our faulty pieces; remember not our rusted parts,
It's not the petty imperfections that define us but
The way we hold our hearts,
And the way we hold our heads,
I hope they write your names beside mine
On my gravestone when I'm dead.
And when we're dead let our voices carry on
To find a better song.
To find a better song and sing along.”

Nine, 2009.
La Dispute.

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ÍNDICE

INTRODUÇÃO GERAL

Os diplópodes pertencem ao subfilo dos Myriapoda, este último sendo formado por quatro classes: Chilopoda (Centopéias ou lacraias), Diplopoda (Piolhos-de-cobra), Pauropoda e Symphyla (ambos formando o grupo popularmente chamado de micro-miriápodes). São animais caracterizados pelo corpo alongado e com muitos pares de pernas, variando de 8 (Tetramerocerata: Pauropoda) até 375 pares (*Illacme plenipes* Cook & Loomis, 1928: Diplopoda).

Os diplópodes, comumente conhecidos como gongolos, embuás ou piolhos-de-cobra, representam um grupo dos animais mais antigos a conquistarem o ambiente terrestre, com idade aproximada de 420 milhões de anos (Rota-Stabelli *et al*., 2013; Selden & Read, 2008). Esses animais são caracterizados pela presença de diplossegmentos e dois pares de pernas por segmentos (com exceção dos quatro primeiros segmentos). A grande diversidade do grupo é encontrada nos ambientes tropicais, embora habitem todos os continentes do planeta (com exceção da Antártida), podendo ser encontrados, principalmente, em todos os extratos do solo, na serrapilheira e sob troncos e pedras (Hopkin & Read, 1992). Apresentam importante papel biológico, sendo considerados um dos principais grupos responsáveis pela ciclagem e fragmentação de nutrientes orgânicos (Hoffman, 1990c; Hopkin & Read, 1992).

A classe apresenta aproximadamente 12.000 espécies descritas (Sierwald & Bond, 2007), embora estima-se que esse número seja ainda maior, podendo alcançar cerca de 80.000 espécies (Adis, 2002). Atualmente, Diplopoda é constituída por 16 ordens, 144 famílias e cerca de 2.950 gêneros (Shelley, 2003).

Polydesmida Leach, 1815 representa a mais rica e diversa ordem dentre os diplópodes. Suas espécies são conhecidas como *flat-backed millipedes* ou ainda, em algumas regiões do Brasil, como centopeias-de-telhadinho. Atualmente, a ordem apresenta cerca de 31 famílias, 1.437 gêneros e 5.480 espécies (Hoffman *et al.*, 2002; Shelley, 2003; Shear *et al.*, 2016). Segundo Sierwald *et al.* (2003), Polydesmida é facilmente reconhecida pelas seguintes sinapomorfias: i) ausência de olhos; ii) presença de cavidade sinovial; iii) pleura dos esternitos fundida e sem sutura; iv) glândulas de defesa bicompartimentadas; e v) número de anéis corporais sub-constantes, variando de 18 a 20, com exceção de Dobrodesmidae.

Várias foram às tentativas de organização da ordem em nível de famílias (Pocock, 1895; Cook, 1895; Silvestri, 1897; Attems, 1898; 1899; 1914; 1926; 1937; 1938; 1940; Brolemann, 1902; 1916; Verhoeff, 1941; Jeekel, 1971; Hoffman, 1980), sendo a última grande classificação, e largamente utilizada atualmente, proposta por Shelley (2003), baseando-se nas ideias propostas por Brolemann (1916), Jeekel (1971) e Hoffman (1980). Embora exista uma grande quantidade de trabalhos relacionados à classificação do grupo, pouquíssimos esforços visaram testar as relações dos grupos propostos, através de uma abordagem filogenética. Segundo Means & Marek (2017) a falta de estudos sistemáticos para Polydesmida – bem como para Diplopoda como um todo – dificultou a investigação desse táxon, onde até o número de descrições alfa-taxonômicas das espécies, e em termos de investigação e dedicação ao melhor conhecimento do grupo, ficam bem atrás de outros grupos de invertebrados mais conhecidos, em cerca de 100 anos de "atraso". Uma das poucas exceções é o trabalho de Simonsen (1990) que discute a filogenia das subordens de Polydesmida, onde mostra a subordem Chelodesmidea sustentada pelo caráter apomórfico "coxa do gonopódio externa à abertura", sendo grupo irmão de Polydesmidea + Dalodesmidea.

A genitália masculina exposta e de fácil interpretação facilitou o estudo desses animais ao longo da história, garantindo aos polidesmídeos, com ênfase para Chelodesmidea, o status de maior grupo dentre os Diplopoda. Esta grande diversidade pode ser explicada pela baixa capacidade de dispersão desses animais, resultando em uma grande quantidade de grupos endêmicos (Hopkin & Read, 1992).

Chelodesmidae, proposta por Cook (1895), é a segunda maior família, não só entre os Polydesmida, como também de toda a classe Diplopoda, com cerca de 800 espécies atualmente descritas. Segundo Hoffman (1982b) a família é extremamente diversa e de difícil definição, e isso se deve, em grande parte, pela ausência de uma diagnose precisa e por um posicionamento filogenético incerto. A própria proposição de Chelodesmidae, feita por Cook (1895) conta com caracteres diagnósticos extremamente gerais e imprecisos.

As primeiras propostas de classificação para Chelodesmidae, assim como para milípedes em geral, eram baseadas no uso de caracteres somáticos (e.g. coloração, número de poros e de segmentos etc.). Foi somente a partir de Brolemann (1916), que os gonopódios passaram a ser largamente utilizados para as descrições e diagnose das

espécies e grupos, devido a uma morfologia somática geralmente conservadora (talvez devido a seus hábitos de escavação) e à suposta importância da forma dos gonopódios na aplicação do isolamento reprodutivo (Means & Marek, 2017).

Chelodesmidae apresenta uma historia conturbada quanto a sua organização interna (Pena-Barbosa *et al.*, 2013). Após Cook (1895), sendo Chelodesmidae não levada em consideração, Attems (1899) propõem uma nova organização, fornecendo uma diagnose para Leptodesminae (sinônimo-junior de Chelodesmidae). A descrição do gonopódio feita pelo autor é, assim como a exemplo de Cook (1895), simplista e nada delimitadora. Leptodesminae é elevada posteriormente ao status de família por Attems (1914) e Brolemann (1916), independentemente.

Hoffman (1950) demonstrou que Leptodesmidae é sinônimo-júnior de Chelodesmidae, realizando uma síntese da família e a re-descrição da espécie-tipo *Chelodesmus marxii* Cook & Collins, 1895 (hoje sinônimo junior de *Eurydesmus angulatus* deSaussure, 1860). Posteriormente, Hoffman (1980) publica seu trabalho intitulado "*Classification of the Diplopoda*", organizando vários grupos dentro de Diplopoda. Especificamente, para Chelodesmidae, divide a família em Chelodesminae (espécies neotropicais) e Prepodesminae (espécies majoritariamente africanas), bem como também divide estas em tribos.

Ao longo de diversos trabalhos, seja por descrição original ou por mudanças de status, Hoffman passa a incrementar essa organização das espécies em tribos, acreditando que dessa forma, as tribos refletiriam grupos naturais, baseados em características comuns que uniriam as espécies e gêneros (Sierwald, 2009). Hoffman ampliou para 19 o número de tribos em Chelodesmidae e ainda começaria a organizar Prepodesminae, propondo uma única tribo, Thanatomimini Hoffman & Read, 1990, para fauna africana. Desta forma, as seguintes tribos passam a compor a subfamília na região neotropical: Arthrosolaenomeridini Hoffman, 1976; Batodesmini Cook, 1896; Caraibodesmini Hoffman, 1979a; Chelodesmini Hoffman, 1980; Chondrodesmini Hoffman, 1978; Cornalatini Hoffman, 1990a; Dibolostethini Hoffman, 2009; Gonorygmatini Hoffman, 1995; Leptodesmini Attems, 1898; Lepturodesmini Hoffman, 1975; Macrocoxodesmini Hoffman, 1990b; Pandirodesmini Silvestri, 1932; Platinodesmini Hoffman, 1981; Priodesmini Hoffman, 1977; Sandalodesmini Hoffman,

1982a; Strongylomorphini Hoffman, 1981; Telonychopodini Verhoeff, 1951; Trachelodesmini Cook, 1896; Trichomorphini Hoffman, 1979b.

Dentre as tribos estudadas por Hoffman (1976) um grupo composto por três gêneros endêmicos do Brasil forma Arthrosolaenomeridini. Neste trabalho, o autor distingue a tribo pela ausência de apófise coxal no gonopódio; telopódito laminado com um *cingulum* na margem lateral; processo pré-femoral longo e fino com um lóbulo dorso-basal e esternitos anteriores com quatro lóbulos cônicos (Hoffman, 1976). Entretanto, de acordo com a análise de Pena-Barbosa (2015), mesmo com a tribo sendo recuperada como monofilética, tais sinapomorfias putativas também ocorrem em outras tribos dentro da subfamília.

O elenco atual de Arthrosolaenomeridini é constituído pelos gêneros: *Arthrosolaenomeris* Schubart, 1943 (2 spp.), *Angelodesmus* Schubart, 1962 (4 spp.) e *Gangugia* Schubart, 1947 (2 spp.). Hoffman (1976) sugere que estes três gêneros estão estritamente relacionados pela presença do *cingulum*, na margem lateral do telopódito. Contudo estruturas análogas ao *cingulum* também foram encontradas em outras tribos de Chelodesminae, não relacionadas com Arthrosolaenomeridini (Pena-Barbosa, 2015). Pena-Barbosa (2015) ao testar as relações filogenéticas entre as tribos de Chelodesminae demonstrou que Arthrosolaenomeridini é monofilética, que se mostra sustentada apenas por homoplasias: i) formato do órgão de Tömösváry (= *incisura lateralis*) subretangular; ii) presença de projeção ventral no quinto esternito; iii) formato da paranota arrendondado; e iv) presença de *cingulum*.

A tribo Arthrosolaenomeridini possui como principais características de identificação a conformação do gonopódio, composto por uma porção basal (gonocoxa), contendo macrocerdas laterais; e uma porção distal (telopódito) dividida em dois ramos bem desenvolvidos e estreitos: o ramo externo (solenômero) se apresentando como ramo único contendo um c*ingulum* de posição variável e um evidente canal seminal, e o ramo interno (processo pré-femoral) variando em formato de acordo com os gêneros. A distribuição das espécies da tribo é registrada para as regiões centro-oeste e sudeste do Brasil (Hoffman, 1976).

O presente projeto objetiva a revisão taxonômica e análise cladística de Arthrosolaenomeridini, de forma a elucidar sua sistemática e subsidiar futuros estudos referente ao grupo. A dissertação de mestrado é composta por dois capítulos, ambos apresentados em forma de artigo. O capítulo 1 compreende os resultados da análise

filogenética baseada em caracteres morfológicos de Arthrosolaenomeridini, enquanto o capítulo 2 contém a revisão taxonômica da tribo supracitada. Os resultados do capítulo 2 são baseados nos resultados filogenéticos descritos no capítulo 1.

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CHAPTER 1

Phylogenetic analysis of tribe Arthrosolaenomeridini Hoffman, 1976 (Diplopoda: Polydesmida: Chelodesmidae)

Abstract.

In this study, we performed a cladistic analysis for Arthrosolaenomeridini. The matrix is composed by 18 terminals as ingroup and 7 as outgroup in a dataset containing 64 morphological characters. Based on the results, Arthrosolaenomeridini was recovered as monophyletic with Macrocoxodesmini + Telonychopodini as sister group. The genera *Arthrosolaenomeris* Schubart, 1943 and *Gangugia* Schubart, 1947 was recovered as monophyletic. On the other hand, the genus *Angelodesmus* Schubart, 1962 was recovered as paraphyletic and redefined as monotypic. The tribe is now composed by the genera *Arthrosolaenomeris* Schubart, 1943 (6 spp.), *Gangugia* Schubart, 1947 (6 spp.), *Angelodesmus* Schubart, 1962 (monotypic), *Abiliodesmus* gen. nov. (4 spp.) and *Folcloredesmus* gen. nov. (monotypic). The resulting synapomorphies for the tribe are: presence of lateral macrosetae, in mesal aspect, in gonocoxae; telopodite with a cingulum on the lateral margin and solenomere as a single branch.

Key words. Brazil, Neotropical, millipedes, Chelodesminae

INTRODUCTION

Chelodesmidae, proposed by Cook (1895), is the second largest family, not only among the Polydesmida, but also for the class Diplopoda, with more than 800 described species. Despite the efforts of several authors over the centuries to describe species, there is no a proper diagnosis neither a phylogenetic position for the family. According to Hoffman (1982), Chelodesmidae is extremely diverse and difficult to define succinctly, and this is due to Cook's own description of Chelodesmidae in 1895, which has very general and imprecise diagnostic characters.

Hoffman (1980) published the work titled “Classification of the Diplopoda”, organizing several groups within the class Diplopoda. Specifically, for Chelodesmidae, the author proposed the division of the family into two subfamilies: Chelodesminae (Neotropical species) and Prepodesminae (African species and disjuncts records from Spain), as well as their respective division into tribes. Throughout several works Hoffman would increase to 19 the number of tribes in Chelodesminae. In addition, Hoffman revisited Prepodesminae proposing the tribe Thanatomimini Hoffman & Read, 1990. Among the 800 species recognized for the family, only 345 species are assigned into the tribal classification (Bouzan *et al.*, 2017).

According to Enghoff *et al.* (2015), the order Polydesmida, including most of its families (e. g. Chelodesmidae) needs an extensive study based on a phylogenetic approach. For this, cladistic analysis and revisions focused on supra-generic level become of paramount importance (Hoffman, 1976). Few cladistic studies were carried out in order to the better understanding of the relationships of the Chelodesmidae species (e.g., Pena-Barbosa *et al.*, 2013 for *Odontopeltis*; Bouzan *et al.*, 2019 for *Atlantodesmus*). In 2015, Pena-Barbosa presented a thesis on the monophyly of the tribes proposed for Chelodesminae, as well as proposing a hypothesis for the relationship between these tribes.

Among the Chelodesminae with current tribal designation, Arthrosolaenomeridini, composed of three genera endemic to Brazil received attention from Hoffman (1976). This tribe is currently characterized by the absence of coxal apophysis in the gonopod; a laminated telopodite with a cingulum on the lateral margin; a long prefemoral process with a dorso-basal lobe and anterior sternites with four conical lobes (Hoffman, 1976).

However, according to the recent analysis of Pena-Barbosa (2015) such putative synapomorphies also occur in other tribes within the subfamily, unrelated to Arthrosolaenomeridini. Pena-Barbosa (2015) performing a morphology-based cladistic analysis to test the phylogenetic relationships among the tribes of the subfamily Chelodesminae, cited the following characters in their analysis, corroborating the clade of Arthrosolaenomeridini, different from those proposed by Hoffman (1976): sub-retangular Tömösváry organ (*incisura lateralis*); presence of ventral projection in the fifth sternite; paranota with rounded shaped; and presence of cingulum. Although in his

analysis, using only one species of each genus of Arthrosolaenomeridini, the tribe appeared as a monophyletic group, all the characters that support the tribe are homoplastic and currently, the internal relationship of the tribe have not yet been revealed.

The tribe Arthrosolaenomeridini is currently composed of the genera *Arthrosolaenomeris* Schubart, 1943 (2 spp.), *Angelodesmus* Schubart, 1962 (4 spp.) and *Gangugia* Schubart, 1947 (2 spp.). The first Arthrosolaenomeridini species described was *Arthrosolaenomeris chapadensis* described by Schubart in 1943 and recorded for the state of Mato Grosso do Sul (Schubart, 1943). The remaining species were later reported for several states of the Central-west region of Brazil (Schubart 1947, 1960, 1962; Hoffman, 1976). A total of 8 nominal species of Arthrosolaenomeridini species have been described so far. Most of them have been recorded only once. In this study, a morphology-based cladistic analysis is performed to test the monophyly of Arthrosolaenomeridini, as well as the proposition of internal evolutionary relationships of the group and identify and determine synapomorphies for the groups of the tribe.

MATERIAL AND METHODS

Material examined

The examined material belongs to the following institutions (acronyms and curators in parentheses): Field Museum of Natural History, Chicago, Illinois, USA (FMNH, P. Sierwald); Instituto Butantan, São Paulo, Brazil (IBSP, A. D. Brescovit); Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ, A. B. Kury); Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZSP, R. Pinto da Rocha), Universidade Federal do Mato Grosso, Mato Grosso, Brazil (CZUFMT MYR, A. Chagas-Jr).

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The material was examined immersed in alcohol 70-80%, with a Leica MZ125 stereomicroscope. Photographs were taken with a Leica DFC 500 digital camera mounted on a Leica MZ16A stereomicroscope. Extended focal range images were composed with the program Leica Application Suite version 2.5.0. Scanning electron

micrographs (SEM) images were taken using a FEI Quanta 250 SEM with attached SLR digital camera at Instituto Butantan. For SEM preparations, the specimens were selected and cleaned with brushes and by an ultrasonic cleaner. The material was dissected and dehydrated through a series of ethanol (80% to 100%), critical point dried, fixed on metal stubs with adhesive copper tape and sputter coated with gold. The terminology and abbreviations follow Pena-Barbosa *et al.,* (2013) and Bouzan *et al.,* (2019).

Data matrix

The data matrix is composed by 25 terminal taxa, 7 comprising the outgroup and 18 the ingroup. The outgroup was chosen based on the recent studies (Pena-Barbosa *et al.,* 2013; Pena-Barbosa, 2015) and includes representatives of species of the tribes Batodesmini Cook, 1896, Strongylomorphini Hoffman, 1981, Chondrodesmini Hoffman, 1978, Macrocoxodesmini Hoffman, 1990 and Telonychopodini Verhoeff, 1951. The two latter were scored based on the matrix data from Pena-Barbosa (2015). *Igaraparana batesi* Hoffman, 1982 (Batodesmini), was selected as the root based on the recent phylogenetic analysis (Pena-Barbosa, 2015) and others taxonomic works (Hoffman, 1977; Bouzan *et al.,* 2019).

The ingroup is composed by species belonging to all valid genera of Arthrosolaenomeridini as well as two undescribed new genera. In total, all the 8 species recognized for the tribe were included with other 10 undescribed species (see the taxonomy section for their descriptions – Chapter 2).

The dataset was scored with 64 morphological characters. 39 characteres are herein proposed for the first time and 25 characters were scored based on the previous cladistic analysis for Chelodesmidae groups (Pena-Barbosa *et al.,* 2013; Pena-Barbosa, 2015; Bouzan *et al.,* 2019). Inapplicable characters are referred as –, and unobserved characters as ?. The characters modifications are indicated in the character list (Table I). All characters were treated as nonadditive (Table II). The description of characters follows Sereno (2007). All characters were treated as unordered and the autapomorphies were kept in the analysis, since it is possible to use them in future analysis.

Cladistic analysis

The phylogenetic analysis was performed under the parsimony criterion using TNT ver. 1.5 (Goloboff *et al.,* 2008a; Goloboff & Catalano, 2016). The dataset was

analyzed with Traditional Search under equal weights (EW) and weighting regimes against homoplasy with the implied weighting option (Goloboff, 1993; Goloboff *et al.*, 2008b). The analysis was carried out using the following parameters: number of repls. 1000 and 80 trees to save per replication. For the implied weighing different values of concavity constant were used (*k* = 1-10, 15, 20, 25, 30). Branch support was calculated through absolute Bremer support (Bremer, 1988; Bremer, 1994) and relative Bremer support (Bremer, 1994; Goloboff & Farris, 2001). The list of the characters is presented in the Table I.

Concerning the different topologies for different values of *k*, the tree topology that shared the highest number of nodes with the other trees was considered the most stable, and thus, used for our discussion. WinClada v. 1.00.08 (Nixon, 2002) was used for character state optimizations and only unambiguous optimizations were analyzed. Alternative reconstructions for ambiguous characters were optimized under AccTran and DelTran for complementary discussion on characteres descriptions − Table I (Agnarsson & Miller, 2008).

RESULTS

The cladistic analysis under equal weights resulted in one most parsimonious tree (MPT) with 175 steps (CI = 0.451; RI = 0.678). As results, the tribe was recovered as monophyletic and all relationship for the genera was well resolved (Fig. 3A). For the analysis under implied weighting, all different *k* values also recovered the tribe as monophyletic − *k* = 1 (Fig. 3B), *k* = 2–15 (Fig. 1), *k* = 20, 25, 30 (Fig. 3A). Thus, considering the maximum congruence and stability of the results, we decided to choose the trees obtained with *k* = 2–15 to discuss the relationships of Arthrosolaenomeridini (Figs 1–2).

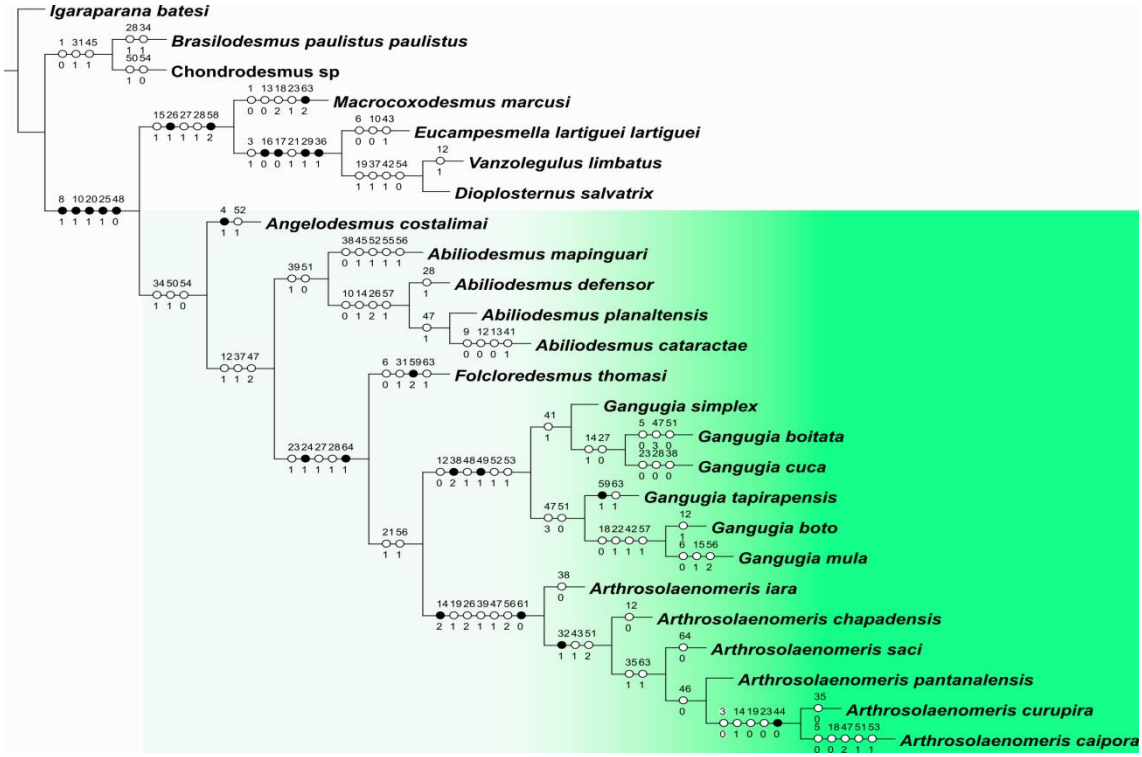

FIGURE 1. Topology obtained under implied weighting (*k* = 7). Black circles show non-homoplasious synapomorphies and white circles show homoplasious ones. Character numbers are placed over the branches and the states are shown below the branches.

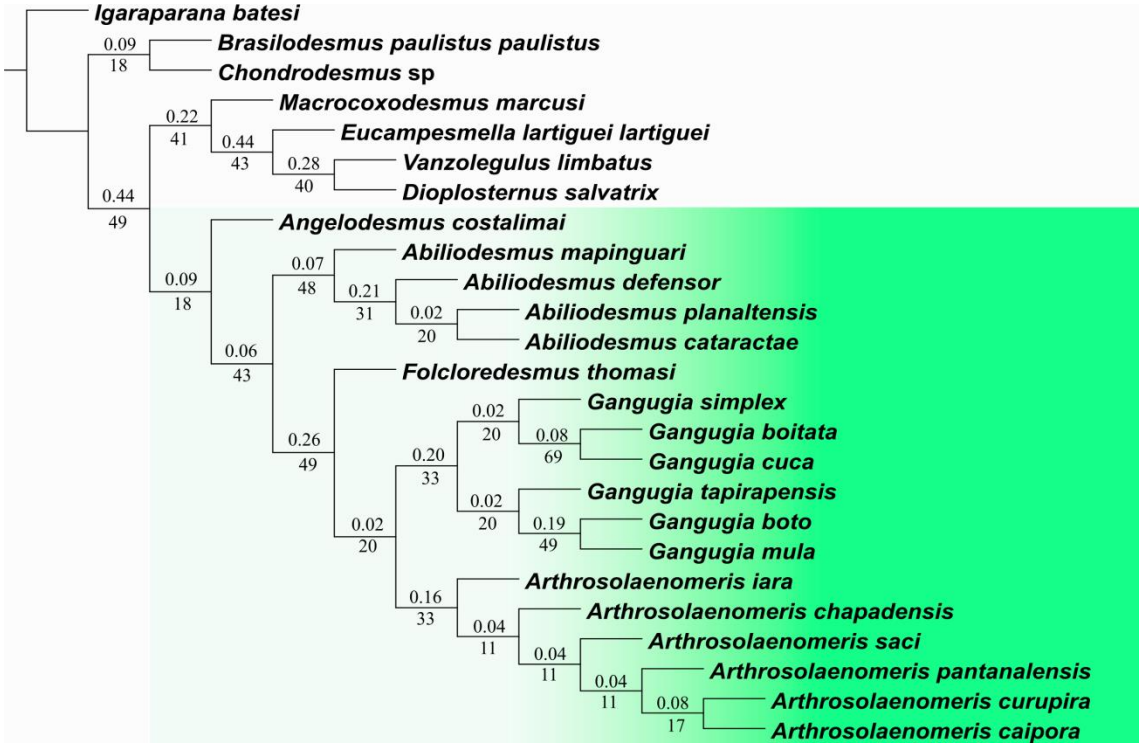

FIGURE 2. Topology obtained under implied weighting (*k* = 7). Numbers above the branches are absolute Bremer support values in units of fit and relative Bremer support are shown below the branches.

The topology recovered under EW showed the same result to those with *k* = 20, 25, 30 (Fig. 3A). Based on the *k* = 2−15, the differences obtained in relation to other topologies are: i) *Chondrodesmus* sp. is represented in a different clade compared to *Brasilodesmus paulistus paulistus* [in *k* = 1: Fig. 3B]; ii) the clade (*Arthrosolaenomeris* + (*Folcloredesmus* gen. nov. + *Gangugia*)) was recovered as monophyletic [in *k* = 20, 25, 30 and EW: Fig. 3A]; iii) internal relationships within the genus *Arthrosolaenomeris*: ((((*Arthrosolaenomeris caipora* sp. nov. + (*A. curupira* sp. nov. + (*A. pantanalensis* + (*A saci* sp. nov. + (*A. chapadensis* + *A. iara* sp. nov.)))) [in *k* = 20, 25, 30 and EW: Fig. 3A].

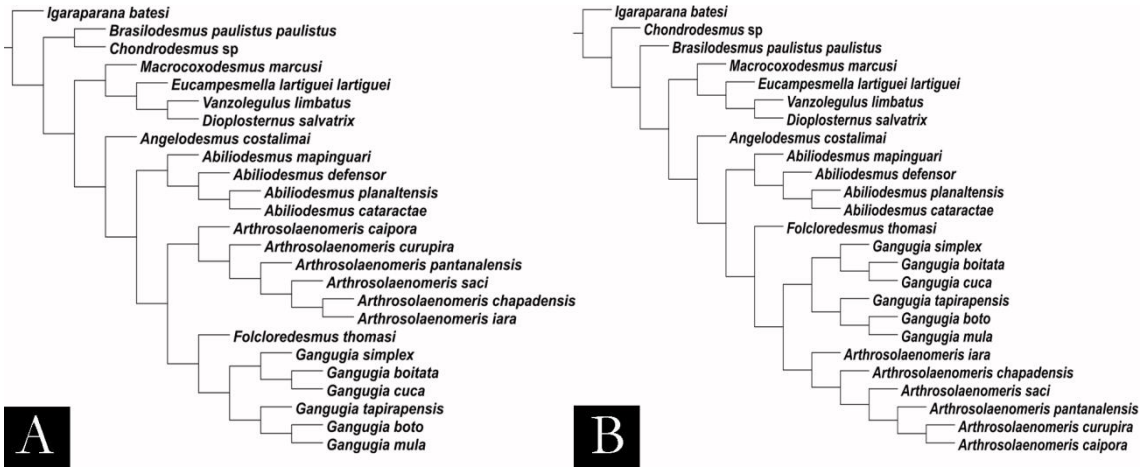

FIGURE 3. Most parsimonious tree obtained under different regimes of weighting: (A) Equal weights and impled weighting, value of concavity k = 20, 25, 30; (B) Implied weighting, value of k = 1.

Arthrosolaenomeridini was recovered as monophyletic and arose as sister to clade the Macrocoxodesmini + Telonychopodini (Fig. 1). The tribe is represented by five genera *Arthrosolaenomeris* (6 spp.), *Angelodesmus* (monotypic), *Gangugia* (6 spp.), *Abiliodesmus* gen. nov. (4 spp.) and *Folcloredesmus* gen. nov. (monotypic), recovered as monophyletic in all topologies obtained under equal weights and implied weighting. Arthrosolaenomeridini (Fig. 1), as redefined in our study, is supported by three homoplastic synapomorphies based on the gonopods characteristics (i.e. presence of lateral macrosetae in the gonocoxae, in mesal aspect (char. 34 [1]); telopodite with a cingulum on the lateral margin (char. 50 [1]) and solenomere as a single branch (char. 54 [0]).

Angelodesmus, as defined by Hoffman (1976), was not recovered as monophyletic in our analysis (Fig. 1), since *A. planaltensis* (Schubart, 1960); *A. cataractae* Hoffman, 1976; and *A. defensor* Hoffman, 1976 were recovered in a different clade (see taxonomic section for the new combination). The type-species *A. costalimai* Schubart, 1962, was recovered as the first clade to diverge within Arthrosolaenomeridini, mainly by the absence of some synapomorphies of later groups of the tribe, i.e. ventral projections of the seventh sternite (Fig. 7A) and angulation of the prefemoral process (Figs 15C-E).

The remaining species of *Angelodesmus* arose in a different clade recovered as sister to (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)), with two

homoplastic synapomorphies: i) presence of a constriction in the basal portion of the prefemoral process (char. 39 [1]); and ii) cingulum in a basal position (char. 51 [0]). This clade is here refered as *Abiliodesmus* gen. nov.

The clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)) is supported by two non-homoplastic synapomorphies: i) presence of a ventro-apical projection in the prefemur of the legs (char. 24 [1]) and ii) irregular egde of the epigyne (char. 64 [1]). In addition, the clade also shares three homoplastic synapomorphies: i) the granules on the tibia of the walking legs (char. 23 [1]); ii) the posterior margin of the gonopod aperture reaching half of the coxae of ninth pair of legs (char. 27 [1]); iii) a central support sclerotized (char. 28 [1]).

The clade *Folcloredesmus* gen. nov. was recovered as monophyletic and supported by a non-homoplastic synapomorphy: sub-triangular apex of the vulvae, in lateral view (char. 59 [2]). Three homoplastic synapomorphies confirm the monophyly of this clade: i) patche of color just on the edge of the paranota (char. 6 [0]); ii) presence of spiniform process in the gonocoxae (char. 31 [1]); iii) epigyne trianguliform (char. 63 [1]).

The clade *Gangugia* + *Arthrosolaenomeris* is supported by two homoplastic synapomorphies, such a accentuated dorsal lobe on prefemur of fifth leg (char. 21 [1]); and the descendant apex of the solenomere sickle-shaped (char. 56 [1]).

Gangugia was recovered as monophyletic and supported by several synapomorphies. Two non-homoplastic synapomorphies are the presence of the angulation of the prefemoral process by 210° (char. 38 [2]) and prefemoral process, in ventral view, sharply curved (char. 49 [1]). The homoplastic synapomorphies are: i) absence of a pair of ventral projections on the seventh body ring (char. 12 [0]); ii) prefemoral process, narrow in ventral view (char. 48 [1]); iii) cingulum, with spiral format in ectal view (char. 52 [1]); and iv) cingulum, conical-shaped in ventral view (char. 53 [1]).

Arthrosolaenomeris was recovered as a monophyletic group and two non-homoplastic synapomorphies support the genus: i) the ventral rectangular projections in the sternites just after the gonopods (char. 14 [2]); and ii) the projected operculum of the vulvae, in lateral view (char. 61 [0]). Others five homoplastic synapomorphies

recovered for the genus: i) short and thick setae on the ventral part of the podomeres in the anterior legs (char. 19 [1]); ii) posterior edge of the gonopod aperture with a small dentiform process (char. 26 [2]); iii) presence of a constriction in the basal portion of the prefemoral process (char. 39 1]); iv) position of the prefemoral process coverin the mesal side of the acropodite (char. 47 [1]); v) apex of the solenomere abruptly descending (char. 56 [2]).

DISCUSSION

Our results show a well-supported relationship between Macrocoxodesmini + Telonychopodini as sister group of Arthrosolaenomeridini. For this, the genus *Eucampesmella* Schubart, 1955, previously assigned to Macrocoxodesmini by Golovatch & Hoffman (2004), was recovered related to Telonychopodini species corroborating with Pena-Barbosa *et al.* (2013).

The male gonopod was a very useful tool along the millipede's history classification, mainly for species-level alpha-taxonomy, however as discussed for Means & Marek (2017) several morphological differences between closely related species mask synapomorphies among higher-level taxa. While genitalic characters are a premier source of highly divergent features to differentiate species, they appear problematic above the species level (Means & Marek, 2017). These may be the case for Chelodesmidae species and corroborated with our study since that all the characteristics that supported Arthrosolaenomeridini are homoplastic synapomorphies related to gonopods features.

In our study, we reinterpret the morphology of the cingulum. The function of this structure is still unknown, it is speculated to be a sign of possible flexibility in the acropodite region, being delimited by its similarity to a fissure or small invagination in the gonopod structure. Species of Arthrosolaenomeridini have a cingulum extremely conspicuous (Hoffman, 1976). However, the cingulum in Arthrosolaenomeridini is not distinct from those of other Chelodesmidae, our results corroborate the suggestion made by Hoffman (2000), in which the presence of the structure is merely a recurrent homoplasy in different groups within the family.

Importantly to be highlighted, phylogenetic relationships of Chelodesmidae still require more investigation to achieve a better understanding of the morphological

characters (Pena-Barbosa *et al.*, 2013; Bouzan *et al.*, 2019), as well as the delineation of its generic and tribal limits. In Arthrosolaenomeridini species we can find some features concerning the position (basal, medial or apical) and form (in ectal or ventral view) of the cingulum. Based on that, the cingulum is an important synapomorphy for the tribe, in this study also helped in the elucidation questions as to the internal relation of the species.

Hoffman (1976) observed in some Arthrosolaenomeridini species a peculiar projection in the dorso-basal portion of the prefemoral process. However, the author did not examine *Angelodesmus costalimai*, the type species of the genus, which has no dorso-basal projection. Based on our examination, we observed the structure in all others representatives of the tribe (except in *Folcloredesmus thomasi* sp. nov.). In this perspective, the presence of this structure (char. 40) was recovered as ambiguous in our analysis (see page 44 for discussion; Appendix 1A). Based on our results, the genus *Angelodesmus*, as defined by Hoffman (1976), was recovered as paraphyletic in our analysis, since *A. costalimai* was the first linage to diverge. The new genus *Abiliodesmus* gen. nov. is created to the remaining species. It is important to highlight that Hoffman (1976) suggested a putative relationship to these species, mainly by the similarities on the gonopods.

Schubart (1943) and Hoffman (1976) emphasized the importance of the presence of a secondary process in medial portion in the prefemoral process of the gonopod (char. 43) as a diagnostic feature for *Arthrosolaenomeris*. This process is absent in *A. iara* sp. nov. In this perspective, the presence of the medial secondary process shown a homoplastic synapomorphy for an inner clade of *Arthrosolaenomeris* (char. 43 [1]) - (also occurring in *Eucampesmella lartiguei lartiguei*). Another secondary process, located in the basal portion is observed in some species of *Gangugia* (*G. boto* sp. nov. and *G. mula* sp. nov.; char. 42). In addition, a secondary process located in the apical region is observed in *Abiliodesmus mapinguari* sp. nov. (char. 45). In this work, these secondary processes were treated as non-homologous according to their topographic correspondence.

An important feature is the presence of a coxal apophysis in the gonocoxae in *Folcloredesmus* gen. nov., composing the only group of Arthrosolaenomeridini which

posses this characteristic. The absence of this apophysis was diagnosed by Hoffman (1976) for the tribe.

Schubart (1947) described the genus *Gangugia* emphasizing that the prefemoral process and the solenomere, as both narrow, parallel and forming a half circle. Our study provides a phylogenetic support for these features regarding the prefemoral process as important synapomorphies for the genus (char. 38 [2]; char. 48[1]; char. 49 [1]).

Although the female genitalia morphology has been neglected by several authors over the years, the characters examined on the genitalia recovered important features for the phylogeny. For the 18 known species of Arthrosolaenomeridini, just for 12 species the males and females are recognized. Perhaps, the study of additional material of these species will help for a better taxonomic and phylogenetic definition for these groups. In our analysis we recovered monophyletic groups based on vulvae's synapomorphies. Our results indicate a transformation series from circular to cylindrical-shaped vulva for the members of the clade Macrocoxodesmini + Telonychopodini, as observed by Pena-Barbosa *et al.*, (2013). A transformation to oval-shaped is recovered for the members of Arthrosoloenomeridini. Some genera show synapomorphies related to the female genitalia, as the operculum projected in *Arthrosolaenomeris* and the sub-triangular vulvae in *Folcloredesmus* gen. nov. In addition, the irregular edge of the posterior border of the vulvae's opening (= epigyne) was recovered as a non-homoplastic synapomorphy in (*Folcloredesmus* gen. nov. + (*Gangugia* + *Arthrosolaenomeris*)).

Hoffman (1976) discussed a evolutionary relation between the genera of the tribe. According to the author, *Angelodesmus* would be the sister group of *Gangugia*, and the latter related closely to *Arthrosolaenomeris*. The author suggested that *Angelodesmus* and *Gangugia* are closely related based on two characters of gonopod: presence of basal cingulum and the triangular lobe on the base of the prefemoral process. However, in our analysis the presence of a basal cingulum (char. 51) seems as a homoplastic characteristic with three independent transformations, occurring in the genus *Abiliodesmus* gen. nov. and two times within the *Gangugia* clade; and based on our analysis of types material, the triangular dorso-basal lobe of the prefemoral process (char. 41 [1]) are only found in *Abiliodesmus cataractae* comb. nov. and support the *Gangugia* clade (*G. simplex* + (*G. boitata* sp. nov. + *G. cuca* sp. nov.)). In addition,

Hoffman (1976) concluded that all the species included in the tribe are occupying the same general area of Brazil. The author suggested their common origin and differentiation in this region. Thus, corroborating with Hoffman (1976), the tribe is predominantly distributed to Central-west region of Brazil, with some records for the southeastern and northern regions.

Although our results have elucidated several issues involving the tribe, *Angelodesmus* is presented as paraphyletic in our analysis and defined as a monotypic genus. Two new genera are proposed to better define the real diversity of the species. Thus, in this study, we provide the most complete phylogenetic analysis for Arthrosolaenomeridini with all your genera and species, including new taxa. Being also the first cladistic analysis performed at a tribal level for the family.

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Sierwald, P. 2009. Contributions to Myriapod Taxonomy: The Milliped and Centiped Genera and Species Described by Dr. Richard Lawrence Hoffman. - In: A Lifetime of Contributions to Myriapodology and the Natural History of Virginia: A Festschrift in Honor of Richard L. Hoffman's 80th Birthday.Virginia Museum of Natural History, Martinsville, VA: 113-147.

SUPPORTING INFORMATION

List of vouchers

Batodesmini

Igaraparana batesi Hoffman, 1982

ECUADOR, Pastaza, Cushueme, Rio Cushueme, 320m, 150km SE of Puyo, 01°28'55"S, 78°00'24"W, 15-28.v.1971, B. Malkin leg., 1♂ (FMNH 0000103001).

Strongylomorphini

Brasilodesmus paulistus paulistus (Brölemann, 1902)

BRAZIL, São Paulo, Peruíbe, Estação Ecológica Juréia/Itatins, 24°16'38"S, 47°00'44"W, 05.v.1994, A. Eterovic coll., 1♂ (IBSP 1130); xii.1998, A.D. Brescovit *et al.* coll., 1♀ (IBSP 981).

Chondrodesmini

Chondrodesmus sp.

BRAZIL, Amazonas, Rio Purus, Margem direita, 03°99'08"S, 61°49'39"W, 26.x-10.xi.2010, Recoder *et al.* coll., 1♂ (IBSP 3823).f

Macrocoxodesmini

Macrocoxodesmus marcusi Schubart, 1947

BRAZIL, Minas Gerais, Manhuaçu, 20°15'30"S, 42°02'01"W, Rio Matipó, Fazenda Floresta, xii.1919, R. Fonseca coll., 1♂ (MZSP).

Eucampesmella lartiguei lartiguei Silvestri, 1897

BRAZIL, Pernambuco, Rodovia BR 101, 20°15'30"S, 42°02'01"W, 15.iii.1999, A. Kury & A.Giupponi coll., 4♂ (MNRJ 11609).

Telonychopodini

Dioplosternus salvatrix Hoffman, 2005

BRAZIL, Mato Grosso, Diamantino, Chapada dos Parecis, 14°00'S, 57°00'W, xi.1993, D. Novaes & R. Pardini coll., 1♂ (IBSP 1084).

Vanzolegulus limbatus Hoffman, 2002

BRAZIL, Mato Grosso, Vila Bela da Santíssima Trindade, 15°00'S, 59°57'W, 22-23.x.2016, Y.V. Marques coll., 1♂ (CZUFMT MYR - 850).

Arthrosolaenomeridini

Arthrosolaenomeris chapadensis Schubart, 1943

BRAZIL, Mato Grosso do Sul, Indubrasil, Campo Grande, 20°26'34"S, 54°38'47"W, 17.x.1938, Instituto Osvaldo Cruz coll., 1♂ (MZSP 1092); São Paulo, Rosana, Usina Hidrelétrica Engenheiro Sérgio Motta, Porto Primavera, 22°34'47"S, 53°03'32"W, 1999-2000, Equipe Butantan coll., 1♀ (IBSP 1049).

Arthrosolaenomeris pantanalensis Schubart, 1943

BRAZIL, Mato Grosso, São Luiz de Cáceres (Now Cáceres), 16°04'15"S, 57°40'44"W, ii.1940, Passarelli coll., 1♂ (MZSP 1085); Porto Estrela; 15°19'28"S, 57°13'39"W, E.E. Serra das Araras, 12.xi.2017, T.F. Conceição coll., 1♀ (CZUFMT MYR 847).

Arthrosolaenomeris saci sp. nov.

BRAZIL, Mato Grosso do Sul, Bonito, 21°07'16"S, 56°28'55"W, 14-23.x.2002, Equipe Biota coll., 1♂ (IBSP 2571); 1♀ (IBSP 2581).

Arthrosolaenomeris curupira sp. nov.

BRAZIL, Mato Grosso, Nova Xavantina, 14°40'24"S, 52°21'11"W, xi.1949, Instituto Butantan Expedition coll., 1♂ (IBSP 59).

Arthrosolaenomeris caipora sp. nov.

BRAZIL, Mato Grosso, Vale São Domingos & Pontes de Lacerda, Usina Hidrelétrica Guaporé, 15°07'00"S, 58°58'00"W, 08.x.2002, I. Knysak coll., 1♂ (IBSP 1569).

Arthrosolaenomeris iara sp. nov.

BRAZIL, Mato Grosso, Vale São Domingos & Pontes de Lacerda, Usina Hidrelétrica Guaporé, 15°11'60"S, 59°22'00"W, 03.x.2002, G. Marçal coll., 1♂ (IBSP 1577); Diamantino, 14°09'43"S, 57°08'01"W, Chapada dos Parecis, xi.1993, D. Novais & R. Pardini coll., 1♀ (IBSP 7537).

Gangugia tapirapensis Schubart, 1947

BRAZIL, Mato Grosso, Barra do Tapirapé, 23.xi.1939−15.iii.1940, A. L. de Carvalho coll., 1♂ (MZSP 1076); 2♂ 2♀ (MZSP 1070)

Gangugia simplex Schubart, 1958

BRAZIL, Goiás, Aragarças, 15°53'52"S, 52°15'02"W, x.1952−x.1953, H. Sick coll., 1♂ (MZSP 1077).

Gangugia boitata sp. nov.

BRAZIL, Goiás, Mineiros, Parque Nacional das Emas, 18°22'01"S, 52°47'59"W, x.1992, M. Barroso coll., 1♂ (IBSP 1061).

Gangugia cuca sp. nov.

BRAZIL, Tocantins, Porto Nacional, 10°42'30"S, 48°25'01"W, Fazenda Sandoval, 28.xi.2013, A. Chagas-Jr & A. Giupponi coll., 1♂ (IBSP 7600).

Gangugia boto sp. nov.

BRAZIL, Pará, FLONA Carajás, 06°00'32"S, 49°58'13"W, Parauapebas, 19-24.i.2012, R. de Andrade *et al.* coll., 1♂ (IBSP 7539).

Gangugia mula sp. nov.

BRAZIL, Pará, Tucuruí, 03°42'01"S, 49°42'00"W, UHE Tucuruí, 1984, Instituto Butantan Expedition coll., 1♂ (IBSP 277); 1♀ (IBSP 278).

Angelodesmus costalimai Schubart, 1962

BRAZIL, Goiás, Jataí, 17°52'54"S, 51°42'51"W, i.1955, M. Carrera coll., 1♂ (MZSP).

Abiliodesmus planaltensis (Schubart, 1960), comb. nov.

BRAZIL, São Paulo, Mirassol, Jaci, 20°52'56"S, 49°34'11"W, 11.i.1950, O. Schubart coll., 1♂ (MZSP 1086); Ribeirão Preto, 21°10'39"S, 47°48'37"W, Mata Santa Tereza, 06-11.i.2006, I. Cizauskas coll. 1♀ (IBSP 3569).

Abiliodesmus cataractae (Hoffman, 1976), comb. nov.

BRAZIL, Goiás, Jataí, 17°52'54"S, 51°42'51"W, Fazenda Cachoeirinha, xi.1962, Departamento de Zoologia Expedition coll., 1♂ (MZSP 1065); 1♀ (MZSP 1066).

Abiliodesmus defensor (Hoffman, 1976), comb. nov.

BRAZIL, Goiás, Jataí, 17°52'54"S, 51°42'51"W, Fazenda Aceiro, xi.1962, R. Hoffman coll., 1♂ (MZSP 1067).

Abiliodesmus mapinguari sp. nov.

BRAZIL, Tocantins, Palmas, 10°12'47"S, 48°21'37"W, x.2001, I. Knysak & R. Martins coll., 1♂ (IBSP 1699); Porto Nacional, 10°42'30"S, 48°25'01"W, Fazenda Giovam, 01.xii.2013, A. Chagas-Jr & A.B. Kury coll., 1♀ (CZUFMT MYR 834).

Folcloredesmus thomasi sp. nov.

BRAZIL, Mato Grosso, Cotriguaçu, Fazenda São Nicolau, 09°50'25"S, 58°14'53"W, 11.xii.2009, L. D. Battirola coll., 1♂ (IBSP 5452); 2♀ (IBSP 5453).

Table I

List of characters

Character descriptions include length (L), consistency index (ci), retention index (ri), fit (F) values for the preferred tree (Analysis under $k = 7$). For characters used in previous works the reference to its most recent usage by means of the following form: (e.g. Bouzan *et al.*, 2019, character #2).

Head

1. **Row of setae on apex of the head; occurrence:** (L = 2, ci = 0.5, ri = 0.5, F = 0.88). (0) absent; (1) present (Fig. 4A).

   Some species of Polydesmida have series of rows of setae on the dorsal surface of the head, as discussed by Pena-Barbosa *et al.*, 2013. The apex row is located above the antennae. In this analysis the presence of this row of setae is plesiomorphic. There are two independent losses of the row in *Brasilodesmus paulistus paulistus* + *Chondrodesmus* sp. and in *Macrocoxodesmus marcusi*.

2. **Row of setae on apex of the head; pattern:** (L = 1, ci = 1, ri = 1, F = 1). (0) 1+1; (1) 2+2 (Fig. 4A).

   The formula of the row of setae '1+1' was recovered as a synapomorphy for the clade (*Eucampesmella lartiguei lartiguei* + (*Dioplosternus salvatrix* + *Vanzolegulus limbatus*)).

Gnathochilarium

3. **Setae on stipes; pattern:** (L = 4, ci = 0.25, ri = 0.57, F = 0.7). (0) not completely filled (Fig. 4C); (1) completely filled (Fig. 4B).

   The condition of stipes completely filled of setae was recovered in the clade *Eucampesmella lartiguei lartiguei* + Telonychopodini and for the genera *Arthrsolaenomeris* and *Folcloredesmus* gen. nov.. For the tribe Arthrosolaenomeridini and based on differents criteria of optimization two hypothesis can be suggested: i) the character state "completely filled" is a homoplastic synapomorphy for the clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)) with a reversal to the plesiomorphic state in *Gangugia* (AccTran; Appendix 1A); ii) two independent transformations for a completely filled stipes occuring in *Arthrosolaenomeris* and *Folcloredesmus* gen. nov. (DelTran; Appendix 1B).

4. **<u>Lateral folds; occurrence:</u>** (L = 1, ci = 1, ri = 1, F = 1). (0) absent; (1) present (Fig. 4D).

   The presence of the lateral folds was recovered as autapomorphic for *Angelodesmus costalimai*.

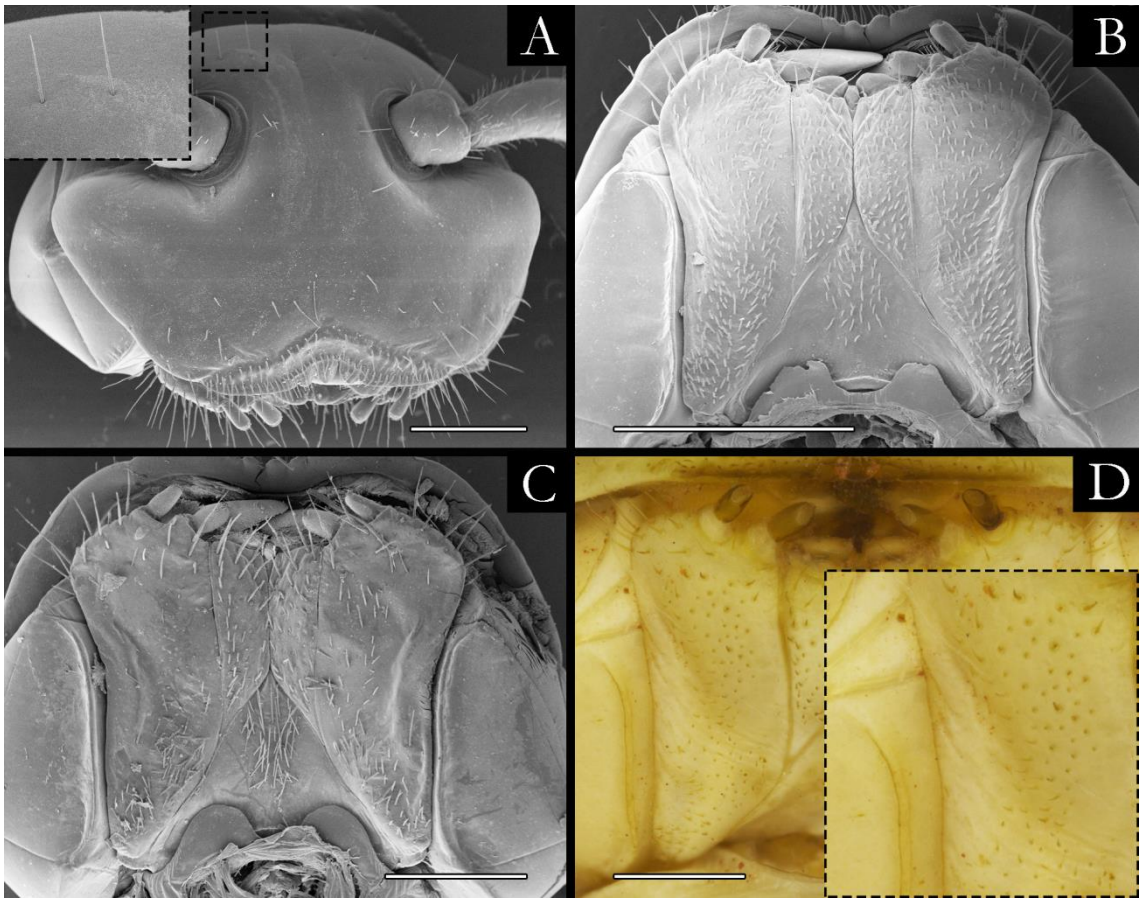


FIGURE 4. A) *Arthrosolaenomeris pantanalensis*, head; B) *Folcloredesmus thomasi* sp. nov., gnathochilarium; C) *Abiliodesmus planaltensis* comb. nov., gnathochilarium; D) *Angelodesmus costalimai*, detail of gnathochilarium. Scale bars: A, 1 mm; B, 2 mm; C, 1 mm; D, 0,5 mm.

Body

5. **<u>Coloration of the body rings; pattern (Bouzan *et al.*, 2019, character #1):</u>** (L = 3, ci = 0.33, ri = 0, F = 0.78). (0) uniform (Fig. 5A); (1) not uniform (Figs 5B-D).

   The uniform pattern of coloration was recovered indepently for *Arthrosolaenomeris caipora* and for *Gangugia boitata* sp. nov.

