



Two new species of Neotropical *Leptomorphus* Curtis (Diptera: Mycetophilidae)

SCOTT J. FITZGERALD

Pacific Northwest Diptera Research Lab, 1460 SW Allen St., Corvallis, OR, 97333 USA.

✉ woodyfitz@gmail.com; <https://orcid.org/0000-0001-9650-9271>

urn:lsid:zoobank.org:author:E04F0272-65C8-415D-A9DE-6D6EB2D90B9E

Abstract

Two new species of *Leptomorphus* Curtis, *L. guatemalensis* sp. n. and *L. juxtafurcatus* sp. n., are described from Guatemala, figured, and compared with congeners. The new species belong to the clade including the “*furcatus*” and “*walkeri*” species-groups as defined by Borkent & Wheeler (2012). *L. guatemalensis* sp. n. can be recognized by the gonocoxite bulbous and crescent-shaped with the apex asetose and spatula-like, but remains without a clear sister-species. Based on the structure of the male terminalia, particularly the presence of submedian, pointed lobes on sternite nine, *L. juxtafurcatus* sp. n. is suggested to be the sister-species to *L. furcatus* Borkent from the southwestern USA and northern Mexico; these species can be distinguished by the form of the gonocoxites.

Key words: systematics, taxonomy, fungus gnats, Sciophilinae

Introduction

Leptomorphus Curtis is arguably one of the best studied genera of mycetophilid fungus gnats, as it is one of the few genera with a revision treating species on a world scale through both a taxonomic and phylogenetic lens, as well as summarizing all available data on immatures and biology (Borkent & Wheeler 2012). The genus includes some of the largest fungus gnats (with body-size ranging up to 14 mm) and includes 46 species worldwide, with nine recognized from the Neotropical region (Borkent and Wheeler 2012, Papp & Ševčík 2011, Kaspřák et al. 2017). *Leptomorphus* is most similar in general habitus to *Eudicrana* Loew, which has similar wing venation and also includes some rather large species; it is perhaps no surprise that the two genera were found to be sister taxa in the morphological phylogenetic analysis of Sciophilini by Borkent & Wheeler (2013). In contrast, two molecular phylogenetic studies found *Eudicrana* as either sister-group to, or in the same clade as, *Sciophila* Meigen (Ševčík et al. 2013 and Kaspřák et al. 2019). *Leptomorphus* can be distinguished from *Eudicrana* in having cell r_1 subquadrate or absent and three ocelli close together on the vertex (except *L. perplexus* Borkent which has ocelli more spread out) versus cell r_1 about three times as long as wide and only two ocelli present near eye margins (Vockeroth 2009). Vockeroth (2009) also states that in *Leptomorphus* C does not extend beyond the apex of R_{4+5} while it is produced slightly beyond the apex in *Eudicrana*. Due to a mistranscription (C. Borkent pers. comm.) the diagnosis of *Eudicrana* provided by Borkent & Wheeler (2013) states that C is *not* produced beyond the apex, but this is clearly not the case as throughout the remainder of the paper the character state given for *Eudicrana* is C extending beyond the apex of R_{4+5} . A number of other studies also confirm that C is produced beyond the apex in *Eudicrana* (e.g., Johannsen 1909 & 1910, Matile 1991, Vockeroth 2009, Henao-Sepúlveda et al. 2020).

Only three species of *Leptomorphus* have been previously recorded from Central America, *L. brandiae* Borkent and *L. eberhardi* Borkent, both from Costa Rica, and *L. fasciculatus* Edwards, from Panama south to Brazil. The present study adds two new species from Guatemala and discusses their phylogenetic placement based on the species-groups defined by Borkent & Wheeler (2012).

Materials and methods

Terminology follows Cumming and Wood (2017) with terminalia orientation and terminology following (Borkent & Wheeler 2012) to assist ease of comparison between studies. Additionally, although terminalia is rotated 90 degrees, discussion of terminalia is presented as if unrotated (e.g., cerci are dorsal to gonostyli). Terminalia were macerated in warm dilute KOH for several minutes to remove soft tissue, then rinsed in distilled water and dilute acetic acid. Terminalia preparations were placed in a small genitalia vial containing glycerol and pinned beneath the specimen. Photographs were taken with a Canon EOS 60D with a MP-E 65 mm macro lens or mounted on a Nikon Optiphot microscope. Multiple photographic images were stacked into a single composite image using CombineZP image stacking software. In photographs and drawings, structures that are behind other structures (i.e. the structure is being observed through a semi-transparent structure which lies in front of it) are indicated by the abbreviation in *italics* and, where needed, a dashed (rather than solid) line pointing to the structure. Material examined is deposited in the following collections: Canadian National Collection of Insects, Ottawa, Ontario, Canada (CNCI); the author's collection, Corvallis, Oregon (SFC); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); Colección de Artrópodos de la Universidad del Valle de Guatemala, Guatemala City, Guatemala (UVGC).

