

## ***Wundacaenis*, a New Genus of Caenidae (Insecta : Ephemeroptera) from Australia**

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### *Abstract*

A new genus, *Wundacaenis*, is erected for three new species of Australian caenid mayflies. The genus is diagnosed by possession of distinctive lobes on the anterolateral margins of the mesonotum. The distribution of *Wundacaenis* extends from the Kimberleys in Western Australia, through the Alligator Rivers Region in the Northern Territory, and down the eastern coast to the Shoalhaven River in New South Wales.

### **Introduction**

Collections from the Alligator Rivers Region in the Northern Territory of Australia have included occasional nymphs of a caenid mayfly that was distinctly different from all the species described in the only Australian caenid genus, *Tasmanocoenis*. These specimens were rare, and not associated with adults. In 1988 and 1989, the Office of the Supervising Scientist for the Alligator Rivers Region funded a study of the Ephemeroptera in the local streams and billabongs. This provided the opportunity to collect and rear adults of this infrequently collected mayfly.

Successful collection and rearing of this species has enabled full description of this new genus. Two other species, one from the Shoalhaven River system (Upper Kangaroo River) in New South Wales and one from the Barambah Creek near Murgon in Queensland, are also described from nymphal material only, and are placed in the new genus.

### **Methods**

Nymphs and adults collected in the Alligator Rivers Region were associated in the laboratory. Mature nymphs were placed in 2-L plastic containers containing water from the collecting site. Each container was covered with fine mesh, and was examined twice per day and the nymphal exuvia and adults were preserved together. Adult material was supplemented by means of UV light traps over a tray of ethanol. The bulk sample was sorted in the laboratory under a dissecting microscope and specimens were preserved in 75% ethanol. Nymphs and adults were dissected and mounted on slides in polyvinyl lacto-phenol mounting medium. Illustrations were made with a camera lucida.

Terminology and most characters used in the descriptions are after Malzacher (1984, 1986).

Unless otherwise stated, all types are placed in the Australian National Insect Collection (ANIC), CSIRO, Canberra.

Genus *Wundacaenis*, gen. nov.

Type species: *Wundacaenis dostini*, sp. nov.

*Description**Imago*

As only one species has been associated for this genus, the differentiation of generic v. specific characteristics cannot be made. Until more than one species is known in the adult stage, a generic diagnosis for this life stage would be premature, especially when the nymphal characteristics clearly differentiate this genus from all other caenid genera. A full description of the adult is given for the type species, *Wundacaenis dostini*, sp. nov.

*Mature nymph*

Head smooth, lacking protuberances. Pedicel of antennae  $2-3 \times$  length of scape (Fig. 6), with few short setae. Length of apical segment of antennal filament approximately equal to preceding segment length. Tentorial body rectangular, length  $0.75 \times$  width. Pronotum wider than head, longer at marginal apexes than at midline; lateral flanges well developed (Figs 7, 32, 57), lateral margins finely serrated or lined with microtrichia; anterolateral margin with 1-2 short spine setae. Mesonotum with distinct rounded or angular projections, or lobes, on anterolateral corners (Figs 7, 32, 57); complex microtrichia with anastomosing veinlets present on dorsal surface (Figs 13, 33, 64). Leg margins lined with setae, femora of mid and hind legs with complex microtrichia on surface; tarsal claws of fore, middle and hind legs with 3-6 small blunt proximal teeth (Figs 12, 38, 65), hind claws may have additional fine comb of short hair-like teeth (Fig. 66).

Abdominal segments 7 and 8 with setae on posterior margin of tergite; setae absent on abdominal tergite 1. Abdominal segment 2 with a large hooked dorsal median projection. Sternite of abdominal segment 9 triangular, posterior margin truncated and concave (Figs 21, 49, 74). Abdominal segments 4-9 with posterolateral projections (Figs 15, 40, 67). Terminal filament longer than cerci. Six pairs of gills on abdominal segments 1-6. First gill filamentous, 2-segmented with long setae (Fig. 14). Second gill operculate with a triangular dorsal ridge, mesal ridge well developed with few short setae, extending almost to posterior margin of gill cover (Figs 16, 41, 68); surface of gill cover with complex microtrichia (Figs 19, 44, 70). Margin of gill cover lined with long pinnate setae (Figs 20, 43, 72). Submarginal row of simple microtrichia present on ventral surface of gill cover (Figs 18, 45, 71). Gills 3-6 triangular or rounded with tracheal filaments single, bifid or multifid and with longitudinal band of short bifid bristles on dorsal surface.

Labrum rectangular,  $2-3 \times$  broader than long, anterior margin with a shallow median concavity, lateral and anterior margins with spine setae (Figs 24, 50, 78). Mandibles stout, with marginal setae (Figs 26, 28, 52, 54, 80, 82), outer incisors with 3-4 teeth, inner with 2-3 teeth (Figs 27, 29, 53, 55, 81, 83). Glossae of hypopharynx not produced, anterior margin concave, paragnaths lined with setae (Figs 31, 84). Maxillae slender, with 2-3 spines at apices; palpi 3-segmented (Figs 25, 51, 79). Labium with 3-segmented palpi (Figs 30, 56, 85).

*Discussion*

*Wundacaenis* can be distinguished from all other genera in the Caenidae, including *Tasmanocoenis*, by the following combination of nymphal characters: mesonotum with distinct rounded or angular lobes on anterolateral margins; setae absent on abdominal tergite I; sternite of abdominal segment IX triangular with posterior margin truncated and concave; gill cover with mesal ridge extending almost to posterior margin; body, legs and gill cover with complex anastomosed microtrichia.

With the description of *Wundacaenis*, there are now two genera of Caenidae in Australia. *Tasmanocoenis* was reviewed by Alba-Tercedor and Suter (1990). The presence of the lateral processes on the thorax is unique in the Caenidae but resembles those processes found in the nymphs of *Neophemera* McDunnough (Neophemeridae), a genus found in the

Holarctic and Oriental regions. However, the adult characteristics, as determined from *W. dostini*, clearly place *Wundacaenis* in the Caenidae.

The distribution of *Wundacaenis* extends from the Kimberleys in Western Australia, through the Alligator Rivers Region in the Northern Territory, and down the eastern coast to the Shoalhaven River system in New South Wales.

### Etymology

*Wunda-* from the Nunggubuyi aboriginal language for a projection or jutting out, referring to the lobes on the mesothorax of the nymphs of this caenid.

### Key to the Nymphs of *Wundacaenis*

1. Mesonotum with an angular projection on the anterior margin (Fig. 32); coxae of mid and hind legs with angular projection (Figs 35-36) ..... *W. angulata*, sp. nov.  
Mesonotum with rounded lobes on the anterior margins (Figs 7, 57); coxae of mid legs lacking angular projection ..... 2
2. Mesonotal lobes small (Fig. 7); fore femora with longitudinal row of setae (Fig. 11); coxae of all legs lacking projections; hind tarsal claw with only 1 type of proximal teeth; body, gill covers and mid and hind femora with round, complex microtrichia (Figs 13, 19); mesal fork of triangular ridge of gill cover lined with short spines (Fig. 17) ..... *W. dostini*, sp. nov.  
Mesonotal lobes large (Fig. 57); fore femora with transverse row of setae (Fig. 63); coxae of hind legs with a projection (Fig. 60); hind tarsal claw with 2 types of teeth (Fig. 66); body, gill covers and mid and hind femora with fan-like, complex microtrichia (Fig. 62, 70); mesal fork of triangular ridge of gill cover lined with stalked microtrichia (Fig. 69) .....  
..... *W. flabellum*, sp. nov.

### *Wundacaenis dostini*, sp. nov.

(Figs 1-31)

#### Material Examined

*Holotype.* Adult ♂ from Magela Ck just upstream of the Ranger Outlet Pipe, collected 19.v.1988 (reared 20.v.1988), mounted on 3 slides, and cast skin of nymph mounted on 2 slides.

*Paratypes.* Reared ♂ and cast skin mounted on slides, from the type locality; 7♂ adults, Kambolgie Ck, 13°32'S.,132°23'E., 25.v.1988, coll. P. J. Suter, and A. Wells; 9 nymphs, South Alligator R. upstream of Fisher Ck, 13°34'S.,132°34'E., 18.iv.1989, coll. P. J. Suter and A. Wells; 4 nymphs, South Alligator R. at Gimbat, 13°35'S.,132°36'E., 20.iv.1989, coll. P. J. Suter and A. Wells.

