

AUSTRALIAN CUMACEA. No. 7¹

THE GENUS CYCLASPIS

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Fig. 1-60.

INTRODUCTION.

UNTIL recently, little intensive collecting of Cumacea was carried out in the Pacific. A rather prolonged investigation of some areas off southern and eastern Australia makes it possible to state now that these crustaceans, while not so abundant as the Amphipoda, here constitute an important part of the bottom fauna. They are found in the stomachs of some of the Australian fishes but, excepting the more strongly calcified forms, are usually in such fragmentary condition that specific identification is not possible. In jars of sea water, Amphipoda collected at the same time as Cumacea have been observed feeding upon the latter, biting off the anterior part of the thorax and discarding the rest of the body with the spiny legs and uropods attached.

I am particularly indebted to my colleague, Mr. Keith Sheard, for his very able help in securing the unusually large collection now available for study. Much of the material to be dealt with was taken by the Federal Research Vessel "Warreen" in waters off South Australia, Victoria, southern Queensland and, particularly, New South Wales. Dr. H. Thomson, Chief of the Fisheries Division of the Commonwealth Council for Scientific and Industrial Research, has co-operated whole-heartedly in encouraging and making possible this search for members of an order which, generally, is not accorded much attention.

Collecting methods which have proved most productive of results are (1) the use of formalin (Hale, 1936, p. 404); (2) the employment of a submerged light of low candlepower at night (Sheard, 1941, p. 12, and Hale, 1943, pp. 337, 338); (3) a "one man" modified Agassiz drift trawl evolved by Sheard, who will shortly describe it.

The depths at which the submarine light was used ranged down to 100 metres or more, but the bottle containing the lamp tended to leak at greater depths.

In night collecting with a submarine light, as many as a dozen species have been found in the net after a short immersion (twenty minutes). Generally, a superabundance of males, and in some cases males only, was attracted. On the other hand, Miss Patricia Mawson, to whom I am indebted for collections made from a jetty, secured only females and juveniles of *Cyclaspis usitata* on two occasions; this is discussed under the species.

Through the courtesy of the authorities of the Australian Museum, I have been able to examine the small collection of Cumacea in that institution; included is material taken by the H.M.C.S. "Thetis" in 1898 (for stations see Mem. Aust. Mus. iv, 1898, pp. 20-22).

My thanks are due to Miss Gwen Walsh for the drawings reproduced in fig. 1, 36 A to C, and 39.

(1) See also Hale, 1928, 1932, 1936, 1937, 1937a and 1943.

ing has been carried out in only relatively small areas, more than half the described species have been taken there. Going a little further, and including the whole of the Australian region, we find in this region forty-four of the sixty-one known species.

The occurrences of the species are as follows:

ARCTIC OCEAN.

longicaudata Sars.

NORTH ATLANTIC OCEAN.

longicaudata Sars.
varians Calman.
unicornis Calman.
longipes Calman.

SOUTH ATLANTIC OCEAN.

spectabilis Zimmer.

INDO-PACIFIC OCEAN.

ETHIOPIAN REGION.

carinata Zimmer.

ORIENTAL REGION.

costata Calman.
picta Calman.
formosae Zimmer.
herdmani Calman.
hornelli Calman.
cingulata Calman.
uniplicata Calman.

AUSTRALIAN REGION (Australian Sub-region).

North-western Australia.

mjobergi Zimmer.
supersculpta Zimmer.
candida Zimmer.

South Australia.

caprella Hale.
sheardi sp. nov.
mjobergi Zimmer.
cretata sp. nov.
granulosa sp. nov.
pura Hale.
cottoni Hale.
tribulis Hale.
bovis Hale.
mawsonae sp. nov.
usitata Hale.
simula sp. nov.
spilotes Hale.

Victoria and Tasmania.

sheardi sp. nov.
clarki sp. nov.
tribulis Hale.
australis Sars.
munda sp. nov.

New South Wales.

gibba sp. nov.
lucida sp. nov.
mollis sp. nov.
fulgida sp. nov.

sheardi sp. nov.
cretata sp. nov.
concinna sp. nov.
globosa sp. nov.
clarki sp. nov.
pinguis sp. nov.
nitida sp. nov.
tribulis Hale.
bovis Hale.
usitata Hale.
aspera sp. nov.
australis Sars.
cana sp. nov.
munda sp. nov.
sabulosa sp. nov.

Southern Queensland.

strigilis sp. nov.
pruinosa sp. nov.

Northern Queensland.

levis Thomson.
similis Calman.

AUSTRALIAN REGION. Austro-Malayan Sub-region.

bicornis Zimmer.
pusilla Sars.
persculpta Calman.
exsculpta Sars.
sibogae Calman.

AUSTRALIAN REGION. New Zealand Sub-region.

North Island.

levis Thomson.
coelebs Calman.
argus Zimmer.
thomsoni Calman.

South Island.

levis Thomson.
calmani sp. nov.
elegans Calman.
similis Calman.
triplicata Calman.

AUSTRALIAN REGION. Polynesian Sub-region.

No species recorded.

NORTH-EASTERN PACIFIC OCEAN.

nubila Zimmer.

SOUTHERN OCEAN.

quadrituberculata Zimmer.

ANTARCTIC OCEAN.

glacialis Hansen.
gigas Zimmer.

KEY TO SPECIES.

Keys are necessarily arbitrary. In that dealing with the species of *Cyclaspis*, and presented herein, an attempt has been made to group as far as possible forms with broad structural features in common. Its use will necessitate a more than cursory examination of material in hand, but that is really necessary whatever form of summary is adopted.

Following the inevitable addition of forms as yet unknown and with fuller knowledge of some of those already recorded, there is no doubt that modification of the key will be necessary.

STRUCTURE.

Carapace. The primary surface pattern consists of the universal fine network (fig. 9, C; 32, D, etc.), often linked with faint pitting but always present even in the most polished forms. This minute reticulation may follow the formation of ridges in that the edges are placed end to end along the line of a carina, as in the only one occurring in *pinguis*, that of the dorsum, which runs the whole length of the animal (fig. 30, F). The relative size of the reticulation shows some specific variation.

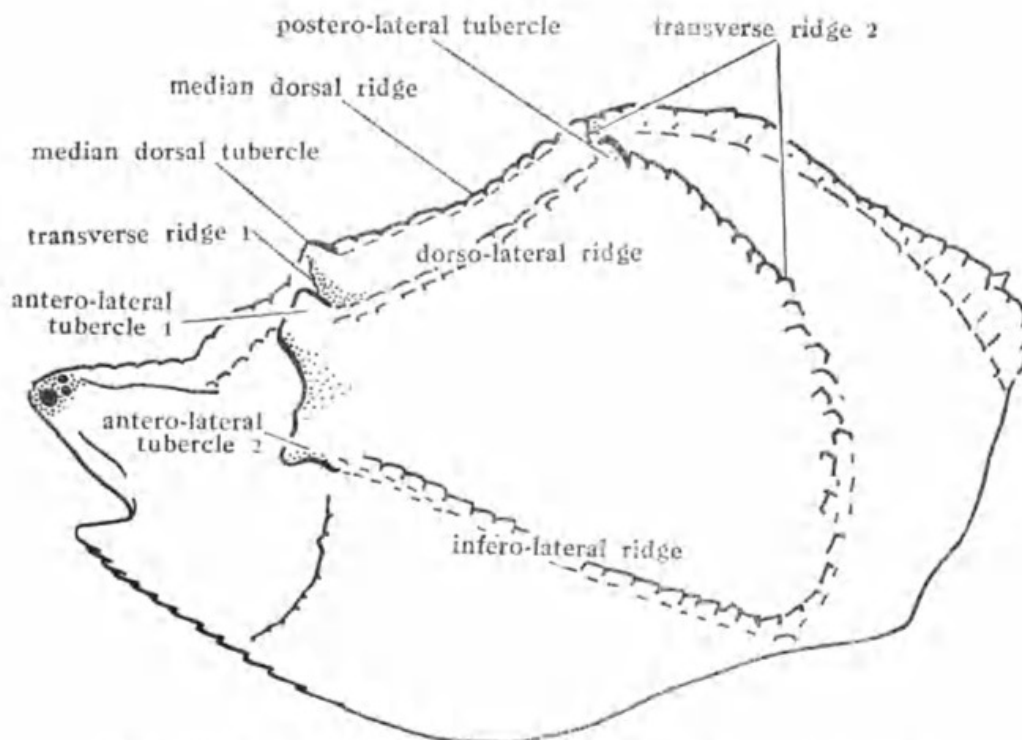


Fig. 2. Ridges and tubercles of carapace of *Cyclaspis tribulis* juvenile.

Superimposed, as it were, on the fine network, there may be a much larger secondary reticulation formed by a denser calcification of the edges of rather deep pits. This produces the honeycomb-like effect referred to by Zimmer in describing *bicornis* (1921a, p. 127, fig. 22); it is well-marked in some members of the *exsculpta* group and is illustrated herein for *mawsonae* (fig. 40). The edges of the secondary reticulation may be placed end to end so as to play a part in emphasizing true carinae (*mawsonae*) or pseudo-carinae (*bicornis*).

The ridge most commonly present is that running along the mid-dorsal line; it is very rarely absent, but may be faint, particularly on the posterior half. Alongside the anterior half of it there is often a more or less distinct shallow depression

on each side. When these depressions are fairly pronounced, their hinder end is marked by a slight emargination of the dorsal outline and their lateral limits form a fold running from the middle of the length of the carapace to the posterior ends of the pseudorostral sutures, then approximately along the curve of the latter. The smooth appearance of the species in Section 1 of the key is scarcely, if at all, affected by these slight folds, and they are not to be confused with the true lateral ridges found in many forms of Section 2.

Again, in some species of Section 1, the edge of the short shallow gutter often present back of the antennal notch may be slightly emphasized to form the so-called antennal "ridge"; this is faint, but can be discerned by rotating the stage so as to vary the lighting.

The development of antero-lateral tubercles, one below the other, is a common but not universal feature in Section 2; there may also be one or (rarely) two postero-lateral elevations on each side. Both antero-lateral and postero-lateral tubercles may be crossed by carinae (into which they merge) or only one such ridge may be present; these transverse carinae may continue across the back (*exsculpta*, *persculpta*, *tribulis*, *australis*, etc.).

Recognition of the basic arrangement of the ridges and tubercles in the *exsculpta* group may present difficulties in some cases, unless juveniles as well as adults of both sexes are studied, a consummation devoutly to be desired but rarely possible. In the young of *tribulis*, for instance, all the ridges enclosing the depressed quadrilateral area on the side of the carapace are distinct, although the tubercles are small. The juvenile is used in fig. 2 to illustrate the plan of sculpture and the terminology.

The pair of small depressions, sometimes deep pits, at the base of the frontal lobe, have been referred to by Zimmer.

Elevation of the *mid-line* of the dorsum to form teeth is rare; it occurs in *unicornis* Calman, *bicornis* Zimmer, and *uniplicata* Calman.

Pedigerous somites. The exposure or concealment of the first somite seems to be of no special taxonomic import, nor do the marginal plumose hairs which Zimmer comments upon. The shape of the somites and their carinae are best described by illustrations, as is also the often distinctive contour of the dorsum of the second somite.

Pleon. The abdomen is fairly uniform in structure. It may be unusually long (*sibogae*, *cana*) or short (*gibba*); robust (male of some species, see for instance *sheardi*) or slender and flexible (*pinguis*). Articular pegs are usually, if not always, present but may be so inconspicuous that they are detected with some difficulty.

Peraeopods. Although the thoracic appendages exhibit no gross variation, the proportions of the joints are constant in adult or almost adult specimens of a species and there are other features worthy of note.

The terminology used in the present descriptions should be mentioned here. While recognizing its reasonableness, I have not adopted Hansen's nomenclature, but in order to avoid confusion and to facilitate comparison with earlier diagnoses have adhered as previously to the widely used coxa, basis, ischium, merus, carpus, propodus and dactylus for the joints 1 to 7 of Stebbing, etc. In Hansen's interpretation of the limb joints as found in most Peracarida, ischium, as here used, = *preischium*; merus = *ischium*; carpus = *merus*; and propodus = *carpo-propodus*. It might perhaps be simpler to follow Stebbing's practice, but there again, his second joint equals Hansen's third, and so on.

The inner apical "angle" of the basis of the first peraeopod is in some species produced to form a subtriangular tooth-like process which may be comparatively pronounced (see *strigilis*, *cretata*, *granulosa*, *formosae*, *herdmani*, *hornelli*, etc. Almost always a long plumose seta is present at the external apical angle of this

joint and sometimes there is a shorter second apical seta, well separated from the first.

The second peraeopods are remarkably uniform in structure; the proportions of the joints vary little, but the relative lengths of the spines, particularly those of the distal end of the dactylus, are useful.

The third to fifth peraeopods, judging from the available specimens, and from reference to published figures, are similar in many of the species. Nevertheless, in the proportions of the joints and the number and length of the setae, they sometimes prove an aid in separating closely allied forms but do not conform in the groupings governed by the structure of the carapace. For instance, *tribulis*, a highly sculptured member of the *exsculpta* section, has posterior peraeopods similar to those of *mjobergi* (fig. 3, K), a "smooth" species. On the other hand, *globosa* and *pinguis* fall naturally together, but their posterior thoracic appendages are considerably different (cf. fig. 3, E and J).

Zimmer (1933, p. 334, fig. 2) described in detail the fifth peraeopod of *Diasstylis rathkei*, drawing attention to the fact that the spines (or setae) of the carpus, propodus and dactylus of the posterior legs constitute a sort of digging scoop or rake (see also Foxon, 1936, p. 382, and Hale, 1943, pp. 341 and 342).

The following notes concerning the posterior peraeopods in *Cyclaspis* are based on the examination of twenty-nine Australian species which are available for study. Setae are usually present on the six distal segments of these limbs. In *globosa*, for instance (fig. 3, A), the inner face of the basis is provided with plumose bristles; the ischium bears two strong subapical setae, the merus has one; there is a fan of distal setae, approximating in number and length to those of the ischium, at the outer angle of the carpus and in this case an isolated seta on the outer margin; a single seta is articulated at the outer angle of the propodus, alongside the base of the dactylus, which has a small inner seta.

Other insignificant setae may be present; for instance, there is often a tiny bristle at the inner side of the longest carpal seta, and there may be one on the outside of the dactylus. The terminal joints of the posterior legs of thirteen Australian species are shown in fig. 3.

The propodal seta is always single, curved in the same direction as the dactylus and, except in *simula* (fig. 3, B), it is stout and reaches at least almost to the tip of the limb, sometimes far beyond it. The pronged fork formed by this seta and the dactylus is supplemented (again excepting *simula*) by a long seta at the outer distal angle of the carpus; this is as stout as the propodal seta and extends to about the level of the tip of the last-named; close to this are seated one to four thinner setae (successively decreasing in length and diameter if more than one is present); a few more widely separated setae may be present on the outer and sometimes inner margin also of the carpus (fig. 3, J, K, N).

These "fossorial" setae, and apparently always those of the ischium and merus also, are flexible, particularly in the distal half or third, where they are sometimes curled in preserved material (fig. 3, N). In the terminal half or third, the seta exhibits a slight narrowing and thence to the tip its chitin shows a distinct spiral structure (fig. 3, D¹ and E¹).

C. simula (fig. 3, B) constitutes a type apart in that the sole armature of the limb is an unusually feeble propodal spine and a short plumose seta on the basis; the species is known from a single subadult male.

Of the other available Australian species, *pruinosa*, *spilotes*, *pinguis*, *cretata*, *cana*, *caprella*, *gibba*, *sheardi*, *cottoni*, *strigilis*, *concinna*, *clarki*, and *granulosa* have only two carpal setae. In most of these the longest carpal seta and the propodal seta reach only to about the level of the tip of the dactylus, while the second carpal seta is rather feeble (fig. 3, C and D), or is not much more than half as long as the stouter one (fig. 3, E and F). On the other hand, the propodal

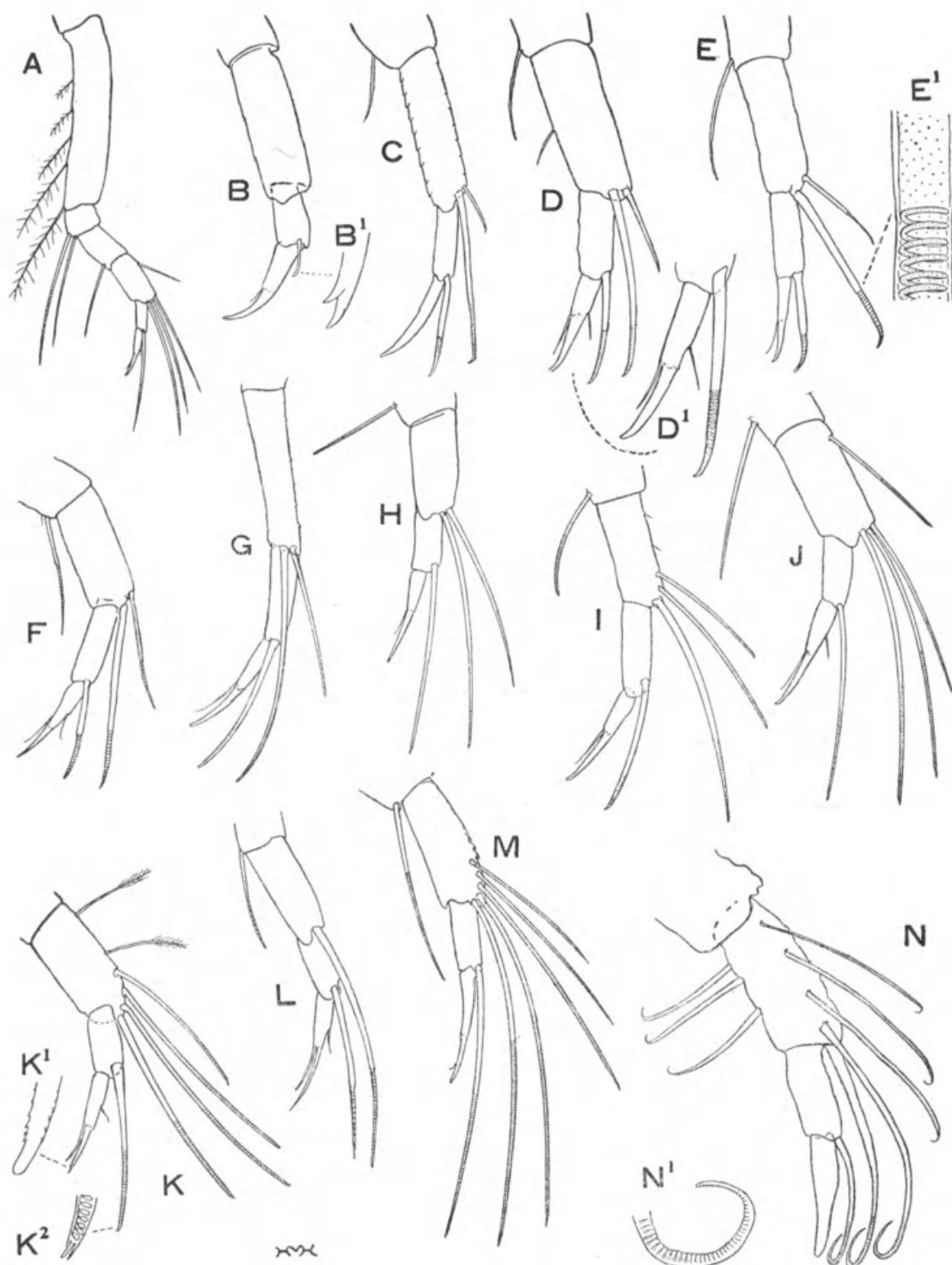


Fig. 3. Fourth peraeopods of *Cyclops* spp.; A, the whole limb; B to N, carpus, propodus and dactylus. A, *globosa*; B, *simula*; B¹, apex of propodal seta. C, *pruinosa*; D, *spilotes*; D¹, dactylus and propodal seta. E, *pinguis*; E¹, seta at junction of flexible and proximal portions. F, *cretata*. G, *cana*. H, *caprella*. I, *aspera*. J, *globosa*. K, *mjobergi*; K¹, tip of dactylus; K², tip of seta. L, *tribulis*, 2.7 mm. juvenile. M, *lucida*. N, *bovis*; N¹, apical portion of seta (A, $\times 52$; B, E, F, H, J, L, M and N, $\times 145$; C, $\times 110$; D, G, I and K, $\times 95$; B¹, $\times 725$; E¹ $\times 1,150$; K¹, K² and N¹, $\times 400$).

seta and longest carpal seta reach well beyond the tip of the dactylus in *cana* (fig. 3, G); *caprella* (fig. 3, H), and *coltoni* (fig. 35, F), while the second carpal seta is much more than half as long as the main one.

C. munda, *fulgida*, *australis*, *mawsonae*, *aspera*, *globosa*, *nitida* and *usitata* have three carpal setae; the longest reach to the tip of the dactylus in the first five species (as in fig. 3, I), but the propodal and two of the carpal setae are relatively much longer in *globosa* (fig. 3, A and J), *nitida* (fig. 34, C) and *usitata* (fig. 41, D).

C. mjobergi, *tribulis* and *sabulosa* have long setae; the propodal and three of the four carpal setae here present reach to well beyond the apex of the dactylus (fig. 3, K).

The greatest development of the fossorial setae is found in *molliis* and *lucida* (fig. 3, M), in which they are very long, with five on the carpus. In *bovis* also the setae are long, but are differently arranged (fig. 3, N); there are two setae at the distal outer angle of the carpus, preceded by three on the outer margin; there are also three on the inner face of this joint.

C. pura is a variable species in size and in the character of some of its appendages. The posterior peraeopods have two to three setae at the outer distal angle of the carpus and often one on the outer margin; the longest setae reach to the tip of the dactylus or a little beyond, sometimes well beyond.

A limited number of very juvenile specimens has been examined; it would seem that the setae are as long, or about as long, as in the adult but may be fewer in number. In *tribulis* for instance, the adult posterior legs are much as in fig. 3, K, but the 2.7 mm. juvenile has only one long carpal spine (fig. 3, L). On the other hand, in *usitata*, the setae at 2 mm. are as in the 7 mm. adult.

Uropoda. These appendages are recognized as useful aids to diagnosis by all authors, and with good reason. In mature or almost mature examples they vary very little in the same sex, but caution is necessary in dealing with young specimens.

Where strongly indurated forms are concerned, too much reliance cannot be placed upon the number of plumose setae present; they are brittle in such, and tend to be lost wholly or in part either during the wear and tear of life or after preservation. They are found in full number after ecdysis (fig. 43, E). Serrations and spines of the inner margins persist and their arrangement as well as number is of specific import.

The apices of both rami may be simple and acute, or the tip of the exopod and more rarely of the endopod also, may be narrowly truncate, with one or more articulated spines. Whatever their character, it is constant within a species.

Attention is here directed to minute articulated processes found always in some species of the *levis* group on the apex of the exopod. They appear to be modified or rudimentary spines and the term *mucrones* is here applied to them (see fig. 6, E; 31, C and J; 34, D, etc.). Each mucro is generally leaf-like and as many as three mucrones of unequal size may be present on the ramus. The presence of these mucrones affords real assistance in preliminary sorting of material as, although insignificant in size, when once recognized, they are easily discernible with the binocular at a low magnification. In the highly indurated *exculpta* group, it seems that mucrones may be present in the young but absent in the adult, for instance, *bovis* and *tribulis*; in the last-named, the apex of both endopod and exopod bears a mucro in the shape of a very minute spine, but in the adult the tips of the rami are dilated (exopod) or subacute (cf. fig. 36, H and E). On the other hand, the adult of *aspera* has always two inconspicuous mucrones on the narrowly truncate apex of the exopod (fig. 46, F), and in *sabulosa* there is a flattened mucro on the exopod of the adult (fig. 58, G, and 60, C¹).

KEY TO SPECIES OF *CYCLASPIS*.

SECTION 1.

Sides of carapace without ridges or tubercles in either sex.

Viewed from above the lateral contour of the carapace is always evenly curved or slightly sinuate from posterior margin to front of pseudorostral lobes and it is never abruptly wider across the region of the last-named.

Usually polished and perfectly smooth except for the universal reticulate patterning, but sometimes slightly roughened owing to the presence of granules (*granulosa*, *sheardi*, etc.), or raised edges of reticulations (*clarki*) or many fine striae (*costata* and *strigilis*).

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. A prominent tooth on mid-line of dorsum of carapace 3.
No prominent tooth on mid-line of dorsum of carapace 4.
3. A small median dorsal tooth at base of ocular lobe; rami of uropod slender, with simple apices *bicornis* Zimmer.
No tooth at base of ocular lobe; rami of uropod wide, with articulated apical spines *unicornis* Calman.
4. Pseudorostral lobes meeting for an appreciable distance in front of ocular lobe .. 5.
Pseudorostral lobes barely or not meeting in front of ocular lobe (*levis* group) .. 13.
5. Eye entirely absent 6.
Eye developed, prominently pigmented (*picta* group) 7.
6. Carapace subglobose; pseudorostrum short. Peduncle of uropod shorter than rami *longicaudata* Sars.
Carapace compressed; pseudorostrum long. Peduncle of uropod more than twice as long as rami *carinata* Zimmer.
7. Carapace with a low, median, dorsal projection at posterior end *gibba* sp. nov.
Carapace without median, dorsal projection at posterior end 8.
8. Carapace with many longitudinal rows of minute granules. Peduncle of uropoda not longer than telsonic somite *costata* Calman.
Carapace smooth. Peduncle of uropoda much longer than telsonic somite 9.
9. Both rami of uropod with at least one articulated terminal spine 10.
Both rami of uropod without terminal spine 11.
10. First peraeopod short, with carpus not reaching level of antennal tooth. Rami of uropod barely half as long as peduncle *picta* Calman.
First peraeopod long, with carpus reaching level of antennal tooth. Rami of uropod about two-thirds as long as peduncle *varians* Calman.
11. Peduncle of uropod one and two-third times as long as exopod, which bears a mucro. Carpus of first peraeopod one-third as long again as propodus *lucida* sp. nov.
Peduncle of exopod not or little longer than exopod, which is without mucro. Carpus of first peraeopod not longer than propodus 12.
12. Setae of third to fifth peraeopods long; five on carpus, the longest reaching for nearly half their length beyond tip of dactylus *mollis* sp. nov.
Setae of third to fifth peraeopods short; three on carpus, none reaching beyond tip of dactylus *fulgida* sp. nov.
13. Endopoda of uropoda with apex acute and without articulated terminal spines .. 14.
Endopoda of uropoda with at least one articulated terminal spine 31.
14. Exopoda of uropoda with apex acute and lacking terminal spines or mucrones .. 15.
Exopoda of uropoda with one or more articulated terminal spines or mucrones .. 27.
15. Carapace with numerous fine longitudinal striae *strigilis* sp. nov.
Carapace without longitudinal striae 16.
16. Carapace with a low median dorsal projection at posterior end 17.
Carapace without median dorsal projection at posterior end 18.

17. Carapace with dorsal carina distinct for whole length and with a conspicuous pit on each side alongside posterior median projection. Peduncle of uropod longer than rami *sheardi* sp. nov.
Carapace with dorsal carina obsolete for posterior two-thirds of length; no conspicuous pits at posterior end. Peduncle of uropod shorter than rami .. *mjobergi* Zimmer.
18. Carapace not globose, compressed in the male and young female. Uropods slender, the peduncle longer than telsonic somite 19.
Carapace globose in both sexes. Uropods stout, the peduncle shorter than, or barely as long as, telsonic somite 24.
19. Propodus of first peraeopods almost as long as merus and carpus together .. 20.
Propodus of first peraeopods subequal in length to carpus .. 21.
20. Inner margin of endopod of uropod with a row of setae, followed by seven to eight slender spines (adult male) *levis* Thomson.
Inner margin of endopod of uropod with three to six proximal spines, followed by a row of fifteen to twenty-three shorter spines (both sexes) *cretata* sp. nov.
21. Carapace roughened with fine granules *granulosa* sp. nov.
Carapace not granulate 22.
22. Basis of first peraeopods with a large apical tooth-like projection, reaching to distal margin of ischium. Peduncle of uropod not longer than rami .. 23.
Basis of first peraeopods without large apical tooth. Peduncle of uropod longer than rami *concinna* sp. nov.
23. Rami of uropod longer than peduncle (subadult female) .. *formosae* Zimmer.
Rami of uropod equal in length to peduncle (ovigerous female) .. *herdmani* Calman
24. Size small, ovigerous female 3.5 mm. Ocular lobe dilated anteriorly, with prominent circular dark lenses *pusilla* Sars.
Size large, ovigerous female 7 mm. or more. Ocular lobe not dilated anteriorly but somewhat triangular, with lenses pale and elongate 25.
25. Carapace overhanging second pedigerous somite posteriorly. Third to fifth peraeopods with long setae (fig. 3, A and J) *globosa* sp. nov.
Carapace not overhanging second pedigerous somite. Third to fifth peraeopods with short setae (fig. 3, E) 26.
26. Carapace coarsely pitted, slightly rugose. Pleon robust. Dactylus of second peraeopods with longest terminal spine shorter than propodus and dactylus together and with the two remaining apical spines subequal *clarki* sp. nov.
Carapace smooth. Pleon slender. Dactylus of second peraeopods with longest terminal spine as long as propodus and dactylus together, and with the two remaining apical spines unequal *pinguis* sp. nov.
27. Exopoda of uropods with one or more mucrones 28.
Exopoda of uropods with one or more spines 29.
28. Peduncle of uropod at most half as long again as rami (adult male) .. *pura* Hale.
Peduncle of uropod two-thirds as long again as rami (adult male) .. *nitida* sp. nov.
29. Basis of first peraeopods only three-fourths as long as rest of limb and with an apical tooth, reaching distal margin of ischium *hornelli* Calman.
Basis of first peraeopods subequal in length to rest of limb, with apical tooth short or absent 30.
30. First peraeopods with propodus longer than carpus which is subequal in length to dactylus; no tooth at apex of basis (= *levis* Calman, *nec* Thomson) .. *calmani* sp. nov.
First peraeopods with propodus subequal in length to carpus which is much longer than dactylus; a short tooth at apex of basis, reaching middle of length of ischium *cottoni* Hale.
31. First peraeopods unusually long and slender, the basis not much more than half as long as rest of limb *longipes* Calman.
First peraeopod short, the basis distinctly longer than rest of limb *nubila* Zimmer.

SECTION 2.

Sides of carapace never smooth, but with ridges or tubercles, or both.

Viewed from above the lateral contour of the carapace, owing to the sculpture, is rarely evenly curved, particularly in the female; when antero-lateral tubercles are developed it is often abruptly widest across the hinder part of the pseudorostral lobes in the male.

1. Carapace encircled by a collar-like ridge *cingulata* Calman.
Carapace not encircled by a collar-like ridge 2.
2. Sides of carapace never almost smooth, with at least one tumidity (antero-lateral tubercle) or obtuse tooth-like projection below pseudorostral suture 3.
Sides of carapace almost smooth, with no tumidity or other projection below pseudorostral suture 24.
3. A depressed quadrilateral area on each side of carapace in at least female, the edges defined by ridges or the corners marked by prominent projections (*exsculpta* group) .. 4.
No depressed quadrilateral area on side of carapace 15.
4. Carapace with two transverse ridges on back in female; the first connects the upper antero-lateral tubercles of each side and the posterior one may be absent in the male .. 5.
Carapace with one transverse ridge (crossing back in posterior half), or none .. 12.
5. With a post-ocular tubercle on mid-line of carapace, immediately in front of first transverse carina *tribulis* Hale.
No post-ocular tubercle on mid-line of carapace 6.
6. Carapace with antero-lateral tubercle large, elevated and tooth-like; posterior transverse carina produced on each side of back, forming a pair of conspicuous teeth .. 7.
Carapace with antero-lateral tubercle and posterior transverse carina not elevated to form large teeth 8.
7. Peduncle of uropod subequal in length to rami (subadult female) *persculpta* Calman.
Peduncle of uropod much longer than rami, more than twice as long in subadult female *bovis* Hale.
8. Carapace with ridges swollen; dorso-lateral carinae as well as median carina on posterior part projecting slightly beyond hinder margin as three tubercles 9.
Carapace with ridges not swollen; no dorso-lateral carinae on posterior part, so that only one tubercle (median) occurs at hind margin 10.
9. Estimated length, subadult female, under 5 mm.; a short ridge running forward from lower antero-lateral tubercle *exsculpta* Sars.
Length, subadult female, 10 mm.; no ridge running forward from lower antero-lateral tubercle *supersculpta* Zimmer.
10. With a longitudinal ridge from below antennal tooth almost to end of carapace (male) *mawsonae* sp. nov.
With no such ridge 11.
11. Mid-dorsal projection at hinder end of the slender carapace feeble; ridges feeble, the second transverse carina widely interrupted on back. Dorsal margin of second pedigerous somite oblique *candida* Zimmer.
Mid-dorsal projection at hinder end of rotund carapace large; ridges well defined, the second transverse carina not widely interrupted on back. Dorsal margin of second pedigerous somite elevated *usitata* Hale.
12. Cephalothorax and pleon covered with small spines; no ridges on back or sides of carapace *aspera* sp. nov.
Cephalothorax and pleon not covered with small spines; well-defined ridges on sides of carapace 13.
13. A transverse carina across posterior part of back *australis* Sars.
No transverse carinae on back 14.
14. Quadrangular area on side of carapace with four prominent tubercles *elegans* Calman.
Quadrangular area on side of carapace with one or two prominent tubercles *similis* Calman.
15. Sides of carapace with tubercles or ridges posterior to the one or two antero-lateral tubercles 16.
Sides of carapace without elevation posterior to the antero-lateral tubercles .. 23.
16. Side of carapace with three obliquely transverse carinae 17.
Side of carapace with one transverse curved carina or none 18.
17. Carapace unusually small, less than half as long as pleon in female, and without mid-dorsal projection at hinder margin *sibogae* Calman.
Carapace more than half as long as pleon and with a mid-dorsal projection at hinder margin *triplicata* Calman.
18. With a longitudinal ridge from antennal tooth to about middle of length of carapace .. 19.
With no long ridge running back from antennal tooth 20.
19. Dorsum of carapace, as seen from side, rising abruptly to an obtusely angular peak at middle of length *simula* sp. nov.
Dorsum of carapace smoothly rounded *coelebs* Calman.

20. Side of carapace with a curved, swollen ridge on posterior portion .. 21.
Side of carapace with a tubercle, but no ridge, on posterior portion .. 22.
21. Eye lenses absent .. *glacialis* Hansen.
Eye lenses present (? = *glacialis*) .. *gigas* Zimmer.
22. Carapace subcylindrical, less than half as long as pleon and with two antero-lateral tubercles and a tubercle at termination of pseudorostral suture (male) .. *cana* sp. nov.
Carapace subglobose, half as long as pleon with one antero-lateral tubercle and no tubercle at end of pseudorostral suture (male) .. *quadrilobulata* Zimmer.
23. Eye lobe as wide as long. First peraeopod slender, with basis considerably longer than rest of limb, and dactylus about as long as carpus .. *munda* sp. nov.
Eye lobe narrow, much longer than wide. First peraeopod not slender, with basis equal in length to rest of limb and dactylus less than half as long as carpus .. *pruinosa* sp. nov.
24. Eye lenses absent and carapace globose with one short ridge on each side. Peduncle of uropod stout, not half as long as telsonic somite .. *spectabilis* Zimmer.
Eye lenses prominent and carapace compressed with one or two fine or faint ridges on each side. Peduncle of uropod elongate, as long or longer than telsonic somite .. 25.
25. Carapace with a prominent mid-dorsal tooth over base of eye-lobe .. *uniplicata* Calman.
Carapace with no dorsal tooth .. 26.
26. A slight but obvious incision in dorsal margin of carapace at middle of length. Exopod of uropod with no apical spine, but with mucro .. *sabulosa* sp. nov.
No incision in dorsal margin of carapace at middle of length. Exopod of uropod with slender apical spine .. 27.
27. With one ridge on each side of carapace. Propodus of first peraeopods much longer than dactylus .. 28.
With two ridges on each side of carapace. Propodus of first peraeopods sub-equal to dactylus .. *argus* Zimmer.
28. Side ridge of carapace faint, short and transverse, confined to posterior half of carapace .. *thomsoni* Calman.
Side ridge of carapace fine but distinct, curving obliquely forwards from middle of length of dorsal carina almost to inferior margin .. *spilotes* Hale.

SECTION 1.

Carapace with an anterior, lateral horn on each side.

Cyclaspis caprella Hale.

Cyclaspis caprella Hale, 1936, p. 395, fig. 1-2.

Unique because of the forwardly directed acute horns at the front of the carapace, a feature not found in any other member of the genus *Cyclaspis*. The pair of dorso-lateral elevations on each of the last two pedigerous somites and first pleon somite are also distinctive.

Males and subadult females, taken by townet and submarine light, are in hand from several localities in Spencer Gulf, where the type male was secured.

In the adult male, as viewed from the side, the dorsal portion of the anterior margin of the second pedigerous somite forms an open V with the upper part of the hinder edge of the carapace; the dorso-lateral "tubercles" of the fourth and fifth pedigerous somites are acutely triangular and tooth-like; the pair on the first pleon somite are obtuse (misprint "obscure" in original description) and subtriangular.

Subadult males and females have only a very small V-shaped dorsal incision between the carapace and the second pedigerous somite; the dorso-lateral elevations of the last two pedigerous somites are less acute and those of the first pleon somite are quite different, having the form of slender, acute, procurved and divergent thorns.

The exopod of the uropod bears two slender apical mucrones of almost equal length.

picta group.

Carapace moderately compressed with back rather rounded and median carina faint, particularly on posterior half; pseudorostral lobes meeting for an appreciable distance in front of the large ocular lobe and rather narrowly truncate anteriorly.

Apices of both rami of uropods simple, or both with spines, or exopods with mucrones.

The carapace is inclined towards the subglobose in the female of *costata*, *picta* and the four Australian species.

CYCLASPIS GIBBA sp. nov.

Ovigerous female. Integument smooth, finely reticulate and having the appearance of very shallow pitting; thin and not calcified.

Carapace relatively large, more than one-third of total length of animal; greatest width, which is in posterior half, is equal to the depth and two-thirds of

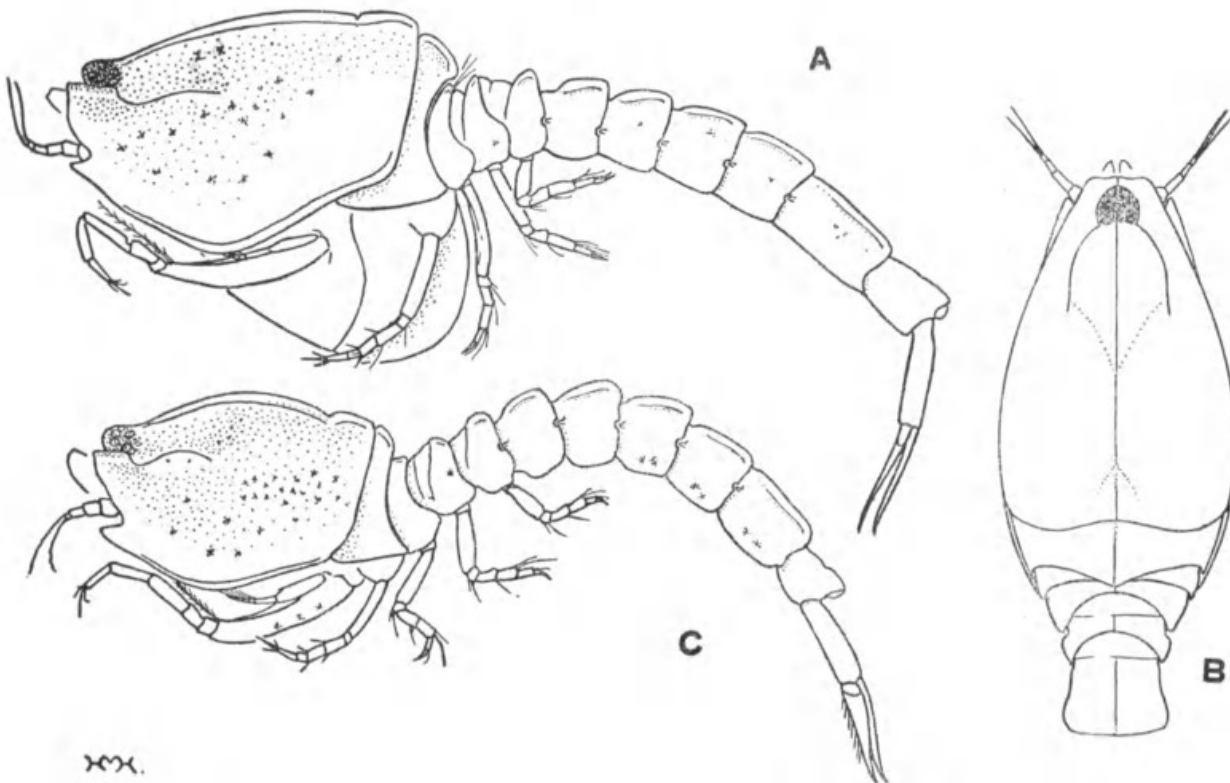


Fig. 4. *Cyclaspis gibba*, type female; A, lateral view and B, cephalothorax from above. C, Lateral view of paratype subadult female ($\times 32$).

length; dorsum with a sharp, longitudinal median carina, emarginate at about five-sixths of length and slightly more markedly elevated posterior to the incision; there is a faint depression on each side of the anterior half of the dorsal carina. Antennal notch large and wide, and antennal tooth subacute. Pseudorostral lobes meeting in front for a short distance (about one-fourth of length of ocular lobe). The ocular lobe (as wide as long) is elevated, barely constricted basally, and is strongly pigmented, but with the lenses (apparently nine or so) not distinct; when the animal is viewed from the side the eye is very prominent.

