

Three new species of *Austrophlebioides* Campbell and Suter (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) from the Wet Tropics bioregion of north-eastern Australia

Faye Christidis^{1*} and John C Dean²

¹*School of Tropical Biology, James Cook University, Townsville, Qld 4811, Australia.*

²*Environment Protection Authority, Freshwater Sciences Unit, Ernest Jones Drive, Macleod, Vic. 3085, Australia.*

Abstract Three new species of the mayfly genus *Austrophlebioides* Campbell and Suter are described from the Wet Tropics bioregion of north-eastern Australia: *A. rieki* sp. n., *A. wooroonooran* sp. n. and *A. porphyrobranchus* sp. n. The three species are similar, and are characterised in the male imago by the presence of a prominent ventral projection on each lobe of the penes and segment one of the claspers narrowing at about one-third length, and in the nymph by the absence of fine setae along the outer margin of the mandible between the median setal tuft and the outer incisor. The generic diagnosis of the nymphal stage is modified slightly to accommodate the three new species.

Key words *Austrophlebioides*, Leptophlebiidae, mayflies, taxonomy.

INTRODUCTION

The genus *Austrophlebioides* was established by Campbell and Suter (1988) for two Australian species previously assigned to the New Zealand genus *Deleatidium* Eaton. *Deleatidium pusillum* Harker was redescribed by Campbell and Suter (1988) and designated the type species of *Austrophlebioides*. At that time, *Deleatidium unguiculare* (Ulmer) was also transferred by Campbell and Suter (1988) to *Austrophlebioides*. Two additional species, *A. marchanti* and *A. booloumbi*, were described by Parnrong and Campbell (1997) and the generic diagnosis was modified to accommodate *A. marchanti*. The original diagnosis of the genus included the presence of fine ventral spines on the penes. These are absent in *A. marchanti*, and Parnrong and Campbell (1997) regard this character as species-specific rather than characteristic of the entire genus. On the basis of the morphology of the male genitalia, Parnrong and Campbell (1997) also transferred *Deleatidium decipiens* Harker to *Austrophlebioides*. The genus presently comprises five described species, *A. pusillus*, *A. unguicularis*, *A. marchanti*, *A. booloumbi* and *A. decipiens*, all of which are endemic to Australia. Additional undescribed species of *Austrophlebioides* have been recognised (Dean 1999), but these are known as nymphs only and will be described when adult material is available.

The nymphs of *Austrophlebioides* are typically found on stones in cool forest streams. The adults are aerial/terrestrial and live for only a few days. The genus is widely distributed

in eastern Australia (Dean 1999). Until recently, taxonomic studies on the genus have centred around New South Wales and Victoria, with the fauna of northern and north-eastern Australia receiving little attention. In this article we describe three new species of *Austrophlebioides* from the Wet Tropics bioregion of north-eastern Australia.

MATERIALS AND METHODS

Nymphs were collected from streams by carefully removing individuals from the surface of stones with forceps. Individuals for rearing were placed in aerated containers, and all other specimens were preserved in 70% ethanol. Nymphs were reared individually in chambers similar to those recommended by Edmunds *et al.* (1976), in water collected from the same stream locality as the nymph, at temperatures ranging between 18°C and 24°C. Nymphs and imagos of all three species were associated through rearing.

All material examined was preserved in 70% ethanol. Imago wings were dissected and dry mounted on slides as recommended by Edmunds *et al.* (1976). Dissected wings were floated on top of several drops of 70% ethanol on a slide and a coverslip was carefully placed over the wings. The coverslip was secured with two thin strips of gummed paper. Male genitalia were cleared in 10% potassium hydroxide and mounted on slides in Euparal. The mouthparts, fore and hind legs, and some abdominal gills of nymphs were also mounted in Euparal. Specimens for scanning electron microscopy were dehydrated in a graded series of ethanol, critical-point dried, coated with gold or platinum, and viewed with a Phillips XL 20 or JEOL 5410 LV scanning electron microscope.

*Email: faye.christidis@jcu.edu.au

The terminology used in this study follows Edmunds *et al.* (1976). All measurements are in millimetres and were made using a stereo dissecting or compound microscope and an eyepiece graticule. The relative lengths of the segments of the male foreleg are given as a ratio of the length of each segment to the length of the tibia. The actual length of the tibia is presented in parentheses. All drawings were prepared using a microprojector or a camera lucida attached to either a Leica MZ6 stereo microscope or an Olympus BH-2 compound microscope. Holotypes and paratypes (which comprise additional imagos, subimagos and well-developed nymphs collected from the type locality) have all been lodged in the Queensland Museum (QM), Brisbane, Australia. Some non-type material is retained in the collection of Faye Christidis (FC).

The three species are morphologically similar and only the first, *A. wooroonooran* sp. n., is described in full. For the other two species, only those characters that differ from *A. wooroonooran* sp. n. or are important for general species recognition are given.

TAXONOMY

Genus *Austrophlebioides* Campbell and Suter (1988)

Type species. *Austrophlebioides pusillus* (Harker 1954) (originally placed in *Deleatidium*).

Revised generic diagnosis. Diagnosis of the nymph follows that given by Campbell and Suter (1988), except: mandible with or without fine setae along outer margin between setal tuft and outer incisor; and one to two elongate ventral spines in apical third of all tarsi or middle and hind tarsi only.

Austrophlebioides wooroonooran sp. n. (Figs 1–20)

Austrophlebioides ‘Henrietta’ Christidis (2001)

Types. Queensland. Holotype: male imago reared from nymph, Henrietta Ck, Wooroonooran National Park (17°33.9’S, 145°45.4’E), collected 5.vi.1999, F. Christidis (QM). Paratypes: all from the type locality, all collected by F. Christidis: 1 reared male imago, 18.vi.1998; 5 reared male imagos, 2 reared male subimagos, 2 reared female imagos, 2 nymphs, 30.v.1999; 1 reared male imago, 2 reared male subimagos, 1 reared female imago, 2 nymphs, 5.vi.1999; 8 nymphs, 24.iv.1998; QM.

Other material examined (not types). Queensland. Type locality: 1 nymph, 31.xii.1997; 5 male imagos, 29.v.1999, F. Christidis (FC). Charmillan Ck (17°42.1’S, 145°31.3’E): 1 reared male imago, 3 reared female imagos, 1 reared female subimago, 12 nymphs, 1.vi.1999, F. Christidis (QM).

Etymology. Named for the type locality, Wooroonooran National Park. To be used as a noun in apposition.