*Other material examined.* **Northern Territory:** 1 nymph, Magela Ck at Bowerbird Billabong, 12°47'S.,133°02'E., 30.vi.1988, P. Dostine; 3 nymphs, Magela Ck at Bowerbird Billabong, 12°47'S., 133°02'E., 15.iv.1989, P. Dostine; 1 nymph, Magela Ck 1.5 km downstream of Bowerbird Billabong, 12°46'S.,133°02'E., 28.v.1988, P. J. Suter and A. Wells; 1 nymph, Djalkmara Billabong, 12°40'S., 132°55'E., 16.iv.1989, P. J. Suter and A. Wells; 5 nymphs, 2♀ subimagos, Magela Ck at Ranger Outlet Pipe, 12°41'S.,132°56'E., 19.v.1988, P. J. Suter and A. Wells; 2 nymphs, Magela Ck at Stoned Billabong, 12°38'S.,132°53'E., 11.iv.1989, P. J. Suter and A. Wells; 1 nymph and reared ♀ imago, Magela Ck nr Corndorl Billabong, 12°37'S.,132°53'E., 17.v.1988, P. J. Suter and A. Wells; 3 nymphs, Magela Ck at inlet to Mudginberri Billabong, 12°36'S.,132°53'E., 18.v.1988, 12.iv.1989, 4 nymphs and 1 subimago, 22.iv.1989, 2 nymphs, P. J. Suter and A. Wells; 1 nymph and 2♂ imagos, Mudginberri Billabong, 12°36'S.,132°53'E., 18.v.1988, P. J. Suter and A. Wells; 9.iii.1979, 2 nymphs, R. Marchant; 1 nymph, 2♀ subimagos, 1♂ imago, Wildman R. on Arnhem Hwy, 12°50'S.,132°02'E., 2.vi.1988, P. Dostine; 3 nymphs, South Alligator R., Site 1, 13°36'S.,132°37'E., 14.vi.1988, P. Dostine; 1 nymph South Alligator R., Coronation Hill, Site 2, 13°35'S.,132°36'E., 30.xi.1987, M. McKaige; 2 nymphs, South Alligator R. at Gimbat, 13°35'S.,132°36'E., 20.iv.1989, 24.v.1988, 2 nymphs, P. J. Suter and A. Wells; 1 nymph, South Alligator R. downstream of Fisher Ck, 13°34'S.,132°34'E., 24.v.1988, P. J. Suter and A. Wells; 3 subimagos, South Alligator R. upstream of BHP camp, 13°32'S.,132°32'E., 25-26.v.1988, 19.iv.1989, 1 nymph, P. J. Suter and A. Wells; 34♂ imagos, 10 nymphs, Kambolgie Ck, 13°32'S.,132°23'E., 25.v.1988, P. J. Suter and A. Wells; 2 nymphs, Barramundie Ck below falls, 13°22'S.,132°28'E., 26.v.1988, P. J. Suter and A. Wells; 2♂ imagos, Graveside Ck, 13°18'S.,132°32'E., 18.v.1988, P. Dostine, 29.v.1988, 1 nymph, P. J. Suter and A. Wells; 3 nymphs, Hickey Ck, 12°55'S.,132°50'E., 29.v.1988, P. J. Suter and A. Wells. **Western Australia:** >50 imagos, 6.5 km NW. of Mt Bell, Kimberley, 17°10'S.,125°17'E., 25-26.v.1988, T. Houston (W.A. Museum Reference 88/1453). **Queensland:** 1 nymph, Barambah Ck, Site 1, nr

Murgon, 26°18'S., 152°02'E., 18.xi.1989, D. Conrick; 1 nymph, 1♂ subimago, Wenlock Ck at Telegraph Crossing, 12°28'S., 142°38'E., 15.ii.1992, G. Byron and D. Blake; 1 nymph, Bertie Ck at Telegraph Crossing, 11°50'S., 142°30'E., D. Cartwright and A. Wells.

All material from the Northern Territory except the holotype and paratypes are deposited in the Museum and Arts Galleries of the Northern Territory, Darwin; that from Western Australia in the Western Australian Museum; and that from Queensland in the Queensland Museum.

### Description

#### Imago

Body length: males, 2.5–3.2 mm; females, 3.5–3.9 mm. Wing length: males, 1.5–2.2 mm; females, 2.8–3.2 mm. Terminal filament length of males: 7.0–10.5 mm.

Head with separate lateral eyes. Antennal pedicel 2–3× longer than scape, flagellum 0.53 mm long. Thorax robust; pronotum narrower than head. Prosternum triangular longer than broad, apex blunt (Fig. 2). Head and thorax brown, abdomen cream with black markings on abdominal sternites 1–9 (Fig. 3); abdominal segments 5–7 with small posterolateral projection (Fig. 4). Legs slender and delicate; fore legs longer than mid and hind legs; males with 5 tarsal segments on all legs, females with 4 tarsal segments; in males tarsal claws of fore legs similar, both blunt and club shaped, dissimilar in mid and hind legs, one blunt club-shaped, one slender, curved and sharp; females with each pair dissimilar, as above. Tarsal segment formula of fore leg 2, 3, 4, 5, 1. Wings (Fig. 1) hyaline with opaque pterostigmal region;  $iR_2$  joins  $R_2$  in apical half of wing;  $ICuA_1$  forked with  $CuA_2$  distad of  $CuA_1$ - $CuP$  crossvein; posterior margin lined with short bristles. Genitalia: forceps strongly bowed, lacking apical tufts; penes broad with slight apical indentation, with a ventral inverted U-shaped structure, few papillae present; styliiger plate convex; styliiger sclerite with 2 long apophyses; lateral sclerite long, not strongly sclerotised (Fig. 5). Three long terminal filaments present.

#### Nymph

Body length, 2.3–4.2 mm; cerci, 1.3–3.0 mm; terminal filament, 1.6–3.2 mm.

General body colour brown. Head dark brown with light central spot in the fronto-clypeal region, between the antennae. Antennae with scape, pedicel, and 3–4 segments of the flagellum brown, apices of other segments brown, pedicel 2–3× length of scape, with 4–6 short setae, length of first segment of flagellum approximately equal to pedicel length (Fig. 6); antennae 1.0–1.4 mm long.

**Thorax.** Pronotum brown with darker spots, lateral margins lighter, anterolateral margin with 1 spine seta, lateral margins serrated. Mesonotum width equal to width of pronotum, with small rounded lateral lobes projecting laterally beyond margins of pronotum (Fig. 7); no mottled pattern in older specimens, but slightly lighter around mesothoracic hump in younger specimens; round complex anastomosed microtrichia present (Fig. 13). Legs banded (Figs 8–10), femora of all legs with a large oval region on the inner margin; legs with black spot in distal  $\frac{1}{2}$  of femur, tibia and tarsus with a central dark brown band; fore femur with 6 bifid, pinnate setae in a longitudinal row (Fig. 11); claws long, slender, slightly curved, with 4–6 small proximal teeth (Fig. 12); femora of middle and hind legs with round anastomosed microtrichia and tarsal claws with 3–8 proximal teeth.

#### Ratios of leg segments:

fore leg, 1.00:0.60:0.60 (0.44 mm);

