SHALLOW-WATER CUMACEAN CRUSTACEA FROM AUSTRALIA AND LOMBOK (INDONESIA): FAMILIES BODOTRIIDAE AND LEUCONIDAE

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Twenty species are identified from the families Bodotriidae and Leuconidae from 39 shallow-water stations around Australia and one location in Indonesia. Of these 20 species, two are possibly conspecific. One species of the genus *Leptocuma* has to stay in open nomenclature because of the poor condition of the specimen. The genus with the most species is *Cyclaspis* with 11 representatives in the samples. Two of them, *Cyclaspis ursulae* sp.n. from the *exsculpta*-group and *Cyclaspis lissa* sp.n., are new to science; *Cyclaspis strumosa* and *C.* cf. *strumosa* are also discussed. A new species of the genus *Mossambicuma* is described. This genus has been monotypic since Day (1978) described it from the western Indian Ocean. New species are also described for the genera *Leptocuma*, *Glyphocuma*, *Picrocuma* and *Bodotria*. Only one representative of the family Leuconidae was found, in Tasmania, extending the distribution of that species, *Ommatoleucon ocularis*.

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Following the comprehensive studies of Herbert Hale from 1928 to 1952 (Hale 1928, 1936, 1937, 1944, 1945, 1948, 1952) on Cumacea from Australia, very little work was done on these Crustacea in this region until Tafe & Greenwood (1996) did their investigations at Moreton Bay, Queensland.

The family Bodotriidae comprises 31 genera, five of them endemic to Australian waters. The Bodotriidae genus with the most species is *Cyclaspis* with 118 species, many (46%) of them described from Australia. Despite the comprehensive and intensive studies of the authors mentioned above, even more undescribed species remain. The descriptions of two of these are given here. For detailed generic diagnosis and subdivision of the genus see Tafe & Greenwood (1996) and for synonyms see Bacescu (1988).

The other genera mentioned in this study are *Bodotria* (Atlantic, Indian and Pacific oceans), *Leptocuma* (Australia and West Atlantic), *Mossambicuma* (Western Indian Ocean, Mozambique), *Glyphocuma* (Australia), *Picrocuma* (Australia) from the family Bodotriidae and *Ommatoleucon* (Australia) from the family Leuconidae.

Material And Methods

Material collected in shallow coastal waters using a hand net by Prof. Dr. G. Hartmann and Dr. G. Hartmann-Schröder during their expedition to Australia September 1975 to February 1976:

Western Australia

WA sample 10, Broome, 10 September, fine sandy eulitoral

WA samples 14+15, Broome, close to Willie Creek

WA samples 17+18, Derby, 20 September, silty lower eulitoral

WA sample 23, Broome, 24 September, mangroves

WA sample 27, Port Hedland, 27 September, close to low tide, fouling

WA sample 28, Port Hedland, 27 September, fine sand on reef top

WA sample 30, Port Hedland, 28 September, silty clay, mangroves

WA sample 35, Port Samson, 30 September, sand and algae, coarse sand and mud

WA sample 37, 7 km east of Dampier, Horsines Cove, 2 October, shell hash – sand, mangroves

WA sample 39, Dampier, 3 October, fine sand eulitoral, in front of tidal flat edge

WA sample 46, 24 km south of Exmouth, 10 October, fine sand, eulitoral, between reefs

WA sample 66, Drummonds, close to Geraldton, 21 October, fine sand

WA samples 67+68, Jurien close to Cervantes, 24 October, sand

South Australia

SA sample 126, Port Lincoln, Proper Bay, 4 December, sand and seagrass
SA sample 129, Port Augusta, 6 December, mangroves, silt and shell hash

Victoria

VIC sample 148, Foster, Port Welshpool, 28 December, mangroves, soft silty sand
VIC sample 165, southern dead end of Clarence River, near Yamba, 18 January 1976, brackish water and mangroves.

Additional unidentified material was available from the South Australian Museum, Adelaide:

Various stations, Noosa R., 40 mesh tow net, June 1940, leg. ISR Munro;
Whiting Ground, Waterhouse Bay, east end Thistle Island, 4 March 1931, 8 – 8.3 fathoms;
North end Herald Bight, Shark Bay, 3 fathoms, sand, 'Isobel' W.H., 21 November 1945, submarine light, temperature: 24.22° C;
Whalers Bay, Thistle Is., 3 February 1941, submarine light, leg. K. Sheard;
Near Pt. Maclaren, Thorny Passage, Whiting Ground, 3.5 fathoms, 8–8.30 pm, 2 March 1941, submarine light, leg. K. Sheard.

Material collected by Dr. V. Siegel and the author, shallow subtidal water:

Tasmania

TAS Nubeena, 6 November 1995, soft silty sand with detritus
TAS Marion Bay, 5 November 1995, fine sand and sea grass

Queensland

QLD, Lizard Island 1992:
11 November, mangroves, 0.1 m, soft sand
12 November, Turtle Bay, 15 m, sand
13 November, sand, 10 m
14 November, Turtle Bay, 16 m, coarse sand
15 November, Turtle Bay, 15 m, soft sand
17 November, Mermaid Bay, 7–10 m
17 November, sand, 7 m
18 November, North Reef, 19 m, sand
19 November, Lagoon, 7 m, sand
19 November, Watson's Bay, 17 m, sand
19 November, sand, 2 m
20 November, Pidgin Point, 12 m
20 November, Watson's Bay, 16 m
21 November, South Reef, 12 m

Material collected by Dr. J. Martens and Dipl. Biol. U. Heuer:

Indonesia, Lombok, Plankton/Neuston, 9 March 1996, 0–10 cm.

The material is deposited at the Zoological Museum of the University of Hamburg (ZMH) or in the South Australian Museum, Adelaide (SAM).

Systematics

Order CUMACEA Krøyer, 1846

Family BODOTRIIDAE T. Scott, 1901

Subfamily BODOTRIINAE T. Scott, 1901

Genus ***Bodotria*** Goodsir, 1843

Bodotria* cf. *biplicata Gamô, 1964
(Figure 1)

Material

Lombok: 1 juvenile male; ZMH K 39930.

Remarks

The juvenile male (1.5 mm in length) has the pleopods barely developed; the total length is about half as long as the holotype (2.7 mm). Its two lateral carinae and the dorsomedian carina are well marked in the anterior half, the pitted structure of the carapace makes the individual similar to *B. pulchella* (Sars, 1878). It is differentiated from *B. pulchella* by the unsegmented uropod's endopod, which makes it likely to be conspecific with *B. biplicata*.

Distribution

Japan, Korea and Indonesia.

Bodotria* cf. *minuta Kurian, 1961
(Figure 1)

Material

Lombok: 1 juvenile female; ZMH K 39929.

Remarks

The juvenile female in the collection has the uropods' rami missing. It fits quite well with Kurian's (1961) description: carapace without carinae, first free pereionite small, in the present female not as free as in adult female, pigment spots present, as figured by Kurian.

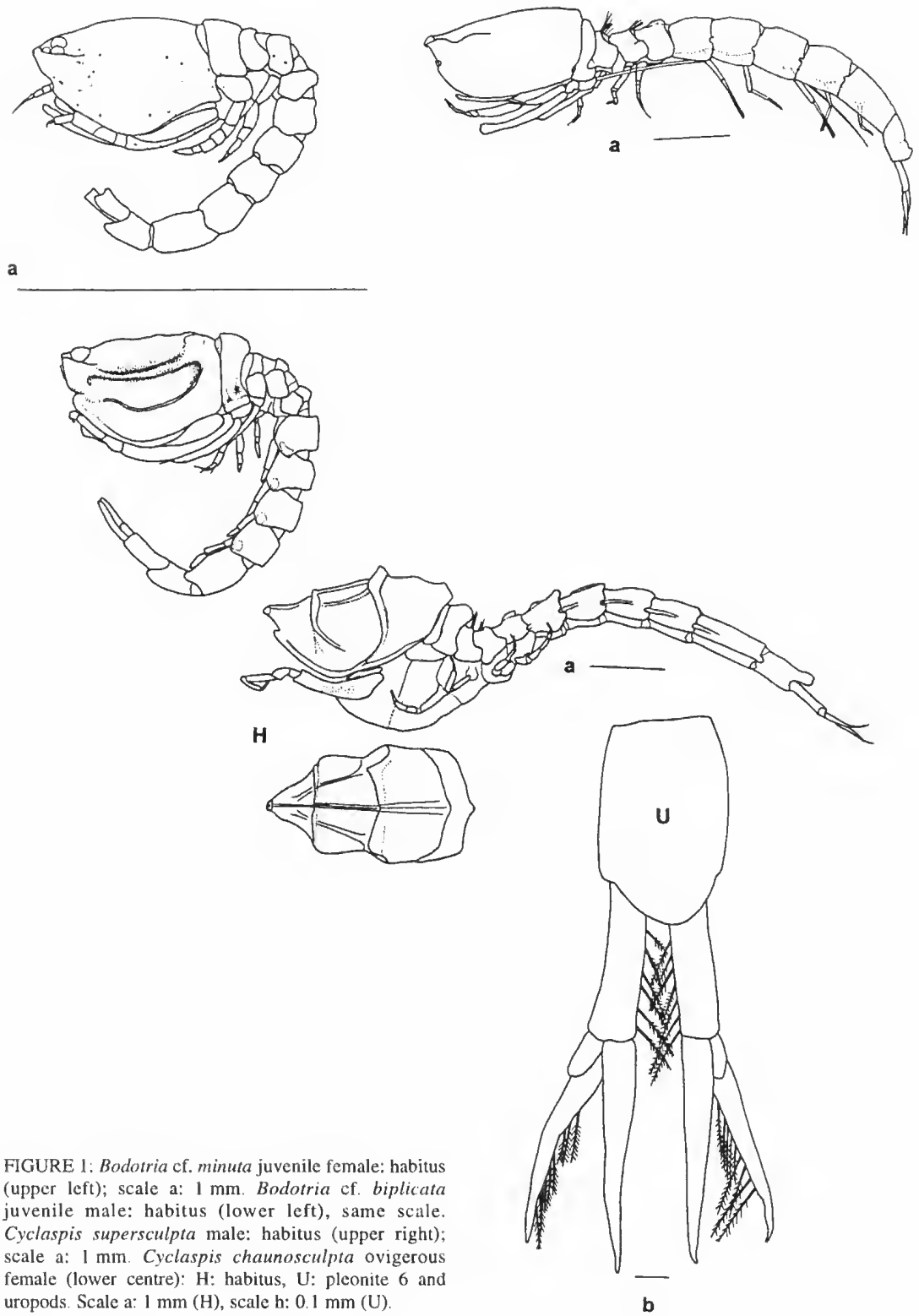

FIGURE 1: *Bodotria* cf. *minuta* juvenile female: habitus (upper left); scale a: 1 mm. *Bodotria* cf. *biplicata* juvenile male: habitus (lower left), same scale. *Cyclaspis supersculpta* male: habitus (upper right); scale a: 1 mm. *Cyclaspis chaunosculpta* ovigerous female (lower centre): H: habitus, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (U).

Distribution

Southern India and Indonesia.

Bodotria unacarina sp.n.

(Figures 2 and 3)

Material

WA: 35: 1 subadult male, 1 subadult female, 1 juvenile.

QLD: Lizard Island 1992: Turtle Bay (15 November, 15 m): 2 juvenile females; Pidgin Point: 1 subadult male, 1 juvenile female, ZMH K 39931; sand (2 m): 3 ovigerous and 2 subadult females, 1 male, 10 juveniles; SAM C 5996.

Holotype: ovigerous female SAM C 5995a, SAM C 5995b: extremities of paratype

Paratypes: 2 ovigerous females, 2 subadult females, 1 male (dissected), SAM C 5996

Leg.: V. Siegel & U. Mühlenhardt-Siegel

Date: 19 November 1992

Locus typicus: Australia, Great Barrier Reef, Lizard Island, sand (2 m).

Diagnosis

Bodotria with one lateral carina in female, uropod's endopod unsegmented, 11 and one terminal setae on endopod in male, two median and one terminal setae in female, no scaly structure on carapace, uropod's peduncle longer than endopod in male.

Description

Based on holotype, ovigerous female, 2.2 mm length in total:

Carapace with a dorsomedian carina and one lateral carina on each side, proportion length to height 1.6, length to width 1.2. Pseudorostrum shorter than length of ocular lobe; siphonal tube moderately long; dorsomedian line straight; antennal notch narrow; anterolateral margin smooth.

Integument granulose; eyes with six lenses. First free thoracic segment not visible, the second pedigerous segment longer than following, free segments combined shorter than carapace, lateral carina continued on second pedigerous segment, third to fifth segment with lateral plates.

Abdomen 1 mm in length, a little shorter than carapace and free thoracic segments combined, pleonite 6 proportion length to width 1.2.

Description of extremities is based on paratype, ovigerous female:

First antenna geniculated, basal article longest, middle article shortest, main flagellum two-segmented, distally with two aesthetases and one seta, accessory flagellum rudimentary, only three setae visible; mandible pars incisiva with three teeth, between pars incisiva and pars molaris 11 setae.

Maxilliped 2 long basis, merus outer margin dilated, carpus and propodus equal in length, longer than merus, dactylus with stout terminal seta; maxilliped 3 basis longest article, with short distal prolongation, not reaching articulation between ischium and merus; ischium longer than merus, merus with short terminal prolongation, carpus distally geniculated, propodus and dactylus subequal in length, terminal seta stout, exopod present (not figured).

Pereiopod 1 basis longer than rest of extremity, carpus second longest article, propodus and dactylus subequal in length, dactylus half as wide as propodus, exopod present; pereiopod 2 basis longer than rest of extremity, covered with hair-like setae, ischium missing, merus and carpus equal in length, propodus short, dactylus tapering with one terminal and two subterminal setae; pereiopods 3 to 5 similar in shape, the hinder extremities getting shorter due to diminishing length of basis; uropod's endopod unsegmented, one long and one short seta at inner margin, one terminal seta, peduncle longer than pleonite 6 (length proportion 1.7) and endopod (length proportion 1.6), exopod a little shorter than endopod.

Male with five pairs of well developed pleopods, 2.8 mm in length, abdomen longer than carapace and free thoracic segments combined, pseudorostral lobes meeting in a point in front of ocular lobe, abdominal segments larger than in female; proportions of peduncle to pleonite 6 is 1.1, peduncle to endopod 1.2, pleonite 6 length to width 1.4. Bases of first two pedigerous extremities longer than in female, uropod's peduncle with ten long and seven shorter setae, endopod with nine spine at inner margin, additional one terminal and one subterminal spine, exopod with 11 long plumose setae at inner margin and one strong terminal seta.

Etymology

The new species is named after its most striking morphological character, the single lateral carina.

Remarks

Bodotria species with unsegmented uropod's endopod, one lateral carina, and proportion of pleonite 6 length to width close to 1.2, as in the new species are: *B. arenosa* (Goodsir, 1843) from the northeastern Atlantic; *B. armata* Tafe &

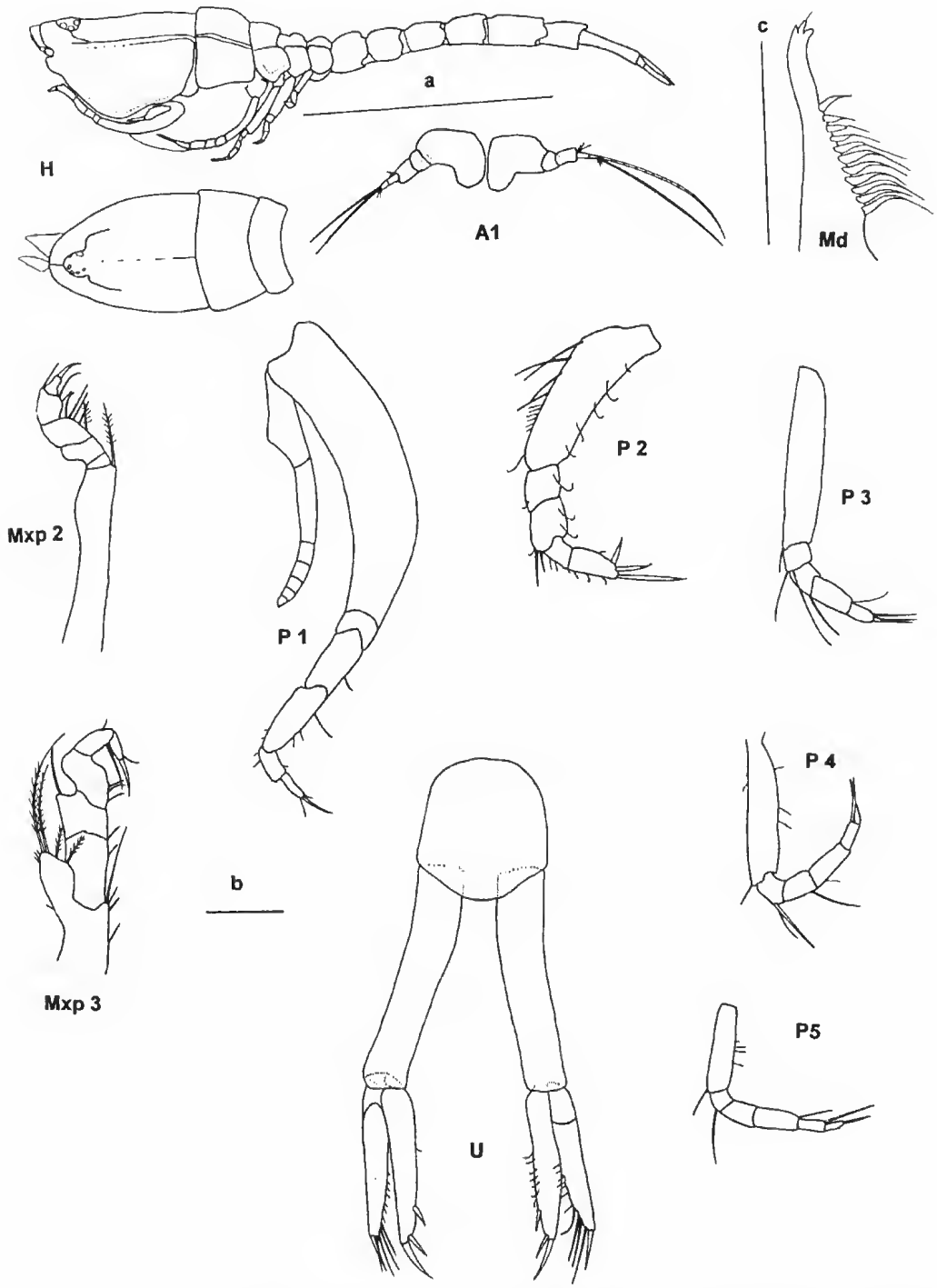

FIGURE 2: *Bodotria unacarina* sp.n. ovigerous female: H: habitus female, A1: first antenna, Md: mandible, Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (A1, Mxp2, Mxp3, P1, P2, P3, P4, P5, U), seale e: 0.1 mm (Md).

