

First description of the male of *Morellia (Trichomorellia) callidimera* (Bigot) (Diptera, Muscidae), with examination of type material

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Abstract. *Morellia (Trichomorellia)* Stein, 1918 is a Neotropical subgenus with eight known species occurring from Mexico to Argentina. *Morellia (T.) callidimera* (Bigot) was described in 1887 based on a female specimen from Mexico. The male of *M. (T.) callidimera* is described here for the first time, 139 years after the original description, including images of the habitus and drawings of the male and female terminalia. The female holotype of *M. (T.) callidimera* and its junior synonym *M. (T.) fulvipes* were examined and redescribed. *Morellia (T.) callidimera* is recorded from Veracruz (Mexico) for the first time.

Keywords. Mexico; Neotropical region; Redescription; Taxonomy; Type examination.

INTRODUCTION

In the Neotropical region, *Morellia* Robineau-Desvoidy comprises 33 species in four subgenera (de Carvalho *et al.*, 2005; Nihei & de Carvalho, 2011; Löwenberg-Neto & de Carvalho, 2013). Among them, *Morellia (Trichomorellia)* Stein, 1918 is exclusively Neotropical and includes eight species recorded from Mexico, Guatemala, Venezuela, Colombia, Ecuador, Peru, Bolivia, Brazil, and Argentina (Pont, 2000; de Carvalho & Couri, 2002; Pont *et al.*, 2005; Löwenberg-Neto & de Carvalho, 2013). There are no characters to support the monophyly of the subgenus (Pamplona, 1983).

Morellia (Trichomorellia) callidimera (Bigot) and *M. (T.) fulvipes* (Bigot) were described in the same paper based on females from Mexico (without more detailed locality information), differing only in leg coloration (Bigot, 1887). Wulp (1896) subsequently reported *M. (T.) callidimera* from Guerrero (Mexico). Pont (2000) examined the types and synonymized *M. (T.) fulvipes* with *M. (T.) callidimera*. Snyder (1949) described *Dasymorellia fulvitibia* based on female specimens from Guatemala and Mexico, later recognized as a junior synonym of *M. (T.) callidimera* (de Carvalho *et al.*, 2005).

Here, the male of *M. (T.) callidimera* is described for the first time, including images and drawings of the male and female terminalia. The holotypes of *M. (T.) callidimera* and *M. (T.) fulvipes*

were examined, and morphological variation and synonymy are briefly discussed. The distribution is updated with the first record from Veracruz (Mexico).

MATERIAL AND METHODS

The material used in this study is based on specimens from the British Museum of Natural History (BMNH), London, United Kingdom; and the Entomological Collection at the Instituto de Ecología, Xalapa (IEXA), Veracruz, Mexico.

The distal half of the abdomen was removed for examination of the terminalia. Dissected structures were cleared and softened in cold potassium hydroxide (KOH) 10% for 24 h, transferred to acetic acid, dehydrated in 70% alcohol and then placed in glycerin.

Observations and photographs were made using a Leica S8 APO stereomicroscope equipped with an MC170 HD camera. Terminalia were examined with a Zeiss Primo Star compound microscope with an AmScope M120-2 L-PB10 (5mpx) camera. Images were edited in Adobe Photoshop, and drawings were made in Adobe Illustrator. Morphological terminology follows Cumming & Wood (2017). The following abbreviations are used: *a* = anterior; *ad* = anterodorsal; *av* = anteroventral; *d* = dorsal; *p* = posterior; *pd* = posterodorsal; *pv* = posteroventral.

