



Genus *Plesiommata* Provancher (Hemiptera: Cicadellidae) in Argentina: first detailed description of the female genitalia and comparisons with its neotropical congeners

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Abstract *Plesiommata* Provancher is a sharpshooter genus with six species described, three present in the Neotropics. The morphology of the female genitalia of this genus is still poorly known. In this contribution, the female genitalia of *P. mollicella* (Fowler) and *P. corniculata* Young are described and illustrated for the first time. The vector species *P. corniculata* Young is recorded as new for Argentina. A key to Neotropical species including new female genital characters is presented along with updated information as new distribution records, host plant records and phytosanitary importance.

Key words Cicadellinae, female genitalia, morphology, sharpshooters.

INTRODUCTION

Cicadellinae are a very large and diverse subfamily that contains over 2313 species placed in 329 genera (McKamey 2009). Distributed worldwide, cicadellines feed on the xylem of a wide variety of vascular plants, and most species are polyphagous. The ecology and host associations of few cicadelline species, mainly those of economic importance, have been studied thoroughly. Sharpshooters, as they are commonly named, are an economically important group because they contain the main vectors of the pathogen *Xylella fastidiosa* (Bacteria: Xanthomonadaceae), the causal agent of many important plant diseases around the world including Citrus Variegated Chlorosis (CVC) and Pierce's disease (PD) among others (Nielson 1968; Redak *et al.* 2004). The taxonomy of sharpshooters is based mostly on characters of the male genitalia; however, several studies showed that female terminalia could contribute to the taxonomy of the group (Mejidalani 1998; Leal *et al.* 2009; Mejidalani & Silva 2010; Meng & Yang 2012; Carvalho & Mejidalani 2014).

According to Young (1968), Cicadellinae is divided into two tribes, the New World Proconiini and the cosmopolitan Cicadellini. Included in the latter is the genus *Plesiommata* Provancher that occurs from Canada and eastern and central USA to Argentina. So far, six species have been described with only three present in the Neotropics: *P. corniculata* Young, *P. mollicella* (Fowler) and *P. zanolae* Cavichioli (Young 1977; Cavichioli 1999). All described species of *Plesiommata* can be distinguished from other Cicadellini by (1) forewing hyaline to pale translucent, with inner two antepical cells open basally; (2) abdomen of males with conspicuous basal apodemes; and (3) aedeagus with a pair of slender processes arising basiventrally and extending dorsally over the shaft (Young 1977). *Plesiommata mollicella* was described by Fowler (1900) based on material from Mexico. Young (1977), in his

revision of the tribe Cicadellini, included illustrations of the external parts of the male genitalia. In that contribution, the new species *P. corniculata* was described, and a key to all species presented. More recently, *P. zanolae* was described by Cavichioli (1999) based on specimens from Mato Grosso, Brazil.

Biological information on *Plesiommata* species is scarce and outdated. Host plant associations are known for few species with most records on herbaceous plants in pastures, cereal crops and weedy vegetation of citrus groves (Redak *et al.* 2004). So far, the genus includes a confirmed vector of the bacterium *X. fastidiosa*, *P. corniculata* (Krüger *et al.* 2000), that is frequently found in citrus orchards in Brazil (Marucci *et al.* 2002; Yamamoto *et al.* 2002; de Molina *et al.* 2010).

Considering the phytosanitary importance of these species and that several species may coexist in the same environment and be difficult to distinguish, in this study, the female genitalia of *P. mollicella* and *P. corniculata* are described and illustrated. A key to the Neotropical species, including female genital characters, is presented. New distributional and host plant records are added along with updated epidemiology information.

MATERIAL AND METHODS

Type and nontype material housed in the following collections were examined: North Carolina State University at Raleigh (NCSU), Colección Entomología, Museo de Ciencias Naturales de La Plata (MLP) and Colección Entomología, Instituto Fundación Miguel Lillo (IFML). In addition, several specimens were collected in Bella Vista, Corrientes, Argentina (28°30' 32.08"S 59°02'35.22"O) on grassy weeds of citrus groves using a manual sweep net. Specimens from field collections were preserved in 70% EtOH for morphological studies. Males and females were dissected using a stereoscopic microscope

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following the techniques proposed by Oman (1949) and Mejdalani (1998), respectively. Identification followed Young (1977) and terminology Nielson (1965), with the exception of the third valvulae, which are treated herein as the gonoplacs as proposed by Mejdalani (1998). Photographs of female structures were taken with a digital camera attached to a Zeiss microscope, and digital images were assembled using COMBINE ZM open software (Hadley 2011). The key to Neotropical species was adapted from that of Young (1977). Specimens studied are deposited in the Colección Entomología Museo de Ciencias Naturales de La Plata (MLP) and Colección Entomología, Instituto Fundación Miguel Lillo (IFML). Abbreviations used in this paper are as follows: AP = articulation point, DE = denticles, TO = tooth, VID = ventral interlocking device.

