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LUIZA FAGUNDES RODRIGUES DE SOUZA

Novo gênero para Edessinae (Hemiptera, Heteroptera, Pentatomidae) com sete espécies novas

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SUMÁRIO

A new genus of Edessinae (Hemiptera, Heteroptera, Pentatomidae) with seven new species

ABSTRACT

Edessinae, belonging to the family Pentatomidae, is considered monophyletic and is distinguished by its remarkable morphological variation. With approximately 500 species organized into 17 genera, Edessinae is the second most diverse and numerous subfamily of Pentatomidae. Currently, Edessinae is being subjected to various taxonomic revisions and adjustments aimed at organizing and clarifying this complex group. Due to its significant morphological variation, the subfamily faces numerous challenges related to taxonomy and nomenclature. Thus, the objective of this study was to describe a new genus composed of seven new species. With the aid of a stereomicroscope, the structures of the body, including the head, thorax, abdomen, female genitalia, and especially the male genitalia, were described. Illustrations and a map of the geographic distribution are presented. This genus is characterized by having a flat metasternal process, narrow with the anterior bifurcation margin evanescent and the apex acuminate; short pygophore with shallow floor presenting an expansion that embraces the base of the parameres; simple, reddish or orange parameres, curved dorsoposteriorly; distal part swollen in posterior view; expanded black lateral margins. This work aims to contribute to the knowledge of Edessinae diversity, enriching the understanding and taxonomic classification of this group. Species recognition is extremely important to improve knowledge about the taxon and diversity of the Neotropical region.

Key words: Neotropical region; Stink bug; Taxonomy.

Novo gênero para Edessinae (Hemiptera, Heteroptera, Pentatomidae) com sete espécies novas

RESUMO

Edessinae, pertencente à família Pentatomidae, é considerada monofilética e se distingue por apresentar uma notável variação morfológica. Com aproximadamente 500 espécies organizadas em 17 gêneros, Edessinae é a segunda subfamília mais diversificada e numerosa. Atualmente, Edessinae está passando por diversas revisões e ajustes taxonômicos com o objetivo de organizar e clarificar este grupo complexo desde a sua proposição. Devido à sua grande variação morfológica, a subfamília enfrenta numerosos desafios relacionados à taxonomia e nomenclatura. Deste modo, o objetivo deste estudo foi descrever um novo gênero composto por sete espécies novas. Foram descritas, com auxílio do estereomicroscópio, as estruturas do corpo, como cabeça, tórax, abdome, genitália feminina e, principalmente, a genitália masculina. As ilustrações e o mapa de distribuição geográfica são apresentados. Esse gênero é caracterizado por possuir o processo metasternal plano, estreito com a margem da bifurcação anterior evanescente e o ápice acuminado; pigóforo curto, assoalho raso apresentando uma expansão que abraça a base dos parâmeros. Este trabalho visa contribuir para o conhecimento da diversidade de Edessinae, enriquecendo a compreensão e a classificação taxonômica deste grupo. O reconhecimento de espécies é extremamente importante para melhorar o conhecimento sobre o táxon e a diversidade da região Neotropical.

Palavras-chaves: Percevejos, Região Neotropical Taxonomia.

INTRODUÇÃO GERAL

Hemiptera é considerada a ordem mais diversa dentre os insetos hemimetábolos, possuindo mais de 106 mil espécies distribuídas em todo o planeta (Grazia et al. 2024). Esta ordem é composta de insetos que possuem hábitos terrestres, aquáticos ou semiaquático e possuem como principal característica o aparelho bucal picador-sugador no formato de um rostro, sendo este onde estão localizados os estiletes mandibulares e maxilares (Grazia et al. 2024). A posição do rostro em repouso é utilizada para diagnosticar as subordens de Hemiptera, sendo quatro conhecidas atualmente: Sternorrhyncha, Auchenorrhyncha, Coleorrhyncha e Heteroptera (Grazia et al. 2024).

Os representantes de Heteroptera possuem o rostro se originando na porção anterior da cabeça e grande parte deles podem ser facilmente caracterizados por possuirem a asa anterior modificada em hemiélitro, sendo a porção proximal coriácea e a porção distal membranosa (Grazia et al. 2024). São popularmente chamados de percevejos e fede-fede, na linguagem popular, por conta das glândulas odoríferas presentes no metatórax do adulto e nos tergos abdominais III ao VII dos jovens (Grazia et al. 2024). Ecologicamente, este táxon possui uma vasta variedade quanto aos seus hábitos alimentares, tendo espécies fitófagas, micófagas, zoofitófagas, predadoras e hematófagas, facilitando assim sua ocupação em quase todos os tipos de habitats (Schuh & Slater 1995; Weirauch & Schuh 2011; Grazia et al. 2024).

Heteroptera possui mais de 45.000 espécies descritas, contando com 92 famílias distribuídas em todo os continentes, com exceção da Antártica (Weirauch & Schuh 2011; Panizzi & Grazia 2015 Grazia et al. 2024). Dentre as famílias destaca-se Pentatomidae, a terceira família mais numerosa dentro de Heteroptera, com mais de 940 gêneros e 5.000 espécies (Rider et al. 2018; Grazia et al. 2024;).

Este táxon possui sua monofilia apoiada pelas seguintes sinapomorfias: perda da *valvulae* VIII; *valvulae* IX reduzida e fundida aos valvíferes IX; ausência dos gonângulos e ducto do receptáculo invaginado, formado por três paredes (Grazia et al. 2008). Os representantes de Pentatomidae também podem ser caracterizados por possuírem antenas com cinco artículos antenais, escutelo grande e triangular, mesosterno carenado, tarsos trímeros e espiráculos do esterno abdominal II cobertos pela metapleura (Grazia et al. 2024).

Neste táxon, em sua maioria, as espécies possuem hábitos alimentares fitófagos, sendo apenas as espécies de Asopinae predadoras (McPherson et al. 2018; Grazia et al. 2024). Do ponto de vista econômico, a família Pentatomidae pode causar grandes prejuízos para a agricultura, como *Edessa meditabunda* (Fabricius, 1794) e *Nezara viridula* (Linnaeus, 1758), sendo reportadas como pragas de monoculturas, principalmente de soja, algodão e milho causando graves perdas econômicas (McPherson et al. 2018).

Edessinae é a segunda subfamília mais diversa dentro de Pentatomidae com mais de 500 espécies já descritas. É considerado um táxon monofilético apoiado pelas seguintes sinapomorfias: carena do mesosterno mais baixa que o processo do metasterno; esternitos abdominais II e III lateralmente fundidos; falo com vesica reduzida; e presença de uma projeção em forma de bico sobre a íntima vaginal

(Barcellos & Grazia, 2003a; Nunes et al. 2019). Além dos caracteres morfológicos, dados moleculares também indicam a monofilia da subfamília (Roca-Cusachs et al. 2021).

Histórico taxonômico de Edessinae

Atualmente, Edessinae *sensu stricto* é composta por 17 gêneros: *Edessa* Fabricius, 1803 (com mais de 450 espécies), *Brachystethus* Laporte, 1832 (10 espécies), *Ascra* Say, 1837 (14 espécies), *Peromatus* Amyot & Serville, 1843 (sete espécies), *Pygoda* Amyot & Serville, 1843 (nove espécies), *Hypoxys* Amyot & Serville, 1843 (50 espécies), *Olbia* Stål, 1862 (três espécies), *Pantochlora* Stål, 1870 (uma espécie), *Mediocampus* Thomas, 1994 (uma espécie), *Doesburgedessa* Fernandes, 2010 (cinco espécies), *Paraedessa* Silva & Fernandes, 2013 (nove espécies), *Grammedessa* Correia & Fernandes, 2016 (12 espécies), *Plagaedessa* Almeida & Fernandes, 2018 (quatro espécies), *Anisoedessa* Nunes & Fernandes, 2019 (seis espécies), *Graziaedessa* Eger, 2021 (uma espécie), *Calcatedessa* Silva & Fernandes, 2021 (quatro espécies) e *Odara* Campos & Fernandes, 2022 (11 espécies), mas tal composição não é unanimidade entre os pesquisadores. Rider (2025) e colaboradores (2018), incluem ainda na subfamília os gêneros *Lopadusa* Stål, 1860, *Pharnus* Stål, 1867, *Neopharnus* Van Duzee, 1910 e *Praepharnus* Barber & Bruner, 1932, porém ainda não foi testada em uma análise filogenética, no trabalho e no catálogo não há uma explicação para tal inclusão.

O táxon foi inicialmente descrito como "Édessides" por Amyot & Serville (1843) para alocar gêneros relacionados a *Edessa* Fabricius, 1803, *Brachystethus* Laporte, 1832 e cinco novos gêneros: *Peromatus, Pygoda, Hypoxys, Dorypleura* (Lepeletier & Serville, 1825) e *Aceratodes* (De Geer, 1773). Dallas (1851) propôs o nome Edessidae, considerando no táxon os gêneros *Edessa*, *Brachystethus*, *Peromatus*, *Aceratodes*, e gêneros que atualmente compõem Tessaratomidae e Dinidoridae, além de sinonimizar *Dorypleura*, *Hypoxys* e *Pygoda* a *Edessa*. Stål (1862) descreveu o gênero *Olbia* e reconheceu *Edessa*, *Olbia* e *Brachystethus* como pertencentes a Edessidae. Após isso, Walker (1868), expandiu a composição da família ao adicionar mais espécies, e manteve os táxons inicialmente propostos por Dallas (1851). A classificação de Stål (1872) trouxe modificações significativas à Edessidae. *Aceratodes* e um subgênero de *Pentatoma* – *Ascra* Say (1832) – foram considerados sinônimos de *Edessa.* Porém, o autor continuou utilizando os nomes sinonimizados à *Edessa* como grupos de espécies.

No catálogo de Lethierry & Severin (1893), os gêneros de Amyot e Serville (1843): *Peromatus, Dorypleura, Hypoxys, Pygoda* e *Aceratodes* – bem como, *Ascra* Say (1832) – foram considerados como sinônimos de *Edessa*. Em seguida, Kirkaldy (1909), em seu catálogo, considerou o táxon como tribo Edessini, composta por *Edessa, Peromatus* e *Olbia*. O mesmo autor considerou *Ascra, Aceratodes, Dorypleura, Hypoxys* e *Pygoda* como subgêneros de *Edessa*, contudo não realizou a alocação das espécies nesses subgêneros. O táxon foi reconhecido como subfamília apenas em 1979 por Rolston e McDonald.

Desde o início do século, Edessinae é alvo de vários estudos taxonômicos envolvendo desde

revisões de táxons incluídos ou relacionados com a subfamília (exemplos: Barcellos & Grazia, 2003b; Santos et al. 2015; Fernandes et al. 2018; Nunes et al. 2020; Silva & Fernandes, 2021) e à proposição de novos gêneros para a subfamília (Fernandes, 2010; Silva et al. 2013; Correia & Fernandes, 2016; Almeida et al. 2018; Silva & Fernandes, 2021; Eger, 2021; Campos & Fernandes, 2022).

Edessa representa o gênero mais abundante dentro da subfamília Edessinae, no entanto, apresenta muitos problemas taxonômicos e nomenclaturais. Tal situação se deve a grande quantidade de espécies descritas, juntamente com identificações equivocadas, bem como uma notável variação morfológica. O gênero foi considerado um depósito de espécies, visto que todas as espécies que não se enquadram nos demais gêneros da Edessinae eram consideradas como pertencentes à *Edessa* (Fernandes, 2010). Por conta disso, Fernandes & van Doesburg (2000a) propuseram organizar o gênero em grupos de espécie. Em decorrência disso, ao longo dos últimos 25 anos Edessinae tem sido alvo de revisões, incluindo descrição de novos gêneros, revalidação de táxons genéricos e a descrição de novas espécies (Fernandes & van Doesburg, 2000ab; Fernandes et al., 2018; Nunes et al., 2020; Silva & Fernandes 2021; Campos & Fernandes, 2022). Essas iniciativas visam organizar o táxon, conforme sugerido por Fernandes e van Doesburg (2000a).

Objetivos

Objetivo geral

- Colaborar com o conhecimento sobre a diversidade morfológica de Edessinae, descrevendo um gênero novo composto apenas por espécies novas que apresentam um conjunto de características únicas.

