

RESEARCH ARTICLE

A new species of the sharpshooter genus *Soosiulus* (Insecta: Hemiptera: Cicadellidae: Cicadellini) from the Brazilian Amazon Forest, with notes on a putative complex of species

 Gabriel Mejdalani¹, Stéphanie R. Carvalho¹, Victor Quintas¹, Nathalia H. Pecly¹

¹Departamento de Entomologia, Museu Nacional, Universidade Federal do Rio de Janeiro. 20940-040 Rio de Janeiro, RJ, Brazil.

Corresponding author: Gabriel Mejdalani (mejdalan@acd.ufrj.br)

<http://zoobank.org/57E51C5B-365E-4386-8C61-00CC9E37933C>

ABSTRACT. *Soosiulus belterrensis* sp. nov. is described and illustrated from the Amazon Forest of the state of Pará, northern Brazil. Both the male and female terminalia are treated in detail, in addition to color features. With the addition of this new taxon, the diverse Neotropical genus *Soosiulus* Young, 1977 now comprises 28 species. The new species is the first one proposed for *Soosiulus* after the original generic description. It appears to be included in a complex with eleven other *Soosiulus* species, all of them sharing a very similar color pattern. Among the members of this putative complex, the aedeagus of *S. belterrensis* sp. nov. is most similar to those of *S. hastatus* Young, 1977 and *S. ruber* Young, 1977, due to the presence of a pair of conspicuous dorsoapical processes. However, in *S. hastatus* and *S. ruber* the aedeagus has also a retrorse ventroapical process originated from a lobe; both process and lobe are not present in the new species. In addition, the female sternite VII in *S. hastatus* and *S. ruber* is convex posteriorly, whereas it has a distinct median emargination in the new species.

KEY WORDS. Cicadellinae, leafhopper, morphology, Neotropical Region, taxonomy.

INTRODUCTION

Cicadellinae (sharpshooter leafhoppers) includes currently about 2,400+ species in circa 330 genera (Wilson and Turner 2007, McKamey 2007, Bartlett et al. 2018). This subfamily is very diverse and includes taxa from all major zoogeographical regions, being exceedingly rich in the Neotropics (Young 1968, 1977, Mejdalani 1998). They are among the largest and most brightly colored of the leafhoppers (Wilson and Turner 2007). Among the three most diverse leafhopper subfamilies, viz., Deltocephalinae, Typhlocybinae, and Cicadellinae, the latter is certainly the one most thoroughly studied in Brazil. However, new Cicadellinae genera and species are still frequently discovered in the country's major biomes (Amazon Forest, Atlantic Forest, and Cerrado). All known members of the Cicadellinae are xylem-feeders (Young 1968), and some of them are vectors of the bacterium *Xylella fastidiosa* Wells et al., 1987, which causes diseases in various agricultural plants (Redak et al. 2004). Currently, two tribes are recognized within this subfamily, a New World Proconiini and a cosmopolitan Cicadellini (Young 1968, 1977, 1986, Mejdalani 1998, McKamey 2007).

Soosiulus Young, 1977 (type species: *Poeciloscarta fabricii* Metcalf, 1965) is a diverse Neotropical genus that comprises 27 species (McKamey 2007). Most of the known species were described by Young (1977) in his comprehensive and detailed taxonomic review of the New World Cicadellini. This genus, which is distributed from Costa Rica and Panama through the Amazon region in Brazil and to Peru and Bolivia, includes species that are red or orange, contrastingly marked with black (Young 1977, Wilson et al. 2009). Other genera that include species showing a similar color pattern are *Ladoffa* Young, 1977, *Ramosulus* Young, 1977, *Poeciloscarta* Stål, 1869, *Aurigoniella* Takiya, Mejdalani & Felix, 2001, *Subrasaca* Young, 1977, and *Parasubrasaca* Mejdalani & Cavichioli, 2013 (Young 1977, Wilson et al. 2009, Cavichioli and Takiya 2010, Mejdalani and Cavichioli 2013). *Soosiulus* can be distinguished from these similar genera by the following combination of features (Young 1977): (1) crown with area between ocelli flattened or slightly concave, without a median fovea; (2) antennal ledges, in lateral view, with anterior margin rectilinear and oblique; (3) epistomal suture interrupted medially; (4) forewings convex apically, apical membranous area distinct; (5) male pygofer with fairly numerous macrosetae usually extending

in a broad diagonal group from middle of disk posterodorsally to dorsoapical margin, without processes; (6) subgenital plates slender, triangular, not extending as far posteriorly as pygofer apex; (7) paraphyses present and usually paired and symmetrical (exception: *S. fulgidus* Young, 1977, in which they are reduced to a longitudinal bar-like sclerite located at the apex of connective).