The whole cephalothorax is ovoid when seen from above (fig. 4, B).

Pedigerous somites together half as long as carapace; first wholly concealed; second to fourth with distinct dorsal carina and fifth with feeble dorso-lateral carinae also; second somite overhanging the third in the mid-line and with the dorsal ridge almost crest-like, arched and sloping down from the dorsal outline of carapace.

Pleon (as noted) relatively small; with a distinct median carina, and with feeble dorso-lateral carinae on first to fifth somites; articular pegs small.

First antennae stout and, for *Cyclaspis*, conspicuous; second and third segments of peduncle subequal in length, together longer than the basal joint, and each about as long as the two-jointed flagellum; the jointed terminal appendages are as long as last peduncular and flagellar segments together.

First peraeopod short and stout, the propodus reaching level of antennal tooth; the robust basis is equal in length to the rest of the limb, with the inner apical angle produced and tooth-like, and with an unusually long plumose seta at external apical angle, reaching to distal end of carpus; propodus shorter than carpus (five-sixths as long) and one-fourth as long again as dactylus.

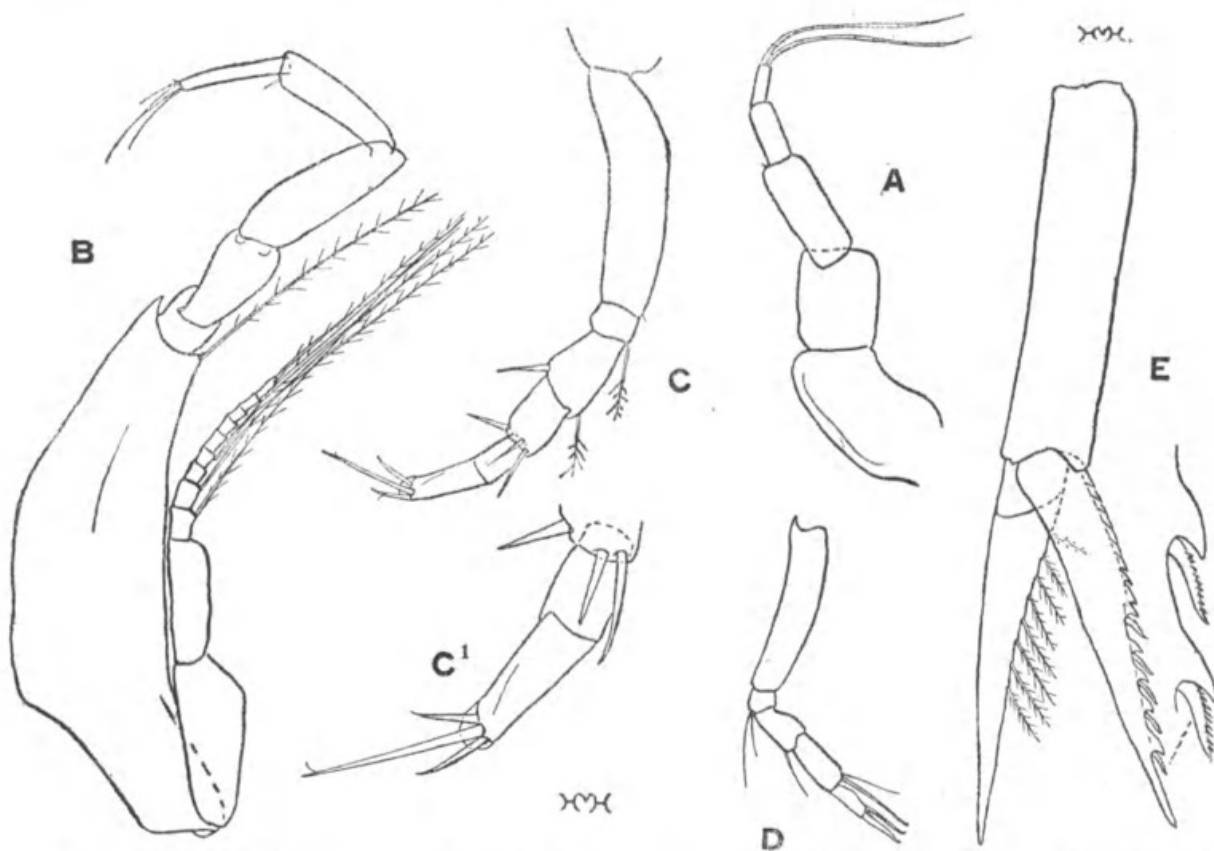


Fig. 5. *Cyclaspis gibba*, type female; A, first antenna; B, C and D, first, second and fourth peraeopods; E, uropod (A and C', $\times 200$; B to E, $\times 100$).

Second peraeopods with basis shorter than rest of limb; ischium with a plumose seta; merus shorter than carpus and propodus together, with a strong apical spine, and at opposite angle a plumose seta; carpus with three spines on distal margin; propodus (unarmed as usual) more than half as long as dactylus, which has at apex a spine longer than itself and two equal spines barely one-half its length.

Fossorial legs with setae sparse and short (fig. 5, D), none reaching beyond tip of dactylus.

Uropods stout; peduncle much longer than the rather short telsonic somite and as long as the rami, which are equal in length, wide, and tapering to simple, acute apices; exopod with eight plumose setae, on the proximal two-thirds of inner margin of second segment; endopod with most of inner margin serrate; the serrations are closed (confluent) on proximal half, but these are followed by five widely open incisions in each of which is seated a serrated, slightly sinuate spine.

Colour: semi-transparent with dark stellate spots.

Length 3 mm.

Subadult female. The differences are best shown by a comparison of fig. 4, A and C. The carapace is a little deeper and wider, the antennal notch is more open, and the fifth pleon somite is shorter than in the adult, while the second thoracic somite is scarcely backwardly produced dorsally.

Length 2.6 mm.

Loc. New South Wales, off Jibbon, 30 fath. (K. Sheard, submarine light, May 1943). Type ovigerous female in South Australian Museum, Reg. No. C. 2415.

This species has a characteristic general facies owing to the emargination, near the hinder margin, of the dorsal edge of the large and robust carapace, the large antennal notch, the prominent ocular lobe, etc.

C. sheardi has a somewhat similar elevation at the hinder end of the carapace but otherwise is so entirely different that it cannot be confused with *gibba*.

CYCLASPIS LUCIDA sp. nov.

Ovigerous female. Like the following species (*mollis*) in structure of carapace, pedigerous somites and pleon, and with the last four pairs of peraeopods similar; the first peraeopods and the uropods, however, distinguish it, while the following comparative details may be noted.

Antennal notch moderately open and tooth subacute (fig. 6, A). First antenna with basal segment of peduncle longer than second and third together, and with third longer than second.

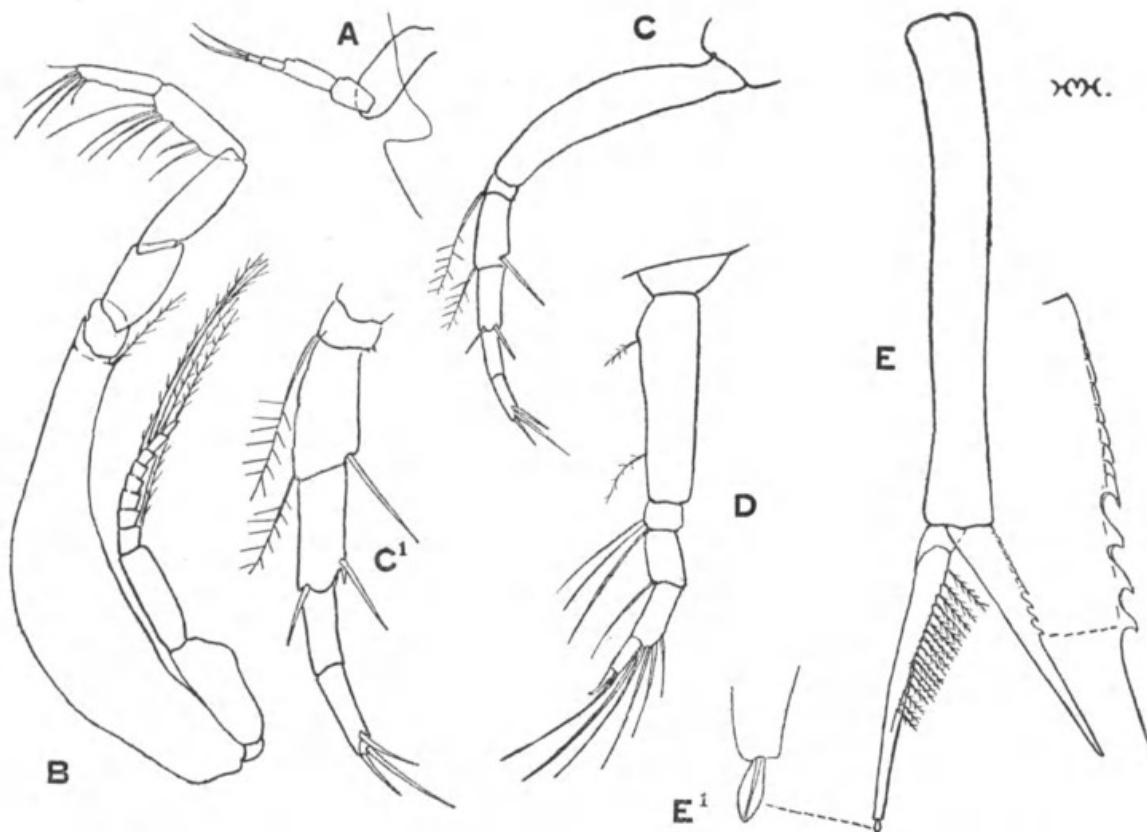


Fig. 6. *Cyclaspis lucida*, type female; A, first antenna and antennal notch; B, C and D, first, second and fourth peraeopods; E, uropod; E¹, muero of exopod of uropod (A to E, $\times 67$; C¹, $\times 134$; E¹, $\times 335$).

Basis of first peraeopods a little longer than rest of limb, the apex with the usual external seta, and with a prominent tooth at inner angle; carpus, propodus and dactylus stout; carpus one-third as long again as propodus and half as long again as dactylus.

Second peraeopods with basis as long as rest of limb; ischium with a plumose seta; merus slightly longer than carpus but shorter than propodus and dactylus together, with a long but feeble inner subapical spine, and an outer apical plumose seta; carpus with two distal spines; propodus and dactylus subequal in length.

Third to fifth peraeopods with long setae (fig. 3, M. and 6, D), those of carpus and propodus reaching well beyond tip of dactylus; carpus of third and fourth with five fossorial setae, those of fifth with four.

Uropods with peduncle one and two-thirds times as long as the exopod, which is one-sixth as long again as the endopod; exopod, with a row of seventeen plumose setae, leaving distal third unfurnished, and with a mucro at apex; endopod without spinules, but with four prominent serrations, preceded by closed incisions, in proximal half of inner edge, posterior to which the branch tapers narrowly to its acute apex.

Colour white, with sparse, sooty chromatophores.

Length, 5 mm.

Loc. New South Wales: Cronulla, 8 feet (K. Sheard, submarine light, Sept. 1942). Type in South Australian Museum, Reg. No. C. 2400.

CYCLASPIS MOLLIS sp. nov.

Ovigerous female. Integument smooth and polished, without pitting or granulation, but with a regular, minute reticulate or squamose patterning; thin and not calcified, so that it bends but does not fracture under pressure.

Carapace with upper margin in lateral view, and sides as seen from above, smoothly and quite markedly curved, without any sign of projections; in dorsal view it is ovoid; length almost two-sevenths of total length of animal; widest at second third of length, where it is two-thirds its length; dorsum with a low carina, which is most distinct on anterior half, where it is flanked by a shallow depression on each side; thence, as it continues back, it is wider but more feeble, terminating before it reaches the hinder margin, which is evenly rounded and in side view slopes obliquely downward and forward. Antennal notch wide, rounded, and antennal angle acutely rounded. Pseudorostral lobes meeting in front for a distance equal to almost half the length of eye-lobe, which is subtriangular in shape not constricted at base, broad (as wide as long) with prominent brown pigment and with large but obscurely defined lenses.

Exposed pedigerous somites together much more than half as long as carapace. First somite only partly concealed, the exposed portion short; second somite longer than third, fourth or fifth somites, with anterior margin parallel to posterior edges of carapace, the dorsum smoothly rounded in side view and continuing the dorsal outline of carapace; second to fifth somites with a feeble median dorsal carina.

Pleon with feeble articular pegs and with a faint median dorsal ridge on each somite; first to fourth somites subequal in length, each only two-thirds as long as fifth; telsonic somite distinctly shorter, not much more than half length of fifth.

First antennae relatively long; first joint of peduncle not quite as long as second and third segments together; third as long as second and less than twice as long as the flagellum, which is two-jointed, the first joint nearly twice as long as second; two short, four-jointed sensory apical appendages (? damaged, fig. 8, A).

Third maxillipeds stout; basis geniculate, less than twice as long as remaining segments together, and expanded externally at apex, the lobe not reaching much beyond level of apex of ischium and with stout plumose setae; merus expanded externally, the apex of lobe attaining level of outer anterior angle of carpus, which is widest and subtruncate apically; carpus longer than dactylus, widest anteriorly, more than half as long as merus or carpus, which are subequal in length.

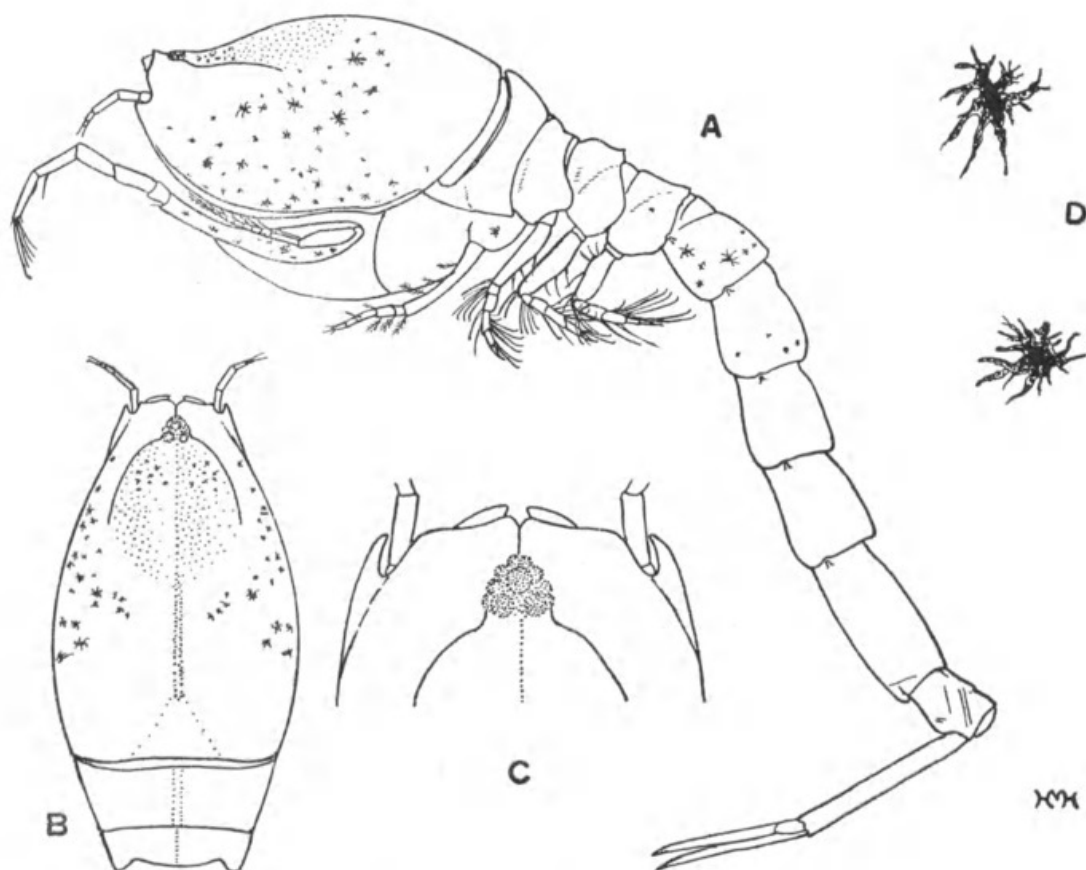


Fig. 7. *Cyclopsis mollis*, type female; A, lateral view; B, carapace and anterior pedigerous somites from above; C, anterior portion of carapace; D, chromatophores (A and B, $\times 19$; C, $\times 45$; D, $\times 120$).

First peraeopods long, merus reaching level of antennal tooth; basis longer than rest of limb, with a plumose seta at outer apical angle and a tiny tooth at inner angle; carpus, propodus and dactylus subequal in length, merus a little shorter; dactylus stout, with several long terminal setae.

Second peraeopods slender, with basis about as long as remaining joints together; merus and carpus of almost equal length, each about as long as propodus and dactylus together; propodus four-fifths as long as dactylus, which has the three apical spines unusually weak, the longest almost as long as dactylus and with tip slightly curved (fig. 8, D); basis, ischium and merus with long, plumose setae but no spines; carpus with a subapical slender spine.

Third to fifth peraeopods richly furnished with long, stout setae (fig. 8, E and F), those of carpus and propodus reaching well beyond apex of dactylus; basis stout, in third and fourth legs as long as rest of limb, in fifth shorter; merus in all three not very markedly shorter than carpus and longer than propodus.

Uropods long, the peduncle longer than fifth pleon somite and about twice

as long as telsonic somite; rami slender, subequal in length, four-fifths as long as peduncle and with apices subacute, rounded; exopod with half a dozen plumose setae on first half of inner margin; endopod with eight serrations, each set with a spinule, at about middle third of inner edge.

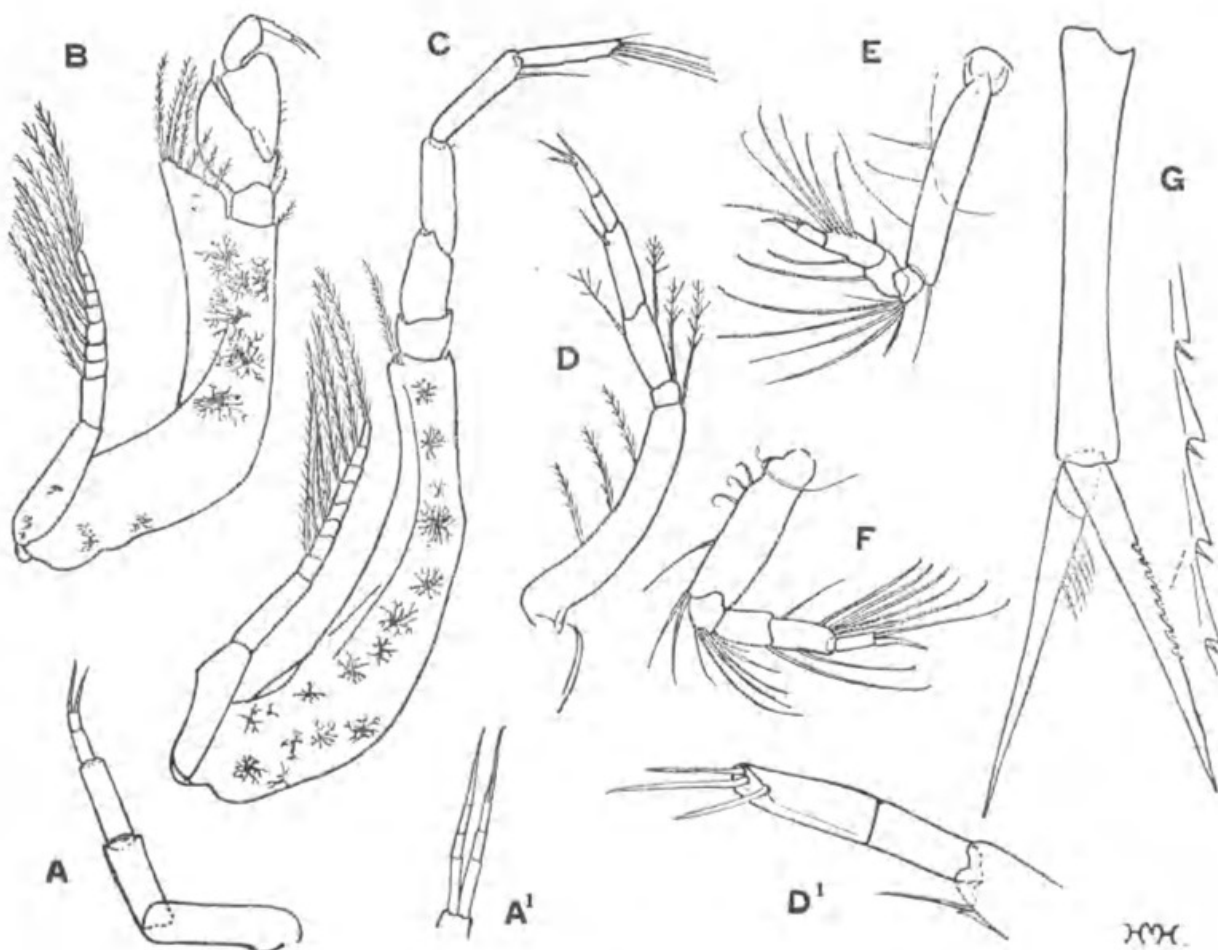


Fig. 8. *Cyclaspis mollis*, type female; A, first antenna and A1, its sensory terminal appendages; B, third maxilliped; C to F, first, second, third and fifth pereopods; D1, terminal joints of second pereopod; G, uropod (A, $\times 67$; A1, $\times 175$; B to G, $\times 40$; D1, $\times 120$).

Colour white, with large and small brown stellate spots as shown in figures. Length 6.6 mm.

Loc. New South Wales: Cronulla, 8 feet (K. Sheard, submarine light, Sept. 1942). Type in South Australian Museum, Reg. No. C. 2399.

CYCLASPIS FULGIDA sp. nov.

Ovigerous female. Integument smooth and polished, with minute, fairly regular reticulate patterning (fig. 9, C), thin and scarcely calcified, but slightly stronger than in *mollis*.

Carapace ovate in dorsal view, with upper edge as seen from the side, and lateral contours from above, evenly and smoothly curved; there is, however, an almost imperceptible emargination in the dorsal outline at about the middle of the length and marking the hinder limit of a shallow lateral depression lying on each side of a low median carina, which continues towards the posterior end

of the carapace as a wider flattened area, giving the appearance of a faint double ridge. The length of the carapace is more than two-sevenths that of the whole animal; twice as long as deep, and widest at middle of length where it is distinctly wider than deep. Antennal notch wide; antennal tooth subacute, with a short, obsolete ridge leading back from it for a short distance. Pseudorostral lobes meeting in front for a distance equal to only about one-fourth of length of ocular lobe. Ocular lobe prominent, elevated, very slightly longer than wide, and not constricted at base; it is darkly pigmented and ten black lenses are developed.

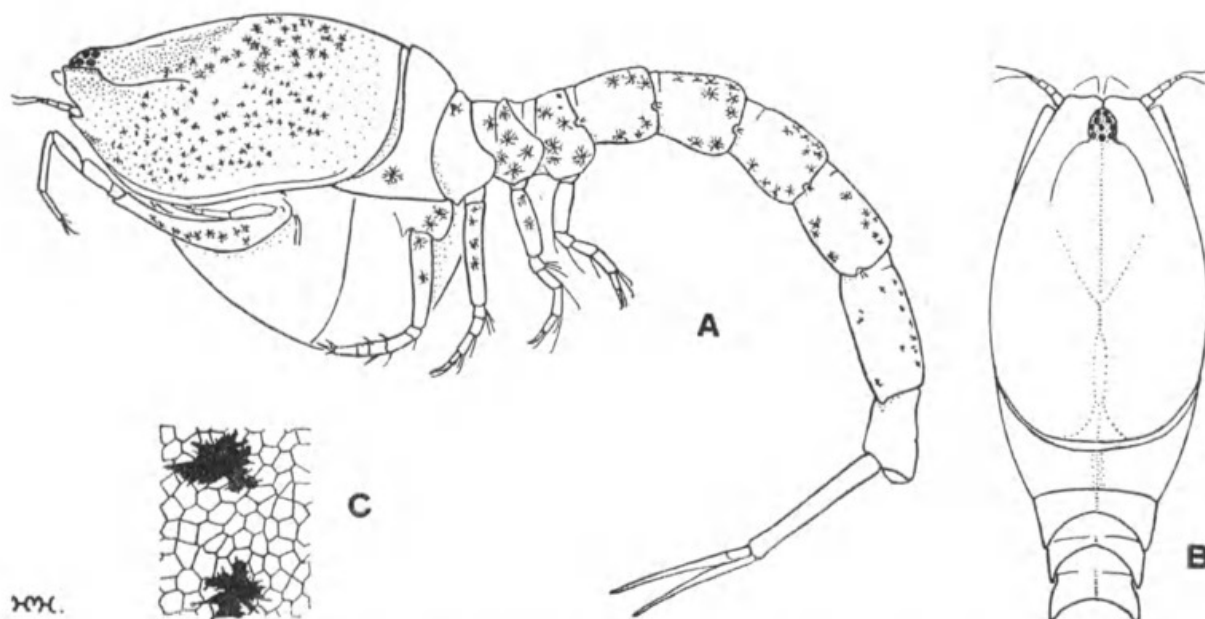


Fig. 9. *Cyclopsis fulgida*, type female; A, lateral view; B, cephalothorax from above; C, reticulate pattern and chromatophores of integument (A and B, $\times 20$; C, $\times 175$).

Five pedigerous somites are exposed; together they are much more than half as long as the carapace; second somite as long as third and fourth together, smoothly tapering, and in side view continuing the even curve of the dorsal margin of the carapace.

Pleon with a faint median carina and with feeble articular pegs; first to fifth somites successively increasing in length, the fifth only one-fourth as long again as the fourth; telsonic somite as long as third, with shallow dorsal notch.

First antennae relatively long; the first segment of the peduncle is as long as the remainder of the appendage; second joint stouter and longer than third, which is as long as the two-jointed flagellum; apical appendages twice as long as flagellum.

First peraeopods with carpus reaching level of antennal tooth; basis equal in length to remaining joints together, with a long plumose seta (reaching beyond apex of merus) at external apical angle, and two projections at inner angle, one being prominent and tooth-like (fig. 10, B¹); carpus, a little shorter than propodus, which is almost one-third as long again as the slender dactylus.

Second peraeopods stout, with basis longer than remaining joints together; ischium with a plumose seta; merus as long as carpus and propodus together, with a spine at inner apical angle and a plumose seta at outer; carpus with two subapical spines, the inner stouter than the outer, and with inner apical angle acutely produced; propodus barely more than half as long as the stout dactylus, which is equal in length to the longest of its strong apical spines.

Fossorial legs with setae short, none reaching beyond end of dactylus; basis longer or as long as rest of limb in third and fourth pairs.

Uropods long, the peduncle half as long again as telsonic somite and equal in length to the subequal rami, which are slender and tapering, with apices simple and acute; proximal half of inner margin of exopod with a row of plumose setae, that of endopod with a series of thirteen small spines, successively increasing in length, and with the last two more widely spaced than the others.

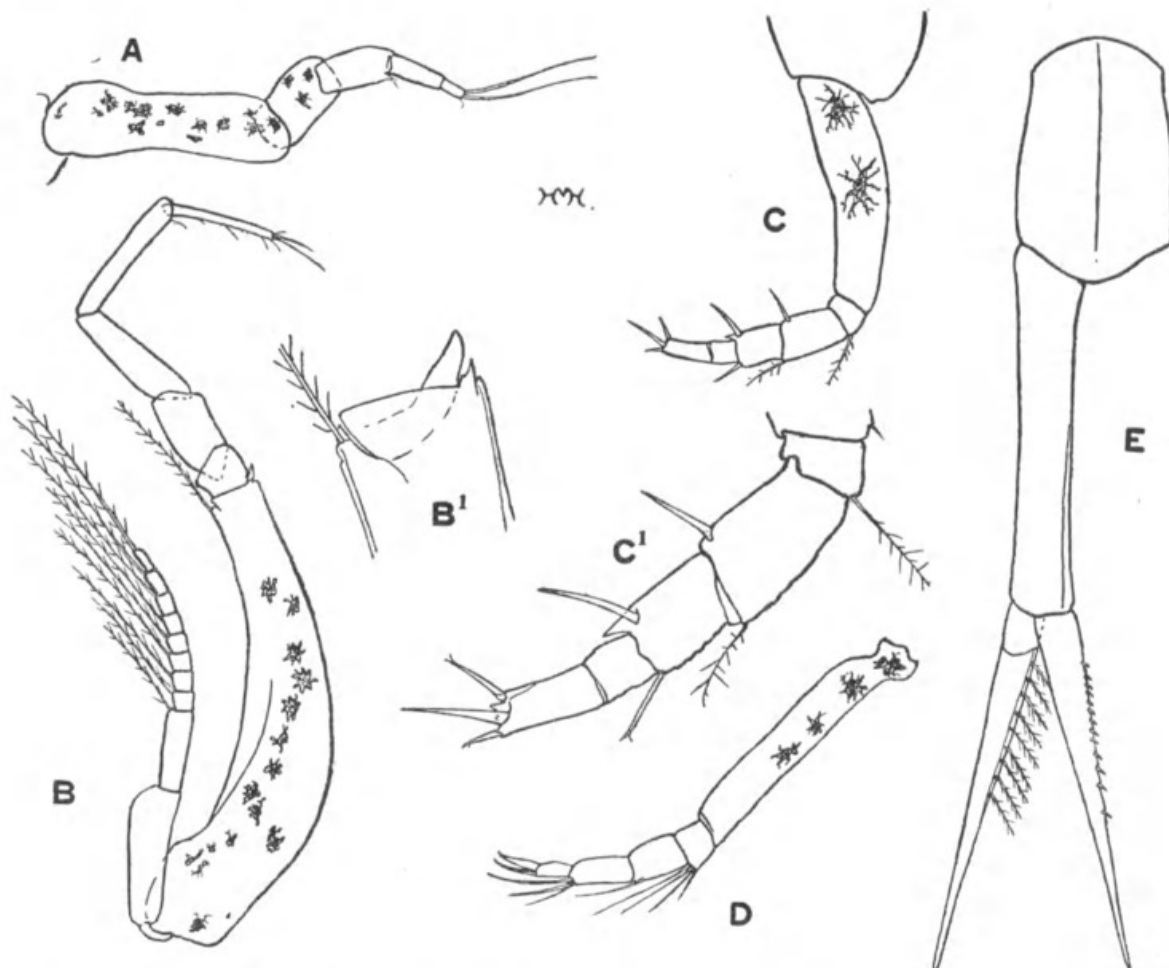


Fig. 10. *Cycloaspis fulgida*, type female; A, first antenna; B, C and D, first, second and third pereopods; B1, distal end of basis of first pereopod; E, telsonic somite and uropod (A, B1 and C1, $\times 110$; B to E, $\times 47$).

Colour white, with a pattern marked out by sooty black chromatophores, as illustrated.

Length 5.75 mm.

Loc. New South Wales: Cronulla, 8 feet (K. Sheard, submarine light, Sept. 1942). Type in South Australian Museum, Reg. No. C. 2424.

This species is rather close to *mollis*, but is readily distinguished by the following characters. The ocular lobe is relatively larger and more prominent and the eye-lenses are distinct (at least when cleared in Euparal); the antennal tooth appears more acute owing to the development of a faint ridge leading back from it. In the shorter basis of the first leg the apical inner tooth is well-developed. The second pereopod is markedly stouter, with an inner apical spine on the merus, and the segments are of different proportions. The fossorial limbs have much shorter setae. The uropods also are distinctive.

levis group (a).

Carapace moderately compressed, the back angularly rounded; pseudorostral lobes barely meeting in front of the large or moderate ocular lobe.

Apices of both rami of uropods simple.

The three "miscellaneous" species assigned here each possess a feature of the carapace not found in any other member of the *levis* group: *strigilis* has fine striae, *sheardi* a conspicuous pit on each side alongside a median, posterior dorsal projection, while in *mjobergi* the dorsal carina is absent for the greater part of its length, although the back is angular.

CYCLASPIS STRIGILIS sp. nov.

Adult male. Integument thin and fragile, shining, with a minute squamose pattern.

Carapace with dorsal edge slightly sinuate, scarcely arched; more than one-fourth of total length of animal and almost twice as long as deep; in dorsal view

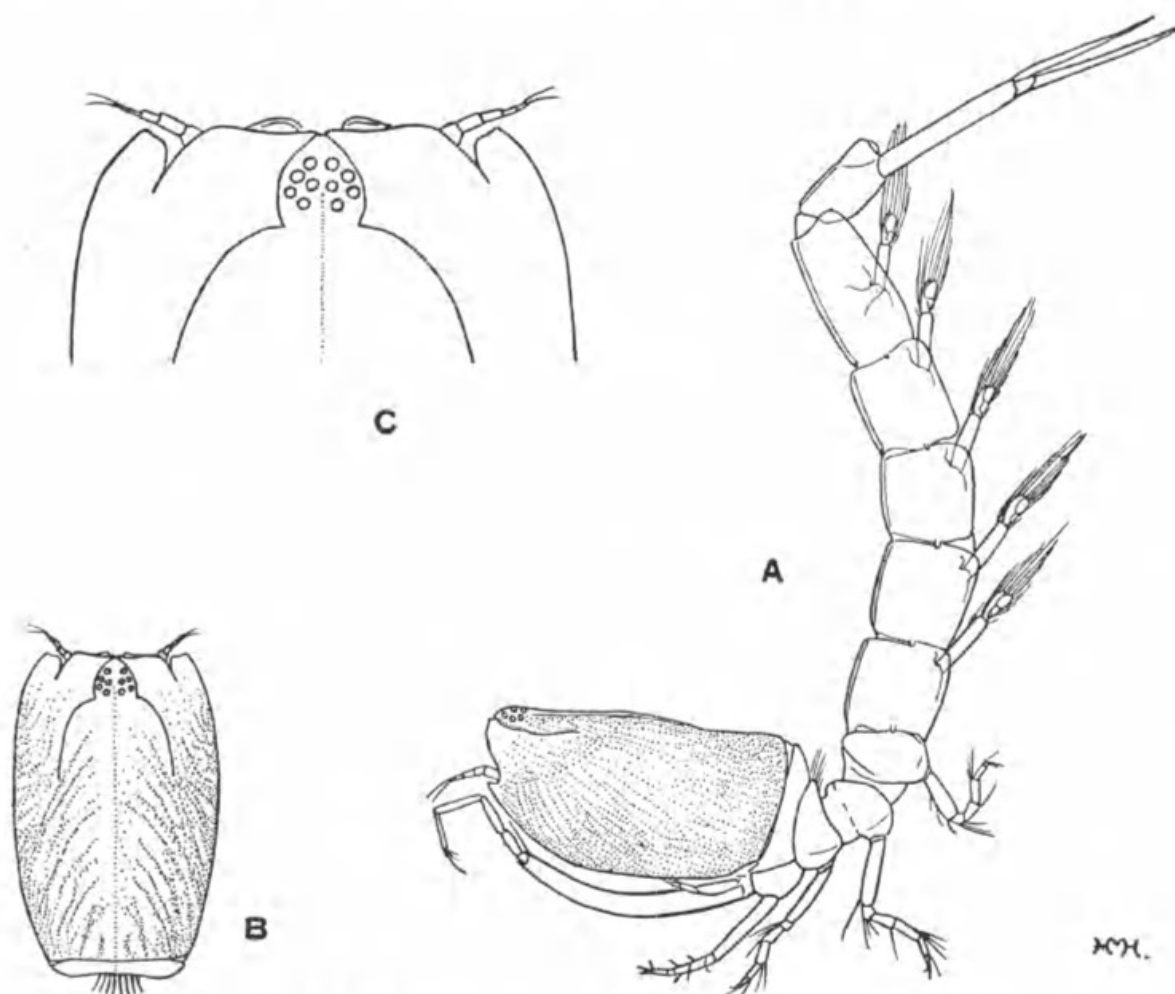


Fig. 11. *Cyclaspis strigilis*, type male; A, lateral view; B, carapace from above; C, anterior portion of carapace (A and B, $\times 25$; C, $\times 60$).

it is barrel-shaped, widest in anterior half, where its breadth is equal to two-thirds its length and is much greater than the depth; dorsum with a fine median carina for whole length, and sides marked with numerous oblique striae. Pseudorostral lobes not meeting in front of eye-lobe. Antennal notch rather wide and tooth distinct. Ocular lobe almost as wide as long, somewhat triangular in shape, and with ten small but distinct lenses.

Exposed pedigerous somites two, four and five with fine median dorsal carina; dorsal portion of third somite very short, sides expanded; second deep, its dorsal margin sloping steeply back from level of upper edge of carapace.

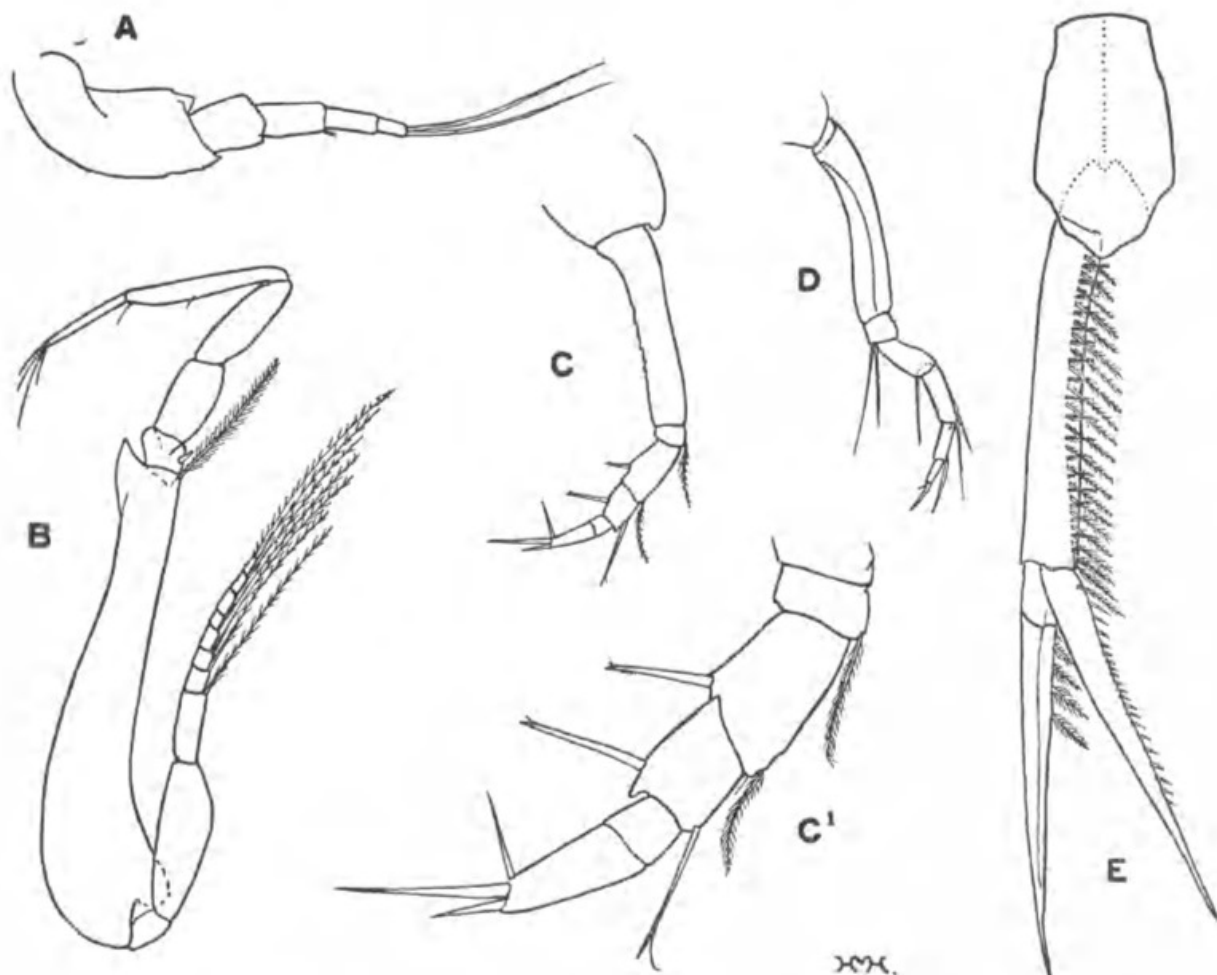


Fig. 12. *Cyclaspis strigilis*, type male; A, first antenna; B, C and D, first, second and third peraeopods; E, telsonic somite and uropod. (A, $\times 130$; B to E, $\times 67$; C', $\times 200$).

Pleon robust, the first to fourth and telsonic somites equal in length; each somite with a fine median dorsal carina that of telsonic somite terminating at anterior end of fused telson; articular pegs small but distinct.

First antennae with accessory flagellum distinct; basal segment about as long as rest of appendage; second and third joints subequal in length, each a little shorter than the two-segmented flagellum.

First peraeopod with carpus reaching to level of antennal angle; basis barely longer than rest of limb, with inner apical angle produced and external angle with a long plumose seta, which reaches well beyond apex of merus; propodus about one-half as long again as either merus, carpus or dactylus, the last three segments not differing much in length; ischium with a short external spine, and longest terminal seta of dactylus as long as the last-named.

Second peraeopod with basis a little longer than rest of limb; ischium with a plumose seta; merus as long as carpus and propodus together, with a plumose seta and a subapical spine; carpus with two subapical spines; propodus less than half as long as dactylus, which is shorter than its longest terminal spine.

