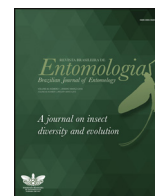




REVISTA BRASILEIRA DE
Entomologia
A Journal on Insect Diversity and Evolution

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Systematics, Morphology and Biogeography

Two new species of *Hanshumba* from Southeastern Brazil and a key to males of the genus (Insecta: Hemiptera: Cicadellidae: Cicadellini)



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ARTICLE INFO

Article history:

Received 24 July 2018

Accepted 29 August 2018

Available online 10 September 2018

Associate Editor: Daniela Takiya

Keywords:

Cicadellinae

Leafhopper

Morphology

Sharpshooter

Taxonomy

ABSTRACT

The genus *Hanshumba* Young, 1977 is recorded from Southeastern and Southern Brazil (Atlantic Forest) and currently includes only three species. Here we describe and illustrate, based mainly on features of the male terminalia, two new species from State of Espírito Santo, Municipality of Santa Teresa: *H. setifera* sp. nov. and *H. teresa* sp. nov. The former can be distinguished by the male pygofer and anal tube with large processes bearing numerous setae and the aedeagus with pair of dentiform processes on median portion, whereas the latter has three pairs of longitudinal flanges on the aedeagal shaft. A key to males of the genus is added and its taxonomic status is briefly discussed.

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Introduction

The genus *Hanshumba* Young, 1977 is recorded from Southeastern and Southern Brazil (Atlantic Forest) and currently comprises only three species of small and similarly colored sharpshooters (Young, 1977; Mauro-Barr and Carvalho, 2008; Takiya et al., 2018): *H. brasura* Young (type-species), *H. similis* Mauro-Barr & Carvalho, and *H. cavichiolii* Mauro-Barr & Carvalho. Young (1977, p. 82) included *Hanshumba* in his *Dilobopterus* generic group. Among the 27 genera assigned to this diverse group, *Hanshumba* appears to be most similar to *Exogonia* Melichar, 1926 (Mauro-Barr et al., 2009) and *Eldarbala* Young, 1977 (Young, 1977) based on features of the external morphology, color markings, and male terminalia. *Hanshumba* can be distinguished from those two genera, as well as from the remaining genera of the Neotropical Cicadellini, by the following combination of features: (1) total body length 5–7 mm; (2) dorsum yellow to green mottled with many irregular dark brown vermiculations and spots; (3) head well produced anteriorly and deltoid, without apical thornlike projection; (4) male pygofer well or strongly produced posteriorly, without processes or with peculiar inner process bearing

setae, without area of flexion in the middle portion; (5) subgenital plate triangular, gradually tapered toward apex, not extending as far posteriorly as pygofer apex; (6) aedeagus expanded apically; (7) paraphyses present, symmetrical, with one or two pairs of rami.

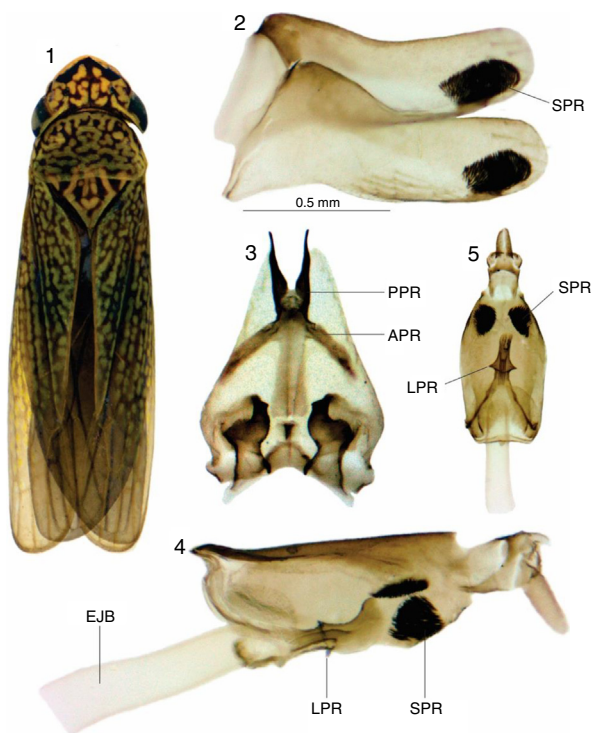
In this paper, two new species of *Hanshumba* from Southeastern Brazil (State of Espírito Santo, Municipality of Santa Teresa) are described and illustrated. A new key to males of *Hanshumba*, based on features of the aedeagus and paraphyses, is provided.

