



Systematics, Morphology and Biogeography

Seven new species of *Limnophora* Robineau-Desvoidy (Diptera: Muscidae) from Ecuador



João Manuel Fogaça*, Claudio J.B. de Carvalho

Department of Zoology, Universidade Federal do Paraná, Curitiba, PR, Brazil

ARTICLE INFO

Article history:

Received 28 April 2015

Accepted 12 May 2015

Available online 19 June 2015

Associate Editor: Márcia S. Couri

Keywords:

Biodiversity

Key to species

Lectotype designation

South America

Taxonomy

ABSTRACT

Here we describe seven new species of *Limnophora* from Ecuador: *Limnophora bifasciata* **sp. nov.** from Napo, Quito; *Limnophora equatoriensis* **sp. nov.** from Zamora-Chinchipec, Zamora; *Limnophora femurosetalis* **sp. nov.** from Zamora-Chinchipec, Zamora; *Limnophora lamasi* **sp. nov.** from Zamora-Chinchipec, Zamora; *Limnophora longivittata* **sp. nov.** from Napo, Quito; *Limnophora penai* **sp. nov.** from Azuay, Cuenca and *Limnophora polleti* **sp. nov.** from Napo, Quito. We provide an identification key for the ten recognized species of *Limnophora* from Ecuador, including *L. marginata* Stein, 1904, *L. pica* (Macquart, 1851) and *L. saeva* (Wiedemann, 1830). We also redescribed *Limnophora marginata* Stein, 1904, and designated designed lectotype male and paralectotypes males and females of the species.

© 2015 Published by Elsevier Editora Ltda. on behalf of Sociedade Brasileira de Entomologia. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

The fly genus *Limnophora* Robineau-Desvoidy, 1830 in the family Muscidae is found worldwide and comprises approximately 230 species (Xue et al., 2012). In South America, only four species had been found in Ecuador: *L. marginata* Stein, 1904, *L. pica* (Macquart, 1851), *L. platystoma* (Thomson, 1869) and *L. saeva* (Wiedemann, 1830) (Löwenberg-Neto and de Carvalho, 2013). *Limnophora marginata* was described based on three males and two females from Colombia (Pont, 2013: 87). The male genitalia were described and illustrated for the first time (Lopes and Couri, 1987: 652) without analysis of the type specimens. The species is currently known from Argentina, Brazil, Colombia and Ecuador (Löwenberg-Neto and de Carvalho, 2013).

Limnophora pica (Macquart, 1851) was described from a male specimen collected in Brazil (Pont, 2012). That male was designated as the lectotype and the species was redescribed, with figures (head, hind femur, abdomen, wing; Albuquerque 1950: 1–2. This species is currently known from Brazil, Costa Rica, Ecuador, Jamaica and Mexico (Löwenberg-Neto and de Carvalho, 2013).

Limnophora platystoma was described by Thomson (1869) from male specimens collected in Ecuador (de Carvalho et al., 2005). After the original description, only Stein (1910) examined the type specimens. These syntypes may be lost because they were not found in

the Naturhistoriska Riksmuseet (NHRS), as indicated by de Carvalho et al. (2005). This species is known only from Ecuador (Löwenberg-Neto and de Carvalho, 2013).

Limnophora saeva was described by Wiedemann (1830) based on an unspecified number of male specimens collected in Brazil (Pont, 1997: 110). The male and female genitalia were described and illustrated, but not based on type specimens (Lopes and Couri, 1987: 652). This species is known from Argentina, Bolivia, Brazil, Costa Rica, Ecuador, Guatemala, Guyana, Mexico, Panama, Peru and Venezuela (Löwenberg-Neto and de Carvalho, 2013).

Here we describe an additional seven species of *Limnophora* from Ecuador and provide an identification key for the ten species now recognized from Ecuador. We also redescribe *Limnophora marginata* Stein, 1904 and designate the lectotype male and paralectotypes males and females.

Material and methods

The material used here is housed in the following institutions: the Universidad Técnica Particular de Loja (UTPL), San Cayetano Alto, Ecuador; Royal Belgian Institute of Natural Sciences (RBINS), Brussels, Belgium; Museu de Zoologia da Universidade de São Paulo (MZSP), São Paulo, Brazil; Entomological collection Padre Jesus Santiago Moure (DZUP), Curitiba, Brazil; National Museum of Natural History [formerly United States National Museum] (USNM), Washington D.C., USA; the Museum für Naturkunde der Humboldt-Universität (ZMHB), Germany, Berlin.

* Corresponding author.

E-mail: fogacabio@gmail.com.br (J.M. Fogaça).

Morphological terminology follows Cumming and Wood (2009). The list of type material is coded in which a slash indicates a new line and labels are within quotation marks. Information within square brackets is an additional notation not written on the labels. Measurements of holotype specimens are within braces. We did not include *L. platystoma* in the Ecuadorian *Limnophora* key, because it could not be recognized without analysis of type specimens.

Taxonomy

Limnophora Robineau-Desvoidy, 1830

Diagnosis. Male. Distance between eyes about 0.03–0.08 times head width; eyes finely and sparsely ciliated or bare; dorsocentral setae 0–2+1–4; prealar seta absent; prosternum setulose; apical portion of vein M slightly bent forward; wing with cilia on both sides of base of radial sector; sternite 1 bare or with setulae. Female: similar to male but dichoptic, distance between eyes about 0.30–0.42 times head width; frontal seta with 4–6 setae; fronto-orbital plate with few setulae.

Key to adult of *Limnophora* Robineau-Desvoidy from Ecuador, except *L. platystoma* (Thomson, 1869)

1. Presutural dorsocentral setae absent. Acrostichal setae not differentiated. Male: 11–13 pairs of frontal seta.....*L. lamasi* sp. nov.
- 1'. Presutural dorsocentral setae present. Acrostichal setae differentiated. Male: fewer than 11 pairs of frontal seta.....2
2. Dorsocentral setae 2+4.....3
- 2'. Dorsocentral setae 2+3.....5
3. Meron and sternite 1 with setulae.....*L. polleti* sp. nov.
- 3'. Meron and sternite 1 bare.....4
4. Arista pubescent with long hairs, much greater than the diameter of arista at base. Humeral callus and notopleura gray pollinose. Wing without cloudy spots.....*L. pica* (Macquart, 1851)
- 4'. Arista almost bare, with hairs shorter than diameter of arista at base. Humeral callus and notopleura not gray pollinose. Wing with conspicuous brown cloudy spots at the costal margin of apex of R₂₊₃ vein.....*L. saeva* (Wiedemann, 1830)
5. Vein R₁ bare.....*L. equatoriensis* sp. nov.
- 5'. Vein R₁ with setulae.....6
6. Vein R₁ with conspicuous setulae on dorsal and ventral surface. Vein R₄₊₅ setulose dorsally distal to vein r-m. Fore tibia with a median seta on posterior surface.....*L. penai* sp. nov.
- 6'. Vein R₁ with conspicuous setulae only on dorsal surface. Vein R₄₊₅ setulose dorsally only at base. Fore tibia without median seta on posterior surface.....7
7. Hind femur with a complete row of long setae on anteroventral surface. Male: frontal setae in 10 pairs.....*L. femurosetalis* sp. nov.
- 7'. Hind femur with 4–6 setae on anteroventral surface of distal half. Male: frontal setae in 6–8 pairs.....8
8. Palpus filiform, not dilated apically. Scutum dark brown without vittae.....*L. marginata* Stein, 1904
- 8'. Palpus filiform, slightly dilated apically. Scutum dark brown with vittae.....9
9. Prescutum dark brown with 2 conspicuous white vittae extending over scutellum. Male: cercal plate rounded on posterior view.....*L. longivittata* sp. nov.
- 9'. Prescutum dark brown with 2 conspicuous white vittae, thin at beginning, thick at end of scutum. Male: cercal plate not rounded.....*L. bifasciata* sp. nov.

Limnophora marginata Stein, 1904 (Figs. 1–6)

Diagnosis. This species is easily recognized by having dorsocentral setae 2+3; vein R₁ with conspicuous setulae on median half dorsal surface; Rs node and base of vein R₄₊₅ setulose dorsally.

Redescription. Male. Length: Body: 7.6 mm, Wing: 5.76 mm.

Color. Face silver pollinose. Antenna and arista dark brown. Palpus dark brown. Calypters uniformly yellowish. Halter yellow. Wing hyaline yellowish with brown cloudy spots at the costal margin at apex of vein R₂₊₃. Presutural scutum dark brown with 2 spots near scutum; humeral callus and notopleura gray pollinose; scutum dark brown with 2 spots near scutellum that coincide with third postsutural dorsocentral seta; scutellum dark brown. Pleurae dark brown with katepisternum mostly gray pollinose. Legs dark brown.

Abdomen with median longitudinal silver vittae on all tergites and dark brown with silver lateral round areas on all tergites.

Head: Holoptic, distance between eyes about 0.08 times head width, eye finely and sparsely ciliated. Inner and outer vertical setae as long as, but somewhat finer than, ocellar seta; frontal setae in 7 pairs; 1 proclinate orbital seta. Ocellar setae long; ocellar triangle with a tuft of hairs. Flagellomere 1 about 2 times pedicel length, ending before insertion of vibrissa. Arista with hairs shorter than diameter of the arista at base. Parafacial and fronto-orbital plate bare. Palpus filiform, not dilated apically.

Thorax. Chaetotaxy. Acrostichals 0+1; dorsocentrals 2+3, all setae developed and of same length; intra-alars 2+1; supra-alars 2; basal postpronotals 2; notopleurals 2; postsupra-alars 2. Scutellum with 2 long setae basal and apical. Anepisternum with six long setae; katepisternal 1+2. Prosternum setulose.