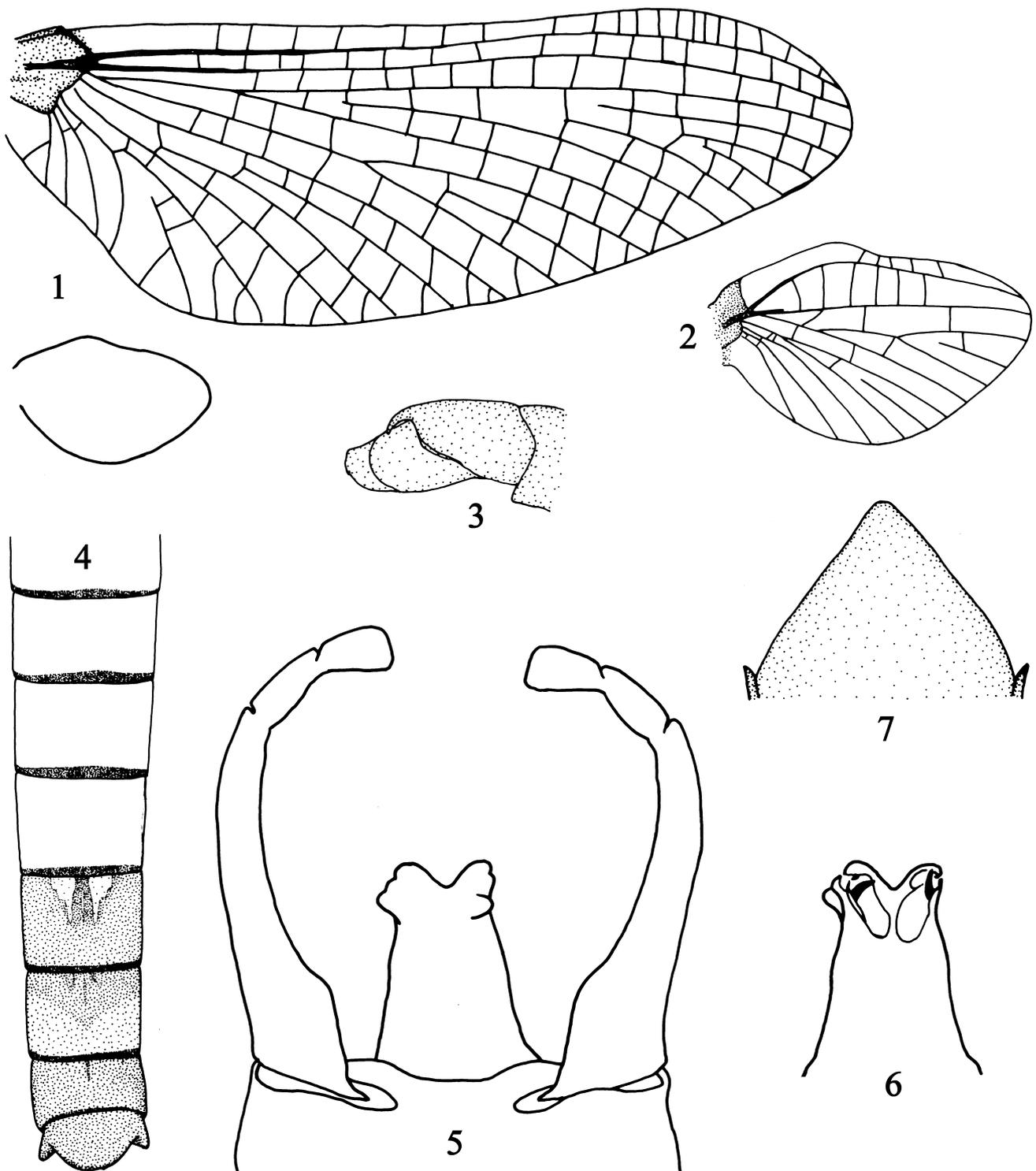
Male imago. Length: body 7.1–8.3 mm, forewings 8.0–8.7 mm. Head pale brown. Eyes in contact dorsally. Upper portion of eye brownish-red, lower portion black. Antennae

pale brown. Thorax mostly pale brown. Wings hyaline (Figs 1,2), costal and subcostal cells in apical third of forewing whitish, longitudinal veins and cross veins yellowish brown. Forewing with 16–20 costal cross veins; MA forked at about 0.5 distance from base of vein to margin of wing, fork symmetrical; MP₂ attached to MP₁ at about 0.2 length of MP₁; ICu₁ usually attached at base to CuA–CuP cross vein. Hind wing 0.23–0.24 times length of forewing; width 0.58–0.64 of length; with 6–8 costal cross veins and 5–7 subcostal cross veins; costal margin with concavity at about midlength; vein Sc 0.95–0.96 length of hind wing (Fig. 2). Foreleg with femur golden brown, remainder of leg pale yellowish-brown. Middle and hind legs pale yellowish-brown. Length ratios of segments in foreleg 0.82–0.90: 1.00 (2.5–2.8 mm): 0.04–0.05: 0.35–0.42: 0.31–0.38: 0.23–30: 0.10–0.11. Claws dissimilar, one with an apical hook, the other pad-like (Fig. 3). Abdomen as in Figure 4. Terga 1–6 translucent whitish in appearance, terga 7–10 opaque reddish-brown. Anterior of terga 7–8 with paired pale submedian maculae. Posterior margin of all terga with a transverse black band (Fig. 4). Sternite 1 brown along lateral margins, sterna 2–6 translucent, and sterna 7–10 opaque pale brown with a pink hue. Genitalia pale brown to cream. Claspers 3 segmented, segment 1 narrowing at about 0.3 of length, segment 3 slightly shorter than segment 2, segment 2 about 0.24 length of segment 1 (Fig. 5). Penes fused in basal 0.8 of length, widest at base and tapering towards apex (Figs 5,8,9). Each penis lobe with a large subapical dorsal spine, most of which is embedded within lobe with only tip of spine showing at surface (Figs 6,9), and a prominent ventral projection (Figs 10,11). Penes reaching beyond 0.60 length of segment 1 of clasper (Fig. 5). Caudal filaments pale brown with reddish-brown bands at annulations, terminal filament slightly longer than cerci.

Female imago. Length: body 7.2–8.5 mm, forewings 9.2–10.0 mm. Similar to male except as follows. Eyes black, separated on meson of head by a distance of 2.5 times the maximum width of an eye. Fore wing with 19–22 costal cross veins. Hind wing 0.22–0.24 length of forewing; width of hind wing 0.56–0.57 of length; with 7–9 costal cross veins and 7–9 subcostal cross veins. Pronotum pale brown with reddish-brown pigmentation. Abdomen reddish-brown with paired pale submedian maculae present at anterior margin of all terga. Sterna pale brown to cream with limited dark reddish-brown pigmentation. Ninth sternum entire, apically pointed (Fig. 7).

Subimago. Similar in appearance to imago except as follows. Wings pale brown. Abdominal terga 1–6 of male subimago opaque pale brown, submedian maculae visible at anterior of terga 2–6 as well as on terga 7–8; sterna opaque pale brown, sterna 1–2 with some darker brown markings.

