



Unusual sexually dimorphic head morphology in Lauxaniidae (Diptera: Lauxanioidea)—a new species of the genus *Trivialia* Malloch from Peru

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Abstract

A new species of the New World genus *Trivialia* Malloch from Peru is described and illustrated, along with discussion of unusual head morphology in Lauxaniidae. This new species represents an odd case where only a single known species in an otherwise non-dimorphic genus displays extreme sexual dimorphism.

Key words: sexual dimorphism, new species, taxonomy

Introduction

Head morphology is quite variable, and can be bizarre, in lauxaniids (see Gaimari & Silva 2020 and Gaimari & Miller 2021 for photos of Neotropical and Afrotropical genera, respectively). For example, some genera have the frons and face extended forward beyond the eye margin to an angle greater than 90° (e.g., *Cainohomoneura* Stuckenberg, 1971, most of the Trigonometopini). Besides such elongations of the head, there are also examples of the face and gena being extended ventrally (e.g., *Cestrotus* Loew, 1862, *Lauxanostegana* Malloch, 1933, *Procestrotus* Stuckenberg, 1971, some Eurochoromyiinae). There are many examples of facial modifications, from being strongly convex (e.g., *Physegenua* Macquart, 1848, *Physoclypeus* Hendel, 1907) to having one or multiple strong bumps (e.g., *Triconopsis* Hendel, 1914, *Cephalella* Malloch, 1926), the face extended dramatically forward (e.g., *Cephaloconus* Walker, 1860) or even a distinct facial lobe extended down over the clypeus (e.g., *Zanjensiella* Stuckenberg, 1971). Oddities of the gena occur in some Eurychoromyiinae, especially *Eurychoromyia* Hendel, 1910, with its broad upper plane of the head and the gena strongly sloping down to a small oral cavity and with whitish hairs forming a pattern of stripes along the slope of the gena (Gaimari & Silva 2010b). In some genera (e.g., *Hypagoga* Hendel, 1907, *Prochaetops* Bezzi, 1928) the setae along the oral margin are greatly elongated and pointed forward, while in other genera there are other strange setal enlargements (e.g., *Drepanephora* Loew, 1869).

In all of the preceding examples, the head morphology is consistent between males and females. Sexual dimorphism is less common, with the most striking example being the horns in the genus *Wawu* Evenhuis, in Evenhuis & Okadome, 1989, with which males fight. Within this genus, males have at least an elongated horn extended out and curved upwards from the lower margin of the face. In at least one species, there is also an upper horn extended out and curved downwards from the upper margin of the lunule between the antennae. An example of more variable sexual dimorphism occurs in the genus *Prosopophorella* Meijere, 1918, in which males of some species (e.g., *P. buccata* (Meijere, 1910)) have a distinct median process on the lower margin of the face that is not present in females, while males of other species (e.g., *P. zhuae* Shi & Yang, 2009) have an enlarged and protuberant clypeus, with one undescribed species (discussed in Stuckenberg 1971, and the specimen was studied by the first author) having the enlarged clypeus further modified into a long, porrect horn.

Although different in structure from any of these examples, the species of *Trivialia* Malloch, 1923 described herein follows the same trend of being strongly sexually dimorphic, except in this instance the male has each gena strongly produced forward and tipped with a pair of very strong horn-like setae oriented upwards and a weaker long

seta originating slightly proximal to the tip and oriented medially. For *Wawu* and *Prosopophorella*, all the species have at least some sexual dimorphism in head morphology, but the example herein is a single species within a genus that otherwise displays no sexual dimorphism, being the first time such a situation has been encountered in Lauxaniidae.

The genus *Trivialia* has been variously treated as a subgenus of *Deceia* Malloch, 1923 (Malloch 1923, Malloch & McAtee 1924) and *Pseudogriphoneura* Hendel, 1907 (Malloch 1926, Hendel 1936), and as a full genus (Shewell 1965 and all later citations). Prior to Gaimari & Silva (2010a), this genus was monotypic and was known only as Nearctic in distribution. Stuckenberg (1971) considered this an endemic Nearctic genus. Besides the one Nearctic species found in the southeastern United States, Gaimari & Silva (2010a, 2020) combined six species from other genera into *Trivialia* from Central America, northern South America, and the southern West Indies, significantly expanding its range. The species found herein is the farthest south for the genus.

Although species of this genus are relatively uncommonly collected, the genus is widespread, with species occurring in the New World with the farthest north point being in the eastern United States at about 39°N latitude and the farthest south being about 13°S latitude in western South America. The genus was included in the keys to genera in Shewell (1987, Nearctic genera) and Gaimari & Silva (2010a, New World genera), and was cataloged in Gaimari & Silva (2020).

Material and methods

General terminology follows Cumming & Wood (2017). Male and female terminalia were removed and macerated in hot 85% lactic acid at 100–120°C for 30 minutes. After study and photographs, terminalia were stored in a microvial filled with glycerin, which was fixed to the respective specimen pin. External morphology photographs were taken with a Leica MC170 HD digital camera attached to a Leica M165C stereomicroscope. Genitalia photographs were taken with a Leica DFC295 digital camera attached to a Leica M205C stereomicroscope.