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RESULTS

Taxonomy

Order Diptera Linnaeus, 1758

Family Muscidae Latreille, 1802

Subfamily Muscinae Latreille, 1802

Genus *Morellia* Robineau-Desvoidy, 1830

Subgenus *Trichomorellia* Stein, 1918

Diagnosis: Male holoptic. Eyes setulose. Arista plumose. Humerals 4. Prealar strong. Dorsocentrals 2+4. Acrostichals 2+2-3. Katepisternals 1+2. Wings with cilia at node on both surfaces (except *M. (T.) benoisti* Pamplona). Apical portion of vein M bent forward. Lower calypter glossiform, about twice longer than the upper calypter. Fore tibia on dorsal surface with 2 preapical setae. Hind tibia with a strong posterodorsal seta (calcar) (adapted from de Carvalho & Couri, 2002).

Morellia (Trichomorellia) callidimera (Bigot, 1887)

callidimera Bigot, 1887: clxxiv [also 1888: 615] (*Curtonevra*).

Holotype female, BMNH [Ref. Pont, 2000: 8]. Type-locality: "Mexique". Distribution: Mexico, Guatemala.

callimera, error [Bigot (1888: 615)].

calimera, error.

Morellia callimera; Wulp (1896: 302) (Mexico); Stein (1919: 108) (cat.); Séguy (1935: 110) (cat.); Séguy (1937: 393) (cat.); Albuquerque (1956: 37) (cat.); Pont (1972: 8) (cat.).

Cyrtoneura callimera; Giglio-Tos (1896: 12) (Mexico, as *calimera*).

Dasymorellia callimera; Albuquerque & Lopes (1979: 330) (cat.); de Carvalho *et al.* (1993: 9) (cat.); Pont (2000: 8) (notes on type); de Carvalho & Couri (2002: 42) (Neotropical Region, key).

Morellia (Trichomorellia) callidimera; de Carvalho *et al.* (2005: 34) (cat., new combination); Löwenberg-Neto & de Carvalho (2013: 15) (distribution).

fulvipes Bigot, 1887: clxxiv [also 1888: 613] (*Curtonevra*).

Holotype female, BMNH [Ref. Pont (2000: 14)]. Type-locality: "Mexique".

Mydaea? fulvipes; Stein (1919: 119) (cat.); Séguy (1937: 285) (cat.).

Unplaced species of Cyrtoneurinae; Pont (1972: 58) (cat.).

Dasymorellia fulvipes; de Carvalho *et al.* (1993: 9) (cat., new combination); Pont (2000: 14) (notes on type and nomenclature, junior synonymy of *callidimera*); de Carvalho & Couri (2002: 41) (listed).

Morellia (Trichomorellia) fulvipes; de Carvalho *et al.* (2005: 34) (cat., new combination).

fulvitibia Snyder, 1949: 22 (*Dasymorellia*). Holotype female, AMNH (American Museum of Natural History, New York, New York, USA), paratypes, AMNH. Type-locality: Guatemala, Guatemala City.

Dasymorellia fulvitibia; Albuquerque (1951: 8) (cat.); Pont (1972: 10) (cat.).

Diagnosis: Eyes short-setulose, almost bare. Parafacial, facial, and gena with gray pruinosity. Antennae and palpi dark brown. Gena with weak and sparse setulae. Acrostichals 2+2. Hind femur with a row of *ad* setae and one median *pv* seta. This species differs from *M. (T.) benoisti*, *M. (T.) seguyi* (Pamplona), and *M. (T.) trichops* (Malloch) by the short-setulose eyes, and from *M. (T.) flavipalpis* (Pamplona) by the dark brown antennae. Males can be also distinguished from other species of the subgenus by the mid femur bearing 2 thick, truncate apical *d* setae and by the hind tibia with a row of approximately 20 long and thin *pv* setae.

Male: Body length: 7.5 mm. Wing length: 7.0 mm.

