

## Two further species groups and new species among Australian *Hydrobiosella* Tillyard: new species from south-eastern Australia (Trichoptera: Philopotamidae)

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### Abstract

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Eleven philopotamid caddisfly species in the genus *Hydrobiosella* Tillyard are newly described from Australia, based on small differences in features of the male genitalia. These species are placed in two new species groups, one based on *H. letti* Korboot, the other on *H. bandabanda* sp. nov.

The five species of the *Hydrobiosella bandabanda* group, all newly described here: *H. bandabanda*, *H. jibboor*, *H. jirrama*, *H. tarrong* and *H. tiarka*, share features of phallus with two or more embedded spines subapically and both preanal appendages and parameres absent. Females of four of these species are also figured in part. All five species are endemic to the eastern half of Victoria, mainland Australia.

The *H. letti* species group comprises seven species: *Hydrobiosella bifurca*, *H. bos*, *H. excilatas*, *H. fibra*, *H. incisura*, *H. letti* Korboot and *H. tenuitas*, united in having features such as elongate, nearly straight parameres arising near middle to base of phallus, no obvious spines in phallus and presence of preanal appendages. Females of two of these species are also partly figured. These seven species are all endemic to eastern coastal mainland Australia, from north-eastern Victoria to eastern Queensland.

### Keywords

Trichoptera, caddisflies, Philopotamidae, *Hydrobiosella*, Australia.

### Introduction

The recent history of the genus *Hydrobiosella* Tillyard in Australia is revised and summarized by Cartwright (2010, 2012a, 2012b). In brief, the first Australian species in the genus were described in 1953 by Mosely (in Mosely and Kimmins, 1953). Further species were added by Korboot (1964); Jacquemart (1965); (Neboiss, 1977, 1982, 2003) and Cartwright (2010, 2012a, 2012b). A total of 53 species of *Hydrobiosella* are known worldwide: from Australia (43 species — Cartwright 2012b), New Zealand (4 species — Morse 1999) and New Caledonia (6 species — Espeland and Johannson 2007).

Groups were first recognized among Australian *Hydrobiosella* by Neboiss (1977) for Tasmanian species). He diagnosed three groups based primarily on male genitalia and these, the *H. bispina*, *H. eminentia* and *H. waddama* species groups were detailed more recently and included in an updated key to the Australian species and species group (Cartwright 2010, 2012a, 2012b). Two further species groups are diagnosed here and include 11 newly described species which bring to 54 the total number of Australian species of *Hydrobiosella*. Australian mainland species in the *H. waddama* group have recently been reviewed (Cartwright 2012b).

In this study of the newly recognised *Hydrobiosella bandabanda* group, 60 male and 10 female specimens were

examined, determined to be referable to five very similar species. The more common species in the group were, *H. tiarka* comprising about 41% of specimens, *H. bandabanda* 30%, *H. jirrama* 17%, and *H. tarrong* with about 10% of specimens. One species, *H. jibboor*, is known from only one specimen. No differentiation of female genitalia has been established as yet. All five species were collected from south-eastern Australia, within the Bassian region, a distribution suggestive of a 'southern' origin.

This revision of the Australian '*Hydrobiosella letti*' group is based on some 37 male and 36 female specimens, referred to seven species. The most common species, *H. bifurca*, contributed about 79% of all *H. letti* species group specimens. All six other species are known from fewer than five specimens. The seven species of this group, including the six new species were collected from eastern Australia, north-eastern Victoria, central-eastern New South Wales and eastern Queensland. Three of the seven species are from north-eastern Queensland, so southern or northern Australia origins could be postulated equally for the group.

### Methods and abbreviations

Among species in this genus, size, and body and wing colour can be useful distinguishing characters, but are often variable. Wing and body colour can be most useful in freshly preserved



material but the colour often fades with time in alcohol. Most of the material studied has been preserved in alcohol for many years and was on loan from Museum Victoria, made available by the late Dr Arturs Neboiss. Depositories for specimens are abbreviated as follows: Museum Victoria, Melbourne (NMV), Australian National Insect Collection, Canberra (ANIC), the Natural History Museum, London (BMNH) and the Queensland Museum, Brisbane (QM). All specimens, including types, mentioned in the text are lodged in the NMV unless stated otherwise.

Males of each species are most easily distinguished by genitalic features, but usually require clearing of the abdomen in potassium hydroxide. Females were paired with respective males on the basis of similarities in size and coloration, and on wing venation and locality.

Figured specimens are identified by the notebook numbers of Dr Arturs Neboiss (NMV), prefix PT-; or the author; prefix CT-. Terminology used generally follows that of Neboiss (1977, 1982), Blahnik (1998, 2005) and Holzenthal et al. (2007). Terminology used for genitalic parts are indicated on selected figures for each genus and additionally where necessary. Typically, setae or spines are illustrated only on the right side of the figure (as viewed) to enable a better view of the underlying structures. Length/width measurements generally mean maximum length divided by maximum width.

## Descriptions

### *Hydrobiosella* Tillyard 1924

*Hydrobiosella* Tillyard 1924: 288; Mosely and Kimmins 1953: 387; Neboiss 1977: 45; Neboiss 2003: 55.

*Type species. Hydrobiosella stenocerca* Tillyard by monotypy.

Generic descriptions are given by Tillyard (1924: 288); Mosely and Kimmins (1953: 387) and Neboiss (1977: 45).

### Key to males of known Australian groups (or ungrouped species) of *Hydrobiosella* Tillyard (after Cartwright 2010, 2012)

1. Phallus without pair of parameres (Figs 2, 3, 5, 6; Cartwright 2012a, figs 2, 3; Neboiss 1986, figs pp. 99, *H. amblyopia*; 101, *H. tasmanica*; 102, *H. corinna*) ..... 2
- Phallus with pair of parameres (Cartwright 2010, figs 2, 3, 5, 6; Neboiss 1986, figs pp. 99, *H. michaelsoni*, *H. waddama*; 101, *H. letti*; 102, *H. bispina*; 103, *H. arcuata*) ..... 6
2. Preanal appendages present, usually small (Cartwright 2012a, figs 2, 3; Neboiss 1977, figs 204, 205, 216, 217; Neboiss 1986, figs pp. 101, *H. tasmanica*; 102, *H. corinna*; Neboiss 2003, figs 8a–h) ..... 3
- Preanal appendages absent (Figs 2, 3, 18, 19; Neboiss 1986, figs pp. 99, *H. amblyopia*; 101, *H. tasmanica*) ..... 4
3. Preanal appendages relatively slender, elongate and ‘unattached’ to segment IX (Cartwright 2012a, figs 2, 3, 5); NE-Qld ..... *Hydrobiosella eminentia* group

- Preanal appendages often short and bulbous or ‘attached’ to segment IX (Neboiss, 1977, figs 204–211; Neboiss 1986, figs p. 102, *H. corinna*; Neboiss, 2003, figs 8A–H); Tas ..... *Hydrobiosella corinna* group
- 4. Phallus apically with downward projecting spine(s) (Neboiss 1977, figs 216–221, 225, 226; Neboiss 1986, figs p. 101, *H. armata*, *H. tasmanica*; Neboiss 2003, figs 10A–G, 11A–G, 12A–F); Tas ..... *H. tasmanica* group
- Phallus apically without downward projecting spine(s) (Figs 2, 3; Neboiss 1982, fig. 12; Neboiss 1986, figs p. 99 *H. amblyopia*) ..... 5
- 5. Segment IX with a large disto-lateral projection (Neboiss 1982, fig. 12; Neboiss 1986, figs p. 99 *H. amblyopia*); S-WA ..... *H. amblyopia* (ungrouped)
- Segment IX without a large disto-lateral projection (Figs 2, 3, 5, 6); C and NE Vic ..... *H. bandabanda* group
- 6. Inferior appendages with harpago with dark row of setae forming fringe along ventral margin (Cartwright 2010, figs 3, 6; Neboiss 1986, figs pp. 102, *H. bispina*; 103, *H. arcuata*); E-Vic, E-NSW, E-Qld ..... *Hydrobiosella bispina* group
- Inferior appendages with harpago without dark row of setae forming fringe along ventral margin (Figs 18, 19; Neboiss 1986, figs pp. 99, *H. michaelsoni*, *H. waddama*) ..... 7
- 7. Parameres elongate and sinusoidal, attached ventrally to base of phallus (Cartwright 2012b, figs 2, 3, 5, 6; Neboiss 1977, fig. 233; Neboiss 1986, figs p. 99, *H. waddama*); Tas, SE Aust. .... *Hydrobiosella waddama* group
- Parameres not elongate and sinusoidal, not attached ventrally to base of phallus (Figs 18, 19; Neboiss 1982, figs 9, 10; Neboiss 1986, figs pp. 99, *H. michaelsoni*; 101, *H. letti*) ..... 8
- 8. Parameres curved strongly and crossed (Neboiss 1982, figs 9, 10; Neboiss 1986, figs p. 99; *H. michaelsoni*); S-WA ..... *Hydrobiosella michaelsoni* (Ulmer) (unplaced to group)
- Parameres not curved strongly and crossed (Figs 18, 19; Neboiss 1986, figs p. 101, *H. letti*); NE-Vic, CE-NSW, E-Qld ..... *Hydrobiosella letti* group

### *Hydrobiosella bandabanda* group

**Diagnosis.** Key characters of males in the group are phallus without parameres but with two or more embedded spines subapically and preanal appendages absent.

