



Research paper

Comparative morphology of female genitalia of the sharpshooter genus *Syncharina* (Hemiptera: Cicadellidae), with notes on the generic group *Cicadella*



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ABSTRACT

The sharpshooter genus *Syncharina* Young, 1977 includes four known species distributed in South America. Traditionally, the taxonomy of cicadellines is based mainly on male characters; however, several studies have demonstrated the existence of diagnostic features in the female genitalia. In this contribution, the female genitalia of the genus *Syncharina* are studied in order to add new female characters for species identification. Also, new female characters of the supposedly related genera *Helochara* Fitch, and *Helocharina* Melichar, are discovered, and their relationship with *Syncharina* is discussed. Additional comparative notes on *Syncharina* and other related genera included in the generic group *Cicadella* Latreille are provided. A diagnosis of the genus *Syncharina*, including new characters from the female genitalia, and a key to the four species included, are presented. Notes on the geographic distribution of *Syncharina* are provided along with new country and province records for *Syncharina* and *Helocharina*. *Syncharina* species can be distinguished by consistent female characters, including traits of sternite VII, the pygofer, the basal area of the first valvula and the gonoplags. Based on ovipositor morphology, the genus *Syncharina* can be more clearly distinguished from *Helocharina* and *Helochara*. Little variation was seen in the ovipositors among the species in *Cicadella*, exposing the conservative nature of the first and the second valvulae in this group. The female genitalia provide useful characters for the taxonomy of *Syncharina* and their close relatives.

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1. Introduction

Cicadellinae sharpshooters are a large and diverse group with over 2000 species placed in 329 genera which makes it the third largest subfamily of the Cicadellidae leafhoppers (McKamey, 2007). Traditionally, the subfamily consists of two tribes, a New World Proconiini, and a cosmopolitan Cicadellini, taxonomically larger, with nearly 160 genera (approximately 1100 species) in the New World (Mejidalani, 1998). Some species of this group are important vectors of *Xylella fastidiosa* (Bacteria: Xanthomonadaceae), a xylem-borne phytopathogenic bacterium (Redak et al., 2004).

The genus *Syncharina* Young, 1977 comprises four species restricted to South America with records in Argentina, Bolivia, Brazil, Chile and Uruguay (Osborn, 1926; Young, 1977). In his revision of the Cicadellini, Young (1977) established the genus

including the species *S. argentina* (Berg, 1879), *S. linea* (Taschenberg, 1884), *S. lineiceps* (Spinola, 1852) and *S. punctatissima* (Signoret, 1854). These species can be distinguished by characteristics of the male genitalia (paraphyses) and the colour pattern (Young, 1977); however, overall color is quite variable with specimens ranging from totally dark brown to the typical green–yellowish (Remes Lenicov and Tesón, 1985; Young, 1977). According to Young (1977), *Syncharina* is apparently related to the genus *Helochara* Fitch, based on the pitting of the anterior dorsum, and allied to *Helocharina* Melichar, based on the anterior punctuation and the male paraphyses. This author included these three genera within the large generic group complex *Cicadella* Latreille, grouped mainly by characteristics of the male genitalia. This complex also includes six additional genera, *Chlorogonalia* Young, *Draeculacephala* Ball, *Carnecephala* Ball, *Tylozygus* Fieber, *Ciminius* Metcalf and Bruner, *Plesiommata* Provancher, and the Old World species *Cicadella viridis* (Linnaeus).

Traditionally, the taxonomy of cicadellines is based mostly on characters of the male genitalia making it difficult or impossible to

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identify female specimens (Carvalho and Mejdalani, 2014). However, in the last few years, the importance of ovipositor morphology and its relative structures (abdominal sternites VII and VIII) has increased and several studies have yielded numerous features of taxonomic interest. Even so, the morphological diversity of these structures remains poorly known compared to the current knowledge of males. Consequently, for determination of the species, the male genitalia and the colouration pattern are commonly used since females are rarely treated. The female morphology of several sharpshooter species has been studied in Brazil (Camisão et al., 2014; Carvalho and Mejdalani, 2014; Leal et al., 2009; Mejdalani, 1995, 1998), USA (Hummel et al., 2006) and China (Meng and Yang, 2012) but the few studies done on Argentinean species, mainly concern females of the tribe Proconiini (Dellape, 2015; Dellape and Paradell, 2011; Remes Lenicov and Tesón, 1985). So, new morphological and comparative studies of the female genitalia in a great number of genera and species are needed to enhance the knowledge of this group.

The objective of this work is to study the female genitalia of the genus *Syncharina* in order to add new female characters for species identification. We provide a diagnosis of the genus *Syncharina* including new characters from the female genitalia, and a key to the four species that includes previous species characters and adds new female characters. We present a detailed description and illustrations of the female genitalia of *S. linea*; only major differences are highlighted for *S. argentina*, *S. lineiceps* and *S. punctatissima*. We add new female characters of the supposedly related genera (*Helochara* and *Helocharina*), and discuss their relationship with *Syncharina* based on ovipositor characters. This preliminary analysis represents the first comparative study between females of the generic group *Cicadella*. In addition, comments on the biogeographic distribution of *Syncharina* along with new country and province records in Argentina are provided. The results of our study should give useful information to enhance our knowledge on the morphological diversity of sharpshooter female genital structures as well as their taxonomic potential.

2. Materials and methods

Type and nontype specimens borrow by the following collections were examined:

MLP – Museo de La Plata, Buenos Aires, Argentina (Ana M.M. de Remes Lenicov).

IFML – Instituto Fundación Miguel Lillo, Tucumán, Argentina (Emilia C. Pérez).

SEMC – Snow Entomological Collection, Natural History Museum/Biodiversity Research Center, University of Kansas, Lawrence, USA (J. Thomas, Michael S. Engel).

USNM – United States National Museum, Washington, USA (Stuart McKamey).

Additional specimens collected by the authors in Jujuy province, Argentina were examined.