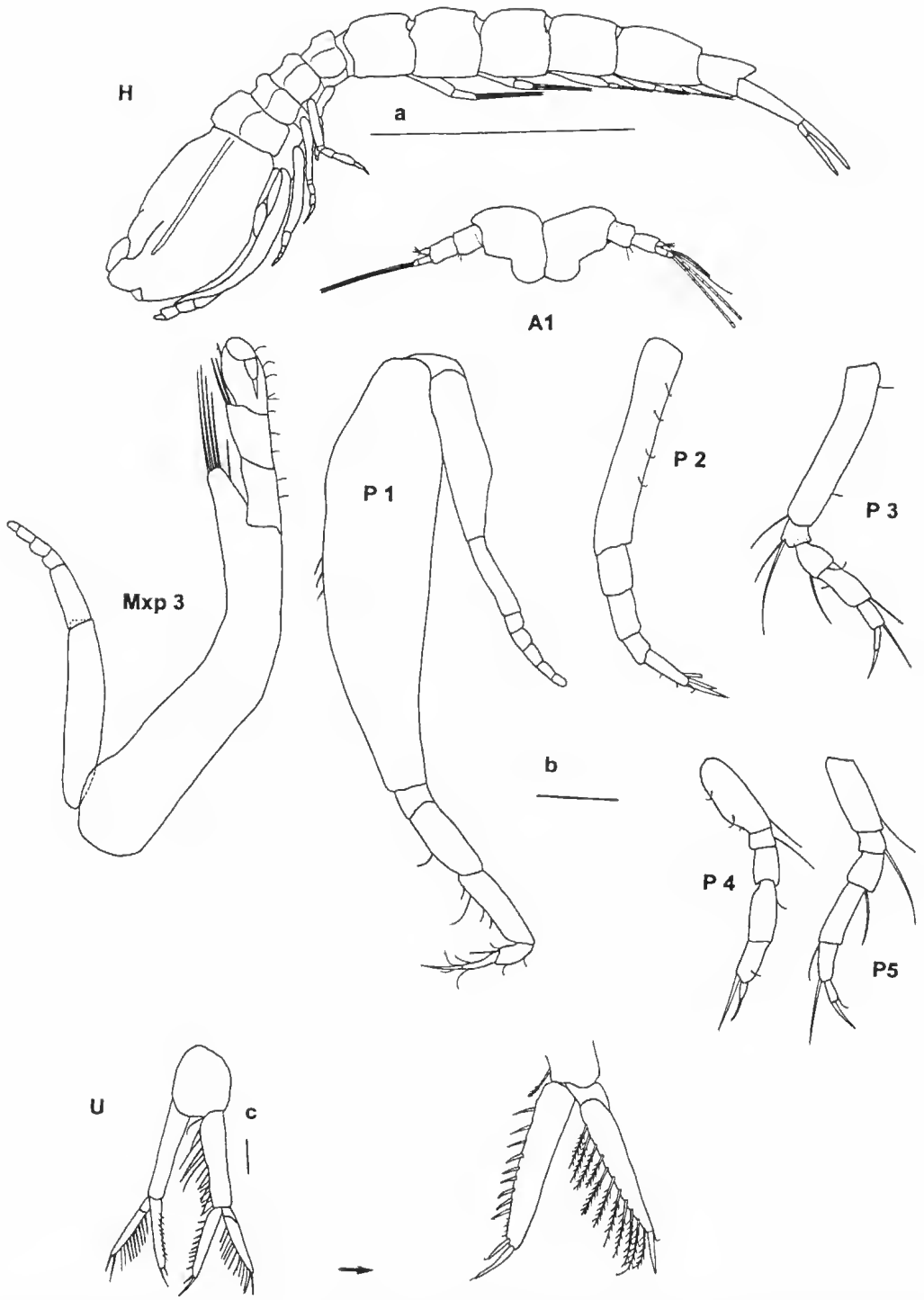

FIGURE 3: *Bodotria unacarina* sp.n. adult male: H: habitus, subadult male A1: first antenna, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (A1, Mxp3, P1, P2, P3, P4, P5, U enlarged), scale c: 0.1 mm (U).

TABLE 1: Comparison of some characters of selected *Bodotria* species with unsegmented uropod's endopod. n.d.: no data.

	Bodotria arenosa	*Bodotria armata*	*Bodotria armata*	*Bodotria rugosa*	*Bodotria serrata*	*Bodotria unacarina* n.sp.	*Bodotria unacarina* n.sp.
sex	male	female	male	female	male	female	male
lateral carina	1	1	1	1	1	1	1
Proportions							
pleonite 6 length:width	1.3	1.2	1.2	1.3	1.1	1.2	1.4
peduncle:pleonite 6	1.7	1.5	1.6	1.2	2.5	1.7	1.1
peduncle:endopod	1.5	1.4	n.d.	1.2	1.6	1.6	0.9
pedigerous segment visible?	–	?	?	+	?	–	–
setae at endopod	4+1	?	11+1	2+2	13+2	2+1	11+1

Greenwood, 1996 from Moreton Bay, Queensland; and *B. rugosa* Gamô, 1963 and *B. serrata* Harada, 1967 from Japan (Table 1). The new species resembles *B. arenosa* with respect to the females' length proportions of the uropod's peduncle to pleonite 6 and endopod, respectively. It differs from that species in the number of setae on the endopod. The new species differs from the geographically close species *B. armata* in missing the scaly structure of the integument, and the length proportions peduncle to endopod and to pleonite 6. The female's length proportion of peduncle to pleonite 6 is 1.5 in *B. armata* and 1.7 in *B. unacarina* sp.n., and the proportion of peduncle to endopod is 1.4 in *B. armata* and 1.6 in *B. unacarina* sp.n. The male's length proportions of peduncle to pleonite 6 are 1.6 in *B. armata* compared to 1.1 in *B. unacarina* sp.n. The differenees between females of the new species and *B. rugosa* are the relatively longer uropod's pedunele relative to pleonite 6 and endopod in the new species. The differences between males of the new species and *B. serrata* is the relatively shorter uropod's peduncle.

Genus *Cyclaspis* Sars, 1865

Cyclaspis caprella Hale, 1936
(Figure 4)

Material

TAS: Nubeena: 1 subadult, 2 ovigerous females; ZMH K 39917.

Remarks

Hale (1936) described the male of his new species from Yorke Peninsula, South Australia, and emended the description for the males from the same location (Hale, 1944). He mentioned the females (Hale, 1944) and gave a short description and a few figures of the females from Kettering, Tasmania (Hale, 1948). Additional figures of the females' extremities are given herein. The species is easily identified by the anterior 'horns' formed by the acute anterolateral corners, narrow ocular lobe with terminal eye, pseudorostral lobes not meeting in front of the ocular lobe, strongly elevated second pedigerous segment, fourth and fifth pedigerous segments with a pair of triangular teeth on dorsum, the first pleonite with a strong procurved tooth on each side near the dorsal posterior end. The uropod's exopod has two apical muerones, as mentioned by Hale (1944).

Cyclaspis chaunosculpta Tafe & Greenwood, 1996
(Figure 1)

Material

QLD: Lizard Island 1992: Lagoon (7 m): 1 female with developed oostegites; ZMH K 39920.

Remarks

The habitus of the specimen fits quite well with the figure in Tafe & Greenwood (1996). Additionally, pleonite 6 and uropods are figured (Fig. 3). The carapace structure of the Lizard Island specimens seems to have smaller sponge-like pits than in the Moreton Bay specimens.

Cyclaspis cottoni Hale, 1937
(Figure 5)

Material

TAS: Marion Bay: 3 ovigerous females, 4 adult and 5 subadult males; SA: 126 (Port Lincoln): 1

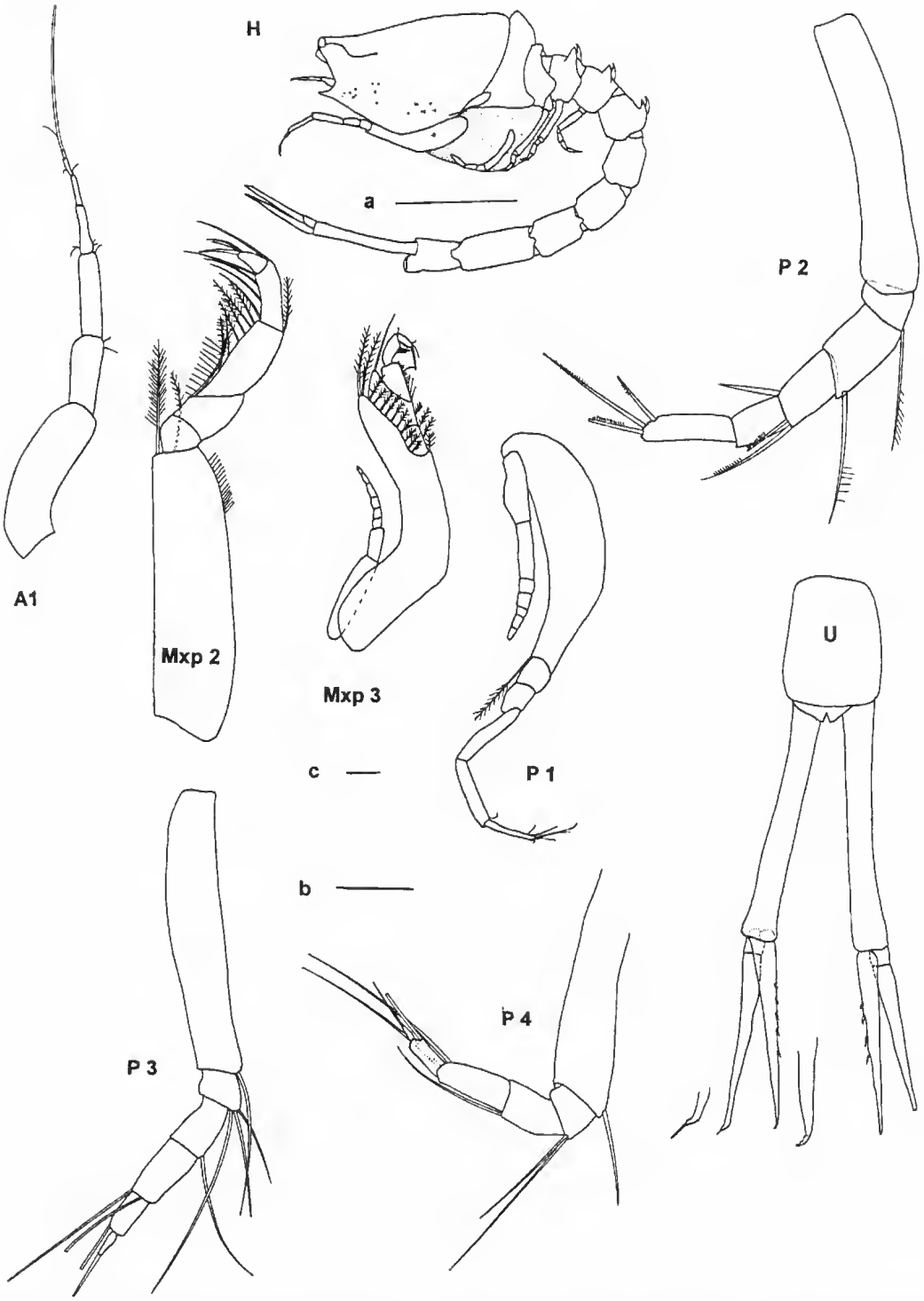

FIGURE 4: *Cyclaspis caprella*, ovigerous female: H: habitus, A1: antenna 1, Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1 to P4: pereiopod 1 to 4, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (A1, Mxp2, P2, P3, P4), scale c: 0.1 mm (Mxp3, P1, U).

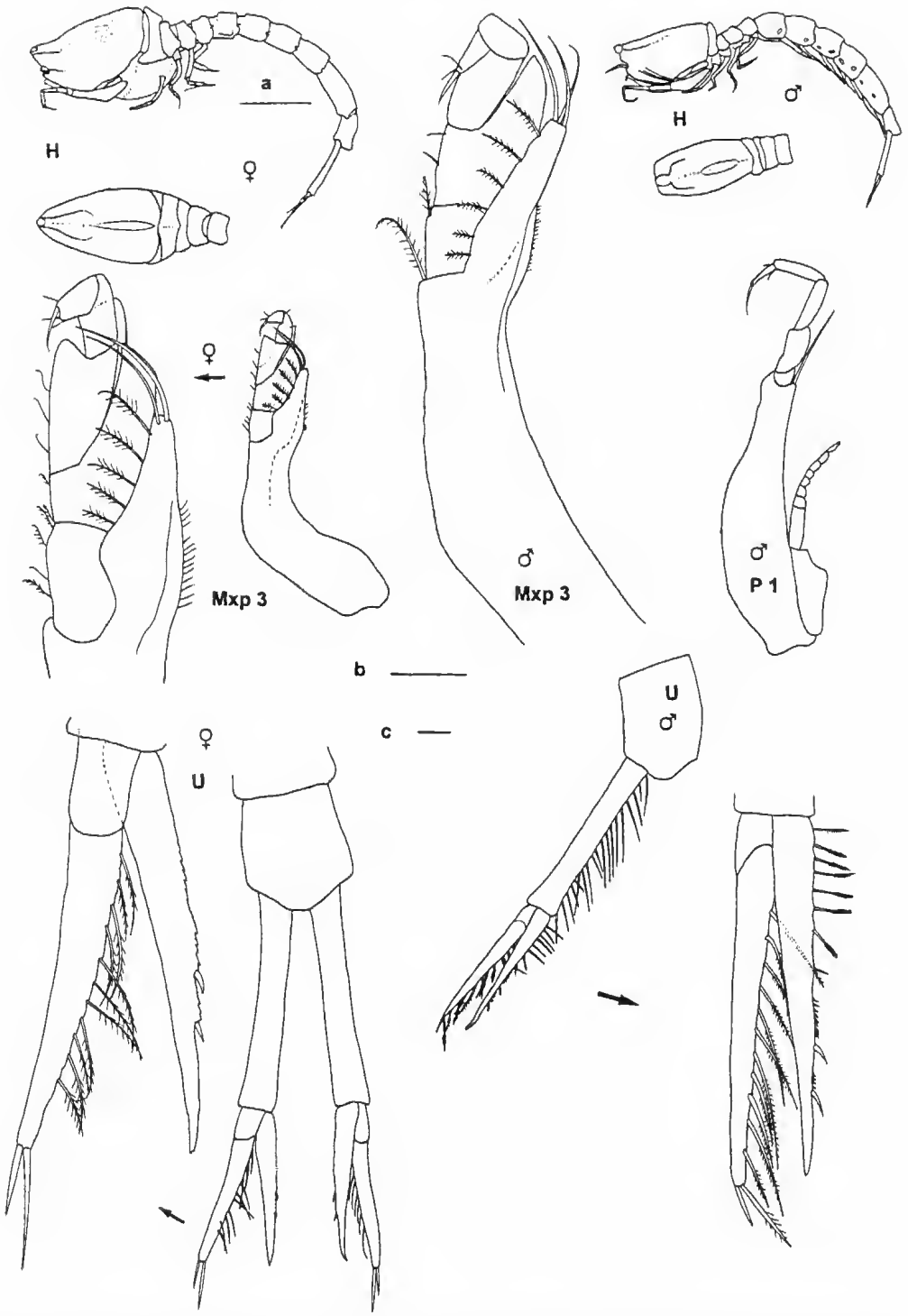

FIGURE 5: *Cyclaspis cottoni*: H: habitus ovigerous female and adult male, Mxp3: maxilliped 3, P1: pereiopod 1, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (Mxp3 male, Mxp3 female enlarged, male and female uropods enlarged), scale c: 0.1 mm (female Mxp3, P1, U).

ovigerous and 3 non-ovigerous females, 1 male (broken), 12 juveniles; SA: 129 (Port Augusta): 10 females, 4 males, 2 juveniles; VIC: 148: 1 ovigerous, 6 non-ovigerous and 7 juvenile females; ZMH K 39918.

Remarks

Hale (1937) described an ovigerous female and some years later (Hale, 1944) the male. The most striking characters are impressions at the termination of the anterior, clear-cut part of the dorsal carina and waviness of the double posterior portion of the carapace (Hale 1937; 1944). Hale stated the close position to *C. herdmani* Calman, 1904. It differs from that species in uropods' exopods distally being truncate with two terminal spines rather than acute as in *C. herdmani*.

The specimens from Tasmania (Figure 5) show the female's uropods' endopods proximal part appearing slightly serrated due to the scaly structure, and having two spines in the distal part, the exopod with 11 plumose setae at inner margin.