**Description.** Head and nota dorsally brown to dark brown with pale setal warts and scutellum, abdomen brownish dorsally and ventrally, paler laterally; wings light brown to brown. Medium-sized adults. Forewing length about 2.8–3.1 times maximum width, males: 5.9–9.8 mm; females: 6.1–10.8 mm; wing venation (Fig. 1), similar to the type species *H. stenocerca* (Mosely and Kimmins 1953, fig. 265a), *H. bispina* (Cartwright, 2010, fig. 1) and *H. waddama* (Mosely and



Kimmins 1953, fig. 269a), R1 simple, forks 1, 2, 3, 4 and 5 present; forks 1 and 2 sessile; fork 2 with nygma present, length about 1.3–1.4 times length fork 1; fork 3 shorter, length 0.7 times length fork 2, fork 3 length ranging from between 1.8–1.9 times length footstalk, cross-veins r-m and m contiguous at fork 3; fork 4 similar length to fork 3, fork length about 7 times length footstalk; fork 5 very long, length between 1.6–1.7 times length fork 4; discoidal cell closed, length between 3.7–3.8 times maximum width. Hind wing length about 2.4–2.5 times maximum width; forks 1, 2, 3 and 5 present; forks 1 and 2 sessile; fork 2 with nygma, length fork 2 between 1.4–1.5 times length fork 1; fork 3 shorter, length about 0.6 times length fork 2, fork 3 slightly longer than footstalk, length fork ranging between 1.3–1.4 times length footstalk; fork 5 very long, length between 1.8–1.9 times length fork 3; discoidal cell closed, length between 4.0–4.1 times maximum width; with three longer anal veins (Fig. 1).

**Male.** Segment IX with a shallow, wide V notch medially on distal margin (Figs 4, 7, 10). Preanal appendages absent. Segment X mainly sclerotised, dorso-ventrally compressed; in dorsal view, with a 'tongue-shaped' process, tapered distally, rows of fine hairs meso-laterally and usually a pair of small knobs baso-laterally (Figs 2, 5). Phallus generally robust, tube-like, with a pair of spines sub-apically, sometimes with one or two spines more basally (Figs 2, 3, 5, 6). Inferior appendages with two segments, in lateral view, basal segment usually more robust and longer than harpago. Harpago has a small field of dark spines meso-distally (Figs 3, 6).

**Female.** Genitalia typical of genus with a small projection on sternite IX mesodistally (Figs 38–41).

**Larva.** Confirmed larvae are known for *H. bandabanda*. These larvae match *Hydrobiosella* sp. AV2 (Cartwright, 1997). The diagnostic features are head wide and angular laterally, and forecoxa with two sclerotised processes on anterior margin, one longer than the other (Cartwright, 1997, fig. 1.3). *Hydrobiosella* sp. AV2 larvae are recorded mainly from riffle habitats of very small to medium-sized streams between 0.4–8 m wide at moderate to high altitudes between 800–1460 m (Suter et al. 2006).

#### Key to males of species of the *Hydrobiosella bandabanda* group from Australia

1. Segment X dorsally with a central ridge bearing pair of acute lateral processes (Figs 2, 2a); EC-Vic ..... *H. bandabanda*
- Segment X without a central dorsal ridge (Figs 5, 8) ..... 2
2. Segment X with sub-apical spine (Fig. 6); E-Vic ..... *H. tiarka*
- Segment X without apical spine (Figs 9, 12) ..... 3
3. Segment X in lateral view with apical half slender, not dilated apically; inferior appendages with terminal segment dilated slightly in apical half (Fig. 9); NE-Vic ..... *H. tarrong*

- Segment X in lateral view with apical half robust, dilated apically; inferior appendages with terminal segment not dilated in apical half (Figs 12, 15) ..... 4
- 4. Segment X with a dorsal 'bump' subapically (Fig. 12); NE-Vic ..... *H. jibboor*
- Segment X without a dorsal 'bump' subapically (Fig. 15); NE-Vic ..... *H. jirrima*

#### *Hydrobiosella bandabanda* sp. nov.

Figures 1, 2, 2a, 3, 3a, 4, 4a, 38, 38a

**Holotype.** Male. Victoria, Toorongo Falls, 7 km NE of Noojee, (about 37°51'S, 146°00'E), 27 Nov 1981, J. Morse & A. Neboiss (NMV, T-21392).

**Paratypes.** Victoria. 4 males (specimen CT-593 figured), 1 female (specimen CT-594 figured), collected with holotype; 7 males (specimen PT-581 figured), 2 females (specimen CT-612 figured), Newlands Ck, Upper Thomson R. (about 37°37'S, 146°10'E), 26 Feb 1978, TR Survey (NMV).

**Other material examined.** Victoria. 2 males, Falls Ck Ski Village, 26 Mar 1957, A. Neboiss; 1 male, Cumberland Falls, SE of Marysville, 7 Jan 1971, A. Neboiss; 1 male, Baw Baw Ski Village, 4900 ft, 8 Jun 1974, J.C.; 1 male, Cement Ck, Mt Donna Buang Rd, 3 Mar 1980, J. Dean?; 1 male, small ck 1 km N Rum Ck, 9 Nov 1983, D. Cartwright (NMV).

**Diagnosis.** Males of *Hydrobiosella bandabanda* can be distinguished from those of other species in the group by a central dorsal ridge or groove with a pair of lateral acute processes on segment X.

**Description.** Wings typical of the genus (Fig. 1), similar to those of *H. bispina* (Cartwright, 2010, fig. 1). Length of forewing; male 6.7–9.1 mm, female 7.2–9.3 mm.

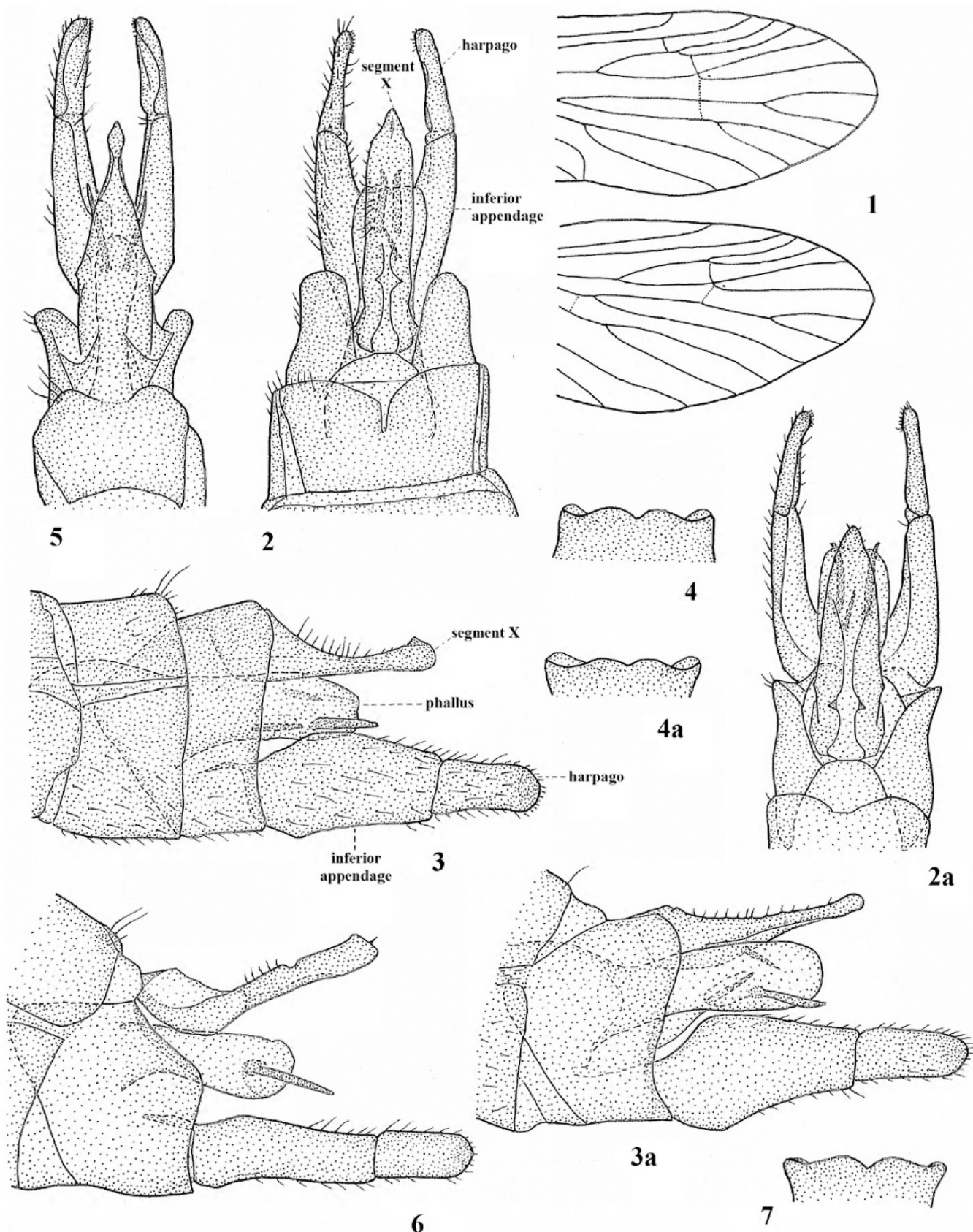
**Male.** Segment IX with a shallow, wide V-shaped notch medially on distal margin (Figs 4, 4a). Segment X in dorsal view, a 'tongue-shaped' process, with sides almost parallel, a pair of small knobs baso-laterally, tapered distally and with a central dorsal ridge or groove bearing a pair of lateral acute processes (Figs 2, 2a), length about 3–3.5 times width; in lateral view broad-based, slightly curved (Fig. 3), or straight (Fig. 3a) slender in middle, usually slightly dilated distally with a sub-apical 'knob' (Fig. 3), sometimes without 'knob' (Fig. 3a). Phallus generally tube-like, robust, with a pair of sub-apical spines and two smaller spines basally (Figs 2, 2a, 3, 3a). Inferior appendages in lateral view, with basal segment broadest near middle, length about twice maximum width; harpago shorter, length about half length basal segment, more slender, length about twice maximum width, apex broadly rounded (Figs 3, 3a).

