

# THE BODOTRIIDAE (CRUSTACEA: CUMACEA) OF MORETON BAY, QUEENSLAND

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Of 29 species of the Bodotriidae (Cumacea) collected from 40 sites in Moreton Bay (1989-1993) 22 are new records for the region and 18 are new species. Of the new species 5 are left in open nomenclature because insufficient material is available on which to base a description. The ♀ of *Glyphocuma halei*, previously unknown, is also described. Keys are given to the subfamilies, genera and species of Bodotriidae from Moreton Bay. The keys to species of *Cyclaspis*, *Glyphocuma*, and *Leptocuma*, are broadened to include all Australian species. Where a high degree of sexual dimorphism exists within species, such as those in the genus *Glyphocuma*, separate keys to the sexes are constructed. □ Crustacea. Moreton Bay, Australia. Peracarida, Zooplankton.

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This is the first major taxonomic investigation of Cumacea in Queensland waters. Isolated or small collections have been studied in works by Hale (1944a,b, 1948, 1949a), Stephenson *et al.* (1978) and Stephenson (1980a,b). The most significant taxonomic works on Australian Cumacea were published between 1928 and 1953 by H.M. Hale. In 1953 he listed 160 species from the W, S and E coasts of Australia.

The Bodotriidae is more diverse than all other families (94 species) in Australian waters (Bacescu, 1988, 1990, 1992b). *Cyclaspis* is by far the most species rich genus and its genetic centre is in the Australasian region (Bacescu, 1992b). The Nannastacidae (45 species) and Gynodiastylidae (36 species) are also well represented around the Australian coastline, while the Diastylidae (15 species), Leuconidae (2 species) and Lampropidae (2 species) are poorly represented. Highest diversity in all families occurs on the Pacific Coast, particularly near rivers, while the S coast has the fewest species (Hale, 1953a).

Five families of Cumacea are represented in the species which have previously been collected from Moreton Bay. They are the Bodotriidae, Nannastacidae, Gynodiastylidae, Diastylidae and Leuconidae. The Bodotriidae is most diverse, as in other areas around Australia (Hale, 1953a). Its dominant genus is *Cyclaspis*. Sixteen bodotriid species were recorded for Queensland waters by Hale between 1928 and 1951. Greenwood & Johnston (1967) added one and Stephenson *et al.* (1978), Stephenson (1980a,b), Bacescu (1990, 1992b) added 6 more. This paper describes fur-

ther new species, and summarises the distribution of bodotriid species in Moreton Bay (Figs 1, 2).

Sexual differences within a species include sculpturing and armature of the body, and the number of spine-like setae and fine setae on appendages. They also include more basic differences which enable greater swimming capacity in the male and a marsupium in the ♀ (Jones, 1963).

Specimens described were collected between 1989 and 1993. 787 plankton samples were taken from 40 sites (Fig. 1). Most were taken by sledge-net sampler (approx. 85% at all sites), some by plankton net (approx. 10% at sites 28, 29, 31), and the remainder by re-entry tray (sites 28, 32) and light-trap (site 24).

Two methods of specimen preparation for the SEM were trialled, using ♀♀ of *Bodotria armata* sp. nov. (Fig. 8). The freeze-substitution method (right hand side) eliminated the problem of salt crystallisation and therefore proved to be the most satisfactory method of SEM preparation (Tafe, 1995).

Measurements of somites and segments are taken along midlines of the entire sections, not just the exposed portions. Length measurements of whole specimens are recorded as standard lengths, measured from the anterior end of the pseudorostrum to the posterior end of the telsonic somite, excluding spine-like setae and fine setae.

**TERMINOLOGY.** Terminology (Fig. 3) follows the more recent works on the group (e.g., Day, 1975, 1978a,b, 1980; Watling, 1989, 1991a,b; Felgenhauer, 1992; Roccatagliata, 1989, 1993).

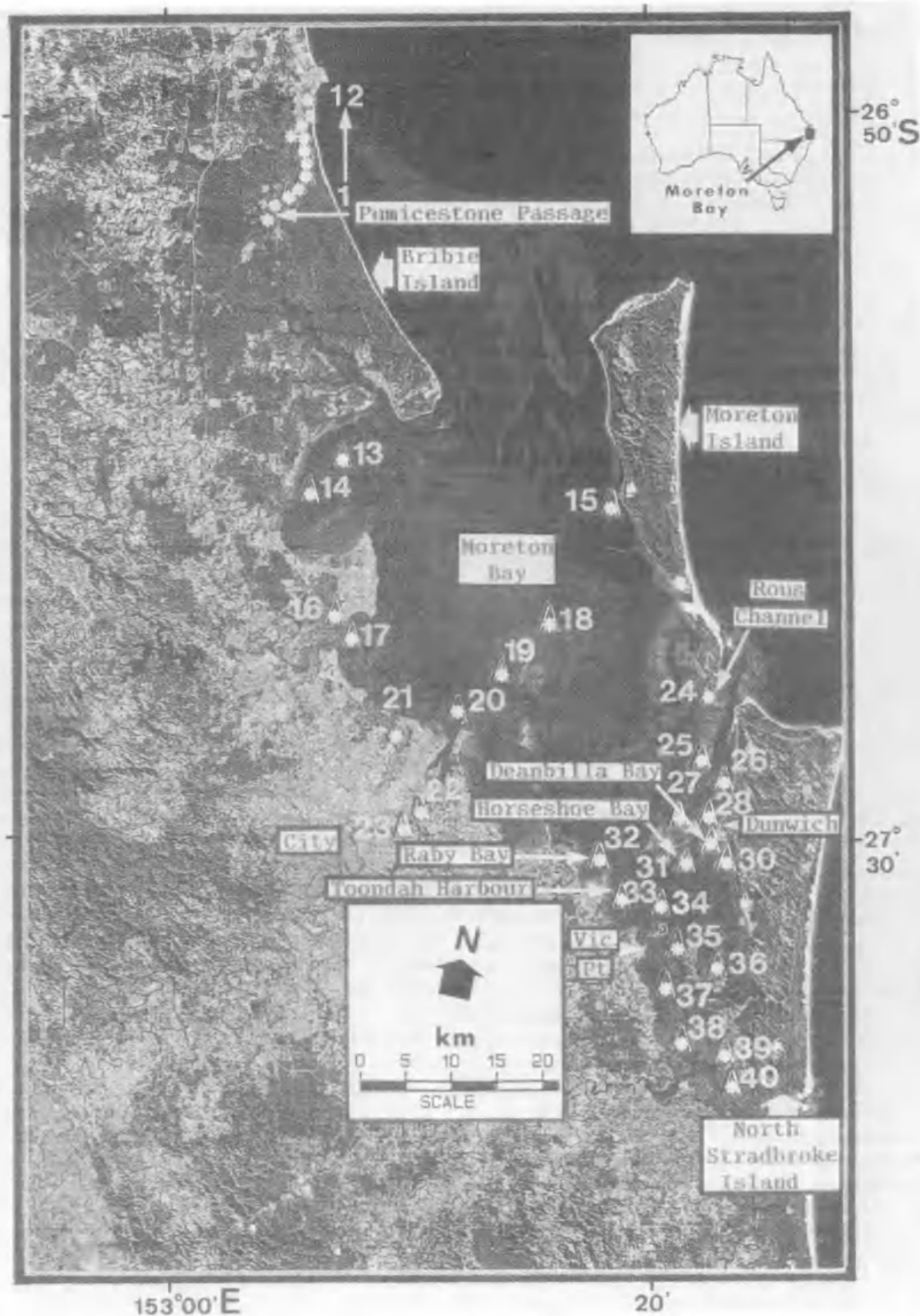


FIG. 1. Satellite photograph of Moreton Bay showing sampling locations (supplied courtesy Ross Quinn through Sunmap, from Landsat imagery, Australian Centre for Remote Sensing, Canberra).

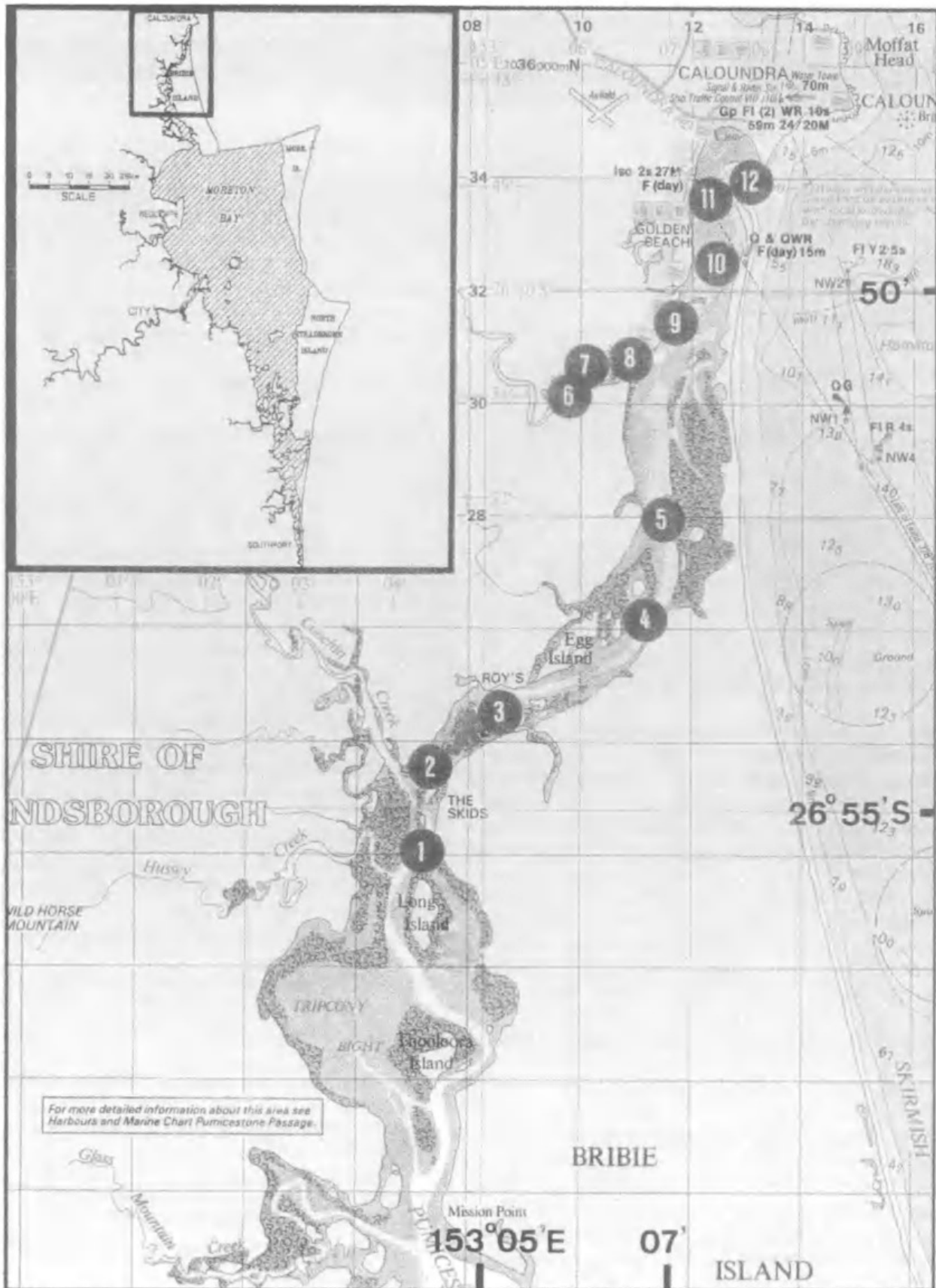


FIG. 2. Map of part of Moreton Bay showing sampling locations in upper Pumicestone Passage (from Queensland Boating Safety Chart, Harbours and Marine, Brisbane).

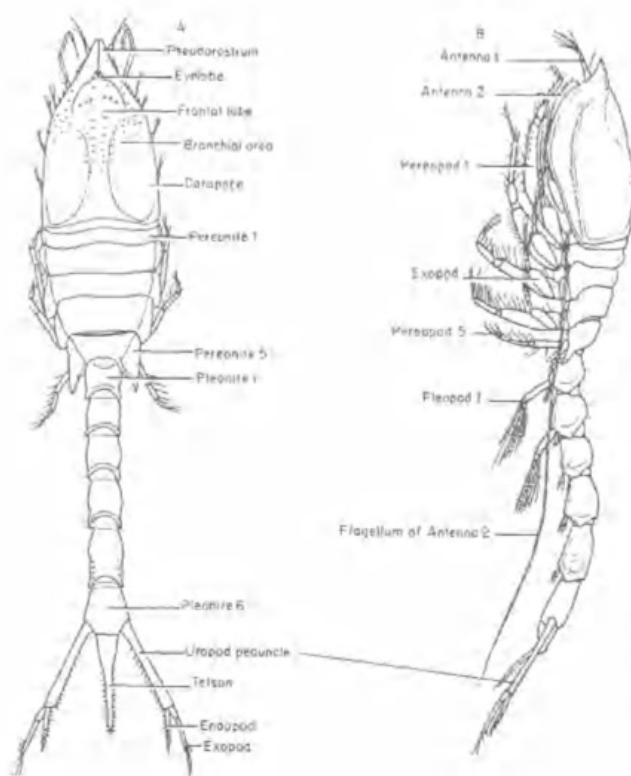


FIG. 3. *Diastylis rathkei*. A, ♀ in dorsal view. B, adult ♂ in lateral view (after Sars, 1900).

As compared to older papers pereopod replaces peracopod, segment replaces joint, pereonite replaces pedigerous somite or thoracic somite, pleonite replaces pleon somite or abdominal somite and telsonic somite replaces anal or sixth pleon somite. In descriptions of carapace features, such as ridges and tubercles, the terminology employed by Hale (1944a:66) has been retained. In descriptions of appendages and their setation, Watling (1989) and Felgenhauer (1992) are followed. In relation to appendages lateral refers to that margin/border of the appendage facing the lateral body surface and medial refers to that margin directed toward the midline of the body.

The classification of substratum given in the distribution section of each species follows the U.S. Department of Agriculture (USDA) classification of grain sizes [i.e. coarse sand (2,000–1,000 µm), medium sand (1,000–500 µm), fine sand (500–125 µm), coarse silt (125–63 µm) silt/mud (63–2 µm)], as given in Gee & Bauder (1986) and Giere et al. (1988). Geographic areas of the Australian marine environment are shown on Fig. 4. The classification of abundance is: uncommon= individuals taken in total of all

samples; common=10–100 individuals; very common= 100–1,000; abundant=1,000 individuals.

**ABBREVIATIONS.** Abbreviations used include: L.V. (lateral view), D.V. (dorsal view), V.V. (ventral view), D.L.V. (dorsolateral view), V.L.V. (ventrolateral view), A.L.V. (anterolateral view), P.L.V. (posterolateral view), SEM (scanning electron microscope), PSM (permanent slide mount), S.L. (standard length), QM (Queensland Museum), AM (Australian Museum), SAM (South Australian Museum).

## RESULTS

Eight genera and 29 species (18 new) of Bodotriidae were taken from Moreton Bay. Thirteen of those species are described, the remaining five species lacking sufficient specimens to enable full descriptions. The previously undescribed ♀ of *Glyphocuma halei* Greenwood & Johnston is described. Twenty-two of the 29 species are new records for Moreton Bay.

Taxonomic keys are either updated to include the new species, or newly constructed where necessary. The keys to species of *Cyclaspis*, *Glyphocuma* and *Leptocuma* are extended to include all known Australian species (Indo-Australasian species in the case of *Cyclaspis*). Where a high degree of sexual dimorphism exists (e.g., in *Glyphocuma*), keys to the sexes are kept separate.

Adults of *Cyclaspis ornosculpta* sp. nov. exhibit a high degree of sexual dimorphism, typical for members of the *exsculpta* group. Changes to morphology during the development of *C. ornosculpta* sp. nov. are documented for both sexes.

## KEY TO THE FAMILIES OF CUMACEA IN MORETON BAY

(Adapted from Hale, 1946a; Jones, 1963, 1976)

1. No independent telson. Endopod of uropod with 1 or 2 segments ..... 2  
 Telson present. Endopod of uropod with 2 or 3 segments ..... 3
2. In both sexes the last 4 pairs of pereopods either without exopods or with very small rudimentary exopods. ♂ with 5 pairs of pleopods ..... *Bodotriidae*  
 In the ♀ at most the last 3 pairs of pereopods without exopods, in male only the last. ♂ with 0 or 2 pairs of pleopods ..... 4
3. ♂ with one or two pairs of pleopods. ♀ third maxi-



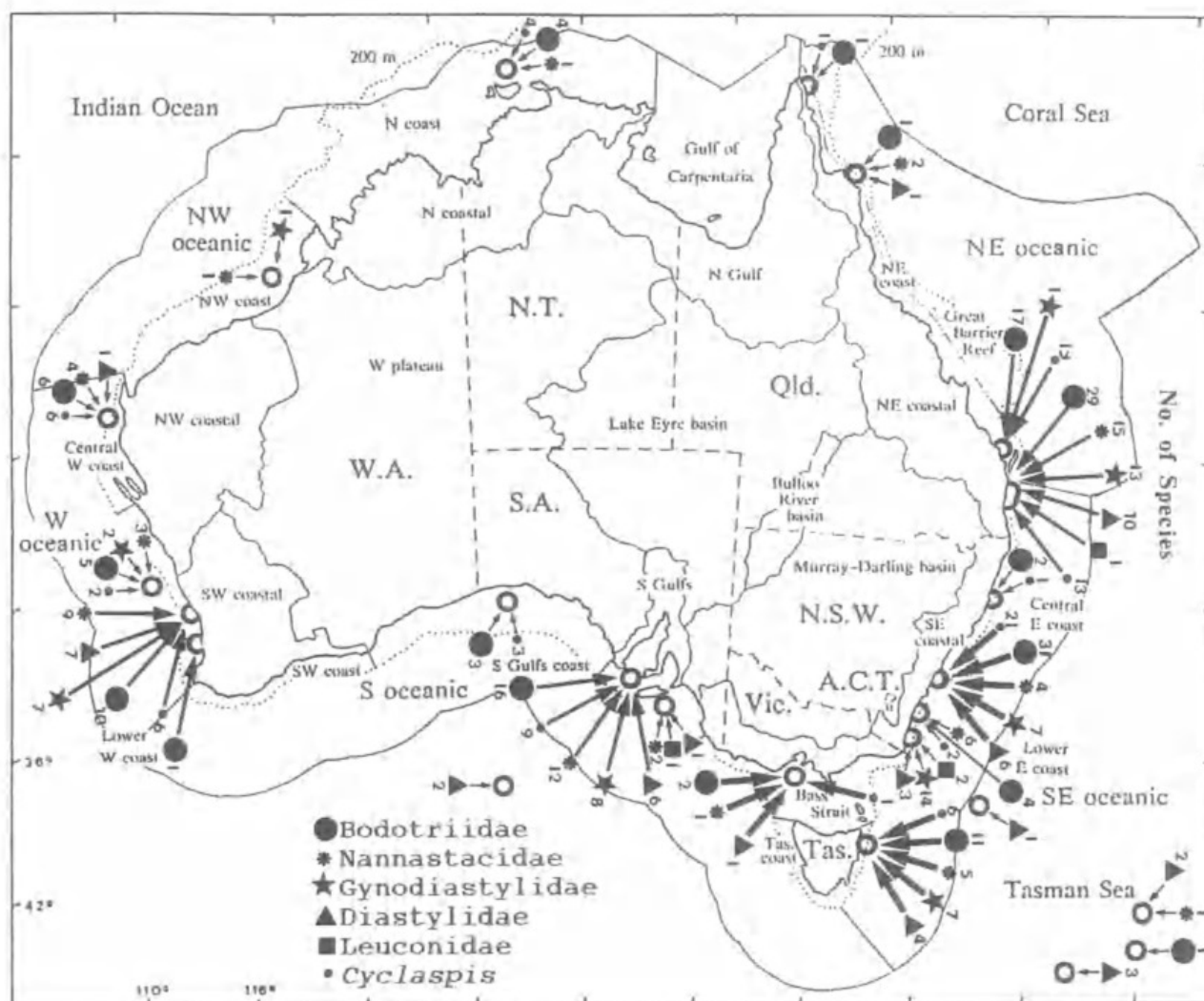


FIG. 4. States, standard drainage divisions, coastal zones within the 200m bathymetric contour, and the 200 nautical mile Australian fishing zones (courtesy Crustacean Section, Australian Museum).

Iliped with exopod (except *Paradiastylis*)

..... Diastylidae

♂ with no trace of pleopods. ♀ third maxilliped lacks exopod ..... Gynodiastylidae

4. Endopod of uropod 1-segmented. ♀ has last 3 pairs of pereopods without exopods, in ♂ only last pair. ♂ without pleopods

..... Nannastacidae

Endopod of uropod 2-segmented. ♀ has last 2 pairs of pereopods without exopods, in ♂ only last pair. ♂ with 2 pairs of pleopods

..... Leuconidae

Family BODOTRIIDAE T. Scott, 1901 emend.  
Kurian, 1951

**DIAGNOSIS.** No free telson. Pleopods in males only, with an outer process on endopod, usually 5 pairs, occasionally 2 or 3 pairs. Mandibles narrow at base. Endopod of uropod 1- or 2-segmented.

**REMARKS.** The family is distinguished from the Diastylidae and Gynodiastylidae by the lack of an independent telson, and from the Nannastacidae and Leuconidae by the 5 pairs of pleopods in the male (except for the Mancocuminae which are not known from Australian waters). There are at least 317 species of Bodotriidae described worldwide, 94 of which occur in Australian waters (including the new species described below). Australian species are distributed amongst the genera as follows: *Bodotria*, 4; *Cyclaspis*, 58; *Eocuma*, 1; *Iphinoe*, 1; *Gaus-sicuma*, 1; *Gephyrocuma*, 4; *Glyphocuma*, 6; *Leptocuma*, 10; *Picrocuma*, 3; *Pomacuma*, 3; *Sympodomma*, 2; *Zenocuma*, 1.

The family is divided into 3 subfamilies; the Bodotriinae Scott, 1901, have exopodites on only the first pair of pereopods, the Vaunthompsoniinae Sars, 1878 have exopodites on at least the first 2 pairs of pereopods; the Mancocuminae

Watling, 1977 have exopodites on at least the first 3 pairs of pereopods.

**KEY TO SUBFAMILIES AND GENERA OF  
AUSTRALIAN BODOTRIIDAE**  
(Adapted from Jones, 1976 and Hale, 1944b)

1. Exopods on first pereopods only . . . . . *Bodotriinae*. 2  
Well developed or rudimentary exopods on at  
least first to third pereopods . . . . . *Vaunthompsoniinae*. 5
2. Five free pereionites. Endopod of uropod 2-seg-  
mented . . . . . *Iphinoe* Bate  
Four free pereionites. Endopod of uropod 1 or 2-  
segmented . . . . . 3
3. Carapace with strong lateral ridges separating dor-  
sal from lateral regions throughout length . . . . . *Bodotria* Goodsir  
Carapace without strong lateral ridges separating  
dorsal from lateral regions throughout length . . . . . 4
4. Uropods with peduncle more than half the length  
of the rami. Carapace without lateral horns. En-  
dopod of uropod 1-segmented . . . . . *Cyclaspis* Sars  
Peduncle less than half the length of the rami.  
Carapace with lateral horns. Endopod of uropod  
2-segmented . . . . . *Eocuma* Marcusen.
5. First pereopods with joints curiously expanded . . . . . 6  
First pereopods not so modified . . . . . 8
6. First antenna strongly geniculate, with joints of  
peduncle sub-globose . . . . . *Gephyrocuma* Hale  
First antenna not strongly geniculate, joints not at  
all globose . . . . . 7
7. Telsonic somite well produced posteriorly. Basis  
of first pereopod with distal lobe . . . . . *Pomacuma* Hale  
Telsonic somite subtruncate, scarcely produced  
posteriorly. Basis of first pereopod with no dis-  
tal lobe . . . . . *Zenocuma* Hale
8. Second pereopod with a distal brush of setae on  
propodus and dactylus, but no spine-like setae . . . . . *Leptocuma* Sars  
Second pereopod without brushes of setae on ter-  
minal segments but with spine-like setae on at  
least dactylus . . . . . 9
9. Dorsal plate of telsonic somite subtruncate  
posteriorly and not at all produced between  
bases of uropods . . . . . 10  
Dorsal plate of telsonic somite rounded or an-  
gular posteriorly and produced between bases of  
uropods . . . . . 11
10. Dorsal plate of telsonic somite truncate posteri-  
orly. Endopod of pleopods with narrow external  
process . . . . . *Cumopsis* Sars  
Dorsal plate of telsonic somite excavated  
posteriorly. Endopod of pleopods without exter-  
nal process . . . . . *Heterocuma* Miers
11. Third maxilliped with merus much longer than is-

chium but shorter than carpus

- . . . . . *Vaunthompsonia* Bate
- Third maxilliped with merus subequal in length  
to ischium and carpus . . . . . 12
12. Ocular lobe present . . . . . 13  
Ocular lobe absent . . . . . 14
13. Fourth pereopod of male with exopod . . . . . *Glyphocuma* Hale  
Fourth pereopod of male without exopod . . . . . *Symphodomma* Stebbing
14. Pseudorostral lobes meeting in front of ocular  
lobe. Anal portion of telsonic somite much  
shorter than rest of somite . . . . . *Bathycuma* Hansen  
Pseudorostral lobes not meeting in front of ocular  
lobe. Anal portion of telsonic somite as long as  
rest of somite . . . . . *Gaussicum* Zimmer

**Subfamily BODOTRIINAE Scott, 1901**

**DIAGNOSIS.** Exopods present on first pair of  
pereopods; first pereionite usually concealed;  
endopod of uropod often undivided.

***Bodotria* Goodsir, 1843**

**DIAGNOSIS.** Cuticle strongly calcified.  
Carapace with strong lateral ridges separating  
dorsal from lateral regions throughout length.  
First pereionite not visible in dorsal view, second  
is long. In both sexes only first pereopod with  
exopod. Second pereopod basis and ischium not  
distinctly separated. Endopod of uropod one or  
2-segmented, with distal segment always shorter.

***Bodotria maculosa* Hale, 1944**  
(Figs 5A-F, 6A,C,E)

*Bodotria maculosa* Hale, 1944b:226, figs 1,2, Hale,  
1949a:107, fig. 1.

**MATERIAL EXAMINED.** HOLOTYPE  
SAMC2365, adult ♂, 4.2mm long, Dangerous Reef,  
Spencer Gulf; PARATYPES SAMC2448, ♂, 3.5mm  
long, off Port Hacking, NSW, 50 m, on sand; AM  
unreg., Lizard Island, Qld; QMW20471, ovig. ♀, S.L.  
2.9mm, SEM mount, Horseshoe Bay, 27°30'S,  
153°21'E, site 31, D. Tafe, 11 Oct. 1990, 2-3m, sand,  
35.5ppt salinity, 24.5°C water temperature.

**DIAGNOSIS.** Carapace with median dorsal  
ridge; lateral carina prominent, below which is  
secondary carina which curves up posteriorly to  
meet primary lateral carina; dorsal surface with  
coarse squamose-reticulate patterning formed by  
large, shallow pits; line of shallow pits immedi-  
ately above secondary lateral carina. Antennal  
notch deep and narrow. Pseudorostral lobes wide,  
truncate anteriorly, and reach apex of ocular lobe.

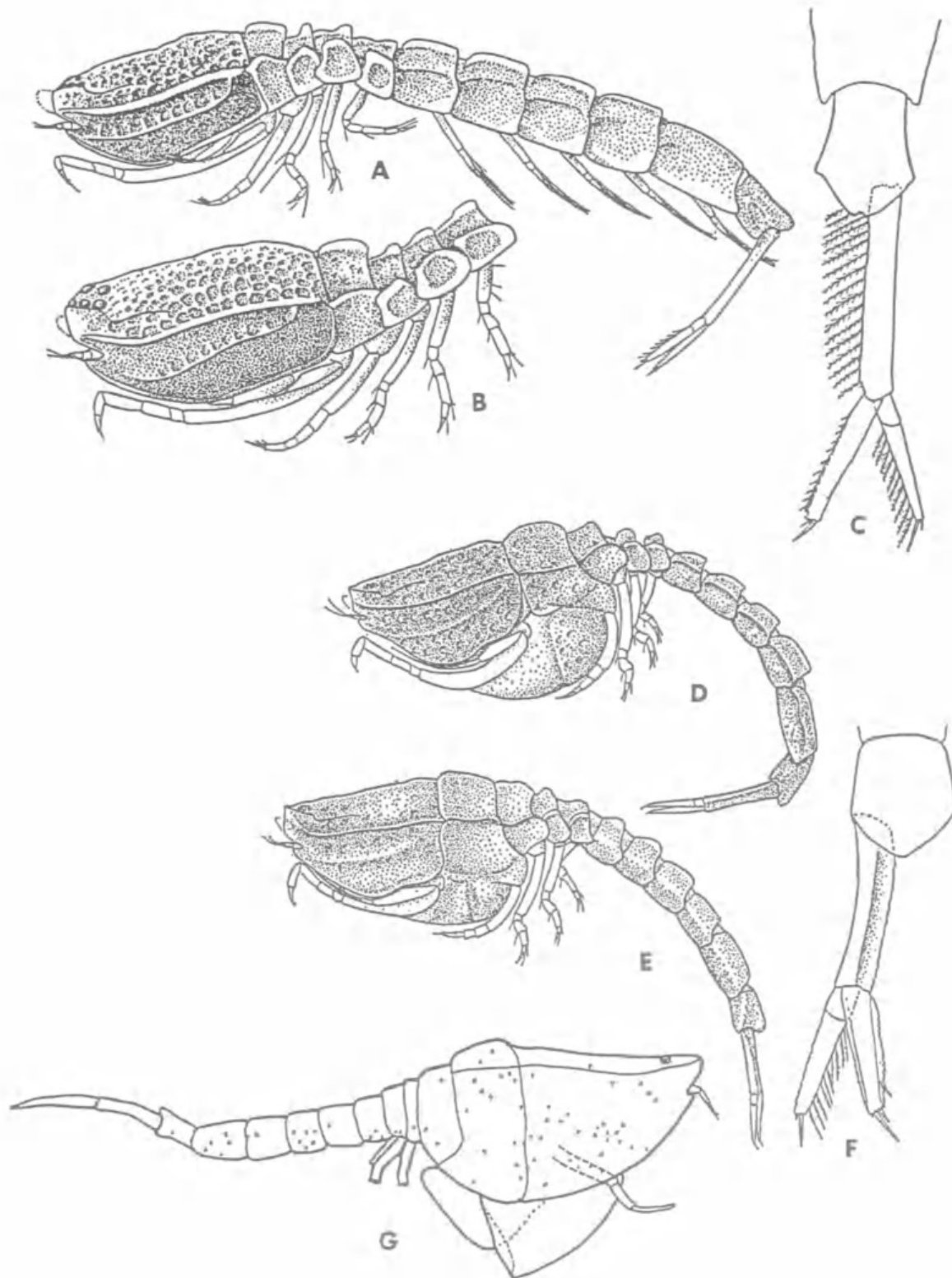


FIG. 5. A-F, *Bodotria maculosa*. A-C, ♂♂. A, form from SA, LV. B, form from NSW, LV. C, telsonic somite and uropod of S.A. form, DV. (A-C after Hale, 1944b). D-F, gravid ♀♀. D, form from Western Australia, LV. E, form without lateral carina on pleon, from WA, LV. F, telsonic somite and uropod of latter WA form, DV. (D-F after Hale, 1949a). G, *Bodotria* sp. nov. 2, gravid ♀, LV.

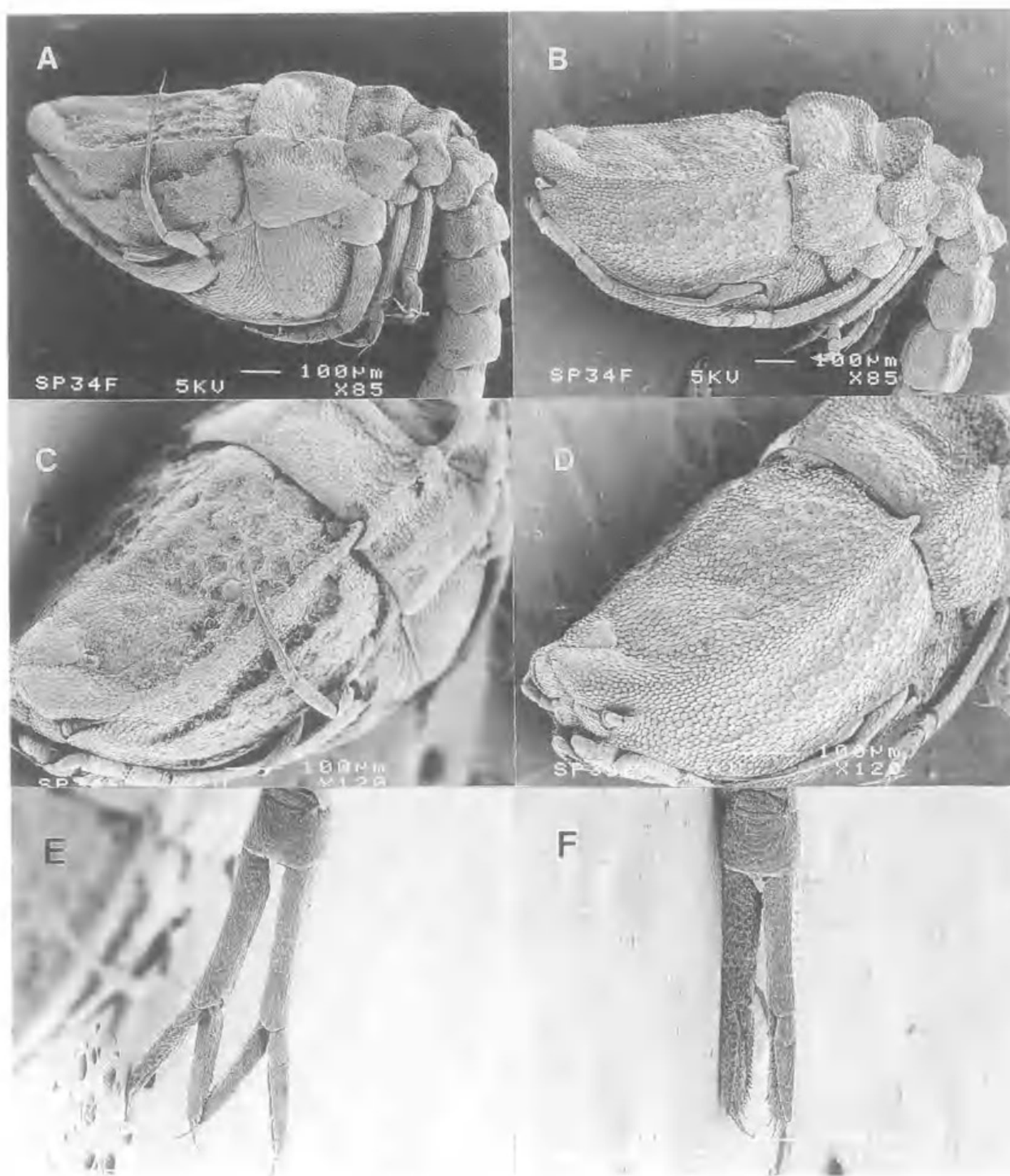


FIG. 6. A, *Bodotria maculosa* Hale ♀ carapace LV, shows squamose-reticulate patterning on carapace and absence of lateral carinae on pleonites. B, *Bodotria armata* sp. nov. ♀ carapace LV, shows lateral carinae on pleonites and absence of squamose-reticulate patterning on carapace. C, *Bodotria maculosa* Hale ♀ carapace DLV, shows prominent lateral carina. D, *Bodotria armata* sp. nov. ♀ carapace DLV, shows overlapping scales and absence of lateral carina. E, *Bodotria maculosa* Hale ♀ uropods VV, shows relatively long, cylindrical peduncles. F, *Bodotria armata* sp. nov. ♀ uropods VV, shows relatively short, angular edged peduncles.



**Colour.** Orange or brown with numerous black chromatophores dotted over entire body.

**S.L.** Adult ♂ 3.5-4.5mm, Adult ♀ 2.9-3.1mm.

**HABITAT AND DISTRIBUTION.** On sand; 2-50m depth. Central and Lower East Coast, S. Gulfs Coast, Central and Lower West Coast (Fig. 4).

**REMARKS.** *Bodotria maculosa* resembles *B. arenosa* Goodsir, 1843 and *B. pumilio* Zimmer, 1921 (= *B. similis* Calman, 1907), but is easily distinguished by the elevated dorsal carinae of the last 3 pedigerous somites (Fig. 5A,D). It is further distinguished from *B. arenosa* by the wider carapace in dorsal view, and the relatively shorter peduncle of the uropod (Figs 5C,F, 6E); from *B. pumilio* by the larger adult size (*pumilio* 2-2.25mm). The Moreton Bay specimen agrees closely with the type series and with the Lizard Island specimens.

Hale noted considerable variation in the sculpture of the carapace and size range of adults (1944b:226). He described two males, one from NSW (Fig. 5A) and 1 from SA (Fig. 5B). The NSW form is smaller, has more pronounced squamose pitting of the carapace, and has more slender thoracic appendages with longer spine-like setae and fine setae. Two ♀♀ forms were described from WA (Hale, 1949a). One form exhibits strong lateral carinae on the pereionites and pleonites (Fig. 5D) while in the other form such carinae are totally lacking (Fig. 5E). When both forms are adult as these are, such differences indicate that more than one species may be involved. Hale designated a type for both the SA and NSW forms so it will be necessary to erect a lectotype for the SA form to be the true *B. maculosa* should further studies conclusively separate the SA, WA and NSW forms as separate species.

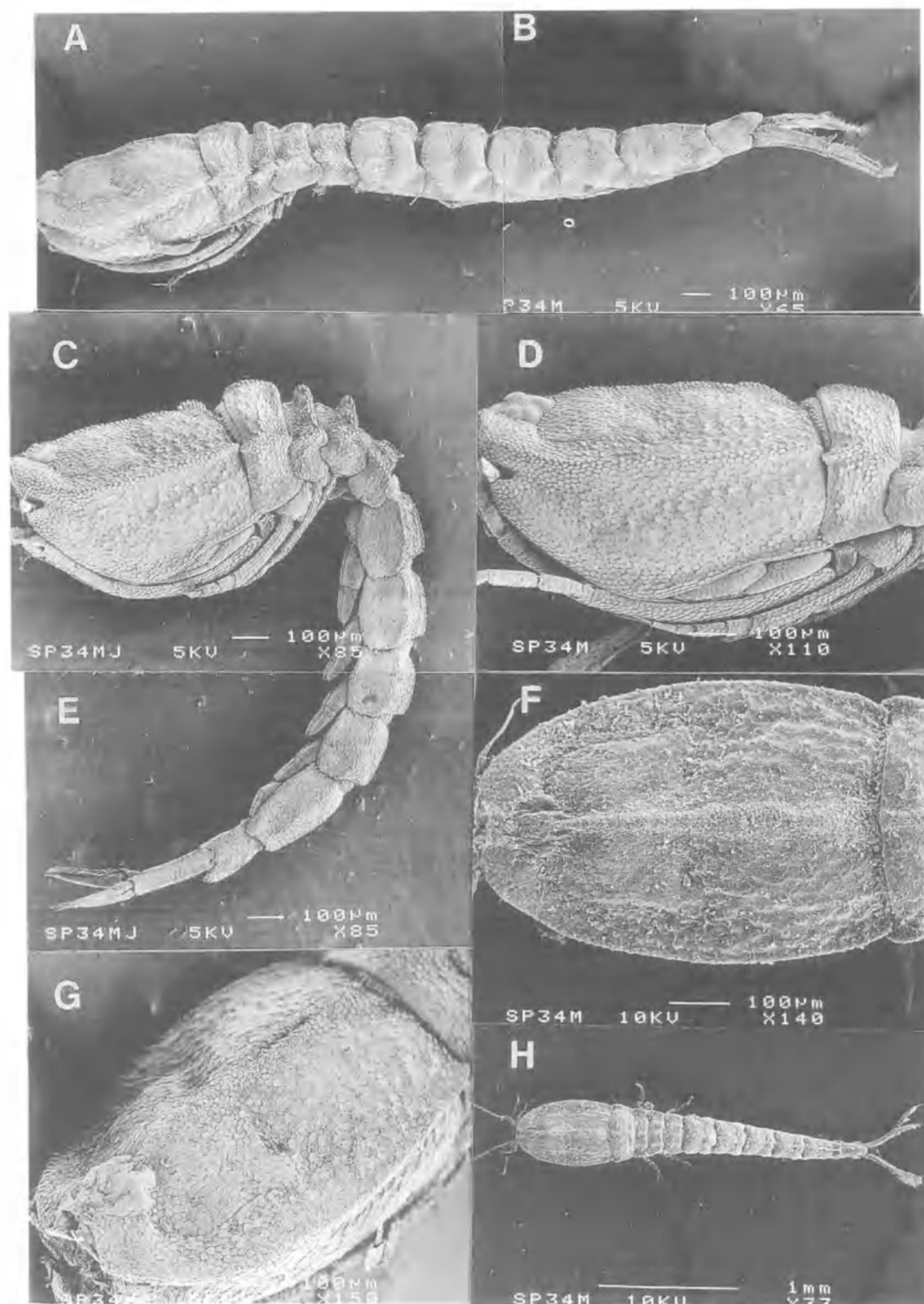
Hale's figure (1949a, fig. 1B), of pereopod 4 is probably incorrectly labelled and should read 'prp.5', since his own drawings of the whole specimen show long basal segments on pereopods 1-4.

***Bodotria armata* sp. nov.**  
(Figs 6B,D,F, 7-11)

**MATERIALEXAMINED.** HOLOTYPE QMW20472 adult ♂ (S.L. 3.2mm), PSM #53, Horseshoe Bay, 27°30'S, 153°21'E, site 31, D. Tafe, 11 Oct. 1990, 2-3m, sand, 35.5 ppt salinity, 24.5°C water temperature. PARATYPES QMW20473 ovig. ♀, allotype, S.L. 2.9mm, PSM #54, same data as holotype;

QMW20474 adult ♂, S.L. 3.0mm, PSM #51, same data as holotype; QMW20475 ovig. ♀, S.L. 2.7mm, PSM #52, same data as holotype; QMW20476 ovig. ♀ S.L. 2.6mm, SEM mount, same location as holotype, 7 April 1991; QMW20477 adult ♂, S.L. 3.1mm, SEM mount, same location as holotype, 7 April 1991; QMW20478 adult ♂, S.L. 3.0mm, PSM #27, same location as holotype, 4 Feb. 1993; QMW20479 ovig. ♀, S.L. 2.4mm, PSM #28, same location as holotype, 4 Feb. 1993.

**DESCRIPTION. MALE.** Integument calcified, covered with small, rounded overlapping scales. Carapace 0.25 S.L.; with strong median dorsal ridge, almost straight in lateral view; lateral ridges prominent, extending length of carapace; carapace 0.74 as wide as long, lateral margins rounded in dorsal view. Antennal notch deep and narrow. Pseudorostral lobes wide, joining anteriorly to ocular lobe which is as wide as long (Fig. 7A-G). Pereonite 1 almost fully concealed. Pereonite 2 as long as fourth or fifth, longer than third; second to fifth pereonites with strong median dorsal and lateral ridges (Fig. 7C,D,G). Pleon robust and tapering in dorsal view; all five pleonites with median dorsal ridges but without defined lateral ridges; first 4 pleonites and telsonic somite subequal in length, fifth pleonite 1.5 times as long as fourth (Fig. 7A-C,E,F,H). Telsonic somite projecting posteriorly over bases of uropods. Posterior margin rounded with median notch in dorsal view (Figs 7B,E,H, 8). First antenna 3-segmented with terminal segmented flagellum; first segment geniculate, longer than next two segments combined; second segment shorter and stouter than third, with two fine setae distomedially, one distolaterally; third segment with three fine distolateral setae; first segment of flagellum twice as long as second, with three proximolateral setae; second segment with two aesthetascs and two fine setae distally (Fig. 8A). Third maxilliped as in *B. maculosa*. First pereopod with carpus reaching level of antennal tooth of carapace; basis c.0.5 as long again as rest of appendage, distal margin not produced, with 2 slender setae; ischium very short, c. 0.33 as long as merus, both segments devoid of long setae; carpus longer than merus and more than twice as long as propodus, which is subequal in length to dactylus; dactylus with 3-4 slender setae distally and strong terminal spine-like seta, subequal in length to segment; all segments of endopod with short spine-like setae on posterior surface; Exopod well developed; 2 slender proximal segments and 5 short distal segments; all segments except basal segment with 2 long setae distally



(Fig. 10A). Pereiopods 2-5 5-segmented (excluding coxa), ischium not separated from basis; carpus and dactylus subequal in length; terminal spine-like seta longer than dactylus; small scattered setae on all segments (Fig. 10B-E). Pereiopod 2 with basal segment slightly longer than combined length of remaining segments, with 4-5 plumose setae and brush of small setae on lateral margin; merus subequal in length to carpus and twice as long as propodus; carpus and dactylus each with three strong spine-like setae distally (Fig. 10B). Pereiopod 3 with basis longer than combined length of remaining segments; merus shorter than each of remaining segments, with 2 long setae distally; carpus shorter than propodus, with one long seta distally; propodus with spine-like seta distally, extending to distal margin of dactylus, which itself bears two terminal spine-like setae subequal in length (Fig. 10C). Pereiopod 4 with basis almost as long as remaining segments combined, with proximolateral seta, distolateral seta and lateral brush of fine setae; merus 0.5 as long as carpus, with 2 distolateral setae; carpus shorter than propodus, with distolateral seta; propodus with proximolateral seta and distomedial spine-like seta, extending to distal margin of dactylus; dactylus with 2 terminal spine-like setae subequal in length (Fig. 10D). Pereiopod 5 with basis much shorter than remaining segments combined, with distolateral seta; merus shorter than carpus, with distolateral seta; carpus shorter than propodus, with distolateral seta; propodus with distomedial spine-like seta, extending to distal margin of dactylus, which itself bears two terminal spine-like setae subequal in length (Fig. 10E). Peduncle of uropod 1.6 times as long as telsonic somite, lined with plumose setae on whole length of inner margin; endopod single-jointed, slightly longer than telsonic somite or exopod, with 9-10 truncated spine-like setae on inner margin, a short subterminal and long terminal spine-like seta; inner and outer margins more or less serrate; exopod with 11-12 plumose setae on inner margin, long terminal spine-like seta and short terminal simple seta (Fig. 8B,C).

**FEMALE.** Integument calcified and covered with

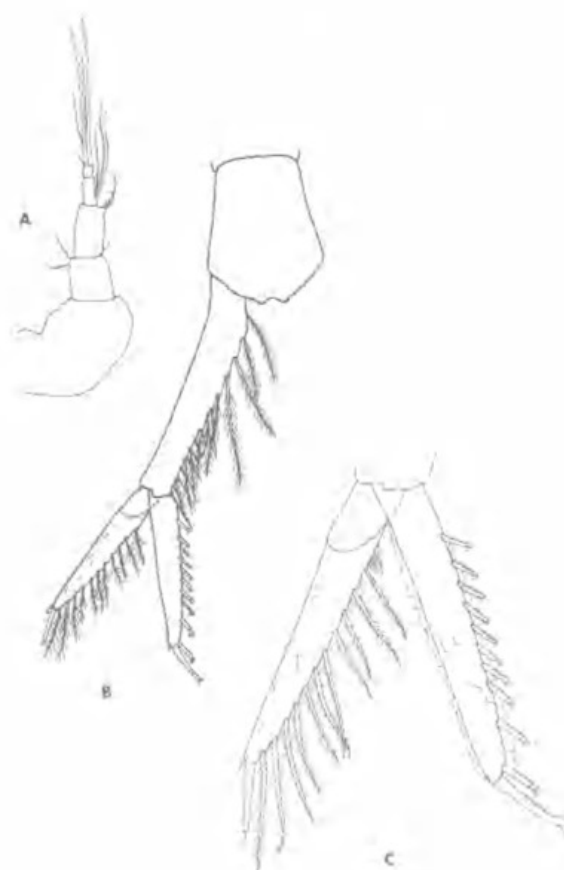
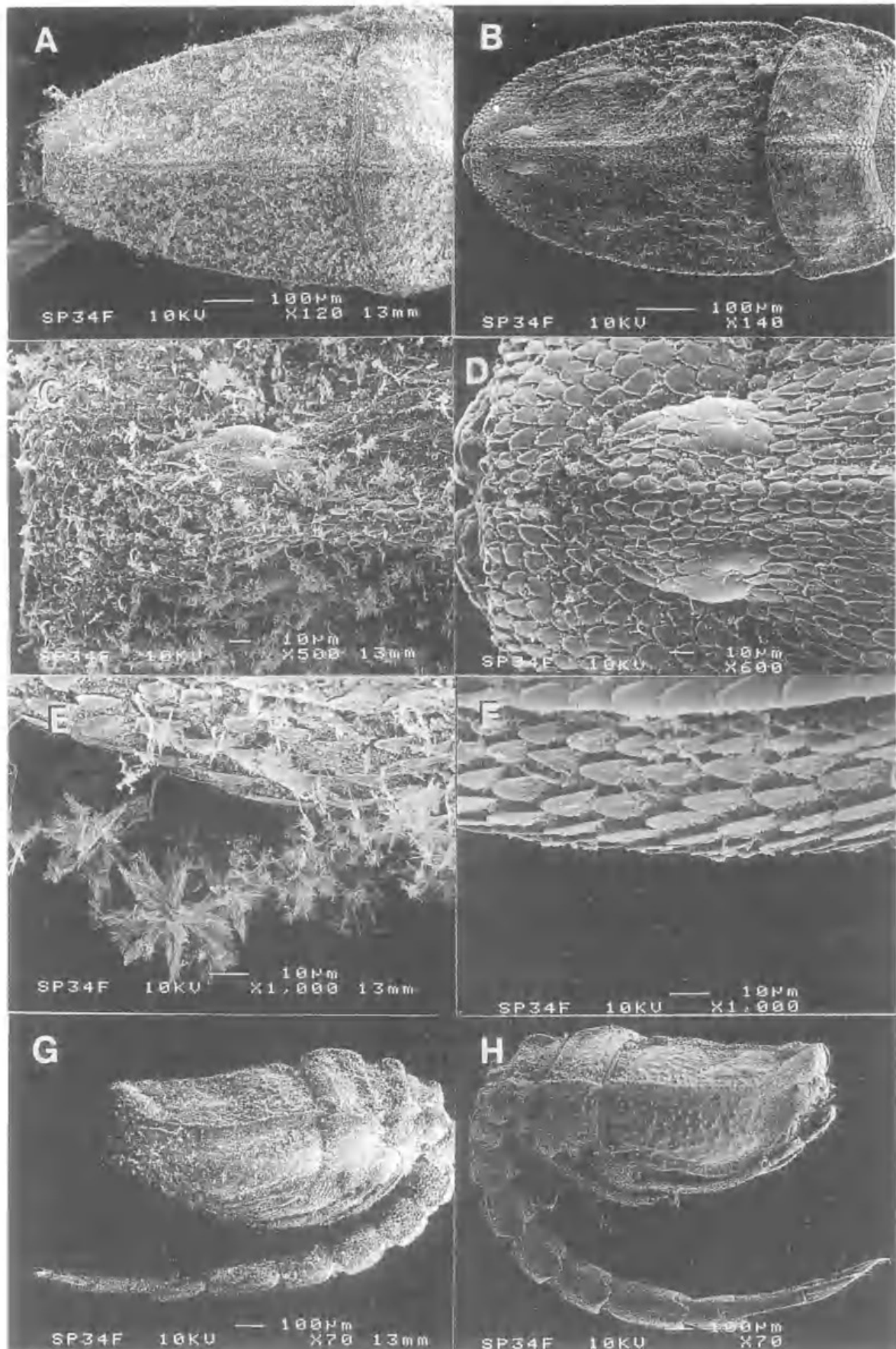


FIG. 8. *Bodotria armata* sp. nov., holotype adult ♂. A, first antenna. B, uropod, DV. C, rami of uropod, DV.

small, rounded overlapping scales, as in the male (Fig. 6B,D). Carapace more than 0.25 S.L.; with strong median dorsal and lateral ridges, as in male; carapace 0.85 as wide as long, lateral margins rounded in dorsal view. Antennal notch and pseudorostral lobes as in ♂ (Figs 6B,D, 9B,D,H). First pereonite almost fully concealed by second, which is longer than pereonites 3-5; all visible pereonites have strong median dorsal and lateral ridges, the dorsal ridges being distinctly keel-like (Figs 6B,D, 9B). Pleon robust, all 5 pleonites with median dorsal ridge and first 3 with defined lateral ridges; first 4 pleonites and telsonic somite subequal in length, fifth pleonite 1.5 times as long

FIG. 7. *Bodotria armata* sp. nov. ♂. A,B, whole mount adult LV, shows relative lengths of carapace and somites. C,E, whole mount subadult LV, shows pronounced dorsal lobes of pereonites, lateral carinae on pleonites and mild lateral carinae on pleonites 3-5. D, carapace adult LV, shows almost straight dorsal edge, overlapping scales and absence of lateral carina. F, carapace adult DV, shows maximum width in mid-region of carapace and median dorsal ridge extending over full length. G, carapace adult DLV, shows dorsal ridge extending over full length and absence of squamose-reticulate patterning. H, whole mount adult DV, shows median dorsal ridge extending continuously along carapace, pereon and pleon.