Objetivos específicos

- Descrever e diagnosticar sete espécies novas
- Elaborar uma chave de identificação para as espécies que compõem o gênero novo

REFERÊNCIAS

Almeida, F.A., Nunes, B.M. & Fernandes J.A.M. (2018) A new genus and new species of Edessinae (Hemiptera: Heteroptera: Pentatomidae). *Zootaxa*, 4377(2), 254-268. https://doi.org/10.11646/zootaxa.4377.2.6

Amyot, C.J.B. & Serville, A. (1843) Historie naturelle des insects. Hémiptéres. Cuyrage accompagné de planches. Librairie encyclopédique de Roret, Paris, lxxvi + 675 pp., 12 pls.

Barcellos, A. & Grazia, J. (2003a) Cladistic analysis and biogeography of *Brachystethus* Laporte (Heteroptera, Pentatomidae, Edessinae). Zootaxa 256: 1-14. https://doi.org/10.11646/zootaxa.256.1.1

Barcellos, A. & Grazia, J. (2003b) Revision of *Brachystethus* (Heteroptera, Pentatomidae, Edessinae). Iheringia. Série Zoologia, 93(4), 413-446. http://dx.doi.org/10.1590/S0073-47212003000400008

Campos, B.B., Nunes, B.M., Bitar, M.V.S. & Fernandes, J.A.M. (2020) Description of a new group of species of *Edessa* Fabricius, 1803 (Hemiptera: Pentatomidae: Edessinae) with translucent spot on hemelytra. Zootaxa, 4810 (1), 131–142.

Campos, B. & Fernandes, J.A.M. (2022). *Odara*, a new genus to Edessinae (Hemiptera, Pentatomidae) with eleven new species. Insect Systematics & Evolution. 1–38. 10.1163/1876312X-bja10040.

Correia, A.O. & Fernandes, J.A.M. (2016) *Grammedessa*, a new genus of Edessinae (Hemiptera: Heteroptera: Pentatomidae). Zootaxa, 4107(4), 541-565. https://doi.org/10.11646/zootaxa.4107.4.4

Dallas, W.S. (1851) *List of the specimens of hemipterous insects in the collection of the British Museum Parte 1*. Londres, 390 p, 15 pls.

Eger, J.E. (2021) *Graziaedessa anastrephae* (Heteroptera: Pentatomidae: Edessinae) a new genus and species collected in Multilure® fruit fly traps baited with ammonium acetate and putrescine. Zootaxa, 4958(1), 643-648.

Ely E Silva E.J., Fernandes J.A.M. & Grazia J. (2006) Caracterização do grupo E. rufomarginata e

descrição de sete novas espécies (Heteroptera, Pentatomidae, Edessinae). Iheringia, Série Zoologia 96(3): 345 –362.

Fernandes, J.A.M. (2010) A new genus and species of Edessinae from Amazon Region (Hemiptera: Heteroptera: Pentatomidae). Zootaxa, 2662(1), 53-65. https://doi.org/10.11646/zootaxa.2662.1.3

Fernandes J.A.M. & Campos L.D. (2011). A new group of species of Edessa Fabricius, 1803 (Hemiptera: Heteroptera: Pentatomidae). Zootaxa 3019: 63 –68.

Fernandes J.A.M. & Van Doesburg P.H. (2000a) The E. dolichoceragroup of Edessa Fabricius, 1903 (Heteroptera: Pentatomidae: Edessinae). Zoologische Mededeelingen Leiden 73(20): 305–315.

Fernandes J.A.M. & Van Doesburg P.H. (2000b) The E. beckeri group of Edessa Fabricius, 1803 (Heteroptera: Pentatomidae: Edessinae). Zoologische Mededeelingen Leiden 74(7): 143 –150.

Fernandes J.A.M., Van Doesburg P.H. (2000c) The E. cervus-group of Edessa Fabricius, 1803 (Heteroptera, Pentatomidae, Edessinae). Zoologische Mededeelingen Leiden 74(8): 151 –165.

Fernandes J.A.M., Greve C. & Van Doesburg P.H. (2001) The E. collaris-group of Edessa Fabricius, 1803 (Heteroptera, Pentatomidae, Edessinae). Zoologische Mededeelingen Leiden 75(15): 239– 250.

Fernandes, J.A.M., Nascimento, A.T.S. & Nunes, B.M. (2018) Revision of Pygoda Amyot & Serville, 1843 stat. rest. (Heteroptera: Pentatomidae: Edessinae) with description of four new species. Zootaxa, 4461(2), 205-232.
https://doi.org/10.11646/zootaxa.4461.2.3

Fernandes, J.A.M. & da Silva, V.J. (2021) A new species group to Edessa, the E. ovina group, with description of a new species (Heteroptera: Pentatomidae: Edessinae) from Brazil. Zootaxa 4958: 628–642.

Grazia, J., Schuh, R.T. & Wheeler, W.C. (2008) Phylogenetic relationships of family groups in Pentatomoidea based on morphology and DNA sequences (Insecta: Heteroptera). Cladistics, 24 (6): 932–976. https://doi.org/10.1111/j.1096-0031.2008.00224.x

Grazia, J., Panizzi, A.R., Greve, C., Schwertner, C.F., Campos, L.A., Garbelotto, T.D.A. & Fernandes, J.A.M. (2015) Stink Bugs (Pentatomidae). In: Panizzi AR, Grazia J (Eds) True bugs (Heteroptera) of the Neotropics. Springer: Dordrecht. 681–756.

Grazia, J.; Takiya, D.M.; Wolff, V.R.S.; Schwertner, C.F.; Mejdalani, G.; Cavichioli, R.R.; Peronti, A.L.B.G.; Queiroz, D.L.; Burckhardt, D.; Fernandes, J.A.M.; Moreira, F.F.F.; Gil-Santana, H.R.; Ferreira, P.S.F.; Carrenho, R.; Brugnera, R.; Guidoti, M. (2024). Hemiptera Linnaeus, 1758, pp. 368 456. In: Rafael, J.A.; Melo, G.A.R.; Carvalho, C.J.B. de; Casari, S. & Constantino, R. (eds). Insetos do Brasil: Diversidade e Taxonomia. 2ª ed. Instituto Nacional de Pesquisas da Amazônia, Manaus. Cap. 25. 880 pp.

Kirkaldy, G.W. (1909) Catalogue of the Hemiptera (Heteroptera) Vol. I: Cimicidae. Berlin, Felix L. Dames, xl+392 p.

Lethierry, L. & Severin, G. (1893) Cataloge Général des Hémipteres. Tome I: Hétéroptéres: Pentatomidae. Bruxelles, Musée Royal d'historie Naturalle de Belgique, x+ pp 286.

McPherson, J.E., Bundy, C.S. & Wheeler, A.G. (2018) Overview of the Superfamily Pentatomoidea. In: McPherson JE (Ed) Invasive stink bugs and related species (Pentatomoidea): biology, higher systematics, semiochemistry, and management. CRC Press, 3–21.

Nascimento, D.A., Mendonça, M.T.S. & Fernandes, J.A.M. (2017) Description of a new group of species of Edessa (Hemiptera: Pentatomidae: Edessinae). Zootaxa, 4254 (1), 136–150.

Nunes, B.M., Wallner, A.M. & Fernandes, J.A.M. (2019) Anisoedessa, a new genus of Edessinae (Hemiptera: Heteroptera: Pentatomidae) and considerations on Edessinae relationships based on cladistic analysis. Arthropod and Systematics, 77(2), 215–237.

Nunes, B.M., Campos, L.D., Mendonca, M.T.S., Cunha, E.V.P. & Fernandes, J.A.M. (2020) Revision of Hypoxys Amyot & Serville, 1843 stat. rest. (Heteroptera, Pentatomidae). Zootaxa, 4742(3): 401–441
https://doi.org/10.11646/zootaxa.4742.3.1

Panizzi, Antônio R., and Jocélia Grazia, eds. *True bugs (Heteroptera) of the Neotropics*. Vol. 2. Dordrecht: Springer Netherlands, 2015.

Rider, D.A., Schwertner, C.F., Vilímová, J., Rédei, D., Kment, P. & Thomas, D.B. (2018) Higher

Systematics of the Pentatomoidea. In: McPherson JE (Ed) Invasive stink bugs and related species (Pentatomoidea): biology, higher systematics, semiochemistry, and management. CRC Press, 25–201.

Rider, D.A. (2025). Genus Index, Pentatomoidea Home Page. Disponível em: https://www.ndsu.edu/pubweb/~rider/Pentatomoidea/Genus_Index/genus_index.htm

Roca-Cusachs, M., Schwertner, C. F., Kim, J., Eger, J., Grazia, J., & Jung, S. (2021) Opening pandora's box: Molecular phylogeny of the stink bugs (Hemiptera: Heteroptera: Pentatomidae) reveals great incongruences in the current classification. Systematucs Entomology. 47, 36–51.

Rolston L.H. & McDonald, J.D. (1979) Keys and diagnoses for the families of Western Hemisphere Pentatomoidea, subfamilies of Pentatomidae and tribes of Pentatominae (Hemiptera). Journal of the New York Entomological Society 87, 189–207

Santos B.T.S., Nascimento A.T.S. & Fernandes J.A.M. (2014) Proposition of a new species group in Edessa Fabricius, 1803 (Heteroptera: Pentatomidae: Edessinae). Zootaxa 3774(5): 441 – 459.

Santos, B.T.S., Silva, V.J. & Fernandes, J.A.M. (2015) Revision of Ascra with proposition of the bifida species group and description of two new species (Hemiptera: Pentatomidae: Edessinae). Zootaxa 4034 (3), 445–470. http://dx.doi.org/10.11646/zootaxa.4034.3.2

Schuh, T.T. & Slater, J.A. (1995) *True bugs of the world (Hemiptera:Heteroptera): Classiifcation and natural history*. Cornell UNIVERSITY press, Ithaca, New York, xii, 338 pp.

Silva V.J. & Fernandes J.A.M. (2012) A new species group in Edessa Fabricius, 1803 (Heteroptera: Pentatomidae: Edessinae). Zootaxa 3313: 12 –22.

Silva, V.J., Nunes, B.M. & Fernandes, J.A.M. (2013) Paraedessa, a new genus of Edessinae (Hemiptera: Heteroptera: Pentatomidae). Zootaxa, 3716 (3), 395–416. https://doi.org/10.11646/zootaxa.3716.3.4

Silva, P.A.L. & Fernandes, J.A.M. (2021). Calcatedessa gen. n. a new genus sister to Grammedessa Correia & Fernandes (Heteroptera, Pentatomidae, Edessinae) based on a cladistic analysis. Insect Systematics & Evolution, 1, 1-21. https://doi.org/10.1163/1876312X-bja10025

Stål, C. (1862) Hempitera Mexicana enumeravit speciesque novas descripsit. Stettiner Entomologische Zeitung, 23, 109−118.

Walker, F. (1868) Catalogue of the specimens of Hemiptera Heteroptera in the collection of the British Museum. Part III. British Museum, London, 599 p

Weirauch, C. & Schuh, R.T. (2011) Systematics and evolution of Heteroptera: 25 years of progress. Annual review of Entomology, 56, 487–510. https://doi.org/10.1146/annurev-ento-120709-144833

Capítulo I

A new genus of Edessinae (Hemiptera, Heteroptera, Pentatomidae) with seven new species

O capítulo I desta Dissertação foi elaborado e formatado conforme as normas da publicação científica *Insect Systematics & Evolution*, as quais se encontram em anexo (Anexo I).

Insect Systematics & Evolution

A new genus of Edessinae (Hemiptera, Heteroptera, Pentatomidae) with seven new species

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Abstract

Edessinae, belonging to the family Pentatomidae, is considered monophyletic and is distinguished by its remarkable morphological variation. With approximately 500 species organized into 17 genera, Edessinae is the second most diverse and numerous subfamily of Pentatomidae. Currently, Edessinae is being subjected to various taxonomic revisions and adjustments aimed at organizing and clarifying this complex group. Due to its significant morphological variation, the subfamily faces numerous challenges related to taxonomy and nomenclature. Thus, the objective of this study was to describe a new genus composed of seven new species. With the aid of a stereomicroscope, the structures of the body, including the head, thorax, abdomen, female genitalia, and especially the male genitalia, were described. Illustrations and a map of the geographic distribution are presented. This genus is characterized by having a flat metasternal process, narrow with the anterior bifurcation margin evanescent and the apex acuminate; short pygophore with shallow floor presenting an expansion that embraces the base of the parameres; simple, reddish or orange parameres, curved dorsoposteriorly; distal part swollen in posterior view; expanded black lateral margins. This work aims to contribute to the knowledge of Edessinae diversity, enriching the understanding and taxonomic classification of this group. Species recognition is extremely important to improve knowledge about the taxon and diversity of the Neotropical region.

