

NEW SPECIES OF *APTEROBIROINA* L. PAPP AND
BENTROVATA RICHARDS (DIPTERA, SPHAEROCERIDAE)
FROM AUSTRALIA

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Apterobiroina flavipes sp. n., *A. truncata* sp. n., *Bentrovata flavithorax* sp. n., *B. minor* sp. n., *B. nigrithorax* sp. n. are described from Australia and compared to their type species *Apterobiroina australis* L. Papp, 1979 as well as to *Bentrovata regalis* Richards, 1973. All these species are wingless, and only *A. australis* and *A. flavipes* have halteres. Keys are given for their identifications. With 53 original figures on seven tables.

Key words: *Apterobiroina*, *Bentrovata*, new species, wingless species, Australia, taxonomy.

INTRODUCTION

In the course of a collection revision of the Diptera Collection of the Department of Zoology, Hungarian Natural History Museum, Budapest, there emerged again the necessity of the descriptions of some wingless specimens, which were selected and separated to species but left undescribed ten years ago.

Reduction of wings and even that of halteres is a widespread phenomenon among the species of Sphaeroceridae. One can find wingless or reduced-winged species in all the four subfamilies, most of them in the subfamily Limosiniinae. Their best expert, Prof. O. W. Richards, published 25 papers and book chapters on them between 1931 and 1980, e.g. RICHARDS (1965). The highest proportion of the wingless and reduced-winged species and genera are living in the Afrotropical Region (see PAPP & ROHÁČEK 2021). In Australia, five such genera were reported, four of them were described by RICHARDS (1973). A fifth wingless sphaerocerid was described six years later by PAPP (1979). Later, up to now, no additional description on wingless sphaerocerids has been published from that continent (ROHÁČEK *et al.* 2001, MARSHALL *et al.* 2011).

Below five new species are described in two genera, which were formerly monotypic. We are convinced that some other undescribed species or even genera have been hidden in nature and will be found and described later.

* The manuscript has been kindly corrected by Mihály Földvári, Zoltán Soltész and the editor-in-chief on the basis of the reviewers' opinions, as the author has unfortunately passed away in the meantime.

MATERIAL AND METHODS

The story /origin of the specimens, which served as a base of this paper, is very interesting, and we are lucky that we managed to clear it up completely. Thus, in February 1981, the late Prof. Dr. Sándor Mahunka, who was not only the Head of the Department of Zoology, HNHM that time, but also the Curator of the Chelicerata Collection, received material in numerous bottles from Dr. George Hangay of the Australian Museum, Sydney Australia, gained from pitfall trap collections by Dr. Hangay. The world-famous scientist of the terricolous mites had an assistant who selected not only the mites but also other arthropods from those alcoholic materials, among them also dipterous flies. (Prof. Mahunka might describe and publish new species of terricolous mites from those materials; one can find his papers most probably in the literature of Acari.) We guess – based on a list found in the Diptera Collection archives – that were some 160–170 dipterous specimens, including 45 wingless Sphaeroceridae. That selected material was given to the Diptera Collection (sometime between the end of 1981 and 1985). These latter specimens were left in alcohol for an unknown period of time, later minuten-pinned and double-mounted by the assistants of the Diptera Collection. All those 45 specimens are comparatively well-preserved (only some tarsi and numerous head and thoracic setae are broken away) and bear the printed labels, which we publish below. However, the name of the collector, Dr. George Hangay, is not given on any of them.

The 46th specimen was collected by Professor Tamás Pócs (Eszterházy Károly University, Eger, Hungary) in March 2000, and was given to the Diptera Collection in alcohol from the Chelicerata Collection, similarly to those other flies from Australia.

The types and other specimens are housed in the Diptera Collection of the Department of Zoology, Hungarian Natural History Museum, Budapest (HNHM) and in the Australian Museum, Sydney, Australia (AM).

Nine specimens of four species (all but one are paratypes) have been sent to the Australian Museum. The claim of the Australian colleagues that all the holotypes from collection specimens from Australia have to be returned to Australia have since long been debated, but not by me. I have always returned the holotypes of the borrowed collection materials to the collections possessing the unnamed collection specimens. However, we have to stress also here that these collection specimens have never been in Australia; they were created in Budapest, Hungary. On the other hand, we were to express our goodwill by that action.

The terminology, incl. abbreviations, follows that of ROHÁČEK (1982, 1998). The paired structures are mentioned as singular. The abbreviation (in brackets behind the datum about sex) “gen. prep.” means that the abdomen of the specimen had been removed, then was prepared in 10 % sodium-hydroxide, washed in lukewarm water, following it in lactic acid, washed again, and preserved in a plastic microvial with glycerol.

TAXONOMY

The two genera look similar in general appearance (Fig. 38, cf. Papp 1979: fig. 9). At present we can give a key for differentiation as follow:

1. Frons without stripes. 2 pairs of *ors*. Head setae *occe* and *occi* missing. Some species (*A. australis* and *A. flavipes*) have halteres. Male genitalia

- (Figs 1–15) with broad and blunt postgonite (Figs 5–6, 12–13). Dorsal part of synsternite comparatively long (Fig. 8). Ventro-medial process of synsternite with 2 rows of thick, blunt, black thorns/pegs (Figs 9–10). Surstylus larger, divided into 2 lobes and with numerous large setae (Figs 4–5, 14–15). Female genitalia with spermathecae better sclerotised and with a large bulb on initial section of duct (Figs 19–20). Epiproct weakly sclerotised, with a pair of dorsal setulae (Figs 16, 18). Cerci longer and with longer setae (Figs 16–18) *Apterobiroina* L. Papp, 1979
- Frons usually with 5 longitudinal stripes. Only 1 pair of *ors*. Head setae *occe* and *occi* though small, well-discernible. Halteres completely reduced in all species. Abdominal setae less dense than in *Apterobiroina*. Male genitalia with slender postgonite whose apex is narrow and proclinate (Figs 27, 37, 48). Dorsal part of synsternite short (Figs 24, 30, 46). Ventro-medial process of synsternite with unarranged (Figs 21–22) thick setae or those are in 1 row (Figs 31–32, 44–45). Surstylus smaller, rounded (not divided), with 1 extremely large thorn (Figs 26, 34–35, 49–50). Female genitalia with less sclerotised spermathecae, spermathecae with a small bulb on initial section of duct (Figs 28, 39–40, 53). Cerci shorter, with short setae (Figs 29, 41–42). Epiproct membranous, without a pair of dorsal setulae (Figs 29, 41–42) *Bentrovata* Richards, 1973

Having studied the genitalia of all the species below, I cannot state that these genera would be derivatives of *Biroina* Richards (cf. PAPP 1995). It is a matter of course (at least for me) that they cannot have any relationships to the apterous Sphaeroceridae of other continents (e.g. RICHARDS 1965).

Apterobiroina L. Papp, 1979

Apterobiroina L. Papp, 1979: 370.

Type species: *Apterobiroina australis* L. Papp, 1979: 371.

