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Studies of Australian *Hydrobiosella* Tillyard: a review of the Australian species of the *Hydrobiosella bispina* Kimmins group (Trichoptera: Philopotamidae)

David I. Cartwright

13 Brolga Crescent, Wandana Heights, Victoria, 3216, Australia (cartwright@hotkey.net.au)

Abstract

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Descriptions and keys are provided for males of 12 philopotamid caddis fly species in the genus *Hydrobiosella* Tillyard, *H. bispina* group. Among these are ten new species from Australia: *Hydrobiosella bilga*, *H. dugarang*, *H. gurara*, *H. moorda*, *H. mundagurra*, *H. nandawar*, *H. thurawal*, *H. unispina*, *H. woonoongoora* and *H. yokunna*. Females of six of the species are also described. Group separation is based on male genitalic characteristics, the key features for the *H. bispina* group being inferior appendages with an elongate terminal segment, fringed ventrally by a row of dark setae, and nearly all species with paired, hooked lateral processes on segment ten. Of the 12 species treated here, all are endemic to the east coast region of the Australian mainland.

Keywords

Trichoptera, caddis flies, Philopotamidae, Hydrobiosella, Australia

Introduction

Records of *Hydrobiosella* Tillyard in Australia are relatively recent; the genus was first described in 1924 for a New Zealand species, *H. stenocerca* Tillyard. Only in 1953 were the first Australian species recognised in the genus, with the transfer of the southern Western Australian species *H. michaelseni* (Ulmer 1908) from *Dolophilus* and description of *H. arcuata* Kimmins from southeastern Queensland, *H. bispina* Kimmins from New South Wales, and *H. cognata* Kimmins, *H. tasmanica* Mosely and *H. waddama* Mosely all from Tasmania (in Mosely and Kimmins, 1953). Subsequently, the following species were added: *H. letti* Korboot (1964) from New South Wales, *H. armata* Jacquemart (1965), *H. anasina*, *H. cerula*, *H. corinna, H. orba* and *H. sagitta* all from Tasmania (Neboiss, 1977), and *H. amblyopia* Neboiss (1982) from southern Western Australia. Neboiss (2003) added six more Tasmanian species, *H. anatolica*, *H. disrupta*, *H. otaria*, *H. propinqua, H. scalaris* and *H. tahunense*, bringing the total Australian species of *Hydrobiosella* to 20.

Ross (1956) recognised *Hydrobiosella* as a subgenus of *Sortosa* Navas, but during his work on Tasmanian caddis flies, Neboiss (1977) reinstated it to full species status. At the same time, he placed the Tasmanian species in three groups — the *H. corinna* group and the *H. tasmanica* group each with four species; and *H. waddama* with only one species. In 2003, Neboiss added a further six species to the *H. tasmanica* group, bringing the Tasmanian *Hydrobiosella* total to 15 species. Although the Tasmanian *Hydrobiosella* have been well studied, until now, little effort has been expended on the mainland Australian members of the genus — only five species are presently recorded. Among them, two in the group are being studied here: *H. arcuata* and *H. bispina*, and one of the new species described below was cited in a checklist as *Hydrobiosella* sp. nov. PT-2029 (Walker et al., 1995).

Henderson (1983), in his systematic study of New Zealand philopotamids, discussed the wider relationships between New Caledonian and Australian *Hydrobiosella* species. He found that synapomorphies of the New Zealand species of *Hydrobiosella* are not consistent in the known Australian species, thus concluding that the Australian species cannot be placed as a monophyletic group in his classification. Finally, he commented 'too little is known at present for a full understanding of the relationships of this family', especially 'the lack of detailed information on the Australian and South American fauna …' This present revision is the first of a series in which all the Australian *Hydrobiosella* groups will be revised. Once key characters of the different groups are identified, relationships of the Australian groups with other philopotamid groups, particularly species in New Zealand and New Caledonia, can be assessed.

In this taxonomic revision of the Australian *Hydrobiosella bispina* group, about 250 male and female specimens were examined and referred to 12 species. The most common species, *H. woonoongoora*, represented about 34% of the total specimens examined, *H. unispina* about 22% and *H. bispina* about 21%. Six of the 12 species are known from fewer than five specimens. The 12 species, including the ten new species, were collected from southern and eastern Australia. All except

two species (from northeastern Queensland) are from the Bassian region, which is suggestive of a 'southern' origin, a thesis supported by the fact that the genus is known only from Australia, New Zealand and New Caledonia.

Methods and abbreviations

Among *Hydrobiosella* species — size, body and wing colour can be useful characters, but are variable. Colour can be a useful character in live or freshly preserved material but, with time, it often fades in alcohol. All the *H. bispina* group specimens were stored in alcohol, and many for over 20 years. Most of the material studied was on loan from Museum Victoria and made available by Dr Arturs Neboiss. Depositories for specimens are abbreviated as follows: Museum Victoria, Melbourne (NMV), Australian National Insect Collection, Canberra (ANIC) and the Natural History Museum, London (BMNH). All specimens mentioned in the text, including types, are lodged in the NMV unless stated otherwise.

Males of each species are readily distinguished by genitalic features, but often require clearing of the abdomen in potassium hydroxide. Females were paired with respective males on the basis of similarities in size and colouration, and on locality.

Figured specimens are identified by the notebook numbers of Dr Arturs Neboiss (prefix PT-) or the author (prefix CT-). Terminology generally follows that of Neboiss (1977, 1982), Blahnik (2005) and Holzenthal et al. (2007). However, past authors have used a variety of names for the same structures as outlined by Muñoz-Quesada and Holzenthal (2008, p. 8). For example, in this study, 'harpago' is used instead of apical or terminal segment of the inferior appendages, and 'preanal appendage' is used instead of superior appendage or cercus. Abbreviations for genitalic parts are indicated on selected figures. Typically, setae or spines are illustrated only on the right side of the figure (as viewed) to enable a better depiction of the underlying structures. Length and width measurements generally refer to the maximum length divided by maximum width.

Descriptions

Hydrobiosella Tillyard

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

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

1. Phallus without pair of parameres (Neboiss 1986, figs pp. 99; *H. amblyopia*, 101; *H. armata*, *H. tasmanica*, 102; *H. orba*, *H. corinna*) 2

– Phallus with pair of parameres (Neboiss 1986, figs pp. 99; *H. michaelseni*, *H. waddama*, 101; *H. letti*, 102; *H. bispina*, 103; *H. arcuata*) 4

2. Preanal appendages present, usually small (Neboiss 1977, figs 204–211; Neboiss 1986, figs p. 102 *H. orba*, *H. corinna*; Neboiss 2003, figs 8a–h); Tas ..... *H. corinna* group

– Preanal appendages absent (Neboiss 1986, figs pp. 99 *H. amblyopia*, 101 *H. armata*, *H. tasmanica*) 3

3. 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) (Neboiss 1982, fig. 12; Neboiss 1986, figs p. 99 *H. amblyopia*); S-WA ..... *H. amblyopia* (ungrouped)

4. Inferior appendages with harpago with dark row of setae forming fringe along ventral margin (figs 2–4; 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 (Neboiss 1986, figs pp. 99 *H. michaelseni*, *H. waddama*, 101 *H. letti*) 5

5. Parameres elongate and sinusoidal, attached ventrally to base of phallus (Neboiss 1977, fig. 233; Neboiss 1986, figs p. 99 *H. waddama*; Neboiss 2003, figs 12g, h); Tas, SE Aust. ..... *H. waddama* (group — only one species described)

– Parameres not elongate and sinusoidal, not attached ventrally to base of phallus (Neboiss 1982, figs 9, 10; Neboiss 1986, figs pp. 99 *H. michaelseni*, 101 *H. letti*) 6

6. Parameres curved strongly and crossed (Neboiss 1982, figs 9, 10; Neboiss 1986, figs p. 99 *H. michaelseni*); S-WA ..... *H. michaelseni* (ungrouped)

– Parameres not curved strongly and crossed (Neboiss 1986, figs p. 101 *H. letti*); CE-NSW ..... *H. letti* (ungrouped)

Hydrobiosella bispina group

Diagnosis. Key features of males in the group are inferior appendages with the harpago elongate, often angled near middle, with a dark row of setae forming a fringe along ventral margin; segment X with a pair of lateral lobes, which usually end in small hooks.