TAXONOMY

Key to neotropical species of *Plesiommata*

The characteristics of *P. zanolae* were taken from Cavichioli (1999). This species keys to couplet '2' in Young's (1977) key as follows:

- 1 Crown of head with a median black spot behind apex 2
Crown of head with an apical black spot but no median spot behind it 3
- 2 Aedeagal shaft in lateral view with a dorsal expansion at midlength; valvula I of ovipositor with VID long, distinct on basal half of shaft, dorsal margin of valvula II bearing discontinuous and protuberant teeth, each tooth with posterior margin declivous bearing minuscule denticles *P. mollicella* (Fowler) (Fig. 2)
Aedeagal shaft in lateral view abruptly expanded at apex, without a dorsal expansion at midlength; valvula I of ovipositor with VID short, distinct on basal third of shaft, dorsal margin of valvula II bearing contiguous, non-protuberant teeth, each tooth with posterior margin concave bearing larger denticles *P. corniculata* Young (Fig. 1)
- 3 Specimens with a narrow median dark-brown stripe on pronotum, scutellum and anal margin of forewings *P. zanolae* Cavichioli. See Cavichioli (1999: 1014).
Specimens without such a stripe Nearctic species. See Young (1977: 600).

Plesiommata corniculata Young 1977

(Fig. 1)

Plesiommata corniculata Young 1977: 601

Material examined

Holotype

Male: Rio 'Caraguata'\Mato Grosso\Brazil\March 1953(F. Plaumann) (NCS).

Other material

ARGENTINA: 1 male, 1 female, Concordia Entre Ríos\XII-19-1941\Birabén-Bezzi (MLP); 1 male, Federación Entre Ríos\XII-03-1941\Birabén-Bezzi (MLP); 2 males, El Rabón Santa Fe\XI-27-1939\Birabén-Bezzi (MLP); 4 males, 1 female, Santa Inés Misiones\XII-13-1941\Birabén-Bezzi (MLP); 3 males, 5 females, Montecaseros\Corrientes\II-11-1987 con luz\Paniagua (MLP); 1 male, Mercedes Corrientes\XII-16-1941\Birabén-Bezzi (MLP); 1 male, 1 female, Bella Vista Corrientes\III-10-2015\B. Defea (MLP); 1 male, 1 female, Bella Vista Corrientes\V-12-2015\B. Defea (MLP).

Female genitalia

Sternite VII (Fig. 1b) short, basal width 2× median length. Posterior margin transverse, sometimes with short median tip, lateral margins convergent posteriorly and rounded laterally. Internal sternite VIII membranous, not forming sclerites. Pygofer (Fig. 1c), in lateral view, suboval with posterior margin short and narrowly rounded; with several robust macrosetae on apical half extending anteriorly along ventral margin and many macrosetae clustered on dorsal surface. Valvifers I (Fig. 1d), in lateral view, subrectangular with anterodorsal margin scarcely more sclerotized. Valvulae I of ovipositor (Fig. 1f), in lateral view, blade-shaped, basal end directed upward with anterior edge rounded. Dorsal sculptured area extending along apical 4/5 of shaft, formed mostly by scale-like processes not imbricated, arranged in oblique lines. Ventral sculptured area less developed, covering median 1/3 of shaft, formed mostly by horizontal spaced processes except subapical surface covered by scale-like processes. Ventral interlocking device distinct on basal third of shaft. Apex acute (Fig. 1g). Valvifers II (Fig. 1e), in lateral view, slender subrectangular shaped, with a median rounded area less sclerotized next to robust microsetae clustered near articulation point; posterior margin concave and more sclerotized. Valvulae II (Fig. 1h), in lateral view, broad beyond basal curvature, with dorsal margin of shaft almost straight and bearing approximately 16 contiguous teeth, each tooth (Fig. 1i,j) subtriangular with posterior margin concave and longer than anterior margin, bearing numerous subtriangular denticles. Preapical prominence absent; apical area distinctive with margins sharpened and denticulate, apex rounded (Fig. 1k); ducts reaching teeth and apex. Gonoplacs (Fig. 1l), in lateral view, with basal half narrow and apical half distinctly expanded; apex rounded.

