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Manual of Neotropical Diptera. Nemestrinidae[1]

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According to Bernardi (1973: 230; and further contributions), the Recent genera of Nemestrinidae are thus classified:

1. Subfamily Atriadopinae [Atriadopsinae of Bernardi, 1973] – genera *Atriadops* Wandolleck, 1897 (Brazil, Afrotropical, Oriental, New Guinea, Australia), *Ceyloniola* Strand, 1928 (Sri Lanka), *Nycterimyia* Lichtwardt, 1909 (Afrotropical, Oriental, New Guinea, Australia) and *Nycterimorpha* Lichtwardt, 1909 (Oriental, Australia).
2. Subfamily Cyclopsideinae – genus *Cyclopsidea* Mackerras, 1925 (Australia).
3. Subfamily Falleniinae [= Trichopsideinae] – genera *Fallenia* Meigen, 1820 (Palearctic), *Neorhyncocephalus* Lichtwardt, 1909 (Palearctic, Nearctic, Neotropical) and *Trichopsidea* Westwood, 1839 [= *Symmictus* Loew, 1858] (Nearctic, Palearctic, New Guinea, Australia).
4. Subfamily Hirmoneurinae – genera *Hirmobequaertia* Bernardi, 1976 (Laos), *Hirmoia* Bernardi, 1976 (Oriental), *Hirmoneura* Meigen, 1820 (Palearctic, Oriental), *Hirmoneuropsis* Bequaert, 1932 (Neotropical), *Hirmoneurota* Bernardi, 1976 (Oriental), *Hyrmophlaeba* Rondani, 1863 (Neotropical), *Indohirmoneura* Bequaert, 1932 (Sri Lanka), *Neohirmoneura* Bequaert, 1920 (Nearctic [1 sp. in Mexico], Palearctic) and *Parahirmooneura* Bernardi, 1976 (Palearctic).
5. Subfamily Nemestrininae – genera *Moegistorhynchus* Macquart, 1940 (South Africa), *Nemestrinus* Latreille, 1802 (Palearctic), *Prosoeca* Schiner, 1867 (Afrotropical), *Stenobasipteron* Lichtwardt, 1910 (Afrotropical), *Stenopteromyia* Lichtwardt, 109 (Palearctic), *Trichophthalma* Westwood, 1835 (Australia, South America (Chile, Argentina)).

The family probably originated in the Late Triassic/Early Jurassic (Ansorge & Mostovski, 2000) and many fossils are known, from the Jurassic of Karatau (Kazakhstan), China, Eichstätt (Germany), the Lower Cretaceous of Spain, Russia and Mongolia, the Eocene of Germany, the Oligocene of Florissant, Colorado (U. S. A.) (cf., for instance, Ansorge & Mostovski, 2000; Bequaert, 1936, 1947; Bequaert & Carpenter, 1936; Bernardi, 1973: 221, 237-239, 260, 282; Evenhuis,1994; Mostovski, 1998; Mostovski & Martínez-Delclòs, 2000; Nagatomi & Yang, 1998; Ren, 1998a; Wedmann, 2007; Zhan, Yan, Ren & Ge, 2008).

Wedmann (2007) made this interesting comment: "The fossil record shows that the Nemestrinidae is a very ancient taxon, with representatives of the basal Archinemestriinae known from Jurassic and Cretaceous localities (Mostovski,