6. **<u>Patches of color, paranota; pattern (Bouzan *et al.*, 2019, character #2):</u>** (L = 5, ci = 0.4, ri = 0.25, F = 0.7). (0) just on the edge of the paranota (Fig. 5B); (1)

also on the posterior margin of the paranota (Fig. 5C); (2) just on the prozonite (Fig. 5D).

The character state ‘patches of color just on the edge of the paranota’ was recovered as homoplastic in a great number of chelodesmidean species, appearing independently in *Brasilodesmus paulistus paulistus* + *Chondrodesmus* sp., *Eucampesmella lartiguei lartiguei*, *Folcloredesmus thomasi* sp. nov. and *Gangugia mula* sp. nov.. Patches of color just on the prozonite was recovered as autapomorphic for *Gangugia cuca* sp. nov.

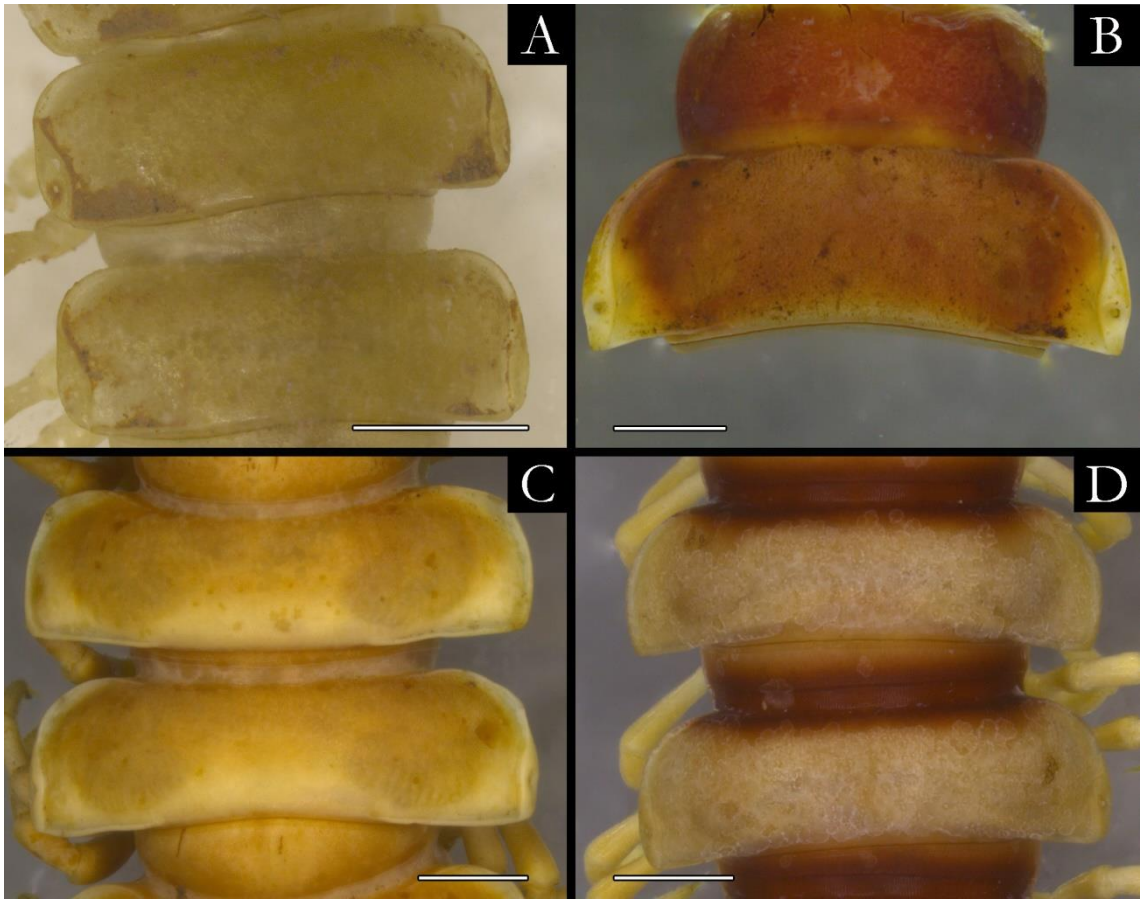


FIGURE 5. Paranota, dorsal view. A) *Gangugia boitata* sp. nov.; B) *Brasilodesmus paulistus paulistus*; C) *Gangugia tapirapensis*; D) *G. cuca* sp. nov.. Scale bars: 2mm.

7. **Ventral projections on the fourth body ring pressed against each other; (Bouzan *et al.*, 2019, character #5):** (L = 2, ci = 0.5, ri = 0, F = 0.88). (0) absent; (1) present (Fig. 6A).
8. **Ventral projections on the fifth body ring; occurrence (Bouzan *et al.*, 2019, character #6):** (L = 1, ci = 1, ri = 1, F = 1). (0) absent; (1) present (Fig. 6B).

The presence of ventral projections on the fifth body ring was recovered as a synapomorphy for (Arthrosolaenomeridini + (Macrocoxodesmini + Telonychopodini)).

9. **Ventral projections on the fifth body ring; number (Pena-Barbosa *et al.*, 2013, character #8):** (L = 3, ci = 0.33, ri = 0, F = 0.78). (0) two; (1) four (Fig. 6B).

   Chelodesmidae species can present one or two pairs of projections on the sternites of the fifth body ring between the legs. The presence of two pairs of ventral projections on the fifth body ring occurs independently in Arthrosolaenomeridini and Telonychopodini (DelTran; Appendix 1B). In addition, another hypothesis can be suggested: the character state "four" is a synapomorphy for the clade (Arthrosolaenomeridini + (Macrocoxodesmini + Telonychopodini)) with two reversal to the plesiomorphic state in *Macrocoxodesmus marcusi* and *Eucampesmella lartiguei lartiguei* (AccTran; Appendix 1A)

10. **Pair of ventral projections on sixth body ring; occurrence (Pena-Barbosa *et al.*, 2013, character #9):** (L = 3, ci =0.33, ri = 0.67, F = 0.78). (0) absent; (1) present (Fig. 6C).

    The presence of a pair of ventral projections on sixth body ring optimizes a synapomorphy for (Arthrosolaenomeridini + (Macrocoxodesmini + Telonychopodini)), with two independent reversals in *Eucampesmella lartiguei lartiguei* and in (*Abiliodesmus defensor* comb. nov. + (*A. cataractae* comb. nov + *A. planaltensis* comb. nov.)).

11. **Pair of ventral projections on sixth body ring; length:** (L = 1, ci = 1, ri = 1, F = 1). (0) short (Fig. 6C); (1) 3x more elongated than in the previous state (Fig. 6D).

    The presence an elongated ventral projection on the sixth body ring was recovered as synapomorphic for Telonychopodini.

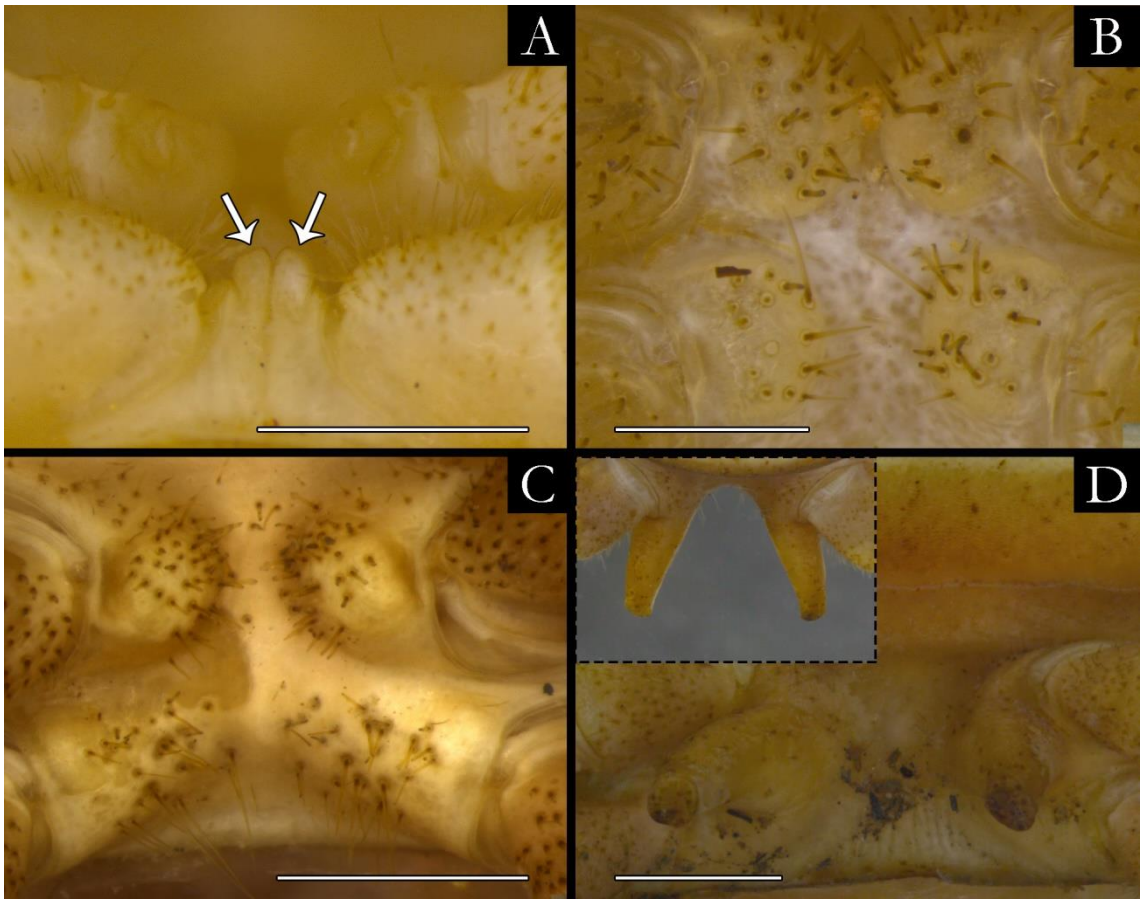


FIGURE 6. Sternites. A) *Arthrosolaenomeris curupira* sp. nov., 4th body ring, arrows to the ventral projection; B) *Folcloredesmus thomasi* sp. nov., 5th body ring; C) *Arthrosolaenomeris saci* sp. nov., 6th body ring; D) *Dioplosternus salvatrix*, 6th body ring. Scale bars: 1 mm. Arrow refers to the projection of the 4th body ring.

12. **Pair of ventral projections on the seventh body ring; occurrence (Pena-Barbosa *et al.*, 2013, character #10):** (L = 7, ci = 0.14, ri = 0.45, F = 0.54). (0) absent; (1) present (Fig. 7A).

    Few males of Chelodesmidae possess a pair of projections right below the gonopod aperture. The presence of these projections is homoplastic, appearing independently in *Vanzolegulus limbatus* and within Arthrosolaenomeridini: (*Abiliodesmus* gen. nov. + (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*), with independent reversals to the plesiomorphic state in *Abiliodesmus cataractae* comb. nov., *Arthrosolaenomeris chapadensis* and for *Gangugia*.

13. **Pair of ventral projections on the sternites after the gonopod; occurrence (Bouzan *et al.*, 2019, character #9):** (L = 2, ci = 0.5, ri = 0, F = 0.88). (0) absent; (1) present (Figs 7B-D).

    The absence of these projections appears independently in *Macrocoxodesmus marcusi* and *Abiliodesmus cataractae* comb. nov..

14. **Pair of ventral projections on the sternites after the gonopod; format:** (L = 7, ci = 0.29, ri = 0.55, F = 0.58). (0) rounded (Fig. 7B); (1) acuminated (Fig. 7D); (2) rectangular (Fig. 7C).

    The characteres states "rounded" and "acumined" occur several times in different clades. However, the rectangular condition is recovered as synapomorphic for *Arthrosolaenomeris,* with the acuminated condition recovered in *A. curupira* sp. nov. + *A. caipora* sp. nov..

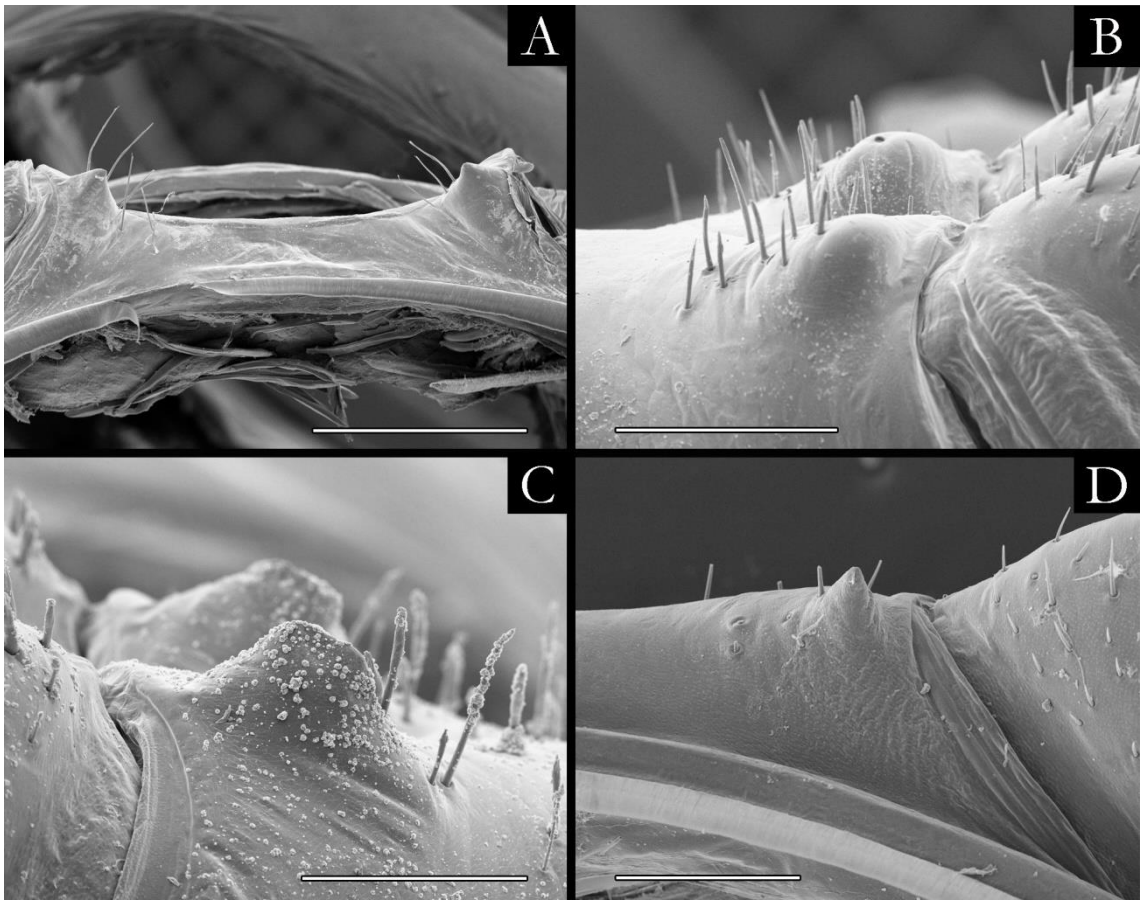


FIGURE 7. Sternites, ventral projections. A) *Arthrosolaenomeris saci* sp. nov., 7th body ring; B) *Folcloredesmus thomasi* sp. nov., 9th body ring; C) *A. saci*, 9th body ring; D) *Abiliodesmus planaltensis* comb. nov., 9th body ring. Scale bars: A, 1 mm; B, 0,5 mm; C, 0,3 mm; D, 0,3 mm.

15. **Tracheal aperture; format (Pena-Barbosa, 2015, character #17):** (L = 2, ci = 0.5, ri = 0.75, F = 0.88). (0) oval (Fig. 8A); (1) flattened (Fig. 8B).

    The flattened tracheal aperture occurs independently in the clade Macrocoxodesmini + Telonychopodini and in *Gangugia mula* sp. nov.

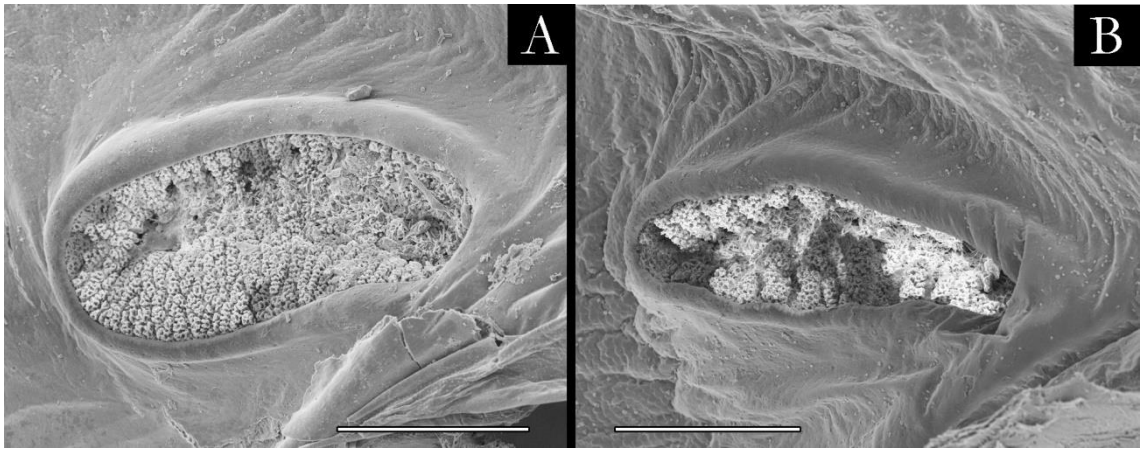


FIGURE 8. Tracheal aperture, 7th body ring. A) *Arthrosolaenomeris pantanalensis*; B) *Dioplosternus salvatrix*. Scale bars: 0,2 mm

16. **Ozopore on the edge of paranota; position (Pena-Barbosa *et al.*, 2013, character #11):** (L = 1, ci = 1, ri = 1, F = 1). (0) medial (Fig. 9B); (1) posterior (Fig. 9A).

    The medial position of the ozopore on the paranota edge optimizes as a synapomorphy for *Eucampesmella lartiguei lartiguei* + Telonychopodini.

17. **Peritremata; position (Pena-Barbosa, 2015, character #29):** (L = 1, ci = 1, ri = 1, F = 1). (0) center-anterior (Fig. 9B); (1) center-posterior (Fig. 9A).

    The character state "center-anterior" optimizes as a synapomorphy for *Eucampesmella lartiguei lartiguei* + Telonychopodini.

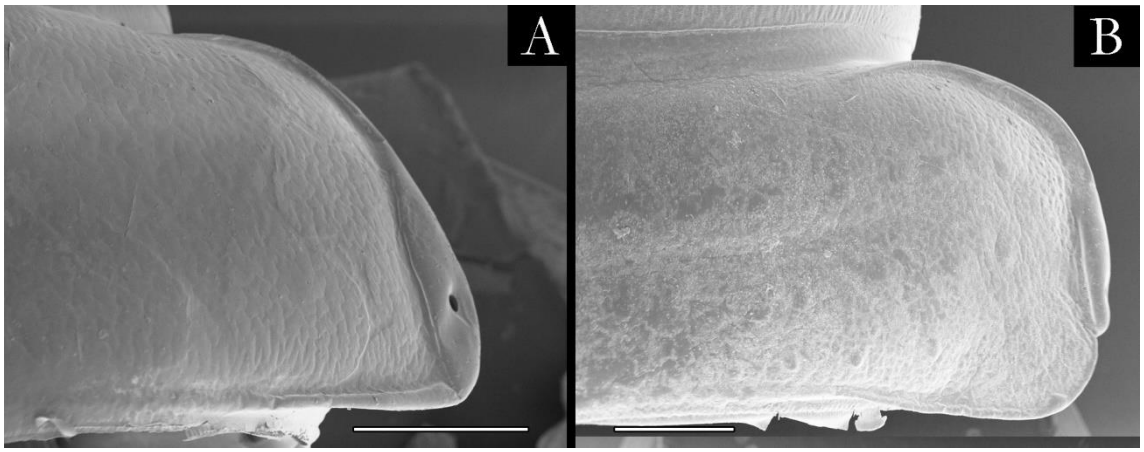


FIGURE 9. Paranota, dorsal view, ozopore. A) *Arthrosolaenomeris pantanalensis*; B) *Dioplosternus salvatrix*. Scale bars: 1 mm.

18. **Paranota; alignment in posterior view (Pena-Barbosa *et al.*, 2013, character #13):** (L = 8, ci = 0.25, ri = 0.4, F = 0.54). (0) straight (Fig. 10B); (1) curved ventrally (Fig. 10C); (2) curved dorsally (Fig. 10A).

    Highly homoplastic. The paranota curved dorsally is plesiomorphic in this analysis. The character states "straight" and "curved ventrally" appear independently in different clades.

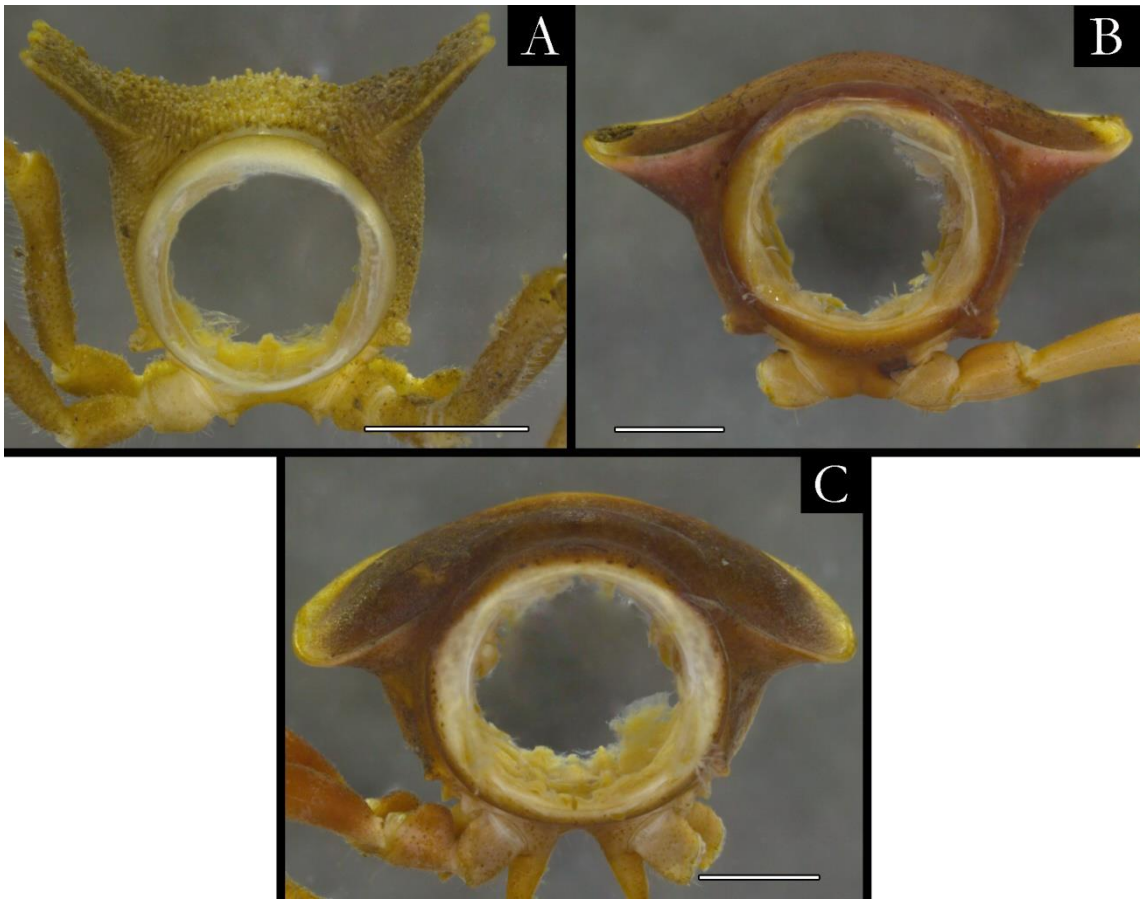


FIGURE 10. Body ring, oral view. A) *Igaraparana batesi*; B) *Brasilodesmus paulistus paulistus*; C) *Dioplosternus salvatrix*. Scale bars: 2 mm.

Legs

19. **Thick ventral setae; occurrence:** (L = 3, ci = 0.33, ri = 0.6, F = 0.78). (0) absent (Fig. 11B); (1) present (Fig. 11A).

    The occurrence of these setae is a homoplastic synapomorphy shared with Telonychopodini and *Arthrosolaenomeris*, with a reversal to the plesiomorphic condition in *A. curupira* sp. nov.+ *A. caipora* sp. nov.

20. **Dorsal lobe on prefemur of fifth leg; occurrence (Pena-Barbosa *et al.*, 2013, character #16):** (L = 1, ci = 1, ri = 1, F = 1). (0) absent; (1) present (Figs 11A-B).

    In this analysis the presence of a dorsal lobe on the prefemur is an apomorphic condition for (Arthrosolaenomeridini + (Macrocoxodesmini + Telonychopodini)).

21. **Dorsal lobe on prefemur of fifth leg; format:** (L = 2, ci = 0.5, ri = 0.83, F = 0.88). (0) slight (Fig. 11B); (1) accentuated (Fig. 11A).

The accentuated dorsal lobe occurs independently in *Eucampesmella lartiguei lartiguei* + Telonychopodini and in *Arthrsolaenomeris* + *Gangugia*.

FIGURE 11. Leg, seventh body ring. A) *Arthrosolaenomeris saci* sp. nov.; B) *Abiliodesmus defensor* comb. nov.. Scale bars: 1 mm.

22. **Ventral projection on the coxae; occurrence:** (L = 2, ci = 0.5, ri = 0.5, F = 0.88). (0) absent; (1) present (Fig.12A).

    The presence of a ventral projection on the coxae is plesiomorphic in this analysis and also occurs in *Gangugia mula* sp. nov.+ *Gangugia boto* sp. nov..

23. **Granules on the tibia; occurrence:** (L = 4, ci = 0.25, ri = 0.7, F = 0.7). (0) absent; (1) present (Fig. 12C).

    In this dataset the "absent" state is plesiomorphic with two independent changes to the derived state "present": in *Macrocoxodesmus marcusi* and in the clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)). In the last clade, two independent reversals occur: one in *Arthrosolaenomeris* (*A. caipora* sp. nov. + *A. curupira* sp. nov.) and the other within *Gangugia* (*G. cuca* sp. nov.).

24. **Ventro-apical projection on the prefemur; occurrence (Pena-Barbosa, 2015, character #31):** (L = 1, ci = 1, ri = 1, F = 1). (0) absent; (1) present (Fig. 12B).

    The presence of ventro-apical projection is a synapomorphy for the clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)).

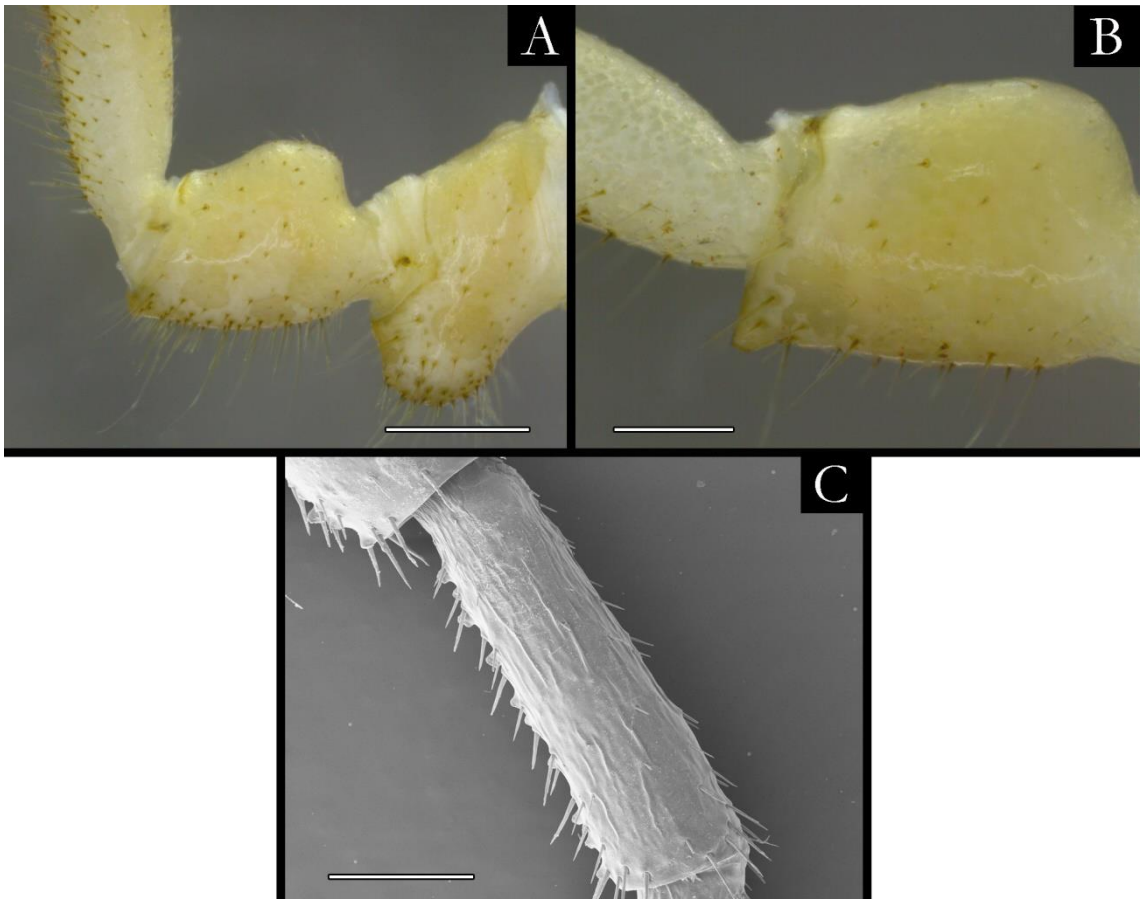


FIGURE 12. A) *Gangugia boto* sp. nov., ventral projection on the coxae; B) *Gangugia boto* sp. nov., ventro-apical projection on the prefemur; C) *G. tapirapensis*, granules on the tibia. Scale bars: A, 1 mm; B-C, 0,5 mm.

Gonopod

25. **Gonopod aperture; format:** (L = 1, ci = 1, ri = 1, F = 1). (0) rounded (Fig. 13A); (1) excavated (Figs 13B-D).

    The format excavated is an apomorphic condition for (Arthrosolaenomeridini + (Macrocoxodesmini + Telonychopodini)).

26. **Gonopod aperture, posterior border; format (Pena-Barbosa *et al.*, 2013, character #20):** (L = 3, ci = 0.67, ri = 0.91, F = 0.88). (0) smooth (Fig. 13A); (1) with prominent folds (Fig. 13D); (2) one dentiform process (Fig. 13C).

    The smooth condition is the plesiomorphic state in this analysis; there is a apomorphic state change in Macrocoxodesmini + Telonychopodini which features ‘with prominent folds’. The character state ‘one dentiform process’ is recovered as homoplastic, which evolved independently in *Arthrosolaenomeris*

and internal to the genus *Abiliodesmus* gen. nov.: (*A. defensor* comb. nov. + (*A. planaltensis* comb. nov.+ *A. cataractae* comb. nov.)).

27. **Gonopod aperture, central support sub-triangular ; occurrence (Pena-Barbosa *et al.*, 2013, character #22):** (L = 3, ci = 0.33, ri = 0.78, F = 0.78). (0) absent (Fig. 13A); (1) present (Fig. 13B).

    The presence is a homoplastic synapomorphy for the clade Macrocoxodesmini + Telonychopodini and (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)). Within *Gangugia,* a reversal to the absent condition occurs in *G. cuca* sp. nov. + *G. boitata* sp. nov..

28. **Gonopod aperture, posterior border; length (Pena-Barbosa *et al.*, 2013, character #23):** (L = 7, ci = 0.29, ri = 0.29, F = 0.58). (0) not reaching the coxae of ninth pair of legs (Figs 13A, C); (1) excavation reaching half of the coxae of ninth pair of legs (Fig. 13B); (2) deeply excavated, exceeding the coxae of ninth pair of legs (Fig. 13D).

    As discussed by Pena-Barbosa *et al.* (2013) Chelodesmidae species with large gonocoxae have a deeply excavated posterior margin of the gonopod aperture. The character state “not reaching the coxae of ninth pair of legs” represents a plesiomorphy in this dataset. Within the Arthrosolaenomeridini the change to the character state “excavation reaching half of the coxae of ninth pair of legs” is recovered for the clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)) and independently in *Abiliodesmus defensor* comb. nov. The posterior border deeply excavated, exceeding the coxae of ninth pair of legs only occurrs in *Eucampesmella lartiguei lartiguei* and *Dioplosternus salvatrix.*

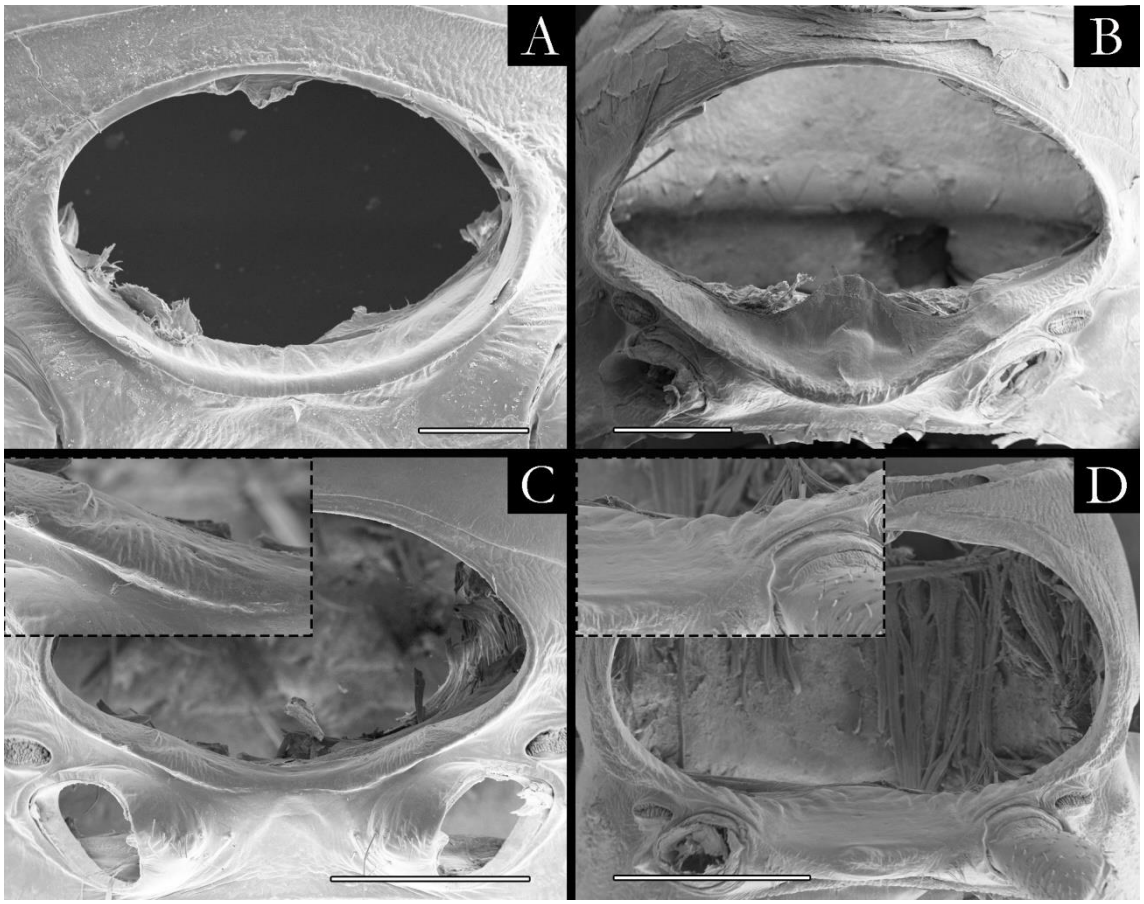


FIGURE 13. Gonopod aperture. A) *Brasilodesmus paulistus paulistus*; B) *Gangugia tapirapensis*; C) *Abiliodesmus planaltensis* comb. nov.; D) *Dioplosternus salvatrix*. Scale bars: A) 0,5 mm; B-C) 1mm; D) 2 mm.

29. **Gonopod aperture, posterior border, ventral elevation; occurrence (Pena-Barbosa, 2015, character #42):** (L = 1, ci = 1, ri = 1, F = 1). (0) absent; (1) present.

    The ventral elevation is a synapomorphy of *Eucampesmella lartiguei lartiguei* + Telonychopodini.

30. **Gonocoxae; format:** (L = 4, ci = 0.25, ri = 0.67, F = 0.70). (0) cylindrical (Fig. 14A); (1) globose (Fig. 14B).

    The globose gonocoxae appear in *Macrocoxodesmus marcusi* and Telonychopodini. In addition, within Arthrosolaenomeridini we can hypothesize: i) the character state "globose" is a homoplastic synapomorphie for the clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)) with a reversal to the plesiomorphic state in *Arthrosolaenomeris* (AccTran; Appendix

1A); ii) two independently transformations for a globose gonocoxae in *Folcloredesmus* gen. nov. and *Gangugia* (DelTran; Appendix 1B).

31. **Gonocoxae, spiniform process; occurrence (Pena-Barbosa *et al.*, 2013, character #27):** (L = 2, ci = 0.5, ri = 0.5, F = 0.88). (0) absent; (1) present (Fig. 14C).

    The absence of a spiniform process was recovered as a plesiomorphy in this analysis. Two character state changes were recovered as a derived condition: *Brasilodesmus paulistus paulistus* + *Chondrodesmus* sp. and in *Folcloredesmus thomasi* sp. nov.

32. **Gonocoxae, prolonged roundness in oral view; occurrence:** (L = 1, ci = 1, ri = 1, F = 1). (0) absent; (1) present (Fig. 14D).

    The character state "present" appears within *Arthrosolaenomeris* in (*A. chapadensis* + (*A. saci* sp. nov. + (*A. pantanalensis* + (*A. caipora* sp. nov. + *A. curupira* sp. nov.)))).

33. **Gonocoxae, dorsal macrosetae; pattern (Bouzan *et al.*, 2019, character #16):** (L = 2, ci = 0.5, ri = 0, F = 0.88). (0) two; (1) three or more (Fig. 14D).

    The presence of two dorsal macrosetae was recovered as plesiomorphic in this analysis and occurring independently in *Brasilodesmus paulistus paulistus.*

34. **Gonocoxae, lateral macrosetae in mesal view; occurrence:** (L = 2, ci = 0.5, ri = 0.8, F = 0.88). (0) absent; (1) present (Fig. 14E).

    The character state "absent" appears as plesiomorphic in this dataset. The presence of this lateral macrosetae was recovered as a homoplastic synapomorphy for Arthrosolaenomeridini, also occurring in *Brasilodesmus paulistus paulistus.*

35. **Gonocoxae, lateral macrosetae in mesal view; pattern:** (L = 4, ci = 0.25, ri = 0.57, F = 0.70). (0) in a row (Fig. 14E); (1) scattered (Fig. 14F).

    Within Arthrosolaenomeridini the pattern of lateral macrosetae in a row occurs in *Angelodesmus*, *Abiliodesmus* gen. nov. and some *Arthrsolaenomeris* species (*A. saci* sp. nov., *A. pantanalensis* and *A. caipora* sp. nov.). On the other hand, lateral macrosetae with scattered pattern occurs in *Folcloredesmus* gen. nov., *Gangugia* and also in the rest of *Arthrosolaenomeris* species (*A. iara* sp. nov., *A. chapadensis* and *A. curupira* sp. nov.). Using AccTran (Appendix 1A) the character state "scattered" is plesiomorphic in the analysis, with one transformation to the character state "in a row", being a homoplastic

synapomorphy for the clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)). Within *Arthrosolaenomeris* a reversal to the plesiomorphic state occurs in the clade (*A. saci* sp. nov. + (*A. pantanelesis* + (*A. curupira* sp. nov. + *A. caipora* sp. nov.))), a independently transformation to a lateral macrosetae in a row pattern occurs in: *A. curupira* sp. nov. Using DelTran (Appendix 1B) the character state "scattered" was recovered three times independently in the data set in: *Angelodesmus, Abiliodesmus* gen. nov. and in the clade (*A. saci* sp. nov. + (*A. pantanelesis* + (*A. curupira* sp. nov. + *A. caipora* sp. nov.))).

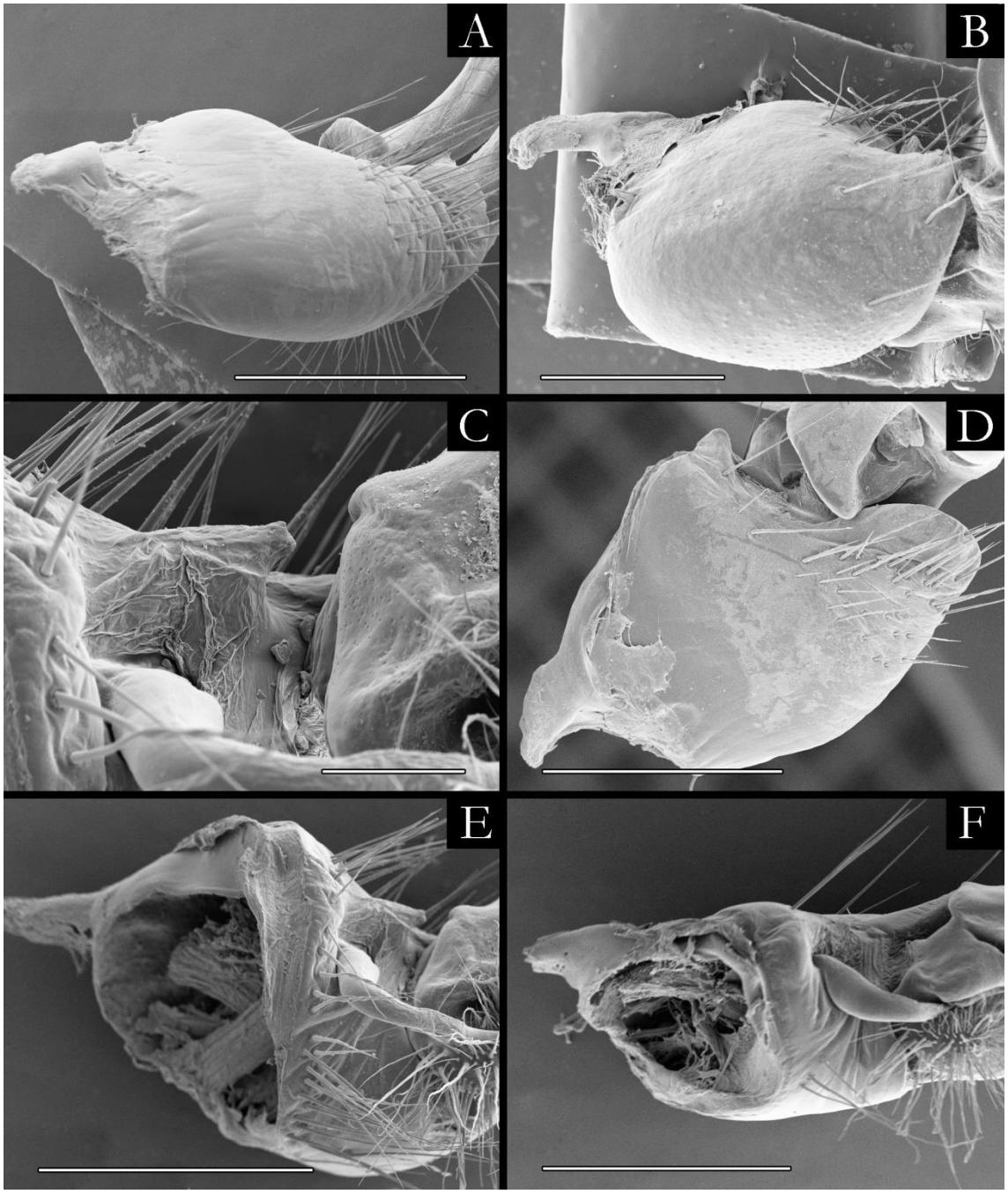


FIGURE 14. Gonocoxa. A) *Arthrosolaenomeris pantanalensis*; B) *Gangugia*

tapirapensis; C) *Folcloredesmus thomasi* sp. nov.; D) *A. pantanalensis*; E) *F. thomasi* sp. nov.; F) *Abiliodesmus mapinguari* sp. nov. Scale bars: A-B, D-F) 1 mm; C) 0,2 mm.

36. **Prefemoral region; format:** (L = 1, ci = 1, ri = 1, F = 1). (0) continuous with the acropodite region (Fig. 15B); (1) discontinuous with the acropodite region (Fig. 15A).

    The character states "discontinuous with the acropodite region" is a synapomorphy of *Eucampesmella lartiguei lartiguei* + Telonychopodini.

37. **Prefemoral process, basal portion; format:** (L = 2, ci = 0.5, ri = 0.8, F = 0.88). (0) straight (Fig. 15B); (1) with angulation (Figs 15C-E).

    The angulation in the basal portion in the prefemoral process was recovered independently in Telonychopodini and in the clade (*Abiliodesmus* gen. nov. + (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*))).

38. **Prefemoral process, basal portion, degree of angulation:** (L = 4, ci = 0.5, ri = 0.67, F = 0.78). (0) 90° (Fig. 15D); (1) 30° (Fig. 15C); (2) 120° (Fig. 15E).

    The "30°" condition is the plesiomorphic state in this dat set; there is a three independently changes to the character state "90°" in *Abiliodesmus mapinguari* sp. nov., *Arthrosolaenomeris iara* sp. nov. and *Gangugia cuca* sp. nov.. However the angulation of 120° appears as synapomorphy for *Gangugia*.

39. **Prefemoral process, basal portion, constriction; occurrence:** (L = 2, ci = 0.5, ri = 0.89, F = 0.88). (0) absent; (1) present (Fig. 15F).

    The constriction of the basal portion occurs independently in two genera within Arthrosolanomeridini: *Abiliodesmus* gen. nov. and *Arthrosolaenomeris*.

40. **Prefemoral process, dorso-basal lobe; occurrence:** (L = 2, ci = 0.5, ri = 0.88, F = 0.88). (0) absent (Fig. 15B); (1) present (Fig. 15C).

    The absence of a dorso-basal lobe is plesiomorphic in this analysis. Thus, two hypothesis can be maded: i) using AccTran (Appendix 1A), the presence is an apomorphic condition for the clade (*Abiliodesmus* gen. nov. + (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*))), with a reversal to the plesiomorphic condition in *Folcloredesmus* gen. nov.; ii) two transformations for a "present" state character occurs independently in *Abiliodesmus* gen. nov. and in *Arthrosolaenomeris* + *Gangugia* (DelTran; Appendix 1B).

41. **Prefemoral process, dorso-basal lobe; format:** (L = 2, ci = 0.5, ri = 0.67, F = 0.88). (0) rounded (Figs 15C-D); (1) sub-triangular (Fig. 15E).

The “sub-triangular ” character condition appears independently two times: in *Abiliodesmus cataractae* comb. nov. and in the clade (*Gangugia simplex* + (*G. cuca* sp. nov. + *G. boitata* sp. nov.)).

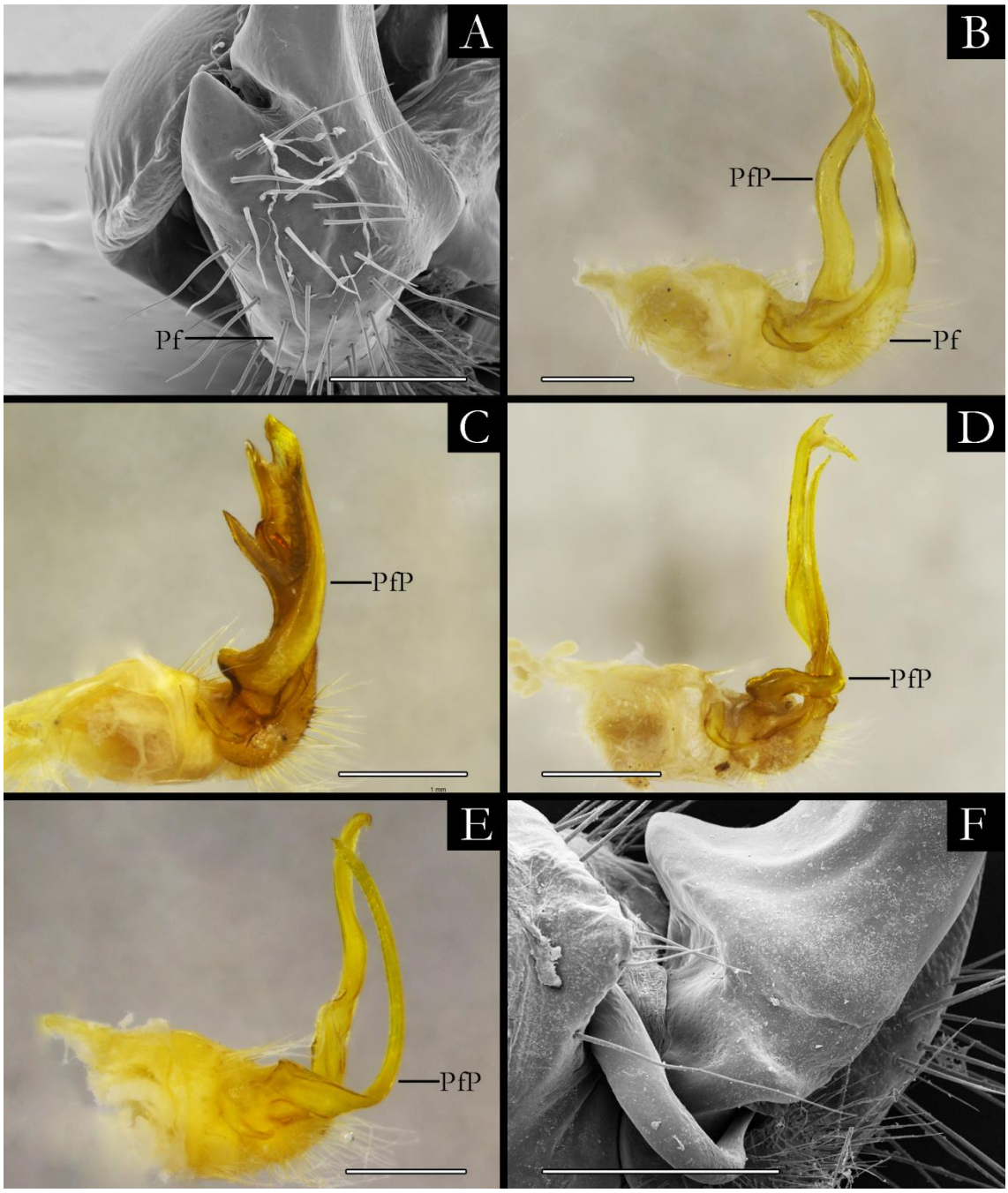


FIGURE 15. Gonopod. A) *Eucampesmella lartiguei lartiguei*; B) *Angelodesmus costalimai*; C) *Arthrosolaenomeris saci* sp. nov.; D) *Abiliodesmus mapinguari* sp. nov.; E) *Gangugia simplex*; F) *A. saci* sp. nov. Scale bars: A-E) 1 mm; F) 0,5 mm. Abbreviations: *Pf*, prefemoral region; *PfP*, prefemoral process.

42. **Prefemoral process, basal projection; occurrence:** (L = 2, ci = 0.5, ri = 0.67 F = 0.88). (0) absent; (1) present (Fig. 16A).

    The presence of a basal projection in the prefemoral process was recovered independently in Telonycophodini and in *Gangugia mula* sp. nov.+ *G. boto* sp. nov.

43. **Prefemoral process, medial projection; occurrence:** (L = 2, ci = 0.5, ri = 0.8, F = 0.88). (0) absent; (1) present (Figs 16B-C).

    A medial projection in the prefemoral process appears within *Arthrosolaenomeris* in (*A. chapadensis* + (*A. saci* sp. nov. + (*A. pantanalensis* + (*A. caipora* sp. nov. + *A. curupira* sp. nov.)))), also occurring independently in *Eucampesmella lartiguei lartiguei*.

44. **Prefemoral process, medial projection; length:** (L = 1, ci = 1, ri = 1, F = 1). (0) short (Fig. 16B); (1) 2x more elongated than in the previous state (Fig. 16C).

    The character state "short" occurs only in *Arthrosolaenomeris caipora* sp. nov. + *A. curupira* sp. nov..

45. **Prefemoral process, apical projection; occurrence:** (L = 2, ci =0.5, ri = 0.5, F = 0.88). (0) absent; (1) present (Fig. 16D).

    The presence of an apical projection in the prefemoral process was recovered independently *Brasilodesmus paulistus paulistus* + *Chondrodesmus* sp. and in *Abiliodesmus mapinguari* sp. nov..

