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Redescription of the adult male and description of the puparium of *Hirmoneuropsis luctuosa* (Philippi) (Diptera, Nemestrinidae) from central Chile

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ABSTRACT

The male of *Hirmoneuropsis luctuosa* (Philippi, 1865) is redescribed and the puparium is described and illustrated for the first time. *Hirmoneuropsis luctuosa* is compared with other species of the genus. Illustrations of diagnostic characters of the male and pupa are also provided.

Introduction

The Nemestrinidae or tangle-veined flies are a small group of brachycerous flies with about 300 extant and fossil species in more than 20 genera; the family has a worldwide distribution (Bernardi, 1973), but specimens are sometimes hard to find in some regions. The adult flies are usually moderate to large stout flies with a densely pilose body. Adults frequent visit flowers, feeding upon the nectar. Nemestrinid larvae are internal parasitoids of other insects – such as Orthoptera (Greathead, 1958), Coleoptera (Richter, 1997), and Mantodea (Haenni and Borer, 2007). The species of *Hirmoneuropsis* Bequaert develop in larvae of scarabaeid beetles (Richter, 1997). They have a peculiar wing venation with a compound diagonal crossvein and the apical veins running parallel to the hind margin of the wing and terminating anterior to its apex.

The family was revised worldwide by Bernardi (1973). In the Neotropics the family is represented by four subfamilies, six genera, and 64 species (Papavero and Bernardi, 2009a). In Chile, 4 genera and 39 species are known (Papavero and Bernardi, 2009a) with the genus *Trichophthalma* Westwood the most diversified. The nemestrinids have been studied in Chile by Philippi (1865), Stuardo (1930a, b, 1932, 1934, 1935, 1936), Wagenknecht (1940), and Angulo (1971, 1976).

The genus *Hirmoneuropsis* Bequaert (1932) was described as a subgenus of *Hirmoneura* Meigen belongs to subfamily Hirmoneurinae, tribe Hyrmophlaebini, and comprises 35 species (Bernardi, 1976, 1977; Papavero and Bernardi, 2009a) with most species distributed in Argentina and Chile (Angulo, 1971; Papavero and Bernardi, 2009a; Kosmann et al., 2014).

Knowledge of the immatures of Neotropical species is poor (Papavero and Bernardi, 2009b); immatures only of four species are known – *Neorhynchocephalus sackenii* (Williston) (Prescott, 1960, 1961), *Neorhynchocephalus sulphureus* (Wiedemann) (Crouzel and Salavin, 1943), the pupal skin of *Hirmoneuropsis articulata* (Philippi) (Stuardo, 1936), and the larvae of Falleniinae, which form a respiratory tube (Léonide, 1962; Prescott, 1955, 1961); that tube is lacking in the larva of *Hirmoneura obscura* Meigen (Handlirsch, 1882, 1883).

The objective of the present work is to redescribe the male and to describe for the first time the puparium of *Hirmoneuropsis luctuosa*, then by contributing to our knowledge of the biodiversity of the Diptera of Chile.

Material and methods

Morphological terminology follows Teskey (1969) for pupal exuviae and to Cumming and Wood (2009) for adults. The central zone of Chile has a mediterranean climate with seven months of dry conditions and five months with rains. Broad sclerophyll evergreen trees and shrubs dominate the vegetation. The puparium were found 3–5 cm beneath the soil surface of a *Lithraea* forest,

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on a steep and humid hillside; they were collected with a hand trowel. Specimens were transported to the laboratory and kept in plastic boxes with a wet paper towel to maintain conditions similar to those of the natural habitat until the emergence of adult. Photographs were taken using a Nikon trinocular stereomicroscope SMZ 1500 and digital camera DS-Fi2. Depth of field was enhanced by NikonTD ACT-2U software stacking multiple images. Terminalia were macerated in 10% KOH at approx. 95 °C for 3 h to remove soft tissue, then rinsed in distilled water and dilute glacial acetic acid, and dissected in water.

