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On the identities *of Rhinoleucophenga pallida* Hendel and *Rhinoleucophenga obesa* (Loew) (Diptera, Drosophilidae), with description of a new sibling species from Brazil

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ABSTRACT

Rhinoleucophenga pallida Hendel, 1917 (type species of the genus) is redescribed based on its female holotype and a male from a nearby locality, and *Rhinoleucophenga obesa* (Loew, 1872) on its two syntypes, which are designated as the male lectotype and a female paralectotype. Both are valid species. A proposal is made to establish the genus *Pseudophortica* Sturtevant, 1918 (type species *R. obesa*), a junior synonym of *Rhinoleucophenga*, to subgenus rank and include all species of *Rhinoleucophenga* described or redescribed from males except *R. pallida*, which is unique in having a remarkable pedunculate surstylus, among other differences. The North American *R. obesa* is compared to its closest sibling, the South American species *Rhinoleucophenga gigantea* (Thomson, 1869). The occurrence of *R. obesa* in Brazil is also questioned, as suggested long ago by Marshall R. Wheeler. The specimens from Brazil previously identified as such most probably belong to the new species described in the present paper as *Rhinoleucophenga* (*Pseudophortica*) *cantareira* sp. nov. (type locality: Parque Estadual da Cantareira, City of São Paulo, State of São Paulo, Brazil). Numerous photomicrographs of their habitus and male terminalia taken with a Smartphone's rear camera and digitally stacked to create images with greater depth of focus are provided.

Introduction

In the New World genus *Rhinoleucophenga*, established by Hendel (1917), 29 species have been described thus far. Some are only known from their original descriptions, and their identities have not yet been clarified through redescription of their type specimens using current standards. Some descriptions, moreover, lack reliable identity characters, such as species only known from females, which are virtually indistinguishable (Vilela and Bächli, 2009).

Almost half a century elapsed between the publication of the seminal revision of the genus *Rhinoleucophenga* by Malogolowkin (1946) and the first step for an effective problem-solving process through the redescription of the holotype of *Rhinoleucophenga gigantea* (Thomson, 1869) by Vilela (1990). Then, three additional species, *Rhinoleucophenga flaviceps* Duda, 1929, *Rhinoleucophenga punctulata* Duda, 1929 and *Rhinoleucophenga subradiata* Duda, 1929, were revised by Vilela and Bächli (2009), including comments on the identities of certain Neotropical species. Since 2009, many species were described or redescribed by Culik and Ventura (2009), Schmitz et al. (2009), Junges and Gottschalk (2014), Poppe et al. (2014, 2015, 2016, 2017, 2018) ,Vidal and Vilela (2015)Carvalho-Filho et al. (2019).

Herein the type specimens of *Rhinoleucophenga obesa* (Loew) and *Rhinoleucophenga pallida* Hendel were analyzed to improve their accurate identification. Additionally, some non-type specimens previously identified by different authors as belonging to the first species were checked for comparisons, and, based on them as well as on previously published descriptions, redescriptions and illustrations, a new species from Brazil is described. All specimens analyzed have very similar external morphology, therefore, an analysis of structures of the male terminalia is essential.

It is worth noting that based on the wing pattern all analyzed specimens will run to couplet #1 in Malogolowkin's (1946) key leading to the species *Rhinoleucophenga obesa.*

Material and methods

The redescriptions were based on the two syntypes (one male, one female) of *Rhinoleucophenga obesa* Loew, 1872, on loan from

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Figs. 1–4. *Rhinoleucophenga pallida* Hendel, 1917, male non-type specimen, Urubamba river, Meshagua, Peru [08.X.1903; NHW], habitus, four views. 1, oblique dorsal, 2, left lateral, 3, head and thorax dorsal, 4, abdomen dorsal. Scale bar = 1 mm.

the Museum of Comparative Zoology (MCZ), Harvard University, Cambridge MA 02138, and the female holotype and one male non-type specimen of *Rhinoleucophenga pallida* Hendel, 1917, on loan from the Naturhistorisches Museum Wien (NHMW). In addition, four undetermined non-type specimens (two males, two females) housed in the Zoologisches Museum, Universität Zürich (ZMUZ), the female paratype of *Phortica hirtifrons* Johnson, 1913 as well as two female non-type specimens collected in Florida and North Carolina, all from the MCZ collection, were analyzed.

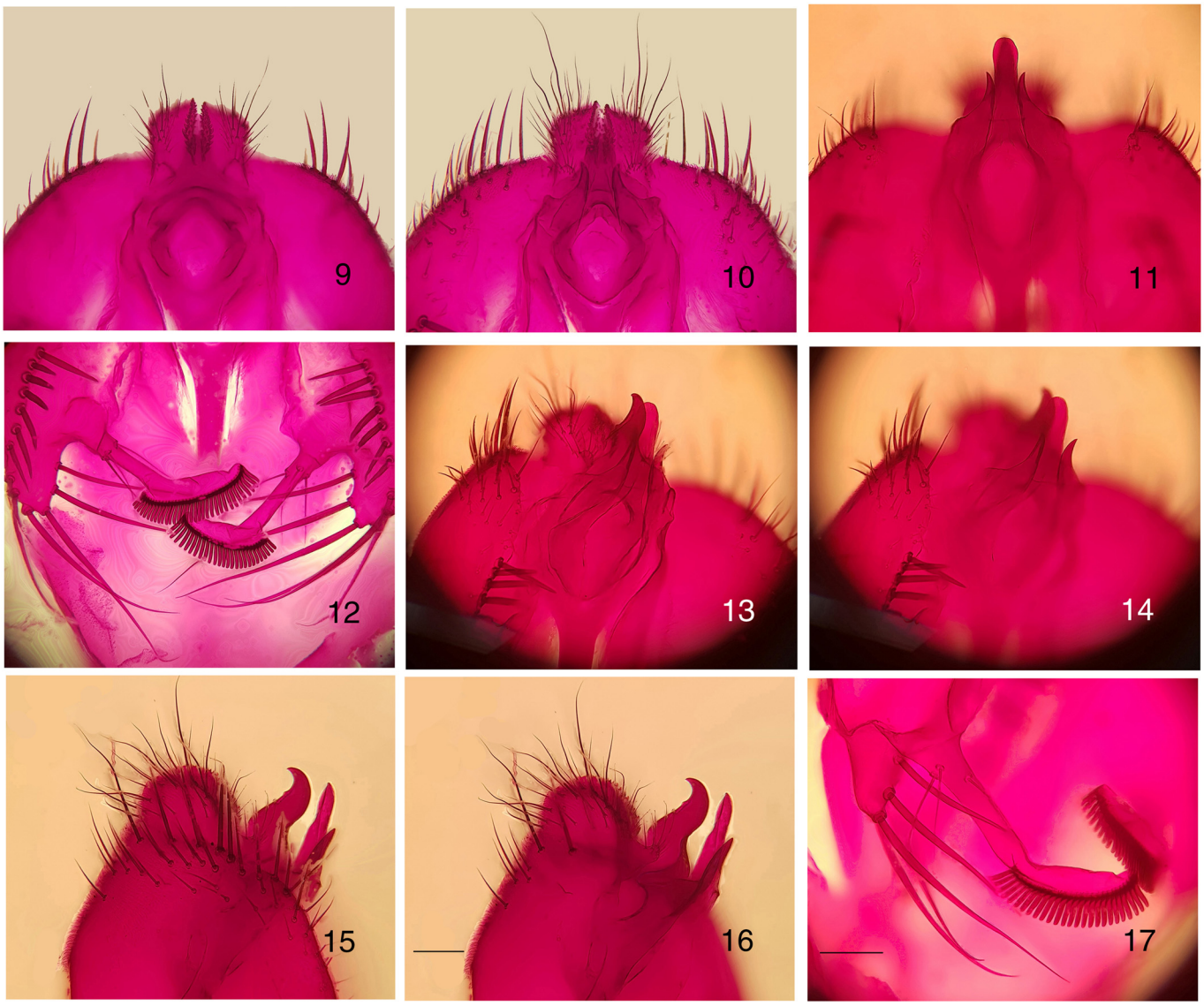
Label data attached to each type specimen are cited in full with a slash indicating a line change, and a double-slash, a label change. Our own notes or interpretations are included in brackets (also in other items throughout the text). For measurements and indices see Vilela and Bächli (1990); for morphological terminology see Vilela and Bächli (2000) and Bächli et al. (2004). For a survey of references under each binomial we follow Bächli (2018). Our internal numbering is given as [#...].

Adult habitus photomicrographs were taken with the rear camera of a smartphone Samsung Galaxy S8, attached by means of a magnetic adapter to a Wild stereomicroscope eyepiece (under 10×, 16×, or 40× objectives), followed by stacking dozens of pictures of each specimen in several views with the open-source software

Figs. 5–8. *Rhinoleucophenga pallida* Hendel, 1917, male non-type specimen, Urubamba river, Meshagua, Peru [08.X.1903; NHW], habitus, four close-ups. 5, left katepisternum, lateral view, 6, scutellum, dorsal, 7, head, frontodorsal, 8, terminalia, oblique dorsal. Scale bar = 1 mm.

Combine ZP (Hadley, 2010) to create an all-in-focus composite as detailed by Bächli & Vilela (2019). Images were taken with the autofocus disabled, either with the camera set to default or optically zoomed to 2× or 3×.

Preparations of microscope slides were made following Wheeler and Kambysellis (1966) and Kaneshiro (1969) as modified by Bächli et al., 2004. The abdominal sclerites, including the disarticulated male terminalia, are preserved in microvials filled with glycerin and attached by the stopper to the pin of the respective specimen. Refer to Vilela and Bächli (2000) and Bächli et al. (2004) for further details. Similar to the habitus photomicrographs cited above, the terminalia were photomicrographed with the same smartphone attached to a Zeiss compound microscope eyepiece (under 10×, 16×, or 25× objectives) as detailed above and by Bächli and Vilela (2019). Photomicrographs of the internal male terminalia (except hypandrium) of the holotype of *Rhinoleucophenga gigantea* (Thomson, 1869), previously loaned from the Naturhistoriska Riksmuseet Stockholm (NRS) to the first author late last century (Vilela, 1990) were included for comparisons. For this purpose, the old and unpublished analogue negatives of the aedeagus and associated sclerites of *R. gigantea* were digitized with an Epson scanner (Perfection 4180 photo). Male terminalia were drawn



Figs. 9–17. *Rhinoleucophenga pallida* Hendel, 1917, male non-type specimen, Urubamba river, Meshagua, Peru [08.X.1903; NHW], terminalia, nine close-ups. 9, cerci, ventral view, 10, aedeagus tip and outer paraphyses, ventral, 11, aedeagus tip and outer paraphyses, posteroventral, 12, broom-shaped surstyli, posterior, 13, aedeagus and aedeagal apodeme tips, oblique ventral, 14, aedeagus tip and outer paraphyses, oblique ventral, 15, epandrium, cercus, dorsal plate and aedeagus tip, left lateral, 16, aedeagus, dorsal sclerite [= inner paraphyses fused to each other?] and outer paraphyses, left lateral, details of the peduncle of broom-shaped surstylus, lateral. Scale bars = 0.1 mm (9–16, same scale).

using a camera lucida (1.8×) attachment on a Zeiss compound microscope under a 10× or 16× objective.

Unless otherwise indicated, all photomicrographs in the same plate were taken and enlarged to the same magnification.

The images of line drawings as well as of digitized analogue negatives and of composite photomicrographs taken either with a stereo or a compound microscope were finally edited with Adobe Photoshop (Elements 2.0) or Graphic Converter (6.7) software.

Results

Rhinoleucophenga Hendel, 1917

Type species: *Drosophila pallida* Hendel, 1917 (orig. des.).

Pseudophortica Sturtevant, 1918: 37 (syn. by Duda, 1925: 150) [see below as subgenus].

Type species: *Drosophila obesa* Loew, 1872: 102 (orig. des.).

Older references and the last updated diagnosis were given by Vilela and Bächli (2009).

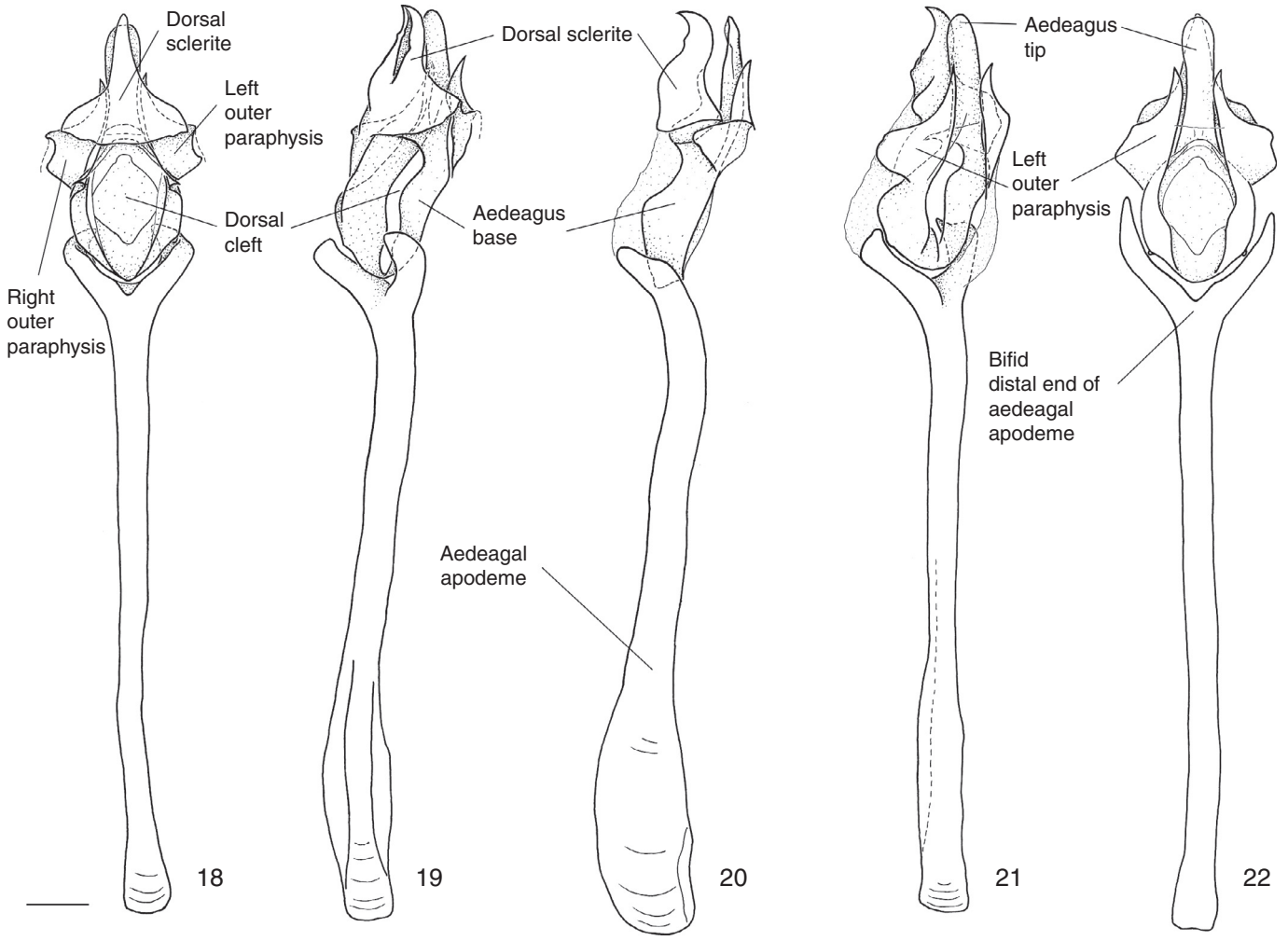
Since then: Vilela, 2008 (biology); Yassin and David, 2009 (phylogeny).