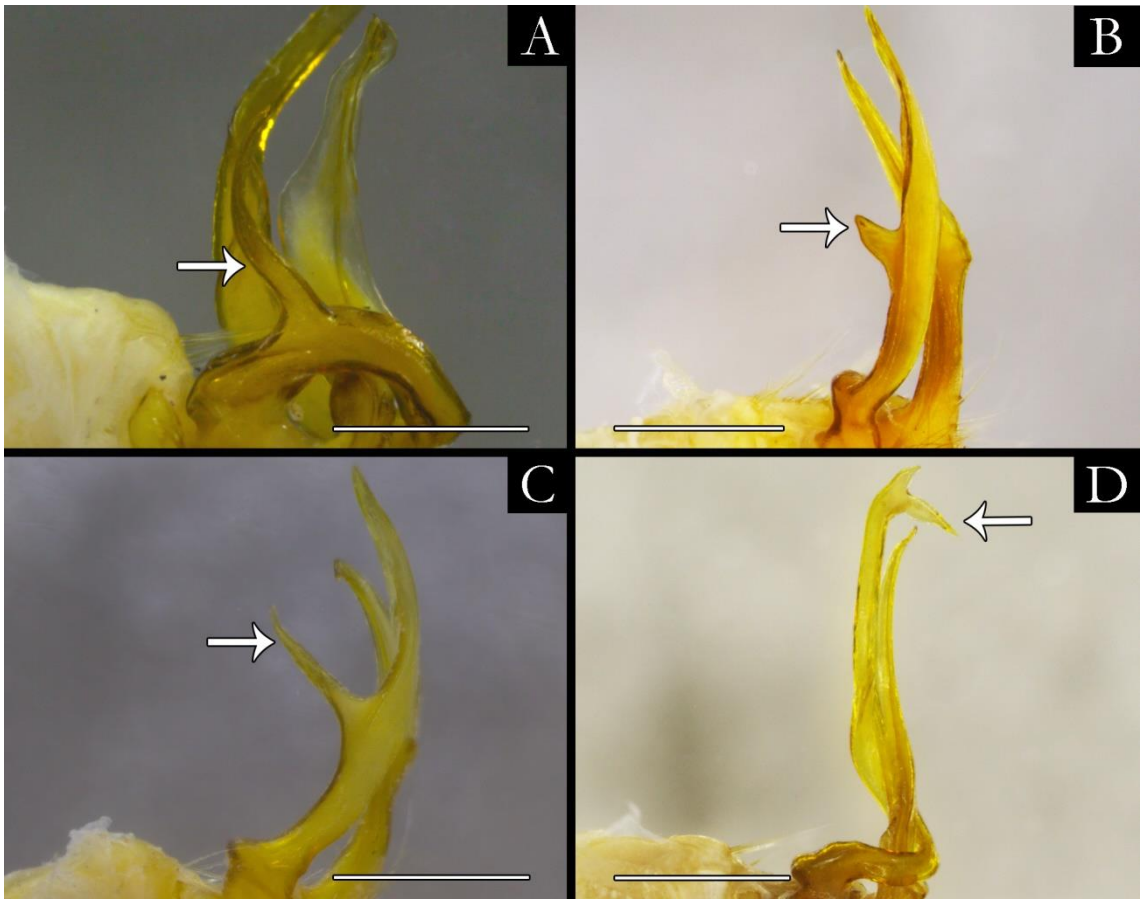


FIGURE 16. Gonopod, mesal view. A) *Gangugia boto* sp. nov.; B) *Arthrosolaenomeris curupira* sp. nov.; C) *Arthrosolaenomeris pantanalensis*; D) *Abiliodesmus mapinguari* sp. nov. Scale bars: 1 mm. Arrows refer to the secondary process in the prefemoral process.

46. **Prefemoral process, indentations; occurrence:** (L = 4, ci = 0.25, ri = 0.25, F = 0.7). (0) absent; (1) present (Fig. 17D).

    Two hypothesis can be suggested for the evolution of indentations in the prefemoral process within Arthrosolaenomeridini: i) using AccTran (Appendix 1A), the presence is an apomorphic condition for the clade *Arthrosolaenomeris* + *Gangugia*, with several reversals to the plesiomorphic condition among the clade; ii) an homoplastic synapomorphy for *Arthrosolaenomeris*, with a reversal to the "absent" character state condition in (*A. pantanalensis* + (*A. caipora* sp. nov. + *A. curupira* sp. nov.)) and other two independently a transformation to the derived character state occurs within *Gangugia*: in *G. tapirapensis* and *G. simplex* (DelTran; Appendix 1B).

47. **Prefemoral process; position:** (L = 10, ci = 0.3, ri = 0.36, F = 0.5). (0) dorsal side (Fig. 15B); (1) mesal side of the acropodite (Fig. 15C); (2) covering the ventral side (Fig. 15E); (3) curving towards the ectal side of the acropodite (Fig. 15D).

    Highly homoplastic. Within Arthrosolaenomeridini the character state "mesal side of the acropodite" is recovered independently in the clades (*Abiliodesmus cataractae* comb. nov. + *A. planaltensis* comb. nov.) and *Arthrosolaenomeris*. The prefemoral process covering the ventral side of the solenomere was recovered in *Folcloredesmus* gen. nov., *Gangugia* (*G. simplex* and *G. cuca* sp. nov.) and in *Arthrosolaenomeris caipora* sp. nov. The character state "curving towards the ectal side of the acropodite" occurs in *Abiliodesmus* gen. nov. and within *Gangugia* (*G. tapirapensis* + (*G. mula* sp. nov. + *G. boto* sp. nov)) and in *G. boitata* sp. nov.

48. **Prefemoral process, ventral view; format**: (L = 5, ci = 0.4, ri = 0.67, F = 0.7). (0) foliate (Figs 17B-C); (1) narrow (Fig. 17D); (2) flattened (Fig. 17A).

    A flat prefemoral process in ventral side is a plesiomorphic condition in this analysis. The "foliate" character state appears to be an apomorphy for the clade (Arthrosolaenomeridini + (Macrocoxodesmini + Telonychopodini)), inside this group three changes for a narrow-shaped prefemoral process appears: two times in the clade of *Abiliodesmus* gen. nov.: *A. mapinguari* sp. nov. and *A. defensor* comb. nov.; and a homoplastic synapomorphy for *Gangugia*.

49. **Prefemoral process, ventral view; format:** (L = 1, ci = 1, ri = 1, F = 1). (0) straight (Figs 17A-C); (1) sharply curved (Fig. 17D).

    The prefemoral process sharply curved, in ventral view was recovered as a non-homoplastic synapomorphy for *Gangugia*.

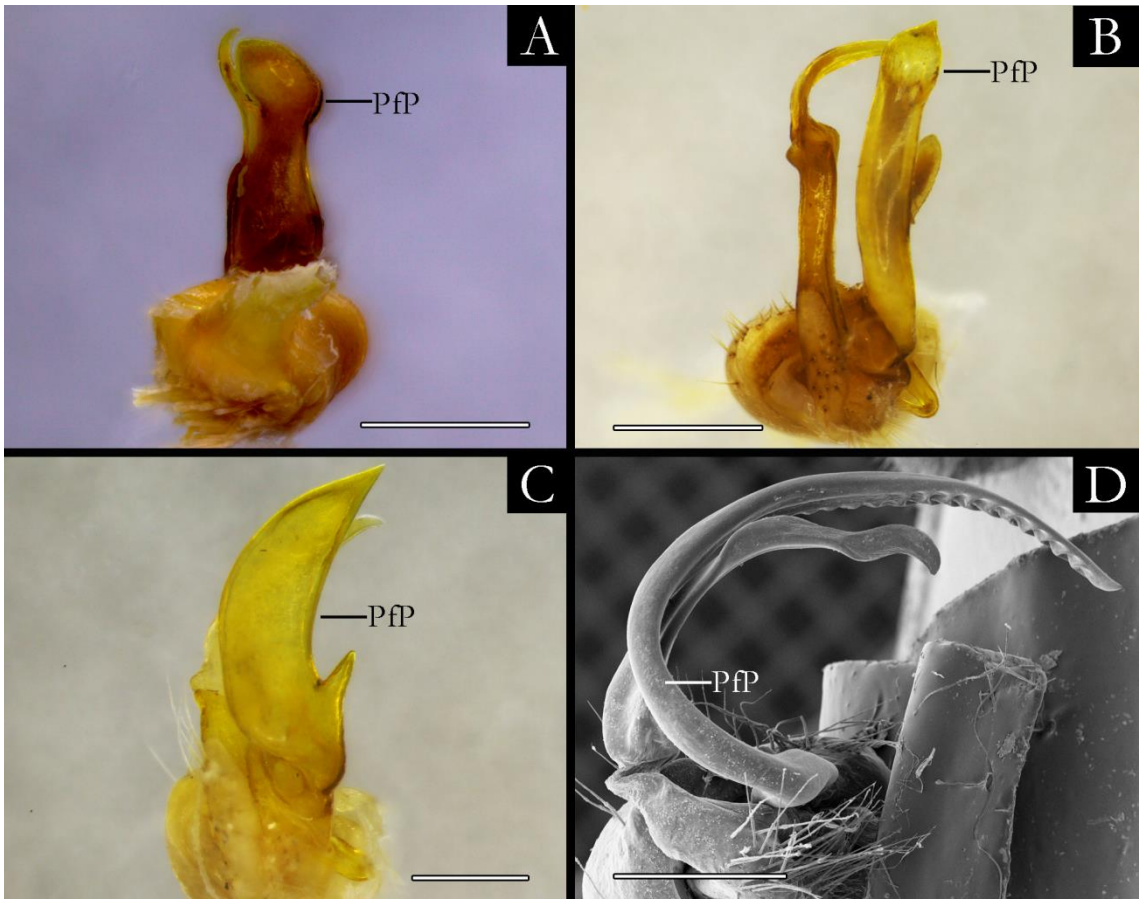


FIGURE 17. Gonopod. Dorsal view: A) *Brasilodesmus paulistus paulistus*; Ventral view: B) *Arthrosolaenomeris saci* sp. nov.; C) *Arthrosolaenomeris caipora* sp. nov.; D) *Gangugia tapirapensis.* Scale bars: A, C) 0,5 mm; B, D) 1 mm. Abbreviations: *PfP*, prefemoral process.

50. **Cingulum; occurrence (Bouzan *et al.*, 2019, character #21):** (L = 2, ci = 0.5, ri = 0.8, F = 0.88). (0) absent; (1) present (Figs 18A-C).

    The presence of a cingulum was recovered as a homoplastic synapomorphy for Arthrosolaenomeridini and shared with *Chondrodesmus* sp.

51. **Cingulum; position (Bouzan *et al.*, 2019, character #23):** (L = 6, ci = 0.33, ri = 0.56, F = 0.64). (0) basal (Fig. 18A); (1) medial (Fig. 18B); (2) apical (Fig. 18C).

    Among Arthrosolaenomeridini the plesiomorphic character state recovered was the median position of the cingulum, however three independently changes for a basal position occur: a homoplastic synapomorphy for *Abiliodesmus* gen. nov. and two times within *Gangugia*: *G. boitata* sp. nov. and the clade (*G. tapirapensis* + (*G. mula* sp. nov. + *G. boto* sp. nov.)). The character state "apical" appears within *Arthrosolaenomeris* in (*A. chapadensis* + (*A. saci* sp.

nov. + (*A. pantanalensis* + (*A. caipora* sp. nov. + *A. curupira* sp. nov.)))) and was also observed in the out group *Chondrodesmus* sp.; a reversal to the "medial" condition occurs in *A. caipora* sp. nov..

52. **Cingulum, ectal view; format:** (L = 3, ci = 0.33, ri = 0.71, F = 0.78). (0) slit (Fig. 18B); (1) spiral (Fig. 18A).

    Angelodesmus, *Abiliodesmus mapinguari* sp. nov. and *Gangugia* shared the derived character condition "Cingulum in spiral format, in ectal view".

53. **Cingulum, ventral view; format:** (L = 3, ci = 0.67, ri = 0.67, F = 0.88). (0) slit (Fig. 18D); (1) conical (Fig. 18E); (2) fold (Fig. 18F).

    The "conical" character state was recovered in *Gangugia* and in *Arthrosolaenomeris caipora* sp. nov., in the other hand the "fold" condition appears as a autapomorphy for *Chondrodesmus* sp.

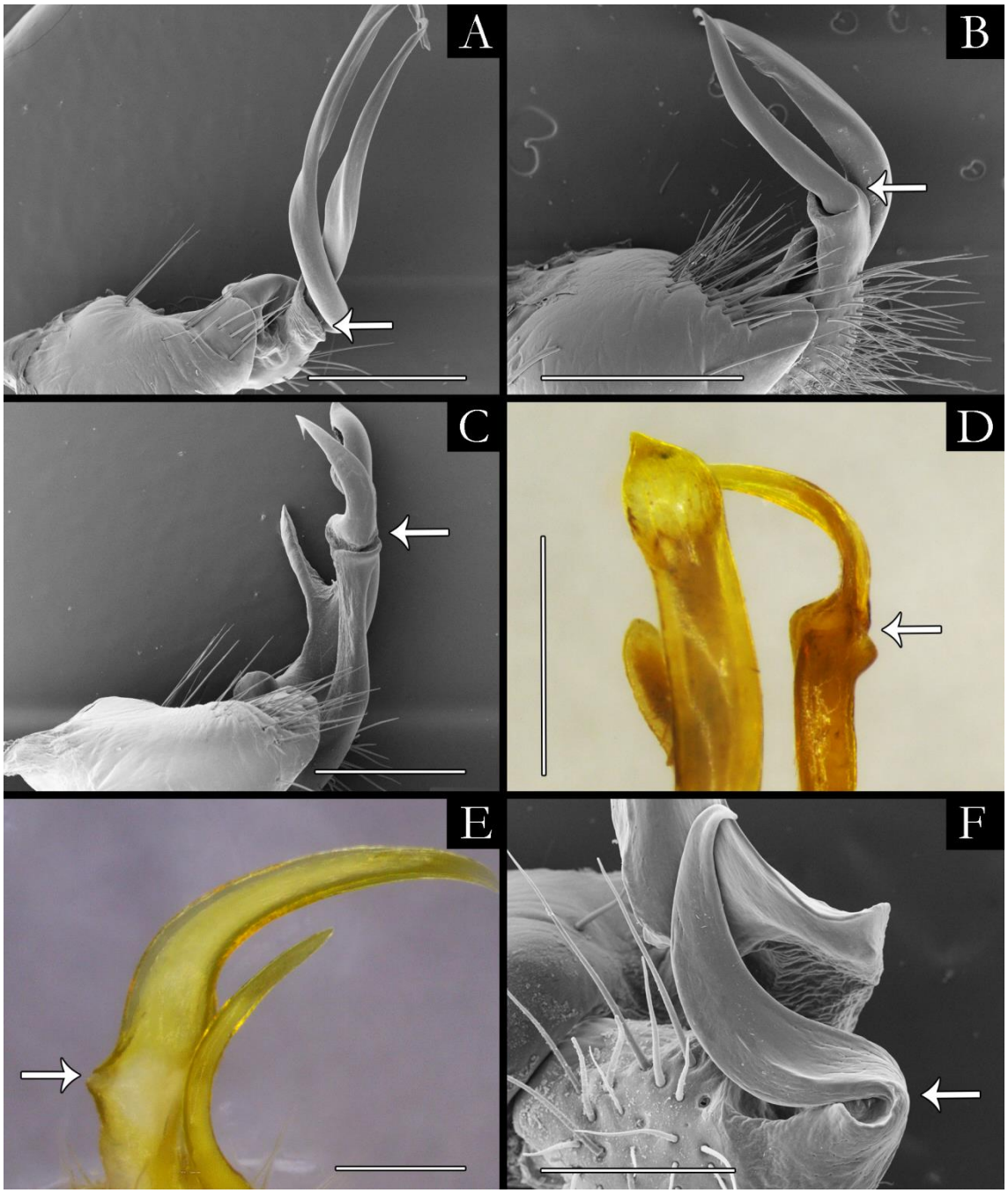


FIGURE 18. Gonopod. (A-C) Ectal view. A) *Abiliodesmus mapinguari* sp. nov.; B) *Folcloredesmus thomasi* sp. nov.; C) *Arthrosolaenomeris saci* sp. nov.. (D-F) Ventral view. D) *Arthrosolaenomeris saci* sp. nov.; E) *Gangugia cuca* sp. nov.; F) *Chondrodesmus* sp. Scale bars: A-D) 1 mm; E) 0,5 mm; F) 0,3 mm. Arrows refer to cingulum.

54. **Acropodite region; number of branches (Bouzan *et al.*, 2019, character #27):** (L = 3, ci = 0.33, ri = 0.33, F = 0.78). (0) single branch (Fig. 19B); (1) two branches (Fig. 19A).

The character state “two branches” appears as plesiomorphic in this dataset. The presence of a single branch was recovered as a homoplastic synapomorphy for Arthrosolaenomeridini, also occurring independently in *Chondrodesmus* sp. and in Telonychopodini.

55. **Solenomere, sigmoid curvature; occurrence:** (L = 3, ci = 0.33, ri = 0, F = 0.78). (0) absent; (1) present (Fig. 17D).

    The sigmoid curvature in the solenomere was observed in *Abiliodesmus mapinguari* sp. nov., *Gangugia tapirapensis* and *Gangugia boto* sp. nov..

56. **Solenomere, apex; format:** (L = 4, ci = 0.5, ri = 0.82, F = 0.78). (0) ascending (Fig. 19B); (1) sickle-shaped descendant (Fig. 19C); (2) abruptly downward (Fig. 19D).

    The “sickle-shaped descendant” character state appears for the *Gangugia* clade, also occurring in *Abiliodesmus mapinguari* sp. nov.. The solenomere apex abruptly downward was recovered as a homoplastic synapomorphy for *Arthrosolaenomeris*, also occurring independently in *Gangugia mula* sp. nov..

57. **Solenomere, lateral expansion; occurrence:** (L = 2, ci = 0.5, ri = 0.75, F = 0.88). (0) absent; (1) present (Fig. 19B).

    Two independently transformations to the derived character state “present” occurs: one in the clade (*Abiliodesmus defensor* comb. nov. + (*A. planaltensis* comb. nov. + *A. cataractae* comb. nov.)) and another in (*G. mula* sp. nov. + *G. boto* sp. nov.).

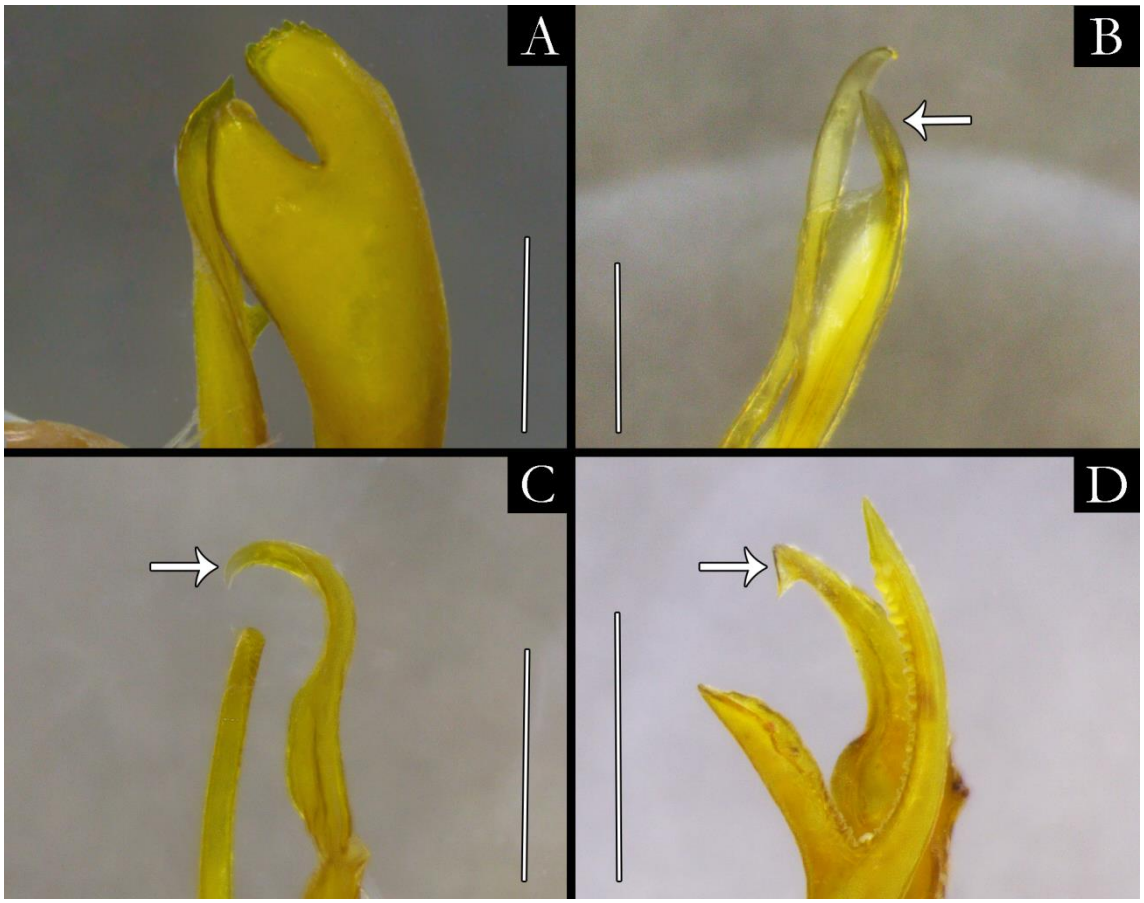


FIGURE 19. Gonopod. A) *Eucampesmella lartiguei lartiguei*; B) *Abiliodesmus defensor* comb. nov.; C) *Gangugia simplex*; D) *Arthrosolaenomeris chapadensis*. Scale bars: A, C-D) 1 mm; B) 0,5 mm. Arrows refer to the apex of the solenomere.

Vulvae

58. **Vulvae, ventral view; format (Pena-Barbosa *et al.*, 2013, character #46):** (L = 2, ci = 1, ri = 1, F = 1). (0) round (Fig. 20A); (1) oval (Fig. 20B); (2) cylindrical (Fig. 20C).

All species of Arthrosolaenomeridini examined showed females with a oval-shaped vulvae.

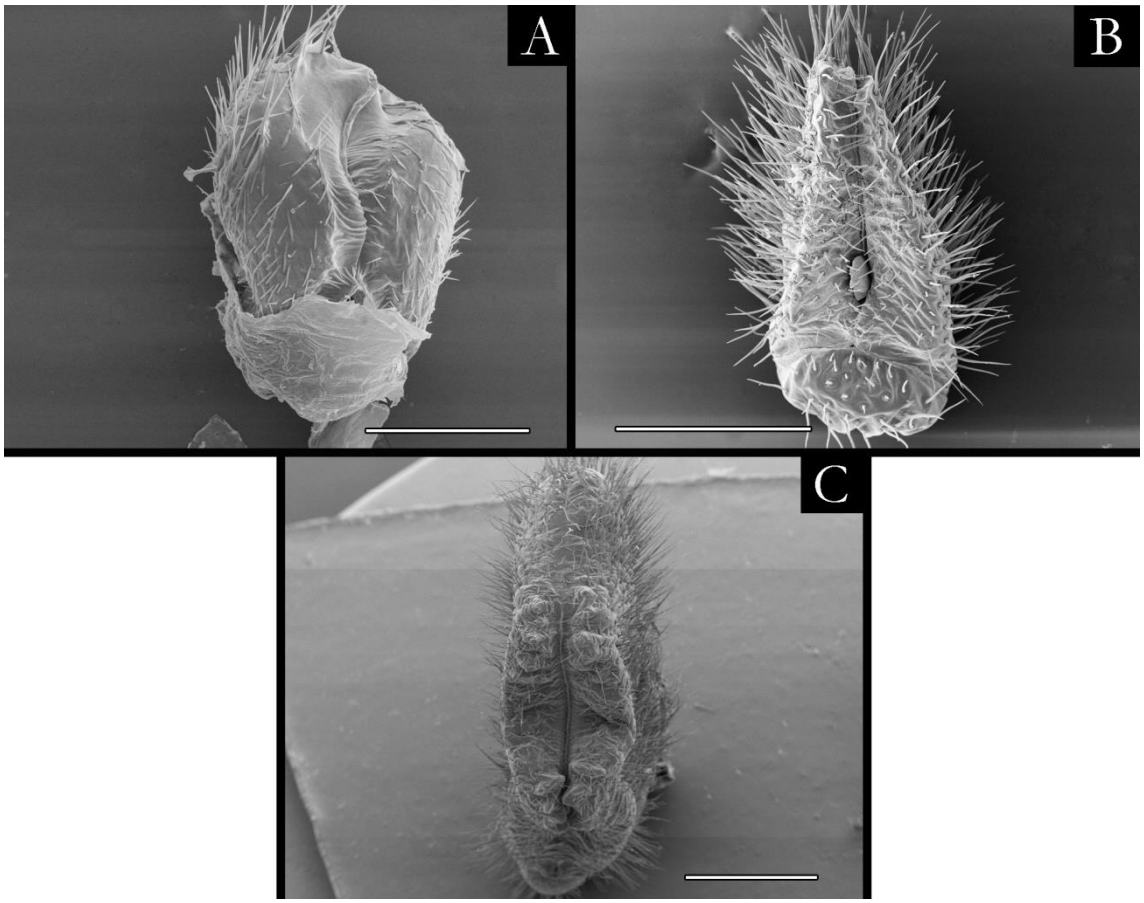


FIGURE 20. Vulva, ventral view. A) *Brasilodesmus paulistus paulistus*; B) *Abiliodesmus planaltensis* comb. nov.; C) *Eucampesmella lartiguei lartiguei*. Scale bars: A) 0,4 mm; B) 0,5 mm; C) 1 mm.

59. **Vulvae, apex, lateral view; format (Bouzan *et al.*, 2019, character #30):** (L = 2, ci = 1, ri = 1, F = 1). (0) rounded (Figs 21A-B); (1) rectangular (Fig. 21C); (2) sub-triangular (Fig. 21D).

    The apex of the vulvae rounded is plesiomorphic condiction in this dat set. The "rectangular" character state appears to be a autapomorphy for the *Gangugia tapirapensis*. On the other hand, the apex of the vulvae sub-triangular was recovered as an autapomorphy for *Folcloredesmus thomasi* sp. nov..

60. **Vulvae, apex, lateral view; format, when rounded:** (L = 1, ci = 1, ri = 1, F = 1). (0) longer than wide (Fig. 21A); (1) of the same proportion (Fig. 21B).

    The character state "of the same proportion" was observed on *Gangugia mula* sp. nov. and the members of *Arthrosolaenomeris*.

61. **Operculum, lateral view; format:** (L = 1, ci = 1, ri = 1, F = 1). (0) projected (Fig. 21B); (1) not projected (Fig. 21A).

The operculum projected in lateral view was recovered as a non-homoplastic synapomorphy for *Arthrosolaenomeris*.

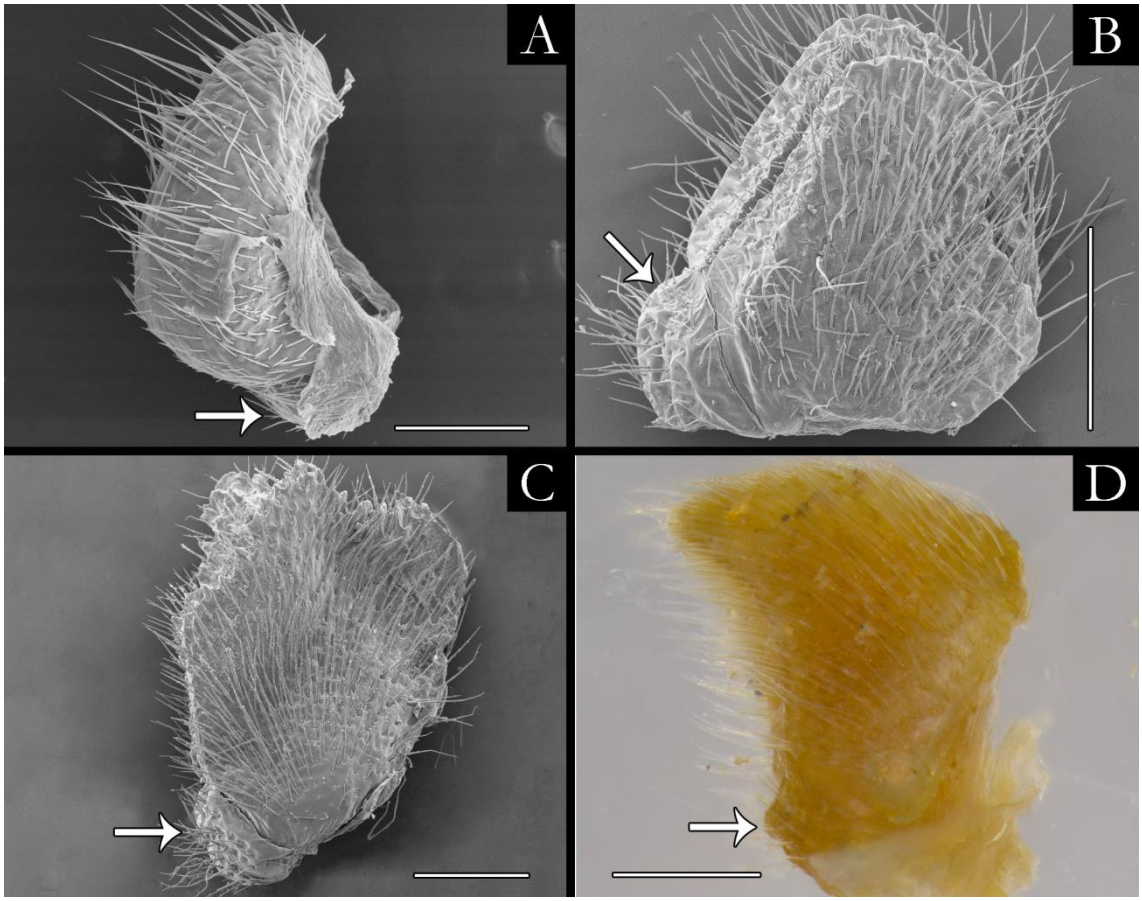


FIGURE 21. Vulva, lateral view. A) *Brasilodesmus paulistus paulistus*; B) *Arthrosolaenomeris pantanalensis*; C) *Gangugia tapirapensis*; D) *Folcloredesmus thomasi* sp. nov.. Scale bars: A) 0,3 mm; B-D) 0,5 mm; C) 1 mm. Arrows refer to the operculum.

62. **Vulvae aperture, epigyne; occurrence:** (L = 1, ci = 1, ri = 1, F = 1). (0) absent (Fig. 22A); (1) present (Figs 22B-C).

    The presence of epigyne is known for several Polydesmida. Its presence was not usually described for Chelodesmidae species, since it is confined to few taxonomical works. In this analysis the presence of the epigyne was recovered for the clade (Arthrosolaenomeridini + (Macrocoxodesmini + Telonychopodini)).

63. **Vulvae aperture, epigyne; format:** (L = 4, ci = 0.5, ri = 0.33, F = 0.78). (0) rounded (Fig. 22C); (1) trianguliform (Fig. 22B); (2) rectangular.

The character state “rounded” is plesiomorphic condiction in this dat set. Three independently transformations for a trianguliform epigyne in: *Folcloredesmus*, *Gangugia tapirapensis* and (*A. saci* sp. nov. + (*A. pantanalensis* + (*A. caipora* sp. nov. + *A. curupira* sp. nov.)))). The epigyne rectangular was recovered as a autapomorphy for *Macrocoxodesmus marcusi*.

64. **<u>Vulvae aperture, epigyne, edge; format:</u>** (L = 2, ci = 0.5, ri = 0.8, F = 0.88). (0) regular (=smooth) (Fig. 22C); (1) irregular (Fig. 22B).

    The irregular egde of the epigyne was recovered as a non-homoplastic synapomorphy for the clade (*Folcloredesmus* gen. nov. + (*Arthrosolaenomeris* + *Gangugia*)).

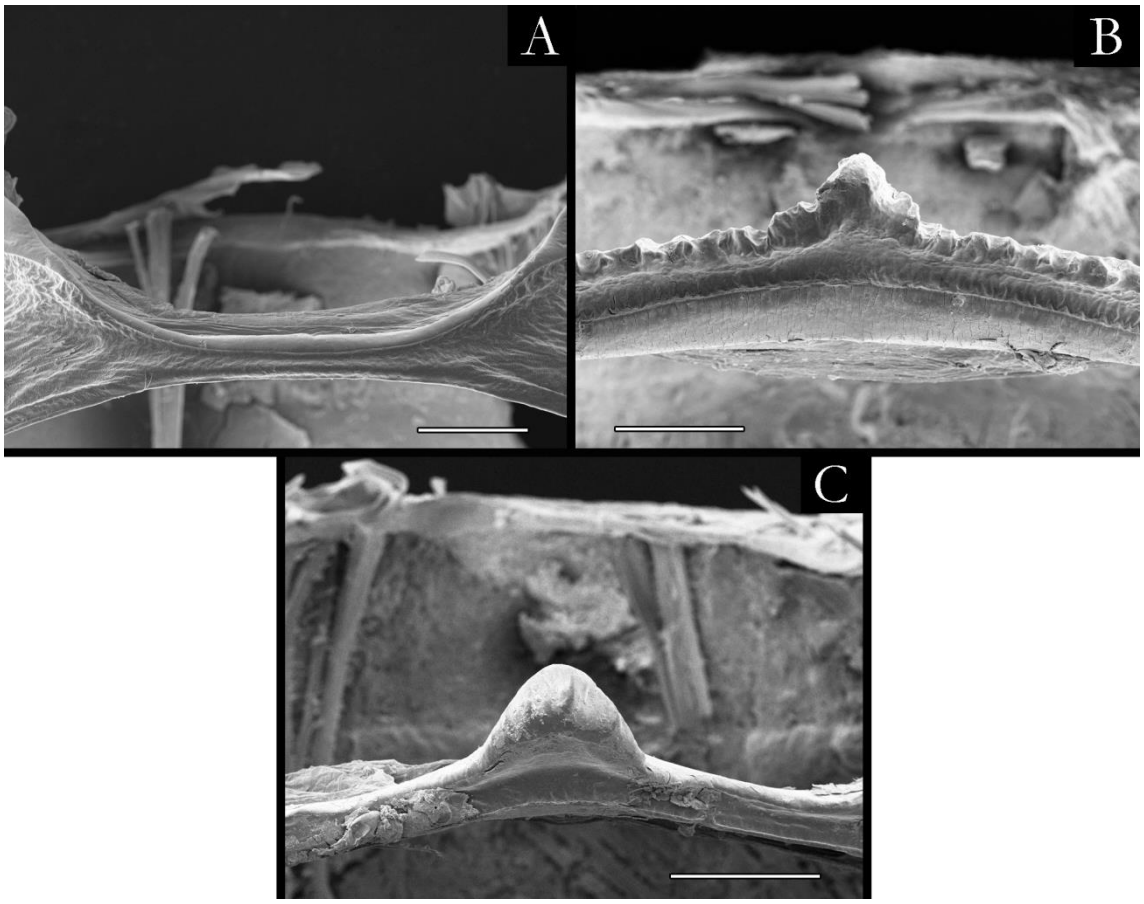


FIGURE 22. Posterior margin of the vulvae opening. A) *Brasilodesmus paulistus paulistus*; B) *Gangugia tapirapensis*; C) *Abiliodesmus planaltensis* comb. nov.. Scale bars: 0,5 mm

Table II. Morphological matrix for the cladistics analysis. Symbols used: unseen (?); inapplicable (–)

Terminals	**Characters**																			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Igaraparana batesi	1	1	0	0	0	-	0	0	-	0	-	1	1	1	0	1	1	2	0	0
Brasilodesmus p. paulistus	0	-	0	0	1	0	1	0	-	0	-	0	1	0	0	1	1	0	0	0
***Chondrodesmus* sp.**	0	-	0	0	1	0	0	0	-	0	-	0	1	1	0	1	1	0	0	0
Macrocoxodesmus marcusi	0	-	0	0	1	1	1	1	0	1	0	0	0	-	1	1	1	2	0	1
Eucampesmella l. lartiguei	1	0	1	0	1	0	1	1	0	0	-	0	1	1	1	0	0	0	0	1
Vanzolegulus limbatus	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1
Dioplosternus salvatrix	1	0	1	0	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1
Arthrosolaenomeris chapadensis	1	1	1	0	1	1	1	1	1	1	0	0	1	2	0	1	1	1	1	1
Arthrosolaenomeris pantanalensis	1	1	1	0	1	1	1	1	1	1	0	1	1	2	0	1	1	1	1	1
Arthrosolaenomeris saci	1	1	1	0	1	1	1	1	1	1	0	1	1	2	0	1	1	1	1	1
Arthrosolaenomeris curupira	1	1	0	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1
Arthrosolaenomeris caipora	1	1	0	0	0	-	1	1	1	1	0	1	1	1	0	1	1	0	0	1
Arthrosolaenomeris iara	1	1	1	0	1	1	1	1	1	1	0	1	1	2	0	1	1	1	1	1
Gangugia tapirapensis	1	1	0	0	1	1	1	1	1	1	0	0	1	0	0	1	1	1	0	1
Gangugia simplex	1	1	0	0	1	1	1	1	1	1	0	0	1	0	0	1	1	1	0	1
Gangugia boitata	1	1	0	0	0	-	1	1	1	1	0	0	1	1	0	1	1	1	0	1
Gangugia cuca	1	1	0	0	1	2	1	1	1	1	0	0	1	1	0	1	1	1	0	1
Gangugia boto	1	1	?	?	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0	1
Gangugia mula	1	1	?	?	1	0	1	1	1	1	0	0	1	0	1	1	1	0	0	1
Angelodesmus costalimai	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	1	0	0	1
Abiliodesmus planaltensis	1	1	0	0	1	-	1	1	1	0	-	1	1	1	0	1	1	1	0	1
Abiliodesmus cataractae	1	1	0	0	1	1	1	1	0	0	-	0	0	-	0	1	1	0	0	1
Abiliodesmus defensor	1	1	0	0	1	1	1	1	1	0	-	1	1	1	0	1	1	0	0	1
Abiliodesmus mapinguari	1	1	0	0	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	1
Folcloredesmus thomasi	1	1	1	0	1	0	1	1	1	1	0	1	1	0	0	1	1	0	0	1

MATRIX (cont.)

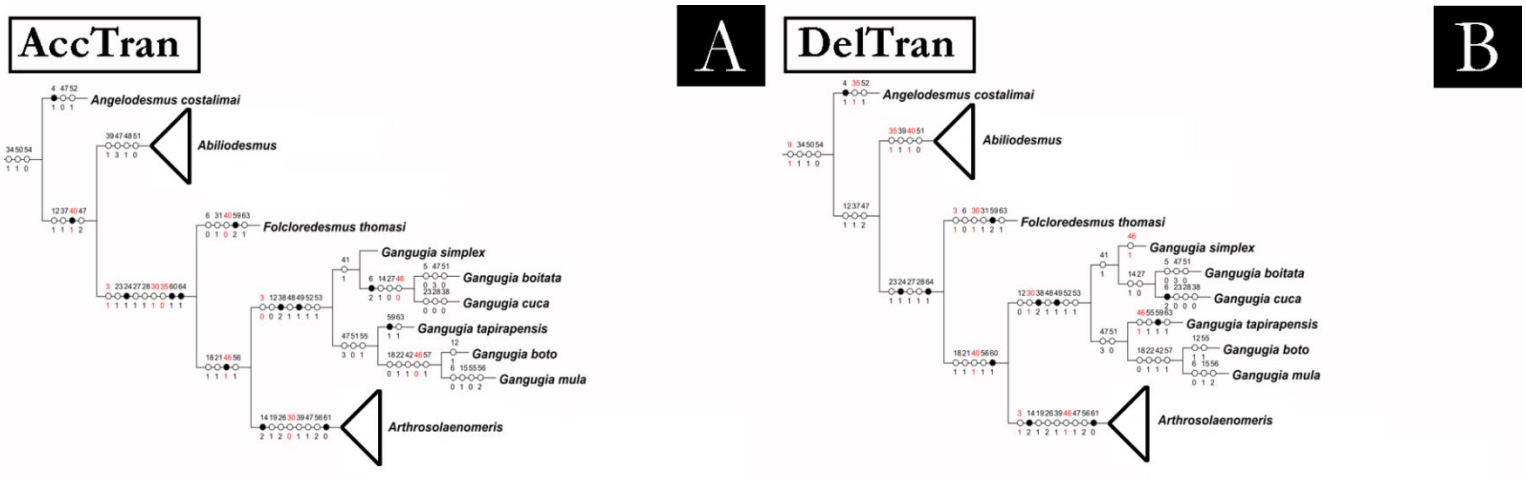
Terminals	Characters																			
	21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Igaraparana batesi	-	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	-	0	0
Brasilodesmus p. paulistus	-	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	-	0	0
***Chondrodesmus* sp.**	-	0	0	0	0	0	0	0	0	0	1	0	1	0	-	0	0	-	0	0
Macrocoxodesmus marcusi	0	0	1	0	1	1	1	1	0	1	0	0	1	0	-	0	0	-	0	0
Eucampesmella l. lartiguei	1	0	0	0	1	1	1	2	1	0	0	0	1	0	-	1	0	-	0	0
Vanzolegulus limbatus	1	0	0	0	1	1	1	1	1	1	0	0	1	0	-	1	1	1	0	0
Dioplosternus salvatrix	1	0	0	0	1	1	1	2	1	1	0	0	1	0	-	1	1	1	0	0
Arthrosolaenomeris chapadensis	1	0	1	1	1	2	1	1	0	0	0	1	1	1	0	0	1	1	1	1
Arthrosolaenomeris pantanalensis	1	0	1	1	1	2	1	1	0	0	0	1	1	1	1	0	1	1	1	1
Arthrosolaenomeris saci	1	0	1	1	1	2	1	1	0	0	0	1	1	1	1	0	1	1	1	1
Arthrosolaenomeris curupira	1	0	0	1	1	2	1	1	0	0	0	1	1	1	0	0	1	1	1	1
Arthrosolaenomeris caipora	1	0	0	1	1	2	1	1	0	0	0	1	1	1	1	0	1	1	1	1
Arthrosolaenomeris iara	1	0	1	1	1	2	1	1	0	0	0	0	1	1	0	0	1	0	1	1
Gangugia tapirapensis	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	0	1	2	0	1
Gangugia simplex	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	0	1	2	0	1
Gangugia boitata	1	0	1	1	1	0	0	1	0	1	0	0	1	1	0	0	1	2	0	1
Gangugia cuca	1	0	0	1	1	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1
Gangugia boto	1	1	1	1	1	0	1	1	0	1	0	0	1	1	0	0	1	2	0	1
Gangugia mula	1	1	1	1	1	0	1	1	0	1	0	0	1	1	0	0	1	2	0	1
Angelodesmus costalimai	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	-	0	0
Abiliodesmus planaltensis	0	0	0	0	1	2	0	0	0	0	0	0	1	1	1	0	1	1	1	1
Abiliodesmus cataractae	0	0	0	0	1	2	0	0	0	0	0	0	1	1	1	0	1	1	1	1
Abiliodesmus defensor	0	0	0	0	1	2	0	1	0	0	0	0	1	1	1	0	1	1	1	1
Abiliodesmus mapinguari	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	1	1
Folcloredesmus thomasi	0	0	1	1	1	0	1	1	0	1	1	0	1	1	0	0	1	1	0	0

MATRIX (cont.)

Terminals	Characters																								
	41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**
Igaraparana batesi	-	0	0	-	0	0	0	2	0	0	-	-	-	1	0	0	0	?	?	?	?	?	?	?
Brasilodesmus p. paulistus	-	0	0	-	1	0	0	2	0	0	-	-	-	1	0	0	0	0	0	0	1	0	-	0
***Chondrodesmus* sp.**	-	0	0	-	1	0	1	1	0	1	2	0	2	0	0	0	0	?	?	?	?	?	?	?
Macrocoxodesmus marcusi	-	0	0	-	0	0	1	0	0	0	-	-	-	1	0	0	0	2	0	0	1	1	2	0
Eucampesmella l. lartiguei	-	0	1	1	0	0	0	0	0	0	-	-	-	1	0	0	0	2	0	0	1	1	0	0
Vanzolegulus limbatus	-	1	0	-	0	0	1	0	0	0	-	-	-	0	0	0	0	?	?	?	?	?	?	?
Dioplosternus salvatrix	-	1	0	-	0	0	1	0	0	0	-	-	-	0	0	0	0	?	?	?	?	?	?	?
Arthrosolaenomeris chapadensis	0	0	1	1	0	1	1	0	0	1	2	0	0	0	0	2	0	1	0	1	0	1	0	1
Arthrosolaenomeris pantanalensis	0	0	1	1	0	0	1	0	0	1	2	0	0	0	0	2	0	1	0	1	0	1	1	1
Arthrosolaenomeris saci	0	0	1	1	0	1	1	0	0	1	2	0	0	0	0	2	0	1	0	1	0	1	1	0
Arthrosolaenomeris curupira	0	0	1	0	0	0	1	0	0	1	2	0	0	0	0	2	0	?	?	?	?	?	?	?
Arthrosolaenomeris caipora	0	0	1	0	0	0	2	0	0	1	1	0	1	0	0	2	0	?	?	?	?	?	?	?
Arthrosolaenomeris iara	0	0	0	-	0	1	1	0	0	1	1	0	0	0	0	2	0	1	0	1	0	1	0	1
Gangugia tapirapensis	0	0	0	-	0	1	3	1	1	1	0	1	1	0	1	1	0	1	1	-	1	1	1	1
Gangugia simplex	1	0	0	-	0	1	2	1	1	1	1	1	1	0	0	1	0	?	?	?	?	?	?	?
Gangugia boitata	1	0	0	-	0	0	3	1	1	1	0	1	?	0	0	1	0	?	?	?	?	?	?	?
Gangugia cuca	1	0	0	-	0	0	2	1	1	1	1	1	1	0	0	1	0	?	?	?	?	?	?	?
Gangugia boto	0	1	0	-	0	0	3	1	1	1	0	1	?	0	1	1	1	?	?	?	?	?	?	?
Gangugia mula	0	1	0	-	0	0	3	1	1	1	0	1	?	0	0	2	1	1	0	1	1	1	0	1
Angelodesmus costalimai	-	0	0	-	0	0	0	0	0	1	1	1	0	0	0	0	0	?	?	?	?	?	?	?
Abiliodesmus planaltensis	0	0	0	-	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0
Abiliodesmus cataractae	1	0	0	-	0	0	1	?	0	1	0	0	?	0	0	0	1	1	0	0	1	1	0	0
Abiliodesmus defensor	0	0	0	-	0	0	3	1	0	1	0	0	0	0	0	0	1	?	?	?	?	?	?	?
Abiliodesmus mapinguari	0	0	0	-	1	0	3	1	0	1	0	1	?	0	1	1	0	1	0	0	1	1	0	0
Folcloredesmus thomasi	-	0	0	-	0	0	2	0	0	1	1	0	0	0	0	0	0	1	2	-	1	1	1	1

Table III. Summary statistics from the implied weighting analysis. K: concavity constant; N: number of most parsimonious trees; CI: ensemble consistency index; RI: ensemble retention index; RC: ensemble rescaled consistency index L: tree length; F: total fit.

K	N	CI	RI	RC	L	F
1	1	0.4463	0.6711	0.2995	177	32.89
2	1	0.4489	0.6745	0.3028	176	39.93
3	1	0.4489	0.6745	0.3028	176	43.99
4	1	0.4489	0.6745	0.3028	176	46.69
5	1	0.4489	0.6745	0.3028	176	48.61
6	1	0.4489	0.6745	0.3028	176	50.07
7	1	0.4489	0.6745	0.3028	176	51.21
8	1	0.4489	0.6745	0.3028	176	52.13
9	1	0.4489	0.6745	0.3028	176	52.89
10	1	0.4489	0.6745	0.3028	176	53.53
15	1	0.4489	0.6745	0.3028	176	55.63
20	1	0.4514	0.6779	0.3060	175	56.81
25	1	0.4514	0.6779	0.3060	175	57.56
30	1	0.4514	0.6779	0.3060	175	58.09



Appendix 1. The most parsimonious tree obtained in the cladistic analysis under implied weighting (k = 7). Detail of the characters #3, #9, #30, #35, #40 and #46 (in red). A, under AccTran opmization; B, under DelTran opmization. Black circles correspond to unique transformations, and white circles correspond to homoplastic transformations.

CHAPTER 2

A review of the millipede tribe Arthrosolaenomeridini Hoffman, 1976 (Polydesmida: Chelodesmidae)

Abstract. The Brazilian chelodesmid tribe Arthrosolaenomeridini Hoffman, 1976 is revised. Currently the tribe contains three genera: *Arthrosolaenomeris* Schubart, 1943, *Gangugia* Schubart, 1947, *Angelodesmus* Schubart, 1962. We provided in this study detailed redescriptions, drawings and distribution maps for all species and genera, as well for the two new genera and the ten new species. In addition, we include an identification key to all the genera and species of Arthrosolaenomeridini.

Key words. Brazil, Neotropical, Diplopoda, Chelodesminae

INTRODUCTION

In the class Diplopoda, Chelodesmidae Cook, 1895 is the second largest family, with almost 800 described species and belonging to the easily recognized order Polydesmida Leach, 1814 (Brewer *et al.,* 2012; Hoffman, 1980; Shear, 2011; Pena-Barbosa *et al.,* 2013). Members of the family has a wide range of colors, paranota with a variety of shapes, and males with numerous and differentiable processes on the gonopods (Hoffman, 1976; Pena-Barbosa *et al.,* 2013; Bouzan *et al.,* 2017).

Hoffman (1980) proposed the division of Chelodesmidae into two subfamilies, Chelodesminae Cook, 1895 for the Neotropical species, and Prepodesminae Cook, 1896 for the members from some regions of Africa. During his lifetime, Hoffman proposed 19 tribes for Chelodesminae and only one for Prepodesminae. Among the 800 species, only 345 species are assigned into the tribal classification for the family, while of those remaining there are still require taxonomic studies and without any criterion regarding the tribal position (Bouzan *et al.,* 2017).

In the Chelodesminae, the tribe Arthrosolaenomeridini Hoffman, 1976 contains species widely distributed in the Brazilian Cerrado (Hoffman, 1976). Members of the tribe are conspicuous and colorful (Fig. 1). Arthrosolaenomeridini is currently characterized by the absence of coxal apophysis in the gonopod; a laminated telopodite with a cingulum on the lateral margin; a long prefemoral process with a dorso-basal lobe and anterior sternites with four conical lobes (Hoffman, 1976). However, according to the recent analysis of Pena-Barbosa (2015) such putative synapomorphies also occur in other tribes within the subfamily, unrelated to Arthrosolaenomeridini.

FIGURE 1. (A-B) Live male specimen of *Folcloredesmus thomasi* **sp. nov.**, from Fazenda São Nicolau, Cotriguaçu, Mato Grosso, Brazil. Photo by: Domingos de Jesus Rodrigues.

The current casting of Arthrosolaenomeridini consists of the genera *Arthrosolaenomeris* Schubart, 1943 (2 spp.), *Angelodesmus* Schubart, 1962 (4 spp.) and *Gangugia* Schubart, 1947 (2 spp.). However, several systematic problems are related to these taxa, for example, lack of more complete descriptions, deficient diagnosis for the species and absence of hypotheses about their internal relationships.

In view of the above, the aim of this study is to revise the poorly known Brazilian tribe Arthrosolaenomeridini. This includes detailed redescriptions, drawings and distribution maps for all species and genera, as well for the two new genera and the ten new species. In addition, we include an identification key to all the genera and species of Arthrosolaenomeridini. The results of this chapter are based on the phylogenetic results described in chapter 1.

MATERIAL AND METHODS

The material examined is deposited in the following Institutions (curators in parentheses): **IBSP**, Instituto Butantan, São Paulo, Brazil (A. D. Brescovit); **MNRJ**, Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil (A. B. Kury); **MZSP**, Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (R. Pinto da Rocha); **CZUFMT MYR**, Universidade Federal do Mato Grosso, Mato Grosso, Brazil (A. Chagas-Jr); **VMNH**, Virginia Museum of Natural History, Vírginia, USA (K. Ivanov)

Morphological drawings were performed using a Leica MZ12 stereoscope, with a *camera lucida*. Photographs were taken with a Leica DFC 500 digital camera mounted on a Leica MZ16A stereomicroscope. Extended focal range images were composed with Leica Application Suite version 2.5.0. Images of SEM were taken using a FEI Quanta 250 SEM with attached SLR digital camera at Instituto Butantan. All measurements are in millimeters. To terminology we follow Pena-Barbosa *et al.*, (2013) for gonopods; Koch (2015) for vulvae (= cyphopods) and, Attems (1898) and Brölemann (1900) for other somatic characters.

Geographical coordinates of collection localities were obtained from the labels or georeferenced approximately using Google Earth (and are given in square brackets).

Taxonomy

Arthrosolaenomeridini Hoffman, 1976

Arthrosolaenomeridini Hoffman, 1976: 171 – 183; Hoffman, 1980: 151.

Diagnosis. Arthrosolaenomeridini males differ from others Chelodesminae males by the combination of the following characteristics: presence of a row of setae 2 + 2 at the apex of the head (Fig. 2A); presence of two pairs of ventral projections in the fifth sternite (Fig. 3B); presence of lateral macrosetae, in mesal aspect, in gonocoxae (Fig. 8D); and laminated telopodite with a cingulum on the lateral margin (Figs 5A-B); prefemoral process of the gonopod long and thin (Figs 5A-B).

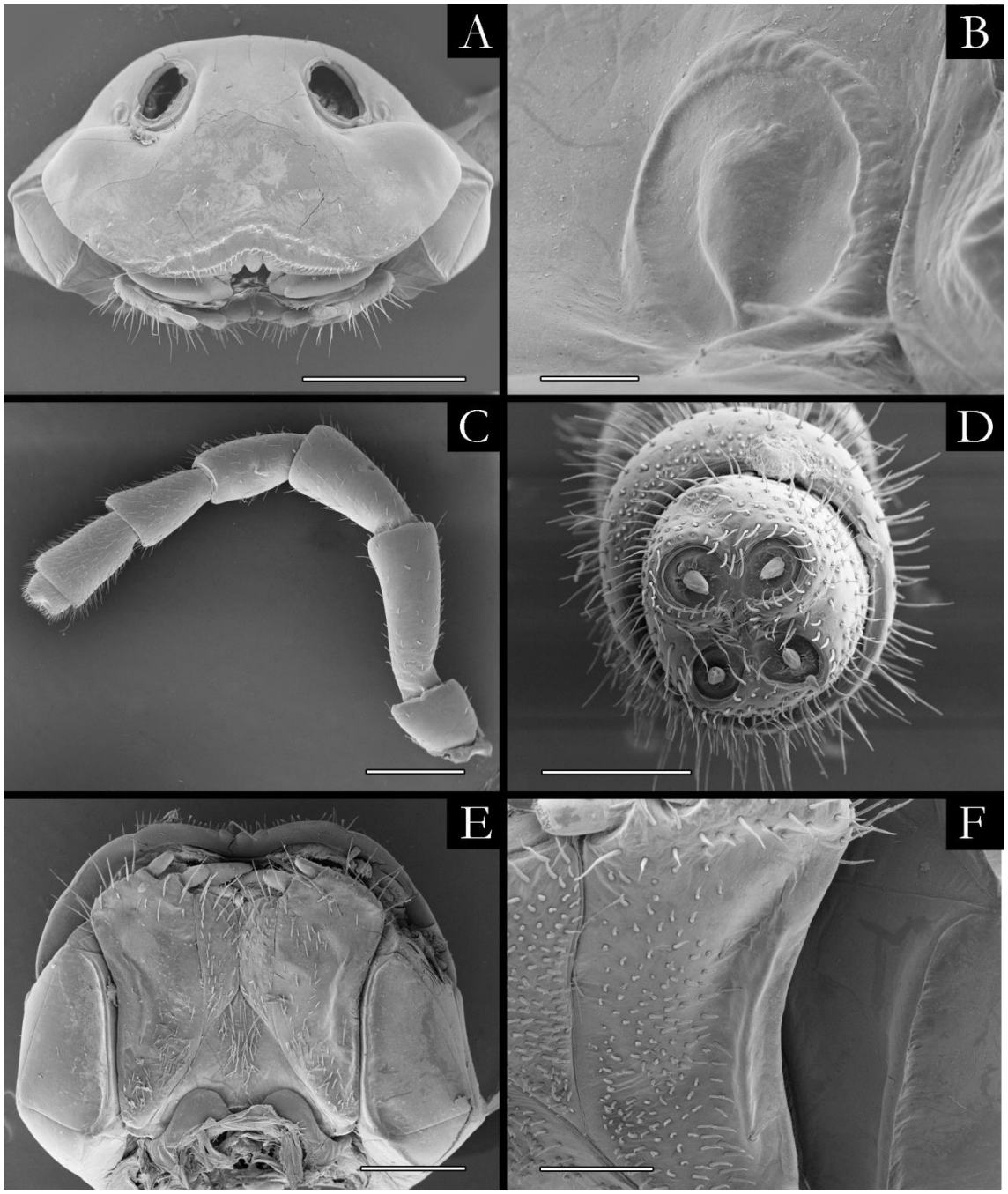


FIGURE 2. (A-B, F) Structures of *Arthrosolaenomeris pantanalensis* (IBSP 530). (C-E) Structures of *Abiliodesmus planaltensis* **comb. nov.** (IBSP 3570). A, dorsal surface of the head; B, detail of incisura lateralis; C, antennae in lateral view; D, detail of the last antennomeres; E, detail of gnathochilarium; F, detail of the stipes of the gnathochilarium. Scale bars: A) 2 mm.; B) 100 µm.; C) 1 mm; D) 300 µm.; E) 1 mm; F) 500 µm.