Results

Hirmoneuropsis luctuosa (Philippi)
(Figs. 1–8)
Hermoneura luctuosa Philippi, 1865: 661
Hirmoneuropsis luctuosa n.comb. Bernardi, 1977

Material examined

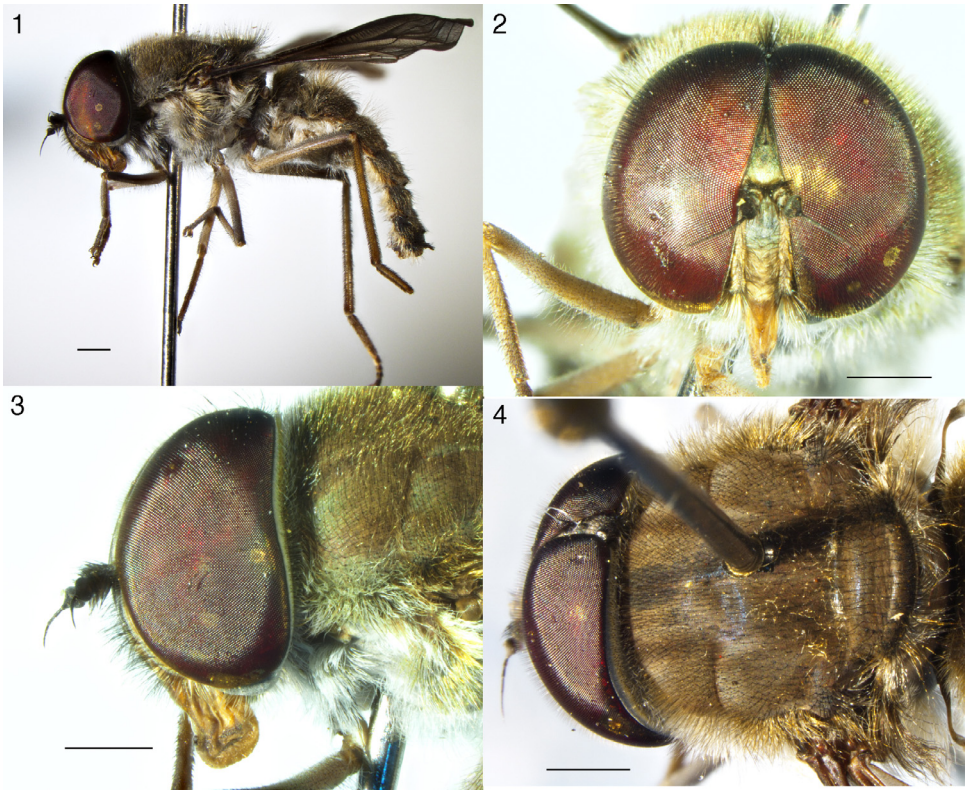
Región de Valparaíso, 1 male El Granizo 2.XII.1952, E.Z.R. col.; 1 male El Salto 19.XII.1964 C. Vivar col. Región Metropolitana: Cordillera Province, 1 male Qda. Los Almendros (33°43′50″ S/70°29′23″ W) elevation 959 m, Reserva Nacional Río Clarillo, 4.XI.1997, P. Estrada col. Material examined deposited in the Instituto de Entomología Collection, Universidad Metropolitana.