Subgenus *Rhinoleucophenga* Hendel, 1917

Rhinoleucophenga (Rhinoleucophenga) pallida Hendel, 1917: 45

(Figs. 1–31)

Rhinoleucophenga pallida Hendel, 1917: 45 (description). Duda, 1924: 179 (key), Malloch and McAtee, 1924: 33 (synonymy); Duda, 1927: 43 (description, figures, key, distribution); Malogolowkin, 1946: 416 (synonymy); Wheeler, 1952: 193 (synonymy); Wheeler, 1970: 79.5 (affiliation); Wheeler, 1981: 29 (affiliation); Bächli, 1988: 142 (types); Grimaldi, 1990: 71 ff.



Figs. 18–22. *Rhinoleucophenga pallida* Hendel, 1917, male non-type specimen, Urubamba river, Meshagua, Peru [08.X.1903; NHW], five views of aedeagus, dorsal sclerite [= inner paraphyses fused to each other?], outer paraphyses and aedeagal apodeme, from dorsal through ventral. Scale bar = 0.1 mm.

(description [misidentification], phylogeny); Brake and Bächli, 2008: 292 (affiliation); Culik and Ventura, 2009: 419 (distribution).

Type locality

Peru: Meshagua [probably misspelled for Mishagua river, a tributary of the Urubamba river], Urubambafluss [Urubamba river].

Diagnosis

Body length ♂ 3.6 mm, ♀ 4.2 mm. General colour yellowish. Wing transparent, with darkened crossveins and partly brownish marginal border. Frons with about 75 interfrontal setulae. Frontal index ♂ = 1.20, ♀ = 1.11. Arista with10 dorsal, 7 long ventral and about 5 short inner branches, plus short terminal fork. Externally most similar to its three sibling species regarding their external morphology (*R. cantareira*, sp. nov., *R. gigantea* and *R. obesa*), from which it differs in the male terminalia and also in the number of interfrontal setulae (unknown for *R. gigantea*). Epandrium strongly developed; posterior margin of cercus bearing three rows of hooked scales (serrate in profile view) in the lower half; surstylus remarkably broom-shaped, slightly fused to epandrium through a peduncle (so far unique within its genus), bearing a convex row of 26–33 evenly spaced, quite long, distally diverging and roundish-tipped prensisetae; dorsal sclerite (putatively the inner paraphyses fused to each other) of aedeagus relatively large, triangle-shaped in dorsal view, distally grooved in obliquedorsal view, sinuate and distally pointed upwards in profile; aedeagus proximally ring-shaped, distally spatula-shaped in dorsal and ventral views, proximally sinuate in lateral view; outer paraphysis anteriorly membranous, distally sclerotized and sharply pointed, bare; aedeagal apodeme more than twice as long as aedeagus, dorsally deeply bifid at distal end with slightly turned inwards tips.

Material examined

Holotype ♀, labelled: "Peru-Meshagua [Mishagua? river] / 2. 10. 03/Urubambafl. [Urubamba river] // 170 [handwritten] // Rhinoleuco-/phenga/pallida H. [handwritten] / det. Hendel // SYNTYPUS [incorrect] / Rhinoleucophenga pallida H. G. Bächli det. 1985 [white label with red margin, in part handwritten] // TYPUS [red label] // *Rhinoleucophenga / pallida* Hendel / Vilela & Bächli det. 2017 // HOLOTYPE // ♀″ (NHW).

[#4] Non-type specimen ♂, labelled: "Peru-Meshagua [Mishagua? river] / 8. 10. 03 / Urubambafl. [Urubamba river] // 166 [handwritten] // Rhinoleuco- / phenga / pallida ♂ / d. Duda [handwritten] // SYNTYPUS [incorrect] / Rhinoleuc. / pallida H. / G. Bächli det. 1985 [white label with red margin, in part handwritten] //

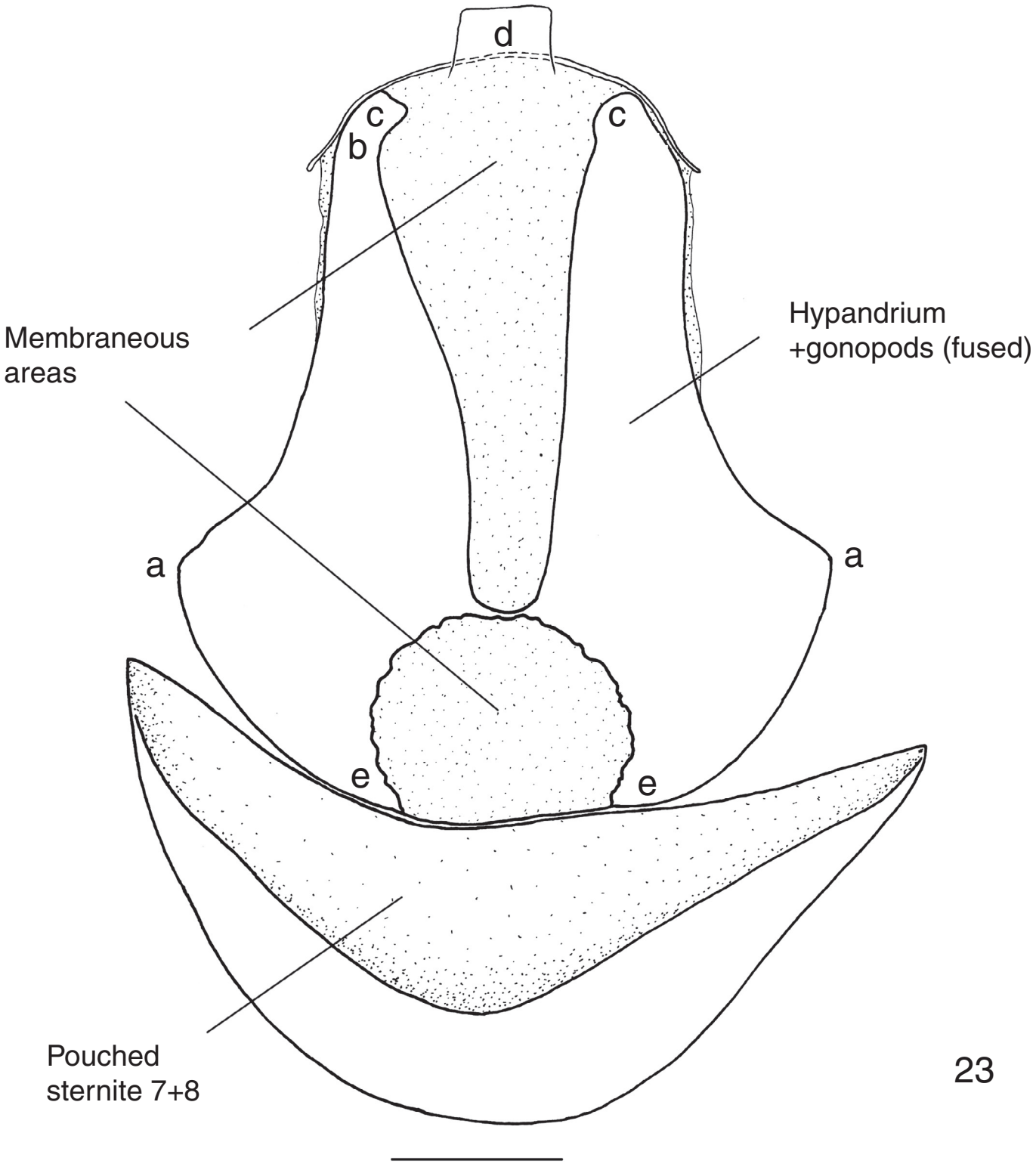


Fig. 23. *Rhinoleucophenga pallida* Hendel, 1917, male non-type specimen, Urubamba river, Meshagua, Peru [08.X.1903; NHW], hypandrium+gonopods [fused to each other], sternites 7+8 [fused to each other?], posterior view. The lower case letters in the hypandrium figure indicate articulation points with other sclerites: a (epandrium), b (dorsal arch), c (outer paraphyses), d (ventral rod of aedeagal apodeme), and e (sternite 8). Scale bar = 0.1 mm.

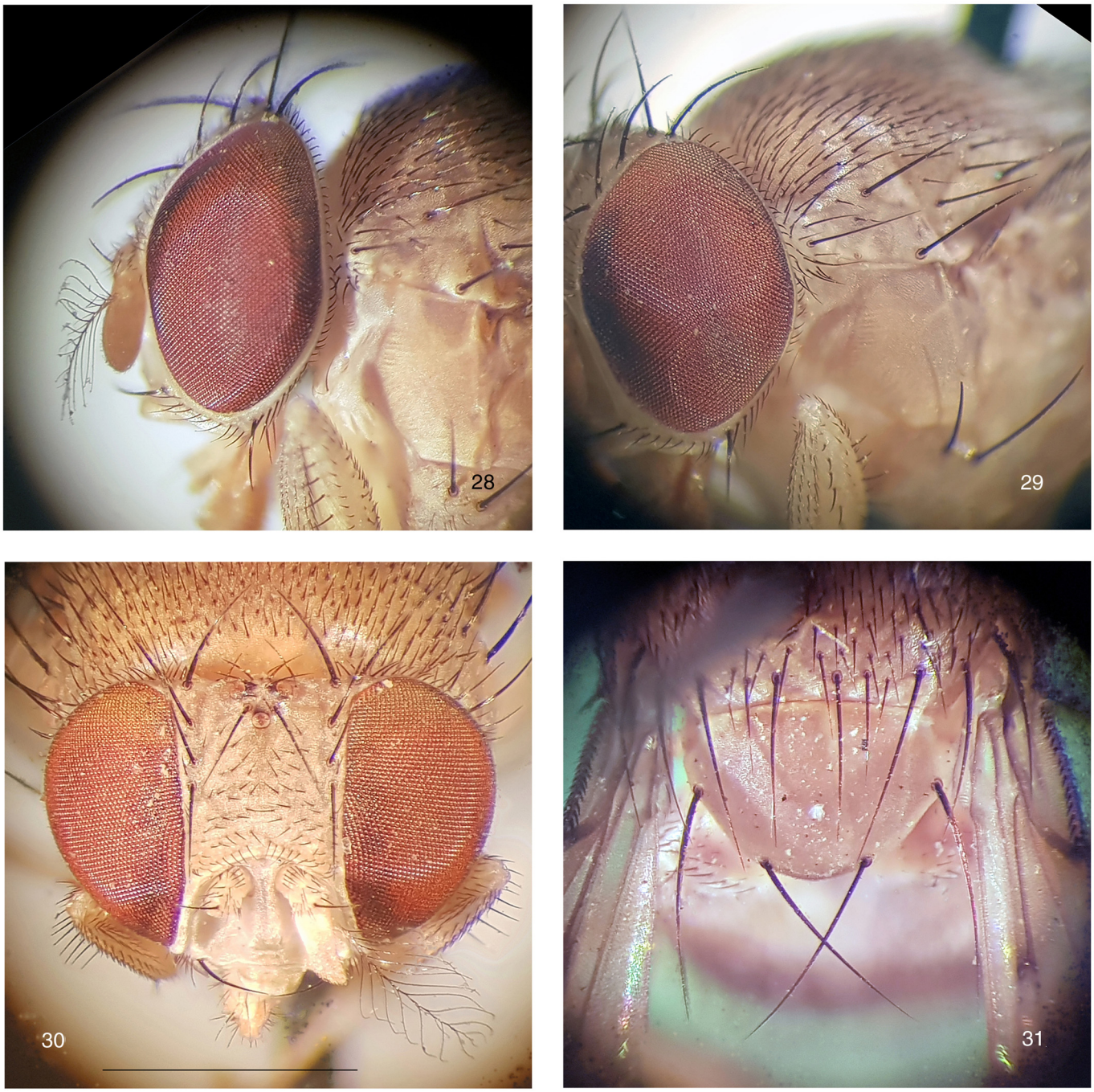
Figs. 24–27. *Rhinoleucophenga pallida* Hendel, 1917, female holotype, Urubamba river, Meshagua, Peru [02.X.1903; NHW], habitus, four views. 24, oblique dorsal, 25, left lateral, 26, head and thorax dorsal, 27, abdomen dorsal. Scale bar = 1 mm.

TYPUS [red label] // *Rhinoleucophenga* / *pallida* Hendel / Vilela & Bächli det. 2017 // ♂" [microvial with terminalia and other abdomen remains] (NHW).

Description

♂ (Figs. 1–23). Following the decision of Duda (1927:44), we accept that this specimen belongs to the same species as the holotype of *R. pallida* because, in addition to the great external similarity including wing pattern, both specimens were putatively collected from nearby places along Urubamba river (Peru), and the former was collected only 6 days later than the latter.