Results

Leptomorphus guatemalensis Fitzgerald sp. n.

Figs. 1–3

urn:lsid:zoobank.org:act:E8EFC947-0A07-4C07-B9E4-3412E08EEEE1

Type material. Holotype: Male (Figs. 2–3), point-pinned, missing right front leg, terminalia in vial pinned under specimen. White label: “GUATEMALA: Guatemala, Puerta Parada, 1850 m alt., 24–31 Aug. 2013, Col.: J.C. Schuster,” (CNCI). Red label: “HOLOTYPE / *Leptomorphus* / *guatemalensis* / Fitzgerald.” **Paratypes:** same data as HT except: 17–21 Aug. 2013, 1 male (SFC); 24–31 Aug. 2013, 2 males (1 SFC, 1 UVGC); 31 Aug.–7 Sept. [no year, but probably 2013], 2 males (1 SFC, 1 USNM); 7–14 Sept. 2013, 1 male (SFC); 14–21 Sept. 2013, 2 males (SFC); 21–28 Sept. 2013, 2 males (1 SFC, 1 UVGC); Bosques cipres, 29 Sept.–5 Oct. 2013, 1 male (SFC); 12–19 Oct. 2013, 1 male (SFC); Bosque cipres, 19–26 Oct. 2013, 2 males (SFC); 20–27 June 2015, 1 male (SFC); 1840m, 16–23 June 2018, 1 male (SFC); 1840m, 30 June–7 July 2018, 1 male (SFC); 1840m, 7–14 July 2018, 2 males (SFC).

Diagnosis. *L. guatemalensis* sp. n. can be distinguished from other New World *Leptomorphus* by the combination of the following characters: R_4 absent, male fore tibia with dense row (comb) of short bristles on anteroventral surface, tergite 9 with two pairs of pointed lobes on posterior margin (one pair lateral and the other ventral submedian and separated by a U-shaped indentation), gonocoxite bulbous, crescent-shaped with apex asetose and spatula-like.

Remarks. *L. guatemalensis* sp. n. will key to couplet 20 (*L. walkeri* Curtis) in Borkent & Wheeler (2012).

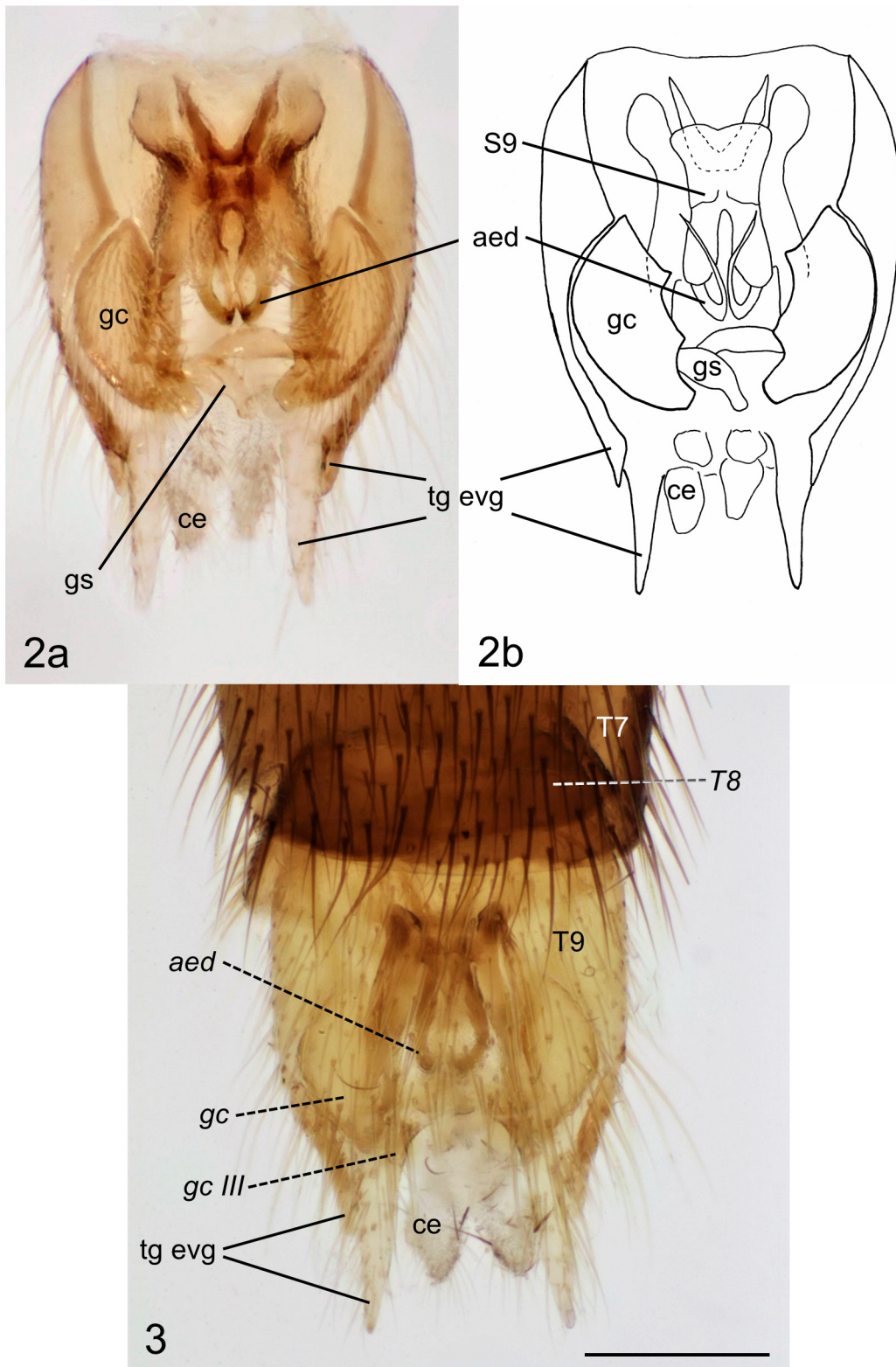
Etymology. The specific epithet is derived from the type locality.

