South American Species of *Stridulivelia* (Hemiptera: Heteroptera: Veliidae): Identification Key, Diagnoses, Illustrations, and Updated Distribution

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**SOUTH AMERICAN SPECIES OF *STRIDULIVELIA* (HEMIPTERA:
HETEROPTERA: VELIIDAE): IDENTIFICATION KEY, DIAGNOSES,
ILLUSTRATIONS, AND UPDATED DISTRIBUTION**

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Abstract.—The genus *Stridulivelia* Hungerford (Heteroptera: Veliidae: Veliinae) is composed by 15 species, which are divided into the subgenera *Stridulivelia* s.str. Hungerford and *Aenictovelina* Polhemus. The nominal subgenus includes ten species restricted to South America, ranging from Colombia to Argentina. The other subgenus contains five primarily Mesoamerican species, one of which extends its distribution into northern South America. An updated identification key, diagnoses, notes, and illustrations of all South American species are provided.

Key Words: Aquatic insects, Gerromorpha, *Stridulivelia* (*Aenictovelina*), *Stridulivelia* (*Stridulivelia*), taxonomy, Veliinae

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The genus *Stridulivelia* Hungerford (Heteroptera: Veliidae: Veliinae) is composed by 15 species, which are characterized by having the sides of thorax with several glabrous, depressed structures and at least the first two visible abdominal segments with transverse lateral sulci (Hungerford 1929; Polhemus and Spangler 1995; Rodrigues et al. 2014). It is divided into two subgenera: *Stridulivelia* s.str. Hungerford and *S.* (*Aenictovelina*) Polhemus. Species of *Stridulivelia* s.str. have stridulatory structures on hind femur and abdominal connexiva, whereas those of *S.* (*Aenictovelina*) lack stridulatory structures (Drake and Menke 1962; Polhemus 1979; Polhemus and Spangler 1995).

The nominal subgenus occurs in South America and includes ten species: *S. alia* (Drake); *S. anta* Polhemus and Spangler; *S. astralis* (Drake and Harris); *S. ayacucho* Polhemus and Spangler; *S. quadrispinosa* (Hungerford); *S. raspa* (Hungerford); *S. stridulata* (Hungerford); *S. strigosa* (Hungerford); *S. tersa* (Drake and Harris); and *S. transversa* (Hungerford) (Polhemus and Spangler 1995). The other subgenus contains five primarily Mesoamerican species: *S. cinctipes* (Champion), *S. epeixis* (Drake and Menke), *S. pueblana* (Drake), *S. secerna* Polhemus and *S. speciosa* Polhemus and Polhemus (Drake and Menke 1962; Polhemus 1979).

The genus is widespread in South America, ranging from Colombia to

Argentina, and individuals are usually found in streams, although they also have been recorded from lentic environments (Polhemus and Spangler 1995, Mazzucconi and Bachmann 1997, Dias-Silva et al. 2013b). They can be collected along the margins of water bodies, hidden among emergent vegetation (Nieser and Melo 1997; personal observations).

Polhemus and Spangler (1995) revised *Stridulivelia* s.str., described new species, and proposed an identification key. Some of the steps of the key, however, were based on the ratios between the antennomere lengths and head width or on the number of transverse lateral sulci on the abdominal segments, which are subject to variation in certain species and can cause some confusion. In the present study, we propose a new identification key based on more stable characters and provide diagnoses, illustrations and the updated geographical distribution of each species.

MATERIAL AND METHODS

This study was based on the examination of dry specimens deposited in the National Museum of Natural History (NMNH), Smithsonian Institution, Washington D.C., USA. Unfortunately, males of *S. (S.) raspa* were not available and, therefore, their characters are not included in the diagnosis of the species. Photographs were taken using a Cannon EOS 5D camera and combined into multi-focal images using Visionary Digital® Software. Label data are given inside quotation marks, with a reversed slash (\) separating lines on the labels and a semi-colon separating labels of a specimen.

Identification key to South American *Stridulivelia* Hungerford

[modified from Polhemus and Spangler (1995)]

1. Stridulatory structures absent
.. *S. (Aenictoveliea) [S. (A.) cinctipes]*
- Stridulatory structures present on dorsum of hind femur (as in Figs. 19, 30, 53) and outer margins of abdominal connexiva (as in Figs. 23, 34) *S. (Stridulivelia)* 2
2. Middle tarsus with three blade-like structures (modified claws and arolium, Fig. 4); male hind trochanter armed with a spur (Fig. 1) *S. (S.) transversa*
- Middle tarsus with narrow, falcate claws and setae-like arolia (Fig. 3); male hind trochanter unarmed or armed with only small spinules (Fig. 2) 3
3. Pronotal humeral angles spinose (Figs. 13, 15, 17, 18) *S. (S.) alia*
- Pronotal humeral angles not spinose (as in Figs. 19, 21) 4
4. First four or five visible abdominal segments with transverse lateral sulci (Fig. 64) *S. (S.) tersa*
- First two or three visible abdominal segments with transverse lateral sulci (as in Figs. 43, 46, 56) 5
5. Hind femur long and slender, about 1.5X wider than middle femur, without a distinctly larger spine on distal 2/3 of posterior margin (Fig. 53A) *S. (S.) strigosa*
- Hind femur incrassate, more than 2X wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (as in Figs. 39, 47) 6
6. Stridulatory structure on outer margin of abdominal connexiva formed by a row of widely separated knob-like denticles (as in Fig. 34) 7
- 6'. Stridulatory structure on outer margin of abdominal connexiva formed by a row of tightly packed minute pegs (Fig. 46) or a row of fine vertical ridges (as in Fig. 23) 8
7. Male genital segment I ventrally with a distinct central lobule on posterior margin (Fig. 51); paramere with rounded apex (Fig. 79); female abdominal tergite VIII with long projections, subequal to the length of the segment at midline (Fig. 50) *S. (S.) stridulata*

