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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A B S T R A C T

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 Espirito 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. cavichioli* 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) dorso 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 arc 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 Espirito 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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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 carina declivious 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 antapical cells, and costal apical cell; with three closed antapical 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 verniculations and spots. Anterior margin of crown and mesonotum with larger spots. Membrane of forewing translucent, with green spots on antapical 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. Paratypes (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 \ Lucía 9-12/XI/2007 \ S. Buys Col.” (MNR); Paratype, one male: same data as the holotype except “16/XII/2007” (MNR).

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 setifera* sp. nov. (Figs. 6–12)

Diagnosis. This new species can be recognized by the following combination of features: (1) apical portions 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, posterior one directed posterad, slightly distal such that the mesal edge forms a small obtuse angle; convex, obtuse apically; mesal margin slightly more inclined and convex. Frons with median portion slightly convex, muscle impressions inconspicuous; epistomal suture obscure medially; clypeus not protuberant, its contour continuing profile of frons.

**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; frontotergal 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.

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.
 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; frontal 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 carina 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 antepetral cells, and costal apical cell; with three closed antepetral 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 antepetral 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 subtruncated; 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 spine-like 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 setae; one pair of internal setae close to apex, one pair located in middle of shaft, oriented anteriorly; marginal setae not with distinct crown near apex.

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.

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

Female unknown.


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 Exoxonagia and, interestingly, with Ochroacta Stål, 1869, which is currently assigned to the Proconini (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 Ochroacta the oldest name. Indeed, Takiya’s (2007) comprehensive morphological and molecular phylogenetic analyses of the Cicadellinae indicated that Ochroacta should be transferred to the Cicadellinae. 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 Exoxonagia, Ochroacta 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.

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