



The genus *Manota* Williston (Diptera: Mycetophilidae) in Mexico

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Abstract

The genus *Manota* Williston is represented in Mexico by the following species: *M. hidalgoensis* sp. n., *M. ibanezi* sp. n., *M. mexicanan* sp. n. and *M. nubicola* sp. n. The first three species were found in cloud forests near Tlanchinol in the state of Hidalgo, and the fourth one in a rainforest at Dos Amates in the state of Veracruz.

Key words: Diptera, Mycetophilidae, Mexico, *Manota*, new species

Introduction

The fungus gnat genus *Manota* is worldwide in distribution. The number of described species has increased rapidly in recent years and currently stands at 149, divided between the biogeographic regions as follows: Afrotropical 27 (Enderlein 1910, Matile 1972, 1978, Söli 1993, Jaschhof & Mostovski 2006, Hippa 2008b), Australian-Oceanian 18 (Tonnoir & Edwards 1927, Edwards 1928, Colless 1966, Matile 1993, Hippa 2007), Neotropical 30 (Williston 1896, Enderlein 1911, Lane 1948, Jaschhof & Hippa 2005), Oriental 66 (Senior-White 1922, Hippa 2006, 2008a, 2009, Hippa & Papp 2007), Palaearctic 8 (Lundström 1913, Ševčík 2002, Papp 2004, Hippa & Kjærandsen, manuscript in preparation). One species, *M. biunculata* Hippa, is common to the Australian-Oceanian and Oriental regions. In addition, one unnamed species is mentioned from the Nearctic region (Sherman 1920, Vockeroth 1981). So far as the Neotropical region is concerned, one species is described from St. Vincent, Lesser Antilles (Williston 1896), two from Brazil (Enderlein 1911, Lane 1948) and 27 from Costa Rica (Jaschhof & Hippa 2005). None of the Neotropical species have been recorded since their original description.

We have recently studied the material of fungus gnats collected by Malaise traps in cloud forests near Tlanchinol in the state of Hidalgo and in the most northern of the New World tropical rainforests at Dos Amates in the state of Veracruz. Among other Diptera, we found 10 specimens of *Manota* which proved to belong to four different species, all new. The aim of the present paper is to describe and name these species and thereby to add to knowledge of the very poorly known mycetophilid fauna of Mexico (Papavero and Ibáñez-Bernal 2001, 2003).

Material and methods

The material was collected and preserved in 70% ethanol. We detached the abdomen from each specimen and macerated it in warm concentrated potassium hydroxide (KOH). We then detached the hypopygium beyond segment 8. After washing in water and step-wise dehydration in alcohol, we placed the parts of the abdomen for a few seconds in clove oil (eugenol), after which we mounted them in “Euparal between two pieces of

cover glass, which enables the specimen to be studied from both sides under a compound microscope. Such preparations are now attached to glass slides by a couple of strips of adhesive tape across their edges and are easily detached when needed. Other parts of the body have not been treated with potassium hydroxide, but after dehydration we mounted them as they were in "Euparal".

The morphological terminology follows Hippa and Papp (2007) except for the tegmen which is here called the aedeagus. The terminology is explained in Figs 1–4.

Illustrations were made with the aid of a drawing tube attached to a Leitz Diaplan or Leitz Laborlux compound microscope.

The material is deposited in the Collection of Arthropods with Medical Importance, Mexico City (CAIM) and in the Swedish Museum of Natural History, Stockholm (SMNH).

The following abbreviations are used in the figures: ae = aedeagus, cr = cercus, cr 1 = basal segment of cercus, cr 2 = distal segment of cercus, c s = curved sensillum, dm 1 = lobe at dorsal mesial margin of gonocoxa, ej a = ejaculatory apodeme, gs = gonostylus, gx = gonocoxa, gx a = gonocoxal apodeme, gx l = posterolateral lobe of gonocoxa, gx d = dorsal mesial margin of gonocoxa, gx v = ventral mesial margin of gonocoxa, hpr = hypoproct, jx b = basal body of juxtagonostylar seta or setae, jx s = juxtagonostylar seta or megaseta, pm 1–pm 5 = palpomeres 1–5, psg = parasegment, ps 1 = parastylar lobe, st 7–st 10 = sternites 7–10, tg 7–tg 9 = tergites 7–9.

Description of the species

Manota hidalgoensis sp. n.

Figs 2 A–D

Male. Colour. Head pale brown, frons, vertex and dorsal part of occiput darker brown, ventral part of two basal flagellomeres paler than rest of antenna, mouthparts paler than face. Thorax brown, preepisternum 2 paler than the other parts. Legs unicolorous pale yellowish. Wing unicolorous yellowish-brown; haltere yellowish-brown with dark brown knob. Abdominal tergites brown, sternites very pale, almost colourless. All the setosity pale, yellowish or brownish, the thicker setae seeming darker than the finer setae and trichia.