Techniques for preparation and examination of male and female genitalia follow Oman (1949) and Mejdalani (1998), respectively. Dissections were made using a Zeiss SV6 stereoscope, and genital features were examined with a Leitz Wetzlar microscope. The dissected parts were stored in microvials with glycerin and pinned below the specimen. Photographs were taken using a reflex camera attached to the Zeiss microscope, and digital images were assembled using Combine ZM open software. Measurements (given in millimeters) were made with an ocular micrometer. Total body length (TL) was measured from the tip of the crown to the tip of the fore wings. Female characters were obtained from the examination of 10 specimens, except for *S. linea*. Terminology follows mainly Hill (1970) and Nielson (1965), with the exception of the third valvulae,

Table 1
Distribution of the genus *Syncharina*.

| Species | General distribution | Distribution in Argentina |
|------------------------------------|--|---|
| <i>S. argentina</i> (Berg) | Argentina, Brazil, Uruguay. New record: Paraguay: Departamento San Pedro. | BA ¹ , C ¹ , Co ¹ , Ch ¹ , F ¹ , SF ¹ , ER ² New records: Jujuy, Misiones, Tucumán. |
| <i>S. linea</i> (Taschenberg) | Argentina | Mendoza ³ |
| <i>S. lineiceps</i> (Spinola) | Chile, Argentina | Río Negro ⁴ |
| <i>S. punctatissima</i> (Signoret) | Argentina, Bolivia, Brazil. New record: Uruguay: Montevideo. | Co ¹ , ER ¹ , M ¹ , SF ¹ , BA ¹ , C ⁵ , S ⁶ , J ⁷ New records: Catamarca, Tucumán, San Juan. |

General distributions extracted from Young (1977) and Osborn (1926). Distributions in Argentina (superscripts indicate the bibliographic reference): ¹Remes Lenicov and Tesón (1985), ²Paradell et al. (2006), ³Young (1977), ⁴Paradell et al. (2011), ⁵Tesón et al. (1986), ⁶Paradell (1995) and ⁷Remes Lenicov et al. (1997). Abbreviations: BA, Buenos Aires; Ch, Chaco; C, Córdoba; Co, Corrientes; ER, Entre Ríos; F, Formosa; J, Jujuy; M, Mendoza; S, Salta; SF, Santa Fe.

which are treated herein as the gonoplas as proposed by Mejdalani (1998). The female genitalia of the species *S. linea* are described in detail; only the differences are provided for the other species of the genus. The characters of the female genitalia herein treated complement those of Young (1977). Specimens determined by D.A. Young were used to describe some of the species herein treated and named as “reference specimens”. *Helocharina gayi* (Spinola) was determined based on Young's description and illustrations. The key to species was adapted from those of Young (1977) and Paradell et al. (2011). Data on the geographical distribution of *Syncharina* species are compiled in Table 1. Biogeographical provinces considered in the distributional note follow those of Morrone (2006). Abbreviations used in this paper are as follows: DSA = dorsal sculptured area, VSA = ventral sculptured area, AP = articulation point, PP = preapical prominence.

3. Results

3.1. Genus *Syncharina* Young

Syncharina Young, 1977: 603.

Type species: *Tettigonia punctatissima* Signoret, 1854: 16.

Diagnosis. Small to medium green–yellowish cicadellines ranging in length from 3.5 to 8.5 mm; pronotum with dorsopleural carina present but incomplete; basal portion of forewings coarsely punctate, with central anteapical cell open basally; male styles shorter than apex of connective; first valvulae of ovipositor with sculpturing pattern formed by imbricate scale-like processes; shaft of second valvulae of ovipositor with subtriangular teeth, each tooth bearing small pointed denticles on posterior margin.

3.1.1. *S. linea* (Taschenberg) (Figs. 1(A); 2; 3(G); 6(A, B) and 7(A–C))

Tettigonia linea Taschenberg, 1884: 451.

Syncharina linea Young, 1977: 607 [n. comb.] ().

Additional characters of the female genitalia. Sternite VII (Fig. 2A), in ventral view, with posterior margin irregularly concave, usually with a small median lobe notched centrally. Surface with two groups of microsetae irregularly arranged on each side. Internal sternite VIII membranous, not forming sclerites. Pygofer (Fig. 2C), in lateral view, elongate; well produced with dorsal margin straight and posterior margin broadly rounded; anteapical surface with micro- and large macrosetae, few extending anteriorly along ventral margin. Valvifers I (Fig. 2B), in lateral view, suboval, dorsal margin markedly convex and more sclerotized attaining midlength and forming an anterior ledge; anterior vertex angular

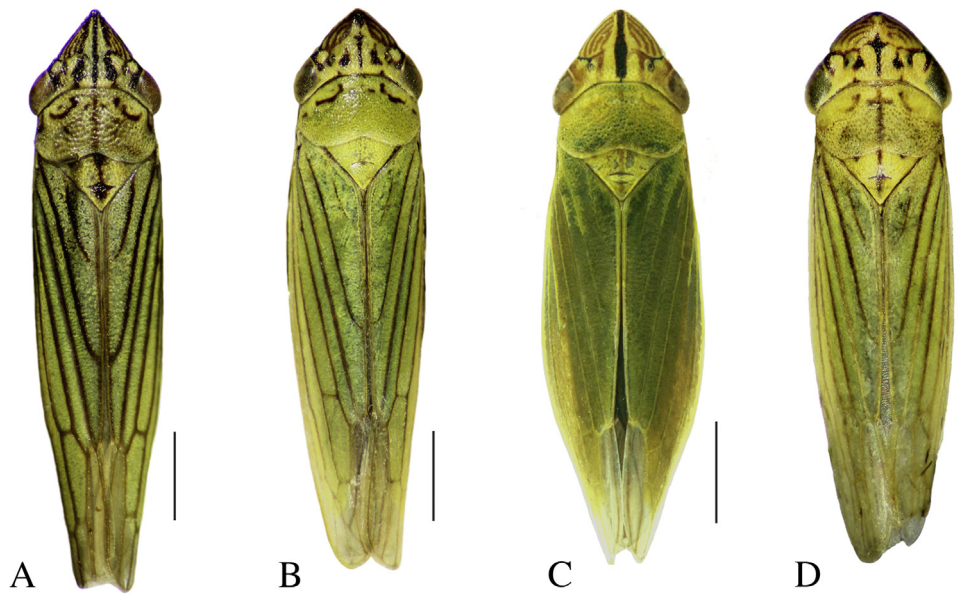


Fig. 1. Dorsal habitus of *Syncharina* species. (A) *S. linea* (Taschenberg). (B) *S. argentina* (Berg). (C) *S. lineiceps* (Spinola). (D) *S. punctatissima* (Signoret). Scale bar: A–D = 2 mm.

and posterior margin rounded. Valvulae I (Fig. 2E), in lateral view, blade-shaped; shaft straight basally, with apical third curved dorsally; basal area, in lateral view, truncate (Fig. 3G); dorsal margin more sclerotized basally forming a ledge with a slight concavity beyond basal curvature. Dorsal sculptured area (DSA) extending nearly $\frac{3}{4}$ of apical shaft, with sculpturing pattern formed by imbricate scale-like processes; dorsal margin of anteapical third partially smooth. Ventral sculptured area (VSA) less developed, formed by scale-like processes becoming clearly distinct towards subapical area. Ventral interlocking device distinct on basal half of shaft. Dorsal margin of anteapical third without scales forming a smooth ledge; preapical area of blade with conspicuous denticles on dorsal margin. Apex narrowly round, directed dorsally (Fig. 2F). Valvifers II (Fig. 2D), in lateral view, nearly fusiform with anterior margin biconvex and posterior margin rectilinear and markedly sclerotized; Articulation point (AP) conspicuous with a small group of short robust microsetae. Valvulae II (Fig. 2G), in lateral view, broad beyond basal curvature, with dorsal margin of shaft bearing 21–23 non-contiguous teeth, each tooth subtriangular with posterior margin declivous and longer than anterior margin, bearing numerous pointed denticles; proximal teeth small and rounded. Preapical prominence (PP) absent; apical margins denticulate; apex rounded (Fig. 2I); ducts reaching dorsal margin and apex. Gonoplasts (Fig. 2J), in lateral view, length of anterior portion sub-equal to the posterior and markedly narrower; surface mostly smooth with basal and anteapical areas covered by spine-like processes, with scattered microsetae extending anteriorly along ventral margin; apex narrowly round.