Body length was measured by adding the length from the base of the antenna (but without antennae, and not accounting for the extended gena) through the base of the halter with the abdominal length from halter to tip, to account for differential curling of the abdomens among specimens. For head ratios (which did not take the extended gena of the male of the new species into account): the head length and height were measured from lateral view, respectively, from the point at the top of the face below the antennal base through the posterior occiput, and from the ocelli through the bottom edge of the subgena; the head width, frons width, and frons length were measured from dorsal view, with head width measured through the widest part, frons width through the anterior ocellus, and frons length from the anterior ocellus through the anterior edge of the frons. On the thorax, the scutal width is measured at the level of the anterior postsutural supra-alar setae, and the scutellar width is measured through the area of contact with the scutum. In the wing, the width was measured at the level just proximal to tip of M_1 ; cell dm length was measured from crossvein bm-m through the anterior tip of crossvein dm-m. All other measurements were made through their maximum widths, lengths, heights, etc.

The holotype male and paratype female of the new species are deposited in the Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM).

TRIVIALIA Malloch

Trivialia Malloch, 1923: 53 (as subgenus of *Deceia* Malloch, 1923).

Type species. *Deceia fuscocapitata* Malloch, 1923: 53 (original designation).

Diagnosis. This genus can be differentiated from other lauxaniids by the following combination of characteristics. On the head, the frons is broader than long, bare of setulae, with the fronto-orbital setae reclinate and strong, with the posterior seta stronger. The ocellar setae are short and divergent, shorter than the postocellar setae. The eyes are almost round and are not narrowed below. The face is flat and dull (not glossy). The antennal first flagellomere is black, and the arista is short plumose with the basal-most dorsal rays usually the longest, and with shorter rays below. The scutum has 2 pairs of postsutural dorsocentral setae (and no presutural dorsocentral setae), with the anterior seta at about the midpoint between the posterior seta and the transverse suture. The postsutural intra-alar

seta is absent (i.e., this genus is not in the *Minettia* group of genera). The anterior scutellar setae are parallel to slightly convergent, while the posterior scutellar setae are divergent. On the pleuron, the anepimeron is bare and there is 1 strong katepisternal seta (sometimes with an additional weaker seta anteriorly). On the wing, the costal setulae end well before the apex of R_{4+5} (as is typical in Lauxaniinae), and the R veins are bare.

Immatures. Unknown for the genus.

Distribution. North America (USA [eastern, Virginia south to Florida]), West Indies (St. Vincent), Central America (Costa Rica, Panama), South America (Colombia, Ecuador, Peru [new record]).

Remarks. Stuckenberg (1971) and Shewell (1987) considered this an endemic Nearctic genus. Besides being included in the key to Nearctic genera, Shewell (1987) provided a figure of the lateral head of the type species, *Trivialia fuscocapitata* Malloch, 1923, which was also included in Gaimari & Silva (2010a). Photographs (lateral and dorsal habitus and oblique head) of the lectotype of one of the included species, *Trivialia venusta* (Williston, 1896), was also provided by Gaimari & Silva (2020).

***Trivialia aitupa*, sp. nov.**

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(Figures 1–5)

Etymology. Literally “tooth god” or “prong god”, from the combination of Guarani words *ãi* meaning prong, tooth, or teeth + *tupã* meaning god, in reference to the extreme genal setae of this species; a noun in apposition.

Diagnosis. The male is characterized by each gena being extended forward with a pair of very large and thick setae extended dorsally, while the female does not share this feature. The ocellar setae are small and divergent. The frons is about $2 \times$ wider than long and lacks setulae, and the 2 fronto-orbital setae are reclinate, with the posterior seta larger and located at the midpoint between the inner vertical seta and lunule, while the anterior seta is located at the midpoint between the posterior seta and lunule. The antenna has a silvery pruinose scape, a pedicel that is silvery pruinose on the inner surface and black on the outer surface, and a black first flagellomere. The arista is plumose. The pleural region and legs are pale yellow, while the dorsal thorax is darker orange with brown. There are 2 dorsocentral setae, with the anterior seta located at the midpoint between the transverse suture and the posterior seta. The abdomen has brown medial spots on tergites 3–6.

Adult, ♂ (Fig. 1A), ♀ (Fig. 3A). Body length 3.1 mm in ♂, 3.2 mm in ♀.

Description of ♂:

