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**Cirolanidae (Crustacea: Isopoda)
of Australia**

NIEL L. BRUCE

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To Tom,
with very many thanks
for your continuing help and
assistance.

My very best wishes to you

Neil



CIROLANIDAE (CRUSTACEA : ISOPODA) OF AUSTRALIA

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ABSTRACT. An account is given of the cirolanid fauna of Australia. The total number of species recorded is 102, of which 51 are new. Two new species not yet recorded from Australian coastal waters are also included. Full descriptions of all genera are given, and detailed descriptions and figures are given for all species not previously recorded from Australia or in need of redescription. The following genera and species are recorded from Australian waters: *Anopsilana* (2 species), *Bathynomus* (3 species), *Cartetolana* (1 species), *Cirolana* (30 species), *Eurydice* (8 species), *Eurylana* (1 species), *Excirolana* (1 species), *Hansenolana* (1 species), *Metacirolana* (7 species), *Natanolana* (31 species), *Neocirolana* (5 species), *Orphelana* (1 species), *Pseudolana* (7 species), and three new genera—*Booralana* (2 species), *Dolicholana* (1 species) and *Limicolana* (1 species).

Keys to the Australian genera and species are provided. Discussion on characters of taxonomic utility is given. Annotated lists for all non-Australian genera and species are provided, and brief notes on the natural history of the family are provided.

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Australia occupies a geographic position of some significance; its northern shores are at the centre of the Indo-West Pacific Region, the western and eastern coasts are on the Indian and Pacific Oceans respectively, and the southern coasts are adjacent to the sub-antarctic seas. Taxonomic research in Australia has profound significance for these areas as, without exception, their shallow-water peracarid faunas are poorly known.

Although the peracarid crustacean fauna of Australia has been perhaps better studied than that of adjacent areas, the extent of our knowledge has, until very recently, been extremely limited. This is clearly demonstrated by the work of J.L. Barnard and Margaret M. Drummond in their continuing series of publications on the Australian Amphipoda (Barnard, 1972, 1974; Barnard & Drummond, 1978, 1979) in which they have recorded 278 species, of which 181 (65%) are new. These studies deal only with the southern half of Australia, and demonstrate the variety to be expected.

The only other peracarid order to receive detailed attention is the Cumacea, revised by Hale in a long series of papers up to the early 1950's (Hale, 1951, 1953). The Tanaidacea have received no recent treatment other than that of Boesch (1973). The Mysidacea are equally poorly known, the recent catalogue provided by Mauchline & Murano (1977) listed only fifteen species from Australian waters. Until recently our knowledge of

Australian Isopoda was in a similarly poor state.

Of the shallow-water marine isopod families, the Cirolanidae are second in number of genera and species only to the Sphaeromatidae. On a world wide basis, the study of isopod taxonomy in the tropics and subtropics is still in its infancy. As marine invertebrate taxa often reach their greatest diversity in tropical areas, Australia seemed a particularly appropriate place to undertake a monographic study of such a family. In Australia, the standard works of reference to the Cirolanidae and related families were those of Hale (1925, 1926, 1940). From the time of Hale to the first of the present series of articles that I published on the Cirolanidae (Bruce, 1979) only one new species of cirolanid was recorded from Australian waters (Griffin, 1975). Effectively, Australian cirolanids were little studied.

MATERIALS AND METHODS

Specimens for study were obtained by personal collecting on the Great Barrier Reef (intertidally, and subtidally using SCUBA), from sand beaches of southeastern Queensland and northern New South Wales, and general intertidal collecting at various localities around Australia. The bulk of the material was obtained on loan from the various state museums, and also museums abroad. Type specimens were studied, where available, of all *Natatolana* from the Indo-

Pacific, north-western Pacific and southern Oceans. Type specimens of most central Pacific and Indonesian Cirolanidae were also examined.

For each genus there is a diagnosis, giving characters that allow rapid identification, and 'additional characters' including all characters typical of the entire genus.

In the account of each species is a section that includes all the available data for the specimens examined. With type localities of new species, I have attempted to restrict the position by giving approximate coordinates in the section 'Type locality'. To avoid repetition, data for the Crib Point Environmental Survey is tabulated in the appendix; data for the Port Phillip Bay survey is given in Poore et al. (1975). Up to mid-1982, a total of over 3,000 specimens had been examined.

The description of each new species is taken from the holotype and a matched dissected paratype. Where material was limited, the holotype has been partially dissected. In all new species descriptions, whole animal figures are of the holotype.

Beaches were surveyed using a 1.0 mm mesh sieve. On beaches of coarse sand, the substratum was sieved thoroughly, then deposited into a bucket. Cirolanids generally swim to the surface before burrowing back into the sand. Coral reefs were sampled by extracting the macrofauna of dead coral rocks, night-lighting for plankton, sieving sandy substrata and examining sponges and algae. The last three habitats yielded few cirolanids, and were eventually ignored.

Only figures and remarks essential for identification are given for species which have already been described in detail and for which no new data are being offered.

The length of an animal varies somewhat, depending on the degree of stretching or contraction at death. Measurements were taken through the eye, coxae and along the pleotelson. Small specimens were measured using a micrometer eye piece, those larger than 40 mm were measured with a millimetre rule. On curved specimens, the measurements were generally taken as two straight lines from pereonite 4 or 5.

The names proposed for new species have been derived from four specific sources. Aboriginal names were obtained from 'Aboriginal Words of Australia', 'Aboriginal Place Names of Australia' (Anon, 1965, 1967) and McCarthy (1971). Classical names were derived from Brown (1956).

ABBREVIATIONS

AM	Australian Museum, Sydney
AMSBS	Australian Museum Shelf Benthic Survey
BM(NH)	British Museum (Natural History), London
CPBS	Crib Point Benthic Survey
CSIRO	Commonwealth Scientific and Industrial Research Organization
HDWBS	Hunter District Water Board Survey
JCUNQ	James Cook University, North Queensland
MNHN	Museum Nationale d'Histoire Naturelle, Paris

NLB	N.L. Bruce
NMV	Museum of Victoria, Melbourne
NSW	New South Wales
NT	Northern Territory
NTM	Museum and Art Galleries of the Northern Territory, Darwin
ovig.	ovigerous
PPB	Port Phillip Bay, Victoria
Qld	Queensland
QM	Queensland Museum, Brisbane
SA	South Australia
SAM	South Australian Museum, Adelaide
Tas.	Tasmania
TM	Tasmanian Museum and Art Gallery, Hobart
USNM	National Museum of Natural History, Smithsonian Institution, Washington
Vic.	Victoria
WA	Western Australia
WAM	Western Australian Museum, Perth
WBES	Western Port Bay Environmental Survey
WP	Western Port, Victoria
ZMUC	Zoologisk Museum, University of Copenhagen

REVIEW OF CIROLANID TAXONOMY

The subfamily Cirolaninae was established within the Cymothoidae by Dana (1852), elevated to family rank by Harger (1880) and first revised by Hansen (1890). Hansen (1905) later published a separate account of the family, treating only those species found off European coasts. These two works established the character of the family, even though the family and generic diagnoses lacked precision by present standards. They represent the first comprehensive treatments of the family, and were the first that recognised that clear divisions could be distinguished within the largest genus, *Cirolana*.

Between 1890 and 1912, various workers published descriptions of genera and species. There were only two major contributors. Richardson (1905) reviewed the isopod fauna of America (including 24 species of Cirolanidae) and also recorded species from Japan (Richardson, 1904a) and the Philippines (Richardson, 1910). Stebbing (1900 to 1910b) contributed a series of excellent papers (mainly on Indian Ocean isopods) in which he described three new genera and eleven species of Cirolanidae.

Racovitza (1912) gave a superb review of the family, a work that seems never to have received the recognition it deserves. It is possible that it has been overlooked because it dealt largely with troglobitic species, whereas most isopod systematists work primarily on the marine fauna. In this study, Racovitza covered six important points which are listed below, together with comments of my own in parentheses:

1. The correctness of the family name Cirolanidae. (Use of the family name Eurydicidae Stebbing persisted until 1971.)

2. The usefulness of mouthpart morphology. (The

morphology of mouthparts was and still is frequently ignored by authors describing species of Cirolanidae.)

3. Morphological character assessment suggested that the Cirolanidae is the most primitive of isopod families, not the most advanced of the Crustacea as suggested by Schioedte (1868).

4. Most cirolanid genera would be found to possess a sixth peduncular article to the antenna as proposed by Hansen (1903). (Authors up to the late 1970's have been confused over this point.)

5. The genus *Cirolana* of Hansen (1890, 1905) "n'est pas une coupe generique", there are distinct lines within the genus that should be defined and Hansen's (1890, 1905) sections ought to be established as genera. Racovitza supplied a list of the most useful characters to use, including frontal lamina, antennae and pereopods. (Racovitza's considerations have received little attention from taxonomists working on cirolanids.)

6. Racovitza established the following subfamilies for the existing genera, except for *Pseudaega* which was not mentioned: Bathynominae (*Bathynomus*); Eurydicinae (*Eurydice*, *Pontogelos*); Colopistinae (sic) (*Colopisthus*); Hansenolaniinae (*Hansenolana*, and two new genera to be created for *Metacirolana sphaeromiformis* and *M. hansenii*); Faucheriinae (*Faucheria*); Cirolaninae (*Cirolana*, *Annina*, *Cirolanides*, *Conilera* and *Typhlocirolana*).

The establishment of these six subfamilies is of special importance as these subdivisions were used, virtually unaltered, by Monod (1930) in the last classificatory work on the family. In spite of the statement that he had no intention of going into detail over the classification of the family, Monod (1930: 130) went on to offer a wealth of opinion and considerations. He discussed the impossibility of defining Racovitza's subfamilies, relegated them to "groups", warned against the conservation of overly large, ill-defined genera, and showed how the inadequacy of many previous descriptions had hampered progress in classifying cirolanid genera.

The greatest influence on the classification of cirolanid genera was affected by Monod's (1930) expansion and clear presentation of Racovitza's subdivisions. Although these groups of genera remained undefined and, in most cases, a rationale for placing a genus within a group was not given, this scheme gained immediate acceptance because it provided a framework within which authors could place new genera. This scheme was again presented unchanged by Monod (1971a) and later expanded to include 27 genera (Monod, 1972). The only author to question the integrity and homogeneity of these groups was Monod (1971a, 1972) himself.

Bowman (1975) provided fresh insight into the classification of cirolanid genera when he arranged the genera according to degree of pleonite fusion. This was not proposed as an alternative to the existing scheme but it did bring attention to a character of fundamental importance that had been largely overlooked in the past.

KEY WORKS ON THE CIROLANID FAUNA OF MAJOR GEOGRAPHICAL AREAS

Europe and the Mediterranean. Reviewed by Hansen (1890, 1905); later contributions by Jones (1969, 1979a) and Jones & Naylor (1967, on British *Eurydice*); Monod (1930) reviewed the Cirolanidae of Europe and North-west Africa.

Northern America. Richardson (1905) covered previous work, whilst Schultz (1969) provided a more recent catalogue. Recent publications include Bowman (1975, 1977a), Bowman et al. (1981), Bruce (1985), Brusca & Ninos (1978) and Cole & Minckley (1970).

South America. a) Caribbean. Reviewed by Menzies & Glynn (1968). Recent articles are those of Botosaneanu & Stock (1979), Bowman (Bowman & Franz, 1982; Bowman & Iliffe, 1983), Bruce (Bruce, 1985; Bruce & Bowman, 1982), Notenboom (1981), Carpenter (1981), Menzies & Kruczynski (1983) and Kensley (1984a).

b) Atlantic. No comprehensive revisions have been undertaken. Articles published include Lemos de Castro and Silva Brum (1969) (review of the genus *Excirolana*), Koenig (1972), Lemos de Castro & Lima (1976) and Moreira (1972) (dealt with *Eurydice*).

c) Pacific. Carvacho (1977) reviewed previous works; Brusca & Iverson (1985) recorded the Pacific species from Costa Rica.

West Africa. Fauna very poorly known with about four species recorded. Papers contributed by Brian & Darteville (1949), Monod (1931, 1952, 1976) and Bruce (1982b).

South Africa. Kensley (1978c) reviewed all previous records; also Kensley 1984b.

East Africa. Contributions from Budde-Lund (1908), Bruce (1981c) and Jones (1971, 1976).

Red Sea. Previous knowledge summarised by Bruce & Jones (1978).

India. Poorly known, the most comprehensive work being that of Pillai (1967). Hamsa & Nammalwar (1978) provided a key to the *Cirolana* species of India, but their literature coverage was incomplete. Contributions from Barnard (1935, 1936) and Eleftheriou & Jones (1976).

Tropical Pacific. There exists a dearth of information on this vast area. There are contributions from Richardson (1910) on the Philippines, Nordenstam (1946) on the central South Pacific, while Nierstrasz (1930, 1931) described species from the Indonesian area, as well as cataloguing all the known Indo-Pacific species (Nierstrasz, 1931). Bruce (1982a) reviewed the cirolanid fauna of the Papua New Guinea region.

North-west Pacific. Bruce & Jones (1981) reviewed Japanese cirolanids, while Kussakin (1979) covered the Russian coasts; recent contributions by Nunomura (1981a, b, 1982, 1984, 1985).

NATURAL HISTORY

There is little information on the ecology of cirolanids from areas other than sand beaches. Most data are concerned with a limited number of species of the genera *Eurydice* and *Excirolana*. Brief ecological notes on other species from coral reef and rocky shore habitats have been given by Jones (1976), Bruce (1980a, b) and Bruce & Jones (1981). The distribution of Australian cirolanid genera amongst habitat types is shown in Table 1.

Cirolanids are a characteristic component of the sand beach fauna, and in Australia the representative sand beach genera are *Pseudolana* and *Excirolana*. *Eurydice*, which is common on the sand beaches of Europe (Jones, 1969; Jones & Naylor, 1967), the Indian Ocean (Jones, 1971, 1974; Eleftheriou & Jones, 1976) and Japan (Bruce & Jones, 1981) is known only from subtidal sediments in Australia. Jones (1971, 1974) and Dexter (1977) have demonstrated that there is no universal 'cirolanid-zone' on sand beaches, and that cirolanids may be found at any level or all levels of a sand beach. Where several cirolanid species occur on a single beach, species may segregate and minimise their areas of overlap. Species have been shown by Jones (1971) and Eleftheriou & Jones (1976) to prefer beaches of a characteristic sand particle size, degree of exposure and position on the beach. Dexter (1977) has shown that in *Excirolana braziliensis* there is a maturity-related distribution on a beach, with adults occurring at higher tide levels and manca at lower tide levels. In Australia, Dexter (1983b) has shown that *Pseudolana* species segregate according to the degree of wave action on a particular beach.

On coral reefs, cirolanids are found primarily in crevices, vacant burrows and in cracks in dead coral rock. The representative genera occupying these habitats

are *Cirolana*, *Hansenolana*, *Metacirolana* and *Neocirolana*. The genera *Eurydice* and *Natatolana* occur in the sediments off the reef itself. On the reef flat at Heron Island, no cirolanids were found in the sediments. The most abundant coral-reef cirolanids are members of the *Cirolana parva* complex of species.

The subtidal and continental shelf sediment is richly populated by cirolanids, and is the major habitat recorded for the genus *Natatolana*. A total of 11 genera and 57 species have been taken from these habitats in Australia (Table 1).

Mangroves and the estuarine reaches of rivers and creeks are not rich in cirolanid species. In low and variable salinity habitats, *Anopsilana* is commonly found in dead wood bored by *Sphaeroma* or *Teredo*. In north-western Australia and the Northern Territory, *Limicolana* has been taken from burrows in mangrove mud. Less commonly, species of the *Cirolana parva* group are taken where freshwater influence is slight. In the more saline reaches of rivers or estuaries, species of *Pseudolana*, *Natatolana* and *Cirolana* have been taken from the subtidal sediments.

In subtropical and temperate waters of Australia, the cirolanid-rich intertidal and subtidal habitats of coral reefs and mangrove estuaries are reduced or absent, and the number of cirolanid species consequently drops. On temperate rocky coasts, large algae are a prominent feature. Although cirolanids are not generally associated with algae, they have been taken from amongst algal holdfasts, and in South Africa *Cirolana imposita* is common in this habitat (Shafir & Field, 1980). On rocky shores, cirolanids (mainly *Cirolana* species) will generally be found in any situation that provides refuge. Typical examples are in rock crevices, under rocks, amongst the massed remains of dead barnacles, dense

Table 1. Distribution of Australian cirolanid genera among various habitats. (+ indicates the presence of a genus in a particular habitat, blank denotes absence of records) **A:** intertidal, **B:** subtidal (0-200 m), **C:** coral reefs, **D:** sand beaches, **E:** subtidal sediments, **F:** mangrove mud, **G:** estuarine, **H:** dead wood, **I:** rocky substrata, **J:** continental slope (200-1000 m).

	A	B	C	D	E	F	G	H	I	J	
<i>Eurydice</i>		+			+		+				Sand beach dwellers in northern hemisphere
<i>Excirolana</i>	+			+							Sand beaches
<i>Pseudolana</i>	+	+		+	+		+				Sand beaches, and shallow subtidal
<i>Eurylana</i>	+										On sand beaches in New Zealand and New Guinea
<i>Metacirolana</i>	+	+	+		+				+	+	In Australia, primarily a coral reef genus
<i>Bathynomus</i>		+								+	Deep on the continental slope, taken in trawls
<i>Cirolana</i>	+	+	+		+		+	+	+	+	
<i>Anopsilana</i>	+						+	+			In tropical rivers and creeks
<i>Neocirolana</i>		+	+		+					+	
<i>Hansenolana</i>	+		+				+	+			
<i>Booralana</i>		+								+	Known only from baited traps
<i>Orphelana</i>		+			+						
<i>Natatolana</i>		+			+		+			+	Subtidal sediments
<i>Dolicholana</i>		+			+					+	
<i>Cartetolana</i>		+									A commensal of crinoids
<i>Limicolana</i>	+					+					Burrows in mangrove mud

mussel clumps and in clumps of coralline algae. Rocky-shore species are not usually found in sedimentary habitats.

Most cirolanids are taken on the continental shelf; only 11 of the 102 species recorded here having been collected at depths greater than 200 metres. Six of these are *Natanolana* species. In general, cirolanids are scarce at depths beyond 20 metres, although this may be in part due to lack of collecting effort. Two species (*Natanolana bowmani* and *N. laewilla*) have been taken between 900 and 1200 metres, the greatest depth known for any cirolanid in Australia, and in the world only exceeded by records of *Bathynomus giganteus* and *Natanolana caeca*.

In Australia, no cirolanid has yet been collected from permanent freshwater. The genus *Anopsilana* penetrates at least to the upper limits of mangrove distribution, and species of *Anopsilana* and *Pseudolana* will inhabit creeks that at low tide have only pure fresh water flowing. In contrast, the family is well represented in the freshwater of springs, wells and caves in Africa, Europe, the Middle East, Caribbean and southern United States. In most cases these species are found in areas which were, in prehistoric times, inundated by the sea (Bowman, 1964; Botosaneanu & Stock, 1979). Such areas do exist in Australia.

To obtain quantitative data from hard substrata is difficult and, unlike sand beaches, may involve the destruction of the substratum being sampled. Hutchings (1978) has described the problems encountered in trying to obtain quantitative samples from coral reef rock. On Heron Island, the numbers of cirolanids obtained per coral rock sample (enough coral to fill a 5 litre bucket) were so low as to preclude statistical analysis. Of the eight species collected from coral rock at Heron Island, three are known from less than five specimens, and two more are known from less than 12 specimens.

Records of cirolanid population densities have mainly been recorded for species inhabiting particulate substrata. Hewatt (1937) recorded *Cirolana harfordi* at densities up to 12,600 per m², and Dexter (1977) gave figures between 2,000 per m² and 6,000 per m² for *Excicrolana braziliensis*. Jones (1971) found that the greatest number of cirolanids on a 200 metre beach transect in Kenya was 46. On beaches around Sydney, Dexter (pers. comm.) has found that *Pseudolana towrae* occurs at an average density of 44 per m², while *P. concinna* averaged between 76 per m² and 266 per m².

Little data exist for the density of subtidal species, although some, such as *Natanolana variguberna* are clearly abundant in the near shore sediments (Holdich et al., 1981). From material obtained by the extensive collections of the Port Phillip Bay and the Western Port surveys (Poore et al., 1975), estimates of densities can be made for *Natanolana longispina* and *N. wowine*. These appear to occur regularly at densities of 10 to 30 per m² but occasionally peak at about 1,000 per m².

Although these high figures suggest that cirolanids occur in large numbers, most species have to be considered scarce. Of the species dealt with here, 83

(81.4%) are known from less than 50 specimens and 57 (55.9%) are known from 12 or less. Species likely to be found occurring in large numbers include members of the *Cirolana parva* group, various *Natanolana* species, and sand beach species.

Cirolanids have for a long time been considered as parasites of fish, as they were commonly found attached to fish, especially fish caught in nets. Stebbing (1893) gave a vivid account of cirolanid feeding habits, describing *Natanolana borealis* as "a savage devourer of fish", *Politolana concharum* as feeding "sweetly" on crabs, and *Eurydice* as a "vicious biter". *Conilera*, however, Stebbing referred to as "parasites". In spite of the clear documentation of cirolanids as predatory scavengers (Hale, 1925, 1929b; Jones, 1968; Sekiguchi, 1982; Sekiguchi et al., 1981, 1982), reference to cirolanids as parasites has been persistent (Menzies et al., 1955; Naylor, 1972), with Moreira & Sadowsky (1978) listing six species as parasites of elasmobranchs.

Hale (1925, 1929b) described how the cleaning of skeletons for zoological collections can be achieved by immersion of the specimen at a locality where cirolanids are abundant. Hale (1929b) also described cirolanids attacking and killing sharks, bringing about the collapse of the South Australian shark fishery. Recently cirolanids have been reported as attacking netted sharks (Sekiguchi et al., 1981) and also killing them by eating their way into the shark's vital organs (Bird, 1981).

Brusca (1981) stated that cirolanids are primarily benthic scavengers and predators, attaching temporarily to fish from which they extract a meal. Brusca (1981) also referred to cirolanids as benthic scavengers, predators and micropredators. There are very few descriptive accounts of the mode of feeding, and therefore many assessments of their feeding habits (especially with regard to live fish) are speculative. Jones (1968) reported that *Eurydice* will attack living animals of almost every phylum. Holdich (1981) has described how *Eurydice* swims in the swash zone, or emerges from freshly wetted sand to catch stranded terrestrial arthropods. Results of traps set for cirolanids as well as the occurrence of cirolanids on anglers' baits, in crab and lobster pots and on netted fish, all support the suggestion that they appear to be opportunistic predatory scavengers. Genera taken in traps include *Cirolana*, *Pseudolana*, *Eurydiana*, *Excicrolana*, *Natanolana*, *Booralana* and *Anopsilana*. *Bathynomus immanis* specimens were caught while apparently feeding on fish in the trawl, as has been reported for *B. giganteus* by Holthuis & Mikulka (1972).

Certain genera are never caught in baited traps. At Heron Island, traps were set in areas where *Metacirolana* species were known to occur, yet species of this genus were never taken, no matter which bait was used. This suggests that *Metacirolana* may be less of a scavenger than *Cirolana*. Similarly, I have not been able to trap *Eurydice*, and the accounts of Jones (1968) and Holdich (1981) suggest that species of this genus are primarily opportunistic predators rather than scavengers.

Cirolanid isopods have rarely been recorded as the food item of any other animal. Likely predators of intertidal species would include birds and fish (Johnson, 1976a). Jones (1968) recorded *Eurydice* as being cannibalistic. Amongst the specimens I examined, two specimens of an unidentifiable *Natatolana* species were from the gut contents of a scombroid fish, and I have seen two specimens of *Natatolana woodjonesi* taken from the gut of *Sillago schombergi* (Family Sillaganidae). Shafir & Field (1980) considered predation an important factor in mortality of *Cirolana imposita*, but did not support their assertion with any data.

Of all the species of Cirolanidae, only *Cartetolana integra* appears to have an obligate association as a symbiont. This species is found only on crinoids, although the range of crinoid host species is not known. Collection data and Potts (1915) suggest that it inhabits the aboral surface of the host, and also enters the anal cavity. *Neocirolana hermitensis*, from collection data, is known to associate with hermit crabs of the genus *Dardanus*.

A few organisms occur as commensals or epibionts of cirolanids. Two species of barnacles have been reported from *Bathynomus giganteus* by Holthuis & Mikulka (1972), *Dichelapsis bathynomi* Annandale, and *Octolasmis aymoni* (Lessona & Tapparone-Canafri) (see Newman, 1967). *Bathynomus pelor* had numerous lepadid barnacles on the pereopods and tergites; these barnacles (kindly identified by Dr B.A. Foster) belong to the widely distributed species *Temnaspis excavatum* (Hoek). Other organisms occasionally found on cirolanids include serpulid worms, hydroids and algae. *Pseudolana* are, in some localities, infested by a stalked ciliate protozoan (pers. obs.), also recorded as an ectobiont on *Exciorolana chiltoni* by Klapow (1972). Nielsen & Stromberg (1965) recorded an unnamed species of Cryptoniscinae (Isopoda, Epicarida) from *Natatolana borealis*, and I have seen the larvae of cryptoniscan isopods on several species of Australian cirolanids. Pillai (1963) described the only adult cryptoniscan recorded from a cirolanid, *Cirolaniscus willeyi* Pillai, taken from the brood pouch of a single female of *Anopsilana willeyi*.

DISTRIBUTION

Discussion of the wider distribution of the Australian cirolanid fauna is, due to the dearth of data from adjacent oceans, largely meaningless. At present over 86% of Australian species are endemic. Of the 16 genera, only 3 are endemic; *Limicolana* n. gen., *Orphelana* and *Pseudolana*. The extent to which those species and genera recorded from Australia extend into the Indian and Pacific Oceans simply is not known.

Of the non-endemic Australian species *Dolicholana elongata*, *Anopsilana pustulosa*, *A. willeyi*, *Natatolana albicaudata*, *Hansenolana anisopous* and *Exciorolana orientalis* all have wide Indo-West Pacific distributions. *Metacirolana japonica* has been recorded from northern New Zealand, northwards along eastern Australia and

Indonesia to Japan. *Eurydice orientalis* has also been recorded from the central Indo-West Pacific but the extent of its range is uncertain. *Cirolana harfordi* has a discontinuous distribution with two disjunct North Pacific populations and a southern Australian population. *Eurylana arcuata* occurs in New Zealand, the United States west coast and south-eastern Australia, but the wide distribution of this species is probably due to ship borne introductions (Bowman et al., 1981).

Within Australia, species commonly have distributions that extend along south-eastern (New South Wales and Victoria) or eastern (Queensland) coasts. Only seven species have distributions that include both eastern and western tropical coasts, and only three species occur on both south-eastern and south-western temperate coasts.

There is a marked drop in species numbers along the eastern coast from low to high latitudes. The number of recorded species for Queensland (excluding the Coral Sea) is 52, New South Wales 27, Victoria and South Australia 22, and Tasmania 12. As collecting effort and sublittoral sampling in Queensland has been far less extensive than in the southern states, a clear increase in species diversity towards the tropics is indicated.

The large genera *Eurydice*, *Cirolana*, and *Natatolana* all contain groups of morphologically similar species. In most cases these groups have wide Indo-West Pacific distributions. The *Cirolana parva* group is primarily tropical in distribution, as is the *Eurydice orientalis* group. The *Cirolana tuberculata* group has a tropical Indo-West Pacific distribution. All of the *Natatolana* species groups have wide distributions, but the *Natatolana valida* group is restricted to temperate or cooler southern hemisphere waters. Two species groups, the *Eurydice acuticauda* group and the *Cirolana* southern group, are restricted to Australia's south-eastern coasts.

TAXONOMY

Cirolanidae Dana

The synonymies include only those references which give a diagnosis or some discussion of the taxon.

- Cirolaninae Dana, 1852: 204.—1853a: 748; 1853b: 1438; Hansen, 1895: 12; 1905: 337; Nierstrasz & Schuurmans Stekhoven, 1930: 69; Nierstrasz, 1931: 147; Gurjanova, 1933: 427; 1936: 66; Menzies, 1962a: 122; Naylor, 1972: 24.
- Cirolanidae.—Harger, 1880: 304; Hansen, 1890: 310; Stebbing, 1893: 341; 1900: 628; 1902: 49; Sars, 1899: 68; Richardson, 1905: 81; Thielemann, 1910: 8; Norman & Scott, 1906: 40; Racovitza, 1912: 203; Vanhöffen, 1914: 495; Monod, 1930: 129; Van Name, 1936: 421; Eales, 1950: 114; Menzies & Frankenberg, 1966: 48; Menzies & Glynn, 1968: 36; Menzies & George, 1972: 19; Menzies & Kruczynski, 1983: 80; Schultz, 1969: 168; Jansen, 1978: 145; 1981: 5; Kensley, 1978c: 61; Argano, 1979: 54; Kussakin, 1979: 157; Brusca, 1973: 189; 1980: 226; Holdich, Harrison & Bruce, 1981: 557.
- Eurydicidae Stebbing, 1905: 10.—Hale, 1925: 129; 1929b: 246; Pillai, 1967: 268.

Not Cirolanidae.—Menzies, 1962a: 113; Naylor, 1972: 24. (Includes the families Aegidae, Cirolanidae, Corallanidae, Cymothoidae and Phoratopodidae).

Diagnosis. Eyes lateral, small, multifaceted (when present); lateral grooves at each posterolateral angle of cephalon. Coxal plates present on pereonites 2–7, each plate separated from tergite by a distinct suture. Pleon with 5 unfused segments (36 of 43 genera); pleonite 5 with free lateral margins, or overlapped by pleonite 4 (35 of 43 genera). Frontal lamina present. Mandible with tridentate incisor, lacinia mobilis, large blade-like molar process and palp. Maxillule with 11–14 spines on exopod, 3 or 4 robust plumose spines on endopod. Maxilla with palp and exopod; provided with long setae. Maxilliped palp 5-articulate; endite present. Anterior pereopods (1–3) ambulatory with prominent robust dactyls, posterior pereopods (4–7) ambulatory or natatory. Pleopods all membranous, without ridges or folding. Uropods situated at anterolateral angles of pleotelson, freely articulating; both rami well developed and mobile (41 of the 43 genera).

Variation within the family. There are 18 freshwater and troglobitic genera, and these show morphologies that are highly modified. It seems that no character utilised in the family diagnosis occurs without exception throughout the family. The result is a rather broad family diagnosis. The variations in family characters are discussed below.

BODY SHAPE. Cirolanids have been described as having a semi-cylindrical or strongly vaulted body shape (Richardson, 1905; Naylor, 1972; Kussakin, 1979). Body shape in cross section is commonly hemispherical, with the tergites being strongly arched. Genera with this shape include *Cirolana*, *Natatolana* and *Eurydice*. Others have a distinctly flattened body shape—*Hansenolana*, certain species of *Metacirolana* and several freshwater genera. A character which has been used to separate cirolanids from sphaeromatids is the former's inability to roll into a ball (conglobate). While generally true, four freshwater genera—*Faucheria*, *Sphaerolana*, *Skotobaena* and *Turcolana*—can conglobate, as well as *Natatolana pilula* which can at least partially conglobate.

PLEON. Most genera have 5 unfused pleonites with the 6th being fused to the telson, forming the pleotelson. In some genera the pleonites have coalesced to varying degrees and in differing ways. *Faucheria* has all the pleonites totally fused to the pleotelson. Bowman (1975) has summarised the variety of pleon conditions.

MOUTHPARTS. In most genera the mandible has a broad tridentate incisor. In *Neocirolana*, some *Natatolana* and *Orphelana* it is narrow, and in *Orphelana* it is barely tridentate. In *Cartetolana*, the incisor is massive, and the lacinia mobilis and molar process vestigial. The maxilla is reduced in several genera, often the palp and exopod are reduced or, as in *Arubolana*, even absent. The maxilliped endite varies in prominence from vestigial (*Eurydice*) to large with 5 or more coupling hooks (*Bathynomus*).

ANTENNULE AND ANTENNA. The cirolanid antennule is generally described as having three peduncular articles, although articles 1 and 2 have a tendency to coalesce (Bruce, 1981a, b). At the end of the third is often a short article. This article has been considered as part of the flagellum (e.g. Hale, 1925, describing *Neocirolana obesa*) or the third peduncular article (Jones, 1976, describing *Cirolana carina*), or often illustrated but not discussed (e.g. Bowman, 1966). Bruce (1981a) discussed this terminal article, pointing out that the cirolanid antennule could be considered to have 4 peduncular articles. Wägele (1983) considered this fourth article to be part of the flagellum. In this, Wägele (1983) is at odds with his own interpretation of the antennal homologies. Wägele figured the isopod antenna with five or six articles: precoxa (often lost), coxa, basis, and articles I, II and III. The last three he regarded as peduncular in function and morphology. Wägele identified the basis of the antenna by the presence of an exopod in some Asellota and Oniscoidea. The antennule of *Bathynomus* has a vestigial exopod at the end of the third peduncular article, and this identifies the first three peduncle articles as precoxa, coxa and basis. In *Bathynomus*, the Serolidae, and the Bathynataliidae, the fourth antennule article is clearly peduncular in function and morphology (e.g. cuticular thickness, lack of aesthetascs) and, to maintain the homology, must correspond to the antenna peduncle article I of Wägele. The cirolanid antennule has 4 peduncular articles or reductions from that condition to 3 articles. This occurs by loss of the fourth article in *Eurydice* and *Dolicholana* or, more commonly, by fusion of peduncular articles 1 and 2 as shown by *Neocirolana* and several species of *Cirolana*. Examples of cirolanid antennules and antennae are shown in Fig. 1.

The antennae of cirolanids are routinely described as having a peduncle of five articles. Hansen (1903) clearly illustrated the presence of a basal article in *Bathynomus*, and considered this to be the first peduncular article. As this article is not part of the articulating structure of the peduncle and is difficult to observe, Hansen (1903, 1905) modified his diagnosis and key to an antennal peduncle with at least five visible articles. The basal article is figured for three genera (Fig. 1F–G). Of the Australian genera, in only *Eurydice* and *Excirolana* is the article absent. In *Metacirolana*, *Hansenolana* and *Orphelana* I could not determine its presence or absence.

Remarks. Family diagnoses have frequently failed to utilise characters by which the Cirolanidae could be separated from the Corallanidae and other minor families such as the Phoratopodidae. From studying collections made by survey teams and museum workers expert in crustaceans other than the isopods, it is clear that the family most frequently confused with the Cirolanidae is the Corallanidae. The surest way to separate the two families is by examination of the mouthparts. All the Corallanidae have a strongly curved, hook-like maxillule (Bruce et al., 1982) which is usually easy to see. Additionally, in corallanids, the

maxilla is vestigial and all genera lack the maxilliped endite. In the field, corallanids can usually be recognised by the stronger setation of the pereon, pleon and pleotelson, and by their larger eyes. The family Tridentellidae is readily separated by having a styliform maxillule and a maxilla with abundant serrate, scale-like spines (Bruce, 1984). It is also possible to confuse some aegid species with the Cirolanidae. However, the stout hooks on the maxilliped and the strongly hooked dactyls on pereopods 1–3 of the Aegidae separate them from cirolanids. A key for separating the families Cirolanidae, Corallanidae, Aegidae, Tridentellidae and Cymothoidae was given by Bruce (1985).

Classification of the Genera

Only one scheme for grouping genera within the Cirolanidae has been developed, allocating the genera into six subfamilies (Racovitza, 1912). Monod (1930,

1971a, 1972) expanded this scheme, placing all genera into seven groups, but did not recognise them as subfamilies. He considered the boundaries of the groups to be too vague and too many of the genera to be inadequately defined. Monod made no attempt to define the seven groups and, except for his "Groupe *Hansenolana*", offered no rationale as to why the genera were being grouped. Since Monod's (1930) work the number of genera has increased from nineteen to forty-three, including the genera described in this work. Placement of a genus within a group was usually on the basis of similarity to a particular genus or genera, rather than by diagnostic morphological characteristics of the whole group.