Description. Head and nota dorsally brown to dark brown with setal warts and scutellum pale, abdomen brownish dorsally and ventrally, paler laterally; wings light brown to brown. Medium sized adults. Forewing length, males: 5.9–8.8 mm; females: 6.1–8.7 mm; forewing length about 2.9–3.0 times maximum width, wing venation similar to the type species *H. stenocerca*, R1 simple, forks 1, 2, 3, 4 and 5 present; forks 1 and 2 sessile; fork 2 with nygma, about 1.6–1.7 times length fork 1; fork 3 shorter, length 0.6–0.7 times length fork 2, fork 3 length about

2.0 times length footstalk, cross-veins r–m and m contiguous or nearly meeting at fork 3; fork 4 similar length to fork 3, fork length about 4 times length footstalk; fork 5 very long, length between 1.7–1.8 times length fork 4; discoidal cell closed, length about 4.5 times maximum width. Hind wing length about 2.5–2.6 times maximum width, with forks 1, 2, 3 and 5 present; fork 1 usually sessile, occasionally with very short footstalk; fork 2 sessile, nygma present, fork 2 length between 1.3–1.4 times fork 1 length; fork 3 length about 0.5–0.6 times fork 2 length, fork 3 similar length to footstalk; fork 5 very long, length between 2.1–2.2 times length fork 3; discoidal cell closed, length between 4.5 times maximum width; with three anal veins (fig. 1).

Male. Segment IX usually with a small rounded notch medially on ventrodistal margin (figs 7, 13), rarely without (figs 10, 19). Preanal appendages absent. Segment X mainly sclerotised with a central pale, mostly membranous mesal lobe, with one or two pairs of short hairs subapically (figs 5–6); with a pair of more pigmented lateral lobes, which usually end in small hooks (figs 8–9). Phallus generally tube-like, slightly dilated subapically, with a pair of slender, straight or slightly curved parameres arising from the phallus basolaterally (figs 2–3, 5–6). Inferior appendages two segmented, in lateral view, basal segment robust, harpago more slender, straight to sharply angled near middle (figs 3, 6).

Female. Genitalia typical of genus, sometimes with a small projection, which can be diagnostic, on sternite VIII mesodistally (figs 38–49).

Larva. Confirmed larvae are unknown, although *Hydrobiosella* spp AV8 and AV15 (Cartwright, 1997) almost certainly belong to this group. *Hydrobiosella* sp. AV8 larvae have been recorded mainly in riffle habitats from small to medium streams 2–13 m wide at low to moderate altitudes between 70–1200 m (Suter et al. 2006). These larvae have the forecoxa with two sclerotised processes on the anterior margin and the anterior margin of the frontoclypeus convex.

Remarks. The 12 species in this group are known from eastern mainland Australia, ranging from northeastern Queensland to eastern Victoria (latitudinal range 16°35'–37°18'S). Females of only six species have been associated.

Key to males of species of the Australian *Hydrobiosella bispina* group

1. Inferior appendages with harpago straight or with ventral margin forming a weakly obtuse angle (figs 3, 6) 2
– Inferior appendages with harpago neither straight nor with ventral margin forming a weakly obtuse angle, but forming almost a right angle (figs 21, 24, 36) 7
2. Segment X with a dorsal spine (Fig. 3); NE-Qld ..... *H. unispina*
– Segment X without a dorsal spine (figs 6, 9) 3
3. Segment X without subapical, lateral pair of hooks (figs 5–6); CE-NSW ..... *H. gurara*
– Segment X with subapical, lateral pair of hooks (figs 8–9, 11–12) 4
4. Segment X in dorsal view with apex rounded, slightly bulbous and dorsoventrally flattened (figs 8–9); NE-NSW ..... *H. nandawar*
– Segment X in dorsal view with apex not rounded and dorsoventrally flattened, slender and laterally compressed (figs 11–12, 14–15) 5
5. Segment X with robust subapical, lateral pair of hooks, apex slender in lateral view (figs 11–12); NE-Qld ..... *H. dugarang*
– Segment X without robust subapical, lateral pair of hooks, apex not slender in lateral view (figs 14–15, 17–18) 6
6. Inferior appendages with harpago dilated slightly in apical half (fig. 15); E-Vic ..... *H. bilga*
– Inferior appendages with harpago not dilated slightly in apical half (fig. 18); C-Qld ..... *H. mundagurra*
7. Parameres very long, reaching tip of inferior appendages (figs 20–21); E-NSW ..... *H. bispina*
– Parameres not very long, not reaching tip of inferior appendages (figs 23–24) 8
8. Inferior appendages with harpago curved strongly in distal half so apex is pointing downwards (fig. 24); SE-Qld ..... *H. arcuata*
– Inferior appendages with harpago not curved strongly in distal half so apex is pointing posteriorly (figs 27, 30) 9
9. Segment X in dorsal view with apex tapered gradually, not constricted sub-apically (fig. 26); CE-NSW ..... *H. moorda*
– Segment X in dorsal view with apex not tapered gradually, constricted subapically (figs 29, 32) 10
10. Segment X in lateral view with apex slightly bulbous, not curved downwards; subapical, lateral pair of hooks directed outwards (figs 29–30); SE-Qld ..... *H. woonoongoora*
– Segment X in lateral view with apex not slightly bulbous, curved slightly downwards; subapical, lateral pair of hooks directed downwards (figs 32–33, 35–36) 11
11. Inferior appendages with basal segment tapered strongly distally; harpago not dilated slightly in distal half (fig. 33); CE-NSW ..... *H. thurawal*
– Inferior appendages with basal segment not tapered strongly distally; harpago dilated slightly in distal half (fig. 36); CE-NSW ..... *H. yokunna*

Hydrobiosella unispina sp. nov.

Figures 2–4, 38–39

Holotype. Male, Queensland, Mt Spec State forest, Camp Ck trib., 18°57'S, 146°10'E, 760 m, 11 Jun 1994, A. L. Sheldon (NMV, T- 20893).
Paratypes. Queensland. 1 male (specimen PT-2029 figured), Mt

Spec, at light, 11 May 1975, R. Storey and D. Hancock; the following sites all Mt Spec State forest, 18°57'S, 146°10'E, A. L. Sheldon; 1 male, Birthday Ck above weir, 820 m, 6 Dec 1993; 1 male, Camp Ck proper, 760 m, 11 Jun 1994; 1 male, 1 female (specimen CT-635 figured), Camp Ck trib., 760 m, 15 May 1994; 1 male, same site, 5 Dec 1993; 1 male, 1 female, same site, 15 Mar 1994; 1 male, same site, 12 Dec 1993; 2 males, 1 female, same site, 6 Jul 1994, 1 male, same site, 6 Nov 1993; 1 male, same site, 23 Apr 1994; 2 males, same site, 21 Nov 1993; 1 male, same site, 20 Dec 1993; 1 male, same site, 15 Oct 1993; 1 male, same site, 4 Mar 1994 (NMV).

Other material examined. Queensland. 1 female, Upper Little Mossman R., Mt Lewis, 10 Dec 1974, M. S. Moulds; 1 male, 'top of the range', 19 Butler Drive, Kuranda, 335 m, 16°48'S, 145°38'E, 1–15 Feb 2007, D. C. F. Rentz (ANIC); the following sites all Mt Spec State forest, 18°57'S, 146°10'E, A. L. Sheldon: 1 male, 3 females, unnamed ck, Paluma Dam Rd, 860 m, 17 Jan 1994; 1 male, same site, 11 Jun 1994; 1 male, same site, 6 Jul 1994; 1 male, unnamed ck 'cascade', 920 m, 17 May 1994; 2 males, 'Confusion' Ck, trib. to unnamed ck, Paluma Res., 17 May 1994; 2 females, Birthday Ck above weir, 820 m, 20 Dec 1993; 2 males, 1 female, same site, 22 Oct 1993; 1 male, same site, 6 Nov 1993; 2 females, same site, 13 Nov 1993; 1 female, same site, 21 Nov 1993; 1 male, Birthday Ck below falls, 760 m, 11 Jun 1994; 1 male, Birthday Ck, Iron Cabin, 790 m, 12 Feb 1994; 1 male, Birthday Ck, 870 m, 16 Jan 1994; 2 males, 1 female, same site, 31 Oct 1993; 2 males, Williams Ck trib., 745 m, 13 Nov 1993; 2 males, same site, 15 May 1994; 1 female, Camp Ck trib., 760 m, 13 Dec 1993; 1 female, Echo Ck trib., 735 m, 7 Nov 1993 (NMV).