Keywords
Brazilian Amazon, Neotopical region, Stink bugs, Taxonomy.

Introduction

Edessinae is the second most numerous subfamily of Pentatomidae, with approximately 500 described species. The subfamily constitutes a monophyletic taxon supported by the following synapomorphies: the carina of the mesosternum lower than the process of the metasternum; abdominal sternites II and III laterally fused; the phallus with a reduced vesica; and a triangular-shaped projection in the vaginal intima (Barcellos & Grazia, 2003; Nunes et al., 2019); in addition to morphological characters, molecular data also indicate the monophyly of the subfamily (Roca-Cusachs et al., 2021).

Currently, Edessinae sensu stricto is composed of 17 genera, but this arrangement is not unanimous

among researchers. Rider (2025) and collaborators (2018) include *Lopadusa* Stål, 1860, *Pharnus* Stål, 1867, *Neopharnus* Van Duzee, 1910, and *Praepharnus* Barber & Bruner, 1932 in the subfamily, but this composition has not yet been tested in a phylogenetic analysis, and the author does not explain such inclusion. Over the past 25 years, the taxon has been the subject of various studies, including the description of new genera, revalidation of generic taxa, and the description of new species (Fernandes & van Doesburg, 2000a; Fernandes et al., 2018; Nunes et al., 2020; Silva & Fernandes, 2021; Campos & Fernandes, 2022).

Aiming to contribute to the understanding of the morphological diversity of the subfamily, this study aims to describe a new genus, composed exclusively of species unknown to science.

Material and methods

For the study, 37 specimens obtained through loans from the following institutions were analyzed:

Depositories

INPA – Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil;

MNRJ – Museu Nacional do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil;

MPEG – Museu Paraense Emílio Goeldi, Belém, Pará, Brazil;

UEMA – Universidade Estadual do Maranhão, São Luís, Maranhão, Brazil;

UFPA – Universidade Federal do Pará, Belém, Pará, Brazil;

JEE – Particular collection Joseph E. Eger, Tampa, United States of America.

The information on the labels of the examined material was organized as follows (when available): country name in uppercase and bold; number of males (♂) and/or females (♀); name of the department or state in bold; municipality and specific location; geographic coordinates in square brackets ([]); collection date; collection method; collector(s); and acronym of the collection where the specimens are available in parentheses. Repeated information was not cited again.

Descriptions

The study of the specimens was conducted using a Leica S8 APO stereomicroscope for the observation and description of structures of systematic importance. The terminology used in the morphological descriptions follows Nunes et al. (2020) for general body morphology; Kment & Vilímová (2010) for the thorax; Dupuis (1970) for male genitalia; Zhou & Rédei (2020) for female genitalia. Measurements, in millimeters, were obtained with the aid of a measuring reticle attached to the eyepiece of the Leica S8 APO stereomicroscope.

Specimens were illustrated through photographs taken with a Leica DFC 450 camera attached to a Leica M205A stereomicroscope and assembled in Helicon Focus 8. The species distribution map was generated in QGIS (2021) from the data obtained on the labels.

Results and discussion

Edessinae gen.nov

(Figures 1-10)

Diagnosis. Small to medium-sized species (12-14 mm). Dorsal surface green or yellowish-green (Fig 1A-G). Humeral angles slightly developed with acuminate apex (Fig 1A-G). Corium yellow to reddish-brown variegated (Fig 1A-G). Ventral surface yellow or yellowish-green (Fig 2A-G); presence of narrow green horizontal bands along the margins of each segment (Fig 2A-G). Metasternal process narrow, short, not surpassing mesocoxae, acuminate apex (Fig 2A-G). Male. Dorsal rim broadly excavated leaving the base of the parameres exposed and setulose (Fig 5A). Superior process of genital cup laminar or piriform, black or brown, perpendicular to proctiger; posterior part slightly swollen; process adjacent to dorsal rim and oblique to proctiger (Fig 7C). Paramere partially or completely reddish or orange, curved; anterior part swollen in posterior view; basal part cilindric; lateral margins expanded, rounded and black; posterior face striated (Fig 4C). Pygophore floor shallow, setulose; with expansion covering the base of the paramere (Fig 9C); inner lateral wall with a swollen area. Ventral rim with swollen median excavation area (Figs 3C-D). Female. Valvifer VIII with a small middle crease (Figs 3E, 5E, 6E). Laterotergite IX surpassing tergite VIII by 1/3 of its lenght (Figs 3E, 5E, 6E)

General description. Head. Dorsal surface not punctuated (Fig 1A-G). Mandibular plates moderately sulcate; lateral margins yellowish or concolorous with the surface. Tylus green, triangular (Fig 1A-G). Ocellus with a yellow spot at the base. Bucculae not punctuated, covering ½ or the entire first segment of the rostrum; anterior margin rounded (Fig 2A-G). Rostrum yellowish; apex of segment IV with a dark spot (Fig 2A-G). Antennae yellow or reddish-brown; antennomeres in ascending order of size (I>II>III>IV>V) (Fig 1A-G).

Thorax. Pronotum punctuated, except in the region of the scars and on the lateral margins which are not punctuated; anterolateral margin yellow; posterolateral margin sinuous; posterior margin convex (Fig 1A-G). Humeral angles dentiform (Fig 1A-G). Scutellum with yellow lateral margins; punctuated, anteriorly with deep, large, sparse punctuations; medially and posteriorly with shallow, small, uniformly distributed punctuations; apex excavated, not punctuated, sharp (Fig 1A-G). Corium punctuated; punctuations concolorous with the surface or black, deep, densely and uniformly distributed; veins yellowish (Fig 1A-G). Membranous part of the wing metallic brown; opaque (Fig 1A-G). Ventral surface punctuated, punctuations concolorous, shallow, small, and restricted to the posterior half of each segment. Evaporatorium opaque, concolorous with the surface; lateral area with rounded notch (Fig 2A-G). Peritreme wrinkled, long, reaching ¾ of the distance between the gland opening and the lateral thorax (Fig 2A-G). Metasternal process flat; anterior bifurcation arms evanescent, covering ½ or the entire segment IV of the rostrum (Fig 2A-G). Legs reddish-brown or yellow; posterior part of the femur with brown teeth (Fig 1A-G).

Abdomen. Dorsal surface punctuated; punctuations concolorous with the surface, shallow, small, densely and uniformly distributed. Connexivum yellow or green, with median callus; posterolateral angle projected with acuminate and black apex (Fig 1A-G). Segment VII with distal margin with dark

spot; projected (Fig 1B). Ventral surface, presence of green bands on the pseudosutures and intersegmental regions (Fig 2A-G). Spiracles elliptical. Trichobothria in line with the spiracles.

Male. Pygophore dorsoposteriorly open (Fig 8A). Dorsal rim rough, with a median depression (Fig 4A). Posterolateral angles developed, narrow, with long setae, rounded apex (Fig 6A). Proctiger cylindrical; dorsal surface smooth; lateral slightly sulcate, setulose; posterior face oval, corrugated (Fig 3C). Ventral rim setulose with long setae, median excavation widely opened (Fig 8B).

Female. Valvifer VIII convex, setulose (Figs 3E, 5E, 6E). Valve IX exposed posteriorly (Figs 3E, 5E, 6E). Valvifer IX trapezoidal, setulose, slightly excavated laterally (Figs 3E, 5E, 6E). Laterotergite VIII triangular; acuminate black apex surpassing laterotergite IX (Figs 3E, 5E, 6E). Laterotergite IX triangular; excavated base; acuminate black apex, surpassing mediotergites VIII (Figs 3E, 5E, 6E).

Differential diagnosis. This genus is differentiated from others in Edessinae by having the metasternal process short, not surpassing mesocoxae, with a narrow anterior acuminate apex; the pygophore with a broadly excavated dorsal border; paramere short with a cilindrical basal part and broad, rounded or fan-like distal part. The new genus resembles *Hypoxys* Amyot & Serville, 1843, *Paraedessa* Silva & Fernandes, 2013, and *Anisoedessa* Nunes & Fernandes, 2019 in having slightly developed humeral angles with an acuminate apex, a variegated brown corium with yellow veins, segment VII projected below the level of laterotergites IX and a distal margin with a dark spot. It shares with *Paraedessa* the expansion on the pygophore floor, but differs by the proctiger laterally constricted, while *Paraedessa* is diagnosed by having the posterior face of the proctiger laterally expanded. The genus differs from *Hypoxys* by the humeral angles concolorous with the pronotum, whereas in *Hypoxys* the humeral angles are associated with a dark spot, either from a band in the posterior region of the pronotum projecting to the angles or just a dark spot at the apex of the humeral angles (when the species do not have a band on the pronotum). Additionally, the new genus has the costal margin of the corium concolorous with the surface, while in *Hypoxys* the costal margin has a black spot at the base of the costal margin. The new genus and *Anisoedessa* have intersegmental bands on the ventral surface of the body; however, the new genus differs from *Anisoedessa* by intersegmental bands green and not associated with metallic sheen (in A*nisoedessa* the species have intersegmental bands with metallic sheen).

Distribution (Fig. 10). FRENCH GUIANA; BRAZIL: Amazona, Pará, Maranhão, Mato Grosso, Rondônia, Acre

Key to the species of Gen. n.

1. Connexivum without a green spot in the anterior and posterior regions under each segment 2

- Connexivum yellow with a green spot in the anterior and posterior regions under each segment (Fig 1B, C, G) 4

2. Superior process of the genital cup laminar (Figs 9C-D)..... sp 243a

- Superior process of the genital cup piriform (Figs 4D, 8D)..... 3

3- Central part of the dorsal rim of the pygophore biconcave (Fig8A) .....sp 228

- Central part of the dorsal rim of the pygophore concave (Fig 4A) ..... sp 18

4. Corium yellow variegated with a median brown spot (Fig 1G) ..... sp 94a

- Corium brown or reddish-brown variegated with yellow (Fig 1B, C, D) 5

5. Central part of the dorsal rim of the pygophore concave (Fig 6A,C) ..... sp 18b

- Central part of the dorsal rim of the pygophore biconvex (Fig 5A,C; 7A,C) ... 6

6. Superior process of the genital cup piriform; (Fig 5C, D) ..... sp 18a

- Superior process of the genital cup laminar; (Fig 7C, D)..... sp 18c

Gen. nov. sp. nov. 94a

(Figs 1G; 2G; 3A-E; 10)

Holotype male. BRAZIL. Rondônia: 1 ♂ 62 km SW Ariquemes, nr, Fznda. Rancho Grande, 8–20–XI–1994, J.E. Eger, MV & Black Lights; Rhondonia Species #22, sp 94a, Fernandes, J.A.M (JEE).

Paratype. 1 ♀ BRAZIL. Rondônia: 1 ♂ 62 km SW Ariquemes, nr, Fznda. Rancho Grande, 5–17–X–1993, J.E. Eger, MV & Black Lights; Rhondonia Species #22, sp 94a, Fernandes, J.A.M (JEE).

Material examined. Paratypes: BRAZIL: Amazonas: 3 ♂ Coari, Rio Urucu, Petrobras, jazida 2; 6-III-2010, Fernandes, J.A.M. e equipe cols.//borda mata, [S04º52'58.0" W065º20'15.3"], luz mista HG e luz negra (UFPA). Acre: 1 ♂ [Senador Guiomard], Fazenda Experimental Catuaba-UFAC, armadilha luminosa, mata fragmentada (UFPA). Mato Grosso: 4 ♂ Cláudia, 09–X–2010, Miranda, R.M. col.; 1 ♂ Claudia, 10/X/2010, Col.: Barreto, M.R (UFPA).

Measurements: Total length: 12.2-14.2; head width: 2.2-2.9; interocular distance: 1.1-1.3; pronotum length: 2.3-2.9; pronotum width: 6.9-8.4; abdominal width: 6.6-7.8; antennal segment lengths: I: 0.3-0.5; II: 0.9-1.2; III: 1.2-1.9; IV: 3.3-3.6

Description. Head. Antenna reddish (Fig 1G).

Thorax. Pronotum punctuated with punctuations concolorous with the surface, shallow, densely and uniformly distributed (Fig 1G). Corium yellow variegated with median brown spot (Fig 1G). Legs with yellow coxae; femur, tibia, and tarsus reddish (Fig 2G). Evaporatorium concolorous with greenish bands (Fig 2G).

Abdomen. Connexivum yellow with greenish spots in the anterior and posterior regions of each segment (Fig 1G). Apex of abdominal segment VII surpassing laterotergites VIII and IX (Fig 3E).