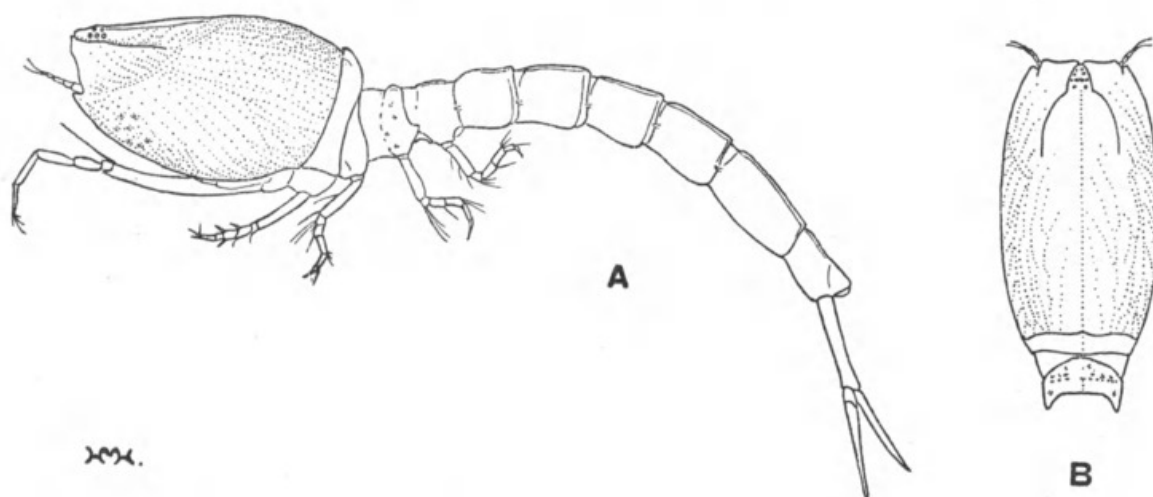


Fig. 13. *Cyclaspis strigilis*, paratype female; A, lateral view; B, carapace and anterior pedigerous somites from above ($\times 25$).

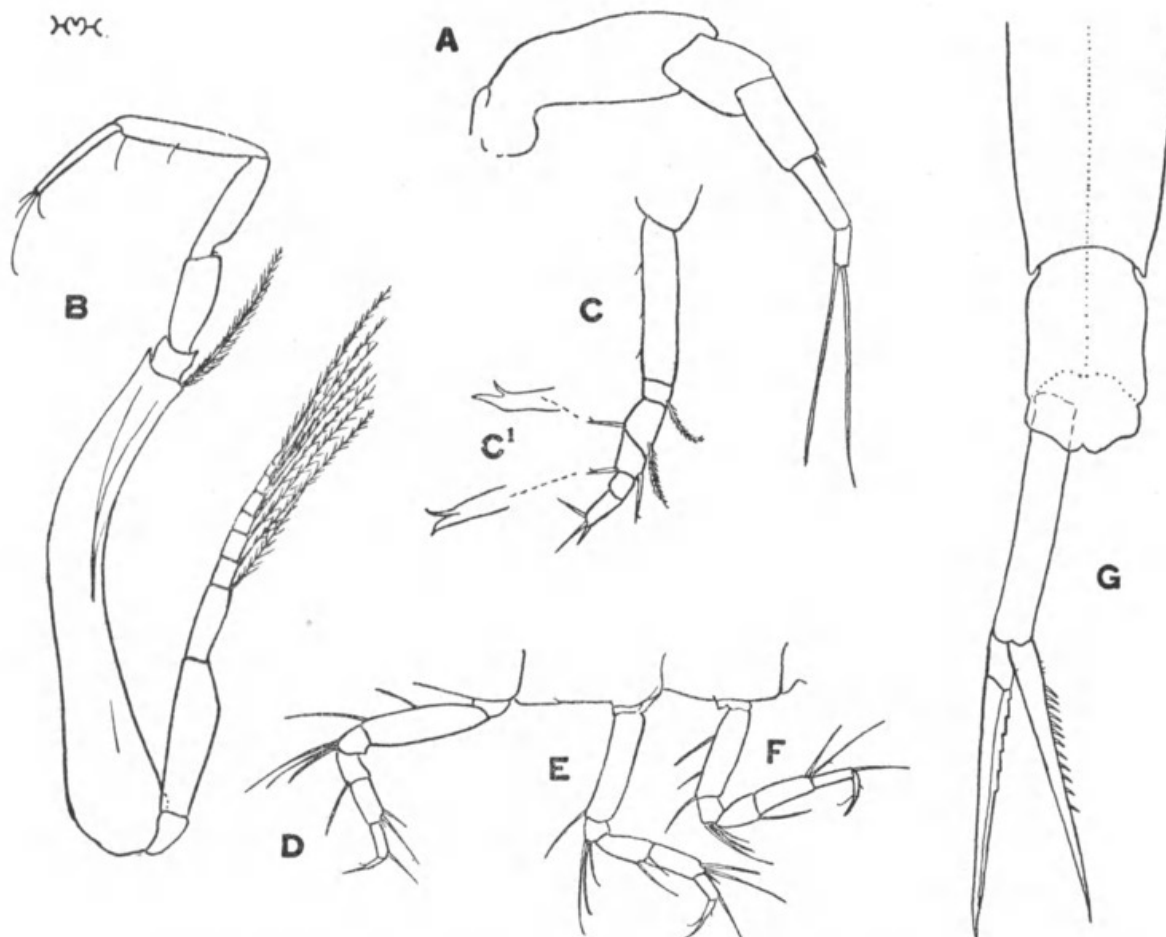


Fig. 14. *Cyclaspis strigilis*, paratype female; A, first antenna; B to F, first to fifth pereopods; G, telsonic somite and uropod (A, $\times 200$; B to G, $\times 67$; C1 $\times 335$).

Basis of fossorial limbs shorter than remaining joints together, and carpus longer than merus; setae as in fig. 3, F.

Peduncle of uropoda half as long again as telsonic somite, its inner margin with a double row of plumose setae, those of one series twice as long as the others;

rami narrow, apically acute; endopod a little shorter than exopod, longer than peduncle, and with twenty finely serrate spines on inner edge; exopod longitudinally excavate interiorly, where the proximal third bears plumose setae, which are a little stouter than those of the peduncle.

Colourless, transparent.

Length, 4.4 mm.

Non-ovigerous female. Carapace almost one-third of total length, with striae, etc. as in male, but with dorsal edge more arched, and with length much less than twice the depth. In dorsal view it is barrel-shaped, widest at middle of length and relatively narrower than in male, the breadth being less than two-thirds the length, and equal to the depth. Thoracic appendages much as in male (fig. 14, D-F).

Peduncle of uropoda less than one-third as long again as telsonic somite, without setae; the narrow, apically acute rami are longer than the peduncle; the endopod has twelve spines on inner edge; exopod with six tiny incisions in inner margin.

Colourless except for a few brown chromatophores on carapace and fourth pereopod somite.

Length 3.6 mm.

Loc. Queensland, off Fraser Island; lat. 24° 20' S.; long. 153° 02' E. ("Warreen," Mar. 1938). Types in South Australian Museum, Reg. No. C. 2412-2413.

The two available specimens have the integument not at all calcified, but this may be due to a recent ecdysis; species taken with them are indurated.

CYCLASPIS SHEARDI sp. nov.

Adult male. Integument calcified, but delicate and brittle; surface finely pitted (reticulate) and with larger granules which, though about four times as wide as the reticulations, are still small and inconspicuous.

Carapace with dorsal edge very slightly arched, elevated in a distinct hump near posterior end, its depth equal to greatest width and more than half its length, which is two-sevenths of total length of animal. Pseudorostral lobes barely meeting in front of ocular lobe and with anterior margins truncate and slightly sinuate; dorsum with a median longitudinal carina, on each side of which, near the posterior end, there is a large pit; the upper edge of each pit is raised and smooth. Ocular lobe large, as wide as long and with nine prominent, darkly pigmented lenses. Antennal notch widely open; antennal tooth subacute; a faint ridge leads back for a short distance from the tooth.

The four exposed pedigerous somites together are more than half as long as carapace and each has a distinct dorsal carina; the second fits intimately against the carapace and its dorsal contour continues the hump of the back, then curves sharply down; third to fifth somites with postero-lateral angles backwardly produced in the form of rounded lobes.

Pleon relatively massive; the first three somites much deeper than the last pedigerous somite; articular processes small but distinct; first to fourth and telsonic somites subequal in length, fifth half as long again as fourth; the groove indicating the fused telson is unusually distinct; there is a distinct dorsal carina for whole length of pleon, terminating at this groove.

First antenna with basal joint of peduncle fully as long as remainder of appendage; second joint stouter than third and subequal to it, and to the two-jointed flagellum, in length; sensory terminal filaments moderately long.

Basis of second maxillipeds half as long again as remaining joints together. Third maxillipeds with basis nearly twice as long as palp and with outer distal merus reaching to level of articulation of carpus and propodus.

First pereopod less than one-fourth as long again as carapace, the carpus reaching slightly beyond level of antennal angle; basis one-fourth longer than remaining joints together, with a long, plumose seta at outer apical angle; only a feeble suggestion of an apical tooth; merus with a small peg-like articular process at distal end; carpus half as long again as merus and barely longer than propodus; dactylus three-fifths length of propodus with two slender terminal setae, and a few insignificant hairs.

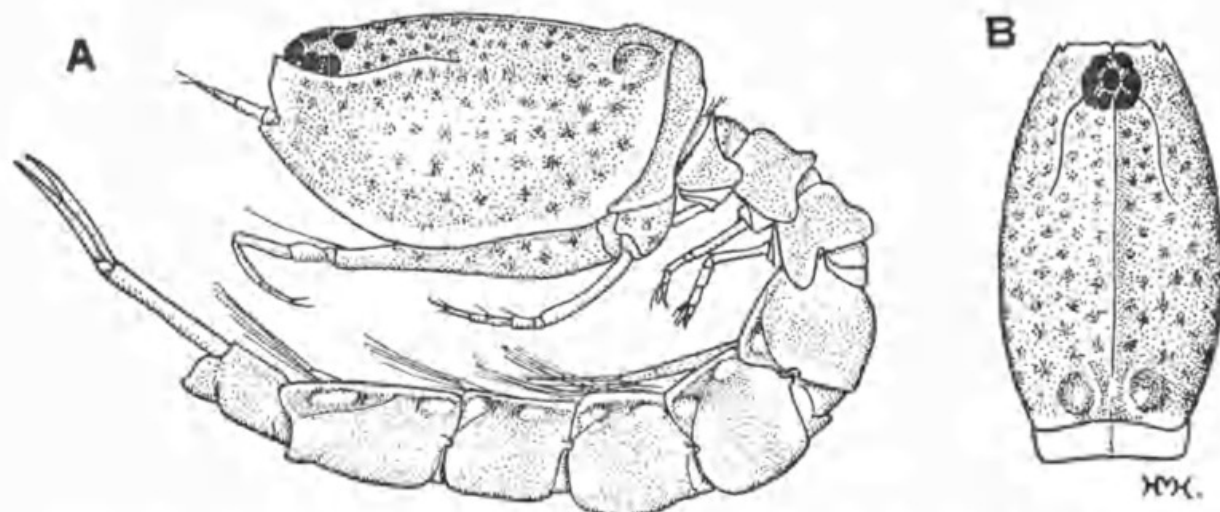


Fig. 15. *Cyclopsis sheardi*, type male; A, lateral view and B, carapace from above ($\times 28$).

Basis of second pereopods not quite as long as remaining joints together; merus unarmed, not as long as carpus and propodus together; carpus barely longer than dactylus, with two unequal spines (one about twice as long as the other) at outer distal angle, and one, shorter, near the inner angle, which is somewhat produced; propodus two-thirds as long as dactylus, which is a little shorter than its longest terminal spine; other two apical dactylar spines short, unequal in length.

Posterior pereopods with two setae at outer distal angle of carpus, the longer not reaching beyond apex of dactylus.

Peduncle of uropods half as long again as telsonic somite, almost as long as fifth pleon somite and about one-fifth as long again as rami; its inner edge bears a row of long plumose setae, the distal few shorter than the others; exopod barely longer and a little narrower than endopod, with a row of plumose setae on inner margin, leaving apical third unfurnished; proximal half of inner margin of endopod occupied by a row of nine serrate spines followed by a series of seven stouter spines set in serrations, which occupy most of the distal half; apices of both rami simple and subacute.

Colour in alcohol, cream with dark brown shading and stellate markings as shown in figure. Pleon with a series of oval transparent areas.

In life the body was "vivid green with sapphire eyes and with prominent pale spots on pleon (tow-net in daylight)."

Length 5.2 mm.

Loc. South Australia: Spencer Gulf, off Wardang Island (K. Sheard, tow-net, Mar, 1938); Spencer Gulf, off Wallaroo, 5 fath. (K. Sheard, Feb. 1938); Spencer Gulf, Page Island, 9 fath., and Kangaroo Island, Antechamber Bay (K. Sheard, 1939); Spencer Gulf, Corny Point (K. Sheard, 1941). Tasmania: off Cape Barren Island (D. L. Serventy, tow-net, Nov. 1939). New South Wales, off Jibbon 40 metres (Cronulla Station 6, July 1943).

At all but two tow-net localities many specimens were attracted by submarine lights; all are males.

Examples taken at night were often, but by no means always, pale or light brown. The dark colour markings are variable.

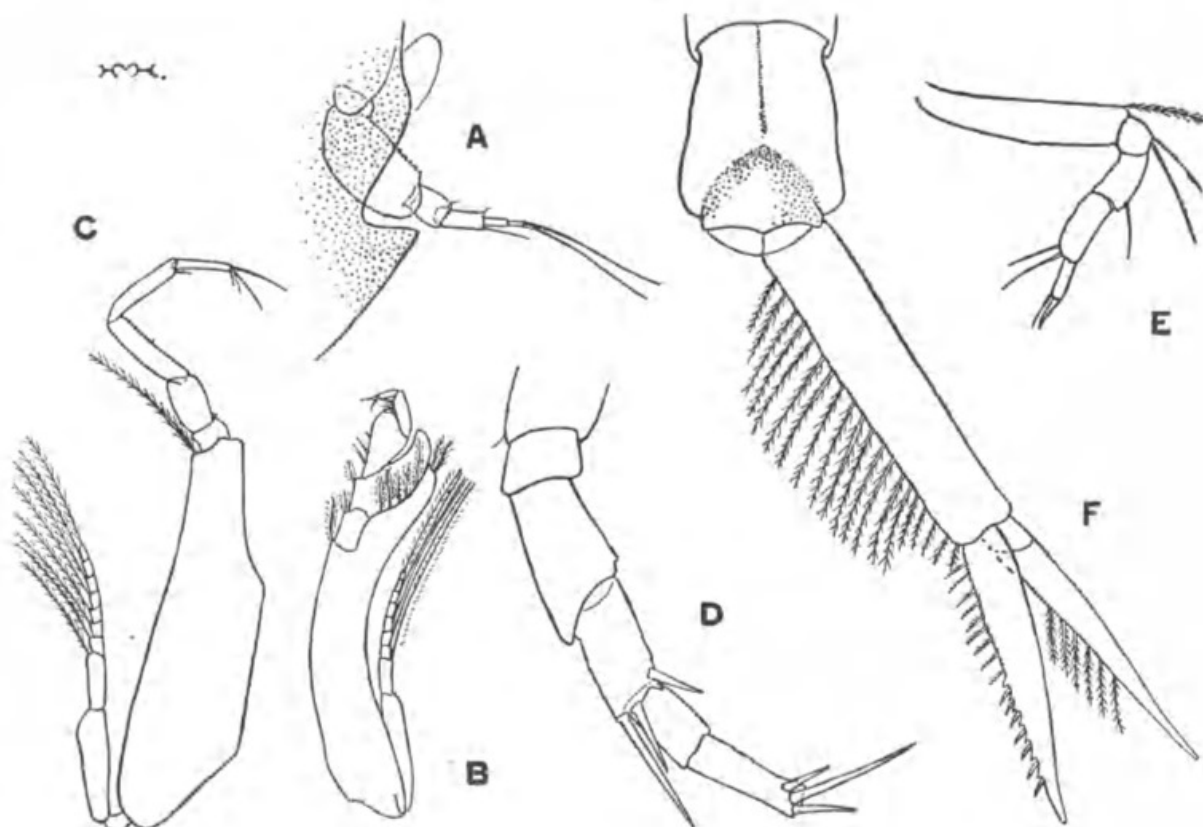


Fig. 16. *Cyclaspis sheardi*, paratype male; A, first antenna and antennal notch; B, third maxilliped; C, D and E, first, second and third pereopods; F, telsonic somite and uropod (A, E and F, $\times 64$; B, $\times 36$; C, $\times 40$; D, $\times 110$).

The salient features of *sheardi* are the pits near the posterior end of the carapace, the large and prominent eyes, the relatively massive carapace and pleon, and the well marked groove indicating fusion of telson and preceding somite.

It is with much pleasure that I name this pretty species after Mr. Keith Sheard, who has proved an able and enthusiastic collector of Australian Cumacea.

CYCLASPIS MJOBERGI Zimmer.

Cyclaspis mjobergi Zimmer, 1921, p. 11, fig. 14-16.

A large number of males from South Australia seem, with little doubt, to be referable to this species which, as noted by Zimmer, is separated from related members of the genus, having no pseudorostrum and no ridging of the carapace, by the absence of a complete median dorsal carina on the carapace. The specimens now in hand have the surface pitting, the carinae and obsolete carinae, as described for the types but the size is considerably smaller, the anterior margin of the carapace below the antennal notch is more oblique and the uropods are of different proportions. In these appendages the peduncle is about three-fifths as long as the telsonic somite, and the rami are certainly not a little shorter than the peduncle,

but are more than one-third as long again; further, the inner margin of the exopod bears long plumose setae.

The following details may be noted also:

Ocular lobe almost twice as long as wide, broadest anteriorly, where the five lenses are large and pigmented. First antenna with basal joint of peduncle one-third as long again as second, which is equal in length to third; flagellum two-segmented with two terminal appendages.

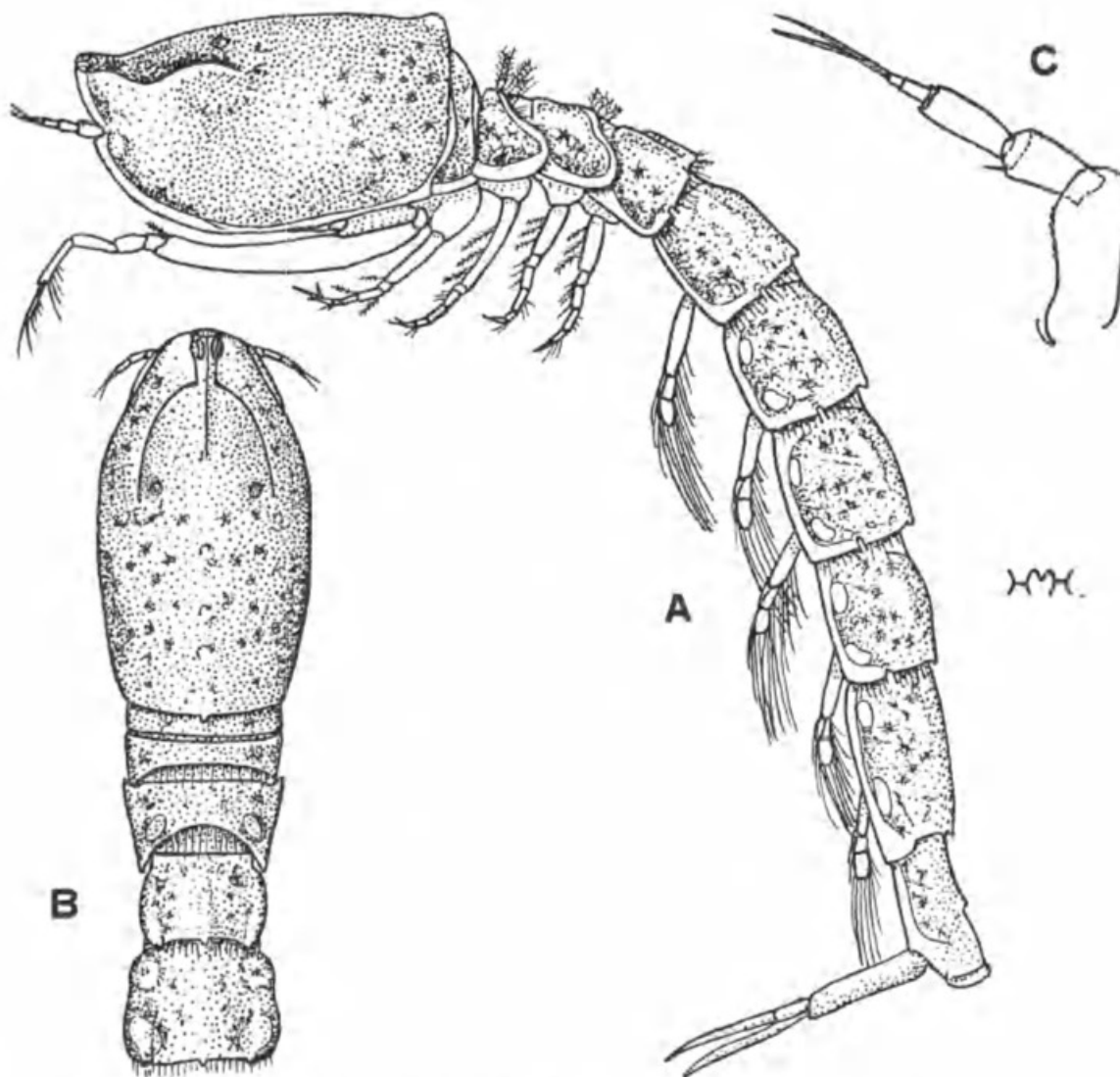


Fig. 17. *Cyclaspis mjobergi*, adult male; A, lateral view; B, cephalothorax and first pleon somite from above; C, first antenna (A and B, $\times 18$; C, $\times 84$).

Third maxillipeds stout; basis widened and produced forwards at apex, the lobe reaching a little beyond middle of length of merus and with plumose setae on anterior edge; merus almost as long as carpus and propodus together, expanded externally to form a wide rounded lobe; dactylus as long as propodus, carpus wider and slightly longer.

First peraeopods with basis long, fully half as long again as remaining segments together, and bearing a plumose seta at outer apical angle; carpus longer than dactylus and five-sixths as long as propodus, which is longer than ischium and merus together.

Basis of second peraeopods slightly longer than remaining joints together; merus as long as carpus and propodus combined and a little longer than dactylus, which is shorter than its longest apical spine; basis, ischium and merus with an apical plumose seta.

Basis of third to fifth legs with long plumose setae; basis of third and fourth as long as rest of limb, of fifth shorter; merus and carpus of these peraeopods subequal in length; for setae see fig. 3, K, and 18, D.

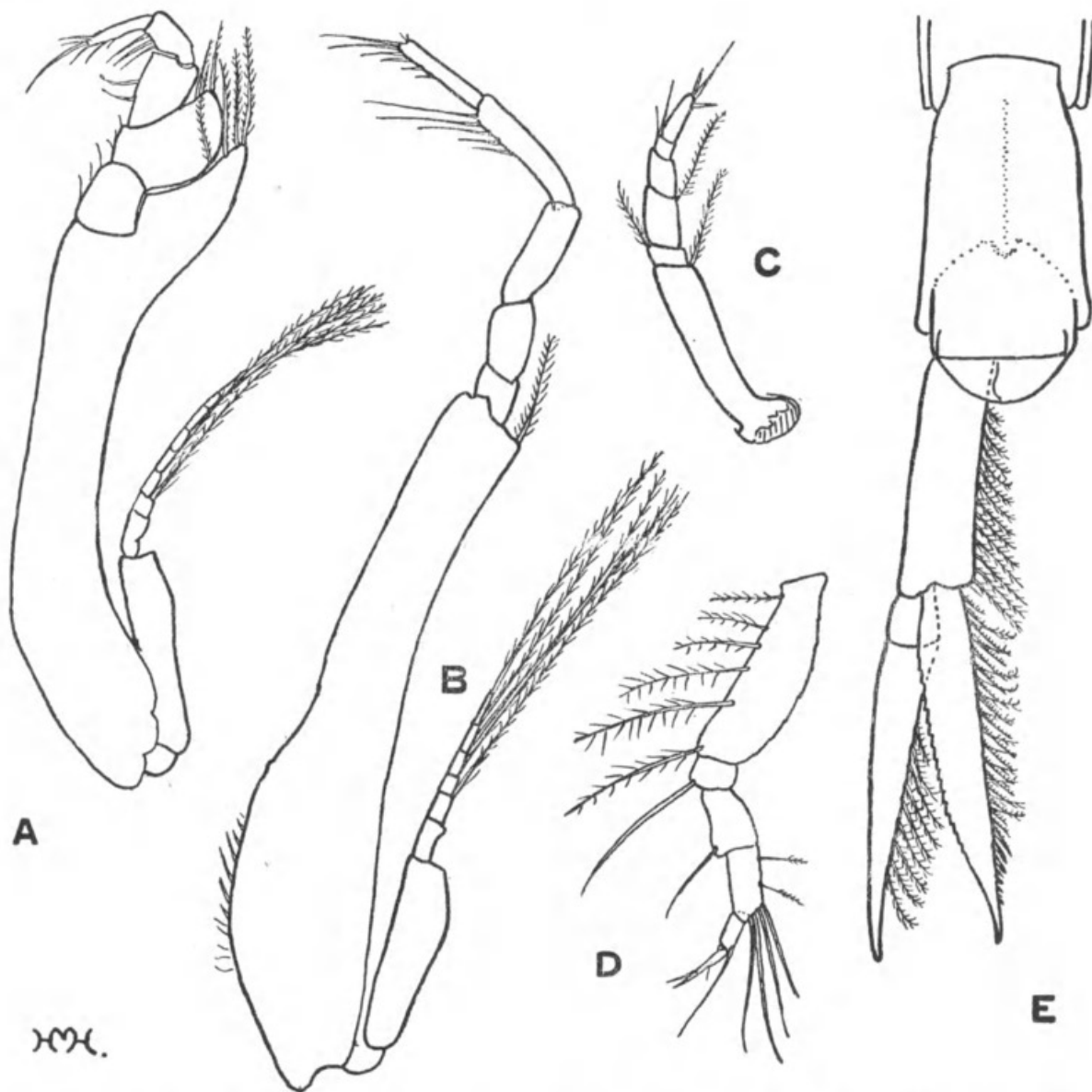


Fig. 18. *Cyclaspis mjobergi*, adult male; A, third maxilliped; B to D, first, second and fourth peraeopods; E, telsonic somite and uropod ($\times 50$).

The carapace is slightly tumid beneath the posterior half of each pseudorostral suture. There is a distinct short median longitudinal carina anteriorly only; it ends abruptly at the middle of length of frontal lobe.

The colour pattern is variable. Some specimens are darkly pigmented, with large chromatophores as shown in fig. 17, A; others are grey with few or no darker spots. Often, but not always, the anterior portion of the carapace is markedly lighter, with conspicuous demarkation.

Length 8 mm. to 9 mm.

Loc. South Australia: St. Vincent Gulf, Brighton (Patricia Mawson and L. M. Angel, Oct. 13, 1941, 8.15 to 8.30 p.m.; Oct. 22, 1941, 9.30 to 9.45 p.m., and Nov. 13, 1941, with submarine light traps.)

Hab. North-Western Australia and South Australia.

This record considerably extends the known range of the species. It is of interest that despite years of collecting in St. Vincent Gulf, *mjobergi* was not taken until males swarmed on two separate dates in shallow water (the specimens were secured from a jetty). In the first haul a "white" submarine light of low candle-power was employed and over two thousand examples were found in the net after an immersion of fifteen minutes; a few individuals of other Cumacea and some Amphipods were also present. Nine days later the same procedure was adopted with a green light and about seven hundred specimens congregated in the net in fifteen minutes. As before all were males of almost uniform size. In a third haul three weeks after this only a few males were found. The collectors used red submarine light at the same time as the green. Amphipoda predominated in the red light-trap but the reverse obtained in the green.

levis group (b).

Carapace compressed, particularly in male and subadult female, the sides rising steeply to the sharp median carina of the back; pseudorostral lobes truncate anteriorly, barely or not meeting in front of the ocular lobe, which is large, with prominent lenses.

Apices of both rami of uropods simple.

Four Australian species, if Foxon's Queensland record for the New Zealand *levis* is correct; it is assumed herein that the last-named has all the above characters.

CYCLASPIS LEVIS Thomson.

Cyclaspis levis Thomson, 1892, p. 264, pl. xvi, fig. 1-6, and pl. xvii, fig. 7-26; Foxon, 1932, p. 389.

With a score of species clustering, as it were, around this form, it is unfortunate that it is insufficiently diagnosed and that it has not been rediscovered without doubt during the past half century. The group name is retained because *levis* has been so often referred to.

It may be assumed that Thomson's interpretation of the ocular lobe and its lenses (his specimens were from surface and shallow water) is as improbable as the dramatic apical projection of the basis of the first peraeopods which he illustrates (Calman, 1907, p. 9). Venturing further, and supposing that the rest of Thomson's description and figures are reasonably accurate, then *cretata*, *granulosa*, *concinna*, *formosae* and *herdmani* fall naturally into place beside it. If *levis* really possesses an apical tooth (of more reasonable size than described) on the basis of the first legs, then *concinna* is removed from the list. In any case, *cretata* seems to be closest to *levis* but is distinguished by the more numerous and shorter spines on the inner edge of the endopod of the uropod where there are no slender setae as figured by Thomson (see key to species); *pura* has uropods similar to those shown for *levis*.

Stebbing (1913, p. 32, *syn.*) queries Calman's reference of some New Zealand specimens to *levis* and that author himself expressed uncertainty. The provisional name *calmani* is herein proposed for these examples.

Foxon more recently records *levis* from north-eastern Queensland, but no details concerning his material are given.

CYCLASPIS CRETATA sp. nov.

Adult male. Integument thin, calcified but somewhat flexible; glossy, with fine reticulate pattern and very small pitting.

Carapace with dorsal edge only slightly arched, two-sevenths of total length of animal, and twice as long as deep; moderately compressed, its width equal to depth; there is a thin, median longitudinal carina for anterior half of length, flanked on each side by a distinct depression, the posterior termination of which is marked by a slight but evident emargination of the dorsal edge as seen from the side; posterior to this the carina is much less distinct (really a narrow, depressed area with a somewhat bifurcate appearance); there is a faint depression on each

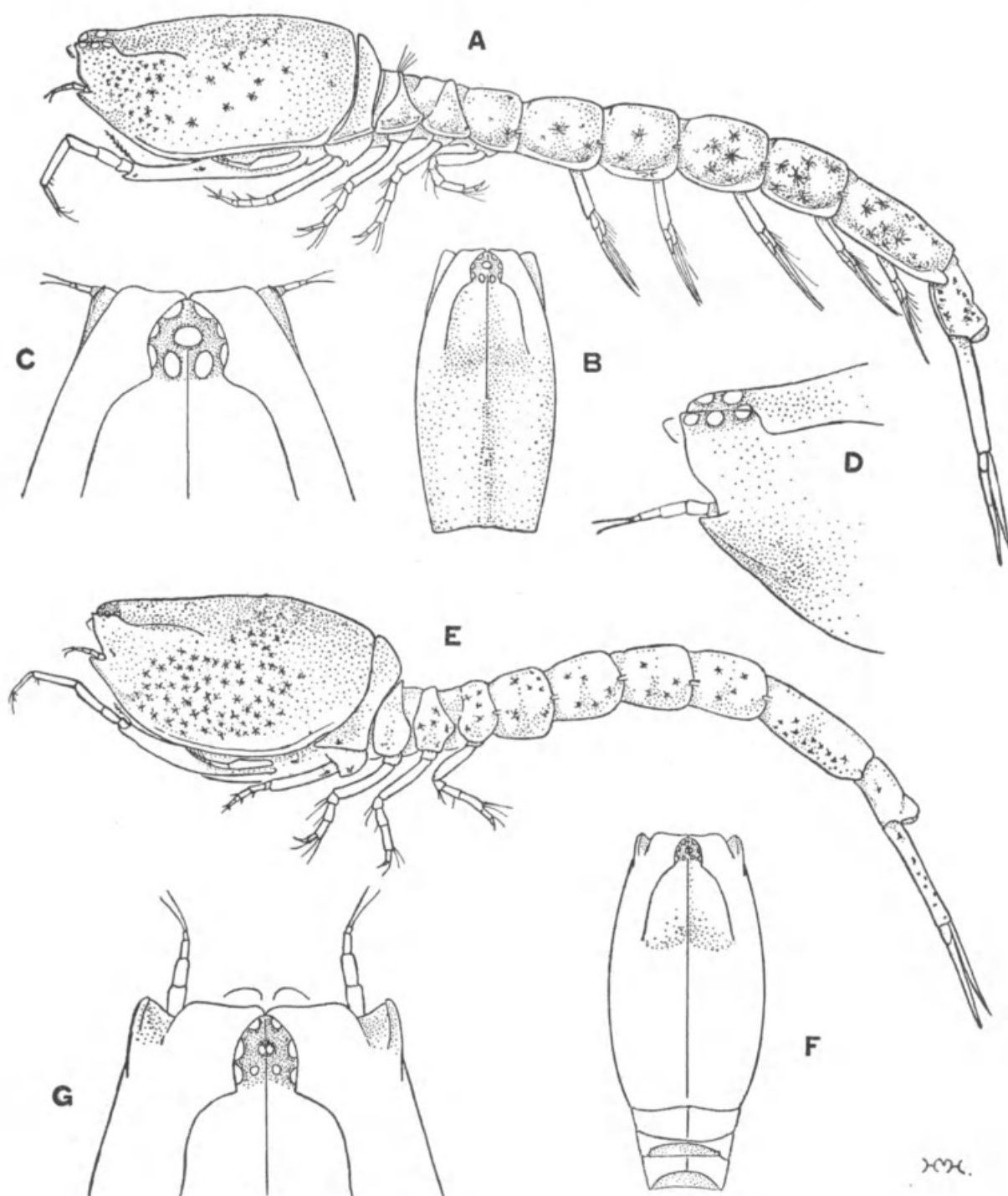


Fig. 19. *Cyclaspis cretata*, type male; A, lateral view; B, carapace from above; C and D, upper and side views of frontal portion of carapace. Allotype female; E, lateral view; F, carapace and anterior pedigerous somites from above; G, anterior portion of carapace (A, B, E and F, $\times 20$; C, D and G, $\times 40$).

side below the pseudorostral suture and behind the dorso-lateral excavations are faint indentations, lending a suggestion of a coarse squamose pattern. Antennal notch moderately wide, with a very faint short groove leading back from it; a short rounded ridge runs back from the narrowly rounded antennal tooth, giving it a subacute appearance. Pseudorostral lobes truncate and slightly sinuate in front, barely meeting in front of ocular lobe. Ocular lobe wide, constricted at base, roundly subtriangular, as wide as long, and with nine prominent lenses; strongly pigmented.

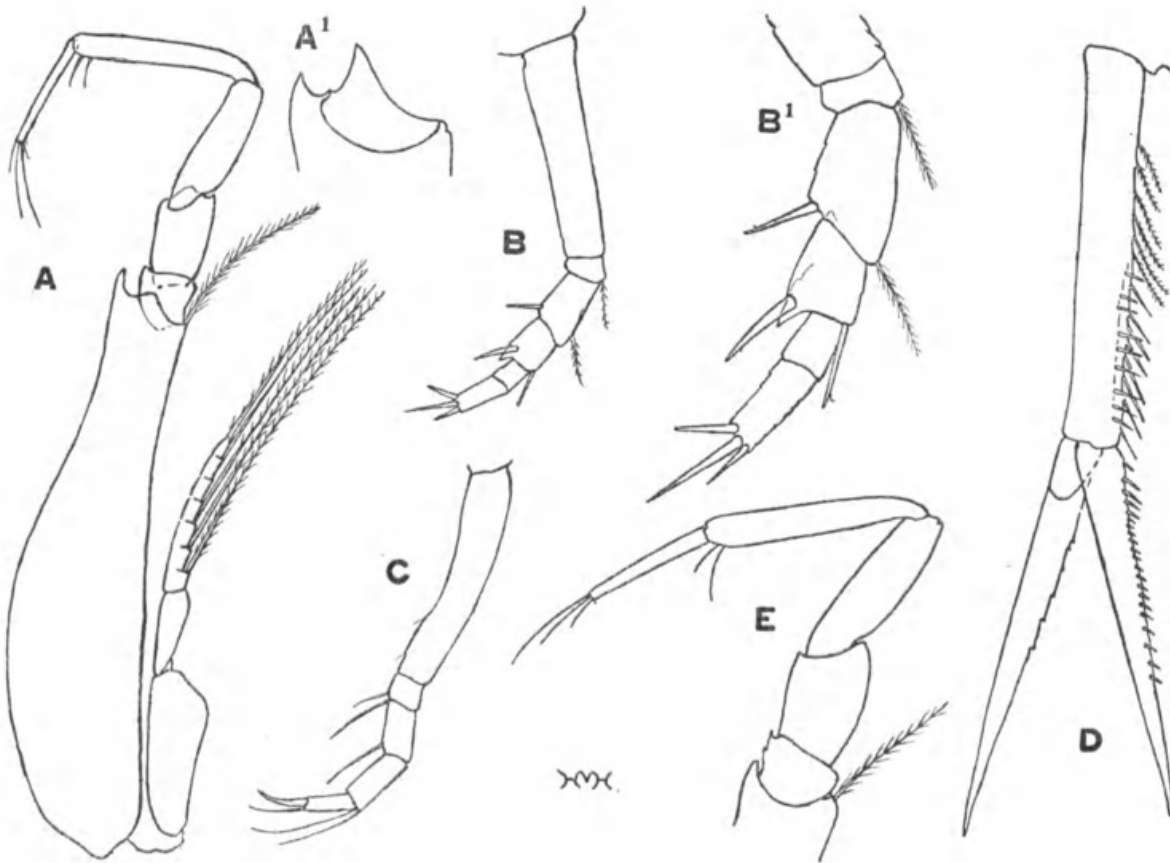


Fig. 20. *Cyclaspis cretata*, paratype male; A, first peraeopod and A¹, distal end of its basis; B and B¹, second peraeopod; C, third peraeopod; D, uropod. E, Terminal joints of first peraeopod of allotype female (A to E, $\times 67$; A¹ and B¹, $\times 134$).

The four exposed pedigerous somites together are much more than half the length of the carapace; each has a faint median longitudinal carina; dorsal edge of second slightly rounded, descending steeply from the level of the hinder edge of carapace; third and fourth with the usual lateral subtriangular area distinctly delineated, each as long as the slightly expanded pleural portions of second.

Pleon somites each with a fine, thin ridge; somites one to five with obsolete dorso-lateral carinae and (like fifth peraeon somite) with the sides tumid fore and aft, a shallow groove between the elevations; articular processes small but distinct; first four and telsonic somites equal in length; telsonic somite with dorsal notch moderate.

First antenna with second segment almost as long as third, and stouter, the two together much shorter than the basal segment.

First peraeopod with carpus just reaching level of antennal tooth; basis barely longer than rest of limb, its apex with a long exterior plumose apical seta (reaching beyond distal end of merus) and with two tooth-like projections, the

inner not quite attaining distal end of ischium (fig. 20, A¹); propodus one-fifth as long again as carpus and fully half as long again as dactylus, which is longer than its longest terminal seta.

Basis of second peraeopod as long as rest of limb; ischium with an outer plumose seta; merus longer than carpus and propodus together and as long as propodus and dactylus together, with a strong spine at inner distal angle, and an outer plumose seta; carpus with a stout spine inserted near the acute, tooth-like apical inner angle, and a more slender outer spine; propodus barely more than half length of dactylus, which is shorter than its longest terminal spine.

Fossorial legs with the setae short (fig. 3, F); merus and carpus subequal in length; basis of third as long as rest of limb.

Peduncle of uropods about one-third as long again as telsonic somite and as long as exopod; inner margin with half a dozen plumose setae on proximal portion, followed by about the same number of slender spines, set above which is a row of shorter spines; both rami with apex simple and narrowly acute; exopod a little longer than endopod, with half a dozen incisions in inner margin, endopod with five slender serrate proximal spines on inner margin, followed by a row of sixteen shorter and stouter spines of slightly different type, the series ending at about second third of length.

Colour chalky white, with sooty stellate markings and faint blackish mottling. Length 6 mm.

Adult female (developing marsupium). Differs from male as follows. The carapace is a little wider and deeper, and is larger, almost one-third of the total length. The ocular lobe is slightly narrower, so that it appears less constricted basally; the lenses are smaller and less distinct, the median one seemingly formed of two components. The exposed pedigerous somites together are less than half as long as the carapace and the dorsal edge of the second slopes downwards less steeply.

In the first peraeopods the propodus is relatively a little longer, one-fourth as long again as merus and one and three-fourths times as long as dactylus.

The uropods are of the same proportions, but the peduncle lacks setae and spines; the proximal spines of the inner edge of the endopod are followed by a row of fifteen short spines, which increase gradually in length as in the male.

Length 5.3 mm.

Loc. New South Wales; Cronulla, 8 feet (K. Sheard, submarine light, Sept. 1942, 8 to 8.20 p.m.) Types in South Australian Museum, Reg. No. C. 2418.

A single female and several adult males are available. The spines on the inner margin of the endopod show some variation—three to six proximal spines followed by fifteen to twenty-three shorter ones.

South Australian form of cretata. Adult males differ from the examples described above as follows:

The dactylus of the first peraeopods is relatively a little longer (the propodus not quite half as long again as it); the basis is longer than the rest of the limb. The uropods are as in *granulosa* with a wide fan of inner plumose setae on the peduncle and with plumose setae on the inner edge of the exopod.

Colour chalky white; sparse black dots sometimes present.

Length 4.2 mm. to 6 mm.