Diagnosis

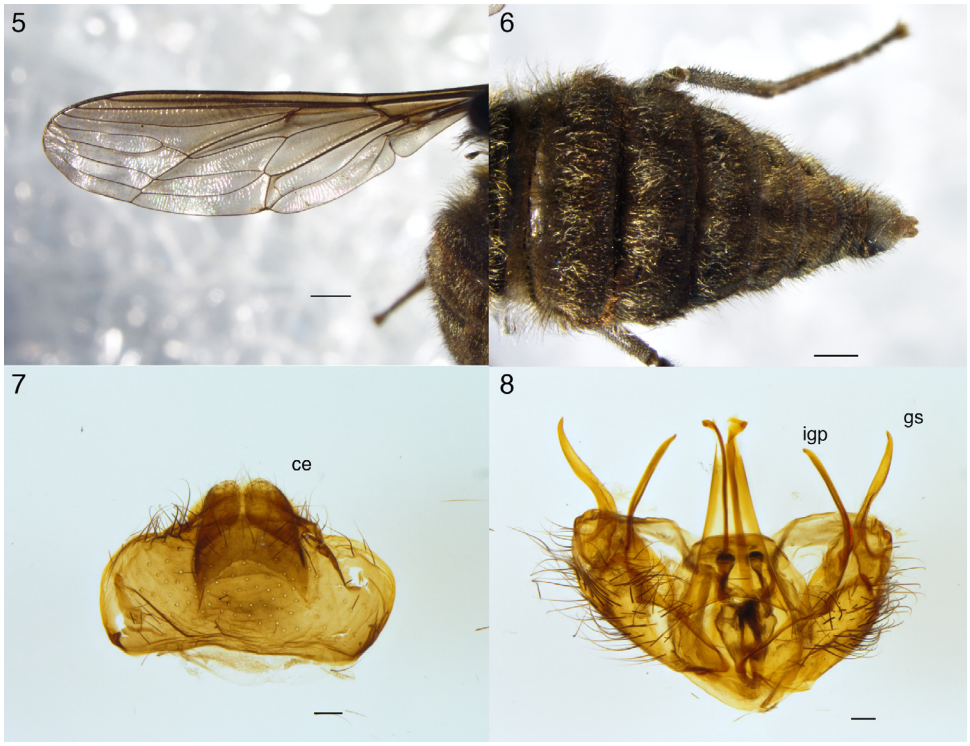
Body color grayish. Scutum dark-brown pollinose with long black hairs. Wing smoky without sectorial vein. Legs brownish-gray pollinose. Abdomen dark gray; first segment with tuft of yellowish, long and thin hairs on the lateral margin; lateral margin of tergites II–V with long and thin whitish hairs (Fig. 1).

Description

Male. Body length: 10.5–13.5 mm; wing length: 12.5–13.5 mm. Head. Holoptic eyes slightly touching in upper ¼ with short abundant whitish hairs, ommatidia larger in upper 2/3–3/4; occiput grayish pollinose, with short whitish hairs, larger lateral to compound eye; ocellar tubercle raised, polished dark gray, with proclinate dark hairs; frons dark-gray pollinose; face brownish polished gray, with long whitish hairs around oral margin and long black hairs near margin of compound eyes and base of antenna (Fig. 2). Gena with long whitish hairs. Antenna dark-gray pollinose; scape with black hairs on dorsal and ventral surface (Fig. 3); pedicel cylindrical, with long, thin black hairs; first flagellomere ovoid and slightly flattened, 3× longer than pedicel; proboscis short, ½ the length of the eyes; palpus short, brownish-gray pollinose, with short, thin and sparse light-brown hairs. Thorax dorsal view: scutum dark-brown pollinose, with long, thin and sparse black hairs; notopleuron dark-brown pollinose with long black and yellowish hairs; scutellum dark-brown pollinose, with very long black hairs, and thin whitish hairs on base (Fig. 4). Pleura: postpronotal lobe gray pollinose, with dense long, thin whitish hairs; anepisternum gray pollinose, with dense long, thin yellowish hairs, and very few black hairs; katepisternum gray pollinose, with long whitish hairs; anepimeron, meropleurite, mediotergite, laterotergite, metepisternum and metepimeron with long whitish hairs. Wing (Fig. 5): smoky, darker in costal margin; C with delicate black bristles surrounding wing; cell sc and r_1 brownish completely; R_1, R_{2+3}, R_4, R_5, M_1, and M_2 straight and almost parallel to each other; without sectorial vein; CuA_2 and A_1 touching wing margin, cell cup open; alula hyaline; wing 3x longer than wide. Stalk of halter darker brown with delicate yellow bristles near base; knob dark brown on