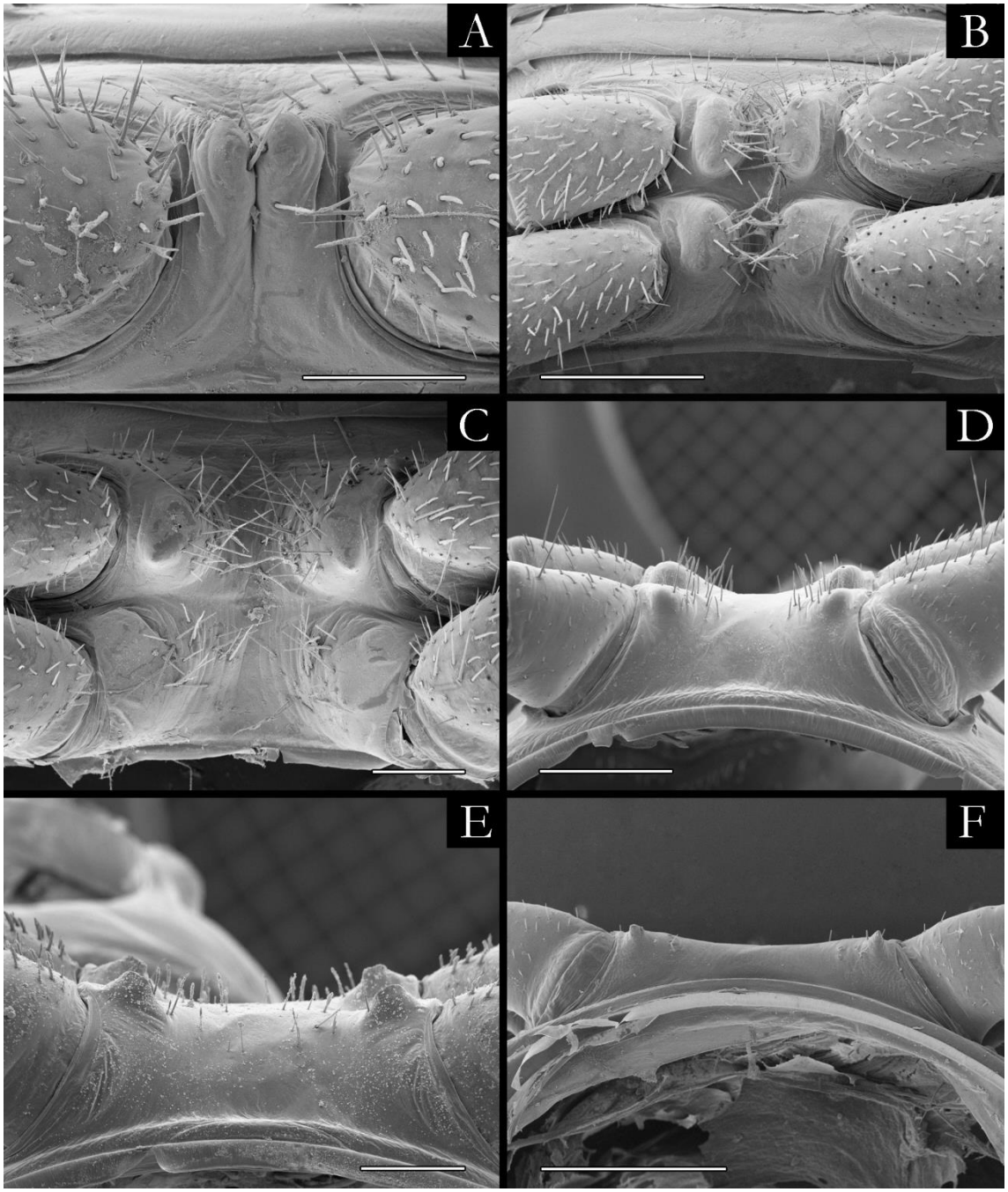


FIGURE 3. (A-C) *Arthrosolaenomeris pantanalensis* (IBSP 530). (D) *Folcloredesmus thomasi* **sp. nov.** (CZUFMT MYR 833). (E) *Arthrosolaenomeris saci* **sp. nov.** (IBSP 1148). (F) *Abiliodesmus planaltensis* **comb. nov.** (IBSP 3570). A, sternite of body ring 4 in dorsal view; B, sternite of body ring 5 in dorsal view; C, sternite of body ring 6 in dorsal view; D-F, sternite of body ring 9 in dorsal view. Scale bars: A) 500 µm.; B) 1 mm; C) 1 mm; D) 1 mm; E) 500 µm.; F) 1 mm.

Description notes. Body length between 39.07 mm (*Abiliodesmus defensor* **comb. nov.**) and 75.74 mm (*Gangugia mula* **sp. nov.**). Gonopod: composed of an basal portion (gonocoxae), containing lateral macrosetae; and a distal portion (telopod) divided into two well-developed, narrow branches: the external branch (solenomere) presenting as a single branch containing a variable-position cingulum and an evident spermatic groove, and the internal branch (prefemoral process) varying in size and format according to genera (Figs 8D, 24D, 39D, 41D, 52D).

Distribution. The tribe is distributed in the northern region (Pará and Tocantins), central-west region (states of Goiás, Mato Grosso and Mato Grosso do Sul) and southeast (São Paulo) of Brazil (Fig. 7).

Composition. *Arthrosolaenomeris* Schubart, 1943; *Gangugia* Schubart, 1947; *Angelodesmus* Schubart, 1962; *Abiliodesmus* **gen. nov.**; *Folcloredesmus* **gen. nov.**

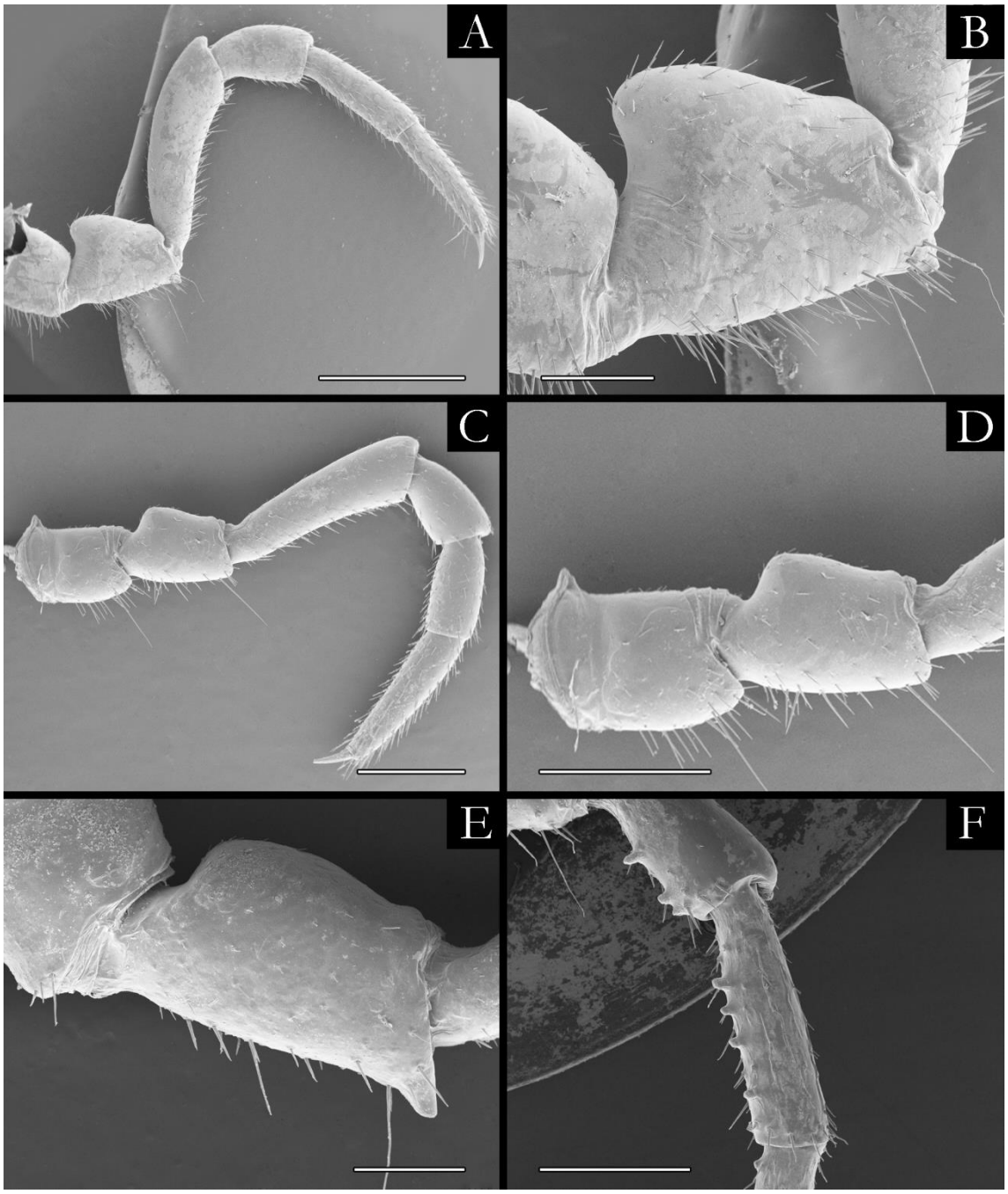


FIGURE 4. (A-B) *Arthrosolaenomeris pantanalensis* (IBSP 530). (C-D) *Abiliodesmus planaltensis* **comb. nov.** (IBSP 3570). (E-F) *Gangugia tapirapensis* (MNRJ 12008). A, leg (5th leg pair) in lateral view; B, detail of the dorsal lobe on prefemur; C, leg (5th leg pair) in lateral view; D, detail of the dorsal lobe on prefemur; E, detail of the ventral projection on the coxae; F, detail of the granules on the tibia. Scale bars: A) 2 mm.; B) 500 µm.; C) 1 mm; D) 1 mm; E) 500 µm.; F)1 mm.

Key to males

1 Without angulation in the basal portion in the prefemoral process (Figs 39D-F).....*Angelodesmus*
Some degree of angulation in the basal portion in the prefemoral process (Fig. 32D)……...2

2 Presence of a coxal apophysis in the gonocoxae (Fig. 54E).....
.....*Folcloredesmus* **gen. nov.**
Absence of coxal apophysis in the gonocoxae.....3

3 Gonocoxae globose (Fig. 26B).....*Gangugia*
Gonocoxae cylindrical (Fig. 15B).....4

4 Cingulum with medial or apical position (Fig. 22B).....*Arthrosolaenomeris*
Cingulum with basal position (Fig. 50B).....*Abiliodesmus* **gen. nov.**

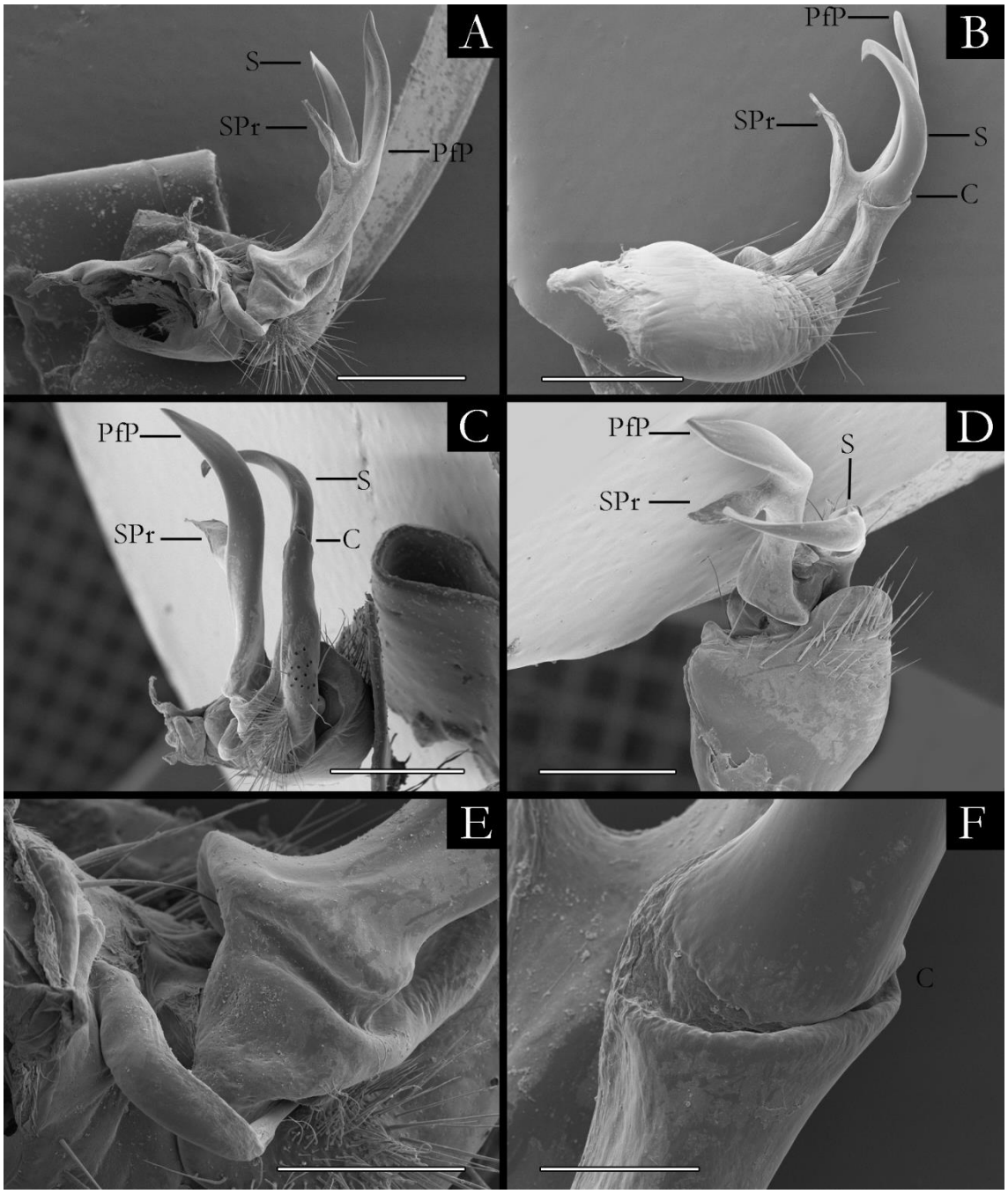


FIGURE 5. *Arthrosolaenomeris pantanalensis* (IBSP 530). A, left gonopod in mesal view; B, right gonopod in ectal view; C, left gonopod in ventral view; D, right gonopod in oral view; E, detail of dorso-basal lobe of the prefemoral process; F, detail of cingulum. Scale bars: A) 1 mm.; B) 1 mm; C) 1 mm; D) 1 mm; E) 400 µm.; F) 200 µm. Abbreviations: C, cingulum; PfP, prefemoral process; SPr, secondary process of the prefemoral process; S, solenomere.

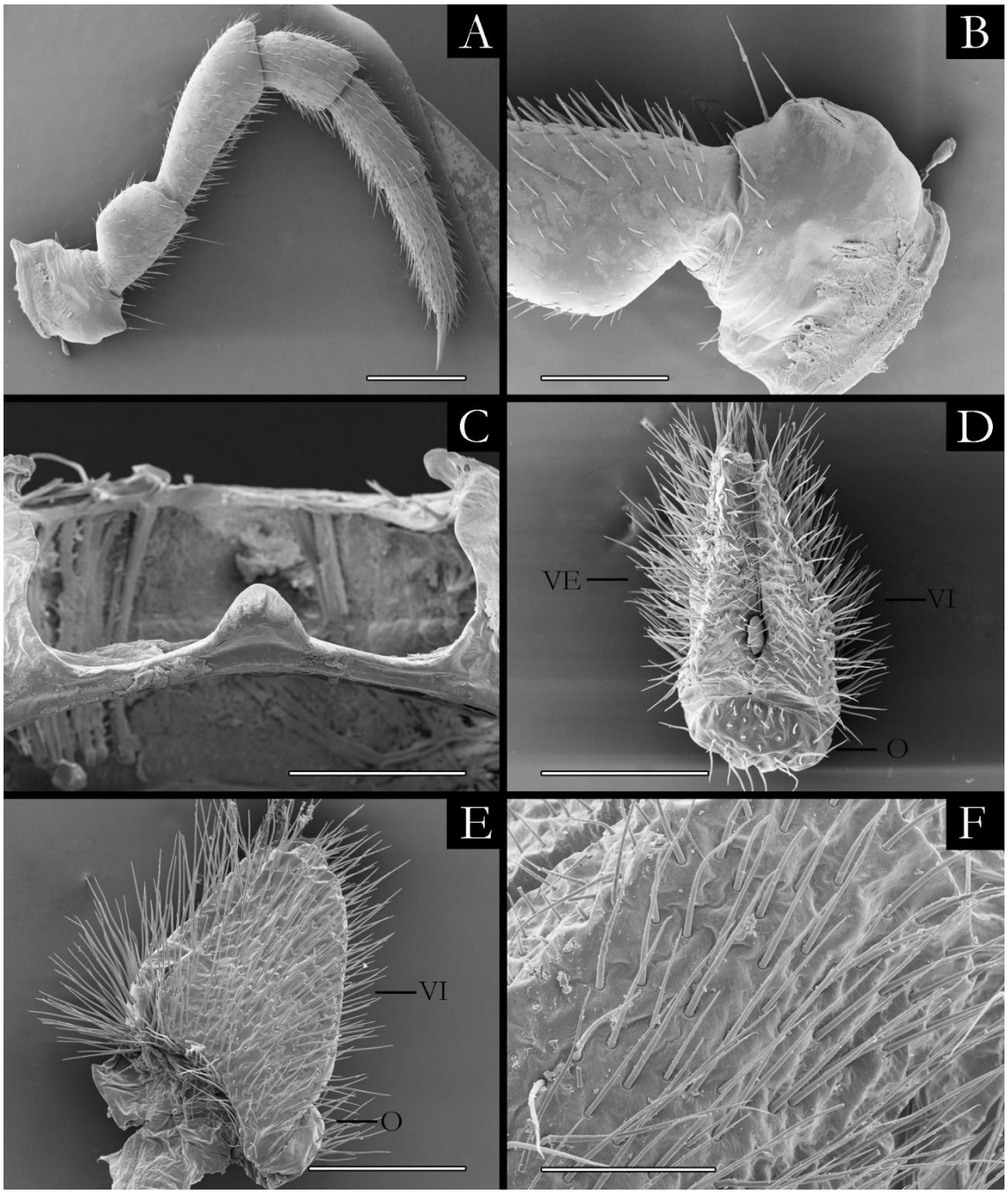


FIGURE 6. (A-B) *Arthrosolaenomeris pantanalensis* (IBSP 530). (C-F) *Abiliodesmus planaltensis* **comb. nov.** (IBSP 3570). A, leg of the third body ring; B, detail of the genital papilla; C, vulvae sternite; D, left vulva in ventral view; E, right vulva in lateral view ; F, detail of the internal valve. Scale bars: A) 1 mm.; B) 500 µm.; C) 1 mm.; D) 500 µm.; E) 500 µm.; F) 200 µm. Abbreviations: EV, external valve; Op, operculum; IV, internal valve.

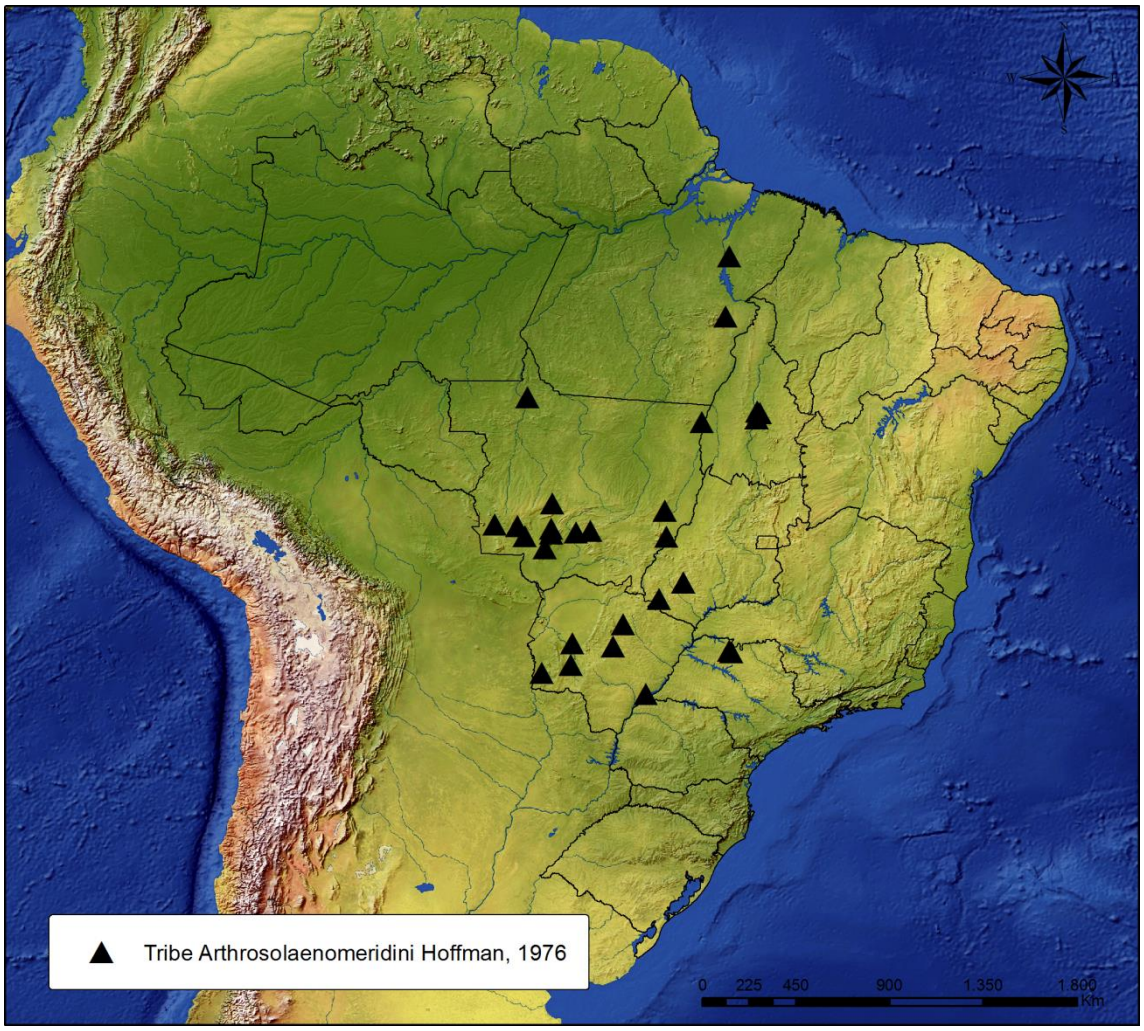


FIGURE 7. Distribution map of Arthrosolaenomeridini species.

Arthrosolaenomeris Schubart, 1943

Arthrosolaenomeris Schubart, 1943: 143. Type species: *A. chapadensis* Schubart, 1943, by original designation; Schubart, 1958: 205; Schubart, 1960: 453; Jeekel, 1971: 249; Hoffman, 1976: 177; Hoffman, 1980: 151.

Diagnosis. Males of *Arthrosolaenomeris* differ from those of other Arthrosolaenomeridini genera by the combination of the following characters: rectangular ventral projections in the sternites after the gonopods (Fig. 3E) (acuminated in *A. curupira* **sp. nov.** and *A. caipora* **sp. nov.**); posterior edge of the gonopod aperture with a small dentiform process; presence of a secondary process in medial portion in the prefemoral process of the gonopod (Fig. 8D) (absent in *A. iara* **sp. nov.**)**;** presence of a

rounded extension in the gonocoxae, in oral view (Fig. 5D); and apex of the solenomere abruptly descending (Figs 8D-F).

Redescription. *General characters:* Body length between 47.78 mm (*A. caipora* **sp. nov.**) and 69.42 mm (*A. iara* **sp. nov.**). Coloration (specimens long preserved in 70% ethanol) variable between species, ranging from ocher to reddish brown, paranota tip and posterior border of the metaterga slightly whitish (some specimens of *A. pantanalensis* show a purple coloration for the whole body). Sternite of sixth body ring with two pairs of ventral projections; seventh with a pair (absent in *A. chapadensis*) and sternites after the gonopod with two pairs of rectangular ventral projections (Fig. 3E) (acuminate in *A. curupira* **sp. nov.** and *A. caipora* **sp. nov.)**. Paranota form: round to slightly rectangular (Figs 10B, 18B). Legs: podomeres with several thick ventral setae (Fig. 4A) and granules in the tibia (Fig. 4F) (except in *A. curupira* **sp. nov.** and *A. caipora* **sp. nov.**), dorsal lobe of prefemur conspicuous (Fig. 4B) and a ventro-apical projection in the prefemur (Fig. 4E).
Male characters: posterior edge of the gonopod aperture with a small projection. Gonopods: gonopod coxae equivalent to about half the length of the telopodite, cylindrical, without a spiniform process. Prefemoral process (Figs 5A-B): elongate with a dorso-basal process and a secondary process in its medial portion (long in *A. chapadensis*, *A. pantanalensis*, *A. saci* **sp. nov.**, *A. iara* **sp. nov.** and short in *A. curupira* **sp. nov.**, *A. caipora* **sp. nov.**). Cingulum in a apical position (Fig. 10F) (middle position in *A. caipora* **sp. nov.**). Solenomere long and thin with your apex abruptly descending (Fig. 8D).

Female characters: Vulvae: oval-shaped, having equal proportions in lateral view, with an operculum advanced (Figs 9C-D).

Distribution. States of Mato Grosso, Mato Grosso do Sul and São Paulo (Fig. 23).

Composition. Two species described: *Arthrosolaenomeris chapadensis* Schubart, 1943; *A. pantanalensis* Schubart, 1943. Four new species: *A. saci* **sp. nov.;** *A. curupira* **sp. nov.;** *A. caipora* **sp. nov.;** *A. iara* **sp. nov.**

Key to males

1 Absence of secondary process in the prefemoral process (Fig. 20D).....

.....*A. iara* **sp. nov.**
Presence of secondary process in the prefemoral process.....2

2 Secondary process short (Fig. 16D).....3
Secondary process long (Fig. 13D).....4

3 Presence of a lateral row of macrosetae in the gonocoxae, in mesal view (Fig. 16D).....*A. curupira* **sp. nov.**
Absence of a lateral row of macrosetae in the gonocoxae, in mesal view (Fig. 18D).....*A. caipora* **sp. nov**

4 Prefemoral process without indentation.....*A. pantanalensis*
Prefemoral process with indentation (Fig. 13D).....5

5 Presence of a conspicuous groove in the apex of the prefemoral process (Fig. 15C).....*A. saci* **sp. nov.**
Absence of a conspicuous groove in the apex of the prefemoral process.....*A. chapadensis*

Arthrosolaenomeris chapadensis Schubart, 1943

Figures 8-9, 23

Arthrosolaenomeris chapadensis Schubart, 1943: 144, 160, 161, figs 28−38. Male holotype from Indubrasil, Campo Grande (20°26'34"S, 54°38'47"W), Mato Grosso do Sul, Brazil, 17.X.1938, Instituto Osvaldo Cruz coll., deposited in MZSP 1092, examined. Paratypes: one male from Camapuã (19°31'54"S, 54°02'37"W), Mato Grosso do Sul, Brazil, X.1938, Camargo coll., deposited in MZSP 1090 and two males from Porto Murtinho (21°41'56"S, 57°52'56"W), Mato Grosso do Sul, Brazil, XII.1929, R. Spitz coll. deposited in MZSP 522 and 536, respectively, examined; Schubart, 1958: 238; Hoffman, 1976; 177; Golovatch, Hoffman, Adis, Marques, Raizer, Silva, Ribeiro, Silva & Pinheiro, 2005: 276.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: presence of indentations in the prefemoral process (Fig. 8D) and absence of a conspicuous groove in the apex of the prefemoral process (Fig. 8D).

Redescription. Male (Holotype, MZSP 1092): Coloration (long-preserved in 70% ethanol): Head and antennae ocher with the seventh antennomere having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body ocher and paranota tip with the same color as the body (Figs 8A-C). Gnathochilarium covered by several setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternites of the fifth and sixth segments with two pairs of intumescences (=process) covered with setae,

seventh sternite without projections and the others post-gonopod sternites presenting pairs of small rectangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher; presence of a pronounced dorsal lobe in the prefemur of the anterior legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the tibia and tarsus; short and thick setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated and with a small process. Telson ocher; triangular hypocroct with two setae. Total length: 65.98. Total width: 10.02. Collum, long 3.10, width 9.33. Antennomere lengths (1>7): 0.71; 1.91; 1.82; 1.62; 1.56; 1.51; 0.39. Podomeres lengths (1>7): 1.03; 1.60; 2.78; 1.52; 1.96; 1.97; 0.68. Gonopod aperture, long 1.98, width 3.35. Telson, long 0.77. Gonopod: long 2.86, width 2.07. Coxae: long 1.11, width 1.02. Telopodite: long 2.77, width 1.00. Prefemoral process long (greater than or equal to the solenomere) and narrow (Fig. 8E). Presence of a large secondary process positioned in its medial portion (Fig. 8D). Posterior portion to the secondary process with several indentations. Solenomere long and narrow (Fig. 8F). Cingulum positioned central-posteriorly (Fig. 9B). Apex of the solenomere abruptly descending (Fig. 8D).

Female (IBSP 1049): Body as in male. Total length: 57.60. Total width: 9.35. Antennomere lengths (1>7): 0.87; 1.72; 1.54; 1.36; 1.37; 1.38; 0.33. Podomeres lengths (1>7): 0.82; 1.26; 2.62; 1.04; 1.12; 1.63; 0.55. Telson, long 1.38. Epigyne rectangular shaped (Fig. 9E). Vulvae (Figs 9C-D): long 1.34, width 0.68. External valve: long 0.98, width 0.34. Internal valve: long 0.94, width 0.28. Operculum: long 0.39, width.0.56.

Distribution. Mato Grosso do Sul and São Paulo, Brazil (Fig. 23).

Additional material. BRAZIL: *São Paulo:* Rosana (22°34'47"S, 53°03'32"W), Usina Hidrelétrica Engenheiro Sérgio Motta (Porto Primavera), one male, one female and one juvenile, 1999-2000, Equipe Butantan coll. (IBSP 1049).

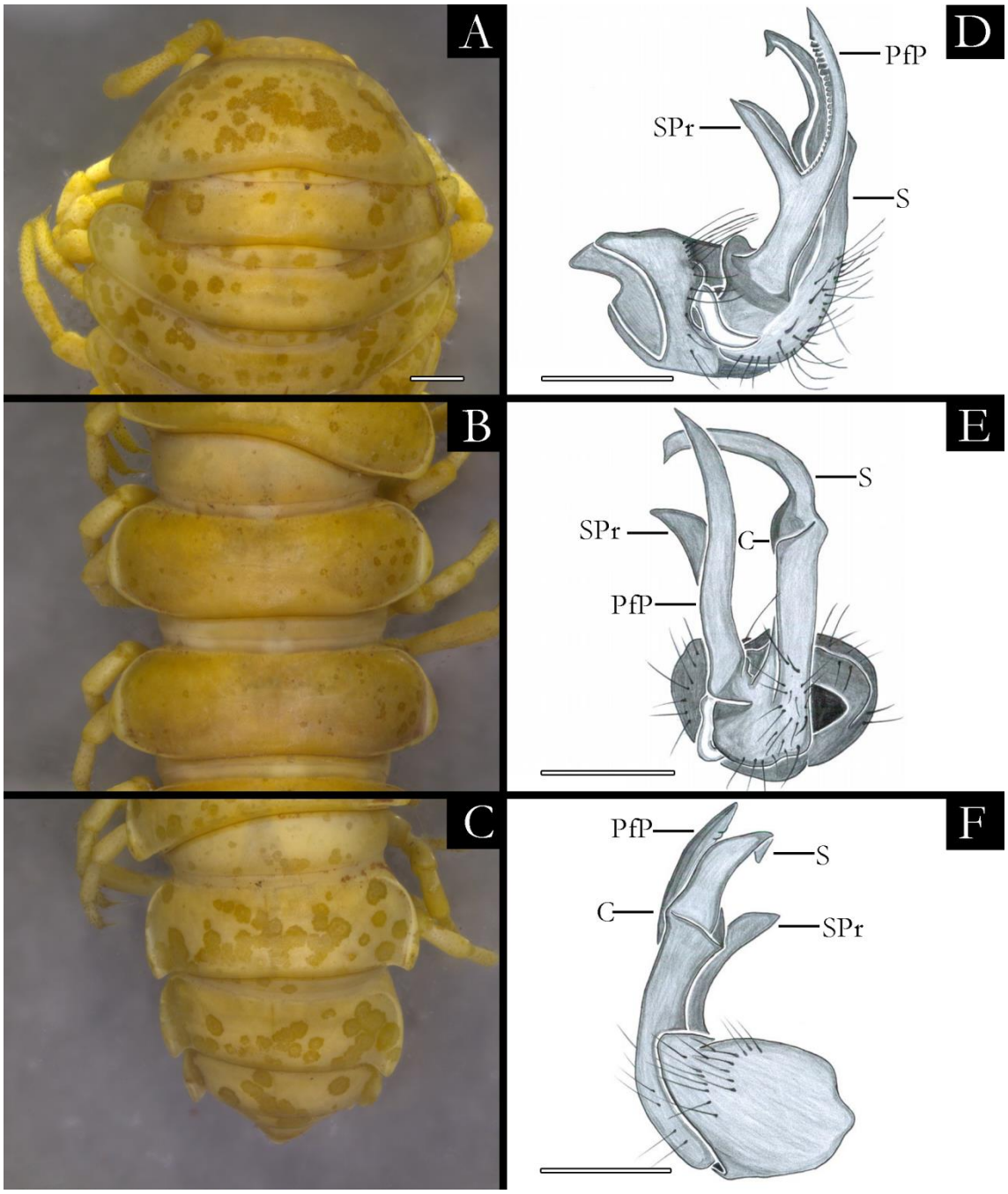


FIGURE 8. *Arthrosolaenomeris chapadensis* (holotype, MZSP 1092), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

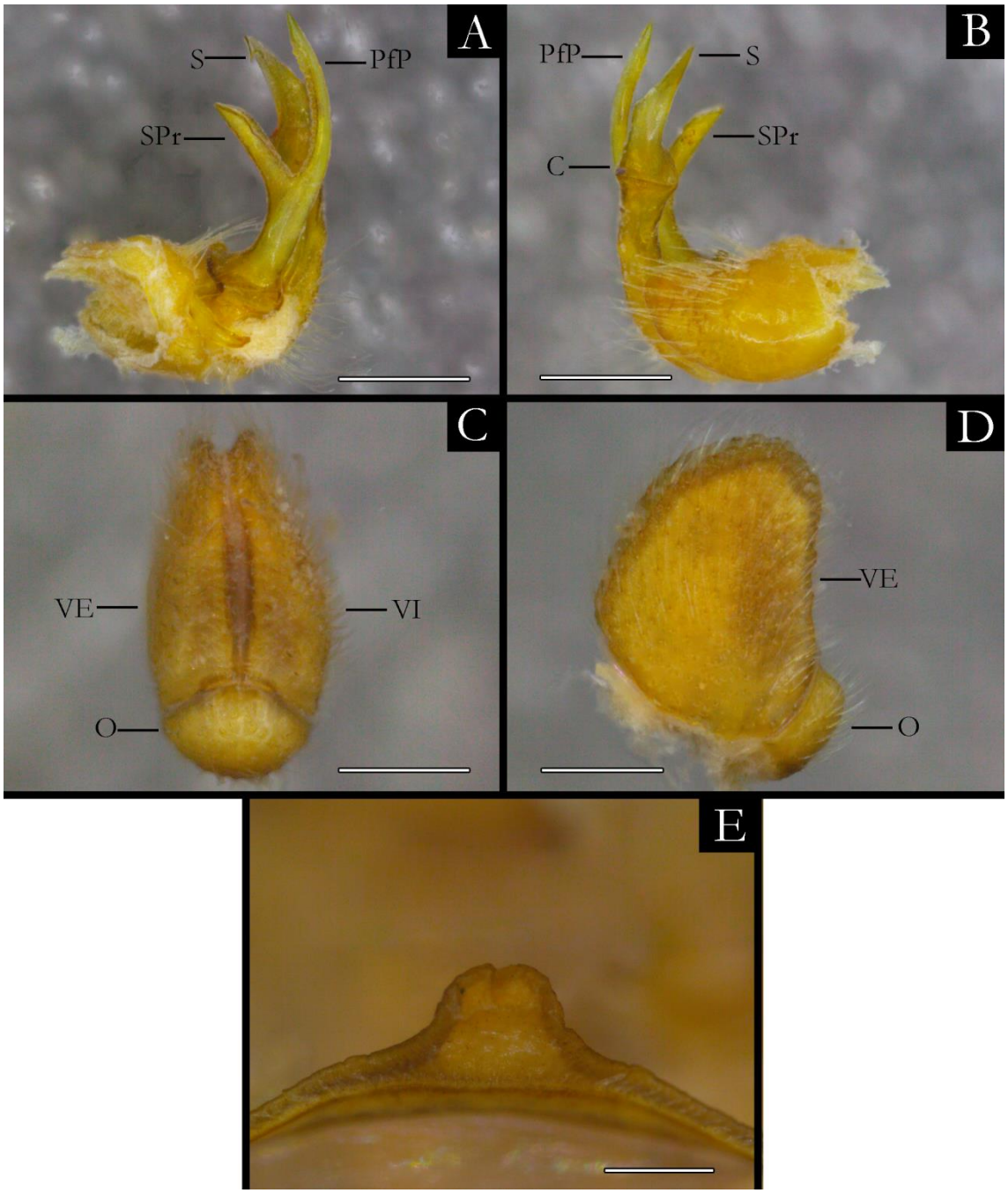


FIGURE 9. *Arthrosolaenomeris chapadensis*. Left gonopod (holotype, MZSP 1092), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (IBSP 1049). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 0,5 mm. Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

Arthrosolaenomeris pantanalensis Schubart, 1943

Figures 10-12, 23

Arthrosolaenomeris pantanalensis Schubart, 1943: 145, 161, 162, figs 39−45. Male holotype from São Luiz de Cáceres (Now Cáceres), (16°04'15"S, 57°40'44"W), Mato Grosso, Brazil, II.1940, Passarelli coll., deposited in MZSP 1085, examined; Schubart, 1958: 238; Hoffman, 1976: 177; Golovatch, Hoffman, Adis, Marques, Raizer, Silva, Ribeiro, Silva & Pinheiro, 2005: 276.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: absence of indentations in the prefemoral process (Fig. 10D) and a long secondary process in the prefemoral process (Fig. 10D).

Redescription. Male (Holotype, MZSP 1085): Coloration (long-preserved in 70% ethanol): Head reddish yellow and antennae ocher with the seventh antennomere having three well-demarcated invaginations and one slight invagination between the sensory cones. Body reddish brown and paranota tip with the same color as the body (Fig. 10A-C). Gnathochilarium covered by several setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternites of the fifth and sixth segments with two pairs of intumescences (=process) covered with setae, seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small rectangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs reddish brown; presence of a pronounced dorsal lobe in the prefemur of the anterior legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated, concave and with a small process. Telson ocher; hypocroct triangular with two setae. Total length: 60.16. Width total: 9.05. Collum, long 2.73, width 8.74. Antennomere lengths (1>7): 0.77; 1.80; 1.82; 1.45; 1.43; 1.40; 0.42. Podomeres lengths (1>7): 1.02; 1.26; 2.25; 1.32; 1.60; 1.57; 0.52. Gonopod aperture, long 1.76, width 2.86. Telson, long 1.12. Gonopod: long 2.90, width 2.17. Coxae: long 1.01, width 1.14. Telopodite: long 2.76, width 1.06. Prefemoral process long (greater than the solenomere) and narrow (Fig. 10E). Presence of a large secondary process positioned in its medial portion (Fig. 10D). Posterior portion to the secondary process without indentations. Solenomere long and narrow (Fig. 10F).

Cingulum positioned central-posteriorly (Fig. 10F). Apex of the solenomere abruptly descending (Fig. 10D).

Female (CZUFMT MYR 847): Body as in male. Total length: 50.48. Width total: 6.92. Antennomere lengths (1>7): 0.54; 1.39; 1.12; 1.06; 1.13; 1.04; 0.25. Podomeres lengths (1>7): 0.62; 0.82; 1.87; 0.71; 0.76; 1.22; 0.39. Telson, long 0.97. Epigyne triangular shaped (Fig. 11E). Vulvae (Fig. 11D-E; 12A-B): long 1.06, width 0.55. External valve: long 0.76, width 0.24. Internal valve: long 0.69, width 0.26. Operculum: long 0.30, width 0.50.

Distribution. Mato Grosso, Brazil (Fig. 23).

Additional material. BRAZIL: *Mato Grosso:* Cáceres (16°04'15"S, 57°40'44"W), eighteen ind., XII.1997, M. Callefo coll. (IBSP 530); seven males, X.1917, E. Garbe coll. (MZSP 410); Porto Estrela (15°19'28"S, 57°13'39"W), Estação Ecológica Serra das Araras, two males and two females, 12.XI.2017, T.F. Conceição coll. (CZUFMT MYR 847); two males, 19.XI.2017, N. Barrozo coll. (UFMT MYR 848); five males, 19.XI.2017, T.F. Conceição coll. (UFMT MYR 842); one male, 16.XI.2015, A. Chagas-Jr & A.B. Kury coll. (CZUFMT MYR 845); Chapada dos Guimarães (15°27'39"S, 55°44'58"W), Chapada Aventura, two males and one female, 07.XI.2015, A. Chagas-Jr *et al.* col. (CZUFMT MYR 840); Fazenda Morro da Lage, one male, 28.X.2017, M. Moreno coll. (CZUFMT MYR 846); Cuiabá (15°35'47"S, 56°05'48"W), Bairro Nova Esperança I, one male, 17.XII.2015, E. Santos coll. (CZUFMT MYR 844); campus UFMT, one male, Marques & Hallis coll. (CZUFMT MYR 832); Sede EESA – Arquidiocesana de Cuiabá, four females, 16.XI.2015 (CZUFMT MYR 843); Nova Xavantina (14°40'24"S, 52°21'11"W), two males and two females, XII.1946, H. Sick coll. (MZSP 1087); one male, XII.1946, H. Sick coll. (MZSP 1088).

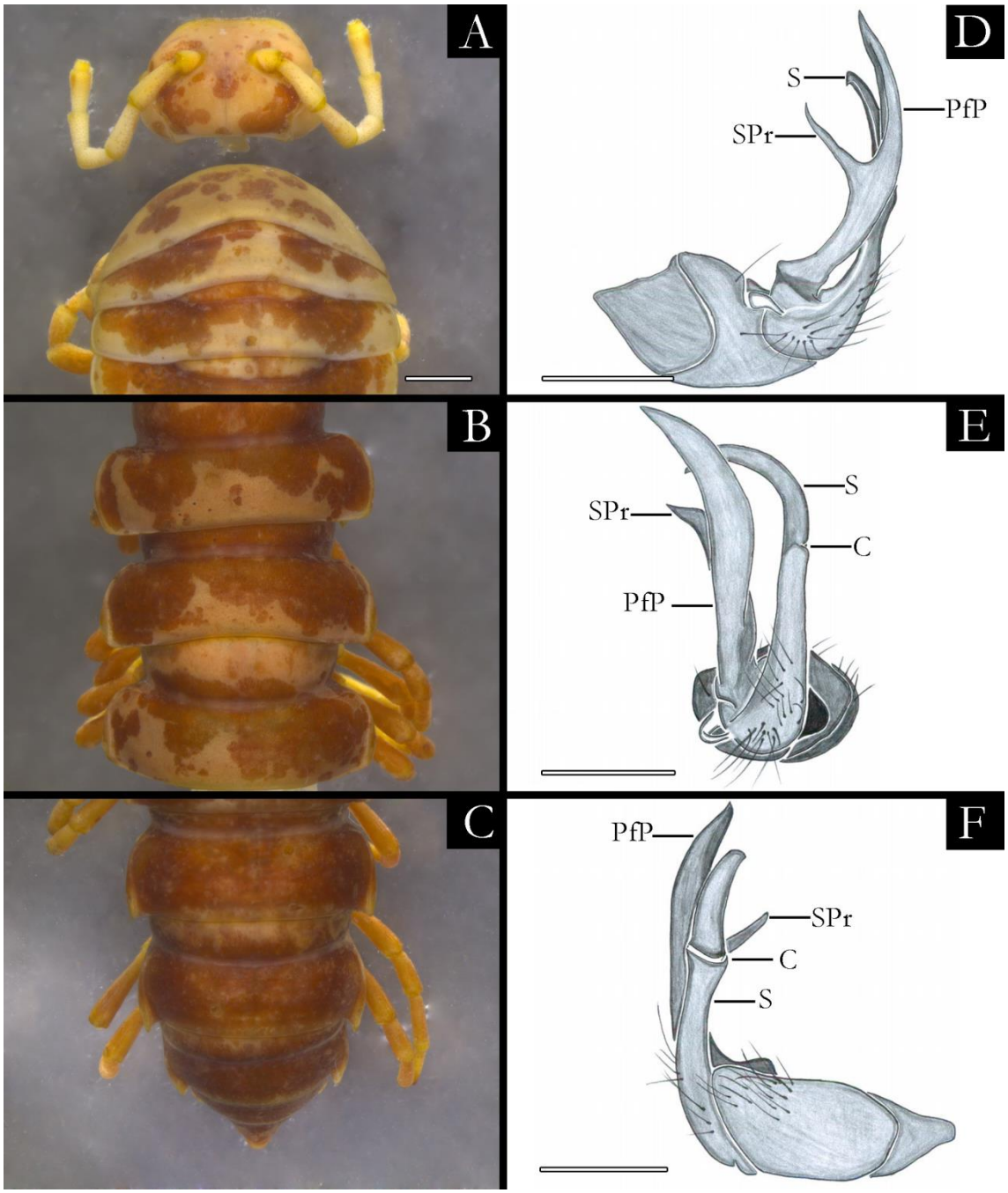


FIGURE 10. *Arthrosolaenomeris pantanalensis* (holotype, MZSP 1085), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

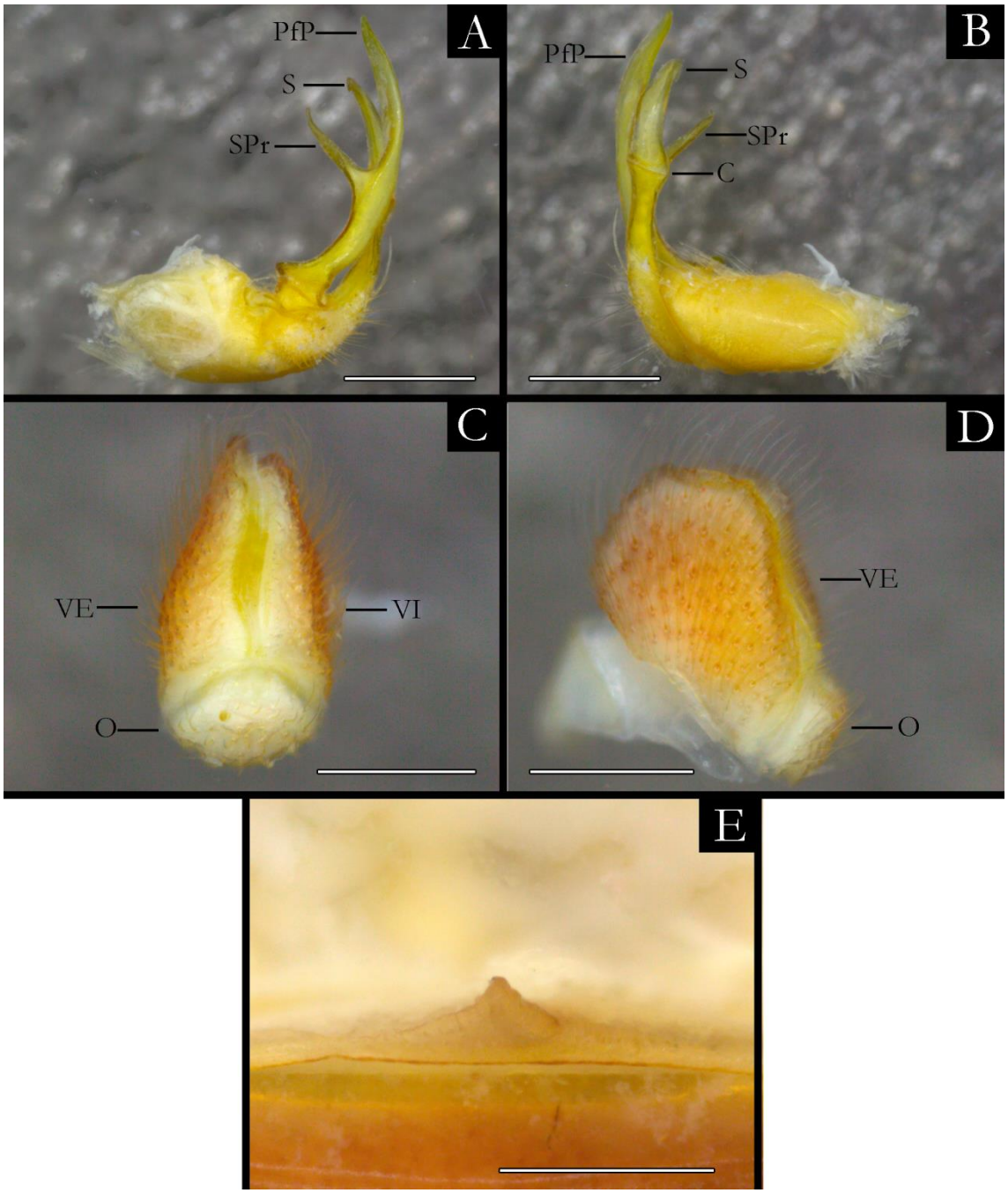


FIGURE 11. *Arthrosolaenomeris pantanalensis*. Left gonopod (holotype, MZSP 1085), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (CZUFMT MYR 847). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 0,5 mm. Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

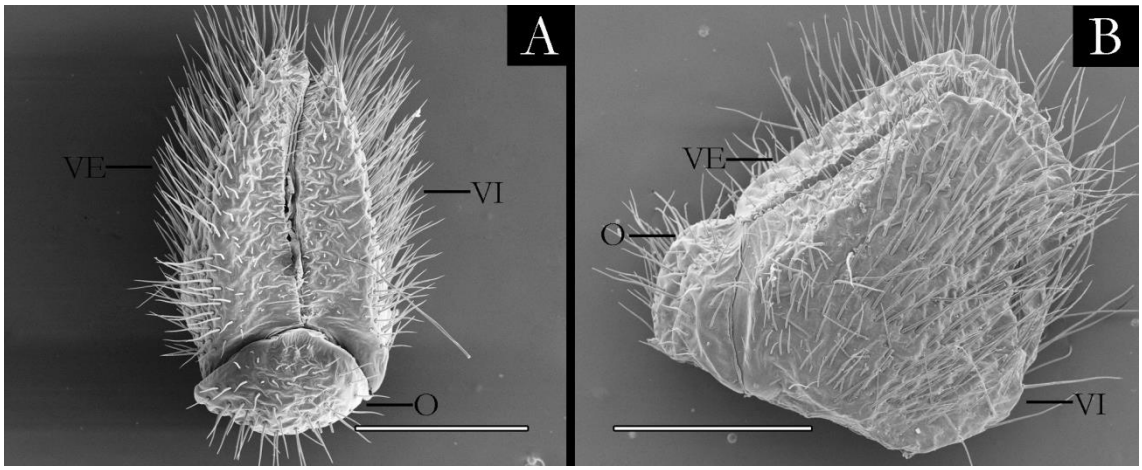


FIGURE 12. *Arthrosolaenomeris pantanalensis* (CZUFMT MYR 840). Left vulva. (A), ventral view; (B), lateral view. Scale bars: 500 µm. Abbreviations: EV, external valve; IV, internal valve; Op, operculum.