Diagnosis. *Hydrobiosella unispina* can be separated from other species in the group by the dorsal spine on segment X and segment IX produced into a triangular point medially on distal margin.

Description. Wings similar to those of *H. arcuata* (fig. 1), length of forewing: male 6.7–8.0 mm, female 7.2–8.7 mm.

Male. Segment IX without a noticeable notch on mesodistal margin, instead produced into a triangular point (fig. 4). Segment X with mesal lobe broadbased, dorsoventrally compressed in distal two-thirds, with a mesodorsal spine (figs 2–3); in dorsal view, subtriangular or tongue shaped, tapered distally, length about 2.3 times maximum width, with a pair of lateral lobes, without projecting hooks (fig. 2); in lateral view slender, downcurved in distal two-thirds (fig. 3). Inferior appendages in lateral view, with basal segment subrectangular, length about 1.8–1.9 times maximum width; harpago nearly as long as basal segment, more slender, length about 3.5 times width, weakly (obtusely) angled near middle (fig. 3).

Female. Genitalia typical of genus, with a small triangular projection on sternite VIII mesodistally (figs 38–39).

Etymology. *Unispina* — Latin for 'one spine' (spine on tergum X).

Remarks. *Hydrobiosella unispina* is a common species and has been collected mainly from the Mt Spec area of northeastern Queensland (latitudinal range 16°35'–18°57'S).

Hydrobiosella gurara sp. nov.

Figures 5–7

Holotype. Male (specimen CT-577 figured), New South Wales, Jerusalem Falls near Karuah (about 32°39'S, 151°57'E), 6 Dec 1988, G. Theischinger (NMV, T-20913).

Diagnosis. *Hydrobiosella gurara* can be separated from other species in the group by the absence of lateral subapical hooks on segment X and from *H. unispina* by the absence of a dorsal spine on segment X.

Description. Wings similar to those of *H. arcuata* (fig. 1), length of forewing: male 6.5 mm.

Male. Segment IX with a deep notch on mesodistal margin (fig. 7). Segment X with robust mesal lobe, broadbased, with a pair of pigmented lateral lobes, without hooks (figs 5–6); in dorsal view subtriangular, tapered slightly distally with a rounded apex (fig. 5). Phallus robust (fig. 6). Inferior appendages in lateral view, with basal segment subquadrate, length about 1.5 times maximum width; harpago longer than basal segment, length about 1.3–1.4 times length basal segment, slender, length about 5.5 times width, narrowed and weakly (obtusely) angled near middle, slightly dilated in apical third (fig. 6).

Female. Unknown.

Etymology. *Gurara* — Australian Aboriginal (New South Wales) word for 'long' or 'tall' (harpago on inferior appendages).

Remarks. The holotype male is the only specimen of *Hydrobiosella gurara* collected from the type locality in central-eastern New South Wales (latitude 32°39'S).

Hydrobiosella nandawar sp. nov.

Figures 8–10

Holotype. Male, New South Wales, Mt Kaputar, 30°16'S, 150°10'E, 3 Jan 1986, G. Theischinger (NMV, T-20914)

Paratype. New South Wales. 1 male (specimen CT-428 figured), Mt Kaputar Nat. Pk, Dawson Springs, 9 Oct 1973, A. Neboiss (NMV).

Diagnosis. *Hydrobiosella nandawar* can be separated from other species in the group by the rounded, slightly bulbous and dorsoventrally flattened apex on segment X.

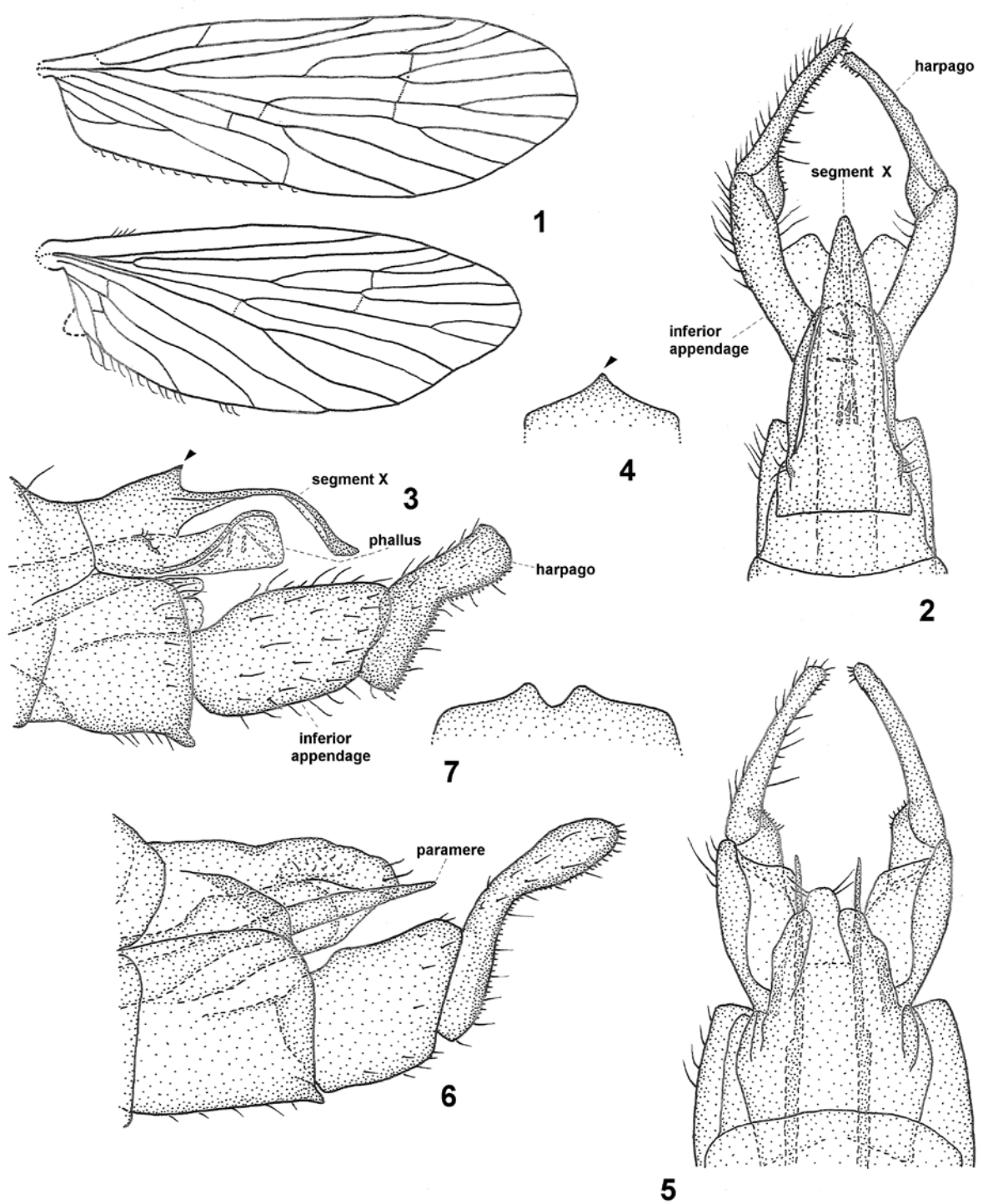
Description. Wings similar to those of *H.arcuata* (fig. 1), length of forewing: male 7.6–8.0 mm.