**Female.** Genitalia typical of genus, with a small acute projection on sternite IX meso-distally (Figs 38, 38a).

**Etymology.** *Bandabanda* – Australian aboriginal word for split or broken open (dorsal groove on segment X).

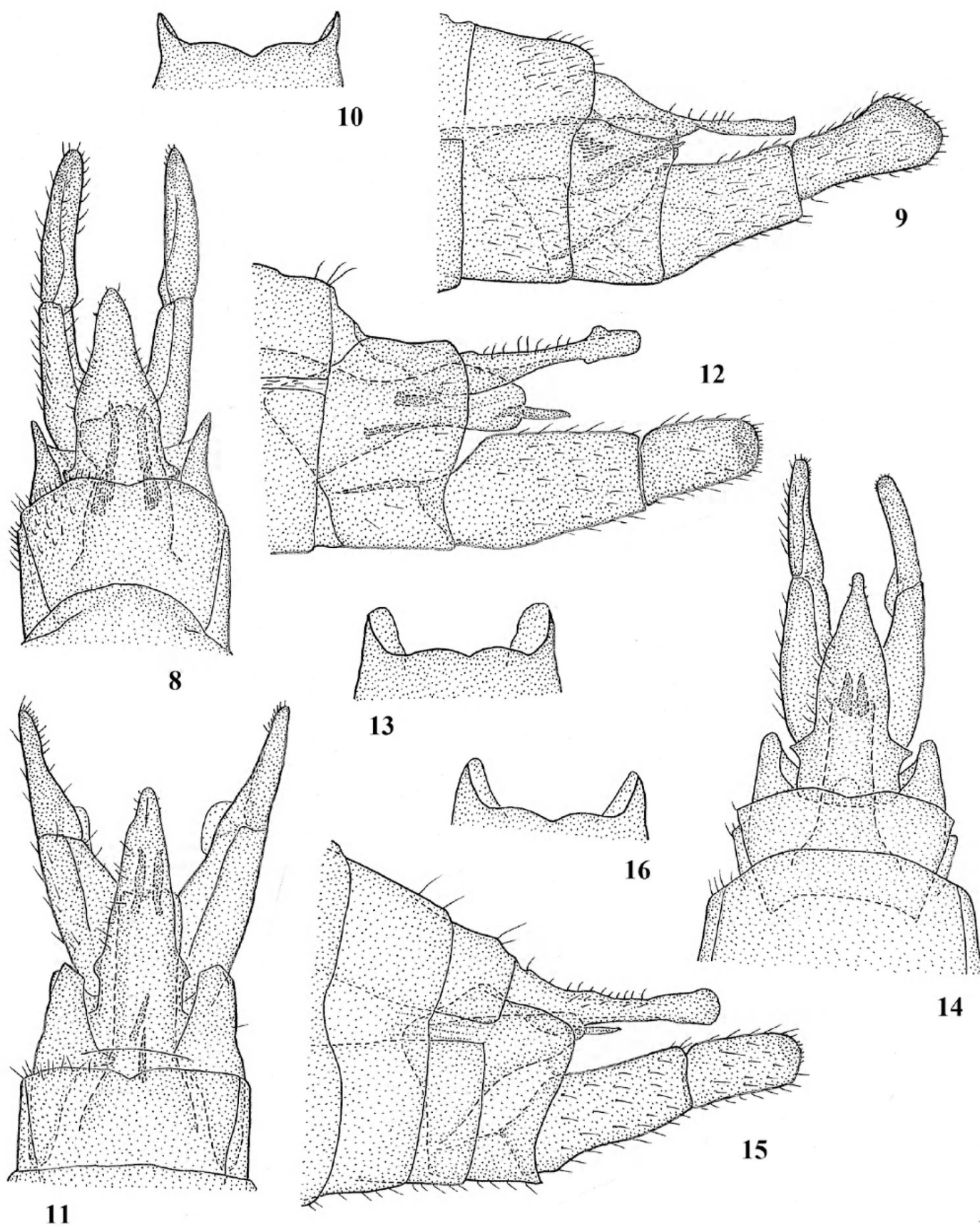
**Remarks.** *Hydrobiosella bandabanda* shows slight variation among the 21 specimens collected from 7 localities in eastern-central and north-eastern Victoria (latitudinal range 36°52'–37°51'S).





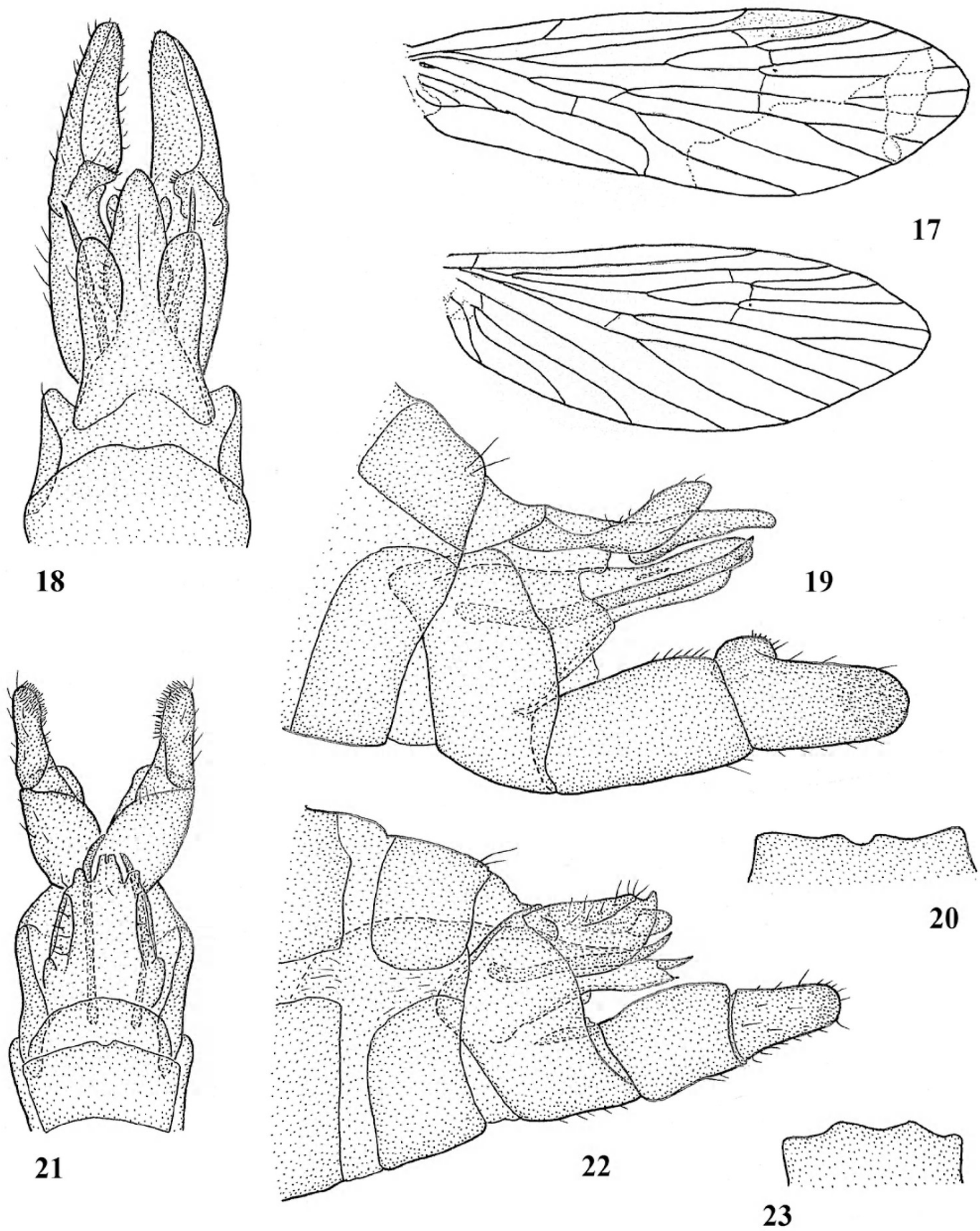
Figures 1–7. *Hydrobiosella* spp.: 1, *Hydrobiosella bandabanda* sp. nov., distal part of wings; 2–7, *Hydrobiosella* spp., male genitalia in dorsal, lateral and part ventral views; 2–4, *Hydrobiosella bandabanda* sp. nov.; 2, dorsal; 3, lateral; 4, ventral, mesodistal margin of segment IX; 2a–4a, *Hydrobiosella bandabanda* sp. nov. (variant); 2a, dorsal; 3a, lateral; 4a, ventral, mesodistal margin of segment IX; 5–7, *Hydrobiosella tiarka* sp. nov.; 5, dorsal; 6, lateral; 7, ventral, mesodistal margin of segment IX.