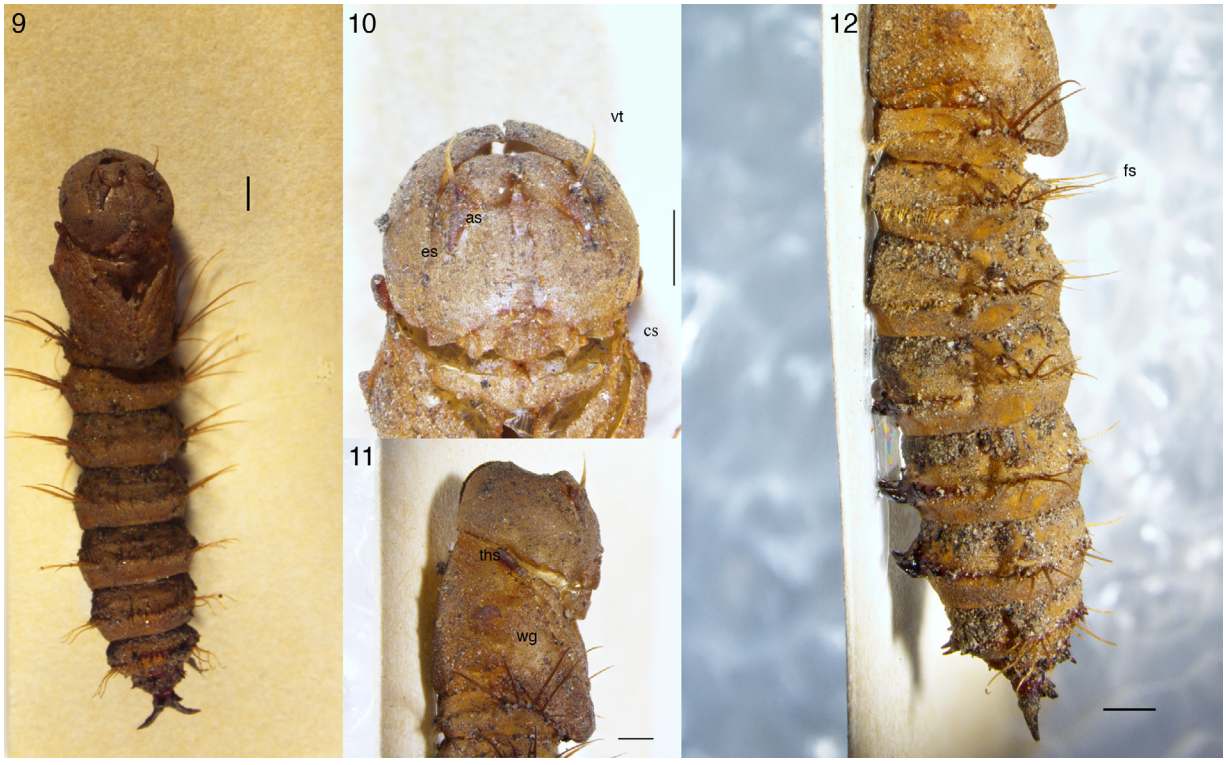


Figs. 1–4. *Hirmoneuropsis luctuosa* (Philippi, 1865). 1. Adult male; 2. Head of male frontal view; 3. Head of male lateral view; 4. Thorax in dorsal view. Scale bar = 1 mm.

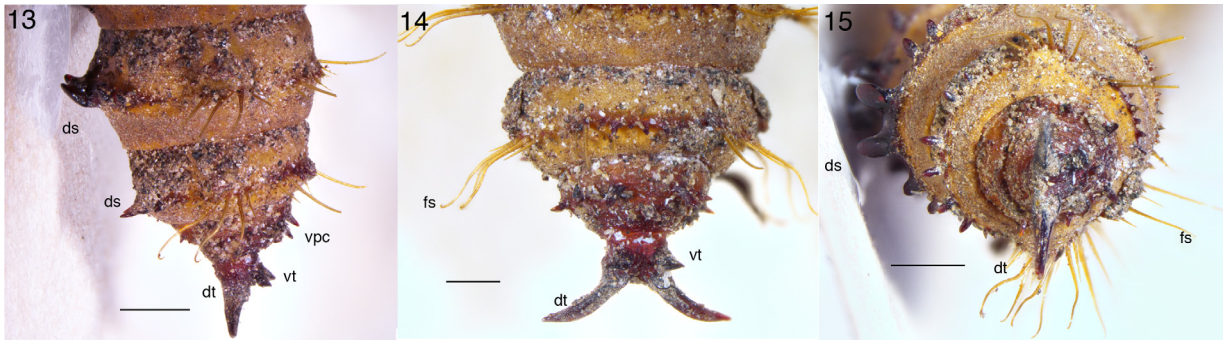


Figs. 5–8. *Hirmoneuropsis luctuosa* (Philippi, 1865). 5. Wing; 6. Abdomen in dorsal view; 7. Epandrium and cerci (ce); 8. Gonocoxite (gc), inner gonocoxal process (igp) and gonostylus (gs). Scale bar = 1 mm.