Material and methods

Photographs of the body in dorsal view and of the male terminalia were prepared with *CombineZP* (free software developed by Alan Hadley), using a digital camera attached to a Zeiss Stemi 2000-C stereomicroscope. Dissected male terminalia parts were stored in small glass vials with glycerin and attached to the pins, below the specimens, as suggested by Young and Beirne (1958). Descriptive terminology adopted herein followed mainly Young (1968, 1977, 1986), except for the facial areas of the head (Hamilton, 1981; Mejdalani, 1993, 1998). Studied specimens are deposited at Museu Nacional (MNRJ) – Universidade Federal do Rio de Janeiro (Rio de Janeiro). Label data were quoted exactly with a reversed virgule (\) separating lines on labels.

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Figs. 1–5. *Hanshumba setifera* sp. nov., male. 1, body, dorsal view, length 5.6 mm (antennae and legs not depicted). Terminalia: 2, pygofer lobes, lateral view; 3, subgenital plates, connective, styles, and paraphyses, dorsal view; 4, aedeagus and anal tube, lateroventral view; 5, aedeagus and anal tube, ventral view. APR, anterior ramus of paraphyses; EJB, ejaculatory bulb; LPR, lateral process of aedeagus; PPR, posterior ramus of paraphyses; SPR, setose process.

Results

Hanshumba setifera sp. nov.

(Figs. 1–5)

Diagnosis. *Hanshumba setifera* sp. nov. can be readily distinguished from the other four known species of the genus by the following combination of features: (1) apical portions of male pygofer (Fig. 2) and segment X (anal tube) (Figs. 4, 5) with conspicuous process bearing numerous setae; (2) style (Fig. 3) with apex obliquely truncate, foot-shaped; (3) aedeagal shaft (Figs. 4, 5) with distal half curved dorsally and with pair of dentiform processes on median portion; (4) paraphyses (Fig. 3) with two pairs of rami, anterior one directed anterad, thick, and obtuse apically, whereas posterior one directed posterad, slender, and acute apically.

Length of male holotype 5.6 mm; male paratype 5.1 mm.

Holotype description

Head (Fig. 1), in dorsal view, well produced anteriorly, deltoid, obtuse apically; median length of crown approximately 7/10 of interocular width and 4/10 of transocular width. Surface of crown convex, without sculpturing or setae, minutely punctate behind apex; frontogenal suture extending onto crown to near ocellus. Ocelli located on imaginary line between anterior eye angles, slightly closer to anterior eye angle than to median line of crown on right side and approximately equidistant on left side. Antennal ledge, in dorsal view, slightly protuberant; in lateral view, with anterior margin slightly oblique and convex. Frons with median portion slightly convex, muscle impressions inconspicuous; epistomal suture obscure medially; clypeus not protuberant, its contour continuing profile of frons.

Thorax (Fig. 1) with pronotal width slightly greater than transocular width of head; pronotum with lateral margins slightly convergent anteriorly, posterior margin slightly emarginate; dorso-lateral carena declivous anterad, indistinct at area adjacent to eye; disk transversely rugulose. Mesonotum with scutellum not transversely striate. Forewing with membrane not sharply delimited, including at least apical cells, much of anteapical cells, and costal apical cell; with three closed anteapical cells, their bases proximal to claval apex; with four apical cells, base of fourth more proximal than base of third. Hind wing with vein R2 + 3 incomplete. Hind leg with femoral setal formula 2:1:1; length of first tarsomere approximately equal to combined length of two more distal tarsomeres, with two parallel rows of small setae on plantar surface.

Color (Fig. 1). Ground color of dorsum yellow to green mottled with many irregular dark brown vermiculations and spots. Anterior margin of crown and mesonotum with larger spots. Membrane of forewing translucent, with green spots on anteapical cells. Face, lateral and ventral portions of thorax, and legs mostly yellow; superior portions of antennal ledge and lateral lobe of pronotum with brown spot.

