



## Review of *Nasuconia* Sakakibara, 2006 (Hemiptera: Membracidae) with description of three new species

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### Abstract

The treehopper genus *Nasuconia* Sakakibara, 2006 previously included four species and was recorded only from Brazil. Here we provide a revised diagnosis of the genus and describe three new species: *Nasuconia ellenfutterae* **sp. nov.** from Ecuador, *Nasuconia guianensis* **sp. nov.** from French Guiana and *Nasuconia yasuni* **sp. nov.** from Ecuador. The genus can be distinguished by the following combination of characters: frontoclypeus conical with transverse grooves, obliquely projected forward at least 1/3 of its length beyond suprantennal margin; pronotum navicular, low, punctate, with longitudinal elevated lines or nodes; first valvulae with ventral interlocking device distinctively sinuate. Two informal species groups are recognized based on characters of the head, forewing and leg chaetotaxy. A key to species, photographs, updated morphological descriptions, and the first descriptions of the female and male genitalia of *Nasuconia* species are provided. Comparisons of cucullate setae and fine abdominal integument structures are also made using scanning electron microscopy.

**Key words:** Darnini, Neotropical region, treehoppers, morphology

### Introduction

The Neotropical treehopper tribe Darnini includes a few peculiar genera that superficially resemble weevils (Coleoptera), due to their brownish coarsely textured pronotum and elongated heads. These genera, including *Cyphotes* Burmeister, 1835; *Aspona* Stål, 1862; *Hypheodana* Metcalf, 1952; *Taunaya* Fonseca, 1934; and *Nasuconia* Sakakibara, 2007, occur primarily in tropical rainforests and remain poorly studied. The previous morphological definitions of these genera overlap and their phylogenetic status also remains unclear.

Walker (1862) described *Oxygonia lineosa* from Rio de Janeiro, Brazil. *Oxygonia* Fairmaire, 1846, a junior homonym, was replaced by *Gelastogonia* Kirkaldy, 1904. Funkhouser (1927) cataloged Walker's species as *Gelastogonia lineosa*. Metcalf & Wade (1965) and McKamey (1998), included the species in *Maturnaria* Metcalf, 1965; as a junior synonym of *M. ephippigera* (Fairmaire, 1846). Sakakibara (2006) transferred the species to Darnini and established the genus *Nasuconia* which included four species, all from Brazil: *N. lineosa* (Walker, 1862), *N. catarina* Sakakibara, 2006, *N. nanica* Sakakibara, 2006, and *N. curculionoida* Sakakibara, 2006. Here we provide a revised description of *Nasuconia* and describe three new species including the first records of the genus for Ecuador and French Guiana. This brings the total known species of the genus to seven.

Natural history of *Nasuconia* Sakakibara is unknown. Morphological assessments allow us to identify two well-differentiated species groups within the genus: *lineosa*-group and *curculionoida*-group. Interestingly these morphological groups seem to be restricted to specific geographic areas. The *lineosa*-group is restricted to the southeast of Brazil, and the *curculionoida* group has a wider distribution including Ecuador, Brazil and French Guiana (Fig. 15). According to label information species are found in lowlands 100–800 meters above sea level.

## Materials and methods

Specimens were examined with the aid of a Leica MZ16 stereomicroscope with 25× magnification and photographed with a Leica DFC480. Multiple layers were stacked using Helicon Focus to produce a single image. Genitalia structures were dissected and soaked in 10% KOH to remove unsclerotized tissue, then transferred to a water bath for five minutes. Genitalia were analyzed and photographed in glycerin, and then stored in micro vials pinned below the specimens. General terminology used in species descriptions follows Deitz (1975) and Sakakibara (2006); genitalia terminology follows Mejdalani (1998), Snodgrass (1993) and Peclý *et al.* (2019); abdominal integument sculpture follows Dietrich (1989). Measurements were made with Image J software version 1.52k. SEM examinations were conducted in the Microscope Imaging Facility of the American Museum of Natural History, New York; specimens were mounted on aluminum stubs with double-sided adhesive, sputter coated with Au-Pd, and imaged under high vacuum using a Hitachi S-4700 FESEM. Acronyms for museums and entomological collections are as follows:

**DZUP:** Universidade Federal do Parana, Museu de Entomologia, Curitiba, Parana, Brazil.

**FSCA:** Florida State Collection of Arthropods, Gainesville, Florida, USA.

**NCSU:** North Carolina State University Insect Collection, Raleigh, North Carolina, USA.

**NHMUK:** The Natural History Museum London, England.

**QCAZ:** Museo de Zoología of Pontificia Universidad Católica del Ecuador, Quito, Ecuador.

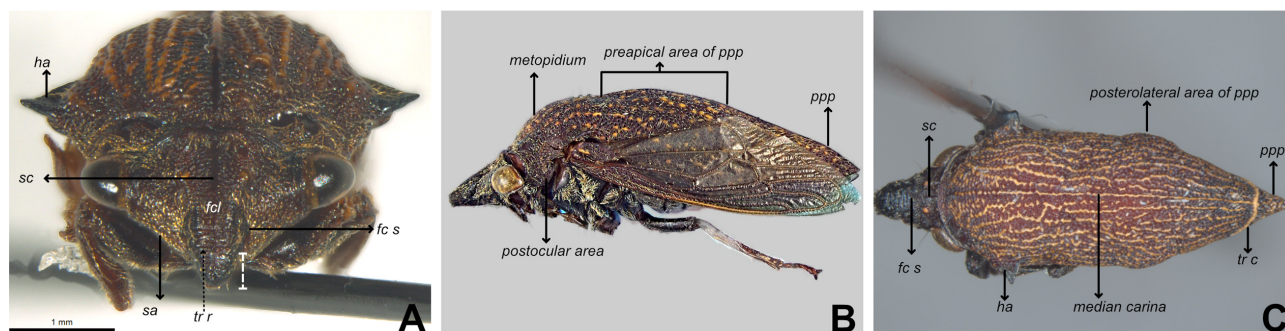
**USNM:** National Museum of Natural History, Washington DC, USA.

## Results

### *Nasuconia* Sakakibara, 2006

*Nasuconia* Sakakibara, 2006: 190–192. Type-species: *Oxygonia lineosa* Walker, 1862: 303–319 by original designation.

**Diagnosis:** (1) Frontoclypeus conical, obliquely projected forward at least 1/3 of its length beyond suprantennal margin, with transversal ridges; (2) pronotum navicular, low; (3) pronotum punctate, with discontinuous longitudinal yellow lines or nodose; (4) humeral angles short, triangular, slightly projected laterally; (5) pro- and mesotibia subfoliate; (6) first valvulae with ventral interlocking device distinctively sinuate; (7) aedeagus with postero-apical margin flattened.



**FIGURE 1. Head and pronotal characters. *Nasuconia*;** A. anterior view; B. Lateral view; C. Dorsal view. Abbreviations. **fcl**: frontoclypeus (vertical dash line shows frontoclypeal extension); **fc s**: frontoclypeal suture; **ha**: humeral angles; **ppp**: pronotal posterior process; **sa**: suprantennal margin; **sc**: coronal suture; **tr c**: transversal carina; **tr r**: transversal ridges.

**Description. Color and sculpture.** Brown or black, pronotum marked with yellow longitudinal lines or nodes; head punctate, pubescent; pronotum rough, irregular, with longitudinal elevated lines or nodes; forewing hyaline, basal costal coriaceous area (Fig. 6A *ca*) similar to pronotal pattern, some species with distinctive macula in apical cells or costal area (Figs. 6C; 6D; 6E); abdominal sclerotization heterogeneous, with strongly sclerotized sternite contrasted with almost membranous tergite (Fig. 10C); abdominal sternites with conspicuous pits (Figs. 10A; 10B). **Head.** In anterodorsal view, triangular, longer than wide; coronal suture distinct (Fig. 1A *sc*); vertex slightly convex;

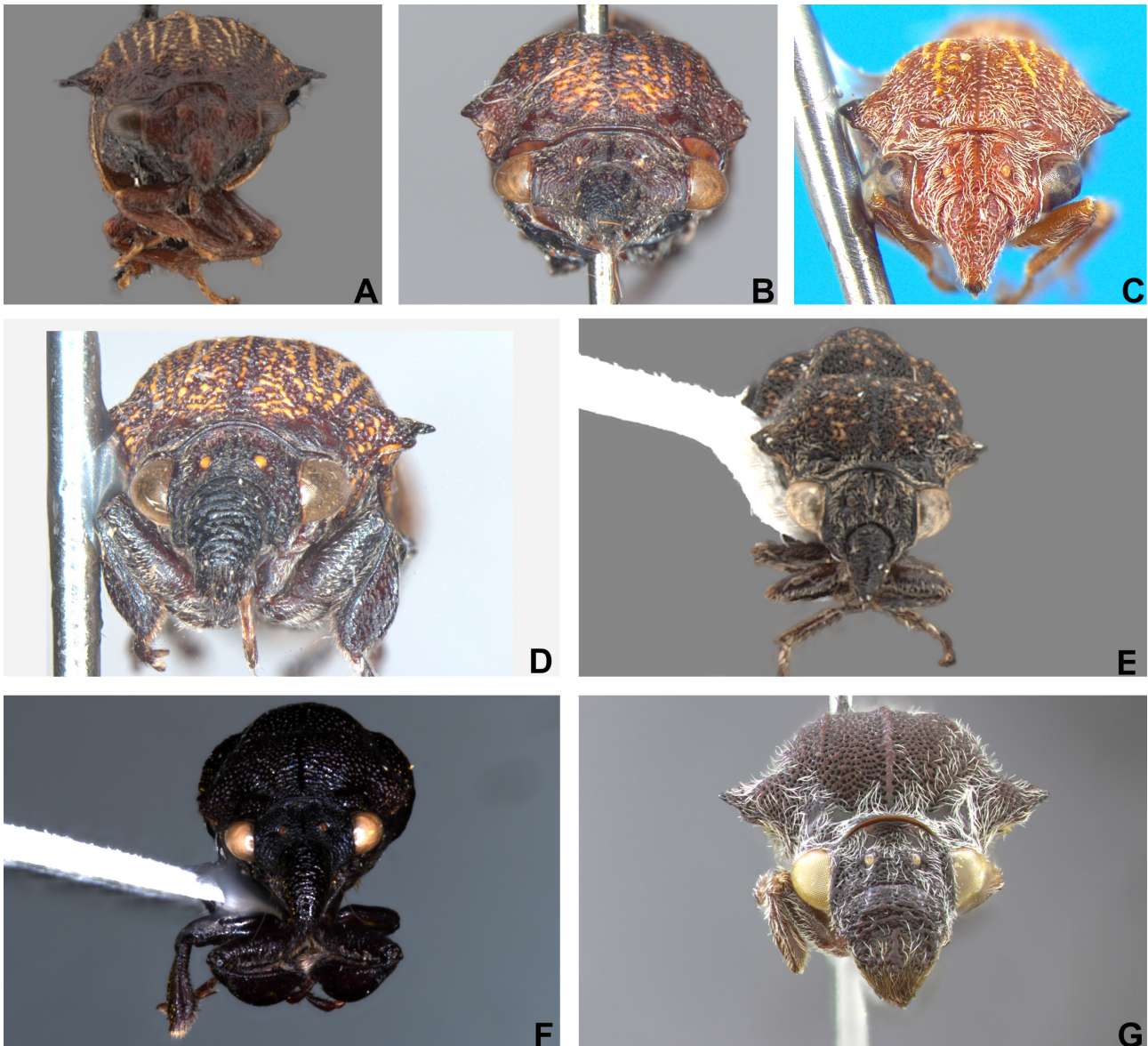
ocelli conspicuous, closer to the eye and superior margin than to each other; eyes ovoid; frontoclypeal suture arched (Fig. 1A *s fc*); suprantennal margins straight (Fig. 1A *l sa*), not sinuate; frontoclypeus distinctly conical (wider in the base than apex), projected forward at least 1/3 of its length beyond margins of supra-antennal margin (Fig. 1A *fc l*), with transverse ridges (Fig. 1A *tr r*), in lateral view apex of frontoclypeus straight (Figs. 3A–C) or bent downwards (Figs. 3D–G). **Thorax.** *Pronotum.* In lateral view, navicular, low, slightly sinuate, metopidium convex, preapical area of posterior pronotal process not notably enlarged (Figs. 1B; 2); postocular area simple, not extending below eye (Fig. 1B). In dorsal view, posterolateral area of posterior pronotal process gradually tapering to apex (Figs. 4A–C) or bulged laterally abruptly narrowing to pronotal apex (Figs. 4D–G); median carina elevated and percurrent; humeral angles triangular, acutely projected laterally (Fig. 1C *ha*). *Forewing.* (Fig. 6) covered almost entirely by pronotum; veins R and M close to costal margin; R vein branching beyond forewing midlength; M and Cu fused basally but separated near base; area between Cu and claval suture (Cl) forming obtuse triangle, two discoidal and five apical cells, *s* crossvein usually absent; 2 m-cu crossveins present. *Legs.* Pro- and mesofemur with two longitudinal rows of cucullate setae on ventral surface, parallel each other (Figs. 8A; 8C; 9A; 9C); pro and mesotibia subfoliate (Figs. 7A–B; 7D–E), with two parallel, longitudinal rows of cucullate setae (Figs. 8E; 8G; 9B; 9D); chaetotaxy of metafemora and metatibia variable among species groups (see genus comments: remarks of cucullate setae). **Abdomen.** Pleurites not fused to tergites (Fig. 10C); pleurites and sternites located ventrally (Figs. 10A; 10D), sclerotization heterogeneous (sternites and pleurites more sclerotized than tergites) (Fig. 10C); sternites with conspicuous pits (Figs. 10A–B, see remarks on abdominal integumental structure). *Male.* Pygofer without dorsal carina; lateral plate projected dorsally, approximately same size as subgenital plate; subgenital plates fused basally (Fig. 11A); aedeagus, slender, oblong, in lateral view scoop-shaped, postero-apical margin flattened, gonopore membrane not enlarged (Figs. 12A; 12C; 12E); style, with apical hook curved or straight (Figs. 12B; 12D; 12E). *Female.* *First valvulae,* (Fig. 13). In lateral view, dorsal and ventral margins convex; apex acute; dorsal sculptured area (DSA) striate with some striae branched; ventral sculptured area (VSA) restricted to apical portion of valvula, formed by discontinuous ridges; ventral interlocking device (VID) extended from base to approximately 4/5 length of valvulae, distinctly sinuate, variable among species; ramus (RAM) sclerotized, extended from base to apex; dorsal and ventral margins of apical area variable in shape among species. *Second valvula,* (Fig. 14) more sclerotized than first valvula; dorsal and ventral margin approximately parallel-sided; apex blunt, apical portion with scale-like processes; apical margin with teeth that vary in size and number among species; ramus (RAM) extended from base to apex of valvulae; above ramus linear ducts (DUC) directed to dorsal margin opening in pores (PO). Gonoplac, not variable among species, long with rounded apex, basal portion distinctively more narrow than apical section, with macrosetae along ventral margin (Fig. 11B).