At present, I consider Monod's (1972) most recent expansion of Racovitza's (1912) scheme unacceptable. The splitting up of the once vaguely defined and overlarge genus *Cirolana* was achieved through considerable refinement of generic character

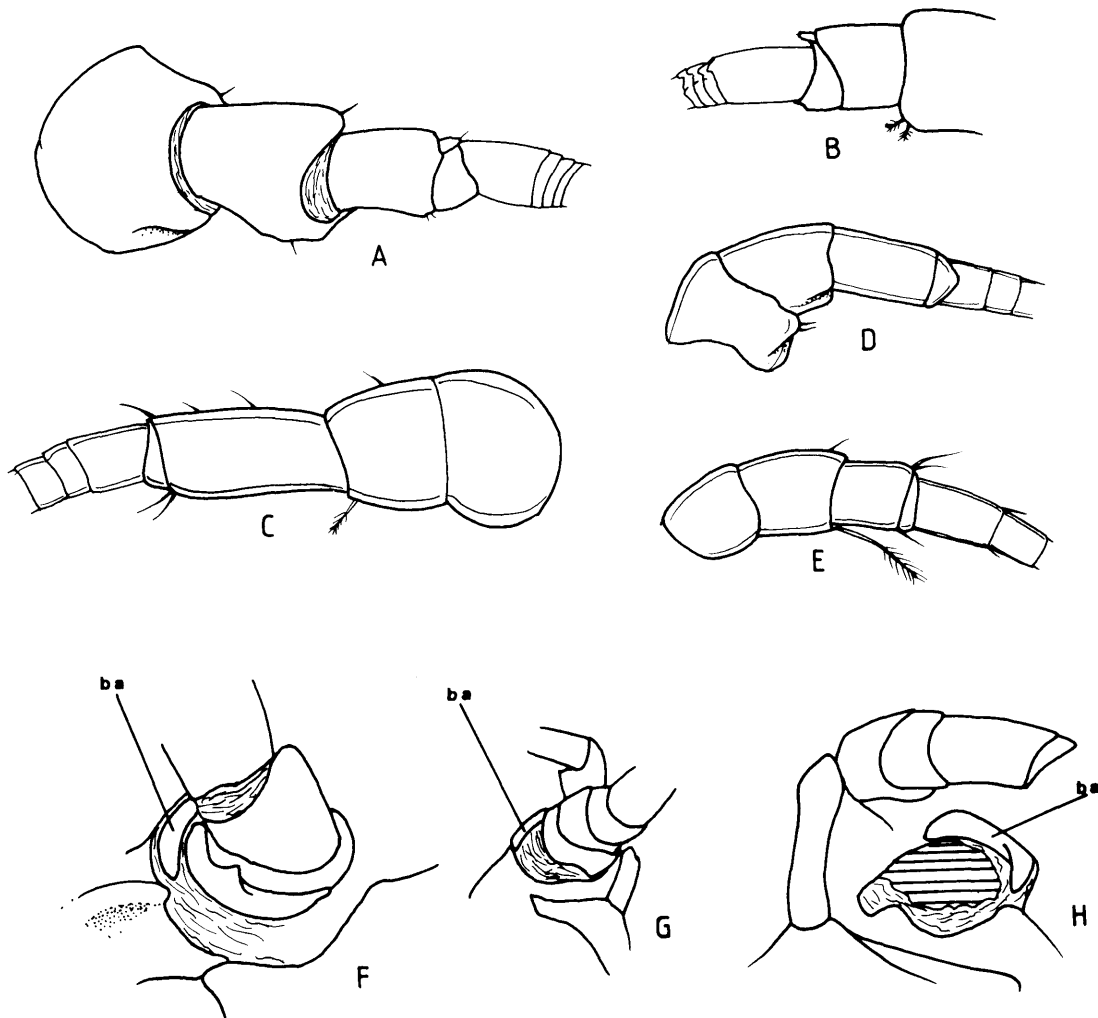


Fig. 1. Antennular peduncles (A–E) and antennal bases (F–H) of selected cirolanid genera; b.a., basal article. A, *Bathynomus immanis* n. sp., anterior view; B, *B. immanis* n. sp., articles 3 and 4, posterior view; C, *Cirolana australiense*; D, *Pseudolana brevifimbria*; E, *Metacirolana japonica*; F, *B. immanis* n. sp.; G, *Cirolana cranchii*; H, *Natatolana rossi*.

discrimination (Bruce, 1981b). Characters little used in the past, such as the relative length of the antennule and antennal peduncle articles, total pereopod morphology, pleopod shape, and clypeal morphology, were used to diagnose and describe genera.

The use of more detailed generic descriptions revealed the heterogeneity of Monod's (1971a, 1972) seven groups. For example, the "Groupe *Hansenolana*" was one whose validity Monod himself questioned. Comparison of the figures given in this work clearly demonstrate that *Neocirolana* is most closely related to *Cirolana*, as is *Saharolana*. Less obviously, *Hansenolana* is most similar to *Cirolana* (see the generic comments on *Hansenolana*) rather than *Metacirolana*. *Metacirolana* is most closely allied to the genera *Colopisthus* and *Arubolana*, all three of these genera having antennule, antennal, mouthpart, pereopod and pleopod morphologies that are essentially the same.

Although a full character state analysis is yet to be undertaken for the Cirolanidae, it is possible to perceive some major groupings of the marine genera. A major division occurs between those genera with a triangular laminar projecting blade clypeus, and those that have a flat and sessile clypeus. Other characters associated with the projecting clypeus include the pleon usually having 5 free (not overlapped, not fused) pleonites, and the male pleopod with the appendix masculina in a sub-basal or medial position. These characters isolate the marine genera *Annina*, *Eurydice*, *Eurylana*, *Exciorolana*, *Colopisthus*, *Metacirolana*, *Pseudaega* and *Pseudolana*. Within this group of genera, *Eurydice* occupies a place apart with unique antennule, antennal, maxilliped, uropod and pleotelson morphology. The genera *Annina*, *Exciorolana*, *Pseudaega*, *Pseudolana* and *Eurylana* all have robust pereopods, elongate pleopod rami, lobate pleopod peduncles, prominent penes and medial insertion of the appendix masculina.

The remaining marine genera can be further split into two groups. The first group is characterised by: antennal peduncle articles 3 and 4 subequal in length, without a secondary unguis on the pereopod dactyls; anterodistal margins of the ischium and merus of pereopods 1 to 3 produced; abundant long plumose setae on the posterior pereopods; no ornamentation of the somites; frontal lamina usually flat and narrow. The genera included in this group are *Conilera*, *Conilorpheus*, *Dolicholana* n. gen., *Natatolana*, *Oncilorpheus*, *Orphelana* and *Politolana*. The second group of genera all share the following characters: antennal peduncular articles 4 and 5 subequal and longest; frontal lamina flat and short; robust pereopods which lack long plumose setae; pereopod dactylus with prominent secondary unguis; penes reduced or absent; appendix masculina in a basal position; pleonite 5 always laterally overlapped by pleonite 4; lateral margins of pleonite 3 often posteriorly produced. The marine genera within this group are *Cirolana*, *Anopsilana*, *Calyptolana*, *Limicolana*, *Neocirolana* and *Hansenolana*. The freshwater genera *Saharolana* and *Haptolana* are also very close to *Cirolana*. The relationships of the

remaining marine (and freshwater) genera remain to be elucidated.

Characters of Taxonomic Utility

Somatic. CEPHALON: presence or absence of rostral point; presence or absence and development of interocular or submarginal furrows; eye size.

PEREON: any ornamentation of dorsal surfaces; in *Natatolana*, differences in the coxal furrows, especially presence or absence; in *Eurydice*, coxal shape.

PLEON: any ornamentation of dorsal surfaces is usually species specific; relative length of pleonite 1, particularly in *Eurydice*. In *Natatolana*, *Eurydice* and the *Cirolana parva* species group, fine details of pleonite lateral margins most useful.

PLEOTELSON: nearly always shows some species specific characters, but in some species complexes (e.g. within different *Eurydice* species groups) it is of no use. Characters to observe are general morphology, spination and setation. In most species, number of pleotelson spines is constant and is often diagnostic.

Appendages. ANTENNULE AND ANTENNA: within genera, peduncle often of little use; length of flagellum frequently useful. In *Cirolana*, relative length of antennule third peduncular article, and degree of fusion between articles 1 and 2 should be noted.

FRONTAL LAMINA AND CLYPEUS: details of frontal lamina often diagnostic, but often do not separate closely related species; of little use in *Eurydice* and *Pseudolana*. Clypeus generally of little use.

MOUTHPARTS: generally of little use in separating species within a genus; exception is *Neocirolana* where mouthparts are of prime importance. Maxilliped may offer supportive characters.

PEREOPDS: vary in usefulness between genera; male first pereopod, in species groups where it is sexually dimorphic, may offer species specific characters. In *Natatolana*, spination of pereopods 1-3, and shape of basis of pereopods 6 and 7 are important characters to note.

PENES: vary in usefulness between genera. In *Cirolana*, presence, absence and position all useful characters.

PLEOPODS: vary in usefulness between genera; often nearly identical within species groups, otherwise very useful. Shape, setation, appendix masculina morphology all important. First two pairs of pleopods in male particularly useful. In *Eurydice*, the only difference is in morphology of appendix masculina.

UROPODS: usually show species specific characters; shape, relative length of rami, setation and spination should all be noted. Fine details of uropod morphology particularly important in *Cirolana* group of species.

Key to Australian Genera of Cirolanidae

1. Clypeus flat. 6
—Clypeus freely projecting. 2
2. Prominent rostral process separating antennules. *Excirrolana* p. 39
—Without prominent rostral process. 3
3. Uropods with peduncle not produced. *Eurydice* p. 11
—Uropods with peduncle produced. 4
4. Frontal lamina linear. *Pseudolana* p. 43
—Frontal lamina broad. 5
5. Pleonite 5 lateral margins not laterally enclosed by pleonite 4. *Metacirolana* p. 31
—Pleonite 5 lateral margins laterally enclosed by pleonite 4. *Eurylana*
6. Pereopods 5–7 ambulatory, articles not flattened. 9
—Pereopods 5–7 natatory, articles flattened. 7
7. Pereopods 5–7 with ischium to propodus flattened; basis without long plumose marginal setae. *Orphelana* p. 125
—Pereopods with all articles flattened; basis with long plumose marginal setae. 8
8. Frontal lamina narrow, flat. *Natatolana* p. 52
—Frontal lamina with posterior part ventrally produced. *Dolicholana* p. 122
9. Posterior of frontal lamina produced ventrally. *Booralana* p. 136
—Entire frontal lamina flat. 10
10. Pleopod peduncles with respiratory branchiae. *Bathynomus* p. 126
—Pleopod peduncles without respiratory branchiae. 11
11. Endopods of pleopods 3–4 with marginal setae. 12
—Endopods of pleopods 3–4 without marginal setae. 14
12. Mandibles massive; molar vestigial. *Cartetolana* p. 209
—Mandibles not massive; molar normal (e.g. Fig. 116). 13
13. Mandibles with narrow incisor (e.g. Fig. 144). *Neocirolana* p. 200
—Mandibles with broad incisor (e.g. Fig. 116). *Cirolana* p. 138
14. Pereopod 1 propodus massive, subchelate. *Hansenolana* p. 214
—Pereopod 1 propodus not massive, ambulatory. 15
15. Pereopod 1 dactylus with secondary unguis; penes small or absent. *Anopsilana* p. 196
—Pereopod 1 without secondary unguis; flat obvious penes present. *Limicolana* p. 214

Eurydice Leach

Eurydice Leach, 1815: 354, 370.—Milne-Edwards, 1840: 237; Hansen, 1890: 362; 1905: 356; 1916: 165; Sars, 1899: 72; Richardson, 1905: 123; Stebbing, 1910a: 95; Tattersall, 1911: 202; Vanhöffen, 1914: 505; Barnard, 1914: 350a; 1940: 387; Nierstrasz & Schuurmans Stekhoven, 1930: 60; Hale, 1933: 558; Naylor, 1957: 3; 1972: 26; Menzies & Barnard, 1959: 31; Menzies & Frankenberg, 1966: 48; Menzies & Glynn, 1968: 170; Menzies & Kruczynski, 1983: 84; Schultz, 1969: 170; Jones, 1971: 201; Moreira, 1972:

60; Brusca, 1973: 203; 1980: 228; Kussakin, 1979: 158; Bruce & Jones, 1978: 396; 1981: 67; Holdich, Harrison & Bruce, 1981: 596.

Slabberina Beneden, 1861: 88.

Helleria Czerniavsky, 1868: 81 (not *Helleria* Ebner, 1868—Tyloidea).

Branchuropus Moore, 1901: 167.—Richardson, 1905: 128. *Pelagonice* Soika, 1955: 49. (Subgenus of *Eurydice*).

Type species. *Eurydice pulchra* Leach, 1815. Type material at British Museum (Natural History).

Diagnosis. Pereonites 1 and 2 subequal in length. Pleonite 5 lateral margins not overlapped by pleonite 4. Antennule peduncle article 2 at right angles to article 1. Antenna peduncle 4-articulate. Frontal lamina reduced; clypeus with downwardly projecting triangular blade. Maxilliped endite reduced, without coupling hooks. Pereopods 5-7 with ischium to propodus flattened, setose. Pleopods rounded, only endopod of pleopod 5 without setae; appendix masculina inserted medially. Uropod peduncle not produced, exopod lateral margin without setae.

Additional characters. Body 2.5-3.5 times longer than broad, smooth, without ornamentation; dorsal surface of pereon and pleon with medial sensory setae. Pleon with lateral margins of pleonites 2-5 produced. Pleotelson with anterodorsal depression.

Antennule article 4 very short. Frontal lamina not united with clypeus, anterior part projects ventrally. Mandibular palp with third terminal article truncate. Maxilliped palp article margins not produced, lateral margins without setae, medial margins with few setae. Pereopods 1-3 ambulatory, merus anterodistal margin not produced, all dactyls with slender secondary unguis. Pereopod 1-3 with anterior margins of ischium and merus not produced; spine opposing dactylus conspicuously large, half as long as dactylus. Flattened penes present on sternite 7. Exopods of pleopods 3-5 with complete suture. Pleopod 1 peduncle about as long as wide. Uropods not projecting beyond apex of pleotelson.

Sexual dimorphism. The sexes are generally immediately separable. Males have a narrow elongate body shape, with the pleon often as long as the pereon. Females have a strongly vaulted pereon, a short pleon and are usually more ovate in outline. The antennular and antennal flagellae are generally far longer in males. In many species, the male has a plicate process present on many articles of the antennal flagellum.

Remarks. The genus is immediately separable from all others by the distinctive antennule, antennal, pleotelson, and uropod morphology. *Eurydice* is

unusual amongst the Cirolanidae in the form of the maxilliped which has the endite greatly reduced, and also in the shape and setation of the palp. No other cirolanid genus shows these maxilliped characters, although two species of *Neocirolana* approach this maxilliped form.

Eurydice is represented around Australia by eight species, all of which are exclusively subtidal. In Australia there are no intertidal sand beach *Eurydice* species. In Europe, Western Indian Ocean and Japan, *Eurydice* is the dominant sand beach isopod (Jones, 1969, 1971, 1974; Eleftheriou & Jones, 1976; Bruce & Jones, 1981), except in the tropics where it may be displaced by *Excirolana*. In Australia the dominant sand beach isopods are species of *Pseudolana*, and on the tropical coast of Queensland, *Excirolana orientalis* is present.

The genus *Eurydice* is large, comprising a total of 45 known species. Notwithstanding the large number of species, the genus is easily defined and recognised, and has no obvious subgroupings except on the basis of pleotelson shape and the presence or absence of pleotelson spines. Soika (1955) proposed the subgenus *Pelagonice* for pelagic species that also lacked spines on pleotelson. Jones & Naylor (1967) considered the subgenus unacceptable. They pointed out that both *E. inermis* and *E. truncata* occur in the benthos and are thus not purely pelagic. However, Soika's division does recognise the only visible separation within the genus. That is, species with pleotelsonic spines and those without. Of those species without spines, only *E. inornata* has been convincingly demonstrated to be intertidal (Jones, 1971). Whether or not this division is of systematic value is questionable since virtually no other differences seem to correlate with the lack of spines. In Australia, *Eurydice* does not occur intertidally, and no species has pleotelson spines.

The most closely allied cirolanid genus appears to be *Metacirolana*. Characters in common between the two genera include: pereonite 1 short, all pleonites free, prominent penes and a projecting clypeus. Both genera are sexually dimorphic.

Key to Australian Species of *Eurydice*

1. Posterior margin of pleotelson truncate (*E. orientalis* group). 2
 —Posterior margin of pleotelson acute (*E. acuticauda* group). 5
2. Pleotelson posterior margin very narrow with 4 setae. *E. woka*
 —Pleotelson posterior margin moderately narrow with 6-8 setae. 3
3. Pleonite 1 largely concealed by pleonite 7. *E. minya*
 —Pleonite 1 largely exposed. 4
4. Male with antennule flagellum long; antennal flagellum reaching pleotelson
 or further. *E. orientalis*
 —Male with antennule flagellum short; antennal flagellum reaching pleonite 3. *E. wyuna*

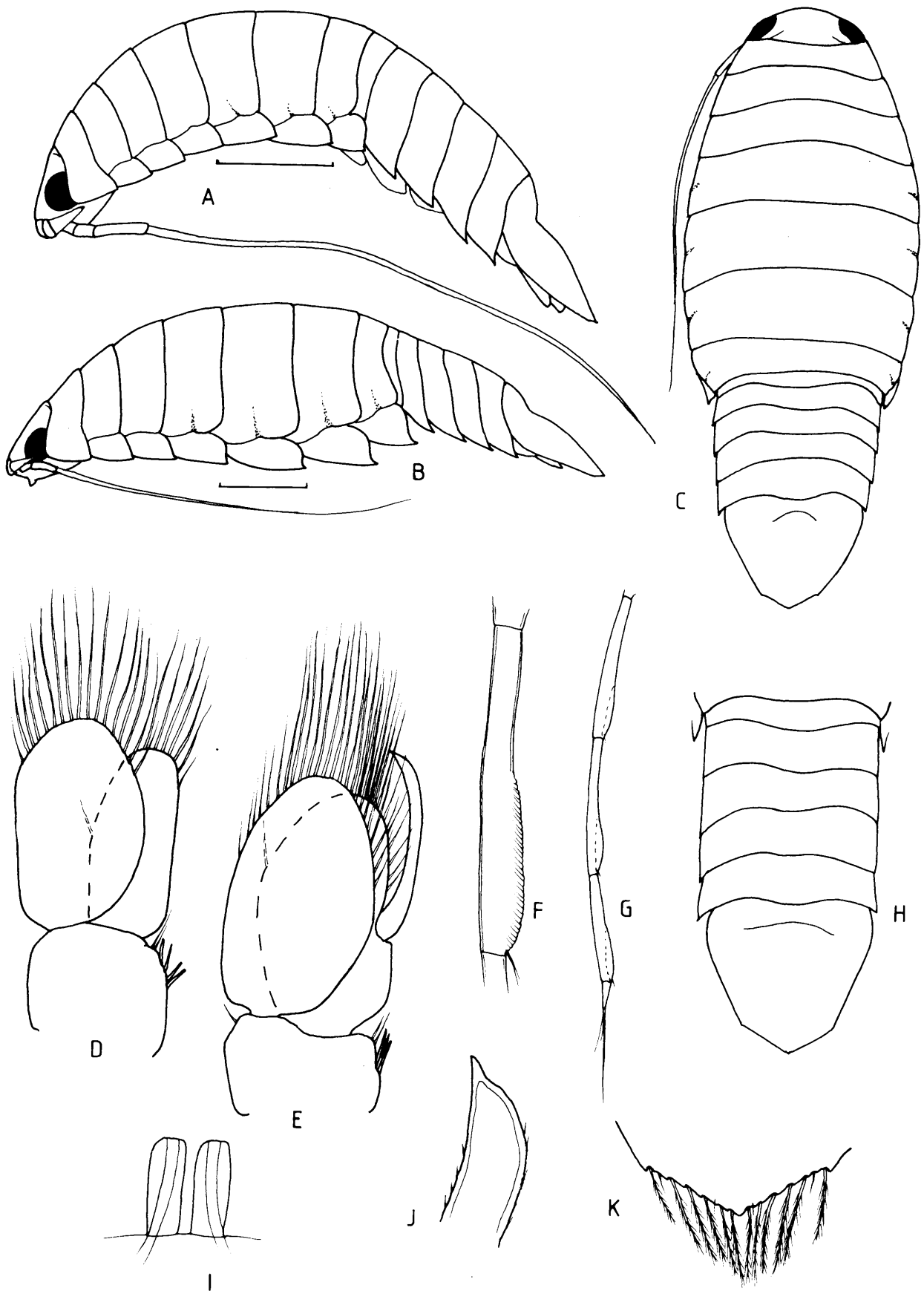


Fig. 2. *Eurydice acuticauda*. A, D–J, male 5.6 mm WP; B, C, K female 5.0 mm WP. A, lateral view (male); B, lateral view (female); C, dorsal view (female); D, pleopod 1; E, pleopod 2; F, antenna, flagellar article 20; G, antenna, flagellar articles 21–24; H, pleon; I, penes; J, appendix masculina, apex; K, pleotelson, posterior margin. Scale 1.0 mm.

- 5. Pleotelson with posterior margins concave. *E. spenceri*
- Pleotelson with posterior margins smoothly tapered. 6
- 6. Prominent coxal points on all coxae; appendix masculina with acute apical process. *E. binda*
- Coxal points only on pereonites 5–7; appendix masculina apical process reduced or absent. 7
- 7. Antennal flagellum longer than pleon (male); coxal points on pereonites 5–7 distinct. *E. acuticauda*
- Antennal flagellum shorter than pleon (male); coxal points on pereonites 5–7 feebly developed. *E. tarti*

***Eurydice acuticauda* Bruce**

Figs 2, 3

Eurydice acuticauda Bruce, 1981a: 645, figs 1, 2. (Part).

Material examined. Male (5.6 mm), 7 females (4.9–6.3 mm), WP, Vic., 22 Oct. 1971, from plankton, coll. R.H. Miller. Female (5.0 mm), WP, Vic., 38°21.17'S, 145°15.93'E, 20 Nov. 1973, sand. 2 female (5.2, 5.6 mm, ovig.), WP, Vic., 38°25.83'S, 145°19.28'E, 21 Nov. 1973. All type material examined by Bruce (1981a) was also re-examined.

Types. Held at the Museum of Victoria, Melbourne.

Type locality. Western Port, Vic., 38°27'S, 145°14'E.

Description of male. Body about 3.5 times as long as wide, straight sided. Eyes moderately large, red or black. Coxae with posterior margins only slightly produced, those of pereonites 5–7 with slight points. Pleonite 1 largely concealed by pereonite 7. Pleotelson about as long as broad, posterior margin forming acute angle, provided with 12–14 plumose setae, each set within a notch.

Antennule peduncle articles 1–3 short, approximately subequal in length; flagellum short, composed of 3 articles, proximal article as long as peduncle, provided with numerous aesthetascs. Antenna long, peduncle extending to middle of pereonite 1; peduncular article 3

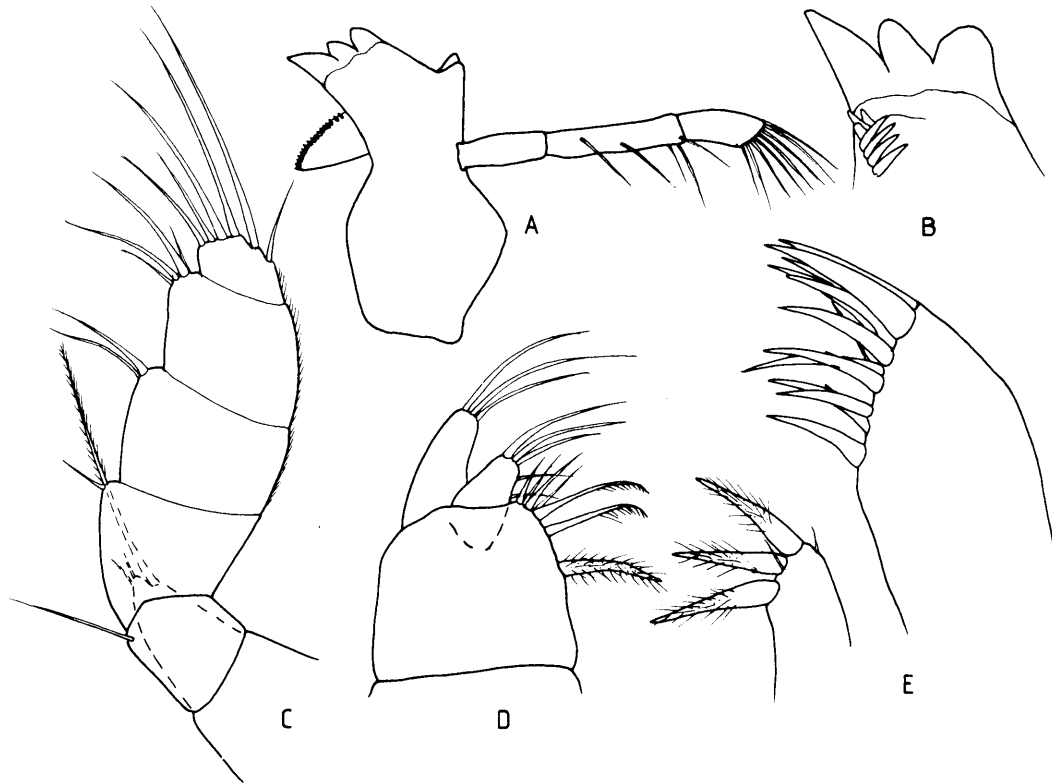


Fig. 3. *Eurydice acuticauda*, male 5.6 mm, WP. A, left mandible; B, right mandible, detail of incisor and spine row; C, maxilliped; D, maxilla; E, maxillule.

as long as combined length of articles 1 and 2 and about half as long as article 4; flagellum extremely long, extending to or just beyond apex of pleotelson, composed of 24 elongate flagellar articles, each with plicate process at distal end.

Pereopod 1 short with few setae; prominent spine present on anterodistal angle of ischium; posterior borders of merus, carpus and propodus with 4, 1 and 3 spines respectively; distal spine of propodus opposes dactylus which has well developed secondary unguis. Pereopods 2 and 3 similar to pereopod 1 but less robust. Pereopod 7 large, anterior margins of all articles except basis with numerous setae, ischium with 2 prominent spines on anterodistal angle, merus with 2 groups of spines on anterior margin, and further group on each distal angle, as has carpus; propodus with 2 single spines and single terminal spine; posterior margins with fewer setae, each article except basis with 2 groups of spines and third group at distal angle. Pereopod 6 similar to pereopod 7 but slightly longer, pereopods 4 and 5 shorter.

Pleopod 2 appendix masculina extending beyond inner ramus by 0.2 of its length, slightly recurved, apex coming to blunt point. Uropod peduncle lateral margin armed with row of about 12 stout setae and single spine. Exopod subovate, about half as long as endopod, posterior margin with 8 long plumose setae, distolateral angle with 2 small spines and group of about 6 setae; lateral margin with 3 small setae. Endopod posterior margin truncate, armed with about 13 plumose setae; lateral margin with 5 plumose setae; lateral distal angle with 2 small spines between which lies group of simple setae.

Female. Coxae of pereonites with acute points on posterolateral margins. Antenna slightly shorter than male, composed of 12 articles all lacking plicate process. Otherwise, female differs only in sexual characters.

Colour. Reddish brown with black chromatophores in alcohol.

Size. Largest female 6.5 mm, largest male 5.5 mm.

Remarks. The original description of *E. acuticauda* was based on material from Western Port, although specimens were included from Port Phillip Bay and the coast of New South Wales. The variation between specimens was commented on but at the time there seemed insufficient evidence to separate species. The discovery of two mature males of what is now described as *Eurydice binda* allowed the recognition that the Western Port, Port Phillip Bay and NSW populations are distinct.

Males of these two species can be distinguished by differences in appendix masculina morphology, length of the penes, differences in the length of the antennal flagellum and differences in the shape of the antennal flagellum articles.

Females are all rather similar and less easy to separate. Female *E. acuticauda* differ from *E. binda* by having the coxal points less well developed, particularly on the coxae of pereonites 2–4. Females of *E. acuticauda* are

separated from *E. tarti* by having a slightly wider posterior margin to the pleotelson, by having more distinct points on the coxae of pereonites 5–7, and in having the posterior lateral margin of pleonite 5 less convex.

All the type material designated by Bruce (1981a) belongs to this species, except that from NSW, which belongs to *E. binda*. The Port Phillip Bay material was not included in the type series, and is here described as *E. tarti*.

Distribution. Known only from Western Port, Victoria, at depths of 3–5 metres.

Eurydice spenceri Bruce

Fig. 4

Eurydice spenceri Bruce, 1981a: 649, fig. 3.

Types. Held at the Stockholm Museum of Natural History, Sweden; two paratypes held at the South Australian Museum.

Type locality. Spencer Gulf, SA.

Remarks. This species can be separated from *E. acuticauda* by the more excavate hind margin of the pleotelson and the spatulate appendix masculina. Other differences are the greater number of spines on the posterior pereopods and the lack of a prominent spine on the anterior angle of the merus of pereopod 1.

Distribution. Known only from the type locality, where it was taken in 1856.

Eurydice binda n. sp.

Figs 5, 6

Eurydice acuticauda Bruce, 1981a: 645, figs 1, 2 (Part).

Material examined. Female (5.4 mm), east of Burwood Beach, 3.5 kms south of Hunter River, NSW, 32°57'S, 151°44.8'E, 31 Oct. 1975, 22 m; female (5.1 mm), same as previous station but 28 Jan. 1976, 22 m; 2 females (4.8, 5.1 mm), east of Belmont Beach, 16 kms south of Hunter River, NSW, 33°02.5'S, 151°40.8'E, 20 May 1975, 18 and 22 m; female (4.4 mm), east of McMaster's Beach, Gosford, NSW, (6.2 mm), 3 females (4.6, 5.0, 5.2 mm), off Lorne, Bass Strait, Vic., Mar. 1980, coll. D. O'Sullivan. Male (6.9 mm, crushed), south-west of Beachport, SA, 37°09.5'S, 138°30.0'E, 20 June 1962, 144 m, coll. CSIRO.

Types. Holotype male NMV J1710. Paratypes NMV J925, J1711-J1712; AM P23053-P23056, P23156, P30347.

Type locality. Bass Strait, off Lorne, Vic., 39°S, 144°E.

Description of male. Body about 3.5 times as long as wide. Cephalon anterior margin indented, with blunt median process. Pereonites 5 and 6 longer than others which are subequal in length. All coxae with small acute process at posteroventral angle; all with posterior margin convex, markedly so in coxae of pereonites 6 and 7. Pleonite 1 partially concealed by pereonite 7, pleonites 4–5 subequal in length, ventral posterior angles acute. Pleotelson posterior margin acute, with 8 plumose setae.

Antennule peduncle articles 1–2 subequal in length, article 3 slightly shorter than 2; flagellum composed of

1 long article and 1 or 2 short articles, extends to posterior of cephalon. Antenna peduncle article 4 subequal in length to total lengths of peduncle articles 1-3; flagellum extending to posterior of pleotelson composed of 26 slender articles, with small plicate process on about articles 10-24.

Frontal lamina clypeus, labrum and mouthparts not examined in detail but generally as for others of genus. Projecting part of clypeus short.

Pereopod 1 with 3 blunt and 2 acute spines on posterior margin of merus; carpus with 1 long acute spine; propodus with 4 acute spines on palm. Pereopods 2-3 similar to 1, generally with more and larger spines. Pereopods 4-6 becoming progressively longer. Pereopod 7 shorter than 6, particularly propodus; anterior margin conspicuously indented on merus, carpus and propodus, each indentation being provided with 1-4 spines; posterior margin less indented, each article except basis with 3 groups of spines as well as spines at distal angles; all margins setose except basis and posterior margin of ischium and merus.

Penes present on sternite 7, flat, about 3.4 times longer than wide.

Pleopods 1-3 with peduncle projecting slightly above coupling hooks. Pleopod 2 with broad curved appendix

masculina standing well clear of endopod, apex with acute process on lateral margin. Uropod exopod lateral margin convex, with 3 fine setae and 1 plumose seta, distal margin subtruncate, with 8 plumose setae, lateral angle with 2 small spines. Endopod distal margin truncate, with about 10 long plumose setae, distolateral angle with 2 small spines; lateral margin with 4 setae, medial with 1. Peduncle with 9 long setae and single spine on lateral margin.

Female. Generally similar to male, but antennal flagellum shorter, with 16 articles, articles themselves shorter, lacking plicate process. Antennule peduncle article 3 slightly longer than in male; antennule flagellum with fewer aesthetascs. Lastly, pereopod 7 with merus, carpus and propodus markedly shorter than male. Male length to width ratio of merus, carpus and propodus is 1.60, 1.95 and 3.60; in the female it is 1.16, 1.10 and 2.60. Furthermore, in females, merus and carpus are equal in length while in males carpus is two thirds longer than merus.

Colour. Overall pale brown with chromatophores forming darker brown transverse bands. Eyes black.

Size. Largest specimen male 6.6 mm.

Remarks. This species is very similar to *E. acuticauda*.

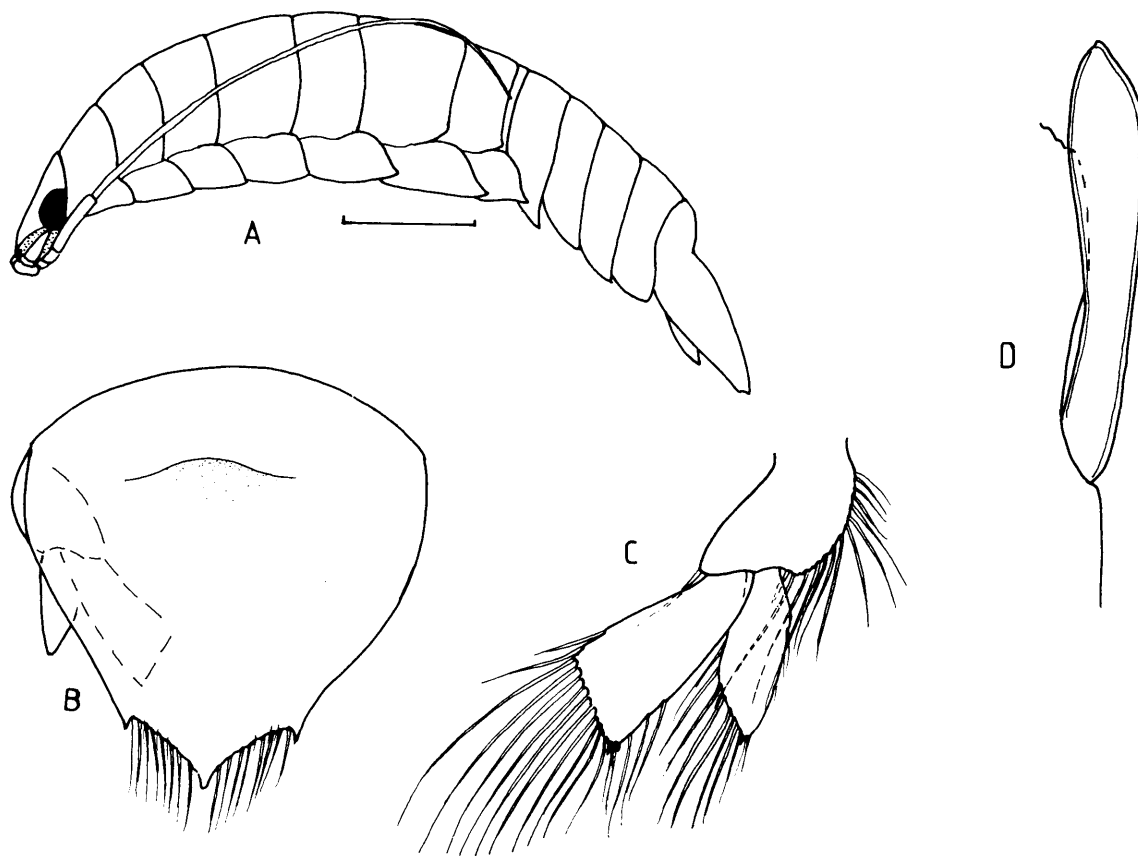


Fig. 4. *Eurydice spenceri*. A, holotype, lateral view; B, pleotelson; C, uropod; D, appendix masculina. Scale 1.0 mm.

Mature males are readily separated by appendix masculina differences and the proportional length of the penes. Other differences between the two species include the relative size of the projecting clypeus and more prominently rounded coxae, each with a point in the new species; otherwise these two species are similar. *Eurydice spenceri* is also similar and has a similar appendix masculina. In that species, the posterior margins of the pleotelson are concave, the uropodal

exopod is far more slender, the coxae of pereonites 2-5 lack points, and the posterolateral angle of pleonite 5 is less acute.

Distribution. Off the Hunter River, NSW; off Lorne, Vic.; and off Beachport, SA; at depths of 20-144 metres.

Etymology. *Binda* is an Aboriginal word meaning deep water.