The male's endopods' proximal part has eight moderate long setae, the distal part being serrated with two distal spines, acute tip, the exopod with at least 11 plumose setae at inner margin, and the peduncle with 10 long plumose setae at proximal part, and 12 serrated setae at distal part.

Distribution

Extended to Tasmania, South Australia and Victoria.

Cyclaspis granulosa Hale, 1944

Material

Whiting Ground, Waterhouse Bay, east end Thistle Island, 4 March 1931, 8.0–8.3 fathoms; 4 males; SAM C 5989.

Remarks

The specimens from the collection of the South Australia Museum fit quite well the following characters given for *C. granulosa*; namely the roughened structure of the carapace, the shape of pereiopod 1, and the proportions and armature of the uropods.

Cyclaspis pura Hale, 1936

Material

Whalers Bay, Thistle Is., 3 February 1941, submarine light, leg. K. Sheard, 1 large, non-ovigerous, and 2 subadult females; SAM C 5990.

Remarks

The specimens belong to the 'levis group' and resemble closely the description of *C. pura* given in Hale (1936, 1944) in that the uropod's peduncle is only a little longer than the rami, without long setae, and the exopod has two terminal mucrones; the uropod's endopod is acute and in the present material has three marginal serrated spines distally, proximal part serrated; reticulation of carapace as figured in Hale's description.

Cyclaspis supersculpta Zimmer, 1921
(Figure 1)

Material

WA: 46: 4 subadult females, 6 juvenile females, 2 adult males, 15 juveniles; ZMH K 39919.

Remarks

Tafe & Greenwood (1996) described *C. chaunosculpta* (see below) as being very similar to *C. supersculpta* Zimmer, 1921, only differing in having (*C. supersculpta*) or not having (*C. chaunosculpta*) lateral bulges on either side of the median dorsal ridge of the carapace; *C. chaunosculpta* with more strongly developed transverse ridges than in *C. supersculpta*. Because of their variability, structures of the carapace are not reliable characters to separate species, "...since the ornamentation does not correspond uniformly with any other obvious distinguishing characters" (Day, 1978). Nevertheless, the ornamentation of the carapace is often used to separate species of the genus *Cyclaspis* (Tafe & Greenwood, 1996). To find out whether the two species *C. supersculpta* and *C. chaunosculpta* are synonyms, more detailed analyses, such as molecular studies, are necessary.

The present material resembles closely the figure in Zimmer (1921).

Cyclaspis strumosa Hale, 1948
(Figure 6)

Material

QLD: Lizard Island 1992: Turtle Bay (15 Nov., 15 m): 1 juvenile female, 1 adult male, 1 juvenile; Turtle Bay (12 Nov., 15 m): 1 juvenile female, 1 subadult male; sand (7 m): 1 subadult female, 2 juveniles; sand (10 m): 1 juvenile; Pidgin Point: 1 juvenile female; Mermaid Bay: 1 juvenile; ZMH K 39924.

Remarks

There are only two species described for

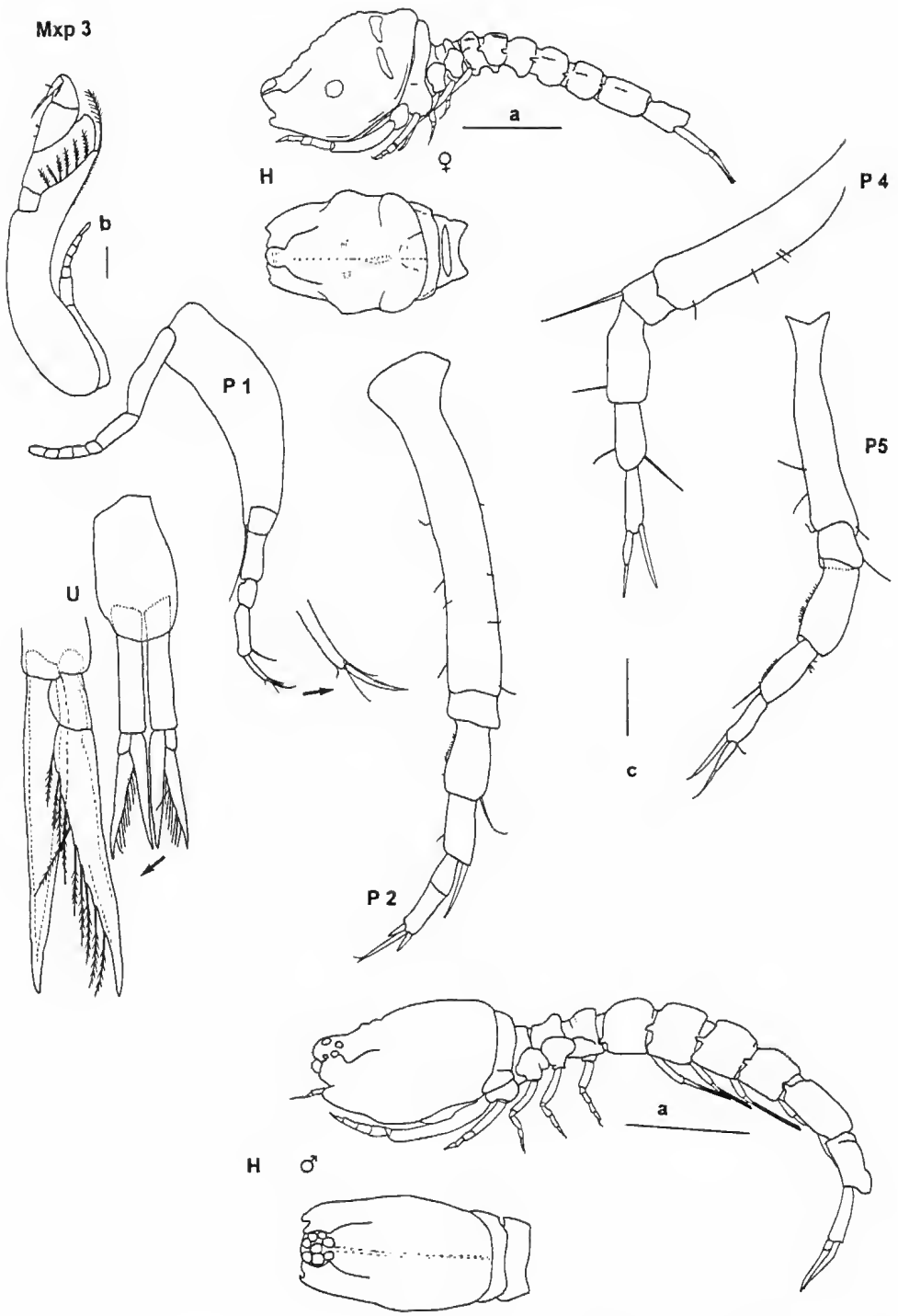

FIGURE 6: *Cyclaspis strumosa*: H: subadult female (above) and male (below) habitus from lateral, and carapace from dorsal; female extremities: Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H, female and male), scale b: 0.1 mm (Mxp 3, P1, U), scale c: 0.1 mm (P2, P4, P5).

Australian waters with an undulated dorsomedian line in the frontal lobes region: *Cyclaspis rudis* Hale, 1948 and *C. strumosa* Hale, 1948. Neither species is included in the determination key presented by Tafe and Greenwood (1996). *C. rudis* is among others characterised by a scaly structure of the carapace's integument. The specimens from Lizard Island resemble in most respects *C. strumosa*. The juvenile female's outline (total length 2.7 mm) from dorsal view with a swollen posterior part of the carapace given in Hale (1948) is different from the outline of the non-ovigerous female (total length 4.75 mm) from Lizard Island. The female's extremities are figured herein. They resemble – aside of the sexual differences typical for males like stouter basis in first pereiopod, and more setae at uropod's peduncle and endopod's inner margin – those of the male given by Hale (1948). The inner and outer margins of pereiopods 1 and 2 are not serrated as in Hale's figures.

Cyclaspis* cf. *strumosa Hale, 1948
(Figure 7)

Material

QLD: Lizard Island 1992: Mermaid Bay (7 m): 2 males; ZMH K 39925.

Description

Based on adult male, 4.3 mm in length.

Carapace 1.3 mm in length; ocular lobe wide, reaching tip of pseudorostral lobes; pseudorostral lobes not meeting in front of ocular lobe; siphonal tube very short; antennal notch narrow, subrostral tooth not acute; mediodorsal line a little undulated; free thoracic segments short, combined 0.7 mm in length, the last two with dorsal hump; abdomen 2 mm in length, longer than carapace and free thoracic segments combined; pleonite 6's proportion length to width 1.7.

First antenna basal article a little geniculated, longer than following two articles combined; accessory flagellum missing, main flagellum two-segmented, its basal article more than twice as long as distal, two terminal aesthetases; second antenna reaching end of body; mandible with four teeth at pars incisiva, 12 long and strong setae between pars incisiva and pars molaris.

Maxilliped 3 basis longer than rest of extremity, distal prolongation over articulation merus to carpus, ischium longer than body of merus, merus with wide and long distal prolongation reaching articulation carpus to propodus, carpus distally widened, as wide as length of propodus, dactylus short with stout terminal seta, exopod present; pereiopod 1 basis longer than rest of extremity, propodus second longest article, exopod present (not figured); pereiopod 2 basis subequal to rest of extremity, merus subequal in length to carpus, carpus with three outer distal serrated setae, propodus shorter than dactylus, the latter with two short and one distal setae, which is longer than dactylus; pereiopods 3 to 5 similar in shape, basis shorter than rest of extremities, merus to propodus subequal in length, dactylus short, distal seta at propodus at least equal in length to dactylus and its terminal seta combined; uropod's peduncle equal in length to pleonite 6, a little longer than unsegmented endopod (length proportion 1.1), 13 plumose setae at inner margin of peduncle and endopod as well, both rami with acute tip, no terminal seta.

Female unknown.

Remarks

The specimens from Lizard Island resemble the species described by Hale (1948), but differ from the described adult male in basis, merus and carpus of pereiopod 1 and 2, and uropods' endopods having no serration.

Cyclaspis* cf. *agrenosculpta Tafe & Greenwood, 1996
(Figure 8)

Material

QLD: Lizard Island 1992: Turtle Bay (15 m, sand): 1 subadult and 1 juvenile female; Watson's Bay (17 m): 1 female with developed oostegites; ZMH K 39921.

Remarks

Female (subadult, total length 7.62 mm) from Watson's Bay, with right uropod's endopod's subacute tip a little damaged, inner margin serrated with nine hyaline 'teeth'; exopod with 11 plumose setae, subacute tip, rami equal in length, longer than peduncle, length proportion peduncle to rami 0.78, length proportion peduncle to pleonite 6 is 0.81; these specimens from Lizard Island differ from those described by Tafe & Greenwood (1996) in having uropod's rami equal in length instead of exopod longer, and peduncle shorter instead of longer than rami and pleonite 6, respectively, in Moreton Bay specimens. Habitus, shape of first and second pereiopods, sculpturing of carapace and structure of integument are the same in Lizard Island and Moreton Bay females, so they seem to be conspecific. Additional figures

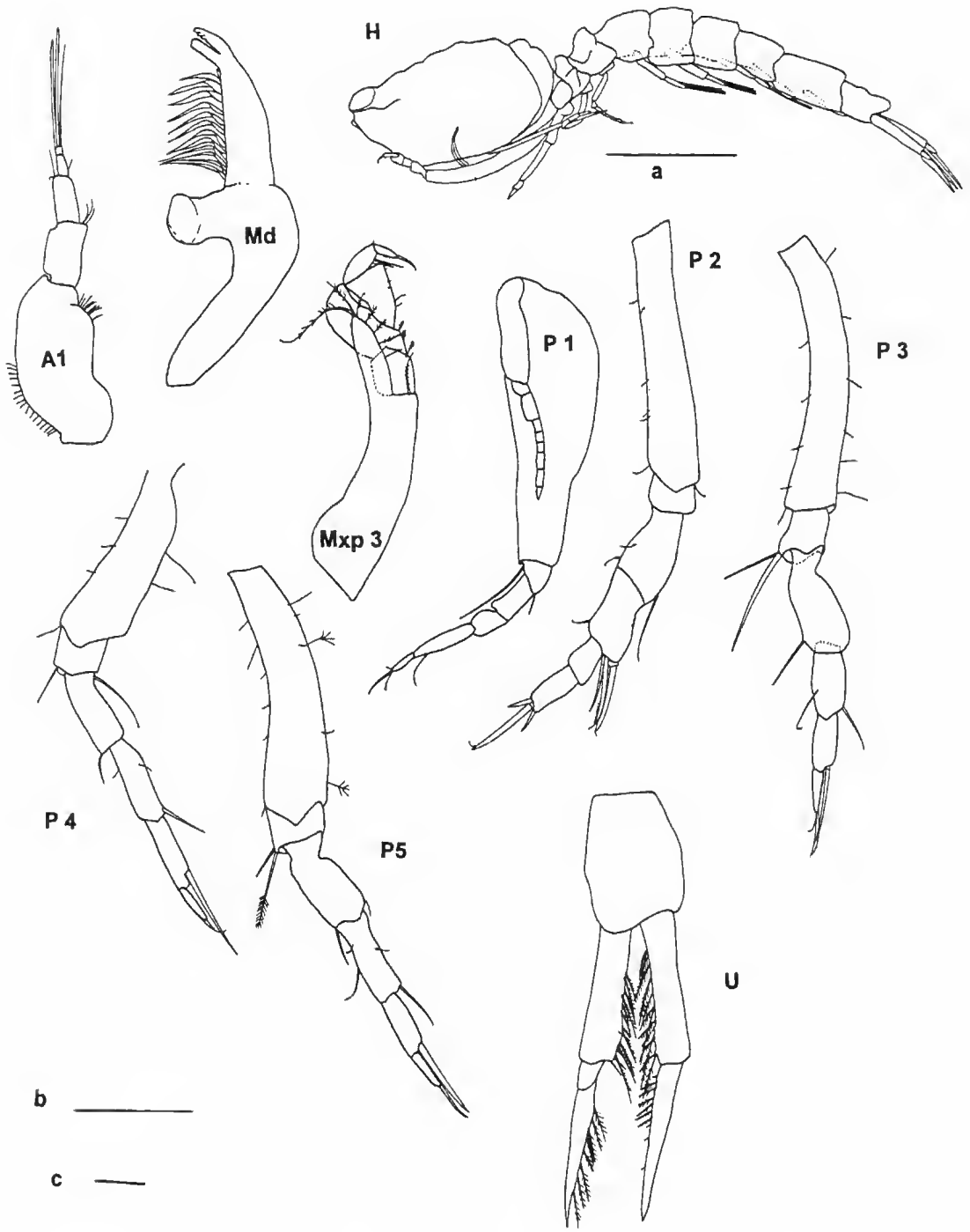

FIGURE 7: *Cyclaspis* cf. *strumosa* male: H: habitus, Md: mandible, A1: first antenna, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods, left exopod and right endopod figured. Scale a: 1 mm (H), scale b: 0.1 mm (A1, Md, P2, P3, P4, P5), scale c: 0.1 mm (Mxp 3, P1, U).

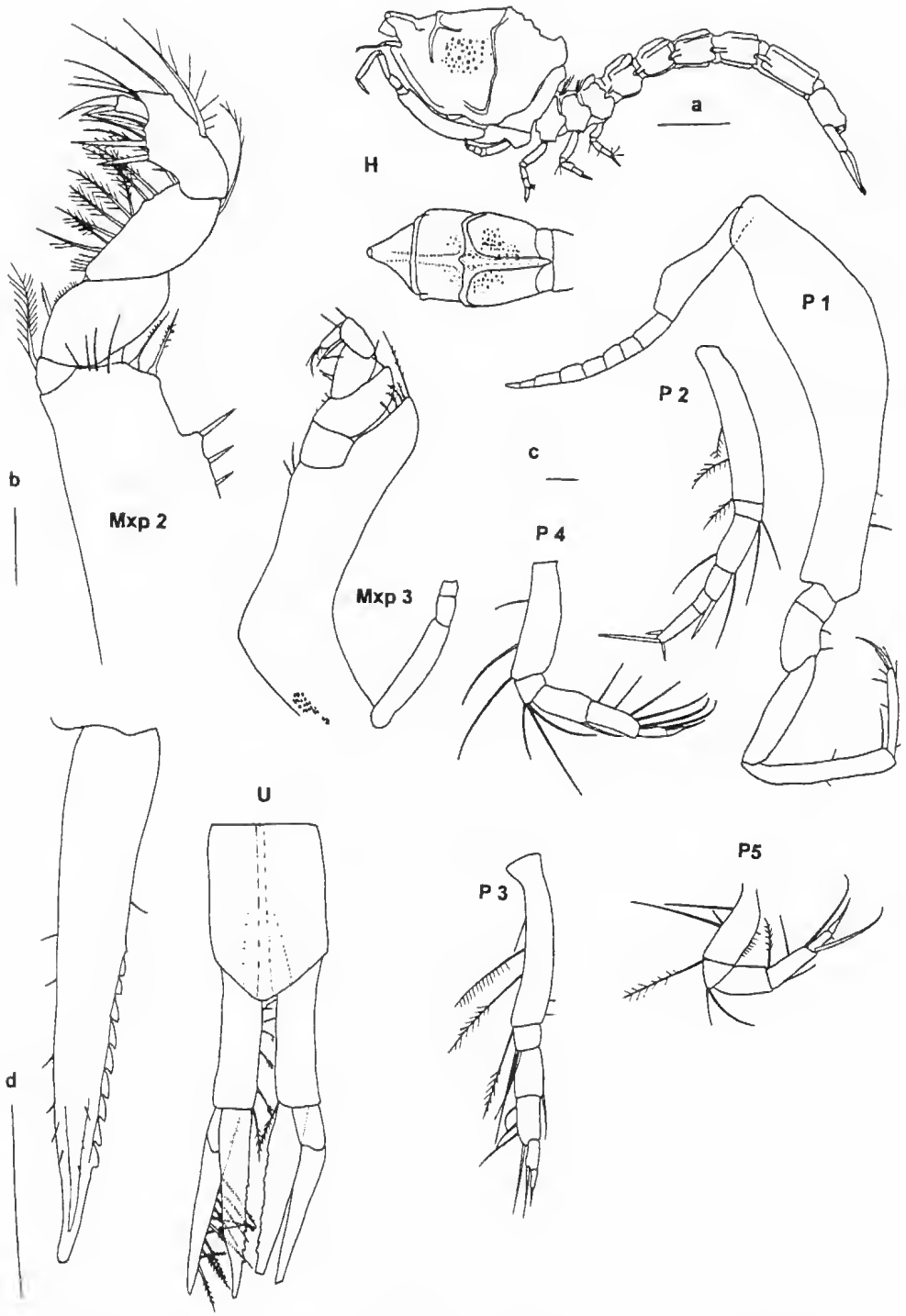

FIGURE 8: *Cyclaspis* cf. *agrenosculpta* subadult female: H: habitus, Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (Mxp2), scale c: 0.1 mm (Mxp 3, P1, P2, P3, P4, P5, U), scale d: 0.1 mm (uropod's endopod enlarged).

of maxilliped 2 and 3, and pereiopods 1 to 5 are given herein (Fig. 8).