Head pale yellowish, setae black (Fig. 7). Frons pale yellowish, with about 75 short interfrontal setulae which are predominantly bent inwards (Fig. 7). Frontal length 0.61 mm; frontal index = 1.20, top to bottom width ratio = 1.10 (Fig. 7). Frontal triangle indistinct, slightly microtrichose, about 50% of frontal length; ocellar triangle microtrichose, about 30% frontal length. Orbital plates slightly microtrichose, about 60% frontal length. Orbital setae almost in a row, distance of or3 to or1 = 120% of or3 to vtm, vt index = 1.07, postocellar setae wide apart, bent inwards,



Figs. 28–31. *Rhinoleucophenga pallida* Hendel, 1917, female holotype, Urubamba river, Meshagua, Peru [02.X.1903; NHW], habitus, four close-ups. 28, head, left lateral view, 29, head and thorax, oblique dorsal, 30, head, frontodorsal, 31, scutellum, dorsal. Scale bar = 1 mm.

about 33% of frontal length; vibrissal index = 0.29. Face pale yellowish. Carina almost parallel-sided, slightly prominent downwards, with a shallow longitudinal furrow (Fig. 7). Cheek index about 13. Eye index = 1.36. Occiput slightly concave. Antenna pale yellowish. Flagellomere 1 parallel-sided, length to width ratio = 2.11. Arista with 10 dorsal, 7 ventral and about 5 small inner branches, plus short terminal fork. Palpus yellowish.

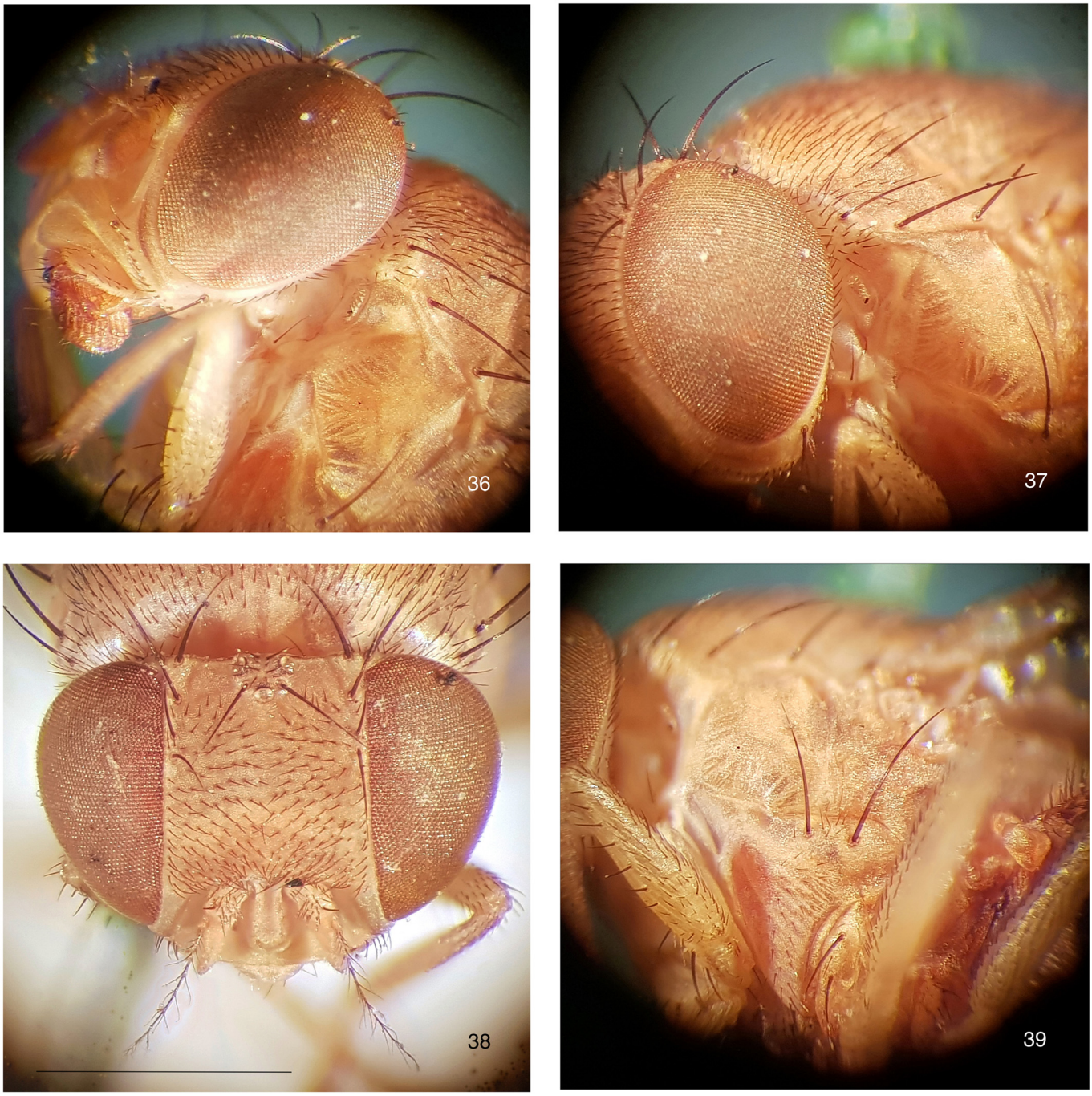
Thorax brownish-yellow (Fig. 1–3), length about 2.8 mm (Fig. 2). Scutum slightly microtrichose, 12 rows of acrostichal setae. Two postpronotals, h index = 0.57. Transverse distance of dorsocentral setae 370% of longitudinal distance; dc index = 0.55; distance between apical scutellars about 80% of that of the apical to the basal one; basal ones divergent, apical ones crossed, scut index = 1.02. Pleura pale yellowish (Fig. 5), sterno index = 1.00. Halter yellow. Legs yellowish, middle tibia with 2 preapical and one ventral apical setae.

Wing transparent, slightly brownish towards tip, both crossveins with broad brownish shadow (Figs. 1 and 2), area around tip of C_1 slightly brownish, length 3.22 mm, length to width ratio = 2.36. Indices: C = 2.62, ac = 1.75, hb = 0.67, 4C = 1.17, 4v = 2.11, 5x = 1.33, M = 0.67, prox. x = 1.06.

Figs. 32–35. *Rhinoleucophenga obesa* (Loew, 1872), male lectotype, Texas, USA [MCZ], habitus, four views. 32, oblique dorsal, 33, left lateral, 34, head and thorax dorsal, 35, abdomen dorsal. Scale bar = 1 mm.

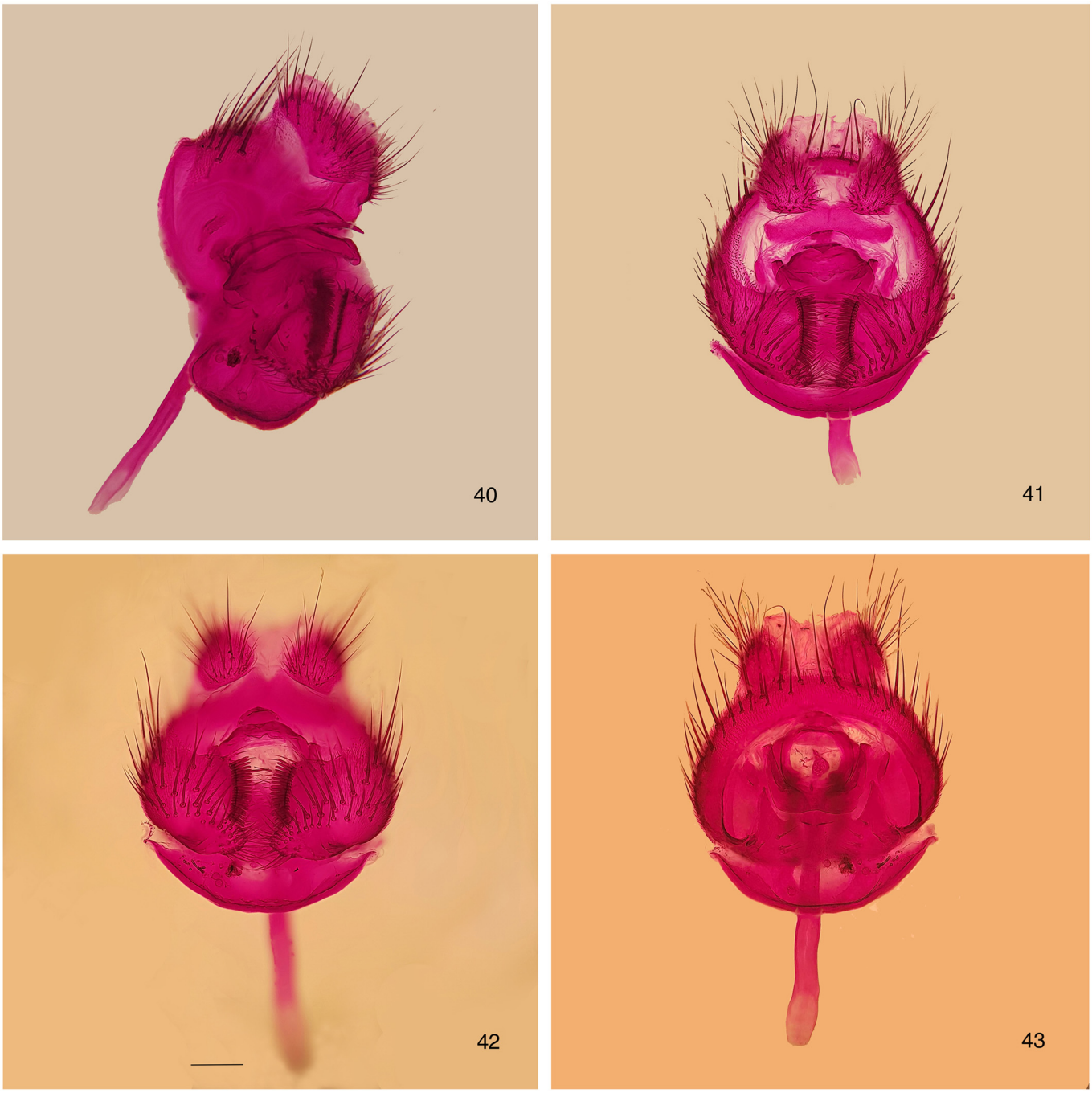
Abdomen yellowish (Fig. 2, 4), obviously with postmortem brownish darkening, but hind margins of tergites pale.

Terminalia ♂ (Figs. 8–23). Epandrium (Figs. 8, 15) conspicuously well developed, anteriorly bare, distally setose and microtrichose (Fig. 15); ventral lobe double-walled (Fig. 17), innerly bearing two rows of setae (Fig. 12): one upper, vertical row of 7 strong and not so long setae and a lower row of 6 remarkably long, pointed inwards, marginally positioned setae; ventral lobe medially positioned, tuberculate, blunt-tipped, projected inwards, setose, devoid of microtrichiae. Cercus (Figs. 9, 10, 15, 16) strongly reduced, mediodorsally setose and microtrichose, anterior margin connected to posterior margin of hypandrium by membranous tissue, posterior margin conspicuously bordered with three rows of hooked scales (serrate in profile view) in the lower half (Fig. 9) and one row in the upper half, lateroventrally bearing a small lobe (Fig. 10). Surstylus conspicuously broom-shaped (Figs. 12, 17), with a convex row of 26 (right surstylus) or 33 (left surstylus) evenly spaced, quite long, distally diverging and roundish-tipped prensisetae, fused to median inner wall of epandrium ventral lobe by a very long tube proximally bearing three long thin setae (Fig. 17); linked to decasternum by a long (as long as surstylus tube), and wrinkled membranous strip. Decasternum unrecognizable, probably



Figs. 36–39. *Rhinoleucophenga obesa* (Loew, 1872), male lectotype, Texas, USA [MCZ], habitus, four close-ups. 36, head, left lateral view, 37, head and thorax, oblique dorsal, 38, head, frontodorsal, 39, katepisternum, left lateral. Scale bar = 1 mm.

membranous. Hypandrium (Fig. 23) conspicuously projected dorsad, where it articulates to outer paraphysis, anteriorly expanded laterally, where it articulates to epandrium, mostly sclerotized, anterior and posterior margin convex and medially membranous, anteriorly bearing a circular membranous area and articulating with the posterior margin of the bag-shaped sternite 7 (probably 7+8 [fused to each other]) whose anterior margin is projected posterad to form a kind of ventral pouch where the surstyli and epandrial lobe are sheltered when terminalia are not protruded; gonopod completely fused to hypandrium arms, devoid of seta. Aedeagus (Figs. 18–22) proximally ring-shaped, distally spatula-shaped in dorsal and ventral (Figs. 11, 18, 22) views, anterodorsally sinuate in lateral view, distally connected to the supposedly fused pair of inner paraphyses, flanked by outer paraphyses, relatively short, ca. 1/3 length of aedeagal apodeme and linked to it by membranous tissue. Outer paraphysis (Figs. 18–22) proximally membranous, distally strongly sclerotized and apparently double-walled, roughly a sinuate, distally turned upwards triangle (in lateral view, Fig. 20), devoid of seta (as in *Rhinoleucophenga gigantea*), pointed outwards at the very end (in dorsal and ventral views); it articulates medially to distal sclerotized projection of hypandrium by membranous tissue. Inner



