



# Taxonomic revision and phylogeny of the sharpshooter genus *Dasmeusa* Melichar, 1926, with a scanning electron microscopy study of *D. pauperata* (Fabricius, 1803) (Hemiptera: Cicadellidae: Cicadellini)

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## Abstract

The genus *Dasmeusa* is distributed in Northern and Northeastern Brazil and the Guianas. Until the present study, six species were recognized within *Dasmeusa*. The species of this genus are very similar in terms of color and external morphology, being distinguished mainly by the male terminalia. Here, we review and redescribe *Dasmeusa* and its species, describe four new species, and present the first phylogenetic analysis of the genus, including 40 morphological characters and 15 terminal taxa. *Dasmeusa flavescens* Metcalf and *Erythrogonia bicolor* Metcalf are considered junior synonyms of the type-species, *Dasmeusa pauperata* (Fabricius). Scanning electron microscopy was employed for a detailed study of the integument of the type-species, including sensilla, surface sculpturing, brochosomes, organ of Evans, and other structures. The phylogenetic analysis with equal weights resulted in nine most parsimonious trees. The implied weighting method resulted in two trees, both with the same ingroup topology as observed in one of the nine equal-weights trees. This preferred topology is as follows: ((*D. basseti* (*D. mendica* (*D. rafaeli* **sp. nov.**, *D. falcifera* **sp. nov.**))) (*D. isabellina* (*D. oriximina* **sp. nov.** (*D. pauperata* (*D. imperialis*, *D. dinizi* **sp. nov.**))))). *Dasmeusa* was recovered as monophyletic in all trees, being supported by five apomorphic characters.

## Key words

Cicadellinae, cladistics, morphology, Neotropical region, SEM, sensilla

## 1. Introduction

Melichar produced an extensive monograph on the taxonomy of the Cicadellinae (“Monographie der Cicadellinen”), which was published, posthumously, between 1924 and 1951 (Melichar 1924, 1925, 1926, 1931, 1951). In the third volume, Melichar (1926) provided an identification key to 101 genera of the “Cicadellaria”, a group roughly equivalent to the tribe Cicadellini. The genus *Dasmeusa* was included in this key (p. 324) but was not formally described in the *Monographie*, nor species were included. China (1938) designated *Cicada pauperata* Fabricius, 1803 as the type-species of *Dasmeusa*. Metcalf (1955) included a second species in the genus, *Dasmeusa flavescens* Metcalf, 1955, which was a new name for the preoccupied *Tettigonia lurida* Signoret, 1853. The genus was also catalogued or listed by Neave (1939), Evans (1947), Metcalf (1965), Zanol and de Menezes (1982), Oman et al. (1990), McKamey (2007), Wilson et al. (2009), and Takiya et al. (2023).

Only in 1977, in the detailed revision of the New World Cicadellini published by Young, *Dasmeusa* was formally described, including characters of the external morphology, male and female terminalia, a key to species, and a new species (*D. mendica* Young, 1977). More than twenty years later, Cavichioli and Chiamolera (1999) added two new species, *D. basseti* Cavichioli & Chiamolera, 1999 and *D. isabellina* Cavichioli & Chiamolera, 1999. Recently, Pecly et al. (2019) described another new taxon (*D. imperialis* Pecly et al., 2019). Thus, *Dasmeusa* included, until the present work, six species, being recorded from Northern and Northeastern Brazil and the Guianas (Young 1977; Cavichioli and Chiamolera 1999; McKamey 2007; Pecly et al. 2019).

In his revision of the Cicadellini, Young (1977) considered *Dasmeusa* related, in many morphological features, to *Paromenia* Melichar, 1926. According to him, species of *Dasmeusa* could be distinguished from those of *Paromenia*, as well as from the remaining New World genera of the tribe, by the following combination of features: (1) dorsum of (preserved) specimens usually yellow (whitish- to greenish-yellow in life), often with orange shades or spots at the base and near apex of forewing; (2) body slender; (3) head well produced anteriorly and with anterior margin rounded; and (4) male terminalia with paraphyses.

Based on raw morphological similarities, Young (1968, 1977) divided the genera of the New World Cicadellinae into intuitive groups. He included *Dasmeusa* in the *Paromenia* group, which currently has other 13 genera (Young 1977; Cavichioli 1996, 2000; Takiya and Cavichioli 2004): *Paromenia* Melichar, 1926, *Onega* Distant, 1908, *Jozima* Young, 1977, *Baleja* Melichar, 1926, *Lebaja* Young, 1977, *Parathona* Melichar, 1926, *Sailerana* Young, 1977, *Tacora* Melichar, 1926, *Punahuana* Young, 1977, *Backhoffella* Schmidt, 1928, *Alocha* Melichar, 1926, *Albiniana* Cavichioli, 1996, and *Jeepiulus* Cavichioli, 2000. Considering that a comprehensive analysis of the phylogenetic relationships among

the circa 330 known genera of the Cicadellinae has so far not been attempted, the generic groups proposed by Young (1977), including the *Paromenia* group, are regarded as reasonable starting points for outgroup choices in cladistic studies. Cavichioli (1992), in his doctoral study, carried out a phylogenetic analysis, based on morphological data, of the *Paromenia* group. In his study, *Dasmeusa* was recovered as the sister group of *Tacora*, a relationship supported by the angulated inferior third of the frons.

Although Young (1968, 1977, 1986) published outstanding monographs of the Cicadellinae, including a myriad of detailed descriptions of new genera and species, as well as redescrptions, we believe that further morphological investigations on this subfamily are necessary, focusing on the general body morphology, male terminalia, and especially the female terminalia (Mejdalani 1998). Various structures can be better described and used for an in depth understanding of species phylogenetic relationships and detailed taxonomic studies (Mejdalani 1995, 1998; Carvalho and Mejdalani 2014). Furthermore, the phylogenetic relationships within the Proconiini and Cicadellini are poorly understood, and cladistic studies involving species of one genus or groups of genera are still relatively rare. Available publications are relatively recent (e.g., Cavichioli 1997, Takiya and Mejdalani 2004, Ceotto and Mejdalani 2005, Ceotto et al. 2007, Leal et al. 2009, Felix and Mejdalani 2011, Silva et al. 2015, and Leal et al. 2020) and none of them are dedicated specifically to the genus *Dasmeusa*.

In the present paper, we redescribe the genus *Dasmeusa* and describe four new species. All previously known species are redescribed, including new diagnostic morphological characters (with the exception of *D. imperialis* because it was recently described). *Dasmeusa flavescens* Metcalf, 1955 and *Erythrogonia bicolor* Metcalf, 1949 are herein considered junior synonyms of the type-species *Dasmeusa pauperata* (Fabricius, 1803). We also provide an identification key to males, a list of the valid species, and a map showing their distribution. Morphological data are employed to investigate the phylogenetic relationships among the species of *Dasmeusa*; our outgroups include six genera of the *Paromenia* group. Scanning electron microscopy (SEM) was employed for a detailed study of the integument of the type-species, including sensilla, surface sculpturing, brochosomes, organ of Evans, and various other structures.

## 2. Material and methods

### 2.1. Specimens examined

The studied specimens belong to the following institutions: Coleção Entomológica Pe. Jesus Santiago Moure, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba (**DZUP**); Coleção Entomológica Prof. José Alfredo Pinheiro Dutra, Departamento de Zoologia,

Universidade Federal do Rio de Janeiro, Rio de Janeiro (**DZRJ**); Coleção de Invertebrados, Instituto Nacional de Pesquisas da Amazônia, Manaus (**INPA**); Departamento de Entomologia, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro (**MNRJ**); Coleção Entomológica, Museu Paraense Emílio Goeldi, Belém (**MPEG**); Serviço de Entomologia, Museu de Zoologia, Universidade de São Paulo, São Paulo (**MZSP**); and Zoologische Abteilung, Naturhistorisches Museum Wien, Vienna (**NHMW**). In quotations of label data, a reversed virgule (\) separates lines on a label. Using the online tool SimpleMapp (Shorthouse 2010), we prepared an updated map to show the known distribution of *Dasmeusa* species in South America. Records were obtained from specimens deposited in the collections mentioned above, as well as from the literature (Young 1977; Zanol and de Menezes 1982; Basset 1999; Cavichioli and Chiamolera 1999; McKamey 2007; Wilson et al. 2009; Pecly et al. 2019).

## 2.2. Terminology and techniques for preparation of specimens

The morphological terminology adopted here followed mainly Young (1968, 1977, 1986), except for the head (Hamilton 1981; Mejdalani 1993, 1998) and female terminalia (Nielson 1965; Hill 1970). Use of the term paraphyses (plural; singular: paraphysis) for *Dasmeusa*, as well as for other sharpshooter genera, followed Young (1977: 291), who employed the plural for biramous structures like the ones treated here. Use of the term gonoplac followed Mejdalani (1998). The total length of specimens was measured from the apex of the crown to the tips of the forewings at rest position (Young 1977). Techniques for preparation of genital structures followed mainly those of Oman (1949) for males and Mejdalani (1998) for females. Dissected parts were stored in small vials with glycerin, as suggested by Young and Beirne (1958). Photographs of the body in dorsal view were taken with a Leica M205 C stereomicroscope and processed with LAS 4.6 software. Composite images created from the in-focus areas of the original photographs were produced by CombineZP, a free software developed by Alan Hadley (<http://combinezp.software.informer.com>). Photographs of the ovipositor valvulae were taken with a Leica DMC2900 light microscope and processed with LAS 4.6 software.

## 2.3. Abbreviations

### 2.3.1. Morphology

**Ap** = appendix; **Br** = brochosomes; **Cl** = clypeus; **Cs** = claval sulcus; **Cx** = coxa; **DEN** = denticle; **DSA** = dorsal sculptured area; **DUC** = duct; **Fe** = femur; **Fl** = flagellum; **Fr** = frons; **Fw** = forewing; **Ge** = gena; **La** = labium; **Lb** = labrum; **Lg** = laterotergite; **Me** = mesonotum;

**Mi** = microtrichia; **Ms** = maxillary stylet; **Mu** = muscle impression; **OE** = organ of Evans; **Om** = ommatidium; **Pe** = pedicel; **PPR** = preapical prominence; **RAM** = ramus; **Sb** = sensilla basiconica; **Sc** = s. coeloconica; **Scp** = scape; **Se** = setae; **Sp** = s. placodea; **Spi** = spiracle; **St** = s. trichodea; **TOO** = tooth; **Tr** = trochanter; **VID** = ventral interlocking device; **VLI** = valvifer I; **VSA** = ventral sculptured area.

### 2.3.2. Brazilian states

**AM** = Amazonas; **AP** = Amapá; **BA** = Bahia; **RR** = Roraima; **SE** = Sergipe.

## 2.4. Scanning electron microscopy (SEM)

The external morphology of *D. pauperata* was studied using scanning electron microscopy (SEM). Our descriptions of microstructures and sensilla followed mainly Evans (1973), Dietrich (1989), Gorb (2001), and Hao et al. (2016). Specimens were glued to an iron stub with double-sided tape, coated with gold, and analyzed in a JEOL JSM 6510 scanning electron microscope at Centro de Microscopia Eletrônica, Instituto de Biologia (Universidade Federal do Rio de Janeiro).

## 2.5. Taxon sampling and phylogenetic study

The ingroup consisted of nine species of *Dasmeusa*. Due to difficulties of associating females to accurately identified males of five species of the genus, females were not included in the phylogenetic analysis, unfortunately. Our outgroup choice was based on the *Paromenia* generic group proposed by Young (1977) based on raw morphological similarities, as well as on the unpublished parsimony analysis of this group conducted by Cavichioli (1992). Generic groups suggested by Young (1977) were used in other phylogenetic analyses of genera of the Cicadellini (*Draeculacephala* Ball, 1901: Dietrich 1994; *Parathona* Melichar, 1926: Cavichioli 1997; *Lissoscarta* Stål, 1869: Felix 1999; *Balacha* Melichar, 1926: Takiya and Mejdalani 2004, Quintas et al. 2020; *Scoposcartula* Young, 1977: Leal et al. 2009; *Apogonalia* Evans, 1947: Felix and Mejdalani 2011; *Subrasaca* Young, 1977: Silva et al. 2015; and *Scopogonalia* Young, 1977: Leal et al. 2020). Accordingly, our outgroups are six representatives of the *Paromenia* generic group, viz., *Paromenia auroguttata* (Signoret, 1853), *Onega bracteata* Young, 1977, *Jozima leucopa* (Walker, 1858), *Sailerana solitaria* (Signoret, 1853), *Tacora johanni* Mejdalani, Silva and Garcia, 2011, and *Jeepiulus flavus* Cavichioli, 2000. The number of specimens examined of each terminal taxon, their geographical distribution, and collections are listed in Table 1.

**Table 1.** Taxa included in the phylogenetic analysis of *Dasmeusa* and outgroups. The number of males examined, their collections, and geographical distribution are provided for each species.

Species	Specimens	Collection	Country (state, province, or department)
<i>Paromenia auroguttata</i>	1	DZRJ	Brazil (Rio de Janeiro)
<i>Onega bracteata</i>	1	DZRJ	Ecuador (Napo)
<i>Jozima leucopa</i>	2	DZRJ	Brazil (Amazonas)
<i>Sailerana solitaris</i>	2	INPA, DZRJ	Brazil (Amazonas)
<i>Tacora johanni</i>	2	INPA, DZRJ	Brazil (Roraima)
<i>Jeepiulus flavus</i>	3	DZRJ, DZUP	Brazil (Mato Grosso)
<i>Dasmeusa basseti</i>	3	DZRJ, DZUP	French Guiana (Laussat, Montagne des Chevaux), Guyana (Mabura Hill)
<i>Dasmeusa dinizi</i>	3	DZRJ	French Guiana (Laussat, Montagne des Chevaux)
<i>Dasmeusa falcifera</i>	3	DZRJ	French Guiana (Laussat, Montagne des Chevaux)
<i>Dasmeusa imperialis</i>	3	INPA, DZRJ, MNRJ	Brazil (Amazonas)
<i>Dasmeusa isabellina</i>	2	DZUP, MNRJ	Brazil (Pará)
<i>Dasmeusa mendica</i>	3	DZRJ, DZUP	French Guiana (Montagne des Chevaux, Réserve Naturelle de la Trinité)
<i>Dasmeusa oriximina</i>	1	DZRJ	Brazil (Pará)
<i>Dasmeusa pauperata</i>	3	INPA, DZRJ, DZUP	Brazil (Amazonas, Bahia, Roraima)
<i>Dasmeusa rafaeli</i>	3	INPA, DZRJ	Brazil (Amazonas)

## 2.6. Character coding

Morphological characters of the head, thorax, and male terminalia were identified based on their topographical identity before proposing hypotheses of primary homology, i.e., character state identity (De Pinna 1991; Brower and Schawaroch 1996; Brower and De Pinna 2012), that were coded in the unpolarized data matrix (Nixon and Carpenter 1993). The order of transformation of character states was established a posteriori by the rooting procedure (see section 2.7 below). The matrix (Appendix 1) was assembled using the software Mesquite (Maddison and Maddison 2021). Character statements were composed considering the four fundamental functional components proposed by Sereno (2007), viz., locator, variable, variable qualifier (when needed), and character states. Most characters were transformational but some were neomorphic (Sereno 2007). Missing data were coded as ‘-’. Characters, as well as their consistency index (ci) and retention index (ri) (except for uninformative characters), are listed in the results of the phylogenetic analysis.

## 2.7. Cladistic analysis

The implicit enumeration algorithm of TNT was used for estimating most parsimonious trees (Goloboff et al. 2008). The outgroup *Sailerana solitaris* was employed for rooting the trees. Multistate characters were treated as unordered (Fitch parsimony). We carried out an equal weights search and an implied weighting search (Goloboff 1993), the latter with  $k = 3$ . The strict consensus method was employed to summarize all resulting most parsimonious trees from the equal weights analysis. Branch support was calculated using absolute decay indices (Bremer 1994) and the non-parametric bootstrap method with 1000 pseudoreplicates (Felsenstein 1985). Autapomorphic characters were included in the data ma-

trix, as suggested by Yeates (1992). Character states were optimized onto the preferred tree using Winclada, ver. 1.00.08 (Nixon 2002).

## 3. Results

### 3.1. Taxonomy

#### 3.1.1. Genus *Dasmeusa* Melichar, 1926

Figs 1–18

**Type-species.** *Cicada pauperata* Fabricius, by subsequent designation of China (1938: 183).

**Diagnosis.** Specimens preserved in collections usually pale yellow; whitish-yellow to greenish-yellow in life; forewing with preapical area with irregular orange transverse band or with second apical cell with distinct red spot. Head moderately to strongly produced anteriorly; coronal suture distinct, elongate, extending anteriorly beyond interocellar line; frons, in lateral view, with inferior third slightly angulate. Pronotum with lateral margins convergent anteriorly; posterior margin rectilinear. Forewing subhyaline; apex slightly expanded and obliquely truncate; with four apical cells, base of fourth approximately aligned with base of third; costal apical cell broadened posteriorly. Male terminalia with pygofer bearing basiventral lobe; without processes; subgenital plate triangular, not fused basally to its counterpart; style without preapical lobe; aedeagus with shaft short, usually with single process, rarely with pair of processes; paraphyses present, biramous, with or without processes on stalk. Female terminalia with sternite VII well produced posteriorly; pygofer well produced posteriorly; valvula I abruptly narrowed apically, with ventroapical margin

somewhat sinuous and apex acute; valvula II with dorsal margin convex, teeth non-contiguous, mostly subtriangular. See systematic notes after the generic description and section 4.3 of the discussion for additional information on the identification of the genus.

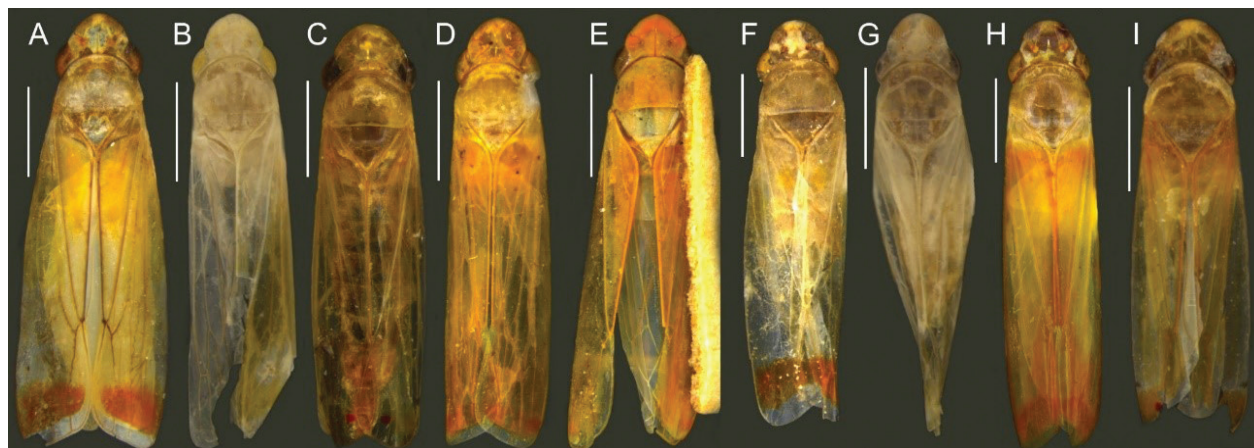
**Description. Length.** ♂♂ 7.4–10.8 mm; ♀♀ 8.4–10.3 mm. **Head:** in dorsal view, moderately to strongly produced anteriorly; median length of crown varying from 5/10 to 9/10 of interocular width and from 4/10 to 6/10 of transocular width; anterior margin generally rounded; without carina at transition from crown to face; coronal suture distinct, elongate, extending anteriorly beyond interocellar line; frontogenal suture extending onto crown and usually attaining ocellus; ocelli large or of moderate size, located approximately on imaginary line between anterior eye angles, or slightly before or slightly behind this line, each ocellus approximately equidistant between median line of crown and adjacent eye angle; antennal ledge, in dorsal view, varying from not protuberant to slightly protuberant; in lateral view, with anterior margin oblique and convex. Frons, in anterior view, convex; median area mostly smooth; muscle impressions distinct; in lateral view, inferior third slightly angulate; epistomal suture incomplete medially; clypeus, in lateral view, convex, continuing inferior contour of frons. **Thorax:** pronotum, in dorsal view, with width slightly greater than or approximately equal to transocular width of head; lateral margins convergent anteriorly; posterior margin rectilinear; dorsolateral carina complete, rectilinear, declivent anteriorly; disk without pubescence or punctures. Mesonotum with scutellum not transversely striate and without punctures. Forewing with membrane indistinct; veins not elevated; apex slightly expanded and obliquely truncate; with four apical cells, base of fourth approximately aligned with base of third; with three closed antepical cells, their bases located more proximally than claval apex; costal apical cell broadened posteriorly; without antepical plexus of veins; texture subhyaline. Hind wing with vein  $R_{2+3}$  incomplete. Hind leg with femoral setal formula 2:1:1; first tarsomere longer than combined length of two more distal tarsomeres, with two longitudinal parallel rows of small setae on plantar surface. **Coloration:** head, pronotum, mesonotum, forewings, and legs of preserved specimens usually yellow (whitish-yellow to greenish-yellow in life); preapical area of each forewing with irregular orange transverse band or with distinct red spot on second apical cell. **Male terminalia:** pygofer, in lateral view, moderately to strongly produced posteriorly; with basiventral lobe; without processes; anteroventral margin with distinct group of microsetae. Subgenital plate, in ventral view, not fused basally to its counterpart; not extending as far posteriorly as pygofer apex. Connective, in dorsal view, usually T-shaped, rarely V-shaped; arms broad. Style, in dorsal view, without preapical lobe. Aedeagus, in lateral view, with shaft usually short and bearing single ventral process, more rarely with pair of processes or with apical digitiform projection. Paraphyses present, symmetrical or slightly asymmetrical, with or without processes on

stalk. **Female terminalia:** sternite VII, in ventral view, well produced posteriorly; narrowing gradually towards apex. “Internal” sternite VIII, in dorsal view, usually without sclerotized areas. Pygofer, in lateral view, well produced posteriorly; posterior margin narrowly rounded to subacute; macrosetae distributed mostly on posterior half. Valvula I, in lateral view, abruptly narrowed apically, ventroapical margin somewhat sinuous, apex acute; dorsal sculptured area extending from basal portion to apex of blade, formed mostly by scale-like processes arranged in oblique lines (strigate); ventral sculptured area restricted to apical portion of blade, formed mostly by scale-like processes; base of valvula forming lobe directed anterad; ventral interlocking device located on basal third or basal half of blade. Valvula II, in lateral view, with dorsal margin convex; blade with about 45 to 60 non-contiguous, mostly subtriangular teeth; preapical prominence distinct; apex obtuse; denticles distributed on teeth and on dorsal and ventral apical portions of blade (ventral dentate apical portion longer than dorsal portion); valvula with ducts extending towards teeth and apical area. Gonoplac of the usual Cicadellinae type: in lateral view, with basal half narrow; apical half expanded, gradually narrowing towards apex; latter obtuse.