In this paper, a new species of *Soosiulus* is described and illustrated from the Amazon Forest of Brazil (state of Pará). Both the male and female terminalia are treated in detail, in addition to color features. This is the first species described for the genus after the detailed revision published by Young (1977). The possible existence of a complex of species within *Soosiulus* is briefly discussed.

MATERIAL AND METHODS

We have been able to study a series of 19 specimens of the new species, including females and males, which were collected by means of the use of a light trap. These specimens have been deposited in the following institutions: Departamento de Entomologia, Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ, Rio de Janeiro), Coleção Entomológica Prof. José Alfredo P. Dutra, Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro (DZRJ, Rio de Janeiro), and Coleção Entomológica Padre Jesus Santiago Moure, Departamento de Zoologia, Setor de Ciências Biológicas, Universidade Federal do Paraná (DZUP, Curitiba). Techniques for preparation of male and female terminalia structures followed Oman (1949) and Mejdalani (1998), respectively. Dissected terminalia parts were stored in small vials with glycerin and attached below the specimens, as suggested by Young & Beirne (1958). Structural terminology followed mainly Young (1968, 1977), except for the facial areas of the head (Hamilton 1981, Mejdalani 1993, 1998) and the female terminalia (Nielson 1965, Hill 1970). Use of the term gonoplac followed Mejdalani (1998). Photographs of the body in dorsal view, of the face, and of the female sternites VII and VIII were made using a digital camera attached to a Motic SMZ-171 stereomicroscope. Photographs of the ovipositor valvulae were taken with a digital camera attached to Nikon Eclipse E200 light microscope. Line drawings were prepared with the aid of a camera lucida attached to a Nikon SMZ1270 stereomicroscope.

TAXONOMY

Soosiulus belterrensis sp. nov.

Figs 1–19

<https://zoobank.org/F73C9079-B47C-4D0A-A9B9-E62DCCB3CDAB>

Diagnosis. Head (Fig. 2) with pair of distinct black apical spots at transition crown-face. Aedeagal shaft (Fig. 7), in lateral view, slightly curved dorsally; its apex with pair of strong spiniform processes directed dorsally and almost reaching pygofer apex; without ventroapical lobe and without retrorse

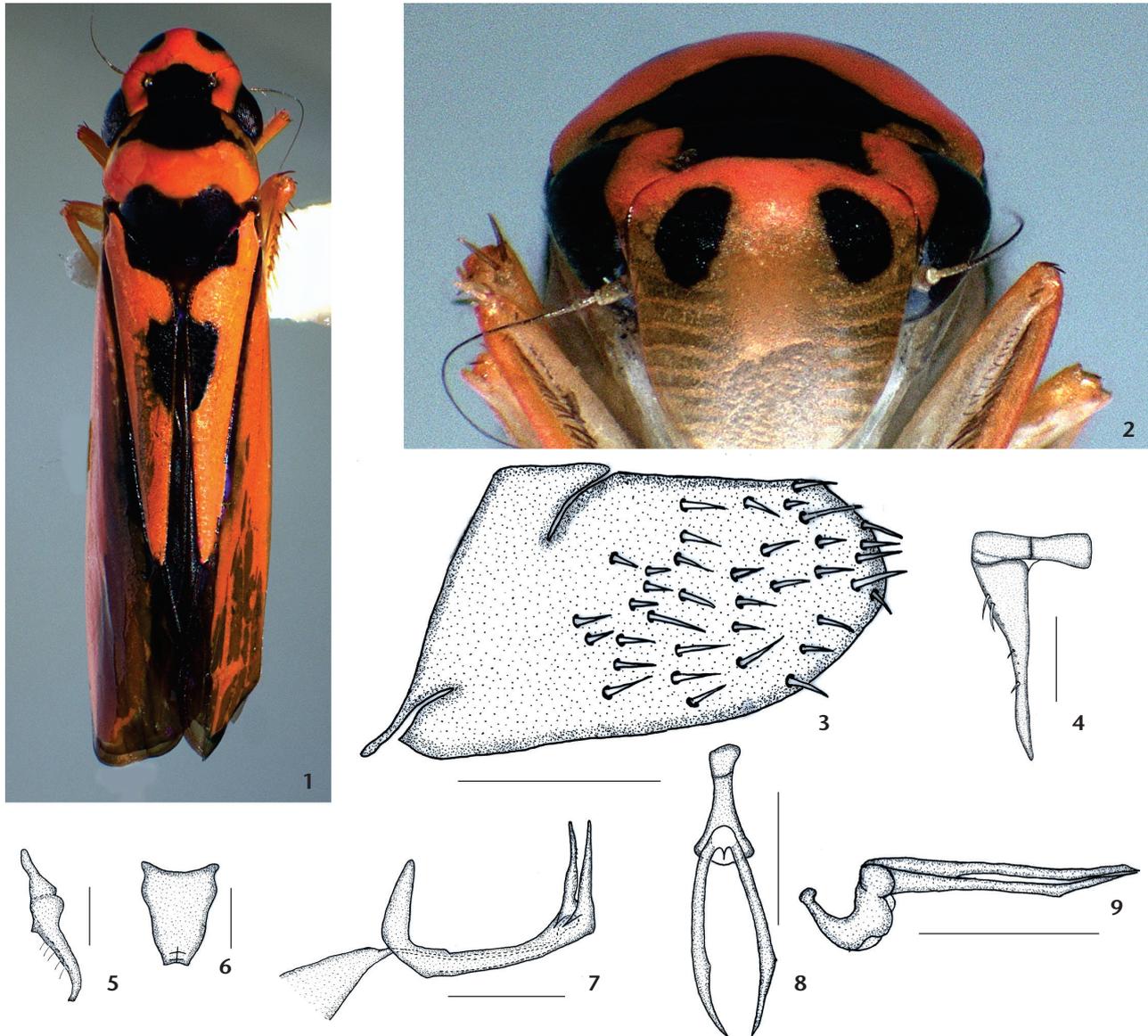
ventroapical process. Female sternite VII (Fig. 10), in ventral view, with posterior margin convex on each side of distinct median emargination.