**Comments:** Overall *Nasuconia* Sakakibara is similar to *Cyphotes* Burmeister, *Aspona* Stål, *Taunaya* Fonseca, and *Hypheodana* Metcalf. After morphological assessment of the available material, there is not one single character to define each genus within this generic complex; rather the combination of characters of the head and pronotum should be considered to differentiate them. Thus, *Nasuconia* differs from other mentioned genera in having the frontoclypeus more strongly conical and projected forward, with the surface transversely ridged, and the pronotum in lateral view with the preapical part of the posterior process low (about the same height as the metopidium). *Cyphotes* and *Aspona* have the frontoclypeus less elongated and the preapical pronotal area usually elevated (much higher than the metopidium). *Hypheodana* has the frontoclypeus ovoid, not conical (Sakakibara, 2005), usually projected ventrad perpendicular to the long axis of the body (Sakakibara, 2005). *Taunaya* has the frontoclypeus oblong (Fonseca, 1934), and the pronotum with the preapical part of posterior process strongly convex.

*Nasuconia* was previously reported only for Brazil. Here we record the genus for Ecuador and French Guiana for the first time. The distribution of the genus is likely broader than has previously been reported and further sampling for this group is needed. Species of *Nasuconia* are found in lowlands between 60–800 meters altitude. Female terminalia characters are potentially valuable for taxonomy; here we adopt terminology used in Cicadellidae (Mejidalani 1998, Cavichioli & Takiya 2012, Cavichioli & Mejidalani 2015, Peclý *et al.* 2019) due to the lack of recent detailed studies on these structures in Membracidae.

Morphological assessments of the genus allow us to identify two species groups well differentiated morphologically: *lineosa*-group and *curculionoida*-group. Examination of *N. nanica* and *N. catarina*, was based on photographs of the holotypes, descriptions and key characters follow Sakakibara (2006). Further morphological assessment of these species is needed to evaluate details of forewing venation, femur setae and male and female genitalia.





**FIGURE 2.** *Nasuconia* Sakakibara Anterior view. **A.** *Nasuconia lineosa*; **B.** *Nasuconia catarina*; **C.** *Nasuconia nanica*; **D.** *Nasuconia curculionoida*; **E.** *Nasuconia guianensis* **sp. nov.** (♂ FSCA); **F.** *Nasuconia ellenfutterae* **sp. nov.** (♀ QCAZ); **G.** *Nasuconia yasuni* **sp. nov.** (♀ QCAZ).

#### Cucullate setae and abdominal integument sculpture in *Nasuconia*

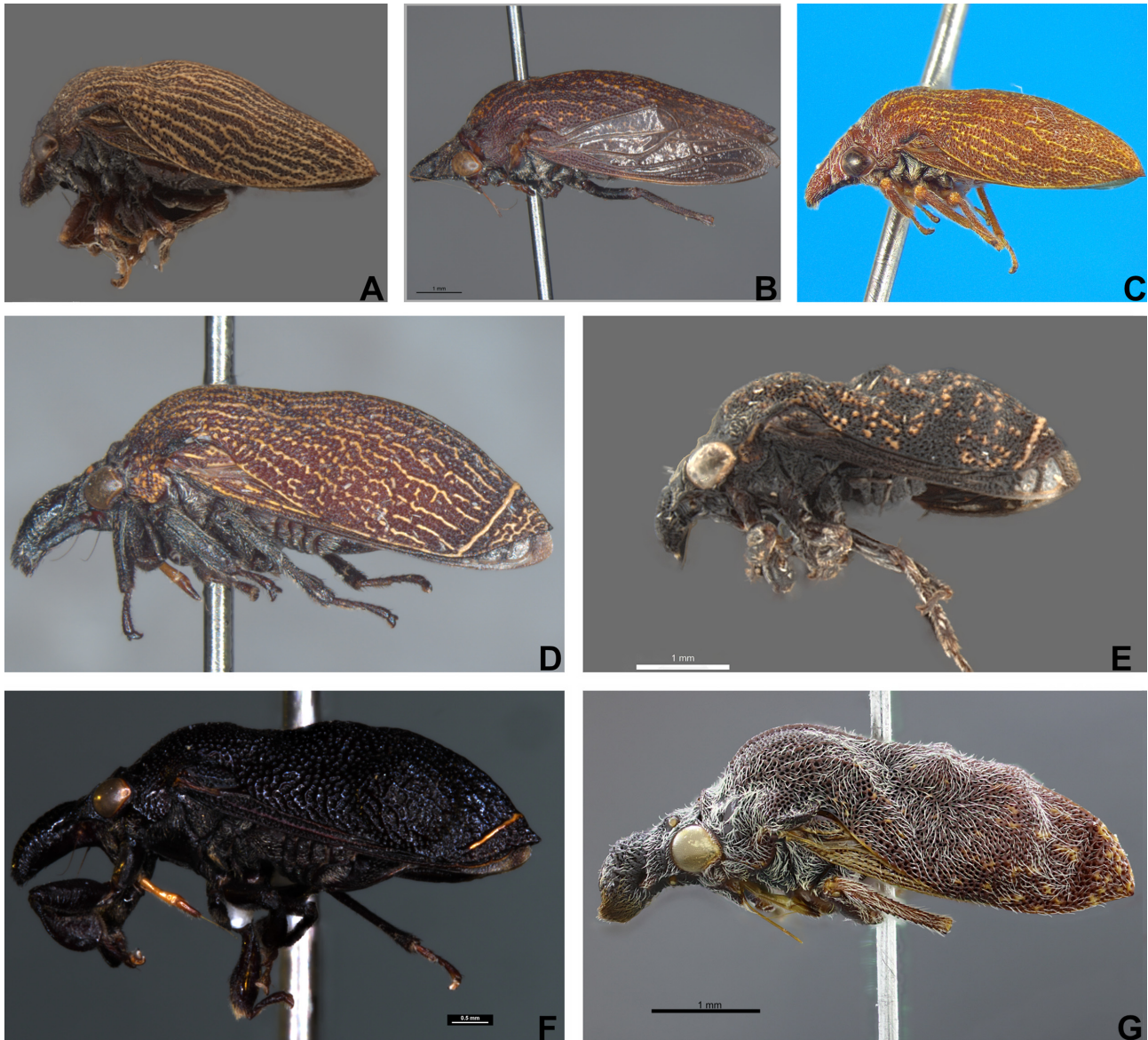
As in other Darnini genera, *Nasuconia* has opposing rows of cucullate setae on the ventral sides of the femora and tibiae. Presence of such setae on one or more pairs of legs is considered a synapomorphy defining the tribe Darnini (Deitz 1975; Dietrich *et al.* 2001; Roy *et al.* 2007). To further explore this important taxonomic character, here we conducted a preliminary comparison of the cucullate setae of two *Nasuconia* specimens, *Nasuconia lineosa* (Walker, 1862) and *Nasuconia ellenfutterae* **sp. nov.** representing the two informal species groups recognized here.

*Cucullate setae* (*cs*). Consist of a cuticular projection (Fig. 8D *cp*), associated with a spine-like trichoid sensillum (Fig. 8D *tr*); the *cp* is smooth in the base, with parallel longitudinal ridges distally (Fig. 8D *r*). *Pro- and mesofemora*. *Cs* arranged in two parallel rows (Figs. 8A; 8C; 9A; 9C), general shape conical sensilla trichodea differ in length and density being longer and more abundant in *N. lineosa* (Fig. 8B). In *N. ellenfutterae* the femur surface is covered with numerous sensilla placodea (Figs. 8C–D *pl*). *Pro- and mesotibia*. *Cs* arranged in rows basally, scattered distally (Figs. 8E; 8G; 9B; 9D); shape of *cp* differs from those of femora in being flattened (Figs. 8F; 8H). *Metafemora*. *N. lineosa* has *cs* reduced to irregular band of weakly projected ovoid cuticular processes (Fig. 9E), sensilla trichodea



are long as on pro- and mesofemora; in *N. ellenfutterae* only one row of short, flattened *cs* with distal longitudinal ridges are present (Fig. 9G). *Metatibia*. *Cs* flattened, cuticular process short (Figs. 9F; 9H), as commonly found among other Membracidae; *N. lineosa* without *cs* row I (Fig. 7C); *N. ellenfutterae* with all three rows present (Fig. 7F).