Legs. Fore femur with a complete row of posterodorsal and posteroventral setae; fore tibia with 2 apical setae (dorsal and anteroventral). Mid femur on ventral surface with 6 strong setae on basal half; posterior surface with 2 pre-apical setae; mid tibia with 1 median seta on posterior surface and 3 apical setae (anteroventral, ventral and posteroventral). Hind femur with complete row of setae on anterodorsal and anteroventral surface with 4 setae on apical half. Hind tibia with 2 median setae on anterodorsal and anteroventral surfaces; 2 apical setae (anterodorsal and anteroventral).

Wing. Vein R₁ with conspicuous setulae on median half of dorsal surface; Rs node and base of vein R₄₊₅ setulose dorsally and ventrally, vein dm-cu slightly sinuous, apical portion of vein M bent toward vein R₄₊₅.

Abdomen. Tergite III with a row of setae on margin; tergite IV with 1 pair of discal setae; tergite V with a row of setae on margin and 1 pair of discal setae. Sternite 1 bare; sternite 5 trapezoid, longer than wide, with many setae and two apically developed (Fig. 1).

Terminalia. Cercal plate longer than wide, with submedian fusion, apex with long setae on inner margin; surstylus similar in length as cercal plate (Fig. 2). Distiphallus long, about 2.5 times the length of pregonite; postgonite straight and shorter than epiphallus (Fig. 3).

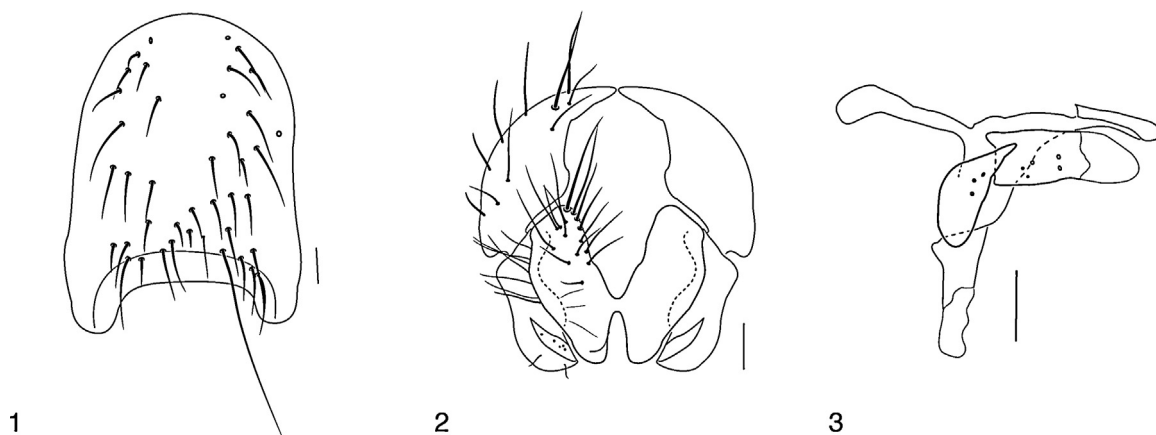
Female. Length: body 6.96 mm; wing 6.32 mm. Similar to male, but dichoptic, distance between eyes 0.36 head width. Frontal seta in 5 pairs, 2 reclinate orbital setae; inner vertical setae convergent; outer vertical setae divergent. Fronto-orbital plate with few setulae.

Type-material examined

Lectotype, designated herein. Male: “Cordill. v. Columbien [Colombia range] \ terra fria \ Thieme S. [green printed label]”; “13872 [white printed label]”; “Type [red printed label]”; “Leucomelina \ (Limnophora) \ pici Mg. [yellowish handwritten label]”; “Limnophora \ marginata Stein [yellowish handwritten label]”; “Zoo. Mus. \ Berlin [yellowish printed label]”; “LECTOTYPE ♂ \ Limnophora marginata \ Stein, 1904 \ Des. J. M. Fogaça & C. J. B. de Carvalho 2015 [white printed label]” (ZMHB). Specimen is in good condition, with almost complete chaetotaxy, but lacking median right leg; right wing is damaged near base.

Paralectotype. Female: “Cordill. v. Columbien [Colombia range] \ terra fria \ Thieme S. [green printed label]”; “13872 [white printed label]”; “Type [red printed label]”; “Limnophora \ marginata \ Type Stein ♀ \ det. Stein [yellowish printed and handwritten label]”; “Zoo. Mus. \ Berlin [yellowish printed label]”; “PARALECTOTYPE ♀ \ Limnophora marginata \ Stein, 1904 \ Des. J. M. Fogaça & C. J. B. de Carvalho 2015 [white printed label]” (ZMHB). Specimen is in good condition, with chaetotaxy complete, lacking tarsi of left median leg.

Additional material examined. ECUADOR. Quito, Baeza, E. Papallacta, 2900 m, 4 males, 3 females, 1.1971, leg. L. E. Peña (MZSP); Loja, Cajanuma, Podocarpus National Park, trail Oso de anteojos, 3000 m, 2 females, 16/ii/2009–20/ii/2009, leg. Marc Pollet & Anja



Figs. 1–3. *Limnophora marginata*, male terminalia: 1. Fifth sternite, dorsal view; 2. Epandrium, surstylus and cercal plate, posterior view; 3. Aedeagus, lateral view (scale 1 mm).

De Braekeleer (UTPL); Loja, Saraguro, 2900 m, 1 female, xi/1970, leg. L. E. Peña (MZSP).

Remarks. There are two male and one female paralectotypes in ZMHB (Pont, 2013: 87) and are labeled accordingly.

Limnophora bifasciata **sp. nov.** (Figs. 7–12)

Diagnosis. This species is easily differentiated by the dorsocentral setae 2+3. Vein R_1 with conspicuous setulae on apex of dorsal surface. Prescutum dark brown with 2 conspicuous white vittae that begin narrow and end wider (triangular) on scutum.

Description. Male. Measurements ($n=5$): Length: Body: 5.6–6.4 mm (6.0 mm). Wing: 4.7–6.09 mm (4.96 mm).

Color. Face gray pollinose. Antenna and arista dark brown. Palpus dark brown. Calypters uniformly whitish, margin yellowish; lower calypter more conspicuous. Halter yellowish. Wing hyaline yellowish with conspicuous brown cloudy spots at the costal margin of apex of vein R_{2+3} . Prescutum dark brown with 2 conspicuous short white vittae that enlarge toward scutum; humeral callus and notopleura gray pollinose; scutum dark brown; scutellum dark brown. Pleurae dark brown with katepisternum mostly gray pollinose. Legs dark brown. Abdomen with median longitudinal silver vittae and dark brown with silver lateral round areas on all tergites.

Head. Holoptic, distance between eyes 0.03–0.06 (0.05) times head width, eye finely and sparsely ciliated. Inner and outer vertical setae equal in length with ocellar seta. Frontal setae in 6–8 (6) pairs; 1 proclinate orbital seta. Ocellar setae long; ocellar triangle a tuft of hairs. Flagellomere I about 1.7–2.4 (1.7) times pedicel length, ends prior to vibrissa insertion. Hairs on arista shorter than diameter of arista at base. Parafacial and fronto-orbital plate bare. Palpus filiform slightly dilated apically.

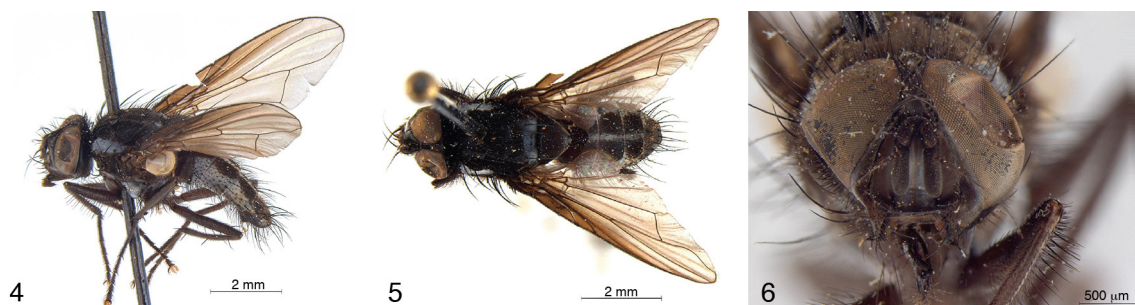
Thorax. Chaetotaxy. Acrostichals 0+1; dorsocentrals 2+3; intra-alars 2+2; supra-alars 2; basal postpronotals 2; notopleurals 2 postsupra-alars 2. Scutellum with well developed lateral, apical scutellar. Anepisternum with 6–7 (6) setae, long; katepisternal seta 1+2. Prosternum setulose.

Legs. Fore femur with complete rows of posterodorsal and posteroventral setae; fore tibia with 2 apical setae (dorsal and posteroventral). Mid femur on ventral surface with 5 stronger setae on basal half, posterior surface with 2 pre-apical setae. Mid tibia with 1 supra-median and sub-median setae on posterior surface; 4 apical setae (anterior, ventral, anteroventral and posteroventral). Hind femur with complete row of setae on anterodorsal surface and anteroventral surface with 4–5 (4) setae on apical half; ventral surface with 5 setae on basal half; hind tibia with 1 median seta on anterodorsal and posterodorsal surfaces; 3 apical seta (ventral and dorsal and anteroventral).