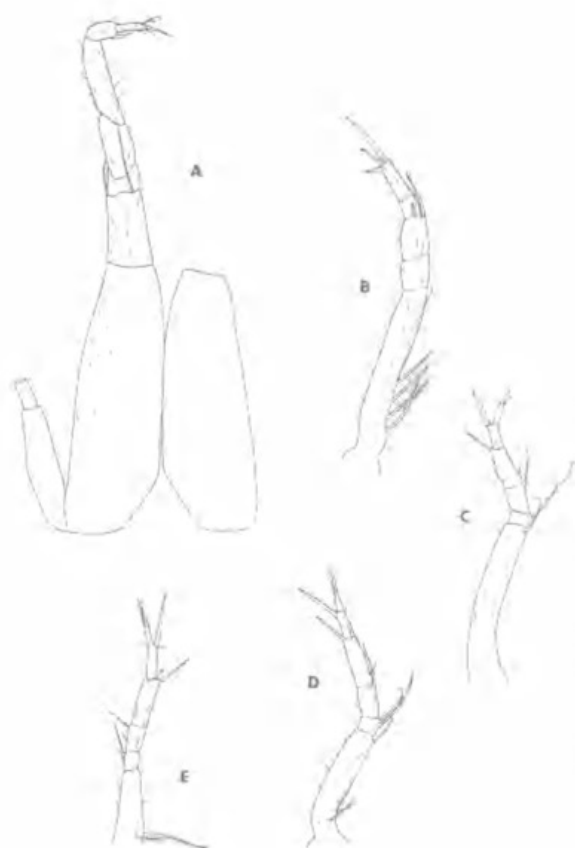


FIG. 10. *Bodotria armata* sp. nov., holotype adult ♂. A, first pereopod. B, second pereopod. C, third pereopod. D, fourth pereopod. E, fifth pereopod.

as fourth (Figs 6B, 9H). Telsonic somite projecting posteriorly over bases of uropods (Fig. 11B). First antenna 3-segmented with terminal segmented flagellum, as in male. Third maxilliped, first, third and fifth pereopods as in male. Basis of second pereopod has only 2 plumose setae, carpus only with 2 distal spine-like setae. Basis of fourth pereopod much longer than remaining segments combined (Fig. 11A). Peduncle of uropod 1.5 times as long as telsonic somite, without plumose setae on inner margin but with small scattered setae on posterior surface; endopod single-jointed, slightly longer than telsonic somite and exopod, with 1 spine-like seta and 6-8 short simple setae on inner margin, a short subterminal and long terminal spine-like seta;

inner and outer margins more or less serrate; exopod with 11 plumose setae on inner margin, long terminal spine-like seta and short terminal seta (Figs 6F, 11B,C).

**Colour.** Orange or brown with numerous black chromatophores in both sexes.

**S.L.** Adult ♂ 3.0-3.2mm, Adult ♀ 2.4-2.9mm.

**HABITAT AND DISTRIBUTION.** On sand; 2-4m; sites 15, 30, 31, 34 and 35. Both sexes are abundant at site 31, and at times outnumber all other cumacean species.

**REMARKS.** *Bodotria armata* resembles *B. maculosa* but is distinguished by the lack of squamose-reticulate patterning on the carapace. Also the scales of the carapace are more pronounced (Figs 6D, 7D, 9D), and the overall size is smaller (0.7x in compared specimens) than that of *B. maculosa*. Minor differences in the ♀ include relatively short, angular uropodal peduncles and lateral carinae on the pleonites (Fig. 6). Minor differences in the ♂ include second segment of first antenna shorter than third; dactylus of first pereopod subequal in length to propodus; terminal spine-like seta of second pereopod longer than dactylus; uropod with 1-2 fewer inner marginal spine-like setae.

The fourth pereopod of the ♀ has a much longer basis than *B. maculosa* (Hale, 1949a, fig. 1B). While *B. armata* differs from both forms of *B. maculosa* described by Hale it more closely resembles the NSW form.

**ETYMOLOGY.** Latin *armata*, armour; for the armour-like overlapping scales on the carapace.

***Bodotria* sp. nov. 1**  
(Fig. 5G)

**MATERIAL.** QMW20480 ovig. (S.L. 2.2mm), in 70% ethanol, site 31, D. Tafe, 11 Oct. 1990, 2-3m, sand, 35.5 ppt salinity, 24.5°C water temperature; specimen poorly preserved.

**Colour.** Whitish with scattered black pigment spots.

**S.L.** Adult ♀ 2.2mm.

**HABITAT AND DISTRIBUTION.** On sand; 3m; 2 ♀ ♀ from site 31, Moreton Bay.

FIG. 9. *Bodotria armata* sp. nov. ♀. A, carapace DV, shows encrusting salt crystals. B, carapace DV, shows surface free of salt crystals. C, ocular lobe DV, shows obscured ocular region. D, ocular lobe DV, overlapping scales of ocular region visible. E, lower carapace LV, shows clinging salt crystals. F, lower carapace LV, shows overlapping scales of lower carapace. G, whole mount LV, shows salt crystals over whole body surface. H, whole mount LV, shows clean body surface with dimpled texture of carapace fully visible.

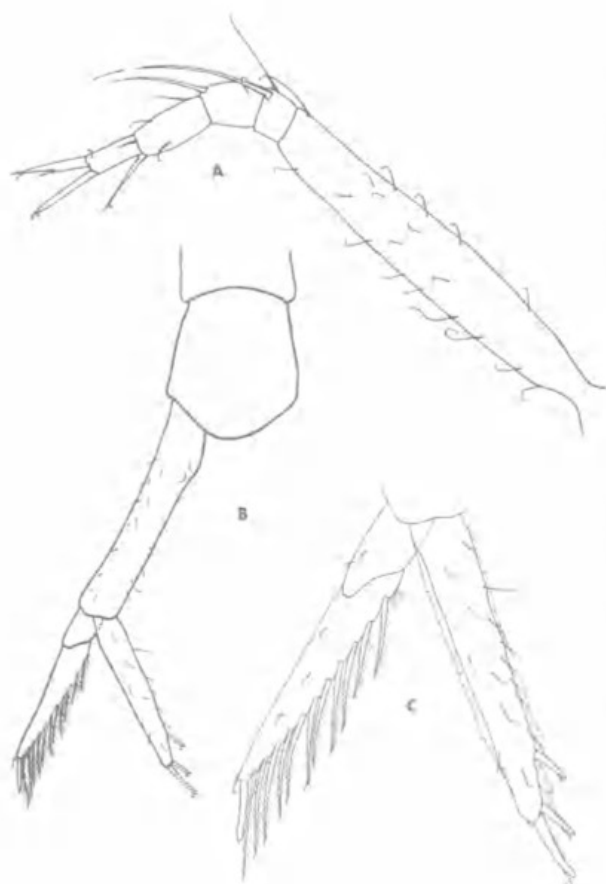


FIG. 11. *Bodotria armata* sp. nov., allotype ovig. ♀. A, fourth pereopod. B, uropod, DV. C, rami of uropod, DV.

REMARKS. *Bodotria* sp. nov. 1 cannot be adequately described until more specimens are secured. The species resembles *B. armata* sp. nov. but the carapace is shorter, broader in dorsal view and not strongly calcified (Fig. 5G); the scales on the carapace are not pronounced, the colouration of the carapace is whitish with scattered black pigment spots, even after being preserved in 70% ethanol for two years (cf brownish without pigment spots in *B. armata*), and the uropods are more delicate.

#### *Cyclaspis* Sars, 1865

DIAGNOSIS. Cuticle strongly calcified. First pereionite seldom visible in dorsal view. Ar-

ticular pegs nearly always present on sides of pleonites. Only first pereopods bear exopod. ♂ with 5 pairs of pleopods. Peduncle of uropods never much shorter than rami; endopod 1-segmented.

REMARKS. 93 species world wide (Bacescu, 1988); found in all oceans, though most species (60%) inhabit shallow water (10-50m) in temperate latitudes of Southern Hemisphere.

#### KEY TO INDO-AUSTRALASIAN SPECIES OF *CYCLASPIS* (Adapted from Hale, 1944a)

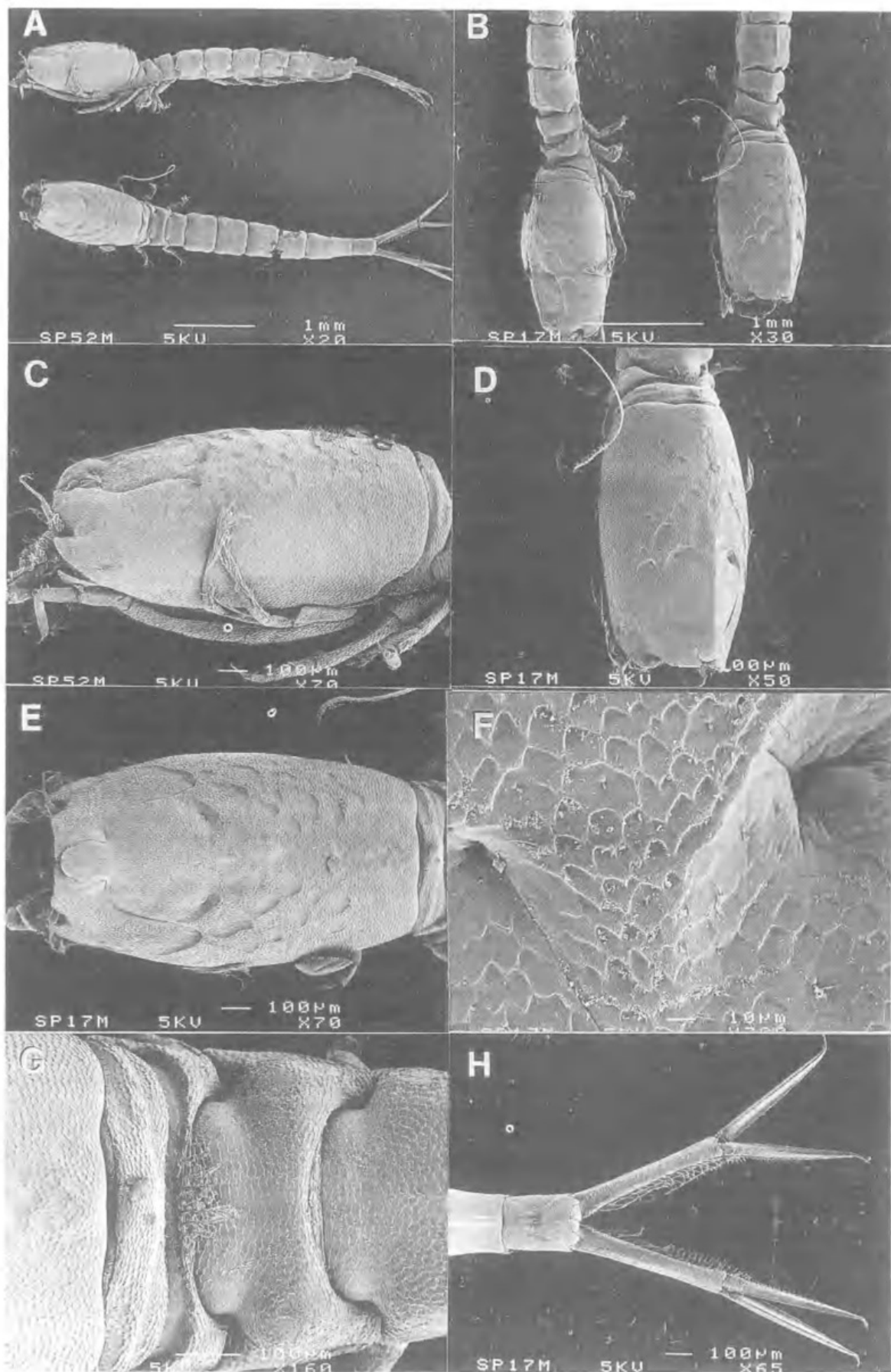
##### SECTION I

Sides of carapace without ridges or tubercles in either sex.

Viewed from above the lateral contour of the carapace is always evenly curved. Carapace usually smooth except for the reticulate patterning, but sometimes slightly roughened owing to granules or pits.

1. Front margin of carapace with an acute, forwardly directed spine on each side, below antennal angle . . . . . *caprella* Hale  
No spines at front of carapace . . . . . 2
2. Pseudorostral lobes meeting for an appreciable distance in front of ocular lobe . . . . . (*picta* group) 3  
Pseudorostral lobes barely or not meeting in front of ocular lobe . . . . . (*levis* group) 11
3. Carapace smooth and delicate, with fine median dorsal ridge for full length of carapace . . . . . 4  
Carapace not as above . . . . . 5
4. Carapace with a low median dorsal projection at posterior end. Rami of uropod subequal in length . . . . . *gibba* Hale  
Carapace with smooth dorsal profile throughout length. Exopod of uropod distinctly longer than endopod . . . . . sp. nov. 2
5. Carapace with many longitudinal rows of minute granules. Peduncle of uropod not longer than telsonic somite . . . . . *costata* Calman  
Carapace smooth. Peduncle of uropod much longer than telsonic somite . . . . . 6
6. Both rami of uropod with at least one articulated terminal spine-like seta . . . . . 7  
Both rami of uropod without terminal spine-like setae . . . . . 8

FIG. 12. *Cyclaspis cretata* Hale ♂. A, whole mounts LV and DV, shows relative lengths of carapace and somites. B, whole mounts (part) DLV, shows carapace and pereionites with dorsal carinae. C, carapace LV, shows antennal notch, depth and length of carapace. D, carapace DLV, shows median dorsal ridge on anterior half. E, carapace DV, shows cretations, apertures and ocular region. F, carapace (dorsal region) DV, detail of apertures in mid-dorsal region. G, Pereionites DV, shows brush of setae on margin of third pereionite. H, uropods DV, shows relative lengths of peduncle and rami.



7. First pereopod short, with carpus not reaching level of antennal tooth. Rami of uropod barely half as long as peduncle, exopod with 2 outer marginal spine-like setae . . . . . *picta* Calman  
First pereopod long, with carpus reaching level of antennal tooth. Rami of uropod about 2/3 as long as peduncle, exopod with 2 outer marginal spine-like setae . . . . . sp. nov. 1
8. Exopod bears a mucrone. Carpus of first pereopod 1/3 as long again as propodus . . . . . *lucida* Hale  
Exopod without mucrone. Carpus of first pereopod not longer than propodus . . . . . 9
9. Peduncle of uropod shorter than exopod. Terminal spine-like seta of second pereopod at least 1/3 as long again as dactylus . . . . . *daviei* sp. nov.  
Peduncle of exopod subequal or longer than exopod. Terminal spine-like seta of second pereopod subequal in length to dactylus . . . . . 10
10. Setae of third to fifth pereopods long; 5 on carpus, the longest reaching for nearly half of their length beyond tip of dactylus . . . . . *mollis* Hale  
Setae of third to fifth pereopods short; 3 on carpus, none reaching beyond tip of dactylus . . . . . *fulgida* Hale
11. Endopod of uropod with at least 1 articulated terminal spine-like seta or mucrone. Carapace heavily calcified and pitted . . . . . *alveosculpta* sp. nov. ♂  
Endopod of uropod with apex acute and without articulated terminal spine-like setae or mucrones. Carapace not heavily calcified or pitted . . . . . 12
12. Exopod of uropod with apex acute and lacking terminal mucrones . . . . . 13  
Exopod of uropod with one or more articulated terminal mucrones . . . . . 30
13. Carapace with numerous fine longitudinal striae . . . . . *strigilis* Hale  
Carapace without longitudinal striae . . . . . 14
14. Carapace with a low median dorsal projection at posterior end . . . . . 15  
Carapace without median dorsal projection at posterior end . . . . . 16
15. Carapace with median dorsal ridge distinct for whole length and with a conspicuous pit on each side alongside posterior median projection. Peduncle of uropod longer than rami . . . . . *sheardi* Hale  
Carapace with median dorsal ridge obsolete for posterior half of length; no conspicuous pits at posterior end. Peduncle of uropod shorter than rami . . . . . *mjobergi* Zimmer
16. Carapace not globose, somewhat laterally compressed in both sexes. Uropods slender, the peduncle longer than the telsonic somite . . . . . 17  
Carapace globose in both sexes. Uropods stout, the peduncle shorter than, or barely as long as, telsonic somite . . . . . 26
17. Propodus of first pereopods almost as long as merus and carpus together . . . . . 18  
Propodus of first pereopods subequal in length to carpus . . . . . 19
18. Inner margin of endopod of uropod with a row of setae, followed by 7-8 slender spine-like setae (adult ♂) . . . . . *levis* Thomson  
Inner margin of endopod of uropod with 3 to 6 proximal spine-like setae, followed by a row of 15-23 shorter spine-like setae (both sexes) . . . . . *cretata* Hale
19. Carapace roughened with fine granules . . . . . *granulosa* Hale  
Carapace not as above . . . . . 20
20. Carapace with two mid-dorsal depressions, one either side of dorsal ridge . . . . . *andersoni* sp. nov.  
Carapace not as above . . . . . 21
21. Carapace somewhat compressed laterally with strong dorsomedial ridge throughout length and no other ridges . . . . . 22  
Carapace not as above . . . . . 23
22. Peduncle of uropod shorter than rami. First pereopod with group of spine-like setae (♂) or fine setae (♀) on medial bulge of basis. S.L. 4-6mm . . . . . *sallai* sp. nov.  
Peduncle of uropod longer than rami. First pereopod without group of spine-like setae (♂) or fine setae (♀) on medial bulge of basis. S.L. 2-4mm . . . . . *cooki* sp. nov.
23. Basis of first pereopods with a large apical tooth-like projection, reaching to distal margin of ischium . . . . . 24  
Basis of first pereopods without large apical tooth . . . . . 25
24. Rami of uropod longer than peduncle (subadult ♂) . . . . . *formosae* Zimmer  
Rami of uropod equal in length to peduncle (ovigerous ♂) . . . . . *herdmani* Calman
25. Peduncle of uropod longer than rami. S.L. <6mm . . . . . *concinna* Hale  
Peduncle of uropod shorter than rami. S.L. >8mm . . . . . *candidoides* Bacescu
26. Size small, ovigerous ♀ 3.5mm. Ocular lobe dilated anteriorly, with prominent circular dark lenses . . . . . *pusilla* Sars  
Size large, ovigerous ♀ 7mm or more. Ocular lobe not dilated anteriorly but somewhat triangular, with lenses pale and elongate . . . . . 27
27. Carapace overhanging second pereonite posteriorly. Third to fifth pereopods with long setae . . . . . *globosa* Hale  
Carapace not overhanging second pereonite posteriorly. Pereopods 3-5 with short setae . . . . . 28

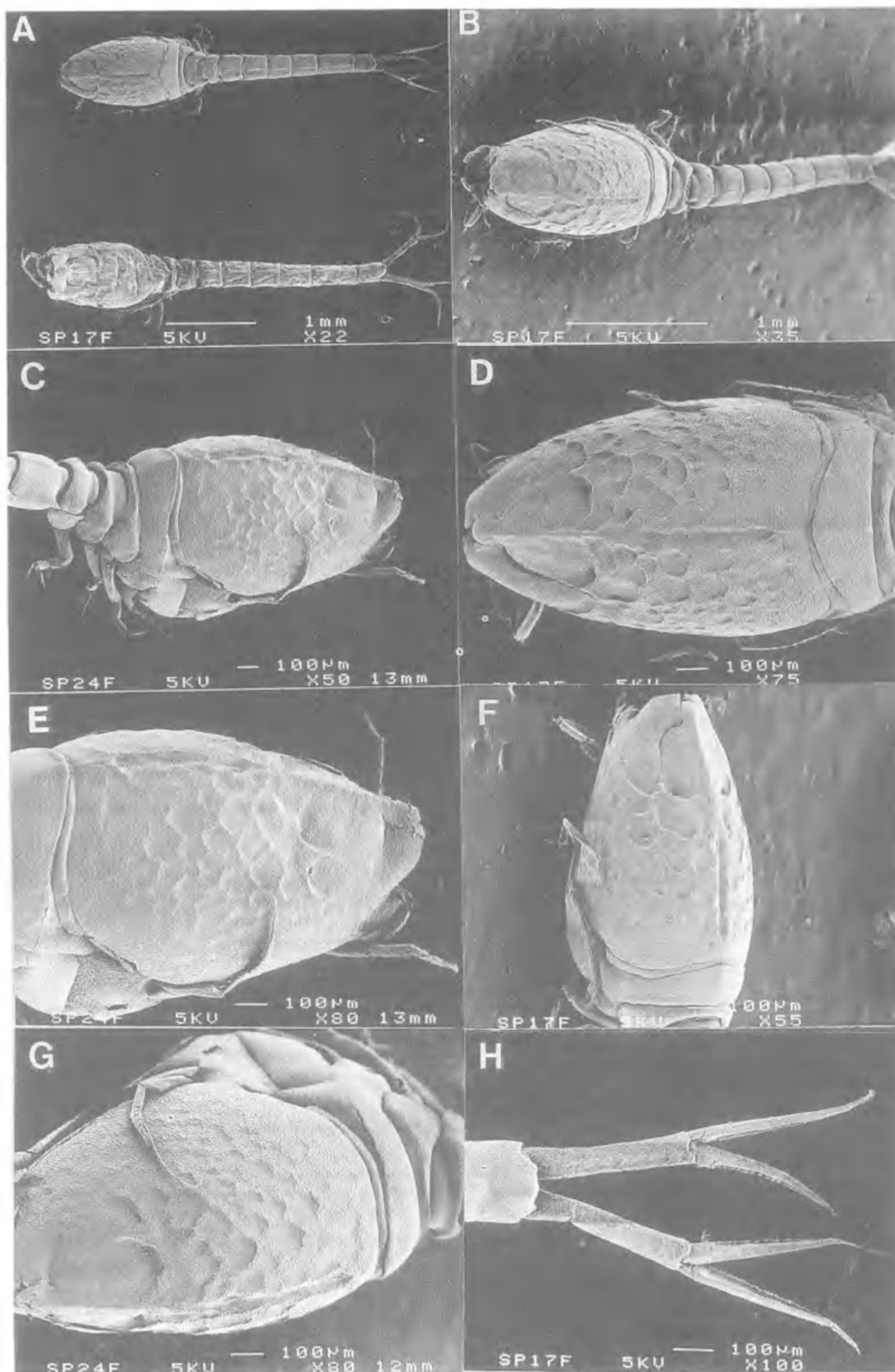


28. Carapace coarsely pitted, slightly rugose. Pleon robust. Dactylus of pereopod 2 with longest terminal spine-like seta shorter than propodus and dactylus together . . . . . *clarki* Hale  
Carapace smooth or with extremely fine reticulation. Pleon slender. Dactylus of pereopod 2 with longest terminal spine-like seta as long as propodus and dactylus together . . . . . 29
29. Optic lobe extends in front of pseudorostral lobes. Peduncle of uropod has setae on inner margin . . . . . *stocki* Băcescu  
Optic lobe does not extend in front of pseudorostral lobes. Peduncle of uropod is devoid of setae on inner margin . . . . . *pinguis* Hale
30. Peduncle of uropods less than 1.5 times as long as telsonic segment and subequal to rami. Exopod with at least 2 elongate unequal mucrones at distal end . . . . . 31  
Peduncle of uropods about twice as long as telsonic segment and longer than rami. Exopod with 1 or 2 short mucrones or spine-like setae at distal end (less than 4x as long as broad) . . . . . 32
31. Exopod of uropod with two unequal mucrones at distal end; ♂ with spine-like setae on basis of first pereopod; ♀ uropod without setae on inner margin of exopod . . . . . *sublevis* Hale  
Exopod of uropod with 3 unequal mucrones at distal end; ♂ without spine-like setae on basis of first pereopod; ♀ uropod with setae on inner margin of exopod . . . . . *tranteri* sp. nov.
32. Exopod of uropod with one or more mucrones 33  
Exopod of uropod with one or more spine-like setae . . . . . 34
33. Peduncle of uropod at most half as long again as rami. Endopod of uropod has proximal half of inner margin naked or with plumose setae (adult ♂) . . . . . *pura* Hale  
Peduncle of uropod 2/3 as long again as rami. Endopod of uropod has 5-6 short spine-like setae on proximal half of inner margin (adult ♂) . . . . . *nitida* Hale
34. Basis of first pereopods only 3/4 as long as rest of limb, with a long apical tooth, reaching distal margin of ischium . . . . . *hornelli* Calman  
Basis of first pereopods subequal in length to rest of limb, with apical tooth short, reaching only mid length of ischium . . . . . *cottoni* Hale
- least one anterolateral tubercle, ridge or tooth-like projection below pseudorostral suture . . . . . 6
2. Carapace with a prominent mid-dorsal tooth over base of ocular lobe . . . . . *uniplicata* Calman  
Carapace with no dorsal tooth . . . . . 3
3. A slight but obvious incision in dorsal margin of carapace at middle of length. Exopod of uropod with no apical spine-like seta, but with mucrone . . . . . *sabulosa* Hale  
No incision in dorsal margin of carapace at middle of length. Exopod of uropod with slender apical spine-like seta . . . . . 4
4. Two ridges on each side of carapace. Propodus of first pereopods subequal in length to dactylus . . . . . *argus* Zimmer  
One ridge on each side of carapace. Propodus of first pereopods much longer than dactylus . . . . . 5
5. Carapace with posterior transverse ridge faint, short and confined to posterior half of carapace. . . . . *thomsoni* Calman  
Carapace without posterior transverse ridge but with fine ridge curving obliquely forwards from median dorsal ridge to antero-inferior margin . . . . . *spilotes* Hale
6. Carapace fully encircled by a collar-like ridge . . . . . *cingulata* Calman  
Carapace not encircled by a collar-like ridge . . . . . 7
7. A quadrilateral area on each side of carapace, defined by ridges or tubercles (distinct and depressed in ♀, often indistinct in ♂) . . . . . (*exsculpta* group) 8  
No quadrilateral area on side of carapace . . . . . 26
8. Carapace with anterior transverse ridge crossing dorsal midline (distinct in ♀, often indistinct in ♂) . . . . . 9  
Carapace with anterior transverse ridge not crossing dorsal midline . . . . . 23
9. Posterior transverse ridge of carapace with 2-3 distinct branching ridges. Propodus of pereopod 1 as long as combined length of ischium, merus and carpus . . . . . *indoaustralica* Băcescu  
Posterior transverse ridge of carapace without distinct branching ridges. Propodus of pereopod 1 not as long as combined length of ischium, merus and carpus . . . . . 10
10. Carapace heavily calcified and composed of a reticulate network of deep craters . . . . . *agrenosculpta* sp. nov.  
Carapace may be heavily calcified and even pitted but not composed of reticulate network of deep craters . . . . . 11
11. Post-ocular tubercle on midline of carapace, immediately in front of anterior transverse ridge. Surface of carapace studded with blunt spines anteriorly . . . . . *tribulis* Hale  
No post-ocular tubercle or blunt spines on anterior of carapace . . . . . 12

## SECTION 2

Sides of carapace never smooth, but with ridges or tubercles, or both. Viewed from above the lateral contour of the carapae, owing to the sculpture, is rarely evenly curved, particularly in the ♀.

1. Sides of carapace almost smooth, with no anterolateral tubercle, ridge or other projection below pseudorostral suture . . . . . 2  
Sides of carapace never almost smooth, with at



12. Texture of carapace scale-like. Peduncle of uropod much longer than rami, more than twice as long in subadult ♀ . . . . . *bovis* Hale  
Texture of carapace pitted. Peduncle of uropod subequal in length to rami . . . . . 13
13. Carapace with reticulate pattern of shallow rounded pits . . . . . 14  
Carapace with honeycomb structure of deep angular pits . . . . . 19
14. Carapace with two lateral carinae running forwards from anterior transverse ridge to front margin of carapace . . . . . *exsculpta* Sars  
Carapace without such carinae . . . . . 15
15. Carapace with median dorsal ridge produced posteriorly as keel-like lobe with notch . . . . . *alveosculpta* sp. nov.  
Carapace with median dorsal ridge produced posteriorly as rounded keel-like lobe without notch . . . . . 16
16. Dorsolateral carinae present between two transverse ridges of carapace . . . . . 17  
No dorsolateral ridges between transverse ridges . . . . . 18
17. Transverse ridges of carapace with denticulations. S.L. 9-11 mm . . . . . *prolifera* Băcescu  
Transverse ridges of carapace smooth. S.L. 4-6 mm . . . . . *ornosculpta* sp. nov.
18. Dactylus of first pereopod at least - as long as propodus . . . . . *candida* Zimmer  
Dactylus of first pereopod less than 2/3 as long as propodus . . . . . *usitata* Hale
19. Carapace with pits separated by thick walls . . . . . *chaunosculpta* sp. nov.  
Carapace with pits separated by network of thin walls . . . . . 20
20. Longitudinal ridge runs obliquely from below antennal tooth almost to end of carapace . . . . . *mawsonae* Hale  
No such ridge . . . . . 21
21. Carapace with median dorsal keel forming 3 lobes posteriorly; posterior transverse ridge rising on either side of median notch into laminar tooth with sharp apex bending forward and downward . . . . . *persculpta* Calman  
Carapace with median dorsal keel forming 1 lobe posteriorly; posterior transverse ridge rising on either side of median line to form blunt forwardly directed tooth . . . . . 22
22. Carapace with small posterolateral lobes either side of median dorsal lobe; exopod of uropod without setae . . . . . *supersculpta* Zimmer  
Carapace without posterolateral lobes either side of median dorsal lobe; exopod of uropod with setae . . . . . *agrenosculpta* sp. nov.
23. Cephalothorax and pleon covered with small spine-like setae; no ridges on back or sides of carapace . . . . . *aspera* Hale  
Cephalothorax and pleon not covered with small spine-like setae; well defined ridges on sides of carapace . . . . . 24
24. Posterior transverse ridge crosses dorsal midline . . . . . *australis* Sars  
Posterior transverse ridge does not cross dorsal midline . . . . . 25
25. Quadrangular area on side of carapace with 4 prominent tubercles . . . . . *elegans* Calman  
Quadrangular area on side of carapace with 1 or 2 prominent tubercles . . . . . *similis* Calman
26. Carapace with tubercles or ridges posterior to the anterolateral tubercles . . . . . 27  
Carapace without tubercles or ridges posterior to the anterolateral tubercles . . . . . 32
27. Side of carapace with 3 obliquely transverse carinae . . . . . 28  
Side of carapace with 1 transverse curved carina or none . . . . . 30
28. Carapace with reticulate pattern of deep angular pits . . . . . *mawsonae* Hale  
Carapace without deep angular pits . . . . . 29
29. Carapace with mid-dorsal projection at hinder margin . . . . . *triplicata* Calman  
Carapace without mid-dorsal projection at hinder margin . . . . . *sibogae* Calman
30. Carapace covered in minute sparse spinules with a well marked spinose median dorsal ridge for whole length; on each side are four rounded tubercles; short ridge leading back from antennal notch (♂) . . . . . *cana* Hale  
Carapace not as above; longitudinal ridge running from antennal tooth to about middle of carapace length . . . . . 30
31. Dorsum of carapace, as seen from side, rising abruptly to an angular peak at middle of length . . . . . *simula* Hale  
Dorsum of carapace smoothly rounded . . . . . *coelebs* Calman

FIG. 13. *Cyclaspis cretata* Hale ♀. A, whole mounts DV, shows relative lengths of carapace and somites. B, whole mount DV, shows carapace, pereionites and pleonites with median dorsal carinae. C, carapace DLV, shows articular peg and median dorsal carina of first pleonite. D, carapace DV, shows ocular region, apertures and absence of setae on margin of third pereionite. E, carapace DLV, shows median dorsal ridge on anterior half and median dorsal depression on posterior half. F, carapace DLV, shows apertures in the bases of both anterior cretations and collar-like first pereionite. G, carapace DLV, shows anterior cretations with apertures and posterior cretations without apertures. H, uropods DV, shows relative lengths of peduncle and rami.

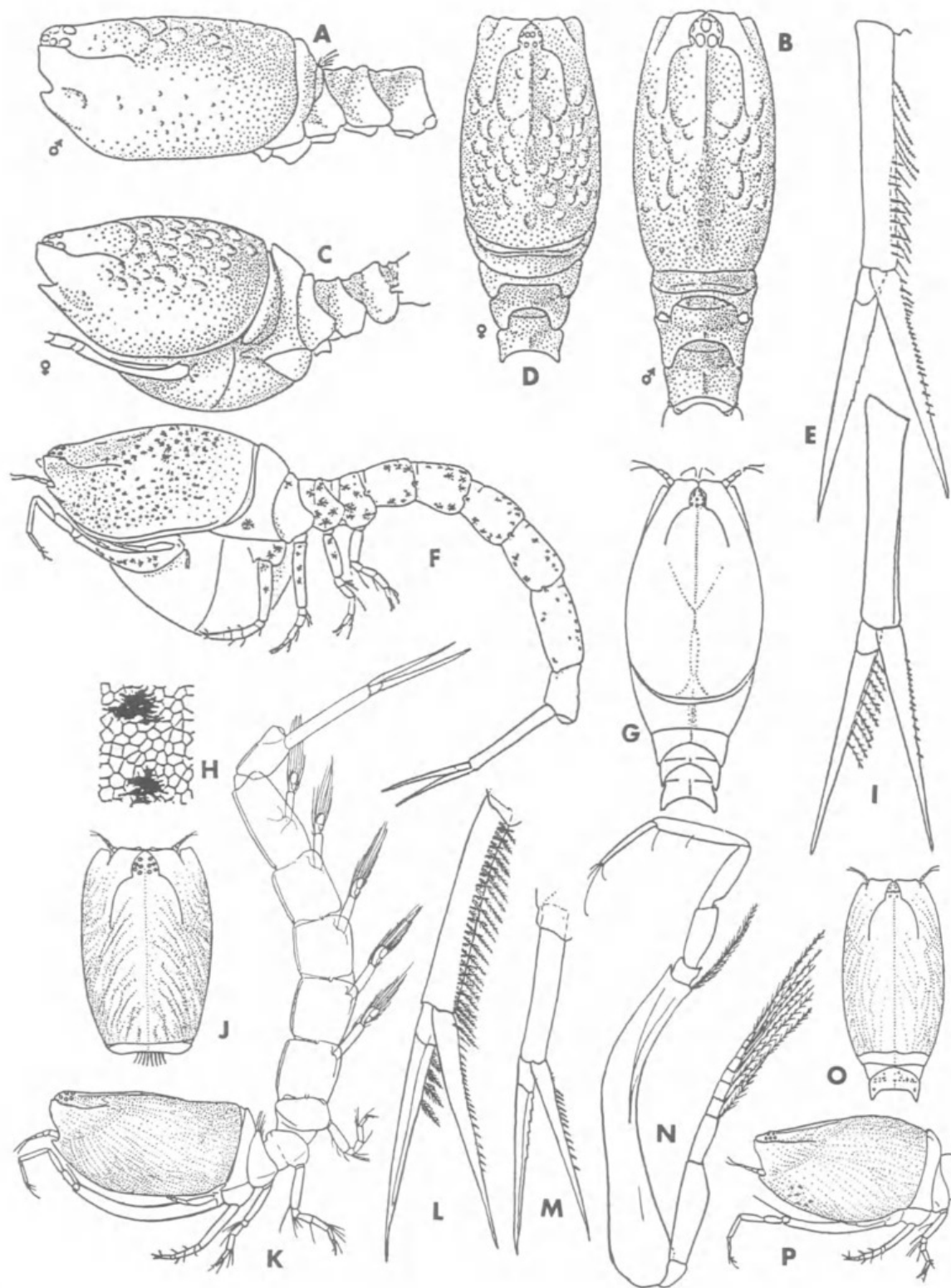


FIG. 14. *Cycloaspis* species. A-E, *Cycloaspis cretata*. A, adult ♂, cephalothorax, LV. B, ♂, DV. C, gravid ♀, cephalothorax, LV. D, DV. (A-D after Hale, 1948). E, paratype ♂ uropod. F-I, *Cycloaspis fulgida*, type ♀. F, LV. G, cephalothorax, DV. H, chromatophores of integument. I, uropod, DV. J-P, *Cycloaspis strigilis*. J-L, type ♂. J, cephalothorax, DV. K, LV. L, uropod, DV. M-P, paratype ♀. M, uropod, DV. N, first pereopod. O, cephalothorax, DV. P, cephalothorax, LV (E-P after Hale, 1944a).





FIG. 15. *Cyclaspis usitata* gravid ♀. A, first antenna. B, mandible. C, pereopod 4. D, first maxilla. E, second maxilla. F, uropods, DV. G, rami of uropod, DV.

32. Ocular lobe narrow, much longer than wide. Pereopod 1 with dactylus about as long as carpus . . . . . *munda* Hale  
 Ocular lobe as wide as long, much longer than wide. Pereopod 1 with dactylus less than half as long as carpus . . . . . *pruinosa* Hale

***Cyclaspis cretata* Hale, 1944**  
 (Figs 12, 13, 14A-E)

*Cyclaspis cretata* Hale, 1944a:91, figs 19,20. Hale, 1948:4, fig. 2.

*Cyclaspis* ? *cretata* Stephenson et al., 1978:210.

**MATERIAL EXAMINED.** HOLOTYPE SAMC2418 ♂ (6mm long), Cronulla, NSW, 2.5m, K. Sheard, submarine light, Sept. 1942. PARATYPES SAMC2366, C2368, C2370, C2371 ♂, ♀, 4.2-5.3mm long, Spencer Gulf, SA, 6m, K. Sheard, Feb. 1941. OTHER MATERIAL QMW20481 adult ♂, S.L. 4.6mm, SEM mount, Rainbow Channel, site 26, 27°27'S, 153°23'E, D. Tafe, 16 Feb. 1989, 6m, on sand,

34 ppt salinity, 25°C water temperature; QMW20482 adult ♀, S.L. 4.2mm, SEM mount, same data as above; QMW20483 adult ♂, S.L. 4.5mm, PSM #41, Horseshoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 14 Aug. 1991, 2-3m, on sand, 27.2 ppt salinity, 16.5°C water temperature.

**Colour.** Whitish with faint brown mottling; sparse black chromatophores sometimes present on carapace and abdomen.

S.L. Adult ♂ 4.2-6.0mm. Adult ♀ 4.0-5.3mm.

**HABITAT AND DISTRIBUTION.** On sand often around coral reefs; 2-25 m; from S. Gulf Coast and Lower West Coast (Fig. 4). NSW: Cronulla. SA: Kangaroo Is. Memory Cove, Spencer Gulf (Hale, 1944a). QLD: Sandy Cape, Noosa River, off Moreton Island (Hale, 1948), Moreton Bay (common in sandy areas). WA: Rottnest Island, Shark Bay, South Passage, Thomson Bay, Abrolhos Islands, Turtle Bay, off Walabi Island and Andaman Island (Hale, 1948).

**REMARKS.** Moreton Bay specimens matched Hale's type specimens but are slightly smaller than his NSW and SA specimens. Both sexes are distinguished from other species by the pattern of pitting on the posterior dorsal surface of the carapace (Figs 12A-F, 13A-G, 14A-D). ♂ ♂ and ♀ ♀s have 4 depressions in the mid-dorsal region of the carapace, located in the bases of the anterior pits (Figs 12D-F, 13D-G). ♂ ♂ have a tuft of short setae on the dorsum of the third pereopod (Figs 12G, 14A), which is not present on the ♀ (Figs 13C-F, 14C). The uropods of the Moreton Bay ♂ ♂ (Fig. 12H) are identical to those figured by Hale (Fig. 14E). The uropods of the ♀ have not been previously figured; those shown here (Fig. 13H) match the original description.

***Cyclaspis fulgida* Hale, 1944**  
 (Fig. 14F-I)

*Cyclaspis fulgida* Hale, 1944a:80, figs 9,10. Hale, 1948:24, fig. 13. Hale, 1953a:72.

**MATERIAL EXAMINED.** HOLOTYPE SAMC2424, ovig. ♀, length 5.75mm, K. Sheard, submarine light, Sept. 1942, 2.5m, Cronulla, NSW. OTHER MATERIAL QMW20484, adult ♂, S.L. 3.9mm, PSM #55, Horseshoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 13 Aug. 1990, 2-3m, on sand, 27 ppt salinity, 16.5°C water temperature.

**Colour.** Whitish, sooty black chromatophores sometimes present on carapace, pereopods and abdomen.

S.L. Adult ♂ 3.9-5.5mm. Adult ♀ 5.75mm.

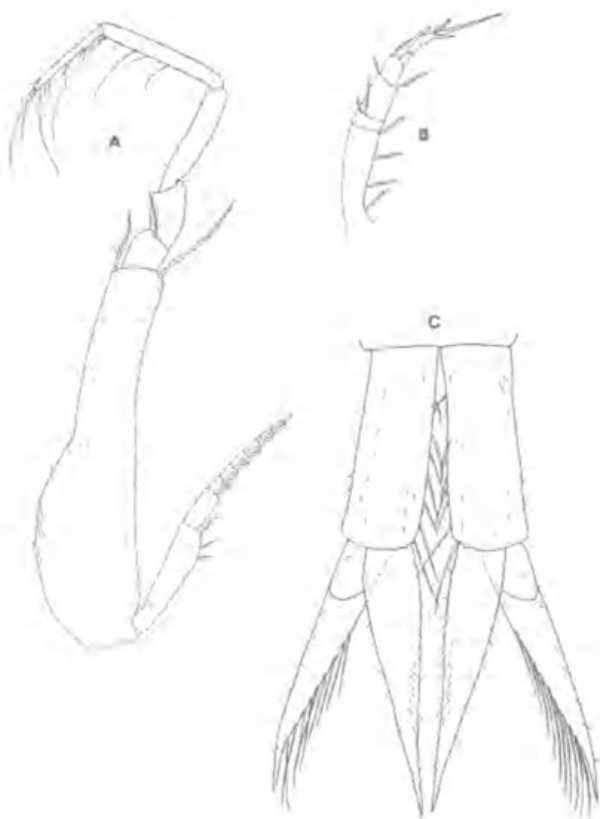


FIG. 16. *Cyclaspis usitata* subadult ♂. A, first pereopod. B, second pereopod. C, uropods, DV.

**HABITAT AND DISTRIBUTION.** On sand; 2-5m; Central East Coast, Lower East Coast, and Lower West Coast (Fig. 4). NSW: Cronulla (Hale, 1944a). WA: Garden Island, Careening Bay (Hale, 1948). Qld: Moreton Bay (Hale, 1948).

**REMARKS.** Moreton Bay specimens match Hale's type specimens from Cronulla. The cuticle is smooth and scarcely calcified and the carapace ovoid in dorsal view. It has a shallow lateral depression on each side of a low median dorsal ridge, which continues towards the posterior as a faint double ridge. The ocular lobe is prominent and slightly elevated. The pseudorostral lobes meet in front of the ocular lobe. The colour of the

cuticle is white with scattered, sooty black chromatophores. This species resembles *C. mollis* but the ocular lobe is more prominent, the basis of the first pereopod has a well developed distomedial tooth and the endopod of the uropod has 13 (cf. 8) medial spine-like setae (Fig. 14I). Common in Moreton Bay.

***Cyclaspis strigilis* Hale, 1944**  
(Fig. 14J-P)

*Cyclaspis strigilis* Hale, 1944a:83, figs 11-14.

**MATERIAL EXAMINED.** SAMC2412-2413 ♂, ♀, off Fraser Island, Qld, 24°20'S, 153°02'E. ('Warreen' Mar. 1938); AMP22642 ♂, ♀, North Head, Sydney; QMW20485 ovig. ♀, S.L. 4.7mm, PSM #20, Pumicestone Passage, site #12, 26°49'S, 153°8'E, J. Greenwood, 26 Jan 1990, 2m, on sand, 34.9 ppt salinity, 27.3°C water temperature.

**Colour.** Colourless to whitish, with a few brown chromatophores on carapace, pereopods and abdomen.

S.L. Adult ♂ 4.4mm. Adult ♀ 3.6-4.7mm.

**HABITAT AND DISTRIBUTION.** On sand; 1-7m; NE and Central E Coast. Qld: Fraser Island area (Hale, 1944a), Moreton Bay.

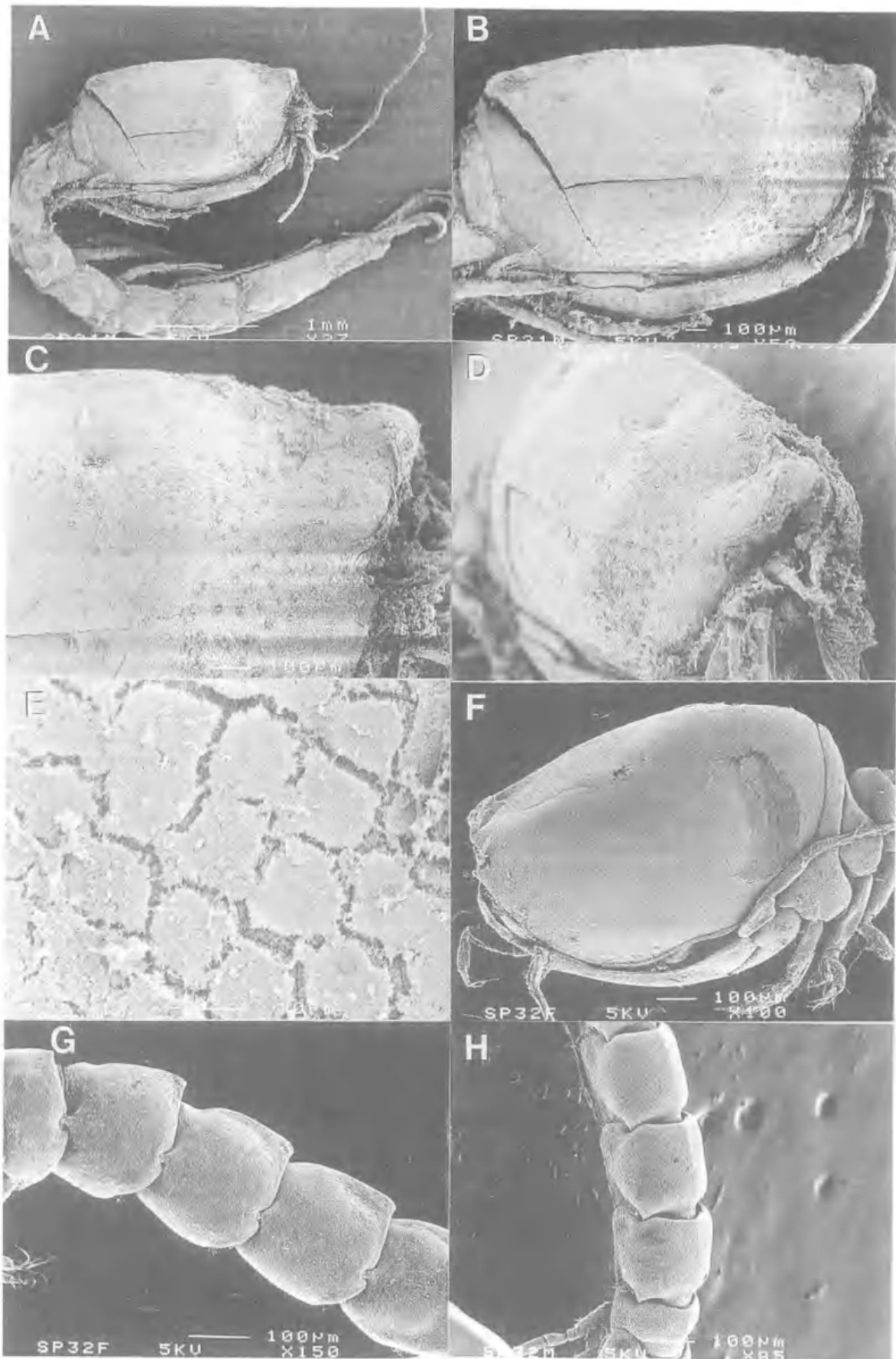
**REMARKS.** ♀ first pereopod of Moreton Bay specimen with inner apical angle of basis rounded rather than pointed as shown by Hale (Fig. 9N). S.L. of Moreton Bay specimen is 30% larger than the type specimen. Otherwise the specimen agrees exactly with the original description.