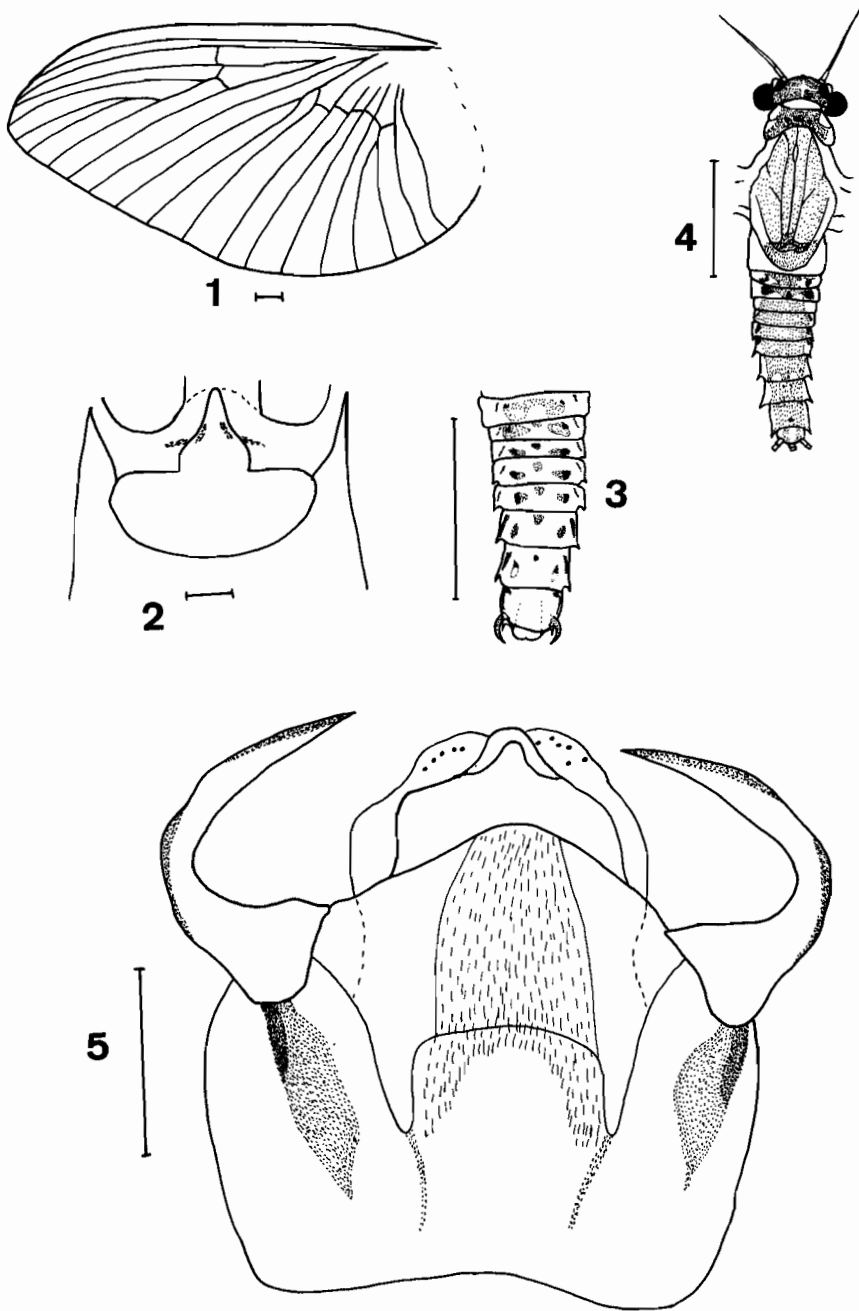
middle leg, 1.00:0.59:0.63 (0.46 mm);

hind leg, 1.00:0.60:0.52 (0.47 mm).

Femur length to width ratios: fore leg, 2.46 (2.10–2.70); middle leg, 2.27 (2.0–2.5); hind leg, 2.38 (2.10–2.50).

**Abdomen.** Tergites brown with light median markings, tergites 7 and 8 also with light lateral markings; tergite 9 with 4 light markings, and tergite 10 brown in mature nymphs, light in immatures; sternites light with black spots, similar to those of adult; hind margin

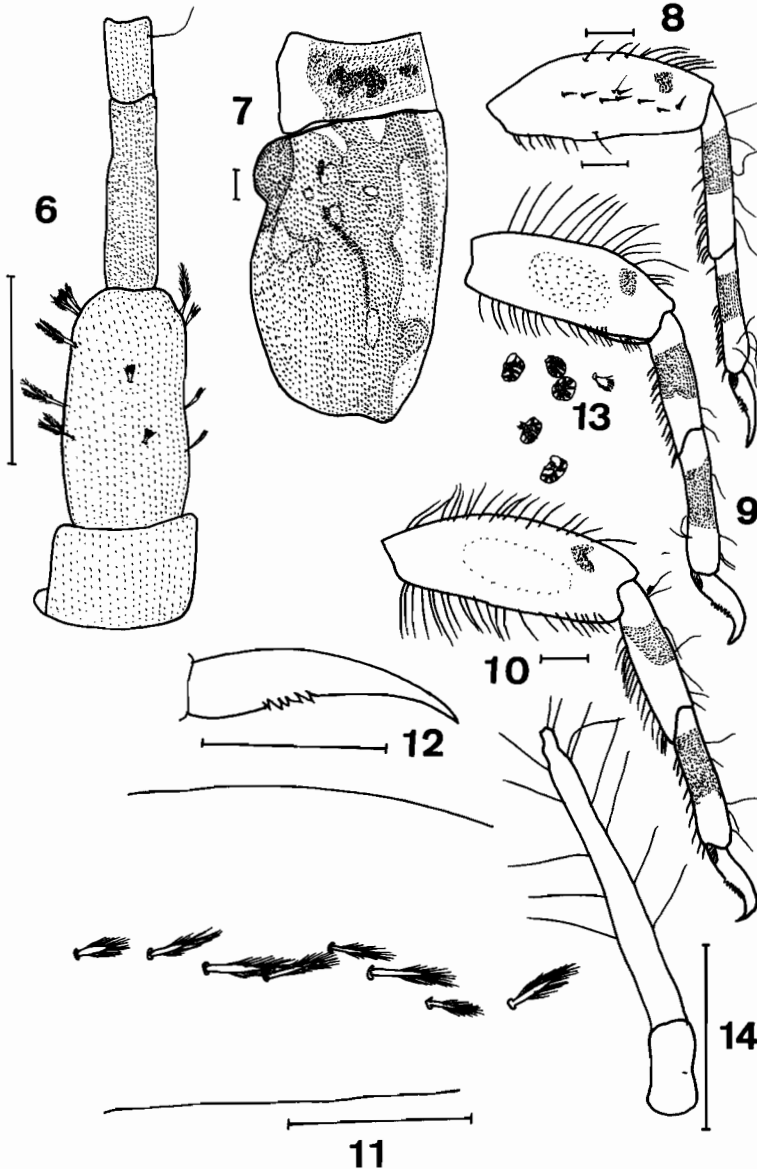
of tergite 7 with numerous long setae, but only 2-4 on tergite 8; lateral backward-pointing spines small on segments 4-9 (Fig. 15); posterior margin of sternite 9 with concave median projection (Fig. 21). Caudal filaments with basal segments lined with long setae  $1.5 \times$  segment length (Fig. 22), apical segments with setae  $2-3 \times$  segment length (Fig. 23). Gills: 1st gill 2-segmented, apical segment length  $3.3 \times$  basal segment length (Fig. 14); 2nd gills with long pinnate bristles on outer and posterior margins (Fig. 20), inner margin with



**Figs 1-5.** Male imago characteristics of *Wundacaenis dostini*: 1, wing venation; 2, prosternum; 3, ventral view of abdomen; 4, dorsal view of adult; 5, genitalia. Scale lines: 1, 2, 5, 0.1 mm; 3, 4, 1 mm.