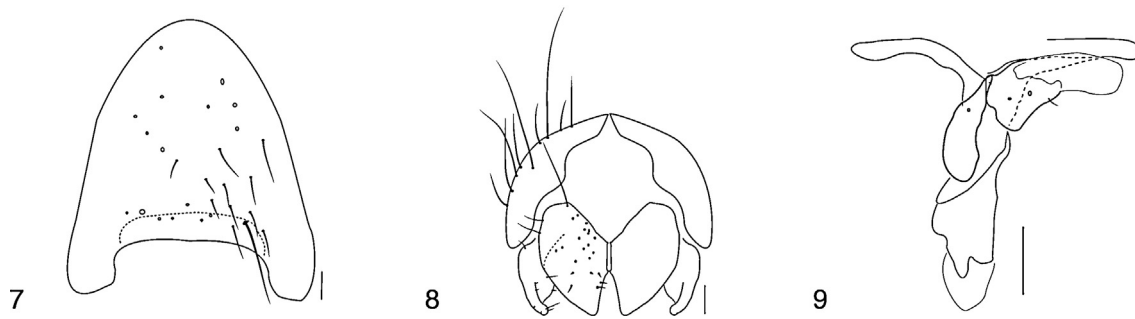
Wing. Vein R_1 with conspicuous setulae on apex dorsal surface; R_s node and base of vein R_{4+5} setulose dorsally and ventrally; vein $dm-cu$ slightly sinuous; apical portion of vein M bent toward vein R_{4+5} .

Abdomen: Tergite III with row of setae on margin; tergite I with 1 pair median marginal seta; tergite V with row of setae on margin and 1 pair median marginal seta on tergite V. Sternite 1 bare; sternite 5 triangular, longer than wide, with few and sparse setae and two apically developed (Fig. 7).

Terminalia. Cercal plate longer than wide, with median fusion, with few and sparse setae on inner apex; surstylus smaller than length than cercal plate (Fig. 8). Distiphallus long, 2.5 times the length of pregonite; postgonite curved and shorter than epiphallus (Fig. 9).



Figs. 4–6. *Limnophora marginata*, male: 4. Lateral view; 5. Dorsal view; 6. Frontal view.



Figs. 7–9. *Limnophora bifasciata* sp. nov., male terminalia: 7. Fifth sternite, dorsal view; 8. Epandrium, surstylus and cercal plate, posterior view; 9. Aedeagus, lateral view (scale 1 mm).

Female. Length: Body: 4.8–6.4 mm. Wing 5.68–6.24 mm. Similar to male, but dichoptic, distance between eyes 0.36–0.40 head width. Frontal seta with 5 setae, 2 fronto orbital setae, anterior reclinate; inner vertical setae convergent; outer vertical setae divergent. Fronto-orbital plate with few setulae. Thorax with wide brown vitta and 2 narrow gray vittae.

Type-material

Holotype. Male: “E. Papallacta \ (Quito Baeza) \ Ecuador. 2900 m. I-1-71 \ L. E. Peña col. [white printed label]”; “Holotipo [red printed label]” (MZSP). Paratypes. Ecuador, 23 males (MZSP, DZUP), 17 females (MZSP, DZUP), same data as holotype; LOJA CAJANUMA: 1 male, “13074 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Oso \ de anteojos, 3000 m, 16/02/2009–\ 20/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet–sample code: EC/2009–\ 31/MP&ADB-012” (UTPL).

Distribution. ECUADOR: Loja (Cajanuma), Napo (Quito).

Etymology. Adjective, agreeing in gender with the feminine *Limnophora*. The epithet refers to the two conspicuous short white vittae on prescutum extending wider to scutum (from de Latin *bi* = two, *fasciata* = vitta, stripe).

Limnophora equatoriensis sp. nov. (Figs. 13–18)

Diagnosis. This species is easily differentiated by the dorsocentral setae 2 + 3, vein R_1 bare on both surfaces and R_{4+5} with setulae near of base of radial sector on dorsal surface.

Description. Male. Measurements ($n=5$): Length: Body: 6.0–6.4 mm (6.0 mm), Wing: 5.6–6.4 mm (6.24 mm).

Color: Face silver pollinose. Antenna dark brown with silver pollinose; arista dark brown. Palpus dark brown. Calypters uniformly whitish with border dark brown more conspicuous at lower. Halter yellowish. Wing hyaline yellowish with conspicuous dark brown cloudy spots from costal margin to apex of vein R_{2+3} . Presutural scutum and scutum dark brown; humeral callus and notopleura gray pollinose; scutum dark brown, without vittae, with 2 silver spots near scutellum; scutellum dark brown. Pleurae dark brown with katapisternum mostly gray

pollinose. Legs dark brown. Abdomen with median longitudinal silver vittae and dark brown with silver lateral round areas on all tergites.

Head: Holoptic, distance between eyes 0.04–0.06 (0.04) times head width; eyes finely and sparsely ciliated. Inner and outer vertical setae shorter than ocellar setae. Frontal seta with 6–8 (6) pairs; 1 proclinate orbital seta near ocellar triangle. Ocellar setae long; ocellar triangle with tuft of short hairs. Antenna not reaching epistoma; flagellomere I about 2.0–3.7 (2.5) times pedicel length, ending before insertion of vibrissa. Hairs on arista shorter than diameter of arista at base. Parafacial and fronto-orbital plate bare. Palpus filiform.

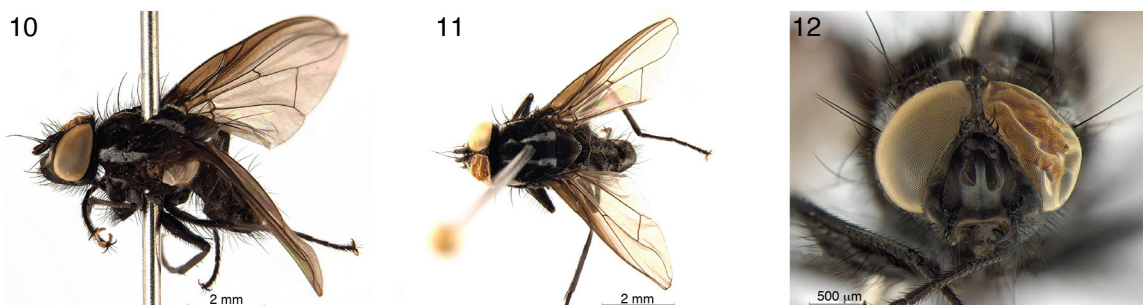
Thorax: Chaetotaxy. Acrostichals 0 + 1; dorsocentrals 2 + 3; intra-alars 2 + 1; supra-alars 2; basal postpronotals 2; notopleurals 2; postsupra-alars 2. Scutellum with well developed lateral, apical scutellar setae. Anepisternum with 6–7 (6) long setae; katapisternal seta 1 + 2. Prosternum setulose.

Legs. Fore femur with complete rows of posterodorsal and posteroventral setae; fore tibia with 2 apical setae (dorsal and anteroventral). Mid femur on ventral surface with 4 strong setae on basal half, posterior surface with 2 pre-apical setae; mid tibia with 1 median setae on posterior surface and 3 apical setae (anteroventral, ventral and posteroventral). Hind femur with complete row of setae on anterodorsal and anteroventral surfaces with 3–5 (3) setae on apical half; hind tibia with 2 median setae on anterodorsal and anteroventral surfaces; 2 apical setae (ventral and anterodorsal).

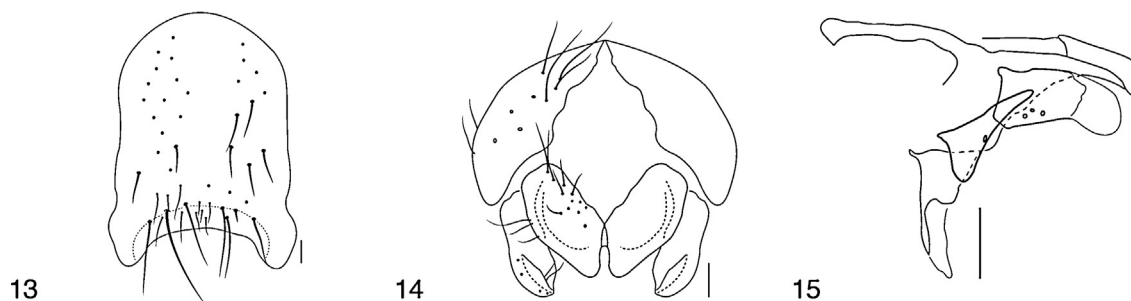
Wing. Vein R_1 bare on both surfaces; R_s node and base of vein R_{4+5} setulose dorsally and ventrally; vein dm-cu straight; apical portion of vein M bent toward vein R_{4+5} .

Abdomen. Tergite III with row of setae on margin; tergite IV with 1 pair median marginal seta; tergite V with row of setae on margin and 1 pair of median marginal seta. Sternite 1 bare; sternite 5 trapezoid, longer than wide, with many and sparse setae and two apically developed (Fig. 13).

Terminalia. Cercal plate longer than wide, with submedian fusion and long setae on inner apex; surstylus greater than cercal plate length (Fig. 14). Distiphallus median, about 1.5 times the



Figs. 10–12. *Limnophora bifasciata* sp. nov., male: 10. Lateral view; 11. Dorsal view; 12. Frontal view.



Figs. 13–15. *Limmophora equatoriensis* sp. nov., male terminalia: 13. Fifth sternite, dorsal view; 14. Epandrium, surstylus and cercal plate, posterior view; 15. Aedeagus, lateral view (scale 1 mm).