Cyclaspis lissa sp.n.
(Figures 9 and 10)

Material

1 juvenile male, 12 juveniles; WA-27: 1 subadult female, 1 subadult male, 4 juveniles; WA-28: 2 juvenile specimens; WA-39: 2 subadult males, 1 subadult female, 2 juveniles; WA-66: holotype: 1 ovigerous female, paratypes: 1 ovigerous female, 2 males, additional specimens: 5 ovigerous and 20 subadult females, 2 adult and 6 subadult males, 24 juveniles; WA-67+68: 1 subadult female; ZMH K 39926. WA-10: 4 ovigerous females, 3 subadult and 5 juvenile females; SAM C 6078.

Holotype: female ZMH K 39927, K 39928: extremities of paratypes female and male

Leg.: G. Hartmann & G. Hartmann-Schröder

Date: 21 October 1975

Locus typicus: Western Australia, Drummonds, close to Geraldton, fine sand

Paratypes: 1 female used for dissection, 1 male, 1 male used for dissection.

Diagnosis

Cyclaspis with no ridges, pits or tubercles on the carapace in female, in male no distinct humps near the dorsal end of carapace, no granular structure on the carapace; very short pseudorostral lobes hardly meeting in a point in front of the ocular lobe; basis of pereiopod 1 without distal tooth and longer than the rest of extremities; uropod's peduncle longer than pleonite 6, and longer than exopod; uropod's exopod slightly longer than endopod; uropods' rami ending with acute tips, no terminal setae or mucrones.

Description

Based on holotype, ovigerous female, total length 3.4 mm.

Carapace smooth, dorsomedian carina present, not pronounced; pseudorostrum very short, meeting in a point in front of ocular lobe; siphonal tube short; antennal notch very small, small subrostral tooth acute; integument calcified; ocular lobe present. Four thoracic segments visible from above, first segment visible in ovigerous female only from lateral, free thoracic segments nearly half as long as carapace; abdomen as long as carapace and thoracic segments combined; pleonite 6 is 1.4 times longer than wide, shorter than uropod's peduncle.

Description of extremities based on paratype, ovigerous female.

Maxilliped 2 basis longer than rest of extremity; merus, carpus and propodus of similar length, dactylus shorter, with stout terminal seta; maxilliped 3 with exopod, geniculated basis longest article, with distal process reaching joint merus to carpus, ischium short, merus with distal process reaching joint carpus to propodus, carpus widened, propodus stout, shorter than carpus, with two terminal setae, dactylus short and stout with stout terminal seta, two subterminal setae.

Pereiopod 1 basis slender, longer than rest of extremity, merus a little longer than ischium, carpus and propodus subequal in length, both a little longer than merus, dactylus slender with one terminal and two subterminal slender setae, exopod present; pereiopod 2 basis shorter than rest of extremity, ischium short, merus second longest article, dactylus subequal in length to merus, with one terminal and two subterminal setae; pereiopod 3 basis about as long as rest of extremity, ischium a little shorter than merus, both articles combined a little shorter than carpus, propodus as long as merus, dactylus slender, similar to terminal seta of propodus; pereiopod 4 basis shorter than rest of extremity, carpus second longest article, dactylus half as long as terminal seta, both combined as long as terminal seta of propodus; pereiopod 5 carpus second longest article after basis, dactylus as long as terminal seta of propodus. Uropod's peduncle without spines at inner margin, longer than exopod, unsegmented endopod shorter than exopod; both rami with acute terminal ending; endopod with 6 serrated spines, exopod with 6 setae at inner margin.

Male: Pseudorostral lobes hardly meeting in a point in front of ocular lobe. Male has developed pleopods of same length as holotype; carapace shorter than in female, abdomen longer than carapace and free thoracic segments combined, four pedigerous thoracic segments visible.

Male's extremities differ from female's — extremities are longer and basis of pereiopod 1 stouter. Uropod's peduncle 1.7 times longer than pleonite 6, inner margin with 18 plumose setae, exopod longer than endopod, the latter with 11 short and proximally with two long setae.

Etymology

The new species is named after the smooth structure of the carapace.

Remarks

Many species of the genus *Cyclaspis* have no

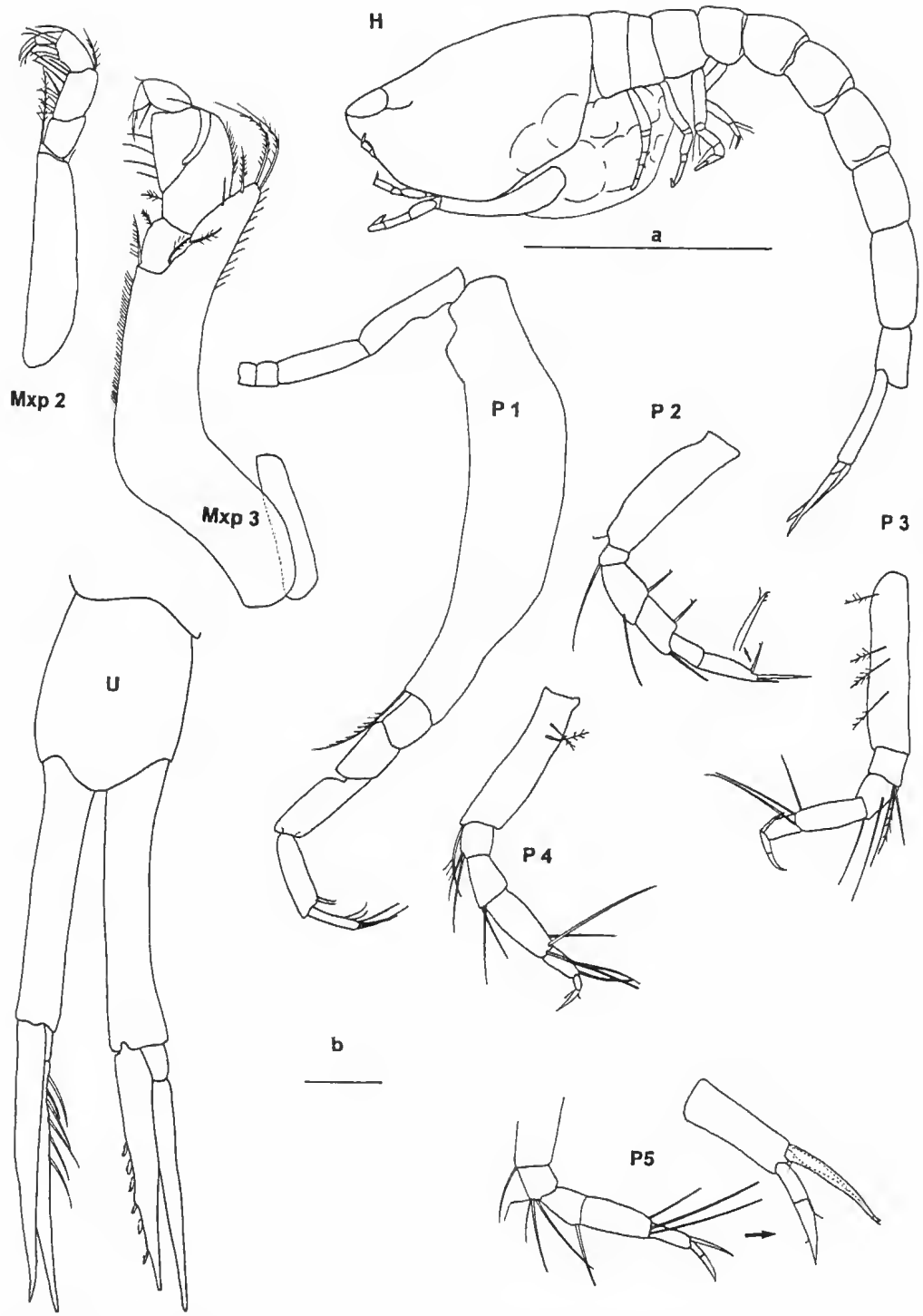

FIGURE 9: *Cyclaspis lissa* sp.n. ovigerous female: Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (Mxp2, Mxp3, P1, P2, P3, P4, P5, U).

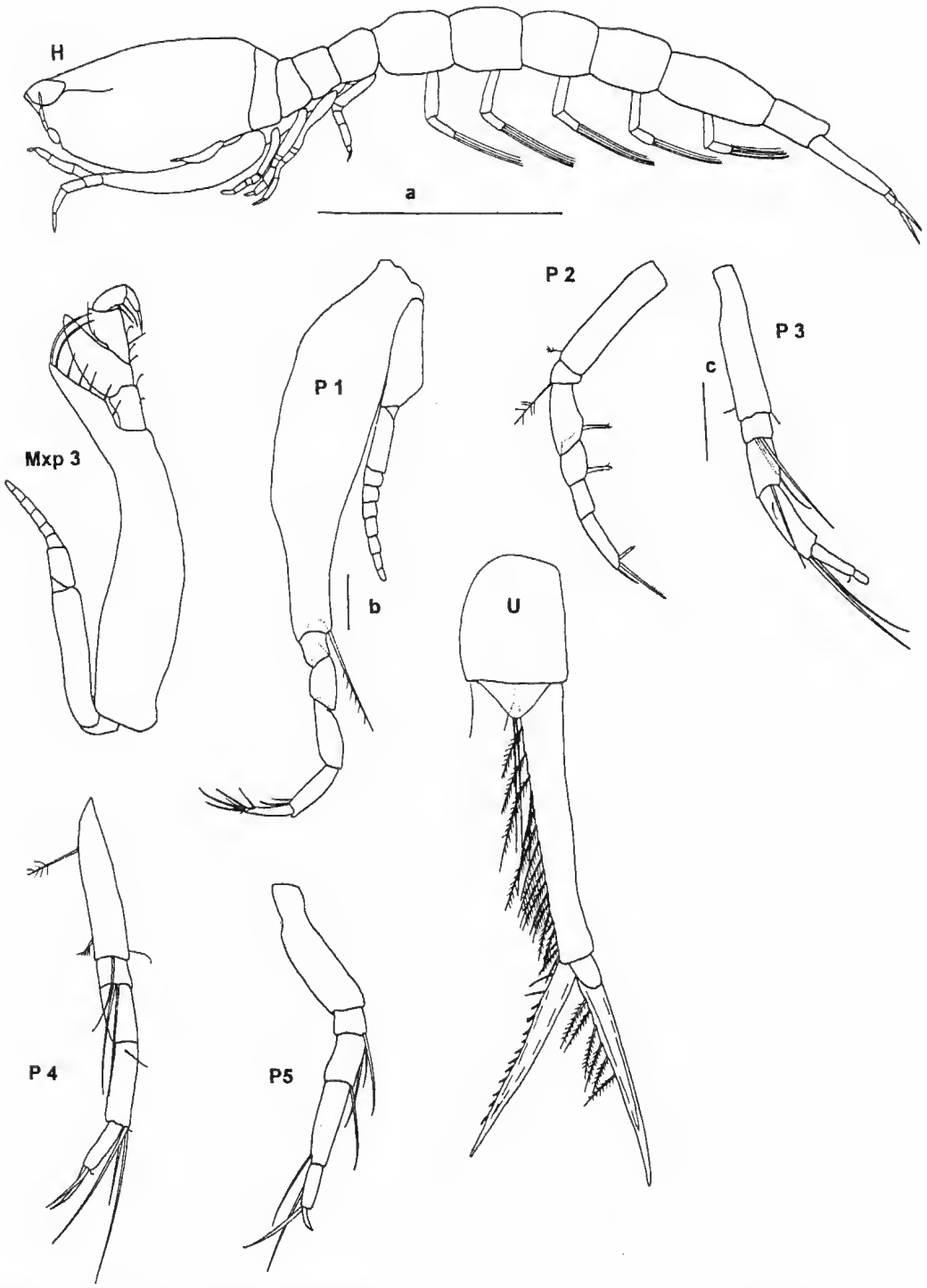

FIGURE 10: *Cyclaspis lissa* sp.n. adult male: H: habitus, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods (the two long 'setae' between the uropods peduncles belong to the antenna's flagella). Scale a: 1 mm (H), scale b: 0.1 mm (Mxp3, P1, U), scale c: 0.1 mm (P2, P3, P4, P5).

ridges, pits or tubercles on the carapace. Hale (1944) erected a key to these species in his section 1. In this section he separated the 'picta group' with eyes developed and the pseudorostral lobes meeting for an appreciable distance in front of the ocular lobe, and the 'levis group' with pseudorostral lobes barely or not meeting in front of the ocular lobe. Tafe & Greenwood (1996) followed him in their emended key. Thirty-five *Cyclaspis* species with a smooth carapace are currently known. Only two species out of these have the following character combination as in the species described above:

1) uropods' rami ending with acute tips, no setae or mucrones
2) very short pseudorostrum or pseudorostral lobes hardly meeting in front of ocular lobe
3) uropod's peduncle longer than pleonite 6
4) uropod's peduncle longer than exopod
5) uropod's exopod longer than endopod
6) basis of pereiopod 1 without distal tooth and longer than the rest of extremities.

The combination of these characters is given in *Cyclaspis sheardi* Hale, 1944. The new species is close to *C. sheardi* because of the terminal seta of pereiopod 2 being longer than dactylus in both species. It differs from *C. sheardi* in not having distinct humps near the dorsal end of carapace in males, and in the absence of a granular structure on the carapace. The pseudorostral lobes in males in *C. sheardi* are very short but clearly meet in front of carapace, whereas they hardly do in *C. lissa* sp.n.

Cyclaspis ursulae sp.n.
(Figures 11 and 12)

Material

WA: 23: 2 subadult females, 1 adult and 1 subadult male, 8 juveniles; WA-30: 28 juveniles; WA-37: 1 ovigerous and 1 subadult female, 1 adult and 7 subadult males, 17 juveniles; ZMH K 39923. WA- 4+15: 2 subadult females, 1 subadult male, 4 juveniles; SAM C 6079.

Habitus: ovigerous female holotype, subadult and adult male

Extremities: WA-23 adult male total length 5.4 mm, pleon damaged; WA-14+15 female with developing oostegites, only carapace to first pleonite, carapace length 1.6 mm.

Holotype: ovigerous female ZMH K 39922a, ZMH K 39922b; extremities of paratypes

Leg.: G. Hartmann & G. Hartmann-Schröder

Date: 2 October 1975

Locus typicus: 7 km east of Dampier, Horsines Cove

Diagnosis

Cyclaspis with quadrilateral area on each side of the carapace defined by ridges, the anterior transversal ridge not crossing the frontal lobe of the carapace of the female, pitted carapace structure in female, unsegmented uropod's endopod acute, uropod's exopod with two distal spines.

Description

Based on the holotype, 5.6 mm length in total.

Carapace seen from lateral with two transverse ridges, the anterior not crossing the frontal lobe, but turning backwards to meet the two 'horns' reaching forwards, formed by posterior ridge; seen from dorsal transverse ridges do not cross dorsomedian ridge but run parallel to it in posterior part; pseudorostral lobes do not meet in front of elongated ocular lobe; siphonal tube short, dorsomedian line a little pronounced; antennal notch small, anterolateral margin smooth, anteroventral margin of carapace smooth, integument reticulate, well calcified; eyes present; four free thoracic segments visible, the first of them (second pedigerous segment) with dorsal prolongation, carapace and free thoracic segments combined 2.81 mm in length.

Abdomen about same length as carapace and free thoracic segments combined, with lateral articular processes and dorsally a faint ridge reaching the fifth pleonite; pleonite 6 shorter than peduncle of uropod, length proportion of peduncle to pleonite 6 is 1.38.

Description of extremities based on paratype (WA-14+15) subadult female, carapace and free thoracic segments combined 2.53 mm in length, abdomen missing.