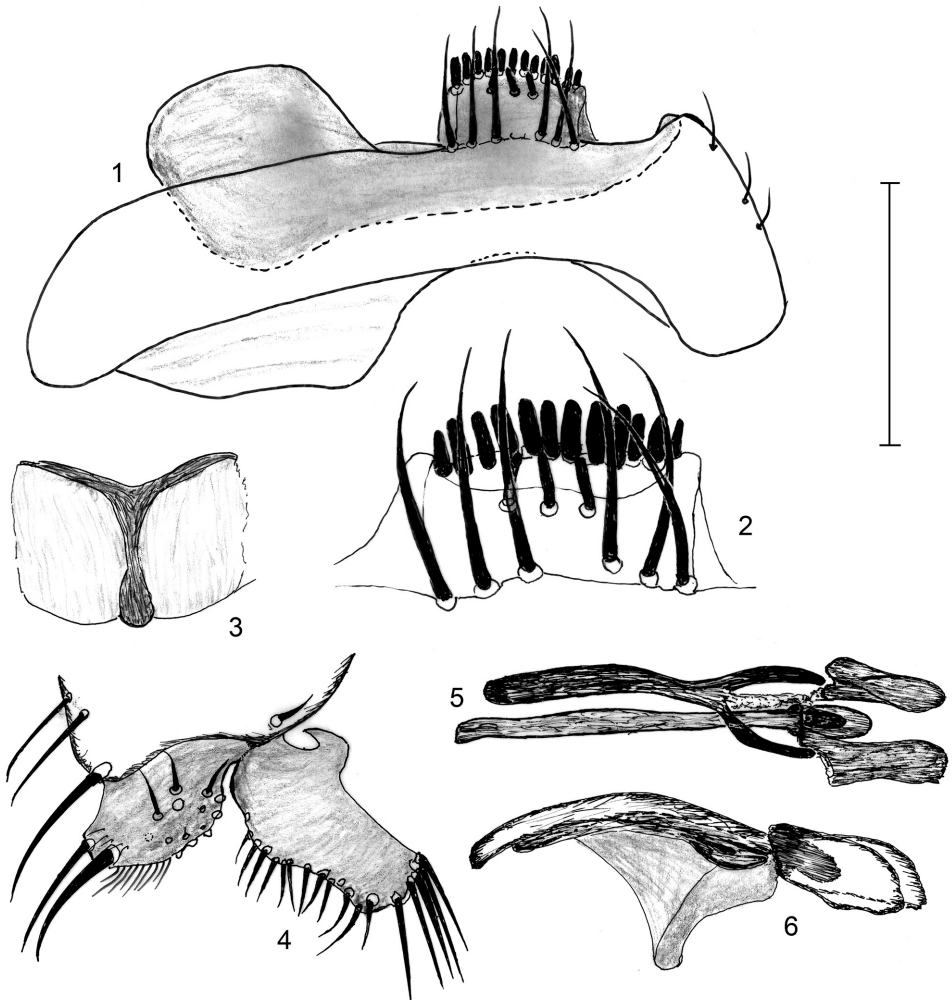
The extended description of the genus is given below.

Head. Head wide with small but distinct ocelli, gena wide. Frons without silvery stripes, i.e. unicolourous. Head setae uneven: *oc* seta long, *vti* long and thick, *vte* minute, 2 latero-clinate *ors* and 4 pairs of *ifr* present. Vibrissa strong and long, *pm* setae weak, no strong genal seta.

Thorax. In dorsal view, very wide dorsal to mid coxae. Posterior part of mesothorax and whole metathorax are with a deep, subcylindrical vertical emargination (Papp 1979: fig. 9), which embraces mid and hind femora when at rest. Thoracic chaetotaxy: 1 *ppnt*, 2 *np*, and 1 pair each of *prsut*, *sa*, small *pa* and *dc* setae. 1 pair of thin *kepst*. Scutellum very short (about 3 times broader

than long), with 2 pairs of strong *sc* setae. Acrostichals short and numerous. All species are wingless, and only *A. australis* and *A. flavipes* have halteres, those are small.

Legs. Short and more or less thickened. Mid tibia with a strong *va*, no mid ventral seta. Antero-dorsal and postero-dorsal setae are paired at basal 1/3 and at about apical 4/5. Hind tibia without dorsal preapical seta.



Figs 1–6. *Apterobiroina australis* L. Papp, paratype male, terminalia. 1 = sternite 5 and ventral part of synsternite, ventral view; 2 = ventro-medial part of synsternite; 3 = subepandrial sclerite, broadest view; 4 = surstylus, broadest (sublateral-subventral) view; 5 = genital complex (without distiphallus), ventral view; 6 = same, lateral view. Scale: 0.2 mm for Figs 1, 5–6; 0.1 mm for Figs 2–4

Abdomen. Barrel-shaped, in males only slightly shorter than head and thorax combined. Preabdominal tergites and sternites extremely strongly developed (sclerotised) and meet laterally. Both males and females with 5 visible preabdominal segments (tergites and sternites). Tergites covered by dense thin, and moderately long microchaetae. Articulation of abdomen to thorax is comparatively broad.

Male genitalia (Figs 1–15). See in the above key.

Female genitalia. Tergites 6–9 wholly membranous. Epiproct weakly sclerotised with a pair of dorsal setulae (Figs 16, 18). Cerci longer with longer setae (Figs 16–18); its apical seta about 0.05 mm. Hypoproct U-shaped, very thin. Sclerotised duct of paired spermathecae comparatively short, duct of single spermatheca also comparatively long. Spermathecae better sclerotised and with a large bulb on initial section of duct (Figs 19–20).

Apteroiroina australis L. Papp, 1979
(Figs 1–6, Papp 1979: fig. 9)

Material studied: 2 male paratypes (HNHM).

For its description, see PAPP (1979). However, male genitalia was not described there.

Male genitalia. Sternite 5 (Fig. 1) c. 5 times broader than long. Subepandrial sclerite (Fig. 3) quadratic. Apical row of pegs on ventro-medial process of synsternite with 12 (6+6) pegs; there is a second row of 3 longer pegs plus 6 longer less distal strong setae (Figs 1–2). Surstylus larger in 2 distinctly divided lobes (Fig. 4), which bear long and thick, medium-long and also numerous short setae. Distiphallus short (Figs 5–6). Postgonite (Figs 5–6) rather short and broad, apex broadly rounded.

Female. Still unknown.