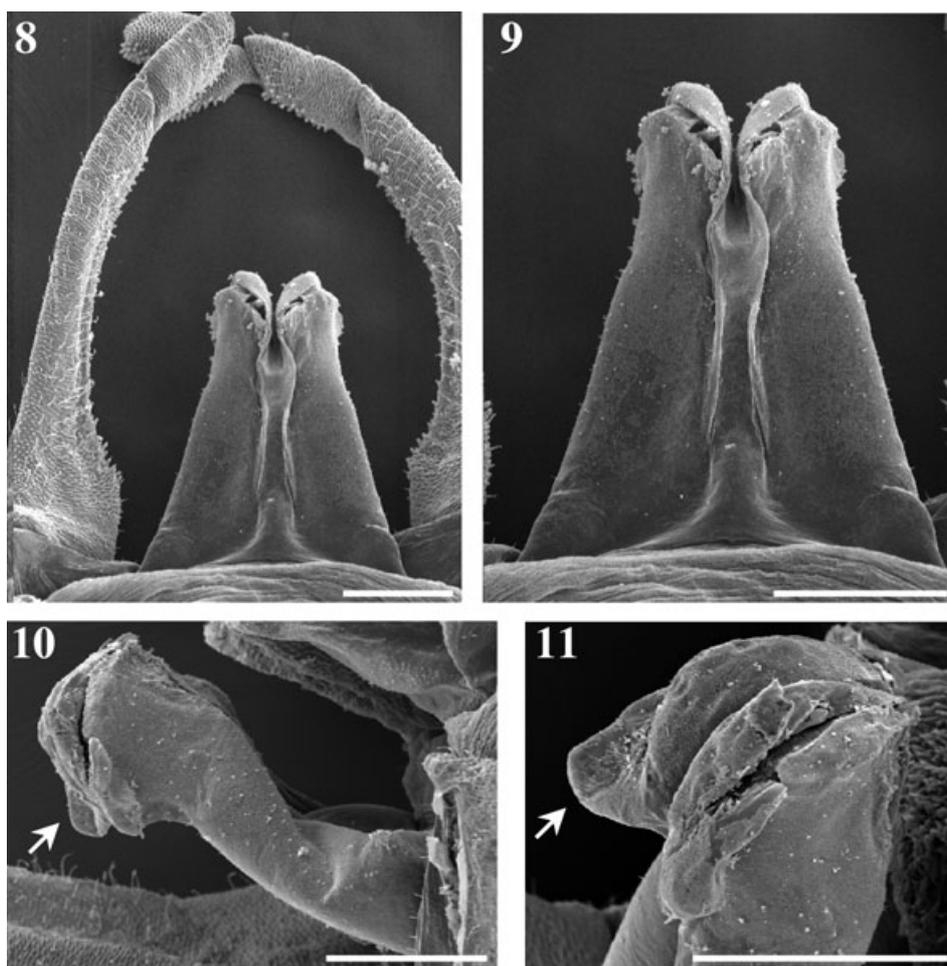
Nymph. Body length: male 7.0–8.9 mm, female 7.5–9.3 mm. Head prognathus, brown. Antennae approximately two times length of head. Mouthparts as in Figures 12–17. Width of labrum 1.19–1.28 times maximum width of clypeus. Lateral margins of clypeus diverging apically (Fig. 12). Anterior margin of labrum with narrow median notch, hooded dorsally; lateral margins rounded; labrum width 2.50–2.75 times max-



Figs 1–7. *Austrophlebioides wooroonooran*. Male imago: (1) wings; (2) hind wing; (3) tarsal claws; (4) abdominal terga 3–10; (5) penes and claspers, ventral view; (6) penes, dorsal view. Female imago: (7) ninth abdominal sternum.

imum length (Fig. 12). Outer margin of mandible smoothly rounded with small median setal tuft, fine setae absent on outer margin between tuft and outer incisor (Fig. 13). Incisors slender with serrated apical teeth. Prostheca well developed. Ligula of hypopharynx with well-developed lateral processes, anterior margin cleft (Fig. 14). Maxillae broad apically

(Fig. 15), with 26–28 subapical pectinate setae. Segments 1 and 2 of maxillary palp of similar length, segment 3 0.61–0.68 length of segment 2. Labium with glossae on about the same plane as paraglossae (Fig. 16). Lateral margins of submentum without setae (Fig. 16). Labial palp with segments 1 and 2 subequal in length, segment 3 0.41–0.45 length of segment 2.



Figs 8–11. *Austrophlebioides wooroonooran*, scanning electron micrographs of genitalia of male imago: (8) penes and claspers, dorsal view; (9) penes, dorsal view; (10) penes, lateral view; (11) apex of penes, lateral view. Arrows indicate ventral projections of penes lobes. Scale bar = 100 μ m.

Thorax brown. Pronotum with small spines on anterolateral margin. Forelegs pale brown with darker brown markings (Fig. 18). Middle and hind femora with small round pale area near base (Fig. 19). Ventral margin of middle and hind tarsi with 1 or 2 elongate spines in apical third. Tarsal claws with ventral teeth which increase in size apically. Abdomen with posterolateral spines present on segments 2–9. Lateral margins of abdominal segments fringed with fine setae. Abdomen brown with some lighter and darker areas. Gills lanceolate, present on segments 1–7; upper and lower lamella about the same size; lateral tracheae well developed (Fig. 20); gill lamellae translucent, cream coloured, tracheae black. Caudal filaments brown, up to 2.5 times length of body, each segment with whorls of spines and short setae.

Remarks. *Austrophlebioides wooroonooran* can be distinguished from all other species of *Austrophlebioides* by the following combination of characters. Male imago: (i) each penis lobe with a prominent ventral projection; (ii) penes without ventral spines; (iii) segment 1 of claspers narrowing at about 0.3 of length; (iv) penes reaching beyond 0.60 length of segment 1 of clasper; (v) abdominal terga with prominent transverse black band along posterior margin; and (vi) longitudinal veins and cross veins of forewing distinct. Nymph: (i) fine setae absent along outer margin of mandible between

median setal tuft and outer incisor; (ii) gills cream coloured; (iii) lateral margins of labrum rounded; and (iv) middle and hind femora with small round pale area near base.

Habitat. The nymphs of *A. wooroonooran* are found on stones within streams in areas of slow to moderate flow, such as pools and runs.

