



Systematics, Morphology and Biogeography

Description of a new Brazilian species of *Mycodrosophila* (Diptera, Drosophilidae) with emphasis on the morphology of phallic sclerites

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ABSTRACT

Mycodrosophila is a cosmopolitan genus of Drosophilidae that comprises approximately 130 species with mycophagous habitats. In this study, we described a new species of *Mycodrosophila* based on morphological traits and included details of the male terminalia. The holotype is from Eugênio Lefèvre, locality in Campos do Jordão municipality, SP, Brazil, located in the Atlantic rainforest biome and was sampled in the 1930s.

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Introduction

The genus *Mycodrosophila* Oldenberg, 1914 is diagnosed by a deep third costal break, with the apex of the first section of the costal vein dark and thickened forming a lappet; it has only one pair of dorsocentral bristles; and the basal scutellars setae are shortened and convergent (Okada, 1968, 1986; Wheeler and Takada, 1963; Bock, 1980). However, there are certain contradictions in the diagnosis of the genus. Some species with small anterior dorsocentral bristles and the absence of the costal lappet were included in *Mycodrosophila* (Bock, 1980; Grimaldi, 2010; Okada, 1986).

Currently, there are approximately 130 species distributed in all of the biogeographic regions of the world (Bächli, 2018). Until now, the *Mycodrosophila* species have been observed in association with macroscopic fungi, mainly mushrooms of the *Polyporus* genus (Polyporales: Polyporaceae) (Bock, 1980; Okada, 1986; Gottschalk et al., 2009; Robe et al., 2014; Valer et al., 2016). In the Neotropical region, eight species are recorded: *M. brunnescens* Wheeler and Takada, 1963, *M. elegans* Wheeler and Takada, 1963, *M. hofmanni* Junges et al., 2016, *M. neoprojectans* Wheeler and Takada, 1963, *M. nigropleura* Wheeler and Takada, 1963, *M. projectans* (Sturtevant, 1916), *M. pseudoprojectans* Wheeler and Takada, 1963, and *M. valentae* Junges et al., 2015 (Gottschalk et al., 2008; Robe et al., 2014; Junges et al., 2016).

The genus was considered rare by the small number of captured specimens in Drosophilidae samplings, whose sample technique favors the capture of frugivorous species (Döge et al., 2007; Gottschalk et al., 2008). However, in recent years, the use of appropriate techniques for the collection of mycophagous Drosophilidae has improved, which has made the capture of *Mycodrosophila* species more frequent (Gottschalk et al., 2009; Robe et al., 2014; Valer et al., 2016).

In this study, we described a new species of the genus *Mycodrosophila*, including the characterization of the male terminalia.