***Apteroiroina flavipes* sp. n.**
(Figs 7–17)

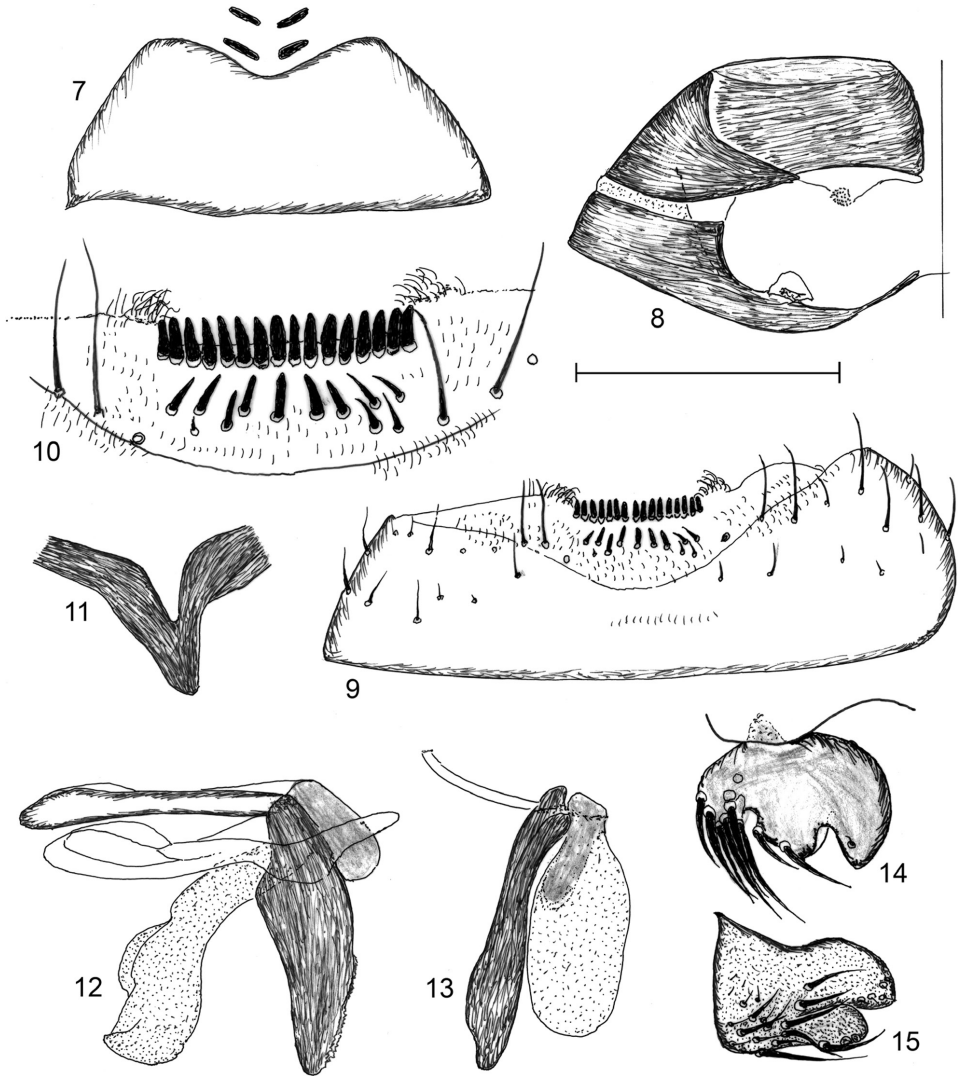
Holotype male (HNHM): AUSTRALIA, NSW, Kioloa State Forest, 4. 1. 1979, No. 1225, pitfall traps.

Paratypes: 2 males 5 females (HNHM, 1 m and 1 f with gen. prep, 1 m and 1 f in AM): same as for the holotype; 1 male (HNHM): *ibid.*, Middle Brothers S. F., 24. 9. 1978.

Body length in mm (holotype): 1.35 (head plus thorax 0.60), paratypes 1.56 (males), 1.67–1.81 (females).

Head. All parts of head, incl. Antenna, yellow. Lunule rounded apically, so not trapezoid as in *Bentrovata*. Facial plate similar to that of *Bentrovata*. 2 *ors* but anterior pair only 3/5 as long as posterior pair and definitely thinner. 2 pairs of strong *ifr*, apexes of anterior

pair crossing. Postocellar minute, hardly discernible, both *vte* and *vti* strong, *vti* emerges 0.4 mm anteriorly to *vte*. Occipitals (*occe*, *occi*) missing. Minute orbital setulae: hardly discernible or wholly missing. Vibrissa only 0.13–0.14 mm long. Gena broad and strongly broadening towards rear, 0.10 mm broad below eye, height of eye 0.20 mm. Genal seta only



Figs 7–15. *Apterobiroina flavipes* sp. n., paratype male, postabdomen and genitalia. 7 = basal sternites, ventral view; 8 = synsternite, subventral view; 9 = sternite 5 with ventro-medial part of synsternite, ventral view; 10 = ventro-medial part of synsternite, ventral view; 11 = hypandrium, ventral view; 12 = genital complex, lateral view; 13 = right postgonite and phallus, dorsal view; 14 = surstylus, broadest dorsal view; 15 = same, broadest ventral view. Scale: 0.4 mm for Figs 7–8, 11; 0.2 mm for Fig. 9; 0.1 mm for Figs 10, 12–15

0.07 mm long, gena incl. peristoma with only 3–4 minute setulae. Scape length less than 0.03 mm but its medial seta 0.08–0.09 mm long. Pedicel with very long dorsal and medial apical-subapical setae, longest one is the medial one, 0.09 mm long. Antennal length 0.165 mm, 1st flagellomere with long (0.03 mm) cilia, arista curved, not precisely measurable, at least 0.40 mm, its cilia c. 0.02 mm long.

Thorax. Thoracic chaetotaxy: 1 *ppnt*, 1 *np*, 1 very long *sa*, 1 *pa*, 1 posterior *dc*, *bsc* both broken on holotype, *asc* 0.41 mm. Katepisternal seta not seen. Halter brown.

Legs. Yellow, fore tibia dark. Fore femur and tibia thickened, much more than in *Bentrovata*. Microchaetae on legs all short. Mid tibia 0.375 mm long, antero-dorsal setae at 0.28 and 0.78 of tibia, posterodorsal at 0.28 and 0.77, i.e. basal pair is precisely paired, all those setae are strong. A short anterior seta at 0.70. No medial ventral seta on mid tibia. No long dorsal preapical seta on hind tibia.

Abdomen. As in the other species of the genus, i.e. preabdominal tergites and sternites meet laterally.

Male genitalia. Structurally same as that of *A. australis*. Sternite 1 strongly reduced (Fig. 7). Ventro-medial part of synsternite (Figs 9–10) with 16 (8+8) strong blunt black thorns/pegs. There is a second row of 8–9 pegs more proximally. Dorsal part of synsternite rather long (Fig. 8). Hypandrium V-shaped (Fig. 11). Surstylus in 2 lobes; anterior lobe smaller, with numerous long setae (Figs 14–15). Postgonite broad, not long, with narrowly rounded apex (Figs 12–13). Basiphallus rather narrow in lateral view. Distiphallus about as long as postgonite (Figs 12–13).

Female genitalia. Preabdominal sternites as large as tergites. Tergites 6 to 9 wholly membranous. Epiproct better sclerotised, with a pair of long setae. Hypoproct comparatively broad (Fig. 17), sternite 9 as broad as hypoproct, with at least 2 pairs of long and thin setae. Cercus (Figs 16–17) comparatively long, 0.07 mm but only 0.015 mm broad; its apical seta 0.05 mm. Hypoproct U-shaped, very thin. Spermathecae similar to those of *A. truncata*.

Remark. Spermathecal ducts are long, they are similar to the ducts of *Rudolfia* (ROHÁČEK 1983).

***Apterobiroina truncata* sp. n.** (Figs 18–20)

Holotype female (HNHM): AUSTRALIA, NSW, Mt. Wilson, 24. 7. 1978, No. 1179, pitfall traps.

Paratypes (HNHM): 1 female (gen. prep.): same as for the holotype.