***Arthrosolaenomeris saci* sp. nov.**

Figures 13-15, 23

Type material. Male holotype from Bonito (21°07'16"S, 56°28'55"W), Mato Grosso do Sul, Brazil, 14-23.X.2002, Equipe Biota coll., deposited in IBSP 2571. Paratypes: four males and one female with the same data of the holotype, deposited in IBSP 2577, IBSP 2568 and IBSP 2581.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Saci". According to the legend, of indigenous origin, characterized by his antics, Saci is a black boy with only one leg, who smokes a pipe and carries a red cap.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: presence of indentations in the prefemoral process (Fig. 13D) and presence of a conspicuous groove in the apex of the prefemoral process (Fig. 13D).

Description. Male (Holotype, IBSP 2571). Coloration (long-preserved in 70% ethanol): Head ocher, with brownish spots. Antennae ochers becoming more whitish along each antennomere towards the apex, the seventh antennomere totally brownish, having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body reddish brown (Fig. 13A-C). In the anterior segments the posterior portion of metazonite is ocher and the edge of the paranota with the same coloration as the body, except for the slightly clearer peritremata. Gnathochilarium covered by several setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view

curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, the posterior pair being less conspicuous, seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small rectangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ochers; presence of a pronounced dorsal lobe in the prefemur of the anterior legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the tibia and tarsus; short and thick setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated and with a small process. Telson reddish brown; hypocroct triangular with two setae. Total length: 64.22. Width total: 10.09. Collum, long, 2.52, width, 9.54. Antennomere lengths (1>7): 0.69; 1.87; 1.92; 1.64; 1.68; 1.40; 0.32. Podomeres lengths (1>7): 1.00; 1.41; 2.69; 1.49; 1.81; 1.85; 0.60. Gonopod aperture, long 1.80, width 3.27. Telson, long 1.31. Gonopod: long 2.97, width 2.19. Coxae: long 1.02, width 1.34. Telopodite: long 2.84, width 0.84. Prefemoral region 1/3 the size of telopodite. Prefemoral process (Figs 13D-E) long, presenting a dorso-basal lobe, starting from an angle of 30°, ascending parallel to the solenomere and partially covering it in mesal view, in the middle part of the process it presents a long secondary process with dagger-shape, with a series of indentations above the secondary process (Fig. 13D). The terminal part presents a conspicuous concavity, the process ending in an acute apex (Fig. 15C). Solenomere long and narrow (Fig. 13F). Cingulum positioned central-posteriorly (Fig. 15B). Apex of the solenomere acute and abruptly descending (Fig. 15A).

Female (paratype, IBSP 2577): Body as in male. Total length: 56.58. Width total: 9.15. Epigyne triangular shaped (Fig. 14E). Vulva (Fig. 14C-D): long 1.35, width 0.68. External valve: long 0.91, width 0.32. Internal valve: long 0.90, width 0.34. Operculum: long 0.50, width 0.55.

Distribution. Mato Grosso do Sul, Brazil (Fig. 23).

Additional material. BRAZIL: *Mato Grosso do Sul:* Bonito (21°07'16"S, 56°28' 55"W), one male, one female and one juvenile, 14.X.1993, A. Eterovic coll. (IBSP

1148); Miranda (20°14'01"S, 56°21'59"W), Fazenda Cayman, one male, X.1992, A. Eterovic coll. (IBSP 7538).

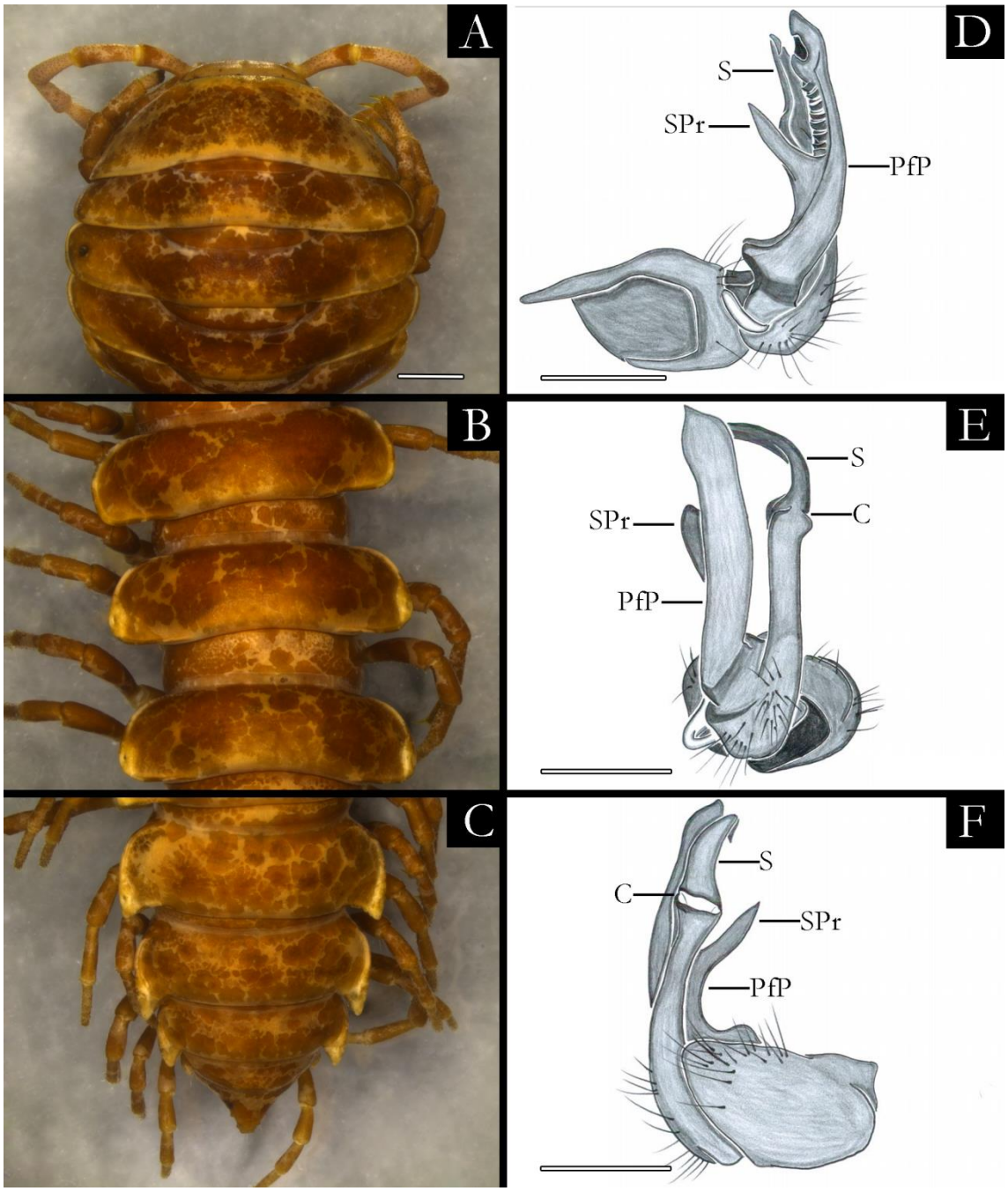


FIGURE 13. *Arthrosolaenomeris saci* **sp. nov.** (holotype, IBSP 2571), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

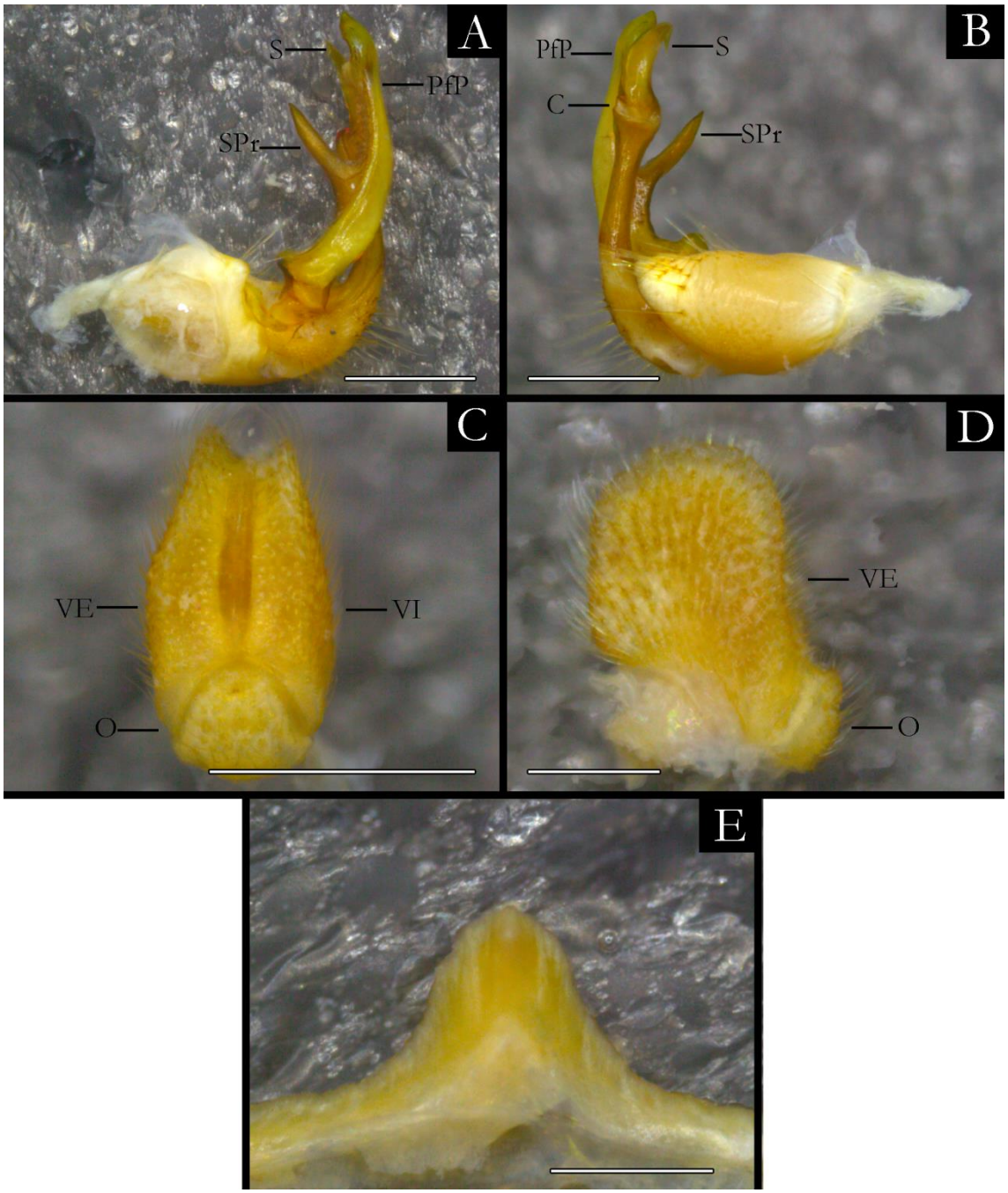


FIGURE 14. *Arthrosolaenomeris saci* **sp. nov.** Left gonopod (holotype, IBSP 2571), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (IBSP 2581). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 1mm (C); 0,5 mm (D-E). Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

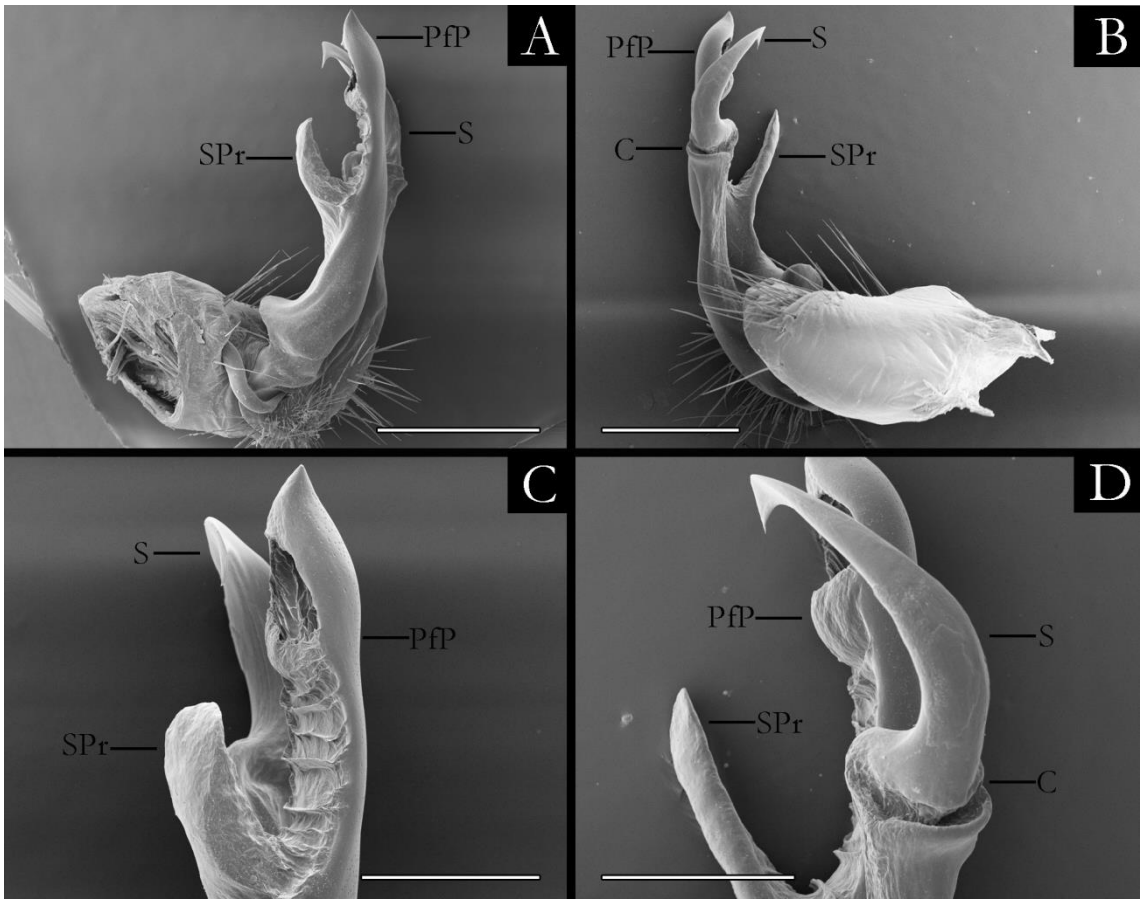


FIGURE 15. *Arthrosolaenomeris saci* **sp. nov.** (IBSP 1148), Left gonopod. A, mesal view; B, ectal view; C, detail of prefemoral process and solenomere, dorso-lateral view; D, detail of cingulum. Scale bars: 1 mm (A-B); 0,5 mm (C-D). Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

***Arthrosolaenomeris curupira* sp. nov.**

Figures 16-17, 23

Type material. Male holotype from Nova Xavantina (14°40'24"S, 52°21'11"W), Mato Grosso, Brazil, XI.1949, Instituto Butantan Expedition coll., deposited in IBSP 59. Paratype: one male with the same data of the holotype, deposited in IBSP 7786.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Curupira". According to the legend, of indigenous origin, Curupira is the protector of the Brazilian forests. One of its most striking features is its backward-facing feet.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: short (2x shorter than in the state elongated) secondary process of the prefemoral process (Fig. 16D) and presence of a lateral row of macrosetae in the gonocoxae, in mesal view (Fig. 16D).

Description. Male (Holotype, IBSP 59). Coloration (long-preserved in 70% ethanol): Head ocher. Antennae ochers with the seventh antennomere having three well-demarcated invaginations and one slight invagination between the sensory cones. Body ocher with the edge of the paranota yellow whitish (Figs 16A-C). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and *stipes* weakly/ sparsely covered. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, the posterior pair being less conspicuous, seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small triangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher whitish; presence of a pronounced dorsal lobe in the prefemur of the anterior legs; ventro-apical projection in the prefemur of the post-gonopod legs; absence of granules on the tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated and with a small process. Telson ocher; hypocroct triangular with two setae, these without a projected base. Total length: 59.40. Width total: 9.76. Collum, long 2.98, width 9.56 Antennomere lengths (1>7): 0.69; 1.85; 1.50; 1.37; 1.38; 1.55; 0.37. Podomeres lengths (1>7): 0.89; 1.33; 2.84; 1.18; 1.59; 1.99; 0.45. Gonopod aperture, long 1.55, width 3.03. Telson, long 1.68. Gonopod: long 3.17, width 1.88. Coxae: long 0.90, width 1.03. Telopodite: long 3.04, width 0.90. Prefemoral region 1/3 the size of telopodite. Prefemoral process (Fig. 16D) long, broad and without indentations, presenting a dorso-basal lobe, starting from an angle of 30°, ascending parallel to the solenomere and partially covering it in mesal view, in the middle part of the process presents a short trianguliform secondary process, acute apex (Fig. 16D). Solenomere long and narrow

(Fig. 16F). Cingulum positioned central-posteriorly (Fig. 16F). Apex of the solenomere acute and abruptly descending (Fig. 16F).

Female: Unknown.

Distribution. Known only from the type locality (Fig. 23).

Additional material. None.

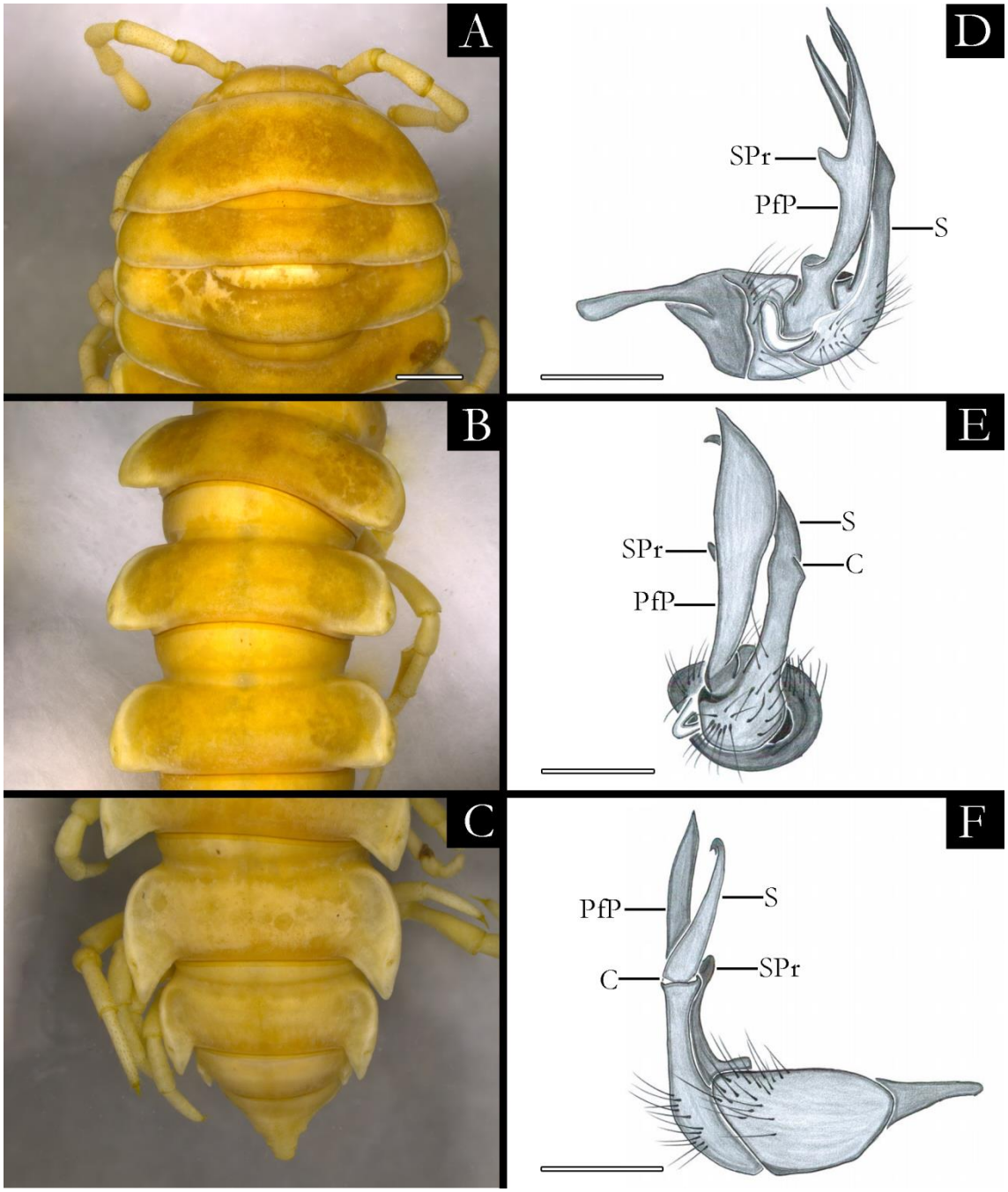


FIGURE 16. *Arthrosolaenomeris curupira* **sp. nov.** (holotype, IBSP 59), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left

gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

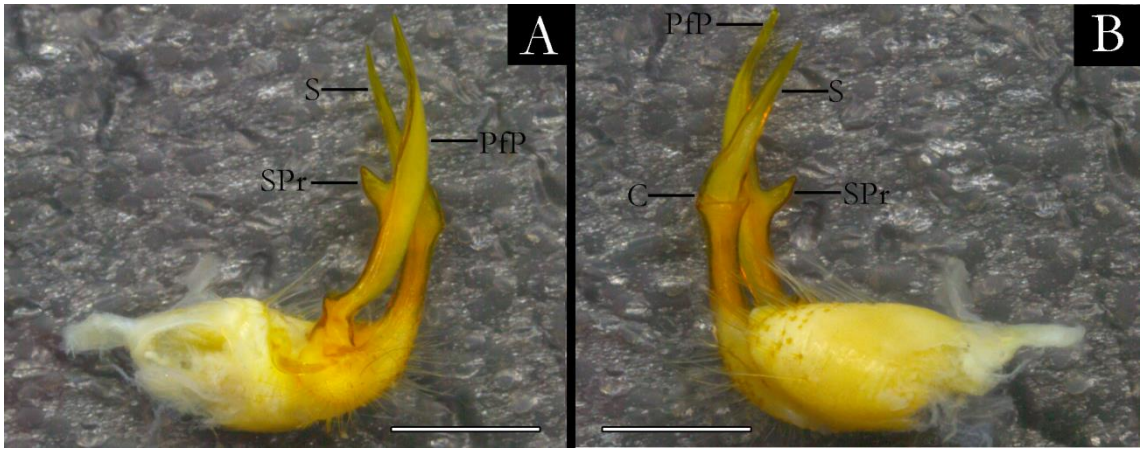


FIGURE 17. *Arthrosolaenomeris curupira* **sp. nov.** (holotype, IBSP 59). Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

Arthrosolaenomeris caipora sp. nov.

Figures 18-19, 23

Type material. Male holotype from Usina Hidrelétrica Guaporé (15°07'00"S, 58°58'00"W), Vale São Domingos & Pontes de Lacerda, Mato Grosso, Brazil, 08.X.2002, I. Knysak coll., deposited in IBSP 1569.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Caipora". According to the legend, of indigenous origin, Caipora is considered the protector of the animals and guardian of the forests. Its origin is in the Tupi-Guarani indigenous mythology and your name means "inhabitant of the bush" in Tupi language.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: short (2x shorter than in the state elongated) secondary process of the prefemoral process (Fig.18D), absence of a lateral row of macrosetae in the gonocoxae, in mesal view (Fig. 18D) and prefemoral process with a more flat aspect in relation to the other species of the genus (Fig. 18E).

Description. Male (Holotype, IBSP 1569). Coloration (long-preserved in 70% ethanol): Head and antennae ocher whitish, with only two invaginations between the

sensory cones. Body ocher and paranota tip with the same color as the body (Figs 18A-C). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and stipes weakly/ sparsely covered. Body rings: cuticle slightly rough; alignment of paranota in posterior view straight; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, the posterior pair being less conspicuous, seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small triangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher whitish; presence of a slight dorsal lobe in the prefemur of the anterior legs; ventro-apical projection in the prefemur of the post-gonopod legs; absence of granules on the tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated and with a small process. Telson ocher; hypocroct triangular with two setae, these without a projected base. Total length: 47.78. Width total: 7.06. Collum, long 2.07, width 6.69. Antennomere lengths (1>7): 0.60; 1.34; 1.39; 1.26; 1.44; 1.37; 0.20. Podomeres lengths (1>7): 0.67; 1.00; 1.96; 0.848; 1.09; 1.48; 0.47. Gonopod aperture, long 1.23, width 2.08. Telson, long 1.07. Gonopod: long 2.00, width 1.65. Coxae: long 0.74, width 1.03. Telopodite: long 1.98, width 0.63. Prefemoral region 1/3 the size of telopodite. Prefemoral process (Figs 19A-B) long and ventrally wide, presenting a dorso-basal lobe, starting from an angle of 30°, ascending parallel to the solenomere and partially covering it in ventral view, in the middle part of the process presents a short secondary process in oval form (Fig. 18D). Prefemoral process ending in an acute apex (Figs 18D-E). Solenomere long, but not reaching the apex of the prefemoral process (Fig. 18F). Cingulum in medial position (Fig. 18F). Apex of the solenomere abruptly descending (Fig. 18D).

Female: Unknown.

Distribution. Known only from the type locality (Fig. 23).

Additional material. None.

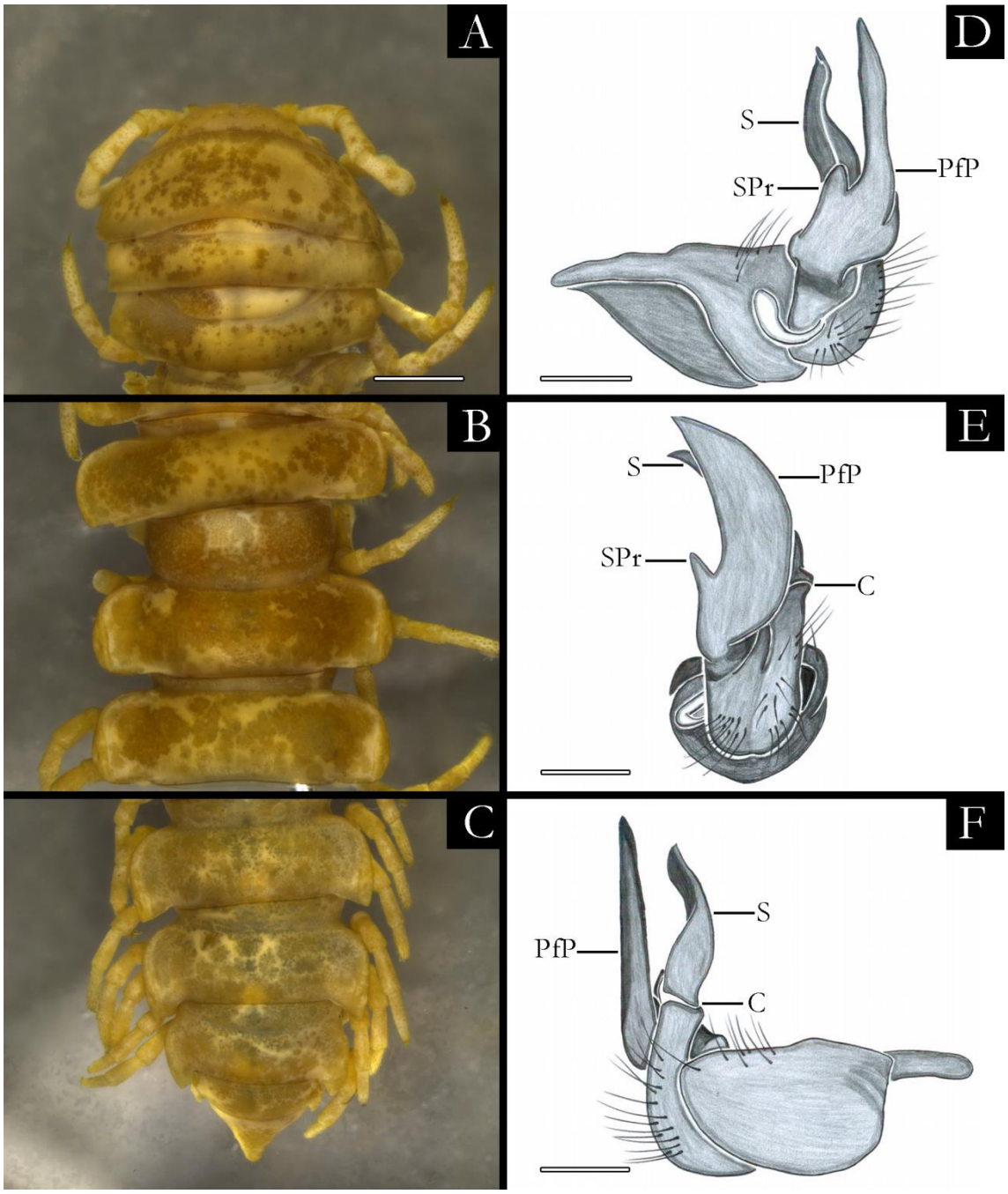


FIGURE 18. *Arthrosolaenomeris caipora* **sp. nov.** (holotype, IBSP 1569), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 0,5mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

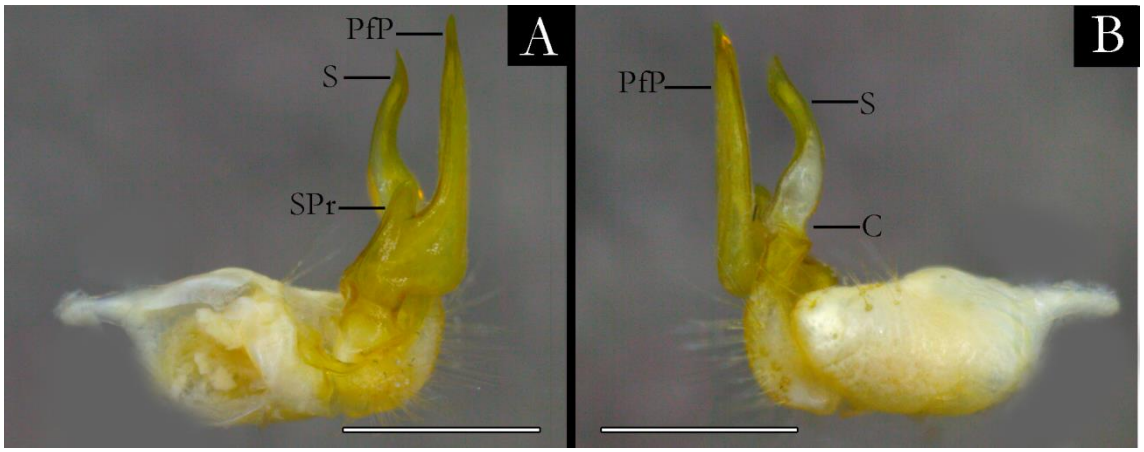


FIGURE 19. *Arthrosolaenomeris caipora* **sp. nov.** (holotype, IBSP 1569). Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

Arthrosolaenomeris iara sp. nov.

Figures 20-23

Type material. Male holotype from Usina Hidrelétrica Guaporé, Vale São Domingos & Pontes de Lacerda (15°11'60"S, 59°22'00"W), Mato Grosso, Brazil, 03.X.2002, G. Marçal coll., deposited in IBSP 1577. Paratypes: one male and one female from Chapada dos Parecis, Diamantino (14°09'43"S, 57°08'01"W), Mato Grosso, Brazil, XI.1993, D. Novais & R. Pardini coll., deposited in IBSP 7537.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Iara". According to the legend, of indigenous origin, Iara is a beautiful mermaid that inhabits the rivers of the north of the country.

Diagnosis. Adult males differ from all other species of the genus by the absence of the secondary process in the prefemoral process (Fig. 20D).

Description. Male (Holotype, IBSP 1577). Coloration (long-preserved in 70% ethanol): Head and antennae ochers with the seventh antennomere darker, with the seventh antennomere having three well-demarcated invaginations and one slight invagination between the sensory cones. Body ocher and paranota tip with the same color as the body (Figs 20A-C). Gnathochilarium: *lingual plate* covered by several setae; *promentum* centrally covered by setae, with smooth edges and *stipes* covered by thick setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; posterior border of the paranota sub-retangular; posterior position of

the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, the posterior pair being less conspicuous, seventh sternite with a small pair of projections and the others post-gonopod sternites presenting pairs of small rectangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher whitish; presence of a pronounced dorsal lobe in the prefemur of all legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the postfemur, tibia and tarsus; short and thick setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated and with a small process and stretch marks, also presenting a central sub triangular support. Telson ocher; hypocroct triangular, presenting two setae displaced proximally of the apex, these without a projected base. Total length: 68.40. Width total: 10.13mm. Collum 2.93 de long, 9.89 width. Antennomere lengths (1>7): 0.77; 2.12; 1.93; 1.62; 1.70; 1.49; 0.44. Podomeres lengths (1>7): 1.24; 1.70; 2.64; 1.51; 1.96; 2.00; 0.56. Gonopod aperture 2.13 long, 3.83 width. Telson 1.43 long. Gonopod: 2.92 long, 2.90 width. Coxae: 1.18 long, 1.50 width. Telopodite: 2.92 long, 1.48 width. Prefemoral region 1/3 the size of telopodite. Prefemoral process long and acute, starting from an angle of 90°, ascending parallel to the solenomere and partially covering it in mesal view (Fig. 20D). Solenomere long, wide in the middle zone due to the presence of the cingulum and narrowing at the apex (Fig. 20F). Cingulum in medial position (Fig. 20F). Apex of the solenomere abruptly descending (Fig. 20D).

Female (paratype, IBSP 7537): Body as in male, except for sternites with triangular projections, legs showing dorsal projections not conspicuous and without granules. Total length: 69.42. Width total: 9.49. Collum 3.15 long, 8.82 width. Antennomere lengths (1>7): 0.73; 1.95; 1,45; 1.30; 1.35; 1.22; 0.35. Podomeres lengths (1>7): 0.83; 1.06; 2.06; 1.04; 1.44; 1.50; 0.46. Telson 1.46 long. Epigyne rounded with irregular edges (Fig. 21E). Vulvae (Figs 21C-D): 1.42 long, 0.67 width. External valve: 1.01 long, 0.30 width. Internal valve: 0.99 long, 0.28 width. Operculum: 0.44 long, 0.54 width.

Distribution. Mato Grosso, Brazil (Fig. 23).

Additional material. BRAZIL: *Mato Grosso:* Vila Bela da Santíssima Trindade (15°00'00"S, 59°57'00"W), Fazenda Barranco Alto, four males, two females and one juvenile, 14.XI.2015, A. Chagas-Jr & A.B. Kury coll. (CZUFMT MYR 841); Porto Esperidião (15°51'11"S, 58°27'36"W), one male, 18-22.XII.1976, P.E. Vanzolini coll. (MZSP 1081).

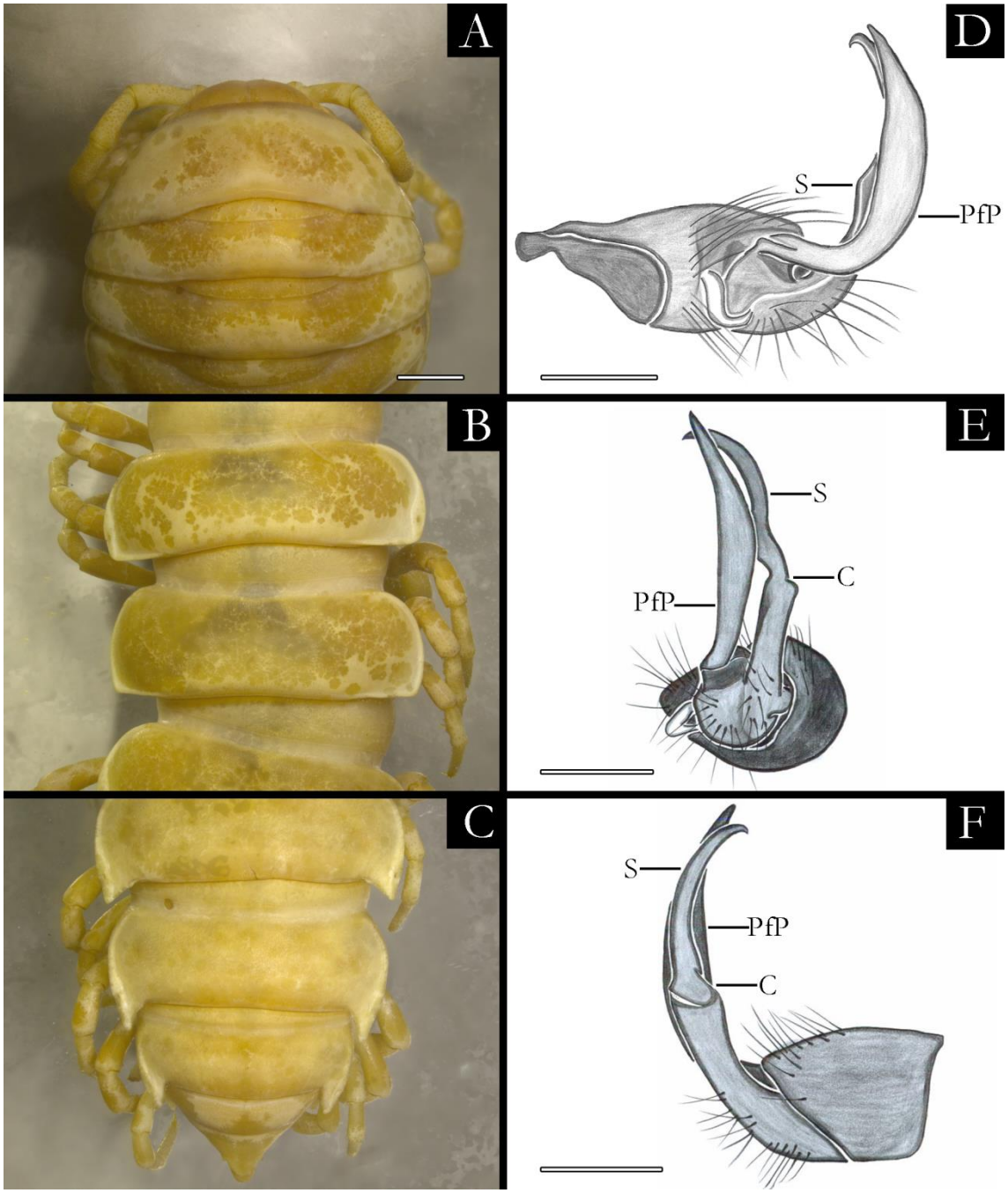


FIGURE 20. *Arthrosolaenomeris iara* **sp. nov.** (holotype, IBSP 1577), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left

gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

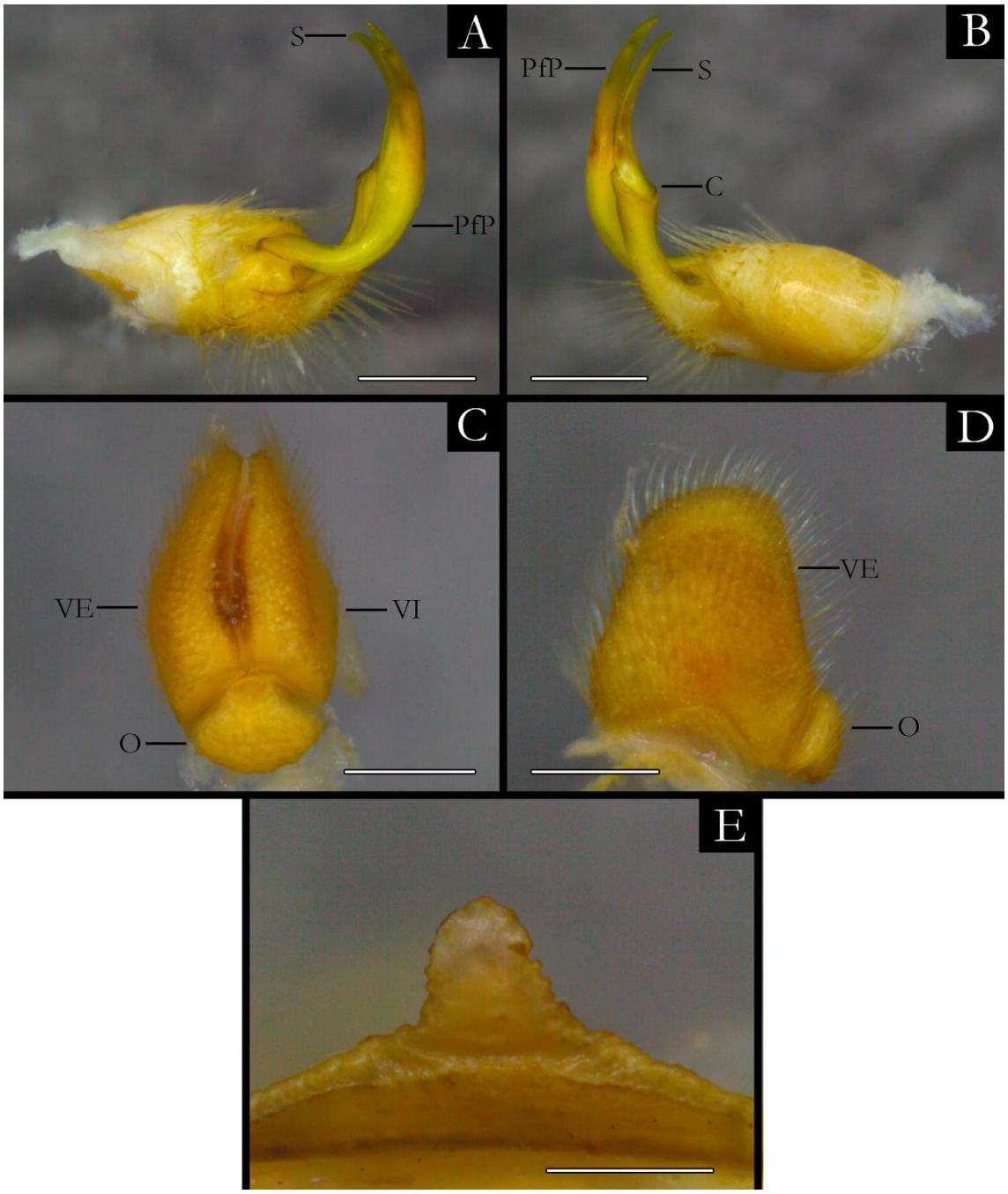


FIGURE 21. *Arthrosolaenomeris iara* **sp. nov.** Left gonopod (holotype, IBSP 1577), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (IBSP 7537). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 1mm (C); 0,5 mm (D-E). Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere.

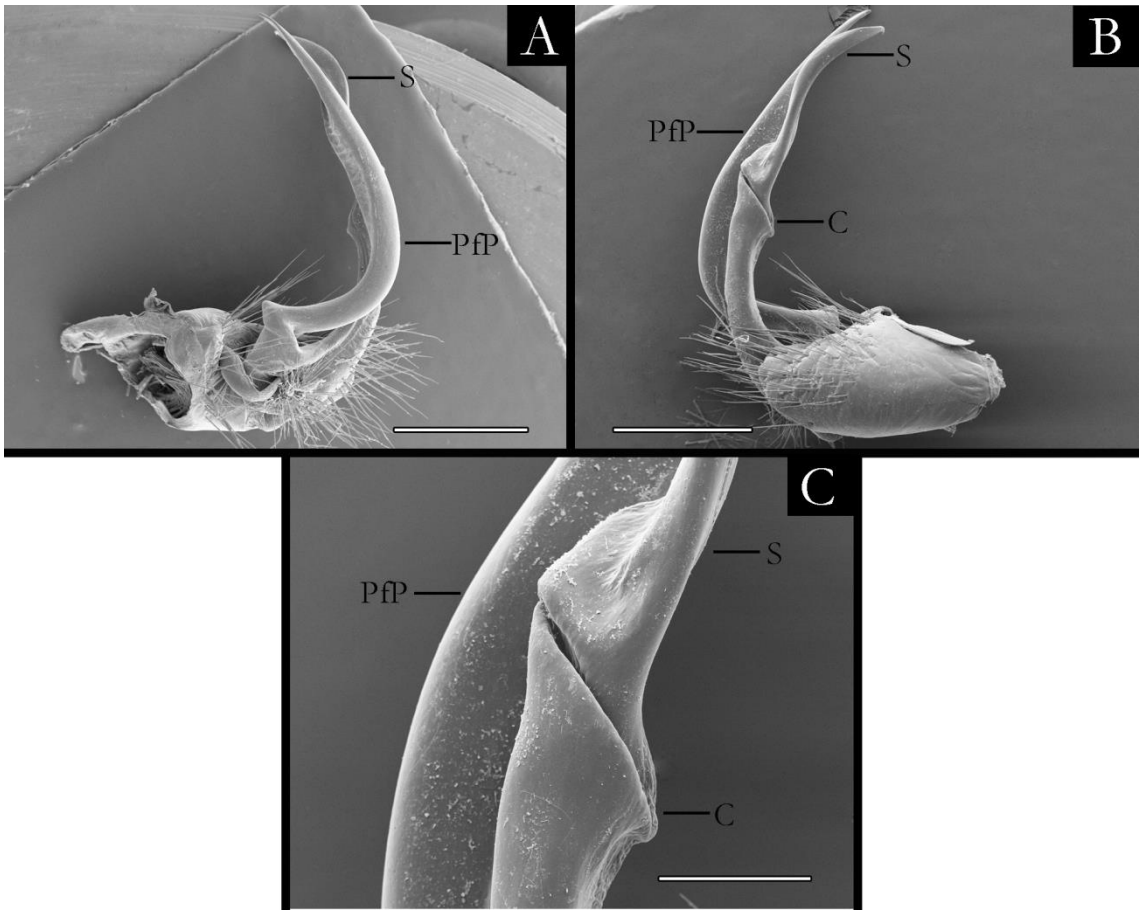


FIGURE 22. *Arthrosolaenomeris iara* **sp. nov.** Left gonopod (CZUFMT MYR 841), A, mesal view; B, ectal view; C, detail of cingulum. Scale bars: 1mm (A-B); 0,3 mm (C). Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

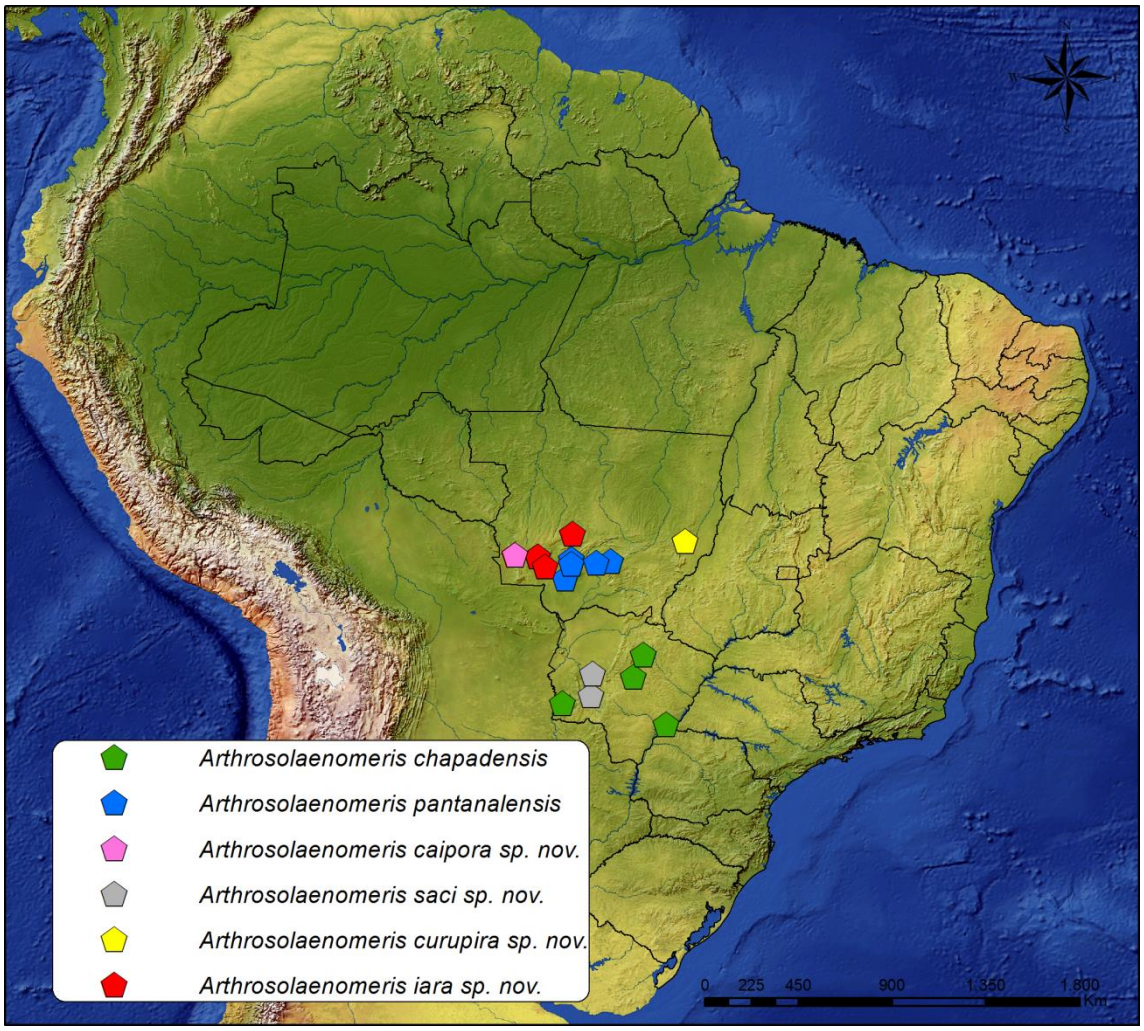


FIGURE 23. Distribution map of *Arthrosolaenomeris* species.

Gangugia Schubart, 1947

Gangugia Schubart, 1947: 7. Type species: *G. tapirapensis* Schubart, 1947, by original designation; Schubart, 1958: 205; Jeekel, 1971: 264; Hoffman, 1976: 177; Hoffman, 1980: 151.

Diagnosis. Males of *Gangugia* differ from those of other Arthrosolaenomeridini genera by the combination of the following characters: gonocoxae globosely (Fig. 26B); prefemoral process starting descending in its initial portion - angulation of the prefemoral process by 120° (Fig. 24D) (except *G. cuca* **sp. nov.**); prefemoral process narrow and sharply curved, in a ventral view (Figs 24D-F).

Redescription: *General characters:* Body length between 39.07 mm (*G. boitata* **sp. nov.**) and 69.42 mm (*G. mula* **sp. nov.**). Coloration (specimens long preserved in 70% ethanol) variable between species, ranging from ocher to brown, in general the paranota tip and posterior border of the metaterga slightly whitish (*G. cuca* **sp. nov.** show the coloration of the prozonite reddish brown). Sternite of sixth body ring with two pairs of ventral projections; absence of a pair on the seventh sternite (present in *G. boto* **sp. nov.**) and sternites after the gonopod with two pairs of rounded ventral projections (Fig. 3D) (acuminate in *G. boitata* **sp. nov.;** *G. cuca* **sp. nov.)**. Paranota form: round to slightly rectangular (Figs 24B, 30B). Legs: podomeres without thick ventral setae, dorsal lobe of prefemur conspicuous (Fig. 4B), ventral projection on the coxae (Fig. 35C) present only in *G. boto* **sp. nov.** and *G. mula* **sp. nov.**, presence of granules in the tibia (Fig. 4F) (absent in *G. cuca* **sp. nov.**) and a ventro-apical projection in the prefemur (Fig. 4E).

Male characters: posterior edge of the gonopod aperture smooth. Gonopods: gonopod coxae equivalent to about half the length of the telopodite, globose, without a spiniform process. Prefemoral process (Fig. 26B): elongate and thin involving the solenomere in ectal view (*G. simplex* and *G. cuca* **sp. nov.** don't involve the solenomere completely, just until ventral view) presence of a dorso-basal process (rounded in *Gangugia tapirapensis, G. boto* **sp. nov.,** *G. mula* **sp. nov.** and sub-triangular in *Gangugia simplex, G. boitata* **sp. nov.,** *G. cuca* **sp. nov.**) and a basal secondary process is present in *G. boto* **sp. nov.,** *G. mula* **sp. nov.**). Cingulum in basal position (middle position in *G. simplex* and *G. cuca* **sp. nov.**). Solenomere long and thin with your apex with hook-shaped (Figs 28E-F).

Female characters: Vulvae: oval-shaped. In lateral view: rounded in *G. mula* **sp. nov.** and rectangular in *G. tapirapensis*.

Distribution. States of Pará, Tocantins, Goiás and Mato Grosso, Brazil (Fig. 38).

Composition. Two species described: *Gangugia tapirapensis* Schubart, 1947; *Gangugia simplex* Schubart, 1958, and four new species: *G. boitata* **sp. nov.;** *G. cuca* **sp. nov.;** *G. boto* **sp. nov.;** *G. mula* **sp. nov.**

Key to males

1. Prefemoral process without indentation (Fig. 32D)….....2
   Prefemoral process with indentation (Fig. 26C).....3
2. Sigmoid curvature present in the apex of the solenomere (Fig. 24D).....*G. tapirapensis*
   Sigmoid curvature absent in the apex of the solenomere.....*G. simplex*
3. Presence of secondary process in the prefemoral process (Fig. 34D).....4
   Absence of secondary process in the prefemoral process.....5
4. Presence of membranous-triangular lateral flap at the apex of the solenomere (Fig. 36F).....*G. mula* **sp. nov.**
   Absence of membranous-triangular lateral flap at the apex of the solenomere.....*G. boto* **sp. nov.**
5. Prefemoral process reaching the apex of the solenomere (Fig. 30D).....*G. boitata* **sp. nov.**
   Prefemoral process not reaching the apex of the solenomere (Fig. 32D).....*G. cuca* **sp. nov.**

Gangugia tapirapensis Schubart, 1947

Figures 24-27, 38

Gangugia tapirapensis Schubart, 1947: 8, figs 4−8. Syntypes: 5 males, 5 females and 15 juveniles from Barra do Tapirapé (Now known as Santa Terezinha) (-10.471803°; -50.515290°), Mato Grosso, Brazil, 23.XI.1939−15.III.1940, A. L. de Carvalho coll., deposited in MZSP 1069, 1070, 1071, 1076 and MNRJ 11822, examined (male lectotype [MZSP 1076] and all remaining material as paralectotypes here designated). Schubart, 1958: 238; Hoffman, 1976: 179; Golovatch, Hoffman, Adis, Marques, Raizer, Silva, Ribeiro, Silva & Pinheiro, 2005: 277.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: presence of indentations in the prefemoral process (Fig. 26C) and presence of a sigmoid curvature in the apex of the solenomere (Fig. 26C).