Head. Antennal flagellomere 4, Fig. 2 A. Palpomere 3 of maxillary palpus with apicomeresial extension, with three apically expanded curved sensilla; palpomere 4 with parasegment; palpomere 5 1.3 times as long as palpomere 4. Number of large postocular setae 8–9. **Thorax.** Anepisternum setose, with 37–42 setae, anterior basalare non-setose, preepisternum 2 non-setose, laterotergite non-setose, episternum 3 setose, with 8–11 setae. **Wing.** Similar to Fig. 1 B, length 1.9 mm. **Hypopygium,** Figs 2 B, C, D: Sternite 9 with the lateral margin fused with gonocoxa, with a deep medial furrow, posteriorly extending to the middle between anterior margin of gonocoxa and base of gonostyli, anterior margin deeply incised, the setae similar to the adjacent ventral setae of gonocoxa. Ventral mesial margins of gonocoxa slightly concave, close to one another. Posteroventral margin of gonocoxa transverse at middle and then curving posteriad to form the mesial margin of large posterolateral lobe. Ventral setosity of gonocoxa unmodified. No parastylar lobe observable. No paraapodemal lobe observable. Dorsal mesial margin of gonocoxa simple, convex. At dorsal medial margin, lying on a more ventral level, with two lobes, a more anterior finger-like lobe bearing a long sharp megaseta and a more posterior low lobe bearing 7–8 blunt megasetae. In addition, with a membranous pointed lobe between the latter and the juxtagonostylar megasetae. Setae on the dorsal side of gonocoxa unmodified except for a large transverse megaseta at base of the large posterolateral lobe. Two juxtagonostylar megasetae present, the more ventral one flattened and flame-shaped, the more dorsal one rod-like with a short fine apex, both megasetae arising from a common basal body which is nearly as long as the megasetae. Gonostylus short, broadening from narrow base to broad and transverse apex, non-setose except for apical margin where there are two long setae at apicomeresial angle, three strong curved setae at middle of margin and a group of fine setae at apicolateral angle. Aedeagus elongate-subtriangular, without distinct lateral shoulders, without

submembraneous lateral lobes on posterior half. Hypoproct large, posteriorly extending as far as gonostylus, with circa 40 setae on each half, distributed mainly on lateral areas. Cerci separate mesially.

Female. Unknown.

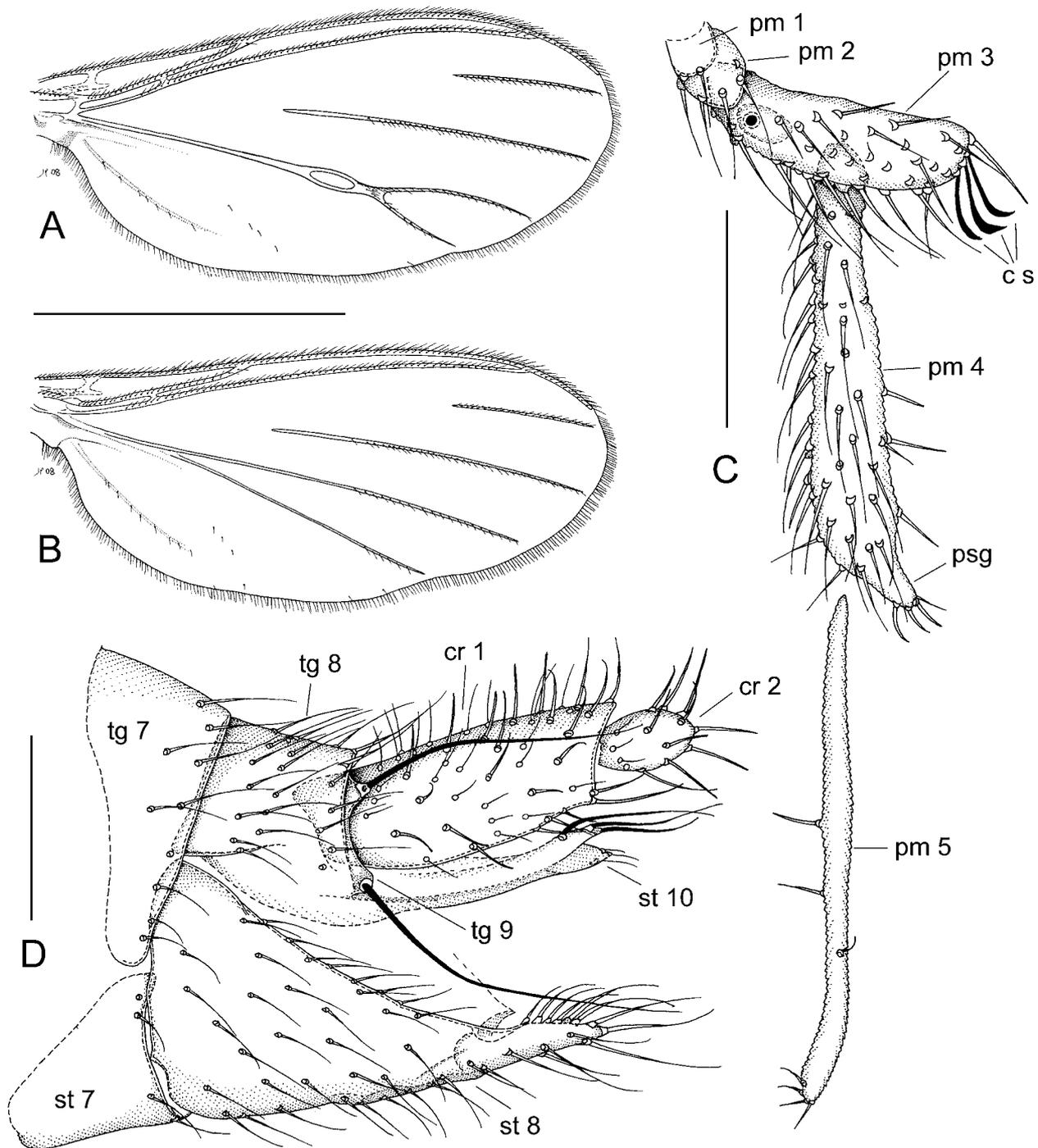


FIGURE 1. Male wing (A, B), dorsal view, male maxillary palpus (C), mesial view, apical part of female abdomen (D), lateral view. **A, B, C.** *Manota nubicola* **sp. n.** (paratypes). **D.** *M. mexicanan* **sp. n.** Scale for A and B 1 mm, for C and D 0.1 mm.