Male. Pygophore with dorsal rim with a brown spot and medially concave (Fig 3A,C). Posterolateral angles of the pygophore straight (Fig 3A-B). Superior process of the genital cup piriform, lower part dilated and excavated (Fig 3C-D). Paramere reddish, lanceolate; posterior margin narrowing to the apex; anterior part slightly swollen, acute in posterior view; posterior face with a median keel from

apex to base (Fig 3C). Lateral wall of the pygophore strongly swollen (Fig 3C-D). Ventral rim with a median dark spot, U-shaped excavation (Fig 3B).

Female. valvifer VIII with clearly visible crease, arched posterior margin, rounded lateral margin; sutural rim dark and posteriorly divergent (Fig 3E). Valve IX slightly visible posteriorly. Laterotergite IX base sulcate.

Differential diagnosis. This species is characterized by a yellow variegated corium with a median brown spot, distinguishing it from others. The *Gen. nov. sp. nov. 94a*, *Gen. nov. sp. nov. 18a*, and *Gen. nov. sp. nov. 18b* have yellow connexivum with greenish spots in the anterior and posterior regions of each segment. With *Gen. nov. sp. nov. 18*, it shares the dorsal rim of the pygophore with a concave excavation, but *Gen. nov. sp. nov. 94a* differs from *Gen. nov. sp. nov. 18* by having a dark spot on the dorsal rim (*Gen. nov. sp. nov. 18* does not have a spot); *Gen. nov. sp. nov. 94a* has the paramere anteriorly acute and slightly swollen while in *Gen. nov. sp. nov. 18* the paramere is anteriorly rounded and strongly swollen.

Gen. nov. sp. nov. 18

(Figs 1A; 2A; 4A-D; 10)

Holotype male. BRAZIL. Mato Grosso: 1 ♂ Diamantino, Faz. S. João, 01–79, O. Roppa & A. Domingos (MNRJ).

Measurements: Total length: 13.1; head width: 2.5; interocular distance: 1.2; pronotum length: 2.7; pronotum width: 7.2; abdominal width: 6.8; antennal segment lengths: I: 0.4; II: 1.0; III: 1.4; IV: 2.9; V: 3.1

Description. Head. Antennae brown (Fig 1A).

Thorax. Pronotum punctuated, anterior half with shallow, large, sparse punctuations associated with green spots; posterior half with punctuations concolorous with the surface, shallow, small, and uniformly distributed (Fig 1A). Corium reddish-brown variegated (Fig 1A). Legs yellow, with the distal part of the tibia reddish (Fig 2A). Evaporatorium concolorous with the surface (Fig 2A).

Abdomen. Connexivum homogeneously yellow (probably green).

Male. Pygophore with dorsal rim concolorous with the rest of the surface and medially concave (Fig 4A,C-D). Posterolateral angles directed laterally (Fig 4A-B). Superior process of the genital cup piriform with a median constriction (Fig 4C-D). Paramere club-shaped, yellow, base reddish; posterior margin rounded; anterior part swollen, rounded in posterior view (Fig 4C-D). Lateral wall of the pygophore swollen (Fig 4C-D). Ventral rim, median excavation U-shaped (Fig 4B).

Female. unknown.

Differential diagnosis. Gen. nov. sp. nov.18 and *Gen. nov. sp. nov. 228* have a club-shaped paramere, but *Gen. nov. sp. nov. 18* has a dorsal rim with a medially concave excavation, while *Gen. nov. sp. nov. 228* has a medially biconvex excavation.

Gen. nov. sp. nov. 18a

(Figs 1B; 2B; 5A-E; 10)

Holotype male. BRAZIL. Pará: 1 ♂ Bom Jardim, REBIO- Res. Biol. Gurupi, Armad. Luminosa Base, 05–15.VI.2010, J. C. Silva, J. A. Silva, A. A. Santos, T. T. A. Silva (UEMA)

Paratype. 1 ♀ Bom Jardim, REBIO- Res. Biol. Gurupi, Armad. Luminosa Móvel, 17-27.I.2010, F. Limeira-de-Oliveira, J. T. Câmara & M. B. Aguiar Neto, cols (UEMA). 1 ♀ Bom Jardim, REBIO- Res. Biol. Gurupi, Armad. Luminosa Base, 05–15.VI.2010, J. C. Silva, J. A. Silva, A. A. Santos, T. T. A. Silva (UEMA); 1♂ 1♀ same data (UFPA)

Material examined. Paratypes: BRAZIL: 1 ♂ Benevides, 19 a 25-III-1993, N. Bittencourt, *Edessa* sp. nov 228, Silva, V. J. 2017 det, MPEG 05022188 (MPEG); 1 ♀ Benevides, 15 a 19- III-1993, J.A. Pena, *Edessa* sp. nov 228, MPEG 05022138 (MPEG). Maranhão: 4 ♂ 2 ♀ Bom Jardim, REBIO- Res. Biol. Gurupi, Armad. Luminosa Base, 05–15.VI.2010, J. C. Silva, J. A. Silva, A. A. Santos, T. T. A. Silva (UEMA); 1♂ 1♀ same data (UFPA); 2 ♂ Bom Jardim, REBIO- Res. Biol. Gurupi, Armad. Luminosa Móvel, 17-27.I.2010, F. Limeira-de-Oliveira, J. T. Câmara & M. B. Aguiar Neto, cols (UEMA).

Measurements: Total length: 11.7-14.5; head width: 2.1-2.6; interocular distance: 1.1-1.3; pronotum length: 2.7-3.3; pronotum width: 6.6-8.1; abdominal width: 6.2-7.8; antennal segment lengths: I: 0.4-0.6; II: 0.8-1.1; III: 1.0-1.8; IV: 3.0-3.6; V: 2.7-3.4

Description. Head. Antennae reddish (Fig 1B).

Thorax. Pronotum punctuated, anterior region with shallow, large, sparse punctuations associated with green spots; posterior part with punctuations concolorous with the surface, shallow, small, and uniformly distributed (Fig 1B). Corium greenish-brown (Fig 1B). Legs with the posterior region of the tibia and tarsi reddish (Fig 2B).

Abdomen. Connexivum yellow with greenish spots in the anterior and posterior regions of each segment (Fig 1B). Apex of abdominal segment VII level with laterotergite IX (Fig. 5E).

Male. Pygophore with dorsal rim concolorous with the rest of the surface; medially biconcave (Fig 5A,C-D). Posterolateral angles directed laterally (Fig 5A-B). Superior process of the genital cup piriform, lower part dilated and excavated; presence of a median groove (Fig 5C-D). Paramere orange and piriform; posterior margin slightly developed and dilated; anterior part well swollen and globoid (Fig 5C-D). Lateral wall of the pygophore slightly swollen (Fig 5C-D). Ventral rim with a broadly open U-shaped median excavation (Fig 5B).

Female. Valvifers VIII with barely developed crest, arched posterior margin; rounded lateral margin; sutural rim contiguous (Fig 5E). Valve IX slightly visible posteriorly (Fig 5E). Valvifer IX with a straight posterior margin (Fig 5E).

Differential diagnosis. Gen. nov. sp. nov. 18a and *Gen. nov. sp. nov. 228* are similar in having the distal part of the paramere strongly swollen and the superior process of the genital cup piriform. However, these species are distinguished by the superior process of the genital cup in species *Gen. nov. sp. nov. 18a* being excavated in the lower part, while in *Gen. nov. sp. nov. 228* it is flat.

Gen. nov. sp. nov. 18b

(Figs 1C; 2C; 6A-E; 10)

Holotype male. BRAZIL. Amazonas: 1 ♂ Petrobras, Jaz. 2, rio Urucu; Coari, 6-III-2010, Fernandes, J.A.M, borda mata, [S04º52'58.0" W065º20'15.3"], luz mista HG e luz negra (INPA).

Paratype. BRAZIL: Amazonas: 1 ♀ Petrobras, Jaz. 2, rio Urucu; Coari, 6-III-2010, Fernandes, J.A.M, borda mata, [S04º52'58.0" W065º20'15.3"], luz mista HG e luz negra (INPA).

Measurements: Total length: 13.6-14.5; head width: 2.5-2.6; interocular distance: 1.1-1.3; pronotum length: 3.1-3.6; pronotum width: 7.2-8.3; abdominal width: 6.8-7.6; antennal segment lengths: I: 0.7; II: 1.4; III: 1.8; IV: 3.9; V: -

Description. Head. Antennae, antennal segment I yellow, segments II–V reddish (Fig 1C-D).

Thorax. Pronotum punctuated with two patterns of punctuations; shallow, large, sparse punctuations associated with green spots in the anterior region; punctuations concolorous with the surface, shallow, small, and uniformly distributed (Fig 1C). Corium variegated brown (Fig 1C). Legs: posterior region of the tibia and tarsi reddish (Fig 2C).

Abdomen. Connexivum yellow with greenish spots in the anterior and posterior regions of each segment (Fig 1C). Apex of abdominal segment VII below the level of laterotergite IX (Fig 6E).

Male. Pygophore with dorsal rim slightly darker than the rest of the surface;medially concave (Fig 6A,C-D). Posterolateral angles straight (Fig 6A-B). Superior process of the genital cup piriform, lower part concave (Fig 6C-D). Paramere with posterior margin rounded; anterior part slightly swollen, rounded (Fig 6C-D). Lateral wall of the pygophore slightly swollen (Fig 6C-D). Ventral rim with a median U-shaped excavation (Fig 6B).

Female. Valvifers VIII with arched posterior margin; straight lateral margin; sutural rim contiguous (Fig 6E). Valve IX not visible (Fig 6E). Laterotergite IX base sulcate (Fig 6E).

Differential diagnosis. See comments of the *Gen. nov. sp. nov. 94a*

Gen. nov. sp. nov. 18c

(Figs. 1D; 2D; 7A-D; 10)

Holotype male. BRAZIL. Amazonas: 1 ♂ Manaus, ZF2 jm-14, estrada, 15-18.vi.2004, lençol: luz mista, J. A. Rafael, C. S. Motta, F. Godoi, S. Trovisco & A. Silva Fº (INPA).

Measurements: Total length: 12.2; head width: 2.5; interocular distance: 1.2; pronotum length: 2.7; pronotum width: 7.1; abdominal width: 6.3; antennal segment lengths: I: 0.6; II: 0.9; III: 1.4; IV: 3.2; V: -

Description. Head. Antennae brown (Fig 1D).

Thorax. Pronotum with shallow, large punctuations, homogeneously distributed, associated with green spots (Fig 1D). Corium reddish-brown, slightly variegated (Fig 1D). Legs yellow with reddish tarsi (Fig 2D).

Abdomen. Connexivum yellow.

Male. Pygophore with dorsal rim slightly darker than the rest of the surface; medially biconvex (Fig 7A,C-D); mediolateral areas darker and slightly expanded (Fig 7A). Posterolateral angles directed laterally (Fig 7A-B). Superior process of the genital cup laminar, rectangular (Fig 7C). Paramere reddish; posterior margin laminar and slightly developed; anterior part rounded and slightly concave at the apex (Fig 7C-D). Lateral wall of the pygophore flattened (Fig 7D). Ventral rim, median excavation broadly open in a V-shape (Fig 7B).

Female. unknown.

Differential diagnosis. *Gen. nov. sp. nov. 18c* and *Gen. nov. sp. nov. 243a* have a laminar superior process of the genital cup, but they differ in the anterior tumecence of the paramere. *Gen. nov. sp. nov. 18c* has a slightly developed tumecence while *Gen. nov. sp. nov. 243a* has a strongly developed one.

Gen. nov. sp. nov. 228

(Figs 1E; 2E; 8A-D; 10)

Holotype male. BRAZIL. Pará: 1 ♂ Benevides, est. Neópolis, sítio D. Doca, VII.1991, W.L. Overal, *Edessa* sp. nov 228, Silva, V. J. 2017 det, MPEG 05022129 (UFPA)

Paratype. BRAZIL: Pará: 1 ♂ Benevides, est. Neópolis, sítio D. Doca, VII.1991, W.L. Overal, *Edessa* sp. nov 228, Silva, V. J. 2017 det, MPEG 05022127 (UFPA).

Measurements: Total length: 11.7-12.4; head width: 2.5; interocular distance: 1.2; pronotum length: 2.9-3.0; pronotum width: 6.9-7.3; abdominal width: 6.6-6.8; antennal segment lengths: I: 0.6; II: 0.8-0.9; III: 0.8-1.3; IV: 3.2-3.8; V: 3.1

Description. Head. Antennae brown (Fig 1E).