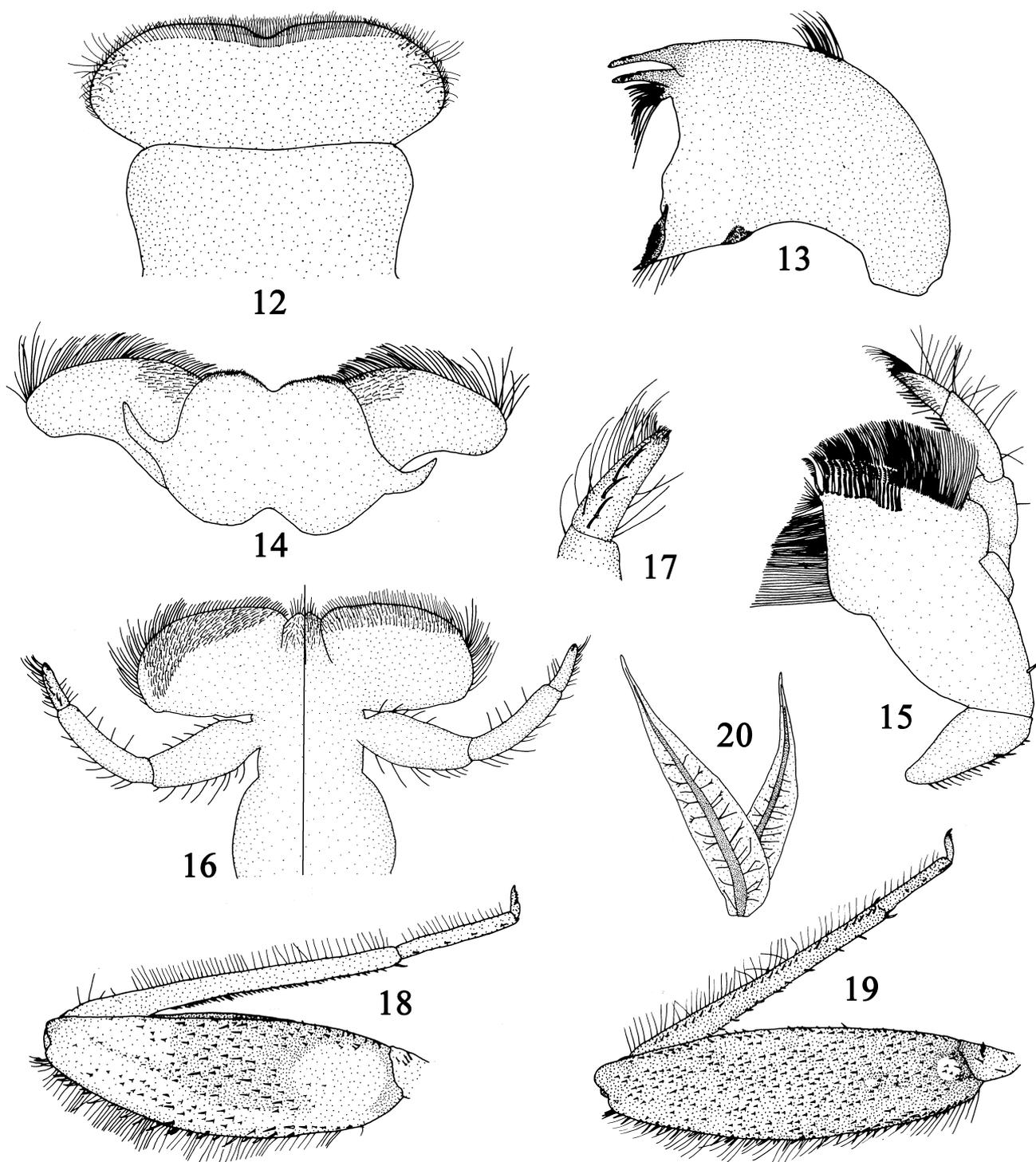
***Austrophlebioides rieki* sp. n. (Figs 21–41)**

Austrophlebioides ‘Daintree’ Christidis (2001)

Types. Queensland. Holotype: male imago reared from nymph, Oliver Ck, Daintree National Park (16°8.3’S, 145°26.4’E), collected 23.viii.1999, F. Christidis (QM). Paratypes: all from the type locality, all collected by F. Christidis: 6 reared male imagos, 5 reared female imagos, 1 reared male subimago, 1 reared female subimago, 23.viii.1999; 10 nymphs, 22.viii.1999; QM.

Other material examined (not types). Queensland. Type locality: 2 nymphs, 22.viii.1999; 1 nymph, 28.xii.1997; 3 male imagos, 23.viii.1999, F. Christidis (FC). Emmagen Ck 16°2.5’S, 145°27.3’E: 3 reared male imagos, 1 reared female imago, 19.vi.1998, F. Christidis (QM).

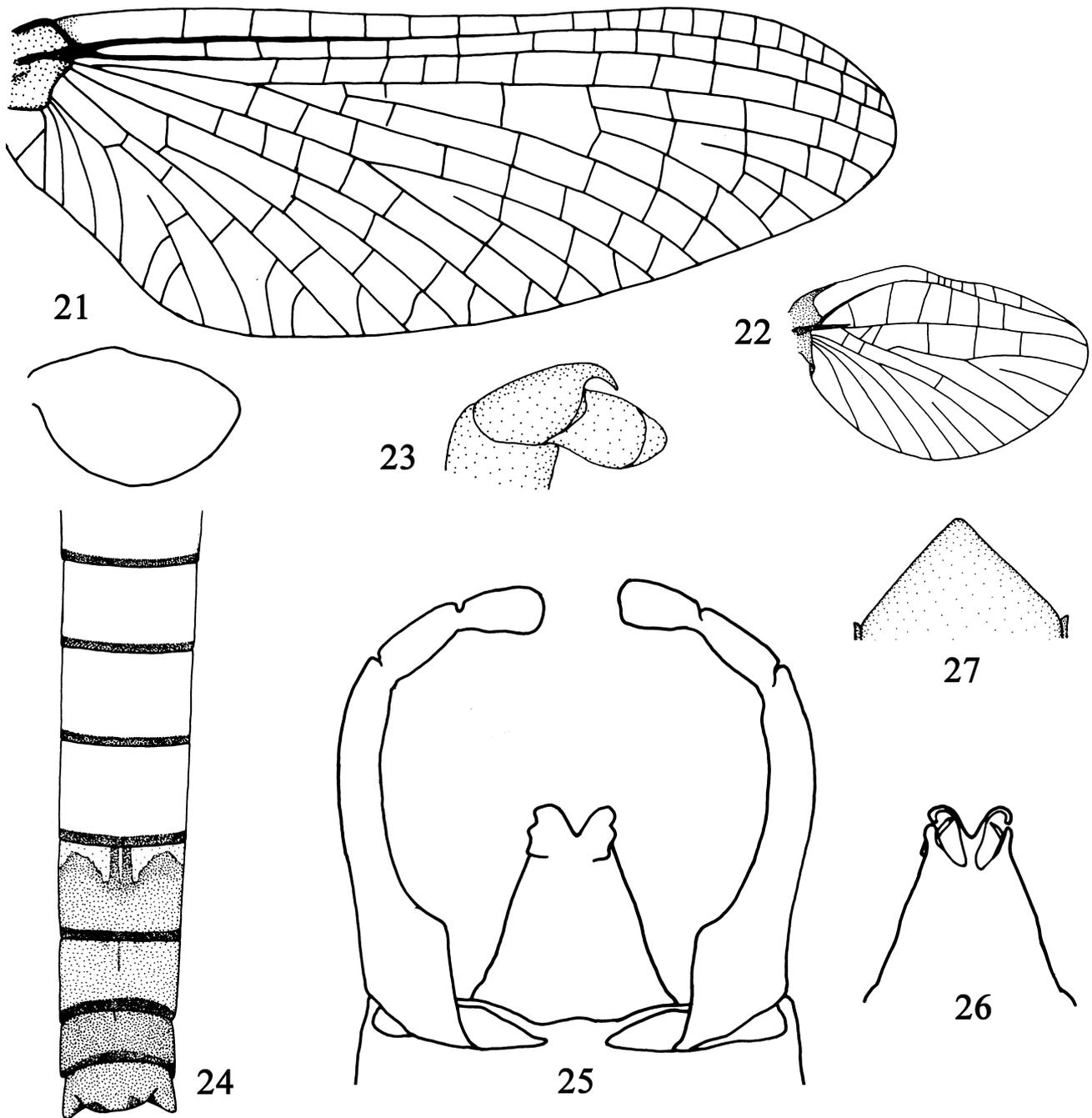
Etymology. This species is named for Edgar Riek in recognition of his contribution to mayfly research.



