BULLETIN OF MARINE SCIENCE, 30(1): 108–130, 1980 CORAL REEF PAPER

CIROLANIDAE (CRUSTACEA: ISOPODA) OF AUSTRALIA. HERON ISLAND AND THE CAPRICORN GROUP

Niel L. Bruce

ABSTRACT

Collections of cirolanid isopods taken from Heron Island and adjacent reefs of the Capricorn Group of the Great Barrier Reef are reported. One species of *Eurydice*, and five species of *Cirolana* are recorded, three new to science and one, *C. parva*, constituting a new record for Australia. Brief notes on the ecology and distribution of the species are given, and a key is provided to the known species of the "group *Hansenolana*" of the genus *Cirolana*. The systematics of these species are discussed.

The isopod fauna of Australia has been little studied, the early studies being primarily centered on the southerly and southeastern parts of the continent (Baker, 1908; 1910; 1926; 1928; Haswell, 1881; 1882; Thomson, 1892; Whitelegge, 1902) or as part of reports dealing with larger geographic areas (Boone, 1918; Dana, 1853; Miers, 1884; Studer, 1884; Potts, 1915). The most recent major work has been that of Hale (1925; 1926) who gave a comprehensive review, in two parts, of the family Cymothoidae in Australia. Since then there has only been sporadic publication of reports largely by foreign authors (Bowman and Kuhne, 1974; Monod, 1970; 1971a; 1973; Naylor, 1966) and also by local workers (Hale, 1933; 1940; Poore, 1975; 1977).

Of these reports most dealt briefly with the family and up to the time of the review given by Hale (1925) only seven species had been described or recorded from Australian waters. That study and two later publications (Hale, 1933; 1940) elevated the total numbers of cirolanid species known from Australia to 19, a figure likely to be enlarged as more collections are made in tropical regions of Australian northern coasts and from the deeper continental shelf areas.

The present work forms the first of a series that will deal with the systematics of the family Cirolanidae from various parts of the continent using material collected primarily from the intertidal and shallow subtidal reefs around Heron Island and adjacent islands of the Capricorn Group. For a more complete description of these islands and reefs see Flood (1977). Unless otherwise stated, material has been retained in the collections of the author.

MATERIALS AND METHODS

The bulk of the specimens were obtained by fragmenting dead coral heads, coral boulders, and algal concretions and then "dunking" the fragments in a bucket of sea water to which a few drops of concentrated formaldehyde had been added. The washings were sieved through a net of 1-mm mesh diameter. The siftings were bottled in fresh seawater without preservative for later examination in the laboratory. Other habitats such as algae, sponges, and alcyonarians were examined, but these yielded no cirolanids.

Simple traps consisting of an inverted cone set in the mouth of a perforated plastic jar were also used. These were set at various points on the reef flat at dusk, baited with fish or mollusc flesh and collected the following morning. One sample of nocturnal plankton was collected with the aid of a hand net of approximately 1-mm mesh diameter and the use of a spotlight to concentrate the plankters at the water surface.

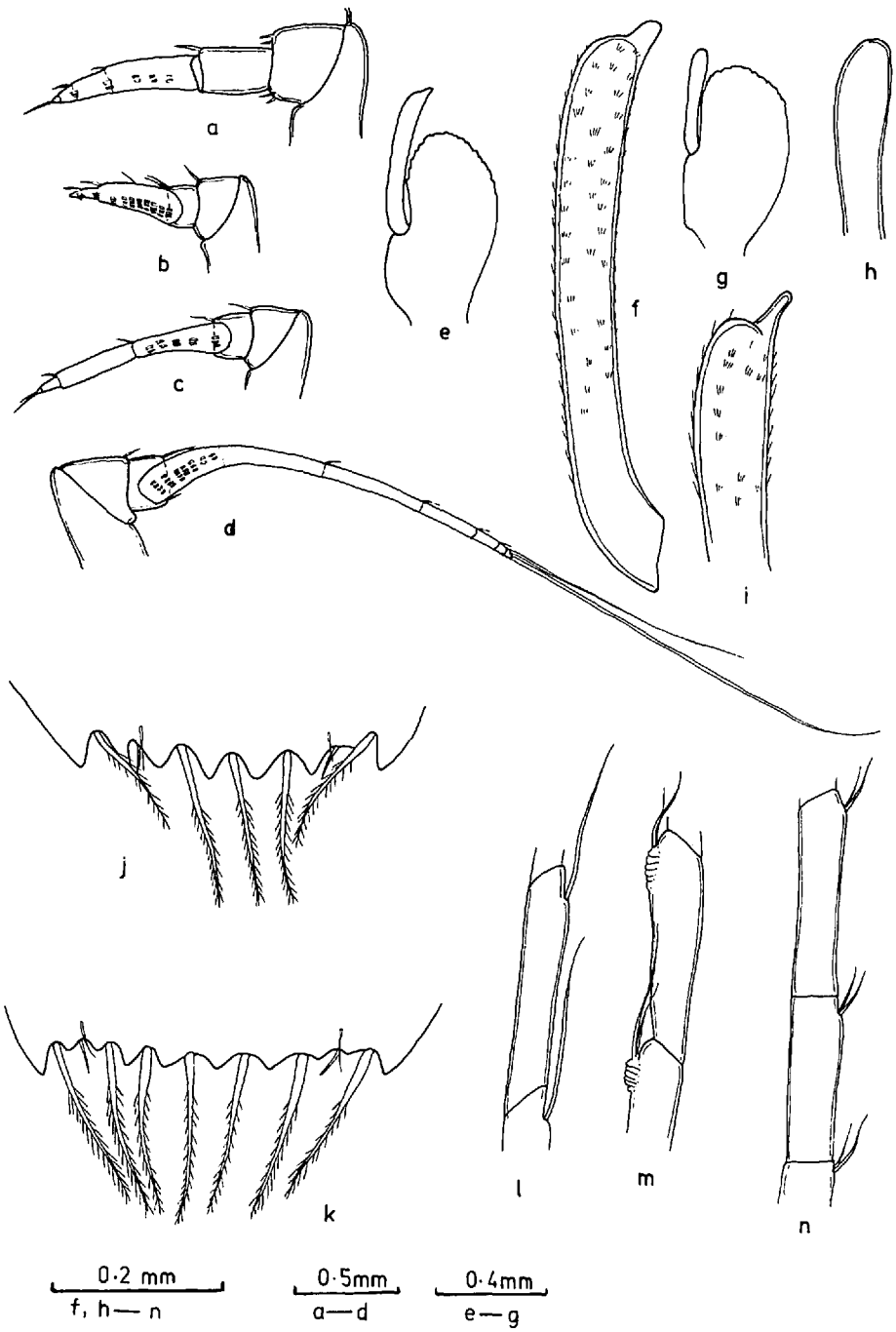

Figure 1. *Eurydice orientalis* Hansen, 1890: a, Antennule of ♀, 4.0 mm; b, ♂, 4.0 mm; c, ♂, 3.7 mm; d, ♂, 6.0 mm; e, Pleopod 2 and appendix masculina; f, ♂, 4.0 mm; g, h, ♂, 3.7 mm. Antennal segments of 1, ♀, 4.0 mm; m, ♂, 4.0 mm; n, ♂, 5.0 mm.

SYSTEMATICS

Genus Eurydice Leach, 1815

Eurydice orientalis Hansen
Figure 1

Eurydice orientalis Hansen, 1890: 369, pl. 6, figs. 2–2h.—Richardson, 1910: 8.—Nierstrasz, 1930: 3; 1931: 147.—Hale, 1933: 558.—Monod, 1934: 7, pls. IV, V A–B.—Barnard, 1936: 148.

Material examined.—1♂, 9♀, 3.0 mm–3.7 mm, Heron Island boat harbour, 12.6.1978. Coll. N. L. Bruce. 1♂, 4.0 mm, from sand in 25 m depth off Wistari Reef. 16♂ and ♀, nocturnal surface plankton, 15.9.1978, and 61♂ and ♀, 23.11.1978, nocturnal surface plankton. Coll. D. Fisk.

Remarks.—A considerable amount of variation is shown by this species. Some of this variation can be attributed to changes due to increasing maturity and size. This includes differences shown by the antennule (Fig. 1a–d) and the appendix masculina (Fig. 1e–h). In one male examined one appendix masculina was blunt and the other had the typical acute tip. The posterior margin of the telson (Fig. 1j,k) varies in width and in the number of setae present. Smaller individuals tend to have narrower posterior margins, but some variation exists between specimens of similar size.

Some males show the development of a plicate process (Fig. 1m) but this is absent in other males (Fig. 1n) and all females (Fig. 1l).

Distribution.—This is the most southerly record for the species previously known from Low Islands (Hale, 1933), Indochina (Monod, 1934), Philippines (Richardson, 1910), Indonesia, Celebes, New Guinea (Nierstrasz, 1930; 1931), and Ceylon (Barnard, 1936).

Genus Cirolana Leach, 1818

Cirolana parva Hansen

Only a restricted synonymy is given. For a comprehensive synonymy see Bowman (1977) and Monod (1976, p. 151).

Restricted Synonymy.—*Cirolana parva* Hansen, 1890: 340, pl. II, figs. 6–6G, pl. III, figs. 1–1d.—Richardson, 1905: 111, figs. 93–95.—Bowman, 1977: 653, figs. 1–3.—*Cirolana cranchii*, Nordenstam, 1946: 4, figs. 1–5. (=*C. cranchii* Leach, 1818?).

Material examined.—141 specimens ♂, ♀ and manca stages, ranging in size from 3.0 mm to 11.0 mm. 91 taken from baited traps and 38 from hard substrata, Heron Island, 29.5.1978–12.6.1978. Also 5, Wreck Island, 4.6.1978; 3, Tryon Island, 5.6.1978; 1, North Reef and 3, Wilson Island, 7.6.1978. Coll. N. L. Bruce.