Discussion. *M. hidalgoensis* is similar to *M. arenalensis* Jaschhof & Hippa, known from Costa Rica. The two species are distinguished by the shape and chaetotaxy of the gonostylus. In *M. hidalgoensis* the gonostylus widens from base to a very broad transverse apex, whilst in *M. arenalensis* the gonostylus is narrow throughout the whole length; in *M. hidalgoensis* there are two fine setae at the apicomesimal angle, whilst in *M.*

arenalensis there is one fine and one conspicuously thicker seta; and in *M. hidalgoensis*, there are three very strong curved setae at the apical margin between the apicomésial and apicolateral corners, whilst in *M. arenalensis* the setae are absent. Furthermore, the two species differ by the dorsomesial chaetotaxy of the gonocoxa. In *M. hidalgoensis* there are 5–6 megasetae on the lobe between the large anterior-most megaseta and the juxtagonostylar megasetae, whilst in *M. arenalensis* there are only three; and in *M. hidalgoensis* the more dorsal of the juxtagonostylar megasetae is rod-like, whilst in *M. arenalensis* it is flat and slightly bilobed. *M. arenalensis* differs from the three other Mexican species dealt with in this paper by having a non-setose laterotergite.

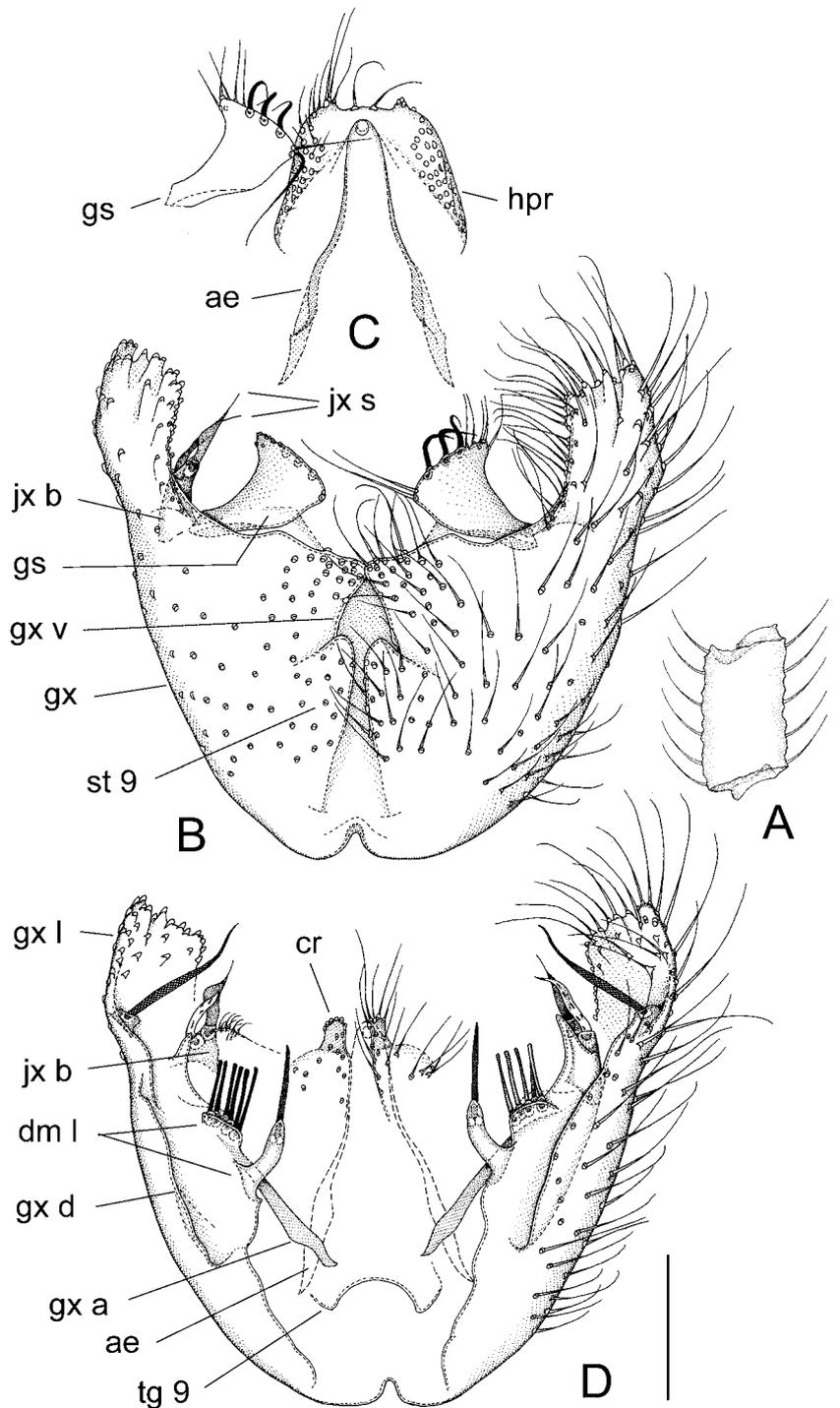


FIGURE 2. *Manota hidalgoensis* sp. n. (holotype): **A.** Antennal flagellomere 4, lateral view. **B.** Hypopygium, ventral view. **C.** Gonostylus, hypoproct and aedeagus, ventral view. **D.** Hypopygium, dorsal view. Scale 0.10 mm.