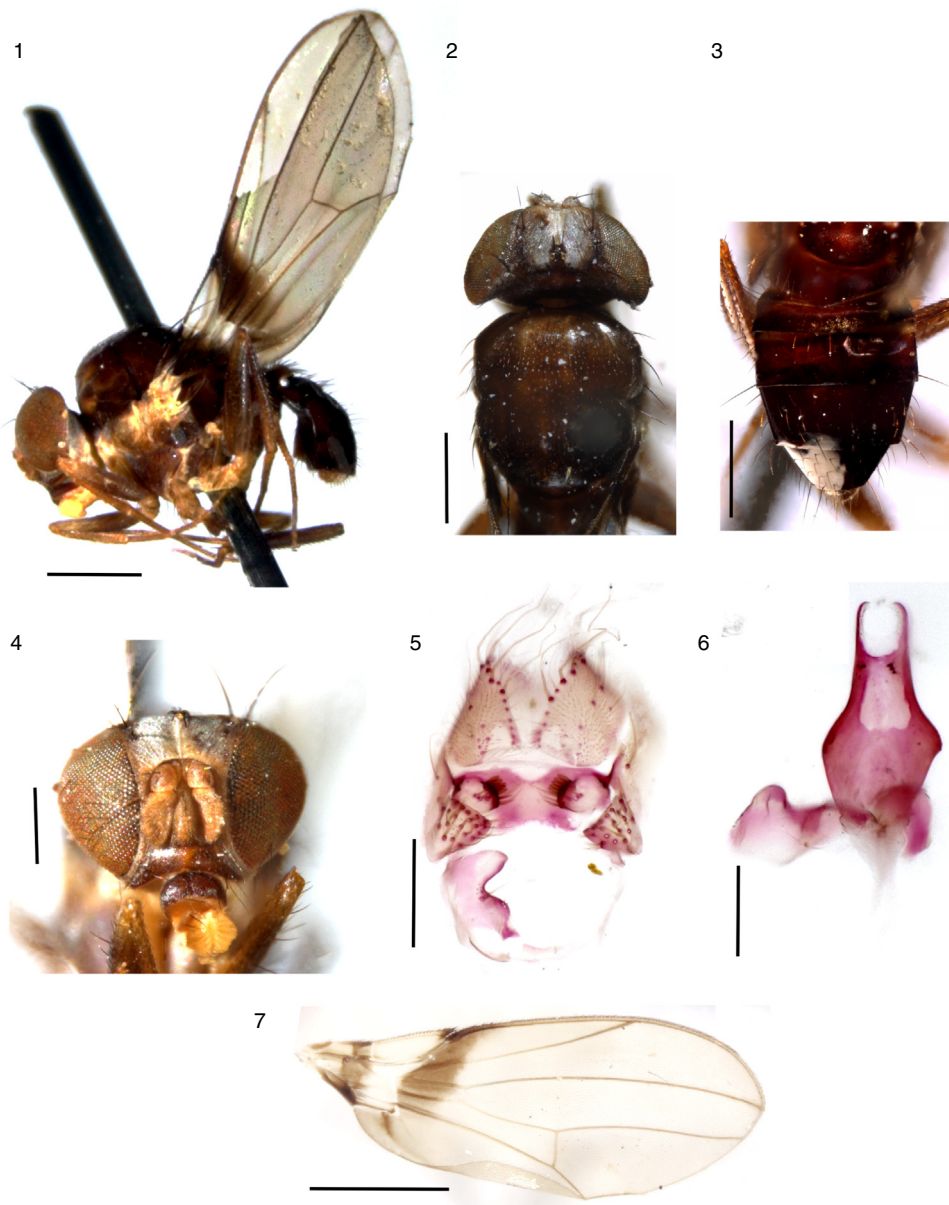
Materials and methods

The male holotype of *Mycodrosophila cornuta* sp. nov. was deposited in the Coleção Entomológica do Instituto Oswaldo Cruz (CEIOC), Rio de Janeiro, RJ, Brazil. It was provided from samples realized in the state of São Paulo and was dried and double mounted. Identification was achieved on the basis of general body characteristics and male terminalia morphologies.

We chose to adapt the proceedings described by Bächli et al. (2004) for the morphological analysis of the terminalia, in which the apex of the abdomen was removed with the help of minute pins and microsurgical scissors. The extracted portion of the abdomen was clarified with potassium hydroxide (KOH) in a 10% aqueous solution for approximately 24 h at room temperature. The sample was then washed with water and colored with GAGE (aqueous solution of acid fuchsin 0.17% and acid clorhidric 0.83%) also for approximately 24 h at room temperature. The portion of the abdomen

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Figs. 1–7. Holotype of *Mycodrosophila cornuta* sp. nov. 1: lateral view; 2: thorax, dorsal view; 3: abdomen, dorsal view; 4: head, frontal view. Scale bars = 0.5 mm. 5–6: male terminalia; 5: epandrium, cerci, surstylus, decasternum, hypandrium and progonites, in posterior view; 6: phallus and phallapodeme, ventral view. Scale bar = 0.1 mm. 7: Wing. Scale bars = 0.5 mm.

was dehydrated in 70% ethanol and dissected in glycerol using an Olympus CL 6000 stereomicroscope. For the drawings and photomicrographs, the phallic sclerites were mounted on a temporary slide with glycerin gelatin (no-flavor gelatin 10% in solution in 1:1 water: glycerin).

