indicated by an abrupt depression, posterior margin broadly rounded, provided with about 28 long plumose setae and pair of small submedian spines.

Antennule flagellum slightly longer than peduncle, composed of about 11 articles, first of which is long, remainder all short. Antenna flagellum with about 18 articles, extending to posterior of pereonite 2.

Frontal lamina with anterior extremity freely projecting; anterior two thirds with ventral surface excavate, narrowing from base to apex, which in ventral view appears truncate; posterior one third of frontal lamina produced downwards in form of horn, anterior face excavate, posterior face domed. Labrum with posterior margin shallowly excised.

Maxilliped with conspicuously plumose setae on lateral margin of palp articles 2–4, and long slender endite extending to palp article 3 and armed with 2 coupling hooks, terminal spine, 4 plumose setae and 2 simple setae.

Pereopod 1 with slender basis, posterodistal margin with setae, ischium with anterodistal angle moderately produced, with about 6 setae; single plumose seta situated on anterior surface half way along article; merus with anterodistal margin strongly produced, extending over propodus by half its length, provided with setae and single terminal spine, posterior margin with 8 acute spines; carpus short, with 2 spines, propodus with 5 acute spines on palm, and shorter, acute spine opposing dactylus. Pereopods 2–3 similar to 1 but differ principally in having anterodistal angle of ischium strongly produced, anterodistal margin of merus with about 8 strong spines, and having the posterior margins of ischium, merus and propodus with more abundant and stouter spines. Pereopod 7 with continuous long plumose setae along anterior margin, and along posterodistal margin; both margins of ischium with long setae, posterior margin with 3 spines, anterodistal angle with 2 spines; merus with long setae and spine on distal angle of both margins, carpus with spines at distal angles; propodus with single spine on posterior margin, and additional spines opposing dactylus.

Pleopod 1 with lateral margins of endopod converging rapidly to narrow apex; exopod slightly longer than endopod; peduncle with about 8 coupling hooks on medial margin; pleopod 2 similar to 3 but exopod slightly broader; pleopods 4–5 with exopods sparsely setose. Uropods extending slightly beyond apex of pleotelson, peduncle with medial margin only slightly produced. Exopod three quarters length of endopod, both margins setose, straight, apex rounded, provided with 1 spine, setae of medial margin long. Endopod medial margin broadly rounded, slightly excised just before apex, lateral margin straight, both margins with setae on distal one third of their length, medial margin with 1–3 spines.

Male. No male examined but, from Hansen's (1890) figures, appendix masculina is as long as inner ramus, and attached sub-basally. All other characters are similar but maxilliped endite is figured with 3 coupling hooks.

Colour. Ground colour is pale tan to cream, posterior segments of pereon and the pleon are densly covered with black chromatophores which extend onto the anterior part of the pleotelson. Ventral surfaces of the cephalon, pereopods and pleopods 1–3 with abundant chromatophores.

Size. Up to 18 mm (Hale, 1925); Hansen (1890) recorded the species up to 20 mm.

Remarks. This species can be immediately identified by the pleotelson and uropod characters in conjunction with its elongate shape and unique frontal lamina morphology.

Distribution. Hale's locality is given as New South Wales; present material originates from the central Queensland coast. Other records include India (Milne-Edwards, 1840), South China Sea from Singapore to Hong Kong (Milne-Edwards, 1840), Gulf of Thailand, South China Sea (Monod, 1934), Java (Nierstrasz, 1931), and Japan (Iwasa, 1965).

Orphelana Bruce

Orphelana Bruce, 1981a: 651.

Type species. *Orphelana perplexa* Bruce, 1981a, by monotypy. Type held at the Museum of Victoria.

Diagnosis. Antennule peduncle article 3 longest. Antenna peduncle articles 4–5 subequal in length and longest. Frontal lamina reduced, flat and triangular. Mandible with obscurely tridendate incisor. Maxilliped endite with one coupling hook. Pereopods 1–3 with anterodistal margin of ischium and merus produced. Pereopods 5–7 with articles other than basis flattened. Pleopod 1 endopod less than half as wide as exopod; pleopod 5 endopod without setae, other pleopods with both rami setose; appendix masculina inserted submedially.

Additional characters. Eyes absent. Pereonite 1 longer than pereonite 2. Pleon composed of 5 segments, pleonite 5 encompassed by pleonite 4.

Antennule peduncle 4-articulate, article 3 twice as long as 2; flagellum shorter than peduncle; antennule peduncle articles 1–3 short; articles 4–5 longer; flagellum shorter than peduncle. Clypeus sessile. Mandible palp not reaching beyond incisor; molar process with cuspidate spines. Maxillule elongate. Maxilliped palp lateral margins smoothly curved, without long setae; endite with terminal spine. Pereopods 1–3 ambulatory, 5–7 natatory. All dactyls with slender secondary unguis. Pleopods 3–5 with complete suture across exopod. Uropods with medial margin of peduncle produced.

Remarks. The mouthparts clearly distinguish this genus from others in the family. No other genus shows a similar arrangement of spines on the gnathal surface of the maxillule endite in combination with an irregular mandible incisor and a short mandibular palp. The form

of the antennae, antennules and pleopods show a close similarity to those of the genus *Conilorpheus*. Only the first and second pleopods have been figured for that genus, and these correspond closely to those of *Orphelana*. The pereopods of the two genera are dissimilar as those of *Conilorpheus* are all ambulatory while the posterior pereopods of *Orphelana* are natatory.

The genus *Eurydice* also shows some similarity to *Orphelana*. The form of the pleopods are similar with elongate peduncles, the appendix masculina not arising basally on the inner ramus of pleopod 2, and the exopods of pleopod 3–5 each with a distinct suture. Pereopods 5–7 are natatory, flattened and provided with numerous setae, as are the posterior pereopods of most species of *Eurydice*. *Orphelana* is readily separated from the genus *Eurydice* by the form of the uropods, in having a sessile clypeus, the morphology of the antennule and antenna, and mouthparts.

Orphelana perplexa Bruce
Fig. 86

Orphelana perplexa Bruce, 1981a: 651, figs 4–6.

Types. Holotype held at the Museum of Victoria.

Type locality. Crib Point, Western Port, Vic.

Remarks. This species is known only from the single specimen described in detail by Bruce (1981a). It is distinguished from other Cirolanidae by the generic characters.

Distribution. Known only from the type locality.

Bathynomus Milne-Edwards

Bathynomus Milne-Edwards, 1879: 21.—Milne-Edwards & Bouvier, 1902: 171; Gurjanova, 1936: 68; Hessler, 1969: R374; Holthuis & Mikulka, 1972: 575.

Bathynomous.—Boone, 1927: 130; Menzies, 1962c: 194 *(lapsus calami)*.

Type species. *Bathynomus giganteus* Milne-Edwards, 1879, by monotypy. Type held at the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA.

Diagnosis. Pleonites 3–4 with posterolateral margins produced to posterior of pleon. Pleotelson posterior margin with teeth-like serrations, without spines. Antennule with small exopod at end of peduncle article 3. Antenna peduncle articles 3–4 subequal in length, 5 longest. Frontal lamina triangular; clypeus anteromedial portion produced. Maxilliped endite with 4–7 coupling hooks. Pereopods 1–3 with anterodistal margin of ischium and merus produced pleopods with all rami setose, respiratory branchiae on all endopods; appendix masculina inserted medially.

Additional characters. Body ovate in shape, coarsely punctate, without sculpting. Cephalon without rostral process; eyes lateral, not visible in dorsal view; anterior narrow, broadening towards posterior which has V-shaped excision. Pereonite 1 distinctly longer than other pereonites, all coxae visible in dorsal view, all with oblique carina. Pleon as wide as pereon; pleonite 1 with lateral margins not produced; pleonite 2 with lateral margins moderately produced.

Antennule peduncle 4-articulate; peduncle articles 1–3 becoming progressively shorter; flagellum longer than peduncle, multi-articulate. Antenna peduncle 5-articulate, article 1 being very short, article 2 about 2.5 times longer than 1; flagellum longer than peduncle, multi-articulate.

Frontal lamina obscured in ventral view, joins cephalon, separates antennular bases; clypeus sessile. Mandible molar process and lacinia mobilis well developed; left mandible with prominent keratinised tooth on anterolateral portion of lacinia; palp 3-articulate, not reaching incisor. Maxillule with prominent spines on exopod, endopod with 4 spines. Maxilla entire. Maxilliped palp articles broad, wider than their articulating junctions, terminal article triangular, articles 2–5 with plumose setae on lateral margins, simple setae on medial margins.

Pereopods ambulatory, all with simple dactyls. Pereopod 1 with anterodistal margin of ischium and merus weakly to moderately produced, pereopods 2–3 with anterodistal margin of merus strongly produced. Pereopods 4–7 basically similar, becoming progressively longer towards posterior; basis with setae on anterior margin.

Penes present as 2 distinct, well separated flattened lobes.

Exopods of pleopods 3–5 with partial suture; lateral margin of peduncle with distinct lobe which increases in prominence towards posterior; medial margin of pleopods 1–2 with about 9 coupling hooks. Respiratory branchiae present on dorsal and ventral surface of all endopods, except pleopod 1 where they occur only dorsally. Appendix masculina not extending beyond ramus. Uropods not extending beyond posterior of pleotelson; both rami with marginal setae and spines; peduncle produced along medial margin of endopod.

Sexual dimorphism. Females are the same as males, but possess rudimentary to fully developed oostegites at base of pereopods. In absence of penes, this character positively identifies non-ovigerous females.

Remarks. The genus *Bathynomus* was established by Milne-Edwards in 1879, the fourth cirolanid genus to be described. A second species was added to the genus by Ortmann (1894), and Richardson (1910) elevated the number of species to four. The remaining species were all described in the 1970's.

The only similar cirolanid genus is *Parabathynomus* Barnard (Kensley, 1978b), known only from South Africa. This genus is distinguished by having respiratory branchiae on the pleopod peduncles, a basally inserted appendix masculina, and by lacking dentations on the posterior margin of the pleotelson. Small specimens of *Bathynomus*, which approach the *Booralana* species

in size, can be distinguished by their more ovate body shape, by the pleotelson characters and also by the presence of respiratory branchiae on the pleopods.

Because of the inadequacy of the original descriptions, the types of *Bathynomus affinis, B. propinquus* and *B. decemspinosus* were examined. A specimen of *B. doederlini* from Sagami Bay (the type locality), Japan, was also examined. To aid future identifications, figures (Fig. 87, 88G–I) of these species are given.

The first described species of this genus immediately captured the interest of carcinologists by virtue of its immense size, and also the presence of respiratory branchiae on the pleopods. Undoubtedly these characters influenced Wood-Mason & Alcock (1891) to elevate the genus to family status. This move was not

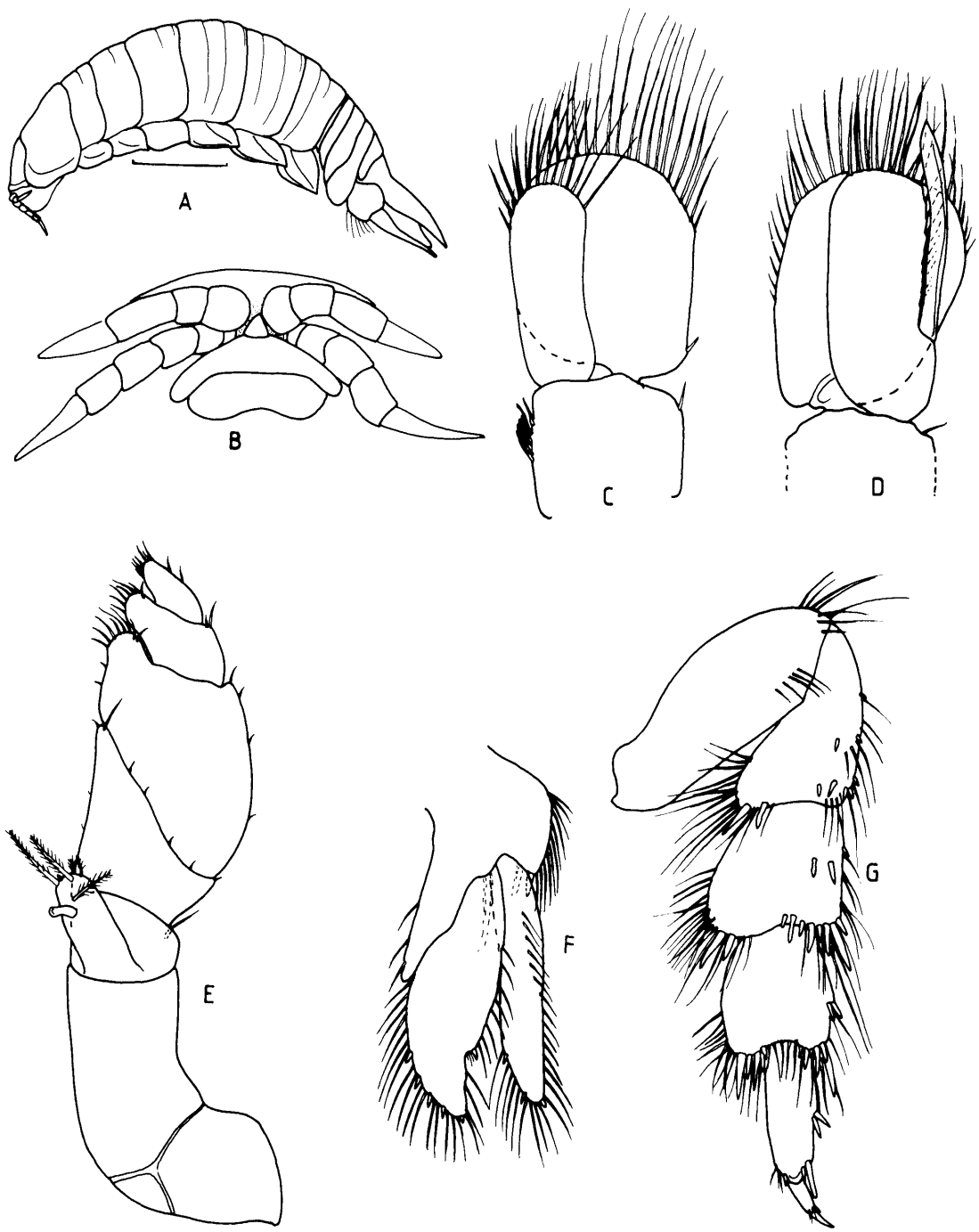

Fig. 86. *Orphelana perplexa.* **A,** lateral view; **B,** clypeal region; **C,** pleopod 1; **D,** pleopod 2; **E,** maxilliped; **F,** uropod; **G,** pereopod 7. Scale 2.0 mm.

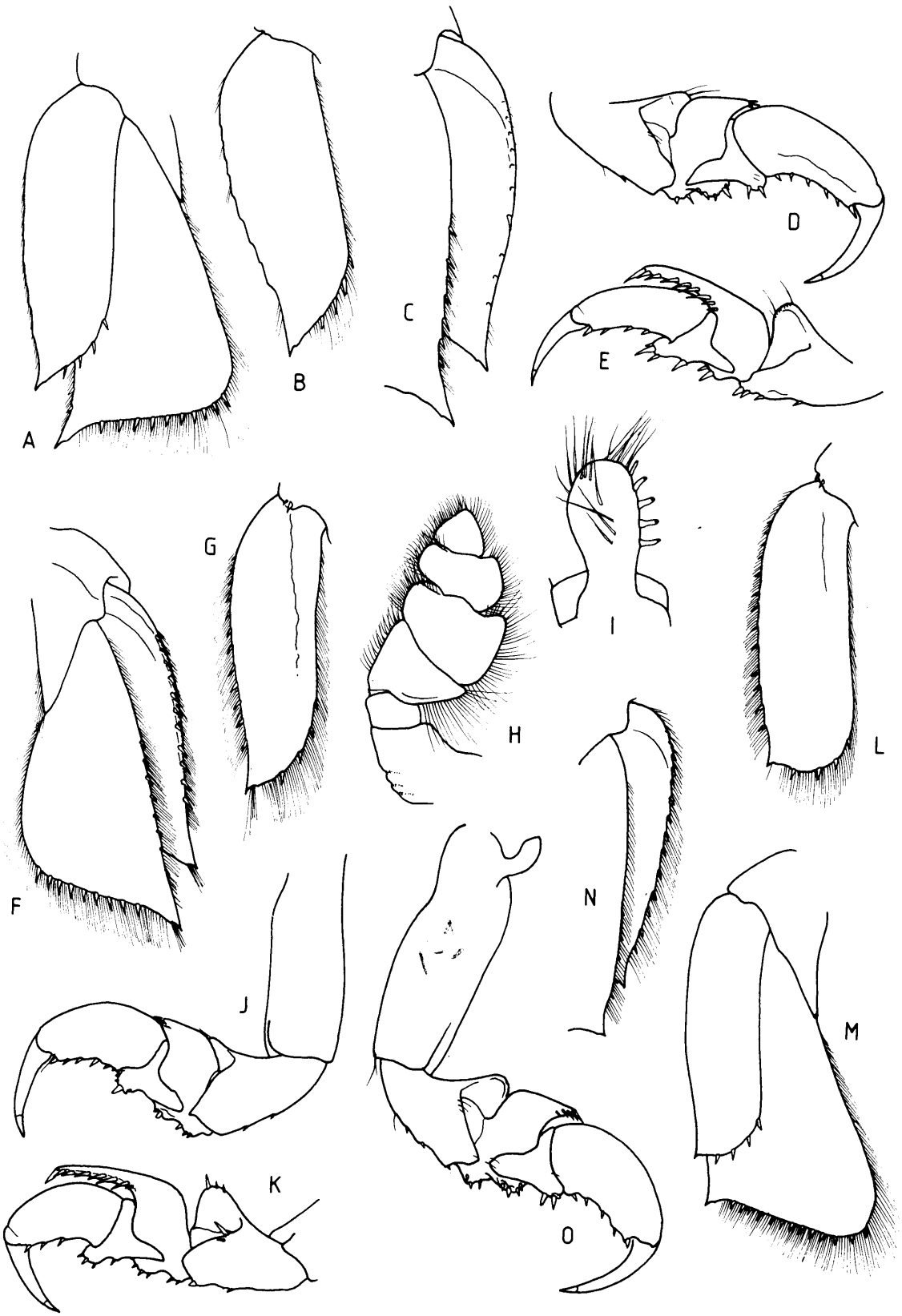

Fig. 87. Non-Australian *Bathynomus*. A–E *Bathynomus affinis* holotype: **A,** uropod, ventral view; **B,** uropod exopod, ventral view; **C,** uropod, lateral margins, dorsal view; **D,** pereopod 1; **E,** pereopod 3 (uropods drawn in situ). F–K, *Bathynomus doederlini,* female 110 mm, Sagami Bay, Japan: **F,** uropod, dorsal view; **G,** uropod exopod, ventral view; **H,** maxilliped; **I,** maxilliped endite; **J,** pereopod 1; **K,** pereopod 2. L–O, *Bathynomus propinquus,* holotype: **L,** uropodal exopod, ventral view; **M,** uropod, ventral view; **N,** uropod, lateral margins, dorsal view; **O,** pereopod 1.

recognized by Hansen (1903) nor by later workers except Barnard (1924), and more recently, Schultz (1979, p. 81). Though there was no discussion why the family name was used, Schultz (1979) apparently considered that a 6-articulate antennal peduncle, coupled with the indication of the maxillipedal somite at the posterior of the cephalon by two grooves, was sufficient to separate the *Bathynomus* as a family. It should be made clear that *Bathynomus* has a 5-articulate antennal peduncle, and the second article illustrated by Milne-Edwards & Bouvier (1902) is in fact the connective tissue between articles 1 and 2. Hansen (1903) discussed the number of antennal peduncle articles present in the Cirolanidae, and this topic has been discussed in the section dealing with variation within the family. As far as I have seen, all Cirolanidae (except for *Hansenolana)* have the presence of the maxillipedal somite indicated by two grooves. In all family characters, *Bathynomus* unmistakably belongs to the Cirolanidae. There are three characters unique to *Bathynomus:* the rudimentary scaphocerite on the antennule, full pleopod setation, and a robust maxilliped endite with 4–7 coupling hooks. I do not consider these characters to be of sufficient importance to merit the separation of *Bathynomus* as a family.

Imaizumi (1953) has suggested that, along with his *Bathynomus* sp., the species described by Woodward (1870) and Rathbun (1935) are closer to *Bathynomus* than *Aega,* and may be better regarded as fossil *Bathynomus.* Examination of figures of several species of the genus *Palaega* Woodward show that there are two different groups. The very well preserved *Palaega pumila* Gall & Grauvogel, 1971 is clearly very different from the others, and is very close to modern Cirolanidae in appearance. This species has 5 free pleonites. The other species of *Palaega* have pleonite 5 with the lateral margins encompassed by pleonite 4, and the appearance of the pleon and pleotelson is far closer to that of *Bathynomus* than to other existing Isopoda.

Key to Australian Species of *Bathynomus*

1. Uropod exopod lateral margin setose on distal two thirds; armed with 5 spines. ..... *B. immanis*

——Uropod exopod lateral margin setose on distal three quarters; armed with 10 or more spines. 2

2. Uropod exopod lateral margin concave, posterior margin convex. ..... *B. kapala*

——Uropod endopod lateral margin feebly concave, posterior margin straight. ... *B. pelor*

Bathynomus kapala Griffin
Fig. 88A–F

Bathynomus ?affinis.—Hale, 1940: 292, pl. 18 (not *Bathynomus affinis* Richardson, 1910).

Bathynomus kapala Griffin, 1975: 104, figs 1–8, pl. 15.—Coleman, 1981: 106, fig. p. 36.

Material examined. Male (93 mm, immature), female (97 mm, with oostegites), paratypes, south of Ulladulla, NSW, 35°34′S, 150°43′E, 8 June 1971, in prawn trawl, 423–405 m., coll. AM on FRV *Kapala.* Also examined: 20 specimens in 16 samples between 26°31′S, 153°00′E and 28°01′S, 154°00′S, trawled by QFS off south-east Queensland, at 400–600 metres.

Types. Held at the Australian Museum, Sydney.

Type locality. Off Woollongong, NSW.

Descriptive notes. All coxae with distinct oblique furrow; posteroventral angle bluntly rounded; coxae of pereonites 5–7 narrow. Uropodal exopod with continuous marginal setae except at anterolateral angle; lateral margin with 10 spines, medial margin with 3. Endopod with continuous marginal setae, lateral margin distinctly concave, with 4 spines, posterior margin convex, with 10 spines.

Remarks. The pleotelson characteristically has the median dentation bifid, or less frequently, truncate (Griffin, 1975), and usually there are 2 prominent dentations and one small dentation on each side of the median one. The uropods are also distinctive in this species, no other species having such a concave lateral margin to the uropodal endopod, nor such a nearly truncate or rectangular shaped uropodal exopod. In *B. affinis, B. decemspinosus* and *B. deoderlini* the distal margin of the uropodal exopod is tapered.

Bathynomus pelor is the most similar species to *B. kapala.* The uropodal endopod has a concave lateral margin, but far less so than in *B. kapala. Bathynomus kapala* has 7 pleotelson teeth compared to 9 for *B. pelor.*

Distribution. New South Wales coast from Port Stephens to Cabo Island and off the northern Victoria coast, at depths of 270–585 metres (Griffin, 1975); off south-eastern Queensland at depths of 400–600 metres.

Bathynomus immanis n. sp.
Figs 89, 90

Material examined. 19 males (85–155 mm), 16 females (86–112 mm), 2 indeterminate sex (62, 98 mm), east of Hinchinbrook Island, Qld, 18°02′S, 147°10′E, 27 Feb. 1979, in prawn trawl, 320–260 m, coll. AM on RV *Lady Basten.* 3 males (133, 135, 165 mm), 2 females (92, 115 mm), east of Rockhampton, Qld, 23°7′S, 153°29′E, 29 Sept. 1980, 378–324 m, coll. J. O'Brien. 3 males (135, 118 mm, damaged spec.), female (121 mm), east of Rockhampton, Qld, 23°11′S, 153°00′E, 20 Sept. 1980, 420 m. Female (127 mm), east of Rockhampton, Qld, 23°30′S, 153°04′E, 20 Sept. 1980, 540 m, coll. QM.

Types. Holotype, male AM P32383. Paratypes, QM W9298, 7976; AM P30478.

Type locality. East of Hinchinbrook Island, Qld, 18°02′S, 147°10′E.

Description of male. Pereonite 1 with distinct longitudinal submarginal carina; coxae becoming

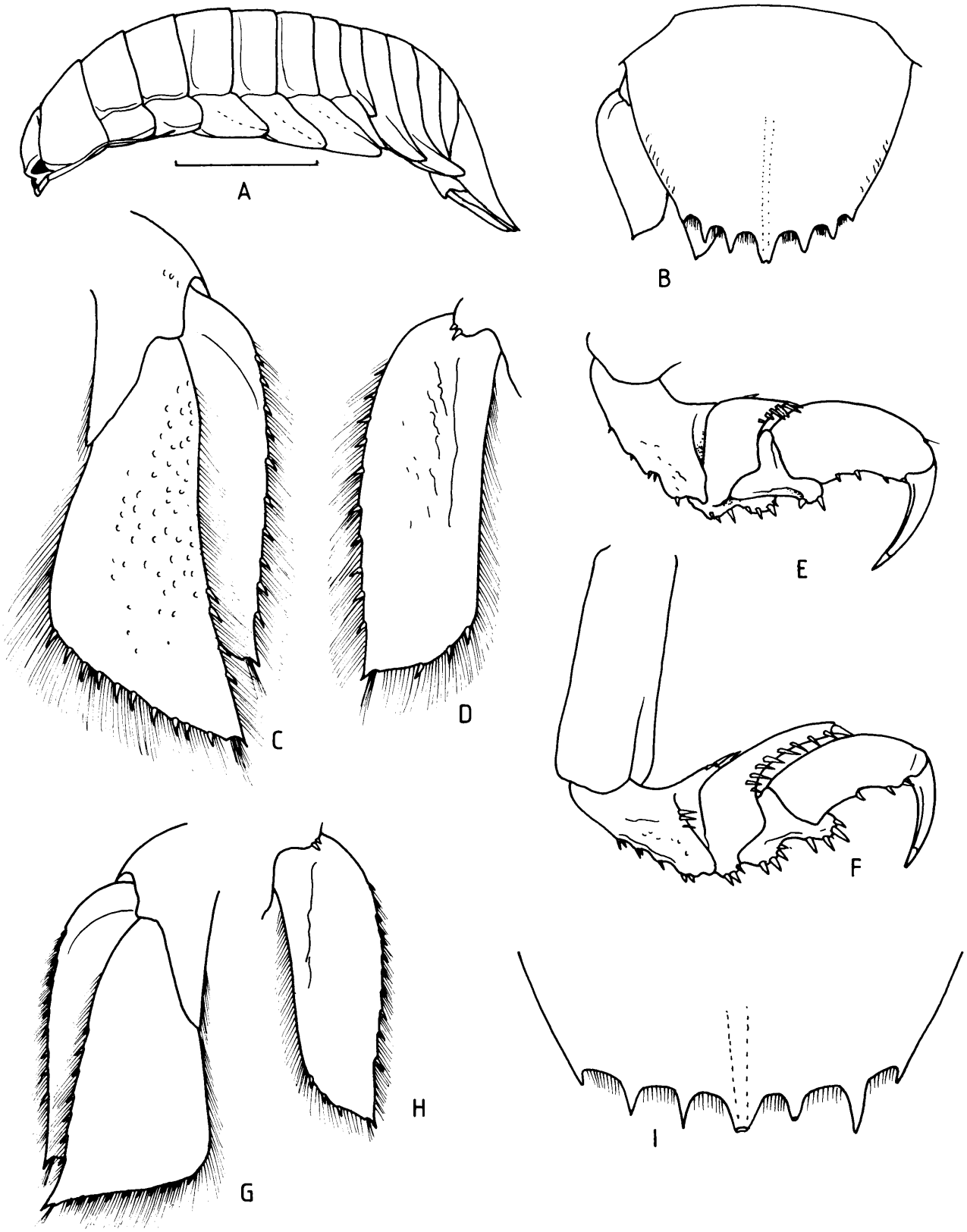

Fig. 88. A–F, *Bathynomus kapala,* female paratype: **A,** lateral view; **B,** pleotelson, dorsal view; **C,** uropod, dorsal view; **D,** uropod exopod, ventral view; **E,** pereopod 1; **F,** pereopod 2. G–I, *Bathynomus decemspinosus,* holotype: **G,** uropod dorsal view; **H,** uropod exopod, ventral view; **I,** pleotelson, posterior margin. Scale 25.0 mm.

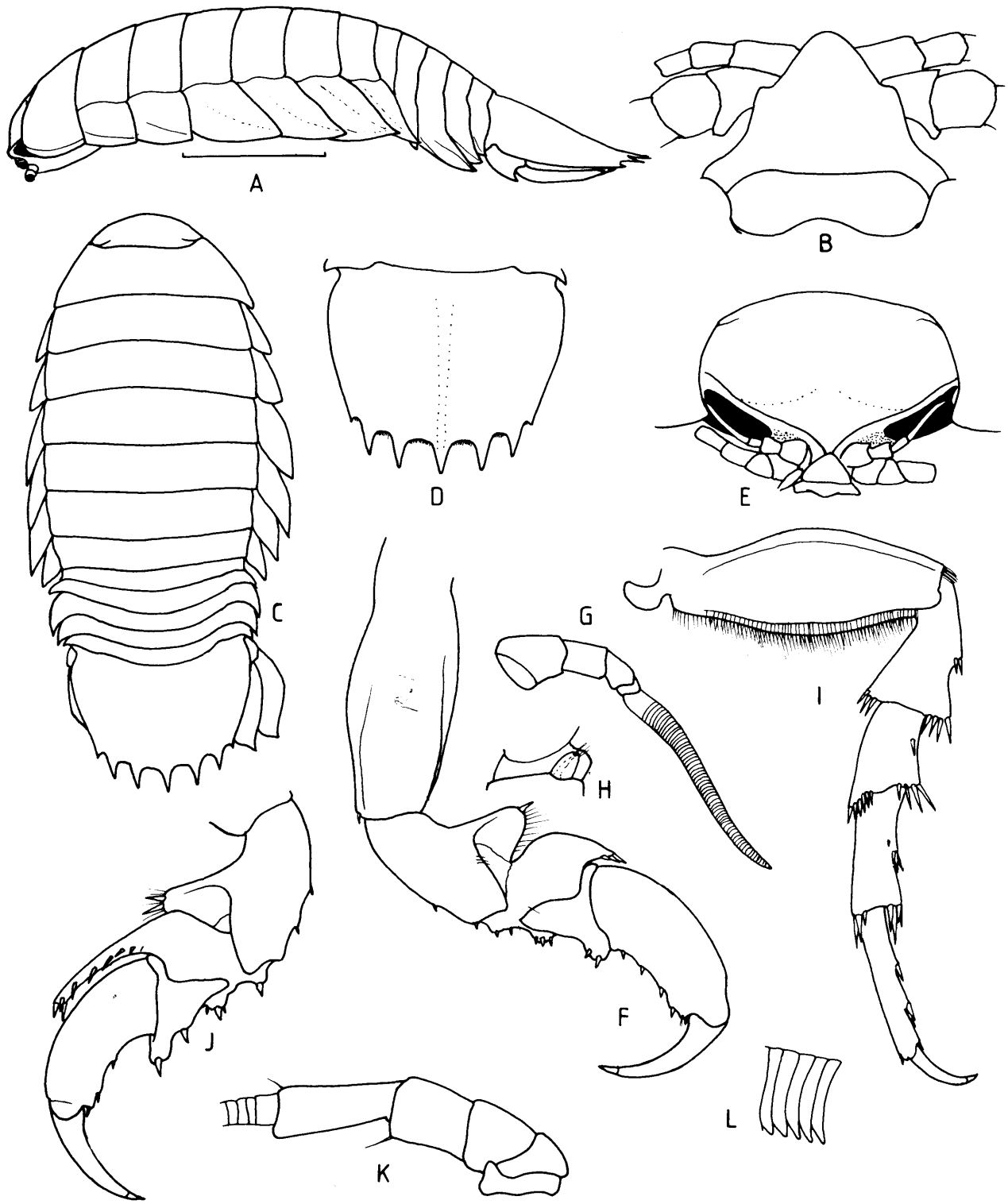

Fig. 89. *Bathynomus immanis* n. sp. A–E, male holotype; remainder male paratype ll0 mm. **A**, lateral view; **B**, clypeal region, ventral view; **C**, dorsal view; **D**, pleotelson, dorsal view; **E**, cephalon, anterior view; **F**, pereopod 1; **G**, antennule; **H**, antennule exopod on peduncle article 3; **I**, pereopod 7; **J**, pereopod 2; **K**, antennal peduncle; **L**, antennule, flagellar articles 20–24. Scale 30 mm.

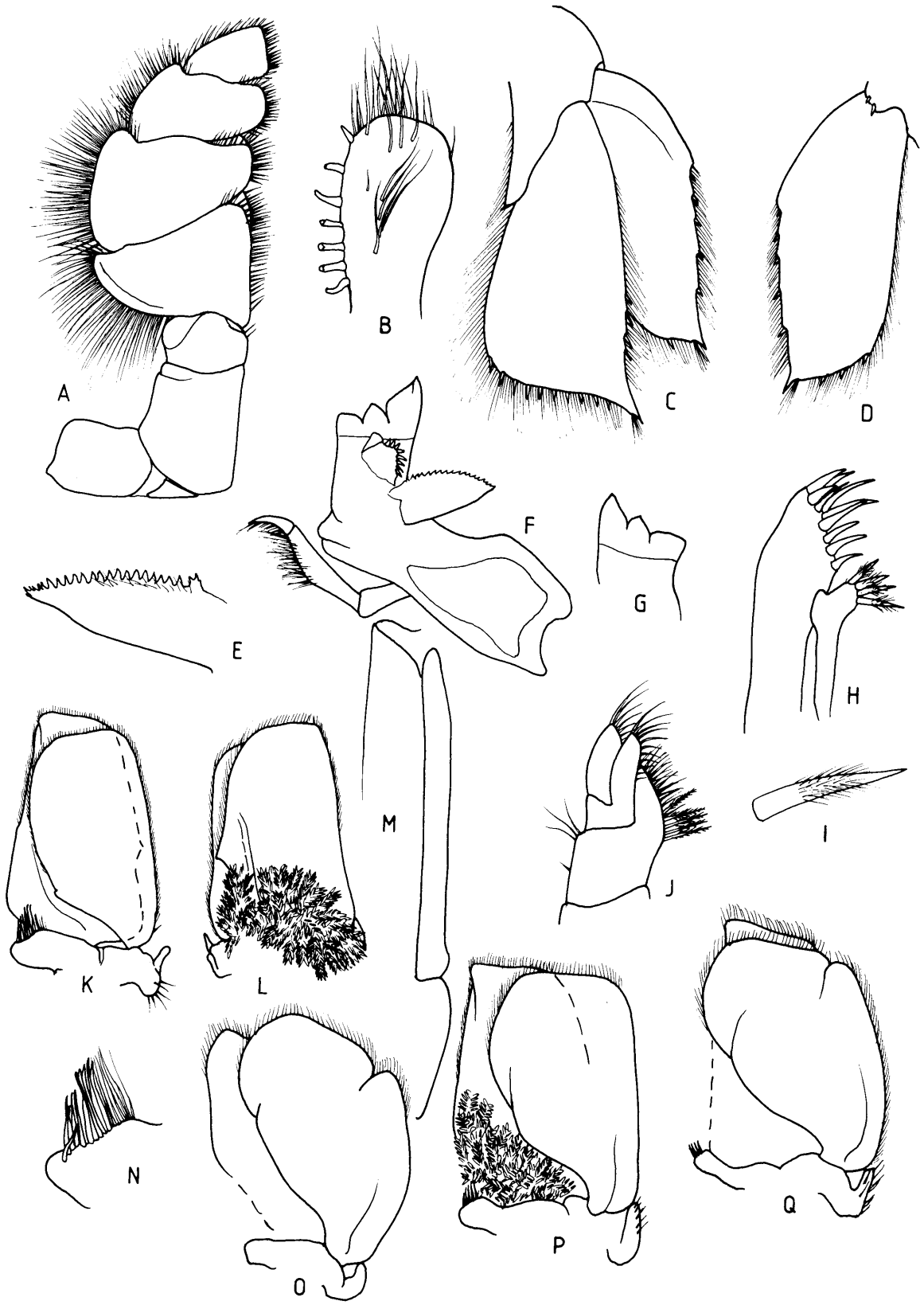

Fig. 90. *Bathynomus immanis* n. sp., male paratype 100 mm, except M, female paratype 165 mm. **A,** maxilliped; **B,** maxilliped endite; **C,** uropod, dorsal view; **D,** uropod exopod, ventral view; **E,** mandible, molar process; **F,** left mandible; **G,** right mandible, incisor; **H,** maxillule; **I,** maxillule endite, distal spine; **J,** maxilla; **K,** pleopod 1, ventral view; **L,** pleopod 1, dorsal view; **M,** appendix masculina; **N,** pleopod 1, medial margin of peduncle; **O,** pleopod 5 (branchiae omitted); **P,** pleopod 2; **Q,** pleopod 4 (branchiae omitted).

progressively more produced towards posterior, each with feeble oblique furrow. Lateral margins of pleonites 2–5 with oblique furrows. Pleotelson very slightly longer than wide, median dorsal ridge present; posterior margin with 5 prominent dentations, lateral teeth being smaller, marginal setae present between dentations.

Antennule peduncle with each article shorter than preceding article, article 3 exopod with about 4 terminal setae; flagellum extending to posterior of eye, composed of about 67 articles, each article with projecting process on posterior margin, with aesthetascs on posterior margin. Antenna peduncle article 1 extremely short, articles 2–5 becoming progressively longer; flagellum extending to posterior of pereonite 3, composed of about 65 articles.

Frontal lamina triangular, lateral margins carinate; clypeus long, anterior margin with medial 0.75 produced, lateral margins converging slightly; posterior lateral margin expanded laterally, produced just beyond width of labrum.

Mandibles similar, both with strongly tridentate incisor; left mandible with heavily keratinized tooth at anterior edge of lacinia; molar process with 22 strong teeth, and submarginal setae; palp with abundant setae on lateral margin of distal half of article 2 and all of article 3. Maxillule with 5 stout plumose setae on endite; exopod and palp with 14 and 12 setae respectively. Maxilliped endite with 7 coupling hooks.

Pereopod 1 with 2 small spines on posterior margin and 1 spine and setae at anterodistal angle of ischium; merus with 3 spines at anterodistal angle, posterior margin sinuate with 2 groups of spines; carpus with 2 spines at posterodistal angle; propodus with 4 spines on palm, 4th small spine just prior to dactylus. Pereopods 2–3 similar to pereopod 1, but spines on ischium to carpus larger than on pereopod 1; merus with 7 spines on anterior process; propodus with 2 spines on palm. Pereopods 4–7 similar, increasing in length posteriorly. Pereopod 7 with marginal setae along anteromedial margin; distal margin of ischium to carpus with single clusters of spines, propodus with 2 clusters of spines, further spines at distal extremity.

Penes present as flattened lobes, each angled medially.

Pleopod peduncles with 9 coupling hooks on pleopod 1, decreasing to 5 on pleopod 4. Appendix masculina inserted about one third of way from base, tapering slightly at apex, not exceeding length of inner ramus. Uropods with lateral margin of exopod armed with 5 spines and marginal setae on distal 0.66 of its length; medial margin with continuous marginal setae and 4 spines. Endopod slightly longer than exopod, lateral margin sinuate, armed with 4 spines, marginal setae along distal 0.66 of its length; lateral and distal margins with continuous setae, distal margin feebly sinuate, provided with 10 spines.

Female. Only one mature female was present in the material examined, and differed from the male only in the sexual characters. Immature females did not differ significantly from the males.

Size. Average size for males 106 mm, females 100 mm. The only mature male (with an appendix masculina) measured 165 mm.

Development. Species characteristics did not vary with differences in size. The smallest specimen (62 mm) had fully developed seventh pereopods, but its sex could not be determined. Immature females could be recognised by the presence of rudimentary oostegites at the bases of the pereopods, and immature males by the presence of penes at sternite 7. Only one female and one male specimen showed mature characters. A female of 112 mm had fully developed oostegites, while the largest specimen, a male measuring 165 mm, had fully formed appendix masculina.

Remarks. This species is readily separated from other Australian species by the prominence of the pleotelson dentations, as well as by differences in the shape and spination of the uropods. The anterior third of the lateral margin of the uropod exopod is without setae in *B. immanis,* whilst in *B. kapala* and *B. pelor* this lateral margin is almost entirely setose.

Amongst the specimens of *B. immanis* examined, several were found to have two lateral dentations absent. This variation should alert workers against placing undue emphasis on pleotelson dentation when a large series of specimens is not at hand. The largest male specimen was not selected as holotype as it was rather damaged.

Distribution. Off the Queensland coast between Hinchinbrook Island and Rockhampton, at depths of 323–540 metres.

Etymology. *Immanis* is a Latin word meaning huge, frightful or fierce.

Bathynomus pelor n. sp.

Figs 91, 92

Material examined. Female (118 mm, immature), 225 km north-north-west of Port Hedland, WA, 18°18′S, 118°08′E, 20 May 1978, 297–330 m, coll. B. Hutchins. Male (105 mm, juvenile), immature specimen (63 mm), 250 km north-west of Port Hedland, WA, 18°40′S, 116°30′E, 5 Apr. 1982, 700 m, Engel trawl; female (110 mm, juvenile), 250 km north-west of Port Hedland, WA, 18°40′S, 116°42′E, 4 Apr. 1982, 600 m, Engel trawl; female (108 mm, juvenile), 250 km north-west of Port Hedland, WA, 18°29′S, 116°36′E, 4 Apr. 1982, 700 m, mud, Engel trawl; all coll. J Paxton, M. McGrouther on FRV *Soela.*

Types. Holotype, AM P32857. Paratypes, AM P32588, P32589, P32560; WAM 38-81.

Type locality. Off Port Hedland, WA, 18°40′S, 116°30′E.

Description of female. Pereonite 1 with distinct submarginal carina; coxae becoming progressively more produced towards posterior, those of pereonite 7 with posteroventral angle attenuated; all coxae with distinct oblique furrow. Lateral margin of pleonites 2–5 with oblique furrows. Pleotelson slightly longer than wide, posterior margin with 9 prominent dentations and 2 smaller lateral dentations.

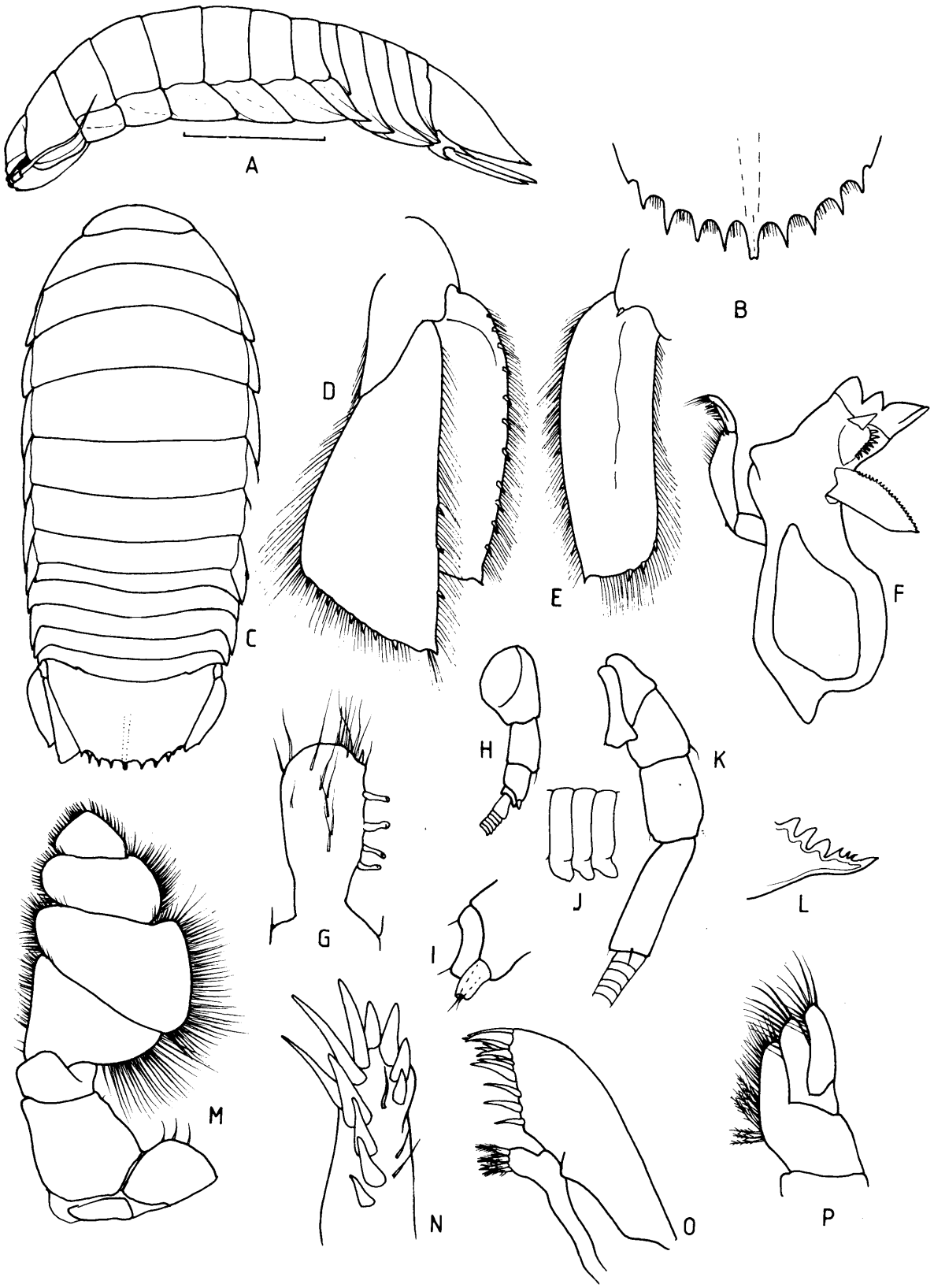

Fig. 91. *Bathynomus pelor* n. sp. A–C, holotype; remainder male 118 mm. **A,** lateral view; **B,** pleotelson, dorsal view; **C,** dorsal view; **D,** uropod, dorsal view; **E,** uropod exopod, lateral view; **F,** mandible; **G,** maxilliped endite; **H,** antennule peduncle; **I,** antennule exopod; **J,** antennule flagellum, articles 7–9; **K,** antennal peduncle; **L,** molar process, distal extremity; **M,** maxilliped; **N,** maxillule, gnathal surface of exopod; **O,** maxillule; **P,** maxilla. Scale 30.0 mm.

Antennular and antennal peduncles similar to *B. immanis*. Antennule flagellum with about 50 articles, antennal flagellum with about 48 articles.

Frontal lamina, clypeus, scarcely differing from *B. immanis*. Maxilliped endite with 5 coupling hooks.

Pereopod 1 with 2 spines at anterodistal angle of ischium, 2 small spines on posterior margin; merus with 9 spines along anterior margin, posterior margin sinuate, with 2 groups of 3 spines; carpus with 2 large and 1 small spine on posterior margin; propodus with 3 spines on palm, and 4th spine prior to dactylus. Pereopods 2–3 similar, generally more spinose than pereopod 1; ischium with 3 spines at anterodistal angle, and merus with 14 spines along anterior process, palm of propodus with 2 spines. Pereopods 4–7 similar to other species of the genus.

Uropods not extending beyond pleotelson. Endopod with marginal setae along entire length of all margins except small anterolateral portion; lateral margin shallowly concave, with 3 spines, posterior margin very nearly straight with 8 spines. Exopod lateral margin setose except for anterolateral angle, provided with 11 or 12 spines; medial margin sub-parallel with lateral margin rounding abruptly at posterior; provided with 3 spines.

Male. Not known.

Variation. Three specimens had a pleotelson dentation of 9 prominent teeth, with 2 small lateral teeth; 2 specimens had 7 prominent and 2 reduced teeth. All specimens but one had 3 spines on the medial margin of the uropod exopod and 3 spines on the lateral margin of the uropod endopod; one specimen had 4 on those margins.

Colour. Tan in alcohol.

Size. Up to 118 mm.

Remarks. This species is most similar to *B. kapala*. The number of prominent telson dentations is 9 compared to 5 for *B. kapala*. Griffin (1975) pointed out that *B. kapala* can occasionally have 7 pleotelson dentations. *Bathynomus immanis,* which normally has 7, occasionally has 5, the small lateral dentations being lost. Other differences can be seen in the uropods of the two species, especially the shape of the endopod which in *B. kapala* has a convex posterior margin and a distinctly concave lateral margin. *Bathynomus pelor* also has more spines on the anterior margin of the merus of pereopods 1 and 2 (9 and 14) than does *B. kapala* (6 and 10).

Distribution. Taken from several stations, all in the immediate vicinity of the type locality.

Etymology. *Pelor* is a Greek word meaning huge or large.

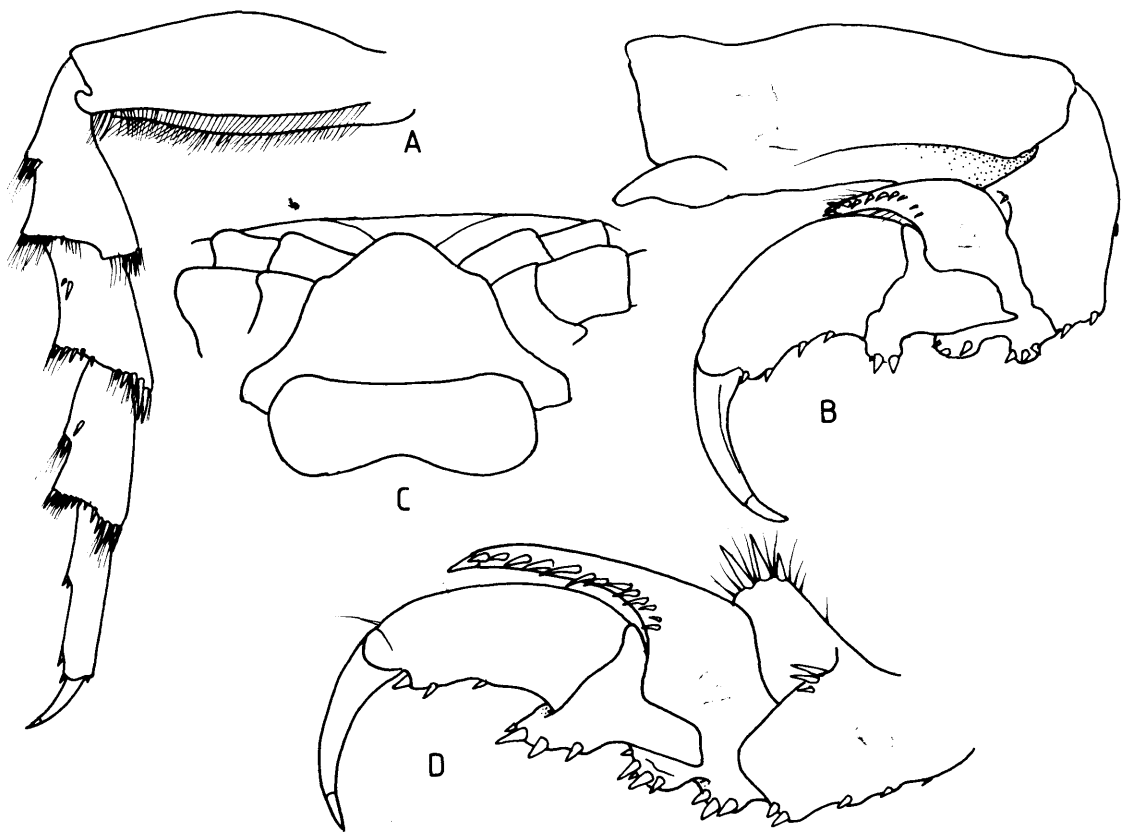

Fig. 92. *Bathynomus pelor* n. sp., male paratype 118 mm. **A**, pereopod 7; **B**, pereopod 1; **C**, clypeal region; **D**, pereopod 2.

Booralana n. gen.

Type species. *Cirolana bathynella* Bruce, 1981a, original designation. Types held at the South Australian Museum (C3829, C3830).

Diagnosis. Pleonites 3–4 with posterolateral margins produced to posterior of pleon. Pleotelson posterior margin without spines. Antennule peduncle article 3 longest. Antenna peduncle articles 4–5 subequal in length and longest. Frontal lamina with posteroventral part produced. Clypeus sessile. Maxilliped endite with 2 coupling hooks. Pereopods 2–3 with anterodistal margins of merus produced. Pleopod peduncles with lobes on lateral margin; endopods of pleopods 3–4 with 3 or 4 small setae, endopod of pleopod 5 without setae; appendix masculina inserted basally.

Additional characters. Body about 3 times as long as wide. Eyes narrow, scarcely visible in dorsal view. Pereonite 1 longer than 2.

Antennular peduncle 4-articulate, articles 1–2 short, article 3 longer than combined lengths of articles 1 and 2; flagellum longer than peduncle. Antennal peduncle 5-articulate, articles 1–3 short, 4–5 each as long as combined length of articles 1–3. Mouthparts similar to *Cirolana* except maxilliped which has palp articles with densely setose margins, and medial margin of palp articles 2–3 moderately produced. Pereopods all ambulatory, all dactyls without secondary unguis. Penes present. Medial margin of pleopods 1–4 with 8–10 coupling hooks; exopods of pleopods 3–5 with suture feebly indicated. Uropod peduncle medial margin moderately produced; rami with few or no spines.

Remarks. The characters that best separate *Booralana* from *Cirolana* are the setation of the pleopods, with pleopod 3 and 4 endopods nearly naked, the shape of the eyes, frontal lamina, the lack of biungiculate dactyls on the pereopods, and the ischium of pereopods 2–3 being strongly produced. The large size of the two species (exceeding 4 cm) also aids identification.

The general form of the cephalon, frontal lamina, clypeus, maxilliped, pereopods, uropods and pleon suggest that *Booralana* and *Parabathynomus* are allied. *Parabathynomus* is distinguished by possessing respiratory branchiae on the pleopods.

Etymology. *Booral,* an Aboriginal word meaning big, combined with *-ana* to indicate family affinity. Gender is feminine.

Key to Species of *Booralana*

——Pleotelson with two prominent submedian ridges. ..... *B. wundurra*

——Pleotelson with dorsal surface unornamented. ..... *B. bathynella*

Booralana bathynella (Bruce)

Fig. 93

Cirolana bathynella Bruce, 1981a: 655, figs 7,8; 1981b: 961.

Material examined. Male (32.2 mm), 9 females (22.6–44.8 mm, mean 33.9 mm), west of King Is., Bass Straight, Tas., 21 Oct. 1950, 180 m. Female (36.0 mm) east of Maatsuyker Is., S. Tas., 30 Aug. 1978, 83 m, from pot, coll. A. McGifford.

Types. Held by the South Australian Museum.

Type locality. Tasmania.

Descriptive notes. The male is, in most characters, similar to female. Lateral margin of uropodal exopod with marginal setae far more profuse. Penes slightly longer than wide, rectangular in shape. Pleopod 2 appendix masculina arising basally, extending beyond endopod by 0.12 its length.

Pereopod 1 with 6 short conical spines on posterior margin of merus. Pereopod 2 similar to 1, but with 3 spines on anterodistal angle, 8 spines on posterior margin of merus; propodus less robust than pereopod 1, and carpus and ischium proportionally longer.

Remarks. The lack of ornamentation on the broad, truncate pleotelson separates this species from the only other member of the genus.

Distribution. Maatsuyker Island, off southern Tasmania; King Island, Bass Straight.

Booralana wundurra n. sp.

Figs 94, 95

Material examined. Male (16.2 mm), 2 mancas (10.0, 12.9 mm), south-west of Geraldton, WA, 20°49′S, 114°24′E, 11 Oct. 1963, 126–130m, CSIRO Stn 214. 3 males (31.6, 42.0, 56.5 mm), 2 females (15.5, 46.6 mm), manca (12.5 mm), west off Mullaloo Beach, WA, 13 Jan. 1974, 117 m, coll. G Ericson. Male (20.1 mm), Torbay, WA, 13 June 1957, fish bait in craypot, rock bottom; 2 males (20.1, 25.2 mm), female (32.7 mm), manca (12.9 mm), Corbett Is., Recherche Archipelago, WA, 3 Feb. 1960, 22–45 m, on crab pot bait, coll. R.W. George.

Types. Holotype, male (56.5 mm), WAM 4-82. Paratypes, WAM 39-80, 42-80.

Type locality. Off Mullaloo Beach, Perth, WA, 31°47′S, 115°44′E.

Description of male. Body about 2.5–3 times as long as wide, heavily calcified, coarsely punctate. Cephalon anterior margin formed into thickened ridge projecting over antennule, behind which is sub-marginal depression, followed by raised ridge. Eyes red. Pereonite 1 with anteroventral and posterior angles produced; coxae becoming progressively more produced towards posterior; posterior margin of coxae 4–7 crenelate, partially concealed in lateral view of coxae 5 and 6, wholly concealed on coxae of pereonite 7. Pleonites all visible, lateral margin pleonites 2–3 forming plates. Pleotelson slightly longer than maximum width, curves smoothly to abruptly terminated apex, with upturned rim occupying about median half of posterior margin; dorsal surface domed anteriorly with marginal ridges

on each side, and pair of feebly sinuate submedian ridges.

Antennule flagellum extending to pereonite 1, composed of 25 articles, first of which is 3 times longer than second. Antenna flagellum extending to pereonite 4, composed of about 45 articles.

Frontal lamina anteroventral surface with median and 2 marginal ridges; anterior margins concave.

Pereopod 1 with 6 stout conical spines on posterior margin of merus; carpus with single acute spine; propodus with 3 acute spines on palm, fourth opposing the dactylus. Pereopods 2–3 similar, less robust than pereopod 1, with groups of spines on posterior margins of ischium; 7 stout and 8 acute spines on posterior margin of merus; anterior margin armed with 6 acute spines; propodus with 4 acute spines on palm and fifth opposing dactylus. Pereopod 7 slender, distal angles of all articles except basis provided with long acute spines; posterior margins with additional spines.

Appendix masculina extending only slightly beyond apex of endopod. Uropod apices falling well short of pleotelson apex. Exopod distinctly shorter than endopod, margins subparallel, lateral margin crenelated for 0.8 of its length, medial margin only crenelated distally. Endopod with medial margin smooth, distal margin truncate, crenelated, lateral margin irregularly crenelated for half its length. All margins setose except for lateral margin of exopod, which is setose and distal 0.2 only.

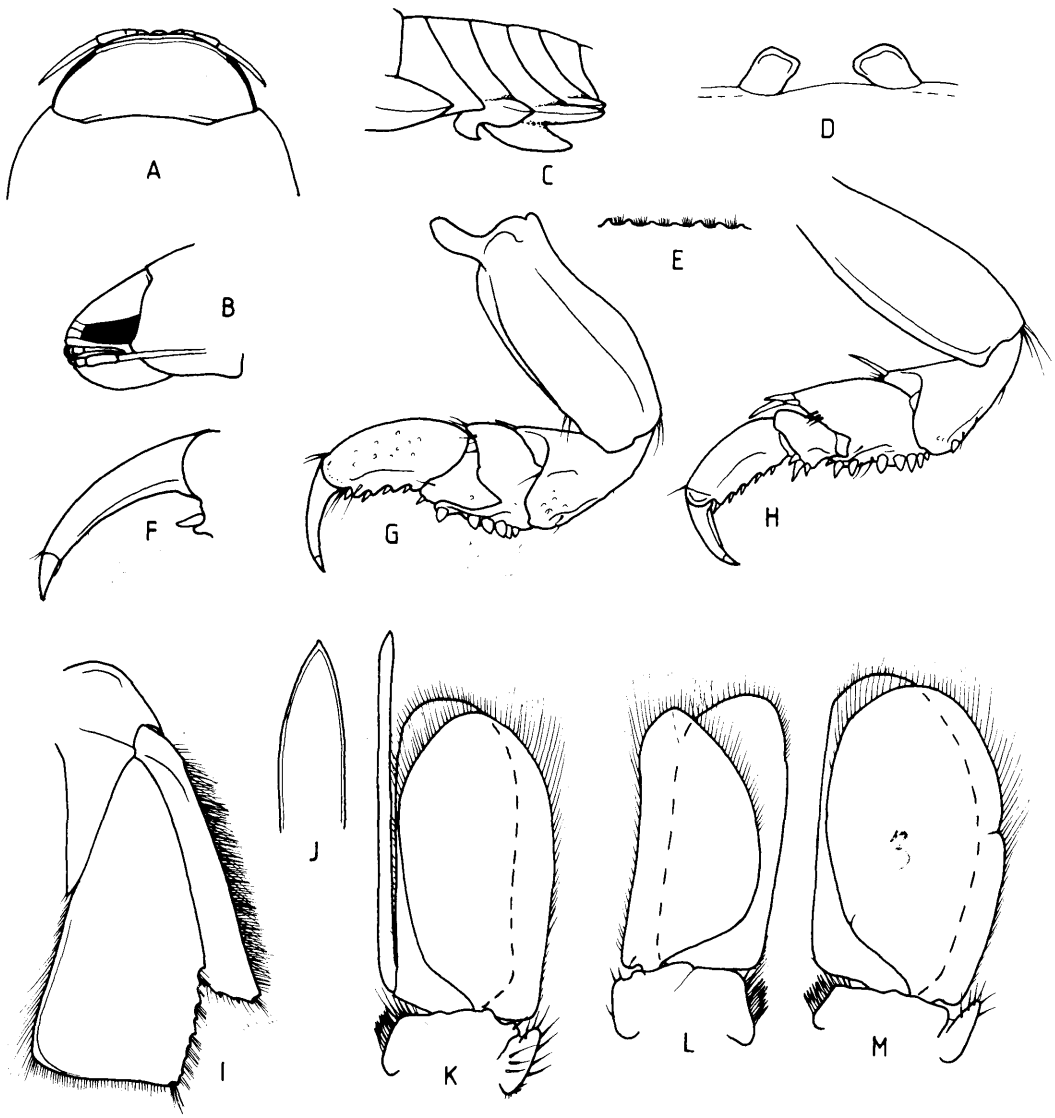

Fig. 93. *Booralana bathynella,* male 32.2 mm, except E, female 36.6 mm. **A,** cephalon, dorsal view; **B,** cephalon, lateral view; **C,** pleon, lateral view; **D,** penes, in situ; **E,** pleotelson, median point, posterior margin; **F,** pereopod 1, dactylus; **G,** pereopod 1; **H,** pereopod 2; **I,** uropod; **J,** appendix masculina, apex; **K,** pleopod 2; **L,** pleopod 1; **M,** pleopod 3.