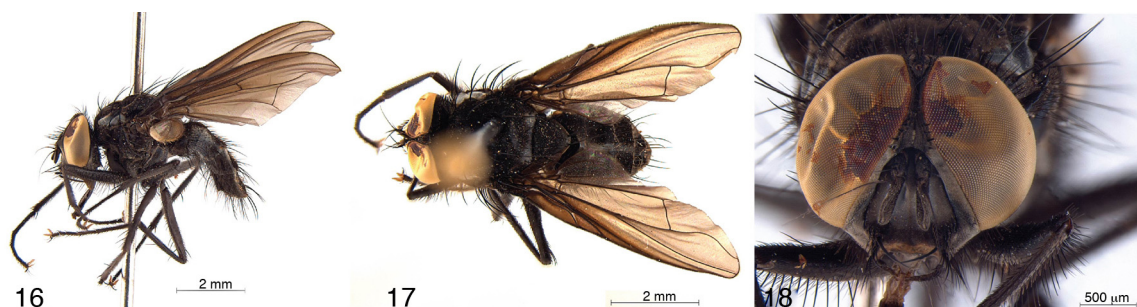
length of pregonite; postgonite slightly curved and shorter than epiphallus (Fig. 15).

Female. Length: Body: 6.6–7.2 mm, Wing 6–6.6 mm. Similar to male, but dichoptic, distance between eyes 0.30–0.42 times head width. 4 frontal setae; 2 fronto-orbital setae, anterior reclinate; inner vertical setae convergent; outer vertical setae divergent. Fronto-orbital plate with few setulae. Abdomen with 1 pair of discal setae on tergite V.

Type material

Holotype. Male: “13050-(EC) [Ecuador] Zamora Chinchipe: San \ Francisco, Reserva Biológica San Francisco trail Rio San Francisco \ 2000 m, 03°58'30" S 79°04'25" W, 13-\ 18/02/2009 (YPT), leg. M. Pollet & A. \ De Braekeleer, sorted by M. Pollet- \ sample code: EC/2009-30/MP&AD [white printed label]”; “Holotipo [red printed label]” (UTPL). Paratypes. ECUADOR, ZAMORA CHINCHIPE: 2 males, same data as holotype (DZUP); 3 females, “13051-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San \ Francisco, trail Canal, 2000 m \ 03°58'30" S 79°04'25" W, 13/02/2009-\ 18/02/2009 (YPT), leg. M. Pollet & \ A. de Braekeleer, sorted by M. Pollet-sample code: EC/2009-\ 30/MP&ADB-003” (DZUP); 5 females, “13053-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San \ Francisco, trail Canal, 2000 m \ 03°58'30" S 79°04'25" W, 13/02/2009-\ 18/02/2009 (YPT), leg. M. Pollet & \ A. de Braekeleer, sorted by M. Pollet-sample code: EC/2009-\ 30/MP&ADB-005” (DZUP); 1 male, 3 females, “13054-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San \ Francisco, trail Canal, 2000 m, \ 03°58'30" S 79°04'25" W, 13/02/2009-\ 18/02/2009 (YPT), leg. M. Pollet & \ A. de Braekeleer, sorted by M. Pollet-sample code: EC/2009-\ 30/MP&ADB-014” (DZUP); 1 male, “13089-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Francisco trail Rio San Francisco, \ 2000 m, 03°58'30" S 79°04'25" W \ 18/02/2009–25/02/2009 (YPT), leg. \ M. Pollet & A. De Braekeleer \ sorted by M.

Pollet-sample code: \ EC/2009-33/MP&AD” (UTPL); 1 female, “13090-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Francisco trail Rio San Francisco, \ 2000 m, 03°58'30" S 79°04'25" W, \ 18/02/2009–25/02/2009 (YPT), leg. \ M. Pollet & A. De Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009” (DZUP); 2 males, 13 females, “13102-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 79°04'25" W, 17-25/02/2009 (YPT), \ leg. M. Pollet & A. de Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-33/MP&ADB-015” (UTPL); 11 males, 9 females, “13103-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 25/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-36/MP&ADB-016” (UTPL); 1 female, “13130-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Francisco trail Rio San Francisco \ 2000 m, 03°58'30" S 79°04'25" W, \ 25/02–03/03/2009 (YPT), leg. \ M. Pollet & A. De Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-33/MP&AD” (DZUP); 3 females, “13133-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 25/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-36/MP&ADB-005” (DZUP); 2 females, “13134-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 25/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009” (DZUP); 1 female, “13140-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 25/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-36/MP&ADB-012” (DZUP); 2 females, “13143-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San \ Francisco, trail Canal, 2000 m, \ 03°58'30" S 70°04'25" W, 25/022009-\ 3/03/2009 (YPT), leg. M. Pollet & A. Braekeleer, \ sorted by Marc \ Pollet-sample code: EC/2009-\ 36/MP&ADB-015” (UTPL); 17 males, 5 females, “13144-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran



Figs. 16–18. *Limmophora equatoriensis* sp. nov., male: 16. Lateral view; 17. Dorsal view; 18. Frontal view.

\ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 25/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer \ sorted by M. Pollet-sample code: \ EC/2009-36/MP&ADB-016" (DZUP); 3 females, "13169-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 13/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-36/MP&ADB-017" (UTPL); LOJA CAJANUMA: 1 female, "13065 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Los Miradores, 3000 m, 16/02/2009- \ 20/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 31/MP&ADB-00" (DZUP); 2 males, 1 female, "13067 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Los Miradores, 3000 m, 16/02/2009- \ 20/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 31/MP&ADB-00" (UTPL); 1 female, "13068 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Los Miradores, 3000 m, 16/02/2009- \ 20/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 31/MP&ADB-006" (DZUP); 1 male, 5 females, "13073 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Oso \ de anteojos, 3000 m, 16/02/2009- \ 20/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 31/MP&ADB-011" (DZUP); 4 males, 8 females, "13074 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Oso \ de anteojos, 3000 m, 16/02/2009- \ 20/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 31/MP&ADB-012" (UTPL); 5 females, "13170 (EC) Loja: Cajanuma \ Podocarpus National Park, trail \ Bosque Nublado, 3000 m, 16/02/2009- \ 5/03/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 37/MP&ADB-013" (DZUP); 3 males, 4 females, "13106 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Los Miradores, 3000 m, 20/02/2009- \ 27/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 34/MP&ADB-003" (UTPL); 1 female, "13107 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Los Miradores, 3000 m, 20/02/2009- \ 27/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 34/MP&ADB-004" (UTPL); 1 female, "13109 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Los Miradores, 3000 m, 20/02/2009- \ 27/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 34/MP&ADB-006" (DZUP); 4 females, "13114 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Oso \ de anteojos, 3000 m, 20/02/2009- \ 27/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 34/MP&ADB-011" (DZUP); 1 male, 4 females, "13115 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Oso \ de anteojos, 3000 m, 20/02/2009- \ 27/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \

34/MP&ADB-012" (DZUP); 3 females, "13147 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Los Miradores, 3000 m, 27/02/2009- \ 05/03/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 37/MP&ADB-003" (DZUP); 1 male, 5 females, "13155 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Oso \ de anteojos, 3000 m, 27/02/2009- \ 5/03/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 37/MP&ADB-011" (DZUP); 3 females, "13156 (EC) Loja: Cajanuma \ Podocarpus National Park, trail Oso \ de anteojos, 3000 m, 20/02/2009- \ 27/02/2009 (YPT), leg. Marc Pollet & \ Anja De Braekeller, sorted by Marc \ Pollet-sample code: EC/2009- \ 37/MP&ADB-012" (DZUP).

Additional material examined. PERU. Cuzco: Est. Biol. Wayquecha, troche Oso Near 2nd landslide, 2006 m, 13.1845°S 71.58453 1 male, 8-11/xii/2011, leg. Norrbom, Steck. Sutton & Nolzco (USNM).

Distribution. ECUADOR: Loja (Cajanuma), Zamora-Chinchipe (Zamora). PERU: Cuzco (Cuzco).

Etymology. Name in apposition. The specific epithet refers to Ecuador, the country of origin of the studied material.

Limnophora femurosetalis sp. nov. (Figs. 19–24)

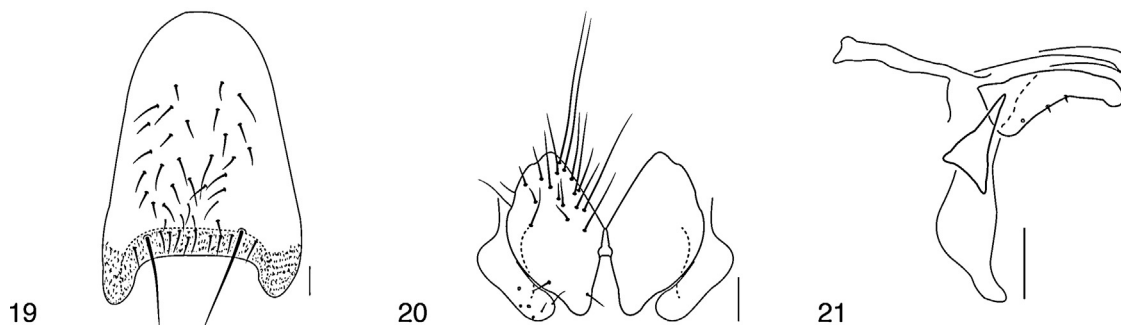
Diagnosis. This species is easily differentiated by the dorsocentral setae 2 + 3, vein R₁ dorsally setulose, hind femur with complete row of long setae on anterodorsal and anteroventral surface and frontal setae in 10 pairs.