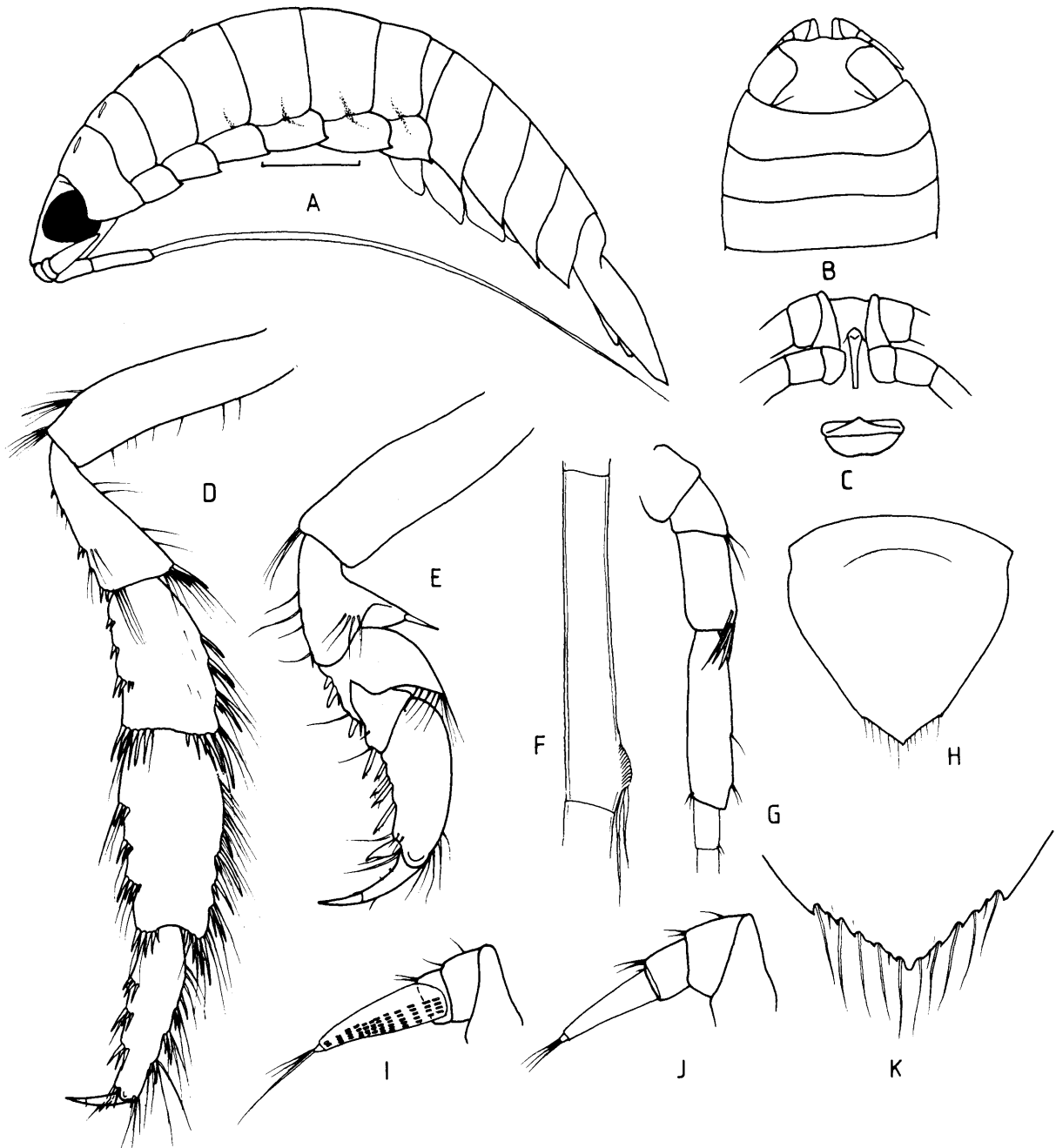


Fig. 5. *Eurydice binda* n. sp. A-G, male holotype; I, female paratype; remainder male paratype. A, lateral view; B, cephalon, anterior pereonites, dorsal view; C, clypeal region; D, pereopod 7; E, pereopod 1; F, antenna, flagellar article 17; G, antennal peduncle; H, pleotelson; I, antennule (male); J, antennule (female); K, pleotelson, posterior margin. Scale 1.0 mm.

Eurydice tarti n. sp.

Figs 7, 8

Eurydice acuticauda Bruce, 1981a: 645, figs 1, 2 (Part).

Material examined. Male (4.1 mm), manca (3.0 mm), PPB, Vic., PPBS Stn 924, 21 Sept. 1970, mud, 22 m; male (3.8 mm), 2 females (4.3, 4.4 mm), PPB, Vic., PPBS Stn 986, 12 Oct. 1971, sand, 4 m; male (5.2 mm), female (4.2 mm), PPB, Vic., PPBS Stn 974, 13 Oct. 1971, sand, 5 m; male (5.0 mm, crushed), 2 females (4.5, 5.0 mm), PPB, Vic., PPBS Stn 968, 13 Oct. 1971, sand, 8 m; female (4.7 mm), PPB, Vic., PPBS Stn 945, 16 Nov. 1971, sand, 2 m, coll. Ministry for Conservation, Vic.

Types. Holotype, male 5.2 mm, NMV J1714. Paratypes, NMV J1715-J1717; AM P32375, P32376.

Type locality. Port Phillip Bay, Vic., 38°20'S, 144°40'E.

Description of male. This species is extremely similar to *Eurydice acuticauda*, and the description deals only with points of difference. Coxal points present on coxae of pereonites 5-7. Posterolateral margins of pleonite 5

convex; posterolateral margins of pleonites 2-5 acute, barely produced. Pleotelson posterior margin acute, provided with 10 plumose setae; lateral margin feebly convex.

Antenna flagellum extending to pleonite 3, composed of 24 articles, without plicate processes.

Penes slightly less than twice as long as wide, rectangular in shape.

Pleopod 2 appendix masculina curved, extending slightly beyond apex of endopod, apex blunt.

Female. Similar to male, but antennal flagellum shorter, with 12 articles; these articles far longer and more slender than those of male. Coxal points more clearly discernable but small on coxae of pereonites 2-3.

Size. Largest male 5.2 mm, largest female 5.0 mm.

Remarks. In the remarks given with the original description of *Eurydice acuticauda*, comments were made on the differences between Western Port, Port Phillip Bay and New South Wales populations. The

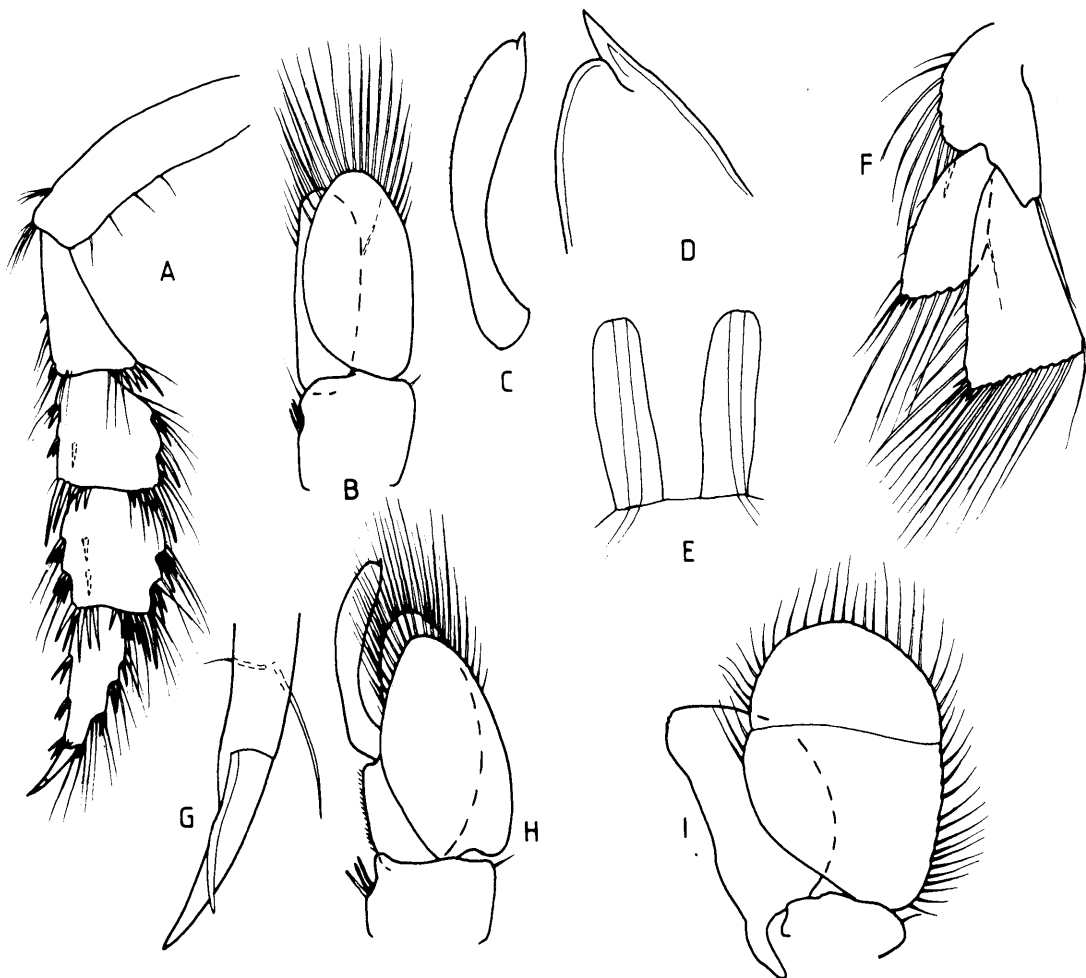


Fig. 6. *Eurydice binda* n. sp. B-E, G, H, male holotype; remainder female paratype. A, pereopod 7; B, pleopod 1; C, appendix masculina; D, appendix masculina, apex; E, penes; F, uropod; G, pereopod 1, dactylus apex; H, pleopod 2; I, pleopod 5.

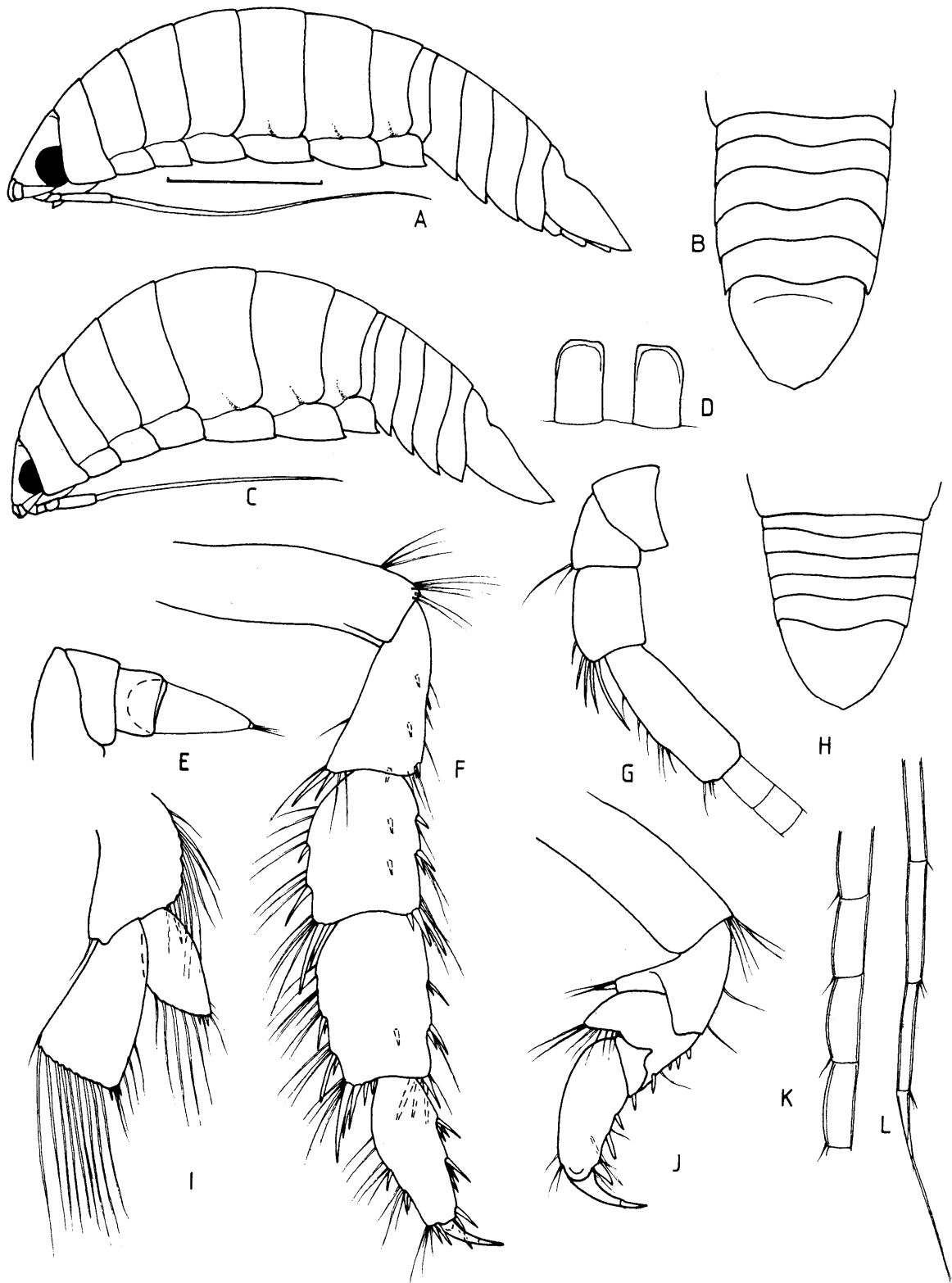


Fig. 7. *Eurydice tarti* n. sp. A, B, E-G, J, K, male holotype; C, H, I, L, female paratype; D, male paratype. A, lateral view (male); B, pleon (male); C, lateral view (female); D, penes; E, antennule; F, pereopod 7; G, antennal peduncle; H, pleon (female); I, uropod; J, pereopod 1; K, antenna (male), flagellar articles 18-20; L, antenna (female), flagellar articles 10-12. Scale 1.0 mm.

discovery of mature males of *E. binda* in the Bass Strait and off South Australia showed that the NSW females originally included as *E. acuticauda* belonged to separate species. Examination of fresh material of *E. acuticauda* (from Western Port) led to the conclusion that the Port Phillip Bay *Eurydice* should be recognised as a species. The differences are slight but appear constant. It now seems likely that these species are in fact allopatric, with *E. binda* distributed on oceanic coasts from Newcastle, NSW, to South Australia, and *E. acuticauda* and *E. tarti* existing as separate isolated populations within the virtually enclosed bays of Western Port and Port Phillip.

Eurydice tarti is separated from others of the complex by its short antennal flagellum (never reaching the pleotelson) which, in the male, has short articles without a plicate process, by the short pleon which has the posterolateral margins of pleonite 5 convex and, in the male, by the lack of obvious coxal points, and the blunt and relatively short appendix masculina.

Distribution. Known only from the type locality, taken at depths of 2–22 metres.

Etymology. *Tarti* is an Aboriginal word for little sister, and alludes to the similarity of species to *E. acuticauda*.

Eurydice orientalis Hansen

Figs 9, 10

Eurydice orientalis Hansen, 1890: 369: pl. 6, figs 2–2h.—Richardson, 1910: 8; Nierstrasz, 1930: 3, fig. 1; 1931: 147; Hale, 1933: 558; Barnard, 1936: 48; Bruce, 1980b: 158. Not *Eurydice orientalis*.—Monod, 1934: 7, pl. IV, IXA,B;

Bruce, 1980a: 110: fig. 1 (= *E. wyuna* and *E. minya*); Holdich, Harrison & Bruce, 1981: 596, fig. 15 (= *E. minya*).

Material examined. 2 males (4.2, 4.4 mm), syntypes, Java Sea, 2°25'S, 106°50'E, 1869, 14.4 m. 3 males (4.3, 4.5 (damaged), 5.0 mm), Barrow Is., WA, 2 Sept. 1954, tide running, 8 p.m. coll. K. Sheard. 2 males (3.7, 3.9 mm), off Southern Point, Mermaid Cove, Lizard Is., Qld, 8 Oct. 1978, in sand between coral outcrops, 6.1 m, coll. C. Short & P.C. Terrill. Male (3.5 mm), Halifax Bay, Townsville, Qld, 23 Nov. 1976, sandy mud, 10.8 m, coll. JCUNQ. 2 males (3.5, 3.6 mm), 2 females (3.1, 3.4 mm), 2 post manca (2.9, 2.9 mm), 6 manca (1.9–2.8 mm), Wistari Reef edge, Capricorn Group, Qld, 15 Sep. 1978, surface plankton, coll. A.J. Bruce.

Types. Two syntypes held at the Zoologisk Museum, Copenhagen, Denmark.

Type locality. Java Sea, north of Jakarta, Indonesia, 3°25'S, 106°50'E.

Description of male. Body nearly 4 times as long as wide. Cephalon anterior margin barely indented, minute rostral process present; submarginal carina running between each eye. Pereonites 1–6 become progressively longer, pereonite 7 distinctly shorter than 6; coxae of pereonites 5 and 6 with minute points at ventrodiscal angle. Pleonite 1 shorter than 2, posterolateral angles of pleonites 2–4 with their points all clear of next segment; posterolateral margins of pleonites 1 to 4 not visible dorsally, those of pleonite 5 expressed laterally, conspicuous in dorsal view. Pleotelson slightly shorter than wide, lateral margins feebly convex; posterior margin truncate about 0.33 as wide as greatest width, provided with 7 plumose setae, each seta between a dentation; the 2nd seta medial to each lateral margin

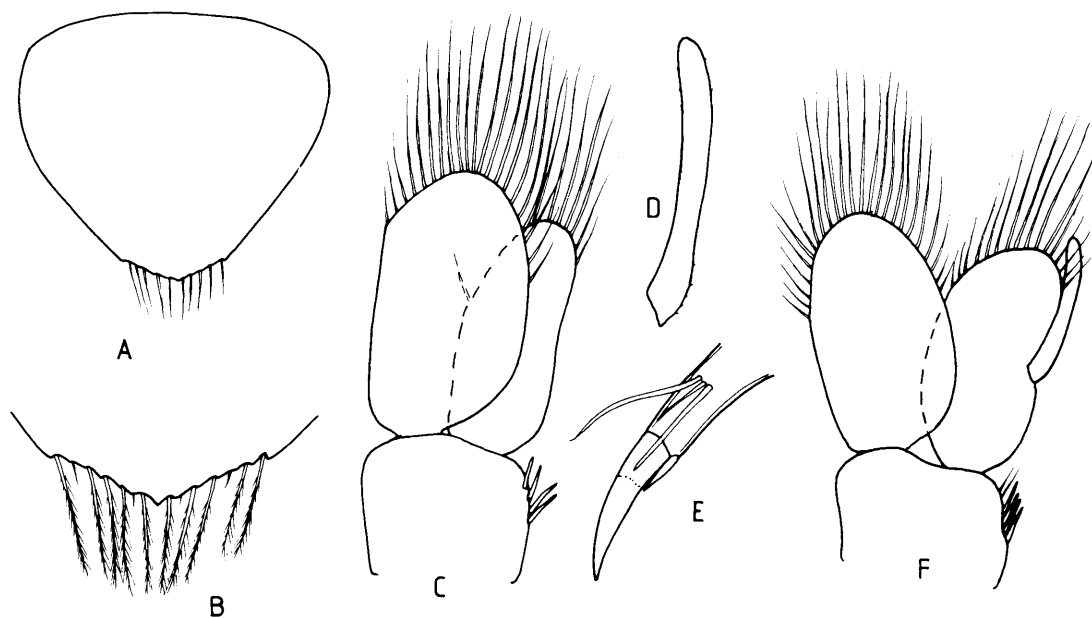


Fig. 8. *Eurydice tarti* n. sp. A, B, female paratype; C–F, male holotype. A, pleotelson; B, pleotelson, posterior margin; C, pleopod 1; D, appendix masculina; E, pereopod 1, dactylus apex; F, pleopod 2.

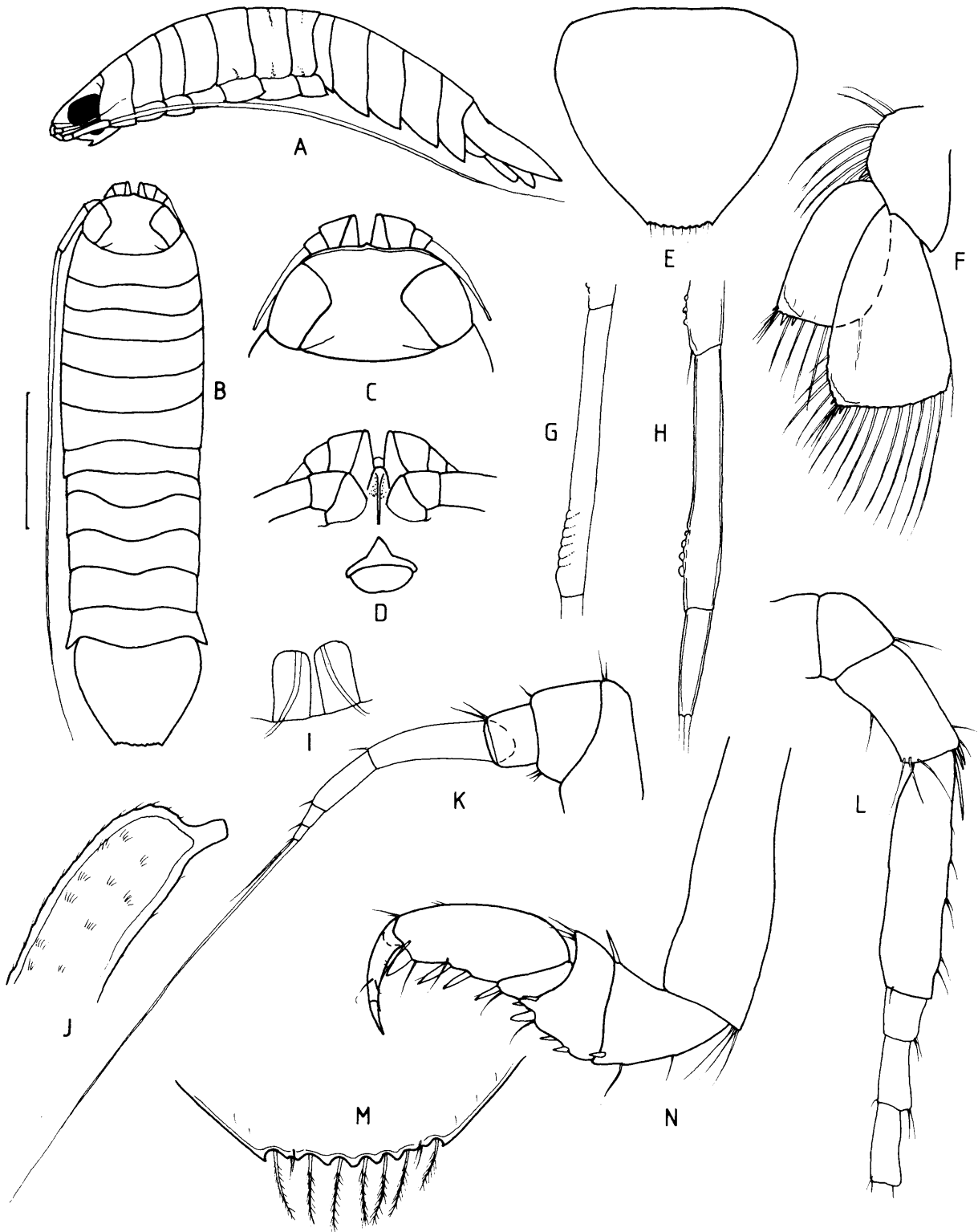


Fig. 9. *Eurydice orientalis*. A-C, male 3.9 mm, Lizard Is.; D, male 5.0 mm Barrow Is.; remainder male 3.7 mm, Lizard Is. A, lateral view; B, dorsal view; C, cephalon, dorsal view; D, clypeal region; E, pleotelson; F, uropod; G, antenna, flagellar article 12; H, antenna, flagellar articles 20, 21; I, penes; J, appendix masculina, apex; K, antennule; L, antennal peduncle; M, pleotelson, posterior margin; N, pereopod 1. Scale 1.0 mm.

always simple; lateral dentation not prominent.

Antennule peduncle articles 1-2 subequal in length, article 3 slightly shorter; flagellum with 4 articles, article 1 twice as long as 2, while 3 and 4 short; article 4 with stiff setae greater in length than peduncle. Antenna flagellum composed of about 21 articles, extending beyond pleotelson; flagellum articles become longer and very slender towards distal end; distal articles with plicate process which, on articles 19-21, form into small tubercles.

Anterior margin of frontal lamina rounded; clypeus with medial half produced to form triangular process. Maxilliped with lateral margin strongly curved, palp article 3 about twice as wide as long, article 4 two and one half times wider than long.

Pereopod 1 with 3 spines on posterior margin of merus, carpus with 1 and propodus with 2 acute spines on palm; ischium with single spine at anterodistal angle and 1 on medial distal margin. Pereopods 2 and 3 similar to pereopod 1 but with additional spine on posterior margin of ischium. Pereopod 7 with margins of merus and carpus with 1 group of marginal spines and cluster at each distal angle; propodus with 2 spines on anterior margin and 2 spines on posterior margin as well as

terminal spines on either side of the dactylus base.

Penes set close together, twice as long as broad.

Pleopod 2 appendix masculina extending beyond endopod by a little more than 0.1 its width (about 0.2 of the length of the appendix masculina), broadest distally, lateral margin with short apical projection. Uropod rami margins slightly convex; medial margin of exopod noticeably rounded. Exopod less than twice (1.7) as long as wide, distal margin with 7 plumose setae and 2 spines, lateral margin with 1 spine. Endopod with 10 plumose setae on distal margin, 4 on lateral margin, and 2 small spines on either side of lateral distal angle. Peduncle lateral margin with 8 plumose setae and single spine.

Female. No female specimens were seen that could be positively assigned to this species. Those from Wistari Reef, Capricorn Group were tentatively included.

Variation. The specimens from Barrow Island, while identical with respect to pereon, pleon and pleotelson morphology, the form of the appendix masculina, penes and maxilliped, differed slightly in the form of the articles of the antennal flagellum. In the specimens from eastern Australia, the distal articles are extremely

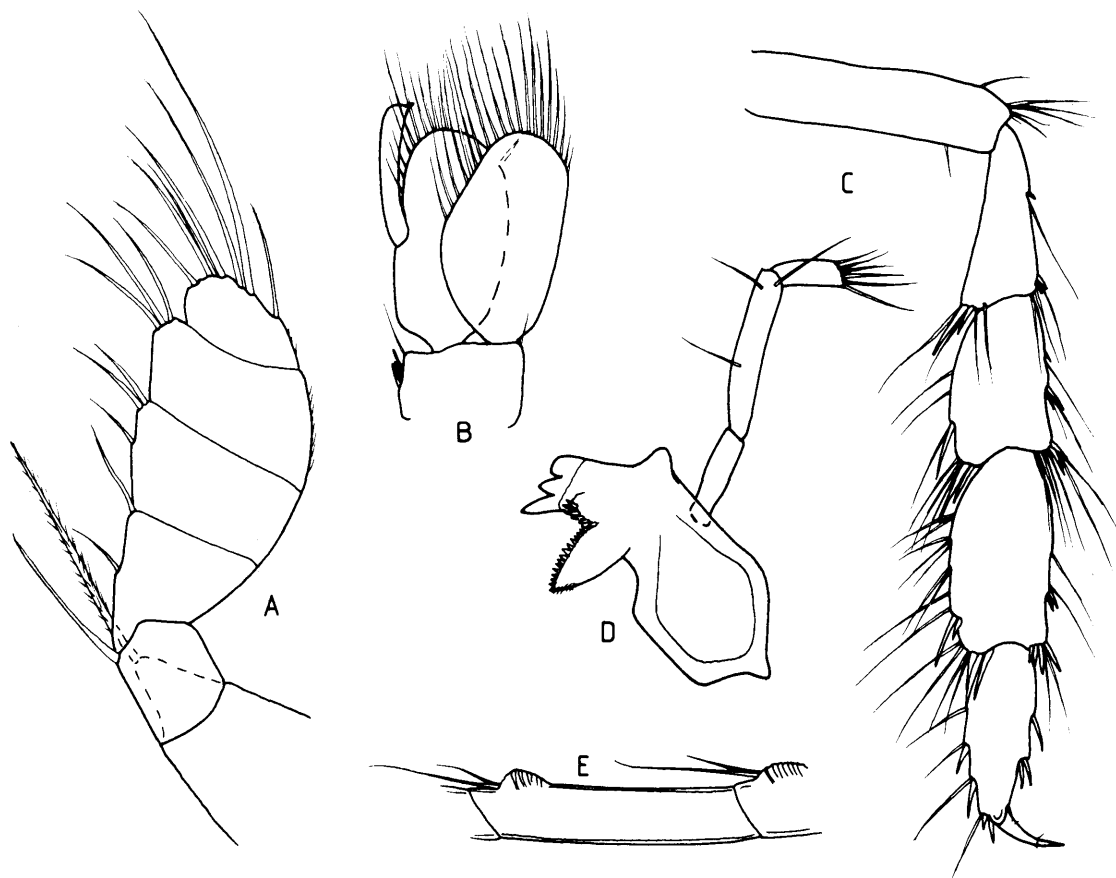


Fig. 10. *Eurydice orientalis*. A, E, D, male 4.5 mm, Barrow Is.; remainder male 3.7 mm, Lizard Is. A, maxilliped; B, pleopod 2; C, pereopod 7; D, mandible; E, antenna, flagellar article 23.

slender, and the plicate process is feebly developed. In Barrow Island specimens the flagellum has more articles (26 versus 21) and these are shorter with a prominent plicate process.

Colour. Barrow Island specimens are all dark brown. Lizard Island specimens are white to cream with black chromatophores.

Size. Largest specimen 5.0 mm.

Remarks. The type specimens of *Eurydice orientalis* are, due to their age, in a somewhat rubbed and fragile state. Comparison of Australian material to the syntypes revealed few differences. The antennular flagellum in Hansen's specimens is composed of 6 articles, with the penultimate article longest. In Australian specimens, the antennular flagellum is composed of 4 articles. Neither of Hansen's specimens had the lateral margins of pleonite 5 expressed outward. Until further material is available the Australian and Java Sea material are considered conspecific.

The males of this species can be identified by the form of the pleon, with the lateral margins of pleonite 5 only expressed outwards, the relative shortness of pereonite 7, and the posterior margin of the pleotelson with the lateral dentitions most prominent. The characters that separate males include the appendix masculina extending only a short way beyond the endopod, and the lengths of the antennular and antennal flagellum. Females have not yet been positively identified, and although female *E. minya* and *E. woka* can be separated, *E. wyuna* females as yet cannot be separated from *E. orientalis*.

Distribution. In Australia, recorded from Barrow Island in tropical Western Australia and along the eastern coast as far south as Heron Island, Qld. Also recorded from the Philippines (Richardson, 1910), Indonesia (Nierstrasz, 1931), Papua New Guinea (Nierstrasz, 1930), Sri Lanka (Barnard, 1936) and Indo-China (Monod, 1934). Monod's (1934) record seems unlikely to be this species as the uropodal exopod is clearly far narrower than in *E. orientalis*. All records other than Hansen's and the present records should be regarded with caution.

***Eurydice woka* n. sp.**

Figs 11, 12

Eurydice orientalis.—Bruce, 1980a: 110, fig. 1 (Part) (not *Eurydice orientalis* Hansen, 1890).

Material examined. 6 males (4.2, 4.4, 4.5, 4.6, 4.7, 4.8 mm), Heron Is., Capricorn Group, Qld, 1980, from night plankton, Heron-Wistari Channel. Female (4.2 mm), Heron Is., Capricorn Group, Qld, 1980, night plankton, coll. A.J. Bruce. 6 males (3.7, 3.8, 4.4, 4.8, 5.0 mm), female (3.8 mm), 3 manca (2.7, 2.6, 3.2 mm), Heron-Wistari channel, Capricorn Group, Qld, 23 Nov. 1978, night plankton, coll. D Fisk.

Types. Holotype, male, QM W9801. Paratypes, QM W9802-W9804; AM P32377; USNM 190719.

Type locality. Heron Island, Capricorn Group, Great Barrier Reef, Qld, 23°26.5'S, 151°43.5'E.

Description of male. Body nearly 4 times as long as wide. Cephalon anterior margin only slightly indented, with obscure rostral point. Pereonites 2–6 becoming progressively longer; pereonite 7 shorter than 6. Coxae of pereonites 5 and 6 each with small point at posterior ventral angle. Pleonites all well exposed, lateral margin of pleonites 2–5 slightly expressed laterally; posterolateral margin of pleonite 5 very slightly convex. Pleotelson with dorsal depression faint; lateral margin convex, converging smoothly to posterior margin which is provided with 4 plumose setae, and less than 0.2 of the maximum width of pleotelson.

Antennule peduncle articles 1–2 subequal in length, article 3 slightly longer, flagellum composed of 4 articles, first being 5 times longer than wide, second shorter than first but elongate, and articles 3 and 4 short; article 4 bears 1 long stiff seta which is greater than length of peduncle and flagellum combined; flagellum including seta extends to pereonite 3. Antenna peduncle articles 1 and 2 short, article 4 twice as long as article 3; flagellum composed of about 30 articles, extending to pleotelson; articles becoming progressively longer distally, plicate process barely developed.

Frontal lamina anterior margin appearing rounded; clypeus with median half triangular, produced and projecting.

Pereopod 1 without spines on ischium, merus with 3 spines on posterior margin, anterior margin with about 5 setae; merus with single spine at posterodistal angle; propodus with 3 acute spines on palm, and robust spine opposing dactylus. Pereopods 2 and 3 similar to 1, with additional spines on posterior margin of ischium, propodus with only 2 spines on palm. Pereopods 4–7 similar, pereopod 6 longest. Pereopod 7 with basis and ischium slender; ischium with single spine on posterior margin and 2 spines at posterodistal angle, anterodistal angle with 2 large spines; merus with 3 groups of spines on each margin; carpus with 4 groups of spines on posterior margin, anterior margin with only 2 groups of spines, but with 3 groups of setae; propodus with 4 groups of spines on posterior margin, anterior margin with 2 groups of spines and 2 groups of setae.

Penes set close together on sternite 7, rectangular in shape, about twice as long as wide.

Pleopod 2 appendix masculina exceeding endopod by 0.2 its length, slightly curved, apex rounded, with small blunt process on lateral margin; surface with microtrichs. Uropod endopod truncate, all margins very nearly straight; posterior margin with 13 plumose setae, lateral angle with 1 small spine on either side, lateral margin with 3 short setae. Exopod shorter than endopod, posterior margin subtruncate with 8 plumose setae and 2 small spines, lateral margin with single small spine. Peduncle lateral margin with 7 long plumose setae and single spine; medial margin with single seta.

Female. Pleonite 1 not as produced as in male, pleon length shorter. Both antennule and antenna with flagellae much shorter; antennal flagellum with about 15 articles extending to pereonite 6 or 7; distal articles

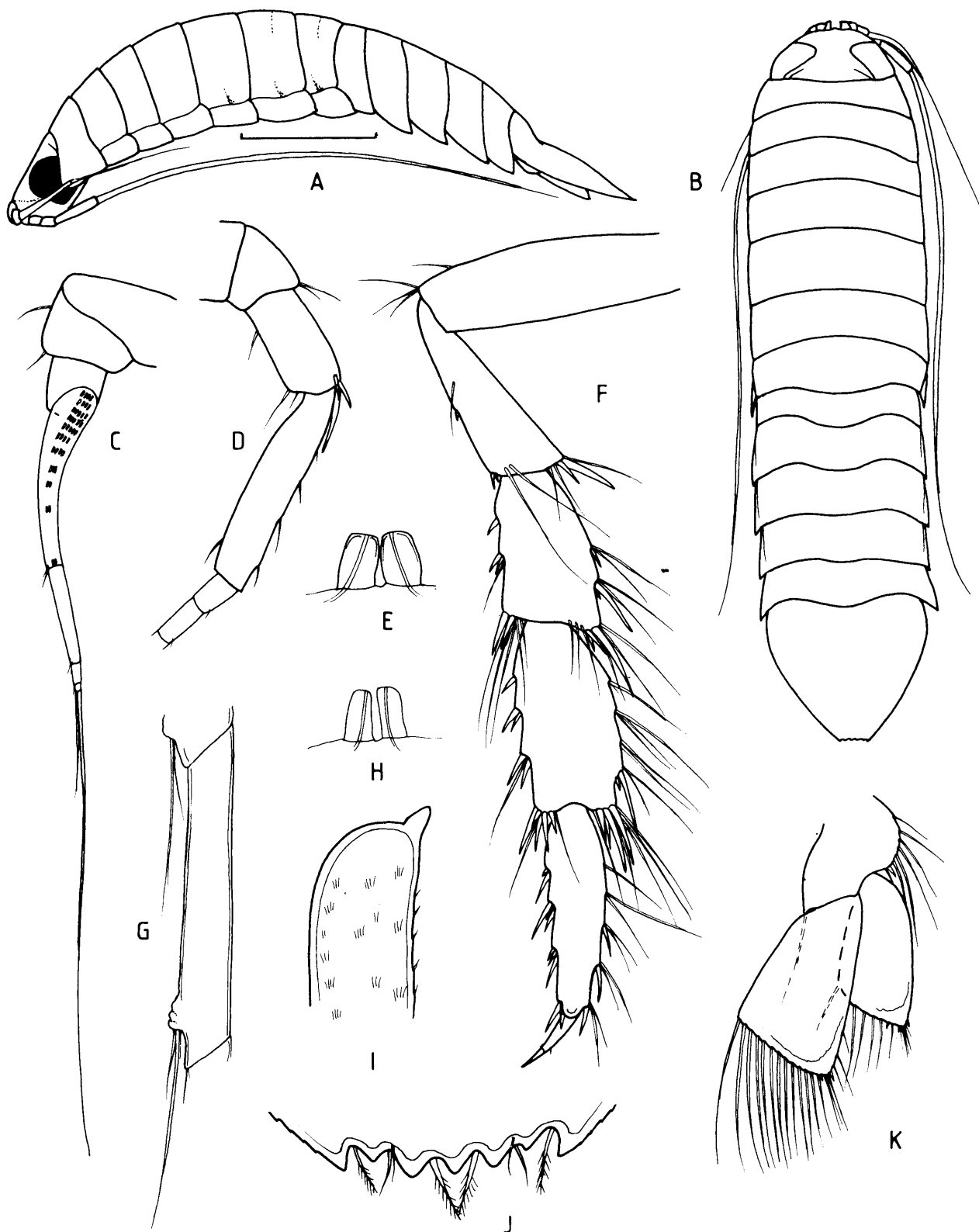


Fig. 11. *Eurydice woka* n. sp. A, B, H, holotype; remainder male paratype 4.6 mm. A, lateral view; B, dorsal view; C, antennule; D, antennal peduncle; E, penes; F, pereopod 7; G, antenna, flagellar article 20; H, penes (in situ); I, appendix masculina, apex; J, pleotelson, posterior margin; K, uropod. Scale 1.0 mm.

elongate. Pereopod 6 and 7 somewhat shorter than in male.