Female. Similar to male, apparently not growing as large; only males develop upturned pleotelson apex.

Development. The sculpting on the pleotelson, and more noticeably, the upturning of the pleotelson apex, are far more prominent on larger specimens. Smallest adult 15.5 mm, largest manca 12.9 mm.

Colour. Cream, eyes red, chromatophores not apparent.

Size. Up to 56.6 mm.

Remarks. The sculpting of the pleotelson, morphology of the uropods and frontal lamina separates this imposing species from all other Cirolanidae.

Distribution. From the Recherche Archipelago off Western Australia's south-eastern coast, to Geraldton on the western coast, at depths of 22–130 metres.

Etymology. *Wundurra* is an Aboriginal word

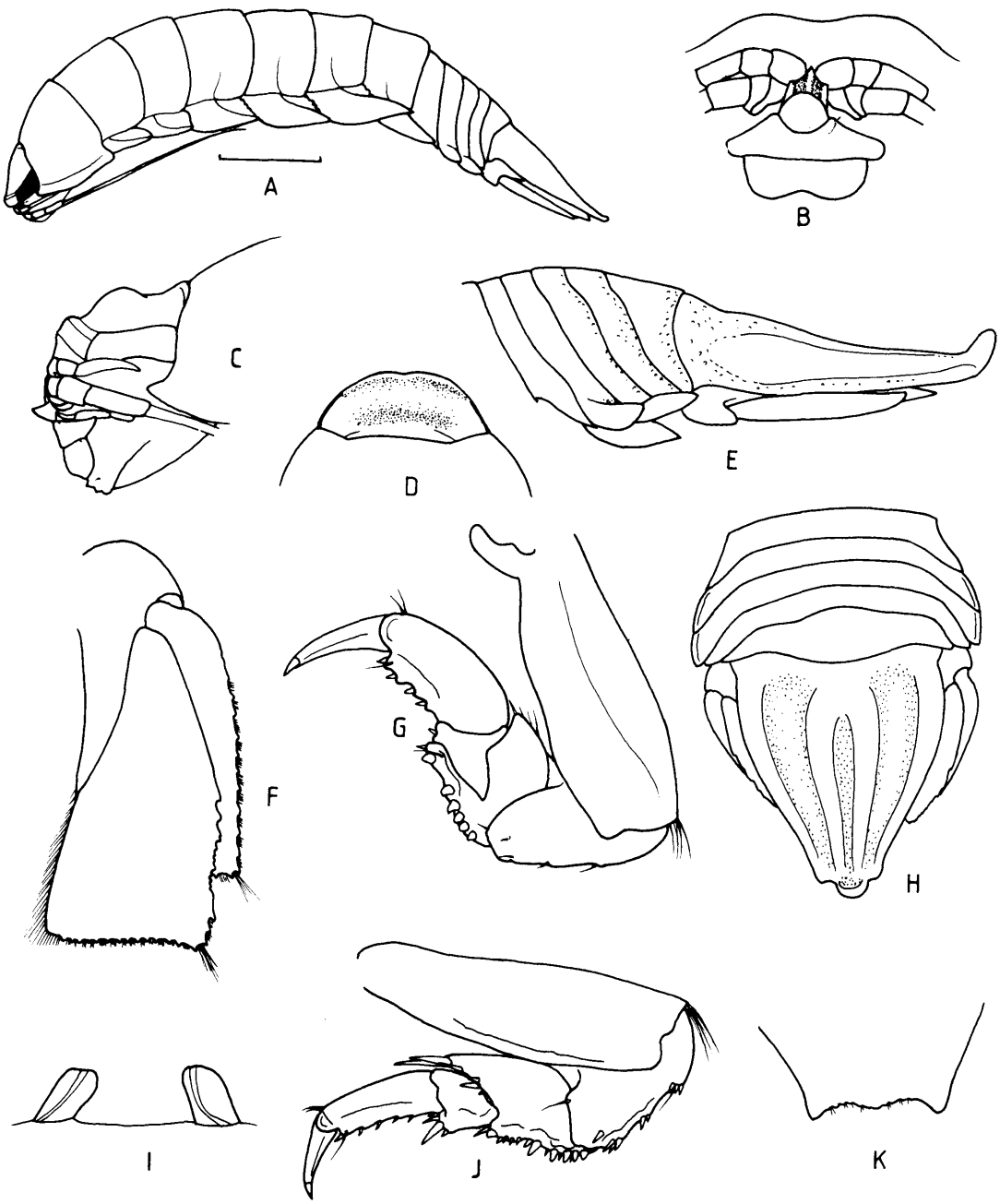

Fig. 94. *Booralana wundurra* n. sp. B, C, E, holotype; remainder paratypes: A, male 31.6 mm; K, female 12.0 mm; I, male 42.0 mm. **A**, lateral view; **B**, clypeal region; **C**, cephalon, lateral view; **D**, cephalon, dorsal view; **E**, pleon and pleotelson; **F**, uropod; **G**, pereopod 1; **H**, pleon and pleotelson, dorsal view; **I**, penes; **J**, pereopod 2; **K**, pleotelson apex. Scale 5.0 mm.

meaning warrior, a suitable epithet for this fierce-looking species.

Cirolana Leach

Cirolana Leach, 1818: 347.—Milne-Edwards, 1840: 235; Dana, 1852: 204; 1853a: 770; Bate & Westwood, 1867: 294; Miers, 1876: 109; Haswell, 1882b: 286; Hansen, 1890: 318; 1905: 11; Stebbing, 1893: 342; 1902: 40; 1904a: 11; 1904b: 701; 1905: 19; 1910a: 98; 1910b: 216; Sars, 1899: 69; Richardson, 1899a: 822; 1904a: 35; 1905: 82; Moore, 1901: 166; Norman & Scott, 1906: 40; Thielemann, 1910: 8; Barnard: 1914: 351a; 1920: 345; 1935: 306; 1940: 392; Hale, 1925: 129; 1929b: 247; Nierstrasz & Schuurmans Stekhoven, 1930: 3; Monod, 1930: 130; Van Name, 1936: 422; Gurjanova, 1933: 427; 1936: 67; Brian & Dartevelle, 1949: 111; Menzies, 1962a: 122; Menzies & Frankenberg, 1966: 19; Schultz, 1969: 177; Naylor, 1972: 28; Brusca, 1973: 203; 1980: 228; Jones, 1976: 210; Kensley, 1978c: 61; Kussakin, 1979: 190; Bruce, 1981b: 946, figs. 1a-c, 2a,b, 3a,b, 4a, 5a,b.

Nelocira Leach, 1818: 347.

Type species. *Cirolana cranchii* Leach, 1818, by monotypy. Type material held at the British Museum (Natural History), London (Bruce & Ellis, 1982).

Diagnosis. Pleonite 1 often concealed by pereonite 7; pleonite 5 lateral margins endompassed by those of pleonite 4. Pleotelson posterior margin with setae and spines. Antennule peduncle article 3 longest. Antenna peduncle articles 4–5 longest. Frontal lamina flat, about twice as long as wide, clypeus sessile. Maxilliped endite with 2 coupling hooks. Pereopods 1–3 with anterodistal margins of ischium and merus not produced. Pleopod peduncle without lateral lobes; only endopod of pleopod 5 without setae; appendix masculina inserted basally.

Additional characters. Body 2–3 times as long as

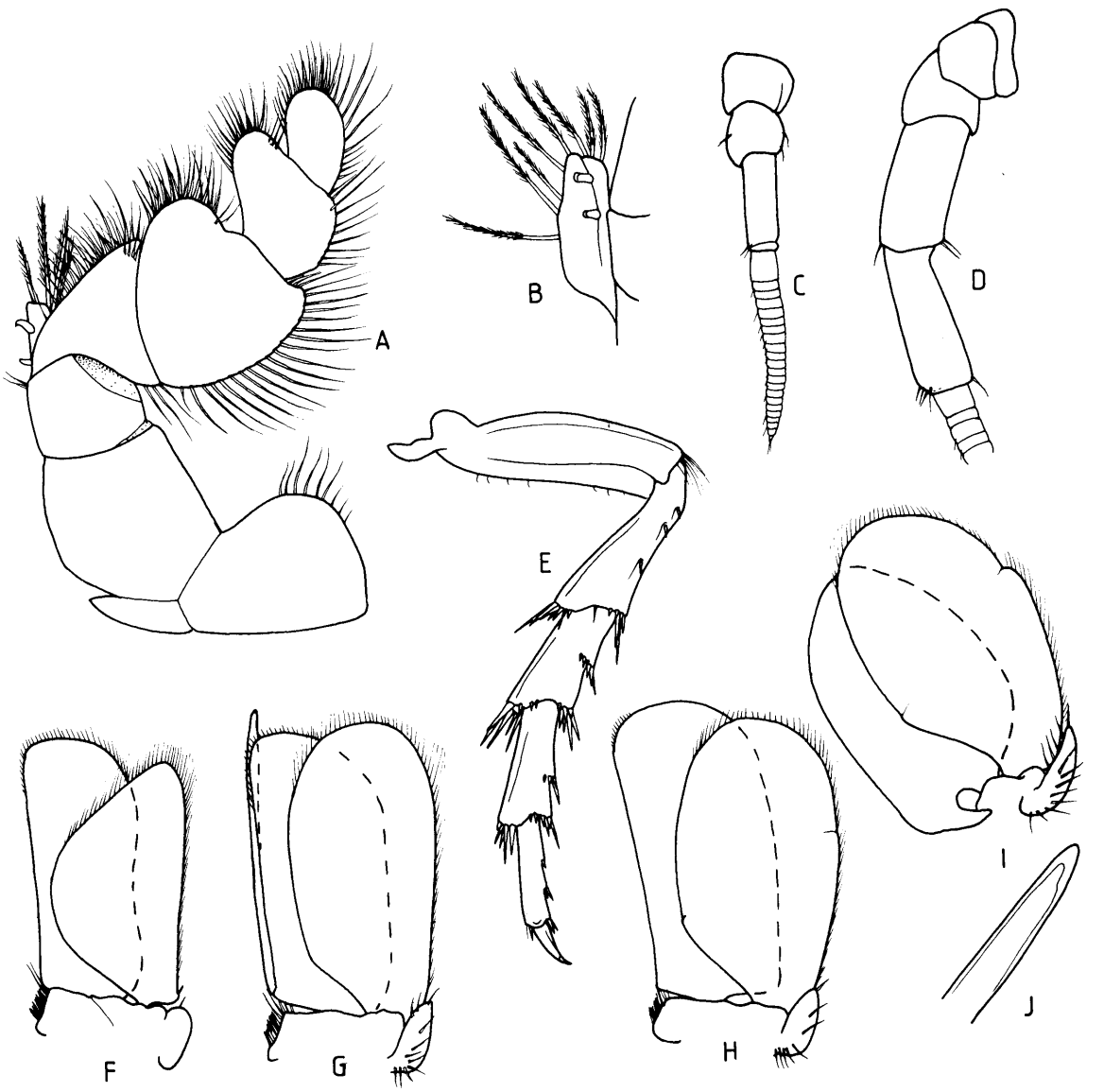

Fig. 95. *Booralana wundurra* n. sp., paratype male 42.0 mm. **A**, maxilliped; **B**, maxilliped endite, medial view; **C**, antennule; **D**, antennal peduncle; **E**, pereopod 7; **F–I**, pleopods 1, 2, 3 and 5 respectively; **J**, appendix masculina, apex.

wide, surface smooth, punctate or sculpted; pereonite 1 half as long again as pereonite 2. Eyes lateral when present. Pleonite 3 lateral margins often produced to posterior of pleonite 5.

Antennule peduncle usually 4-articulate, occasionally 2 or 3-articulate, always shorter than antenna; antennal peduncle 5-articulate, basal article may be visible. Frontal lamina either pentagonal or rounded, sessile, or with anterior margin freely projecting. Mandible with 3-articulate palp extending beyond incisor. Maxillule with 12–14 robust spines on gnathal surface of exopod. Maxilla entire. Maxilliped palp articles broad, endite with 2 coupling hooks, several plumose setae. All pereopods ambulatory; all dactyls with secondary unguis; 1–3 shorter than 4–7; pereopods 4–7 with articles not flattened nor expanded, distal margins of articles generally spinose. Penes may be present on sternite 7. Pleopod peduncles broader than long; rami similar, not markedly elongate. Borders of uropodal rami with plumose setae interspersed with spines; peduncle produced along medial margins of endopod.

Sexual dimorphism. There is very little variation between the sexes. Females tend to be larger, and in many cases show less sculpting than males. In two groups of species, the *C. parva* group, and the southern-group, the females lack the dense fringe of setae present in the merus, carpus and propodus of the male pereopod 1. In many males the antennal flagellum is more setose than that of the female.

Remarks. The genus *Cirolana* has long been the dominant genus of the family. The second described genus of what was to become the family Cirolanidae grew rapidly in size and by 1900 contained 26 species. By 1950 there had been a further 48 species described, and by 1981 over 114 species had been placed in *Cirolana,* about half the total number of species known for the family. Against this expansion, the genus *Cirolana* had remained at best very loosely defined, incorporating specific characters that had elsewhere been used to separate genera.

This situation was addressed by Bruce (1981b) where the former genus *Cirolana* was split into seven genera. Four of these genera were already established, but three of them *(Metacirolana, Neocirolana* and *Anopsilana)* had been virtually ignored since their inception. *Natatolana* comprised the largest new division, with about thirty species. The genus *Cirolana,* defined by Bruce (1981b), now contains a total of 67 species, including the Australian species.

The distribution of species of the genus is world wide, from the intertidal to depths rarely exceeding 200 metres. The greatest abundance of species occurs within the tropics, and as sublittoral benthic collections are made in little studied tropical areas, the numbers of species are likely to increase dramatically, as evidenced by the increase in the number of species now found in Australian waters.

The Australian species of the genus *Cirolana* fall readily into three groups. The most uniform of these is the group forming part of the worldwide *Cirolana parva* complex of sibling species. All of the species in this group are characterised by having a flat pentagonal frontal lamina with the anterior part overlapped by a downward projection of the rostral process. None of the Australian species show any form of sculpting, and all have the lateral margin of the uropodal exopod with continuous marginal setae and 6–10 spines. In all these species the posterior lateral margins of pleonite 3 are produced, and largely overlap the lateral margin of pleonite 4. Many of the species have the males with dense marginal setae on the posterior margins of pereopod 1. This setal fringe cannot be used as a reliable species character. Three species, *C. portula, C. erodiae* and *C. hesperia* have males with or without a setose fringe to the first pereopod. Small and immature males lack the setae but, in the species mentioned, some mature males also lack the setae.

The other two groups have disjunct distributions, one being tropical, the other southeastern. The two groups have some characters in common: the presence of transverse pereonal furrows in many species, and the lateral margin of the uropod with sparse setae and about 3 spines. The southern group is distinguished by males having the merus, carpus and propodus with a dense fringe of setae along the posterior margin, and an appendix masculina that is nearly twice as long as the endopod. There is generally little or no nodulose sculpting of the pereon, pleon or pleotelson. In all of these species the endopod of pleopod 1 narrows rapidly towards the apex.

The third group includes all those species showing nodulose sculpting of the pereon, pleon or pleotelson. The males of this group never have a setose fringe on pereopod 1, the appendix masculina extends only a little way beyond the endopod, and the endopod of pleopod 1 is not markedly tapered.

Several species do not fit readily into these groups. *Cirolana lata* and *Cirolana* sp. show no obvious affinity with any of these groups. *Cirolana cooma* is closest to the tuberculate group in having a short appendix maxculina and only 3 spines on the lateral margin of the uropodal exopod, but lacks any form of sculpting. *Cirolana harfordi* has abundant setae and spines on the uropodal exopod, and the shape of the cephalon together with the short frontal lamina suggests a close affinity to the European species *C. cranchii. Cirolana schioedtei* does not accord entirely with the generic description given here for *Cirolana,* yet is not distinctive eneough to merit a separate genus, and is here placed in the *incertae sedis* section.

Closely related genera include *Anopsilana* and *Neocirolana. Anopsilana* is distinguished by having pleopods 3–5 with naked endopods, and *Neocirolana* has a very narrow mandible incisor, as well as other mouthpart reductions.

Key to Major Species Groups within Australian *Cirolana*

This key is intended to allow workers to establish which of the groups their specimens belong to, and places together species that are closely related. This is intended as a supplement to the dichotomous species key.

1. Pereon, pleon and pleotelson with nodular sculpting. ..... Tuberculate group

——Pereon unornamented, pleon and pleotelson with ornamentation reduced or absent. 2

2. Lateral margin of uropodal exopod with continuous marginal setae and 6–10 spines. ..... *Cirolana parva* group

——Lateral margin of uropodal exopod with about 3 spines, sparse setae. ..... Southern group

Tuberculate group. Australian species are *Cirolana capricornica* n. sp., *C. curtensis* n. sp., *C. garuwa* n. sp., *C. kombona* n. sp., *C. magdalaina, C. oreonota* n. sp., *C. tuberculosa* n. sp. and *C. tumulosa.* Other species belonging to the group are *C. bovina, C. corrugis, C. fluviatilis, C. incisicauda, C. palifrons, C. pleonastica, C. saldanhae, C. sulcata, C. sulcaticauda, C. transcostata, C. venusticauda* and *C. undulata.*

***Cirolana parva* group.** Australian species are *C. australiense, C. arafurae* n. sp., *C. brocha* n. sp., *C. erodiae* n. sp., *C. hesperia* n. sp., *C. improceros* n. sp., *C. mekista* n. sp., *C. portula* n. sp., *C. solitaria* n. sp. and *C. stenoura* n. sp. Other species belonging to this group are *C. chaloti, C. diminuta* and *C. parva.*

Southern group. The species of this group are *C. furcata, C. halei, C. similis, C. triloba* and *C. victoriae.*

Key to Australian Species of *Cirolana*

1. Pereon, pleon and pleotelson with distinct sculpting. 21

——Pereon and pleon without, or with slight sculpting. 2

2. Lateral margin of uropodal exopod with continuous marginal setae and spines. 3

——Lateral margin of uropodal exopod with about 3 spines; setae sparse. 15

3. Frontal lamina pentagonal; apex over-lapped by rostral process. 6

——Frontal lamina not pentagonal. 4

4. Frontal lamina with anterior margin truncate; eyes absent. ..... *C. lata*

——Frontal lamina not truncate; eyes present. 5

5. Frontal lamina narrow; pleotelson smoothly rounded without conspicuous spines. ..... *Cirolana* sp.

——Frontal lamina broader anteriorly, anterior margins concave; pleotelson apex acute, with conspicuous spines. ..... *C. schioedtei*

6. Antennule peduncle 4-articulate. 11

——Antennule peduncle 3-articulate. 7

7. Paired lateral penes present. ..... *C. improceros*

——Penes opening flush with surface. 8

8. Pereopod 1 with dense setose fringe; appendix masculina without acuminate tip. 9

——Pereopod 1 without dense setose fringe; appendix masculina apex with acuminate tip. ..... *C. stenoura*

9. Ischium to propodus with setose fringe; appendix masculina twice as long as endopod. ..... *C. mekista*

——Carpus, propodus, half of merus with setose fringe; appendix masculina less than twice as long as endopod. 10

10. Pereopods 4 to 7 robust, pleopod 1 endopod medial margin feebly convex. ..... *C. solitaria*

——Pereopods 4 to 7 not robust, pleopod 1 endopod lateral margin feebly concave. ..... *C. arafurae*

11. Pereopod 1 without setose fringe, uropod apices not bifid. ..... *C. brocha*

——Pereopod 1 with or without setose fringe, uropods with bifid apices. 12

12. Uropods with lateral margins sinuate. ..... *C. portula*

——Uropods with lateral margins not sinuate. 13

13. Uropodal exopod with lateral margin straight, lateral margin of pleopod 1 endopod straight. ..... *C. hesperia*

——Uropodal exopod with lateral margin convex, lateral margin of pleopod 1 endopod concave. 14

14. Pleotelson apex rounded, 8 spines. ..... *C. erodiae*

——Pleotelson apex narrow, 10-14 spines. ..... *C. australiense*

15. Pleonite 5 with 3 nodules. ..... *C. triloba*

——Pleon without ornamentation. 16

16. Pleotelson with 1 or 2 obscure longitudinal ridges. 17

——Pleotelson without ridges. 18

17. Pleotelson with single indistinct ridge; male with setose fringe on pereopod 1. ..... *C. victoriae*

——Pleotelson with 2 indistinct submedian ridges; male pereopod 1 without setose fringe. ..... *C. morilla*

18. Frontal lamina pentagonal. 19

——Frontal lamina with rounded margins. ..... *C. cooma*

19. Clypeus with 2 flat lobes. ..... *C. furcata*

——Clypeus entirely flat. 20

20. Lateral margins of pleonite 4 encompassed by pleonite 3. ..... *C. similis*

——Lateral margin of pleonite 4 free. ..... *C. halei*

21. Frontal lamina with anterior margin rounded. ..... *C. magdalaina*

——Frontal lamina pentagonal. 22

22. Pleotelson with 2 curved carinae, pleonite 4 with single tubercle. ..... *C. kendi*

——Pleotelson and pleon with numerous tubercules. 23

23. Uropods densely setose; marginal setae and spine on lateral margin of exopod. ..... *C. harfordi*

——Lateral margin of uropodal exopod with about 3 spines; setae sparse. 24

24. Pereonites 2–6 without obvious sculpting. 25

——Pereonites 2–6, some with distinct sculpting (generally 5 and 6). 28

25. Pereon totally without sculpting. ..... *C. tumulosa*

——Pereonite 7 with sculpting. 26

26. Apex of pleotelson acute, pleonite 4 with 3 prominent tubercles. ..... *C. capricornica*

——Apex of pleotelson truncate. 27

27. Pleonites 4–5 with prominent median tubercle; lateral margins of pleotelson feebly concave. ..... *C. oreonota*

——Pleonites 3–5 with numerous small tubercles; pleotelson margins slightly convex. ..... *C. curtensis*

28. Pereonites 1–7 with sculpting; pleotelson with 2 submedian carinae. .... *C. tuberculosa*

——Pereonites 5–7 with sculpting. 29

29. Pleon with prominent median tubercles on pleonites 4–5; lateral tubercles distinctly smaller than median. ..... *C. kombona*

——Pleon with median tubercles of pleonites 4–5 slightly larger than lateral tubercles; numerous small tubercles on pleon. ..... *C. garuwa*

Cirolana sp.

Fig. 96

Material examined. Manca (3.5 mm), north-east of Coffs Harbour, NSW, 29°57′S, 153°24′E, 11 Nov. 1951, 75 m, in muddy sand, *Galathea* Stn 547.

Description. Body about 2.5 times as long as wide; pleon noticeably narrower than pereon. Cephalon with median part of anterior margin indented, interocular furrow entire. Eyes round. Coxae all visible in dorsal view, each with distinct oblique carinae; coxae of pereonites 4–6 becoming progressively more acute, projecting beyond posterior of segment. Pleonite 1 and most of pleonite 2 concealed by pereonite 7; posterolateral margins of pleonite 3 broad, extending to posterior of pleon, encompassing but not concealing posterolateral margins of pleonite 4. Pleotelson dorsal surface convex, posterior margin with about 7 spines and 16 marginal setae.

Antennule peduncle articles 1 and 2 subequal in length, article 3 longer than their combined lengths; flagellum shorter than peduncle, composed of about 8 articles, extending to anterior of pereonite 1. Antenna peduncle articles 1–2 short, article 3 slightly longer, article 4 longer than 3, article 5 longest; flagellum composed of about 16 articles, extending to pereonite 3.

Frontal lamina about 3 times longer than wide, anterior margin very slightly expanded. Maxilliped endite with single coupling hook.

Pereopod 1 with setae at anterodistal angles of ischium and merus; posterior margin of merus with 3 blunt and 2 acute spines, carpus with 1 spine, and propodus with 2 spines on palm and robust spine opposing dactylus; dactylus not biungiculate, at base of unguis lies small spiniform process. Pereopods 2–3 similar, but lack spines on palm of propodus, generally more spinose. Pereopod 6 with prominent spines at anterodistal angles of ischium to carpus; posterior margin with spines at distal angles and medially placed on margin.

Pleopods 3–5, exopods without obvious suture. Pleopod 1 peduncle slightly wider than long, endopod about half as broad as exopod, medial margin straight, lateral margin concave; exopod with spine at proximal angle of lateral margin, medial margin strongly convex, broadest at 0.66 of its length. Pereopod 2 similar but peduncle shorter, rami with straighter margins. Uropods not extending beyond pleotelson, endopod posterior margin slightly concave, with 5 spines, lateral margin with 2 spines; exopod lanceloate, shorter than endopod, lateral margin with 5 spines, medial with 4. All margins of both rami with plumose setae.

Colour. Pale cream in alcohol, chromatophores not apparent.

Size. Full adult size not known, present specimen 3.5 mm.

Remarks. This single specimen is very distinctive despite its immaturity. Few isopods in the family, and few in the genus *Cirolana* have the anterior margin of the cephalon indented. This feature, coupled with the largeness of the posterolateral margin of pleonite 3 separates it from most other species. *Cirolana stebbingi* also shows these features, but is otherwise very different.

The form of pleopods 1 and 2 suggests an affinity to the genera *Politolana* and *Conilorpheus* but the antennules, antennae and pereopods agree more closley with those of *Cirolana*. This species also differs from *Cirolana* in not having biungiculate dactyls on the pereopods. Until adults are known, the species is provisionally assigned to *Cirolana*.

Cirolana cooma n. sp.

Fig. 97

Material examined. Male (4.5 mm), Halifax Bay, Townsville, Qld, 25 Dec. 1976, sand 14.5 m, coll. JCUNQ.

Types. Holotype, QM W9817.

Type locality. Halifax Bay, Townsville, Qld, 19°9′S, 146°19′E.

Description of male. Body about 3 times as long as wide, unornamented. Cephalon anterior margin smoothly rounded. Coxae of pereonites 4–7 with oblique carina. Pleonite 3 with posterolateral margin not produced to posterior of pleon. Pleotelson lateral margins straight, converging to smoothly rounded apex; posterior margin with 6 spines amongst short plumose setae.

Antennule peduncle 3-articulate, article 2 slightly shorter than 1, flagellum composed of about 9 articles,

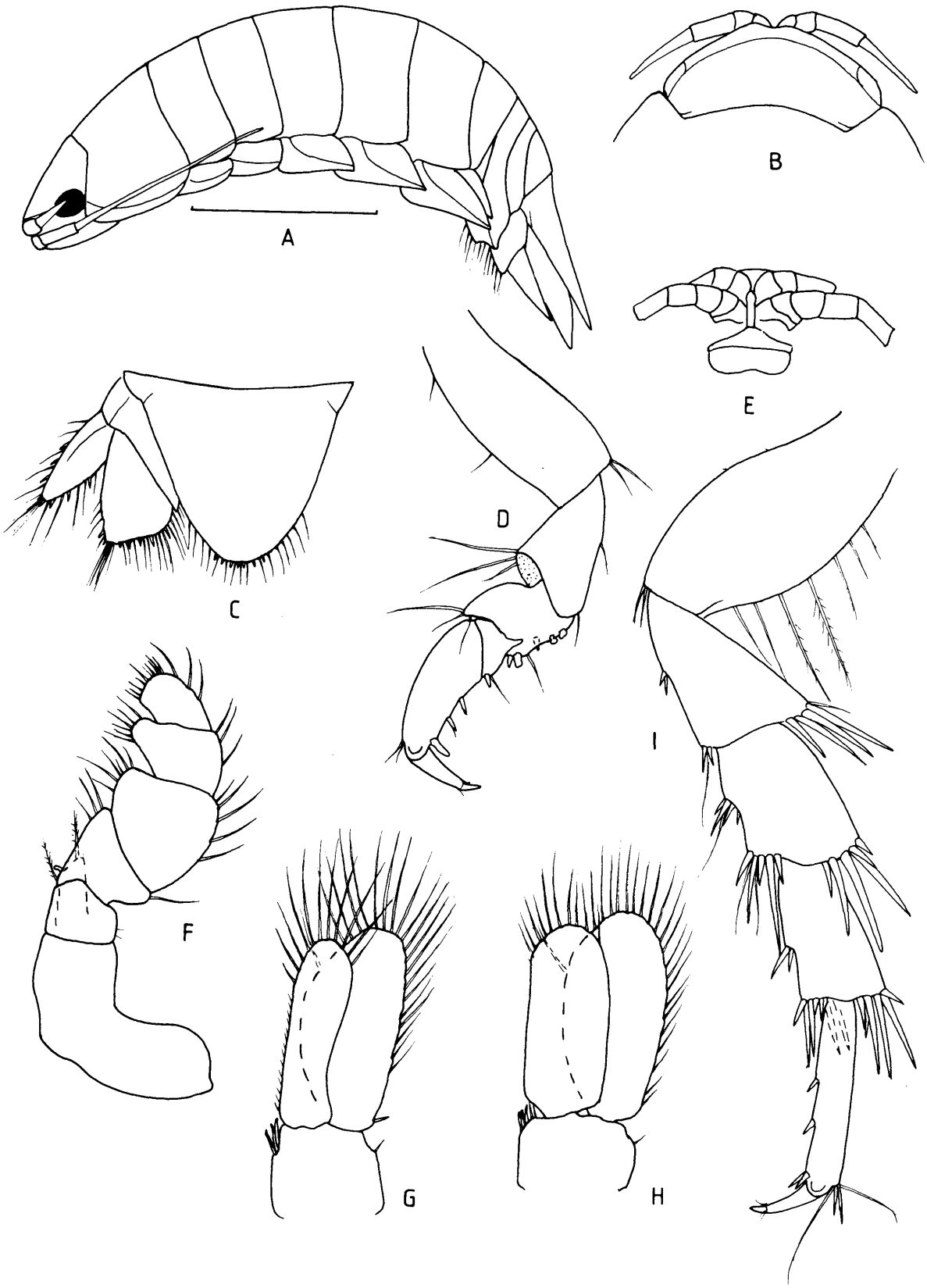

Fig. 96. *Cirolana* sp. **A,** lateral view; **B,** cephalon, dorsal view; **C,** pleotelson and uropod; **D,** pereopod 1; **E,** clypeal region; **F,** maxilliped; **G,** pleopod 1; **H,** pleopod 2; **I,** pereopod 7. Scale 1.0 mm.

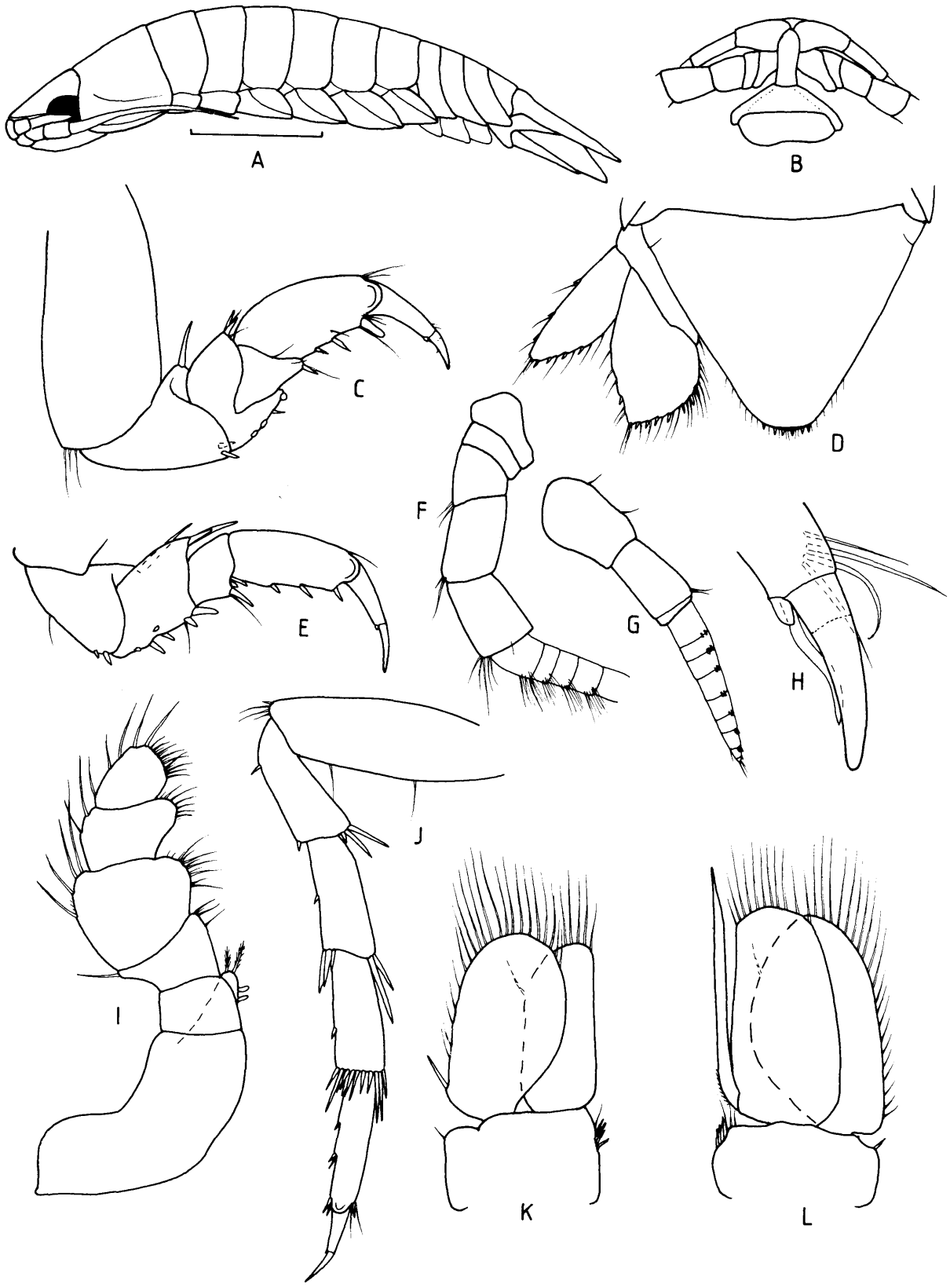

Fig. 97. *Cirolana cooma* n. sp., holotype. **A**, lateral view; **B**, clypeal region; **C**, pereopod 1; **D**, pleotelson and uropod; **E**, pereopod 2; **F**, antennal peduncle; **G**, antennule; **H**, pereopod 1, dactylus; **I**, maxilliped; **J**, pereopod 7; **K**, pleopod 1; **L**, pleopod 2. Scale 1.0 mm.

first of which is longest. Antenna peduncle articles 4–5 proportionally shorter than usual for genus; flagellum composed of 17 articles, extending to pereonite 4; proximal flagellar articles with abundant setae.

Frontal lamina 2.5 times longer than wide, pentagonal, without abrupt angles; lateral margins slightly concave.

Pereopods with few spines, dactyls slender. Pereopod 1 with 3 small nodular spines and 1 acute spine on ischium posterior margin, anterior margin with 2 acute spines; merus with single acute spine; propodus with 2 acute spines on palm, third robust spine opposing dactylus. Pereopods 2–3 similar, more spinose than pereopod 1; pereopod 2 with 4 prominent blunt spines on posterior margin of merus, carpus with 3 spines on posterior margin. Pereopod 7 slender, posterior margins of ischium, merus and carpus with single spine each, additional spines on posterodistal angles.

Vasa deferentia opening flush with surface of sternite 7.

Pleopod 2 appendix masculina arising basally, extending beyond endopod by 0.2 of its length. Uropods extending slightly beyond apex of pleotelson. Exopod shorter than endopod, lateral margin with 3 short spines, medial margin with 4 spines set amongst marginal setae. Endopod with 1 spine on lateral margin, about 6 short marginal setae spread along distal half; medial margin with 8 spines set amongst continuous marginal setae.

Female. Not known.

Colour. White in alcohol, chromatophores not apparent.

Size. 4.5 mm.

Remarks. The elongate shape of the frontal lamina, the pleotelson shape and spination, together with the slender pereopod dactyls serve to distinguish this species from all others.

Distribution. Known only from the type locality.

Etymology. The epithet is an Aboriginal word meaning one, and refers to the species being known from a single specimen.

Cirolana harfordi (Lockington)

Fig. 98

Aega harfordi Lockington, 1877: 46.

Cirolana californica Hansen, 1890: 338, pl. 3. fig. 1.—Calman, 1898: 247.

Cirolana harfordi.—Richardson, 1899a: 822; 1899b: 163; 1900: 217; 1904a: 213; 1904b: 658; 1905: 109, figs 91, 92; Holmes, 1904: 319; Stafford, 1913: 165, figs 1-3; Nierstrasz, 1931: 158; Schultz, 1969: 183, fig. 286; Miller, 1975: 296; Johnson, 1976a: 343; 1976b: 351; Kussakin, 1979: 194, figs 73-75; Bruce, 1981b: 950.

Cirolana harfordi japonica Theilemann, 1910: 11, figs 5-7.—Shiino, 1965: 541, fig. 716; Bruce & Jones, 1981: 77, fig. 8a-f.

Cirolana theilemanni Kussakin, 1979: 196.

Cirolana toyamaensis Nunomura, 1982: 24, figs 1-4.

Material examined. 10 males (10.2–17.9 mm), 26 females (6.3–15.5 mm), under Fremantle Bridge, Swan River, WA, 10 June 1980, under rocks and amongst mussels, coll. NLB. Female (9.5 mm), off Lorne, Vic., Bass Strait, March 1980, coll. D. O'Sullivan. Female (10.7 mm ovig.), Berry's Bay, Waverton, NSW, 29 Nov. 1972, scrapings from hull of *Ben Shortidge* on slipway, coll. P. Hutchings. A series of 7 specimens from California and from Japan were also examined.

Type locality. California.

Descriptive notes. Cephalon with 2 interocular furrows, one running along anterior margin, second from dorsal surface of each eye. Frontal lamina pentagonal, broader anteriorly. Pleotelson with 2 submedian processes; posterior margin with about 10 spines. All pereopods with very few setae. Pleopod 2 appendix masculina extending beyond inner ramus by 0.2 of its length, apex with small process, minute scales on inner margin. Uropods both rounded, extend beyond apex of pleotelson; margins densely setose, setae concealing most spines.

Colour. In life, dark slate grey. Under close examination the dorsal surfaces, antennae, pereopods and uropods are densely covered by brown and black chromatophores.

Size. Up to 17.9 mm. Johnson (1976a) recorded specimens up to 18.0 mm, and also showed that males grow to a larger size than do females. Japanese specimens (Bruce & Jones, 1981) did not exceed 10.0 mm.

Remarks. This species has been described in detail by Kussakin (1979). Bruce & Jones (1981) detailed the differences between Japanese and Californian material, and concluded that while the races may be distinct, they were the one species. Kussakin (1979) concluded that Theilemann's (1910) variety was a different species. This is not supported by comparison of the Japanese and American material, nor by comparison to Australian material. His proposed new name for the Japanese material (Kussakin, 1979: 196) is here treated as a synonym. Similarly, the differences by which Nunomura (1982) separated *C. toyamaensis* from *C. harfordi* fall within the geographical variation in morphology shown by Australian, American and Japanese specimens.

Australian material agrees very closely with Californian material except for the spination of the pleotelson. All Australian material has 9–10 spines, as opposed to 30–36 on Japanese and American specimens. Southern Japanese specimens are small and more heavily sculpted. It should be noted that the two submedian processes and the crenelation of the posterior margin of the posterior pereonites and pleonites is present on Californian material, although this has been overlooked by many workers.

The isopod described as *C. harfordi* var. *spongicola* by Stafford (1912) appears to belong to the *C. parva* group of species.

Distribution. Discontinuous in the North Pacific with two forms, one in Japan and on U.S.S.R. coasts, the other occurring on the Pacific seaboard of the United

States. Australian records are from Fremantle, WA, off Lorne, Vic., and Waverton, NSW.

Cirolana lata Haswell
Fig. 99

Cirolana lata Haswell, 1881: 192, pl. 4. fig. 1; 1882a: 286.—Hale, 1925: 143, fig. 8; Nierstrasz, 1931: 157; Bruce, 1981b: 950.

Material examined. Female (16.5mm), holotype, off Broughton Is., near Port Stephens, NSW, 50 m.

Types. Holotype held at the Australian Museum.

Type locality. Off Broughton Islands, NSW.

Remarks. The state of the specimen does not allow any expansion on the description given by Hale (1925). Additional figures given here should allow positive identification of the species.

The rectangular shape of the frontal lamina, smoothly rounded cephalon anterior margin, and the morphology of the antennule and antennae, together with the shape of the uropods serves to distinguish *Cirolana lata* from other eyeless *Cirolana* species.

Distribution. Known only from the type locality.

Cirolana furcata Bruce
Fig. 100

Cirolana furcata Bruce, 1981a: 666, fig. 13.—1981b; 950.

Material examined. Male (7.5 mm), off Long Reef, Sydney, NSW, 10 Apr. 1972, among laminarian holdfasts, clumps of

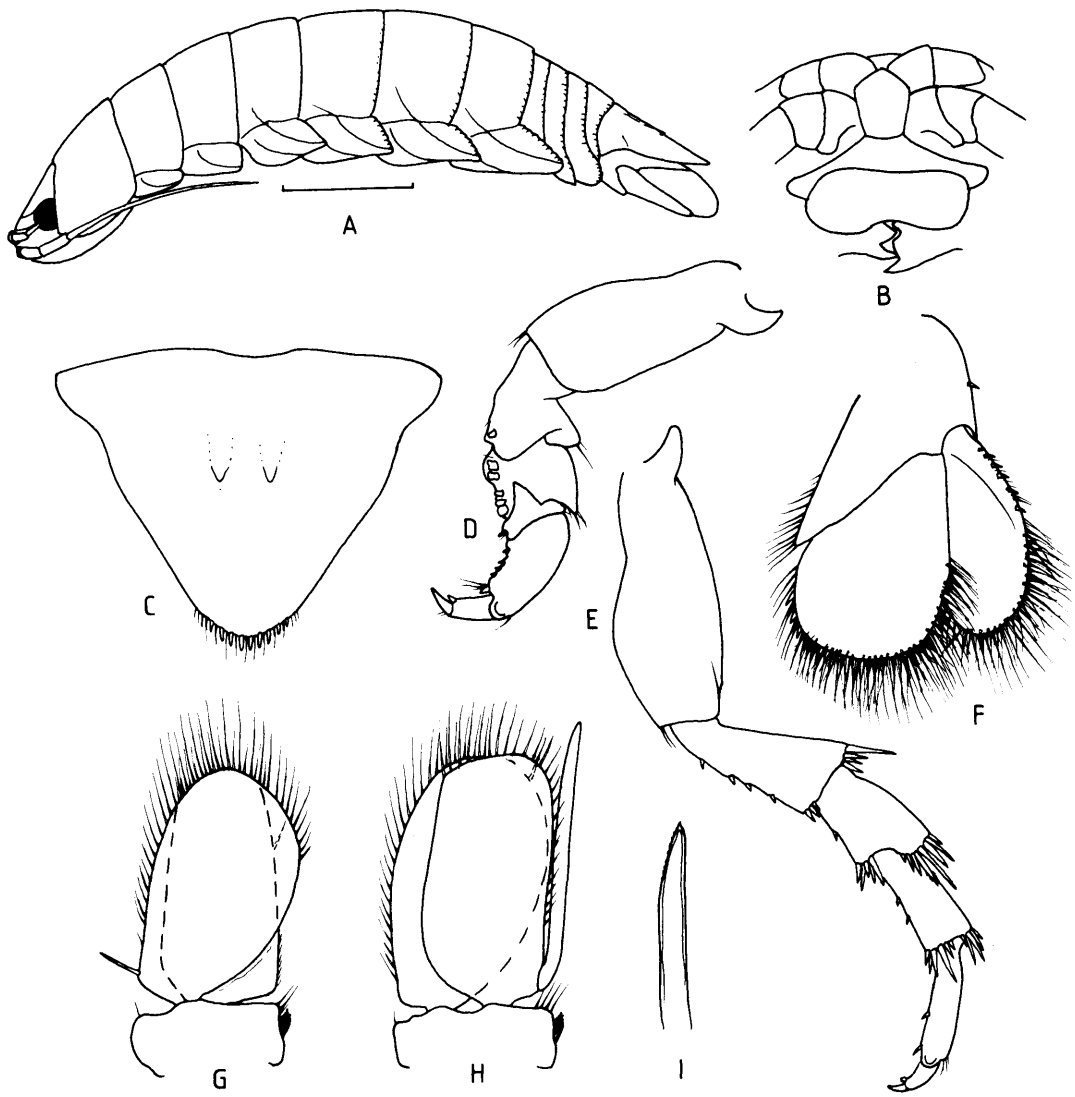

Fig. 98. *Cirolana harfordi,* male 14.4 mm, Fremantle. **A,** lateral view; **B,** clypeal region; **C,** pleotelson; **D,** pereopod 1; **E,** pereopod 7; **F,** uropod; **G,** pleopod 1; **H,** pleopod 2; **I,** appendix masculina, apex. Scale 3.0 mm.

ascidians attached to rocks, 32 m, coll. P. Hutchings.

Types. Held at the Australian Museum, Sydney.

Type locality. Off North Head, Sydney, NSW.

Remarks. Previously known only from a female and one manca (Bruce, 1981a), the male is here recorded for the first time. It shows the setation of the first pereopod and elongate appendix masculina that is characteristic of this group. The species is readily separated from other *Cirolana* species by the unique projections on the clypeus.

Distribution. Known only from Sydney, NSW.

Cirolana halei Bruce
Fig. 101B, C

Cirolana halei Bruce, 1981a: 658, figs 9, 10.—1981b: 950.

Types. Holotype and paratype held at the Australian Museum, Sydney; additional paratypes held at the South Australian Museum and the Museum of Victoria.

Type locality. Off Stockton Beach, north of Hunter River, NSW.

Remarks. This species can be identified by the combination of the following characters: pentagonal frontal lamina, biarticulate antennule peduncle, and 8 spines on the pleotelson.

The very similar *Cirolana similis* is distinguished by having the posterolateral margins of pleonite 3 overlapping pleonite 4, and by having 6 spines on the posterior margin of the pleotelson, as opposed to 8 spines in *C. halei.*

Distribution. Off Hunter District coast, NSW, between 15–32 m, from fine sand.

Cirolana similis Bruce
Fig. 101D

Cirolana similis Bruce, 1981a: 668, fig. 14.—1981b: 950.

Material examined. 2 males (5.0, 5.6 mm), 2 females (4.4,

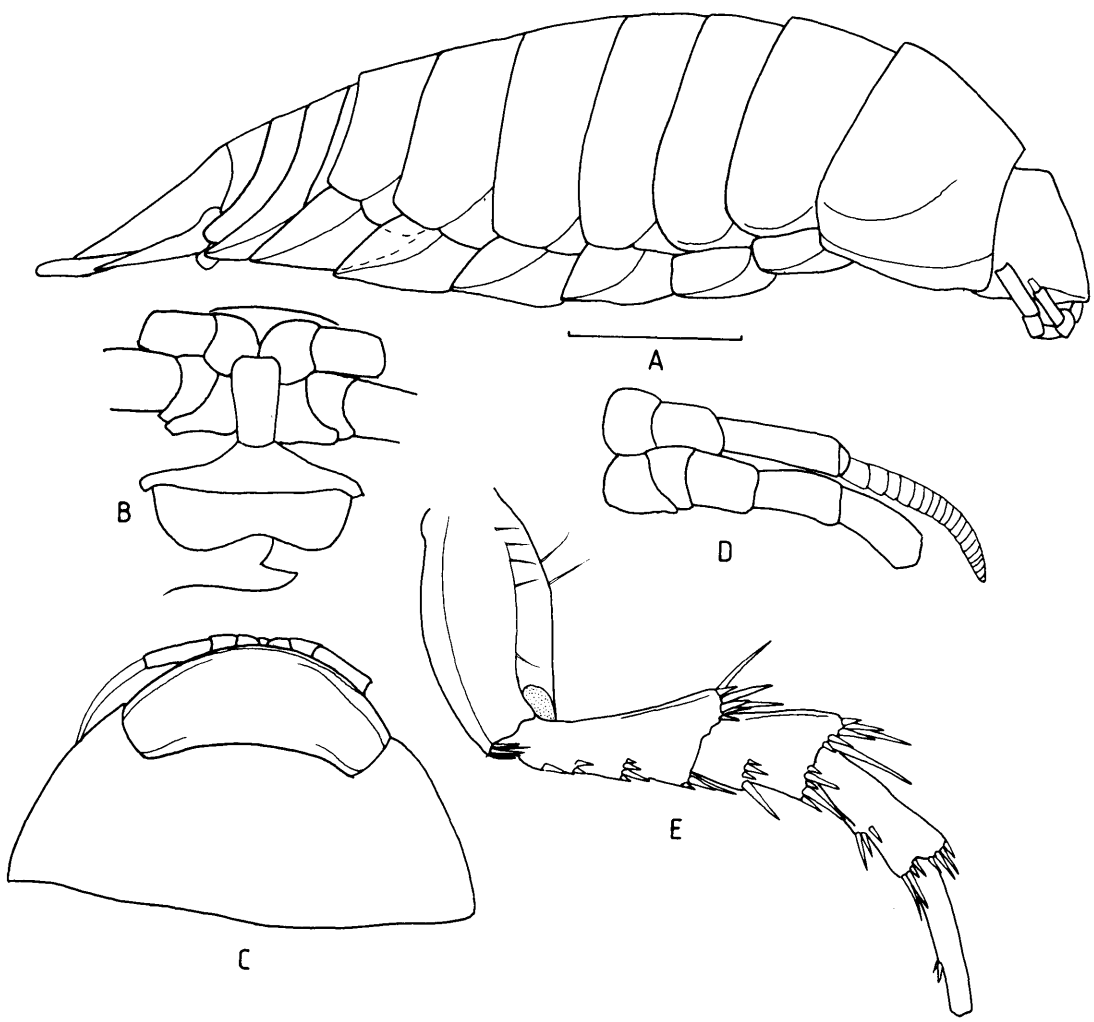

Fig. 99. *Cirolana lata,* holotype. **A,** lateral view; **B,** clypeal region; **C,** cephalon and pereonite 1, dorsal view; **D,** antennule, antenna, in situ; **E,** pereopod 6, in situ. Scale 3.0 mm.

5.0 mm), off Sydney, NSW, 33°47'S, 151°43'E, 5 Dec. 1977, 192 m, coll. AM. Male (6.4 mm), 2 female (4.8, 5.5 mm), off Sydney, NSW, 33°58'S, 151°29'E, 8 June 1962, 150 m. coll. R.L. Thomas, CSIRO. 2 males (5.8, 6.3 mm), 5 females off Sydney, NSW, 33°59'S, 151°35'E, 9 Aug. 1973, 198 m, coll. AMSBS. 3 males (5.0. 5.1, 5.6 mm), 3 females (3.8, 4.5, 4.9 mm), and 27 unmeasured males and females, north-east of Tas., 37°05'S, 150°05'E, 30 Apr. 1914, 70–100 m, from *Endeavour*, coll. T. Mortensen. Male (4.1 mm), Bass Strait, 30°14.7'S, 146°00'E, 26 Nov, 1973, 68 m, coll. B.J. Smith.

Types. Holotype and paratypes held at the Australian Museum; additional paratypes held at the South Australian Museum and the Museum of Victoria.

Type locality. Off Malabar, Sydney, NSW.

Remarks. This species can be separated from *C. triloba* by the total lack of sculpting of the pleon and pleotelson, by differences in frontal lamina morphology, and by lacking impressed lines on the pereon segments. The longer frontal lamina and cephalic tubercle separate this species from *C. halei* and the flat clypeus of *C. similis* separates it from *C. furcata*.

Distribution. From off Sydney to Bass Strait, at depths of 33–198 metres.

Cirolana triloba Bruce
Fig. 101A

Cirolana triloba Bruce, 1981a: 662, figs 11, 12.—1981b: 950.

Types. Held by the Australian Museum, Sydney; additional paratypes at the Museum of Victoria.

Type locality. Off Malabar, Sydney, NSW.

Remarks. This species can be separated from all others of the genus by the ornamentation of the pleon and pleotelson.

Distribution. Off Malabar, NSW, at depths of 66–71 metres (Bruce, 1981a).

Cirolana victoriae Bruce
Fig. 101E,F

Cirolana victoriae Bruce, 1981a: 670, fig. 15.—1981b: 950.

Types. Holotype held by the Museum of Victoria.

Type locality. Western Port, Vic.

Remarks. This species can be separated from *C. triloba* by the lack of pleonal tubercles, shape of the frontal lamina, the far more rounded uropods, and the

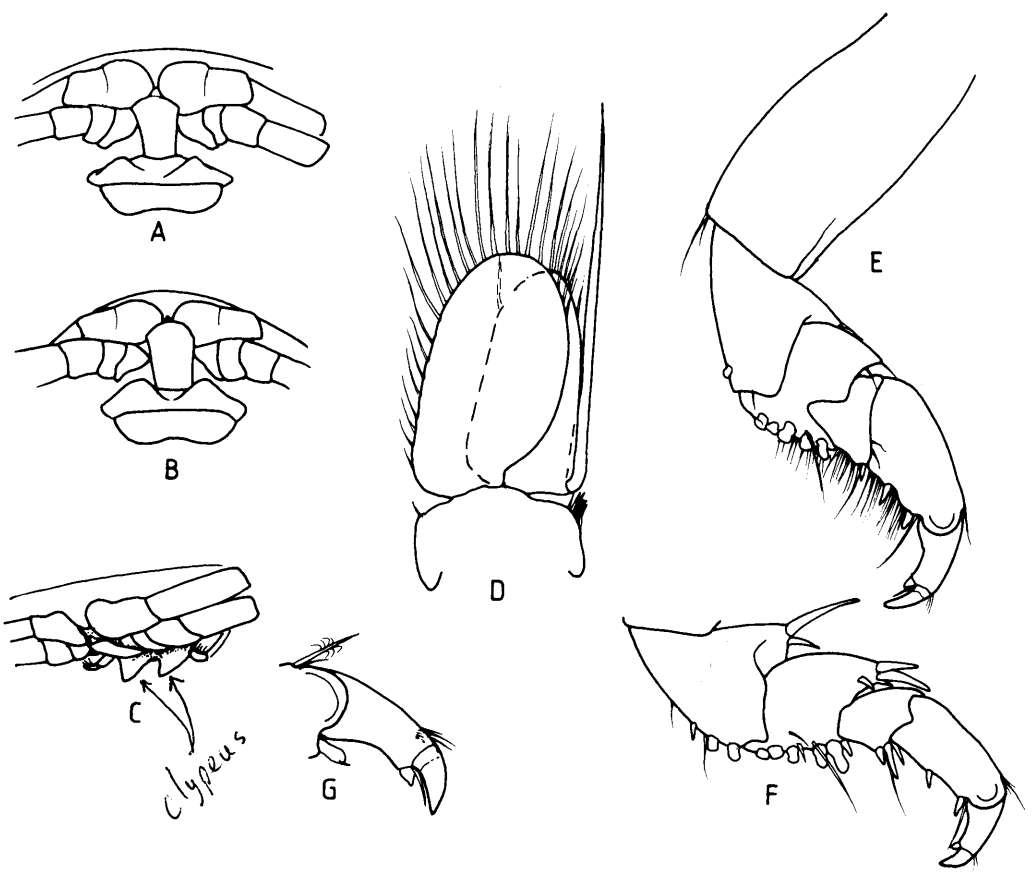

Fig. 100. *Cirolana furcata*, male, Long Reef, Sydney. **A–C**, clypeal region, different perspectives; **D**, pleopod 2; **E**, pereopod 1; **F**, pereopod 2; **G**, pereopod 1, dactylus.

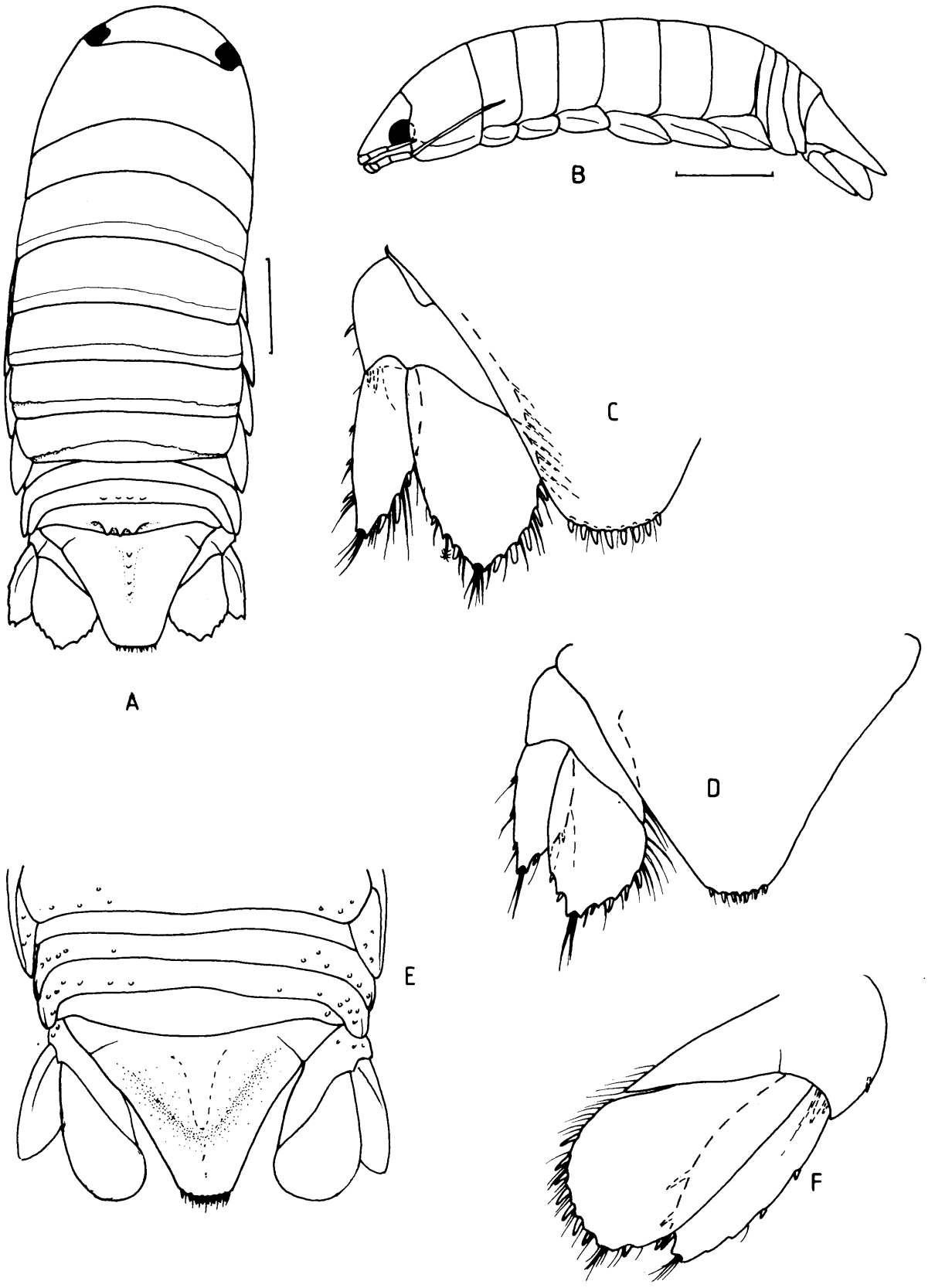

Fig. 101. **A,** *Cirolana triloba;* **B,** *Cirolana halei,* lateral view; **C,** the same, pleotelson and uropod; **D,** *Cirolana similis,* pleotelson and uropod; **E,** *Cirolana victoriae,* pleon and pleotelson; **F,** the same, uropod. Scale 1.0 mm.

presence of an ill-defined median longitudinal pleotelson on the pleotelson. The last two characters also separate *C. victoriae* from *C. halei, C. furcata* and *C. similis.*

Distribution. Known only from the type locality.

Cirolana capricornica n. sp.

Fig. 102

Cirolana pleonastica.—Nordenstam, 1946: 9; Bruce, 1980a: 111, figs 2-4 (not *C. pleonastica* Stebbing, 1900: 692, pl. LXVIIA).