- Male genital segment I ventrally at most with a central expansion, but not forming a lobule (Figs. 32, 34); paramere with acute apex (Fig. 76); female abdominal tergite VIII with short projections, about one third the length of the segment at midline (Fig. 36)*S. (S.) ayacucho*
- 8. Stridulatory structure on outer margin of abdominal connexiva formed by a row of tightly packed minute pegs (Figs. 29, 46)9
- Stridulatory structure on outer margin of abdominal connexiva formed by a row of fine vertical ridges (as in Fig. 23)10
- 9. Body length 3.40–4.30 mm; male without ventral projections on last abdominal segment (Figs. 27, 29); apically rounded paramere with anterior margin abruptly expanded before middle (Fig. 75); posterior margin of female abdominal tergite VIII straight; apex of female proctiger, in dorsal view, acute (Fig. 28)*S. (S.) astralis*
- Body length 4.40–4.80 mm; male with a pair of projections ventrally on last abdominal segment; apically acute paramere with anterior margin not abruptly expanded (Fig. 78); posterior margin of female abdominal tergite VIII with a notch; apex of female proctiger, in dorsal view, rounded (Figs. 44, 45)*S. (S.) raspa*
- 10. Body length 3.90–4.50 mm; apex of paramere acute (Fig. 74)*S. (S.) anta*
- 10'. Body length 4.70–5.40 mm; apex of paramere rounded (Fig. 77)*S. (S.) quadrispinosa*

Stridulivelia (Aenictovelina) cinctipes
(Champion, 1898)

(Figs. 5–11, 12, 72)

Velia cinctipes Champion, 1898: 141, 143, plate IX (description, illustration, key); Kirkaldy and Torre-Bueno 1909:

205 (distribution, list); Allee and Torvik 1927: 67 (ecology).

Velia (Stridulivelia) cinctipes: Hungerford 1929: 55–59 (subgenus placement, illustration, key); Drake and Menke 1962: 413, 415–416, plate 3 (illustration, key, records).

Stridulivelia cinctipes: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Alvarez and Roldán-Pérez 1983: 40, 44 (ecology, illustration); Froeschner 1999: 277 (distribution, list); Moreira et al. 2011b: 22 (distribution, list); Pacheco-Chaves et al. 2014: 185 (records).

Stridulivelia (Aenictovelina) cinctipes: Polhemus 1979: 46 (description of subgenus); Polhemus and Spangler 1995: 128, 130–131 (diagnosis, illustration, key, map, records).

Material examined.—3♂♂, 4♀♀ (NMNH): ‘Costa Rica: N. of\ Esparza\ XII. 24, 1969; CL 1264\ J.T. Polhemus.’ 2♂♂, 2♀♀ (NMNH): ‘Costa Rica, S. San\ Isidro del General\ CL1278, XI-27-1969\ J.T. Polhemus.’ 2♂♂, 3♀♀ (NMNH): ‘Panama,\ El Valle\ CL1298; I-3-70\ J.T. Polhemus’. 1♀ (NMNH): ‘Barro Colorado\ C.Z. Panama\ Feb. 6-8, 1939\ Carl. J. Drake’; ‘CJ Drake\ Coll 1956’; ‘*Velia\ cinctipes* Champ.\ Det. J. P. Polhemus.’ 1♀♀ (NMNH): ‘Colombia: Sierra\ Nevada de Santa\ Marta, Pueblo Bello,\ 1200 m.\ April 14-15, 1968’; ‘Borys Malkin’ ‘*Velia\ cinctipes* Champ.\ Det. J. T. Polhemus.’ 1♂, 4♀♀ (NMNH): ‘Barro Colorado\ C.Z. Panama\ Feb.\ 6-8, 1939\ Carl. J. Drake’; ‘CJ Drake\ Coll. 1956.’ 1♂, 11♀♀ (NMNH): ‘Panama Canal\ Zone 1936\ Rozeboom’; ‘C J Drake\ Coll 1956.’ 1♂, 2♀♀ (NMNH): ‘Puntarenas\ Costa Rica\ 16 VII 57\ D R Lauck’; ‘C J Drake\ Coll 1956’.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 5, 7, 8, 10); stridulatory structures absent; first five or six visible abdominal segments with transverse lateral

Figs. 1–4. 1, Metathoracic trochanter, *S. transversa*. 2, Metathoracic trochanter, *S. anta*. 3, Metathoracic tarsus, *S. anta*. 4, Metathoracic tarsus, *S. transversa*. BLS: blade-like claws; SP: spur.

sulci (Fig. 11); middle tarsus with three blade-like structures (modified claws and arolium, as in Fig. 4); male hind trochanter usually armed with a long, stout spur (Fig. 6); spur extremely variable, almost lacking in some specimens and extremely long in others; hind femur two to four times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (Figs. 5–11); last abdominal sternite of male without lateral projections (Fig. 6, 11); male genital segment I ventrally rounded (Fig. 6); male procotiger without anterocentral projection; paramere with complex shape, a strong projection on anterior margin, and apex acute (Fig. 72); female abdominal tergite VIII without projections (Fig. 10).