Etymology. The name is a Latinised derivation from the Mexican state of Hidalgo where the type locality is situated.

Types. *Holotype.* Male, MEXICO, Hidalgo, Tlanchinol, 3 km carretera Tlanchinol-Apantlazol, Bosque Mesofilo Montaña, Trampa Malaise, 2 al 6 agosto 1977, Cols. Blackaller J., Salceda S.B. & Perez A. (in CAIM).

Paratypes. 2 males with same data as the holotype except 5 junio and 8 marzo (in CAIM and NHRS).

***Manota ibanezi* sp. n.**

Figs. 3 A, B, C

Male. Colour. Head yellowish-brown, frons, vertex and occiput darker brown. Antenna unicolorous, concolorous with face. Mouthparts pale yellowish, paler than the face. Thorax pale brown, ventral part of preepisternum 2 paler than the other parts. Legs pale yellowish, apices of coxae 2 and 3 and their trochanters infuscated, the apical part of femur 3 very faintly darker than the other parts. Wing unicolorous yellowish-brown; haltere yellowish-brown with dark brown knob. Abdominal tergites pale brown, sternites very pale, almost colourless. All the setosity pale, yellowish or brownish, the thicker setae seeming darker than the finer setae and trichia. **Head.** Antennal flagellomere 4, Fig. 3 A. Palpomere 3 of maxillary palpus with apicomerial extension, with 4 apically expanded curved sensilla; palpomere 4 with parasegment; palpomere 5 1.4 times as long as palpomere 4. Number of large postocular setae 8. **Thorax.** Anepisternum setose, with 40 setae, anterior basalare setose, with 9 setae, preepisternum 2 non-setose, laterotergite setose, with circa 13 setae, episternum 3 setose, with 6 setae. **Wing** similar to Fig. 1 B, length 1.5 mm. **Hypopygium,** Figs 3 B, C: Sternite 9 with lateral margin fused with gonocoxa, anterior margin with a shallow notch, posterior margin apparently convex and extending to level of the base of parastylar lobes, but in the single mount the adjoining membranous structures protrude posteriad and make the sternite longer than it probably usually is; setae similar to the ventral setae of gonocoxa. Ventral mesial and posterior margins of gonocoxa contiguous, slightly sigmoid. Parastylar lobe well-developed but rather firmly fused with gonocoxa, directed posteromesad, with 4 apical setae. Paraapodemal lobe absent. Dorsal mesial margin of gonocoxa simple, slightly convex, posteriorly with a few stronger setae differing from other dorsal setosity, the posteriormost being strongest, megaseta-like. At dorsal mesial margin, lying on a more ventral level, with a semi-globular lobe bearing circa 10 megasetae. Otherwise, setae on dorsal side of gonocoxa unmodified. With no distinct posterolateral lobe on gonocoxa. Gonocoxal apodemes unusually curved in the single mount. Juxtagonostylar setae absent or not identifiable. Gonostylus broadly oval, apically not lobed, ventral side with unmodified setae, dorsal side non-setose, at apex with one straight and two curved setae which are conspicuously stronger than the other gonostylar setae. Aedeagus with a narrow parallel-sided apical half which abruptly widens to circa three times as broad as basal half; apical part without membranous lateral lobes; the apex curved ventrad. Hypoproct large, extending further posteriad than gonostyli, with circa 25 scattered setae on each half. Cerci mesially separate. Tergite 9 unusually well visible, connected with cerci.

Female. Unknown.

Discussion. *M. ibanezi* is similar to *M. major* Jaschhof & Hippa and *M. squamulata* Jaschhof & Hippa. It is most easily distinguished from both by the setae at the apical margin of the gonostylus. In *M. ibanezi* there are three conspicuously stout, short setae, a straight one and two curved ones, whilst in *M. major* and *M. squamulata* the apical setae are similar to other gonostylar setae except for being very long. Furthermore, *M. ibanezi* differs by lacking a very strong transverse megaseta posteriorly at the dorsal mesial margin of the gonocoxa. In *M. major* and *M. squamulata*, the megaseta is much thicker than the megasetae on the sub-globular lobe situated more anteriorly at the dorsal mesial margin of gonocoxa, whereas in *M. ibanezi* the homologous seta is inconspicuous and thinner than the megasetae on this lobe. *M. ibanezi* differs from *M. squamulata* and resembles *M. major* by the simple, not bilobed apex of the gonostylus. It differs from *M. major* and is similar to *M. squamulata* in having circa 10 instead of over 15 megasetae on the above-

mentioned sub-globular lobe.

Etymology. The species is named after Dr Sergio Ibáñez-Bernal, one of the collectors of the holotype.

Types. *Holotype*. Male, MEXICO, Veracruz, Loc. Dos Amates, 24 julio 1995, Trampa Malaise, Cols. Ibáñez-Bernal S. & Paz Rodríguez (in CAIM).