Material examined. 17 males (5.5-7.6 mm, mean 6.25 mm), 10 females (5.0-8.8 mm, mean 6.3 mm), Sandy Island No. 2, Cobourg Peninsula, NT, 11°5.5′S, 132°0.7′E, 21 Oct. 1981, baited trap, 10 m, coll. NTM. Female (8.2 mm), Battery Point, Thursday Is., Qld, Apr. 1979; female (7.9 mm), Bampfield Head, Prince of Wales Island, Thursday Is., Qld., Apr. 1979, coll. P.C. Young. Female (6.5 mm), 2 miles N.E. of Hanniball Is., off Cape York, 11°33′S, 142°57′E, 15 Feb. 1979, 5 m; male (8.0 mm), north-east corner South Island, Sir Charles Hardy Is., Cape York, 11°55′S, 143′17′E, 14 Feb. 1979, coral sand, 1-6 m, coll. AM. 2 males (6.9, 9.5 mm), 7 females (8-11.4 mm), 12 June 1978; 2 males (9.5, 10.5 mm), 12 females (6.3-10.5 mm), 26 June 1979; male (8.2 mm), 8 females (5.0-8.0 mm), manca (3.7 mm), 6 Dec. 1979, all trapped on western reef flat, Heron Is., Great Barrier Reef, Qld. Manca (3.7 mm), Wistari Reef, Great Barrier Reef, Qld, 4 Dec. 1979, reef slope, 11 m; manca (2.5 mm), Heron Is., Great Barrier Reef, Qld, 8 Dec. 1979, in pools, north-east reef edge, coll. NLB. Male (7.7 mm), 12 March 1962; 2 males (7.6, 8.5 mm), females (7.5 mm) 3 March 1963; 2 males (8.3, 8.5 mm), female (8.0 mm), 28 Apr. 1963, all Good Friday Is., Abrolhos Group, WA, in craypots, 10-20 m. Also, specimens from the following localities: Bereford Is., Van Diemens Gulf, 11°29.3′S, 131°57.5′E; Trepang Bay, 11°08′S, 131°57.7′E and Black Point, 11°9.0′S, 132°51.4′E, Cobourg Peninsula, NT.

Types. Holotype, male QM W9825. Paratypes, QM W9826-W9829; AM P28776, P28779, P28784, P28786, P28111; WAM 17-80, 22-80, 52-83; NTM Cr000235.

Type locality. Heron Island, Great Barrier Reef, Qld, 23°26.5′S, 151°54′E.

Description of male. [Detailed figures of specimens from the type locality are given by Bruce (1980a) under the name *C. pleonastica*]. Cephalon with interocular

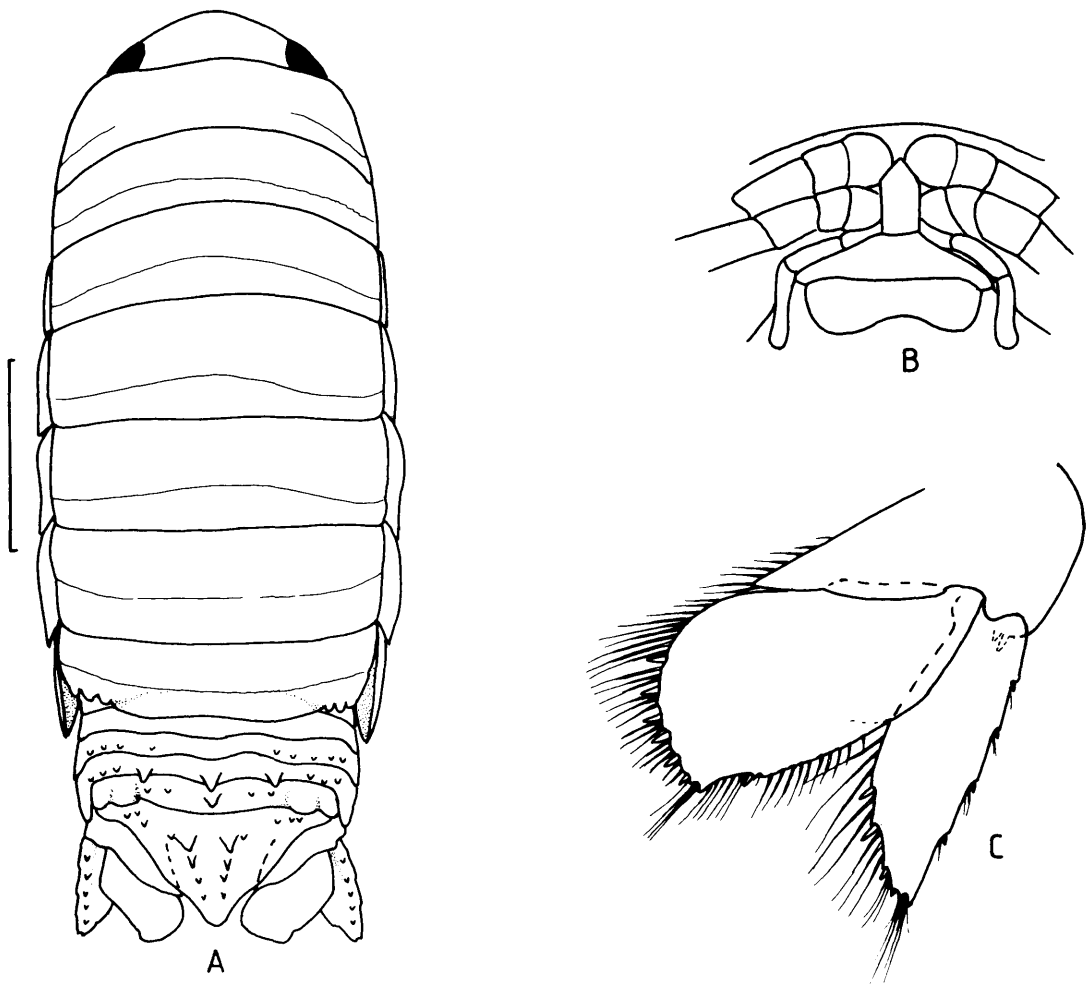

Fig. 102. *Cirolana capricornica* n. sp. **A**, dorsal view, holotype; **B**, clypeal region; **C**, uropod. Scale 2.0 mm.

carina present on broadly rounded anterior margin. Posterior margin of all pereonites with transverse impressed line. Posterolateral margin of pereonite 7 denticulate. Coxae on pereonites 2–3 small, not produced, coxae 4–7 becoming progressively more produced, each with ill-defined oblique carina; coxae 3–8 visible in dorsal view. Posterior margins of pleonites 3–5 denticulate, pleonite 4 with 3 large and about 6 small tubercles, pleonite 3 with single large median tubercle and additional small ones. Pleotelson short, about twice as wide as long, fringed with about 40 plumose setae and 6 stout spines on posterior margin; dorsal surface bearing 2 rows of tubercles which become progressively smaller posteriorly, as well as scattered small tubercles on anterior lateral surface.

Antennule short, just reaching pereonite 2; peduncular articles 1 and 2 short, appearing fused, although suture is distinct. Antenna flagellum extending to pereonite 4, composed of about 22 articles.

Mandible palp terminal article armed with 3 long and 11 short serrate setae, article 2 with about 12 setae on lateral margin; medial margins of articles 2–3 with spinnules; apex of terminal article smoothly rounded, not truncate. Maxillule with 3 stout plumose spines on endopod, proximal spine largest; gnathal surface of exopod with about 12 stout spines some of which are serrate. Maxilla with 5 and 8 setae on palp and exopod respectively; endopod with 3 long plumose setae and about 13 simple setae. Maxilliped broad, medial margin of article 4 of palp only moderately produced; article 5 short and broad. Endite with 2 coupling hooks and 4 terminal and 1 lateral plumose setae.

Pereopod 1 with 6 tubercular and 2 acute spines on posterior margin of merus; propodus with 2 spines on palm, third robust spine opposing dactylus. Pereopods 2–3 similar, less robust and generally with more and larger spines than pereopod 1. Pereopod 7 with clusters of spines at anterodistal angles of ischium, merus and carpus; merus with distolateral margin entirely spinose; posterior margin of ischium to propodus with short marginal spines, and groups of spines at distal angles of merus and carpus.

Vas deferentia open flush with surface of sternite 7.

Pleopods 3–5 with partial suture on exopod. Pleopod 1 peduncle with 2 coupling hooks and 4 plumose setae on inner margin; single spine on lateral distal angle, the spine increasing in prominence from pleopod 1 to pleopod 5. Pleopods 2–4 with 4 coupling hooks. Pleopod 2 appendix masculina exceeding exopod by 0.13 of its length; tip narrowing to irregular point. Uropod peduncle underside armed with 2 spines; both rami extending beyond pleotelson. Endopod lateral margin angular, small incision near apex, posterior margin broadly rounded with about 6 spines amongst fringe of plumose setae. Exopod narrow, lanceolate, less than half width of endopod, lateral margin straight with 4 short spines, medial margin fringed with plumose setae, armed with 4 spines; upper lateral surface with 5 small tubercles.

Female. As for male with exception of sexual characters; sculpting generally less well developed than in male.

Colour. White with a faint yellow tinge on dorsal surface of pleon segments. White in alcohol.

Size. Both males and females approaching 12.0 mm in length.

Remarks. Under the remarks for *C. pleonastica* from Heron Island (Bruce, 1980a), attention was given to the differences between Heron Island material and that described by Stebbing (1900). Barnard (1936) compared specimens from Ceylon to the 'cotypes', and although he mentioned differences that corresponded to Heron Island material, he concluded they were the one species.

Comparison of Stebbing's syntypes to Australian material reveal that there are two species involved. *Cirolana pleonastica* is distinguished by elongate tubercles on pereonites 5–7, a dense mass of setae on the uropodal exopod, distinct pleonal and pleotelson sculpting, and a sinuate lateral margin to the uropodal endopod and exopod. Examination of the material examined by Nordenstam (1946) revealed that they belong to the Australian species.

The species is uniform in appearance throughout its range and can be recognised by the lack of sculpting on all pereonal segments except pereonite 7, by the arrangement of pleon tubercles, with three prominent tubercles on pleonite 4 (all others being smaller), by the shape of the uropodal endopod, and by the distinctly sinuate lateral margin of the pleotelson which converges to a narrowly rounded apex.

Distribution. Barrier Reef from Heron Island to Lizard Island, Torres Strait, Cobourg Peninsula, Northern Territory, and Western Australian coast to the Abrolhos Islands.

Etymology. The Tropic of Capricorn runs through the Capricorn group of islands, and so the name is derived.

Cirolana curtensis n. sp.

Fig. 103

Material examined. Male (6.3 mm), 4 females (6.1, 6.5, 7.1, 8.2 mm), Calliope River, Gladstone, Qld, Van Veen grab, between 1975 and 1980, coll. P. Saenger & J. Moverley. 2 males (4.5, 4.9 mm), females (5.5 mm), manca (2.5 mm), Gladstone Harbour, Qld, April 1976, coll. S. Cook. Male (7.8 mm), Port Curtis, Gladstone, Qld, 4 Dec. 1975, diving sample 10 m, coll. P. Saenger. 60 specimens males, females and mancas from Calliope River and 37 specimens males, females and mancas, dredged from Port Curtis, 1975, coll. P. Saenger & J. Moverley.

Types. Holotype, female (7.3 mm) QM W9805. Paratypes, QM W9806-W9808.

Type locality. Calliope River mouth, Gladstone, Qld, 23°50′S, 151°15′E.

Description of male. Body about 2.5 times as long as wide. Cephalon with distinct interocular carina along anterior margin. Pereonite 1 with 2 horizontal impressed

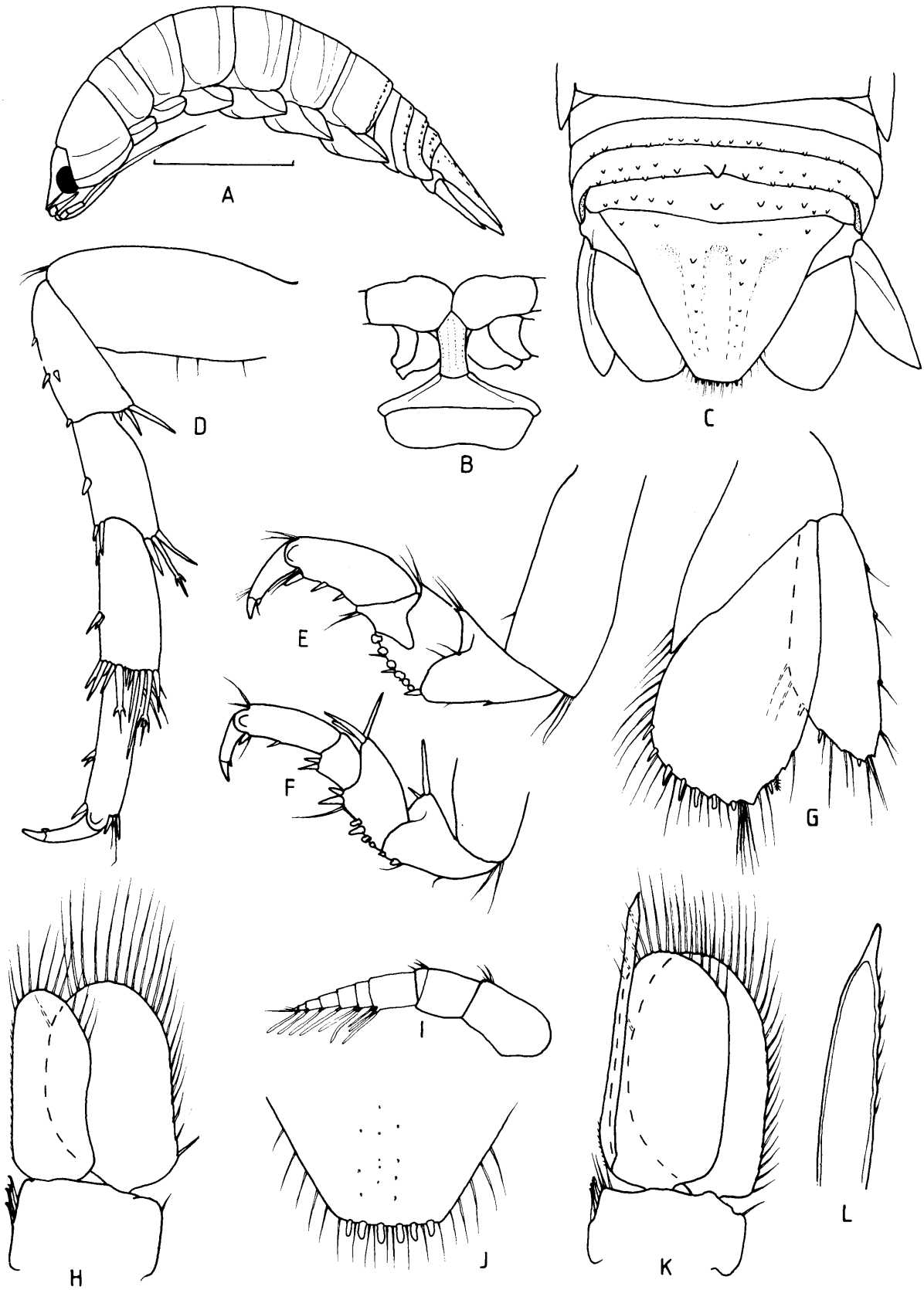

Fig. 103. *Cirolana curtensis* n. sp. A–C, holotype; remainder male paratype. **A**, lateral view; **B**, clypeal region; **C**, pleon and pleotelson; **D**, pereopod 7; **E**, pereopod 1; **F**, pereopod 3; **G**, uropod; **H**, pleopod 1; **I**, antennule; **J**, pleotelson, apex; **K**, pleopod 2; **L**, appendix masculina, apex. Scale 2.0 mm.

lines; pereonites 2–6 each with 2 faint transverse impressed lines, pereonite 7 with transverse impressed line and row of submarginal denticles. All coxae carinate. Pleonite 1 largely concealed by pereonite 7; pleonite 3 with row of about 18 small marginal tubercules. Pleonite 4 with median tubercle most prominent, with 5 marginal and 4 submarginal tubercles on either side; pleonite 5 with median tubercle most prominent, but less developed than that of pleonite 4, and with further 10 submarginal tubercles. Pleotelson little shorter than long, lateral margin very slightly convex, posterior margin truncate, armed with 6 stout spines and about 17 setae. Dorsal surface with 2 ill-defined longitudinal ridges, each of which bear 4 indistinct tubercles.

Antennule peduncle biarticulate; flagellum composed of 7 articles, article 1 just shorter than peduncle article 2. Antenna flagellum composed of about 18 articles extending to pereonite 3.

Frontal lamina sessile, pentagonal, lateral margin concave, slightly carinated, ventral surface with obscure longitudinal ridge.

Pereopod 1 with single spine at posterodistal angle of ischium, merus posterior margin with 6 blunt and 2 acute spines, carpus with 2 setae at posterodistal angle, propodus with 2 spines on palm and robust spine opposing dactylus. Pereopods 2–3 similar to pereopod 1 but additional spines on ischium, merus and carpus; propodus with single spine on palm. Pereopod 7 with spines at distal angles of all articles except basis; carpus with continuous row of spines along distal margin, some of which are pectinate.

Vasa deferentia opening flush with surface of sternite 7.

Pleopod 1 endopod with lateral margin concave, exopod broadly rounded; peduncle with 5 coupling hooks. Pleopod 2 appendix masculina extending beyond endopod by 0.25 of its length, apex with narrow projection. Pleopods 3–5 with complete suture on exopod. Uropods not extending beyond apex of pleotelson, exopod slightly shorter than endopod. Exopod with medial margin convex, with 3 spines, lateral margin with 3 small spines, each set in indentation along with single seta. Endopod with 1 spine and 1 sensory seta on lateral margin, medial margin with 7 spines and continuous marginal setae.

Female. Similar to male.

Colour. Pale cream to brown in alcohol. Eyes dark brown to red. Chromatophores not apparent.

Size. Largest male 7.8 mm, largest female 7.1 mm.

Remarks. *Cirolana curtensis* appears close to *C. fluviatilis* as figured by Kensley (1978c) and Pillai (1967). Barnard's (1935) figures of *C. fluviatilis* are less similar. *Cirolana curtensis* can be separated from that species by its sessile pentagonal frontal lamina, the less abundant and less distinct tuberculation of the pereon and pleon, and by having a truncate pleotelson apex. *Cirolana pleonastica* is also similar, but that species has more prominent tubercles on the pleon, a narrow posterior margin to the pleotelson, and the males have a dense patch of setae on the upper surface of the uropodal exopod.

The largest specimens develop tubercles on the anterolateral margins of the pleotelson, and on the lateral margin of the uropodal exopod. On smaller mature specimens (i.e. with pereopod 7 fully developed, and the males with a fully developed appendix masculina), the pereonal and pleonal sculpting is very poorly developed and very hard to see.

Distribution. Port Curtis Harbour and Calliope River, Gladstone, Qld, to a depth of 10 metres.

Etymology. Specific name is derived from the type locality.

Cirolana garuwa n. sp.

Fig. 104

Material examined. Male (6.1 mm), Good Friday Bay, Abrolhos Is., WA, 28 Feb. 1963, on craypot ropes, 18 m.

Types. Holotype, WAM 37-80.

Type locality. Good Friday Bay, Abrolhos Islands, WA, about 28°30'S, 113°45'E.

Description of male. Body about 2.5 times as long as wide. Cephalon with smoothly rounded anterior margin, with distinct interocular carina. Eyes round. Pereonite 1 with 2 lateral horizontal furrows on each side and single transverse furrow. Pereonites 2–7 with 1–2 transverse furrows which increase in prominence on posterior segments; pereonites 5–7 with submarginal row of tubercules, most prominently developed on pereonite 7. All coxae with carina. Pleonite 1 without tubercles, median one largest, set to the anterior, side; pleonite 3 with row of 11 submarginal tubercles and between these, slightly to anterior, lie small tubercles; pleonite 4 with 6 prominent submarginal tubercles, median one largest, set to the anterior, lying between larger tubercles are small tubercles; pleonite 5 with median tubercle largest, with 4 tubercles on each side. Pleotelson lateral margins very feebly sinuate, posterior margin subtruncate, armed with 8 spines between which lie pairs of setae; dorsal surface flat, with 2 indistinct submedian longitudinal ridges on which lie series of 6 tubercles, only anterior pair being at all prominent; further small tubercles present anteriorly, and also submarginally along lateral margins.

Antennule peduncle biarticulate, flagellum composed of about 10 articles of similar length, each article with several aesthetascs. Antenna flagellum extending to pereonite 3.

Frontal lamina pentagonal, lateral margins concave; indistinct median ridge present. Other mouthparts not examined in detail, but appear similar to other species of genus.

Pereopod 1 robust; ischium with 2 acute submarginal spines on posterior margin; merus with 6 large blunt spines and 3 acute spines; carpus with single spine and seta at posterodistal angle; propodus with 2 spines on palm, and large spine opposing dactylus. Pereopods 2–3

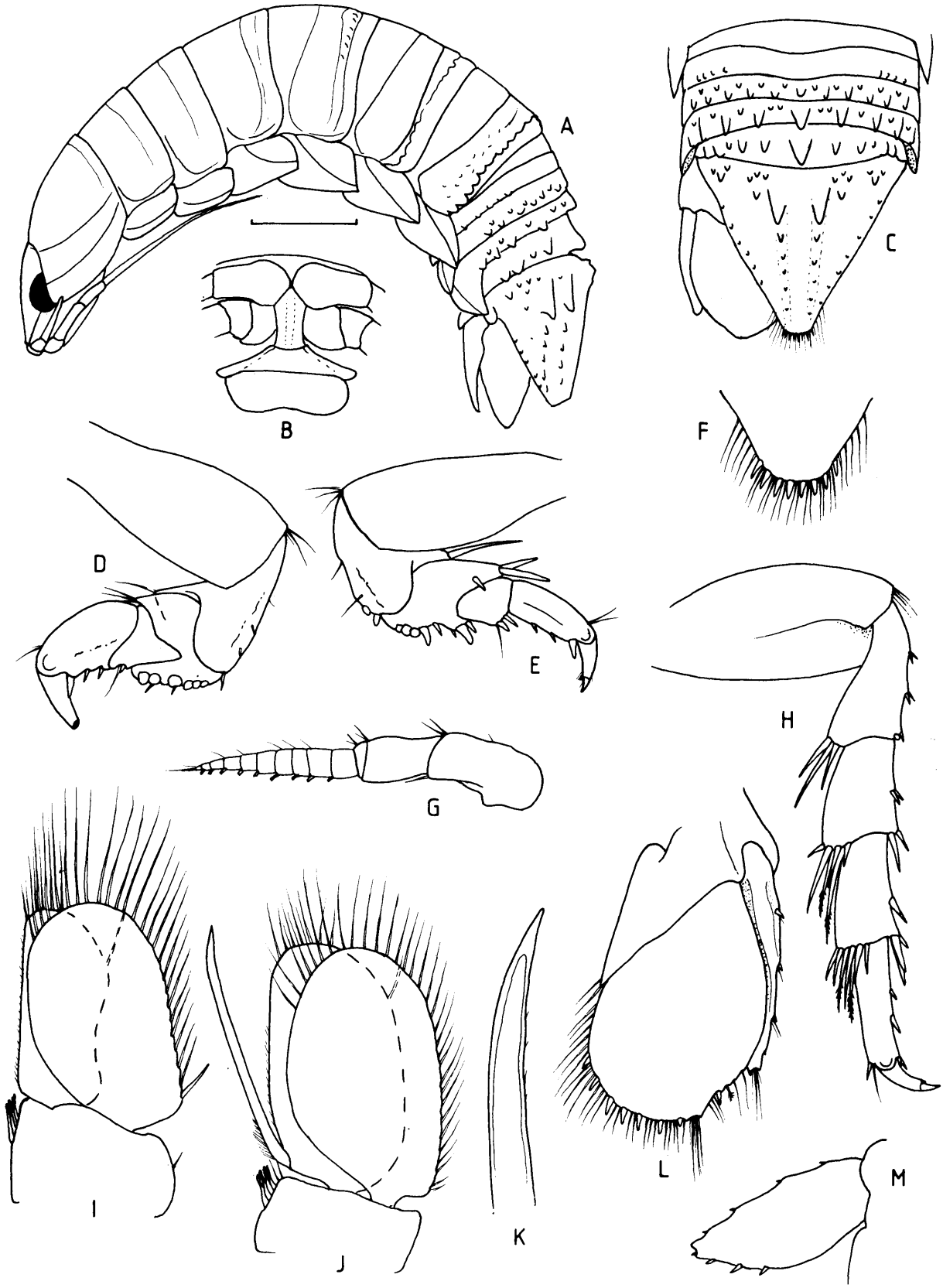

Fig. 104. *Cirolana garuwa* n.sp. holotype. **A**, lateral view; **B**, clypeal region; **C**, pleotelson (reconstruction); **D**, pereopod 1; **E**, pereopod 3; **F**, pleotelson apex; **G**, antennule; **H**, pereopod 7; **I**, pleopod 1; **J**, pleopod 2; **K**, appendix masculina, apex; **L**, uropod; **M**, uropod endopod, ventral view (setae omitted). Scale 1.0 mm.

similar to 1 but with greater number of spines. Pereopod 7 with long spines, some of which are pectinate at anterodistal angles of ischium, merus and carpus; posterior margins with more groups of robust spines.

Vasa deferentia opening flush to surface of sternite 7.

Pleopod 1 endopod lateral margin concave; pleopod 2 appendix masculina slightly longer than endopod, curving in slightly at tip. Uropods extending slightly beyond pleotelson apex; endopod broad and round, lateral margin with single spine and few setae; medial margin with 7 spines and continuous row of marginal setae; exopod distinctly shorter than endopod, lateral margin with distinct dorsal ridge, with 4 small spines, each set in small indentation in which are also 1 or 2 setae; medial margin with 4 spines, marginal setae extending by 3 setae beyond anterior spine.

Female. Not known.

Colour. Pale brown in alcohol, chromatophores not apparent.

Size. 6.1 mm.

Remarks. The shape of the uropods together with the form of the pleon and pleotelson sculpting separate *C. garuwa* from other similar species. Both *C. kombona* and *C. capricornica* are very similar. *Cirolana kombona* has a large trilobed median tubercle on pleonite 4, the frontal lamina with straight margins and the endopod of pleopod 1 smoothly tapered. *Cirolana capricornica* has a similar frontal lamina, but the pleon lacks the numerous small tubercles present in *C. garuwa*. Other differences include the shape and setation of the uropods, the shape of the pereonal tubercles and the shape of the endopod of pleopod 1.

Distribution. Known only from the type locality.

Etymology. *Garuwa* is an Aboriginal word for the sea, the source of the specimen.

Cirolana kendi n. sp.

Fig. 105

Material examined. Male (6.6 mm), manca (3.3 mm), off Chinaman's Ridge, Lizard Is., Qld, 14°40'S, 145°28'E, 13 Oct. 1978, fine sand, 12 m, coll. J.K. Lowry.

Types. Holotype, AM P28788. Paratype, manca AM P32345.

Type locality. Lizard Island, Qld, 14°40'S, 145°28'E.

Description of male. Body about 3 times as long as wide, sides sub-parallel. Cephalon without rostral point, interocular carina feeble, eyes conspicuous, rectangular. Pereonites 2–7 with feeble impressed line running across middle of each segment; all coxae with entire carina. Pleonite 1 almost entirely concealed by pereonite 7; pleonite 4 with single median tubercle, lateral margins encompassing pleonite 5. Pleotelson two thirds as long as wide; lateral margins slightly sinuate, setose along posterior third, apex narrowly rounded, with 5 spines; dorsal surface with 2 narrow distinct curved submedian ridges.

Antennule flagellum extending to pereonite 1; antenna flagellum extending to pereonite 3.

Frontal lamina lateral margins parallel, widening slightly before narrowing to anterior point.

Pereopods 1–3 short, robust, 4–7 slender. Pereopod 1 with 2 acute spines at posterodistal angle; merus with 3 acute and 7 tubercular spines on posterior margin; carpus with single acute spine and seta; propodus with 2 acute spines on palm, and robust blunt spine opposing dactylus. Pereopod 7 with few setae, anterior margin with spines only at distal angles of articles 2–5; posterior margins of ischium, merus and carpus with blunt spines; distal margin of carpus with numerous spines, many of which are pectinate.

Vasa deferentia opening flush with surface of sternite 7.

Pleopod 1 endopod about half as wide as exopod, lateral margin concave. Pleopod 2 appendix masculina extending only slightly beyond endopod. Uropods extending beyond apex of pleotelson; endopod with medial margin broadly rounded, with 6 spines and continuous marginal setae, lateral margin with anterior 0.66 straight, distal 0.33 slightly recessed, with only 1 spine; exopod with lateral margin very nearly straight, provided with 4 small spines and as many setae, medial margin convex, with 3 spines amongst marginal setae; apex bifid.

Female. Not known.

Colour. Pale cream in alcohol. Chromatophores not apparent.

Size. Holotype measures 6.6 mm.

Remarks. The shape and ornamentation of the pleon and pleotelson distinguishes this species from all others of the genus. The carinae on the pleotelson are readily visible on the immature specimen, and are probably present in the female.

Distribution. Known only from the type locality.

Etymology. The specific epithet is the Aboriginal word for lizard and alludes to the type locality.

Cirolana kombona n. sp.

Fig. 106

Material examined. 2 females (4.2, 3.9 mm), manca (2.6 mm), Chinaman Head, Lizard Is., Qld, 7 Nov. 1976, 3.7 m, among coral reef rocks, coll. P. Hutchings & P. Weate. Female (3.6 mm), north-east of South Is., Lizard Is., Qld, 17 Dec. 1980, reef edge 7–9 m, coll. NLB.

Types. Holotype, female (4.2 mm) AM P27005. Paratypes, AM P27008; QM W9818.

Type locality. Lizard Island, Qld, 14°40'S, 145°28'E.

Description of female. Body about 2.5 times as long as wide, surface minutely nodulose. Cephalon anterior margin smoothly rounded, interocular carina present. All pereonites with transverse impressed lines: pereonite 1 with 1, pereonites 2–3 with 2, 4–7 with 3; posterior line of pereonites 6–7 forming nodulose ridge. All coxae with distinct carinae; coxae of pereonites 6–7 project beyond posterior of segment. Pleonite 1 entirely

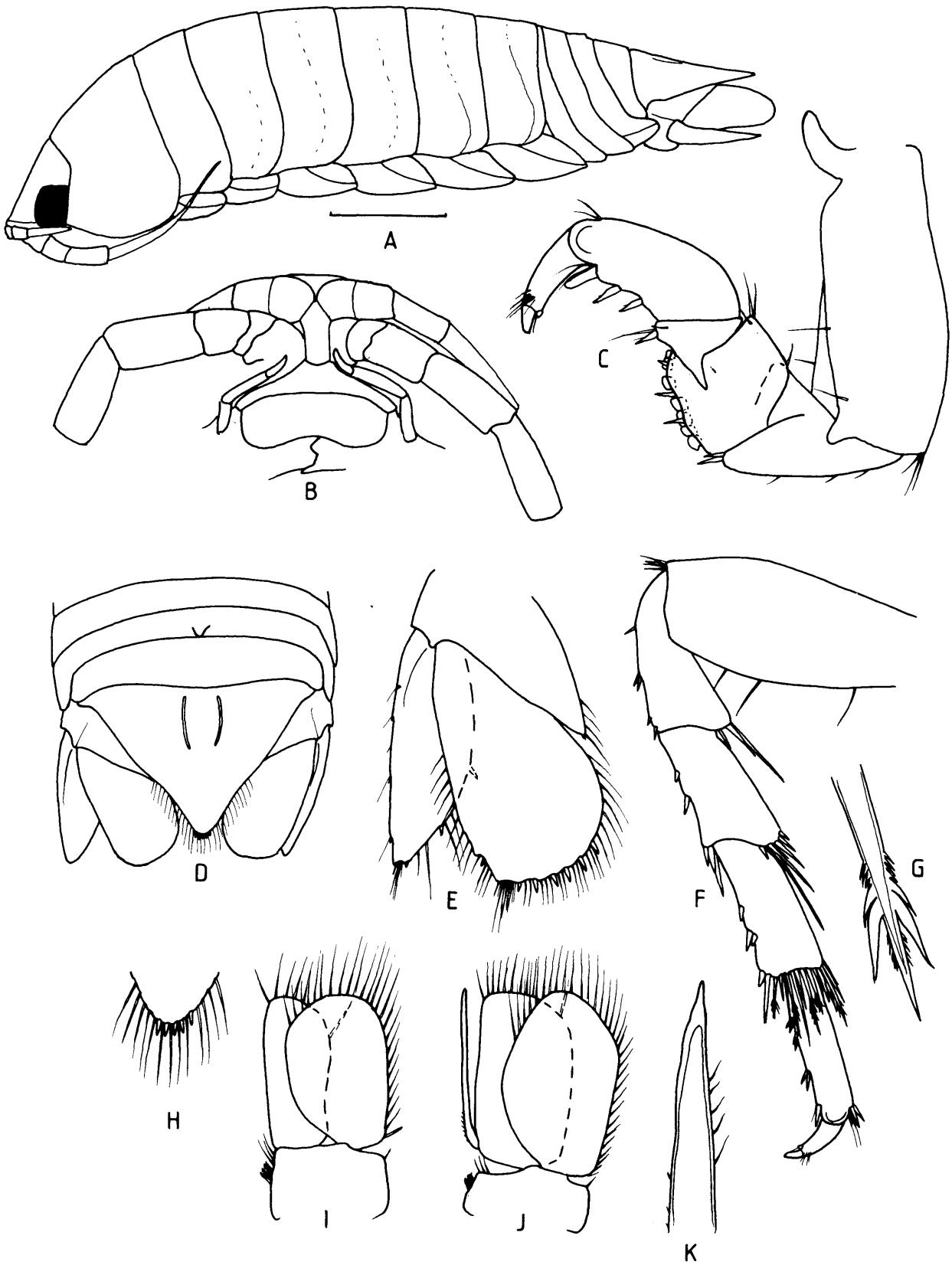

Fig. 105. *Cirolana kendi* n. sp., holotype. **A**, lateral view; **B**, clypeal region; **C**, pereopod 1; **D**, pleon and pleotelson; **E**, uropod; **F**, pereopod 7; **G**, pereopod 7, pectinate spine from carpus; **H**, pleotelson apex; **I**, pleopod 1; **J**, pleopod 2; **K**, appendix masculina, apex. Scale 1.0 mm.

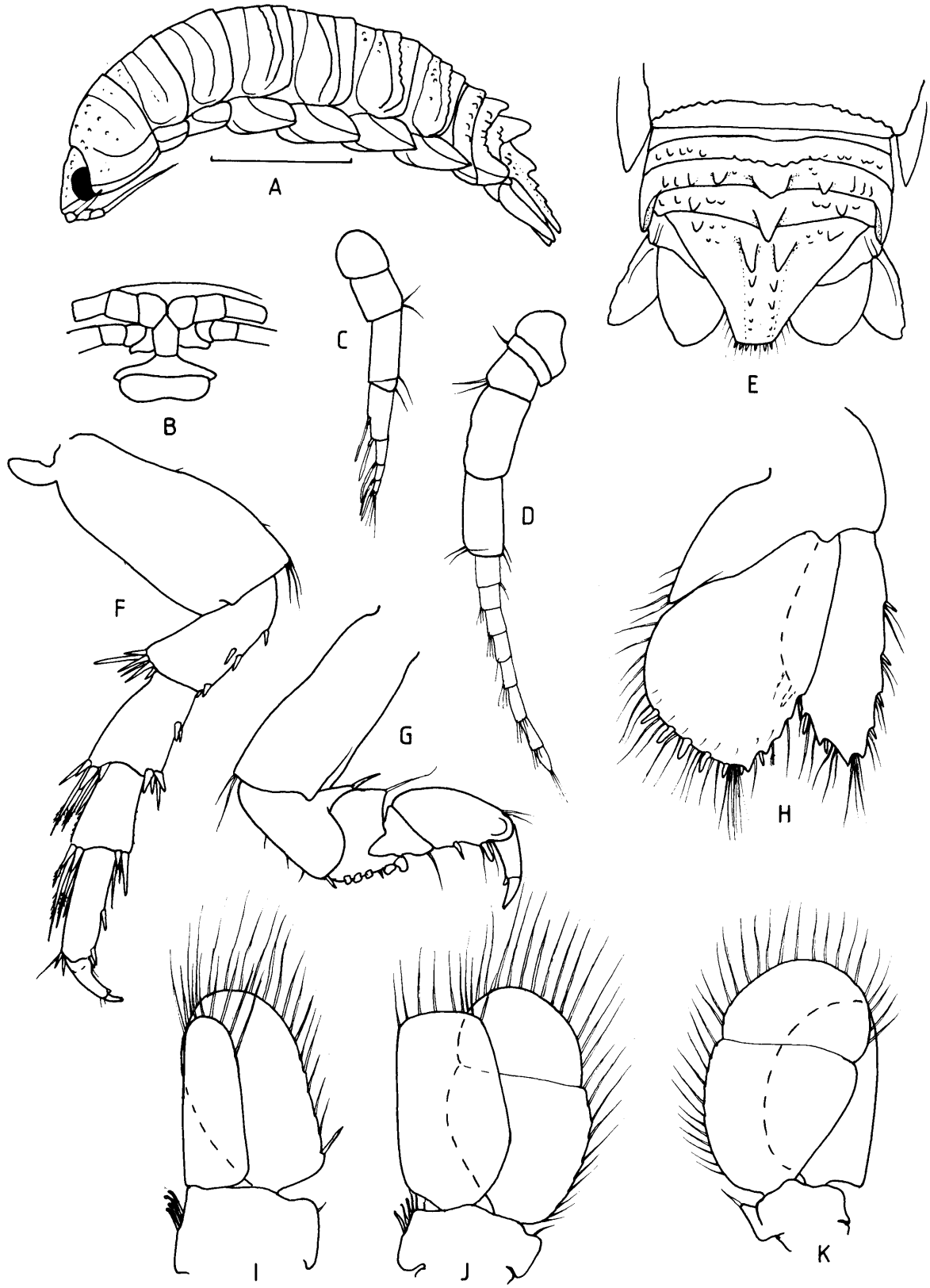

Fig. 106. *Cirolana kombona* n. sp. A, B, E, holotype; remainder paratype. **A**, lateral view; **B**, clypeal region; **C**, antennule; **D**, antenna; **E**, pleon and pleotelson; **F**, pereopod 7; **G**, pereopod 1; **H**, uropod; **I**, pleopod 1; **J**, pleopod 3; **K**, pleopod 5. Scale 1.0 mm.

concealed by pereonite 7; pleonite 3 with about 12 small submarginal tubercles, medial posterodorsal margin nodulose; pleonite 4 with broad prominent median tubercle and 3 small tubercles on each side as has pleonite 5. Pleotelson with raised median surface on which lie paired tubercles, decreasing in size towards posterior; additional submarginal anterior tubercle present on each side; lateral margins very nearly straight; apex truncate, armed with 6 spines.

Antennule flagellum short, extending to pereonite 1, composed of 5 articles of which first is longest. Antenna peduncle article 5 shorter than 4, flagellum slender, composed of 8 articles, extending to posterior of pereonite 2.

Frontal lamina pentagonal, lateral margins diverging slightly anteriorly, anterior margins straight. Other mouthparts not examined in detail, but generally similar to other species of genus.

Pereopod 1 with 1 spine at anterodistal angle of ischium, merus with 5 tubercular spines on posterior margin, carpus without spines and propodus with single spine on palm and robust spine opposing dactylus. Pereopods 2–3 similar to pereopod 1 but less robust and more spinose at anterodistal angles of ischium and merus and posterior margin of carpus. Pereopod 7 with groups of spines at anterodistal angles of ischium to carpus, additional spines on posterior margins and angles of ischium, merus and propodus.

Pleopod 1 endopod half as wide as exopod, straight sided; exopod with spine at proximal lateral angle. Pleopods 3–5 with complete suture on exopod. Uropods extending very slightly beyond apex of pleotelson. Endopod with distal half of lateral margin recessed slightly, with 2 spines, medial margin rounded with 5 spines amongst marginal setae. Exopod broadest half way along its length, lateral margin with 4 indentations, each bearing 1 spine, posterior to spine 2 setae; medial margin convex, with 2 spines, apex bifid.

Male. Not known.

Colour. Cream in alcohol. No chromatophores.

Size. 3.6–4.2 mm.

Remarks. This species may be distinguished by the conspicuous transverse furrowing of the pereon segments, a feature quite visible in the manca. The pleon and pleotelson sculpting is also unique. The female collected in 1980 has the median process of pleonite 4 more distinctly trilobate than the holotype. As pereonal and pleonal sculpting is generally less developed in females only, males of this species would be likely to show a similar pattern.

Distribution. Known only from the type locality.

Etymology. *Kombona* is an Aboriginal word for old woman, and alludes to the fact that the specimens are female and 'wrinkled'.

Cirolana magdalaina Bruce
Fig. 107

Cirolana magdalaina Bruce, 1980b: 159, fig. 2.—1981b: 950.

Type. Holotype held at the Queensland Museum.

Type locality. Magdalaine Cay, Australian Coral Sea.

Remarks. *Cirolana sulcaticauda* shows the greatest affinity to *C. magdalaina,* but numerous points separate the species. These differences include the frontal lamina, details of the antennule, spination of the pereopods, and the sculpting of the pleon and telson. *Cirolana sulcaticauda* has 3 tubercules each on pleonites 3–5 and the ridges on the telson are not tuberculate. *Cirolana magdalaina* has 5 tubercles on pleonite 5, those for pleonites 3–4 are indistinct, and the submedian ridges of the pleotelson are tuberculate.

Cirolana tuberculosa from Heron Island is also similar, but is distinguished by having tuberculate posterior margin to all pereonites, and having the pleon far more nodulose than in *C. magdalaina.*

Distribution. Known only from the type locality.

Cirolana morilla n. sp.
Figs 108, 109

Material examined. 5 males (2.2, 2.4, 2.5, 3.2, 3.3 mm), 5 females (2.1, 2.3, 2.5, 2.8, 3.7 mm), Port Curtis, Gladstone, Qld, 1975, dredged, coll. P. Saenger & J. Moverly.

Types. Holotype, male QM W10230. Paratypes QM W10231; AM P33553; USNM 210895.

Type locality. Gladstone, Qld, 23°50′S, 151°15′E.

Description of male. Body about 2.5 times as long as wide. Cephalon with anterior margin smoothly rounded; interocular carina present. Pereonite 1 with 2 furrows on lateral surfaces; pereonites 3–7 with transverse furrows, increasing in prominence towards posterior segments; coxae each with complete diagonal furrow. Pleonite 1 and part of pleonite 2 concealed by posterior margin of pereonite 7. Pleotelson narrows rapidly to rounded apex provided with 6 stout spines and short marginal setae; dorsal surface with 2 ill-defined submedian ridges.

Antennule short, peduncle article 3 longest; flagellum composed of 5 articles, 4–5 distinctly longer than 1–3; article 5 longest; flagellum composed of 10 articles, extends to posterior of pereonite 1.

Frontal lamina about twice as long as wide, lateral margins diverging slightly. Mandible incisor moderately narrow; molar process with few teeth on anterior margin; palp robust with stout pectinate spines on articles 2–3.

Pereopod 1 with few spines or setae, propodus slender, with single spine on palm. Pereopods 2–3 similar to 1, but propodus more robust, articles generally more spinose. Pereopod 7 robust, with spines at distal angles of ischium, merus and carpus, with additional spines along posterior margins of all articles except basis.

Vasa deferentia opening flush with surface of sternite 7.

Pleopods with transverse suture across exopods of pleopods 3–5. Pleopod 1 with peduncle as long as wide; endopod about half width of exopod. Pleopod 2 with both rami subequal in length and width; appendix masculina arising basally, extending slightly beyond distal margin of endopod. Pleopods 3–4 with endopod distinctly shorter and narrower than exopod, provided with 6–7 setae on truncate distal margin. Uropods extending slightly beyond apex of pleotelson. Exopod shorter than endopod, margins tapering smoothly to apex; lateral margin with 2 spines and associated setae, medial margin with 2 spines and long setae. Endopod broadly rounded, lateral margin with 1 spine, medial with 4. Neither ramus with bifid apex.

Female. Similar to the male, but the transverse lines and pleotelson carinae may be harder to observe.

Colour. Pale tan in alcohol, chromatophores not apparent.

Size. Largest specimen 3.7 mm, average length of both males and females 2.7 mm.

Remarks. This small species is distinguished by the smoothly rounded anterior margin of the cephalon, the long pentagonal frontal lamina, and shape and ornamentation of the pleotelson. Similar Australian species are *C. cooma* and *C. tumulosa*. It can easily be distinguished from those species by differences in the morphology of the characters listed above. The narrowness of the endopod of pleopod 1, morphology of the mandible, shortness of the antennule flagellum, and the slender propodus of pereopod 1 are further distinctive features.

Distribution. Known only from the type locality.

Etymology. *Morilla* is an Aboriginal word meaning ridge, and alludes to the ridges of the pleotelson.

Cirolana oreonota n. sp.

Fig. 110

Material examined. 3 males (6.1, 6.9, 7.5 mm), east of main wharf, Thursday Is., Torres Strait, Qld, 29 June 1976, in sandy mud and rocks, coll. W.F. Ponder.

Types. Holotype AM P32167. Paratypes AM P28796.

Type locality. Thursday Island, Torres Strait, 10°05′S, 142°18′E.

Description of male. Body about 3 times as long as wide, sides subparallel. Cephalon with anterior margin smoothly rounded, interocular carina present. Eyes round, pereonites 1–4 without transverse impressed line; pereonites 5–7 with transverse impressed line, posterior of pereonites 6–7 with submarginal nodulose ridge. All coxae with distinct carina except those of pereonite 4, where carina is feeble. Pleonite 1 entirely concealed by pereonite 7; pleonite 3 with median tubercle and further 6–7 small lateral tubercles on each side; pleonites 4–5 with prominent median tubercle and 4–5 smaller tubercles on either side. Pleotelson about 0.75 as long as wide, dorsal surface flat, with 2 pairs of prominent submedian tubercles, and further 2 pairs of small

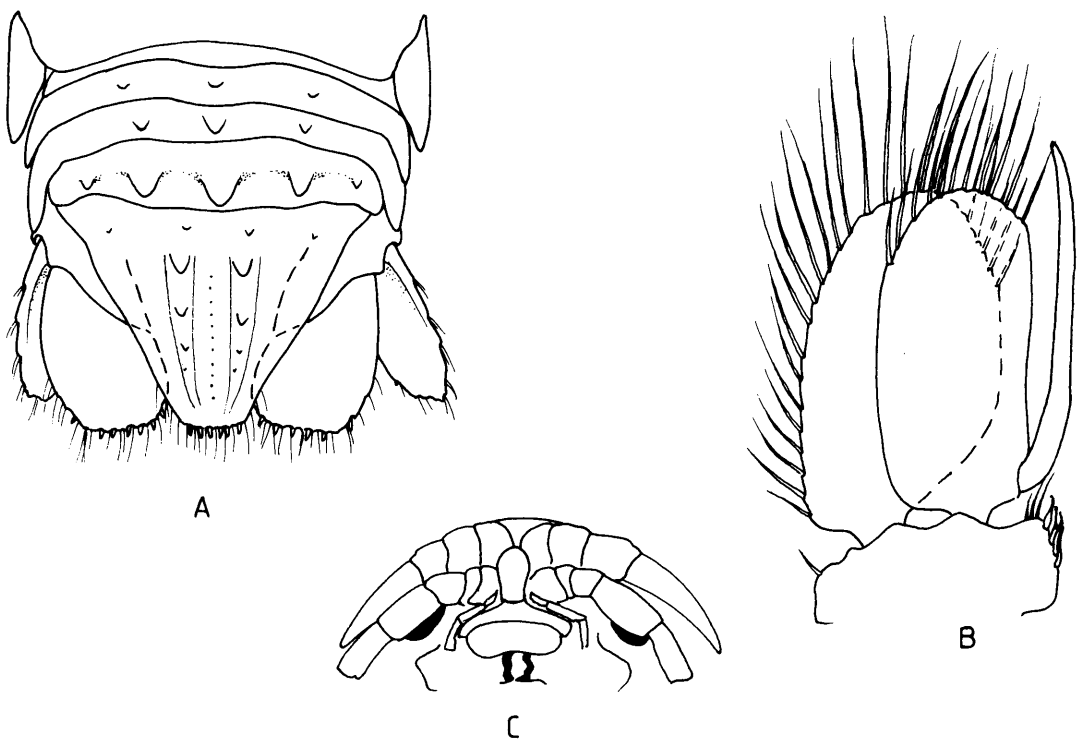

Fig. 107. *Cirolana magdalaina*, holotype. **A**, pleon, dorsal view; **B**, pleopod 2; **C**, clypeal region.

median tubercles; distal margin truncate, provided with 8 spines and marginal setae.

Antennule peduncle articles 1 and 2 fused, flagellum extending to pereonite 1, composed of about 10 articles, first of which is longest. Antenna peduncle article 4 slightly shorter than 5, twice as long as article 3; flagellum extends to anterior of pereonite 3.

Frontal lamina pentagonal, lateral margins parallel, anterior margins excavate, ventral surface slightly domed. Maxilliped endite with 2 coupling hooks and 4 plumose setae.

Pereopod 1 robust, with few setae; anterodistal angle of ischium with slender spines; anterodistal angle of merus with 3 setae, posterior margin with 2 acute and

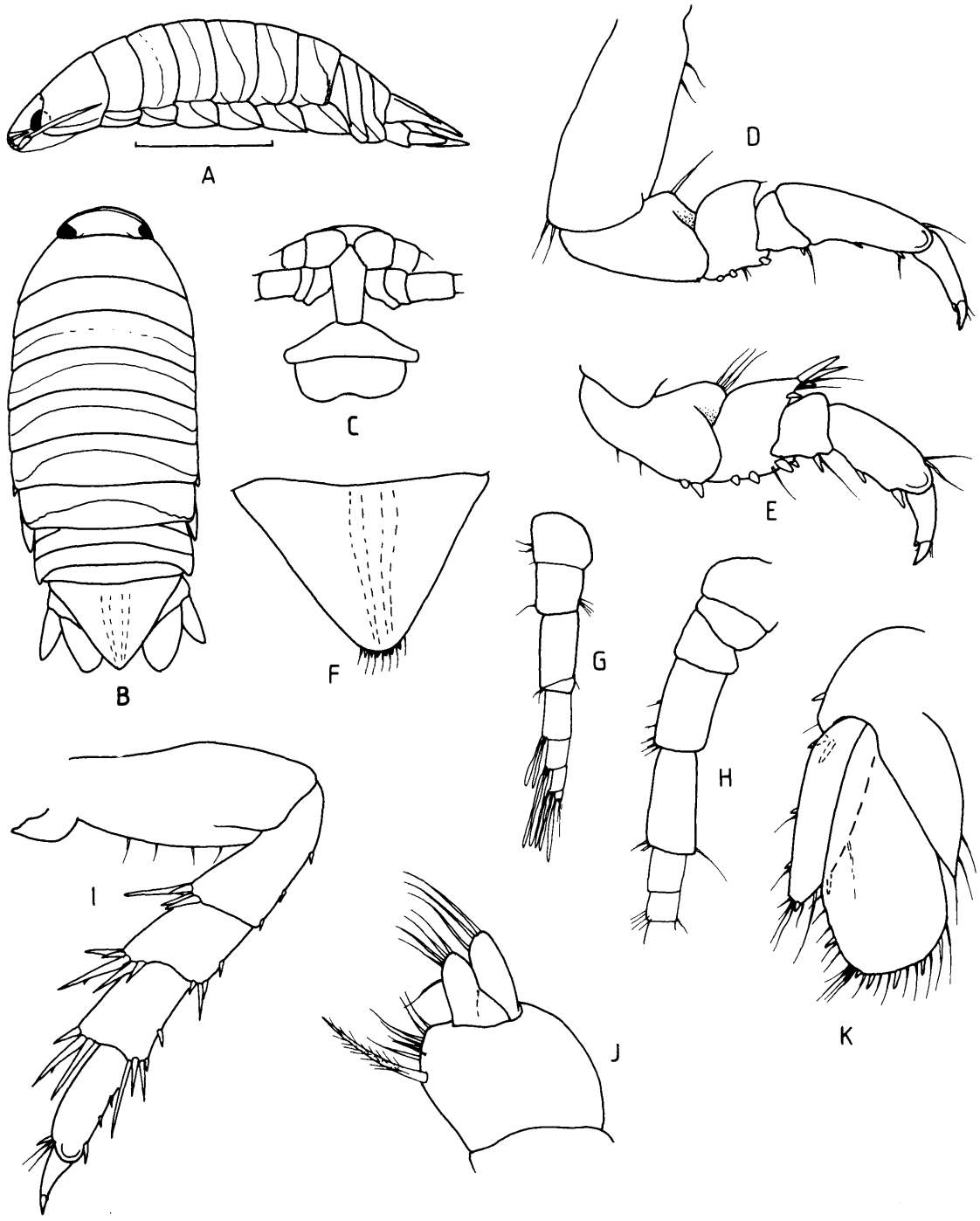

Fig. 108. *Cirolana morilla* n. sp. A–C, F, holotype; remainder female paratype. **A**, lateral view; **B**, dorsal view; **C**, clypeal region; **D**, pereopod 1; **E**, pereopod 2; **F**, pleotelson; **G**, antennule; **H**, antennal peduncle; **I**, pereopod 7; **J**, maxilla; **K**, uropod. Scale 1.0 mm.

6 tubercular spines; carpus with single seta on posterior margin; propodus with 2 spines on palm and robust spine opposing dactylus. Pereopods 2–3 similar, but less robust than pereopod 1, anterodistal angles of ischium and merus more spinose as is posterior margin of carpus; propodus with single spine on palm. Pereopod 7 with few setae; spines present at anterodistal angles of ischium and merus, at posterodistal angle of merus, and distal margin of carpus; additional pairs of spines on posterior margins of articles 2–5.

Vasa deferentia opening flush to surface of sternite 7.

Uropods extending beyond pleotelson apex. Endopod broadly rounded; lateral margin straight, with 2 distal spines, medial margin with 8 spines amongst marginal setae. Exopod widest at 0.66 along its length, medial margin convex, with 3 spines, lateral margin with 4 spines, each spine being set in slight indentation along with 1–3 setae.

Female. Not known.

Colour. Reddish brown in alcohol, chromatophores not visible.

Size. To 7.5 mm.

Remarks. This species, as with many Australian *Cirolana,* is best recognised by the arrangement of pleonal tubercles and pleotelson configuration together with the shape of the frontal lamina. Similar species include *C. pleonastica, C. harfordi, C. tumulosa* and *C. capricornica,* all having pentagonal frontal laminas. *Cirolana oreonota* is the only species which has a prominent median tubercle on pleonites 3, 4 and 5, and subequal small lateral tubercles.

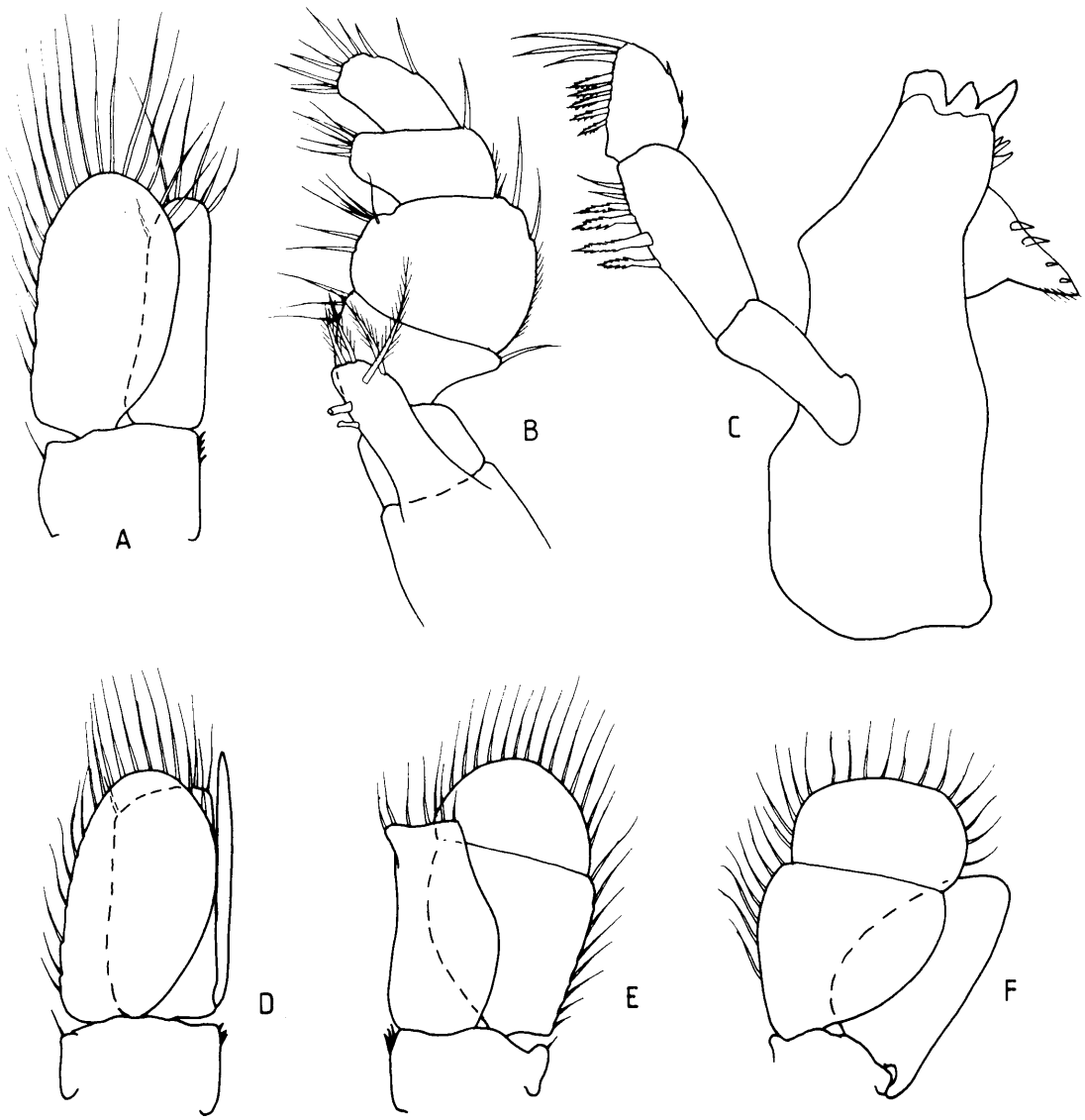

Fig. 109. *Cirolana morilla* n. sp., paratype. **A**, pleopod 1; **B**, maxilliped; **D–F**, pleopods 2, 3, 5 respectively.

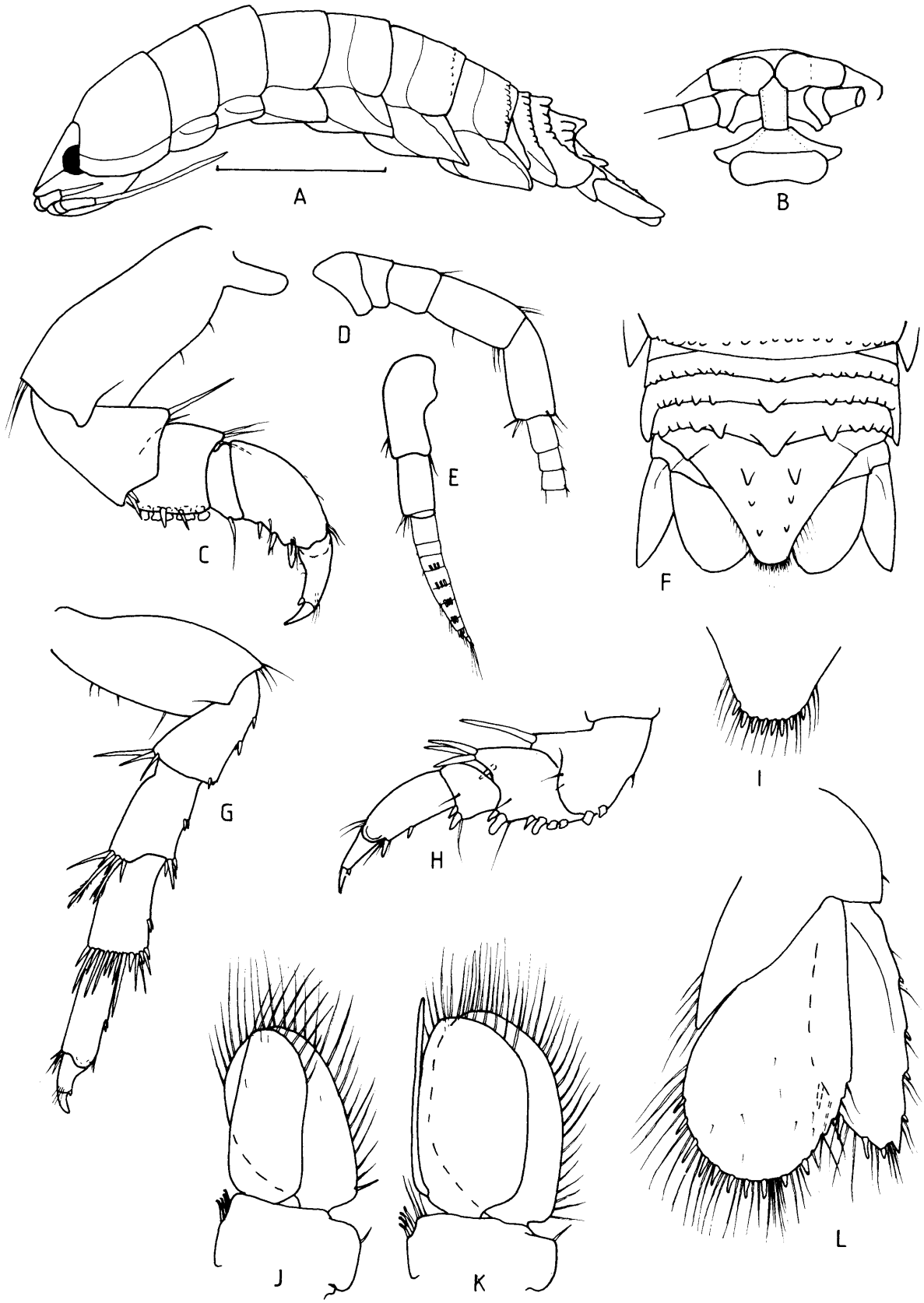

Fig. 110. *Cirolana oreonota* n. sp. A, B, F, I, holotype; remainder male paratype. **A,** lateral view; **B,** clypeal region; **C,** pereopod 1; **D,** antennal peduncle; **E,** antennule; **F,** pleon and pleotelson; **G,** pereopod 7; **H,** pereopod 3; **I,** pleotelson apex; **J,** pleopod 1, **K,** pleopod 2; **L,** uropod. Scale 2.0 mm.