Stridulivelia (Stridulivelia) alia
(Drake, 1957)

(Figs. 13–18, 37, 73)

Velia alia Drake 1957: 115–116 (description).

Striduivelia alia: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Moreira et al. 2011a: 662 (records); Cunha et al. 2015: 427 (ecology).

Stridulivelia (Stridulivelia) alia: Polhemus 1979: 46 (subgenus placement); Polhemus and Spangler 1995: 128, 131, 132–134 (diagnosis, illustration, key, map, records); Moreira et al. 2011b: 22 (distribution, list).

Material examined.—1♂ holotype (NMNH): ‘Bartica Dist.\ Br. Guiana\ 25-V-1944’ ‘C J Drake\ Coll 1956’; ‘Holotype\ *Velia\ alia* Drake’. 1♀ allotype (NMNH): ‘Suriname\ leg. Geijskes\ sectee.\ busheckee\ 7-6-1944’; ‘Allotype\ *Velia\ alia* Drake’ ‘*Velia\ alia*♀\ Allotype\ Drake’. 8♂♂, 12♀♀ (NMNH): ‘Venezuela, Amazonas\ small stream 1km. N. of\ Alto Mavaca base camp\ 2°1’20’’N, 65°7’0’’W\ 228 m. 22°C 4 Feb. 1989\ CL 8006 D.A. Polhemus’. 5♂♂, 6♀♀ (NMNH): ‘Brazil, Amazonas\ Igarape da Anta, Reserva Ducke, 25 km. NE of\ Manaus, 60 m. 24.5°C.\ 25 August 1989 CL 2472\ D.A. and J.T Polhemus’. 2♂♂, 2♀♀ (NMNH): Surinam\ SN

Figs. 5–11. *Stridulivelia cinctipes*. 5, Macropterous male, dorsal view. 6, Micropterous male, ventral view. 7, Micropterous male, dorsal view. 8, Macropterous female, dorsal view. 9, Micropterous female, ventral view. 10, Micropterous female, dorsal view. 11, Micropterous male, lateral view. LC: transverse lateral sulci on abdominal pleurites; SP: spur.

368\ N. Nieser'; 'Saramacca\ Coesewijne Project\ 3-III-70 SN 368\ 55°25' 5°20'.

Diagnosis.—Pronotal humeral angles spinose (Figs. 13, 15, 17, 18); stridulatory structure on outer margin of abdominal connexiva not anteriorly extended towards mesoacetabulum, formed by a row of fine

vertical ridges (Fig. 16); first three visible abdominal segments with transverse lateral sulci (Fig. 16); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); male hind trochanter armed with small spinules (as in Fig. 2); hind femur incrassate, about two times wider

Fig. 12. Map of the geographical distribution of the subgenera *Stridulivelia* s.str. and *Aenictovelia*.

than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (Figs. 13, 15); stridulatory structure on dorsum of hind femur small, longer than wide (Fig. 13); last abdominal sternite of male with a pair of lateral projections (Fig. 14); male genital segment I ventrally with posterior margin rounded (Fig. 14); male proctiger with V-shaped anterocentral projection, with width subequal to width of proctiger; paramere with apex slightly acute (Fig. 73); female abdominal tergite VIII with projections, with half the length to as long as segment at midline (Figs. 17, 18).

Stridulivelia (Stridulivelia) anta
Polhemus and Spangler, 1995

(Figs. 2, 3, 19-25, 37, 74)

Stridulivelia (Stridulivelia) anta
Polhemus and Spangler 1995: 128,

132, 134-137 (description, illustration, key, map); Moreira et al. 2011b: 22 (distribution, list).

Stridulivelia anta: Dias-Silva et al. 2013a: 135 (ecology).

Material examined.—1♀ holotype (NMNH): 'Amazonas\ Igarape Barro Branco nr.\ Reserva Ducke HQ, 25 Km\ NE Manaus, 50m.\ 27 August 1989 CL 2475\ D.A. & J.T. Polhemus'; 'Holotype \ *Stridulivelia*\ *anta*\ J.T. Polhemus\ & P. J. Spangler'. 1♂ paratype (NMNH): 'AmazonasGebiet\ nrt. Rio Negro\ Agua Encar-nada\ 27-7-65\ leg. E. J. Fittkau'; 'Paratype\ *Stridulivelia*\ *anta*\ Polhemus & Spangler'. 1♂ paratype (NMNH): 'AmazonasGebiet\ Rio Marauia\ S. Antonio\ 10-1-63\ leg. E. J. Fittkau\ Coll. Amazonas 1960/3'; 'Paratype\ *Stridulivelia*\ *anta*\ Polhemus & Spangler'. 1♂, 5♀♀ paratypes (NMNH): 'Brazil, Amazonas\ Igarape da Anta, Reserva Ducke, 60 m., 24.5°C.\ 25 August 1989

Figs. 13–25. 13–18. *Stridulivelia alia*. 13, Macropterous male, dorsal view. 14, Apterous male, ventral view. 15, Apterous male, dorsal view. 16, Apterous male, lateral view. 17, Macropterous female, dorsal view. 18, Apterous female, dorsal view. 19–25. *Stridulivelia anta*. 19, Macropterous male, dorsal view, metathoracic femur. 20, Micropterous male, ventral view. 21, Micropterous male, dorsal view. 22, Macropterous female, dorsal view. 23, Macropterous male, lateral view. 24, Micropterous female, dorsal view. 25, Abdomen, dorsal view, female. LC: transverse lateral sulci on abdominal pleurites; PRP: pronotal humeral angles spinose; SSF: stridulatory structure on femur; SSC: stridulatory structure on connexivum.

