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Review of the genus *Papagona* Ball, 1935 (Hemiptera: Caliscelidae) including a new Neotropical species

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Abstract

Papagona Ball, 1935 was originally described based on two species from the USA (Arizona). Both species of *Papagona* (*P. papoosa* Ball, 1935, type species of genus, and *P. succinea* Ball, 1935) are redescribed herein based on type specimens, including their previously unknown internal male genitalia. A new species from Brazil (Roraima) is described herein including the male and female terminalia. A taxonomic key to all included species is provided and additional diagnostic characters for this genus are proposed.

Key words: key to species, new diagnosis, Peltonotellini, sensory pits, taxonomy

Introduction

Caliscelidae Amyot & Serville, 1843 is a small and worldwide distributed fulgoroid family (Gnezdilov 2014a) with 245 species described in 78 genera (Bourgoin 2021). Caliscelids are usually brachypterous and small, often measuring from 1 to 5 mm, are frequently confused with nymphs and, therefore, are little collected (O'Brien 2002). They were treated as a family by Melichar (1906), although later considered as a subfamily of Issidae by Fennah (1954). Subsequently Emeljanov (1999) reestablished Caliscelidae as a family based on specific features of the ovipositor. In addition, other studies corroborate this classification from analyses of bioacoustics data by Tishechkin (1998; 2003) and molecular phylogenetic data by Yeh *et al*. (1998; 2005), Urban & Cryan (2007), Song & Liang (2013), and Wang *et al*. (2016).

Although the family has been taxonomically well studied in the Oriental and African regions (e.g., Gnezdilov & Wilson 2006, Gnezdilov 2014b, 2015), the neotropical diversity of Caliscelidae is understudied and currently limited to nineteen species in twelve genera (Metcalf 1958, Bourgoin 2021, Table 1). Only three of twelve genera occurring in the Neotropical Region have been revised (viz. Doering 1940; 1941, Emeljanov 2015), but these revisions did not include the Neotropical species. Those revised were *Bruchomorpha* Newman, 1838, *Fitchiella* Van Duzee, 1917, and *Caliscelis* de Laporte, 1833. In fact, the single *Caliscelis* described from the Neotropical Region, *C. stemmalis* (Burmeister, 1835), is most likely a generic misplacement, as no other native Caliscelini are reported from the New World. The other nine genera have not been revised, although all except *Plagiopsis* Berg, 1883 are monotypic.

Papagona Ball, 1935 was originally described from the US with two species: *P. papoosa* Ball, 1935 (type species) and *P. succinea* Ball, 1935. *Papagona* was characterized by Ball (1935) by the following diagnostic features: (1) vertex flat, long, and narrow, longer than pronotum, subequal to mesonotum length, as long as its basal width; (2) pronotum extremely long and narrow, almost as long as wide, lateral margins carinate and broadly covered with sensory pits; (3) mesonotum elongate with lateral carinae extremely high and region in between them much longer

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than wide; (4) face elongate, retreating, forming a 30° angle with vertex; and (5) frons shaped like a rather long flat-iron, truncate, with two sensory pits below it, sides of frons extremely wide above. These characters and others that may aid in defining the genus are investigated here. Ball (1935) related this genus to *Aphelonema* Uhler, 1876.

Herein we describe a new species of *Papagona* from Brazil, it constitutes the first neotropical record for *Papagona*. We redescribe *P. papoosa* and *P. succinea*, including the previously unknown male genitalia and details of sensory pit distribution. A key to species of *Papagona* and new diagnostic characters to the genus are proposed with the goal to contribute to taxonomic studies of New World Caliscelidae.

TABLE 1. Neotropical Caliscelidae species with their distribution.

Species	Distribution
Bruchomorpha costaricensis Schmidt, 1927	Costa Rica
Bruchomorpha duocantha Caldwell, 1945	Mexico (Coahuila)
Bruchomorpha longipennis Caldwell, 1945	Mexico (Michoacán)
Bruchomorpha minutiforma Caldwell, 1945	Mexico (Guerrero-Morelos)
Caliscelis stemmalis (Burmeister, 1835)	Brazil (Rio de Janeiro)
Concepcionella theunei Schmidt, 1927	Chile (Concepción)
Fitchiella zahniseri Freitas, Dietrich et Takiya, 2020	Panama (Verugas)
Itatiayana banzhafi (Schmidt, 1932)	Brazil (Rio de Janeiro)
Ohausiella andina Schmidt, 1910	Ecuador (Loja)
Paranaso ohausi Schmidt, 1932	Brazil (São Paulo)
Peripola nigra (Melichar, 1906)	Argentina (Buenos Aires)
Plagiopsis bergi Breddin, 1897	Argentina (Patagonia)
Plagiopsis decorata Melichar, 1906	Argentina (Buenos Aires)
Plagiopsis distanti Berg, 1883	Argentina (Buenos Aires)
Plagiopsis scotti Breddin, 1897	Argentina (Patagonia)
Plagiopsola strandi Schmidt, 1927	Costa Rica
Protrocha robusta (Caldwell, 1945)	Mexico (Michoacán)
Protrocha nigrilutea Freitas, Dietrich et Takiya, 2020	Mexico (Michoacán)
Semiperipola saltaensis Schmidt, 1910	Argentina (Salta)

Material and methods

We studied four specimens of a new species of *Papagona* collected with a vacuum sampler at Roraima State. The external habitus of the new species and holotypes of *P. papoosa* and *P. succinea* were photographed using a LEICA DFC450 digital camera coupled to a LEICA M205C stereoscopic microscope and a Nikon DS-Fi2 camera coupled to a Nikon SMZ18 stereomicroscope, respectively. The male holotype of *P. papoosa*, a male paratype of *P. succinea,* and a male and female of the new *Papagona* species were dissected for description of terminalia. Specimens studied are deposited in the Coleção Entomológica Prof. José Alfredo Pinheiro Dutra, Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (DZRJ); Coleção de Invertebrados, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA); Insect Collection, Illinois Natural History Survey, University of Illinois, Champaign, USA (INHS); and National Museum of Natural History, Smithsonian Institution, Washington, DC, USA (USNM).

Redescriptions of *Papagona* species focused on the distribution pattern of sensory pits on sides of frons, pronotum, mesonotum, and abdomen. In their original description (Ball 1935) this information is not detailed.

The abdomens of specimens removed and treated with a warm 10% KOH solution and, after washing, were dissected and photographed in glycerin using a LEICA DFC450 digital camera coupled to a LEICA M205C stereoscopic microscope, and Nikon DS-Fi2 camera coupled to a Nikon Eclipse Ni compound microscope (for genitalia). Illustrations of male genitalia were made using a stereoscopic microscope ZEISS Stemi SV 6 with a camera lucida attached. Terminology of the external morphology follows O'Brien & Wilson (1985) and male and female terminalia follows Bourgoin (1987; 1993) and Gnezdilov & Bourgoin (2009).