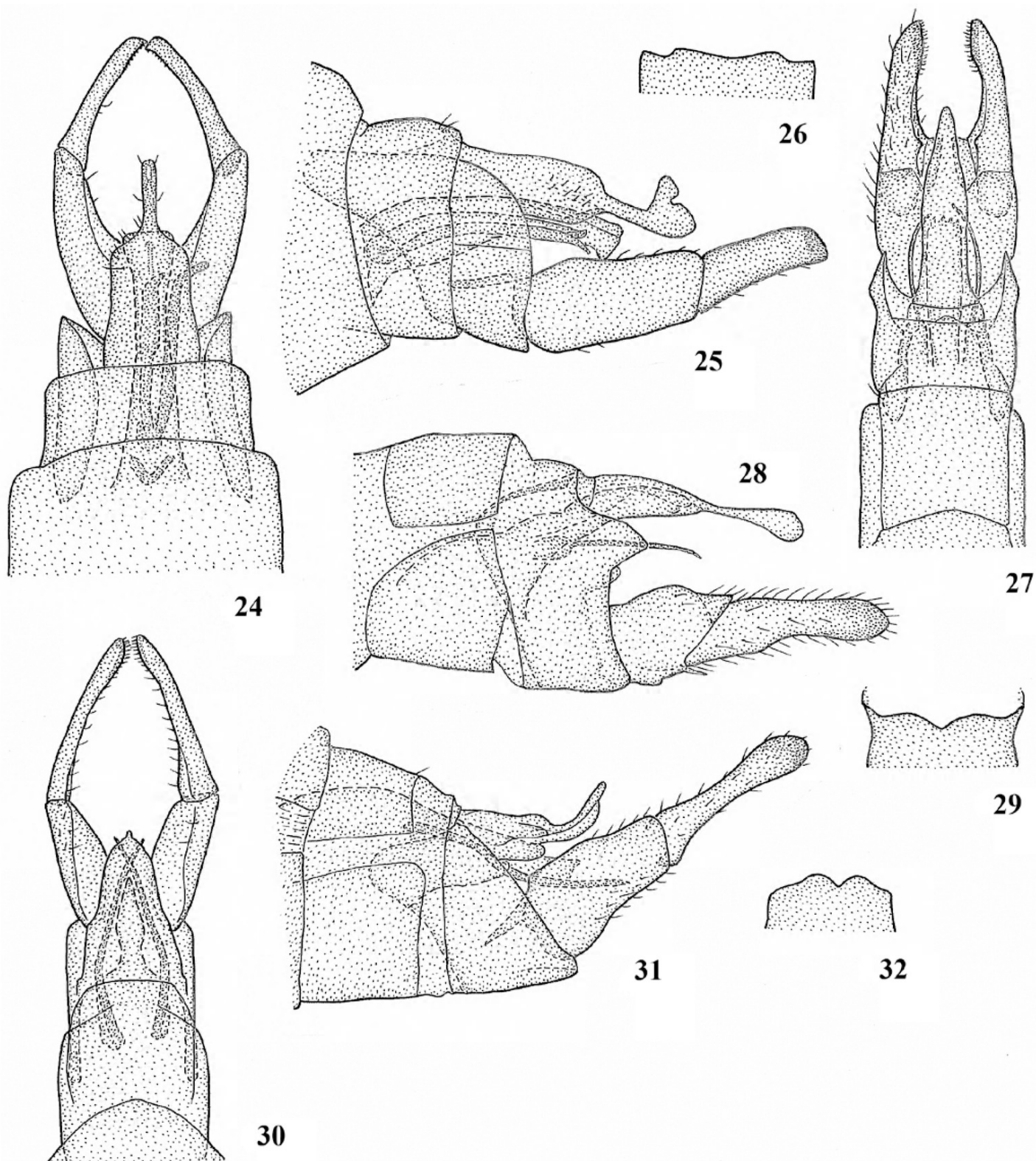
Figures 8–16. *Hydrobiosella* spp.; male genitalia in dorsal, lateral and part ventral views; 8–10, *Hydrobiosella tarrong* sp. nov.; 8, dorsal, 9, lateral, 10, ventral, mesodistal margin of segment IX; 11–13, *Hydrobiosella jibbor* sp. nov.; 11, dorsal; 12, lateral; 13, ventral, mesodistal margin of segment IX; 14–16, *Hydrobiosella jirrima* sp. nov.; 14, dorsal; 15, lateral; 16, ventral, mesodistal margin of segment IX.





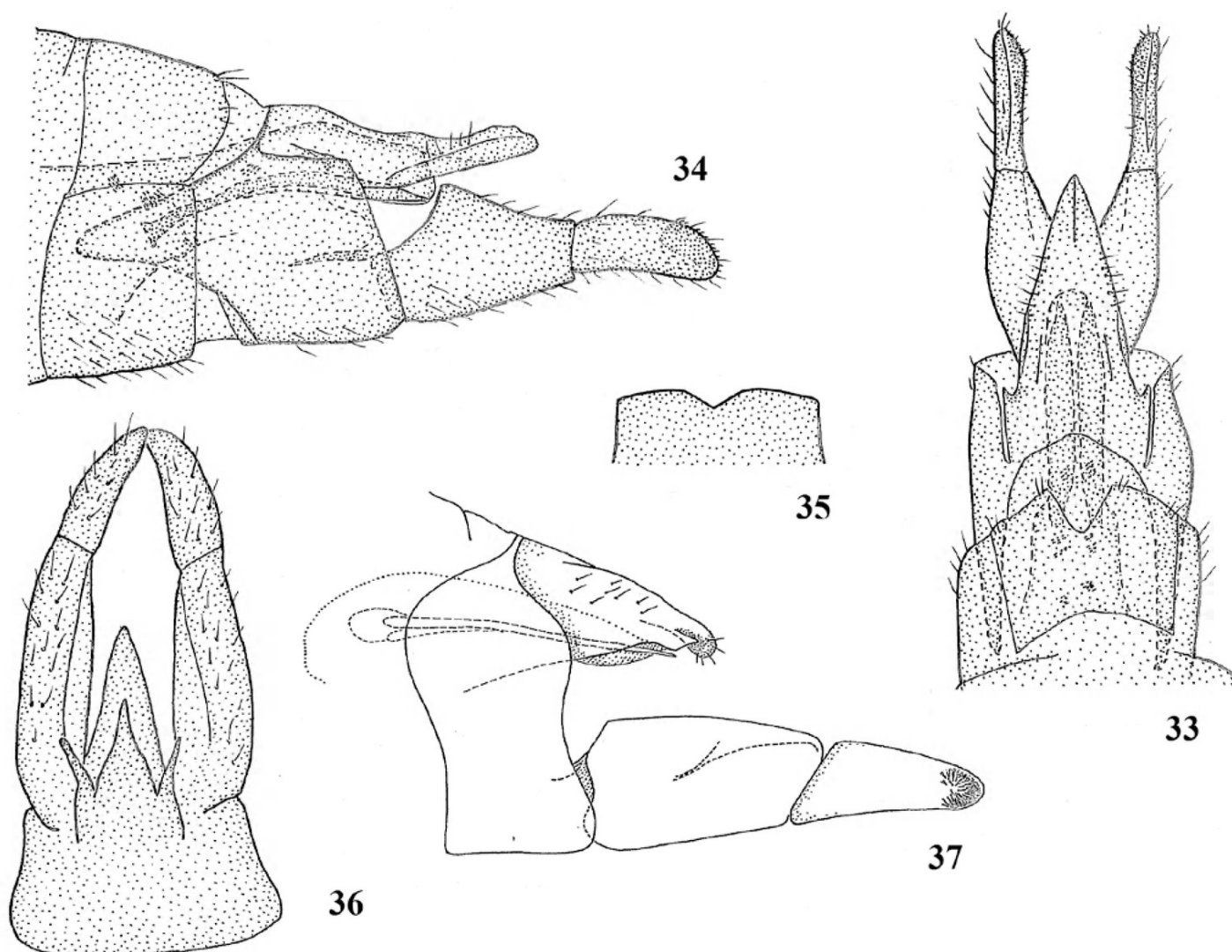
Figures 17–23. *Hydrobiosella* spp.: 17, *Hydrobiosella letti* Korboot., wings. 18–23, *Hydrobiosella* spp., male genitalia in dorsal, lateral and part ventral views; 18–20, *Hydrobiosella fibra* sp. nov.; 18, dorsal; 19, lateral; 20, ventral, mesodistal margin of segment IX; 21–23, *Hydrobiosella bifurca* sp. nov.; 21, dorsal; 22, lateral; 23, ventral, mesodistal margin of segment IX.