Distribution. Known only from the type locality.

Etymology. The specific epithet is derived from the Greek words *oreinos* (= hilly) and *notos* (= back), and alludes to the conspicuous sculpting of the pleon.

Cirolana tuberculosa n. sp.
Figs 111, 112

Material examined. Male (6.5 mm), Heron Is., Great Barrier Reef, Qld, 14 Jan. 1979, in dead coral rubble, reef crest in front of Research Station, coll. NLB. Female (4.5 mm), Heron Is., Great Barrier Reef, Qld, 17 Jan. 1979, reef crest, north side of reef, coll. NLB.

Types. Holotype, male QM W9846. Paratype, QM W9847.

Type locality. Heron Island, Qld, 23°26.5'S, 151°54.5'E.

Description of male. Cephalon anterior margin smoothly rounded, interocular carina prominent. Posterior margin of all pereonites raised to form nodulose ridge; pereonites 5–7 with transverse impressed line towards anterior of segment. Coxae all with entire oblique carina; coxae of pereonites 3–7 visible in dorsal view. Pleonite 1, and most of 2 concealed by pereonite 7; posterolateral margins of pleonite 4 broad; dorsal surface of pleonites 3–4 with prominent median tubercle, and 3 smaller tubercles on each side; pleonite 5 with median tubercle largest, 2 submedian tubercles prominent, and smaller lateral tubercles. Pleotelson lateral margins feebly sinuate, narrowing rapidly to subtruncate posterior margin, armed with 8 stout spines between which lie single, short, plumose setae; dorsal surface with 2 submedian ridges running length of pleotelson, anterior end of these ridges with 2 prominent tubercles, additional tubercles ill-defined; anterolateral portion with submarginal tubercle.

Antennule short, peduncle 4-articulate, flagellum composed of 6 articles, extending to posterior of cephalon. Antenna flagellum extending to posterior of pereonite 2.

Frontal lamina irregularly pentagonal, lateral margins straight, diverging slightly, anterior margin with medial part produced; ventral surface with ill-defined longitudinal ridge. Maxillule has relatively shorter spines on gnathal surface of exopod.

Pereopod 1 with 5 large tubercular spines on posterior margin of merus; carpus with single seta; propodus with 2 acute spines on palm, third robust spine opposing dactylus. Pereopods 2–3 similar, less robust, with more and larger spines than pereopod 1. Pereopod 7 with robust spines along posterior margins of ischium to propodus, anterodistal angles of ischium, merus and carpus with groups of spines, some of which are pectinate.

Vasa deferentia opening flush with surface of sternite 7.

Pleopods 3–5 with transverse suture across exopod. Pleopod 1 endopod lateral margin concave; pleopod 2 appendix masculina slightly curved, extending beyond endopod by about 0.2 of its length. Pleopod 5 endopod tapering from base. Uropod rami extend slightly beyond apex of pleotelson. Endopod smoothly rounded, medial margin with 6 spines, and sparse short marginal setae, lateral margins with 2 spines. Exopod with 3 spines on lateral margin, 3 on medial margin.

Female. Similar to male but sculpting less well developed, especially on pereon segments.

Colour. Translucent in life, without chromatophores.

Size. Holotype, 6.5 mm.

Remarks. The Western Indian Ocean species *C. corrugis* is similar to *C. tuberculosa,* especially as both have extensive pereonal sculpting. In *C. corrugis,* the frontal lamina projects freely, and the sculpting of the pleotelson is distinct. *Cirolana sulcaticauda* is also similar, but lacks sculpting on the anterior pereonites. Monod (1971b) shows also that the frontal lamina shape and pleon sculpting is distinct, and that *C. sulcaticauda* has more spinose posterior pereopods. The only Australian species approaching *C. tuberculosa* in appearance is *C. magdalaina.* This species, which has not been recorded from the Barrier Reef, has less sculpting, a broader pleotelson, and a smoothly rounded, freely projecting frontal lamina.

Distribution. Known only from Heron Island, Qld.

Etymology. The specific epithet refers to the extensive sculpting on the male.

Cirolana tumulosa Holdich, Harrison & Bruce
Fig. 113

Cirolana tumulosa Holdich, Harrison & Bruce, 1981: 560, fig. 3.—Bruce, 1981b: 950.

Material examined. Male (4.6 mm), holotype (QM W6333), female (3.9 mm), allotype (QM W6334), Cleveland Bay, Townsville, Qld, 21 Aug. 1974, 8.8 m, sand mud, coll. JCUNQ.

Type locality. Cleveland Bay, Townsville, Qld.

Descriptive notes. All pereonites have an impressed line running across the middle of the segment. Interocular furrow not present.

Colour. White in alcohol, chromatophores not apparent.

Size. Up to 4.5 mm.

Remarks. This species, described in detail by Holdich et al. (1981), is best identified by the morphology of the pleon, pleotelson and uropods. The arrangement of pleonal tubercles is not shown by any other species.

Distribution. Known only from the type locality.

Cirolana australiense Hale
Figs 114–116

Cirolana cranchii var *australiense* Hale, 1925: 141, fig. 7.—Bruce, 1981b: 950; Bruce & Ellis, 1983: 82.

Cirolana cranchii australiense.—Hale, 1927: 315; 1929b: 248, fig. 241.

Cirolana cranchii-australiense.—Nierstrasz, 1931: 158 (not *Cirolana cranchii* Leach, see Bruce & Ellis, 1983).

Cirolana australiense.—Naylor, 1966: 184.

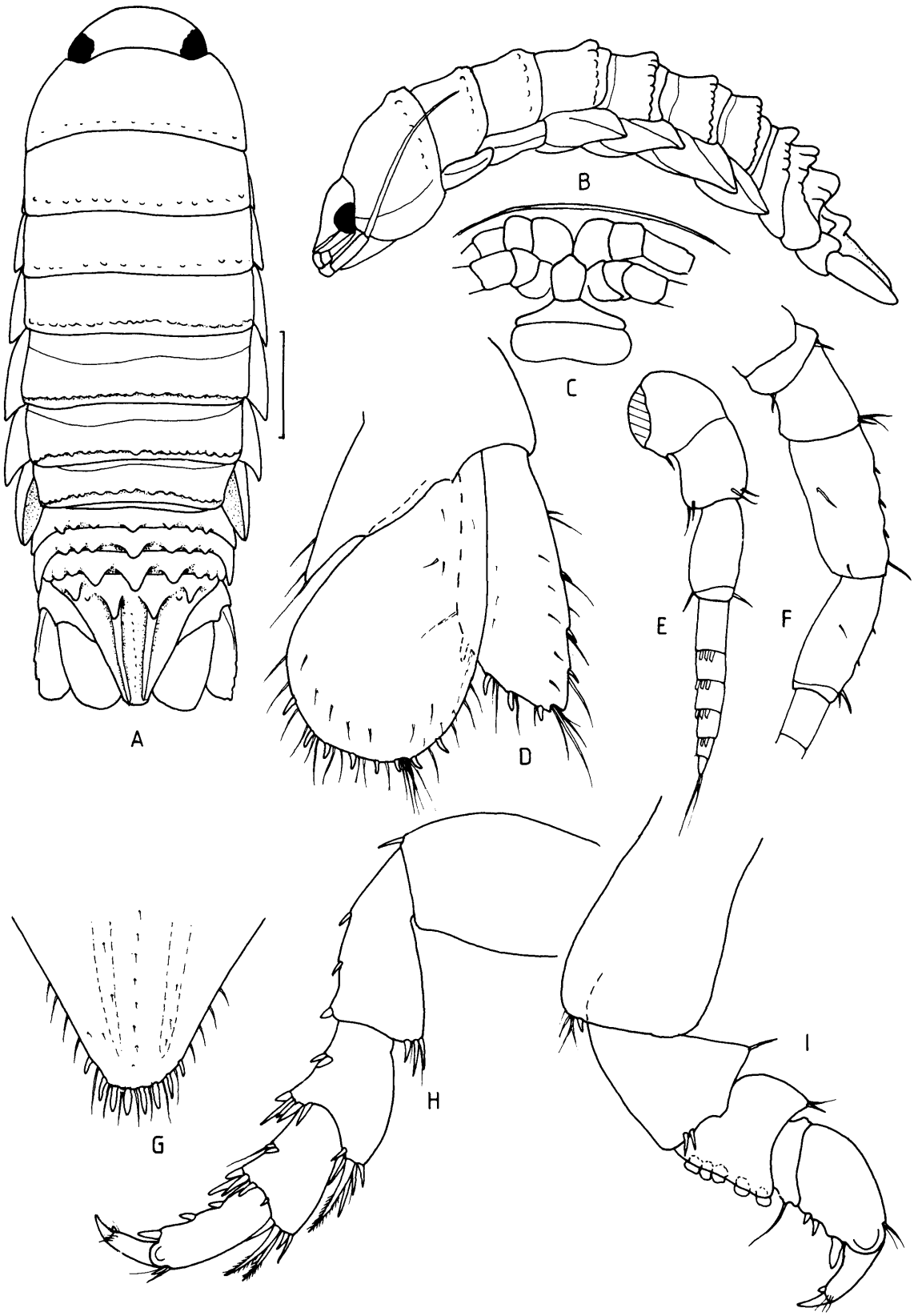

Fig. 111. *Cirolana tuberculosa* n. sp. D, G, female paratype; remainder holotype. **A**, dorsal view; **B**, lateral view; **C**, clypeal region; **D**, uropod; **E**, antennule; **F**, antennal peduncle; **G**, pleotelson apex; **H**, pereopod 7; **I**, pereopod 1. Scale 1.0 mm.

Not *Cirolana australiense* Naylor, 1961: 14, fig. 5.—Hurley, 1961: 267; Bruce, 1981b: 950; Bruce & Jones, 1981: 82, fig. 8f; (all misidentifications); Bruce & Ellis, 1983: 82.

Not *Cirolana cranchi* var *australiense*.—Holdich, Harrison & Bruce, 1981: 578, fig. 9 (= *Cirolana mekista)*.

Material examined. Holotype, male (11.9 mm) (SAM C304), "Allotype", female (11.3 mm) (SAM C305), paratypes 7 males (8.7, 8.7, 8.8, 8.8, 8.9, 9.5, 10.0 mm), 7 females (8.8, 8.9, 9.5, 10.0, 10.1, 10.1, 10.5 mm), (C324), all from Port Willunga, SA, on meat, coll. H.M. Hale. Paratypes?: 2 males (8.2, 12.6 mm), 6 females (7.3, 7.4, 7.8, 8.1, 8.8, 9.5 mm), Sydney, NSW, coll. M. Ward (SAM C325); about 200 males and females from Pt Willunga, SA, part of the series from which holotype was chosen.

Non-type. Male (7.7 mm), Boat Rock, North Stradbroke Is., S.E. Qld., 25 Jan. 1981, coll. R.C. Willan. Female (8.8 mm), north end Balmoral Bay, Sydney, NSW, 29 Jan. 1973, in coralline and red algae on rocks, 1-2 m, coll. W. Ponder. 4 females (6.9-8.1 mm), North Beach, Mosman, Sydney, NSW, 23 Apr. 1955, in rock pools, coll. L.B. Holthuis. Male (6.9 mm), 2 females (6.1, 7.0 mm, ovig.), 2 mancas (3.5, 3.7 mm), Malacoota, Vic., Jan. 1959, coll. W.F. Seed. 2 males

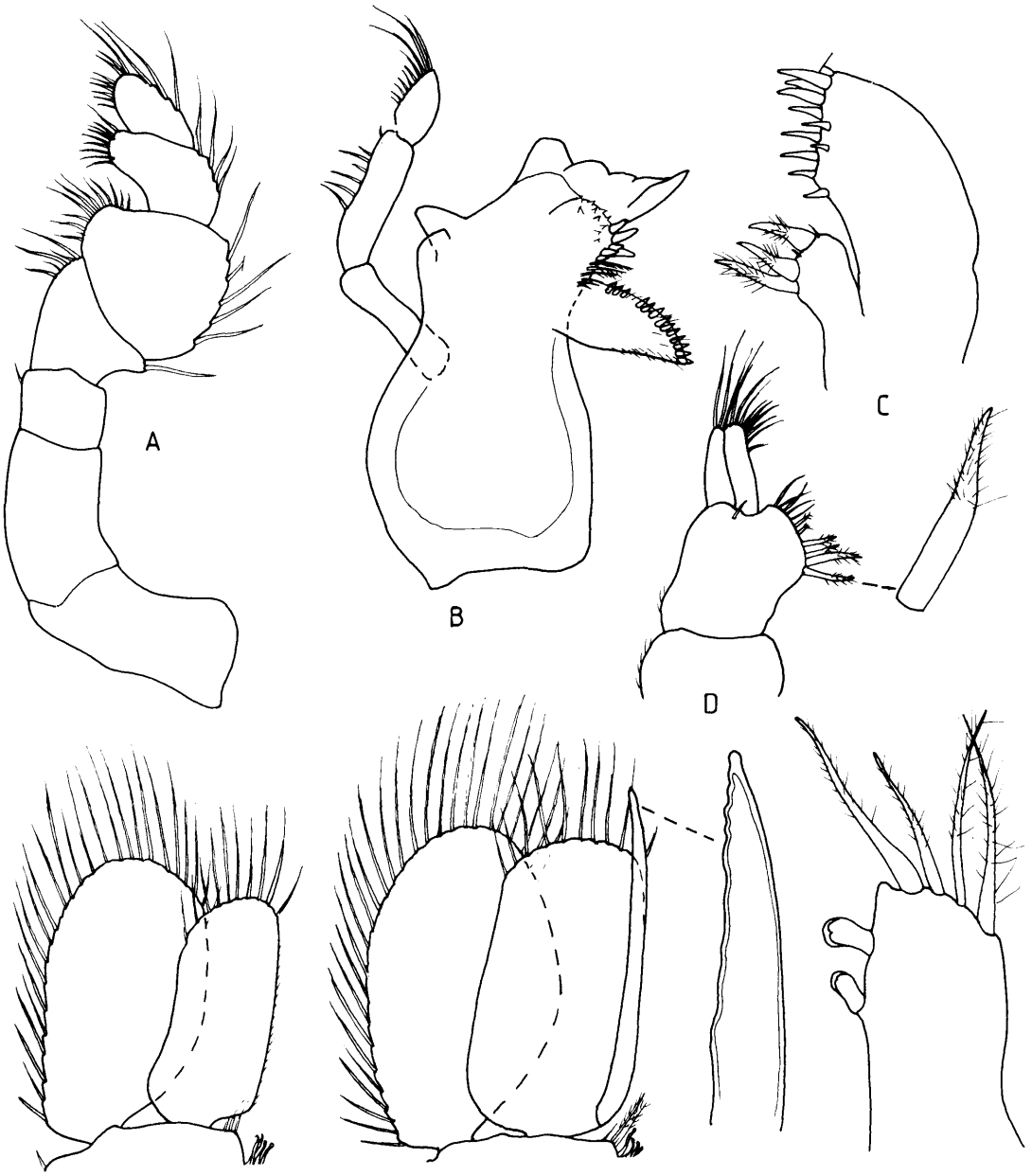

Fig. 112. *Cirolana tuberculosa* n. sp., holotype. **A**, maxilliped; **B**, left mandible; **C**, maxillule; **D**, maxilla; **E**, pleopod 1; **F**, pleopod 2; **G**, maxilliped endite.

(6.5, 6.3 mm), female (6.9 mm), Aireys Inlet, Vic., 5 Jan. 1966, under rocks, coll. W.F. Seed. Male (9.5 mm), Aireys Inlet, Vic., 29 Jan. 1968, sub-littoral, coll. W.F. Seed. Male (8.8 mm), female (6.5 mm), Bastion Point, S. of Mallacoota, Vic., 20 Feb. 1973, under boulder, coll. P. Hutchings. Female (11.3 mm), Honeysuckle Point, Western Port, Vic., 29 Aug. 1962, coll. T. Crawford. Female (10.1 mm, and mancas), Red Rock, Philip Is., Vic., 29 Sept. 1974, sub-littoral, coll. W.F. Seed. 3 females (8.4, 9.8, 11.0 mm), Inverloch, Vic., 15 May 1967, coll. A. Neboiss. Female (5.1 mm), Secret Rock, Port Lincoln, SA, 20 Feb. 1936, coll. W.J. Mahoney. Male (9.0 mm), 3 females (1.4, 6.9, 8.2 mm), Marino, SA (SAM C327); male (6.3 mm), Mallets Cove, SA, from sponge (SAM C328); female (8.3 mm), St Vincent's Gulf, SA. Male (14.0 mm), Green Point, Marrawah, W. Tas., 21 Jan. 1975, coll. G. Prestedge. 2 males (15.8, 12.3 mm), female (9.5 mm), Godfreys Beach, Stanley, N.W. Tas., 4 Aug. 1976, coll. J.R. Penrose. 2 females (10.1, 11.9 mm), Coles Beach, Davenport, N.W. Tas., 23 Mar. 1976, coll. J.R. Penrose. 2 females (6.9, ovig., 5.2 mm), Margate Beach, S.E. Tas., 1977, shallow marine, coll. T. Walker.

Types. There is some uncertainty over the status of much of Hale's material. Some material listed as types by museums does not bear data that corresponds to that given by Hale (1925: 142). Hale clearly had an abundance of material from which he selected specimens for study. Holotype SAM C304; paratypes, allotype, SAM C305; the South Australian Museum also holds a series of specimens catalogued as paratypes.

Type locality. Port Willunga, SA.

Description of male. Body about 2.5–3 times as long as wide, surface smooth, or very minutely punctate. Cephalon with distinct rostral process which extends ventrally to overlap apex of frontal lamina; dorsal surface with submarginal interocular carina and interocular carina running to anterior dorsal angle of each eye. Pereonite 1 with 2 horizontal furrows. Coxae become progressively more produced to posterior, those of pereonites 4–7 extending beyond posterior of segment; all coxae with distinct carinae. Pleonite 1 usually largely concealed by pereonite 7, pleonite 2 with posterolateral margins moderately produced; pleonite 3 with posterolateral margins produced to posterior of pleon; posterolateral margin of pleonite 4 moderately acute, encompassing lateral margins of pleonite 5. Pleotelson lateral margins slightly convex, converging smoothly to narrow point; posterior margin armed with 8 spines between which lie 2–3 short plumose setae.

Antennule peduncle 4-articulate, articles 1 and 2 short, their combined length equal to that of peduncular

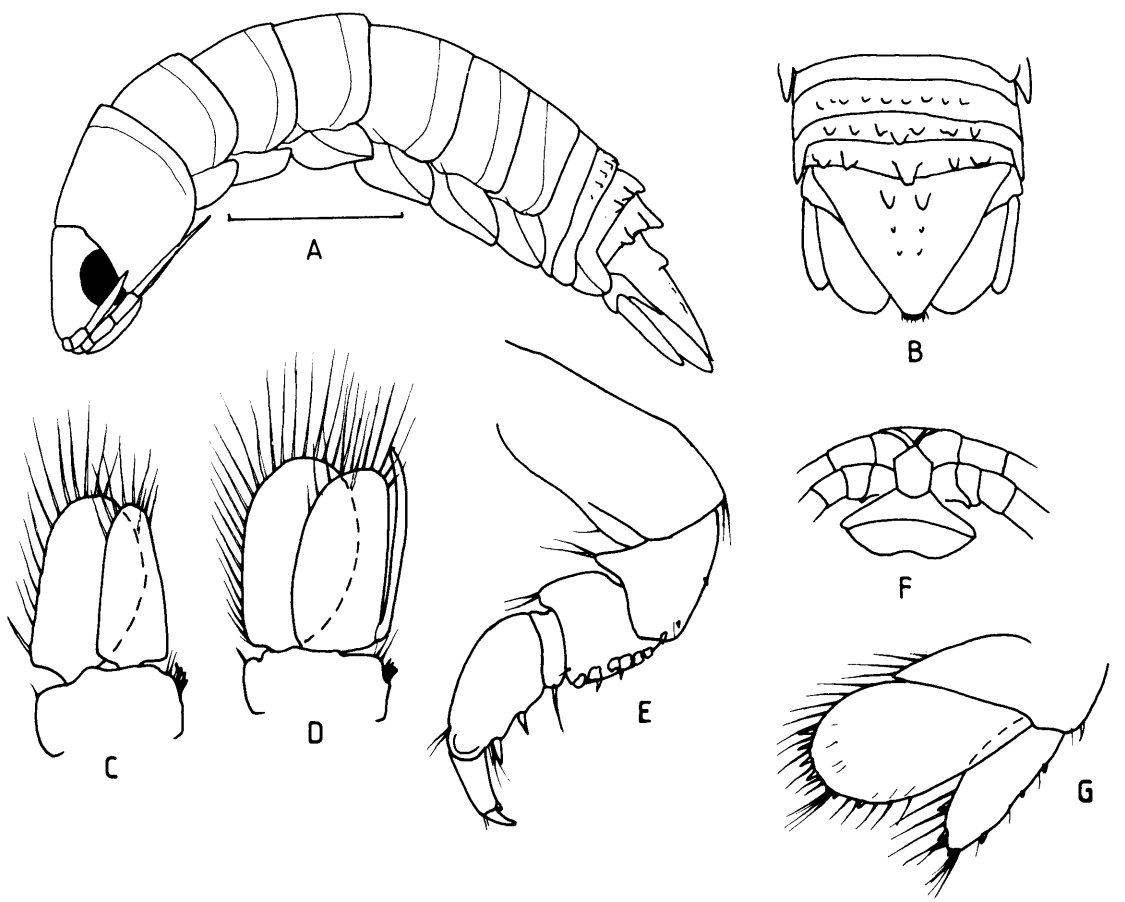

Fig. 113. *Cirolana tumulosa.* A, B, F, holotype; remainder paratype. **A**, lateral view; **B**, pleon; **C**, pleopod 1; **D**, pleopod 2; **E**, pereopod 1; **F**, clypeal region; **G**, uropod. Scale 1.0 mm.

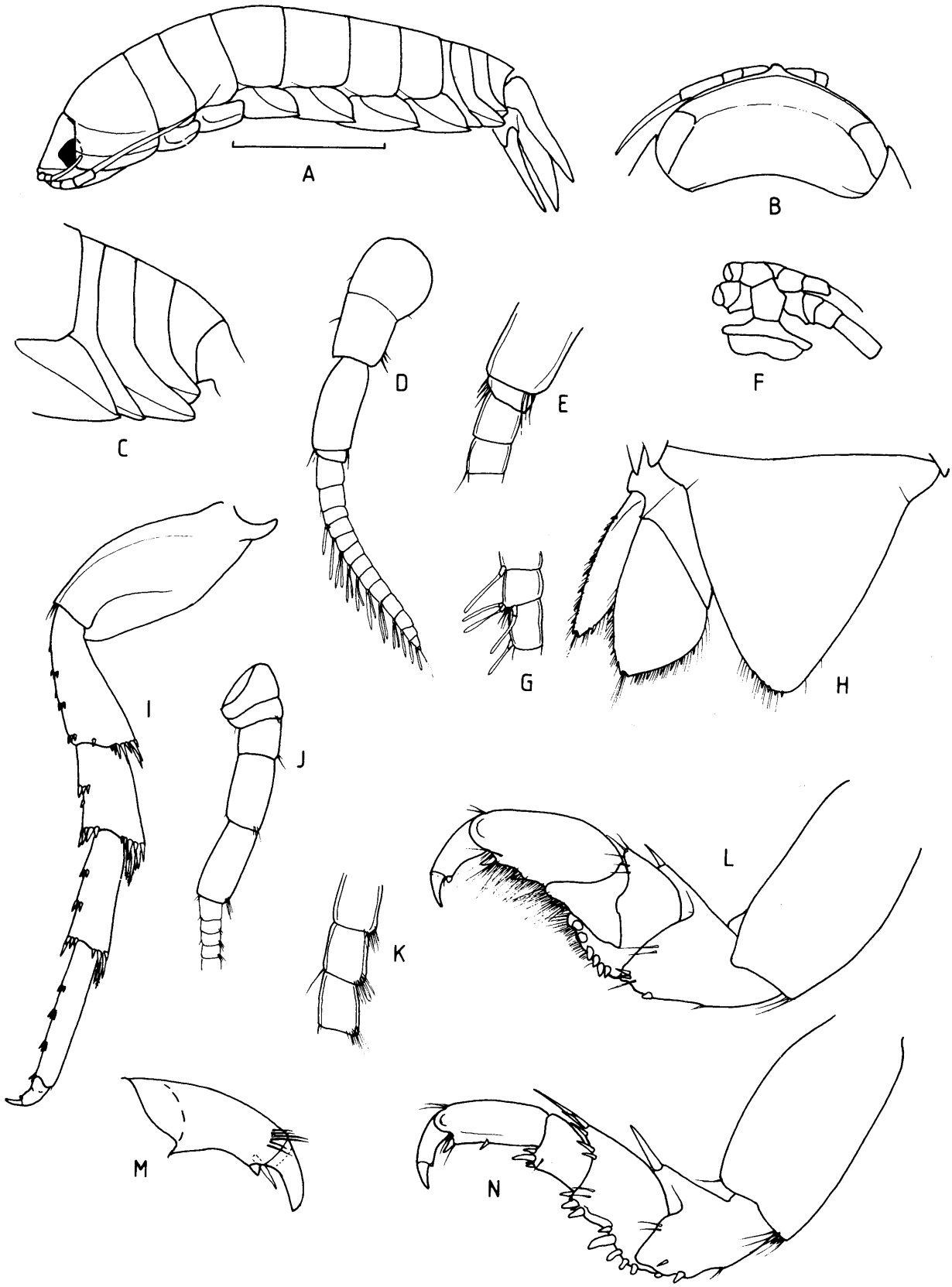

Fig. 114. *Cirolana australiense.* A-C, F, H, holotype; remainder male paratype 11.4 mm. **A,** lateral view; **B,** cephalon, dorsal view; **C,** pleon, lateral view; **D,** antennule; **E,** antennule, distal part of peduncular article 3; **F,** clypeal region; **G,** antennule, flagellar articles 9-10; **H,** pleotelson and left uropod; **I,** pereopod 7; **J,** antenna peduncle; **K,** antenna, flagellum articles 14-16; **L,** pereopod 1; **M,** pereopod 1, dactylus; **N,** pereopod 3. Scale 3.0 mm.

article 3; flagellum composed of about 13 articles, first 2 longer than remainder, articles 3–12 with aesthetascs; flagellum extends to pereonite 1. Antenna flagellum of 24 articles, extending to pereonite 3; peduncle with articles 1–2 short, 3 slightly longer; articles 4–5 subequal in length, each about 3 times as long as article 3.

Frontal lamina pentagonal, about as long as wide, apex overlapped by rostral process; lateral margins diverge slightly. Clypeus narrow, anterior margin straight; labrum about as long as clypeus. Mandible incisors asymmetrical, right mandible with posterior tooth of incisor prominent, left mandible with distinct tridentate incisor; molar process with about 20 teeth, posterodistal margin setose; lacinia mobilis with 5–10 spines; palp with numerous setae on lateral margin of article 2, article 3 with 15 pectinate spines of subequal length along lateral margin and 3 long terminal spines. Maxillule with 11 robust spines and 1 slender spine on

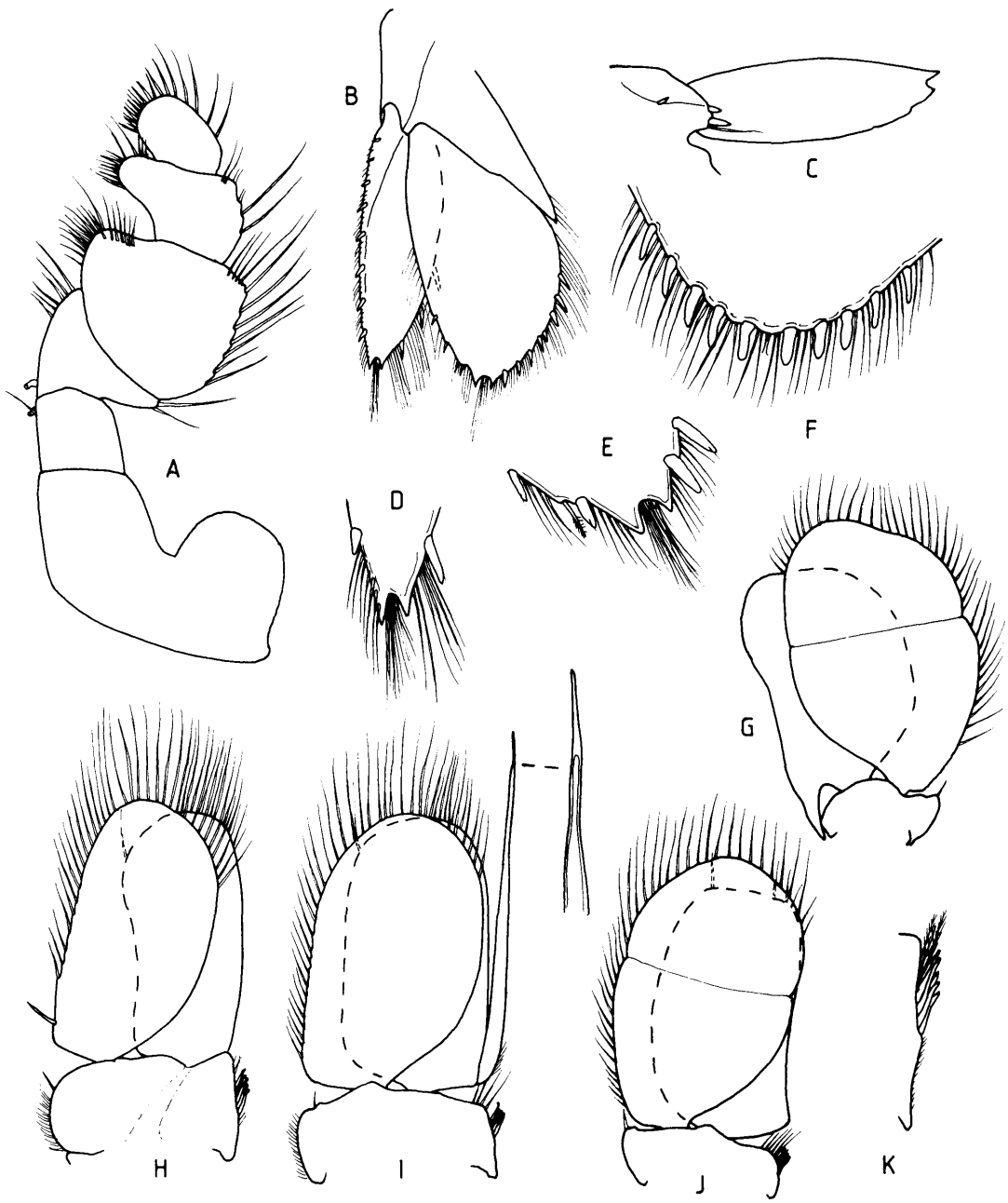

Fig. 115. *Cirolana australiense,* male paratype 11.4 mm. **A**, maxilliped; **B**, uropod; **C**, uropod peduncle, ventral view; **D**, uropod exopod, apex; **E**, uropod endopod, apex; **F**, pleotelson, posterior margin; **G**, pleopod 5; **H**, pleopod 1; **I**, pleopod 2; **J**, pleopod 4; **K**, pleopod 1, medial margin of peduncle.

gnathal surface of exopod; endopod with 3 robust plumose spines, proximal spine longest. Maxilla with 7 and 9 long setae on palp and exopod respectively, endopod with numerous setae on medial margin, proximal 2 being robust and plumose. Maxilliped palp lateral margins of articles provided with long setae, medial margins with stout setae; article 4 with medial distal angle produced; endite with 2 coupling hooks and 4 plumose setae on distal margin, 3 on lateral.

Pereopods all robust, becoming progressively longer towards posterior body, pereopod 6 being longest. All pereopods with biungiculate dactyls. Pereopod 1 with dense fringe of setae along posterior margins of merus, carpus and propodus; basis with about 3 setae at posterodistal angle; ischium with single spine at anterodistal angle, with 1 blunt spine and 2 acute spines at posterodistal margin and angle; merus with 6 robust spines on posterior margin; carpus with single spine at posterodistal angle; propodus with 1 spine on palm and large spine at base of posterodistal angle; dactylus with wide flat setae adjacent to secondary unguis, and row of 5 fine setae proximal to base of primary unguis. Pereopods 2–3 similar, less robust than 1; ischium, merus and carpus proportionally longer, anterodistal angle of ischium with 1–3 stout spines, merus with 5 spines; posterior margin of merus distinctly sinuate, with 8 large blunt spines; posterodistal angle of carpus with group of 4 spines; propodus with single spine on palm. Pereopod 7 virtually without setae, anterior margins with spines at distal angles only; posterior margins with groups of 1–3 spines, while posterodistal angles of merus and carpus each bear cluster of spines; spines on posterior margin are shorter than those of anterior margin, many of which are pectinate.

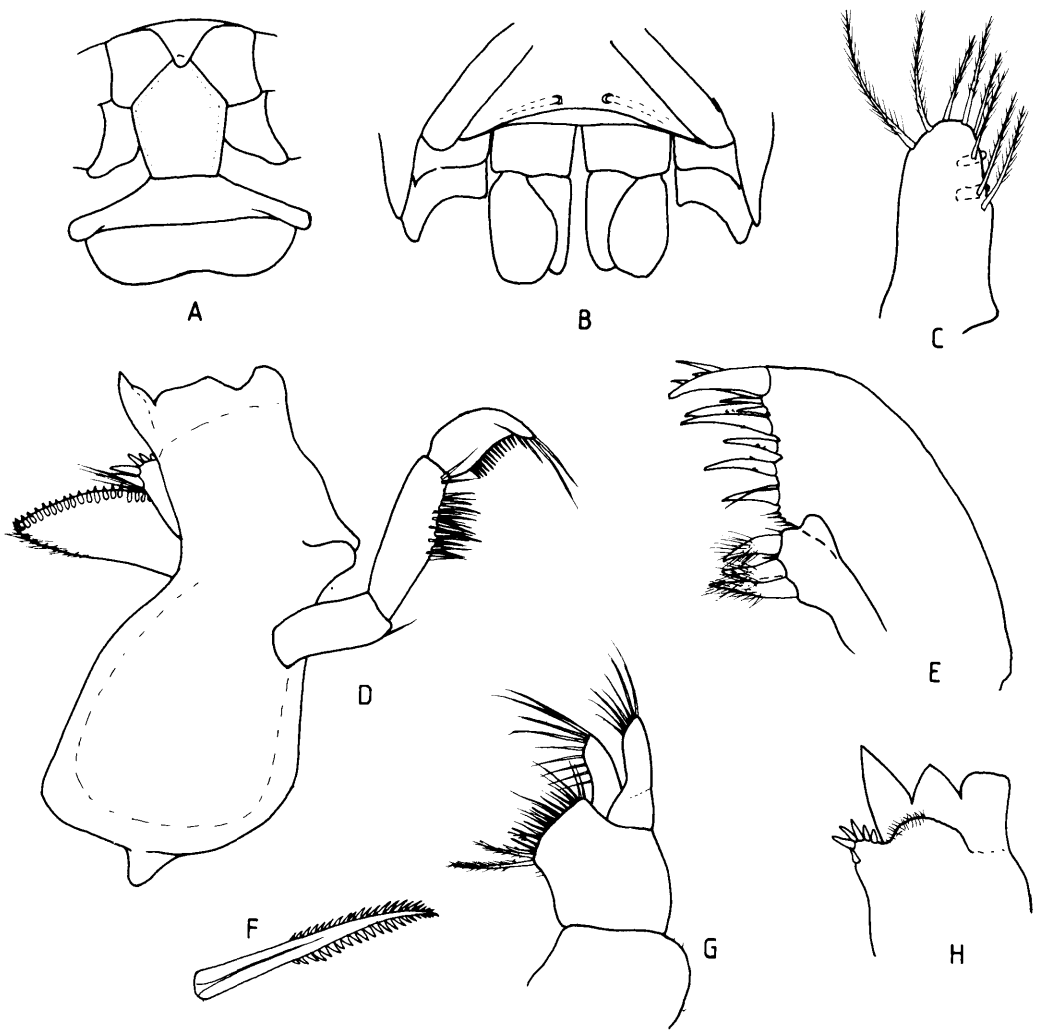

Fig. 116. *Cirolana australiense.* **A,** clypeal region, male paratype 11.4 mm; **B,** sternite 7, male Mallacoota; **C–H,** male 12.3 mm, Tasmania; **C,** maxilliped endite; **D,** right mandible, ventral view; **E,** maxillule; **F,** seta from maxilliped palp article 2; **G,** maxilla; **H,** left mandible, incisor.

Vasa deferentia opening flush with surface of sternite 7.

Pleopods 3-5 with exopods with complete suture. Pleopod 1 endopod only slightly shorter than exopod, lateral margin distinctly concave, distal width slightly greater than basal width; exopod lateral margin straight, medial and distal margin broadly rounded; peduncle with 5 coupling hooks on medial margin and single spine on proximal angle of lateral margin. Pleopod 2 rami subequal in length, endopod margins subparallel; appendix masculina arising basally, exceeding apex of endopod by 0.2 of its length. Pleopods 3-4 similar, endopod shorter than exopod, apex truncate. Pleopod 5 with both rami broadly rounded, distal margin of exopod slightly indented. Uropods extending beyond apex of pleotelson, rami subequal in length; apices of both rami distinctly bifid. Endopod medial margin convex, armed with 7 spines and continuous fringe of plumose setae, lateral margin with setae along distal 0.66 of its length, with 3 spines and sensory spine set proximally to distal spine. Exopod lanceolate, medial margin with 3 spines, lateral margin with 8. Peduncle with 1 spine lateral margin and 2 spines on ventral margin.

Female. Generally similar to male, though usually smaller; never with setal fringe on posterior margins of pereopod 1.

Development. Juveniles and mancas are essentially similar to adults but may have fewer spines on the pleotelson and appendages.

Variation. Material examined here covers a wide geographical range, and remarkably little variation is shown. Thirty topotypic specimens were examined to determine the most frequent number of spines on the pleotelson and uropods and the following results were obtained. The pleotelson usually has 8 spines (73.3%) with a range 6-10. Although Hale (1925b) mentions a range of 6-14, I have not seen any with more than 10. The uropodal exopod has 8-9 spines on the lateral margin depending on size, and always 3 on the medial margin. The uropodal endopod always has 3 spines on the lateral margin and 6 (45.5%) or 7 (48.5%) on medial margin. I have seen one specimen with 11 and one with 14 spines on the medial margin. It is often possible to identify supernumery spines, as these generally disrupt the even spacing of the spines. The 5th spine from the uropodal endopod apex in Fig. 115B is one such spine. It should be noted that all adult males have a setose first pereopod.

Colour. Nearly all specimens densely coverered by brown chromatophores over dorsal surface. Chromatophores absent from appendages, other than antennule and antennal peduncles. Hale noted on one of his labels "life colour whitish, mottled with black".

Size. Largest male 15.8 mm, largest female 12.3 mm. Mancas recorded up to 3.7 mm. Average sizes derived from the topotypes examined yield male 8.9 mm, female 8.5 mm.

Remarks. Hale (1925) described this species as a varietal form of *Cirolana cranchii.* Undoubtedly the Australian species is distinct from *C. cranchii,* the shape and spination of the pleotelson and uropods of both species being distinct (Bruce & Ellis, 1983). A further point of distinction is that *C. cranchii* does not have the posterolateral margins of pleonite 3 strongly produced as in *C. australiense.*

Unfortunately, owing to the presence of several closely similar species, it is not possible to determine whether or not Naylor's (1961) New Zealand record of the species is the same as *C. australiense.*

Diagnostic characters useful in identifying this species include the shape of the frontal lamina, the presence of a single spine on the palm of pereopods 1-3, the characteristic shape and spination of the pleotelson and uropods and the from of the posterolateral margins of the pleonites.

Distribution. South Australia: Port Willunga, Semaphore, St Vincents Gulf, Port Lincoln, Hallets Cove; Victoria: Mallacoota, Aireys Inlet, Phillip Island, Honeysuckle Point, Western Port; Tasmania: Margate Beach, S.W. Tas., Coles Beach Devonport, Godfreys Beach, Stanley; New South Wales: Balmoral Bay and Mosman at Sydney, Long Reef at Collaroy; Queensland: North Stradbroke Island.

Cirolana arafurae n. sp.

Figs 117, 118

Material examined. 2 males (5.0, 6.0 mm), 8 females (3.8, 3.8, 3.9, 4.0, 4.2,4.5, 4.7, 5.2 mm), 26 mancas (1.7-2.9 mm), Kei Is., Indonesia, 5°34′S, 132°26′E, 23 May 1927, 25-60 m, coral; male (6.9 mm), Kei Is., Indonesia, 5°35′S, 132°42′E, 10 Apr. 1922, 5 males (5.4, 5.6, 6.9, 7.5 mm), Kei Is., Indonesia, 20-25 m, sand, trawi; 2 females (4.5, 4.7 mm), 4 mancas (2.2-3.0 mm), Tajando Is., Indonesia, 5°32′S, 132°20′E, 1 May 1922, 15 m, coral; 5 males (4.1 mm, 4.4, 4.5, 4.8 mm), 9 females (3.5-4.4 mm), manca (2.0 mm), Walir Is., Indonesia, 5°35′S, 132°20′E, 3 May 1922, 20 m, sand and coral; all coll. Th. Mortensen 1922 Kei Islands Expedition.

Types. Holotype and paratypes ZMUC; remaining paratypes NTM Cr000229.

Type species. Kei Islands, Indonesia, 5°34′S, 132°26′E.

Description of male. Due to the similarity of this species to *C. erodiae* a slightly abbreviated description is given with emphasis on the differences.

Cephalon with distinct interocular and submarginal furrow. Posterolateral margins of pleonite 3 not extending to posterior of pleonite 4. Pleotelson with small median apical projection and 8 spines.

Frontal lamina, clypeus and mouthparts as for *C. erodiae.*

Pereopod 1 with dense fringe of setae along posterior margins of merus, carpus and propodus; merus with 5 blunt tubercular spines on posterior margin; palm of propodus with 2 slender spines. Pereopods 2-3 similar to 1 but carpus proportionally longer and propodus less robust; generally with more and longer spines. Pereopod 7 with clusters of spines at anterodistal angle of ischium,

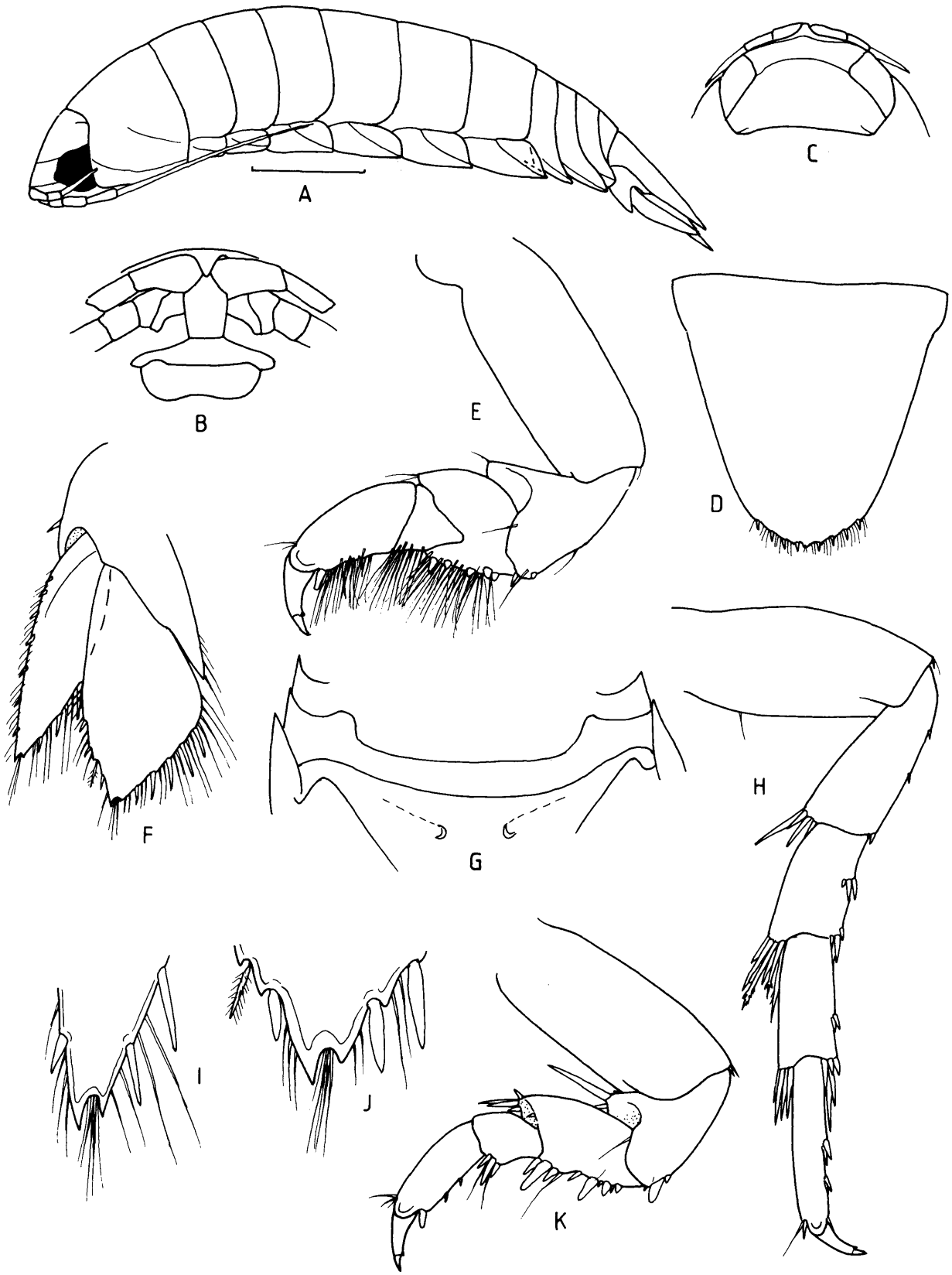

Fig. 117. *Cirolana arafurae* n. sp. A–D, G, holotype; remainder male paratype. **A,** lateral view; **B,** clypeal region; **C,** cephalon; **D,** pleotelson; **E,** pereopod 1; **F,** uropod; **G,** vasa deferentia, sternite 7; **H,** pereopod 7; **I,** uropod exopod, apex; **J,** uropod endopod, apex; **K,** pereopod 2. Scale 1.0 mm.

and distal angles of merus and carpus; otherwise sparsely spined.

Vasa deferentia present on sternite 7, separated by 0.2 of width of sternite.

Pleopod 1 exopod very slightly shorter than endopod, lateral margin feebly concave. Pleopod 2 appendix masculina straight, about 1.6 times longer than endopod. Uropods extending beyond apex of pleotelson. Endopod with 4 spines on medial margin, 3 spines on lateral margin; apex bifid with lateral process prominent. Exopod with 3 spines on medial margin, 6 on lateral; apex bifid with lateral process prominent.

Female. Apart from sexual characters, and lacking the setal fringe of pereopod 1, same as the male.

Variation. Only occasional specimens showed slight differences in uropod spination. In some specimens the lateral margin of the uropodal exopod had 5 spines, in one specimen the medial margin of the uropod had 3 spines instead of the more usual 4.

Colour. White, a creamy yellow in alcohol.

Size. Largest male 7.5 mm, largest female 5.2 mm, largest manca 3.0 mm.

Remarks. This species is closest to *Cirolana erodiae* from Heron Island, but differs in several important characters. *Cirolana arafurae* has the vasa deferentia set wider apart than in *C. erodiae,* the appendix masculina is straight not bent laterally, and the uropod apex has the lateral process prominent, not subequally bifid. In addition, the spination of the uropods differs slightly, *C. erodiae* having noticeably more spines on the lateral margin of the exopod.

Distribution. Known only from the vicinity of the Kei Islands, Indonesia.

Etymology. Derived from the Arafura Sea.

Cirolana brocha n. sp.

Figs 119, 120

Cirolana parva.—Bruce, 1980a: 110 (Part) (not *C. parva* Hansen, 1890).

Material examined. 4 males (6.0–7.9 mm), 13 females (5.0–8.2 mm), Little Ramsay Bay, Hinchinbrook Is., Qld, 29 Aug. 1978, trapped amongst oyster and granite rubble, littoral. Heron Island, Capricorn Group, Great Barrier Reef series:

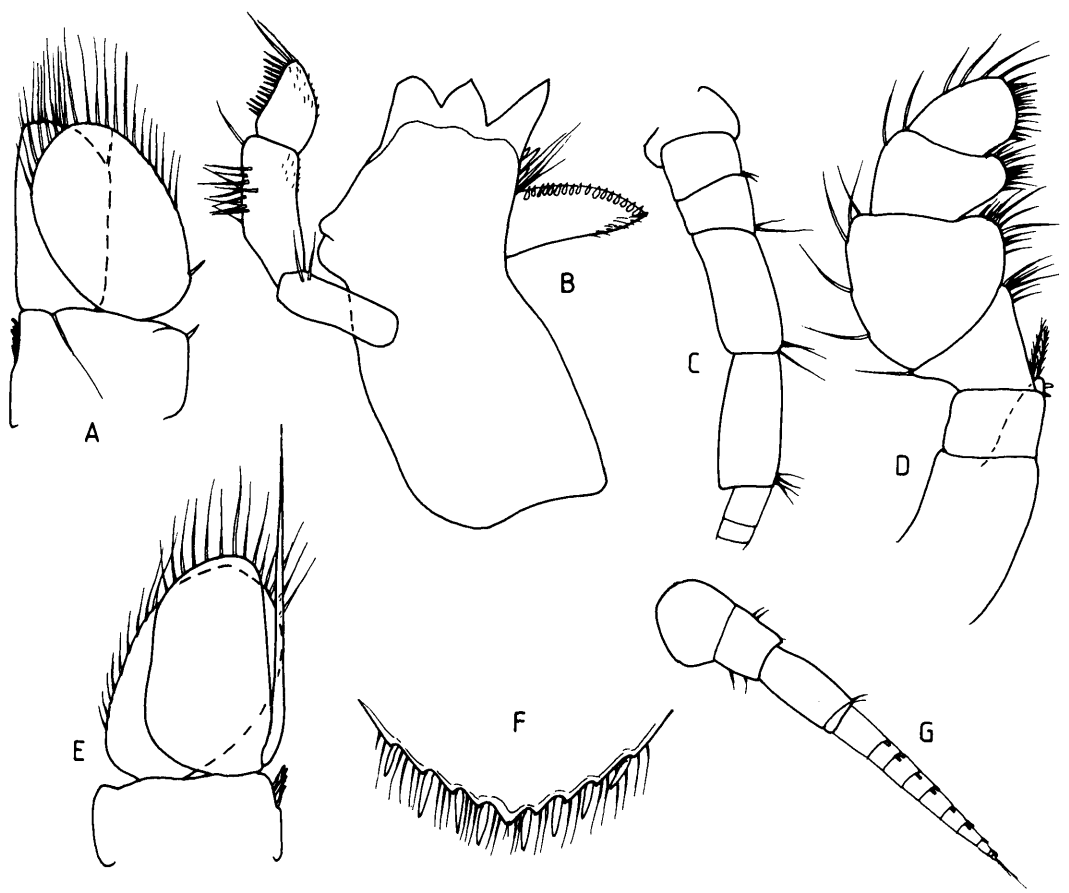

Fig. 118. *Cirolana arafurae* n. sp., male paratype. **A**, pleopod 1; **B**, mandible; **C**, antennal peduncle; **D**, maxilliped; **E**, pleopod 2; **F**, pleotelson, posterior margin; **G**, antennule.

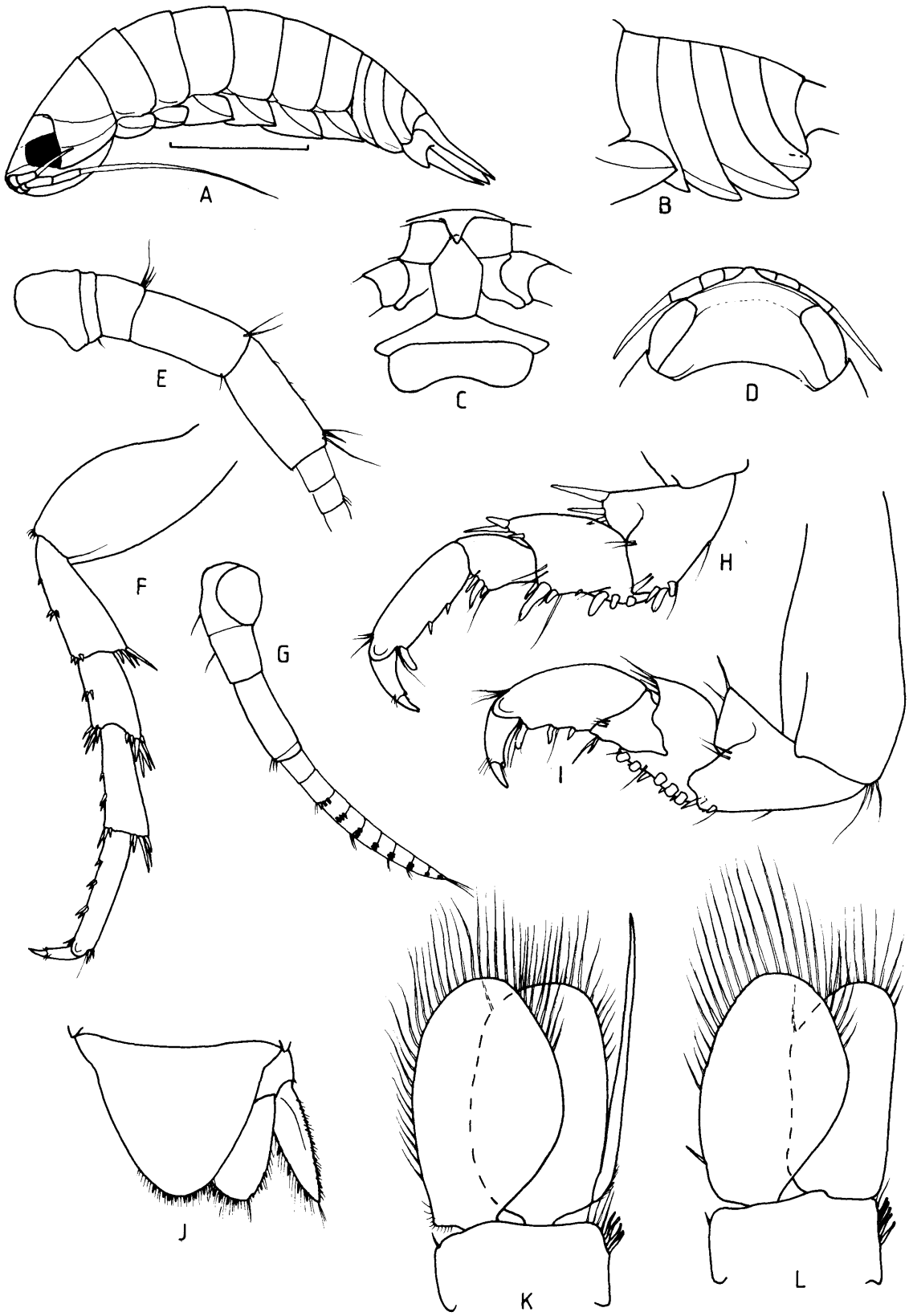

Fig. 119. *Cirolana brocha* n. sp. A-D, J, holotype, male 8.2 mm; remainder male 7.2 mm paratype. **A**, lateral view; **B**, pleon, lateral view; **C**, clypeal region; **D**, cephalon, dorsal view; **E**, antennal peduncle; **F**, pereopod 7; **G**, antennule; **H**, pereopod 2 (basis omitted); **I**, pereopod 1; **J**, pleotelson and uropod; **K**, pleopod 2; **L**, pleopod 1. Scale 2.0 mm.

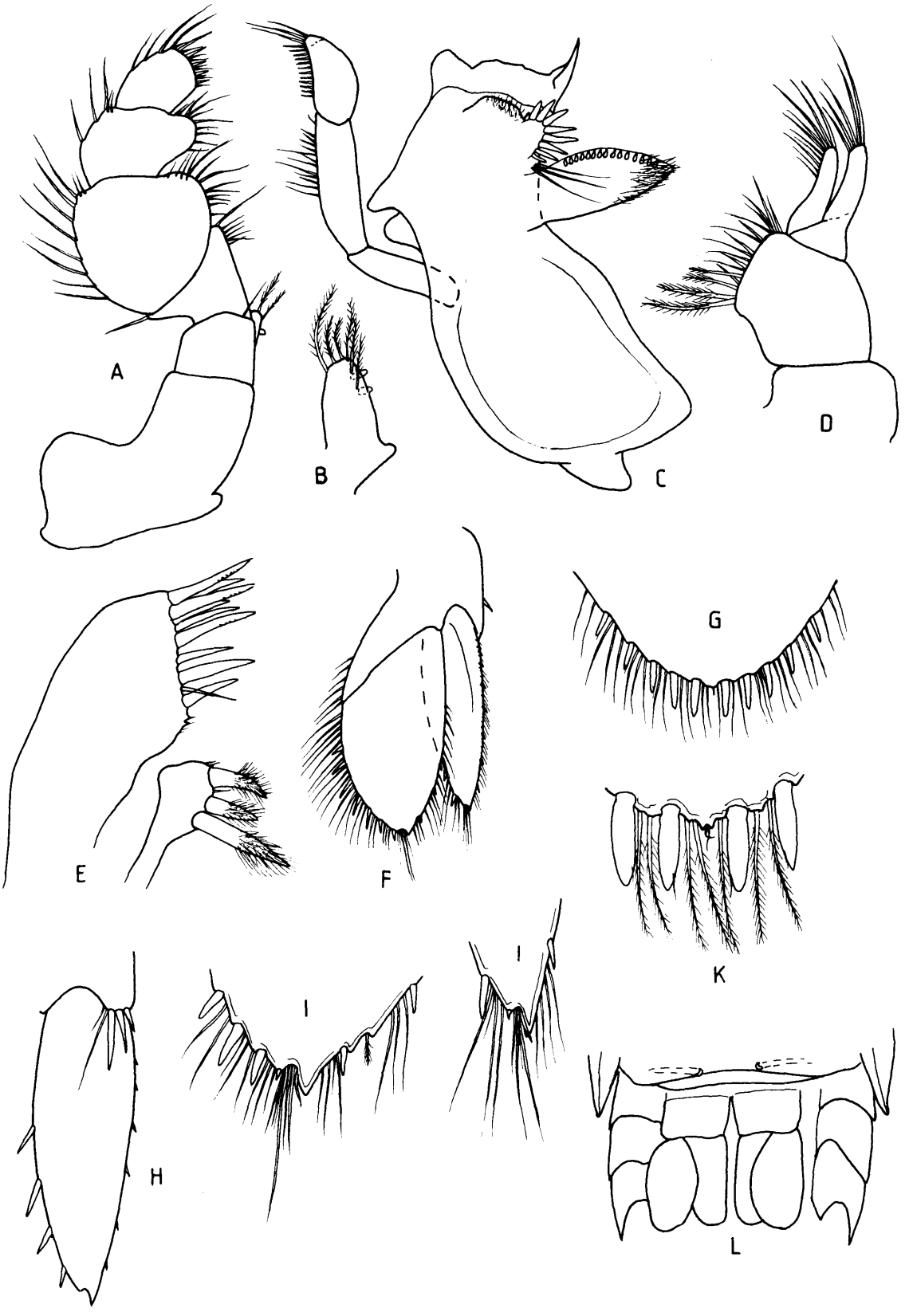

Fig. 120. *Cirolana brocha* n. sp. L, holotype, male 8.2 mm; remainder paratype male 7.0 mm. **A**, maxilliped; **B**, maxilliped endite; **C**, left mandible, ventral view; **D**, maxilla; **E**, maxillule; **F**, uropod, **G**, pleotelson, posterior margin; **H**, uropod peduncle and exopod, ventral view showing spines; **I**, uropod endopod, apex; **J**, uropod exopod, apex; **K**, pleotelson, apex; **L**, sternite.7.

18 males (5.0–8.2 mm), 15 females (4.5–8.2 mm, 1 ovig.), 25 May 1979, boulder zone, northern reef edge, trapped. 2 males (7.0, 8.3 mm), 11 females (4.4–9.4 mm), 12 mancas (3.2–5.0 mm), 30 Nov. 1979, trapped behind northern reef crest. Male (7.5 mm), female (8.5 mm), 2 June 1978, from coral block. All coll. NLB.