*Abdominal integument sculpture*. Abdominal terga in *Cyphotes*-group genera are characterized by a granular, punctate appearance (Figs. 10A; 10D) (Deitz 1975). In *Nasuconia* two fine structural features were found: (1) sensilla trichodea, hair-like setae, abundant in *N. lineosa* (Fig. 10E); and (2) acanthae, unicellular structures, which vary from a single tooth-like projection to pectinate processes. In *N. lineosa* only pectinate acanthae area present (Figs. 10E–F), while both simple and pectinate acanthae are present in *N. ellenfutterae* (Figs. 10G–I). The sculpture of the anterior part of each abdominal sternite is different from the posterior part, the acanthae are only well developed and prominent on the anterior part and the setae and pits are only present on the posterior area.



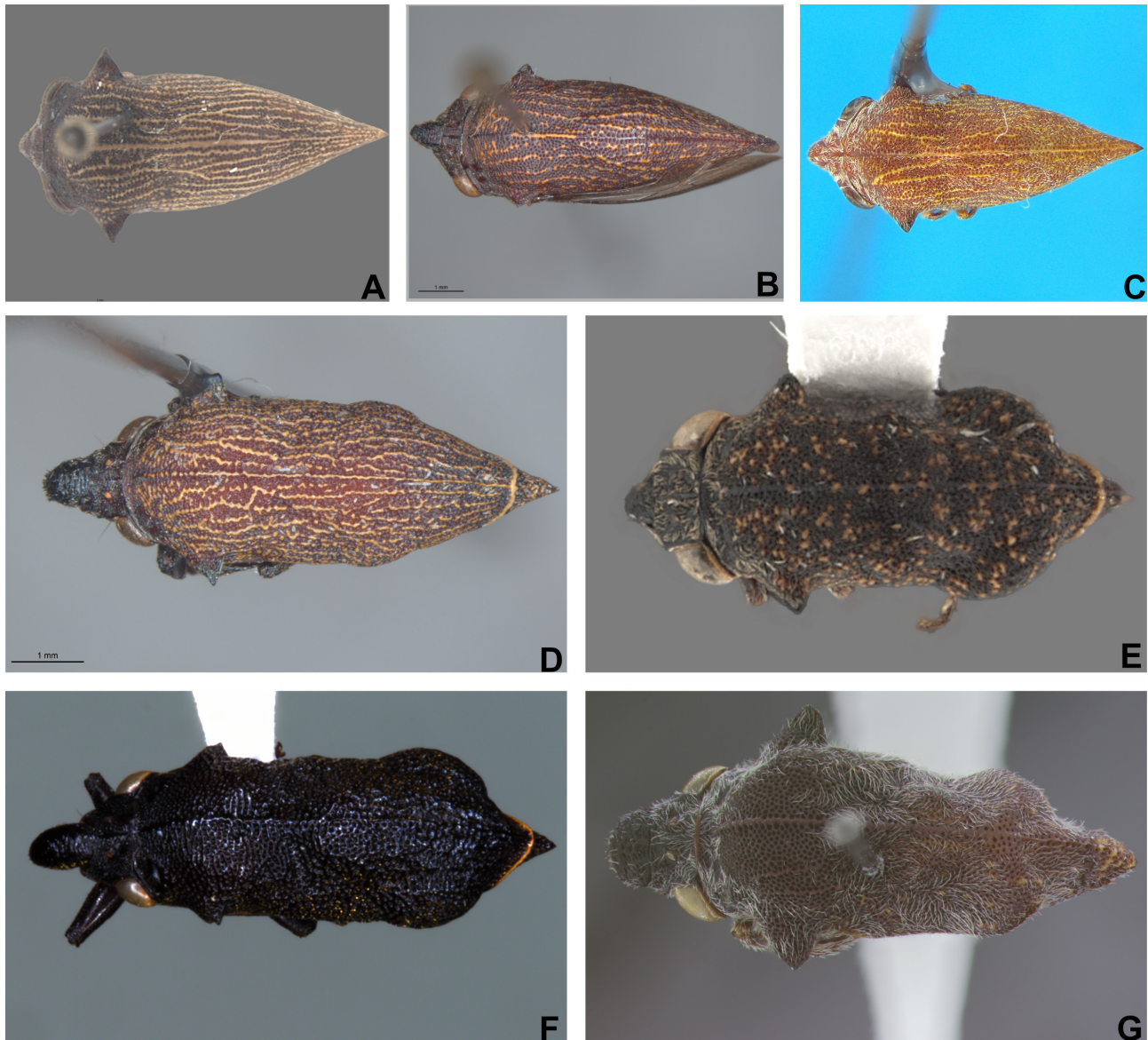
**FIGURE 3.** *Nasuconia* Sakakibara Lateral view. **A.** *Nasuconia lineosa*; **B.** *Nasuconia catarina*; **C.** *Nasuconia nanica*; **D.** *Nasuconia curculionoida*; **E.** *Nasuconia guianensis* sp. nov. (♂ FSCA); **F.** *Nasuconia ellenfutterae* sp. nov. (♀ QCAZ); **G.** *Nasuconia yasuni* sp. nov. (♀ QCAZ).

## Species Descriptions

### *LINEOSA*-GROUP

Species of this group may be recognized as follows: (1) in lateral view, frontoclypeus straight, not curved ventrad (Figs. 3A–C); (2) pronotum with elevated longitudinal yellow lines; (3) in dorsal view, posterior pronotal process evenly convex, gradually narrowing to apex, not projected posterolaterally (Figs. 4A–C); (4) posterior pronotal process without preapical transverse carina; (5) metafemur with cucullate setae in ventral surface absent or reduced (Fig. 7C); (6) metatibia with row I of cucullate setae absent (Fig. 7C); (8) forewing vein  $R_{4+5}$  gradually curved (not strongly bent) distally (Fig. 6A).

**Species included:** *N. lineosa* Sakakibara; *N. catarina* Sakakibara; *N. nanica* Sakakibara.



**FIGURE 4.** *Nasuconia* Sakakibara Dorsal view. **A.** *Nasuconia lineosa*; **B.** *Nasuconia catarina*; **C.** *Nasuconia nanica*; **D.** *Nasuconia curculionoida*; **E.** *Nasuconia guianensis* sp. nov. (♂ FSCA); **F.** *Nasuconia ellenfutterae* sp. nov. (♀ QCAZ); **G.** *Nasuconia yasuni* sp. nov. (♀ QCAZ).



### *Nasuconia lineosa* (Walker, 1862)

(Figures. 2A, 3A, 4A, 6B, 7A–C, 8A–B, 8E–F, 9A–B, 9E–F, 10A–F, 11A, 12A–B, 13A)

Type species: *Oxigonia lineosa* Walker, 1862: 318 [new. sp. Type loc: Brazil, Rio de Janeiro]; Funkhouser, 1927: 315 [Catalogued: *Gelastogonia lineosa*]; Broomfield, 1971: 359 [Designate lectotype male NHMUK]; Metcalf and Wade, 1965: 1055 [Catalogued: *Maturnaria ehippiger*; syn. *Gelastogonia lineosa*]; McKamey, 1998: 610 [Catalogued: *Maturnaria ehippiger*]; Sakakibara 2006 189–192 [new. comb.; sp. rev.; photographs]

**Diagnosis.** (1) Frontoclypeus extended 1/3 beyond suprantennal margin (Fig. 2A); (2) preapical area of posterior pronotal process enlarged (Fig. 3A); (3) pronotum brown; (4) style, apical hook straight (Fig. 12B).

**Description.** (Modified from Sakakibara 2006). **Color and sculpture.** Head, pronotum, legs, and abdomen brown, pronotum contrasting with yellow longitudinal and discontinuous lines. **Head.** Vertex with longitudinal lines; frontoclypeus projected 1/3 beyond suprantennal margin (Fig. 2A). **Thorax. Pronotum.** In lateral view, preapical part of posterior process higher than metopidium (Fig. 3A); in dorsal view, depressed just behind the humeral angles forming a V-shaped groove (Fig. 4A). **Forewing.** R vein bifurcate in two branches  $R_{1+2+3}$ , *s* crossvein absent (Fig. 6B). **Abdomen. Male.** Aedeagus (Fig. 12A) corona with dorsal margin denticulate; style, (Fig. 12B) wider basally and narrowing apically, L-shaped, apical hook and shank forming a right angle, margin dorso-apical of hook straight. **Female. First valvulae,** (Fig. 13A) ventral interlocking device (VID) extended from base to approximately 4/5 length of valvula, distinctively sinuous along valvula length; with scattered circular pores (PO); apical area without prominent tooth. **Second valvulae,** (Fig. 14A) apical margin smooth without teeth on ventral or dorsal areas.

**Measurements (mm). Male/Female.** Body length: 7.00/7.06; pronotum length: 6.42/6.70; pronotum height: 2.09/2.18; head width: 2.60/2.62; head height: 1.48/1.50; distance between apices humeral angles: 3.82/3.84.

**Material examined.** Brazil: Sta Catharina, near Mafra. W.50. S.26. 800 m. XII-1927. A. Maller. B. M. 1930-286. 1 female (NHMUK 013588145) || Brazil. Sta. Catharina, Hansa Humboldt. W. 50. S. 26. 100m. 1930. Maller. B. M. 1930-286. 1 male (NHMUK 013588146) || Brazil, S. Catharina, Mafra. Dec-1930. A. Maller collector. Frank Johnson Donor. 1 female (NCSU) || Brazil. Santa Catharina. 1 female (NCSU) || Brazil, S. Catharina, Mafra. Dec-1930. A. Maller collector. Frank Johnson Donor. 1 male (NCSU) || Brazil. S. Am. Brasilien Hansa. Jnkopt. 1937. Fr. J. Clermont. 1 female (DZPU 488897). || Brazil. Santa Catharina. 1 female (NCSU) || Brazil. S. Am. Brasilien Hansa. Jnkopt. 1937. Fr. J. Clermont. 1 male (DZPU 488898) || Brazil. Vicosa, Mina Geraes, 7-IV-1933. E. L. Hambleton. 1 female (USNM).

**Comments.** This is the type species of the genus, closely related to *N. nanica* and *N. catarina*, which are similar in frontoclypeus characters and pronotal shape and sculpture. In both *N. lineosa* and *N. catarina* the *s* crossvein is absent and the R vein is bifurcate into two branches  $R_{1+2+3}$  and  $R_{4+5}$ ; these may also be diagnostic characters for the *lineosa*-group but need to be confirmed for *N. nanica*. *N. lineosa* is only recorded from Brazil.

### *Nasuconia catarina* Sakakibara, 2006

(Figures. 2B, 3B, 4B, 6A)

Type species: *Nasuconia catarina* Sakakibara, 2006: 190 [sp. nov.; description, photograph]

**Diagnosis.** (1) Frontoclypeus extended 1/2 of its length beyond suprantennal margin (Fig. 2B); (2) preapical area of posterior pronotal process evenly convex; (3) pronotum dark brown; (4) in lateral view, head (vertex and frontoclypeus) obliquely directed forward (Fig. 3B).