Description. *Male* (Fig. 1). **Head:** Yellow-orange, except area immediately around ocelli dark brown. Head with dark appressed setae posterior to ocelli. Antenna brown except scape, pedicel and tapered base of flagellomere one yellow-orange. Scape slightly projecting anteroapically with tuft of anteroapical setae, pedicel with a few small setae antero- and posteroapically and one stronger seta posteroapically. Flagellomeres barrel-shaped, slightly laterally compressed, flagellomere 6 ca. 2X as long as broad. Clypeus and face cream-colored, clypeus oval, somewhat bulbous with light brown, apically-directed setae. Labellum and palpus yellowish, palps five-segmented. Eye with sparse, short inter-ommatidial setulae scattered on surface. Three ocelli in a straight line, close together at vertex, lateral ocelli larger in diameter. **Thorax:** Scutum yellowish in ground color, gradually becoming brown on posterior 2/5, anteriorly either with a pair of brown spots along anterior margin or with two thin brown posteriorly converging stripes and a very thin medial stripe. Surface of scutum covered with small brown appressed setae; macrosetae absent except a cluster of one to several setae near cream-colored humeral ridge and several rows of setae laterally. Scutellum yellowish-brown with small dark appressed setae and a pair of slightly stronger setae on apical margin (often only represented by a pair of larger setal sockets). Mediotergite yellowish-brown medially, whitish laterally,