Coloration: Head: Antennae and palpi dark brown, basal half of arista light brown. Frontal vitta dark brown; fronto-orbital plate, gena, lunule, and parafacial dark brown with gray pruinosity (Fig. 1A). **Thorax:** Dark brown, with a central gray pruinose stripe reaching the middle of the pronotum, becoming inconspicuous until the transversal suture of the mesonotum (Fig. 1D). Gray pruinosity on the postpronotal lobe and notopleuron (Fig. 1C). Scutum with an inconspicuous pattern formed by three gray pruinose stripes reaching the base of scutellum, contrasting with four black stripes (Fig. 1D). Scutellum dark brown with inconspicuous lateral gray pruinosity (Fig. 1E). **Legs:** Fore leg dark brown. Mid leg dark brown, with the basal two-thirds of the femur yellow. Hind leg dark brown with the femur yellow with the apical fourth dark brown (Fig. 1B). Claws dark brown, lighter basally. Pulvilli white. **Abdomen:** Dark brown, with gray pruinosity forming irregular dorsal and lateral stripes and spots on tergites 1+2 to 4. Tergite 5 entirely pruinose (Fig. 1E).

Head: Holoptic. Distance between eyes similar to anterior ocellus width (Fig. 1A). Postpedicel 2.5 times longer than pedicel. Arista long plumose, with the longest hairs about ¼ the length of the arista. Ocellar setae long, about half-length of the frontal setae. 13-14 pairs of frontal setae: 6-7 convergent, 6 proclinate, and 1 reclinate (Fig. 1B); extending from the antennae insertion to almost the anterior ocellus. Inner vertical setae convergent, 2.5 times longer than outer vertical setae. Outer vertical setae divergent. Postocellars short, half-length of the ocellar setae. Gena twice as high as pedicel length.

Thorax: Acrostichal setae 2+2. 7 irregular rows of acrostichal presutural setulae. Dorsocentrals 2+4, the first post-sutural half-length of the others. Intra-alars 2. Prealar seta long, with the same length to the posterior notopleural. Notopleuron with 2 setae and with covered setulae, the first one slightly longer than the posterior one. A row of about 10 anepisternal setae, the upper 4 longer. Prosternum bare. Katepisternals 1+2, with the anterior and upper posterior seta twice as long as the lower posterior one. Proepisternum and katepimeron bare. Anepimeron setulose. Meron bare, with setulae above hind coxa. Scutellum with a long pair of apical and basal setae, the basal pair slightly longer; a pair of prebasal setae about ¼ the length of the basal pair; a pair of subapical