Thorax. Pronotum with shallow, large, homogeneously distributed brown punctuations (Fig 1E). Corium reddish-brown, slightly variegated (Fig 1E). Legs, femur yellow, distal part of tibia and tarsi reddish (Fig 2E).

Abdomen. Connexivum yellow.

Male. Pygophore with dorsal rim darker than the rest of the surface (Fig 8A); medially biconvex (Fig 8A,C-D). Posterolateral angles directed laterally (Fig 8A-B). Superior process of the genital cup piriform, moderately swollen, excavated; base margin concave (Fig 8C-D). Paramere orange, club-shaped; posterior margin rounded; anterior part sub-rounded (Fig 8C-D). Lateral wall of the pygophore slightly swollen (Fig 8C). Ventral rim, median excavation broadly open in a U-shaped (Fig 8B).

Female. unknown.

Differential diagnosis. See comments of the *Gen. nov. sp. nov. 18* and *Gen. nov. sp. nov. 18a*.

Gen. nov. sp. nov. 243a

(Figs 1F; 2F; 9A-D; 10)

Holotype male. BRAZIL. GUIANA FRANCESA: 1 ♂ 12 km W of Risquetout 5-XII-2002, J. E. Eger,

N04º54.673', W052º11.150', 58 m, MV Light, *Edessa* sp. FG15, det. J.E. Eger, 2006, sp. 243a Fernandes, JAM, (JEE)

Paratype. Amazonas: 1 ♂ Manaus, Res. Ducke, AM 010, km 10, 26-27/VIII/1992, Motta, C.S. *et al.*. (INPA 2002).

Measurements: Total length: 11.4-12.2; head width: 2.4; interocular distance: 1.2-1.4; pronotum length: 2.9-3.0; pronotum width: 6.7-6.9; abdominal width: 6.7-6.8; antennal segment lengths: I: 0.5; II: 0.8-0.9; III: 0.8-1.3; IV: 3.2-3.6; V: 3.1

Description. Head. Antennae reddish (Fig 1F).

Thorax. Pronotum with large, shallow brown punctuations, associated with green spots, homogeneously distributed (Fig 1F). Corium reddish-brown (Fig 1F). Legs, femur yellow, tibia and tarsi reddish (Fig 2F).

Abdomen. Connexivum green, with a median reddish spot (Fig 1F).

Male. Pygophore with dorsal rim slightly darker than the rest of the surface (Fig 9A); medially biconvex (Fig 9A,C-D). Posterolateral angles directed laterally (Fig 9A-B). Superior process of the genital cup laminar (Fig 9C-D). Paramere reddish, subcylindrical; posterior margin rounded, slightly developed and swollen; anterior part rounded (Fig 9C). Lateral wall of the pygophore flattened (Fig 9D). Ventral rim with a broadly open U-shaped median excavation (Fig 9D).

Female. unknown.

Differential diagnosis. See comments of the *Gen. nov. sp. nov. 18c*.

Acknowledgment

We thank the curators of the collections for the loan of the specimens studied here. This study was financed, in part, by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq). (JAMF: CNPq 311345/2018–2).

References

Barcellos, A. & Grazia, J. (2003) Cladistic analysis and biogeography of *Brachystethus* Laporte (Heteroptera, Pentatomidae, Edessinae). *Zootaxa* **256**: 1–14.

Campos, B. & Fernandes, J.A.M. (2022) *Odara*, a new genus to Edessinae (Hemiptera, Pentatomidae) with eleven new species. *Insect Systematics & Evolution*: 1–38. https://doi.org/10.1163/1876312X-bja10040.

Dupuis, C. (1970) Heteroptera. In: Tuxen, S.L. (ed.) *Taxonomist's glossary of genitalia of insects*. Munksgaard, Copenhagen, Denmark: pp. 190–208.

Fernandes, J.A.M. & Van Doesburg, P.H. (2000a) The *E. dolichocera* group of *Edessa* Fabricius, 1803 (Heteroptera: Pentatomidae: Edessinae). *Zoologische Mededeelingen Leiden* **73(20)**: 305–315.

Fernandes, J.A.M., Nascimento, A.T.S. & Nunes, B.M. (2018) Revision of *Pygoda* Amyot & Serville,

1843 stat. rest. (Heteroptera: Pentatomidae: Edessinae) with description of four new species. *Zootaxa* **4461(2)**: 205–232.

Kment, P. & Vilímová, J. (2010) Thoracic scent efferent system of Pentatomidae (Hemiptera: Heteroptera): a review of terminology. *Zootaxa* **2706**: 1–77. https://doi.org/10.11646/zootaxa.2706.1.

Nunes, B.M., Wallner, A.M. & Fernandes, J.A.M. (2019) *Anisoedessa*, a new genus of Edessinae (Hemiptera: Heteroptera: Pentatomidae) and considerations on Edessinae relationships based on cladistic analysis. *Arthropod Systematics* **77**(2): 215–237.

Nunes, B.M., Campos, L.D., Mendonça, M.T.S., Cunha, E.V.P. & Fernandes, J.A.M. (2020) Revision of *Hypoxys* Amyot & Serville, 1843 stat. res. (Heteroptera: Pentatomidae). *Zootaxa* **4742(3)**: 445–470.

QGIS Development Team (2021) *QGIS Geographic Information System*. Open Source Geospatial Foundation Project. Available from: https://qgis.osgeo.org (accessed 01 Jan 2021).

Roca-Cusachs, M., Schwertner, C.F., Kim, J., Eger, J., Grazia, J. & Jung, S. (2021) Opening Pandora's box: Molecular phylogeny of the stink bugs (Hemiptera: Heteroptera: Pentatomidae) reveals great incongruences in the current classification. *Systematic Entomology* **47**: 36–51.

Rider, D.A., Schwertner, C.F., Vilímová, J., Rédei, D., Kment, P., and Thomas D.B. (2018) Higher Systematics of the Pentatomoidea. In 'Invasive stink bugs and related species (Pentatomoidea): biology, higher systematics, semiochemistry, and management' (Ed. J. E. McPherson). Pp. 28–141. (CRC Press, Boca Raton).

Rider, D.A. (2025) Genus Index, Pentatomoidea Home Page. Available from: https://www.ndsu.edu/pubweb/~rider/Pentatomoidea/Genus_Index/genus_index.htm (accessed 13 May 2025).

Silva, P.A.L. & Fernandes, J.A.M. (2021) *Calcatedessa* gen. n., a new genus sister to *Grammedessa* Correia & Fernandes (Heteroptera, Pentatomidae, Edessinae) based on a cladistic analysis. *Insect Systematics & Evolution*: 1–21.

Zhou, Y. & Rédei, D. (2020) From lanceolate to plate-like: Gross morphology, terminology, and evolutionary trends of the trichophoran ovipositor. *Arthropod Structure and Development* **54**: 1–29. https://doi.org/10.1016/j.asd.2020.100914.

Illustrations and legend

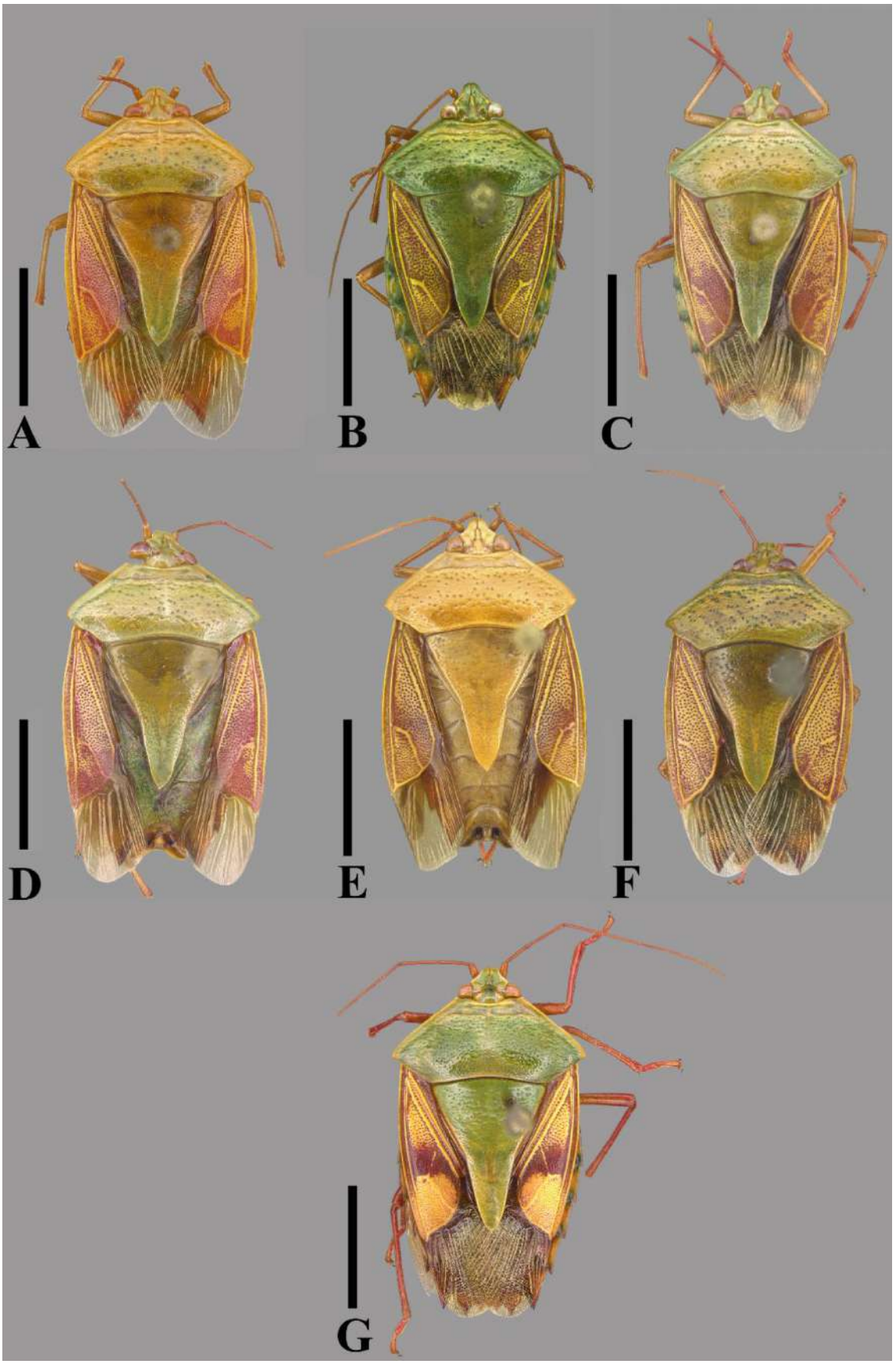

Figure 1. Dorsal view of the species (Scale= 5mm). A *Gen. nov. sp. nov. 18*; B *Gen. nov. sp. nov. 18a*; C *Gen. nov. sp. nov. 18b*; D *Gen. nov. sp. nov. 18c*; E *Gen. nov. sp. nov. 228*; F *Gen. nov. sp. nov. 243a*; G *Gen. nov. sp. nov. 94a*