There is another female in the HNHM: [typed text] Australia 2000. 03. leg: Pócs T., No: 0086a. Through the courtesy of Prof. Dr. Tamás Pócs we received detailed information on this specimen, as follow: Southern Tasmania, W edge of Mount Field National Park, along the trail to Growling Swallet, at 540–580 m alt. 42°41.2'S, 146°29.6-30'E. Wet sclerophyll *Eucalyptus regnans*, *E. obliqua* forest and *Nothofagus cunninghamii* temperate rain forest. Coll. S. & T. Pócs and P. J. Dalton, 13 March 2000. Although, it seems less probable that among these apterous flies, the Tasmanian female is conspecific with that one from New South Wales. I cannot make a distinction of this specimen to the paratype. Consequently, I designated it also as a paratype.

Head. Gena broad, 0.07 mm below eye and strongly broadening posteriorad. 2 *ors* but anterior pair only 3/5 length of posterior one. 3 medium-long pairs of *ifr*. Ocellar seta very large. *Occe* and *occi* 0.02 mm long. Medial seta of scape 0.04 mm long. Flagellomere rounded but with a slight antero-dorsal apex. Arista on lateral surface. Apical seta of palp 0.03 mm.

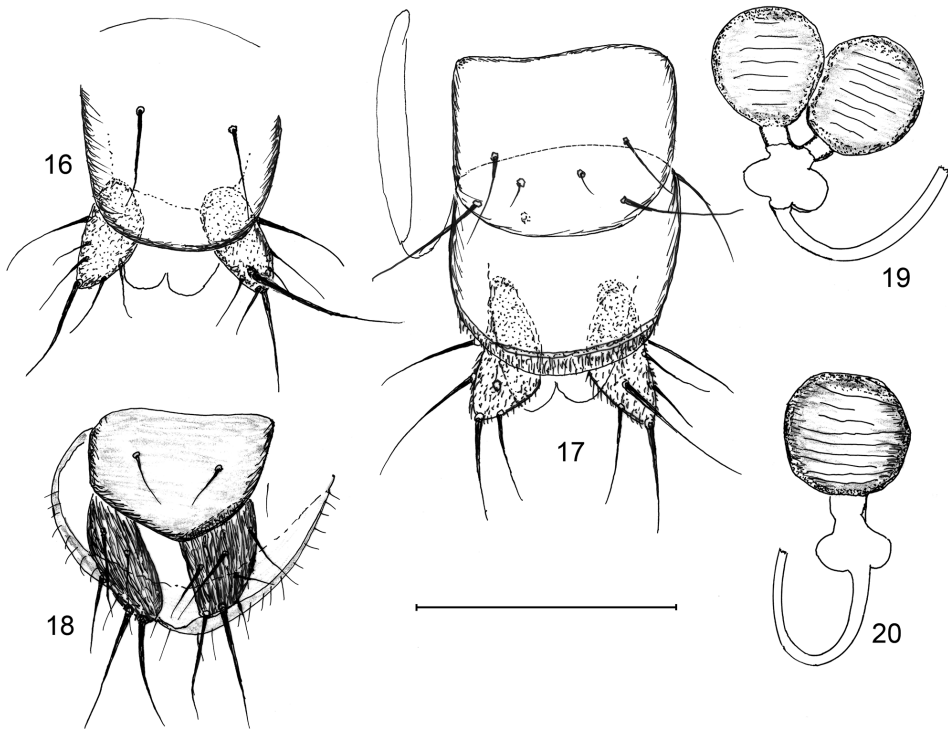
Thorax. Haltere completely absent. Only 1 pair of *dc*, scutellum twice broader than long.

Legs. Mid tibia with 2 pairs of *ad-pd* setae at 1/3 and 2/3 (antero-dorsals slightly more distal). No mid ventral seta. Ventroapical thorn on hind tibia minute, 0.02 mm.

Abdomen. Length of abdomen 1.12 mm, breadth 0.81 mm. Length of tergites 2–4 (mm): 0.35, 0.31, 0.23. Length of sternites 1–5 (mm): 0.19, 0.31, 0.20, 0.14.*

Male. Unknown.

Female genitalia (Figs 18–20). Dorsal seta on epiproct small (Fig. 18). Cercus comparatively long, with 2 long apical and several shorter less distal setae. Spermathecae (Figs 19–20) spherical, large, strongly sclerotised and with a large bulb each on the initial section of ducts (Figs 19–20).



Figs 16–20. *Apterobiroina* species, paratype females, genitalia. 16–17: *A. flavipes* sp. n.: 16 = epiproct and cerci, dorsal view; 17 = hypoproct and cerci, ventral view. 18–20: *A. truncata* sp. n.: 18 = epiproct, cerci and hypoproct, dorsal view; 19 = paired spermathecae; 20 = single spermatheca. Scale: 0.1 mm for all

* A measurement is missing, maybe the size of sternite 1 is negligible.

Key to the known species of *Apterobiroina* L. Papp, 1979

1. Haltere completely absent; ocellar seta very large. Thorax and legs all black. Dorsal seta on female epiproct short (Fig. 18) *A. truncata* sp. n.
- Haltere normal, though small; ocellar seta smaller. At least tarsi, bases and apexes of tibiae yellow. Dorsal seta of female epiproct long (Fig. 16) 2
2. All parts of head, incl. antenna, yellow; all parts of legs but fore tibia yellow. Fore tibia brown. Knob of haltere wax-yellow to ochre, stalk even lighter. Apical row of pegs on ventro-medial process of synsternite with 16 pegs (Figs 9–10). Distiphallus long (Figs 12–13). Surstylus smaller, in 2 smaller lobes (Figs 14–15) *A. flavipes* sp. n.
- Only anterior 1/3 to 2/5 of frons yellow; and only tarsi, bases and apexes of tibiae reddish yellow. Haltere with black knob and brown stalk. Apical row of pegs on ventro-medial process of systemite with 12 pegs. Distiphallus short (Figs 5–6). Surstylus larger, in 2 distinctly divided lobes (Fig. 4) *A. australis* L. Papp, 1979

Bentrovata Richards, 1973

Bentrovata Richards, 1973: 301, 394.

Type species: *Bentrovata regalis* Richards, 1973: 395.

The description of the genus was given by RICHARDS (1973). Some additional characters as well as a description of male and female genitalia are given below.

Head. Frons usually with 5 whitish or silvery stripes. Only 1 pair of *ors*. Head setae *occe* and *occi* though small, well-discernible. Arista about 3–4 times as long as antenna with short cilia only.

Thorax. Pleura anteriorly without any emargination; a large emargination present on distal 1/3 of thorax, which receives mid and hind femur when at rest. Prosternum linear, with a small triangular dilatation posteriorly (see RICHARDS 1973). Scutellum with distinctly curved posterior margin (in contrast to the straight margin in *Monteithiana* Richards, 1973). No wings or halteres, i.e. totally reduced (absent).

Legs. Similar to those of *Apterobiroina*, i.e. short and more or less thickened. Mid tibia with a strong *va*, no mid ventral seta. Antero-dorsal and postero-dorsal setae are paired at basal 1/3 and about apical 4/5. Hind tibia without dorsal preapical seta.

Abdomen. Strongly sclerotised, lateral margins of preabdominal tergites and sternites nearly meet laterally. Female postabdomen small, telescoped (Fig. 38).