Types. Holotype, male QM W9810. Paratypes, QM W9811; AM P32362.

Type locality. Heron Island, Capricorn Group, Qld, 23°26.5'S, 151°54.5'E.

Description of Heron Island male. Due to the similarity of this species to *C. erodiae,* a slightly abbreviated description is given with emphasis on the differences.

Cephalon with submarginal furrow and feeble dorsal interocular furrow. Pleon with posterolateral margins of pleonite 2 barely produced; posterolateral margins of pleonite 3 not reaching posterior of posterolateral margins of pleonite 4, superior margin slightly curved. Pleotelson lateral margins convex, converging smoothly to apex, posterior margin not serrate, provided with 10 stout spines, between which lie 2–3 short plumose setae; apex with pair of short simple setae.

Frontal lamina as for previous species, but clypeus with straight anterior margins; about 0.2 as long as wide. Posterodistal portion of molar process conspicuously setose.

Pereopods essentially similar to previous species but males without setal fringe on posterior margins of pereopod 1.

Vasa deferentia opening flush with ventral surface of sternite 7, separated by 0.2 width of sternite.

Pleopod 1 endopod lateral margin concave. Pleopod 2 appendix masculina exceeding endopod by 0.2 of its length, narrowing smoothly to point. Exopods of pleopods 3–5 with complete suture. Uropods extending slightly beyond pleotelson apex, both rami subequal in length. Exopod lateral margin with about 7 spines set amongst marginal setae, medial margin with 4 long spines; apex not bifid, the medial process absent, small acute spine lies adjacent to exopod apex. Endopod with 3 spines on lateral margin, 7 on medial margin, marginal setae present except for proximal third of lateral margin; apex not bifid, with small acute spine set medially to apex. Peduncle with lateral spine and 3 spines on ventrolateral angle.

Female. Similar to the male.

Variation. All the Heron Island specimens examined show a uniform appearance. All specimens had 10 spines on the pleotelson, penial opening position did not vary, and the form of the pleotelson spines remained constant. The uropodal endopod always had 3 spines on the lateral margin and usually 7 on the medial margin (81%). The exopod had 7–9 spines on the lateral margin and always had 4 spines on the medial margin.

The sample of 17 specimens from Hinchinbrook agrees closely with the Heron Island material, particularly in the form of the uropod apices, pleotelson spination, pleopods 1 and 2, and the opening position of the vasa deferentia. Differences occur in the spination of the uropods. The Heron Island material had an endopod spination (medial margin spines: lateral margin spines) of 7:3 (81%), whilst Hinchinbrook specimens showed the following spine formulas: 5:3 (25%), 6:3 (71%) and 7:3 (2%). The exopods had a spination of 3:7 (59%) with 4:7 (15%) being scarce. The specimens from the two areas are otherwise identical.

Colour. Translucent with black to dark brown chromatophores in life. In alcohol white. Chromatophores tend to form a transverse band at posterior of dorsal surfaces of pereonites.

Size. Males 5.0–8.8 mm, average 6.84 mm; females 4.9–9.5 mm, average 6.25 mm; mancas 3.2–5.0 mm.

Remarks. The characters by which this species can be separated from others of the group include the form and spination of the uropods and pleotelson, the non-bifid uropodal apices, the concave shape of the lateral margin of the endopod of pleopod 1, the relative position of the penial openings, and the length of the appendix masculina in mature males.

It can be separated from *Cirolana erodiae,* with which it is sympatric, by having non-bifid uropodal apices, and a non-serrate pleotelson with 10 spines, the spines themselves being considerably larger those of *C. erodiae.* Further differences include having 4 spines on the medial margin of the uropodal exopod, and in having the vasa deferentia placed wider apart.

Distribution. Queensland: Heron Island reef, Capricorn Group, southern Great Barrier Reef; and Hinchinbrook Island.

Etymology. Specific name is derived from the Latin word *brochus* which means projecting teeth, and refers to the prominent pleotelson spines.

Cirolana erodiae n. sp.

Figs 121, 122

Cirolana parva.—Bruce, 1980a: 110 (Part); 1980b: 158 (not *C. parva* Hansen, 1890).

Material examined. 10 males (3.5 imm., 4.9, 5.0, 5.2, 5.4, 5.5, 5.6, 6.9, 7.0, 8.3 mm), 16 females (3.7–6.9 mm, mean 5.4), manca (3.2 mm), north of reef edge, Heron Island, 25 May 1979, boulder zone, trapped, coll. NLB. 2 males (5.8, 8.2 mm), 3 females [5.8 mm (embryos), 6.5, 7.2 mm], off North edge of Wistari Reef, Capricorn Group, 16 Sept. 1978, coll. D. Fisk. Female (6.2 mm with emergent embryos), Wreck Is., Capricorn Group, 4 June 1978, coll. NLB. 7 males (4.0–7.9 mm), 6 females (5.1–6.9 mm), 2 mancas (3.8, 4.0 mm), Heron Is., 10 June 1978, trapped on reef edge, in front of research station, coll. NLB. 2 males (3.2, 4.9 mm), 2 females (5.0, 5.6 mm), 7 mancas (2.0–3.2 mm), Heron Island, 11 June 1978, mid reef flat, trapped, coll. NLB. 2 males (4.4, 4.3 mm), 4 females [4.3–4.5 mm (one ovig.)], Heron Is., 24 June 1979, Blue Pools, north side of reef, coll. NLB. 2 males (5.0, 6.0 mm), 2 females (5.2, 5.4 mm), Heron Is., 21 June 1979, trapped inner reef flat by resort, coll. NLB. Male (7.5 mm), Heron Is., 29 June 1979, pools behind north-west reef edge, coll. NLB. Male (7.5 mm), 2 females (3.7, 5.0 mm), Wistari Reef, Capricorn Group, 4 Dec. 1979, S.W. face, 12 m, coll. NLB.

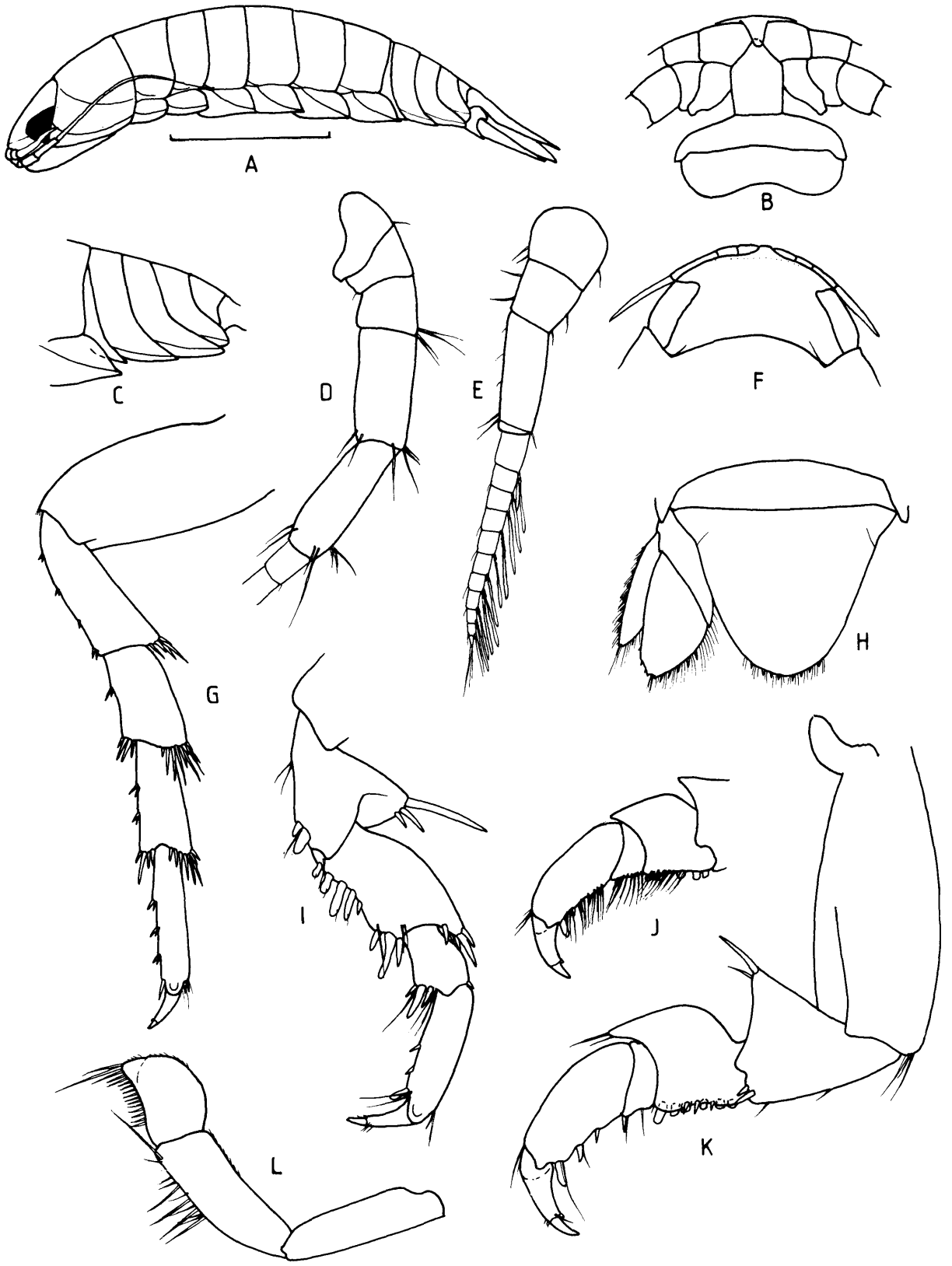

Fig. 121. *Cirolana erodiae* n. sp. A–C, F, holotype, male 6.9 mm; remainder male 7.0 mm paratype. **A**, lateral view; **B**, clypeal region; **C**, pleon, lateral view; **D**, antennal peduncle; **E**, antennule; **F**, cephalon, dorsal view; **G**, pereopod 7; **H**, pleotelson and uropod; **I**, pereopod 2; **J**, pereopod 1, distal articles male 5.0 mm; **K**, pereopod 1; **L**, mandibular palp. Scale 2.0 mm.

3 males (4.9, 5.0, 5.0 mm), 3 females (3.8, 5.1, 6.7 mm ovig.), 2 mancas (2.5, 3.5 mm), Heron Island, 8 Dec. 1979, pools behind north-west reef edge, coll. NLB. 2 females (6.2, 6.5 mm), Heron Island, 10 Dec. 1980, reef flat, coll. A.J. Bruce. 2 males (5.6, 6.9 mm), Heron Island, 11 Oct. 1980, central reef flat, coll. A.J. Bruce. 2 females (5.2, 5.6 mm), One Tree Is., Capricorn Group, 25 Sept. 1967, dead coral, coll. F.H. Talbot.

Male (5.2 mm), Palfrey Island, Lizard Group, 14 Dec. 1980, 7 m, coll. NLB. Manca (3.0 mm), Bird Island, Lizard Group, 15 Dec. 1980, reef crest, 1 m, coll. NLB. Female (5.0 mm, ovig.), South Island, Lizard Group, 17 Dec. 1980, north east reef edge, 7-9 m, coll. NLB. Female (4.5 mm, ovig.), Lizard Is., 18 Dec. 1980, patch reef in lagoon channel, 7-9 m, coll. NLB. 4 males (5.0, 5.1, 5.1, 5.3 mm), 4 females (3.2, 3.8, 5.0 ovig., 5.5 ovig.), 2 mancas (2.8, 3.0 mm), Lizard Is., 18 Dec. 1980, patch reef in lagoon channel, 1 m, coll. NLB.

Coral Sea reefs: Male (5.0 mm), 2 mancas (2.9, 3.0 mm), Willis Is., 10 May 1979, 10 m, on reef flat. 3 males (3.0, 4.1, 4.2 mm), 3 females (3.9, 4.0, 4.5 mm), Magdalaine Cay, 26 Apr. 1979, 0m, reef rock. Male (3.9 mm), female (6.4 ovig.), Magdalaine Cay, 27 Apr. 1979, 0m. Male (5.0 mm), 2 females (7.3, 5.9 mm, ovig.), Long Is., Chesterfield Reefs, 5 May 1979, 12 m. Male (6.0 mm), Long Is., Chesterfield Reefs, 5 May 1979, 1 m. 2 males (6.0, 6.2 mm), 2 mancas (3.0, 3.1 mm), Bennett Is., Chesterfield Reefs, 6 May 1980, 1 m, northern reef fringe. 2 males (5.0, 6.5 mm), 2 females (ovig. 7.3, 3.9 mm), Long Is., Chesterfield Reefs, 5 May 1979, 12 m, reef slope. Female (5.0 mm), 2 mancas (3.0, 3.2 mm), Bennett Is., Chesterfield Reefs, 8 May 1979, 1 m, lagoon. Male (8.4 mm), North Cay, Chesterfield Reefs, 10 May 1979, 2 m, in pool. 2 males (5.3, 5.7 mm), North Cay, Chesterfield Reefs, 10 May 1979, 10 m, reef slope. 2 females (6.0, 5.5 mm), North Cay, Chesterfield Reefs, 10 May 1979, lagoon. Female (4.0 mm), Brodie Cay, Marion Reefs, 12 May 1979, 0 m, reef flat. All coll. NLB.

Types. Holotype, male QM W9776. Paratypes, QM W9777-W9791, W9813, W9816; AM P30340, P32359-P32361; USNM 190715.

Type locality. Heron Island, Capricorn Group, Qld, 23°26.5'S, 150°54.5'E.

Description of Heron Island male. Body about 3 times as long as wide, smooth, unornamented. Cephalon with rostral point, and feeble submarginal interocular carina. Pereonite 1 with 2 horizontal furrows on each side; pereonites 2-7 with coxae progressively more produced, those of pereonites 6-7 extending beyond posterior of segment; each coxa with complete furrow. Pleonite 1 usually concealed by pereonite 7; pleonite 2 with posterolateral margins moderately produced; pleonite 3 with posterolateral margins narrowing rapidly, produced to posterior of pleon; pleonite 4 with posterolateral margin encompassing pleonite 5; pleonites 3-4 with horizontal carinae. Pleotelson lateral margins convex, apex broadly rounded, posterior margin with 8 spines, each set within indentation; 2 short plumose setae set between spines, apex with small indented projection in which lie 2 short simple setae.

Antennule peduncle 4-articulate; article 3 slightly shorter than combined lengths of articles 1 and 2; flagellum extends to pereonite 1, composed of about 11 articles, first of which is longest. Antenna similar to other species of group, flagellum extending to pereonite 4.

Frontal lamina pentagonal, lateral margins subparallel, about 1.5 times as long as greatest width, apex overlapped by downward projection of rostral process. Clypeus anterior margin rounded, about 0.2 as long as greatest width. Mandible palp with fine scales on medial margin.

Pereopods 1-3 moderately robust, pereopod 1 more so than others, pereopod 6 longest. Pereopod 1 with or without fringe of setae on merus, carpus and propodus; posterior margin of merus with 6 blunt and 3 acute spines, carpus with single acute spine and seta, propodus with 2 spines on palm and large spine opposing dactylus. Pereopods 2-3 similar to pereopod 1, but merus and propodus proportionally longer, additional spines present at anterodistal angles and posterior margins of ischium, merus and carpus; propodus with 2 spines on palm. Pereopods 5-7 similar, pereopod 7 not differing from other species of group.

Vasa deferentia opening flush with surface of sternite 7, openings separated from each other by 0.1 width of sternite.

Pleopod 1 endopod very slightly shorter than exopod, lateral margin straight; pleopod 2 appendix masculina 1.5 times as long as inner ramus, characteristically bent laterally, narrowing gradually to acute point. Pleopods 3-5 with complete suture. Uropods extending beyond apex of pleotelson, exopod 0.8 as long as endopod, all margins convex. Exopod with 9 short spines on lateral margin amongst which lie short setae, medial margin with 3 long spines; apex distinctly bifid. Endopod with 3 short spines on lateral margin, each set within slight serration; between 2nd and 3rd spines lies plumose sensory seta; medial margin with 5 spines and continuous row of marginal setae; apex distinctly bifid. Peduncle with single spine on lateral margin and 3 spines on ventral distal angle.

Female. Apart from sexual characters, same as the male.

Variation. Only three males had a setose first pereopod, and these were only from a single sample. The shape of the posterior margin of the pleotelson is more acute in some specimens than in others. Of a series of 36 Barrier Reef specimens examined, all had 8 spines on the pleotelson, the medial margins of the endopod had 5 spines (60%) or 4 (30%), and the lateral margin always had 3 spines. The exopod had 7-9 spines on lateral margin, the number increasing with size of the specimen, and always had 3 spines on the medial margin.

A series of 14 fully grown undamaged adults from the Coral Sea reefs was examined and found to agree with *Cirolana erodiae* in all respects except details of the uropod spination. At Heron Island the usual number of spines on the medial margin of the endopod is 5 (60%) or 4 (30%), while in material from the Coral Sea, 4 (75%) was more frequent. The number of spines on the lateral margin of the exopod was fewer, 6 in 93%

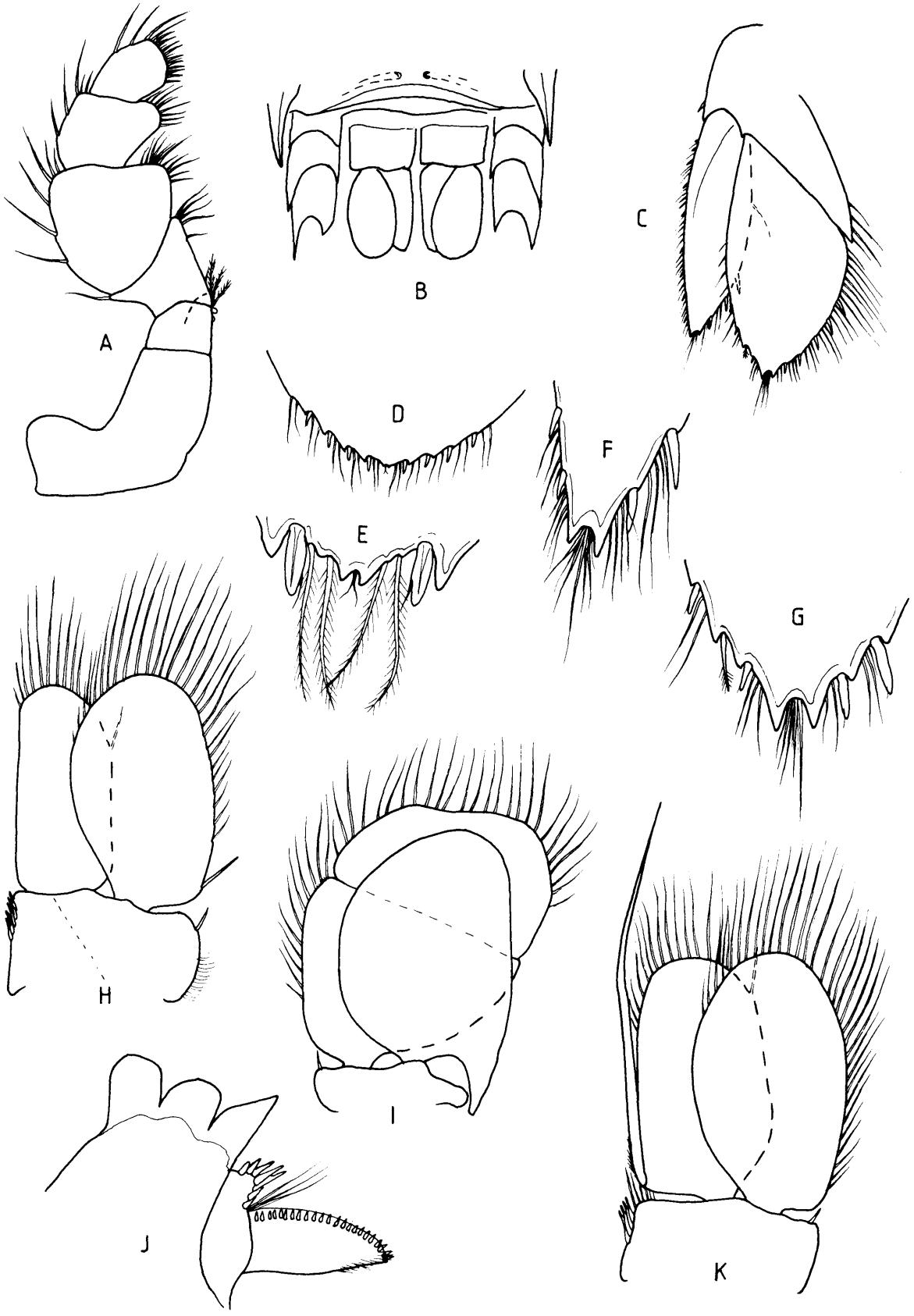

Fig. 122. *Cirolana erodiae* n. sp. A, holotype; remainder male paratype 7.0 mm. **A**, maxilliped; **B**, sternite 7; **C**, uropod; **D**, pleotelson, posterior margin; **E**, pleotelson apex; **F**, uropod exopod, apex; **G**, uropod endopod, apex; **H**, pleopod 1; **I**, pleopod 5; **J**, mandible, distal part; **K**, pleopod 2.

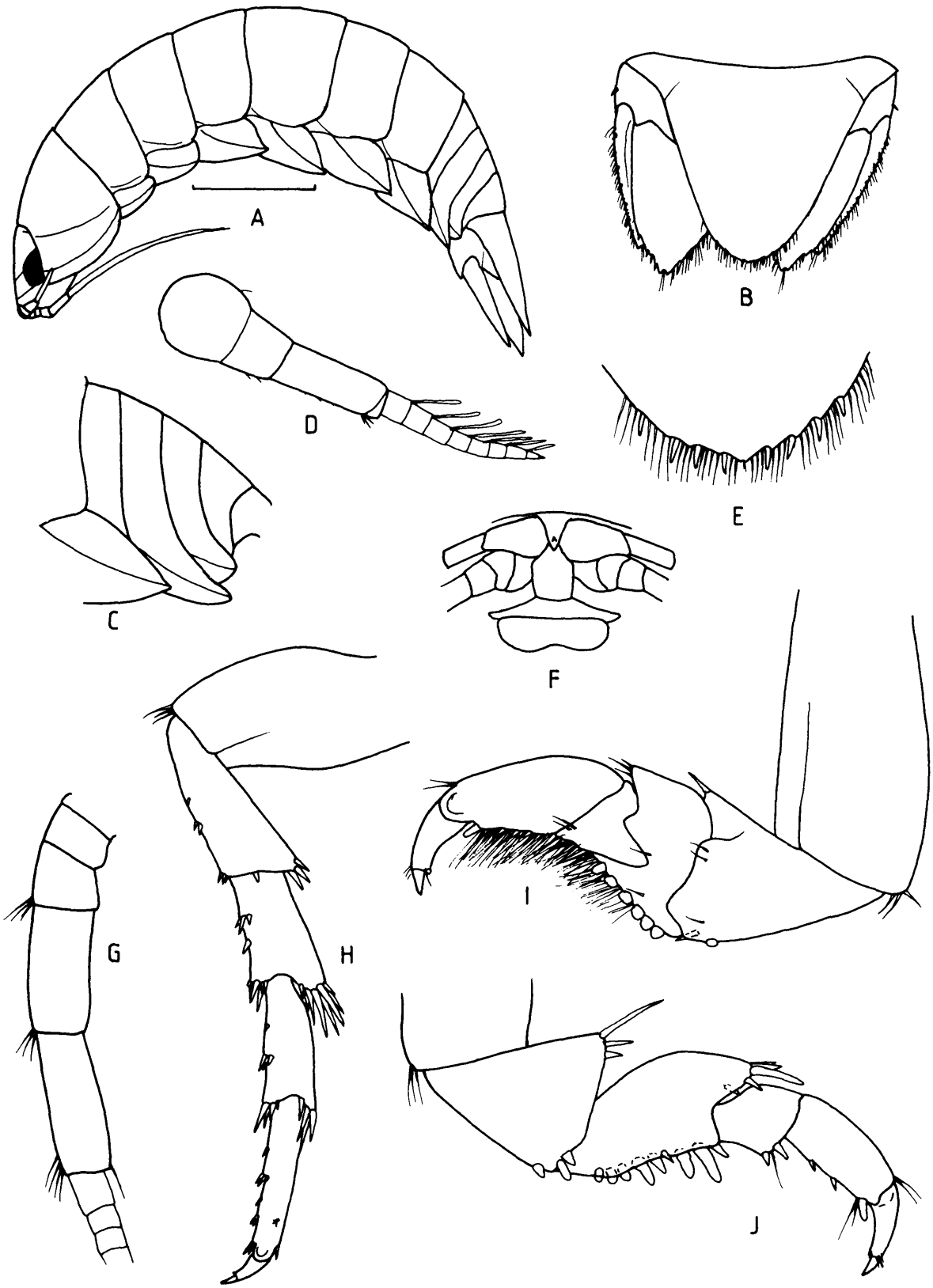

Fig. 123. *Cirolana hesperia* n. sp. A-C, F, 11.3 mm holotype; remainder male paratype 9.5 mm. **A**, lateral view; **B**, pleotelson, dorsal view; **C**, pleon lateral view; **D**, antennule; **E**, pleotelson, posterior margin; **F**, clypeal region; **G**, antennule peduncle; **H**, pereopod 7; **I**, pereopod 1; **J**, pereopod 2. Scale 2.0 mm.

of specimens from the Coral Sea, rather than 7-9 as in specimens from Heron Island.

Colour. All specimens are translucent with black or dark brown chromatophores in life. The chromatophores tend to form a band at the posterior of the dorsal surface of the pereonites.

Size. Males 3.5–8.3 mm, average 5.67 mm; females 3.7–7.2, average 5.84 mm. The smallest ovigerous female measured 4.5 mm. Mancas 2.0–4.0 mm.

Remarks. In only one trap sample did males have a setose first pereopod, and in these the development of the character was not conspicuous. Within the Capricorn Group, the species is uniform in appearance and there is no difficulty in separating this species from *C. brocha,* the other sympatric member of the group. The characters useful in identifying this species include the shape of the pleotelson, the bifid apices of the uropods, the spination of the uropods, the width of separation of the penes, and in mature males the greater length of the appendix masculina, which is also bent laterally.

Distribution. Eastern coast of Australia on reefs of the Great Barrier Reef, from the Capricorn Group in the south to Yonge Reef and Lizard Is. in the north; Coral Sea reefs from the Chesterfield Archipelago to Willis Island.

Etymology. The epithet is derived from *erodios,* a Greek word for Heron, and refers to the type locality.

Cirolana hesperia n. sp.

Figs 123, 124

Material examined. Male (9.5 mm), female (6.9 mm), Victoria Street, Cottesloe, WA, 16 Mar. 1961, coll. W.H. Butler. Male (7.2 mm), Point Perron, WA, 26 June 1966, 1 m, coll. W.M. Butler. Male (8.2 mm), Pt Perron, WA, 8 Sept. 1962, coll. W.H. Butler. 2 males (11.3, 8.3 mm), Bathurst Bay, Rottnest Is., WA. 10 females (5.3–8.3 mm), 16 females (5.0–8.2 mm), Parmelia Bank, 1 km west of Woodmans Point, WA, 13 Feb. 1972, coll. B.R. Wilson. Female (6.5 mm), south-west of Bongora, WA. 30°45′S, 114°54′E, 11 Aug. 1962, 60 m, coll. CSIRO. Male (6.3 mm), female (6.9 mm), Mondarin Is., Recherche Archipelago, WA, 6 Feb. 1960, in craypots, 18–36 m, coll. R.W. George. 2 males (6.9, 8.6 mm), 6 miles south-west of Rottnest Is., WA, 14 Feb. 1960, 60 m, coll. B.R. Wilson. Male (8.8 mm), 1.5 miles west of southern end Garden Is., WA, 13 July 1962, dredged 18 m, coll. R.W. George. Male (7.0 mm), west of Garden Is., WA, 32°01′S, 115°31.05′E, 8 Mar. 1972, 27–33 m, coll. L. Marsh & W.M. Shepperd. 2 males (6.9, 11.1 mm), 4 females (6.0–10.1 mm), off Carnac Is., near Fremantle, WA, 3 July 1962, in sand in craypots, 3.6 m. 3 males (6.2, 6.4, 6.6 mm), 10 females (6.9–10.2 mm), west side of Long Island, Recherche Archipelago, WA, 3 Feb. 1960, 1.8–9 m. Female (10.1 mm), Wharton Is., Recherche Archipelago, WA, 9 May 1960, in craypots, 2–18 m, coll. R.W. George.

Types. Holotype, male WAM 3-82. Paratypes WAM 47-80 to 55-80, 1346/62-30, 37-87, 5-82; AM P30365.

Type locality. Bathurst Bay, Rottnest Island, WA, 32°00′S, 115°33′E.

Description of male. Body about 2.5 times as long as wide. Cephalon with 2 entire interocular furrows. Pereonite 1 with 2 horizontal furrows on lateral sides; coxae of pereonites 2–7 each with complete furrow. Pleonite 1 concealed by pereonite 7, posterolateral margin of pleonite 3 acutely produced, those of pleonite 4 rounded. Pleotelson lateral margins very straight, posterior border rounded, with short plumose setae and 8 spines.

Antennule peduncle article 3 slightly shorter than combined length of articles 1 and 2; flagellum composed of about 9 articles, extending to pereonite 1. Antennal flagellum composed of about 26 articles, extending to pereonite 3.

Frontal lamina pentagonal, 1.3 times as long as greatest width.

Pereopod 1 with dense fringe of setae on distal half of merus; ischium with single spine at anterodistal angle, posterodistal angle with 1 acute and 1 blunt spine; merus with 6 blunt spines on posterior margin; propodus with 2 acute spines on palm, third blunt spine opposing dactylus. Pereopods 2–3 similar, articles other than basis proportionally longer than in pereopod 1, generally more spinose, except propodus. Pereopod 7 relatively slender, spination similar to others of group.

Vasa deferentia open flush with surface of sternite 7, separated by less than 0.2 width of sternite.

Pleopod 1 exopod and endopod subequal in length; lateral margin of endopod barely concave. Pleopod 2 appendix masculina about 1.5 times as long as endopod. Uropods extend slightly beyond apex of pleotelson. Exopod lateral margin straight, with 8 spines set amongst marginal setae; medial margin with 3 spines amongst long setae; apex bifid. Endopod with 2 spines, sensory seta and short plumose setae on lateral margin, medial margin with 6 stout spines set amongst plumose setae; apex bifid.

Female. Similar to male but for sexual characters.

Variation. Numerous males lack the setose fringe on pereopod 1, but are otherwise the same as the described specimens. The sample from Parmelia Bank contained 16 males, showing both forms, with and without the setose fringe.

Colour. In alcohol, dorsal surfaces with dense pattern of brown chromatophores.

Size. Largest male 11.3 mm, female 6.9 mm.

Remarks. At first sight this species appears nearly identical to *C. australiense.* The following characters of *C. hesperia* separate the two species: the palm of the propodus of pereopod 1 has 2 spines, the pleotelson is markedly broader, the lateral margin of uropodal exopod is straight, pleonite 4 has the posterolateral margins rounder, the antennule flagellum has fewer articles (9, *C. australiense* has 13), the shape of the endopod of pleopod 1 differs, and the appendix masculina is slightly longer.

Cirolana portula is also similar but can be distinguished by the sinuate uropod margins, and also by the far longer appendix masculina.

Distribution. Western Australia: Cottesloe, Rottnest Island, Pt Peron and Recherche Archipelago.

Etymology. *Hesperia* is a Latin word meaning western, and refers to the distribution of the species.

Cirolana improceros n. sp.

Figs 125, 126

Cirolana cranchii var *australiense*.—Holdich, Harrison & Bruce, 1981: 578, fig. 9 (Part) (not *Cirolana cranchii* Leach, 1818; not *Cirolana australiense* Hale, 1925).

Material examined. 4 males (4.4, 4.5, 5.3, 5.5 mm), 4 females (4.8 ovig, 5.1 ovig, 6.0, 6.5 mm), Table Head, Port Essington, Cobourg Peninsula, NT, 2 May 1982, in rubble, 2–4 m; male (4.8 mm), female (5.6 mm, ovig.), Sandy Is. ±2, Port Essington, Cobourg Peninsula, NT, 2 May 1982, in rubble, 13 m; coll NTM. Male (7.0 mm), 4 females (8.9, 6.2, 5.4, 4.9 mm), Bampfield Head, Thursday Is., Qld, April 1979, collected by beam trawl over sea grass, coll. P.C. Young. Male (7.5 mm), female (5.3 mm), Nina Bay, Hinchinbrook Is., Qld, 31 Aug. 1978, trap set amongst intertidal boulders, coll. NLB. Male (6.9 mm), female (5.1 mm), Ramsay Bay (southern end), Hinchinbrook Is., Qld, 29 Aug. 1978, trapped amongst oyster and granite rubble, coll. NLB. Female (6.2 mm), Kissing Point, Townsville, Qld, 11 May 1976, rock crevice, coll. D.M. Holdich. 2 males (5.1, 5.0 mm), females (5.5 mm), manca (3.3 mm), Horseshoe Bay, Magnetic Is., Qld, 25 Apr. 1976, from dead coral, coll. D.M. Holdich.

Types. Holotype, male (7.5 mm), QM W9836. Paratypes, QM W9837-W9839; AM P28780; USNM 190716; NTM Cr000233, Cr000234.

Type locality. Nina Bay, Hinchinbrook Island, Qld, 18°20'S, 146°17.5'E.

Description of male. Body about 2.75 as long as wide, cephalon with rostral process, anterior interocular carina and ill-defined furrow running from anteromedial angle of each eye. Pereonites 2–7 as for others of group. Pleonite 3 with posterolateral margins acute, moderately produced, pleonite 4 with posterolateral margins rounded. Pleotelson lateral margins convex, smoothly converging to apex; posterior margin with 8 spines set amongst plumose setae; apex with 2 short simple setae in shallow excision.

Antennule peduncle 3-articulate, flagellum composed of about 12 articles, extending to pereonite 1. Antenna with flagellum of about 22 articles, extending to posterior of pereonite 3.

Frontal lamina 1.6 times as long as greatest width, lateral margins diverging slightly, anterior margins concave; apex overlapped by rostral process. Clypeus 6.4 times wider than long. Mandible molar process lacks

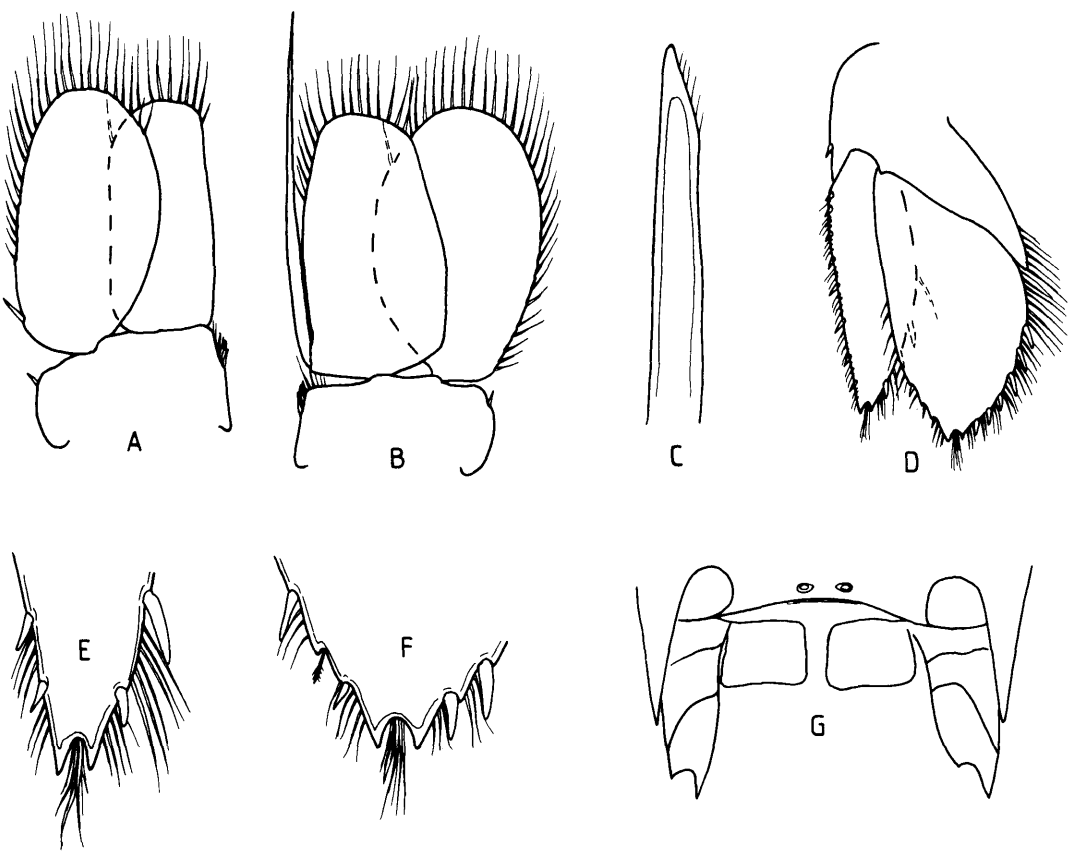

Fig. 124. *Cirolana hesperia* n. sp., male paratype 9.5 mm. **A**, pleopod 1; **B**, pleopod 2; **C**, appendix masculina, apex; **D**, uropod; **E**, uropod exopod, apex; **F**, uropod endopod, apex; **G**, sternite 7.

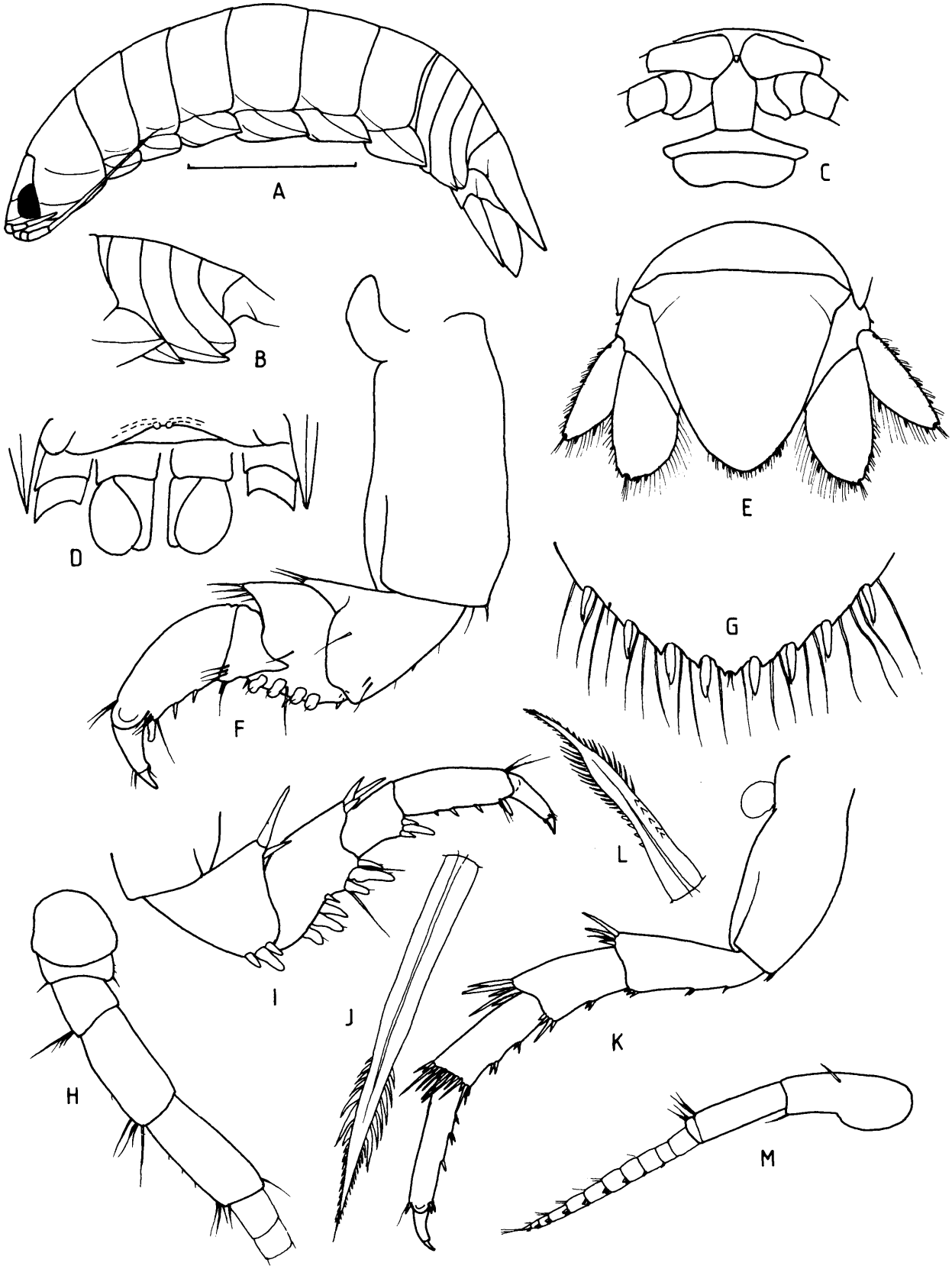

Fig. 125. *Cirolana improceros* n. sp. A–E, holotype; G, female paratype; remainder male paratype. **A,** lateral view; **B,** pleon, lateral view; **C,** clypeal region; **D,** sternite 7, ventral view; **E,** pleotelson and uropods; **F,** pereopod 1; **G,** pleotelson posterior margin; **H,** antennal peduncle; **I,** pereopod 2; **J,** spine, distal margin of carpus, pereopod 7; **K,** pereopod 7 (bobble on basis is an epizooite); **L,** spine, anterior distal angle of ischium, pereopod 7; **M,** antennule. Scale 2.0 mm.

setules on posterodistal surface.

Pereopod 1 robust, ischium with single spine at posterodistal angle; merus with 4 stout blunt spines and 2 acute spines on posterior margin; carpus with single spine and seta on posterior margin; propodus with 2 acute spines on palm and third robust spine opposing dactylus. Pereopods 2–3 similar; pereopod 2 with blunt spines at posterodistal angle of ischium; merus with 6 blunt and 1 acute spine on posterior margin, anterodistal angle with 3 spines on posterior margin. Pereopods 5–7 similar, pereopod 7 longest.

Penes present on sternite 7, set very close together, protruding very slightly.

Pleopod 1 endopod lateral margin distinctly concave, widest at two thirds of the way along its length. Pleopod 2 appendix masculina moderately robust, extending beyond endopod by 0.16 of its length, apex abruptly narrowed, slender, recurved. Uropods extending beyond apex of pleotelson, exopod slightly shorter than endopod. Exopod with continuous short marginal setae and 6 spines on lateral margin, medial margin with setae and 3 spines; apex unequally bifid, medial process more prominent. Endopod with 3 small spines, sensory setae and short setae on lateral margin; medial margin with 5 spines and continuous plumose setae; apex unequally bifid, medial process more prominent.

Female. Similar to male, but pereopod 1 slightly less robust, with posterior margin of merus bearing 6 spines which are not quite as robust as in male.

Variation. In the material from Hinchinbrook, the number of spines on the pleotelson varied from 7–9, though 8 would appear normal. The usual spination of the exopod is: medial margin 3 spines, lateral margin 6. Spination of the endopod is: medial margin 5, lateral 3.

Specimens from Torres Strait are identical except for the single male which has the lateral margin of the endopod of pleopod 1 rather straight, although the ramus is still broader distally than at the base.

Colour. Tan to white in alcohol, with black or brown chromatophores along the posterior of pereon and pleon segments.

Size. Males 4.8–7.5 mm, females 4.8–8.9 mm.

Remarks. The feature that at once separates the male of this species from all other Australian species is the presence of close set stubby protruding penes on sternite 7. Pereopod 1 of the male has only 4 robust spines on the posterior margin of the merus, rather fewer than most other species which usually have 5–6. *Cirolana*

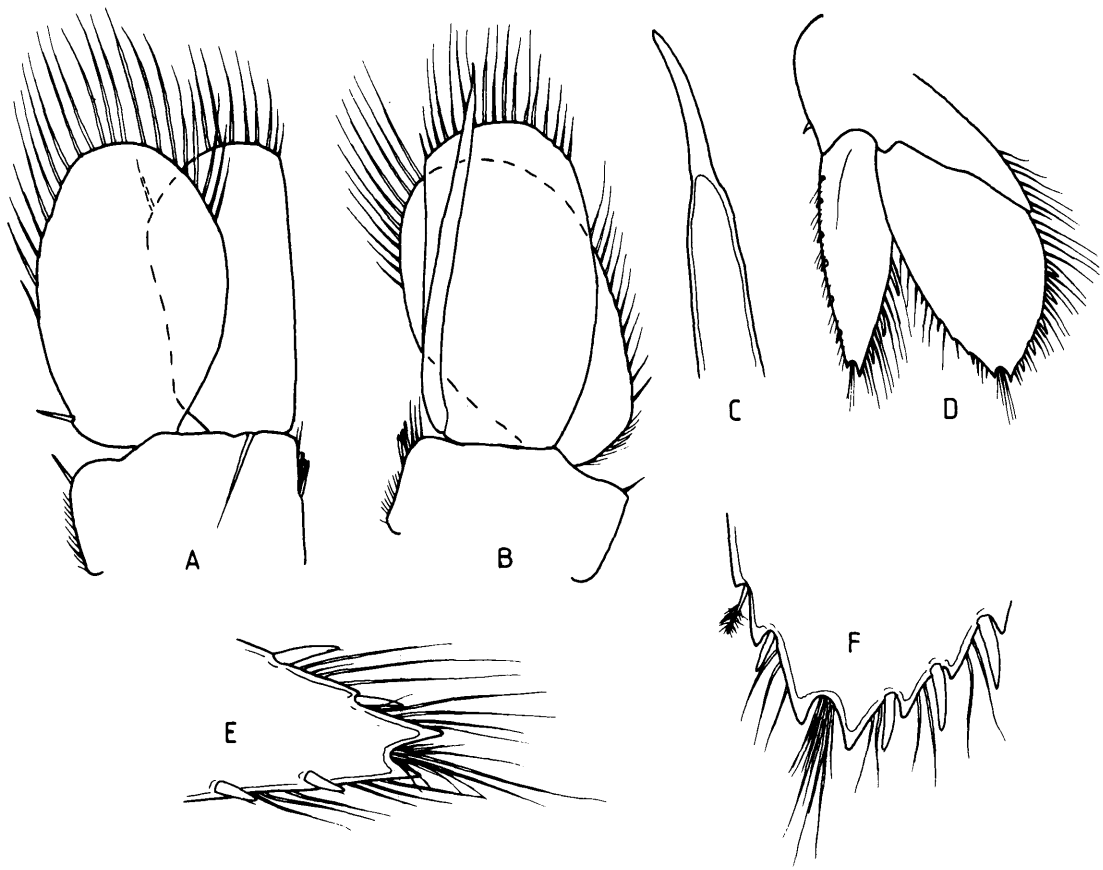

Fig. 126. *Cirolana improceros* n. sp., male paratype. **A**, pleopod 1; **B**, pleopod 2; **C**, appendix masculina, apex; **D**, uropod; **E**, uropod exopod, apex; **F**, uropod endopod, apex.

stenoura has only 4 spines, and also has a similar appendix masculina, but the vasa deferentia are further apart, and the pleotelson has only 6 spines.

Females are best identified by having a 3-articulate antennule peduncle, by the shape of the endopod of pleopod 1, spination of the pleotelson, and by the form of the uropod apices. The shape of the posterolateral margins of pleonite 4 is also useful in separating this species from others.

Distribution. Queensland: Townsville, Hinchinbrook Island. North and westwards to Thursday Island, Torres Strait and the Northern Territory.

Etymology. *Improceros* is a Latin word meaning undersized, and alludes to the shortness of the appendix masculina.

Cirolana mekista n. sp.

Figs 127, 128

Cirolana cranchii Leach, var. *australiense*.—Holdich, Harrison & Bruce, 1981: 578, fig. 9 (part) (not *Cirolana cranchii* Leach, 1818; not *C. australiense* Hale, 1925).

Material examined. 7 males (4.3–5.0 mm), 9 females (3.5–4.0 mm), 8 mancas (2.9–3.0 mm), Black Point, Port Essington, Cobourg Peninsula, NT, 11°9.0′S, 132°51.4′E, 18 July 1981, shore isopod traps, coll. NTM. Male (6.9 mm), 6 females (6.9–8.2 mm), Cairns, Qld., coll. CSIRO, no other data. Male (dissected), 2 females (7.6, 5.6 mm), Kissing Point, Townsville, Qld, 10 July 1976, wedged in rocks; male (5.5 mm, imm.), Townsville Harbour, Qld, 11 July 1976, among barnacles and tubeworms on pontoon, coll. D.M. Holdich. 3 males (6.2, 6.9, 8.2 mm), 2 females (5.6 ovig., 6.2 mm), manca (2.7 mm), Port Curtis, Qld, 1975, dredged; male (6.9 mm), Calliope River, Gladstone, Qld, 1975, coll. P. Saenger. Female (6.8 mm), Broome, WA, 9 Oct. 1975; male (4.9 mm, imm.), Broome, WA, 24 Sept. 1975, in mangroves; male (6.3 mm), Port Hedland, WA, 27 Sept. 1975, coll. Hartmann & Hartmann-Schroeder.

Types. Holotype, male, QM W9830. Paratypes, QM W9831–W9835; AM P30399, P32685; WAM 6-82, 7-82; NTM Cr.000230–Cr.000232.

Type locality. Gladstone, Qld, 23°50′S, 151°16′E.

Description of male. Body about 2.75 times as long as wide. Cephalon with interocular carina along anterior margin, with faint furrow running from anterodorsal angle of each eye. Pereonites and coxae similar to other species of group. Pleonites 2–3 with posterolateral margins acute, pleonite 3 posteriorly produced; pleonite 4 with posterolateral margins rounded, dorsal part slightly concave. Pleotelson lateral margins convex; posterior margin broadly rounded, armed with 8 spines on either side of which lie 2 short setae.

Antennule peduncle biarticulate, flagellum extending to pereonite 1, composed of about 12 articles. Antennal flagellum composed of about 30 articles, extending to pereonite 4.

Frontal lamina pentagonal, 1.75 times longer than greatest width, anterior part overlapped by rostral process; maxilliped with shorter setae than other species.

Pereopod 1 with dense mass of setae along posterior margin of all articles except basis; ischium with 2 acute spines at anterodistal angle, posterodistal angle with 1 blunt spine; merus with 6 tubercular spines; carpus with single spine on posterior margin; propodus with stout spine opposing dactylus and 2 spines on palm. Pereopods 2–3 similar, less robust than pereopod 1, with more abundant and larger spines on ischium, merus and carpus.

Vasa deferentia opening flush with surface of sternite 7, separated by about 0.1 width of sternite.

Pleopod 1 endopod lateral margin concave; pleopod 2 appendix masculina twice as long as endopod, apex lateral margins with microtrichs, bluntly rounded. Uropods extending slightly beyond apex of pleotelson. Exopod slightly shorter than endopod, lateral margin with 7 spines, medial margin with 3 spines; apex bifid. Endopod lateral margin with 3 spines, medial margin with 5 spines, apex bifid.

Female. Similar to male, but pereopod 1 slightly less robust; with 1 blunt and 2 acute spines at posterodistal angle of ischium; 6 blunt and 9 acute spines on posterior margin of merus.

Variation. Two males were encountered that had not yet achieved full development of the appendix masculina. These males lacked the setal fringe on pereopod 1, but the appendix masculina was very slender and clearly about 1.5 times longer than the endopod.

Colour. White to cream to pale brown in alcohol, with chromatophores forming a faint band at the posterior of the dorsal surfaces of the segments.

Size. Largest male 6.9 mm, largest female 8.2 mm.

Remarks. The males are immediately identified by the very long appendix masculina and the mass of setae on the posterior margins of pereopod 1 (all articles except basis and dactylus). Females are far harder to identify, but can be distinguished from females of *C. improceros* by lacking the distinctly rounded pleonite 4, which has the superior part of the posterolateral margin convex. Females of *C. erodiae* are also very similar and are best separated by the shape of the endopod of pleopod 1, the slightly different arrangement of spines on the posterior margin of the pleotelson, the shorter setae on the lateral margin of the maxilliped, having more spines on the lateral margin of the uropodal exopod, and also in having a 4-articulate antennule peduncle.

Distribution. Queensland: Gladstone, Townsville and Cairns; Northern Territory: Cobourg Peninsula; north Western Australia: Broome and Port Hedland.

Etymology. Derived from the Greek word *mekos* (length) combined with the superlative - *istos,* and alludes to the length of the appendix masculina.

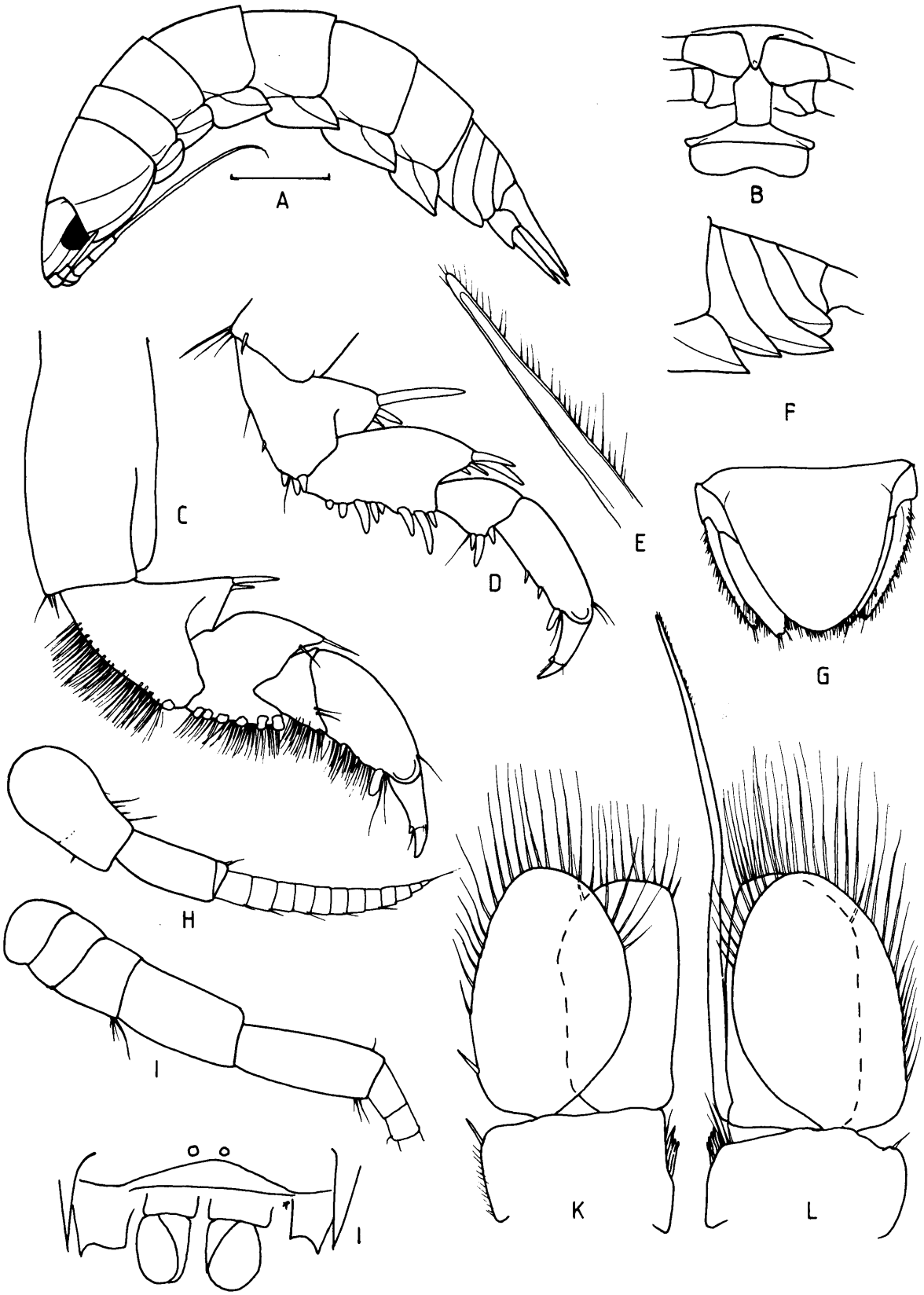

Fig. 127. *Cirolana mekista* n. sp. A-C, E-G, J, L, holotype; remainder female paratype, Cairns. **A**, lateral view; **B**, clypeal region; **C**, pereopod 1; **D**, pereopod 2; **E**, appendix masculina, apex; **F**, pleon lateral view; **G**, pleotelson, dorsal view; **H**, antennule; **I**, antennal peduncle; **J**, ventral view, sternite 7; **K**, pleopod 1; **L**, pleopod 2. Scale 1.0 mm.

Cirolana portula n. sp.

Figs 129, 130

Material examined. 2 males (10.5, 6.3 mm), female (10.5 mm), CPBS Stn. C4, Crib Point, Western Port, Vic., 28°21'S, 145°14'E, 29 Sept. 1964, Smith MacIntyre Grab, 12 m. Female (8.8, ovig.), Crib Point, Western Port, Vic., 12 Oct. 1964, depth of 8.9 m. Female (8.2 mm, ovig.), Western Port Bay, Vic., 25 Nov. 1974, all coll. Ministry for Conservation, Vic. About 300 males and females with no data other than "Tasmania".

Types. Holotype, male (10.5 mm) NMV J1128. Paratypes, NMV J1343, J1344; AM P32169, P32170.

Type locality. Crib Point, Western Port, Vic., 38°23'S, 145°14'E.

Description of Western Port male. Body 2.75–3 times as long as wide, cephalon with dorsal interocular furrow, and furrow running posterior to anterior margin. Pereonite 1 with 2 horizontal furrows, coxal plates of pereonites 2–7 each with a complete furrow. Pleonite 1 largely concealed by pereonite 7; posterolateral margins of pleonites 3–4 produced, both moderately narrow, those of pleonite 3 acute, those of pleonite 4 rounded. Pleotelson lateral margins very nearly straight, converging smoothly to narrowly rounded apex; posterior margin with 8 spines set amongst short plumose setae.

Antennule peduncle 4-articulate; flagellum extending to pereonite 1, composed of about 9 articles, first of which is distinctly longest; antenna flagellum reaching pereonite 4, composed of about 24 articles.

Frontal lamina lateral margins slightly divergent, anterior margins concave; apex overlapped by rostral process.

Pereopod 1 with mass of setae along posterior margin of propodus and carpus; merus with setae less dense; merus with 6 stout and 3 acute spines on posterior margin, carpus with single spine, propodus with 2 spines on palm, 3rd robust spine opposing dactylus. Pereopods 2–3 similar, less robust and more spinose than pereopod 1. Pereopod 7 similar to the other species of the group, but articles more robust.

Penes opening flush with ventral surface of sternite 7, separated by about 0.1 width of sternite.

Pleopod 1 endopod lateral margin only very slightly concave. Pleopod 2 appendix masculina slender, 1.8 times longer than endopod, apex curved medially. Uropods projecting slightly beyond apex of pleotelson. Exopod shorter than endopod, lateral margin slightly sinuate, with 7 spines set between marginal setae; medial margin with 3 long spines and long plumose setae; apex appearing narrow and produced, subequally bifid, lateral process being more prominent. Endopod with 3 spines and sensory setae on sinuate lateral margin, short plumose setae along distal half; medial margin with 5 spines set amongst long plumose setae; apex slightly produced, markedly bifid, with lateral process most prominent.

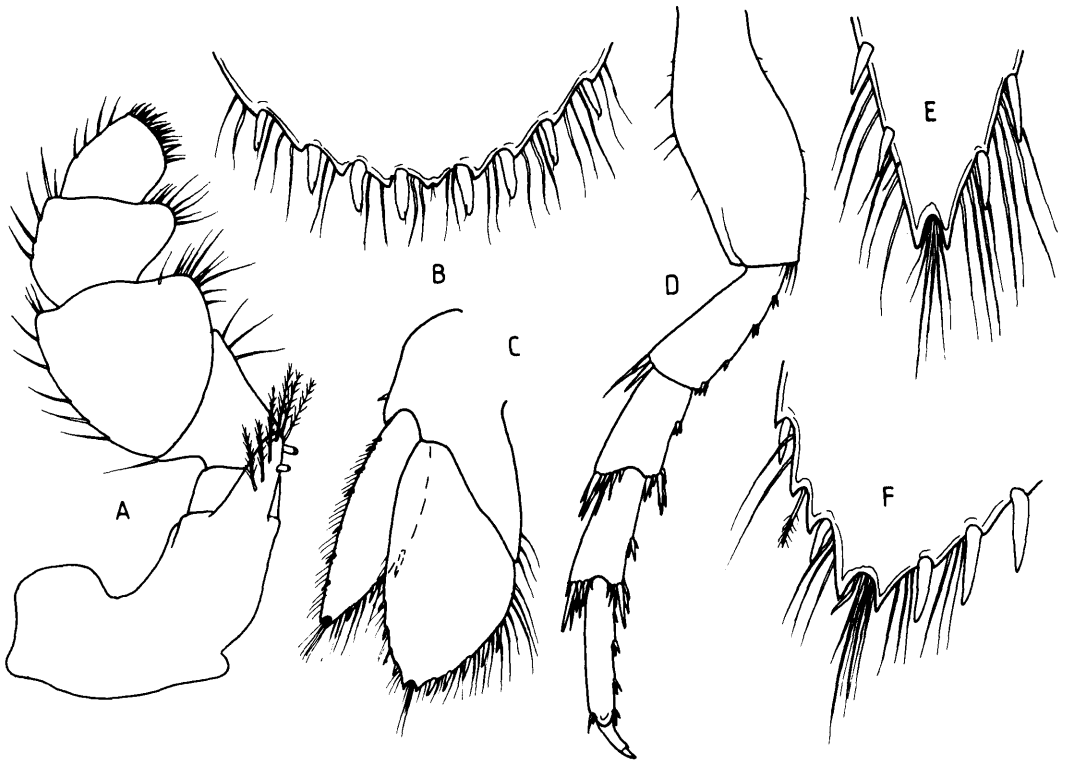

Fig. 128. *Cirolana mekista* n. sp., female paratypes, Cairns. **A**, maxilliped; **B**, pleotelson, posterior border; **C**, uropod; **D**, pereopod 7; **E**, uropod exopod, apex; **F**, uropod endopod, apex.