Head (Figs 2A–C). Mostly orangish yellow; $1.3 \times$ higher than long, $1.5 \times$ wider than high, $1.15 \times$ wider than scutum; eye $1.4 \times$ higher than long; gena height (directly below eye) $0.2 \times$ eye height. Most prominent feature is the strongly produced gena with extremely large tusk-like setae (discussed below). Vertex orange pruinose; slightly concave from dorsal view; inner vertical seta longer and stronger than outer, with distance between them about $1/2$ that from inner vertical seta to central vertex. Ocellar triangle brown pruinose; small, slightly raised, placed slightly in front of vertex; ocelli subequal in size and in small equilateral triangle, with few tiny setulae. Ocellar setae small, divergent. Postocellar setae cruciate, smaller than outer vertical seta. Postocular area with 2 regular rows of postocular setulae. Frons bronzy pruinose, with some orangish around edge of ocellar triangle; $2.1 \times$ wider than long; frons flat, curved evenly into facial plane; with 2 strong reclinate fronto-orbital setae, posterior seta located at midpoint between inner vertical seta and lunule, with anterior seta located at midpoint between posterior seta and lunule and about half length of posterior seta; frons not setulose. Lunule low, narrowly arched. Antenna mostly dark brown, except ventral surface of scape and base of arista pale; with small keel between antennal bases; scape silvery pruinose; pedicel silvery pruinose on inner surface, black on lateral surface, with 1 dorsal seta and 2–3 longer ventral setae; first flagellomere dark brown pruinose, paler at apex, $1.6 \times$ longer than high and $2.0 \times$ longer than scape and pedicel combined, with rounded apex; arista black, except basal 2 segments orange, plumose with upper basal rays longest and lower rays uniformly short. Gena strongly produced forward and angled slightly down; orange, except silvery pruinose along eye margin; from lateral view extended 0.4 mm beyond nearest edge of eye, with strong genal setae directed forward along extension; from anterior view, gena extended at a downward angle, appearing as 0.7 mm below bottom of eye, with gena and parafacial strongly arched above with mouthparts visible within cavity formed by genal extensions; inner surface of genal extension with strong subapical setae oriented dorsomedially and cruciate distally; tip of each genal extension with 2 extremely strong (0.8 mm in length, $2 \times$ length of genal extension itself) upwardly-oriented setae, with inner seta stronger than outer, appearing tusk-like.

Postgena pale white, transitioning to orange dorsally to postocular area, with slightly enlarged setae, becoming larger as they transition to the genal setae. Face small, arched along oral margin with parafacial due to extension of the gena; flat silvery pruinose area under oral margin, with narrow brownish clypeus below, under which are mouthparts. Labellum and maxillary palpus brown. Subgena a narrow strip below postgena and basal gena, not extended with gena.

Thorax (Figs 1A, 2C). Scutum slightly arched, length and width subequal; scutellum about $0.4 \times$ length of scutum, with width at base $1.5 \times$ greater than length; scutum yellowish orange with diffuse brown median vitta, diffuse brown in area medial to presutural supra-alar seta and anterior to transverse suture, pale yellow on postpronotum through notopleuron; scutellum yellowish orange with basomedial area brown. Pleural region pale yellow pruinose. Chaetotaxy: 0+2 dorsocentral setae, with anterior seta located at midpoint between posterior seta and transverse suture; prescutellar acrostichal seta present; 1 postpronotal seta; 2 notopleural setae, in anterior and posterior corners, anterior seta stronger; 1 pre- and 1 postsutural supra-alar setae; 2 postalar setae, in anterior and posterior corners; 7–8 irregular rows of acrostichal setulae between dorsocentral setal rows, row of setulae along dorsocentral area, and setulose outside dorsocentral row, notopleuron lacking setulae; proepisternal seta present, strong; anepisternal seta along posterior edge of anepisternum, anepisternum otherwise setulose in posterior $2/3$, with longest setulae ventrally; anepimeron bare; 1 katepisternal seta present, katepisternum otherwise with several smaller setulae anterior of seta, and with several setulae ventrally along midline; 2 pairs scutellar setae, anterior setae parallel to slightly convergent, posterior setae divergent. *Legs*. Pale yellow, very slightly darker on dorsal surfaces of fore and hind femora and on distal tarsomeres. Fore femur with posteroventral row of setae in distal $2/3$, and with irregular row posterodorsally, in addition to scattered setulae; ctenidium absent. Mid femur with 1 short curved posteroventral preapical seta. Hind femur with short row of anterolateral setae in distal $1/4$. All tibiae with preapical dorsal seta, strongest on mid tibia; mid and hind tibia each with a short ventral spur, mid tibia with 1 longer preapical ventral seta, longer than dorsal seta. *Wing*. Hyaline; sapromyziform; veins pale brown. Length 3.0 mm; $2.5 \times$ longer than high. Cell dm 1.0 mm long; $4.0 \times$ longer than crossvein dm-cu. Crossvein r-m located at midpoint of cell dm. Vein R_{4+5} ending at wing tip, subparallel with vein M_1 . Crossvein dm-m straight, located at about basal $1/3$ -point between crossvein r-m and tip of vein M_1 . Vein $CuA+CuP$ short, with A_1 longer. Halter yellow.

Abdomen (Figs 2D–E). Tapering gradually after segment 3. Tergites yellow pruinose from dorsal view, laterally paler yellow to white; setose, longest and strongest along posterior edges of tergites; with brown medial spots on tergites 3–6, starting as narrow and faint on tergite 3 and becoming wider and darker through tergite 6. Sternites pale yellow to white; with sparse fine setae (except sternite 1), slightly longer posterolaterally; sternites 2–5 each slightly wider than long; subequal in width sternite to sternite; setulose, with setulae slightly enlarged in posterolateral corners, sternite 6 a membranous transverse strip.