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1998; Ansorge & Mostovski, 2000). Earliest representatives of Hirmoneurinae are known from the Upper Jurassic (Ansorge & Mostovski, 2000). Among the Cretaceous species are representatives both of extinct taxa (*e.g.*, *Florinemestrius* Ren, 1998a and *Sinonemestrus* Hong and Wang, 1990) and of extant genera [namely, *Hirmoneura, Prosoeca*, and possibly *Nemestrinus* Latreille, 1802 (see Mostovski and Martínez-Delclòs, 2000)]. All known Paleogene Nemestrinidae can be assigned to extant genera (Bequaert and Carpenter, 1936). Among the five species recorded from the Upper Eocene of Florissant, the species *Neorhynchocephalus occultator* (Cockerell, 1908) cannot be distinguished morphologically from the extant New World species *N. volaticus* (Wulliston, 1883) on the basis of the preserved characters (Bequaert and Carpenter, 1926). From this the highly conservative morphology of nemestrnids is evident and suggests that few ecological changes took place in this group. Since extant species of *Hirmoneura* are internal parasites of the larvae of scarabaeid beetles (Handlirsch, 1882; Richter, 1997), this might well have been the case in the Eocene ecosystem of Messel too. Scarabaeid beetles are not uncommon among the fossils from the Messel Pit. Another interesting question is, why are there so many Mesozoic records of nemestrinids and so few Cenozoic fossil records? Since this taxon has a characteristic wing venation, fossils belonging to this group can easily be recognized. Therefore, the lack of nemestrinids from amber reflects a real scarcity of this group in amber. Probably this is due to taphonomic reasons, perhaps in connection with the relatively large size of many species, which are not caught by resin. It could also be connected with the fact that nemestrinids prefer open habitats to forested ones where the resin originated. Another possible explanation might be that nemestrinids actually were more abundant in Mesozoic times than in the Paleogene, consistent with the view that nemestrinids were certainly among the most ancient plant pollinators (e. g., Ren, 1998b. Grimaldi, 1999; Labandeira, 2000, 2005). Ren (1998b) proposed that mid Mesozoic long-proboscid nemestrinid flies from the Yixian Formation in China were consuming nectar from angiospermous seed plants. Labandeira (2000, 2005) argued convincingly that Mesozoic long-proboscid flies, including nemestrinids, fed on nectar-like secretions and pollination droplets of seed plants, such as cheirolepidiaceous conifers, prior to radiation of angiosperms. When angiosperms became dominant during the mid-Cretaceous, the abundance of nemestrinids may have declined due to competitive displacement with new pollinators, resulting in the depauperate fossil record of nemestrinids in the Late Cretaceous and Cenozoic".

Adults frequent flowers, feeding upon the nectar; lists of the plants visited by Neotropical species were given by Stuardo Ortiz (1932, 1934), Angulo (1971: 32, table I), Bernardi (1974: 34, for all the species of *Neorhynchocephalus*), Devoto & Medan (2006) and Devoto, Montaldo & Medan (2006). Angulo (1971: 31) also supplied original data based on the identification of pollen grains adhered to some specimens. See also Aizen (2001) and Souto & Premoli (2003) (*Trichophthalma sp.* in *Alstroemeria aurea*). Long-proboscid nemestrinids are known as specialized pollinators of plant species with tubular flowers (Devoto, Montaldo & Medan, 2006; Goldbaltt & Manning, 2000, 2005; Goldblatt, Bernhardt & Manning, 2002; Goldblatt & Manning, 2005; Goldblatt, Manning & Bernhardt, 1996, 2000; Johnson, 2004; Krenn, Plant & Szucsich, 2003; Manning & Goldblatt, 1996, 1997; Potgieter & Edwards, 2005; Potgieter, Edwards & van Staden, 2007).

Some Nemestrinidae are preyed by Sphecidae (Hymenoptera) (Claude-Joseph, 1928: 126; Alexander, Minckley & Yanega, 1993; Evans, 2002). Angulo (1971: 31) also cites spiders and a robber-fly as predators.