Redescription. Male (Lectotype, MZSP 1076): Coloration (long-preserved in 70% ethanol): Head and antennae ochers with the seventh antennomere having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body ocher and with the lateral border of the paranota and the posterior edge of the metaterga

more whitish (Figs 24A-C). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and stipes weakly/ sparsely covered. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; posterior edge of the paranota sub-retangular; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, the posterior pair being less conspicuous, seventh sternite without projections and the others post-gonopod sternites presenting pairs of small rounded projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ochers with a conspicuous dorsal lobe in the prefemur; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the postfemur, tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring broad; the posterior margin excavated, concave and with stretch marks, also presenting a central sub triangular support. Telson ocher; hypocroct triangular with two setae, these without a projected base. Total length: 62.08. Width total: 9.78. Collum, long 2.82, width 9.11. Antennomere lengths (1>7): 0.81; 2.19; 1.57; 1.45; 1.37; 1.43; 0.37. Podomeres lengths (1>7): 1.03; 1.30; 2.83; 1.25; 1.58; 1.69; 0.47. Gonopod aperture, long 2.00, width 4.32. Telson, long 1.22. Gonopod: long 2.97, width 2.79. Coxae: long 1.37, width 0.98. Telopodite: long 2.25, width 1.85. Prefemoral process long (larger than the solenomere), narrow and curved, terminal portion presenting numerous indentations (Figs 24D-E). Solenomere long, narrow and curved (Fig. 24D). Cingulum in basal position (Fig. 24F). Apex of the solenomere with descending sigmoid curvature (Fig. 24F).

Female (Paralectotype, MZSP 1070): Body as in male, except for the legs; without modifications, only the presence of a slight dorsal lobe in the prefemur of the anterior legs. Total length: 56.19. Width total: 9.00. Antennomere lengths (1>7): 0.65; 1.67; 1.29; 1.22; 1.23; 1.16; 0.36. Podomeres lengths (1>7): 0.69; 1.08; 2.61; 0.92; 1.03; 1.47; 0.43. Telson, long 1.06. Epigyne triangular shaped with irregular edges (Fig. 27D). Vulvae (Figs 27A-B): long 1.57, width 0.83. External valve: long 1.12, width 0.37. Internal valve: long 1.11, width 0.42. Operculum: long 0.45, width 0.63.

Distribution. Known only from the type locality (Fig. 38).

Additional material. BRAZIL: *Mato Grosso:* Barra do Tapirapé (Now known as Santa Terezinha); (-10.471803°; -50.515290°); three males, two females and one juvenile, XI-XII.1939, A. L. de Carvalho coll. (MNRJ 12008); one male, I-II.1940, A. L. de Carvalho coll. (MNRJ 11821); four juveniles, xii.1839-ii.1940, A. L. de Carvalho coll. (MNRJ 11820, destroyed after the Museu Nacional fire in 2018); 84 juveniles (MNRJ 11677, destroyed after the Museu Nacional fire in 2018); 94 individuals, xi-xii.1839, A. L. de Carvalho coll. (MNRJ 11679, destroyed after the Museu Nacional fire in 2018); 42 individuals, (MNRJ 11680, destroyed after the Museu Nacional fire in 2018); one male and one female, I.1940, A. L. de Carvalho coll. (MZSP 1072); one female, I-II.1940, A. L. de Carvalho coll. (MZSP 1073).

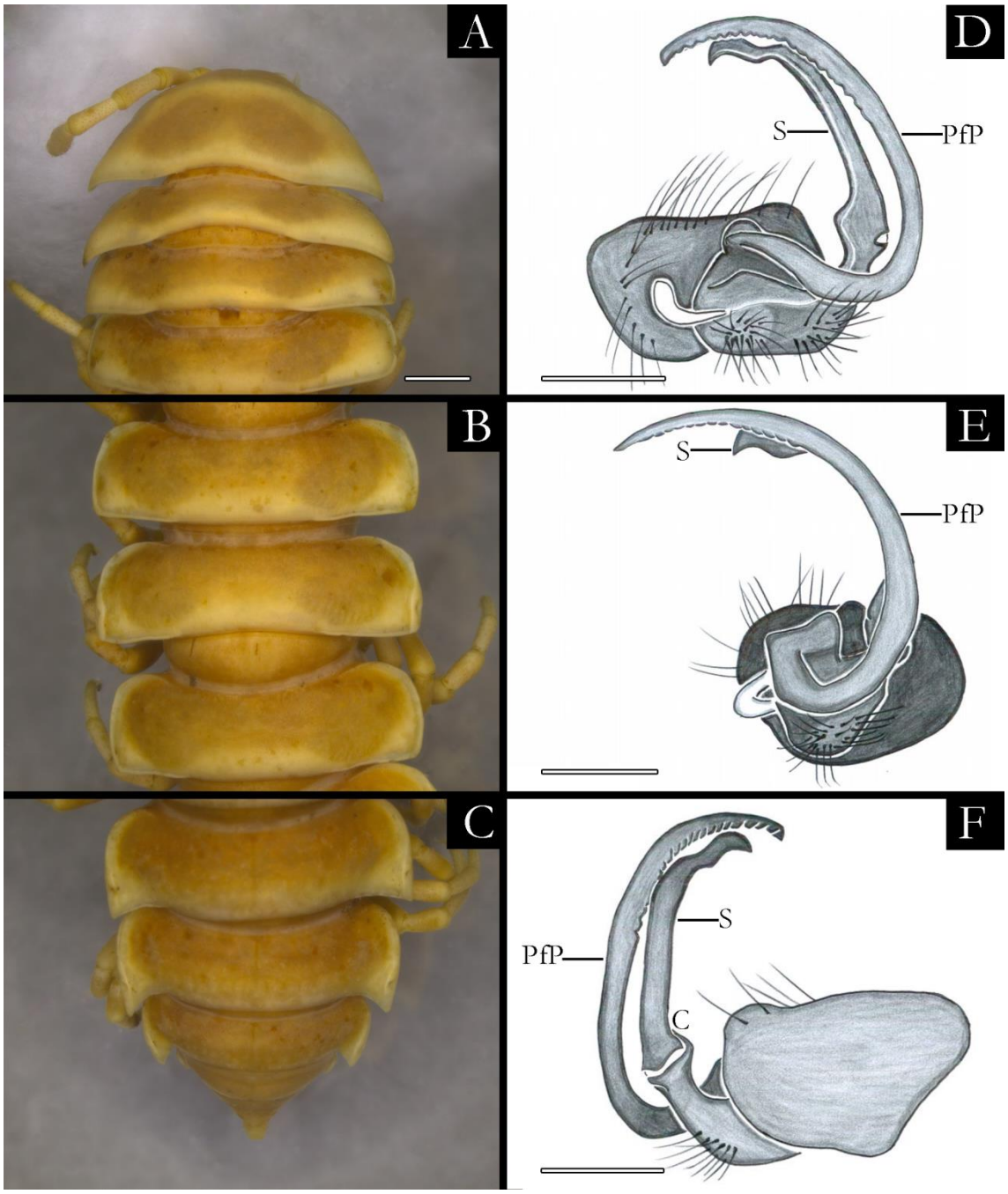


FIGURE 24. *Gangugia tapirapensis* (MZSP 1076), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

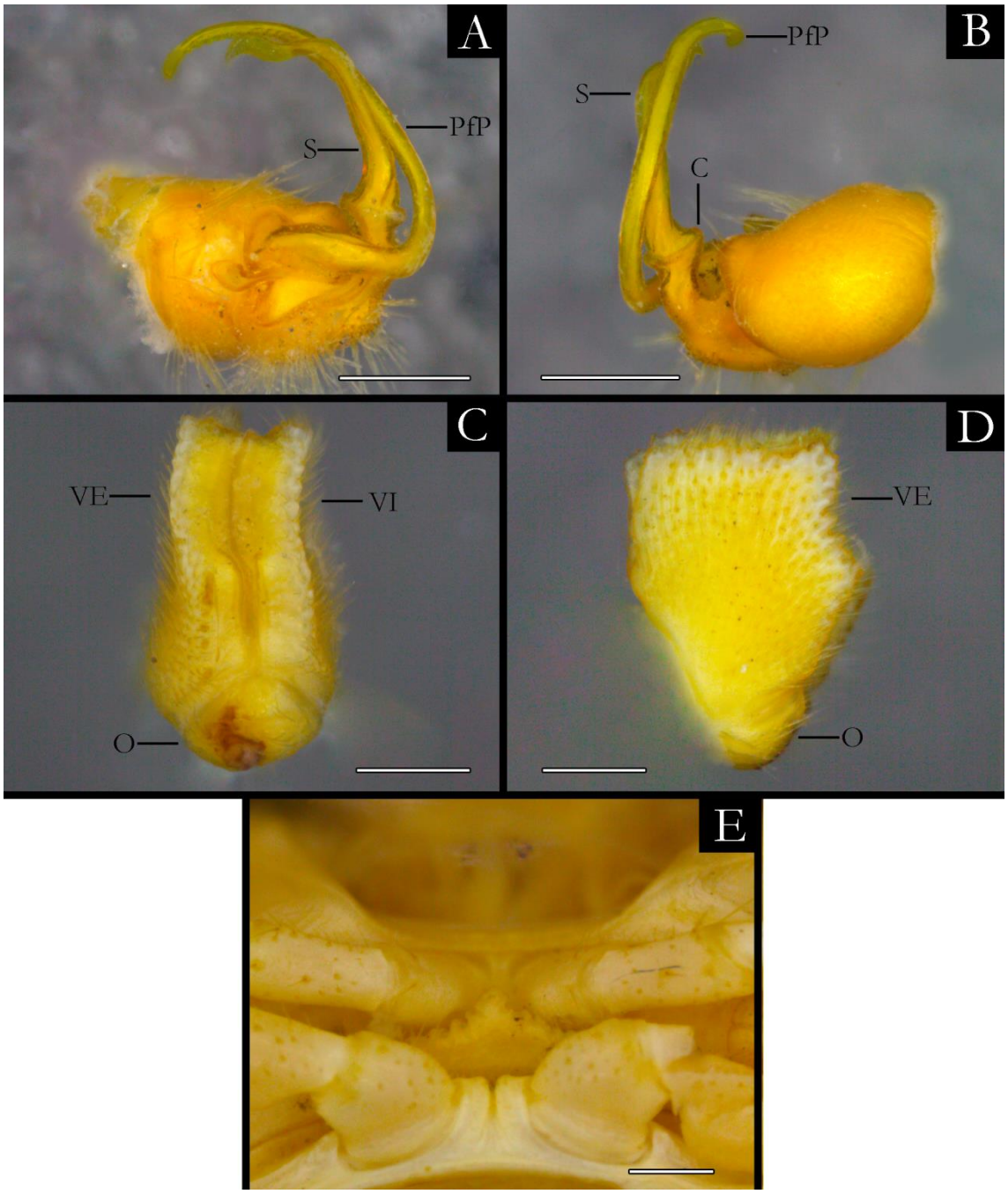


FIGURE 25. *Gangugia tapirapensis.* Left gonopod (MZSP 1076), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (MZSP 1070). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 0,5 mm. Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere.

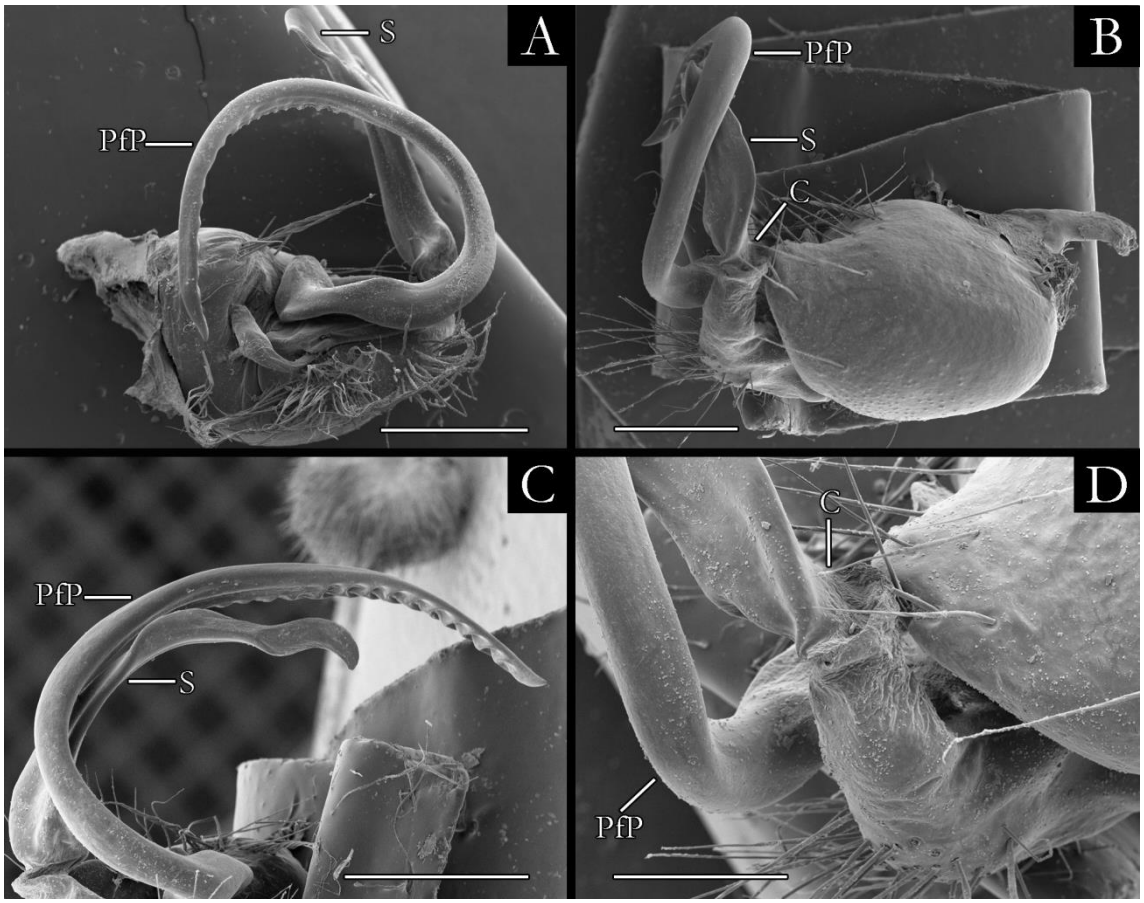


FIGURE 26. *Gangugia tapirapensis* (MNRJ 12008), left gonopod. A, mesal view; B, ectal view; C, detail of prefemoral process and solenomere, ventral view; D, detail of cingulum. Scale bars: 1 mm (A-C); 0,5 mm (D). Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

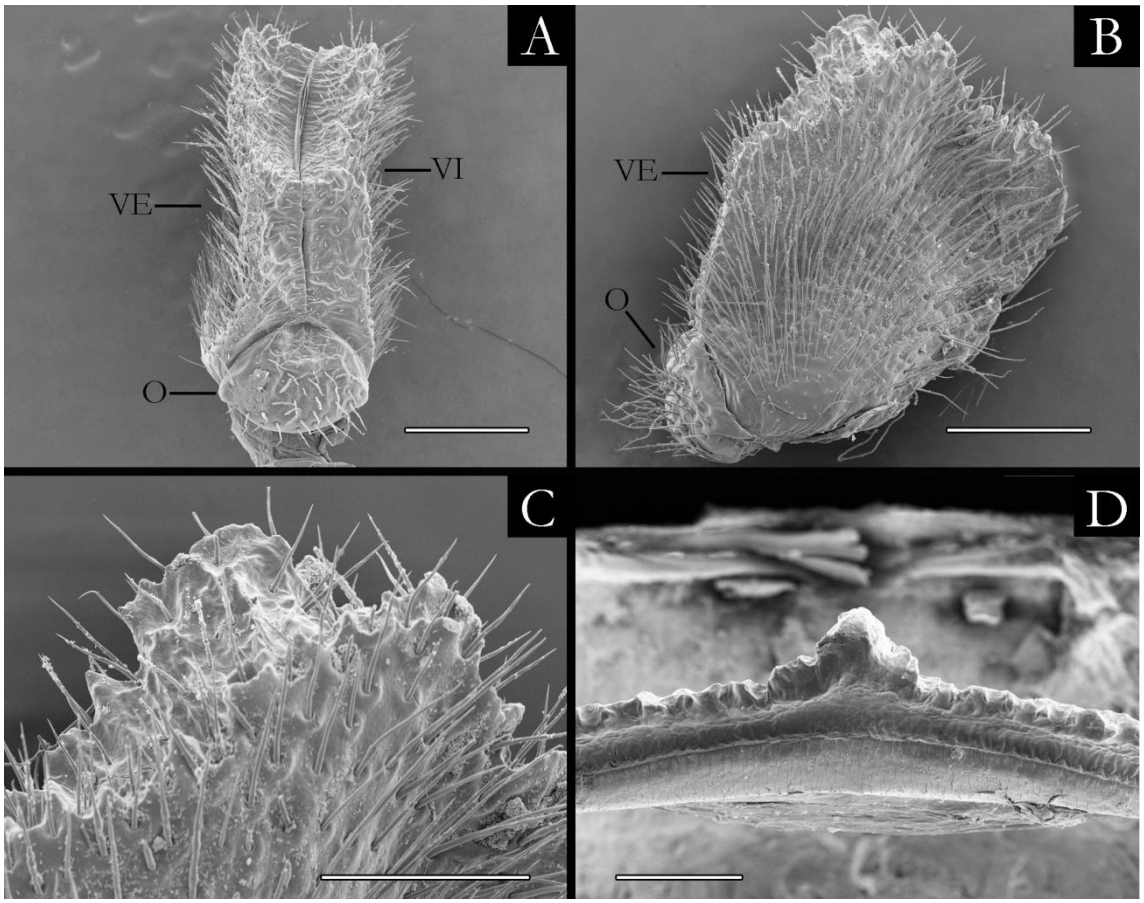


FIGURE 27. *Gangugia tapirapensis* (MNRJ 12008), left vulva. A, ventral view; B, lateral view; C, detail of the apex, lateral view; D, detail of the Posterior margin of the vulvae opening. Scale bars: 1 mm (A-C); 0,5 mm (D). Abbreviations: EV, external valve; Op, operculum; IV, internal valve.

Gangugia simplex Schubart, 1958

Figures 28-29, 38

Gangugia tapirapensis simplex Schubart, 1958: 216, fig. 14. Male holotype and two males paratypes from Aragarças (15°53'52"S, 52°15'02"W), Goiás, Brazil, X.1952−X.1953, H. Sick coll., deposited in MZSP 1077; Paratypes: with same data, deposited in MZSP 1074 and 1075, examined.

Gangugia simplex:-- Hoffman, 1976: 179, figs 11−13, elevated to species rank; Golovatch, Hoffman, Adis, Marques, Raizer, Silva, Ribeiro, Silva & Pinheiro, 2005: 277.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: presence of indentations in the prefemoral process (Fig. 28D)

and the prefemoral process not completely involving the solenomere, in ectal view (Fig. 28E-F).

Redescription. Male (Holotype, MZSP 1077): Coloration (long-preserved in 70% ethanol): Head and antennae ocher yellowish, with the seventh antennomere having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body ocher and with the border of the paranota and posterior margin of the metaterga slightly whitened (Figs 28A-C). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and *stipes* weakly/ sparsely covered, with a larger accumulation of setae in its lower portion. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, the posterior pair extremely slight, seventh sternite broken. Others post-gonopod sternites presenting pairs of small rounded projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ochers yellowish; conspicuous dorsal lobe in the prefemur of the legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the postfemur, tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring broken. Telson ocher; hypocroct triangular with two setae, these without a projected base. Total length: 65.67. Width total: 9.43. Collum, long 2.55, width 8.75. Antennomere lengths (1>7): 0.74; 2.00; 1.78; 1.47; 1.36; 1.47; 0.30. Podomeres lengths (1>7): 1.08; 1.44; 2.61; 1.24; 1.50; 1.48; 0.55. Gonopod aperture, long 1.80, width 3.73. Telson, long 0.93. Gonopod: long 2.98, width 2.39. Coxaee: long 1.17, width 1.09. Telopodite: long 2.83, width 1.34. Prefemoral process long (smaller than the solenomere), narrow and curved, terminal portion presenting several indentations (Fig. 28D). Long, narrow and curved solenomere (Figs 28E-F). Cingulum in medial position (Fig. 28F). Apex of the solenomere sickle-shaped (Fig. 28F).

Female (VMNH): Analyzed only by photos (specimens housed in VNMH), see Hoffman (1976): 179 for details.

Distribution. Goiás, Brazil (Fig. 38).

Additional material. BRAZIL: *Goiás:* Jataí (-10.471803°; -50.515290°), Fazenda Nova Orlândia, two males and one female, I.1964, Exped. Dep. Zool. coll. (VMNH110614).

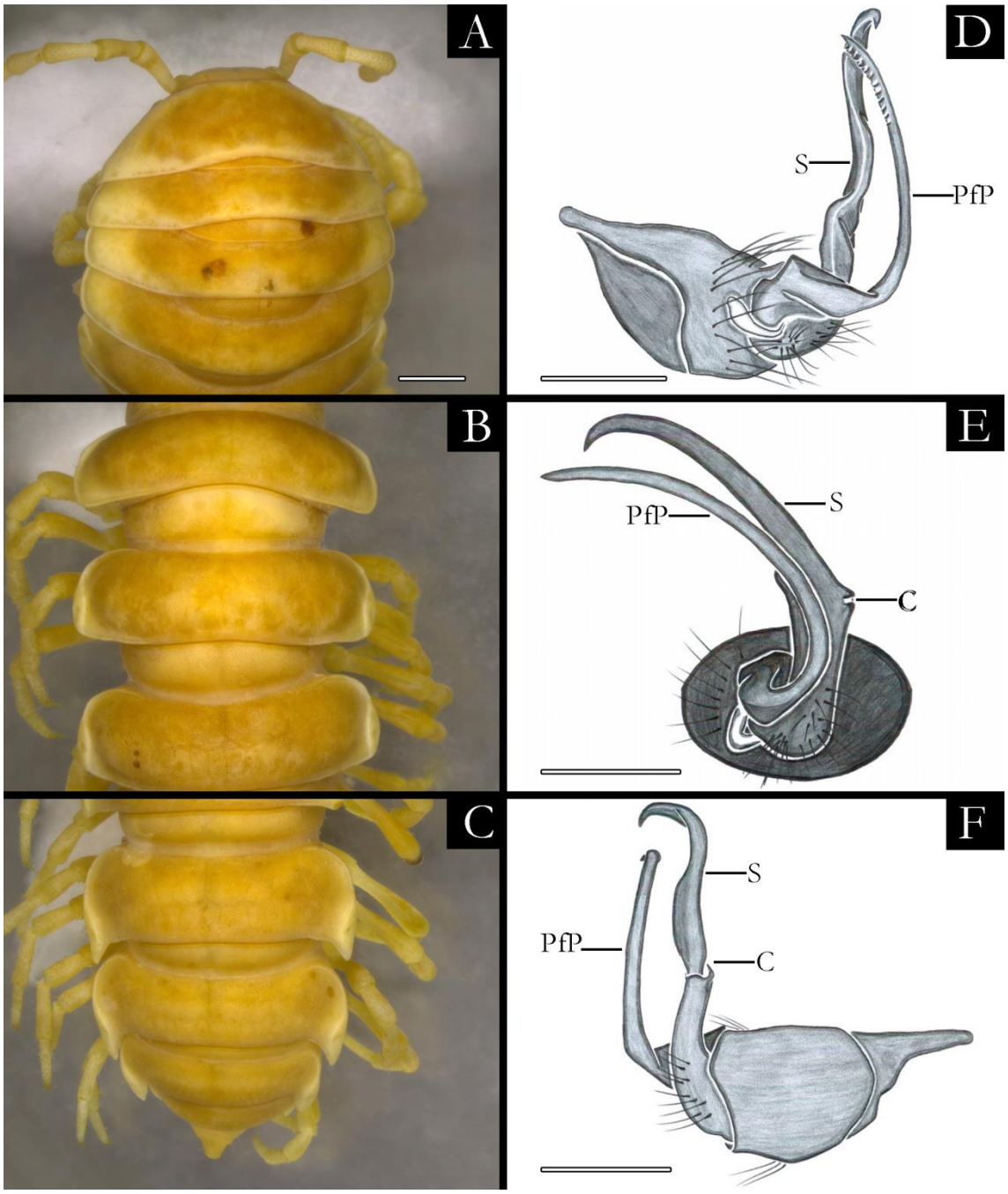


FIGURE 28. *Gangugia simplex* (holotype, MZSP 1077), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

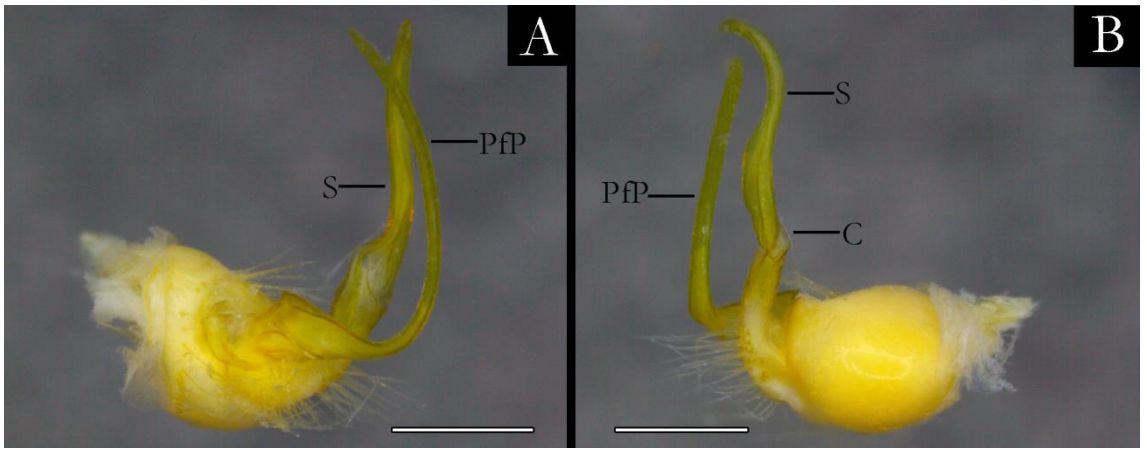


FIGURE 29. *Gangugia simplex* (holotype, MZSP 1077). Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

***Gangugia boitata* sp. nov.**

Figures 30-31, 38

Type material. Male holotype from Parque Nacional das Emas (18°22'01"S, 52°47'59"W), Mineiros, Goiás, Brazil, X.1992, M. Barroso coll., deposited in IBSP 1061.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Boitatá". According to the legend, of indigenous origin, Boitatá is a large fire serpent that protects the animals and the forests from people who try to burn the vegetation.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: gonocoxae conspicuously greater than half the size of the telopodite (Fig. 30D); absence of indentations in the prefemoral process (Fig. 30D); absence of a secondary process in the prefemoral process and presence of a lobe in the solenomere, visible in ventral view (Fig. 30E).

Description. Male (Holotype, IBSP 1061). Coloration (long-preserved in 70% ethanol): Head and antennae ochers with two invaginations between the sensory cones. Body ocher and paranota tip with the same color as the body (Figs 30A-C). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and stipes weakly/ sparsely covered. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge

of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of small projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, seventh sternite without projections and the others post-gonopod sternites presenting pairs of small triangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla, with the papilla opening extremely broad. Legs ocher whitish; presence of a pronounced dorsal lobe in the prefemur of the anterior legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated, concave and with stretch marks. Telson ocher; hypocroct triangular with two setae. Total length: 39.07. Width total: 5.57. Collum, long 2.30, width 5.19. Antennomere lengths (1>7): 0.48; 1.35; 1.10; 1.06; 0.99; 1.00; 0.24. Podomeres lengths (1>7): 0.66; 0.88; 1.50; 0.70; 0.89; 1.10; 0.33. Gonopod aperture, long 1.33, width 2.19. Telson, long 1.05. Gonopod: long 1.58, width 1.68. Coxae: long 0.96, width 1.06. Coxae globose, about 1/2 the size of the telopodite. Telopodite: long 1.44, width 0.74. Prefemoral region short, 1/3 the size of telopodite. Prefemoral process long and falciform, presenting a dorso-basal lobe, starting from an angle of 120°, involving the solenomere in its initial portion, subsequently ascending parallel to the solenomere and partially covering it in ectal view (Figs 30D-F). Solenomere long and falciform, not reaching the apex of the prefemoral process (Fig. 30E). Cingulum in basal position (Fig. 30F). Median portion of the solenomere with a rounded lobe, visible in ventral view (Fig. 30E). Apex of the solenomere sickle-shaped (Fig. 30E).

Female: Unknown.

Distribution. Known only from the type locality (Fig. 38).

Additional material. None.

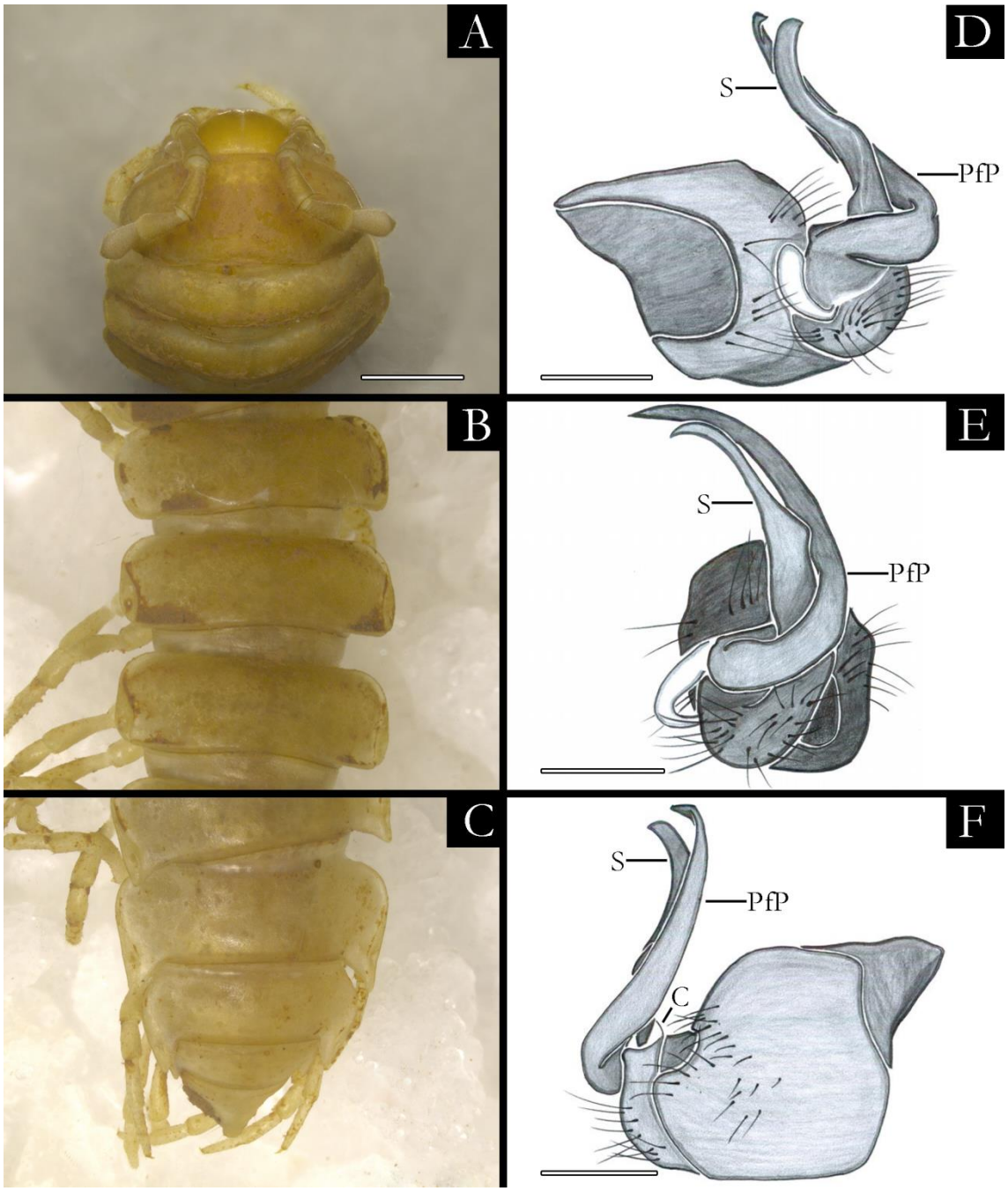


FIGURE 30. *Gangugia boitata* **sp. nov.** (holotype, IBSP 1061), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 0,5 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

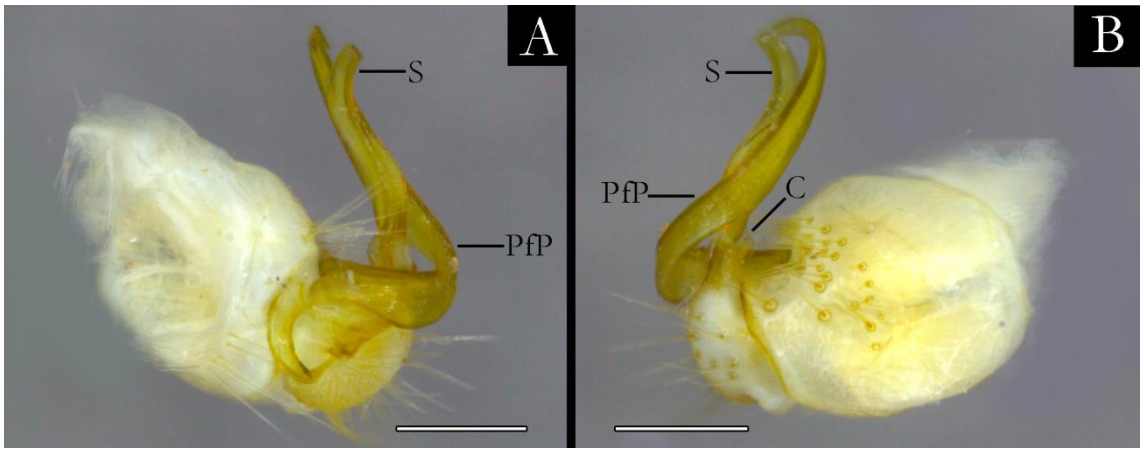


FIGURE 31. *Gangugia boitata* **sp. nov.** (holotype, IBSP 1061). Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 0,5 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

Gangugia cuca **sp. nov.**

Figures 32-33, 38

Type material. Male holotype from Fazenda Sandoval, Porto Nacional (10°42'30"S, 48°25'01"W), Tocantins, Brazil, 28.XI.2013, A. Chagas-Jr & A. Giupponi coll., deposited in IBSP 7600. Paratype: one male with the same data of the holotype, deposited in CZUFMT MYR 838.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Cuca". According to the legend, of Portuguese origin, it is a frightening old witch who has an alligator head, and kidnaps disobedient children.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: absence of indentations in the prefemoral process (Figs 32D, 33A); prefemoral process not reaching the apex of the solenomere (Figs 32D-F) and the prefemoral process not completely involving the solenomere, in ectal view (Figs 32E-F).

Description. Male (Holotype, IBSP 7600). Coloration (long-preserved in 70% ethanol): Head ocher, with area around the antennae and the dorsal groove of the head with brownish coloration. Antennae ocher with the dorsal region of each antennomere presenting brown coloration, the seventh antennomere totally brownish, having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body presenting metazonite with its anterior portion reddish brown and the posterior

portion yellowish whitish, prozonite presenting the anterior portion whitish yellow and the posterior portion brown reddish (Figs 32A-C). Gnathochilarium covered by several setae, with the exception of the stipes weakly/ sparsely covered. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with two pairs of intumescences also covered by setae, the posterior pair being less conspicuous, seventh sternite without projections and the others post-gonopod sternites presenting pairs of small triangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs whitish yellow; presence of a pronounced dorsal lobe in the prefemur of the anterior legs; slight ventro-apical projections in the prefemur in the post-gonopod legs; absence of granules; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated and straight. Telson whitish yellow; hypocroct triangular with two setae. Total length: 51.57. Width total: 8.31. Collum, long 2.93, width 8.00. Antennomere lengths (1>7): 0.69; 1.63; 1.65; 1.50; 1.58; 1.40; 0.30. Podomeres lengths (1>7): 0.83; 1.63; 2.35; 0.97; 1.18; 1.44; 0.50. Gonopod aperture, long 1.42, width 2.91. Telson, long 0.97. Gonopod: long 2.33, width 1.75. Coxaee: long 0.83, width 1.05. Telopodite: long 2.23, width 0.78. Prefemoral region 1/3 the size of telopodite. Prefemoral process as a short blade, elliptical and acute, presenting a dorso-basal lobe, starting from an angle of 90°, ascending parallel to the solenomere and partially covering it in mesal view (Figs 33A-B). Solenomere long, broad in the middle portion due to the presence of the cingulum and narrowing at apex zone (Figs 32D-E). Cingulum in medial position (Fig. 32F). Apex of the solenomere sickle-shaped (Figs 32E-F).

Female: Unknown.

Distribution. Known only from the type locality (Fig. 38).

Additional material. None.

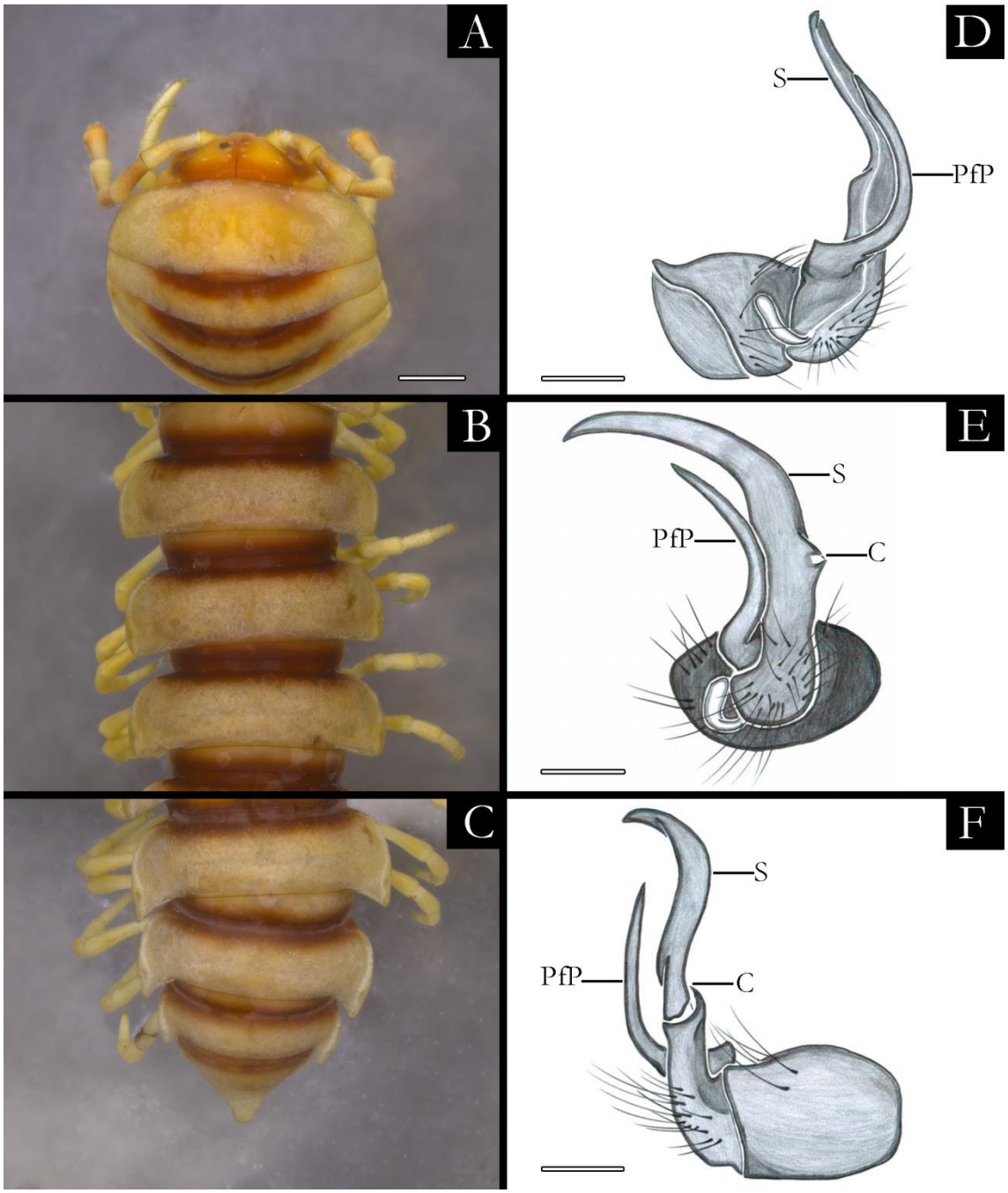


FIGURE 32. *Gangugia cuca* **sp. nov.** (holotype, IBSP 7600), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 0,5 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

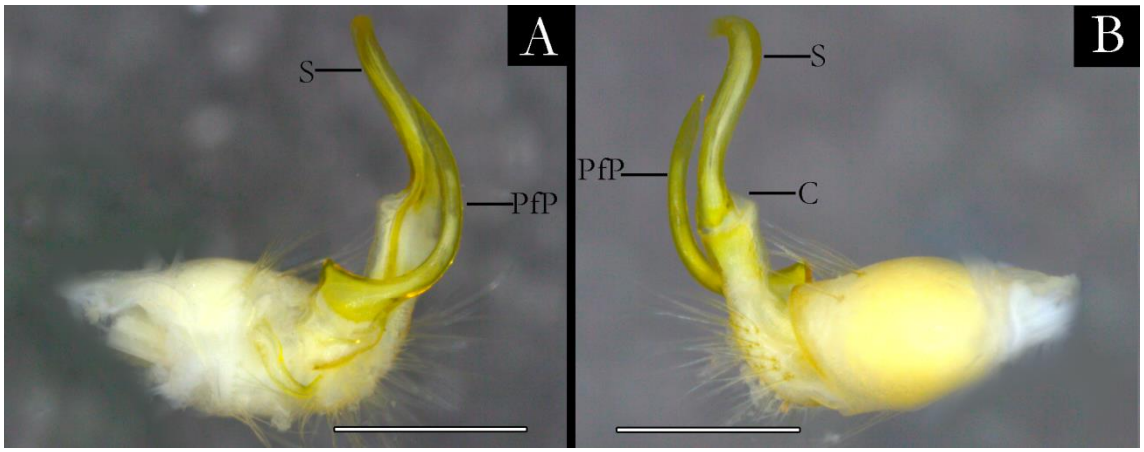


FIGURE 33. *Gangugia cuca* **sp. nov.** (holotype, IBSP 7600). Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

Gangugia boto **sp. nov.**

Figures 34-35, 38

Type material. Male holotype from FLONA Carajás (06°00'32"S, 49°58'13"W), Pará, Brazil, 19-24.i.2012, R. Andrade *et al.* coll., deposited in IBSP 7539.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Boto cor-de-rosa". According to the legend, of indigenous origin, the "pink dolphin", which lives in the Amazonian's rivers, turns into a beautiful man on the nights of full moon to get pregnant women. In the next day, he turns into a Boto again.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: legs from the fifth to the eighth segment with ventral projections in the coxae (Fig. 35C); presence of a sigmoid curvature at the apex of the solenomere (Figs 35A-B) and presence of an elongated secondary process in the prefemoral process (Figs 34D-E).

Description. Male (Holotype, IBSP 7539). Coloration (long-preserved in 70% ethanol): Head ocher. Antennae ocher yellowish, with the seventh antennomere having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body brown, with the lateral border of the paranota and the posterior edge of the metaterga yellowish ocher (Figs 34A-B). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and stipes

weakly/ sparsely covered by thick setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view straight; posterior edge of the paranota sub-retangular; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with only the anterior pair of intumescences present, seventh sternite with a pair of projections, eighth and ninth sternites presenting prominent pairs of rounded projections and the others presenting triangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher. Legs from the fifth to the eighth segment with ventral projections in the coxae being the posterior pair of the sixth segment extremely elongated, conspicuous dorsal lobe in the prefemur of the legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the postfemur, tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring broad (Fig. 34C); the posterior margin excavated, concave and with stretch marks, also presenting a central sub triangular support. Telson lost. Long partial: 48.13 (until segment 16). Width total: 10.76. Collum, long 3.27, width 10.56. Antennomere lengths (1>7): 0.96; 2.13; 1.69; 1.65; 1.52; 1.69; 0.40. Podomeres lengths (1>7): 1.17; 1.27; 3.03; 1.28; 1.92; 2.00; 0.50. Gonopod aperture, long 2.90, width 4.55. Gonopod: long 3.69, width 2.64. Coxae: long 1.70, width 1.17. Coxae globose, about 1/2 the size of the telopodite. Telopodite: long 3.15, width 1.45. Prefemoral region short (Figs 35A-B). Prefemoral process (Figs 34D-F) long and curve, presenting a dorso-basal lobe, starting from an angle of 120°, involving the solenomere in its initial portion and subsequently ascending parallel to the solenomere and partially covering it in ectal view (Fig. 34F); in its anterior portion presents an elongated, thin and acuminate secondary process (Fig. 34D). Solenomere long and having a lateral expansion (Figs 34D-E), but not reaching the apex of the prefemoral process. Cingulum in basal position, covered by the prefemoral process. Apex of the solenomere with descending sigmoid curvature (Fig. 34E).

Female: Unknown.

Distribution. Known only from the type locality (Fig. 38).

Additional material. None.

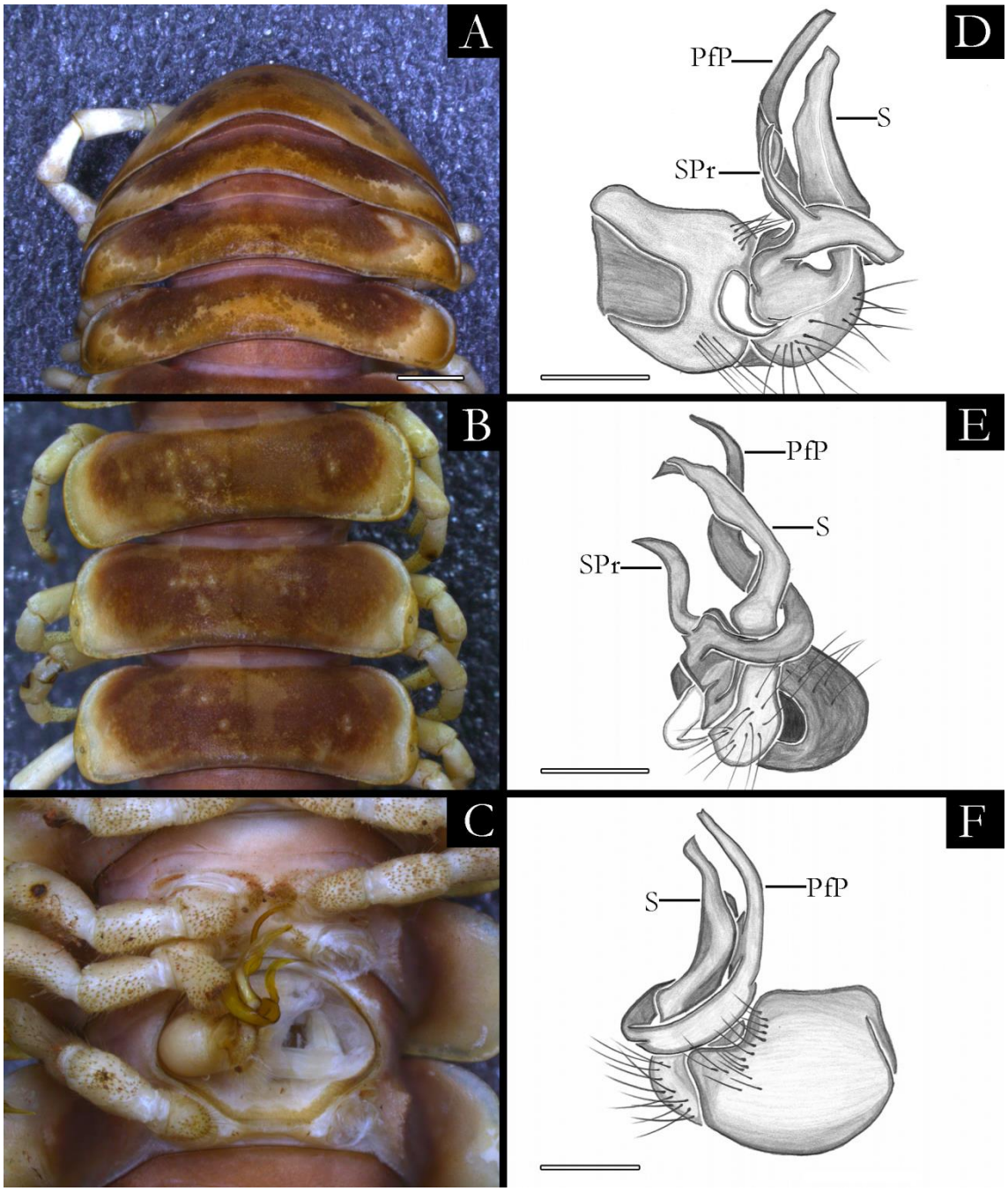


FIGURE 34. *Gangugia boto* **sp. nov.** (holotype, IBSP 7539), dorsal views of anterior (A), midbody (B) and ventral view of 6th and 7th (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

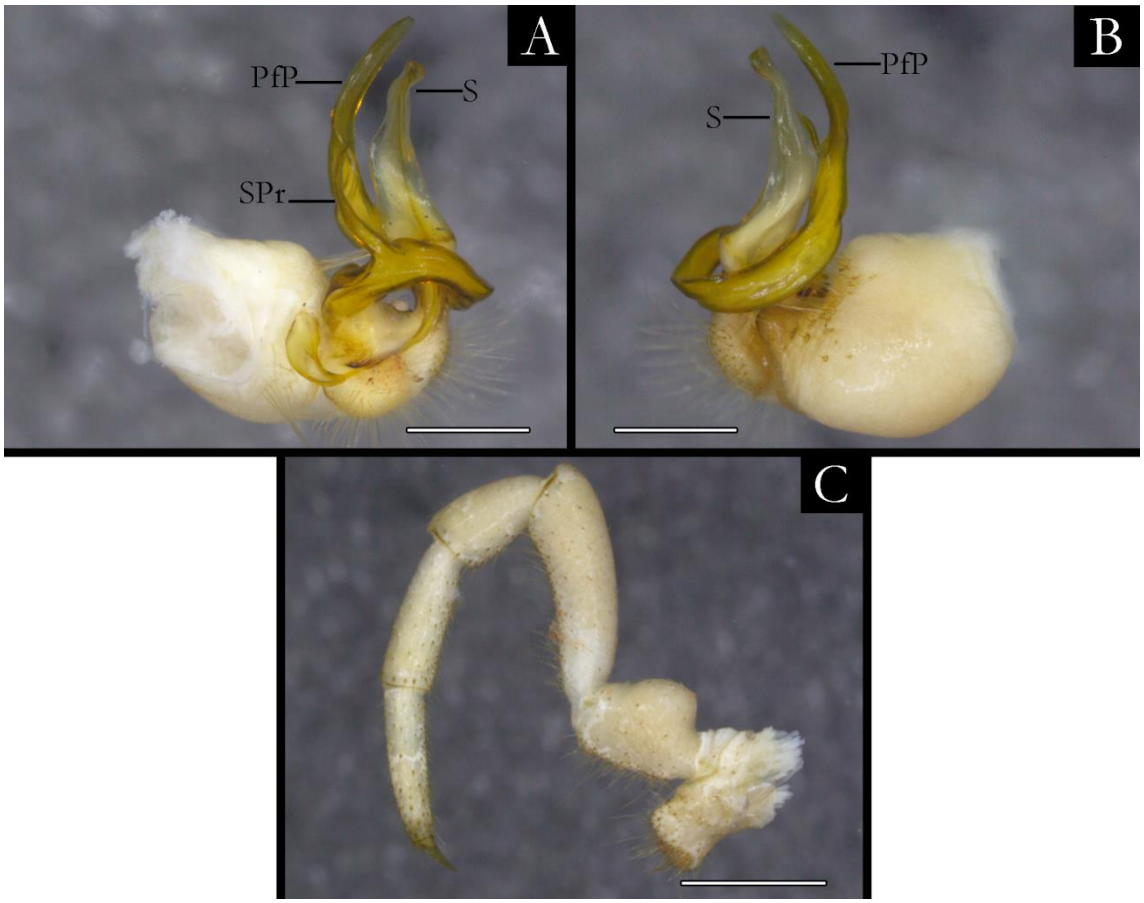


FIGURE 35. *Gangugia boto* **sp. nov.** (holotype, IBSP 7539). (A-B) Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 1 mm. (C), Leg of the 6th body ring. Scale bar: 2 mm. Abbreviations: PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

Gangugia mula sp. nov.

Figures 36-38

Type material. Male holotype from UHE Tucuruí, Tucuruí (03°42'01"S, 49°42'00"W), Pará, Brazil, 1984, Instituto Butantan Expedition coll., deposited in IBSP 277. Paratype: three females with the same data of the holotype, deposited in IBSP 274, IBSP 276, and IBSP 278.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Mula-sem-cabeça". According to the legend, of uncertain origin, it's a mule of brown color that in the place of the head displays a torch of fire.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: legs from the fifth to the eighth segment with ventral

projections in the coxae (Fig. 37C); presence of triangular lateral expansion near the apex of the solenomere (Fig. 36F) and presence of a short secondary process in the prefemoral process (Fig. 36D).