The wing was gently removed with the microsurgical scissors and mounted on a permanent slide with Canada balsam. The specimen was photographed with a Zeiss Discovery V.20 stereomicroscope in lateral, dorsal and frontal views, and the wing and terminalia were also photographed. The disarticulated terminalia were drawn with an Olympus BX40 optical microscope coupled with a camera lucida. All illustrations were made with 1.8× amplification of the camera lucida, 20× amplification of the objective lens and 10× amplification of the ocular lens.

The denomination of the body structures and regions followed [Cumming and Wood \(2010\)](#). The body color description followed [Vilela and Bächli \(2000\)](#). The measurements were performed on

the dried specimen with an Olympus V.20 stereomicroscope and a reticle coupled with the ocular lens.

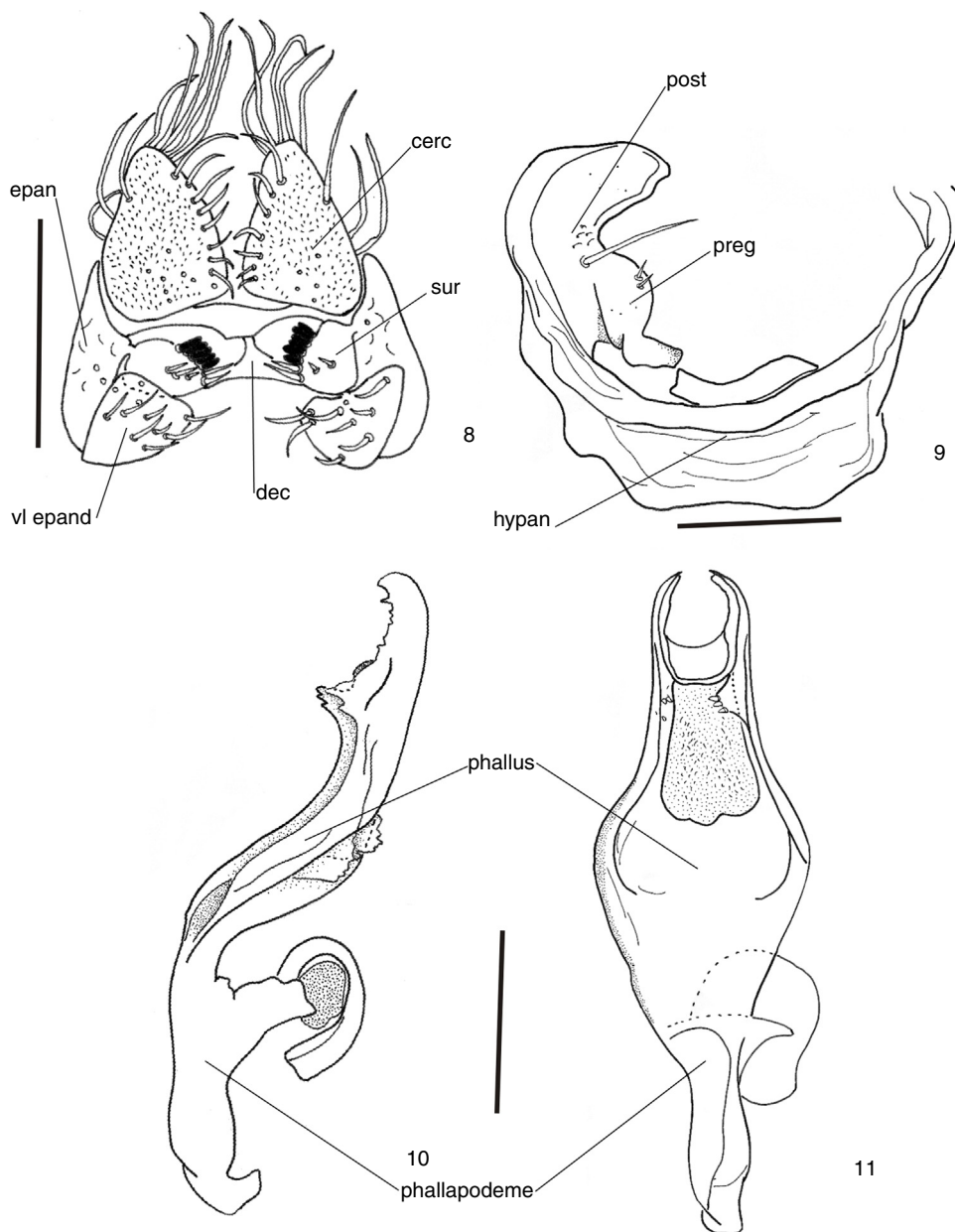
Taxonomy

Mycodrosophila cornuta sp. nov.