CL 2472\ D. A. & J. T. Polhemus'; 'Paratype\ *Stridulivelia\ anta* Polhemus & Spangler'. 2♀ paratypes (NMNH): 'Brazil, Amazonas\ rainforest stream near\ INPA viewing tower\ N. of Manaus, 90 m.\ 29 August 1989 CL 2478\ D. A. & J. T. Polhemus'; 'Paratype\ *Stridulivelia\ anta* Polhemus & Spangler'.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 19, 21, 22, 24); stridulatory structure on outer margin of abdominal connexiva not anteriorly extended towards mesoacetabulum, formed by a row of fine vertical ridges (Fig. 23); first three visible abdominal segments with transverse lateral sulci (Fig. 23); middle tarsus with narrow, falcate claws and setae-like arolia (Fig. 3); male hind trochanter unarmed or armed with small spinules (as in Fig. 2); hind femur incrassate, about two times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (Figs. 19–24); stridulatory structure on dorsum of hind femur small, slightly longer than wide (Fig. 19); last abdominal sternite of male with a pair of lateral projections (Figs. 20, 23); male genital segment I ventrally with posterior margin bulged centrally (Fig. 20); male proctiger with antero-central projection short and undivided, about half as wide as proctiger; paramere long, narrow, with acute apex (Fig. 74); female abdominal tergite VIII without projections (Figs. 24, 25).

Stridulivelia (Stridulivelia) astralis
(Drake and Harris, 1938)

(Figs. 26–30, 38, 75)

Velia (Stridulivelia) astralis Drake and Harris 1938: 200–201 (description).

Stridulivelia astralis: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Mazzucconi and Bachmann 1997: 62

(records); Bachmann 1998: 180 (distribution, list); López-Ruf et al. 2003: 67 (records); Rodrigues et al. 2012: 912 (records); Floriano et al. 2013: 4–5 (list); Dias-Silva et al. 2013b: 231 (records); Coscarón et al. 2015: 7 (type list).

Stridulivelia (Stridulivelia) astralis: Polhemus 1979: 46 (subgenus placement); Polhemus and Spangler 1995: 128, 132, 137–138 (diagnosis, key, map, records); Coscarón and Loíacono 1996: 2 (type list); Moreira et al. 2011b: 22 (distribution, list).

Material examined.—2♂♂ paratypes (NMNH): 'Mattogrosso'; '43'; 'Paratype\ *Velia\ astralis* D and H'; 'C J Drake\ Coll. 1956'; '*Velia\ astralis* D and H'.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 26, 28); stridulatory structure on outer margin of abdominal connexiva anteriorly extended towards mesoacetabulum, formed by a row of tightly packed minute pegs (Fig. 29); first three visible abdominal segments with transverse lateral sulci (Fig. 29); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); male hind trochanter unarmed or armed with small spinules (as in Fig. 2); hind femur incrassate, about two times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (Figs. 26–28, 30); stridulatory structure on dorsum of hind femur small, rastrate (Fig. 30); last abdominal sternite of male without distinct lateral projections, with small rounded expansions (Figs. 27, 29); male genital segment I ventrally with a central expansion (Fig. 27); male proctiger with anterolateral projection; apically rounded paramere with anterior margin abruptly expanded before middle (Fig. 75); female abdominal tergite VIII without projections (Fig. 28).

Figs. 26–36. 26–30. *Stridulivelia astralis*. 26, Macropterous male, dorsal view, paratype. 27, Macropterous male, ventral view, paratype. 28, Macropterous female, dorsal view. 29, Macropterous male, lateral view. 30, Leg, male. 31–36. *Stridulivelia ayacucho*. 31, Macropterous male, dorsal view, paratype. 32, Micropterous male, ventral view, paratype. 33, Micropterous male, dorsal view, paratype. 34, Micropterous female, lateral view, paratype. 35, Micropterous female, dorsal view, paratype. 36, Abdomen, female. LC: transverse lateral sulci on abdominal pleurites; PRT: projections on tergite VIII; SP: large spine; SSF: stridulatory structure on femur; SSC: stridulatory structure on connexivum.

Stridulivelia (Stridulivelia) ayacucho
Polhemus and Spangler, 1995

(Figs. 31–36, 38, 76)

Stridulivelia (Stridulivelia) ayacucho
Polhemus and Spangler 1995: 128, 132, 137–141 (description, illustration, key, map); Moreira et al. 2011b: 23 (distribution, list).

Stridulivelia ayacucho: Bachmann 1998: 180 (distribution, list); Melo and Nieser 2004: 46 (records); Torres et al. 2007: 135 (records); Moreira and Barbosa 2011: 311 (records).

Material examined.—1♂ holotype (NMNH): ‘Venezuela, Amazonas\ Missionary Stream 21 km.\ S. of Tobogan junction\ 22 January 1989 CL 2375\ J. T. Polhemus’; ‘Holotype\ *Stridulivelia\ ayacucho*\ J. T. Polhemus\ and P. J. Spangler’. 2♂♂, 7♀♀ paratypes (NMNH): ‘Venezuela, Amazonas\ Missionary Stream 21 km.\ S. of Tobogan junction\ 22 January 1989 CL 2375\ J. T. Polhemus’; ‘PARATYPE\ *Stridulivelia\ ayacucho*\ Polhemus & Spangler’. 2♀♀ paratypes (NMNH): ‘Venezuela\ Puerto ayacucho\ 39 km.s 15-XI-87\ brok., Coll. 4\ PSS; RAF’. 3♂♂, 5♀♀ (NMNH): ‘Bolivia: Vel. Pr. Los Fierros\ 14°33’S; 60°55’W\ 16–24 Jan, 1998\ S. Spector&S.Ayazama’.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 31, 33, 35); stridulatory structure on outer margin of abdominal connexiva not anteriorly extended towards mesoacetabulum, formed by a row of widely separated knob-like denticles (Fig. 34); first two or three visible abdominal segments with transverse lateral sulci (Fig. 34); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); male hind trochanter armed with small spinules (as in Fig. 2); hind femur incrassate, about 2.5 times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger

than others (Figs. 31–35); stridulatory structure on dorsum of hind femur long, broad, extending onto its posterior surface (Figs. 33, 35); last abdominal sternite of male without lateral projections (Figs. 32, 34); male genital segment I ventrally at most with a central expansion, but not forming a lobule (Fig. 32); male proctiger with a small V-shaped anterocentral projection, with about 1/3 the basal width of proctiger; paramere with apex acute (Fig. 76); female abdominal tergite VIII with short projections, with about one third of the length of the segment at midline (Figs. 35, 36).

Note.—Instead of two transverse lateral sulci on the abdomen, which is typical for the species, the specimens from Bolivia we examined have three, the third one being often reduced to a small dot. Except for this characteristic, the Bolivian material is identical to other populations of *S. ayacucho*.

Stridulivelia (Stridulivelia)
quadrspinosa (Hungerford, 1929)

(Figs. 39–43, 57, 77)

Velia (Stridulivelia) quadrspinosa
Hungerford, 1929: 52–53, 56–59 (description, illustration, key).

Stridulivelia quadrspinosa: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Bachmann 1998: 180 (distribution, list); Moreira et al. 2010: 2798 (records); Moreira et al. 2012: 158 (records); Rodrigues et al. 2012: 912 (records); Dias-Silva et al. 2013b: 231–232 (map, records).

Stridulivelia (Stridulivelia) quadrspinosa: Polhemus 1979: 46 (subgenus placement); Polhemus and Spangler 1995: 128, 132, 141–142 (diagnosis, key, map, records); Moreira et al. 2011b: 23 (distribution, list).

Figs. 37–38. Maps of the geographical distribution. 37, *S. alia* (black circle) and *S. anta* (white square). 38, *S. astralis* (black circle) and *S. ayacucho* (white square).

Material examined.—2♂♂, 3♀♀ junction\ 22 January 1989 CL 2375\ (NMNH): Venezuela, Amazonas\ Mis- J.T.Polhemus'. 1♂ (NMNH): 'Bolivia, sionary Stream, 21 km.\ S. of Tobogan Dept. Beni\ rainforest stream 40 km.\

Figs. 39–46. 39–43. *Stridulivelia quadrispinosa*. 39, Macropterous male, dorsal view. 40, Macropterous male, ventral view. 41, Macropterous female, dorsal view. 42, Abdomen, dorsal view, female. 43, Macropterous male, lateral view. 44–46. *Stridulivelia raspa*. 44, Micropterous female, dorsal view. 45, Abdomen, dorsal view, female. 46, Micropterous female, lateral view. LC: transverse lateral sulci on abdominal pleurites; PRT: projection on tergite VIII; SSF: stridulatory structure on femur; SSC: stridulatory structure on connexivum.

S. of Rurrenabaque, near\ Monte Redondo sawmill\ 12 Sept. 1989 CL 2511\ 350 m. D.A. and J.T. Polhemus'. 10♂♂, 3♀♀ (NMNH): 'Venezuela, Amazonas\ small stream 1 km. N. of\ Alto Mavaca base camp\ 2°1'30"N, 65°7'0"W\ 228 m.\ 22°C 4 Feb. 1989\ CL 8006 D. A. Polhemus'.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 39, 41); stridulatory structure on outer margin of abdominal connexiva not anteriorly extended towards mesoacetabulum, formed by a row of fine vertical ridges (Fig. 43); first three visible abdominal segments with transverse lateral sulci (Fig. 43); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); male hind trochanter armed with small spinules (as in Fig. 2); hind femur incrassate, about two times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (Figs. 39-41); stridulatory structure on dorsum of hind femur small, longer than wide (Fig. 39, 41); last abdominal sternite of male with a pair of lateral projections (Figs. 40, 43); male genital segment I ventrally with posterior margin bulged centrally (Fig. 40); male proctiger with antero-central projection half to as wide as proctiger, sometimes subdivided; paramere long, narrow, with rounded apex (Fig. 77); pair of projections on female abdominal tergite VIII, when present, ranging from small lateral expansions to large projections with length subequal to segment (Figs. 41, 42).

Note.—Polhemus and Spangler (1995) evaluated specimens from Beni (Bolivia) and Loreto (Peru), and found variations such as the first genital segment of males more swollen and females without projections on abdominal tergite VIII. They concluded that, except for these characters, the specimens were very similar to those collected in Brazil

and Venezuela and belonged to the same species. While studying specimens from Venezuela, we found additional variations, such as the ventral posterior margin of male genital segment I centrally projected and the male proctiger with the antero-central projection wide and subdivided.

Stridulivelia (Stridulivelia) raspa
(Hungerford, 1929)

(Figs. 44-46, 57, 78)

Velia (Stridulivelia) raspa Hungerford 1929: 51-52, 56-59 (description, illustration, key).

Stridulivelia raspa: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Bachmann 1998: 180 (distribution, list); Moreira et al. 2011a: 662 (records); Moreira and Campos 2012: 546 (records).