Loc. South Australia: Spencer Gulf, Memory Cove, 3 fath., weedy bottom (K. Sheard, Feb. 1941, 8 to 8.30 p.m.), and Page Is., 9 fath., 7 to 7.30 p.m.; 7 fath., 8 to 8.30 p.m. (K. Sheard, Apl. 1941); Kangaroo Is., Antechamber Bay, 4 fath. (K. Sheard, Apl. 1941, 8 to 8.30 p.m.). Types in South Australian Museum, Reg. No. C. 2366, 2368, 2370 and 2371.

Many specimens were secured by a submarine light; it seems undesirable to accord these examples specific rank.

Salient features of *cretata*: The carapace has the anterior depressions appreciably developed and there is a small emargination in the dorsal profile at their posterior end. The propodus of the first pereopods is obviously longer than the carpus or dactylus and the basis has an apical tooth. The uropods have long peduncle and long, simple and acute rami, the endopod with a row of many small spines, and a few proximal spines of different type.

CYCLASPIS GRANULOSA sp. nov.

Adult male. Integument thin but brittle, finely reticulate.

Carapace in lateral view with dorsal margin almost straight, slightly convex; approximately two-sevenths of total length of animal; slightly wider than

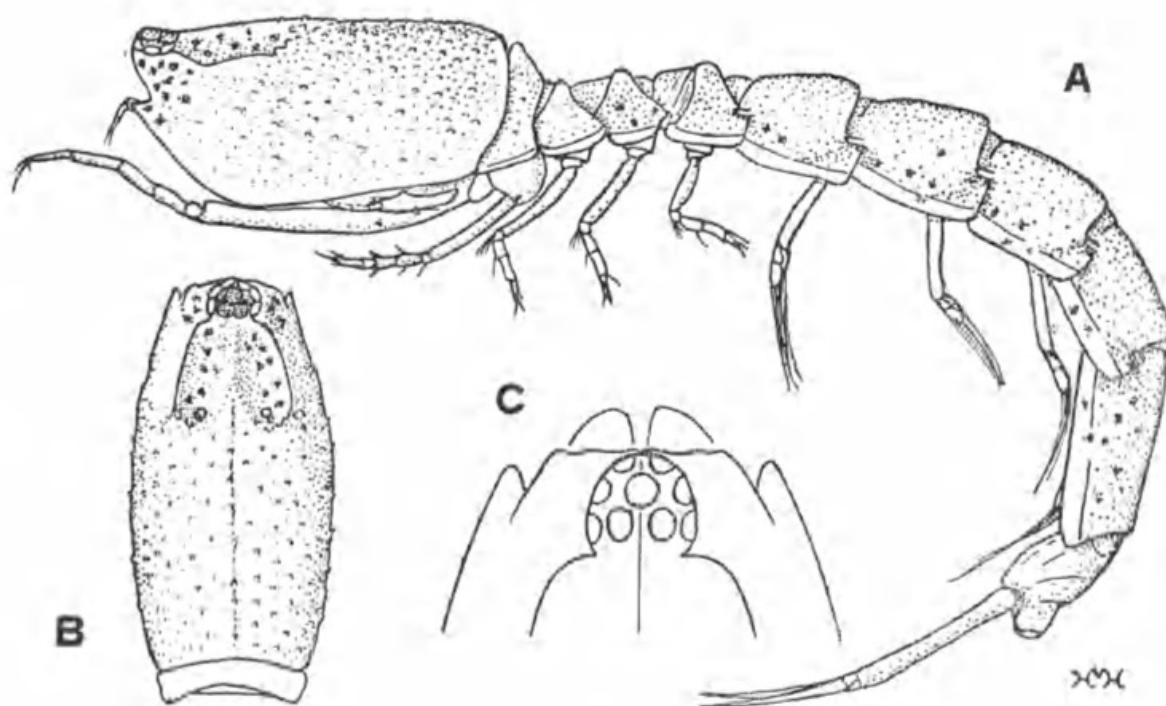


Fig. 21. *Cyclaspis granulosa*, type male; A, lateral view; B, carapace from above. C, Anterior portion of carapace of paratype male (A and B, $\times 23$; C, $\times 50$).

depth, which is one-half of length; surface rather sparsely but conspicuously granulate, particularly in posterior portion; dorsum with an oval depression on each side immediately behind ocular lobe and between carinate mid-line and pseudorostral suture; posterior limit of excavations marked by a very slight emargination of dorsal profile. Pseudorostral lobes reaching to level of apex of ocular lobe but barely meeting in front of it. Ocular lobe rounded, constricted at base, almost as wide as long; nine large lenses, the median three amber, the lateral ones transparent. Antennal notch wide and antennal tooth acute.

Pedigerous somites two to five exposed, each with a median carina, together two-thirds as long as carapace; second somite with dorsal margin sloping sharply down and backwards; third to fifth with triangular lateral area well-defined.

Pleon somites each with a low median dorsal carina; somites one to five with slender articular pegs; first to fourth and telsonic somites subequal in length.

First antenna with the stout basal segment almost as long as the rest of the appendage, without the terminal sensory setae.

Third maxillipeds with basis strongly curved, twice as long as rest of limb, and with outer apical lobe extending forward to level of insertion of carpus; ischium and carpus subequal in length and merus half as long again, with outer apical lobe extending to insertion of propodus.

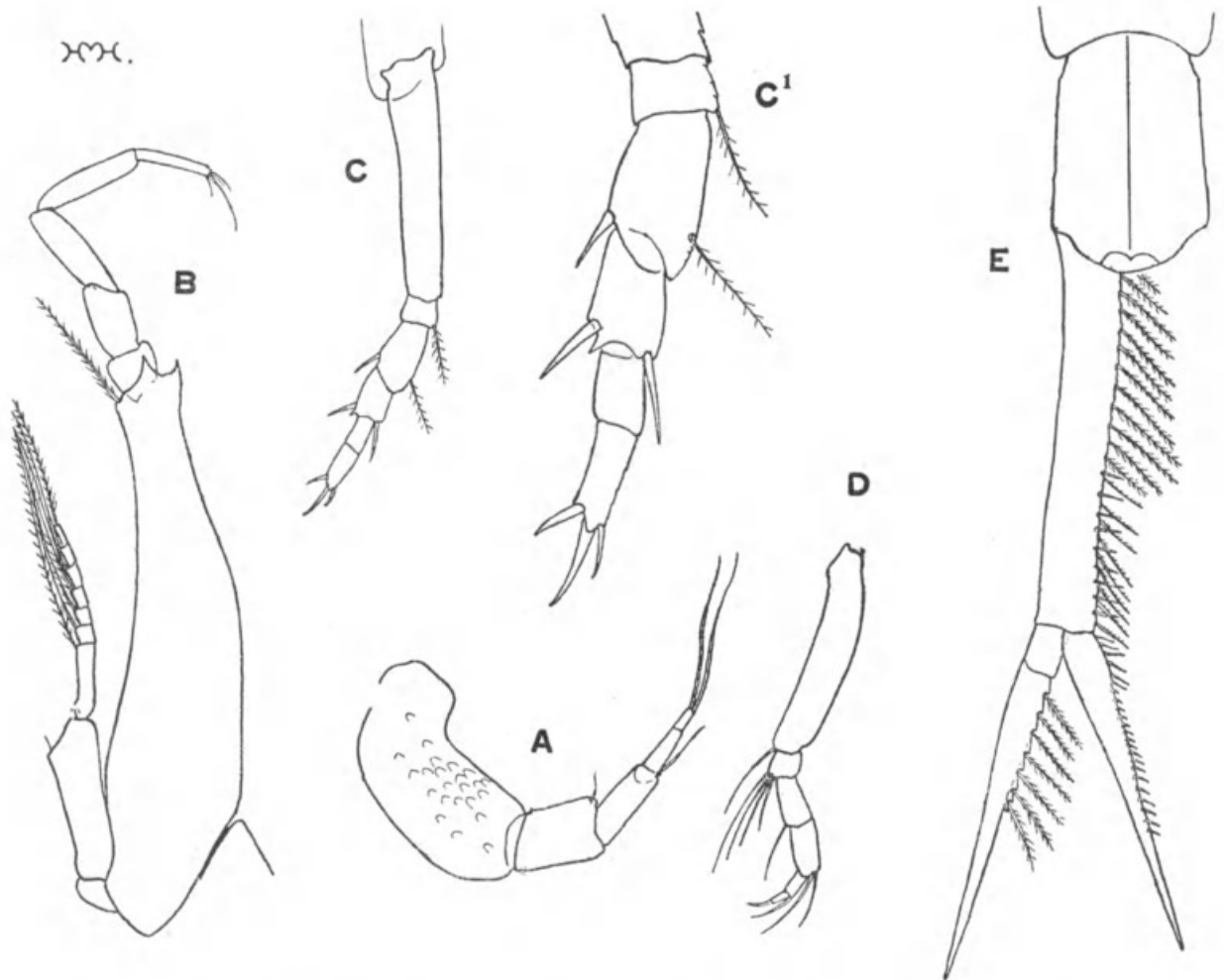


Fig. 22. *Cyclaspis granulosa*, paratype male; A, first antenna; B to D, first, second and third pereopods; E, telsonic somite and uropod (A and C¹, $\times 120$; B to E, $\times 53$).

First pereopod with carpus reaching to level of antennal tooth; basis nearly half as long again as rest of limb, its apex with two tooth-like projections (the inner not reaching distal margin of ischium) and with a plumose seta at external angle; propodus equal in length to carpus and more than half as long again as dactylus, which is as long as longest terminal seta.

Basis of second pereopod a little longer than rest of limb; ischium with an outer apical plumose seta; merus shorter than carpus and propodus together, with a stout spine at inner distal angle, and a plumose, subapical seta on outer margin; carpus subequal in length to dactylus, with a strong spine inserted near the tooth-like inner apical angle and a more slender outer apical spine; propodus three-fourths as long as dactylus, which is equal in length to the longest of its robust, slightly curved, terminal spines.

Fossorial legs as in *C. cretata* with the apical seta of the carpus stout.

Uropods long, the peduncle more than half as long again as telsonic somite; inner edge with a row of long plumose setae on proximal half; these are followed by a series of more slender plumose setae and a parallel row of shorter slender spines; exopod a little longer than endopod and almost as long as peduncle, with a row of seven plumose setae on inner edge, leaving posterior half unfurnished; inner margin of endopod with six slender spines near base, followed by a row of seventeen small short spines, increasing gradually in length backwards, but leaving the distal third of the ramus unarmed.

Colour white, with brown chromatophores on the anterior dorsal depressions of carapace, the pseudorostral lobes, the fourth pedigerous and first five pleon somites.

Length 6.45 m.m.

Loc. South Australia: Waterhouse Bay, east end of Thistle Is., 8 to 8.30 p.m., and Dangerous Reef, 4 fath., 8 to 8.30 p.m. (K. Sheard, submarine light, Mar. 1941). Type in South Australian Museum, Reg. No. C. 2328.

Only males were secured. As with other similar forms taken after dark it is probable that the colour pattern is more apparent in daytime. The spines on the inner margin of the endopod vary little in the available material, five to six proximal slender spines followed by a series of sixteen to seventeen. *C. granulosa* is rather close to *cretata*, particularly to the South Australian form of the last-named, but the roughened appearance of the carapace, due to the granulation, cannot pass unnoticed, while the propodus of the first peraeopods, when the two species are placed side by side, is easily seen to be relatively shorter.

CYCLASPIS CONCINNA sp. nov.

Adult male. Integument as in *pura*. A fine sharp median carina on carapace, exposed pedigerous, and pleon somites.

Carapace with dorsal margin slightly and evenly arched from rear to base of ocular lobe; two-sevenths of total length of animal and with its depth much more than half its length; narrow, the width considerably less than depth and less than half the length. Antennal notch moderately deep, with a short shallow groove running back from it; antennal tooth subacute without antennal ridge. Pseudorostral lobes reaching apex of ocular lobe but barely meeting in advance of it. Ocular lobe subtriangular, rounded anteriorly and constricted at base; as wide as long and with nine large lenses.

Exposed pedigerous somites together more than half as long as carapace; second somite rather short with dorsal edge sloping steeply down from dorsal contour of carapace.

Pleon as in *pura*.

Third maxilliped with basis twice as long as remaining joints together, and with a long narrow apical lobe, one-third as long as rest of basis and capped with plumose setae; merus longer than carpus with a wide lobe reaching level of apex of latter; ischium relatively long subequal in length to the carpus, which is widest anteriorly and as long as propodus and dactylus together.

First peraeopod with carpus not reaching level of antennal angle; basis more than half as long again as rest of limb, with inner apical angle rounded, barely produced, there being present only a minute tooth; external angle with a long plumose seta, reaching beyond middle of length of carpus; carpus a little longer than propodus, which is distinctly longer than dactylus.

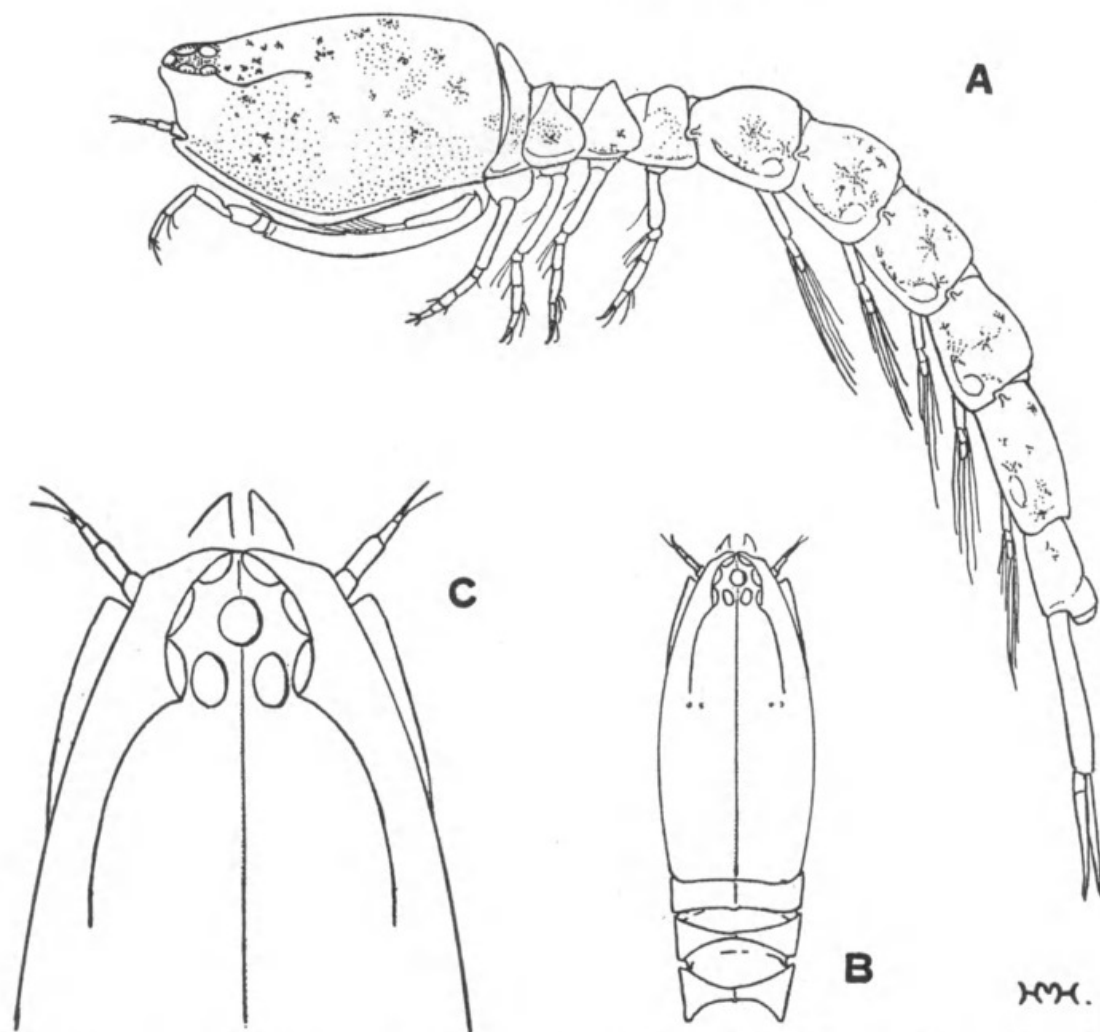


Fig. 23. *Cyclaspis concinna*, type male; A, lateral view; B, carapace and anterior pedigerous somites from above; C, anterior half of carapace (A and B, $\times 30$; C, $\times 82$).

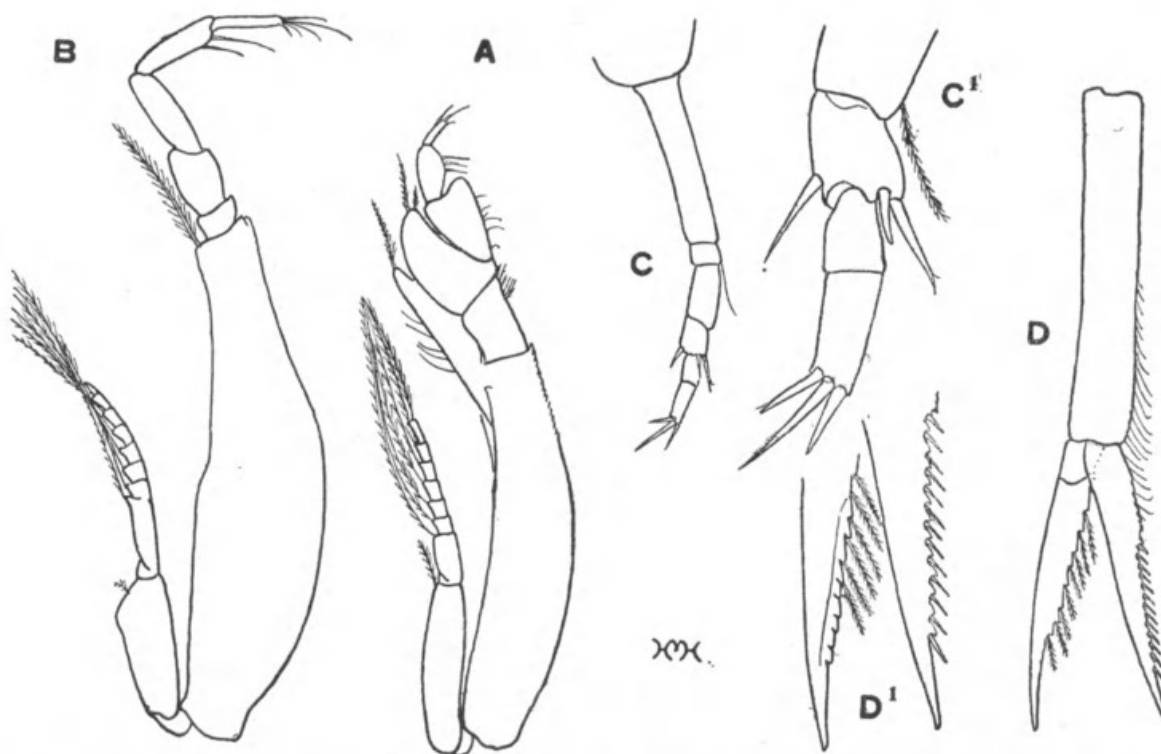


Fig. 24. *Cyclaspis concinna*, paratype male; A, third maxilliped; B and C, first and second pereopods; D, uropod; D1, distal half of rami of uropod (A to D, $\times 67$; C1 and D1, $\times 134$).

Basis of second peraeopods as long as rest of limb; merus subequal in length to carpus and propodus together, and to propodus and dactylus together; carpus with three spines; propodus two-thirds as long as dactylus, which is equal in length to the longest of the stout terminal spines.

Setae of fossorial limbs as in *pura*, fig. 3, F.

Peduncle of uropoda about one and one-half times as long as telsonic somite, and one-fourth as long again as endopod, with marginal setae; exopod with eight plumose setae set in serrations on inner margin; endopod a little shorter than exopod, its inner margin with setae on proximal third and thence with a row of thirteen short and rather slender spines. Both rami narrow, the subacute apices without terminal spines or mucrones.

Colour white, with smoky patches and large black chromatophores.

Length 5 mm.

Loc. New South Wales: Cronulla, 8 feet (K. Sheard, submarine light, Sept. 1942, 8 to 8.20 p.m.) Type in South Australian Museum, Reg. No. 2423.

Only males were taken. They are similar to the males of *pura*, but are separated by the following characters: The carapace lacks a faint antennal ridge and the dorsal margin of the second pedigerous somite is more oblique. The first peraeopods have the segments of different proportions, the basis being relatively longer, and the dactylus shorter. The dactylus of the second peraeopods has stouter and slightly shorter terminal spines. The uropods are very different, the exopod having no terminal mucrones, and the endopod being furnished with a long row of many more and shorter spines.

levis group (o).

Carapace not at all compressed, almost globose, the back broadly rounded, with very fine but distinct median carina; pseudorostral lobes barely meeting in front of the rather small ocular lobe.

Apices of both rami of uropods simple.

A *pusilla*-like assemblage limited to four species.

CYCLASPIS GLOBOSA sp. nov.

Subadult female. Integument indurated, with coarse, clear-cut reticulation.

Carapace almost globose, one-third of total length of animal, and overhanging the pedigerous somites, so that, seen from above, the second and all but the lateral portions of the third are hidden by it (fig. 25, B); widest at the middle of its length, where it is slightly broader than vertical depth, which is equal to three-fourths of the length; dorsum with a fine, unbroken, median carina for whole length. Antennal notch deep and not widely open; antennal tooth large, subacute. Pseudorostral lobes just meeting in front of eye-lobe, truncate in front. Ocular lobe moderately large, subtriangular, slightly longer than wide, not constricted at base and with colourless lenses at sides and apex.

Four pedigerous somites exposed; together they are more than half as long as the carapace, the second somite is not longer than the others and its short dorsal margin (as seen from the side) slopes sharply down from the carapace, which bulges above it; each somite with a median carina for whole length.

Pleon longer than thorax, slender; each somite swollen and with a fine median carina but no other sculpture; first to fourth and telsonic somites subequal in length; articular pegs small but much more distinct than in *clarki*.

First antennae with basal joint of peduncle long, almost equal in length to remaining joints together.

First peraeopods with carpus reaching level of antennal tooth; basis one-fourth as long again as rest of limb, the apex with an external, plumose seta, and

with an apical tooth, which reaches to beyond middle of length of ischium; carpus only slightly shorter than propodus, which is distinctly less than half as long again as dactylus.

Second peraeopods about as long as second to fifth, but stouter; basis a little longer than rest of limb, with plumose setae on inner face; ischium with a plumose seta at outer angle; merus almost as long as carpus and propodus together and with an outer apical plumose seta twice as long as carpus; carpus with two stout, unequal spines; propodus two-thirds as long as dactylus, the longest terminal

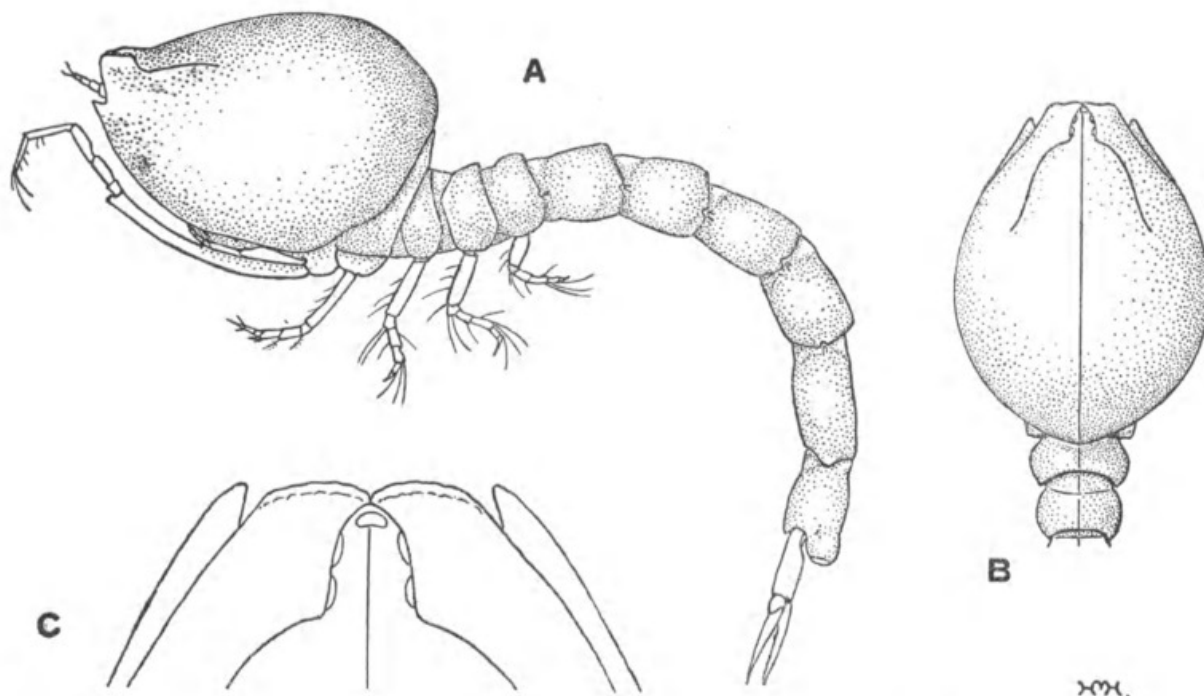


Fig. 25. *Cyclaspis globosa*, type female; A, lateral view; B, cephalothorax from above; C, anterior portion of carapace (A and B, $\times 15$; C, $\times 40$).

spine of which is as long as the merus; the other two spines of the dactylus are unequal, one being one-half, the other only one-fourth, the length of the longest.

Third to fifth peraeopods with merus and carpus subequal in length; carpus with three setae at distal outer angle, longest and propodal seta reaching well beyond apex of dactylus (fig. 3, A and J).

Peduncle of uropoda stout, about two-thirds length of the subequal rami, which are as long as the telsonic somite, and are wide, with simple, narrowly rounded apices; distal half of inner margin of exopod with a few plumose setae, that of exopod serrate.

Colour white.

Length 7 mm.

Juvenile female. Antennal notch a little more widely open than in the older female. Carapace fully as globose and overhanging posteriorly. Fossorial peraeopods of same character.

Length 5.2 mm.

Loc. New South Wales: off Jibbon, 45–50 metres, coarse sand (Cronulla Trawl Station 10, Aug. 1943), and off Wata Mooli, 35 metres, on sand (Cronulla Trawl Station 2, July 1943). Type female in South Australian Museum, Reg. No. C. 2426.

Females only were taken. The shape of the carapace is reminiscent of *Campylaspis*. This and the structure of the posterior pereopods, readily distinguish it from *pinguis*.

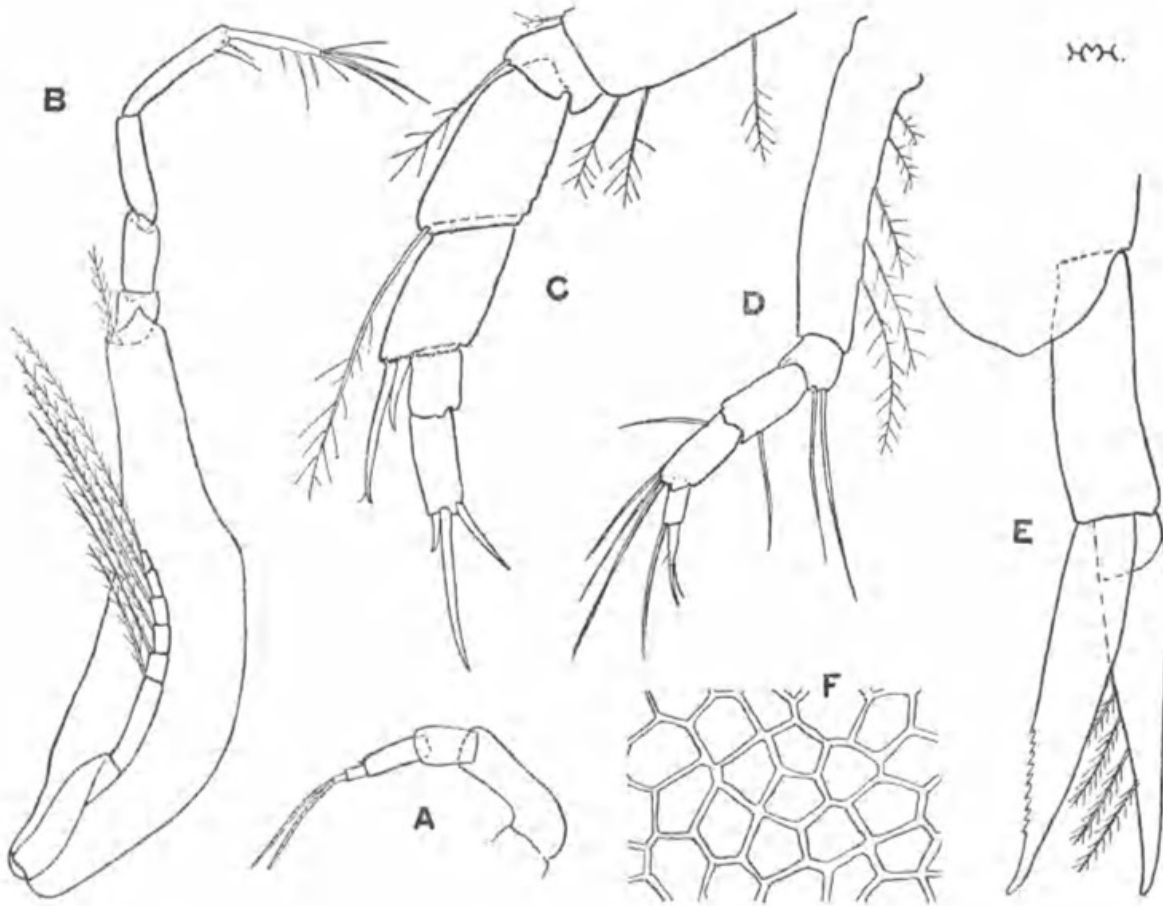


Fig. 26. *Cyclaspis globosa*, paratype female; A, first antenna; B, C and D, first, second and third pereopods; E, uropod; F, reticulation of integument (A, D and E, $\times 64$; B, $\times 40$; C, $\times 115$; F, $\times 325$).

CYCLASPIS CLARKI sp. nov.

Subadult female. Integument highly indurated, with rather large reticulations, the edges of which are thickened to produce a coarse pitting, which gives the carapace in particular a roughened appearance.

Carapace subglobose, with dorsum strongly arched from side to side, and from front to back; one-third of total length excluding telsonic somite, widest in posterior half, where the breadth is five-sixths the length and much more than the vertical depth; dorsum with a fine but unbroken distinct median carina for whole length. Antennal notch deep and moderately wide, antennal tooth large and subacute. Psudorostral lobes just meeting in front of ocular lobe, narrowly truncate in front. Ocular lobe moderately large, subtriangular, a little longer than wide, not constricted at base, and with colourless lenses (five apparent) at sides and apex.

Four pedigerous somites are exposed; together they are only half as long as the carapace; the second somite is scarcely or not longer than any of the others, and its dorsal margin curves steeply down from that of the carapace; each somite, including the anterior spaces between the rounded portions, has a fine median carina.

Pleon longer than thorax; each somite subglobose and with a median carina, otherwise without sculpture; first to fourth and telsonic somites subequal in length; articular pegs only slightly developed.

Basis of third maxillipeds more than twice as long as rest of limb, its outer lobe not reaching distal end of lobe of merus.

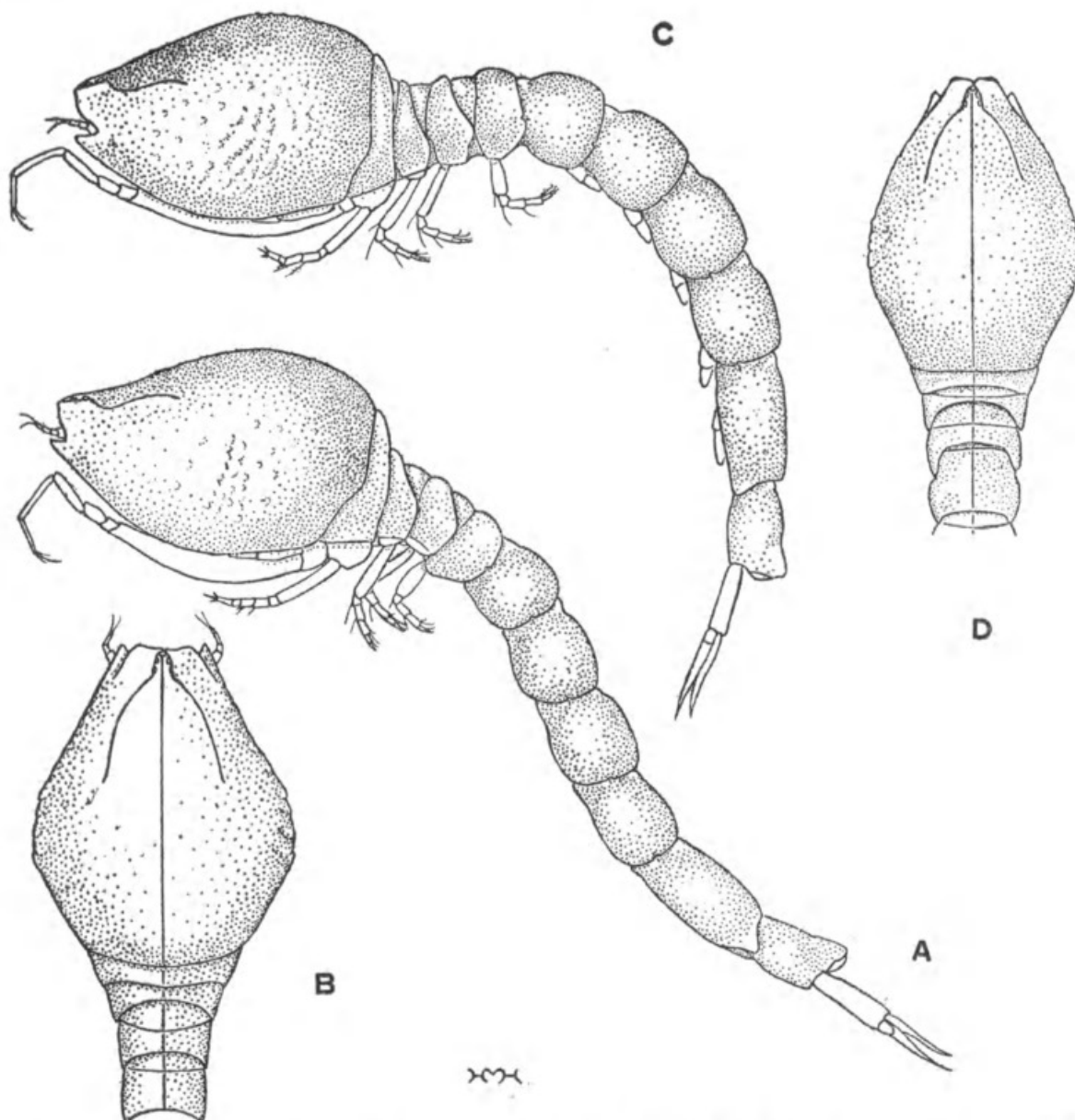


Fig. 27. *Cyclaspis clarki*, type female; A, lateral view; B, cephalothorax from above. Allotype male; C, lateral view; D, cephalothorax from above ($\times 15$).

First peraeopods with carpus not reaching level of antennal tooth; basis one-sixth as long again as remainder of limb, with an external plumose seta, and a shorter inner seta, at apex, the inner angle of which is barely produced; carpus distinctly shorter than propodus, which is fully half as long again as dactylus.

Second peraeopods stout, not much longer than third to fifth; basis longer than rest of limb; merus as long as carpus and propodus together and with a plumose seta; carpus with two stout unequal spines; propodus two-thirds as long as dactylus, which has the terminal spines stout, the longest longer than the joint, the other two subequal in length and less than half as long.

Third to fifth pereopods with fossorial setae not reaching beyond dactylus; two carpal setae, one stout and one feeble (fig. 28, D); basis of third longer than rest of limb.

Peduncle of uropoda stout, not quite as long as telsonic somite and equal in length to endopod, which is serrate on inner margin; exopod slightly longer, with a few plumose setae on distal half of inner margin, both rami wide, with simple apices.

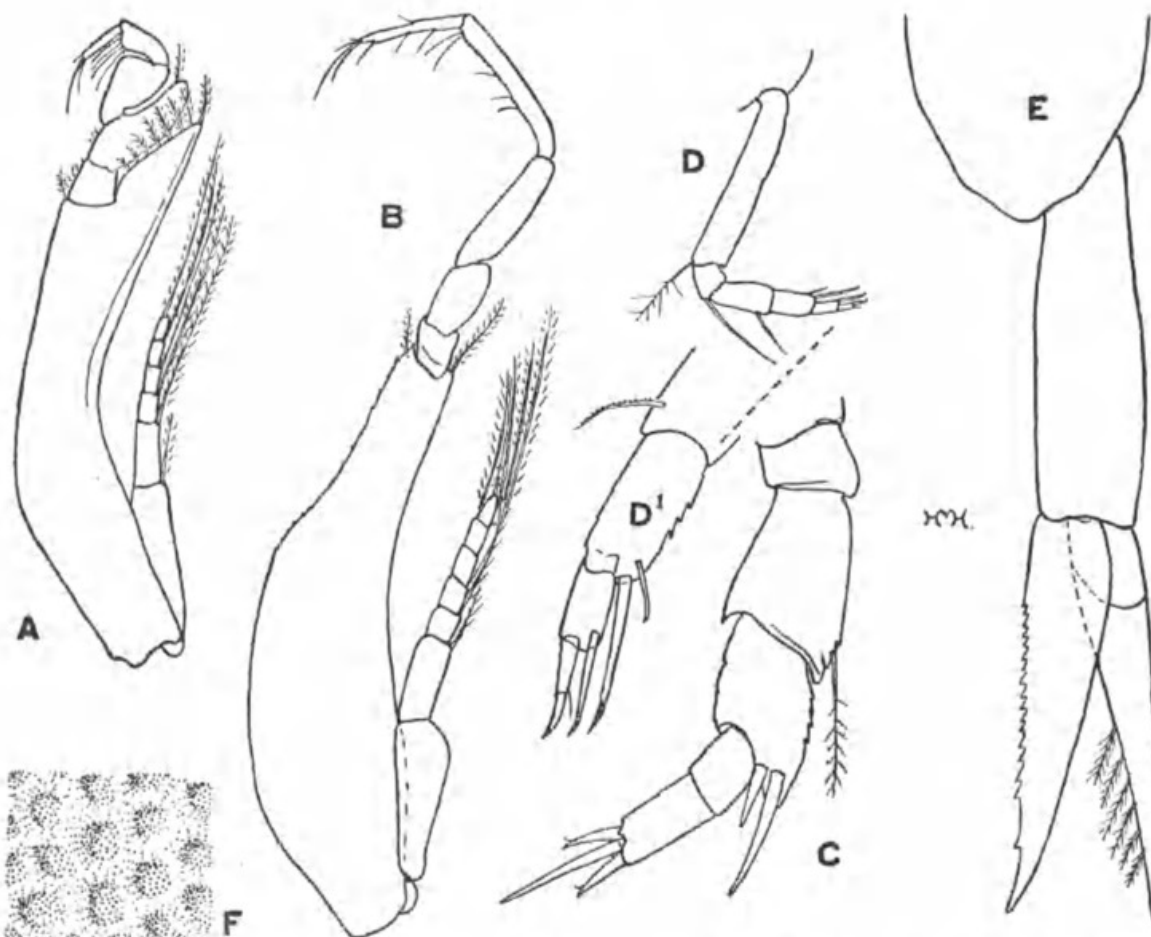


Fig. 28. *Cyclopsis clarki*, paratype female; A, third maxilliped; B, C and D, first, second and third pereopods; E, uropod; F, reticulation of integument (A, B and D, $\times 40$; C and D1, $\times 115$; E, $\times 64$).

Colour very pale brown, almost cream.

Length 7.6 mm.

Subadult male. Carapace narrower than in female, its width equal to depth and to three-fourths of length. First pereopod slightly longer.

Length 7.6 mm.

Loc. Tasmania: off Babel Is., lat $39^{\circ} 55' S.$, long. $148^{\circ} 31' E.$ ("Warreen" Station 29, 1939). New South Wales: off Jibbon, 46-55 fath., sand to mud ("Thetis" Station 48, Mar. 1898), and off Cape Three Points, 41-50 fath., sticky mud and shell ("Thetis" Station 13, Feb. 1898). Type female in South Australian Museum, Reg. No. C. 2347; allotype male in Australian Museum, Reg. No. C. 2235.

This species is named after Mr. G. Clark, technical officer on the "Warreen," who was responsible for care of nets, etc. It has the general appearance of *pinguis* and *globosa* but can be separated with the naked eye by the different shape of the

carapace, and its slightly rugose outline when viewed from above; this rugosity is due to the fact that the thickened margins of the reticulations are particularly prominent on the middle of the sides. Further, in both *punguis* and *globosa* the integument is much less calcified, with the reticulation sharply defined, the pleon is more slender, the spines of the second peraeopods are longer, etc.

C. pusilla Sars apparently also has very feeble, articular abdominal pegs; Sars (1887, p. 19) does not indicate them at all in his figures 21 and 22.

CYCLASPIS PINGUIS sp. nov.

Ovigerous female. Integument indurated, with clear-cut coarse reticulations, larger than in *globosa* (cf. F, fig. 26 and 30).