Male. Segment IX without a noticeable notch medially on distal margin (fig. 10). Segment X mesal lobe with distal third slightly dorsoventrally compressed (figs 8–9); in lateral view, distal third slender, straight (fig. 9); in dorsal view, distal third narrowed subapically, slightly bulbous and rounded apically (fig. 8), with a pair of pigmented lateral lobes, which terminate in small, slightly downward projecting hooks (figs 8–9). Inferior appendages in lateral view, with basal segment length about twice maximum width, broadest in basal third, tapered slightly distally; harpago shorter than basal segment, length about 0.8 times length basal segment, slender, length about 4.5 times width, weakly (obtusely) angled near middle (fig. 9).

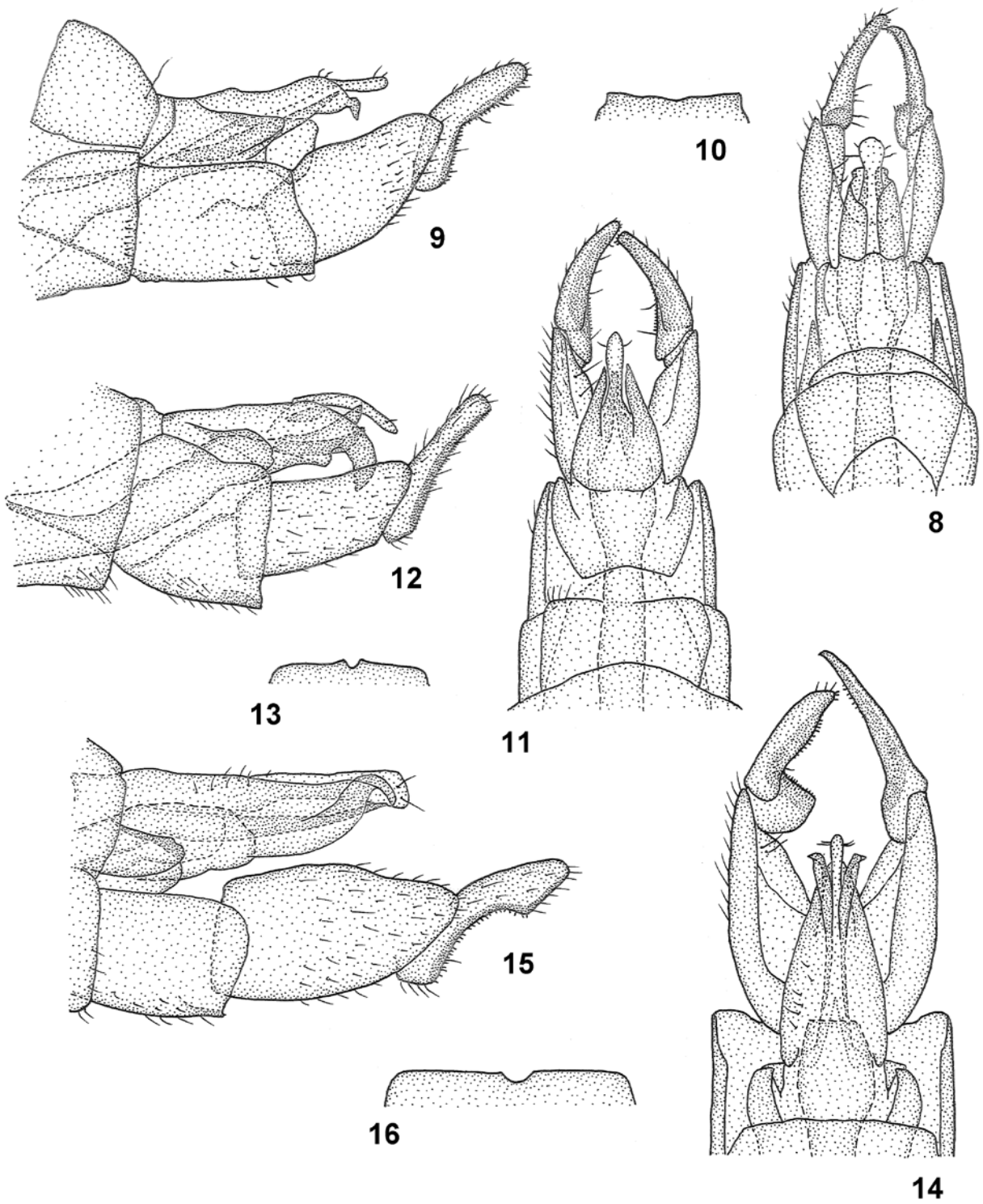
Female. Unknown.

Etymology. *Nandawar* — Australian Aboriginal name for 'Mt Kaputar' (type locality).

Remarks. Two male specimens of *Hydrobiosella nandawar* have been collected from the Mt Kaputar National Park in northeastern New South Wales (latitude 30°16'S).



Figures 1–7. *Hydrobiosella* spp.; 1, *Hydrobiosella arcuata* Kimmins, wings; 2–7, *Hydrobiosella* spp., male genitalia in dorsal, lateral and part ventral views; 2–4, *Hydrobiosella unispina* sp. nov.; 2, dorsal; 3, lateral; 4, ventral, mesodistal margin of segment IX; 5–7, *Hydrobiosella gurara* 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 nandawar* sp. nov.; 8, dorsal; 9, lateral; 10, ventral, mesodistal margin of segment IX; 11–13, *Hydrobiosella dugerang* sp. nov.; 11, dorsal; 12, lateral; 13, ventral, mesodistal margin of segment IX; 14–16, *Hydrobiosella bilga* sp. nov.; 14, dorsal; 15, lateral; 16, ventral, mesodistal margin of segment IX.

Hydrobiosella dugarang sp. nov.

Figures 11–13

Holotype. Male (specimen CT-560 figured), Queensland, Dalrymple Ck near Eungella, 21°02'S, 148°43'E, 3 Apr 1993, G. Theischinger (NMV, T-20915).

Diagnosis. *Hydrobiosella dugarang* can be separated from other species in the group by the robust subapical, lateral pair of hooks and slender apex, both on segment X in lateral view.

Description. Wings similar to those of *H.arcuata* (fig. 1), length of forewing: male 6.2 mm.

Male. Segment IX with a small notch medially on distal margin (fig. 13). Segment X with slender mesal lobe (figs 11–12); in lateral view, slightly downcurved apically (fig. 12); in dorsal view, slender, not narrowed subapically (fig. 11), with a pair of more pigmented lateral lobes, which terminate in robust, downward projecting hooks (figs 11–12). Inferior appendages in lateral view, with basal segment length about twice maximum width, broadest in basal half, tapered slightly distally; harpago about same length as basal segment, slender, straight, length about 5.7–5.9 times width (fig. 12).

Female. Unknown.

Etymology. *Dugarang* — Australian Aboriginal word for 'straight' (inferior appendages).

Remarks. The male holotype is the only known specimen of *Hydrobiosella dugarang* from the type locality in northeastern Queensland (latitude 21°02'S).

Hydrobiosella bilga sp. nov.

Figures 14–16

Holotype. Male, New South Wales, Nungatta Ck, Yambula State Forest (about 37°08'S, 149°29'E), 16–17 Feb 2000, J. Miller (ANIC).

Paratypes. New South Wales. 6 males, collected with holotype (ANIC). Victoria. 1 male (specimen CT-571 figured), Beehive Ck, 30 km N of Cann River, (about 37°18'S, 149°12'E), 21 Mar 1977, A. Neboiss (NMV).

Diagnosis. *Hydrobiosella bilga* can be separated from other species in the group by the combination of the slightly dilated apices and weakly obtuse angle on ventral margin of the harpago and the pair of subapical hooks on segment X.

Description. Wings similar to those of *H.arcuata* (fig. 1), length of forewing: male 7.3–8.4 mm. Forewing fork 2 long, length fork 2 about 1.5 times length of fork 1; length fork 3 about 1.9 times length footstalk; fork 4 length about 7 times length footstalk. Hind wing fork 1 sessile; fork 3 length about twice length of footstalk.