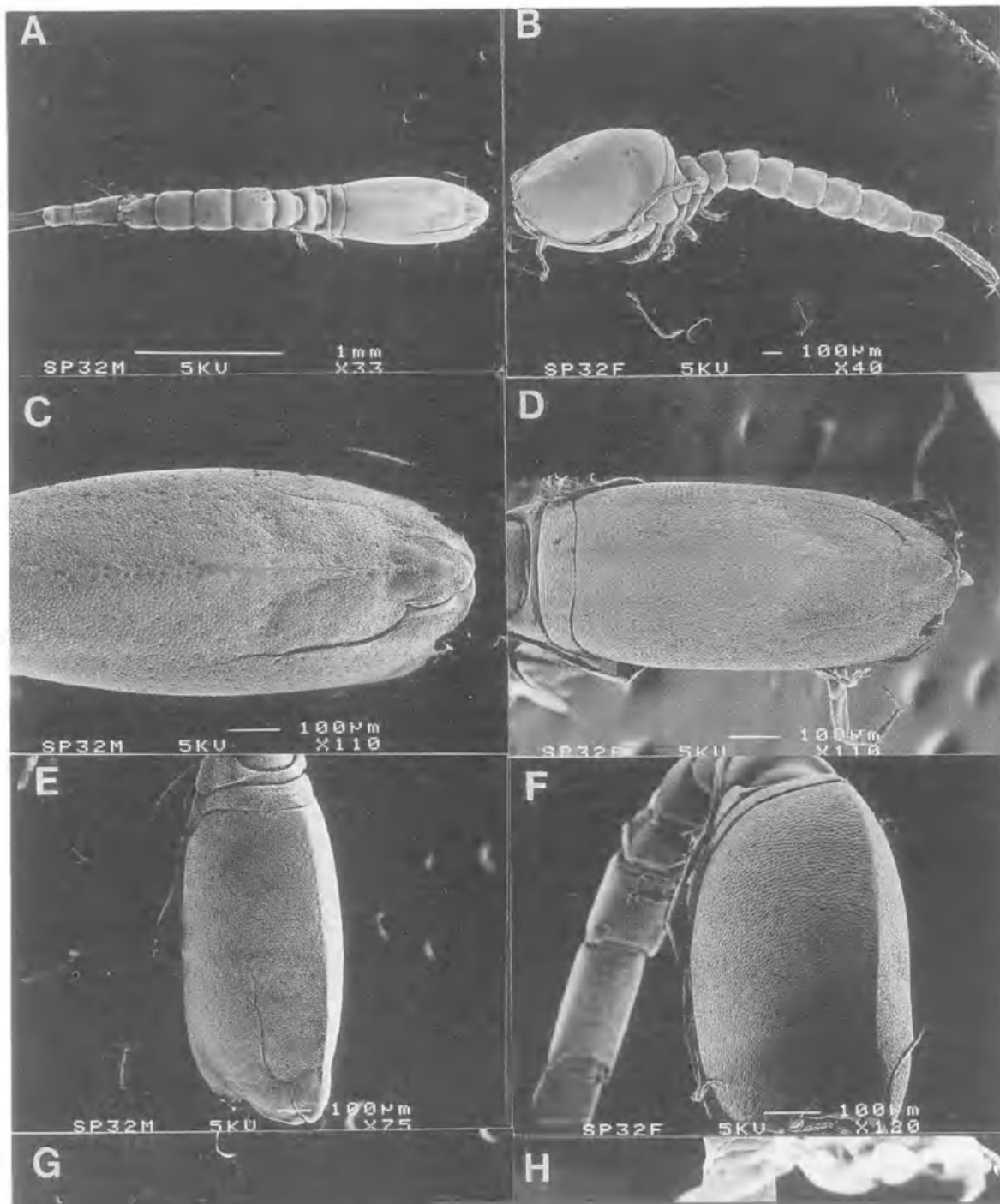
***Cyclaspis usitata* Hale, 1932**  
(Figs 15, 16)

*Cyclaspis usitata* Hale, 1932:549, fig.1; Hale, 1944a:122, figs 43,44.

**MATERIAL EXAMINED.** HOLOTYPE SAMC1841, ♀, S.L. 10mm, St. Vincent Gulf, SA. OTHER MATERIAL AMG917, ♀; QMW20486 ovig. ♀, S.L. 6mm, PSM #12, Pumicestone Passage, site #12, 26°49'S, 153°8'E, J. Greenwood, Mar. 1992, 2m, on sand, 35.4 ppt salinity, 24.5°C water temperature;

FIG. 17. *Cyclaspis alveosculpta* sp. nov. ♂. A, whole mount LV, shows relative lengths of carapace and somites. Also shows affects of partial digestion in fish. B, carapace LV, shows shape of carapace in lateral view. C, Anterior carapace LV, shows reduction of anterior transverse ridge and pattern of pits in integument. D, carapace ALV, shows reduction of anterior and posterior transverse ridges and position of ocular lobe. E, carapace LV, detail of integument showing reticulate pattern of scales. F-H, *Cyclaspis cooki* sp. nov. ♀ F, carapace LV, shows delicate, finely reticulate integument and prominent sub-acute antennal tooth. G, Pleonites 1-3 LV, shows articular notches and median dorsal ridge. H, Pleonites 1-3 DLV, shows fine median dorsal ridge of pleon.







QMW20487 sub-adult, S.L. 5.4mm, PSM #42, Pumicestone Passage, same data as above; QMW20488, sub-adult ♂, S.L. 6mm, PSM #14, off Macleay Island, 27°36'S, 153°22'E, D. Tafe, 9 Nov. 1989, 1.5 m, on fine sand, 34 ppt salinity, 25°C water temperature.

*Colour.* Whitish to yellow.

S.L. Adult ♂: 6-8mm, Adult ♀: 5-9mm.

**HABITAT AND DISTRIBUTION.** On sand; 1-7m; S Gulfs Coast, Lower and Central E Coast. SA: St. Vincent Gulf. NSW: Jervis Bay (Hale, 1944a). Qld: Moreton Bay.

**REMARKS.** The Moreton Bay form is smaller than the SA and NSW forms but similar in size to the WA form. The first antenna, fourth pereopod and uropod of the ♀ (Fig. 15) match those of Hale (1944a:123). The ♂ has not as yet been described. The subadult ♂ from Moreton Bay cannot be described as the ♂ of the species, considering the extent of morphological change which occurs in all members of the *exculpta* group during maturation. Hale (1948) suggested that *C. mjobergi* Zimmer may well be the ♂ of *C. usitata*. Certainly the description of *C. mjobergi* (♂) given by Zimmer (1921) closely resembles the above subadult ♂ of *C. usitata* (♂), however, the length of the former species (type) is recorded as 14mm. Smaller specimens (8-9mm) of *C. mjobergi* (♂) from St. Vincent Gulf (Hale, 1944a: 88), differ in segmentation and setation of the pereopods to the above subadult ♂ of *C. usitata* (Fig. 16).

Hale (1944a:122) recorded a large number of ♀♀ of *C. usitata*, c.7mm in length, from Brighton, SA. He also recorded an ovigerous ♀, 6mm long, from Shark Bay, WA (1948:41). The types of *C. candida* and *C. mjobergi* (Zimmer, 1921), both appear to be too large (12.5 and 14mm respectively) to be considered the ♂ of *C. usitata*.

***Cyclaspis cooki* sp. nov.**  
(Figs 17F,G,H, 18-20)

**MATERIAL EXAMINED.** HOLOTYPE QMW20520, adult ♂, S.L. 5mm, PSM #48, Pumicestone Passage, site 12, 26°49'S, 153°8'E, J. Greenwood,

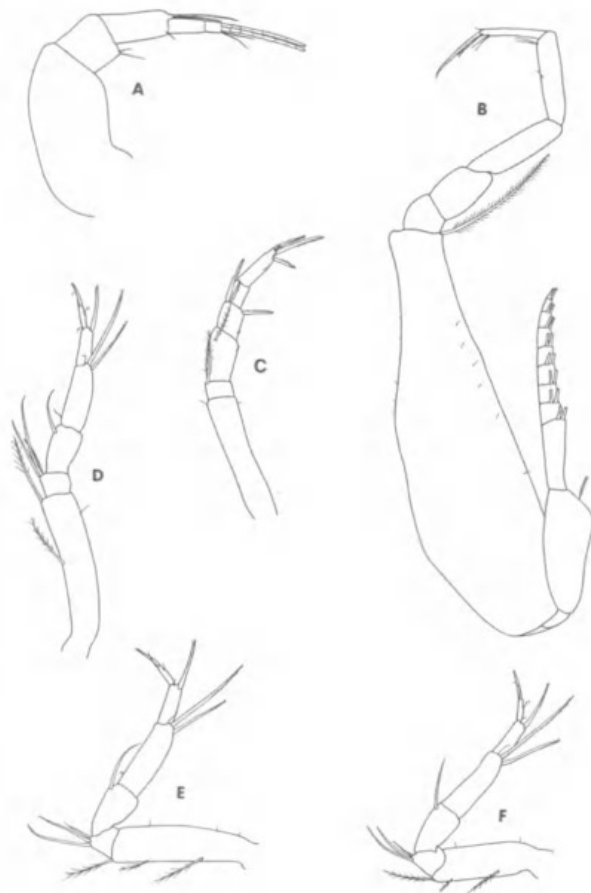


FIG. 19. *Cyclaspis cooki* sp. nov. A-B, holotype adult ♂. A, first antenna. B, first pereopod. C, second pereopod. D, third pereopod. E, fourth pereopod. F, fifth pereopod.

4 May 1990, 2m, coarse sand, 33.3 ppt salinity, 23.5°C water temperature. PARATYPES QMW20521, ovig. ♀, allotype, S.L. 2.5mm, PSM #47, same data as holotype; QMW20522, adult ♂, S.L. 3.06mm, SEM mount, off Coochiemudlo Island, site 35, 5m, sand, 27°34'S, 153°21'E, D.Tafe, 17 June 1990, 34 ppt salinity, 18°C water temperature; QMW20523, adult ♀, S.L. 2.4mm, SEM mount, same data as above.

**DESCRIPTION. MALE.** Integument lightly calcified, delicate and easily broken, even when freshly caught; finely reticulate and sparsely pitted (Fig. 18A,C,E). Carapace length 0.32 S.L. and 0.48 as wide as long in dorsal view, with

FIG. 18. *Cyclaspis cooki* sp. nov. A, ♂ DV, shows relative lengths of carapace and somites. B, ♀ LV, shows relative lengths of carapace and somites. C, ♂ carapace DV, shows shape and texture of carapace. D, ♀ carapace DV, shows shape and texture of carapace. E, ♂ carapace DLV, shows strong median dorsal ridge extending throughout. F, ♀ carapace DLV, shows strong median dorsal ridge extending throughout. G, ♂ uropods DV, shows relative lengths of peduncle and rami. H, ♀ uropods VV, shows relative lengths of peduncle and rami.

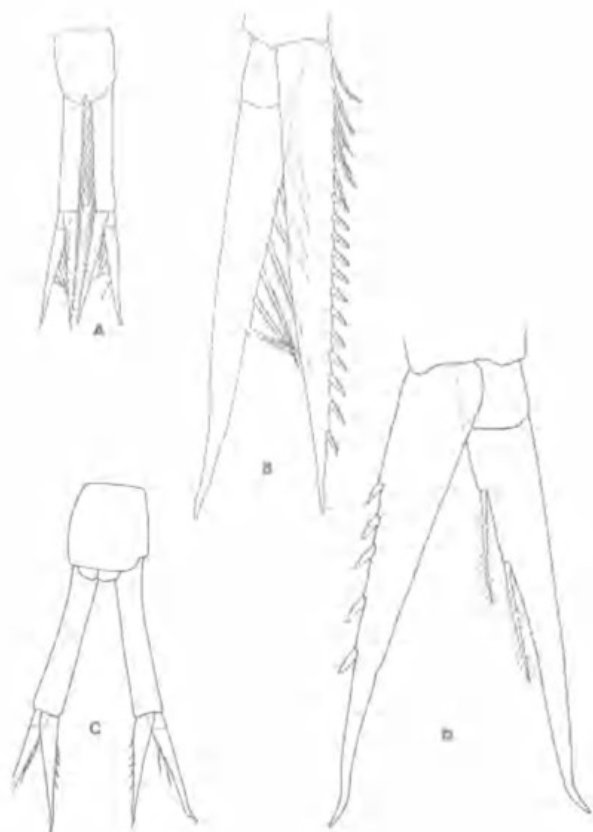
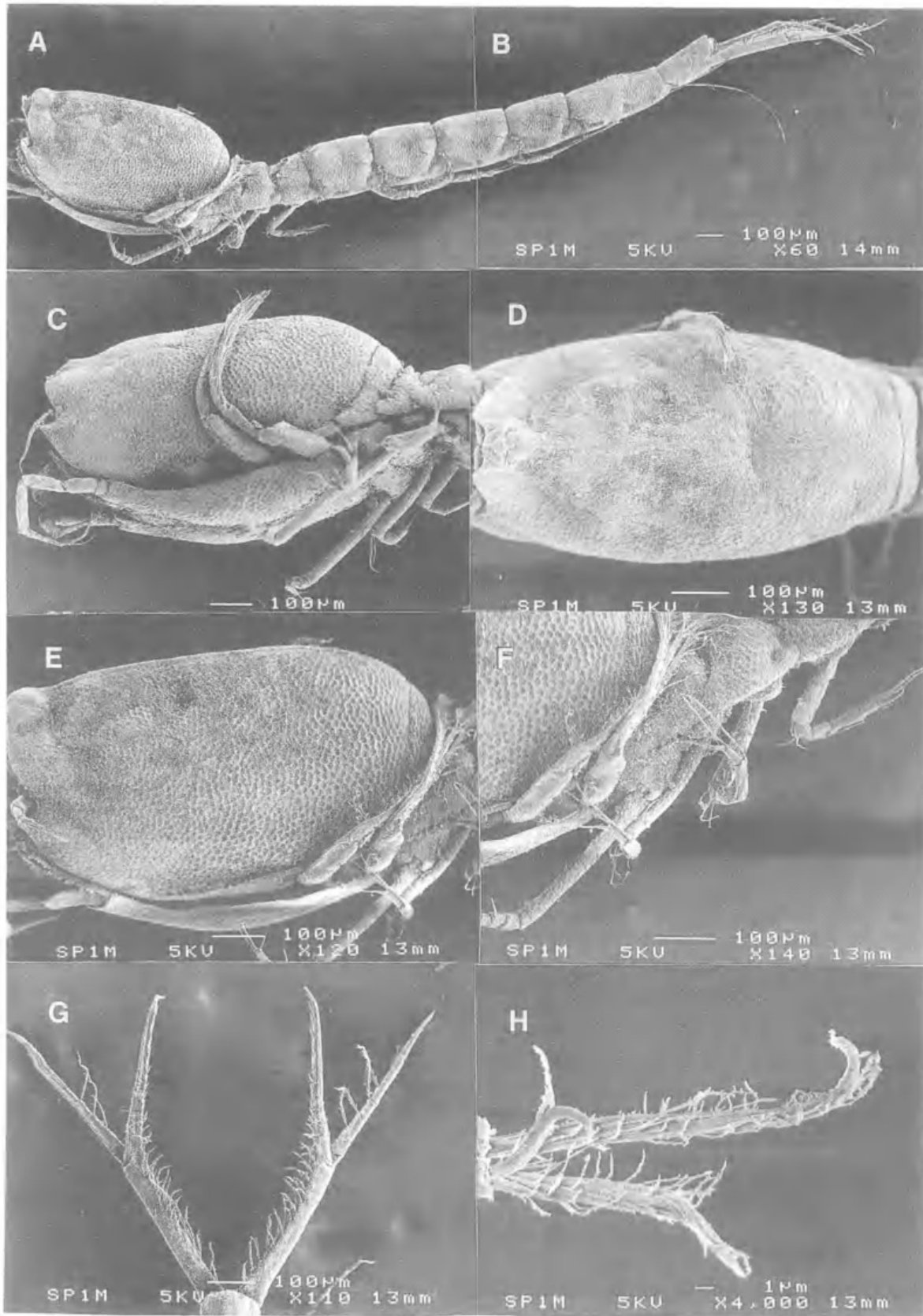


FIG. 20. *Cycloaspis copki* sp. nov. A-B, holotype adult ♂. A, uropods and telsonic somite, DV. B, rami of uropod, DV. C-D, allotype ovig. ♀. C, uropods and telsonic somite, DV. D, rami of uropod, DV.

strong median dorsal ridge throughout length, lateral margins evenly rounded, dorsal edge slightly arched, pseudorostral lobes barely reaching apex of ocular lobe; sides of carapace devoid of ridges or sculpture; antennal notch moderate and visible in dorsal view; antennal tooth subacute, no antennal ridge; pseudorostral lobes wide, joining just anterior to ocular lobe which is almost as wide as long, rounded, with 9 lenses, 3 central surrounded by 6 outer lenses (Fig. 18C,E). Pereion 0.48 as long as carapace; first pereionite fully concealed; second pereionite a narrow collar posterior to carapace; lateral section shorter than each of remaining 3 overlapping pereionites (Fig. 18A,E).

Pleon robust with median dorsal ridge and well-developed lateral articular processes; first 4 pleonites subequal in length, fifth pleonite 1.3 times as long as fourth (Fig. 18A). First antenna 3-segmented with terminal segmented flagellum; first segment somewhat geniculate, longer than second and third segments combined; second segment 0.9 times third segment, with 2 fine setae distolaterally; third segment with 2 slender setae distomedially and one distolaterally; first segment of flagellum twice as long as second, which has 2 aesthetascs and 2 fine setae distally (Fig. 19). All pereopods 7-segmented, with terminal spine-like setae longer than dactylus, except in first pereopod; some spine-like setae have rows of fine spinules distally (Fig. 19). First pereopod with basis 1.2 times length of remaining segments combined, with plumose seta distolaterally; ischium 0.6 times length of merus which is 0.7 times length of carpus; carpus subequal in length to propodus, which is 1.4 times length of dactylus, with 1 medial and 2 distal setae; dactylus with 2 slender terminal spine-like setae, 1 almost as long as itself, 1 terminal seta and 2 stout subterminal setae; exopod well developed, wide proximal segment with 1 short plumose seta distolaterally and 8 shorter distal segments, each with 2 long setae (Fig. 19). Second pereopod with basis 0.8 times length of remaining segments combined, with minute distomedial and distolateral setae; ischium 0.4 times length of merus, with plumose seta distomedially; merus 1.7 times length of carpus, with plumose seta distomedially; carpus 1.4 times length of propodus, with 2 spine-like setae distomedially and 1 spine-like seta distolaterally; propodus 0.5 times length of dactylus, which has 2 terminal spine-like setae, one slightly longer than itself, 1 small terminal seta and 1 subterminal spine-like seta (Fig. 19). Third to fifth pereopods with merus longer than ischium, carpus as long as combined length of propodus and dactylus, the longer of which is propodus; basis with 1-3 plumose setae medially; ischium with 3 setae distomedially; merus with seta distomedially; carpus with 2 spine-like setae and 1 fine seta distolaterally; propodus with spine-like seta and minute seta distally; dactylus

FIG. 21. *Cycloaspis tranteri* sp. nov. ♂. A,B, whole mount LV, shows relative lengths of carapace and somites. C, carapace LV, shows subacute antennal tooth and first pereopod. D, carapace DV, shows maximum width in mid-region and median dorsal ridge visible along anterior 2/3 of carapace. E, carapace LV, shows fine reticulate pattern of pits, and relative length and depth of carapace. F, Pereiopods LV, shows very long basal segment of second pereopod. G, uropods DV, shows relative lengths of peduncle and rami. H, Distal end of exopod DV, shows two setose terminal mucrones and one small curved terminal seta.



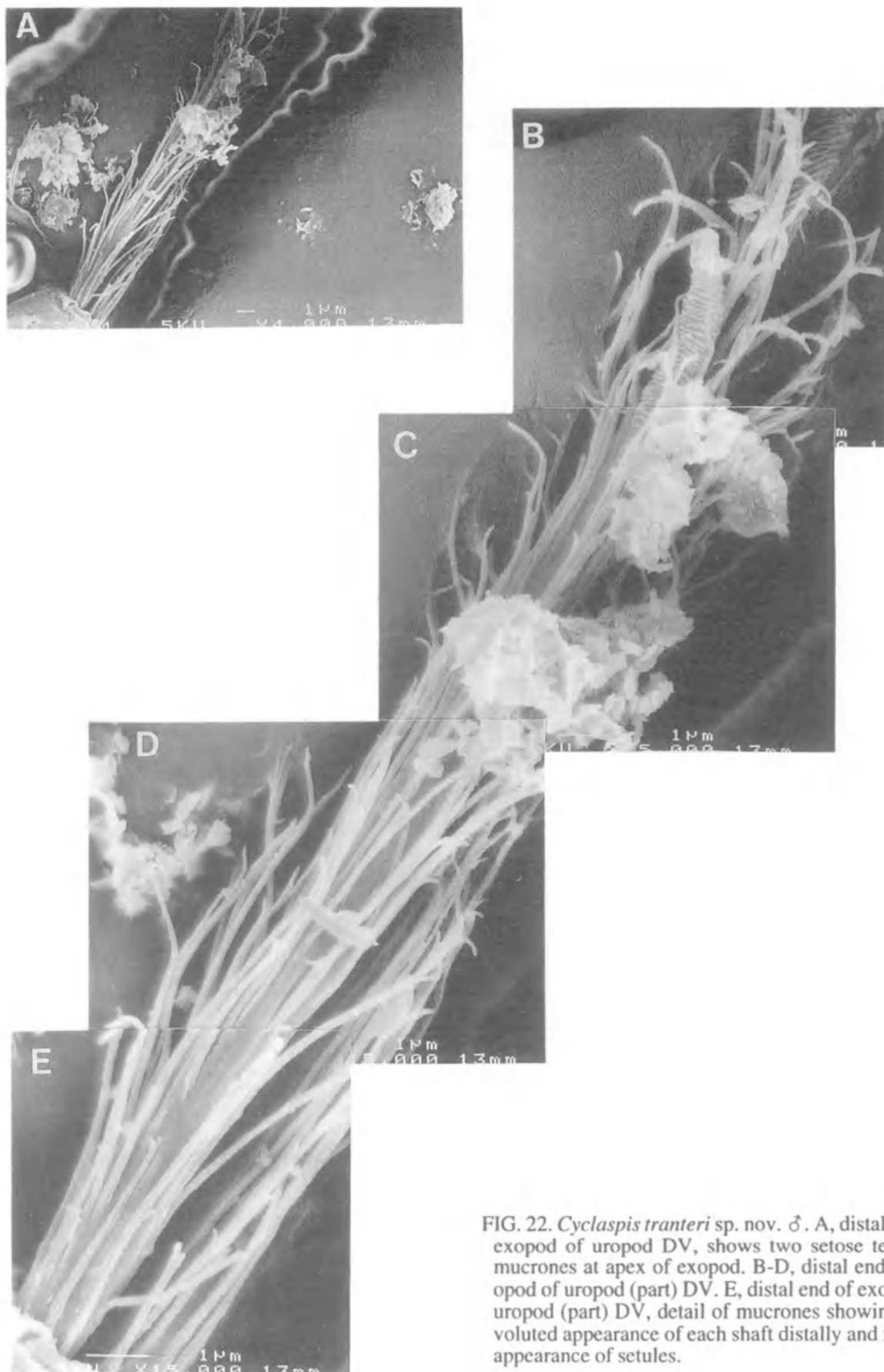


FIG. 22. *Cycloaspis tranteri* sp. nov. ♂. A, distal end of exopod of uropod DV, shows two setose terminal mucrones at apex of exopod. B-D, distal end of exopod of uropod (part) DV. E, distal end of exopod of uropod (part) DV, detail of mucrones showing convoluted appearance of each shaft distally and fibrous appearance of setules.



with terminal spine-like seta, terminal seta and subterminal seta (Fig. 19D-F). Third pereopod with basis slightly shorter than remaining segments combined; ischium 0.4 times length of merus; merus 0.7 times length of carpus; propodus 1.7 times length of dactylus (Fig. 19D). Fourth pereopod with basis 0.7 times length of remaining segments combined; ischium 0.4 times length of merus; merus 0.65 times length of carpus; propodus 1.7 times length of dactylus (Fig. 19E). Fifth pereopod with basis 0.5 times length of remaining segments combined; ischium 0.4 times length of merus; merus 0.7 times length of carpus; propodus 1.7 times length of dactylus (Fig. 19F). Peduncle of uropod 1.8 times as long as telsonic somite, lined with 14-15 plumose setae on inner margin; endopod 0.9 times as long as peduncle, subequal in length to exopod, with 6 slender spine-like setae and 11-12 stout spine-like setae on proximal 3/4 of inner margin, apex pointed, without spine-like setae or mucrones; exopod with 6-8 plumose setae on proximal 2/3 of inner margin, apex pointed, without spine-like setae or mucrones (Fig. 19A,B).

**OVIGEROUS FEMALE.** Integument lightly calcified, finely reticulate and sparsely pitted, as in ♂ (Fig. 18B,D,F). Carapace length 0.35 S.L. with strong median dorsal ridge and sides devoid of ridges or sculpture, as in ♂; width 0.48 times length in dorsal view; antennal tooth subacute and extending to anterior extremity of carapace; ocular lobe and pseudorostral lobes as in ♂ (Figs 17F, 18D,F). Pereion 0.4 times as long as carapace. First pereionite fully concealed by second, both produced ventrally to form the marsupium; pereionites with dorsal ridge, dorsolateral margin of fifth with articulation notch (Fig. 18B). Pleon robust, all five pleonites with dorsal ridge and lateral articulation notches; first 4 pleonites and telsonic somite subequal in length, fifth pleonite 1.5 times as long as fourth (Figs 17G,H, 18B). Telsonic somite projecting posteriorly over bases of uropods (Figs 18B, 20C). First antenna 3-segmented with terminal segmented flagellum, as in ♂. Pereiopods as in ♂ except: merus of second pereopod has stout spine-like seta distolaterally; carpus of third to fifth pereopods each have 3 distal spine-like setae rather than 2 spine-like setae and 1 minute seta. Peduncle of uropod 1.6 times as long as telsonic somite, without plumose setae on inner margin; endopod 0.75 times as long as peduncle, subequal in length to exopod, with 5 spine-like setae on proximal 2/3 of inner margin, apex

pointed, without spine-like setae or mucrones; exopod with 2 plumose setae on proximal 1/3 of inner margin, apex pointed, without spine-like setae or mucrones (Fig. 20C,D).

**Colour.** Cream with small black chromatophores speckled on carapace and abdomen.

S.L. Adult ♂ 3.0-3.5mm. Adult ♀ 2.4-2.5mm.

**HABITAT AND DISTRIBUTION.** Medium and coarse sand; 1-5m water depth; sites 12, 34, 35 in Moreton Bay.

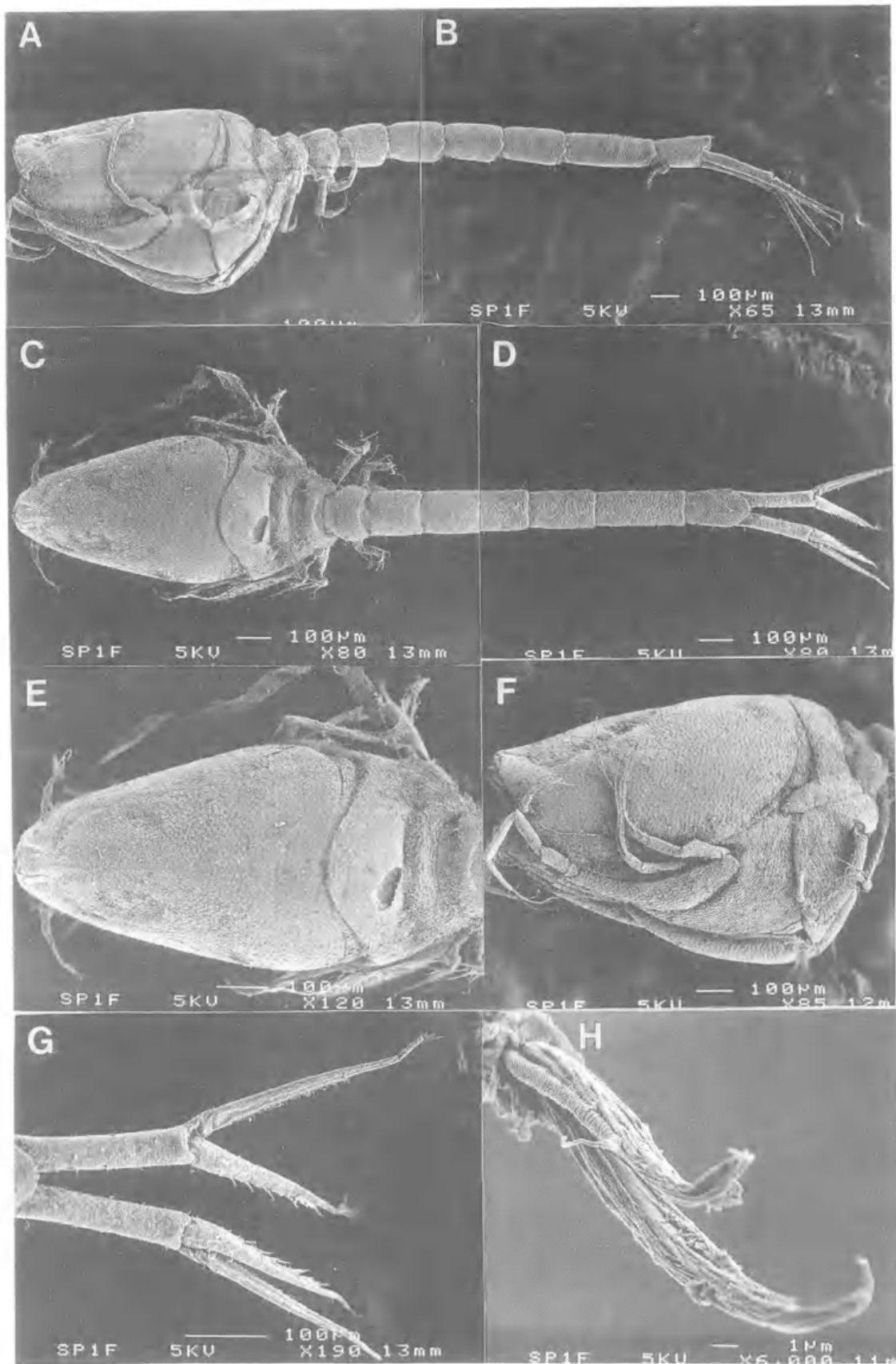
**REMARKS.** *Cyclaspis cooki* resembles *C. pura* Hale from S Aust and *C. juxta* Hale from WA, but the rami of the uropods are longer relative to the peduncle and the setation of the pereopods and uropods is different (Figs 19, 20). Both sexes are common in Moreton Bay.

**ETYMOLOGY.** For Steve Cook, Queensland Museum, who collected the types.

*Cyclaspis tranteri* sp. nov.  
(Figs 21-23, 24I,J, 25)

**MATERIAL EXAMINED.** HOLOTYPE QMW20489, adult ♂, S.L. 2.7mm, PSM #3; PARATYPES QMW20490, ovig. ♀, allotype, S.L. 2.45mm, PSM #2, same data as holotype; QMW20491, adult ♂, S.L. 2.5mm, PSM #4; QMW20492, adult ♀, S.L. 2.5mm, PSM #1; QMW20493, adult ♂, S.L. 2.6mm, SEM mount; QMW20494, ovig. ♀, S.L. 2.4mm, SEM mount; all types from Raby Bay, site 32, 27°30'S, 153°18'E, D. Tafe, 22 July 1989, 5m, sandy mud, 34 ppt salinity, 24.8°C water temperature, same data as holotype.

**DESCRIPTION. MALE.** Integument thin and almost membranous, with fine reticulate pattern of pits (Fig. 21A-E). Carapace 0.27 S.L. twice as long as deep; in profile the dorsal margin evenly curved except for the protruding ocular lobe, with mild post-ocular depression; median dorsal ridge is visible along anterior 2/3 of carapace; in dorsal view carapace is widest in mid-region and tapers slightly towards the front and rear; antennal notch widely open, antennal tooth subacute and visible in dorsal view, no antennal ridge; pseudorostral lobes tapering anteriorly and joining just below ocular lobe (Fig. 21D), join not visible in dorsal view; ocular lobe as wide as long, rounded with distinct corneal lenses, and located at anterior extremity of carapace (Figs 21C-E, 24A,E,I). Pereion 0.55 times as long as carapace; first pereionite fully concealed; second pereionite forming a narrow collar posterior to carapace; as



long as third but shorter than fourth and fifth pereionites (Figs 21C,D, 24A,E,I). Pleon slender and long, no dorsal or lateral ridges; first 4 pleonites subequal in length, each with small lateral articular notches; fifth pleonite 1.5 times as long as fourth (Fig. 21A,B). Telsonic somite subequal in length to fourth pleonite, with posterodorsal projection (Figs 21B, 24F, 25B). First antenna as in *C. sublevis*. Second antenna with flagellum reaching to posterior end of peduncle of uropod (Fig. 21B). All pereiopods 7-segmented, with terminal spine-like setae longer than dactylus. First pereiopod with carpus reaching beyond level of antennal tooth; length of basis 1.2 times rest of appendage, with distomedial margin produced into blunt tooth and with plumose distolateral seta; ischium 0.5 times length of merus which is 0.6 times length of carpus; carpus 0.9 times length of propodus and subequal in length to dactylus; propodus 1.1 times length of dactylus, with 2 medial and 2 distomedial setae; dactylus with 2 slender spine-like setae and 1 seta terminally, 1 spine-like seta and 1 seta subterminally and 1 seta on medial margin; exopod well-developed, very broad proximal segment bearing plumose seta distally, and 8 short distal segments, each with 2 long, plumose setae (Figs 21C, 24A,H, 25A). Second pereiopod as in *C. sublevis* except that terminal spine-like seta is distinctly longer (1.3 times) than dactylus and basis is c. twice length of remaining segments combined (Fig. 21A,F). Pereiopods 3-5 as in *C. sublevis*. Peduncle of uropod 1.3 times length of telsonic somite, with 20-21 plumose setae on

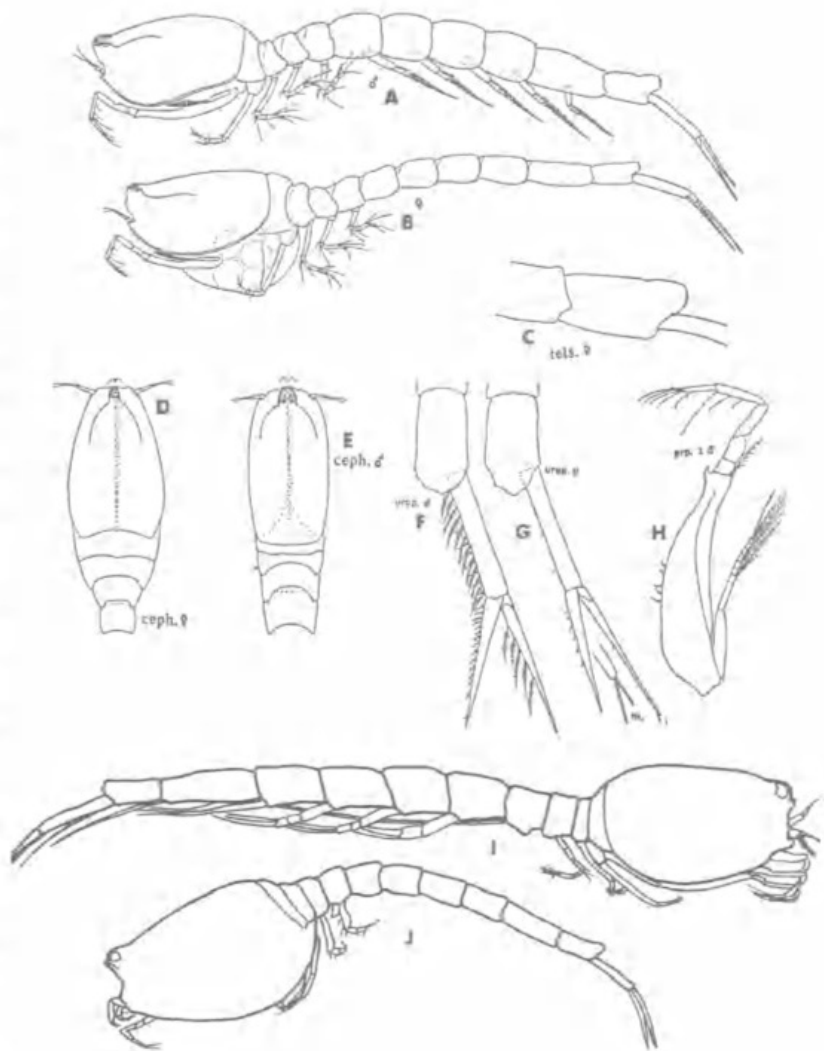


FIG. 24. *Cyclopsis* species. A-H, *Cyclopsis sublevis*. A, type ♂, LV. B, type ovig. ♀, LV. C, telsonic somite of ♀, LV. D, ♀ cephalothorax, DV. E, ♂ cephalothorax, DV. F, ♂ uropod and telsonic somite, DV. G, ♀ uropod and telsonic somite, and m, mucrones of exopod. H, ♂ first pereopod. (A-H, after Hale, 1948). I-J, *Cyclopsis tranteri* sp. nov. I, adult ♂, LV. J, ovig. ♀, LV.

inner margin in 2 rows; endopod subequal in length to peduncle and 0.95 times length of exopod, with 4 plumose spine-like setae and 11 naked spine-like setae on inner margin, and with 2 minute spine-like setae close to the acute distal end; exopod with 5 plumose setae on inner margin, 2 elongate unequal terminal mucrones (setae) and 1 minute curved terminal seta (Figs 21G,H, 22, 24F, 25B,C).

FIG. 23. *Cyclopsis tranteri* sp. nov. ♀. A, whole mount LV, shows relative lengths of carapace and somites. C, whole mount DV, shows bulbous carapace and slender pleon. E, carapace DV, shows maximum width in posterior region and fine reticulate pattern of pits. F, carapace LV, shows relative length and depth of carapace. G, uropods DV, shows relative lengths of peduncle and ramī. H, Distal end exopod of uropod DV, shows two terminal setose mucrones and one small non-setose (convoluted) seta.

**OVIGEROUS FEMALE.** Integument thin and almost membranous, with fine reticulate pattern of pits, as in ♂ (Fig. 23A-E). Carapace 0.29 S.L. almost as deep as long; in profile the dorsal margin has a slight even curve except for the protruding ocular lobe; dorsal ridge is barely visible along anterior 1/2 of carapace; in dorsal view carapace is widest in posterior 1/2 and tapers anteriorly; antennal notch less widely open than in ♂; antennal tooth subacute, no antennal ridge; pseudorostral lobes tapering anteriorly and joining just below ocular lobe (Figs 23A-F, 24B,D,J). Pereion 0.6 times as long as carapace; first pereionite narrow but visible; second pereionite meets carapace dorsally and continues smooth curve of dorsal profile; pereionites 3-5 taper posteriorly in dorsal view (Fig. 23A-F). Pleon very slender, no dorsal or lateral ridges; first 4 pleonites subequal in length, each with minute lateral notches; fifth pleonite 1.4 times as long as fourth (Figs 23A-D, 24B,J). Telsonic somite subequal in length to fourth pleonite and 0.7 times length of fifth pleonite, with posterodorsal projection (Figs 23B,D, 24C). First antenna as in ♂. Segmentation of pereopods as in ♂; endopod of first pereopod without distal tooth and exopod with slender basis (Fig. 15D); setation of pereopods 2-5 as in ♂. Peduncle of uropod 1.3 times length of telsonic somite, without setae on inner margin; endopod 1.1 times length of peduncle, 0.9 times length of exopod, with 4-7 naked spine-like setae on inner margin and 2 minute spine-like setae close to the acute distal end; exopod with 3-4 plumose setae on inner margin, 2 elongate unequal terminal mucrones (setae) and 1 minute curved terminal seta (Figs 23G,H, 24G, 25E,F).

*Colour.* Cream and translucent.

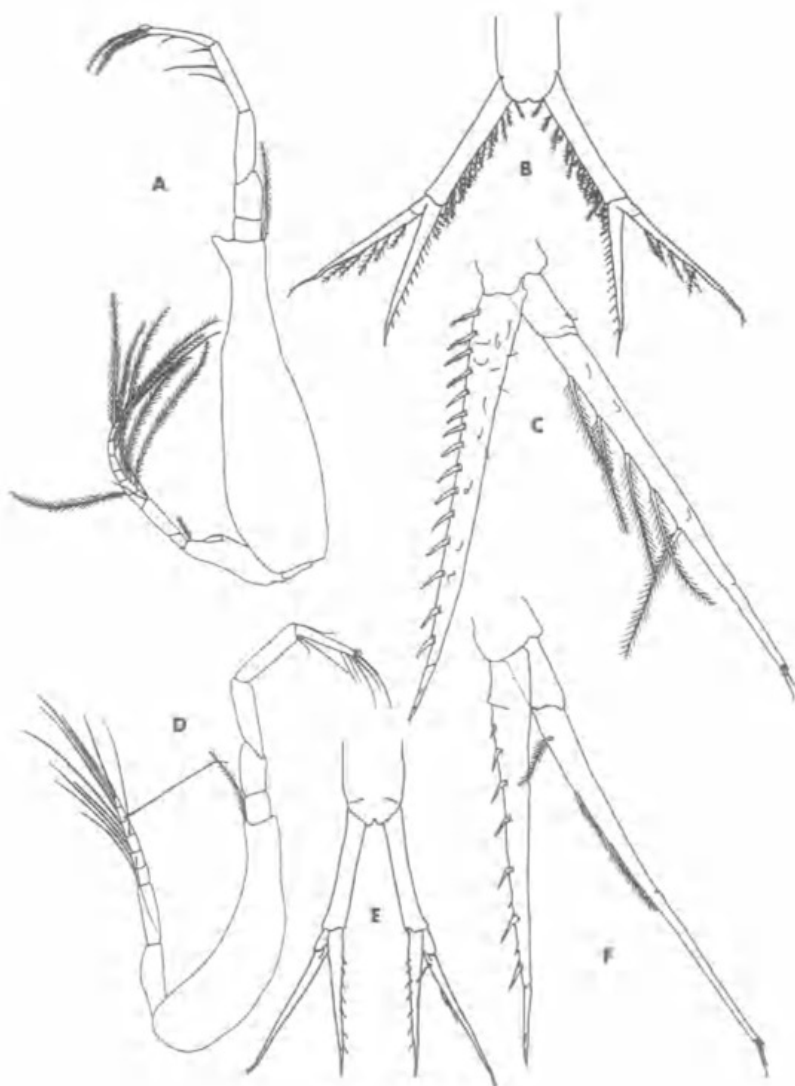


FIG. 25. *Cyclaspis tranteri* sp. nov. A-C, holotype adult ♂. A, first pereopod. B, uropods, DV. C, rami of uropod, DV. D-F, allotype ovig. ♀. D, first pereopod. E, uropods, DV. F, rami of uropod.

S.L. Adult ♂ 2.4-2.7mm. Adult ♀ 2.3-2.5mm.

**HABITAT AND DISTRIBUTION.** In 4-7m over silt and fine sand; Raby Bay, off Cleveland Point.

**REMARKS.** *C. tranteri* closely resembles *C. sublevis* Hale from Broome, WA, and the Hawkesbury River, NSW (AMP28613). However, the new species has 3 mucrones on the exopod of the uropod, rather than 2 mucrones, and a long terminal spine-like seta (longer than dactylus) on the second pereopod. In addition the ♂ has no spine-like setae on the medial bulge of the first



TABLE 1. Uropod spination of *C. sublevis* and *C. tranteri*.

	<i>C. sublevis</i>		<i>C. tranteri</i>	
	♂ C2997	♀ C2998	♂♂	♀♀
Peduncle setae	19	6	20-21	5
Endopod spines	15	6	14-15	4-7
Exopod setae	5	0	5-6	3-4
Exopod mucrones	2	2	3	3

pereiopod. The standard lengths of both ♂s and ♀s are, on average, 8 to 10% smaller than *C. sublevis*. Spination of uropods compares with that of *C. sublevis* (Hale, 1948:10, figs 5, 6) (Table 1)

The 2 larger mucrones are setose filaments (Fig. 22). The third naked and smaller filament is present in both sexes (Figs 21H, 23H).

*C. sublevis* belongs to the *levis* group and most closely resembles the much larger New Zealand *C. calmani* Hale (= *levis* Calman not Thomson) (Hale, 1948), but in *C. calmani* the basis of the first pereiopod has no distal tooth and the rami of the uropod are relatively shorter. There remains confusion as to whether *C. levis* Thomson and *C. calmani* Hale are two separate species or variations within the one species.

Thomson's original description and figures of *C. levis* had a number of inaccuracies (Calman, 1907; Hale, 1944a; Jones, 1963) with the major points of confusion being relative proportions of segments of the first pereiopods and presence or absence of terminal spine-like setae on the rami of the uropods. Hale (1944a) concluded that the differences between Thomson's and Calman's specimens were consistent, in spite of the confusion, and erected a new species, *C. calmani*, which he thought was related to both *C. levis* and *C. sublevis*. In the key we follow Bacescu (1988) in synonymising *calmani* and *levis*.

Specimens of *C. tranteri* can be distinguished from *C. sublevis* by the setae on the inner margin of the exopod of the uropod in the ♀ and by structural differences of the first pereiopod in the ♂. They include the absence of spine-like setae on the basal segment of the endopod and a broad basal segment on the exopod. These 2 species are distinguished within the genus by the proportion and spination of the uropod. Also the slender dactylus of pereiopods 3-5 separates *C. tranteri* and *C. sublevis* within the *levis* group. *C. tranteri* was abundant over sandy mud.

ETYMOLOGY. For David Tranter, for his contribution to zooplankton research in Australia.

***Cyclaspis ornosculpta* sp. nov.**  
(Figs 26-30)

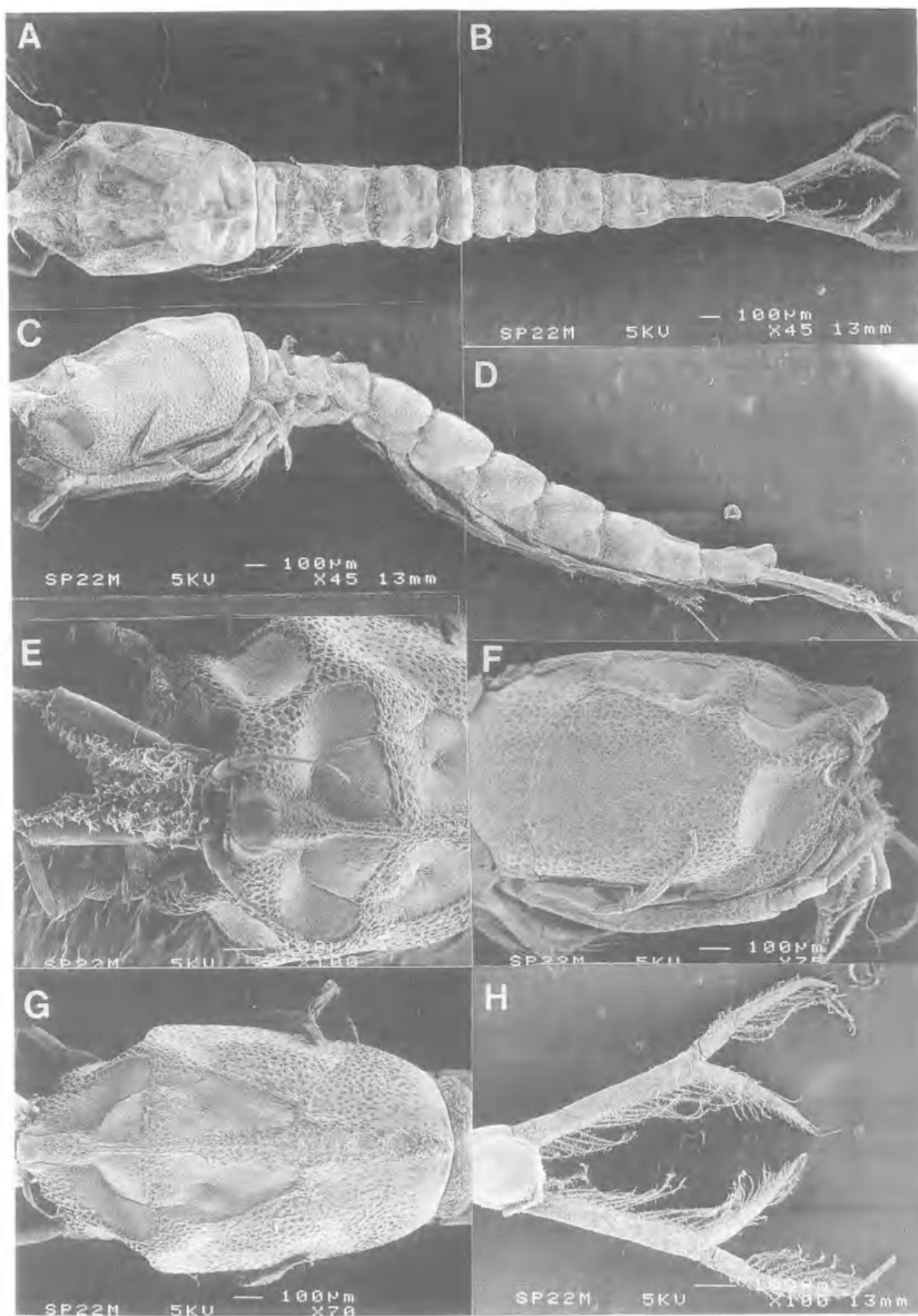
MATERIAL EXAMINED. HOLOTYPE QMW20495, adult ♂, S.L. 5.04mm, PSM #57, Pumicestone Passage, site 5, 26°52'S, 153°7'E, J. Greenwood, 28 Jan 1991, 3m, sand, 36 ppt salinity, 31°C water temperature. PARATYPES. QMW20496, ovig. ♀, allotype, S.L. 4.76mm, PSM #58, Pumicestone Passage, site 3, 26°54'S, 153°5'E, otherwise same data as holotype; QMW20497, adult ♂, S.L. 4.3mm, SEM mount, same data as holotype; QMW20498, ovig. ♀, S.L. 4.25mm, SEM mount, same data as holotype.