Male genitalia (Figs 2E, 4A–F) pale yellow. Syntergosternite 7+8 simple, bare, transversely saddle shaped. Epandrium simple; sparsely setose, length and width at widest point subequal, width slightly tapering towards base. Surstylus distinct but not obviously articulated with epandrium, but rather broadly connected; setose, especially laterally and ventrally, otherwise setulose; thick basally and gradually tapering distally, with small thorn-like process distomedially at sharp angle. Central process present between bases on surstyli, below cerci. Cercus large, simple, rounded, heavily setose. Phallus parallel sided, about $4 \times$ longer than wide; basiphallus sclerotized basally invaginated and distally with distinct dorsally-projecting hook bracing the basal part of the distiphallus, this hook distinctly Y-shaped from dorsal view; distiphallus membranous laterally, encasing strongly sclerotized internal tube composed of long sclerotized teeth to distal opening. Hypandrium a narrow transverse strip, with basal corners extended outward; bare. Postgonite small, thin, ribbon-like, curved dorsally from hypandrium to articulate near middle of phallus. Pregonite absent. Ejaculatory apodeme not evident (likely damaged in dissection).

Description of ♀ (differences from ♂):

Head (Figs 3B–D). $1.4 \times$ higher than long, $1.6 \times$ wider than high, $1.1 \times$ wider than scutum; eye $1.3 \times$ higher than long; gena height (directly below eye) $0.1 \times$ eye height. Frons $1.8 \times$ wider than long. Gena not produced, silvery pruinose along eye margin up through parafacial; setae along gena small, very small along ventral part of parafacial. Face flat, $1.2 \times$ wider than high, orange, smooth, with central brown mark at lower edge.

Thorax (Fig. 3A). Scutum diffuse brownish orange with vitta not evident, paler orange on postpronotum through notopleuron; scutellum brownish orange, slightly darker basomedially. Pleural region yellowish orange pruinose. Chaetotaxy: 8 irregular rows of acrostichal setulae between dorsocentral setal rows; 2 katepisternal setae present with anterior seta much smaller and finer. *Legs*. Fore tibia and fore and mid tarsus darker than in male. *Wing*. Length 3.15 mm.