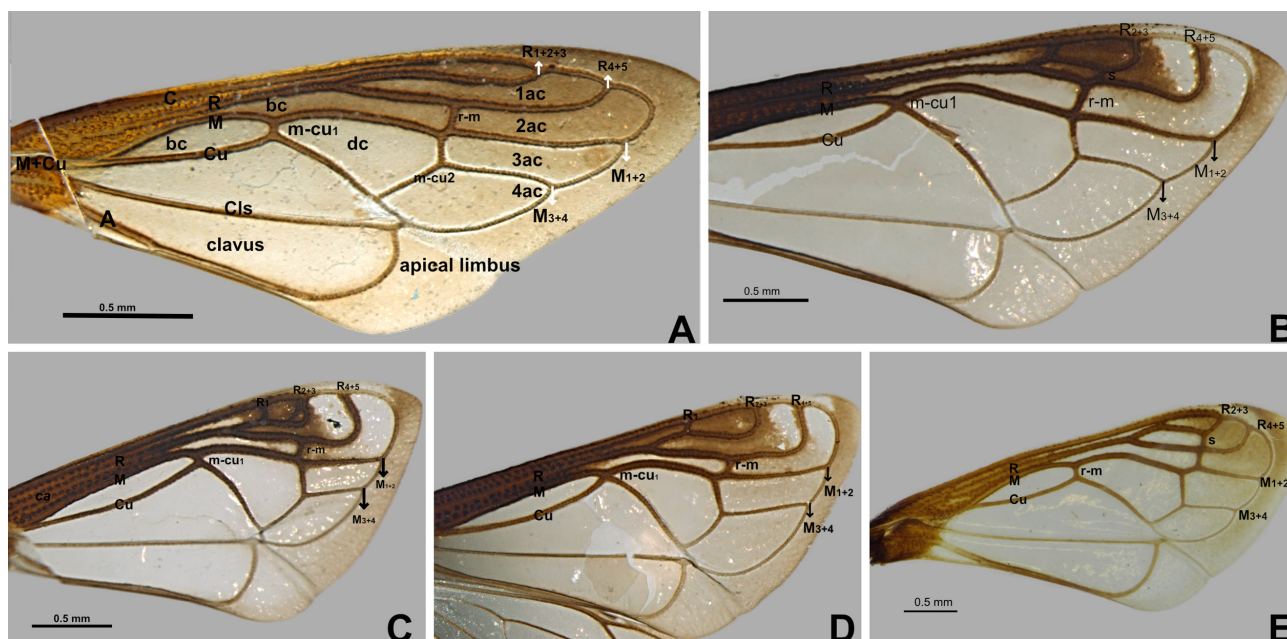
**Description.** (Modified from Sakakibara 2006). **Color and sculpture.** Head, pronotum, and legs dark brown, pronotum with yellow longitudinal elevated lines, formed by discontinuous sequences of dots. **Head.** Vertex without longitudinal lines. Frontoclypeus projected 1/2 beyond suprantennal margin (Fig. 2B). **Thorax. Pronotum.** In lateral view, preapical area of posterior pronotal process and metopidium evenly convex (Fig. 3B). **Forewing.** R vein bifurcate in two branches  $R_{1+2+3}$  and  $R_{4+5}$ ; *s* crossvein absent. **Female.** Unknown.

**Measurements (mm). Male.** Total length 8.60; width of head 2.76; length of head 1.60; distance between apices of humeral angles 3.48.

**Material examined.** Photograph of the holotype in DZUP, provided by Paulo Alveranga. Holotype label information (Sakakibara, 2005: 190p) BRASIL. Santa Catarina: “Brusque-SC | XII.1970 | V.O. Becker” (legs missing, except the left hind leg) (DZUP).



**Comments.** As stated by Sakakibara (2006), *N. catarina* differs from *N. lineosa* in the following characters: frontoclypeus in *N. catarina* extended  $\frac{1}{2}$  of its length, while in *N. lineosa* it is extended  $\frac{1}{3}$  beyond the suprantennal margin. The pronotum is low in both species but the depression behind the humeral angles is less marked in *N. catarina*; in lateral view, the pronotum of *N. catarina* is regularly convex. This species is recorded only from Santa Catarina, Brazil in the city of Brusque.



**FIGURE 6.** Forewing venation *Nasuconia* Sakakibara; **A.** *Nasuconia lineosa*; **B.** *Nasuconia curculionoida*; **C.** *Nasuconia guianensis* sp. nov.; **D.** *Nasuconia ellenfutterae* sp. nov.; **E.** *Nasuconia yasuni* sp. nov.; Abbreviations. ac: apical cell; bc: basal cell; ca: coriaceous area; cls: claval suture; dc: discoidal cell; R: Radial vein; M: Medial vein; Cu: Cubital vein.

### *Nasuconia nanica* Sakakibara, 2006

(Figures. 2C, 3C, 4C)

Type species: *Nasuconia nanica* Sakakibara, 2006: 191 [sp. nov.; description, photograph]

**Diagnosis.** (1) Frontoclypeus extended  $\frac{2}{3}$  of its length beyond suprantennal margin; (2) In lateral view, head (vertex and frontoclypeus) in the same oblique line as metopidium; (3) pronotum yellow.

**Description.** (Modified from Sakakibara 2006) **Color and sculpture.** Head, pronotum, and legs yellow and brown, thorax beneath, apex of humeral angles and apex of abdomen black; pronotum with yellow longitudinal elevated lines; head and pronotum densely pubescent covered with yellow setae. **Head:** Vertex without longitudinal lines. Frontoclypeus, projected  $\frac{2}{3}$  beyond suprantennal margin (Fig. 2C). **Thorax. Pronotum.** In lateral view, preapical area of posterior pronotal and metopidium process evenly convex (Fig. 3C). Female unknown.

**Measurements (in mm). Male.** Total length 5.64; width of head 1.84; length of head 1.48; distance between apices of humeral angles 2.56.

**Material examined.** Photograph of the holotype *N. nanica* (DZUP) provided by Olivia Evangelista. Holotype label information (Sakakibara 2005: 191). BRASIL. Bahia: “Encruzilhada-BA | Brasil – XI.1972 | Seabra/Alvarenga.

**Comments.** The characters described by Sakakibara to differentiate *N. nanica* from *N. catarina* include only color and size. These characters could be due to intraspecific variation; characters of the genitalia and forewing venation should be examined to validate the identity of the species. In *N. nanica* and *N. lineosa* the dorsal margin of the head (vertex and frontoclypeus), is continuous with the contour of the metopidium in lateral view (Figs. 3A; 3C), contrasting with *N. catarina* in which the dorsal margin of the head (vertex and frontoclypeus) forms an angle with the anterior margin of the metopidium. This species is recorded only from Encruzilhada, Bahia, Brazil.

## CURCULIONOIDA-GROUP

Species of this group may be recognized as follows: (1) frontoclypeus, markedly curved downward, transversely striate, with about 2/3 of total length projected beyond suprantennal margin (Figs. 3D–G); (2) preapical part of posterior pronotal process usually enlarged, posterior process convex, gradually descending to apex; in dorsal view, with distinctive mid-dorsal humps behind humeral angles, posterolateral area projected into rounded swellings that vary in size among species (Figs. 4D–G), posterior process ending abruptly in an acute apex, with a distinct and continuous elevated carina crossing transversely between lateral margins before apex (Fig. 1C *tr c*), indistinct in *N. yasuni*. (3) forewing usually with distinctive macula in 1<sup>st</sup> and 2<sup>nd</sup> apical cells (Fig. 6B); (4) R<sub>4+5</sub> strongly bent (Figs. 6B–E); (5) metatibia with three rows of cucullate setae (Fig. 7F).

**Species included:** *N. curculionoida*; *N. ellenfutterae* **sp. nov.**; *N. guianensis* **sp. nov.**; *N. yasuni* **sp. nov.**.

### *Nasuconia curculionoida* Sakakibara, 2006

(Figures. 2D, 3D, 4D, 6C, 13B, 14B)

Type species: *Nasuconia curculionoida* Sakakibara, 2006: 191 [sp. nov.; description, photograph]

**Diagnosis.** (1) Preapical area of posterior pronotal process evenly convex; (2) in dorsal view, posterolateral area weakly projected; (3) *s* crossvein present; (4) first valvula ventral interlocking device bent downward at mid-length of valvula; (5) second valvulae, with teeth in dorso apical margin; (6) pronotum with yellow longitudinal lines

**Description.** (Modified from Sakakibara 2006). **Color and sculpture.** Head black, pronotum dark brown humeral angles, thorax, legs, and abdomen, black; pronotum with longitudinal elevated yellow lines; frontoclypeus with surface corrugated. **Head.** Vertex without longitudinal lines. (Fig. 2D). **Thorax.** *Pronotum.* In lateral view, preapical area of posterior pronotal process low, almost evenly convex, with depression behind humeral angles, weakly marked (Fig. 3D); in dorsal view, posterolateral area of pronotum weakly projected laterally (Fig. 4D). *Forewing.* 1<sup>st</sup> apical cell with distinctive macula; *s* crossvein present (Fig. 6C). **Abdomen.** *Female.* *First valvula,* (Fig. 13B) ventral interlocking device (VID) with one sinuous area at mid-length of valvula; dorsal margin of apex distinctly serrate, with blunt teeth (TOO) arranged irregularly; tip with denticles (DEN); two ventral preapical prominences (PP) present; pores scattered on valvula. *Second valvulae,* (Fig. 14B) dorsoapical margin with about five small blunt teeth of variable sizes; tip of valvula serrate in dorsal and ventral margin. Male Unknown.

**Measurements (mm).** *Female.* Total length: 7.05; pronotum length: 5.71; pronotum height: 1.71; head width: 2.56; head height: 2.24; distance between apices of humeral angles: 2.87.

**Material examined.** Guyane Française. Montagne des Chevaux. 21-XII-2013. Swing. S.E.A.G. 1 female (DZUP). Photograph of the holotype specimen (DZUP) provided by Paulo Alveranga. Holotype label information (Sakakibara 2005: 191) BRAZIL. Mato Grosso: “SINOP-M. Grosso Brasil – X.1975 | M. Alvarenga”. Sakakibara (2006).

**Comments.** The pronotal coloration and sculpture of *N. curculionoida* is similar to that of species of the *lineosa*-group, but this species differs in the following characters: frontoclypeus longer and curved downward; head narrower; ocelli larger; suprantennal margin tapering forwards and pronotal apex with elevated transverse carina. *N. curculionoida* differs from *N. guianensis* **sp. nov.** in the pronotal shape and sculpture, and longer frontoclypeus; and from *N. yasuni* **sp. nov.** in pronotal shape and sculpture and female genitalia characters. This species is newly recorded from French Guiana.

### *Nasuconia guianensis* **sp. nov.**

(Figures. 2E, 3E, 4E, 6D, 12C–D)

**Diagnosis.** 1) Preapical area of posterior pronotal process enlarged in three humps; (2) in dorsal view, posterolateral area projected beyond humeral angles; (3) *s* crossvein absent; (4) style with margin dorso apical strongly curved; (5) pronotum with yellow nodes.