Material examined. ARGENTINA: Mendoza: 4 females, 2 males Potrerillos, Alt. 4000 ft., 16-20-III-20, Cornel University Expedition, det. D. A. Young 1970; 1 female, 1 male, Potrerillos, Alt. 4000 ft., 16-20-III-20, Cornel University Expedition, det. Kramer 1971, USNM.

Distribution. Argentina (Young, 1977) (Table 1).

3.1.2. *Syncharina argentina* (Berg) (Figs. 1(B) and 3(A, D))

Tettigonia argentina Berg, 1879: 251.

Syncharina argentina; Young, 1977: 607 [n. comb.].

Additional characters of the female genitalia. Sternite VII (Fig. 3A), in ventral view with posterior margin convex, slightly enlarged medially forming a small median lobe. Pygofer (Fig. 3D), in lateral view, elongate, moderately produced with dorsal margin

nearly straight and posterior margin broadly subround; anteapical surface with several micro- and robust macrosetae, few extending anteriorly along ventral margin. Valvulae II, in lateral view, with dorsal margin of shaft bearing 19–24 teeth. Gonoplasts (Fig. 3J) with surface of ventral margin, anteapical and basal areas covered by spine-like processes, with small scattered microsetae along the ventral margin. Other invariant characters (Valvifers I and II and valvula I) as described above for *S. linea*.

Material examined. SYNTYPES: 2 males, 2 females, Buenos Aires, Argentina, Berg n° 1756/1–4, MLP. ARGENTINA: Misiones: 1 male, 3 females, Loreto, Colección Ogloblin, MLP. Tucumán: 1 male, 1 female, Rinconada, IV-47, Ares, det. D. A. Young; 1 male, 1 female, Siambón, II-46, Olea, det. D. A. Young. Santa Fé: 1 male, 2 females, Villa Guillermina, II-46, Willink-Hayward, IFML. Entre Ríos: 3 males, 3 females, Colón, 2006, G. Bonnot, s/arrozo con red. Jujuy: 2 males, 3 females, Potrero de Yala, 14/I/2015, light trap, Defea-Lucia col., MLP. PARAGUAY: Asunción: 1 male, 2 females, Distrito Capital, 20-22-I-65, R. Golbach, IFML. San Pedro: 2 males, 6 females, Carumbé, 28-I-10-III-65, R. Golbach, IFML.

Distribution. Argentina, Brazil, Uruguay (Young, 1977; Osborn, 1926) and Paraguay (new record) (Table 1).

3.1.3. *Syncharina lineiceps* (Spinola) (Figs. 1(C) and 3(B, E))

Tettigonia lineiceps Spinola, 1852: 283.

Draeculacephala chilensis DeLong, 1967: 184 [syn.].

Syncharina lineiceps Young, 1977: 607 [n. comb.].

Additional characters of the female genitalia. Sternite VII (Fig. 3B), in ventral view with posterior margin convex, moderately produced forming three lobes, a median conspicuous lobe and a smaller lobe on each lateral margin. Pygofer (Fig. 3F), in lateral view, moderately produced with dorsal margin nearly straight and posterior margin narrowly round; anteapical surface with micro- and small macrosetae, a few extending anteriorly along ventral margin. Valvulae II, in lateral view, dorsal margin of shaft bearing 22–26 teeth. Gonoplasts (Fig. 3I) with ventral surface and anteapical and basal areas covered by spine-like processes, without macro- and microsetae; apex broadly round. Other invariant characters (Valvifers I and II and valvula I) as described above for *S. linea*.

Material examined. ARGENTINA: Río Negro: El Bolsón: 2 males, 8-XII-2005, Rocca, s/arándano en floración; 3 females, 1-IV-2006, Rocca, s/arándano vegetativo; 1 male, Rocca, s/arándano en fruc-

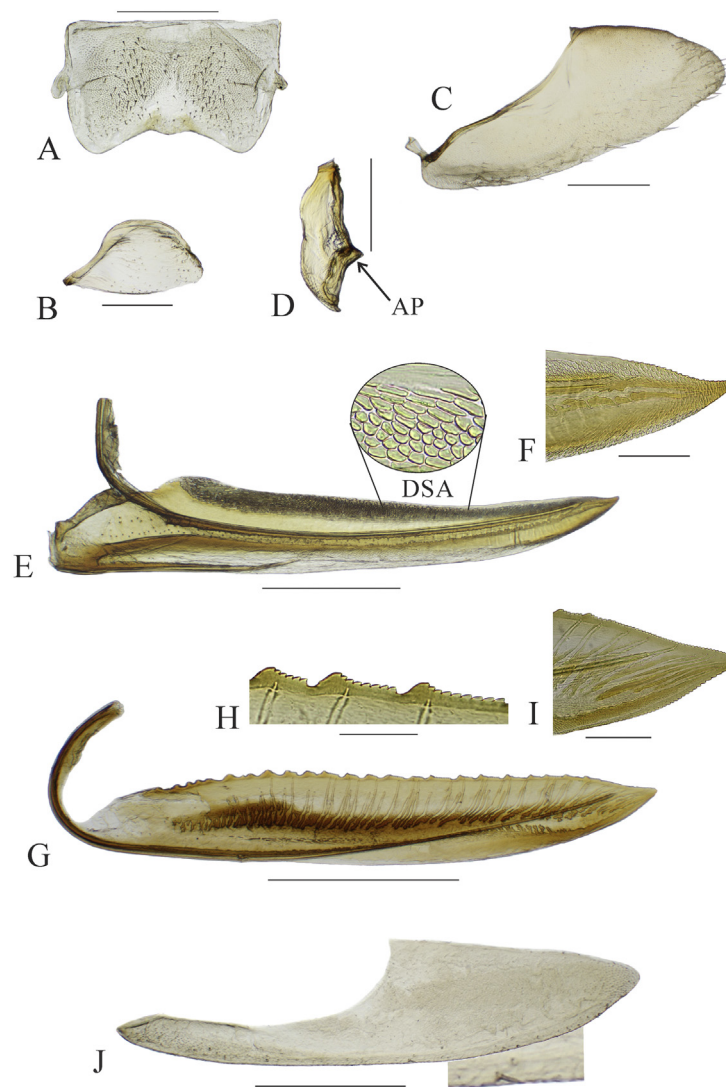


Fig. 2. Female genitalia of *Syncharina linea* (Taschenberg). (A) Sternite VII, ventral view. (B) Valvifer I, lateral view. (C) Pygofer, lateral view. (D) Valvifer II, lateral view. (E, F) Valvula I, lateral view. (E) General aspect, dorsal sculptured area (DSA), in detail. (F) Apex. (G–I) Valvula II, lateral view. (G) General aspect. (H) Tooth. (I) Apex. (J) Gonoplac, ventral margin in detail. Scale bar: A–E, G, J = 0.5 mm; F, I = 0.1 mm; H = 0.05 mm.