Carapace subglobose, strongly arched from back to front and from side to side; ovoid in shape as seen from above, tapering slightly to the front and widest at middle of length, where it is distinctly broader than deep; depth more than

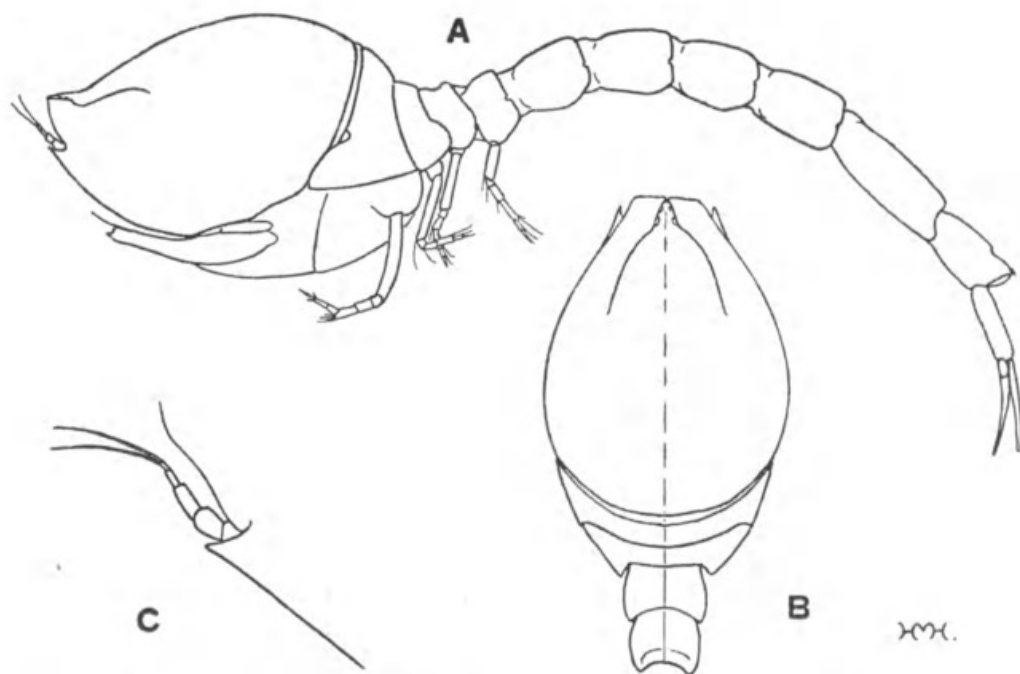


Fig. 29. *Cyclaspis punguis*, type female; A, lateral view; B, cephalothorax from above. C, antennal notch and first antenna of male (A and B, $\times 15$; C, $\times 40$).

two-thirds of length. Antennal notch deep and rather narrow; antennal tooth acute. Ocular lobe as in *clarki* and *globosa*. Pseudorostral lobes just meeting in front and narrowly truncate anteriorly.

A dorsal carina runs for whole length of carapace, pedigerous somites and pleon; it is very distinct but very fine; structurally it is formed by the arrangement end to end, in a median longitudinal line, of the raised margins of the reticulations (fig. 30, F).

Five pedigerous somites are exposed, the first being short; together they are more than two-thirds as long as carapace; second expanded laterally, where it is almost as long as third to fifth combined, and with dorsal margin, seen from the side, continuing the even curve of the carapace.

Pleon slender, and flexible, with feeble articular pegs; each somite subcylindrical; first to fourth and telsonic somites subequal in length; fifth about half as long again as any one of them.

First antenna with basal joint robust, almost as long as remaining joints of peduncle and flagellum without the jointed terminal sensory appendages, which are as long as the peduncle.

Third maxillipeds as in *clarki* and *globosa*.

Basis of first peraeopods with a long and a short apical plumose seta and with inner angle barely at all produced; terminal joints missing.

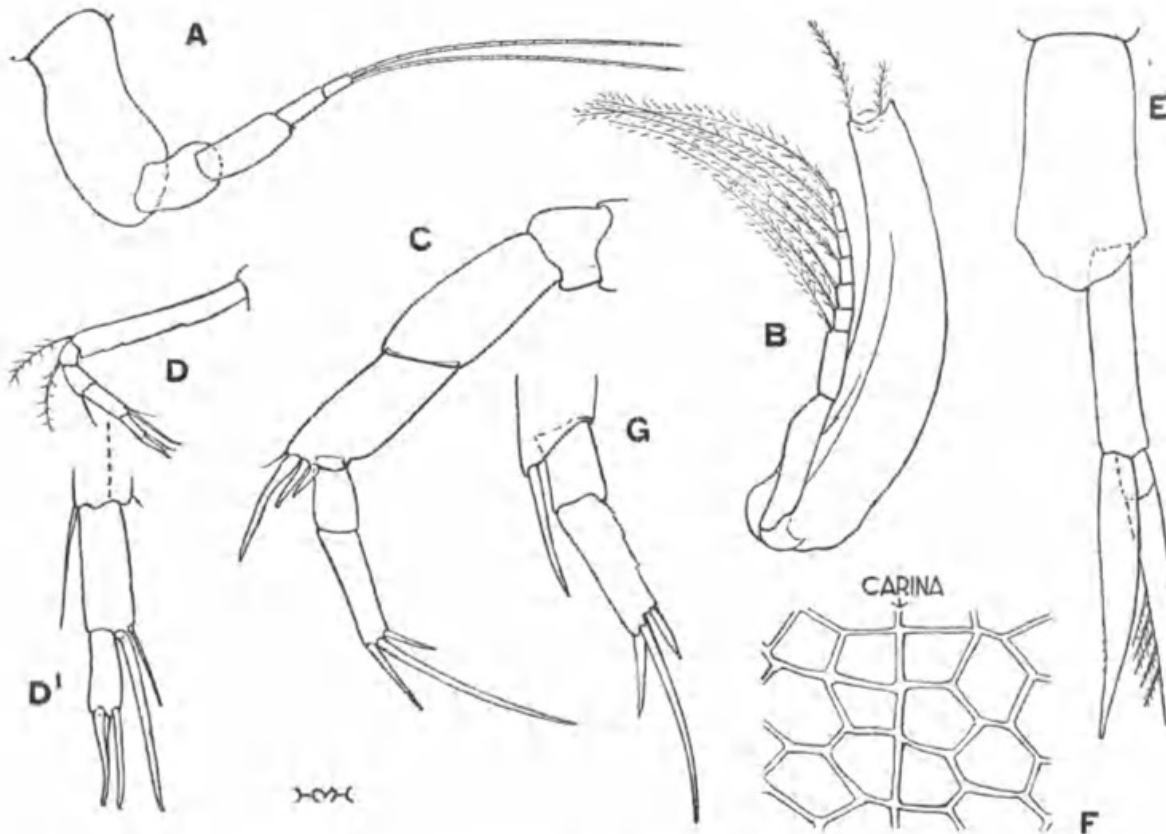


Fig. 30. *Cyclaspis pinguis*, type female; A, first antenna; B, basis of first peraeopod; C and D, second and third peraeopods; E, telsonic somite and uropod; F, reticulation of carapace and dorsal carina; G, terminal joints of second peraeopod of male (A, C, D¹ and G, $\times 115$; B, D and E, $\times 40$; F, $\times 325$).

Second peraeopods stout; basis longer than rest of limb; merus equal in length to propodus and dactylus together and a little longer than carpus, which has three unequal stout spines on outer distal margin; propodus two-thirds as long as dactylus, the longest terminal spine of which is distinctly longer than propodus and dactylus together; the two remaining dactylar spines are unequal, the longer less than half length of the main spine.

Fossorial legs much as in *clarki*, but more slender (cf. D, fig. 28 and 30).

Peduncle of uropoda not very stout, shorter than telsonic somite and a little shorter than the blade-like, subequal rami, which have simple subacute apices; distal half of inner margin of exopod with a few plumose setae, that of endopod serrate.

Colour white.

Length 7 mm.

Male. (Considerably damaged). The first of the pedigerous somites is completely hidden and the second is shorter than in the ovigerous female. The antennal notch and first antenna are as in the female. The last pedigerous and

the first four pleon somites have feeble dorsal tubercles on the mid-line—these are wholly absent in the female.

Only one spine is present on the carpus of the second peraeopods, but the terminal dactylar spines are identical (fig. 30, C and G).

Loc. New South Wales: from stomach of Morwong or Jackass Fish—*Dactylopagrus macropterus* (A. C. Simpson, July 1939). Type in South Australian Museum, Reg. No. C. 2360.

The above-mentioned fish is trawled in Australian waters to a depth of at least 100 fathoms. The specimen examined had been feeding upon *Bodotria* sp., *Hemilamprops* sp., Diastylids, *C. pinguis*, etc.; most of the stomach contents were in fair condition, and include several new species of Cumacea.

The third to fifth peraeopods are as in *clarki*, but as mentioned, are less robust. Apart from the distinctive shape of the carapace the two species show many dissimilarities. In *pinguis* the pleon is markedly more slender, the three terminal spines of the second peraeopods are all of different lengths, and the surface reticulation is larger and clearly defined.

Seen from above, the thorax is of distinctive character in each of the species here assigned to the *pusilla* group.

levis group (*d*).

Carapace compressed, particularly in male and subadult female, the sides rising steeply to the sharp median carina of the back; pseudorostral lobes barely meeting in front of the ocular lobe, which is large, with prominent lenses.

Apex of endopod of uropod simple, that of exopod with mucrones.

Two Australian species.

CYCLASPIS PURA Hale.

Cyclaspis pura Hale, 1936, p. 405, fig. 1-2, and 1937, p. 61.

A large number of examples from Spencer and St. Vincent Gulfs, and Kangaroo Island, South Australia, are now available; some specimens were taken from the stomach of a Mullet (*Mugil cephalus*) by Prof. T. Harvey Johnston. The following additional notes are necessary to the original description.

The sides of the carapace rise steeply to the sharp median dorsal carina. The carina is distinct on the second pedigerous somite and although faint is present on all the remaining somites; there are also indications of dorso-lateral carinae on those of the pleon.

Viewed from above the carapace differs in shape in the sexes. In non-ovigerous females it is widest at about the middle of its length and the sides are evenly rounded (fig. 31, H). In the male it is very slightly widest towards the front and the sides are less curved. Ovigerous females (fig. 31, G) have the carapace widest in the posterior half and tapering towards the front. The ocular lobe (fig. 31, I) is wide in both sexes (almost as wide as long) roundly subtriangular in shape constricted at base, generously pigmented and with nine large lenses, the three in the middle dark, the lateral ones pale. There is a faint ridge, discernible only with difficulty, running back for a short distance from the antennal notch.

Five pedigerous somites are exposed always in the ovigerous female, but the first is concealed in males and subadult females.

The apex of the basis of the first peraeopod has the usual apical external plumose seta (which reaches to the middle of the length of the carpus) and a shorter internal seta; the carpus is barely longer than the propodus, which is little longer than the dactylus.

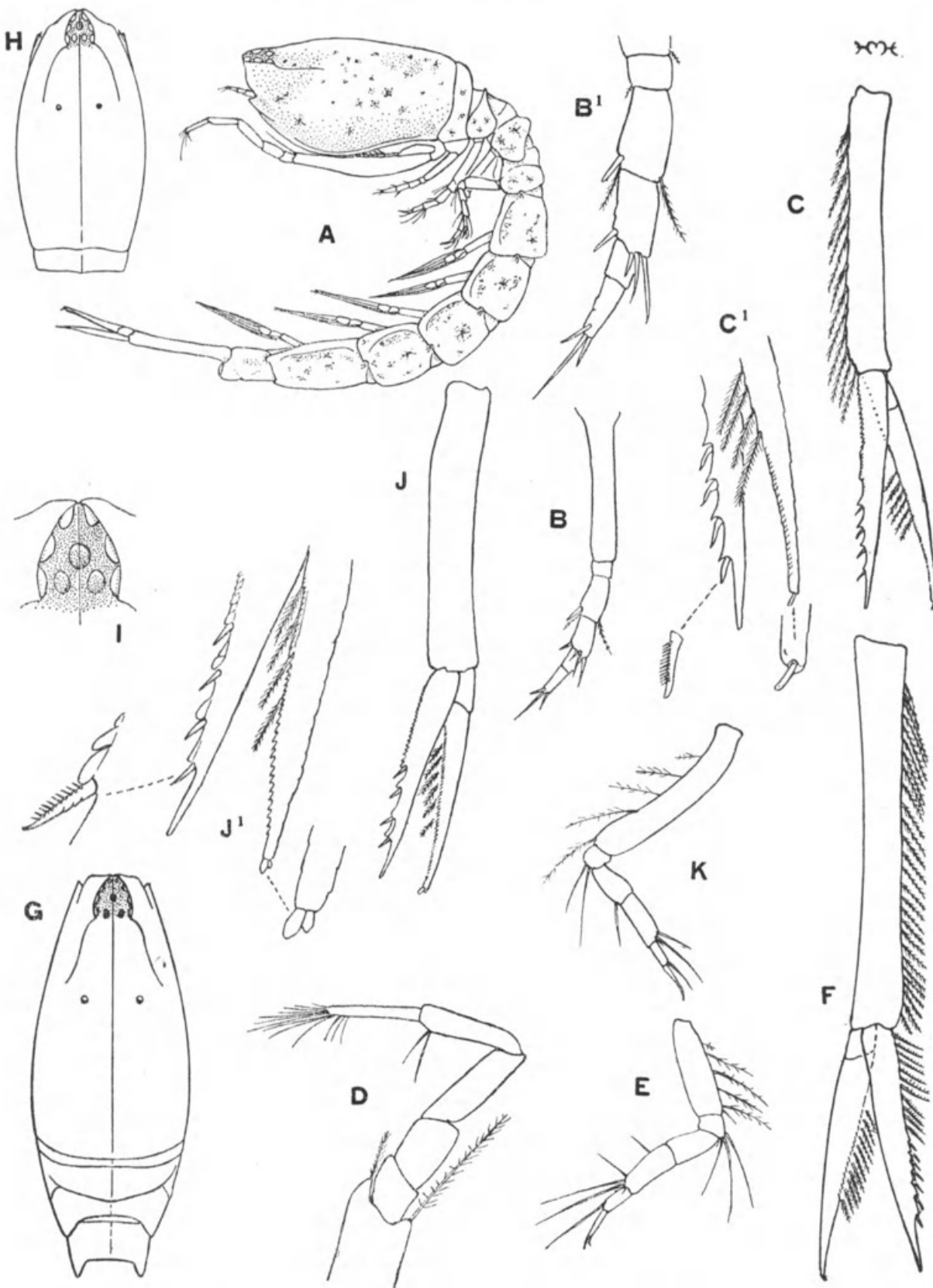


Fig. 31. *Cyclaspis pura*. Adult 4 mm. male; A, lateral view; B, second peraeopod; C, uropod and C1, terminal half of its rami. Adult 5.5 mm. male; D, terminal joints of first peraeopod; E, fifth peraeopod; F, uropod. G, Cephalothorax of ovigerous female from above. Subadult female; H, carapace from above; I, ocular lobe; J, uropod and J1, terminal half of its rami; K, third peraeopod (A, G and H, $\times 25$; B to F, and J to K, $\times 64$; I, $\times 180$; B1, C1 and J1, $\times 115$).

In the uropods the exopod is a little longer than the endopod and bears always one or two terminal mucrones.

The fossorial legs have two to three setae on the carpus, the longest reaching, with propodal seta, to apex of dactylus, or beyond it.

Adult males and ovigerous females vary in size from about 4 mm. to 6.1 mm., and one is inclined at first to recognize two species.

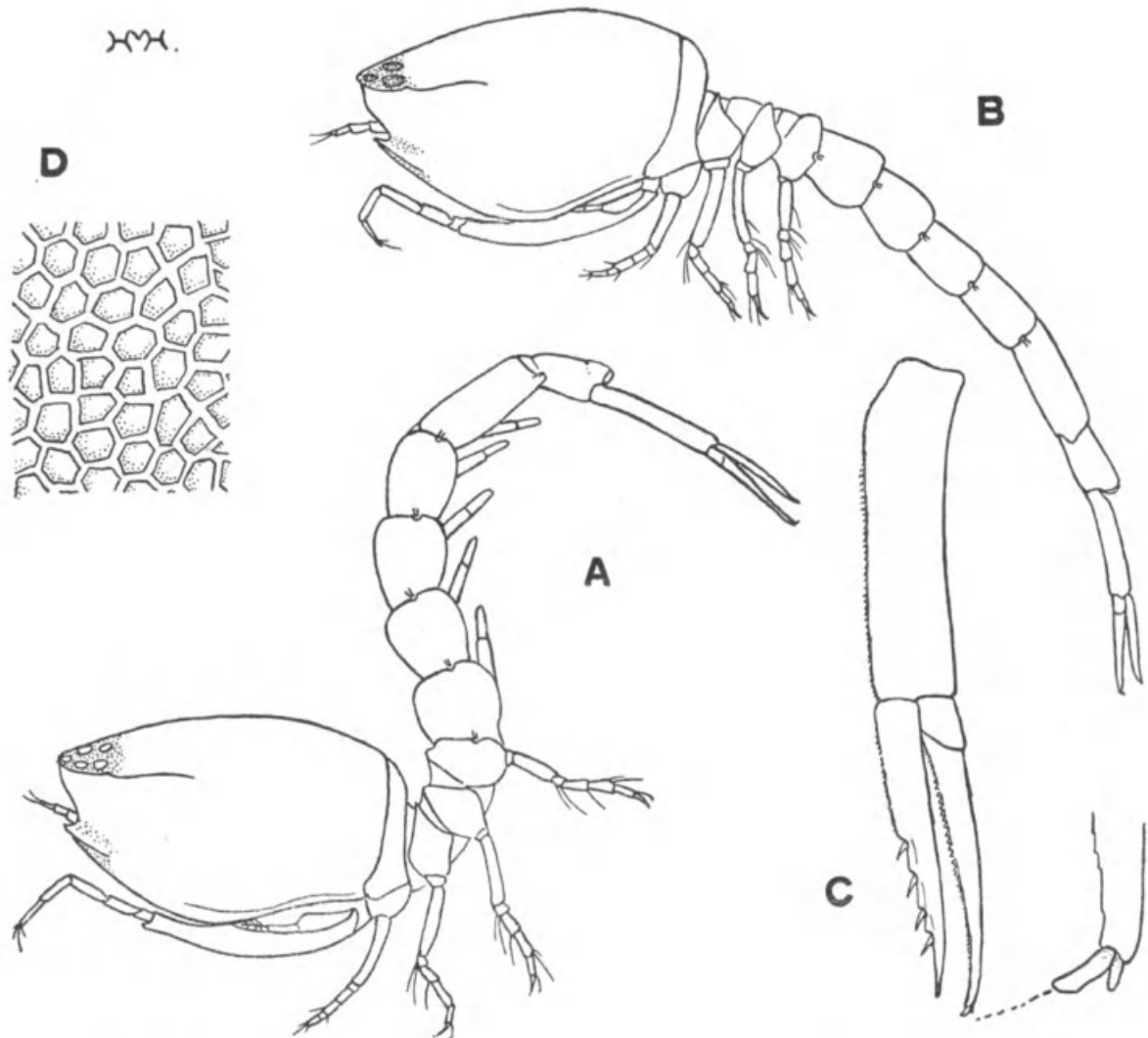


Fig. 32. *Cyclaspis pura*. A, lateral view of juvenile male. Juvenile female; B, lateral view; C, uropod; D, reticulation of carapace (A and B, $\times 29$; C, $\times 84$; D, $\times 180$; mucrones of exopod of uropod, $\times 400$).

Ovigerous females vary little excepting in size; in the smaller examples the peduncle of the uropod is relatively short, barely one-third longer than the rami.

In all females the peduncle of the uropods lacks plumose setae while the serrate inner margin of the endopod bears two to four comb-edged spines, but no proximal slender spines (fig. 31, J). The inner edge of the exopod is furnished with a few plumose setae.

Adult male (4.1 mm. to 4.7 mm.). Carapace with dorsal edge slightly and evenly arched, about two-sevenths of total length and almost twice as long as deep; in section it is almost lenticular, its width less than depth; the sides rise steeply to a sharp median longitudinal carina, which extends for whole length. Antennal notch moderately wide and deep; from it a short

shallow groove runs back and down; the short faint ridge leading back from the apex of the antennal tooth accentuates its acute appearance. Pseudorostral lobes reaching quite to apex of ocular lobe but not meeting in advance of it.

The peduncle of the uropod is relatively short, as in the female, but its peduncle bears plumose setae; the inner margin of the endopod is armed with four or five spines and in some specimens these are preceded by about half a dozen or less slender serrate spines (or setae); in others these proximal spines are entirely absent as in the female (fig. 31, C).

Basis of second peraeopods as long as rest of limb; merus longer than carpus and as long as propodus and dactylus together; with a spine at inner distal angle, and two apical setae; carpus with four distal spines; propodus about equal in length to ischium, and more than half length of dactylus, which is not as long as its longest terminal spine.

Adult male (larger form, to 6.1 mm.). The peduncle of the uropod is half as long again as the rami and bears a long row of plumose setae, the distal ones of different type; the exopod has more setae than in the smaller males, while the endopod is armed with a dozen (or a little less) slender spines on proximal half, followed by four to eight stouter spines with inset bases; the greater number of distal spines occurs in the largest of the males.

The dactylus of the first peraeopods has a terminal brush of about a dozen setae.

Subadult female. In a nearly adult female, with undeveloped marsupium, the carapace is slightly more arched dorsally than in the male, the median carina appearing rather more pronounced when viewed from above; also it is wider and deeper, and as wide as deep. Antennal notch wider. Antennal ridge and ocular lobe as in male. The first pedigerous somite is not at all exposed. The first peraeopods are relatively a little shorter, and there is no spine on the merus of the second peraeopods.

Peduncle of uropoda without long setae, much less than twice as long as telsonic somite but nearly one-third as long again as rami; exopod with six marginal plumose setae and with two terminal mucrones; inner margin with four serrate spines.

Length 4.2 mm.

Juvenile male (fig. 32, A). Carapace deeper and with dorsal margin more arched than in adult and first peraeopods a little shorter. Ocular lobe and uropods much the same.

Length 3.5 mm.

Juvenile female (fig. 32, B-D). Carapace relatively deeper than in older female and more arched dorsally. The ocular lobe is of the same shape; nine distinct lenses cannot be made out always, but appear as three large, oval, darkened areas. The peduncle of the uropoda is shorter and stouter but is a little longer than the rami; endopod with two to four marginal spines; exopod without plumose setae, but with finely serrate inner edge and two terminal mucrones.

Length 3.6 mm.

The differences in the curve of the dorsal edge of the carapace in male and female, and in the juveniles, are subtle but definite. In the last-named it is practically evenly arched, without the slight sinuation most apparent in the adult male.

CYCLASPIA NITIDA sp. nov.

Adult male. Integument thin, lightly calcified; surface shining, with tiny reticulate patterning and moderately distinct scattered pits.

Carapace with dorsal edge evenly arched (except for the usual prominence of the adult male ocular lobe); two-sevenths of the total length of animal, dis-

tinely less than twice as long as deep, compressed, its width less than depth and barely more than half its length; there is a thin median longitudinal carina for whole length, flanked at anterior half by a low depression on each pseudorostral lobe, their hinder termination not marked by an emargination of the dorsal profile. Antennal notch rather widely open and with a short, shallow groove leading back from it; antennal tooth subacute, and no antennal ridge. Pseudorostral lobes truncate and a little sinuate in front, just meeting in advance of eye-lobe. Ocular lobe large and prominent, blackish, as wide as long, rounded, constricted at base, and with eleven large lenses.

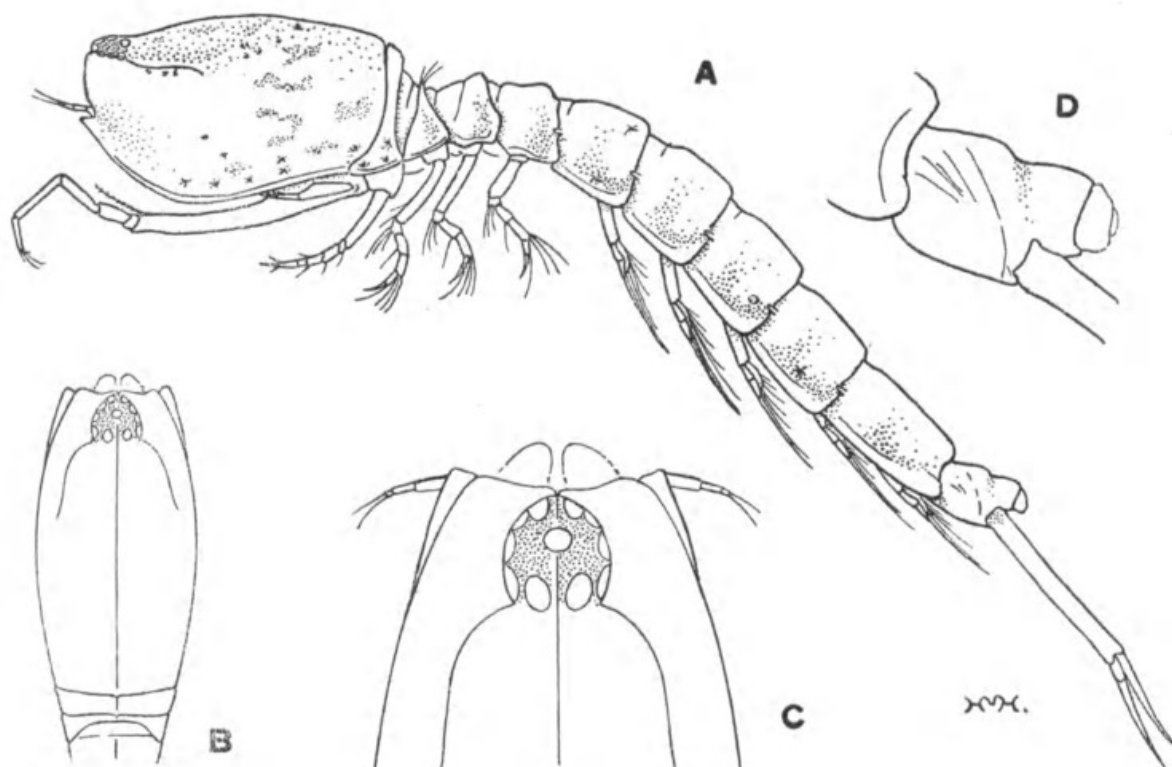


Fig. 33. *Cyclaspis nitida*, type male; A, lateral view; B, carapace and anterior pedigerous somites from above. Paratype male; C, anterior portion of carapace; D, telsonic somite from the side (A and B, $\times 27$; C and D, $\times 67$).

The four exposed pedigerous somites together are more than half as long as the carapace, each with a low median carina; dorsal edge of second rounded, continuing slightly obliquely the curve of the upper edge of carapace; third and fourth as long as expanded pleural portions of second; last three somites with the sides rather conspicuously tumid on posterior half.

Pleon somites stout, each with a low median carina; obsolete dorso-lateral carinae on first to fifth somites, which have the sides tumid fore and aft; telsonic somites subequal in length to first to fourth and with the dorsal notch deep.

Basis of third maxillipeds with rather narrow apical lobe, and ischium relatively long.

First peraeopod with carpus reaching just beyond level of antennal angle; basis fully one and one-half times as long as rest of limb, with a long external, plumose seta (reaching well beyond distal end of merus) and a tiny tooth-like projection, at apex; the propodus is subequal in length to carpus (barely shorter than it); dactylus rather short, two-thirds as long as propodus, and equal to longest terminal seta.

Basis of second peraeopods shorter than rest of limb; ischium and merus each with an outer plumose subapical seta; merus without spine, not as long as carpus and propodus together, and much shorter than propodus and dactylus together; carpus with inner angle produced as tiny tooth and with three slender distal spines, the outermost much the longest; dactylus relatively long, but not twice as long as propodus, inner edge serrate; longest terminal spine not quite as long as the dactylus.

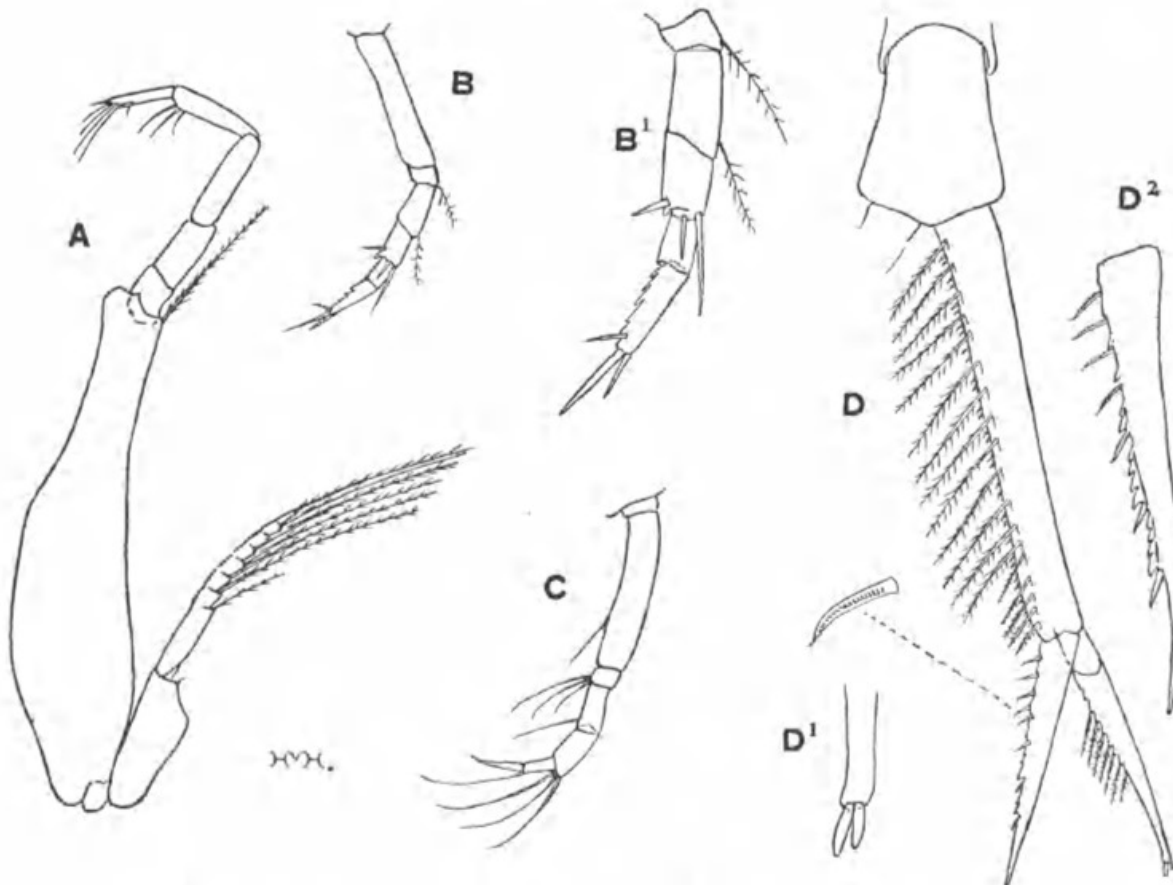


Fig. 34. *Cycolaspis nitida*, paratype male; A to C, first, second and third peraeopods; D, uropod; D¹, apex of exopod of uropod; D², endopod of uropod (A to D, $\times 67$; B¹ and D², $\times 134$; D¹, $\times 270$).

Fossorial legs with setae relatively well-developed (ischium three, merus one, carpus three and propodus one); the propodal seta is about twice as long as dactylus; merus and carpus subequal in length; basis of third peraeopod as long as rest of limb.

Peduncle of uropod twice as long as telsonic somite, and one and two-third times length of subequal rami; inner edges with a series of long plumose setae for whole length, the distal five shorter, more slender and serrate rather than plumose; below setae is a row of spinules; exopod with inner margin serrate and set with seven plumose setae at middle third, apically with two mucrones; endopod with inner margin serrate (as in fig. 34, D²) with five slender spines on proximal half and two spines, simpler, stouter and more downbent, on posterior half; apical third narrow, unarmed and with acute tip.

Colour: semi-transparent, with sooty mottlings and a few black spots.

Length 4 mm.

Loc. New South Wales: Cronulla, 8 feet, 8 to 8.20 p.m., and near Jibbon,

30 fath. (K. Sheard, Sept. 1942 and May 1943). Type in South Australian Museum, Reg. No. C. 2416.

Males only, taken with submarine light.

The spines on the inner margin of the endopod of the uropod vary from five to nine (proximal half) plus two to three; the exopod has seven or eight plumose setae at middle third in all examples.

Separated from the related species by the characters given in the key. Easily determinable under low magnification are the absence of slight dorsal emargination of the carapace, and antennal ridge; the short rami of the uropoda in relation to peduncle and with mucrones on exopod, together with the long setae of the posterior peraeopods.

levis group (*e*).

Carapace as in *pura* and *nitida*.

Apex of endopod of uropod simple, that of exopod with spines.

One Australian species, and one from New Zealand.

CYCLASPIS CALMANI sp. nov.

Cyclaspis levis Calman (*nec* Thomson), 1907, p. 8, pl. v, fig. 6-8.

The present writer agrees with Calman in supposing some gross inaccuracies in Thomson's description of *levis* but (with apologies to Dr. Calman) assumes that the uropods and terminal joints of the first peraeopods should have been reasonably clear to the author of the species and that his figures of these features are, with reservations, useful.

The examination of a large number of specimens of various species of the *levis* group substantiates the fact that the presence or absence of terminal spines on the rami of the uropods or of mucrones on the exopod alone, provides a constant and reliable specific character. Thomson shows the apices of both rami as simple and it seems unlikely that he could have overlooked terminal spines while observing the armature of the inner margin of the endopod (see also notes under *levis* herein).

The two species in question would be separated thus:

Exopod of uropod with an apical spine. First peraeopods with propodus little longer than
carpus. *calmani*.

Both rami of uropod without terminal spine. First peraeopods with propodus much longer
than carpus (nearly as long as merus and carpus together). *levis*.

CYCLASPIS COTTONI Hale.

Cyclaspis cottoni Hale, 1937, p. 62, fig. 1-2.

Some adult males, up to 4 mm. in length, and secured by submarine light collecting in two fathoms, are available from Pt. Lincoln and Corny Point, Spencer Gulf, South Australia. The male allotype, also from Spencer Gulf, was not fully mature.

The carapace of these males is wider in front than in the ovigerous female (Hale, *ut supra*, fig. 1, b) and the breadth across the front is about equal to that posteriorly; the ocular lobe is not much longer than wide, is black in colour, and bears nine distinct lenses; the middle three are black and are larger than the lateral ones, which are pale yellow and increase successively in size from front to back; the dorsal carina of the carapace reaches to apex of ocular lobe.

The first antennae are a little longer than in the female. First peraeopods much as in female but dactylus is a shade shorter, two-thirds length of propodus, and has a strong terminal seta and two or three thinner and shorter setae, as

in some of the related forms, not a brush such as occurs in the adult male of *pura*, etc.

The second peraeopods have a plumose seta on ischium, an outer apical spine on merus, two opposite apical spines on carpus and the dactylus is twice as long as the propodus. The third to fifth legs have the fossorial setae long, two on the carpus, and reaching well beyond apex of dactylus, as in fig. 3, H.

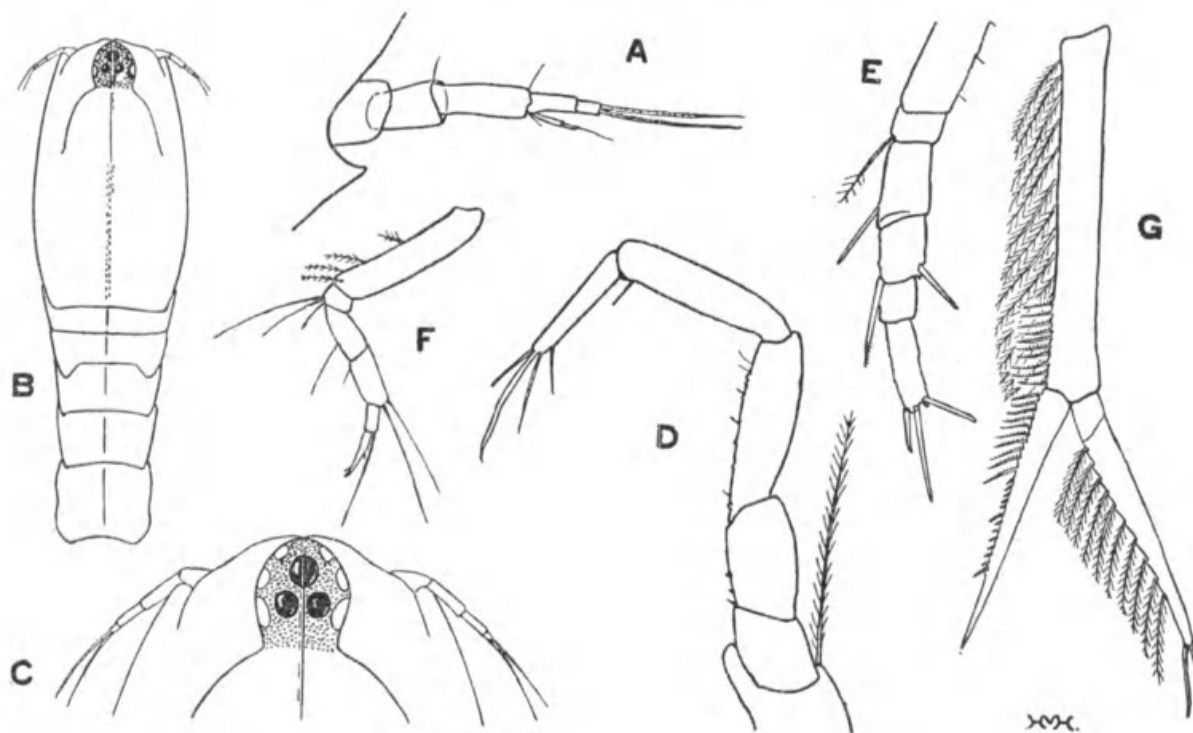


Fig. 35. *Cyclaspis cottoni*, adult male; A, antennal notch and first antenna; B, cephalothorax and first pleon somite from above; C, anterior portion of carapace; D and E, terminal joints of first and second peraeopods; F, fourth peraeopod; G, uropod (A, D and E, $\times 110$; B, $\times 25$; C, F and G, $\times 64$).

In the uropoda the peduncle is more than one-third as long again as the equal rami and bears a row of plumose setae on inner margin and, above these on posterior fourth, a row of shorter setae; the inner margin of the endopod has a row of about ten setae proximally, followed by a row of thirteen short spines, five short, one longer, six short and one longer; distal portion unarmed and apex simply pointed; endopod with a series of long plumose setae; apex truncate with a long and a short terminal spine.

SECTION 2.

exsculpta group.

Each side of carapace with two antero-lateral tubercles and at least one postero-lateral prominence, the last sometimes massive; these assist in marking out the subquadrangular depressed area characteristic of the group. Excepting the spinose *aspera*, this lateral concavity is emphasized by more or less distinct enclosing ridges, including two transverse carinae which extend across the back in at least the female of all but *australis*, where only the posterior carina is developed on the back.

In the female the carapace as seen from the side, and from above, is uneven owing to bold sculpturing. Marked sexual dimorphism may occur in the fully adult (i.e. *tribulis*) and the lateral concavity of the male be hardly existent, although its outline is marked more or less by elevations and by ridges.

Mucrones are present on the apex of the exopod of the uropod of *aspera*; they are found in the juvenile of *tribulis* and *bovis* but not in the adult.

Eight Australian species, including *similis*, which is recorded from Queensland by Foxon, and excluding *exsculpta*, which was taken off the northern tip of Queensland, actually in the Austro-Malayan sub-region.

CYCLASPIS TRIBULIS Hale.

Cyclaspis tribulis Hale, 1928, p. 34, fig. 3-4.

Specimens from a number of localities and ranging in size from 2.7 mm. (juveniles with last pair of peraeopods undeveloped) to 13 mm. to 15 mm. (ovigerous females and adult males), enable one to discuss the great variation exhibited by the species.

All examples possess the median dorsal elevation, *p.o.t.* in accompanying figures, at the base of the ocular lobe, and anterior to the first transverse carina, referred to in the original description of the species; even in juveniles 2.7 mm. in length it is represented by a very slight prominence (fig. 36, G). In the subadult it may be tooth-like (fig. 36, F, of an example 10 mm. in length) rounded-conical, or in the form of a compound tubercle.

Ovigerous females (from Tasmania and New South Wales) show a remarkable development of the sculpture previously described for the 12 mm. subadult c.f. Hale, 1928, fig. 3, a and b with fig. 36 A-C herewith). The surface of the carapace is coarsely reticulate posteriorly, more or less strongly tuberculate or studded with blunt spines anteriorly. The dorsal elevation at the base of the eye-lobe is a transversely elongate, flat-topped tubercle and is connected by a very short longitudinal carina to the first transverse ridge. The pseudorostral suture is fused. The median dorsal ridge is wide and flattened, with irregular edges; the dorsal margin of the carapace and the dorso-lateral carina may be more or less spinose. The prominences on the transverse ridges are very large; the posterior pair are concave and spoon-like in front. The median tubercle at the hinder end of the carapace is large and conical in old specimens. The first pedigerous somite is exposed, but is short.

In the first peraeopods (imperfect in the types) the basis is a little longer than the remainder of the limb, and has serrated edges; the ischium is two-thirds as long as the merus, which is expanded distally; the carpus is twice as long as the merus, a little longer than the dactylus and three-fourths as long as the propodus: the anterior segments sometimes bear sparse black spots.

As in the types the rami of the uropods are subequal in length to the peduncle the exopod slightly longer than the endopod and with the apex dilated; the inner margin of the endopod is spinulose for half its length and that of the exopod bears strong plumose setae.

Length 13 mm. to 14 mm.

Submature males and females, 7 mm. to 10 mm. in length, may have more or less strongly developed teeth on the dorsum and on the dorso-lateral ridges; in these individuals the propodus of the first legs is longer than the carpus and the peduncle of the uropoda is as long, or almost as long, as the rami.