Description. Male. Measurements ($n = 1$): Length: Body 4.5 mm. Wing 5.2 mm.

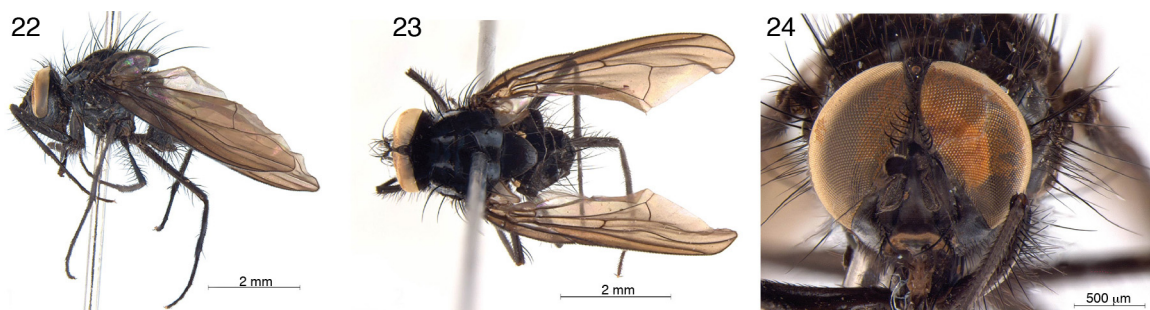
Color. Face silver pollinose. Antenna and arista dark brown. Palpus dark brown. Calypters uniformly whitish, edge darker brownish, lower more conspicuous. Halter yellowish. Wing hyaline yellowish with brown cloudy spots from costal margin to apex of vein R₂₊₃. Prescutum dark brown, humeral callus and notopleura gray pollinose; prescutum with 2 short vittae becoming wider toward scutum, scutum dark brown; scutellum dark brown. Pleurae dark brown with katepisternum mostly gray pollinose. Legs dark brown. Abdomen with median longitudinal silver vittae and dark brown with silver lateral round areas on all tergites.

Head. Holoptic, distance between eyes 0.03 times head width; eye finely ciliated. Inner and outer vertical setae somewhat shorter than ocellar setae. Frontal setae in 10 pairs; 2 reclinate orbital setae. Ocellar setae long, ocellar triangle tuft of hairs. Flagellomere I about 3.5 times pedicel length, ending before insertion of vibrissa. Hairs on arista shorter than diameter of arista at base. Parafacial and fronto-orbital plate bare. Palpus filiform.

Thorax. Chaetotaxy. Acrostichals 0 + 1; dorsocentrals 2 + 3; intra-alars 2 + 1; supra-alars 2; basal postpronotals 2; notopleurals 2; postsupra-alars 2. Scutellum with well developed lateral, apical



Figs. 19–21. *Limnophora femurosetalis* sp. nov., male terminalia: 19. Fifth sternite, dorsal view; 20. Epandrium, surstylus and cercal plate, posterior view; 21. Aedeagus, lateral view (scale 1 mm).



Figs. 22–24. *Limnophora femurosetalis* sp. nov., male: 22. Lateral view; 23. Dorsal view; 24. Frontal view.

scutellar setae. Anepisternum with 6 long setae; katepisternal seta 1: 2. Prosternum setulose.

Legs. Fore femur with complete rows of posterodorsal and posteroventral setae; fore tibia with 1 apical seta on dorsal surface. Mid femur on ventral surface with 5 strong setae on basal half; posterior surface with 2 pre-apical setae; mid tibia with 1 supra-median and sub-median setae on posterior surface; 3 apical setae (anterior, ventral and posteroventral). Hind femur with complete row of setae on anterodorsal and anteroventral surface, posteroventral with 6 setae on basal half; hind tibia with 1 median seta on anteroventral surface; 2 apical setae (anterodorsal and anteroventral).

Wing. Vein R_1 with conspicuous setulae on apical dorsal surface; R_s node and base of vein R_{4+5} setulose dorsally and ventrally; vein $dm-cu$ slightly sinuous, apical portion of vein M bent toward vein R_{4+5} .

Abdomen. Tergite III with row of setae on margin; tergite IV with 1 pair median marginal setae; tergite V with row of setae on margin and 1 pair median marginal setae. Sternite 1 bare, sternite 5 triangular, longer than wide, with few and sparse setae and two apically developed (Fig. 19).

Terminalia. Cercal plate longer than wide, with median fusion, with long setae on apex; surstylus smaller than cercal plate length (Fig. 20). Distiphallus long, about 2.5 times the length of pregonite; postgonite curved and with similar length of epiphallus (Fig. 21).

Female. Unknown.

Type material

Holotype. Male: "13053-(EC)[Ecuador] Zamora Chinchipe: San \ Francisco, Reserva Biológica San \ Francisco, trail Canal, 2000 m, \ 03°58'35" S 79°04'25" W, 13 - 13/02/2009- \ 18/02/2009 (YPT), leg. M. Pollet & \ Anja De Braekeleer, sorted by Marc \ Pollet-sample code: EC/2009-30/MP&ADB-005 [white printed label]"; "Holotipo [red printed label]" (UTPL). Paratypes: 1 male, same data as holotype (UTPL).

Distribution. ECUADOR: Zamora-Chinchipe (Zamora).

Etymology. Adjective, agreeing in gender with the feminine *Limnophora*. The epithet refers to the conspicuous rows of long setae on anterodorsal and anteroventral surfaces of the hind femur.

Limnophora lamasi sp. nov. (Figs. 25–30)

Diagnosis. This species is easily differentiated by the dorsocentral setae 0 + 1, acrostichal seta not differentiated, vein R_1 setulose dorsally on apex, vein R_{4+5} with setulae almost reaching the vein $r-m$, katepisternal setae 1 + 1.

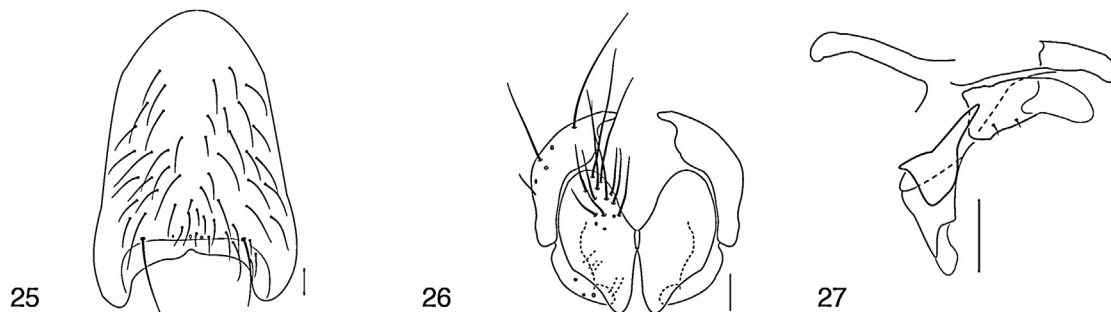
Description. Male. Measurements ($n=4$): Length: Body: 5.6–7.2 mm (5.6 mm). Wing: 5.76–6.0 mm (6.0 mm).

Color. Face silver pollinose. Antenna and arista dark brown. Palpus dark brown. Calyptera uniformly brownish with margin dark brown, lower more conspicuous. Halter yellowish. Wing hyaline yellowish with conspicuous brown cloudy spots from costal margin to apex of vein R_{2+3} . Prescutum dark brown; humeral callus and notopleura gray pollinose; scutum dark brown gray pollinose near scutoscutellar suture; scutellum dark brown. Pleurae dark brown with katepisternum mostly gray pollinose. Legs dark brown. Abdomen with median longitudinal silver vittae and dark brown with silver lateral round areas on all tergites.

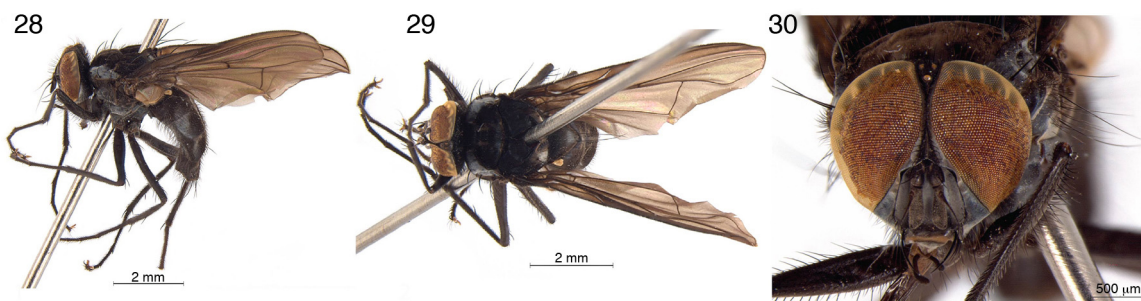
Head. Holoptic, distance between eyes 0.02–0.03 (0.03) times head width; eye finely and sparsely ciliated. Inner and outer vertical setae long and same length as ocellar seta. Frontal seta with 11–13 (13) pairs of setae; 2 reclinate orbital seta. Ocellar setae long; ocellar triangle a tuft of hairs. Flagellomere I about 1.8–4.0 (3.1) times pedicel length, ending before insertion of vibrissa. Arista with few fine hairs, shorter than the diameter of arista at base. Parafacial and fronto-orbital plate bare. Palpus cylindrical slightly dilated apically.