dorsal surface and light brown on ventral surface. Legs: grayish-brown pollinose; coxae grayish pollinose, with long, thin whitish hairs on anterior surface; trochanters with short white hairs on anterior surface; femora grayish pollinose with short, thin whitish hairs on anterior surface and long, thin hairs on posterior surface; tibiae I and II with delicate short black bristles on anterior surface; tibiae III with abundant short black hairs; tarsus with short, delicate light brown bristles on anterior surface, and short, strong



Figs. 9–12. Pupa of *Hirmoneuropsis luctuosa* (Philippi, 1865). 9. Lateral view; 10. Head in frontal view (vt, vertical tubercle; as, antennal sheaths; es, epicranial suture; cs, cephalothorax suture); 11. Head and thorax in lateral view (ths, thoracic spiracle; wg, wing); 12. Abdomen in lateral view (fs, fringe spines). Scale bar = 1 mm.



Figs. 13–15. Pupa of *Hirmoneuropsis luctuosa* (Philippi, 1865). 13. Anal segment in lateral view (ds, dorsal spine; vpc, ventral preanal comb; vt, ventral tubercle; dt, dorsal tubercle); 14. Anal segment in ventral view (fs, fringe spines; vt, ventral tubercle; dt, dorsal tubercle) (scale bar = 0.5 mm); 15. Anal segment of the pupa in posterior view (ds, dorsal spines; fs, fringe spines; dt, lateral tubercle). Scale bar = 1 mm.

dark-brown bristles on posterior surface, first tarsomere longer than others; pulvillus smaller than claws. Abdomen (Fig. 6): dark gray; first segment with tuft of yellowish longer and thin hairs on lateral margin; lateral margin of tergites II–V with long and thin whitish hairs; tergites III–V with long and thin whitish hairs; sternites light gray, sternites with thin whitish hairs. Terminalia: dorsal view: epandrium short, broader than long, with long black bristles, basal margin concave, apical margin rounded; cercus ovoid-rectangular (Fig. 7). Gonocoxite base broad with bristles elongated; inner gonocoxal process slender tapered apically with apex and curved upwards. Gonostylus elongated, slightly broader basally. Aedeagus with apical region upwardly arched down curved with rounded apex (Fig. 8).

Description of the puparium (Figs. 9–15).

Dimensions: body length 16.5–17.5 mm, maximum width 4.0–4.5, obtect, 4× longer than their greatest diameter, slightly arched dorsally and completely colored brown, more dark in the aster (Fig. 9).

Head: narrower and shorter than thorax; vertical tubercle prominent and developed 0.86–1.06 mm arising at the base of antennal sheaths, antennal sheaths 0.74 mm long and 0.29 mm wide not touching the epicranial suture, prominent, irregularly annulate, widely separated, ventrolaterally divergent, longer than their basal diameter; maxillary palp poorly differentiated (Fig. 10).

Thorax: each wing sheath with one tubercles positioned on the costal margin of the wing sheath (Fig. 11). Thoracic spiracle 0.67 mm long and 0.21 mm wide, touching cephalothoracic suture, prominent. Legs reaching half wings sheaths; forelegs touching thoracic spiracle (Fig. 11). Without other setae.