tificación, MLP. CHILE: Cautin: 1 male, 1 female, Prov. Rio Cautin Cajon, 3-I-66, Flint and Cekalovic; Malleco: 1 female, Rio Malleco Lolenco, 3-I-66, Flint & Cekalovic; Maule: 1 male, Nirivilo, 15-XII-76, Gurney, wet past, 1 male, Reloca, 16-XII-76, A. B. Gurney; West San Javier: 2 females, 15-XII-76, Gurney and Barria, USNM.

Distribution. Argentina and Chile (Young, 1977; Paradell et al., 2011) (Table 1).

3.1.4. *Syncharina punctatissima* (Signoret) (Figs. 1(D) and 3(C, F, H))

Tettigonia punctatissima Signoret, 1854: 16.

Syncharina punctatissima Young, 1977: 607 [n. comb.].

Additional characters of the female genitalia. Sternite VII (Fig. 3C), in ventral view convex, posterior margin moderately produced forming a distinct median lobe. Pygofer (Fig. 3E), in lateral view, short, dorsal margin with a small notch basally and posterior margin nearly truncate; antepical surface with micro- and macrosetae, several extending anteriorly along ventral margin. Valvulae I (Fig. 3H) in lateral view with basal area narrowly

rounded. Valvulae II, in lateral view with dorsal margin of shaft bearing 21–25 teeth. Gonoplares (Fig. 3J) as in *S. argentina*. Other invariant characters (Valvifers I and II and valvula I) as described above for *S. linea*.

Material examined. ARGENTINA: Tucumán: 1 male, 1 female, Monte Bello, det. D. A. Young; 1 males, 3 females, Siambón, II-46, Olea, det. D. A. Young, IFML. Catamarca: 1 male, 1 female, 6-IV-1968, Willink & Terán. San Juan: 1 male, 2 females, Villa Aberastain (Pocito), 20-25-I-64, B. A. Torres & Ferreyra. Mendoza: 1 male, 3 females, Las Heras, 15-III-45, B. Torres, det. D. A. Young. Entre Ríos: 3 males, 3 females, Colón, 2006, G. Bonnot, on rice. URUGUAY: 1 male, 2 females, Montevideo, J. Tremoleras collection, det. D. A. Young, MLP.

Distribution. Argentina, Bolivia, Brazil (Young, 1977) and Uruguay (**new record**). (Table 1).

3.2. Key to species of *Syncharina* Young

1. Medium species, length (♀ 7.5–8.5 mm, ♂ 6.5–7 mm); male plates with numerous multiserial microsetae; posterior margin of

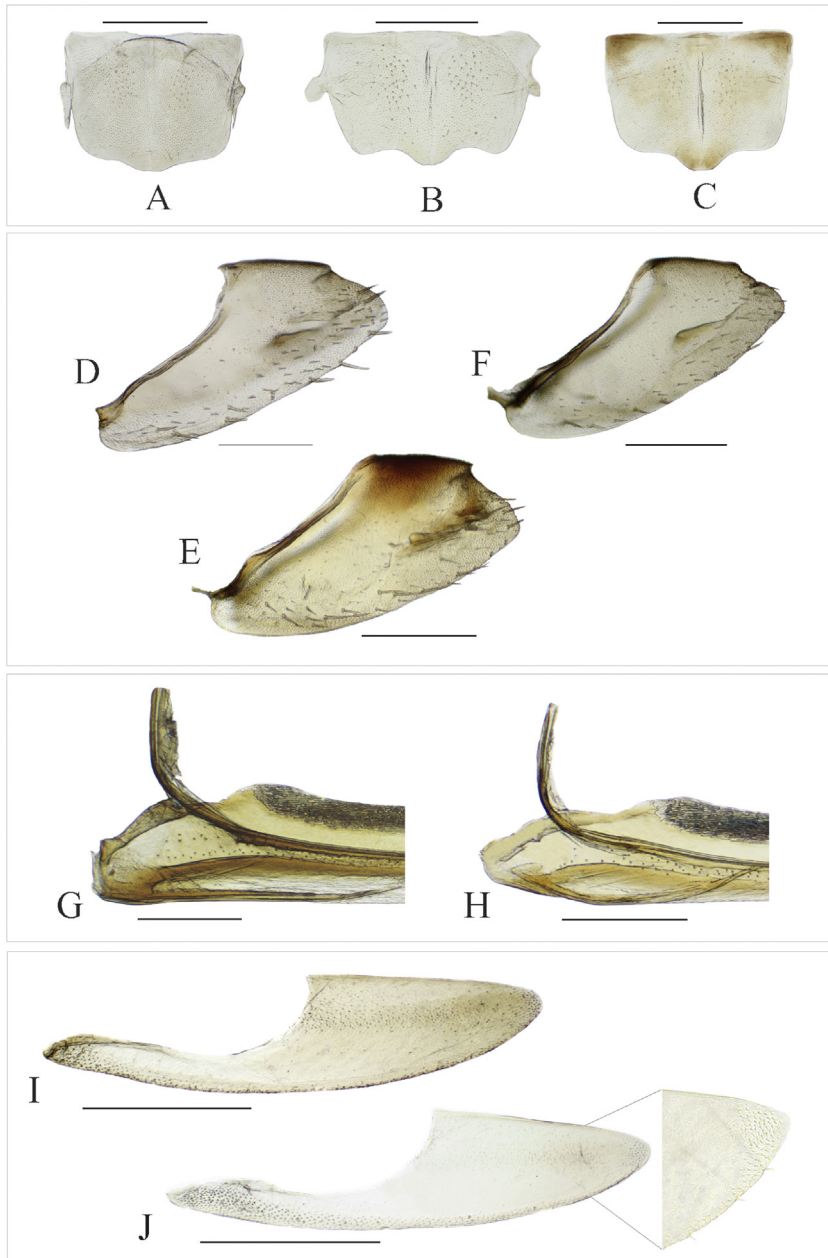


Fig. 3. Female genital structures of *Syncharina* species. *S. argentina* (Berg): (A) Sternite VII, ventral view. (D) Pygofer, lateral view. (G) Basal portion of Valvula I. (J) Gonoplac, with apex detail. *S. lineiceps* (Spinola): (B) Sternite VII, ventral view. (F) Pygofer, lateral view. (G) Basal portion of Valvula I. *S. punctatissima* (Signoret): (C) Sternite VII, ventral view. (E) Pygofer, lateral view. (H) Basal portion of Valvula I. (J) Gonoplac, apex detail. *S. lineica* (Taschenberg): (G) Basal portion of Valvula I. (I) Gonoplac. Scale bar: A–F, I, J=0.5 mm; H, G=0.3 mm.