The Falleniinae have acridiophagous larvae (Crouzel & Salavin, 1943; Fuller, 1938; Greathead, 1958, 1963; Honwood & Hales, 1991; Léonide, 1962a, 1962b, 1963, 1964a, 1964b, 1968, 1969; Milner, Baker & Cliff, 2002; Noble, 1936; Oliff, 1891; Prescott, 1955, 1960, 1961; Rivera García, 2004; Sanchez & Onsager, 1994; Smith, 1958; Spencer, 1931, 1932, 1945; York & Prescott, 1952). Among the Hirmoneurinae, the larvae of *Hirmoneura obscura* Meigen, 1820 feed upon larvae and pupae of *Rhizotrogus solstitialis* (Coleoptera, Scarabaeidae) (Brauer, 1883; Handlirsch, 1882, 1883; Osten Sacken, 1883; Richter, 1997); two Chilean species, *Hirmoneuropsis exotica* (Wiedemann, 1824) and *Hyrmophlaeba articulata* (Philippi, 1865) are also reported to feed upon scarabaeids (resp. Bruch, 1817 and Stuardo Ortiz, 1934). See also Riley (1883). Haehnni & Borer (2007) have recently reported *Atriadops vespertilio* (Loew, 1858) parasitizing Mantodea, in Gambia.

Our knowledge of the immature stages of Neotropical species is very meager. The larva and pupa are known from *Neorhynchocephalus sackenii* (Williston, 1880) (Prescott, 1960, 1961) and *Neorhynchocephalus sulphureus* (Wiedemann, 1830) (Crouzel & Salavin, 1943). The pupal skin of *Hyrmophlaeba articulata* (Philippi, 1865) was described and illustrated by Stuardo Ortiz (1936: 174-175, fig. 14. The larvae of Falleniinae form a respiratory tube (Léonide, 1962b; Prescott, 1955, 1961); that tube is lacking in the larva of *Hirmoneura obscura* Meigen, 1820. There seems also to be a difference in the number of the fleshy processes on the last abdominal segments of the larvae and in the presence or absence of hooks on the spines of the abdominal pseudopods (Bernardi, 1979: 217).

Key to subfamilies, tribes and genera

1. Proboscis well-developed, longer than head (Figures 1-2; Plate II, figs. 1-5; Plate III, fig. 1) 2
   Proboscis shorter than head or vestigial (Figure 3; Plate I, figs. 1-5; Plate III, figs. 2-4) 3

2 (1). Eyes densely pilose (Figure 2) (subfamily Nemestrininae) .... *Trichophthalma*, subg. *Eurygastromyia* Lichtwardt, 1910
Eyes bare (Figure 1) (subfamily Falleniinae) .... *Neorhynchocephalus* Lichtwardt, 1910

3(1). Behind R_1, five veins reach the apical margin of the wing (Figure 4); ocelli present (subfamily Hirmoneurinae) 4
Behind R_1, four (or three) veins reach the apical margin of the wing (Figure 5); ocelli absent (subfamily Atriadopinae) .... *Atriadops* Wandolleck, 1897

4(3). Frons elevated, although weakly so (Figure 3), and densely covered by long pilosity (tribe Hirmoneurini) .... *Neohirmoneura* Bequaert, 1920
Frons flat, without any sign of elevation, only pollinose or with a few minute, sparse hairs or a little tuft of hais near the antennal basis (tribe Hyrmophlaebini) .... *Hyrmophlaeba* Rondani, 1863

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Plate I. 1. *Hirmoneuropsis luctuosa* (Philippi). 2, 4. *Hyrmophlaeba articulata* (Philippi). 3. *Hirmoneuropsis brevirostrata* (Bigot). 5. *Hirmoneuropsis strobelii* (Rondani) (after Stuardo Ortiz, 1932: pl. III).