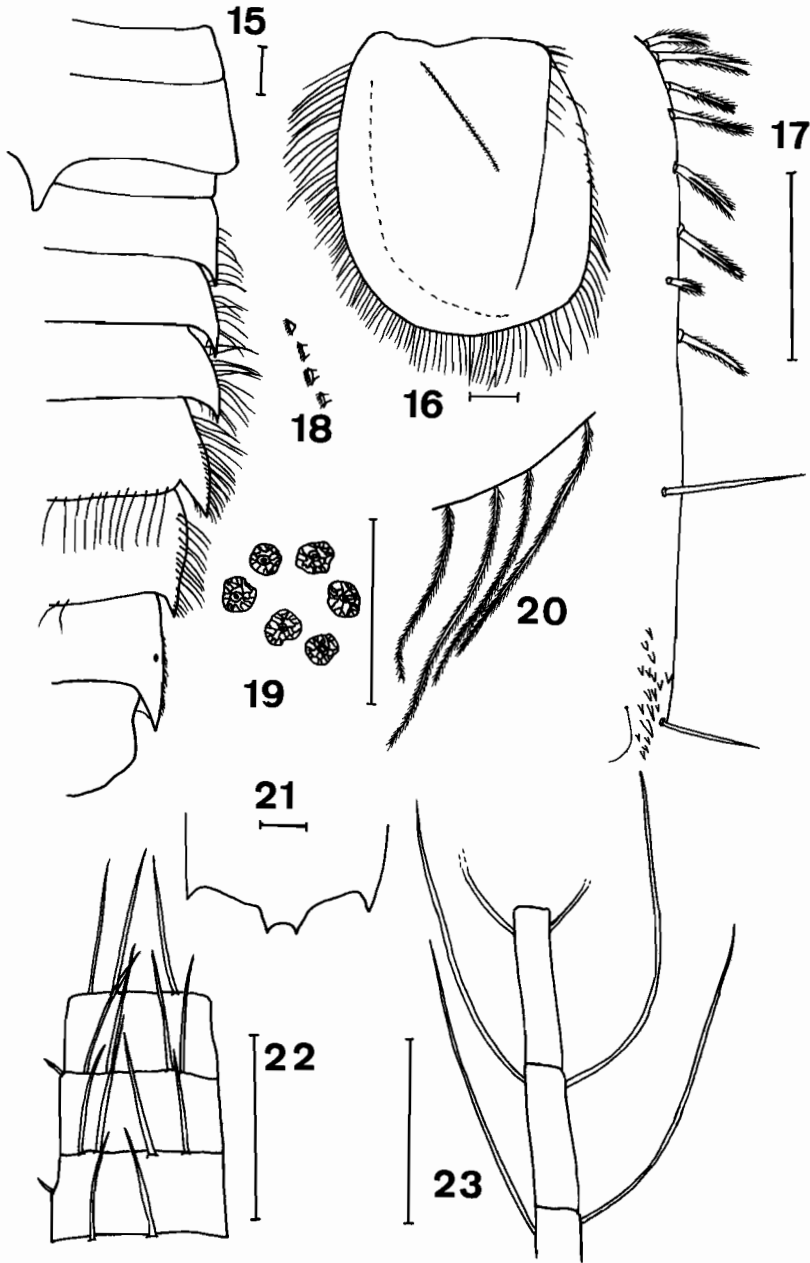
shorter bristles; mesal ridge constructed of short spines, with 5-7 short bifid bristles basally (Fig. 17); submarginal row of microtrichia on ventral surface simple (Fig. 18); surface of gill with round complex anastomosed microtrichia (Fig. 19); 3rd to 6th gills oval, fringed with multifid tracheal filaments.

**Mouthparts.** Labrum (Fig. 24) with long setae, broadly emarginate, width  $2.2 \times$  length. Left mandibles (Fig. 28) with few long bristles on margins, outer incisors with 4 teeth, inner incisors with 2 teeth, prostheca robust, bifid with long multifid setae (Fig. 29). Outer margin of right mandible (Fig. 26) with numerous long setae, outer incisors with 3 apical teeth, short setae present, inner incisors with 2 teeth and short setae, prostheca robust, with multifid apical setae (Fig. 27). Hypopharynx as shown in Fig. 31. Maxilla (Fig. 25): galeo-



**Figs 6-14.** Nymphal characteristics of *Wundacaenis dostini*: 6, base of antennae; 7, pronotum and mesonotum; 8, fore leg; 9, mid leg; 10, hind leg; 11, setae of transverse row of fore femur; 12, fore tarsal claw; 13, microtrichia on thorax; 14, 1st gill. Scale lines: 0.1 mm.

lacinia with 4 apical teeth, palpi longer than galeo-lacinia, segment ratios 1.00:0.77:1.17 (0.15 mm). Labium (Fig. 30): paraglossae as long as glossae; proximal segment of labial palp 1.45× longer than broad, lateral margin with 6–8 short, robust pinnate setae; distal segment short, triangular with a blunt apical projection; segment ratio 1.00:0.85:0.60 (0.13 mm).

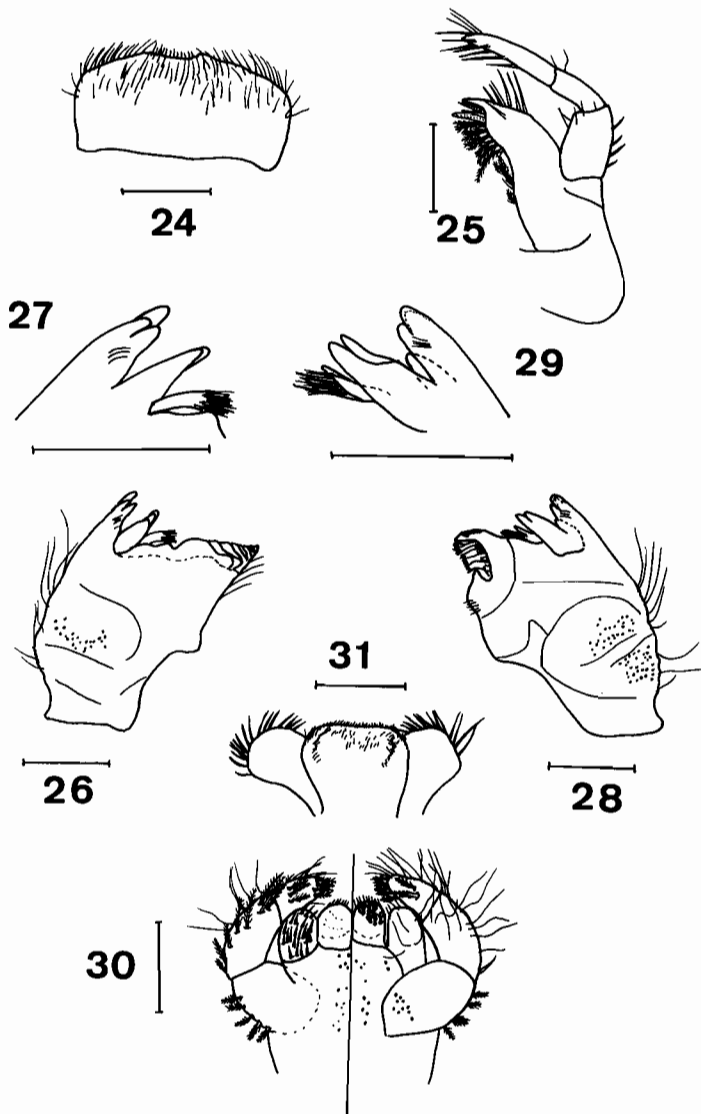


**Figs 15–23.** Nymphal characteristics of *Wundacaenis dostini*: 15, posterolateral spines on abdomen; 16, 2nd gill; 17, setae on the mesal fork of the triangular ridge of the 2nd gill; 18, microtrichia of the submarginal row of 2nd gill; 19, microtrichia on the surface of 2nd gill; 20, setae on the posterolateral margin of 2nd gill; 21, 9th sternite; 22, segments of the basal third of the cerci; 23, segments of the apical third of the cerci. Scale lines: 0.1 mm.

*Discussion*

The species can be distinguished from the other species of *Wundacaenis* by the following combination of characters: coxae of all legs lacking projections, mesonotal lobe small, fore femora with longitudinal row of setae, mesal fork of the triangular ridge of gill cover lined with short spines and sternites with distinct dark spots similar to the adult markings.

The male imago of this species is the only one known for this genus, and it differs from *Tasmanocoenis* in the following characteristics: distinct markings on the sternites, posterolateral projection on abdominal segments 5–9, and the penes structure with a ventral inverted U-shaped process.



**Figs 23–31.** Nymphal characteristics of *Wundacaenis dostini*: 24, labrum; 25, maxilla; 26, right mandible; 27, incisors and prostheca of right mandible; 28, left mandible; 29, incisors and prostheca of left mandible; 30, labium; 31, hypopharynx. Scale lines: 0.1 mm.



*Etymology*

The species is named for Peter Dostine from OSS, whose collections, local knowledge and assistance in this study have been greatly appreciated.

*Wundacaenis angulata*, sp. nov.

(Figs 32–56)

*Material Examined*

*Holotype.* 1 nymph mounted on 2 slides from Barambah Ck nr Murgon, Site 8, 26°18'S., 152°02'E., collected 2.ix.1989, during the Bjelke-Petersen Dam Environmental Study by the Queensland Water Resource Commission and Griffith University by D. Conrick.

*Paratypes.* 1 nymph in ethanol from the type locality (Site 8), collected 8.ix.1988 by D. Conrick; 1 nymph in ethanol from Site 6 on Barambah Ck, collected 2.vi.1988 by D. Conrick; 1 nymph in ethanol from the type locality (Site 8), collected 2.ix.1988 by D. Conrick.

*Description**Imago*

Unknown.

*Nymph*

Body length, 5.8–6.0 mm; cerci, 3.2 mm; terminal filament, 3.3 mm.

General body colour brown, head dark brown with light central spot in the fronto-clypeal region, between the antennae. Antennae with scape, pedicel and 3–4 segments of the flagellum brown, pedicel 2–3 × length of scape, with numerous short setae, length of first segment of flagellum  $\frac{3}{4}$  length of pedicel; antennae 2 mm long.