Results

Family Caliscelidae Amyot & Audinet-Serville, 1843

Subfamily Caliscelinae Amyot & Audinet-Serville, 1843

Tribe Peltonotellini Emeljanov, 2008

Genus *Papagona* Ball, 1935

Papagona—Ball 1935: (Original description). Doering 1939: 449 (Key). Doering 1940: 145 (Redescription, key to species).

Type species. *Papagona papoosa* Ball, 1935.

Amended diagnosis. Vertex (Figs 2B, E, H, 5A, 6B) sub-hexagonal with anterior margin short. Frons (Figs 2A, D, C, F, G, I, 5B, C, 6A, C) with pair of sublateral carinae converging toward fastigium, approximately parallel approaching frontoclypeal suture, enclosing subtriangular median region (central plate of frons), longer than wide at widest portion, with one sensory pit on each side near frontoclypeal suture; in lateral view, not extending anteriorly beyond sublateral carinae; sides of frons (Figs 2C, F, I, 5C, 6C) extremely wide above, with sensory pits in a triangle-like distribution, and not fused above clypeus (Figs 2A, D, G, 5B, 6A). Clypeus without carina. Ocelli absent. Eyes oblong. Antennae short. Pronotum (Figs 2B, E, H, 5A, 6B) subrectangular; longer than half of width; posterior margin almost straight; with median carina; median portion of disc, depressed and without sensory pits; with sensory pits bordering lateral margins of disc and a group of inner ones at posterior half; lateral lobe (Figs 2C, F, I, 5C, 6C) with only one sensory pit and longitudinal carina. Mesonotum (Figs 2B, E, H, 5A, 6B) with lateral carinae; region in between lateral carinae, depressed and without sensory pits; region outerad of each lateral carina with sensory pits. Brachypterous; with reduced venation. Legs simple; with carinae and setose; tibia III with single lateral spine; apex of tibia III with five apical spines; basitarsus III and second tarsomere III with two apical spines. Abdominal tergites (Figs 2B, 5A, 6B) conspicuously elevated medially in males; in lateral view, abdominal tergite III with sensory pits (Figs 2C, F, 5C, 6C, 7); tergites IV to VII (Figs 2C, F, 5C, 6C, 7) with one to three sensory pits followed by isolated ventral pair aligned vertically; tergite VIII (Fig. 7) with one to two sensory pit. Phallus (Figs 3E–H, 5G, H, 6E, F) with endosoma formed by two asymmetrical sides, of which the longer side is apically developed in a comma-like structure and shorter side of endosoma is connected ventrally to longer side by a subtriangular ventral expansion; phallobase shorter than endosoma; aedeagus narrowing apically and with two long and thinner aedeagal hooks.

Remarks. *Papagona* is easily distinguishable from other New World caliscelid genera because it is the only one with sensory pits on abdominal tergite III (Figs 2C, F, 5C, 6C, 7). Other characters, as the central plate of frons with ventral pair of sensory pits within (Figs 2A, D, G, 5B, 6A) and sides of frons with sensory pits in a triangle-like distribution are also very characteristic of this genus (Figs 2C, F, I, 5C, 6C). In other New World genera, such as *Aphelonema*, *Bruchomorpha*, or *Fitchiella*, the central plate of frons never contains sensory pits within and sensory pits at sides of frons are mainly distributed as two well-defined rows (especially in *Bruchomorpha* and *Fitchiella*). Ball (1935) pointed out that *Aphelonema* was allied to *Papagona*, however, based on our ongoing studies of New World Caliscelidae, these genera do not share diagnoseable similarities except from the presence of sensory pits on body of adults, which characterize Peltonotellini. A phylogenetic analysis based on combined morphology and DNA sequences (de Freitas *et al*., in prep.) places *Papagona* as the sister to all other 11 Peltonotellini genera (including five undescribed genera) sampled.

Sexual dimorphism is common in the genus, as in other caliscelids, where the coloration of males is more conspicuous than of females, which are usually brownish yellow and larger than males (Figs 1, 2A–F). Additionally, abdominal tergites of males are medially elevated (Fig. 2B, E).

Key to male specimens of *Papagona*

1. Face, forewings, and abdomen mostly orangish red (Fig. 6A–C) . . . . . ***Papagona succinea*** Ball, 1935
-. Face, forewings, and abdomen mostly black (Figs 2A–C, 5A–C) **2**
2. Anterior margin of vertex almost rounded (Fig. 5A); frons without median carina (Fig. 5B); abdomen with tergites bearing dorsolateral pair of small pale-yellow maculae (Fig. 5A); sternites, in lateral view, with lateral white maculae (Fig. 5C); phallus with pair of aedeagal hooks subequal and curved anterodorsally (Fig. 5G, H) . . . . . ***Papagona papoosa*** Ball, 1935
-. Anterior margin of vertex almost pointed (Fig. 2B, H); frons with median carina (Fig. 2A, D, G); abdomen with tergites bearing dorso-median pair of small and conspicuous yellow maculae (Fig. 2B, H); sternites, in lateral view, with lateral white maculae small and faint (Fig. 2C, I); phallus with pair of aedeagal hooks, of which one is long and curved anterodorsally, and other is strongly curved laterally, crossing the sides of phallus (Fig. 3E–H) . . . . . ***Papagona dietrichi* sp. nov.**

***Papagona dietrichi* sp. nov.**

(Figs 1–4, 7)

Type locality. Brazil, Roraima State, ESEC Maracá.

Description. *Body length.* Male (Fig. 1A), 2.9 mm; Female (Fig. 1B), 4.4 mm.

FIGURE 1. Live specimens of *Papagona dietrichi* **sp. nov.**: (A) male specimen; (B) female specimen. Photographs by Dr. C. H. Dietrich.

*Color***.** Males (Figs 1A, 2A–C). Body mainly black with some regions yellowish-brown. Vertex, pronotum, and mesonotum yellowish-brown with broad median longitudinal white stripe crossing these structures (Figs 1A, 2B). Forewing with corium mostly black with apex light brown and two small circular pale maculae in between corium and clavus, one at base and another near midlength of claval suture; clavus brown (Fig. 2B, C). Legs mostly yellow; metafemur black (Fig. 2B, C). Abdominal tergites with dorsal median pair of small and conspicuous yellow maculae (Fig. 2B); lateral white maculae of abdominal sternites in lateral view smaller and fainter (Fig. 2C); and thoracic and abdominal sternites mostly white medially (Fig. 2A, C).

Females (Figs 1B, 2D–F). Body mainly brown with some regions light brown. Vertex, pronotum, and mesonotum light brown with lighter brown broader median longitudinal stripe crossing these structures (Fig. 2E). Forewing hyaline brown (Fig. 2E). Legs brown (Fig. 2F). Abdomen with tergite III with lateral white macula (Figs 1B, 2F); all tergites with median longitudinal broad light brown stripe (Fig. 2E).