Male genitalia. Dorsal part of synsternite short (Figs 24, 30, 46). Ventro-medial process of synsternite with unarranged (Figs 21–22) thick setae or those are in 1 row (Figs 31–32, 44–45). Surstylus smaller, rounded (not divided), with 1 large thorn (Figs 26, 34–35, 49–50). Postgonite slender, its apex narrow and proclinate (Figs 27, 37, 48).

Female genitalia. Spermathecae less sclerotised, with a small bulb on initial section of duct (Figs 28, 39–40, 53). Cercus shorter, with short setae (Figs 29, 41–42, 51–52). Epiproct membranous, without a pair of dorsal setulae (Figs 29, 41–42, 51–52).

Bentrovata flavithorax sp. n.
(Figs 21–29)

Holotype male (HNHM): WESTERN AUSTRALIA, Gully Rd., Nornalup-Walpole Nat. Pk. – 25. 1. 1979 to 6. 3. 1979, No. 1496, pit fall traps.

Paratypes (HNHM, 2 m, 3 f in AM): 5 males 8 females (1 m 1 f gen. prep.): same as for the holotype; 3 males 6 females (HNHM): *ibid.*, Nornalup-Walpole Nat. Pk., No. 1495; 1 female (HNHM): *ibid.*, Treen Brook S. F., No. 1492.

Body length (mm): 1.58 (holotype), 1.66–1.81 (paratypes).

Frons without longitudinal stripes. Thorax contrastingly yellow.

Male genitalia. Larger blunt black thorns/pegs of ventro-medial process of synsternite are unarranged (Figs 21–22). Dorsal part of synsternite short (Fig. 24). Pseudocerci large (Fig. 23). Hypandrium Y-shaped, with long apodeme (Fig. 25). Surstylus (Fig. 26) short, with an extremely large black thorn ventrally. Distiphallus (Fig. 27) rather short; postgonite long and narrow, with a proclinate, nearly sharp apex.

Female genitalia. Abdomen at broadest 0.60 mm. Length of tergites 3–5 (mm): 0.225, 0.36, 0.225. Length/width of sternites 3–6 (mm): 0.12×0.67, 0.17×0.68, 0.12×0.66, 0.09×0.41. Epiproct membranous, without setae (Fig. 29). Spermathecae long ovoid (Fig. 28), neck of spermathecae without warts.

Bentrovata minor sp. n.
(Figs 30–37)

Holotype male (gen. prep., HNHM): WESTERN AUSTRALIA, Nornalup-Walpole Nat. Pk. – 25. 1. 1979 to 6. 3. 1979, No. 1495, pit fall traps. The holotype is damaged, its fore legs and head and tibial setae are partly lost.

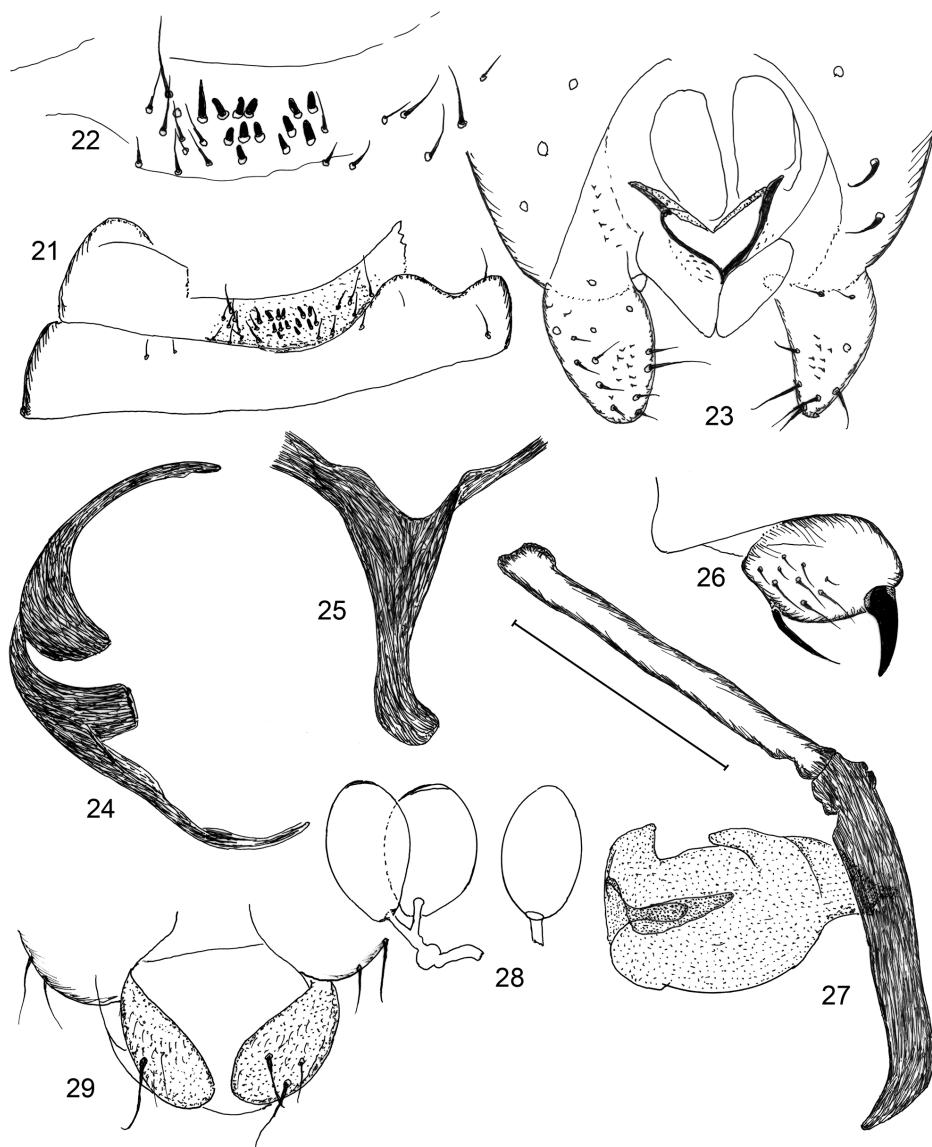
Body length: 1.55 mm.

All body and legs dark. *Ifr* lines distinct. Breadth of gena 0.06 mm behind *vi*, eye's height 0.15 mm.

Abdomen. Abdominal sternites are surprisingly narrow.

Male genitalia. Generally of a *Bentrovata* type. Ventro-medial process of synsternite (Figs 31–32) with strong, black thorns/pegs in 1 row, 16 (8+8) pegs are to be counted. Dorsal part of synsternite (Fig. 30) short. Pseudocerci (Fig. 33) indistinct. Hypandrium (Fig. 36) Y-shaped, apodeme medium-long. Surstylus (Figs 34–35) short, with only 1 strong, comparatively short ventral thorn. Distiphallus (Fig. 37) medium-long and less broad than in *B. flavithorax*. Postgonite (Fig. 37) long, slender, slightly curved, with a gently proclinate, blunt apex.

Female. Unknown.