Figs. 1–11

Type series: Holotype: ♂ labels with the information “*Mycodrosophila cornuta* sp. nov. Mendes e Gottschalk. HOLÓTIPO ♂/Eug.[ênio] Lefevre (S.[ão] Paulo) [Brazil], Trav. Lopes et Oiticica, 1.XI.[19]37”. The information between the square brackets was added by us. The abdominal sclerites and the terminalia were stored in a microvial in glycerin and attached to the specimen. The right wing was mounted on a slide, as previously described, and stored with the holotype.

Type locality: The label with collection information was pointed out “Eug. Lefevre (S. Paulo)”. In a search, we found that Eugênio



Figs. 8–11. Illustration of male terminalia. Holotype of *Mycodrosophila cornuta* sp. nov. 8: epandrium, cerci, surstylus and decasternum in posterior view; 9: hypandrium, left pregonite and postgonite, ventral view; 10: phallus and phallapodeme, lateral view; 11: phallus and phallapodeme, ventral view. Scale bars = 0.1 mm. *Abbreviations:* cerc, cercus; dec, decasternum; epan, epandrium; par, paraphysis; post, postgonite; preg, pregonite; sur, surstylus; vl epan, ventral lobe of epandrium.

Lefèvre is a locality in Campos do Jordão municipality, state of São Paulo, Brazil.

Diagnosis. Body color mainly dark brown; dark brown thorax; pleura mainly dark brown, with an irregular yellow area that extended obliquely from the base of the wing until the insertion of the first pair of legs; abdomen brown, with tergites I and II shining; arista with 4 dorsal and 1 ventral branch; flagellomere brown, length 2× the length of the pedicel; facial carina brown, prominent; legs mainly dark brown, coxa and the base of other articles light brown; wings light brown; R_{2+3} straight; two transversal dark bands at the proximal region of the wing, one at the height of the h vein, and the other at the height of the sc break of C and extending to CuA.

Description. ♂ Head. Dark brown; width = 1.02 mm. Eyes pilose, brown. Facial carina brown. Flagellomere brown. Aristae brown with 4 dorsal and 1 ventral branch plus a terminal fork. Orbital

plates dark brown. Orbital bristles dark brown. Distance between or1 and or2 = 0.06 mm, between or1 and or3 = 0.10 mm, and between or2 and or3 = 0.04 mm. Front velvet gray, lateral margin slightly lighter. Ocular triangle black, length approximately 1/3 of front length; anterior frontal width equal to frontal length, posterior frontal width slightly straighter than anterior width. Face dark brown. Gena brown, slightly whitish. Proboscide yellow, palps and labellum brown. Postocellar setae lost.

Thorax. Brown; scutum slightly glowing, with 10 irregular rows of acrostichal setae; pleura dark brown, with an irregular yellow area that extended obliquely from the base of the wing until the insertion of the first pair of legs; scutellum with basal scutellar setae convergent, apical scutellar setae lost. Legs mainly dark brown, coxa and the base of other articles light brown. Length: 1.25 mm, width: 0.9 mm.

Wings. Slightly brown. Lappet present in sc break, preeminent. R_{2+3} straight in the direction of C. R_{4+5} and M somewhat convergent, both slightly posteriorly curved. Two transverse dark bands at the proximal region of the wing, one at the height of the h vein, and the other at the height of the sc break of C and extending to CuA. bM-Cu present. Halteres yellow. Indices: C = 1.14; ac = 4.45; hb = 0.68; 4c = 1.59; 4v = 1.92; 5x = 1.28; M = 0.47; prox. x = 0.65. Length: 2.81 mm.

Abdomen. All tergites blackish brown, tergites I and II shining.