Remarks.—This species is here referred to as *C. parva* on the basis of a linguiform telson and narrow clypeus (Bowman, 1977). There is a great deal of confusion surrounding the species *C. parva* and *C. cranchii* Leach (Nordenstam, 1946; Monod, 1976). Australian material originally referred to as a variety of *C. cranchii* (Hale, 1925) was raised to specific rank by Naylor (1961). It would be unproductive to enter the debate at present, but study of a large series of specimens from the Australian coastline should determine the validity of the varietal forms.

This was the commonest species in Kenya (Jones, 1976) and is also the commonest species of the genus on the reefs around Heron Island. *C. parva* was present in all samples, and constituted 79% of all individuals collected.

Distribution.—Pan tropical, recorded for the first time from Australia.

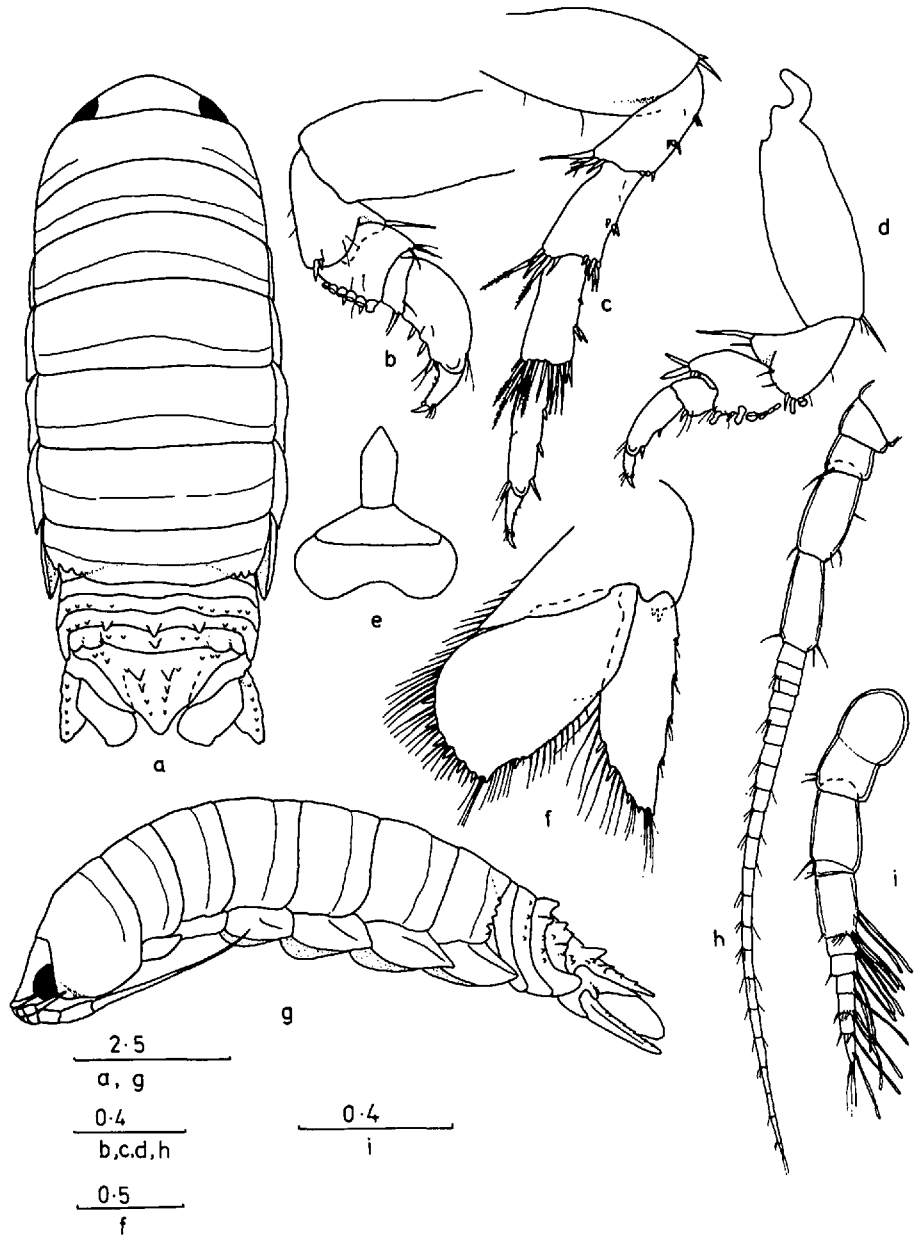

Figure 2. *Cirolana pleonastica* Stebbing, 1900: a, dorsal view; b, peraeopod 1; c, peraeopod 7; d, peraeopod 2; e, labrum, clypeus and frontal lamina; f, uropods; g, lateral view; h, antenna; i antennule. Scales are shown in mm.

Cirolana pleonastica Stebbing
Figures 2, 3, 4

Cirolana pleonastica Stebbing, 1900: 629, pl. LXVIIA.—Barnard 1935: 309, fig. 18a; 1936: 151.—Nordenstam, 1946: 9.—Jones, 1976: 215; *Non* Chilton, 1924: 883, fig. 4a–c; 1926: 180, fig. 2a–b.

Material examined.—2♂♂, 9.6 mm each, 7♀♀, 8 mm–11.4 mm (mean length 11.0 mm). All from traps, Heron Island, 12.6 1978. Coll. N. L. Bruce.

As the present material differs in several ways from the original description (Stebbing, 1900) a supplementary description with full figures is given here.

Description of Male.—Cephalon with interorbital carina present on broadly rounded anterior margin. Posterior margin of all peraeon segments with transverse impressed line. Posterolateral margin of peraeon segment 7 denticulate (Fig. 2g). Coxae on segments 2 and 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 pleon segments 3–5 denticulate, segment 4 with 3 large and about 6 small tubercles, segment 3 with single large median tubercle and additional small ones. Vas deferens flush with surface.

ANTENNULE: Short, just reaching peraeon segment 1 (Fig. 2g). Peduncular segments 1 and 2 short, appearing fused, although suture is distinct (Fig. 2i). *Antenna* with peduncular segments 1–3 very short, combined lengths equal to that of segment 4 which is subequal in length to segment 5.

MOUTHPARTS: *Mandible* typical of the genus (Fig. 3e,f). Mandibular palp with terminal segment armed with 3 long and 11 short serrate setae, segment 2 with about 12 setae on lateral margin. Medial margins of segments 2 and 3 with spinnules; apex of terminal segment smoothly rounded, not truncate. *Maxillule* (Fig. 3c) 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 (Fig. 3b); endopod with 3 long plumose setae and about 13 simple setae. *Maxilliped* broad (Fig. 3a), inner margin of segment 4 of palp only moderately produced; segment 5 short and broad. Endite with 2 coupling hooks and 4 terminal and one lateral plumose setae.

PLEOPODS: All with fringe of plumose setae with exception of endopod of pleopod 5 which is glabrous (Fig. 4a–e). Exopod of pleopods 3–5 with partial suture. Protopod of pleopod 1 with 2 coupling hooks and 4 plumose setae on inner margin, and a 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 with appendix masculina (Fig. 4b) which exceeds the exopod by ⅛ of its length; tip narrowing to an irregular point (Fig. 4f).

TELSON: Short, about twice as long as greatest width, fringed with about 40 plumose setae and 6 stout spines on posterior margin (Fig. 3d). Dorsal surface bears two rows of tubercles which become progressively smaller posteriorly, as well as scattered small tubercles on anterior lateral surface. *Uropod* with underside of peduncle armed with 2 spines, both rami extending beyond telson (Fig. 2a). Endopod with lateral margin angular, small excision near apex, posterior margin broadly rounded with about 6 spines amongst fringe of plumose setae (Fig. 2f). Exopod narrow, lanceolate, less than half width of endopod, outer margin straight with 4 short spines, inner margin fringed with plumose setae, armed with 4 spines; upper lateral surface with 5 small tubercles.

Female.—As for the male with the exception of the sexual characters.

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

Remarks.—The differences between Heron Island material and the original description (Stebbing, 1900) are as follows. The uropodal exopod lacks the numerous setae mentioned and figured in the original description, the pleonal tubercles show a different arrangement, and the terminal segment of the mandibular palp

Figure 3. *Cirolana pleonastica* Stebbing, 1900: a, maxilliped; b, maxilla; c, maxillule; d, apex of telson; e, mandible, dorsal view; f, mandible, ventral view. Scales are shown in mm.

is rounded, whereas in the original description it is shown as being truncate. The Heron Island material also differs in the presence of an interorbital ridge and of tubercles on the uropodal exopod, neither of which was indicated in the original description.