Colour. Translucent in life with black and brown chromatophores forming transverse bands. In alcohol, pale cream.

Size. Males range 3.7–5.0 mm, average 4.5 mm. Females up to 4.2 mm. Largest manca 3.2 mm.

Remarks. This species is at once separated from all

others by the narrowness of the posterior margin of the pleotelson, which is less than one fifth of the maximum width. This character is clearly visible in females and mancas. The male appendix masculina is similar to others of this group, but the apical projection is shorter than in most species.

Stebbing (1910a) described and briefly figured *Eurydice humilis*. This species is very close to the Australian form but the description and figures do not

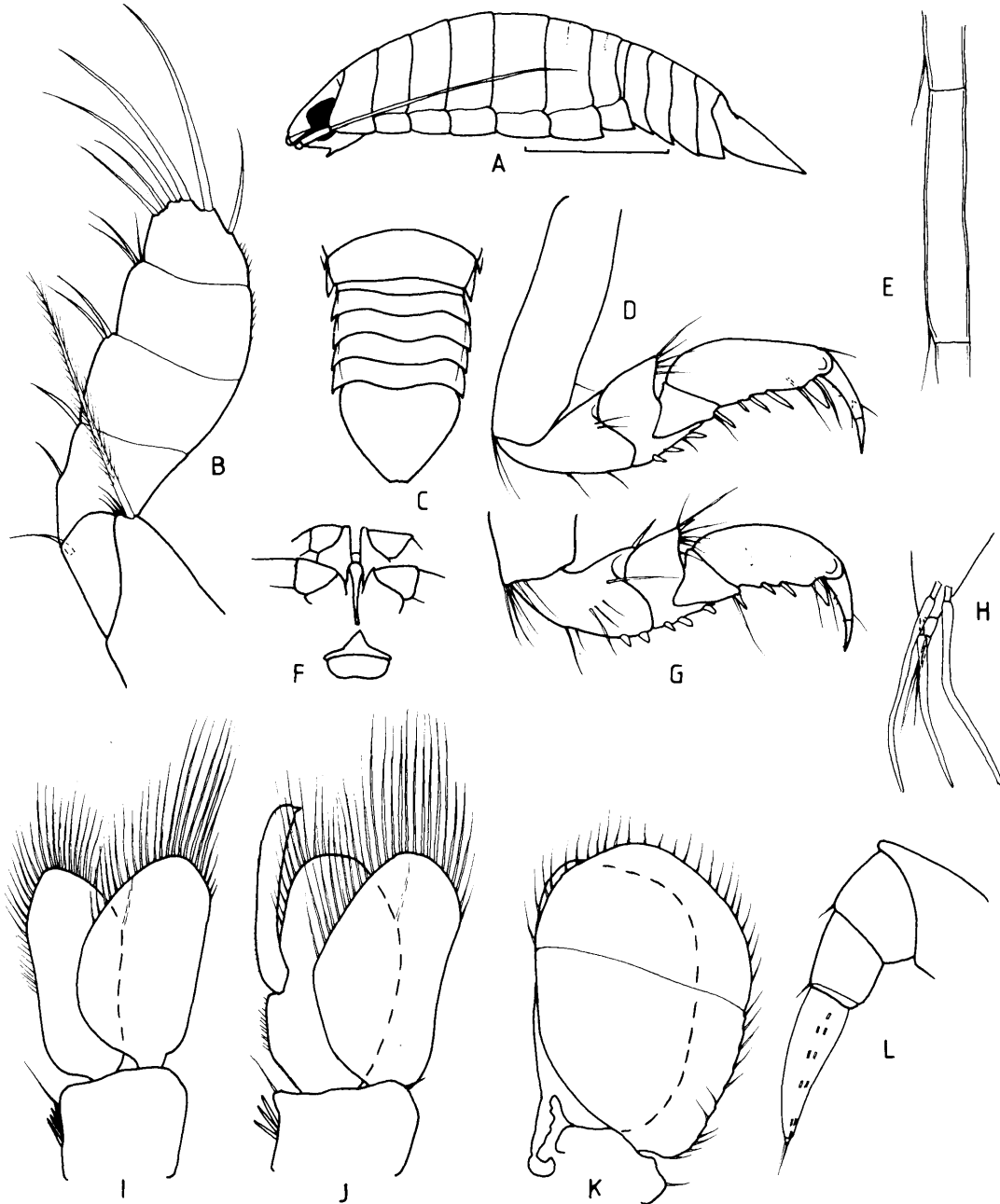


Fig. 12. *Eurydice woka* n. sp., paratypes: B, male 4.5 mm; A, C, E, H, L, female 3.8 mm; remainder male 5.0 mm. A, lateral view (female); B, maxilliped; C, pleon and pleotelson; D, pereopod 1; E, antenna, flagellar article 13; F, clypeal region; G, pereopod 2; H, antennule, flagellum apex; I, pleopod 1; J, pleopod 2; K, pleopod 5; L, antennule. Scale 1.0 mm.

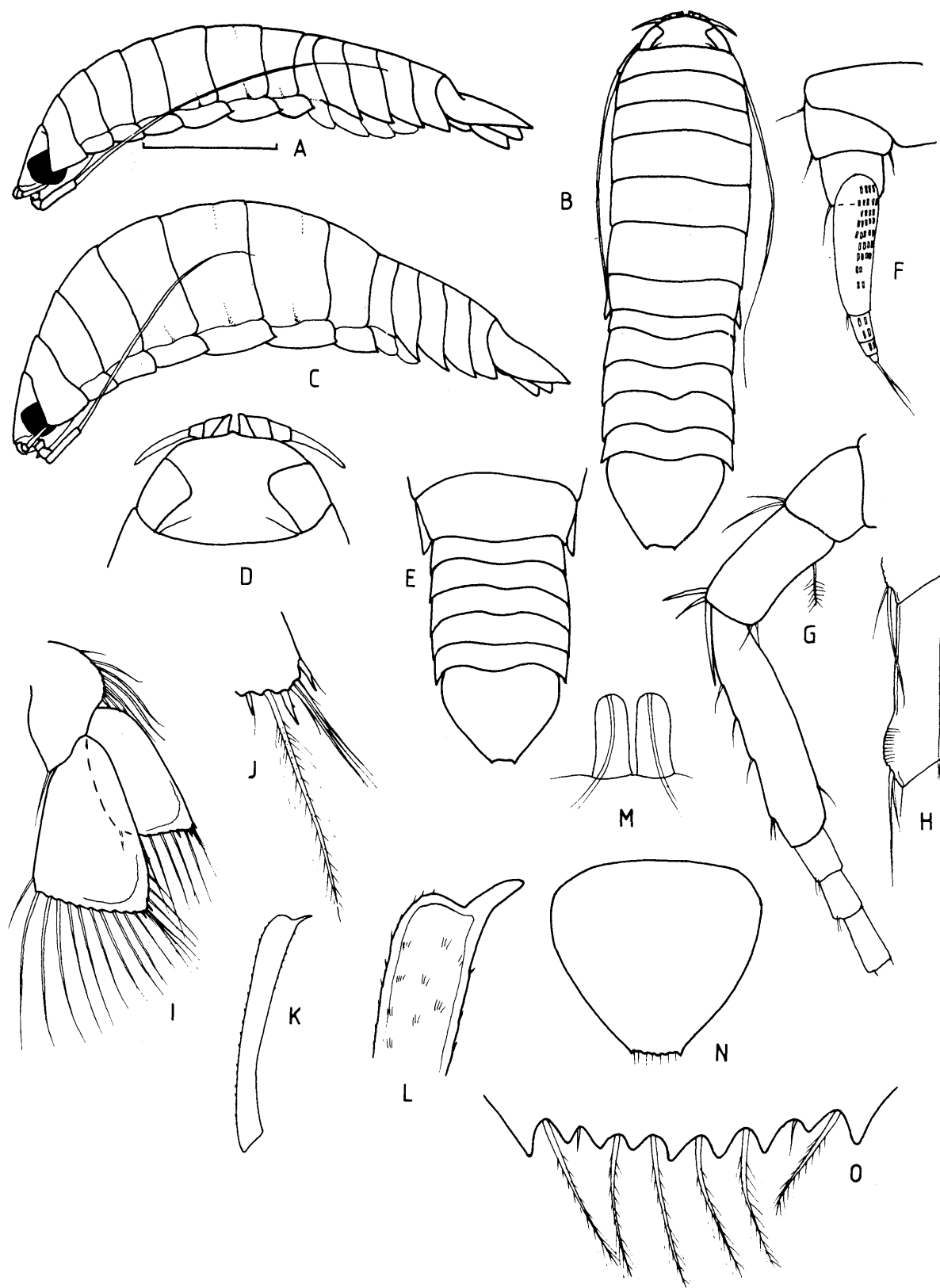


Fig. 13. *Eurydice wyuna* n. sp. **A, B, D**, holotype; **C, E** female paratype 4.4 mm; remainder male paratype 3.7 mm. **A**, lateral view; **B**, dorsal view; **C**, lateral view (female); **D**, cephalon, dorsal view; **E**, pleon and pleotelson; **F**, antennule; **G**, antennal peduncle; **H**, antenna, flagellar article 15; **I**, uropod; **J**, uropod exopod, distolateral angle; **K**, appendix masculina; **L**, appendix masculina, apex; **M**, penes; **N**, pleotelson; **O**, pleotelson, posterior margin. Scale 1.0 mm.

allow many comparisons to be made. It appears that *E. humilis* has an equally narrow posterior margin but it is not truncate as in *E. woka*. Unfortunately, the holotype of *E. humilis* appears to have been lost.

Distribution. Known only from the type locality.

Etymology. *Woka* is an Aboriginal word meaning to swim.

Eurydice wyuna n. sp.

Figs 13, 14

Eurydice orientalis.—Bruce, 1980a: 110, fig. 1 (Part) (not *E. orientalis* Hansen, 1890).

Material examined. 32 males (3.5–4.7 mm, mean 3.9mm), 6 females (3.5–4.4 mm, mean 3.9 mm), manca (3.6 mm), Heron Is., Qld, 1979, night plankton, Heron-Wistari channel,

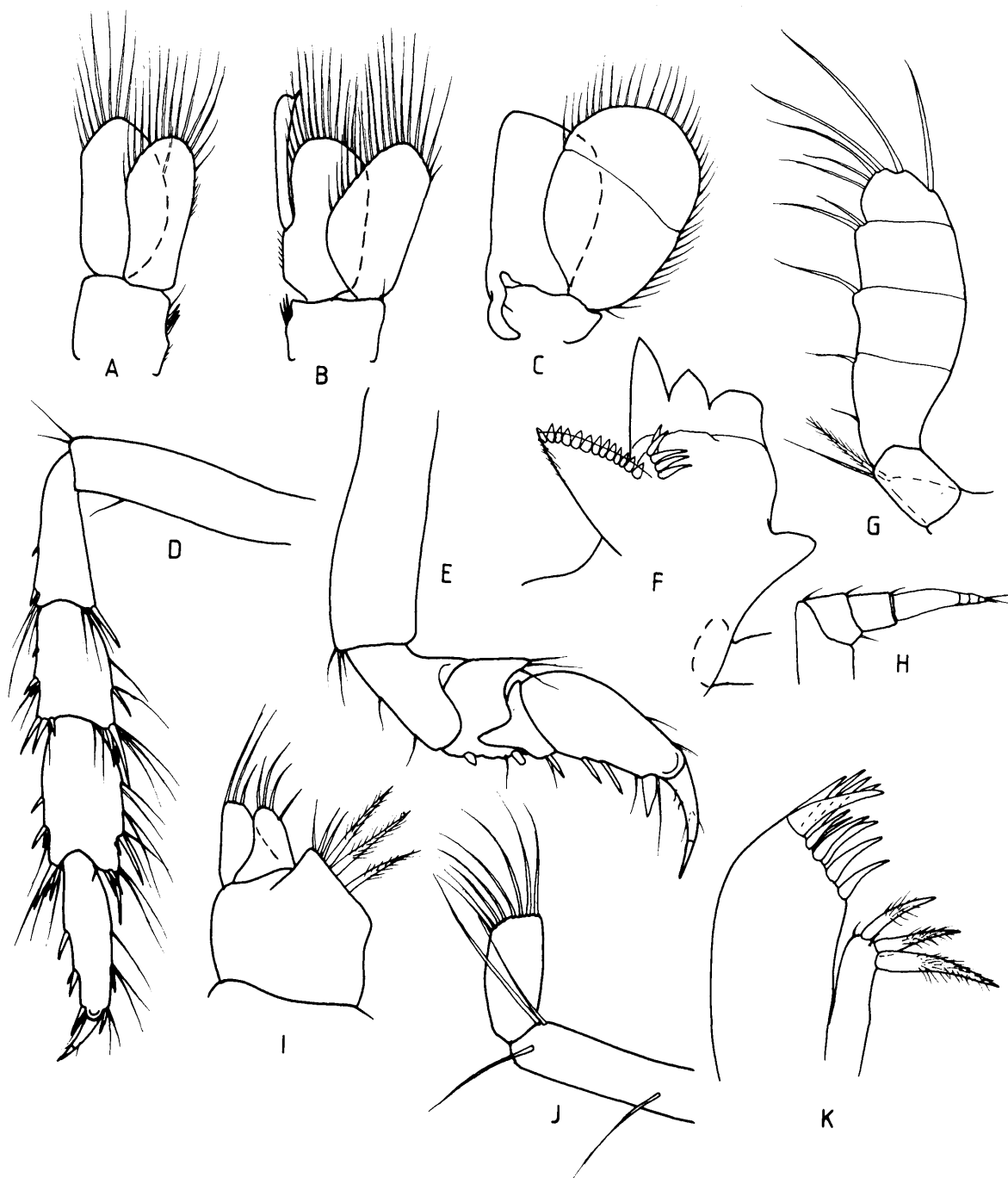


Fig. 14. *Eurydice wyuna* n. sp. H, male paratype 3.7 mm, remainder male paratype 3.9 mm. A, pleopod 1; B, pleopod 2; C, pleopod 3; D, pereopod 7; E, pereopod 1; F, mandible; G, maxilliped; H, antennule; I, maxilla; J, mandibular palp, terminal article; K, maxillule.

coll. D. Fisk. 2 males (3.8, 3.1 mm), 3 manca (1.9, 2.0, 2.5 mm), Heron Is., Qld, 20 Nov, 1979, surface night plankton, at mouth of boat channel, coll. B. Hodgson.

Types. Holotype, male, QM W9792. Paratypes, QM W9793, W9794; AM P32378; USNM 190720.

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

Description of male. Body about 3.5 times as long as wide, cephalon with feeble rostral point, anterior margin not indented. Pereonites 1–6 becoming progressively longer, pereonites 7 slightly shorter than 6; coxal plates of pereonites 5–7 with small points at posteroventral angle. Pleonites all visible, lateral margins not expressed outwards. Pleotelson lateral margins very slightly convex, posterior margin slightly more than 0.2 maximum width of pleotelson, lateral dentations prominent; provided with 6 plumose and 2 small simple setae.

Antennule peduncle articles short, article 3 slightly longer than 2; flagellum extends to posterior of cephalon, composed of 1 long and 3 short articles, provided with numerous aesthetascs. Antenna flagellum composed of 25 articles, extending to pleonite 3 or 4; articles become progressively longer towards the distal end of flagellum, each provided with obvious plicate process.

Frontal lamina, clypeus and mouthparts generally similar to those of *E. orientalis*; maxilliped somewhat more slender than in related species.

Pereopod 1 with 2 blunt spines on posterior margin of merus; carpus with single acute spine; propodus with 2 acute spines on palm. Pereopod 7 with margins of ischium to basis with 2 groups of spines as well as at distal angle; anterior margin of merus to propodus with spines at distal angle, and further single or pair of spines on margin.

Penes flat, about twice as long as broad.

Pleopod 2 appendix masculina extending beyond endopod by about 0.33 of its length; broadest distally with well developed apical process on lateral margin. Uropod rami about twice as long as broad. Endopod distal margin very nearly truncate, provided with 6 plumose setae and 2 acute spines, lateral margin with single spine at distal angle. Endopod medial and distal margins straight, lateral margin very slightly convex; distal margin with 11 plumose setae; lateral angle with spine on either side. Peduncle lateral margin with 7 plumose setae and 1 spine.

Female. Pleon distinctly narrower than pereon, segments shorter than in male. Antennule peduncle article 3 slightly longer than male; antennal flagellum shorter, extending to pereonite 6, composed of about 18 articles, without plicate processes.

Colour. Black and brown chromatophores scattered over dorsal surface giving an overall dark brown or black banded appearance. Chromatophores present on pereopods.

Size. Both males and females from the large sample averaged at 3.9 mm.

Remarks. *Eurydice woka* and *E. minya* are both easily separated from *E. wyuna*. *Eurydice woka* has an extremely narrow pleotelson hind margin, and the males also have longer antennae and antennules, while *E. minya* can be separated by pleonite 1 being almost entirely hidden by pereonite 7.

Mature male *Eurydice orientalis* can be separated by having longer antennule and antennal flagellae, by having the lateral margins of pleonite 5 produced outwards, and also by having a proportionally shorter appendix masculina. Other differences include the antennal flagellum articles being longer (not true for the Western Australian specimen from Barrow Island), and the uropods being broader than in *Eurydice wyuna*.

The males have been separated from mixed samples taken from Heron Island. Separation of females remains a problem. The diagnostic characters of the antennal flagellum are absent from females, as are those of the pleon. Until female specimens can be positively assigned to *E. orientalis*, separation of females remains in doubt.

Distribution. Known only from the vicinity of Heron Island, Queensland.

Etymology. *Wyuna* is an Aboriginal word meaning clear water.

Eurydice minya n. sp.

Figs 15, 16

Eurydice orientalis.—Bruce, 1980a: 110, fig. 1 (Part) (not *E. orientalis* Hansen, 1890).

Eurydice inermis.—Holdich, Harrison & Bruce, 1981: 599, fig. 16 (not *Eurydice inermis* Hansen, 1890).

Material examined. 4 males (2.7–3.5 mm, average 3.24 mm), 15 females (2.5–3.9 mm, average 3.17 mm), Halifax Bay, Townsville, Qld, 23 Nov. 1976, soft mud on sandy mud, and particulate substrata 2.5–10.8 m. 2 males (3.1, 3.2 mm), N.E. channel, Cleveland Bay, Townsville, Qld, 17 Apr. 1976, plankton sample. Male (2.7 mm), 2 females (3.0, 3.1 mm, ovig.), Halifax Bay, Townsville, Qld, 23 Feb. 1977, soft mud on sandy mud, all JCUNQ. '3-Bays Survey'. Male (3.7 mm, damaged), 2 females (3.8, 3.5 mm), Heron Island, Qld, 1979, night plankton, Heron-Wistari channel, coll. D. Fisk. Male (3.2 mm, sub-adult), 5 females (2.9, 3.5, 3.5, 3 and 3.7 mm), Heron Island, Qld, 12 June 1978, boat harbour, coll. NLB.

Types. Holotype, male, QM W9766. Paratypes, QM W7816, W7817, W7924, W9767–W9771, W9841–W9845; AM P32379; USNM 190718.

Type locality. Halifax Bay, Townsville, Qld, 19°09'S, 147°19'E.

Description of male. Body about 3 times as long as wide. Cephalon with feeble rostral point, anterior margin scarcely indented. Coxae with obscure point on ventral posterior angle. Pleonite 1 almost entirely concealed by pereonite 7, pleonites 2–4 with lateral margins not expressed outwards, posterolateral margin of pleonite 5 tending to be slightly convex. Pleotelson posterior margin provided with 8 plumose setae and 2 short simple setae.

Antennule peduncle articles 2–3 subequal in length; flagellum composed of 4 articles, first of which is

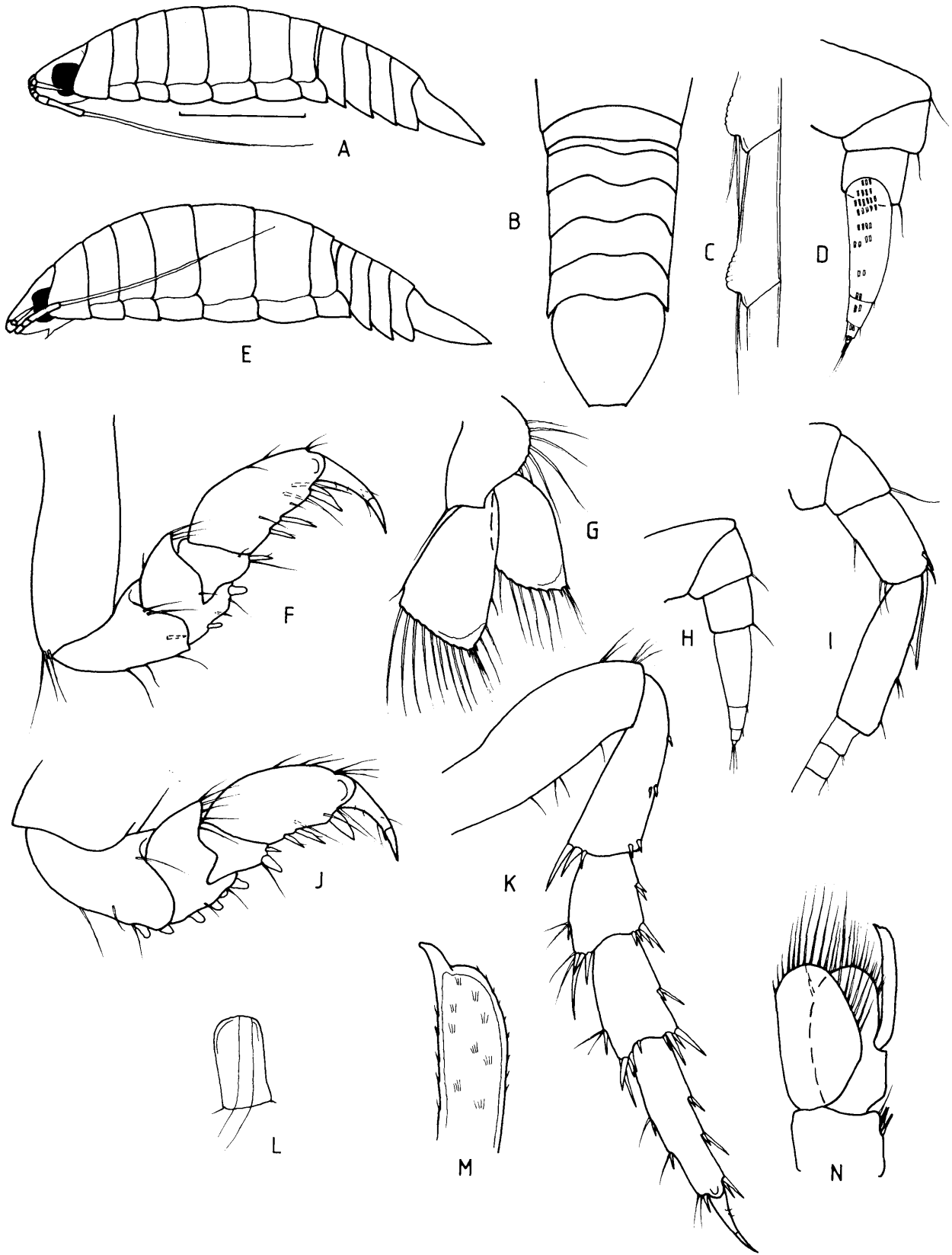


Fig. 15. *Eurydice minya* n. sp. **A, B**, holotype; **E, H, I**, female 3.5 mm, Townsville; remainder male 3.7 mm, Heron Is. **A**, lateral view; **B**, pleon, dorsal view; **C**, antenna, flagellar article 17; **D**, antennule; **E**, lateral view; **F**, pereopod 1; **G**, uropod; **H**, antennule; **I**, antennal peduncle; **J**, pereopod 2; **K**, pereopod 7; **L**, pene; **M**, appendix masculina, apex; **N**, pleopod 2. Scale 1.0 mm.

distinctly longest. Antenna flagellum extending to pereonite 6-7, composed of about 20 articles, articles 5 onwards each with distinct plicate process.

Frontal lamina, clypeus and mouthparts not differing from others of the *E. orientalis* group.

Pereopod 1 with 2 stout spines on posterior margin of merus, 1 acute spine on posterior margin of carpus, and propodus with 2 acute spines on palm. Pereopod 2 similar to 1 but with additional and larger spines. Pereopod 7 without setae on posterior margin of ischium to propodus; anterior margin sparsely setose.

Penes subrectangular in shape, about twice as long as broad.

Pleopod 2 appendix masculina extending beyond endopod by about 0.33 of its length, distolateral margin with pointed process. Uropod with both rami about twice as long as broad. Exopod lateral and distal margins merging smoothly; distal margin not truncate, provided with 6 plumose setae and 2 small acute spines; lateral margin with single small spine. Endopod with 10 plumose setae and 1 spine on truncate distal margin; lateral margin slightly convex with 3 setae and 1 acute spine. Peduncle lateral margin with 6 plumose setae and single spine.

Female. Generally similar to male, lacking plicate process on flagellar articles of antenna. Pereopod 7 somewhat broader and distinctly more setose than male.

Colour. Pale brown to white in alcohol, with transverse bands of black and brown chromatophores. In life, translucent but for the chromatophores.

Size. The average size of males from Townsville area was 3.24 mm and females 3.17 mm. The only fully

mature male specimen was a damaged one from Heron Island measuring 3.7 mm.

Remarks. As with the other species of this group, the morphology of many of the appendages are so similar as to be taxonomically useless. The characters by which this species can be consistently separated from others is the very short pleonite 1, antennal flagellum not extending beyond the pereon, and males having pereopod 7 almost without setae.

This species was recorded as *Eurydice orientalis* by Bruce (1980c) and as *Eurydice inermis* by Holdich et al. (1981). Comparison with the types of *E. inermis* showed that the two species are separate. The appendix masculina of each species is clearly distinct, and other points of difference are pleonite 1 of *E. minya* being shorter, the antennal peduncle of the female with shorter articles, and the uropodal exopod broader.

There exist two other records of *E. inermis* from the Indo-Pacific region. The first was that of Pillai (1967). There are numerous differences between Pillai's figures and those of Hansen (1890, 1905) and the Australian species. It seems probable from Pillai's figures that his species is new. The second record was given by Bruce & Jones (1978) who expressed some doubt as to the validity of their *E. inermis* determination. In view of the differences in appendix masculina shape and of the presence of several closely similar species in Australia, it seems likely that the Red Sea species is not *E. inermis* but another, possibly new, species.

Distribution. Heron Island and Townsville, Queensland.

Etymology. *Minya* is an Aboriginal word meaning small, and alludes to the small size of the species.

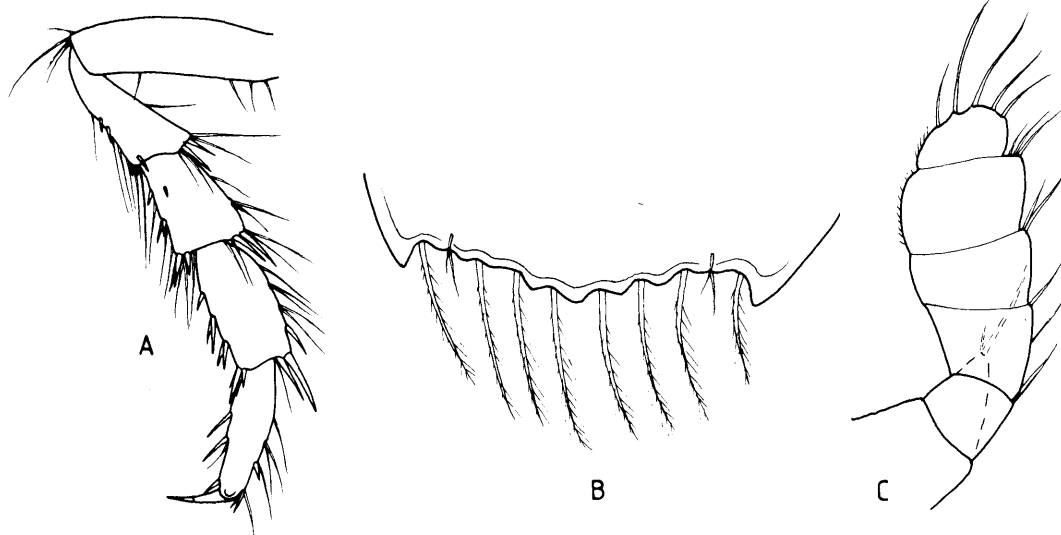


Fig. 16. *Eurydice minya* n. sp. All specimens from Townsville. **A**, pereopod 7 (female); **B**, pleotelson, posterior margin (male); **C**, maxilliped (female).

Metacirolana Nierstrasz

Metacirolana Nierstrasz, 1931: 147, 162.—Kussakin, 1979: 212; Bruce, 1981b: 950, figs. 1f-i, 2c-f; 3c,d; 4b; 5e,g.
Paracirolana Nierstrasz, 1931: 147.

Type species. *Cirolana japonica* Hansen, 1890; designated by Kussakin (1979), not Nierstrasz (1931) who merely indicated the two species be placed within the genus. Holotype held by the Zoologisk Museum, Copenhagen, Denmark.

Diagnosis. Pereonites 1–2 subequal in length. Pleonite 5 lateral margins not overlapped by pleonite 4. Antennule peduncle articles colinear, article 2 longest. Antenna peduncle 5-articulate. Frontal lamina anterior margin dilated, freely projecting; clypeus with downwardly projecting triangular blade. Maxillule endopod spines slender, feebly plumose. Maxilliped endite with one coupling hook. Pereopods 5–7 slender, with few setae or spines. Pleopods rounded, only endopod of pleopod 5 without setae; appendix masculina inserted basally or sub-basally. Uropod peduncle medial margin produced, rami with setae on all margins.

Additional characters. Body generally twice as long as wide, posterior pereonites and pleon may be sculpted. Pleon lateral margins extending out horizontally.

Antennule 4-articulate; antenna peduncle article 5 longest. Left mandible incisor with accessory tooth on lateral margin. Maxillule endopod spines either without setules or feebly plumose. Maxilla palp and exopod tending to be reduced. Maxilliped palp articles slender. All pereopods ambulatory with few spines or setae. Pereopods 1–3 short, merus anterodistal margin not produced; 4–7 with articles not flattened; dactyls with secondary unguis feeble or absent. Pleopods undifferentiated, rami similar; peduncle broader than long, without lobes. Pleotelson and uropods usually feebly plumose, with or without spines.

Sexual dimorphism. The flagellum of the antennule tends to be longer in the male. The males are also often more slender and with a longer pleon than the females.

Remarks. Bruce (1981b) has discussed the taxonomy of the genus. The genus is readily identified by the long second article of the antennule peduncle, the projecting clypeus, dilated frontal lamina, and pleonal and mouthpart morphology. In some species the fifth pleonite is partially overlapped by the fourth.

The genus is clearly related to the genera *Colopisthus* and *Arubolana*. The single species of *Colopisthus* occurs in the Caribbean (Menzies & Glynn, 1968) and West Africa (Monod, 1952) and, from the generic diagnosis given by Richardson (1905) and Menzies & Glynn (1968), the similarities of the two genera can be seen. The figures, given by Monod (1952) and Menzies & Glynn (1968), of the mouthparts demonstrate the close affinities of the two genera. The dominating difference is that *Colopisthus* has the pleon with four segments (Menzies & Glynn, 1968) or, as Monod (1952) describes it, two free pleonites. The genus *Arubolana* shows clear affinities with *Metacirolana* in the overall appearance and in the morphology of mouthparts, antennae and pereopods. This is a brackish-water species that has a near terminal appendix masculina.

Some authors considered two new genera were necessary to contain species now placed in *Metacirolana* (Racovitza, 1912; Nierstrasz, 1931), while Stebbing (1910a) thought *M. sphaeromiformis* sufficiently similar to the genus *Hansenolana* as to include it in that genus. While shape is similar to some species of *Metacirolana*, the appendages of *Hansenolana* are of the same form as those of genera such as *Cirolana* and *Neocirolana*. Species within the genus can be grouped according to eye size and body shape, those with small eyes having a dorsoventrally compressed body. These differences do not, at present, merit generic status.

Key to Australian Species of *Metacirolana*

1. Pleotelson with ridges. *M. rugosa*
—Pleotelson unornamented. 2
2. Pleotelson, uropods prominently spinose. *M. spinosa*
—Pleotelson, uropods without spines. 3
3. Eyes small; lateral margins of pleonites rectangular. *M. nana*
—Eyes not small; posterolateral margin of pleonites acute. 4
4. Pleotelson moderately narrow. 5
—Pleotelson broad. 6
5. Pleotelson apex converging smoothly; medial margin of uropodal endopod sinuate. *M. japonica*
—Pleotelson apex subtruncate; uropodal endopod broadly rounded. *M. basteni*
6. Pleotelson broadly rounded; uropods feebly serrate. *M. anatola*
—Pleotelson and uropods distinctly serrate. *M. serrata*

Metacirolana basteni (Bruce)

Fig. 17A, B

Cirolana basteni Bruce, 1980b: 166, figs 5, 6.
Metacirolana basteni.—Bruce, 1981b: 954.

Types. Types held at the Queensland Museum Brisbane (additional paratypes at the AM, BM(NH), and USNM).

Type locality. North Cay, Chesterfield Reefs, Coral Sea (Bruce, 1980b).

Remarks. *Metacirolana basteni* is most similar to *Metacirolana rotunda* (Bruce & Jones, 1978). The

antennule and uropodal exopod are shorter in *M. basteni*, which also lacks the carina on the lateral margins of pereonites 6 and 7 and the median carina of the pleotelson.

A similar species, *M. serrata* (Bruce, 1980a), has been described from the Barrier Reef, and *M. basteni* can be distinguished from that species by the broadness of the uropodal endopod, and the telson being truncate and angular rather than smoothly rounded.

Distribution. Mellish Reef and Chesterfield Reefs, Coral Sea.