Juvenile examples, 2.7 mm. or so in length (and taken with a 40 mesh trawl in New South Wales), have the primary reticulation of the carapace relatively coarse and the elevations far less prominent, the propodus of the first peraeopods not or scarcely longer than the carpus and the peduncle of the uropods relatively short, only about half the length of the rami; both rami of the uropoda bear terminal mucrones (fig. 36, H²).

Adult males (from Tasmania) are so markedly dissimilar from the subadult of this sex (c.f. Hale, 1928, fig. 3, b, and fig. 37, A-B herewith) that one is inclined to give them specific rank. Comparison, however, shows that the struc-

ture is essentially the same, and that evidently the carapace becomes elongated and narrowed in old examples, not expanded and deepened as in large females.

Integument strongly calcified and reticulated. Carapace less than one-third total length of animal, twice as long as deep, and wider than deep; as seen from

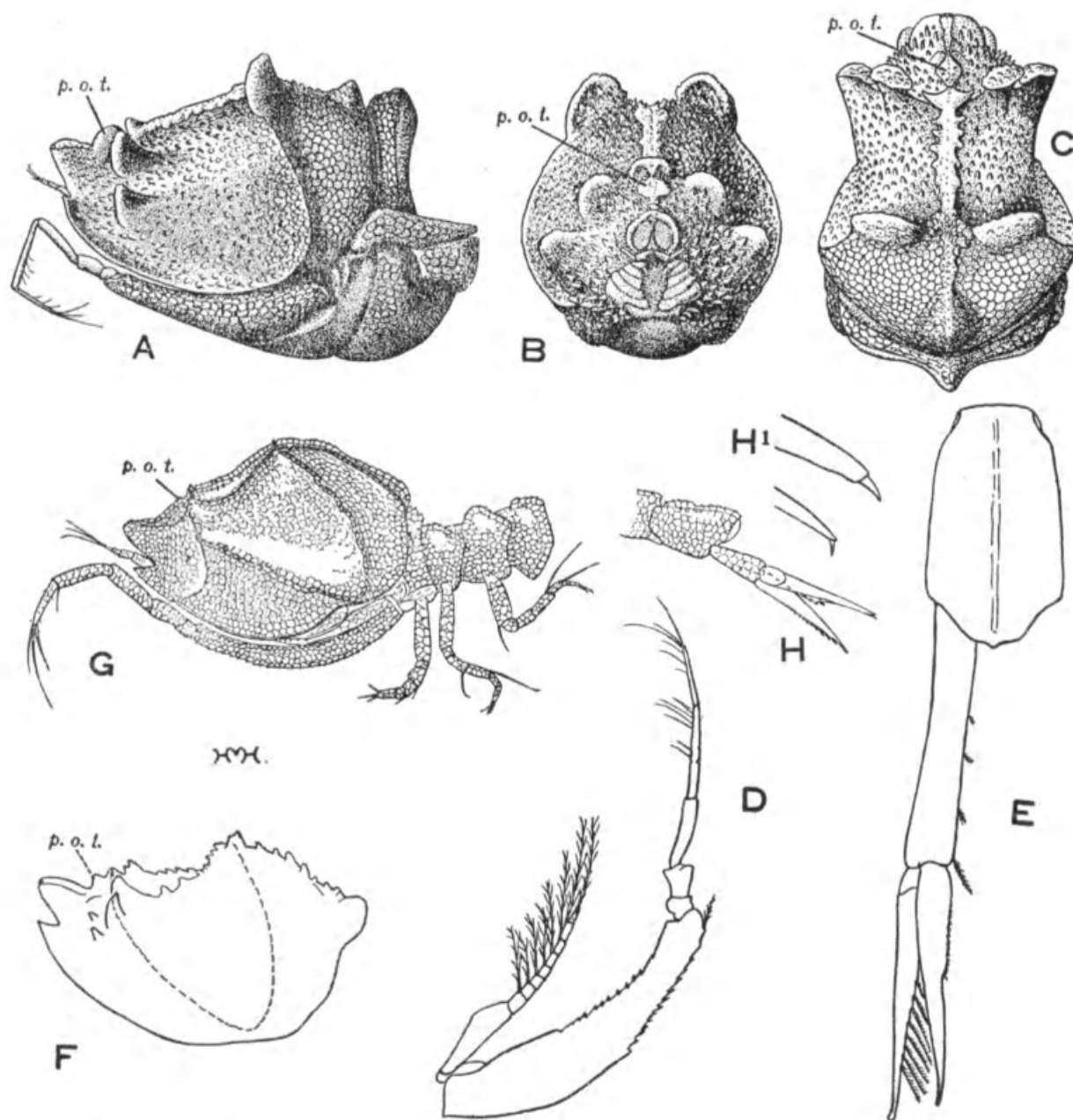


Fig. 36. *Cyclaspis tribulis*, ovigerous female; A, B and C, carapace from side, front and above; D, first pereopod; E, telsonic somite and uropod. F, Carapace of a "spiny" non-ovigerous female. Lateral views of G, cephalothorax and H, telsonic somite and uropod of juvenile; H¹, apices of rami of uropod (A to C, $\times 8\frac{1}{2}$; D and F, $\times 12$; E, $\times 20$; G and H, $\times 34$; H¹, $\times 145$).

the side the dorsal margin is only slightly elevated posteriorly, thence a little convex to base of ocular lobe, where there is a marked tumidity (*p.o.t.*); each antero-lateral area immediately behind pseudorostral lobes expanded laterally (so that in dorsal view the carapace is widest here) and with two confluent tumidities armed with conical tubercles; pseudorostral lobes with short elevated ridges; sides of carapace with coarse reticulations and a few short ridges.

Posterior to the middle of the length there is a pair of blunt tubercles (corresponding to the large postero-lateral prominences of the adult female); from each of these a faintly defined posterior transverse ridge runs obliquely back to meet, near inferior margin of carapace, a still fainter "ridge," which curves back from the lower of the antero-lateral prominences; these carinae, with the obsolete

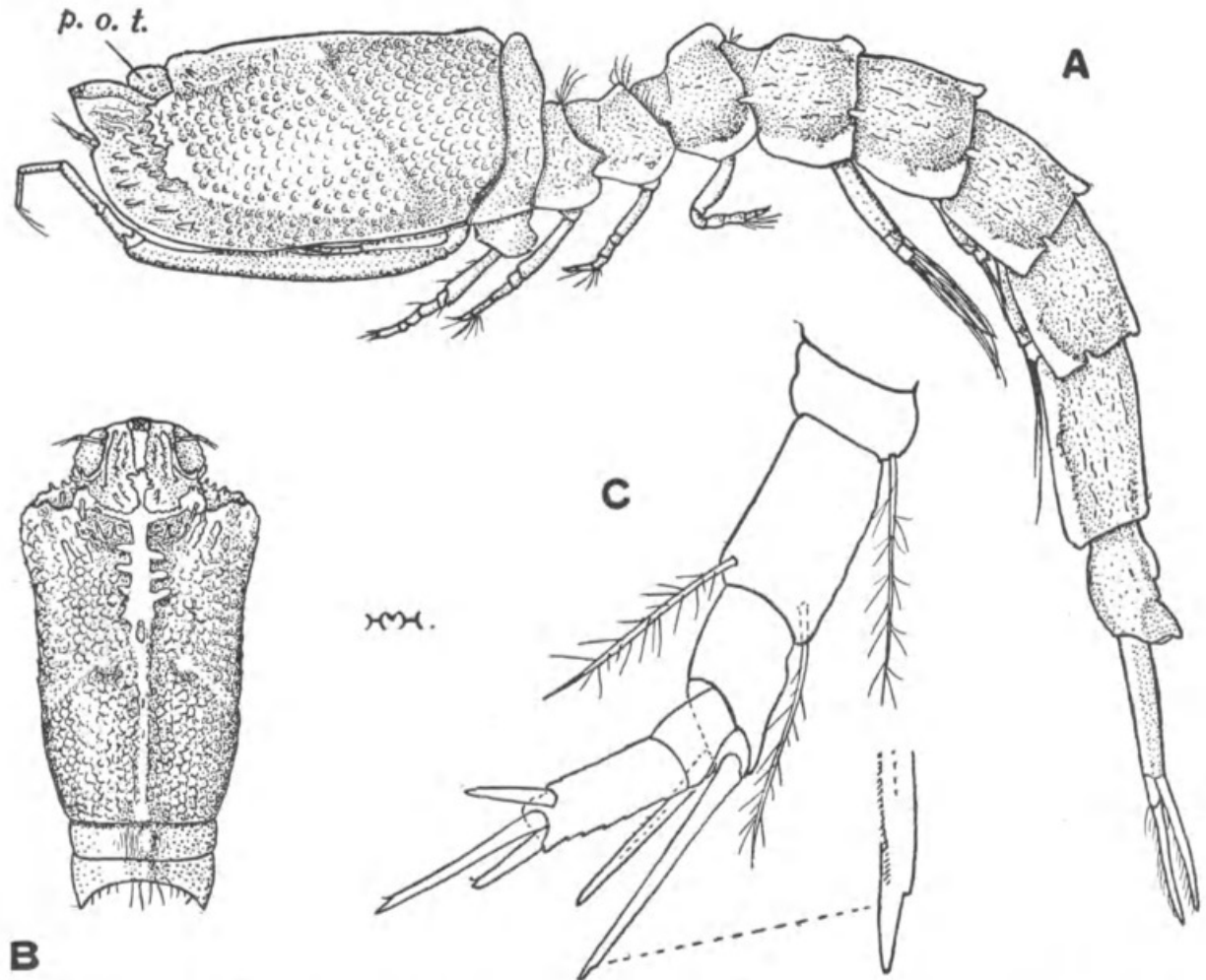


Fig. 37. *Cyclaspis tribulis*, adult male; A, lateral view; B, carapace from above; C, terminal joints of second pereopod (A and B, $\times 11$; C, $\times 84$).

dorso-lateral ridge, enclose an area which is scarcely at all concave. Dorsum with a median, smooth longitudinal carina, irregularly expanded, particularly at base of ocular lobe and posterior to the pseudorostral lobes, where a few lateral projections extend from it, as in the adult female; immediately behind pseudorostral lobes an irregular flattened carina extends sideways to each of the upper antero-lateral tumidities, forming a cross with median carina. Pseudorostral lobes not quite reaching to level of apex of ocular lobe, which is narrow, widest anteriorly and bears distinct lenses. Antennal notch wide and antennal tooth obtusely angular.

First pedigerous somite concealed; second elevated dorsally, and third to fifth with dorsal carinae.

Pleon very much more robust than in adult female; each somite with median carina, produced a little backwards on first four somites (as on last pedigerous somite); first five with distinct articular pegs; fifth somite about one-fourth as long again as the others, which are subequal in length.

Third maxilliped with basis three times as long as rest of limb; outer apical lobe reaching to level of insertion of carpus; merus twice as long as ischium and half as long again as carpus, which is subequal to propodus and dactylus.

First peraeopods with distal end of carpus reaching well beyond antennal notch; basis slightly produced apically, one-third as long again as rest of limb; carpus a little shorter than propodus, one-fourth as long again as dactylus and twice as long as merus, which is half as long again as ischium.

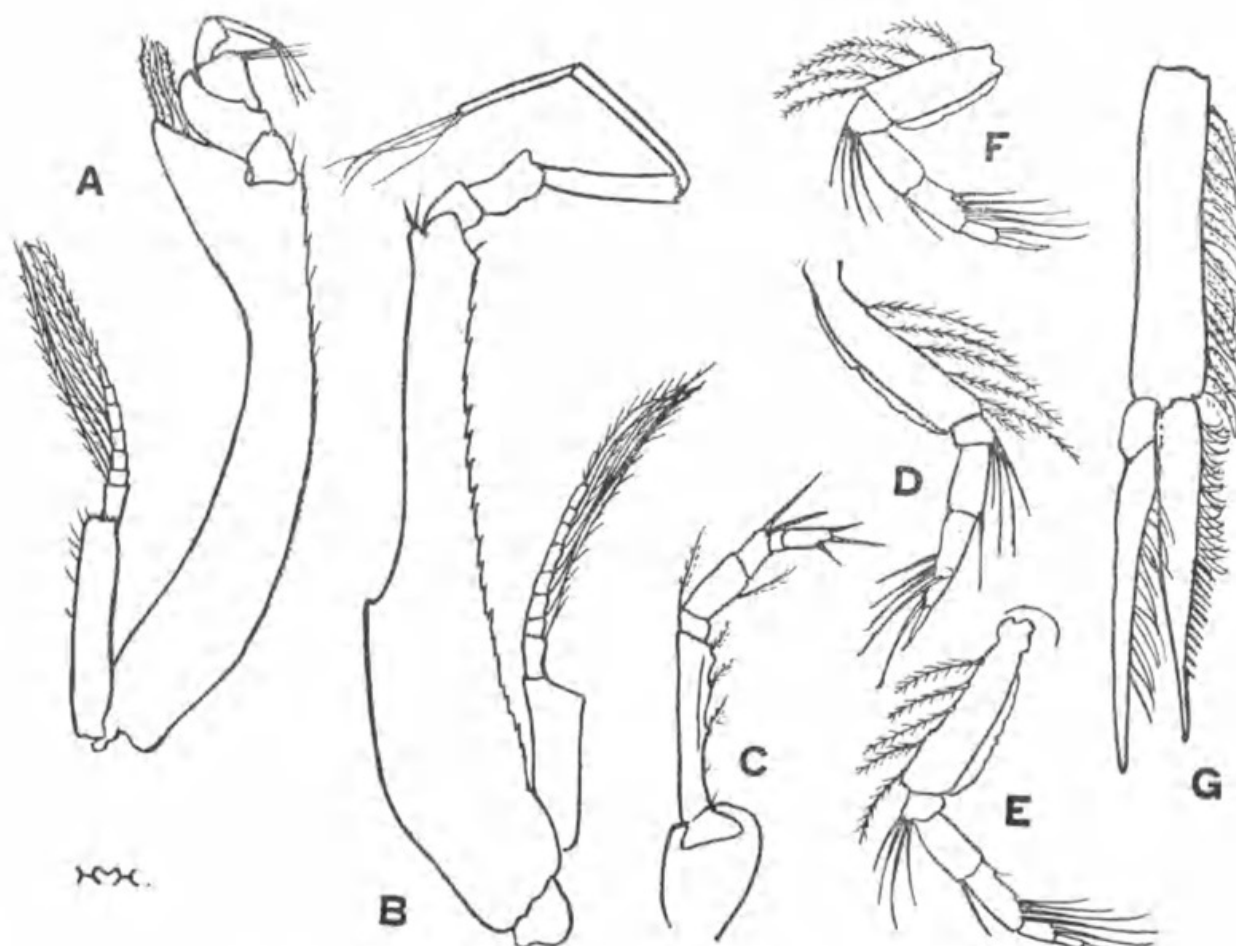


Fig. 38. *Cyclaspis tribulis*, adult male; A, third maxilliped; B to F, first to fifth peraeopods; G, uropod ($\times 25$).

Basis of second to fifth peraeopods with carinate inner margin. Second with basis longer than rest of limb; merus with two plumose setae, longer than carpus, and about as long as propodus and dactylus together; carpus with two unequal terminal spines; dactylus with a terminal spine as long as itself and two smaller spines. Basis of fourth and fifth peraeopods deep, little more than twice as long as depth (including crest) in fifth.

Peduncle of uropoda about one-fourth as long again as telsonic somite and equal in length to exopod, which is one-tenth as long again as endopod; inner margin of exopod with setae, that of endopod with hairs on anterior half and about a dozen short spines on posterior half; inner margin of peduncle with plumose hairs.

Colour white.

Length 13.5 mm. to 15 mm.

Loc. Tasmania: off Babel Is., 0-50 metres ("Warreen" Station 29, 1939). New

South Wales: Lat. $28^{\circ} 37' S.$, long. $153^{\circ} 42' E.$ (K. Sheard, submarine light, Sept. 1938, 10.30 p.m. to 12.5 a.m.); off Wata Mooli, 70 metres, 9 a.m., and off Jibbon, 70 metres, and 45-50 metres (K. Sheard, July-Aug. 1943).

Hab. South Australia, Tasmania and New South Wales.

The above characters and those mentioned in the original description serve to separate *tribulis* from the North-Western Australian *supersculpta* Zimmer (1921, p. 7, fig. 8-11). Even in the very young of *tribulis* there is a slight trace of the elevation at the base of the eye-lobe, not shown in the figure of Zimmer's much larger specimen. It is unfortunate that a complete individual of *exsculpta* Sars (1877, p. 20, pl. i, fig. 24-26) from Torres Strait, is not available. Sars' species, described from the thorax only, was under 5 mm. long (estimated by Stebbing, 1913, p. 35) and while the sculpture is entirely different from that of *tribulis*, it is very close to *supersculpta*.

CYCLASPIS BOVIS Hale.

Cyclaspis bovis Hale, 1928, p. 32, fig. 1-2.

A young example, 6.5 mm. in length, and with the last pair of peraeopods not developed, is referred to this species; it has the carapace relatively more massive and more strongly sculptured than in the almost adult female (c.f. fig. 39, A and Hale, 1928, fig. 1).

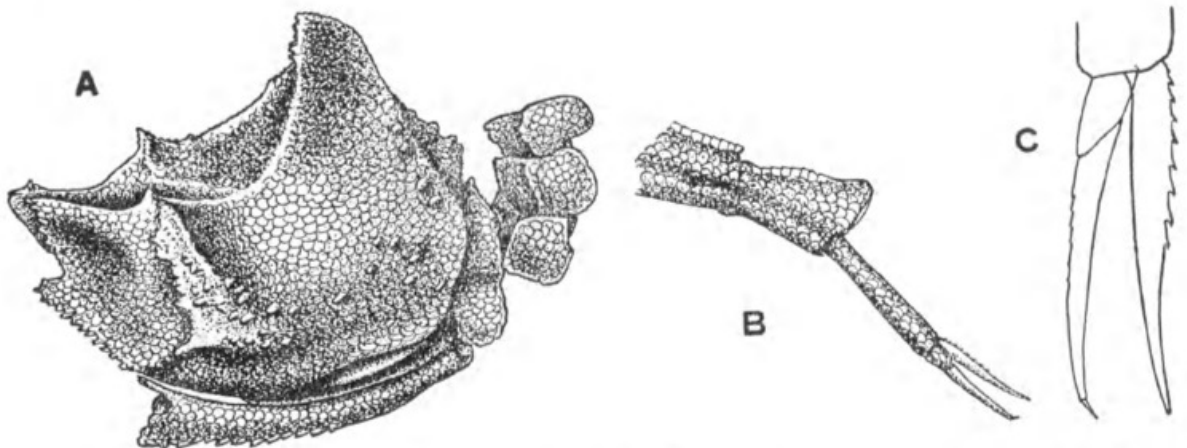


Fig. 39. *Cyclaspis bovis*, juvenile; lateral views of A, thorax and B, telsonic somite and uropod; C, rami of uropod (A and B, $\times 12$; C, $\times 66$).

The sides of the carapace are conspicuously excavate; the depression is bounded in front by the large and very much elevated antero-lateral tooth and dorso-laterally by a ridge extending forward from the posterior horns; the remainder of the edges of the depression bears large granules; these last are vaguely grouped at the sites of the two low elevations which are recorded for the types on the posterior part of the sides.

The anterior transverse ridge is elevated and tuberculate medianly; the sculpture of the integument is squamose-reticulate.

The uropods are relatively shorter than in the adult and the apex of the exopod (dilated in the adult) has a mucro; the endopod is barely longer than the exopod, is four-fifths as long as the peduncle (less than half as long in adult) and the inner margin has eight teeth.

Loc. New South Wales; off Cape Three Points, 41-50 fath. ("Thetis" Station 13, Feb. 1898).

The species is large; the South Australian types, though immature, are 18

and 19.5 mm. in length. It has the same general plan of sculpture as its ally, the Austro-Malayan *persculpta* Calman (1905, p. 3, pl. i, fig. 1-3), but presents a number of obvious differences.

This young specimen offers an interesting comparison with the juveniles of *tribulis* in that the sculpturing is more massive than in the subadult; the condition is reversed in *tribulis*.

CYCLASPIS MAWSONAE sp. nov.

Adult male. Integument strongly calcareous.

Carapace a little less than one-third of total length, twice as long as deep and a little wider than deep; in profile the dorsal margin is slightly convex, with a shallow indentation at about middle of length.

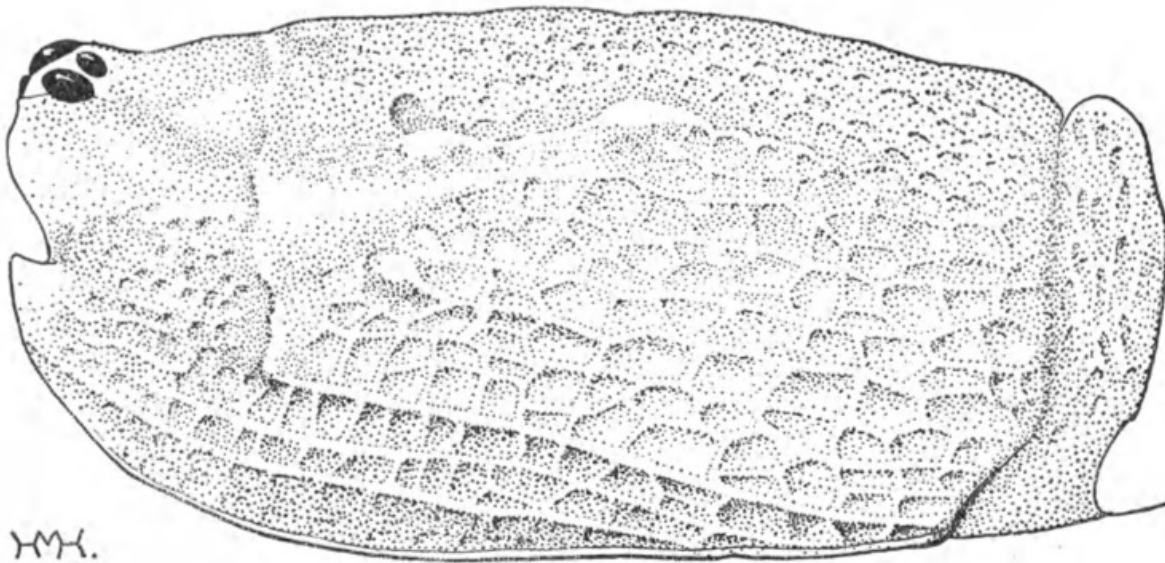


Fig. 40. Carapace of paratype male of *Cyclaspis mawsonae* ($\times 42$).

The carapace is coarsely reticulately pitted, with a fine reticulate background pattern as described for *usitata*, but the coarse reticulations are particularly large and distinct and their edges, arranged end to end, play an important part in the formation of longitudinal ridges (see fig. 40); the limy granules of the integument are thick on the raised edges of the large reticulations, but the bottoms of the pits are less calcified (fig. 41 D, by transmitted light).

The anterior transverse carina crosses the back and continues to the sides, where it traverses the two antero-lateral tubercles; from the lower of the last-named a longitudinal ridge, emphasized by the edges of the large reticulations, runs back to the hinder margin of the carapace; beneath this a similar ridge extends from below the antennal tooth to the inferior margin, near its hinder end; above it the edges of the reticulate pits mark less defined longitudinal carinae and there is a dorso-lateral ridge; the posterior transverse ridge is absent, but is indicated by a scarcely discernible irregularity of the surface; there is a blunt dorsal longitudinal ridge. Pseudorostral lobes barely reach to level of apex of ocular lobe, which is moderately wide, with bisinuate anterior margin, and bears seven pigmented lenses, arranged as in fig. 41 C. Antennal notch rather narrow and antennal tooth subacute; pseudorostral suture fused.

Pedigerous somites together two-thirds as long as carapace; first somite concealed; second, fourth and fifth somites each with an elevated carina, that of

second and fourth almost tooth-like; second to fifth somites successively increasing in length and with infero-lateral portions more or less backwardly produced.

First antenna with basal joint longer than second and third together; flagellum shorter than second or third joints, which are subequal in length.

Third maxilliped with basis about two and three-fourths times as long as remaining joints together; outer apical angle rounded, reaching to level of middle of length of merus, which is more than twice as long as carpus; dactylus, propodus and carpus subequal in length.

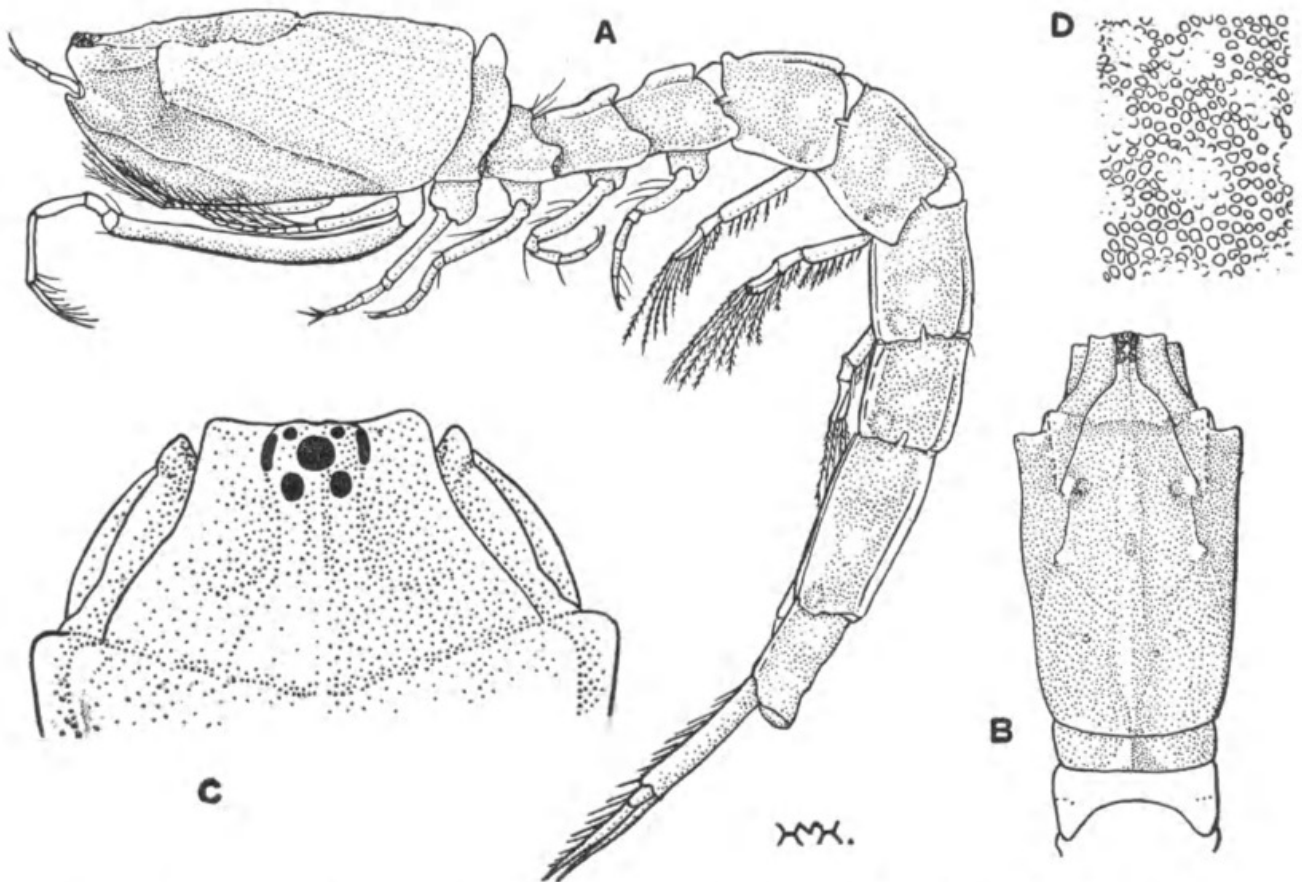


Fig. 41. *Cyclaspis mawsonae*, paratype male; A, lateral view; B, dorsal view of carapace; C, anterior portion of carapace; D, calcification of carapace (A and B, $\times 15$; C, $\times 40$; D, $\times 72$).

First peraeopods with distal end of carpus reaching beyond antennal angle; basis nearly one-half as long again as remainder of limb, with apex produced and with two plumose setae; merus half as long again as ischium and more than half as long as carpus which is a little shorter than propodus and longer than dactylus.

Second peraeopod with basis a little longer than rest of limb, with merus almost as long as carpus and propodus together; dactylus almost as long as carpus and one-third as long again as propodus, with a stout terminal spine much longer than itself and two shorter robust spines; ischium and merus each with a plumose seta; carpus with two stout unequal spines, the longer serrate, and reaching to level of apex of dactylus.

Basis of third peraeopod as long as rest of limb, and with long plumose setae on inner margin; ischium with two setae; merus equal in length to carpus and with one subapical seta; carpus about one-half as long again as propodus, and bearing two subapical setae (almost slender spines) and a spine which reaches level of apex of dactylus; propodus with a similar but shorter spine, also

reaching to same level (fig. 42, D); dactylus almost as long as propodus, with a slender subapical spine and a minute spine on outer margin; fourth and fifth pereopods similar, but basis as usual successively shorter.

Peduncle of uropoda about one-sixth as long again as telsonic somite and subequal in length to exopod, which is barely longer than endopod (35.34) and

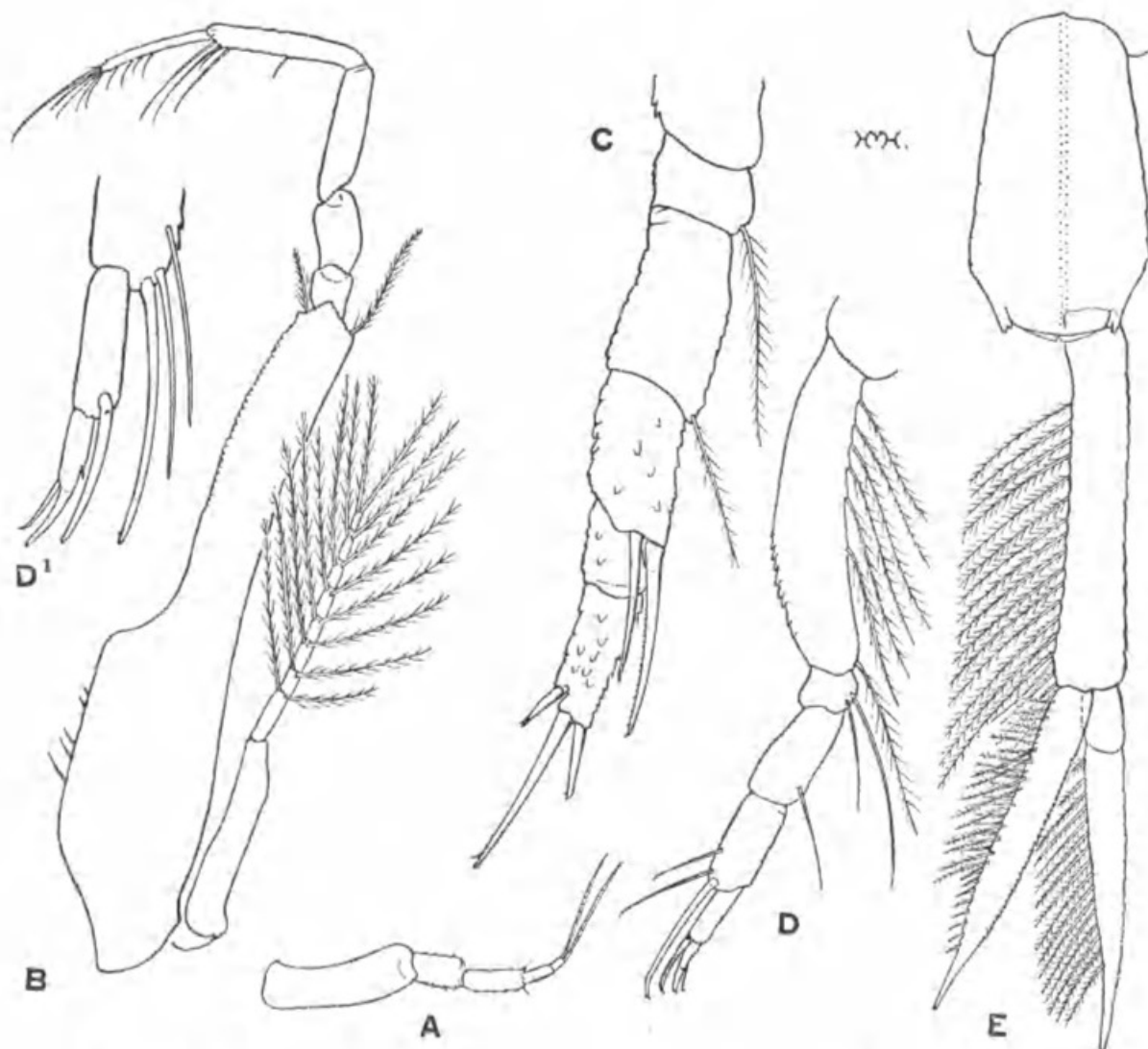


Fig. 42. *Cyclaspis mawsonae*, paratype male; A, first antenna; B, C and D, first, second and third pereopods; E, telsonic somite and uropod (A and D, $\times 64$; B and E, $\times 40$; C and D1, $\times 115$).

has the apex subacute and simple; inner margins of exopod and peduncle with a dense fringe of long setae; endopod with acute apex but no terminal spine, the inner margin with two rows of plumose setae on proximal half and about eight spines on distal half; terminal fifth of both rami unarmed.

Colour white, with a few large and rather scattered brown spots.

Length 10 mm.

Loc. South Australia: St. Vincent Gulf, off Brighton jetty (Patricia Mawson and L. M. Angel, submarine light, Oct. 13, 1941, 9.30 to 9.45 p.m.). Type male in South Australian Museum, Reg. No. C. 2356.

Over three hundred specimens were taken from a swarm of males, and a series of thirty or so was preserved. As shown in the figures, plumose setae are well-developed on the basis of the fossorial legs and on the uropods.

This species, which is named after Miss Patricia Mawson, somewhat resembles the male of *tribulis*, but the sculpturing is very different, and the joints of the maxillipeds and peraeopods are of different proportions.

Although *mawsonae* obviously belongs to the *exsculpta* group, it has no posterior transverse carina (mere suggestion only) and no quadrangular depression on the side. *C. candida* (male only known) has a faint posterior transverse carina according to Zimmer (1929, p. 9, fig. 12-13), the inferior portion of the carapace is not marked off by an oblique longitudinal ridge running back from below antennal tooth, the lower ridge of the "quadrangle" does not continue right to the hinder edge of the carapace, and the upper margin of the second pedigerous somite is steeply oblique, not elevated as in *mawsonae*.

Acceptance of the fact that extreme sexual dimorphism occurs in *tribulis* leads to consideration of the possibility of an association between the swarming of *mawsonae* males and that, a week later at the same place, of newly moulted *usitata* females with fully developed but empty marsupium.

In the case of *tribulis*, however, there are definite features linking the sexes—the presence of a post-ocular tubercle at all stages, the distinctive character of the dorsal carina of the carapace, the fossorial limbs, etc. There are no such parallels in *mawsonae* and *usitata*, but on the contrary the sculpture of the carapace and the fossorial limbs are markedly different; the setae of these peraeopods are much longer in *usitata*, and in both sexes of *tribulis*, than they are in *mawsonae* (c.f. D in fig. 42 and 43).

CYCLASPIS USITATA Hale.

Cyclaspis usitata Hale, 1932, p. 549, fig. 1.

Further material throws a little more light on this species, which is apparently abundant in parts of St. Vincent Gulf, South Australia; as previously suggested it is possible that *usitata* is the female of *candida* Zimmer (1921, p. 9, fig. 12-13) from North-Western Australia.

Like the members of the *exsculpta* group in general, it is a highly calcified species. The type (10 mm.) is the largest example so far secured. In this the second transverse carina of the carapace is interrupted on the back.

Adult females. A large number of females, 7 mm. or so in length, was collected at Brighton, South Australia, by Miss Patricia Mawson, using a submarine light. In these the second transverse carina of the carapace is continued across the back to the median carina, although it is faint immediately alongside the last-named. The anterior transverse ridge, as it crosses the back, has a well-marked median projection, sometimes tooth-like; it is more distinct inferiorly than in the larger type female.

First antenna stout and relatively large, with basal joint shorter than second and third together; third little longer than second; flagellum very short.

The basis of the second peraeopods is a little longer than the rest of the limb and its inner edge bears a row of stout plumose setae; ischium and merus each with two subapical setae but no spines; carpus short, together with propodus as long as merus, and with one stout apical spine; longest terminal spine of dactylus as long as dactylus plus propodus. Fossorial peraeopods stout; carpus not much longer than merus and with three subterminal setae which with propodal seta reach well beyond apex of dactylus (fig. 43, D).

Peduncle of uropods distinctly shorter than rami, with plumose hairs, on inner margin; exopod a little longer than endopod, with a long row of inner plumose hairs, and with apex subacutely rounded; endopod with inner edge serrate.

Subadult females (New South Wales), show the surface patterning well. The front of the pseudorostral lobes, the antennal tooth area and part of the lower edge of the carapace are finely reticulate; beyond these portions there occurs a coarse reticulate or squamose pitting with diameter about six times that of the small reticulations, which are continued on the edges of the secondary reticulation.

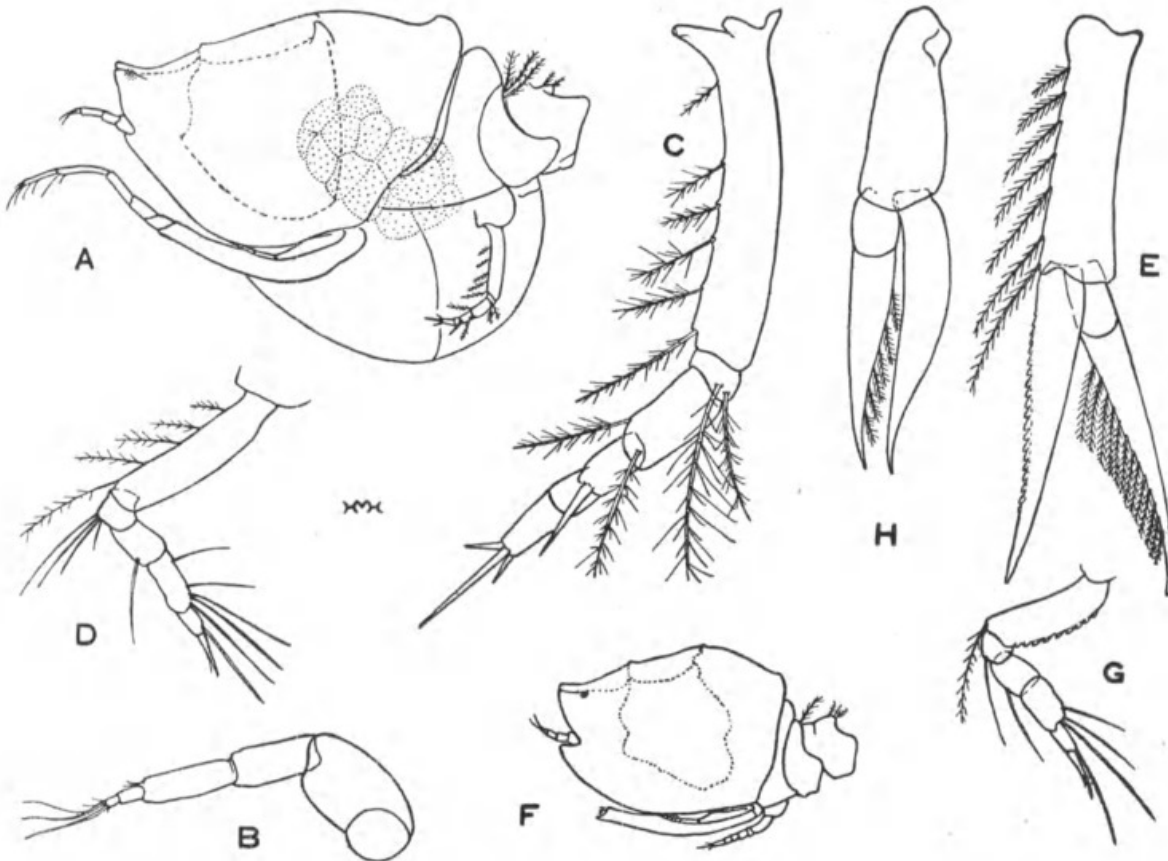


Fig. 43. *Cyclaspis usitata*, newly moulted, transparent adult female; A, cephalothorax; B, first antenna; C and D, second and fourth pereopods; E, uropod. Juvenile, 2.3 m.m.; F, cephalothorax; G, fourth pereopod; H, uropod (A, $\times 16$; B, C and G, $\times 72$; D and E, $\times 45$; F, $\times 26$; H, $\times 116$).

The anterior transverse carina is distinct and is elevated medianly to form a small dorsal tooth; thence as it continues downwards on each side it crosses two low tumidities which are slightly concave immediately in front of the carina, so that a tooth-like prominence results. In some cases the upper of these projections is angular and almost spine-like. The "blunting" of these features in the type female may be due to age.

In lateral view the profile of the narrow ocular lobe is straight; thence the dorsal outline rises obliquely to the first transverse carina, but is quite unbroken by tooth or tubercle; between the two transverse carinae the margin is very slightly concave and posterior to it is arched upwards and downwards; at the hinder end of the back the median conical elevation is large.

In dorsal view the carapace is of equal width where crossed by the transverse carinae.

The stout uropods are less than twice as long as the telsonic somite; the peduncle is a little shorter than the endopod, which is slightly longer than the exopod, and six times as long as wide.

Colour yellow.

Length to 7 mm.