Female. Only differing from male by sexual characters.

Variation. A series of about 300 specimens were received from Tasmania, unfortunately in a somewhat dried out state and without data. These appear to be the same species as *C. portula* but differ in males not having a setose pereopod 1, and in the uropod endopod being more or less equally bifid. The appendix masculina is as long as the type males of *C. portula* but only slightly curved.

Colour. Brown in alcohol, eyes red or dark brown.

Size. Largest male 10.5 mm, females 8.3–10.5 mm.

Remarks. The characters that most readily separate this species from others of the group are the sinuate

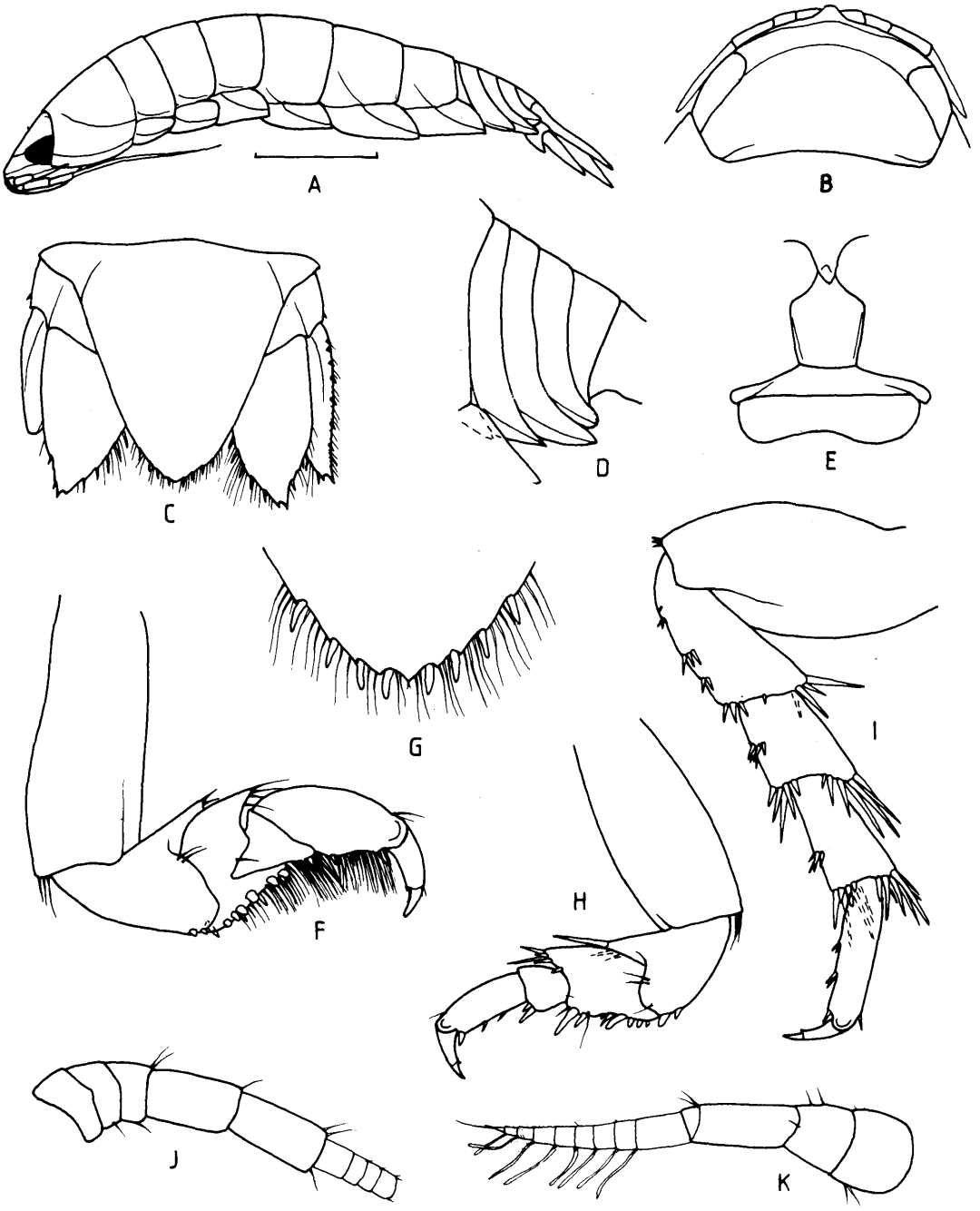

Fig. 129. *Cirolana portula* n. sp. A–C, E, F, holotype; remainder female paratype. **A**, lateral view; **B**, cephalon, dorsal view; **C**, pleotelson and uropods; **D**, pleon, lateral view; **E**, clypeal region; **F**, pereopod 1; **G**, pleotelson, posterior margin; **H**, pereopod 2; **I**, pereopod 7; **J**, antennal peduncle; **K**, antennule. Scale 2.0 mm.

shape of the uropod lateral margins, the greater length of the spines on the medial margin of the uropods, and the elongate appendix masculina of the male. Other useful characters include the unequally bifid uropod apices, the proportions of pereopod 7, and the shape of the posterolateral margins of the pleonites.

Of the two males, only one, the holotype, had a setose first pereopod, the smaller male lacked this feature, but otherwise was similar.

Distribution. Victoria: Western Port; Tasmania.

Etymology. *Portula* is the diminutive of the Latin word *porta* (= door) and refers to the type locality.

Cirolana solitaria n. sp.

Figs 131, 132

Material examined. Male (6.9 mm), S.W. Solitary Is., NSW, 17 May 1972, small ascidian covered bounders. 3 males (5.0, 5.6, 5.7 mm), S.W. Solitary Is., NSW, 17 May 1972. 8 males (5.0–6.5 mm), 8 females (5.0–6.9 mm) west side of Solitary Is., NSW, 18 May 1972, in clumps of coral and ascidians. 6 males (5.0–6.2 mm), 7 females (4.9–5.7 mm), west side of Solitary Is., NSW, 19 May 1972, in clumps of coral and ascidians, coll. P. Hutchings & P. Weate.

Types. Holotype, male AM P32381. Paratypes, AM P30349, P30367-P30372.

Type locality. Solitary Islands, NSW, 29°53′E, 145°47′E.

Description of male. Body slightly more than 2.5 times as long as wide. Cephalon with rostral process, anterior margin with interocular carina and distinct furrow running from anteromedial angle of each eye. Pereonite 1 about twice as wide as pereonite 2, all coxae with distinct carina; coxae of pereonites 4–7 with posteroventral angle produced to small point. Pleonite 1 almost entirely concealed by pereonite 7, posterolateral margins of pleonites 3–4 rounded. Pleotelson with lateral margins straight, converging smoothly to broadly rounded, feebly serrate posterior margin armed with 8 stout spines.

Antennule peduncle articles 1–2 appearing fused

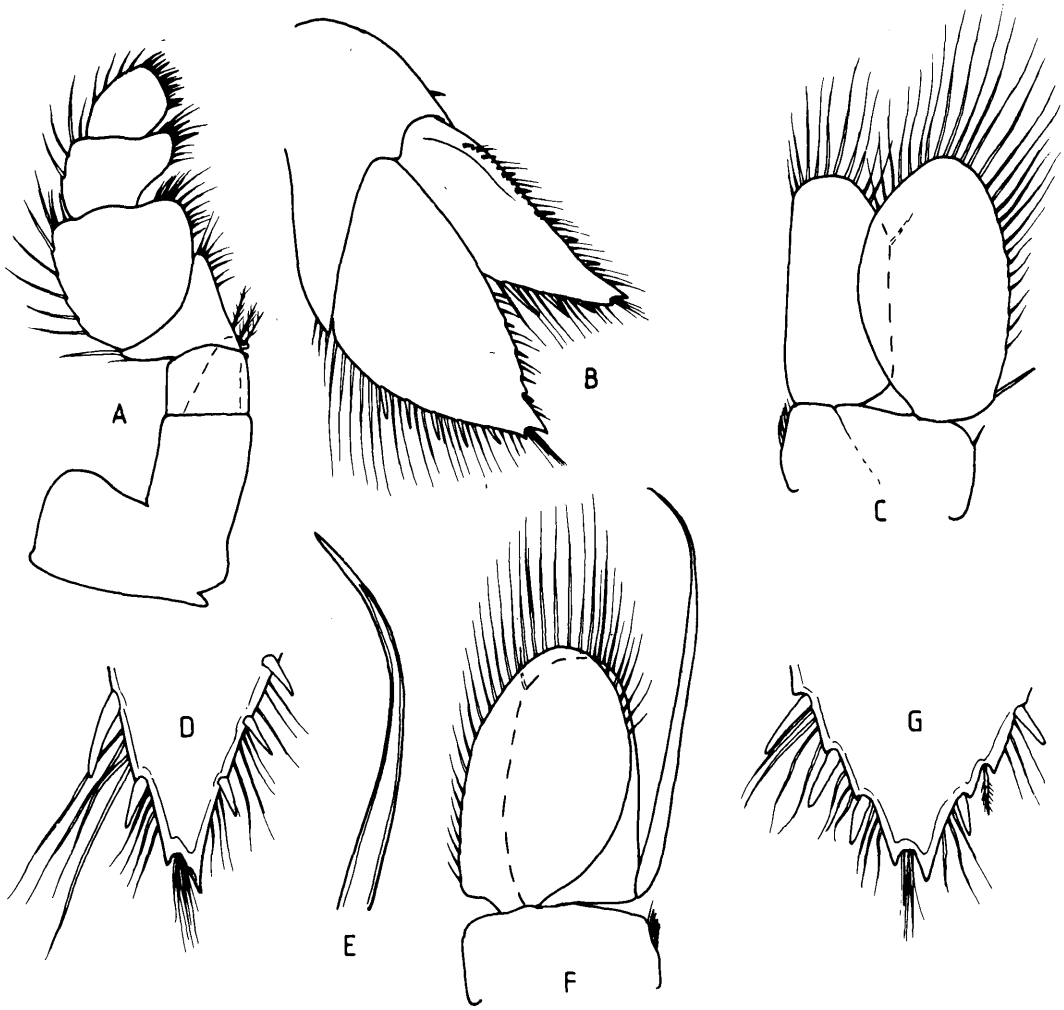

Fig. 130. *Cirolana portula* n. sp. A–D, G, female paratype; E, F, holotype. **A**, maxilliped; **B**, uropod; **C**, pleopod 1; **D**, uropod exopod, apex; **E**, appendix masculina, apex; **F**, pleopod 2; **G**, uropod endopod, apex.

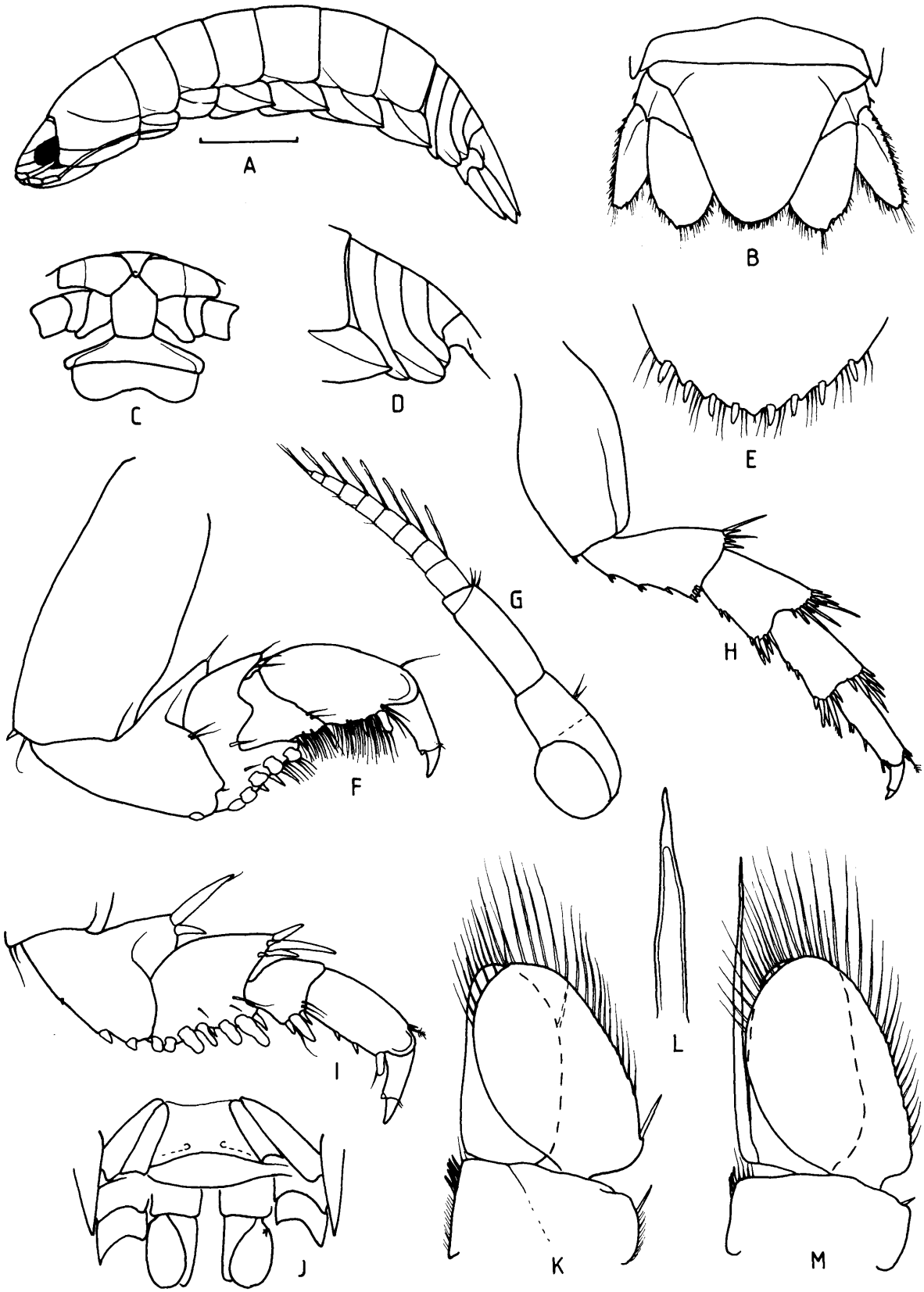

Fig. 131. *Cirolana solitaria* n. sp. A–E, holotype; remainder male paratype. **A**, lateral view; **B**, pleotelson, dorsal view; **C**, clypeal region; **D**, pleon, lateral view; **E**, pleotelson, posterior margin; **F**, pereopod 1; **G**, antennule; **H**, pereopod 7; **I**, pereopod 2; **J**, ventral view, sternite 7; **K**, pleopod 1; **L**, appendix masculina, apex; **M**, pleopod 2. Scale 1.0 mm.

although suture is distinct; flagellum composed of about 8 articles extending to pereonite 1. Antenna flagellum extending to posterior of pereonite 2, composed of about 20 articles.

Frontal lamina about 1.5 times longer than broad, lateral margins diverging slightly, anterior margins slightly concave, apex overlapped by rostral process.

Pereopod 1 with fringe of setae on posterior margins of propodus, carpus and distal half of merus; ischium with shallow blunt tubercular spine at posterodistal angle; merus with posterior margin feebly sinuate, with 5 tubercular and 2 acute spines; propodus with 2 acute spines on palm, and stout spine opposing dactylus. Pereopods 2–3 similar, anterodistal angles of ischium and merus with 2 and 5 spines respectively; posterior margins of ischium and merus with 2 and 7 stout spines respectively, merus with additional acute spine; carpus with 1 large and 2 smaller spines on posterodistal margin; propodus with 2 spines on palm. Pereopod 7 with spination similar to other members of group, but articles 4–5 distinctly shorter, width to length ratios of (ischium to propodus) 1:1.7, 1:1.2, 1:1.6 and 1:3.6.

Vasa deferentia open flush to surface of sternite 7, separated from each other by slightly more than 0.1 width of sternite (0.145).

Pleopod 1 endopod margins subparallel, lateral margin tapering from slightly more than 0.66 of its length. Pleopod 2 appendix masculina exceeding endopod by slightly more than one third of its length (0.35), apex narrow. Uropods extending slightly beyond apex of pleotelson, rami subequal in length. Endopod medial margin feebly serrate, armed with 5 spines and marginal setae, lateral margin distinctly serrate with 3 small spines and single sensory setae, marginal setae present in distal half only; apex shallowly bifid. Exopod with 3 spines and marginal setae on medial margin, lateral margin with 7 spines and continuous marginal setae; apex bifid.

Females. Females lack setose margin of pereopod 1, and in characters other than sexual, are indistinguishable from males.

Variation. All specimens present a constant appearance, except for some aberrations of spines on the uropods. One specimen had 9 spines on the medial margin of one endopod. A total of 36 specimens were examined and the normal spination is as follows: pleotelson with 8 spines (86%), uropodal endopod with 5 spines on medial margin, 3 on lateral (72%), 6 on medial, 3 on lateral (13%). Uropodal exopod with 3 spines on medial margin 7 on lateral (92%); larger specimens had an extra spine on the lateral margin.

Colour. All densely covered by brown chromatophores.

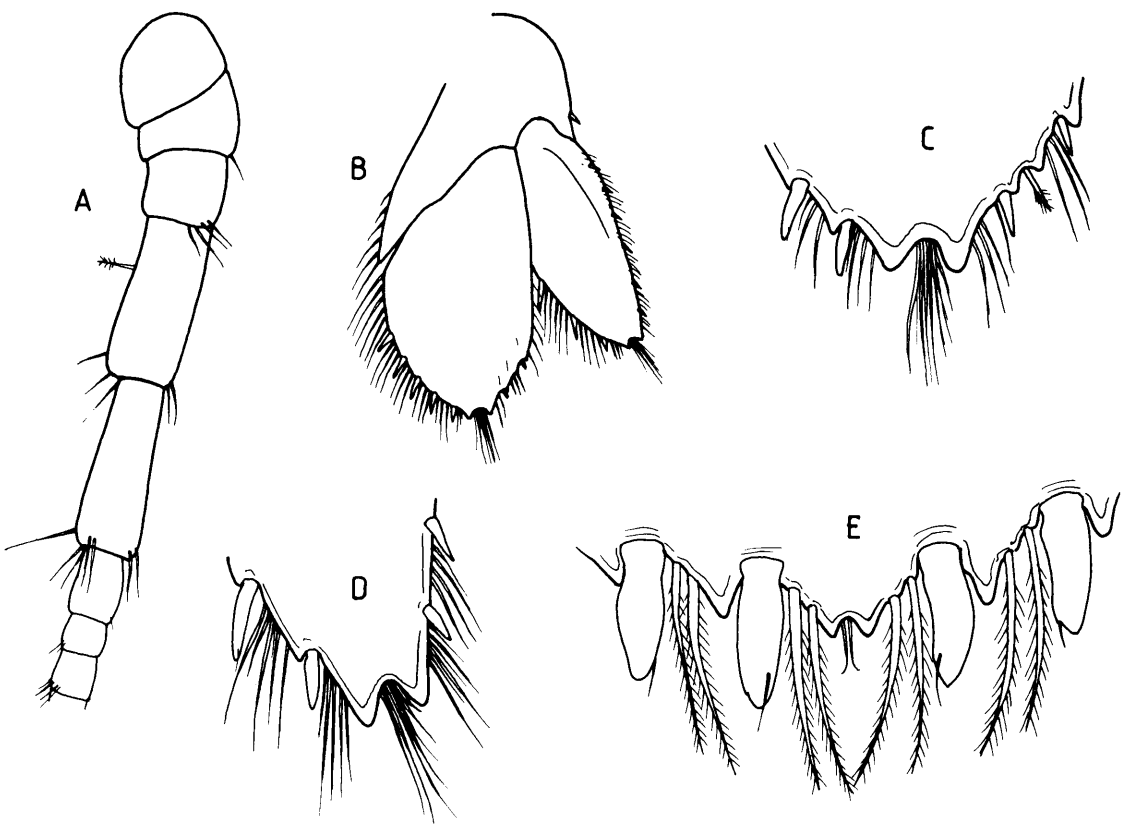

Fig. 132. *Cirolana solitaria* n. sp., male paratype. **A**, antennal peduncle; **B**, uropod; **C**, uropod endopod, apex; **D**, uropod exopod, apex; **E**, pleotelson, apex.

Size. Males 5.0–6.9 mm, females 4.9–6.9 mm. Females were ovigerous from 5.0 mm upwards.

Remarks. A variety of characters separates this species from others of the group. The far rounder posterolateral margin of pleonites 3 and 4 together with the short articles of pereopods 6 and 7 separate this species from most others. *Cirolana australiense* has a far narrower pleotelson, and pleopod 1 and the uropods differ in their shape and spination. *Cirolana brocha* has 10 spines on the pleotelson and lacks bifid apices to the uropods. *Cirolana erodiae* has a distinct appendix masculina and the clypeus of all species vary slightly from each other. *Cirolana stenoura* from Lizard Is., has only 6 spines on the pleotelson, has the antennule peduncle distinctly 3-articulate, and a distinct appendix masculina.

Distribution. Solitary Islands, NSW.

Etymology. *Solitaria* is a Latin word meaning alone, and refers to the type locality.

Cirolana stenoura n. sp.

Figs 133, 134

Material examined. Male (7.5 mm), 2 females (7.6, ovig., 8.0 mm), Lizard Is., Qld, 16 Apr. 1978, between Research Point and Freshwater Beach, littoral, on clumps of oysters, coll. P. Weate, S. Oldfield, P. Berents. Female (7.7 mm), islet at north end of Kranket Is., Madang, New Guinea, 25 May 1970, coll. W. Ponder, B. Coleman. Male (5.1 mm), Nightcliffe, Darwin, NT, 26 June 1980, in intertidal sandstone, coll. NLB.

Types. Holotype, female (8.0 mm) AM P32168. Paratypes AM P27015, P30351; NTM Cr000236.

Type locality. Lizard Island, Great Barrier Reef, Qld, 14°41.4'S, 145°27.5'E.

Description of male. Body about 2.5 times as long as wide. Cephalon with downwardly projecting rostral point; anterior margin with submarginal interocular carina. Pleonites visible, pleonites 2–3 with posterolateral margins moderately produced, not narrow, each with horizontal furrow; pleonite 4 posterolateral margins broadly rounded. Pleotelson lateral margins straight, converging to narrowly rounded apex armed with 6 stout spines; posterior margin not serrate, up to 6 setae placed proximally to proximal spine at each side.

Antennule peduncle 3-articulate, second article 1.05 times as long as first; flagellum composed of about 12 articles, extending to pereonite 1. Antenna flagellum extending to pereonite 3.

Frontal lamina 1.3 times as long as greatest width, lateral margins diverging slightly, anterior margins convex; apex overlapped by rostral process.

Pereopod 1 without fringe of setae on distal articles; posterior margins of merus with 4 tuberculate spines and 2 acute spines, carpus with single spine and setae; propodus with 3 small spines on palm and fourth opposing dactylus; dactylus noticeably more robust than other species. Pereopods 2–3 similar, far more spinose than pereopod 1; palm of propodus with 2 spines. Pereopod 7 similar to other species of group.

Vas deferentia opening flush with ventral surface of sternite 7; separated by little more than 0.1 width of sternite.

Pleopod 1 endopod lateral margin straight. Pleopod 2 appendix masculina extending beyond endopod by 0.2 its length, apex with appendiculate projection. Pleopods 3–5 with complete suture across exopod; endopod of pleopod 3 with 7 setae, endopod of pleopod with 4 setae. Uropods extending distinctly beyond apex of pleotelson, rami subequal in length. Exopod with 8–10 spines on lateral margin, 3 spines on medial margin, apex shallowly bifid. Endopod with 2 spines on lateral margin, 6 on medial margin. Both rami without obvious serrations, with marginal setae.

Female. Other than sexual characters, no significant differences.

Variation. The spine present on the medial margin of uropodal peduncle figured was present only on that particular uropod. All females had only 2 spines on the palm of the propodus of pereopod 1. All specimens had 6 spines on the pleotelson apex, but unfortunately the uropod spination could not be checked accurately as the Lizard Island material was not in good condition. The spination given would appear typical. The small male from Darwin had 5 spines on the medial margin of the endopod.

Colour. Specimens from Lizard Island and Madang have the entire dorsal surfaces, uropods, antennule, frontal lamina and clypeus covered by brown chromatophores; the Darwin specimen had brown chromatophores on the mediodorsal surface.

Size. Male, 7.5 mm; largest female, 8.0 mm.

Remarks. The largest female was chosen as holotype, as the largest male had several malformed appendages and could not be taken as typical. As with other species, the pleotelson and uropod shape and spination is diagnostic. The form of the pleonites is also a good character in asssisting species determination. The biarticulate antennule peduncle, the short appendiculate appendix masculina in conjunction with lack of penes separates this species from all others.

Distribution. Lizard Island, northern Great Barrier Reef; Darwin, NT; and Madang, Papua New Guinea.

Etymology. The epithet is derived from a combination of the Greek words *steno* (= narrow) and *oura* (= tail).

Cirolana schioedtei Miers

Fig. 135

Cirolana schioedtei Miers, 1884: 302, pl. 33A, a, a'.— Nierstrasz, 1918: 103, pl. IX fig. 1, 2, 16–19; 1931: 151; Hale, 1925: 148, fig. 10; Holdich, Harrison & Bruce, 1981: 581, fig. 10; Bruce, 1981b: 961.

Material examined. Male (25.0 mm), 2 females (26.5, 30.2 mm), Broome, northwestern WA, 26 Feb. 1917, coll. E.J.

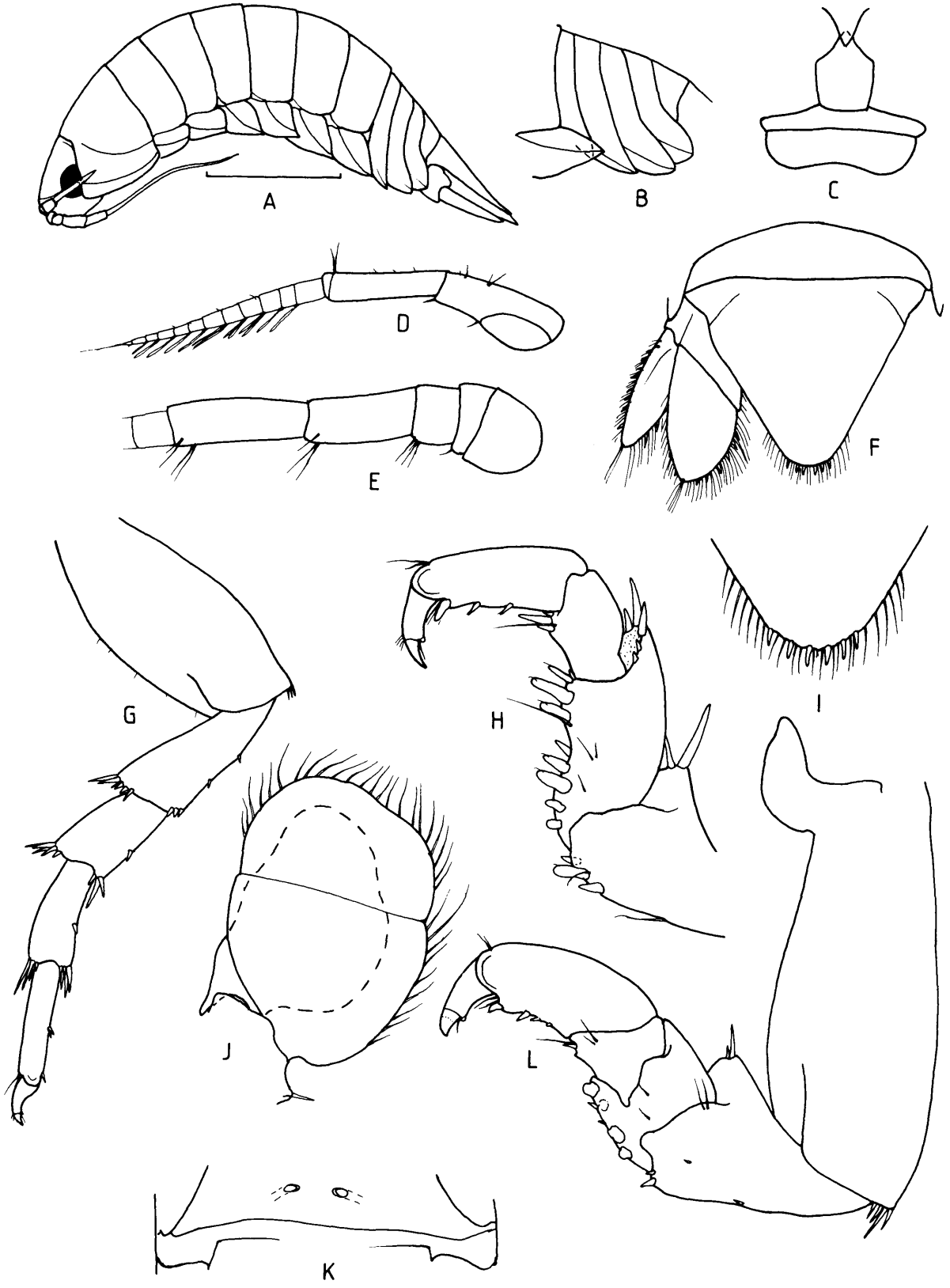

Fig. 133. *Cirolana stenoura* n. sp. A–C, holotype; F, I, J, female paratype, Madang; remainder male paratype 7.5 mm. **A**, lateral view; **B**, pleon, lateral view; **C**, frontal lamina, clypeus and labrum; **D**, antennule; **E**, antennal peduncle; **F**, pleotelson; **G**, pereopod 7; **H**, pereopod 2; **I**, pleotelson apex; **J**, pleopod 5; **K**, ventral surface, sternite 7; **L**, pereopod 1. Scale 2.0 mm.

Stuart (each animal bearing a metal tag, numbering 9372, 9375, 9376). 4 females (17.8, 20.1, 20.6, 22.6 mm), Derby, WA, 1975, coll. V. Semenuik. Male (17.0 mm), 30 miles north of Dampier, Archipelago, WA, 2 June 1960, 65.8 m, sand, coll. Royce. Female (29.6 mm), west of North West Cape, WA, 21°48'S, 113°56'E, 1 Feb. 1964, 120–126 m, beam trawl, CSIRO Stn 24. Female (25.2 mm), 40 miles off Barrow Island, WA, *Big John* oil rig, Dec. 1974, coll. Lynn Harris. 2 females (16.4, 17.6 mm), south-west of Geraldton, WA, 29°5'S, 113°50'E, 16 Feb. 1964, 128–146 m, CSIRO Stn 54. Female (20.1 mm, ovig.) west-north-west of Rottnest Is., WA, 14 Aug. 1962, 171–173 m, dredged on sponges, coll. R.W. George. Male (23.8 mm), Darwin, NT, 14 Nov. 1970, sand bar No. 1, coll. O.J. & J. Cameron. Female (17.6 mm), Torres Straits, Qld, 10°44'S, 144°07'E, 16 March 1975, 54 m, *Alpha Helix* Stn 4, coll. Ball & Paxton. Female (15.7 mm), Halifax Bay, Townsville, Qld, 22 Oct. 1974, 16.3 m, mud on sandy mud, coll. P. Arnold. Female (35.5 mm), Hayman Is., Whitsunday Group, Qld, Jan. 1936, coll. H. Groyer.

Types. Held by the British Museum of Natural History.

Type locality. Arafura Sea. Miers (1884) examined several specimens but, from his text, he appears to be describing the specimens from the Arafura Sea.

Descriptive notes. This species has been described in detail by Hale (1925) and by Holdich et al. (1981). Anterior margin of cephalon with interocular carina, and submarginal interocular furrow. Pleonite 1 concealed by pereonite 7, pleonite 2 with posterolateral angles acute, pleonite 3 with posterolateral angles produced to posterior of pleon, with 3 longitudinal

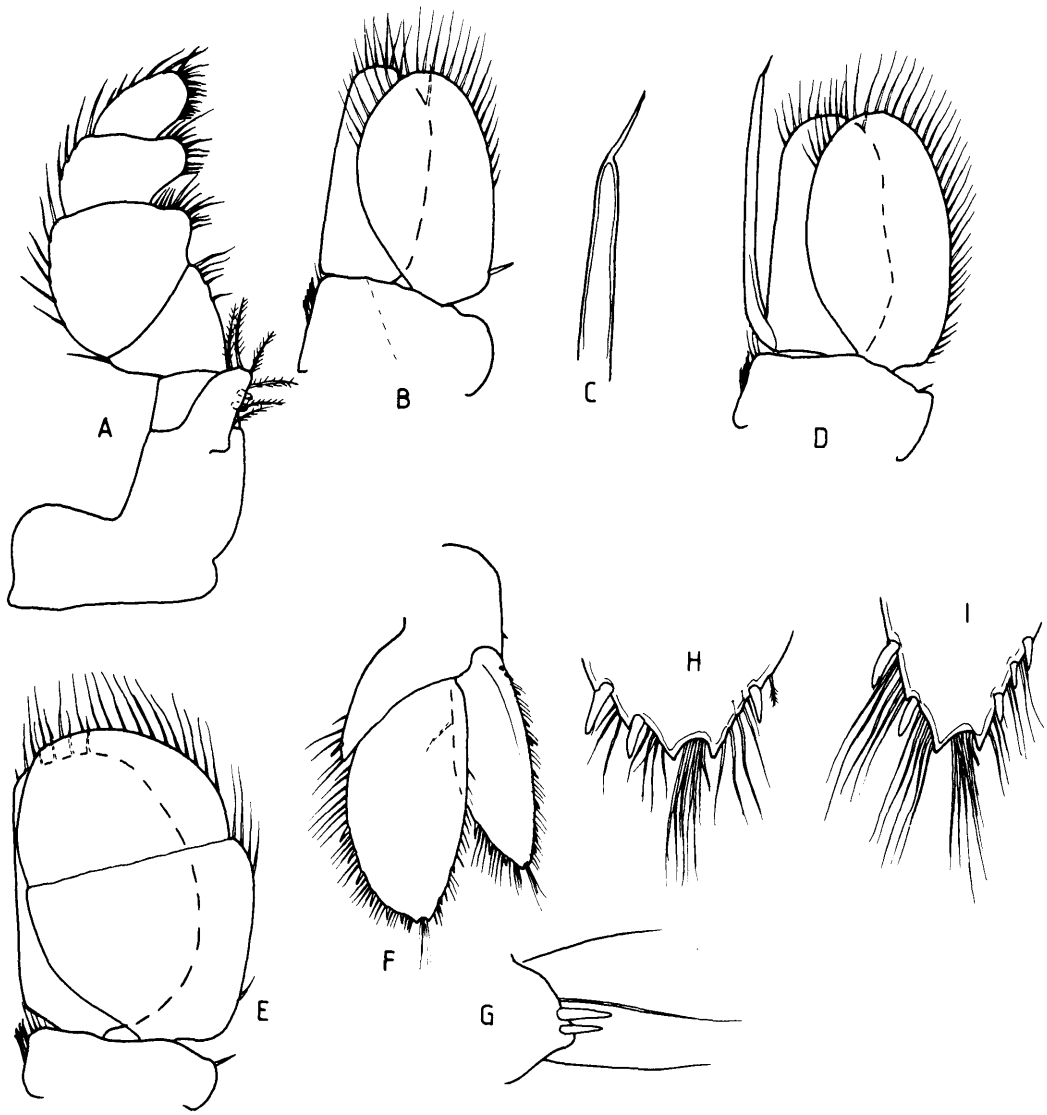

Fig. 134. *Cirolana stenoura* n. sp., male paratype 7.5 mm, except E, female paratype, Madang. **A**, maxilliped; **B**, pleopod 1; **C**, appendix masculina, apex; **D**, pleopod 2; **E**, pleopod 3; **F**, uropods; **G**, uropod peduncle, ventral distal lateral angle; **H**, uropod endopod, apex; **I**, uropod exopod, apex.

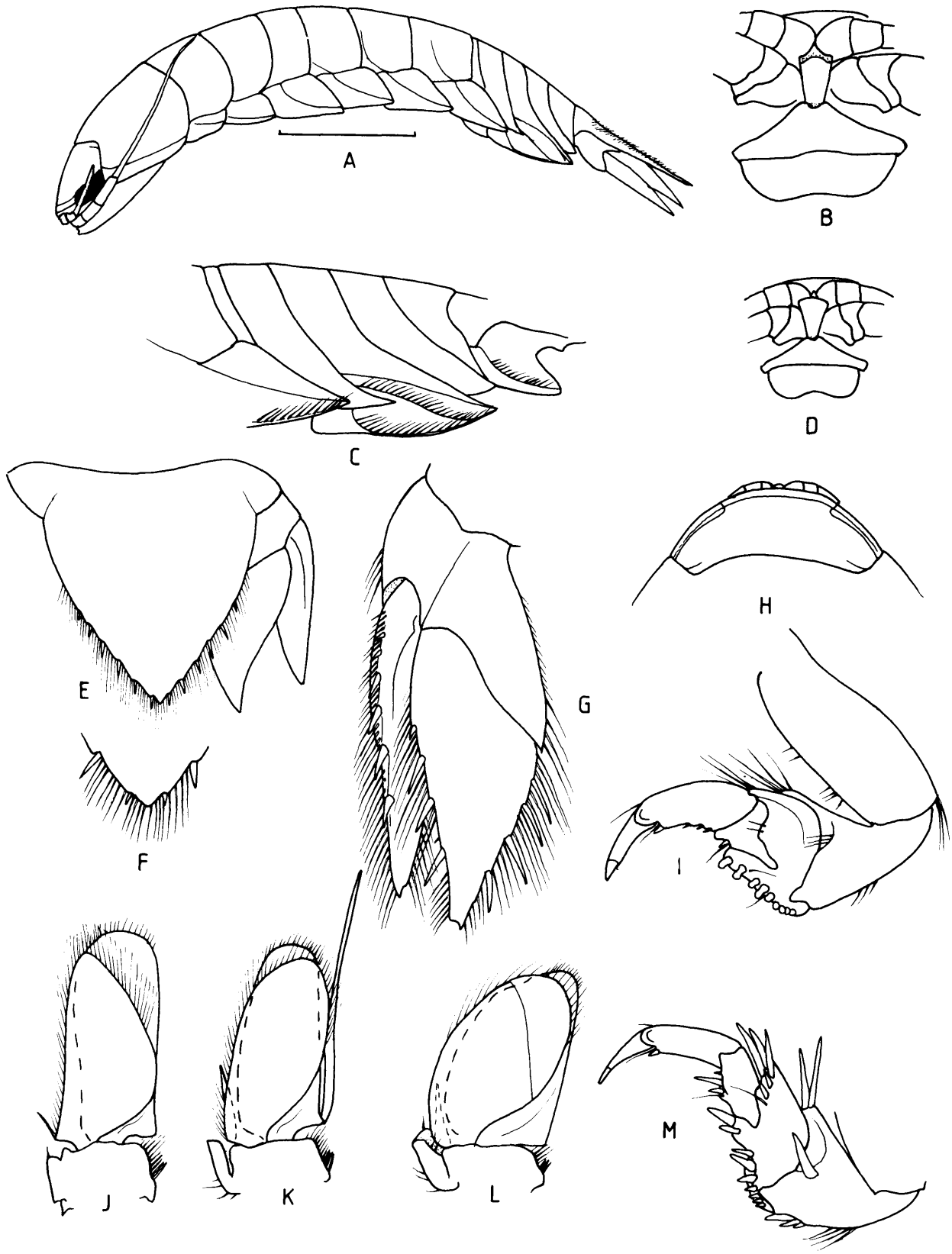

Fig. 135. *Cirolana schioedtei.* A, C, H, male 25.0 mm, Broome; B, female 29.6 mm N.W. Cape; remainder male 17.0 mm Dampier, WA. **A**, lateral view; **B**, clypeal region (female 29.6 mm); **C**, pleon, lateral view; **D**, clypeal region (male 17.0 mm); **E**, pleotelson; **F**, pleotelson, apex; **G**, uropod; **H**, cephalon, dorsal view; **I**, pereopod 1; **J**, pleopod 1; **K**, pleopod 2; **L**, pleopod 5; **M**, pereopod 3. Scale 5.0 mm.

carinae, ventral 2 of which are setose. Pleotelson of large males and females with setae on dorsal surface (most specimens did not show this feature).

Antennal flagellum composed of up to about 70 articles, in largest specimens extending to pereonite 6. Frontal lamina in 2 forms, either with anterior margin convex, projecting slightly, with small process protruding between antennal bases, or modification of this in Western Australian specimens where the "anterior margin" stops there is excavate extention. Base of frontal lamina in all cases sessile. Maxilliped endite with 2 coupling hooks.

Pleopod 2 appendix masculina exceeding endopod by 0.33 its length.

Sexual variation. The males and females are essentially similar except for two points. The females never develop the degree of setosity on the dorsal surfaces of the pleotelson shown by larger males. In specimens of both sexes less than 25.0 mm long, a variable degree of setosity is shown. The accessory lamellae at the base of the exopod is far more strongly developed, being quite conspicuous in the females, while in the males it is slender and easily overlooked. The setation of the endopods of pleopods 3-4 is reduced in the males when compared to the females.

Colour. The specimens from Broome collected in 1917 are dark brown. Others cream, with a faint band of chromatophores along the posterior of the pereon segments.

Size. The largest female just exceeds 35 mm. A female of 20.1 mm had fully developed oostegites, whilst all specimens had pereopod 7 fully developed.

Remarks. This large species is easily recognized by the form of the eye and shape of the pleotelson and uropods. The unique form of the pleopods separates it from all other *Cirolana,* but in other characters it is similar. Pleopod 1 has the same shape as that of *Booralana bathynella* and *B. wundurra* with which it also shares reduced setation of the endopod of pleopods 3-4, and the eye shape.

Distribution. Rottnest Island, along the Western Australian coast (Geraldton, North West Cape, Barrow Island, Dampier Archipelago) to Darwin, Torres Strait, and south to Townsville and Hayman Island on the east coast. Recorded at depths of 16.3-173 metres.

Anopsilana Paulian & Deboutteville

Anopsilana Paulian & Deboutteville, 1956: 87.—Bruce, 1981a: 955, figs 5i-l.
Troglocirolana Rioja, 1956: 447.
Haitilana Notenboom, 1981: 314.

Type species. *Anopsilana poissoni* Paulian & Deboutteville, 1956, by monotypy.

Diagnosis. Similar to *Cirolana* but with endopods of pleopods 3-5 entirely without setae, and slightly smaller than exopods. Penes absent.

Sexual dimorphism. In the species that show pereon and pleotelson sculpting, this is noticeably less developed in females than in males. In female *Anopsilana willeyi* (Stebbing, 1904a) sculpting is almost totally lacking. Females also tend to be larger.

Remarks. The species placed in this genus are from either brackish or freshwater habitats. Monod (1976) discussed the systematic position of the genus *Anopsilana,* and gave detailed figures of the type species. He concluded that the generic diagnosis differed in no way from the genus *Cirolana.* In his discussion he made no mention of the very different pleopod setation, a character used in the separation of many genera. It is proposed to retain the genus *Anopsilana* as valid, and it can be separated from the very closely related genus *Cirolana* by the different pleopod morphology. Species of *Anopsilana* are found in low and variable salinity and from freshwater in wells and caves.

The genus *Troglocirolana* Rioja, 1956 was established with a detailed figured description of the only species of the genus, *T. cubensis.* Examination of the detailed figures given by Rioja fail to reveal any differences between *Troglocirolana* and *Anopsilana* as diagnosed by Bruce (1981b). Unfortunately both descriptions were published in 1956, and I have not been able to ascertain which of these appeared first. At present, I shall regard *Anopsilana* as senior as that genus has received the most recent treatment.

Notenboom (1981) established the genus *Haitilana,* and again his figures and description reveal no differences from the diagnosis of *Anopsilana,* and that genus is here placed in synonymy with *Anopsilana.*

The reduction of marginal setae together with a decrease in size of the pleopodal endopod is associated with the occurrence of species in freshwater habitats, these characters being shown by most freshwater cirolanid genera.

Key to Australian Species of *Anopsilana*

——Frontal lamina pentagonal. ..... *A. willeyi*

——Frontal lamina with anterior margin rounded. ..... *A. pustulosa*

Anopsilana pustulosa (Hale)

Fig. 136

Cirolana pustulosa Hale, 1925: 139, fig. 6.—Nierstrasz, 1931: 157; Barnard, 1935: 308; Jones, 1976: 215; Hamsa & Nammalwar, 1978: 519; Holdich, Harrison & Bruce, 1981: 557, fig. 2.
Cirolana capitella Barnard, 1955: 54, fig. 26d-g.—Kensley, 1978c: 65, fig. 26F.
Cirolana rustulosa.—Roman, 1970: 167 (*lapsus calami).*
Anopsilana pustulosa.—Bruce, 1981b: 955; 1982a: 61; Bowman & Franz, 1982: 526.

Types. Held at the Australian Museum, Sydney.

Type locality. Cooktown, Qld.

Material examined. 9 males (7.0-8.5 mm), 12 females

(6.9–8.7 mm), Endeavour River, Cooktown, Qld, Nov. 1975, at airport crossing, taken from *Macrobrachium* sp., coll. R. Monroe. Male (10.9 mm), Redbank Creek, Trinity Inlet, Cairns, Qld., 12 July 1974, coll. R. Timmins. 3 males (8.0–10.1 mm), 8 females (5.9–8.0 mm), Mourilyan Harbour, south of Innisfail, Qld, 8 Oct. 1970, coll. R. Turner. 33 males (6.3–10.8 mm), 44 females (5.0–7.5 mm), 2 mancas (3.2, 3.8 mm), Little Ramsay Bay, Hinchinbrook Is., Qld, 29 Aug. 1978, trapped amongst intertidal mangroves, coll. NLB. Male (6.9 mm), Kurrimine (south) Qld, 21 May 1976, taken from *Teredo* bored wood, coll. D.M. Holdich. 3 males (6.3–10.0 mm), 9 females (4.9–7.6 mm), Barnes Creek, Mackay, Qld, 24 Nov. 1970, 2 miles up creek, coll. R. Turner.

Remarks. This species has recently been described in some detail by Holdich et al. (1981). The figures given here supplement those given by Holdich et al., and enable easy species recognition. The description given by Holdich et al., suggests that the dactyls are simple. This is not the case as all dactyls are clearly biungiculate. The species is readily identified by the sculpting of the cephalon, pereon and pleon, and by the rounded anterior margin of the frontal lamina.

Anopsilana luciae appears closely related, and examination of the battered female holotype reveals that the only difference is the lack of pleotelson spines and lack of tubercles on the pereon and pleon. Description of the male of *A. luciae* will be needed before further comparison between the two species can be made.

Distribution. East Africa (Jones, 1976), Mozambique (Barnard, 1955), Madagascar (Roman, 1970), India (Hamsa & Nammalwar, 1978), Papua New Guinea (Bruce, 1982a); in Australia it occurs commonly at low or variable salinity habitats along the mainland coast of tropical Queensland, from Mackay to Torres Strait in the north.

Anopsilana willeyi (Stebbing)
Figs 137, 138

Cirolana willeyi Stebbing, 1904a: 11, pl. 3.—Nierstrasz, 1931: 58; Barnard, 1935: 312, fig. 18b; Pillai, 1954: 5; 1967: 270, fig. 2a–b; Jones, 1976: 216; Hamsa & Nammalwar, 1978: 517.

Cirolana nigra Chilton, 1924: 884, pl. LX figs 3, 6.

Anopsilana willeyi.—Bruce, 1981b: 955.

Material examined. 2 males (7.2, 8.8 mm), 5 females (6.5, 6.6, 7.2, 7.6, 8.3 mm), Endeavour River, Cooktown, Qld,

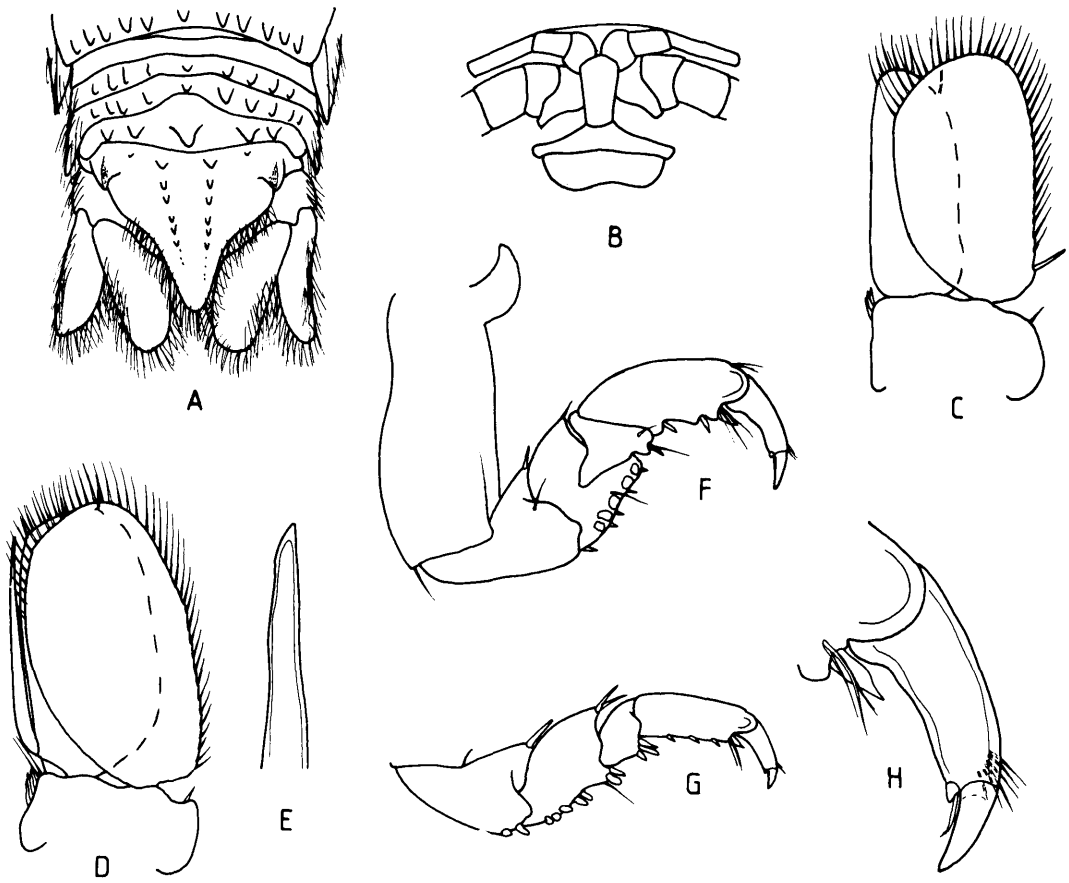

Fig. 136. *Anopsilana pustulosa,* male 10.5 mm, Hinchinbrook Is. **A**, pleon and pleotelson; **B**, clypeal region; **C**, pleopod 1; **D**, pleopod 2; **E**, appendix masculina, apex; **F**, pereopod 1; **G**, pereopod 2; **H**, pereopod 1, dactylus.

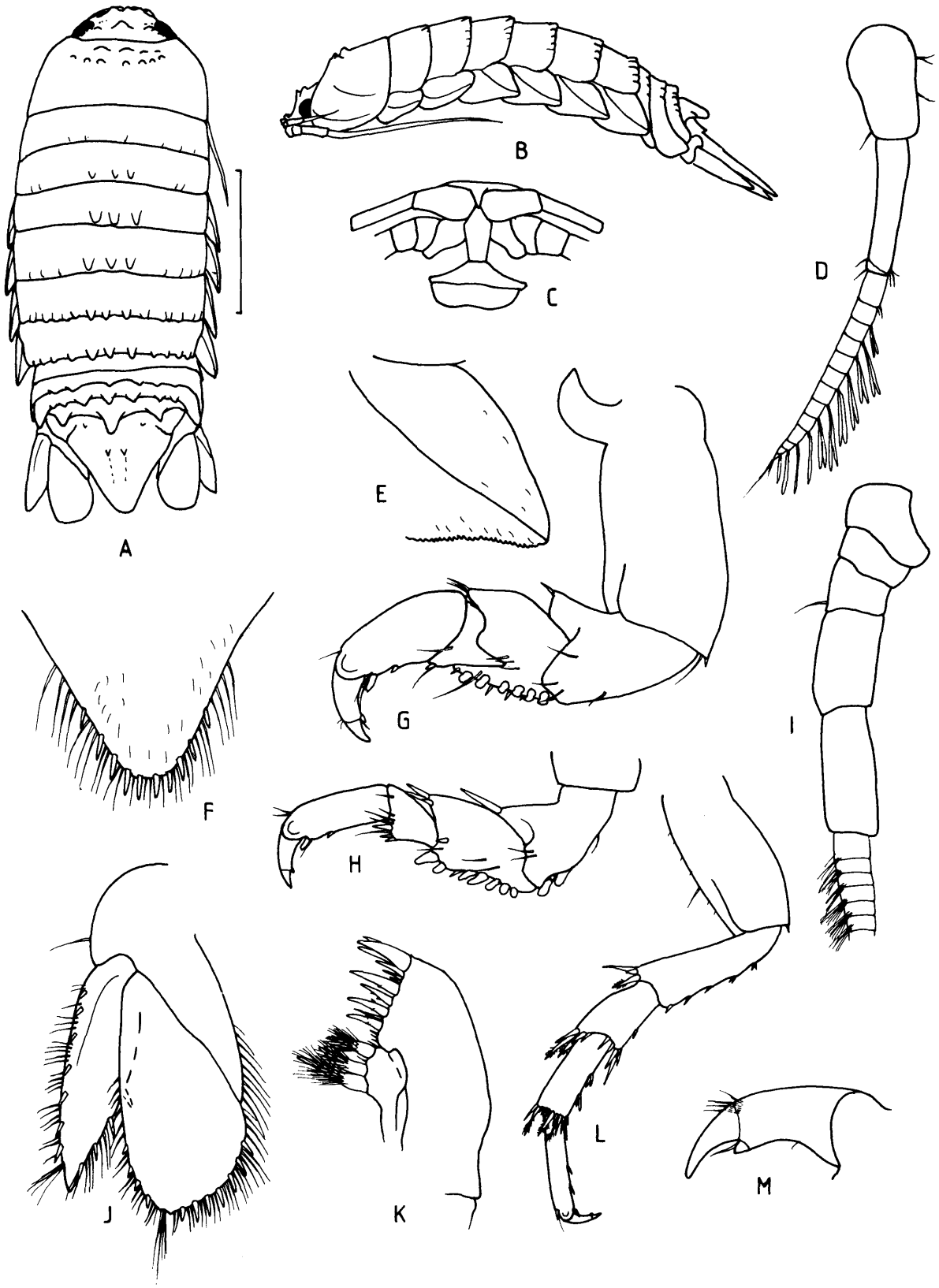

Fig. 137. *Anopsilana willeyi*, male 7.2 mm, Cooktown. **A**, dorsal view; **B**, lateral view; **C**, clypeal region; **D**, antennule; **E**, coxal plate, pereonite 7; **F**, pleotelson apex; **G**, pereopod 1; **H**, pereopod 2; **I**, antennal peduncle; **J**, uropod; **K**, maxillule; **L**, pereopod 7; **M**, pereopod 2, dactylus. Scale 2.0 mm.

Nov. 1975, at Airport crossing, taken from *Macrobrachium* sp., coll. R. Monroe. Manca (3.8 mm), Newell Beach, Cairns, Qld, 29 May 1976, from wood, coll. D.M. Holdich. Female (6.9 mm), S.E. Missionary Bay, Hinchinbrook Is., Qld, 1 Sept. 1978, trapped amongst mangroves, coll. NLB. Female (5.5 mm), Kurramine (south), Townsville, Qld, 21 May 1976, from wood, coll. D.M. Holdich.

Types. Not located.

Type locality. Sri Lanka.

Description of male. Body about 2.75 times as long as wide. Anterior margin of cephalon with 3 raised processes; further raised processes lie on median side of each eye, prominent central process present; median rostral process separating antennular bases. Pereonite 1 with anterodorsal margin nodulose; posterior margin of pereonite 2–7 with denticulation becoming progressively more pronounced; pereonites 3–7 with median group of 3 tubercules more strongly developed than remainder. All coxae with complete carina; ventral margins of coxae 5–7 minutely crenelated. Pleonite 1 concealed by pereonite 7; posterior margins of pleonite 3 with about 7 indistinct tubercules; pleonite 4 with 1 median and 2 submedian tubercules prominent, further 2 indistinct tubercules on each side; pleonite 5 with large tubercules. Pleotelson dorsal surface flat, lateral margins with 2 feeble sub-median carinae, and 2 tubercules; lateral margins sinuate, with long plumose setae along distal half of their length, apex armed with 10 stout spines; surface with scattered setules.

Antennule peduncle 3-articulate; article 2 distinctly longer than article 1; flagellum composed of about 13 articles, extending to middle of pereonite 1. Antenna flagellum extending to posterior of pereonite 4; proximal articles densely setose.

Frontal lamina pentagonal, lateral and anterior margins straight, apex overlapped by median rostral process.

Pereopod 1 with 6 tubercular spines and 4 acute spines on posterior margin of merus; carpus with single small spine at posterodistal angle; propodus with single spine on palm, and stout spine opposing prominently biungiculate dactylus. Pereopods 2–3 similar; posterodistal margin of ischium with 2 large blunt spines; posterior margin of merus with 8 blunt spines. Pereopod 7 with 5 spine groups on posterior margin of ischium; distal angles of merus and carpus with groups of spines, many of which are pectinate.

Penes set adjacent to one another, protruding only very slightly as small rounded bumps.

Pleopods with complete suture on exopods of

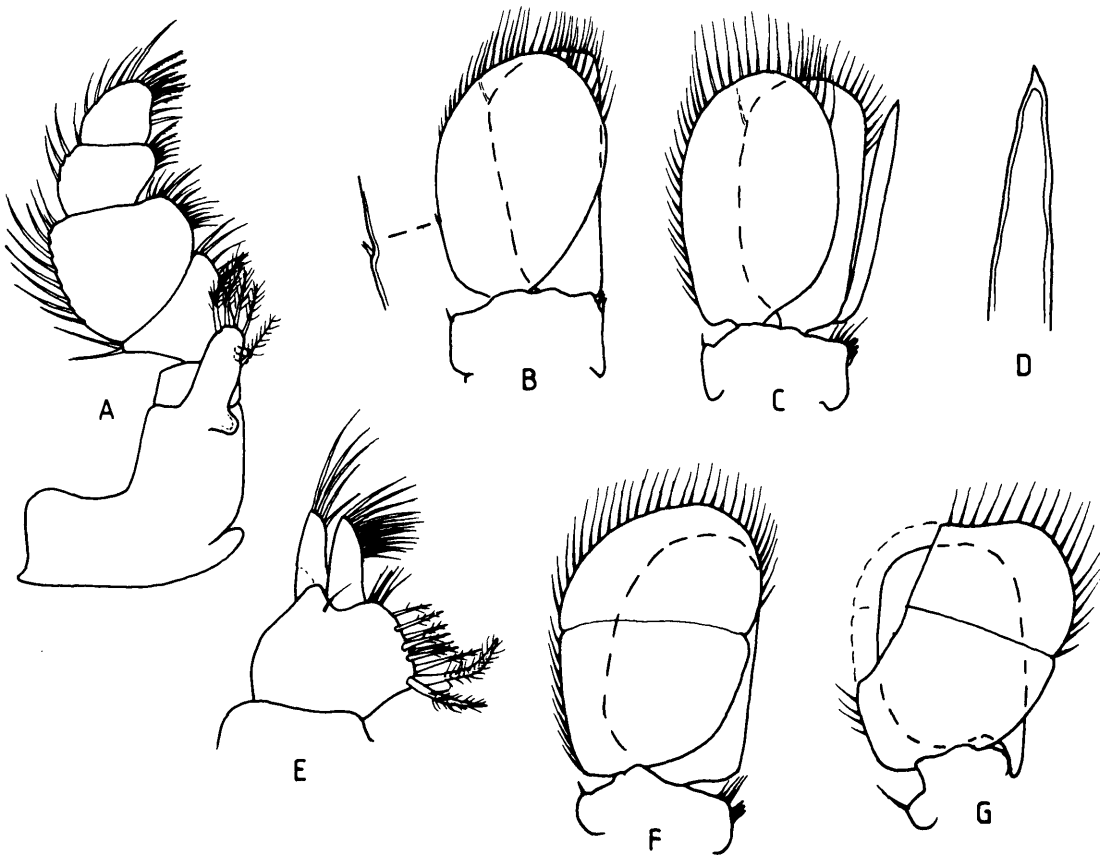

Fig. 138. *Anopsilana willeyi*, male 7.2 mm, Cooktown. **A**, maxilliped; **B**, pleopod 1; **C**, pleopod 2; **D**, appendix masculina, apex; **E**, maxilla; **F**, pleopod 3; **G**, pleopod 5.

pleopods 3–5. Pleopod 1 without prominent spine at proximolateral angle of exopod; endopod with both margins straight, distinctly broader at distal extremity than at base. Pleopod 2 appendix masculina relatively broad, as long as inner ramus, apex with small pointed tip. Uropods set clear of pleotelson, and extending slightly beyond pleotelson apex. Endopod lateral margin straight, provided with short plumose setae along distal half, amongst which are set 4 spines; medial margin rounded, provided with continuous plumose marginal setae and 2 short spines; apex very slightly indented. Exopod with both margins concave, lateral margin with short setae and 7 short spines, medial margin with 4 short spines; apex set medial to terminal projection.