- female sternite VII irregularly concave (Fig. 1A) 3
- S. lineica* (Taschenberg) 2
- Small species, length (♀ 5–7 mm, ♂ 3.5–5 mm); male plates with uniseriate small macrosetae; posterior margin of female sternite VII irregularly convex 2
- 2. Crown with a median, wide black line throughout its length (Fig. 1C); male paraphyses, in ventral view, crossed; posterior margin of female sternite VII with three lobes, one median large and two smaller on each side (Fig. 3B) 3
- S. lineiceps* (Spinola) 3
- Crown with a median, narrow black line not projected from the apex; if present, male paraphyses not crossed; posterior margin of female sternite VII with one median lobe 3
- 3. Crown, pronotum and scutellum with a median black line (Fig. 1D); male paraphyses, in ventral view, forcipate; female sternite VII moderately produced medially forming a prominent lobe (Fig. 3C); basal area of valvula I, in lateral view, narrowly rounded (Fig. 3H) 3
- *S. punctatissima* (Signoret) 3
- Crown with a median black line (Fig. 1B); male paraphyses, in ventral view, lanceolate and not forcipate; female sternite VII short and forming a slightly distinct median lobe (Fig. 3A); basal area of valvula I, in lateral view, truncate (Fig. 3G) 3
- *S. argentina* (Berg).

4. Discussion and concluding remarks

Comparisons on the female genitalia of *Syncharina* species not only confirm Young's illustrations but also report the presence of other interspecific variations of the pygofer, valvulae I and the gonoplasts. The female features pointed out by Young (1977) for both sternites VII and VIII, the pygofer and the second valvula were also observed in the specimens studied herein. According to Young, the posterior margin of sternite VII in *S. linea* is regularly concave; however, the specimens of *S. linea* examined by the present authors presented the posterior margin concave but with a small median lobe knotted medially (Fig. 2A). We consider that this variation could be related to the observation of unmacerated specimens by Young. The female abdominal sternite VII is frequently used for separating species or genera in sharpshooters as in other groups of leafhoppers (Greene, 1971; Meng and Yang, 2012; Young, 1977, 1986). We provide descriptions and illustrations of sternite VII of *Syncharina* species. Based on these observations, differences in the posterior margin can clearly distinguish the four species. Additionally, interspecific variations of the pygofer (Fig. 3D–E) and the first valvula were observed (Fig. 3G, H). Characters of the pygofer, such as the presence of processes or lobes and the chaetotaxy, have been used to separate genera or species within a genus (Defea et al. *Austral Entomology*, in press; Meng and Yang, 2012; Takiya and Cavichioli, 2004; Young, 1977). In the species studied here, variations on both dorsal and posterior margins of the pygofer were observed; accordingly, we provide the descriptions and illustrations of the pygofer of the four *Syncharina* species. Young (1977) and recent contributions (Leal et al., 2009; Meng and Yang, 2012) reported variations on basal area of the first valvula in many Cicadellini (e.g. *Scoposcartula* Young, *Jakrama* Young, *Macunolla* Young, *Erythrogonia* Melichar and *Seasogonia* Young); the present study revealed that the form of the basal area, in lateral view, provides evidence to separate *S. punctatissima* from the other *Syncharina* species. Regarding the gonoplasts, we observed differences among species with respect to the apex, chaetotaxy and disposition of the tegumentary processes. Previously, Takiya and Cavichioli (2004) reported differences on the gonoplasts for *Onega* Distant species. The structures of the ovipositor such as the second valvifers, the first valvulae (general aspect and the sculptured areas), teeth (form and location) and denticles of the second valvulae were comparatively conservative, showing slight variation among the studied species. The conservative condition of these structures was also reported by Carvalho and Mejdalani (2014) for the genus *Erythrogonia* Melichar. We consider important to mention that almost no intraspecific variations in the four species studied here were observed except in the first valvifer (form) and the second valvula (form, width and number of teeth). Some of these traits were previously proposed by Remes Lenicov and Tesón, (1985) to separate *S. argentina* and *S. punctatissima*, but considering the intraspecific variations, the second valvula may not efficiently separate both species. In addition, the recognition of female diagnostic characters can ease the identification of the species in cases of radical colour variations (observed by Young (1977) for two *Syncharina* species) and in some species complexes (e.g. complex *laeta* sensu Medler, 1963 in the genus *Erythrogonia*) in which the species are difficult to distinguish externally. Our data on body length confirm Young's observations that females (and males) of *S. linea* are larger than those of *S. argentina*, *S. lineiceps* and *S. punctatissima*. We provide the measurements for each species.

5. Biogeographic comments

Previous and present geographic records show that the South American genus *Syncharina* is commonly found in many environ-

ments. In Argentina, the species *S. punctatissima* and *S. argentina* have a wide range of distribution with records in many biogeographic provinces (Chaco, Pampa, Parana, Prepuna, Puna, Monte) of the Neotropical region. In contrast the two other species are restricted to central and south of Argentina and Chile, occurring in shrublands of the Monte province (central Argentina), and in the Subandean province (Andean region), dominated mainly by perennial grass steppes (Bertiller and Bisigato, 1998; Paruelo et al., 2007). The record of *Syncharina lineiceps* from this biogeographic province represents the most austral limit of the genus. Of particular interest is the occurrence of *S. linea* in the South American Transition Zone, specifically in the Central part of the Monte province. This natural area, with 30% of its biota endemic, has strong relationships with the Neotropical region, particularly with the Chacoan subregion, but it also shows faunal elements from the Andean biota (Roig et al., 2009). The records of *S. linea* only from Mendoza province leads to consider it as a possible species endemism of the Central Monte.

6. Study on *Cicadella* group

6.1. *Helocharina gayi* (Spinola) (Figs. 4(A–E); 6(E, F) and 7(G–I))

Tetigonia gayi Spinola, 1852: 285.

Helocharina gayi Young, 1977: 610 [listed].