Stridulivelia (Stridulivelia) raspa: Polhemus 1979: 46 (subgenus placement); Polhemus and Spangler 1995: 128, 132, 142-143 (diagnosis, key, map, records); Moreira et al. 2011b: 23 (distribution, list).

Material examined.—4♀♀ (USMN): 'Amazonasgebiet\ Rio Madeira\ Ig. Tres Casas\ 10.11.41\ leg. H. Sioli'; 'Homeotype *Velia raspa* Hungerford\ Compared with type\ by J. T. Polhemus'.

Diagnosis.—Pronotal humeral angles not spinose (Fig. 44); stridulatory structure on outer margin of abdominal connexiva anteriorly extended towards mesoacetabulum, formed by a row of tightly packed minute pegs (Fig. 46); first three visible abdominal segments with transverse lateral sulci (Fig. 46); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); hind femur incrassate, about two times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger

than others (Figs. 44, 45); stridulatory structure on dorsum of hind femur small, rastrate (Figs. 44, 45); paramere with anterior margin sinuous and apex acute (Fig. 78); female abdominal tergite VIII without projections (Figs. 44, 45).

Stridulivelia (Stridulivelia) stridulata
(Hungerford, 1929)

(Figs. 47–51, 58, 79)

Velia (Stridulivelia) stridulata Hungerford, 1929: 53–54, 55–59 (description, illustration, key).

Velia stridulata: Roback and Nieser 1974: 36 (records).

Stridulivelia stridulata: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Pereira and Melo 2007: 645 (records); Moreira and Campos 2012: 546–547 (records); Dias-Silva et al. 2013b: 231, 233 (map, records).

Stridulivelia (Stridulivelia) stridulata: Polhemus 1979: 46 (subgenus placement); Polhemus and Spangler 1995: 128, 132, 142–145 (diagnosis, illustration, key, map, records); Moreira et al. 2011b: 23 (distribution, list).

Material examined.—1♀ (NMNH): ‘Suriname\ VII kreek\ 10-VII-55’; ‘*Velia stridulata*\ allotype\ Hung’. 4♂♂, 9♀♀ (NMNH): ‘Brazil, Amazonas\ Igarape Barro Branco nr.\ Reserva Ducke HQ, 25 km. NE of Manaus, 50 m.\ 27 August 1989 CL 2475\ D. A. & J. T. Polhemus’. 3♀♀ (NMNH): ‘AmazonasGebiet\ Manaus\ IG. Gigante\ 3-7-64\ leg. E.J. Fittkau\ Coll. Amazonas 1960/3’. 1♂ (NMNH): ‘Surinam\ SN299\ N. Nieser\ Saramacca\ Rd.to S. –Brug\ 26-I-1976’; ‘*Stridulivelia stridulata*\ Hungfd.\ Det. J. T. Polhemus’. 1♂ (NMNH): ‘Suriname\ SN095\ 22-VIII-69\ N. Nieser’; ‘SN095’; ‘Zanderijsavanne\ Carolina Kreek’; ‘*Stridulivelia stridulata*\ Hungerford\ Det. JT Polhemus’.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 47, 49); stridulatory structure on outer margin of abdominal connexiva not anteriorly extended towards mesoacetabulum, formed by a row of widely separated knob-like denticles (Fig. 51); first two visible abdominal segments with transverse lateral sulci (Fig. 51); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); male hind trochanter armed with small spinules (as in Fig. 2); hind femur incrassate, about 2.5 times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (Figs. 47–49, 51); stridulatory structure on dorsum of hind femur long, broad, extending onto its posterior surface (Fig. 49); last abdominal sternite of male without lateral projections (Figs. 48, 51); male genital segment I ventrally with a distinct lobule on posterior margin (Fig. 51); male proctiger with a small V-shaped anterocentral projection, with about 1/3 the basal width of proctiger; paramere with apex rounded (Fig. 79); female abdominal tergite VIII with long projections, subequal to the length of the segment at midline (Figs. 49, 50).

Note.—The above mentioned allotype from Suriname is part of the Drake collection in the NMNH. Despite being a historically important specimen, it was collected in 1955, whereas the species was described in 1929. Therefore, it cannot be part of the type series originally studied by Hungerford (1929).

Stridulivelia (Stridulivelia) strigosa
(Hungerford, 1929)

(Figs. 52–56, 58, 80)

Velia (Stridulivelia) strigosa Hungerford, 1929: 50–51, 56–59 (description, illustration, key).

Figs. 47–56. 47–51. *Stridulivelia stridulata*. 47, Apterous male, dorsal view. 48, Apterous male, ventral view. 49, Micropterous female, dorsal view. 50, Abdomen, dorsal view, female. 51, Apterous male, lateral view. 52–56. *Stridulivelia strigosa*. 52, Macropterous male, dorsal view. 53, Micropterous male, ventral view, metathoracic femur. 54, Micropterous male, dorsal view. 55, Micropterous female, dorsal view. 56, Micropterous male, lateral view. LOB: lobule on posterior margin of ventrite VIII; LC: transverse lateral sulci on abdominal pleurites; PRT: projection on tergite VIII; SSF: stridulatory structure on femur; SSC: stridulatory structure on connexivum.

Stridulivelia strigosa: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Moreira and Campos 2012: 547 (records); Dias-Silva et al. 2013b: 231 (list); Cordeiro and Moreira 2015: 24 (records); Cunha et al. 2015: 427 (ecology).