**Systematic notes.** According to the results of our cladistic analysis, the genus *Dasmeusa* can be distinguished from other members of the *Paromenia* group, as well as from other sharpshooters, by a combination of the following synapomorphic traits: (1) posterior margin of pronotum rectilinear (Fig. 8A); (2) apex of forewing obliquely truncate (Fig. 8B); (3) base of fourth apical cell of forewing approximately aligned with base of third apical cell (Fig. 8B); (4) anteroventral margin of male pygofer with distinct group of microsetae (Fig. 3B) (this character state is present in all known species of the genus; however, it was not illustrated herein for all of them because the delicate setae are sometimes not adequately preserved after the preparation of specimens in 10% KOH); (5) presence of paraphyses (Fig. 8G–I).

### 3.1.2. Species included in *Dasmeusa* (Fig. 1)

- D. basseti* Cavichioli & Chiamolera, 1999. French Guiana [new record] and Guyana.
- D. dinizi* Peely, Takiya, Cavichioli & Mejdalani **sp. nov.** French Guiana.
- D. falcifera* Peely, Takiya, Cavichioli & Mejdalani **sp. nov.** French Guiana.
- D. imperialis* Peely, Takiya & Mejdalani, 2019. Brazil (Amazonas State).
- D. isabellina* Cavichioli & Chiamolera, 1999. Brazil (Pará State).
- D. mendica* Young, 1977. French Guiana and Guyana.
- D. oriximina* Peely, Takiya, Cavichioli & Mejdalani **sp. nov.** Brazil (Pará State).
- D. pauperata* (Fabricius, 1803), type-species. Brazil (Roraima, Amazonas, Pará, Sergipe, and Bahia states), French Guiana, Guyana, and Suriname.
- D. rafaeli* Peely, Takiya, Cavichioli & Mejdalani **sp. nov.** Brazil (Amazonas State) and Guyana.



**Figure 1.** Species of *Dasmeusa*, body in dorsal view (antennae and legs not depicted). **A** *D. basseti*, **B** *D. dinizi* sp. nov., **C** *D. falcifera* sp. nov., **D** *D. imperialis*, **E** *D. isabellina*, **F** *D. mendica*, **G** *D. oriximina* sp. nov., **H** *D. pauperata* (type-species), **I** *D. rafaeli* sp. nov. Scale bars: 2 mm.

### 3.1.3. Key to males of *Dasmeusa*

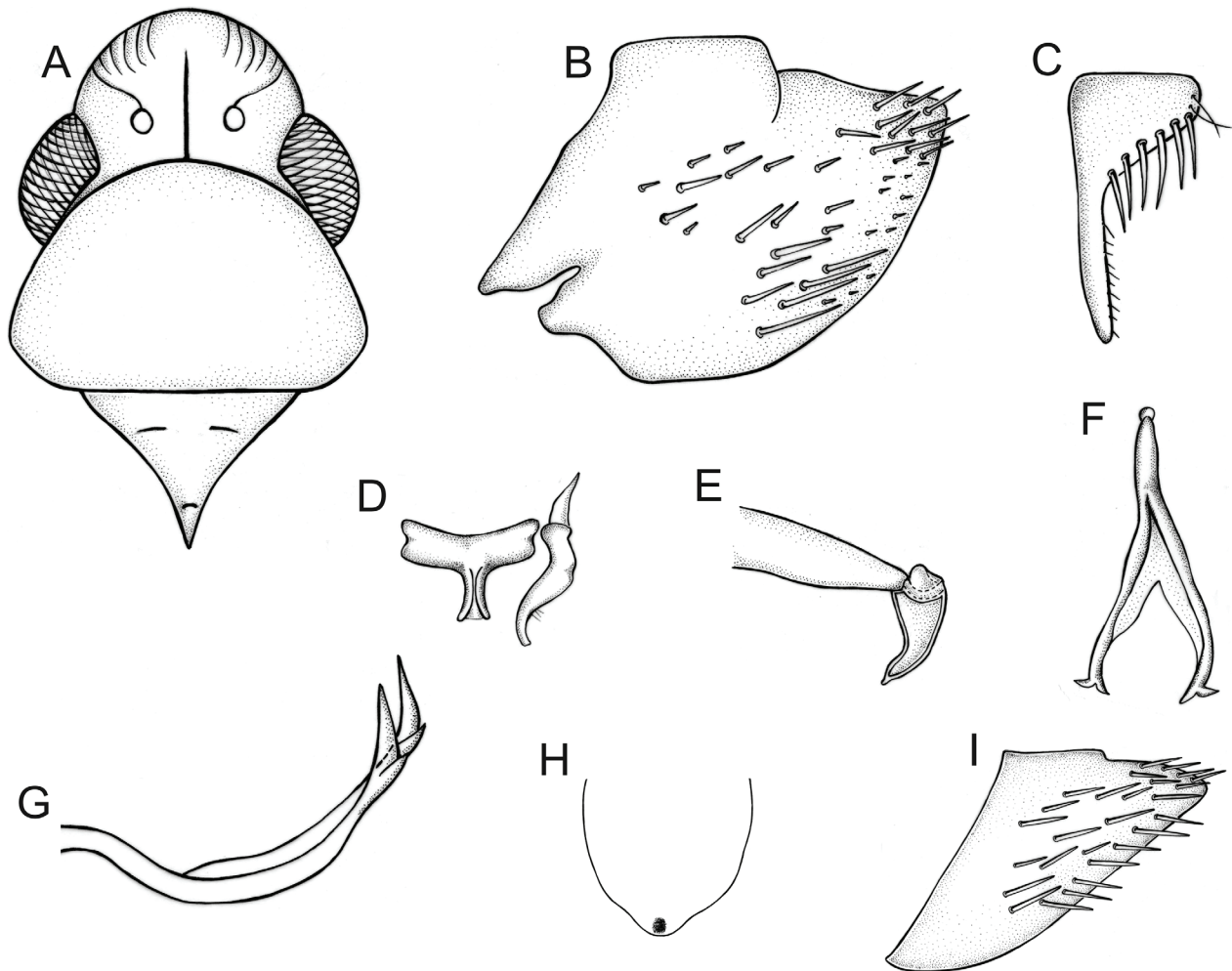
- 1 Forewing with orange tinge (Fig. 1E); pygofer with posterior margin obliquely truncate (Fig. 5B); paraphyses with stalk, in lateral view, distinctly broadened apically (Fig. 5G) ..... *D. isabellina* Cavichioli & Chiamolera
- 1' Without above combination of features ..... 2
- 2 Forewing with small red spot near apex (Fig. 1C, I); connective with stalk much longer than one arm width (Figs 4D, 12E) ..... 3
- 2' Forewing without small red spot near apex; connective with stalk subequal or shorter than one arm width (Figs 2D, 3D, 5D, 6D, 7D, 8D) ..... 4
- 3 Pygofer strongly produced posteriorly (Fig. 4B); aedeagus with shaft only slightly curved ventrally, bearing ventral dentiform process at basal half (Fig. 4E); paraphyses with apical portion of rami, in lateral view, curved dorsally (Fig. 4G) ..... *D. falcifera* sp. nov.
- 3' Pygofer moderately produced posteriorly (Fig. 12B); aedeagus with shaft strongly curved ventrally, not bearing ventral dentiform process at basal half (Fig. 12F); paraphyses with apical portion of rami, in lateral view, straight (Fig. 12H) ..... *D. rafaeli* sp. nov.
- 4 Aedeagus with large ventral lobe and dorsoapical digitiform projection (Fig. 8F); paraphyses with rami strongly divergent (Fig. 8G, H) ..... *D. pauperata* (Fabricius)
- 4' Terminalia not as above ..... 5
- 5 Paraphyses without processes on stalk (Figs 2F, G, 6G, H); ventral margin of aedeagal shaft completely produced into robust process directed ventrally (Fig. 2E) or without such a process (Fig. 6E) ..... 6
- 5' Paraphyses with processes on stalk (Figs 3F, G, 7F, G); ventral margin of aedeagal shaft with preapical portion produced into robust process directed ventrally (Figs 3E, 7E) ..... 7
- 6 Aedeagus with pair of small, ventral preapical sclerotized dentiform processes (Fig. 6E, F); paraphyses rami with apex acute (Fig. 6G, H) ..... *D. mendica* Young
- 6' Aedeagus with whole ventral margin produced into a single, strong, slightly bifid process directed ventrally (Fig. 2E); paraphyses rami with apex bifurcate (Fig. 2F) ..... *D. basseti* Cavichioli & Chiamolera
- 7 Paraphyses with processes of stalk strongly developed (Fig. 7G) ..... *D. oriximina* sp. nov.
- 7' Paraphyses with processes of stalk small (Fig. 3G) ..... 8
- 8 Paraphyses with single pair of processes on stalk, located dorsoapically, and rami slightly curved inwardly in dorsal view (Pecly et al. 2019: fig. 6) ..... *D. imperialis* Pecly, Takiya & Mejdalini
- 8' Paraphyses with two pairs of processes on stalk, one located dorsally at apical third and another ventrally at apex (Fig. 3F, G), and rami subparallel in dorsal view (Fig. 3F) ..... *D. dinizi* sp. nov.

### 3.1.4. Species descriptions

#### 3.1.4.1. *Dasmeusa basseti* Cavichioli & Chiamolera, 1999

Figs 1A, 2A–I

**Length.** ♂ paratypes 8.8–9.2 mm (n = 2); ♀ paratype 9.6 mm; ♂♂ 8.8–9.2 mm (n = 3). **Head** (Figs 1A, 2A): in dorsal view, well produced anteriorly; median length of crown approximately 7/10 of interocular width and 4/10 of transocular width; anterior margin rounded; ocelli large, located approximately on imaginary line between



**Figure 2.** *Dasmeusa basseti* Cavichioli & Chiamolera, 1999. **A–G** Male. **A** head, pronotum, and mesonotum, dorsal view; **B** pygofer, lateral view; **C** subgenital plate, ventral view; **D** connective and style, dorsal view; **E** ejaculatory bulb and aedeagus, lateral view; **F** paraphyses, dorsal view; **G** paraphyses, lateral view; **H–I** female; **H** sternite VII, ventral view; **I** pygofer, lateral view.

anterior eye angles; surface of crown concave; antennal ledge, in dorsal view, not protuberant. **Thorax** (Figs 1A, 2A) with pronotum, in dorsal view, with width slightly greater than transocular width of head. Forewing with base of fourth apical cell approximately aligned with base of third; forewing of female, in rest position, exceeding apex of ovipositor.

**Coloration (Fig. 1A).** Head, pronotum, and mesonotum light brown; ocelli orange. Forewing pale yellow, translucent, with veins light brown, preapical area with irregular, orange transverse band. Face, lateral and ventral portions of thorax, and legs mostly light brown.

**Male terminalia.** Pygofer (Fig. 2B), in lateral view, with posterior margin obliquely truncate superiorly and rounded inferiorly, apex obtuse; macrosetae distributed mostly on posterior half but some located more anteriorly. Subgenital plate (Fig. 2C), in ventral view, with basal half broad and distal half very narrow; with elongate uniseriate macrosetae on basal half, microsetae distributed along outer lateral margin. Connective (Fig. 2D), in dorsal view, T-shaped; stalk carinate dorsally, subequal in length to one arm width. Style (Fig. 2D), in dorsal view, slender,

elongate, extending posteriorly beyond apex of connective; apex narrow, directed ventrally, truncate. Aedeagus (Fig. 2E) symmetrical; shaft short; whole ventral margin of shaft produced into strong, slightly bifid process directed ventrally, posterior margin of process smooth; gonoduct distinct, curved, gonopore located apically. Paraphyses slightly asymmetrical, elongate, extending well beyond subgenital plate apex; stalk shorter than rami; in dorsal view (Fig. 2F), rami fused to each other along their basal halves (each bifurcate at apex; in lateral view (Fig. 2G), stalk arched dorsally, rami directed dorsally, narrower along apical half.

**Female.** Terminalia with sternite VII (Fig. 2H), in ventral view, with posterior margin narrowly rounded. Pygofer (Fig. 2I), in lateral view, with posterior margin narrowly rounded; macrosetae distributed on posterior portion and extending anteriorly along ventral margin. Valvula I, in lateral view, with ventral interlocking device located on basal third of blade. Valvula II, in lateral view, with about 47 non-contiguous teeth.

**Material examined.** French Guiana [new record] • 1 ♂: “FRENCH GUIANA: Laussat \ P3 \ 05°28'31.6"N – 053°35'07.3"W \ 30.IX.2010

\ Lamarre G. Leg"; "White sand forest \ Vitre trap (V 7)" (DZRJ) • 1 ♂: "FRENCH GUIANA: Montagne \ des Chevaux \ 4°44'56"N - 52°26'28"W, alt. 75 m \ 14.viii.2011 \ Malaise trap \ SEAG col." (DZRJ) • 1 ♂: "FRENCH GUIANA: Montagne \ des Chevaux \ 4°44'56"N - 52°26'28"W, alt. 75 m \ 09.viii.2011 \ window trap \ SEAG col." (MNRJ) • 1 ♂: "FRENCH GUIANA: Montagne \ des Chevaux \ 4°44'56"N - 52°26'28"W, alt. 75 m \ 24.iii.2012 \ Malaise trap \ SEAG col." (MNRJ). Guyana • 1 ♂ **paratype**: "#CICA00476 \ Pentaclethra macroloba [host-plant] \ Camoudi 11-03-1997"; "Hand collecting/beatng \ Station 2616 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll." (DZUP) • 1 ♂: "#CICA 076 \ Pentaclethra macroloba \ Camoudi 21/4/1997"; "Hand collecting/beatng \ Station 6069 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset Coll."; "3193" (DZUP) • 1 ♂ **paratype**: "#CICA00476 \ Catostemma fragrans [host-plant] \ Camoudi 11-3-1997"; "Hand collecting/beatng \ Station 4126 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll." (DZUP) • 1 ♀ **paratype**: "#CICA00476 \ Catostemma fragrans \ Camoudi 9-05-1997"; "Hand collecting/beatng \ Station 3557 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll." (DZUP) • 1 ♀ **paratype**: "#CICA 076 \ Catostemma fragrans \ Camoudi 24-10-1997"; "Hand collecting/beatng \ Station 2476-1 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "9864" (DZUP) • 1 ♀ **paratype**: same data as preceding except "29-11-1996"; "Station 3273"; "2572" (DZUP) • 1 ♀ **paratype**: "#CICA 076 \ Eperua rubiginosa [host-plant] \ Camoudi 24-10-1997"; "Hand collecting/beatng \ Station 2551-2 \ On seedlings trees"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "6916" (DZUP) • 1 ♂ **paratype**: "#CICA 076 \ Eperua rubiginosa \ Camoudi 16-9-1997"; "Hand collecting/beatng \ Station 4184 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "9556" (DZUP) • 1 ♀ **paratype**: same data as preceding except "12-6-1997"; "Station 5473"; "6208" (DZUP).

**Taxonomic notes.** Cavichioli and Chiamolera (1999) considered the habitus of *D. basseti* (Fig. 1A) similar to that of *D. pauperata* (Fig. 1H), whereas they regarded the male terminalia similar to those of *D. isabellina*, mainly due to the shape of the aedeagus (Figs 2E, 5E). However, *D. basseti* can be easily distinguished from these two species by the paraphyses (Fig. 2F, G) with the rami fused to each other along their basal halves, each one bifurcate at apex.

### 3.1.4.2. *Dasmeusa dinizi* Pecly, Takiya, Cavichioli & Mejdalani sp. nov.

<https://zoobank.org/D83BA1EF-A99A-491E-824F-AF447F59D486>

Figs 1B, 3A–G

**Length.** ♂ holotype 8.4 mm; ♂ paratypes 8.0–8.4 mm (n = 3). **Male holotype. Head** (Figs 1B, 3A): in dorsal view, strongly produced anteriorly; median length of crown approximately 9/10 of interocular width and 4/10 of transocular width; anterior margin rounded; ocelli large, located approximately on imaginary line between anterior eye angles; surface of crown slightly concave; antennal ledge, in dorsal view, slightly protuberant. **Thorax** (Figs 1B, 3A) with pronotum, in dorsal view, with

width slightly greater than transocular width of head. Forewing with base of fourth apical cell approximately aligned with base of third; with three anteapical cells, their bases obscure.

**Coloration (Fig. 1B).** Head, pronotum, mesonotum, and legs pale yellow. Forewing pale yellow, translucent, preapical area with irregular orange transverse band.

**Male terminalia.** Pygofer (Fig. 3B), in lateral view, with posterior margin rounded; macrosetae distributed mostly on posterior half but some located more anteriorly. Subgenital plate (Fig. 3C), in ventral view, with basal half broad and distal half very narrow; with elongate uniseriate macrosetae on basal half, microsetae distributed along outer lateral margin. Connective (Fig. 3D), in dorsal view, T-shaped; stalk carinate dorsally, shorter than one arm width. Style (Fig. 3D), in dorsal view, slender, extending posteriorly beyond apex of connective; narrowed apically, apex obtuse. Aedeagus (Fig. 3E) symmetrical; shaft short; ventral margin of shaft with preapical portion produced into robust process directed ventrally, posterior margin of process dentate; gonoduct distinct, gonopore located dorsoapically. Paraphyses slightly asymmetrical, articulated with apex of connective; elongate, extending well beyond subgenital plate apex; stalk longer than rami; in dorsal view (Fig. 3F), stalk long and robust, with pair of small dorsal processes on apical third and pair of small ventroapical processes; in lateral view (Fig. 3G), stalk slightly sinuous; rami slender, directed dorsally, narrowing towards apex.

**Female unknown.**

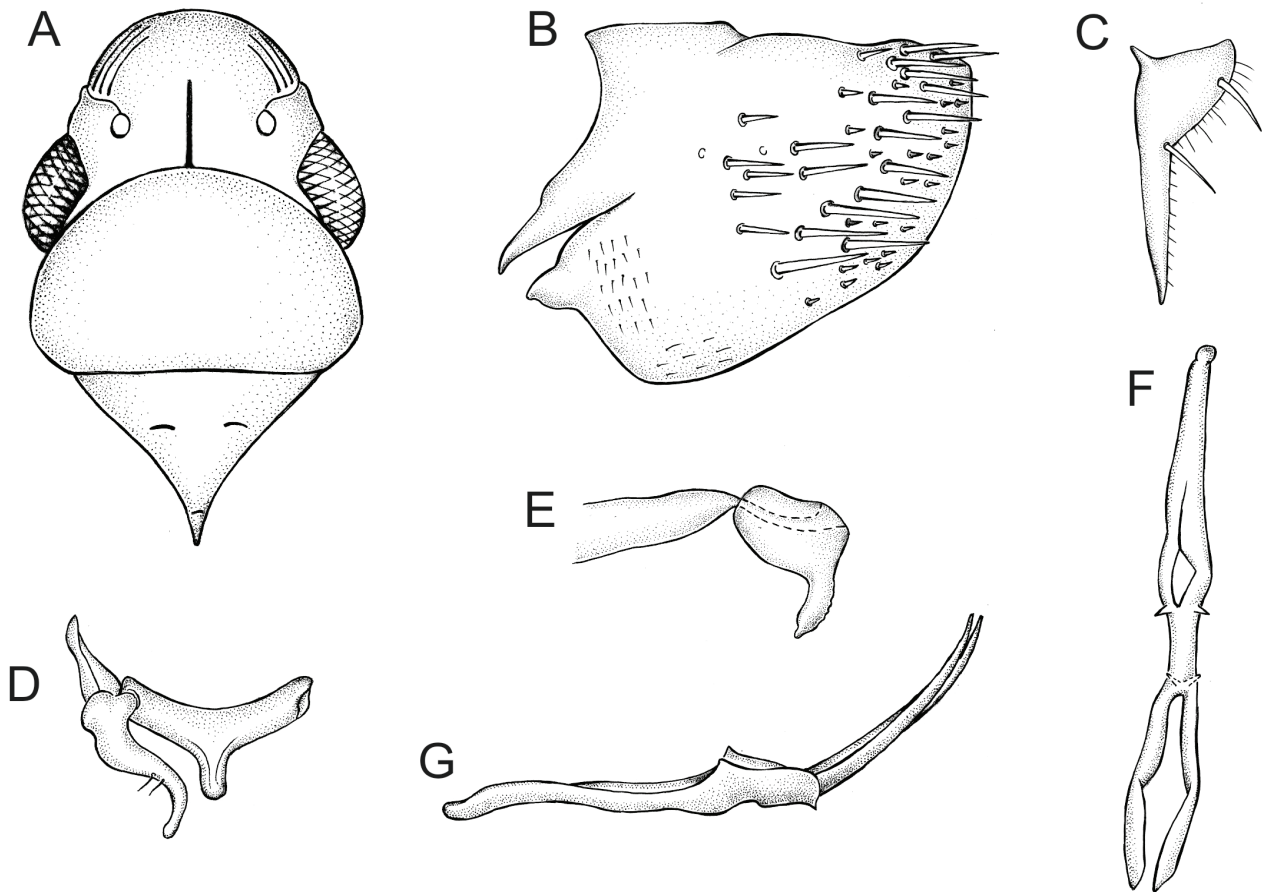
**Etymology.** The name of the new species, *dinizi*, refers to the biologist André Luis Diniz Ferreira, in recognition of his friendship to the first author and contribution as a skilled insect collector.