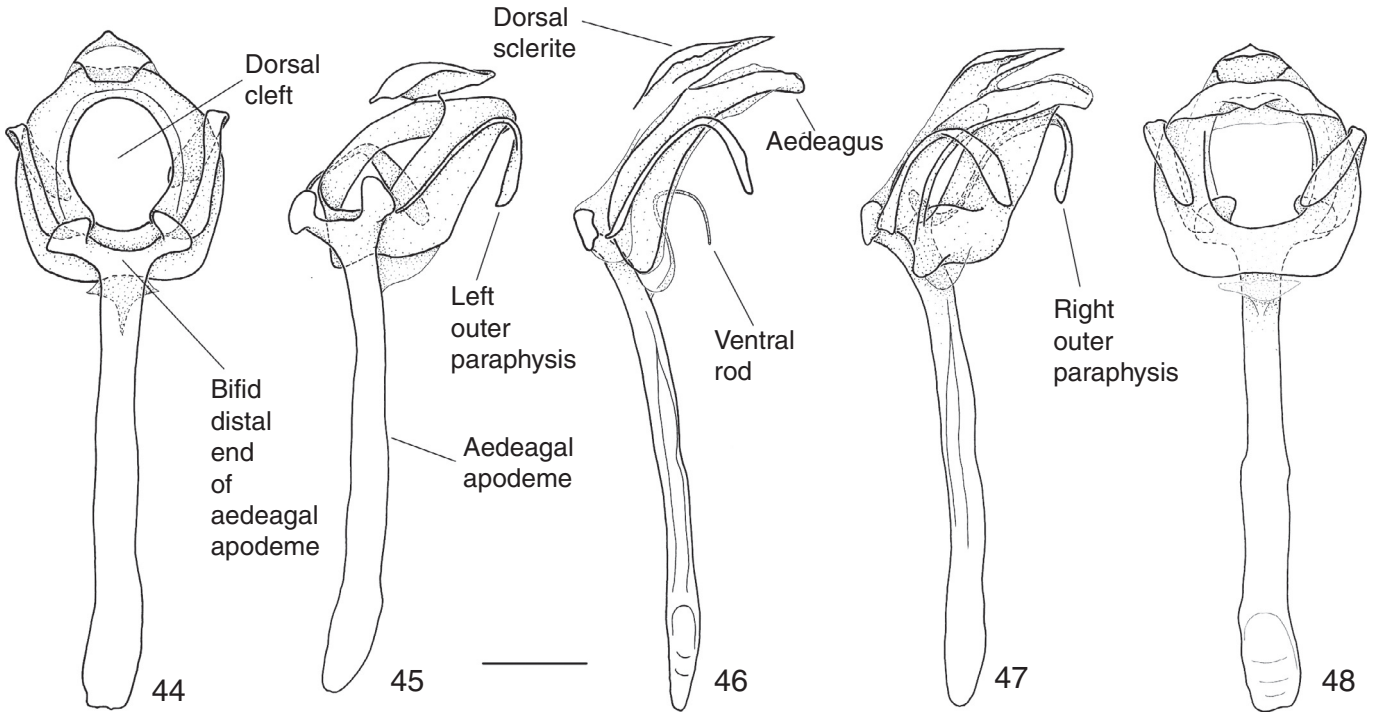
Figs. 40–43. *Rhinoleucophenga obesa* (Loew, 1872), male lectotype, Texas, USA [MCZ], four views of terminalia and sternite 7+8 [fused to each other?] 40, oblique posterior, 41, posterior, 42, posteroventral, 43, anterior. Scale bar = 0.1 mm.

paraphyses most probably fused to each other forming a dorsodistal triangle-shaped sclerite (or dorsal plate) (Fig. 18), anteriorly fused to mediodorsal region of aedeagus. Aedeagal apodeme (Figs. 18–22) very long, rod-shaped, distally bifid (Figs. 18, 22), anteriorly expanded dorsoventrally in lateral view; ventral rod a mostly undistinguishable narrow membranous stripe.

♀(Figs. 24–31)

Differences to male: Abdomen yellowish-brown, tergite 1+2 paler, tergites 4 and 5 with a diffuse brownish longitudinal stripe. Palpus slightly enlarged.

Measurements: Frontal length 0.70 mm, frontal index = 1.11, top to bottom width ratio = 1.08. Frontal triangle about 50% of frontal length; ocellar triangle about 30% of frontal length. Orbital plates about 60% of frontal length. Distance of or3 to or1 = 140% of or3 to vtm, or1 / or3 ratio = 0.96, or2 / or1 ratio = 0.96, vt index = 1.06, postocellar setae = 29% of frontal length, ocellar setae = 76% of frontal length; vibrissal index = 0.27. Cheek index about 12. Eye index = 1.42. Flagellomere 1 (left one only) ratio = 1.91.



Figs. 44–48. *Rhinoleucophenga obesa* (Loew, 1872), male lectotype, Texas, USA [MCZ], five views of aedeagus, dorsal sclerite [= inner paraphyses fused to each other?], outer paraphyses and aedeagal apodeme, from dorsal through ventral. Scale bar = 0.1 mm.

Thorax length 2.48 mm (Fig. 25). h index = 1.00. Transverse distance of dorsocentral setae 380% of longitudinal distance; dc index = 0.59, scut index = 1.00, sterno index = 0.97.

Wing length 3.85 mm. Indices: C = 2.56, ac = 1.56, hb = 0.72, 4C = 0.96, 4 v = 1.62, 5x = 1.00, M = 0.46, prox. x = 0.81.

Distribution

Peru (type locality).

Comments

As mentioned previously, this species cannot be easily distinguished from other *Rhinoleucophenga* species with similar wing pattern.

Hendel (1917) mentioned only the female, which is, therefore, the holotype. The male mentioned by Duda (1927: 43) with wrong date [3.X.03, instead of 8.X.03], is therefore a non-type specimen. Between 1917 and 1925, this specimen was sent by Hendel to Duda, among undetermined specimens, i.e. Hendel never considered it as syntype.

Duda (1927:44) illustrated in left lateral view the terminalia, with the huge, anteriorly bare, epandrium, of the same Peruvian non-type male specimen cited above that we have analyzed in the present paper. In his figure 13, lowercase letters were used to identify four sclerites, as follows: (a) *äussere Gen.-Anh.* [= *Genitalanhänge*, outer genital appendices], (b) *innere Gen.-Anh.* [= *Genitalanhänge*, inner genital appendices], (c) *ventrale Lamellen* [ventral lamella], and d (omitted from the figure caption [cercus?]). According to our interpretation and nomenclature, the dorsal line of lowercase letter "a" points to what we call dorsal sclerite (or fused inner [not outer] paraphyses), ventral line of "a" points the aedeagal tip, lines "b" point the tips of the outer [not inner] paraphyses, "c" points the ventral pouch (probably originated from fusion of sternites 7+8), and "d" points the right cercus, bearing a ventral lobe. Compare Figs. 14–16 of the present paper with Duda's Fig. 13.

The male terminalia of one specimen housed in the collections of American Museum of Natural History, identified and illustrated by Grimaldi (1990: 73, fig. 404 [right ventral area of epandrium and fused surstylus in posterior view]); 75, fig. 422 [hypandrium, aedeagus, outer paraphyses and aedeagal apodeme in ventral view]) as belonging to *Rhinoleucophenga pallida* does not belong to this species. The collection site of this misidentified specimen was omitted in the cited paper. Its outer paraphysis distally bear three setulae, indicating that such specimen could belong to an undetermined species closely related to *R. obesa* (see redescription below) or alternatively, this character could be polymorphic. If this is true, they could belong to the same species as the male specimen collected in Austin (TX, USA), whose terminalia bear two setulae at the distal end of outer paraphysis, and identified and illustrated by Wheeler and Takada (1971) as belonging to *R. obesa*.

As far as known, the within *Rhinoleucophenga* unique terminalia characters of *R. pallida* allow the conclusion that *R. pallida* is obviously a member of a different evolutionary trend, whereas the other known *Rhinoleucophenga* species in general are much similar in terminalia, therefore, most probably form a group of closer related species. See also our comments under *R. obesa*.

Subgenus *Pseudophortica* Sturtevant, 1917, new status

Rhinoleucophenga (Pseudophortica) obesa (Loew, 1869)

(Figs. 32–53, 66, 68–69; Figs. 54–65, 67 for *Phortica hirtifrons*)

Drosophila obesa Loew, 1872: 102 (description).

Osten Sacken, 1878: 205 (affiliation); Aldrich, 1905: 643 (affiliation).

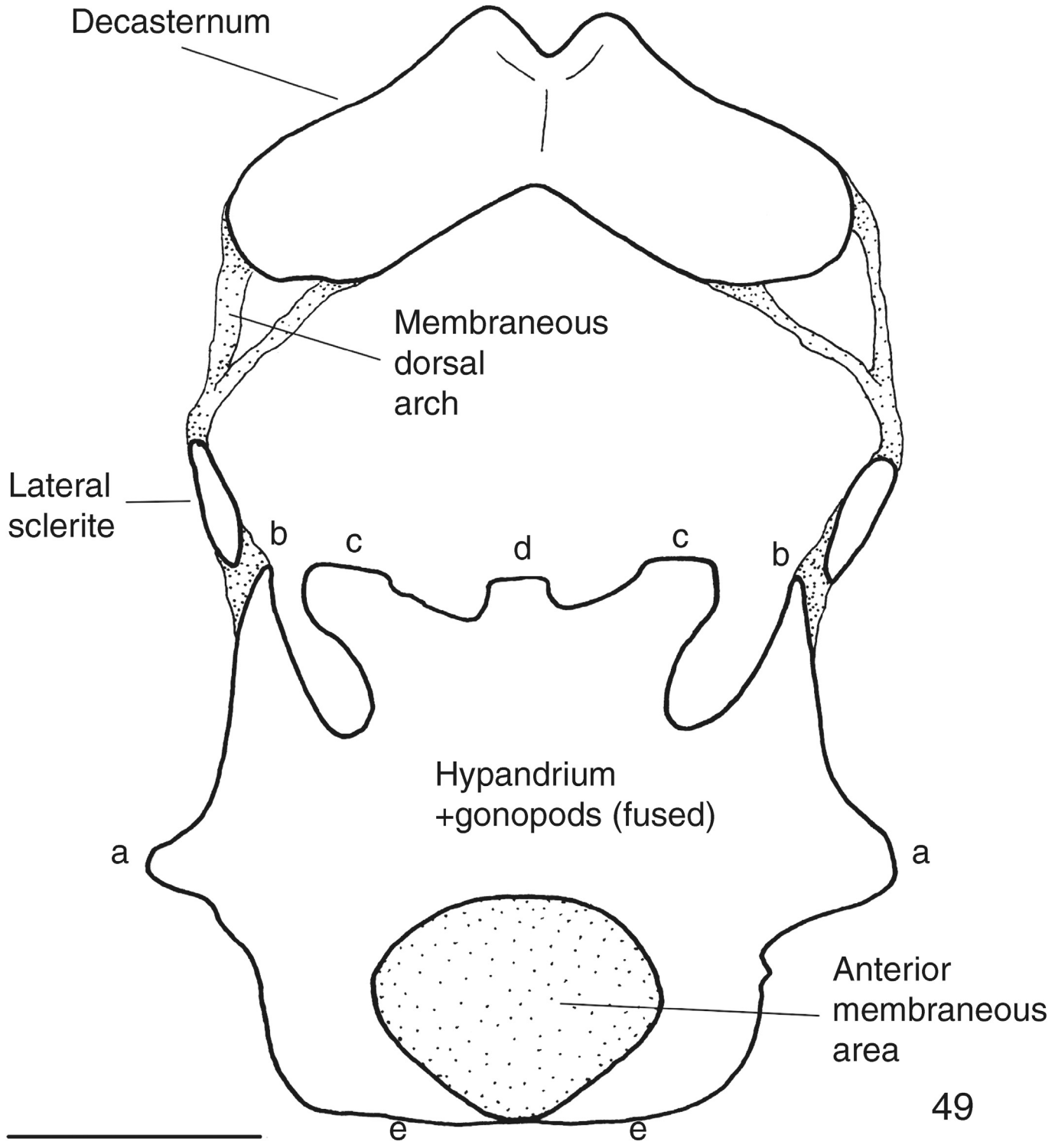


Fig. 49. *Rhinoleucophenga obesa* (Loew, 1872), male lectotype, Texas, USA [MCZ], decasternum, membranous dorsal arch, lateral sclerite and hypandrium+gonopods [fused to each other], posterior view. The lower case letters in the hypandrium figure indicate articulation points with other sclerites: a (epandrium), b, (lateral sclerites and dorsal arch), c (outer paraphyses), d (ventral rod of aedeagal apodeme), and e (sternite 8). Scale bar = 0.1 mm.

Pseudophortica obesa (Loew):

Sturtevant, 1918a: 37 (synonymy, distribution); Sturtevant, 1918b: 441 (affiliation, distribution). Sturtevant, 1921: 58 (synonymy, distribution); Brake and Bächli, 2008: 291, 292 (synonymy, affiliation).

Rhinoleucophenga obesa (Loew): [many of the following references may be based on misidentifications, see comments below]

Malloch and McAtee, 1924: 33 (synonymy); Duda, 1927: 42 (key, description, synonymy); Curran, 1934: 324 ff. (description, figures); Costa Lima, 1935: 62 (description, figures, biology); Brimley,

Figs. 50–53. *Rhinoleucophenga obesa* (Loew, 1872), female paralectotype, Texas, USA [MCZ], habitus, four views. 50, oblique dorsal, 51, left lateral, 52, head and thorax dorsal, 53, abdomen dorsal. Scale bar = 1 mm.

1938: 388 (distribution): Parish and Cushing, 1938: 754 (distribution); Clausen, 1940: 413 (biology); Fulmek, 1943: 82 (biology); Patterson, 1943: 36, plate II (description, distribution, figure); Malogolowkin, 1946: 416 (synonymy, key, description, figure; Hsu, 1949: 87 (description, figures); da Costa Lima, 1950: 247 (affiliation); Thompson, 1950: 1 (biology); Grandi, 1951: 458 (biology); Thompson, 1951: 12 (biology); Wheeler, 1952: 193, 194 (synonymy, distribution); Box, 1953: 83 (biology); de Castro, 1953: 365 (description); Wheeler, 1959: 194 (affiliation); Throckmorton, 1962: 213 ff. (description, figures, phylogeny); Wheeler, 1965: 763 (affiliation); Wheeler, 1970: 79.5 (affiliation); Wheeler and Takada, 1971: 227 (description, figures); Ashburner, 1981: 407 (biology); Val et al., 1981: 135 (distribution); Wheeler, 1981a: 29 (affiliation); Wheeler, 1981b: 112 (distribution); Ferrar, 1987: 149 (biology); Grimaldi, 1990: 55 ff. (description, figures, phylogeny); Vilela, 1990: 499 ff. (synonymy); Remsen and O'Grady, 2002: (phylogeny, distribution); Blauth and Gottschalk, 2007:91 (distribution); De Toni et al., 2007: 207 ff. (biology); Gottschalk et al., 2007: 854 (distribution); Chaves and Tidon, 2008: 344 (distribution); Gottschalk et al., 2008: 510 (distribution); Hochmüller et al., 2010: 290 (distribution); van der Linde et al., 2010: 29 (phylogeny); Junges and Gottschalk, 2014: distribution; Poppe et al., 2014: 220 (key,

Figs. 54–57. *Rhinoleucophenga obesa* (Loew, 1872), female paratype of junior synonym *Phortica hirtifrons*, Crescent City, Florida, USA [IV.1908; MCZ], habitus, four views. 54, oblique dorsal, 55, left lateral, 56, head and thorax dorsal, 57, abdomen dorsal. Scale bar = 1 mm.

distribution); Poppe et al., 2015: 362 (key, description, figures); Roque et al., 2015: 73 (distribution); Poppe et al., 2017: 252 (distribution, phylogeny); Poppe et al., 2018 (distribution, comparison).