Figures 24–32. *Hydrobiosella* spp.; male genitalia in dorsal, lateral and part ventral views; 24–26, *Hydrobiosella incisura* sp. nov.; 24, dorsal; 25, lateral; 26, ventral, mesodistal margin of segment IX; 27–29, *Hydrobiosella tenuitas* sp. nov.; 27, dorsal; 28, lateral; 29, ventral, mesodistal margin of segment IX; 30–32, *Hydrobiosella exilatis* sp. nov.; 30, dorsal; 31, lateral; 32, ventral, mesodistal margin of segment IX.





Figures 33–37. *Hydrobiosella* spp.; male genitalia; 33–35, *Hydrobiosella bos* sp. nov.; male genitalia in dorsal, lateral and part ventral views; 33, dorsal; 34, lateral; 35, ventral, mesodistal margin of segment IX; 36–37, *Hydrobiosella letti* Korbout; male genitalia in dorsal and lateral views; 36, dorsal; 37, lateral.

***Hydrobiosella tiarka* sp. nov.**

Figures 5–7, 39

**Holotype.** Male. Victoria. Cement Ck nr Warburton (about 37°43'S, 145°43'E), 8 Dec. 1970, A. Neboiss (NMV, T-21407).

**Paratypes.** Victoria. 7 males, collected with holotype; 4 males (specimen PT-584 figured), same loc. and coll., 27 Mar 1972; 1 male, same loc., 29 Sep 1990, B. Armitage; 1 male, Cement Ck, 5 Feb 1955, A. Neboiss; 1 male, same loc. and coll., 19 Nov 1955; 1 female (specimen CT-614 figured), Cement Ck, Mt Donna Buang, 8 Apr 1976, Cartwright; 1 male, same loc. and coll., 1 Dec 1976 (NMV).

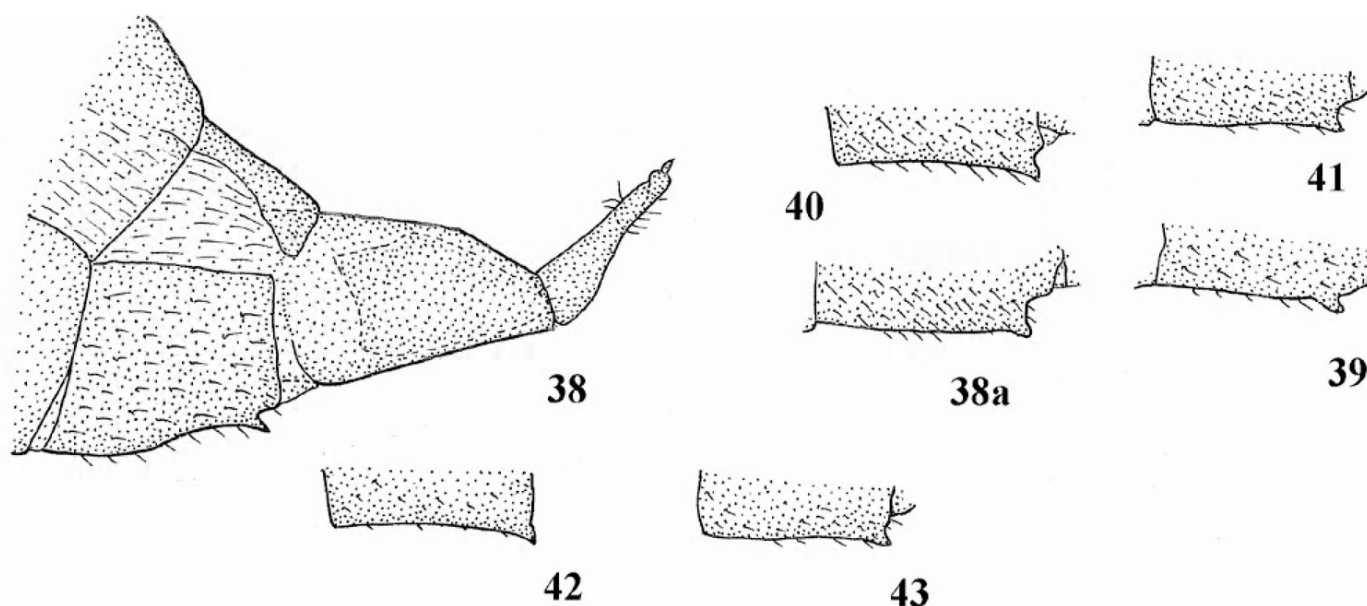
**Other material examined.** Victoria. 3 males, Cement Ck Mt Donna Buang-Warburton Rd, 23 Feb 2012, D. Cartwright; 1 male, Erica, 29 Jan 1960, A. Neboiss; 1 male, 1 female, Toorong Falls, NE Noojee, 17 Dec 1970, A. Neboiss; 1 male, Britannia Ck, 6km S of Warburton, 27 Feb 1976, A. Neboiss; 3 males, 1 female, Ada R. on Ada River Rd, 37°50.8'S 145°52'E, 19 Jan 1979, Latrobe C Survey; 1 male, same loc. and coll., 10 Feb 1980 (NMV).

**Diagnosis.** Males of *Hydrobiosella tiarka* can be separated from those of other species in the group by the small apical spine and slightly bulbous apex on segment X.

**Description.** Wings similar to those of *H. bandabanda* (Fig. 1); length of forewing, male 6.7–9.8 mm; female 8.2–10.8 mm.

**Male.** Segment IX with a shallow, wide V-shaped notch medially on distal margin (Fig. 7). Segment X in dorsal view, a 'tongue-shaped' process, with almost parallel sides in basal half, with a pair of very small knobs meso-laterally, tapered strongly distally to a small apical, slightly bulbous knob, length about 2.9 times width, without a central dorsal ridge or groove (Fig. 5); in lateral view broad-based, narrowed at basal third, slender with almost parallel sides in distal two thirds, with short apical spine (Fig. 6). Phallus generally tube-like, robust, with a pair of slightly divergent sub-apical spines (Figs 5, 6). Inferior appendages in lateral view, slender, with basal segment sub-rectangular, length





Figures 38–43. *Hydrobiosella* spp. Female genitalia (part segment VIII) in lateral view; 38, *Hydrobiosella bandabanda* sp. nov.; lateral; 38a, *Hydrobiosella bandabanda* sp. nov. (variant) lateral; 39, *Hydrobiosella tiarka* sp. nov.; lateral; 40, *Hydrobiosella tarrong* sp. nov.; lateral; 41 *Hydrobiosella jirrima* sp. nov.; lateral; 42, *Hydrobiosella bifurca* sp. nov.; lateral; 43, *Hydrobiosella bos* sp. nov.

about 2.8 times maximum width; harpago shorter, length about half length basal segment, length about 2.1 times maximum width, with broad rounded apex (Fig. 6).

**Female.** Genitalia typical of genus, with a small projection on sternite IX meso-distally (Fig. 39).

**Etymology.** *Tiarka* – Australian Aboriginal word for toothpick or sharp (apical spine on tergum X).

**Remarks.** Twenty-six male and three female specimens of *Hydrobiosella tiarka* have been collected from six localities in eastern-central Victoria (latitudinal range 37°43'–37°58' S).

#### *Hydrobiosella tarrong* sp. nov.

Figures 8–10, 40

**Holotype.** Male. Victoria, Cement Ck nr Warburton (about 37°43'S, 145°43'E), 26 Mar 1958, A. Neboiss (NMV, T-21425).

**Paratypes.** Victoria. 2 males (specimen CT-609 figured), 3 females (specimen CT-610 figured), collected with holotype; 1 male, same loc. and coll., 27 Mar 1972 (NMV).