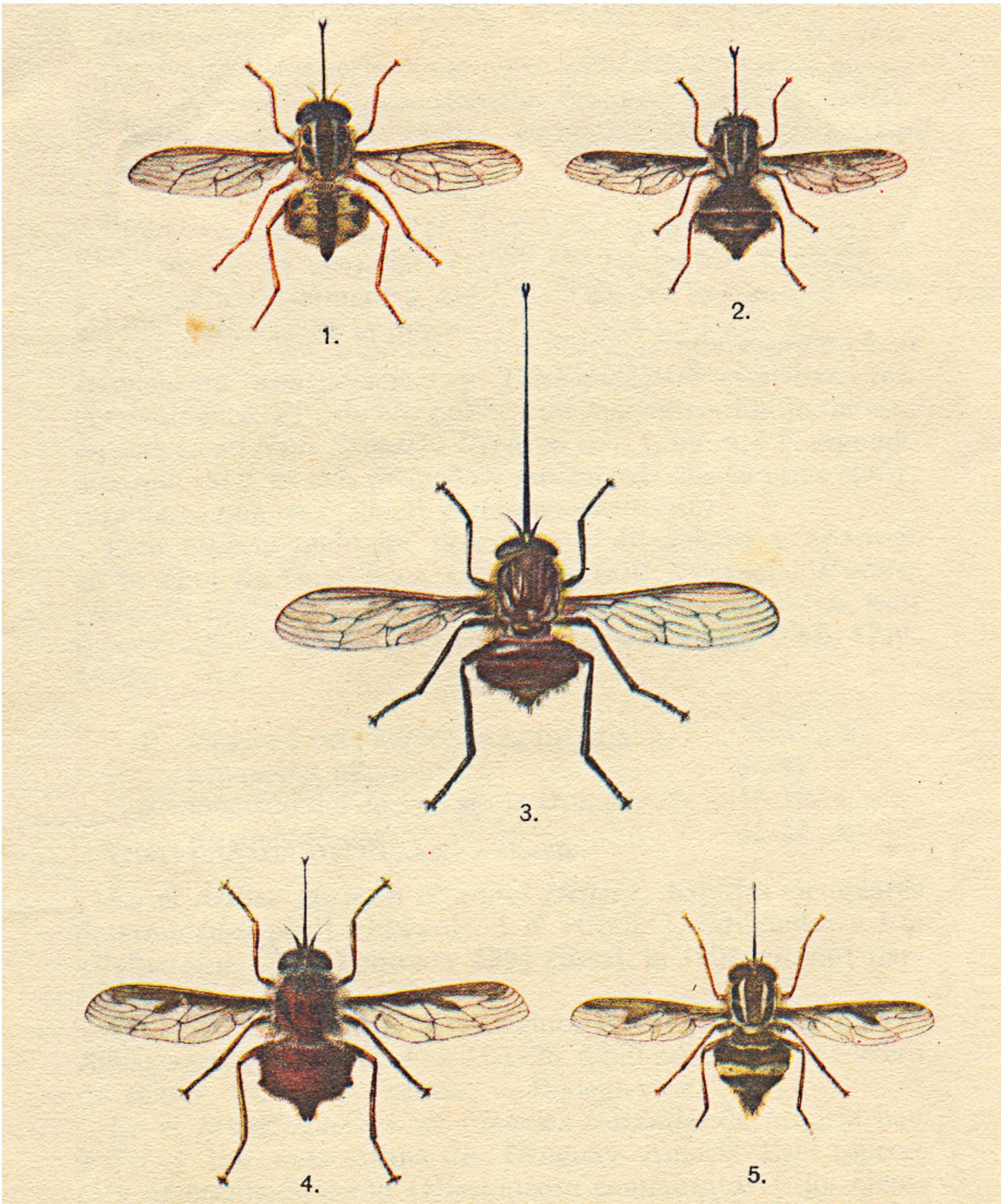

Plate II. 1. *Trichophthalma* (*Eurygastromyia*) *barbarossa* (Bigot). 2. *Trichophthalma* (*Eurygastromyia*) *eximia* (Philippi). 3. *Trichophthalma* (*Eurygastromyia*) *landbecki* (Philippi). 4. *Trichophthalma* (*Eurygastromyia*) *niveibarbis* (Bigot). 5. *Trichophthalma* (*Eurygastromyia*) *philippii* Rondani (after Stuardo Ortiz, 1935: pl. VII).