**Description.** **Color and sculpture.** General color black; eyes yellow, ocelli black; pronotum black contrasted

with yellow areas; legs and abdomen brown; head surface corrugated; head, pronotum, and legs covered with scattered yellow setae; pronotum with yellow nodes arranged irregularly. **Head.** Vertex with two parallel rugae extended from the anterior margin of vertex to the ocelli; suprantennal margin strongly punctate; frontoclypeus with numerous transversal lines, covered with yellow setae over apex and lateral margin (Fig. 2E). **Thorax.** *Pronotum.* In lateral view sinuate, preapical part of posterior process, with depression behind humeral angles notably marked, followed by a small cone-shaped hump, posterior pronotal process gradually curved (Fig. 3E); in dorsal view, posterolateral area rounded, distinctly projected laterally beyond humeral angles, pronotum abruptly narrowing in an acute apex (Fig. 4E). *Forewings.* 1<sup>st</sup> apical cell with distinctive macula, *s* crossvein absent (Fig. 6D). **Abdomen.** *Male.* Aedeagus, (Fig. 12C) margin dorsal of corona with denticuli; style (Fig. 12D) in lateral view sinuate, margin dorsoapical of hook strongly curved. Female unknown.

**Measurements (mm).** *Male.* Total length: 4.8; pronotum length: 3.9; pronotum height: 1.06; head width: 1.53; head height: 1.19; distance between apices of humeral angles: 2.15.

**Etymology.** This species is named according to the country where the species was found.

**Material examined. Holotype.** Pinned. (♂ FSCA). **French Guiana**, 1 km S. Amazon Nature Lodge. 30 km SE Roura on Kaw Rd., N4°32.961' W052°12.830. 288m. MV light. 3/4-VI-2005. J. E. Eager & M. T. Messenger. Coll.

**Comments.** This and the previous species are the first records of the genus for French Guiana. This species is somewhat similar to *N. curculionoida* Sakakibara but differs in the pronotal color and sculpture, pronotal shape, and forewing lacking the *s* crossvein. In *N. curculionoida* the pronotum has elevated yellow discontinuous lines; in *N. guianensis* **sp. nov.** the pronotum has elevated yellow irregular discontinuous nodes. Contrasted with *N. curculionoida* but similar to the species described below, the lateral pronotal profile is not continuously convex or rounded in *N. guianensis*, but has three distinctive cone-shaped humps.

### *Nasuconia ellenfutterae* sp. nov.

(Figures. 2F, 3F, 4F, 5; 6E, 7D–F, 8C–D, 8G–F, 9C–D, 9G–H, 10G–I, 11B, 13C, 14C)

**Diagnosis.** (1) Preapical area of posterior pronotal process enlarged with two rounded humps; (2) in dorsal view, posterolateral area projected, about the same point of humeral angles; (3) *s* crossvein absent; (4) apex of first valvulae with dorsal and ventral margin serrate; (5) second valvulae, dorso apical margin with about four irregular teeth; (6) pronotum black; lacking yellow longitudinal lines or nodes.

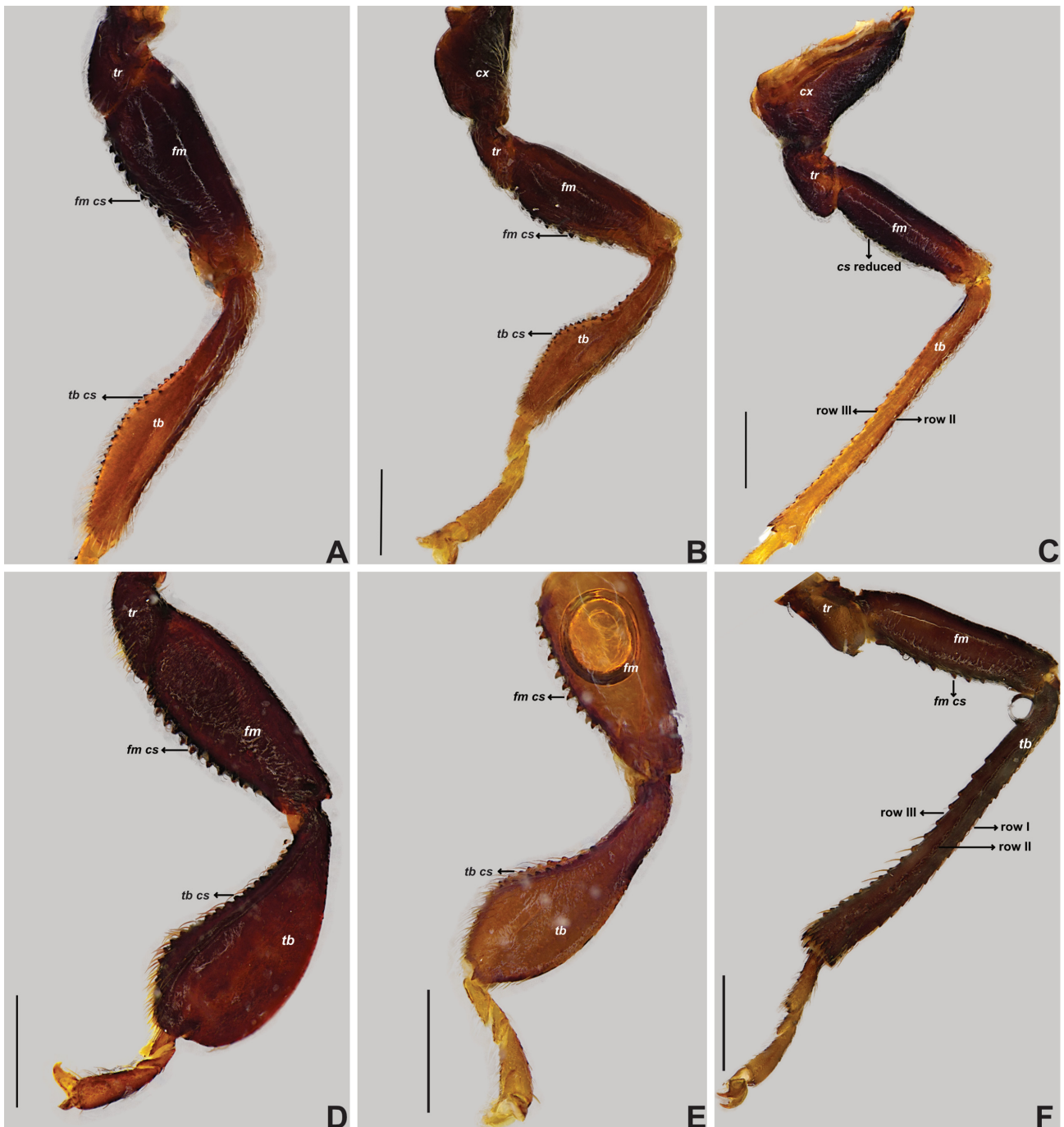
**Description. Color and sculpture.** Head, pronotum, and legs black, eyes yellow, ocelli brown, legs black contrasting with yellow tarsi; rostrum distinctively yellow. Head, pronotum, ventral side of abdomen corrugated, strongly punctate; frontoclypeus with transversal rugae; forewing area costal punctate; legs densely pubescent with minute yellow setae. **Head.** Vertex with longitudinal elevated lines from the anterior margin to the suprantennal margin (Fig. 2F). **Thorax.** Proepisternum about twice longer than meso and metasternum (Fig. 5). *Pronotum*, in lateral view, followed by a concave with depression behind humeral angles (Fig. 3F); in dorsal view, posterolateral area rounded, projected laterally, about the same point of humeral angles (Fig. 4F). *Forewing.* 1<sup>st</sup> and 2<sup>nd</sup> apical cells with distinctive macula; *s* crossvein absent (Fig. 6E). **Abdomen.** *Female.* *First valvula*, (Fig. 13C) ventral interlocking device (VID) slightly sinuate; dorsal margin declined in apex, apex serrate, with about denticles (DEN) distributed on ventral and apical margin. *Second valvulae*, (Fig. 14C) dorso apical margin with about four irregular teeth, tip of valvulae with regular denticles located in dorsal and ventro-apical area. *Male.* Unknown.

**Measurements (mm).** *Female.* Total length: 7.58; pronotum length: 5.94; pronotum height: 1.71; head width: 1.5; head height: 2.00; distance between apices of humeral angles: 2.60.

**Etymology.** The specific epithet is a patronym for Ellen Futter who served as director of the AMNH for 30 years, the first woman to serve in this role. Ellen Futter's unique and creative leadership fostered robust scientific discovery.

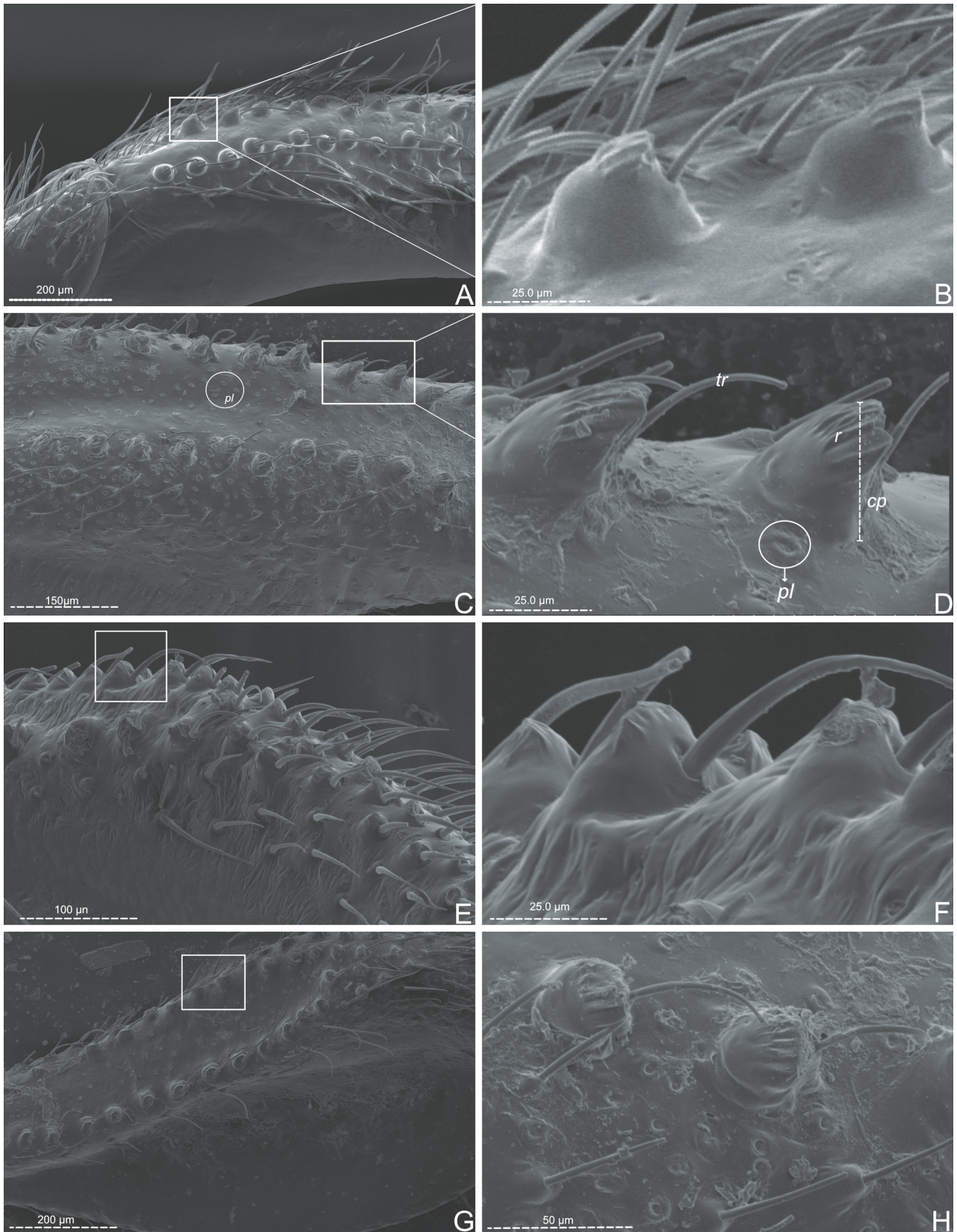
**Material examined. Holotype.** Pinned. (♀ QCAZ: 273254) **Ecuador**, Orellana, Reserva Etnica Waorani. 1 Km Onkone Gare Camp Transect. Ent. 216.3 m. 06-Oct-1995. 00°39'25.7" S 076°27'10.8" W T.L. Erwin. *Et al.* Fogging Terre firme forest: Lot # 1213.