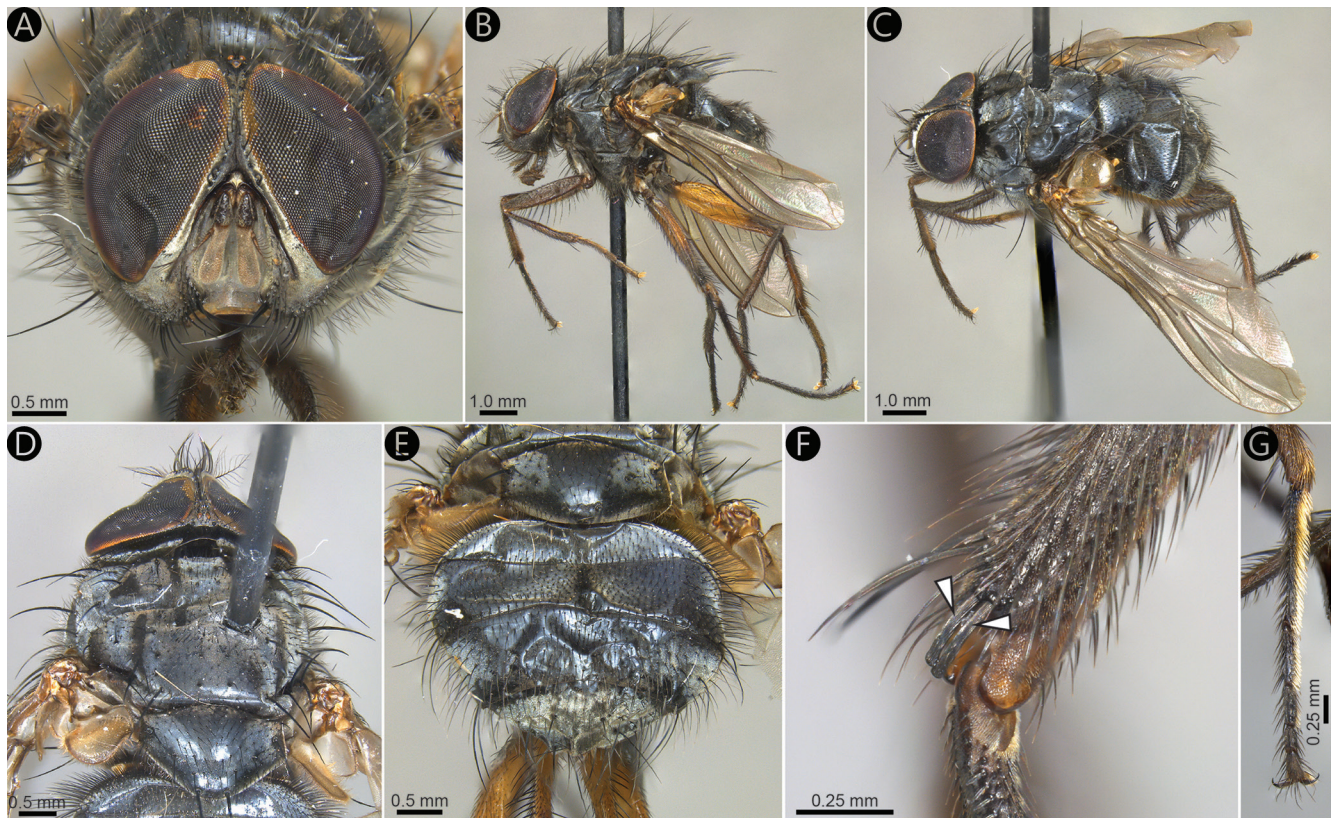


Figure 1. *Morellia (Trichomorellia) callidimera* (Bigot). Male: head, frontal view (A); habitus, lateral view (B); habitus, dorsal view (C); thorax, dorsal view (D); abdomen, dorsal view (E); mid femur, anterodorsal view (F); hind tarsi, lateral view (G).

scutellar setae half-length of the apical pair; and a discal scutellar pair with about $\frac{2}{3}$ the length of the apical setae.

Wing: Hyaline. Vein M strongly curved (Fig. 1C). Vein R_{4+5} with setulae on both dorsal and ventral surfaces, extending from R_s to nearly the apex of R_{4+5} . Calypters yellow, with light brown margins (Fig. 1C).

Legs: Fore femur with a long row of setae on *pd* and *pv*, and several shorter setae on the posterior surface. Fore tibia with a long apical seta on *d* and *pv*. Mid femur with a row of short *a* setae, twice longer than the covered setulae, reaching half of the femur, the last one longer, twice longer than the others; a row of posterior setae on the apical half; 3-4 *p* to *pd* preapical setae; 2 thick, truncate apical *d* setae (Fig. 1F); and 2-3 long *pv* setae, the median one longer than the femur width. Mid tibia with 3 median *pd* and 3 median *p* (twice longer than the *pd* setae); a long apical seta on *av* and *v*, both with half-length of the basitarsus; short apical seta on *a*, *av*, *pv*, and *pd*. Hind femur with a row of *ad* setae; a long median *pv* (as long as the femur width); 5-6 *av* setae on apical $\frac{3}{4}$ (setae longer than femur width); a row of 2-3 preapical *d*; and one short preapical seta on *pd*, *p*, and *av*. Hind tibia with 5-7 *ad*; a row of approximately 20 long and thin *pv*; 6 *av* (twice longer than tibia width); two *pd*: 1 supramedian and 1 submedian (calcar), calcar twice longer than tibia width; preapical seta on *d* and *ad*; apical seta on *a*, *ad*, *av*, and *v*, the *av* twice longer than the others; apical $\frac{1}{4}$ of hind tibia and tarsi 1-3 covered by white-yellowish covered setulae on posterior surface (Fig. 1G).