Phortica hirtifrons Johnson, 1913: 88 (description, distribution): Sturtevant, 1918: 37 (synonymy); Sturtevant, 1921: 58 (synonymy); Duda, 1927: 42 (synonymy); Costa Lima, 1935: 63 (synonymy); Malogolowkin, 1946: (synonymy); Wheeler, 1952: 193 (synonymy); Wheeler, 1965: 763 (synonymy); Wheeler, 1981: 29 (synonymy); Brake and Bächli, 2008: 292 (synonymy).

Type locality

USA: Texas.

Diagnosis

Body length 4.5 mm. General colour yellowish. Wing transparent, with darkened crossveins and partly brownish marginal border. Frons with 170–190 interfrontal setulae. Frontal index

Figs. 58–61. *Rhinoleucophenga obesa* (Loew, 1872), female non-type specimen, Myrtle Beach, South Carolina, USA [23.VI.1943; MCZ], habitus, four views. 58, oblique dorsal, 59, left lateral, 60, head and thorax dorsal, 61, abdomen dorsal. Scale bar = 1 mm.

$ = 1.12, £ = 1.00. Arista with 8 dorsal, 5–6 long ventral and 6–7 short inner branches, plus short terminal fork. Externally most similar to its three sibling species (*R. cantareira*, sp. nov, *R. gigantea* and *R. pallida*), from which it differs regarding the male terminalia. Epandrium densely setose at distal 2/3, with about 26 upper and 52 outer lower setae; surstylus fused to epandrium bearing a convex (straight at certain angles) row of ca. 21 evenly spaced, quite long, roundish-tipped prensisetae; aedeagus ring-shaped, distally bearing one small, dorsal, folded over itself (when aedeagus is not protruded), pentagon-shaped (in dorsal view) sclerite or plate (putatively the inner paraphyses fused to each other); outer paraphysis dorsoventrally flattened, anteriorly no bifid, slightly shorter than aedeagus, devoid of setae (as in *R. gigantea*); distal end of aedeagal apodeme shallowly bifid with turned inwards but not sharply pointed tips (in dorsal view).

Material examined

Lectotype ♂ (by present designation), labelled: "Texas / Lefr. // 82 [handwritten] // Loew / Coll. // Type / 13414 [number handwritten] // MCZ-ENT / 00303649 // *Rhinoleucophenga* / *obesa* (Loew) / Vilela

Figs. 62–65. *Rhinoleucophenga obesa* (Loew, 1872), female non-type specimen, Orlando, Florida, USA, [IV.1929; MCZ], habitus, four views. 62, oblique dorsal, 63, left lateral, 64, head and thorax, 65, abdomen. Scale bar = 1 mm.

& Bächli det. 2017 // Lectotype // ♂" [microvial with terminalia and other abdomen remains] (MCZ).

Paralectotype ♀ (by present designation), labelled: "Texas / Lefr. [both handwritten] // Loew / Coll. // obesa // Lw. Cent. X [all handwritten] // Type / 13414 [number handwritten] // Ant Image / Database // MCZ-ENT / 00013414 // *Rhinoleucophenga / obesa* (Loew) / Vilela & Bächli det. 2017 // Paralectotype // ♀" (MCZ).

Description

♂ (Figs. 32–49)

Head generally yellowish. Frons with about 170 short interfrontal setulae which in upper half are predominantly bent inwards, in lower half more downwards. Frontal length 0.93 mm; frontal index = 1.12. Frontal triangle indistinct, about 24% frontal length;

Figs. 66–69. *Rhinoleucophenga obesa* (Loew, 1872), close-ups of four female specimens, head, frontodorsal view. 66, paralectotype, Texas, USA [MCZ]; 67, paratype of junior synonym *Phortica hirtifrons*, Crescent City, Florida, USA [IV.1908; MCZ], 68, non-type specimen, Myrtle Beach, South Carolina, USA [23.VI.1943; MCZ], 69, non-type specimen, Orlando, Florida, USA, [IV.1929; MCZ]. Scale bar = 1 mm.

ocellar triangle with brownish margins inwards of the ocelli, about 20% frontal length. Orbital plates about 50% frontal length. Orbital setae almost in a row, distance of or3 to or1 = 155% of or3 to vtm, or1 / or3 ratio = 1.05, or2 / or1 ratio = 0.73, vt index = 0.85, postocellar setae short, bent inwards, obviously distant, not crossed, about 15% of frontal length, ocellar setae = 49% of frontal length; one vibrissal seta. Cheek index about 8. Eye index = 1.43. Flagellomere 1 parallel-sided, length about 1.8 times width. Arista with 8 dorsal, 6 ventral and about 6 short inner branches, plus short terminal fork. Proboscis and palpus yellow.

Thorax and legs yellowish. Length about 2.5 mm, 12 rows of acrostichal setae. One postpronotal. Transverse distance of dorsocentral setae about 350% of longitudinal distance; dc index = 0.56, distance between apical scutellars about 90% of that of the apical to the basal one; basal ones divergent; scut index about 1.0. Sterno index = 0.9. Halter yellow.

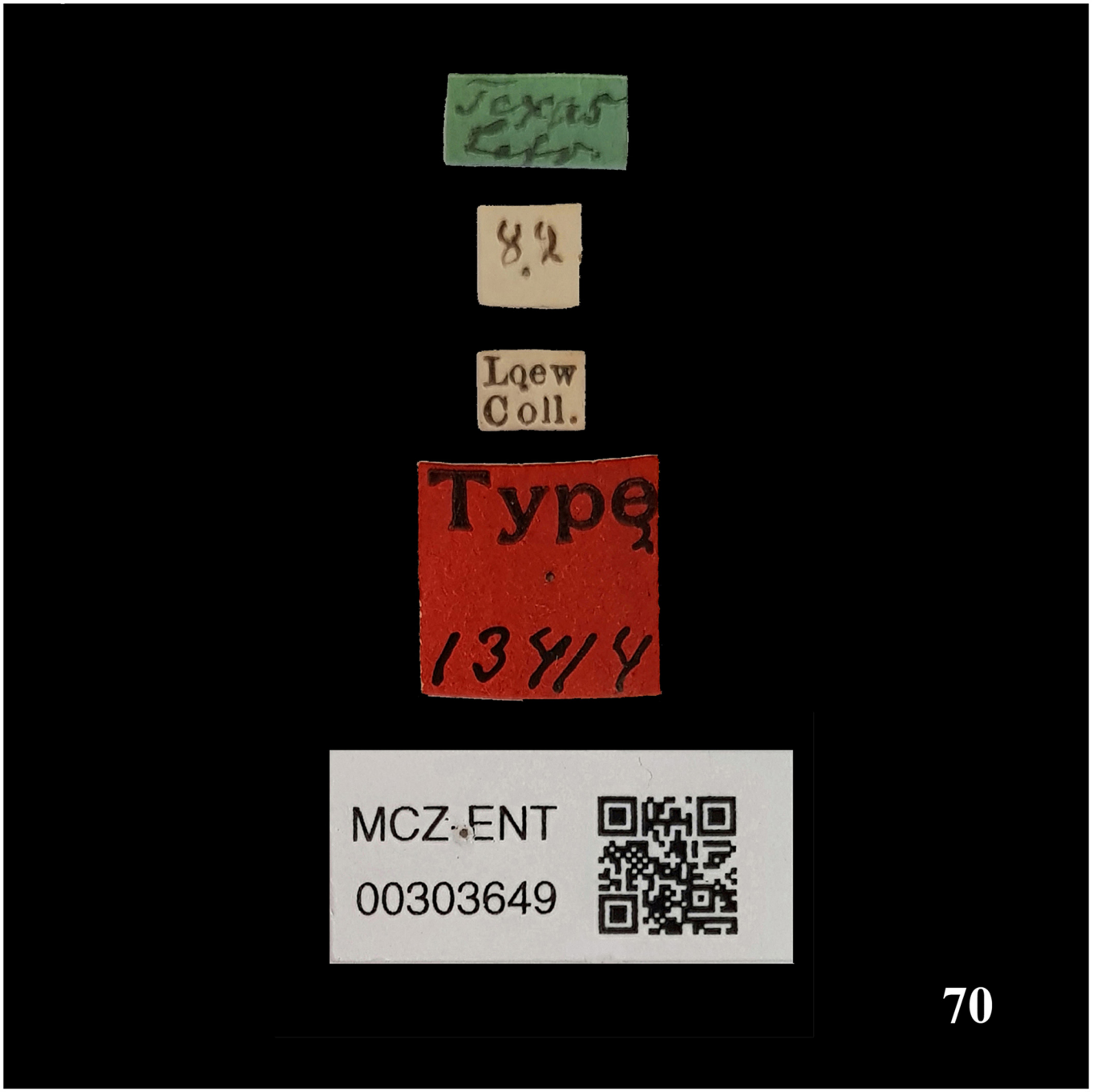


Fig. 70. *Rhinoleucophenga obesa* (Loew, 1872), labels of the male lectotype.

Wing transparent, but both crossveins brownish, the external one brownish shadowed, costal margin slightly infuscate, in particular between r_{2+3} and r_{4+5}, length = 4.02 mm, length to width ratio = 2.6. Indices: C = 3.59. ac = 1.16, hb = 0.41, 4C = 0.71, 4 v = 1.39, 5x = 0.88, M = 0.45, prox. X = 0.81.

Abdomen generally yellowish, slightly darkened apicad, tergites III and IV with indistinct brownish marginal bands.

Terminalia ♂ (Figs. 40–49). Epandrium (Figs. 40–43) ventrally double-walled microtrichose except for proximal $^{1/2}$ and ventral area and tip, densely setose (Figs. 41–43) (sparsely setose in *R. cantareira* sp. nov.) at distal 2/3 with about 26 upper (ca. 18 in *R. cantareira* sp. nov.) and 52 outer lower setae (only ca. 30 in *R. cantareira* sp. nov.), proximal ones smaller, distal ones larger, smallest and thinnest at ventral inner tip; ca. 40 inner lower smaller setae, plus one inner very strong seta adjacent to the third upper prensisetae; anterodorsal margin convex, anteroventral margin concave; ventral lobe not recognizable, probably fused to surstylus. Cercus of median size (Figs. 40–43), anteriorly connected to epandrium by membranous tissue, microtrichose, setose, devoid of ventral lobe; apparently connected anteroventrally to a squared, slightly sclerotized decasternum; ventral margin straight. Surstylus (Figs 40–42) completely fused to epandrium, not microtrichose,

Figs. 71–73. *Rhinoleucophenga gigantea* (Thomson, 1869), male holotype, Buenos Aires, Argentina [NRS], three views of aedeagus, outer paraphyses and aedeagal apodeme. 71, dorsal, 72, left lateral, 73, ventral. Scale bar = 0.1 mm.

with a slightly convex (straight at certain angles) (conspicuously sinuate in *R. cantareira* sp. nov.) row of 21 (left side) and 20 (right side) evenly spaced, quite long, roundish-tipped prensisetae. Decasternum (Fig. 49) sclerotized, as large as cercus, shaped like a spread pair of wings (or a pair of pollinia) anteriorly fused to each other, vertically and upper positioned behind lower half of cerci (a narrow, horizontally positioned rectangle-shaped stripe in *R. cantareira* sp. nov.). Hypandrium (Fig. 49) reduced, connected to epandrium with membranous tissue, as long as aedeagus (excluding aedeagal apodeme), roughly squared in ventral (posterior) view, anteromedian region membranous, forming a circle and articulating with the posterior margin of the bag-shaped sternite 7 (or 7+8) whose anterior margin is projected posterad to form a kind of ventral pouch where the surstyli and epandrial lobe are sheltered when terminalia are not protruded; anterior margin straight, posterior margin with two sublateral projections (outer and inner) that connect the hypandrium with membranous dorsal arch (Fig. 49b) and outer paraphyses (Fig. 49c) respectively; posterior hypandrium process rudimentary (Fig. 49d), where the connection with ventral rod of aedeagal apodeme occurs; gonopod unrecognizable, probably completely fused to posterior margin of hypandrium and represented by the inner projections (Fig. 49c), devoid of seta; lateral margins medially expanded outwards (Fig. 49a), where hypandrium and epandrium articulate; within the membranous stripe connecting outer sublateral projection to dorsal arch and decasternum (probably attached to each other) there is a small, sclerotized, and somewhat elliptical lateral sclerite (also present in *R. gigantea*; see Vilela, 1990: 501, figs. 3–5). Aedeagus (Figs. 44–48) dorsoventrally flattened, somewhat ringed, shaped like a toilet seat without lid, distally bearing one dorsal, folded over itself (when aedeagus is not protruded), pentagon-shaped (in dorsal view) sclerite; articulated to aedeagal apodeme by membranous tissue; flanked by outer paraphyses. Outer paraphysis dorsoventrally flattened, slightly shorter than aedeagus, proximally not bifid (bifid in *R. gigantea* [Fig. 70 and Vilela, 1990: 502, figs 8–9]), distally not widened, devoid of setulae (four setulae at distal tip in *R. cantareira* sp. nov.), turned ventrad at tip, and articulated to aedeagal apodeme by membranous tissue. Aedeagal apodeme twice as long as aedeagus, rod-shaped, dorsally bifid at posterior end, ventral rod tilde-shaped in lateral view, mostly membranous.

♀(Figs. 50–53, 66)

We accept that this specimen is a paralectotype of *R. obesa* because both lectotype and paralectotype specimens were collected together. Differences to male: Palpus distinctly broadened. Abdomen distinctly darker towards tip.

Measurements: Frontal length 0.85 mm, frontal index = 1.00, top to bottom width ratio = 0.88, about 190 interfrontal setulae. Distance of or3 to or1 = 110% of or3 to vtm, or2 / or1 ratio = 0.60, vt index 0.90, postocellar setae = 22% of frontal length, ocellar setae = 56% of frontal length; vibrissal index = 0.28, Cheek index about 9. Eye index = 1.49. Flagellomere 1 ratio = 1.82. Arista with 7–9 long dorsal, 5–7 long ventral and about 7 short inner branches, plus short terminal fork.

Thorax length 2.36 mm; dc index = 0.56, scut index = 0.98, sterno index = 0.83.