Male. Segment IX with a small shallow notch medially on distal margin (fig. 16). Segment X mesal lobe with a pair of short hairs/bristles subapically, slightly laterally compressed; in dorsal view slender, not narrowed subapically (fig. 14), with a pair of more pigmented lateral lobes, which terminate in small, slender, slightly outward and downward projecting hooks (figs 14–15). Inferior appendages in lateral view, with basal segment length about 1.8 times maximum width, broad basally, tapered slightly distally; harpago more slender, straight with slightly convex ventral margin, slightly dilated in apical third (fig. 15).

Female. Unknown.

Etymology. *Bilga* — Australian Aboriginal word for 'bee's nest' (type locality — Beehive Creek).

Remarks. Eight male specimens of *Hydrobiosella bilga* have been collected from the two localities in southeastern New South Wales and eastern Victoria (latitudinal range 37°08'–37°18'S).

Hydrobiosella mundagurra sp. nov.

Figures 17–19, 40–41

Holotype. Male, Queensland, Carnarvon Gorge Nat. Pk, 25°15'S, 148°24'E, 12 Nov 1990, G. Theischinger (NMV, T-20917).

Paratypes. Queensland. 5 males (specimen CT-575 figured), 15 females (specimen CT-607 figured), collected with holotype (NMV).

Other material examined. Queensland. 16 females, collected with holotype (NMV).

Diagnosis. *Hydrobiosella mundagurra* can be separated from other species in the group by the combination of harpago, which is straight and not dilated in distal half, and segment X with slender lateral pair of hooks and slender apex in dorsal view.

Description. Wings similar to those of *H. arcuata* (fig. 1), length of forewing: male 5.9–6.7 mm, female 6.5–8.7 mm. Forewing fork 2 long, length fork 2 about 1.5 times length of fork 1; fork 3 length about 1.6 times length footstalk; fork 4 length about 4.6 times length footstalk. Hind wing fork 1 with short footstalk; fork 3 length about 1.9 times length of footstalk.

Male. Segment IX without a noticeable notch medially on distal margin (fig. 19). Segment X mesal lobe with a pair of short hairs/bristles subapically, slightly laterally compressed; in dorsal view slender, not narrowed subapically (Fig. 17), with a pair of more pigmented lateral lobes, which terminate in small, slender, slightly outward and downward projecting hooks (figs 17–18). Inferior appendages in lateral view, with basal segment length about 1.9 times maximum width, broad basally, tapered slightly distally; harpago more slender, nearly straight (fig. 18).

Female. Genitalia typical of genus, with a small rounded projection on sternite VIII mesodistally (figs 40–41).

Etymology. *Mundagurra* — named for the Australian Aboriginal dreaming rainbow serpent believed to have created Carnarvon Gorge.

Remarks. Six males and many females of *Hydrobiosella mundagurra* have been collected from the type locality in central-eastern Queensland (latitude 25°15'S).

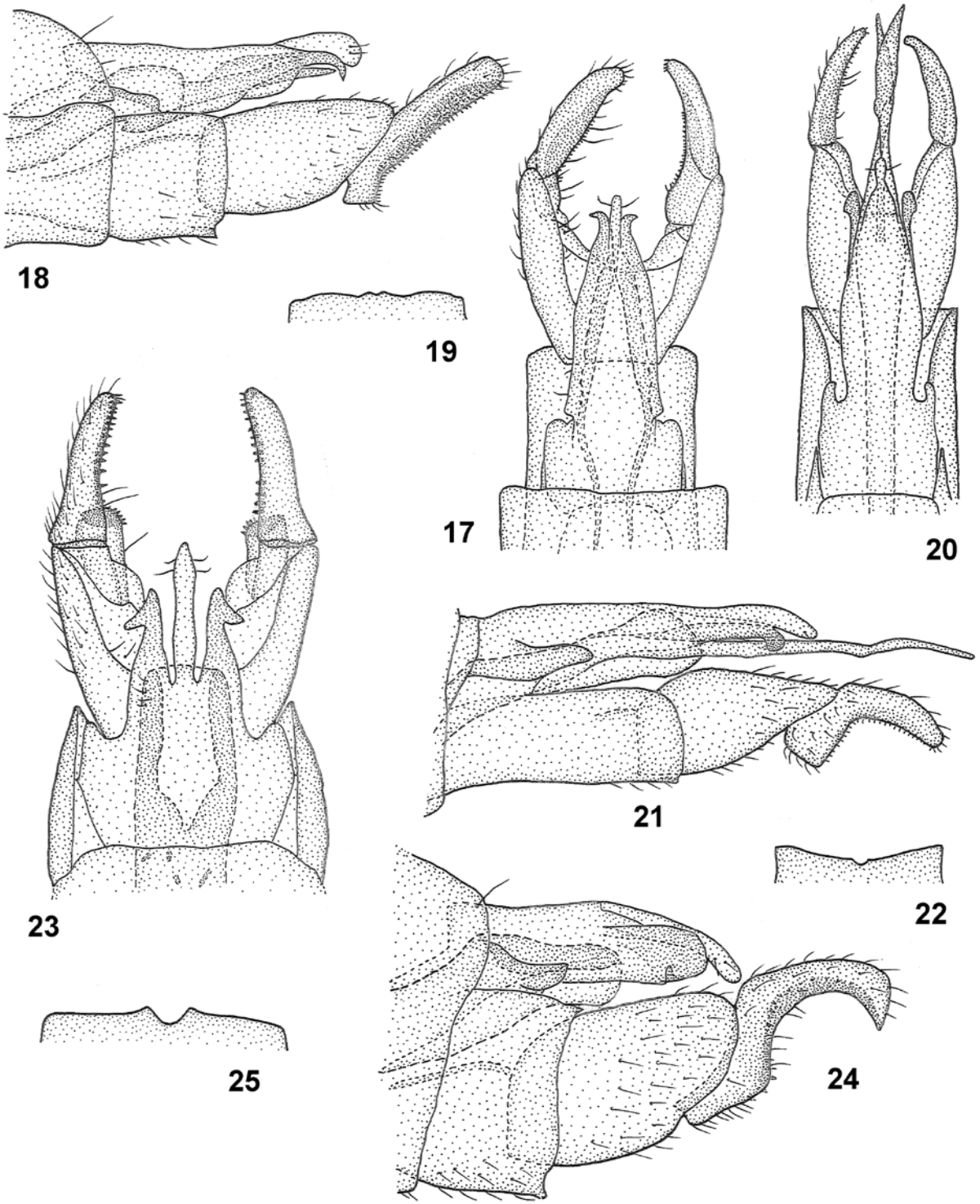
Hydrobiosella bispina Kimmins

Figures 20–22, 42–43

Hydrobiosella bispina Kimmins in Mosely and Kimmins, 1953: 394, fig. 270.—Neboiss, 1986: 102.

Type material (not seen). Holotype. Male, New South Wales, Stanwell Park, 23 Apr 1916, R. J. Tillyard (BMNH).

Paratype (not seen). New South Wales. 1 male, collected with holotype (BMNH).



Figures 17–25. *Hydrobiosella* spp. male genitalia in dorsal, lateral and part ventral views; 17–19, *Hydrobiosella mundagurra* sp. nov.; 17, dorsal; 18, lateral; 19, ventral, mesodistal margin of segment IX; 20–22, *Hydrobiosella bispina* Kimmins.; 20, dorsal; 21, lateral; 22, ventral, mesodistal margin of segment IX; 23–25, *Hydrobiosella arcuata* Kimmins; 23, dorsal; 24, lateral; 25, ventral, mesodistal margin of segment IX.