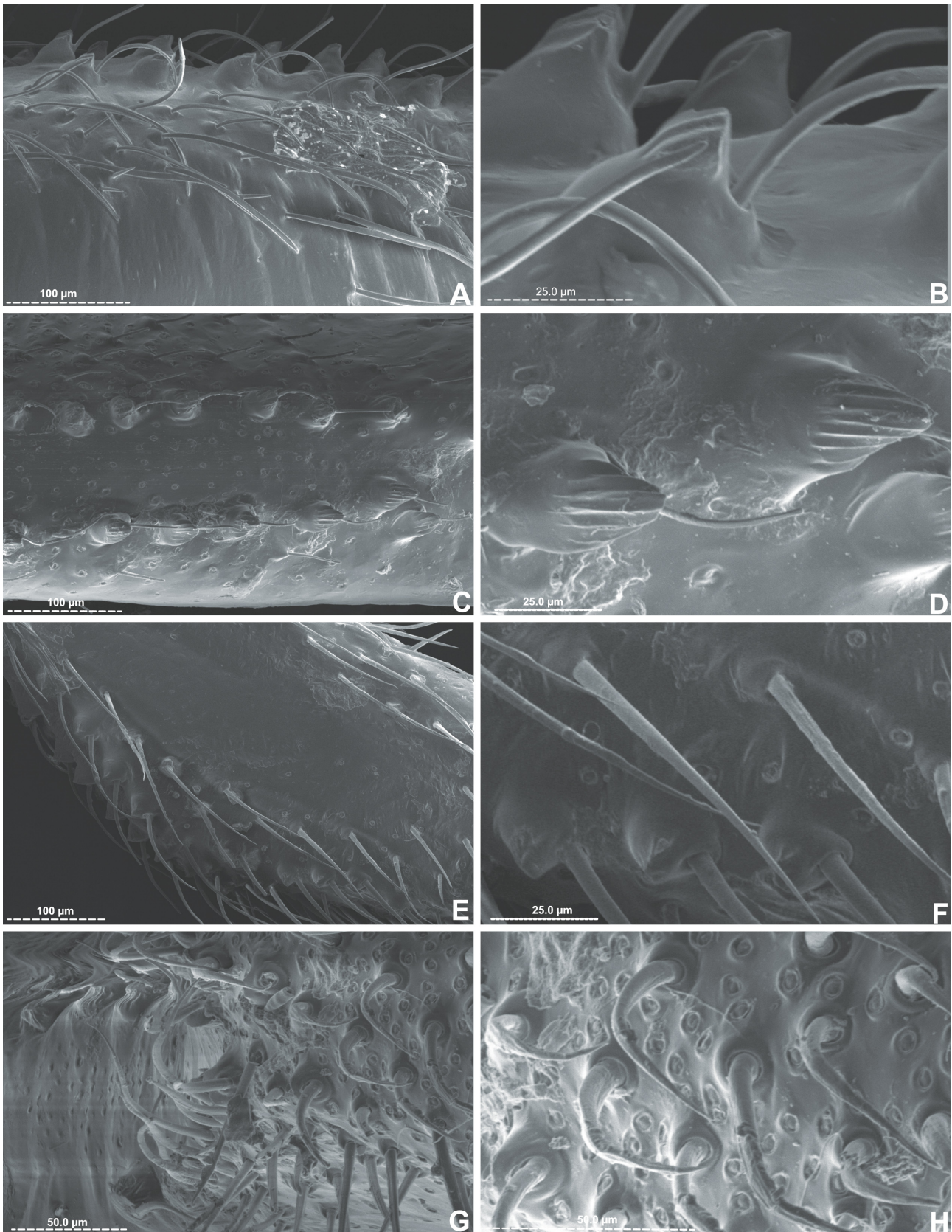
**FIGURE 7.** (A–C) Legs *Nasuconia lineosa*-group. *Nasuconia lineosa*; **A.** Prothoracic Leg; **B.** Mesothoracic leg; **C.** Metathoracic leg; (D–F) Legs *Nasuconia curculionoida*-group. *Nasuconia ellenfutterae* **sp. nov.**; **D.** Prothoracic Leg; **E.** Mesothoracic leg; **F.** Metathoracic leg. Scale. 0.5 mm. Abbreviations. **cx:** coxa; **fm cs:** femur cucullate setae; **fm:** femur; **tb cs:** tibia cucullate setae; **tb:** tibia; **tr:** trochanter.

**Comments.** This species is similar to *N. curculionoida* and *N. guianensis* **sp. nov.** in the frontoclypeus shape, and the transverse elevated line of the pronotal posterior process. It differs from *N. curculionoida* and *N. guianensis* **sp. nov.** in the color and pronotal sculpture. The latter species are brown and with elevated lines or nodes; *N. ellenfutterae* **sp. nov.** is black overall without lines or nodes on the pronotum. The notably enlarged proepisternum is unique to *N. ellenfutterae* **sp. nov.** The first valvulae in *N. curculionoida* have two preapical prominences that are absent in *N. ellenfutterae* **sp. nov.**; the second valvulae of *N. ellenfutterae* **sp. nov.** have about four irregular prominent teeth, in contrast with the small blunt teeth on the dorsal margin in *N. curculionoida*. This species represents the first record of the genus from Ecuador.



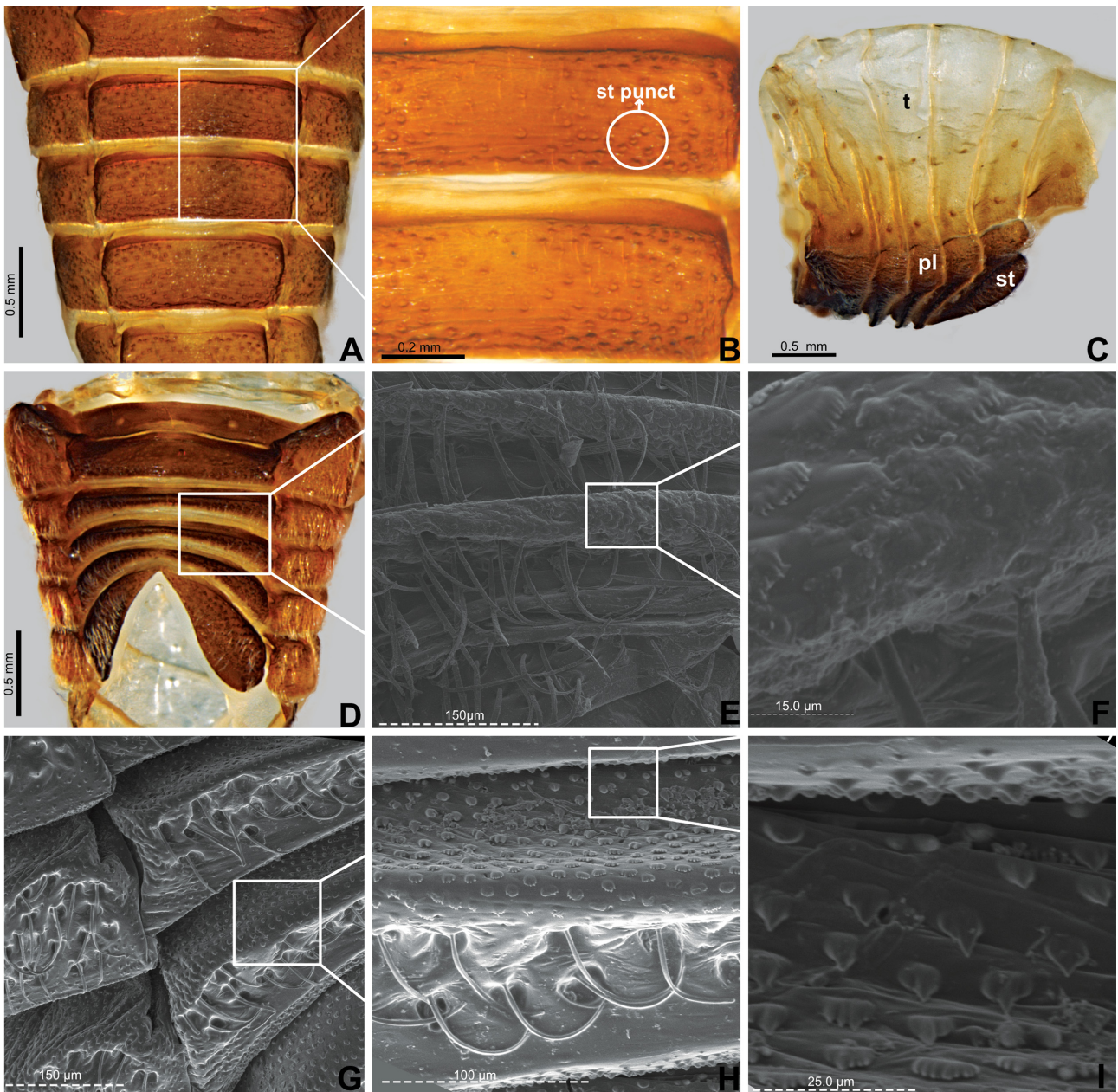
**FIGURE 8.** Ventral view of anterior femur and tibia showing rows of cucullate setae in two different microscopic scales. (A–D) Anterior femur. (A–B) *Nasuconia lineosa*-group. *Nasuconia lineosa*; (C–D) *Nasuconia curculionoida*-group. *Nasuconia ellenfutterae* sp. nov.; Anterior tibia. (E–F) *Nasuconia lineosa*-group. *Nasuconia lineosa*; (G–H) *Nasuconia curculionoida*-group. *Nasuconia ellenfutterae* sp. nov.; Abbreviations. **cp**: cuticular process; **pl**: sensilla placodea; **r**: ridges; **tr**: sensilla trichodea.





**FIGURE 9.** Meso- and metathoracic femur and tibia showing rows of cucullate setae. *Nasuconia lineosa*-group. *Nasuconia lineosa*; **A.** Mesothoracic femur; **B.** Mesothoracic tibia; *Nasuconia curculionoida*-group. *Nasuconia ellenfutterae* **sp. nov.**; **C.** Mesothoracic femur; **D.** Mesothoracic tibia; *Nasuconia lineosa*; **E.** Metathoracic femur; **F.** Metathoracic tibia; *Nasuconia ellenfutterae* **sp. nov.** **G.** Metathoracic femur; **H.** Metathoracic tibia.





**FIGURE 10.** (A–B) Abdomen ventral view in two different magnifications. ♂ *Nasuconia lineosa*; (C–F) ♀ *Nasuconia lineosa*; C. Abdomen lateral view; D. Abdomen ventral view; (E–F). SEM showing microtexture abdominal punctations in two different magnifications; (G–I) ♀ *Nasuconia ellenfutterae* sp. nov.; SEM showing microtexture abdominal punctations in three different magnifications. Abbreviations: **pl**: pleurites; **st**: sternum; **st punct**: sternite punctation; **t**: tergum.