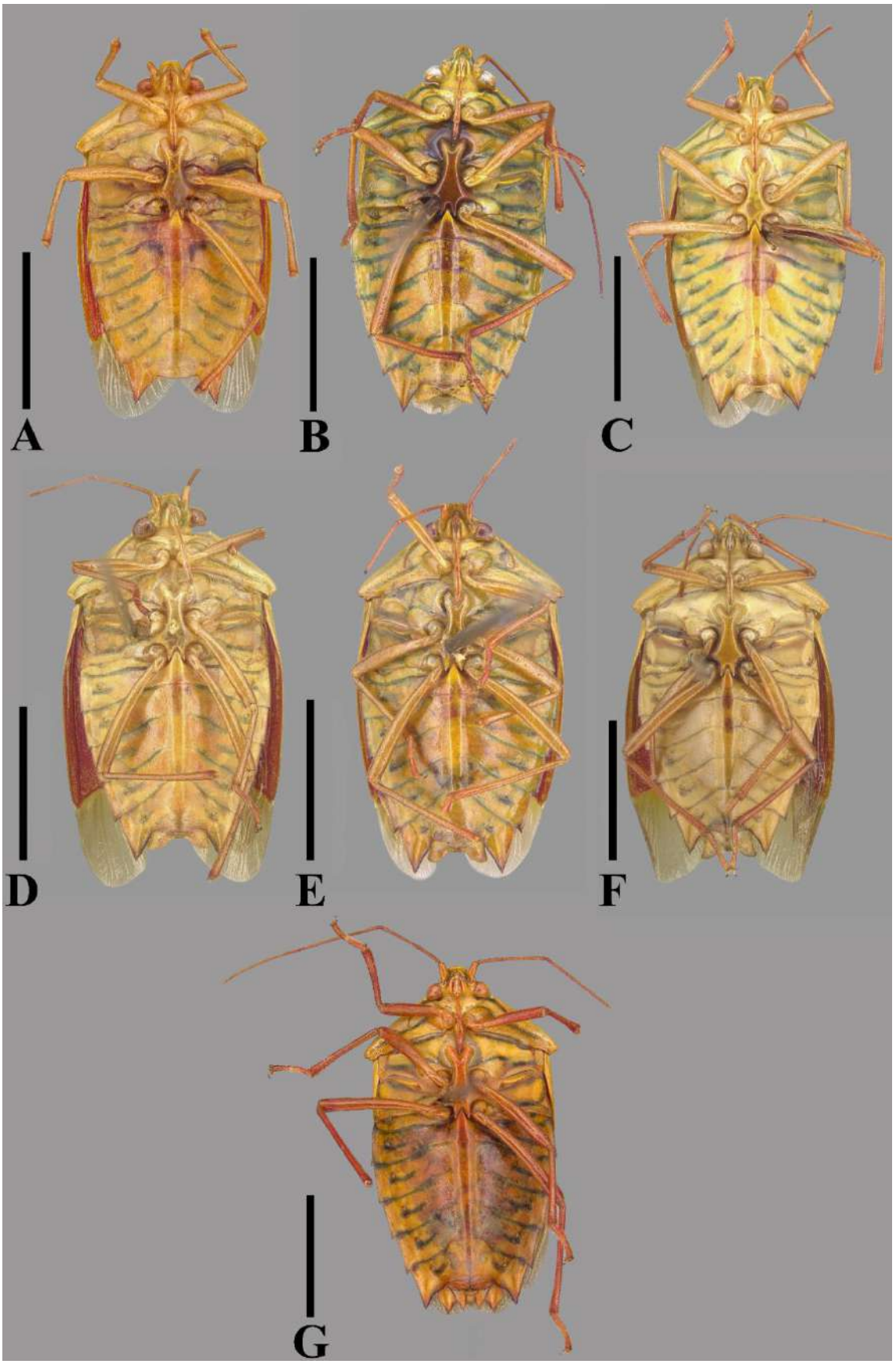

Figure 2. Ventral view of the species (Scale= 5mm). A *Gen. nov. sp. nov. 18*; B *Gen. nov. sp. nov. 18a*; C *Gen. nov. sp. nov. 18b*; D *Gen. nov. sp. nov. 18c*; E *Gen. nov. sp. nov. 228*; F *Gen. nov. sp. nov. 243a*; G *Gen. nov. sp. nov. 94a*

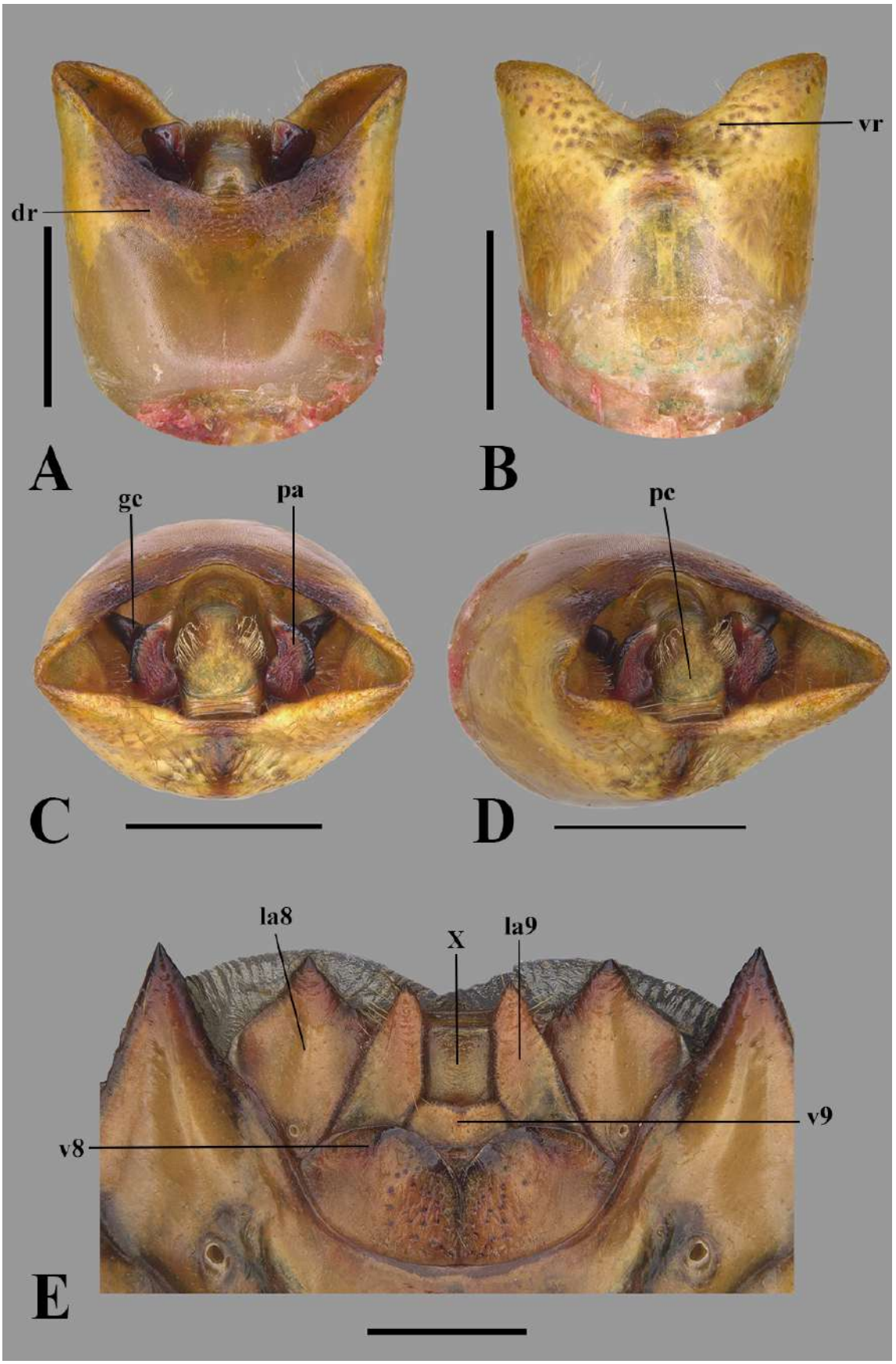

Figure 3. Genitalia of *Gen. nov. sp. nov. 94a* A–D: Male genitalia. A: Pygophore in dorsal view. B: Pygophore in ventral view. C: Pygophore in posterior view. D: Pygophore in posterolateral view. E: Female genital plates in ventral view. dr: dorsal rim. v8: valvifer VIII. v9: valvifer IX. gc: genital cup. la8: laterotergites VIII. la9: laterotergites IX. pc: proctiger. pa: parameres. vr: ventral Rim. X: Segment X. Scale = 1 mm.

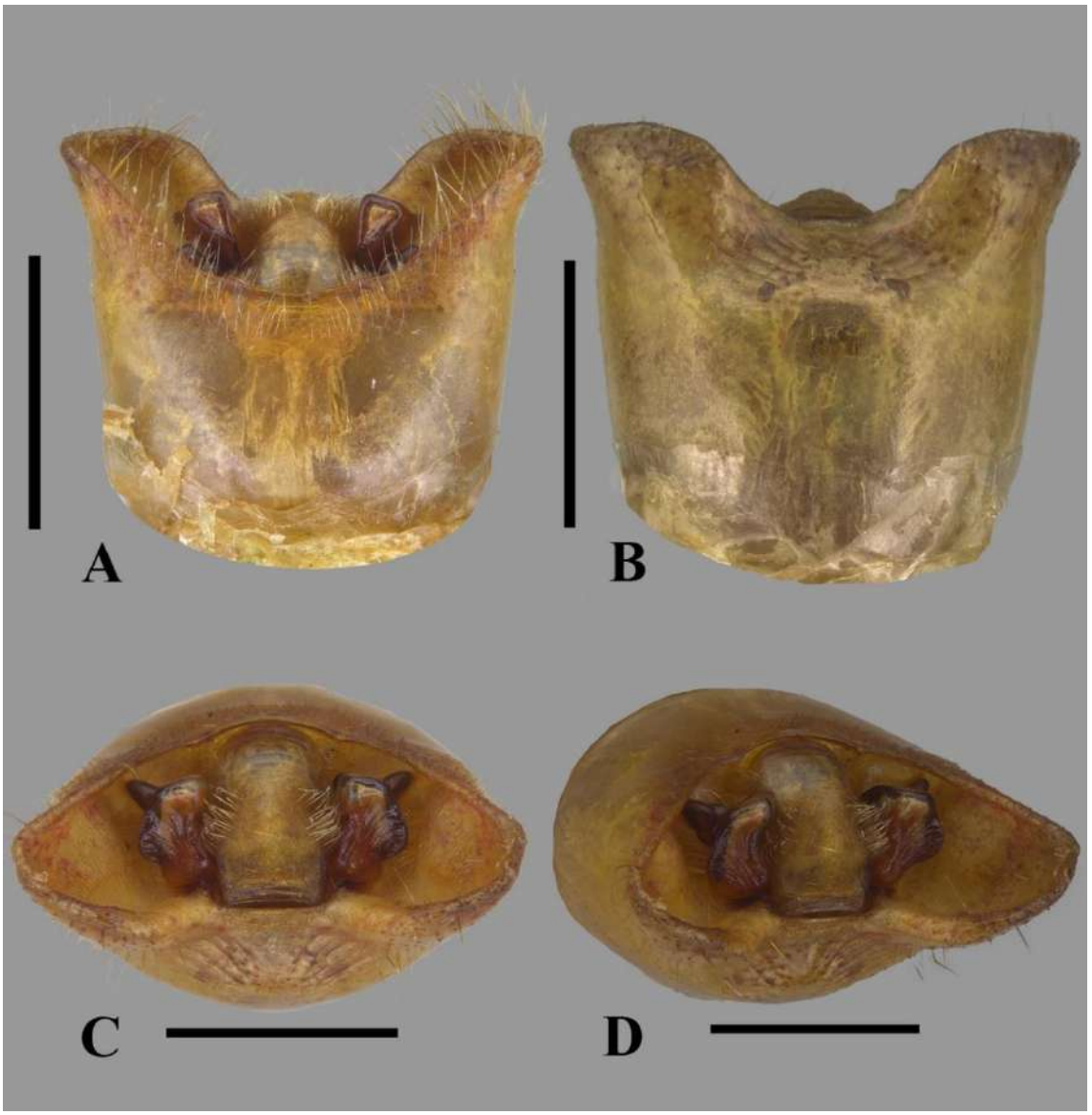

Figure 4. Genitalia of *Gen. nov. sp. nov. 18* A–D: Male genitalia. A: Pygophore in dorsal view. B: Pygophore in ventral view. C: Pygophore in posterior view. D: Pygophore in posterolateral view. Scale = 1 mm.