Female. Similar to male, but shows less sculpting. Flagellum of antenna lacks conspicuous setae.

Colour. Some specimens of the Cooktown material were pale, with little evidence of chromatophores. Most specimens were densely mottled with dark and pale brown chromatophores.

Size. Largest male, 8.8 mm; largest female, 8.3 mm.

Remarks. The sculpting of the cephalon, pereonites and pleon easily distinguishes this species from *A. pustulosa* as well as from all other similar *Cirolana* species. The length of the second peduncular article of the antennule, and the lack of a conspicuous spine on the exopod of pleopod 1 are two unusual features of this species.

Distribution. Queensland: Cooktown, Cairns, Hinchinbrook Island and Townsville. Also East Africa (Jones, 1976), Sri Lanka (Stebbing, 1904a) and Thailand (Chilton, 1924).

Neocirolana Hale

Neocirolana Hale, 1925: 153.—Holdich, Harrison & Bruce, 1981: 583; Bruce, 1981b: 955, figs. 6g,h.

Type species. *Neocirolana obesa* Hale, 1925, by monotypy. Types held by the Australian Museum, Sydney, P8203, P9204.

Diagnosis. Differs from *Cirolana* only in having mandible incisor markedly narrow, and lacinia mobilis greatly reduced. Antennule always 3-articulate.

Sexual dimorphism. None observed.

Remarks. The five species of *Neocirolana* are a varied assemblage; only one, *N. excisa,* being recorded from beyond Australian waters. There are two groups within the genus: one with *N. obesa, N. maculata* and *N. excisa,* the other with *N. hermitensis* and *N. bicrista.* The unifying characters of the first group are the shape of the maxilliped, pleotelson and uropods, while those of the second group are the shape of the maxilliped (which has the palp articles scarcely produced, and without setae), the frontal lamina and appendix masculina.

Within the genus as a whole there is a lack of uniformity of the mouthpart morphology. All species show a reduced mandible incisor, but the degree of reduction is variable. *Neocirolana maculata* and *N. obesa* have a similar maxilla, but in the other three species this appendage differs immensely. In *N. hermitensis* the maxilla is reduced while in others it is of the normal cirolanid form. The single trait attributable to all species is that they all show some form of mouthpart reduction. Hale (1925) in establishing this genus used a variety of characters. On close comparison with members of the genus *Cirolana* the only consistent difference apparent is the form of the mandibles. It is proposed to retain the genus *Neocirolana* as valid, and it can be separated from the closely related genus *Cirolana* by having narrower mandible incisor, a reduced lacinia mobilis, and often showing other mouthpart reductions.

Key to Species of *Neocirolana*

1. Pleotelson with 2 distinct carinae. ..... *N. bicrista*

——Pleotelson without carinae. 2

2. Uropod apices not bifid. ..... *N. hermitensis*

——Uropod apices bifid. 3

3. Anterior margin of cephalon smoothly rounded. 4

——Anterior margin of cephalon with median rostral point. ..... *N. maculata*

4. Uropod endopod, lateral margin deeply excised. ..... *N. excisa*

——Uropod endopod, lateral margin not deeply excised. ..... *N. obesa*

Neocirolana bicrista Holdich, Harrison & Bruce
Fig. 139

Neocirolana bicrista Holdich, Harrison & Bruce, 1981: 584, fig. 11.—Bruce, 1981b: 956.

Material examined. Type material: male (3.7 mm), holotype, and male (3.6 mm), 2 females (3.7, 4.4 mm), paratypes, Halifax Bay, Townsville, Qld, 25 May 1976, 11 m, coll. P. Arnold.

Types. Held by the Queensland Museum, Brisbane.

Type locality. Halifax Bay, Townsville, Qld.

Descriptive notes. Comparison of the type series to the original description revealed certain inaccuracies. These are here corrected, and further detail is given of the mouthparts.

Dorsal surface of pleotelson bears 3 parallel carinae, submedian pair being very prominent, central one being less distinct. Pleotelson 1.5 times wider than long; anterolateral angles conceal uropod peduncle in dorsal view.

Mandible lacinia mobilis with 5–6 short spines; molar process with about 9 teeth. Maxillule endopod with 3 stout, sparsely plumose spines. Maxilla exopod and palp with 2 stout curved spines; exopod with further 4 short spines; endopod with 4 simple setae and abundance of setules. Maxilliped palp with distal angles of articles only slightly produced; endite with 1 coupling hook.

Pereopod 1 with secondary unguis of dactylus only

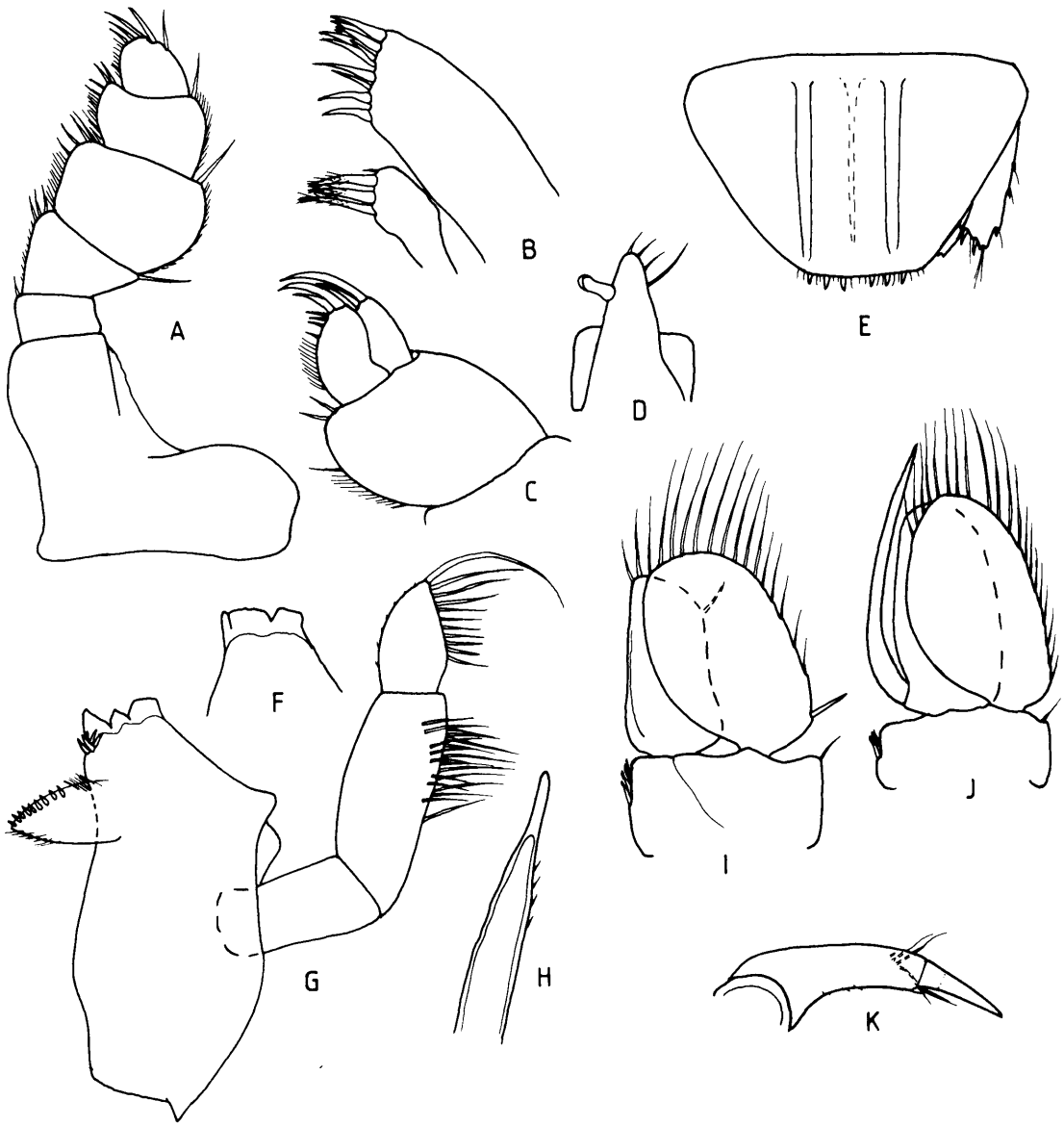

Fig. 139. *Neocirolana bicrista.* I, J, male paratype; remainder female paratype. **A**, maxilliped; **B**, maxillule; **C**, maxilla; **D**, maxilliped endite; **E**, pleotelson; **F**, left mandible, incisor; **G**, right mandible; **H**, appendix masculina, apex; **I**, pleopod 1; **J**, pleopod 2; **K**, pereopod 1, dactylus.

feebly developed; dactylus as long as propodus, when folded back appears prehensile.

Remarks. Of the species placed in *Neocirolana, N. bicrista* most closely approaches *N. hermitensis.* The maxilliped palp and maxillule are similar in both species. The maxilla of each species are not similar, that of *N. bicrista* being unusual in having the endopod reduced, and the exopod and palp being provided with spines.

Several characters serve to distinguish *N. bicrista.* The ornamentation and shape of the pleotelson is unique, and immediately identifies the species. Unusual characters include the pereopods bearing very few spines, the great length of the dactyls, which also have a feebly developed secondary unguis.

Distribution. Known only from Townsville, Qld.

Neocirolana hermitensis (Boone)

Figs 140, 141

Cirolana hermitensis Boone, 1918: 592, pl. 31 fig. 2.—Hale, 1925: 132.

Neocirolana hermitensis.—Bruce, 1981b: 956.

Material examined. Male (8.8 mm), Pidgeon Is., Wallabi Group, Abrolhos Is., WA, May 1959, attached loosely to hermit in craypot, coll. P. Bennett & Lennard. 2 females (8.2, 8.8 mm), Pelsart Group, Abrolhos Is., WA, 2 July 1963, coll. R. Thomas. Female (6.9 mm), 40 miles west of Cape Jaubert, WA, 13 Oct. 1962, on sponge, 41 m, coll. R.W. George. Male (8.2 mm), female (6.6 mm, ovig.), Black Point, Cobourg Peninsula, NT, 11°09.0'S, 132°51.4'E, 28 April 1982, within gastropod shell with *Dardanus* sp., coll. NTM. Female (6.3 mm), west of Nassau Reef, Gulf of Carpentaria, Qld, 8 Mar. 1977, R.V. *Sprightly* Stn 75, 20 m, coll. E.G. Rhodes. Male (5.0 mm), Watsons Bay, Lizard Is., Qld, 21 Sept. 1973, sandy bottom 12 m, coll. W. Ponder & P. Coleman.

Types. I have not been able to locate the type specimens.

Type locality. Hermit Is., Montebello Group, northern WA (Boone, 1918).

Description of male. Body dorsoventrally flattened, about 2.5 times as long as wide. Cephalon with small downwardly projecting rostral process, and anterior submarginal furrow; anterolateral angle of cephalon acute. Eyes small, ocelli deep set. Coxae of pereonites 2–7 each with entire carina. Pleonite 1 entirely concealed by pereonite 7, pleonite 3 with posterolateral margins produced to posterior of pleonite 5, encompassing lateral margin of pleonite 4. Pleotelson broadly rounded, posterior margin feebly crenelate, provided with 8 spines, to each side of which lie 2–3 short plumose setae.

Antennule with 3rd short fused peduncular article; flagellum subequal in length to peduncle with about 10 articles, extending to pereonite 1. Antenna flagellum with about 20 articles, extending to posterior of pereonite 2.

Frontal lamina pentagonal, lateral and anterior margins markedly concave, apex narrowly rounded; broadest at lateral angles; clypeus 3 times wider than long. Mandible incisor moderately narrow; lacinia mobilis with 8 spines; molar process with about 25 teeth, distal ones of which are slender; palp medial margins minutely spinulose. Maxillule with 3 robust, sparsely plumose spines on endopod; exopod with about 11 stout and 1 slender spine on gnathal surface. Maxilla palp absent, exopod reduced with 3 terminal setae; endopod with about 10 short setae, proximal 2 being plumose. Maxilliped palp with distal angles of articles barely produced; palp articles set in line; endite reduced, without coupling hooks.

Pereopod 1 with dense fringe of setae along posterior margins of ischium and merus; merus with row of 5 acute spines on posterior margin and group of 4 spines at posterodistal angle; propodus with 2 acute and 2 blunt spines on palm; dactylus primary unguis abruptly narrowed. Pereopod 2–3 similar to 1, but generally more spinose, setae on posterior margins of ischium and merus less dense; some distal spines on merus conspicuously flattened and rounded at tip. Pereopod 7 with groups of spines at distal angle of ischium, merus and carpus; posterior margins of all articles except basis with additional short spines; spines at posterodistal angles include flattened bladelike spines.

Vasa deferentia open flush with ventral surface of sternite 7; openings elliptical in shape.

Pleopod exopods 3–5 with indistinct suture; peduncles 1–4 with 3 coupling hooks on medial margin. Pleopod 1 with endopod about 3.5 times as long as greatest width, half as wide as exopod. Pleopod 2 medial proximal angle produced basally; appendix masculina 1.5 times as long as greatest length of endopod. Uropods extending slightly beyond apex of pleotelson, exopod distinctly shorter than endopod. Exopod margins convex, apex rounded, not bifid; lateral margin with about 9 spines, medial margin with 4. Endopod lateral margin nearly straight, medial margin distally truncate, apex not bifid; lateral margin with 2 spines and single sensory setae, medial margin with 9 spines. Peduncle with lateral spine and 3 spines at ventral distolateral distal angle.

Female. In nearly all respects similar to male, only non sexual differences being lack of setose fringe on pereopods 1–3. Pereopod 1 in specimens examined with more spines.

Colour. This species has a distinct pattern of two brown or black transverse bands on each pereonite, and single bands on pleonites 3 and 4. The bands on the pleotelson run longitudinally. The specimens from the hermit crab shell had a ground colour of vivid lemon yellow when alive (A.J. Bruce, pers. comm.).

Size. Largest female, 8.2 mm; largest male, 8.8 mm.

Remarks. The types of this species have proved impossible to locate, but fortunately the original figures illustrated the colour pattern. As this pattern is unique amongst the cirolanids, there seems little doubt that the specimens here examined do in fact belong to Boone's species (Boone, 1918).

The assignment of this species to *Neocirolana* poses some problems as the mandible is not markedly narrow. The antennule, frontal lamina, clypeus and second

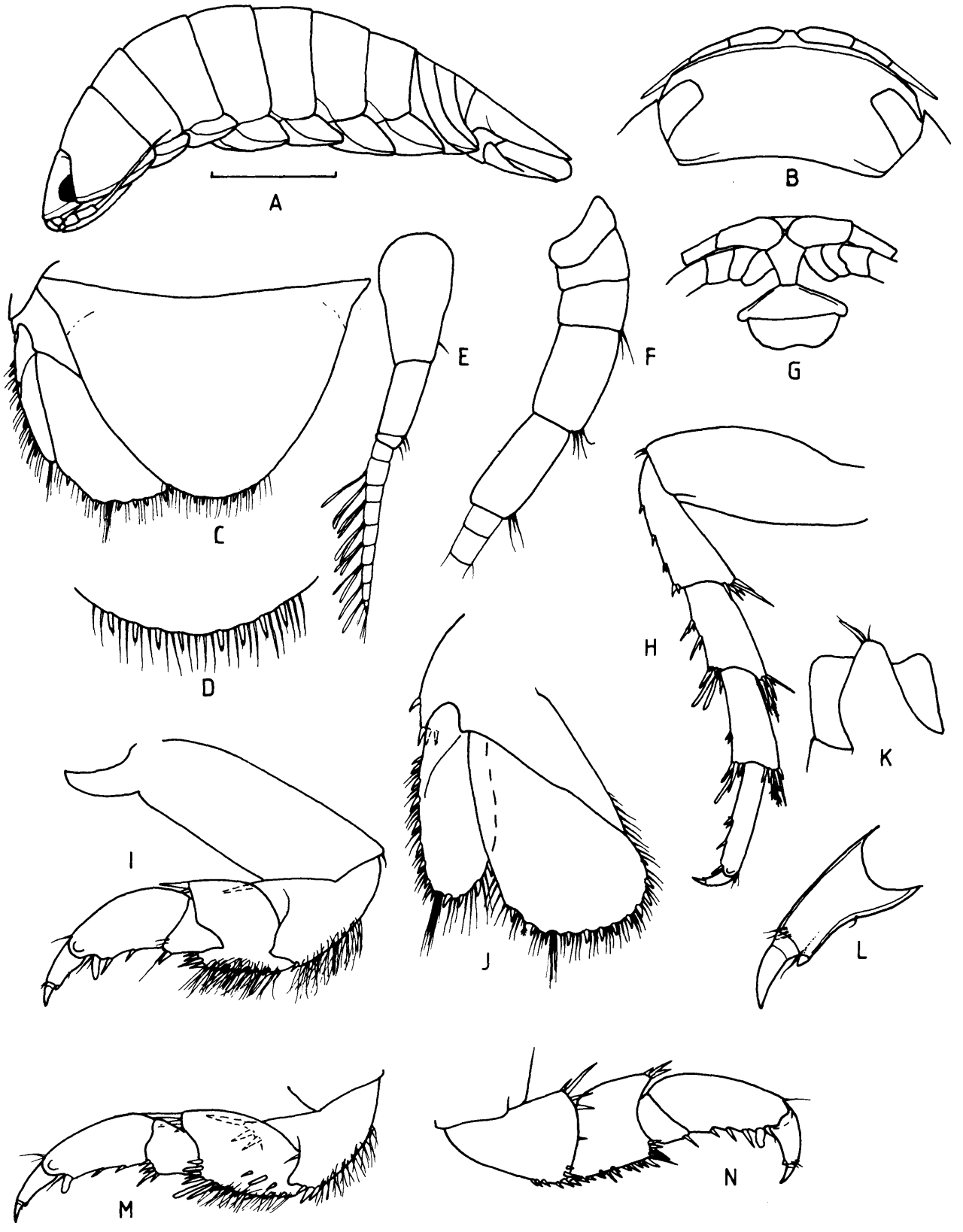

Fig. 140. *Neocirolana hermitensis.* I, K–M, male 8.8 mm; remainder female 8.2 mm, Abrolhos Is. **A**, lateral view; **B**, cephalon dorsal view; **C**, pleotelson and uropod; **D**, pleotelson, posterior margin; **E**, antennule; **F**, antennal peduncle; **G**, clypeal region; **H**, pereopod 7; **I**, pereopod 1; **J**, uropod; **K**, maxilliped endite; **L**, pereopod 1 dactylus; **M**, pereopod 2; **N**, pereopod 1 (male). Scale 2.0 mm.

pleopod accord well with *N. obesa*. The maxilliped has a reduced endite, linearly arranged palp articles, and the maxilla has only 1 article. The setation of pereopods 1-3 together with the shape of pleopod 1 are at odds with those of *N. obesa* and *N. bicrista*. The maxilliped and appendix masculina are similar to those of *N. bicrista*.

Although the specific name refers to the type locality, it is particularly appropriate as *Neocirolana hermitensis* is known to associate with hermit crabs. Three of the present specimens were taken in association with hermit crabs.

Distribution. Originally recorded from the Montebello Islands in northern WA, now recorded from the Abrolhos Islands and Cape Jaubert, WA; Cobourg Peninsula, NT; Gulf of Carpentaria and Lizard Island, Qld.

Neocirolana obesa Hale

Figs 142, 143

Neocirolana obesa Hale, 1925: 154, fig. 12.—Nierstrasz, 1931: 162; Naylor, 1966: 184; Bruce, 1981b: 955, fig. 6g,h.

Material examined. Male (7.5 mm), manca (3.0 mm), off Moreton Bay, Qld, 27°27'S, 153°37'E, 29 Mar. 1969, Kimbla Stn 2, coll. W. Ponder. Manca (3.0 mm), Shag Rock, off North Stradbroke Is., Qld, 22 Aug. 1979, from sponge, ca. 12 m, coll. N. Svennivig. 3 males (5.5, 6.5, 6.9 mm), 2 females (7.5, ovig. 6.0 mm), reef, 2 km off Stradbroke Is., Qld, 24 Mar. 1975, 10–25 m, amongst algae, coll. J.E. Watson. Female (6.9 mm ovig.), off Nelson Head, Port Stephens, NSW, 27 Oct. 1980, 16 m, sand and shell grit, coll. J. Hall & I. Loch. 2 males (6.2, 5.0 mm), 2 females (4.9 mm, 7.5 mm), same as previous, 18 m. Female (6.0 mm), manca (2.9 mm), east of North Head, Sydney, NSW, 33°49'S, 151°18'E, 19 Feb. 1973, 25.9 m, in association with *Halme gigantea*. Series of 8 mancas (2.5-3.5 mm), off North Head, Sydney, NSW, 19 Feb. 1973,

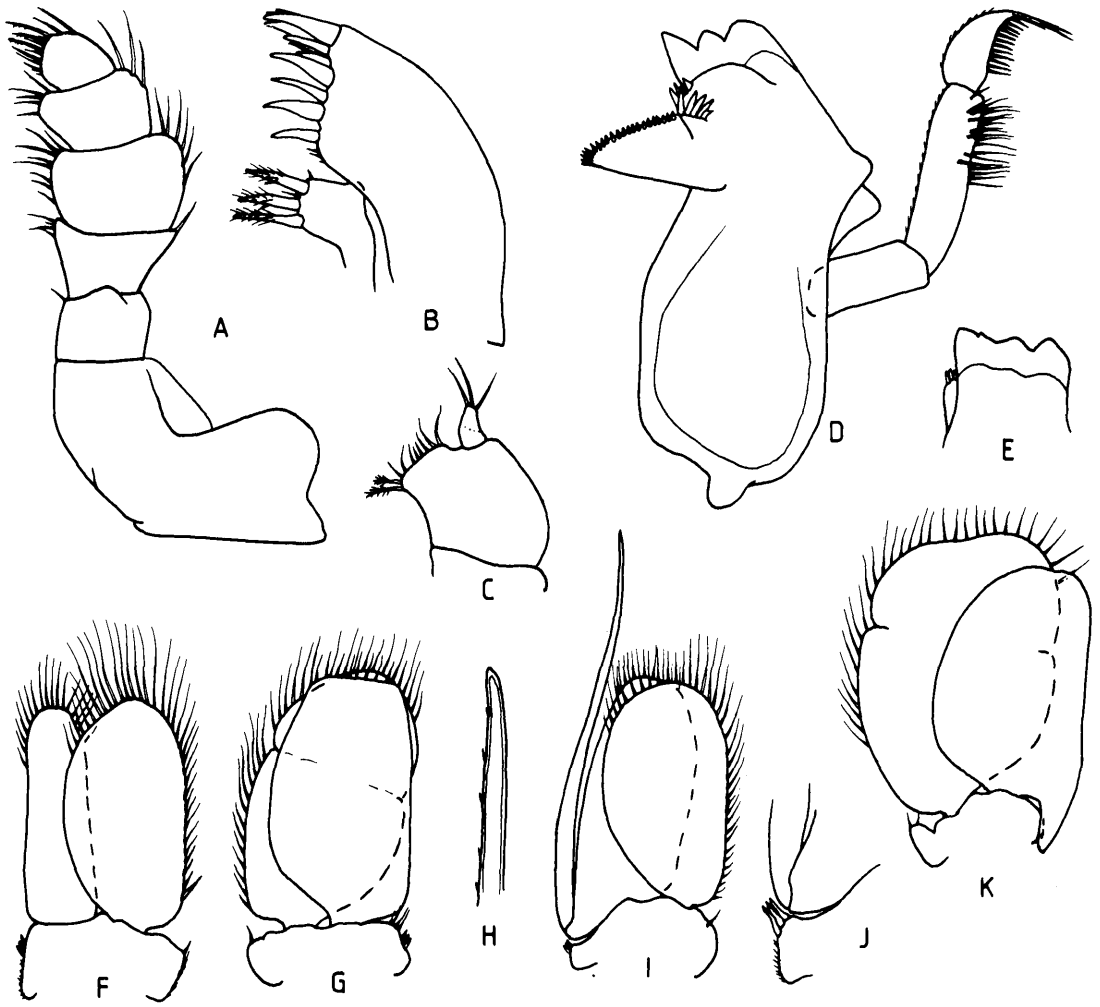

Fig. 141. *Neocirolana hermitensis*. B, G, K, female 8.2 mm; remainder male 8.8 mm. **A**, maxilliped; **B**, maxillule; **C**, maxilla; **D**, right mandible; **E**, left mandible, incisor; **F**, pleopod 1; **G**, pleopod 3; **H**, appendix masculina, apex; **I**, pleopod 2; **J**, pleopod 2, medial margin of peduncle; **K**, pleopod 5.

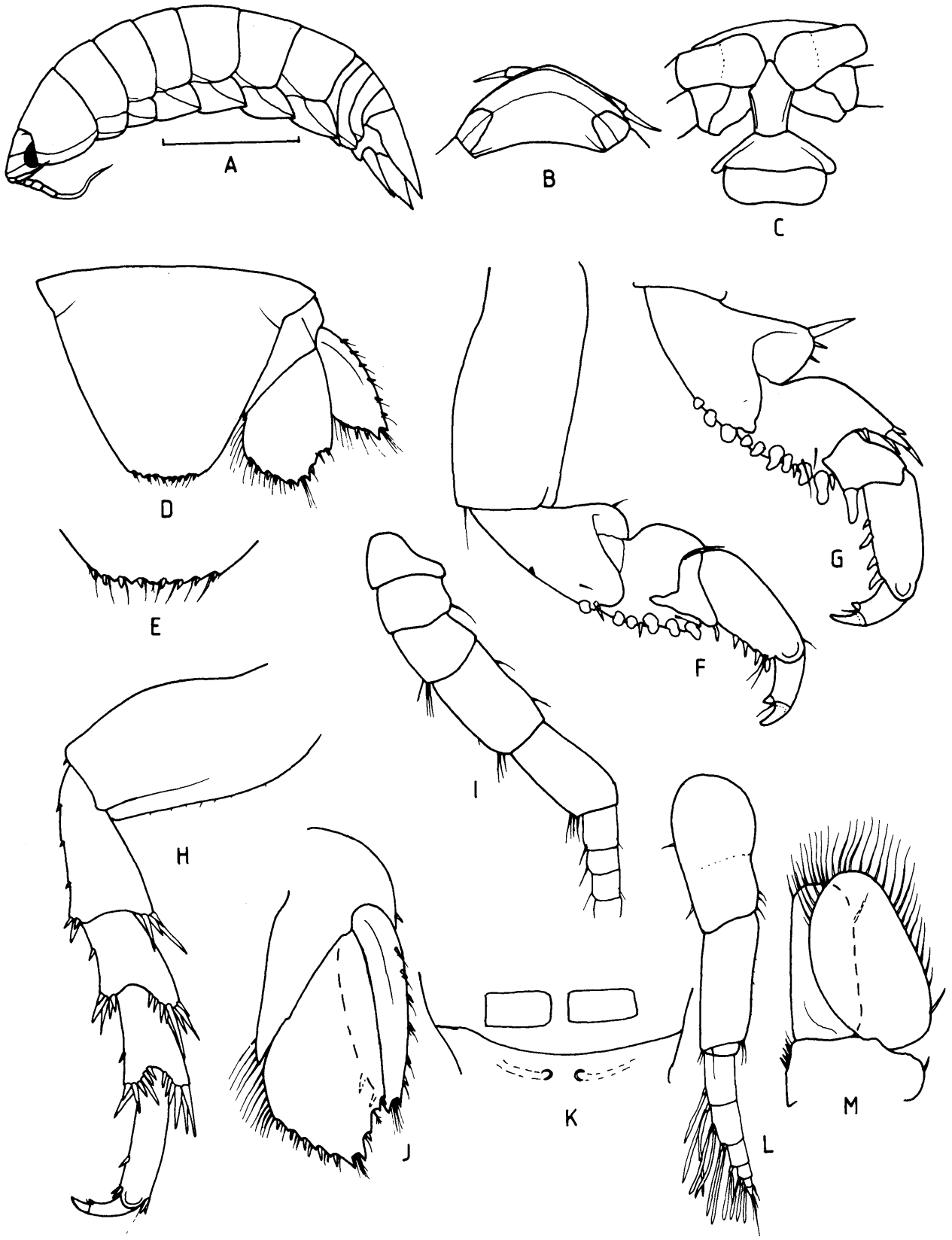

Fig. 142. *Neocirolana obesa,* male 6.9 mm, Stradbroke Is. **A,** lateral view; **B,** cephalon, dorsal view; **C,** clypeal region; **D,** pleotelson and uropods; **E,** pleotelson, posterior margin; **F,** pereopod 1; **G,** pereopod 2; **H,** pereopod 7; **I,** antennal peduncle; **J,** uropod; **K,** sternite 7, showing penes; **L,** antennule; **M,** pleopod 1. Scale 2.0 mm.

24 Feb. 1974, 20 Feb. 1973, and east of Malabar, Sydney, NSW, 33°57'S, 151°19'E, 17 May 1972, 19.8–49 m, all coll. AMSBS. Male (6.9 mm), female (7.6 mm), Lace Bay, NSW, 14 Jan. 1978, coll. A. Reynold.

Types. Held by Australian Museum, Sydney.

Type locality. Port Stephens, NSW.

Descriptive notes. Hale (1925) described this species in detail, and only a supplementary description is given here.

Pleotelson with 8 spines on posterior margin, with single short setae adjacent to each spine.

Frontal lamina pentagonal, lateral and anterior margins concave; clypeus 3 times wider than long; labrum with slight medial indentation. Mandible with 3–6 spines on lacinia mobilis; molar process with about 21 teeth; palp robust. Maxillule with about 12 spines on gnathal surface of exopod, most of which have strongly developed serrations; endopod with 3 stout plumose spines.

Vasa deferentia opening flush with surface of sternite 7.

Pleopod 1 endopod almost rectangular in shape; pleopod 2 appendix masculina distinctly basal, twice as long as endopod; medial margin of peduncle produced. Pleopods 3–5 with complete suture on exopod. Uropods extending slightly beyond apex of pleotelson. Exopod shorter than endopod, lateral margin with 6 spines and 6 short setae, medial margin with 2–3 spines, apex bifid. Endopod with distal third of lateral margin excised, with 2 spines and sensory seta; medial margin with 5 spines and continuous row of setae, those setae between spines being distinctly shorter than those placed proximally to spine; apex bifid.

Female. Same as male. Ovigerous females slightly broader.

Colour. White to pale brown with scattered small chromatophores. Mancas tend to have the chromatophores arranged in two transverse bands

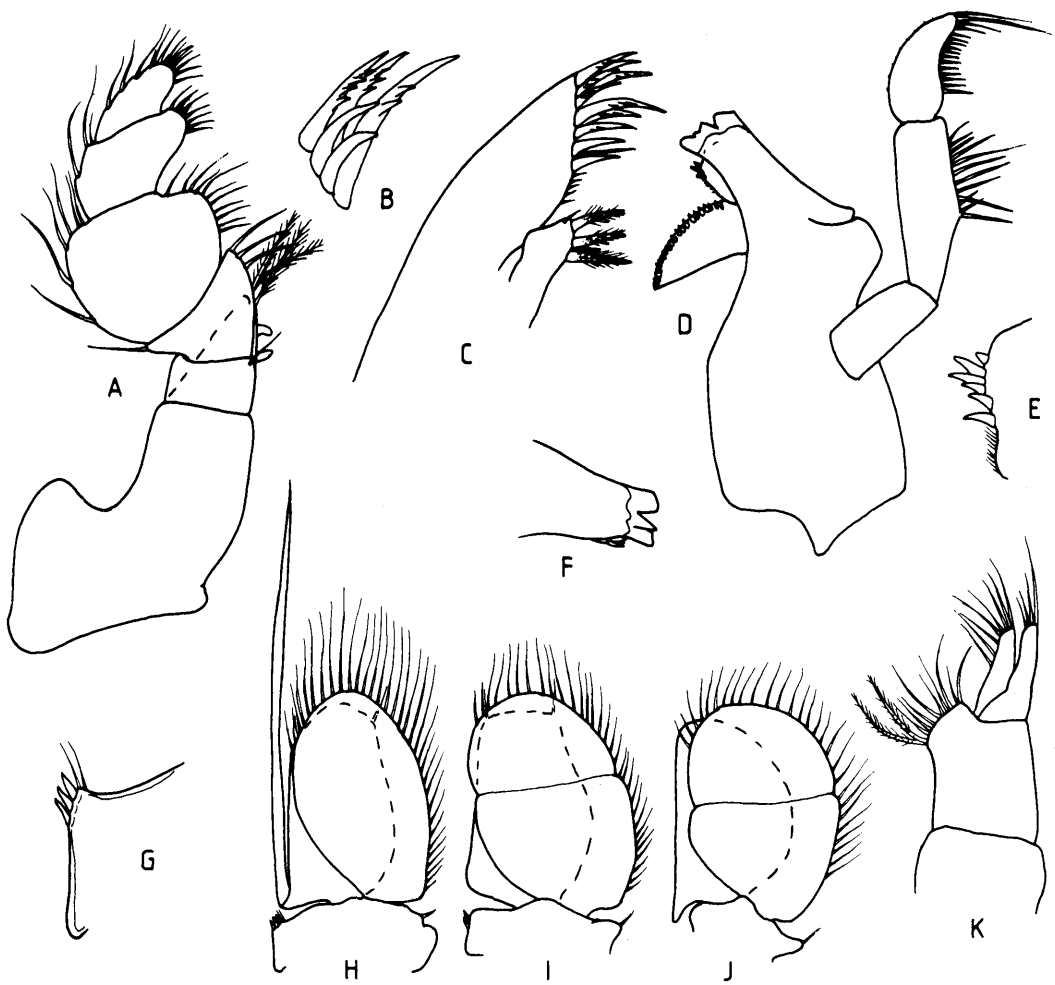

Fig. 143. *Neocirolana obesa,* male 6.9 mm. **A,** maxilliped; **B,** maxillule, gnathal spines; **C,** maxillule; **D,** left mandible; **E,** left mandible, lacinia; **F,** right mandible, incisor; **G,** pleopod 2, medial margin of peduncle; **H,** pleopod 2; **I,** pleopod 4; **J,** pleopod 5; **K,** maxilla.

towards the posterior of the pereon segments.

Size. Largest male recorded by Hale (1925) was 9.0 mm. Of the specimens examined here, the largest female was 7.5 mm and the largest male 6.9 mm. Mancas recorded up to 3.5 mm.

Remarks. Several features distinguish this species from others of the genus. *Neocirolana maculata* is the most similar, and *N. obesa* is separated by having a smoothly rounded anterior margin to the cephalon, a complete dorsal interocular furrow, far shorter antennule flagellum, posterior margin of the pleotelson broader, and the male lacking penes. The short antennule flagellum is unique within the genus.

Distribution. Moreton Bay, Qld, to Sydney, NSW, at depths of 10–49 metres. Naylor (1966) recorded this species from Port Phillip Bay, Vic., but comprehensive sublittoral collections made there by Poore et al. (1975) did not obtain this species.

Neocirolana excisa (Richardson)

Figs 144, 145

Cirolana excisa Richardson, 1910: 6, fig. 4, 5.—Nierstrasz, 1931: 156; Bruce, 1980a: 127, 128.
Neocirolana excisa.—Bruce, 1981b: 957.

Material examined. 3 males (5.0, 6.7, 7.5 mm), syntypes, Jolo Island, Philippines, 18 Sept. 1909, 45 m. Male (5.8 mm), Port Bremer, Cobourg Peninsula, NT, 11°08.5′S, 132°18.8′E, 2 May 1982, 6 m, from broken coral boulders, coll. NTM.

Types. Three syntypes, USNM 41012.

Type locality. Jolo Island, Philippines.

Description. Body slightly more than twice as long as wide. Cephalon without median rostral point; interocular furrow present. Coxae of pereonites 2–7 each with entire diagonal furrow; coxae of pereonites 2–5 almost rectangular, those of pereonites 6–7 slightly produced posteriorly. Pleonite 1 and part of pleonite 2 concealed by posterior margin of pereonite 7; pleonite 3 with lateral margins extending to posterior of pleon. Pleotelson shallowly domed, posterior margin subtruncate, provided with 8 spines and short marginal setae.

Antennule peduncle articles 1–2 fused, peduncle article 3 about same length as articles 1 and 2; flagellum with 10 articles, extends to posterior of pereonite 1. Antenna with flagellum of 23 articles extending to posterior of pereonite 4.

Frontal lamina pentagonal; lateral and anterior margins straight; lateral margins diverging slightly. Mandible with distal half markedly narrow; molar acute; lacinia mobilis with about 6 spines. Maxillule with strongly pectinate spines on exopod; endopod with 3 robust plumose spines. Maxilla with palp broad, greatly expanded; exopod also broad but less so. Maxilliped similar to that of *N. obesa.*

Pereopods 1–3 robust; pereopod 1 with single spine at posterior distal angle of ischium and 5 stout spines on posterior margin of merus; propodus with 2 spines on palm and robust spine opposing the biungiculate dactylus. Pereopods 2–3 similar to 1, but carpus proportionally longer. Pereopod 7 with distal angles of ischium, merus and carpus expanded, provided with robust spines; posterior margin of ischium scalloped, with spines at each indentation.

Vasa deferentia open flush with surface of sternite 7.

Pleopod 1 endopod sub-rectangular. Pleopod 2 appendix masculina twice length of endopod, curving laterally. Uropods extending slightly beyond apex of pleotelson, exopod distinctly shorter than endopod. Exopod with 7 spines on lateral margin, 3 on medial. Endopod with 2 spines on strongly indented lateral margin, 4 on medial. Both rami with bifid apices.

Female. Not known.

Colour. White in alcohol, densely covered by black chromatophores.

Size. Largest specimen 7.5 mm.

Remarks. This species is easily identified by the broad posterior margin of the pleotelson and the strong excised uropodal endopod, from which it takes its name. The mandible has a markedly narrow incisor, while the expanded form of the maxilla article is unique to the species.

Distribution. Northern Territory, Australia; and Philippines (Richardson, 1910).

Neocirolana maculata n. sp.

Figs 146, 147

Material examined. Male (4.7 mm), female (6.0 mm), Wistari Reef, Capricorn Group, Qld, 3 Dec. 1979, 21 m, N.W. reef slope, in dead coral. Manca (2.2 mm), Brodie Cay, Marion Reef, Coral Sea, 19°17′S, 152°13′E, 12 May 1979, outer reef slope, 15–20 m. All coll. NLB.

Types. Holotype, male, QM W9820. Paratypes, QM W9821-W9823.

Type locality. Wistari Reef, Capricorn Group, Great Barrier Reef, Qld, 23°26′S, 151°54′E.

Description of male. Body about 2.5 times as long as wide. Cephalon anterior margin with small downwardly projecting rostral process, and submarginal furrow. Pereonite 1 with single horizontal furrow. Coxae of pereonites 2–7 become progressively more produced towards posterior, each with diagonal furrow. Pleonite 1 concealed by pereonite 7; pleonite 3 produced to posterior of pleon. Pleotelson dorsal surface domed, lateral margins converging smoothly, posterior margin rounded, with 6 short stout spines, beside each of which lies single plumose setae; median point of posterior margin with pair of small simple setae.

Antennule peduncle biarticulate, but with trace of suture present on peduncular article 1, flagellum slightly longer than peduncle, composed of about 11 articles. Antenna flagellum extending to posterior pereonite 2 and composed of about 12 articles.

Frontal lamina pentagonal, lateral margin diverging, anterior margin concave, apex acute. Mandible lacinia

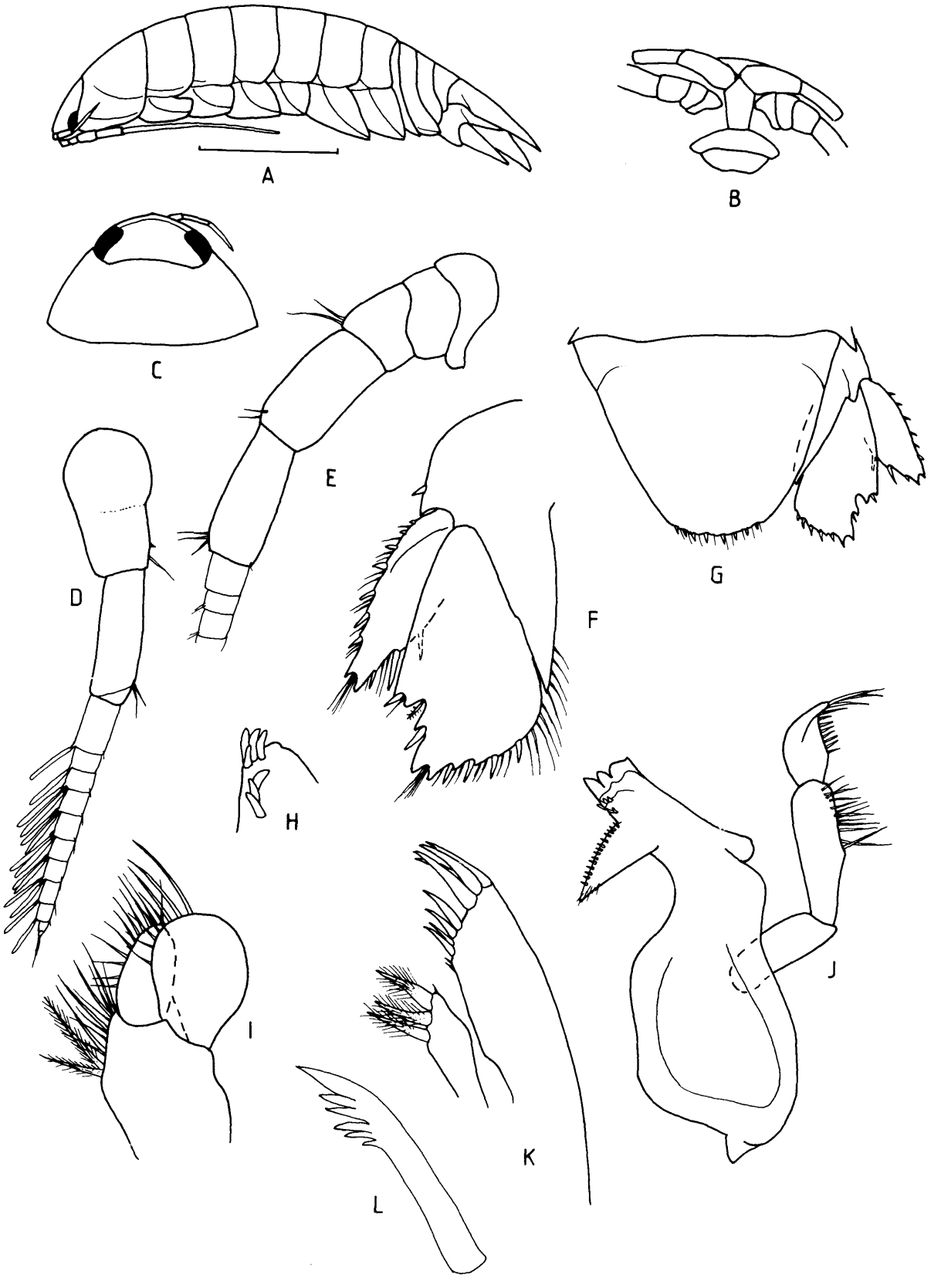

Fig. 144. *Neocirolana excisa,* syntype, except D, E, male, NT. **A,** lateral view; **B,** clypeal region; **C,** cephalon and pereonite 1; **D,** antennule; **E,** antennal peduncle; **F,** uropod; **G,** pleotelson, uropod; **H,** mandibular lacinia; **I,** maxilla; **J,** mandible; **K,** maxillule; **L,** maxillule, gnathal spine of exopod. Scale 2.0 mm.

mobilis reduced, with 3 spines only, palp articles 2 and 3 broad, distal lateral half of palp article 2 with numerous setae, lateral margin of palp article 3 with row of about 7 pectinate spines.

Pereopods all robust. Pereopod 1 with 5 blunt and 1 acute spine on posterior margin of merus, 1 spine on carpus and 2 spines on palm of propodus, with third robust spine opposing dactylus. Pereopods 2–3 similar, less robust than pereopod 1, with more numerous spines on ischium, merus and carpus.

Penes present on posterior of sternite 7, set close together, slightly produced, in form of short triangular pappillae.

Pleopods with complete suture on exopods of pleopods 3–5. Pleopod 1 endopod slender, 3 times longer than wide, half as broad as exopod, tapering towards apex. Pleopod 2 appendix masculina about twice length of endopod. Uropods extending slightly beyond apex of pleotelson. Exopod slightly shorter than endopod, lateral margin with 4 spines and short plumose setae, medial margin with 3 spines and plumose setae; apex bifid. Endopod with about 3 setae and 2 spines on lateral margin, medial margin with continuous row of setae and 3 spines; apex bifid; lateral margin with distal 0.66 slightly excavate.

Female. Similar to male, but larger.

Colour. In life translucent, with black chromatophores, forming a distinctive reticulate pattern, which is not as obvious when the chromatophores are contracted.

Size. Up to 6.0 mm.

Remarks. The characters that best identify this species are the shape of the uropods which have bifid apices, the endopod lateral margin not being indented, and pleotelson details. The chromatophore pattern is also distinctive, but whether reliable as in *N. hermitensis* it is not possible to say. *Neocirolana maculata* is the only species of the genus with penial processes.

Distribution. Wistari Reef, southern Great Barrier Reef; and Marion Reefs, Coral Sea.

Etymology. The specific name is derived from the Latin word *macula,* meaning spot or mark.

Cartetolana Bruce

Cartetolana Bruce, 1981b: 959, figs 6a–f.

Type species. *Cirolana integra* Miers, 1884.

Diagnosis. All pleonites visible; pleonite 3 laterally encompassing pleonite 4, and pleonite 4 encompassing pleonite 5. Pleotelson posterior margin with setae and spines. Antennal peduncle articles 1 and 2 subequal in length. Antenna peduncle article 4 longest. Frontal lamina flat, about twice as long as wide; clypeus sessile.

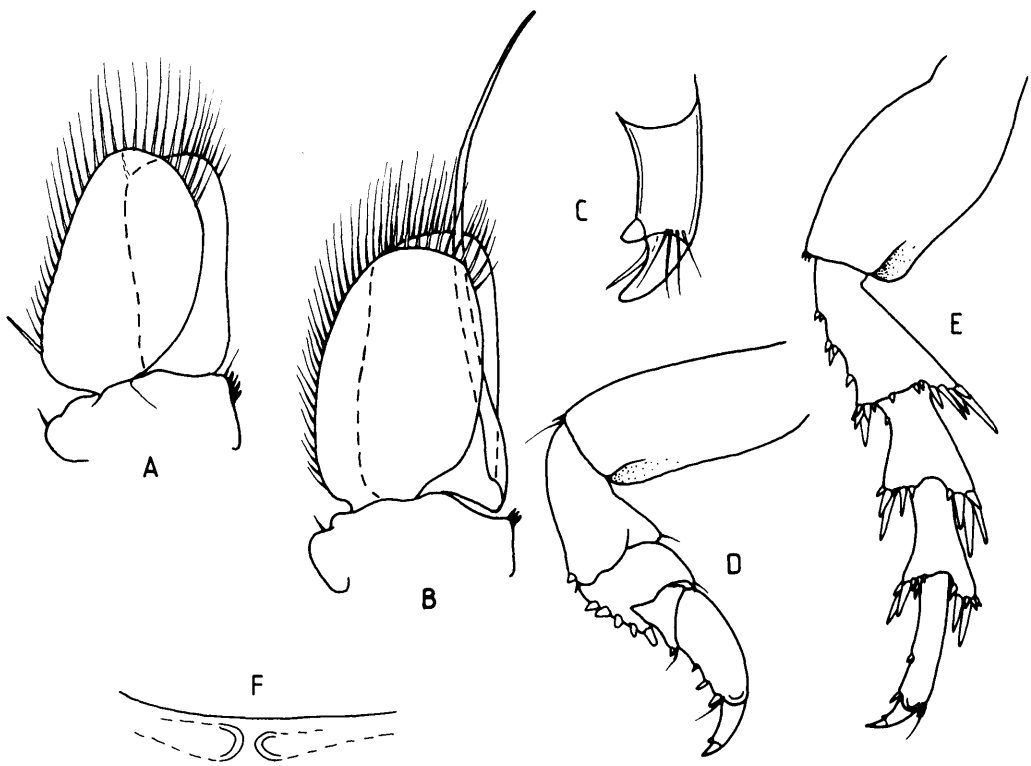

Fig. 145. *Neocirolana excisa,* syntype. **A,** pleopod 1; **B,** pleopod 2; **C,** pereopod 1, dactylus; **D,** pereopod 1; **E,** pereopod 7; **F,** vasa deferentia.

Mandible massive, palp not extending beyond cutting edge; lacinia mobilis and molar process vestigial. Maxilliped endite with 4–5 stout (but not hooked spines). Pereopods 2–3 with anterodistal margin of merus strongly produced. Pleopod peduncles without lateral lobes, only endopod of pleopod 5 without setae.

Additional characters. Body smooth, about twice as long as wide; pereonite 1 twice as long as pereonite 2.

Antennule peduncle 3-articulate, articles 1–2 being fused. Antenna peduncle articles 1–3 shorter than 4 and 5. Mandible directed strongly forwards, incisor heavily keratinised, ventral surface recessed to accommodate

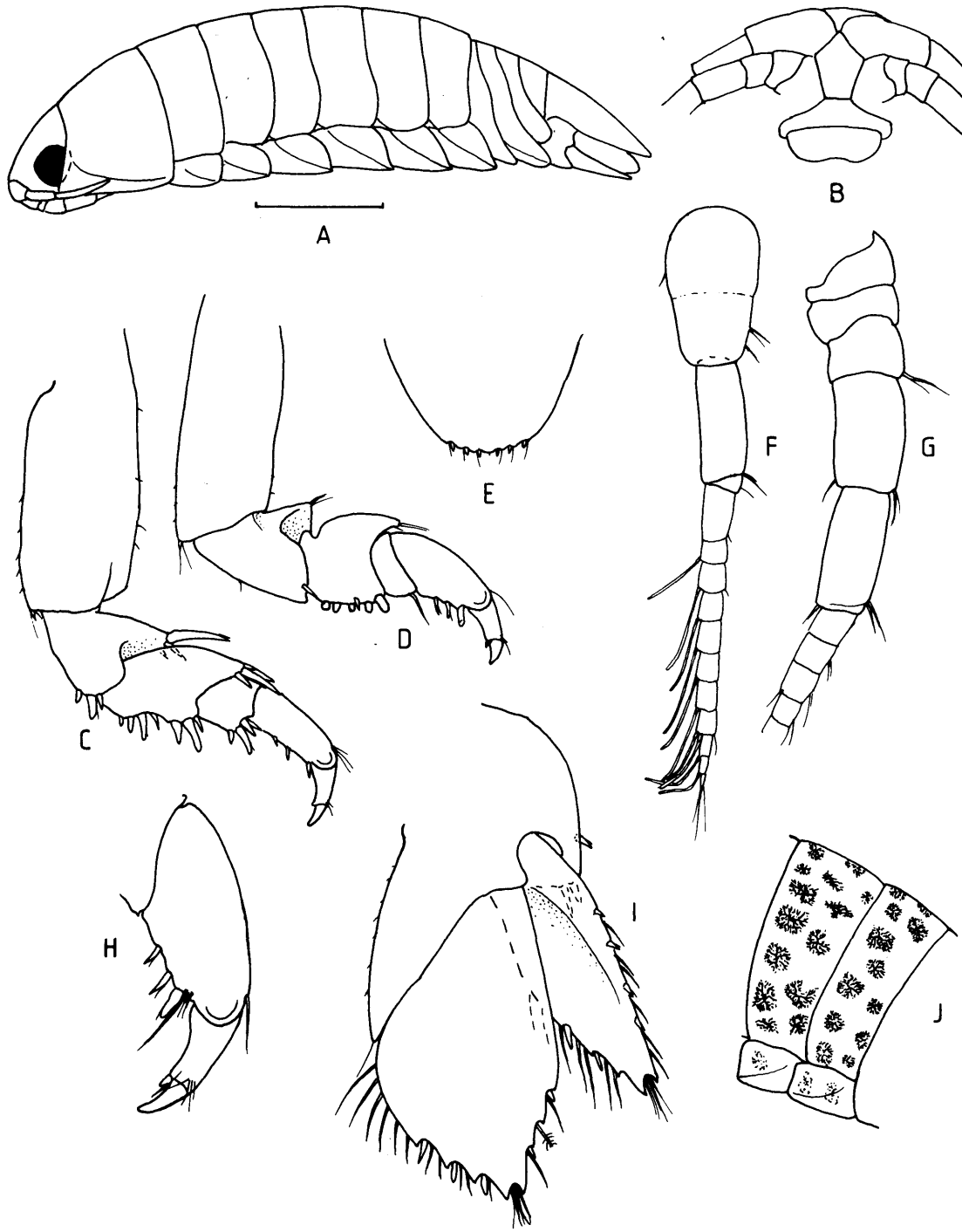

Fig. 146. *Neocirolana maculata* n. sp. A, B, E, holotype; remainder female paratype. **A**, lateral view; **B**, clypeal region; **C**, pereopod 2; **D**, pereopod 1; **E**, pleotelson, posterior margin; **F**, antennule; **G**, antennal peduncle; **H**, pereopod 1, propodus; **I**, uropod; **J**, pereonites 2 and 3. Scale 1.0 mm.

opposing incisor; palp 3-articulate. Maxillule with slender spatulate spines on gnathal surface of exopod, endopod with 3 slender simple spines. Maxilla normal, endopod slightly reduced. Pereopods all ambulatory, articles of pereopods 5–7 somewhat flat. Pleopods not differing significantly from *Cirolana*. Uropod peduncle produced along medial margin of endopod; uropod rami with short spines and setae.

Sexual variation. Males not seen.

Remarks. Bruce (1981b) discussed the taxonomy of this genus. The morphology of the mouthparts and clypeal region serves to separate *Cartetolana* from other genera.

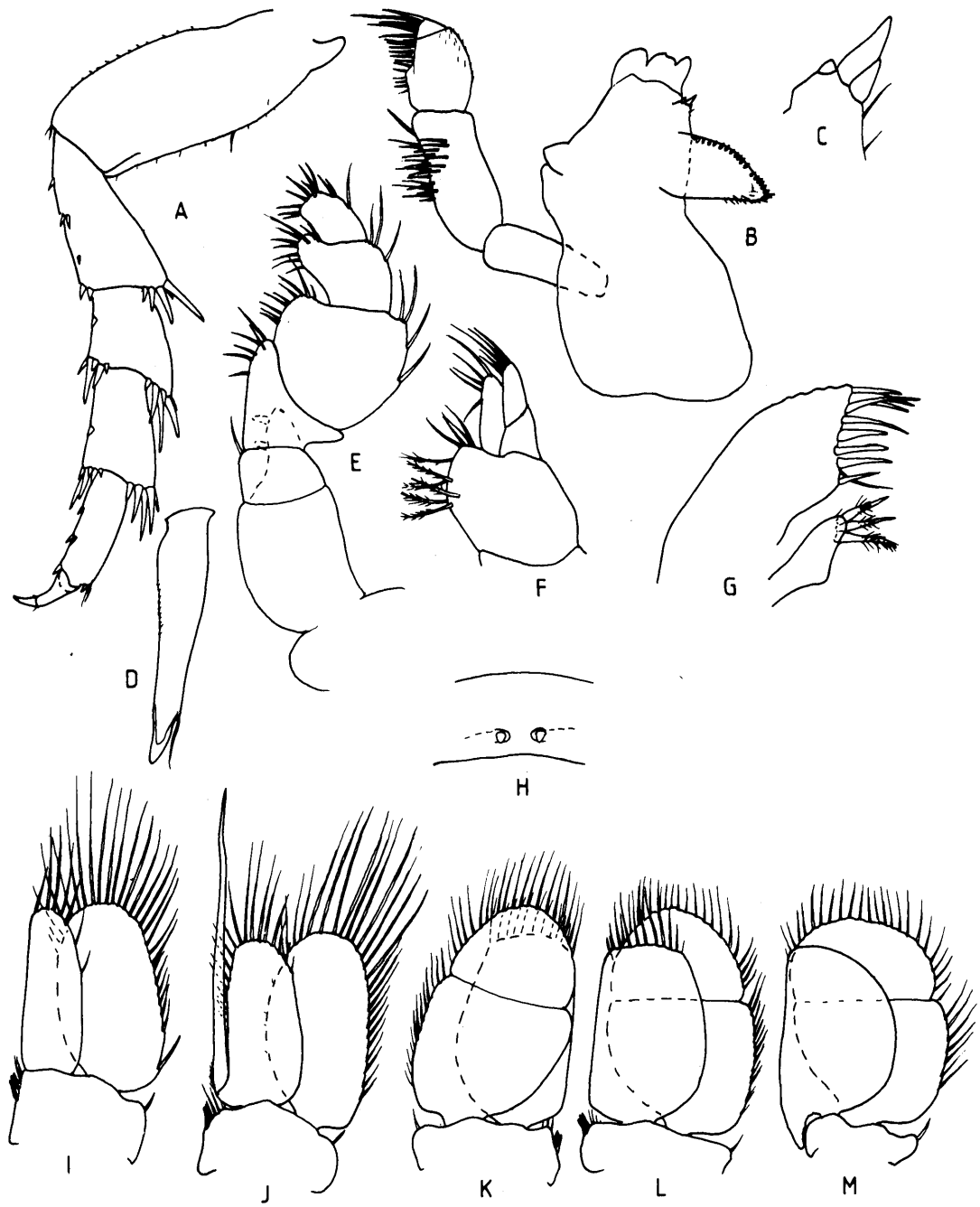

Fig. 147. *Neocirolana maculata* n. sp. H, I, J, holotype; remainder female paratype. **A**, pereopod 7; **B**, left mandible; **C**, lacinia; **D**, spine from anterodistal angle of ischium, pereopod 7; **E**, maxilliped; **F**, maxilla; **G**, maxillule; **H**, penes, in situ; **I–M**, pleopods 1–5 respectively.

Cartetolana integra Miers
Figs 148, 149

Cirolana lata var *integra* Miers, 1884: 304.
Cirolana lineata Potts, 1915: 89, fig. 6, pl. 1 fig. 4.—Hale 1925: 145, fig. 9; Nierstrasz, 1931: 152, figs 14, 15.
Cartetolana lineata.—Bruce, 1981b: 960.

Material examined. Female (11.9 mm, ovig.), Pearl Shoals, off Broome, WA, 14 Sept. 1929, on disc of crinoid, coll. A.A. Livingston. Female (9.5 mm, ovig.), Bunker Bay, Cape Naturaliste, WA, 30 Mar. 1974, internal parasite of *Comanthus*, coll. B.R. Wilson. Female (11.3 mm), Black Point, Port Essington, Cobourg Peninsula, NT, 29 Apr. 1982, 10–12 m, from *Himerometra magnipinna*, coll. NTM. Female (11.3 mm, ovig.), 2 miles north-east of Hannibal Is., Qld, 11°33'S, 142°57'E, 15 Feb. 1979, 22–23 m, trawled on sand, coll. AM. Female (9.5 mm, with embryos), One Tree Is., Capricorn Group, Qld, 28 July 1979, windward drop off, 20 m, on crinoid *Himerometra robustipinna*, coll. L. Owens. Also examined, type material of *C. lata* var *integra* Miers, BM (NH) 1881: 31.

Types. Held at the British Museum (Natural History), 1881: 31.

Type locality. "Albany Island, North Queensland" (Miers, 1884).