Abdomen: Tergites 4 and 5 with long marginal setae (Fig. 1E). Sternite 1 ciliated. Sternite 5 quadrangular, slightly longer than wide, covered by longer setae on its posterior region (Fig. 2A).

Terminalia: Cerci medially connected in dorsal view, with a rounded ventral extremity; surstyli curved inwards (Fig. 2B). In lateral view, the epandrium, cerci, and surstyli have similar widths; the surstyli bears a rounded posteroapical projection (Fig. 2C). Pregonite twice longer than postgonite, bearing 2 long submedian setae (Fig. 2D). Phallapodeme apically enlarged (Fig. 2D). Epiphallus as long as the postgonite (Fig. 2D). Distiphallus apically enlarged, with a triangular shape (Fig. 2D).

Morphological variation: Body length: 5.0-8.0 mm. Wing length: 5.0-7.5 mm. In some specimens, the anterior presutural acrostichal are short and difficult to distinguish from the covered setulae. The lower calypter margin is yellow in some specimens. Setulae on vein R_{4+5} extend from the base of R_s to near the apex of R_{4+5} on both dorsal and ventral surfaces, they are more conspicuous beyond R_s , whereas the most apical setulae are inconspicuous, sparse, or absent in some specimens. Legs coloration is variable (see Discussion).

Female: As in male, except as follows. **Head:** Dichoptic (Fig. 3A, D). Ocellar setae long, slightly longer or similar in length to the frontal setae. 11-12 pairs of convergent frontal setae, 2 pairs of proclinate orbital setae (the anterior one twice longer), and 2 pairs of reclinate orbit-