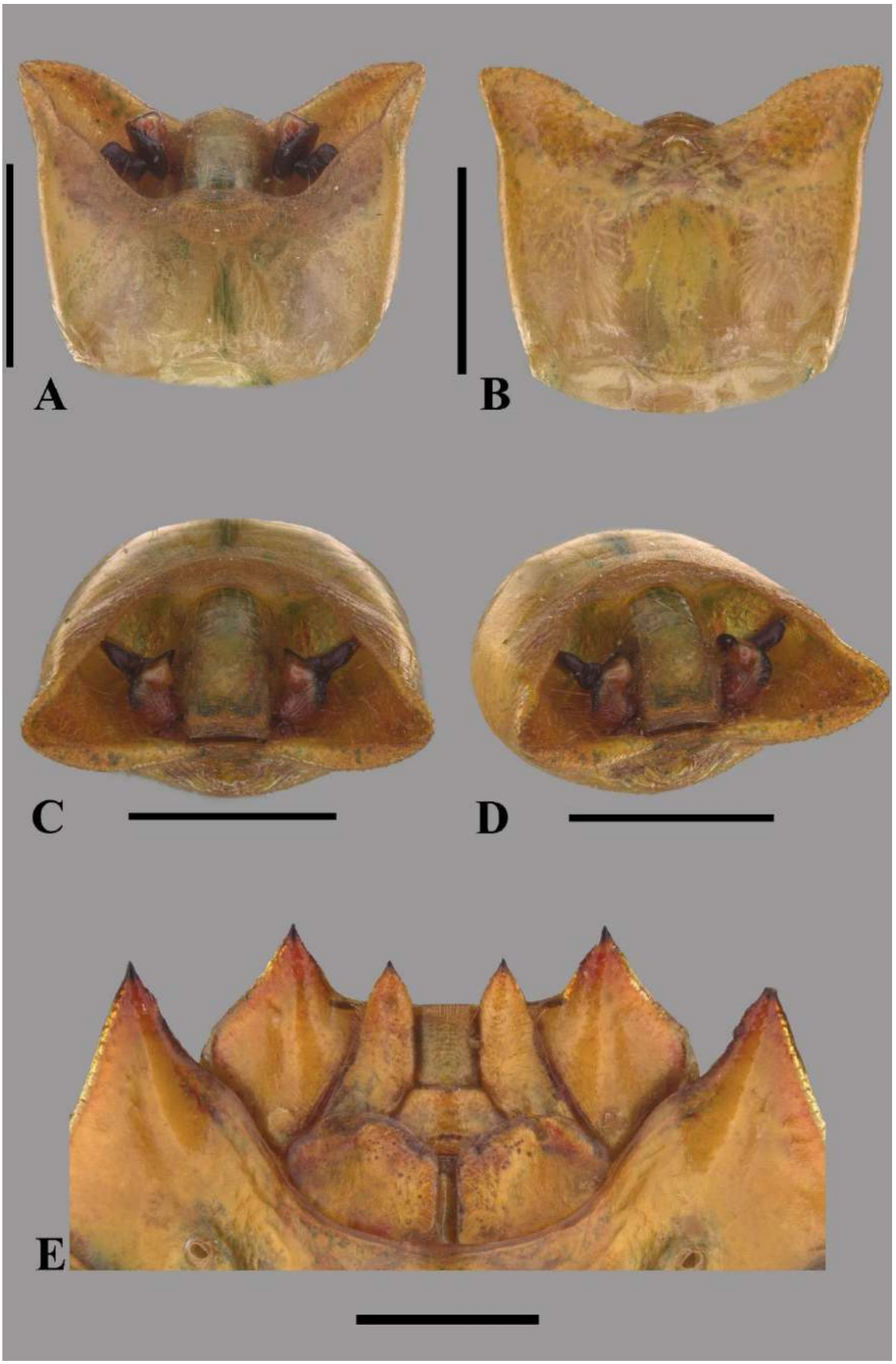

Figure. 5. Genitalia of *Gen. nov. sp. nov. 18a* A–D: Male genitalia. A: Pygophore in dorsal view. B: Pygophore in ventral view. C: Pygophore in posterior view. D: Pygophore in posterolateral view. E: Female genital plates in ventral view. Scale = 1 mm.

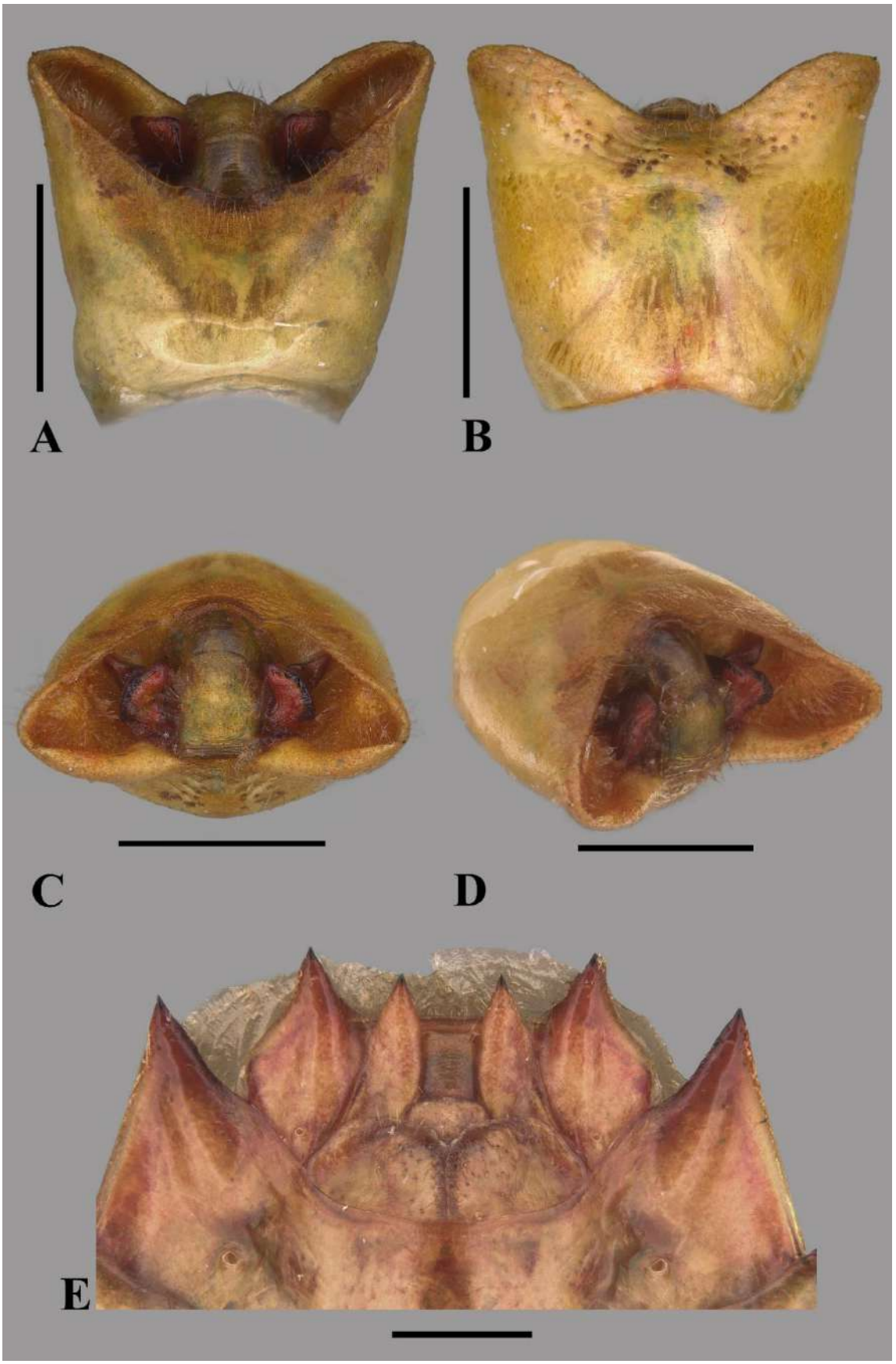

Figure 6. Genitalia of *Gen. nov. sp. nov. 18b* A–D: Male genitalia. A: Pygophore in dorsal view. B: Pygophore in ventral view. C: Pygophore in posterior view. D: Pygophore in posterolateral view. Scale = 1 mm.

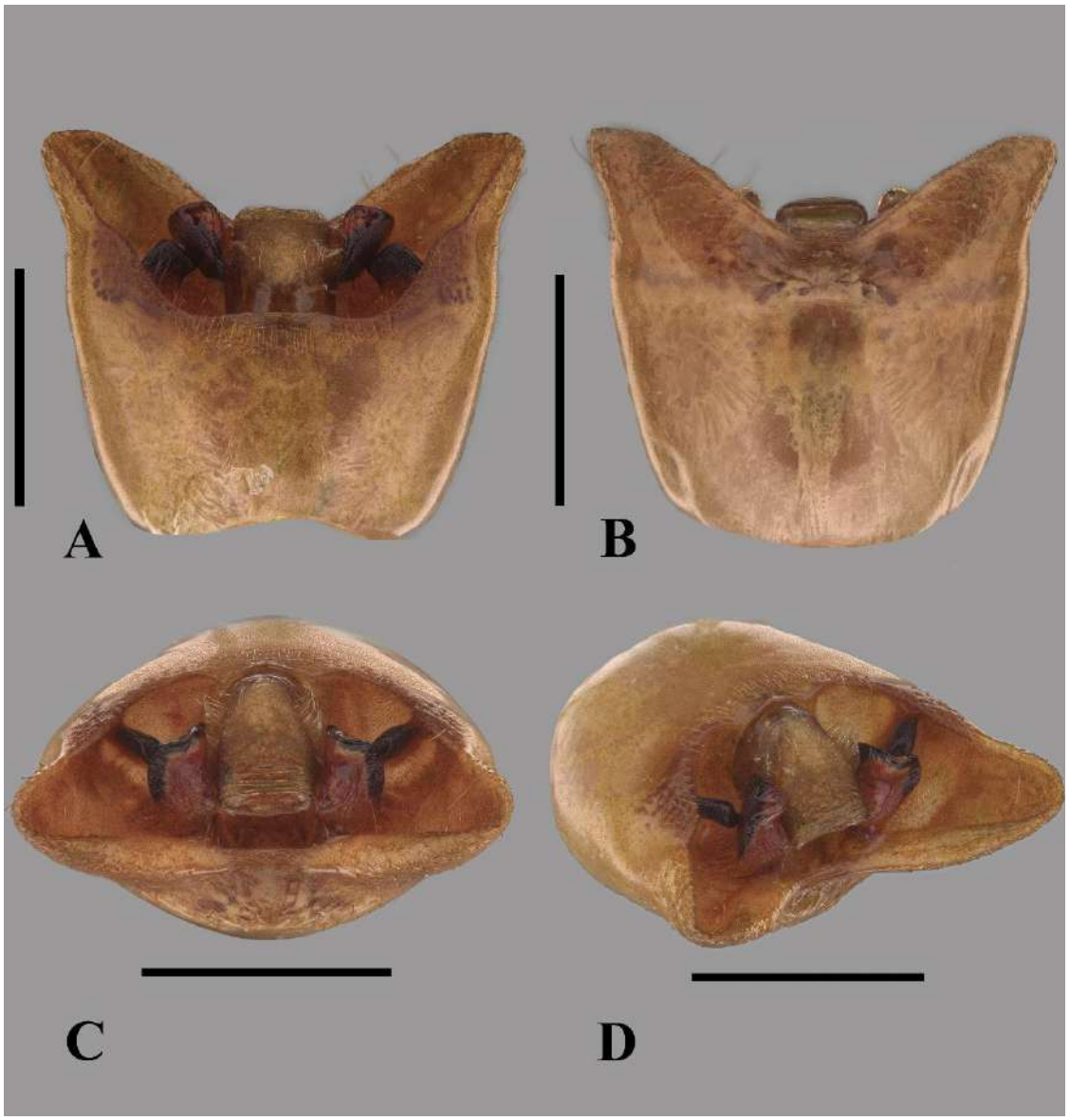

Figure 7. Genitalia of *Gen. nov. sp. nov. 18c* A–D: Male genitalia. A: Pygophore in dorsal view. B: Pygophore in ventral view. C: Pygophore in posterior view. D: Pygophore in posterolateral view. Scale = 1 mm.