Thorax. Chaetotaxy. Acrostichals not differentiated; dorsocentrals 0 + 1; intra-alars 1; supra-alars 1; basal postpronotals 1; notopleurals 2; postsupra-alars 2. Scutellum with well developed lateral, apical scutellar. Anepisternum with 6–7 (7) long setae; katepisternal setae 1 + 1. Prosternum setulose.

Legs. Fore femur with complete rows of posterodorsal and posteroventral setae; fore tibia with 2 apical setae (dorsal and posteroventral). Mid femur on posterior surface with 2 pre-apical setae; mid tibia with 1 supra-median and submedian on posterior surface and 3 apical setae (anteroventral, ventral and posteroventral). Hind femur with complete row of setae on



Figs. 25–27. *Limnophora lamasi* sp. nov., male terminalia: 25. Fifth sternite, dorsal view; 26. Epandrium, surstylus and cercal plate, posterior view; 27. Aedeagus, lateral view (scale 1 mm).



Figs. 28–30. *Limnophora lamasi* sp. nov., male: 28. Lateral view; 29. Dorsal view; 30. Frontal view.

anterodorsal, anteroventral surface with 1–3 (1) setae on apical half; hind tibia with 2 median seta on anterodorsal and anteroventral surfaces; 2 apical setae (anterodorsal and anteroventral).

Wing. Vein R_1 with conspicuous setulae on apical dorsal surface; Rs node setulose dorsally and ventrally; vein R_{4+5} with setulae almost reaching to vein $r-m$, vein $dm-cu$ sinuous, apical portion of vein M bent toward vein R_{4+5} .

Abdomen. Tergite IV with 3 lateral marginal seta; tergite V with row of setae on margin and 1 pair median marginal seta. Sternite 1 bare; sternite 5 triangular, longer than wide, with few setae and two apically developed (Fig. 25).

Terminalia. Cercal plate longer than wide, with median fusion, with long setae on inner apex; surstylus smaller than length of cercal plate (Fig. 26). Distiphallus median, about 2.0 times than length of pregonite; postgonite slightly curved and shorter than epiphallus (Fig. 27).

Female. Length: Body: 4.8–6.0 mm, Wing 5.2–6.56 mm. Similar to male, but dichoptic, distance between eyes 0.32–0.35 times head width. Six frontal setae, 2 fronto-orbital reclinate setae, inner vertical setae long and convergent. Fronto-orbital plate with few setulae.

Type material

Holotype. Male: “13050-(EC)[Ecuador] Zamora Chinchipe: San \ Francisco, Reserva Biológica San \ Francisco, trail Rio San Francisco \ 2000 m, 03°58'35" S 79°04'25" W, 13-\ 18/02/2009 (YPT), leg. M. Pollet & A. \ De Braekeleer, sorted by M. Pollet-\ sample code: EC/2009-30/MP&ADB-005 [white printed label]”; “Holotipo [red printed label]” (UTPL). Paratypes: 2 males, 1 female same data as holotype. (1 male UTPL; 1 male, 1 female DZUP); 3 females, “13102-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco trail Canal, 2000 m, 03°58'35" S \ 79°04'25" W, 17-25/02/2009 (YPT), \ leg. M. Pollet-A. De Braekeleer, \ sorted by M. Pollet-sample code: EC/2009-30/MP&AD-015” (UTPL); 2 females, “13138-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco trail Rio San Francisco, 2000 m, \ 03°58'35" S 79°04'25" W, 25/02/2009- \ 3/03/2009 (RPT), leg. Marc Pollet & \

Anja De Braekeleer, sorted by Marc \ Pollet-sample code: EC/2009-30/MP&AD-010” (DZUP); 2 males, 1 female, “13103-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 25/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-36/MP&ADB-016” (UTPL, DZUP); 1 male, “13144-(EC) Zamora Chinchipe: San \ Francisco, Reserva Biológica San Fran \ cisco, trail Canal, 2000 m, 03°58'30" S \ 70°04'25" W, 25/02-03/03/2009 (YPT), \ leg. M. Pollet & A. Braekeleer, \ sorted by M. Pollet-sample code: \ EC/2009-36/MP&ADB-016” (DZUP).

Distribution. ECUADOR: Zamora-Chinchipe (Zamora).

Remarks. Some specimens have katepisternal 1:2 setae. All other characters did not vary.

Etymology. Name in apposition. The specific epithet pays tribute to Dr. Carlos José Einicker Lamas, an eminent Brazilian dipterist.

Limnophora longivittata sp. nov. (Figs. 31–36)

Diagnosis. This species is easily differentiated by the dorsocentral setae 2+3. Vein R_1 with conspicuous setulae on apex dorsal surface. Prescutum dark brown with 2 conspicuous white vittae extending over scutellum.

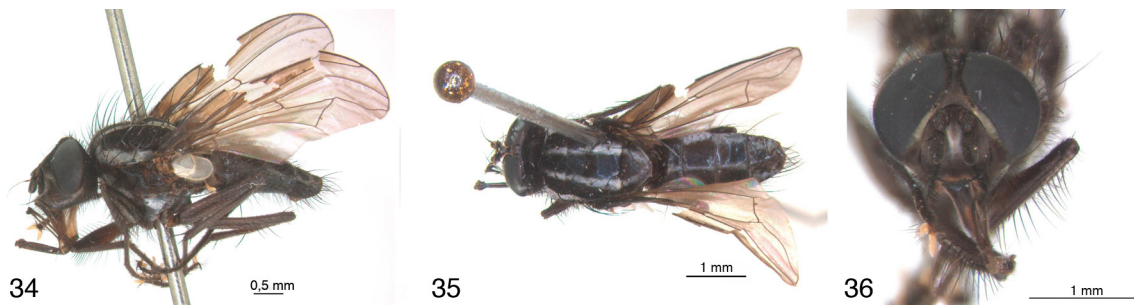
Description. Male. Measurements ($n=3$): Length: Body: 6.0–6.16 mm (6.16 mm). Wing: 5.36–5.6 mm (5.52 mm).

Color. Face gray pollinose. Antenna and arista dark brown. Palpus dark brown. Calypters uniformly whitish. Halter brownish with knob yellowish. Wing hyaline yellowish with conspicuous brown cloudy spots from costal margin to apex of vein R_{2+3} . Prescutum dark brown with 2 conspicuous white vittae extending over scutellum; humeral callus and notopleura gray pollinose; scutum dark brown; scutellum dark brown. Pleurae dark brown with katepisternum mostly gray pollinose. Legs dark brown. Abdomen with median longitudinal silver vittae and dark brown with silver lateral round areas on all tergites.

Head. Holoptic, distance between eyes 0.06–0.08 (0.07) times head width; eye finely and sparsely ciliated. Inner and outer



Figs. 31–33. *Limnophora longivittata* sp. nov., male terminalia: 31. Fifth sternite, dorsal view; 32. Epandrium, surstylus and cercal plate, posterior view; 33. Aedeagus, lateral view (scale 1 mm).



Figs. 34–36. *Limnophora longivittata* sp. nov., male: 34. Lateral view; 35. Dorsal view; 36. Frontal view.

vertical setae long same length than ocellar seta. Frontal seta with 6–7 (7) pairs of setae; 1 proclinate orbital seta near triangle ocellar. Ocellar setae long; ocellar triangle a tuft of hairs. Flagellomere I about 1.7–1.8 (1.7) times pedicel length, ending before insertion of vibrissa. Arista with hairs shorter than diameter of the arista at base. Parafacial and fronto-orbital plate bare. Palpus filiform slightly dilated apically.

Thorax. Chaetotaxy. Acrostichals 0+1; dorsocentrals 2+3, all developed and same length; intra-alars 2+2; supra-alars 2; basal postpronotals 2; notopleurals 2; postsupra-alars 2. Scutellum with well developed lateral, apical scutellar. Anepisternum with 5–6 (5) long setae; katapisternal seta 1+2. Prosternum setulose.

Legs. Fore femur with complete rows of posterodorsal and posteroventral surfaces; fore tibia with 2 apical setae (dorsal and posteroventral). Mid femur on ventral surface with 4–7 stronger setae on basal half and posterior surface with 2 pre-apical setae; mid tibia with 1 supra-median and sub-median setae on posterior surface; 3 apical setae (ventral, anteroventral and posteroventral). Hind femur with complete row of setae on anterodorsal and anteroventral surfaces with 4–6 (6) setae on apical half; ventral surface with 5 setae on basal half; hind tibia with 1 median seta on anterodorsal and posteroventral surfaces; 3 apical setae (ventral, anterodorsal and anteroventral).

Wing. Vein R_1 with conspicuous setulae on apex dorsal surface; R_s node and base of vein R_{4+5} setulose dorsally and ventrally; vein dm-cu slightly sinuous; apical portion of vein M bent toward vein R_{4+5} .

Abdomen: Tergite III with row of setae on margin; tergite IV with 1 pair median marginal seta; tergite V with row of setae on margin and 1 pair median marginal seta. Sternite 1 bare; sternite 5 triangular, longer than wide, with few and sparse setae and two apically developed (Fig. 31).

Terminalia. Cercal plate longer than wide, with submedian fusion, with long setae on apical half; surstylus smaller than length of cercal plate (Fig. 32). Distiphallus long, about 2.5 times than length of pregonite; postgonite slightly curved and smaller than epiphallus (Fig. 33).

Female. Length: Body: 5.8–6.4 mm. Wing: 5.68–6.24 mm. Similar to male but, dichoptic, distance between eyes 0.38–0.42 times head width. Frontal seta with 5 setae, 2 fronto orbital setae, anterior reclinate; inner vertical setae convergent; outer vertical setae divergent. Fronto-orbital plate with few setulae. Thorax with wide vittae brown and 2 narrow vittae gray.