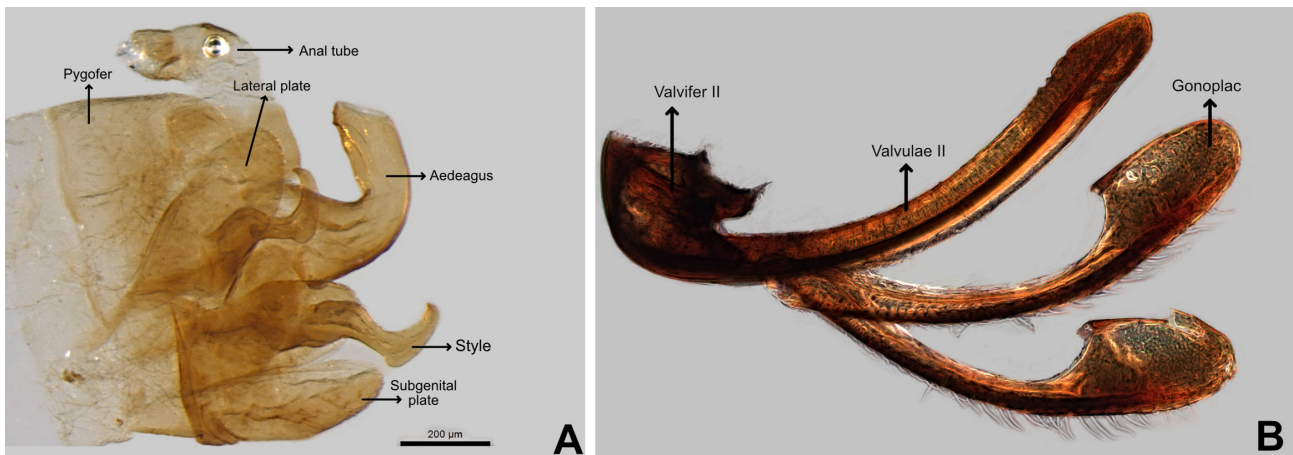


FIGURE 11. A. Lateral and subgenital plate. *Nasuconia lineosa*; B. Gonoplac. *Nasuconia ellenfutterae* sp. nov. .

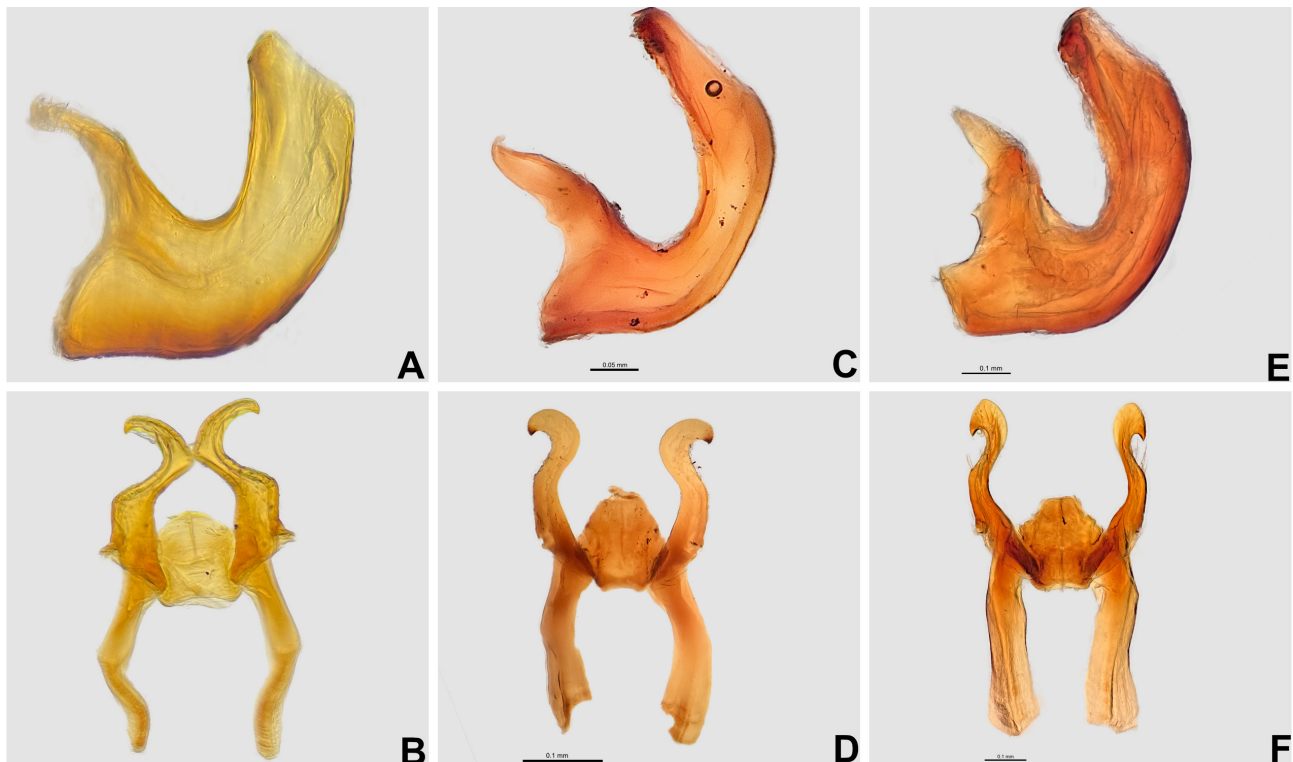
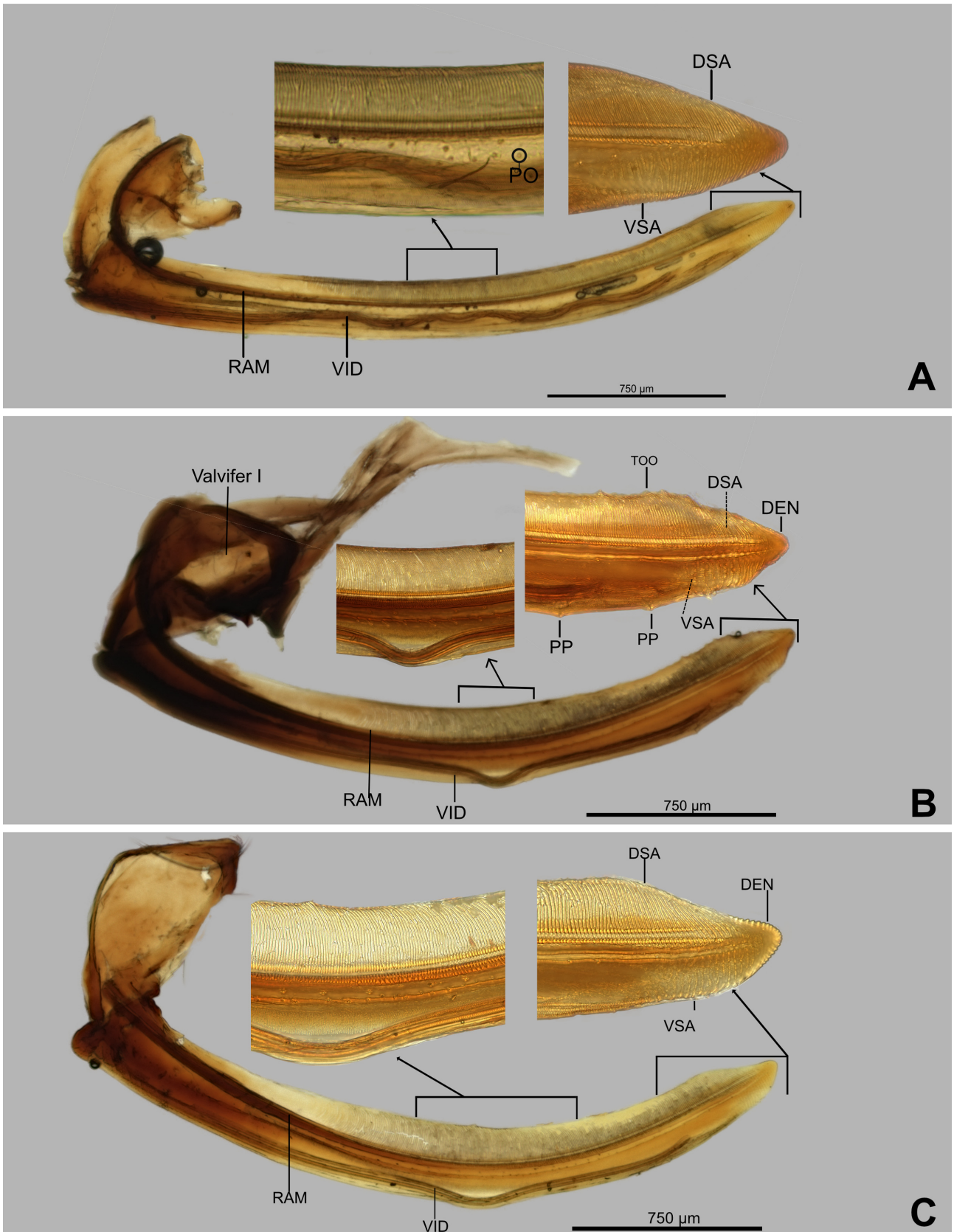


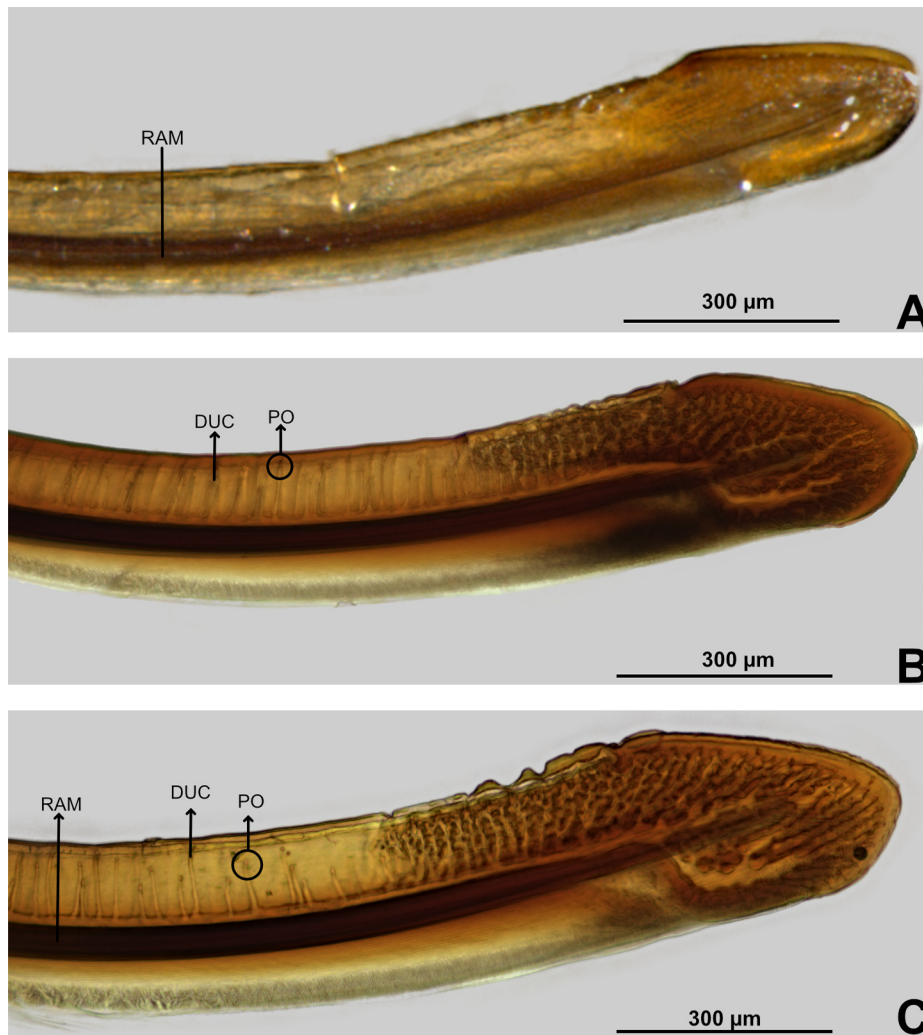
FIGURE 12. Male genitalia *Nasuconia* Sakakibara. (A–B) *Nasuconia lineosa* A. Aedeagus lateral view; B. Style posterior view; (C–D) *Nasuconia guianensis* sp. nov.; C. Aedeagus lateral view; D. Style posterior view; (E–F). *Nasuconia yasuni* sp. nov.; E. Aedeagus lateral view; F. Style posterior view.