Structure. Head and thorax. Vertex (Fig. 2B, E, H) with anterior margin slightly pointed; anteriorly converging to rounded apex; slightly longer than basal width at midline; longer than pronotum length at midline. Frons (Fig. 2A, D, G) with median carina which does not reach fastigium, weak in males and conspicuous in females; in lateral view (Fig. 2C, F, I), each side with row of eight sensory pits bordering sublateral carina, four pits bordering frontogenal carina, and a pair of pits bordering fastigium (linking the other two rows providing a triangle-like arrangement—with three isolated pits within, aligned diagonally).

Pronotum (Fig. 2B, E, H) with six sensory pits bordering lateral margins of disc and a group of fiver inner ones at posterior half. Mesonotum (Fig. 2B, E, H) with median carina; region outerad of lateral carina with eight to ten sensory pits.

Abdomen. Tergite III (Figs 2C, F, 7), in lateral view, with one to two sensory pits (two in holotype). Tergites IV (Fig. 2C, F, 7), in lateral view, with one row of two to three sensory pits (three in holotype) followed by an isolated ventral pair. Tergites V (Fig. 2C, F, 7), in lateral view, with one row of three sensory pits (three in holotype) followed by an isolated ventral pair. Tergites VI (Fig. 2C, F, 7), in lateral view, with one row of three sensory pits (three in holotype) followed by an isolated ventral pair. Tergites VII (Fig. 2C, F, 7), in lateral view, with one row of two to three sensory pits (three in holotype) followed by an isolated ventral pair. Tergite VIII (Fig. 7), in lateral view, with one to two sensory pits (two in holotype).

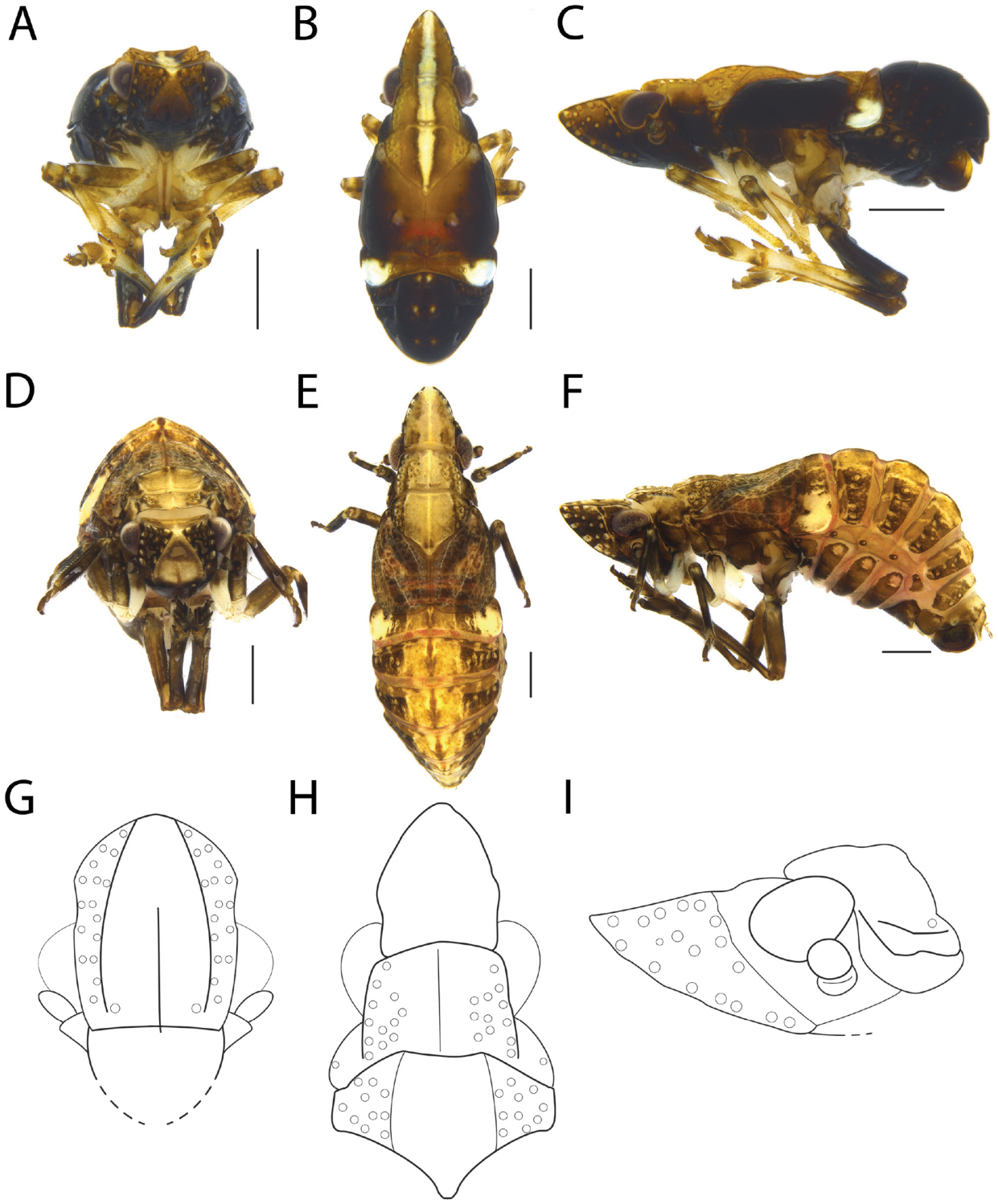

FIGURE 2. Habitus of *Papagona dietrichi* **sp. nov.**, male holotype (DZRJ): (A) Frontal view; (B) dorsal view; (C) lateral view. Habitus of female paratype (DZRJ): (D) frontal view; (E) dorsal view; (F) lateral view. Line drawings of head and thorax: (G) frontoventral view; (H) dorsal view; (I) lateral view. Scale bar = 0.5 mm.

Male terminalia. Pygofer (Fig. 3A) with anterior margin concave; posterior margin with concavity on ventral half. Connective (Fig. 3B) with tectiform structure bearing tectiductus; ventral support inverted Y-shaped. Gonostylus (Fig. 3D) hook-like; anterior portion pointed; caudal portion curved anterodorsally; dorsal margin follows almost straight and with protuberance in between anterior and median third; ventral margin mostly rounded; median third longer than high, setose. Endosoma (Fig. 3E–H) enclosing almost all phallobase and aedeagus lengths laterally and ventrally; asymmetrical, with two different sides linked ventrally, of which: one side is longer and with apex curved ventrally, comma-like; and other side is shorter and apically truncated, bearing triangular expansion ventrally directed to the longest side of endosoma at aedeagus midlength (Fig. 3E, F). Phallobase membranous, shorter than endosoma; enclosing aedeagus half-length laterally and ventrally; slightly visible in lateral view, apically and dorsally. Aedeagus (Fig. 3E–H) opened dorsally; apically, narrowing and with pair of aedeagal hooks (Fig. 3F–H), subequal in length, longer and thinner than aedeagus, but curved differently: one aedeagal hook curved anterodorsally and which follow the comma-like and longer apical lobe of endosoma; the other strongly curved laterally, crossing aedeagus ventrally. Suspensorium V-shaped. Anal tube (Fig. 3I, J), in dorsal view, as long as wide and with posterior margin rounded; setose.