Juveniles, about 2.3 mm. in length, are similar to young of *tribulis*, but the carapace lacks a post-ocular dorsal projection; the characteristic ridging of the carapace is pronounced, but the posterior median elevation is low and as usual the appendages are stouter and relatively shorter than in the adult.

The peduncle of the uropods is stout, much shorter than the rami, which are relatively wider than in older examples.

Loc. South Australia: St. Vincent Gulf. New South Wales: Jervis Bay.

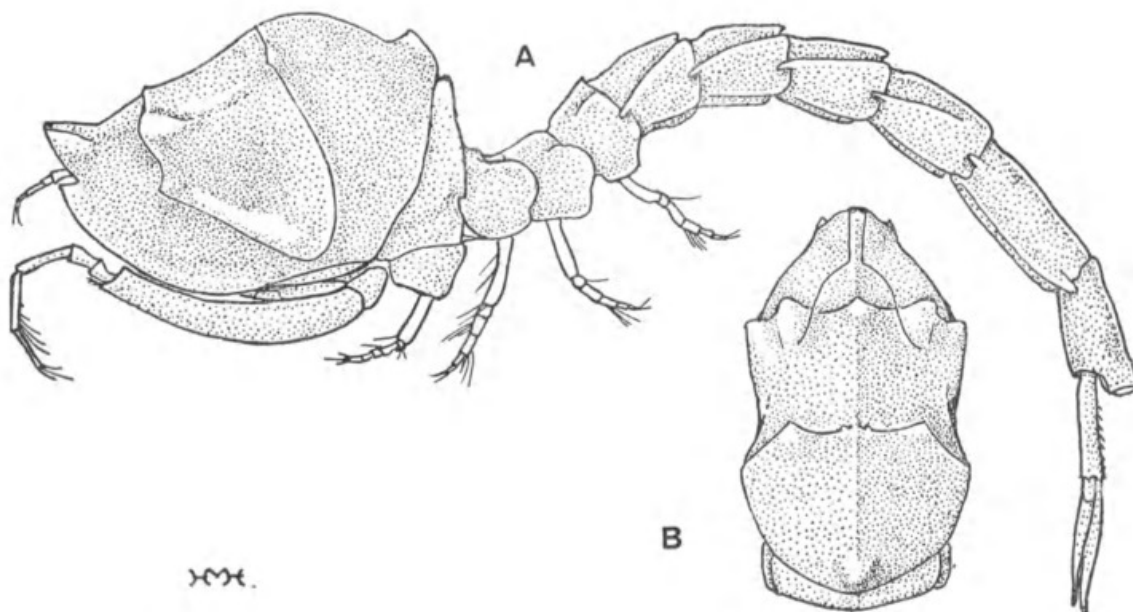


Fig. 44. *Cyclopsis usitata*, subadult female (New South Wales); A, lateral view; B, carapace from above ($\times 19$).

Material attracted to light at Brighton, October 22, 1941, and again in November 1943, consisted largely of subadult and adult females, all of which had recently moulted. They were almost all flaccid, the integument transparent with black pigment spots, and not at all or scarcely calcified, although in some induration was proceeding and the very coarse pitted patterning characteristic of the *exsculpta* group was noticeable. These adult females are smaller than the type (7 mm. as against 10 mm.) and about equal in size to the subadult female from New South Wales which is figured (fig. 44 A and B). The marsupium is fully developed but contains no eggs; the ovaries are swollen with large ova (approx. 0.4 mm.) easily visible through the transparent integument as large, bright yellow masses (fig. 43, A). It may be that, as in some other Crustacea, mating occurs at this period.

Some of the specimens discussed above, females and juveniles, were attracted by green light on November 22, 1941, at 8.15 p.m., and it is worthy of note that at the same place and time Cumacea flocked around the green light in much greater numbers than the ever present Amphipoda, which appeared in overwhelming numbers when a red light was used. A "white" lamp produced practically the same result as the green.

As noted under *mawsonae*, the male of that species swarmed at Brighton on October 13, 1941, a week prior to the swarming of the females of *usitata*.

CYCLASPIS ASPERA sp. nov.

Subadult male. Integument firm, calcified; reticulate and conspicuously spinulose.

Carapace with dorsal margin little arched in lateral view, one-fourth of total length of animal, more than one-half its own length and about two-thirds of greatest breadth. Carapace with four lateral spinose elevations on each side; two are placed at about the first fourth of length close together, the one imme-

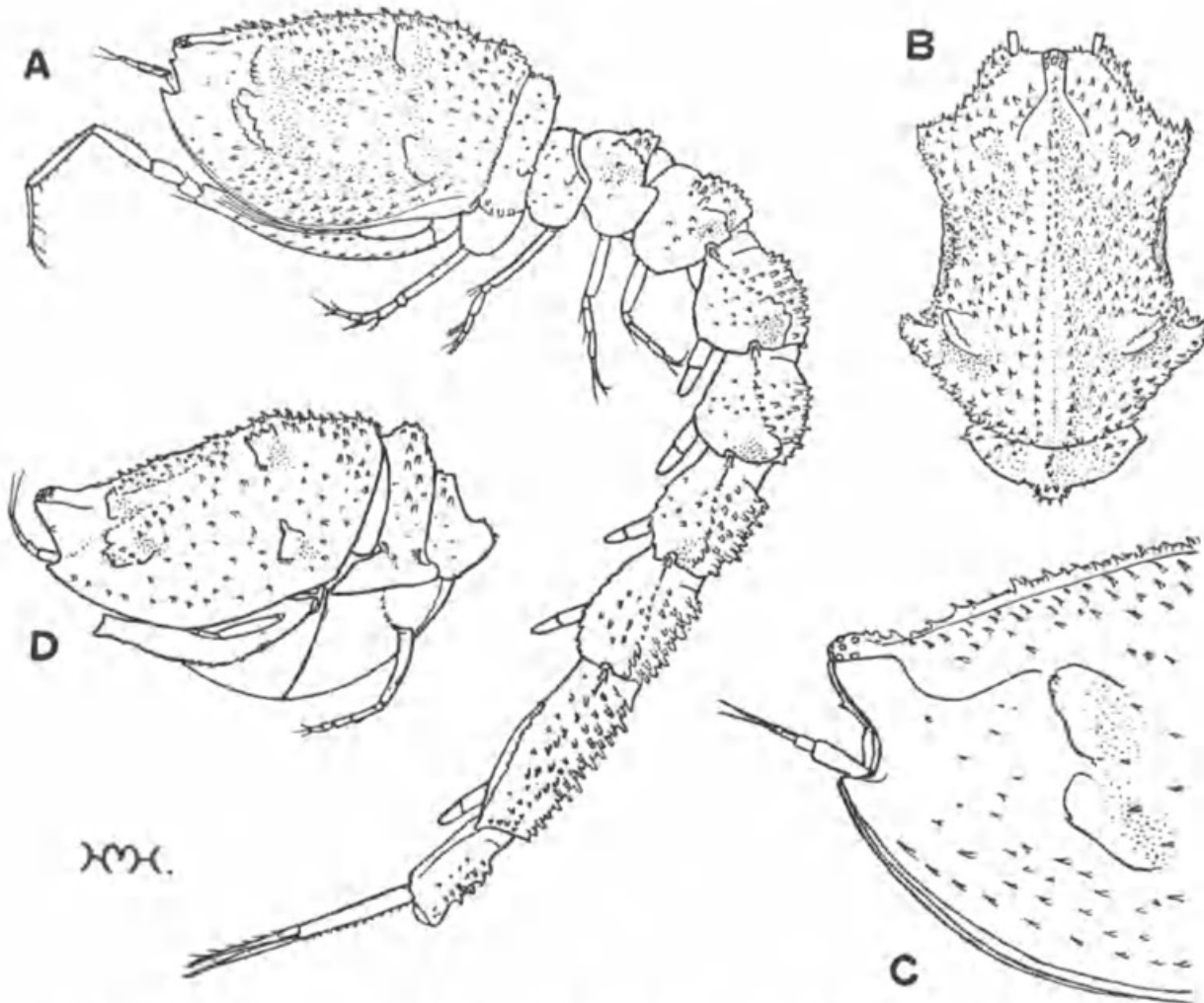


Fig. 45. *Cyclaspis aspera*. A, lateral view of type male. B, carapace of paratype male from above and C, lateral view of front portion of carapace. D, lateral view of carapace and anterior thoracic somites of female. (A, B and D, $\times 15\frac{1}{2}$; C, $\times 32$).

diately above the other; the other two are situated at three-fourths of the length, one above the other, but widely separated; the side of the carapace has a quadrangular concavity, the four corners marked by the spinose elevations but enclosing ridges are obsolete; in dorsal view the width is greatest across the ventral postero-lateral elevations. Dorsum of carapace with a low, spinose median carina, which bifurcates at level of posterior end of ocular lobe, thence running back as two distinct spinose rows which tend to come together again at posterior end of carapace. Pseudorostral lobes not quite attaining apex of ocular lobe, which is much longer than wide, with small but distinct lenses. Antennal notch distinct, moderately deep, and antennal tooth subacute.

First pedigerous somite concealed; second deep, short and elevated dorsally; fifth longer than third and fourth somites.

First five somites of pleon with well-developed articular processes; all but fifth somite subequal in length.

A median dorsal carina (perhaps better described as a defined series of short median spines) extends along the last three thoracic somites and the pleon almost to the end of the telsonic somite, where it bifurcates; the exposed pedigerous and anterior pleon somites bear lateral expansions; these are merely slight spinose elevations on all but the last pedigerous and first pleon somites, where they form wing-like projections.

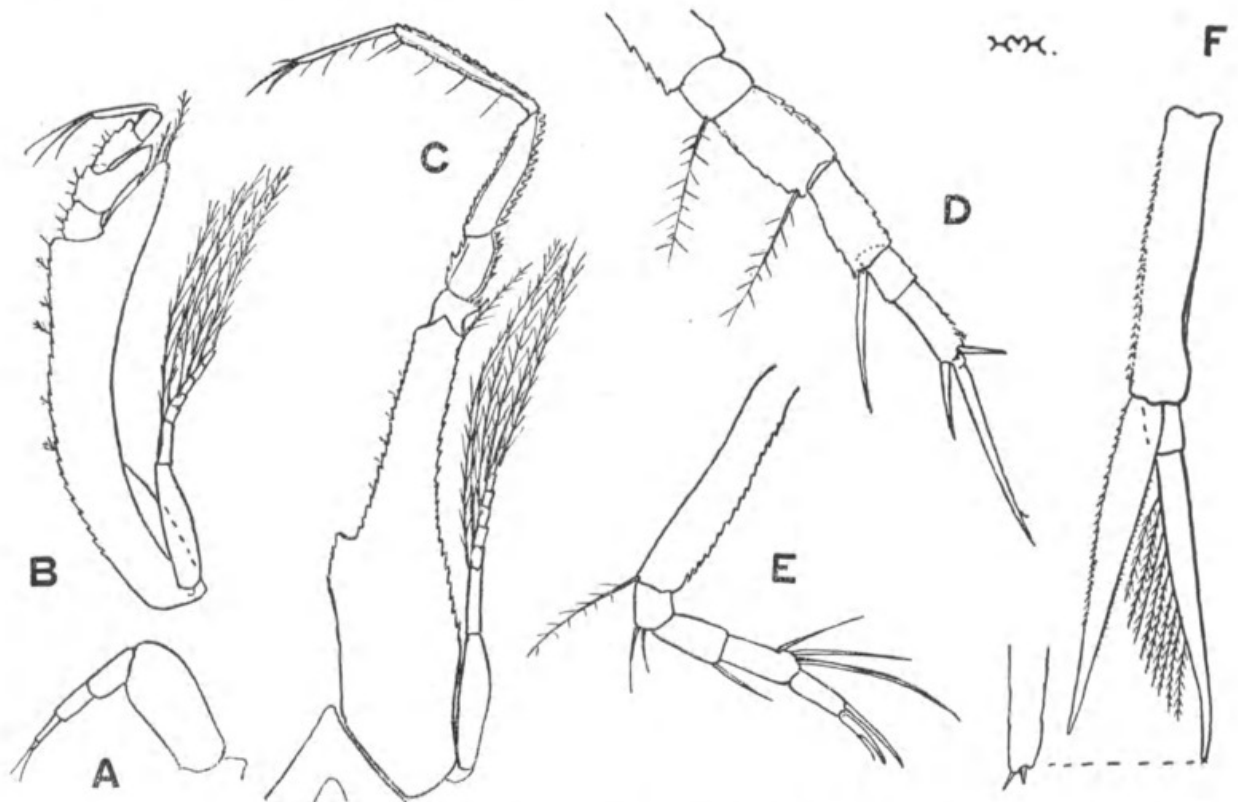


Fig. 46. *Cyclaspis aspera*, type male; A, first antenna; B, third maxilliped; C, D and E, first, second and fourth peraeopods; F, uropod (A and D, $\times 84$; B and C, $\times 26$; E, $\times 50$; F, $\times 35$).

First antennae with second segment stouter and longer than third; second and third together three-fourths as long as stout basal joint.

Basis of third maxillipeds more than twice as long as rest of limb, with outer apical portion reaching forward almost to distal end of merus and capped with plumose setae; carpus as long as the slender dactylus, and twice as long as the propodus; merus, including its apical expansion, as long as carpus and propodus together.

First peraeopod slender, much longer than carapace, its merus reaching forward to level of antennal tooth; basis almost as long as rest of limb, with margins serrate, with a small but distinct apical process, and with a plumose apical seta; merus, carpus, propodus and (to a less defined extent), dactylus with serrated edges; ischium with short spines at outer part of apex; merus half as long as carpus, which is longer than the dactylus and shorter than the propodus.

Basis of second peraeopods longer than rest of limb; merus longer than

carpus and as long as propodus and dactylus together; longest terminal dactylar spine not much shorter than carpus, propodus and dactylus together, the other two unequal.

Last three pairs of pereopods with basis becoming successively shorter; longer than rest of limb in third, a little shorter in fourth and only as long as ischium merus and carpus combined in fifth; setae see fig. 3, I.

Peduncle of uropods shorter than telsonic somite and serrate on outer side; endopod serrate on inner margin, slender, without apical spine, one-sixth as long again as peduncle and a little shorter than the exopod, which bears slender setae on inner margin and two minute apical mucrones.

Colour milky white, without markings.

Length 9.5 mm.

Ovigerous female. Carapace in lateral view of different shape (c.f. fig. 45, A and D); first pedigerous somite partly exposed and the second relatively longer than in the male.

Loc. New South Wales: off Coff's Harbour, 50 metres (K. Sheard, June 1941). East of Pt. Hacking, trawled on mud, 100 metres (K. Sheard, July 1943). Off Botany Bay, 50–52 fath. ("Thetis" Station 37, Mar. 1898), off Jibbon, 46–55 fath. ("Thetis" Station 38, Mar. 1898). Off Cape Three Points, 34–23 fath. ("Thetis" Station 13, Mar. 1898). Eden, 4 miles off shore, in silt, 70 metres (K. Sheard, Oct. 1943). Type male in South Australian Museum, Reg. No. C. 2376.

The four prominent lateral projections of the carapace and the absence of transverse ridges thereon, the long first pereopods and the spinose body distinguish this species.

The lateral elevations are more spinose or more acute in some examples than in those illustrated; the upper and lower antero-lateral elevations are often conjoined on each side, but still retain their character as distinct projections.

CYCLASPIS AUSTRALIS Sars.

Cyclaspis australis Sars, 1887, p. 12, pl. i, fig. 1–20; Calman, 1907, p. 7, Stebbing, 1913, p. 38.

Sars' types from Victoria were subadult. A considerable series now available makes it possible to amplify the original description.

Ovigerous female (8 mm. to 9 mm.). The carapace is about two-thirds as long as deep; in dorsal view it is widest in posterior half where it is three-fourths to five-sixths as long as the medial length. The median longitudinal carina bears a double row of small tubercles. At the first fourth of its length, each side of the carapace has two low antero-lateral tubercles, from the lower of which runs downwards and backwards an obsolete ridge. Behind the middle of the length is a transverse carina (much more defined than the anterior) running from the median ridge a little forwards, then forming a decided angle (postero-lateral tubercle) with its curved lateral continuation, which meets the feeble anterior carina near the inferior margin of the carapace; a low, oblique, swollen dorso-lateral ridge extends from the postero-lateral prominence to the antero-lateral tubercles. The pedigerous and pleon somites are as described by Sars.

The surface is pitted, with the edges of the pits raised to form an ill-marked reticulate pattern. In certain lights these define a faint antennal ridge.

In the first pereopods the basis is distinctly longer than the rest of the limb and bears a seta at external apical angle and a shorter one at inner angle; the carpus is shorter than the propodus (of equal length in Sars' fig. 16) and longer than the dactylus.

The second leg has the basis as long as the remaining joints, the merus longer than the carpus or propodus, which are subequal in length. Setae of posterior pereopods as in fig. 3, I.

The peduncle of the uropoda is as long as the telsonic somite and as the exopod, which is slightly longer than the endopod.

Submature examples have the usual characters of immaturity, the peduncle of the uropods is shorter than the rami, etc. In some examples of both sexes, about 8 mm. long, the ridges and elevations of the carapace are more defined and the surface is coarsely reticulate (fig. 48 D-E).

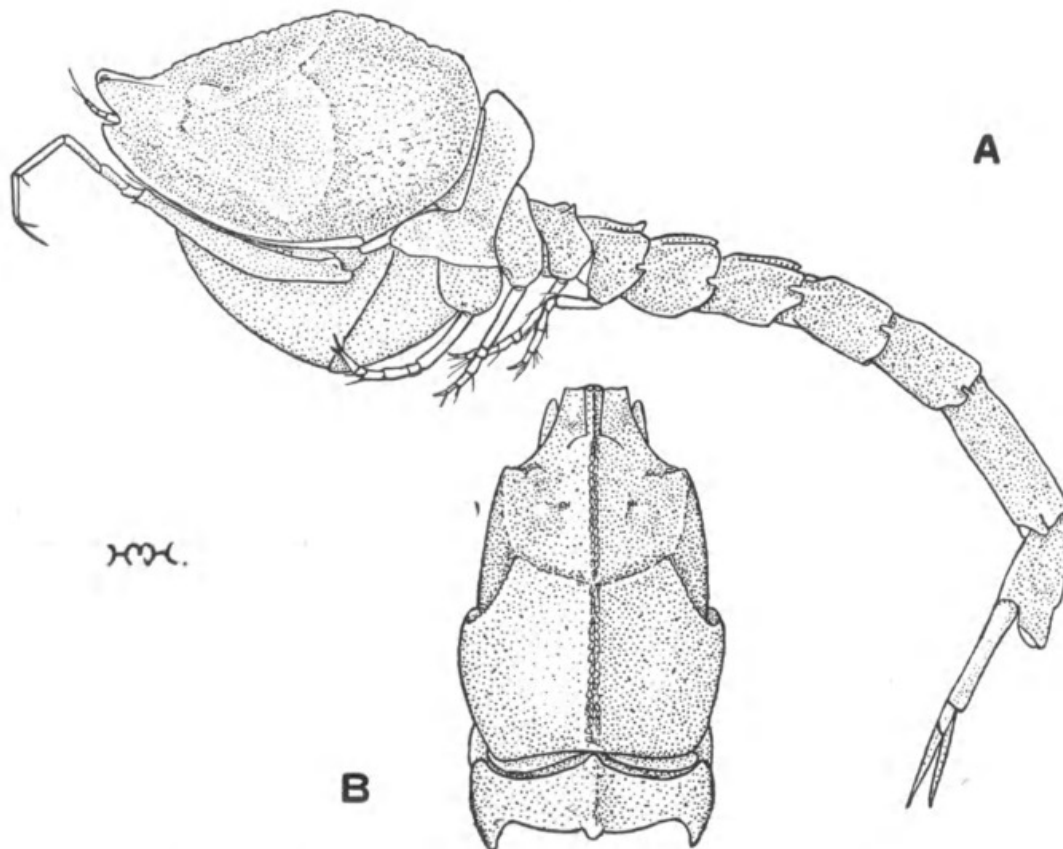


Fig. 47. *Cyclaspis australis*, ovigerous female; A, lateral view; B, carapace from above ($\times 15$).

Loc. Tasmania: Off Babel Is., 0-50 metres ("Warreen" Station 29, 1939). New South Wales: Off Wata Mooli, 35 metres, on sand (Trawl Station 2, July 1943); off Gibbon 70, 40 and 45-50 metres (Trawl Stations 3, 6, 9 and 10, July-Aug. 1943); 5 miles east of Pt. Hacking, 100 metres, on mud (K. Sheard, July 1943); off Cape Three Points, 41-50 fath. ("Thetis" Station 13, Feb. 1898); Eden, 4 miles off shore, in silt, 70 metres (K. Sheard, Oct. 1943).

Hab. Victoria, Tasmania and New South Wales.

In his key to *Cyclaspis* spp. Stebbing (1913, pp. 29-30), from Sars' description, separates *australis* from *exsculpta*, etc., in having "Ridges not enclosing quadrilateral areas on carapace." These areas are present though faintly marked.

In the grouping here adopted, this species has a quite characteristic facies; considering both adults and subadults, it has the sculpturing of the carapace less

marked than in other members of the *exsculpta* group. The elevations, or ridges, bounding the subtriangular depression on the sides of the carapace are not so distinctly defined. The posterior transverse ridge is, however, very definite; the anterior one is traceable but does not meet its fellow on the back to form a dorsal transverse ridge, nor is there at this level a dorsal prominence.

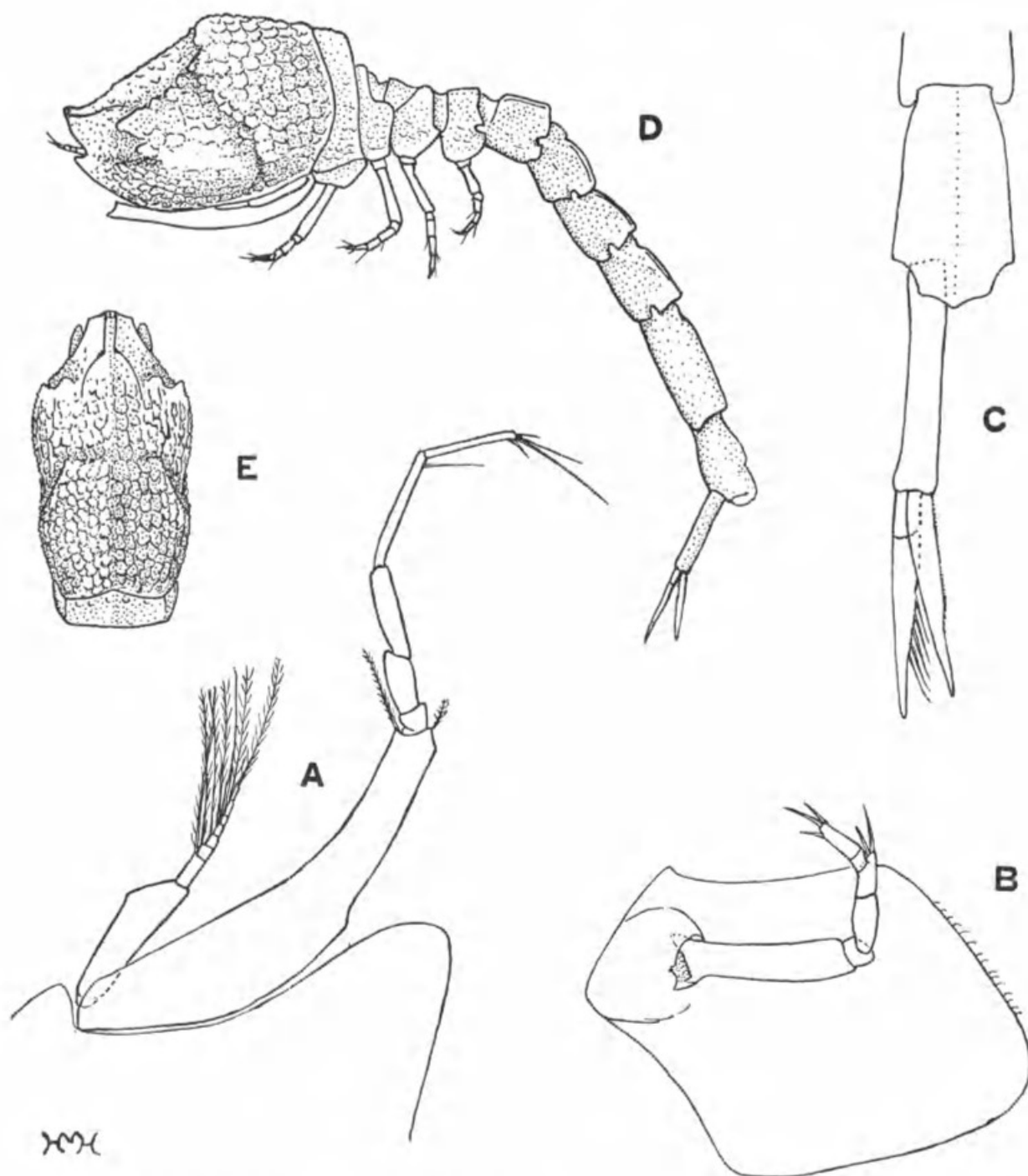


Fig. 48. *Cyclaspis australis*, ovigerous female; A and B, first and second peraeopods; C, telsonic somite and uropod ($\times 26$). Submature, coarsely reticulate female; D, lateral view; E, carapace from above (A to C, $\times 26$; D and E, $\times 15$).

Miscellaneous Species.

The remaining six "sculptured" Australian species form a varied assemblage; the female is known only in *sabulosa*, which makes it still more impossible to group them satisfactorily.

C. simula alone has a long ridge running back from the antennal tooth, as well as other longitudinal ridges on the sides of the carapace, and has the dorsal and lateral contours of the carapace broken and uneven owing to the sculpture.

C. cana, *munda* and *pruinosa* all have the general form of the carapace as in the fully adult male of *tribulis* and *mawsonae* (with the greatest width across the pseudolateral lobes) but the sculpture is entirely different; the female of these species should prove of interest.

C. sabulosa and *spilotes* have each side of the carapace relatively smooth, the single forwardly curved ridge being not at all prominent; it is obsolete for the greater part of its length in the female of the first-named. *C. spilotes* (Hale, 1928, p. 36, fig. 5-6) has a sharply defined, fine ridge traversing the side.

CYCLASPIS SIMULA sp. nov.

Young male. Integument firm, but of egg-shell fragility; finely and evenly squamose throughout.

Carapace in lateral view with dorsal margin slightly elevated posteriorly.

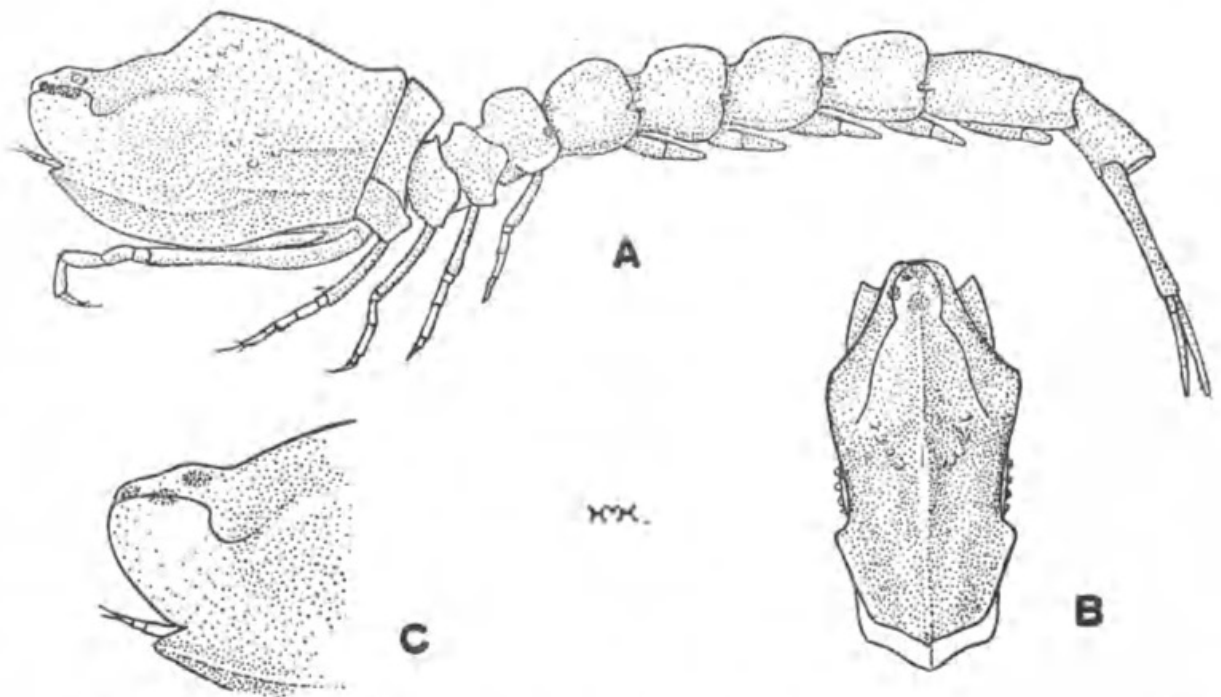


Fig. 49. *Cyclaspis simula*, type male; A, lateral view; B, carapace from above; C, front portion of carapace from the side (A and B, $\times 30$; C, $\times 53$).

thence rising to an abrupt peak at about middle of length (see fig. 49, A); one-third of total length of animal, depth about two-thirds length, and one-fifth greater than breadth; there is a somewhat angular, antero-lateral tumidity on each side, and above this a series of four tubercles; on the lower half of the side and near the posterior margin are two short carinae, one above the other, while from the antennal tooth a longer carina curves backwards to almost meet the lower of the short carinae; there is a group of four tubercles in front of the upper short carina. Pseudorostral lobes reaching to end of ocular lobe. Ocular lobe large, barely longer than wide; lenses sooty. Antennal notch rather narrow and tooth subacute.

First pedigerous somite concealed; second to fifth each with sharp dorsal carina; inferior postero-lateral angles of fifth somite rounded like those of first four pleon somites.

All pleon somites with sharp dorsal carina; somites one to five with well-developed articular processes; first to fourth and telsonic somite subequal in length; fifth one-half as long again.

Third maxillipeds with basis twice as long as rest of limb, with outer apical lobe extending forward to level of insertion of carpus; merus with outer apical lobe extending to a little beyond external apical angle of carpus; ischium a little shorter than carpus and slightly longer than propodus, which is one-half as long as merus.

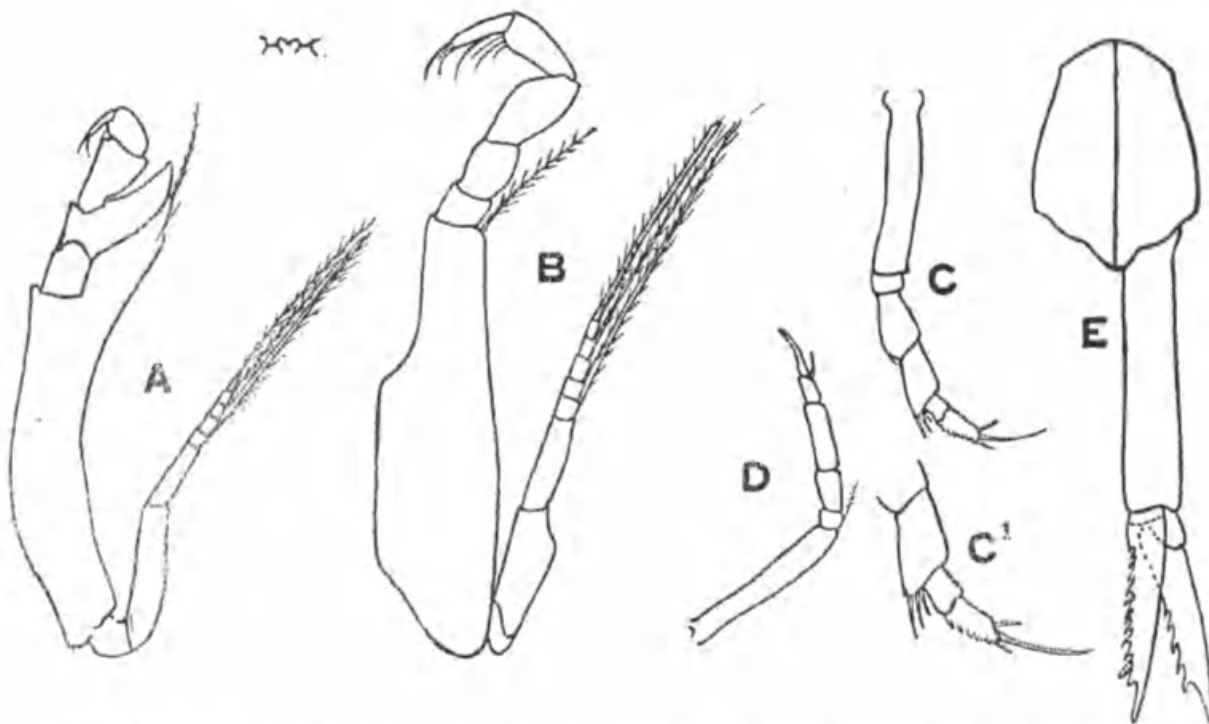


Fig. 50. *Cyclaspis simula*, type male; A, third maxilliped; B, C and D, first, second and fifth pereopods; C, terminal joints of second pereopod; E, telsonic somite and uropod. (A to E, $\times 60$; C1, $\times 86$).

First pereopods only about as long as carapace; basis with a long plumose seta at external apical angle and more than one-fourth as long again as the remainder of limb, the segments of which are stout; ischium little more than half as long as merus, which is equal in length to dactylus and shorter than propodus, which is shorter than carpus.

Second pereopods with basis as long as rest of limb; ischium and propodus short; merus and carpus much longer and subequal in length; merus with an apical spine and carpus with three, all unusually short; dactylus stout, with three terminal spines, the middle very much longer than the others. Third to fifth pereopods as in fig. 3, B; one short plumose seta on basis, and one unusually short seta on propodus; no other armature.

Peduncle of uropods about one-fourth as long again as telsonic somite; rami equal in length, three-fourths as long as peduncle, rather broad, apically simple and acute, inner edges coarsely serrate.

Colour milk white, without any dark pigment.

Length 3.9 mm.

Loc. South Australia: Page Is., 9 fath. (K. Sheard, submarine light, April 1941, 7 to 7.30 p.m.). Type in South Australian Museum, Reg. No. C. 2331.

CYCLASPIS CANA sp. nov.

Adult male. Integument strongly calcified.

Carapace small, less than half length of pleon and about one-fourth of total length; a little more than twice as long as depth, which is slightly less than greatest width; dorsal margin in lateral view scarcely at all arched; surface not pitted,

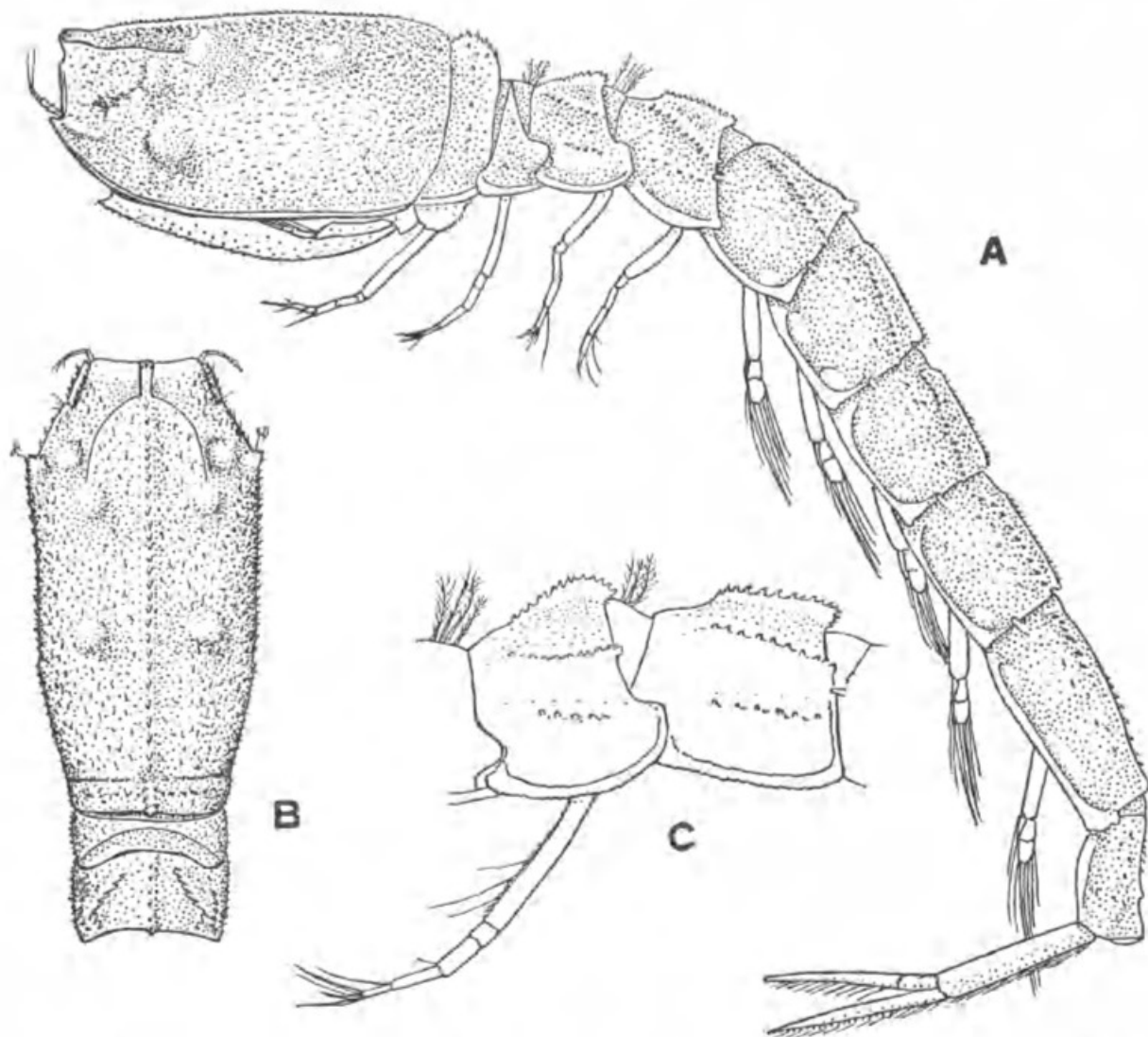


Fig. 51. *Cyclaspis cana*, type male; A, lateral view; B, carapace and first four pedigerous somites from above; C, fourth and fifth pedigerous somites from the side. (A and B, $\times 15\frac{1}{2}$; C, $\times 32$).

with very fine reticulate pattern, and with minute sparse spinules; there is a well-marked, spinose, median longitudinal carina for whole length and a short groove leading back from the antennal notch; on each side are four rounded tubercles, one (upper antero-lateral tubercle, from which extends obliquely forward an obsolete spinose ridge) on the hinder portion of the pseudorostral lobe, one below this, one immediately behind the termination of the pseudorostral lobe, and one at same level, at two-thirds of length; a feeble infero-lateral tubercle is also

present. The carapace is widest across the lower of the anterior tubercles. Pseudo-rostral lobes not meeting in front of ocular lobe. Antennal notch wide and angle subacute. Ocular lobe narrow with distinct lenses.

Exposed pedigerous somites, with exception of third somite which is extremely short dorsally, each with a spinose carina; on the fourth and fifth this is raised to form a thin serrated crest, below which is a spinose dorso-lateral oblique ridge.

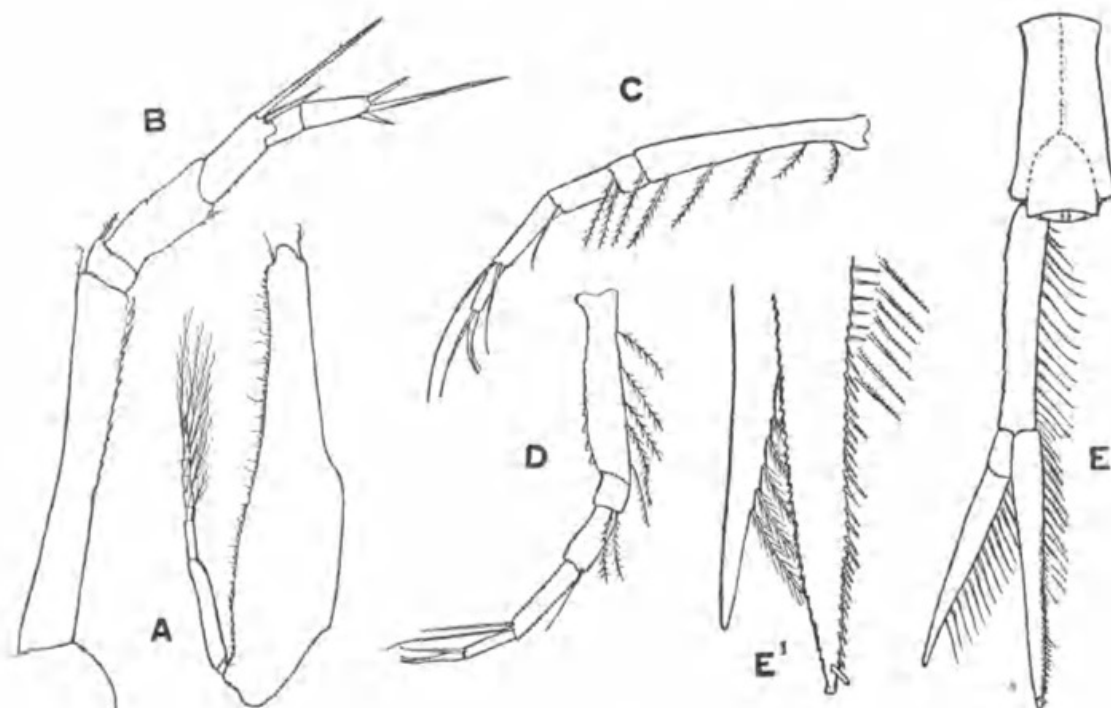


Fig. 52. *Cycloaspis cana*, type male; A, basis of first peraeopod; B, C and D, second, fourth and fifth peraeopods; E, telsonic somite and uropod; E1, terminal half of rami of uropod. (A and E, $\times 25$; B and E1, $\times 64$; C and D, $\times 40$).