Geographical distribution

Bolivia, Brazil, Colombia, Costa Rica, Grenada, British Guiana (Guyana), Dutch Guiana (Surinam), Mexico, Panama, Paraguay, Trinidad and Venezuela (Young 1977). New country and provincial records: **Argentina: Corrientes, Entre Ríos, Misiones and Santa Fe.**

Host plants

'Sweet potato', 'avocado', 'grasses' (Young 1977), *Citrus sinensis* 'sweet orange' (Marucci *et al.* 2002; Yamamoto *et al.*

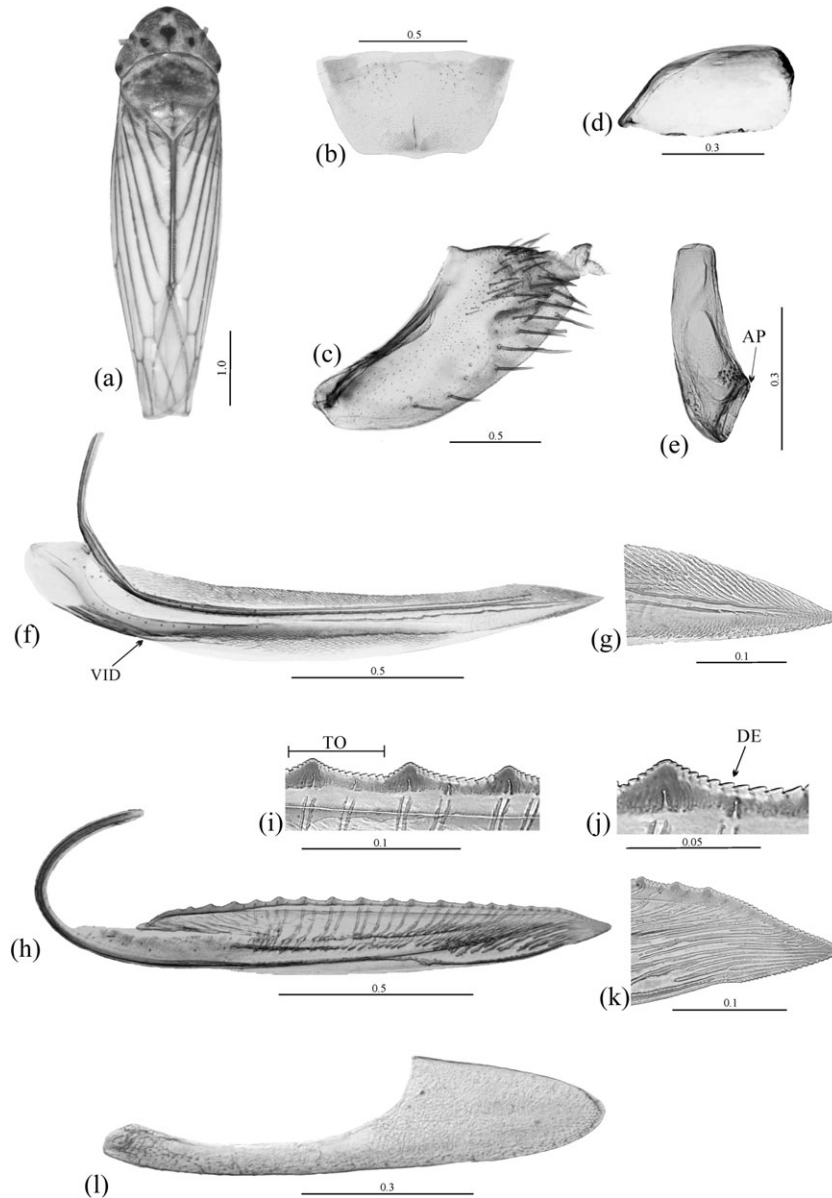


Fig. 1. *Plesiommata corniculata* Young. Female, dorsal view (a); sternite VII, ventral view (b); pygofer, lateral view (c); valvifer I, lateral view (d); valvifer II, lateral view (e); valvula I, lateral view (f); apical area (g); valvula II, lateral view (h); teeth (i); tooth (j); apical area (k); gonoplac (l). Measurements in millimetres (mm).

2002; Ott *et al.* 2006; Coelho *et al.* 2008; de Molina *et al.* 2010) and *Coffea arabica* ‘coffee’ (Garita-Cambronero *et al.* 2008).

Phytosanitary importance

Vector of *X.fastidiosa* in Brazil (Krüger *et al.* 2000).