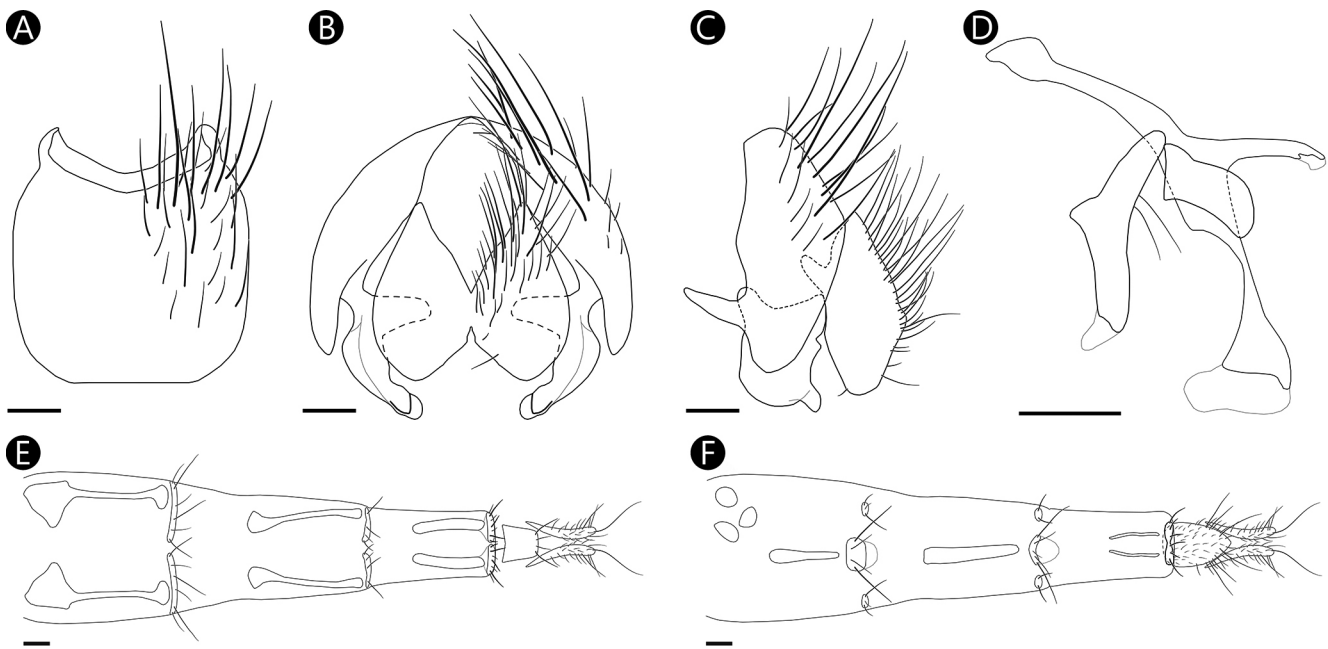


Figure 2. *Morellia (Trichomorellia) callidimera* (Bigot). Male: sternite 5, ventral view (A); epandrium, cerci, and surstyli, posterior view (B); epandrium, cerci, and surstyli, lateral view (C); aedeagus and associated structures, lateral view (D). Female: ovipositor, dorsal view (E); ovipositor, ventral view and spermathecae (F). Scale bar: 0.1 mm.

al setae (the posterior one slightly longer). Inner vertical setae convergent, twice longer than the outer vertical setae. Postocellars slightly shorter than frontal setae. **Thorax:** Dorsocentral presutural setae of similar length. A row of 8-9 anepisternal setae. Scutellum with a long pair of apical and basal setae, the basal pair slightly longer; a pair of prebasal with $\frac{1}{2}$ the length of the basal pair; a pair of subapical scutellar setae $\frac{1}{4}$ the length of the apical pair; and a discal scutellar pair approximately $\frac{2}{3}$ the length of the apical setae. **Wing:** Calypter yellow, with

margin ranging from light brown to yellowish (Fig. 3B, E). **Legs:** Mid femur with 3 *p* to *pd* preapical setae; without thick, truncate apical *d* setae; the 2-3 *pv* setae shorter than in males. Mid tibia with 3 median *p*; the *pd* are shorter than in male, almost indistinguishable from the cover setulae. Hind femur with a median *pv* seta with about half as long as femur width; 5-6 *av* setae on the apical $\frac{3}{4}$ of the femur, as long as femur width. Hind tibia with 4 *ad*; without a row of long and thin *pv*; 4 *av* as long as tibia width. **Terminalia:** Tergites 6 conspicuously enlarged