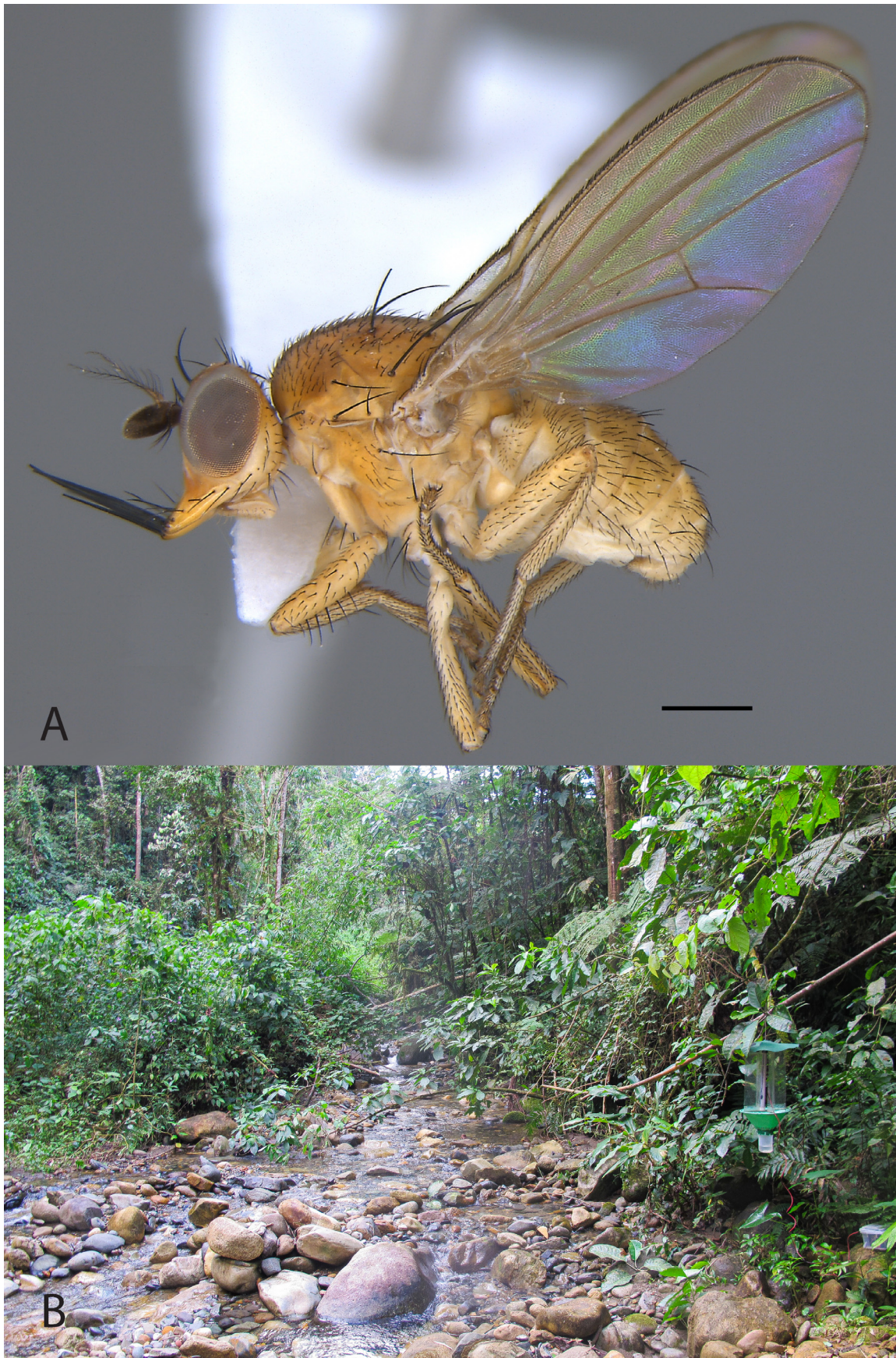


FIGURE 1. *Trivialia aitupa*, **sp. nov.**, holotype male. A. Habitus, lateral view. Measure bar = 0.5 mm. B. Type locality in Quincemil, Cusco Province, Peru (courtesy of D.M. Takiya).

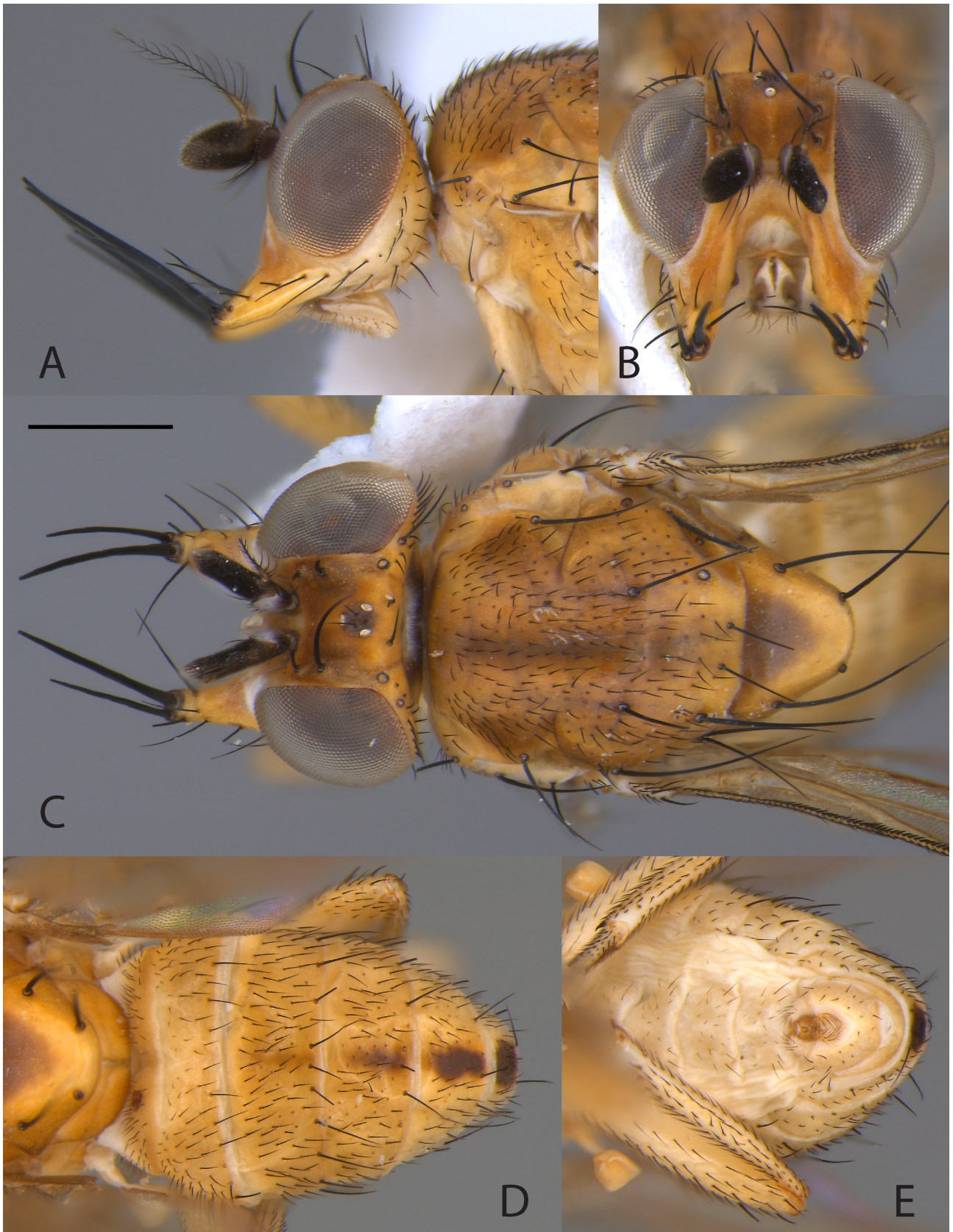


FIGURE 2. *Trivialia aitupa*, **sp. nov.**, holotype male. A. Head, lateral view. B. Head, anterior view. C. Head and thorax, dorsal view. D. Abdomen, dorsal view. E. Abdomen, ventral view. Measure bar = 0.5 mm.