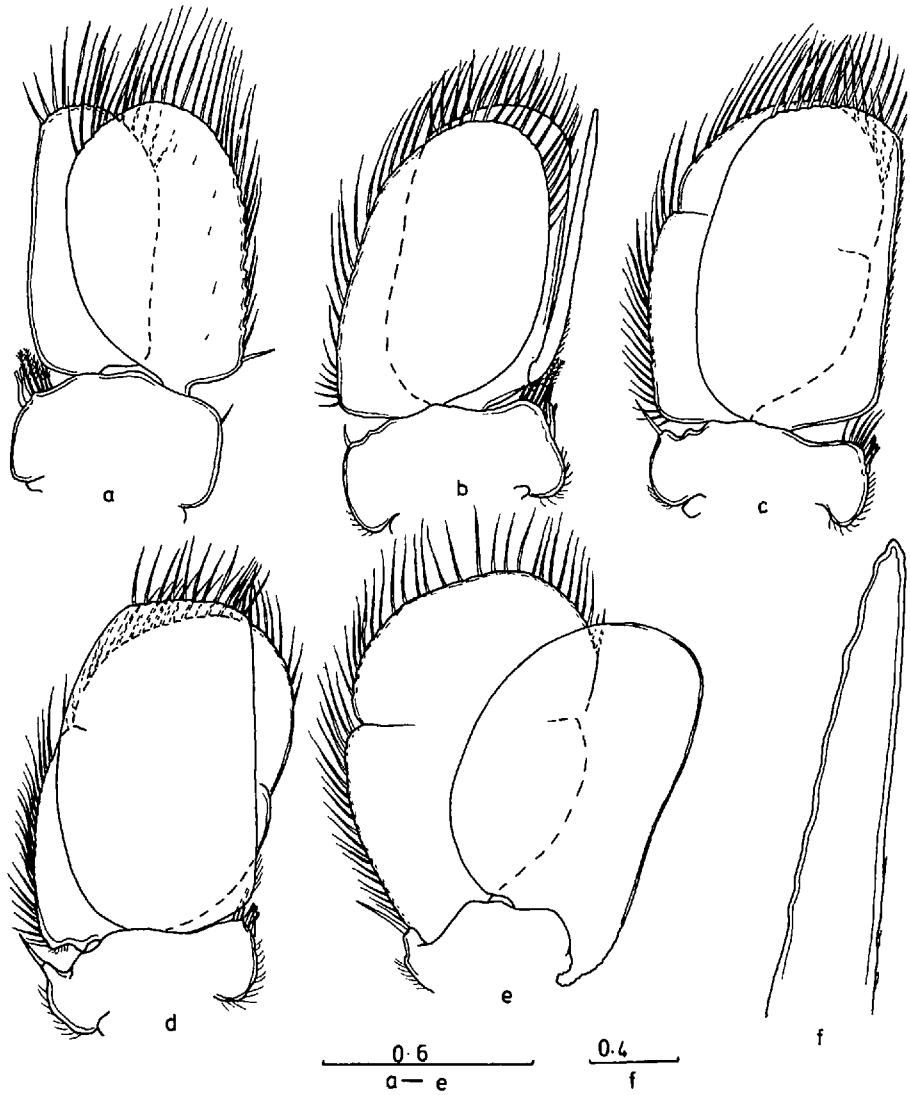

Figure 4. *Cirolana pleonastica* Stebbing, 1900: a–e, pleopods 1–5, respectively; f, apex of appendix masculina. Scales are shown in mm.

These differences were thought to be sufficient to separate the Australian material as a distinct species. However, Barnard (1936) compared his specimens with the cotypes and mentioned that the specimen he examined possessed "a short traverse ridge between the eyes" and that "the three middlemost tubercles on pleon segments 4 and 5 are distinctly more prominent than any of the others." This accords well with the specimens from Heron Island.

Distribution.—New Britain (Stebbing, 1900), Ceylon (Barnard, 1936), Gilbert Islands and Cape Jaubert, Australia (Nordenstam, 1946) and from the Kenya coast of the Indian Ocean (Jones, 1976).

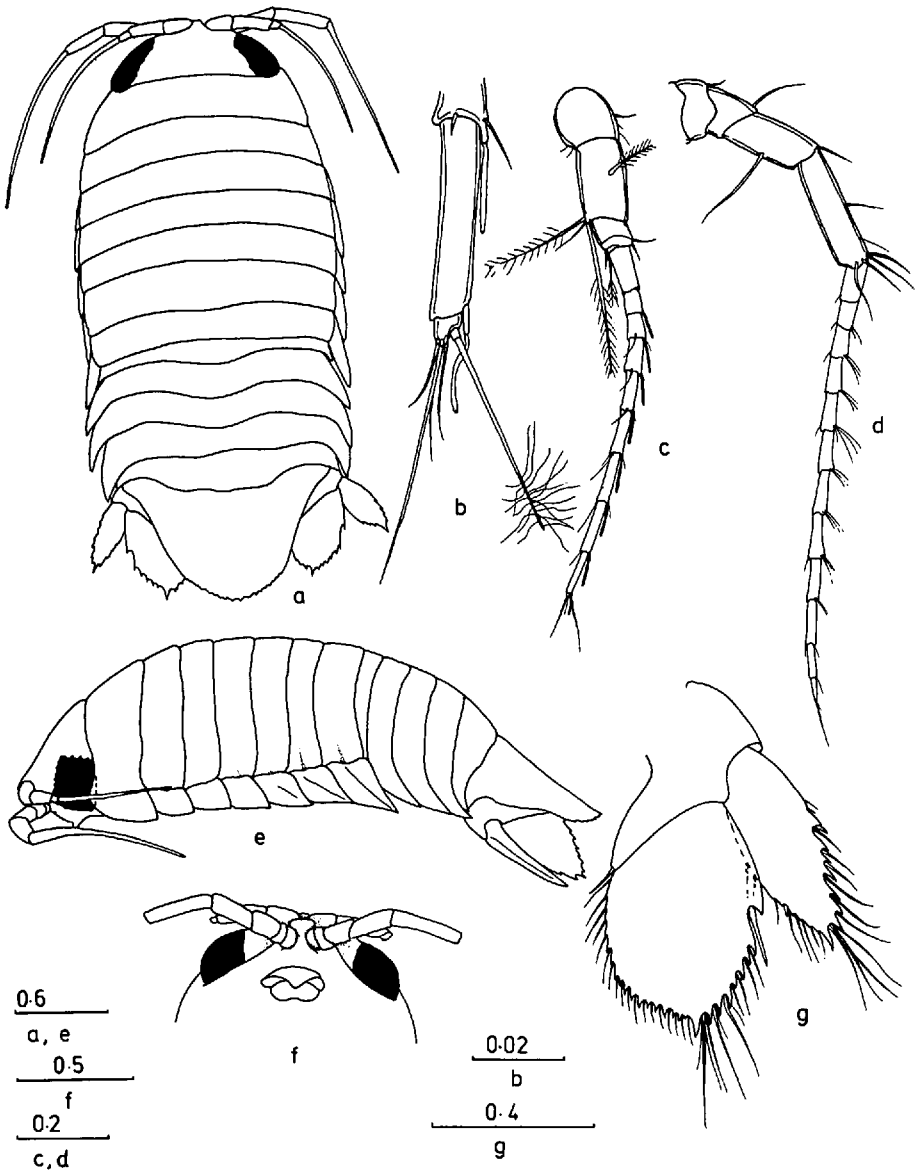

Figure 5. *Cirolana serrata* sp. nov. holotype: a, dorsal view; b, apex of antennule; c, antennule; d, antenna; e, lateral view; f, cephalon, ventral view; g, uropods. Scales are shown in mm.

Cirolana serrata new species
Figures 5, 6, 7

Material examined.—1♂ 3.6 mm, Shark Bay, Heron Island, 12.6.1978. Coll. N. L. Bruce.

Types.—Holotype. 1♂, Queensland Museum Reg. No. W7820.

Type Locality.—Heron Island, Capricorn Group, Australian Great Barrier Reef, 12.6.1978.

Description of Male Holotype.—Body smooth, ovate, slightly more than twice as long as broad (Fig. 5a). Cephalon about twice as broad as long, anterior margin

with distinct rostral point. *Clypeus* triangular, freely projecting; frontal lamina dilated anteriorly, also freely projecting (Fig. 5f). Eyes large, rectangular, facets distinct.

PERAEON: Segments 2–7 subequal in length, segment one half as long again as segment 2; coxae 3–7 visible dorsally, becoming progressively more produced and more acute (Fig. 5e); coxae 5–7 with faint oblique carina. *Pleon* segments 1–5 all visible, epimera produced on segments 2–5. Lateral margins free, segment 5 partially overlapped by segment 4.

ANTENNULE: Of moderate length, extending to peraeon segment 2. Peduncular segment 2 longest, twice length of segment 1 and three times length of segment 3; segment 3 appears to be formed from 3 fused segments as distinct sutures are visible (Fig. 5c). Flagellum with 9 articles, each with single aesthetasc. Terminal article very short, armed with long articulated brush tipped seta (Fig. 5b). *Antenna* with peduncular segments 1–3 short, their combined lengths equal to that of segment 4 (Fig. 5d); segment 5 half as long again as segment 4. Flagellum composed of 12 articles, extending to peraeon segment 3.

MOUTHPARTS: *Mandible* broad (Fig. 6d); molar process small, armed with 18 teeth; spine row with 8 spines. Mandibular palp long, lateral margins of segments 2 and 3 with 15 and 12 setae, respectively. *Maxillule* with about 10 spines on gnathal surface of exopod some of which are serrate; endopod with three relatively slender feebly plumose spines (Fig. 6f). *Maxilla* with 3 spines on each palp and exopod, both of which are short and broad (Fig. 6b); endopod with single long plumose, and 6 simple setae. *Maxilliped* slender with few long setae on outer margin (Fig. 6a); terminal segment subrectangular, twice as long as broad. Endite with 3 long plumose setae and single coupling hook.

PERAEOPODS 1–3: robust, subchelate, 4–7 slender. Peraeopod 1 with propodus as long as combined lengths of ischium and merus (Fig. 6c); carpus short, almost entirely concealed by merus. Dactyl long, about ⅔ length of propodus. Peraeopod 7 slender (Fig. 6e); ischium twice as long as merus; carpus and propodus subequal in length. Distal angles of each segment with group of spines, posterior margins of ischium and carpus bear two single spines; posterior margin of carpus with a single, and a pair of spines.

PLEOPODS: With short protopod (Fig. 7a–e) armed with 4 coupling hooks on pleopod 1, 3 on pleopods 2–4. All fringed with plumose setae with the exception of the endopod of pleopod 5 which is glabrous. Pleopods 3–5 with complete suture on exopod; distal margin of pleopods 1–3 distinctly triangular. Pleopod 2 with appendix masculina extending beyond endopod by 1/6 of its length. Medial margin with setules, apex subacuminate.

TELSON: Broadly rounded, without spines (Fig. 5a). *Uropods* strongly serrate, endopod broad, first serration on exterior margin with stout spine (Fig. 5g), fringed with plumose setae; exopod lanceolate, half as wide as endopod, well developed apical notch, single spine present in first serration of inner and outer margins.

Female.—Unknown.

Color.—Semitranslucent with brown and white chromataphores in life. White in alcohol.