Description. Total length: males 6.7–7.0 mm (n = 5), females 7.0–7.3 mm (n = 3). Morphology of head and thorax as in the generic description of Young (1977, p. 369).

Ground color of dorsum (Fig. 1) mostly orange. Head (Fig. 2) with pair of distinct apical spots at transition crown-face and large median basal spot including ocelli, black. Pronotum (Fig. 1) with anterolateral portions brown; with median spot extending along anterior margin, with slender arm projected laterally behind each compound eye, and pair of semioval spots on posterior margin, black. Mesonotum (Fig. 1) mostly black, distal portion of scutellum brown to orange. Forewing (Fig. 1) with spot on each humeral margin connected by narrow band along commissural margin to transcommissural large hastate marking in clavus, black; claval sulcus with black stripe, at corium side, from base to apical portion, narrowed or evanescent apically; apical membranous area translucent brown. Face (Fig. 2) with frons brownish-yellow tinged with orange; remainder of face mostly pale yellow. Lateral and ventral portions of thorax pale yellow; legs pale yellow tinged with orange, foretibiae mostly orange.

Male terminalia. Pygofer (Fig. 3), in lateral view, well produced posteriorly; posterior margin broadly rounded; without processes; with numerous macrosetae distributed mainly on distal two-thirds of disk. Valve (Fig. 4), in ventral view, subrectangular, slightly constricted medially. Subgenital plate (Fig. 4), in ventral view, triangular, elongate, slender, distal two-thirds strongly narrowed; with few uniseriate macrosetae located along outer margin; plate not fused basally to its counterpart; in lateral view, extending almost as far posteriorly as pygofer apex. Style (Fig. 5), in dorsal view, slender, elongate, extending approximately as far posteriorly as apex of connective; apophysis gradually narrowed posteriorly, apical portion curved outwards, bearing setae along outer margin, without preapical lobe; apex subacute. Connective (Fig. 6), in dorsal view, forming elongate, broad subtriangular plate directed dorsally. Aedeagus (Fig. 7) symmetrical; shaft, in lateral view, slightly curved dorsally; apex with pair of strong spiniform processes directed dorsally and almost reaching pygofer apex; without ventroapical lobe and without retrorse ventroapical process; gonopore located apically. Paraphyses (Figs 8–9), in dorsal view, short-stalked, articulated with apex of connective; with pair of rami, each one elongate, slender, tapered apically, and with acute apex.