Type material

Holotype. Male: “E. Papallacta \ (Quito Baeza) \ Ecuador. 2900 m. 1-1-71 \ L. E. Peña col. [white printed label]”; “Holotipo[red printed label]” (UTPL). Paratypes. 2 males, 2 females, same data as holotype (UTPL, DZUP).

Distribution. ECUADOR: Napo (Quito, E. Papallacta).

Etymology. Adjective, agreeing in gender with the feminine *Limnophora*. The specific epithet refers to the 2 conspicuous white long vittae extending over scutellum (from de Latin *longus* = long, *vitta* = stripe).

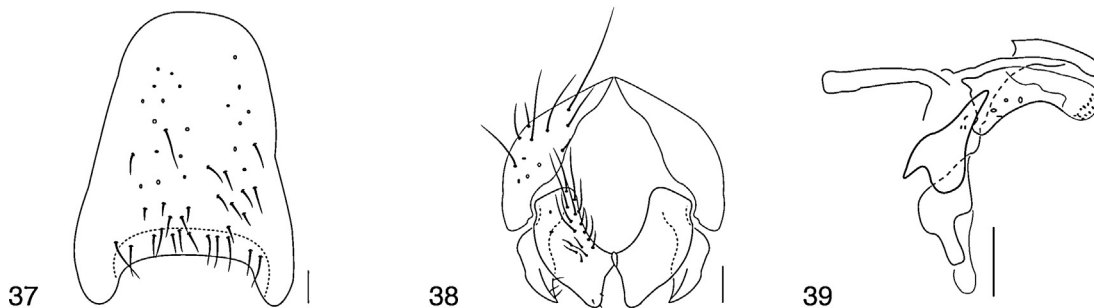
Limnophora penai sp. nov. (Figs. 37–42)

Diagnosis. This species is easily differentiated by the dorsocentral setae 2+3, vein R_1 with conspicuous setulae on apical dorsal e ventral surfaces; R_s node setulose and vein R_{4+5} setulose dorsally beyond vein r-m.

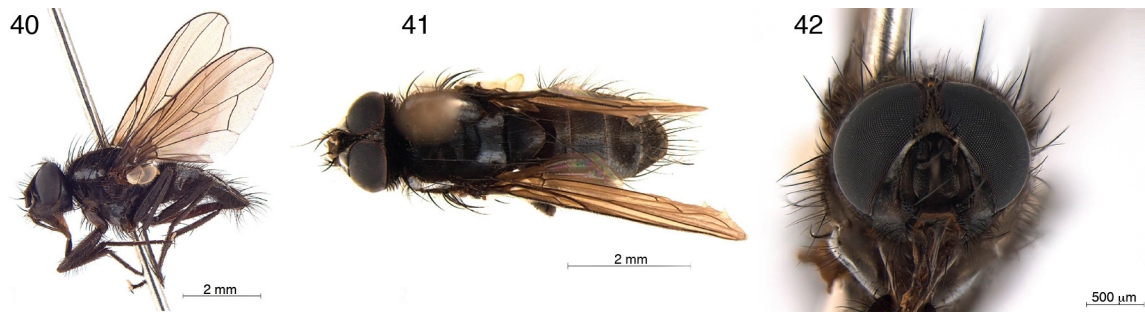
Description. Male. Measurements ($n=5$): Length: Body: 5.8–6.8 mm (6.16 mm). Wing: 4.8–5.68 mm (5.36 mm).

Color. Face silver pollinose. Antenna and arista dark brown. Palpus dark brown. Calypters uniformly whitish. Halter yellow. Wing hyaline with costal margin distinctly yellowish to apex of vein R_{2+3} . Prescutum dark brown, humeral callus and notopleura gray pollinose; scutum dark brown with white gray pollinose near scutellum; scutellum dark brown. Pleurae dark brown with katapisternum mostly gray pollinose. Legs dark brown. Abdomen with median longitudinal silver vittae and dark brown with silver lateral round areas on all tergites.

Head. Holoptic, distance between eyes 0.03–0.06 (0.05) times head width, eye finely and sparsely ciliated. Inner and outer vertical setae same length as ocellar seta; Frontal seta with 6–7 (6) pairs;



Figs. 37–39. *Limnophora penai* sp. nov., male terminalia: 37. Fifth sternite, dorsal view; 38. Epandrium, surstylus and cercal plate, posterior view; 39. Aedeagus, lateral view (scale 1 mm).



Figs. 40–42. *Limnophora penai* sp. nov., male: 40. Lateral view; 41. Dorsal view; 42. Frontal view.

1 proclinate orbital seta. Ocellar setae long; ocellar triangle a tuft of hairs. Flagellomere 1 about 1.5–3.0 (3.0) times pedicel length, ending before insertion of vibrissa. Arista with hairs shorter than diameter of arista at base. Parafacial and fronto-orbital plate bare. Palpus filiform, slightly dilated apically.

Thorax. Chaetotaxy. Acrostichals 0+1; dorsocentrals 2+3; intra-alars 2:2; supra-alars 2; basal postpronotals 2; notopleurals 2; postsupra-alars 2. Scutellum with well developed lateral, apical scutellar setae. Anepisternum with 6–8 (7) long setae; katepisternal seta 1+2. Prosternum setulose.

Legs. Fore femur with complete rows of posterodorsal and posteroventral setae; fore tibia with median seta on posterior surface; 2 apical setae (dorsal and posteroventral). Mid femur on ventral surface with 5 stronger setae on basal half; posterior surface with 2 pre-apical setae; mid tibia with 1 supra-median and sub-median setae on posterior surface; 3 apical setae (anterior, ventral and posteroventral). Hind femur with complete row of setae on anterodorsal surface and anteroventral surface with 4–5 (5) setae on apical half; hind tibia with 1 median seta on anterodorsal and posteroventral surfaces; 2 apical setae (dorsal and anteroventral).

Wing. Vein R_1 with conspicuous setulae on apex of dorsal and ventral surfaces; R_s node setulose and vein R_{4+5} setulose dorsally beyond vein r-m, vein dm-cu slightly sinuous, apical portion of vein M bent toward vein R_{4+5} .

Abdomen. Tergite III with row of setae on margin; tergite IV with 1 pair median marginal seta; tergite V with row of setae on margin and 1 pair median marginal seta. Sternite 1 bare; sternite 5 triangular, longer than wide, with few and sparse setae (Fig. 37).

Terminalia. Cercal plate longer than wide, with submedian fusion, with long setae on inner apex; surstylus smaller than length of cercal plate (Fig. 38). Distiphallus median, about 2.0 times the length of pregonite; postgonite curved and similar length of epiphallus (Fig. 39).

Female. Length: Body: 5.52–6.0 mm. Wing: 4.96–5.6 mm. Similar to male but, dichoptic, distance between eyes 0.42–0.43 times head width. Frontal seta with 5 pairs of setae, 2 reclinate orbital setae; inner vertical setae convergent; outer vertical setae divergent. Fronto-orbital plate with few setulae. Thorax with wide vitta brown and 2 narrow vittae gray ending on scutellum. Wing hyaline, without cloudy spots.

Type material

Holotype. Male: “Faz. Maria Isabel, \ Sur Cuenca 2800 m. \ Rio Tarqui, \ Ecuador. XII-1970 \ L. E. Peña col.[white printed label]”; “Holotipo [red printed label]” (MZSP). Paratypes. 1 male, 2 females same data as holotype. (1 female MZSP, 1 male, 1 female DZUP); 10 males, 9 females “E. Papallacta \ (Quito Baeza) \ Ecuador. 2900 m. I-1-71 \ L. E. Peña col.” (MZSP; DZUP); GIRÓN: 5 males, 2 females, “Sta. Isabel, Girón \ Ecuador. 1800–2400 m. \ XII-1970 \ L. E. Peña col.” (3 males, 1 female MSZP; 2 males, 1 female DZUP); CHAUCHA: 6 males, 1 female, “Chaucha (N. Cañar) \ Ecuador 3300 m. \ XII-1970

\ L. E. Peña col.” (MZSP; DZUP); SARAGURO: 1 male, 1 female, “S. de Saraguro, \ 2900 m. Ecuador \ XI. 1970 \ L. E. Peña col.” (DZUP).

Distribution. ECUADOR: Azuay (Cuenca, Giron), Cañar (Chaucha), Loja (Saraguro).

Etymology. Name in apposition. The specific epithet is a tribute to L. E. Peña, who collected an important number of specimens used in this study.

Limnophora polleti sp. nov. (Figs. 43–48)

Diagnosis. This species is easily differentiated by the dorsocentral setae 2+4, vein R_1 dorsally setulose on apex, vein R_{4+5} dorsally with setulae almost reaching apex, meron and sternite 1 with setulae.

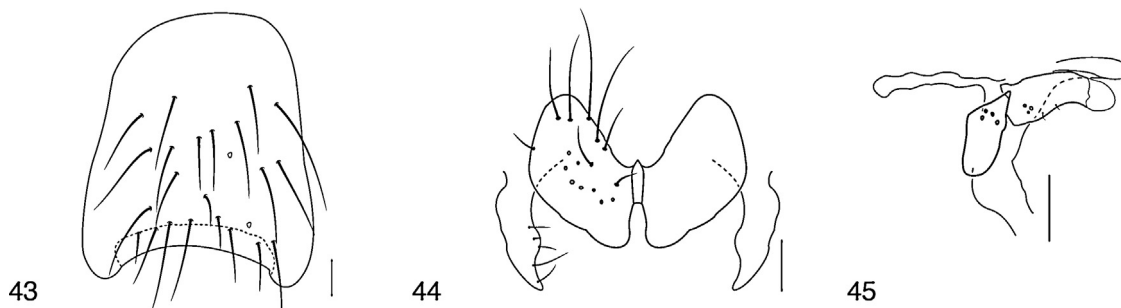
Description. Male. Measurements ($n=2$): Length: Body: 5.6–6.4 mm (6.4 mm). Wing: 5.68–5.76 mm (5.68 mm).