Wing length 4.03 mm, length to width ratio = 2.13. Indices: C = 3.55, ac = 1.18, hb = 0.40, 4C = 0.69, 4 v = 1.38, 5x = 1.08, M = 0.48, prox. x = 0.79.

Paratype (♀) of *Phortica hirtifrons* (Figs. 54–57, 67), glued to a narrow strip of cardboard [maybe a different species].

Figs. 74–77. *Rhinoleucophenga cantareira* sp. nov., male holotype, Parque Estadual da Cantareira, São Paulo, SP, Brazil [I.1953; ZMUZ], habitus, four views. 74, oblique dorsal, 75, left lateral, 76, head and thorax dorsal, 77, abdomen dorsal. Scale bar = 1 mm.

Measurements: Frontal length 0.97 mm, frontal index = 1.14, top to bottom width ratio = 0.94. Distance of or3 to or1 = 150% of or3 to vtm, vt index 0.91, postocellar setae =18% of frontal length. Eye index = 1.41. Flagellomere 1 ratio = 1.82. Arista with 7 long dorsal, 6 long ventral and about 7 short inner branches, plus short terminal fork.

Thorax length 2.42 mm.

Wing length about 4 mm. Indices: C = 3.95, ac = 1.19, hb = 0.42, 4C = 0.61, 4v = 1.32, 5x = 0.80, M = 0.39, prox. x = 0.48.

Distribution

Texas. Other published records may be doubtful because the identity of the respective specimens remains open. However, considering the wide distribution area, some records may be correct. See comments below.

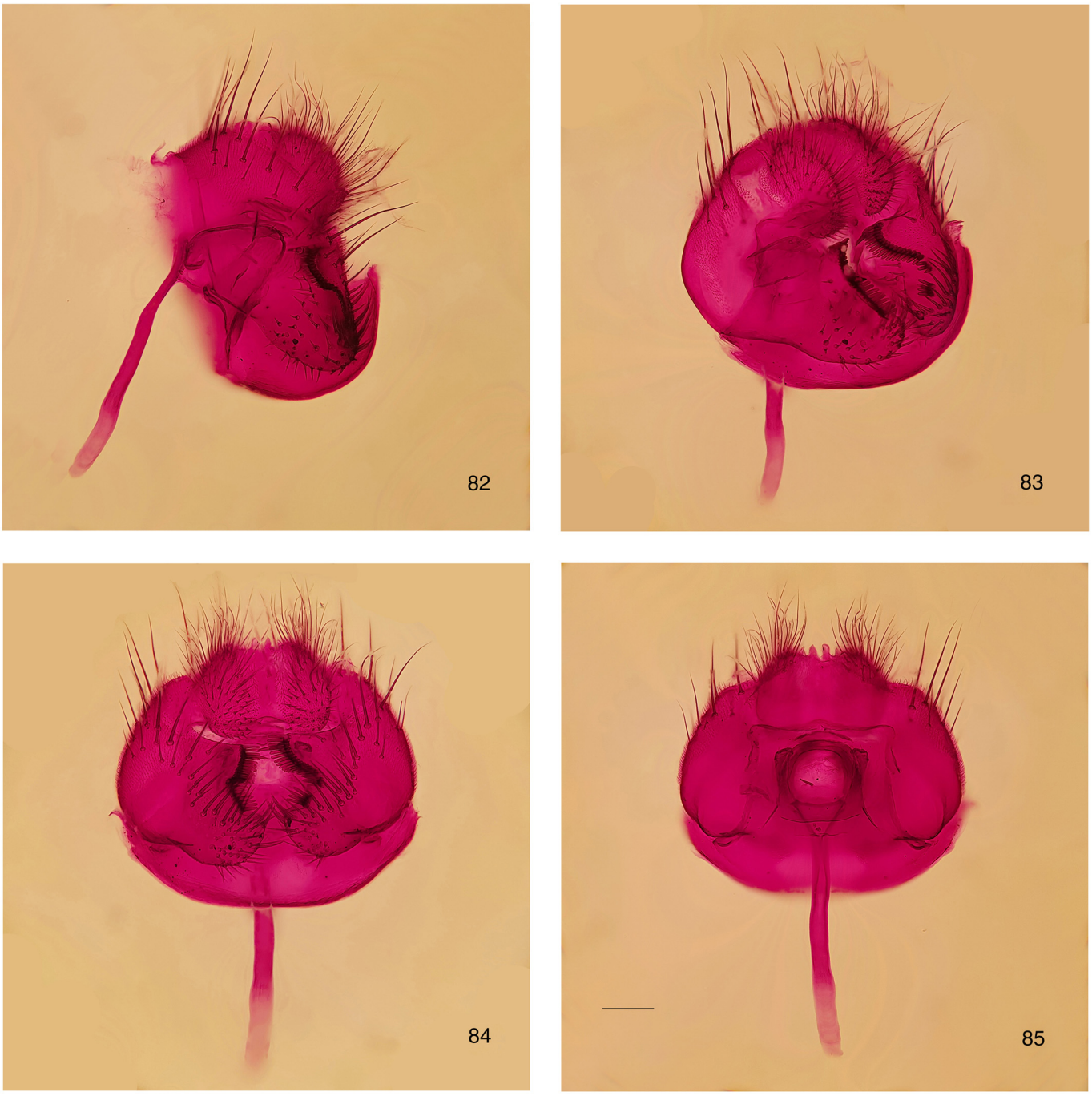
Comments

The first label (Fig. 70) attached to the male lectotype reads "Texas / Lefr." [handwriting not clearly legible]. We suspect the unreadable word could refer either to a small or forgotten locality name in the state of Texas, not found in actual maps, or to the collector. However, if it refers to the latter, the collector name should read Belfrage according to Loew (1872). In his paper about the collection sites of Gustav Wilhelm Belfrage, Geiser (1933) cited approximate localities only; we suggest that either Houston or more probably

Figs. 78–81. *Rhinoleucophenga cantareira* sp. nov., male holotype, Parque Estadual da Cantareira, São Paulo, SP, Brazil [I.1953; ZMUZ], habitus, four close-ups. 78, head, frontodorsal, 79, scutellum, dorsal, 80, head, left lateral, 81, left katepisternum, lateral. Scale bar = 1 mm.

Bosque County are likely localities as Belfrage lived at these sites for longer periods.

According to the male terminalia illustrations from the literature, the inner paraphyses drawings of a specimen from Austin (TX, USA) identified by Wheeler and Takada (1971) as belonging to *R. obesa* are distally setulose (bearing 2 setulae). So are those (bearing 3 setulae) of a specimen from the state of Mato Grosso [unspecified locality] (Brazil) identified by Malogolowkin (1946) as belonging to the same species. However, it should be noted that the prensisetae of the surstylus of the first specimen are arranged in an apparently slightly convex row while those of the latter species are arranged in a conspicuous sinuate row. Based on this terminalia character we consider that the latter species clearly belongs to a species different from *R. obesa*. Nevertheless, the specimen from Austin could be ascribed to *R. obesa* if one considers the possibility that the character presence/absence of setulae at distal end of outer paraphysis could be polymorphic. It should also be noted that the outer paraphyses of the lectotype of

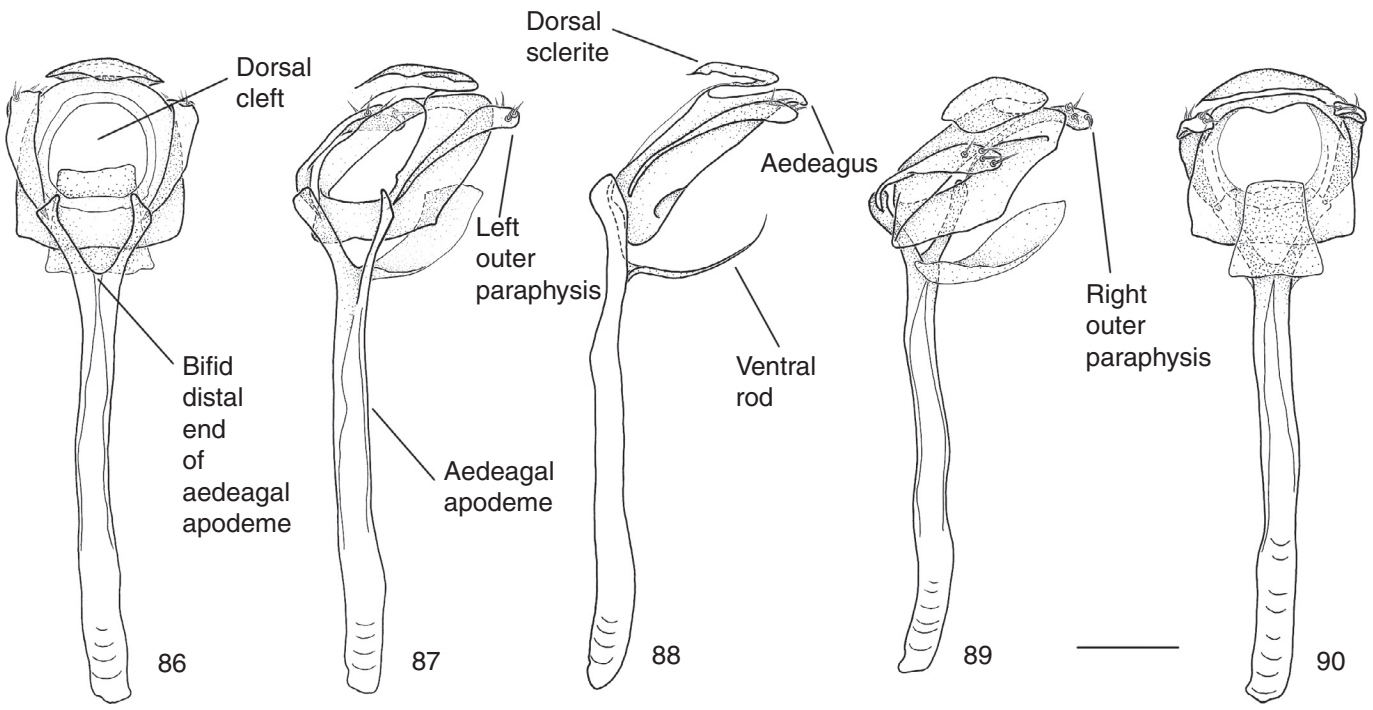


Figs. 82–85. *Rhinoleucophenga cantareira* sp. nov., male holotype, Parque Estadual da Cantareira, São Paulo, SP, Brazil [I.1953; ZMUZ], four views of terminalia and sternite 7+8, 82, left lateral, 83, oblique posterior, 84, posterior, 85, anterior. Scale bar = 0.1 mm.

R. obesa are devoid of setulae, as it happens with the holotype of *R. gigantea* (Figs. 71–73 and Vilela, 1990: figs. 8–12), and the prensisetae of their surstyli are arranged in a convex and not a sinuate row.

Comparison of the internal male terminalia of the lectotype of *R. pallida* (Figs. 18–23) with those of the lectotype of *R. obesa* (Figs. 44–49) as illustrated in the present paper has shown that they are remarkably different from each other, in disagreement with the following statement made by Malloch and McAtee (1924: 33) under the subtitle Genus *Rhinoleucophenga* Hendel: "Hendel's species *pallida* is a synonym of *obesa* Loew".

We have also analyzed and photomicrographed the female paratype of *Phortica hirtifrons* Johnson (Figs. 54–57, 67) of the MCZ, labelled "Crescent City / Fla. Apr.'08 / Van Duzee", and two female specimens of the MCZ, one labelled "Myrtle Beach, S. C. [South Carolina] / VI. 23. 1943 / C. T. Parsons" (Figs. 58–61, 68), the other labelled "Orlando Fla [Florida] / IV.29" (Figs. 62–65, 69).



Figs. 86–90. *Rhinoleucophenga cantareira* sp. nov., male holotype, Parque Estadual da Cantareira, São Paulo, SP, Brazil [I.1953; ZMUZ], five views of aedeagus, outer paraphyses and aedeagal apodeme, from dorsal through ventral. Scale bar = 0.1 mm.

However, we abstain from identifying them, because females remain unidentified. We do hope that the holotype of *Phortica hirtifrons*, housed in the American Museum of Natural History, New York, is indeed a male (as stated by Johnson), which would in the future be allowed to confirm its synonymy with *R. obesa* from Texas.

Rhinoleucophenga (Pseudophortica) cantareira sp. nov. (Figs. 74–122)

Type locality

Brazil, State of São Paulo, City of São Paulo, Parque Estadual da Cantareira [Cantareira State Park].

Diagnosis

Body length about 5 mm. General colour yellowish. Wing with both crossveins brownish shadowed, costal border slightly darkened, darker towards wing tip, also tip of r_1 slightly darkened. Frons with about 150 interfrontal setulae. Frontal index about 1.10–1–20. Arista with 7–11 long dorsal, 6–9 long ventral and about 6–8 short inner branches, plus short terminal fork. Epandrium sparsely setose and only at distal 1/3 (proximal 2/3 devoid of setae). Surstylus with a conspicuously sinuate row of ca. 25 evenly spaced, quite long, and roundish-tipped prensisetae. Aedeagus dorsoventrally flattened, somewhat ringed, toilet seat-shaped, distally bearing one dorsal, folded over itself, pentagon-shaped sclerite. Outer paraphysis dorsoventrally flattened, proximally not bifid (as in *R. obesa*, but bifid or even trifid in *R. gigantea*, Fig. 71), slightly shorter than aedeagus, distally widened and bearing four setulae (slightly widened distally and devoid of setulae in *R. gigantea*, not widened distally but devoid of setulae in *R. obesa*). Aedeagal apodeme distally deeply (or not so) bifid with sharply pointed (or somewhat squared) tips not remarkably turned inwards; ventral rod tilde-shaped in lateral view, mostly membranous.

Material examined

Holotype ♂, labelled: "Brasilia, [Brazil] / Cantareira S.P. [São Paulo state] / I. 1953 / da Cunha leg. // *Rhinoleucophenga* / Cantareira [both handwritten] // *Rhinoleucophenga* / *obesa* Loew / G. Bächli det. // *Rhinoleucophenga* / *cantareira* sp. nov. / Vilela & Bächli det. 2017 // HOLOTYPE" [microvial with terminalia and other abdomen remains] (ZMZ).