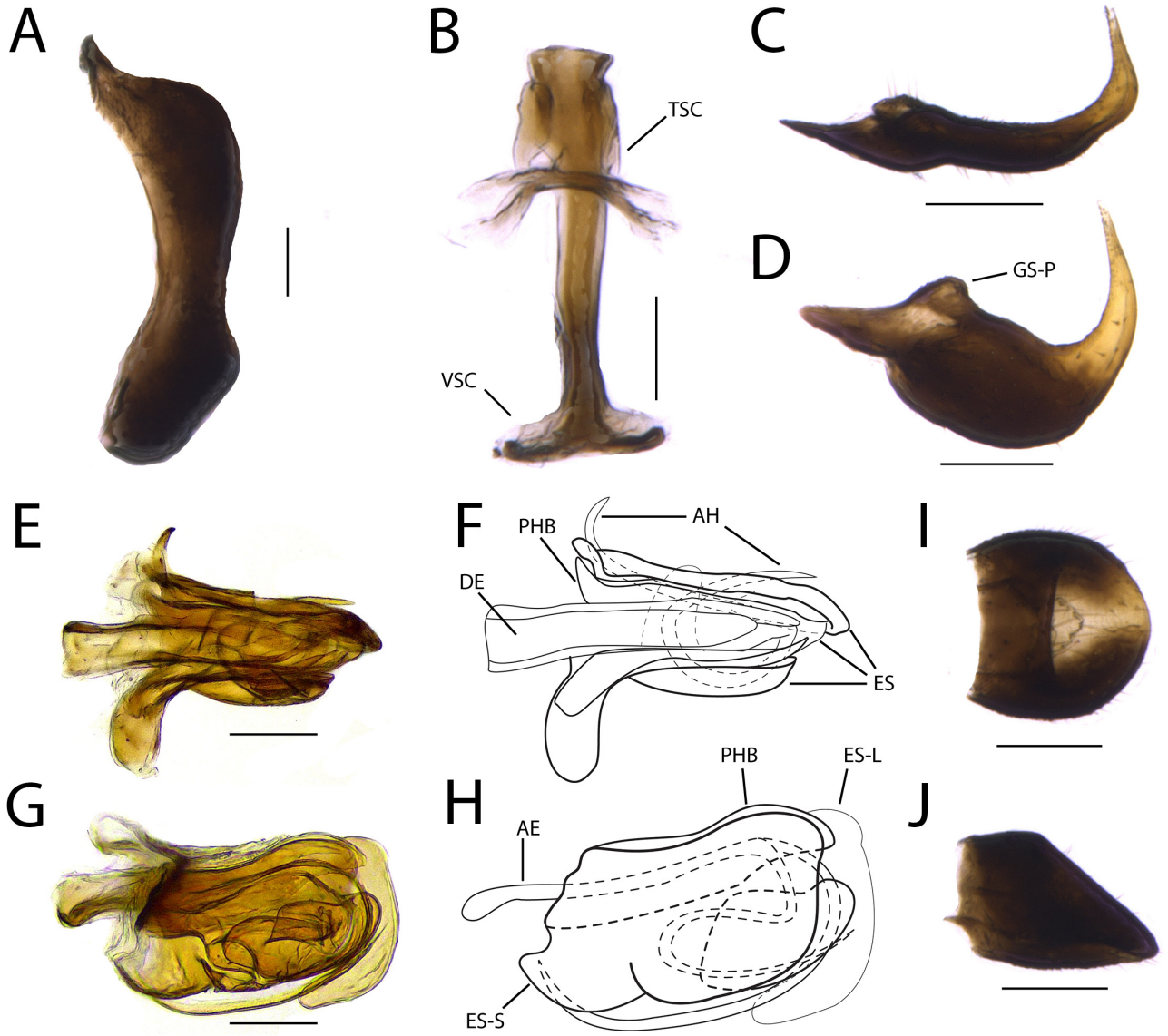

FIGURE 3. Male terminalia of *Papagona dietrichi* **sp. nov.**, male holotype (DZRJ): (A) Pygofer, lateral view; (B) connective, anterior view; (C–D) style, dorsal view (C) and lateral view (D) views. (E–H) phallus, dorsal view (E, F) and lateral view (G, H). (I–J) Anal tube dorsal view (I) and lateral view (I). Labels: AE—Aedeagus; AH—Aedeagal hooks; DE—Ductus ejaculatorius; ES—Endosoma; ES-L—Endosoma longer side (comma-like); ES-S—Endosoma shorter side; GS-P—Gonostylus protuberance on dorsal margin; PHB—Phallobase; TSC—Tectiform structure of the connective; VSC—Ventral support of the connective. Scale bar = 0.1 mm.

Female terminalia. Posterior margin of sternite VII (Fig. 4B) medially bearing two slightly round projections; setose. Gonoplacs (Fig. 4C) sclerotized; subrectangular; setose. Anterior connective lamina of gonapophysis VIII (Fig. 4D) with two apical teeth, curved and subequal; with wide rounded and sclerotized flap laterad of teeth. Posterior connective lamina of gonapophysis IX (Fig. 4E, F) distal part, in lateral view (Fig. 4F), with several straight and thin spines, starting on stem and following almost until apex; spines of distal part are larger than spines on stem; middle portion with several pits (Fig. 4F); apex setose (Fig. 4F); region in between the distal parts with three plates of setae (Fig. 4E). Segment X of anal tube (Fig. 4G, H) as long as wide; posterior margin (Fig. 4G) pointed; setose.

Taxonomic notes. The new species is similar to *Papagona papoosa* in coloration, but they can be distinguished by some external morphological characters and male terminalia. This species differs from other species of the genus by the following group of characters: (1) male coloration pattern (Figs 1, 2A–C) is similar to *P. papoosa* (with slight differences on abdominal sternites coloration), but very different from *P. succinea* (which is red or reddish-yellow); (2) length and shape of vertex (Fig. 2B, E, H), longer and more pointed than other species of the genus; (3) central plate of frons with median carina which is absent in *P. papoosa*; (4) sides of frons with three sensory pits aligned diagonally in the middle of triangle of sensory pits (Fig. 2C, F, I); (5) posterior margin of pygofer with concavity on ventral half (Fig. 3A); (6) protuberance of gonostylus more conspicuous than in other species of genus (Fig. 3D); and (7) phallus with pair of aedeagal hooks, one curved anterodorsally and other curved laterally, crossing sides of phallus (Fig. 3E–H).