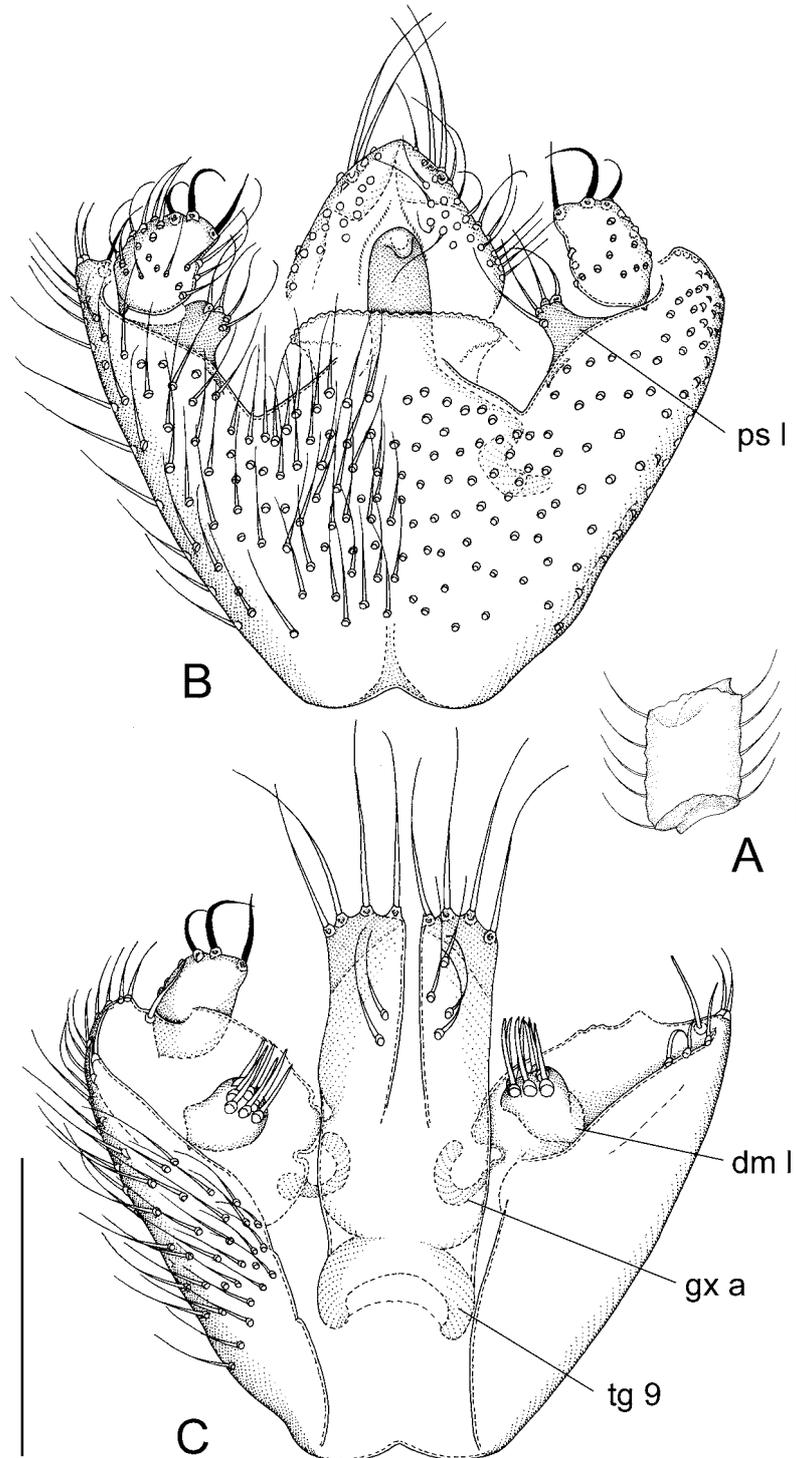


FIGURE 3. *Manota ibanezi* sp. n. (holotype): **A.** Antennal flagellomere 4, lateral view. **B.** Hypopygium, ventral view. **C.** Hypopygium, dorsal view. Scale 0.10 mm.