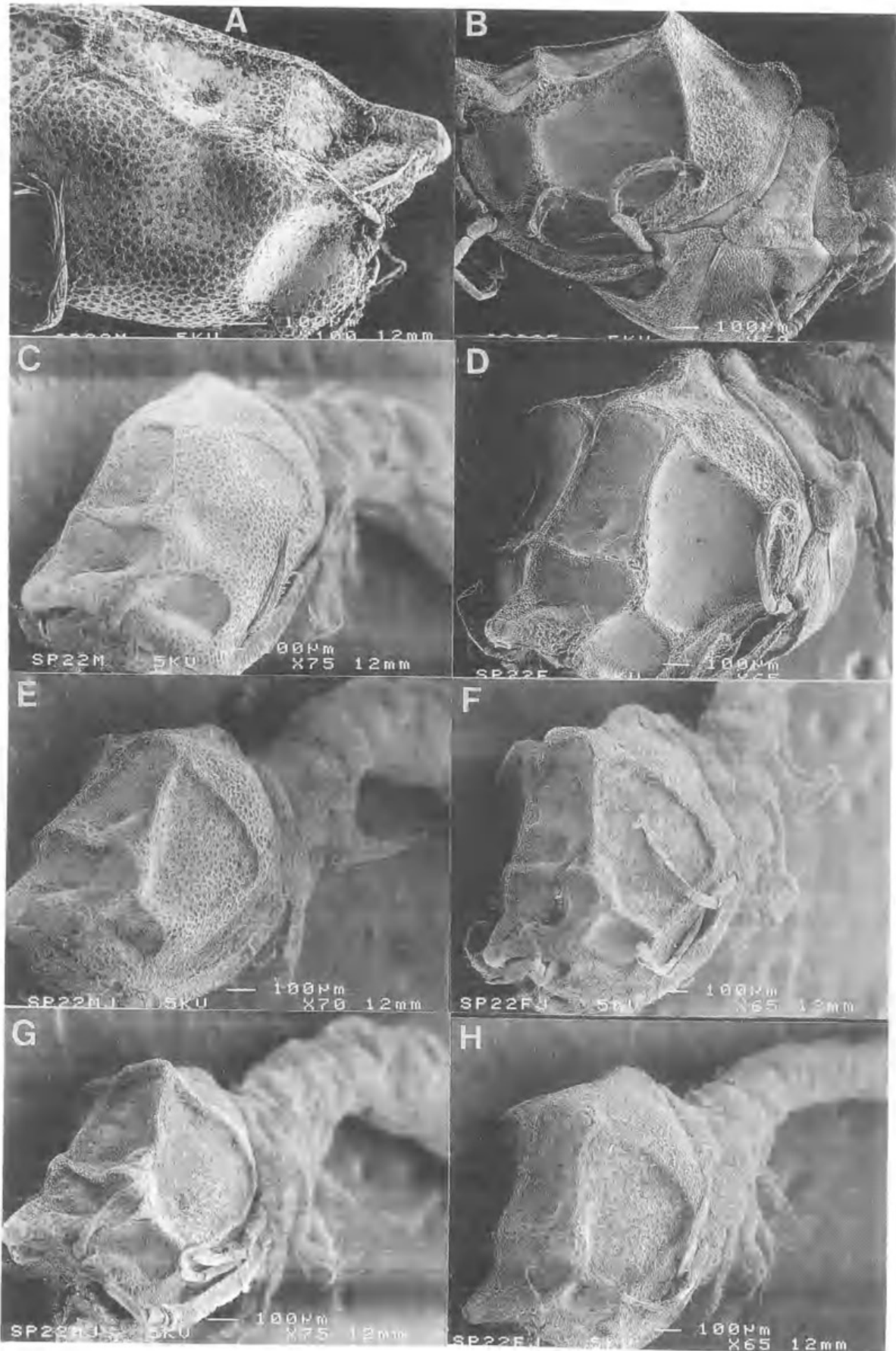
DESCRIPTION. MALE. Integument calcified, with reticulate pattern of shallow pitting (Fig. 26A-D). Carapace 0.3 S.L. twice as long as deep; in profile the dorsal margin is slightly convex with mild post-ocular depression; median dorsal ridge is visible along length of carapace and pronounced on anterior half; in dorsal view carapace is widest in region of anterior transverse

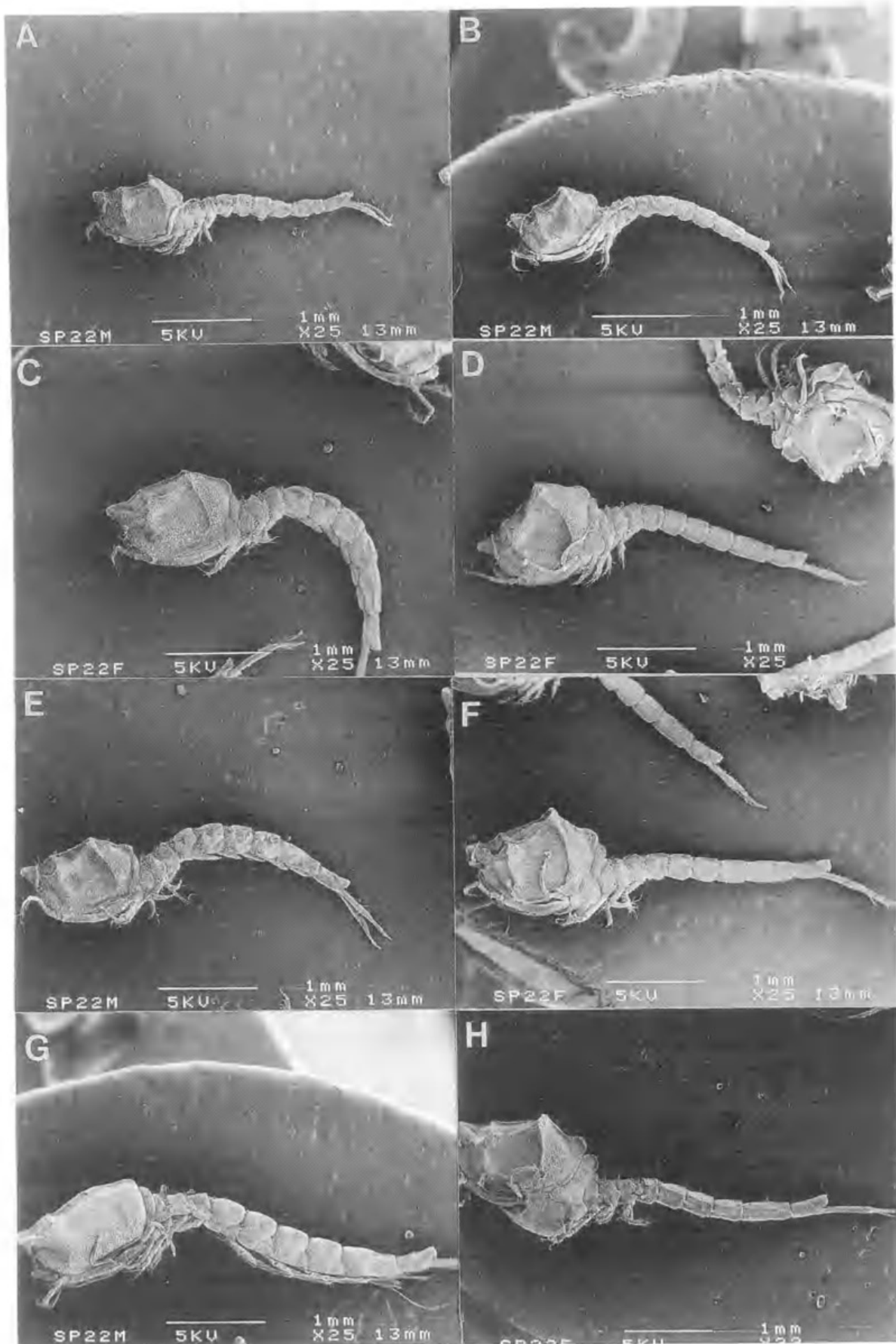
(captions for two following pages)

FIG. 26. *Cyclaspis ornosculpta* sp. nov. ♂. A, whole mount (part) DV. B, whole mount (part) DV, shows relative lengths of carapace and somites. C, whole mount (part) LV. D, whole mount (part) LV shows lateral articulation notches of pleonites. E, Anterior carapace A.DV shows ocular lobe and reticulate pattern of pits. F, carapace LV shows reduced anterior and posterior transverse ridges. G, carapace DV shows median dorsal ridge along length. H, uropods DV shows relative lengths of peduncle and rami.

FIG. 27. *Cyclaspis ornosculpta* sp. nov. A, carapace adult ♂ LV, shows reduced sculpture. B, carapace ovigerous ♀ LV, shows accentuated sculpture. C, carapace adult ♂ DLV, shows reduced sculpture. D, carapace ovigerous ♀ DLV shows accentuated sculpture. E, carapace late subadult ♂ DLV, shows slightly reduced sculpture. F, carapace late subadult ♀ DLV shows retention of sculpture. G, carapace early subadult ♂ DLV, shows moderate sculpture. H, carapace early subadult ♀ DLV, shows moderate sculpture.









ridge; in lateral view posterior transverse ridge visible only as fine line behind slightly depressed quadrilateral area; antennal notch a short groove; antennal tooth subacute, no antennal ridge; pseudorostral lobes tapering anteriorly and joining just below ocular lobe, join not visible in dorsal view; ocular lobe as wide as long, rounded, and located at anterior extremity of carapace (Fig. 26E-G). Pereion 0.5 times as long as carapace; first pereionite fully concealed; second pereionite forms a narrow collar posterior to carapace, as long as third but shorter than pereionites 4 and 5; tufts of short setae on posterodorsal margins of last 3 pereionites (Fig. 26A-D). Pleon robust, no dorsal ridges; first four pleonites subequal in length, each with lateral notch in posterior margin and oblique carina extending anteriorly and ventrally from notch; fifth pleonite 1.6 times as long as fourth, with 5 short spine-like setae on posterodorsal margin (Fig. 26A-D). Telsonic somite shorter than fifth pleonite and longer than fourth, with posterodorsal projection (Fig. 26B,D). First antenna 3-segmented with terminal segmented flagellum; first segment somewhat geniculate, longer than second and third segments combined; second segment subequal in length to third, with fine seta distomedially; third segment with 2 terminal and 2 subterminal setae; first segment of flagellum 1.6 times as long as second, which bears 2 aesthetascs and 2 fine setae distally (Fig. 29A). All pereopods with terminal spine-like setae longer than dactylus; first and third to fifth pereopods 7-segmented, second 6-segmented since ischium is fused with basis. Pereiopod 1 with carpus reaching beyond level of antennal tooth; length of basis 1.1 times rest of appendage, distal margin not produced, with plumose distomedial seta and numerous small lateral setae; ischium 0.9 times length of merus, with plumose distomedial seta; merus 0.6 times as long as carpus, with small distolateral projection; carpus subequal in length to propodus which is 1.2 times length of dactylus, with group of 5 distomedial setae; dactylus with 2 slender spine-like setae and 1 seta terminally, and 5 setae along medial margin; exopod well-developed, slender proximal segment with 3-4 short setae distolaterally and 8 short distal segments, each with 2 long setae (Fig. 29B). Pereiopod 2 with fused



FIG. 29. *Cyclopsis ornosculpta* sp. nov. holotype adult ♂. A, first antenna. B, pereiopod 1. C, pereiopod 2. D, pereiopod 3. E, pereiopod 4. F, pereiopod 5.

basis and ischium (join barely discernible) slightly longer than combined length of remaining segments, with 4 plumose setae laterally and 2 plumose setae distomedially; merus 1.8 times length of carpus, with plumose seta distomedially; carpus 1.2 times length of propodus, with 2 strong spine-like setae and rounded process distally; dactylus 2.3 times length of propodus, with 1 long and 2 short spine-like setae distally, each with a subterminal seta (Fig. 29C). Pereiopods 3-5 with merus longer than ischium, propodus longer than dactylus and carpus longer than combined length of propodus and dactylus; basis with 4-6 plumose setae medially; ischium with 3 setae distomedially; merus with seta distomedially; carpus with 3 setae laterally and 2 spine-like setae distolaterally; propodus with spine-like seta dis-

FIG. 28. *Cyclopsis ornosculpta* sp. nov. A, juvenile ♂ LV. B, juvenile ♀ LV. Sexes indistinguishable on external morphology. C, early subadult ♂ LV. D, early subadult ♀ LV. Pleopods developing in ♂, transverse ridges developing in ♀. E, Late subadult ♂ LV. F, Late subadult ♀ LV. Posterior transverse ridge higher in ♀. pleon slender in ♀, robust in ♂. G, ♂ LV. H, Ovigerous ♀ LV. Pleopods and second antennae fully developed in ♂, marsupium developed in ♀. sculpture of carapace reduced in ♂, accentuated in ♀.

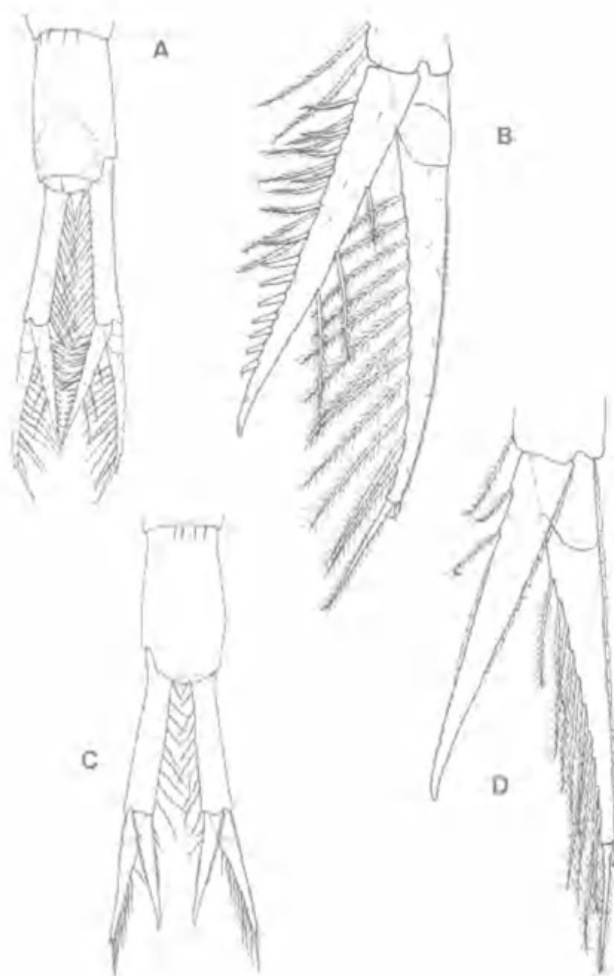


FIG. 30. *Cyclaspis ornosculpta* sp. nov. A-B, holotype ♂. A, uropods and telsonic somite, DV. B, rami of uropod, DV. C-D, allotype ovig. ♀. C, uropods and telsonic somite, DV. D, rami of uropod, DV.

tolaterally; dactylus with terminal spine-like seta and 1-2 terminal setae; some spine-like setae have rows of fine spinules distally (Fig. 29D-F). Pereiopod 3 with basis subequal in length to remaining segments combined; ischium 0.6 times length of merus; merus 0.9 times length of carpus, with distomedial seta; propodus 1.3 times length of dactylus (Fig. 29D). Pereiopod 4 with basis 0.8 times length of remaining segments combined; ischium 0.4 times length of merus which is 0.9 times length of carpus; propodus 1.3 times length of dactylus (Fig. 29E). Pereiopod 5 with basis 0.7 times length of remaining segments combined; ischium 0.5 times length of merus which is 0.9 times length of carpus; propodus 1.5 times length of dactylus (Fig. 29F). Peduncle of uropod subequal in length to telsonic somite, with 15-16 plumose setae on inner margin; endopod 0.8

times length of peduncle and 0.95 times length of exopod, with 12 plumose setae and 6-7 short spine-like setae on inner margin, apex pointed, with serrate inner edge, outer margin with 3 plumose setae; exopod with 12 plumose setae on inner margin, 1 long terminal spine-like seta and 2 minute terminal setae, outer margin with row of fine setae (Figs 26H, 30A,B).

**OVIGEROUS FEMALE.** Integument calcified, with reticulate pattern of shallow pitting on raised areas of carapace and abdomen (Fig. 27B,H). Carapace 0.35 S.L. almost as deep as long; in profile the dorsal margin is raised in regions of transverse ridges and depressed in postocular region; median dorsal ridge is strong and visible along length of carapace, forming rounded process at posterior extremity; in dorsal view carapace is widest in region of posterior transverse ridge; anterior and posterior transverse ridges and dorso- and inferolateral ridges well developed; depressed quadrilateral region well defined by ridges; antennal notch, antennal tooth and pseudorostral lobes as in ♂ (Figs 27B,D, 28H). Pereion 0.5 times as long as carapace; first pereionite almost fully concealed; second pereionite with rounded dorsal projection, pereionites 3-5 with low dorsal profile and tapering posteriorly (Figs 27B, 28H). Pleon robust but much more slender than in ♂, no dorsal or lateral ridges; first 4 pleonites subequal in length, each with lateral articulation notches; fifth pleonite 1.7 times as long as fourth, with 4 short spine-like setae on posterodorsal margin (Figs 27B, 28H). Telsonic somite shorter than fifth pleonite and longer than fourth, with posterodorsal projection (Figs 28H, 30C). First antenna as in ♂. All pereiopods with terminal spine-like setae longer than dactylus; first and third to fifth pereiopods 7-segmented, second 6-segmented as in ♂. Segmentation of pereiopods same as in ♂; carpus of pereiopods 3-5 with 2 rather than 3 setae laterally. Peduncle of uropod subequal in length to telsonic somite, with 9-10 plumose setae on inner margin; endopod 0.8 times length of peduncle, 0.95 times length of exopod, with 2 plumose setae on proximal 1/2 of inner margin, apex bluntly pointed, with serrate inner edge, inner and outer margins with fine scale-like teeth; exopod with 8-10 plumose setae on inner margin, long terminal spine-like seta and minute terminal seta, outer margin with scale-like teeth and scattered fine setae (Fig. 30C,D).

**Colour.** Cream to brown, black

chromatophores dotted on carapace and abdomen.

S.L. Adult ♂ 4.3-5.0mm. Adult ♀ 4.3-4.8mm.

**HABITAT AND DISTRIBUTION.** Most common over silt and fine sand but were also present over medium and coarse sand in summer in 1-9m of water; 12 sites in Pumicestone Passage, sites 21 and 36. Their occurrence in sledge net samples was highly seasonal, with peak abundances in summer.

**REMARKS.** *Cyclaspis ornosculpta* exhibits sexual dimorphism in the adult similar to that in *C. elegans* Calman, 1907 which species it resembles but can be readily distinguished from by the 2 transverse ridges on the carapace in dorsal view. While early juvenile stages of ♂♂ and ♀♀ of the new species are alike, late juveniles and adults are readily separated by the pleopods in the ♂ and ornate carapace sculpture in the ♀.

Adult ♂s have well-developed second antennae and 5 pairs of pleopods, typical of ♂♂ of the Bodotriidae (Fig. 26C,D). The heavily sculptured appearance of the carapace of the adult ♀ is absent in the adult ♂ (Fig. 27A-D). The quadrilateral area of the adult ♂ is not distinctly recessed like that of the ♀ and the posterior transverse ridge is barely visible.

Late subadult ♂♂ have partially developed pleopods and reduced sculpturing of the carapace compared to late subadult ♀♀ (Fig. 27E,F). The postocular depression of the dorsal median ridge is more acute in the ♀, as is the height of the posterior transverse ridge. Both features are most highly developed in the adult ♀. Early subadult ♂♂ and ♀♀ cannot be distinguished on external morphology until pleopods begin to develop in the ♂ (Fig. 27G,H).

Comparison of the developmental stages of both sexes (Fig. 28) shows the gradual development of sexual dimorphism. The sex of juveniles is indistinguishable on external morphology alone (Fig. 28A,B) but early subadult ♂♂ can be distinguished from ♀♀ by having a more robust abdomen and the appearance of pleopod buds (Fig. 28C,D). The quadrilateral areas of both sexes become more developed at this stage. Late subadult ♂♂ exhibit a slight reduction in the definition of the quadrilateral area and transverse processes while the reverse occurs in late subadult ♀♀ (Fig. 28E,F). The most marked changes occur in the final stage of development when the carapace of the ♂ elongates and simultaneously

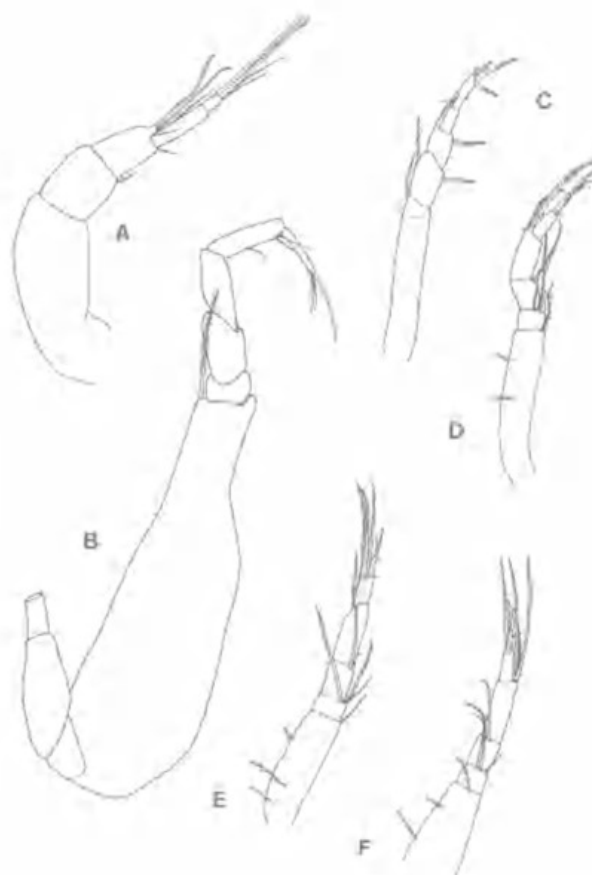


FIG. 31. *Cyclaspis andersoni* sp. nov. holotype ♂. A, first antenna. B, pereopod 1. C, pereopod 2. D, pereopod 3. E, pereopod 4. F, pereopod 5.

loses definition of the quadrilateral area and transverse processes. The ♀, on the other hand, develops calcified posterolateral tubercles and a posterior tubercle along the median dorsal ridge. The dorsal margin of the second pereonite also becomes elevated as a tubercle. The postocular depression becomes more acute in the ♀ and develops into an angular kink in some post-ovigerous ♀♀. In contrast the post-ocular depression in the ♂ remains mildly concave and may even flatten out slightly. The carapace of the ♂, like that of the ♀, calcifies on maturity (Fig. 28G,H).

Calman (1907) noted that the subadult ♂ of *C. elegans* more closely resembles the adult ♀ than it does when full grown. It appears from his description and figures that development follows a similar pattern to that of *C. ornosculpta*.

**ETYMOLOGY.** Orno-, a contraction of ornate, and the *exsculpta* species group to which it belongs.

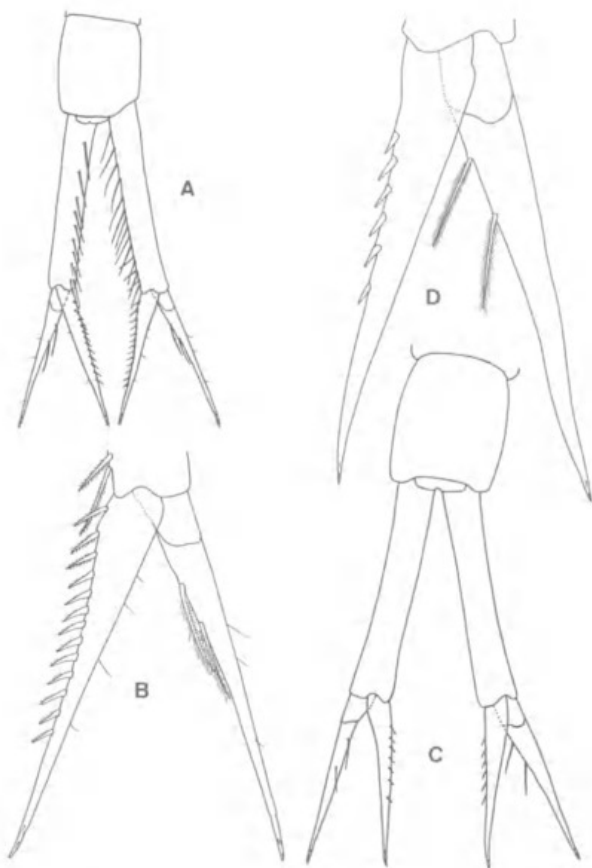


FIG. 32. *Cyclopsis andersoni* sp. nov. A-B, holotype ♂. A, uropods and telsonic somite, DV. B, rami of uropod, DV. C-D, allotype ovig. ♀. C, uropods and telsonic somite, DV. D, rami of uropod, DV.

***Cyclopsis andersoni* sp. nov.**  
(Figs 31-35)

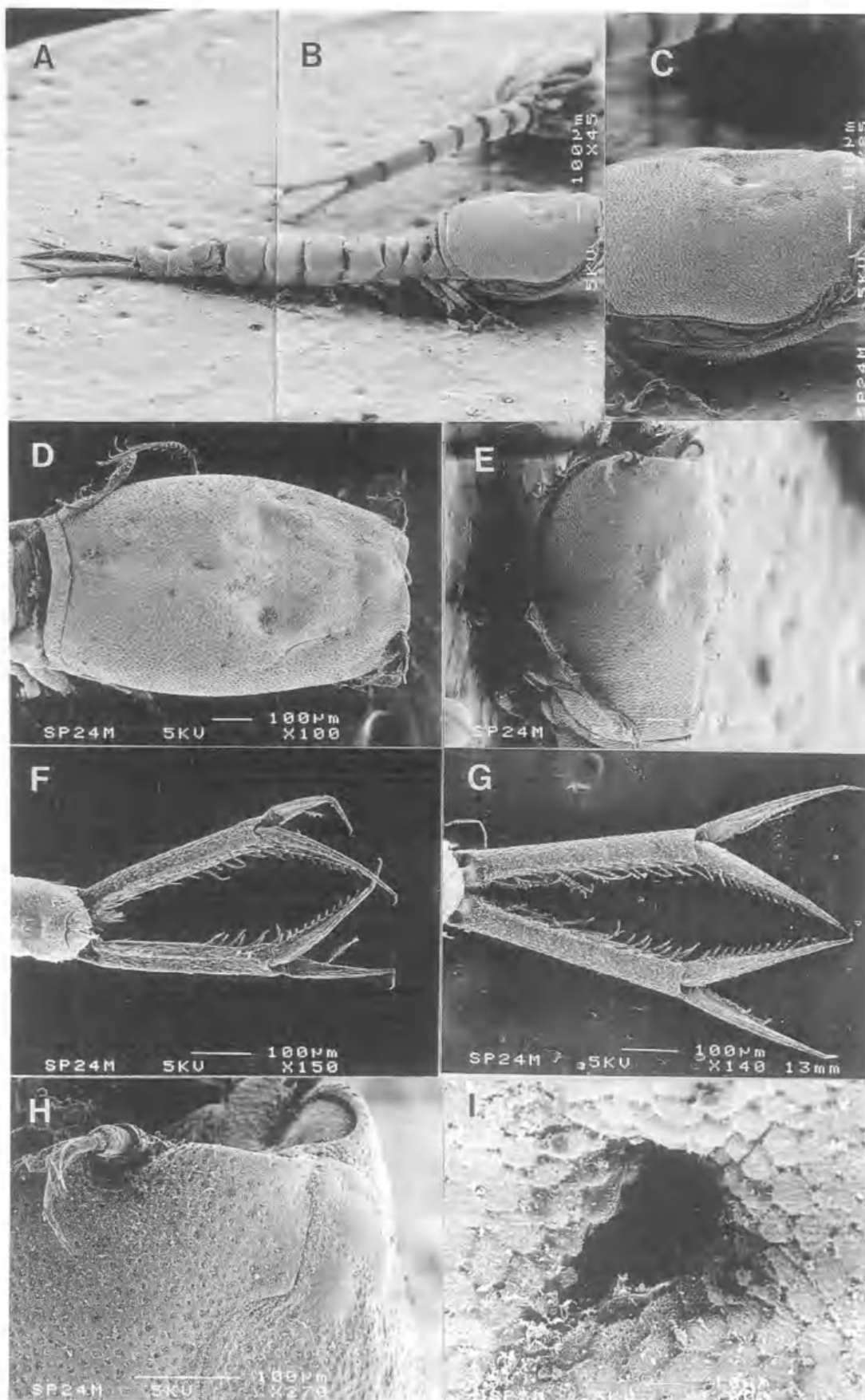
**MATERIAL EXAMINED.** HOLOTYPE QMW20499, adult ♂, S.L. 2.9mm, PSM #23, Pumicestone Passage, site 10, 26°50'S, 153°7'E, J. Greenwood, 26 Feb 1991, 2m, sand, 34 ppt salinity, 27.2°C water temperature. PARATYPES QMW20500, ovig. ♀, allotype, S.L. 3.5mm, PSM #56, Horseshoe Bay, 27°30'S, 153°21'E, D. Tafe, 2-3m, sand, 13 Aug. 1990, 27.2 ppt salinity, 16.5°C water temperature; QMW20501, adult ♂, S.L. 2.8mm, SEM mount, off Dunwich, 27°29'S, 153°22'E, D. Tafe, 4m, sand, 17 April 1990, 33 ppt salinity, 26.5°C water

temperature; QMW20502, ovig. ♀, S.L. 2.3mm, SEM mount, same data as above; QMW20503, adult ♂, S.L. 2.85mm, in 70% ethanol, Pumicestone Passage, site 10, 26°50'S, 153°7'E, J. Greenwood, 25 Jan 1990, 2m, sand, 34.9 ppt salinity, 27.3°C water temperature; QMW20504, ovig. ♀, S.L. 2.4mm, in 70% ethanol, same data as above.

**DESCRIPTION.** MALE. Integument thin, lightly calcified, with small, even reticulate patterning (Fig. 33A-E). Carapace 0.33 S.L. with mild median dorsal ridge on anterior 1/2 and median dorsal recess on posterior 1/2; curvature of carapace is smooth, without lateral ridges, but with middorsal depressions either side of the median dorsal ridge; carapace 0.65 as wide as long, lateral margins evenly curved in dorsal view; antennal notch a short, shallow groove; antennal tooth subacute, no antennal ridge; pseudorostral lobes wide, joining just anterior to ocular lobe which is as wide as long, rounded, with five lenses (Fig. 33A-E,H). Pereion 0.45 as long as carapace; first pereionite partially concealed by second, which forms a narrow collar posterior to carapace, shorter than each of remaining 3 pereionites which are overlapping, with low dorsal profile; tuft of very short setae on posterodorsal margin of third pereionite (Fig. 33B,D). Pleon robust, no dorsal or lateral ridges; first 4 pleonites subequal in length with small lateral articulation notches; fifth pleonite 1.5 times as long as fourth (Fig. 33A,B). Telsonic somite shorter than fifth pleonite and subequal in length to fourth, with posterodorsal projection and shallow dorsal notch (Fig. 33A,F). First antenna 3-segmented with terminal segmented flagellum; segment 1 geniculate, longer than segments 2+3; segment 2 longer than 3, with fine seta distomedially; segment 2 with 2 thick and 2 thin setae distolaterally, and 1 fine seta distomedially; segment 1 of flagellum slender and 4 times as long as second which has 2 aesthetascs and 2 fine setae distally (Fig. 31A). All pereopods 7-segmented, with terminal spine-like setae longer than dactylus. Pereopod 1 with carpus reaching beyond level of antennal tooth; length of basis 1.5 times rest of appendage, rounded tooth and plumose seta on distal margin; ischium 0.3 times

FIG. 33. A-H *Cyclopsis andersoni* sp. nov. ♂. A, B, whole mount LV, shows relative lengths of carapace and somites. C, carapace LV, shows mid-dorsal indentations either side of median dorsal ridge. D, carapace DV, shows ocular lobe, collar-like second pereionite and maximum width of carapace in mid-region. E, carapace DLV, shows median dorsal ridge on anterior half and median dorsal recess on posterior 1/2 of carapace. F, uropods DV, shows posterodorsal projection and shallow dorsal notch on telsonic somite. G, uropods DV, shows relative lengths of peduncle and rami. H, anterior carapace DLV, detail of antennal notch and ocular lobe. I, *Cyclopsis alveosculpta* sp. nov. ♂ DV, shows aperture in dorsum of carapace.





length of merus which is subequal in length to carpus; propodus 1.4 times length of dactylus, with 1 medial and 2 distal setae; dactylus with 2 slender terminal spine-like setae, 1 longer than itself, and 2 stout subterminal setae (Fig. 31B). Pereiopod 2 with division between basal segment and ischium barely visible; basis 0.9 times length of remaining segments combined, with small distomedial seta; ischium 0.3 times length of merus, with plumose seta distomedially; merus 1.7 times length of carpus, with plumose seta distomedially and stout spine-like seta distolaterally; carpus 1.2 times length of propodus, with spine-like seta distomedially and spine-like seta distolaterally; propodus 0.65 times length of dactylus, with small distomedial seta; dactylus slender with 2 terminal spine-like setae, 1 longer than itself, 1 small terminal seta and 1 subterminal spine-like seta (Fig. 31C). Pereiopods 3-5 with merus longer than ischium and propodus longer than dactylus; basis with 2-4 plumose setae medially; ischium with 3 setae distomedially; merus with seta distomedially; carpus with 3 spine-like setae distolaterally; propodus with spine-like seta and minute seta distally; dactylus with terminal spine-like seta, terminal seta and subterminal seta; some spine-like setae have rows of fine spinules distally (Fig. 31D-F). Pereiopod 3 with basis subequal in length to remaining segments combined; ischium 0.65 times length of merus which is 0.65 times length of carpus; propodus 1.3 times length of dactylus (Fig. 31D). Pereiopod 4 with basis 0.7 times length of remaining segments combined; ischium 0.5 times length of merus which is 0.6 times length of carpus; propodus 1.2 times length of dactylus (Fig. 31E). Pereiopod 5 with basis 0.5 times length of remaining segments combined; ischium 0.7 times length of merus which is 0.55 times length of carpus; propodus 1.6 times length of dactylus (Fig. 31F). Peduncle of uropod 1.8 times as long as telsonic somite, lined with 16 plumose setae on inner margin; endopod 0.75 times as long as peduncle and 0.95 times as long as exopod, with 12-13 spine-like setae on proximal 2/3 of inner margin and 2-4 fine setae on outer margin, apex pointed, with 2 minute subterminal spine-like setae; exopod with 2

plumose setae on proximal 1/3 of inner margin and 2-3 fine setae on outer margin, apex pointed, with 3 minute subterminal spine-like setae (Fig. 33F,G, 32A,B).

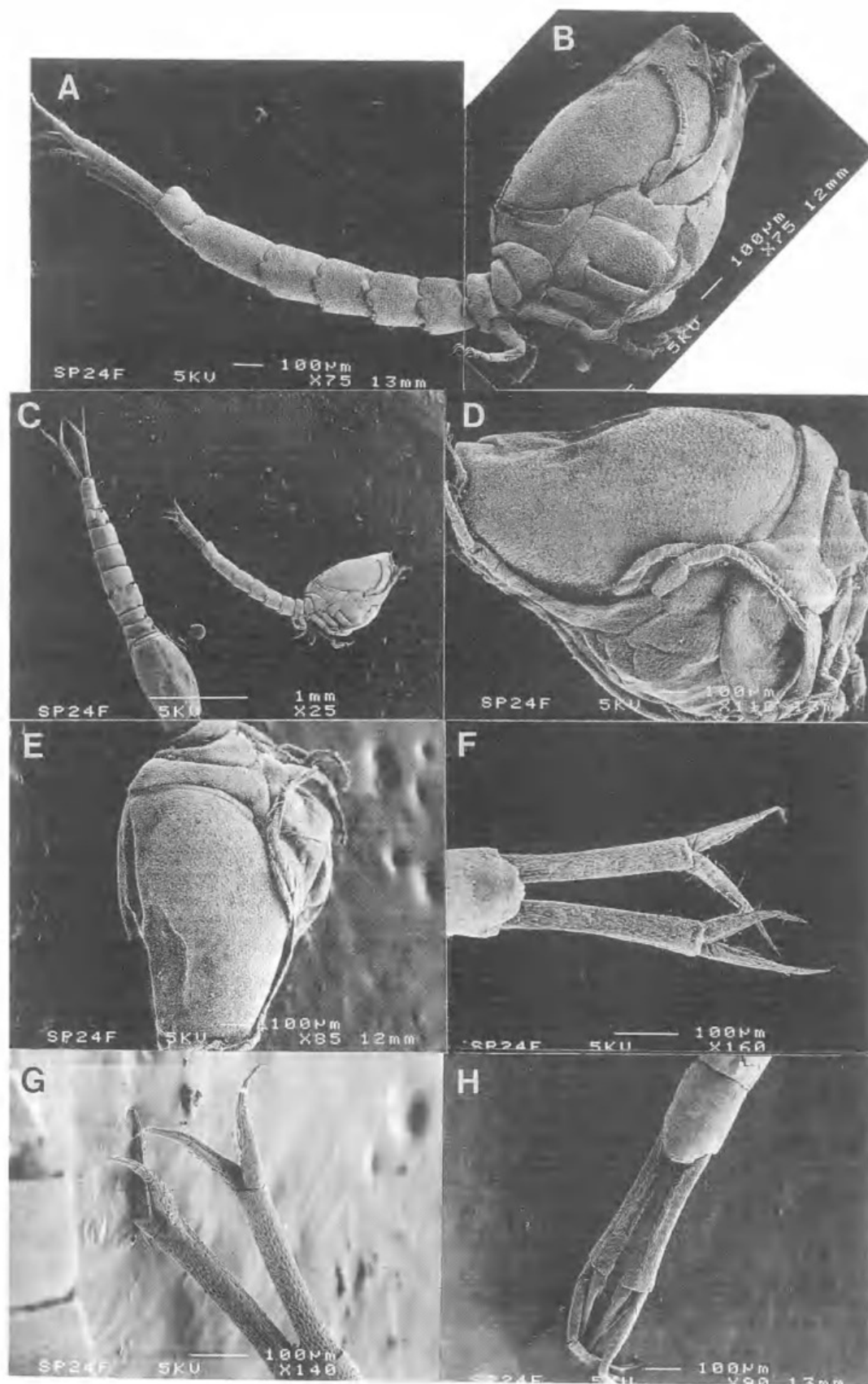
**OVIGEROUS FEMALE.** Integument lightly calcified and covered with fine reticulate pattern, as in the ♂ (Fig. 34A-E). Carapace 0.29 S.L. with strong median dorsal ridge on anterior 1/2 and dorsal groove on posterior 1/2; middorsal depressions either side of ridge; carapace 0.68 as wide as long, lateral margins evenly curved in dorsal view; depth 0.8 times length of carapace in lateral view; antennal notch and pseudorostral lobes as in ♂ (Fig. 34A-E). Pereion 0.44 times as long as carapace; pereionite 1 almost concealed by second, both produced ventrally to form the marsupium; pereionites 3-5 short, without ridges, and tapering in dorsal view; fifth with lateral articulation notch (Fig. 34A,B). Pleon robust and subcylindrical, devoid of dorsal or lateral ridges; first 4 pleonites subequal in length with lateral articulation notches; fifth pleonite 1.5 times fourth with rounded lateral process overlapping telsonic somite (Fig. 34A,B). Telsonic somite 0.55 times fifth pleonite, posterodorsal projection and shallow middorsal notch (Fig. 34F-H). First antenna 3-segmented with terminal segmented flagellum, as in ♂. Pereiopods 1-5 as in ♂ except ischium of 3-5 have 4 rather than 3 setae distally. Peduncle of uropod 1.6 times as long as telsonic somite, without plumose setae on inner margin; endopod 0.75 times as long as peduncle and 0.95 times as long as exopod, with 6-7 spine-like setae on proximal 2/3 of inner margin, apex with fine point and 2 minute subterminal spine-like setae; exopod with 2 plumose setae on proximal 1/3 of inner margin, apex with fine point and 2 minute subterminal spine-like setae (Fig. 32C,D, 34F-H).

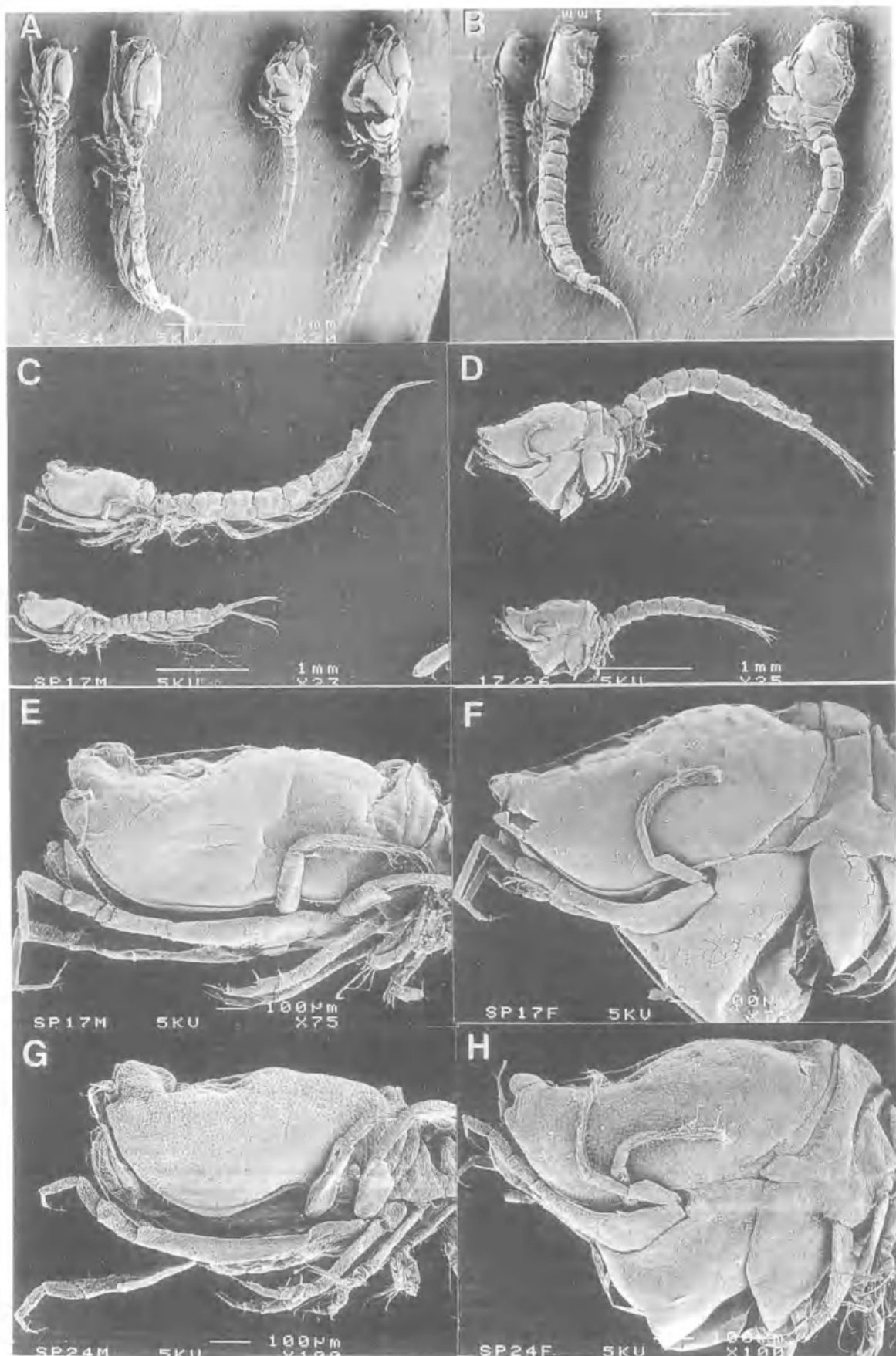
**Colour.** Cream with black chromatophores dotted on carapace and abdomen.

S.L. Adult ♂ 2.8-2.9mm. Adult ♀ 2.3-3.5mm.

**HABITAT AND DISTRIBUTION.** Most commonly over silt and fine sand but were also over medium and coarse sand in summer in 1-5mm of

FIG. 34. *Cyclaspis andersoni* sp. nov. A,B, whole mount, ovigerous ♀, LV, shows relative lengths of carapace and somites. C, whole mounts ♂ (left) and ♀ (right), LV, shows relative sizes of both sexes. D, carapace ovigerous ♀ LV, shows relative length and depth. E, carapace ovigerous ♀ DLV, shows median dorsal ridge on anterior half and median dorsal recess on posterior 1/2. F, uropods second ovigerous ♀ DV, shows posterodorsal projection and shallow dorsal notch bearing 2 minute apertures on telsonic somite. G, uropods ovigerous ♀ VV, shows relative lengths of peduncle and rami. H, uropods third ovigerous ♀ DV, shows posterodorsal projection and shallow dorsal notch bearing 2 minute apertures on telsonic somite.







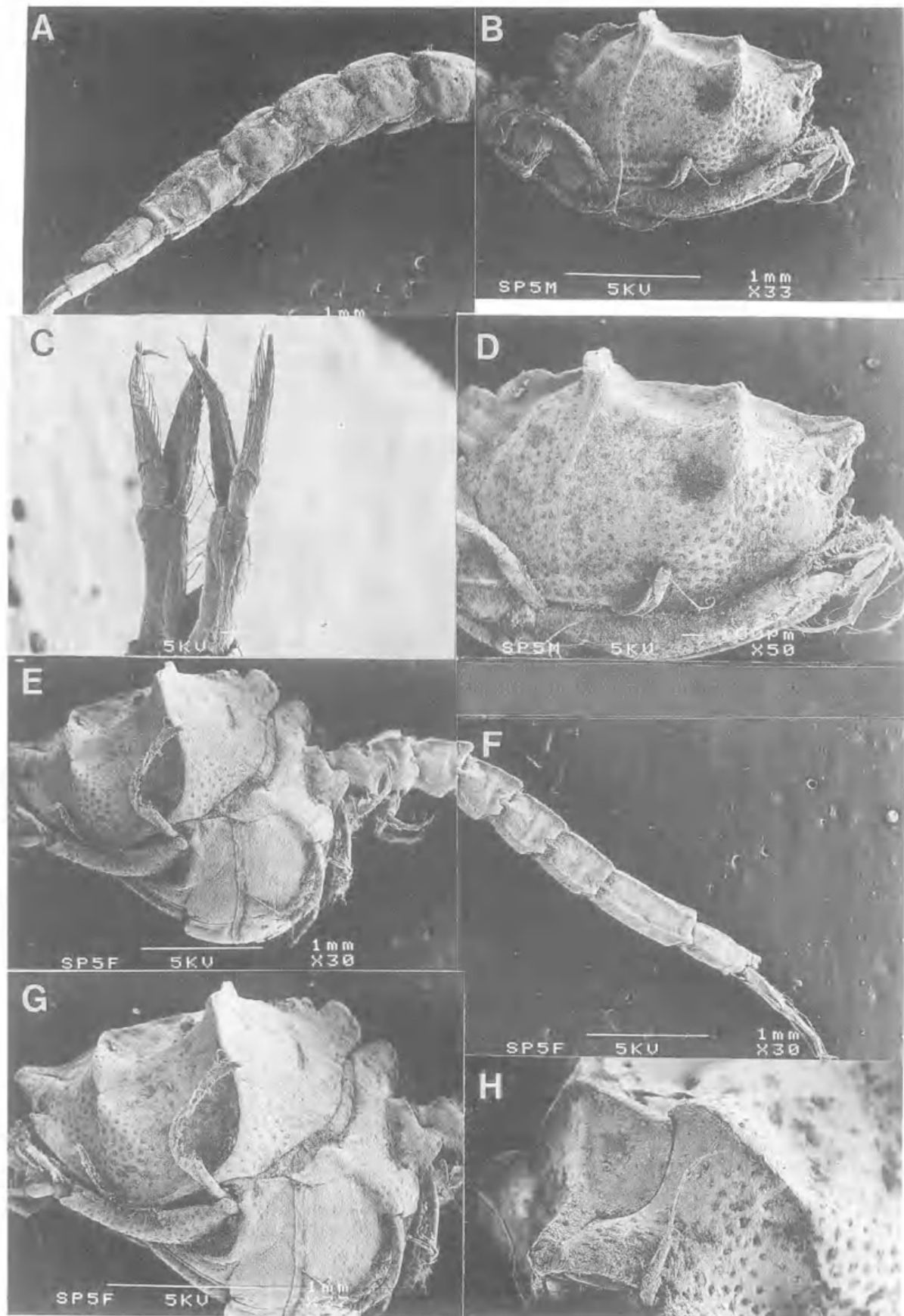


TABLE 2. Setation of  $\delta$  uropods of *C. andersoni* and *C. nitida*.

	<i>C. andersoni</i> sp. nov. (Fig. 33G)	<i>C. nitida</i> (Hale, 1944a)
Peduncle setation	16 long	13 long, 5 short
Endopod setation	12-13 spine-setae	7 spine-setae
Exopod setation	2 long	7 long
Exopod term. mucron	0 mucron	2 mucron

water; sites 1-3, 5, 6, 8-12, 15, 26, 28, 31, 33, 34, 35, and 37.

REMARKS. *Cyclaspis andersoni* is related to *C. nitida* Hale, recorded from NSW and WA. The main differences are in carapace shape and setation of the uropods. Hale (1944a) described the  $\delta$  only of *C. nitida* so only the  $\delta$  of *C. andersoni* can be compared. Both sexes of *C. andersoni* have middorsal depressions either side of the midline, behind which the midline is recessed (Figs 33E, 34E). *C. nitida* has a thin longitudinal median dorsal ridge the length of the carapace and shows no indication of middorsal depressions (Hale, 1944a:110). The ocular lobe in *C. andersoni* has 5 lenses (Fig. 33D) compared to 11 in *C. nitida*. Both species have a fine reticulate patterning over the carapace, with black pigment spots, but the new species has a concentration of black spots on the middorsal region of the carapace and their setation differs (Table 2). The differences in the uropods alone distinguish the species. The uropods of the  $\delta$  of *C. andersoni* lack spines compared to the  $\delta$  (Fig. 34F-H).

*Cyclaspis andersoni* can be distinguished from *C. cretata* Hale and *C. strigilis* Hale, two related species found in SE QLD, by the patterning of the carapace and overall body size. *C. andersoni* is much smaller than *C. cretata* (Fig. 35A-D) and *C. strigilis*. The carapace has a more granular surface texture than *C. cretata* (Fig. 35E-H) which species has a squamose reticulate pattern-

ing on the posterodorsal region (Fig. 35E,F), while *C. strigilis* has numerous oblique striae on the dorsal and lateral surfaces. *C. andersoni* differs from both of the latter species in having relatively short uropodal rami (Fig. 35C,D). *Cyclaspis andersoni* was the second most abundant cumacean species taken by sledge-net at sites 10-12.

SEM photographs of cumaceans vary in quality depending on the fragility of the specimen (degree of calcification), the state of preservation and the method used for SEM preparation. Specimens shown in Figs 33 and 34 were freshly caught and transferred live to liquid nitrogen, using the freeze-substitution method (Tafe, 1995). Specimens in Fig. 35 all suffered some degree of shrinkage during critical point drying.

ETYMOLOGY. For Prof Don Anderson, Sydney University.

***Cyclaspis alveosculpta* sp. nov.**  
(Figs 17A-E, 33I, 36-39, 70E-G)

MATERIAL EXAMINED. HOLOTYPE QMW20505, adult  $\delta$ , S.L. 7.5mm, PSM #61, Middle Banks, 27°12'S, 153°18'E, S. Cook, Sept. 1972, 8m, sand, 35 p.p.t. salinity, 23°C water temperature. PARATYPES QMW8536, ovig.  $\delta$ , allotype, S.L. 7.2mm, same data as holotype; QMW20506, ovig.  $\delta$ , S.L. 6.8mm, SEM mount, Horseshoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 17 April 1990, 3 m, sand, 33 p.p.t. salinity, 25°C water temperature; QMW20507, subadult  $\delta$ , S.L. 6mm, SEM mount, same data as above; QMW20508, ovig.  $\delta$ , S.L. 7mm, PSM #11, Raby Bay, 27°30'S, 153°18'E, D. Tafe, 9 Nov. 1989, 5 m, sandy mud, 35 p.p.t. salinity, 25°C water temperature; QMW20509, adult  $\delta$ , S.L. 7.8mm, PSM #66, same data as holotype; QMW20510, 2 adults  $\delta$ , S.L. 7.4, 7.5mm, PSM #60, off Goat Island, 27°31'S, 153°22'E, D. Tafe, 17 April 1990, from guts of Apogonidae; QMW20511, subadult  $\delta$ , S.L. 7.2mm, PSM #59, Raby Bay, 27°30'S, 153°18'E, D. Tafe, 22 July 1989.