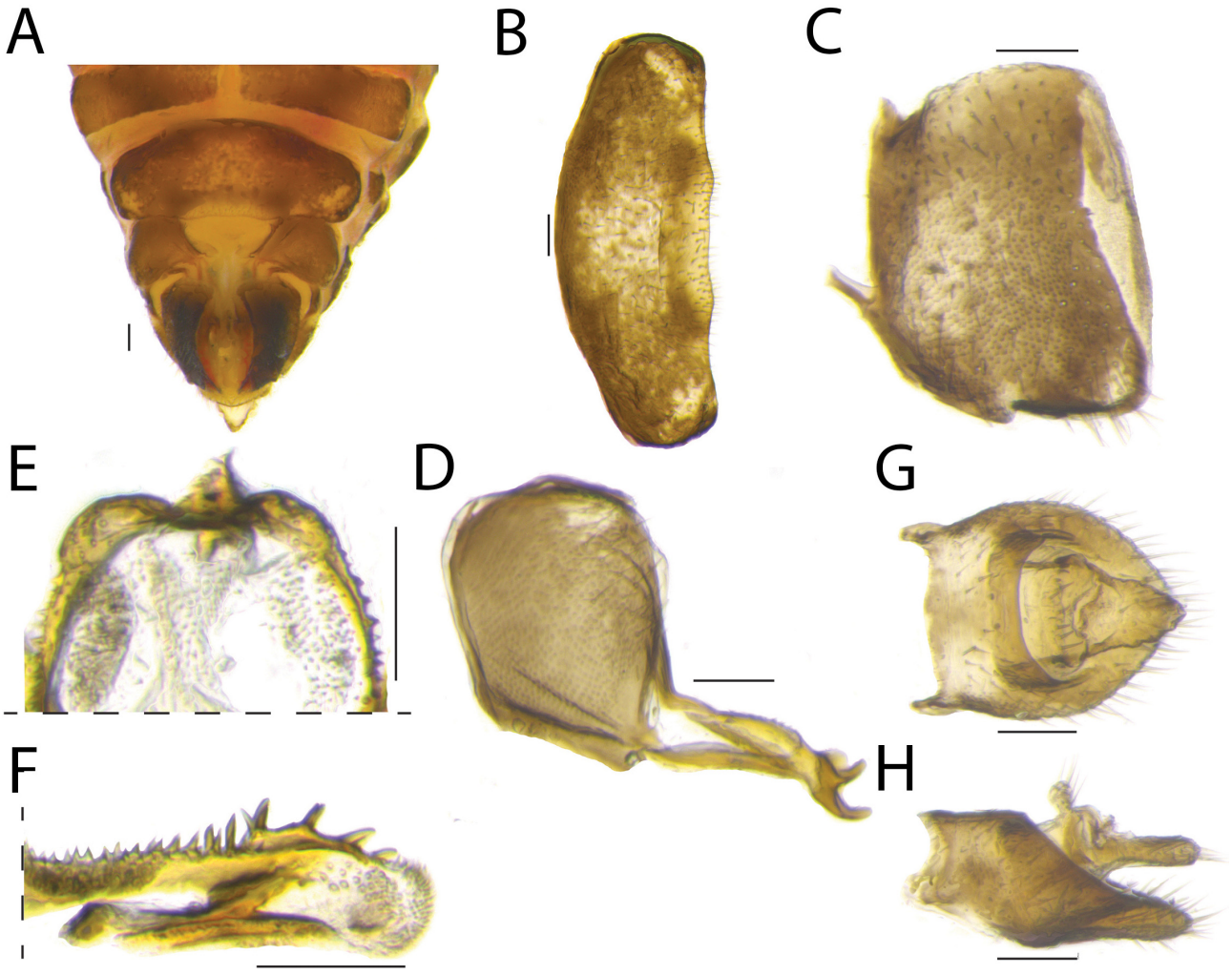

FIGURE 4. Female terminalia of *Papagona dietrichi* **sp. nov.**, female paratype (DZRJ): (A) External female terminalia, ventral view; (B) sternite VII, lateral view; (C) gonoplac, lateral view; (D) anterior connective lamina of gonapophysis VIII; (E–F) posterior connective lamina of gonapophysis IX, basal part, dorsal view (E) and distal part, lateral view (F); (G–H) anal tube dorsal view (G) and lateral view (H). Scale bar = 0.1 mm.

Plant associations. Unfortunately, as type specimens were collected using a vacuum sampler, no specific plant record was taken. However, vacuum samples were taken mostly from dense grasses in a dry lake bed.

Etymology. The specific epithet is an honorific for Dr. Christopher H. Dietrich (INHS), who collected specimens of the type series and many other caliscelids from Central and South America and allowed us to study these curious planthoppers.

Studied material. Holotype: male, Brazil, Roraima, ESEC Maracá, 3.3605°N 61.4322°W, 100 m, 24 Mar. 2016, C. Dietrich *coll.*, vacuum sample (DZRJ, DNA voucher ENT5050). **Paratypes:** 1 male, Brazil, Roraima, ESEC Maracá, 3.3605°N 61.4322°W, 100 m, 24 Mar. 2016, D.M. Takiya *coll.*, vacuum sample (INPA); 1 female, same data as preceding (INHS). 1 female, same data as preceding (DZRJ).

Papagona papoosa Ball, 1935

(Fig. 5)

Papagona papoosa—Ball 1935: 41 (Original description)

Type locality. Arizona, Santa Cruz River, near Tubac (according to Ball 1935).

Amended description. *Body length.* Male, 2.6 mm (Ball 1935).

Color. Males (Fig. 5A–C). Body mainly black with some regions yellowish-brown. Vertex, pronotum, and mesonotum yellowish-brown with broad median longitudinal white stripe crossing these structures (Fig. 5A). Forewing with corium mostly black with apex light brown and two small circular pale maculae in between corium and clavus, one at base and another near midlength of claval suture; clavus brown (Fig. 5A). Legs mostly yellow; metafemur black (Fig. 5B, C). Abdomen with tergite III with lateral white macula (Fig. 5A, C); each segment of abdomen with dorsal median pair of small and few conspicuous yellow maculae (Fig. 5A); in lateral view, sternites with lateral white macula (Fig. 5A).

Structure. Head and thorax. Vertex (Fig. 5A) with anterior margin rounded; as long as basal width at midline; subequal to pronotum length at midline. Frons (Fig. 5B) without median carina; in lateral view (Fig. 5C) each side with row of seven sensory pits bordering sublateral carina, four pits bordering frontogenal carina, and a pair of pits bordering fastigium (linking the other two rows providing a triangle-like arrangement—with two isolated pits within, aligned diagonally).

Pronotum (Fig. 5A) with six sensory pits bordering lateral margins of disc and a group of fiver inner ones at posterior half. Mesonotum (Fig. 5A) without median carina; region outerad of lateral carina with eight to nine sensory pits.