*Thorax.* Pronotum (Fig. 32) brown with no clear markings, lateral margins lighter, anterolateral margin with 1–2 spine setae and 4–5 pinnate bristles, lateral margins serrated, hind anterolateral margin with 1 spine seta. Mesonotum width equal to width of pronotum, but with large angular and pointed lateral lobes projecting laterally beyond margins of pronotum (Fig. 32); round complex microtrichia present on surface (Fig. 33). Legs banded (Figs 34–36), femora of all legs with a large oval region on the inner margin; legs with black spot in distal  $\frac{1}{3}$  of femur, tibia and tarsus with a proximal dark brown band; fore femur with bifid, pinnate setae in a longitudinal row (Fig. 37), claws long, slender, slightly curved, with 9 small proximal teeth (Fig. 38); femora of middle and hind legs with round complex microtrichia, tarsal claws of middle legs with 7–8 proximal teeth; hind legs with 9–10 proximal teeth. Coxae of middle leg with a small angular process (Fig. 35); coxae of hind leg with large angular process (Figs 36, 39).

## Ratios of leg segments:

fore leg, 1.00:0.70:0.63 (0.31 mm);

middle leg, 1.00:0.65:0.60 (0.38 mm);

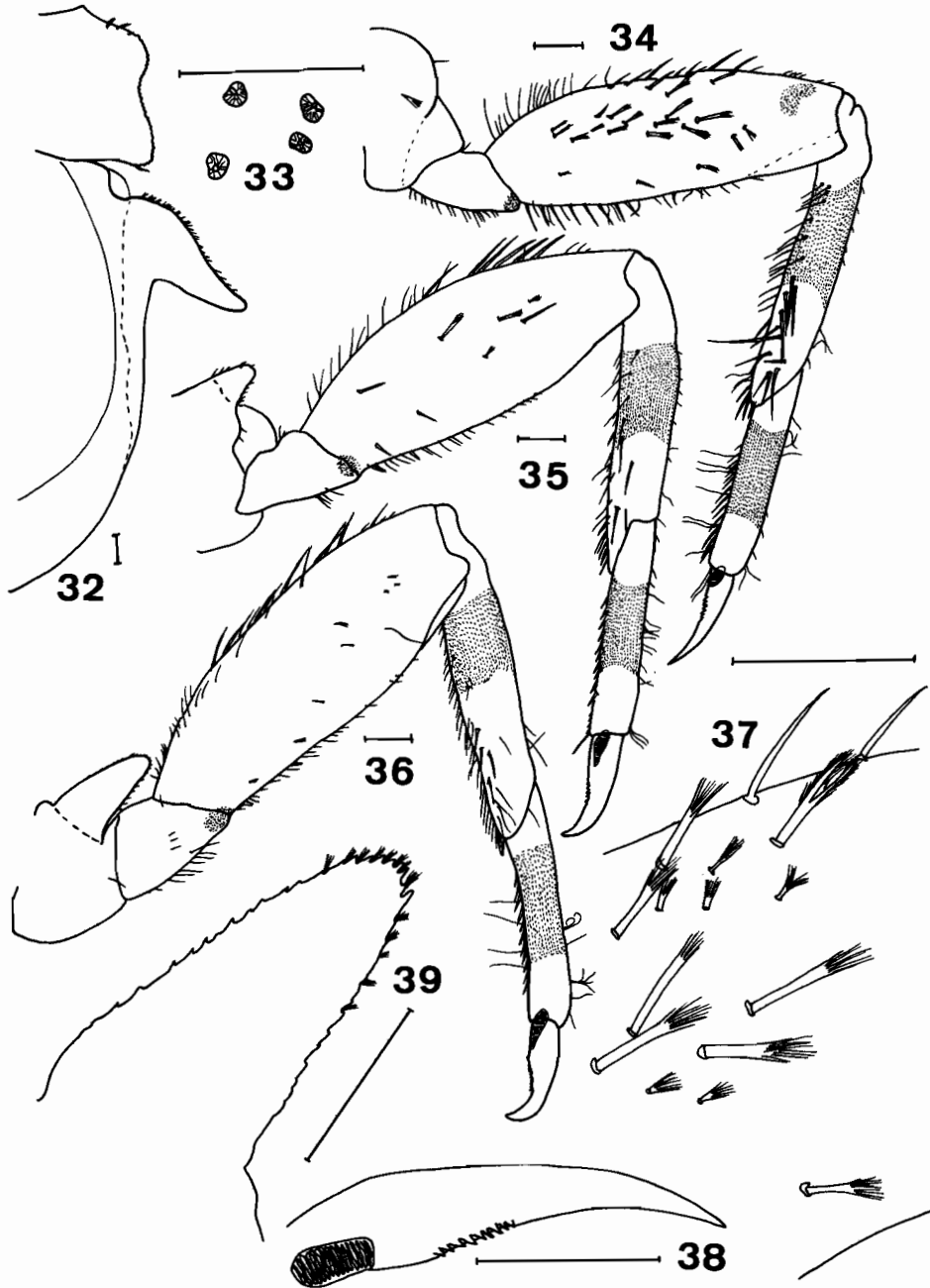
hind leg, 1.00:0.61:0.56 (0.36 mm).

Femur length to width ratios: fore leg, 2.81; middle leg, 2.75; hind leg, 3.27.

*Abdomen.* Tergites brown; sternites light without markings, hind margins of tergite 7 with numerous long setae, but only 2–4 short setae on tergite 8; lateral backward-pointing spines large on segments 4–9 (Fig. 40) with a small projection on segment 3; posterior margin of 9th sternite triangular with concave median margin (Fig. 49). Caudal filaments with basal segments 1–12 with short lateral setae 0.5–1.0 × segment length (Fig. 46), segments 12–17 with setae 1 × segment length, segments 18–38 with setae 2–3 × segment length (Fig. 47), segments 38+ with only fine hairs, inter segmental setae present on segments 18–38 (Fig. 48). Gills: 1st gill 2-segmented, apical segment length 6 × basal segment length; 2nd gills (Fig. 41) with long pinnate bristles on outer and posterior margins (Fig. 43), inner margin with shorter bristles; mesal ridge constructed of short spines, with c. 10 short bifid setae basally (Fig. 42) and stalked microtrichia present; submarginal row of micro-

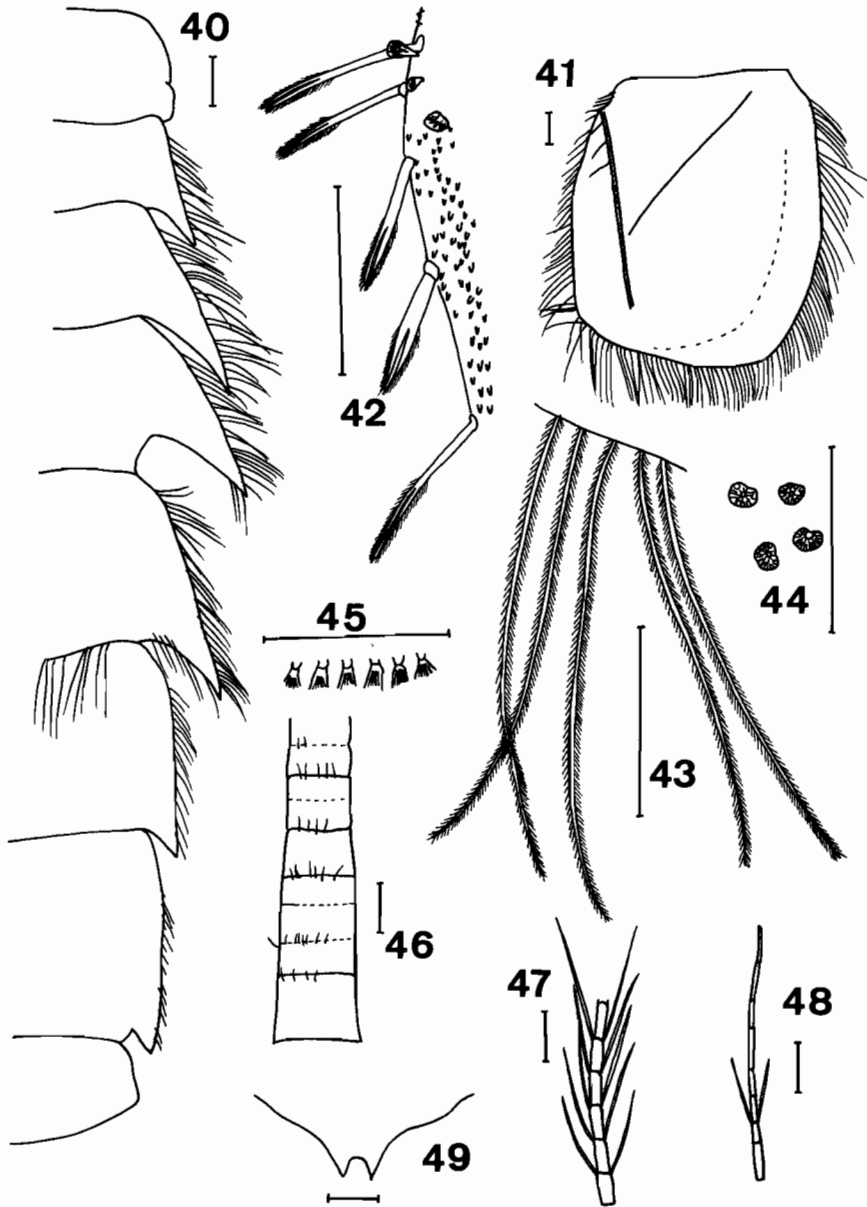
trichia on ventral surface simple (Fig. 45); surface of gill with round complex microtrichia (Fig. 44); 3rd to 6th gills oval, fringed with multifid tracheal filaments.