Terminalia. Epandrium horseshoe-shaped, equal height and width. Ventral lobes projected forward with approximately 15 prominent bristles. Surstylus with 5–6 prenisetae. Cerci free, pilose. Postgonites (gonopods *sensu* Bächli et al., 2004) prominent, fused with hypandrium, with a long seta and five small setulae near the connection with pregonites (paraphysis *sensu* Bächli et al., 2004). Pregonites fused with postgonites and two setulae in the inner margin. Hypandrium large, rounded and U-shaped, with almost the same size as the epandrium. Phallus (aedeagus *sensu* Bächli et al., 2004) long, apically tapered and bifurcated; dorsal surface of aedeagus membranous, with 2–3 spurs inclined ventrally. Phallapodeme (aedeagal apodeme *sensu* Bächli et al., 2004) slender, length about a half of the aedeagus length, with a ventral projection (ventral rod *sensu* Vilela, 1983) and apex touching and fused with the posteromedial margin of hypandrium.

♀. Unknown.

Distribution. Known only by type locality.

Etymology. The specific epithet derives from the Latin “cornutum”, which means horned, and it was proposed in allusion to the format of the aedeagus, with projections resembling horns.

Discussion

Mycodrosophila cornuta sp. nov. described here has particularities that allow for the distinction of the other species described for the genus by the external morphology, in addition to differences in the masculine terminalia. The species recorded in Brazil differed from *Mycodrosophila cornuta* sp. nov. by the smaller number of lines of the acrostical setulae (6–8) that were irregularly arranged in *M. neoprojectans*, *M. projectans*, *M. elegans* and *M. nigropleura*; by the coloration of the pleura, which was mainly pale in *M. nigropleura*, *M. elegans*, *M. hofmanni*, *M. valentae* and *M. projectans* but with an oblique brown stripe in *M. nigropleura*; yellow or light brown legs in *M. neoprojectans*, *M. projectans*, *M. hofmanni*, *M. valentae* and *M. elegans*; and abdomen with yellow areas in some tergites in *M. nigropleura*, *M. elegans*, *M. hofmanni*, *M. valentae*, *M. neoprojectans*, *M. pseudoprojectans* and *M. projectans*. Furthermore, there are some differences in the pattern of dark spots in the wings of *M. hofmanni*, *M. neoprojectans* and *M. pseudoprojectans* that do not have dark areas in the region of the h vein in direction to alula and have a smaller dark area in the C margin than *Mycodrosophila cornuta* sp. nov., extending from the R_1 and CuA veins. *Mycodrosophila nigropleura* has a dark area in the apex of the R_{2+3} vein that is darker than *Mycodrosophila cornuta* sp. nov. *Mycodrosophila elegans* has a dark area in the dM-Cu vein and in the apex of R_{4+5} and has darker clouded areas, mainly in the apex of R_{2+3} , than *Mycodrosophila cornuta* sp. nov.

Mycodrosophila cornuta sp. nov. resembles *M. brunnescens* but can be distinguished by the wing morphology and coloration. *Mycodrosophila cornuta* sp. nov. has a brown gena with a whitish area, not yellowish as in *M. brunnescens*; it has 10 irregular lines of acrostical setulae, while *M. brunnescens* has only 8 lines of acrostical setulae; it has a yellow halter, while *M. brunnescens* has a yellow halter with dark base; and *Mycodrosophila cornuta* sp. nov. has legs that are mostly brown, with light brown coxa and the base of the other articles, while *M. brunnescens* has entirely light brown legs.

The distal half of R_{2+3} is lighter colored than *M. brunnescens*, R_{2+3} is not curved in the direction of C, and the lappet in the sc break is less developed. Additionally, the acrostical setae are more numerous, and the genae is brown. Additionally, the abdomen is darker and shine less than in *M. brunnescens*. Unfortunately, the male genitalia of *M. brunnescens* remain unknown, but the differences observed were sufficient to circumscribe the species. Other *Mycodrosophila* species have more differences in morphology than *M. brunnescens* when compared to *M. cornuta* sp. nov., including in the male terminalia (Wheeler and Takada, 1963; Junges et al., 2016).

Conflicts of interest

The authors declare no conflicts of interest.

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