Color. Face silver pollinose. Antenna and arista dark brown. Palpus dark brown. Calypters uniformly whitish with border brownish, lower more conspicuous. Halter brownish with knob yellowish. Wing hyaline brownish with dark brown cloudy spots from costal margin to apex of vein R_{2+3} . Prescutum dark brown, humeral callus and notopleura gray pollinose, scutum dark brown gray pollinose near scutoscuteellar suture; scutellum dark brown. Pleurae dark brown with katepisternum mostly gray pollinose. Legs dark brown. Abdomen with median longitudinal silver vittae and dark brown with silver lateral round areas on all tergites.

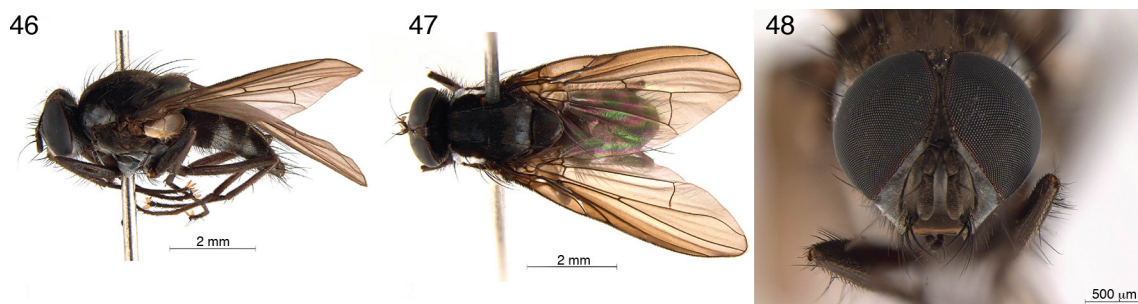
Head. Holoptic, distance between eyes 0.02 times head width; eye finely and sparsely ciliated. Inner and outer vertical setae somewhat shorter than ocellar setae. Frontal seta with 6–7 (7) pairs; 1 proclinate orbital seta near ocellar triangle. Ocellar setae long; ocellar triangle a tuft of hairs. Flagellomere 1 about 2 times pedicel length, ending before insertion of vibrissa. Arista with hairs shorter than diameter of the arista at base. Parafacial and fronto-orbital plate bare. Palpus filiform slightly dilated apically.

Thorax. Chaetotaxy. Acrostichals 0+1; dorsocentrals 2+4, first and second postsutural seta somewhat shorter than others; intra-alars 2+2 the setae postsutural somewhat developed, but distinct; supra-alars 1; basal postpronotals 2; notopleurals 2. postsupra-alars 2. Scutellum with well developed lateral, apical scutellar. Anepisternum with 6 long setae; katepisternal seta 1+2. Meron with setulae. Prosternum setulose.

Legs. Fore femur with complete rows of posterodorsal and posteroventral setae; fore tibia with dorsal, anteroventral apical seta. Mid femur with 2 (1) stronger setae on ventral basal surface; mid tibia with 1 supra-median and sub-median setae on posterior surface and 3 apical setae (anteroventral, ventral and posteroventral). Hind femur with complete row of setae on anterodorsal, anteroventral surface with 3–5 (3) setae on apical



Figs. 43–45. Male terminalia. *Limnophora polleti* sp. nov., male terminalia: 43. Fifth sternite, dorsal view; 44. Epandrium, surstylus and cercal plate, posterior view; 45. Aedeagus, lateral view (scale 1 mm).



Figs. 46–48. *Limnophora polleti* sp. nov., male: 46. Lateral view; 47. Dorsal view; 48. Frontal view.

half; hind tibia with 2 median seta on anterodorsal and anteroventral surfaces; 2 apical setae (anterodorsal and anteroventral).

Wing. Vein R1 with conspicuous setulae on apical dorsal surface; Rs node setulose dorsally and ventrally; vein R₄₊₅ with setulae almost reaching to dorsally and ventrally; vein dm-cu slightly sinous, apical portion of vein M bent toward vein R₄₊₅.

Abdomen. Tergite III with row of setae on margin; tergite IV with 1 pair median marginal seta; tergite V with row of setae on margin and 1 pair median marginal seta. Sternite 1 with setulae, sternite 5 trapezoid, longer than wide, with many and sparse long setae (Fig. 43).

Terminalia. Cercal plate longer than wide, with median fusion, with few and sparse long setae on apical half; surstylus greater than length of cercal plate (Fig. 44). Distiphallus small, about 1.5 times than length of pregonite; postgonite curved and shorter than epiphallus (Fig. 45).

Female. Length: Body: 6.0–6.4 mm, Wing: 5.76–6.32 mm. Similar to male, but dichoptic, distance between eyes 0.33–0.35 times head width. Frontal seta with 4 pairs of setae; 1 pair reclinate orbital setae; inner vertical setae convergent; outer vertical setae divergent. Fronto-orbital plate with few setulae.

Type material

Holotype. Male: “E. Papallacta \ (Quito Baeza) \ Ecuador. 2900 m. I-71 \ L. E. Peña col.[white printed label]”; “Holotipo [red printed label]” (UTPL). Paratypes, 1 male, 3 females, same data as holotype (UTPL, DZUP); OTAVALO: 1 male, “N. Perueho \ (Otavalo) Ecuador \ 2000 m. I-1971 \ L. E. Peña col.” (UTPL); CUENCA: 1 female, “Faz. Maria Isabel, \ Sur Cuenca 2800 m. \ Rio Tarqui, \ Ecuador. XII-1970 \ L. E. Peña col.” (UTPL).

Distribution. ECUADOR: Azuay (Cuenca), Imbabura (Otavalo), Napo (Quito, E. Papallacta).

Etymology. Name in apposition. The specific epithet refers pays tribute to Dr. Marc A. Pollet, who lent us many specimens used in this study.

Conflict of interest

The authors declare no conflicts of interest.

Acknowledgements

We thank Joachim Ziegler (ZMHB), Carlos Iván Espinosa (UTPL), Carlos José Einicker Lamas (MZSP), Allen Norrbom (USNM) and Marc A. A. Pollet (RBINS) for loaning the material used in the study. We thank Taxonline – Rede Paranaense de Coleções Biológicas and Laboratório de Entomologia Médica e Veterinária (UFPR) for specimen photographs. We are very grateful to Marc Pollet (www.naturalsciences.be/) for all his generous support for this project. The Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) provided a graduate scholarship (process number 130404/2013-6, JMF) and grant (process number 304713/2011-2, CIBC). James J. Roper revised the English and offered suggestions to improve the text.

References

- Albuquerque, D.D.O., 1950. Primeiras notas sobre alguns Muscidae de Macquart, da coleção do Museu de Paris. Bol. Mus. Nac., N. S., Zool. 98, 1–7.
- de Carvalho, C.J.B., Couri, M.S., Pont, A.C., Pamplona, D.M., Lopes, S.M., 2005. A catalogue of the Muscidae (Diptera) of the neotropical region. Zootaxa 860, 1–282.
- Cumming, J.M., Wood, D.W., 2009. Adult morphology and terminology. 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. 2. NRC Research Press, Ottawa, Ontario, Canada, pp. 9–50.
- Lopes, S.M., Couri, M.S., 1987. Estudo sobre Limnophorinae – IV – Contribuição ao conhecimento de *Limnophora* Robineau-Desvoidy, 1830 (Diptera, Muscidae). Rev. Bras. Entomol. 47, 647–655.
- Löwenberg-Neto, P., de Carvalho, C.J.B., 2013. Muscidae (Insecta: Diptera) of Latin America and the Caribbean: geographic distribution and check-list by country. Zootaxa 3650, 1–147.
- Pont, A.C., 1997. The Muscidae and Fanniidae (Insecta, Diptera) described by C.R.W. Wiedemann. Steenstrupia 23, 87–122.

- Pont, A.C., 2012. Muscoidea (Fanniidae, Anthomyiidae, Muscidae) described by P. J. M. Macquart (Insecta, Diptera). *Zoosystema* 34, 39–111.
- Pont, A.C., 2013. The Fanniidae and Muscidae (Diptera) described by Paul Stein (1852–1921). *Zoosyst. Evol.* 89, 31–166.
- Stein, P., 1910. Die von Thomson beschriebenen Anthomyiden der Eugenes Resa. *Wien. Ent. Ztg.* 29, 66–77.
- Thomson, C.G., 1869. Diptera. Species nova descriptis. In: Kongliga svenska fregatten *Eugenes resa omkring jorden under befäl af C.A. Virgin, åren 1851–1853*. Part II, Zoologi, 1, Insecta. P. A. Norstedt & Soner, Stockholm, pp. 443–614.
- Wiedemann, C.R.W., 1830. *Aussereuropäische zweiflügelige Insekten*. Part II, Hamm, Schultz, xii + 684 + xi pp.
- Xue, W.-Q., Bai, S.-C., Dong, W.-X., 2012. A study of the genus *Limnophora* Robineau-Desvoidy (Diptera: Muscidae), with descriptions of six new species from China. *J. Insect. Sci.* 12, 1–17.