**Mouthparts.** Labrum (Fig. 50) with long setae, broadly emarginate, width  $2.5 \times$  length. Outer margin of right mandible with numerous long setae, outer incisors with 3 apical teeth, short setae present, inner incisors with 2 teeth and short setae, prosthema robust, with multifid apical setae (Fig. 53). Left mandibles (Fig. 54) with few long bristles on margins,



**Figs 32-39.** Nymphal characteristics of *Wundacaenis angulata*: 32, pronotum and mesonotum; 33, microtrichia on thorax; 34, fore leg; 35, mid leg; 36, hind leg; 37, setae of transverse row of fore femur; 38, fore tarsal claw; 39, basal projection of coxa of hind leg. Scale lines: 0.1 mm.

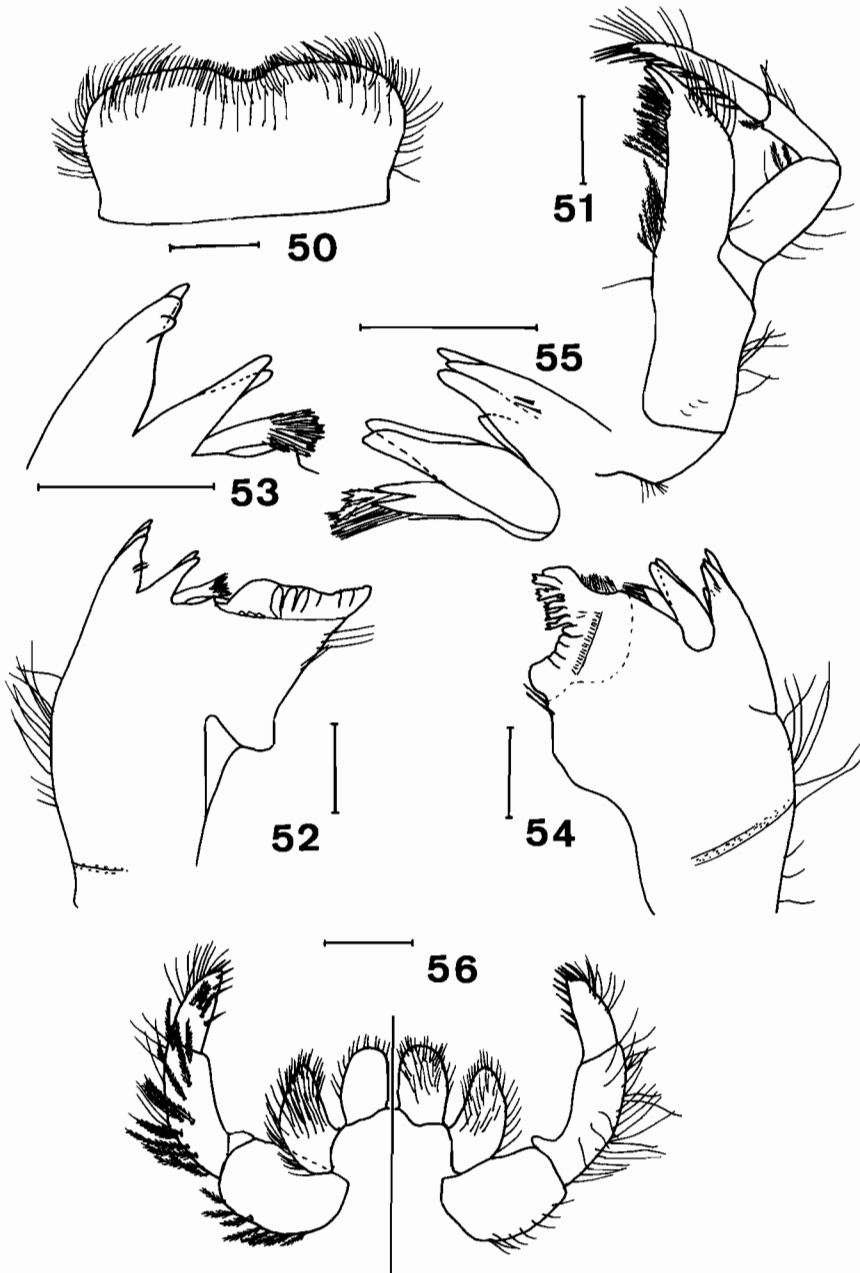
outer incisors with 3 apical teeth and 1 inner lateral tooth, inner incisors with 3 teeth, prostheca robust with long multifid setae (Fig. 55). Maxilla (Fig. 51): galeo-lacinia with 2 apical teeth, palpi longer than galeo-lacinia, segment ratios 1.00:0.89:1.28 (0.15 mm). Labium (Fig. 56): paraglossae as long as glossae; proximal segment of labial palp 1.66× longer than broad, lateral margin with 12-13 short, robust pinnate setae; distal segment short, triangular with a blunt apical projection; segment ratio 1.00:1.15:0.60 (0.14 mm).



**Figs 40-49.** Nymphal characteristics of *Wundacaenis angulata*: 40, posterolateral spines on abdomen; 41, 2nd gill; 42, setae of the mesal fork of the triangular ridge of the 2nd gill; 43, setae on the posterolateral margin of 2nd gill; 44, microtrichia on the surface of 2nd gill; 45, microtrichia of the submarginal row of 2nd gill; 46, segments of the basal third of the cerci; 47, segments of the apical third of the cerci; 48, apical segments of the cerci; 49, 9th sternite. Scale lines: 0.1 mm.

*Discussion*

This species can be distinguished from the other species of *Wundacaenis* by the following combination of characters: pronotum with lateral margins serrated; mesonotum with large angular, pointed lateral lobes; coxae of mid and hind legs with angular processes; sternites lacking dark markings; femora of fore legs with longitudinal row of setae; hind tarsal claws with basal teeth only; body, mid and hind femora, and gill covers with round complex microtrichia.



**Figs 50–56.** Nymphal characteristics of *Wundacaenis angulata*: 50, labrum; 51, maxilla; 52, right mandible; 53, incisors and prostheca of right mandible; 54, left mandibles; 55, incisors and prostheca of left mandible; 56, labium. Scale lines: 0.1 mm.

This species is known only from Barambah Creek, near Murgon, at Sites 8 and 6; the latter is now submerged beneath the waters of the Bjelke-Petersen Dam.

### Etymology

The specific epithet, *angulata*, refers to the angular mesothoracic lobe on the nymph.

### *Wundacaenis flabellum*, sp. nov.

(Figs 57–85)

#### Material Examined

*Holotype*. 1 nymph mounted on 2 slides, Upper Kangaroo R., approximately 8 km NE. of Kangaroo Valley, N.S.W., 34°42'S., 150°35'E., coll. John Dean, 21.i.1973.

*Paratypes*. 10 nymphs in ethanol from the type locality, coll. J. Dean, 21.i.1973; 4 nymphs in ethanol from the type locality, coll. J. Dean, 23.ix.1972.

#### Description

##### *Imago*

Unknown.

##### *Nymph*

Body length, 3.4–5.8 mm; cerci, 2.4–3.4 mm; terminal filament, 2.8–3.4 mm.