Figs 21–29. *Bentrovata flavithorax* sp. n., male and female paratypes, postabdomen and genitalia. 21–27: male: 21 = sternite 5 and ventral part of synsternite, ventral view; 22 = ventro-medial part of synsternite, ventral view; 23 = pseudocerci and subepandrial sclerite, caudal view; 24 = synsternite, anterior view; 25 = hypandrium, ventral view; 26 = surstylus, broadest (sublateral-subventral) view; 27 = postgonite, phallus and phallapodeme, lateral view. 28–29: female: 28 = spermathecae; 29 = cerci, dorsal view. Scale: 0.4 mm for Fig. 24; 0.2 mm for Fig. 21; 0.1 mm for Figs 22–23, 25–29

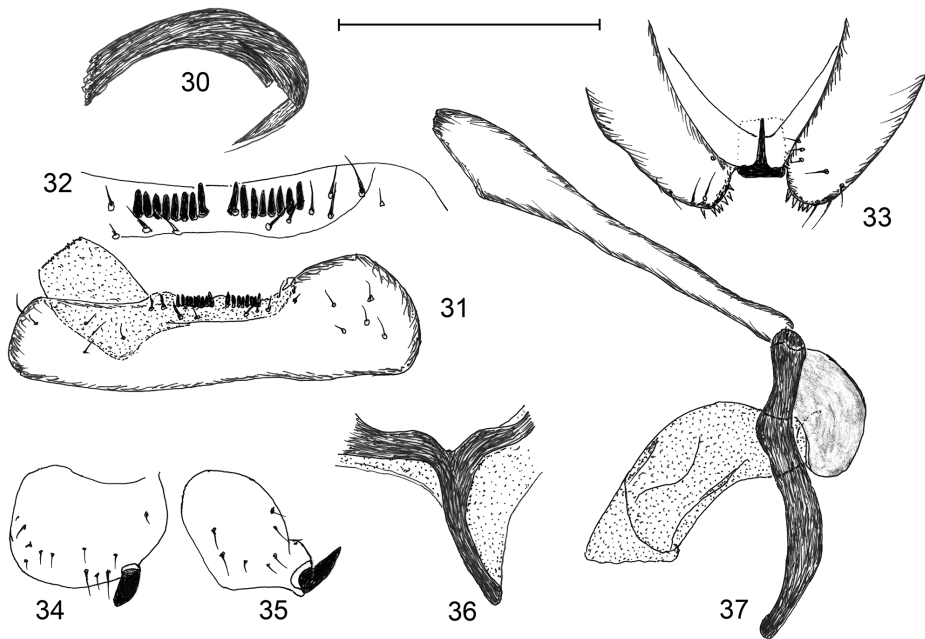
***Bentrovata nigrithorax* L. Papp et Szappanos, sp. n.**
(Figs 38–42)

Holotype female (HNHM): WESTERN AUSTRALIA, Nornalup-Walpole Nat. Pk. – 25. 1. 1979 to 6. 3. 1979, No. 1495, pitfall traps.

Paratypes: 3 females (2 HNHM, 1 of them with gen. prep, 1 in AM): same as for the holotype; 1 female (HNHM): WESTERN AUSTRALIA, Boranup Drive nr. Karridale – 25. 1. 1979 to 6. 3. 1979, No. 1490, pitfall traps.

Body length in mm (holotype): 1.60, head plus thorax 0.81, abdomen 1.02, 1.66–1.70 (paratypes).

Head. Mostly ochre, contrasting the blackish dark brown abdomen. Clypeus slightly protruding, carina low but strongly protruding between antennae. Facial plate shiny yellow, slightly concave in profile. Frons with 5 longitudinal stripes: 1 sagittal, 2 *ifr* and 2 orbital ones. The stripes are white (yellowish white) on greyish yellow or ochre basic colour. Lunule large trapezoidal. Gena below eye 0.10 mm broad, strongly broadening towards rear, height of eye 0.29 mm. Ocellar seta the strongest seta of head (Fig. 38), strongly upright and curved, from base to tip 0.23 mm long. 2 pairs of strong *ifr* plus a minute pair most anteriorly. *vte* and *vti* emerge close to each other (distance 0.04 mm), *vte* almost totally caudal



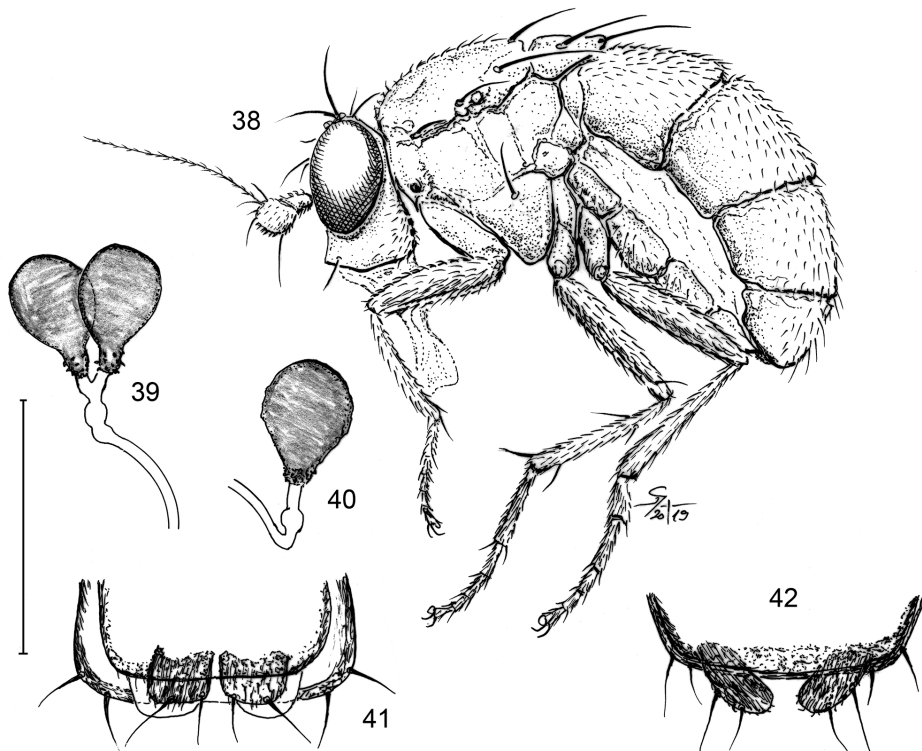
Figs 30–37. *Bentrovata minor* sp. n., holotype male, terminalia and genitalia. 30 = dorsal part of synsternite, anterior view; 31 = sternite 5 and ventral part of synsternite, ventral view; 32 = ventro-medial part of synsternite, ventral view; 33 = ventral part of epandrium and subepandrial sclerite, caudal view; 34 = surstylus, lateral view; 35 = same, ventral view; 36 = hypandrium, ventral view; 37 = left postgonite, phallus and phallapodeme, lateral view.

Scale: 0.4 mm for Fig. 30; 0.2 mm for Figs 31, 33, 36; 0.1 mm for Figs 32, 34–35, 37

to *vti*. Postocellar pair minute, indiscernible, *occi* 0.08 mm, *occe* c. 0.02 mm only. Only 1 pair of strong *ors* (though 2 seta on the right side of holotype) and some minute orbital setulae more anteriorly. Vibrissa strong and long, curved from apex to tip 0.22 mm. Genal seta comparatively long, upcurved, 0.10 mm long, no peristomal row of setae but some scattered short peristomal and genal setae present. Antenna 0.21 mm long, arista subapical, emerge at about apical 3/5 of first flagellomere, curved (not precisely measurable) c. 0.62–0.63 mm long. Scape 0.04 mm only, with a 0.08–0.09 mm long medial seta. Pedicel with a wreath of apical-subapical setae, which are long on medial half of the apical edge, medial one is the longest one, 0.11 mm. First flagellomere infuscated with 0.03 mm long dense hairs.