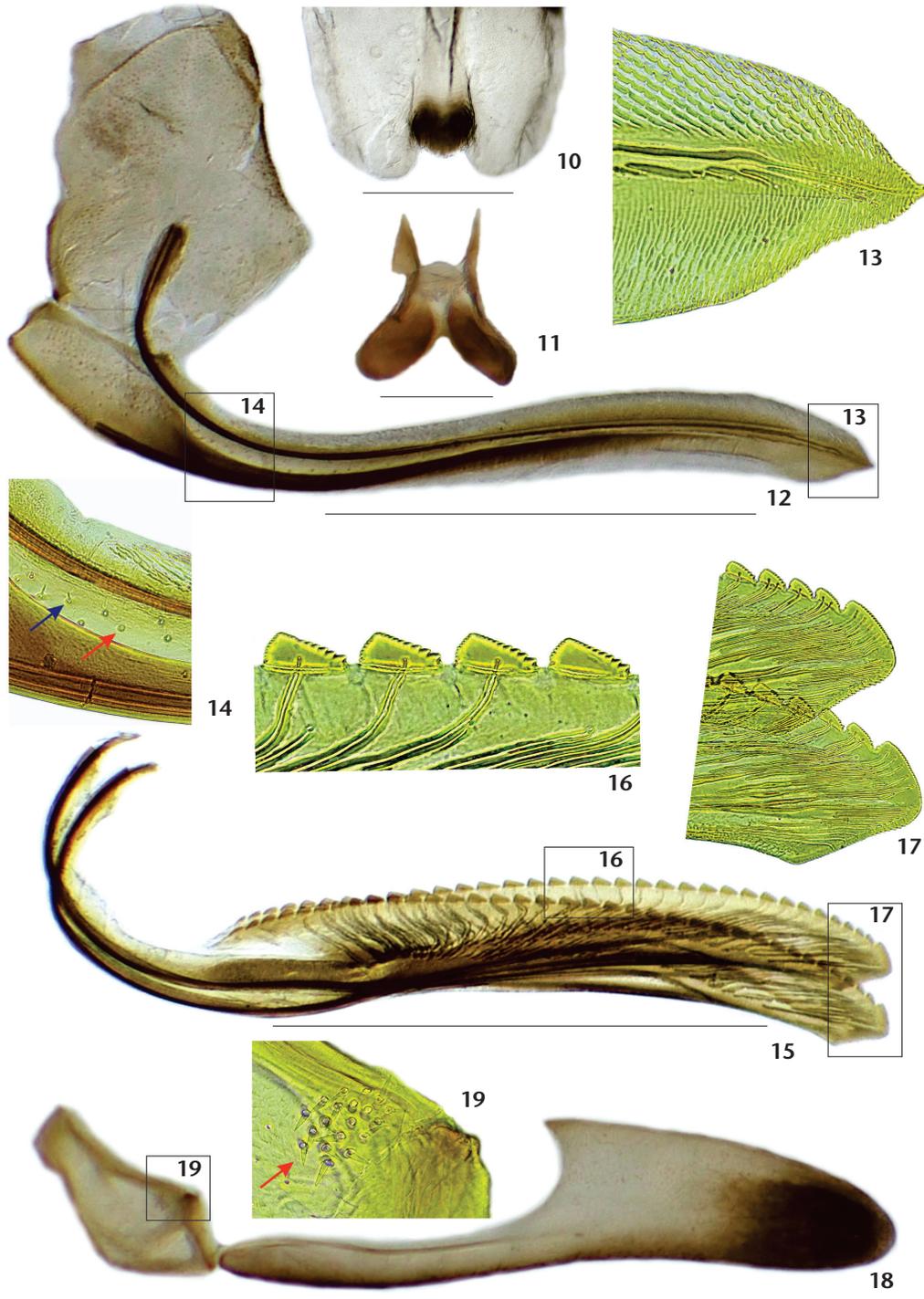
Female. Color pattern and external form similar to those of male. Terminalia. Sternite VII (Fig. 10), in ventral view, elongate, slightly narrowed posteriorly; posterior margin convex on each side of distinct median emargination. Pygofer, in lateral view, well produced posteriorly; ventral margin slightly sinuous; apex narrowly rounded; macrosetae distributed mostly on posterior portion and extending anteriorly along ventral area, absent on basal portion of disk. “Internal” sternite VIII, in dorsal view, formed by pair of lateral outer sclerotized areas associated with