Description of female. Cephalon deeply immersed in pereonite 1, central part of dorsal surface depressed. Eyes large, subrectangular in lateral view. Pereonite 1 longest; coxae becoming progressively more produced towards posterior. Pleon markedly narrower than pereon, pleonite 1 partially or wholly concealed by pereonite 7, lateral margins of pleonites 2–4 produced,

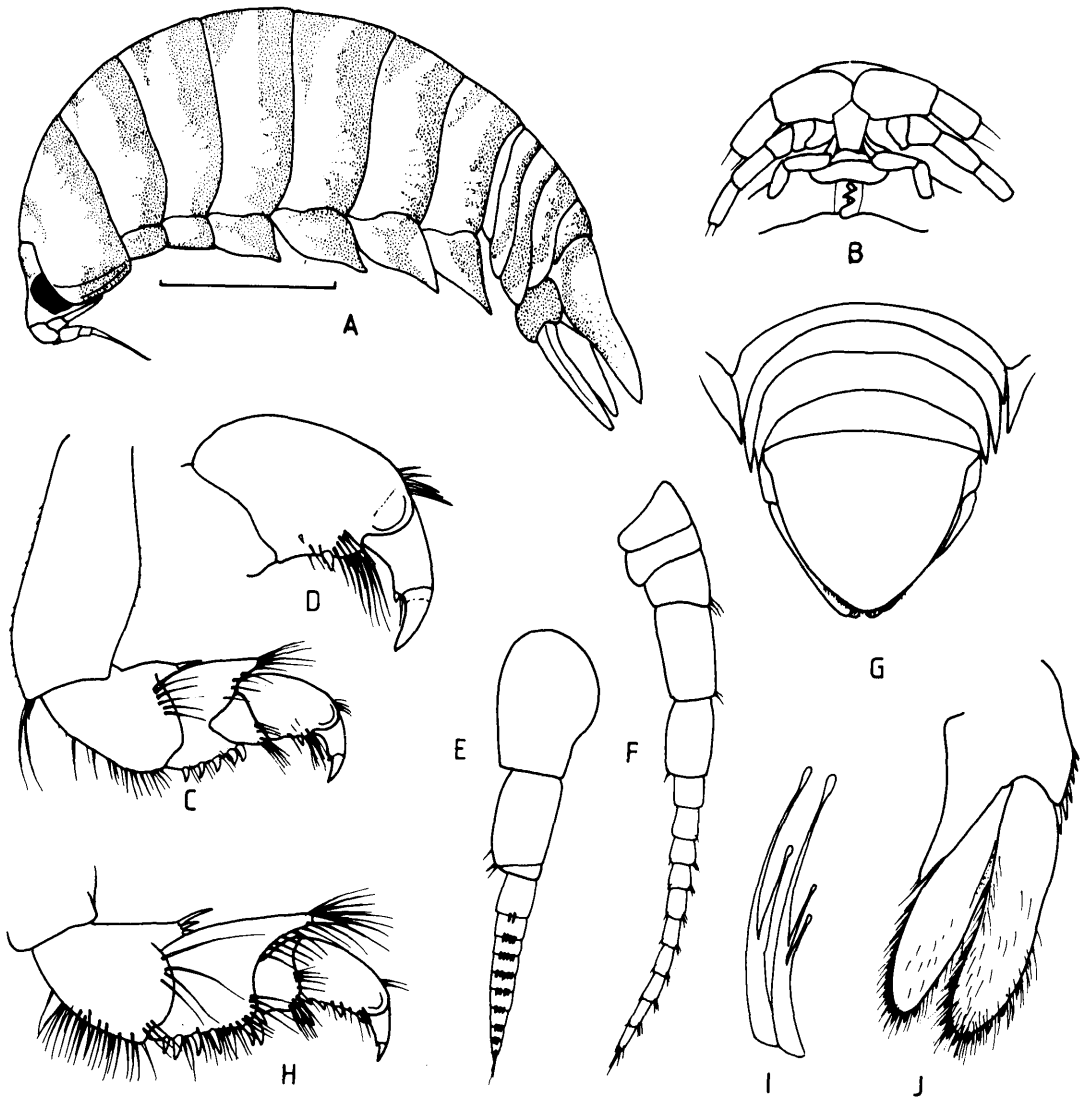

Fig. 148. *Cartetolana integra*. A, female 9.5 mm, One Tree Is.; remainder female 11.3 mm, Hannibal Is. **A**, lateral view; **B**, clypeal region; **C**, pereopod 1, **D**, pereopod 1, propodus; **E**, antennule; **F**, antenna; **G**, pleon and pleotelson; **H**, pereopod 2; **I**, maxillule, spines from gnathal surface of exopod; **J**, uropods, ventral view. Scale 3.0 mm.

those of pleonite 4 encompassing the lateral margins of pleonite 5. Pleotelson strongly vaulted, lateral margins angled ventrally, posterior margin armed with 16 spines and numerous setae.

Antennule flagellum short, composed of 10 articles, extending to pereonite 1; flagellar articles each with aesthetascs. Antenna slender, flagellum composed of about 11 short articles.

Frontal lamina pentagonal, anterior margins slightly concave; clypeus and labrum both narrow. Spatulate spines of maxillule exopod may possess strongly developed branches.

Pereopods all biungiculate. Pereopod 1 robust, propodus and dactylus short; ischium with setae along posterior margin; carpus with setae and 5 recurved species on posterior margin, anterodistal angle moderately produced, setose; carpus with dense tuft of setae on posterodistal angle; propodus with 1 spine on palm and 1 opposing dactylus, distal margin of palm with dense row of setae. Pereopods 2–3 similar to 1 but all articles proportionally longer, anterodistal angle of ischium with 3 spines, merus with abundant setae; posterior margins with numerous setae, ischium with 7 recurved spines, carpus with 3 spines and propodus with 2 spines on palm, 1 opposing dactylus. Pereopod 7 with posterior margins of merus, carpus and propodus densely spinose, distal margins and lateral angles of ischium, merus and carpus also spinose; anterior surfaces of basis with minute setae.

Pleopods with exopods of pleopods 3–5 with complete transverse suture. Peduncle of pleopods 1–3 with 6 coupling hooks on medial margin, pleopod 4 with 4. Uropods project slightly beyond apex of pleotelson. Peduncle flat; angled ventrally, exopod with its plane projecting downwards, endopod with its plane at about 90° to exopod, apices of both rami of both uropods forming tunnel with pleotelson; position of uropods largely under pleotelson. Both rami subequal in length, exopod ventral distal surface setose, lateral margin with 5 spines, medial margin with 5 spines and abundant setae; endopod with 3 spines on lateral margin, about 9 spines on medial margin; peduncle with 6 stout spines on lateral margin.

Male. No male specimens were available to be examined. Potts (1915) described the appendix masculina as "slender, much longer than inner ramus...".

Colour. Preserved specimens show two chromatophore patterns, the banded pattern and also a striped pattern where the chromatophores form three stripes that run the length of the body, one along the

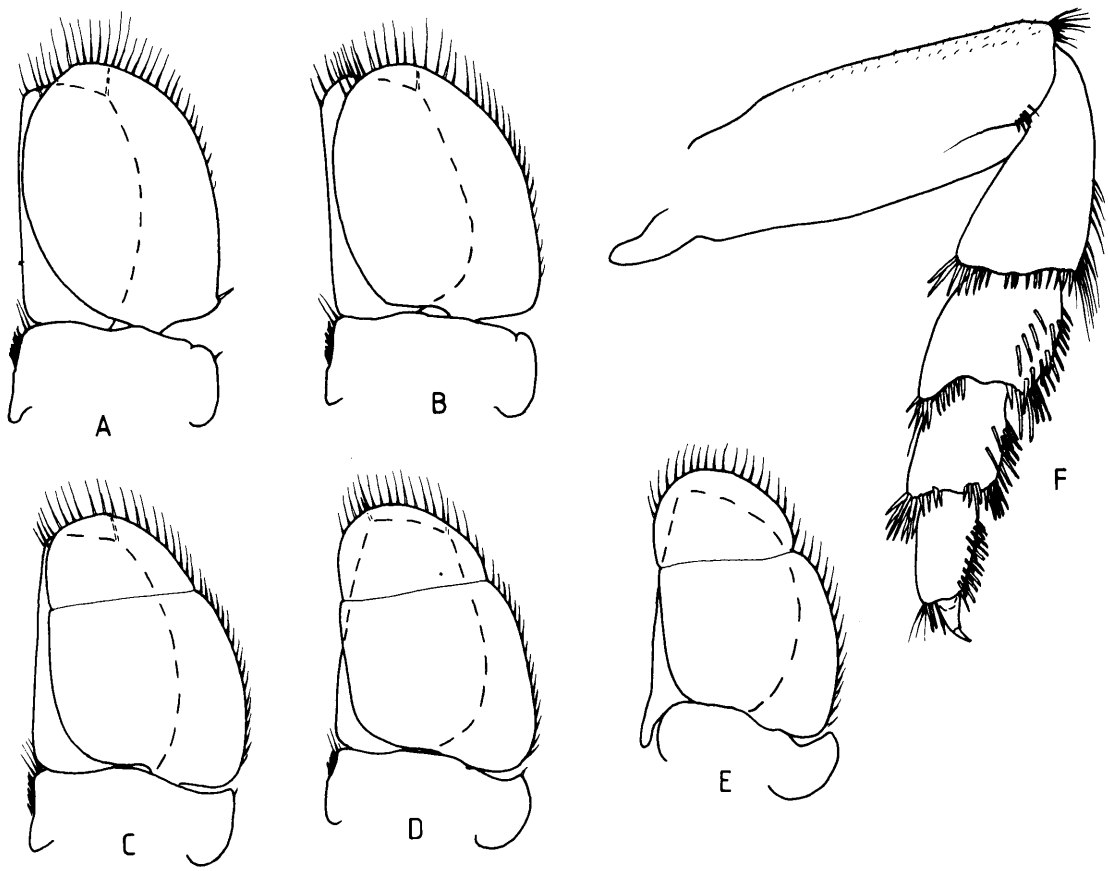

Fig. 149. *Cartetolana integra,* female 11.3 mm, Hannibal Is. **A–E,** pleopods 1–5 respectively; **F,** pereopod 7.

median axis of the animal, and two sublateral stripes extending to the lateral margins of the pleon, pleotelson and uropods.

Size. Hale recorded the species as up to 12 mm, present material is just a little shorter.

Remarks. This species can immediately be recognised by the unusual form of the pleotelson and uropods, and by the massive mandibles, obvious in ventral view. To my knowledge, it is the only cirolanid isopod that is an obligate commensal, and is an associate only of crinoids. Nothing is known of the association, but the massive mandibles suggest that it may feed by biting off crinoid cirri.

Distribution. Recorded from One Tree Island, Capricorn Group, and Hannibal Island, Qld; Cobourg Peninsula, NT; Broome and Cape Naturaliste, WA. Nierstrasz (1931) recorded the species from Aru Isles, Arafura Sea, between Papua New Guinea and Australia.

Hansenolana Stebbing

Hansenolana Stebbing, 1900: 634.—Monod, 1930: 132, 134; 1971a: 7; 1972: 215; Nierstrasz, 1931: 161.

Type species. *Hansenolana anisopous* Stebbing, 1900. Type held at the British Museum (Natural History), London.

Diagnosis. Pleonites 1–2 concealed by pereonite 7; pleonite 5 laterally overlapped by pleonite 4. Pleotelson posterior margin without spines. Antennule peduncle articles 1–2 subequal in length. Antenna articles 3–5 subequal in length and longest. Frontal lamina flat, clypeus sessile. Maxillule endopod with 4 slender spines. Maxilliped endite with one coupling hook. Pereopod 1 propodus massive, sub-chelate; pereopods 2–3 with ischium and merus not produced. Pleopods peduncles without lateral lobes, endopods of pleopods 3–5 without setae; appendix masculina inserted basally.

Additional characters. Cephalon widest anteriorly, maxilliped somite not indicated. Pereonite 1 twice as long as pereonite 2. Pleon obviously narrower than pereon.

Antennule peduncle 3-articulate, articles 1–2 fused; flagellum articles elongate; antenna peduncle 5-articulate, articles 1–2 shorter than 3–5. Mouthparts as for *Cirolana* except maxilla articles reduced. Pereopod 1 dactylus with slender secondary unguis; pereopods 2–7 slender, without long setae; all dactyls biungiculate. Pleopods 3–5 with endopods distinctly smaller than exopod. Uropod peduncle produced.

Sexual dimorphism. Females reach a larger size than males.

Remarks. Stebbing (1900), and later Monod (1930) allied *Hansenolana* to the group of species later contained within the genus *Metacirolana*. Monod (1930, 1971a, 1972) placed *Hansenolana* in a group of genera that included *Neocirolana, Saharolana, Conilorpheus* and *Metacirolana*. The rationale behind this grouping was never fully explained, and Monod (1971a) did express doubts as to the homogeneity of the grouping. Examination of the Australian specimen and a critical appraisal of Stebbing's (1900) and Monod's (1971a) figures suggest that *Hansenolana* belongs to the *Cirolana* group of genera, and is in fact quite remote from *Metacirolana*. Numerous characters ally *Hansenolana* to the *Cirolana* group, these characters being the morphology of the pereon, the pleon, the sessile frontal lamina and clypeus, the form of the antenna, antennules, mouthparts and the pereopod dactyls. All these characters are strongly contrasted when compared to *Metacirolana*.

Hansenolana anisopous Stebbing
Fig. 150

Hansenolana anisopous Stebbing, 1900: 635, pl. LXVIIIA.—Nierstrasz, 1931: 161; Monod, 1971a: 7, figs 1–26.

Material examined. Manca (3.1 mm), Casuarina Beach, Lizard Is., Qld, 12 June 1976, beach rock, upper shore, coll. D.M. Holdich. Additional material: 18 specimens including males (6.2–10.5 mm) and females (7.9–11.3 mm), all from rotting wood in estuarine or mangrove habitats from Murray River, Qld (QM), Prince of Wales Is., Torres Strait, Mandai Estuary, Singapore (AM), and Vavu'a Is., Tonga (USNM).

Types. Holotype held at the British Museum (Natural History).

Type locality. Isle of Pines, New Caledonia.

Remarks. This species was described in excellent detail by Stebbing (1900). Monod (1971a) later described fully a second specimen from the type locality. Monod's description differed from Stebbing's in that his specimen had the maxilla with only a single lobe. Examination of the single specimen from Lizard Island suggests the normal condition for the species is the maxilla with all articles present, but the exopod and palp are reduced when compared to most Cirolanidae.

The whole animal is markedly flattened, and Monod's (1971a) figure for the clypeal region did not fully describe the frontal lamina. In ventral view it appears truncated anteriorly but it in fact continues dorsally, and separates the antenna and antennules. The maxilliped differ from previous figures (Stebbing, 1900; Monod, 1971a) in having the lateral margin of the palp straighter, and in possessing fewer, but far larger setae.

Distribution. New Caledonia: Isle of Pines (Monod 1971a, Stebbing, 1900); Queensland: Lizard Island, Murray River, Prince of Wales Island. Also Singapore and Tonga.

Limicolana n. gen.

Type species. *Limicolana dinjerra* n. sp., by monotypy. Types held at the Western Australian Museum, Perth, and the Queensland Museum, Brisbane.

Diagnosis. Pleonites all visible, lateral margins of pleonite 4 encompassing those of pleonite 5. Pleotelson posterior margins with spines and setae. Antennule peduncle 3 longest. Antenna peduncle articles 4–5

longest. Frontal lamina posteriorly narrow, anterior margin projecting; clypeus sessile. Maxilliped endite with 2 coupling hooks. Pereopods 2-3 with merus anterodistal margin strongly produced. Pleopod peduncles with lateral lobes, endopods of pleopods 3-5 without setae; appendix masculina inserted submedially.

Additional characters. Body smooth, cephalon anterior margin medially recessed; pereonite 1 longer than 2.

Antennule peduncle articles 1-2 short, article 3 more than 1.5 times longer than their combined lengths; flagellum 1.5 times longer than peduncle. Antenna peduncle articles 1-2 short, article 3 as long as combined lengths of 1-2, article 4 longer than length of articles 1-3 combined, and article 5 more than 1.5 times as long as article 4. Mouthparts as for *Cirolana*. Pereopods ambulatory, all dactyls simple; spine opposing dactylus very small; pereopods 4-7 with few setae, articles not flattened. Penes present on sternite 7. Pleopods 3-5 exopods without transverse suture. Uropod peduncle medial margin produced.

Sexual dimorphism. None observed.

Remarks. Whilst most closely resembling *Cirolana*, *Limicolana* is not obviously allied to any marine genus. It differs from the *Cirolana* group of genera in the antennular and antennal peduncles having elongate distal articles, the shape of the cephalon, the anterodistal margins of the merus of pereopods 2-3 being produced, the lack of biungiculate dactyls, the lack of a robust spine opposing the dactylus, the presence of flat penes, and the point of insertion of the appendix masculina.

Etymology. The name is dervied from the coupling of the Latin words *limus* (= mud), *caula* (= burrow) to the ending *-olana* to indicate familial affinity. Gender is feminine.

Limicolana dinjerra n. sp.

Figs 151, 152

Material examined. 2 males (14.8, 11.9 mm), female (12.6 mm), Derby, WA, Aug. 1975, mangrove sea cliff, coll. V. Semenuik. Male (13.7 mm), E. Alligator River, and 6 males (13.3-15.8 mm), 6 females (11.8-12.6 mm), Flying Fox Is., E. Alligator River, Kakadu National Park, NT, June, 1981, in burrows in mud bank, coll. P.J.F. Davie.

Types. Holotype, male (15.8 mm) QM W9682. Paratypes, QM W9682, W9683; WAM 30-80, 31-80.

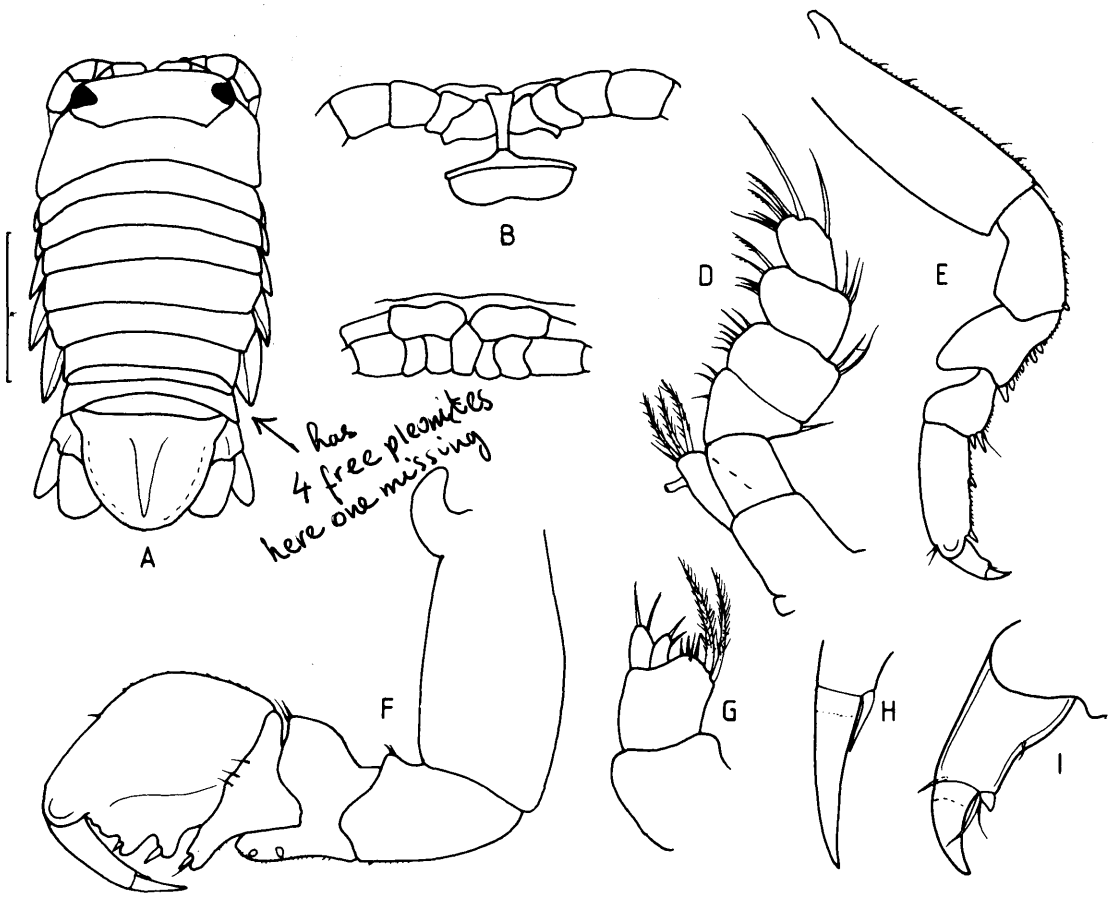

Fig. 150. *Hansenolana anisopous*, manca 3.2 mm, Lizard Is. **A**, dorsal view; **B**, clypeal region; **C**, cephalon, anterior view; **D**, maxilliped; **E**, pereopod 2; **F**, pereopod 1; **G**, maxilla; **H**, pereopod 1, dactylus apex; **I**, pereopod 2 dactylus. Scale 1.0 mm.

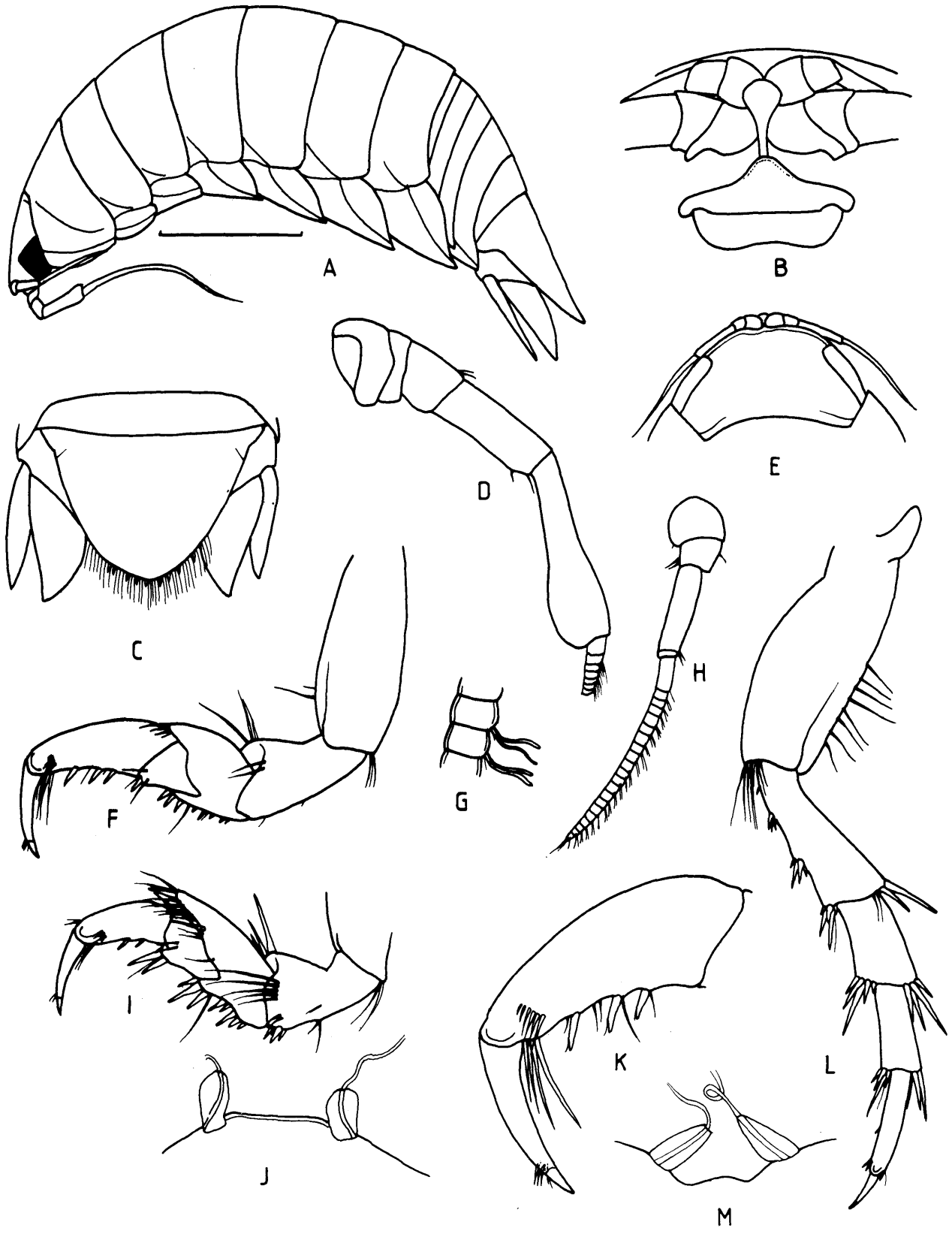

Fig. 151. *Limicolana dinjerra* n. sp. A-C, E, holotype; L, male 11.9 mm; M, male 15.4 mm, NT; remainder male 14.8 mm, Derby. **A**, lateral view; **B**, clypeal region; **C**, pleotelson; **D**, antennal peduncle; **E**, cephalon dorsal view; **F**, pereopod 1; **G**, antennule, flagellum articles 9, 10; **H**, antennule; **I**, pereopod 2; **J**, penes; **K**, pereopod 1, propodus; **L**, pereopod 7; **M**, penes. Scale 3.0 mm.

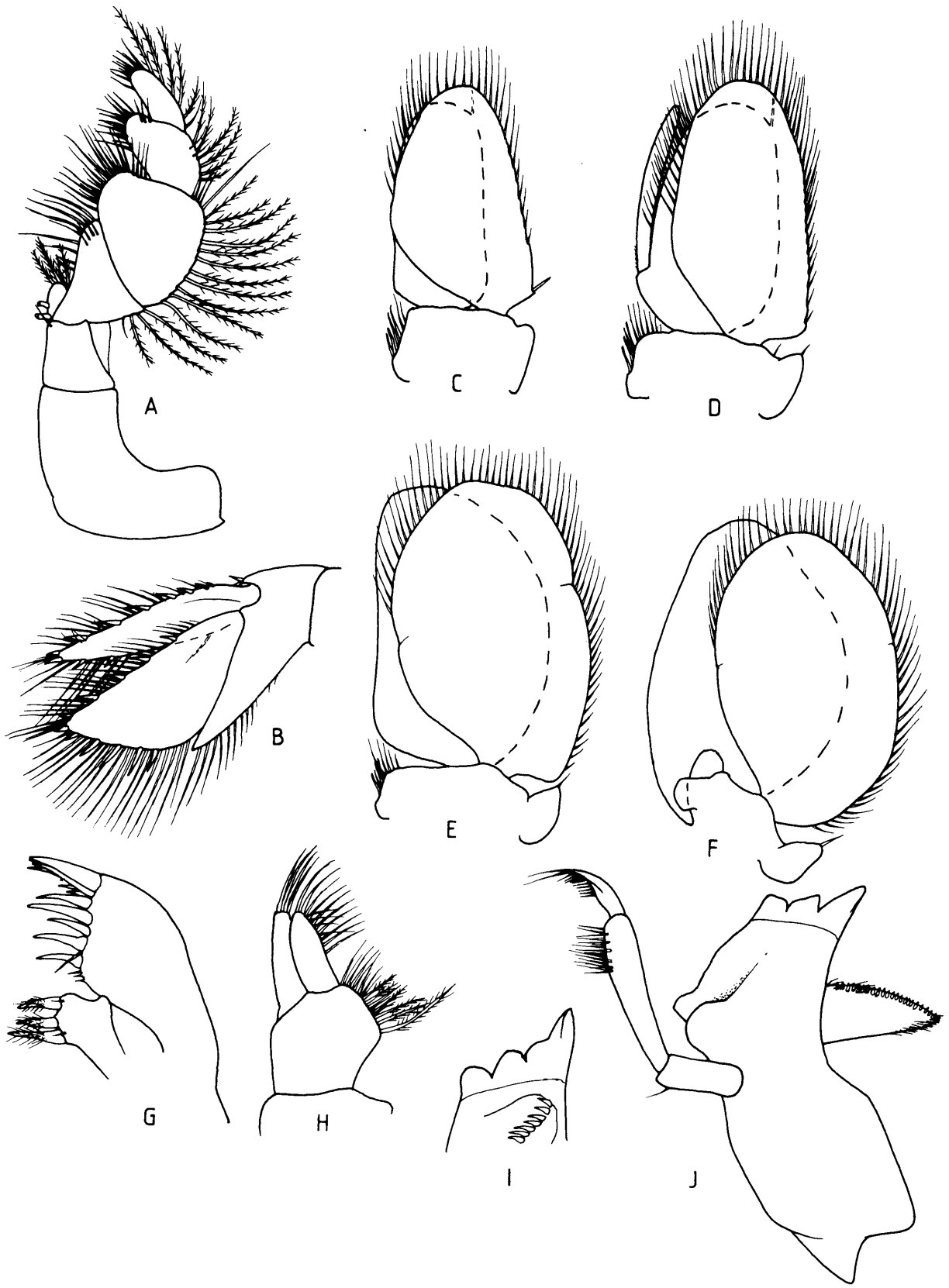

Fig. 152. *Limicolana dinjerra* n. sp. B, male 11.9 mm; remainder male paratype 14.8 mm, Derby. **A**, maxilliped; **B**, uropod; **C–F**, pleopods 1, 2, 4, 5 respectively; **G**, maxillule; **H**, maxilla; **I**, left mandible, incisor; **J**, right mandible.

Type locality. Flying Fox Island, E. Alligator River, NT, 12°14'S, 130°50'E.

Description of male. Body strongly vaulted, about 2.5 times as long as wide. Cephalon with minute median rostral point. Eyes large, numerous facets. Coxae of pereonites 2–7 with entire carina; posteroventral angle of coxae 4–7 with small point. Pleon with posterolateral margins of pleonite 4 with horizontal furrow. Pleotelson smoothly curving to apex; posterior margin with 8 or 9 stout spines set amongst long plumose setae.

Antennule flagellum composed of about 20 articles, extends to posterior of pereonite 1; flagellar article 1 about 3 times longer than article 2. Antennal peduncle article 5 with distal extremity swollen, flagellum composed of 20 articles, extends to pereonite 5; articles provided with abundant setae.

Frontal lamina with margins rounded, posterior part narrow, anterior margin rounded; clypeus with median third of anterior margin produced forwards. Maxilliped with prominently plumose setae on medial margin of palp articles 1 or 2 to 5.

Pereopod 1 with few setae, except at anterodistal angle of ischium and merus, and distal extremity of propodus; posterior margins of merus with 8 acute spines, carpus with 1 spine, and propodus with 3 spines on palm. Pereopods 2–3 similar to 1 but more and larger spines on posterior margins of ischium, merus and carpus. Pereopod 7 moderately slender with few setae except at posterodistal angle and anterior margin of basis; remaining articles with spines at distal margins, 2 clusters of short spines on posterior margin of ischium, and single spine on palm of propodus.

Penes present on sternite 7, set wide apart, penes flat in shape, narrowest apically, about 2.5 times longer than wide.

Pleopod 2 appendix masculina not projecting beyond apex of endopod. Uropods extending slightly beyond apex of pleotelson, rami subequal in length. Exopod narrow, lateral margin with about 7 stout curved spines, medial margin with 3. Endopod apex narrow, lateral margin with 5 stout curved spines, medial margin with 6. All margins with long plumose setae, both rami with non-bifid apices.

Female. Similar to male, but distal portion of 5th peduncular article of antenna not swollen, and flagellar articles not as setose.

Variation. The description is based largely on the specimens from Derby, the Northern Territory specimens only being received shortly before the final draft. Differences between the two areas include the Northern Territory specimens having the penes more strongly tapered, the appendix masculina slightly more acute, and the presence of plumose setae on the medial margin of maxilliped palp article 1. Otherwise the specimens from the two areas are identical.

Colour. White to cream with black chromatophores. Life colour not recorded.

Size. Largest specimens were a male of 15.8 mm and females 12.6 mm. Average sizes for specimens from the Alligator River were male: 14.5 mm, female 17.0 mm.

Remarks. This species can be separated from other cirolanids by the generic characters.

Distribution. Derby, WA, and East Alligator River, NT, in "...open burrow systems that penetrate the muddy soil of the mangroves..." (V. Semenuik, in litt.). The habitat is figured by Semenuik (1980: pl. 2b).

Etymology. The specific epithet is an Aboriginal word meaning west.

INVALID CIROLANID NAMES

To avoid potential confusion when referring to the literature, a list of invalid species and generic names is given. The senior synonym or correct family is given in brackets. Bibliographic references are not all included as most will be found in the literature cited for the senior synonym.

Bermudalana Bowman & Iliffe, 1983 *(Arubolana).*
Branchuropus Moore, 1901 *(Eurydice).*
Cirolana albinota Vanhöffen, 1914 *(Natatolana meridionalis).*
Cirolana anadema Glynn, 1972 *(Cirolana theleceps).*
Cirolana bathyalis Menzies & George, 1972 *(Metacirolana japonica).*
Cirolana bicarinata Pillai, 1954 *(Cirolana fluviatilis).*
Cirolana bombayensis Joshi & Bal, 1959 *(Excirolana orientalis).*
Cirolana caeca Kensley, 1978a *(Metacirolana anocula).*
Cirolana californica Hansen, 1890 *(Cirolana harfordi).*
Cirolana capitella Barnard, 1955 *(Anopsilana pustulosa).*
Cirolana deminuta Menzies & George, 1972 *(Natatolana californiensis).*
Cirolana globicipites Beneden, 1870, *nomen nudum.*
Cirolana kincaidi Hatch, 1947 *(Excirolana chiltoni).*
Cirolana keopckei Bott, 1954 *(Excirolana braziliensis).*
Cirolana laevis Studer, 1884 *(Aega,* Aegidae, see Bruce, 1981b).
Cirolana lineata Potts, 1915 *(Cartetolana integra).*
Cirolana magellanica Pfeffer, 1887, *nomen nudum.*
Cirolana nigra Chilton, 1924 *(Anopsilana willeyi).*
Cirolana ornamenta Menzies & George, 1972 *(Tridentella,* Corallanidae, see Bruce, 1981b).
Cirolana pumicea Hale, 1925 *(Dolicholana elongata).*
Cirolana robusta Menzies, 1962a *(Eurylana arcuata).*
Cirolana salvadorensis Schuster, 1954 *(Excirolana braziliensis).*
Cirolana spinipes Bate & Westwood, 1868 *(Natatolana borealis).*
Cirolana thielemani Kussakin, 1979 *(Cirolana harfordi).*
Cirolana toyamaensis Nunomura, 1982 *(Cirolana harfordi).*
Conilera grampoides Gourret, 1891 *(Cirolana cranchii).*
Conilera montagui Leach, 1818 *(Conilera cylindracea).*
Eurydice achata Dahl, 1916 *(Eurydice pulchra).*
Eurydice achata Băcescu, 1948 *(Eurydice affinis).*

Eurydice branchuropus Menzies & Barnard, 1959 *(Eurydice caudata).*
Eurydice carangis Van Name, 1920 *(Excirolana latipes).*
Eurydice elengantula Hansen, 1890 *(Eurydice dollfusi).*
Eurydice polydendrica Norman & Stebbing, 1882, *nomen nudum (Metacirolana hanseni).*
Eurydice stygia.—Menzies, 1962c. Menzies (1962c) refers to "*Eurydice stygia* G.O. Sars, Hansen, 1916". I can find no reference to this species in the Zoological Record nor in Hansen (1916) and the earlier works of Hansen (1890, 1895, 1905). Therefore I consider the species as *nomen nudum.*
Excirolana bowmani Jones & Icely, 1981 *(Annina lacustris).*
Excirolana japonica Kussakin, 1979 *(Excirolana chiltoni).*
Haitilana Notenboom, 1981 *(Anopsilana).*
Helleria Czerniavsky, 1868 *(Eurydice).*
Helleria Ebner, 1868 (Tyloidea).
Nelocira Leach, 1818 *(Cirolana).*
Nelocira swainsoni Leach, 1818 *(Cirolana cranchii).*
Paracirolana Nierstrasz, 1931 *(Metacirolana).*
Pelagonice Soika, 1955 (sub-genus of *Eurydice).*
Pontogeloides Barnard, 1914 *(Excirolana).*
Slabberina Beneden, 1861 *(Eurydice).*
Slabberina agata Beneden, 1861 *(Eurydice pulchra).*
Slabberina agilis Sars, 1865 *(Eurydice pulchra).*
Slabberina gracilis Bovallius, 1868 *(Eurydice pulchra).*
Troglaega Brian, 1932 *(Sphaeromides).*
Troglocirolana Rioja, 1956 *(Anopsilana).*
Typhlocirolana gurneyi Racovitza, 1912 *(Typhlocirolana fontis).*

ANNOTATED LIST OF NON-AUSTRALIAN GENERA AND SPECIES

Annina Budde-Lund, 1908. The genus has recently been redefined by Jones (1983), and now includes *Annina lacustris* Budde-Lund, from East Africa (Monod, 1968), *A. kumari* (Bowman, 1971a) from Singapore, and *A. mesopotamica* (Ahmed, 1971) from the Arabian Gulf. Species of the genus occur in tropical estuarine and marine habitats, usually in burrows or dead wood, but have not so far been collected from Australian coasts.

Anopsilana *acanthura* (Notenboom, 1981). Haiti, Caribbean, from a well.
A. browni (Van Name, 1936) n. comb. Freshwater streams in Cuba. I have examined specimens from mangroves in Costa Rica (Bruce, 1985) and the species belongs to *Anopsilana.*
A. crenata Bowman & Franz, 1982. A blind freshwater cave species from a well on Grand Cayman Is., Bahamas.
A. cubensis (Hay, 1903). Cuba, blind and troglobitic (Roija, 1956).
A. luciae (Barnard, 1940). South Africa, estuarine.
A. oaxaca Carvacho & Haasmann, 1984. Amongst mangroves, southern Pacific coast of Mexico.
A. poissoni Paulian & Deboutteville, 1956. Madagascar, blind troglobitic species.
A. radicicola (Notenboom, 1981). Haiti, Caribbean, from a karstic spring.

Antrolana Bowman, 1964. *A. lira* Bowman, the only species of the genus was collected from a cave in Virginia, U.S.A.

Arubolana Botosaneanu & Stock, 1979. *A. imula* Botosaneanu & Stock, the type species, is known from the hypogean waters of the Lesser Antilles, Caribbean. Notenboom (1984) synonymised *Bermudalana* Bowman & Iliffe, 1983, with *Arubolana* and the genus now also contains *A. parvioculata* Notenboom, 1984 and *A. aruboides* (Bowman & Iliffe, 1983).

Bahalana Carpenter, 1981. There are two species of this genus, *B. geracei* Carpenter, 1981, the type species, and *B. cardiopus* Notenboom, 1981, both from freshwater caves in the Bahamas (Notenboom, 1981).

Bathynomus. Because of the inadequacy of the original descriptions, the types of *Bathynomus affinis, B. propinquus* and *B. decemspinosus* were examined. A specimen of *B. doederlini* from Sagami Bay (the type locality), Japan, was also examined. To aid future identifications, figures (Figs 87, 88G–I) of these species are given.
B. affinis Richardson, 1910 (Fig. 87A-E). Known from the Philippines and the South China Sea (Shih, 1972). The shape and spination of the uropods are useful characters by which to identify this species.
B. decemspinosus Shih, 1972 (Fig. 88G–I). Known from a single immature specimen taken off Taiwan.
B. doederlini Ortmann, 1894 (Fig. 87F–K). This species is moderately well known (Holthuis & Mikulka, 1972) and has been recorded from Japan, the South China Sea, and the Philippines.
B. giganteus Milne-Edwards, 1879. Caribbean, Gulf of Mexico, northern Indian Ocean (Holthuis & Mikulka, 1972) and Brazil (Lemos de Castro, 1978). Monod (1973), in a footnote, states that this species occurs off Madagascar. Taken at depths to 2000 metres.
B. miyarei Lemos de Castro, 1978. Brazil, depths of 22–280 metres.
B. propinquus Richardson, 1910 (Fig. 87L–O). Known only by the type specimen. Monod's (1973) record is clearly not of this species as the uropods and pleotelson are very different.
Bathynomus sp. Imaizumi, 1953. A fossil fragment from Middle Miocene rocks in Japan.

Calyptolana Bruce, 1985. *C. hancocki* Bruce, the only species of the genus, was described from subtidal sediments off the Netherland Antilles, southern Caribbean.

Ceratolana Bowman, 1977b. *C. papuae* Bowman, the only species of the genus, was obtained from mangroves near Port Moresby, Papua New Guinea.

Cirolana

ATLANTIC OCEAN.

C. albida Richardson, 1901. Florida, U.S.A. (Richardson, 1905).

C. chaloti Bouvier, 1901. West Africa, Gabon to Angola (Bruce, 1982b).

C. cranchii Leach, 1818. European coasts, extending into the Mediterranean Sea (Bruce & Ellis, 1982).

C. imposita Barnard, 1955. South Africa, 15–360 metres (Kensley, 1978c).

C. minuta Hansen, 1890. Caribbean. The frontal lamina has the posterior portion projecting down, allowing easy identification.

C. obtruncata Richardson, 1901. Caribbean (Martin & Felder, 1984).

C. palifrons Lemos de Castro & Lima, 1976. Recorded from Brazil by Lemos de Castro & Lima (1976); their figures do not agree with those of Barnard who described the species from a single damaged male from the Indian Ocean.

C. parva Hansen, 1890. Caribbean (Bruce & Bowman, 1982), recently recorded from Pacific Costa Rica (Brusca & Iverson, 1985).

C. saldanhae Barnard, 1951. South Africa, shallow subtidal (Kensley, 1978c).

C. sulcata Hansen, 1980. South Africa, 5–84 metres (Kensley, 1978c).

C. transcostata Barnard, 1959. South Africa, to 86 metres (Kensley, 1978c).

C. undulata Barnard, 1914. South Africa, 11–50 metres (Kensley, 1978c).

C. vicina Barnard, 1914. False Bay, South Africa, intertidal (Bruce & Ellis, 1983).

SOUTH AFRICA. Two species are distributed on both Atlantic and Indian Ocean coasts.

C. incisicauda Barnard, 1940. Intertidal (Kensley, 1978c).

C. littoralis Barnard, 1920. Intertidal (Kensley, 1978c).

INDIAN OCEAN.

C. bougaardti Kensley, 1984b. East London to Transkei; South Africa, 630–775 metres.

C. bovina Barnard, 1940. South and East Africa to India, shallow sublittoral (Jones, 1976).

C. carina Jones, 1976. Kenya, shallow sublittoral.

C. corrugis Jones, 1976. Kenya to the Red Sea, shallow sub-littoral (Bruce & Jones, 1978).

C. fluviatilis Stebbing, 1902. South Africa, estuarine (Kensley, 1978c).

C. meinerti Barnard, 1920. South Africa, 150 metres (Kensley, 1978c).

C. palifrons Barnard, 1920. South Africa (Kensley, 1978c).

C. perlata Barnard, 1936. India.

C. rugicauda Heller, 1861. South Africa, St. Paul and Amsterdam Islands (Kensley, 1978c).

C. sulcaticauda Stebbing, 1904b. East Africa (Jones, 1976) to India and Sri Lanka (Monod, 1924; 1971b).

C. theleceps Barnard, 1940. South Africa to the Red Sea (Bruce & Jones, 1978).

C. venusticauda Stebbing, 1902. South Africa, 11–50 metres. (Kensley, 1978c).

PACIFIC OCEAN.

C. albicauda Nunomura, 1985. Middle Japan; this species does not appear to differ from *Dolicholana elongata.*

C. canaliculata Tattersall, 1921. Off New Zealand.

C. coronata Bruce & Jones, 1981. Japan, 90 metres.

C. diminuta Menzies, 1962b. Pacific coasts of California (Bruce & Bowman, 1982).

C. epimerias Richardson, 1910. Philippines.

C. fornicata (Mezhov, 1981) n. comb. From about 2,000 metres, Pacific Ocean; initially placed in the genus *Metacirolana,* but agrees more closely with the genus *Cirolana.*

C. harfordi var *spongicola* Stafford, 1912. There is insufficient data available to assess the status of this subspecies.

C. indica Nierstrasz, 1931. Indonesia.

C. latistylis Dana, 1853a. The types of this species were probably lost with the sinking of the sloop *Peacock* (Bowman, pers. comm.). The original description and figures are wholly inadequate to allow a species or genus determination to be made. The species is here relegated to the status of *species inquirenda.* All specimens determined as *Cirolana latistylis* that I have examined (Whitelegge, 1897; Richardson (Searle) 1914; Nordenstam, 1946) have all belonged to the *Cirolana parva* group of species.

C. lignicola Nunomura, 1984. East China Sea.

C. manora Bruce + Javed 1987. Pakistan.

C. pleonastica Stebbing, 1900. Reliably known only from the type locality. The East African (Jones, 1976) and Australian (Bruce 1980a; Nordenstam, 1946) records proved to be erroneous; that of Bruce (1980a) is here described as *Cirolana capricornica* and that of Jones (1976) is an, as yet, undescribed species (pers. obs.).

C. sadoensis Nunomura, 1981b. Sea of Japan. This species shows no clear affinity to any existing group of *Cirolana* species.

C. tuberculata (Richardson, 1910) n. comb. Jolo Light, Philippines. Examination of Richardson's (1910) type material (USNM 40910) shows that the species clearly belongs to *Cirolana,* not *Alcirona.*

C. vanhoeffeni Nierstrasz, 1931. Indonesia.

Cirolanides Benedict, 1896. *C. texensis* Benedict, the type species has been figured in detail by Bowman (1964). The species occurs in underground waters in Texas, U.S.A.

Colopisthus Richardson, 1902. The only species of the *genus, C. parvus,* has been recorded from the Caribbean (Menzies & Glynn, 1968), and West Africa (Monod, 1952).

Conilera Leach, 1818. *C. cylindracea* (Montagu) is a well known subtidal scavenger ocurring around the North Atlantic coasts (Kussakin, 1979; Richardson, 1905). *Conilera stygia* Packard, 1900 is a poorly known (Richardson, 1905) freshwater well

inhabitant, recorded only from Monterey, Mexico. The systematic position remains to be elucidated (Vandel, 1965); Cole & Minckley (1966) suggested that it may belong to *Speocirolana.*

Conilorpheus Stebbing, 1905. Represented in the Indian Ocean by three species, *C. herdmani* Stebbing, 1905, the type species of the genus, *C. scutifrons* Stebbing, 1908 and *C. blandus* Barnard, 1955. The two latter species are known only from South Africa.

Creaseriella Rioja, 1953. Represented by a single species, *C. anops* (Creaser, 1936). The genus is close to *Cirolana* but has pleonite 5 only half as wide as pleonite 4, and has fused penes. Known from freshwater caves on the Yucatan Peninsula, Mexico (Rioja, 1953).

Eurydice

ATLANTIC OCEAN

E. affinis Hansen, 1890. North East Atlantic, Mediterranean (Monod, 1930; Kussakin, 1979).
E. caeca Hansen, 1916. North Atlantic, 1800 metres.
E. clymeneia Monod, 1926. Morocco.
E. convexa Richardson, 1900. Florida, U.S.A.
E. czerniavsky Băcescu, 1948. Mediterranean, intertidal (Jones, 1969).
E. dollfusi Monod, 1930. Mediterranean, Adriatic and Black Sea (Jones, 1969; Kussakin, 1979).
E. elongata Moreira, 1972. Brazil.
E. emarginata Moreira, 1972. Brazil.
E. grimmaldi Dollfus, 1888. North East Atlantic, oceanic (Jones & Naylor, 1967; Kussakin, 1979).
E. inermis Hansen, 1890. Widely reported from Europe to Australia (Holdich et al., 1981). Probably restricted to Atlantic and Mediterranean coasts of Europe. (See *E. minya* for discussion).
E. littoralis (Moore, 1901). Caribbean, U.S.A. (Menzies & Frankenberg, 1966), Brazil (Moreira, 1972), and Colombia (Caravacho, 1983).
E. longispina Jones, 1969. Mediterranean, intertidal.
E. piperata Menzies & Frankenberg, 1966. Georgia, U.S.A., to Gulf of Mexico (Menzies & Kruczynski, 1983).
E. pontica (Czerniavsky, 1868). Black Sea (Băcesco, 1949a) and Mediterranean (Jones, 1969; Kussakin, 1979).
E. pulchra Leach, 1815. Atlantic coast of Europe and North Africa. Intertidal (Jones & Naylor, 1967).
E. racovitzae Băcescu, 1949a. Mediterranean.
E. rotundicauda Norman, 1906. Eastern North Atlantic, Mediterranean (Jones, 1969).
E. spinigera Hansen, 1890. Atlantic and Mediterranean coasts of Europe, shallow subtidal (Jones & Naylor, 1967; Jones, 1969).
E. truncata (Norman, 1868). Northeastern Atlantic, Mediterranean (Monod, 1930; Kussakin, 1979). Also reported from the Indian Ocean (Stebbing, 1910a) though this record should be regarded with caution.
E. valkanovi Băcescu, 1949b. Black Sea.

INDIAN OCEAN

E. agilis Jones, 1971. Kenya, subtidal (not *E. agilis* (Sars) = *E. pulchra* Leach).
E. arabica Jones, 1974. Red Sea, intertidal.
E. cavicaudata Jones, 1971. Kenya, intertidal.
E. chelifer Jones, 1971. Kenya, intertidal.
E. humilis Stebbing, 1910a. Maldives. It appears that the holotype of *E. humilis* may have been lost. The British Museum (Natural History) and the Cambridge and Oxford University Museums have no record of the species. At the time of publication Rev. Stebbing was working at Oxford, and Dr J. Hull, the curator there, informs me that the Stebbing collection went to the BM(NH) in a practically useless condition as the alcohol had evaporated. This transfer was believed to have taken place around 1933. The British Museum (Natural History) has no record of this species.
E. indicis Eleftheriou & Jones, 1976. Southwestern India.
E. inornata Jones, 1971. Kenya, intertidal.
E. longicornis (Studer, 1883). South Africa, shallow subtidal (Kensley, 1978c).
E. longipes Jones, 1971. Kenya, intertidal.
E. peraticis Jones, 1974. Red Sea to West India (Eleftheriou & Jones, 1976).

PACIFIC OCEAN

E. akiyamai Nunomura, 1981a. From an estuary, Central Japan.
E. bathypelagica Schultz, 1977. Sub-Antarctic.
E. caudata Richardson, 1900. Southern California to Ecuador (Bowman, 1977a).
E. longiantennata Nunomura & Ikeharo, 1985. Sea of Japan, subtidal.
E. nipponica Bruce & Jones, 1981. Japan, intertidal.
E. subtruncata Tattersall, 1921. New Zealand, oceanic.

Eurylana cooki (Filhol, 1885). Known only from New Zealand (Jansen, 1981).
E. pore Bruce, 1982a. Known only from southern Papua New Guinea.

Excirolana

ATLANTIC

E. armata (Dana, 1853a). Argentina and Brazil (Lemos de Castro & Silva Brum, 1969).
E. braziliensis Richardson, 1912. Caribbean coasts southwards to Brazil, also present on the East Pacific Coasts (Glynn et al. 1975).
E. latipes (Van Name, 1920). West Africa, South Africa and Brazil (Lemos de Castro & Silva Brum, 1969).

INDO-WEST PACIFIC

E. mayana (Ives, 1891). Somewhat uncertain distribution, as other species have been identified as *E. mayana;* Caribbean (Lemos de Castro & Silva Brum, 1969).
E. affinis (Jones, 1971). Kenya.
E. geniculata Jones 1974. Kenya.
E. natalenis (Vanhöffen, 1914). South Africa (Barnard, 1925; Kensley, 1978c).

EAST AND NORTH PACIFIC

E. chilensis Menzies, 1962a. Chile, South America (Carvacho, 1977).
E. chiltoni (Richardson, 1905). Japan to California (Bruce & Jones, 1981), and Formosa (Iwasa, 1965).

E. linguifrons (Richardson, 1905). California.
E. monodi Carvacho, 1977. Chile.

Faucheria Dollfus and Viré, 1905. The single species of the genus *F. faucheria* Dollfus and Viré occurs in subterranean waters in France, and has been described in detail by Racovitza (1912).

Gnatholana Barnard, 1920. The single species, *G. mandibularis* Barnard, has never been fully described, although Barnard (1959) gave additional figures of the mandible. Known only from South Africa.

Haptolana Bowman, 1966. *H. trichostoma* Bowman, the type species, recorded from freshwater, in a cave, Cuba; *Haptolana somala* Messana & Chelazzi, 1984, from a well in northern Somalia.

Metacirolana

ATLANTIC OCEAN
M. agaricicola Kensley, 1984a. Carrie Bow Cay, Belize, Caribbean Sea.
M. halia Kensley, 1984a. Carrie Bow Cay, Belize, Caribbean Sea.
M. hanseni (Bonnier, 1896). Off European Coasts to 1000 metres (Kussakin, 1979).
M. menzeisi Kensley, 1984a. Carrie Bow Cay, Belize, Caribbean Sea.
M. riobaldoi (Lemos de Castro & Lima, 1976). Brazil.

INDIAN OCEAN
M. anocula (Kensley, 1984b) n. comb. Originally described as a *Cirolana* species (Kensley, 1978a); off St Lucia, South Africa, 550 metres.
M. bicornis (Kensley, 1978a). Off St Lucia, South Africa, 750 metres.
M. convexissima (Kensley, 1984b). n. comb. Off Transkei, South Africa.
M. fishelsoni (Bruce & Jones, 1978). Red Sea, shallow subtidal.
M. mbudya Bruce, 1981c. Tanzania, shallow subtidal.
M. monodi (Jones, 1976). Aldabra.
M. rotunda (Bruce & Jones, 1978). Red Sea to Tanzania. (Bruce, 1981c).

PACIFIC OCEAN
M. costaricensis Brusca & Iverson, 1985. Pacific coasts of Costa Rica, intertidal.
M. joanneae (Schultz, 1966). California, 218 metres. Cosmopolitan.
M. sphaeromiformis (Hansen, 1890). Caribbean (Menzies & Glynn, 1968) and Pacific (Nordenstam, 1946).

Mexilana Bowman, 1975. The only known species is *M. saluposi* Bowman, from a cave in Mexico.

Natatolana

ATLANTIC OCEAN
N. borealis (Lilljeborg, 1851). European coasts (Hansen, 1905), also off South Africa (Kensley, 1975, 1978c).
N. caeca (Dollfus, 1903). European coasts at depths of 1210–2500 metres (Hansen, 1905). This species has never been fully described, nor figured.
N. gallica (Hansen, 1905). Atlantic coasts of Europe. This species is similar in appearance to *N. woodjonesi.*
N. gracilis (Hansen, 1890). West Indies to Brazil (Koening, 1972).
N. hirtipes (Milne-Edwards, 1840). Luderitz to East London, South Africa, to 200 metres.
N. neglecta (Hansen, 1890). Mediterranean. Hansen (1905) discussed this species in detail.
N. schmidti (Hansen, 1905). Northeastern Atlantic, Faroes, to 1047 metres.

INDO-WEST PACIFIC OCEAN
N. curta (Richardson, 1910). Philippines.
N. japonensis (Richardson, 1904a). Japan.
N. narica (Bowman, 1971b). New Zealand.
N. natalensis (Barnard, 1940). Natal, South Africa, shallow subtidal.
N. pilula (Barnard, 1955). Lambert's Bay to Natal, to 66 metres.
N. rossi (Miers, 1876). New Zealand (Kussakin, 1967).
N. virilis (Barnard, 1940). Port Elizabeth to Natal, South Africa, 66–80 metres.

EAST PACIFIC OCEAN
N. californiensis (Schultz, 1966). California, 813 metres.
N. chilensis (Menzies, 1962a). Chile, shallow subtidal.
N. natalis (Menzies & George, 1972). Off Peru.

SOUTHERN OCEANS
N. albinota (Vanhöffen, 1914). Subantarctic, to about 100 metres. Schultz's (1977) record is more likely to be of *N. pastorei.* Examination of Vanhöffen's type specimens revealed that they are indistinguishable from the holotype of *N. meridionalis* (Hodgson), and *N. albinota* has to be regarded as a junior synonym.
N. anopthalma (Kussakin & Vasina, 1982). n. comb. Off the Kerguelen Islands, Indian Ocean, 175 metres.
N. intermedia (Vanhöffen, 1914). Antarctic coasts (Kussakin, 1967).
N. meridionalis (Hodgson, 1910). Antarctic coasts. The senior synonym of *N. albinota.*
N. nitida (Hale, 1952). Kerguelen and Crozet Islands, southern Indian Ocean. (Kensley, 1980).
N. obtusata (Vanhöffen, 1914). Antarctic coasts.
N. oculata (Vanhöffen, 1914). Antarctic coasts (Kussakin, 1967).
N. pallidocula (Kussakin & Vasina, 1982) n. comb. Off the Kerguelen Islands, Indian ocean, 310 metres.
N. pastorei (Giambiagi, 1925). Tierra del Fuego.

Neocirolana evaconta Bruce + Javed 1987.

Oncilorpheus Paul & Menzies, 1971. Known from an incomplete adult and two juveniles of the type species, *O. stebbingi* Paul & Menzies. Taken off Venezuela at 73 metres.

Parabathynomus Barnard, 1924. Kensley (1978b) redescribed the single species of the genus, *P. natalensis,* which has been recorded only from South Africa.

Politolana Bruce, 1981b. The species of the genus have a primarily North Atlantic distribution, and have been catalogued by Bruce (1981b).

Pontogelos Stebbing, 1910a. The only known specimen of this monotypic genus appears to have been lost (along with *Eurydice humilis,* see comments for that species). Fortunately Stebbing's description of *P. aselgokeros* is good and should allow ready identification of future specimens. At present the taxonomic position of the genus is uncertain.

Pseudaega Thomson, 1883. The five species of the genus are known only from New Zealand (Jansen, 1978).

Saharolana Monod, 1930. *S. seurati* Monod is the only species of the genus, known from an underground stream at Kebili, Tunisia.

Skotobaena Ferrara & Monod, 1972. Two species are known: *S. mortoni* Monod, 1972, the type of the genus; and *S. monodi* Ferrara & Lanza, 1978, both from wells in Somalia.

Speocirolana Bolívar y Pieltain, 1950. Species of the genus include the type species, *S. palaezi* Bolivar y Pieltain, 1950; *S. bolivari* Rioja, 1953; *S. thermydronis* Cole & Minckley, 1966; *S. pubens* Bowman, 1982; *S. endeca* Bowman, 1982; and *S. guerrai* Contreras-Balderas & Purata Velarde, 1982.

Sphaerolana Cole & Minckley, 1970. Type species, *S. interstitialis* Cole & Minkley, and *S. affinis* Cole & Minkley. Both species were taken from thermal springs in Mexico.

Sphaeromides Dollfus, 1897. The type species *S. raymondi* Dollfus, collected from subterranean waters in France, has been described in detail by Racovitza (1912). Other species are *S. bureschi* Strouhal, 1963, *S. polateni Angelov, 1968 from Bulgaria, and S. virei* (Vallé, 1910; Brian, 1923) from Yugoslavia. Sket (1964) discussed three subspecies of *S. virei,* and Pljakic (1968) recorded the subspecies *S. bureschi serbica* from Yugoslavia.

Turcolana Argano & Pesce, 1980. The genus is represented by a single species, *T. cariae* Argano & Pesce, from underground waters in Turkey. This species can conglobate.

Typhlocirolana Racovitza, 1905. This is the most speciose of the freshwater genera, with at least seven species. The type species is *T. moraguesi* Racovitza, 1905. The genus is widely distributed around the Mediterranean with records from North West Africa, the Balaeric Islands off Spain, and Israel. The species are *T. moraguesi* (Balaerics; also Italy, Argano, 1979), *T. lulli* Pujiula, 1911 (Balaerics), *T. rifani* Margalef, 1953 (Balaerics, Margalef, 1958), *T. buxtoni* Racovitza, 1912 (Algeria), *T. fontis* (Gurney, 1908) (Algeria), *T. reichi* Por, 1962 (Israel) and *T. steinitzi* Strouhal, 1960 (Israel). Monod (1930) considered *T. gurneyi* Racovitza, 1912 to be a synonym of *T. fontis.* Racovitza (1912) considered the validity of *T. lulli* to be doubtful, and that the species was likely to be a synonym of *T. moraguesi.*

INCERTAE SEDIS

Cirolana sp. Australia.

Cirolana bathypelagica Schultz; 1977. This sub-antarctic species was described from a single juvenile, and appears to have aberrant mouthparts when compared to other species of the genus.

Cirolana porcellana Barnard, 1936. From Barnard's (1936) description, this species is most similar to *Dolicholana* but needs redescribing before its systematic position can be confirmed.

Cirolana quadripustulata Hurley, 1957. This species possesses a complex frontal lamina and projecting clypeus. In some ways similar to *Booralana,* it also approaches *Natatolana* in the form of the antennule, and pereopods. Known only from New Zealand.

Cirolana schioedtei. Australia.

Cirolana stebbingi Nierstrasz, 1931. In many ways this species appears most similar to the genus *Sphaeromides.* Known only from off Indonesia.

Cirolana urostylis Menzies, 1962a. Carvacho (1977) elaborated on the original description. Important characters such as the frontal lamina, clypeus and pleopods have not yet been described, and it is not possible to assign this species to a genus. The morphology of pereopod 1 is not consistent with that of *Cirolana.* Known only from Chile.

Eurydice caeca Hansen and *E. bathypelagica* Schultz are not typical of the genus.

Hesse (1866) recorded three new species of *Cirolana* from European coasts, but as the identity and correct family placement of these species is entirely uncertain I have not included the names in this list.

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APPENDIX

The data for the Crib Point Environmental Survey are given here to avoid repetition in the material sections of *Natatolana longispina, N. nammuldi, N. woodjonesi* and *N. wowine.*

Station	Date		Substratum
A1	14.vii.1964	7.55 m	—
21N	29.iii.1965	8.1 m	Very fine sand, mud, some broken shell
21S	9.iii.1965	9.9 m	Sand, some mud, much broken shell
22N	18.iii.1965	12.6 m	Shelly sand
22S	9.iii.1965	10.0 m	Sand with mud, much broken shell, some small stones
24N	4.iii.1965	9.0 m	Sand with very little mud
24S	1.iii.1965	10.8 m	Almost pure sand, some very fine mud
25N	10.iii.1965	10.1 m	Pure sand, little mud
3000	8.vi.1965	14.9 m	Pure sand, little mud
31N	29.iii.1965	14.4 m	Fine sand, and mud
31S	8.iv.1965	14.4 m	Fine sand, and mud
32N	23.iii.1965	13.1 m	Sandy gravel
34X	1.iii.1965	13.86 m	Almost pure sand
35S	1.iii.1965	13.0 m	Almost pure sand
51B	30.iii.1965	16.3 m	Sand and mud

INDEX

Australian genera, species and principal account in bold print.

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