with 5–6 stronger setae on posterolateral corners and small appressed setae covering medial area. Laterotergite yellowish-brown with dark small appressed setae anteriorly and larger stronger setae posteriorly; anterior margin of laterotergite not reaching katepisternum. Remaining pleurae cream to yellowish, bare except anteprepronotum and proepisternum with setae. *Legs*: Coxae cream-colored, remainder of legs primarily yellowish, gradually becoming brown distally; hind femur yellow with apex tipped in brown, apices of other femora yellow. Mid femur without apical spine-like process. Fore tibia with a row of short closely-spaced setae (comb) along length of anteroventral surface. Tibial spurs brown, 1:2:2. *Wing*: Length ca. 6.0 mm, (n = 3), largely hyaline, but with faint apical macula covering most of wing tip (often darker anteriorly) and faint cloud over base of Rs/r-m (see Fig. 1). R₄ absent, remainder of venation as in Fig. 1. Macrotrichia in all cells. Setae on basal posterior margin of wing alternating long and short. Halteres yellowish. *Abdomen*: Tergite 1 brown, 2 brown (sometimes with extreme posterolateral corners yellowish), 3–6 anteriorly yellow, posteriorly brown, and 7–8 brown, (Fig. 1). Tergite 8 much broader than long, telescoped within segment 7, asetose. Sternite 8 small, setose, with posterior margin convex, broadly triangular. *Terminalia* (Figs. 2–3): Yellow. Sternite 9 internal, minute, anterior half of sclerite light brown, nearly transparent and only very lightly sclerotized, with posterolateral corners very slightly drawn out into minute points. Posterior half of sternite 9 transparent, consisting of a pair of rounded lobes extending posteriorly and cradling apex of aedeagus, lobes separated by a median slit-like invagination extending about ½ the total length of the sclerite. Tergite 9 longer than wide with two pairs of pointed lobes on posterior margin; ventrally with a pair of elongate strongly tapered submedian lobes separated by a U-shaped indentation and laterally with a shorter tapered point (Figs. 2 & 3, tg evg) which appears acute in ventral view, but is narrowly rounded apically in lateral view. Gonocoxite placed centrally on tergite 9 (considering posterior lobes as part of total length); short, bulbous, crescent-shaped with inner (medial) margin slightly serrate and apex asetose, spatula-like. Gonostylus flattened, blade-like, slightly curved with some setae on the anterior edge; narrow basally, broadest medially, followed by a distinct constriction (easiest to see in posteroventral view) and a more strap-like apical portion with very apex rounded and spatulate. Gonocoxite III a small rounded, digitate, setose lobe just dorsal to base of gonostylus, but not fused to it. Aedeagus, median in position, a pair of long whip-like strands, curving dorsoapically with apex cradled by posterior lobes of sternite 9. Parameres lateral to aedeagus, long, slender, rod-like, apex terminating near gonocoxite III. Cerci fleshy, setose.



FIGURE 1. *L. guatemalensis* sp. n., male, habitus (left wing removed). Scale bar = ca. 1.0 mm.



FIGURES 2–3. *L. guatemalensis* sp. n., holotype, male terminalia. 2a. Ventral, (photograph). 2b. Ventral, (line drawing). 3. Dorsal. Scale bar = ca. 0.25 mm. Abbreviations: aed, aedeagus; ce, cercus; gc, gonocoxites; gc III, gonocoxite III; gs, gonostylus; S9, sternite 9; tg evg, tergal evagination; T7, tergite 7; T8, tergite 8; T9, tergite 9.

Female. As in male, except as follows. Wing ca. 6.0–7.0 mm (n=2). Fore tibia without comb of short setae on anteroventral surface. Cercus yellow.

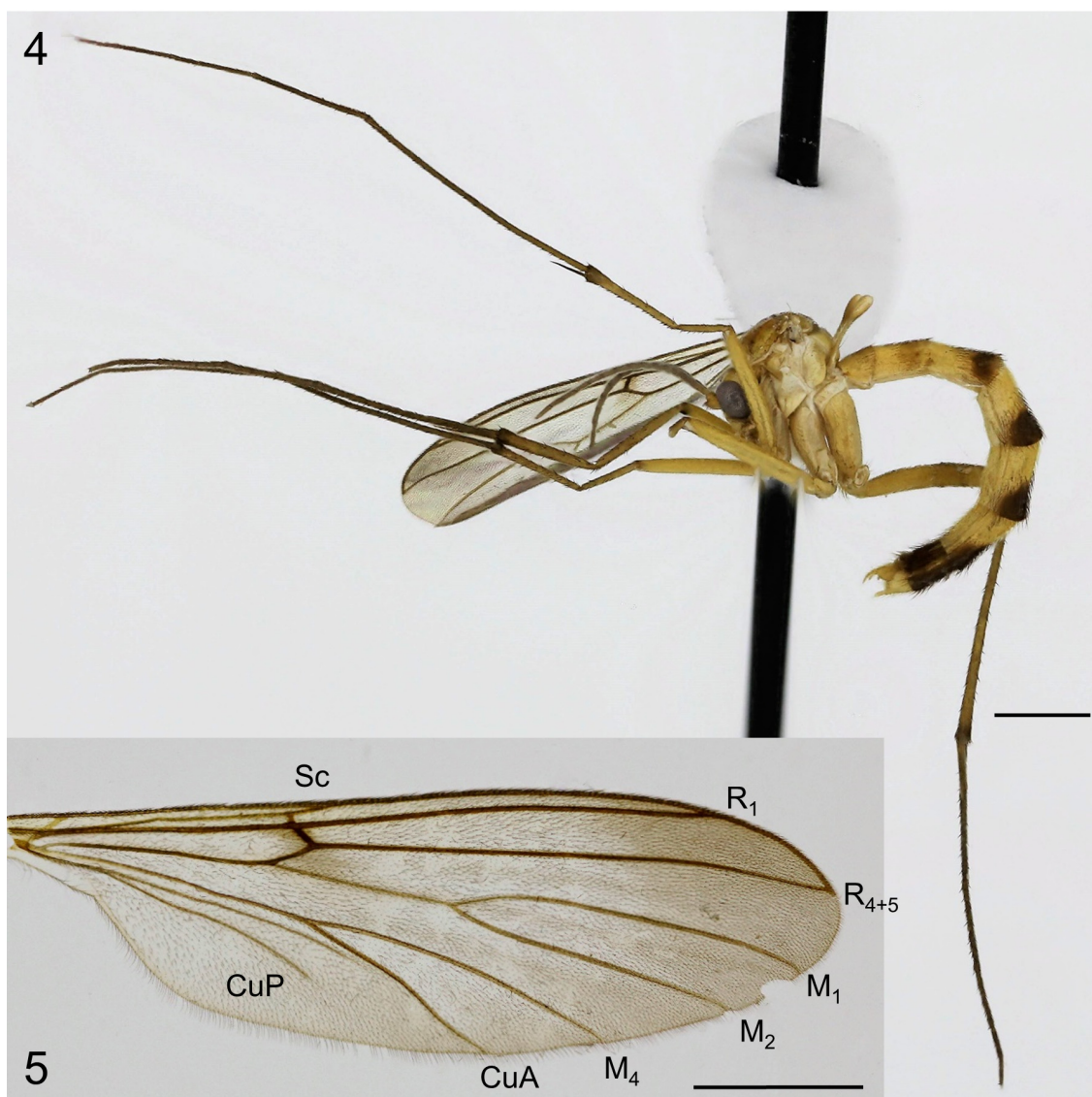
Distribution. Guatemala.