Material examined. New South Wales. 3 males, 6 females, Wilson R., Wilson R. Reserve, 11 Feb 2008, R. St Clair; 1 male, Wilson R., Bobs Ridge Rd, 31°15'S, 152°31'E, 4 Dec 2007, A. Glaister, J. Dean and R. St Clair; 1 male (specimen PT-579 figured), Tubrabucca, Barrington Tops, 15 Nov 1953, A. Neboiss (NMV); 2 males, 16 females, Dilgry R., Banksia camp ground, 31°53'S, 151°32'E, 2 Dec 2007, A. Glaister, J. Dean and R. St Clair; 3 males, 4 females, Gloucester R., Gloucester R. camping area, 32°03'S, 151°41'E, 1 Dec 2007, A. Glaister, J. Dean and R. St Clair; 1 male, 1 female (specimen CT-605 figured), Gloucester Tops, el. 1280 m, Malaise, 19 Nov to 4 Dec 1988, D. Bickle; 3 males, 1 female, Gloucester Tops, 32°04'S, 151°34'E, el. 1300 m, 2–3 Dec 1988, Theischinger and Mueller; 1 male, 1 female, Jerusalem Falls near Karuah, 6 Dec 1988, G. Theischinger; 1 male, 1 female, Wilson R. near Bellangry, 5 Dec 1988, G. Theischinger; 1 male, Wollomi Brook, The Basin, Olney State Forest, 33°06'S, 151°14'E, 26 Nov 2007, A. Glaister, J. Dean and R. St Clair (NMV).

Diagnosis. *Hydrobiosella bispina* can be separated from other species in the group by the very long parameres, which reach the tip of the inferior appendages.

Description. (Revised after Kimmins in Mosely and Kimmins, 1953.) Wings similar to those of *H.arcuata* (fig. 1), length of forewing: male 6.3–8.3 mm, female 7.2–8.6 mm. Forewing fork 2 long, length fork 2 about 1.5 times length of fork 1; length fork 3 about twice length footstalk; fork 4 length about 8 times length footstalk. Hind wing fork 1 sessile; fork 3 length about 1.5 times length of footstalk.

Male. Segment IX with small, shallow notch medially on distal margin (fig. 22). Segment X with a slender mesal lobe, with a pair of short hairs/bristles subapically, in lateral view slightly downturned distally (fig. 21); in dorsal view slightly narrowed subapically (fig. 20); with a pair of pigmented lateral lobes, which end in small, slightly downward and outward projecting rounded hooks (figs 20–21). Phallus generally slender, slightly dilated subapically; with a pair of very slender and elongate parameres arising from the phallus near the apex (fig. 21). Inferior appendages in lateral view, with basal segment length about twice maximum width, broadest near middle, tapered strongly distally; harpago more slender, with ventral margin sharply angled at about 90 degrees near middle, tapered slightly distally (fig. 21).

Female. Genitalia typical of genus, with a small, shallow, triangular projection on sternite VIII mesodistally (figs 42–43).

Remarks. Males and females of *Hydrobiosella bispina* have been collected from nine sites in addition to the type locality, all in eastern New South Wales (latitudinal range 31°15'–33°06'S).

Kimmins' (in Mosely and Kimmins 1953) and Neboiss' (1986) figures have been redrawn to allow direct comparisons and to accompany the description that is revised in light of new interpretations of *Hydrobiosella* genitalic structures.

Hydrobiosella arcuata Kimmins

Figures 1, 23–25, 44–45

Hydrobiosella arcuata Kimmins in Mosely and Kimmins, 1953: 397, fig. 271. —Neboiss, 1986: 103.

Type material (not seen). Holotype. Male, Queensland, Montville, 3 Oct 1912, R. J. Tillyard (BMNH).

Material examined. Queensland. 1 male, Booloumba Ck, 8 km SW Kenilworth, 26°39'S, 152°39'E, 12 Dec 1984, G. Theischinger; 1 male (specimen CT-573 figured), Booloumba Ck, Mary R. catchment, 26°41'S, 152°37'E, 26 Oct 1993, collector unknown; 1 male, 1 female, Branch Ck, Brisbane R. catchment, 26°52'S, 152°41'E, 26 Apr 1993; collector unknown; 1 male, 2 females (specimen CT-603 figured), Stony Ck, Brisbane R. catchment, 26°52'S, 152°43'E, 18 Aug 1992; collector unknown (NMV).

Diagnosis. *Hydrobiosella arcuata* can be separated from other species in the group by the shape of the harpago, where the ventral margin is curved or arched strongly so that the apex points downwards.

Description. (Revised after Kimmins in Mosely and Kimmins, 1953). Wings similar to other species in the group (fig. 1), length of forewing: male 6.3–7.3 mm, female 6.1–8.0 mm. Forewing fork 2 long, length fork 2 about 1.6 times length of fork 1; length fork 3 about twice length footstalk; fork 4 length about 4.5 times length footstalk. Hind wing fork 1 sessile or with very short footstalk; fork 3 length about 1.0–1.3 times length of footstalk.

Male. Segment IX with shallow notch medially on distal margin in between a pair of small knobs (fig. 25). Segment X with a slender mesal lobe, with a pair of short hairs/bristles subapically, in lateral view slightly downturned distally (fig. 24); in dorsal view not narrowed subapically (fig. 23), with a pair of more pigmented lateral lobes, which terminate in small, slightly backward and outward projecting hooks (figs 23–24). Phallus truncate apically, with a pair of robust parameres arising from the phallus subapically (fig. 24). Inferior appendages in lateral view, with basal segment length about 1.7 times maximum width, broad basally, rounded distally; harpago more slender, with ventral margin sharply angled near middle, curved in distal half with downward pointing acute apex (fig. 24).

Female. Genitalia typical of genus, with a small, shallow, rounded projection on sternite VIII mesodistally (figs 44–45).

Remarks. Males and females of *Hydrobiosella arcuata* have been collected from five sites in addition to the type locality, all in southeastern Queensland (latitudinal range 26°39'–26°52'S).

Kimmins' (in Mosely and Kimmins 1953) and Neboiss' (1986) figures have been redrawn to allow direct comparisons and to accompany the description that is revised in light of new interpretations of *Hydrobiosella* genitalic structures.

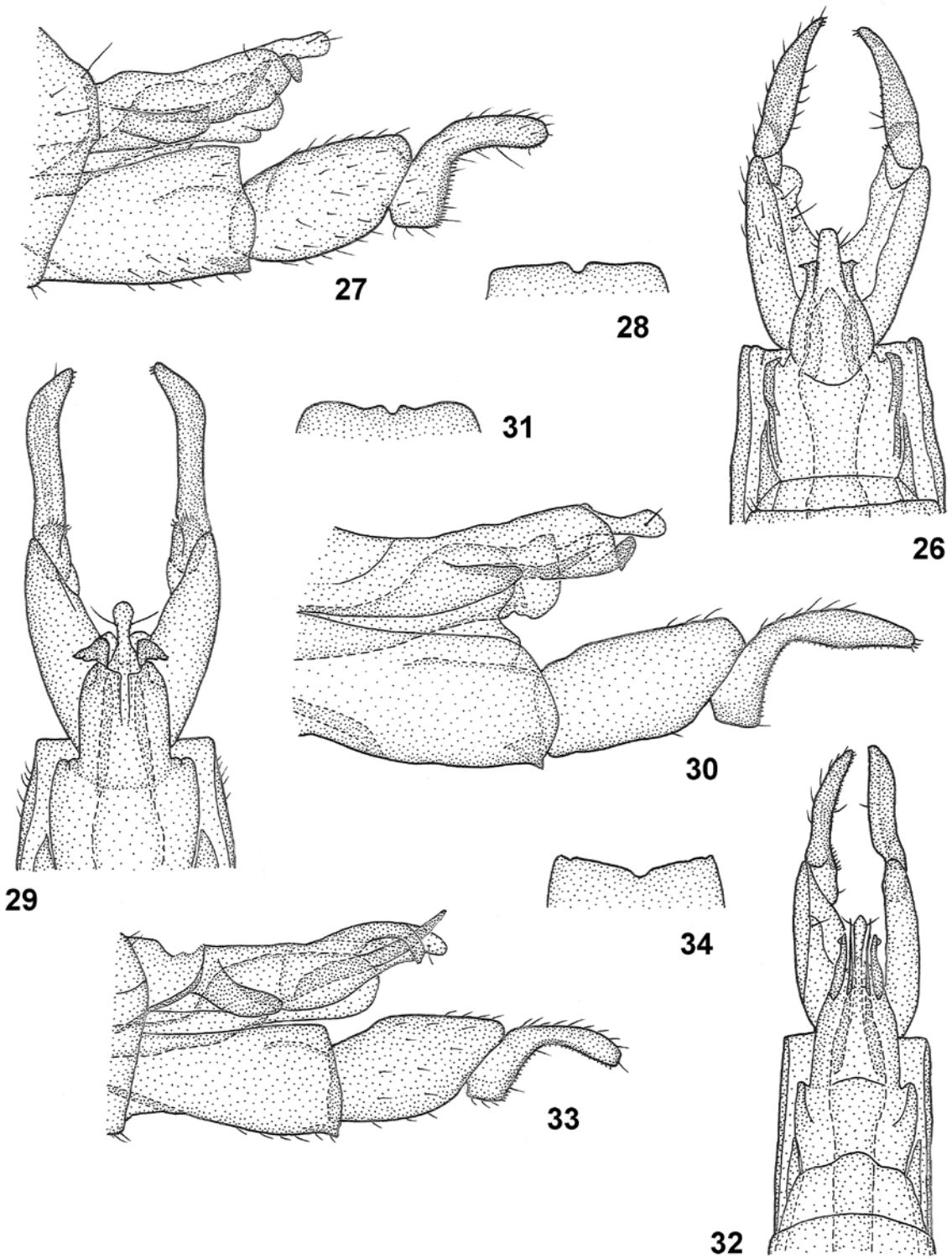
Hydrobiosella moorda sp. nov.