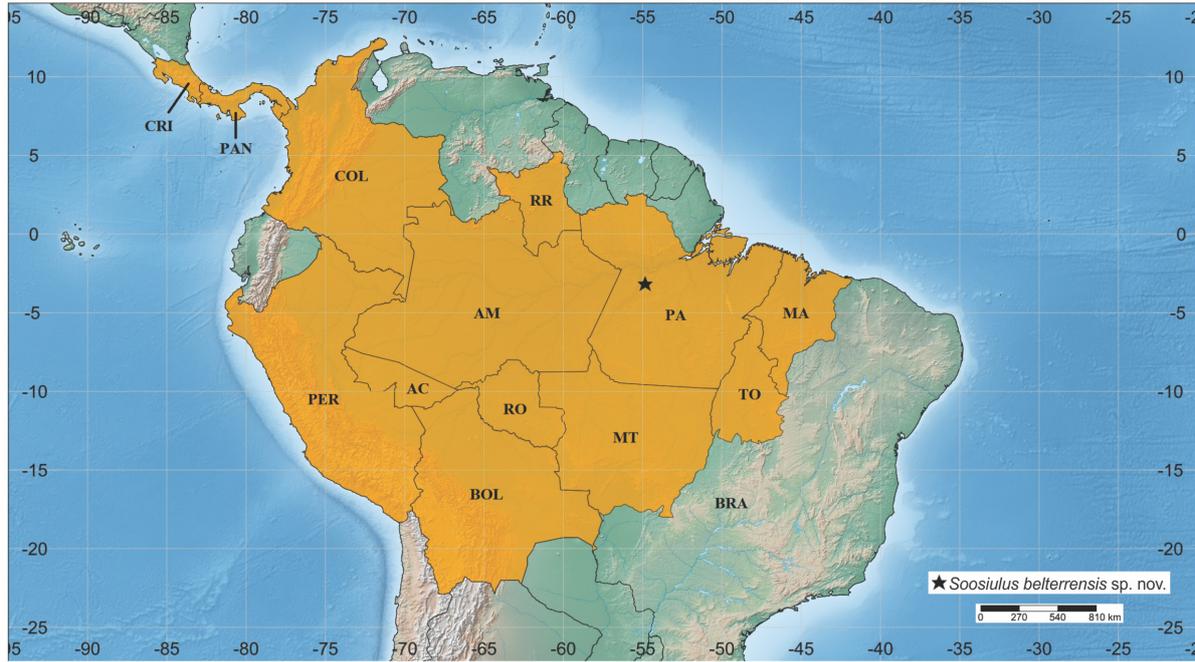
Figures 1–9. *Soosiulus belterrensis* sp. nov., male: (1) body, dorsal view (total length 6.7 mm); (2) face, anterodorsal view; (3) pygofer, lateral view; (4) valve and subgenital plate, ventral view; (5) style, dorsal view; (6) connective, dorsal view; (7) part of the ejaculatory bulb and aedeagus, lateral view; (8) paraphyses, dorsal view; (9) paraphyses, lateral view. Scale bars: 3, 4, 7, 8, 9 = 0.5 mm, 5, 6 = 0.25 mm.

sternite VII and pair of complex elongate sclerites (Fig. 11) located between valvifers I above ovipositor base; posterior portions of latter pair of sclerites rounded and strongly sclerotized. Valvifer I (Fig. 12), in lateral view, subrectangular; surface with scattered denticuli and pores. Valvula I, in ventral view, with basal portion expanded and forming projection directed inwardly; blade (Fig. 12), in lateral view, slightly curved ventrally along apical fourth; ventroapical portion slightly expanded; apex acute; dorsal sculptured area (Fig. 13) extending from basal portion to apex of

blade, formed mostly by scale-like processes arranged in oblique lines, except basally (Fig. 14) with irregular linear processes positioned more horizontally; ventral sculptured area (Fig. 13) restricted to apical portion, formed mostly by slender scale-like processes; blade surface, especially basal half (Fig. 14), with few small setae [trichoid sensilla] and many pores located below or adjacent to ramus, basiventral surface with distinct group of denticuli; ventral interlocking device distinct, located on basal half of blade. Valvifer II (Fig. 18), in lateral view, somewhat



Figures 10–19. *Soosiulus belterrensis* sp. nov., female: (10) distal two-thirds of sternite VII, ventral view; (11) posterior sclerites of "internal" sternite VIII, dorsal view; (12) valvifer I and valvula I, lateral view; (13) apex of valvula I, showing dorsal and ventral sculptured areas; (14) basal portion of valvula I, showing setae (blue arrow) and pores (red arrow); (15) valvulae II, lateral view; (16) teeth at median portion of valvula II; (17) apices of valvulae II; (18) valvifer II and gonoplac, lateral view; (19) sensory field of setae (red arrow) near articulation point of valvifer II. Scale bars = 1 mm, except for 11 = 0.5 mm.