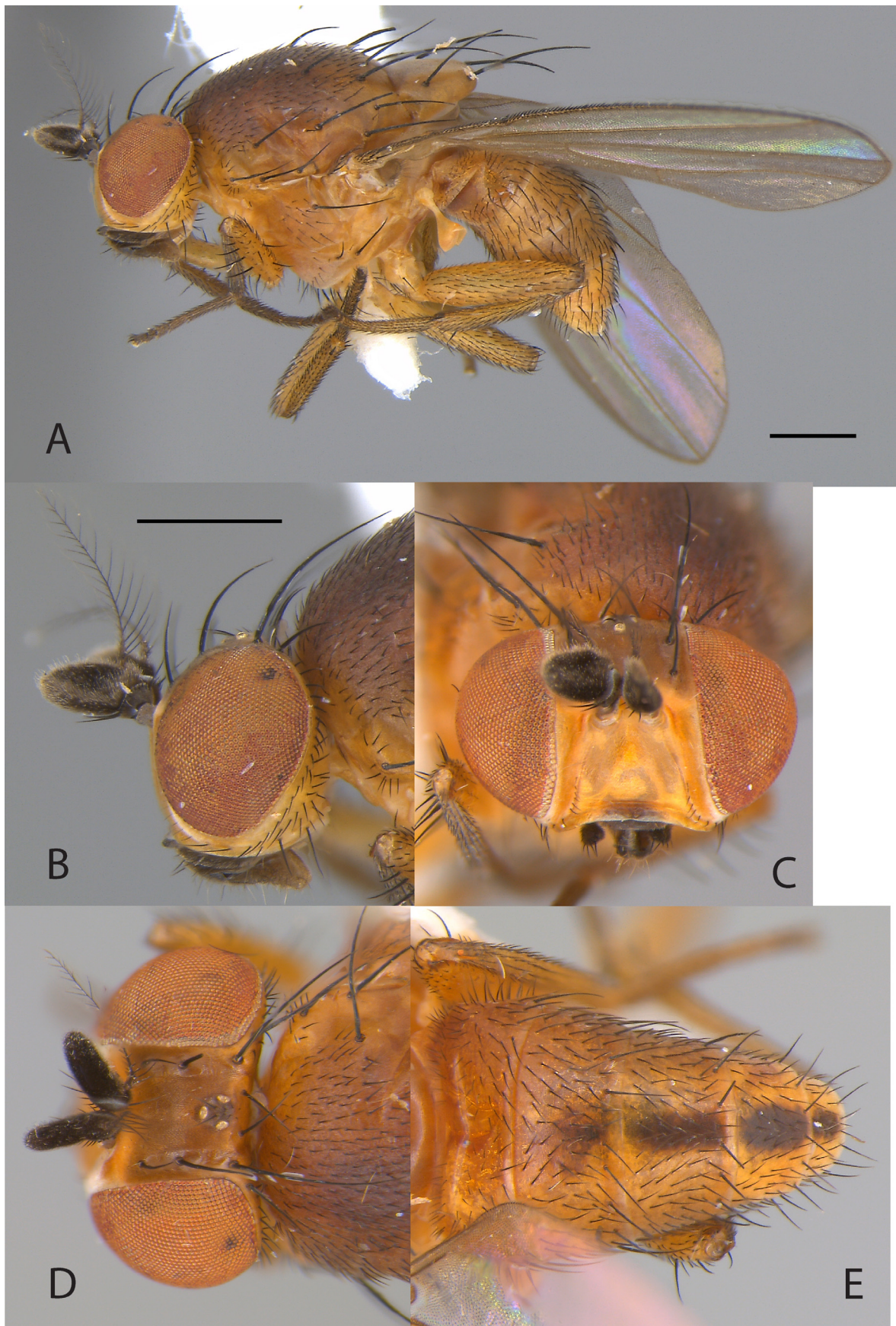


FIGURE 3. *Trivialia aitupa*, **sp. nov.**, paratype female. A. Habitus, lateral view. Measure bar = 0.5 mm. B. Head, lateral view. C. Head, anterior view. D. Head, dorsal view. E. Abdomen, dorsal view. Measure bar = 0.5 mm.