Figs 12–20. Austrophlebioides wooroonooran. Nymph: (12) labrum and clypeus; (13) right mandible; (14) hypopharynx; (15) maxilla, ventral view; (16) labium, dorsal view left of line and ventral view right of line; (17) segment 3 of labial palp, dorsal view; (18) foreleg; (19) hind leg; (20) abdominal gill.

Male imago. Length: body 5.9–7.2 mm, forewings 6.0–7.3 mm. Head pale brown to pale reddish-brown. Eyes with upper portion brownish-red, lower portion black. Antennae pale reddish-brown. Thorax brown. Wings hyaline (Figs 21,22), longitudinal veins and cross veins pale yellow-

ish-brown. Forewing with 14–18 costal cross veins. Hind wing 0.22–0.24 times length of forewing; width 0.63–0.65 of length; with 6–8 costal cross veins and 5–6 subcostal cross veins; vein Sc 0.94–0.96 length of hind wing (Fig. 22). Legs pale yellowish-brown, except femur of foreleg golden brown.



Figs 21–27. *Austrophlebioides rieki*. Male imago: (21) wings; (22) hind wing; (23) tarsal claws; (24) abdominal terga 3–10; (25) penes and claspers, ventral view; (26) penes, dorsal view. Female imago: (27) ninth abdominal sternum.

Length ratios of segments in foreleg 0.83–0.92: 1.00 (1.7–2.3 mm): 0.04: 0.38–0.46: 0.38–0.42: 0.27–0.31: 0.11–0.12. Claws dissimilar (Fig. 23). Abdomen (Fig. 24) with terga 1–6 translucent whitish in appearance and terga 7–10 reddish-brown. Terga 7–8 with paired pale submedian maculae along anterior margin. Posterior margin of all terga with dark brown to black band (Fig. 24). Sternite 1 brown, sterna 2–6 translucent, and sterna 7–10 opaque pale brown. Genitalia pale brown. Claspers with segment 1 narrowing at about 0.3 of length; segment 3 slightly shorter than segment 2, segment 2

about 0.25 length of segment 1 (Fig. 25). Penes fused along basal 0.85 of length (Figs 25,28,29). Each penis lobe with a large subapical dorsal spine embedded within lobe (Fig. 26) and a prominent ventral projection (Figs 30,31). Penes reaching beyond 0.60 length of segment 1 of clasper (Fig. 25). Caudal filaments whitish with reddish-brown bands at annulations.

Female imago. Length: body 5.9–7.0 mm, forewings 6.6–8.0 mm. Similar to male except as follows. Eyes black, separated on meson of head by a distance of approximately two



Figs 28–31. *Austrophlebioides rieki*, scanning electron micrographs of genitalia of male imago: (28) penes and claspers, dorsal view; (29) penes, dorsal view; (30) penes, lateral view; (31) penes, ventral-lateral view. Arrow indicates ventral projection of penes lobe. Scale bar = 100 μ m.

times the maximum width of an eye. Thorax pale brown. Forewing with 17–19 costal cross veins. Hind wing length 0.19–0.22 length of forewing; width 0.57–0.58 of length; with 5–7 costal cross veins and 6–7 subcostal cross veins. Abdomen reddish-brown; paired pale submedian maculae present at anterior margin of all terga, most clearly visible on terga 2–8. Sterna pale brown, sterna 1–2 with reddish brown markings. Ninth sternum entire apically (Fig. 27).

Subimago. Similar in appearance to imago except wings pale brown and abdominal terga 1–6 of male subimago opaque pale brown.

Nymph. Body length: male 6.6–7.4 mm, female 6.1–7.7 mm. Head brown. Mouthparts as in Figures 32–37. Width of labrum 1.28–1.38 times maximum width of clypeus. Lateral margins of labrum angular; labrum width 2.86–3.03 times maximum length (Fig. 32). Mandible without fine setae on outer margin between setal tuft and outer incisor (Fig. 33). Maxillary palp with segments 1 and 2 of similar length, segment 3 0.60–0.71 times length of segment 2. Labial palp with segments 1 and 2 subequal in length, segment 3 0.40–0.43 times length of segment 2. Thorax brown. Legs pale brown with darker markings (Figs 38,39). Middle and hind femora with a pale area in basal half in the form of an elongated streak (Fig. 39). Ventral margin of middle and hind tarsi with 1 or 2 elongate spines in apical third (Fig. 40). Abdominal terga brown with some lighter and darker areas. Abdominal sterna pale brown. Gills lanceolate; lamellae translucent, cream