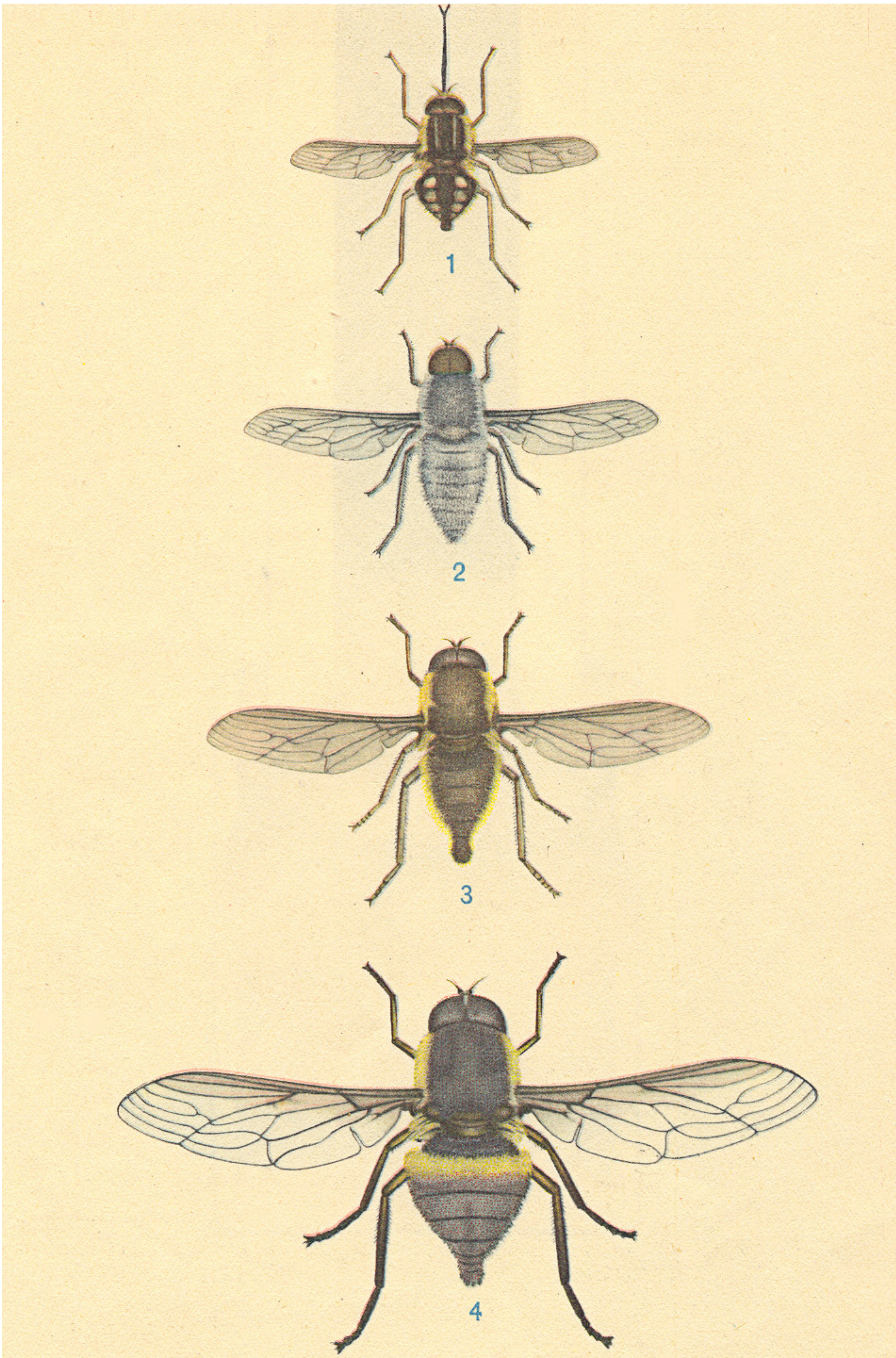

Plate III. 1. *Trichophthalma* (*Eurygastromyia*) *jaffueli* Stuardo Ortiz. 2. *Hirmoneuropsis silvai* (Stuardo Ortiz). 3. *Hyrmophlaeba ruizi* (Stuardo Ortiz). 4. *Hirmoneuropsis orellanai* (Stuardo Ortiz) (after Stuardo Ortiz, 1936: pl. XVI).