Male terminalia with pygofer (Fig. 2), in lateral view, strongly produced posteriorly; distal half distinctly narrower than basal half; posterior margin convex; posteroventral portion with conspicuous inner process bearing numerous setae, additional processes absent; macrosetae distributed on posterior third and forming ventral group on median third. Subgenital plate (Fig. 3), in ventral view, subtriangular, with basal fourth expanded and then narrowing gradually toward apex; surface with mostly small macrosetae along outer margin, microsetae also present; plates not fused to each other at base; in lateral view, not extending as far posteriorly as pygofer apex. Connective (Fig. 3), in dorsal view, Y-shaped; stalk broad and with median keel. Style (Fig. 3), in dorsal view, extending posteriorly beyond apex of connective; with distinct outer preapical lobe; outer preapical area bearing setae; apex obliquely truncate, foot-shaped. Aedeagus (Figs. 4, 5) symmetrical; shaft, in lateral view, with distal half curved dorsally; gonoduct distinct, gonopore located ventroapically; in ventral view, shaft with pair of small dentiform processes on median portion. Paraphyses (Fig. 3), in dorsal view, with stalk broad, articulated with apex of connective; with two pairs of rami: anterior one directed anterad, thick, obtuse apically and posterior one directed posterad, slender, acute apically. Anal tube (Figs. 4, 5), in lateral view, with segment X bearing conspicuous inner process covered by numerous setae (similar to that of pygofer).

Female unknown.

Material examined. Male holotype: “BR/ES [State of Espírito Santo], Santa Teresa \ Estação Biológica Santa \ Lucia 9-12/XI/2007 \ S. Buys Col.” (MNRJ). Paratype, one male: same data as the holotype except “16/XII/2007” (MNRJ).

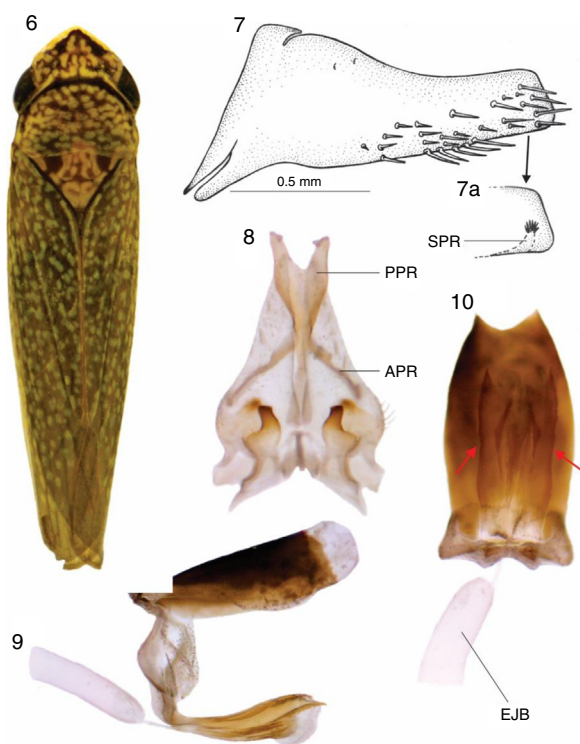
Known distribution. Atlantic Forest, Southeastern Brazil, State of Espírito Santo (new genus record).

Etymology. The new species name, *setifera*, refers to the conspicuous setose processes of the male pygofer and anal tube (Figs. 2, 4, 5).

Hanshumba teresa sp. nov.

(Figs. 6–12)

Diagnosis. This new species can be recognized by the following combination of features: (1) apical portion of male pygofer (Figs. 7, 7a) with small inner process bearing apical setae and segment X (anal tube) (Figs. 9, 10) without such process; (2) style (Fig. 8) with apex transversely truncate, not foot-shaped; (3) aedeagal shaft (Figs. 9–12) with three pairs of longitudinal flanges, two of them elongate and forming spiniform processes at apex; (4) paraphyses (Fig. 8) with two pairs of rami, anterior one directed anterad,



Figs. 6–10. *Hanshumba teresa* sp. nov., male. 6, body, dorsal view, length 5.9 mm (antennae and legs not depicted). Terminalia: 7, pygofer lobe, lateral view (inner setose process illustrated in Fig. 7a); 8, subgenital plates, connective, styles, and paraphyses, dorsal view; 9, aedeagus and anal tube, lateral view; 10, aedeagus and anal tube, ventral view (red arrows indicate the aedeagal shaft). APR, anterior ramus of paraphyses; EJB, ejaculatory bulb; PPR, posterior ramus of paraphyses; SPR, setose process.

elongate, slender, and with subacute apex, whereas posterior one directed posterad, fused to each other for most of their length, and with obtuse apex.

Length of male holotype 5.9 mm; male paratype 5.8 mm.