***Manota mexican* sp. n.**

Figs 1D, 4 A–F

Male. **Colour.** Head pale brown, frons, vertex and dorsal part of occiput darker brown, pedicellus and ventral part of flagellomere 1 paler than rest of antenna, mouthparts paler than face. Thorax brown. Legs pale yellowish, femur 3 infuscated on both basal and apical fourth. Wing unicolorous yellowish-brown; haltere yellowish-brown with dark brown knob. Abdominal tergites brown, sternites very pale brownish, almost colourless. All the setosity pale, yellowish or brownish, the thicker setae seeming darker than the finer setae and trichia. **Head.** Antennal flagellomere 4, Fig. 4 A. Palpomere 3 of maxillary palpus with apicomerial extension, with 3 apically expanded curved sensilla; palpomere 4 with parasegment; palpomere 5 1.2 times as long as palpomere 4. Number of large postocular setae 11. **Thorax.** Anepisternum setose, with 50 setae, anterior basalare non-setose, preepisternum 2 non-setose, laterotergite setose, with 21 setae, episternum 3 setose, with circa 10 setae. **Wing.** Similar to Fig. 1 B, length 2.0 mm. **Hypopygium,** Figs 4 C–F: Sternite 9 with lateral margin fused with gonocoxa, posterior margin transverse, extending to middle of gonocoxa, anterior margin deeply incised, the setae few, similar to the adjacent ventral setae of gonocoxa. Ventral mesial margins of gonocoxa straight, close to one another, parallel, roundly angularly turning towards transverse posterior margin. Ventral setosity of gonocoxa unmodified, at middle of posterior margin with a curved seta differing from other setosity. No parastylar lobe observable. No paraapodemal lobe observable. Dorsal mesial margin of gonocoxa sigmoid. At dorsal medial margin, lying on a more ventral level, with an elongated lobe bearing three blunt megasetae on its posterior end and one partly cleft megaseta on its anterior end. Setae on dorsal side of gonocoxa unmodified except for two long flattened setae posteriorly at dorsal mesial margin. Without posterolateral lobe on gonocoxa. With three very strong setae posterolaterally on gonocoxa. Two juxtagonostylar megasetae present, both of which are flattened and flame-shaped, dorsal one broader than ventral one, both arising from a common basal body which is about as long as the megasetae. Gonostylus narrow, elongate-oval with a slight shoulder-like widening at middle of lateral margin, ventral side non-setose, dorsal side with 4 subapical setae and 1 curved seta at middle of lateral margin. Aedeagus elongate-subtriangular, without distinct lateral shoulders, with prominent submembranous lateral lobes on posterior half, apex straight, not curved ventrad. Hypoproct large but in the single specimen extending posteriorly only to level of base of gonostyli, with circa 20 setae on each half, distributed mainly on lateral areas. Cerci mesially separate.

Female. Similar to male. Antennal flagellomere 4, Fig. 4 B. Number of large postocular setae 10. Anepisternum with 56 setae, laterotergite with 23 setae, episternum 3 with 12 setae. Wing length 2.1 mm. Apical part of abdomen, Fig. 1 D: tergite 9 on each side with two long setae arising from large basal tubercles, cercus two-segmented.

Discussion. *M. mexican* is similar to *M. planistylus* Jaschhof & Hippa, *M. rectolobata* Jaschhof & Hippa and *M. intermedia* Jaschhof & Hippa, known from Costa Rica. It is distinguished from all three by having two of the setae posterodorsally on the gonocoxa flattened and expanded instead of having all the setae in this area unmodified. Furthermore, it differs from *M. planistylus* and *M. rectolobata* by the shape of the gonostylus which has the shoulder-like widening at the middle of the lateral margin, not sub-basally, and from *M. planistylus* and *M. intermedia* by the large leaf-like expansion on the more dorsal juxtagonostylar megaseta. In *M. planistylus* the megaseta is also rather broad, but it is not similarly abruptly widened. In the single male of *M. mexican*, the apex of the aedeagus appears straight, unlike the three other species mentioned here, in which it is curved ventrad. *M. mexican* is the only New World *Manota* of which the female is known.

Etymology. The name is from the Nahuatl language and means Mexican.

Types. *Holotype.* Male, MEXICO, Hidalgo, Tlanchinol, 3 km carretera Tlanchinol-Apantlazol, Bosque Mesofilo Montaña, Trampa Malaise, 29 septiembre al 2 octubre 1997, Cols. Blackaller J., Salceda S.B. & Perez A. (in CAIM).

Additional material. 1 female with same data as the holotype except 2 al 6 agosto 1997 (in CAIM).