Description. Male (Holotype, IBSP 277). Coloration (long-preserved in 70% ethanol): Head light brown. Antennae ocher yellowish, with the seventh antennomere having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body brown, with the edge of the paranota lighter (Fig. 36A-C). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and stipes weakly/ sparsely covered by thick setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view straight; posterior edge of the paranota sub-retangular; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with only the anterior pair of intumescences present, seventh sternite with a pair of projections, eighth and ninth sternites presenting prominent pairs of rounded projections and the others presenting triangular projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher yellowish. Legs from the fifth to the eighth segment with ventral projections in the coxae being the posterior pair of the sixth segment extremely elongated, conspicuous dorsal lobe in the prefemur of the legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring broad; the posterior margin excavated, concave and with stretch marks, also presenting a reduced central sub triangular support. Telson ocher; hypocroct triangular with two setae, these without a projected base. Total length: 65.51. Width total: 11.50. Collum, long 3.44, width 10.82. Antennomere lengths (1>7): 0.95; 2.38; 2.14; 1.88; 1.79; 1.70; 0.35. Podomeres lengths (1>7): 1.19; 1.69; 2.99; 1.42; 1.86; 1.90; 0.45. Gonopod aperture, long 2.46, width 4.87. Telson, long 1.41. Gonopod: long 3.42, width 3.07. Coxae: long 1.51, width 1.36. Coxae globose, about 1/2 the size of the telopodite. Telopodite: long 3.33, width 1.62. Prefemoral region short (Figs 37A-B). Prefemoral process (Fig. 36D-F) long and curve, presenting a dorso-basal lobe, starting from an angle of 120°, involving the solenomere in its initial portion and subsequently ascending parallel to the solenomere and partially covering it in ectal view (Fig. 36F); in its anterior portion

presents an elongated, thin and acuminate secondary process (Fig. 36D). Solenomere long, curve and having a lateral expansion (Fig. 36F), but not reaching the apex of the prefemoral process. Cingulum in basal position, covered by the prefemoral process. Apex of the solenomere abruptly descending (Figs 36D-E).

Female (IBSP 276): Body as in male, except for the legs; without modifications. Total length: 75.74. Width total: 11.46. Antennomere lengths (1>7): 0.74; 2.07; 1.98; 1.70; 1.66; 1.75; 0.35. Podomeres lengths (1>7): 1.10; 1.29; 3.048; 1.040; 1.28; 1.62; 0.32. Telson, long 1.35. Epigyne rounded with irregular edges (Fig. 37D). Vulvae (Figs 37E-F): long 2.20, width 0.88. External valve: long 1.17, width 0.39. Internal valve: long 1.17, width 0.43. Operculum: long 0.32, width 0.62.

Distribution. Known only from the type locality (Fig. 38).

Additional material. None.

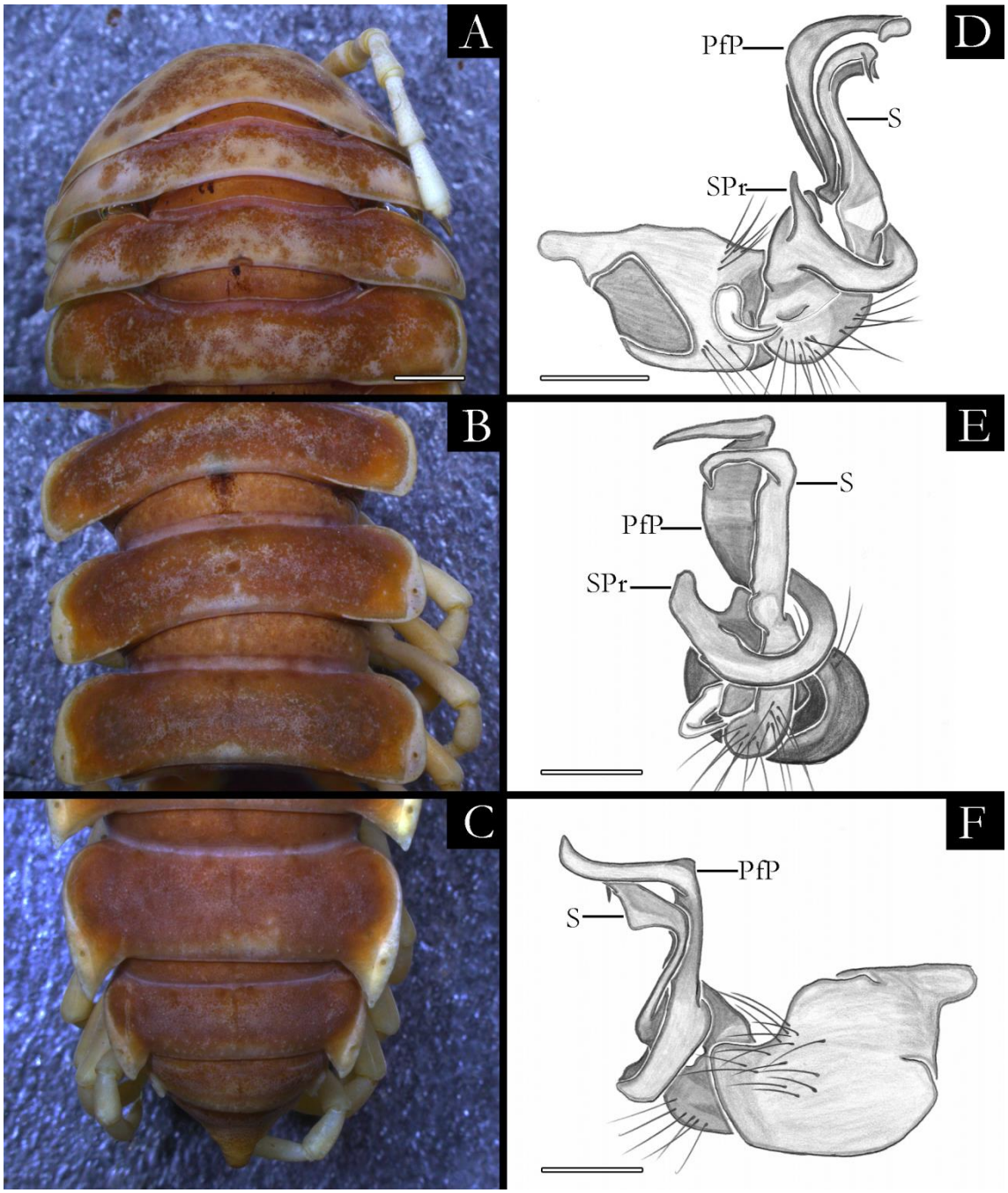


FIGURE 36. *Gangugia mula* **sp. nov.** (holotype, IBSP 277), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: PfP, prefemoral process; SPr, secondary process of the prefemoral process; S, solenomere.

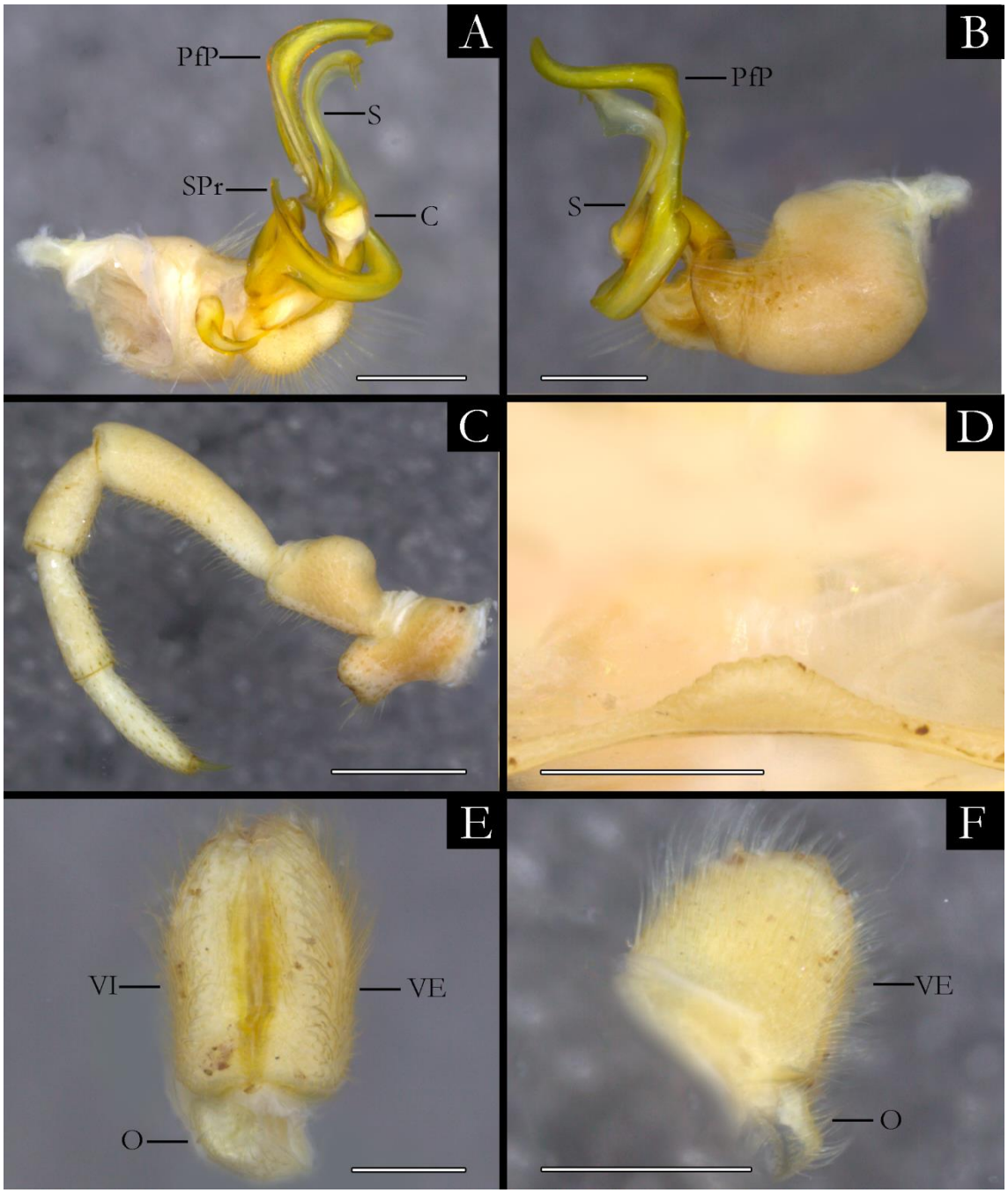


FIGURE 37. *Gangugia mula* **sp. nov.** (holotype, IBSP 277). Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 1 mm. (C), Leg of the 6th body ring. Scale bar: 2 mm. Left vulva (IBSP 276). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 1 mm. Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere; SPr, secondary process of the prefemoral process.

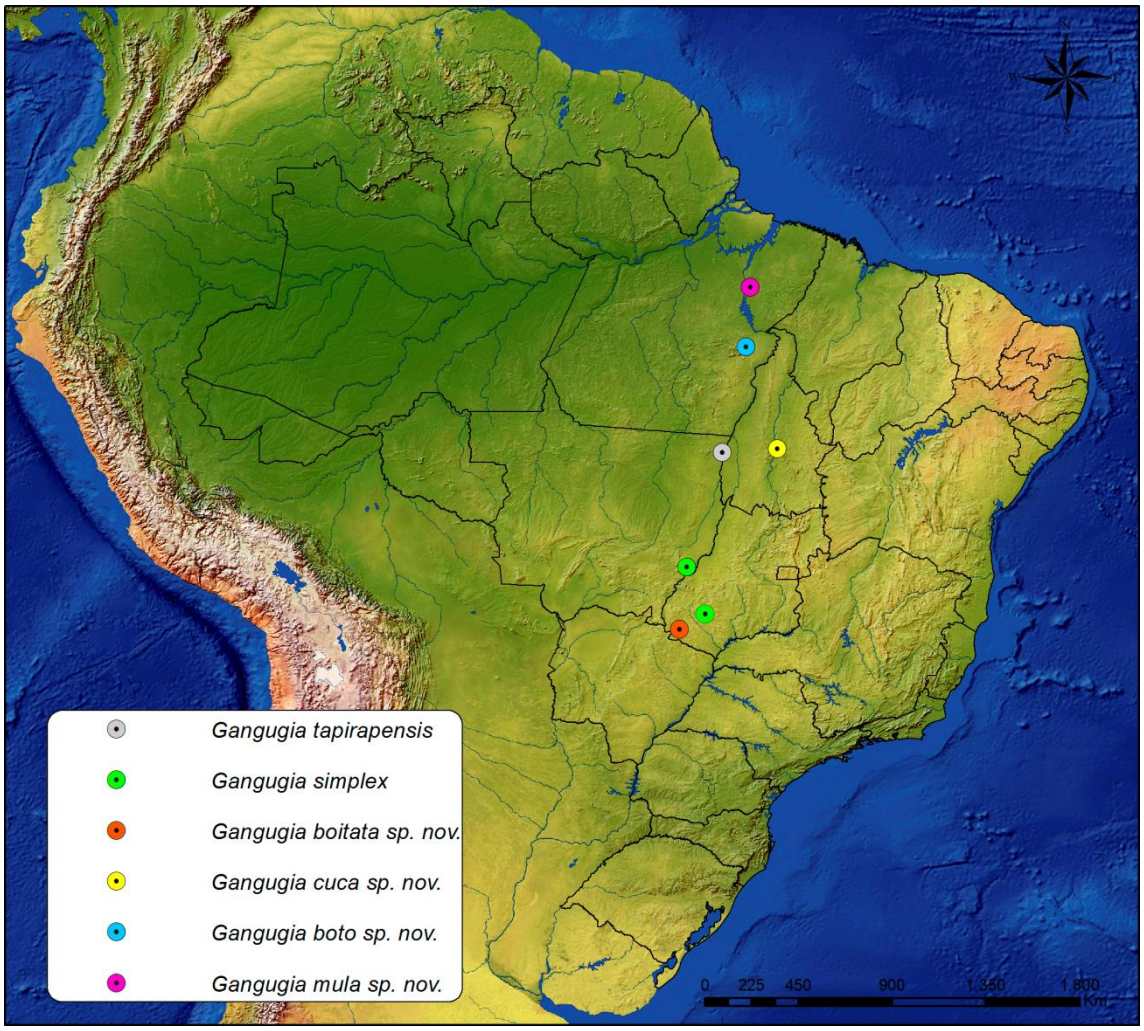


FIGURE 38. Distribution map of *Gangugia* species.

Angelodesmus Schubart, 1962

Angelodesmus Schubart, 1962: 258. Type species: *A. costalimai* Schubart, 1962, by original designation; Hoffman, 1976: 173; Hoffman, 1980: 151; Shelley *et al.*, 2000: 84

Diagnosis. Males of *Angelodesmus* differ from those of other Arthrosolaenomeridini genera by the combination of the following characters: stipes of the gnathochilarium with lateral folds; gonocoxae with acuminate shaped, in ectal view (Fig. 39F); dorso-basal lobe in the prefemoral process absent (Fig. 39D); apex of the solenomere with the terminal zone marked by a stretch mark (Figs 39D, F).

Redescription: *General characters:* Coloration (specimen long preserved in 70% ethanol) whitish yellow, paranota tip and posterior border of the metaterga slightly whitish. Sternite of sixth body ring with two pairs of ventral projections; seventh body

ring without projections and sternites after the gonopod with two pairs of rounded ventral projections (Fig. 4D). Paranota form: round (Fig. 39B). Legs: without modifications only a slightly dorsal lobe on prefemur (Fig. 4C).

Male characters: posterior edge of the gonopod aperture without projections. Gonopods: gonopod coxae equivalent to about half the length of the telopodite, cylindrical and acuminated in ectal view, without a spiniform process (Fig. 40B). Prefemoral process: elongate and thin, without a dorso-basal process (Fig. 40A). Cingulum in a middle position (Fig. 40B). Solenomere also long and thin with your apex ascending (Fig. 40A).

Female characters: unknown.

Distribution. State of Goiás, Brazil (Fig. 55).

Composition. One species described: *Angelodesmus costalimai* Schubart, 1962.

Angelodesmus costalimai Schubart, 1962

Figures 39-40, 55

Angelodesmus costalimai Schubart, 1962: 258, figs 3−4. Male holotype from Jataí (17° 52'54"S, 51°42'51"W), Goiás, Brazil, I.1955, M. Carrera coll., deposited in MZSP, examined; Hoffman, 1976: 174.

Diagnosis. The same characteristics of the genus.

Redescription. Male (Holotype, MZSP): Coloration (long-preserved in 70% ethanol): Head and antennae ocher whitish with the seventh antennomere having three well-demarcated invaginations and one slight invagination between the sensory cones. Body ocher with the edges of the paranota whitish (Figs 39A-C). Gnathochilarium: *lingual plate* covered completely by sparsely setae; *promentum* only centrally covered by setae, with smooth edges and *stipes* completely covered by sparsely setae and positioned mainly in the median region, presenting lateral folds. Body rings: cuticle slightly rough; alignment of paranota in posterior view straight; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternites of the fifth and sixth segments with two pairs of intumescences also covered by setae,

the posterior pair less conspicuous, seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small rounded projections. Leg pair of the third body ring missing. Legs whitish; presence of a slight dorsal lobe in the prefemur of the anterior legs; absence of ventro-apical projection in the prefemur, granules and ventral setae in the podomeres. Gonopod aperture on seventh body ring with the posterior margin excavated, concave and smooth. Telson ocher whitish; hypocroct not prominently triangular, presenting two setae, these without a projected base. Total length: 52.69. Width total: 10.5. Collum, long 1.97, width 6.67. Antennomere lengths (1>7): 0.66; 1.74; 1.53; 1.33; 1.29; 1.29; 0.37. Podomeres lengths (1>7): 0.91; 1.13; 2.16; 0.99; 1.28; 1.51; 0.42. Gonopod aperture, long 1.10, width 2.02. Telson, long 1.22. Gonopod: long 2.14, width 1.50. Coxae: long 0.68, width 0.91. Telopodite: long 2.14, width 0.72. Prefemoral process long (size equal to the solenomere), sinuous and narrow, covering the apex of the solenomere (Figs 40A-B). Solenomere long and narrow (Fig. 39D). Cingulum in medial position (Fig. 39F). Apex of the solenomere acuminate and ascending with the terminal zone marked by a stretch mark (Figs 39D, F).

Female: Unknown.

Distribution. Known only from the type locality (Fig. 55).

Additional material. None.

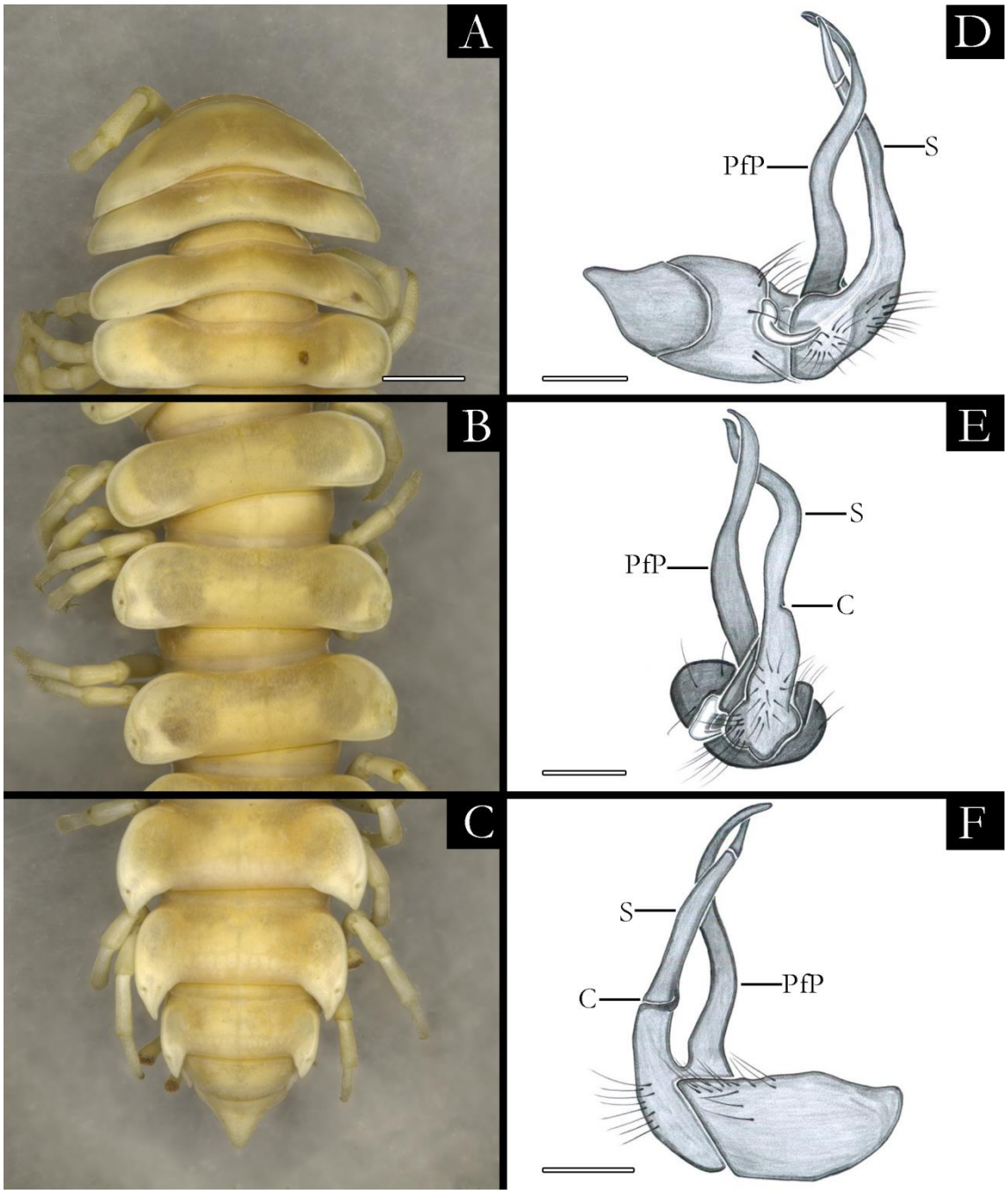


FIGURE 39. *Angelodesmus costalimai* (holotype, MZSP), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 0,5 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

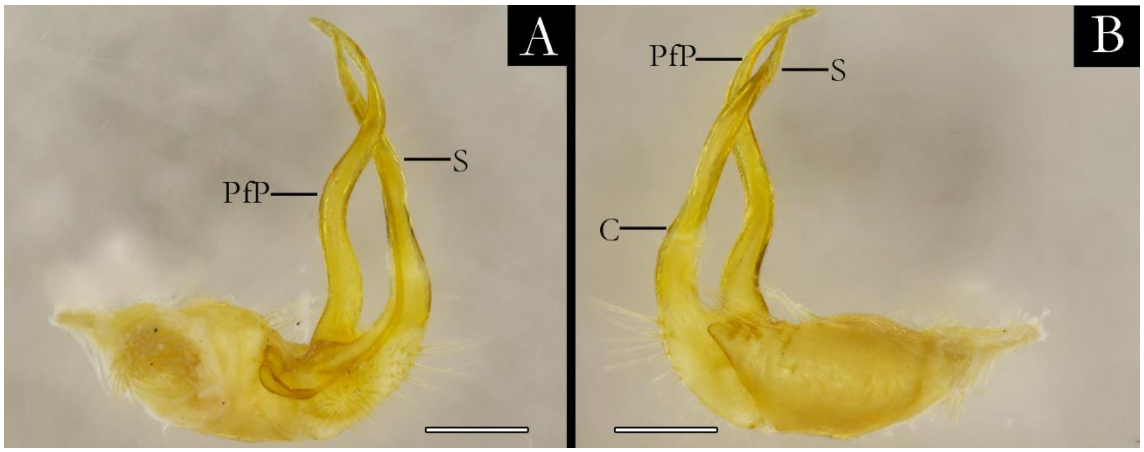


FIGURE 40. *Angelodesmus costalimai* (holotype, MZSP). Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

***Abiliodesmus* gen. nov.**

Type species. *Abiliodesmus planaltensis* **comb. nov.** (Schubart, 1960).

Etymology. The genus name is taken as a noun in apposition honoring a very important person in life for the first author, considered a great storyteller with the combining stem "-desmus," meaning band, commonly used in generic names in this order of millipedes.

Diagnosis. Males of *Abiliodesmus* **gen. nov.** differ from those of other Arthrosolaenomeridini genera by the combination of the following characters: slightly dorsal lobe on prefemur in the legs (Figs 4C-D); lateral macrosetae dispersed on the gonocoxae, in mesal view (Fig. 41D); cingulum with a basal position (Fig. 41F); and presence of a membranous lateral flap at the apex of the solenomere (Fig. 46D) (absent in *Abiliodesmus* mapinguari **sp. nov.**).

Description: *General characters:* Body length between 34.63 mm (*A. defensor* **comb. nov.**) and 69.15 mm (*A. mapinguari* **sp. nov.**). Coloration (specimens long preserved in 70% ethanol) variable between species, ranging from ocher to reddish brown, paranota tip and posterior border of the metaterga slightly whitish. Sternite of sixth body ring without ventral projections (present in *A.* mapinguari **sp. nov.**); seventh with a pair of ventral projections (absent in *A. cataractae* **comb. nov.**) and sternites after the gonopod with two pairs of acuminate ventral projections (Fig. 3F) (absent in *A. cataractae* **comb. nov.** and rounded in *A. mapinguari* **sp. nov.**). Paranota form: round to slightly

rectangular (Figs 41B, 46B). Legs: without modifications only a slightly dorsal lobe on prefemur (Fig. 4C).

Male characters: posterior edge of the gonopod aperture with a small projection (absent in *A. mapinguari* **sp. nov.**). Gonopods: gonopod coxae equivalent to about half the length of the telopodite, cylindrical, without a spiniform process (Fig. 43B). Prefemoral process: elongate and thin with a dorso-basal process (Fig. 41D). Cingulum in a basal position (Fig. 46F). Solenomere long with your apex ascending and lateral membranous expansion (Fig. 46D) (absent in *A. mapinguari* **sp. nov.**).

Female characters: vulvae (Figs 42C-D): oval-shaped, having different proportions in lateral view.

Distribution. States of Tocantins, Goiás and São Paulo (Fig. 51).

Composition. Three species described: *Abiliodesmus planaltensis* **comb. nov.** (Schubart, 1960); *Abiliodesmus cataractae* **comb. nov.** (Hoffman, 1976); *Abiliodesmus defensor* **comb. nov.** (Hoffman, 1976), and one new species: *Abiliodesmus mapinguari* **sp. nov.**

Key to males

1. Prefemoral process involving completely the solenomere, in ectal view.....2
   Prefemoral process involving the solenomere only in mesal view…….....3
2. Presence of secondary process at the apex of the prefemoral process (Fig. 48D).....*A. mapinguari* **sp. nov.**
   Absence of a secondary process in the apex of the prefemoral process……..*A. defensor* **comb. nov.**
3. Apex of the solenomere wide (Fig. 44D).....*A. cataractae* **comb. nov.**
   Apex of the solenomere narrow (Fig. 41D).....*A. planaltensis* **comb. nov.**

Abiliodesmus planaltensis (Schubart, 1960) **new combination**

Figures 41-43, 51

Arthrosolaenomeris planaltensis Schubart, 1960: 453, figs 1−2. Male holotype from Jaci (20°52'56"S, 49°34'11"W), Mirassol, São Paulo, Brazil, 11.I.1950, O. Schubart coll., deposited in MZSP 1086, examined.

Angelodesmus planaltensis:-- Hoffman, 1976: 176.

Diagnosis. Adult males differ from all other species of the genus by the presence of a narrow lateral expansion in the solenomere (Figs 42B, 43B).

Redescription. Male (Holotype, MZSP 1086): Coloration (long-preserved in 70% ethanol): Head and antennae ochers with the seventh antennomere having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body ocher with the edges of the paranota whitish (Figs 41A-C). Gnathochilarium: *lingual plate* covered completely by sparsely setae; *promentum* only centrally covered by setae, with smooth edges and *stipes* covered by sparsely setae, mainly in its lower portion. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of intumescences covered by setae, the posterior pair less conspicuous, and sixth sternite without modifications; seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small acute projections. Leg pair of the third body ring missing. Legs ochers; presence of a pronounced dorsal lobe in the prefemur of the anterior legs; absence of ventro-apical projection in the prefemur and granules; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated, with a fold and stretch marks. Telson ocher; hypocroct triangular with two setae. Total length: 50.84. Width total: 7.48. Collum, long 1.87, width 6.68. Antennomere lengths (1>7): 0.61; 1.67; 1.30; 1.12; 1.37; 1.30; 0.38. Podomeres lengths (1>7): 0.70; 0.94; 2.20; 0.97; 1.12; 1.55; 0.43. Gonopod aperture, long 1.29, width 2.34. Telson, long 0.81. Gonopod: long 2.71, width 2.11. Coxae: long 0.84, width 0.98. Telopodite: long 2.56, width 1.12. Prefemoral process long (slightly larger than the solenomere) and narrow (Fig. 41D). Solenomere long (Fig. 41F), presence of a lateral membranous expansion (Figs 41E-F). Cingulum in basal position (Fig. 41F). Apex of the solenomere acuminate and ascending (Fig. 41D).

Female (IBSP 3569): Body as in male. Total length: 54.76. Width total: 8.18. Antennomere lengths (1>7): 0.49; 1.69; 1.38; 1.46; 1.34; 1.11; 0.30. Podomeres lengths (1>7): 0.82; 0.99; 2.18; 0.78; 1.02; 1.43; 0.59. Telson, long 1.72. Epigyne rounded with regular edges (Fig. 42E). Vulvae (Fig. 42C-D): long 1.20, width 0.57. External valve: long 0.81, width 0.26. Internal valve: long 0.78, width 0.27. Operculum: long 0.37, width 0.45.

Distribution. São Paulo, Brazil (Fig. 51).

Additional material. BRAZIL: *São Paulo:* Monte Aprazível (20°46'21"S, 49°42'51"W), Fazenda São José do Varjão, three females and one juvenile, 09.I.1950, O. Schubart coll. (MZSP 1084); Ribeirão Preto (21°10'39"S, 47°48'37"W), Mata Santa Tereza, three males and one female, 06-11.I.2006, I. Cizauskas coll. (IBSP 3569); four males and one female, 06-11.I.2006, I. Cizauskas coll. (IBSP 3570).

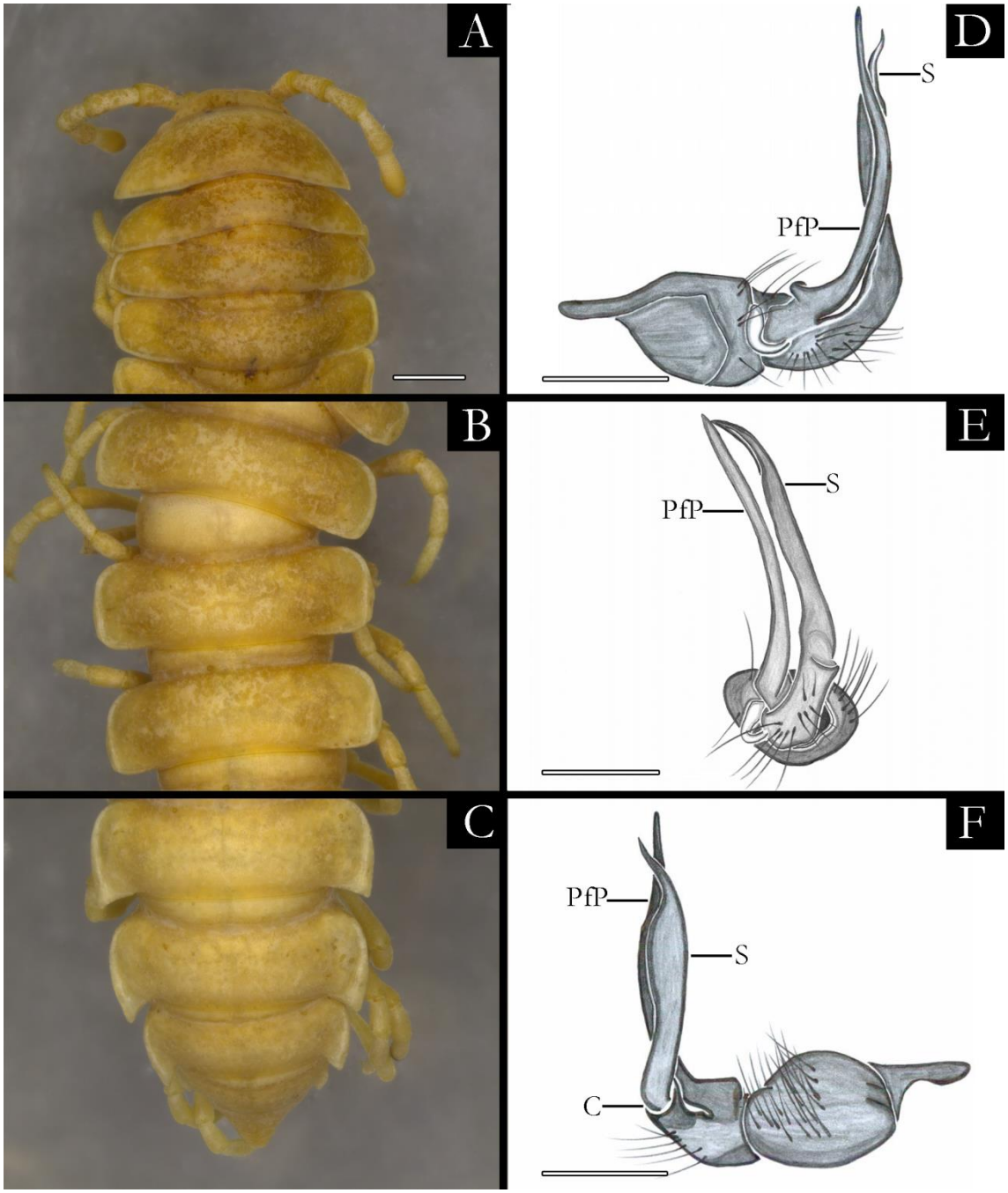


FIGURE 41. *Abiliodesmus planaltensis* **comb. nov.** (holotype, MZSP 1086), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left

gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

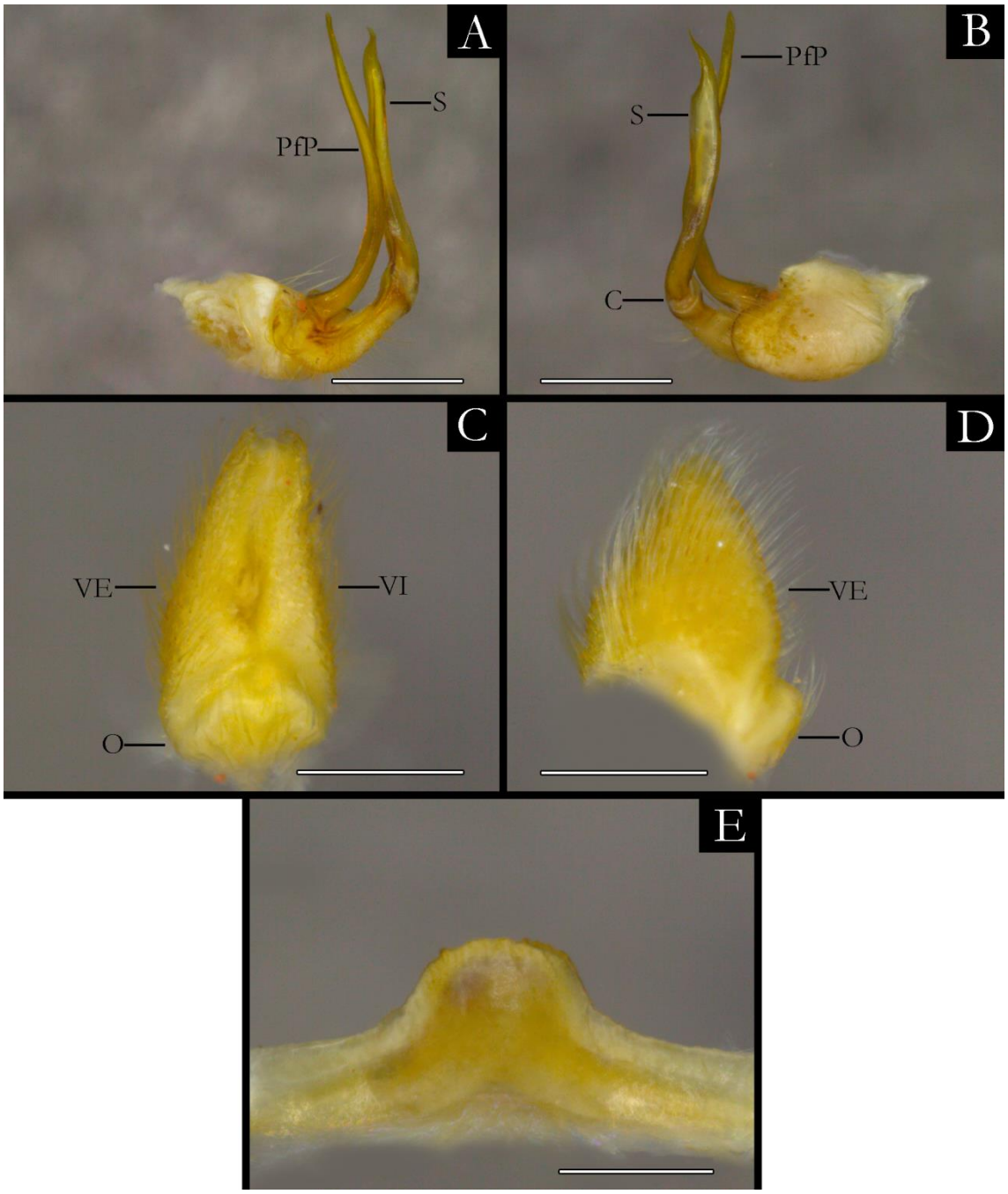


FIGURE 42. *Abiliodesmus planaltensis* **comb. nov.** Left gonopod (holotype, MZSP 1086), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (IBSP 3569). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 0,5 mm. Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere.

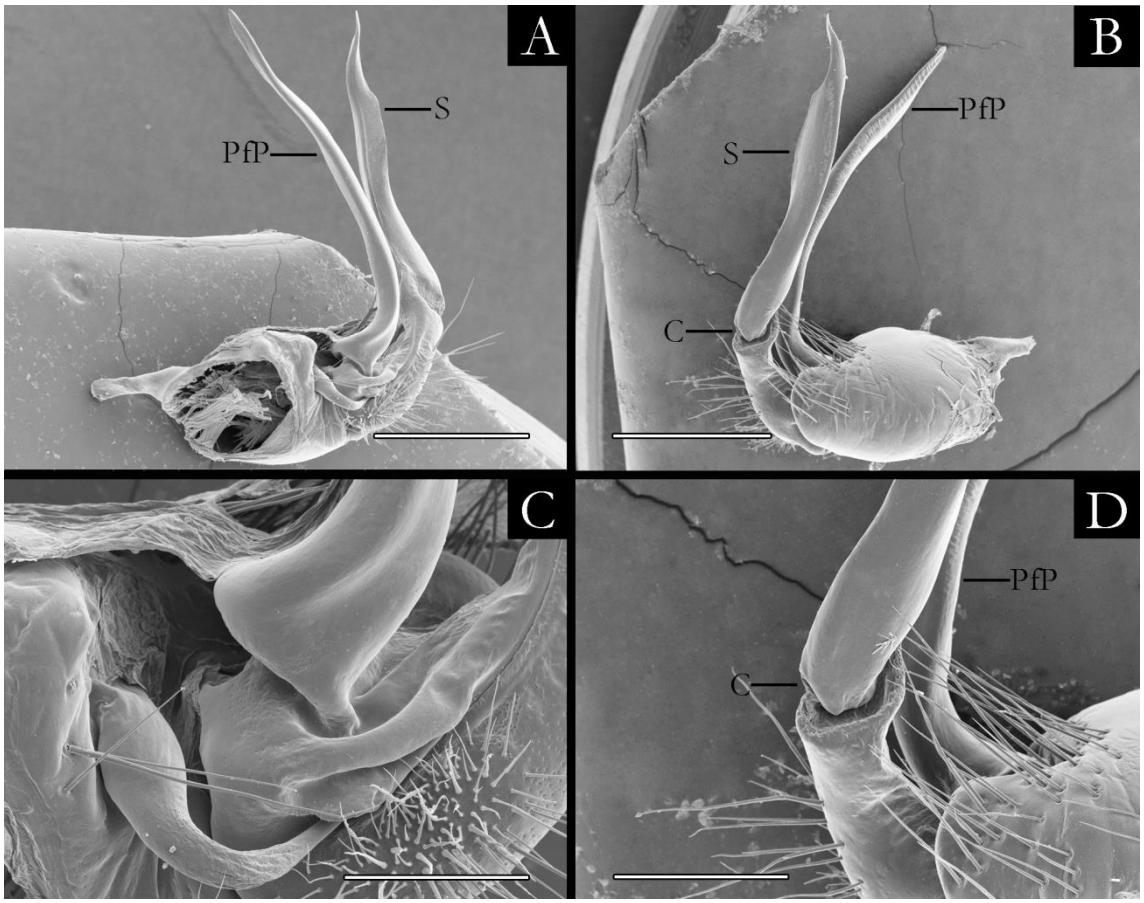


FIGURE 43. *Abiliodesmus planaltensis* **comb. nov.** (IBSP 3570), left gonopod. A, mesal view; B, ectal view; C, detail of dorso-basal lobe of the prefemoral process, mesal view; D, detail of cingulum. Scale bars: 1 mm (A-B); 0,3 mm (C); 0,5 mm (D). Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

Abiliodesmus cataractae (Hoffman, 1976) **new combination**

Figures 44-45, 51

Angelodesmus cataractae Hoffman, 1976: 174, figs 1−6. Male holotype and female paratype from Fazenda Cachoeirinha, Jataí (17°52'54"S, 51°42'51"W), Goiás, Brazil, XI.1962, Departamento de Zoologia Expedition coll., deposited in MZSP 1065 and 1066, respectively, examined.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: sternite of seventh body ring without ventral projections, presence of a large lateral expansion in the solenomere (Figs 44D-E) and the prefemoral process not involving the solenomere, in ectal view (Fig. 44E).

Redescription. Male (Holotype, MZSP 1065): Coloration (long-preserved in 70% ethanol): Head and antennae ochers with the seventh antennomere having three well-demarcated invaginations and one slight invagination between the sensory cones. Body

ocher with the edges of the paranota whitish (Figs 44A-C). Gnathochilarium: *lingual plate* covered completely by sparsely setae; *promentum* only centrally covered by setae, with smooth edges and *stipes* covered by sparsely setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view straight; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, fifth sternite with two pairs of intumescences covered by setae, the posterior pair less conspicuous, others sternites without modifications. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher yellowish, presence of a slight dorsal lobe in the prefemur of the anterior legs; absence of ventro-apical projection in the prefemur and granules; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated with a fold and stretch marks. Telson ocher; hypocroct triangular with two setae. Total length: 37.14. Width total: 5.88. Collum, long 1.83, width 5.52. Antennomere lengths (1>7): 0.52; 1.40; 1.25; 1.09; 1.03; 1.17; 0.30. Podomeres lengths (1>7): 0.69; 0.88; 1.98; 0.83; 1.03; 1.39; 0.45. Gonopod aperture, long 1.14, width 1.93. Telson, long 0.95. Gonopods: lost.

Female (paratype, MZSP 1066): Body as in male. Total length: 35.90. Width total: 5.64. Antennomere lengths (1>7): 0.51; 0.91; 1.06; 1.06; 0.83; 1.16; 0.22. Podomeres lengths (1>7): 0.50; 0.74; 1.64; 0.55; 0.70; 1.13; 0.38. Telson, long 0.81. Epigyne rounded with regular edges (Fig. 45C). Vulvae (Figs 45A-B): long 0.95, width 0.50. External valve: long 0.63, width 0.22. Internal valve: long 0.64, width 0.22. Operculum: long 0.32, width 0.39.

Distribution. Known only from the type locality (Fig. 51).

Additional material. None

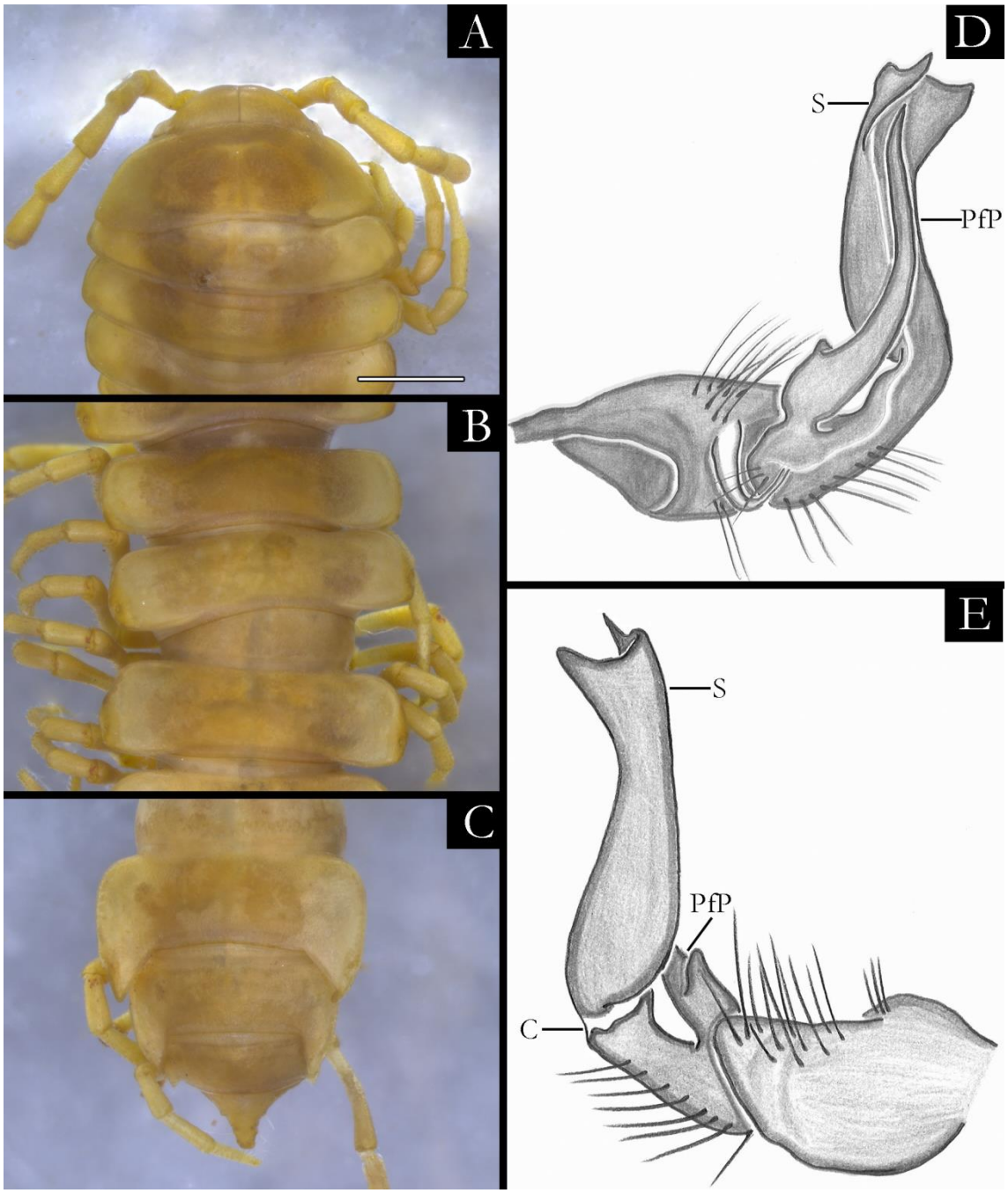


FIGURE 44. *Abiliodesmus cataractae* **comb. nov.** (holotype, MZSP 1065), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod (Modified by Hoffman, 1976). (D), mesal view; (E), ectal view. Scale bars: 0,5 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

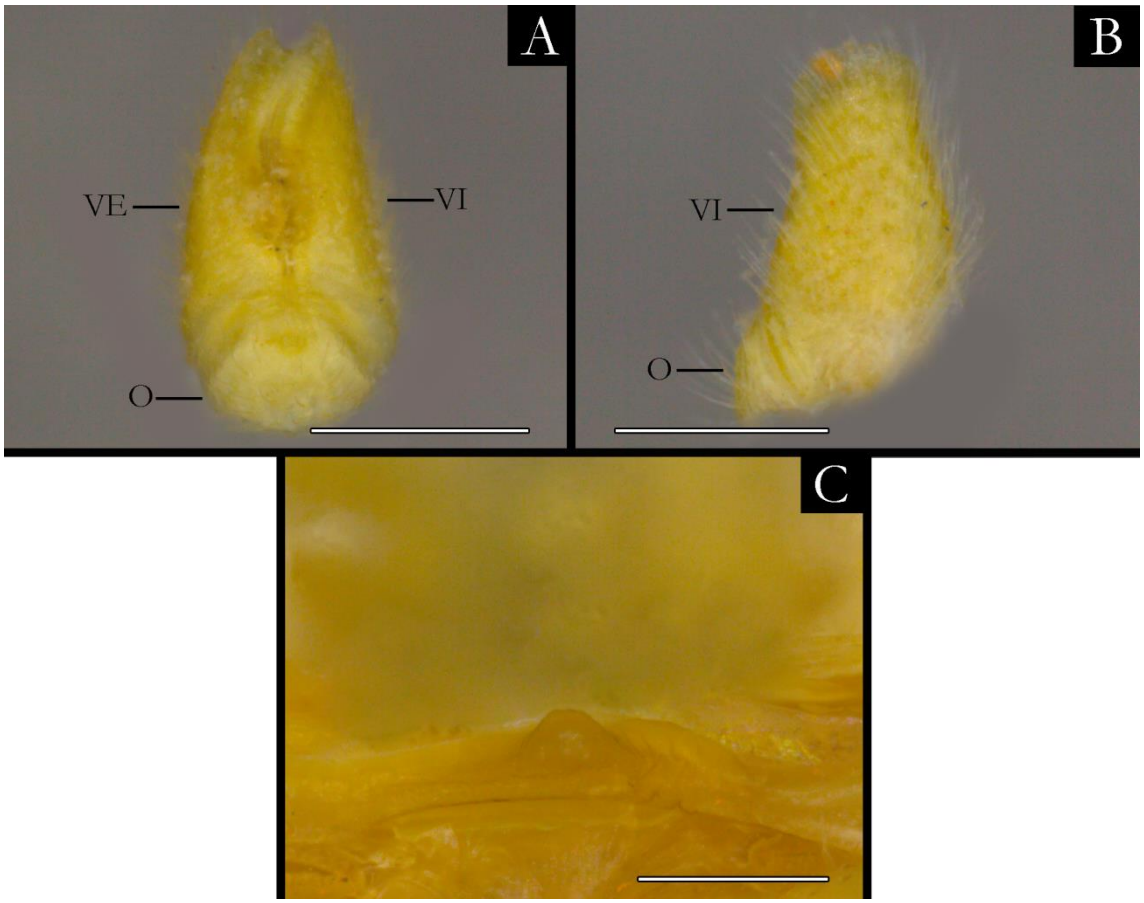


FIGURE 45. *Abiliodesmus cataractae* **comb. nov.** (paratype, MZSP 1066), left vulva. A, ventral view; B, lateral view; C, detail of the posterior margin of the vulvae opening. Scale bars: 0,5 mm. Abbreviations: EV, external valve; IV, internal valve; Op, operculum

Abiliodesmus defensor (Hoffman, 1976) **new combination**

Figures 46-47, 51

Angelodesmus defensor Hoffman, 1976: 174, figs 7−10. Male holotype from Fazenda Aceiro, Jataí (17°52'54"S, 51°42'51"W), Goiás, Brazil, XI.1962, R. Hoffman coll., deposited in MZSP 1067, examined. Paratypes: one male, with same data of the holotype, MZSP 1068; one male and one female with the same data of the holotype, deposited in VMNH 110613.1 and VMNH 110613.2, respectively, examined.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: presence of a wide lateral expansion in the solenomere (Fig. 46D) and the prefemoral process completely involving the solenomere, in ectal view (Fig. 46F).

Redescription. Male (Holotype, MZSP 1067): Coloration (long-preserved in 70% ethanol): Head and antennae ochers with the seventh antennomere having two well-demarcated invaginations and two slight invagination between the sensory cones (both antennae of the holotype are broken). Body ocher with the edges of the paranota whitish (Figs 46A-C). Gnathochilarium: *lingual plate* covered completely by sparsely setae; *promentum* only centrally covered by setae, with smooth edges and *stipes* covered by sparsely setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view straight; paranota with posterior edges rounded; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of intumescences covered by setae, the posterior pair less conspicuous, and sixth sternite without modifications; seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small acute projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher yellowish, presence of a slight dorsal lobe in the prefemur of the anterior legs; absence of ventro-apical projection in the prefemur and granules; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated, with a fold and stretch marks. Telson ocher; hypocroct not prominently triangular, presenting two setae, these without a projected base. Total length: 34.63. Width total: 5.26. Collum, long 1.39, width 4.62. Antennomere lengths (1>7): 0.46; 1.28; 1.09; 1.17; 1.18; 1.10; 0.34. Podomeres lengths (1>7): 0.55; 0.70; 1.74; 0.68; 0.79; 1.27; 0.39. Gonopod aperture, long 1.03, width 1.68. Telson, long 0.93. Gonopod: long 1.99, width 0.94. Coxae: long 0.58, width 0.29. Telopodite: long 1.99, width 0.65. Prefemoral process long (slightly larger than the solenomer) and narrow (Fig. 46E). Solenomere long with a lateral membranous expansion (Fig. 46D). Cingulum in basal position (Fig. 46F). Apex of the solenomere acuminate and ascending (Figs 47A-B).

Female (paratype, VMNH): Analyzed only by photos, see Hoffman (1976): 176 to taxonomic notes.

Distribution. Known only from the type locality (Fig. 51).

Additional material. None.