Figures 26–28

Holotype. Male, New South Wales, (about 33°41'S, 150°17'E), Pulpit Hill Ck, Megalong Valley, 8 Oct 1985, A. Neboiss (NMV, T-20938).

Paratypes. New South Wales. 2 males (specimen PT-1421 figured), collected with holotype (NMV).

Diagnosis. *Hydrobiosella moorda* can be separated from other species in the group by the combination of segment X in dorsal view with a robust, gradually tapered apex, not constricted subapically, and the ventral margin of the harpago sharply angled at about 90 degrees near middle with apex pointing posteriorly.



Figures 26–34. *Hydrobiosella* spp. male genitalia in dorsal, lateral and part ventral views; 26–28, *Hydrobiosella moorda* sp. nov.; 26, dorsal; 27, lateral; 28, ventral, mesodistal margin of segment IX; 29–31, *Hydrobiosella woonoongoora* sp. nov.; 29, dorsal; 30, lateral; 31, ventral, mesodistal margin of segment IX; 32–34, *Hydrobiosella thurawal* sp. nov.; 32, dorsal; 33, lateral; 34, ventral, mesodistal margin of segment IX.

Description. Wings similar to those of *H.arcuata* (fig. 1), length of forewing: male 8.0–8.8 mm. Forewing fork 2 long, length fork 2 about 1.5 times length of fork 1; length fork 3 about 1.5 times length footstalk; fork 4 length about 5.3 times length footstalk. Hind wing fork 1 sessile; fork 3 length about 1.3–1.4 times length of footstalk.

Male. Segment IX with a small shallow notch medially on distal margin (fig. 28). Segment X with a robust mesal lobe, with a pair of short hairs/bristles subapically, in lateral view not downturned distally (fig. 27); in dorsal view, tapered slightly distally, not narrowed subapically (fig. 26); with a pair of more pigmented lateral lobes that end in small, slightly downward and outward projecting hooks (figs 26–27). Inferior appendages in lateral view, with basal segment length about 1.9 times maximum width, broadest near middle, rounded distally; harpago more slender, ventral margin sharply angled at about 90 degrees near middle (fig. 27).

Female. Unknown.

Etymology. Moorda — Australian Aboriginal word for 'blue mountain' (type locality — Blue Mountains).

Remarks. Three male specimens of *Hydrobiosella moorda* have been collected from the type locality in central-eastern New South Wales (latitude 33°41'S).

Hydrobiosella woonoongoora sp. nov.

Figures 29–31, 46, 47

Holotype. Male, New South Wales, Upper Crystal Ck at Crystal Ck rainforest retreat, 28°15'S, 153°18'E, 25 Dec 2006, A. Wells (ANIC).

Paratypes. New South Wales. 20 males, 16 females (specimen CT-636 figured), collected with holotype (ANIC). Queensland. 4 males (specimen CT-567 figured) Coomera Ck, Lamington Nat. Pk, 8 Feb 1961, F. A. Perkins (NMV).

Other material examined. New South Wales. 12 males, collected with holotype (ANIC); 1 male, 4 females, same site and collector, 26 Dec 2006 (ANIC); 1 male, 1 female, same site and collector, 24 Dec 2006 (ANIC). Queensland. 4 females, Coomera Ck, Lamington Nat. Pk, 8 Feb 1961, F. A. Perkins; 4 males, 1 female, Lamington Nat. Pk, 28 Jan 1963, G. Monteith; 1 male, 1 female, Lamington Nat. Pk, 27 May 1959, collector unknown; 1 male (damaged), Binna Burra, 22 May 1964, B. Genn (NMV); 1 male, 1 female, Binna Burra, Lamington Nat. Pk, 750 m, 28°11'S, 153°11'E, 10 Nov 1988, E. S. Nielsen and M. Horak (ANIC); 4 males, 3 females, Binna Burra, 28°12'S, 153°11'E, Lamington Nat. Pk, 3–10 Nov 1984, E. D. Edwards; 1 male, 'Gwingamma', 6 km SW of Tallebudgera, 28°11'S, 153°23'E, 18–23 Apr 1994, Malaise trap, Rentz, Lee, Upton (ANIC); 2 males, Redwood Park, Toowoomba, 27°35'S, 151°59'E, 8 Nov 1988, E. S. Nielsen and M. Horak (ANIC).

Diagnosis. *Hydrobiosella woonoongoora* can be separated from other species in the group by small differences in segment X; the mesal lobe in has a slightly bulbous apex and the lateral lobes have apical hooks directed outwards.

Description. Head, body and wings brownish, some specimens paler. Wings similar to those of *H.arcuata* (fig. 1), length of forewing: male 6.4–8.1 mm, female 6.6–8.2 mm. Forewing fork 2 long, length fork 2 about 1.6 times length of fork 1; length fork 3 about 1.9 times length footstalk; fork 4 length about 4.6–5.4 times length footstalk. Hind wing fork 1 with very short footstalk; fork 3 length about twice length of footstalk.

Male. Segment IX with small shallow notch medially on distal margin (fig. 31). Segment X with mesal lobe slightly bulbous apically, with a pair of short hairs/bristles subapically, in lateral view not downturned distally (fig. 30); in dorsal view, narrowed slightly subapically (fig. 29), with a pair of pigmented lateral lobes, which terminate in small, outward projecting hooks (figs 29–30). Inferior appendages in lateral view, with basal segment length about twice width, broad basally, rounded distally; harpago more slender, with ventral margin sharply angled at about 90 degrees near middle, very slightly dilated in apical third (fig. 30).

Female. Genitalia typical of genus, with a small, rounded projection on sternite VIII mesodistally (figs 46–47).

Etymology. Woonoongoora — Australian Aboriginal word for the Lamington National Park ranges (type locality — Lamington National Park).

Remarks. Many male and female specimens of *Hydrobiosella woonoongoora* have been collected from five sites near the type locality in northeastern New South Wales and southeastern Queensland (latitudinal range 27°35'–28°15'S).

Hydrobiosella thurawal sp. nov.

Figures 32–34, 48–49

Holotype. Male, New South Wales, Minnamurra Falls (about 34°38'S, 150°44'E), ?12 Aug 1967, N. Hynes and joint collector unknown (NMV, T-20945).