Holotype description

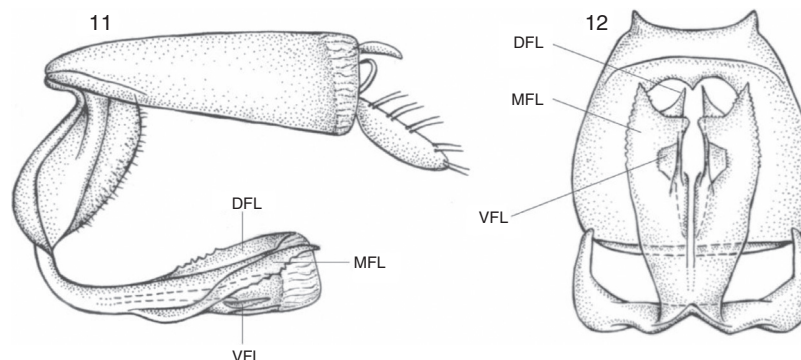
Head (Fig. 6), in dorsal view, well produced anteriorly, deltoid, subacute apically; median length of crown approximately 7/10 of interocular width and 4/10 of transocular width. Surface of crown slightly depressed between apex and ocelli, without sculpturing or setae, minutely punctate behind apex; frontogenal suture extending onto crown to near ocellus. Ocelli located on imaginary line between anterior eye angles, each slightly closer to adjacent anterior eye angle than to median line of crown. Antennal ledge, in

dorsal view, slightly protuberant; in lateral view, with anterior margin vertical, concave superiorly and convex inferiorly. Frons with median portion flattened, muscle impressions inconspicuous; epistomal suture obscure medially; clypeus not protuberant, its contour continuing profile of frons.

Thorax (Fig. 6) with pronotal width approximately equal to transocular width of head; pronotum with lateral margins slightly convergent anteriorly, posterior margin emarginate; dorsolateral carena declivous anterad, indistinct at area adjacent to eye; disk transversely rugulose. Mesonotum with scutellum not transversely striate. Forewing with membrane not sharply delimited, including at least apical cells, much of anteapical cells, and costal apical cell; with three closed anteapical cells, their bases proximal to claval apex; with four apical cells, base of fourth more proximal than base of third. Hind wing with vein R2 + 3 incomplete. Hind leg with femoral setal formula 2:1:1; length of first tarsomere approximately equal to combined length of two more distal tarsomeres, with two parallel rows of small setae on plantar surface.

Color (Fig. 6). Ground color of dorsum pale yellow to green mottled with many irregular brown vermiculations and spots. Anterior margin of crown and mesonotum with larger spots. Membrane of forewing translucent, with green spots on anteapical cells. Face, lateral and ventral portions of thorax, and legs mostly yellow; superior portions of antennal ledge and lateral lobe of pronotum with brown spot.

Male terminalia with pygofer (Figs. 7, 7a), in lateral view, strongly produced posteriorly; distal half narrower than basal half; posterior margin subtruncate; posteroventral portion with small inner process bearing apical setae, additional processes absent; macrosetae distributed on posterior third and extending ventroanteriorly onto median third. Subgenital plate (Fig. 8), in ventral view, subtriangular, with basal fourth distinctly expanded and then narrowing gradually toward apex; surface with mostly small macrosetae along outer margin, microsetae also present; plates not fused to each other at base; in lateral view, not extending as far posteriorly as pygofer apex. Connective (Fig. 8), in dorsal view, Y-shaped; stalk with high median keel. Style (Fig. 8), in dorsal view, extending posteriorly beyond apex of connective; with distinct outer preapical lobe; outer preapical area bearing setae; apex transversely truncate, not foot-shaped. Aedeagus (Figs. 9–12) symmetrical; shaft, in lateral view, distinctly expanded apically; in dorsolateral view, with three pairs of longitudinal flanges (ventral one small, median and dorsal ones elongate and forming spini-form processes at apex), borders of flanges minutely serrate; apical portion of shaft membranous; gonoduct distinct, gonopore located ventroapically. Paraphyses (Fig. 8), in dorsal view, with stalk gradually narrowing posterad, articulated with apex of connective; with two pairs of rami: anterior one directed anterad, elongate, slender, with subacute apex and posterior one directed posterad, fused to each other for most of their length, with obtuse apex bearing small



Figs. 11–12. *Hanshumba teresa* sp. nov., aedeagus and anal tube. 11, lateral view. 12, ventral view. DFL, dorsal flange; MFL, median flange; VFL, ventral flange.

keel. Anal tube (Figs. 9–12), in lateral view, with segment X not bearing inner process.

Female unknown.