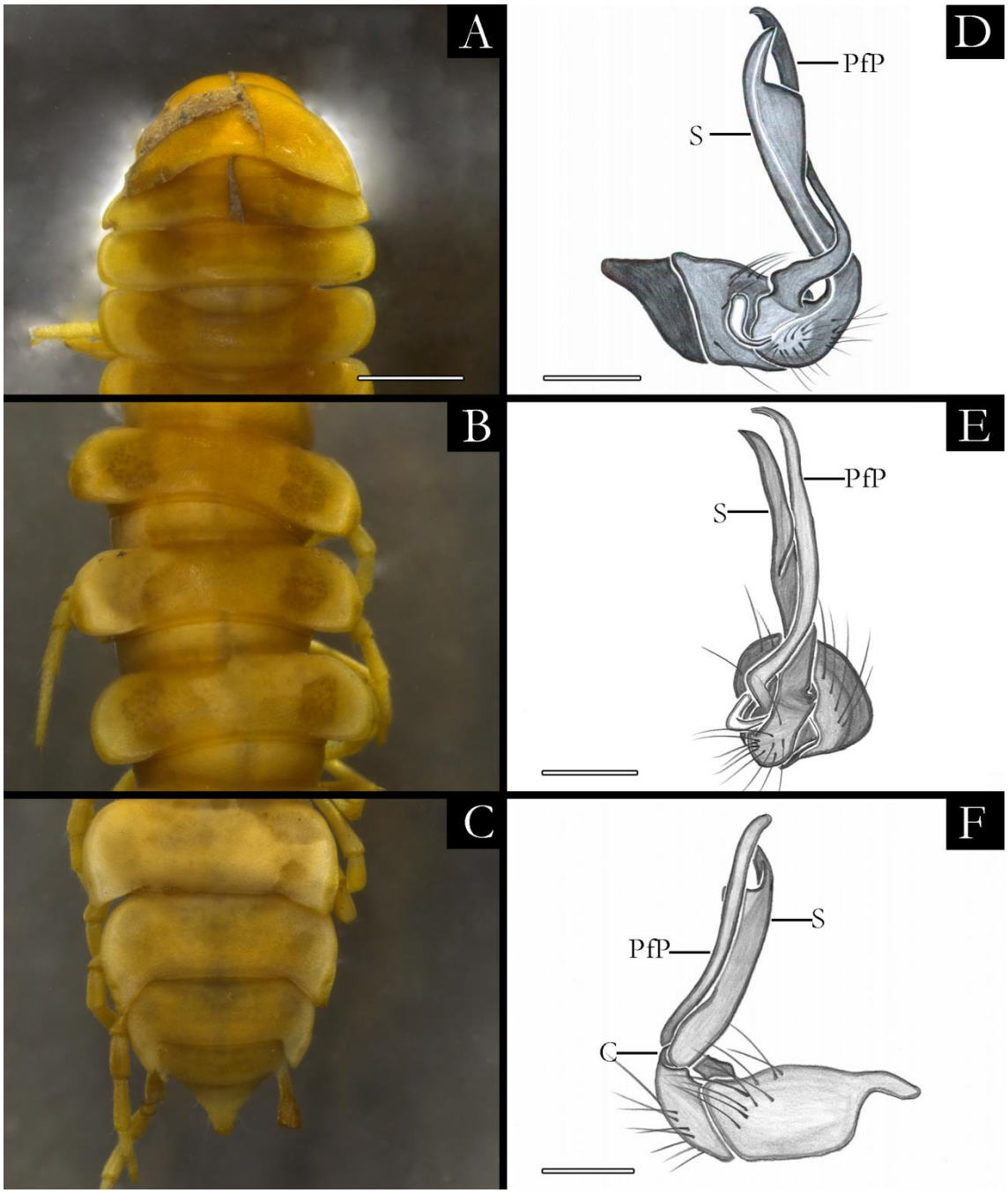


FIGURE 46. *Abiliodesmus defensor* **comb. nov.** (holotype, MZSP 1067), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 0,5 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

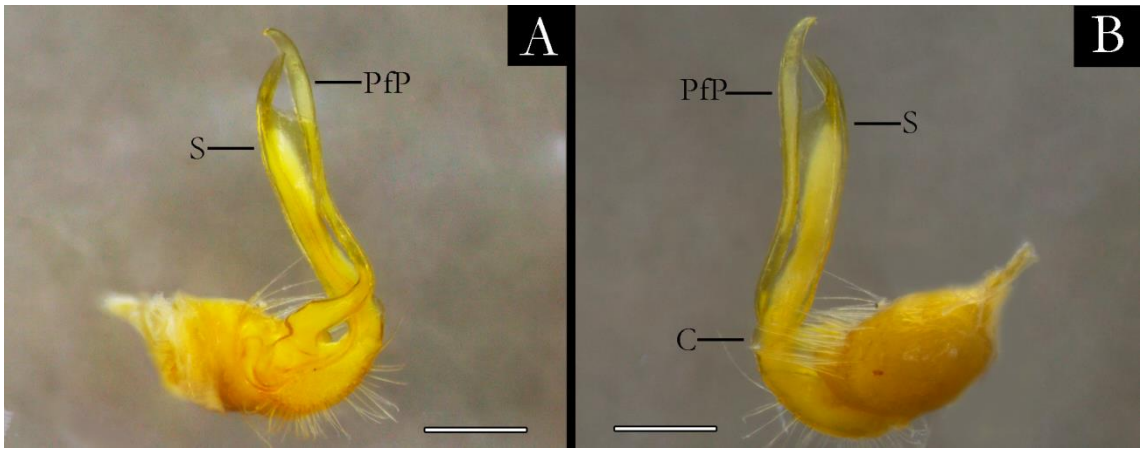


FIGURE 47. *Abiliodesmus defensor* **comb. nov.** (holotype, MZSP 1067), Left gonopod. (A), mesal view; (B), ectal view. Scale bars: 0,5 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

Abiliodesmus **mapinguari sp. nov.**

Figures 48-51

Type material. Male holotype from Palmas (10°12'47"S, 48°21'37"W), Tocantins, Brazil, X.2001, I. Knysak & R. Martins coll., deposited in IBSP 1699. Paratypes: two females with same data of the holotype, IBSP 7787; one male and one female from Fazenda Giovam, Porto Nacional (10°42'30"S, 48°25'01"W), Tocantins, Brazil, 01.XII.2013, Chagas-Jr & A.B. Kury coll., deposited in CZUFMT MYR 834.

Etymology. The species epithet is a reference of the Brazilian folkloric character "Mapinguari". According to the legend, of indigenous origin, the "Mapinguari" is a hairy giant with one eye on the forehead and the mouth at the navel, living in the Amazon rainforest of Brazil and Bolivia.

Diagnosis. Adult males differ from all other species of the genus by the combination of the following characters: presence of a secondary process at the apex of the prefemoral process (Figs 50C-D); absence of a lateral expansion in the solenomere (Figs 50A-B) and the prefemoral process involving the solenomere, in ectal view (Fig. 50B).

Description. Male (Holotype, IBSP 1699). Coloration (long-preserved in 70% ethanol): Head reddish brown with the labrum yellowish. Antennae reddish brown; with the seventh antennomere having two well-demarcated invaginations and two slight invaginations between the sensory cones. Body reddish brown with the edges of the paranota whitish (Figs 48A-C). Gnathochilarium: *lingual plate* covered completely by sparsely setae; *promentum* only centrally covered by setae, with smooth edges and

stipes covered by thick setae in the upper and lower inner portion. Body rings: cuticle slightly rough; alignment of paranota in posterior view curved ventrally; posterior edge of the paranota sub-retangular; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth with two pairs of projections covered by setae, the posterior pair less conspicuous and sixth sternite only the anterior pair of intumescences present, seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small rounded projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ocher whitish presence of a slight dorsal lobe in the prefemur of the anterior legs; absence of ventro-apical projection in the prefemur and granules; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated, concave and with stretch marks. Telson reddish brown; hypocroct triangular with two setae. Total length: 59.44. Width total: 9.64. Collum 3.04 long, 8.85 width. Antennomere lengths (1>7): 0.72; 1.68; 1.52; 1.78; 1.73; 1.44; 0.29. Podomeres lengths (1>7): 0.92; 1.25; 2.30; 0.95; 1.21; 1.56; 0.55. Gonopod aperture 1.70 long, 3.03 width. Telson 1.82 long. Gonopod: 3.15 long, 2.25 width. Coxae: 1.00 long, 1.27 width. Telopodite: 3.09 long, 0.95 width. Prefemoral region short, 1/4 the size of telopodite. Prefemoral process (Figs 48D-F) long and narrow, presenting a dorso-basal lobe, starting from an angle of 90°, involving the solenomere in its initial portion, subsequently ascending parallel to the solenomere and partially covering it in ectal view, apex dividing into two acute projections (Fig. 48D). Solenomere long, but not reaching the apex of the prefemoral process (Fig. 48D). Cingulum in basal position (Fig. 48F). Apex of the solenomere sickle-shaped with sigmoid curvature (Fig. 50D).

Female (paratype, IBSP 1699): Body as in male. Total length: 69.15. Width total: 9.62. Collum 3.43 long, 9.60 width. Antennomere lengths (1>7): 0.72; 2.00; 1.77; 1.51; 1.61; 1.44; 0.42. Podomeres lengths (1>7): 0.92; 1.12; 2.22; 1.00; 1.13; 1.60; 0.49. Telson 1.47 long. Epigyne rounded with regular edges (Fig. 49E). Vulvae (Figs 49C-D): 1.50 long, 0.70 width. External valve: 1.16 long, 0.29 width. Internal valve: 1.04 long, 0.34 width. Operculum: 0.37 long, 0.54 width.

Distribution. Tocantins, Brazil (Fig. 51).

Additional material. BRAZIL: *Tocantins:* Porto Nacional (10°42'30"S, 48°25'01"W), Fazenda Giovam, one male, 02.XII.2013, A. Chagas-Jr & A.B Kury coll. (CZUFMT

MYR 839); woods near the to the Tocantins River, one male, 29.XI.2013, A. Chagas-Jr & A. B. Kury coll. (CZUFMT MYR 837); Taquaruçu (10°18'21"S, 48°10'17"W), Vai Quem Quer, one male, 30.XI.2013, A. Chagas-Jr & A.B. Kury coll. (CZUFMT MYR 836).

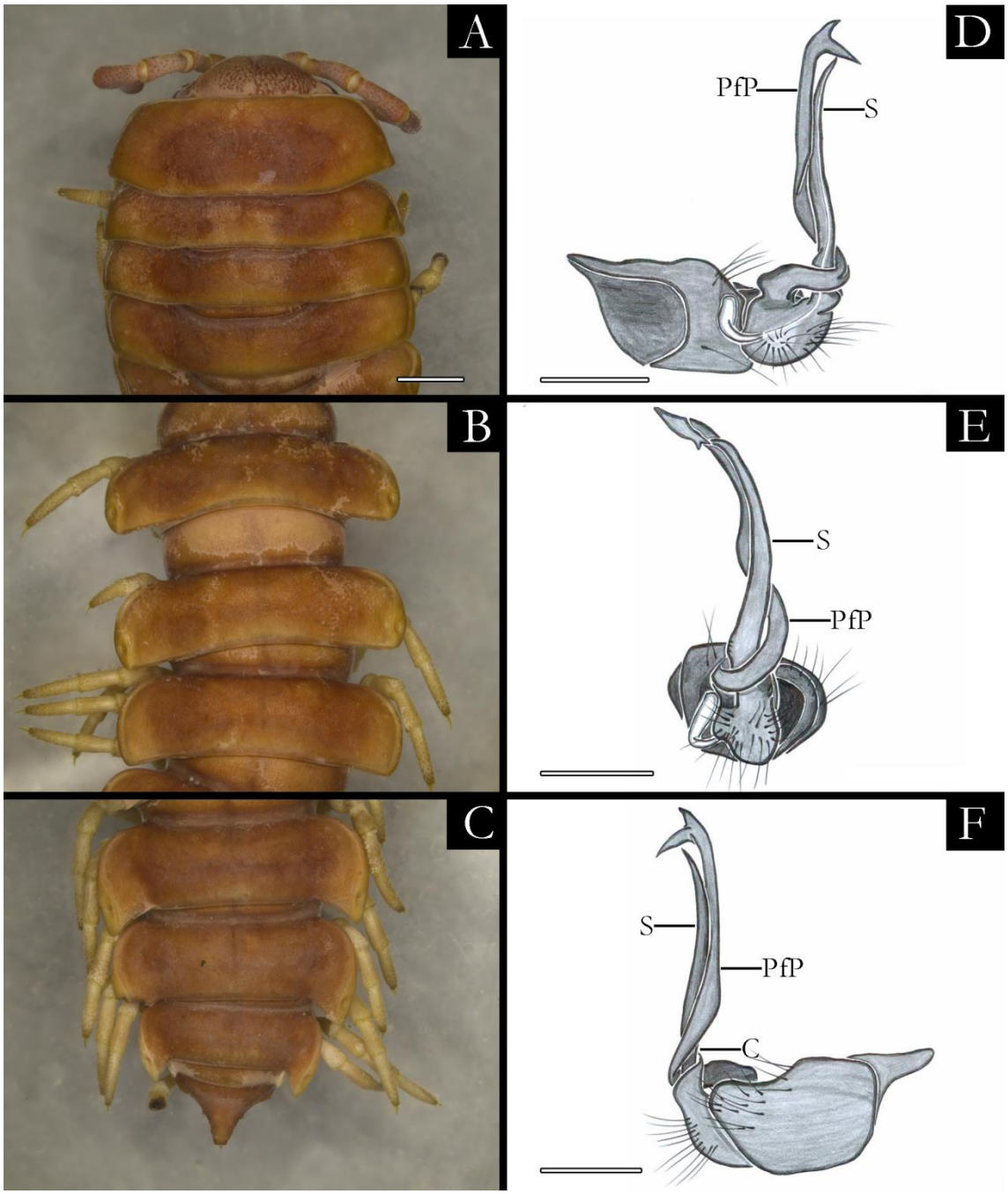


FIGURE 48. *Abiliodesmus mapinguari* **sp. nov.** (holotype, IBSP 1699), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

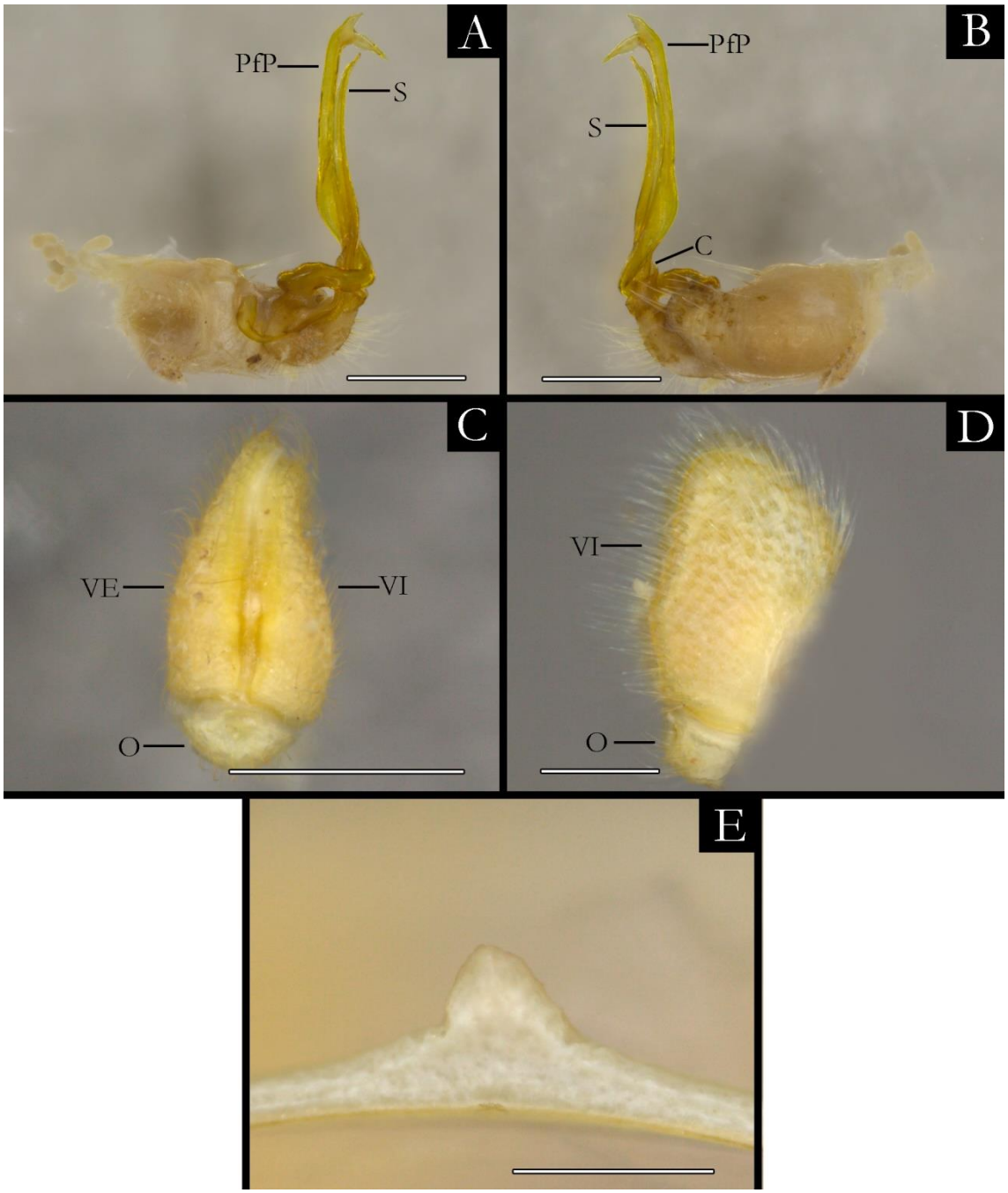


FIGURE 49. *Abiliodesmus mapinguari* **sp. nov.** Left gonopod (holotype, IBSP 1699), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (CZUFMT MYR 834). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 0,5 mm. Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere.

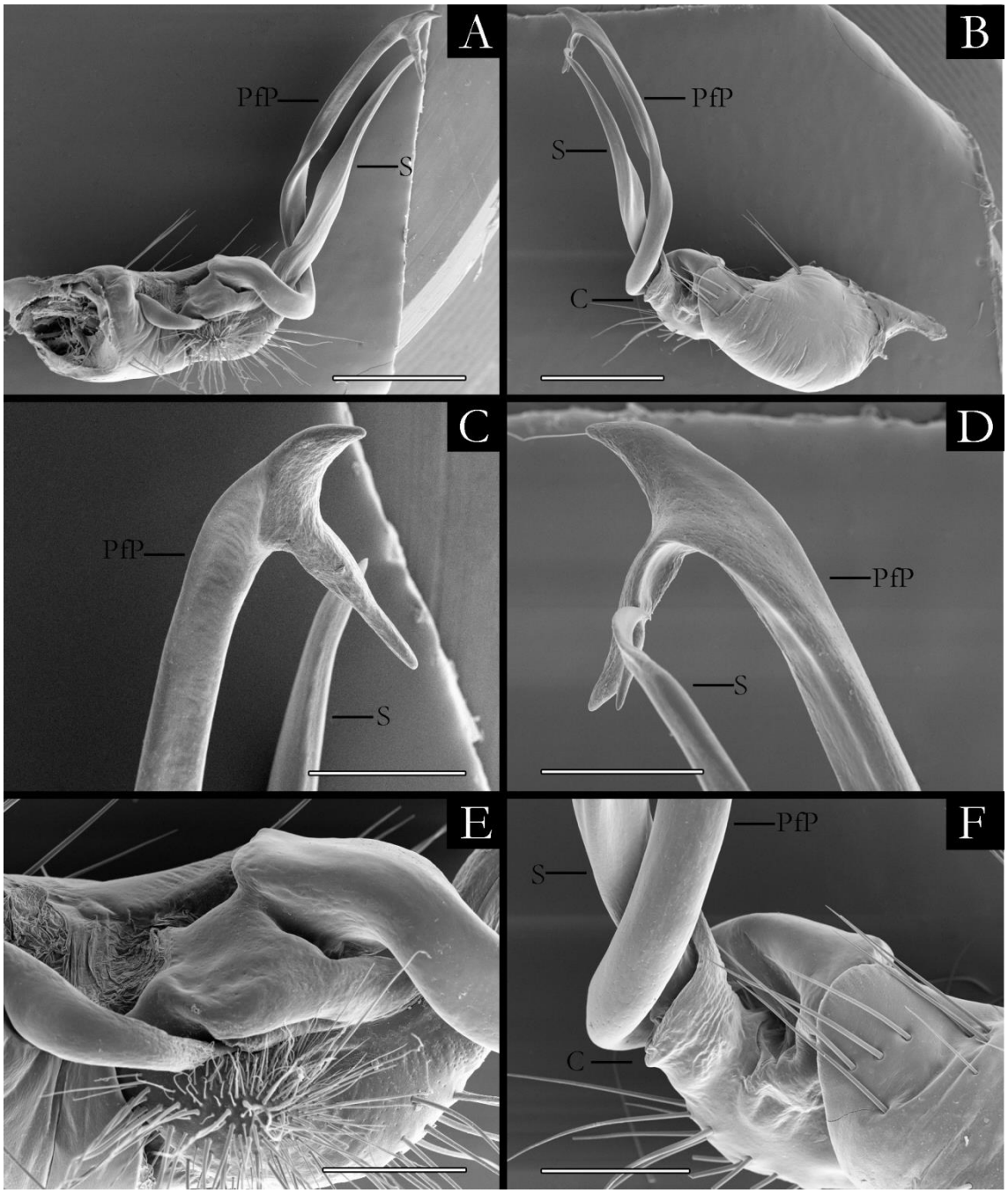


FIGURE 50. *Abiliodesmus mapinguari* **sp. nov.** (CZUFMT MYR 839), left gonopod. A, mesal view; B, ectal view; C, detail of prefemoral process and solenomere, mesal view; D, detail of prefemoral process and solenomere, ectal view; E, detail of dorso-basal lobe of the prefemoral process, mesal view; F, detail of cingulum. Scale bars: 1 mm (A-B); 0,3 mm (C-E); 0,4 mm (F). Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

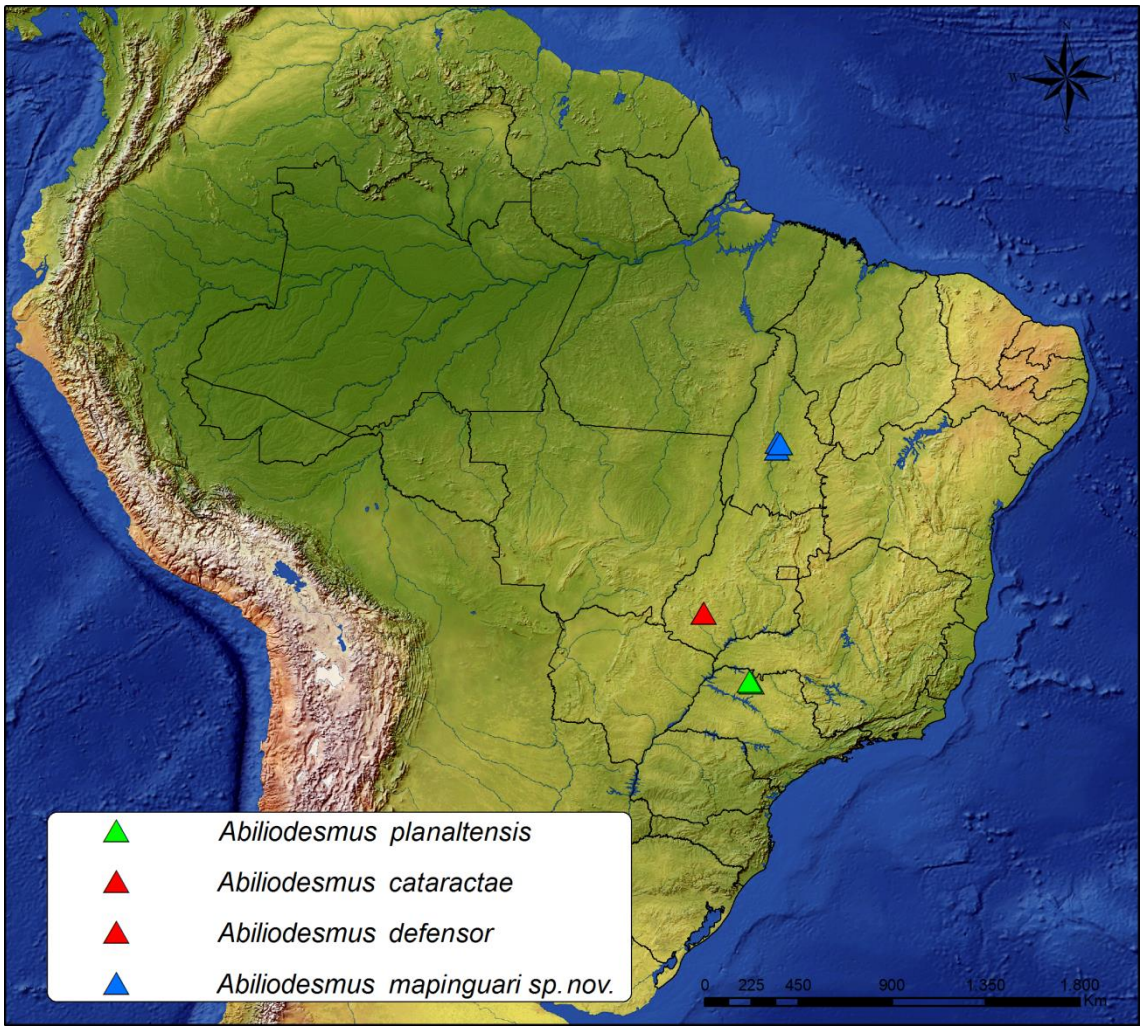


FIGURE 51. Distribution map of *Abiliodesmus* **gen. nov.** species.

***Folcloredesmus* gen. nov.**

Type species. *Folcloredesmus thomasi* **sp. nov.**

Etymology. The genus name comes from the Portuguese word for "Folclore" (culture shared by a particular group of people, as the tales characters used as species epithet in this paper) with the combining stem "-desmus", commonly used in generic names in this order of millipedes.

Diagnosis. Males of *Folcloredesmus* **gen. nov.** differ from those of other Arthrosolaenomeridini genera by the combination of the following characters: paranota with sub-triangular shaped (Fig. 52B); slightly dorsal lobe on prefemur in the legs (Fig. 4C); presence of a coxal apophysis in gonocoxae (Fig. 54E).

Description: *General characters:* Coloration (specimen long preserved in 70% ethanol) ocher with the paranota tip slightly whitish. Sternite of sixth body ring with two pairs of ventral projections; seventh body ring with a pair of projections and sternites after the gonopod with two pairs of rounded ventral projections (Fig. 3D). Paranota form: sub-triangular (Fig. 52B). Legs: slightly dorsal lobe (Fig. 4D), a ventro-apical projection in the prefemur (Fig. 4E), and presence of granules in the tibia (Fig. 4F).

Male characters: posterior edge of the gonopod aperture without projections. Gonopods: gonopod coxae equivalent to about half the length of the telopodite, cylindrical, with a spiniform process (Fig. 50E). Prefemoral process: elongate and thin (Fig. 52D) and with indentations in the apical portion, in ectal view (Fig. 54D). Cingulum in medial position (Fig. 54B). Solenomere also long and thin with your apex slightly curveted (Fig. 54C-D).

Female characters: Vulvae: oval-shaped, sub-triangular in lateral view.

Distribution. State of Mato Grosso (Fig. 55).

Composition. One species: *Folcloredesmus thomasi* **sp. nov.**

***Folcloredesmus thomasi* sp. nov.**

Figures 52-55

Type material. Male holotype from Fazenda São Nicolau (09° 50' 25"S, 58° 14' 53"W), Cotriguaçu, Mato Grosso, Brazil, 02.XI.2014, M. Karam-Gemael coll., deposited in IBSP 7788. Paratypes: four males and two females from Fazenda São Nicolau, Cotriguaçu, Mato Grosso, Brazil, 11.XII.2009, L. D. Batirola coll., deposited in IBSP 5452 and IBSP 5453.

Etymology. The species epithet is taken as a noun in apposition honoring a very important person in life for the first author, who has a passion for the stories of Brazilian folklore.

Diagnosis. The same characteristics of the genus.

Description. Male (Holotype, IBSP 5453). Coloration (long-preserved in 70% ethanol): Head and antennae ochers with the seventh antennomere broken. Body ocher with the edges of the paranota whitish (Fig. 52A-C), however in fresh collected

specimens the body's coloration is reddish brown with the edge of the paranota yellowish (Figs 1A-B). Gnathochilarium: *lingual plate* covered by several setae; *promentum* only centrally covered by setae, with smooth edges and *stipes* completely covered by sparsely setae. Body rings: cuticle slightly rough; alignment of paranota in posterior view straight; posterior edge of the paranota sub-retangular; posterior position of the peritremata on the edge of paranota; ozopore medial-posterior situated in paranota. Sternite of the fourth segment with a pair of projections, sternite of the fifth segment with two pairs of projections covered with setae and sixth segment with only the anterior pair of intumescences present, seventh sternite with a pair of projections and the others post-gonopod sternites presenting pairs of small rounded projections. Leg pair of the third body ring with the coxae presenting the rectangular genital papilla. Legs ochers whitish; presence of a slightly dorsal lobe in the prefemur of the anterior legs; ventro-apical projection in the prefemur of the post-gonopod legs; granules on the tibia and tarsus; thin setae on the ventral part of the podomeres in the anterior legs. Gonopod aperture on seventh body ring with the posterior margin excavated, concave and stretch marks. Telson ocher; hypocroct not prominently triangular, presenting two setae, these without a projected base. Total length: 55.69. Width total: 7.46. Collum 2.66 long, 7.65 width. Antennomere lengths (1>7): 0.62; 1.62; 1.49; 1.54; 1.55; 1.64; 0.26. Podomeres lengths (1>7): 0.99; 1.42; 2.33; 1.29; 1.52; 1.85; 0.47. Gonopod aperture 1.54 long, 3.01 width. Telson 1.20 long. Gonopod: 2.37 long, 2.37 width. Coxae: 1.13 long, 1.26 width. A small spiniform process present (Fig. 52D). Telopodite: 2.30 long, 0.87 width. Prefemoral region 1/3 the size of telopodite. Prefemoral process (Figs 52D-F) long, narrow and falciform, starting from an angle of 30°, ascending parallel to the solenomere and partially covering it in ventral view; in ectal view, with indentations in the apical portion (Fig. 54D). Cingulum in medial position (Fig. 52F). Solenomere long and thin with your apex acute and slightly curveted (Fig. 52F).

Female (paratype, IBSP 5453): Body as in male. Total length: 67.74. Width total: 8.90. Collum 3.40 long, 8.27 width. Epigyne short and triangular with irregular edges (Fig. 53E). Vulvae (Figs 53C-D): 1.21 long, 0.75 width. External valve: 0.89 long, 0.40 width. Internal valve: 0.88 long, 0.37 width. Operculum: 0.30 long, 0.35 width.

Distribution. Known only from the type locality (Fig. 55).

Additional material. BRAZIL: *Mato Grosso:* Cotriguaçu, Fazenda São Nicolau (09° 50' 25"S, 58° 14' 53"W), two males, X.2017 (CZUFMT MYR 849); Cotriguaçu,

Fazenda São Nicolau (09° 50' 25"S, 58° 14' 53"W), ten males, 02.XI.2014, M. Karam-Gemael coll. (CZUFMT MYR 833).

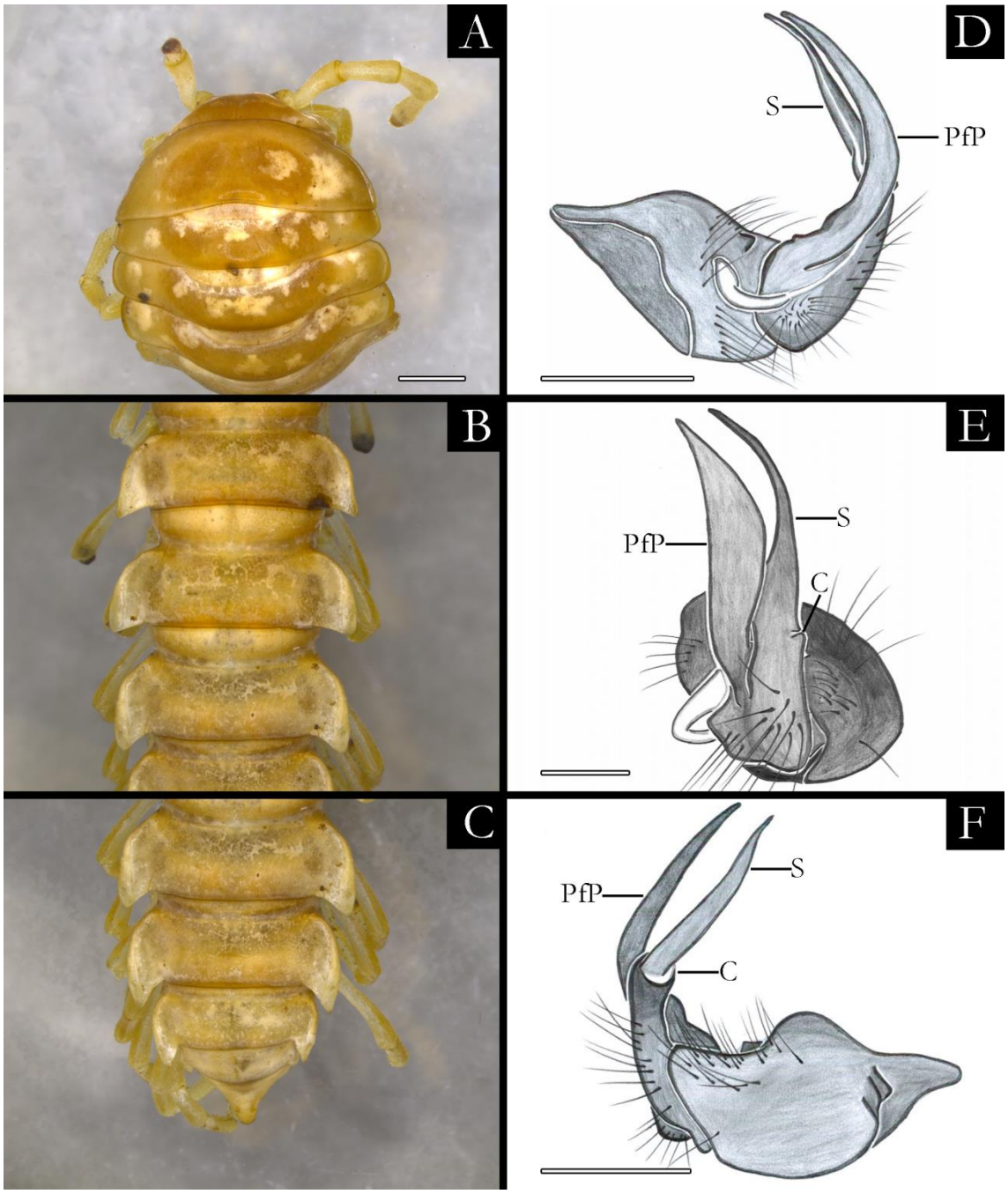


FIGURE 52. *Folcloredesmus thomasi* **sp. nov.** (holotype, IBSP 5452), dorsal views of anterior (A), midbody (B) and posterior (C) body rings. Scale bars: 2 mm. Left gonopod. (D), mesal view; (E), ventral view; (F), ectal view. Scale bars: 1 mm. Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

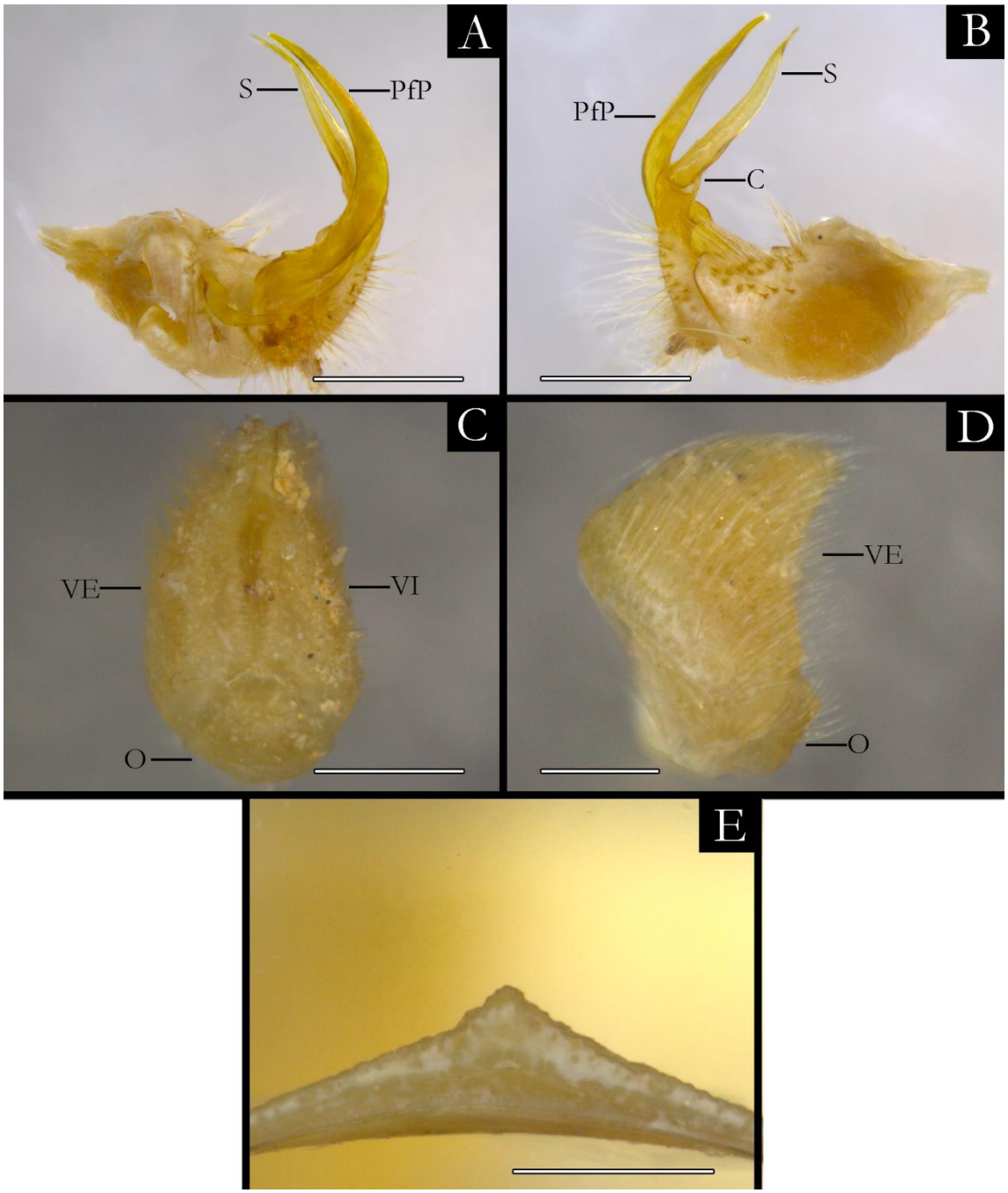


FIGURE 53. *Folcloredesmus thomasi* **sp. nov.** Left gonopod (holotype, IBSP 5452), (A), mesal view; (B), ectal view. Scale bars: 1 mm. Left vulva (IBSP 5453). (C), ventral view; (D), lateral view; (E), detail of the posterior margin of the vulvae opening. Scale bars: 0,5 mm. Abbreviations: C, cingulum; EV, external valve; IV, internal valve; Op, operculum; PfP, prefemoral process; S, solenomere.

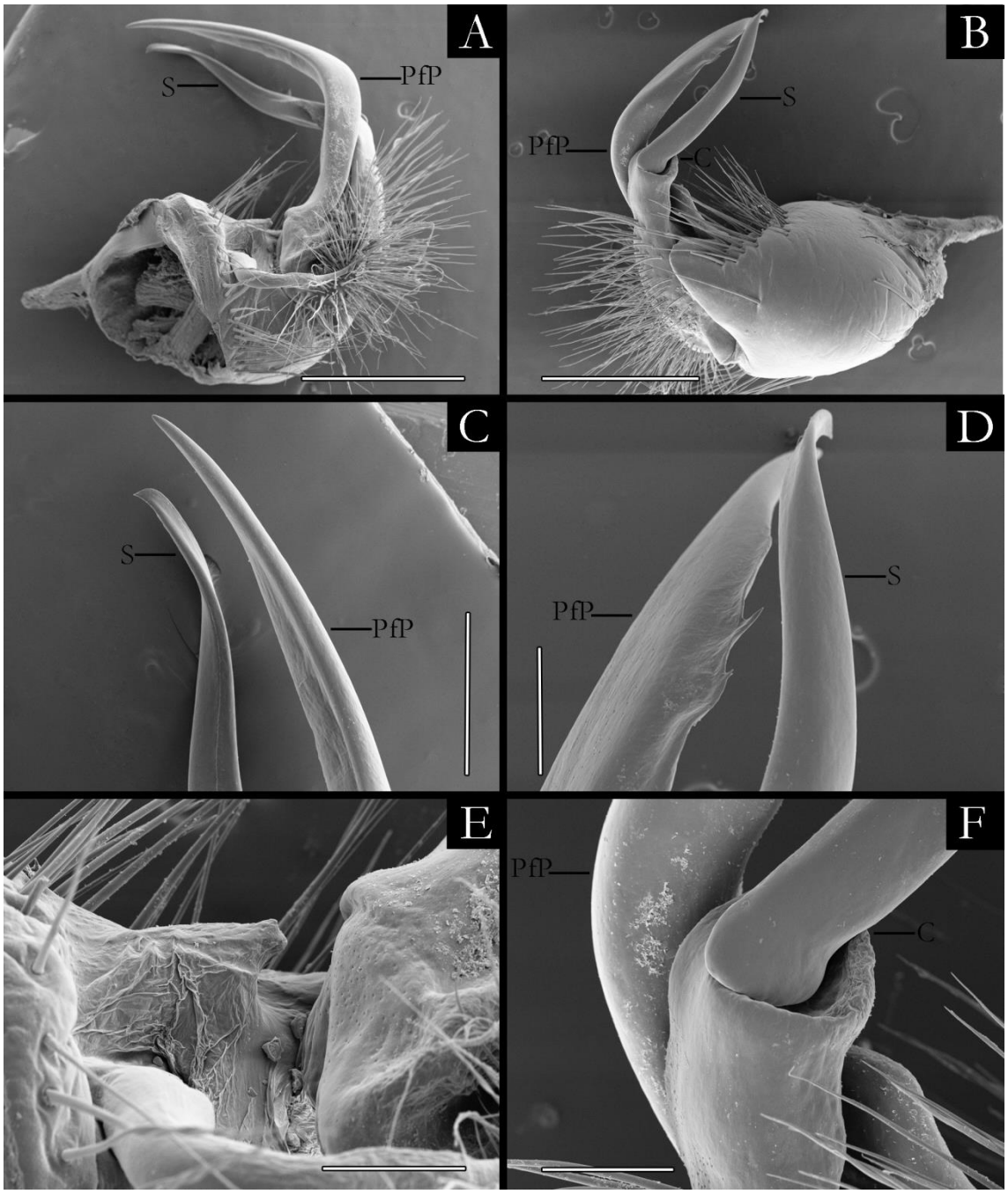


FIGURE 54. *Folcloredesmus thomasi* **sp. nov.** (CZUFMT MYR 833), left gonopod. A, mesal view; B, ectal view; C, detail of prefemoral process and solenomere, mesal view; D, detail of prefemoral process and solenomere, ectal view; E, detail of the spiniform process in the gonocoxae; F, detail of cingulum. Scale bars: 1 mm (A-B); 0,4 mm (C); 0,2 mm (D-F). Abbreviations: C, cingulum; PfP, prefemoral process; S, solenomere.

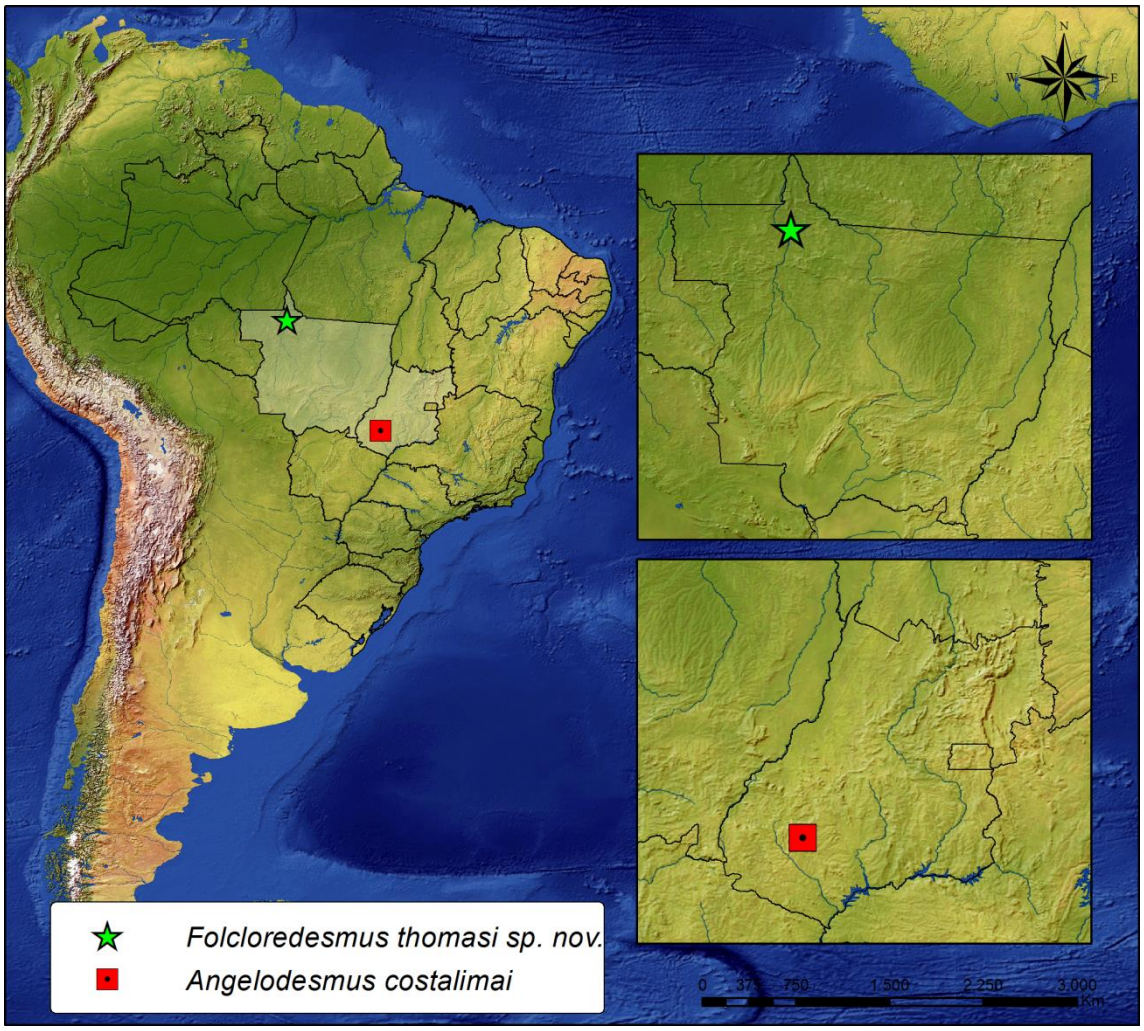


FIGURE 55. Distribution map of *Angelodesmus* and *Folcloredesmus* **gen. nov.** species.

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CONCLUSÕES GERAIS

- A tribo Arthrosolaenomeridini foi recuperada como monofilética.
- Arthrosolaenomeridini aparece como grupo-irmão das tribos Macrocoxodesmini + Telonychopodini.
- Os gêneros *Arthrosolaenomeris* Schubart, 1943 e *Gangugia* Schubart, 1947 foram recuperados como monofiléticos, ao passo que o gênero *Angelodesmus* Schubart, 1962 foi recuperado como parafilético e redefinido como monotípico.
- Arthrosolaenomeridini inclui cinco gêneros: *Arthrosolaenomeris* Schubart, 1943, *Gangugia* Schubart, 1947, *Angelodesmus* Schubart, 1962, *Abiliodesmus* gen. nov. and *Folcloredesmus* gen. nov.
- A tribo é suportada pela presença de macro-cerdas laterais na gonocoxa, em vista mesal; pelo telopódito com um cingulum na margem lateral e o solenômero se apresentando como ramo único.
- Uma chave de identificação para todos os gêneros e espécies da tribo é apresentada.
- Dez espécies e dois novos gêneros são descritos: *Arthrosolaenomeris saci* **sp. nov.;** *A. curupira* **sp. nov.;** *A. caipora* **sp. nov.;** *A. iara* **sp. nov.;** *Gangugia boitata* **sp. nov.;** *G. cuca* **sp. nov.;** *G. boto* **sp. nov.;** *G. mula* **sp. nov.;** *Abiliodesmus* gen. nov. (*A. mapinguari* **sp. nov.**) e *Folcloredesmus* gen. nov (*F. thomasi* **sp. nov.**).
- Redescrições, diagnoses, desenhos e mapas de distribuição são fornecidos para todas as espécies e gêneros.

RESUMO

Chelodesmidae é uma das famílias mais diversas de Polydesmida, compreendendo cerca de 800 espécies descritas, distribuídas em 172 gêneros, 20 tribos e duas subfamílias. Entre as tribos que compõem a subfamília Neotropical Chelodesminae, Arthrosolaenomeridini representa um grupo extremamente interessante que ocorre na região Centro-Oeste do Brasil. Atualmente, a tribo contém três gêneros: *Arthrosolaenomeris* Schubart, 1943, *Gangugia* Schubart, 1947, e *Angelodesmus* Schubart, 1962. Neste estudo, realizamos uma análise cladística incluindo 18 espécies de Arthrosolaenomeridini e 7 espécies de outras tribos de Chelodesminae associadas como grupo externo. A matriz é composta por 64 caracteres morfológicos, 39 caracteres são aqui propostos pela primeira vez e 25 caracteres foram selecionados com base em análises cladísticas anteriores para outros grupos de Chelodesmidae. Os dados foram analisados sob o critério de parcimônia, utilizando TNT 1.5. Com base nos resultados, Arthrosolaenomeridini foi recuperado como monofilético com Macrocoxodesmini + Telonychopodini como grupo irmão. Os gêneros *Arthrosolaenomeris* Schubart, 1943 e *Gangugia* Schubart, 1947 foram recuperados como monofiléticos. O gênero *Angelodesmus* Schubart, 1962 foi recuperado como parafilético e redefinido como monotípico. A tribo agora é composta pelos gêneros *Arthrosolaenomeris* Schubart, 1943 (6 spp.), *Gangugia* Schubart, 1947 (6 spp.), *Angelodesmus* Schubart, 1962 (monotípico), *Abiliodesmus* gen. nov. (4 spp.) e *Folcloredesmus* gen. nov. (monotípico). As sinapomorfias resultantes para a tribo são: presença de macrosetas laterais, em aspecto mesal, nas gonocoxas; telopódito com um cingulum na margem lateral e solenômero como um único ramo. Além disso, foi realizada a revisão taxonômica da tribo Arthrosolaenomeridini. São fornecidas neste estudo redescrições detalhadas, desenhos e mapas de distribuição para todas as espécies e gêneros, bem como para os dois novos gêneros e as dez novas espécies. Dois novos gêneros são descritos: *Abiliodesmus* gen. nov e *Folcloredesmus* gen. nov; bem como dez novas espécies: *Arthrosolaenomeris saci* **sp. nov.;** *A. curupira* **sp. nov.;** *A. caipora* **sp. nov.;** *A. iara* **sp. nov.;** *Gangugia boitata* **sp. nov.;** *G. cuca* **sp. nov.;** *G. boto* **sp. nov.;** *G. mula* **sp. nov.;** *Abiliodesmus mapinguari* **sp. nov.** e *Folcloredesmus thomasi* **sp. nov.** Além disso, foram incluídas chaves de identificação para todos os gêneros e espécies de Arthrosolaenomeridini.

Palavras-chave: Filogenia, taxonomia, região Neotropical, espécies novas

ABSTRACT

Chelodesmidae is one of the most diverse family belonging to Polydesmida, comprising almost 800 described species distributed in 172 genera, 20 tribes and two subfamilies. Among the tribes within the Neotropical subfamily Chelodesminae, Arthrosolaenomeridini represents a very interesting group occurring in the Central-West region of Brazil. Currently the tribe contains three genera: *Arthrosolaenomeris* Schubart, 1943, *Gangugia* Schubart, 1947, and *Angelodesmus* Schubart, 1962. In this study, we conducted a cladistic analysis including 18 species of Arthrosolaenomeridini and 7 species of other associated Chelodesminae tribes as an outgroup. The matrix is composed of 64 morphological characters, 39 characteres are herein proposed for the first time and 25 characters were scored based on the previous cladistic analysis for Chelodesmidae groups. The data was analyzed under the parsimony criterion, using TNT 1.5. Based on the results, Arthrosolaenomeridini was recovered as monophyletic with Macrocoxodesmini + Telonychopodini as sister group. The genera *Arthrosolaenomeris* Schubart, 1943 and *Gangugia* Schubart, 1947 was recovered as monophyletic. The genus *Angelodesmus* Schubart, 1962 was recovered as paraphyletic and redefined as monotypic. The tribe is now composed by the genera *Arthrosolaenomeris* Schubart, 1943 (6 spp.), *Gangugia* Schubart, 1947 (6 spp.), *Angelodesmus* Schubart, 1962 (monotypic), *Abiliodesmus* gen. nov. (4 spp.) and *Folcloredesmus* gen. nov. (monotypic). The resulting synapomorphies for the tribe are: presence of lateral macrosetae, in mesal aspect, in gonocoxae; telopodite with a cingulum on the lateral margin and solenomere as a single branch. In addition, we conduct a taxonomic revision of the tribe Arthrosolaenomeridini. We provided in this study detailed redescriptions, drawings and distribution maps for all species and genera, as well for the two new genera and the ten new species. Two new genera are described: *Abiliodesmus* gen. nov and *Folcloredesmus* gen. nov; as well ten new species: *Arthrosolaenomeris saci* **sp. nov.;** *A. curupira* **sp. nov.;** *A. caipora* **sp. nov.;** *A. iara* **sp. nov.;** *Gangugia boitata* **sp. nov.;** *G. cuca* **sp. nov.;** *G. boto* **sp. nov.;** *G. mula* **sp. nov.;** *Abiliodesmus mapinguari* **sp. nov.** and *Folcloredesmus thomasi* **sp. nov.** In addition, we include an identification key to all the genera and species of Arthrosolaenomeridini.

Keywords: Phylogeny, taxonomy, Neotropical region, new species