Abdomen. Tergite III (Fig. 5C), in lateral view, with pair of sensory pits. Tergite IV (Fig. 5C), in lateral view, with pair of sensory pits followed by an isolated ventral pair. Tergite V (Fig. 5C), in lateral view, with one row of three sensory pits followed by an isolated ventral pair. Tergite VI (Fig. 5C), in lateral view, with pair of sensory pits followed by an isolated ventral pair. Tergite VII (Fig. 5C), in lateral view, with one row of three sensory pits followed by an isolated ventral pair. Tergite VIII, in lateral view, with pair of sensory pits.

Male terminalia. Pygofer (Fig. 5D) with anterior margin concave; with posterior margin convex. Connective (Fig. 5E) with tectiform structure bearing tectiductus; ventral support inverted Y-shaped. Gonostylus (Fig. 5F) hook-like; anterior portion pointed; caudal portion curved anterodorsally; dorsal margin follows almost straight with a rounded protuberance in between anterior and median third; ventral margin mostly rounded; median third longer than high, setose. Endosoma (Fig. 5G, H) enclosing almost all phallobase and aedeagus lengths laterally and ventrally; asymmetrical, with two different sides linked ventrally: one side is longer and with apex curved ventrally, comma-like; and other side is shorter and apically truncated, bearing sub-triangular expansion ventrally directed to the longest side of endosoma at aedeagus midlength (Fig. 5G). Phallobase membranous, shorter than endosoma; enclosing aedeagus half-length laterally and ventrally; slightly visible in lateral view, apically and dorsally. Aedeagus (Fig. 5G, H) opened dorsally; apically, narrowing and with pair of aedeagal hooks (Fig. 5H), both with same length, longer and thinner than aedeagus, and curved anterodorsally, reaching the base of phallus. Suspensorium V-shaped (Fig. 5G). Anal tube as long as wide; posterior margin rounded; setose.

Taxonomic notes. Although Ball (1935) states in the generic description that the vertex of *Papagona* is longer than pronotum length (see Introduction), in the holotype of *P. papoosa* it appears only slightly longer than pronotum length (Fig. 1A). However, this could be an intraspecific variation or artefact the specimen position when photographed. See taxonomic notes of *P. dietrichi* **sp. nov.** above for comparative notes.

Distribution. United States: Arizona (Ball 1935).

Plant associations. *Muhlenbergia porteri* Scribn. ex Beal (muhly grass, Poaceae) (Ball 1935).

Studied material. Holotype: male (dissected herein), USA, Arizona, Santa Cruz River, 6 Aug. 1932, E. D. Ball (USNM ENT 01513540).

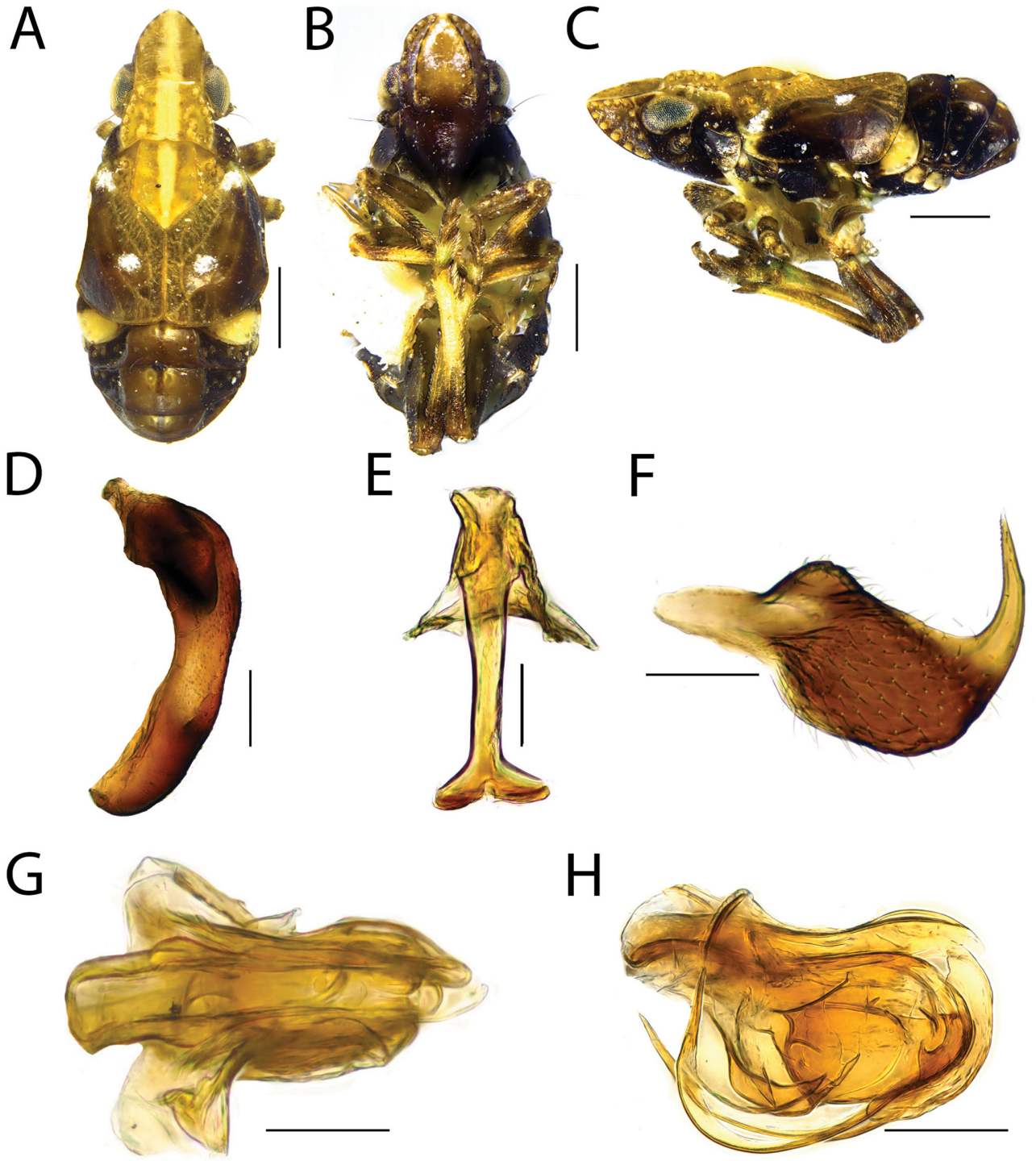

FIGURE 5. *Papagona papoosa* Ball, 1935, male holotype (USNM): (A) Dorsal habitus; (B) ventral habitus; (C) lateral habitus; (D) Pygofer, lateral view; (E) connective, anterior view; (F) style, lateral view; (G–H) Phallus, dorsal view (G) and lateral view (H). Scale bar: A–C = 0.5 mm; D–H = 0.1 mm.