First antenna basis only a little geniculated, longer than two following articles, outer margin hairy, distal article second longest; main flagellum two-segmented with four aesthetascs and two short setae, accessory flagellum short, less than half as long as main flagellum's basal article, with two short setae. Maxilliped 2 basis longer than rest of extremity, distal inner part with one strong spine, merus distal inner part with one long plumose seta reaching distal end of carpus, this article second longest, at inner margin four strong plumose setae; propodus with four pairs of plumose (only one row figured) setae at inner margin, dactylus short with strong terminal spine; maxilliped 3 basis a little geniculated, distal outer

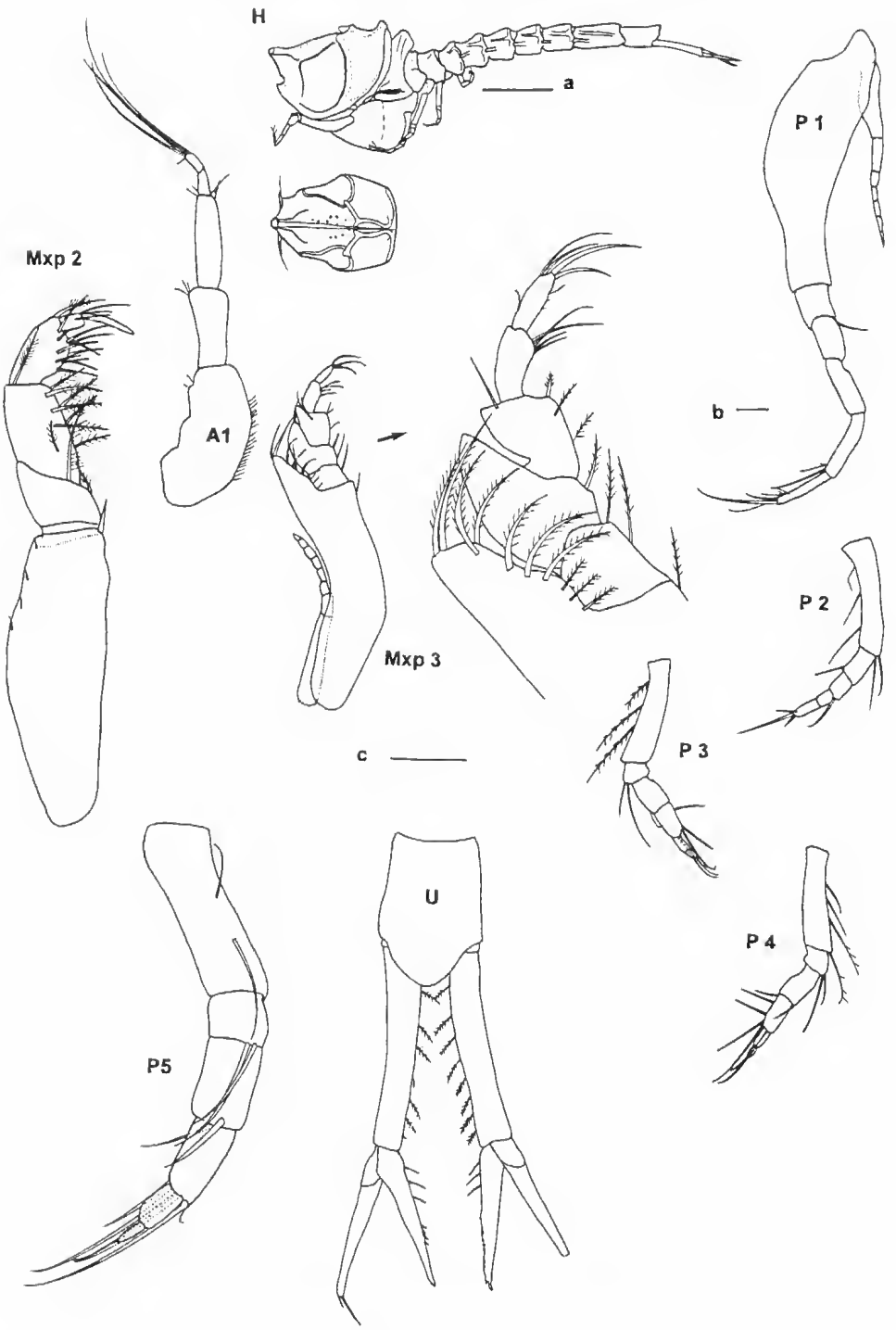

FIGURE 11: *Cyclaspis ursulae* sp.n. ovigerous female: H: habitus, subadult female A1: antenna 1, Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (Mxp3, P1, P2, P3, P4, U), scale c: 0.1 mm (A1, Mxp 2, Mxp 3 distal part, P5).

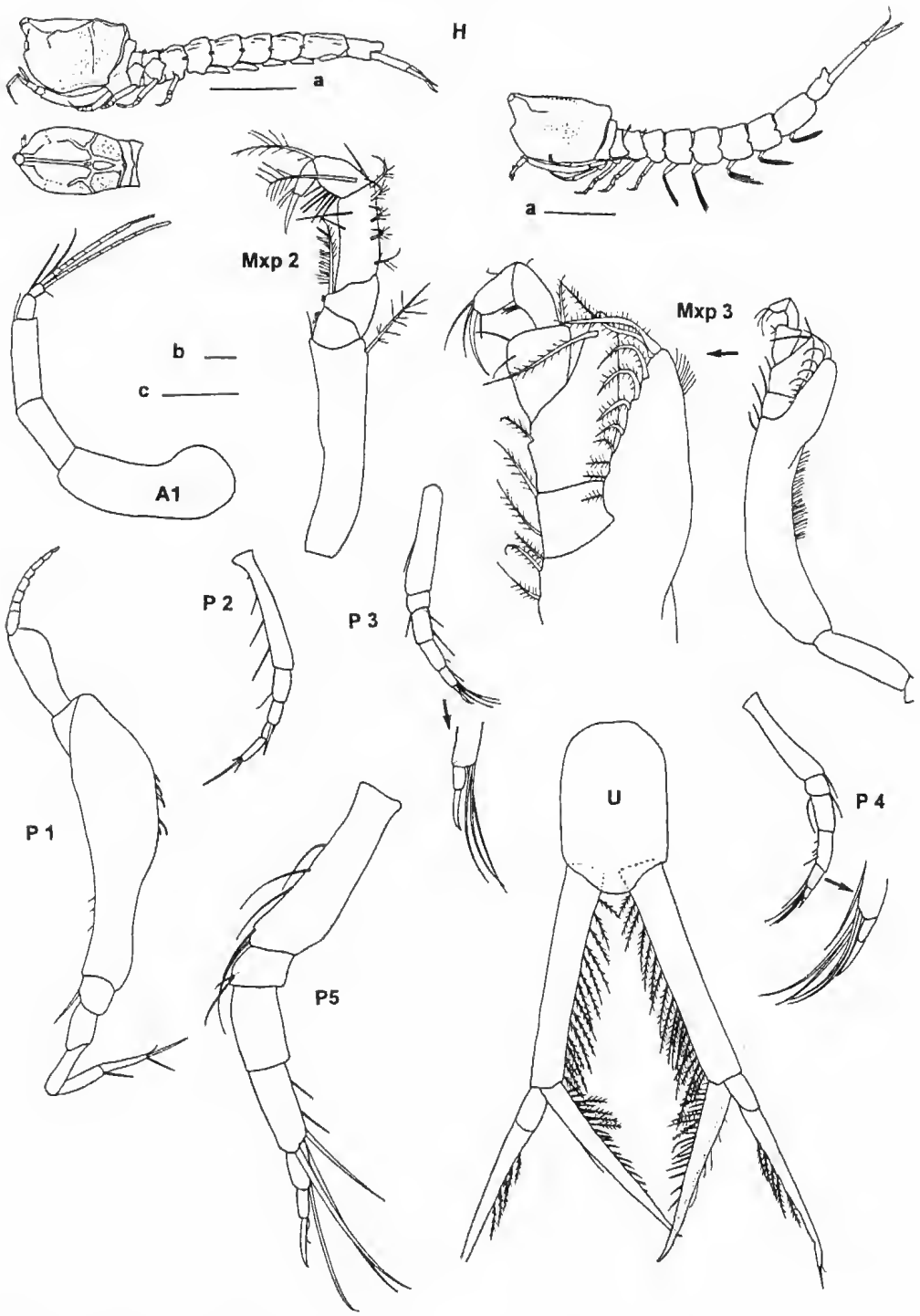

FIGURE 12: *Cyclaspis ursulae* sp.n. male: H: habitus subadult (left) and adult (right) male, subadult male A1: antenna 1, Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (Mxp3, P1, P2, P3, P4, U), scale c: 0.1 mm (A1, Mxp 2, Mxp 3 distal part, P5).

prolongation reaching distal third of merus, prolongation with ten plumose setae; merus outer distal prolongation reaching articulation carpus to propodus; carpus second longest article with strong simple spine at outer and plumose seta at inner distal margin, propodus a little longer than dactylus, dactylus with four terminal spines, one of them strong; exopod present.

Pereiopod 1 basis subequal in length to distal articles combined, ischium equal in length to merus, propodus second longest article, slender dactylus a little shorter than carpus, with three terminal setae, one of them stronger; exopod present. Pereiopod 2 basis longer than rest of extremity, ischium missing, merus second longest article, carpus with one strong distal seta, dactylus longer than carpus, with one strong terminal seta more than twice as long as dactylus, and two subterminal setae.

Pereiopod 3 basis shorter than rest of extremity, ischium with two distal setae, one of them reaching beyond articulation carpus to propodus, merus and carpus equal in length, carpus with two distal setae, two of them reaching to tip of dactylus' strong terminal seta. Pereiopod 4 similar to pereiopod 3. Pereiopod 5 basis shorter than rest of extremity, ischium with two long distal setae, merus with one strong distal spine, carpus with three distal setae, two of them reaching further than dactylus' strong terminal seta.

Uropod's peduncle longer than pleonite 6, and 1.4 times longer than endopod, inner margin with seven or eight simple setae, endopod with three setae at proximal part of inner margin, distal part serrated and with five or seven spines, tip subacute; exopod longer than endopod, inner margin appearing serrated due to scaly structure, one long and one shorter terminal seta.

Adult (5.1 mm in length) and subadult (4.6 mm in length) males (WA-37).

Carapace smooth in adult, sculptured in female as in subadult male, pleonite 6 shorter than uropod's peduncle.

Description of extremities based on male paratype (WA-23). First antenna as in female but first article of peduncle longer and more slender, accessory flagellum minute with three aesthetascs.

Maxilliped 2 as in female, basis with one, propodus with additional two strong plumose setae, carpus with plumose setae at outer margin; maxilliped 3 as in female; pereiopod 1 as in female, basis with 5 spines; pereiopod 2 as in female, basis longer and more slender; pereiopods 3 to 5 as in female; uropods, aside from sexual differences (numerous setae at inner margins of peduncle and rami), as in female.

Etymology

The species is named in memory of Ursula Heuer, the co-collector of the material from Indonesia.

Remarks

The new species and the three species mentioned before belong to the *exsculpta*-group of section 2 (Hale, 1944; Tafe & Greenwood, 1996). This group contains 18 species with a quadrilateral area on each side of the carapace defined by ridges or tubercles, distinct and depressed in females, often indistinct in males (Tafe & Greenwood, 1996). This group can be extended by two species, *C. strumosa* and *C. rudis*. From these species only males or young females are known; the females might show the typical transverse folds while the males have carapace structures like males of other species of the *exsculpta*-group. Within the *exsculpta*-group there is a species subgroup with very similar characters: *C. chaunosculpta* Tafe & Greenwood, 1996, *C. persculpta* Calman, 1905, *C. supersculpta* Zimmer, 1921, *C. tribulis* Hale, 1928, *C. exsculpta* Sars, 1887, *C. usitata* Hale, 1932, and *C. alveosculpta* Tafe & Greenwood, 1996.

A comparison of characters of selected species within the *exsculpta*-group is given in Table 2, not including species with big lateral horns as in *C. aspera* Hale, 1944 and *C. bovis* Hale, 1928, and species with aberrant ridges at carapace like *C. australis* Sars, 1887, *C. indoaustralica* Bacescu, 1992 and *C. similis* Calman, 1907.

The new species resembles *C. ornosculpta* Tafe & Greenwood, 1996 from Moreton Bay, Queensland. The main character differing between the two species is the anterior transverse ridge not crossing the frontal lobe of the carapace of the female in *C. ursulae* sp.n.

Genus ***Mossambicuma*** Day, 1978

Mossambicuma victoriae sp.n.

(Figures 13 and 14)

Material

VIC: 165: 2 females, 2 males, 1 exuvia; ZMH K 39934. 1 male; SAM C 6080.

Holotype: ovigerous female; ZMH K 39932. ZMH K 39933: extremities of paratypes

TABLE 2: Character comparison of the *exsculpta*-group of the genus *Cyclaspis*. C: carpus, M: merus.

***Exsculpta*-group**	***C. agrenosculpta***	***C. alveosculpta***	***C. candida***	***C. chaunosculpta***	***C. ursulae* n.sp female and subad. male**	***C. ursulae* n.sp adult male**
uropod's endopod	bluntly pointed	acute	acute	acute	acute	acute
uropod's exopod	acute	acute or tiny mucro	acute	acute	spine	2 spines
longest ramus	exopod	equal	exopod	equal	exopod	exopod
Length proportion						
peduncle:pleonite 6, male	1.3	0.9	1.2	0.8	1.3	1.4
peduncle:pleonite 6, female	1.0	0.7	–	–	1.4	–
peduncle:endopod, male	1.1	0.8	about 1	0.8	1.2	1.2
peduncle:endopod, female	1.1	0.7	–	–	1.4	–
setae at endopod, male	11 short, 21 long plumose	13 spines, 27 long	plumose setae	9 spines, 12 plumose	4 long, 15 short	4 long, 17 serrated
setae at endopod, female	1 stout, 7 short	11 short	–	–	3 long, 7 spines	–
pereiopod 1	C longer M	C longer M	–	C longer M	C longer M	C longer M
no. of spines at basis, male	18	27	0?	21	–	5
long setae at pereionites	3 to 5	no	3 to 5	3 and 4	3 and 4	3 to 5
structure of carapace	reticulate	reticulate	?	pitted, sponge like	pitted	reticulate
Carapace ridges						
transverse in female	2	2	–	2, first not pronounced	2, not meeting on frontal lobe	2 lateral, 1 from dorsal
transverse in male	2	–	2?	–	–	no
longitudinal	–	humps in female	–	one hump in both sexes	–	1 pair
dorsomedian carina	present	present	–	present	present	present

***Exsculpta*-group**	***C. supersculpta* WA 46**	***C. supersculpta***	***C. exsculpta***	***C. mawsonae***	***C. tribulis***	***C. usitata***
uropod's endopod	acute	acute	acute	acute	acute	acute
uropod's exopod	acute	acute	mucro	acute	acute	acute
longest ramus	subequal	equal	equal	exopod	equal	equal
Length proportion						
peduncle:pleonite 6, male	1	–	0.6	1.2	–	–
peduncle:pleonite 6, female	0.8	0.4	–	–	1	0.8
peduncle:endopod, male	0.9	–	0.6	1.1	–	–
peduncle:endopod, female	0.8	0.6	–	–	1	0.9
setae at endopod, male	7 spines, 7 teeth, 28 plumose	–	4 short, 13 long	7 short, 22 long plumose	–	–
setae at endopod, female	5–6 hairy setae	serrated margin	–	–	14 short spines?	7 short spines
pereiopod 1	C longer M	C equal to M	C longer M	C longer M	C longer M	C longer M
no. of spines at basis, male	15	?	0	0	0	0
long setae at pereionites	3 and 4	3 and 4	3 and 4	3.00	no	no
structure of carapace	–	reticulate	reticulate	reticulate	reticulate	reticulate
Carapace ridges						
transverse in female	–	2	–	–	2	2
transverse in male	–	–	2	1?	–	–
longitudinal	–	–	2 pairs	1 pair	1 pair	–
dorsomedian carina	–	present	present	present	present	present

TABLE 2. (continued)

Exsculpta-group	*C. elegans*	*C. ornosculpta*	*C. prulifica*	*C. persculpta*	*C. rudis*	*C. strumosa*
uropod's endopod	acute	acute	acute	acute	acute	acute
uropod's exopod	spine	with spine	?	acute	acute	acute
longest ramus	subequal	exopod	exopod?	equal	equal	endopod
Length proportion						
peduncle:pleonite 6, male	1.0	1.1	–	–	1	1.1
peduncle:pleonite 6, female	0.8	1.1	–	0.8	–	–
peduncle:endopod, male	1.1	1.3	–	–	0.67	0.9
peduncle:endopod, female	0.9	1.4	1.0	0.8	–	–
setae at endopod, male	18 plumose	7 spines, 12 plumose	?	–	4 setae, 12 long setae	2 stout, 10 slender, serrated
setae at endopod, female	serrated, 5 plumose setae	2 plumose, serrated margin	4 short, serrated	3 spines, serrated	–	–
pereiopod 1	C longer M	C longer M	C longer M	?	C longer M	C shorter M
no. of spines at basis, male	0	0	?	?	0	0
long setae at pereionites	no	no	no	3 and 4	2	no
structure of carapace	?	reticulate	reticulate	pitted	scaly	pitted
Carapace ridges						
transverse in female	2	2	2	2	–	–
transverse in male	2	–	?	–	no	slightly 2 pairs
longitudinal	2 pairs	1 lateral pair	–	2 pairs	1 pair	no
dorsomedian carina	present	present, pronounced	pronounced	present	present	present
Remarks	–	–	–	2 horns at middle	–	–

Leg.: G. Hartmann & G. Hartmann-Schröder
Date: 18. January 1976
Locus typicus: Australia, Victoria, southern dead end of Clarence River, near Yamba, brackish water and mangroves
Paratypes: female and male for dissection of extremities.

Diagnosis

Mossambicuma with long siphonal tubes separated but close together; no abrupt border between carapace and second pereionite in female; uropods' peduncles shorter than pleonite 6 and rami; third maxilliped basis and merus with long distal prolongations; basis of pereiopod 1 geniculated; pereiopod 2 distal seta longer than dactylus.

Compared to the other species of this genus, in *M. elongatum* the basis of third maxilliped is shorter and more geniculated, both basis and merus of third maxilliped having a longer distal prolongation in the new species.