Plesiommata mollicella (Fowler 1900)

(Fig. 2)

Tettigonia mollicella Fowler 1900: 289

Plesiommata mollicella (Fowler), Christensen 1942: 337

The complete synonym list of *P. mollicella* is available on Takiya’s website (Takiya 2015).

Material examined

ARGENTINA: 7 females, Villa Guillermina Santa Fé\II-1946\Willink-Hayward | Det. D. A. Young (IFML); 1 male, Vera Santa Fé\24-XI-1939\Birabén-Bezzi (MLP); 1 male, Reconquista Santa Fé\26-XI-1939\Birabén-Bezzi (MLP); 1 female, Tirol Chaco\7-XII-1939\Birabén-Bezzi (MLP); 1 female, Resistencia Chaco\20-III-1939 | P. Denier (MLP); 1 male, Concordia Entre Ríos\15-XI-2011\J. P. Bouvet | s/arándanos (MLP); 5 females, 5 males Bella Vista Corrientes\VI-2014\B. Defea (MLP).

Female genitalia

Sternite VII (Fig. 2b) short, basal width 2× median length. Posterior margin transverse, lateral margins convergent posteriorly

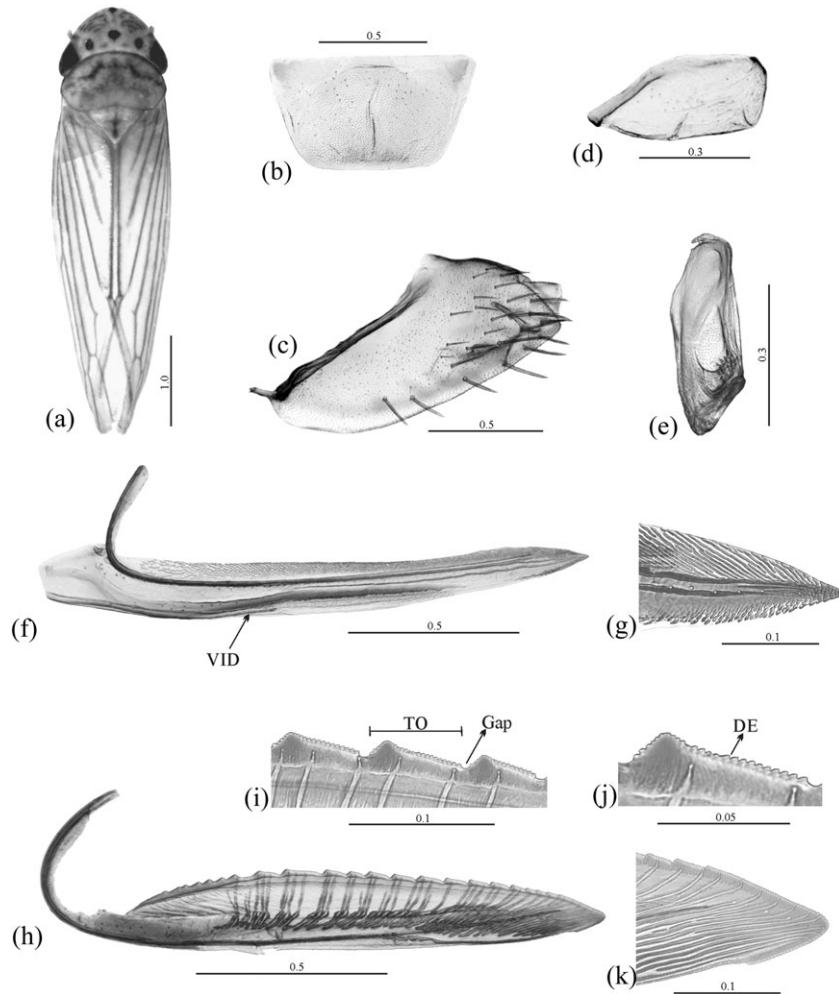


Fig. 2. *Plesiommata mollicella* (Fowler): Female, dorsal view (a); sternite VII, ventral view (b); pygofer, lateral view (c); valvifer I, lateral view (d); valvifer II, lateral view (e); valvula I, lateral view (f), apical area (g); valvula II, lateral view (h); teeth (i); tooth (j); apical area (k). Measurements in millimetres (mm).