Remarks.—This species shows a close similarity to *Cirolana excisa* Richardson, 1910 and *C. minuta* Hansen, 1890. It can be distinguished from the latter by the

Figure 6. *Cirolana serrata* sp. nov.: a, maxilliped; b, maxilla; c, peraeopod 1; d, mandible; e, maxillule; f, peraeopod 7. Scales are shown in mm.

possession of a freely projecting frontal lamina, the short third segment of the antennule, the far narrower maxilliped, details of the uropod, and in having the lateral margins of pleon segment 5 free. It can be separated from the briefly described and figured *C. excisa* by details of the uropods and also the relative proportions of the peduncular segments of the antennule.

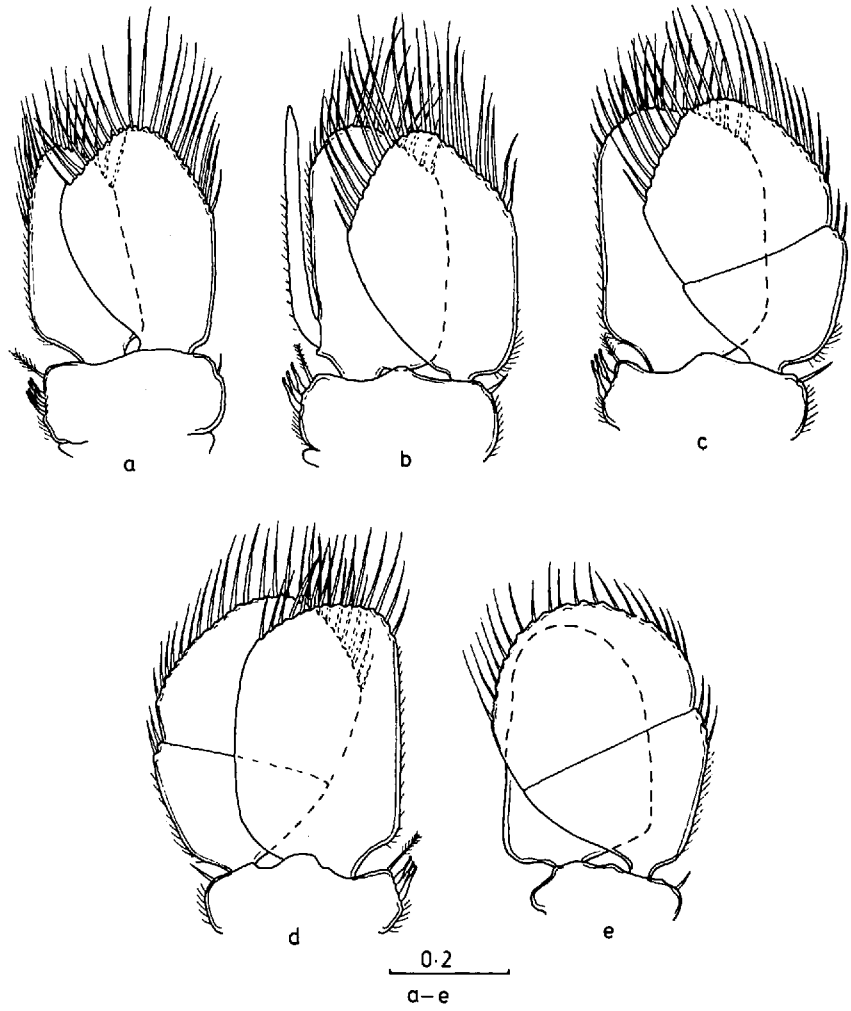

Figure 7. *Cirolana serrata* sp. nov.: a–e, pleopods 1–5. Scale is shown in mm.

The relationships of this species together with the other species described will be fully treated in the discussion.

Distribution.—Known only from type locality.

Etymology.—The epithet is derived from the Latin word *serratus*, meaning saw-like or indented.

Cirolana spinosa new species
Figures 8, 9, 10

Material examined.—5♀♀, 2 at 2.0 mm, 3 at 3.8 mm, ♂ 3.8 mm, 30.5.1978; ♂ 3.7 mm, ♀ 3.8 mm, 3.6.1978; ♀ 2.2 mm, 9.6.78, Heron Island. Coll. N. L. Bruce.

Types.—Holotype 1 ♂. Queensland Museum Reg. No. W7821. Paratypes 4 ♀♀. Queensland Museum Reg. No. W7822.

Type Locality.—Heron Island, Carpricorn Group, Australian Great Barrier Reef. 30.5.1978.

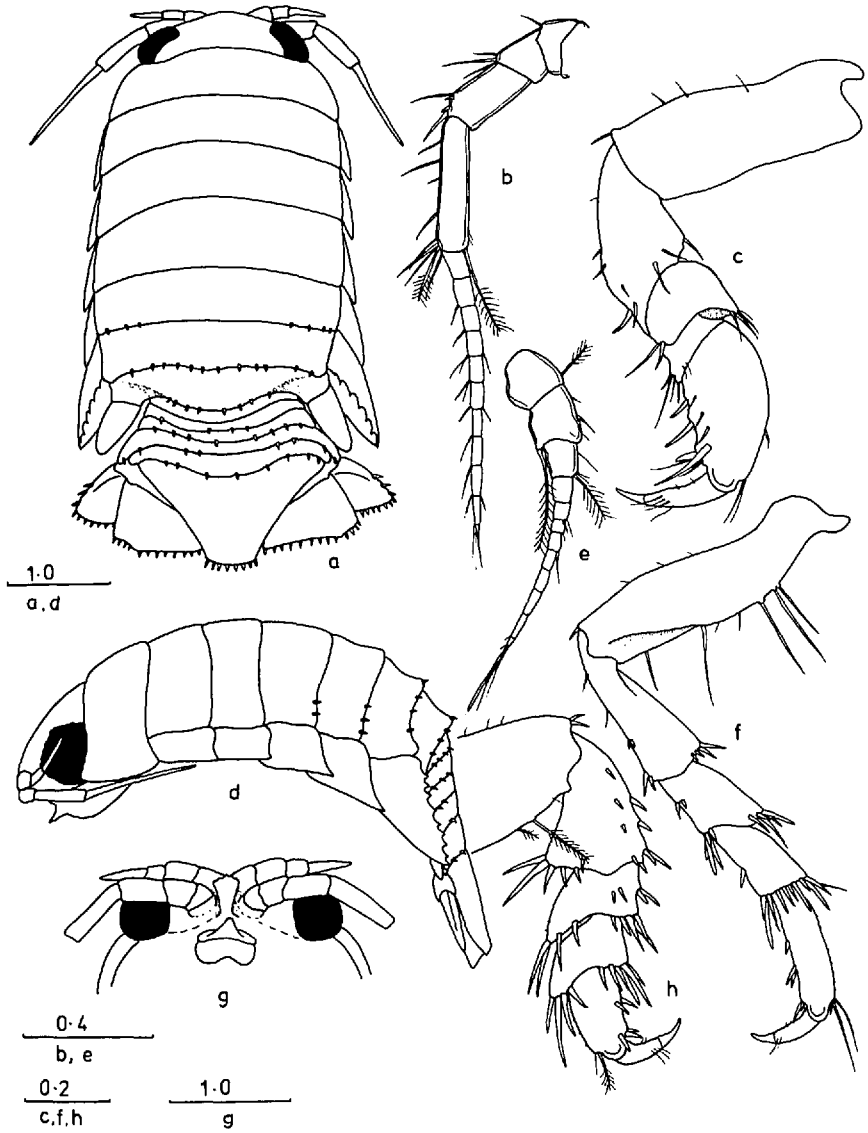

Figure 8. *Cirolana spinosa* sp. nov.: a, holotype, dorsal view; b, antenna; c, peraeopod 1; d, holotype, lateral view; e, antennule; f, peraeopod 7; g, cephalon, ventral view; h, peraeopod 4. Scales are shown in mm.

Description of male holotype.—Body little more than twice as long as greatest width, angular in appearance (Fig. 8a). Cephalon large, anterior margin forming an obtuse angle, without rostral point. *Clypeus* triangular and freely projecting; anterior margin of frontal lamina obscurely truncate and irregular (Fig. 8g). Eyes large, rectangular, facets distinct.

PERAEON: segments 1–4 subequal in length and slightly longer than segments 5 and 6 which are also subequal and longer than segment 7. Hind margins of segments 6 and 7 and lateral margin of segment 5 armed with acute spines. Penes present on ventral surface of peraeonite 7. Coxae 2 and 3 bluntly rounded with