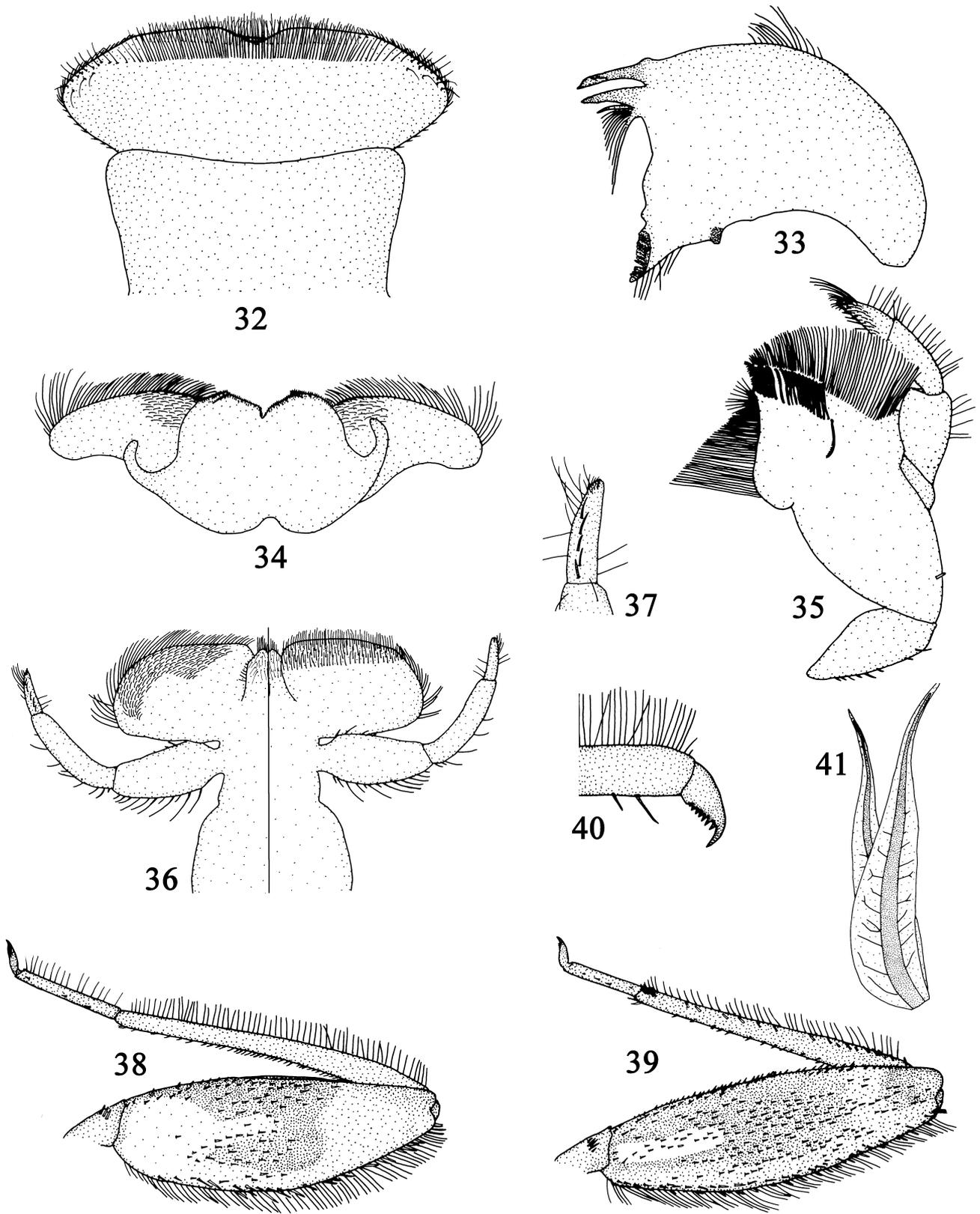
coloured with tracheae black; lateral tracheae moderately developed (Fig. 41).

Remarks. *Austrophlebioides rieki* can be distinguished from all other species of *Austrophlebioides* by the following combination of characters. Male imago: (i) each penis lobe with a prominent ventral projection; (ii) penes without ventral spines; (iii) segment 1 of claspers narrowing at about 0.3 of length; (iv) penes reaching beyond 0.60 length of segment 1 of clasper; (v) abdominal terga with prominent transverse black band along posterior margin; and (vi) longitudinal veins and cross veins of forewing very pale. Nymph: (i) fine setae absent along outer margin of mandible between median setal tuft and outer incisor; (ii) gills cream coloured; (iii) lateral margins of labrum angular; and (iv) middle and hind femora with pale area in basal half in the form of an elongated streak.

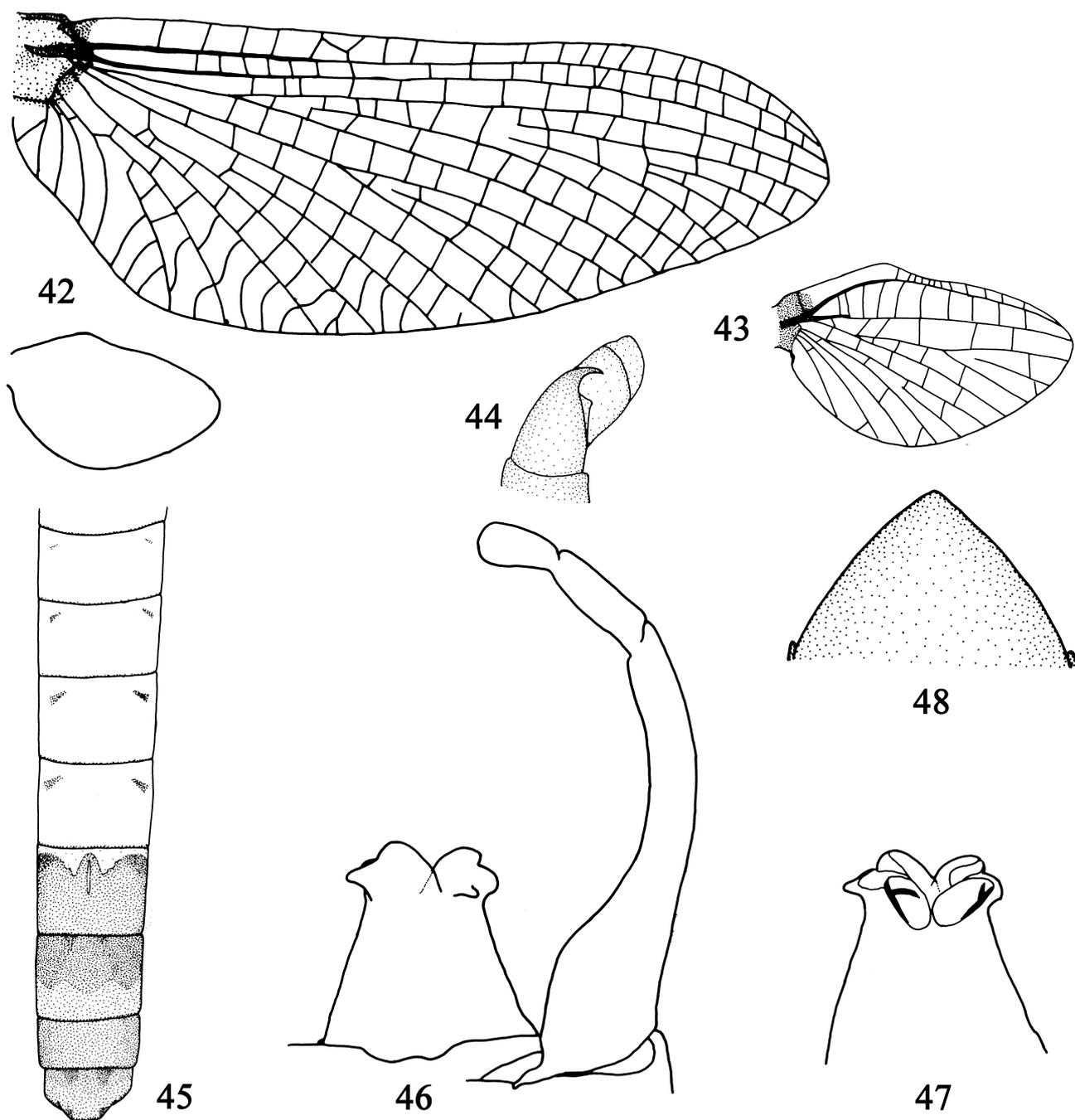
Habitat. Nymphs of *A. rieki* are found commonly on stones in fast flowing sections of streams.