Stridulivelia (Stridulivelia) strigosa: Polhemus 1979: 46 (subgenus placement); Polhemus and Spangler 1995: 128, 132, 145-147 (diagnosis, key, map, records); Moreira et al. 2011b: 23 (distribution, list).

Material examined.—23♂♂, 24♀♀ (NMNH): ‘Surinam\ SN 237\ N. Nieser’; ‘Saramacca\ 2nd trib. Troelikeek\ XI-18-69 SN 237\ 55°20’/5°24’. 3♂♂, 2♀♀ (NMNH): ‘Surinam\ SN092\ N. Nieser’; ‘Zanderijsavanne\ Carolinakreek\ VIII-22-69 SN 092\ 55°10’/5°25’. 1♂, 1♀ (NMNH): ‘Surinam\ Rd to Hannover\ 4-VIII-69 SN 58\ N. Nieser’. 1♂, 1♀ (NMNH): ‘Surinam,\ Zanderijsavanne\ 1st Tributary of\ Colakreek crossing\ road to Matta’; ‘4-IX-1969\ S N 116\ N. Nieser’. 5♂♂, 9♀♀ (NMNH): 1st Trib. Colakreek\ 8-IX-69 SN127\ 55°14’ 5°27’; ‘Suriname\ SN127\ N-Nieser’. 2♂♂, 3♀♀ (NMNH): ‘Suriname\ Carolina-Kreek\ 8-4-1962\ P. H.v. Doesburg Jr.’; ‘*Velia tersa* Dra H\ det. N. Nieser’. 1♂ (NMNH): ‘Surinam\ Zanderij\ Savanne\ 28-VII-69\ Sabakoe-kreek\ SN 044\ J.T. Polhemus\ Collection’; ‘*Velia strigosa*\ Hung\ Det. J. T. Polhemus’. 3♂♂, 4♀♀ (NMNH): ‘AmazonasGebiet\ Rio Negro\ Ig. Barro Br.\ 30-7-62\ leg. E.J. Fittkau\ Coll. Amazonas 1960/3’. 2♂♂, 1♀ (NMNH): ‘Guyana, DubulayRanch\ 5°41’7”N 57°54.6’W\ leaf packs at edge\ Aramatani creek’; ‘Collection #24\ 15 Apr 1995\ P. J. Spangler’.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 52, 54, 55); stridulatory structure on outer margin of abdominal connexiva not anteriorly extended towards mesoacetabulum, formed by a row of

widely separated knob-like denticles (Fig. 56); first three visible abdominal segments with transverse lateral sulci (Fig. 56); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); male hind trochanter unarmed or armed with small spinules (as in Fig. 2); hind femur long and slender, about 1.5 times wider than middle femur, without distinctly larger spine on distal 2/3 of posterior margin (Figs. 53-56); stridulatory structure on dorsum of hind femur large, rastrate (Fig. 53); last abdominal sternite of male without lateral projections (Figs. 53, 56); male genital segment I ventrally with posterior margin rounded (Fig. 53); male proctiger with square-shaped antero-central projection; paramere with apex rounded (Fig. 80); female abdominal tergite VIII without projections (Fig. 55).

Stridulivelia (Stridulivelia) tersa (Drake and Harris, 1941)

(Figs. 59–64, 71, 81)

Velia (Stridulivelia) tersa Drake and Harris 1941: 338-339 (description); Drake and Menke 1962: 415-416, plate 1, plate 3 (description of alate forms, illustration, key).

Velia nama Drake: 1957: 114-115 (description). Synonymized by Polhemus and Spangler (1995).

Stridulivelia tersa: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Nieser and Alkins-Koo 1991: 51, 64 (distribution, illustration, key, list); Melo and Nieser 2004: 46 (records); Pereira and Melo 2007: 645 (records); Moreira et al. 2010: 2798 (records); Moreira and Campos 2012: 547 (records); Rodrigues et al. 2012: 912 (records); Dias-Silva et al. 2013b: 231-232 (records); Cunha et al. 2015 (ecology).

Figs. 57–58. Map of the geographical distribution. 57, *S. quadrispinosa* (black circle) and *S. raspa* (white square). 58, *S. strigosa* (white square) and *S. stridulata* (black circle).

Stridulivelia (*Stridulivelia*) *tersa*:
Polhemus 1979: 46 (subgenus place-
ment); Polhemus and Spangler 1995:

128, 130-131, 147-150 (diagnosis, il-
lustration, key, map, records); Coscarón
and Loíacono 1996: 2 (type list);

Figs. 59–70. 59–64. *Stridulivelia tersa*. 59, Macropterous male, dorsal view. 60, Micropterous male, ventral view. 61, Micropterous male, dorsal view. 62, Macropterous female, dorsal view. 63, Micropterous female, dorsal view. 64, Micropterous male, lateral view. 65–70. *Stridulivelia transversa*. 65, Macropterous male, dorsal view. 66, Apterous male, ventral view. 67, Apterous male, dorsal view. 68, Macropterous female, dorsal view. 69, Apterous female, dorsal view. 70, Apterous male, lateral view. BLS: blade-like claws; LC: transverse lateral sulci on abdominal pleurites; SSF: stridulatory structure on femur; SSC: stridulatory structure on connexivum.

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Fig. 71. Map of the geographical distribution of *S. transversa* (black circle) and *S. tersa* (white square).

Moreira et al. 2011b: 23 (distribution, list); Kment and Kolínová 2013: 861 (type list).

Velia tersa: Coscarón et al. 2015: 7 (type list).