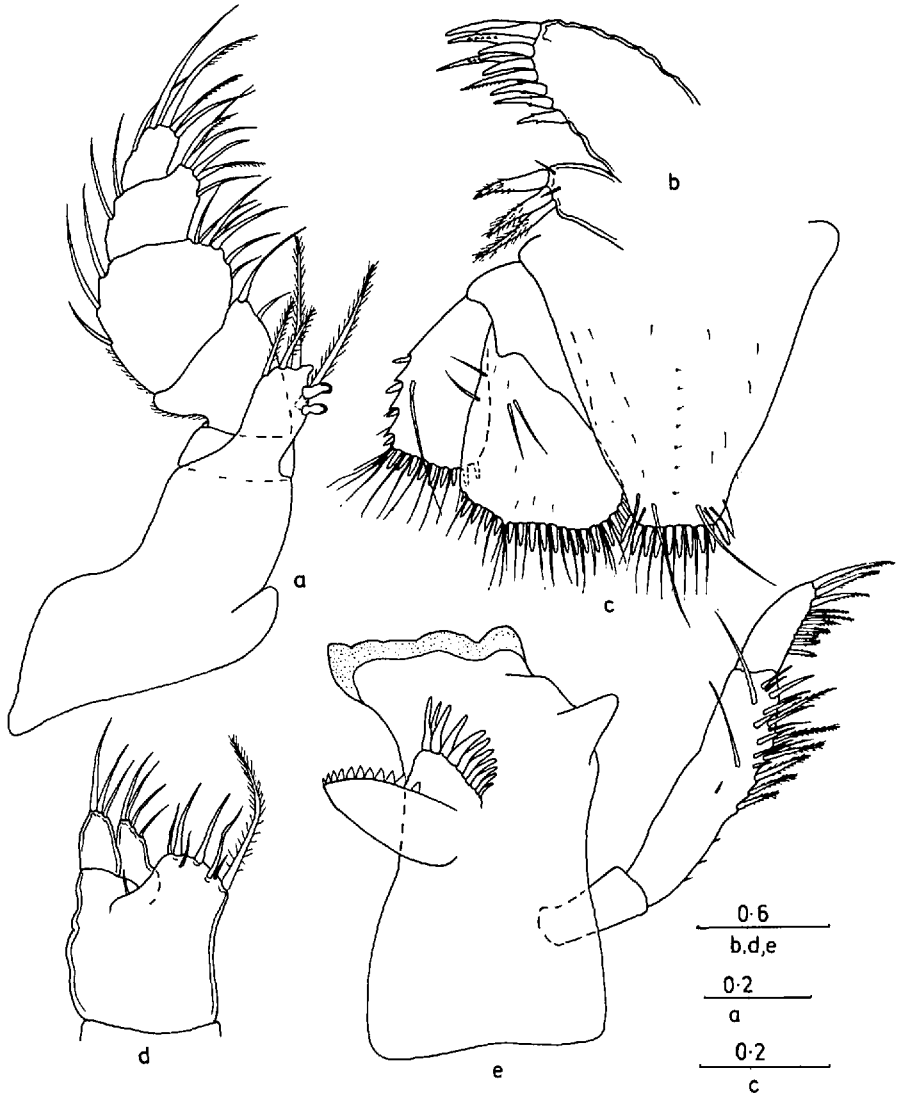

Figure 9. *Cirolana spinosa* sp. nov.: a, maxilliped; b, maxillule; c, telson and uropods; d, maxilla; e, mandible. Scales are shown in mm.

small point (Fig. 8d), coxae 4–6 produced and acute, coxae 6 to the extent of entirely concealing the coxae of segment 7; coxae 2–7 visible dorsally. *Pleon* with all segments free and not overlapped, becoming progressively broader posteriorly; segments 4 and 5 with epimera; hind margins of segments 2–5 armed with spines; segments 1–4 subequal in length and slightly shorter than segment 5.

ANTENNULE: Short, peduncular segment 2 longer than segment 3 and 1 (Fig. 8e). Flagellum composed of 9 articles, reaching posterior margin of cephalon. *Antenna* with first 2 segments very short, their combined lengths equal to that of segment 3 (Fig. 8b); segment 3 about half length of segment 4, which is little more than half length of segment 5; flagellum consists of 10 articles, extends to the posterior of peraeon segment 2.

MOUTHPARTS: *Mandible* broad (Fig. 9e), spine row of 11 spines, molar process small, armed with 11 teeth; mandibular palp with segments 1 and 3 subequal in length, their combined lengths less than that of segment 2; terminal segment with 3 large and 7 small serrate setae. *Maxillule* (Fig. 9b) with 3 relatively slender feebly plumose spines on endopod; gnathal surface of exopod with about 11 stout spines. *Maxilla* (Fig. 9d) with 3 and 4 setae on palp and exopod, respectively; endopod with single long plumose seta and 6 simple setae. Palp and exopod both short and broad. *Maxilliped* with few long setae on outer margins of palp, inner margins with more numerous setae some of which are fringed (Fig. 9a), endite with two prominent coupling hooks and 4 long plumose setae.

PERAEOPODS 1–3: Robust, prehensile; 5–7 ambulatory. Peraeopod 1 (Fig. 8c) with ischium and propodus subequal in length; combined lengths of merus and carpus equal to about half that of propodus. Peraeopod 7 slender, basis with 4 long articulated setae on anterior margin (Fig. 8f), ischium and merus with spines at each distal angle and further pair on posterior margin; carpus with fringe of spines along external distal margin; propodus with 3 groups of spines on posterior margin, terminal group opposing the dactyl. Peraeopod 4 (Fig. 8h) intermediate in form between peraeopods 1–3 and 5–7, being substantially more robust than posterior group but lacking proportions and robust propodus of anterior group; considerably more spinose than the other peraeopods.

PLEOPODS: All with a fringe of plumose setae with exception of endopod of pleopod 5 which is glabrous (Fig. 10a–e). Protopod of pleopods 1–4 with 3 coupling spines on inner margin. Pleopod 1 with inner ramus narrow, half as wide as outer ramus (Fig. 10a). Pleopod 2 with appendix masculina broadest basally, narrows to bifid tip with subapical plumose seta (Fig. 10f). Pleopods 3–5 with complete suture present on exopod.

TELSON: As long as maximum width, sides narrowing evenly to truncate extremity armed with 10 closely set robust spines between which are short plumose setae (Fig. 9e). Each distal angle with group of long setae on dorsal surface. *Uropods,* with endopod broad, hind margin subtruncate, armed with 14 stout closely set spines; lateral margin with an angle, that part between the angle and apex bearing 5 stout spines. Exopod with outer margin serrate bearing 4 spines, posterior margin subtruncate with 8 stout spines.

Female.—Not differing markedly from the male with the exception of sexual characters.

Color.—Translucent with conspicuous brown and white chromatophores on dorsal surfaces. Creamy white with brown chromatophores in alcohol.

Remarks.—This species is abundantly distinct from all other members of the genus, and is readily identified by the spinosity of the peraeon and pleon segments as well as of the telson and uropods. The extremely large coxae on peraeon segment 6 further distinguish it, as does the overall truncate appearance of the telson and uropods.

The relationships of this species to others of the "groupe *Hansenolana*" (Monod, 1930) will be fully treated in the discussion.

Distribution.—Known only from the type locality.

Etymology.—The specific name is derived from Latin *spina* (=spine).

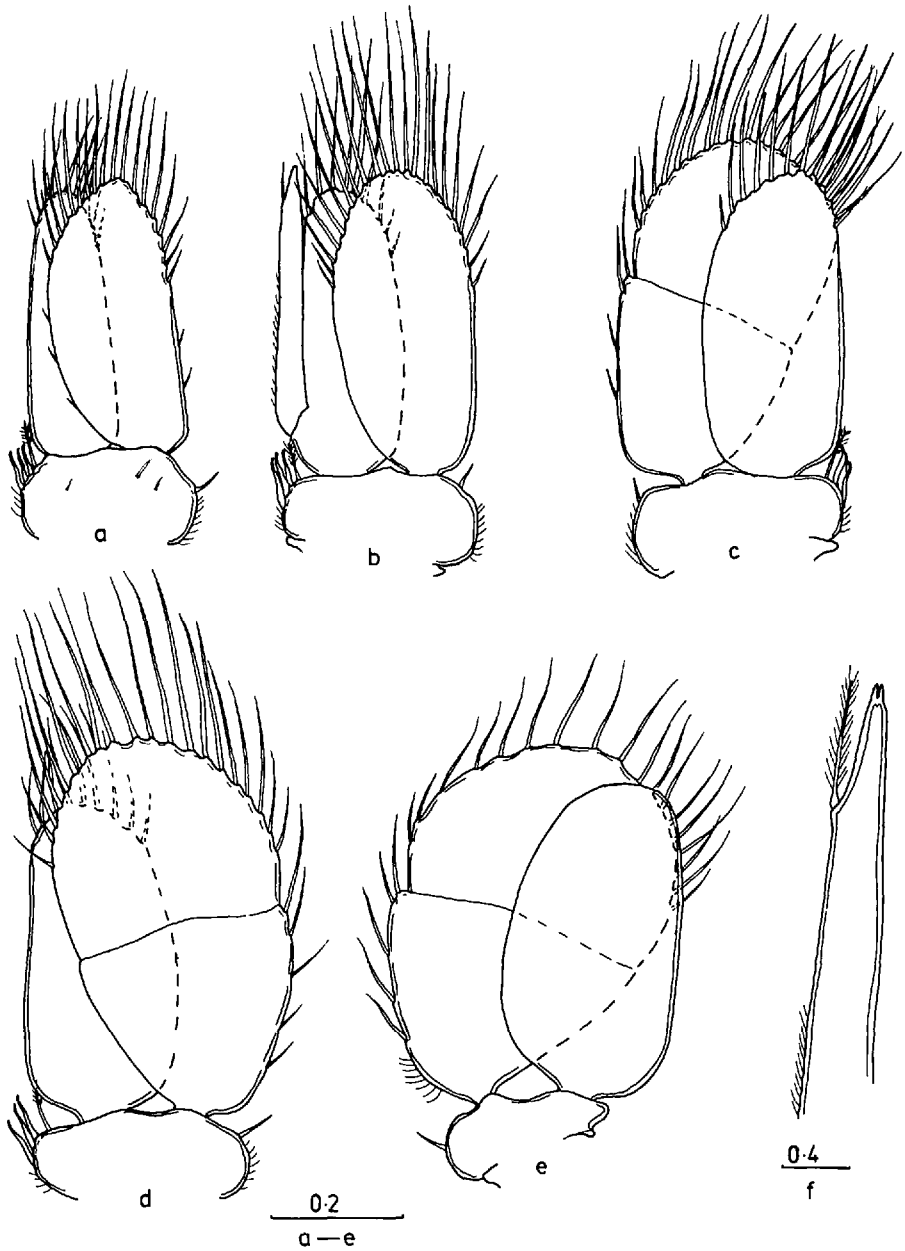

Figure 10. *Cirolana spinosa*: a–e, pleopods 1–5, respectively; f, apex of appendix masculina. Scales are shown in mm.

Cirolana rugosa new species
Figures 11, 12, 13

Material examined.—3♀♀, 3.8 mm, 2.0 mm, 2.00 m, Tryon Island, 5.6.1978. Coll. N. L. Bruce. 1♀, 2.2 mm, Heron Island, 1.6.1977. Coll. R. Reichelt.

Types.—Holotype, 1 ♀, Queensland Museum Reg. No. W7823. Paratypes, 2 ♀♀, Queensland Museum Reg. No. W7824.