General body colour brown. Head dark brown with transverse ridge between the lateral ocelli. Antennal pedicel  $2.6 \times$  length of scape, with 4–6 short setae; length of first segment of flagellum  $0.75 \times$  pedicel length; antennae 1.5 mm long.

*Thorax*. Surface glabrous. Pronotum broader than head, brown with darker spots, lateral margins well developed, posterior and anterior margins produced (Fig. 57), anterolateral margin with 1–2 spine seta, lateral margins appear serrated due to stalked complex microtrichia (Fig. 64), dorsal surface with complex fan-like microtrichia. Width of mesonotum greater than width of pronotum because of the rounded lateral lobes projecting laterally beyond margins of pronotum (Fig. 57), lateral margins appear serrated due to stalked microtrichia, dorsal surface with fan-like microtrichia similar to those in Fig. 62, margins of the thoracic hump lined with large stalked microtrichia. Legs banded, femora without markings, tibia and tarsus with a medial dark brown band (Figs 58–60); fore femur with transverse row of 6–8 bifid bristles (Fig. 63), surface with net-like pattern, claws long, robust, slightly curved, with 6 small proximal teeth (Fig. 65); middle and hind legs femora with fan-like complex microtrichia (Fig. 62), surface with net-like pattern, tarsal claws of middle leg with 8–10 proximal teeth; coxa of hind leg with a large angular process (Figs 60, 61), claw of hind leg with 8 proximal teeth and a short comb of fine hairs centrally (Fig. 66).

Ratios of leg segments:

fore leg, 1.00:0.70:0.63 (0.53 mm);

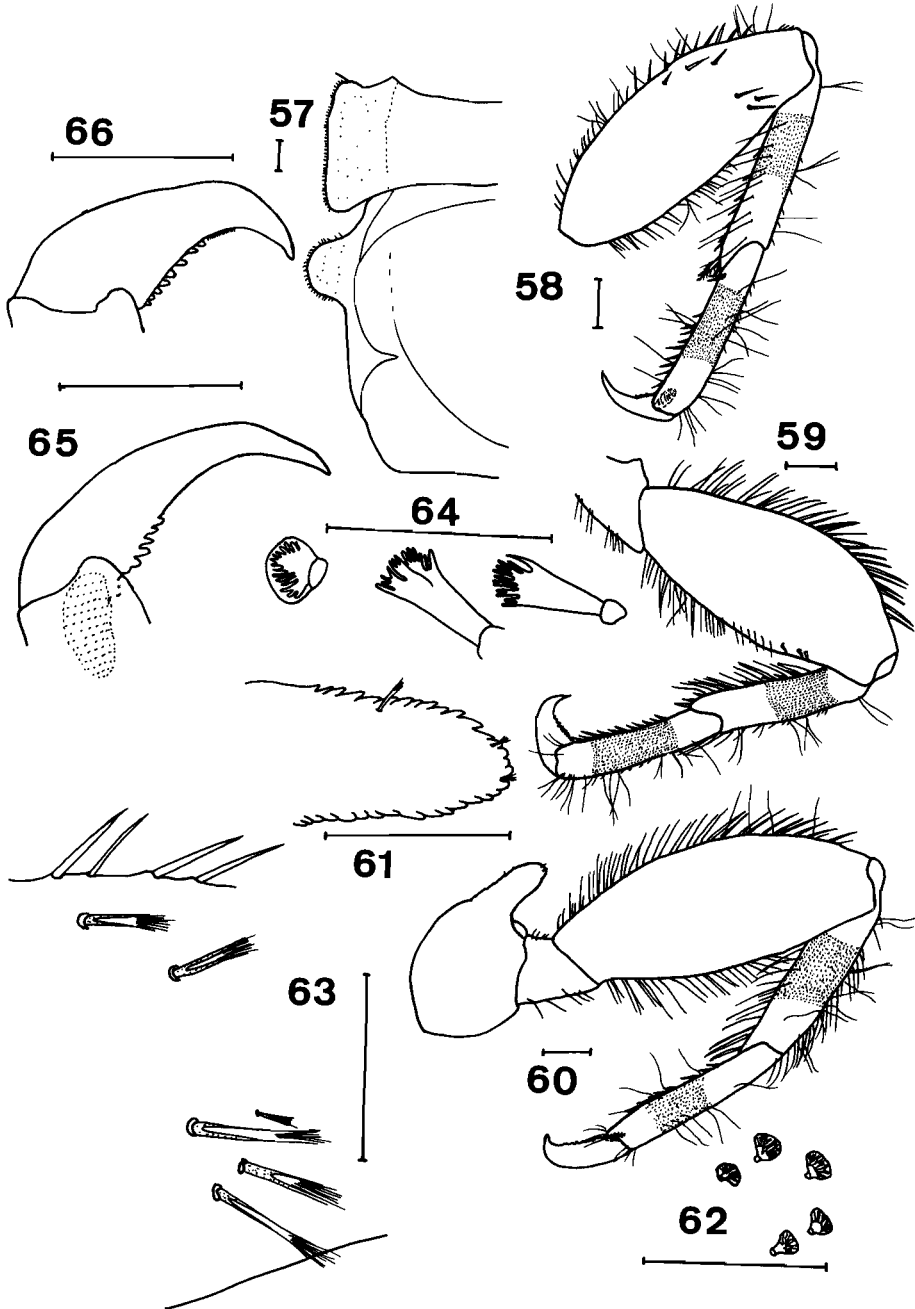
middle leg, 1.00:0.65:0.62 (0.48 mm);

hind leg, 1.00:0.68:0.60 (0.56 mm).

Femur length to width ratios: fore leg, 2.11; middle leg, 1.73; hind leg, 2.00.

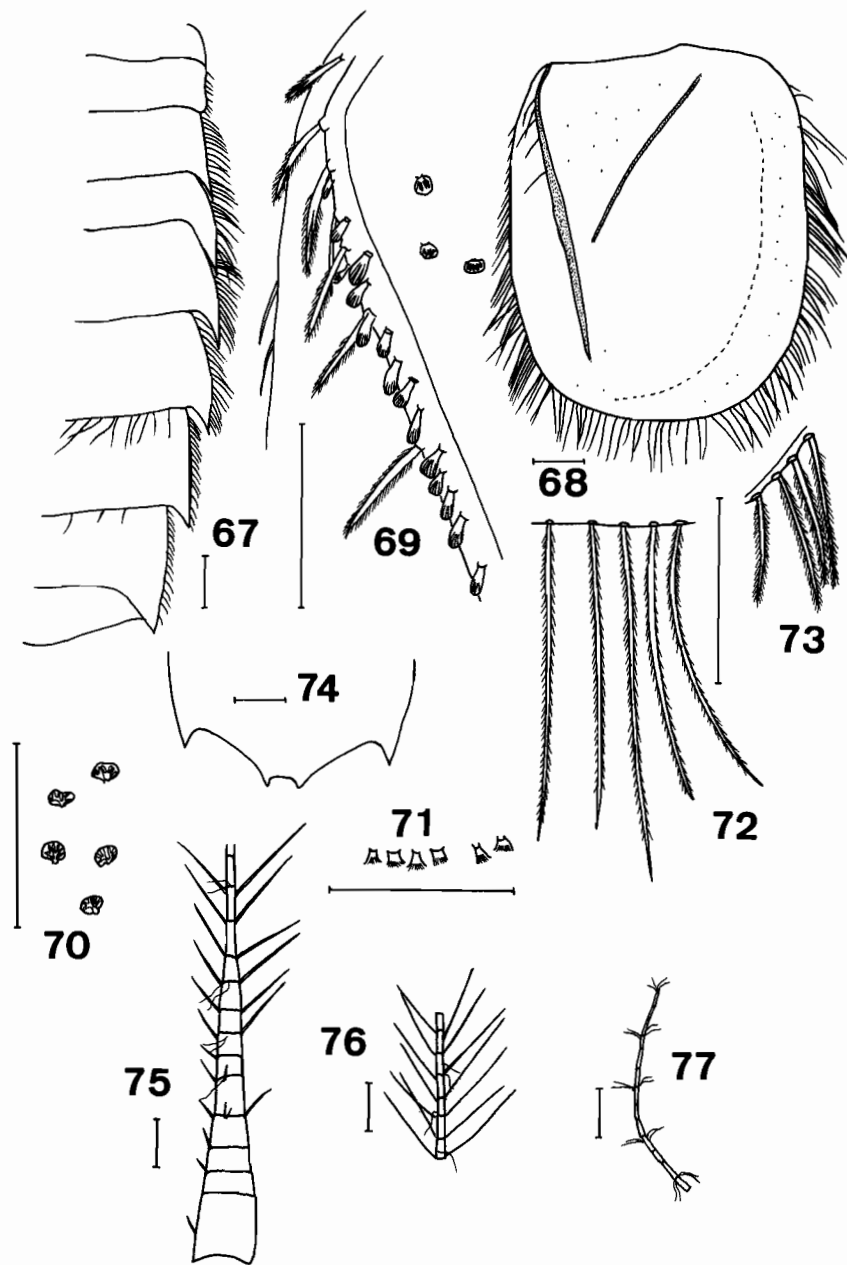
*Abdomen*. Tergites and sternites brown without markings; tergite 1 without dorsal setae; hind margin of tergite 2 with short spines; hind margins of tergites 7 and 8 with numerous long setae; lateral backward-pointing spines large, on segments 4–9 (Fig. 67), posterior margin of sternite 9 with concave median projection (Fig. 74). Caudal filaments with basal segments with a pair of apical setae equal to segment length (Fig. 75), segments 7–13 with apical setae  $2-3 \times$  segment length (Fig. 75), segments 14–19 with a pair of intersegmental setae  $2 \times$  segment length, apical setae  $3 \times$  segment length (Fig. 76), segments 20–26 with apical setae  $2 \times$  length, and apical segments beyond segment 26 with fine hair-like bristles  $1-2 \times$  segment length (Fig. 77). Gills: 1st gill 2-segmented, apical segment