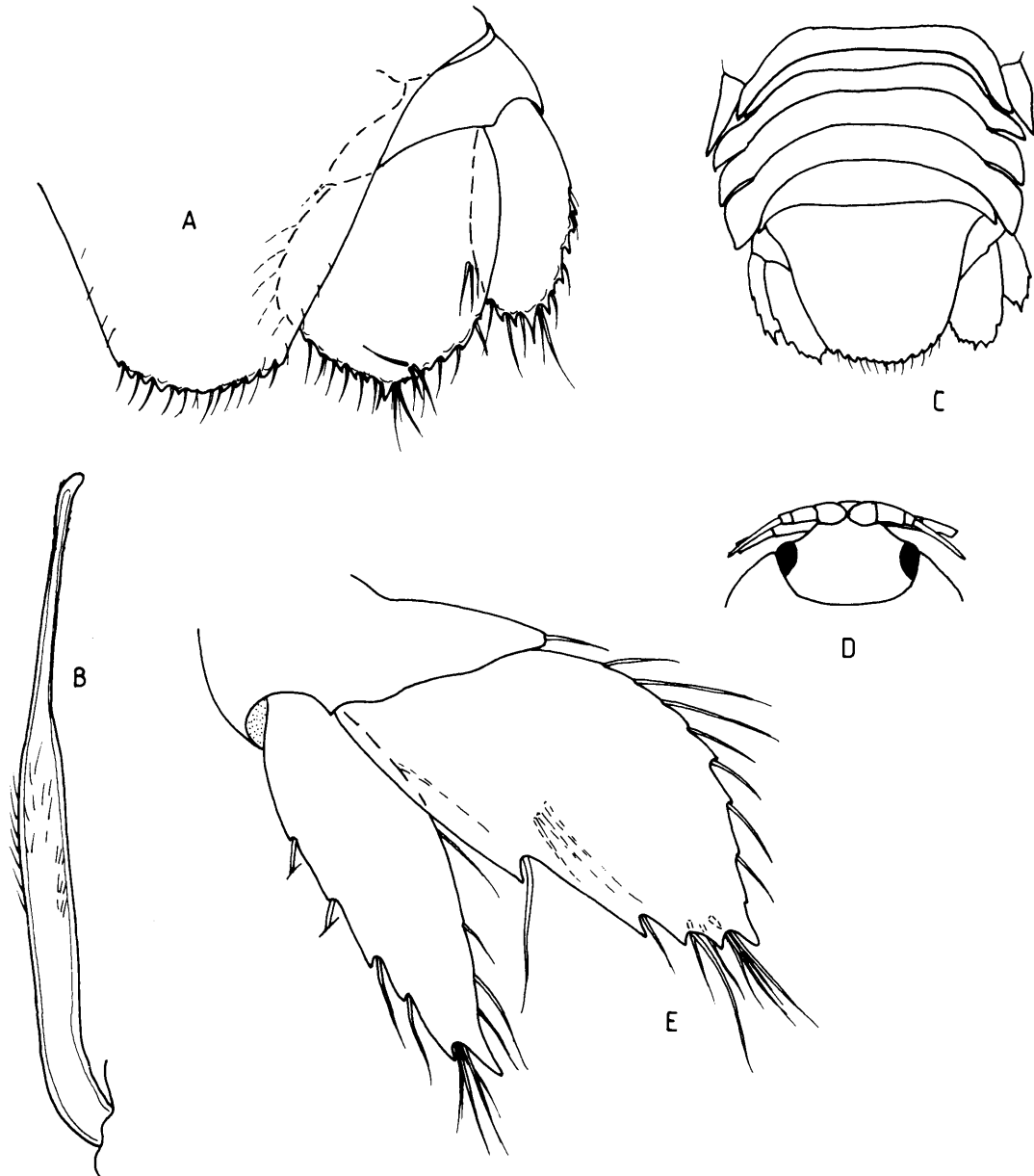


Fig. 17. *Metacirolana basteni*: A, pleotelson and uropod; B, appendix masculina. *Metacirolana nana*: C, pleon, pleotelson; D, cephalon; E, uropod.

Metacirolana serrata (Bruce)

Fig. 18

Cirolana serrata Bruce, 1980a: 115, figs 5–7.*Metacirolana serrata*.—Bruce, 1981b: 954.

Material examined. Lizard Island, Qld series: 2 males (2.5, 1.7 mm), 3 females (1.5, 2.0, 2.9 mm), 12 Dec. 1980, Granite Point, 10–12 m; 3 females (2.1, 2.4, 2.5 mm), 13 Dec. 1980, North Point reef, 11 m, and female (2.7 mm) at 7 m; female (2.1 mm), 14 Dec. 1980, W. of Palfrey Island, 7 m; 6 females (2.0–2.6 mm), 16 Dec. 1980, north of Crystal Beach, 1 m; all coll. NLB. Male (2.0 mm), 2 females (2.3, 2.0 mm), Lodestone Reef (east from Townsville), Qld, Aug. 1976, in dead coral on reef flat, coll. D.M. Holdich. Heron Island series: 2 females (3.3, 3.4 mm with embryos), 3 Jan. 1979, middle reef flat; manca (1.0 mm), 13 Jan. 1979, outer reef flat; female (3.2 mm), manca (1.3 mm), 28 Jan. 1979, inner reef flat; 2 females (2.0, 2.4 mm), 25 Apr. 1979, outer reef flat, N.W. Heron; male (2.7 mm), 10 Nov. 1979, nocturnal surface plankton, Heron-Wistari channel; 4 males (2.0, 3.0, 3.0, 3.2 mm), 19 Oct. 1979, nocturnal plankton, Heron reef lagoon; 2 females (1.9, 2.5 mm ovig.), 27 Nov. 1979, lagoon, 2 m; 2 females (2.3, 2.4 mm), 30 Nov. 1979, Wistari Reef slope, Heron-Wistari channel, 20 m; male (2.8 mm), 30 Nov. 1979, nocturnal plankton, harbour entrance; 3 females (1.6, 2.0, 2.3 mm), 8 Dec. 1979, Canyons, 7 m, all coll. NLB.

Types. Holotype held at the Queensland Museum, Brisbane.

Type locality. Heron Island, Capricorn Group, Australian Great Barrier Reef.

Colour. Semi-translucent with brown and white chromatophores in life. White in alcohol.

Size. Largest male 3.2 mm, largest female 3.4 mm.

Remarks. This species was originally described from a single male. Collection of further material reveals that

the specimen was an immature male. Figures are given of a mature male, which clearly illustrate the differences between immature specimens and mature males. Immature males are similar to females.

Distribution. Queensland: Heron Island and Wistari Reef, Capricorn Group; Townsville; Lizard Island.

Metacirolana nana (Bruce)

Fig. 17C–E

Cirolana nana Bruce, 1980b: 162, figs 2, 3.*Metacirolana nana*.—Bruce, 1981b: 954.

Types. Held at the Queensland Museum, Brisbane, Queensland.

Type locality. Long Island, Chesterfield Reefs, Coral Sea.

Remarks. The relatively small eyes, shape of the cephalon and clypeal morphology serve to identify this species.

Distribution. Known only from the type locality.

Metacirolana anatola n. sp.

Fig. 19

Material examined. Male (2.9 mm), female (2.8 mm, ovig.), east of Bowen, Qld, 20°16'S, 150°51'E, 12 May 1971, 85–100 m, large bottom dredge, coll. AM on HMAS *Kimbla*.

Types. Holotype, male, AM P32384; paratype, AM P30376.

Type locality. Off Bowen, Qld, 20°16'S, 150°51'E.

Description of male. Body about 2.5 times as long as wide. Cephalon with median rostral process; eyes

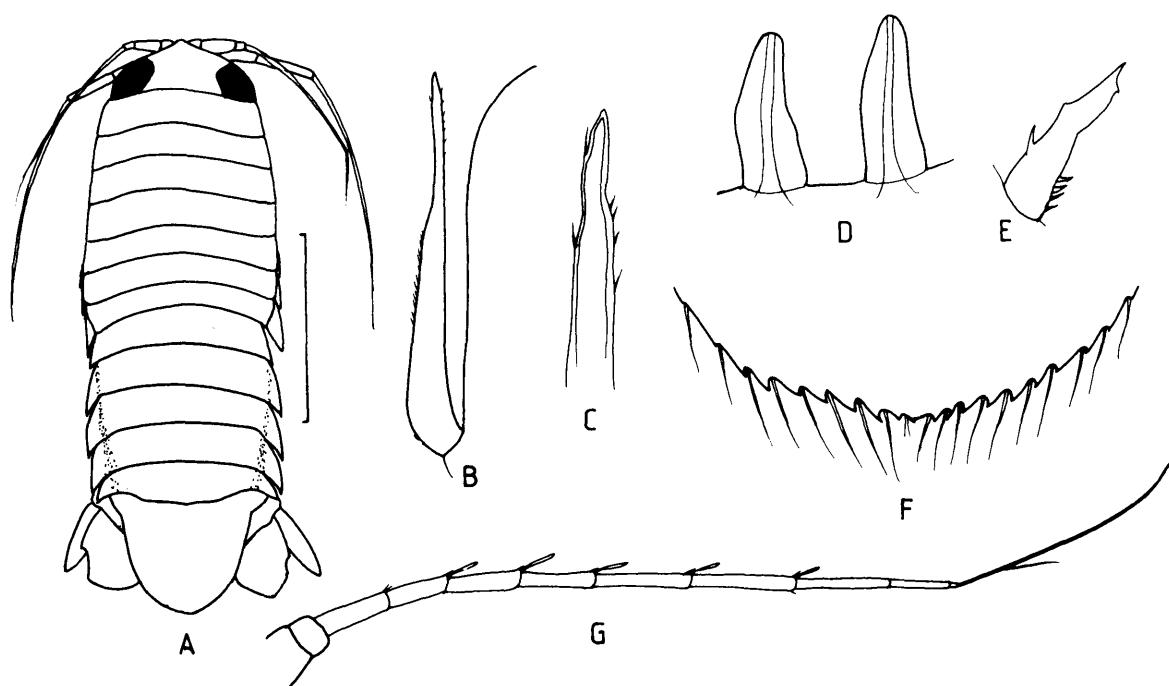


Fig. 18. *Metacirolana serrata*, male 3.0 mm. A, dorsal view; B, appendix masculina; C, appendix masculina, apex; D, penes; E, terminal spine, propodus, pereopod 1; F, pleotelson, posterior margin; G, antennal flagellum. Scale 1.0 mm.

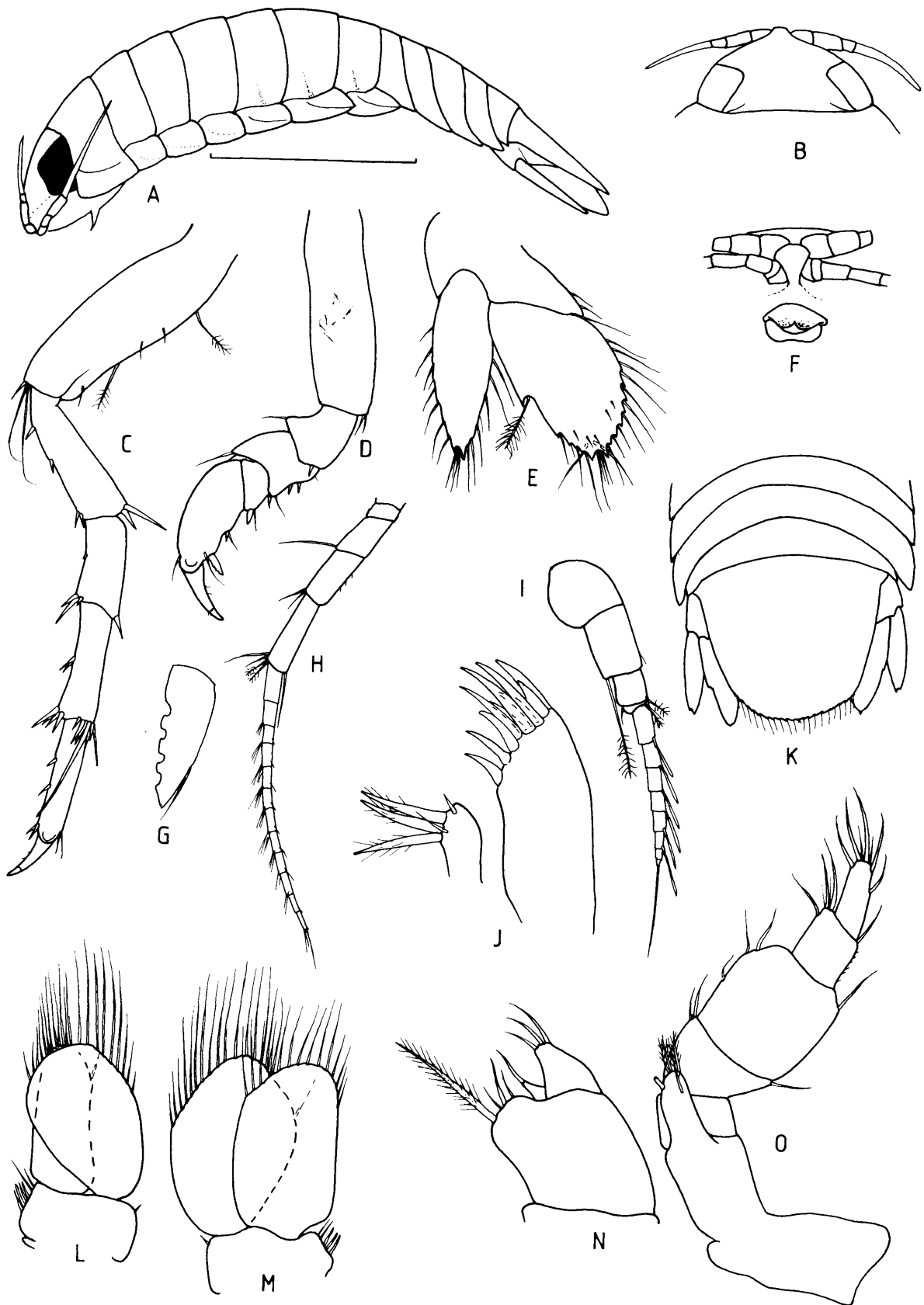


Fig. 19. *Metacirolana anatola* n. sp. A, B, F, K, L, M, male holotype; remainder female paratype. A, lateral view; B, cephalon, dorsal view; C, pereopod 7; D, pereopod 1; E, uropod; F, clypeal region; G, distal propodial spine; H, antenna; I, antennule; J, maxillule; K, pleon and pleotelson; L, pleopod 1; M, pleopod 2; N, maxilla; O, maxilliped. Scale 1.0 mm.

large. Pereonite 1 with single horizontal furrow. Coxae of pereonites 2–7 each with an indistinct furrow, furrows being slightly more prominent on posterior coxae. Pleonites with lateral margins not markedly produced horizontally. Pleotelson slightly shorter than greatest width; posterior margin finely serrated, provided with about 20 short plumose setae, each seta being set within serration; median pair of short simple setae, about 0.33 the length of setae.

Antennule peduncle article 3 about half as long as article 2; flagellum composed of about 8 articles, each with single aesthetasc; terminal article with single long spine. Antenna peduncle slender; flagellum extending to pereonite 2 with about 13 articles of which the first is longest.

Frontal lamina with anterior margin semicircular, freely projecting, basally constricted. Clypeus with posterior margin strongly produced, anterior portion of projection recessed. Maxillule with 10 spines on gnathal surface of exopod; endopod with 3 feebly plumose spines and 2 setae. Maxilla with exopod greatly reduced, palp with 3 setae; endopod with single large plumose seta and 3 simple setae. Maxilliped slender, sparsely setose, palp articles 3–5 rectangular in shape, endite with single coupling hook and 3 plumose setae.

Pereopods all slender, all sparsely setose. Pereopod 1 with 3 spines on posterior margin of merus, 1 spine on posterior margin of carpus, 1 spine on palm of propodus, and 1 large spine opposing dactylus. Pereopods 2–3 similar to pereopod 1, but propodus slightly less robust; 3–4 spines present on posterodistal angle of carpus. Pereopods 4–7 basically similar, increasing in length from 4–6, pereopod 7 being slightly shorter than pereopod 6. Pereopod 6 with spines only at anterodistal angles of all articles except basis; posterior margins except basis with medial spines.

Penes present on sternite 7, short, set adjacent to one another.

Uropods extending slightly beyond apex of pleotelson. Endopod with conspicuous sensory spine placed half way along lateral margin; medial margin with continuous row of plumose setae, distal half feebly serrate, apex bifid, medial process most prominent. Exopod subequal in length to endopod, both margins with setae; apex bifid, medial process most prominent. Both uropodal rami entirely without spines.

Female. In general similar to male but shorter, and the pereon broader. Female specimen has posterior angles of coxal plates more acute than in male.

Colour. Pale tan in alcohol.

Size. Up to 2.9 mm.

Remarks. This species is similar to the two shallow-water reef dwelling species, *M. serrata* and *M. nana*. In *M. serrata* the posterior margin of the pleotelson is less broadly rounded and more obviously serrate, the uropods are far broader, possess more setae, and the endopod of the maxilla is not as reduced. In *M. nana* the shape of the anterior margin of the cephalon differs, the eyes are smaller than in *M. anatola*, the shape of

the frontal lamina differs, and the lateral margins of the pleon segments are expressed horizontally.

The male lacked an appendix masculina on pleopod 2. Both second pleopods lacked this, and nor was there any trace of an emerging and developing appendix masculina. The holotype is an apparently mature male as the penes were distinct, and pereopod 7 was fully developed.

Distribution. Known from the type locality only.

Etymology. *Anatola* is a Greek word meaning southern.

Metacirolana japonica (Hansen)

Figs 20, 21

Cirolana japonica Hansen, 1890: 349, pl. 4, figs 2–21.—Tattersall, 1921: 208, pl. 2, figs 11–16; Monod, 1930: 135, 142, fig. 3; Roman, 1970: 167, 172, 192, 195.

Metacirolana japonica.—Nierstrasz, 1931: 162; Hurley, 1961: 267; Kussakin, 1979: 213, fig. 89; Bruce, 1981b: 952, 954, figs 1c,f; 2c,f; 3c,d; 4b; 5e,f.

Cirolana bathyalis Menzies & George, 1972: 19, figs 10, 11.

Material examined. Holotype, male (3.5 mm), Yeddo Light, Japan, 19 Aug. 1846, *Galathea*, Reinhart. Male (2.7 mm), Kei Is., West Irian, 5°29.5'S, 132°50.0'E, 15 May 1922, 290 m, in sand, shell concretions, coll. Th. Mortensen. 4 males (3.5, 3.7, 4.0, 4.3 mm), 5 females (3.3, 3.6 ovig., 3.8, 4.2 ovig., 4.7 mm ovig.), 8 manca (1.9–3.2 mm), off Sydney, NSW, 33°47'S, 151°43'E, 5 Dec. 1977, 192 m, coll. AM on FRV *Kapala*. 4 males (3.2, 3.6, 3.7, 3.8 mm), 4 females (3.7, 4.0 ovig., 4.1, 4.5 mm), east of Malabar, Sydney, NSW, 33°57'S, 150°19'E, 1973, 32 m, coll. AMSBS. Female (4.7 mm), off Sydney, NSW, 33°58'S, 151°29'E, 18 June 1962, 150 m, coll. CSIRO. Male (3.1 mm), off Port Kembla, NSW, 13 Dec. 1978, 161 m, dredged, coll. A.M. on FRV *Kapala*. Male (4.3 mm), between N.E. Tas. and Vic., 30°10'S, 149°55'E, 15 Sept. 1914, ring trawl, 360–450 m.

Types. Holotype held at Zoologisk Museum, Copenhagen, Denmark.

Type locality. Yeddo, Japan.

Descriptive notes. Anterior margin of cephalon somewhat produced, with minute rostral point; interocular furrow runs behind anterior margin. Faint furrow runs across posterior of each pereonite except pereonite 1. Frontal lamina with anterior part acutely angled; slight transverse ridge present; clypeus with downwardly projecting process, anterior portion of which is excavate. Penes present on sternite 7, set close together, generally angled towards mid line. Largest male with distinctly longer penes than smaller specimens.

Female. Similar to male, except for sexual characters. Females are more ovate, with shorter pleon, and body is more strongly vaulted than in male.

Colour. In alcohol the more recent specimens varied from being virtually without visible chromatophores to an overall dense brown colour. Ground colour pale tan.

Size. Males 3.1–4.3 mm, females 3.2–4.8 mm, manca 1.9–3.2 mm.

Remarks. This species is readily recognizable from

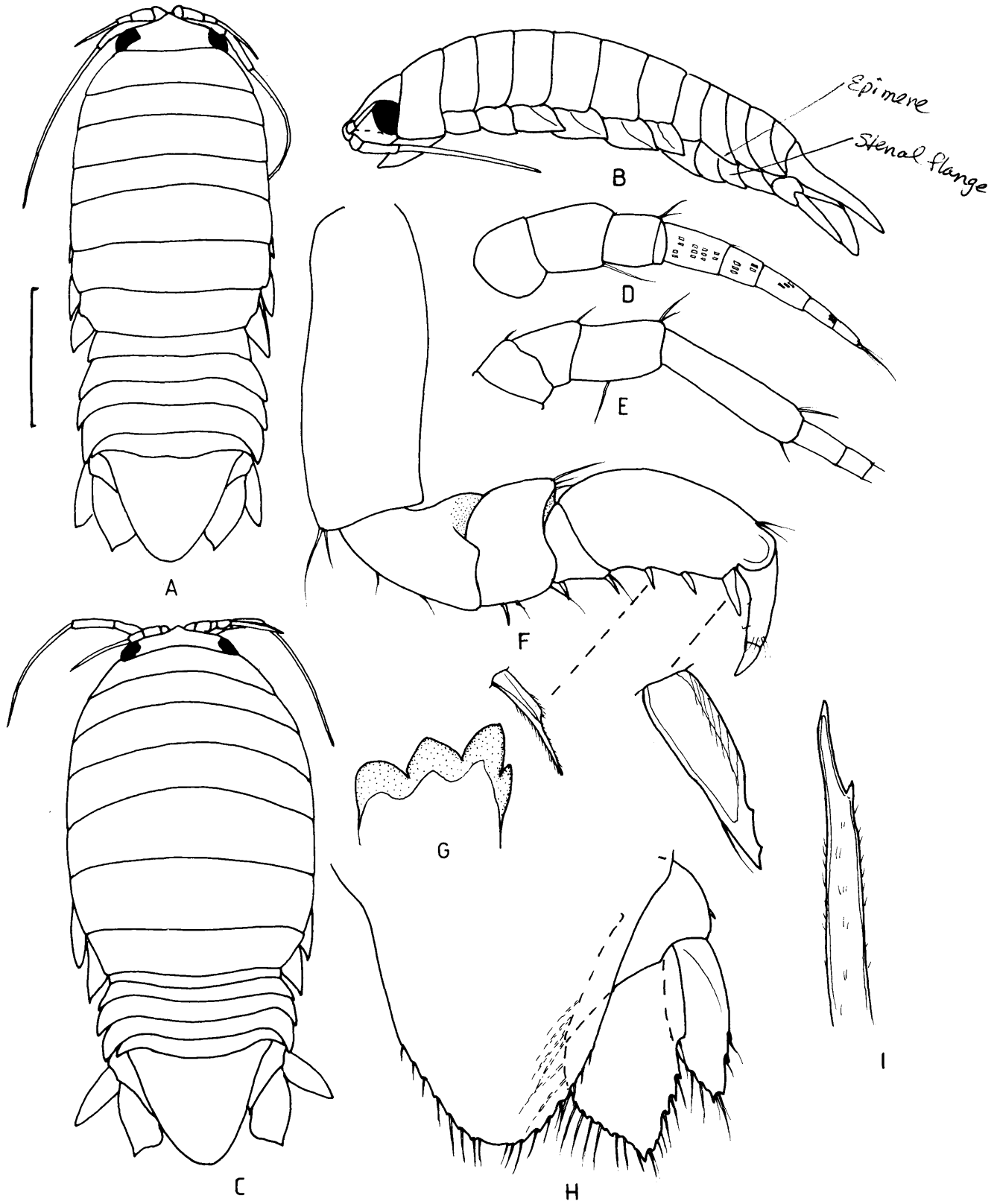


Fig. 20. *Metacirolana japonica*, male 3.6 mm, except C, female 4.5 mm, off Sydney. A, dorsal view; B, lateral view; C, dorsal view; D, antennule; E, antennal peduncle; F, pereopod 1; G, right mandible, incisor; H, pleotelson and uropod; I, appendix masculina, apex. Scale 1.0 mm.

Hansen's (1890) figures. Comparison of the holotype with Australian material revealed that in spite of the wide distribution there was only one species involved. The differences in the shape of the frontal lamina and anterior margin of the cephalon in earlier drawings (Tattersall, 1921; Menzies & George, 1972) are due to differences in perspective. The shape of the pleotelson, uropods, frontal lamina and in the male, the appendix masculina, serve to identify this species.

Menzies & George (1972) described *Cirolana bathyalis*. Comparison of their figures to the holotype and Australian specimens of *M. japonica* reveal that the only differences are that material described by Menzies

& George has smaller eyes. Eye size can vary within species (Tattersall, 1921; Brusca & Ninos, 1978), and this character alone is insufficient to separate Peruvian material as a different species.

Distribution. Eastern seaboard from Tasmania up to New Guinea, at depths of 32–450 m. Originally described from Japan, this species has also been taken off Peru (see remarks).

The record of *M. japonica* from Madagascar given by Roman (1970) should be treated with scepticism as *M. japonica* has neither been recorded from South Africa (Kensley, 1978c), nor shallow-water habitats in East Africa (Jones, 1976; Bruce, 1981c).

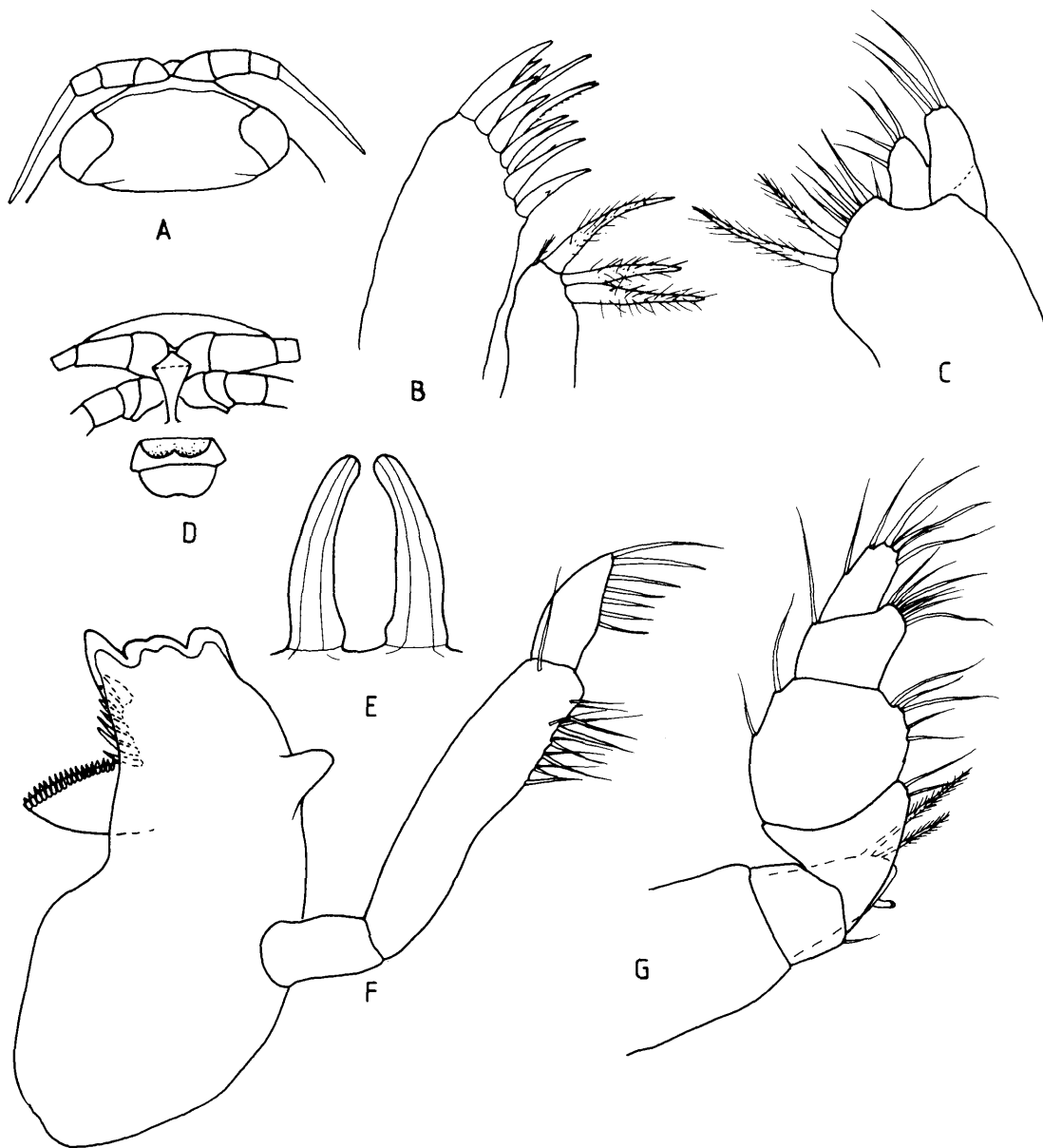


Fig. 21. *Metacirolana japonica*, male 3.6 mm, off Sydney. A, cephalon dorsal view; B, maxillule; C, maxilla; D, clypeal region; E, penes; F, left mandible; G, maxilliped.

***Metacirolana rugosa* (Bruce)**

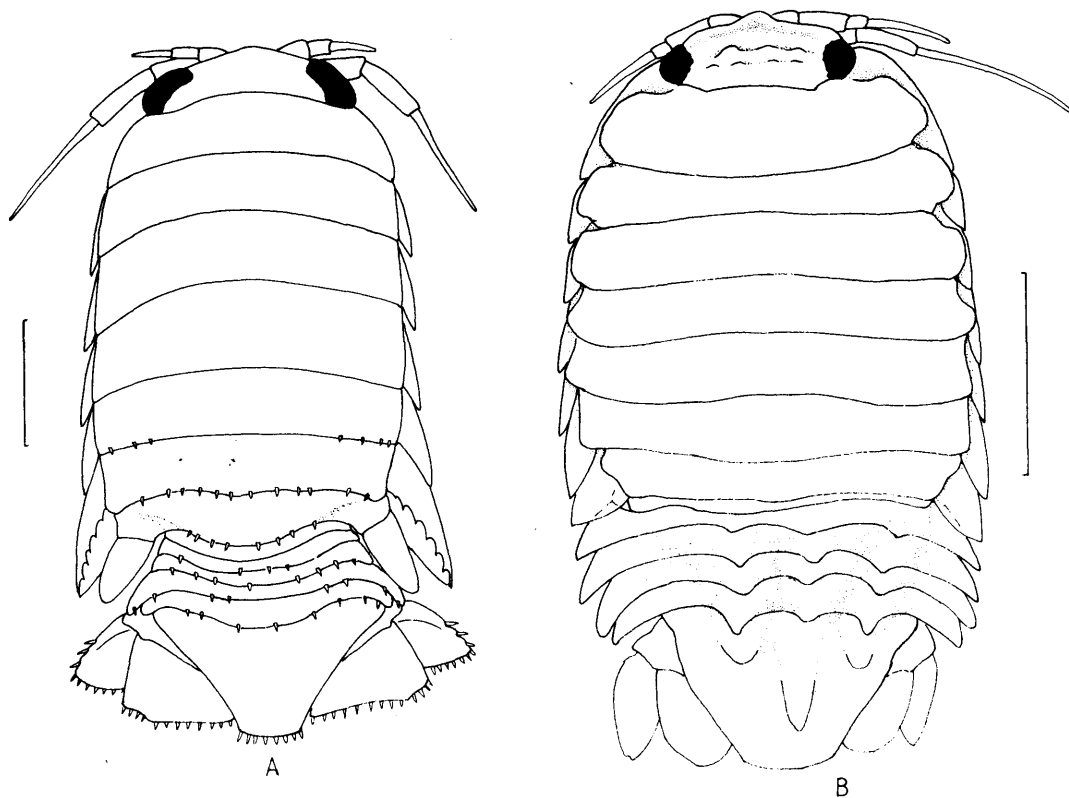
Fig. 22B

Cirolana rugosa Bruce, 1980a: 122, figs 11–13.*Metacirolana rugosa*.—Bruce, 1981b: 954.**Types.** Held at the Queensland Museum, Brisbane (one paratype at USNM).**Type locality.** Tryon Island, Capricorn Group, Australian Great Barrier Reef.**Remarks.** This species shows a close affinity with *M. sphaeromiformis*, *M. hanseni* and *M. monodi*. It can be distinguished from all these species by the sculpting of the cephalon, pleon and telson. *Metacirolana mbudya* from East Africa has similar but distinct sculpting on the pleon and posterior pereonites.**Distribution.** Heron Island and Tryon Island, Capricorn Group, Queensland.***Metacirolana spinosa* (Bruce)**

Fig. 22A

Cirolana spinosa Bruce, 1980a: 118, figs 8–10.*Metacirolana spinosa*.—Bruce, 1981b: 954.**Material examined.** Female (3.5 mm), Lizard Is. Qld, central lagoon, 19 Dec. 1980, in dead coral, 1 m, coll. NLB. Heron Island Series: female (3.3 mm, with embryo), 12 Jan. 1979, outer reef flat; male (4.6 mm), 5 females [2.7, 3.2, 3.7 (with

3 embryos), 3.8 (with 4 embryos), 4.0 mm], 14 Jan. 1979, outer reef flat; male (3.6 mm), 5 females (2.4, 3.1, 3.2, 3.5, 3.7 mm), 25 Dec. 1979, behind north east reef crest; 2 females (2.9 ovig., 3.7 mm ovig.), behind reef crest north east, coll. NLB.

Types. Held at the Queensland Museum, Brisbane.**Type locality.** Heron Island, Capricorn Group, Australian Great Barrier Reef.**Colour.** Translucent with conspicuous brown and white chromatophores on dorsal surface. Creamy white with brown chromatophores in alcohol.**Size.** Largest male 4.6, largest female 4.0 mm.**Remarks.** This species is very different to all other Australian members of the genus, and is readily identified by the spinosity of the pereon segments, pleon segments, telson and uropods. The large coxae on pereon segment 6 further distinguish it, as does the overall truncate appearance of the telson and uropods. Similar species are *M. riobaldoi* from Brazil and *M. halia* from Belize.**Distribution.** Heron Island and Lizard Island, Great Barrier Reef.***Eurylana* Jansen***Eurylana* Jansen, 1981: 5, 7.—Bruce, 1982a: 614.**Type species.** *Cirolana cooki* Filhol, 1885, by designation (Jansen, 1981). Types held at the Muséum National d'Histoire Naturelle, Paris.Fig. 22. A, *Metacirolana spinosa*; B, *Metacirolana rugosa*. Scale 1.0 mm.

Diagnosis. Pereonite 1 about twice as long as pereonite 2. Pleonite 5 largely overlapped by lateral margins of pleonite 4. Antennule peduncle articles colinear. Antenna peduncle 5-articulate. Frontal lamina flat, anterior margin projecting; clypeus with anteriorly directed triangular blade. Pereopods 5–7 not markedly flattened, with abundant setae. Pleopod rami elongate, endopods of pleopods 3–5 without setae; appendix masculina inserted medially. Uropod peduncle medial margin produced, rami with setae on all margins.

Additional characters. Cephalon deeply immersed in pereonite 1. Pleonite 1 largely concealed by pereonite 7; pleonites 1–2 with lateral margins not produced.

Antennule peduncle 4-articulate, peduncle article 3 longest; flagellum longer than peduncle. Antenna peduncle articles 1–3 short, 4–5 long, with peduncle article 5 equal in length to or longer than article 4. Mouthparts similar to *Cirolana*. Pereopods ambulatory, all with simple dactyls. Pereopods 1–3 with anterodistal angle of merus produced. Penes present on sternite 7. Pleopod exopods with incomplete suture; appendix masculina not extending beyond apex of inner ramus.

Remarks. This genus is readily separated from others of the family by the morphology of the clypeal region and pleopods. The lack of a secondary unguis on the dactylus is a further useful character. The genus is known from the Australasian region with two species in New Zealand (Jansen, 1981), one of which occurs in Australia, and a third in New Guinea (Bruce, 1982a). *Eurylana arcuata* has also been recorded from the Pacific coasts and also South and North America, where it was probably introduced (Bowman et al., 1981).

Eurylana arcuata (Hale)

Fig. 23

Cirolana arcuata Hale, 1925: 133, fig. 2.—Naylor, 1961: 11, fig. 4; Hurley, 1961: 267, 292; Morton & Miller, 1968: 454, 481, fig. 167–3; Bowman, Bruce & Standing, 1981: 545, figs 3–9; Bruce, 1981b: 960.

Cirolana robusta Menzies, 1962a: 123, fig. 4D–E.—Ramirez, 1974: 417, fig. 8; Carvacho, 1977: 32, fig. 4; Bruce, 1981b: 961.

Cirolana concinna.—Menzies, 1962a: 123, fig. 40A–E [not *Pseudolana concinna* (Hale, 1925)].

Eurylana arcuata.—Jansen, 1981: 7, fig. 2.

Material examined. 3 males (7.5, 8.9, 9.5 mm), 4 females (8.5, 8.8, 10.3, 10.8 mm), labelled "paratypes" with no other data, SAM C331. Male (5.8 mm), near Newcastle, NSW, summer 1978, splash zone on boulder beach in conjunction with amphipods, coll. S. Smith (no other data available). Male (10.0 mm), female (11.0 mm), Murrumbulga Point, Twofold Bay, NSW, 9 Oct. 1984, intertidal rocks, coll. S.J. Keable. 11 males and females, Murrumbulga Point, Twofold Bay, NSW, 25 June 1985, intertidal rock platform, coll. S.J. Keable. Female (8.0 mm), Aislings Beach, Twofold Bay, NSW, 22 Feb. 1985, dredged 8.5 m, coll. S.J. Keable. Male (5.8 mm), Port Willunga, SA, amongst *Natatolana corpulenta* presumably taken on bait, reported on by Hale (1925) under the remarks for *C. australiense*. Also examined: Menzies' material of *C. robusta*, and *C. concinna* and 8 paratypes of *C. arcuata* from

Broughton Is., NSW.