Description

Based on the holotype, an ovigerous female, length 2.7 mm.

Carapace compressed, longer than free thoracic segments, first segment fused, lateral ridge running from below frontal lobe dorsoposterior to dorsomedian line; pseudorostrum long, siphonal tubes long, separated but close together. Dorsomedian line pronounced in anterior half, less pronounced in posterior part where lateral ridge runs parallel to dorsomedian line, very last part of carapace without ridge or pronounced dorsomedian line; antennal notch shallow; anterolateral margin smooth; anteroventral margin of carapace smooth; integument weakly pitted; eyes present.

Four thoracic segments visible; abdomen 1.1 times longer than carapace and thoracic segments combined; pleonite 6 is 1.5 times longer than uropods' peduncles and 1.4 times longer than wide.

Description of extremities, based on paratype, ovigerous female, length 3 mm. First antenna long, mid article 1.1 times longer than basal one, both combined 1.1 times longer than distal one; main flagellum two-segmented, terminal with one aesthetasc and one short, two long setae, accessory flagellum reduced, replaced by one seta; maxilliped 3 basis geniculated, with long and

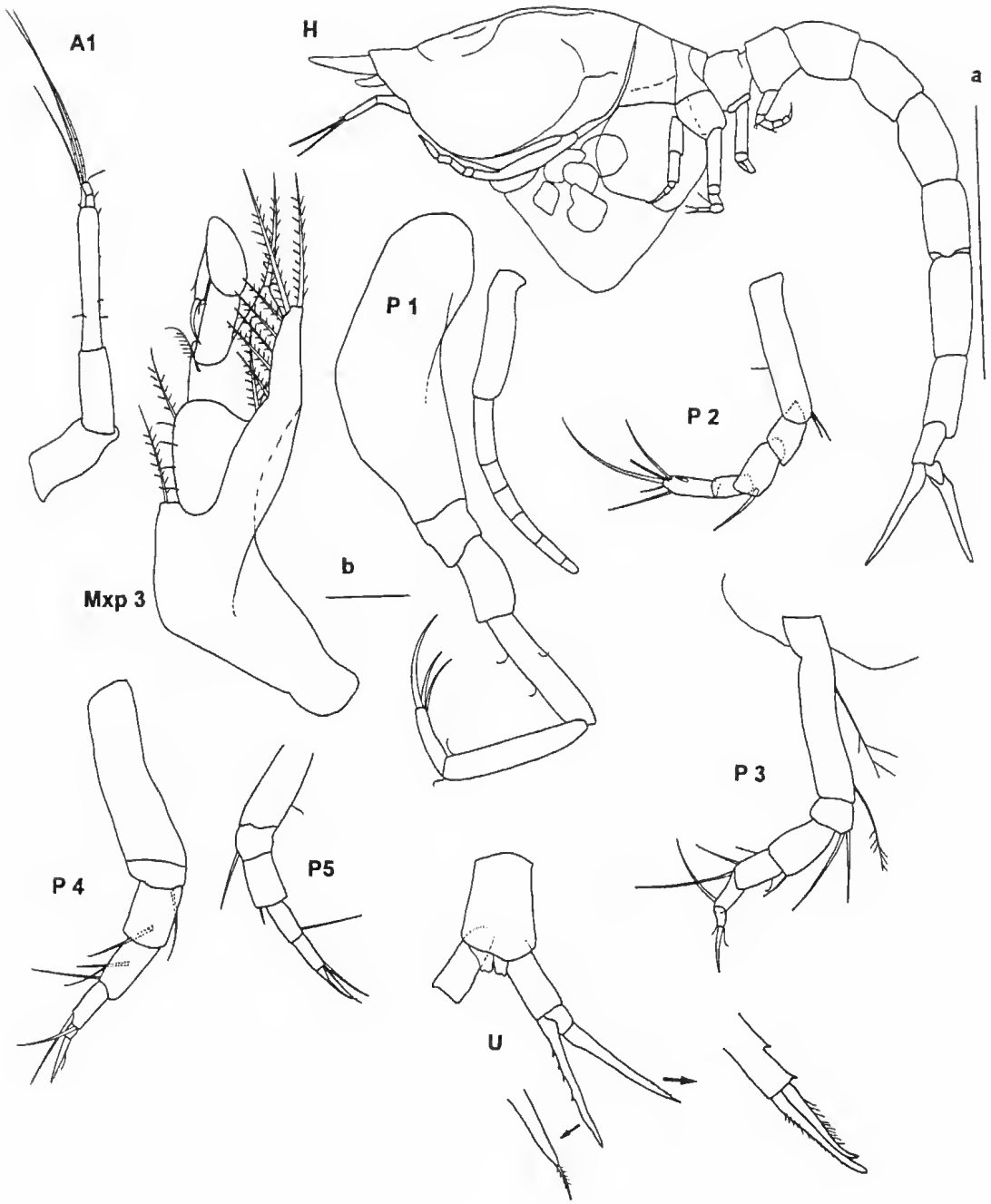

FIGURE 13: *Mossambicuma victoriae* sp.n. ovigerous female: H: habitus, A1: first antenna, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (A1, Mxp3, P1, P2, P3, P4, P5, U).

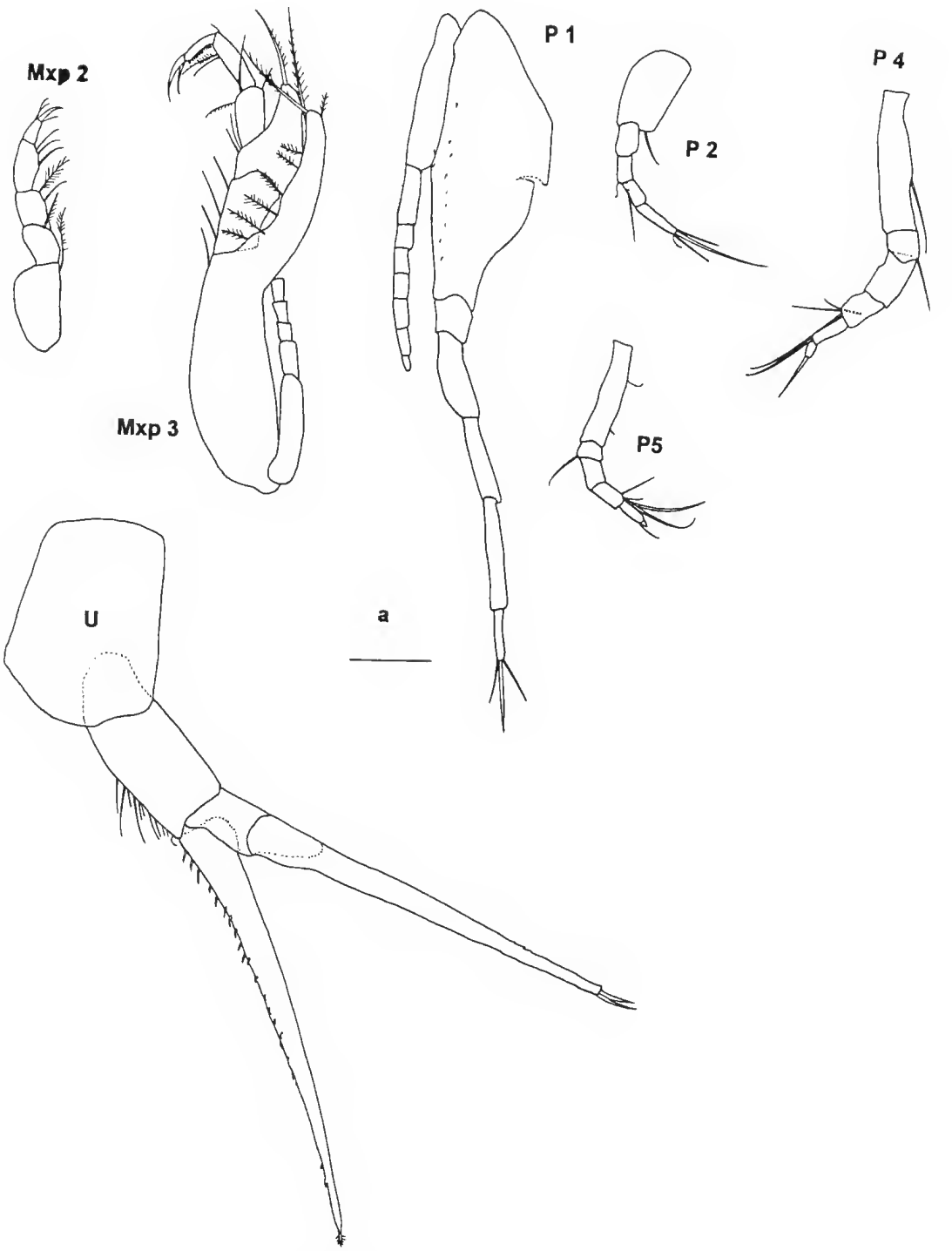

FIGURE 14: *Mossambicuma victoriae* sp.n. male: Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 0.1 mm (Mxp2, Mxp3, P1, P2, P4, P5, U).

wide outer distal prolongation carrying eight plumose setae at inner margin, the two distal ones very long, prolongation almost reaching articulation carpus to propodus; ischium longer than merus, the latter with long and wide outer distal prolongation reaching articulation carpus to propodus, propodus egg shaped, dactylus slender with terminal claw-like seta, exopod present (not figured); pereiopod 1 basis shorter than rest of extremity, slightly geniculated, ischium shorter than merus, both articles combined shorter than carpus, propodus second longest article, dactylus with three terminal setae, exopod present; pereiopod 2 basis shorter than rest of extremity, ischium missing, merus equal in length to dactylus, longer than propodus but shorter than carpus, terminal seta longer than dactylus; pereiopod 3 basis equal in length to rest of extremity, distal seta of carpus reaching tip of terminal seta which is longer than dactylus; pereiopod 4 basis equal in length to rest of extremity, distal seta longer than dactylus; pereiopod 5 similar in shape to pereiopod 4; uropod's peduncle short compared with pleonite 6 and rami, exopod two-segmented, longer than endopod; dorsal ridge with double row of scales, distal tip with two serrated spines; endopod unsegmented with four strong and short spines at inner margin; outer margin scaly, terminal tip with acute plumose seta.

Males dorsomedian line and lateral ridge less pronounced than in female; extremities dissected from male paratype, length 2.5 mm; second antenna reaching articulation of pleomers 3 to 4, pereiopod 1 basis more stout but rest of extremity more slender, pereiopod 2 shorter than in female, uropods' peduncles with 11 setae at distal part of inner margins, endopod with 20 spines at proximal part, distal part with scales, one terminal plumose seta as in female, exopod with two serrated terminal spines.

Etymology

The new species is named after the type locality.

Remarks

Day (1978) described a new genus, *Mossambicuma*, with the striking characters: ischium of maxilliped 3 larger than merus, basis of pereiopod 1 without distal projection, second pereiopod without ischium, uropods' peduncles shorter than pleonite 6 and rami, pleonite 6 shorter than fifth abdominal somite. She mentioned the resemblance to the genus *Eocuma* Marcusen, 1894 but she also stressed the differences from this genus, such as the form of the carapace and the first pereiopod not having the distal projection of basis typical for *Eocuma*. The genus *Mossambicuma* seemed to be monotypic, with the type species *M. elongatum* Day, 1978 found only at the type locality, the Morrumbene estuary (Mühlenhardt-Siegel, 1996). The Australian new species clearly belongs to this genus. It differs from the known species in the female's habitus as there is no abrupt border between carapace and second pereionite, the siphonal tubes are longer, the basis of third maxilliped is shorter and more geniculated, both basis and merus of the third maxilliped have a longer distal prolongation, the basis of pereiopod 1 is geniculated, pereiopod 2 has a distal seta that is longer than the dactylus in the new species but shorter in *M. elongatum*.

Subfamily VAUNTHOMPSONIINAE Sars, 1878

Genus ***Glyphocuma*** Hale, 1944

Glyphocuma oculodentata sp.n.
(Figure 15)

Material

QLD: Lizard Island 1992: Turtle Bay (15 November, 15 m): 3 subadult females; sand (10 m): 1 subadult female, 2 juveniles; Mermaid Bay (7 m): 1 juvenile; Lagoon (7 m): 1 juvenile; ZMH K 39936.

Holotype: adult but non-ovigerous female; SAM C 5997a, SAM C 5997b: extremities of paratype

Leg.: V. Siegel, U. Mühlenhardt-Siegel

Date: 20 November 1992

Locus typicus: Australia, Queensland, Lizard Island, Watson's Bay, 16 m

Paratypes: Watson's Bay (16 m): 2 adult females, 3 juvenile females; SAM C 5998.

Diagnosis

Glyphocuma with six dorsomedian teeth in anterior half of carapace and one strong tooth at anterior end of ocular lobe reaching the tip of pseudorostrum, accessory flagellum of antenna 1 half as long as basal article of main flagellum, uropod's endopod distal article a little longer than basal.

Description

Based on holotype, a subadult female, 7.6 mm in length.

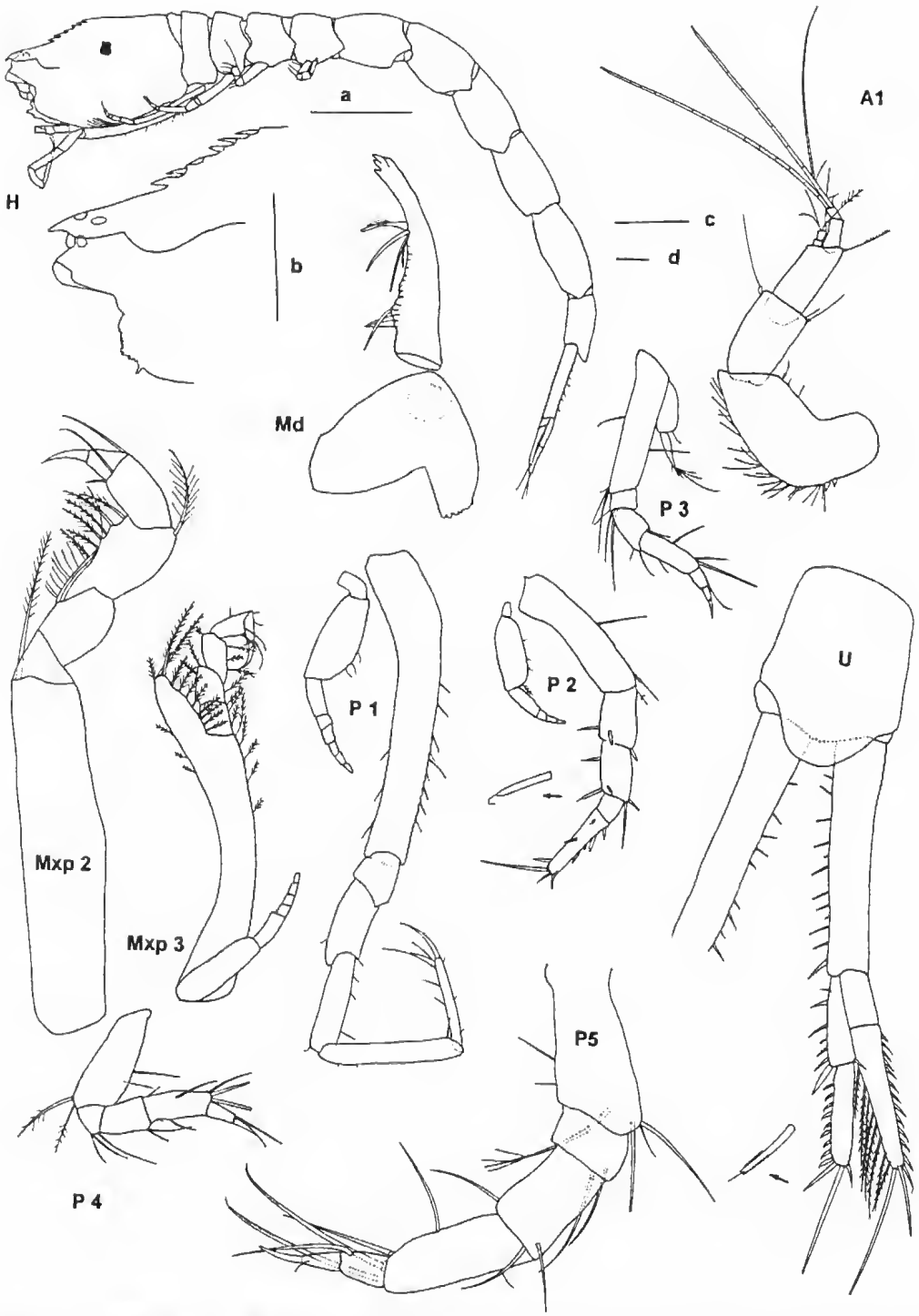

FIGURE 15: *Glyphocuma oculodentata* sp.n. female: H: habitus, A1: first antenna, Md: mandible, Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropod. Scale a: 1 mm (H), scale b: 0.5 mm (anterior part of carapace enlarged), scale c: 0.1 mm (A1, Md, Mxp2, P5), scale d: 0.1 mm (Mxp3, P1, P2, P3, P4, U).

Carapace slender, as long as free thoracic segments, straight to posterior part of frontal lobe, the dentated line ascending, the undentated posterior half straight; pseudorostrum and siphonal tube short; dorsomedian line dentated in anterior half with six teeth; antennal notch reaching the posterior end of ocular lobe; subrostral tooth not pronounced; anterolateral margin serrated; anteroventral margin of carapace smooth; integument with fine reticulate structure as figured in Figure 17; eyes present.

Five free thoracic segments visible from above, the first one short, laterally covered by carapace and second free thoracic segment, third and fourth segments laterally produced backwards; abdomen longer than carapace and thoracic segments combined; pleonite 6 shorter than uropod's peduncle.