Paratype ♂, labelled: "Brasilia [Brazil], S.P. [São Paulo state] L 634 / São Sebastião / 19.–20. III. 1986 / v. Tschirnhaus leg. // L 635 Brazil [handwritten] / Universität Bielefeld // ♂ // *Rhinoleucophenga* / *cantareira* sp. nov. / Vilela & Bächli det. 2017 // PARATYPE" [microvial with terminalia and other abdomen remains] (ZMZ).

Paratype ♀ [#2], labelled: "Brasilia, [Brazil] S.P. [São Paulo state] / X524 São Sebastião / 19.–20.III.1986 / v. Tschirnhaus leg. // X 524 Brazil // *Dros.* sp. [all handwritten] // leg. et det. M. v. Tschirnhaus // ♀ // *Rhinoleucophenga* / *obesa* Loew / G. Bächli det. // *Rhinoleucophenga* / *cantareira* sp. nov. / Vilela & Bächli det. 2017 // PARATYPE" (ZMZ).

Paratype ♀ [#3], labelled: "Brasilia, [Brazil] S.P. [São Paulo state] L 634 / São Sebastião / 19.–20. III. 1986 / v. Tschirnhaus leg. // ♀ // *Rhinoleucophenga* / *obesa* Loew / G. Bächli det. // *Rhinoleucophenga* / *cantareira* sp. nov. / Vilela & Bächli det. 2017 // PARATYPE" (ZMZ).

Description

♂ ($n = 2$) (Figs. 74–107).

Head generally yellow, all setae blackish. Frons yellow, with about 150 short interfrontal setulae which are predominantly bent inwards. Frontal length 0.90–0.99 mm; frontal index = 1.09–1.10, top to bottom width ratio = 1.00–1.02. Frontal triangle indistinct, about 30% frontal length. Orbital plates about half frontal length.

Figs. 91–94. *Rhinoleucophenga cantareira* sp. nov., male paratype, São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], habitus, four views. 91, oblique dorsal, 92, left lateral, 93, head and thorax dorsal, 94, abdomen dorsal. Scale bar = 1 mm.

Ocellar triangle slightly prominent, about 20% frontal length. Orbital setae almost in a line, distance of or3 to or1 = 155% of or3 to vtm, or1 / or3 ratio = 1.08–1.11, or2 / or1 ratio = 0.58–0.64, vt index = 0.92, postocellar setae wide apart, bent inwards, about 17–19% of frontal length, ocellar setae about 49–59% of frontal length, vibrissal index = 0.38. Carina almost parallel-sided, slightly prominent downwards, with a shallow longitudinal furrow. Cheek index about 10. Eye index = 1.33–1.39. Occiput concave, yellowish. Length to width ratio of flagellomere 1 = 2.00. Arista with 9–11 long dorsal, 7–9 long ventral and 6–8 short inner branches, plus short terminal fork.

Thorax yellowish (Figs. 74–77, 91–94), length about 2.72–3.06 mm, about 12 rows of acrostichal setae, only lower postpronotal seta present. Transverse distance of dorsocentral setae about 4 times longitudinal distance; dc index about 0.47–0.55. One pair of prominent central prescutellar setae, about 70% length of posterior dorsocentrals, together with 2 to 3 pairs of very short lateral dorsocentrals. Scutellum apically roundish, scutellar setae almost equidistant; basal ones divergent, distal ones crossed; scut index = 1.02–1.04. Sterno index = 0.95, mid katepisternal seta absent, but a vertical row of small setae present. Halter yellowish. Legs yellowish, preapical seta and ventral apical seta on mid tibia.

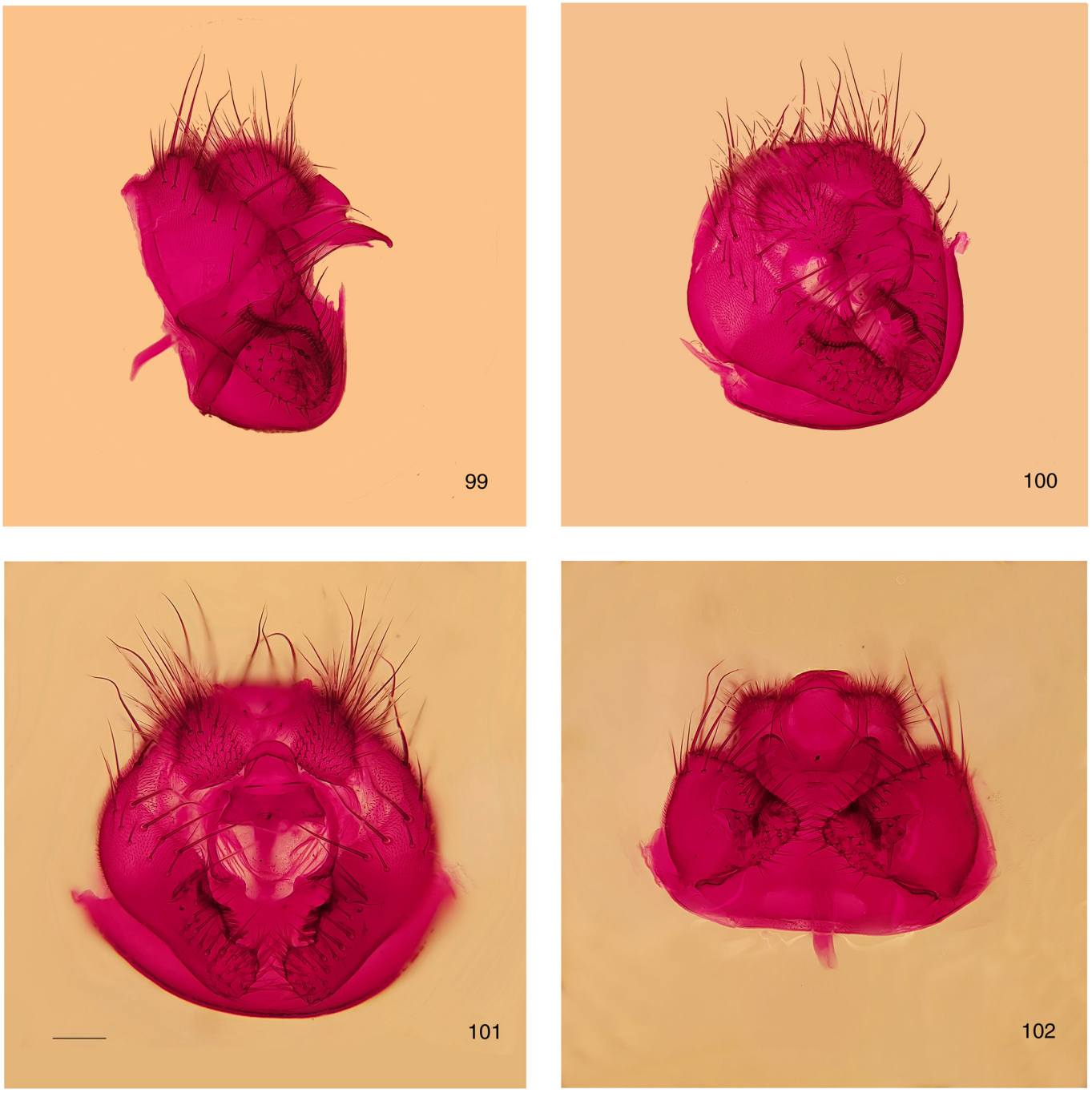
Wing (Figs. 74–76, 92–94): both crossveins brownish shadowed, costal border slightly darkened, darker towards wing tip, also tip of r_1 slightly darkened, length 4.55–4.90 mm, length

Figs. 95–98. *Rhinoleucophenga cantareira* sp. nov., male paratype, São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], habitus, four close-ups. 95, head, oblique frontal, 96, head, frontodorsal, 97, head, frontal, 98, scutellum, dorsal. Scale bar = 1 mm.

to width ratio = 2.00–2.06. Indices: C = 3.26–3.46, ac = 1.15–1.37, hb = 0.42–0.48, 4C = 0.74–0.77, 4 v = 1.37–1.40, 5x = 0.76–0.93, M = 0.37–0.47, prox. x = 0.86–0.90.

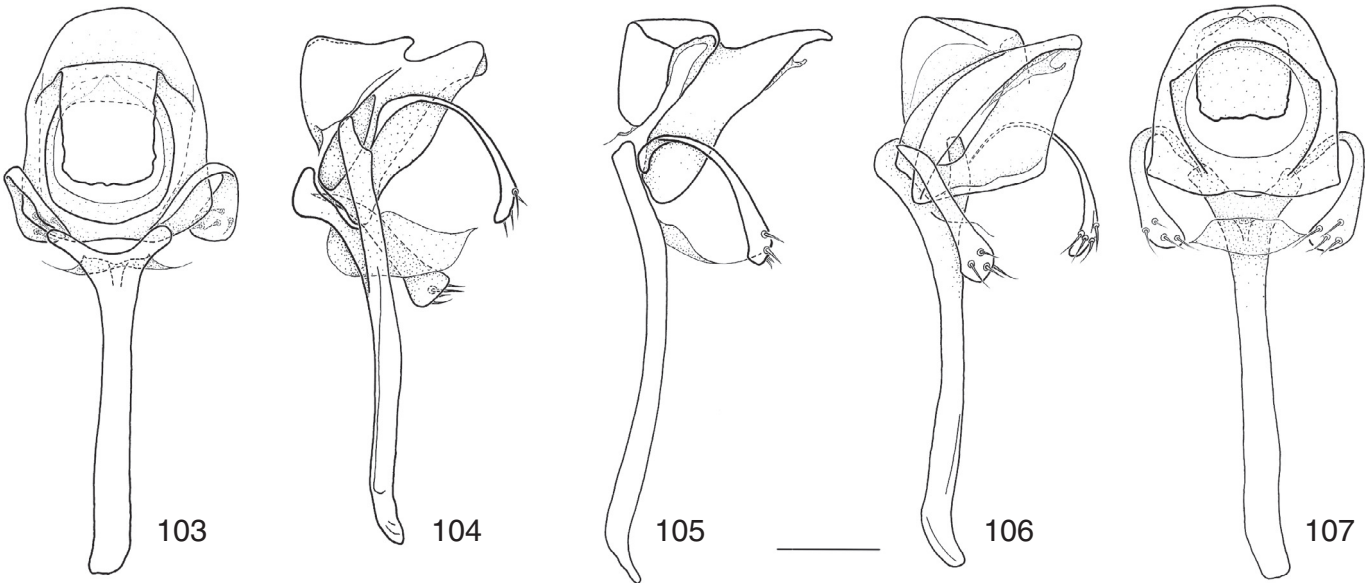
Abdomen (Figs. 75, 77, 92, 94) basally yellowish, darker towards tip, some tergites with a darker apical margin which may be medially broadened.

Terminalia ♂ (Figs. 82–90, 99–107). Epandrium ventrally double-walled, microtrichose except for proximal ¼ and ventral area, sparsely setose (Figs. 84, 100) (densely setose in *R. obesa)* at distal 1/3 with about 18 upper (ca. 26 in *R. obesa*) and 30 outer lower setae (ca. 52 in *R. obesa*), proximal ones smaller, distal ones larger; 30 inner lower smaller setae, plus one inner strong seta adjacent to third upper prensisetae; anterodorsal margin convex, anteroventral margin concave; ventral lobe not recognizable, probably fused to surstylus. Cercus large, anteriorly connected to epandrium by membranous tissue, microtrichose, setose, devoid of ventral lobe; apparently connected anteroventrally to a sclerotized decasternum; ventral margin straight. Surstylus (Figs. 82–84, 100) completely fused to epandrium, not microtrichose, with a conspicuously sinuate row of 26 (left side) and 23 (right side) evenly spaced, quite long, and roundish-tipped prensisetae, bearing a strong seta innerly to second or third dorsal



Figs. 99–102. *Rhinoleucophenga cantareira* sp. nov., male paratype, São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], four views of terminalia and sternite 7+8 [fused to each other?]. 99, left lateral, 100, oblique posterior, 101, posterior, 102, ventral. Scale bar = 0.1 mm.

prensiseta; two gaps seen between some prensisetae at lower right surstylus (Figs. 83, 84) are considered a case of improper development. Decasternum narrow, shaped like a rectangular stripe, sclerotized, horizontally positioned beneath cerci (as large as cercus in *R. gigantea*). Hypandrium reduced, connected to epandrium with membranous tissue, as long as aedeagus (without aedeagal apodeme), roughly square-shaped in ventral (posterior) view, anteromedian region membranous like a circle and articulating with the posterior margin of the bag-shaped sternite 7+8(?), whose anterior margin is projected posterowards to form a kind of ventral pouch where the surstyli and epandrial lobe are sheltered when terminalia are not protruded; anterior margin straight, posterior margin with two sublateral projections (outer and inner) that connect hypandrium with dorsal arch (and associated decasternum) and outer paraphyses respectively; the stripe connecting outer sublateral projection to membranous dorsal arch and sclerotized decasternum (probably attached to each other) is almost but not completely sclerotized since two elliptical sclerites (Fig. 85), close to outer sublateral projections, can be seen from the anterior view of the terminalia (also seen in *R. gigantea* and *R. obesa*, but not in *R. pallida*); posterior hypandrium process rudimentary, where the connection with ventral rod of aedeagal apodeme occurs; gonopod



Figs. 103–107. *Rhinoleucophenga cantareira* sp. nov., male paratype, São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], five views of aedeagus [protruded], outer paraphyses and aedeagal apodeme, from dorsal through ventral. Scale bar = 0.1 mm.

unrecognizable, probably completely fused to posterior margin of hypandrium and represented by the inner projections, devoid of seta; lateral margins medially expanded outwards, where it articulates to epandrium. Aedeagus (Figs. 86–90, 103–107) dorsoventrally flattened, somewhat ringed, shaped like a toilet seat without lid, distally bearing one dorsal, folded over itself, pentagon-shaped sclerite articulated to aedeagal apodeme by membranous tissue; flanked by outer paraphyses. Outer paraphysis (Figs. 89, 106, 107) dorsoventrally flattened and proximally not bifid (as in *R. obesa*, but bifid or even trifid (Fig. 71) in *R. gigantea*), slightly shorter than aedeagus, bearing four setae at distal tip (devoid of setae in *R. gigantea* and *R. obesa*), turned ventralwards at tip, and articulated to aedeagal apodeme by membranous tissue. Aedeagal apodeme (Figs. 86, 87, 89, 91) twice length of aedeagus, rod-shaped, deeply bifid at posterior end, ventral rod (Figs. 86–90, 103–107) tilde-shaped in lateral view, mostly membranous.