Additional characters of the ovipositor. Valvifer I (Fig. 4D), in lateral view, anterior margin concave with dorsal margin forming a fold that reaches tergite VIII; ventral margin markedly concave; surface of dorsal half covered by minute spine-like processes. Valvula I (Fig. 6E) in lateral view with dorsal and ventral margins almost parallel along sinuous shaft; basal area curved dorsally. DSA extending on apical $\frac{3}{4}$ of shaft; sculpturing pattern formed mostly by threadlike structures arranged in oblique lines. VSA less developed, more distinct towards subapical area, formed by scale-like processes. Ventral interlocking device distinct on basal half. Apex acute, directed ventrally (Fig. 6F). Valvifer II (Fig. 4E) in lateral view with anterior margin consistently convex, posterior margin slightly? sclerotized with short microsetae clustered near AP. Valvula II (Fig. 7G) in lateral view with ventral margin flat and dorsal margin consistently convex, bearing subtriangular teeth, each tooth with a conspicuous cusp and posterior margin declivous, both anterior and posterior margins bearing blunt tiny denticles (Fig. 7H); preapical teeth distinctly shorter than the rest (Fig. 7I). Ducts system reaching the cusp of teeth only (Fig. 7G, H). Dorsal and ventral subapical margins denticulate. Apex broadly round, not curved (Fig. 7I). Gonoplasts (Fig. 4F), in lateral view, anterior portion narrow, clearly longer than the broad posterior portion; surface of apical third and ventral margin covered by spine-like processes, with small macrosetae, few microsetae extending anteriorly along ventral margin; apex broadly round.

Material examined. Argentina: Neuquén: 9 males, 4 females, San Martín de los Andes, 640 ms.n.m., 20-II-78, M. Gentili, MLP.

Distribution. Chile (Young, 1977). New record: **Argentina:** Neuquén, San Martín de los Andes.

6.2. *Helochara communis* Fitch (Figs. 5(A–E); 6(C, D) and 7(D–F))

Helochara communis Fitch, 1851: 56.

Additional characters of the ovipositor. Valvifer I (Fig. 5D) in lateral view with anterior margin concave, more sclerotized forming a coarse ledge that ends on dorsal margin. Valvula I (Fig. 6C) in lateral view blade-shaped with basal margin almost truncate; dorsal margin convex on basal half and concave towards the apex; ventral margin almost straight except apical half curved dorsally. DSA extending nearly on apical $\frac{3}{4}$ of shaft; sculpturing pattern maculose, with maculae not overlapping; dorsal margin of anteapical

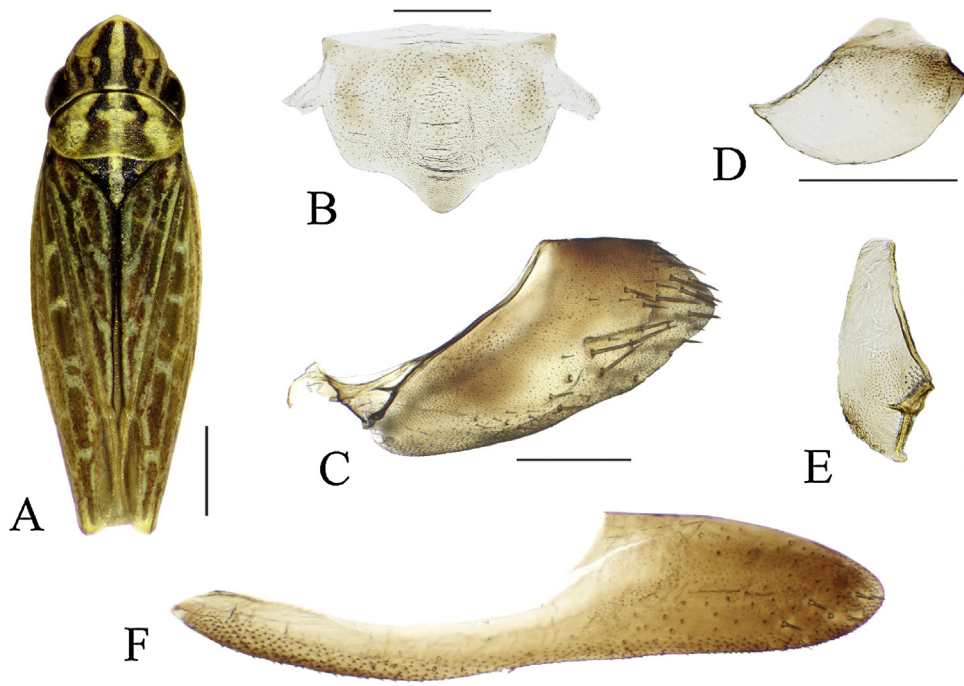


Fig. 4. Female genitalia of *Helocharina gayi* (Spinola). (A) Dorsal habitus. (B) Sternite VII, ventral view. (C) Pygofer, lateral view. (D) Valvifer I, lateral view. (E) Valvifer II, lateral view. (F) Gonoplac. Scale bar: A–D, F = 0.5 mm; E = 0.3 mm.

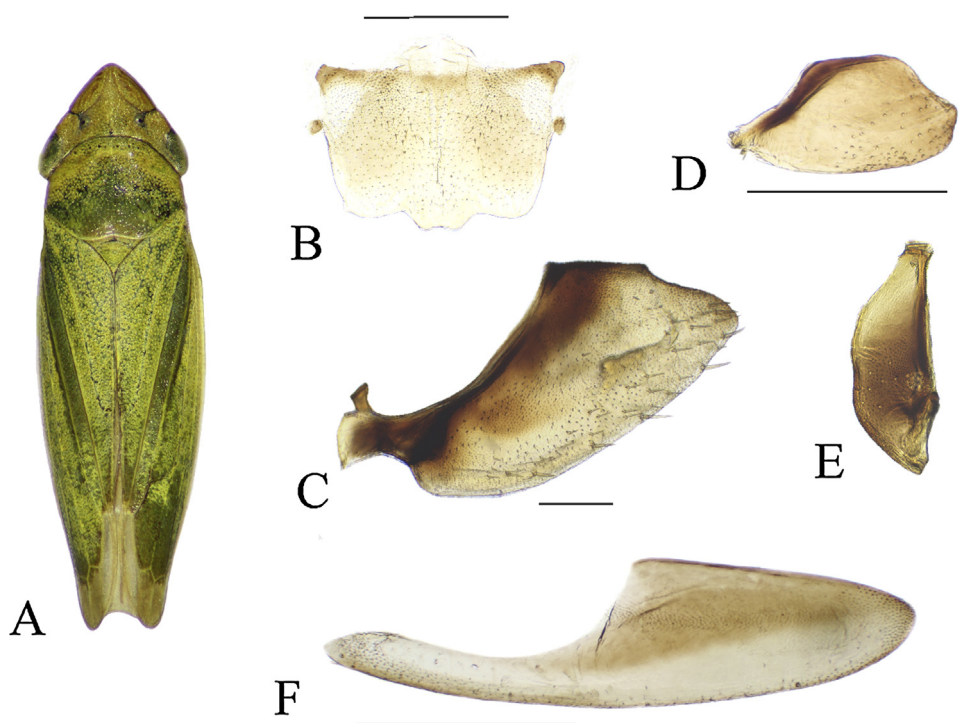


Fig. 5. Female genitalia of *Helochara communis* Fitch. (A) Dorsal habitus. (B) Sternite VII, ventral view. (C) Pygofer, lateral view. (D) Valvifer I, lateral view. (E) Valvifer II, lateral view. (F) Gonoplac. Scale bar: A–D, F = 0.5 mm; E = 0.3 mm.