The description of the extremities is based on paratype, a female. First antenna basal article geniculated with many hair-like setae, both following articles equal in length, main flagellum two-segmented, distally with two aesthetascs and one annulated long seta, accessory flagellum two-segmented, half as long as basal article of main flagellum, with three terminally plumose setae and one shorter simple seta. Mandible with 17 setae, pars incisiva with four terminal 'teeth', pars molaris short and stout. Maxilliped 2 straight, basis longer than rest of extremity, ischium more than half as long as merus, carpus second longest article with 6 plumose setae at inner margin and one at distal outer margin, dactylus short and stout, ending with stout terminal seta; maxilliped 3 basis long and slender, distal prolongation with 11 plumose setae, two of them being twice as long as the others; ischium a little shorter than merus; carpus and propodus equal in length, dactylus with stout terminal seta, exopod present; pereiopod 1 basis shorter than rest of extremity, propodus second longest article after basis, exopod present; pereiopod 2 dactylus second longest article after basis, terminal seta shorter than dactylus, ischium not visible, propodus small, exopod present; pereiopod 3 carpus second longest article after basis, dactylus short with longer terminal seta, exopod present; pereiopod 4 carpus second longest article after basis, terminal seta longer than dactylus; pereiopod 5 carpus second longest article after basis, with two long distal setae reaching beyond tip of dactylus' terminal seta; uropod's peduncle longer than rami with 12 setae at inner margin, rami equal in length, exopod with eight plumose setae at inner and 13 stout setae at outer margin of distal article, endopod two-segmented, basal article a little shorter (factor 0.9) than distal, with seven setae at inner and one at outer distal margin, distal article with ten stout setae, the distal one being longer, one long terminal and one shorter subterminal seta.

Etymology

The new species is named after the tooth on the ocular lobe.

Remarks

The new species resembles *G. dentata* Hale, 1944. In Jones's (1984) species list, *G.* cf. *dentata* (identified by J. Day) is mentioned for Lizard Island. The specimens in the present collection differ from *G. dentata* by: presence of the large tooth at the distal tip of ocular lobe, which is missing in *G. dentata*; accessory flagellum of antenna 1 half as long as basal article of main flagellum, being shorter in *G. dentata*; uropod's endopod distal article a little longer than basal, but the distal being nearly half as long as basal one in *G. dentata*.

Genus ***Leptocuma*** Sars, 1873

Leptocuma longidactylum sp n.
(Figure 16)

Material

North end Herald Bight, Shark Bay, 3 fathoms, sand, 'Isobel' W.H., 21 November 1945, submarine light, temperature: 24.22°C ; 30 males; SAM C 5992.

Holotype: male; SAM C 5991

Locus typicus: Australia, South Australia, north end Herald Bight, Shark Bay, 3 fathoms, sand, 'Isobel' W.H., submarine light, temperature: 24.22°C

Date: 21 November 1945

Diagnosis

Leptocuma with two spines at distal end of first pereiopod's basis, ischium of second pereiopod longer than carpus. Bases of the pereiopods in males more slender and longer, compared to the exopods' bases.

Description

Based on the holotype, adult male, 3.6 mm in length.

Carapace 0.9 mm in length, pseudorostral lobes not meeting in front of ocular lobe, siphonal tube

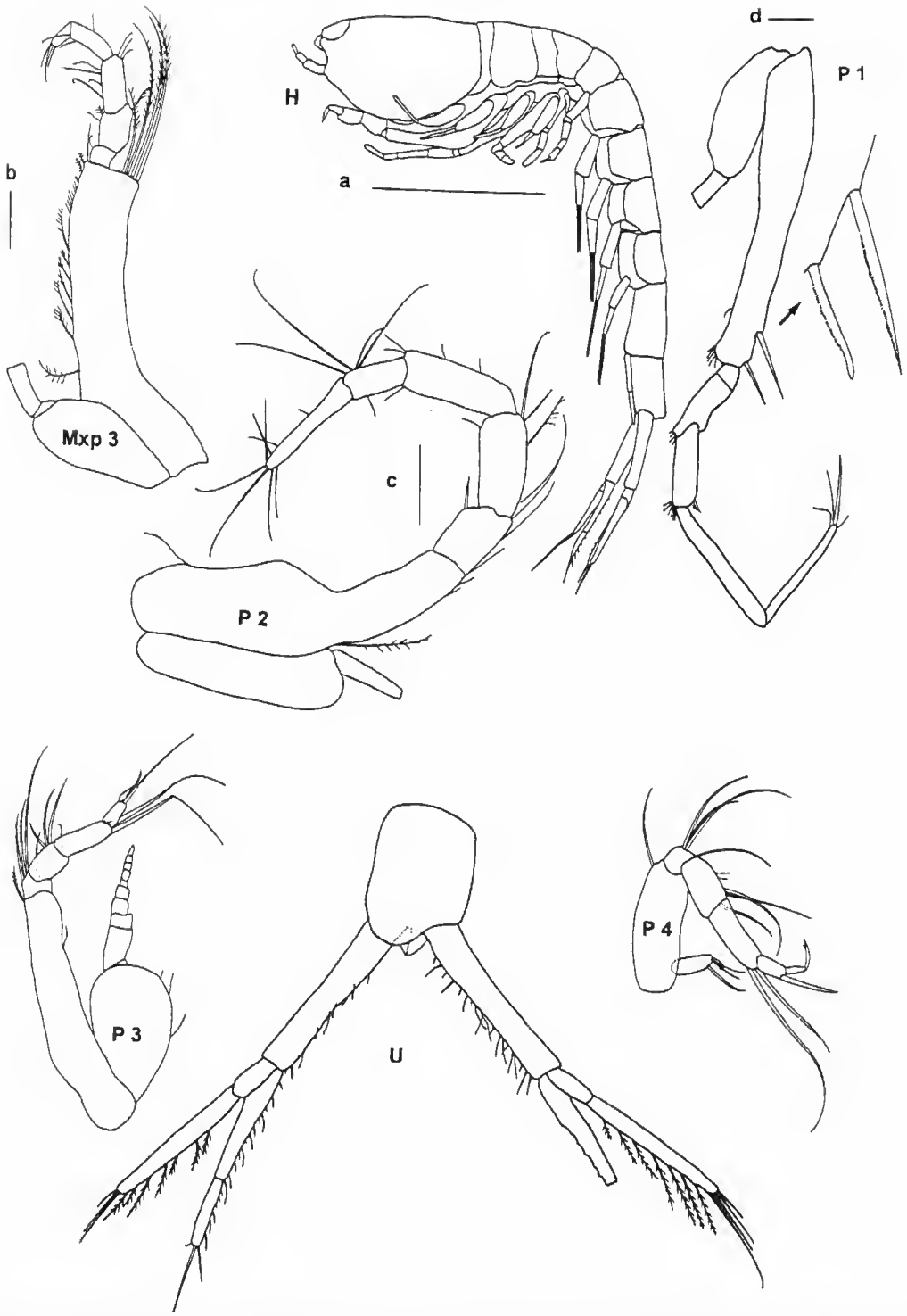

FIGURE 16: *Leptocuma longidactylum* sp.n. adult male: H: habitus, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, U: pleonite 6 and uropods. Scale a: 1 mm (H), scale b: 0.1 mm (Mxp 3, P3, P4), scale c: 0.1 mm (P2), scale d: 0.1 mm (P1, U).

very short, dorsomedian line straight, not pronounced; antennal notch wide and shallow, anterolateral margin rounded, anteroventral margin of carapace smooth; ocular lobe present, no lenses visible; free thoracic segments 0.8 mm in length, second thoracic segment longest; abdomen 1.9 mm in length, longer than carapace and free thoracic segments combined; pleonite 6 shorter than uropod's peduncle.

The description of the extremities is based on the paratype, adult male. Maxilliped 3 basis much longer than rest of extremity, wider than following articles, with four long, plumose setae, inner margin with short plumose setae and hair-like setae; merus a little wider than ischium and carpus, subequal in length to carpus and propodus, exopod present; pereiopod 1 basis longest article but shorter than rest of extremity, at distal inner margin a serrated seta preceded by a longer serrated seta, outer distal edge with hair-like setae; propodus second longest article, exopod present; pereiopod 2 basis longest article but shorter than rest of extremity, proximal part wider than distal, ischium longer than propodus, dactylus second longest article, tapering, exopod present; pereiopod 3 basis longer than rest of extremity, ischium with three long and one shorter distally annulated setae, merus with three annulated setae in distal part; carpus distally with two long simple setae, propodus and dactylus short, exopod present; pereiopod 4 basis longest article but shorter than rest of extremity, distally each article with long simple setae: basis one, ischium three, merus three, carpus two, propodus one stout, dactylus one terminal stout, exopod rudimentary; uropod's peduncle longer than pleonite 6 but shorter than rami, 9 to 19 setae at inner margin; exopod equal in length to endopod, inner margin with seven plumose setae, three terminal long simple setae; endopod two-segmented, proximal article 1.8 times longer than distal, proximal article with 13, distal article with six setae at inner margin, two long terminal and one short hair-like setae at outer distal edge.

Etymology

The new species is named after the long dactylus of the second pereiopod.

Remarks

Nine Australian *Leptocuma* species are described for the genus. According to Tafe & Greenwood (1996) they are divided into two groups:

- Group 1 with smooth strong setae at distomedial margin of first pereiopod's basis, propodus with well developed brush of setae at distal end, uropod's endopod proximal article shorter or only a little longer than distal. Only two of the Australian *Leptocuma* species are in this group: *L. pulleini* Hale, 1928 and *L. vicarium* Hale, 1944.
- Group 2 with serrated seta at distal end of first pereiopod's basis preceded by another serrated seta, distal end of propodus with few setae, uropod's endopod with distal article longer than proximal. The new species belongs to the second group. For South Australia only two *Leptocuma* species are described : *L. pulleini* Hale, 1928, belonging to group 1, and *L. sheardi*, Hale 1936, belonging to group 2.

The new species differs from *L. sheardi* in having the bases of the pereiopods in males more slender, and longer compared to the exopods' bases; the distal articles of the new species' pereiopods bear fewer long setae than those of *L. sheardi*. The most striking characters of the new species are the dactylus being longer than the carpus and the long ischium, both of the second pereiopod, which are unique within the genus.

Leptocuma sp.
(Figure 17)

Material

WA: 46, 1 ovigerous female; ZMH K 39935.

Description

Based on the strongly decalcified female, total length 3.3 mm.

Carapace shorter than five free thoracic segments, pseudorostral lobes not meeting in front of rounded ocular lobe; abdomen subequal in length to carapace and free thoracic segments combined; pleonite 6 a little (1.2 times) longer than wide, two anal valves visible, length proportion of uropod's peduncle to pleonite 6 is 1.5.

Maxilliped 3 basis longer than rest of extremity, slightly geniculated, distal half of inner margin with 14 plumose setae, distal outer margin sloping backwards, with five long plumose setae, exopod present; pereiopod 1 basis longest article, 0.77 as long as rest of extremity, inner margin with seven plumose setae, distal end of inner margin with two stout serrated spines, outer distal end with one short plumose seta, propodus second longest article, 1.1 times longer than slender dactylus,

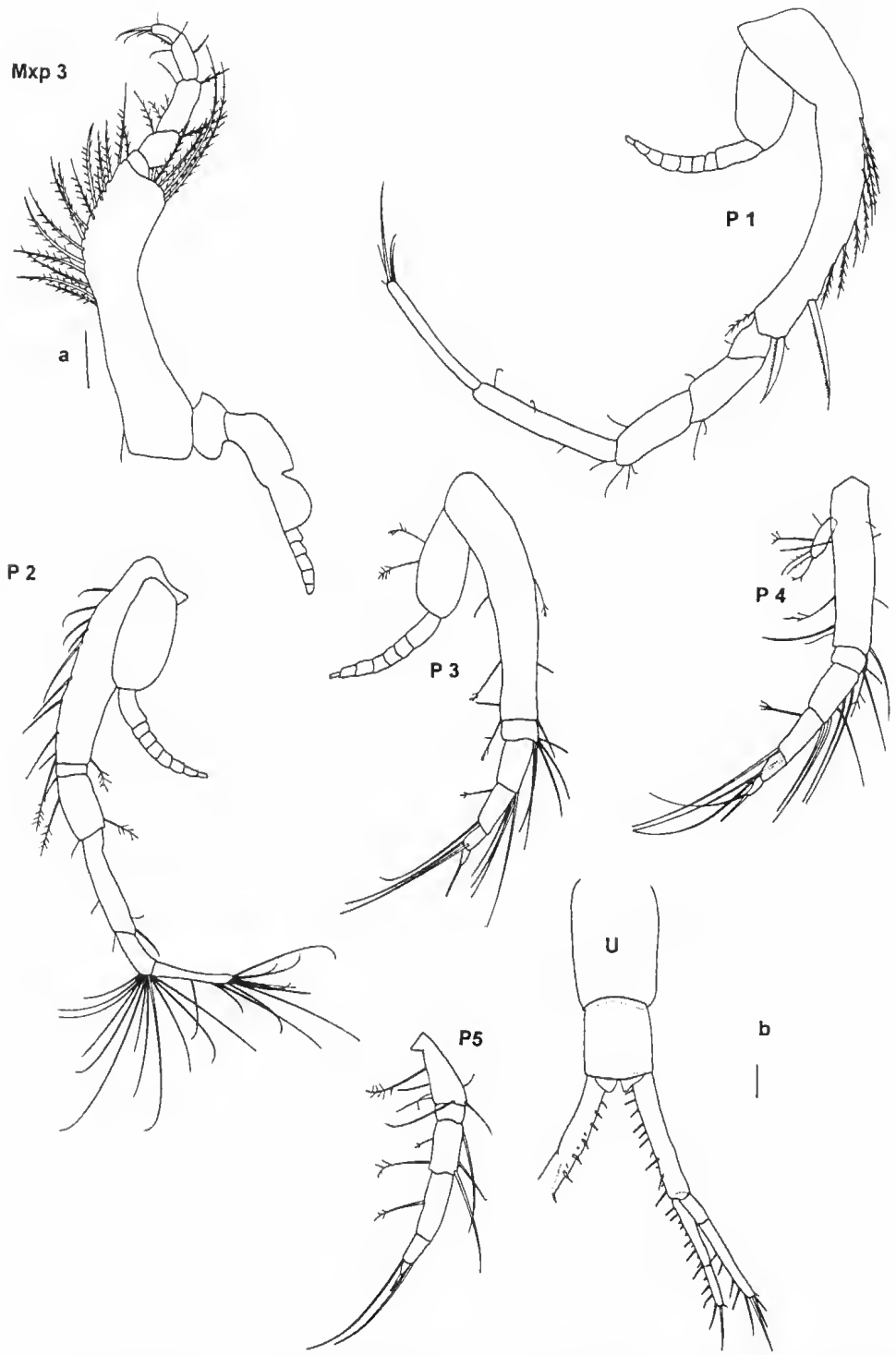

FIGURE 17: *Leptocuma* sp. female: Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 0.1 mm (Mxp3, P1, P2, P3, P4, P5), scale b: 0.1 mm (U).

TABLE 3: Comparison of *Leptocuma* species with two serrated spines at distal end of first pereiopod's basis in either sex.

Character	*L. barbarae*	*L. intermedium*	*L. kennedyi*	*L. obstipum*	*L. serriferum*	*L. sheardi*	*L.* sp.	*L. longidactylum* sp.n.
Length-proportions								
P1, propodus:dactylus	1.2	1.1	1.3	1.1	1.3	1.2	1.1	1.2
uropod's peduncle: endopod	0.9	?	0.9	1	0.9	1.1	1.1	0.9
uropod's endopod basal:distal	1.5	2.6	1.7	2.3f	1.6	2.0	1.2	1.8
longest ramus	exo		equal	equal	equal	equal		equal
P2, propodus:dactylus	0.6	1.3	0.5	0.8	0.6	0.8	0.7	0.6
Number of setae at uropod								
peduncle	18m, 11f	?	5–6m	23m, 16f	15f	17m, 14f	12f	19m
endopod proximal article	16m, 11f	16m	10–11m	16m, 17f	18f	14m, 9f	12f	13m
endopod distal article	8m, 9f	8m	4–5m	8m, 8f	11f	8m, 5f	6f	9m
Maxilliped 3, setae at basis								
inner margin	?	?		last 3/4	long at prox.,short at distal		14 at distal half	10
distal outer margin	?	?		8	6		5	4

m: male; f: female

exopod present; pereiopod 2 basis as long as merus, carpus and propodus combined, carpus second longest article, about twice as long as propodus, propodus with 12 hair-like setae at distal end, 0.68 times as long as tapering dactylus, dactylus with 11 terminal and subterminal hair-like setae, exopod present; pereiopod 3 basis longer than rest of extremity, carpus a little shorter than merus, which is second longest article, propodus and dactylus short, ischium, merus, carpus, and propodus distally with long terminal annulated setae, dactylus with one strong terminal seta, exopod present; pereiopod 4 similar to pereiopod 3, but basis shorter than rest of extremity, exopod rudimentary; pereiopod 5 basis much shorter than rest of extremity, carpus second longest article, fewer setae than preceding extremities, propodus with two long terminal setae. Uropod's peduncle with 12 unequal spiny setae at inner margin, 1.1 times longer than endopod; uropods' rami: exopod with five setae at inner, three at outer margin, and one seta each terminally and subterminally, a little longer than endopod; endopod two-segmented, basal article 1.2 times longer than distal, basal article with 11, distal article with four unequal setae at inner margin, one longer terminal seta.