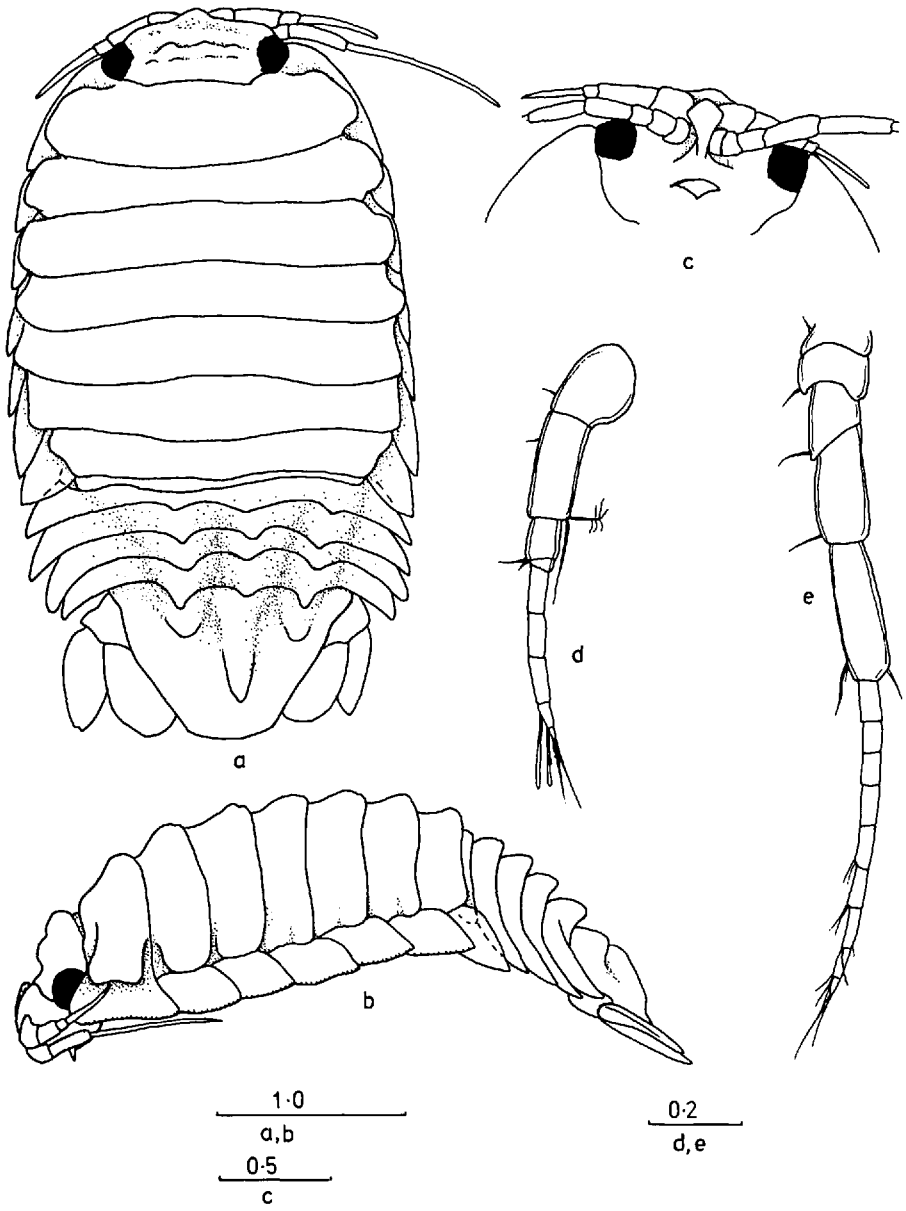

Figure 11. *Cirolana rugosa* sp. nov.: a, holotype, dorsal view; b, holotype, lateral view; c, cephalon, ventral view; d, antennule; e, antenna. Scales are shown in mm.

Type Locality.—Tryon Island, Capricorn Group, Australian Great Barrier Reef. 5.6.1978.

Description of Female Holotype.—Body oval, less than twice as long as maximum breadth, surface punctate (Fig. 11a). Cephalon twice as wide as long, deeply immersed in peraeon segment 1, anterior margin raised to form ridge with small rostral point, dorsal surface with small tubercles. Eyes small, situated at antero-

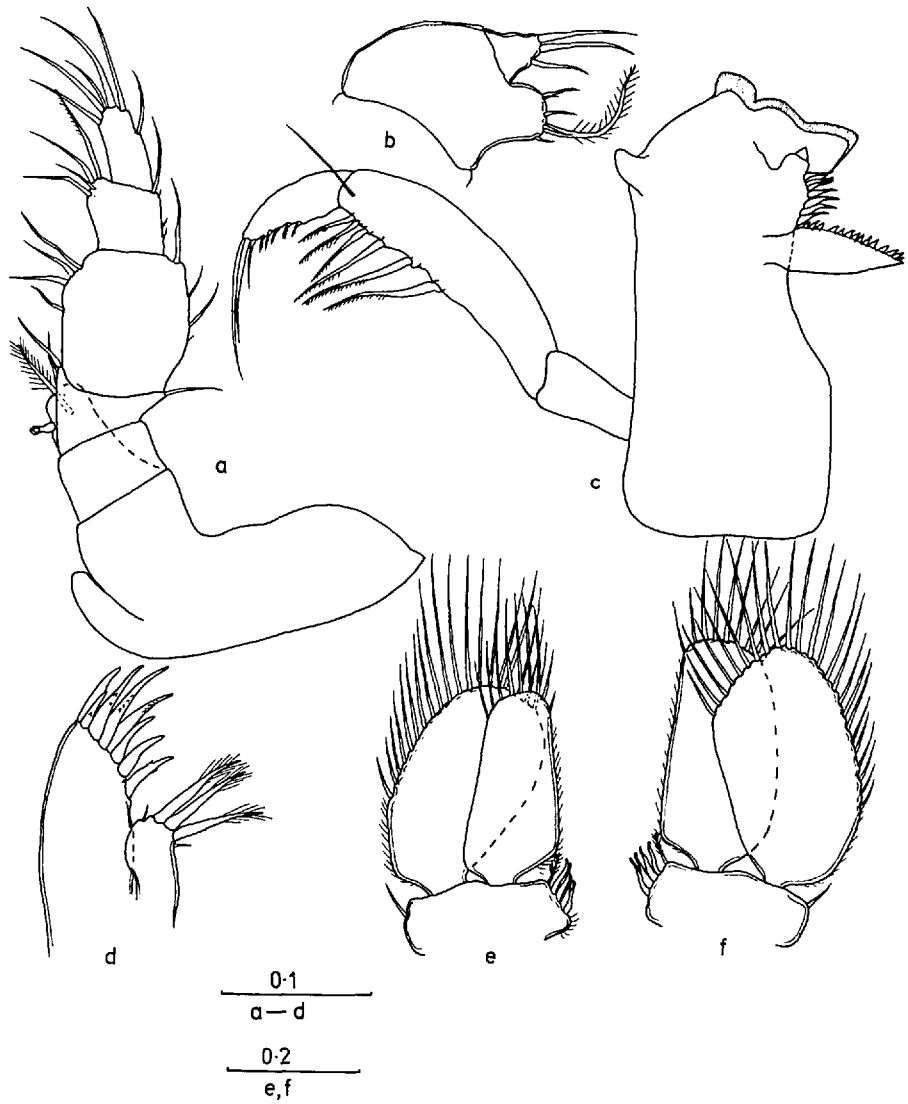

Figure 12. *Cirolana rugosa* sp. nov.: a, maxilliped; b, maxilla; c, mandible; d, maxillule; e, pleopod 1; d, pleopod 2. Scales are shown in mm.

lateral angle of head. *Clypeus* triangular, freely projecting; frontal lamina twice as long as broad, broader anteriorly and freely projecting (Fig. 11c).

PERAEON: Segment one half as long again as segment 2; segments 2–7 subequal in length. Lateral margins of peraeon segment 1 strongly produced giving the appearance of coxae on segment; these projections present in segments 2–4, less so in 5–7. Hind margins of all segments raised. Coxae 2–7 visibly dorsally, all slightly produced, only those of peraeon segments 6 and 7 being at all acute. Margins distinctly crenulate (Fig. 11c). *Pleon* with all segments free, not overlapped; epimera segments 2–5, produced to the width of the peraeon. Segments 2–5 each with 3 large tubercles on the dorsal surface.