(captions for figures on previous two pages)

FIG. 35. A, VLV, left to right, *andersoni*  $\delta$ , *cretata*  $\delta$ , *andersoni*  $\delta$ , *cretata*  $\delta$ . B, DLV, left to right, *andersoni*  $\delta$ , *cretata*  $\delta$ , *andersoni*  $\delta$ , *cretata*  $\delta$ . C, *C. cretata*  $\delta$  (top); *andersoni*  $\delta$  (bottom) LV. D, *C. cretata*  $\delta$  (top); *andersoni*  $\delta$  (bottom) LV, comparison of ovigerous  $\delta$  in lateral view. E, F, *C. cretata* sp. nov. LV. E,  $\delta$  carapace, shows smooth texture of integument. F,  $\delta$  carapace shows smooth texture with cretations. G, H, *C. andersoni* sp. nov., carapace, LV, shows small, even reticulate patterning of integument. G,  $\delta$ . H,  $\delta$ .

FIG. 36. *Cyclaspis alveosculpta* sp. nov. A, B, subadult  $\delta$ , LV, shows reduced transverse ridges (cf.  $\delta$ ) and partially developed pleopods. C, uropods of subadult  $\delta$  VV, shows relative lengths of peduncle and rami. D, carapace of subadult  $\delta$  LV, shows pitting of integument and posterodorsal lobes. E, F, ovigerous  $\delta$ , LV, shows relative lengths of carapace and somites. G, carapace of ovigerous  $\delta$  LV, shows relative length and depth of carapace, and shape of posterodorsal lobes. H, Anterior carapace ALV, shows reticulate pattern of pitting and anterior position of ocular lobe.

## DESCRIPTION. MALE.

Integument strongly calcified with pattern of shallow pitting (Figs 17A-E, 37). Carapace 0.3 S.L., 1.75 times as long as deep, without defined anterior and posterior transverse ridges though both regions are slightly raised on lateral surfaces; median dorsal ridge pronounced throughout carapace length and smoothly convex in profile, with slight postocular depression; antennal notch a short groove; antennal tooth subacute, no antennal ridge; pseudo-rostral lobes tapering anteriorly and joining just below ocular lobe, join not visible in dorsal view; ocular lobe at anterior extremity of carapace; posterior extremity with small dorsal lobe, not raised above line of dorsum (Fig. 37C). Subadult ♂♂ with anterior and posterior transverse ridges well defined and median dorsal ridge produced posteriorly to form 2 raised, plate-like lobes (Fig. 17A-D). Pereion 0.5 as long as carapace; first pereionite concealed by second, which is partially fused with carapace, dorsal profile that of carapace; dorsal profile of remaining pereionites continuous with pleon, fourth and fifth with lateral articulation notches (Fig. 37C). Pleon robust, median dorsal line visible on last two pleonites; each pleonite with lateral articulation notches, first four pleonites subequal in length, fifth 1.6 times as long as fourth (Fig. 37C). Telsonic somite shorter than pleonite 5 and longer than 4, with posterodorsal projection (Fig. 37A,D). First antenna 3-segmented with terminal segmented flagellum. All pereiopods 7-segmented. Pereiopod 1 with carpus reaching beyond level of antennal tooth; length of basis subequal to rest of appendage, with 20-30 stout

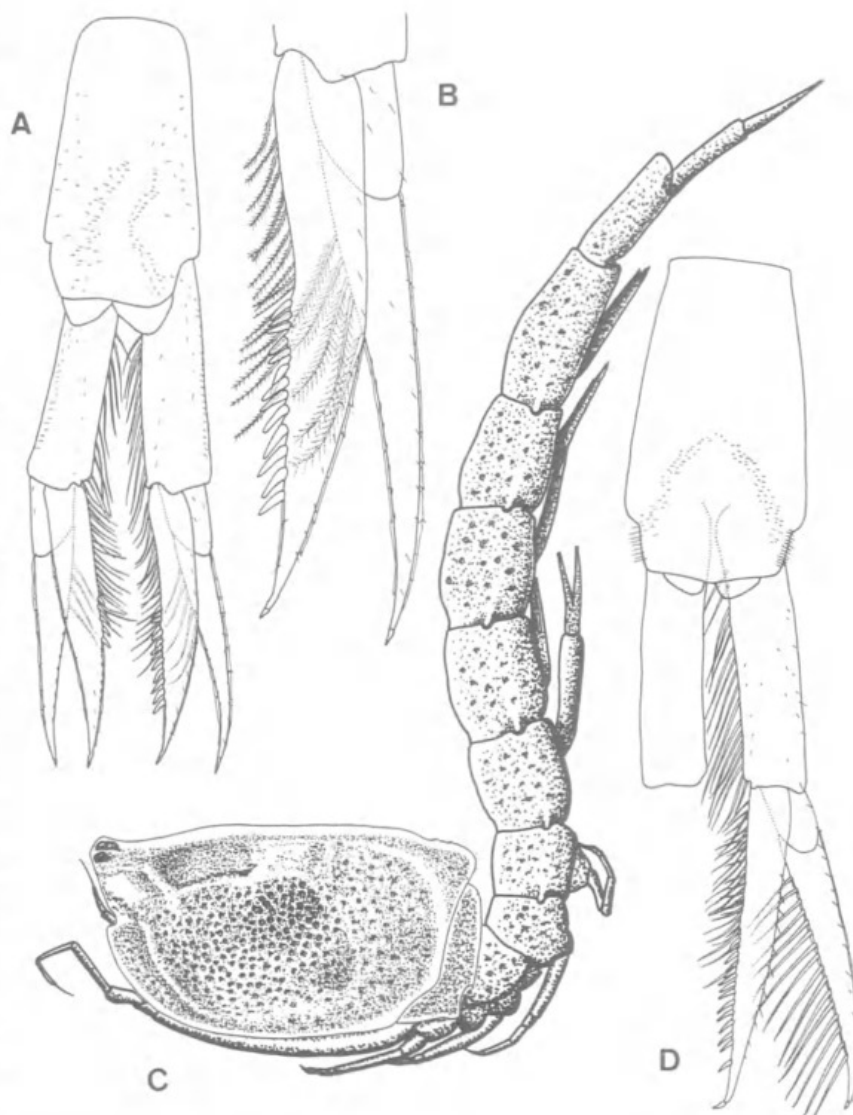


FIG. 37. *Cyclaspis alveosculpta* sp. nov. ♂. A,B, paratype ♂ (removed from gut of *Leiognathus moretoniensis* Ogilby). A, uropods and telsonic somite, DV (some inner marginal spines and setae missing). B, rami of uropod, DV. C,D, holotype ♂. C, LV. D, uropod and telsonic somite, DV.

spine-like setae on proximomedial bulge, 2 plumose distal setae and numerous fine lateral setae; ischium 0.8 times length of merus; merus 0.5 times as long as carpus; carpus 0.9 times length of propodus, with 2 fine medial setae; propodus with 2 distomedial and 4 short medial setae; dactylus 0.85 times length of propodus, with 2 slender spine-like setae and 1 fine seta terminally, 1 spine-like seta and 1 fine seta subterminally and 5 setae along medial margin; exopod well-developed, enlarged proximal segment with 3-4 short setae distolaterally and 8 short distal segments, each with 2 long setae (Fig. 38A). Second pereiopod with basis 0.75 times

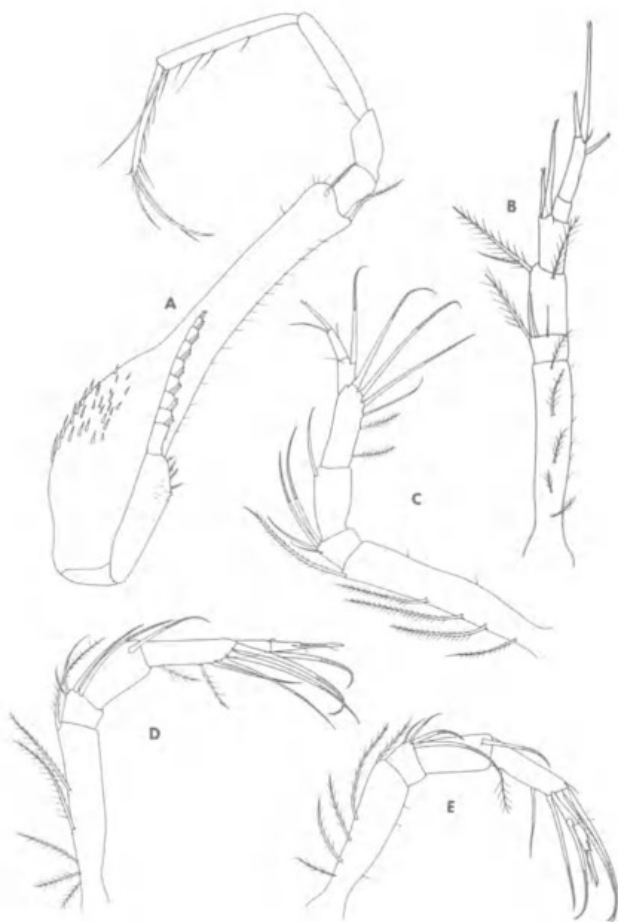


FIG. 38. *Cyclaspis alveosculpta* sp. nov. holotype ♂, A, pereopod 1. B, pereopod 2. C, pereopod 3. D, pereopod 4. E, pereopod 5.

combined length of remaining segments, with 4 plumose setae laterally and 1 distolaterally; ischium 0.3 times length of merus, with 3 setae distomedially; merus as long as combined length of carpus and propodus, with 1 plumose seta distomedially and 1 distolaterally; carpus twice as long as propodus, with 2 strong spine-like setae and rounded process distally; dactylus 3 times length of propodus, with 2 terminal spine-like setae (one at least 1.7 times longer than itself), one subterminal spine-like seta and one subterminal seta (Fig. 38B). Pereiopods 3-5 with merus longer than ischium, carpus longer than merus, propodus longer than dactylus and terminal spine-like seta longer than dactylus; basis with 4-6 plumose setae medially; ischium with 4 setae distomedially; merus with seta distomedially; carpus with 2-3 setae laterally and 3 spine-like setae distolaterally; propodus with spine-like seta and minute seta distally; dactylus with terminal spine-like seta longer than itself, terminal seta

and subterminal seta; some spine-like setae have rows of fine spinules distally (Fig. 38C-E). Pereiopod 3 with basis 0.8 times length of remaining segments combined; ischium 0.4 times length of merus which is 0.8 times length of carpus; propodus 1.2 times length of dactylus (Fig. 38C). Pereiopod 4 with basis 0.7 times length of remaining segments combined; ischium 0.35 times length of merus which is 0.8 times length of carpus; propodus 1.2 times length of dactylus (Fig. 38D). Pereiopod 5 with basis 0.65 times length of remaining segments combined; ischium 0.35 times length of merus which is 0.9 times length of carpus; propodus 1.2 times length of dactylus (Fig. 38E). Peduncle of uropod 0.8 times length of telsonic somite, with plumose setae lining whole inner margin (15-22 setae in fully mature adult); endopod 1.2 times length of peduncle, subequal to length of exopod, with 17-30 plumose setae (2 rows) and 10-15 short spine-like setae on inner margin, apex channelled and slightly curved inwards, with subterminal constriction; exopod with 12-16 plumose setae on inner margin, apex channelled and slightly curved inwards, with subterminal constriction. Fine scattered setae on telsonic somite, peduncle and rami (Fig. 37). Subadult ♂ uropod with shorter peduncle with fewer setae and endopod with shorter setae and spine-like setae (Fig. 36C, 39A).

**OVIGEROUS FEMALE.** Integument strongly calcified with pattern of shallow pitting, as in ♂ (Fig. 36E-H). Carapace length 0.32 S.L. as long as deep including marsupium, with strong anterior and posterior transverse ridges; in profile median dorsal ridge is slightly convex with postocular depression and raised areas in regions of transverse ridges; median dorsal ridge is produced posteriorly to form notched, plate-like lobe; antennal notch a short groove; antennal tooth subacute; pseudorostral lobes tapering anteriorly and joining just below ocular lobe, join not visible in dorsal view; ocular lobe at anterior extremity of carapace (Fig. 36E-H). Pereion 0.5 times as long as carapace. First pereionite a narrow band, visible in lateral view; pereionites 1 and 2 produced ventrally to form the marsupium, second also produced dorsally to form plate-like lobe; pereionites 3 and 4 with lateral overlapping lobes; fifth with lateral articulation notches and well-developed dorsolateral carinae (Fig. 36E-H). Pleon robust, all 5 pleonites with dorsolateral carinae and lateral articulation notches; first 4 pleonites and telsonic somite subequal in length,



fifth pleonite 1.6 times as long as fourth (Fig. 36F). Telsonic somite projecting posteriorly over bases of uropods (Figs 36F, 39D). First antenna 3-segmented with terminal segmented flagellum, as in ♂. Pereiopods as in ♂ except: basis of first pereiopod with only 1 stout spine-like seta on reduced medial bulge, basis of exopod also has reduced bulge compared to ♂; carpus of second pereiopod has only 1 strong spine-like seta distally; ischium of pereiopods 3-5 with only 3 distal setae, carpus with only 1-2 lateral setae (Fig. 39B,C). Peduncle of uropod 0.7 times as long as telsonic somite, with 6-7 plumose setae on inner margin; endopod 1.4 times as long as peduncle, subequal in length to exopod, with row of minute scales and spine-like setae on inner margin, apex channelled with subterminal constriction; exopod with 8-9 plumose setae on inner margin, apex channelled with subterminal constriction (Fig. 39D).

Colour. Cream to fawn.

S.L. Adult ♂ 7.2-7.8mm. Adult ♀ 7.0-7.5mm.

**HABITAT AND DISTRIBUTION.** Most commonly over medium and coarse sand in 1-5m of water; sites 11, 12, 15, 26, 30, 31, 32 and 36.

**REMARKS.** *Cyclaspis alveosculpta* closely resembles *C. usitata* Hale, from NSW and S AUST. The most obvious differences relate to the ridges and tubercles of the carapace. Also the dactylus of pereiopods 1 and 2 are relatively longer in *C. alveosculpta* and the ♂ has many more spine-like setae on the basis of the first pereiopod. Hale (1932:550; 1944a:123) only described and figured the ♀ of *C. usitata* though he later suggested (Hale, 1948:40) it to be the ♀ of *C. mjobergi*, described by Zimmer (1921) from ♂♂ only. It is obvious that the posterior transverse ridge and posterior dorsomedial tubercle of the adult ♀ of *C. usitata* are poorly developed compared those of *C. alveosculpta*. The posterior median dorsal ridge of the carapace is raised in the adult ♂ of *C. mjobergi* but not in *C. alveosculpta*. The dactylus of pereiopod 1 is less than 2/3 as long as the propodus in *C. usitata* and *C. mjobergi* but at least 2/3 as long in *C. alveosculpta*.

*Cyclaspis alveosculpta* superficially resembles *C. munda* Hale from southern NSW, but differs in having spine-like setae on the basis of pereiopod 1 and a very long terminal spine-like seta on pereiopod 2. Roccatagliata (1989) described *C. sculptilis* from Brazil, which resembles *C. alveosculpta*, but the location and

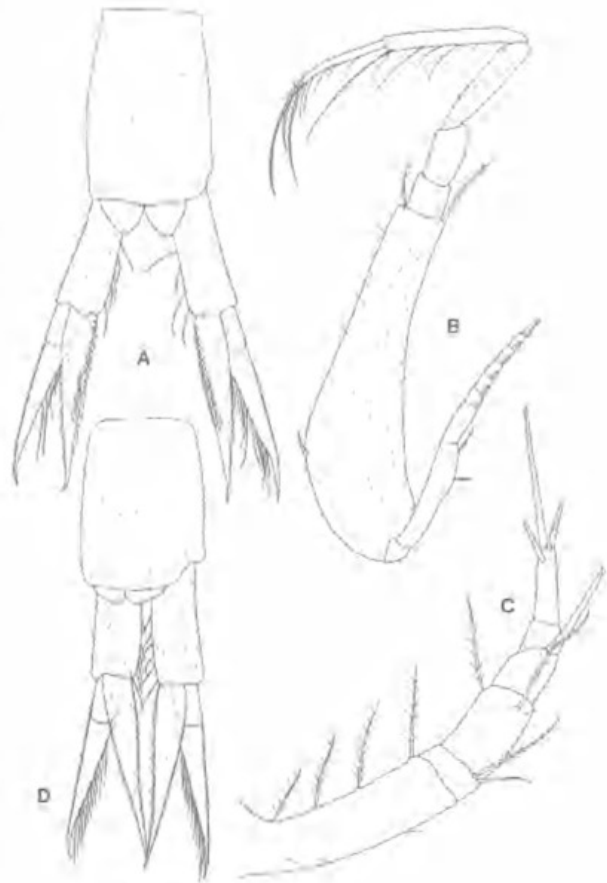
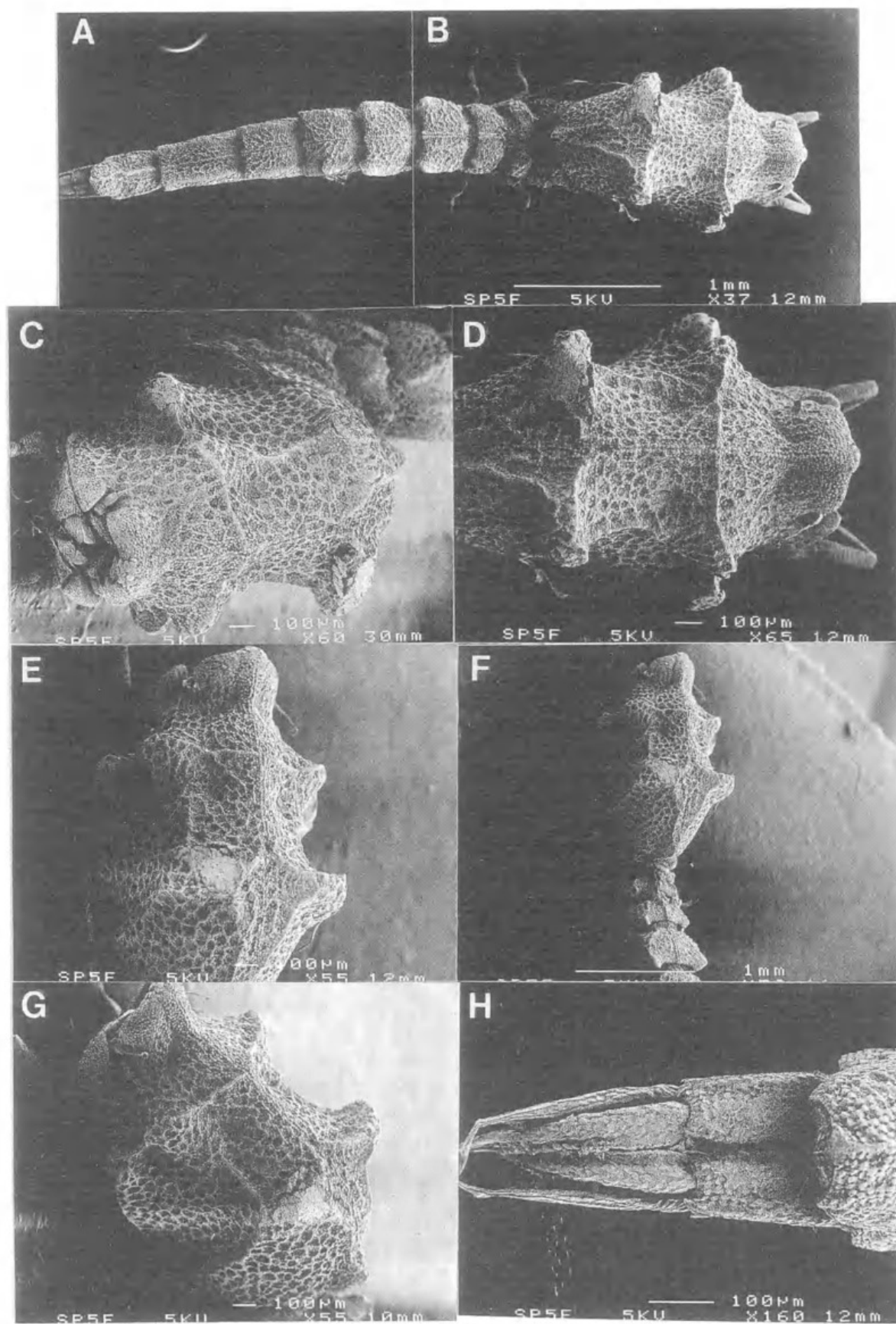


FIG. 39. *Cyclaspis alveosculpta* sp. nov. A, uropods and telsonic somite of subadult ♂, DV. B-D, paratype ovig. ♀. B, pereiopod 1. C, pereiopod 2. D, uropods and telsonic somite, DV.

definition of the posterior transverse ridges on the carapace are different.

♂ and ♀ of *C. alveosculpta* were recorded in the same area, both strongly calcified with reticulate pitting of the carapace. The carapace of the subadult ♂ has similar sculpture to the adult ♀ (Fig. 70E-G), but loses it during the last stage of development (cf. *C. ornosculpta*, Fig. 27). All adults and subadults have 2 dorsal depressions, behind the anterior transverse ridge of the carapace on either side of the median ridge (Figs 33I, 70E,G).

8 adult ♂♂ of *C. alveosculpta* were taken from gut contents of fish (*Leiognathus moretoniensis*, Apogonidae) trawled (17 April 1990) between sites 30 and 31, depth 5-15 m, on sand (S.L. fish 2-7cm). Some setae and spine-like setae have been broken off the uropodal rami (Fig. 37A,B) during the digestive process.



ETYMOLOGY. Latin *alveus*, pit, and *exsculpta* species group.

*Cyclaspis chaunosculpta* sp. nov.  
(Figs 40-43)

**MATERIAL EXAMINED.** HOLOTYPE QMW20512, adult ♂, S.L. 10.32mm, PSM #65, Middle Banks, 27°12'S, 153°18'E, S. Cook, Sept. 1972, 8m, sand, 35 p.p.t. salinity, 23°C water temperature. PARATYPES QMW20513, ovig. ♀, allotype, S.L. 9.5mm, PSM #63, same data as holotype; QMW20514, subadult ♂, S.L. 5.2mm, SEM mount, Horseshoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 17 April 1990, 2-3 m, sand, 33 p.p.t. salinity, 25°C water temperature. QMW8536, 3 adult ♀♀, S.L. 9.0-9.7mm, same data as holotype.

**DESCRIPTION. MALE.** Integument strongly calcified with pattern of pitting which resembles the porous structure of a sponge (Fig. 41A). Carapace 0.3 S.L. depth 0.55 times length, with poorly defined anterior and posterior transverse ridges; profile of median dorsal ridge may be slightly raised in vicinity of both transverse ridges, with shallow post-ocular depression and small posterior lobe; antennal notch a short groove; antennal tooth subacute, no antennal ridge; pseudorostral lobes tapering anteriorly and joining just below ocular lobe, join not visible in dorsal view; ocular lobe at anterior extremity of carapace (Fig. 41A). Pereion 0.65 as long as carapace; pereionite 1 concealed; pereionite 2 without dorsal lobe; pereionites 3-5 with dorsolateral carinae, tufts of setae on posterodorsal margins and dorsal profile continuous with that of pleon; third and fourth with posterolateral overlapping lobes and fifth with lateral articulation notch (Fig. 41A). Pleon robust; each pleonite with lateral articulation notches, first 4 pleonites with dorsolateral carinae and subequal in length, fifth 1.45 times as long as fourth (Fig. 41A). Telsonic somite 0.66 times length of fifth pleonite and subequal to fourth, with swollen posterodorsal projection (Fig. 41A). First antenna 3-segmented with terminal segmented flagellum. All pereopods 7-segmented. Pereopod 1 with carpus reaching beyond level of antennal tooth; basis

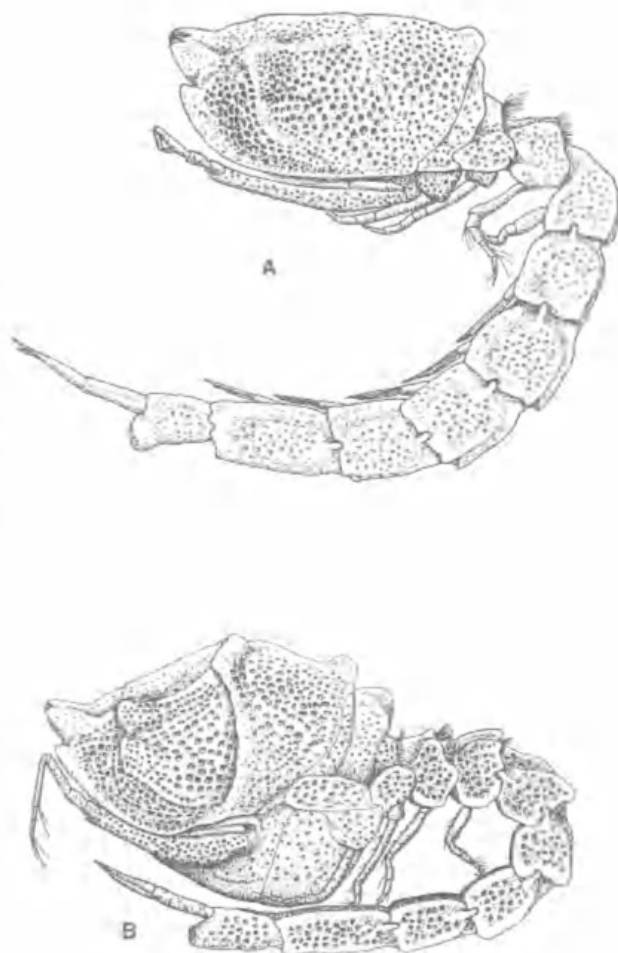


FIG. 41. *Cyclaspis chaunosculpta* sp. nov. type specimens. A, holotype ♂, LV. B, allotype ovig. ♀, LV.

1.1 times rest of appendage, with 20-25 stout spine-like setae on pronounced proximomedial bulge, 2 plumose distal setae and rounded distal lobe which extends at least 1/3 length of ischium; ischium 0.6 times length of merus, which is 0.6 times length of carpus; carpus 0.8 times length of propodus; propodus with 3 distomedial and 5 short medial setae; dactylus 0.55 times length of propodus, with 2 slender spine-like setae and 1 fine seta terminally, 1 spine-like seta and 3 fine seta subterminally and 3 setae along medial margin; exopod well developed, proximal segment with distal bulge bearing 3-4 short plumose setae,

FIG. 40. *Cyclaspis chaunosculpta* sp. nov. subadult ♂. A, B, whole mount DV, shows relative lengths of carapace and somites. C, carapace ALV, shows anterior position of ocular lobe and shape of antennal notch. D, carapace DV, shows maximum width in region of anterior transverse ridge. Integument strongly calcified with pattern of pitting (resembles porous structure of sponge). E, carapace PLV, shows structure of posterior transverse ridge. F, carapace and Pereion PLV, shows dorso lateral projections of pereion. G, carapace DLV, shows median dorsal ridge and anterior and posterior transverse ridges. H, Uropod DV, shows relative lengths of peduncle and rami.

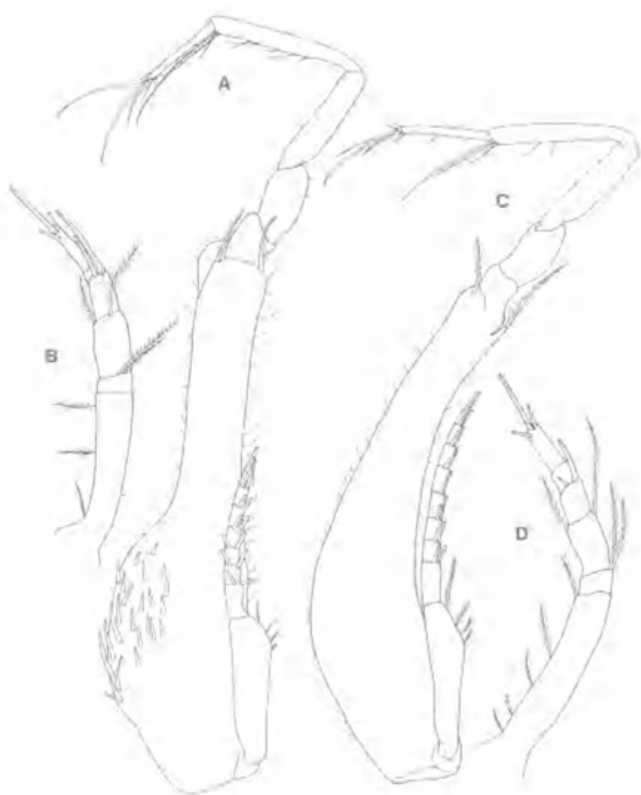


FIG. 42. *Cyclopsis chaunosculpta* sp. nov., A,B, holotype adult ♂. A, pereopod 1. B, pereopod 2. C,D, allotype, ovig. ♀. C, pereopod 1. D, pereopod 2.

8 short distal segments, each with two long setae (Figs 41A, 42A). Pereiopod 2 same as *C. alveosculpta* except ischium has 2 setae distomedially, dactylus is 2.5 times length of propodus and main dactylar spine-like seta is 1.4 times dactylus (Fig. 42B). Pereiopods 3-5 same as *C. alveosculpta* except basis has 3-5 plumose setae medially and dactylar spine-like seta is 0.9 times length of dactylus. Uropod same as *C. alveosculpta* except peduncle of uropod 0.7 times length of telsonic somite, with 16-18 setae lining inner margin, endopod 1.3 times length of peduncle, with 30-40 plumose setae (2 rows) and 9-11 short spine-like setae on inner margin, apex finely channelled and incurved, with subterminal constriction; exopod with 12-14 plumose setae on inner margin, apex finely channelled and incurved (Fig. 43A-C).

**OVIGEROUS FEMALE.** Integument strongly calcified with pattern of deep pitting, as in ♂ (Fig. 41B). Carapace length 0.3 S.L. as deep as long including marsupium, with strong anterior and posterior transverse ridges; in profile median dorsal ridge is convex with postocular depression

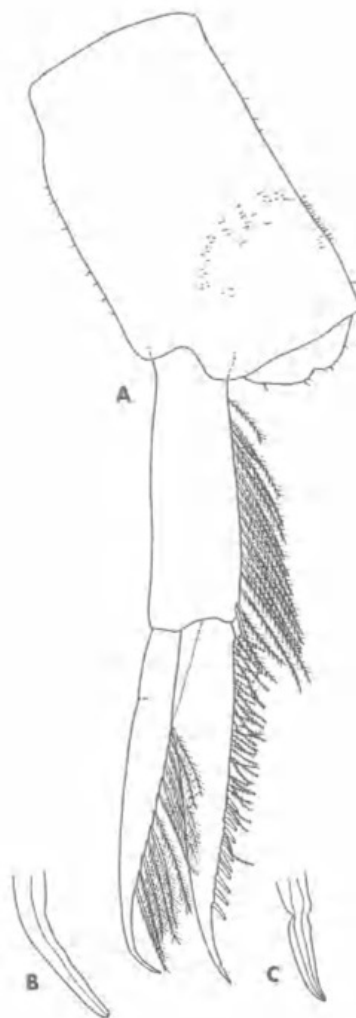


FIG. 43. *Cyclopsis chaunosculpta* sp. nov. holotype ♂. A, uropod and telsonic somite, DLV. B, distal end of exopod. C, distal end of endopod.

and raised areas in regions of transverse ridges; median dorsal ridge produced posteriorly to form rounded plate-like lobe almost as high as median dorsal hump; antennal notch, antennal tooth, pseudorostral lobes and ocular lobe as ♂ (Fig. 41B). Pereion 0.5 times as long as carapace; pereionite 1 a narrow band, visible in lateral view; pereionites 1 and 2 produced ventrally to form marsupium, second also produced dorsally to form plate-like lobe; pereionites 3-5 with dorsolateral carinae, tufts of setae on posterodorsal margins and dorsal profile continuous with that of pleon; pereionites 3 and 4 with posterolateral overlapping lobes and fifth with lateral articulation notch (Fig. 41B). Pleon robust, first 4 pleonites subequal in length, with dorsolateral carinae and lateral articulation notches; fifth pleonite 1.5 times as long as fourth; telsonic



somite projecting posteriorly over bases of uropods (Fig. 41B). First antenna 3-segmented with terminal segmented flagellum, as in ♂. Pereiopods as in ♂ except: basis of pereopod 1 without enlarged distal lobe or spine-like setae on reduced medial bulge; carpus of pereopod 2 has 1 strong and 1 weak spine-like seta distally; ischium of pereopods 3-5 with 3-4 distal setae, carpus has only 1-2 lateral setae in addition to 3 distal spine-like setae (Fig. 42C,D). Uropod same as ♀ of *C. alveosculpta*, except exopod has 11-12 plumose setae on inner margin.

*Colour.* Cream.

*S.L.* Adult ♂ 10.3mm. Adult ♀ 9.0-9.7mm.

**HABITAT AND DISTRIBUTION.** Most common over medium and coarse sand in 1-5m of water; Middle Banks and Horseshoe Bay in Moreton Bay.

**REMARKS.** *Cyclaspis chaunosculpta* closely resembles *C. supersculpta* Zimmer, 1921, from NW Australia. Both species have a reticulate pattern of deep pits on the carapace and abdominal segments; however, *C. supersculpta* also has lateral bulges either side of the median dorsal ridge at the posterior extremity of the carapace. There is no sign of such bulges in juvenile or adult specimens of the new species. Close examination of the holotype of *C. supersculpta* shows that the posterolateral projection on the fifth pleonite is only about half as long as shown by Zimmer (1921, fig. 8). The size of this projection is similar to that of the new species. *C. chaunosculpta* also has more strongly developed transverse ridges than *C. supersculpta*. A comparison of ♀ juveniles of both species (Fig. 43D,E) shows these differences in carapace structure. The subadult ♂ of *C. chaunosculpta* has strong transverse ridges on the carapace, unlike the adult ♂ (Fig. 40).

*C. chaunosculpta* also resembles *C. aspera* Hale, which has been recorded off Coffs Harbour, NSW. The most obvious differences relate to the absence, in *C. chaunosculpta*, of spinules on carapace and somites. Also the anterior transverse ridge is wider than the posterior one in dorsal view, whereas in *C. aspera* the posterior ridge is wider (Hale, 1944a:125, figs 45-46).

*C. chaunosculpta* can be distinguished from *C. candida* and *C. mjobergi* by the shorter peduncle of the uropod relative to its rami. It also differs from the latter species in lacking small tubercles on the middorsal region of the carapace (Zimmer, 1921).

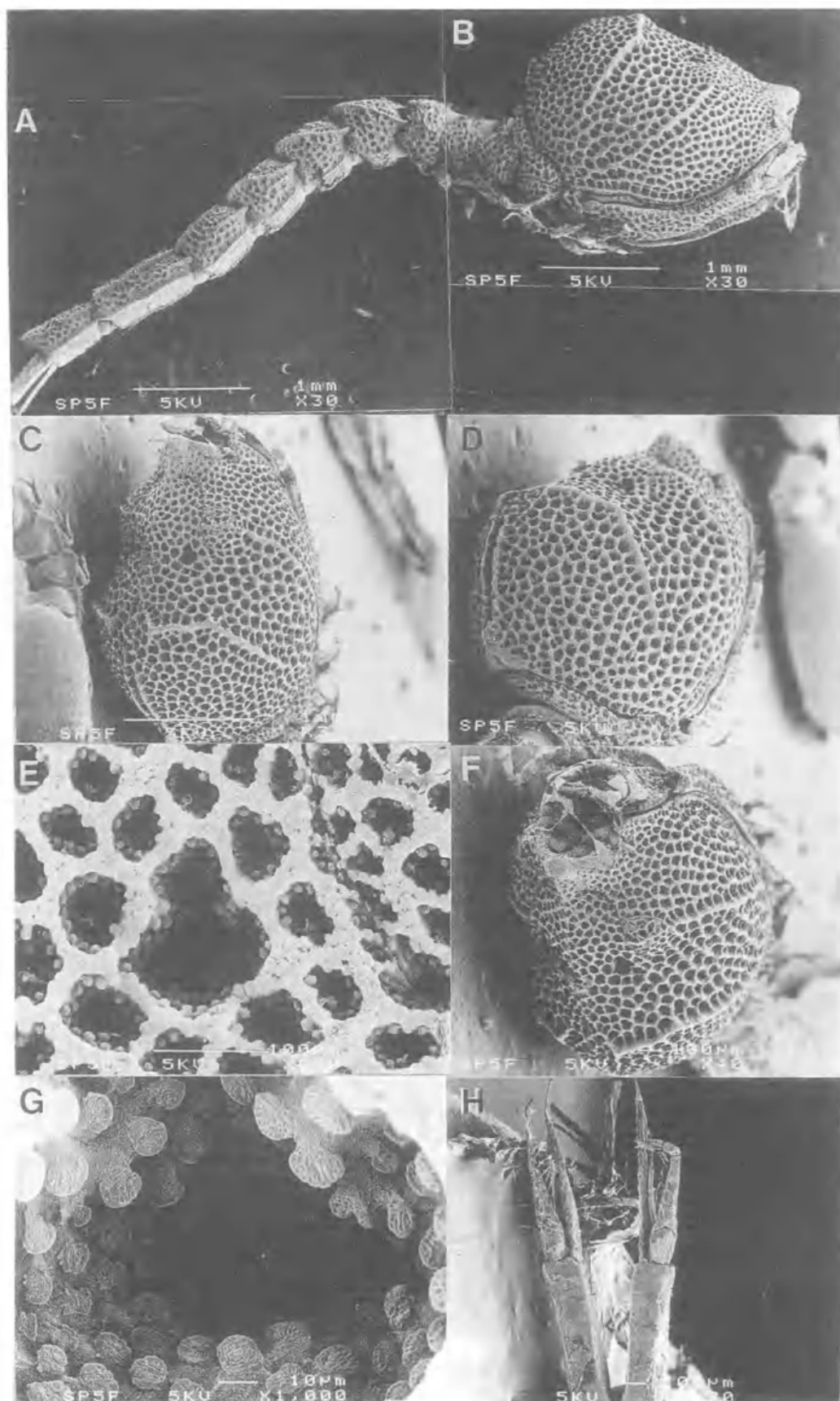
*C. chaunosculpta* can be distinguished from *C. alveosculpta* by the deeper, sponge-like pitting of the carapace, shorter dactylar spine-like seta of the second pereopod and larger overall size.

**ETYMOLOGY.** Greek *chaunos*, porous, sponge-like and the *exsculpta* species group.

***Cyclaspis agrenosculpta* sp. nov.**  
(Figs 44-47)

**MATERIAL EXAMINED.** HOLOTYPE QMW20516, adult ♂, S.L. 10.8mm, PSM #62, Middle Banks, 27°12'S, 153°18'E, S. Cook, Sept. 1972, 8m, sand, 35 p.p.t. salinity, 23°C water temperature. PARATYPES QMW20517, ovig. ♀, allotype, S.L. 9.8mm, PSM #64, same data as holotype; QMW20518, subadult ♀, S.L. 7.4mm, SEM mount, Horseshoe Bay, site 31, 27° 30'S, 153° 21'E, D. Tafe, 10 Jan. 1993, 2-3m, sand, 34 ppt salinity, 26°C water temperature.

**DESCRIPTION.** MALE. Integument strongly calcified with a network of angular pits interspersed by thin calcified ridges (Fig. 45A). Carapace 0.29 S.L. 1.95 times as long as deep, with poorly defined anterior and posterior transverse ridges; profile of median dorsal ridge almost straight, with slight postocular depression and slight posterior hump; antennal notch a short groove; antennal tooth rounded, no antennal ridge; pseudorostral lobes tapering anteriorly and joining just below ocular lobe, join not visible in dorsal view; ocular lobe at anterior extremity of carapace (Fig. 45A). Pereon 0.6 as long as carapace; pereonite 1 fully concealed; pereonite 2 forming a collar behind carapace with dorsal lobe as high as dorsum of carapace; pereonites 3-5 with dorsolateral carinae, tufts of setae on posterodorsal margins and dorsal profile continuous with that of pleon; third and fourth with posterolateral overlapping lobes and fifth with lateral articulation notch and raised dorsum (Fig. 45A). Pleon very robust and calcified; each pleonite with lateral articulation notches and dorsolateral carinae, first 4 subequal in length, fifth 1.6 times as long as fourth (Fig. 45A). Telsonic somite 0.66 times length of fifth pleonite and subequal to fourth, with small mid-dorsal hump and posterodorsal projection (Fig. 45A). First antenna 3-segmented with terminal segmented flagellum; first segment somewhat geniculate. All pereopods 7-segmented. First pereopod with carpus reaching beyond level of antennal tooth; length of basis 1.4 times rest of appendage, with 17-19 spine-like setae and small protrusion on pronounced proximomedial bulge, 2 plumose distal setae and rounded distal lobe extending 1/4



length of ischium; ischium 0.8 times length of merus, which is 0.55 times length of carpus; carpus 0.9 times length of propodus; propodus with 2 slender spine-like setae and 2 setae disromedially; dactylus 0.65 times length of propodus, with 2 slender spine-like setae and 1 fine seta terminally, 1 spine-like seta and 3 fine seta subterminally and 1 seta along medial margin; exopod well-developed, proximal segment with distal bulge bearing 5-6 short plumose setae, 8 short distal segments, each with 2 long setae (Fig. 46A). Pereiopod 2 same as *C. alveosculpta* except ischium has 2 distal setae, smaller of the two carpal spine-like setae reaches distal end of dactylus, dactylus is 2.3 times length of propodus and main dactylar spine-like seta is 1.1 times dactylus (Fig. 46B). Pereiopods 3-5 same as *C. alveosculpta* except basis has 3-7 plumose setae medially, carpus has 1 lateral seta in addition to 3 distal spine-like setae and dactylar spine-like seta is 0.75- 0.85 times length of dactylus. Peduncle of uropod 1.2 times length of telsonic somite (Fig. 45A), with plumose setae lining whole inner margin (26-30 setae in fully mature adult); endopod 0.9 times length of peduncle or exopod, with 25-30 plumose setae (2 rows) and 18 short spine-like setae on inner margin, apex bluntly pointed with subterminal constriction; exopod with 18-20 plumose setae on inner margin, apex channelled, slightly curved inwards (Fig. 47A).

**OVIGEROUS FEMALE.** Integument strongly calcified with a network of angular pits interspersed by thin calcified ridges, as in ♂ (Fig. 45B). Carapace length 0.3 S.L. almost as deep as long including marsupium, with strong anterior and posterior transverse ridges; in profile median dorsal ridge is slightly concave between transverse ridges and slightly convex behind posterior transverse ridge, with postocular depression and small raised lobe at posterior extremity; antennal notch a short groove; antennal tooth subacute, no antennal ridge; pseudorostral lobes and ocular lobe as in ♂ (Fig. 45B). Pereion 0.6 times as long as carapace; pereionite 1 a narrow band, visible in lateral view; pereionites 1 and 2 produced

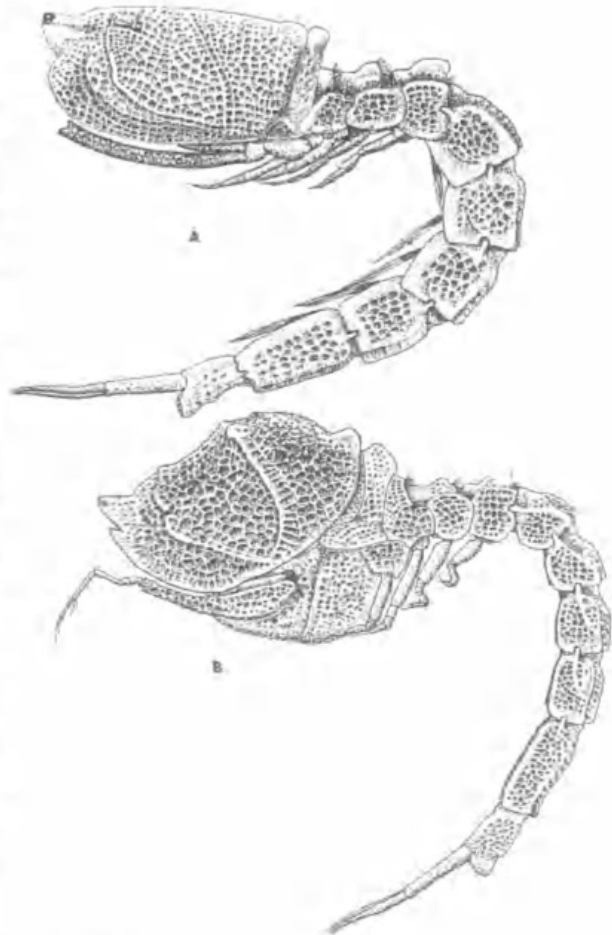


FIG. 45. *Cyclopsis agrenosculpta* sp. nov. types. A, holotype ♂, LV. B, allotype ovig. ♀, LV.

ventrally to form the marsupium, second also produced dorsally to form plate-like lobe almost as high as preceding lobe; fifth with lateral articulation notches and welldeveloped dorsolateral carinae (Fig. 45B). Pleon heavily calcified but slender, all 5 pleonites with dorsolateral carinae; first 4 pleonites subequal in length, with lateral articulation notches; fifth pleonite 1.6 times as long as fourth (Fig. 45B). Telsonic somite 0.66 times length of pleonite 5 and subequal to fourth, with small middorsal hump and posterodorsal projection, as in ♂ (Fig. 45B). First antenna 3-segmented with terminal

FIG. 44. *Cyclopsis agrenosculpta* sp. nov. subadult ♀. A,B, whole mount LV, shows relative lengths of carapace and somites. C, carapace DLV, shows structure of anterior and posterior transverse ridges, aperture located behind anterior ridge. D, carapace PLV, shows recessed median dorsal ridge between posterior transverse ridge and posterior of carapace. E, Structure of carapace DV, shows dorsal aperture and network of calcified pits interspersed by thin chitinised ridges. F, carapace ADV, shows ocular lobe at anterior extremity and profile of posterior transverse ridge. G, Detail of dorsal aperture DV, shows aperture lined with numerous plate-like lobes. H, uropods VV, shows relative lengths of peduncle and rami.

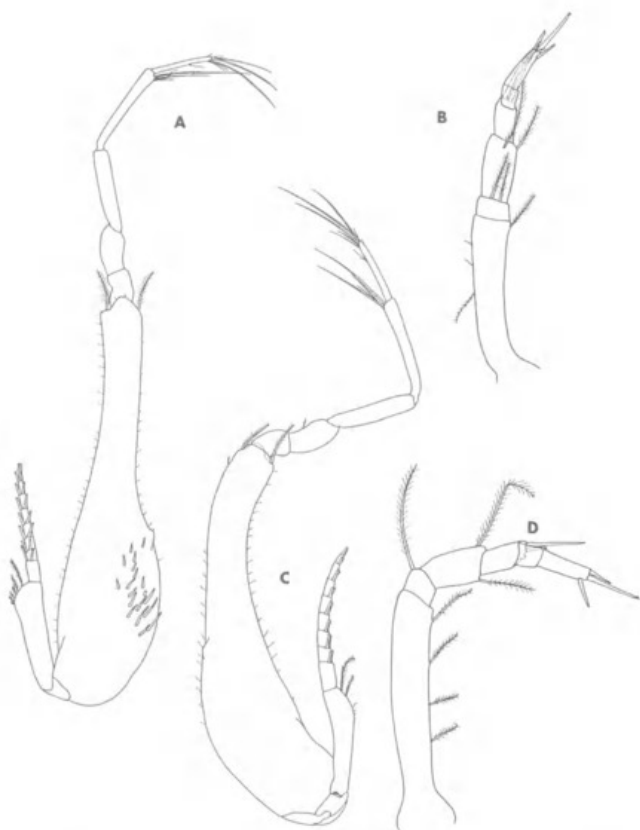


FIG. 46. *Cyclopsis agrenosculpta* sp. nov., A,B, holotype ♂. A, pereopod 1. B, pereopod 2. C-D, allotype ovig. ♀. C, pereopod 1. D, pereopod 2.

segmented flagellum, as in ♂. Pereiopods as in ♂ except: basis of first pereopod without enlarged distal lobe or spine-like setae on reduced medial bulge, though protrusion is present on bulge; carpus of pereopod 2 has 1 strong and 1 weak spine-like seta distally; pereiopods 3-5 with basis with 4-8 medial setae, carpus with 2-3 lateral setae and dactylar spine-like seta 0.83-0.93 times length of dactylus (Fig. 46C,D). Peduncle of uropod 1.1 times as long as telsonic somite, with 7-9 plumose setae on inner margin; endopod subequal in length to peduncle and 0.9 times length of exopod, with a single spine-like seta on middle of inner margin, apex bluntly pointed; exopod with 16-17 plumose setae on inner margin, apex channelled and slightly curved inwards (Fig. 47B).

*Colour.* Cream.

*S.L.* Adult ♂ 10.8mm. Adult ♀ 9.8mm.

**HABITAT AND DISTRIBUTION.** Most common over medium and coarse sand in 1-10m of water; from Middle Banks and Horseshoe Bay, Moreton Bay; uncommon on the western but common on the eastern side of Moreton Bay.

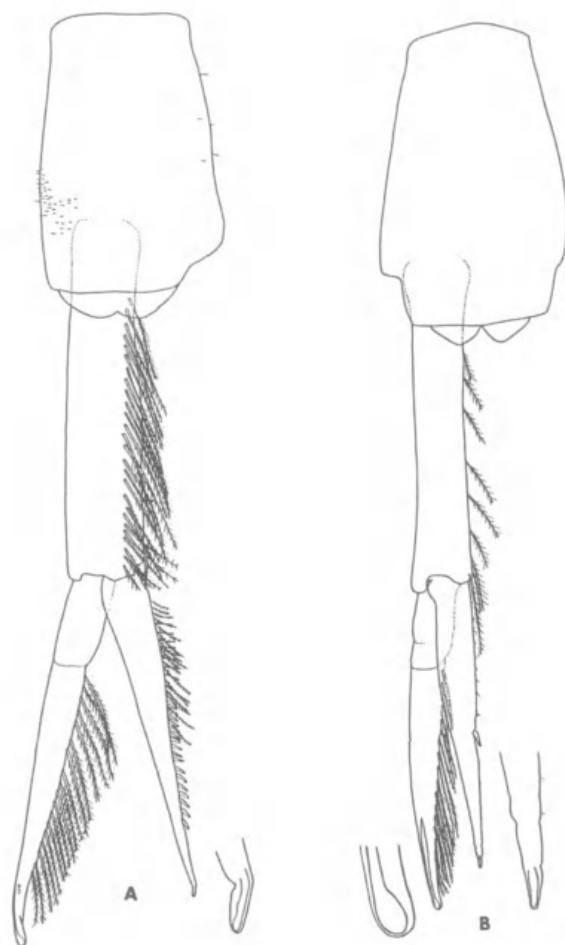


FIG. 47. *Cyclopsis agrenosculpta* sp. nov., A, uropod and telsonic somite of holotype ♂, DV, and distal end of endopod. B, uropod and telsonic somite of allotype ovig. ♀, DV, and distal ends of both rami.