**Type locality.** Laussat (French Guiana).

**Type material.** French Guiana • ♂ **holotype**: "French Guiana: Laussat \ P3 \ 05°28'31.6"N-053°35'07.3"W \ 12.ix.2010 \ Lamarre G. leg"; "White sand forest \ Light trap" (DZRJ). **Paratypes** • 2 ♂♂: same data as the holotype (DZRJ) • 1 ♂: "FRENCH GUIANA: Montagne \ des Chevaux \ 4°44'56"N - 52°26'28"W, alt. 75 m \ 26.vi.2011 \ window trap \ SEAG col." (MNRJ).

**Taxonomic notes.** *Dasmeusa dinizi* sp. nov. (Fig. 1B) is similar to *D. oriximina* sp. nov. (Fig. 1G). These species share many similarities in the male terminalia, especially in the aedeagus and paraphyses. However, *D. dinizi* can be recognized by the two pairs of small processes on the paraphyses stalk (Fig. 3G), one located dorsally at the base of the apical third and another ventrally at the apex.





**Figure 3.** *Dasmeusa dinizi* sp. nov., male. **A** Head, pronotum, and mesonotum, dorsal view; **B** pygofer, lateral view; **C** subgenital plate, ventral view; **D** connective and style, dorsal view; **E** ejaculatory bulb and aedeagus, lateral view; **F** paraphyses, dorsal view; **G** paraphyses, lateral view.

### 3.1.4.3. *Dasmeusa falcifera* Pecty, Takiya, Cavichioli & Mejdalani sp. nov.

<https://zoobank.org/68E07731-F7E3-491B-AFAA-282553964E22>

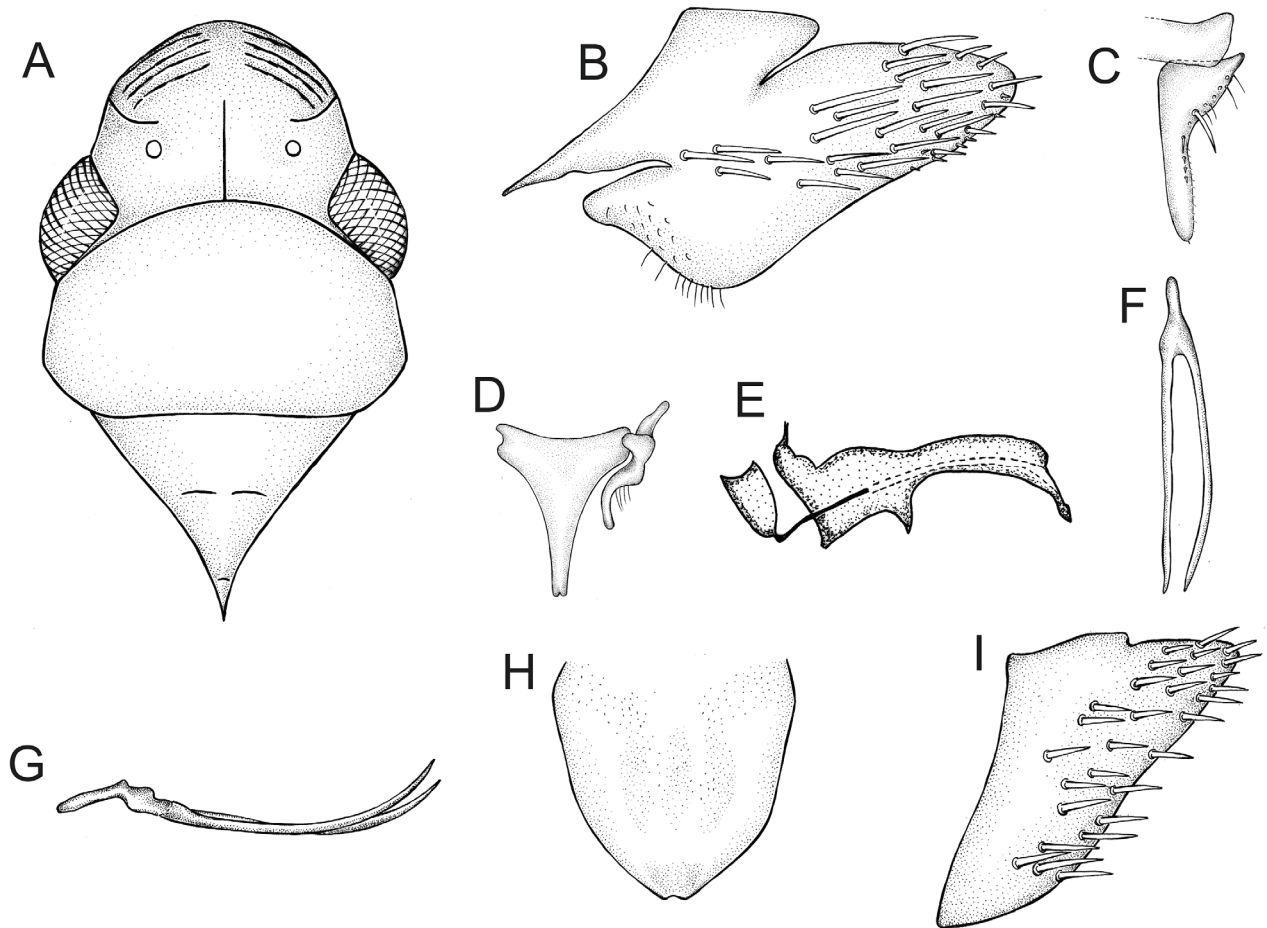
Figs 1C, 4A–I

**Length.** ♂ holotype 7.4 mm; ♂ paratype 8.0 mm; ♀ paratypes 8.4–9.3 mm (n = 3). **Male holotype. Head** (Figs 1C, 4A): in dorsal view, well produced anteriorly; median length of crown approximately 8/10 of interocular width and 5/10 of transocular width; anterior margin narrowly rounded; frontogenal suture extending onto crown but not attaining ocellus; ocelli of moderate size, located approximately on imaginary line between anterior eye angles; surface of crown flat; antennal ledge, in dorsal view, not protuberant. **Thorax** (Figs 1C, 4A) with pronotum, in dorsal view, with width approximately equal to transocular width of head; lateral margins slightly convergent anteriorly. Forewing with base of fourth apical cell approximately aligned with base of third.

**Coloration (Fig. 1C).** Head, pronotum, and mesonotum pale yellow. Forewing pale yellow, second apical cell with distinct red spot.

**Male terminalia.** Pygofer (Fig. 4B), in lateral view, well produced posteriorly; posterior margin narrowly rounded; macrosetae (most of them very large) distributed on posterior half but some located more anteriorly. Subgenital plate (Fig. 4C), in ventral view, with basal half broad and distal half very narrow; with elongate uniseriate macrosetae on basal half, microsetae distributed along outer lateral margin. Connective (Fig. 4D), in dorsal view, V-shaped; stalk not carinate dorsally, much longer than one arm width. Style (Fig. 4D), in dorsal view, slender, elongate, not extending posteriorly beyond apex of connective; slightly narrowed apically, apex obtuse. Aedeagus symmetrical (Fig. 4E); in lateral view, shaft elongate, ventral margin with dentiform process at basal half and elongate process at apex; gonoduct distinct, gonopore located apically. Paraphyses, in dorsal view (Fig. 4F), slightly asymmetrical; elongate, extending well beyond subgenital plate apex; stalk much shorter than rami; in lateral view (Fig. 4G), rami with apexes slightly directed upwards.

**Female terminalia.** Sternite VII (Fig. 4H), in ventral view, with posterior margin slightly emarginate. Pygofer (Fig. 4I), in lateral view, with posterior margin narrowly rounded; macrosetae distributed mostly on posterior half. Valvula I, in lateral view, with ventral interlocking device



**Figure 4.** *Dasmeusa falcifera* sp. nov. A–G Male. **A** head, pronotum, and mesonotum, dorsal view; **B** pygofer, lateral view; **C** valve and subgenital plate, ventral view; **D** connective and style, dorsal view; **E** ejaculatory bulb and aedeagus, lateral view; **F** paraphyses, dorsal view; **G** paraphyses, lateral view; **H–I** female; **H** sternite VII, ventral view; **I** pygofer, lateral view.

located on basal half of blade. Valvula II, in lateral view, with about 60 non-contiguous teeth.

**Etymology.** The name of the new species, *falcifera*, refers to the falciform aedeagus (Fig. 4E).

**Type locality.** Laussat (French Guiana).

**Type material.** French Guiana • ♂ **holotype**: “French Guiana: Laussat \ P3 \ 05°28'31.6"N - 053°35'07.3"W \ 12.ix.2010 \ Lamarre G. leg.”; “White sand forest \ Light trap” (DZRJ). **Paratypes** • 1 ♂: “FRENCH GUIANA: Montagne \ des Chevaux \ 4°44'56"N - 52°26'28"W, alt. 75 m \ 10.v.2011 \ window trap \ SEAG col.” (DZRJ) • 2 ♀♀: same data as preceding except “17.iv.2011” (DZRJ) • 1 ♀: “23.vii.2011” (DZRJ).

**Taxonomic notes.** As mentioned in the key, *D. falcifera* sp. nov. (Fig. 1C) shares with *D. rafaelli* sp. nov. (Fig. 1I) the presence of a distinct red spot at the second apical cell of the forewing. The former can be readily distinguished from the latter, as well as from the remaining known species of the genus, by paraphyses with the apical portion of the rami, in lateral view, directed dorsally (Fig. 4G) and pygofer well produced posteriorly and with the posterior margin narrowly rounded (Fig. 4B).

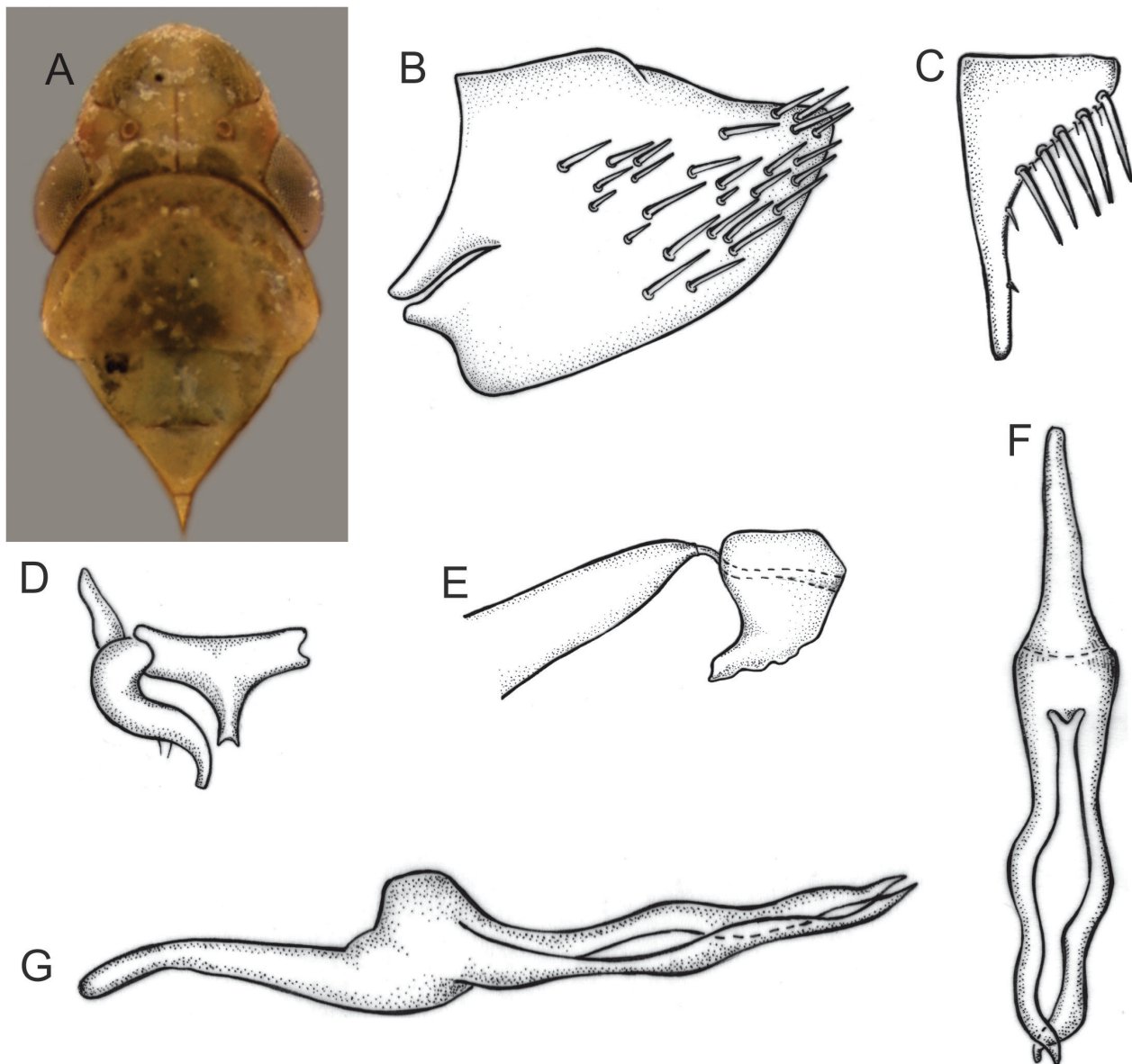
#### 3.1.4.4. *Dasmeusa isabellina* Cavichioli & Chiamolera, 1999

Figs 1E, 5A–G

**Length.** ♂ paratype 8.4 mm; ♂ 7.8 mm. **Head** (Figs 1E, 5A): in dorsal view, strongly produced anteriorly; median length of crown approximately 9/10 of interocular width and 5/10 of transocular width; anterior margin rounded; ocelli large, located approximately on imaginary line between anterior eye angles; surface of crown flat; antennal ledge, in dorsal view, slightly protuberant; in lateral view, with anterior margin convex. **Thorax** (Figs 1E, 5A) with pronotum, in dorsal view, with width slightly greater than transocular width of head; lateral margins convergent anteriorly. Forewing with base of fourth apical cell approximately aligned with base of third.

**Coloration** (Fig. 1E). Head, pronotum, and forewing mostly orange; mesonotum dull white. Frons mostly orange; clypeus pale yellow. Remainder of face (gena and lorum) and lateral and ventral portions of thorax pale yellow; legs mostly pale yellow to orange.

**Male terminalia.** Pygofer (Fig. 5B), in lateral view, with posterior margin obliquely truncate; macrosetae distrib-



**Figure 5.** *Dasmeusa isabellina* Cavichioli & Chiamolera, 1999, male. **A** Head, pronotum, and mesonotum, dorsal view (male holotype, DZUP, UFPR); **B** pygofer, lateral view; **C** subgenital plate, ventral view; **D** connective and style, dorsal view; **E** ejaculatory bulb and aedeagus, lateral view; **F** paraphyses, dorsal view; **G** paraphyses, lateral view.

uted mostly on posterior third but some located more anteriorly. Subgenital plate (Fig. 5C), in ventral view, with basal third broad and distal two-thirds strongly narrowed; with elongate uniseriate macrosetae on basal third, microsetae distributed mostly along outer lateral margin. Connective (Fig. 5D), in dorsal view, T-shaped; stalk carinate dorsally, subequal in length to one arm width. Style (Fig. 5D), in dorsal view, somewhat S-shaped, slender, extending posteriorly beyond apex of connective; narrowed apically, apex obtuse. Aedeagus (Fig. 5E) symmetrical; shaft short, its whole ventral margin produced into strong process directed anteroventrally, posterior margin of process dentate; gonoduct distinct, gonopore located apically. Paraphyses slightly asymmetrical; elongate, extending well beyond subgenital plate apex; stalk shorter than rami (Fig. 5F) and, in lateral view, broadened posteriorly (Fig. 5G); rami, in lateral view, long and slender, their apexes spiniform (Fig. 5G).

#### Female unknown.

**Material examined.** Brazil, Pará State • 1 ♂: “Belterra – PA [Pará State] \ Faz. [Fazenda] Treviso \ 01-10/XII/2018 \ Marcela Monné \ Pedro S. Dias” (MNRJ) • 1 ♂ **paratype**: “Sta. [Santa] Isabel do Pará \ PA, Brasil \ 30.III.1962 \ J. Bechyné col.” (DZUP) • 1 ♂: “Canindé \ Rio Gurupi, PA \ IV.1963, Malkin \ & Pinheiros col.” (MZSP).

**Taxonomic notes.** Cavichioli and Chiamolera (1999) considered *D. isabellina* (Fig. 1E) similar to *D. basseti* (Fig. 1A) in the male terminalia, especially the aedeagus. These two species can be distinguished from each other by the shape of the apex of the paraphyses rami, which are bifurcated in *D. basseti* (Fig. 2F) and not bifurcated in *D. isabellina* (Fig. 5F). The dorsal region of the body (Fig. 1E) is somewhat more orange in *D. isabellina* than in other species of the genus.

### 3.1.4.5. *Dasmeusa mendica* Young, 1977

Figs 1F, 6A–H

**Length.** ♂♂ 9.2–9.6 mm (n = 3). **Head** (Figs 1F, 6A): in dorsal view, well produced anteriorly; median length of crown approximately 8/10 of interocular width and 5/10 of transocular width; anterior margin rounded; ocelli large, located approximately on imaginary line between anterior eye angles; surface of crown slightly concave; antennal ledge, in dorsal view, not protuberant. **Thorax** (Figs 1F, 6A) with pronotum, in dorsal view, with width slightly greater than transocular width of head. Forewing with base of fourth apical cell approximately aligned with base of third.

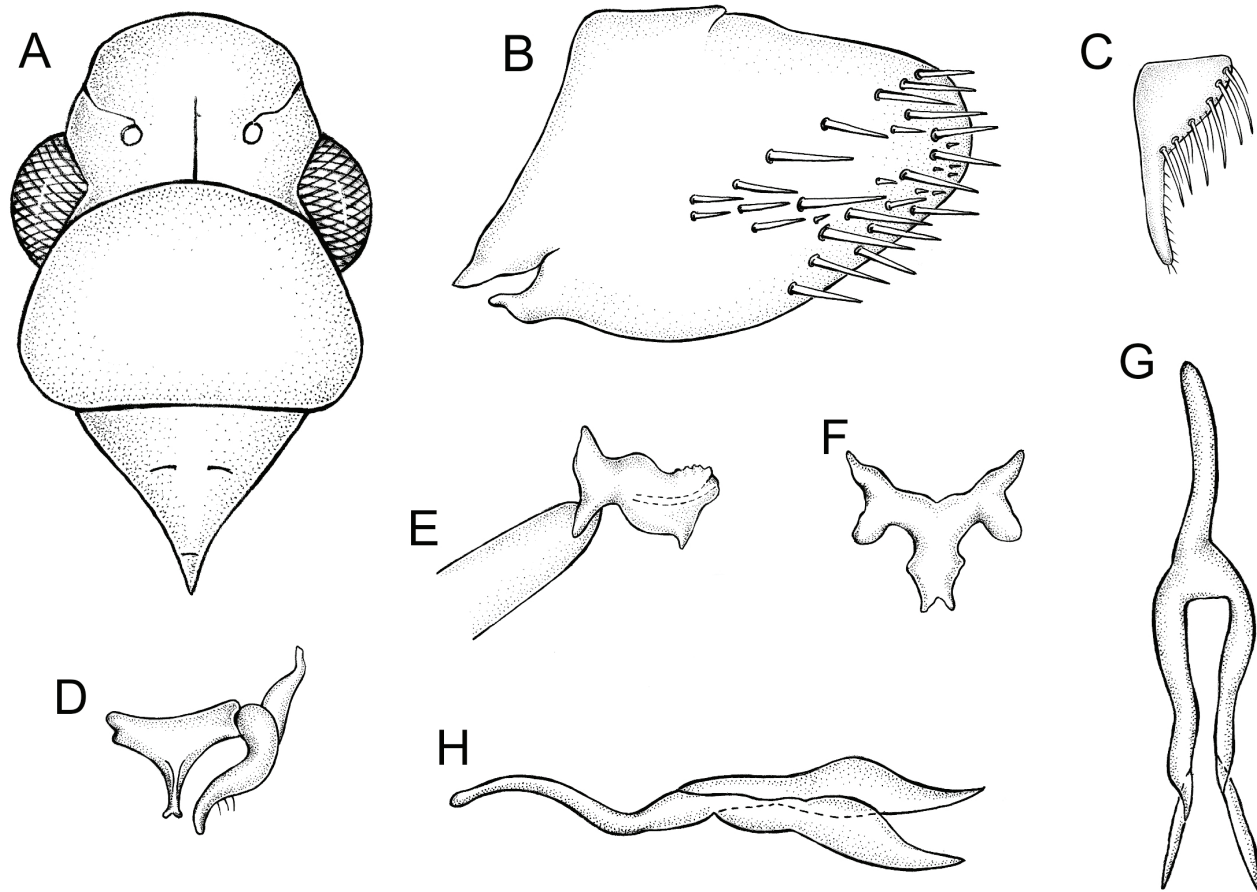
**Coloration (Fig. 1F).** Head, pronotum, and mesonotum pale yellow. Forewing translucent with transverse broad orange stripe across bases of apical cells.