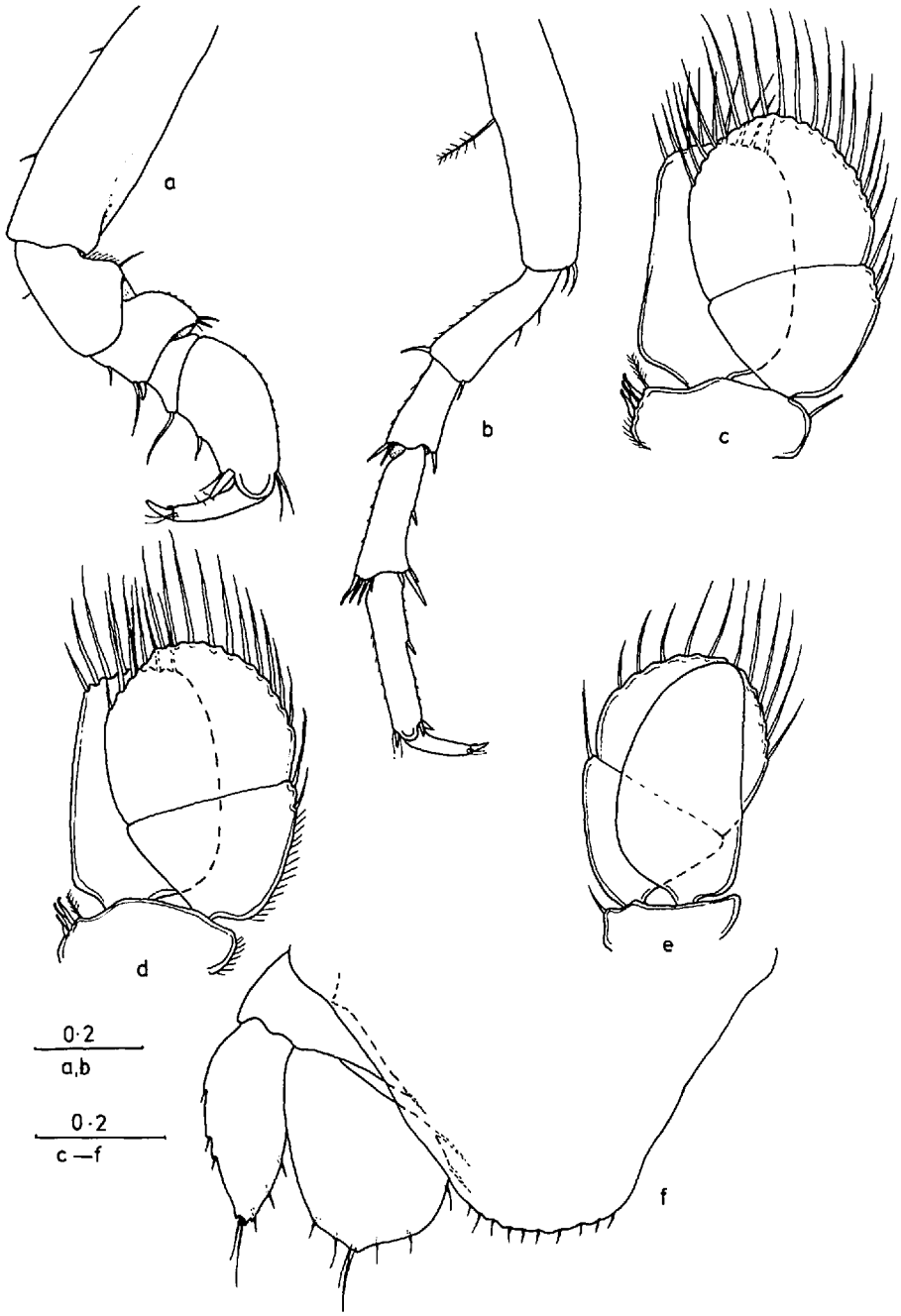

Figure 13. *Cirolana rugosa* sp. nov.: a, peraeopod 1; b, peraeopod 7; c–e, pleopods 3–5, respectively; f, telson and uropods, ♀, 2.0 mm. Scales are shown in mm.

ANTENNULE: Short (Fig. 11d), peduncular segment 2 longest. Flagellum composed of 5 articles, extends half way along peraeon segment 1. *Antenna* with peduncular segments 1 and 2 very short (Fig. 11e) their combined lengths being little greater than that of segment 3 which is about half as long as segment 4 which

is shorter than segment 5 by ⅓ its length. Flagellum with 9 articles, reaching posterior margin of peraeon segment 2.

MOUTHPARTS: *Mandible* similar to those of other members of the genus, spine row with 6 spines and one short triangular distal spine (Fig. 12c). *Maxillule* with three relatively slender feebly plumose spines on endopod; exopod with 8 robust spines on gnathal surface (Fig. 12d), some of which are serrate. *Maxilla* lacking palp (Fig. 12b); exopod short, armed with 3 setae, endopod with single long plumose setae and 5 short simple setae. *Maxilliped* slender, margins of segments of palp with few setae (Fig. 12a); endite with single plumose seta and single simple seta and only one coupling hook.

PERAEOPODS 1–3: robust, 4–7 slender. Peraeopod 1 subchelate (Fig. 13a), very few spines present; anterior margin of ischium slightly produced; propodus with stout spine opposing the dactyl; dactyl is nearly as long as propodus. Peraeopod 7 with ischium and carpus subequal in length and slightly shorter than propodus, (Fig. 13b); merus half as long as propodus. All segments with few spines, carpus with group of spines at each distal angle, as has propodus.

PLEOPODS: All with fringe of plumose setae with exception of pleopod 5 which is glabrous (Fig. 12e,f, Fig. 13c–e). Protopod of pleopods 1 and 2 with 4 coupling hooks, pleopods 3 and 4 with 3. Pleopods 3–5 with complete suture on exopod. Endopod of pleopod 1 narrow, half as wide as exopod, broadest at base and tapering towards apex. Endopods of pleopods 2–5 becoming progressively broader.

TELSON: Broad, twice as wide as long, dorsal surface with 3 conspicuous ridges, median ridge about three times the length of lateral ridges (Fig. 11a). Hind margin broadly rounded with ca. 10 short plumose setae (Fig. 13f). *Uropod* with endopod broad, hind margin rounded, 8 short plumose setae present; exopod half as wide as endopod, outer margin feebly serrate with 3 short setae, apical notch with 2 setae, inner margin with 3.

Male.—Unknown.

Color.—White in alcohol, translucent in life.

Distribution.—Also known from Heron Island.

Etymology.—The specific name is from the Latin word *ruga,* meaning wrinkle or fold.

Remarks.—This species shows a close affinity with *C. sphaeromiformis* Hansen, 1890, *C. hanseni* Bonnier, 1896, *C. monodi* Jones, 1976 and *Hansenolana anisopous* Stebbing, 1900. It can be distinguished from all these species by the sculpturing of the cephalon, pleon and telson.

The pleopodal configuration and nonchelate form of peraeopod places this species in the genus *Cirolana.* However, the unusual maxilla, which lacks the palp, places it closer to *Hansenolana* (Monod, 1971b), if the lack of the maxillar palp is in fact the case for that species as Stebbing (1900) figures the maxilla complete with palp. Another feature it shares with *Hansenolana* are the lateral extension of the anterior peraeon segments.

The lack of the palp on the maxilla appears unique amongst the genus, and may be considered a feature of generic value. However, this species cannot be placed in the genus *Hansenolana* due to the differences in peraeopod and the pleopods. Thus there is but a single character with which to separate and form a new genus, and it seems advisable to leave such action until such time as the mouthparts of all related species are known.

Discussion

The group of related species of the genus *Cirolana* referred to as part of the "groupe *Hansenolana*" by Monod (1930; 1971b) was enlarged by the addition of *Cirolana monodi* Jones, 1976, *C. fishelsoni* Bruce and Jones, 1978 and *C. rotunda* Bruce and Jones, 1978. Of these new species herein described, *C. serrata*, *C. spinosa* and *C. rugosa* form further members of this group.

Originally included in this group by Monod (1930) were the genera *Hansenolana* Stebbing, *Conilorpheus* Stebbing, *Neocirolana* Hale, *Paracirolana* Nierstrasz, *Metacirolana* Nierstrasz, and *Saharolana* Monod. *Paracirolana* and *Metacirolana* were referred back to the genus *Cirolana* (Monod, 1930). *Neocirolana* was considered by Jones (1976, p. 212) to be of doubtful validity having only the relative narrowness of the mandible to distinguish it. Similarly, *Conilorpheus* occupies a somewhat obscure systematic position, apparently being more closely allied to those *Cirolana* showing sculpting of the peraeon and pleon segments (Barnard, 1955), as well as showing similarities to genus *eurydice*.

The characters used in distinguishing the "*Hansenolana*" group include a freely projecting clypeus, frontal lamina which is broader anteriorly and is also freely projecting, the presence of a small rostral point separating the antennules, all pleon segments free and with the lateral margins not overlapped, and the cephalon being deeply set into the first lateral segment with the eyes placed at the anterolateral corners. The mouthparts also show a similarity throughout the group. The mandibles are not unusual, but the 3 spines on the endopod of the maxillule are far more slender than is normal for the genus and only feebly plumose or without setules at all. The maxilla shows a tendency for the palp and exopod to be short and broad rather than slender as is more normal, and in some cases the palp is absent. The maxilliped is slender and the endite usually has only one coupling hook.

Within the group, there are two divisions, those with large eyes, and those with small eyes situated at the anterolateral angles of the head. The latter division includes *C. spaeromiformis* Hansen, *C. hanseni* Bonnier, *C. monodi* Jones and *C. rugosa*. This group approaches the genus *Hansenolana* more closely than the others of the group, particularly *C. rugosa* in having a maxilla without a palp. Of the others, *C. japonica* Hansen, 1890, *C. fishelsoni*, *C. rotunda* and *C. serrata* share most features common to the group. *C. spinosa* appears to occupy a place more apart in having two coupling hooks on the endite and lacking a rostral point, although the bases of the antennules are not properly contiguous. The armature of the peraeon, pleon, telson and uropods is also unique, all other members of the group lacking spines on the telson. Thus of this group, *C. spinosa* occupies a somewhat isolated position and *C. rugosa* occupies a position nearer to *Hansenolana* than others of the group.

A key is provided to this group of *Cirolana* with the proviso that it will likely need amendment as further species of *Cirolana* become better known. *C. joanneae* Schultz, 1966 is one such species. *C. excisa* Richardson, is included on the basis of its similarity to *C. serrata* and also her comment that it is closely allied to *C. japonica*.

Provisional Key to the Genus *Cirolana*

Cirolana with clypeus freely projecting and frontal lamina longer than broad, anterior margin dilated, freely projecting.

1. Eyes small, anterolateral in position 2
1a. Eyes moderate to large 5

2. Telson with ridges or carinate 3
2a. Telson unornamented 4
3. Pleon segments 2–5 each with 3 tubercles ..... *C. rugosa* new species
3a. Pleon segments not tuberculate ..... *C. sphaeromiformis* Hansen 1890
4. Frontal lamina anterior margin carinate, slightly concave ..... *C. hanseni* Bonnier 1896
4a. Frontal lamina straight sided, anterior margin rounded ..... *C. monodi* Jones 1976
5. Telson without spines 6
5a. Telson with spines ..... *C. spinosa* new species
6. Body about 3 times as long as wide 7
6a. Body about 2 times as long as wide 9
7. Uropoda and apex of telson strongly serrate ..... *C. joanneae* Schultz 1966
7a. Uropoda and telson not serrate 8
8. Uropodal exopod with spines, pleon segment 5 overlapped by segment 4 ..... *C. japonica* Hansen 1890
8a. Uropodal exopod without spines, pleon segment 5 not overlapped ..... *C. fishelsoni* Bruce and Jones 1978
9. Uropodal endopod with excision ..... *C. excisa* Richardson 1910
9a. Uropodal endopod without excision 10
10. Telson slightly carinate, apex forming an obtuse angle ..... *C. rotunda* Bruce and Jones 1978
10a. Telson rounded ..... *C. serrata* new species

Ecology

The habitat of *Eurydice orientalis* is the sublittoral sand bottoms in the vicinity of the reefs. At night it emerges to swim in the surface plankton. This is similar to the described behaviour of other species of the genus (Macquart-Moulin, 1977).