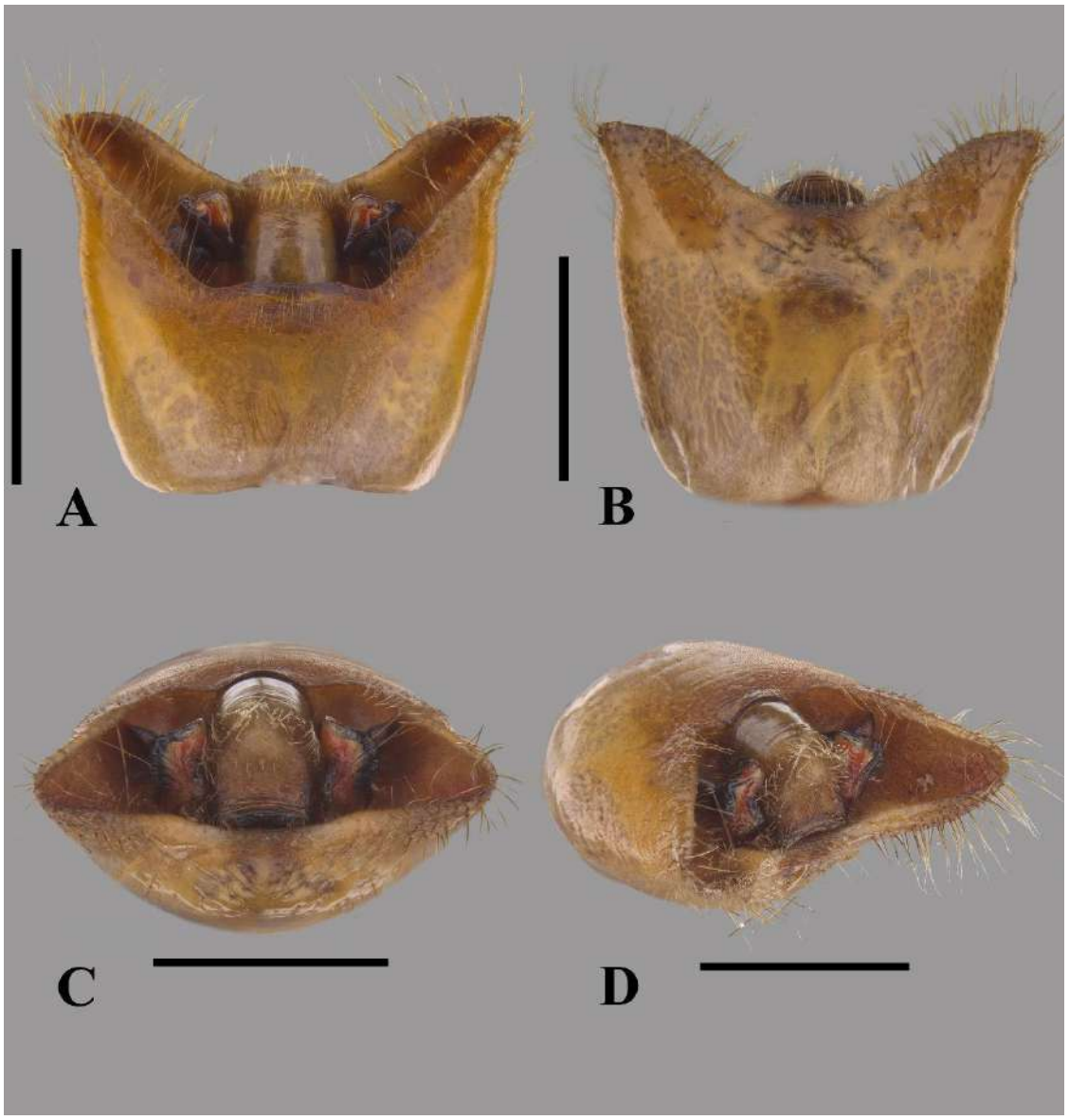

Figure 8. Genitalia of *Gen. nov. sp. nov. 228* A–D: Male genitalia. A: Pygophore in dorsal view. B: Pygophore in ventral view. C: Pygophore in posterior view. D: Pygophore in posterolateral view. Scale = 1 mm.

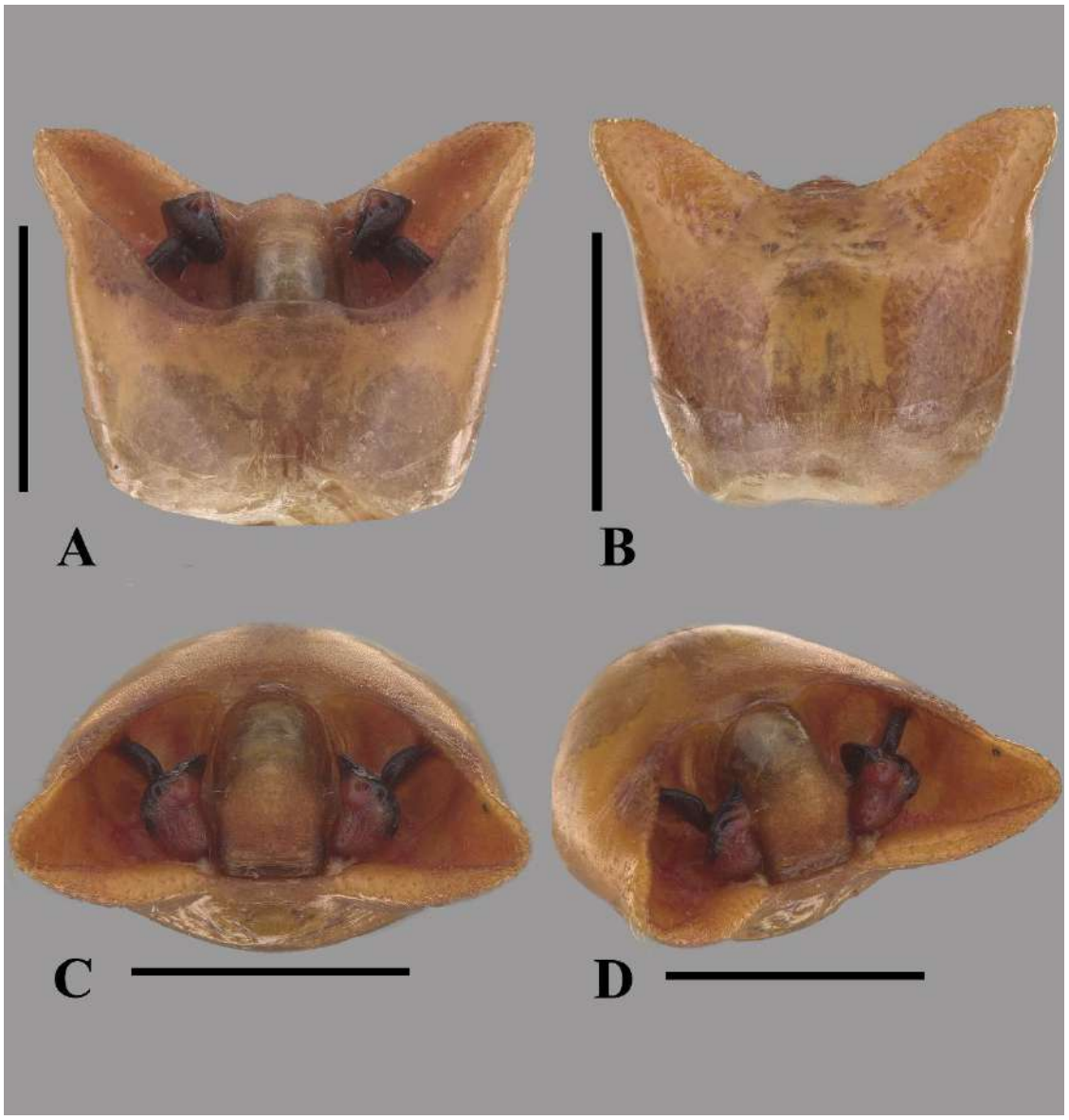

Figure 9. Genitalia of *Gen. nov. sp. nov. 243a* A–D: Male genitalia. A: Pygophore in dorsal view. B: Pygophore in ventral view. C: Pygophore in posterior view. D: Pygophore in posterolateral view. Scale = 1 mm.

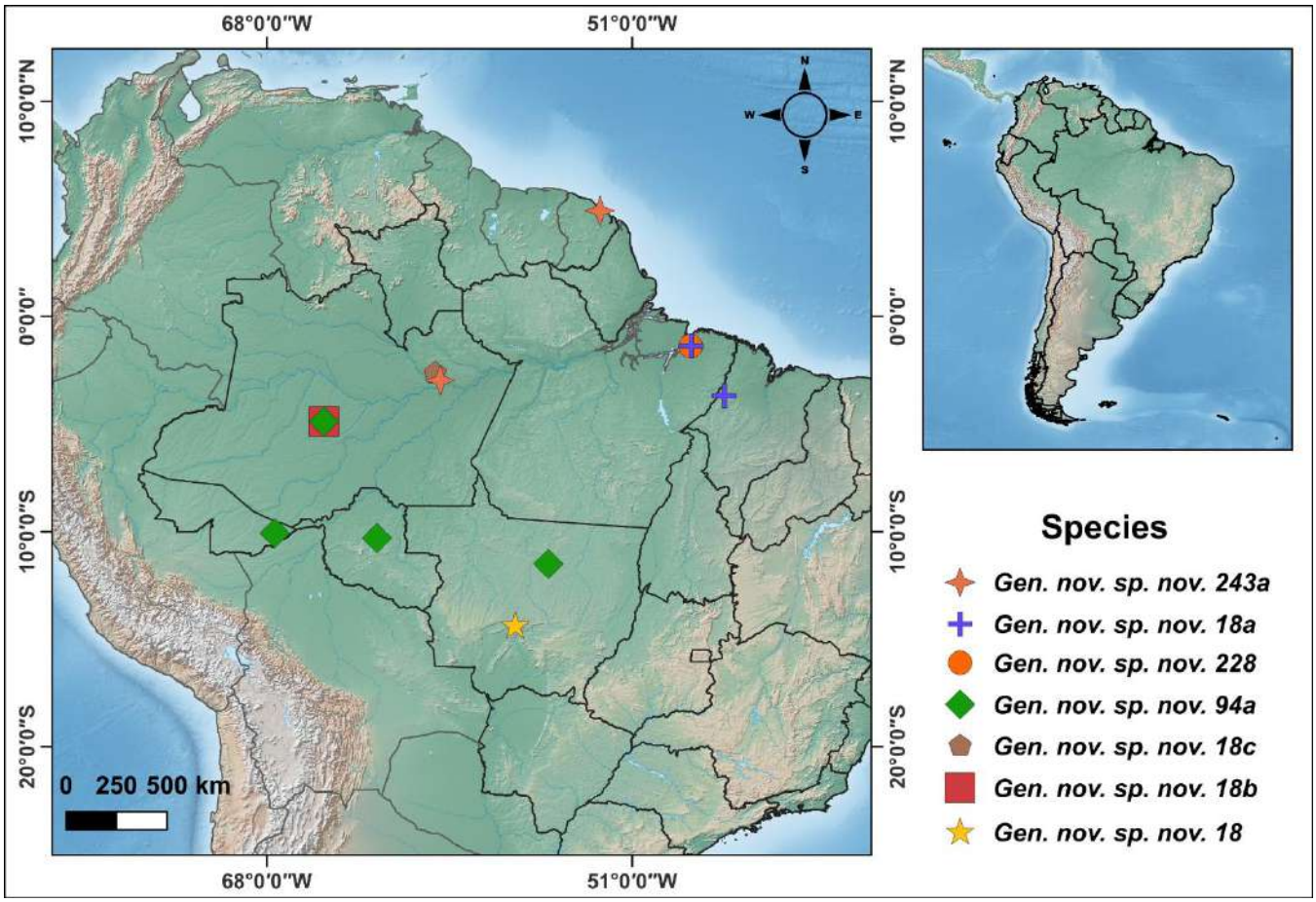

Figure 10 Distributional map of *Gen. nov. sp. nov. 243a*, *Gen. nov. sp. nov. 18a*, *Gen. nov. sp. nov. 228*, *Gen. nov. sp. nov. 94a*, *Gen. nov. sp. nov. 18c*, *Gen. nov. sp. nov. 18b* and *Gen. nov. sp. nov. 18*

CONCLUSÕES GERAIS

Foram descritas sete espécies e consideradas como pertencentes a um novo gênero para Edessinae pois apresentam um conjunto de características diagnósticas como o ângulo umeral pouco desenvolvido e acuminado; processo metasternal plano, estreito com a margem da bifurcação anterior evanescente e ápice acuminado; assoalho do pigóforo curto e com a presença de uma expansão que envolve a base do parâmero; parâmeros avermelhados ou alaranjados e curvados, parte distal intumescida em vista posterior, margens laterais expandidas e pretas. Essas características morfológicas as diferenciam-se das espécies já descritas para a subfamília.

Esse estudo representa um avanço para a contribuição dos estudos de Edessinae, uma vez que novos táxons são propostos e descritos, contribuindo assim para ampliar o conhecimento a respeito da diversidade da fauna insetos neutropicais de Pentatomidae e Edessinae a partir da descrições de espécies e gêneros novos.

Instructions for Authors

ANEXOS

Anexo I – Normas da revista Insect Systematics and Evolution, na qual foi encaminhado para publicação o capítulo I dessa Dissertação.

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Bezděk, A. (2004b) Revision of the genus *Ceratogonia* Kolbe, 1899 (Scarabaeidae: Melolonthinae: Diplotaxini). *Annales Zoologici* **54**: 797-801.

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