Remarks

Five species of the genus *Leptocuma* are described with two serrated spines located distally at the basis of first pereiopod: *L. obstipum* Hale, 1944, *L. intermedium* Hale, 1944 both from New South Wales; *L. serriferum* Hale, 1944 from West Australia and New South Wales; *L. barbarae* Tafe & Greenwood, 1996 and *L. kennedyi* Tafe & Greenwood, 1996 both from Queensland. In *L. sheardi* Hale, 1944 described from South Australia, only males have two serrated spines at the basis of first pereiopod, females have one. The female of the Western Australian material is compared with the other species mentioned (Table 3). It does not fit with any of the described species, so it is probably new. It is not named because of the poor condition of the single specimen.

Genus *Picrocuma* Hale, 1936

Picrocuma poecilotum Hale, 1936

Material

Various stations, Noosa R., 40 mesh tow net, June 1940, leg. ISR Munro; 6 ovigerous females, SAM C 5993.

Remarks

The specimens from the collection of the South Australian Museum fit the most striking characters of *P. poecilotum* given in Hale (1936). These are the large second pereionite, the pseudorostral lobes meeting in front of ocular lobe, a dorsal hump seen in lateral view behind the ocular lobe in males and juveniles, and more posterior in ovigerous females. A comparison of the characters within the genus is given in Table 4.

TABLE 4: Comparison of *Picrocuma* species. l: length, w: width.

	Picrocuma poecilotum	*Picrocuma crudgingtoni*	*Picrocuma rectangularis* n.sp.
Carapace			
male l:w	1.8	1.7	1.7
female l:w	1.5	?	1.6
Dorsal humps	behind ocular lobe	pereionite 2	no
Uropods' endopods' setae			
male	12 + 1 long	6 + 1 long	8 + 1 long
female		3	4 + 1 long
Uropods' proportions			
peduncle l:w, male	3?	2?	4.5
peduncle l:w, female			3.5
endopod l:w, male	3.4	3.9	5.8
endopod l:w, female			3.1
peduncle:pleonite 6, male	1.5	1.4	1.8
peduncle:pleonite 6, female		1.3	1.5
endopod:peduncle, male	1.1	0.9	0.7

l: length; w: width

Picrocuma rectangularis sp.n.
(Figure 18)

Material

WA: 17+18: 7 males, 10 females;

Holotype: non-ovigerous female; ZMH K 39938.

Leg.: G. Hartmann & G. Hartmann-Schröder

Date: 20 September 1975

Locus typicus: Derby, silty lower eulitoral zone

Paratypes: WA-28, Port Hedland, 27 September 1975, fine sand on reef top, 2 males, 3 females, ZMH K 39939; 1 male, 2 females; SAM C 6081.

Diagnosis

Minute species of *Picrocuma*, uropod's peduncle slender, long compared to the other known species, uropods' rami with a rectangular shape.

Description

Based on holotype, female 1.4 mm in length.

Carapace smooth, shorter than free thoracic segments, proportion length to width 1.6; pseudorostrum as long as ocular lobe, siphonal tube not visible; dorsomedian line not pronounced; antennal notch not present; anterolateral margin smooth; anteroventral margin of carapace rounded. Integument, although decalcificated due to fixation in formalin, with a reticulate pattern visible in higher magnification; eye not pigmented.

Five free thoracic segments visible, the first slender, second long; abdomen shorter than carapace and free thoracic segments combined; pleonite 6 shorter than wide (0.9), shorter than uropods' peduncles, length proportion peduncle to pleonite 6 is 1.5.

Description of extremities based on paratype. First antenna basal article geniculated, distal article longest, accessory flagellum minute, main flagellum short, two-segmented, three distal setae.

Maxilliped 3 basis slightly geniculated, shorter than rest of extremity, carpus second longest article, dactylus with strong terminal and three hair-like subterminal setae, exopod present; pereiopod 1 basis shorter than rest of extremity, carpus second longest article, similar in shape to maxilliped 3, exopod present; pereiopod 2 basis shorter than rest of extremity, ischium missing, dactylus second longest article after basis; merus, carpus, and propodus decreasing in length, exopod present; pereiopod 3 with exopod, similar to pereiopods 4 and 5, basis shorter than rest of extremities, carpus second longest article; uropod's peduncle longer than rectangular rami, inner margin without armature, exopod longer than unsegmented endopod, exopod with one long and one short terminal spine, endopod with three spines at inner margin, one terminal spine 0.6 times as long as endopod.

Male 1 mm in length, similar to female, except for following characters: antenna 1 basal article not geniculated, basis of maxilliped 3 more slender, exopods' basal article more rounded than in female in all extremities, uropods' peduncles longer than in female, length proportion peduncle to pleonite 6 is 1.8, rami equal in length, endopod with eight spines at inner margin and one terminal longer one.

Etymology

The new species is named after the rectangular shape of its uropods' rami.

Remarks

Only two species are currently known in the genus *Picrocuma*: *P. poecilotum* Hale, 1936 from Queensland, Tasmania and South Australia and *P. crudgingtoni* Tafe & Greenwood, 1996 from Queensland. The main characters given by Tafe & Greenwood (1996) are compared in Table 4. The most important difference of the new species compared with the known ones is the uropods' rami having a rectangular shape, being longer in males than in females, the endopod having eight lateral plus one terminal spine; and the uropod's peduncle being longer compared to pleonite 6 than in the other two species.

Genus ***Vaunthompsonia*** Bate, 1858

Vaunthompsonia* cf. *cristata Bate, 1858

Material

Near Pt. Maclaren, Thorney Passage, Whiting Ground, 3.5 fathoms, 8-8.30 pm, 2 March 1941, submarine light, leg. K. Sheard: three males, SAM C 5994.

In this material the pereiopods are broken; however, one can infer the specimens are close to *V. cristata* based on the serrated margins of carapace and pleonite 6, and the anal valves each ending in a fine hair. All these characters are typical for this species.

Family LEUCONIDAE Sars, 1878

Genus ***Ommatoleucon*** Watling, 1991

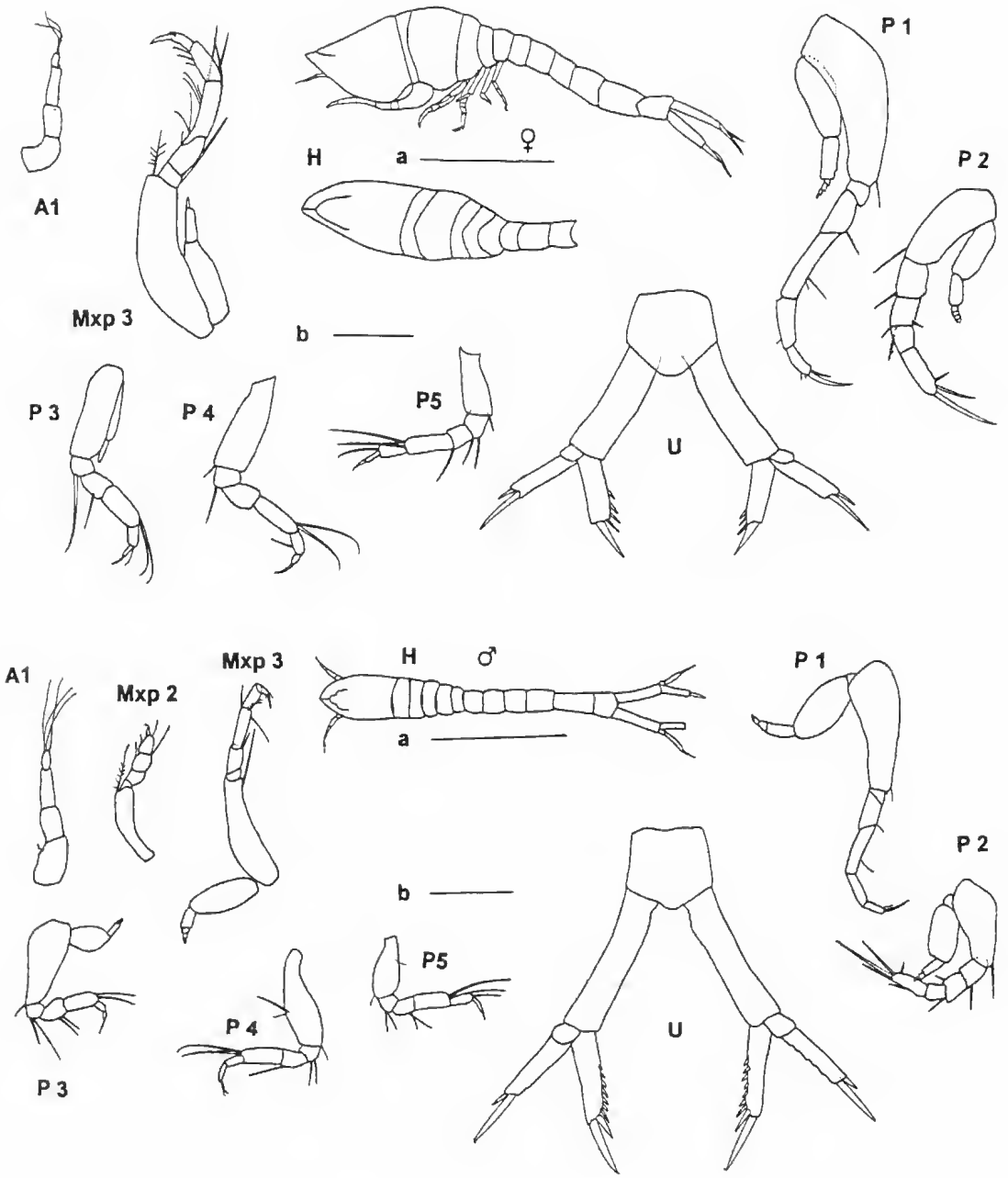

FIGURE 18: *Picrocuma rectangularis* sp.n. female (above): H: habitus, A1: first antenna, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 0.5 mm (H), scale b: 0.1 mm (A1, Mxp3, P1, P2, P3, P4, P5, U). *Picrocuma rectangularis* sp.n. male (below): H: habitus, A1: first antenna, Mxp2: maxilliped 2, Mxp3: maxilliped 3, P1: pereiopod 1, P2: pereiopod 2, P3: pereiopod 3, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 0.5 mm (H), scale b: 0.1 mm (A1, Mxp2, Mxp3, P1, P2, P3, P4, P5, U).

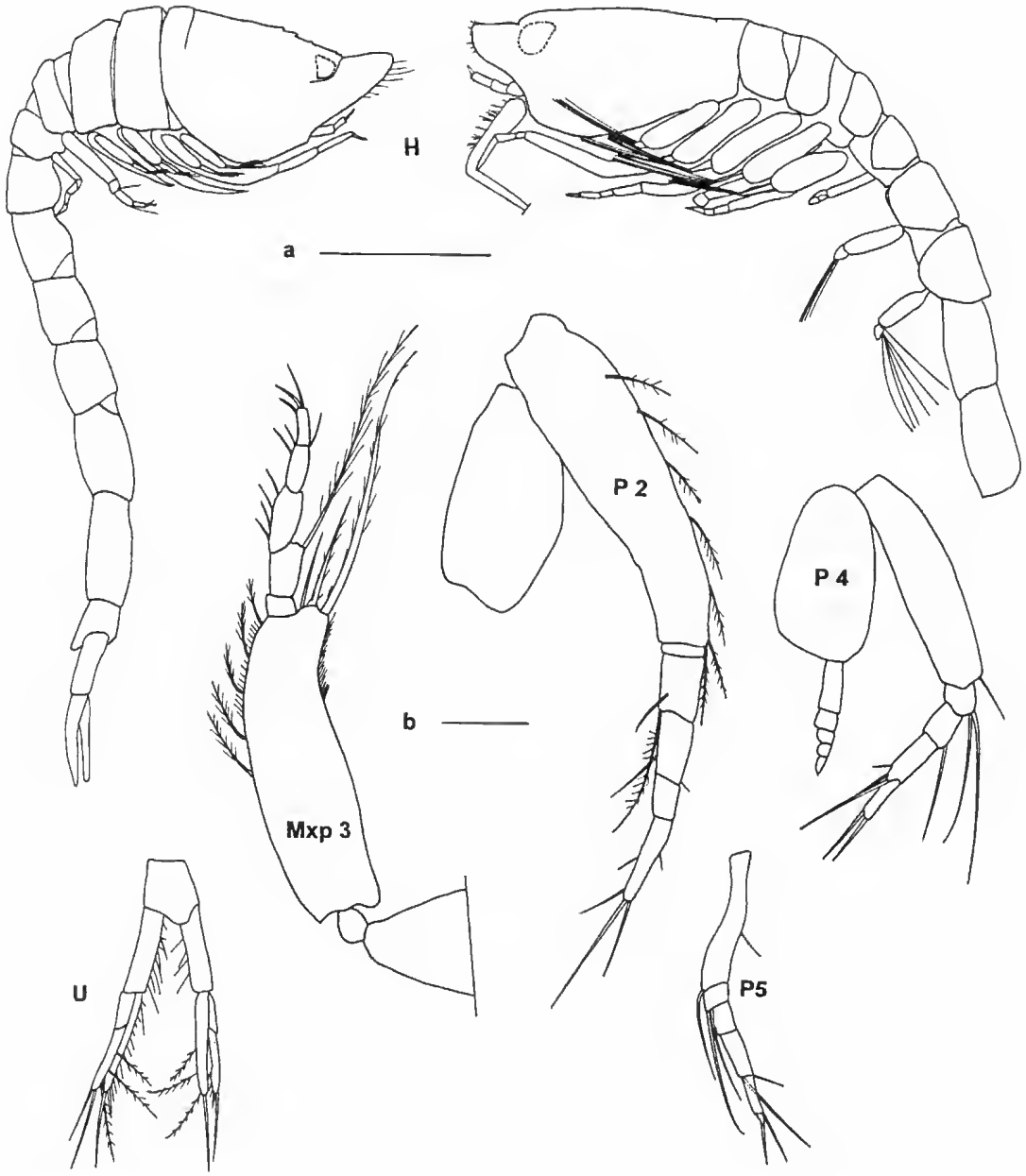

FIGURE 19: *Ommatoleucon ocularis*: H: habitus adult male (upper right) and subadult female (upper left), male's extremities: Mxp3: maxilliped 3, P2: pereiopod 2, P4: pereiopod 4, P5: pereiopod 5, U: pleonite 6 and uropods. Scale a: 0.5 mm (H, U), scale b: 0.1 mm (Mxp3, P2, P4, P5).

Ommatoleucon ocularis (Hale, 1945)
(Figure 19)

Material

TAS: Nubeena: 6 males, 2 subadult females; ZMH K 39937.

Remarks

The first record for members of the family Leuconidae from Tasmania fits well with the characteristics Hale (1945) gave for his new species, *Leucon ocularis*, which was transferred by Watling (1991) into his new genus *Ommatoleucon*. The diagnostic characters of this genus are: uropods' endopods unsegmented, straight pseudorostrum in front fringed with setae, ocular lobe not distinctly defined, eye present, pedigerous segments depressed, uropods' exopods with three unequal distal spines, inner margin with three plumose setae and a spine next to terminal three, endopod with 11 short spines at inner margin. The eye in the present specimens appears to be submerged in the carapace.

Distribution

South Australia, St. Vincent Gulf, 19 m; Tasmania, Nubeena, 0.5 m.

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REFERENCES

Bacescu, M. 1988. Cumacea I. *In* H-E Gruner & LB Holthuis (eds). *Crustaceorum Catalogus*. Pars **7**: 1–173.

Day, J. 1978. Southern African Cumacea, part 2, Family Bodotriidae, subfamily Bodotriinae. *Annals of the South African Museum* **75**(7): 159–290.

Gamô, S. 1964. On three new species of Cumacea from the southern Sea of Japan. *Crustaceana* **7**: 241–253.

Hale, HM. 1928. Australian Cumacea. *Transactions of the Royal Society South Australia* **52**: 31–48.

Hale, HM. 1936. Three new Cumacea from South Australia. *Records of the South Australian Museum* **5**: 395–403.

Hale, HM. 1937. Further notes on the Cumacea of South Australian reefs. *Records of the South Australian Museum* **6**: 61–74.

Hale, HM. 1944. Australian Cumacea, no. 7. The genus *Cyclaspis*. *Records of the South Australian Museum* **8**: 63–142.

Hale, HM. 1945. Australian Cumacea, no. 10, The family Leuconidae. *Transactions of the Royal Society South Australia* **69**: 86–95.

Hale, HM. 1948. Australian Cumacea, no. 14, Further notes on the genus *Cyclaspis*. *Records of the South Australian Museum* **9**: 1–42.

Jones, AR. 1984. Sedimentary relationships and community structure of benthic crustacean assemblages of reef-associated sediments at Lizard Island, Great Barrier Reef. *Coral Reefs* **3**: 101–111.

Kurian, CV. 1961. Three species of Cumacea from the Lakes of Kerala. *Bulletin of the Central Research Institute, University of Kerala, Trivandrum*, **8**: 55–61.

Mühlenhardt-Siegel, U. 1996. Ein Beitrag zur Cumacea-Fauna aus dem Küstenflachwasser des südlichen Afrika, mit Beschreibung von *Cumella hartmanni* sp.n. *Mitteilungen aus dem hamburgischen zoologischen Museum und Institut* **93**: 117–140.

Sars, GO. 1878. Nye Bidrag til Kundskaben om Middelhavets Invertebratfauna. *Archiv for mathematic of naturvidenskab* **3-4**: 1–60.

Tafe, DJ & Greenwood, JG. 1996. The Bodotriidae (Crustacea: Cumacea) of Moreton Bay, Queensland. *Memoirs of the Queensland Museum* **39**(2): 391–482.

Watling, L. 1991. Revision of the cumacean family Leuconidae. *Journal of Crustacean Biology* **11**(4): 569–582.

Zimmer, C. 1921. Results of Dr. E. Mjöberg's Swedish Scientific Expeditions to Australia 1910–13. XXVI Cumaceen. *Kungligen Svenska Vetenskapsakademiens Handlingar* **61**(7): 4–13.