**REMARKS.** *C. agrenosculpta* resembles *C. australis* Sars (1887:12, pl. 1, figs 1-20) from VIC and *C. tribulis* Hale (1928:34, figs 3,4) and *C. mawsonae* Hale (1944a:119) from S AUST. However, the new species is distinguished from all 3 by the pattern of deep, rectangular pits on the carapace. Stephenson et al. (1978:208, 1980:259; Bacescu, 1988:69) recorded *C. agrenosculpta* ♀♀ as *C. tribulis* and ♂♂ as *C. mawsonae* (Stephenson et al., 1978:210; Bacescu, 1988:61). *C. tribulis* and *C. mawsonae* are not known in QLD contrary to Bacescu (1988). Two depressions are located in the dorsal surface of the carapace of *C. agrenosculpta*, roughly in the same positions as for *C. alveosculpta* (Fig. 44C-G). The subadult ♀ of *C. agrenosculpta* closely resembles the adult except for the transverse ridges of the carapace, which are not as well



developed (Fig. 44A,B). The uropod of the subadult ♀ is basically the same as in the adult except for the slightly shorter peduncle and smaller inner marginal spine-like seta of the endopod.

*Cyclaspis agrenosculpta* most closely resembles *C. chaunosculpta* sp. nov., taken from the same area. They can be readily distinguished by the sculpture pattern of the carapace and the relative peduncle length of the uropod.

*Cyclaspis agrenosculpta* can be distinguished from *C. candida* and *C. mjobergi* by the height and shape of the second pereonite. It also differs from the latter species in lacking small tubercles on the mid-dorsal region of the carapace (Zimmer, 1921).

ETYMOLOGY. Greek *agrenon*, net, and the *exsculpta* species group.

***Cyclaspis daviei* sp. nov.**  
(Figs 48-50)

**MATERIAL EXAMINED.**

HOLOTYPE QMW20521, ovig. ♀, S.L. 3.0mm, PSM #19, Horse-shoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 4 Feb. 1993, 2-3m, sand, 34 p.p.t. salinity, 26°C water temperature.

QMW20522, ovig. ♀, S.L. 2.6mm, in 70% ethanol, same data as above; QMW20523, ovig. ♀, S.L. 2.5mm, in 70% ethanol, same data as above.

**DESCRIPTION. OVIGEROUS FEMALE.** Integument thin, lightly calcified, with small, even reticulate patterning (Fig. 48A). Carapace 0.33 S.L. with mild median dorsal ridge on anterior 1/2 and median dorsal recess on posterior 1/2; curvature of carapace is smooth, without lateral ridges; carapace 0.65 as wide as long, lateral margins slightly rounded in dorsal view. Antennal notch a short, shallow groove; antennal tooth subacute, no antennal ridge. Pseudorostral lobes wide, joining just anterior to ocular lobe which is as wide as long, rounded, with 11 lenses (Fig. 48A). Pereon 0.5 times length of carapace; pereonite

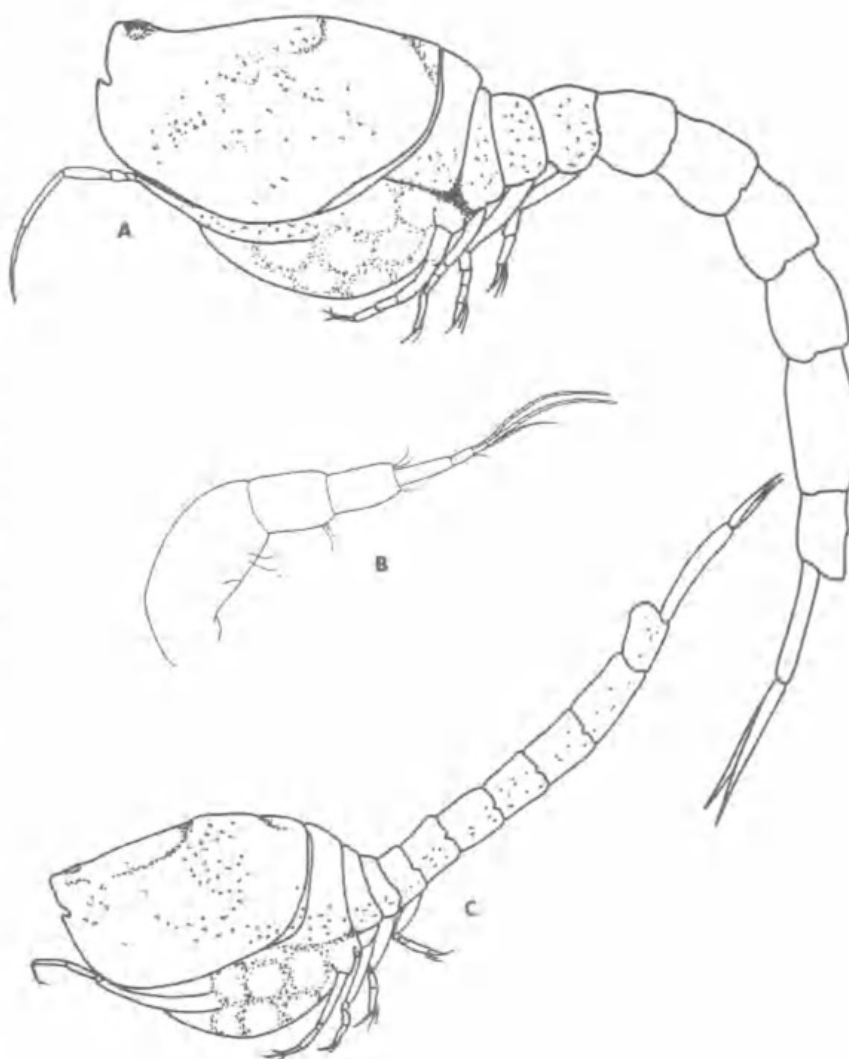


FIG. 48. A,B, *Cyclaspis daviei* sp. nov. paratype ovig. ♀. A, LV. B, first antenna. C, *Cyclaspis andersoni* sp. nov. paratype ovig. ♀, LV.

1 fully concealed by second, which forms a narrow collar posterior to carapace; shorter than each of remaining 3 pereonites which are overlapping (Fig. 48A). Pleon robust, no dorsal or lateral ridges; first 4 pleonites subequal in length, fifth pleonite 1.5 times as long as fourth (Fig. 48A). Telsonic somite shorter than fourth pleonite, with posterodorsal projection. First antenna 3-segmented with terminal segmented flagellum, first segment somewhat geniculate, longer than second and third segments combined; second segment longer than third, with 3 small setae distomedially; third segment with 2 small setae distolaterally and 1 fine seta distomedially; first segment of flagellum 2.5 times as long as second, which bears 2 aesthetascs and 2 fine setae distally (Fig. 48B). All pereopods 7-segmented, with

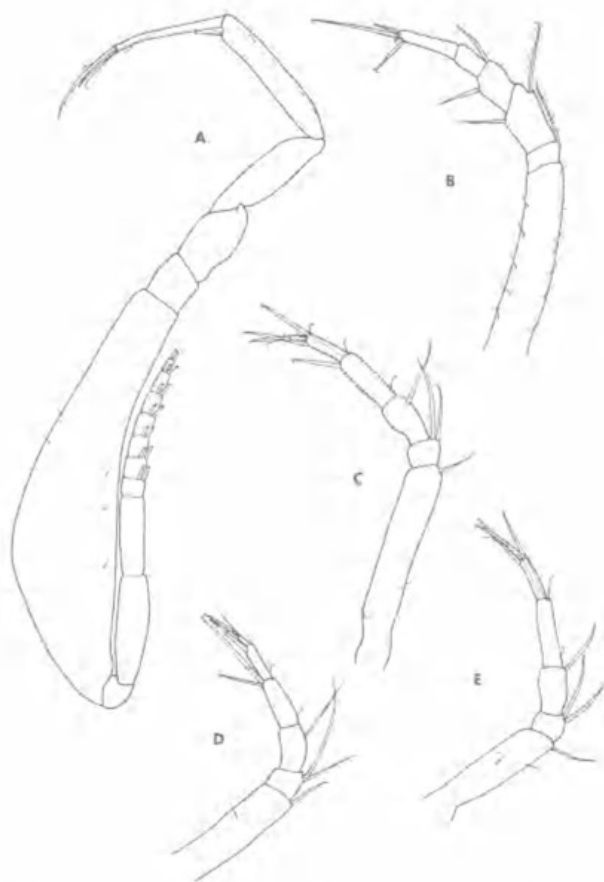


FIG. 49. *Cyclaspis daviei* sp. nov. holotype ♀. A, pereopod 1. B, pereopod 2. C, pereopod 3. D, pereopod 4. E, pereopod 5.

terminal spine-like seta longer than dactylus, except for first pereopod (Fig. 49). Pereopod 1 with carpus reaching beyond level of antennal tooth; length of basis 0.8 times rest of appendage; ischium 0.6 times length of merus which is 0.7 times length of carpus and with small distal process; carpus 0.7 times length of propodus which has 2 small distal setae; dactylus 0.7 times length of propodus with 2 slender terminal spine-like setae, 1 almost as long as itself, and 2 terminal setae (Fig. 49A). Pereopod 2 with basis subequal in length to that of remaining segments combined, with rows of small setae along medial and distal margins; ischium 0.4 times length of merus, with plumose seta distomedially; merus 1.4 times length of carpus, with plumose seta distomedially and spine-like seta distolaterally; carpus 1.3 times length of propodus, with spine-like seta distomedially and spine-like seta distolaterally; propodus 0.5 times length of dactylus which is slender with 2 terminal spine-like setae, the longer one 1.4 times longer than itself, 2 small

terminal seta and 1 subterminal spine-like seta (Fig. 49B). Pereopods 3-5 with merus twice as long as ischium and propodus at least 1.6 times as long as dactylus; basis with seta distomedially; ischium with 2 setae distomedially; merus with seta distomedially; carpus with 1-2 spine-like setae distolaterally, small seta distomedially and small seta proximomedially; propodus with spine-like seta and minute seta distally; dactylus with terminal spine-like seta, terminal seta and subterminal seta (Fig. 49C-E). Pereopod 3 with basis 0.95 times length of remaining segments combined; ischium 0.5 times length of merus which is 0.75 times length of carpus; propodus 1.6 times length of dactylus (Fig. 49C). Pereopod 4 with basis 0.7 times length of remaining segments combined; ischium 0.5 times length of merus which is 0.9 times length of carpus; propodus 1.7 times length of dactylus (Fig. 49D). Pereopod 5 with basis 0.6 times length of remaining segments combined; ischium 0.5 times length of merus which is 0.7 times length of carpus; propodus 1.6 times length of dactylus (Fig. 49E). Peduncle of uropod 1.2 times length of telsonic somite, without plumose setae on inner margin; endopod 1.1 times as long as

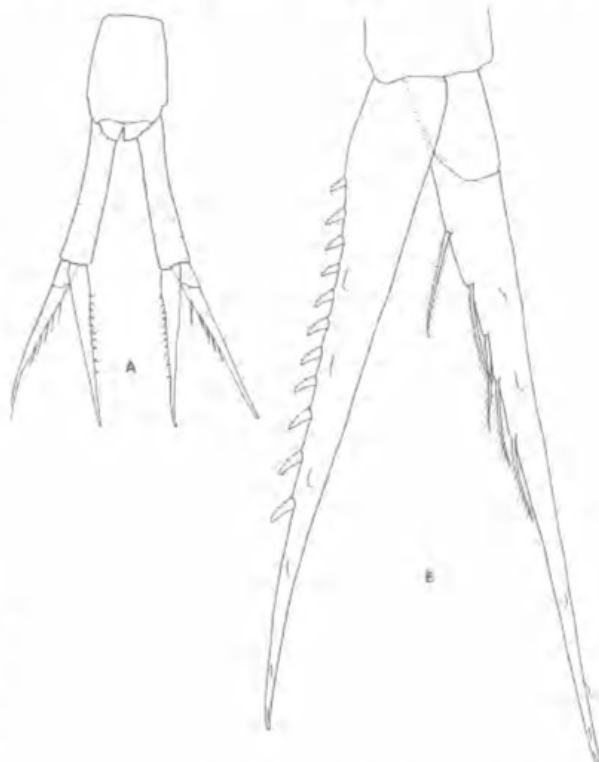


FIG. 50. *Cyclaspis daviei* sp. nov. holotype ♀. A, uropods and telsonic somite, DV. B, rami of uropod, DV.

peduncle and 0.95 times as long as exopod, with 10-11 short spine-like setae on proximal 2/3 of inner margin and 4-5 short setae on dorsal surface, apex pointed, with 2 minute subterminal spine-like setae; exopod with 5 plumose setae on proximal 1/2 of inner margin and 3-4 short setae on dorsal surface, apex pointed, with 2 minute subterminal spine-like setae (Fig. 50).

**Colour.** White, translucent with many black chromatophores on carapace and abdomen.

**S.L.** Adult ♀ 3.0mm.

**HABITAT AND DISTRIBUTION.** Most common over fine sand in 1-5m of water; from sites 12 and 31 in Moreton Bay.

**REMARKS.** *C. daviei* most closely resembles *C. andersoni* but can easily be distinguished by the peduncle of the uropod, which is shorter than the rami. Also the dactylus on pereopod 2 is longer, the setation of the ischium of pereopods 3-5 is different, as is the setation of the uropodal rami, and there are no indentations on the middorsal region of the carapace.

**ETYMOLOGY.** For Peter Davie, Queensland Museum.

***Cyclaspis sallai* sp. nov.**  
(Figs 51-53)

**MATERIAL EXAMINED.** HOLOTYPE QMW20524, adult ♂, S.L. 5.2mm, PSM #49, Pumicestone Passage, site 12, 26°49'S, 153°8'E, J. Greenwood, 24 April 1990, 2m, coarse sand, 30.8 ppt salinity, 18.7°C water temperature. PARATYPE QMW20525, ovig. ♀, allotype, S.L. 4.5mm, PSM #50, same data as holotype.

**DESCRIPTION. MALE.** Integument smooth and calcified, with minute scattered spine-like setae

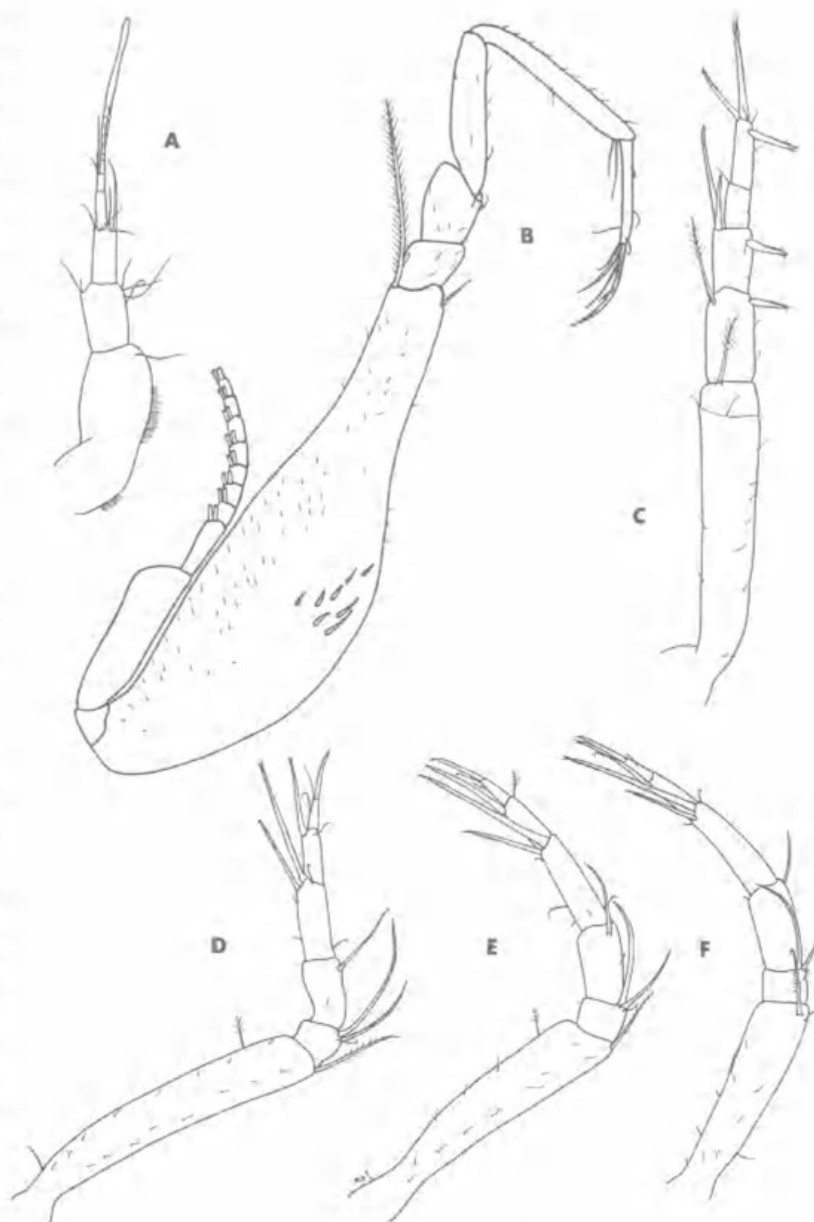


FIG. 51. *Cyclaspis sallai* sp. nov. holotype ♂. A, first antenna. B, pereopod 1, C, pereopod 2. D, pereopod 3. E, pereopod 4. F, pereopod 5.

on surface. Carapace resembles that of *Cyclaspis cooki* except ocular lobe has 10 lenses, 4 central and 6 outer. Pereion 0.5 same as in *C. cooki*. Pleon robust and same as in *C. cooki* except fifth pleonite 1.4 times as long as fourth. First antenna 3-segmented with terminal segmented flagellum; first segment somewhat geniculate, longer than second and third segments combined, with rows of fine setae on anterior (medial) surface; second segment 1.2 times third segment, with 4 fine setae distomedially and 2 setae distolaterally; third seg-

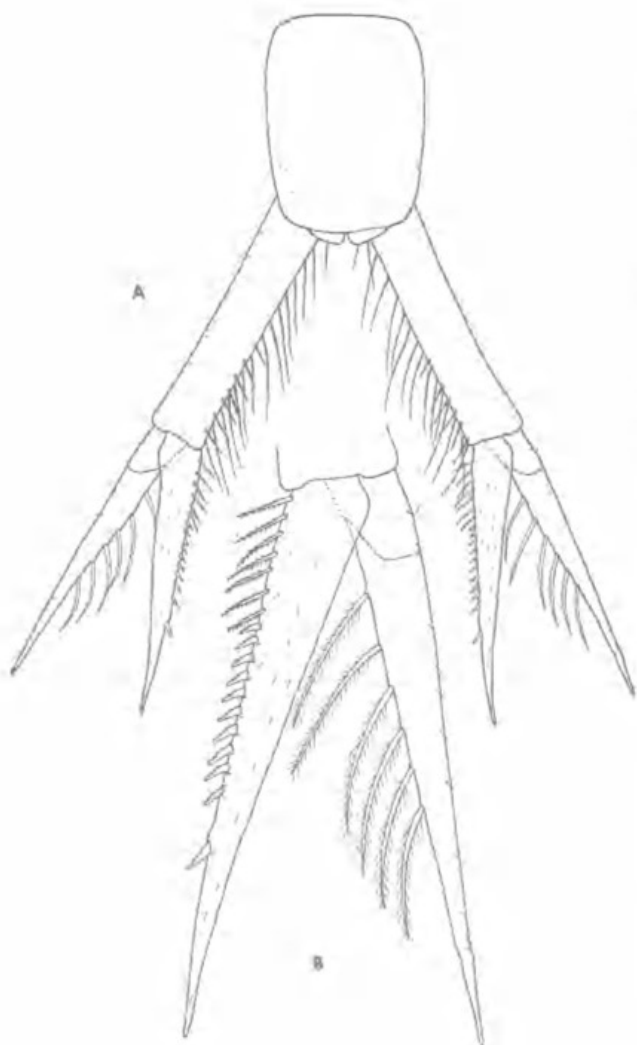


FIG. 52. *Cyclaspis sallai* sp. nov. holotype ♂. A, uropods and telsonic somite, DV. B, rami of uropod, DV.

ment with 3 slender setae distomedially and 2 distolaterally; first segment of flagellum twice as long as second, which has two aesthetascs and 2 fine setae distally (Fig. 51A). All pereopods 7-segmented, with terminal spine-like setae at least as long as dactylus; some spine-like setae have rows of fine spinules distally (Fig. 51B-F). Pereiopod 1 with basis 1.1 times length of remaining segments combined, with simple seta distomedially, plumose seta disto-laterally, and clump of 8 stout spine-like setae on bulge of medial region; ischium 0.65 times length of merus which is 0.5 times length of carpus; carpus 0.8 times length of propodus, which is 1.7 times length of dactylus, with 1 medial and 2 distal setae; dactylus with 2 slender terminal spine-like setae, one as long as itself, 2 terminal setae and stout subterminal seta; exopod well developed,

wide proximal segment, 8 shorter distal segments, each with two long setae (Fig. 51B). Pereiopod 2 with basis 0.8 times length of remaining segments combined, with small distomedial and distolateral setae; ischium 0.4 times length of merus, with plumose seta distomedially; merus 1.4 times length of carpus, with plumose seta distomedially and stout spine-like seta distolaterally; carpus 1.4 times length of propodus, with 2 spine-like setae distomedially and spine-like seta distolaterally; propodus 0.6 times length of dactylus, with fine seta distomedially; dactylus has 2 terminal spine-like setae, the longer one 1.4 times longer than itself, 2 small terminal setae and 1 subterminal spine-like seta; all segments have fine scattered setae (Fig. 51C). Pereiopods 3-5 with merus longer than ischium, carpus as long as combined length of propodus and dactylus, the longer of which is propodus; basis with 1 seta distomedially and fine scattered setae on surface; ischium with 2 long and 1 minute setae distomedially; merus with seta distomedially; carpus with 2 spine-like setae and 1 fine seta distolaterally; propodus with spine-like seta and minute seta distally; dactylus with terminal spine-like seta, terminal seta and subterminal seta (Fig. 51D-F). Pereiopod 3 with basis 1.1 times length of remaining segments combined; ischium 0.5 times length of merus which is 0.8 times length of carpus; propodus 1.7 times length of dactylus (Fig. 51D). Pereiopod 4 with basis 0.95 times length of remaining segments combined; ischium 0.5 times length of merus which is 0.8 times length of carpus; propodus 1.8 times length of dactylus (Fig. 51E). Pereiopod 5 with basis 0.6 times length of remaining segments combined; ischium 0.4 times length of merus which is 0.8 times length of carpus; propodus 1.8 times length of dactylus (Fig. 51F). Peduncle of uropod 1.1 times as long as telsonic somite, lined with 21-22 plumose setae on inner margin (15-16 long, 6-7 short); endopod 1.1 times as long as peduncle, subequal in length to exopod, with 6-7 slender spine-like setae and 10-11 stout spine-like setae on proximal 2/3 of inner margin, the most distal stout spine-like seta being well spaced from the others; apex pointed, without spine-like setae or mucrones; exopod with 6 plumose setae on proximal 2/3 of inner margin, apex pointed, without spine-like setae or mucrones; fine scattered setae on surfaces of telsonic somite, peduncle and rami (Fig. 52A,B).

OVIGEROUS FEMALE. Integument smooth, lightly calcified, with minute scattered setae on carapace



and pleon, as in ♂. Carapace length 0.35 S.L. without distinct dorsal or lateral carinae; width 0.48 times length in dorsal view; antennal tooth subacute and extending to anterior extremity of carapace; ocular lobe and pseudorostral lobes as in ♂. Pereion 0.4 times as long as carapace. Pereionite 1 fully concealed by second, both produced ventrally to form the marsupium; pereionites with dorsal ridge, dorsolateral margin of fifth with articulation notch. Pleon robust, all five pleonites with dorsal ridge and lateral articulation notches; first 4 pleonites and telsonic somite subequal in length, fifth pleonite 1.5 times as long as fourth. Telsonic somite projecting posteriorly over bases of uropods. First antenna 3-segmented with terminal segmented flagellum; first segment geniculate, as in ♂. Pereiopods as in ♂ except: pereiopod 1 has smaller spine-like setae on medial region of basis and 6 reduced terminal segments (rather than 7) on the exopod; carpus of pereiopod 2 has 1 (rather than 2) spine-like setae distomedially (Fig. 53A). Peduncle of uropod 1.3 times as long as telsonic somite, without plumose setae on inner margin; endopod at least as long as peduncle and subequal in length to exopod, with 2 minute setae and 6 stout spine-like setae on proximal two-thirds of inner margin, the most distal stout spine-like seta being well spaced from the others; apex pointed, without spine-like setae or mucrones; exopod with 5 plumose setae on proximal two-thirds of inner margin, apex pointed, without spine-like setae or mucrones; fine scattered setae on surfaces of telsonic somite, peduncle and rami, as in ♂ (Fig. 53B,C).

**Colour.** White to fawn with small black chromatophores speckled on carapace and abdomen.

S.L. Adult ♂ 5.2mm. Adult ♀ 4.5mm.

**HABITAT AND DISTRIBUTION.** Most common over medium and coarse sand in 1-4m of water; from sites 11 and 12 in Moreton Bay. Both sexes are common in Pumicestone Passage, Moreton Bay.

**REMARKS.** *C. sallai* most closely resembles type specimens of *C. cooki*; however, *C. sallai* is 50% larger, more robust, with a covering of fine setae on the pereiopods and uropods. Pereiopod 1 also has spine-like setae on the medial bulge of the basis and a relatively short dactylus, pereiopod 2 has a strong distal spine-like seta on the merus and a relatively short dactylus, and the uropod has rami at least as long as the peduncle.

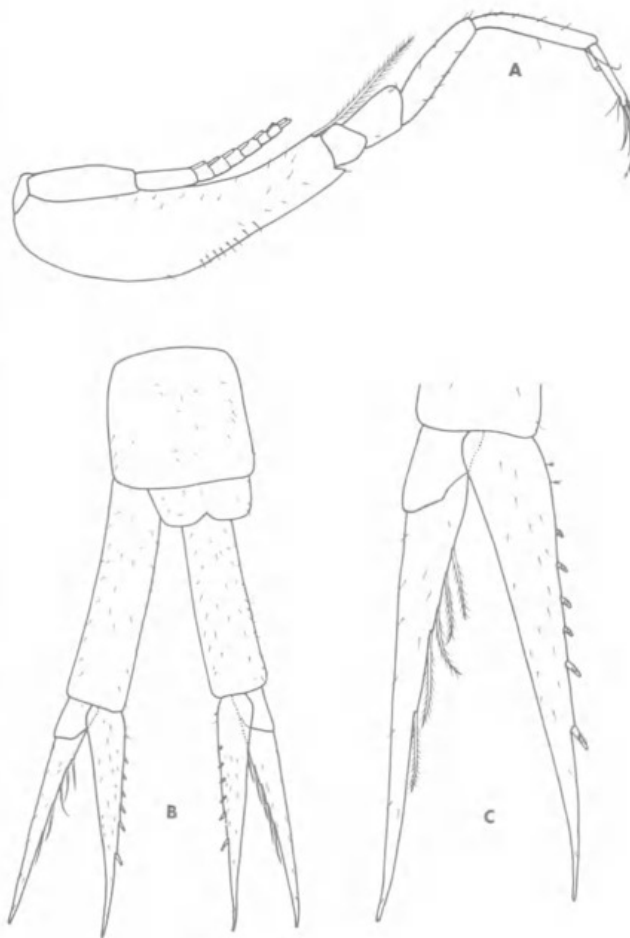


FIG. 53. *Cyclaspis sallai* sp. nov. allotype ovig. ♀. A, pereiopods 1. B, uropods and telsonic somite, DV. C, rami of uropod, DV.

*Cyclaspis sallai* resembles *C. juxta* Hale from S AUST, but the rami of the uropod are much longer relative to the peduncle, and the setation of the uropod is different. The basis of pereiopod 1 has an angular projection on the distomedial margin which may appear rounded or pointed, depending on the orientation of the appendage.

**ETYMOLOGY.** For Michael Salla, who assisted in the field.

#### *Cyclaspis* sp. nov. 1 (Fig. 54A,B)

**MATERIAL EXAMINED.** QMW20515, ovig. ♀, S.L. 1.9mm, in 70% ethanol, off Dunwich, site 28, 27°29'S, 153°22'E, D. Tafe, 20 May 1989, 4 m, sand, 34 p.p.t. salinity, 24°C water temperature; uncommon.

**REMARKS.** Further specimens are required in order to describe the species. *Cyclaspis* sp. nov.

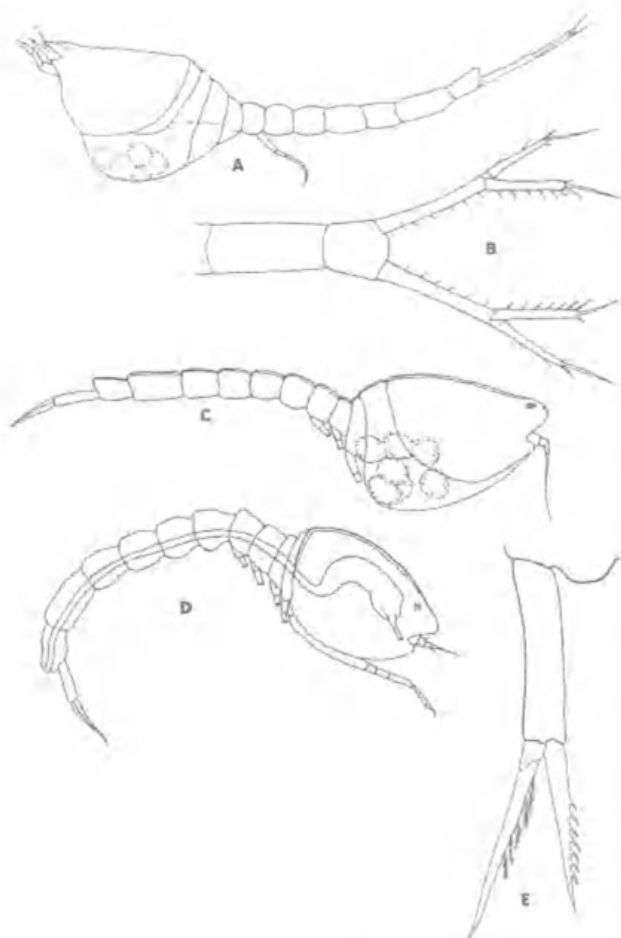


FIG. 54. *Cyclaspis* species. A-B, *Cyclaspis* sp. nov. 1, gravid ♀. A, LV. B, uropods, telsonic somite and pleonite 5, DV. C-E, *Cyclaspis* sp. nov. 2. C, ovig. ♀, LV. D, subadult ♀, LV. E, uropod of ovig. ♀, DV.

1 superficially resembles *C. strigilis* Hale and *C. fulgida* Hale, respectively from Fraser Island, Qld, and Cronulla, NSW. However, it is easily distinguished by terminal spine-like setae on the endopod and exopod of the uropod. Also the carapace does not exhibit the reticulate pattern of sooty black chromatophores, typical of *C. fulgida*, or the numerous oblique striae, typical of *C. strigilis*.

The dorsal line of the carapace of the new species is almost straight in lateral view. The ocular lobe is slightly raised, similar to that of *C. stocki* (Bacescu, 1990), and the pseudorostrum is curiously upturned as 2 pointed filaments (Fig.

54A). Pleonite 5 is 1.5 times the length of pleonite 6 (telsonic somite) and subequal in length to the peduncle of the uropod; the peduncle has 6 short medial spine-like setae and the endopod has 6 medial and 3 terminal spine-like setae. The endopod is subequal in length to the exopod and distinctly shorter than the peduncle (Fig. 54B).

***Cyclaspis* sp. nov. 2**  
(Fig. 54C-E)

**MATERIAL EXAMINED.** QMW20519, ovig. ♀, S.L. 2.7mm, in 70% ethanol, off Coochiemudlo Island, site 34, 27°32'S, 153°20'E, D. Tafe, 17 June 1990, 4m, sand, 35 p.p.t. salinity, 18°C water temperature. QMW20520, subadult ♀, S.L. 2.6mm, same data as above; uncommon.

**REMARKS.** Further specimens are required to describe this species. *Cyclaspis* sp. nov. 2 resembles *C. gibba* Hale (1944a:75, figs 4-5) from Jibbon, NSW. Both species are of similar length (2.6-3.0mm), both have a smooth finely reticulate, ovoid shaped carapace with delicate median dorsal ridge, large antennal notch and subacute antennal tooth. However, adult and subadult ♀♀ of *C. gibba* have more prominent ocular lobes in lateral view than *C. sp. nov. 2*. Setation of the uropods is similar in both species but the exopods are longer, relative to the endopods, in *C. sp. nov. 2* (Fig. 35E).

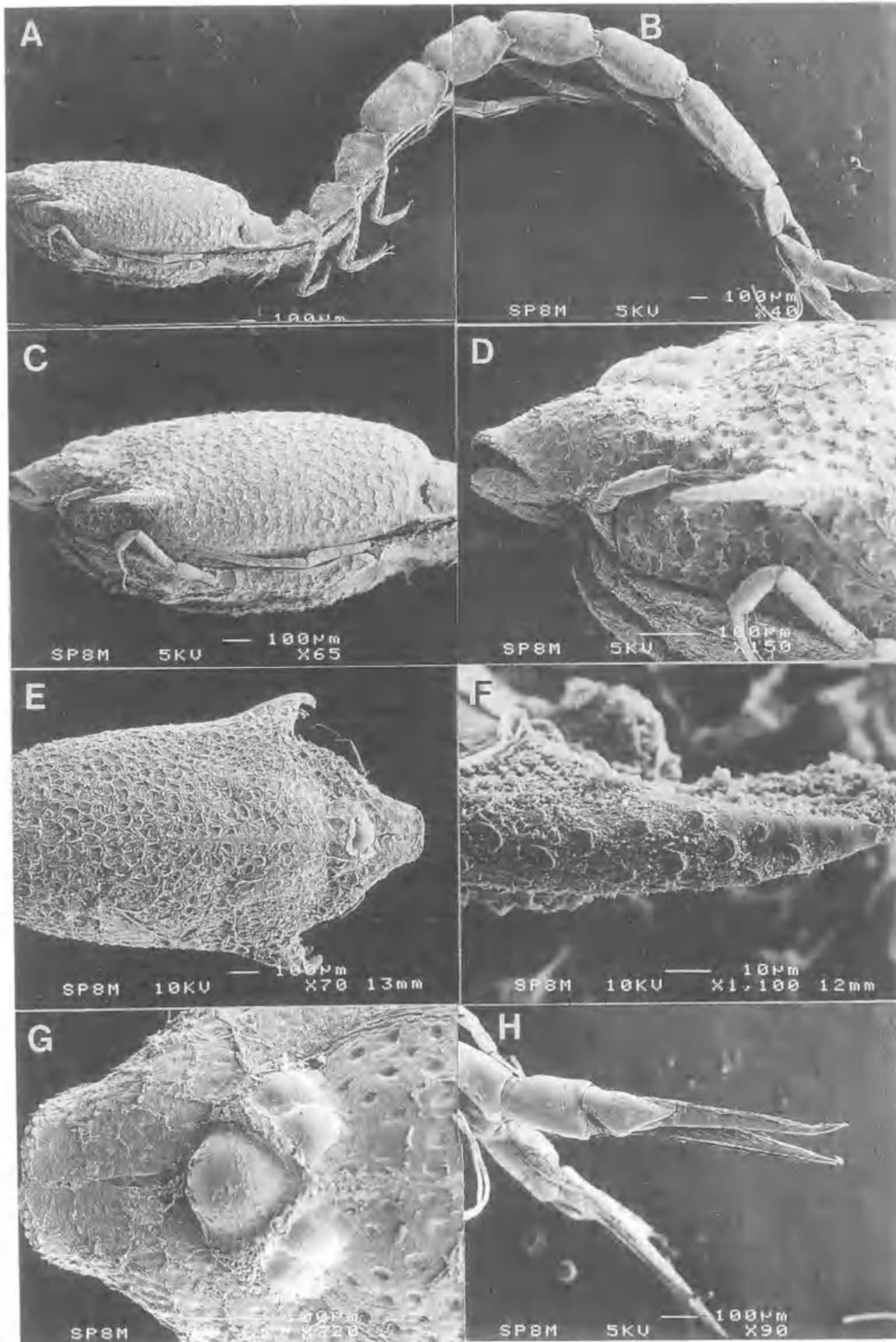
***Eocuma* Marcusen, 1894**

*Cyclaspis* Kossman, 1880:88.

*Eocuma* Marcusen, 1894:170, Day, 1978a:168.

**DIAGNOSIS.** Cuticle strongly calcified and brittle, carapace with lateral horns, at least in ♀. First pereonite and sometimes second firmly united with carapace. Basis of first pereopod prolonged distomedially. Second pereopod with basis and ischium fused. Uropods with peduncle much shorter than rami; inner ramus 1-segmented. Genus includes 23 species worldwide, most of which inhabit warm, shallow (5-50m) waters. Only *E. agrion* has been recorded from Australian waters.

FIG. 55. *Eocuma agrion* Zimmer ♂. A,B, whole mount LV, shows relative lengths of carapace and somites. C, carapace LV, shows curved dorsal profile of carapace. D, anterior carapace LV, shows unusual pseudorostral region. E, carapace DV, shows reticulate pattern of shallow pits and well developed lateral horns. F, lateral horn on carapace LV, shows scale-like surface texture of horn. G, anterior carapace DV, shows wide ocular lobe and pseudorostral projection. H, uropod LV, shows very short peduncle relative to rami.



***Eocuma agrion* Zimmer, 1914**  
(Figs 55, 56A-C)

*Eocuma agrion* Zimmer, 1914:176, figs 1-2. Hale, 1944b:229, figs 3-4. Hale, 1949a:109. Stephenson et al., 1978:208.

**MATERIAL EXAMINED.** QMW20526, adult ♂, S.L. 6.1mm, SEM mount, Horseshoe Bay, site 31, 27° 30'S, 153° 21'E, D. Tafe, 11 Oct 1990, 4m, sand, 35.5 ppt salinity, 24.5°C water temperature. QMW20527, adult ♂, S.L. 6.3mm, in 70% ethanol, same data as above. QMW20528, subadult ♀, S.L. 5.9mm, SEM mount, same data as above. QMW20529, subadult ♀, S.L. 5.7mm, in 70% ethanol, same data as above.

**DISTRIBUTION.** Known from Central East Coast, Lower East Coast and Lower West Coast (Fig. 4). QLD: Moreton Bay (Hale, 1949a); sites 15, 26, 28, 31, and 33, Moreton Bay (herein). NSW: Cronulla (Hale, 1944b). WA: Fremantle, Herald Bight and Broadhurst Bight in Shark Bay, Onslow, Dampier Archipelago, Garden Island (Hale, 1944b, 1949a). Common in Moreton Bay. ♂♂ are taken far more commonly in light-trap samples than ♀♀.

**REMARKS.** Moreton Bay specimens match *E. agrion* in the very long and flexible pleon (Fig. 55A,B). Living specimens are yellowish with a reticulate pattern of pitting on the carapace (Fig. 55C,D,E). The ocular lobe is much wider than long, with 1 large anterior lens and 4 smaller posterior lenses (Figs 55G, 56A). The carapace has large lateral horns in both sexes (Figs 55F, 56A,C). The uropods are held wide apart and the rami of each are also spread (Figs 55, 56B).

Subfamily VAUNTHOMPSONIINAE Sars,  
1878

**DIAGNOSIS.** Exopods on at least first 3 pairs of pereopods. Always 5 pereonites exposed and endopod of uropod 2-segmented. Second antenna of ♀ often 3-segmented and in most genera third segment is distinct.

***Gephyrocuma* Hale, 1936**

*Gephyrocuma* Hale, 1936b:412. Hale, 1944b:247.

**DIAGNOSIS.** Ocular lobe wide and not distinctly separated from frontal lobe, lenses very large. Antennal notch so widely open that no distinct incision or antennal angle is evident. Pleon reduced, at most 2/3 as long as carapace in ♂, shorter in ♀. First antenna strongly geniculate, with segments of peduncle globose. Basis of third maxillipeds without external apical lobe but with very large inner lobe. Basis of pereopod 1 distinctly twisted, with no distal inner lobe. Exopods of pereopods 1 and 2 well-developed, rudimentary on 3 and 4. Uropods with short peduncle and with endopod 2-segmented, the first segment much longer than the second.

**REMARKS.** Four species are known from Australia: *G. pala* from Gulf St. Vincent, SA; *G. repandum* from Cronulla, NSW and Carcening Bay, WA; *G. simile* from Shark Bay, WA; and *G. sp. nov.* 1 from Moreton Bay.

**KEY TO THE AUSTRALIAN SPECIES OF  
*GEPHYROCUMA***  
(Adapted from Hale, 1944b)

1. Exopod of third pereopod 1-segmented . . . . . 2  
Exopod of third pereopod 2-segmented . . . . . 3
2. Second endopod segment of uropod with six inner spine-like setae in ♂, none in ♀  
. . . . . *repandum* Hale  
Second endopod segment of uropod with one inner spine-like seta in ♂ and ♀ . . . . . *sp. nov.* 1
3. Pleon at most barely longer than pereonites together. First segment of endopod of uropod less than twice as long as second . . . . . *pala* Hale  
Pleon at least half as long again as pereonites together. First segment of endopod of uropod at least 4 times as long as second . . . . . *simile* Hale

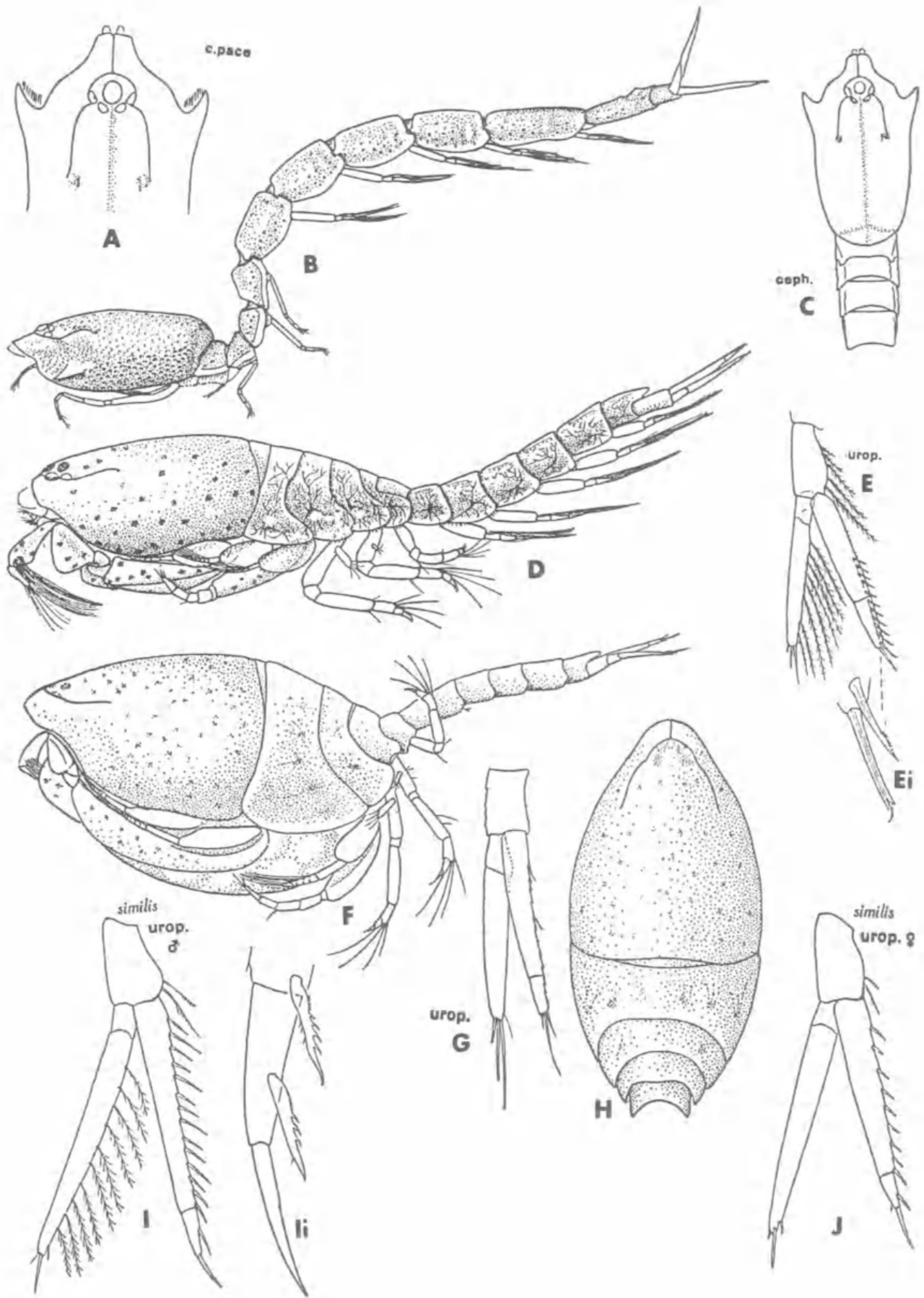
***Gephyrocuma repandum* Hale, 1944**  
(Figs 56D-H, 57H)

*Gephyrocuma repanda* Hale, 1944b:248, figs 15, 16, 17B. Hale, 1949a:110, figs 2, 3.

**MATERIAL EXAMINED.** QMW20530, adult ♂, S.L. 2.3mm, SEM mount, Pumicestone Passage, site 12, 26°49'S, 153°08'E, J. Greenwood, 14 Mar 1991, 2m, sand, 34.2 ppt salinity, 27.0°C water temperature. QMW20531, adult ♂, S.L. 2.2mm, in 70% ethanol, same data as above. QMW20532, adult ♀, S.L. 1.9mm,

FIG. 56. *Eocuma* and *Gephyrocuma* species. A-C, *Eocuma agrion*, ♂. A, anterior portion of carapace, DV. B, LV. C, cephalothorax, DV. D-H, *Gephyrocuma repandum*. D, type ♂, LV. E, paratype ♂ uropod, DV and Ei, terminal spines of endopod. F, ovig. ♀, LV. G, ♀ uropod, DV. H, ovig. ♀ cephalothorax, DV. I-J, *Gephyrocuma similis*. I, type ♂ uropod, DV and Ii, distal segment of endopod. J, type ovig. ♀ uropod, DV. (A-E, Hale, 1944b. F-J, Hale, 1949a).





SEM mount, same data as above. QMW20533, adult ♀, S.L. 2.0mm, in 70% ethanol, same data as above.

**DISTRIBUTION.** Lower and Central East Coast and Lower West Coast (Fig. 4). NSW: Cronulla (Hale, 1944b). Qld: sites 6-9, 10-12 and 31 in Moreton Bay. WA: Garden Island (Hale, 1949a).

**REMARKS.** Moreton Bay specimens match *G. repandum* from Cronulla, NSW; cuticle thin and smooth with blackish chromatophores (Fig. 56D,F); carapace with dorsal margin evenly and slightly convex; ocular lobe much broader than long (Fig. 56D,F,H); pedigerous somites all exposed, together 2/3 as long as carapace (Fig. 56D,F); pleon more than 2/3 as long as cephalothorax (Fig. 57H); exopod of third pereopod 1-segmented (Fig. 56D,F); ♂ uropods stout, peduncle only c. 1/2 as long as exopod, with a row of long plumose setae on inner margin; endopod a little longer than exopod, segment 1 with spinules on inner margin, segment 2 with inner row of 6 stout spine-like setae and 1 terminal spine-like seta; exopod with 8-10 long plumose setae on inner margin and 3 unequal terminal spine-like setae (Fig. 36E); ♀ uropods stout, peduncle shorter than in ♂, with no long inner setae; endopod with denticles but no spine-like setae on inner margin; exopod with 1 inner seta and 3 terminal spine-like setae (Fig. 36G). *G. repandum* was taken in relatively large numbers throughout the year at sites 10, 11 and 12, in combination with *G. barbarae*. It is the most abundant cumacean recorded at site 12 in Pumicestone Passage.

***Gephyrocuma* sp. nov. 1**  
(Figs 57A-G, 70H)

**MATERIAL EXAMINED.** QMW20534, adult ♂, S.L. 1.8mm, SEM mount, Pumicestone Passage, site 12, 26°49'S, 153°08'E, J. Greenwood, 4 May 1990, 2m, coarse sand, 33.3 ppt salinity, 23.5°C water temperature. QMW20535, adult ♀, S.L. 1.5mm, data same as above.

**REMARKS.** Further specimens are required to describe the species. *Gephyrocuma* sp. nov. 1 resembles *G. repandum* Hale and *G. similis* but

differs in shape of pereopod 1, maxillipeds 3 and setation of the uropods (Fig. 57A-D,G). The merus and carpus of maxilliped 3 much more robust than in *G. repandum* and the uropods are devoid of plumose setae (Fig. 57E,G). The endopod and exopod are more robust than in *G. repandum* (Fig. 56E,G) and *G. similis* (Fig. 56I,J), the endopod of both ♂ and ♀ have 5-6 short inner spine-like setae on the first segment, 1 on the second and 1 terminal; exopod with no inner spine-like setae and 3 unequal terminal spine-like setae (Fig. 57D,G). The carapace is covered with a reticulate pattern of crescent shaped scales, between which are scattered pits with short sensory filaments (Figs 57F, 70H).

***Glyphocuma* Hale, 1944**

*Glyphocuma* Hale, 1944b:268.

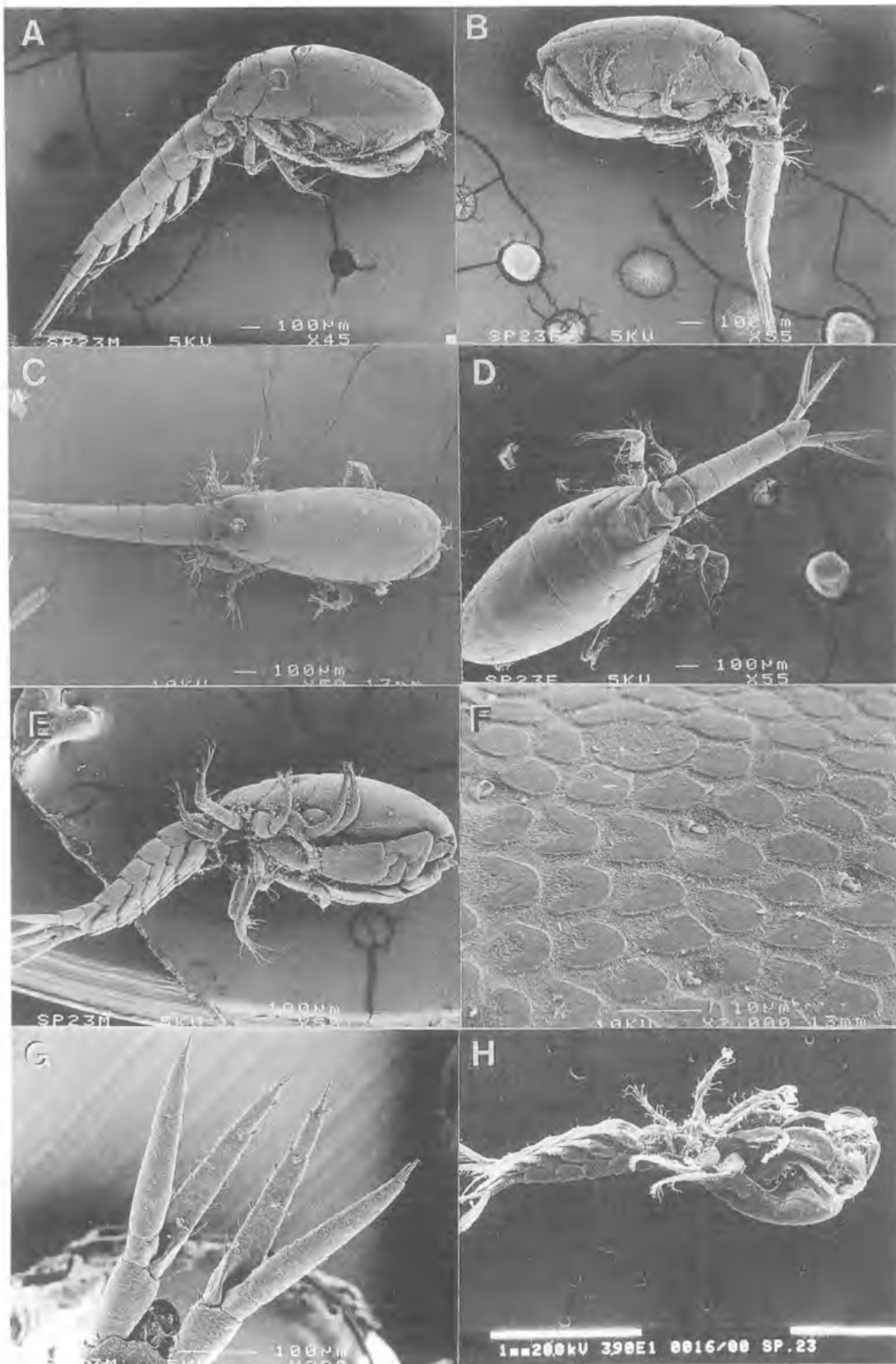
**GENOTYPE.** *Sympodomma bakeri* Hale, 1936a:397.