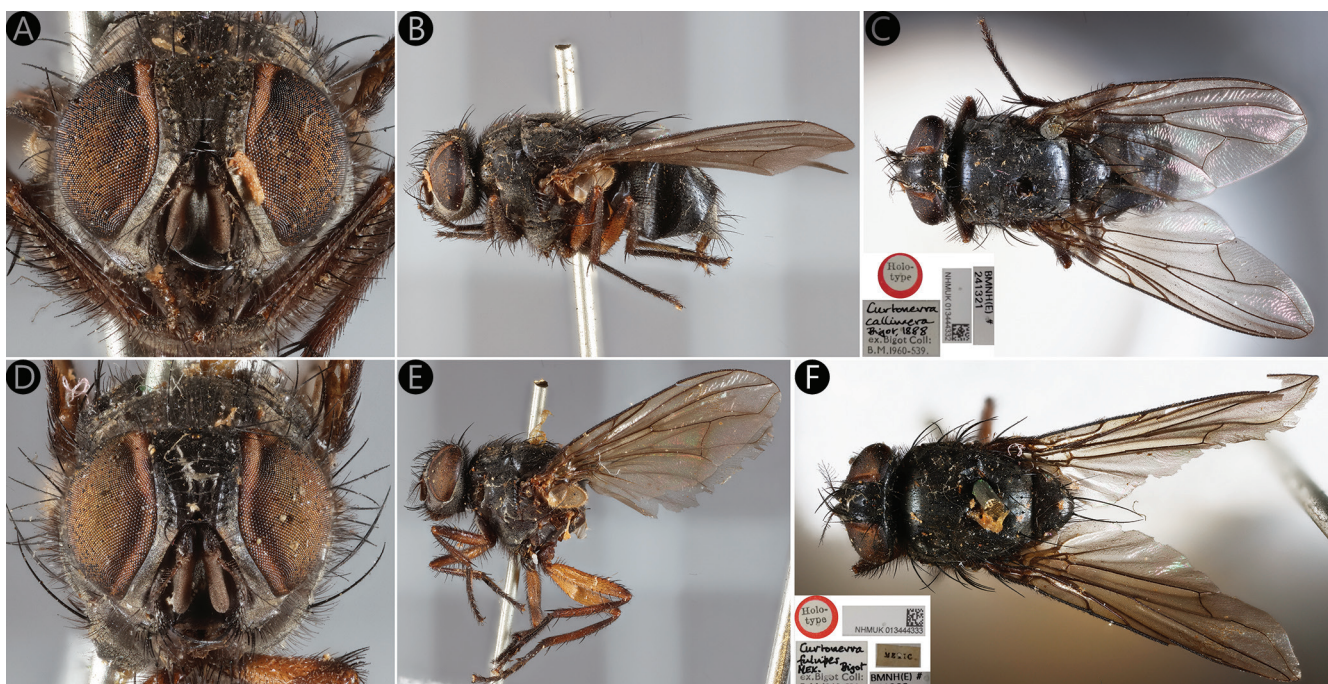


Figure 3. *Morellia (Trichomorellia) callidimera* (Bigot), holotype female: head, frontal view (A); habitus, lateral view (B); habitus, dorsal view (C). *M. (T.) fulvipes* (Bigot), holotype female [junior synonym of *M. (T.) callidimera* (Bigot)]: head, frontal view (D); habitus, lateral view (E); habitus, dorsal view (F).

basally and apically; tergites 7 slightly enlarged basally; tergite 8 narrow; epiproct quadrangular, with 2 pairs of apical setae (Fig. 2E). Sternite 6-8 narrow, with a rounded apical plate; hypoproct triangular, covered by setulae, with 3 pairs of setae on the apical margin; cerci long and narrow, as long as the hypoproct, with a long apical seta slightly shorter than the cerci length (Fig. 2F). Three rounded spermathecae (Fig. 2F).

Type Material examined: Holotype female. "Holotype" (NHM holotype label); "Curtonevra \ callimera \ Bigot, 1888 \ ex. Bigot Coll: \ B.M. 1960-539." (white handwrite/printed label); "NHMUK 013444332" (white printed label); "C. callimera ♀ \ Mexique J. Bigot" (white handwrite label, not in the specimen).

Material examined: Mexico. Guerrero. Amula, 6,000 ft., Sept., H.H. Smith, 1 male (BMNH); Amula, 6,000 ft., August., H.H. Smith, 2 males and 2 females (BMNH); Omilteme, 8,000 ft. July, H.H. Smith, 1 male and 1 female (BMNH); Sierra de las Aguas Escondidas, 7,000 ft., July, H.H. Smith, 4 males [a male dissected in 1978] and 2 females (BMNH); Xucumanatlan, 7,000 ft., July, H.H. Smith, 1 male and 2 females (BMNH). Veracruz. Huatusco de Chicuellar, Las Cañadas, 02.ix.2004, Malaise 1, S. Ibañez, F.A. Pech, J.F. Dzul col. DIP-010863, 1 male (IEXA) [photo and description]; Huatusco, Las Cañadas, 1,340 m, 20.iv.2004, red, V. Hernández, C. Deloya, F.A. Pech, DIP-010213, 2 males (IEXA); Huatusco, Las Cañadas, 1,340 m, 21.iv.2004, Malaise, V. Hernández, C. Deloya, F.A. Pech, DIP-010235, 1 female (IEXA).