***Papagona succinea* Ball, 1935**
(Fig. 6)

Papagona succinea—Ball 1935: 41 (Original description)

Type locality. Arizona, Tucson Mountains (according to Ball 1935).

Amended description. *Body length.* Male, 2.5 mm (Ball 1935).

Color. Males (Fig. 6A–C). Body mainly orangish red. Forewing orange with anterior and intern margin yellowish, and two small circular pale maculae (Fig. 6B, C). Legs yellow with irregular brown maculae (Fig. 6C). Abdomen with tergite III with lateral white macula (Fig. 6C); in dorsal view, abdominal tergite medially orangish red and laterally yellow reddish (Fig. 6B, C); each segment of abdomen with dorsal median pair of small and few conspicuous yellow maculae (Fig. 6B); in lateral view, sternites with lateral white macula (Fig. 6C).

Structure. Head and thorax. Vertex (Fig. 6B) with anterior margin rounded; as long as basal width at midline; subequal to pronotum length at midline. Frons (Fig. 6A) with median carina which does not reach fastigium; in lateral view (Fig. 6A, C), each side with row of seven sensory pits bordering sublateral carina, five pits bordering frontogenal carina, and three pits bordering fastigium (linking the other two rows providing a triangle-like arrangement—with four isolated pits within, aligned diagonally).

Pronotum (Fig. 6B) with six sensory pits bordering lateral margins of disc and a group of seven inner ones at posterior half. Mesonotum (Fig. 6B) without median carina; region outerad of lateral carina with eleven sensory pits.

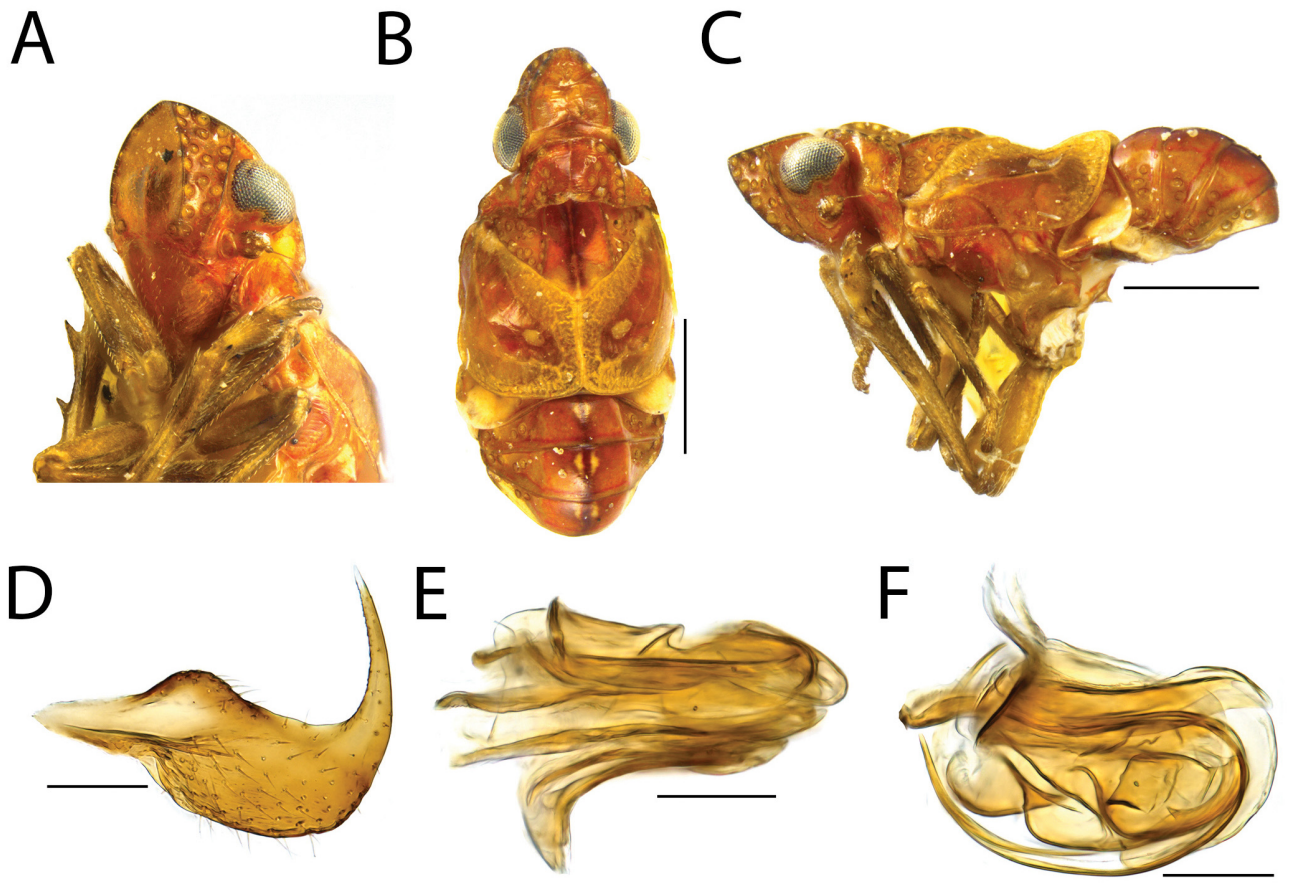

FIGURE 6. *Papagona succinea* Ball, 1935, male holotype (USNM): (A) Ventrolateral view of head; (B) dorsal habitus; (C) lateral habitus. Male paratype (USNM): (D) style, lateral view; (E–F) Phallus, dorsal view (E) and lateral view (F). Scale bar: B–C = 0.5 mm; D–F = 0.1 mm.

Abdomen. Tergite III (Fig. 6C), in lateral view, with two to three sensory pits. Tergite IV (Fig. 6C), in lateral view, with one row of two to three (three in holotype) sensory pits followed by an isolated ventral pair. Tergite V (Fig. 6C), in lateral view, with one row of two to four (two in holotype) sensory pits followed by an isolated ventral

pair. Tergite VI (Fig. 6C), in lateral view, with one row of two to three (two in holotype) sensory pits followed by an isolated ventral pair. Tergite VII (Fig. 6C), in lateral view, with one row of two to three (three in holotype) sensory pits followed by an isolated ventral pair. Tergite VIII, in lateral view, with three sensory pits.