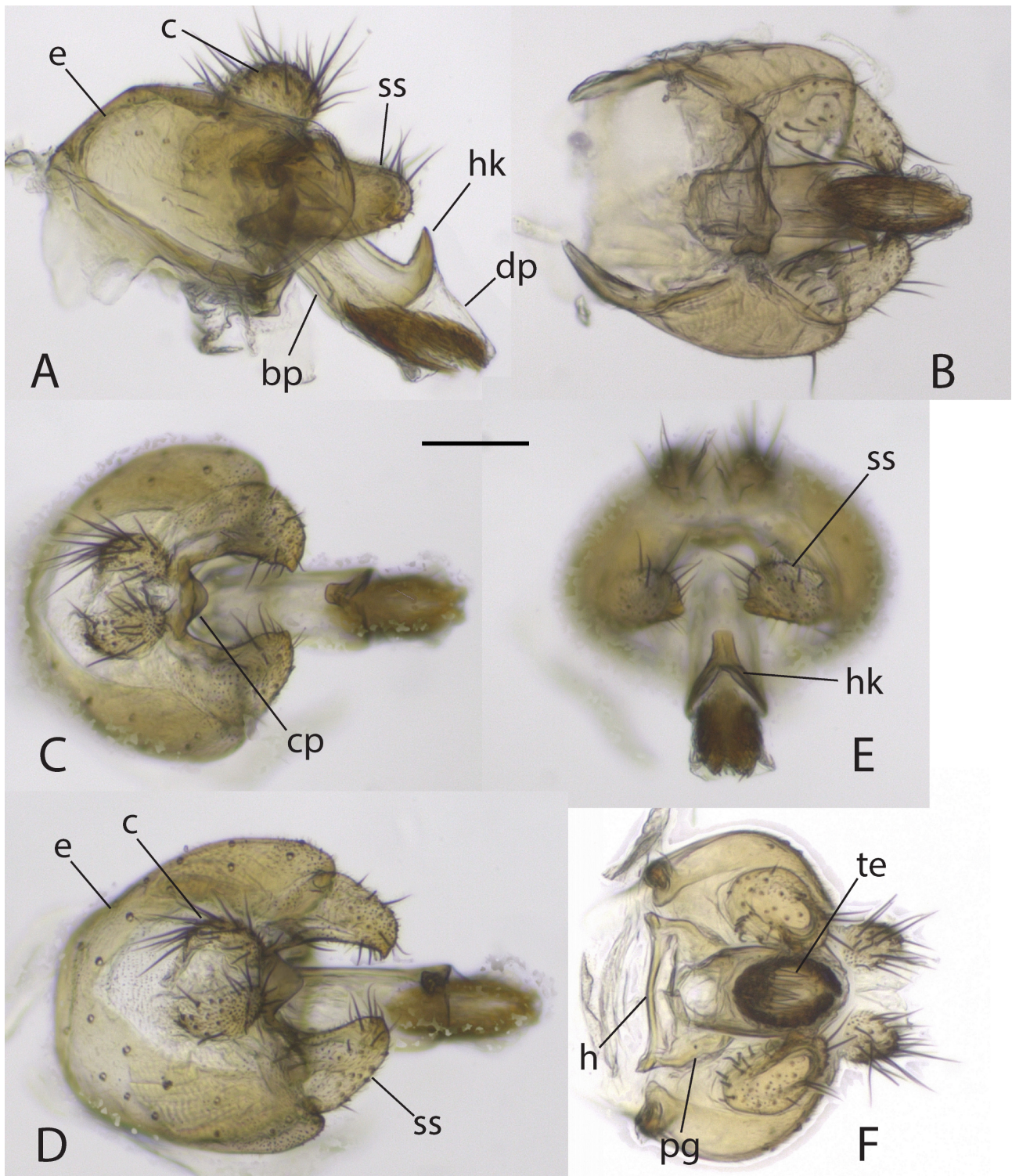


FIGURE 4. *Trivialia aitupa*, **sp. nov.**, holotype male, genitalia. A. Lateral view. B. Ventral view. C. Apicodorsal view. D. Dorsal view. E. Apical view. F. Apicoventral view. Measure bar = 0.1 mm. Abbreviations: bp = basiphallus; c = cercus; cp = central process; dp = distiphallus; e = epandrium; h = hypandrium; hk = hook of basiphallus; pg = postgonite; ss = surstylus; te = teeth of distiphallus.