Thorax. Dark brown. Thoracic chaetotaxy: 1 *ppnt*, 1 *np*, 1 *sa*, 1 *pa*, 1 very strong posterior *dc*. Scutellum with *bsc* 0.325–0.338 mm long, *asc* 0.24 mm, i.e. about as long as *dc* seta. *Acmi* in c. 8 unarranged rows. Pleura only with a strong 0.25 mm long *kepst*.

Legs. Legs predominantly dark brown. Femora thickened but not as strongly as in *Apterobiroina*. Mid femur as long as mid tibia, 0.52 mm. Mid tibia with antero-dorsal setae at 9/42 (short) and 35/42 (long), posterodorsal setae at 10/42 (long) and at 35/42 (very long). A medium-long anterior seta at 31/42. Mid tibial ventroapical seta 0.15 mm long. No long dorsal preapical seta on hind tibia. Second and third tarsomeres of hind tarsus thickened.



Figs 38–42. *Bentrovata nigrithorax* L. Papp et Szappanos, sp. n., paratype female. 38 = habitus, lateral view (del. A. Szappanos); 39 = paired spermathecae; 40 = single spermatheca; 41 = cerci and hypoproct, dorsal view; 42 = same, ventral view. Scale: 0.1 mm for Figs 39–42

Abdomen. Comparatively slightly shorter than in *Apterobiroina*. Length of abdomen 1.02, breadth 0.72. Length of sternite 2 at middle 0.04 mm, laterally 0.08 mm, length of sternites 3–5: 0.23, 0.206, 0.14, sternite 6: 0.06 mm. Sternite 1 present as a pair of minute 0.01×0.01 mm scales.

Male. Unknown.

Female postabdomen and genitalia. Length of tergite 4: 0.27 mm, that of tergite 5: 0.16 mm. Tergite 6 very short, broad tub-shaped, tergite 7 only 0.012 mm long. Tergite 9 in 2 lateral pieces. Sternite 6 very short, sternite 7 even shorter, sternite 8 present as a pair of weakly sclerotised round lamella. Epiproct membranous (Fig. 41); hypoproct (Fig. 42) mostly membranous, composed of a pair of ventral lamellae and a caudal rim of 0.1 mm broad and 0.05 mm long. Cercus 0.04 mm long, 0.025 mm broad (Figs 41–42), apical seta 0.025 mm, with 2 minute dorsal setulae. Sclerotised part of the duct of paired spermathecae only 0.015 mm. Spermathecae pear-shaped. Neck of spermathecae with numerous warts (Figs 39–40).

Bentrovata regalis Richards, 1973 (Figs 43–53)

Material studied: 2 males, 2 females (HNHM, 1 f in AM): WESTERN AUSTRALIA, Burnside nr. Margaret River, pitfall traps (all with the label of “*Bentrovata regalis* Rich. ♂/♀, det. L.Papp 2008”): 1 male, 1 female (gen. prep): 25. 1. 1979 to 6. 3. 1979, No. 1489; 1 male (gen. prep.): *ibid.*, Boranup Drive nr. Karridale – No. 1490; 1 female: *ibid.*, Bolganup Rd., Porongonup Nat. Pk – No. 1508.

The types of this species are from Perth, Kings Park (W.A.).

Head. 2 pairs of long *ifr* setae plus a short more anterior one on the right side. *pvt* negligible, *occe* and *occi* minute (0.03 mm or shorter). Proboscis comparatively very large. Scape’s seta minute. Arista emerges from dorsal middle surface of flagellomere.

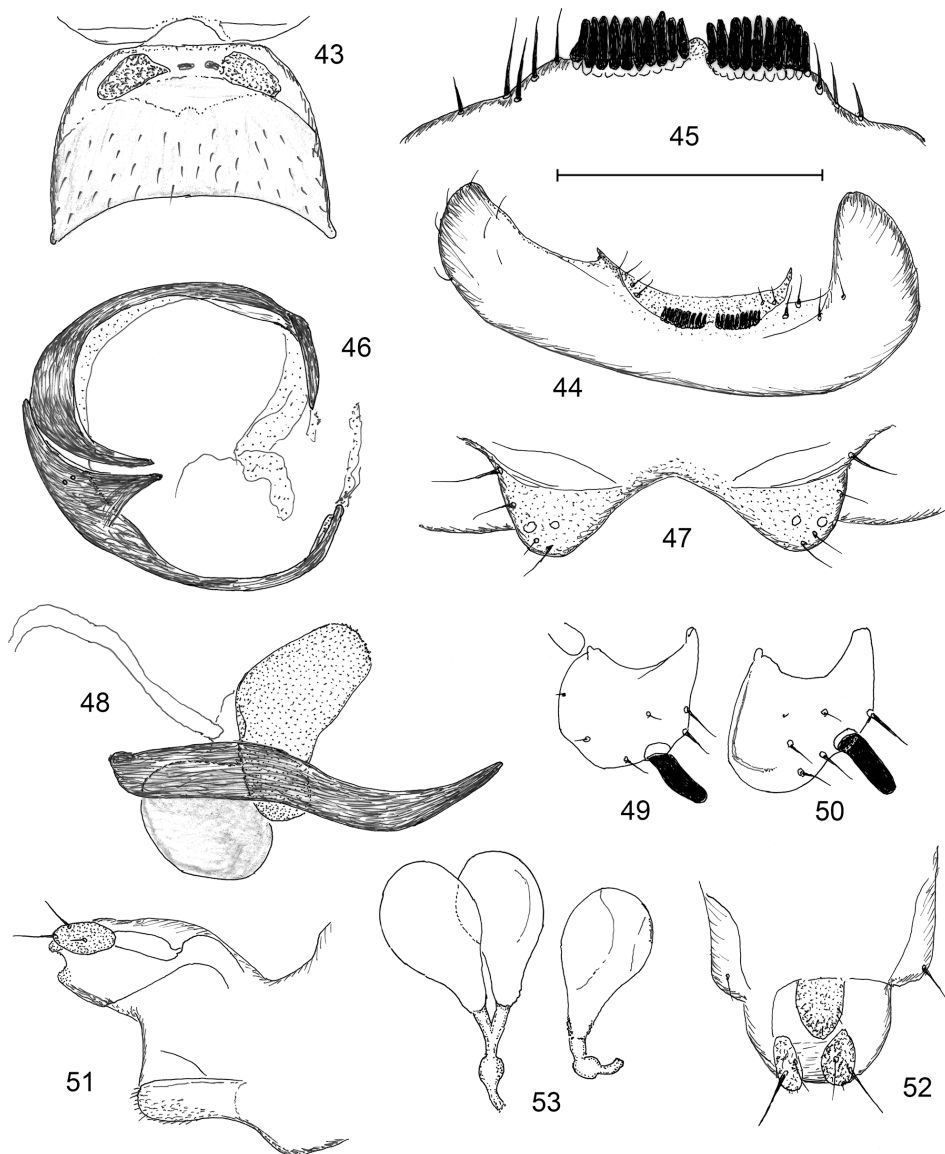
Thorax. Yellow, some parts of pleura ochre. Scutellum twice broader than long.