Leptomorphus juxtafurcatus Fitzgerald sp. n.

Figs. 4–7

urn:lsid:zoobank.org:act:A07F8318-C03B-4D7B-AE08-DB872F479F64

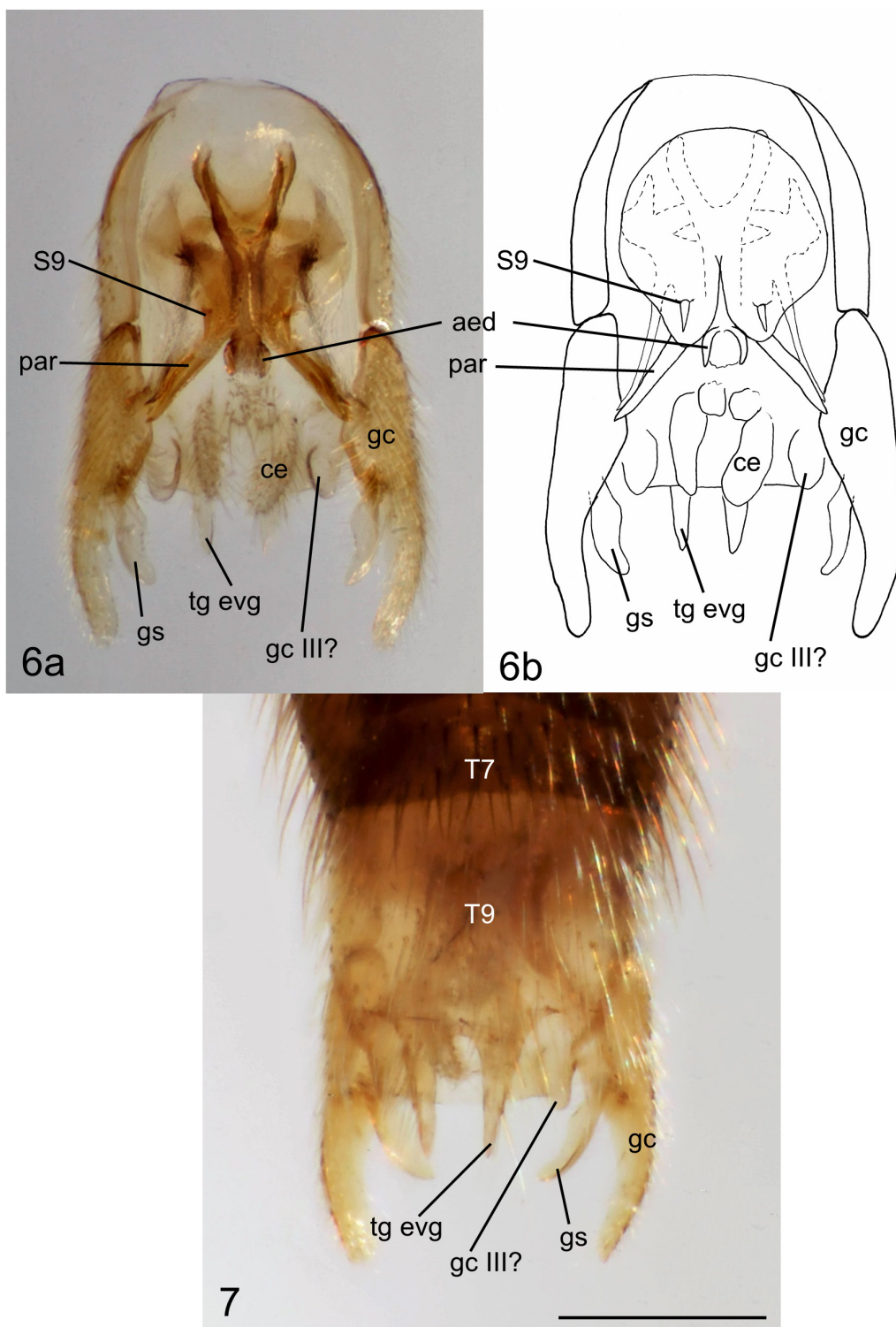
Type material. **Holotype:** Male (Figs. 4–7), point-pinned, missing left rear and mid legs. Terminalia (in vial) and left wing (on point) pinned below specimen. White label: “GUATEMALA: Guatemala, Puerta Parada, 1850 m alt., 3–10 Aug. 2013, Col.: J.C. Schuster,” (CNCI). Red label: “HOLOTYPE / *Leptomorphus* / *juxtafurcatus* / Fitzgerald.”