♀ (*n* = 2) (Figs. 108–122)

Differences to male: Palpus (Figs. 115, 122) distinctly broadened. Abdomen distinctly darker towards tip.

Measurements: Frontal length 0.90–0.94 mm, frontal index = 1.15–1.20, top to bottom width ratio = 1.00–1.02. Distance of or3 to or1 = 110% of or3 to vtm, or1 / or3 ratio about 1.03–1.07, or2 / or1 ratio = 0.59–0.63, vt index 0.97–1.00, postocellar setae = 17% of frontal length, ocellar setae = 48% of frontal length; vibrissal index = 0.40. Eye index = 1.44–1.45. Cheek index 12–16. Flagellomere 1 ratio = 2.00–2.09. Arista with 7–11 long dorsal, 6–7 long ventral and about 6 short inner branches, plus short terminal fork.

Thorax length 2.72 mm; dc index = 0.47–0.55, scut index = 0.98, sterno index = 0.82–0.89.

Wing length 4.37 mm, length to width ratio = 1.89. Indices: C = 3.16–3.59, ac = 1.16–1.25, hb = 0.41–0.44, 4C = 0.74–0.77, 4 v = 1.39–1.50, 5x = 0.75–0.88, M = 0.40–0.45, prox. x = 0.81–0.83.

Etymology

Epithet: Noun, referring to the type locality of the holotype.

Distribution

Brazil. State of São Paulo (but probably present in most Brazilian states).

Comments

We have concluded that specimens of *Rhinoleucophenga* from Brazil identified as *R. obesa* by Malogolowkin (1946) and Costa Lima, 1935, collected in the state of Mato Grosso [unspecified locality] and in Deodoro (state of Rio de Janeiro) respectively were misidentified. They probably belong to *Rhinoleucophenga cantareira* sp. nov. Thus, the records of *R. obesa* sensu Malogolowkin (1946) from most Brazilian biomes as mentioned by different authors during the last decades should be re-evaluated.

The analysis of the aedeagal shape of both the holotype from São Paulo city (Figs. 86–90) and the male paratype from São Sebastião (Figs. 103–107) of *Rhinoleucophenga cantareira* sp. nov. led us to conclude that they were structurally different and could belong to two different species. However, we changed our minds after a more detailed analysis, mainly regarding the epandrial and surstylar structures, in addition to the relative position of two sclerites, the aedeagus and outer paraphyses. According to our interpretation, their relative position changes according to the stage of protrusion of aedeagus, which ranges from retracted to completely protruded. Besides, the folded over itself pentagon-shaped dorsal sclerite, as seen in rest position (Fig. 88), becomes gradually unfolded (Fig. 105) during protrusion of the aedeagus. Our decision is based on the following facts:

The two most common fixation procedures after killing a given fly specimen, for instance with sulphuric ether fume, are either by dehydrating it in open air or by plunging it in ethanol. During both procedures, two situations may occur. If the aedeagus stays in rest position during the killing process it will be fixed in the same exact position. However, if it is protruded in different degrees of protrusion, as sometimes happens, it will be fixed that way. This latter condition gives important information regarding the protrusion process as illustrated for *Leucophenga malgachensis* by Bächli et al. (2005: 36). Additional examples are provided in published

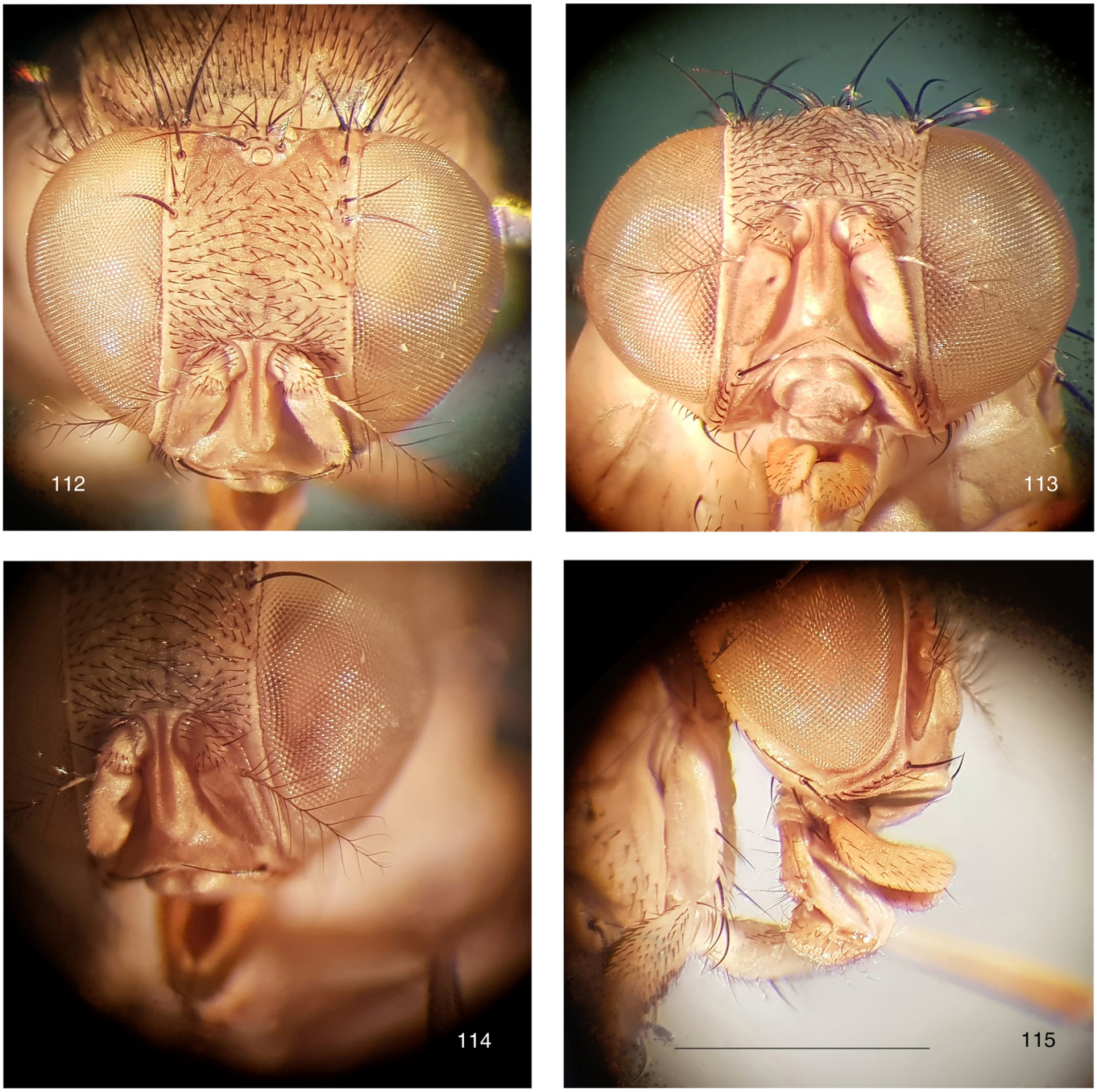
Figs. 108–111. *Rhinoleucophenga cantareira* sp. nov., female paratype [# 1], São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], habitus, four views. 108, oblique dorsal, 109, left lateral, 110, head and thorax dorsal, 111, abdomen dorsal. Scale bar = 1 mm.

photomicrographs of aedeagus and associate sclerites in complete protrusion or in rest in *Drosophila melanogaster* (Bächli and Vilela, 2007, Figs. 50 and 52 respectively), and in *Drosophila suzukii* (see Vilela and Mori, 2014, Figs. 8–10), or those in semi-protruded stage as illustrated for *Rhinoleucophenga subradiata* (Vilela and Bächli, 2009, Figs. 4A–D, 5C, and as discussed in the text, p. 194).

According to Ferris (1950) there are two muscles involved in the aedeagal protrusion, named protractor and retractor. However, we did not analyze the musculature involved in the process. This analysis is much needed for understanding the changes occurring in the relative position of aedeagus and outer paraphysis during the killing and fixation of flies. Please note that for species belonging to different genera or subgenera of Drosophilidae with more complex terminalia, such as those with two pairs of paraphyses, the apparent variation in the aedeagal shape due to different degrees of protrusion should be taken into consideration during identification processes.

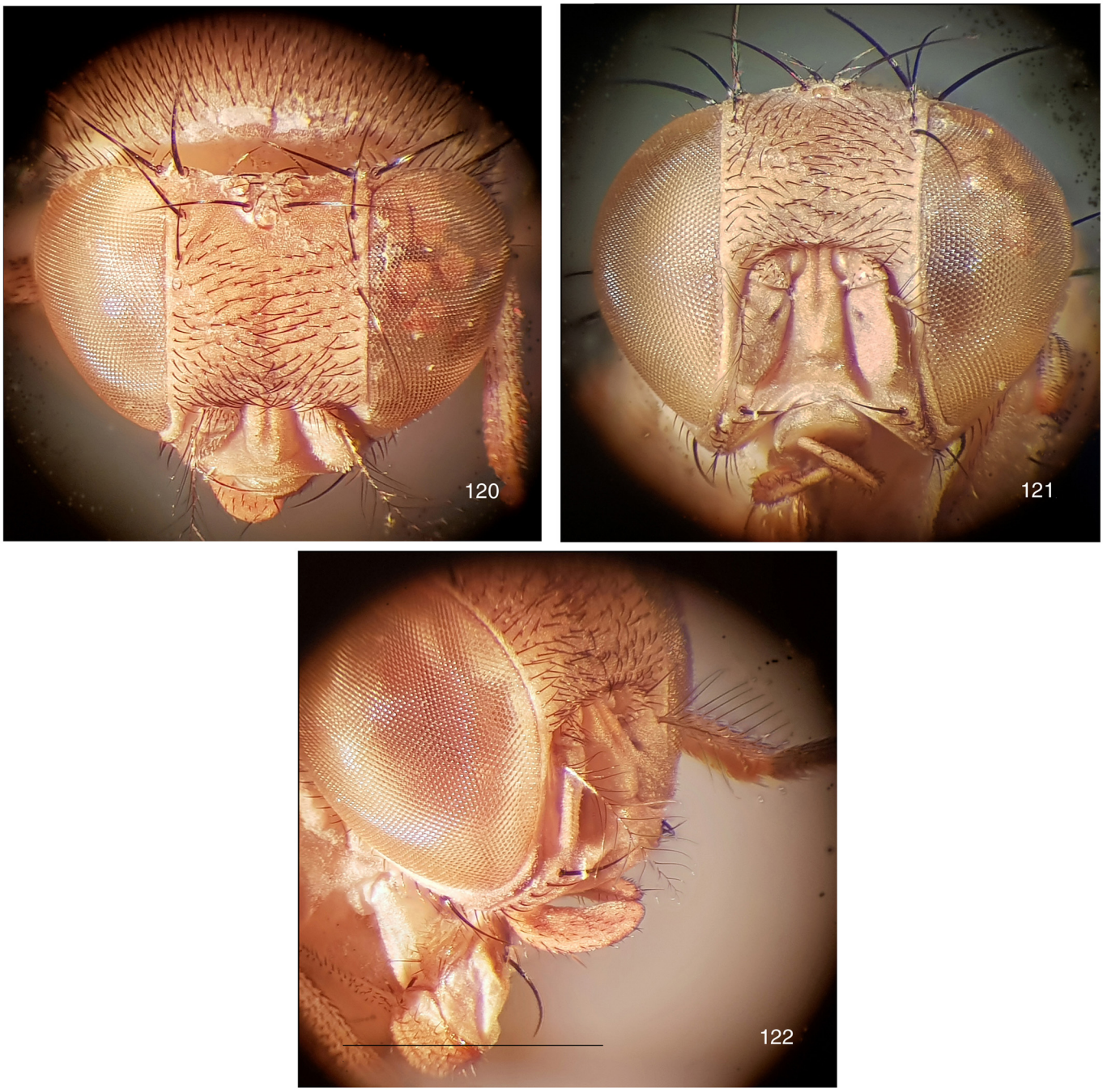
Discussion/Conclusions

Rhinoleucophenga pallida is not a junior synonym of *R. obesa* as stated by Malloch and McAtee (1924) and subsequently followed by Malogolowkin (1946) but not by Wheeler (1981). The redescription and illustrations of the male terminalia of a non-type Peruvian specimen previously identified and partially illustrated by Duda (1927) as belonging to *R. pallida*, is published in the



Figs. 112–115. *Rhinoleucophenga cantareira* sp. nov., female paratype [# 1], São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], habitus, four close-ups. 112, head, frontodorsal view, 113, head, frontal, 114, left arista, frontal, 115, right palpus, lateral. Scale bar = 1 mm.

Figs. 116–119. *Rhinoleucophenga cantareira* sp. nov., female paratype [# 2], São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], habitus, four views. 116, oblique dorsal, 117, left lateral, 3018, head and thorax dorsal, 119, abdomen dorsal. Scale bar = 1 mm.



Figs. 120–122. *Rhinoleucophenga cantareira* sp. nov., female paratype [# 2], São Sebastião, SP, Brazil [19–20.III.1986; ZMUZ], habitus, three close-ups. 120, head, frontodorsal view, 121, head, frontal, 122, head, oblique frontal. Scale bar = 1 mm.

present paper, and has shown a remarkable and completely unique set of sclerites. Our redescription of the lectotype of *R. obesa* confirms the suspicion raised by Wheeler (1970) who questioned the occurrence of *D. obesa* in Brazil. We have also concluded that the Brazilian male specimens identified as *R. obesa* and illustrated by Costa Lima, 1935 and Malogolowkin (1946) most probably belong to an undescribed species, which we have described above under the binomial *Rhinoleucophenga cantareira*, sp. nov. Thus, a proposal is made to reduce to subgeneric rank the taxon *Pseudophortica*, currently considered a junior synonym of *Rhinoleucophenga*, to include all species of the latter taxon but *R. pallida*. Although the shape of the aedeagus, aedeagal apodeme and outer paraphysis were traditionally considered the best diagnostic characters to distinguish closely related species, this is not always true. For instance, clear cut differences among sibling species such as those belonging to the *R. pallida* sibling set (*R. cantareira* sp. nov., *R. gigantea*, *R. obesa* and *R. pallida*), occur in the epandrium, surstylus, decasternum, and hypandrium and could even be more diagnostic than structures of the internal terminalia.

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Conflicts of interest

The authors declare no conflicts of interest.

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