Abdomen: abdominal segments 1–7 each encircled by a row of spines; abdominal segments 1–7 with reniform spiracles in pleural region. T1–T3 with transverse row of 20–25 strong setae different size on anterior margin either side of midline; T4–T6 with two strong spines medially, and 3–4 smaller spines, tergite 7 smaller. Pleuron of abdominal segments 1–6 with 4–5 long, strong setae, and 2–3 smaller. Pleuron of abdominal segment 7 with a 5 strong setae, hooked apically, and 2–3 smaller. Sternites 2–7 with a row of 5–7 strong setae close to posterior margin, smaller than the pleuron. Sternites 5–6 short and with different-sized spines; sternite 7 with spines more developed, and two longer (Fig. 12). Tergite 8 terminates in an aster of paired dorsal and ventral sharply pointed sclerotized tubercles; dorsal tubercles longest (Figs. 13 and 14); anal tubercle with ventral preanal comb prominent, with two well-developed spines (Fig. 15).

Discussion

Five species of *Hirmoneuropsis* lack the sectorial vein: *H. orellanai* (Stuardo), *H. silvai* (Stuardo), *H. brevirostrata* (Bigot), *H. strobelii* (Rondani), and *H. luctuosa* (Philippi). However, these five species exhibit substantial morphological differences between them (general coloration of the body, color of hairs of beard and thoracic pleura, wings, abdominal tergites) and probably have no other relations. *H. luctuosa* is morphologically close to *H. paraluctuosa* (Angulo) in general appearance and color. *H. luctuosa* (Philippi) can be distinguished from *H. paraluctuosa* (Angulo) by the lack of sectorial vein, yellowish legs, and the color of the frons and pleura (Angulo, 1971).

Knowledge of the immature stages of tangle-veined flies is very limited, as is information on the host relations of the species. The importance of these parasites has been demonstrated in their use to suppress populations of Orthoptera (Prescott, 1960).

Of the 36 species cited for Chile (Angulo, 1971), the immature stages of only one species are known, viz. *Hyrmophlaeba articulate* (Philippi), reflecting the limited knowledge of aspects of the biology of immature stages and knowledge of the host.

The pupal morphology described here is similar to that of *H. articulate* (Philippi) described by Stuardo (1936) with a few differences in the vertical tubercles – larger and sclerotized in *H. articulate*, and fewer spines in dorsal fringe, but very different of the pupal skin of *Atriadops vespertilio* (Haenni and Borer, 2007) which lacks pleural and sternal setae or are very short, replaced by short spines in sternum; and abdominal dorsal spines are thicker.

The pupa of *Hirmoneuropsis* is morphologically complex and presents significant taxonomic and phylogenetic characters.

Conflicts of interest

The authors declare no conflicts of interest.

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References

Angulo, A.O., 1971. Los Nemestrinidos de Chile (Diptera: Nemestrinidae). Gayana Zoología 19, 1–175.

Angulo, A.O., 1976. *Trichophthalma jaffueli* Stuardo: Nuevo para Magallanes y algunas consideraciones sistemáticas sobre *Trichophthalma amaena* Bigot y *Eurygastromyia sexmaculata* (Edwards) (Diptera, Nemestrinidae). An. Inst. Patagon. 7, 197–199.

Bequaert, J., 1932. The Nemestrinidae (Diptera) in the V. von Roder Collection. Zool. Anz. 100 (1–2), 13–33.

Bernardi, N., 1973. The genera of the family Nemestrinidae (Diptera: Brachycera). Arq. Zool. 24 (4), 211–309.

Bernardi, N., 1976. Classificação da subfamilia Hirmoneurinae (Diptera, Nemestrinidae). Papéis avulsos Zool., São Paulo 30 (2), 25–33.