Figure 1. Neotropical Nemestrinidae. 1. *Neorhynchocephalus sulfureus* (Wiedemann, 1830).

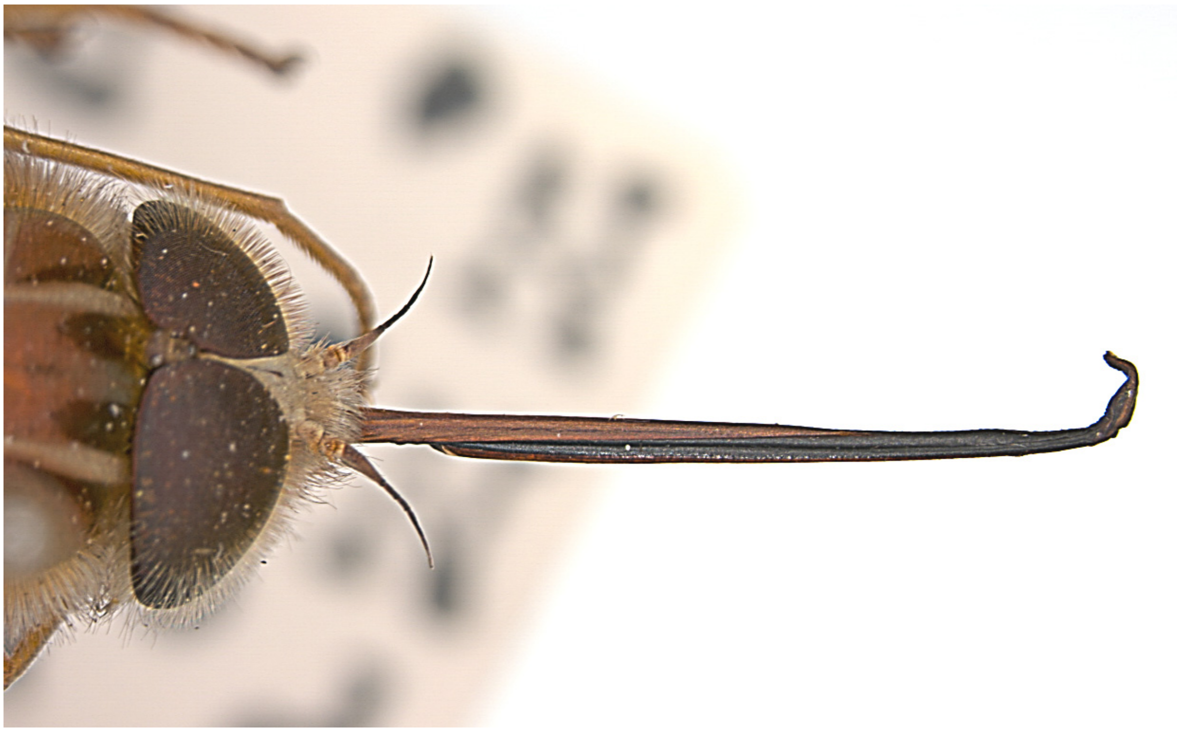

Figure 2. *Trichophthalma* (*Eurygastromyia*) *sp*.

Figure 3. *Neohirmoneura bradleyi* (Bequaert, 1920).

Figure 4. *Hyrmophlaeba maculipennis* (Mcquart, 1850).

Figure 5. *Atriadops maculata* (Wiedemann, 1824).