third smooth partially. VSA slightly developed, almost indistinct along the shaft formed by scale-like processes clearly distinct towards subapical area. Ventral interlocking device short, distinct on basal half of shaft. Apex subacute, curved dorsally (Fig. 6D). Valvifer II (Fig. 5E) in lateral view with anterior margin biconvex and posterior margin rectilinear, more sclerotized; AP inconspicuous with a small group of short robust microsetae. Valvulae II (Fig. 7D) in

lateral view with ventral margin markedly concave and dorsal margin slightly convex bearing protruding subrectangular teeth with irregular tiny denticles on dorsal margin (Fig. 7E); proximal teeth small and rounded. Ducts system reaching teeth and apex (Fig. 7E, F). Dorsal and ventral subapical margins denticulate. Apex round, directed dorsally (Fig. 7I). Gonoplacs (Fig. 5F) in lateral view with length of anterior portion sub-equal to posterior, and markedly nar-

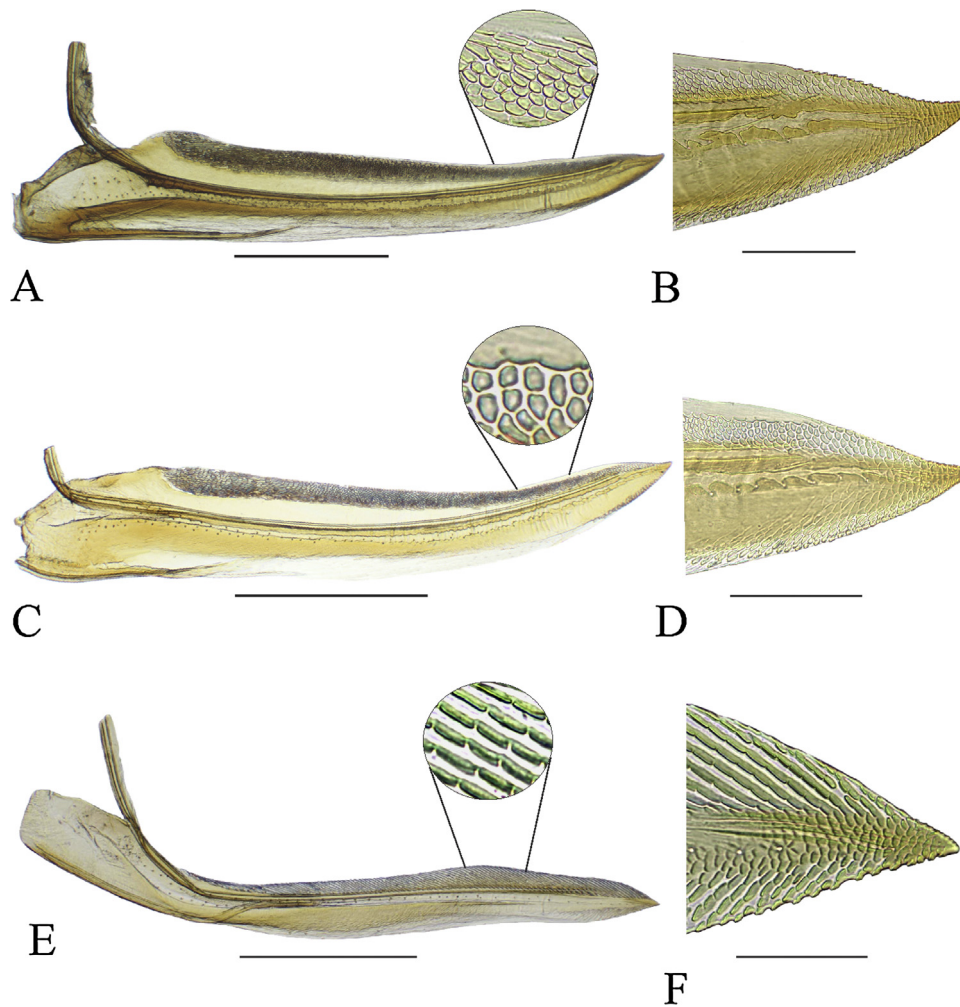


Fig. 6. Valvulae I, apical and dorsal sculptured areas in detail, lateral view: (A, B) *Syncharina linea* (Taschenberg). (C, D) *Helochara communis* Fitch. (E, F) *Helocharina gayi* (Spinola). Scale bar: A, C, E = 0.5 mm; B, D, F = 0.1 mm.

rower; surface of ventral margin and anteapical and basal areas covered by spine-like processes, with small scattered microsetae along the ventral margin; apex broadly round.

Material examined. USA: Montana: 3 females, 3 males, Ravalli County Charlos Heights 22-V-36, C. B. Philip, det. D. A. Young, KU.

Distribution. United States, Canada, Mexico (Young, 1977).

7. Discussion

Following Young (1977), the genus *Syncharina* differs from the related genera *Helochara* in that the central anteapical cell of the forewing is open basally, and from *Helocharina*, by the punctuation on the pronotum and scutellum, and the morphology of the paraphyses in males. According to Mejdalani (1998), the features of the female ovipositor, especially from valvulae I and II, can be useful diagnostic characters for sharpshooter taxonomy. In view of this opinion, we compared the ovipositor of *Syncharina* and their relatives, *Helochara* and *Helocharina*.

The most relevant differences of the first valvula are the overall shaft form, the dorsal sculpturing pattern and the apex; while on the second valvula include the overall shaft form, disposition of teeth and denticles, and the form and orientation of the apex. Both valvulae in *Syncharina* and *Helochara* are largely similar; in contrast, the valvulae of *Helocharina* show clear differences from those of *Syncharina* and *Helochara*. In the last two genera, the shaft of the first valvula (Fig. 6A, C) narrows toward to the apex with

both margins, ventral and dorsal, not parallel; however, the shaft of *Helochara* is wider and markedly more curved than that of *Syncharina*. In contrast, the shaft of *Helocharina* (Fig. 6E) keeps the same width throughout its length with margins almost parallel. Basally, the first valvula is short and not curved in *Syncharina* and *Helochara* but longer and curved dorsally in *Helocharina*. The apex is curved upwards in the former genera (Fig. 6B, D), and downwards in *Helocharina* (Fig. 6E, F). The dorsal sculpturing pattern (DSA) is formed by imbricate scale-like processes in *Syncharina*, and the lack of overlapping scales in *Helochara* (Fig. 6A, C); while in *Helocharina* (Fig. 6F) it is formed by oblique lines of threadlike structures.