**Male terminalia.** Pygofer (Fig. 6B), in lateral view, with posterior margin rounded; macrosetae distributed mostly on posterior half but some located more anteriorly. Subgenital plate (Fig. 6C), in ventral view, with basal half broad and distal half very narrow; with elongate uniseriate macrosetae on basal half, microsetae distributed along outer lateral margin. Connective (Fig. 6D),

in dorsal view, T-shaped; stalk not carinate dorsally, subequal in length to one arm width. Style (Fig. 6D), in dorsal view, slender, elongate, extending posteriorly beyond apex of connective; narrowed apically, apex obtuse. Aedeagus symmetrical (Fig. 6E, F); shaft short; in lateral view, somewhat sinuous; with pair of ventral, preapical sclerotized dentiform processes; dorsal margin dentate; gonoduct distinct, its apical portion slightly curved dorsally, gonopore located apically. Membrane connecting aedeagus to paraphyses with posterior sclerotized rugose lobe located close to aedeagal processes. Paraphyses slightly asymmetrical; elongate, extending well beyond subgenital plate apex; stalk shorter than rami; in dorsal view (Fig. 6G), stalk slender, rami divergent apically; in lateral view (Fig. 6H), stalk slightly arched dorsally, each ramus with dorsal lobe at mid-length and acute apex.

**Female unknown.**

**Material examined.** French Guiana • 1 ♂: “FRENCH GUIANA: Montagne \ des Chevaux \ 4°44'56"N - 52°26'28"W, alt. 75 m \ 18.iii.2012 \ light trap (GEML) \ SEAG col.” (DZRJ) • 1 ♂: same data as preceding except “30.viii.2011” and “light trap (PSA)” (DZRJ) • 1 ♂: “FRENCH GUIANA: Réserve \ Naturelle de la Trinité \ Zone Aya: 4°36'3"N - \ 53°24'43"W, alt. 140m \ 01.vi.2012 \ light trap (PSA) \ SEAG col.” (DZRJ). Guyana • 1 ♂: “British Guiana: \ Essequibo R., \ Moraballi



**Figure 6.** *Dasmeusa mendica* Young, 1977, male. **A** Head, pronotum, and mesonotum, dorsal view; **B** pygofer, lateral view; **C** subgenital plate, ventral view; **D** connective and style, dorsal view; **E** ejaculatory bulb and aedeagus, lateral view; **F** aedeagus, ventral view; **G** paraphyses, dorsal view; **H** paraphyses, lateral view.

Creek. \ 14.viii.1929. \ Oxf. [Oxford] Uni. [University] Expedn. [Expedition] \ B. M. 1929-485." (DZUP).

**Taxonomic notes.** According to Young (1977), the body of *D. mendica* (Fig. 1F) is slenderer and more delicate than that of *D. pauperata* (Fig. 1H). *Dasmeusa mendica* can be distinguished from *D. pauperata*, as well as from the remaining known species of the genus, by the short and somewhat sinuous aedeagus, bearing a pair of ventral, preapical sclerotized dentiform processes (Fig. 6E, F).

### 3.1.4.6. *Dasmeusa oriximina* Pecly, Takiya, Cavichioli & Mejdalani sp. nov.

<https://zoobank.org/25864D01-1835-48FA-8044-503A4CD87F33>

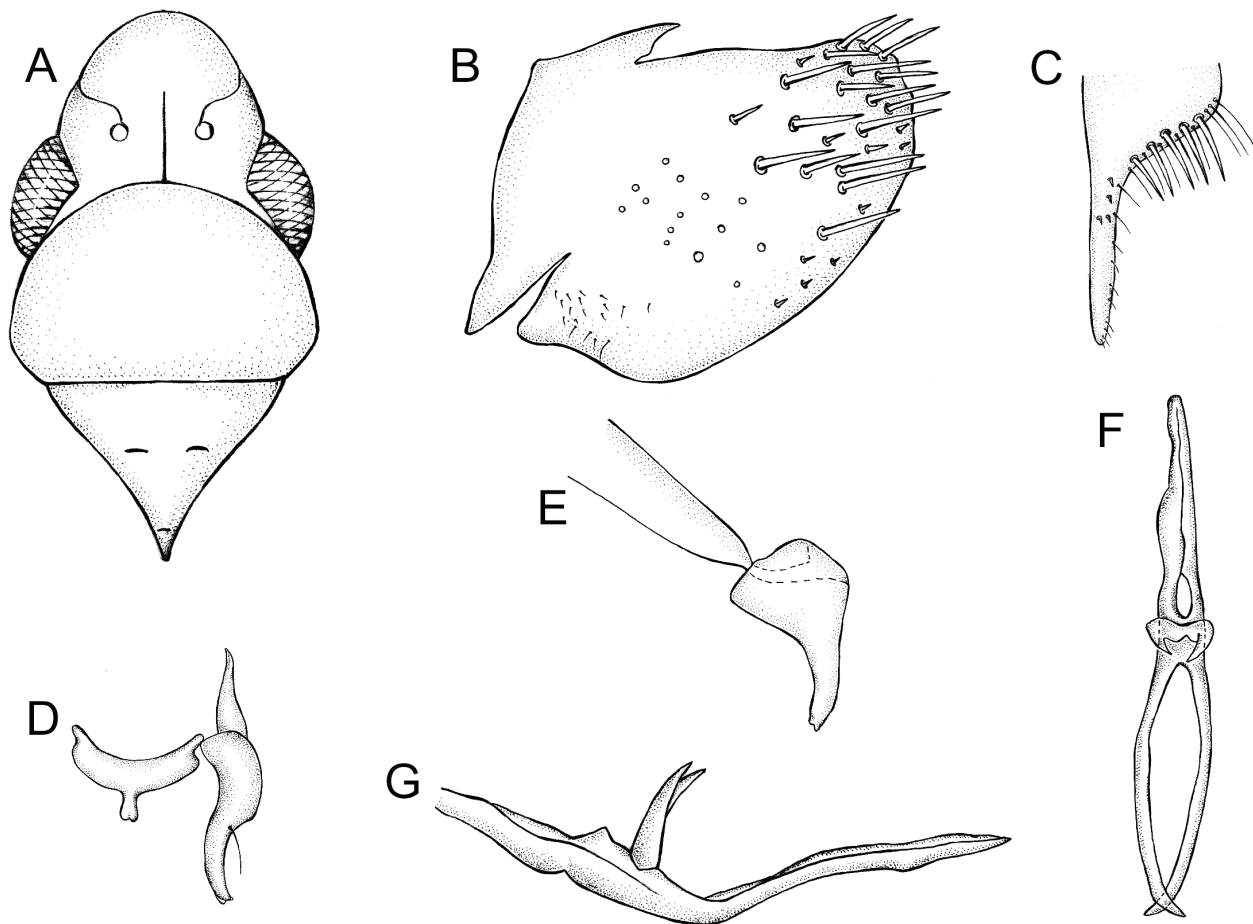
Figs 1G, 7A–G

**Length.** ♂ holotype 8.0 mm. **Male holotype. Head** (Figs 1G, 7A): in dorsal view, strongly produced anteriorly; median length of crown approximately 9/10 of interocular width and 6/10 of transocular width; anterior margin rounded; ocelli large, located approximately on imaginary line between anterior eye angles, each ocellus

approximately equidistant between median line of crown and adjacent eye angle; surface of crown depressed anteriorly; antennal ledge, in dorsal view, slightly protuberant. **Thorax** (Figs 1G, 7A) with pronotum, in dorsal view, with width slightly greater than transocular width of head; lateral margins convergent anteriorly. Forewing with base of fourth apical cell approximately aligned with base of third.

**Coloration (Fig. 1G).** Head, pronotum, mesonotum, and forewing pale yellow.

**Male terminalia.** Pygofer (Fig. 7B), in lateral view, with posterior margin rounded; macrosetae distributed on posterior half but some located more anteriorly. Subgenital plate (Fig. 7C), in ventral view, with basal half broad and distal half very narrow; with elongate uniseriate macrosetae on basal half, microsetae distributed along outer lateral margin. Connective (Fig. 7D), in dorsal view, T-shaped; stalk much shorter than one arm width. Style (Fig. 7D), in dorsal view, slender, elongate, extending posteriorly well beyond apex of connective; slightly narrowed apically, apex obtuse. Aedeagus symmetrical (Fig. 7E); shaft short; ventral margin of shaft with preapical portion produced into robust process directed ventrally, posterior margin of process smooth; gonoduct distinct,



**Figure 7.** *Dasmeusa oriximina* sp. nov., male. **A** Head, pronotum, and mesonotum, dorsal view; **B** pygofer, lateral view; **C** subgenital plate, ventral view; **D** connective and style, dorsal view; **E** ejaculatory bulb and aedeagus, lateral view; **F** paraphyses, dorsal view; **G** paraphyses, lateral view.

gonopore located apically. Paraphyses symmetrical; elongate, extending well beyond subgenital plate apex; in dorsal view (Fig. 7F), stalk subequal in length to rami; rami slightly curved and crossing each other apically; in lateral view (Fig. 7G), stalk approximately rectilinear and with pair of strong dorsoapical processes, rami directed dorsally, narrowed apically.

#### Female unknown.

**Etymology.** The name of the new species, *oriximina*, refers to the type locality (Oriximiná) in Pará State (Northern Brazil). It is a noun in apposition.

**Type locality.** Brazil (Pará State).

**Type material.** Brazil, Pará State • ♂ **holotype**: “BR [Brazil]/ PA [Pará State] – Oriximiná \ Porto Trombetas \ 6-14.viii.2018 \ M.L. Soares & Y. \ Anthoine \ Malaise [trap]” (DZRJ).

**Taxonomic notes.** *Dasmeusa oriximina* sp. nov. (Fig. 1G) is similar to *D. dinizi* sp. nov. (Fig. 1B) in the male terminalia, especially the aedeagus. The former species can be easily distinguished from the latter and other *Dasmeusa* species by the conspicuous dorsal processes of the paraphyses stalk (Fig. 7G).

#### 3.1.4.7. *Dasmeusa pauperata* (Fabricius, 1803)

Figs 1H, 8A–I, 9A–I, 10A–F, 11A, B, 14A–L, 15A–I, 16A–L, 17A–L, 18A–L

*Cicada pauperata* Fabricius, 1803: 71.

*Tettigonia lurida* Signoret, 1853: 662.

*Erythrogonia bicolor* Metcalf, 1949: 260. **Syn. nov.**

*Dasmeusa flavescens* Metcalf, 1955: 264, new name for *Tettigonia lurida* Signoret, 1853: 662, which was preoccupied by *T. lurida* Germar, 1821: 70. **Syn. nov.**

Note: Young (1977: 293) regarded *D. flavescens* as a valid species, but Stål (1869: 77) treated *T. lurida* Signoret as a synonym of *T. pauperata* (Fabricius).

**Length.** ♂♂ 9.5–10.8 mm (n = 5); ♀♀ 9.2–10.3 mm (n = 5). **Head** (Figs 1H, 8A): in dorsal view, well produced anteriorly; median length of crown approximately 8/10 of interocular width and 5/10 of transocular width; anterior margin rounded; ocelli large, located approximately on imaginary line between anterior eye angles; surface of crown slightly concave; antennal ledge, in dorsal view, slightly protuberant; in lateral view, with anterior margin convex. **Thorax** (Figs 1H, 8A) with pronotum, in dorsal view, with width greater than transocular width of head. Forewing (Fig. 8B) with base of fourth apical cell approximately aligned with base of third; forewing of female at rest exceeding apex of ovipositor.

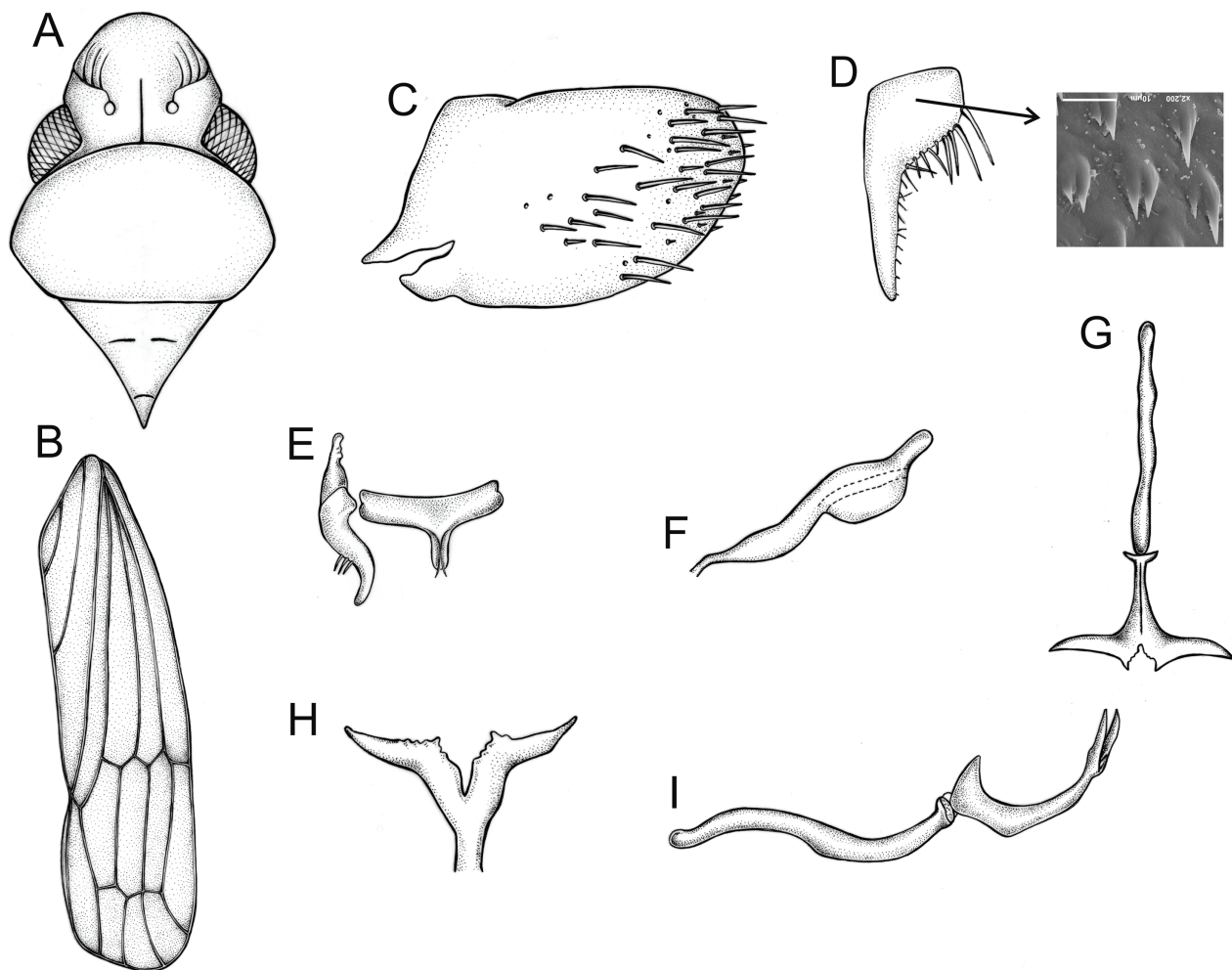
**Coloration (Fig. 1H).** Head, pronotum, and mesonotum mostly brownish-yellow. Forewing yellow, preapical area

with irregular orange transverse band. Face, lateral and ventral portions of thorax, and legs pale yellow.

**Male terminalia.** Pygofer (Fig. 8C), in lateral view, with posterior margin broadly rounded; macrosetae distributed on posterior half but some located more anteriorly. Subgenital plate (Fig. 8D), in ventral view, with basal third broad and distal two-thirds strongly narrowed; with elongate uniseriate macrosetae on basal third, microsetae distributed mostly along outer lateral margin. Connective (Fig. 8E), in dorsal view, T-shaped; stalk not carinate dorsally, shorter than one arm width. Style (Fig. 8E), in dorsal view, somewhat S-shaped, slender, extending posteriorly beyond apex of connective; obtuse apically. Aedeagus symmetrical (Fig. 8F); shaft, in lateral view, with large ventral lobe and dorsoapical digitiform projection; without processes; gonoduct distinct, gonopore located apically. Paraphyses symmetrical; extending approximately as far posteriorly as aedeagal apex; stalk longer than rami; in dorsal view (Fig. 8G), stalk slender and rami fused at base, but strongly divergent at apical half, each ramus irregularly serrate and with small dentiform projection at basal portion (Fig. 8H); in lateral view (Fig. 8I), stalk sinuous, fused bases of rami robust and apices of rami directed dorsally.

**Female terminalia.** Sternite VII (Fig. 9A), in ventral view, triangular, posterior margin rounded. Pygofer (Fig. 9B), in lateral view, with posterior margin narrowly rounded; macrosetae distributed mostly on posterior portion and extending anteriorly along ventral margin. “Internal” sternite VIII, in dorsal view, without sclerotized areas. Valvula I (Fig. 9C–E), in lateral view, with ventral interlocking device elongate, located on basal half of blade. Valvula II (Fig. 9F–I), in lateral view, with about 50 non-contiguous teeth.

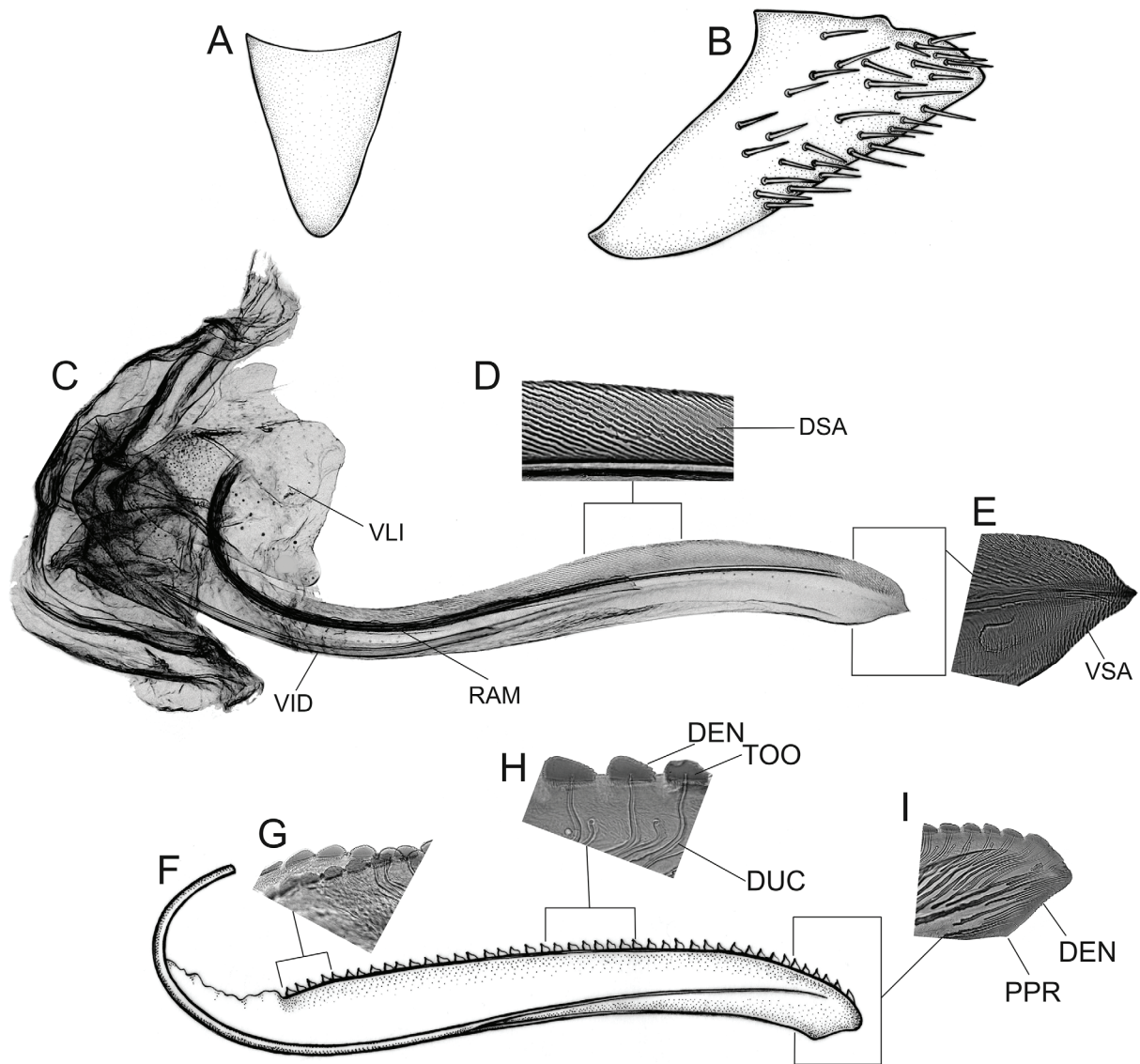
**Material examined.** Brazil, Amazonas State • 1 ♂: “BRASIL: AM [Amazonas State], 80km N [north of] \ Manaus, Reserva do \ PDBFF [Projeto Dinâmica Biológica de Fragmentos Florestais], Km 41 \ 02°24'S, 59°43'W \ 21-22.vii.2004” (DZRJ) • 1 ♂ and 2 ♀♀: same data as preceding except “22.xii-07.i.2005” (DZRJ) • 1 ♂ and 1 ♀: “16-17.ii.2005” (DZRJ) • 2 ♂♂: “05-06.viii.2004” (DZRJ) • 2 ♂♂: “24-25.xi.2004” (DZRJ) • 3 ♂♂ and 3 ♀♀: “08-09.xii.2004” (MNRJ) • 1 ♂: “18-19.viii.2004” (DZRJ) • 1 ♂ and 1 ♀: “15-16.ix.2004” (DZRJ) • 3 ♂♂ and 2 ♀♀: “19-21.i.2005” (MNRJ) • 2 ♂♂: “10-12.xi.2004” (INPA) • 3 ♂♂ and 7 ♀♀: “02-04.iii.2005” (INPA) • 3 ♂♂ and 1 ♀: “27-28.x.2004” (INPA) • 2 ♂♂: “09-10.vi.2004” (INPA) • 1 ♂ and 5 ♀♀: “30.iii-01.iv.2005” (DZRJ) • 1 ♂ and 5 ♀♀: “16-18.iii.2005” (INPA) • 1 ♀: “26-27.v.2004” (INPA) • 1 ♀: “07-08.vii.2004” (DZRJ) • 5 ♀♀: “02-04.ii.2005” (INPA) • 1 ♀: “12-13.v.2004” (INPA) • 2 ♂♂: “BRASIL: Amazonas, Barcelos, Rio \ Aracá, Com. [Comunidade] Bacuquara, \ 00.15309N 063.17743W \ Sweep 12-14/VI/2010 \ Takiya & Cavichioli” (DZUP) • 1 ♂: “Reserva [Florestal Adolpho] Duce \ Manaus, Amazonas \ Brasil 11-XI-1976”; “Collector \ N. D. Penny” (DZUP) • 1 ♂: same data as preceding except “4-X-1976” (INPA) • 1 ♂: “Brasil, Amazonas, S. [São] Gabriel da \ Cachoeira, Rio Uaupés, PEF [Pelotão Especial de Fronteira] \ Querari, 15-30.v.2017 \ 01°04'51.3"N-69°50'32.1"W \ M.L. Oliveira & T. Mahlmann, \ Malaise [trap]” (INPA) • 5 ♂♂: same data as preceding except “1-15.vi.2017” (INPA) • 2 ♂♂: “15-30.