Bernardi, N., 1977. A tribo Hyrmophlaebini (Diptera, Nemestridae, Hirmoneurinae), com treze espécies novas da América do Sul. Papéis avulsos Zool., São Paulo 30 (16), 239–259.
Crouzel, I.S., de Salavin, R.G., 1943. Contribución al estudio de los *Neorhynchocephalus* argentinos (Diptera: Nemestrinidae). An. Soc. Cient. Argent. 136, 145–177.
Cumming, J.M., Wood, D.M., 2009. Adult morphology and terminology. In: Brown, B.V., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E., Zumbado, M. (Eds.), Manual of Central American Diptera, vol. 1. NRC Research Press, Ottawa, Ontario, Canada, pp. 9–50.
Greathead, D.J., 1958. Notes on life history of *Symmictus flavopilosus* Bigot (Diptera: Nemestrinidae) as a parasite of *Schistocerca gregaria* (Forskal) (Orthoptera: Acrididae). Proc. R. Ent. Soc. Lond. Ser. A 33, 107–119.
Haenni, J.P., Borer, M., 2007. First report of a Nemestrinidae (Diptera) parasitoid of the Mantodea. Stud. Dipterol. 14, 61–65.
Handlirsch, A., 1882. Die Metamorphose und Lebensweise von *Hirmoneura obscura* Meig., einem Vertretel der Dipteren-Familie Nemestrinidae. Wien. Ent. Zeitg. l, 224–227.
Handlirsch, A., 1883. Die Metamorphose und Lebensweise von *Hirmoneura obscura* Meig., einem Vertreter der Dipteren-Familie Nemestrinidae. Wien. Ent. Zeitg. 2, 11–15.
Kosmann, C., Lamas, C.J.E., Pujol-Luz, J.R., 2014. Nemestrinidae. In: Roig-Juñent, S., Claps, L.E., Morrone, J.J. (Eds.), Biodiversidad de Artrópodos Argentinos volumen 4. Editorial INSUE–UNT San Miguel de Tucumán, Argentina, pp. 407–415.
Lénonide, J.C., 1962. Formation du pore respiratoire et de la partie proximale du tube respiratoire de la larve de *Symmictus costatus* Loew (Diptera, Nemestrinidae) selon les divers régions du corps de l'hôte. Bull. Zool. Soc. Fr. 87, 550–558.
Philippi, R.A., 1865. Aufzählung der chilenischen Dipteren. Verh. Zool. Bot. Ges. Wien 15, 595–782 (7 plates).
Papavero, N., Bernardi, N., 2009a. Catalogue of neotropical diptera. Nemestrinidae. Neotropical Diptera 7, 1–16.
Papavero, N., Bernardi, N., 2009b. Manual of Neotropical Diptera. Nemestrinidae. Neotropical Diptera 8, 1–11.
Prescott, H.W., 1955. *Neorhynchocephalus sackenii* and *Trichopsidea clausa*, nemestrinid parasites of grasshoppers. Ann. Ent. Soc. Am. 48, 392–402.
Prescott, H.W., 1960. Suppression of grasshoppers by nemestrinid parasites (Diptera). Ann. Ent. Soc. Am. 53, 513–521.
Prescott, H.W., 1961. Respiratory pore construction in the host by the nemestrinid parasite *Neorhynchocephalus sackenii* (Diptera) with notes on respiratory tube characters. Ann. Ent. Soc. Am. 54, 557–599.
Richter, V.A., 1997. Family Nemestrinidae. In: Papp, L., Darvas, B. (Eds.), Contributions to a Manual of Palaearctic Diptera, vol. 2. Science Herald Budapest, pp. 459–468.
Stuardo, C., 1930a. Un género de Nemestrinidae no mencionado para la fauna chilena. Rev. Chil. Hist. Nat. 33 (1929), 161–162.
Stuardo, C., 1930b. Notas entomológicas. Rev. Chil. Hist. Nat. 34, 379.
Stuardo, C., 1932. Sinopsis de los nemestrinidos chilenos del género *Hirmoneura* Meigen (Diptera). Rev. Chil. Hist. Nat. 36, 61–81.
Stuardo, C., 1934. Sinopsis de los nemestrinidos chilenos del género *Trichophthalma* Westwood (Diptera). Rev. Chil. Hist. Nat. 38, 214–248.
Stuardo, C., 1935. Algunas observaciones sobre las costumbres y metamorfosis de *Hirmoneura articulata* Ph. Rev. Chil. Hist. Nat. 38, 197–202.
Stuardo, C., 1936. Nemestrinidos nuevos Chilenos y anotaciones sobre dos especies conocidas. Rev. Chil. Hist. Nat. 40, 169–178.
Teskey, H.J., 1969. Larvae and pupae of some Eastern North American Tabanidae (Diptera). Mem. Entomol. Soc. Can. 63, 1–147.
Wagenknecht, H.R., 1940. Sobre la *Hirmoneura orellanae*. Rev. Chil. Hist. Nat. 43, 145–147.