Distribution: Guatemala (Ciudad de Guatemala) and Mexico (Guerrero, Morelos, and Veracruz) (Snyder, 1949; Löwenberg-Neto & de Carvalho, 2013).

Remarks: The holotype is in good condition, with a dorsal perforation in the thorax.

Morellia (*Trichomorellia*) *fulvipes* (Bigot, 1887) [junior synonym of *M. (T.) callidimera* (Bigot, 1887); Synonymy by Pont (2000: 14)] (Fig. 3D-F).

Material examined: Holotype female. "Holotype" (NHM holotype label); "Curtonevra \ *fulvipes* \ MEX. Bigot \ ex. Bigot Coll: \ B.M. 1960-539." (white handwrite/printed label); "C. *fulvipes* ♀ \ Mexique J. Bigot" (white handwrite label).

Remarks: Holotype in good condition, abdomen and left mid leg missing.

DISCUSSION

No significant morphological differences were observed between the holotype of *M. (T.) callidimera* and *M. (T.) fulvipes*, except for leg coloration. In *M. (T.) callidimera*, the fore femur is light brown and the mid and hind femora are yellow with light brown apex (Fig. 3B). In contrast, in *M. (T.) fulvipes*, the fore femur is

light brown with a yellow base, and mid and hind femora are completely yellow (Fig. 3E).

The material from Guerrero (Mexico) examined by Wulp (1896) and identified as *M. (T.) callidimera* present variation in leg coloration. Fore femur ranges from entirely yellow to yellow basally with a light brown apex, or entirely light brown. The mid femur may bear an apical dark brown area with less than one-fifth of femoral length or extending to approximately one-third. One male specimen with completely yellow legs was previously dissected, and its terminalia is identical to those of the Veracruz specimen described here, indicating that leg coloration is variable within this species.

Given the observed variation in leg, the identical male genitalia among specimens with different leg patterns, and the fact that leg coloration is the only difference between the holotypes of *M. (T.) callidimera* and *M. (T.) fulvipes*, the synonym proposed by Pont (2000) is supported.

The terminalia of the subgenus *Trichomorellia* remain poorly documented. Pamplona (1983) described and illustrated the terminalia of four species. Male terminalia are known for three species: *M. (T.) trichops*, *M. (T.) seguyi*, and *M. (T.) benoisti*. Whereas female terminalia have been described for four species: *M. (T.) trichops*, *M. (T.) seguyi*, *M. (T.) benoisti*, and *M. (T.) flavipalpis*. However, in females only the cerci, epiproct, and hypoproct were illustrated.

The female terminalia of *M. (T.) callidimera* most closely resemble to *M. (T.) flavipalpis*, particularly in lacking spines on the ovipositor (the male of *M. (T.) flavipalpis* is unknown). In contrast, the male terminalia is more similar to *M. (T.) benoisti* and *M. (T.) trichops*, especially in the morphology of the cerci, epandrium, and surstyli. In these three species, the surstyli bear a rounded posteroapical projection in lateral view, although it is narrower in *M. (T.) callidimera*.

Among the species treated by Pamplona (1983), males of *M. (T.) benoisti*, *M. (T.) trichops*, and *M. (T.) seguyi* possess a dorsal protuberance with setae on the mid femur. However, none exhibit modifications comparable to the two thick, truncate dorsal apical setae present in *M. (T.) callidimera*.

In the present study, the female sternites and tergites of *Trichomorellia* are described for the first time. Comprehensive redescriptions of the remaining species are needed to clarify interspecific morphological variation, particularly the male and female terminalia.

Conflicts of Interest: Author declares there are no conflicts of interest.

Ethics Statement: No applicable.

AI Use: No artificial intelligence tools were used in the preparation of this manuscript.

Data Availability: All data generated in this study are included within the article.

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