and rounded laterally. Internal sternite VIII membranous, not forming sclerites. Pygofer (Fig. 2c), in lateral view, suboval with posterior margin short and narrowly rounded; with several robust macrosetae on apical half extending anteriorly along ventral margin and few spaced macrosetae on dorsal surface. Valvifers I (Fig. 2d), in lateral view, subrectangular, with anterodorsal margin more sclerotized and declivous. Valvulae I of ovipositor (Fig. 2f), in lateral view, blade-shaped, basal end straight and anterior edge truncated. Dorsal sculptured area extending along shaft from ramus to apex; formed mostly by scale-like processes not imbricated, arranged in oblique lines. Ventral sculptured area less developed, covering median 1/3 of shaft, formed mostly by horizontal spaced processes except subapical surface covered by scale-like processes. Ventral interlocking device distinct on basal half of shaft. Apex acute (Fig. 2g). Valvifers II (Fig. 2e), in lateral view, wide and subrectangular shaped, with a median rounded area less sclerotized next to robust microsetae clustered near articulation point; posterior margin rectilinear and strongly sclerotized. Valvulae II (Fig. 1h), in lateral view, broad beyond basal curvature, with dorsal margin of shaft regularly convex bearing approximately 24 non-contiguous and protuberant teeth

(Figs. 2i,j), each tooth subtriangular with posterior margin declivous and longer than anterior margin, bearing numerous subtriangular denticles. Preapical prominence absent; apical area broad with margins denticulate; apex rounded (Fig. 2k); ducts reaching teeth and apex. Gonoplacs, in lateral view, with basal half narrow and apical half distinctly expanded; apex rounded (as Fig. 1l).

Geographical distribution

Mexico, Belize, Guatemala, Costa Rica, Panama, Colombia, Venezuela, French Guiana, Ecuador, Bolivia, Paraguay, Brazil and Argentina (Young 1977), Nicaragua (Maes & Godoy 1993). Argentina: Buenos Aires, Cordoba, Salta, Tucuman (Paradell 1995), Misiones (Remes Lenicov *et al.* 1999) and Entre Rios (Paradell *et al.* 2001); New provincial records: Chaco and Santa Fe.

Host plants

Zea mays 'corn', *Triticum aestivum* 'wheat', *Avena sativa* 'oat' and associated weeds (Paradell 1995), *Sorghum vulgare* (Pers.)

'sorghum' (de Remes Lenicov *et al.* 2006), rice (Paradell *et al.* 2014), *Brassica* sp., *Lycopersicon* sp., *Solanum* sp. (Maes & Godoy 1993), *Citrus sinensis* 'sweet orange' and associated weeds (Remes Lenicov *et al.* 1999), *C. reticulata* 'tangerine hybrid' (Dellapé 2013), *Andropogon gayanus* (Toledo *et al.* 1989), weeds associated with *Carica papaya* (Lozada Robles & Arellano Cruz 2008). New host record: *Vaccinium corymbosum* 'blueberry'.

Phytosanitary importance

Positive for *X.fastidiosa* in Entre Ríos province, Argentina (Dellapé 2013).

DISCUSSION

Plesiommata zanolae can be reliably separated from *P. corniculata* and *P. mollicella* by the colour pattern and aedeagal morphology. It is easily recognised by the following: (1) presence of a dark brownish narrow stripe along the pronotum, scutellum and anal margins of the tegmina; and (2) aedeagus shaft subcylindrical with two dorsal expansions that end near the acute apex (Cavichioli 1999:1014). Externally, *P. corniculata* is most similar to *P. mollicella* in having almost the same colour pattern (Figs 1a and 2a). These species can coexist in the same environment and can be distinguished by the aedeagal and ovipositor morphology. *Plesiommata corniculata* presents a short VID in valvula I (Fig. 1f) and contiguous non-protuberant teeth in valvula II (Fig. 1i), each tooth bearing numerous small denticles (Fig. 1j). *Plesiommata mollicella* is characterised by having a long VID, distinctive on the basal half of valvula I (Fig. 2f) and by the presence of discontinuous and protuberant teeth on the dorsal margin of valvula II (Fig. 2i), each tooth bearing numerous tiny denticles (Fig. 2j). Likewise, slight differences can be observed on the remaining female genital structures (sternite VII, pygofer, valvifers I and II) (Figs 1b–e and 2b–e).

ACKNOWLEDGEMENTS

This research was supported in part by Grant 11 N/723 of UNLP, Argentina. Financial support to B. Defea and AM M. Remes Lenicov was provided by Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET) and to S. Paradell by Comisión de Investigaciones Científicas (CIC). We thank the reviewers for their helpful comments and suggestions.

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Accepted for publication 12 April 2016.