FIGURES 4–5. *L. juxtafurcatus* sp. n., holotype male. 4. Habitus (left wing removed). 5. Wing. Scale bars = ca. 1.0 mm.

Diagnosis & remarks. *L. juxtafurcatus* sp. n. can be distinguished from all New World congeners except *L. furcatus* Borkent by sternite nine with a pair of subapical pointed lobes and gonocoxites extending posteriorly as a pair of forcipate lobes. *L. juxtafurcatus* sp. n. is most similar to *L. furcatus* and will key to this species in Borkent and Wheeler (2012), but can be distinguished by the shape of the gonocoxites which are simple (with basal and distal portions continuous), forcipate, tapering apically, and apically unforked, whereas the gonocoxite of *L. furcatus*

is of much different form; the dorsal edge of the gonocoxite is longitudinally cleft, setting off the basal and distal portions of the gonocoxite and forming a strong keel-like shoulder at the apex of the basal portion (not apparent in Borkent & Wheeler 2012, Fig. 104). Additionally, the more distal portion of the gonocoxite of *L. furcatus* is broader, with the medial edge more expanded and blade-like, asetose and the apex of the gonocoxite slightly forked (Borkent & Wheeler 2012, Fig. 104).



FIGURES 6–7. *L. juxtafurcatus* sp. n., holotype, male terminalia. 6a. Ventral (photograph). 6b. Ventral (line drawing). 7. Dorsal. Scale bar = ca. 0.25 mm. Abbreviations: aed, aedeagus; ce, cercus; gc, gonocoxites; gc III?, gonocoxite III? (see Description); gs, gonostylus; par, paramere; S9, sternite 9; tg evg, tergal evagination; T7, tergite 7; T9, tergite 9.

Etymology. The specific epithet *juxtafurcatus* is based on the Latin *juxta* (near, close, next to) as this species is “close to” *L. furcatus* both in morphology and geographic proximity.