Male terminalia. Pygofer with anterior margin concave; posterior margin convex. Connective with tectiform structure bearing tectiductus; ventral support inverted Y-shaped. Gonostylus (Fig. 6D) hook-like; anterior portion pointed; caudal portion curved anterodorsally; dorsal margin follows almost straight and with a rounded protuberance in between anterior and median third; ventral margin mostly rounded; median third longer than high, setose. Endosoma (Fig. 6E, F) enclosing almost all phallobase and aedeagus lengths laterally and ventrally; asymmetrical, with two different sides linked ventrally, of which: one side is longer and with apex curved ventrally, comma-like; and other side is shorter and apically truncated, bearing triangular expansion ventrally directed to the longest side of endosoma at aedeagus midlength (Fig. 6E). Phallobase membranous, shorter than endosoma; enclosing aedeagus half-length laterally and ventrally; slightly visible in lateral view, apically and dorsally. Aedeagus (Fig. 6E, F) opened dorsally; apically, narrowing and with pair of aedeagal hooks (Fig. 6F), subequal in length, longer and thinner than aedeagus, and curved anterodorsally. Suspensorium V-shaped. Anal tube, in dorsal view, as long as wide and with posterior margin rounded; setose.

Taxonomic notes. Differently from the description of Ball (1935), the vertex of this species is not shorter than that of *P. papoosa*. The rest of the morphology is in accordance to the original description. This species can be easily distinguished from other *Papagona* based on its striking color pattern. However, the male terminalia of this species and of *P. papoosa* are very similar without major differences in overall structure of phallus. See taxonomic notes of *P. dietrichi* **sp. nov.** above for more comparative notes.

Distribution. United States: Arizona (Ball 1935).

Plant associations. *Tridens muticus* (Torr.) Nash (Poaceae, as *Triodia mutica*) (Ball 1935).

Studied material. Holotype: male, USA, Arizona, Tucson, 2 Apr. 1933 [original description lists as 4 Apr. 1933], E. D. Ball (USNM ENT 01513569). Paratype: male (dissected herein), USA, Arizona, Tucson, 14 Apr. 1934, E. D. Ball (USNM).

Discussion

Based on the redescriptions of *P. papoosa* and *P. succinea*, and the description of *P. dietrichi* **sp. nov.** we propose to add to Ball's diagnosis of *Papagona* the following group of characters: (1) central plate of frons with sensory pits within it (Figs 5B, 6A); (2) sides of frons with sensory pits in a triangle-like distribution (Figs 2C, F, 5C, 6A, C); (3) lateral lobe of pronotum with only one sensory pit and longitudinal carina (Figs 2C, F, 5C); (4) presence of sensory pits on abdominal tergite III (Figs 2C, 5C, 6C, 10A); (5) abdominal tergites IV to VII with one row of two to three sensory pits followed by an isolated ventral pair aligned vertically (Fig. 7); (6) abdominal tergites conspicuously elevated medially in males (Figs 2B, 5A, 6B); and (7) overall shape of phallus (Figs 3E–H, 5G, H, 6E, F). As in other genera and species studied by us (Freitas *et al.* 2020), the pattern of distribution of sensory pits on sides of frons, lateral lobe of pronotum, and abdominal tergites are a good generic diagnostic character because they usually are consistent among species of the same genus, varying a little in quantities in between specimens or sides of same specimen, but the general pattern remains. The presence of sensory pits on abdominal tergite III and inside the central plate of frons, seems to be unique to *Papagona* among other Peltonotellini genera studied until now, being the best diagnostic generic feature.

Although the new species described herein from Brazil constitutes an extremely distant geographical record from other known species of the *Papagona* (from the USA), this disjunction is an obvious artefact of the lack of information on these small insects in the New World. We have found one female *Papagona* in collected materials from Mexico, but we could not identify it to species because of its lack of coloration and more detailed studies of females of *P. papoosa* and *P. succinea*.

Finally, our unpublished phylogenetic study of Peltonotellini based on molecular and morphological data, consistently recovered *Papagona* as sister to all other Peltonotellini, which affords this genus a high evolutionary importance within the Caliscelidae.

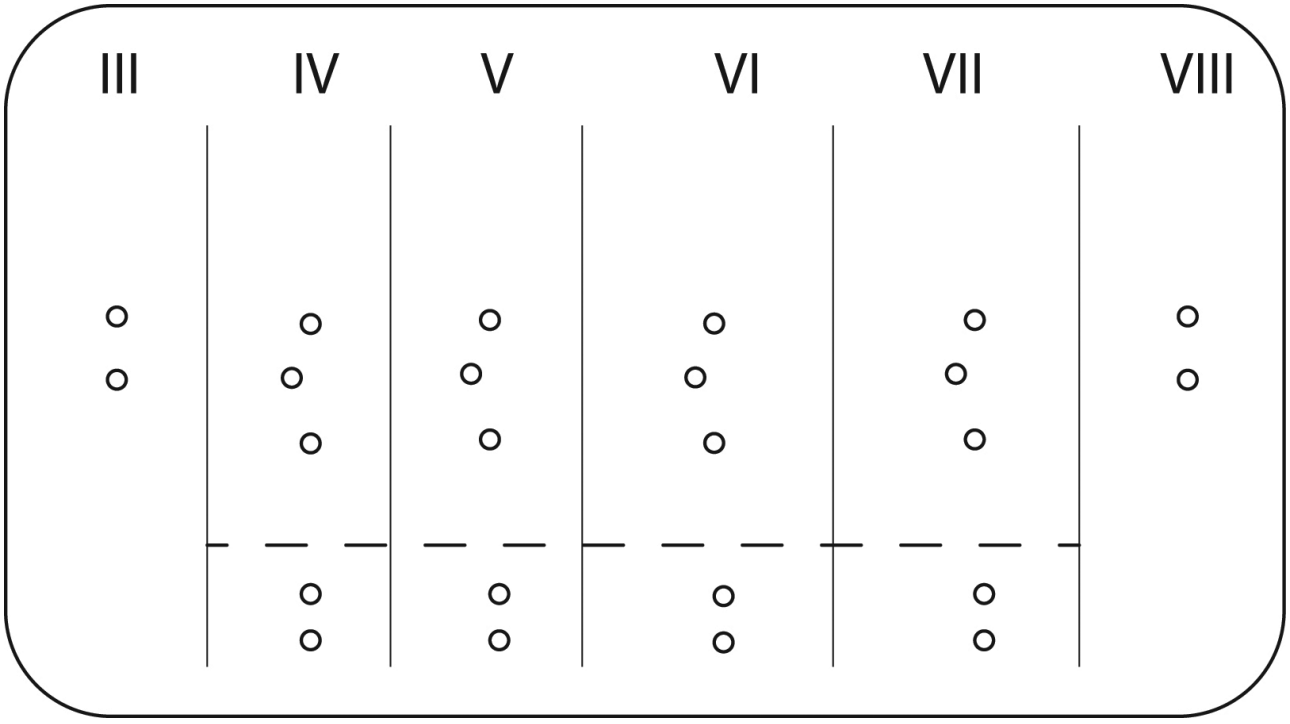

FIGURE 7. Scheme of sensory pit arrangement on sides of abdominal tergites III to VIII of *Papagona dietrichi* **sp. nov.** Dashed line represents an imaginary line, and ventral sensory pits below this line are herein named the isolated ones.

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