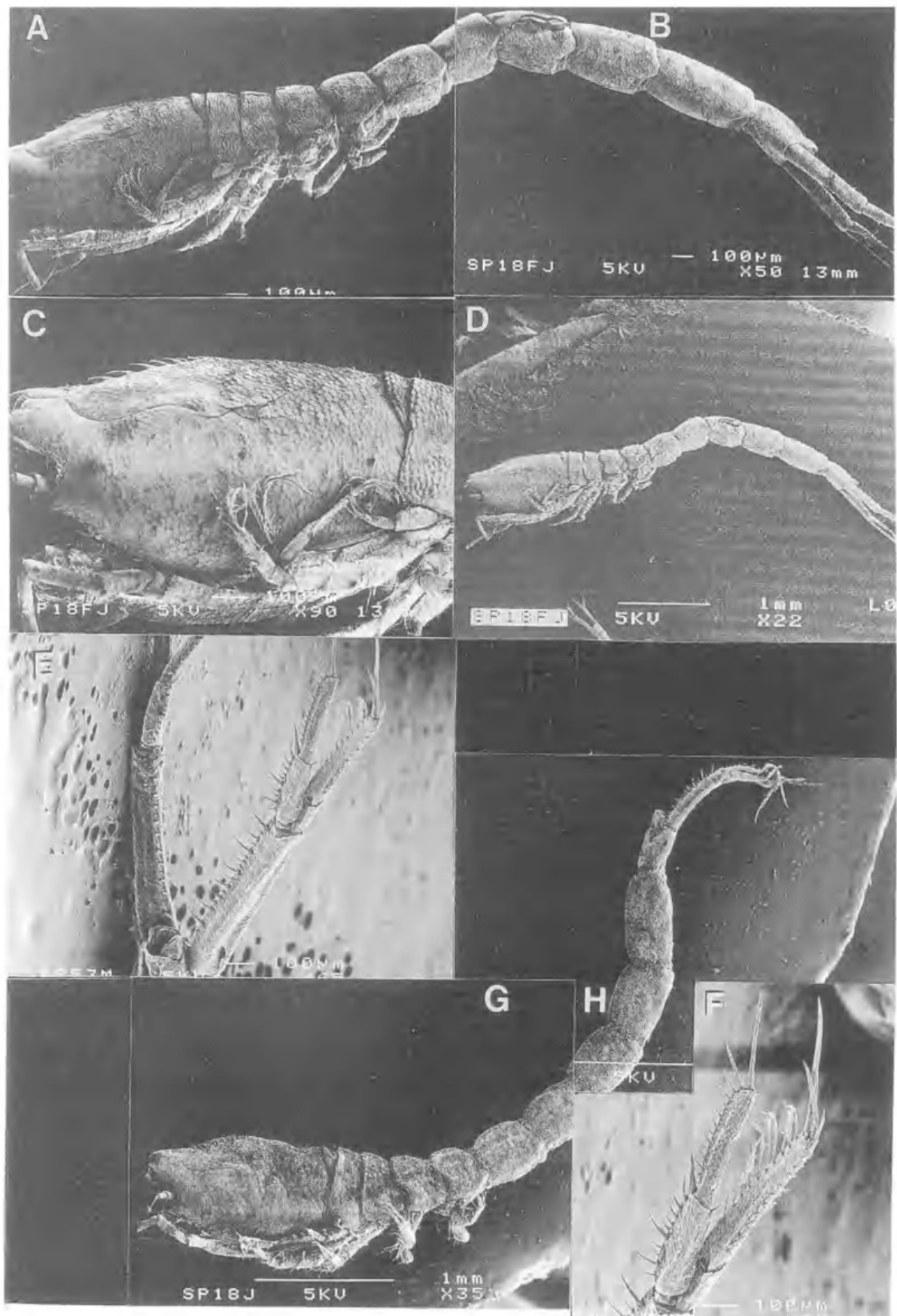
**DIAGNOSIS.** Pseudorostral lobes not extending in front of ocular lobe, which is narrow. Basis of maxilliped 3 with large external laterodistal lobe, dentate on medial edge and reaching distal end of merus. ♂ with exopods on pereopods 1-4, those of fourth pair sometimes small. Female with exopods on pereopods 1-3 only. First antenna with accessory flagellum 2-segmented. Second antenna of ♀ 3-segmented, with conical distal segment distinct. Mandibles elongate, with long row of spine-like setae (up to 20). Telsonic somite produced posteriorly, its apex rounded and slightly excavate.

**REMARKS.** This genus is close to *Sympodomma* but differs in having an exopod on the fourth pereopod of the ♂, and in having the merus of maxilliped 3 less expanded externally. It resembles *Heterocuma* but in that genus the crest of the carapace is not incised in the ♀. Maxilliped 3 of *Glyphocuma* has the carpus widened as in *Cyclaspis*, the terminal segment of the second antenna of the ♀ is tiny, the telsonic somite is very different, and the segments of the flagellum of the ♂ second antenna are extremely short.

*Glyphocuma* contains 5 species, all of which

FIG. 57. A-G, *Gephyrocuma* sp. nov. 1. A, ♂, LV shows relative lengths of carapace and somites. B, ♂, LV shows relative lengths of carapace and somites. C, ♂, DV shows maximum width in anterior region of carapace, tapers posteriorly. D, ♀, DV, shows maximum width in posterior region of carapace. E, ♂, VLV shows robust third maxillipeds. F, ♂, DV, detail of integument of carapace showing crescent shaped scales and minute filaments. G, ♂ uropod, DV, shows robust, sparsely spinuled rami. H, *Gephyrocuma repandum* Hale ♂ VLV shows numerous setae on pereopods and rami of uropods.







are Australian and two of which (*G. halei*, *G. serventyi*) have been previously recorded from Queensland.

**SEXUAL DIMORPHISM.** The ovigerous ♀ and immature ♂ have crest of the carapace finely or coarsely serrate, or incised with resultant angular projections, or strongly ridged. Adult ♂s have the armature of the dorsum obliterated and the antennal notch widely open. They also have the anterolateral portion of pereonite 4 developed as a lobe which may overlap pereonite 3.

#### KEY TO AUSTRALIAN FEMALES OF *GLYPHOCUMA*

(Adapted from Hale, 1944b)

1. Anterior half of crest of carapace cut into 6 or more small teeth . . . . . 2  
Anterior half of crest of carapace smooth or with 1 or 2 incisions, but no teeth . . . . . 3
2. Carapace twice as long as deep, with dorsal teeth inconspicuous; antennal notch narrow; ocular lobe projecting well beyond pseudorostral lobes and with corneal lenses not confined to anterior portion . . . . . *bakeri* (Hale)  
Carapace less than twice as long as deep, with dorsal teeth large; antennal notch wide; ocular lobe not projecting beyond pseudorostral lobes and with small corneal lenses restricted to anterior portion . . . . . *dentatum* Hale
3. Anterior half of crest of carapace smooth. Exopod of uropod with at least 10 plumose setae on inner margin . . . . . *halei* Greenwood & Johnston  
Anterior half of crest of carapace with 1 or 2 incisions. Exopod of uropod with at most 6 plumose on inner margin . . . . . 4
4. Carapace slender, with 2 dorsomedial incisions, the second with 2 or 3 denticles; ocular lobe narrow, more than twice as long as wide, apically rounded in dorsal view . . . . . *inaequale* Hale  
Carapace robust, with 1 dorsomedial incision and 2 or 3 denticles; ocular lobe as wide as long, apically angular in dorsal view . . . . . *serventyi* Hale

#### KEY TO AUSTRALIAN MALES OF *GLYPHOCUMA*

(Adapted from Hale, 1944b)

1. Body slender, the carapace more than twice as long as deep . . . . . 2

Body robust, the carapace less than twice as long as deep . . . . . 4

2. Exopod of uropod without spine-like setae on lateral margin. Exopod of fourth pereopod with flagellum 2-segmented . . . . . *bakeri* Hale  
Exopod of uropod with spine-like setae on lateral margin. Exopod of fourth pereopod with flagellum 4- or 5-segmented . . . . . 3
3. Dorsal edge of carapace smooth; exopod of fourth pereopod with flagellum 4-segmented . . . . . *halei* Greenwood & Johnston  
Dorsal edge of carapace sinuate; exopod of fourth pereopod with flagellum 5-segmented . . . . . *inaequale* Hale
4. Ocular lobe narrow, more than twice as long as wide, with corneal lenses confined to anterior end which is rounded . . . . . *dentatum* Hale  
Ocular lobe as wide as long, with corneal lenses reaching to posterior end which is angular . . . . . *serventyi* Hale

#### *Glyphocuma dentatum* Hale, 1944 (Figs 58A-D, 59A-G)

*Glyphocuma dentatum* Hale, 1944b:273, Figs 33, 34.

**MATERIAL EXAMINED.** QMW20536, subadult ♀, S.L. 4mm, SEM mount, Horseshoe Bay, site 31, 27° 30'S, 153° 21'E, D. Tafe, 7 April 1991, sand, 3m, 33.2 ppt salinity, 24.8°C water temperature; QMW20537, subadult ♂, S.L. 5.5mm, in 70% ethanol, data same as above.

**DISTRIBUTION.** Lower and Central East Coast (Fig. 4). NSW: Port Hacking, Ulladulla, Eden, 46-100m; on mud (Hale, 1944b). Qld: sites 28, 31 and 36 in Moreton Bay.

**REMARKS.** Moreton Bay specimens match *G. dentatum* from Port Hacking, NSW. The degree of dentation of the dorsal edge of the carapace was found to be variable (Figs 58A-D, 59A-G). Common in parts of Moreton Bay.

#### *Glyphocuma halei* Greenwood & Johnston, 1967 (Figs 58E-F, 60)

*Glyphocuma halei* Greenwood & Johnston, 1967:93, figs 1-2.

**MATERIAL EXAMINED. PARATYPES**

FIG. 58. A-D, *Glyphocuma dentatum* ♀. A, B, LV, shows relative lengths of carapace and somites. C, carapace LV, shows 7 slender teeth on dorsal margin. D, whole mount LV, shows anterior end of carapace. E-H, *Glyphocuma halei* ♀. E, uropods DLV, shows relative lengths of peduncle and rami. F, uropod rami DLV, shows spination of rami. G, H, subadult LV, shows smooth dorsum of carapace and relative lengths of segments.

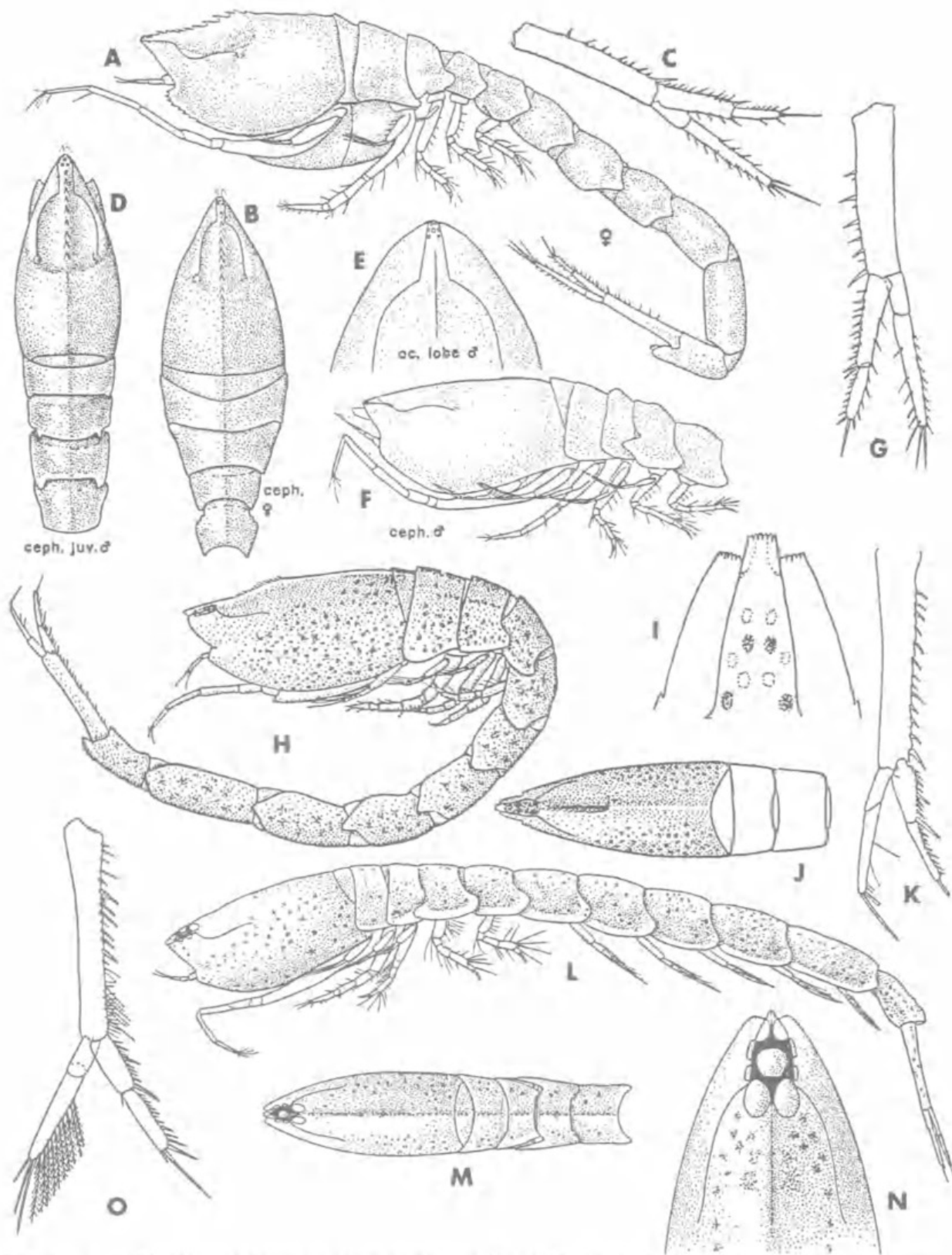


FIG. 59. A-G, *Glyphocuma dentatum*. A, holotype ovig. ♀, LV. B, ♀ cephalothorax, DV. C, paratype ♀ uropod. D, juvenile ♂ cephalothorax, DV. E, allotype ♂ ocular lobe, DV. F, allotype ♂ cephalothorax, LV. G, subadult ♂ uropod. H-O, *Glyphocuma bakeri*. H-K, type ♀. H, LV. I, ocular lobe, DV. J, cephalothorax, DV. K, uropod. L-O, ♂. L, LV. M, cephalothorax, DV. N, ocular lobe, DV. O, uropod. (A-G and L-O, Hale, 1944b. H-K, Hale, 1936a).

QMW20538, adult ♀, allotype, S.L. 10mm, in 70% ethanol, Horseshoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 7 April 1991, sand, 3m, 33.2 ppt salinity, 24.8°C water temperature; QMW20539, subadult ♀, S.L. 5.6mm, SEM mount, off Macleay Island, site 36, 27°36'S, 153°22'E, D. Tafe, 8 Nov. 1989, sand/silt, 2m, 33.2 ppt salinity, 26.8°C water temperature; QMW20540, adult ♂, S.L. 11mm, in 70% ethanol, off Coochiemudlo Island, site 34, 27°32'S, 153°20'E, D. Tafe, 17 June 1990, sand, 5m, 34.8 ppt salinity, 18.8°C water temperature; QMW20541, subadult ♂, S.L. 8.5mm, in 70% ethanol, data same as above.

**DESCRIPTION. FEMALE.** Integument calcified with fine granular texture (Fig. 58G,H). Carapace length 0.25 S.L. with strong median dorsal ridge, the anterior 1/2 of which bears fine crenulations though the dorsal profile is smooth and slightly arched, sides devoid of ridges or sculpture, as in ♂; depth 0.57 times length in lateral view; antennal notch widely open; ocular lobe and pseudorostral lobes as in ♂ (Figs 58G,H, 60F). Pereion 0.86 times as long as carapace. Pereionite 1 visible only above lateral midline; pereionites without lateral ridges, posterolateral margin of pereionite 5 produced as lobe which overlaps pleonite 1, as in ♂ (Fig. 58G,H). Pleon robust, all 5 pleonites without lateral ridges or lateral articulation notches; first 4 pleonites and telsonic somite subequal in length, fifth pleonite 1.35 times as long as fourth (Fig. 58G,H). Telsonic somite projecting posteriorly over bases of uropods (Figs 58H, 60G). First antenna 3-segmented with terminal segmented flagellum; first segment geniculate, as in ♂. Pereiopods as in ♂. Peduncle of uropod 1.2 times as long as telsonic somite, with 14-16 naked spine-like setae along length of inner margin; endopod 0.75 times as long as peduncle and 0.9 times as long as exopod, with 9-11 spine-like setae on inner margin and 1 spine-like seta on

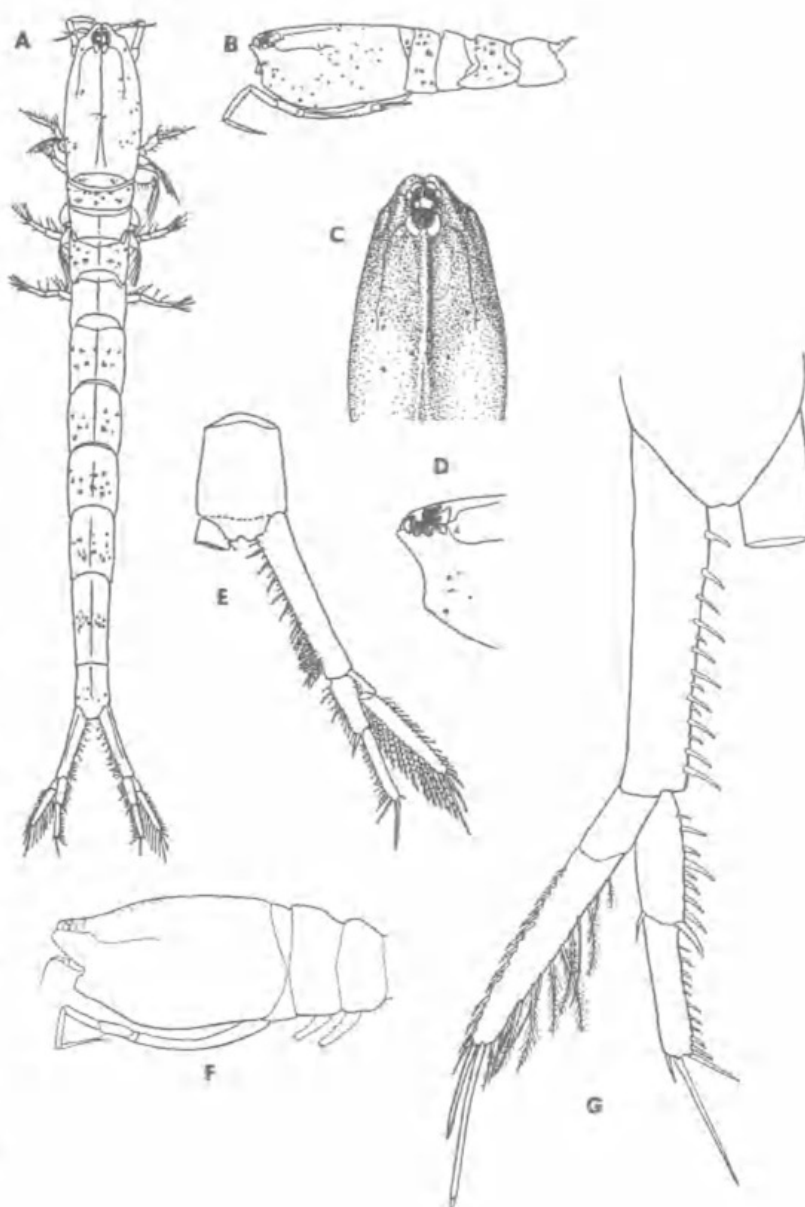


FIG. 60. *Glyphocuma halei*. A-E, ♂. A, DV. B, cephalothorax, LV. C, carapace, DV. D, anterior of carapace, LV. E, uropod and telsonic somite, DV. (All after Greenwood & Johnston, 1967). F-G, ♀. F, cephalothorax, LV. G, uropod, DV.

outer margin of proximal segment, 10-11 spine-like setae on inner margin of distal segment and 3 terminal spine-like setae, the longest of which is as long as the segment; distal segment slightly longer than proximal segment as in ♂; exopod with 11-13 plumose setae on inner margin, 12-14 spine-like setae on outer margin and 3 terminal spine-like setae, the longest of which is at least 1/2 as long as exopod; terminal spine-like setae

of endopod and exopod bear tiny mucrones at apex (Figs 58E,F, 60G).

**Colour.** Cream with scattered brown chromatophores on carapace and abdomen.

S.L. Adult ♂ 9-11mm. Adult ♀ 10mm.

**HABITAT AND DISTRIBUTION.** Most common over medium and coarse sand in 1-4m of water; from Central East Coast (Fig. 4). Qld: Waterloo Bay in Moreton Bay (Greenwood & Johnston, 1967); sites 12, 31, 34 and 36 in Moreton Bay.

**REMARKS.** ♂ specimens matched *G. halei* from the same region. ♀♀ have not previously been found. The adult ♀ from Moreton Bay resembles ♀s of *G. dentatum* from Port Hacking, NSW, but differs in the structure and setation of the uropods (Figs 58E,F, 59C, 60G). In ♂♂ and the adult ♀ of *G. halei* the distal endopod segment of the uropod is longer than the proximal segment (Fig. 60E,G), whereas in *G. dentatum* it is shorter (Fig. 59C,G).

*G. halei* also resembles *G. bakeri*, however, both sexes of *G. halei* bear at least 12 outer spine-like setae on the exopod of the uropod. The same segment in *G. bakeri* has no outer spine-like setae (Fig. 59K,O). Also, as noted by Greenwood & Johnston (1967:98), the rami of the uropod are relatively longer in *G. halei*, and the exopod of the fourth pereopod has 4 segments in *G. halei*, 2 in *G. bakeri*. The general body shape of *G. halei* is very similar to *G. bakeri* in lateral view (Fig. 59H,L), but the carapace is not as slender in dorsal view (Fig. 59I,J,M,N).

The uropods of the *G. halei* ♀ carry terminal spine-like setae on the endopod and exopod, each of which bear distinct terminal spinules (Fig. 60G). Spinules are not present on the terminal spine-like setae of ♀ uropods of *G. dentatum* or *G. bakeri* (Fig. 37C,K).

#### *Leptocuma* Sars, 1873

*Leptocuma* Sars, 1873:24. Hale, 1936b: 409. Hale, 1944b:251.

**DIAGNOSIS.** Pseudorostral lobes extend in front of ocular lobe, not meeting; mandible robust,

with at least 9 spine-like setae; basis of the maxilliped 3 not produced distally; pereopod 2 with brush of distal setae on the propodus and dactylus, but no spine-like setae; antenna 1 with accessory flagellum 1-segmented; telsonic somite produced posteriorly with apex angular; maxilliped 3 with ischium short and merus not as long as carpus; ocular lobe wide, moderate or large in size; second antenna of ♂ with segments of flagellum elongate; pereonite 3 of ♀ produced forward on each side to form lobe overlapping pereonite 2; anterolateral parts of pereonite 4 of ♂ similarly expanded to override pereonite 3.

**REMARKS.** The genotype, *L. kinbergii*, was described from the ♀, taken in the South Atlantic off South America. Only two other species have since been recorded from the Americas, *L. forsmanni* Zimmer, 1943 and *L. patagonicum* Roccatagliata, 1993. Hale (1944b) described 2 Australian species, *L. pulleini* (QLD, NSW, SA) and *L. sheardi* (SA); ♂♂ of these 2 species have 5 pairs of pleopods and the exopod of pereopod 4 is rudimentary, as in the ♀. Hale described *L. intermedium* (NSW), *L. nichollsi* (WA), *L. obustum* (NSW), *L. serriferum* (NSW, WA) and *L. vicarium* (NSW) from Australia. The American species were keyed out by Roccatagliata (1993). The Australian species fall into two well defined groups.

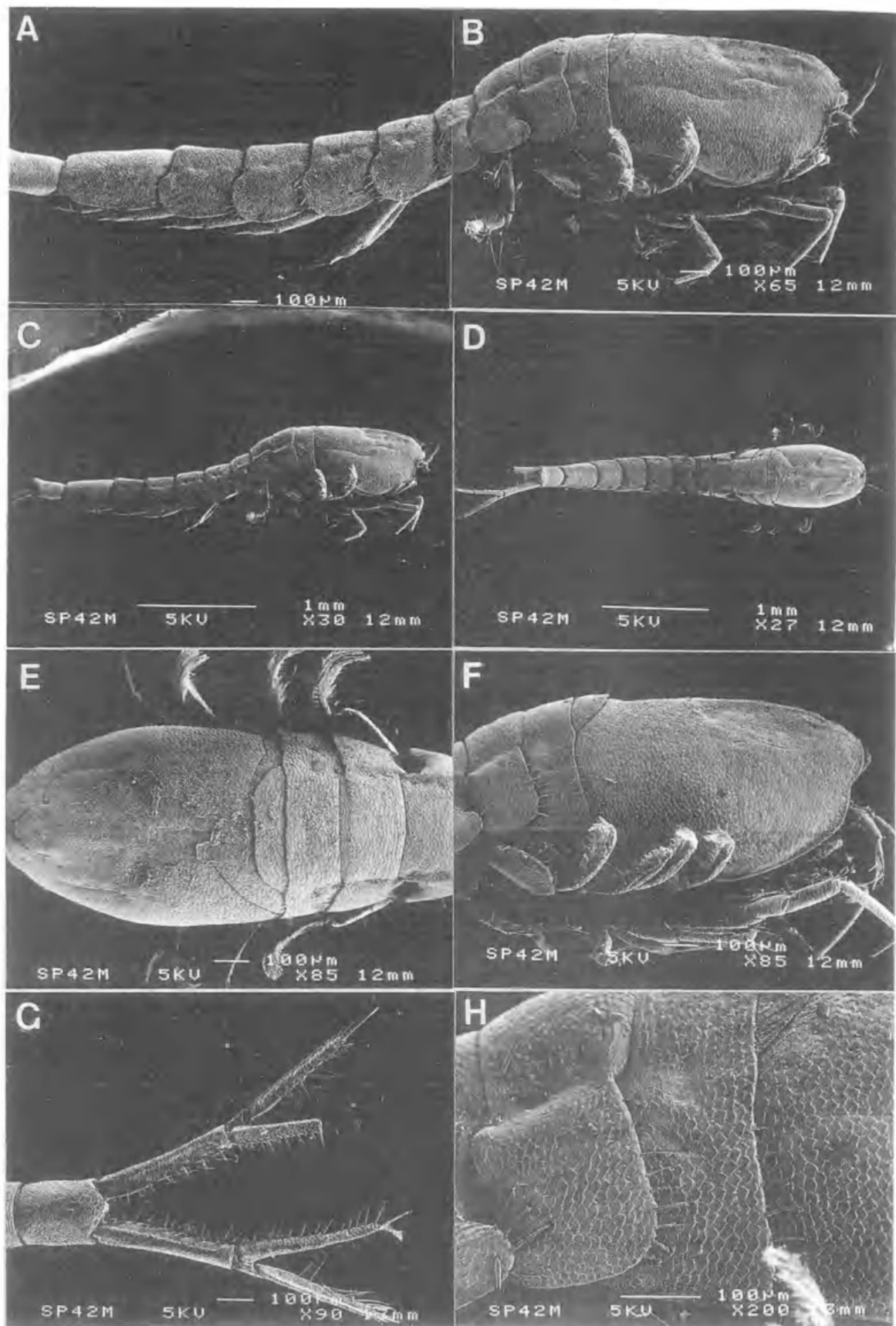
#### KEY TO AUSTRALIAN SPECIES OF *LEPTOCUMA*

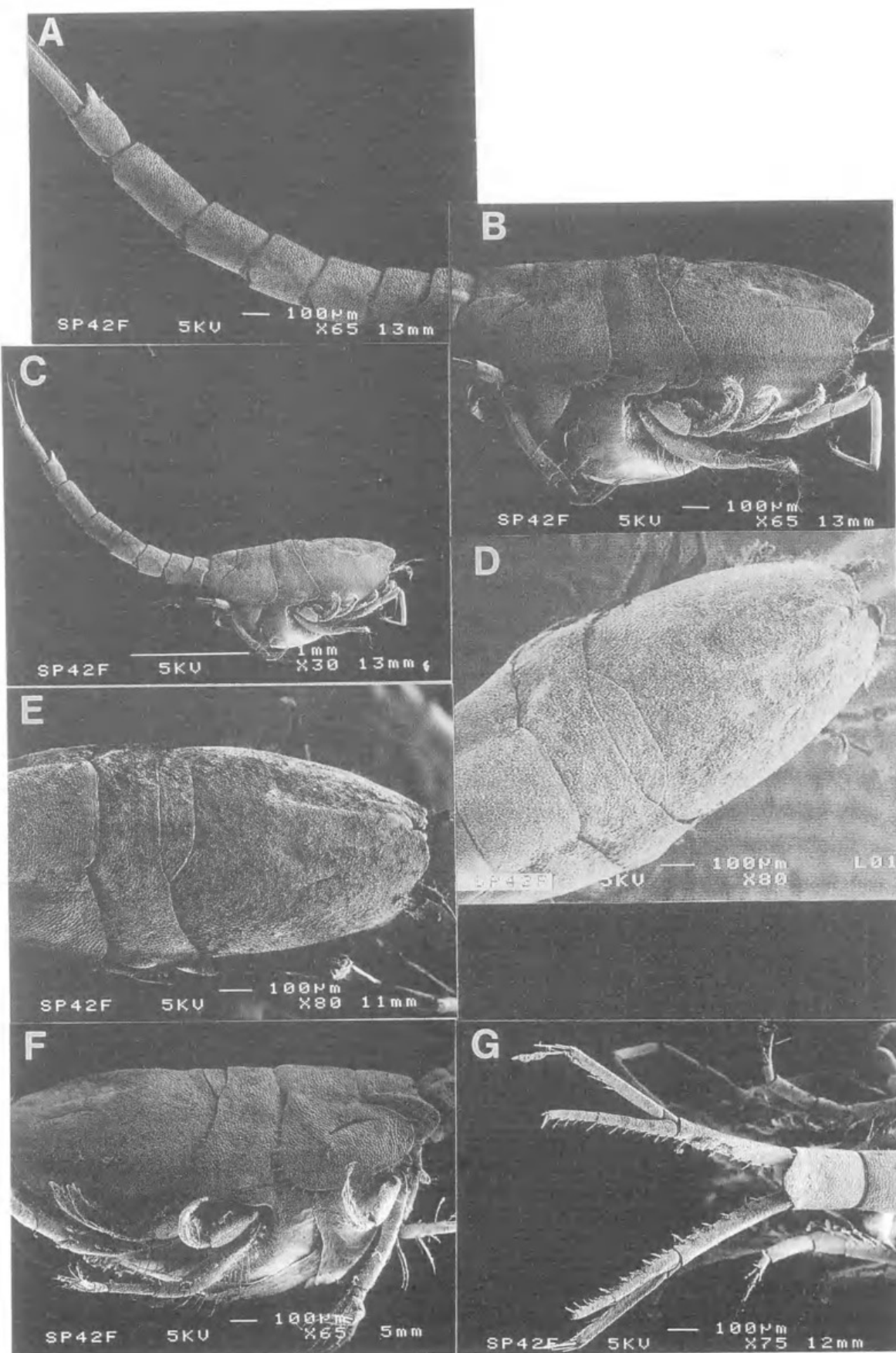
(Adapted from Hale, 1944b)

1. First pereopod with a prominent simple spine-like seta on distomedial margin of basis, preceded by several shorter spine-like setae, and with a well-developed brush of setae at distal end of propodus. Setae of pereopods 3-5 very numerous. Uropod with first segment of endopod shorter, or barely longer, than second. Over 13mm in length . . . . . 2
- Pereopod 1 with a serrate spine-like seta on distomedial margin of basis, preceded by 1 longer spine-like seta, also serrate; with sparse setae at distal end of propodus. Setae of pereopods 3-5 not very numerous. Uropod with first segment of endopod much longer than second. Less than 8mm in length . . . . . 3

FIG. 61. *Leptocuma barbatiae* sp. nov. ♂. A,B, whole mount LV, shows relative lengths of carapace and somites. C, whole mount LV, shows relative lengths of telsonic somite and pleonite 5. D, whole mount DV, shows width tapering from carapace to telsonic somite. E, carapace and pereonites 1-3 DV, shows maximum width in mid-region of carapace. F, carapace and pereonites 1-3 LV, shows relative length and depth of carapace. G, uropods DV, shows relative lengths of peduncle and rami. H, Pereonites 2-3 LV, shows slender spines on anterolateral margins of pereonites 2-3.







2. Second pereopod with carpus 2/3 as long again as merus ..... *pulleini* Hale  
Second pereopod with carpus subequal in length to merus ..... *vicarium* Hale
3. Carapace with strong median dorsal ridge extending from ocular lobe almost to first pedigerous somite ..... 4  
Carapace with at most scarcely distinguishable median dorsal ridge ..... 5
4. Anterolateral margins of pereionites 2 and 3 with a row of spine-like setae. Pereopod 1 has 2 conspicuous serrate spine-like setae on distomedial margin ..... *kennedyi* sp. nov.  
Anterolateral margins of pereionites 2 and 3 without spine-like setae. First pereopod has 4 conspicuous serrate spine-like setae on distomedial margin ..... *nicholli* Hale
5. Dorsal margins of pereionites undulating in lateral view. One of the terminal spine-like setae of endopod of uropod geniculate (♀) or hooked (♂). Pleon with obvious lateral and dorsal carinae ..... *obstipum* Hale  
Dorsal margins of pereionites smooth. Terminal spine-like setae of endopod of uropod straight or barely curved. Pleon smooth or with scarcely distinguishable traces of carinae ..... 6
6. Size under 5mm. Uropod with second segment of endopod much more than half length of first ..... 7  
Size about 7mm. Uropod with second segment of endopod about half length of first ..... 8
7. Anterolateral margins of second and third pedigerous segments with row of short spine-like setae ..... *barbarae* sp. nov.  
Anterolateral margins of second and third pedigerous segments without spine-like setae ..... *serriferum* Hale
8. First pereopod with propodus much longer than dactylus. Second pereopod with propodus and dactylus subequal in length ..... *sheardi* Hale  
First pereopod with propodus scarcely longer than dactylus. Second pereopod with dactylus fully 1/3 as long again as propodus ..... *intermedium* Hale

***Leptocuma barbarae* sp. nov.**  
(Figs 61-64)

**MATERIAL EXAMINED.** HOLOTYPE QMW20542, adult ♂, S.L. 3.3mm, PSM #16, Horseshoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 4 Feb.

1993, 3m, sand, 34.2 ppt salinity, 26°C water temperature. PARATYPES QMW20543, ovig. ♀, allotype, S.L. 3.6mm, PSM #17, same data as holotype; QMW20544, adult ♂, S.L. 3.6mm, PSM #43, Tangalooma, site 15, 27°11'S, 153°19'E, D. Greenwood, 14 April 1990, 8m, sand, 35.5 ppt salinity, 24°C water temperature; QMW20545, ovig. ♀, S.L. 3.7mm, PSM #44, same data as above; QMW20546, ovig. ♀, S.L. 3.5mm, PSM #18, same data as holotype; QMW20547, adult ♂, S.L. 3.2mm, SEM mount, Horseshoe Bay, site 31, D. Tafe, 7 April 1991, 2m, sand, 33.2 ppt salinity, 25.5°C water temperature; QMW20548, ovig. ♀, S.L. 3.1mm, SEM mount, same data as above.

**DESCRIPTION. MALE.** Integument lightly calcified, with fine granular texture (Fig. 61A,B). Carapace length 0.26 S.L. and depth 0.6 times length in lateral view with lateral margins evenly rounded; dorsal edge slightly arched; mild median dorsal ridge present on anterior 1/2 of carapace; lateral surfaces devoid of ridges or sculpture; greatest width at middle of length in dorsal view; antennal notch a shallow concavity, no antennal tooth or antennal ridge; pseudorostral lobes wide, extending anteriorly beyond ocular lobe which is wider than long (Fig. 61A-F). Pereon robust, 0.9 times length of carapace; sides of pereonite 1 concealed by pereonite 2, which bears 7-8 slender spine-like setae on anterolateral margin; pereonite 3 overlaps second laterally and also bears 7-8 spine-like setae on anterolateral margin; pereonite 4 overlaps third and fifth laterally, and bears 4-5 spine-like setae on each of overlapping lobes; pereonite 5 overlaps pleonite 1 laterally and bears 4-5 spine-like setae on overlapping lobe; dorsolateral carinae pereonites 3-5 (Fig. 61A-F,H). Pleon and telsonic somite 0.5 S.L. without dorsal or dorsolateral carinae; first 4 pleonites subequal in length, each with posterolateral overlapping lobes bearing 4-5 small spine-like setae; fifth pleonite 1.3 times as long as fourth. Telsonic somite subequal in length to fourth pleonite, with posterodorsal projection which is U-shaped in dorsal view (Fig. 61A-D,G). First antenna as in *L. serriferum* except peduncle has tuft of about 12 fine setae proximally, third segment has group of 7 setae distally, all of which extend beyond first segment of flagellum. Mandible as in *L. ser-*

FIG. 62. *Leptocuma barbarae* sp. nov. ovig. ♀. A,B, whole mount LV, shows relative lengths of carapace and somites. C, whole mount LV, shows relative lengths of telsonic somite and peduncle of uropod. D, carapace and pereionites 1-3 DV, shows maximum width of carapace in posterior region, median dorsal ridge barely visible, granular texture. E, carapace and pereionites 1-3 DLV, shows median dorsal ridge visible on anterior half of carapace. F, carapace and pereionites 1-4 LV, shows lateral lobes of pereionite 3 overlapping pereionites 2 and 4, slender spines on anterolateral margins of pereionites 2-3. G, uropods DV, shows spination relative lengths of peduncle and rami.



FIG. 63. *Leptocuma barbarae* sp. nov. holotype adult ♂: A, pereiopod 1, B, pereiopod 2, C, pereiopod 4.

*riferum* except there are 10-11 (rather than 12) spine-like setae. Third maxilliped as in *L. serriferum* except setae along medial margin of basis are all plumose and of similar length. All pereiopods 7-segmented (Fig. 63). Pereiopod 1 as in *L. serriferum* except dactylus is 0.82 times length of propodus and dactylar spine-like seta is 0.72 times length of dactylus (Fig. 63A). Pereiopod 2 as in *L. serriferum* except setae on

medial margin of basis are plumose, propodus is 0.8 times length of dactylus and has 8 medial setae (Fig. 63B). Pereiopods 3-5 with merus longer than ischium, carpus slightly longer than merus and longer than combined length of propodus and dactylus; propodus twice length of dactylus; dactylar spine-like seta at least 1.5 times length of dactylus; basis with 2 setae distally, 2-3 medially and 2-3 laterally; ischium with 2-3 spine-like setae and 2-3 setae distally; merus with 1-2 spine-like setae distally and 1-2 setae medially; carpus with 2-3 spine-like setae distally and 1-2 setae laterally; propodus with spine-like seta and minute seta distally; dactylus with terminal spine-like seta, terminal seta and subterminal seta. Exopod of pereiopod 3 well-developed with bulbous basis, like those of pereiopods 1 and 2; exopod of pereiopod 4 rudimentary and 1-segmented. Pereiopod 4 as in *L. serriferum* except basis of endopod has 3 medial and 2 lateral setae (Fig. 63C). Peduncle of uropod 1.35 times length of telsonic somite, lined with 18-19 spinose spine-like setae (2 rows) on inner margin; endopod subequal in length to peduncle and to exopod, with 15-16 spinose spine-like setae on inner margin of proximal segment, 5-6 spinose spine-like setae on inner margin of distal segment (increasing in length distally) and 3 terminal spine-like setae, the longest of which is subequal in length to

distal segment, distal segment 0.6 times length of proximal segment; dorsal surface of both endopodal segments bear numerous fine setae; exopod with 9-10 plumose setae and 2 slender spine-like setae along inner margin, outer margin with short subterminal spine-like seta, 3 terminal spine-like setae, the longest of which is 0.5 times length of exopod; terminal and subterminal



spine-like setae of both rami bear minute apical setae; (Figs 61G, 64A).

**OVIGEROUS FEMALE.** Integument lightly calcified, with fine granular texture, as in ♂ (Fig. 62A-E). Carapace length 0.24 S.L. and depth 0.8 times length in lateral view with lateral margins evenly rounded; dorsal edge slightly arched; median dorsal ridge is obsolete on posterior 1/2 and barely visible on anterior 1/2; lateral surfaces devoid of ridges or sculpture; greatest width at posterior of length in dorsal view; antennal notch a shallow concavity, no antennal tooth or antennal ridge; pseudorostral lobes wide, extending anteriorly beyond ocular lobe which is wider than long (Fig. 62A-E). Pereion robust, 1.25 times length of carapace; sides of pereionite 1 concealed by pereionite 2, which bears 7-8 slender spine-like setae on anterolateral margin; pereionite 3 overlaps second and fourth laterally and bears 9-11 spine-like setae on anterolateral margin; pereionite 4 overlaps fifth laterally and fifth overlaps pleonite 1 laterally; dorsolateral carinae pereionites 3-5 (Fig. 62A-F). Pleon and telsonic somite 0.48 S.L. without dorsal or dorsolateral carinae; first 4 pleonites subequal in length, each subcylindrical with V-shaped posterolateral margins; fifth pleonite 1.5 times as long as fourth. Telsonic somite subequal in length to fourth pleonite, with posterodorsal projection which is U-shaped in dorsal view (Fig. 62B,C,G). First

antenna and mandible as in *L. serriferum* except mandible has 10-11 (rather than 12) spine-like setae. Third maxilliped as in *L. serriferum* except setae along medial margin of basis all plumose and of similar length. Pereiopod 1 as in *L. serriferum* except dactylus 0.82 times length of propodus; dactylar spine-like seta 0.58 times length of dactylus. Pereiopod 2 as in *L. serriferum* except propodus with group of 10 (rather than 5)

distal setae. Pereiopods 3-5 as in *L. serriferum* except basis of fourth with 4 medial and 4 lateral setae. Peduncle of uropod 1.3 times length of telsonic somite, lined with 10-12 spine-like setae on inner margin; endopod 1.2 times length of peduncle and subequal in length to exopod, with 11-15 spine-like setae on inner margin of proximal segment, 5-7 spine-like setae on inner margin of distal segment, 3 terminal spine-like

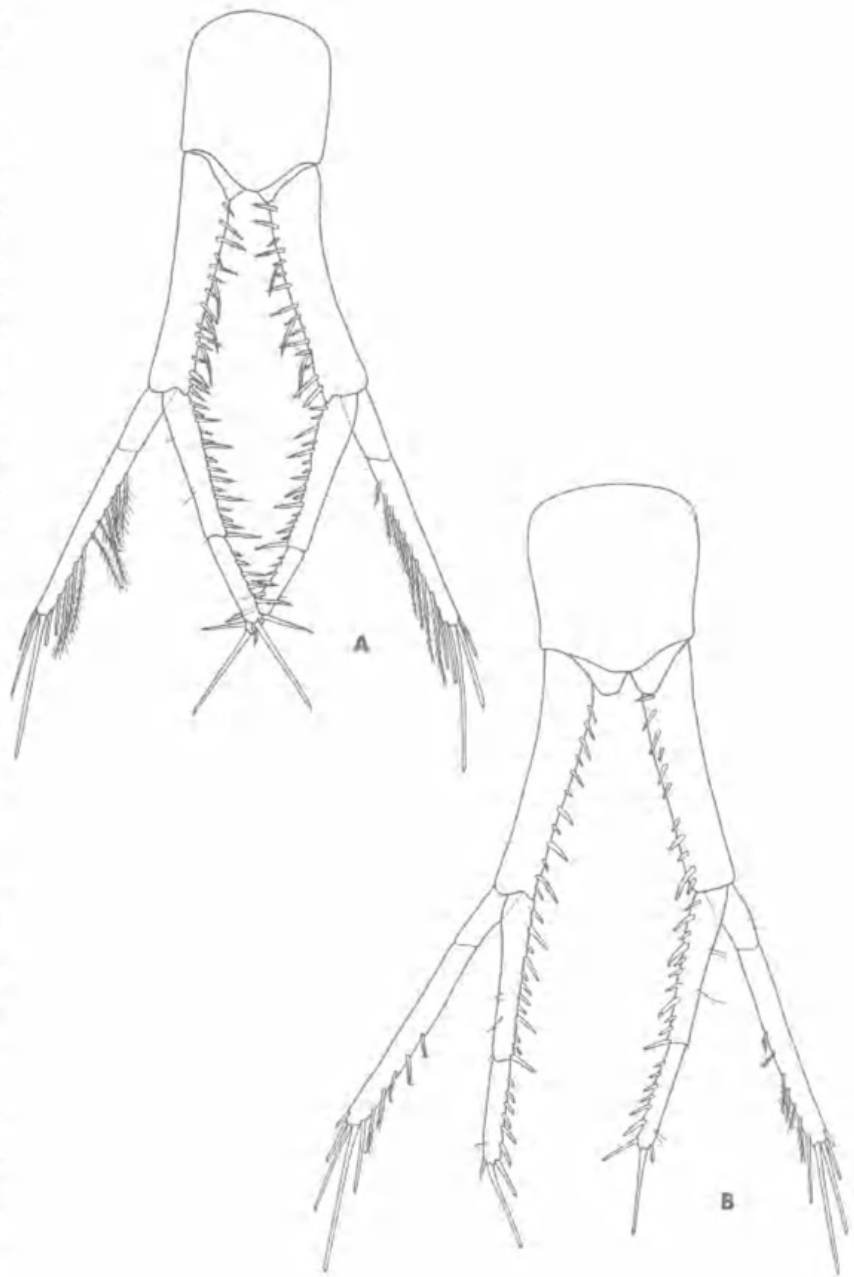
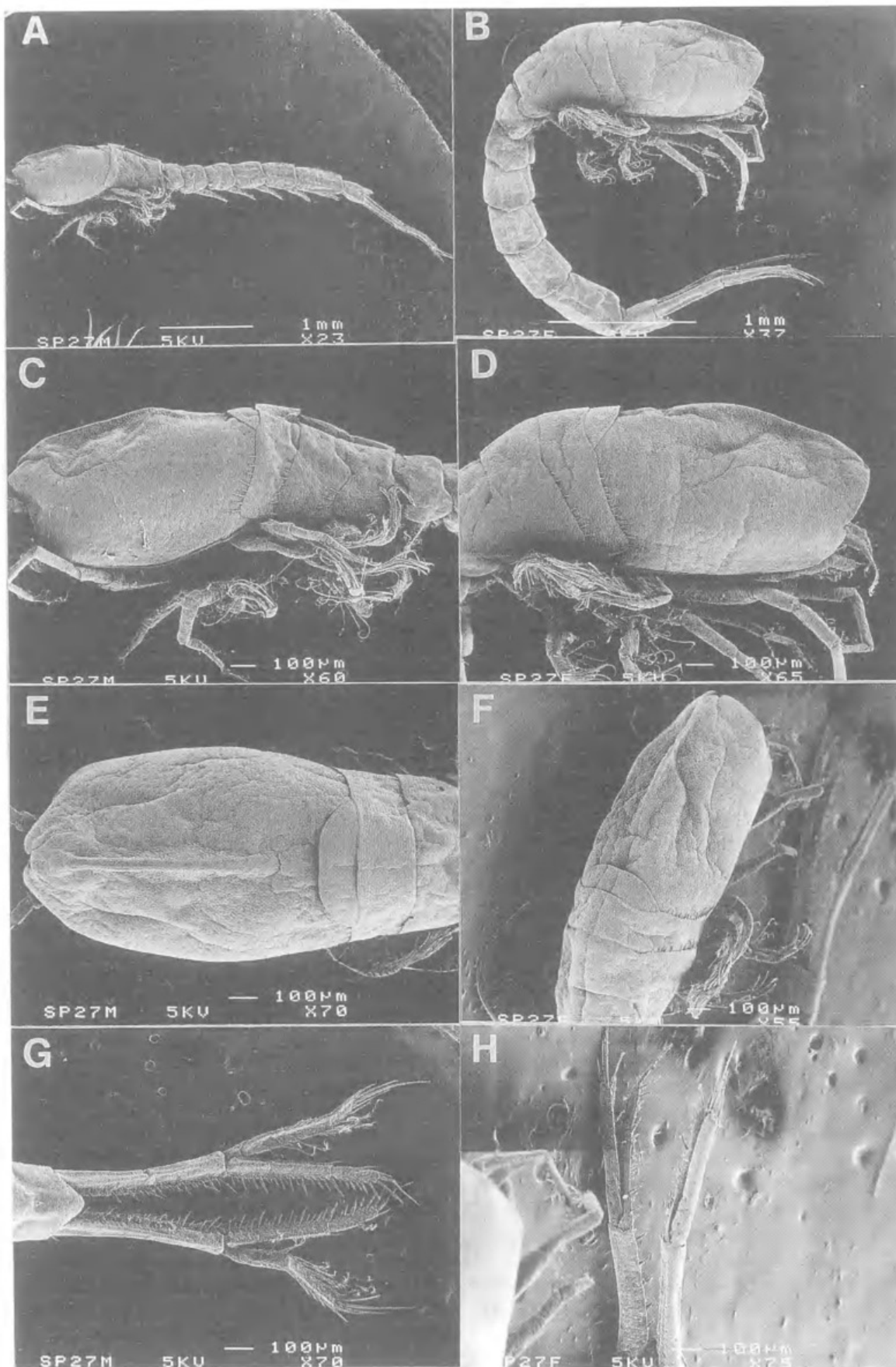


FIG. 64. *Leptocuma barbarae* sp. nov. A, uropods and telsonic somite of holotype ♂, DV. B, uropods and telsonic somite of allotype ovig. ♀, DV.



setae, the longest of which is at least 0.75 times length of distal segment, distal segment at least 0.5 times length of proximal segment; dorsal surface of both endopodal segments bear numerous fine setae; exopod with 5-7 short setae and 2 slender spine-like setae on distal half of inner margin, short subterminal spine-like seta on outer margin, 3 terminal spine-like setae, the longest of which is 0.5 times length of exopod; terminal and subterminal spine-like setae of both rami bear minute apical setae (Fig. 62G, 64B).