Types. Held at the South Australian Museum, Adelaide, and the Australian Museum, Sydney.

Type locality. Little Sirius Cove, Port Jackson, NSW.

Remarks. The taxonomy and distribution of this species has been discussed in detail by Bowman et al. (1981).

The Australian specimens differ from those from the coasts of the Americas by having entire coxal furrows on pereonites 3–7 although the dorsal part is faint, by having large spines on the pereopods, and in having fewer setae on the maxilliped.

Distribution. Newcastle and Twofold Bay, NSW, and Port Willunga, SA. The species was probably introduced from New Zealand (Bowman et al., 1981) and now also occurs on the western coasts of South America and San Francisco Bay, USA.

Excirrolana Richardson

Excirrolana Richardson, 1912: 201.—Hale, 1925: 156; Monod, 1930: 174; 1931: 3; Nierstrasz, 1931: 148; Barnard, 1940: 387; Lemos de Castro & Silva Brum, 1969: 1; Menzies, 1962a: 126; Jones, 1971: 212; Kensley, 1978c: 73; Kussakin, 1979: 181; Bruce & Jones, 1981: 70; Holdich, Harrison & Bruce, 1981: 586.

Pontogeloides Barnard, 1914: 355a.—1940: 389; Monod, 1930: 174; Nierstrasz, 1931: 149.

Pontogeloides (subgenus of *Excirrolana*).—1930: 169; 1931: 3; Brian & Darteville, 1949: 121.

Type species. *Cirolana orientalis* Dana, 1853a, (Richardson, 1912). Location of types not known, and they have probably been lost (Bowman, pers. comm.) when the sloop *Peacock* sank off the mouth of the Columbia River, USA.

Diagnosis. Cephalon with prominent rostrum separating antennule bases. Pereonite 1 about twice as long as pereonite 2. Pleonite 5 not laterally overlapped by pleonite 4. Antennule peduncle articles colinear. Antenna peduncle 4- or 5-articulate. Frontal lamina flat, usually united with rostrum; clypeus with weakly developed triangular blade. Maxilliped endite with one coupling hook. Pereopods 5–7 not markedly flattened, spinose. Pleopod rami elongate, endopods of pleopods 3–5 without setae; appendix masculina inserted basally to medially. Uropod peduncle medial margin weakly produced, exopod lateral margin without setae or spines.

Additional characters. Body smooth, without ornamentation. Cephalon rostrum often dilated anteriorly. Pleotelson with depression at anterodistal surface. Pleonites all visible.

Antennule peduncle 3-articulate, bases separated by frontal lamina; flagellum longer than peduncle. Antenna peduncle articles 1 and 2 (or 3) short, 3–4 (or 4–5) long. Mandible with 2 or 3-articulate palp. Maxilliped generally slender. Maxillule and maxilla similar to *Cirolana*. Pereopods all ambulatory. Pereopods 1–3 with merus anterodistal margin slightly produced. Dactyls prominently biungiculate. Penes

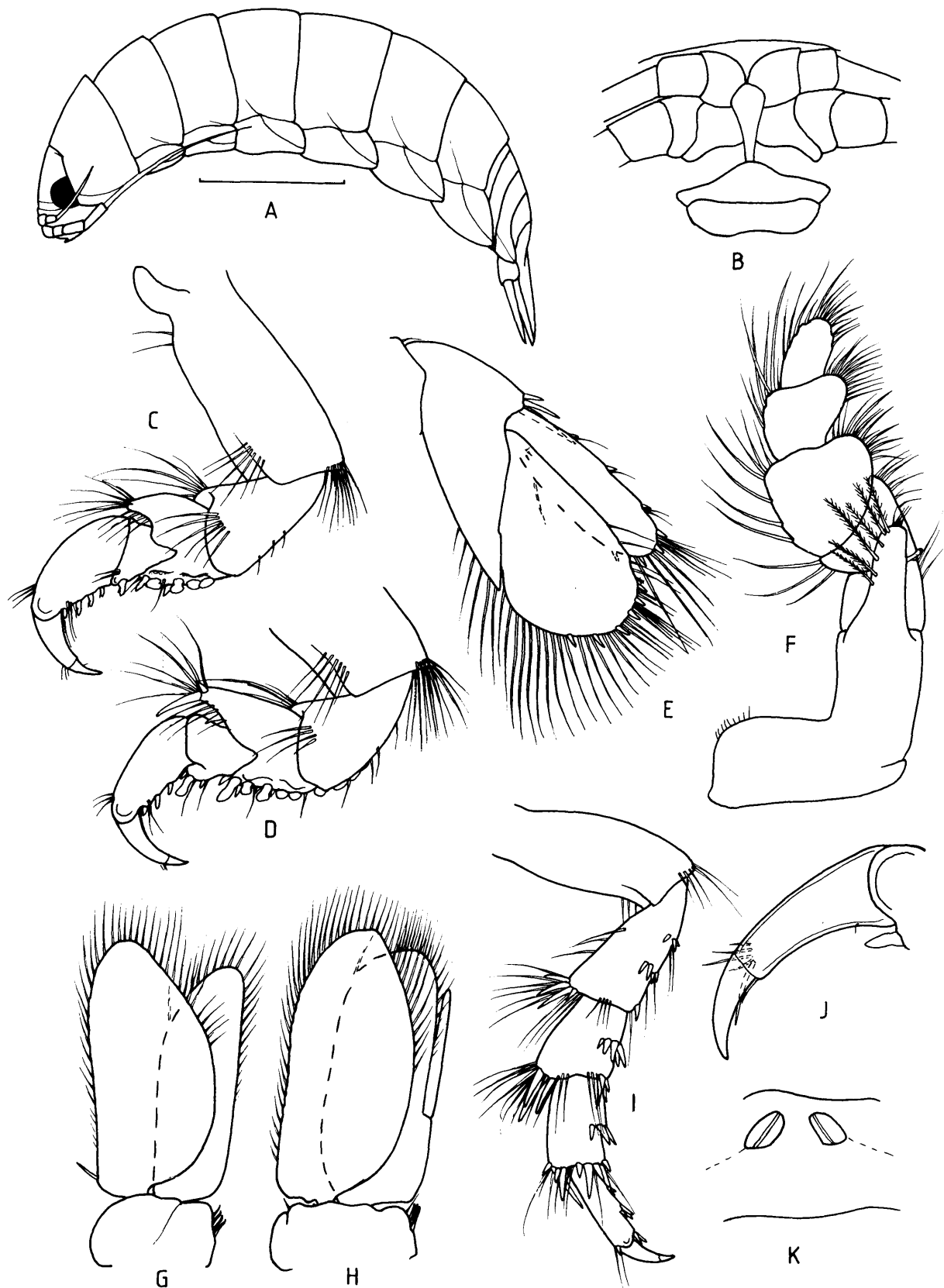


Fig. 23. *Eurylana arcuata*. A, female 8.8 mm; remainder male paratype. A, lateral view; B, clypeal region; C, pereopod 1; D, pereopod 2; E, uropod; F, maxilliped; G, pleopod 1; H, pleopod 2; I, pereopod 7; J, pereopod 1, dactylus; K, penes, in situ. Scale 2.0 mm.

present on sternite 7. Pleopods rami with or without accessory lobes, endopod of pleopod 2 occasionally without setae. Uropods extending well beyond apex of pleotelson, exopod equal to or longer than endopod.

Remarks. The genus *Exciorolana* is, at present, a difficult one to delimit. This is mainly due to the lack of constancy of morphological characters shown by species currently placed in the genus, and the inadequacy of so many of the species descriptions. Coupled to these problems, and emphasising the variety of morphology of the genus, are the problems of the status of the genera *Pontogeloides* and *Annina* Budde-Lund.

The validity of *Pontogeloides* has been discussed (Monod, 1930; Jones, 1971; Carvacho, 1977) but no author has resolved the problem. The characters involved in this discussion are the number of antennal peduncle articles, the number of mandibular palp articles and the morphology and setation of the pleopods. Table 2 shows that the form of these characters are apparently randomly spread throughout the genus *Exciorolana*. It is true that only two species have the endopods of pleopods 2-5 naked, and this is the only character by which *Pontogeloides* can be separated from *Exciorolana*. A biarticulate mandibular palp occurs in several species, and is not associated with accessory lobes to the pleopods, nor possession of a 4-articulate antennal peduncle. At present I regard *Pontogeloides* as a synonym of *Exciorolana*. *Annina* has been recently rediagnosed by Jones (1983), and occupies a position close to *Exciorolana*.

The species of the genus, easily recognised by the large rostrum separating the antennule bases, are distributed on the tropical and subtropical coasts of all oceans. The only temperate species appear to be *Exciorolana chiltoni*, which has a North Pacific distribution (Bruce & Jones, 1981), and *E. linguifrons*. All species are primarily sand beach dwellers.

Exciorolana orientalis (Dana)

Fig. 24

Cirolana (Eurydice) orientalis Dana, 1853a: 773, pl. 51.

Cirolana orientalis.—Hansen, 1890: 353, pl. IV figs 4, 4a-h; Stebbing, 1900: 633; Thielemann, 1910: 17; Richardson, 1910: 4.

Exciorolana orientalis.—Richardson, 1912: 201; Hale, 1925: 156, fig. 14; 1929a: 34; Nierstrasz, 1931: 148; Pichon, 1967: 70, 83; Roman, 1970: 174; Jones, 1971: 213, fig. 8a; 1979b: 677, fig. 3; Holdich, Harrison & Bruce, 1981: 587, fig. 12; Bruce, 1982a: 613.

Cirolana bombayensis Joshi and Bal, 1959: 58, pl. 1.

Exciorolana orientalis.—Fishelson, 1971: 128 (err. typ.).

Material examined. 5 males (7.5, 8.5, 9.6, 9.7, 10.1 mm), 3 females (8.2, 9.5, 10.7 mm), Cape Ferguson, Qld, 9 Dec. 1979, beach in front of Australian Institute of Marine Science, feeding on dead tern, coll. N. Svehnivig. Male (6.3 mm), Black Point, Cobourg Peninsula, NT, 11°9'S, 132°51.4'E, 24 June 1981, trapped on sand, 0.5 m, coll. A.J. Bruce.

Types. The whereabouts of the types is not known.

Type locality. "Sooloo Sea" (Dana, 1853a); Sulu Sea, South of the Philippines.

Colour. In alcohol, pale brown to cream, generally densely covered by chromatophores. Some specimens are chocolate coloured with two pale sublateral bands.

Size. Hale (1925) recorded specimens up to 11 mm. Present material includes an ovigerous female to 10.7 mm. Bruce (1982a) recorded specimens from Papua New Guinea that were 16.0 mm in length.

Remarks. This species has been recorded widely in the Indo-West Pacific but, up until its redescription by Holdich et al. (1981), still remained poorly described. Figures are given here of all mouthparts, of the pleopods, and also of the cephalon, clypeal region and uropod, all of which are useful in aiding recognition of the species.

The species described by Joshi & Bal (1959) as

Table 2. Distribution of potential generic characters among *Exciorolana*. Asterisk indicates where specimens have been examined, otherwise derived from the literature (n = naked).

SPECIES	A2 PEDUNCLE		MANDIBULAR PALP		Setation	PLEOPODS Acc. Lobes	App. ♂
	4-art.	5-art.	2-art.	3-art.			
<i>E. affinis</i>	+		+		2-5 n	+	medial
<i>E. armata</i>	?			+	?	?	basal
<i>E. braziliensis</i> *	+		+		3-5 n	-	s-basal
<i>E. chilensis</i>	?		?	?	?	?	? ?
<i>E. chiltoni</i> *	+		+		3-5 n	-	basal
<i>E. geniculata</i>	?		?	+	3-5 n	+	s-basal
<i>E. hirsuticauda</i> *	+		+		3-5 n	-	s-basal
<i>E. latipes</i> *	+		+		2-5 n	+	medial
<i>E. linguifrons</i>	?		?	?	?	?	?
<i>E. mayana</i>	?		?	+	?	?	s-basal
<i>E. monodi</i>	+		+		?	?	?
<i>E. natalensis</i> *	+		+		3-5 n	+	medial
<i>E. orientalis</i> *	+			+	3-5 n	-	s-basal

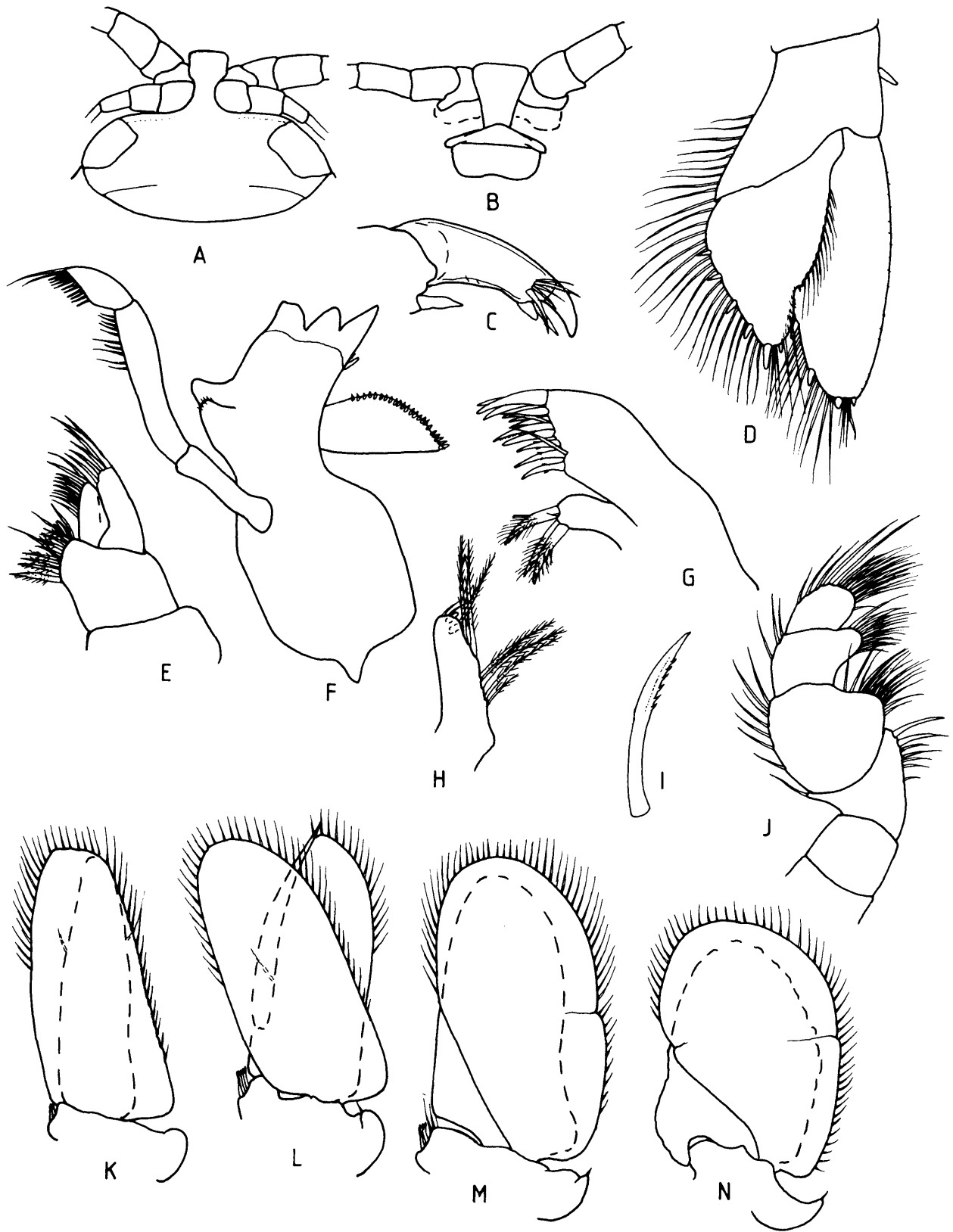


Fig. 24. *Excirolana orientalis*, male 10.1 mm, Townsville. A, cephalon, dorsal view; B, clypeal region; C, pereopod 1, dactylus; D, uropod; E, maxilla; F, right mandible; G, maxillule; H, maxilliped endite; I, medial spine, maxilliped palp article 2; J, maxilliped; K, pleopod 1; L, pleopod 2; M, pleopod 3; N, pleopod 5.

Cirolana bombayensis appears to be entirely similar to *E. orientalis*, the diagnostic uropod shape being clearly indicated.

Distribution. Indo-West Pacific from East Africa eastwards to the Philippines; in Australia from Townsville, Qld, and Cobourge Peninsula, NT.

Pseudolana Bruce

Pseudolana Bruce, 1979: 112; 1980c: 153.—Holdich, Harrison & Bruce, 1981: 590.

Type species. *Cirolana concinna* Hale, 1925, by designation (Bruce, 1979). Types held at the Australian Museum, Sydney, and the South Australian Museum, Adelaide.

Diagnosis. Pereonite 1 about twice as long as pereonite 2. Pleonite 5 not laterally overlapped by pleonite 4. Antennule peduncle articles colinear. Antenna peduncle 5-articled. Frontal lamina linear; clypeus with downward projecting triangular blade. Maxilliped endite with one coupling hook. Pereopods 5–7 not markedly flattened, spinose. Pleopods elongate, pleopods 3–5 endopods without setae; appendix masculina inserted medially. Uropod peduncle medial margin produced, rami with all margins setose.

Additional characters. Body smooth, unornamented, 2–3 times longer than broad. Pleon with 5 visible segments.

Antennule peduncle 4-articulate; flagellum long, extending beyond pereonite 1; antenna peduncle articles 1–2 very short, 4–5 long. Mouthparts generally similar to *Cirolana*, except maxilliped rather more slender, with fewer plumose setae on lateral margin of palp articles 2–3. Pereopods all ambulatory; anterodistal margins of merus of pereopod 1 slightly produced; posterior

pereopods generally with abundant robust spines and setae on anterior margins. Dactylus with feebly produced secondary unguis. Penes present on sternite 7. Pleopods 1–5 with prominent lobe on peduncle lateral margins; exopods of pleopods 3–5 with incomplete transverse suture. Uropods with marginal setae interspersed with spines.

Sexual dimorphism. Males and females are similar except that females may be broader, and reach a slightly greater length.

Remarks. The characters that most readily identify this genus are the linear frontal lamina (occurs rarely in other genera), the freely projecting clypeus, and pleonite 5 with free lateral margins. Less immediately obvious characters include the form of the maxilliped, the point of insertion of the appendix masculina, the elongate shape and the setation of the pleopods. Related genera include *Excicrolana* and *Eurylana*. *Excicrolana* is readily distinguished by the large dilated rostral process, the lack of spines and setae on the lateral margin of the uropodal exopod, and by the more complex pleopods. *Eurylana* has pleonite 5 with lateral margin encompassed by pleonite 4, has the frontal lamina with the ventral surface flat, and the clypeus while projecting, tends to project forward rather than down.

All species have penial processes on sternite 7. Comparison between the different species suggests that the penial processes are too similar to be useful in separating species.

The genus has so far been recorded only from the Australian and Papua New Guinea coasts, with only one species extending to Western Australia. *Pseudolana brevifimbria* is the only species taken outside Australian waters (Bruce, 1982a).

Key to Genus *Pseudolana*

1. Pleonite 4 with lateral margin rounded. *P. brevifimbria*
—Pleonites 3–5 with lateral margins acute. 2
2. Antennule flagellum longer than antenna. *P. dactylosa*
—Antennule flagellum not longer than antenna. 3
3. Pereopods 1–2 with prominent recurved processes on ischium. *P. elegans*
—Pereopods 1–2 without processes. 4
4. Antenna and antennule subequal in length. *P. towrae*
—Antenna (including flagellum) distinctly longer than antennule. 5
5. Posterior margin of pleotelson emarginate. *P. concinna*
—Posterior margin of pleotelson smoothly rounded. 6
6. Pereopod 7 sparsely setose, appendix masculina slender. *P. ovalis*
—Pereopod 7 with abundant setae, appendix masculina club shaped. *P. menertae*

Pseudolana concinna (Hale)

Figs 25, 30G

Cirolana concinna Hale, 1925; 152, fig. 12.—Nierstrasz, 1931: 157; Bruce, 1979: 112.*Pseudolana concinna*.—Bruce, 1979: 112; 1980c: 154, figs 1, 2; Holdich, Harrison & Bruce, 1981: 590, fig. 13; Dexter, 1983a: 99, figs 5–24; 1983b: 464, 465, 468; 1984: 663; 1985: 281, 282.Not *Cirolana concinna*.—Menzies, 1962a; 123, fig. 40A–E (= *Euryllana arcuata*, see Bowman et al., 1981).

Material examined. Male (5.7 mm), 11 females (5.2–7.5 mm, 5 ovig.), Currimundi Beach, Sunshine Coast, Qld, 3 Dec. 1978, above berm, at high water level, coll. NLB. Manca (3.2 mm), Currumbin Beach, Gold Coast, Qld, 3 Apr. 1979, coll. NLB. 2 males (3.8, 5.0 mm), 4 females (3.9, 5.0, 5.5, 5.6 mm), 2 mancas (3.5, 3.7 mm), Currimundi Beach, Sunshine Coast, Qld, 21 Apr. 1979, coll. NLB. Male (6.7 mm), Miami Beach, Gold Coast, Qld, July 1971, coll. D.F. Boesch. 8 males (3.6–5.2 mm), 10 females (3.9–5.3 mm), Belongil Creek beach, Byron Bay, NSW, 25 Aug. 1979; female (6.9 mm), Broken Head, NSW, 24 Aug. 1979; 2 males (5.0, 5.3 mm), 4 females (3.8, 4.4, 4.5, 4.5 mm), Wategos Beach, Cape Byron, NSW, 25 Aug. 1979, in 45 cm depth of sand, coll. NLB. 7 males (4.8–6.7 mm), 3 females (5.3, 6.5, 6.9 mm), Goolwah Beach, SA, 9 Oct. 1973, coll. M. King. Female (5.8 mm), Seven Mile

Beach, S.E. Tas., 18 Mar. 1979, sand at edge of incoming tide, coll. A.J.A. Green. Male (6.3 mm), 3 females (6.5, 6.6, 7.6 mm), Blackmans Bay, Tas., 3 Sept. 1975, coll. T.M. Walker. 4 males (5.7, 6.2, 6.3, 8.1 mm), 3 females (6.8, 7.5, 11.3 mm), Eddystone Point, Tas., 1 May 1978, coll. D. Hoggins. Male (6.9 mm), female (7.6 mm), 10 mancas (2.6–4.9 mm), Cottesloe, WA, 25 May 1980, in sand upper beach; 38 males and females (4.5–7.9 mm), Nancy Cove, Rottnest Is., WA, 3 June 1980, in sand pools; 45 males, females, mancas (from 2.6 mm–8.1 mm), Parker Point, Rottnest Is., WA, 3 June 1980, upper range of wave action, coll. NLB.

Types. Held at the Australian Museum, Sydney.**Type locality.** Cottesloe, WA, designated by Hale (1925).

Remarks. Detailed descriptions of this species have been given by Bruce (1980c) and Holdich et al. (1981). The species can be distinguished from all others in the genus by the emarginate hind margin of the pleotelson, the shape and length of the appendix masculina, together with the comparative lengths of the antennule and antenna and the arrangement of spines and setae of the antenna. The specimens from Western Australia have a broader body shape, and the pleon is noticeably more encompassed by pereonite 7, pleonite 1 being scarcely visible in mature males. The species was found to be abundant on the beaches of Rottnest Island.

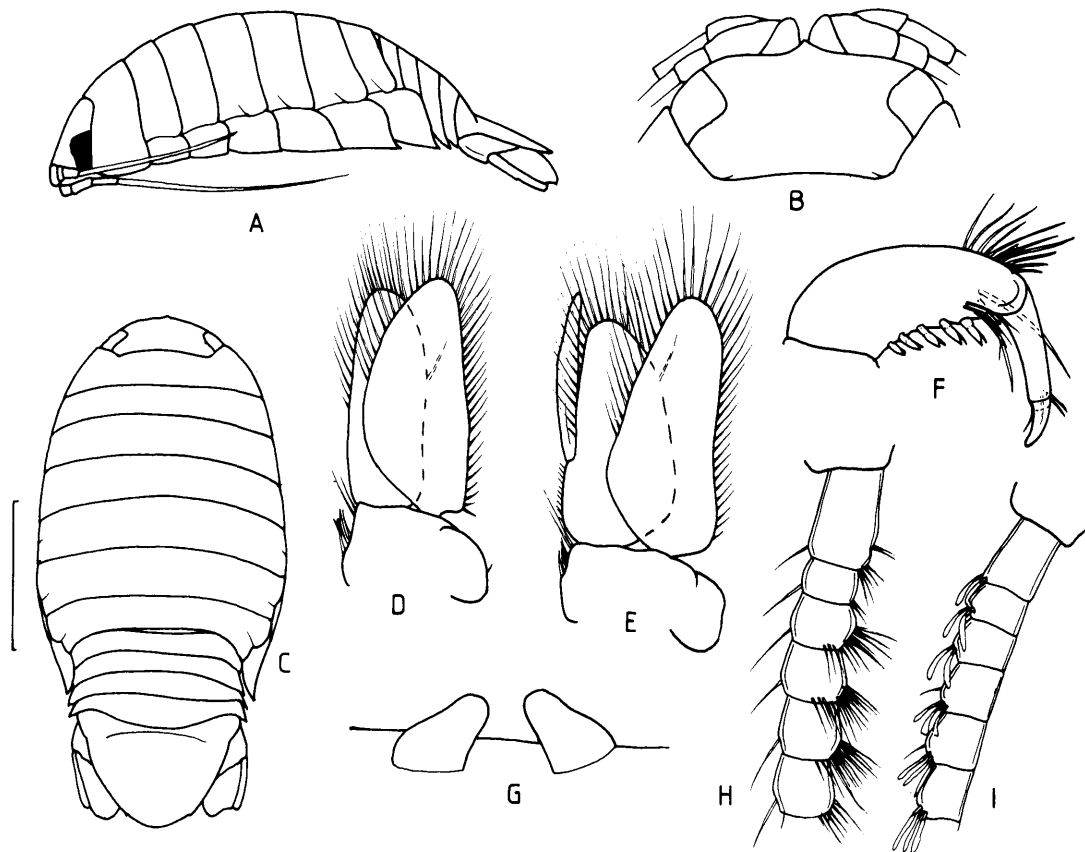


Fig. 25. *Pseudolana concinna*, male 6.9 mm, Cottesloe. **A**, lateral view; **B**, cephalon dorsal view; **C**, dorsal view; **D**, pleopod 1; **E**, pleopod 2; **F**, pereopod 1, propodus and dactylus; **G**, penes; **H**, antenna, proximal flagellar articles; **I**, antennule, proximal flagellar articles. Scale 2.0 mm.

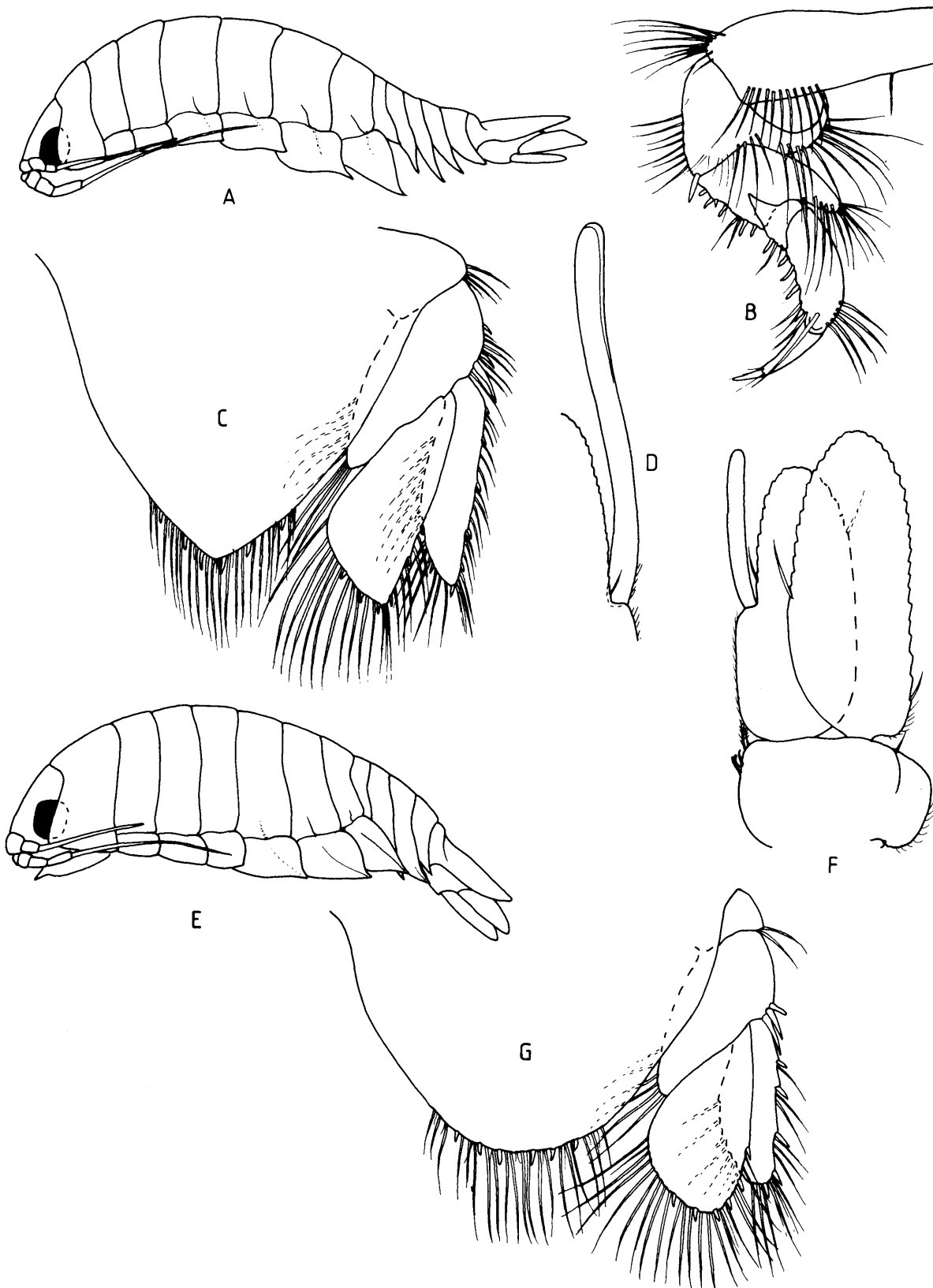


Fig. 26. *Pseudolana elegans*: A, lateral view; B, pereopod 1; C, pleotelson and uropod; D, appendix masculina. *Pseudolana ovalis*: E, lateral view; F, pleopod 2 (setae omitted); G, pleotelson and uropod. Scale 1.0 mm.

Colour. In life, translucent with black chromatophores, some brown chromatophores on pleon.

Size. Queensland material 3–7 mm. Material from Hinchinbrook did not exceed 5 mm. Tasmanian specimens 5–7 mm, one female reaching 10 mm.

Distribution. Common on Queensland beaches as far north as Hinchinbrook Is. (Bruce, 1980c; Holdich et al. 1981); also Byron Bay and Broken Head, northern NSW; Sydney beaches, NSW (Dexter, 1984, 1985); Goolwah Beach, SA; several localities in Tasmania; and Cottesloe and Rottnest Island, WA.

Pseudolana elegans Bruce

Figs 26A–D, 30F

Pseudolana elegans Bruce, 1980c: 157, fig. 3.

Material examined. Manca (4.8 mm), Alexandra Bay, Noosa Heads, Qld, 11 Oct. 1980, at mean tide level; 2 mancans (2.8, 4.8 mm), Belongil Creek, Byron Bay, NSW, 25 Aug. 1979, at creek outflow; male (5.8 mm), female (7.2 mm), 2 mancans (3.6, 5.0 mm), Wategos Beach, Cape Byron, NSW, 23 Aug. 1979, towards low tide level; 6 males (5.7–7.0 mm), 3 females (7.0, 7.5, 7.6 mm), Broken Head, NSW, 24 Aug. 1979, just subtidal; all coll. NLB. Male (6.9 mm), 2 females (5.6, 6.9 mm), east of Belmont Beach, NSW, 33°02'36"S, 151°40'56"E, 20 July 1975, 500 m off beach, depth 6–14 m; 4 males (6.9, 6.9, 7.6, 8.0 mm), female (8.2 mm), east of Stockton Beach, NSW, 32°53'55"S, 151°47'31"E, 30 Nov. 1975, 500 m off beach, 6 m, coll. AM HDWBS.

Types. Held at the Queensland Museum, Brisbane.

Type locality. Frenchmans Bay, North Stradbroke Island, Qld.

Remarks. Distinctive features of *P. elegans* are the

abundant setae on the posterior pereopods, the straight outer margin of the uropodal exopod, the shape of the hind margin of the pleotelson, and the unique process on the ischium of pereopods 1 and 2.

Distribution. On high exposure fine sand beaches (where all the sand passes through a 1.0 mm sieve) at Noosa and Stradbroke Island, Qld; Cape Byron and Broken Head, NSW; and subtidally near Sydney, NSW; at depths of 6–14 metres.

Pseudolana ovalis Bruce

Fig. 26E–G

Pseudolana ovalis Bruce, 1980c: 159, fig. 4.

Material examined. 6 males (3.8–6.9 mm), Toorbul Point, Pumicestone Passage, Moreton Bay, Qld, 7 Sept. 1979, south of bridge, in sand, coll. R.H. Quinn.

Types. Held at the Queensland Museum, Brisbane.

Type locality. Serpentine Creek, Moreton Bay, Qld.

Remarks. Males of *P. ovalis* can be identified from characteristics of the appendix masculina. Both sexes may also be identified by the relative paucity of pereopodal setae, and their ovoid body shape.

Distribution. Serpentine Creek and Pumicestone Passage, Moreton Bay, Qld.

Pseudolana dactylosa Bruce

Fig. 27

Pseudolana dactylosa Bruce, 1980c: 161, fig. 5.

Material examined. 5 males (4.5–7.2 mm), female (8.2 mm), Trinity Inlet, Cairns, Qld, 29 Nov. 1979, from night plankton, coll. Qld State Fisheries Service. 2 mancans (2.5, 3.2 mm),

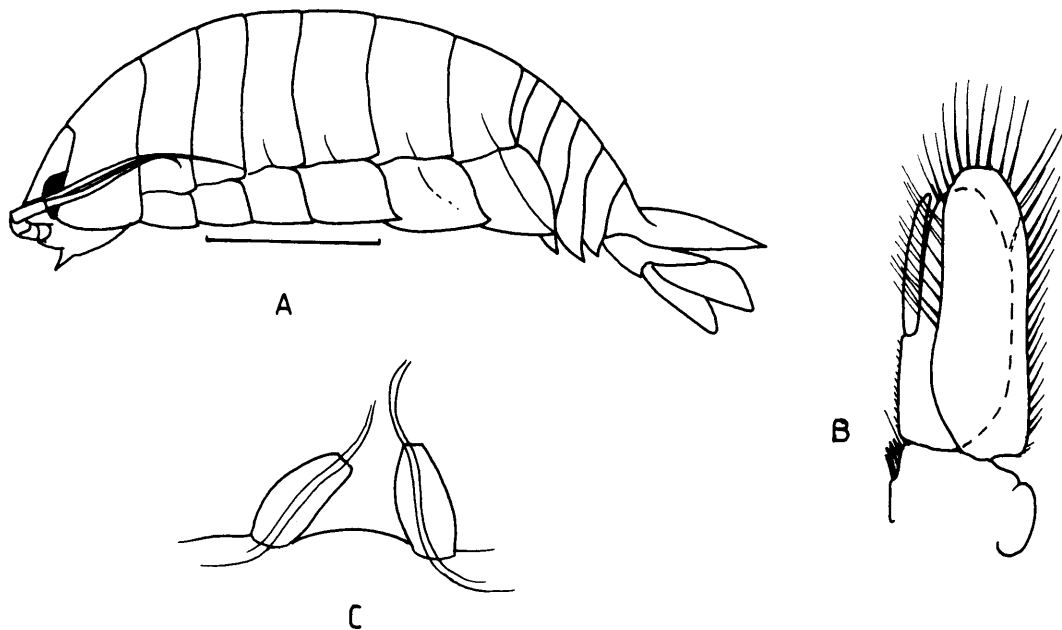


Fig. 27. *Pseudolana dactylosa*, male 9.5 mm, Mary River. A, lateral view; B, pleopod 2; C, penes. Scale 2.0 mm.

Herbert River, Qld, June 1976, in drift net, coll. R. Pearson. 3 females (4.9, 5.0, 5.2 mm), Calliope River, Gladstone, Qld, 1975, coll. P. Saenger. 3 females (6.8, 6.9, 7.3 mm), Crab Is. Creek, Mary River, Qld, 13 Apr. 1982, in intertidal mobile sand bank, coll. NLB & E.J. Fields. 6 males (5.0, 5.7, 6.3, 8.2, 8.3, 9.5 mm), female (5.0 mm), Middle Crab Is., Crab Islands Creek, Mary River, Qld, 16 Apr. 1982, buried below sand surface, intertidal, coll. NLB & E.J. Fields.