**Diagnosis.** Males of *Hydrobiosella tarrong* can be separated from those of other species in the group by the slender apical half of segment X, in lateral view and the inferior appendages with harpago dilated slightly in apical half.

**Description.** Wings similar to those of *H. bandabanda* (Fig. 1); length of forewing: male 7.8–9.0 mm, female 8.5–9.0 mm.

**Male.** Segment IX with a shallow, wide notch medially on distal margin (Fig. 10). Segment X in dorsal view, a 'tongue-shaped' process, with sides almost parallel in basal half, with a pair of very small knobs baso-laterally, tapered distally to a slightly rounded apex, without a central dorsal ridge or groove

(Fig. 8); length about 1.7 times width; in lateral view broad-based, narrowed strongly at midpoint, slender with almost parallel sides in distal half (Fig. 9). Phallus generally tube-like, robust, slightly truncate, with a pair of sub-apical spines and two groups of chitinous spines basally (Figs 8, 9). Inferior appendages in lateral view, robust, with basal segment sub-rectangular, slightly angular meso-dorsally, length about 1.8–1.9 times maximum width; harpago shorter, length about 0.8 times length basal segment, length about 1.9 times maximum width, with slightly dilated, broadly rounded apex (Fig. 9).

**Female.** Genitalia typical of genus, with a small projection on sternite IX meso-distally (Fig. 40).

**Etymology.** *Tarrong* – Australian aboriginal word for teeth (pair of 'chitinous spines' in middle of phallus).

**Remarks.** Four male and three female specimens of *Hydrobiosella tarrong* have been collected from the type locality in eastern-central Victoria (latitude 37°43'S).

#### *Hydrobiosella jibboor* sp. nov.

Figures 11–13

**Holotype.** Male (specimen CT-611 figured). Victoria, Mt Buller, headwaters Chalet Ck, 1400 m (about 37°10'S, 146°25'E), 19 Mar. 1993, I. Campbell (NMV, T- 21437).

**Diagnosis.** Males of *Hydrobiosella jibboor* can be separated from those of other species in the group by the dorsal 'raised ridge' sub-apically on segment X and rounded apex and segment IX with almost straight distal margin.

**Description.** Wings similar to those of *H. bandabanda* (Fig. 1), length of forewing: male 6.9 mm.



**Male.** Segment IX with a weak notch in meso-ventral margin (Fig. 13), and with an almost straight distal margin (Fig. 12). Segment X in dorsal view, a 'tongue-shaped' process, with almost parallel sides in basal third, with a pair of very small knobs baso-laterally, tapered distally to a rounded apex, length about 2.3 times width, without a central dorsal ridge or groove (Fig. 11); in lateral view tapered slightly in basal two thirds, slightly bulbous sub-apically with a small dorsal 'raised ridge' (Fig. 12). Phallus generally tube-like, robust, with a pair of narrowly separated sub-apical spines, with two more spines basally (Figs 11, 12). Inferior appendages in lateral view, robust, with basal segment sub-rectangular, length about twice maximum width; harpago shorter, length about half length basal segment, length about 1.6–1.7 times maximum width, with broad rounded apex (Fig. 12).

**Female.** Unknown.

**Etymology.** *Jibboor* – Victorian Aboriginal word for mountain (type locality – Mt Buller).

**Remarks.** A single male specimen of *Hydrobiosella jibboor* has been collected from the type locality in north-eastern Victoria (latitude 37°10'S).

#### *Hydrobiosella jirrima* sp. nov.

Figures 14–16, 41

**Holotype.** Male. Victoria, McKay Ck, Sassafras Gap (about 36°37'S, 147°47'E), 2 Feb. 1974, A. Neboiss (NMV, T- 21438).

**Paratypes.** Victoria. 3 males (specimen CT-586 figured), collected with holotype; 5 males, 1 female (specimen CT-613 figured), Sassafras Gap, 13 Feb 1963, A. Neboiss; 1 male, Gibbo R., S of Donovan Ck jn, 3 Feb 1974, A. Neboiss; 1 male, roadside trickles, 1.2km N Sassafras Gap, It tr., 11 Feb 2010, R. StClair and D. Cartwright (NMV).

**Diagnosis.** Males of *Hydrobiosella jirrima* can be distinguished from those of other species in the group by the absence of a short dorsal 'raised ridge' subapically and slender apex on segment X.

**Description.** Wings similar to those of *H. bandabanda* (Fig. 1); length of forewing, male 6.6–7.8 mm, female 6.6 mm.

**Male.** Segment IX with a weak wide notch in meso-ventral margin (Fig. 16), and an almost rounded distal margin (Fig. 15). Segment X in dorsal view, a 'tongue-shaped' process, with almost parallel sides in basal quarter, with a pair of very small acute knobs baso-laterally, tapered distally to a narrow apex, without a central dorsal ridge or groove (Fig. 14); length about 1.9 times width; in lateral view weakly broad-based, tapered slightly in basal two thirds, very slightly bulbous apically (Fig. 15). Phallus generally tube-like, robust, with a pair of narrowly separated sub-apical spines (Figs 14, 15). Inferior appendages in lateral view, robust, with basal segment sub-rectangular, length about 2.3 times maximum width; harpago shorter, length about 0.6 times length basal segment, length about twice maximum width, with broad rounded apex (Fig. 15).

**Female.** Genitalia typical of genus, with a small projection on sternite IX meso-distally (Fig. 41).

**Etymology.** *Jirrima* – Australian aboriginal word for a mountain (type locality Sassafras Gap).

**Remarks.** Eleven males and one female of *Hydrobiosella jirrima* have been collected from three sites near the type locality in north-eastern Victoria (latitudinal range 36°37'–36°39'S).

#### *Hydrobiosella letti* group

**Diagnosis.** Key characters of males in the group are parameres elongate and straight or slightly curved, arising near base or middle of phallus, and preanal appendages absent.

**Description.** Head and body generally brown; wings light brown to brown. Medium sized adults. Forewing length, males: 4.5–8.0 mm; females: 5.8–9.4 mm; forewing length about 2.9–3.0 times maximum width, wing venation (Fig. 17), similar to *H. stenocerca* (Mosely and Kimmins 1953, fig 265a), *H. bispina* (Cartwright, 2010, fig. 1) and *H. waddama* (Mosely and Kimmins 1953, fig. 269a), R1 simple, forks 1, 2, 3, 4 and 5 present; forks 1 and 2 sessile; fork 2 with nygma, about 1.3–1.4 times length fork 1; fork 3 shorter, length about two-thirds length fork 2, fork 3 length ranging from between 1.6–1.7 times length footstalk, cross-veins r-m and m contiguous at fork 3; fork 4 similar length to fork 3, fork length about 2.0–2.2 times length footstalk; fork 5 very long, length between 1.9–2.0 times length fork 4; discoidal cell closed, length between 3.7–3.9 times maximum width. Hind wing length about 2.6–2.7 times maximum width, with forks 1, 2, 3 and 5 present; forks 1 and 2 sessile; fork 2 with nygma present, fork 2 length between 1.6–1.7 times length fork 1; fork 3 shorter, length about two-thirds length fork 2, fork 3 longer than footstalk, length fork ranging between 1.9–2.1 times length footstalk; fork 5 very long, length between 1.6–1.7 times length fork 3; discoidal cell closed, length between 4.1–4.3 times maximum width; with three longer anal veins (Fig. 17).

**Male.** Segment IX in lateral view, length between 1.2–1.9 times width, usually sub-rectangular (Figs 19, 37), occasionally projecting and tapered basally (Fig. 25) with a shallow, wide V notch (Figs 29, 32) or wide, shallow concavity medially on distal margin (Figs 23, 26). Segment X mainly sclerotised dorsally, membranous ventrally, usually broadbased, tapered distally; in dorsal view, with a 'tongue-shaped' process (Figs 18, 21, 24). Phallus generally tube-like, parameres slender, elongate and straight or slightly curved, arising near base of phallus (Figs 19, 22, 28). Inferior appendages with two segments, in lateral view, basal segment usually more robust than harpago. Harpago has a small field of dark spines meso-distally (Figs 19, 22, 31).

**Female** Genitalia typical of genus (Figs 42, 43).

**Larva.** No confirmed larvae are known for this group.

**Remarks.** The seven species in this group are known from NE-Victoria, eastern New South Wales and eastern Queensland. Females of only two species have been associated.