Description. *Male* (Fig. 4). *Head:* Yellow-orange, except area immediately around ocelli dark brown. Head with dark appressed setae posterior to ocelli. Antenna brown except scape, pedicel and tapered base of flagellomere one yellow-orange. Scape slightly produced anteroapically with tuft of anteroapical setae, pedicel with a few small setae anteroapically and a few small and large setae posteroapically. Flagellomeres barrel-shaped, slightly laterally compressed, flagellomere 6 ca. 3X as long as broad. Face cream-colored, clypeus yellowish oval, somewhat bulbous with yellow apically-directed setae. Labellum and palpus yellowish, palps five-segmented. Eye with sparse, short inter-ommatidial setulae scattered on surface. Three ocelli in a straight line, close together at vertex, lateral ocelli larger in diameter. *Thorax:* Scutum yellowish in ground color with hint of three broad very light-brown stripes; lateral stripes truncated anteriorly, median stripe tapering posteriorly. Surface of scutum covered with small dark appressed setae; macrosetae absent except a cluster of three setae near cream-colored humeral ridge and several rows of setae laterally. Scutellum yellowish with small dark appressed setae, stronger setae absent. Mediotergite yellowish with small dark appressed setae in dorsal band extending down into ventrolateral corners, cluster of stronger setae ventrolaterally. Laterotergite yellow to cream-colored with yellow small and large setae; anterior margin of laterotergite not reaching katepisternum. Remaining pleurae cream to yellowish, bare except antepronotum and proepisternum with setae. *Legs:* Coxae, femora, and tibiae yellow with apex of tibiae and all tarsi brown. Mid femur without apical spine-like process. Fore tibia with a row of short closely-spaced setae (comb) along length of anteroventral surface, tibial spurs brown, 1:2:2. *Wing:* Length ca. 6.0 mm, (n = 1). Largely hyaline, but with faint apical macula covering most of wing tip and faint cloud over base of Rs/r-m (see Fig. 5). R₄ absent, remainder of venation as in Fig. 5. Macrotrichia in all cells. Setae on basal posterior margin of wing alternating long and short. Halteres yellowish. *Abdomen:* Patterned yellow and brown, segments 1 and 8 shorter. Tergites 1–2 yellow, 3–6 yellow anteriorly, brown posteriorly, 7–8 brown, 9 yellow. Sternites 1–6 yellow, 7–8 brown. Tergite 8 much broader than long, telescoped within segment 7, asetose. Sternite 8 small, setose, rectangular, broader than long. *Terminalia* (Figs. 6–7): Yellow. Sternite 9 internal, small round, transparent except a pair of small sub-median points (as in *L. furcatus*); posteromedially produced posteriorly into a pair of transparent apically rounded lobes cradling tip of aedeagus; lobes separated from each other by a median slit-like cleft. Tergite 9 longer than wide, posterior margin with a pair of elongate, strongly tapered, apically pointed, lobes separated by a U-shaped indentation (Fig. 7, tg evg). Gonocoxite placed centrally on tergite 9 (considering posterior lobes as part of total length); forceps-like, extending beyond posterior margin of tergite 9, apically blunt and not forked. Gonostylus simple scoop-shaped. Aedeagus, median in position, a pair of laterally compressed rods curving dorsally at apex, cradled by median lobate extension of sternite 9. Parameres lateral to aedeagus, long slender, rod-like, strongly divergent. Cerci oval, fleshy, setose. There are two structures that may represent gonocoxite III; the first is a small rounded digitate setose lobe just dorsal to base of gonostylus, but not fused to it (not visible in Fig. 6) and the second is a broad asetose transparent plate between the cerci and tergite 9 with a small rounded lateral lobe on each side (this second structure is treated as “gc III?” in Figs. 6–7).

Female. Unknown.

Distribution. Guatemala.

Discussion

The following discussion of phylogenetic placement of the two new species is based on characters and cladograms from Borkent & Wheeler (2012); only unique synapomorphies (indicated with an “*” on Borkent & Wheeler’s cladograms) have been considered here. The two new species belong to the clade including the “*furcatus*” and “*walkeri*” species-groups based on the gonocoxite positioned on tergite 9 distally or apically (55:1), which makes sense considering these groups include most of the other Nearctic and Neotropical species. However, within this clade the phylogenetic position of these species is less clear. The species lack the synapomorphies defining the *walkeri*-group. This narrows the discussion to the *furcatus*-group which includes all of the previously described Neotropical species and *L. furcatus* Borkent known from the southwestern USA and northern Mexico. The *furcatus*-group is defined by the laterotergite covered with appressed fine trichia; Borkent & Wheeler differentiate trichia from small bristles by the latter having sockets (see couplet 9 in their key), but the laterotergites of the new species

have only small and larger setae/bristles (with sockets); the smaller setae (pale in *L. juxtafurcatus*, dark in *L. guatemalensis*) are similar in size to the small dark setae of the mesonotum, scutellum, and median area of the mediotergite of these species. Furthermore, the new species lack the four synapomorphies that define the Neotropical clade of species within the *furcatus*-group. While the phylogenetic position of the new species is not clear based on the characters discussed above, the very similar morphology of the male terminalia of *L. juxtafurcatus* and *L. furcatus* suggests these latter two are sister-species; they are the only species of *Leptomorphus* with sternite nine produced into a pair of submedian points.