**Figure 8.** *Dasmeusa pauperata* (Fabricius, 1803), type-species, male. **A** Head, pronotum, and mesonotum, dorsal view; **B** forewing; **C** pygofer, lateral view; **D** subgenital plate, ventral view, with SEM of surface sculpturing (microtrichia); **E** connective and style, dorsal view; **F** aedeagus, lateral view; **G** paraphyses, dorsal view; **H** apical portion of paraphyses, posterior view; **I** paraphyses, lateral view.

vii.2017" (INPA) • 2 ♂♂: "Brasil, Amazonas, Manaus, ZF2 \ KM-14, 02°35'21"S-60°06'55"W \ 03-17.viii.2016 \ Malaise grande no chão \ J.A. Rafael & F.F. Xavier" (INPA) • 1 ♂: same data as preceding except "16-31.x.2016" (INPA) • 1 ♂: "1-15.ix.2016" (INPA) • 1 ♂: "BR [Brazil], AM, ZF-2, \ Km-14, 2°35'21"S - \ 60°06'55"W 28.viii.2019, \ solo, J.A. Rafael, N. Peclý \ & A.L. Diniz" (MNRJ) • 1 ♂: "2871"; "Est. [Estrada] Am1. Km 134 \ Mn. [Manaus] Am. [Amazonas State] Br. [Brazil] \ 10/08/68 \ Col - E. V. Silva \ & A. Faustino" (INPA) • 1 ♂: "XI Km 31 \ Manaus \ 21-V-1976 Am \ A.P.A. Luna Dias" (INPA) • 1 ♂: "BRASIL, Amazonas, \ Manaus, AM 010, Km 50 \ Ramal Vó Leuda 14-16. \ VI.2013 Luz mista \ F. Xavier D. Mendes \ P. Grossi & P. Bartholomay" (DZUP). Pará State • 1 ♂: "Utinga \ 7-12-1961"; "Brasil, PA [Pará State] \ J. & B. Bechyné" (MPEG) • 1 ♂: same data as preceding except "25.4.1961" (MPEG) • 1 ♂: "Brasil, Pará, Óbidos, \ Sítio Curió \ 29/VIII - 08/IX/2001"; "014703S 550705W \ Arm. [Armadilha] Malaise"; "J. A. Rafael & J. F. Vidal" (DZUP) • 2 ♂♂: same data as preceding except "29/VIII/2001" (INPA) • 1 ♂: "29/VIII/2001" (DZUP) • 1 ♂ and 1 ♀: "Canindé \ Rio Gurupi, PA [Pará State] \ IV.1963, Malkin \ & Pinheiros col." (MZSP) • 1 ♀: "Benfica \ Ananindeua, PA \ 7.XI.1962 \ J. Bechyné col." (MZSP) • 1 ♂: "Brasil Pará \ Belém Faz. [Fazenda] Vermelha \ 05-II-1981"; "Eniel Cruz" (MPEG) • 1 ♂: "Brasil Pará \ Benevides Faz. \ Morelandia \ 10-VI - a \ 02-VII-1988"; "Brasil Pará \ F.F. Ramos"; "Armadilha \ Malaise" (MPEG). Roraima State • 1 ♂:

"BRASIL, RR [Roraima State], Amajari, \ Tepequém, SESC, 3°44' \ 45"N-61°43'40"W, 1- \ 15.viii.2016, R Boldrini \ & JA Rafael, Malaise \ pequena, Rede Bia" (DZRJ) • 3 ♂♂: "BRASIL - Roraima \ Rio Uruicoera \ Ilha de Maracá \ 02-13.v.1987"; "J. A. Rafael \ J. E. B. Brasil \ L. S. Aquino"; "Armadilha de Malaise" (DZUP) • 1 ♂ and 2 ♀♀: "Brasil, Roraima, ESEC [Estação Ecológica] \ Maracá, Trilha Principal \ 24.iii.2016 \ Malaise \ A.P.M. Santos col." (INPA) • 5 ♂♂: "Brasil, Roraima, ESEC \ Maracá \ 1-15.iii.2016 \ Malaise \ R. Boldrini" (INPA) • 2 ♂♂: "Brasil, Roraima, Alto Alegre, \ ESEC Maracá 3°21'59"N - \ 61°26'04"W, 1-15.x.2916, R. \ Boldrini & J.A. Rafael, \ Malaise pequena, Rede BIA" (INPA). Sergipe State • 1 ♂ and 1 ♀: "BRASIL, SE [Sergipe State], São Cristóvão \ 10°57'S 37°09'W \ A. P. Marques-Costa et al. \ 29-31.i.2010 \ Mata Atlântica YPT" (DZRJ). Bahia State • 1 ♂ and 1 ♀: "Belmonte - \ Barrolândia - BA [Bahia State] \ 1-VIII-1978 \ J. L. Nessimian"; "Estação \ Experimental \ Gregório \ Bondar" (DZRJ) • 1 ♀: "CEPLAC - ITA - \ BUNA [Itabuna] - BA. \ 1-VIII-1978 \ J. L. Nessimian" (DZRJ). French Guiana • 1 ♀: "FRENCH GUIANA: Petite \ Montagne Tortue P14 \ 04°19'14.1"N - 052°14'27.5"W \ 24.xi.2010 \ Lamarre G Leg"; "Terra firme clay forest \ Vitre trap (V10)" (DZRJ) • 1 ♀: "FRENCH GUIANA: Laussat \ P4 \ 05°28'31.6"N 053°35'07.3"W \ 30.ix.2010 \ Lamarre G. Leg"; "Terra firme clay forest \ Vitre trap (V 3)" (DZRJ) • 1 ♀: "FRENCH GUIANA: \ Belvédère de Saül \ 05/II/2010 \ SEAG leg. \ Malaise (M2)" (DZRJ) • 1 ♀: "FRENCH GUI-



**Figure 9.** *Dasmeusa pauperata* (Fabricius, 1803), type-species, female. **A** Sternite VII, ventral view; **B** pygofer, lateral view; **C** valvifer I and valvula I, lateral view; **D** dorsal sculptured area; **E** apical portion; **F** valvula II, lateral view (schematic, see associated photos [G, H, I] for details of teeth and other structures); **G** basal teeth; **H** median teeth; **I** apical portion. **DEN** = denticle; **DSA** = dorsal sculptured area; **DUC** = duct; **PPR** = preapical prominence; **RAM** = ramus; **TOO** = tooth; **VID** = ventral interlocking device; **VLI** = valvifer I; **VSA** = ventral sculptured area.

ANA: Montagne \ des Chevaux \ 4°44'56"N - 52°26'28"W, alt. 75 m \ 21.viii.2011 \ window trap \ SEAG col." (DZRJ) • 1 ♂: same data as preceding except "16.vii.2011" (DZRJ) • 1 ♂: "01.iv.2012" (DZRJ) • 1 ♂: "08.v.2011" (DZRJ) • 1 ♀: "02.viii.2011" (DZRJ). Guyana • 1 ♂: "#CICA001 \ Eperua rubiginosa [host-plant] \ Camoudi 3-7.1997"; "Hand collecting/beatng \ Station 5473 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "6179" (DZUP) • 1 ♀: "#CICA 001 \ Eperua rubiginosa \ Camoudi 15/02/1997"; "Hand collecting/beatng \ Station 5473 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "3739" (DZUP) • 1 ♂: same data as preceding except "9-9-1997" and "6068" (DZUP) • 1 ♂: "#CICA0001 \ Catostemma flagrans [host-plant] \ Camoudi 1-12.1996"; "Hand collecting/beatng \ Station 3557 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "1111" (DZUP) • 1 ♂: "#CICA 001 \ Catostemma flagrans \ Camoudi 18-06-1997"; "Hand collecting/beatng \ Station 5425 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "7937" (DZUP) • 1 ♀: "#CICA001 \ Pentaclethra macroloba [host-plant] \ Camoudi

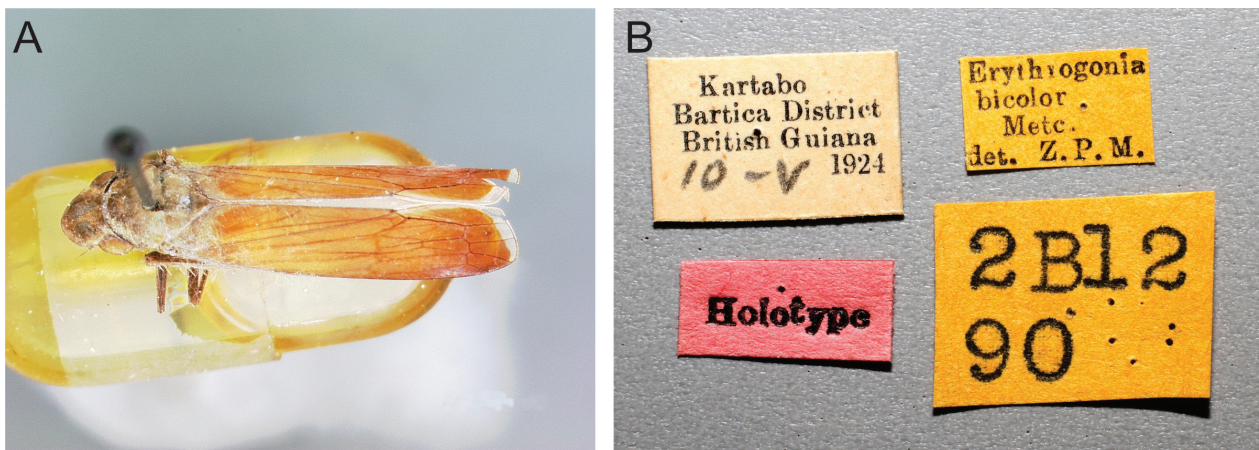
9.9.1997"; "Hand collecting/beatng \ Station 6082 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "6636" (DZUP) • 1 ♂: "#CICA 001 \ Pentaclethra macroloba \ Camoudi 25/7/1996"; "Hand collecting/beatng \ Station \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "2309" (DZUP) • 1 ♀: "#CICA 001 \ Chlorocardium rodiei [host-plant] \ Camoudi 12-3-1997"; "Hand collecting/beatng \ Station 1711 \ Seed/Sapl/Tree"; "Mabura Hill \ GUYANA \ Y. Basset, Coll."; "4364" (DZUP) • 1 ♀: same data as preceding except "6.2-1997" and "4392" (DZUP). Suriname • 2 ♂♂ and 1 ♀: "Anapaiké (Rio Lawa) \ Marowijne distr. [district] \ SURINAME \ XI.[1]968 B. Malkin" (DZUP) • 2 ♀♀: same data as preceding (MZSP).

**Taxonomic notes.** *Dasmeusa pauperata* can be readily distinguished from the remaining known species of the genus by the aedeagus with a large ventral lobe and a dorsoapical digitiform projection (Fig. 8F). The shape of paraphyses, with strongly divergent arms, is also unique (Fig. 8G–I).





**Figure 10.** *Dasmearia flavescens* Metcalf, 1955, female lectotype. **A** Body, dorsal view; **B** body, lateral view (arrow indicates location of angle at inferior portion of frons); **C** labels; **D** face, anterior view; **E** apical portion of abdomen, ventrolateral view; **F** apical portion of abdomen, ventral view. The name *flavescens* was proposed by Metcalf (1955) as a replacement for *lurida* Signoret, 1853, which was preoccupied by *lurida* Germar, 1821. This species is herein considered a junior synonym of *D. pauperata* (Fabricius, 1803). Photos: Werner Holzinger, ©Naturhistorisches Museum Wien (NHMW).



**Figure 11.** *Erythrogonia bicolor* Metcalf, 1949, male holotype, which was treated by Young (1977) as incertae sedis. **A** Body, dorsal view; **B** labels. This species is herein considered a junior synonym of *D. pauperata* (Fabricius, 1803). Photos: ©North Carolina State University Insect Museum (identifier NCSU 45348; <http://specimens.insectmuseum.org/public/specimen/show/39215>).

As mentioned above, *Dasmearia flavescens* Metcalf, 1955 was proposed as a new name for *Tettigonia lurida* Signoret, 1853, which was preoccupied by *T. lurida* Germar, 1821. Young’s (1977) confirmation of Metcalf’s (1955) generic assignment was based on a study of the female

lectotype of *T. lurida* (Fig. 10A–F), which is deposited in the Naturhistorisches Museum Wien. Young (1977) also suggested that *D. flavescens*, which was originally described from Brazil (Young 1977; Zanol and de Menezes 1982; McKamey 2007) and subsequently recorded from

Suriname (Wilson et al. 2009), could be a junior synonym of *D. pauperata* (Fabricius, 1803). We have been able to study photographs of the *T. lurida* lectotype (Fig. 10A–F) and a female specimen from Pará State (“Belém \ Pará - Brazil \ IX.1964 \ E. Dente” [MZSP]). In agreement with Young’s (1977) suggestion, it appears to us that *D. flavescens* is actually a junior synonym of *D. pauperata*.

Young (1977: 1105) treated *Erythrogonia bicolor* Metcalf, 1949 as incertae sedis because he did not find specimens that could be associated with this name. We have examined a photograph of the male holotype (body in dorsal view) of *E. bicolor*, from Guyana, which is deposited at the entomological collection of the North Carolina State University, Raleigh (Fig. 11A). The external form and coloration, as well as the illustrations of the male terminalia provided by Metcalf (1949), suggest that this species is also a junior synonym of *D. pauperata*.

### 3.1.4.8. *Dasmeusa rafaeli* Pecly, Takiya, Cavichioli & Mejdalani sp. nov.

<https://zoobank.org/2B500CCC-C866-4C09-B5F1-35D8ECBF8458>

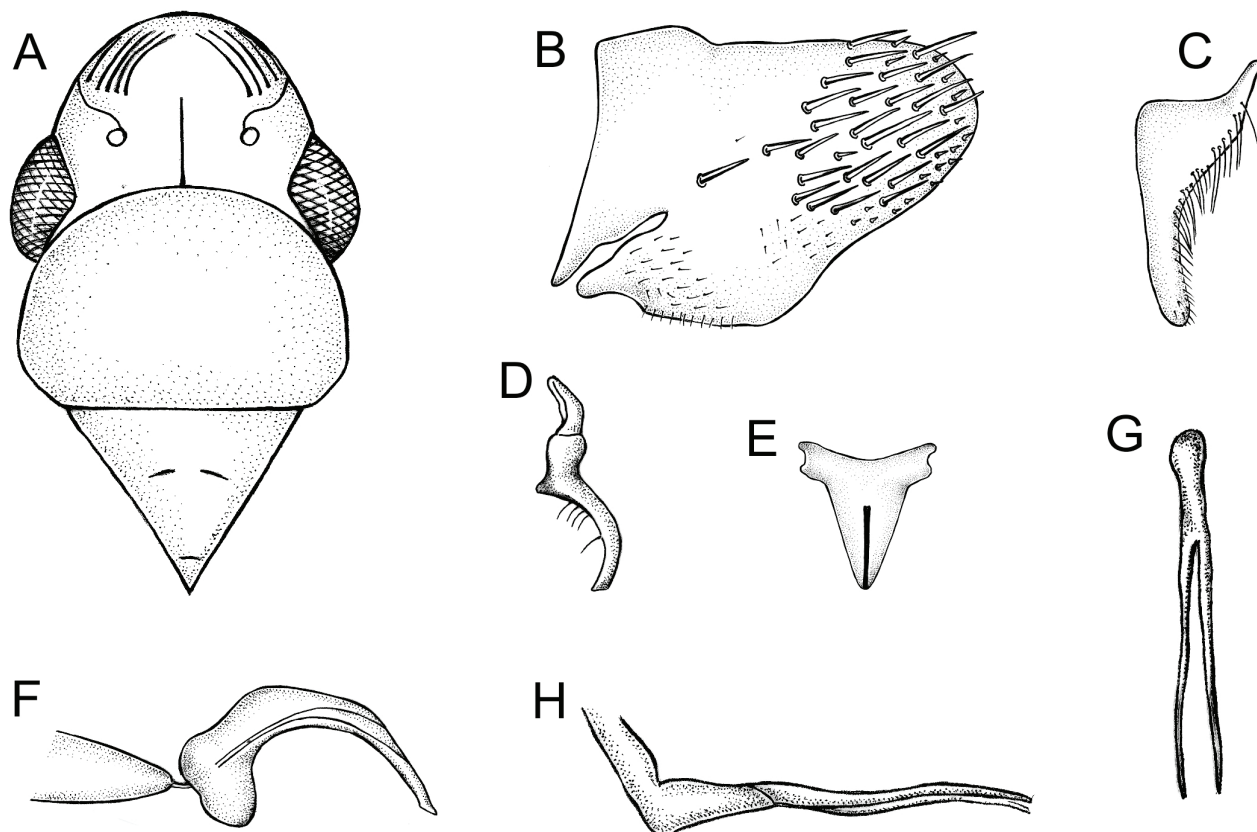
Figs 11, 12A–H

**Length.** ♂ holotype 8.0 mm; ♂ paratypes 7.6–8.0 mm (n = 2). **Male holotype. Head** (Figs 11, 12A): in dorsal

view, well produced anteriorly; median length of crown approximately 8/10 of interocular width and 5/10 of transocular width; anterior margin rounded; ocelli large, located approximately on imaginary line between anterior eye angles; surface of crown convex; antennal ledge, in dorsal view, not protuberant. **Thorax** (Figs 11, 12A) with pronotum, in dorsal view, with width slightly greater than transocular width of head; lateral margins slightly convergent anteriorly. Forewing with base of fourth apical cell approximately aligned with base of third.

**Coloration** (Fig. 11). Head, pronotum, mesonotum, and forewing pale yellow; second apical cell of forewing with distinct red spot.

**Male terminalia.** Pygofer (Fig. 12B), in lateral view, with posterior margin broadly rounded; macrosetae distributed mostly on posterior half but some located more anteriorly. Subgenital plate (Fig. 12C), in ventral view, with basal half broad and distal half narrow; with elongate uniseriate macrosetae on basal half, microsetae distributed along outer lateral margin. Connective (Fig. 12E), in dorsal view, V-shaped; stalk carinate dorsally, much longer than one arm width. Style (Fig. 12D), in dorsal view, slender, elongate, not extending posteriorly beyond apex of connective; narrowed apically, apex obtuse. Aedeagus (Fig. 12F), in lateral view, falciform, with apical spiniform process directed posteroventrally; gonoduct distinct, gonopore located apically. Paraphyses



**Figure 12.** *Dasmeusa rafaeli* sp. nov., male. **A** Head, pronotum, and mesonotum, dorsal view; **B** pygofer, lateral view; **C** subgenital plate, ventral view; **D** style, dorsal view; **E** connective, dorsal view; **F** ejaculatory bulb and aedeagus, lateral view; **G** paraphyses, dorsal view; **H** paraphyses, lateral view.

slightly asymmetrical; elongate, extending posteriorly beyond subgenital plate apex; stalk shorter than rami; in dorsal view (Fig. 12G), rami slender, slightly divergent posteriorly; in lateral view (Fig. 12H), rami narrowing gradually towards apex.

#### Female unknown.

**Etymology.** The name of the new species, *rafaeli*, is given in honor of Dr. José Albertino Rafael (Instituto Nacional de Pesquisas da Amazônia, Manaus) in recognition of his outstanding contribution to the knowledge of the Brazilian entomofauna.