Types. Held at the Queensland Museum, Brisbane.

Type locality. Little Ramsay Bay, Hinchinbrook Island, Qld.

Size. Longest male 9.5 mm, longest female 8.2 mm.

Remarks. *P. dactylosa* is the only species of the genus in which the antennule exceeds the antenna in length, a cirolanid character otherwise shown only by the genera *Pseudaega* and *Pontogelos*. The straight outer margin of the uropodal exopod separates this species from *P. concinna* and *P. ovalis*, while the short appendix masculina, rounder posterior margin of the pleotelson, together with the long pereopod dactyls clearly separate this species from others of the genus.

Distribution. Estuarine or variable salinity creeks from Mary River in the south to north of Cairns.

Pseudolana brevifimbria Holdich, Harrison & Bruce
Figs 28, 30E

Pseudolana brevifimbria Holdich, Harrison & Bruce, 1981: 593, fig. 14.—Bruce, 1982a: 614.

Material examined. Male (4.3 mm), holotype, Pallarenda, Cleveland Bay, Townsville, Qld, 3 Aug. 1976, on beach by mouth of 'Three Mile Creek', coll. D.M. Holdich. 2 males (5.3, 6.0 mm), Motupore Is., Gulf of Papua, Papua New Guinea, 1 Nov. 1980, trapped on beach, coll. A.J. Bruce (reported by Bruce, 1982a).

Types. Holotype held by Queensland Museum, Brisbane.

Type locality. Pallarenda, Cleveland Bay, Townsville, Qld.

Remarks. This species can be separated from the others of the genus by lack of acute posterolateral pleonite margins on pleonite 3, and by the posterior lateral margin of pleonite 4 being rounded. It is also distinguished by the broadly rounded uropodal endopod, and the appendix masculina, which is slightly longer than the endopod, broadening distally.

Examination of the holotype reveals that the number of spines on the posterior margin of the pleotelson is 4, and these are very short. The uropod exopod has 4 spines on the lateral margin and 3 on the medial margin. The posterior margin of the uropod endopod has only 5 spines.

Distribution. Townsville area, Qld; also southern Papua New Guinea (Bruce, 1982a).

Pseudolana towrae Bruce
Figs 29, 30A–D

Pseudolana towrae Dexter, 1983a: 99, *nomen nudum*.

Pseudolana towrae Bruce, 1983: 200, fig. 1.—Dexter, 1983b: 466; 1984: 665, 669; 1985: 281, 282.

Material examined. Male (4.9 mm), 2 females (5.0, 5.5 mm), Upper West Arm, Port Hacking, Sydney, NSW, 13 Nov. 1974, coll. V. Wadley. 5 males (5.0–6.7 mm), 7 females (6.3–6.9 mm, all ovigerous), ca. 60 manca (1.9–3.2 mm), Towra Point, Botany Bay, NSW, 17 Aug. 1980; male (4.7 mm), 6 females (4.4–7.2 mm), manca (3.2 mm), Towra Point, Botany Bay, NSW, 26 Aug. 1980; 2 males (5.5, 6.0 mm), 4 females (5.1–6.9 mm), ca 50 manca (2.0–3.8 mm), Towra Point, Botany Bay, NSW, 6 Jan. 1981; male (4.2 mm), female (5.6 mm), 8 manca (2.2–3.5 mm), Snappermans Bay, NSW, 3 Jan. 1981, all in sand, coll. D.M. Dexter. Male (6.9 mm), Salamander Bay, Port Stephens, NSW, 15 Jan. 1981, coll. G.C.B. Poore. Also examined 25 manca from Ettalong, NSW, 29 Dec. 1980, and 15 manca from Clontarf, NSW, 6 Dec. 1980, coll. D.M. Dexter. Male (6.9 mm), female (7.2 mm, ovig.), Andersons Inlet, Vic., 17 Dec. 1981, coll. R. Patra.

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

Type locality. Towra Point, Botany Bay, Sydney, NSW, 33°57'S, 151°10.5'E.

Description of male. A preliminary diagnosis was given by Bruce (1983); a full description is now provided. Body about 3 times as long as wide. Cephalon with median rostral point. Pereonite 6 longest; coxal plates of pereonites 2–4 scarcely produced, 5–7 with acute posterior point; coxae of pereonite 7 with indistinct partial oblique furrow. Pleonites 3–5 lateral margins acutely produced. Pleotelson with anterodorsal depression, posterior margin subtruncate, with 6 spines interspersed amongst plumose marginal setae.

Antennule flagellum composed of 13 articles, extending to posterior of pereonite 1. Antenna peduncle articles 4–5 proportionally shorter than others of genus, flagellum composed of 11 articles, extending to pereonite 1.

Frontal lamina posterior half slightly broader than anterior; clypeus with rounded projecting blade.

Pereopod 1 with long setae along distal half of anterior margin of basis and at posterior distal angle; anterodistal angle of ischium and merus with abundant setae; posterior margin of merus with 7 spines and stout flat seta; carpus with single spine and seta; propodus with 4 spines. Pereopod 2–3 similar to 1, but with additional and larger spines on all articles except propodus which has fewer, and basis which has none. Pereopod 7 with dense cluster of setae along anterior margin of ischium, merus and carpus; anterodistal angles of ischium to carpus with 1 or more spines; posterior margins of ischium to carpus setose, with spine on margin and at distal angles.

Penes slender, well separated, slightly angled medially.

Pleopod 2 appendix masculina arising approximately half way along endopod; extending beyond endopod by half its length, apex rounded, slightly bent laterally. Uropod with 3 conspicuous spines on distolateral angle of peduncle. Exopod with 5 spines and 10 plumose setae on lateral margin, medial margin with 1 spine, and long plumose setae. Endopod with 4 spines on lateral margin, 2 on medial margin; continuous marginal setae from medial margin to halfway along lateral margin.

Female. Similar to male, but pereon slightly broader.

Colour. Translucent with black and white chromatophores.

Size. Average length of males 5.7 mm, of females 5.4 mm. Largest male was 6.9 mm, largest female, 7.2 mm.

Remarks. Only one other species, *Pseudolana elegans*, has an elongate appendix masculina. *Pseudolana elegans* is readily separated by the recurved process on pereopods 1-2, and by the acute apex of the pleotelson.

Characters which serve to separate females of *P. towrae* include the antennule and antenna being almost equal in length, with the antennal peduncle being markedly shorter than in other species, the shape of uropods, and the subtruncate posterior margin of the pleotelson. This species appears to prefer sheltered sand beach habitats. (Dexter, 1983b, 1984).

Distribution. From Sydney, NSW, to Aireys Inlet, Vic.

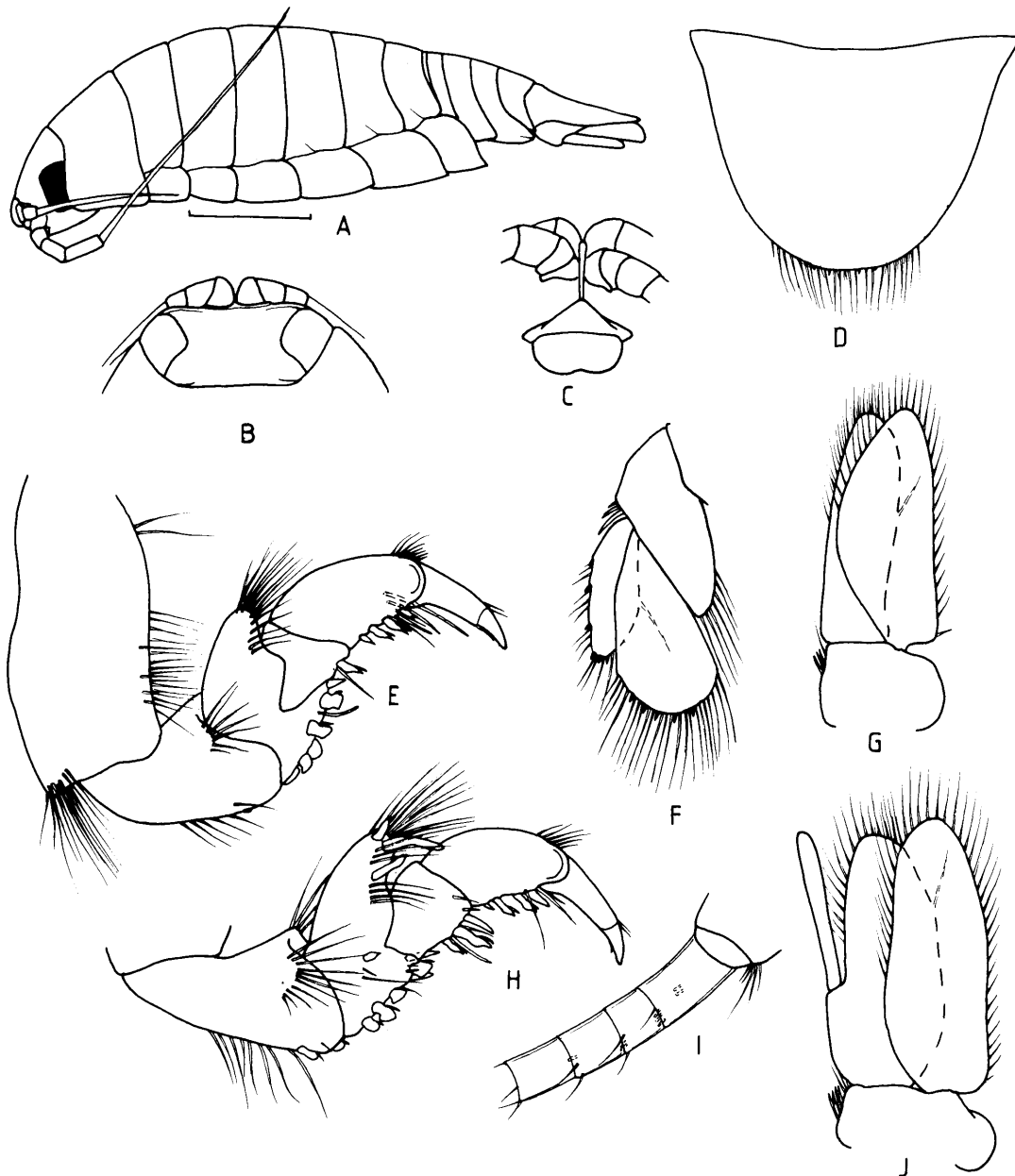


Fig. 28. *Pseudolana brevifimbria*. A-D holotype; remainder, male 5.0 mm. A, lateral view; B, cephalon, dorsal view; C, clypeal region; D, pleotelson; E, pereopod 1; F, uropod; G, pleopod 1; H, pereopod 2; I, antennule flagellum, proximal articles; J, pleopod 2. Scale 1.0 mm.

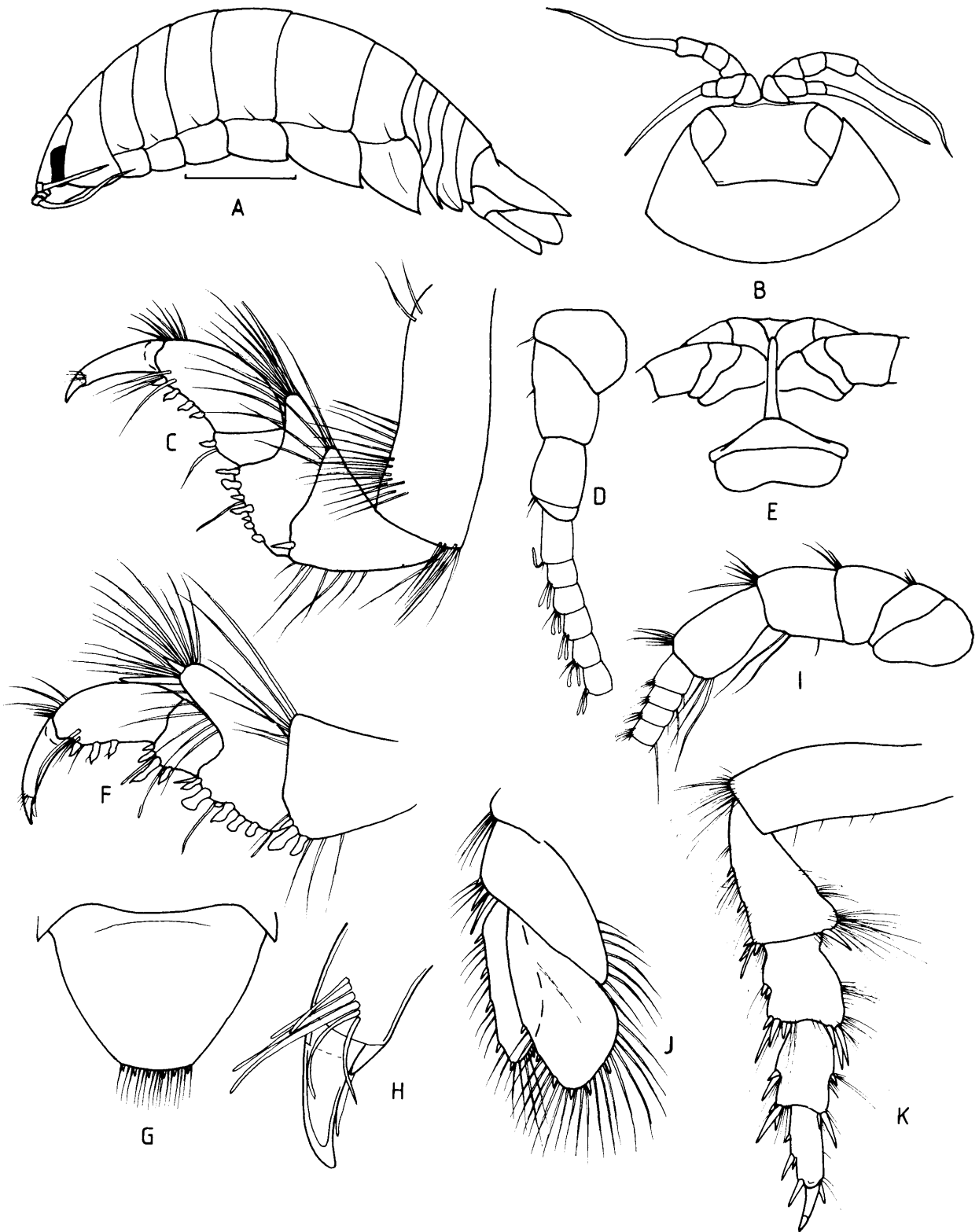


Fig. 29. *Pseudolana towrae*. A, B, G, holotype; J, female paratype; remainder male paratype. A, lateral view; B, cephalon, pereonite 1, dorsal view; C, pereopod 1; D, antennule peduncle; E, clypeal region; F, pereopod 2; G, pleotelson; H, pereopod 1, dactylus apex; I, antennal peduncle; J, uropod; K, pereopod 7. Scale 1.0 mm.

Pseudolana menartae n. sp.

Figs 31, 32

Material examined. 3 males (4.8, 5.1, 6.0 mm), 9 females (5.3–7.9 mm, mean 6.5 mm), 4 mancas (2.9–3.5 mm), Danger Point, Port Bremer, Cobourg Peninsula, NT, 1 May 1982, beach isopod trap, coll. NTM. 2 males (5.0, 5.5 mm), female (5.8 mm), manca (3.7 mm), Coral Bay, Port Essington, NT, 11°11.3'S, 132°3.75'E, 20 July 1981, intertidal pools at low water, coll. NTM.

Types. Holotype, male NTM Cr000225, paratypes NTM Cr000226–Cr000228.

Type locality. Cobourg Peninsula, NT.

Description of male. Body about 2.5 times as long as wide. Coxal plates of pereonites 2–3 with posterior margins rectangular; coxae of pereonites 4–7 with posterior ventral margin produced to form an acute point; coxae of pereonites 6–7 with complete diagonal furrow. Pleon with lateral margins of pleonites 1–2 scarcely produced. Pleotelson shorter than long, posterior margin smoothly rounded, with 4 spines and abundant marginal setae.

Antennule flagellum, composed of 13 articles, extends to posterior of pereonite 2. Antenna peduncle articles relatively short; posterodistal margins of articles 4–5

with long setae; flagellum composed of 17 articles, about first 10 of which have abundant setae, extending to pereonite 3.

Frontal lamina slightly dilated anteriorly.

Pereopod 1 with abundant setae along anterior margin of basis and anterodistal angles of ischium and merus; posterior margin of merus with 3 blunt and 3 acute spines, carpus with 1 acute spine, palm of propodus with 2 acute spines, and third spine opposing dactylus. Pereopod 2 similar to 1, but spines larger and more abundant; anterodistal margin of merus more strongly produced, provided with 3 prominent spines as well as long setae. Pereopod 7 with abundant setae along anterior margins of ischium, merus and carpus; anterior margins of ischium to propodus with spines at distal angle only; posterior margins of ischium to propodus with 3 groups (ischium, propodus) or 2 groups of spines (merus, carpus).

Slender penes present on sternite 7.

Pleopod 2 appendix masculina slightly shorter than length of endopod; apex expanded, spatulate, extends beyond endopod by slightly more than one third of its length (0.37). Uropods extending slightly beyond apex of pleotelson. Exopod lateral margin nearly straight, medial convex; lateral margin with 4 spines, medial with

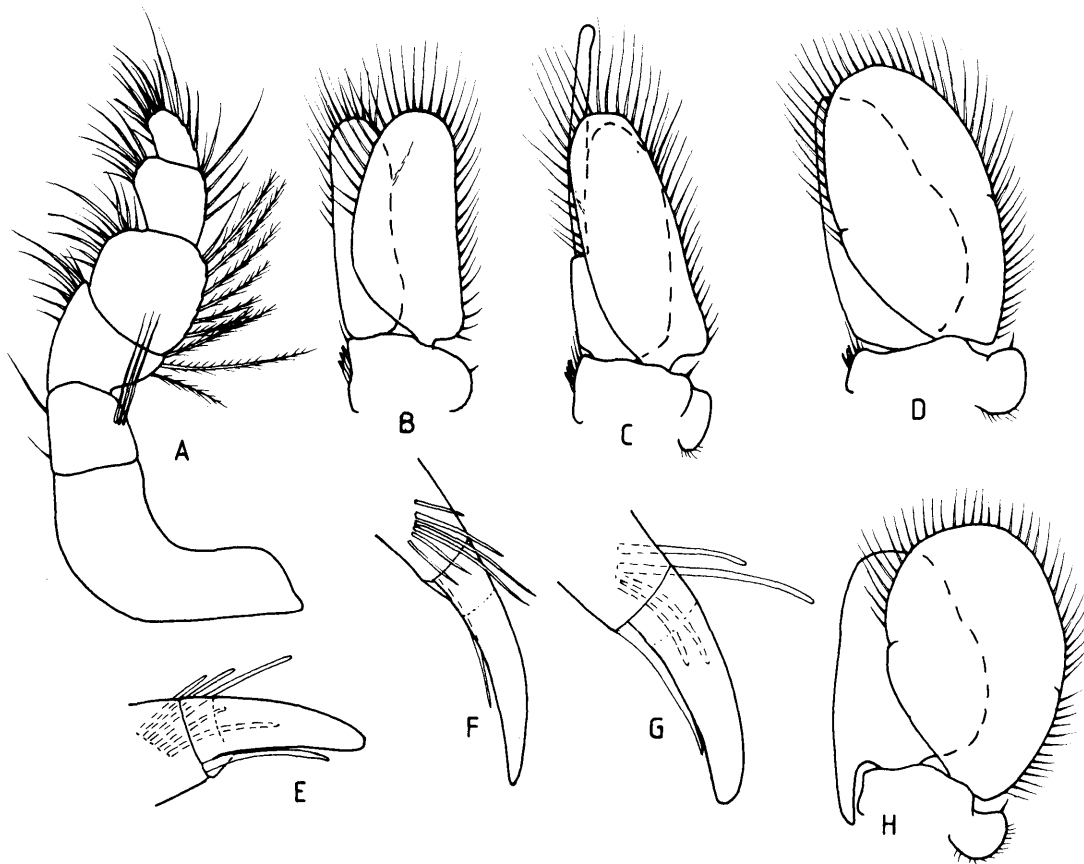


Fig. 30. *Pseudolana towrae*, male paratype: A, maxilliped; B, pleopod 1; C, pleopod 2; D, pleopod 4; H, pleopod 5. Dactylus apex of pereopod 1: E, *P. brevifimbria*; F, *P. elegans*; G, *P. concinna*.

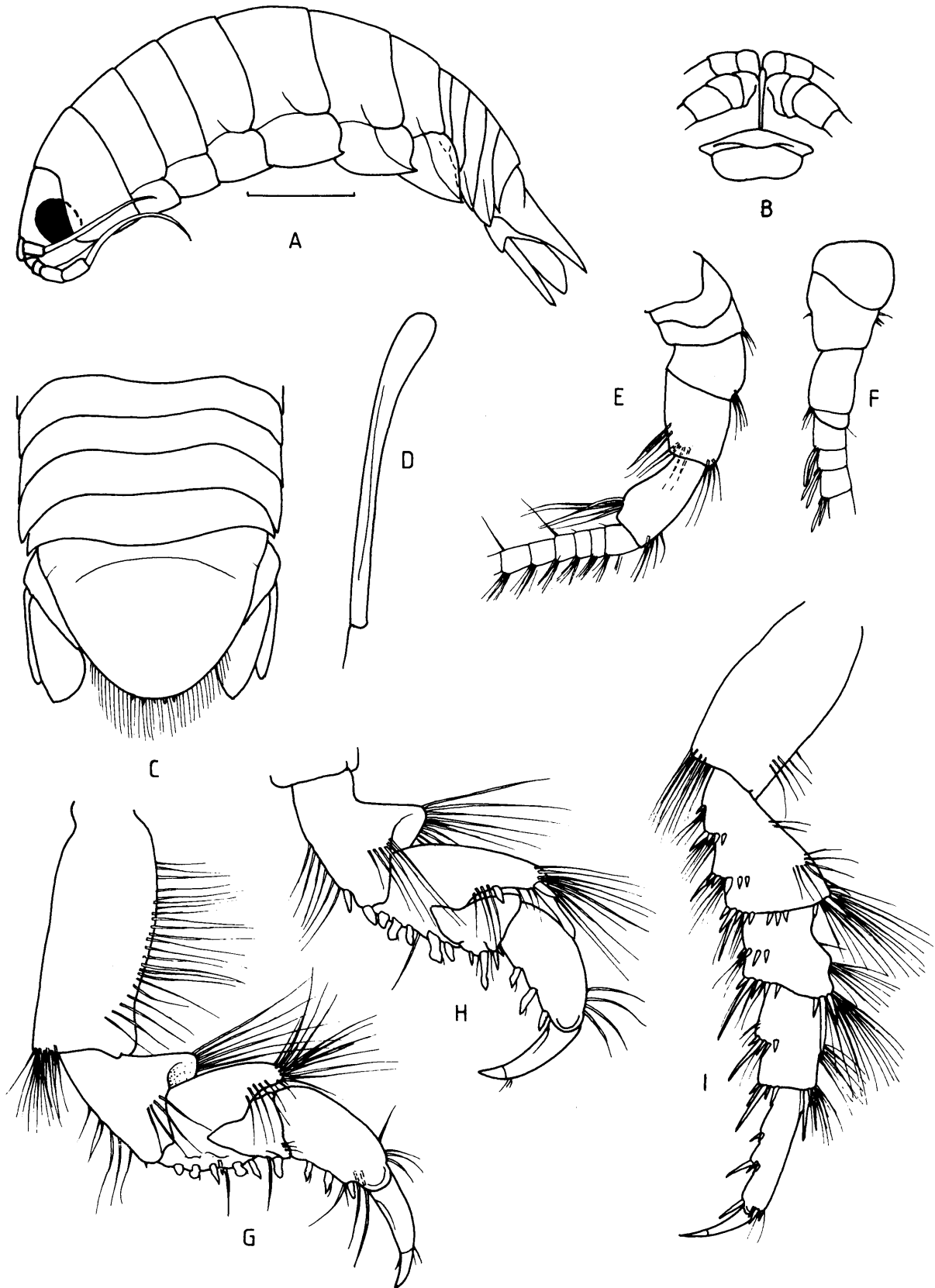


Fig. 31. *Pseudolana menertae* n. sp. A, B, holotype; C, female 7.9 mm; remainder male paratype. A, lateral view; B, clypeal region; C, pleon and pleotelson; D, appendix masculina; E, antennal peduncle; F, antennule peduncle; G, pereopod 1; H, pereopod 2; I, pereopod 7. Scale 1.0 mm.

2, both margins with setae. Endopod lateral margin convex, with setae along distal half only, provided with 3 spines, medial margin entirely setose, with 3 spines.

Female. Similar to male except for sexual characters. Apparently reaching somewhat larger size. Pleon of females slightly longer, and antenna flagellum articles not as setose.

Colour. In alcohol, white with sparse black chromatophores.

Size. Largest male 6.0 mm, largest female 7.9 mm, largest manca 3.7 mm.

Remarks. This species is the most similar to *Pseudolana brevifimbria*. It is readily separated from that species by a longer and spatulate appendix masculina, lateral margins of pleonite 3 being produced, and by the very different shape setation and spination of the uropodal endopod. *Pseudolana ovalis* is similar, but has a shorter appendix masculina, and far fewer setae on the pereopods.

Distribution. Known only from the Cobourg Peninsula, NT.

Etymology. From *menarte*, an Aboriginal word meaning blunt, and alludes to the shape of the appendix masculina.

Natatolana Bruce

Natatolana Bruce, 1981b: 957, figs 1d,e; 2c,d; 3e,f; 4c, 5c,d.

Type species. *Cirolana hirtipes* Milne-Edwards, 1840, by designation (Bruce, 1981b). Types held by the Muséum Nationale d'Histoire Naturelle, Paris, Is. 93.

Diagnosis. Antennule peduncle article 3 longest. Antenna peduncle articles 3–5 subequal in length and

longest. Frontal lamina narrow, about 3.5 times as long as wide. Maxilliped endite with 2–3 coupling hooks. Pereopods 1–3 with anterodistal margins of ischium and merus produced, provided with long setae. Pereopods 5–7 with basis markedly flattened, provided with long setae, other articles flattened. Pleopod 1 endopod greater than half width of exopod; pleopod 5 endopod without setae, other pleopods with both rami setose; appendix masculina inserted basally or sub-basally.

Additional characters. Body about 2.5–3 times as long as broad, smooth, without ornamentation. Pleonite 5 with lateral margins encompassed by pleonite 4. Pleotelson usually with abundant marginal setae amongst which are set spines.

Antennule peduncle and flagellum short, flagellum rarely extending beyond posterior margin of cephalon. Frontal lamina ventral surface usually flat; clypeus sessile. Mandible incisor with posterior cusp prominent. Maxillule and maxilla entire. Maxilliped relatively slender. Pereopod 1–3 ambulatory. Dactyls without secondary unguis. Penes usually absent. Pleopods with peduncle broader than long, lateral margin provided with small lobe, rami similar, not elongate; appendix masculina extending a little beyond end of inner ramus. Uropod rami with marginal plumose setae, usually provided with spines; peduncle medial margin produced.

Sexual dimorphism. Virtually no variation other than of sexual characters. Females tend to be larger.

Remarks. The genus *Natatolana* is one of the most readily recognised of the marine genera. The dorsal surfaces are smooth, polished in appearance, and never show any form of sculpting. The flattening of the basis of the posterior pereopods, and the presence of

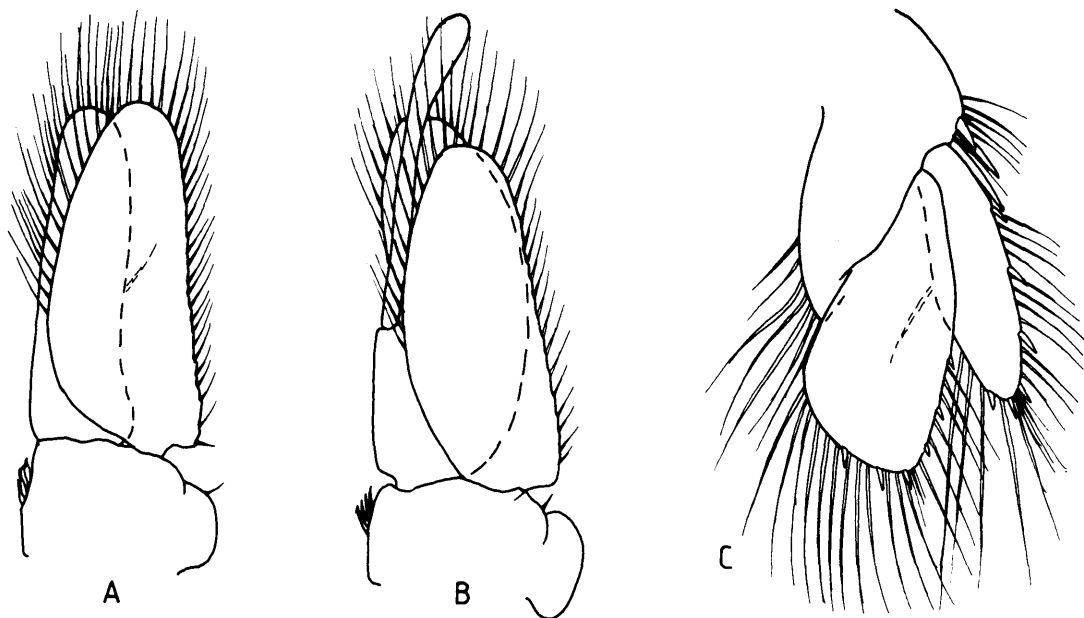


Fig. 32. *Pseudolana menertae* n. sp., male paratype. A, pleopod 1; B, pleopod 2; C, uropod.

abundant, long, natatory setae allows for instant identification. Two genera may be confused with *Natatolana*. The genus *Dolicholana* has similar pereopods, but the frontal lamina structure is very different, and also the endopods of pleopods 3–5 are naked. The genus *Politolana*, which has several characters similar to *Natatolana*, differs in lacking the expanded, setose basis on the posterior pereopods. The appendix masculina of *Politolana* arises sub-medially rather than basally as in *Natatolana*. The genus *Politolana* is discussed by Bruce (1981b).

Three species do not agree entirely with the genus description given here. *Natatolana karkarook* differs in several mouthpart characters. These differences are discussed under the remarks for that species. *Natatolana endota* and *N. prolixa* are clearly related to one another, and are distinguished from others in the genus by having a very acute pleotelson apex, and an extremely long antennal flagellum. The mouthparts of these two species approach those of *N. karkarook*.

Hansen (1890, 1905) first recognized that the species now placed in the genus *Natatolana* formed a group characterised by having a narrow frontal lamina, and pereopods with long natatory setae. Hansen (1905) also commented on the close similarity of the various species to each other, and that great care was needed in determining species identity. The uniformity in appearance of the species led to an appraisal of the species of this group, which left no doubt that a genus should be established (Bruce, 1981b) to contain them. This genus is large, with a total of fifty-four species at the time of writing. This is second in number of species to *Cirolana*. In Australia, *Natatolana* is the largest genus.

The genus is the most widespread of the family, and has more representatives in temperate and cold temperate waters than do other genera. All species are subtidal, and some have been taken at depths in excess of 2,000 metres (Hansen, 1905). Occasional specimens are taken in pools on sand flats at low tide.

Key to Species Groups within *Natatolana*

This key is intended as an aid in identifying species of the genus. At present, six species do not show any particular affinity to these groups. It should be obvious that these species do not belong once comparisons are made to species of the group. The characters of the group are summarised after the key.

1. Pleotelson with distinct dorsal depression. *N. pellucida* group
- Pleotelson without dorsal depression. 2
2. Basis of pereopod 7 narrow; posterolateral margin of pleonite 4 acute. *N. valida* group

—Basis of pereopod 7 broad, posterolateral margin of pleonite 4 rounded. 3

3. Posterior margin of pleotelson rounded. *N. albicaudata* group

—Posterior margin of pleotelson converging to a narrow apex. *N. woodjonesi* group

***Natatolana pellucida* group.** Coxal plates usually with entire furrows; lateral margin of pleonite 3 barely produced; pleotelson with distinct dorsal depression, posterior two thirds flat; pereopod 2 without spines on palm of propodus, pereopod 7 with basis narrow, margins straight. Males with flattened penes on sternite 7. Australian species of this group are *N. pellucida*, *N. corpulenta*, *N. longispina* n. sp., *N. galathea* n. sp., and *N. laewilla* n. sp.

***Natatolana valida* group.** Eyes narrow; coxal plates with furrows feeble or absent; pleonites 3–4 with posterolateral margins acute; pleotelson with posterior margin broad, generally with 8 or more stout spines; palm of pereopod 2 with spines, pereopod 7 with basis broadening distally, margins nearly straight. A further feature of these species are their large size, usually 20–30 mm in length. Australian species of this group are *N. valida*, *N. arcicauda*, *N. lurur* n. sp., *N. matong* n. sp. and *N. thurar* n. sp. Two other species can be placed in this group, *N. rossi* and *N. hirtipes*.

***Natatolana albicaudata* group.** Frontal lamina straight-sided, rounded anteriorly; pleotelson with posterior margin broadly rounded; basis of pereopod 7 broad, but scarcely sinuate; pereopod 2 with spines on palm of propodus. Otherwise similar to the *N. woodjonesi* group. Australian species of this group are *N. albicaudata* and *N. amplocula* n. sp. *Natatolana curta* Richardson fits readily into this group.

***Natatolana woodjonesi* group.** Coxal furrows on all coxae, all incomplete; posterolateral margins of pleonite 3 short, 4 rounded; pleotelson without dorsal depression, apex narrow; palm of pereopod 2 without spines; basis of pereopod 7 broad, anterior margin sinuate. Australian species of this group are *N. woodjonesi*, *N. luticola*, *N. tenuistylis*, *N. variguberna*, *N. angula* n. sp., *N. arrama* n. sp., *N. bulba* n. sp., *N. kahiba* n. sp., *N. nammuldi* n. sp., *N. thalme* n. sp., *N. wowine* n. sp. and *N. wullunya* n. sp.

The species which show no particular affinity to these groups are *N. endota* n. sp., *N. prolixa* n. sp., *N. vieta*, *N. bowmani* n. sp., *N. boko* n. sp. and *N. gorung* n. sp. *Natatolana karkarook*, whilst not belonging to any group, is obviously closer to the *woodjonesi* group.

Key to Australian Species of *Natatolana*

1. Pleotelson with distinct dorsal depression. 2
 —Pleotelson without dorsal depression. 7
2. Antennal flagellum extending to, or beyond pleon. *N. vieta*
 —Antennal flagellum not reaching pleon. 3
3. Posterior margin of pleotelson serrate. *N. galathea*
 —Posterior margin of pleotelson not serrate. 4
4. Coxal plates without furrows. *N. laewilla*
 —Coxal plates with furrows. 5
5. Lateral margins of pleotelson sinuate. *N. corpulenta*
 —Lateral margins of pleotelson convex. 6
6. Posterior margin of pleotelson acute. *N. pellucida*
 —Posterior margin of pleotelson broad. *N. longispina*
7. Antennal flagellum extending beyond pleotelson. 8
 —Antennal flagellum not reaching pleon. 9
8. Lateral margins of pleotelson straight, apex acute with 4 spines. *N. endota*
 —Lateral margin of pleotelson sinuate, apex acute, without spines. *N. proluxa*
9. Labrum with acute laminar projection. *N. karkarook*
 —Labrum flat. 10
10. Propodal palm of pereopod 2 with 1 or more spines. 11
 —Propodal palm of pereopod 2 without spines. 19
11. Sternite 7 of male with penial processes. *N. bowmani*
 —Sternite 7 of male without penial processes. 12
12. Uropodal exopod distinctly shorter than endopod. 13
 —Uropodal rami subequal in length. 14
13. Frontal lamina broadest anteriorly. *N. gorung*
 —Frontal lamina straight sided. *N. lurur*
14. Cephalon without median rostral process. *N. valida*
 —Cephalon with rostral process. 15
15. Pleonite 3 with posterolateral margins produced, acute. 16
 —Pleonite 3 with posterolateral margins not acute. 18
16. Lateral margins of frontal lamina concave. *N. matong*
 —Lateral margins of frontal lamina straight. 17
17. Pleonite 4 with posterolateral margins acute. *N. thurar*
 —Pleonite 4 with lateral margins blunt. *N. arcicauda*
18. Eyes moderate in size. *N. albicaudata*
 —Eyes large in size. *N. amplocula*
19. Pleotelson margins sinuate without spines. *N. boko*
 —Pleotelson lateral margins convex with spines. 20

20. Uropodal endopod with prominent lateral excision. *N. variguberna*
 —Uropodal endopod without lateral excision. 21
21. Pleotelson posterior margin with 4 spines. 22
 —Pleotelson posterior margin with 6 or more spines. 24
22. Uropodal exopod distinctly shorter than endopod. *N. kahiba*
 —Uropodal rami subequal in length. 23
23. Basis of pereopod 7 half as wide as long. *N. thalme*
 —Basis of pereopod 7 more than half as wide as long. *N. woodjonesi*
24. Posterior margins of pleotelson straight, abruptly angled. *N. luticola*
 —Posterior margins of pleotelson smoothly curved. 25
25. Lateral margin of uropodal exopod without spines. 26
 —Lateral margin of uropodal exopod with spines. 27
26. Margins of basis of pereopod 7 strongly convex. *N. arrama*
 —Anterior margin of basis of pereopod 7 with medial part straight. *N. bulba*
27. Frontal lamina slender. 28
 —Frontal lamina medially constricted. 29
28. Pleotelson with 12 spines. *N. angula*
 —Pleotelson with 6 spines. *N. wullunya*
29. Ventrolateral angle of pleonite 2 formed into acute, curved process. *N. tenuistylis*
 —Ventrolateral angle of pleonite 2 not produced. 30
30. Lateral margin of uropodal endopod sinuate. *N. nammuldi*
 —Lateral margin of uropodal endopod convex. *N. wowine*

Natatolana vieta (Hale)

Figs 33, 34

Cirolana vieta Hale, 1925: 150, fig. 11.—1929b: 249, fig. 242; 1940: 288, fig. 1; Nierstrasz, 1931: 157.