20



21

Figures 20–21. (20) map showing the known distribution of the genus *Soosiulus* (dark yellow) and the location of the type locality of *S. belterrensis* sp. nov. (star); (21) type locality: border of a forest at Fazenda Treviso [3°9'10.86"S, 54°50'32.04"W], Belterra, state of Pará, northern Brazil (photo: Pedro Souza-Dias). BOL: Bolivia, BRA: Brazil, COL: Colombia, CRI: Costa Rica, PAN: Panama, PER: Peru. Brazilian states: AC: Acre, AM: Amazonas, MA: Maranhão, MT: Mato Grosso, PA: Pará, RO: Rondônia, RR: Roraima, TO: Tocantins.

pentagonal; inferior half with distinct group of about 20 robust setae (Fig. 19) near articulation point; denticuli and pores also present. Valvula II (Fig. 15), in lateral view, moderately expanded beyond basal curvature; blade slightly curved ventrally; preapical prominence (Fig. 17) distinct, obtuse; apex (Fig. 17) obtuse; dorsal margin with about 35 well defined, mostly subtriangular teeth (Figs 16–17), with distinct small space between them; denticles distributed on teeth and on dorsal and ventral apical portions of blade, except on apex (ventral dentate apical portion much longer than dorsal portion); valvula with ducts (Figs 16–17) extending towards teeth and apex (number of ducts terminating inside teeth varying from zero to two); basal half of valvula with isolated pores. Gonoplac (Fig. 18) of the usual Cicadellinae type: in lateral view, blade extending slightly beyond pygofer apex; distal half distinctly expanded, slightly narrowed apically; apex obtuse; surface with many denticuli, pores, and setae on apical portion and extending anteriorly along ventral margin.

Etymology. The name of the new species refers to the type locality, municipality of Belterra, in the state of Pará.

Type material. Amazon Forest, northern Brazil, state of Pará (Figs 20–21). Nine males and ten females: “Belterra [3°9'10.86"S, 54°50'32.04"W] – PA [state of Pará] \ Faz. [Fazenda] Treviso \ 01-10/XII/2018 \ Marcela Monné \ Pedro S.-Dias” (male holotype and paratypes in MNRJ, except for one couple in DZRJ and one couple in DZUP).

DISCUSSION

The new taxon apparently belongs to a group that includes eleven other *Soosiulus* species; all of them share a very similar dorsal color pattern, including similarly located black markings on an orange background (Fig. 1). Perhaps, these species, which can be distinguished from one another mainly by the structures of the male terminalia, form a complex of closely related forms within the genus (see digital images in Wilson et al. 2009), viz., *S. azatus* Young, 1977, *S. configuratus* (Walker, 1858), *S. decoris* Young, 1977, *S. fabricii* (Metcalf, 1965) (type species), *S. falcifer* Young, 1977, *S. hastatus* Young, 1977, *S. interpolis* Young, 1977, *S. lunatus* Young, 1977, *S. ruber* Young, 1977, *S. sermunculus* (Melichar, 1932), and *S. umaritubanus* Young, 1977. Among the members of this putative group, the aedeagus of the new species (Fig. 7) is more similar to those of *S. hastatus* and *S. ruber*, due to the presence of the pair of dorsoapical processes. However, in *S. hastatus* and *S. ruber* the aedeagus has also a retrorse ventroapical process originated from a lobe (Young 1977); both process and lobe are not present in *S. belterrensis* sp. nov. (Fig. 7). Among these three species, the dorsoapical aedeagal processes of *S. hastatus* are the longest and those of *S. ruber*, the shortest. The female sternite VII in *S. hastatus* and *S. ruber* is convex posteriorly (Young 1977), whereas it has a distinct median emargination in the new species (Fig. 10).