length  $3.6 \times$  basal segment length; 2nd gill (Fig. 68) with long pinnate bristles on outer and posterior margins (Fig. 72), inner margin with shorter bristles (Fig. 73); mesal ridge smooth, lined with distinct stalked fan-like microtrichia, with *c.* 7 short bifid bristles basally (Fig. 69); submarginal row of microtrichia on ventral surface simple (Fig. 71); surface of gill with fan-like complex microtrichia (Fig. 70); 3rd to 6th gills oval, fringed with multifid tracheal filaments.



**Figs 57-66.** Nymphal characteristics of *Wundacaenis flabellum*: 57, pronotum and mesonotum; 58, fore leg; 59, mid leg; 60, hind leg; 61, basal projection of coxa of hind leg; 62, microtrichia on outer surface of femora; 63, setae of transverse row of fore femur; 64, microtrichia on thorax; 65, fore tarsal claw; 66, hind tarsal claw. Scale lines: 0.1 mm.

**Mouthparts.** Labrum with long setae, broadly emarginate, width  $2.0 \times$  length (Fig. 78). Right mandible (Fig. 80) with few long bristles on margins, outer incisors with 3 teeth and basal bristles, inner incisors with 2 teeth, prostheca strap-like with long multifid setae (Fig. 81). Outer margin of left mandibles (Fig. 82) with numerous long setae, outer incisors with 3 apical teeth and 1 inner tooth, short basal bristles present, inner incisors with 3 teeth

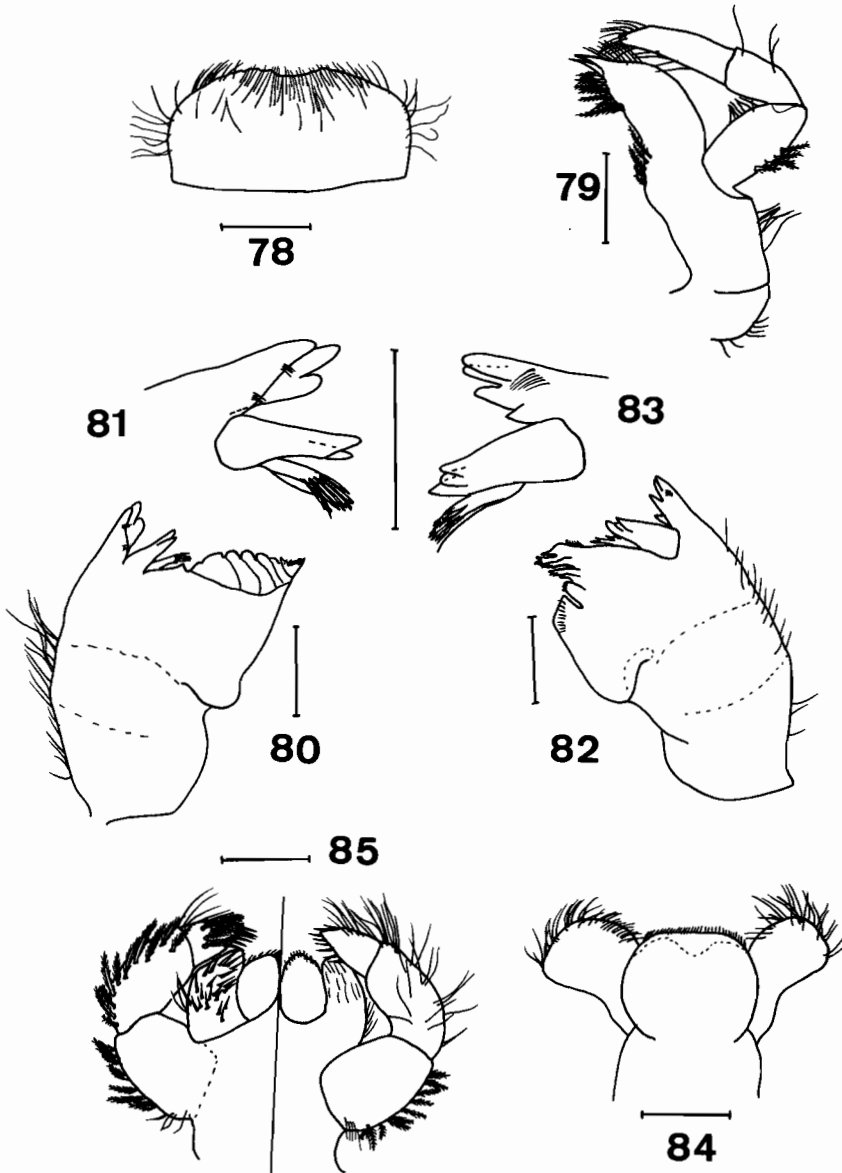


**Figs 67-77.** Nymphal characteristics of *Wundacaenis flabellum*: 67, posterolateral spines on abdomen; 68, 2nd gill; 69, setae of the mesal fork of the triangular ridge of the 2nd gill; 70, microtrichia on the surface of 2nd gill; 71, microtrichia of the submarginal row of 2nd gill; 72, setae on the posterolateral margin of 2nd gill; 73, setae on outer margin of 2nd gill; 74, 9th sternite; 75, segments of the basal third of the cerci; 76, segments of the apical third of the cerci; 77, apical segments of the cerci. Scale lines: 0.1 mm.

and short basal bristles, prostheca robust, with multifid apical setae (Fig. 83). Hypopharynx as shown in Fig. 84. Maxilla (Fig. 79): galeo-lacinia with 4 apical teeth, palpi longer than galeo-lacinia, segment ratios 1.00:1.00:1.19 (0.11 mm). Labium (Fig. 85): paraglossae as long as glossae; proximal segment of labial palp 1.33 × longer than broad, lateral margin with 12–14 short, robust pinnate setae; distal segment short, triangular; segment ratio 1.00:1.25:0.50 (0.11 mm).

#### Discussion

This species can be distinguished from the other species of *Wundacaenis* by the following combination of characters: lateral development of the pronotum lined with stalked micro-



**Figs 78–85.** Nymphal characteristics of *Wundacaenis flabellum*: 78, labrum; 79, maxilla; 80, right mandible; 81, incisors and prostheca of right mandible; 82, left mandible; 83, incisors and prostheca of left mandible; 84, hypopharynx; 85, labium. Scale lines: 0.1 mm.



trichia; mesonotum with large rounded lateral lobes; large dorsal hooked projection on abdominal tergite 2; mesal fork of the triangular ridge of the gill covers lined with stalked fan-like microtrichia; sternites lacking dark markings; femora of fore legs with transverse row of setae; hind tarsal claws with two types of teeth; body, mid and hind femora, and gill covers with fan-like microtrichia.

This species is known only from the type locality.

#### *Etymology*

The specific epithet, *flabellum*, refers to the fan-like microtrichia that are found on the body, legs and gill covers of this species.

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