**FIGURE 13.** First valvulae *Nasuconia* Sakakibara. **A.** *Nasuconia lineosa*; **B.** *Nasuconia curculionoida*; **C.** *Nasuconia ellenfutterae* **sp. nov.**; Abbreviations. **(DSA)** dorsal sculptured area; **(VID)** ventral interlocking device; **(RAM)** ramus; **(VSA)** ventral sculptured area; **(PP)** preapical prominence; **(PO)** pores; **(DEN)** Denticuli; **(TOO)** Tooth.





**FIGURE 14.** Second valvulae *Nasuconia* Sakakibara. **A.** *Nasuconia lineosa*; **B.** *Nasuconia curculionoida*; **C.** *Nasuconia ellenfutterae* sp. nov.; Abbreviations. (**DUC**) Ducts, (**PO**) pores, (**RAM**) ramus.

***Nasuconia yasuni* sp. nov.**

(Figures. 2G, 3G, 4G, 6F, 12E–F)

**Diagnosis.** (1) Preapical area of posterior pronotal process enlarged with two conical humps; (2) In dorsal view, posterolateral area projected laterally not extended beyond humeral angles; (3) *s* crossvein present; (4) style with margin dorsoapically acute; (5) pronotum densely pubescent, lacking elevated longitudinal lines or nodes.

**Description. Color and sculpture.** Head, pronotum, and legs brown, contrasted with scattered punctured yellow areas at pronotal apex. Head, thorax, and abdomen densely pubescent, covered with fine yellow setae; frontoclypeus strongly punctate, corrugated, with transverse and elevated lines. **Head.** Vertex without longitudinal lines (Fig. 2G). **Thorax. Pronotum.** In lateral view, depression behind humeral angles weakly marked, preapical part of posterior process with two small conical humps, (Fig. 3G); in dorsal view, humeral angles followed by a gradual constriction, posterolateral area rounded, projected laterally not beyond humeral angles (Fig. 4G).

**Forewings.** 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> apical cells with distinctive macula; *s* crossvein present; two m-cu crossvein, (Fig. 6G).

**Abdomen. Male.** Aedeagus oblong, compressed in lateral view, gonopore membrane no developed, in posterior view parallel-sided, margin of corona with denticule (Fig. 12E); style in lateral view sinuate, margin dorso-apical of hook acute (Fig. 12F). Female. Unknown.

**Measurements (mm). Male.** Total length: 4.96; pronotum length: 4.02; pronotum height: 1.07; head width: 1.49; head height: 1.29; distance between apices of humeral angles: 2.52.

**Etymology.** This species is named after Yasuni National Park in Ecuador where the species was collected; Yasuni was recognized as a Biosphere Reserve by UNESCO in 1989 and is considered one of the areas with the greatest biodiversity per square meter on the planet.

**Material examined. Holotype.** Pinned. (♀ QCAZ: 273255). **Ecuador**, Orellana, Reserva Etnica Waorani, 1 Km S. Onkone Gare Camp Transect Ent. 216.3 m. alt. S00°39'25.7" W76°27'10.8". 7-Oct-1994. T.L Erwin *et al.* Fogging terre firme forest lot# 896.

**Comments:** This species can be distinguished from other *Nasuconia* species by the pronotal vestiture which, in *N. yasuni*, is densely pubescent, and by the very weak transverse posterior pronotal carina and the pronotal shape.

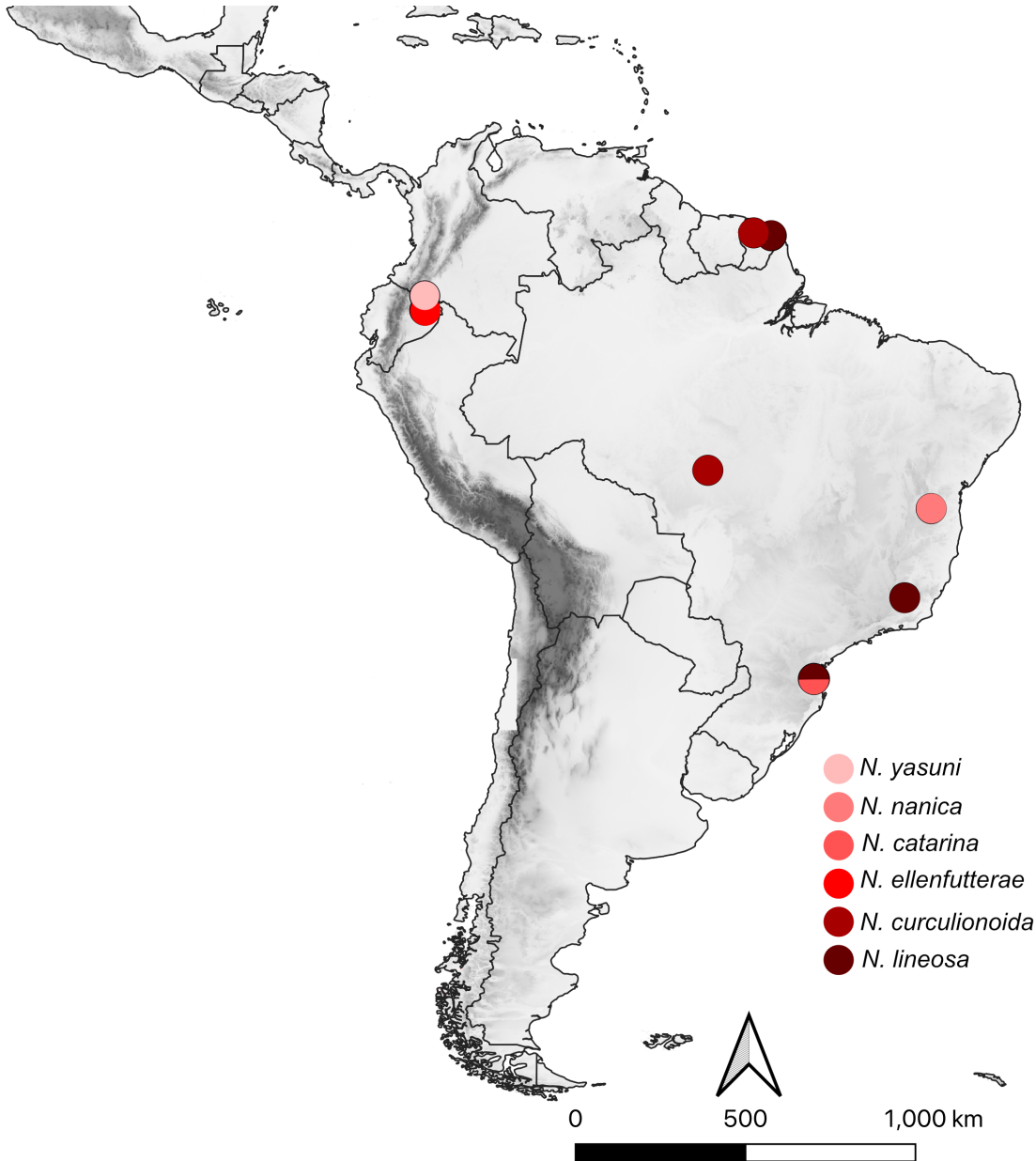


FIGURE 15. Known distribution of *Nasuconia*.

### Key to species of *Nasuconia* Sakakibara

- 1 Frontoclypeus in profile straight (Figs. 3A–C); in dorsal view, posterolateral area of pronotum tapered not projected laterally (Figs. 4A–C); posterior pronotal process lacking a transverse carina;  $R_{4+5}$  only gradually curved distally . . . 2 (*lineosa*-group)
- Frontoclypeus in profile distinctly curved downwards (Figs. 3D–G); in dorsal view, posterolateral area of pronotum rounded projected laterally (Figs. 4C–G); posterior pronotal process with a transverse carina (may be indistinct Fig. 1C *tr c*);  $R_{4+5}$  distinctly bent distally (Fig. 6B) . . . . . 4 (*curculionoida*-group)



- 2 In lateral view, preapical part of posterior pronotal process higher than metopidium (Fig. 3A) . . . . . *N. lineosa*  
 - In lateral view, preapical part of posterior pronotal process about the same height as metopidium (Figs. 3D–C) . . . . . 3  
 3 Frontoclypeus extended 2/3 of its length beyond suprantennal margin (Fig. 2C); in lateral view, head (vertex and frontoclypeus)  
 in the same oblique line as metopidium (Fig. 3C) . . . . . *N. nanica*  
 - Frontoclypeus extended 1/2 of its length beyond suprantennal margin (Fig. 2B); in lateral view, head (vertex and frontoclypeus)  
 obliquely directed forward (Fig. 3B) . . . . . *N. catarina*  
 4 Posterior pronotal process with a transverse carina; pronotum with elevated longitudinal lines or nodes, not densely pubescent  
 (Figs. 3D–F) . . . . . 5  
 - Posterior pronotal process without a distinct transverse carina; pronotum without elevated longitudinal lines or nodes, densely  
 pubescent (Fig. 3G) . . . . . *N. yasuni* **sp. nov.**  
 5 Pronotum sculpture with distinctive yellow longitudinal lines, or nodes, dark brown in color; proepisternum not enlarged . . . . . 6  
 - Pronotum sculpture without distinctive yellow longitudinal lines, or nodes, black in color; proepisternum enlarged . . . . .  
 . . . . . *N. ellenfutterae* **sp. nov.**  
 6. Pronotum with yellow longitudinal lines, not nodes (Fig. 4D); preapical part of posterior pronotal process evenly convex (Fig.  
 3D) . . . . . *N. curculionoida*  
 - Pronotum with yellow discontinuous nodes (Fig. 4E); preapical part of posterior pronotal process with small cone-shaped  
 humps (Fig. 3E) . . . . . *N. guianensis* **sp. nov.**

## Acknowledgments

We thank Fernanda Salazar-Buenaño and Rafael E. Cárdenas from the Invertebrate collection at QCAZ for assistance with Ecuador specimens, Mick Webb from the Natural History Museum, London, UK (NHMUK); Rodney Cavichioli and Albino Sakakibara from Department of Zoology, biological science, University of Paraná, Curitiba, Brazil (DZUP); Stuart McKamey from United States National Museum of Natural History, Washington, D.C. (USNM) for their valuable assistance during the visit to the museum and the loan of Membracidae material. Paulo Alveranga for providing holotypes photographs of *N. curculionoida*, and *N. catarina*; Olivia Evangelista for providing holotype photographs of *N. nanica*. We thank Ruth Salas, Stephen Thurston, Morgan Chase and Phoebe Fu at the American Museum of Natural History for their assistance with imaging.

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