Other diverse New World sharpshooter genera that also include putative species complexes are, for instance, *Acrogonia* Stål, 1869, *Diostostemma* Amyot & Serville, 1843, *Oncometopia*

Stål, 1869, *Tretogonia* Melichar, 1926 (Proconiini), *Erythrogonia* Melichar, 1926, *Juliaca* Melichar, 1926, *Mesogonia* Melichar, 1926, and *Paromenia* Melichar, 1926 (Cicadellini) (Medler 1963, Young 1968, 1977, Rakitov 2016, Pinto et al. 2017, Silva et al. 2017, 2018, Mejdalani et al. 2019, Froza et al. 2021). As in the case of the complex proposed here, species from complexes within these other genera are currently distinguished mostly by the male terminalia. However, detailed studies of the female terminalia are still necessary for all of them. We suspect that much additional species diversity could be hidden within these genera.

ACKNOWLEDGMENTS

We thank our dear MNRJ colleagues Marcela Monné and Pedro Souza-Dias, who collected the type series of the new species. GM is a research productivity fellow from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, process 306197/2021-9). He was also supported by Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ, process E-26/200.082/2019; Apoio Emergencial ao Museu Nacional). SRC receives a PIBIC stipend from Universidade Federal do Rio de Janeiro (UFRJ). VQ and NHP receive, respectively, stipends from CNPq and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) in connection with their D.Sc. studies at the Programa de Pós-graduação em Ciências Biológicas (Zoologia) do Museu Nacional (UFRJ).

LITERATURE CITED

- Bartlett CR, Deitz LL, Dmitriev DA, Sanborn AF, Soulier-Perkins A, Wallace MS (2018) The diversity of the true hoppers (Hemiptera: Auchenorrhyncha). In: Foottit RG, Adler PH (Eds). Insect biodiversity: science and society. Chichester, UK, John Wiley & Sons, vol. 2, 501–590. <https://doi.org/10.1002/9781118945582.ch19>
- Cavichioli RR, Takiya DM (2010) A new species of *Aurignella* Takiya, Mejdalani & Felix (Hemiptera, Cicadellidae, Cicadellinae) from southern Brazil. *Revista Brasileira de Entomologia* 54: 601–603. <https://doi.org/10.1590/S0085-56262010000400010>
- Froza JA, Quintas V, Mejdalani G (2021) A new species of *Erythrogonia* Melichar, 1926 (Insecta: Hemiptera: Cicadellidae: Cicadellini) from the Mantiqueira mountain range, associated with olive orchards. *Zootaxa* 4996: 374–382. <https://doi.org/10.11646/zootaxa.4996.2.11>
- Hamilton KGA (1981) Morphology and evolution of the rhynchotom head (Insecta: Hemiptera, Homoptera). *Canadian Entomologist* 113: 953–974. <https://doi.org/10.4039/Ent113953-11>
- Hill BG (1970) Comparative morphological study of selected higher categories of leafhoppers (Homoptera: Cicadellidae). Ph. D. Thesis, North Carolina State University, Raleigh, University Microfilms, Ann Arbor, 187 pp.