First to fifth pleon somites each with a median carina, a spinose dorso-lateral carina on each side, and a few scattered spinules; each of the three ridges terminates in a small projection at the hinder margins of the somites; telsonic somite with a median carina, which bifurcates at two-thirds of length, an elevation marking the point of separation.

Basis of first peraeopods with two apical plumose setae (rest of limb missing).

Second peraeopod with basis little longer than remaining joints together; merus fully as long as propodus and dactylus together, and longer than carpus; dactylus with terminal spine (which is flanked by two much shorter spines) longer than merus; apex of carpus with a still longer spine, and one which is half as long (fig. 52, B).

Third to fourth peraeopods slender, with long subterminal setae, two being on carpus (fig. 3, G), which is unusually elongate.

Uropods with endopod a little longer than exopod, which is subequal in length to peduncle, and to telsonic somite; inner margin of peduncle with slender setae; endopod with a comb-like series of spines at middle of length of inner edge, followed by a row of stouter downwardly directed spines and preceded and partly overlapped by finely-serrate long setae; there is a separate short, stout spine near

the narrowly subtruncate apex of the endopod and the outer margin is serrate; exopod has the apex subacute and the inner margin bears long plumose setae.

Colour gray, darker on carapace.

Length 11 mm.

Loc. New South Wales: east of Port Hacking, 100 metres, on mud (Cronulla Trawl Station, July 1943). Type male in South Australian Museum, No. C. 2396.

CYCLASPIS MUNDA sp. nov.

Adult male. Integument calcified, with moderately coarse reticulation and with larger, irregular squamose-tuberculate surface markings.

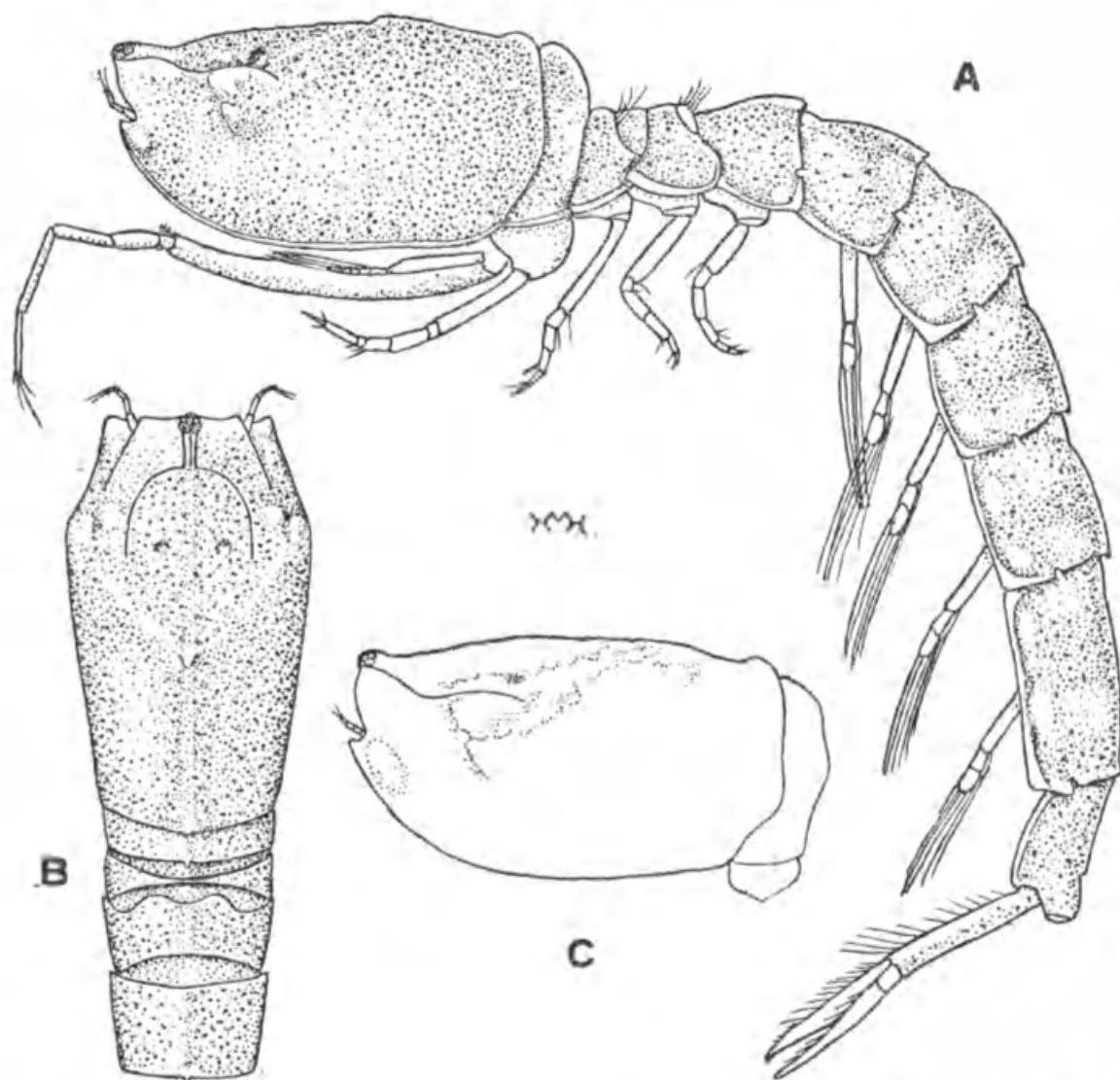


Fig. 53. *Cyclaspis munda*, type male; A, lateral view; B, cephalothorax from above. C, Lateral view of carapace of paratype male ($\times 19$).

Carapace two-sevenths of (three and one-half times in) total length, less than twice as long as depth which is equal to greatest width; dorsal margin in side view little arched, with a slight depression behind middle of length and with a low elevation at posterior end; there is a faint, double, median carina, which becomes single on ocular lobe; from the aforementioned interruption in the dorsal outline there runs obliquely forward an obsolete ridge, below which is a second

and still less easily discernible ridge; below the posterior portion of each pseudo-rostral suture are two confluent antero-lateral tubercles, one below the other; the carapace is widest across the lower of these tumidities. Pseudorostral lobes not meeting in front of ocular lobe. Antennal notch wide and shallow; angle somewhat obtuse, with a small oval tumidity behind it. Ocular lobe narrow, with a mulberry-like mass of prominent, pigmented lenses at anterior end.

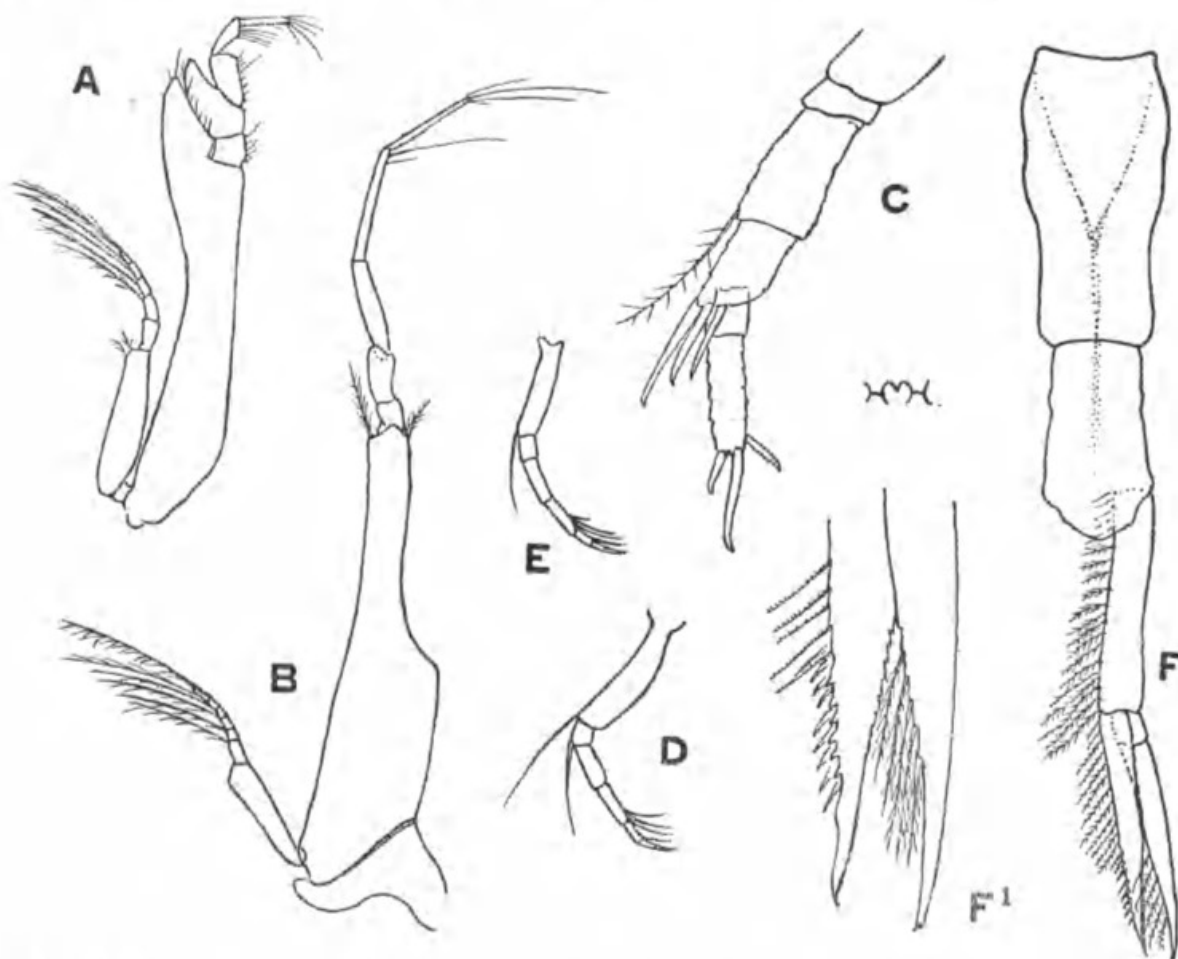


Fig. 54. *Cyclaspis munda*, type male; A, third maxilliped; B, C, D and E, first, second, fourth and fifth pereopods; F, fifth pleon and telsonic somites, and uropod; F1, terminal half of rami of uropod (A, B, D, E and F, $\times 32$; C and F1, $\times 80$).

Pedigerous somites two and five with a median carina which is produced as a little tubercle at posterior margins; fourth with a very faintly marked, double median ridge, not produced at hinder edge; third short dorsally, not carinate.

Sides of pleon somites, unlike leg-bearing ones, tumid fore and aft when seen from above; first to fourth somites each with a median ridge, evanescent anteriorly but slightly produced at hinder end of somite; fifth with a median carina on posterior third, bifurcating anteriorly to form a pair of divergent dorso-lateral carinae; telsonic somite with a low carina, ending abruptly at two-thirds of length, an incision in the dorsal outline at its termination.

Third maxillipeds with basis and merus produced and widened apically to form prominent lobes; carpus longer than propodus or dactylus.

First pereopods slender; basis longer than rest of limb, and with two apical plumose setae; carpus a little shorter than propodus, and as long as the narrow dactylus, which is shorter than its longest terminal seta.

Basis of second pereopods not as long as remaining segments together; merus

longer than carpus and propodus together; dactylus more than twice as long as propodus, longer than its longest terminal spine; merus with a long plumose seta, and carpus with three strong spines on distal margin. Fossorial legs with basis as long as (third) or a little shorter than remaining segments together; setae short, three on carpus as in fig. 3, I. Uropods with rami subequal in length, longer than the peduncle, which is longer than the telsonic somite; endopod with apex acute and slightly curved; both margins serrate, the inner also with a row of eight downwardly-directed spines on posterior third and with serrate setae on anterior two-thirds; inner edge of exopod and peduncle with plumose setae; apex of exopod narrowly rounded, with small mucro.

Colour brown, with darker spotting.

Length 8.75 mm.

Loc. New South Wales: Off Wata Mooli, 35 metres, on sand (Cronulla Trawl Station 2), and off Eden, 30 metres, coarse sand (Cronulla trawled Oct. 1943). Type male in South Australian Museum, Reg. No. C. 2394.

CYCLASPIS PRUINOSA sp. nov.

Adult male. Integument strongly calcified, the body somites with minute spines, giving the animal a hoary appearance.

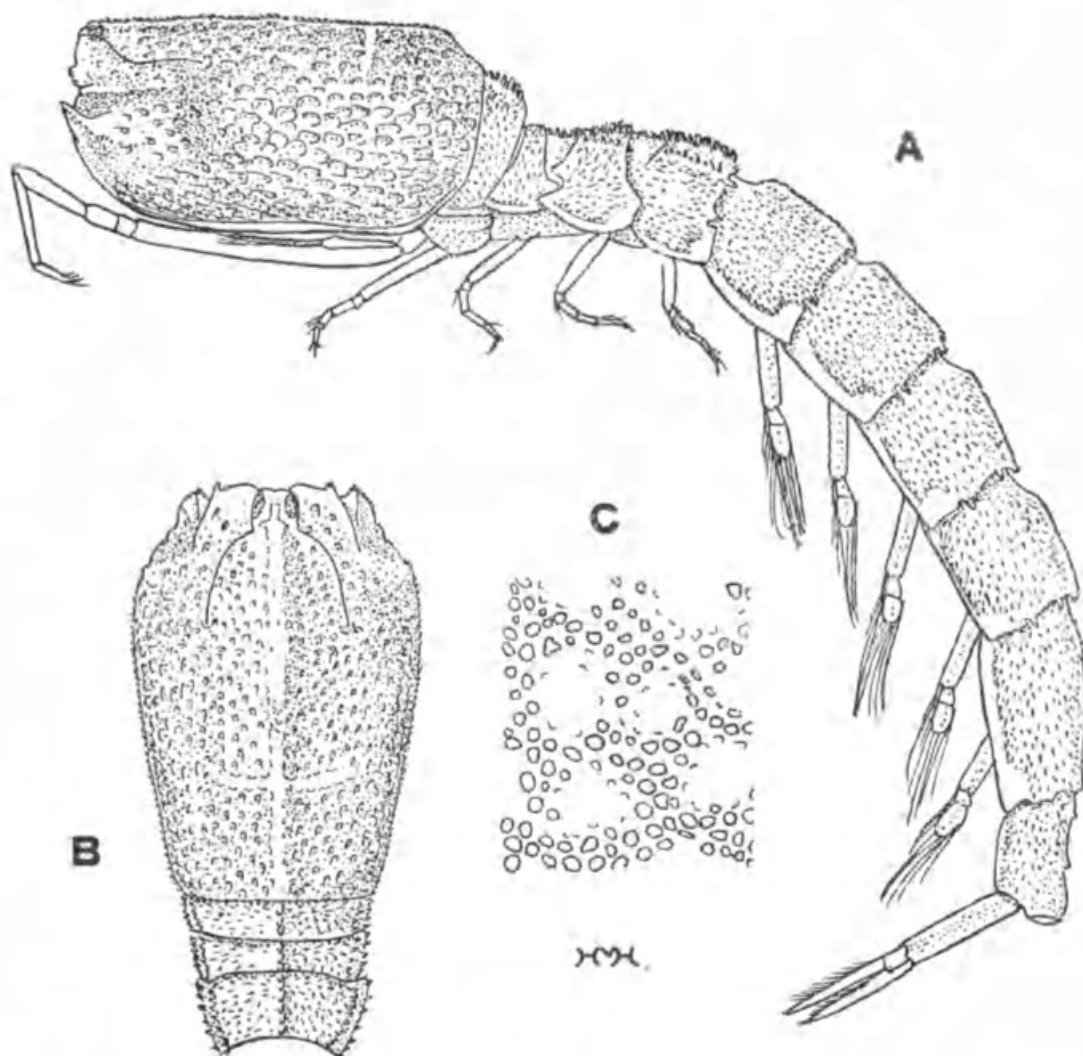


Fig. 55. *Cyclaspis pruinosa*, type male; A, lateral view; B, carapace and second to fourth pedigerous somites from above; C, calcification of carapace (A and B, $\times 18$; C, $\times 140$).

Carapace less than one-fourth of total length and more than twice as long as deep; widest just behind first fourth of length, where it is much wider than deep; dorsal margin in side view not arched and not elevated posteriorly; surface conspicuously pitted; edges of the pits forming a raised reticulate pattern and with minute blunt spines, arranged partly in double rows; there is a low, wide, median longitudinal carina, with margins irregular owing to pitting; at about

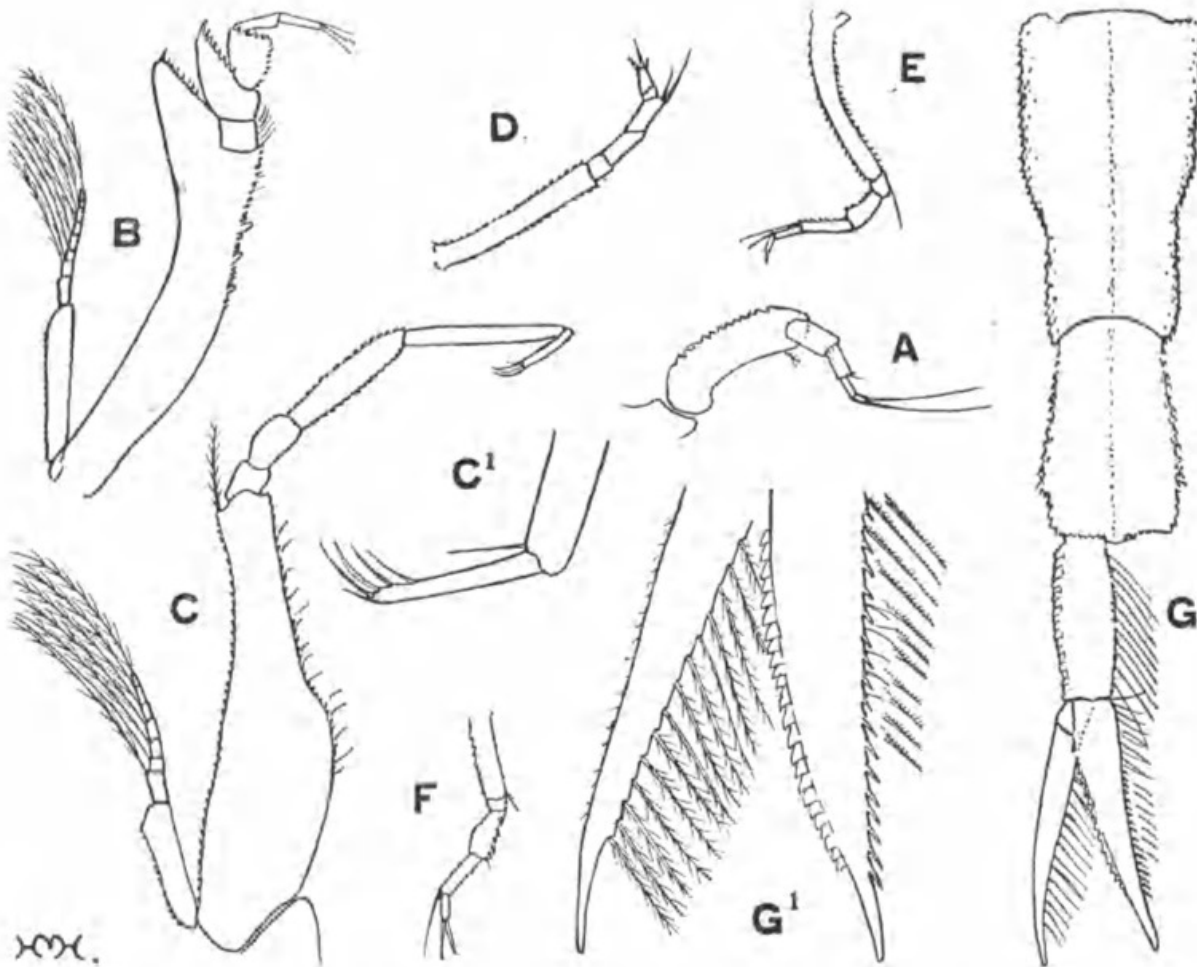


Fig. 56. *Cyclopsis pruinosa*, type male; A, first antenna; B, third maxilliped; C, first pereopod and C¹, dactylus of same; D to F, second, third and fifth pereopods; G, fifth pleon and telsonic somites, and uropod; G¹, terminal half of rami of uropod (A, $\times 50$; B to G, $\times 32$; C¹ and G¹, $\times 84$).

two-thirds of its length this carina is crossed by a similar short transverse carina, scarcely elevated and indicated mainly by its freedom from pitting. Pseudoros-tral lobes barely attaining level of ocular lobe; anterior margin of each with a finely serrated, laminate projection above antennal notch, concealing first antenna when this is directed upwards; from this little lobe a short ridge projects back-wards, and below it is an excavation, immediately above the pronounced, acute antennal tooth, which has a finely serrate antero-inferior edge. Ocular lobe as wide as long, with anterior margin bilobed; eye distinct, a mass of pigment on each side of lobe.

Each pedigerous somite with a spinose dorsal median carina and with a dorso-lateral spinose carina on each side, most distinctly developed on the fourth and fifth somites.

Pleon with a median longitudinal carina for whole length; each of the first to fourth somites have six tiny projections at the hinder margin; two are on the dorsum, close together, while there is on each side a dorso-lateral projection larger than the dorsal ones, and one immediately above each articular peg.

First antennae with first segment of peduncle distinctly longer than all the other joints together; second segment as long as third peduncular joint plus the first of the two segments of the flagellum, which bears the usual two filiform terminal appendages.

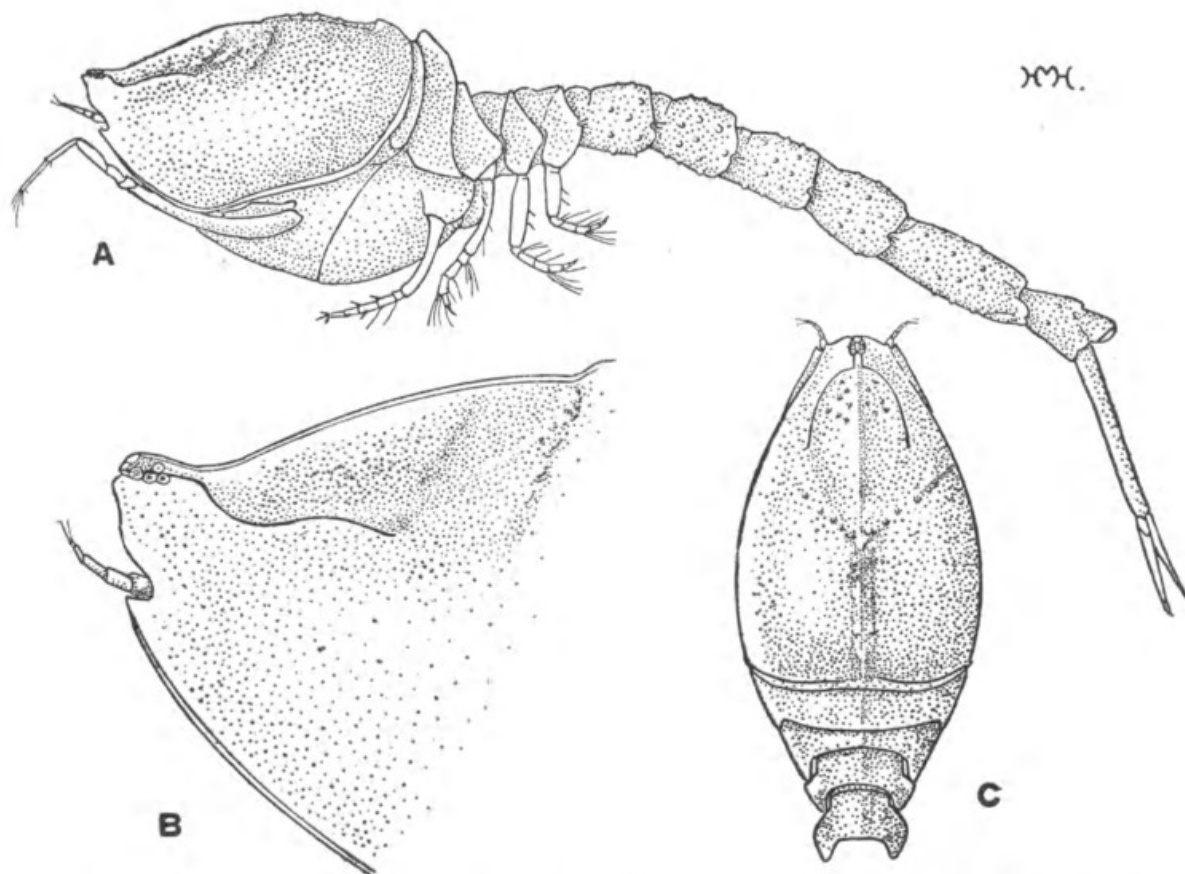


Fig. 57. *Cyclaspis sabulosa*, type female; A, lateral view of whole animal and B, of anterior portion of carapace; C, cephalothorax from above (A and C, $\times 16$; B, $\times 40$).

Third maxillipeds with outer apical portions of basis and merus expanded and produced forwards and with the anterior margins spinose; carpus spinose on apical and inner edges, as wide as long and longer than either propodus or dactylus.

In the first peraeopods the basis is equal in length to the remaining segments together; it bears a plumose seta at outer apical angle and has the margins spinose; carpus stout, with spinose edges, shorter than the much more slender propodus and more than twice as long as the dactylus, which is unusually short, as are its terminal setae (fig. 56, C).

Basis of second peraeopods much longer than rest of limb; merus little longer than carpus, but nearly twice as long as the short and stout dactylus, which is a little shorter than its longest terminal spine.

Basis of third and fourth peraeopods longer than rest of limb, that of fifth shorter; merus shorter than carpus in third and fourth, subequal in fifth; setae sparse and short (see fig. 3, C).

Uropods with exopod barely longer than endopod, but three-fourths as long again as peduncle, which is three-fourths as long as telson and has the margins serrate, the inner with long plumose setae; inner edge of endopod with finely serrate setae and with a long row of about a score of short, stout, downwardly-directed spines; outer edge of endopod serrate; inner edge of exopod with long plumose setae; both rami subacute and simple.

Colour white, pigmentation quite absent.

Length 8 mm.

Loc. Queensland: off Fraser Is., lat. 24° 20' S.; long. 135° 02' E., 25 metres. ("Warreen", Sept. 1938, 7.45 to 8.56 p.m.). Type in South Australian Museum, Reg. No. C. 2395.

CYCLASPIS SABULOSA sp. nov.

Ovigerous female. Integument firm, calcified and easily fractured; polished but with a very fine reticulate patterning.

Carapace with dorsal edge arched, incised at middle of length and with a low, abrupt elevation near posterior end; in dorsal view it is ovoid with the sides smoothly rounded; it is a little less than one-third of total length of animal, almost twice as long as greatest depth and much wider than deep. With a median carina, flanked at middle of length by a faint short, tuberculate ridge, oblique, and with

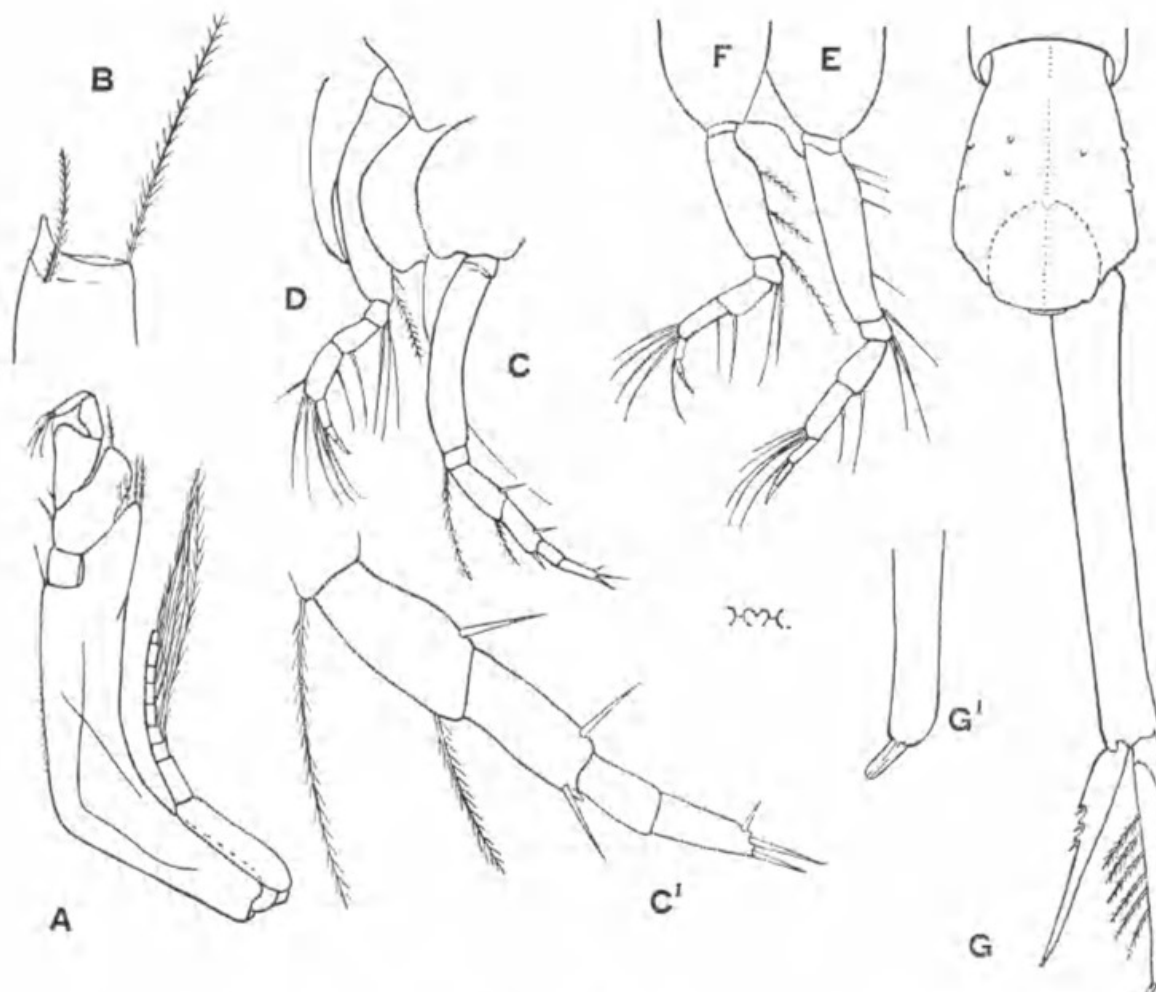


Fig. 58. *Cyclaspis sabulosa*, type female; A, third maxilliped; B, apex of basis of first peraeopod; C to F, second to fifth peraeopods; C1, distal joints of second peraeopod; G, uropod and G1, apex of its exopod with mucro (A, and C to G, $\times 40$; B and C1, $\times 120$; G1, $\times 175$).

a faint tuberculate longitudinal ridge on each side of posterior half; on each side of anterior half is an elongate shallow depression. Pseudorostral lobes not meeting in front of ocular lobe, which is rather narrow with large and partly pigmented lenses. Antennal notch deep and angle subacute, rounded.

Part of first pedigerous somite visible; second to fifth somites each with a low, median dorsal carina; second large, anteriorly elevated to highest level of dorsum of carapace, thence sloping steeply downwards; third short dorsally but expanded backwards infero-laterally; fourth and fifth somites narrower and with sides tumid.

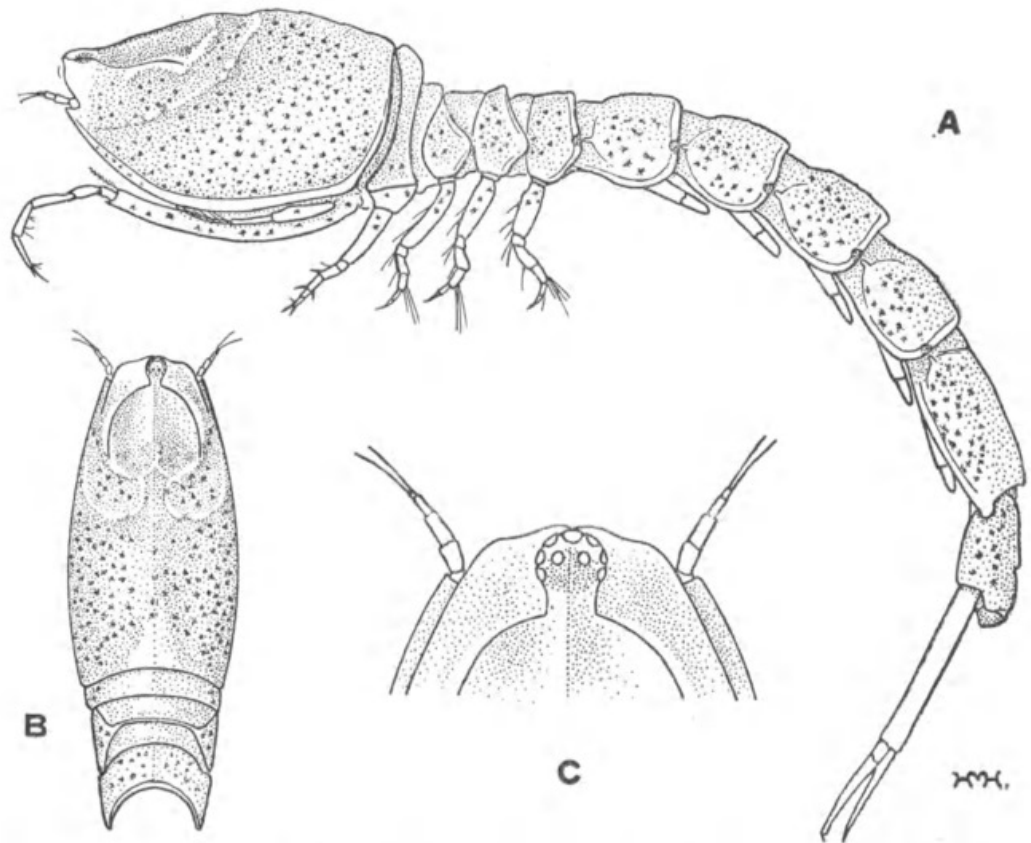


Fig. 59. *Cyclaspis sabulosa*, paratype male; A, lateral view; B, cephalothorax and C, anterior portion of carapace, from above (A and B, $\times 19$; C, $\times 50$).

Pleon somites each with a low median carina and sparsely studded with small tubercles; lateral articular processes well-developed. Telsonic somite with an abrupt dorsal incision at junction of fused telson.

Basis of third maxilliped strongly geniculate, almost twice as long as remainder of limb, with outer apical portion expanded, the large lobe with plumose apical setae; merus wide, with outer lobe reaching distal margin of carpus, which is widest anteriorly and is as long as propodus and dactylus together, but shorter than merus.

First peraeopods with carpus reaching beyond level of antennal angle; basis about one-fifth as long again as rest of limb, with inner apical angle produced forwards to about middle of length of ischium, and with a long plumose seta at external distal angle (reaching to apex of merus), and a shorter subapical seta near inner angle; carpus, propodus and dactylus subequal in length, and to ischium and merus together.

Second peraeopod with basis as long as remaining joints together; ischium

with a long plumose seta; merus a little longer than carpus, as long as propodus and dactylus together, with a slender plumose seta near external apical angle and a spine at inner; carpus with an inner and an outer subapical spine; dactylus not much longer than propodus; the longest dactylar spine and the spines of the merus and carpus are each about as long as propodus.

Basis longer than rest of limb in third legs, equal to it in fourth, and shorter in fifth; carpus longer than merus in all three posterior peraeopods, which have the setae long and well-developed (as in fig 3, K, and 58, C-F).

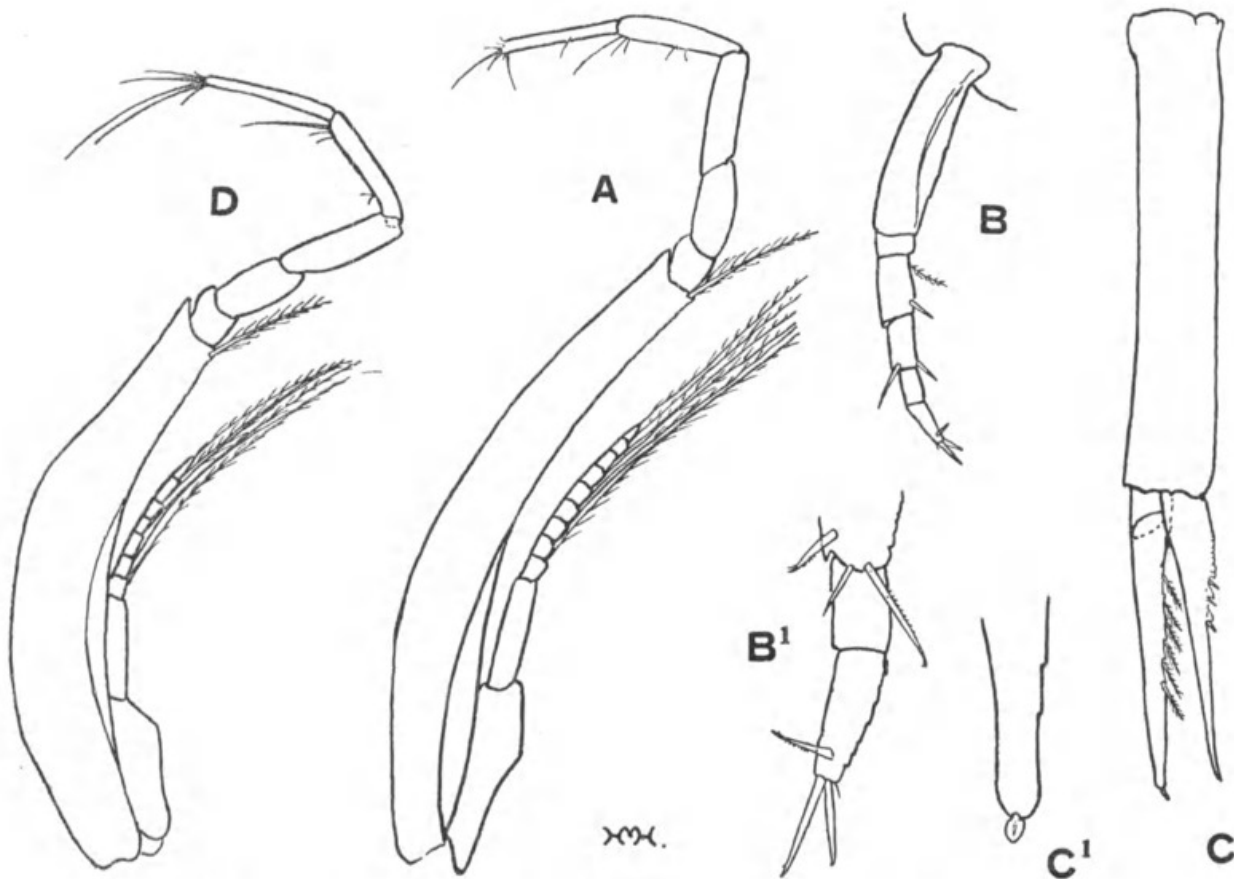


Fig. 60. *Cyclaspis sabulosa*, paratype male; A and B, first and second peraeopods; C, uropod, and C¹, apex of its exopod with mucro. D, first peraeopod of paratype ovigerous female (A to D, $\times 50$; B and C¹, $\times 135$).

Peduncle of uropoda more than one and three-fourths times as long as telsonic somite; endopod half as long as peduncle, narrow in distal half, apically subacute, with three coarse serrations and inset spines on proximal half of inner margin; exopod slightly longer than endopod with a few setae on inner edge, apex slightly dilated and with a mucro (fig. 58, G).

Colour white, the only trace of colour being provided by a few small pale brown chromatophores on frontal lobe.

Length 7 mm. (Ova .31 mm. in greatest diameter).

Subadult male. Integument calcified, with reticulate pattern small but distinct.

Carapace considerably less than one-third of total length of animal; length one and two-thirds times depth; in dorsal view it is suboval in shape, narrower than in female, the width being less than the depth. Sides of carapace devoid of outstanding ridges; on each side of median carina a pair of oblique linear

elevations (or very low, rounded carinae) run forwards, as shown in fig. 59, A and B. The depression on each side of the frontal lobe is more marked than in the adult female.

Ocular lobe sub-circular, not much longer than wide, with nine prominent lenses (fig. 59, C). A thin, median carina on pedigerous and pleon somites as in female. First pedigerous somite concealed. Articular pegs of pleon well-developed.

Basis of first peracopods with apical projection and seta as in female but longer, more than one-fourth as long again as remaining joints together. Carpus of second peracopods with a subapical and two apical spines.

The peduncle of the uropoda is only one and one-third times as long as the telsonic somite, and the subequal rami about two-thirds as long as peduncle; exopod with six plumose setae on inner margin, its apex bulbous and with a transversely flattened mucro (fig. 60, C).

Colour of body light brown, with numerous small, dark brown chromatophores.

Length 7 mm.

A single male and several ovigerous females.

Loc. New South Wales: off Jibbon, 40 metres and 45-50 metres, on coarse sand (Cronulla Stations 6 and 10, July and Aug. 1943). Types in South Australian Museum, Reg. No. C. 2411 and 2414.

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