**Colour.** Pale yellow with conspicuous blackish chromatophores which may appear as dark bands on carapace.

S.L. Adult ♂ 3.2-3.5mm. Adult ♀ 3.1-3.6mm.

**HABITAT AND DISTRIBUTION.** Most commonly over medium and coarse sand in 1-8m of water; from sites 15, 28, 30, 31, 34, and 35 in Moreton Bay. In late summer *L. barbarae* predominated in the water column at night at site 31.

**REMARKS.** The Moreton Bay specimens resemble *L. serriferum* from Cronulla, NSW but differ in the spination of pereionites, pleonites and uropods. Fresh specimens of both *L. barbarae* and *L. serriferum* (Hale, 1944b:261) are coloured pale yellow with conspicuous blackish chromatophores, which in *L. barbarae* may appear as bands on the carapace. The most striking difference between the two species is the presence, in *L. barbarae*, of short spine-like setae on the anterolateral margins of pereionites 2 and 3 and on the posterolateral margins of pleonites 1-4. The spination of the ♀ uropod is also reduced compared to *L. serriferum* (Table 3).

The standard length of *L. barbarae* (♀: 3.6mm, ♂: 3.4mm) is a little smaller than *L. serriferum* (♀: 4.4mm, ♂: 4.2mm).

**ETYMOLOGY.** For Barbara Koh, who assisted in the field.

***Leptocuma kennedyi* sp. nov.**

(Figs 65-67)

**MATERIAL EXAMINED.** HOLOTYPE.

TABLE 3. Uropod setation of *L. serriferum* and *L. barbarae*.

	<i>L. serriferum</i>	<i>L. barbarae</i>
Peduncle spination	15	10-12
Endopod 1 spination	18	11-15
Endopod 2 spination	11	5-7

QMW20549, adult ♂, S.L. 4.3mm, SEM mount, Tangalooma, site 15, 27°11'S, 153°19'E, D. Greenwood, 14 April 1990, 8m, sand, 35.5 ppt salinity, 24°C water temperature. PARATYPES: QMW20550, ovig. ♀, allotype, S.L. 4.2mm, SEM mount, same data as above; QMW20551, adult ♂, S.L. 3.5mm, PSM #15, Horse-shoe Bay, site 31, 27°30'S, 153°21'E, D. Tafe, 4 Feb. 1993, 3 m, sand, 34.2 ppt salinity, 26°C water temperature.

**DESCRIPTION. MALE.** Integument lightly calcified, finely granular and sparsely pitted with minute indentations (Fig. 65A,C). Carapace length 0.26 S.L. and depth 0.6 times length in lateral view with lateral margins evenly rounded; dorsal edge slightly arched and sinuate; dorsum with strong median ridge throughout length; lateral surfaces devoid of ridges or sculpture; greatest width at middle of length in dorsal view; antennal notch a moderate concavity, no antennal tooth or antennal ridge; pseudorostral lobes wide, extending anteriorly beyond ocular lobe which is wider than long (Fig. 65A,C,E). Pereion robust, 0.9 times length of carapace; sides of pereionite 1 concealed by pereionite 2, which bears 9 slender spine-like setae on anterolateral margin; pereionite 3 overlaps second laterally and bears 7-8 spine-like setae on anterolateral margin; pereionite 4 overlaps third and fifth laterally, and bears 3-4 spine-like setae on anterolateral margin; pereionite 5 overlaps first pleonite laterally (Fig. 65A,C). Pleon and telsonic somite 0.5 S.L. with faint dorsolateral carinae; first 4 pleonites subequal in length, each with poorly developed posterolateral overlapping lobes; fifth pleonite 1.6 times as long as fourth. Telsonic somite subequal in length to fourth pleonite, with posterodorsal projection which is V-shaped in dorsal view (Fig. 65A,G). First antenna as in *L.*

FIG. 65. *Leptocuma kennedyi* sp. nov. A, whole mount ♂ LV, shows relative lengths of carapace and somites. B, whole mount ♀ LV, shows relative lengths of carapace and somites. C, carapace and pereionites 1-5 ♂ LV, shows relative length and depth of carapace. slender spines on anterolateral margins of pereionites 1-3. D, carapace and pereionites 1-3 ♀ LV, shows relative length and depth of carapace. slender spines visible on anterolateral margins of pereionites 1-2. E, carapace and pereionites 1-3 ♂ DV, shows strong median dorsal ridge and sparse pitting of carapace. F, carapace and pereionites 1-3 ♀ DLV, shows strong median dorsal ridge and sparse pitting of carapace. G, Uropod ♂ DV, shows relative lengths of peduncle and rami. H, Uropod ♀ VV, shows relative lengths of peduncle and rami.



FIG. 66. *Leptocuma kennedyi* sp. nov. paratype ♂. A, pereopod 1. B, pereopod 2. C, pereopod 4.

*serriferum* except peduncle has tuft of about 20 fine setae proximally, third segment has group of 5 setae distally all of which extend beyond first segment of flagellum. Mandible as in *L. serriferum* except there are 10-11 (rather than 12) spine-like setae. Third maxilliped as in *L. serriferum* except setae along medial margin of basis are all plumose and of similar length. Pereiopod 1 as in *L. serriferum* except dactylus is 0.78 times length of propodus and dactylar spine-like seta

0.66 times length of dactylus (Fig. 66A). Pereiopod 2 as in *L. serriferum* except setae on medial margin of basis plumose, propodus 0.6 times length of dactylus and with 8 distal setae (Fig. 66B). Pereiopods 3-5 with merus longer than ischium, carpus slightly longer than merus and longer than combined length of propodus and dactylus; propodus twice length of dactylus; dactylar spine-like seta at least 1.5 times length of dactylus; basis with 2 setae distally, 2-3 medially and 2-3 laterally; ischium with 2-3 spine-like setae and 2-3 setae distally; merus with 1-2 spine-like setae distally and 1-2 setae medially; carpus with 2-3 spine-like setae distally and 1-2 setae laterally; propodus with spine-like seta and minute seta distally; dactylus with terminal spine-like seta, terminal seta and subterminal seta. Peduncle of uropod 1.5 times length of telsonic somite, lined with 20-22 spinose spine-like setae (2 rows) on inner margin; endopod subequal in length to peduncle and to exopod, with 14-16 spinose spine-like setae on inner margin of proximal segment, 5-6 spinose spine-like setae on inner margin (increasing in length distally) of distal segment, 3 terminal spine-like setae, the longest of which is subequal in length to distal segment; distal segment 0.6 times length of proximal segment; dorsal surface of both endopodal segments bear

numerous fine setae; exopod with 6 plumose setae and 2 slender spine-like setae along inner margin, outer margin with 7 short spine-like setae, 3 terminal spine-like setae, the longest of which is 1/3 the length of exopod; outer edge spine-like setae of exopod and terminal spine-like setae of both rami bear minute apical setae (Fig. 65G, 67A,B).



**OVIGEROUS FEMALE.** Integument lightly calcified, finely granular and sparsely pitted with minute indentations, as in ♂ (Fig. 65B,D). Carapace length 0.24 S.L. and depth 0.63 times length in lateral view with lateral margins evenly rounded; dorsal edge slightly arched and sinuate; strong median dorsal ridge on anterior 3/4 of dorsum; lateral surfaces devoid of ridges or sculpture; greatest width at posterior of length in dorsal view (Fig. Pl 25F); antennal notch very small and subacute; pseudorostral lobes wide, extending anteriorly beyond ocular lobe which as wide as long (Fig. 65B,D,F). Pereion robust, 1.1 times length of carapace; sides of pereionite 1 concealed by second pereionite, which bears 14-15 slender spine-like setae on anterolateral margin; pereionite 3 overlaps second and fourth laterally and bears 9-11 spine-like setae on anterolateral margin and 1-2 on posterolateral margin; pereionite 4 overlaps fifth laterally and fifth overlaps first pleonite laterally; no dorsolateral carinae on pereionites (Fig. 65B,D,F). Pleon and telsonic somite 0.49 S.L. with faint dorsolateral carinae; first 4 pleonites subequal in length, each subcylindrical with small nipple-like projections on posterolateral margins; fifth pleonite 1.6 times as long as fourth. Telsonic somite subequal in length to fourth pleonite, with posterodorsal projection which is V-shaped in dorsal view (Fig. 65B,H). Peduncle of uropod 1.3 times length of telsonic somite, lined with 5-6 spine-like setae on inner margin; endopod 1.1 times length of peduncle and subequal in length to exopod, with 10-11 spine-like setae on inner margin of proximal segment, 4-5 spine-like setae on inner margin of distal segment, 3 terminal spine-like setae, the longest of which is as long as distal segment, distal segment 0.5 times length of proximal segment; dorsal surface of both endopodal segments with numerous fine setae; exopod with up to 5 short setae and 2 slender spine-like setae on distal half of inner margin, short subterminal spine-like seta on outer margin, 3 terminal spine-like setae, the longest of which is 0.5 times length of exopod; terminal and subterminal spine-like setae of both rami bear minute apical setae (Fig. 65B,H).

**Colour.** White with small blackish chromatophores dotted on carapace and pereion.

S.L. Adult ♂ 4.3mm. Adult ♀ 4.2mm.

**HABITAT AND DISTRIBUTION.** Most common over medium and coarse sand in 1-8m of water; sites 15, 28, 31 and 34 in Moreton Bay.

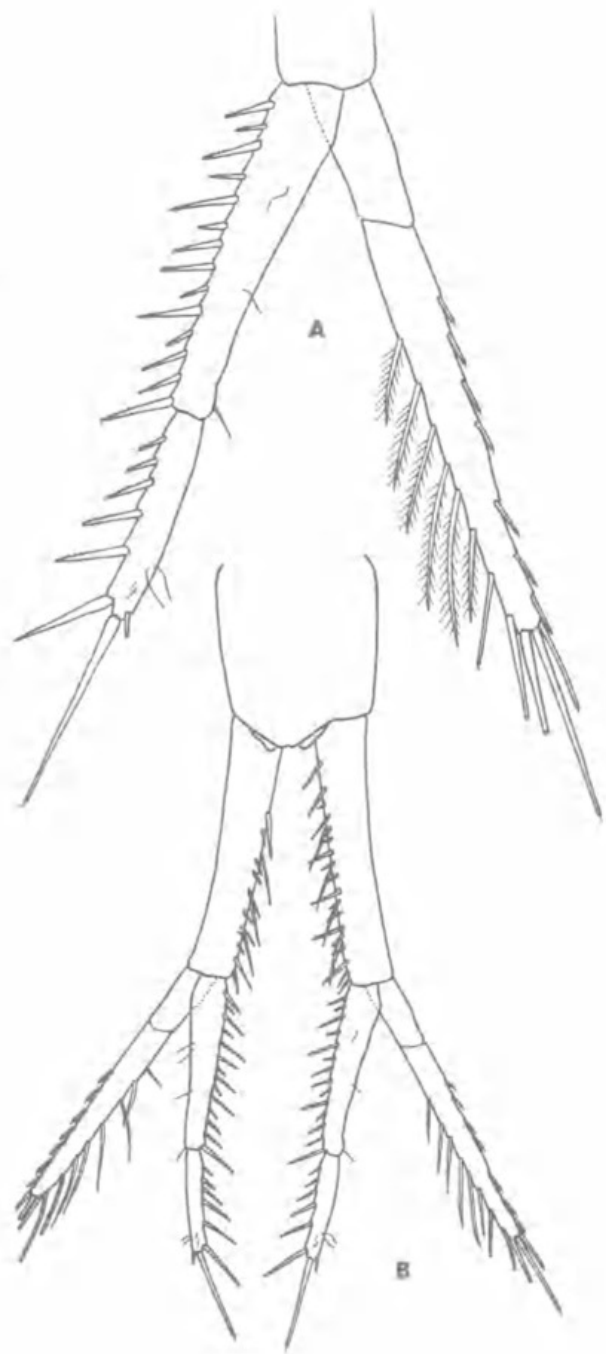


FIG. 67. *Leptocuma kennedyi* sp. nov. paratype adult ♂. A, rami of uropod, DV. B, uropods and telsonic somite, DV.

**REMARKS.** *Leptocuma kennedyi* most closely resembles *L. nicholli* but has rows of spine-like setae on the anterolateral margins of pereionites 2 and 3. Also the first endopodal segment of the uropod is fully twice as long as the second and

has up to 18 inner marginal spine-like setae (cf. 1.5X with 9 spine-like setae in *L. nichollsi*; Hale, 1949a:117).

*L. kennedyi* is larger than *L. barbarae* and smaller than *L. intermedia*. It also differs from the above two species in having a strong median dorsal ridge, extending from the ocular lobe almost to the first pereionite. Like *L. barbarae* it has a row of short spine-like setae in both sexes on the anterolateral margins of pereionites 2 and 3. Unlike *L. barbarae* (Fig. 61G, 62G) the exopod of the  $\delta$  uropod has a row of outer spine-like setae (Fig. 65G). Like *L. intermedia* the body is large and tapering from carapace to telsonic somite. However, the second endopod segment of the uropod ( $\delta$ s only) of *L. kennedyi* is relatively longer than that of *L. intermedia* (Hale, 1944b:265).

ETYMOLOGY. For John Kennedy, Queensland Museum, who assisted in the field.

#### *Picrocuma* Hale, 1936

*Picrocuma* Hale, 1936b:415. Hale, 1945c:177.

DIAGNOSIS. Pseudorostral lobes meeting in front of wide ocular lobe. First antenna with 3-segmented peduncle and rudimentary accessory flagellum. Mandible with spine-like seta row, only 4-5 spine-like setae; incisor portion greatly elongated, with cutting edge tridentate. Third maxilliped with exopod and similar to first pereopod; basis not produced apically. Pereiopods 1-3 with well-developed exopods in  $\delta$ . Uropod of both sexes with endopod 1-segmented. Pereionite 2 longer than others.

GENOTYPE. *Picrocuma poecilotum*.

REMARKS. Salient features of genus are structure of mandible and unspecialised third maxilliped.

#### *Picrocuma poecilotum* Hale, 1936 (Fig. 68)

*Picrocuma poecilotum* Hale, 1936b:415, figs 7a-c, 8a-i. Hale, 1945a:178, figs 22, 23.

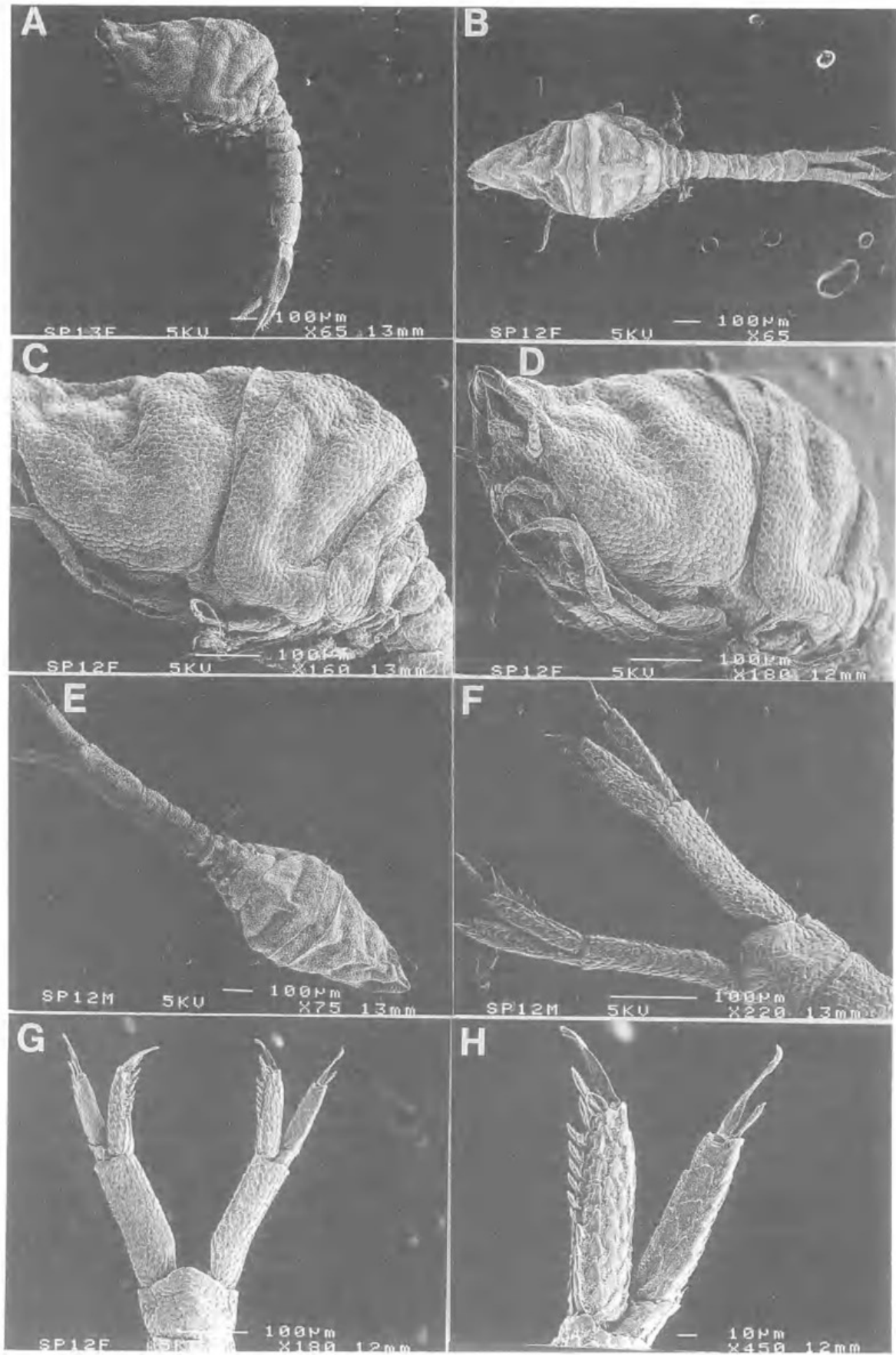
MATERIAL EXAMINED. SAMC2006, ovig.  $\delta$ , holotype, S.L. 1.9mm, Wynyard, Fossil Reef, Tasmania, on stones, Hale, 1936b. OTHER MATERIAL. QMW20552, adult  $\delta$ , S.L. 1.3mm, in 70% ethanol, Tangalooma, site 15, 27°11'S, 153°19'E, D. Greenwood, 14 April 1990, 8m, sand, 35.5 ppt salinity, 24°C water temperature; QMW20553, adult  $\delta$ , S.L. 1.2mm, in 70% ethanol, same data as above; QMW20554, adult  $\delta$ , S.L. 1.4mm, SEM mount, same data as above; QMW20555, adult  $\delta$ , S.L. 1.3mm, SEM mount, same data as above.

DISTRIBUTION. North East Coast, Central East Coast, Tasmanian Coast and S. Gulfs Coast (Fig. 4). QLD: Lizard Is., Myora Bight in Moreton Bay, on sand (Hale, 1945a:180); sites 15, 28, and 31 in Moreton Bay. Tas: Wynyard, Fossil Reef, on stones (Hale, 1936b:417). SA: Sellicks Beach, Gulf St. Vincent, on stones (Hale, 1936b:417).

REMARKS. *P. poecilotum* from Moreton Bay matches the types (SAMC2006) from Tasmania. Standard lengths of adult and subadult  $\delta$   $\delta$  are 1.3 and 0.95mm respectively, smaller than those from Tasmania (Hale, 1936b).

Both sexes are described ( $\delta$  Hale, 1936b;  $\delta$  Hale, 1945a). Hale expressed some uncertainty about the fact that adult  $\delta$   $\delta$  could be up to 40% larger than adult  $\delta$   $\delta$ , and that  $\delta$   $\delta$  from Moreton Bay have the carapace less swollen than the type  $\delta$ . He also pointed out (1936b:417) that, although the species was by far the commonest cumacean at Sellicks Beach, SA, all were immature. The  $\delta$ s he examined from Moreton Bay had 'the carapace less swollen than in the type' (Hale, 1945a:180), and the  $\delta$  lacked sensory filaments on the first antenna that occurred on the same appendage of immature  $\delta$  specimens from SA. It appears that he has combined two species into his description of *P. poecilotum*, the  $\delta$  being of a different species. Both species commonly occur in parts of Moreton Bay. *P. poecilotum* (Fig. 68) has a shorter, more anteriorly tapering carapace, longer uropodal peduncles and deeper textured integument than *P. crudgingtoni* (Fig. 69).

FIG. 68. *Picrocuma poecilotum* Hale. A,B, whole mount  $\delta$ , showing relative lengths of carapace and somites. A, LV. B, DV. C, carapace and pereion  $\delta$  LV, shows arched dorsum and relative lengths of pereionites. D, carapace and pereion  $\delta$  ALV, shows arched dorsum and anteriorly tapering pseudorostral lobes. E, whole mount  $\delta$  DV, shows relative lengths of carapace and somites. F, uropods  $\delta$  DV, shows relative lengths of telsonic somite, peduncle and rami. G, uropods  $\delta$  DV, shows relative lengths of telsonic somite, peduncle and rami. H, uropod rami  $\delta$  DV, shows spination and surface texture of rami.



*Pierocuma crudgingtoni* sp. nov.  
(Fig. 69)

**MATERIAL EXAMINED.** HOLOTYPE QMW20556, adult ♂, S.L. 1.1mm, in 70% ethanol, Hays Inlet, site 17, 27°17'S, 153°09'E, D. Tafe, 12 Oct. 1989, 2m, silt, 33 ppt salinity, 24°C water temperature. PARATYPES QMW20557, ovig. ♀, allotype, S.L. 1.3mm, in 70% ethanol, same data as holotype; QMW20558, adult ♂, S.L. 1.2mm, SEM mount, Pumicestone Passage, site 1, 26°55'S, 153°05'E, J. Greenwood, 14 Dec. 1990, 1.2m, silt, 33.5 ppt salinity, 29°C water temperature; QMW20559, adult ♀, S.L. 1.2mm, in 70% ethanol, same data as above.

**DESCRIPTION. MALE.** Integument lightly calcified, composed of triangular, overlapping scales giving a smooth appearance (Fig. 69). Carapace 0.3 S.L. and 0.6 times as wide as long in dorsal view with lateral margins evenly rounded, widest at midlength; depth 0.5 times length in lateral view with dorsum smoothly arched, no median dorsal or lateral carinae; antennal notch shallow, no antennal tooth or ridge; pseudorostral lobes wide, roundly truncate, joining for a distance in front of ocular lobe equal to 0.15 times length of carapace; ocular lobe twice as wide as long (Fig. 69A-E). Pereion 0.9 times length of carapace; 5 pereionites exposed, first narrows laterally, second is longest, twice as long as third or fourth, fifth longer than fourth, third to fifth tapering in dorsal view (Fig. 69A-E). Pleon and telsonic somite 0.45 S.L. and 1.5 times length of carapace; robust structure, no median dorsal or lateral carinae; no lateral articular processes; first 4 pleonites increasing slightly in length, fifth pleonite 1.5 times as long as fourth; telsonic somite 1.3 times wider than long, posteriorly rounded and slightly produced (Fig. 69A-F). First antenna as in ♂ of *P. poecilotum*, 3-segmented with terminal flagellum; first segment somewhat geniculate, as long as second and third segments combined; second segment subequal in length to third, which bears a group of short setae distally; flagellum segment with a group of 7 sensory filaments distally. All pereopods 7-segmented, except pereopod 2 which has no distinct ischium. Structure of pereopods as in ♂ of *P. poecilotum*

(Hale, 1945a, p.179). Peduncle of uropod 1.4 times length of telsonic somite, very broad, its width 0.45 times its length, and without spination; rami short and robust; endopod 0.85 times length of peduncle and slightly longer than exopod, with 5-6 inner marginal and 2 unequal terminal spine-like setae, the longer 0.35 times ramus length; exopod with 2 unequal terminal spine-like setae, the longer 0.4 times ramus length (Fig. 69F,H).

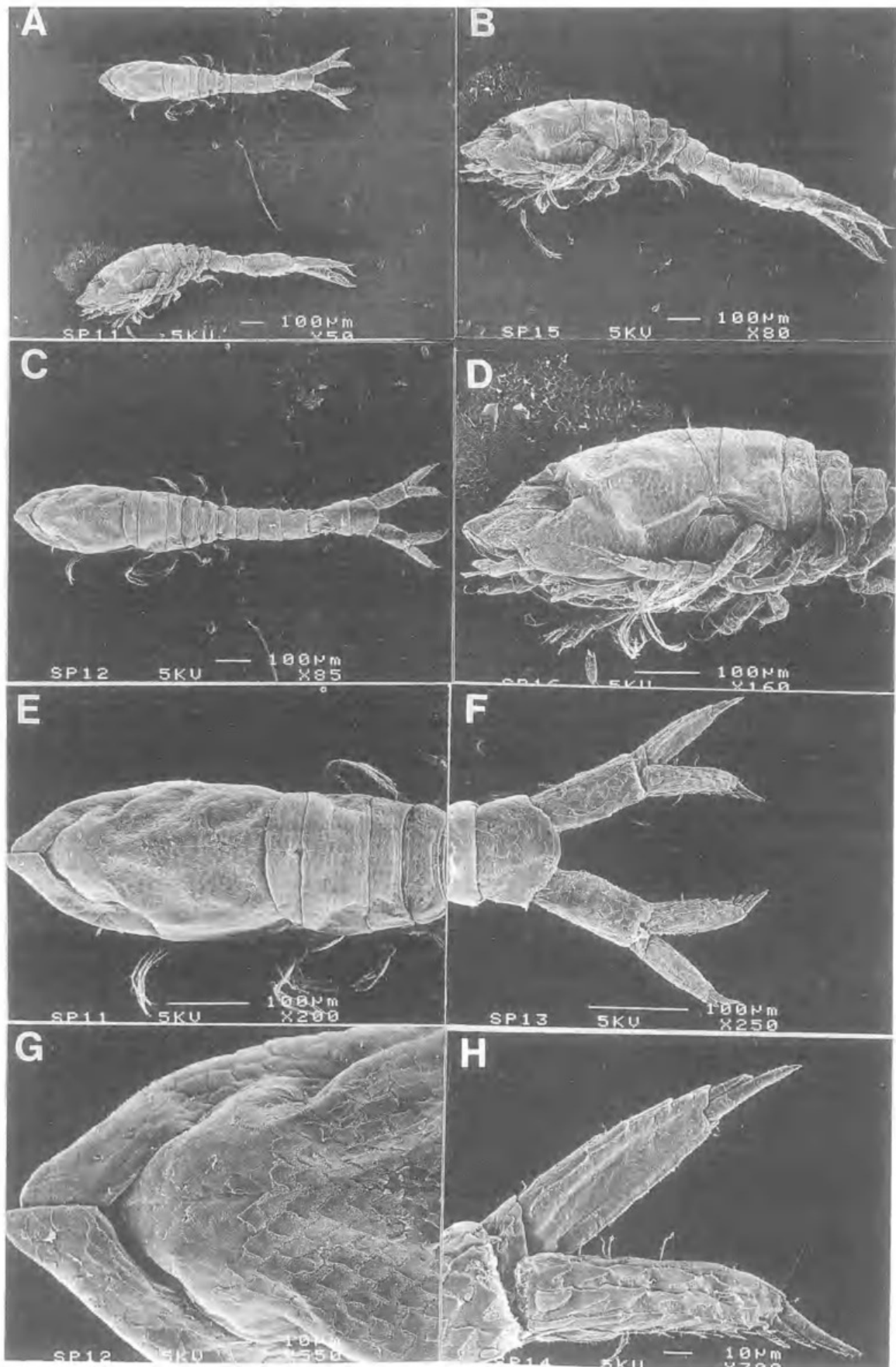
**OVIGEROUS FEMALE.** Integument lightly calcified, composed of smooth triangular, overlapping scales, as in ♂.

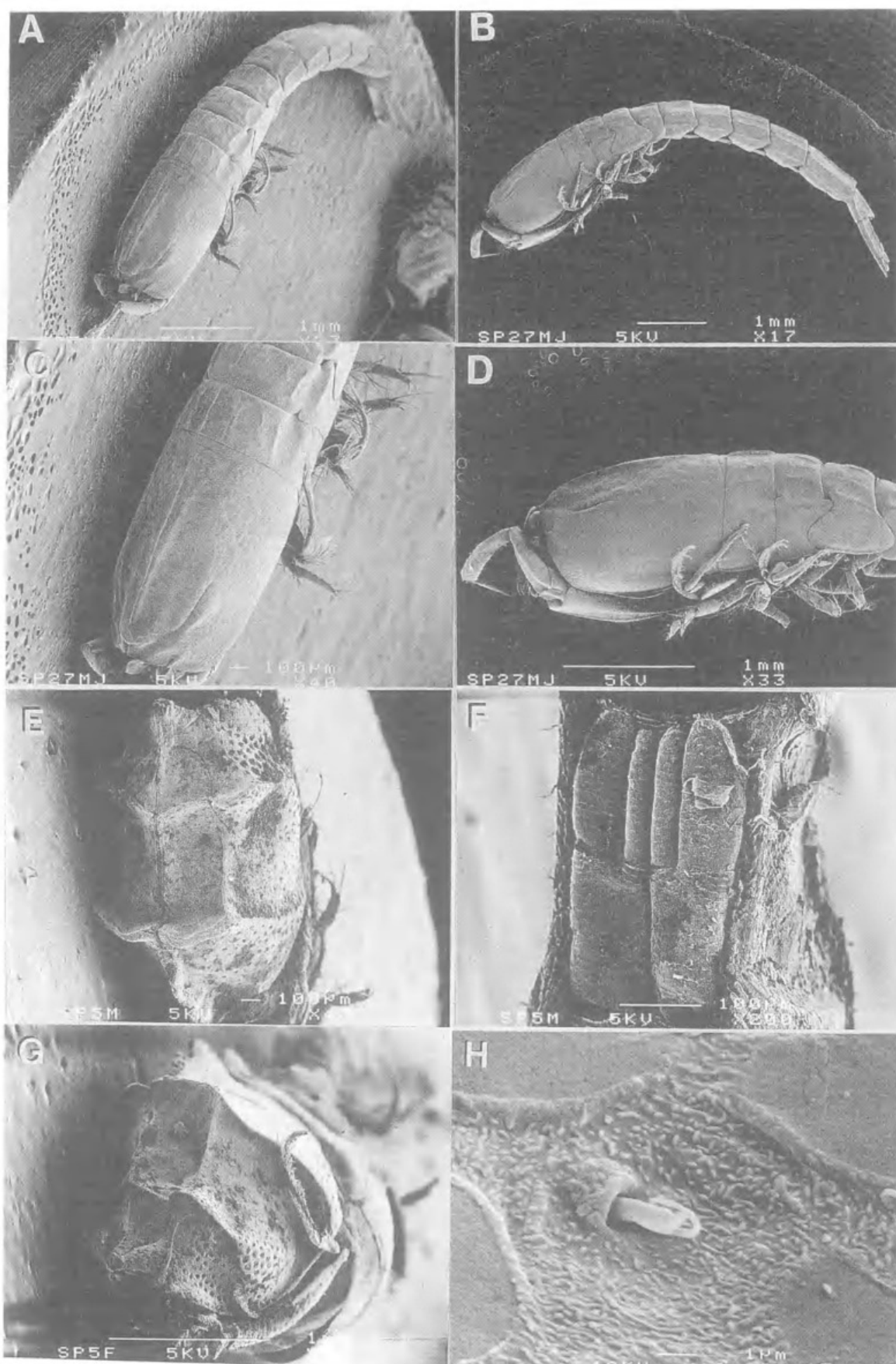
Carapace length 0.25 S.L. and 0.7 times as wide as long in dorsal view with lateral margins evenly rounded and widest at posterior of length; depth 0.6 times length in lateral view with dorsum smoothly arched, no median dorsal or lateral carinae; antennal notch shallow, no antennal tooth or ridge; pseudorostral lobes wide, roundly truncate, joining for a distance in front of ocular lobe equal to 0.2 times length of carapace; ocular lobe and pseudorostral lobes as in ♂. Pereion as long as carapace; 5 pereionites exposed, first narrows laterally, second is longest, twice as long as third or fourth, fifth longer than fourth, third to fifth tapering in dorsal view. Pleon and telsonic somite 0.5 S.L. and 1.7 times length of carapace; robust structure, no median dorsal or lateral carinae; no lateral articular processes; first 4 pleonites increasing slightly in length, fifth pleonite 1.5 times as long as fourth; telsonic somite 1.3 times wider than long, posteriorly rounded and slightly produced. First antenna 3-segmented, with terminal flagellum; first segment somewhat geniculate, as long as second and third segments combined; second segment subequal in length to third, which bears a group of short setae distally; flagellum with a group of 7 sensory filaments distally. Pereiopods 7-segmented, except pereopod 2 which has no distinct ischium. Structure of pereopods same as in ♂. Uropod as in ♂ except peduncle is 1.3 times length of telsonic somite and inner margin of endopod has 3 spine-like setae.

**Colour.** White with mottled brown chromatophores.

FIG. 69. *Pierocuma crudgingtoni* sp. nov. ♂. A, whole mounts DV & LV. B, whole mount LV, shows relative lengths of carapace and somites. C, whole mount DV, shows body tapering from mid-region of carapace to pleonite 4. D, carapace and pereionites 1-5 LV, shows dorsum smoothly arched dorsum, shallow antennal notch and absence of lateral carinae. E, carapace and pereionites 1-4 DV, shows relative lengths of pereionites in dorsal view and absence of median dorsal ridge. F, uropod DV, shows relative lengths and widths of telsonic somite, peduncle and rami. G, anterior carapace DV, shows pseudorostral lobes wide, roundly truncate, joining for a distance in front of ocular lobe. H, uropod rami DV, shows spination and texture of rami.







S.L. Adult ♂ 1.0-1.2mm. Adult ♀ 1.1-1.3mm.

**HABITAT AND DISTRIBUTION.** Most common over fine sand in 1-4m of water; from all sites in Pumicestone Passage, and sites 16, 17, and 31 in Moreton Bay; abundant at sites 1, 2, 3, 9, 10, and 11 in Pumicestone Passage.

**REMARKS.** *P. crudgingtoni* resembles *P. poecilotum*, but lacks the acutely pointed carapace and pronounced dorsal hump. The hump is located in the region of pereionite 2 of the latter species, which is three times longer than pereionite 3 and half as long as the carapace (Fig. 68C,D). In *P. crudgingtoni* it is only twice as long as pereionite 3 and 1/4 as long as the carapace; the peduncle of the uropod is about twice as long as wide (Fig. 69F), compared to at least three times as long as wide for *P. poecilotum* (Fig. 68F,G). The armature of the uropodal endopod is also different in the new species.

The carapace of *P. crudgingtoni* has a smooth appearance, being composed of flattened triangular, overlapping scales (Fig. 69G). In contrast the carapace of *P. poecilotum* is composed of rounded, overlapping scales giving a roughened, pebbled appearance (Fig. 68C,D).

*P. crudgingtoni* has a small, streamlined but robust exoskeleton which, like that of *P. poecilotum*, is well adapted to living amongst sand grains in areas subject to currents or wave action. Both species are very common in silt/fine sand areas of Moreton Bay subject to tidal currents.

**ETYMOLOGY.** For Robert Crudgington, who assisted in the field.

#### *Pomacuma* Hale, 1944

*Pomacuma* Hale, 1944b:241.

**GENOTYPE.** *Pomacuma cognata* Hale, 1944b.

**DIAGNOSIS. FEMALE.** Carapace with pseudo-rostral lobes extending in front of moderately

large ocular lobe and meeting in midline; antennal notch closed but not fused. Five pereionites exposed; first pereionite short. Pleon longer than carapace and pereion combined; telsonic somite well produced posteriorly with distal margin rounded. Third maxilliped with well-developed exopod. First 3 pereiopods with well-developed exopods; pereiopod 4 with rudimentary 1-segmented exopod bearing few setae. Basis of pereiopod 1 widened distally with large lobe on distal end; lobe produced to articulation of ischium and merus. Carpus of pereiopod 2 much shorter than merus. Endopod of uropod 2-segmented, distal segment very short; medial margin of exopod with plumose setae.

**MALE.** Second antenna reaching to end of pleon. Thoracic exopods as in ♀. Five pairs of pleopods.

**REMARKS.** This genus is related to *Zenocuma* but differs in structure of basis of third maxilliped and first pereiopod, and in pseudorostrum and telsonic somite. Two species of *Pomacuma* have been previously recorded off eastern Australia.

#### KEY TO AUSTRALIAN SPECIES OF *POMACUMA*

1. Pleon ridged . . . . . 2  
Pleon not ridged . . . . . *australiae* (Zimmer)
2. Sides of carapace tapering anteriorly in dorsal view. Pereionite 4 with only posterior overlapping lobe in lateral view . . . *cognatum* Hale  
Sides of carapace almost parallel in dorsal view. Pereionite 4 with anterior and posterior overlapping lobes in lateral view . . . . . sp. nov. 1

#### *Pomacuma australiae* (Zimmer, 1921) (Fig. 71A-D)

*Vaunthompsonia australiae* Zimmer, 1921:4, figs 1-7.  
*Leptocuma australiae*; Hale, 1936b:408.

*Pomacuma australiae* Hale, 1944b:244, figs 12-14.  
Hale, 1949a:110.

**MATERIAL EXAMINED.** SAMC2480, 3 ♂, ♀, S.L. 8.7-9.0mm, Fraser Island, Qld (Hale, 1944b);

**FIG. 70.** A-D, *Pomacuma* sp. nov. 1. A, ♂ DLV, whole mount shows dorsal and lateral carinae extending along pereion and pleon. B, ♂ LV, whole mount showing relative lengths of carapace and somites. C, ♂ DLV, carapace truncate anteriorly and almost parallel sided; median dorsal ridge pronounced. D, ♂ LV, carapace and pereionites 1-4 showing basis of pereiopod 1 widened distally, pereiopod 4 with lateral lobes which overlap pereiopods 3 and 5. E-G, *Cyclaspis alveosculpta* sp. nov. E, subadult ♂ DLV, showing strong transverse ridges and reticulate pattern of pitting. F, subadult ♂ VV, pleonite 5 showing immature pleopod 5. G, subadult ♂ ALV, showing high arches of posterior transverse ridge, and strong median dorsal and dorso lateral ridges. H, *Gephyrocuma* sp. nov. 1, ♂, DV, detail of integument anterolaterally showing a sensory filament, protruding from between cuticular plates.

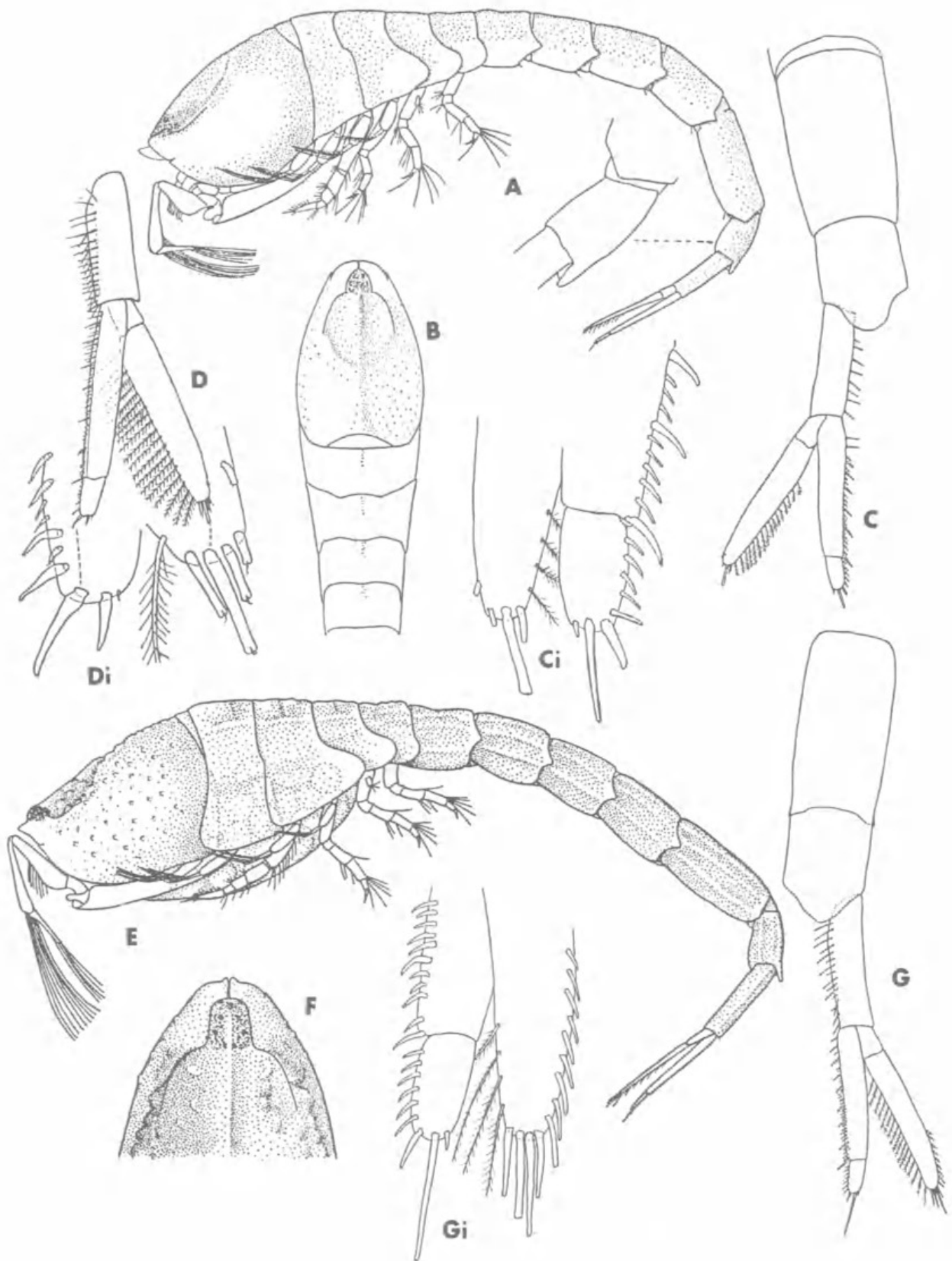


FIG. 71. A-D, *Pomacuma australiae*. A-C, ♀. A, LV. B, cephalothorax, DV. C, uropod, DV. Ci, distal ends of rami. D, ♂ uropod, DV. Di, distal ends of rami. E-G, *Pomacuma cognatum*. E-G, type ovig. ♀. E, LV. F, anterior portion of carapace, DV. G, uropod, DV. Gi, distal ends of rami. (All after Hale, 1944b).



QMW20560, adult ♂, S.L. 8.5mm, in 70% ethanol, off Coochiemudlo Island, site 34, 27°32'S, 153°20'E, D. Tafe, 17 June 1990, 7.5m, silt, 33 ppt salinity, 20°C water temperature. QMW20561, adult ♀, S.L. 8.1mm, in 70% ethanol, data as above.

**DISTRIBUTION.** Central and Lower East Coast, Central and Lower West Coast (Fig. 4). Qld: Fraser Island (Hale, 1944b:246); sites 31 and 34 in Moreton Bay. NSW: Jibbon, Wata Mooli, Eden, Ulladulla (Hale, 1944b:246). WA: Cape Jaubert, Shark Bay (Zimmer, 1921:4). Uncommon in Moreton Bay.

**REMARKS.** Moreton Bay specimens match the types. Two adults and a juvenile were taken by sledge-net during the day and are slightly smaller but otherwise the same as those described by Hale (Fig. 43A-G). The standard length of the ♂ is 8.5mm (cf Hale, 1944b: 9.0mm) and the ♀ is 8.1mm (cf Hale, 1944b: 8.7mm).

*Pomacuma* sp. nov. 1  
(Fig. 70A-D)

**MATERIAL EXAMINED.** QMW20562, subadult ♂, S.L. 4.7mm, SEM mount, Raby Bay, site 32, 27°30'S, 153°18'E, D. Tafe, 17 June 1990, 1300 hours, sledge-net, 5m, sandy mud, 33.8 ppt salinity, 18.7°C water temperature. Uncommon.

**REMARKS.** Further specimens are required to describe the species. The Moreton Bay specimen is subadult but totally unlike any other species of *Pomacuma* described to date. It bears little resemblance to the other two Australian species, *P. australiae* and *P. cognatum*. *P. cognatum* was recorded from the same region by Stephenson et al. (1978) and Stephenson (1980b); the anterolateral angle of its carapace is quite different to that of *Pomacuma* sp. nov. 1. The carapace of the new species has a strong median dorsal ridge extending from the ocular lobe almost to the first pereonite (Fig. 71C). The ocular lobe is wider than long with pseudorostral lobes meeting in front of it. Pereonites 2-4 are virtually as wide as the carapace in dorsal view (Fig. 70C). The pereonites and pleonites have obvious lateral and dorsal carinae (Fig. 70A-D). The uropod has a peduncle at least twice as long as the rami. The anterolateral margins of pereonites 2 and 3 are without spine-like setae. Pereiopod 1 robust with the basis widened distally and extending to the anterolateral curvature of the carapace; it bears a forwardly directed lobe on the distal end, typical of the genus.

## DISCUSSION

This study shows the Bodotriidae to be the dominant family in Moreton Bay, both in terms of the number of species and the abundance of individuals. This is consistent with findings on the E, W and S coasts of Australia. Hale (1937, 1943, 1945b, 1953a) stated that, with regard to the number of species, the bodotriids outnumber the other families on the Indian Ocean and southern Australian coasts, but on the Pacific side the diastylids are equally well represented. However, his Diastylidae included the Gynodiasylidae. There is little doubt the Bodotriidae is the most diverse family on the Pacific coast of Australia.

The Bodotriidae is represented by 59 species off the Pacific coast at latitudes of less than 35°S, compared to 19 species in the Southern Ocean (Bacescu, 1988). It appears from cumacean records in other parts of the world (Sars, 1865; Calman, 1904, 1907, 1911, 1912; Zimmer, 1921; Stebbing, 1912, 1913; Bacescu, 1988; Day, 1975, 1978a; Ledoyer, 1993) that the family is negatively amphipolar. No species of Bodotriidae are yet known from latitudes greater than 70° and only 6% of records are from latitudes greater than 50° (Day, 1978a,b). Brandt (1993) and Ledoyer (1993) showed that cumaceans are abundant on the sea floor in both Arctic and Antarctic seas. Ledoyer (1993) recorded population densities of

74 individuals per cubic metre in the Weddell Sea between depths of 200-1200m; however, he did not record any bodotriids.

Endemism is very high within the Bodotriidae. Less than half (42%) of the 81 species recorded around the Australian coastline occur in waters of more than one coastal zone (Fig. 4), and only 17% are recorded in both Indian and Pacific Oceans (Bacescu, 1988). The two subfamilies of Bodotriidae recorded in Australian waters are disproportionately represented. The Bodotriinae exhibit a much higher diversity of species (54 species) and a much higher rate of occurrence than do the Vauithompsoniinae (27 species), largely due to the high diversity of *Cyclaspis*.

The greatest worldwide diversification of species within the Bodotriidae occurs in southern tropical and temperate latitudes (Day, 1975, 1978a). If it were not for the large number of species of *Cyclaspis* in Australasia, the Bodotriinae would be a mainly tropical group. The Vauithompsoniinae is mainly a temperate

group, with 48% of species occurring between 20° and 50°S (Day, 1978a).

The vast majority of known species (87%) of Bodotriidae are from depths of less than 200 metres, indicating that the family belongs predominantly to the shelf fauna. A number of new species of Bodotriidae and other families have been recorded from depths greater than 200m (Jones & Sanders, 1972; Day, 1978a; Gamo, 1989; Roccatagliata 1989; Jones, 1990; Watling, 1991a,b; Roccatagliata & Heard, 1992; Roccatagliata, 1993), indicating that the apparent lack of deep water species is at least partly due to scarcity of collecting.

In South African waters the numbers of individuals are highest within the Bodotriinae but diversity within this subfamily is much lower than in Australia (Day, 1978a). The ecological reasons for this difference is not clear, but the immediate cause, according to Day (1978a), is the effective colonisation of South African coastal waters by just a few species. *Iphinoe africana* and *I. stebbingi* account for over half the individuals of the Bodotriinae taken from around South Africa, with a further 10

species of this genus being recorded from the region. In Australia *Iphinoe* has not gained as great a foothold, the only recorded species being *I. pellucida*, off NSW and Tasmania.

*Cyclaspis* has been highly successful in colonising Australian coastal waters. It accounts for 60% of bodotriid species, and is widespread in its distribution. Hale (1953a) found that *Cyclaspis* individuals were the most abundant in light-trap catches off Garden Island, W.A. He encountered them everywhere where there was a sandy substratum. Bacesescu (1990, 1992b) described 4 new species of *Cyclaspis* from the northern waters of Australia. In the present study *Cyclaspis* predominated in catches over sand and silt/mud substrata, but *Nannastacus* was more common in seagrass beds (Hale, 1949b, 1953a). Males of both of these genera by far outnumbered ♀♀ in Hale's light-trap catches, as in the present sledge-net catches. It appears that ♂♂ of these two genera are much more active in the water column at night than are ♀♀.

Some species of Bodotriidae were highly restricted in their geographical distributions within Moreton Bay. *Gephyrocuma repandum*, the most abundant species by far at the northern entrance to Pumicestone Passage, was not recorded elsewhere in Moreton Bay or in the upper estuary. *Leptocuma barbara*, the most abundant species in Horseshoe Bay, was not

recorded 8km to the W in Raby Bay. *Cyclaspis tranteri* the most abundant species in Raby Bay, was not recorded in Horseshoe Bay even though over 200 samples were taken there spanning all seasons. Such findings lend support to the view that cumaceans generally have restricted dispersal patterns compared to other peracarids.

The richest areas of those sampled in Moreton Bay were generally the shallow water, marine areas with sandy substrata. High numbers of individuals were consistently taken after sunset in such areas, using a sledge-net sampler at times of slack tide. Despite this the single largest sample was taken at slack high water over a mud substratum. This was an unusually large haul (87 cumaceans per m<sup>3</sup>) for the middle of the day. It was mainly due to a swarm of *Cyclaspis tranteri* which accounted for 92% of cumacean numbers taken. Even more unusual was the fact that the haul was taken over a mud substratum. Repeated samplings at the same location (site 32) on other occasions failed to yield numbers of such magnitude. Similar sledge-net hauls over sandy substrata often yielded catches of at least 50 cumaceans per m<sup>3</sup>, when taken at night on a slack tide.

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