Legs. Predominantly yellow, only mid part of femora light brown. Mid femur with an anterior subapical thorn. Mid tibia with *ad-pd* setae at 3/10 and 4/5 and a short, more anterior seta at 29/40. Ventroapical seta of mid tibia 0.14 mm long.

Abdomen. At broadest 0.87 mm. Sternite 2 (Fig. 43) consists of a pair of small medial and a pair of larger lateral sclerites. Length of tergites 2–5 (mm): 0.30, 0.39, 0.34, 0.21.

Male genitalia. Contours of sternite 5 is the same as Richards’s fig. 91. Dorsal part of synsternite short (Fig. 46). Ventro-medial process of synsternite with a pair of brushes of 20 black, blunt pegs caudally (Figs 44–45). Epandrium deformed on Fig. 92 of RICHARDS (1973) (depressed), consequently much broader than in its original form/state. Hypandrium fused to epandrium, with a medium-long medial apodeme. Pseudocerci small but distinct (Fig. 47). Surstylus short and rounded, with an extremely long, thick, black thorn (Figs 49–50). Distiphallus (Fig. 48) short, with broad apex. Basiphallus comparatively large (Fig. 48). Postgonite long and slender, S-formed, with proclinate, sharp apex (Fig. 48). Phallopodeme very long (broken on the Fig. 93 of RICHARDS 1973).

Female genitalia (Figs 51–53). Length of tergite 4: 0.25 mm, that of tergite 5: 0.16 mm. Tergite 7 so short that it looks like a piece of transverse, thread-like dirt. Cercus minute, with very short setulae (Figs 51–52); epiproct membranous, without setulae; hypoproct rather narrow. Spermathecae (Fig. 53) longish, pear-shaped, neck without any warts.



Figs 43–53. *Bentrovata regalis* Richards, 1973, male and female postabdomen and genitalia. 43–49: male: 43 = basal sternites, ventral view; 44 = sternite 5 and ventro-medial part of synsternite, ventral view; 45 = ventro-medial part of synsternite, ventral view, higher magnification; 46 = synsternite, anterior view; 47 = pseudocerci, caudal view; 48 = genital complex, lateral view; 49–50 = surstylus, in two, slightly different broadest views. 51–53: female: 51 = postabdomen, lateral view; 52 = same, ventral view; 53 = spermathecae. Scale: 0.4 mm for Fig. 43; 0.2 mm for Figs 44, 46; 0.1 mm for Figs 45, 47–53

KEY TO THE KNOWN SPECIES OF *BENTROVATA* RICHARDS, 1973

1. Frons without longitudinal stripes. Large, blunt, black thorns/pegs of ventro-medial process of synsternite unarranged (Figs 21–22). Pseudocerci large (Fig. 23). Female spermathecae long ovoid (Fig. 28), its neck without warts. Thorax contrastingly yellow. **B. flavithorax** sp. n.
- Frons with 5 longitudinal stripes. Large, blunt, black thorns/pegs of ventro-medial process of synsternite in 1 row (Figs 31–32). Pseudocerci small (Fig. 47) or indistinct (Fig. 33). Female spermathecae pear-shaped (Figs 39–40, 53) 2
2. Body smaller, 1.55 mm. Male pseudocerci indistinct (Fig. 33). The black peg of surstylus comparatively short (Figs 34–35). Ventro-medial process of synsternite with 16 (8+8) pegs (Figs 31–32). Female unknown **B. minor** sp. n.
- Body larger (1.60 mm or more). Male pseudocerci small (Fig. 47). The blunt peg of surstylus extremely long (Figs 49–50). Ventro-medial process of synsternite with long, blunt, black pegs in 1 row, with 20 (10+10) pegs (Figs 44–45) 3
3. Thorax dark brown. Legs predominantly dark brown. Neck of spermathecae with numerous warts (Figs 39–40). Male unknown **B. nigrithorax** L. Papp et Szapponos, sp. n.
- Thorax contrastingly yellow. Legs predominantly yellow. Neck of spermathecae without warts or they are indistinct (Fig. 53) *B. regalis* Richards

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Farewell remark. Dear Readers, this is my last paper in the taxonomy of Sphaeroceridae. In the last 50 years, I published much as regards the volume of books, book chapters and scientific papers. As for their quality, it is out of my competence to judge them. Those who used them with benefit are welcome. If I caused you annoyance, I beg your pardon. God bless you all.

REFERENCES

- MARSHALL, S. A., ROHÁČEK, J., DONG, H. & BUCK, M. (2011): The state of Sphaeroceridae (Diptera: Acalyptratae): a world catalog update covering the years 2000–2010, with new generic synonymy, new combinations, and new distributions. – *Acta Entomologica Musei Nationalis Pragae* 51(1): 217–298.

- PAPP, L. (1979): On apterous and reduced-winged forms of the family Drosophilidae, Ephydriidae and Sphaeroceridae (Diptera). – *Acta Zoologica Academiae Scientiarum Hungaricae* **25**: 357–374.
- PAPP, L. (1995): Oriental species of the genus *Biroina* Richards (Diptera: Sphaeroceridae). – *Revue Suisse de Zoologie* **102**: 539–552. <https://doi.org/10.5962/bhl.part.80473>
- PAPP, L. & ROHÁČEK, J. (2021): 99. Sphaeroceridae (Lesser dung flies). In: KIRK-SPRIGGS, A. H. (ed.): *Manual of the Afrotropical Region*. [in print]
- RICHARDS, O. W. (1965): Cl. – Diptera, flightless Sphaeroceridae and Chloropidae. Mission zoologique de l'I.R.S.A.C. en Afrique orientale. (P. Basilewsky et N. Leleup, 1957). – *Annales du Musée Royal de l'Afrique Central, Tervuren, Série in 8°, Sciences Zoologiques* **138**: 415–464.
- RICHARDS, O. W. (1973): The Sphaeroceridae (= Borboridae or Cypselidae; Diptera Cyclorhapha) of the Australian Region. – *Australian Journal of Zoology* (Supplementary series) **22**: 297–401. <https://doi.org/10.1071/AJZS022>
- ROHÁČEK, J. (1982): A monograph and re-classification of the previous genus *Limosina* Macquart (Diptera, Sphaeroceridae) of Europe. Part I. – *Beiträge zur Entomologie, Berlin* **33**: 3–195.
- ROHÁČEK, J. (1983): A monograph and re-classification of the previous genus *Limosina* Macquart (Diptera, Sphaeroceridae) of Europe. Part II. – Part III. – *Beiträge zur Entomologie, Berlin* **33**: 3–195; 203–255.
- ROHÁČEK, J. (1998): 3.43. Family Sphaeroceridae. Vol. 3. Pp. 463–496. In: PAPP, L. & DARVAS, B. (eds): *Contributions to a Manual of Palaearctic Diptera*. Vol. 3, Higher Brachycera. – Science Herald, Budapest.
- ROHÁČEK, J., MARSHALL, S. A., NORRBOM, A. L., BUCK, M., QUIROS, D. I. & SMITH, I. (2001): *World Catalog of Sphaeroceridae (Diptera)*. – Slezské zemské museum, Opava, 414 pp.

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