Material examined.—1♂ holotype 'Trinidad, B. W. I. \ Oct. 27-29, 1938\ Carl J. Drake'; Holotype\ *Velia\ tersa*\ D&H'; 'CJDrake\ Coll 1956'. 1♂ holotype 'Cuatro Ojos\ Bolivia'; 'Rio Piray\ IV-26-1959'; 'Type\ *Velia\ nama* Drake' 'CJDrake\ Coll 1956'; 'CJDrake\ Coll 1956'. 1♂, 18♀♀ paratypes (NMNH): Trinidad. B. W. I. \ Oct. 27-29, 1938\ Carl J. Drake'; '*Velia\ tersa*\ D & H'; 'C J Drake\ Coll. 1956'. 1♂ paratype (NMNH): 'Barinitas\ Dec.; 42 Venez\ P. Anduzee'; '*V.\ tersa*\ winged'.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 59, 61-63); stridulatory structure on outer margin of abdominal connexiva not anteriorly extended towards mesoacetabulum,

formed by a row of widely separated knob-like denticles (Fig. 64); first four or five visible abdominal segments with transverse lateral sulci (Fig. 64); middle tarsus with narrow, falcate claws and setae-like arolia (as in Fig. 3); male hind trochanter unarmed or armed with small spinules (as in Fig. 2); hind femur long and slender, about 1.5 times wider than middle femur, without distinctly larger spine on distal 2/3 of posterior margin (Figs. 59-63); stridulatory structure on dorsum of hind femur large, rastrate (Fig. 59); last abdominal sternite of male without lateral projections (Figs. 60, 64); male genital segment I ventrally with posterior margin slightly bulged centrally (Fig. 60); male proctiger without anterocentral projection; paramere with apex rounded (Fig. 81); female abdominal tergite VIII without projections (Figs. 62, 63).

Stridulivelia (Stridulivelia) transversa
(Hungerford, 1929)

(Figs. 1, 4; 65–70; 71, 82)

Velia (Stridulivelia) transversa Hungerford 1929: 54–55, 57–59 (description, illustration, key).

Stridulivelia transversa: Polhemus 1976: 509 (*Stridulivelia* elevated to genus); Pereira and Melo 2007: 645 (records); Moreira and Campos 2012: 547 (records); Cordeiro and Moreira 2015: 24–25 (records); Cunha et al. 2015: 427 (ecology).

Stridulivelia (Stridulivelia) transversa: Polhemus 1979: 46 (subgenus placement); Polhemus and Spangler 1995: 128, 131, 150–151 (diagnosis, key, map, records); Moreira et al. 2011b: 23 (distribution, list).

Material examined.—2♂♂, 9♀♀ (NMNH): ‘Venezuela, Amazonas\ small stream 1 km. N. of\ Alto Mavaca base camp\ 2°1’30”N, 65°7’0”W\ 228 m.

22°C 4 Feb. 1989\ CL 8006 D. A. Polhemus’; ‘*Stridulivelia\ transversa* Hungerford\ det. D. Polhemus’. 2♂♂, 1♀♀ (NMNH): ‘AmazonasGebiet\ Rio Negro\ Ig. Barro Branco\ Ju.7.62\ leg. E. J. Fittkau\ Coll. Amazonas 1960/3’. 4♂♂, 4♀♀ (NMNH): ‘Brazil, Amazonas\ Igarape Barro Branco nr.\ Reserva Ducke HQ, 25 km.\ NE of Manaus, 50 m.\ 27 August 1989, CL 2475\ D.A. & J.T. Polhemus’.

Diagnosis.—Pronotal humeral angles not spinose (Figs. 65, 67–69); stridulatory structure on outer margin of abdominal connexiva anteriorly extended towards mesoacetabulum, formed by a row of tightly packed minute pegs (Fig. 70); first five visible abdominal segments with transverse lateral sulci (Fig. 70); male sometimes with additional small sulcus on sixth visible segment; middle tarsus with three blade-like structures (modified claws and arolium, Figs. 4, 65); male hind trochanter armed with a spur

Figs. 72–82. Parameres of *Stridulivelia* spp. 72, *S. cinctipes* (modified from Polhemus & Spangler (1995)). 73, *S. alia*. 74, *S. anta* (modified from Hungerford (1929)). 75, *S. astralis*. 76, *S. ayacucho* (modified from Hungerford (1929)). 77, *S. quadrispinosa*. 78, *S. raspa* (modified from Hungerford (1929)). 79, *S. stridulata*. 80, *S. strigosa*. 81, *S. tersa*. 82, *S. transversa*.

(Fig. 1); hind femur incrassate, about two times wider than middle femur, with a spine on distal 2/3 of posterior margin distinctly larger than others (Figs. 65–70); stridulatory structure on dorsum of hind femur small, about twice as long as wide (Fig. 67); last abdominal sternite of male with small lateral projections (Figs. 66, 70); male genital segment I ventrally rounded (Fig. 66); male proctiger without anterocentral projection; paramere basally divided into two lobes, with acute apex (Fig. 82); female abdominal tergite VIII without projections (Figs. 68, 69).

Note.—Polhemus (1979) described the subgenus *Stridulivelia* (*Aenictovelina*) to accommodate primarily Mesoamerican species that lacked stridulatory structures and had the middle tarsi with blade-like claws and downcurving arolia. *Stridulivelia transversa* was kept in the nominal subgenus because it bears stridulatory structures; however, it has the same modifications of middle leg pretarsal structures as seen in *S.* (*Aenictovelina*), which indicates the need for a phylogenetic analysis in order to hypothesize its correct placement, as well as to determine the monophyly of the two subgenera.

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