***Austrophlebioides porphyrobranchus* sp. n. (Figs 42–57)**

Types. Queensland. Holotype: male imago reared from nymph, Charmillan Ck (17°42.1'S, 145°31.3'E), collected 26.viii.2000, F. Christidis (QM). Paratypes: 3 reared male imagos, 1 reared female imago, 1 reared female subimago, 1 reared male subimago, 9 nymphs, same locality and collection date as holotype, F. Christidis (QM).



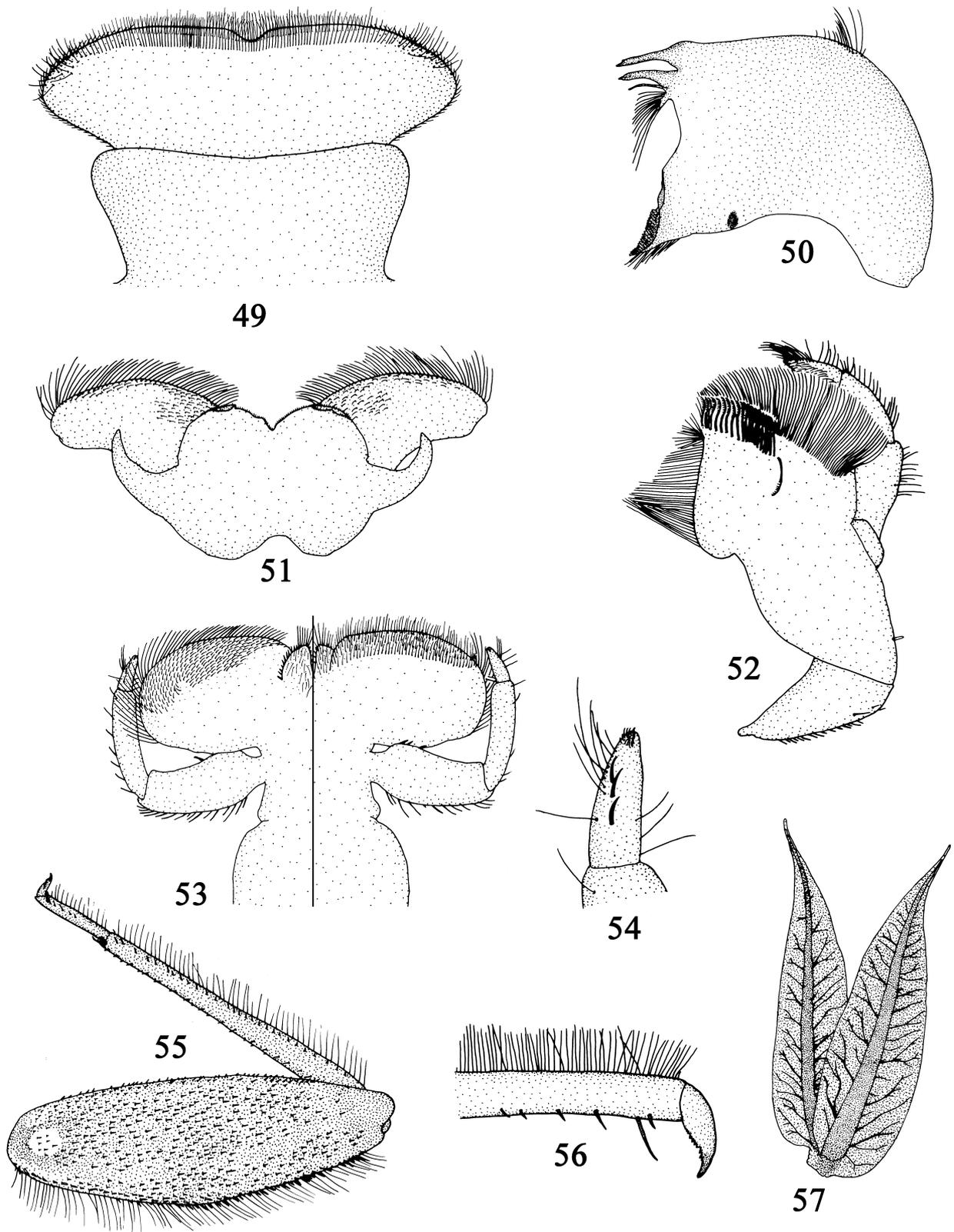
Figs 32–41. Austrophlebioides rieki. Nymph: (32) labrum and clypeus; (33) right mandible; (34) hypopharynx; (35) maxilla, ventral view; (36) labium, dorsal view left of line and ventral view right of line; (37) segment 3 of labial palp, dorsal view; (38) foreleg; (39) hind leg; (40) tarsus and tarsal claw of hind leg; (41) abdominal gill.



Figs 42–48. *Austrophlebioides porphyrobranchus*. Male imago: (42) wings; (43) hind wing; (44) tarsal claws; (45) abdominal terga 2–10; (46) penes and claspers, ventral view; (47) penes, dorsal view. Female imago: (48) ninth abdominal sternum.

Other material examined (not types). Queensland. Type locality: 1 male imago, 1.vi.1999; 2 nymphs, 2.vi.1999; 3 nymphs, 26.viii.2000, F. Christidis (FC). Goolagan Ck 17°36.4'S, 145°45.6'E: 5 nymphs, 25.viii.2000, F. Christidis (QM). Silver Ck below falls (17°35.5'S, 145°44.9'E): 1 reared female imago and 2 nymphs, 25.viii.2000, F. Christidis (QM). **Etymology.** Named after the purple gills of the nymph. From the Greek *porphyra* for purple and *branchos* for gill. **Male imago.** Length: body 9.0–10.5 mm, forewings 9.9–11.3 mm. Head brown. Upper portion of eye brownish-red,

lower portion black. Antennae brown. Thorax dark brown. Wings hyaline (Figs 42,43), longitudinal veins and cross veins yellowish-brown. Forewing with 17–20 costal cross veins. Hind wing 0.26 times length of forewing; width 0.61 of length; with 11–13 costal cross veins and 8–10 subcostal cross veins; vein Sc 0.95–0.97 length of hind wing (Fig. 43). Foreleg with femur brown, remainder of leg yellowish-brown. Middle and hind legs pale yellowish-brown. Length ratios of segments of male foreleg 0.75–0.83: 1.00 (2.3–2.6 mm): 0.03–0.04: 0.40–0.48: 0.36–0.45: 0.25–0.31: 0.08–0.10. Claws dissimilar



Figs 49–57. Austrophlebioides porphyrobranchus. Nymph: (49) labrum and clypeus; (50) right mandible; (51) hypopharynx; (52) maxilla, ventral view; (53) labium, dorsal view left of line and ventral view right of line; (54) segment 3 of labial palp, dorsal view; (55) hind leg; (56) tarsus and tarsal claw of foreleg; (57) abdominal gill.