#### Key to males of species of the *Hydrobiosella letti* group from Australia

1. Segment X with pair of baso-lateral lobes (Figs 18, 19); SE-Qld ..... *H. fibra*
- Segment X without pair of baso-lateral lobes (Figs 21, 22, 24, 25) ..... 2



2. Segment X in dorsal view, with pair of small apico-lateral projections (Fig. 22); NE-Qld ..... *H. bifurca*
  - Segment X in dorsal view, without pair of small apico-lateral projections (Figs 25, 28) ..... 3
3. Segment X laterally compressed apically, with distinctive notch (Figs 24, 25); SE-Qld ..... *H. incisura*
  - Segment X not laterally compressed apically, without distinctive notch (figs 27, 28) ..... 4
4. Inferior appendages in lateral view with harpago length > 3.5 times width (Figs 28, 31) ..... 5
  - Inferior appendages in lateral view with harpago length < 2.5 times width (Figs 34, 37) ..... 6
5. Segment X in lateral view, slightly dilated apically (Fig. 28); in dorsal view, slender; length about 2.8 times maximum width (Fig. 27); NE-Qld ..... *H. tenuitas*
  - Segment X in lateral view, not dilated apically, instead slender and upturned (Fig. 31); in dorsal view, not slender; length about 1.4 times maximum width (Fig. 30); NE-Qld ..... *H. exilatis*
6. Inferior appendages with basal segment angled dorso-mesally (Fig. 34); NE-Vic ..... *H. bos*
  - Inferior appendages with basal segment not angled dorso-mesally (Fig. 37); CE-NSW ..... *H. letti*

***Hydrobiosella fibra* sp. nov.**

Figures 18–20

**Holotype.** Male. Queensland, Kenilworth rainforest (about 26°36'S, 152°44'E), 7 Apr. 1967, N. Dobrotworsky (NMV, T- 21450).

**Paratypes.** Queensland. 2 males, collected with holotype (specimen PT-578 figured) (NMV).

**Diagnosis.** Males of *Hydrobiosella fibra* can be separated from other species in the group by the presence of a pair of stout baso-lateral lobes on tergum X.

**Description.** Wings similar to *H. letti* (Fig. 17); length of forewing, male 6.3–6.6 mm.

**Male.** Segment IX in lateral view, sub-quadrate, length about 1.8–1.9 times width, projecting slightly basally (Fig. 6.3), with a shallow rounded notch medially on distal margin (Fig. 20). Segment X with a pair of large sub-ovate baso-lateral lobes (Figs 18, 19); in dorsal view, 'tongue-shaped' (fig. 18); in lateral view slender, slightly tapered distally (Fig. 19). Phallus generally tube-like, with a pair of straight, slender lateral 'parameres' arising basally (Figs 18, 19). Inferior appendages in lateral view, with basal segment sub-rectangular, length about 1.7–1.8 times maximum width; harpago slightly shorter, length about 1.6 times maximum width; bulbous dorso-basally, tapered slightly distally, broadly rounded apically (Fig. 19).

**Female.** Unknown.

**Etymology.** *Fibra* – Latin for lobe (on tergum X).

**Remarks.** Three male specimens of *Hydrobiosella fibra* have been collected from the type locality in south-eastern Queensland (latitude 26°36'S).

***Hydrobiosella bifurca* sp. nov.**

Figures 21–23, 42

**Holotype.** Male. Queensland, unnamed Ck, Paluma Dam Rd, Mt Spec State Forest, 18°57'S, 146°10'E, 860m, 24 Feb 1994, A.L. Sheldon (NMV, T- 21453).

**Paratypes.** Queensland. 2 males, 3 females, same site and collector, 17 Jan 1994; 2 females, same site and collector, 6 Jul 1994, A.L.S.; 2 males, 5 females, unnamed Ck, 'cascade' on Paluma Dam Rd, 840m, 6 July 1994, A.L.S.; 1 female (specimen CT-656 figured), same site and collector, 31 Oct 1993; 1 male, Camp Ck trib., Mt Spec State Forest, 18°57'S, 146°10'E, 760m, 22 Feb 1994, A.L.S.; 1 female, same site and collector, 23 Apr 1994; 4 females, same site and collector, 6 Jul 1994; 1 male, 1 female, Birthday Ck, below falls, Mt Spec State Forest, 18°57'S, 146°10'E, 760m, 29 Mar 1994, A.L.S.; 1 male (specimen PT-1768 figured), Cairns, Lake Morris Rd, 16 Nov 1988, K. Walker (NMV).

**Other material examined.** Queensland. 1 male, Barron Falls, Kuranda, 16 Jun 1971, E.F. Riek (ANIC); 1 female, U Freshwater Ck, Whitfield Range, Cairns, 24 Aug 1974, M.S. Moulds; 1 male, 1 female, Lock-Davies Ck Rd, Lamb Ra, Mareeba Dist. 10 Nov 1974, M.S. Moulds; 2 males, Fishery Falls, 17°11'S, 145°52'E, 10–11 Nov 2007, A. Cairns, A. Wells, W. Cairns (ANIC); 1 male, small waterfall on Kirrama Range Rd, 9.2km from Nat. Pk sign, -18.20°, 145.83°, 9 May 2011, M. Shackleton and J. Mynott; 1 male, 1 female, 1 km N of Tully Falls, 8 Jan 1976, A. Walford-Huggins; 1 male, Tully Falls, S of Ravenshoe, 11 Jan 1977, Moulds; 1 male, same locality and date, M.S. and B.J. Moulds; 1 male, Birthday Ck, 3.5 km WNN Paluma, 18°59'S, 146°10'E, 7 Apr 1990, R. StClair; 1 male, 1 female, same site and collector, 23 Dec 1989; 1 female, same site and collector, 19 Jan 1990; 1 female, Birthday Ck, above weir, Mt Spec State Forest, 18°57'S, 146°10'E, 820m, 22 Oct 1993, A.L.S.; 1 female, same site and collector, 6 Nov 1993; 1 female, same site and collector, 23 Apr 1994; 1 female, Birthday Ck, below falls, Mt Spec State Forest, 18°57'S, 146°10'E, 760m, 17 Mar 1994, A.L.S.; 1 female, same site and collector, 6 Jul 1994; 2 females, Birthday Ck, Iron Cabin, Mt Spec State Forest, 18°57'S, 146°10'E, 790m, 23 Apr 1994, A.L.S.; 1 female, Camp Ck trib., Mt Spec State Forest, 18°57'S, 146°10'E, 760m, 15 May 1994, A.L.S.; 1 female, same site and collector, 15 Mar 1994; 1 female, unnamed Ck, Paluma Dam Rd, Mt Spec State Forest, 18°57'S, 146°10'E, 860m, 11 Jun 1994, A.L. Sheldon; 1 female, Goodard Ck, Kirrama State For., 18°06'S, 145°41'E, Apr 1993, G. Theischinger; 8 males, 2 females, river on L. Morris Rd, 16.94°S, 145.72°E, M. Shackleton and J. Mynott (NMV).

**Diagnosis.** Males of *Hydrobiosella bifurca* can be separated from those of other species in the group by the pair of small apico-lateral projections on segment X.

**Description.** Wings similar to *H. letti* (Fig. 17); length of forewing, male 5.4–6.6mm, female 5.8–7.5 mm.

**Male.** Segment IX in lateral view, sub-quadrate, length about 1.5 times width, projecting slightly basally (Fig. 22), with a very shallow, wide concavity medially on distal margin (Fig. 23). Segment X robust, in dorsal view, sub-quadrate, length about 1.1–1.2 times width, with a pair of small apico-lateral projections (Fig. 21); in lateral view slightly tapered distally, with a slightly upturned apex (Fig. 22). Phallus generally tube-like; with a pair of straight, slender lateral 'parameres' arising from the phallus near middle (Figs 21, 22). Inferior appendages



in lateral view, with basal segment sub-rectangular, length about 1.3 times maximum width; harpago slightly shorter, more slender, length about 1.5 times maximum width, tapered slightly distally, broadly rounded apically (Fig. 22).

*Female.* Genitalia typical of genus (Fig. 42).

*Etymology.* *Bifurca* – Latin for having two prongs or forks (apico-lateral projections on tergum X).

*Remarks.* Some 24 male and 34 female specimens of *Hydrobiosella bifurca* have been collected from at least twelve sites in north-eastern Queensland (latitudinal range 16°49'–18°59'S). *Hydrobiosella bifurca* was cited in a checklist (Walker et al., 1995) as *Hydrobiosella* sp. nov. PT-1768.

***Hydrobiosella incisura* sp. nov.**

Figures 24–26

Holotype. Male (specimen CT-557 figured), Queensland, National Park (about 28°14'S, 153°09'E), 5 Jun. 1955, collector? (NMV, T-21478).

*Diagnosis.* Males of *Hydrobiosella incisura* can be separated from those of other species in the group by the laterally compressed apex on segment X with distinctive notch.

*Description.* Wings similar to *H. letti* (Fig. 17), length of forewing: male 6.5 mm.

*Male.* Segment IX in lateral view, length about 1.3 times width, projecting and tapered basally (Fig. 25), with a very shallow, wide concavity medially on distal margin (Fig. 26). Segment X robust in basal two-thirds, narrowed in apical third (Figs 24, 25), in dorsal view, slender in apical third (Fig. 24); in lateral view, narrowed subapically, dilated apically with distinctive notch (Fig. 25). Phallus generally tube-like; with a pair of straight, slender lateral 'parameres' arising from the phallus near base (Figs 24, 25). Inferior appendages in lateral view, with basal segment sub-rectangular, length about 2.1 times maximum width; harpago shorter, length about 0.7 times length basal segment, more slender, length about 2.5 times maximum width, tapered slightly distally, broadly rounded apically (Fig. 25).