Borkent & Wheeler (2012) stated they expected additional species of *Leptomorphus* to be discovered since a number of species were described from only a handful of specimens. The two new species described here brings the known Central American species to five. An additional species from the same site in Guatemala, represented by a single female (deposited in UVGC), could not be further evaluated; it keys out to *L. eberhardi* Borkent using Borkent & Wheeler (2012), but does not entirely match the description (same bold wing pattern and general coloration, but has a light brown instead of dark brown mesonotum). Echoing Borkent & Wheeler's (2012) comment from above, it seems likely that more new species will be discovered, particularly considering that all the specimens included in this study were collected from a single site.

Acknowledgements

Thank you to Jack Schuster (UVGC) for making specimens available for study. Thank you also to Chris Borkent, Jan Ševčík, and Olavi Kurina for providing helpful comments on the manuscript which greatly improved the final product.

References

- Borkent, C.J. & Wheeler, T.A. (2012) Systematics and Phylogeny of *Leptomorphus* Curtis (Diptera: Mycetophilidae). *Zootaxa*, 3549 (1), 1–117.
<https://doi.org/10.11646/zootaxa.3549.1.1>
- Borkent, C.J. & Wheeler, T.A. (2013) Phylogeny of the tribe Sciophilini (Diptera: Mycetophilidae: Sciophilinae). *Systematic Entomology*, 38, 407–427.
<https://doi.org/10.1111/syen.12002>
- Cumming, J.M. & Wood, D.M. (2017) Adult Morphology and Terminology. In: Kirk-Spriggs, A.H. & Sinclair, B.J. (Eds.), Manual of Afrotropical Diptera. Volume 1. Introductory chapters and keys to Diptera families. *Suricata. Vol. 4*. South African National Biodiversity Institute, Pretoria, pp. 89–133.
- Henaio-Sepúlveda, C., Wolff, M. & Amorim, D.S. (2020) Four new Neotropical species of *Eudicrana* Loew (Diptera, Mycetophilidae, Sciophilinae) from the Colombian high Andean ecosystems, with comments on the genus. *ZooKeys*, 988, 129–150.
<https://doi.org/10.3897/zookeys.988.49627>
- Johannsen, O.A. (1909) Fascicule 93. Diptera, Fam. Mycetophilidae. In: Wytzman, P. (Ed.), *Genera Insectorum*. Desmet-Verneuil, Bruxelles, pp. 1–141.
- Johannsen, O.A. (1910) The fungus gnats of North America. The Mycetophilidae of North America. Part II. *Bulletin of the Maine Agricultural Experiment Station*, 180, 125–191.
<https://doi.org/10.5962/bhl.title.86674>
- Kasprák, D., Borkent, C. & Wahab, R. (2017) *Leptomorphus sevciki* sp. nov., a remarkable new wasp-mimicking fungus gnat from Brunei (Diptera: Mycetophilidae). *Acta Entomologica Musei Nationalis Pragae*, 57, 195–203.
<https://doi.org/10.1515/aemnp-2017-0068>
- Kasprák, D., Kerr, P., Sýkora, V., Tóthová, A. & Ševčík, J. (2019) Molecular phylogeny of the fungus gnat subfamilies Gnoristinae and Mycomyinae, and their position within Mycetophilidae (Diptera). *Systematic Entomology*, 44, 128–138.
<https://doi.org/10.1111/syen.12312>
- Matile, L. (1991) Diptera Mycetophiloidea Nouvelle-Calédonie. 4. Mycetophilidae Mycomyinae Sciophilinae et Gnoristinae. In: Chazeau, J. & Tillier, S. (Eds.), *Zoologia Neocaledonica. Vol. 2*. Muséum national d'Histoire Naturelle, Paris, pp. 233–250.
- Papp, L. & Ševčík, J. (2011) Eight new Oriental and Australasian species of *Leptomorphus* (Diptera: Mycetophilidae). *Acta Zoologica Academiae Scientiarum Hungaricae*, 57 (2), 139–159.
- Ševčík, J., Kasprák, D. & Tóthová, A. (2013) Molecular phylogeny of fungus gnats (Diptera: Mycetophilidae) revisited: position of Manotinae, Metanepsiini, and other enigmatic taxa as inferred from multigene analysis. *Systematic Entomology*, 38, 654–660.

<https://doi.org/10.1111/syen.12023>

Vockeroth, J.R. (2009) Mycetophilidae (fungus gnats). *In*: Brown, B.V., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E. & Zumbado, M.A. (Eds.), *Manual of Central American Diptera. Vol. 1*. NRC Research Press, Ottawa, Ontario, pp. 1–714.