- McKamey SH (2007) Taxonomic catalogue of the leafhoppers (Membracoidea). Part 1. Cicadellinae. *Memoirs of the American Entomological Institute* 78: 1–394.
- Medler JT (1963) A review of the genus *Erythrogonia* Melichar (Homoptera, Cicadellidae). *Miscellaneous Publications of the Entomological Society of America* 4: 1–33.
- Mejdalani G (1993) Morfologia da cabeça de *Versigonalia ruficauda* (Walker, 1851), com notas sobre a terminologia (Homoptera, Cicadellidae, Cicadellinae). *Revista Brasileira de Entomologia* 37: 279–288.
- Mejdalani G (1998) Morfologia externa dos Cicadellinae (Homoptera, Cicadellidae): comparação entre *Versigonalia ruficauda* (Walker) (Cicadellini) e *Tretogonia cribrata* Melichar (Proconiini), com notas sobre outras espécies e análise da terminologia. *Revista Brasileira de Zoologia* 15: 451–544. <https://doi.org/10.1590/S0101-81751998000200015>
- Mejdalani G, Cavichioli RR (2013) A new genus and species of Cicadellini (Hemiptera: Cicadellidae) from the Brazilian Atlantic Rainforest. *Zoologia* 30: 669–674. <https://doi.org/10.1590/S1984-46702013005000007>
- Mejdalani G, Domahovski AC, Rendón-Mera DI, Cavichioli RR (2019) *Tretogonia* Melichar (Hemiptera: Cicadellidae: Proconiini): two new species from South Brazil and a redescription of *T. dentalis* Emmerich, 1988. *European Journal of Taxonomy* 513: 1–14. <https://doi.org/10.5852/ejt.2019.513>
- Nielson MW (1965) A revision of the genus *Cuernia* (Homoptera, Cicadellidae). *Technical Bulletin of the United States Department of Agriculture* 1318: 1–48.
- Oman PW (1949) The Nearctic leafhoppers (Homoptera: Cicadellidae). A generic classification and check list. *Memoirs of the Entomological Society of Washington* 3: 1–253.
- Pinto AP, Mejdalani G, Takiya DM (2017) Unraveling the white-clothed *Diestostemma* Amyot & Serville: a taxonomic revision of the American sharpshooters of the *D. bituberulatum* complex (Hemiptera: Cicadellidae). *Zootaxa* 4281: 135–164. <https://doi.org/10.11646/zootaxa.4281.1.14>
- Rakitov RA (2016) The *Oncometopia orbona* species group (Hemiptera, Cicadellidae, Proconiini). *Zootaxa* 4168: 109–133. <http://doi.org/10.11646/zootaxa.4168.1.5>
- Redak RA, Purcell AH, Lopes JRS, Blua MJ, Mizell III RF, Andersen PC (2004) The biology of xylem fluid-feeding insect vectors of *Xylella fastidiosa* and their relation to disease epidemiology. *Annual Review of Entomology* 49: 243–270. <https://doi.org/10.1146/annurev.ento.49.061802.123403>
- Silva RS, Cavichioli RR, Takiya DM, Mejdalani G (2017) Descriptions of eight new *Acrogonia* species from the Amazon region, including peculiar features of the female genitalia (Hemiptera: Cicadellidae: Cicadellinae: Proconiini). *Zootaxa* 4244: 515–534. <https://doi.org/10.11646/zootaxa.4244.4.4>
- Silva RS, Cavichioli RR, Takiya DM, Mejdalani G (2018) Descriptions of seven new *Acrogonia* species from South America (Hemiptera: Cicadellidae: Cicadellinae: Proconiini). *Zootaxa* 4374: 375–394. <https://doi.org/10.11646/zootaxa.4374.3.3>
- Wilson MR, Turner JA (2007) Progress in the study of sharpshooter leafhoppers (Hemiptera: Auchenorrhyncha: Cicadellidae) over 150 years: monographs, museums and individuals. *Tijdschrift voor Entomologie* 150: 289–303. <https://doi.org/10.1163/22119434-900000231>
- Wilson MR, Turner JA, McKamey SH (2009) Sharpshooter leafhoppers of the World (Hemiptera: Cicadellidae subfamily Cicadellinae). National Museum Wales. Available online at <http://naturalhistory.museumwales.ac.uk/Sharpshooters> [Accessed: 04/2021]
- Young DA (1968) Taxonomic study of the Cicadellinae (Homoptera: Cicadellidae), Part 1. Proconiini. *Bulletin of the United States National Museum* 261: 1–287. <https://doi.org/10.5962/bhl.part.20869>
- Young DA (1977) Taxonomic study of the Cicadellinae (Homoptera: Cicadellidae). Part 2. New World Cicadellini and the genus *Cicadella*. *Bulletin of the North Carolina Agricultural Experiment Station* 239: i–vi + 1–1135.
- Young DA (1986) Taxonomic study of the Cicadellinae (Homoptera: Cicadellidae). Part 3. Old World Cicadellini. *Bulletin of the North Carolina Agricultural Experiment Station* 281: i–v + 1–639.
- Young DA, Beirne BP (1958) A taxonomic revision of the leafhopper genus *Flexamia* and a new related genus (Homoptera: Cicadellidae). *Technical Bulletin of the United States Department of Agriculture* 1173: 1–53.

Submitted: March 14, 2022

Accepted: May 28, 2022

Editorial responsibility: Marcel Gustavo Hermes

Author contributions

GM dissected the specimens and discovered the new *Soosilus* species. He, SRC, VQ, and NHP prepared and reviewed the illustrations. GM wrote the paper, which was carefully reviewed by the other authors.

Competing interests

The authors have declared that no competing interests exist.

How to cite this article

Mejdalani G, Carvalho SR, Quintas V, Pecly NH (2022) A new species of the sharpshooter genus *Soosilus* (Insecta: Hemiptera: Cicadellidae: Cicadellini) from the Brazilian Amazon Forest, with notes on a putative complex of species. *Zoologia (Curitiba)* 39: e22012. <https://doi.org/10.1590/S1984-4689.v39.e22012>

Published by

Sociedade Brasileira de Zoologia at Scientific Electronic Library Online (<https://www.scielo.br/zool>)

Copyright

© 2022 The Authors.