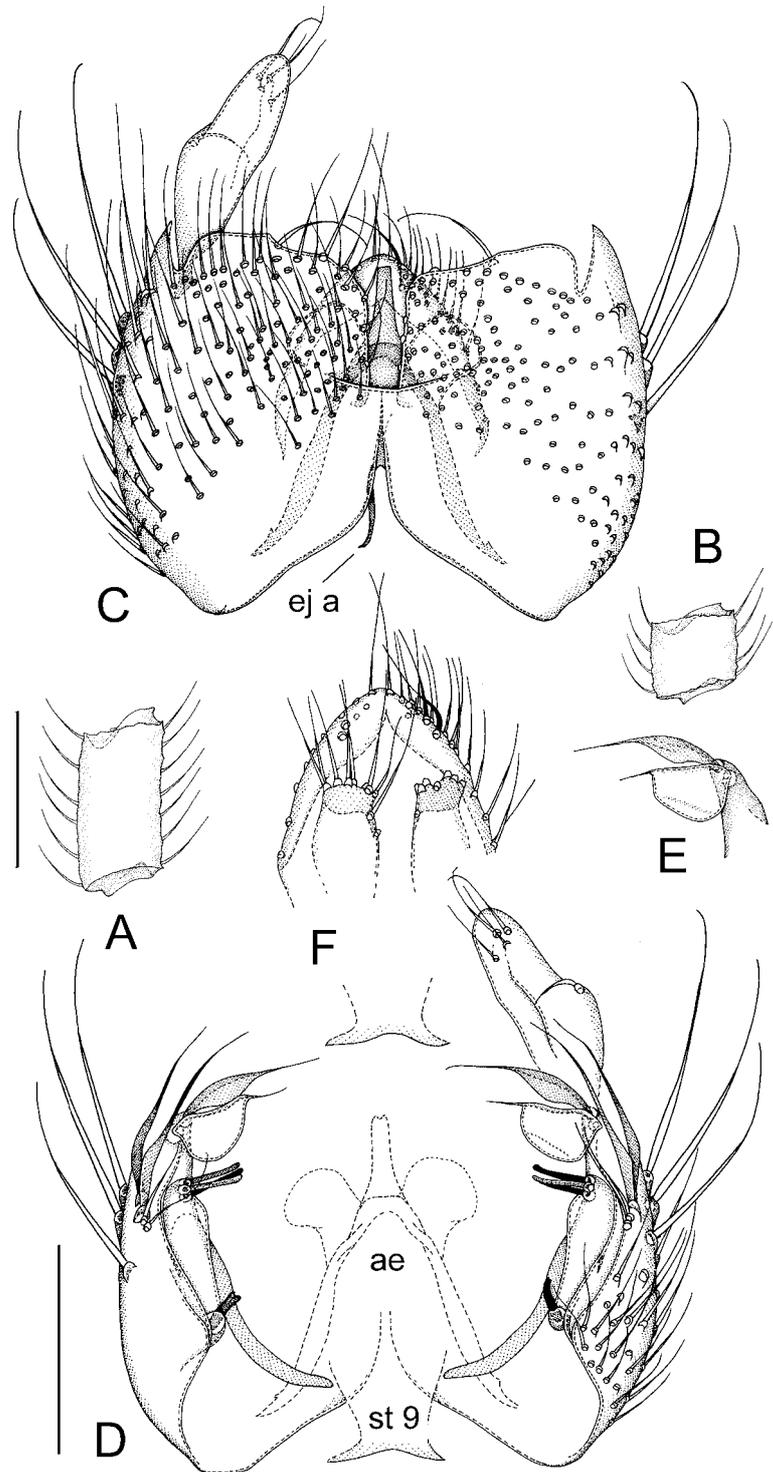


FIGURE 4. *Manota mexicanus* sp. n. (A and C–F holotype): **A.** Male antennal flagellomere 4, lateral view. **B.** Female antennal flagellomere 4, lateral view. **C.** Hypopygium, ventral view. **D.** Hypopygium, dorsal view. **E.** Juxtagonostylar megasetae, dorsal view. **F.** Hypoproct, cerci and tergite 9, dorsal view. Scale 0.10 mm.

***Manota nubicola* sp. n.**

Figs 1 A, B, C, 5 A–D

Male. **Colour.** Head pale brown, frons, vertex and dorsal part of occiput darker brown, pedicellus and ventral

part of flagellomeres 1–3 paler than rest of antenna, mouthparts paler than face. Thorax brown, preepisternum 2 paler than the other parts. Legs unicolorous pale yellowish. Wing unicolorous yellowish-brown; haltere yellowish-brown with dark brown knob. Abdominal tergites brown, sternites very pale, almost colourless. All the setosity pale, yellowish or brownish, the thicker setae seeming darker than the finer setae and trichia. **Head.** Antennal flagellomere 4, Fig. 5 A. Palpomere 3 of maxillary palpus with apicomeresial extension, with 3 apically expanded curved sensilla; palpomere 4 with parasegment; palpomere 5 1.1 times as long as palpomere 4. Number of large postocular setae 10–11. **Thorax.** Anepisternum setose, with 45–70 setae, anterior basalare non-setose, preepisternum 2 non-setose, laterotergite setose, with 16–29 setae, episternum 3 setose, with 1–3 setae. **Wing,** Figs 1 A, B, length 2.0 mm; right wing with an unusual Cu in one paratype (Fig. 1 A). **Hypopygium,** Figs 5 B, C, D: Sternite 9 with the lateral margin fused with gonocoxa, posterior margin transverse, concave, not quite reaching middle length of gonocoxa, anterior margin deeply incised, setae few, similar to the adjacent ventral setae of gonocoxa. Ventral mesial margins of gonocoxa convex, rather close to one another. Mesial margins continuing after a sharp postero-mesial angle as a concave posterior margin which is connected to a rather small lateral lobe. Ventral setosity of gonocoxa unmodified, at posterior margin with a curved seta differing from other setosity, posterolaterally with two very strong setae and a row of circa 5 shorter setae. No parastylar lobe observable. No paraapodemal lobe observable. Dorsal mesial margin of gonocoxa convex, the details appearing very different in different mounts. At dorsal medial margin, lying on a more ventral level, with an elongated lobe bearing three small setae on its posterior end and one slightly stronger seta on its anterior end. Setae on dorsal side of gonocoxa unmodified. Two juxtagonostylar megasetae present, the more ventral one rather weak and simple, the more dorsal one similar but with a large subbasal leaf-like lobe, both setae arising from a common basal body which is almost as long as the setae. Gonostylus broadly oval in lateral or mesial view, narrow in ventral or dorsal view, on ventral side with a few setae at margin and 2–3 longer setae at apex, lateral side non-setose, at dorsomesial margin with a few setae, mesial side with a few scattered setae. Aedeagus elongate-subtriangular, without distinct lateral shoulders, without submembranous lateral lobes on posterior half, the apex curved ventrad. Hypoproct large, posteriorly extending just over the base of gonostyli, with circa 30 scattered setae on each half. Cerci mesially separate. Tergite 9 unusually well visible and connected with the cerci.

Female. Unknown.