*Female.* Unknown.

*Etymology.* *Incisura* – Latin for notch (apex of segment X).

*Remarks.* The single male specimen of *Hydrobiosella incisura* was collected from the type locality in south-eastern Queensland (latitude 28°14'S).

***Hydrobiosella tenuitas* sp. nov.**

Figures 27–29

Holotype. Male (specimen PT-1038 figured), Queensland, Bellenden Ker Range, summit TV stn, 1560m (about 17°16'S, 145°54'E), 1–7 Nov 1981, Earthwatch-Qld Mus. (NMV, T-21479).

*Diagnosis.* Males of *Hydrobiosella tenuitas* can be separated from those of other species in the group by the slender segment X, also slightly dilated apically in lateral view, and the long and slender harpago of the inferior appendages.

*Description.* Wings similar to *H. letti* (Fig. 17), length of forewing: male 7.6 mm.

*Male.* Segment IX in lateral view, length about 1.2 times width, sub-rectangular, not projecting and tapered basally, projecting slightly distally (Fig. 28), with a shallow, wide V-shaped notch medially on distal margin (Fig. 29). Segment X slender, almost parallel sided in basal two-thirds, length about 2.8–2.9 times width, narrowed in apical third (Figs 27, 28), in dorsal view, narrow 'tongue-shaped, tapered slightly in distal third, narrowly rounded apex (Fig. 27); in lateral view, narrowed at about apical third, dilated slightly distally with bulbous apex (Fig. 28). Phallus generally tube-like; with a pair of slightly curved, slender lateral 'parameres' arising from the phallus near middle (Figs 27, 28). Inferior appendages in lateral view, with basal segment sub-trapezoidal, length about 1.4 times maximum width; harpago longer, length about 1.6 times length basal segment, more slender, length about 3.8–3.9 times maximum width, tapered slightly distally, broadly rounded apically (Fig. 28).

*Female.* Unknown.

*Etymology.* *Tenuitas* – Latin for slender (segment X and harpago of inferior appendages).

*Remarks.* The single male specimen of *Hydrobiosella tenuitas* was collected from north-eastern Queensland (latitude 17°16'S). *Hydrobiosella tenuitas* was cited in a checklist (Walker et al., 1995) as *Hydrobiosella* sp. nov. PT-1038.

***Hydrobiosella exilatis* sp. nov.**

Figures 30–32

Holotype. Male: Queensland, Bellenden Ker Range, cable tower 3, 1054m (about 17°16'S, 145°54'E), 25–31 Oct 1981, Earthwatch-Qld Mus. (NMV, T-21480).

Paratypes. 3 males (specimen PT-1037 figured), Mt Bartle Frere, 0.5 km N of South Peak, 1500m, 6–8 Nov 1981, Earthwatch-Qld Mus. (NMV).

*Diagnosis.* In lateral view, males of *Hydrobiosella exilatis* can be distinguished from those of other species in the group by the slender and upturned distal half of segment X; in dorsal view, very flat and appearing broad, length about 1.4 times maximum width, and long and slender harpago of the inferior appendages.

*Description.* Wings similar to *H. letti* (Fig. 17), length of forewing: male 6.4–7.4 mm.

*Male.* Segment IX in lateral view, length about 1.3–1.4 times width, sub-rectangular, slightly projecting basally (Fig. 31), with a shallow, wide V-shaped notch medially on distal margin (Fig. 32). Segment X length about 1.3–1.4 times width, in dorsal view, 'tongue-shaped', broad-based, tapered distally (Figs 30, 31), apex broadly rounded (Fig. 30); in lateral view, narrowed near middle, dilated slightly distally with bulbous apex (Fig. 31). Phallus generally tube-like; with a pair of long, slender, slightly curved, lateral 'parameres' arising from the phallus near middle (Figs 30, 31). Inferior appendages in lateral view, with basal segment sub-rectangular, length about 1.8–1.9 times maximum width, harpago slightly longer, length about 1.1



times length basal segment, more slender, length about 3.5 times maximum width, 'dumb bell- shaped', narrowed near middle, broadly rounded apically (Fig. 31).

*Female.* Unknown.

*Etymology.* *Exilatis* – Latin for slender (harpago of inferior appendages).

*Remarks.* Four male specimens of *Hydrobiosella exilatis* have been collected from two adjacent localities in north-eastern Queensland (latitudinal range 17°16'– 17°24'S). *Hydrobiosella excilatas* was cited in a checklist (Walker et al., 1995) as *Hydrobiosella* sp. nov. PT-1037.

### *Hydrobiosella bos* sp. nov.

Figures 33–35, 43

*Holotype.* Male. Victoria, Eurobin Falls, Mt Buffalo Rd (about 36°42'S, 146°50'E), 3 Dec. 1982, A. Neboiss (NMV, T- 21484).

*Paratype.* Victoria. 1 male (specimen CT-553 figured), 2 females (specimen CT-554 figured), collected with holotype (NMV).

*Diagnosis.* Males of *Hydrobiosella bos* can be distinguished from those of other species in the group by the dorso-mesally angled basal segment on the inferior appendages.

*Description.* Wings similar to *H. letti* (Fig. 17), length of forewing: male 7.6–8.0 mm, female 8.9–9.4 mm.

*Male.* Segment IX robust, in lateral view, length about 1.4 times width, projecting and tapered basally (fig. 34), with a shallow, wide concavity medially on distal margin (Fig. 35). Segment X broad-based, tapered distally (Figs 33, 34), in dorsal view, 'tongue-shaped', length about 1.8–1.9 times width, broadly rounded apex (Fig. 33); in lateral view, straight, with slightly bulbous apex (Fig. 34). Phallus generally tube-like; with a pair of long, slightly curved, 'parameres' arising from the phallus near base (Figs 33, 34). Inferior appendages in lateral view, with basal segment sub-pentangular, length about 1.4 times maximum width, harpago shorter, length about 0.7 times length basal segment, more slender, length about 2.6 times maximum width, sub-ovate, broadly rounded apically (Fig. 34).

*Female.* Genitalia typical of genus with a small acute projection on sternite IX meso-distally (Fig. 43).

*Etymology.* *Bos* – Latin for buffalo (type locality-Mt Buffalo).

*Remarks.* Two males and two female specimens of *Hydrobiosella bos* have been collected from the type locality in north-eastern Victoria (latitude 36°42'S).

### *Hydrobiosella letti* Korboot

Figures 17, 36, 37

*Hydrobiosella letti* Korboot, 1964: 36, figs 40–57. – Neboiss, 1987: 132, figs 7, 8. – Neboiss, 1986: 101.

*Holotype.* Male (not seen): New South Wales, Lett R. near Lithgow, 25 Sep 1962, K. Korboot, T-6182 (QM).

*Other material examined.* Queensland, 1 male (CT-655), Morans Ck above Morans Falls, Lamington Nat. Pk, 28.23°S 153.13°E, 16 Nov 2011, J. Mynott & M. Shackleton.

*Diagnosis.* *Hydrobiosella letti* can be distinguished from other species in the group, especially *H. bos*, by the basal segment of the inferior appendages not angled dorso-mesally and harpago sub-triangular in lateral view.

*Description.* (Revised after Korboot, 1964; Neboiss, 1987). Wings (Fig. 17), length of forewing: male 4.5 mm.

*Male.* Segment IX robust, in lateral view, length about 1.4 times width, projecting and tapered basally (Fig. 37). Segment X broad-based, tapered distally (Figs 36, 37), in dorsal view, 'tongue-shaped', length about 1.8–1.9 times width, broadly rounded apex (Fig. 36); in lateral view, straight, with slightly bulbous apex (Fig. 37). Phallus generally tube-like; with a pair of long, slightly curved, 'parameres' arising from the phallus near base (Figs 36, 37). Inferior appendages in lateral view, with basal segment sub-pentangular, length about 1.4 times maximum width, harpago shorter, length about 0.7 times length basal segment, more slender, length about 2.6 times maximum width, sub-triangular, tapered to broadly rounded apex (Fig. 37).

*Female.* Unknown.

*Remarks.* A single male specimen of *Hydrobiosella letti* is known from the type locality in central-eastern New South Wales (latitude 33°24'S). Korboot's (1963, fig. 45) and Neboiss's (1987, figs 7, 8) figures have been redrawn to allow direct comparisons and to accompany the description that is revised in light of new interpretations of *Hydrobiosella* genitalic and wing structures. Neboiss (1987) commented on the condition of the type specimen and errors in Korboot's original description and that the vial containing the remaining body parts had two locality labels: Lett River via Lithgow and Montville, Queensland. The recently collected male specimen from Lamington National Park in south-eastern Queensland is here referred to *H. letti*, although there are several minute differences in the genitalia (latitude 28°14'S).

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