All species of *Cirolana* with the exception of *C. pleonastica* were taken from dead coral heads, coral rock, or from the *Lithothamnion* ridge. *Cirolana pleonastica* was taken in traps set on the beach rock and appear to inhabit that area rather than areas of living and dead coral. *Cirolana rugosa* has only been found on the exposed northwestern side of Heron Island Reef and on Tryon Island at the most seaward part of the reef front. *Cirolana spinosa* occurs on inside dead coral heads, but is absent from similar habitats in the lagoon area near Shark Bay. *Cirolana parva* was taken from all areas of the reefs.

It is interesting to note that there appears to be a difference in foraging strategy or food preference among the species collected. *Cirolana parva* and *Cirolana pleonastica* entered traps while the other three species did not, even though the traps were set in areas from which these others had been collected. This suggests that *Cirolana parva* and *Cirolana pleonastica* have a more active, free-ranging, food-searching technique than the other three species. These may obtain their food from within the crevices and borings of the dead coral that they inhabit.

Acknowledgments

I thank Dr. Peter Flood for his kindness in allowing me to participate in a helicopter tour of the various islands, thereby providing an invaluable expansion to this survey. I also thank Dr. T. Hailstone for reviewing the manuscript.

Literature Cited

Baker, W. H. 1908. Notes on some species of the isopod family Sphaeromidae family from the South Australian coast. Trans. R. Soc. S. Aust. 32: 138–162. pls. 3–10.

———. 1910. Notes on some species of the isopod family Sphaeromidae from the South Australian coast. Part II. Trans. R. Soc. S. Aust. 34: 75–88.

———. 1926. Species of the isopod family Sphaeromidae from the Eastern, Southern and Western coasts of Australia. Trans. R. Soc. S. Aust. 50: 247–279. pls. 38–53.

———. 1928. Australian species of the isopod family Sphaeromidae (continued). Trans. R. Soc. S. Aust. 52: 49–61.

Barnard, K. H. 1935. Report on the Amphipoda, Isopoda and Tanaidacea in the collections of the Indian Museum. Rec. Ind. Mus. 37: 279–319.
———. 1936. Isopods collected by the R.I.M.S. "Investigator." Rec. Ind. Museum (Calcutta). 38: 147–191.
———. 1935. Additions to the fauna-list of South African crustacea and pycnogonida. Annls. S. Afr. Mus. 43: 1–107.
Boone, P. S. 1918. Descriptions of ten new isopods. Proc. U.S. Nat. Mus. 54: 591–603. pls. 89–92.
Bowman, T. E. 1977. Isopod crustaceans (except Anthuridae) collected on the presidential cruise of 1938. Proc. Biol. Soc., Wash. 89: 653–666.
———, and Kuhne, H. 1974. *Cymodetta gambosa*, a new sphaeromatid isopod (Crustacea) from Australia, with notes on its mating behaviour. Rec. Aust. Mus. 29: 235–244.
Bruce, N. L., and D. A. Jones. 1978. The systematics of some Red Sea Isopoda (family Cirolanidae) with descriptions of two new species. J. Zool. Lond. 185: 395–413.
Chilton, C. 1924. Fauna of Chilka Lake. Tanaidacea and Isopoda. Mem. Ind. Mus. Calcutta. 5: 875–895. 1 pl.
Dana, J. D. 1853. Crustacea Pt. I in United States Exploring Expedition. 1838–1842. 13: 696–805.
Flood, P. G. 1977. Coral cays of the Capricorn and Bunker Groups, Great Barrier Reef province, Australia. Atoll. Res. Bull. 195: 1–23.
Hale, H. M. 1925. Review of Australian isopods of the cymothoid group. Part I. Trans. R. Soc. S. Aust. 49: 128–185.
———. 1926. Review of Australian isopods of the cymothoid group. Part II. Trans. R. Soc. S. Aust. 50: 201–234.
———. 1933. Tanaidacea and isopoda collected by the Great Barrier Reef Expedition, 1928–29. Ann. Mag. Nat. Hist., Ser. 10. 11: 557–565.
———. 1940. Report on the cymothoid isopoda obtained by the F.I.S. "Endeavour" on the coasts of Queensland, New South Wales, Victoria, Tasmania and South Australia. Trans. R. Soc. S. Aust. 64: 288–304. pl. 18.
Hansen, H. J. 1890. Cirolanidae et familiae nonnullae propinque Musei hauniensis. Vidensk. Selsk. Skr. 6, Roekke, Naturis, Og. Math., Afd. 5: 239–425. pls. 1–10.
Haswell, W. A. 1881. On some new Australian marine Isopoda. Part I. Proc. Linn. Soc. N.S.W. 5: 470–481.
———. 1882. On some new Australian marine Isopoda. Part II. Proc. Linn. Soc. N.S.W. 6: 181–196.
Jones, D. A. 1976. The systematics and ecology of some isopods of the genus *Cirolana* (Cirolanidae) from the Indian Ocean region. J. Zool. Lond. 178: 209–222.
Macquart-Moulin, C. 1973. L'activité natatoire rythmique chez les péracarides bentho-planctoniques. Déterminisme andogène des rythmes nycthémèraux. Tethys 5: 209–231.
Miers, E. J. 1884. Crustacea. Pages 178–322 in Report on the Zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881–1882.
Monod, T. H. 1930. Contribution à l'étude des "Cirolanidae." Ann. Sci. Nat. Zool. (10). 13: 129–183.
———. 1934. Isopodes marine des campagnes "de Lanessan." Notes Inst. Océanogr. Indochine. 23: 1–22. Pls. 1–45.
———. 1970. Sur quelques isopodes marins d'Australie. I. Arcturidae. Bull. Mus. Nat. Hist. Nat., Paris. 2e Sér. 42: 1127–1142.
———. 1971a. Sur quelques isopodes marins d'Australie. II. Serolidae. Bull. Mus. Nat. Hist. Nat., Paris. 3è Sér. Zool. 5: 325–333.
———. 1971b. Sur an examplaire topotypique d'*Hansenolana anisopous* Stebbing 1900 (Crust., Isopodes) Cah. Pacif. 15: 7–18.
———. 1973. Sur quelques isopodes marins d'Australie III Gnathiidae, Ilyarachnidae, Munnopsidae et Arcturidae (suppl.). Bull. Mus. Nat. Hist. Nat., Paris. 3è Sér. 115, Zool. 89: 287–294.
———. 1976. Remarques sur quelques cirolanidés. Bull. Mus. Nat. Hist. Nat., Paris. 3è Sér. 358, Zool. 251: 133–161.
Naylor, E. 1961. Some isopoda from the Chatham Islands, including two species of *Cirolana* new to New Zealand waters. Trans. R. Soc. N.Z. 1: 7–17.
———. 1966. Port Phillip Survey 1957–1963. Isopoda Mem. Nat. Mus., Melb. 27: 183–198; 378–384.
Nierstrasz, H. F. 1930. Isopoda. *in* Resultat Scientifiques du voyage aux Indes Orientale Néerlandaises de Le. Aa. Rr. Le Prince et la Princesses Léopold de Belgique. Mem. Mus. R. Hist. Nat. Belg., Hor. Sér. 3: 1–17.
———. 1931. Die Isopoden der Siboga Expedition. III. Isopoda genuina. II. Flabellifera. Siboga Exped. 32(c) (114): 121–233 taft. 1–2.

Nordenstam, A. 1946. Marine isopoda from Professor Dr. Sixten Bock's Pacific Expedition 1917–1918. Ark. Zool. (Stockh.) 37(7): 1–31.

Potts, F. A. 1915. The fauna associated with the Crinoids of a tropical coral reef: with special reference to colour variation. Carnegie Inst. Pap. Dept. Mar. Biol. 8: 73–96.

Poore, G. C. B. 1975. Australian species of *Haliophasma* (Crustacea: Isopoda: Anthuridae). Rec. Aust. Mus. 29: 503–533.

———. 1977. *Austrochaetilia capeli*, a new genus and species of chaetiline idoteid (Isopoda) from Port Phillip Bay, Australia. Crustaceana. 33: 113–118.

Richardson, H. 1910. Marine isopods collected in the Phillipines by U.S. Fisheries Steamer "Albatross" in 1907–1908. Dept. Comm. Lab., Bureau Fish. Doc. 736: 1–44.

Schultz, G. A. 1966. Submarine canyons of Southern California. Part IV. Systematics: Isopoda, Allan Hancock Pacif. Exped. 27: 1–56.

Stebbing, T. R. R. 1900. On crustacea brought by Dr. Willey from the South Seas. *In* Zoological Results, pt. 5: 605–690. Willey, A., ed. Cambridge: Univ. Press.

Studer, T. H. 1884. Isopoden, gesammelt während der Reise S.M.S. Gazelle um die Erde 1874–76. Abh. Preuss. Akad. Wiss. pp. 1–28. Berlin.

Thomson, G. M. 1892. Notes on Tasmanian crustacea with descriptions on two new species. Pap. Proc. R. Soc. Tasm. Art. 6: 45–76.

Whitelegge, T. 1902. Crustacea II. Isopoda I & II *in* Scientific Results of the trawling expedition of H.M.C.S. "Thetis." Vol. I. Mem. Aust. Mus. 4: 201–283.

DATE ACCEPTED: August 20, 1979.

ADDRESS: *Department of Zoology, University of Queensland, St. Lucia., Brisbane, Qld., Australia, 4067.*