Material examined. Male holotype: “BR/ES [State of Espírito Santo], Santa Teresa\Estação Biológica Santa\Lucia 9-12/XI/2007\S. Buys Col.” (MNRJ). Paratype, one male: same data as the holotype (MNRJ).

Known distribution. Atlantic Forest, Southeastern Brazil, State of Espírito Santo (new genus record).

Etymology. The new species name, *teresa* (name in apposition), refers to the Municipality of Santa Teresa in the State of Espírito Santo.

Key to males of *Hanshumba* Young, 1977

1. Paraphyses with two pairs of rami, one directed anterad and another posterad (Figs. 3, 8)..... 2
 - 1'. Paraphyses with single pair of rami directed posterad..... 3
 2. Aedeagus, in ventral view, with pair of small dentiform processes and without longitudinal flanges (Fig. 5)..... *H. setifera* sp. nov. [State of Espírito Santo]
 - 2'. Aedeagus, in ventral view, without small dentiform processes and with three pairs of longitudinal flanges (Figs. 10, 12)..... *H. teresa* sp. nov. [State of Espírito Santo]
 3. Paraphyses rami, in dorsal view, with conspicuous spiniform process directed posterad (Mauro-Barr and Carvalho, 2008, p. 229, fig. 7)..... *H. similis* Mauro-Barr & Carvalho, 2008 [State of Rio de Janeiro]
 - 3'. Paraphyses rami, in dorsal view, without such process..... 4
 4. Aedeagal shaft, in lateral view, with constriction delimiting lobe at apical third (Mauro-Barr and Carvalho, 2008, p. 232, fig. 17)..... *H. cavichioli* Mauro-Barr & Carvalho, 2008 [State of Paraná]
 - 4'. Aedeagal shaft, in lateral view, gradually expanded posterad, without distinct constriction (Young, 1977, p. 260, fig. 211f)..... *H. brasura* Young, 1977 [State of Santa Catarina]

Discussion

The genus *Hanshumba* shares peculiar features of the male terminalia with *Exogonia* and, interestingly, with *Ochrostacta* Stål, 1869, which is currently assigned to the Proconiini (Young, 1968; McKamey, 2007). These features are as follows (Carvalho, 2010): (1) male pygofer and anal tube (segment X) with setose processes (Figs. 2, 4, 5, 7a); (2) aedeagus distinctly expanded apically (Figs. 4, 9, 11); and (3) paraphyses with two pairs of rami (Figs. 3, 8). Preliminary morphological phylogenetic analyses carried out by Carvalho (2010) suggested that the three genera should be synonymized, being *Ochrostacta* the oldest name. Indeed, Takiya's (2007) comprehensive morphological and molecular phylogenetic analyses of the Cicadellinae indicated that *Ochrostacta* should be transferred to the Cicadellini. Nevertheless, this bold hypothesis of synonymization of these three genera has yet to be carefully evaluated by means of analyses employing both molecular and morphological data. Due to its inflated head, which is quite distinct from those of *Hanshumba* and *Exogonia*, *Ochrostacta* is among the most peculiar genera of the Cicadellinae (Young, 1968; see images in Wilson et al., 2009).

Carvalho's (2010) study suggested a monophyletic group including the previously known *Hanshumba* species (*H. brasura*, *H. cavichioli*, and *H. similis*). This clade had the herein described *H. setifera* sp. nov. as its sister group. The clade comprising these

four species was supported by three unambiguous synapomorphies related to the characteristic yellow to green dorsum mottled with many irregular dark brown vermiculations and spots (Fig. 1). This color pattern is also found in *H. teresa* sp. nov. (Fig. 6), which is thus a putative member of the aforementioned monophyletic group. Due to the very similar color pattern of known *Hanshumba* species, it is often difficult to associate males with females. The discovery of our two new species shows once again how the insect fauna from the Brazilian Atlantic forest is still poorly known.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

The manuscript benefited from the useful comments of Victor Quintas (MNRJ) and two anonymous reviewers. Gabriel Mejdalani and Rodney R. Cavichioli are research productivity fellows from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, processes 303627/2014-0 and 305484/2014-1, respectively). Dr. João Roberto Spotti Lopes (Escola Superior de Agricultura “Luiz de Queiroz” – ESALQ) is the advisor of Joyce Froza and his laboratory provided financial support for her visits to the Museu Nacional. Dr. Roberto Antonio Zucchi and Dr. Sinval Silveira Neto (ESALQ) kindly provided access to laboratory facilities. The first author has a stipend from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) in connection with her D.Sc. studies. The specimens described here were collected by Dr. Sandor Buys.

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