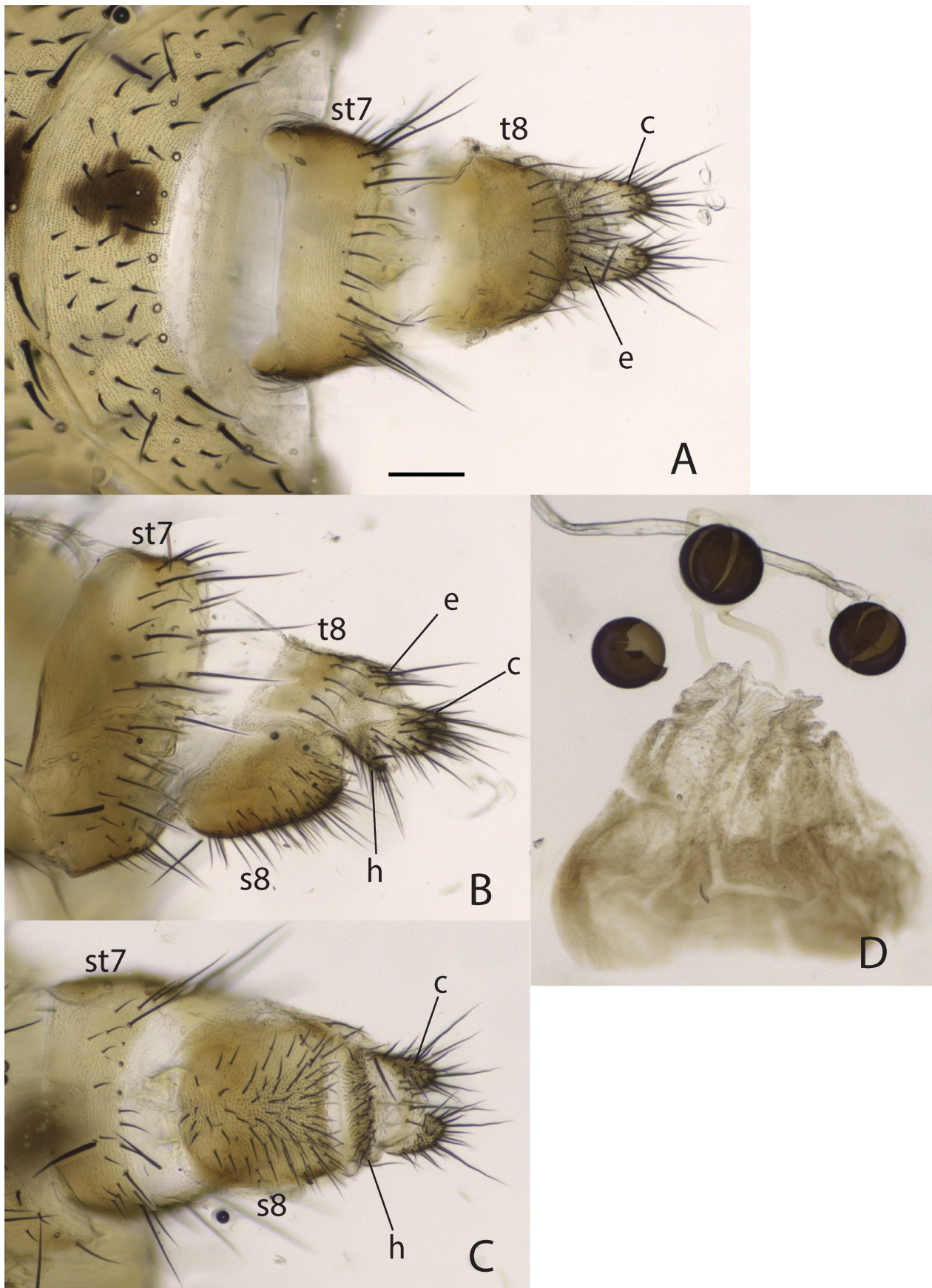


FIGURE 5. *Trivialia aitupa*, **sp. nov.**, paratype female, terminalia. A. Dorsal view. B. Lateral view. C. Ventral view. D. Spermathecae. Measure bar = 0.1 mm. Abbreviations: c = cercus; e = epiproct; h = hypoproct; s8 = sternite 8; st7 = syntergosternite 7; t8 = tergite 8.

Abdomen (Fig. 3E). Tergites 3–6 with brown medial spots, with all spots strong.

Female terminalia (Figs 5A–C). Syntergosternite 7 forming a complete ring, with spiracle embedded laterally; ring most lightly sclerotized ventrally; setose in posterior half all the way around, with strongest setae in transverse row, longest and strongest (as long or longer than syntergite itself) laterally. Tergite 8 nearly 2 × wider than long, length subequal to dorsal length of syntergosternite 7; saddle-shaped; with setae in transverse row. Sternite 8 as long as wide; broadly saddle-shaped and bulging, with lateral margin extending to lateral edge of tergite 8; heavily setose. Epiproct simple, semicircular, setulose. Hypoproct simple, semicircular, most heavily sclerotized as a transverse strip anteriorly, setulose. Cercus simple, papillate, setulose. Spermathecae (Fig. 5D) round, with configuration 1+2, paired spermathecae each 0.11 mm diameter, single spermatheca 0.09 mm; surface smooth.

Type material. Holotype ♂, glued to paper point; dissected, excellent condition; Figs 1A, 2 (pre-dissection); deposited in MUSM with the following labels: 1) PERU: Cusco, Quincemil, 13°13'03.04"S 70°43'40"W, 633m, 23–31.viii.2012; 2) "Sweep, J.A. Rafael, R.R. Cavichioli & D.M. Takiya; 3) "HOLOTYPE, *Trivialia aitupa* Gaimari & Soares [red label, handwritten]. Paratype ♀, glued to paper point; excellent condition; Fig. 3 (pre-dissection); deposited in MUSM, with the following labels: 1) "PERU: Cusco, Quincemil, Pte La Cigarra 13°08'27"S 70°23'14"W, 350m; 2) 01.ix.2012, Sweep, J.A. Rafael, R.R. Cavichioli; 3) "PARATYPE, *Trivialia aitupa* Gaimari & Soares [yellow label, handwritten].

Distribution. Known from the type locality (Fig. 1B) of Quincemil in the westernmost part of the Quispicanchi Province in the Cusco Department of Peru, with the paratype from a spot less than 60 km to the east near Mazuco.

Biology. Unknown.

Remarks. The type locality is in the Camanti-Marcapata Biological Corridor of Peru, as defined by Salvador-Montoya *et al.* (2012), being located between 13.2–13.26°S and 70.77–70.54°W. This region is characterized by extremely high precipitation (up to 7,000 mm per year) and annual mean temperature of 25°C, with vegetational elements including the upper limits of lowland Amazonian moist forest and Andean submontane and montane cloud forest.

Head morphology is quite variable in lauxaniids, but usually at the genus level. Sexual dimorphism is uncommon, but this species represents the particularly uncommon situation where there is sexual dimorphism only in a subset of species within a genus otherwise lacking this dimorphism.

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