**Type locality.** Brazil (Amazonas State).

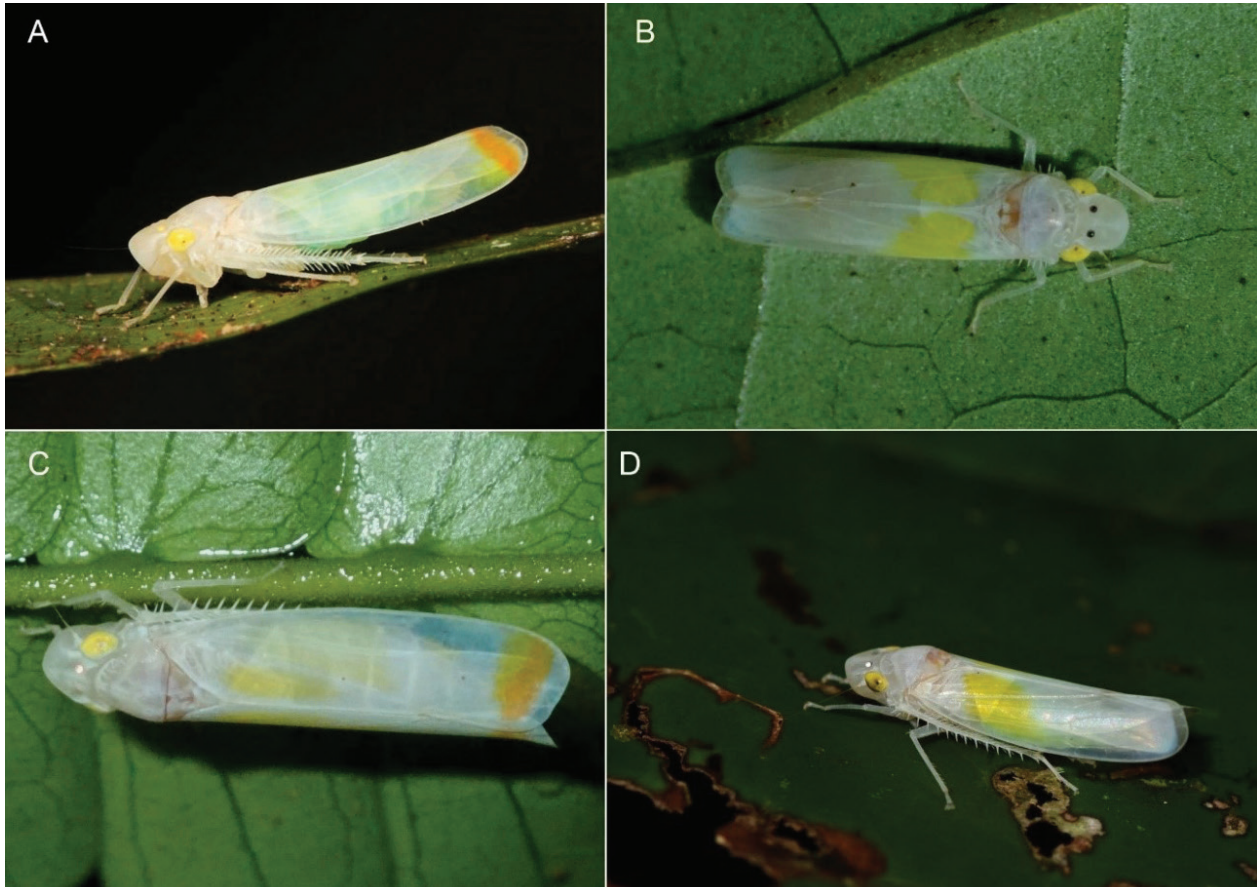
**Type material.** Brazil, Amazonas State • ♂ **holotype**: “BRASIL, AM [Amazonas State], Manaus, \ R. [Reserva] F. [Florestal] Ducke, AM-010 km 26 \ 02°25'49.5"S, 59°58'31.8"W \ Julho/Agosto 1979 \ Fumigação – Dossel \ T. E. Erwin”; “Brazil Canopy Fogging \ Project – July/August \ Dry Samples \ Trans. 10 (1 of 2)” (INPA). **Paratypes** • 1 ♂: “BR [Brazil], A.M., Manaus, ZF-2 \ Km-14, 2°35'21"S - \ 60°06'55"W 18.i - \ 01.ii.2019, YPT, 16mt. alt. \ J.A. Rafael - RedeBia” (DZRJ) • 1 ♂: “BRAZIL: AMAZONAS \ 18.1 Km e [east of] Campinas \ field sta. [station] Km 60 \ n Manaus 22Feb1979 \ 02°30'S 060°15'W”; “Montgomery, Erwin, \ Schimmel, Krischik, \ Date, Bacon colls.”; “Terra firme forest \ canopy fogged with \ Pyrethrum \ Sample #9” (INPA).

**Additional material examined.** Brazil, Amazonas State • 1 ♂: “Brasil AM [Amazonas State] CEPLAC \ Manaus – Rod. [Rodovia] AM010 \ Km 30: 5.X.1977 \ Col. I.S. Gorayeb” (MPEG) • 1 ♂: “BRASIL: AMAZONAS \ 18.1 km e [east of] Campinas \ field sta. [station] Km 60 \ n Manaus 22Feb1979 \ 02°30'S 060°15'W”; “Terra firme forest \ canopy fogged with \ Pyrethrum \ Sample #24”; “Montgomery, Erwin, \ Schimmel, Krischik, \ Date, Bacon colls.” (INPA). Guyana • 1 ♂: “#CICA 075 \ Catostemma fragrans [host-plant] \ Camoudi 24-10-1997”; “Hand collecting/beating \ Station 2809-1 \ Seed/Sapl/Tree”; “Mabura Hill \ GUYANA \ Y. Basset, Coll.”; “9086” (DZUP) • 1 ♀: same data as preceding except “25-10-1997”; “Station 3098-2”; “6926” (DZUP).

**Taxonomic notes.** The color pattern of *D. rafaeli* sp. nov. (Fig. 11) is similar to that of *D. falcifera* sp. nov. (Fig. 1C) because both have a distinct small red spot at the second apical cell of the forewing. The aedeagus of *D. falcifera* bears a conspicuous dentiform process at the basal half of the ventral margin (Fig. 4E), a feature that is not present in *D. rafaeli* (Fig. 12F).

#### 3.1.5. Additional (unidentified) material of *Dasmeusa* (females or specimens without abdomen)

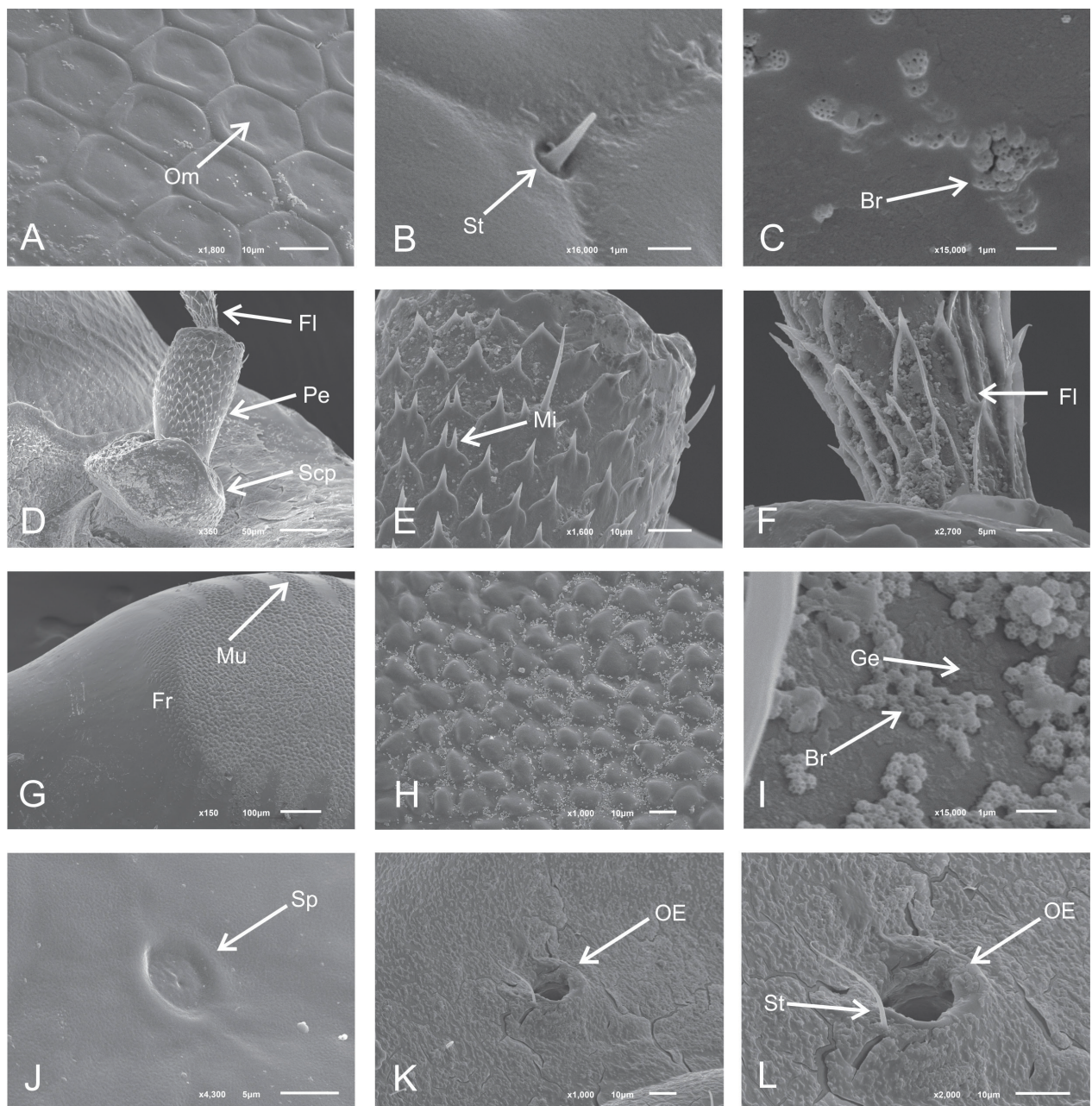
**Brazil:** Amapá State [new record] • 1 ♀: “SERRA DO NAVIO \ Terr. [Território do] Amapá BRASIL \ 30-IX-1957 \ J. Lane leg.”; “Coleção \



**Figure 13.** *Dasmeusa* spp. **A** Maipaima Eco Lodge, Nappi Village, Guyana; photo: Tom Murray, March 18, 2012. **B** Centre Spatial Guyanais, French Guiana; photo: Elendil Cocchi, July 20, 2020. **C** Same as preceding, July 18, 2020. **D** Sinnamary, French Guiana; photo: Elendil Cocchi, November 26, 2021.

J. Lane" (MZSP) • 1 ♀: "Serra Lombarda \ Limão \ 23.8-1961" \ "Brasil, AP [Amapá State] \ J. & B. Bechyné" (MPEG) • 1 ♀: "Rio Felício \ Terr. Amapá BRASIL \ 6/III/1959 \ J. Lane leg." \ "COLEÇÃO \ J. LANE" (MZSP). Amazonas State • 1 ♀: "BRASIL - AM [Amazonas State] \ 21-v-1976 \ I. S. Gorayeb"; "Rod. [Rodovia] AM - 01 \ Km 30" (INPA) • 1 ♀: "Reserva Ducke \ Manaus Amazonas \ Brasil \ 29-x-1976"; "Collector: \ N. D. Penny" (INPA) • 1 ♀: "BRASIL: Amazonas, Barcelos, Rio \ Aracá, Com. [Comunidade] Bacuquara, \ 00.15309N 063.17743W \ Prato Amarelo 12-14/VI/2010 \ Takiya; Rafael & Cavichioli" (DZUP) • 1 ♀: "BRASIL: Amazonas, Santa Isabel \ do Rio Negro, Rio Paduari, \ Igarapé do Maia 00.194410N \ 064.01083W Malaise [trap] \ 08-10/VI/2010 \ Takiya & Cavichioli" (DZUP); one specimen without abdomen: "BRAZIL: Amazonas State \ Rio Abacax-

is, 140Km SE \ Borba, 27-28.V.2008 \ 05°15'09"S 058°41'52"W \ D.M. Takiya sweep" (DZRJ) • 2 ♀♀: "Brasil, AM, Manaus \ PDBFF [Projeto Dinâmica Biológica de Fragmentos Florestais], 2°24'S 59°52'W \ Faz. [Fazenda] Esteio, Res. 1301 \ 04.i.1986, Malaise, \ Bert Klein leg." (INPA) • 2 ♀♀: "BRASIL: Amazonas, Barcelos, Rio \ Aracá, Com. Bacuquara, \ 00.15309N 063.17743W \ Sweep 12-14/VI/2010 \ Takiya & Cavichioli" (DZUP) • 1 ♀: same data as preceding except "Prato Amarelo" \ "Takiya; Rafael & Cavichioli" (DZUP). Pará State • 1 ♀: "Brasil, Pará, Óbidos, \ Fazenda Iupará \ 01/IX/2001"; "Varredura \ J. A. Rafael & \ J. F. Vidal" (DZUP) • 1 ♀: "Pará - Brasil \ Barcarena \ 10-I-1984"; "Brasil Pará \ W. Overal" (MPEG). São Paulo State [?] • 5 ♀♀: "S. [São] José do Barreiro \ Serra da Bocaina \ Faz. do Bonito, SP [São Paulo State] \ M.A. Vulcano col." (MZSP).



**Figure 14.** Scanning electron microscopy (SEM) of the head of *Dasmeusa pauperata* (Fabricius, 1803). **A** Compound eye: ommatidia; **B** interommatidial sensillum trichodeum; **C** brochosomes on ommatidium; **D** antenna: scape, pedicel, and base of flagellum; **E** microtrichia sculpturing on antennal pedicel; **F** scale-like sculpturing on antennal flagellum; **G** surface of frons; **H** sculpturing on frons; **I** surface of gena covered by brochosomes; **J** sensillum placodeum on frons; **K** organ of Evans on maxillary plate; **L** organ of Evans at higher magnification, with adjacent sensillum trichodeum.

**French Guiana:** one specimen without abdomen: “FRENCH GUIANA: Laussat \ P8 \ 05°28'31.6"N – 053°35'07.3"W \ 18.x.2010 \ Lamarre G. leg.”; “Flooded forest \ Vitre trap (V5)” (DZRJ).

**Guyana:** 1 ♀: “GUYANA: Essequibo, \ forest on plateau \ above Kaieteur Falls, \ approx. 400m. alt.”; “17 October 1991 \ J. H. Martin coll. \ B. M. 1991-182” (DZUP) • 2 ♀♀: “h.3079.”; “Brit. Guiana: \ nr. Mazaruni Hd. \ Pakaraima Mts. \ 1932, J.G. Myers.”; “Brit. Mus. \ 1933-400.”; “b m”; “gen. nr. Pa- \ romenia \ ♀ \ d. DAYoung 6” (DZUP).

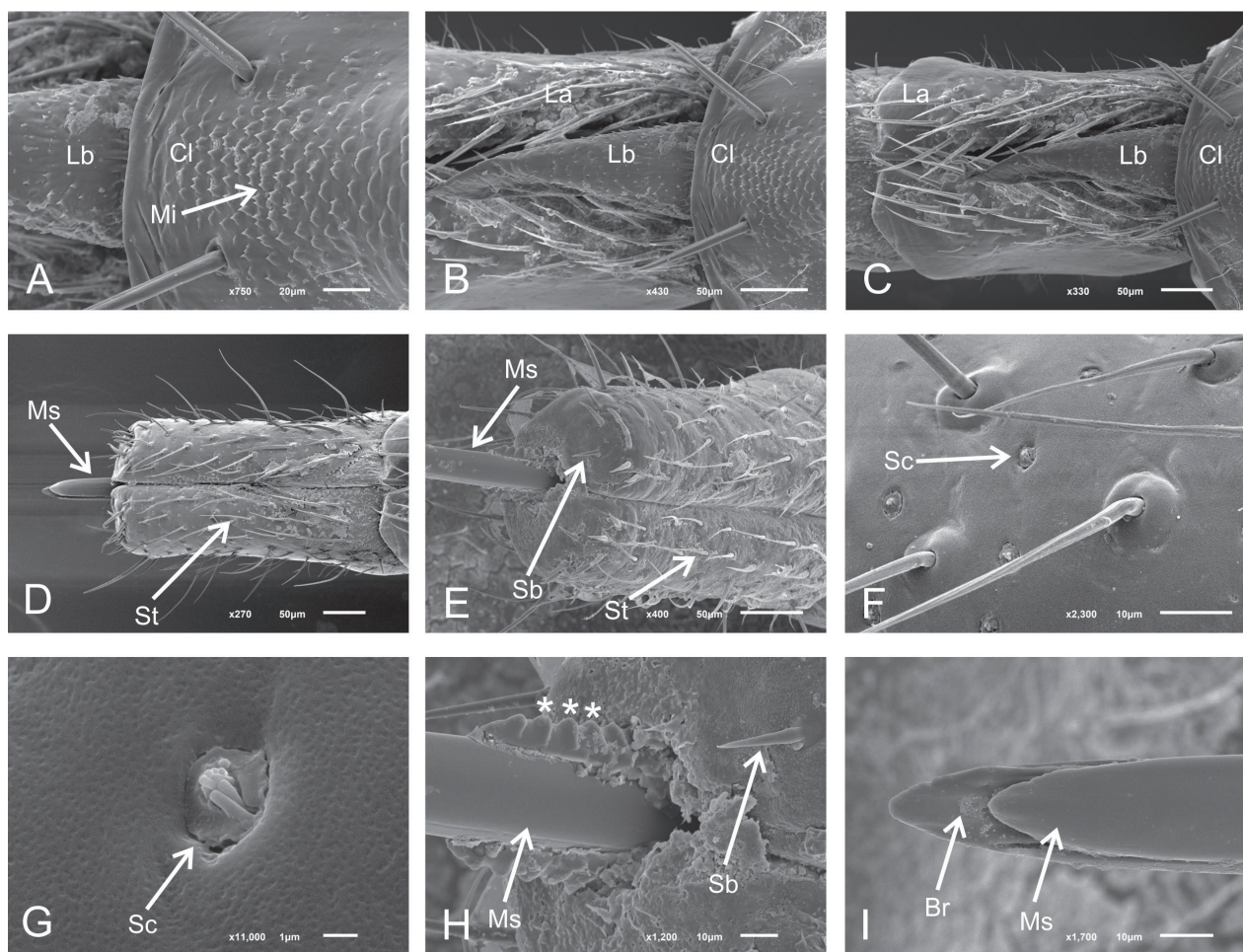
### 3.2. Scanning electron microscopy

The use of scanning electron microscopy (SEM) allowed us to study in detail the integument of *Dasmeusa pauperata*, the type-species of the genus. The following features of the integument were observed for the first time in this genus and are also poorly known in the Cicadellidae as a whole: microtrichia (Figs 14E, 15A, 16B, C, F, G, L, 17J, L, 18I, L), organ of Evans at the maxillary plate (Fig. 14K, L), sensilla basiconica (Fig. 15E, H), s. coeloconica (Figs 15F, G, 18B, C, F, G, H, I), s. placodea (Fig. 14J), and s. trichodea (Figs 14B, L, 15D, E, F, 18D, E, J). We

have also been able to observe brochosomes on various parts of the body, such as the compound eyes (Fig. 14C), gena (Fig. 14I), maxillary stylets (Fig. 15I), mesonotum (Fig. 16D, E), claval sulcus and other areas of the forewing (Fig. 16H, I), legs (Fig. 17D, E), sternal surface of the abdomen (Fig. 18G), and abdominal spiracles (Fig. 18L).

### 3.3. Phylogenetic analysis

The data matrix included 40 morphological characters, of which 14 are from the external morphology and coloration (head and thorax) and 26 from the male terminalia; these characters were coded for 15 terminal taxa (six of them outgroups) (Table S1). Thirty-one characters are binary and nine are multistate; only eight characters were non-informative for the parsimony analysis. The characters and their states are listed below (non-informative ones are indicated).