With regard to the second valvula, differences are even more noticeable. *Syncharina* and *Helochara* have the dorsal margin of the shaft slightly convex, bearing several small rounded teeth near the base, and the ventral margin regularly concave (Fig. 7A, D); likewise, the shaft is wider in *Helochara*. In contrast, the dorsal margin of *Helocharina* is markedly convex, bearing a series of protruding short teeth near the apex (Fig. 6I), and the ventral margin is almost straight (Figs. 7G). The angular apex is directed dorsally in *Syncharina* and *Helochara* (Fig. 7C, F), but is widely round and not curved in *Helocharina* (Fig. 7I). A preapical prominence is only distinct in *Helocharina* (Fig. 7G). Based on teeth and denticles of the second valvula the three genera can be clearly distinguished; *Syncharina* (Fig. 7B) has subtriangular teeth bearing pointed denticles on the posterior margin; in *Helochara* (Fig. 7H, I), each subtriangular tooth bears blunt denticles on both anterior and posterior mar-

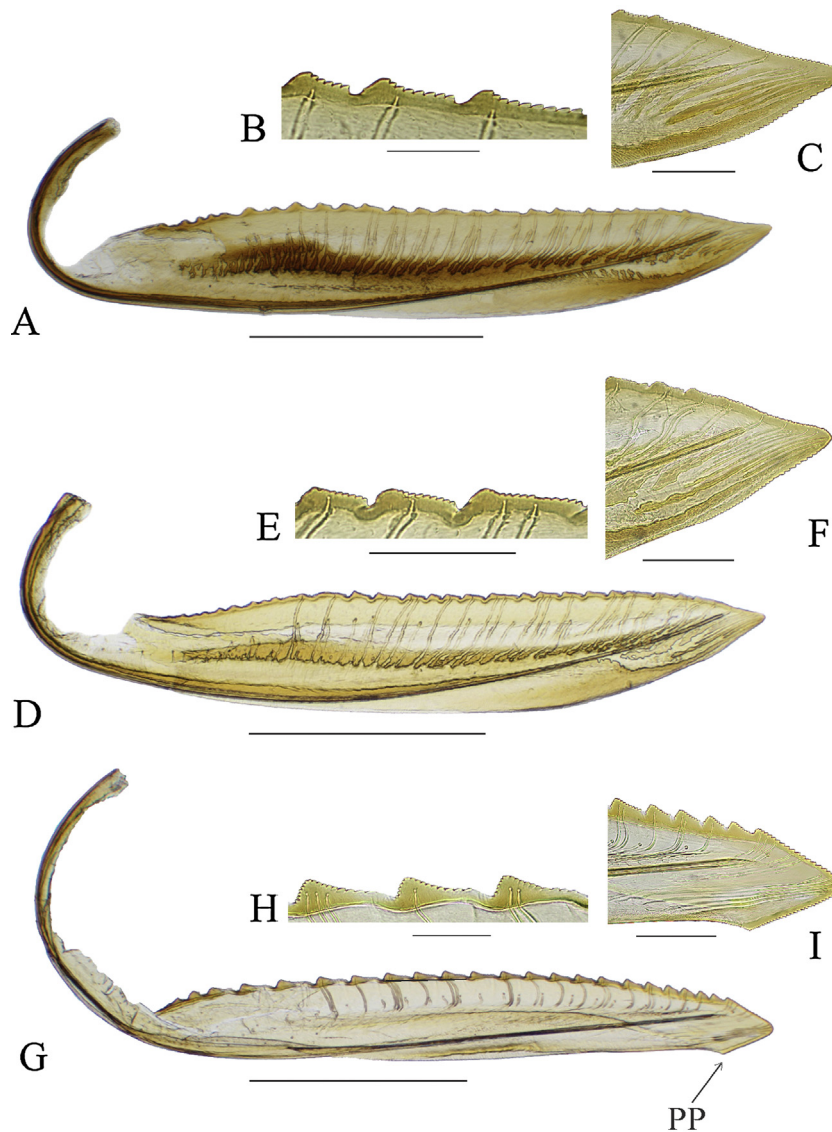


Fig. 7. Valvulae II, apical area and teeth in detail, lateral view. (A–C) *Syncharina linea* (Taschenberg). (D–F) *Helochara communis* Fitch. (G–I) *Helocharina gayi* (Spinola). Scale bar: A, D, G = 0.5 mm; C, F, I = 0.1 mm; B, E, H = 0.05 mm.

gins, and *Helochara* (Fig. 7E) has subrectangular teeth with irregular tiny denticles on the dorsal margin. It is important to mention that considerable similarities in valvifers of *Syncharina* and *Helochara* are also observed; the most notable in the first valvifer (Figs. 2B, 5D) the dorsal margin is markedly convex with an anterodorsal robust ledge, and in the second valvifer (Figs. 2D, 5E) the presence of a biconvex anterior margin. In *Helocharina*, however, the ventral margin of the first valvifer (Fig. 4D) is markedly concave, the anterodorsal margin is thin lined and the anterior margin is extremely acute. Further, the anterior margin of the second valvifer (Fig. 4E) is regularly convex.

In his revision of the Cicadellini, Young (1977) pointed out the resemblance of the second valvula of *Syncharina* and *Helochara* with those of *Cicadella* and *Draeculacephala*, respectively. We compared valvulae I and II of these genera considering previous descriptions and/or illustrations of *Draeculacephala mollipes* and *Cicadella viridis* provided by Balduf (1933), Young (1977) and Meng and Yang (2012). We not only confirm Young's observations on the second valvula but also report a distinctive similarity of the first valvula, exposing the conservative nature of both valvulae within these related genera. In contrast, other contributions ratify Mejdalani's

view; Meng and Yang (2012) found little similarities between some related genera from China, concluding that female characters can be useful for the taxonomy of the Old World Cicadellini. Further, Mejdalani and dos Santos da Silva (2010) arrived at the same opinion for a group of genera of the tribe Proconiini. Apart from this, our results support Young's treatment of *Syncharina* in the *Cicadella* group. The preliminary results herein discussed on female characters not only confirm the relationship between *Syncharina* and *Helochara*, but also suggest a close relation of *Syncharina* with *Draeculacephala* and *Cicadella viridis* instead with *Helocharina*. As Young (1977) exposed, the Cicadellini are an intricate group. The relative lack of morphological variation may be due to a rapid radiation, thus, the male genitalia are not always enough to define and associate genera. For this reason, female characters should also be considered in judging relationships.

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