(Fig. 44). Abdomen as in Figure 45. Terga 1–6 translucent, cream to whitish in appearance; terga 3–6 with small elongated dark marks near lateral margins. Terga 7–10 reddish, terga 7–8 with paired pale submedian maculae along anterior margin. Faint and very narrow black band visible along posterior margin of most terga, but particularly terga 5–9 (Fig. 45). Sternite 1 brown, sterna 2–6 cream to whitish and sterna 7–10 pale brown with a pinkish hue. Genitalia pale brown. Claspers with segment 1 narrowing at about 0.3 of length; segment 3 0.75 length of segment 2, segment 2 about 0.25 length of segment 1 (Fig. 46). Penes relatively short, not reaching to 0.50 length of segment 1 of claspers (Fig. 46). Penes fused in basal 0.76 of length (Fig. 46). Each penis lobe with a large subapical dorsal spine embedded within lobe (Fig. 47) and a prominent ventral projection (Fig. 46). Caudal filaments pale brown with reddish brown bands at annulations. **Female imago.** Length: body 9.0–12.0 mm, forewings 10.9–15.3 mm. Similar to male except as follows. Eyes black, separated on meson of head by a distance of approximately 2.5 times the maximum width of an eye. Thorax pale brown, not as dark as in male imago. Forewing with 21–22 costal cross veins. Hind wing length 0.23 length of forewing; width 0.57–0.58 of length. Abdomen dark red, pale submedian maculae present at anterior margin of all abdominal terga, most clearly visible on terga 2–8. Sternum 1 predominantly dark red, sterna 2–7 pink with dark makings, sterna 8–9 pale pink to cream. Ninth sternum entire apically (Fig. 48).

Subimago. Similar in appearance to imago except wings brown. Thorax of male subimago lighter than male imago and abdominal terga 1–6 opaque, pale brown. Thorax of female subimago darker than female imago.

Nymph. Body length: male 9.0–11.1 mm, female 9.5–13.1 mm. Head, brown. Mouthparts as in Figures 49–54. Width of labrum 1.30–1.41 times maximum width of clypeus. Lateral margins of labrum angular; labrum width 2.94–3.10 times maximum length (Fig. 49). Outer margin of mandible without fine setae between setal tuft and outer incisor (Fig. 50). Maxillary palp with segments 1 and 2 of similar length, segment 3 0.66–0.71 times length of segment 2. Labial palp with segment 1 and 2 subequal in length, segment 3 0.37–0.42 times length of segment 2. Thorax dark brown. Legs brown with darker markings. Hind leg as in Figure 55. Middle and hind femora with small round pale area near base

(Fig. 55). Tarsi of all legs with 1 or 2 elongate ventral spines in apical third (Fig. 56). Abdomen medium to dark brown, venter pale brown. Gills lanceolate, lateral tracheae well developed (Fig. 57); gill lamellae purple, tracheae black.

Remarks. *Austrophlebioides porphyrobranchus* can be distinguished from all other species of *Austrophlebioides* by the following combination of characters. Male imago: (i) each penis lobe with a prominent ventral projection; (ii) penes without ventral spines; (iii) segment 1 of claspers narrowing at about 0.3 of length; (iv) penes relatively short, not reaching beyond 0.50 length of segment 1 of clasper; (v) abdominal terga with only faint transverse black band along posterior margin; and (vi) longitudinal veins and cross veins of forewing distinct. Nymph: (i) fine setae absent along outer margin of mandible between median setal tuft and outer incisor; (ii) purple pigmentation of the gills; (iii) lateral margins of labrum angled; and (iv) middle and hind femora with small round pale area near base.

Habitat. The nymphs of *A. porphyrobranchus* are found on stones in fast flowing areas of streams.

DISCUSSION

The three species of *Austrophlebioides* from the Wet Tropics, *A. rieki*, *A. wooroonooran* and *A. porphyrobranchus*, are closely related and form a distinct species group (Christidis 2001, 2003). They share the following characteristic features. In the male imago, a prominent ventral projection is present on each lobe of the penes, and segment 1 of the claspers narrows at about 0.3 of length. In the nymph, fine setae are absent from the outer margin of the mandible between the outer incisor and the median setal tuft. These fine setae are present in other *Austrophlebioides* species and may have been secondarily lost in the Wet Tropics species. Likewise, in *A. rieki* and *A. wooroonooran* the elongate ventral spines in the apical third of the tarsi, which are typical of the genus, appear to have been reduced or lost from the fore tarsus and are present on the tarsi of the middle and hind legs only. The inclusion of the three Wet Tropics species in *Austrophlebioides* requires some modifications to the generic diagnosis. Diagnosis of the nymph follows that given by Campbell and Suter (1988), except: mandible with or without fine setae along outer

Table 1 Diagnostic features of *Austrophlebioides rieki*, *A. wooroonooran* and *A. porphyrobranchus*

Character	<i>A. rieki</i>	<i>A. wooroonooran</i>	<i>A. porphyrobranchus</i>
Male imago			
Forewing veins	Pale	Distinct	Distinct
Forewing length (mm)	6.0–7.3	8.0–8.7	9.9–11.3
Body length (mm)	5.9–7.2	7.1–8.3	9.0–10.5
Black band along posterior margin of abdominal terga	Prominent	Prominent	Faint
Penes extending along basal segment of clasper	Beyond 0.6 × length	Beyond 0.6 × length	Less than 0.5 × length
Nymph			
Labrum, lateral margins	Angled	Rounded	Angled
Gill colour	Cream	Cream	Purple
Pale area on middle and hind femora	Elongate streak	Round, restricted to base	Round, restricted to base

margin between setal tuft and outer incisor; and one to two elongate ventral spines in apical third of all tarsi or middle and hind tarsi only.

As *A. rieki*, *A. woornooran* and *A. porphyrobranchus* closely resemble each other, and imagos in particular are difficult to distinguish, differences between the three taxa are summarised in Table 1. In addition, there are subtle differences in the apices of the penes lobes (e.g. Figs 9,29).

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