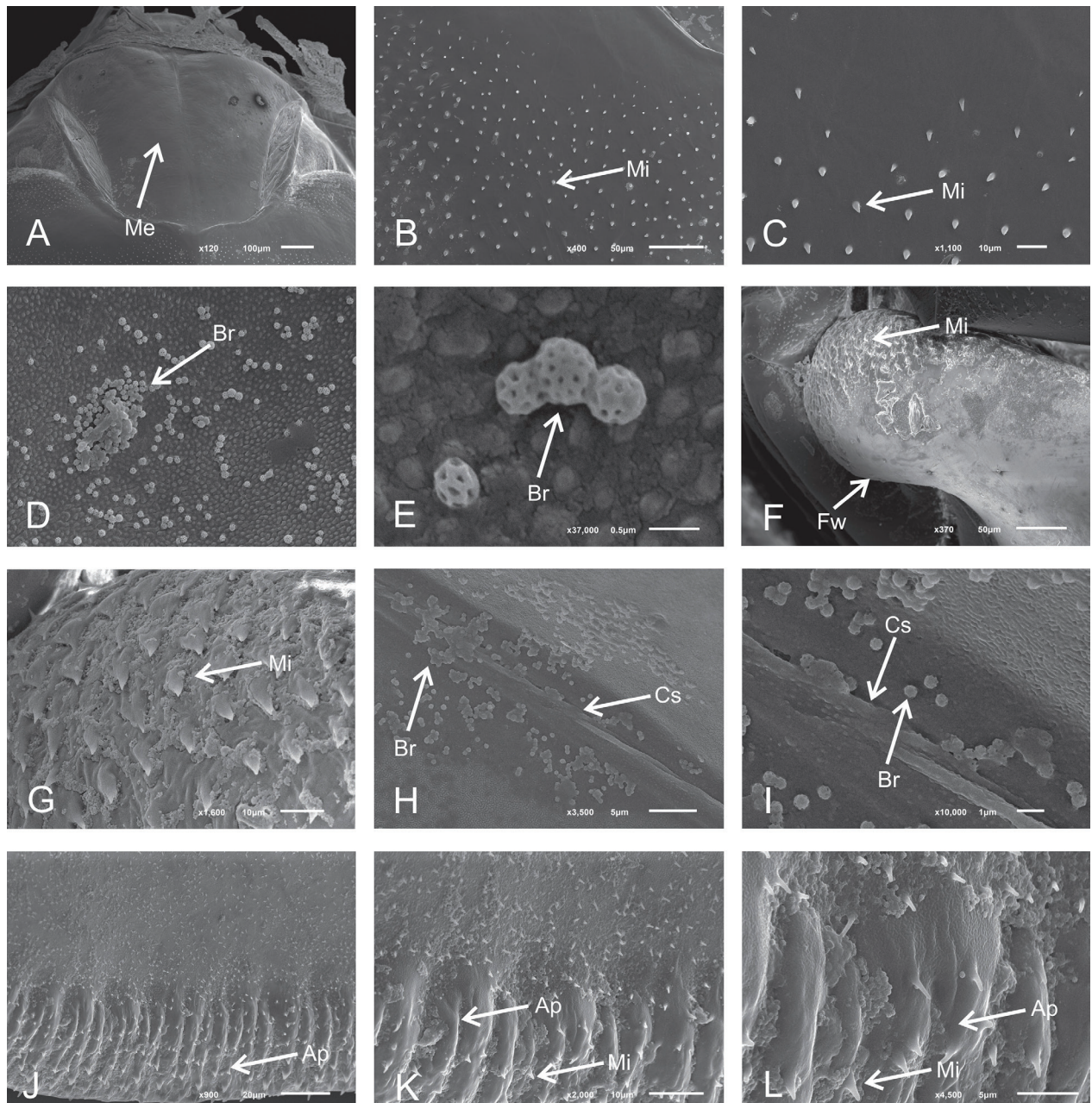


**Figure 15.** Scanning electron microscopy (SEM) of the head of *Dasmeusa pauperata* (Fabricius, 1803). **A** Microtrichia at apex of clypeus; **B** apex of clypeus and labrum; **C** labrum and second article of labium; **D** third article of labium and apex of maxillary stylets; **E** apex of third article of labium and maxillary stylet; **F** sensilla coeloconica of third article of labium; **G** sensillum coeloconicum at higher magnification; **H** maxillary stylet and lateral projections of mandibular stylet (asterisks); **I** apex of maxillary stylets, with brochosomes.

### 3.3.1. List of morphological characters

#### 3.3.1.1. External morphology and coloration

1. Head, crown apex, carina (dorsal view): (0) absent (Fig. 10B), (1) present (Cavichioli and Wyler 1992: fig. 2). Non-informative.
2. Antennal ledge, degree of projection in relation to outline of crown (dorsal view): (0) not protuberant (Fig. 12A), (1) slightly protuberant (Fig. 3A), (2) distinctly protuberant (Young 1977: fig. 233a). ci = 1.000, ri = 1.000.
3. Ocellus, position in relation to imaginary line between anterior eye angles (dorsal view): (0) aligned with angle (Fig. 8A), (1) slightly before angle (Wilson et al. 2009: *Paromenia auroguttata*), (2) slightly behind angle (Mejdalani et al. 2011: fig. 2a). Non-informative.
4. Head, extension of frontogena suture on crown (dorsal view): (0) attaining ocellus (Fig. 8A), (1) not attaining ocellus (Fig. 4A). ci = 0.250, ri = 0.000.
5. Frons, form of superior third (lateral view): (0) rounded (Fig. 10B), (1) rectilinear. ci = 0.333, ri = 0.000.



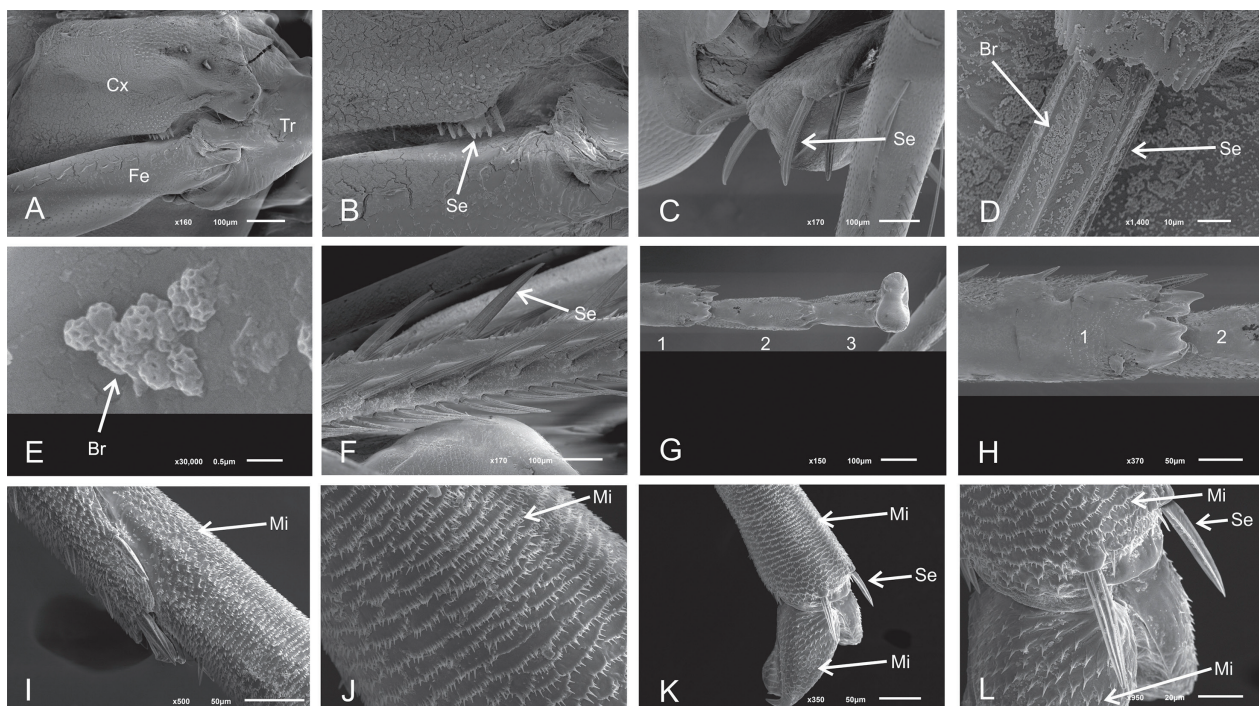
**Figure 16.** Scanning electron microscopy (SEM) of the thorax of *Dasmeusa pauperata* (Fabricius, 1803). **A** Mesonotum surface; **B** mesonotum surface at higher magnification, showing microtrichia; **C** higher magnification of mesonotal microtrichia; **D** surface of scutellum covered by brochosomes; **E** higher magnification of scutellar brochosomes; **F** base of forewing; **G** base of forewing at higher magnification, with microtrichia; **H** claval sulcus of forewing; **I** claval sulcus of forewing at higher magnification, with brochosomes; **J** appendix of forewing; **K** appendix of forewing at higher magnification, showing microtrichia; **L** same as preceding at still higher magnification.

6. Frons, form of inferior third (lateral view): (0) not angulate (Mejdalani 1998: fig. 1), (1) angulate (Fig. 10B, Mejdalani et al. 2011: fig. 2b). ci = 0.500, ri = 0.667.
7. Frons, aspect of surface of superior portion (frontal view): (0) not depressed medially, (1) depressed medially. Non-informative.
8. Pronotum, form of posterior margin (dorsal view): (0) distinctly concave (Young 1977: fig. 233a), (1) slightly concave (Takiya and Mejdalani 2002: fig. 4), (2) rectilinear (Fig. 8A). ci = 1.000, ri = 1.000.
9. Forewing, form of apex (lateral view): (0) convex (Takiya and Mejdalani 2002: fig. 4), (1) obliquely truncate (Fig. 8B). ci = 0.500, ri = 0.750.
10. Forewing, coloration of apical portion, orange stripe: (0) absent (Wilson et al. 2009: *Paromenia auroguttata*), (1) present (Fig. 1A). ci = 0.333, ri = 0.667.
11. Forewing, coloration of apical portion, red spot: (0) absent (Wilson et al. 2009: *Paromenia auroguttata*), (1) present (Fig. 1C). ci = 1.000, ri = 1.000.
12. Forewing, form of costal apical cell: (0) not broadened posteriorly (Young 1977: fig. 121p, Mejdalani 1998: fig. 32), (1) distinctly broadened posteriorly (Fig. 8B). ci = 0.333, ri = 0.333.
13. Forewing, position of base of fourth apical cell in relation to third apical cell: (0) proximal (Young 1977: fig. 121p), (1) aligned (Fig. 8B). ci = 1.000, ri = 1.000.
14. Forewing, aspect of surface: (0) mostly coriaceous (Wilson et al. 2009: *Sailerana solitaria*), (1) mostly

translucent (Fig. 1). ci = 0.667, ri = 0.500. Non-informative.

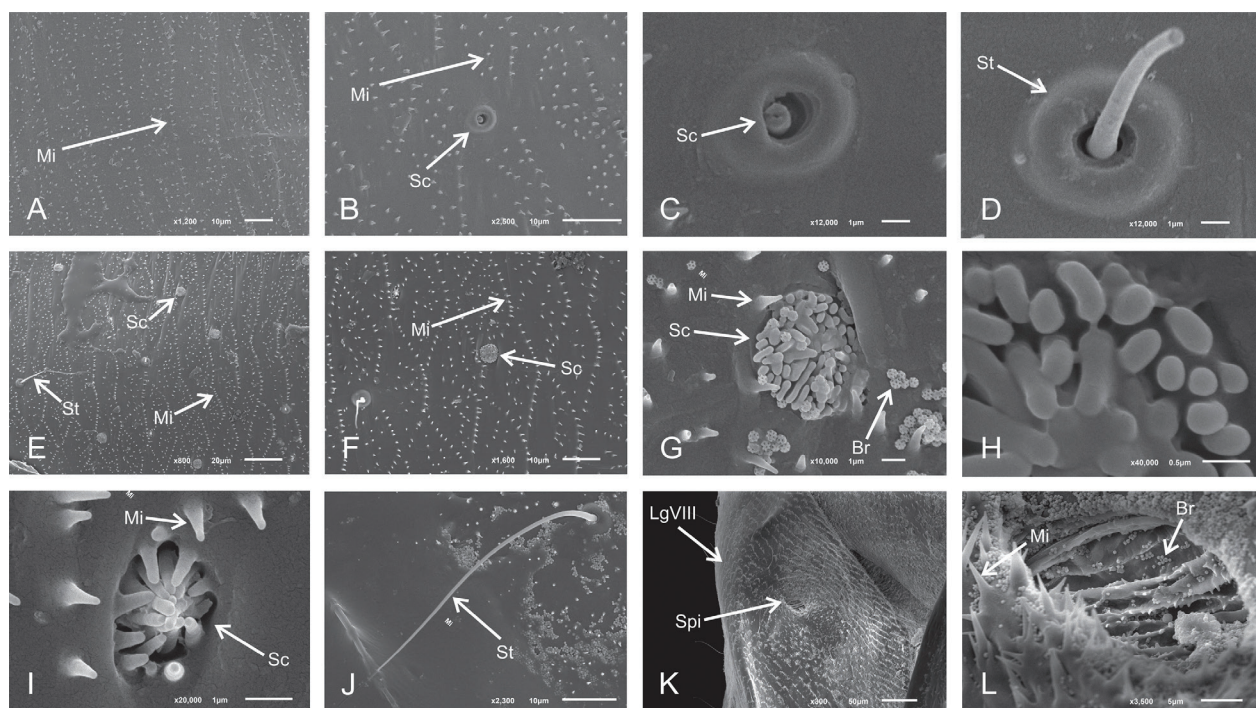
### 3.3.1.2. Male terminalia

15. Pygofer, form of posterior margin (lateral view): (0) rounded (Fig. 8C), (1) truncate (Fig. 2B). ci = 0.333, ri = 0.000.
16. Pygofer, degree of development (lateral view): (0) well produced posteriorly (Fig. 4B), (1) moderately produced posteriorly (Fig. 3B). ci = 0.500, ri = 0.750.
17. Pygofer, chaetotaxy, microsetae forming group on anteroventral portion: (0) absent, (1) present (Fig. 3B, Pecly et al. 2019: fig. 2). ci = 0.500, ri = 0.750.
18. Pygofer, chaetotaxy, distribution of macrosetae: (0) mainly apical third (Mejdalani et al. 2011: fig. 3a), (1) mainly posterior half (Fig. 3B), (2) mainly on posterior margin and extending anteriorly along ventral margin (Young 1977: fig. 233c). ci = 0.667, ri = 0.500.
19. Pygofer, posterodorsal margin, long and broad process with acute apex (lateral view): (0) present (Mejdalani et al. 2011: fig. 3a), (1) absent (Fig. 8C). ci = 0.500, ri = 0.000.
20. Pygofer, distinct lobe, basiventral portion (lateral view): (0) absent (Mejdalani et al. 2011: fig. 3a), (1) present (Fig. 3B). ci = 0.333, ri = 0.500.
21. Subgenital plate, position of apex in relation to pygofer (lateral view): (0) extending as far posterior-



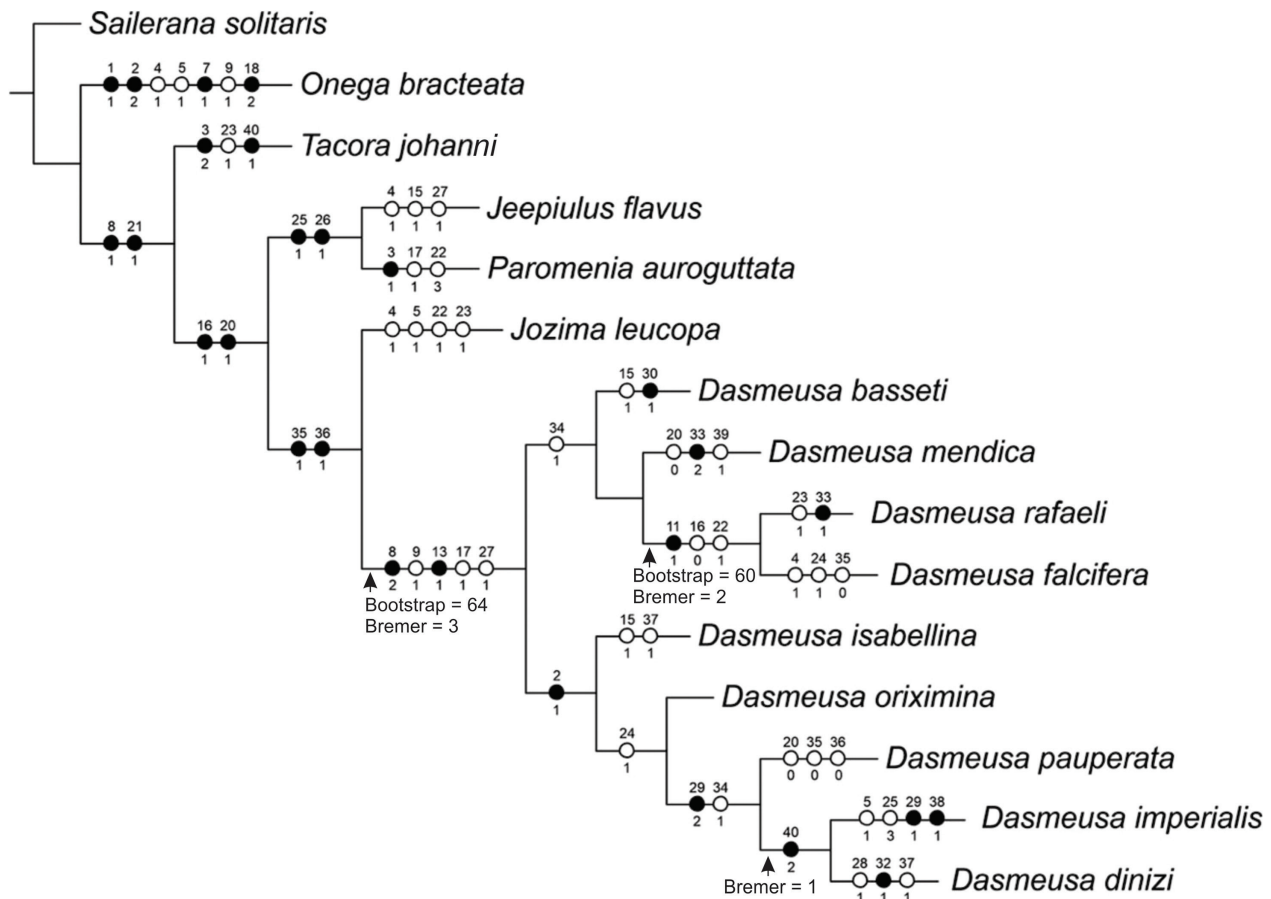
**Figure 17.** Scanning electron microscopy (SEM) of the hind leg of *Dasmeusa pauperata* (Fabricius, 1803). **A** Surface of coxa, trochanter, and femur; **B** surface of coxa and femur at higher magnification, showing group of setae; **C** apex of femur showing macrosetal formula 2:1:1; **D** one seta of the macrosetal formula covered by brochosomes; **E** brochosomes on seta at higher magnification; **F** setae of tibia; **G** tarsus and pretarsus, ventral view; **H** detail of basal tarsomere; **I** articulation between median and distal tarsomere, showing microtrichia; **J** microtrichia of distal tarsomere; **K** apex of tarsus and pretarsus; **L** apex of tarsus and pretarsus at higher magnification.

- ly as pygofer, (1) not reaching pygofer apex. ci = 1.000, ri = 1.000.
22. Connective, shape (dorsal view): (0) Y-shaped (Young 1977: fig. 254e), (1) V-shaped (Fig. 4D), (2) T-shaped (Fig. 2D), (3) transverse bar with anteriorly directed carina (Young 1977: fig. 233e). ci = 0.600, ri = 0.333.
  23. Connective, length of stalk in relation to style (dorsal view): (0) not extending beyond style apex (Fig. 2D), (1) extending beyond style apex (Fig. 4D). ci = 0.333, ri = 0.000.
  24. Connective, median keel of stalk (dorsal view): (0) present (Fig. 12E), (1) absent (Fig. 4D). ci = 0.500, ri = 0.750.
  25. Style, form of apex (dorsal view): (0) acute (Young 1977: fig. 253e), (1) foot-shaped (Young 1977: fig. 229e), (2) rounded (Fig. 3D), (3) truncate (Fig. 2D). ci = 0.500, ri = 0.250.
  26. Style, preapical lobe (dorsal view): (0) absent (Fig. 8E), (1) present (Young 1977: fig. 229e). ci = 1.000, ri = 1.000.
  27. Paraphyses: (0) absent, (1) present (Fig. 8G–I). ci = 0.500, ri = 0.750.
  28. Paraphyses, symmetry (dorsal view): (0) symmetrical (Fig. 8G), (1) slightly asymmetrical (Fig. 5F). ci = 0.333, ri = 0.333.
  29. Paraphyses, stalk length in relation to rami length (dorsal view): (0) shorter than (Fig. 6H), (1) approximately equal to (Pecly et al. 2019: fig. 7), (2) longer than (Fig. 3G). ci = 1.000, ri = 1.000.
  30. Paraphyses, form of apex of each ramus (dorsal view): (0) acute (Fig. 8H), (1) bifurcate (Fig. 2F). Non-informative.
  31. Paraphyses, apical portion of stalk, pair of dorsal spiniform processes: (0) absent (Fig. 5G), (1) present (Fig. 3G). ci = 0.500, ri = 0.500.
  32. Paraphyses, apical portion of stalk, pair of ventral spiniform processes: (0) absent (Fig. 5G), (1) present (Fig. 3G). Non-informative.
  33. Paraphyses, orientation of rami (lateral view): (0) directed dorsally (Fig. 3G), (1) directed posteriorly (Fig. 12H), (2) slightly directed ventrally (Fig. 6H). Non-informative.
  34. Paraphyses, position of apical portions of rami (dorsal view): (0) crossing each other (Fig. 7F), (1) not crossing each other (Fig. 6G). ci = 0.500, ri = 0.500.
  35. Aedeagus, shaft aspect (lateral view): (0) elongate and slender (Fig. 8F), (1) short and compact (Fig. 7E). ci = 0.333, ri = 0.667.
  36. Aedeagus, ventroapical portion of shaft, process (lateral view): (0) absent (Fig. 8F), (1) present (Fig. 3E). ci = 0.500, ri = 0.800.
  37. Aedeagus, ventroapical process, aspect of basidor-sal surface (lateral view): (0) smooth, (1) irregularly serrate. ci = 0.500, ri = 0.000.
  38. Aedeagus, ventroapical process, aspect of ventral surface (lateral view): (0) smooth, (1) irregularly serrate. Non-informative.



**Figure 18.** Scanning electron microscopy (SEM) of the abdomen of *Dasmeusa pauperata* (Fabricius, 1803). **A** Surface of sternite V, showing rows of microtrichia; **B** sternite V, with sensillum coeloconicum; **C** sensillum coeloconicum at higher magnification; **D** sensillum trichodeum of sternite V; **E** sculpturing of sternal surface, including microtrichia, s. coeloconica, and s. trichodea; **F** surface of sternite V at higher magnification, showing microtrichia and s. coeloconicum; **G** s. coeloconicum; **H** s. coeloconicum at higher magnification; **I** s. coeloconicum of sternite V surrounded by microtrichia; **J** s. trichodeum from segment III; **K** laterotergite VIII showing spiracle; **L** spiracle at higher magnification.