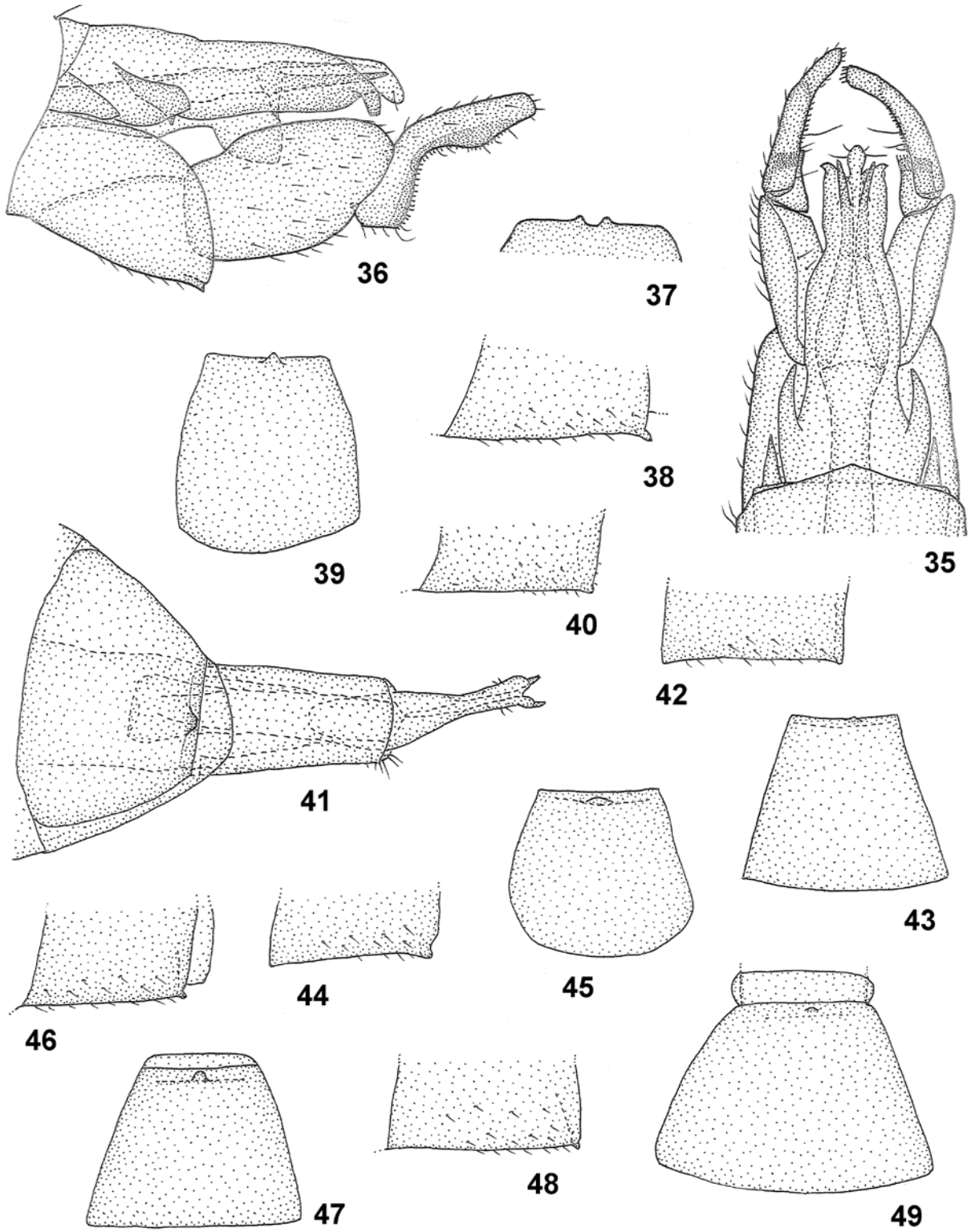
Paratype. New South Wales. 1 male (specimen PT-580 figured), 1 female (specimen CT-604 figured), Minnamurra Falls, W of Kiama, 25 Mar 1973, A. Neboiss (NMV).

Diagnosis. *Hydrobiosella thurawal* can be separated from other species in the group by small differences in segment X and the inferior appendages; segment X in lateral view, with apex not bulbous, curved slightly downwards; lateral lobes with apical hooks directed downwards and not outwards; inferior appendages with basal segment tapered strongly distally; harpago with ventral margin sharply angled at about 90 degrees, not dilated in distal half.

Description. Wings similar to those of *H.arcuata* (Fig. 1), length of forewing: male 6.9–8.5 mm, female 8.7 mm. Forewing fork 2 long, length fork 2 about 1.6 times length of fork 1; length fork 3 about twice length footstalk; fork 4 length about 5.8 times length footstalk. Hind wing fork 1 with very short footstalk; fork 3 length about 2.4 times length of footstalk.

Male. Segment IX with small, shallow notch medially on distal margin (fig. 34). Segment X mesal lobe, with a pair of short hairs/bristles subapically, in lateral view slightly downturned distally (fig. 33); in dorsal view, narrowed subapically, very slightly bulbous apically (fig. 32), with a pair of pigmented lateral lobes, which terminate in small, downward projecting hooks (figs 32–33). Inferior appendages in lateral view, with basal segment length about 1.8 times maximum width, broadest near middle, tapered distally, harpago more slender, ventral margin sharply angled at about 90 degrees near middle (fig. 33).

Female. Genitalia typical of genus, with a small, shallow projection on sternite VIII mesodistally (figs 48–49).



Figures 35–49. *Hydrobiosella* spp.; 35–37, *Hydrobiosella yokunna* sp. nov. male genitalia in dorsal, lateral and part ventral views; 35, dorsal; 36, lateral; 37, ventral, mesodistal margin of segment IX; 38–49, *Hydrobiosella* spp. female genitalia (part segment VIII) in lateral and (segment VIII) ventral view; 38–39, *Hydrobiosella unispina* sp. nov.; 38, lateral; 39, ventral; 40–41, *Hydrobiosella mundagurra* sp. nov.; 40, lateral; 41, female genitalia, ventral; 42–43, *Hydrobiosella bispina* Kimmins; 42, lateral; 43, ventral; 44–45, *Hydrobiosella arcuata* Kimmins; 44, lateral; 45, ventral; 46–47, *Hydrobiosella woonoongoora* sp. nov.; 46, lateral; 47, ventral; 48–49, *Hydrobiosella thurawal* sp. nov.; 48, lateral; 49, ventral.

Etymology. *Thurawal* — Australian Aboriginal name for the area around the type locality.

Remarks. Two males and one female specimen of *Hydrobiosella thurawal* have been collected from the type locality in central-eastern New South Wales (latitude 34°38'S).

Hydrobiosella yokunna sp. nov.

Figures 35–37

Holotype. Male (specimen CT-574 figured), New South Wales, Tuckers Knob, Orara West State Forest, 29°41'S, 152°48'E, 22 Nov 1990, G. Theischinger (NMV, T-20948).

Diagnosis. *Hydrobiosella yokunna* can be separated from other species in the group by small differences in segment X and the inferior appendages; segment X in lateral view, with apex not bulbous, curved slightly downwards; lateral lobes with apical hooks directed downwards and not outwards; inferior appendages with basal segment not tapered strongly distally; harpago with ventral margin sharply angled at about 90 degrees, dilated slightly in distal half.

Description. Wings similar to those of *H.arcuata* (fig. 1), length of forewing: male 6.9–8.5 mm. Forewing fork 2 long, length fork 2 about 1.5 times length of fork 1; length fork 3 about 1.5 times length footstalk; fork 4 length about 7.8 times length footstalk. Hind wing fork 1 with very short footstalk; fork 3 length about 1.2 times length of footstalk.

Male. Sternite IX with shallow notch medially on distal margin in between a pair of small knobs (fig. 37). Tergum X mesal lobe, with a pair of short hairs/bristles subapically, in lateral view slightly downturned distally (fig. 36); in dorsal view, narrowed subapically, slightly bulbous apically (fig. 35); with a pair of pigmented lateral lobes, which terminate in small, downward projecting hooks with slightly truncate apices (figs 35–36). Inferior appendages in lateral view, with basal segment length about 1.7 times maximum width, broadest near middle, rounded distally; harpago more slender, narrowed and with ventral margin angled at about 90 degrees near middle, slightly dilated in apical third (fig. 36).

Female. Unknown.

Etymology. *Yokunna* — Australian Aboriginal word for 'crooked' or 'bent' (terminal segment of inferior appendages).

Remarks. The holotype male is the only specimen of *Hydrobiosella yokunna* collected from the type locality in central-eastern New South Wales (latitude 29°41'S).

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