Discussion. *M. nubicola* resembles *M. acutistylus* Jaschhof & Hippa, *M. rotundistylus* Jaschhof & Hippa, *M. planistylus* Jaschhof & Hippa, *M. rectolobata* Jaschhof & Hippa and *M. intermedia* Jaschhof & Hippa, all known from Costa Rica, as well as *M. mexicanan*. *M. nubicola* differs from *M. acutistylus* and *M. rotundistylus* by having the posterolateral lobe or apophysis of gonocoxa short, not more than one-third of the length of the gonostylus, while in the two other species it is longer than the gonostylus; and from *M. planistylus*, *M. rectolobata*, *M. intermedia* and *M. mexicanan* by having the 1+3 setae on the lobe at the dorsomesial margin of the gonocoxa fine, not thick megasetae, and by having a finger-like hyaline lobe at the latter.

Etymology. The name is derived from the Latin, *nubes*, cloud, *-cola*, -dweller, referring to the collecting habitat in a cloud forest.

Types. *Holotype.* Male, MEXICO, Hidalgo, Tlanchinol, 3 km carretera Tlanchinol-Apantlazol, Bosque Mesofilo Montaña, Trampa Malaise, 9 mayo 1997, Cols. Blackaller J., Salceda S.B. & Perez A. (in CAIM).

Paratypes. 1 male with same data as the holotype except 5 junio 1997 (in CAIM). 2 males with same data except 2 al 6 agosto 1977 (in CAIM and NHRS).

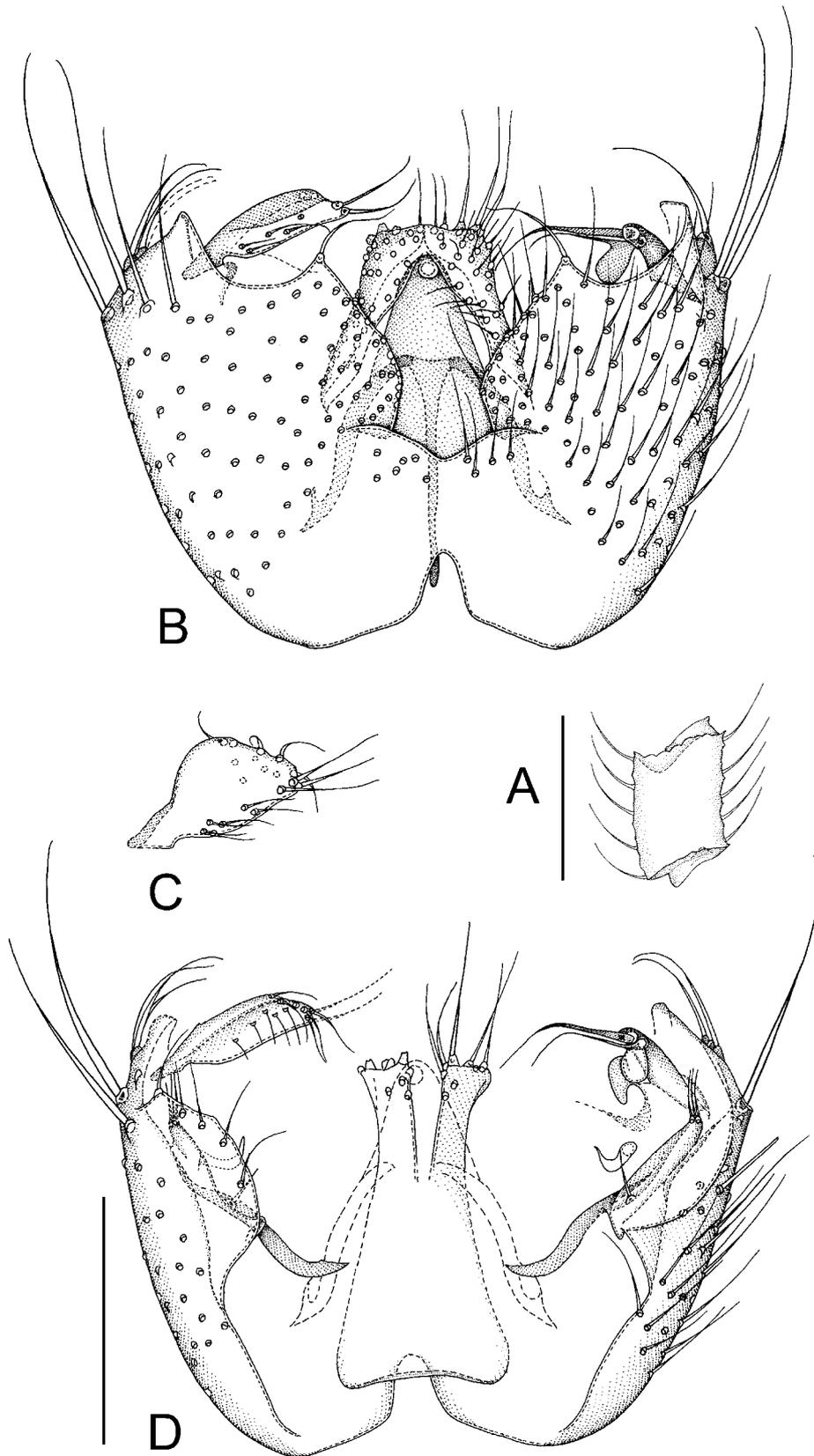


FIGURE 5. *Manota nubicola* sp. n. (A, B, D holotype, C paratype): **A.** Antennal flagellomere 4, lateral view. **B.** Hypopygium, ventral view. **C.** Gonostylus, latero-ventral view. **D.** Hypopygium, dorsal view. Scale 0.10 mm.

Acknowledgements

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