**Figure 19.** One of the nine equally most parsimonious trees of the phylogenetic analysis of *Dasmеusa* (88 steps, CI = 0.580, RI = 0.602). *Sailerana solitaria* was employed for rooting this tree. This is same and only ingroup topology recovered by implied weighting (fit = 7.85000, k = 3). Accordingly, it is considered our preferred hypothesis. Character numbers are indicated above circles and character states below. White circles (○) indicate homoplastic transformations and black circles (●) non-homoplastic transformations. Bootstrap support values (>50) and Bremer decay indexes, when applicable, are shown.

39. Aedeagus, ventroapical portion of shaft, pair of processes (lateral view): (0) absent (Fig. 8F), (1) present (Fig. 6E). ci = 0.500, ri = 0.000.
40. Aedeagus, position of gonopore (lateral view): (0) apical (Fig. 8F), (1) preapical (Mejdalani et al. 2011: fig. 3e), (2) dorsoapical (Fig. 3E). ci = 1.000, ri = 1.000.

### 3.3.2. Main results of the phylogenetic analysis

The analysis with equal weights resulted in nine equally most parsimonious trees (L = 88, CI = 0.580, RI = 0.602). The strict consensus of these trees (Figure S1) is almost entirely polytomous within *Dasmеusa*, but *D. rafaеli* sp. nov. + *D. falcifera* sp. nov. and *D. imperialis* + *D. dinizi* sp. nov. consistently formed clades. All trees recovered *Dasmеusa* as monophyletic, although with relatively low support scores. The implied weighting analysis (k = 3) resulted in two trees (fit = 7.85000), both with the same topology for the ingroup. This ingroup topology, which was also found in one of the nine most parsimonious trees with equal weights, is considered the preferred hypothesis (Fig. 19); it is as follows: ((*D. basseti* (*D. mendica* (*D.*

*rafaeli* sp. nov., *D. falcifera* sp. nov.))) (*D. isabellina* (*D. oriximina* sp. nov. (*D. pauperata* (*D. imperialis*, *D. dinizi* sp. nov.)))). *Jozima* appeared as the sister group of *Dasmеusa* in all calculated trees. Unambiguous apomorphies were optimized onto the preferred tree (Fig. 19).

## 4. Discussion

### 4.1. Phylogenetic analysis

The monophyly of *Dasmеusa* was recovered in all nine most parsimonious trees (Figure S1) and in the implied weighting search (Fig. 19), although with relatively low support scores in both analyses. *Dasmеusa* was supported by the following apomorphic characters mapped onto the preferred tree (Fig. 19): (1) posterior margin of pronotum rectilinear (character 8, state 2, Fig. 2A); (2) apex of forewing obliquely truncate (c. 9, s. 1, Fig. 8B); (3) base of fourth apical cell of forewing aligned with base of third apical cell (c. 13, s. 1, Fig. 8B); (4) microsetae forming distinct group at anteroventral portion of male pygofer (c. 17, s. 1, Fig. 3B); and (5) presence of paraphyses (c.

27, s. 1, Fig. 2F). Preliminary data suggest that the phylogeny of the Cicadellini is characterized by a great number of homoplastic events. Therefore, the apomorphic conditions proposed here should be evaluated primarily in the context of the *Paromenia* group. However, these characters are of course available for further evaluation in future, more comprehensive phylogenetic analyses of the tribe.

The hypothesis of the sister group relationship between *Dasmeusa* and *Jozima* is based on two apomorphic features in the context of the *Paromenia* group: (1) short and compact aedeagal shaft (c. 35, s. 1, Fig. 3E) and (2) presence of ventroapical process of aedeagus (c. 36, s. 1, Fig. 3E). Therefore, our results do not support Young's (1977) suggestion that *Dasmeusa* and *Paromenia* are very closely related genera. Likewise, they do not support Cavichioli's (1992) cladistic hypothesis (unpublished doctoral study), in which *Tacora* was recovered as the sister group of *Dasmeusa*. Young (1977) observed that specimens of *Dasmeusa* are more delicate (i.e., slenderer) than those of *Jozima* and have paraphyses in the male terminalia (Fig. 2F). *Tacora* can be readily differentiated from *Dasmeusa* by the presence of processes on the male pygofer, absence of paraphyses, and conspicuous color pattern (Young 1977; Takiya and Mejdalani 2002; Mejdalani et al. 2011; Wilson et al. 2009).

The external morphology is apparently quite conservative within the genus *Dasmeusa*, with the exception of male terminalia characters (see taxonomic discussion below). Therefore, only a limited number of characters (40) could be considered in the present study for the phylogenetic analysis. However, we hope that our preliminary hypothesis of relationships within *Dasmeusa* (Fig. 19) can be tested in the future by means of the consideration of molecular data. Young (1977: 10) stated that the "Cicadellini are an intricate group" and their "morphology suggests rapid radiation and often shows small discontinuities." Perhaps, *Dasmeusa* species exemplify this rapid radiation situation, a possibility that could be tested in the context of a molecular phylogenetic analysis.

#### 4.2. Scanning electron microscopy of *Dasmeusa pauperata*

Microtrichia (subcellular projections) were found in various parts of the body of *D. pauperata*, such as the antennal pedicel (Fig. 14E), apex of the clypeus (Fig. 15A), mesonotum (Fig. 16B, C), base and apex of the forewing (Fig. 16F, G, K, L), abdominal sternites and laterotergites (Fig. 18A, B, E, F, G, I, L), tarsi and pretarsi (Fig. 17I, J, K, L). These structures give the integument a grainy to finely pubescent appearance at low magnification (Dietrich 1989). According to Hao et al. (2016), they are small rigid projections that occur alone or in groups of two or three. Their function is possibly to assist in increasing frictional force in contact regions (Gorb 1996, 1997, 2001). Gonzaga-Segura et al. (2013) studied the sensory organs in the antennal flagellum of *Leptoglossus zonatus* (Dallas, 1852) (Heteroptera: Coreidae). Micro-

trichia were found on the second flagellomere and, according to those authors, their shape and location suggest that they act as mechanoreceptors, informing the insect about movements of the antenna. They also reported that in this coreid species sensilla coeloconica are generally accompanied by s. basiconica and immersed between microtrichia. We have observed a similar situation in the abdominal sternum of *D. pauperata*, with microtrichia located close to s. coeloconica (Fig. 18G, I).

We observed brochosomes distributed close to microtrichia in various body regions (Fig. 18G, L). Brochosomes are submicron proteinaceous secretory particles synthesized by specialized regions of the Malpighian tubules of leafhoppers (Day and Briggs 1958; Hix 2001; Rakitov 2002; Rakitov and Gorb 2013). These insects display specialized behaviors for applying brochosomes, using the complex setal armature of legs, onto the integument and, more rarely, onto egg nests (Rakitov 1997, 2002; Hix 2001; Azevedo-Filho and Carvalho 2005). These particles are believed to be strongly hydrophobic, having the function of protecting the integument against the adhesion of water and honeydew (Rakitov 1997, 2009; Rakitov and Gorb 2013).

The organ of Evans, sometimes referred to as the maxillary sensillum, is a peculiar structure located, in leafhoppers, on the maxillary plate, next to the lorum (Fig. 14K, L). However, according to Bourgoïn (1986), the position of this organ is variable within the Auchenorrhyncha (for instance, it can occur above the maxillary plate, i.e., at the gena, in some fulgoroids, sometimes close to the antennal foramen). It occurs between the eye and the antennal foramen in the Coleorrhyncha and is apparently absent in the Heteroptera and Sternorrhyncha (Bourgoïn 1986). This organ has been described in leafhoppers as a finger-shaped lobe located within a pit, and has been interpreted as a maxillary gland, modified and reduced maxillary palp, or as a kind of sensory organ (Evans 1973; Cwikla and Freytag 1983; Bourgoïn 1986; Zanol 1988; Tavella and Arzone 1993; Mejdalani 1993, 1998; Dmitriev 2010). Superficially, the organ of Evans is somewhat similar to sensilla coeloconica, as, e.g., the ones described by Ahmad et al. (2016) from the antenna of the pentatomid *Perillus bioculatus* (Fabricius, 1775). This organ is well developed and occurs in the usual position, i.e., at the maxillary plate close to the lorum, in *D. pauperata* (Fig. 14K, L).

Insect sensilla are ectodermal organelles built up by a definite number of characteristic cells (Altner and Prillinger 1980). They consist of an exocuticular outer structure by or through which stimuli are conveyed to one or more sensory cells within the sensilla (Brožek and Bourgoïn 2013). Insects use their sensilla extensively during every step of host probing, acceptance, and feeding (Foster et al. 1983; Parveen et al. 2015). Accordingly, the mouthparts of the Auchenorrhyncha bear many kinds of sensilla. In the labium of *D. pauperata* we have identified sensilla basiconica (Fig. 15E, H) and s. coeloconica (Fig. 15F, G), as well as the very common s. trichodea (Fig. 15D, E, F). Considering that there are no chemoreceptors on the stylets, which are the structures that enter

the tissues of the host plant, these labial sensilla probably provide the only direct sensorial link of the mouthparts with the host plant (see Cobben 1988 and Brožek and Bourgoïn 2013).

According to Brožek and Bourgoïn (2013), sensilla basiconica have a gustatory function, being thus chemoreceptors. They can also receive tactile stimuli originated from the host plant, acting as mechanoreceptors (Wang et al. 2015; Zhao et al. 2010), or function as hygroreceptors (Usha Rani and Madhavendra 1995). A small number of these sensilla are typically located on the apical area of the labium of *D. pauperata* (Fig. 15E), and a similar situation was observed by Leopold et al. (2003) in the glassy-winged sharpshooter [*Homalodisca vitripennis* (Germar, 1821)] and by Quintas and Mejdalani (2021) in the fourth stadium nymph of the sharpshooter *Cavichiana bromelicola* Mejdalani et al., 2014. Leopold et al. (2003) speculated that the small number of sensilla at the labial paired apical sensory fields of *H. vitripennis* might be related to the wide host range of this xylem-feeder (Blua et al. 2000; Hoddle et al. 2003), which includes at least 100 documented plant species; therefore, extensive specific cues from a given plant would not be required. Sensilla coeloconica are widely distributed on the dorsal surface of the three labial segments of the cicadid *Meimuna mongolica* (Distant, 1881) (Hao et al. 2016). Altner and Prillinger (1980) suggested that these sensilla have distinct functions, including hygro-, thermo-, and chemoreceptors. They can perhaps feel by contact or gustation and also respond to odors (Zacharuk 1980; Ahmad et al. 2013). In addition to the labium (Fig. 15F, G), we have found a conspicuous kind of s. coeloconicum in the abdominal sternum of *D. pauperata* (Fig. 18E, F, G, H). A similar sensillum was observed by Dietrich (1989) in the abdomen of the Proconiini sharpshooter *Oncometopia orbona* (Fabricius, 1798).

Sensilla placodea were found on the frons of *D. pauperata* (Fig. 14J). According to Dietrich (1989), these structures consist of a sensory plate of the cuticle surrounded by a membranous ring. Brožek and Bourgoïn (2013) suggested that in the labium of Fulgoroidea (e.g., Achilidae and Nogodinidae) they are chemoreceptors, with an olfactory function, or perhaps thermoreceptors. Kanturski et al. (2017) suggested that these sensilla act as chemoreceptors and hygroreceptors in aphid antennae, whereas Gonzaga-Segura et al. (2013) mentioned that they are located at the base of the scape and could be mechanoreceptors in coreids.

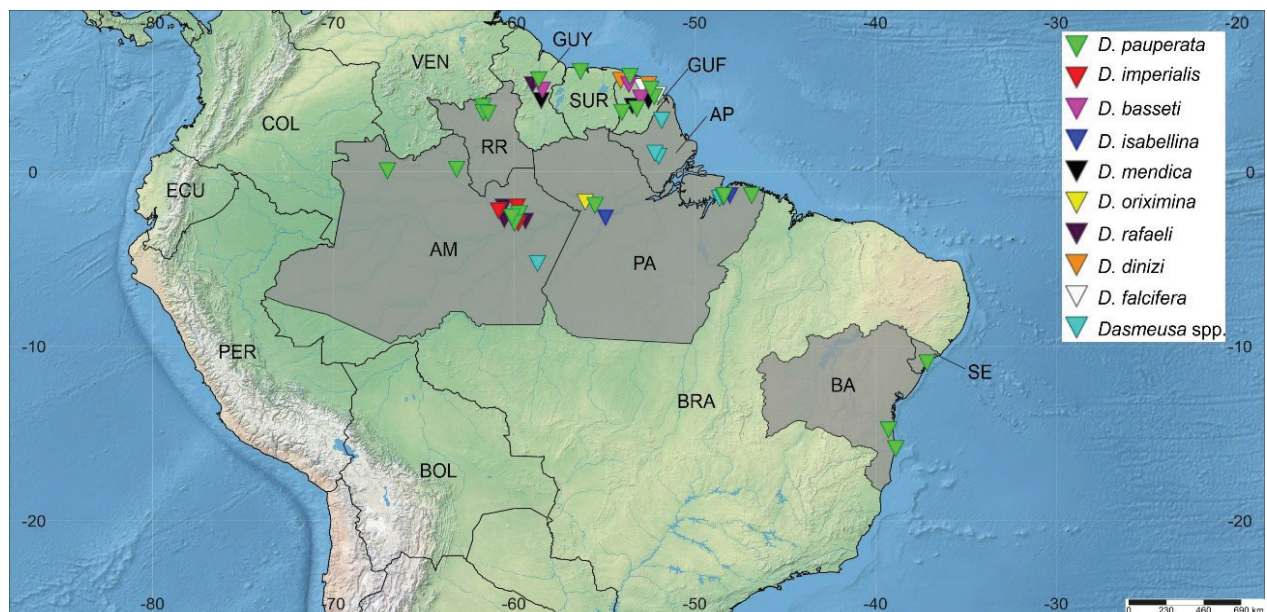
Sensilla trichodea (hair-like structures or setae) of distinct sizes, generally with a pointed apex (Fig. 18J) or sometimes with an apical pore (Fig. 18D), were observed in various portions of the body of *D. pauperata*; those with an apical pore (uniporous) are possibly contact chemoreceptors (see Ahmad et al. 2016). Sensilla trichodea are attached to the body surface in a cup-shaped socket (Fig. 18D) by an articulating membrane (Foster et al. 1983). These sensilla are quite abundant on the labium (Fig. 15B, C, D, E, F), where they act as mechano- and chemoreceptors (Usha Rani and Madhavendra 2005; Zhao et al. 2010; Wang et al. 2015). Mechanosensory

hairs, without pores, located on the lateral portions of the labium (Fig. 15C, D, E), probably detect the degree of labial bending during probing (Backus 1988; Parveen et al. 2015). Parveen et al. (2015) investigated the diversity of labial sensilla in phytophagous (Pentatominae) and predatory (Asopinae) pentatomid bugs; they found that sensilla trichodea are more concentrated at the apical portion of the labium, where they come into contact with the substrate during feeding, probably exerting a gustatory function and receiving stimuli from the plant or animal host. We have observed s. trichodea positioned between the eye ommatidia (Fig. 14B). Such interommatidial sensilla were also found by Quintas and Mejdalani (2021) in *C. bromelicola*.

### 4.3. Taxonomy and known distribution of *Dasmeusa*

With the addition of four new species and the treatment of *D. flavescens* as a junior synonym of *D. pauperata*, the genus *Dasmeusa* currently includes nine species. Our comparative morphological studies indicate that the following combination of easily observable features will most readily distinguish *Dasmeusa* (Figs 1A–I, 13A–D) from other Neotropical Cicadellini genera: (1) head well to strongly produced anteriorly, with coronal suture distinct, elongate, and extending anteriorly beyond intercellular line (Fig. 2A); (2) inferior third of frons slightly angulate (Fig. 10B); (3) pronotum with lateral margins convergent anteriorly and posterior margin rectilinear (Fig. 2A); (4) forewing subhyaline, its apex slightly expanded and obliquely truncate, base of fourth apical cell approximately aligned with base of third, and costal apical cell broadened posteriorly (Fig. 8B); (5) aedeagus usually with ventrally directed process (Fig. 3E); (6) paraphyses always present, with one pair of rami, with or without processes on stalk (Fig. 3F). The identification of *Dasmeusa* species remains somewhat difficult because they are very similar to one another externally (Fig. 1A–I) and can only be confidently done when males are available. Among the studied structures of the male terminalia, the paraphyses and aedeagus are the ones that provide the most useful features for the recognition of the species of the genus (see taxonomic notes for each recognized species and key to males above).

Although females of *Dasmeusa* are still poorly known, it appears that their terminalia structures are quite conservative, showing little significant interspecific variation. For the most part, we have found so far in these structures only subtle variations in the posterior margin of the sternite VII (Figs 2H, 4H, 9A). Young (1977) indicated that male and female genital structures of *Dasmeusa* were similar to those of *Paromenia*. However, our comparisons with genera of the *Paromenia* group revealed similarities of the ovipositor valvula II shared not only with *Paromenia* but also with *Onega* Distant, 1908, *Tacora* Melichar, 1926, *Alocha* Melichar, 1926, *Albiniana* Cavichioli, 1996, and *Baleja* Melichar, 1926 (Cavichioli 1992, 1996; Cavichioli and Wyler 1992; Takiya and Mejdalani 2002;



**Figure 20.** Known distribution of the genus *Dasmeusa*. Records are based on Pecly et al. (2019) and specimens studied herein. Brazilian states highlighted in the map are those with known records of the genus.

Takiya and Cavichioli 2004; Mejdalani and Rodrigues 2008; Mejdalani et al. 2011). The more conservative nature of the female terminalia of the Cicadellinae, in comparison with the male terminalia, has been mentioned, e.g., by Carvalho and Mejdalani (2014). However, the latter authors, as well as several other recent studies, have described useful features of the female terminalia for the recognition of genera and species (e.g., Takiya and Mejdalani 2004, Leal et al. 2009, Dellapé 2015, 2016, Felix and Mejdalani 2017, and Silva et al. 2017, 2018). Furthermore, in a phylogenetic analysis of a group of Proconiini genera, Ceotto and Mejdalani (2005) suggested that characters of the female terminalia were useful for supporting more basal nodes of the tree.

Members of the subfamily Cicadellinae are exclusively xylem-feeders, being usually considered generalists (Novotny and Wilson 1997; Basset and Charles 2000; Nielson and Knight 2000; Redak et al. 2004). Basset (1999) and Basset and Charles (2000) recorded *D. pauperata* and *D. basseti* feeding on seedlings of the following plants in Mabura Hill, Guyana: *Chlorocardium rodiei* (R. H. Schomb.) Rohwer, Richt. & van der Werff (Lauraceae), *Mora gonggrijpii* (Kleinhoonte) Sandwith (Caesalpinaceae), *Pentaclethra maculosa* (Willd.) Kuntze (Leguminosae), and *Catostemma fragrans* Benth. (Bombacaceae). *Dasmeusa rafaelli* sp. nov. has also been collected from *C. fragrans*. Senra et al. (2006) and Feitosa (2017) recorded unidentified specimens of *Dasmeusa* from citrus orchards (*Citrus sinensis* (L.) Osbeck – Rutaceae) in Amazonas State, Brazil. These are the only published records of the genus associated with a plant of economic importance. Leafhoppers are very important agriculturally because they can act as vectors of plant pathogenic viruses or bacteria (Nielson 1968; Freytag and Sharkey 2002; Redak et al. 2004). Among xylem-feeding cicadomorphans, species of the Cicadellinae (sharpshooters) are the most

important vectors of *Xylella fastidiosa* Wells et al., 1987, a pathogenic gram-negative bacterium that infects citrus trees and other cultures in various parts of the world, including Brazil (Redak et al. 2004; Wilson and Turner 2007). All Cicadellinae representatives are considered potential vectors of *X. fastidiosa*, including the *Dasmeusa* specimens recorded by Senra et al. (2006) and Feitosa (2017) in citrus orchards of the Amazon region.

The known distribution of *Dasmeusa* is shown in Fig. 20. Records are based mainly on Pecly et al. (2019) and on specimens deposited in scientific collections. These records indicate that the genus is possibly widely distributed in the Amazon Forest, also occurring in the Atlantic Forest (Northeastern Brazil). We have also studied five females (MZSP) labeled from São Paulo State (Southeastern Brazil, Atlantic Forest); however, it appears to us that these females were possibly incorrectly labeled, as no other specimens from this part of the country have ever been collected or observed during field trips. Unfortunately, the available distribution data of *Dasmeusa* are still considered very fragmentary (Fig. 20). Thus, it will not be possible for us to carry out a formal biogeographic analysis of the genus at this time.

## 5. Competing interests

The authors have declared that no competing interests exist.

## 6. Acknowledgments

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## Supplementary Material 1

### Table S1

**Authors:** Pecly NH, Takiya DM, Cavichioli RR, Mejdalani G (2023)

**Data type:** .pdf

**Explanation note:** Data matrix for the phylogenetic analysis of *Dasmeusa* and outgroup taxa.

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**Link:** <https://doi.org/10.3897/asp.81.e102848.suppl1>

## Supplementary Material 2

### Figure S1

**Authors:** Pecly NH, Takiya DM, Cavichioli RR, Mejdalani G (2023)

**Data type:** .pdf

**Explanation note:** Strict consensus of the nine equally most parsimonious trees of the phylogenetic analysis of *Dasmeusa* and outgroup taxa.

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