Natatolana vieta.—Bruce, 1981b: 958.

Material examined. 2 females (18.2 mm, 1 broken), off Broken Bay, Sydney, NSW, 32°52'S, 152°32'E, 6 Dec. 1978, 144.5 m, coll. B. Rudman, P. Coleman, K. Handley. Manca (4.1 mm), CSIRO Stn G3/175/62, 33°03'S, 154°44'E, 10 Aug. 1962, 156 m, coll. L.R. Thomas. Western Port Bay, Vic., Crib Point, CPBS, Stns: 31E, 3 males (18.0, 11.2, 8.8 mm), manca (8.4 mm); 32E, manca (4.4 mm); 35S, male (12.6 mm), 3 mancas (6.9, 5.0, 5.5 mm); 42N, manca (8.5 mm); 600, manca (5.0 mm); 51N, manca (8.5 mm). Western Port Bay, WBES Stns: 1733, manca (5.8 mm); 979S, broken female. Male (13.8 mm), 3 females (27.7, 25.0, 23.6 mm), SA, 29 Apr. 1978, from school shark, spiral valve, coll. J. Andersen. Manca (5.8 mm), north of Northtown, northern Tas., 10 June 1971, 33.8 m, coll. Sea Fisheries Division. Male (12.6 mm), north of Rottneest Is., WA, 19 Nov. 1962.

Types. South Australian Museum, C278.

Type locality. Encounter Bay, SA.

Descriptive notes. Hale (1925) gave a detailed description which was later slightly expanded (Hale, 1940).

Eyes distinctly narrower anteriorly. Pleon with posterolateral extensions of pleonite 1 and 2 each with 2 distinct spiniform processes; pleonite 2–3 with impressed line. Pleotelson with strong dorsal depression, posterior margin forming point, posterior margin with 4 spines. Frontal lamina narrow, slightly dilated anteriorly, forming an acute point, ventral surface distinctly carinate. Clypeus with 1 median and 2 lateral carinae; labrum with lateral part depressed. Mandible incisor with strongly developed posterior tooth.

Variation. The largest specimens clearly show the pattern of furrows, sculpted clypeus and elongate pleon with a markedly depressed pleotelson. The mancas do not have such distinct characters and are broader in body shape. The smaller specimens can be recognised by the depressed pleotelson and the shape of the uropods. The pleotelsonic depression in smaller individuals lacks the median projection, and the two sub-lateral ridges are less clearly developed.

Sexual variation. Males have longer antennae and narrower body shape.

Size. Largest specimen, female, 27.7 mm. Largest manca 8.5 mm.

Remarks. The wrinkled character of the dorsal

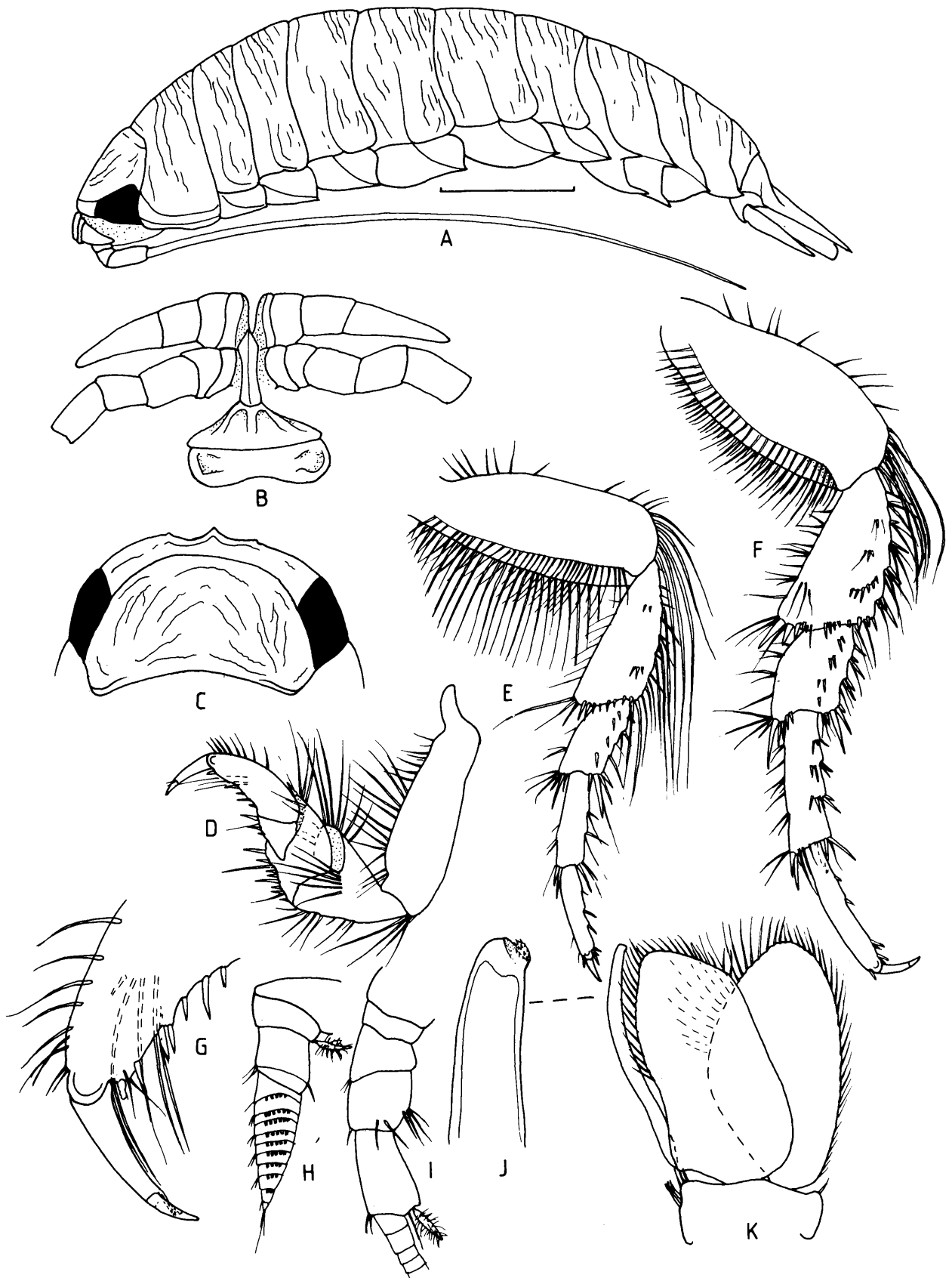


Fig. 33. *Natatolana vieta*. B, male 18.0 mm; remainder male 12.6 mm, WP. A, lateral view; B, clypeal region; C, dorsal surface, cephalon; D, pereopod 1; E, pereopod 7; F, pereopod 6; G, pereopod 1, dactylus; H, antennule; I, antennal peduncle; J, appendix masculina, apex; K, pleopod 2. Scale 3.0 mm.

surfaces of this species at once distinguish it from all others of the genus. These "wrinkles" tend to be more developed in larger specimens. Specimens without the impressed lines can be recognized by the sculpture of the frontal lamina, clypeus and pleotelson, and by the shape of the pleotelson, uropods and lateral margin of the pleon segments. The median longitudinal carina of the pleotelson described by Hale (1940) is absent in all

but one specimen where it is feebly developed.

Distribution. South Australia: Encounter Bay (Hale, 1925), Seaford Bay and south to St Francis Island (Hale, 1940). Present material from Sydney, NSW, Port Phillip Bay, Vic., and Rottnest Island, WA, at depths from 16 metres in Port Phillip Bay to 156 metres off Sydney.

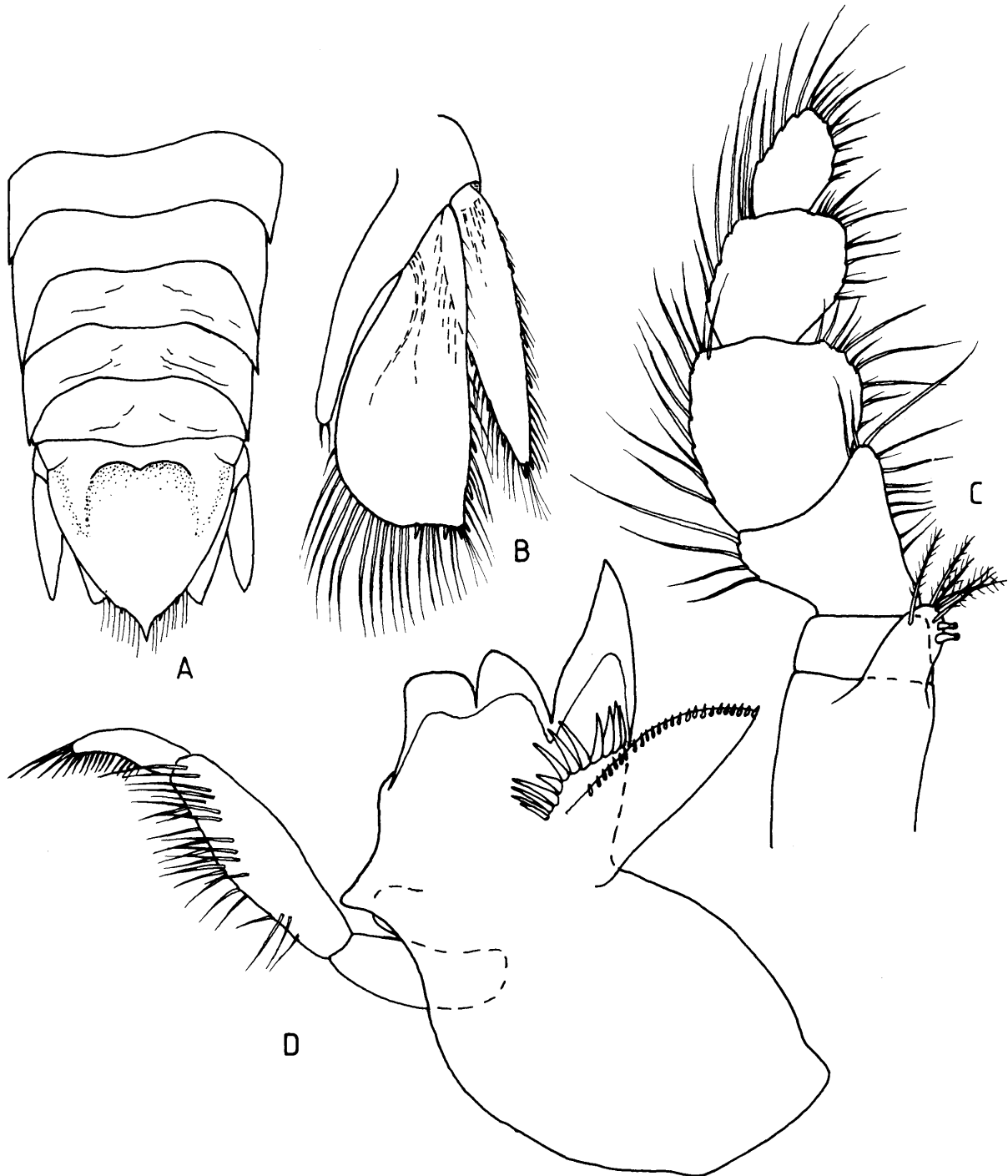


Fig. 34. *Natatolana vieta*. A, male 10.0 mm; remainder male 12.6 mm, WP, Vic. A, pleotelson; B, uropod; C, maxilliped; D, mandible.

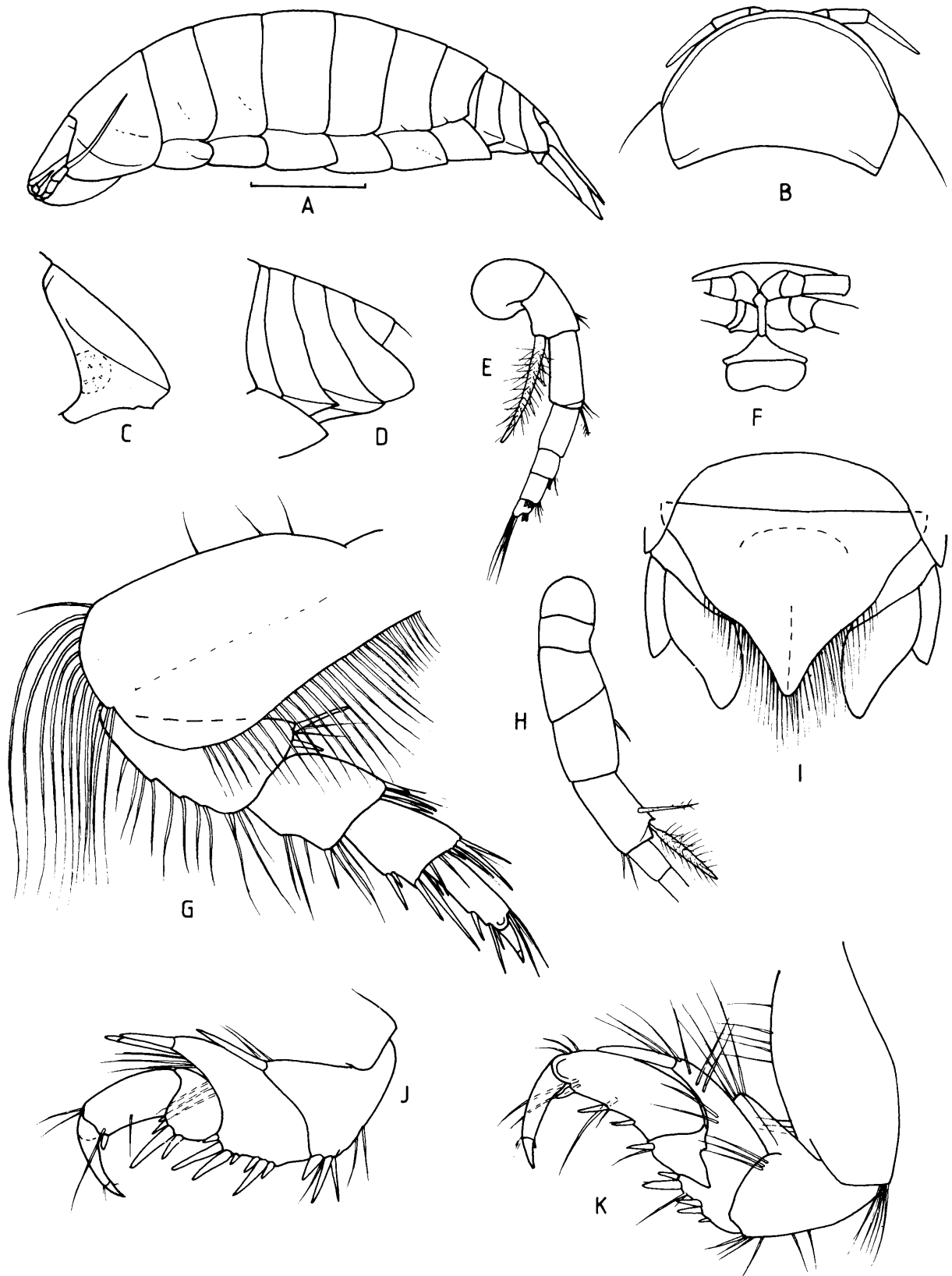


Fig. 35. *Natatolana boko* n. sp. A-D, F, I holotype; remainder paratype. A, lateral view; B, cephalon, dorsal view; C, cephalon, lateral view; D, pleon, lateral view; E, antennule; F, clypeal region; G, pereopod 7; H, antennal peduncle; I, pleotelson and uropods; J, pereopod 3, distal articles; K, pereopod 1. Scale 1.0 mm.

Natatolana boko n. sp.

Figs 35, 36

Material examined. 2 males (5.2, 5.0 mm), 25 miles east of Lady Musgrave Is., Qld, 23°44'S, 152°49'E, 17 Nov. 1977, 357–384 m, shelly grey ooze with forams, coll. F. Rowe & P. Colman.

Types. Holotype, male (5.2 mm) AM P32173; paratype, AM P30382.

Type locality. East of Lady Musgrave Island, Qld, 23°44'S, 152°49'E.

Description of male. Body about 2.5 times as long as wide. Cephalon anterior margin smoothly rounded, rostral point absent. Eyes vestigial; submarginal furrow runs entire length of cephalon. Pereonite 1 with single horizontal furrow. Coxal plates without carinae or impressed lines except for those on pereonite 2 which have faint incomplete lines. Pleonite 1 largely concealed by pereonite 7; pleonite 5 with posterolateral margin produced posteriorly, partially concealing peduncle of uropod in lateral view, without longitudinal furrows. Pleotelson lateral margins markedly sinuate, apex narrow, rounded; posterior half with numerous close-set plumose setae and no spines; anterior dorsal surface

with depression, posterior half formed with acute ridge, visible in angled view, but not from perpendicular.

Antennule peduncle articles 1–2 subequal in length, article 2 with large sensory seta, extending beyond article 3 of peduncle; flagellum short, not reaching pereonite 1, composed of 4 articles, first of which is longest. Antenna flagellum with 12 articles, extending to posterior of pereonite 1.

Frontal lamina with posterior two thirds straight sided, anterior one third formed into acute rhomboid. Maxilliped palp articles 2–3 fused or very nearly so; endite with 2 coupling hooks.

Pereopod 1 with prominent spine on anterodistal angle of merus; posterior margin of merus with 5 spines, carpus with 1 spine and propodus with 2 spines on palm, and 1 opposing dactylus. Pereopods 2 and 3 similar to 1, but anterodistal angle of ischium and merus with additional spines, and additional and longer spines on posterior margins of ischium, merus and carpus; propodus without spines on palm. Pereopod 7 posterior margin of basis straight, almost without setae, anterior margin setose; posterior margin of merus, carpus and propodus with spines, ischium with setae only; anterior margins of ischium to propodus with spines at distal angles.

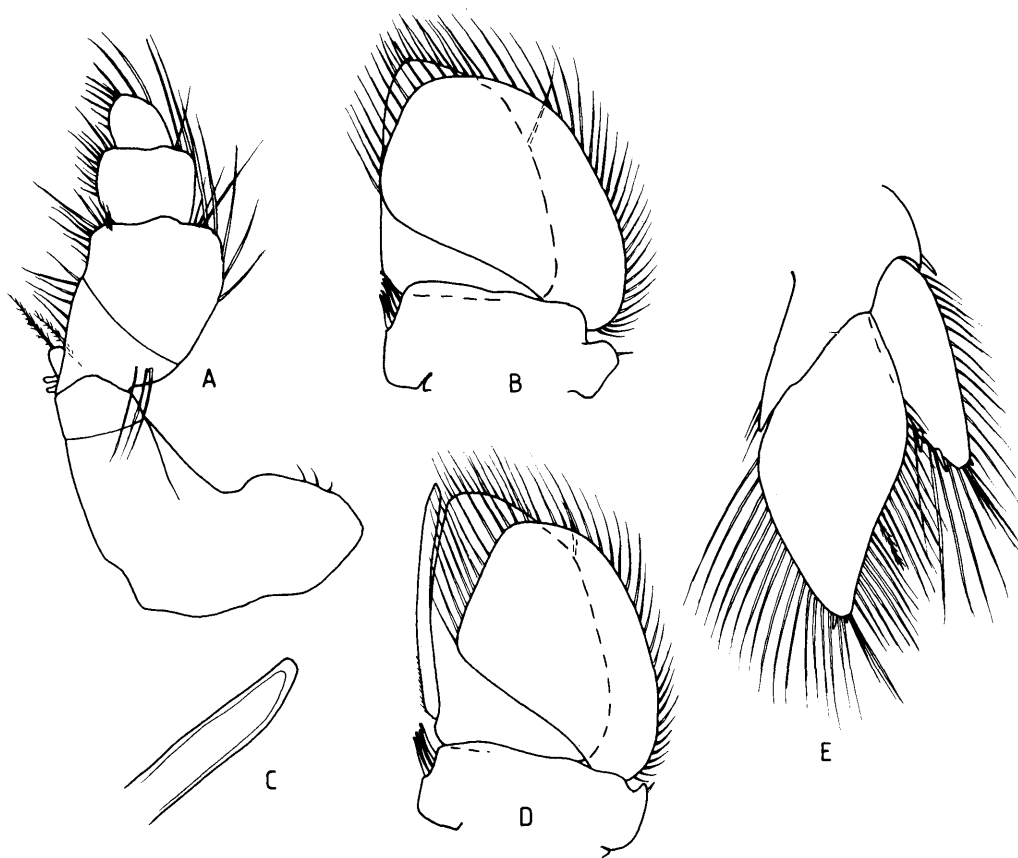


Fig. 36. *Natatolana boko* n. sp., paratype. A, maxilliped; B, pleopod 1; C, appendix masculina, apex; D, pleopod 2; E, uropod.

Vasa deferentia opening flush to surface of sternite 7.

Rami of pleopods 1–2 of approximately equal width. Appendix masculina very slightly curved, extending just beyond tip of endopod. Exopods of pleopods 3–5 without suture. Uropods extending beyond apex of pleotelson. Endopod medial margin smoothly curved, with numerous close setae and 2 subapical spines, lateral margin strongly sinuate, setose for distal two thirds of margin. Exopod two thirds as long as endopod, both margins convex, setose, lateral with single apical spine, medial with 2 spines.

Female. Not known.

Size. Holotype, 5.2 mm.

Colour. Pale brown in alcohol, chromatophores not visible.

Remarks. This species is easily recognised by its flat cephalon without a rostral point, and by the unusual form of the pleotelson and uropods. The eyes appear to be effectively absent, but very faint traces of ocelli are discernable.

Distribution. Known only from the type locality.

Etymology. *Boko* is an Aboriginal word meaning blind.

Natatolana bowmani n. sp.

Fig. 37

Material examined. Male (13.1 mm), 6 manca (4.4–5.0 mm), east of Port Jackson, NSW, 33°32'S, 152°08'E, 10 Dec. 1980, 892–900 m, coll. R. Springthorpe & P. Coleman. Male (13.8 mm), 2 females (8.7, 9.8 mm), east of Port Jackson, NSW, 33°36'S, 152°05'E, 10 Dec. 1980, 1090–1125 m, sledge dredge, coll. R. Springthorpe & P. Coleman. 3 males (9.5, 10.2, 10.7 mm), 4 females [6.9, 10.7, 10.8 (crushed), 14.0 mm ovig.], 4 manca (4.5, 4.9, 5.0, 5.6 mm), east of Port Jackson, NSW, 33°38'S, 152°03'E, 10 Dec. 1980, 880–909 m, sledge dredge, coll. R. Springthorpe & P. Coleman. 2 females (10.0, 13.2 mm), 4 manca (4.0, 5.2, 5.5, 5.8 mm), east of Port Kembla, NSW, 34°27'S, 151°27'E, Dec. 1976, 1200 m, coll. J.K. Lowry.

Types. Holotype, AM P33555; paratypes, AM P31573–P31576, P31905.

Type locality. East of Port Jackson, NSW, 33°36'S, 152°05'E.

Description of male. Body about 2.5 times as long as wide. Cephalon with small rostral point, distinct furrow running from medial margin of each eye; distinct furrow. Eyes vestigial, faint traces of unpigmented ocelli visible. All coxae with complete furrow. Pleonites 1–2 with lateral margins not produced; pleonite 3 with lateral margin slightly produced; pleonite 4 with lateral margins encompassing pleonite 5. Pleotelson with posterior two thirds of dorsal surface distinctly flat, lateral margin smoothly curving to apex on either side of which lie 2 spines set amongst plumose marginal setae.

Antennule peduncle article 2 three quarters length of article 1; long sensory spine at posterodistal angle;

flagellum composed of 10 articles, first of which is longest. Antenna with flagellum of 19 articles, extending to pereonite 3.

Frontal lamina dilated anteriorly, about 4 times as long as wide.

Pereopod 1 slender; merus with 1 spine and abundant setae on anterodistal margin, posterior margin with about 6 acute spines; carpus with 3 acute spines; propodus with 3 acute spines on proximal half of palm and small spine opposing dactylus. Pereopods 2–3 similar to 1, but carpus proportionally longer, posterior margins of ischium, merus and carpus with more abundant and longer spines; propodus with single stout spine on palm. Pereopod 7 slender, basis with posterior margin slightly convex, anterior margin nearly straight, ischium with setae on both margins, slender spines on posterior margins and distal angles; merus and carpus with abundant spines along posterior margins and at distal angles.

Penes present on sternite 7 as 2 well separated flattened lobes.

Pleopod 1 with exopod distal margin very nearly truncate; pleopod 2 appendix masculina arising sub-basally, smoothly curving in towards ramus, only just exceeding apex of endopod. Pleopods 3–5 with feeble trace of transverse suture across exopods. Uropods extending slightly beyond apex of pleotelson. Peduncle similar to others of genus in shape, but medial margin comparatively short. Exopod distinctly shorter than endopod, both margins with fringing setae; lateral margin with 5 spines, medial with 3. Endopod lateral margin very slightly sinuate, with 3 short spines and short marginal setae; medial margin with 5 spines and long setae.

Female. Similar to the male, but pereon slightly broader.

Colour. Yellowish grey in alcohol. Chromatophores not apparent. Eyes with vestigial ocelli appearing white.

Size. Males up to 13.8 mm, females up to 14.0 mm, largest manca 5.8 mm.

Remarks. This species shows no particular affinity for any of the species groups within the genus. The morphology of the cephalon most closely approaches that of *Natatolana gorung*, but the morphology of the pereopods is more similar to that of the *N. rossi* complex. Characters by which this species can be identified are the lack of obvious eyes, the presence of penes, and the morphology of the pleon, pleotelson, uropods and the male appendix masculina.

Distribution. New South Wales coast between Port Jackson and Port Kembla, at 880–1200 m.

Etymology. The epithet honours Dr Tom E. Bowman of the Smithsonian Institution, reknowned for his contribution to cirrolanid taxonomy.

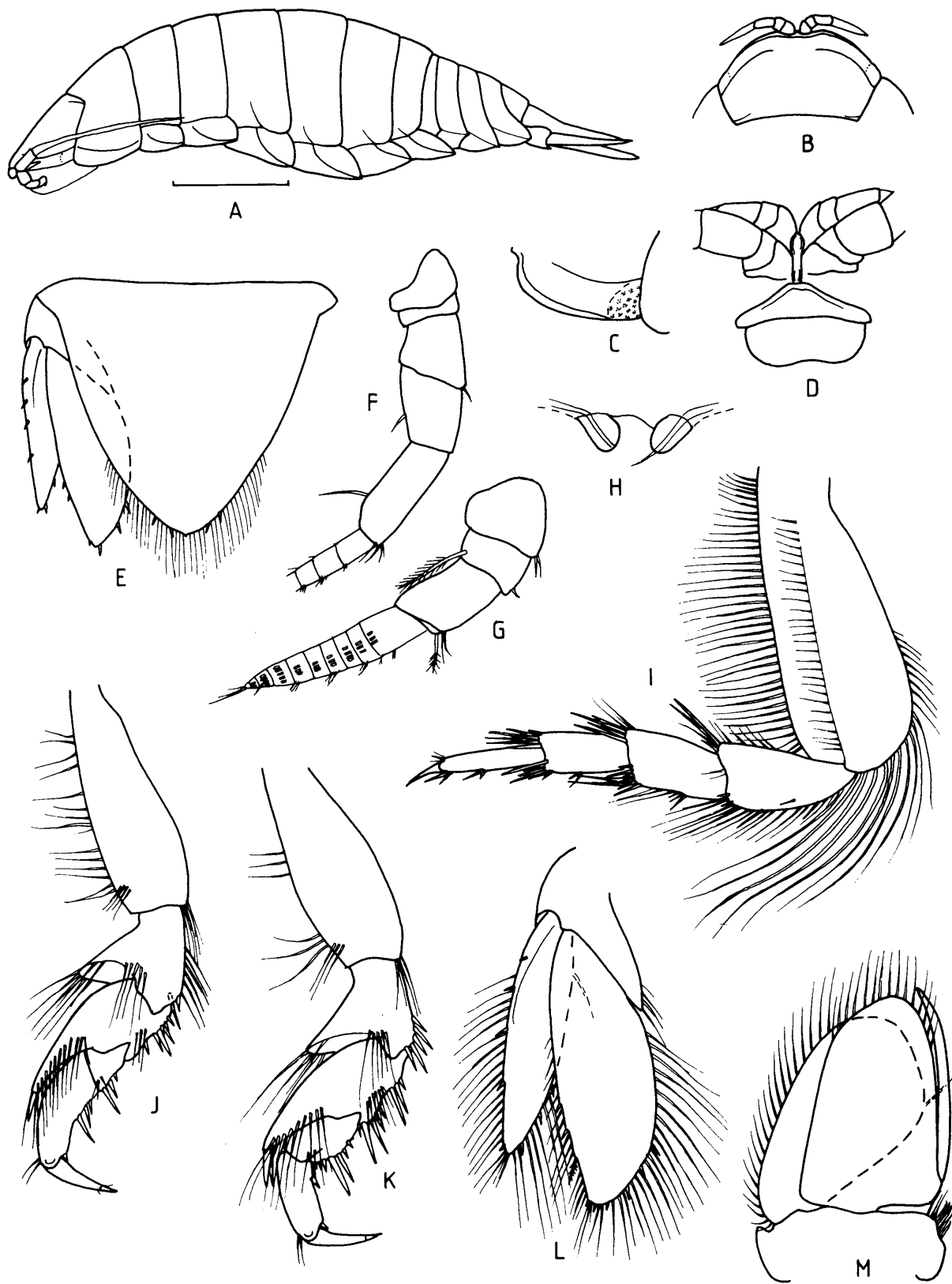


Fig. 37. *Natatolana bowmani* n. sp. A, B, D, E holotype. Paratypes: C, L, 13.5 mm; H, I, M, male 10.7 mm; F, G, J, K, male 13.1 mm. A, lateral view; B, cephalon; C, cephalon, lateral perspective; D, clypeal region; E, pleotelson and uropod; F, antennal peduncle; G, antennule; H, penes; I, pereopod 7; J, pereopod 1; K, pereopod 2; L, uropod; M, pleopod 2. Scale 3.0 mm.

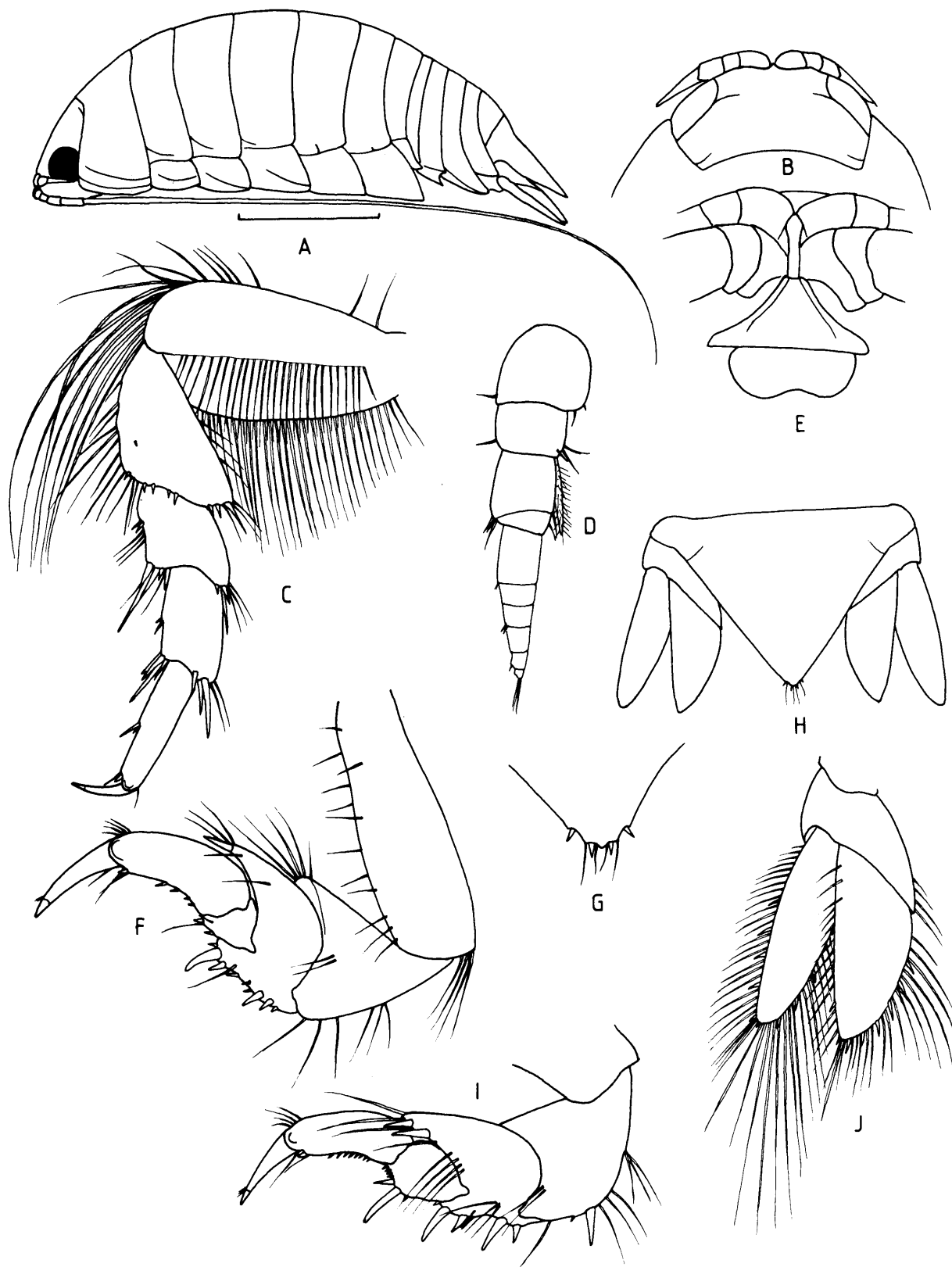


Fig. 38. *Natatolana endota* n. sp., paratype 7.5 mm. A, lateral view; B, cephalon, dorsal view; C, pereopod 6; D, antennule; E, clypeal region; F, pereopod 1; G, pleotelson, apex; H, pleotelson; I, pereopod 3; J, uropod. Scale 2.0 mm.

Natatolana endota n. sp.

Figs 38, 39

Material examined. Male (12.8 mm), female (12.6 mm), Aug. 1929, 10.8 m; female (13.9 mm), Jan. 1930, 9 m, all off Sow and Pigs Shoal, Port Jackson, NSW. Manca (7.5 mm), Stn 16, off Point Corell, northern Tas., 23 m, 10 June 1971, coll. Wesley Vale Offshore Survey, Sea Fisheries Division, Department of Agriculture.

Types. Holotype, male, AM P32172. Paratypes, AM P10693, P10689; TM G1505.

Type locality. Port Jackson, NSW, 33°20'S, 151°16'E.

Description of male. Body strongly vaulted, 2.5 times as long as wide. Cephalon with distinct rostral point; partial furrow running from dorsal margin of each eye. Eyes round in lateral view. Pereonite 1 with 2 lateral furrows. Coxae of pereonites 2-4 with partial furrows, coxae of pereonites 5-6 without furrows. Pleonites all

visible, posterolateral margin of pleonite 3 acute, produced posteriorly, with single longitudinal furrow; posterolateral margin of pleonite 4 acute, less produced than 3, without furrow. Pleotelson little more than two thirds as long as wide, lateral margins straight, converging to form acute apex armed with 4 spines and 4 setae.

Antennule short, peduncle articles 1-3 subequal in length, flagellum longer than peduncle, extending to posterior of eye, composed of 6 articles. Antenna flagellum remarkably elongate, extending beyond telson by one third of body length, composed of about 80 articles.

Frontal lamina straight-sided, expanded anteriorly with blunt, angled anterior margin. Clypeus triangular, broader than labrum. Mandible with moderately narrow incisor, lacinia with 12 stout spines; molar process with about 40 fine teeth. Maxillule with spines on endopod

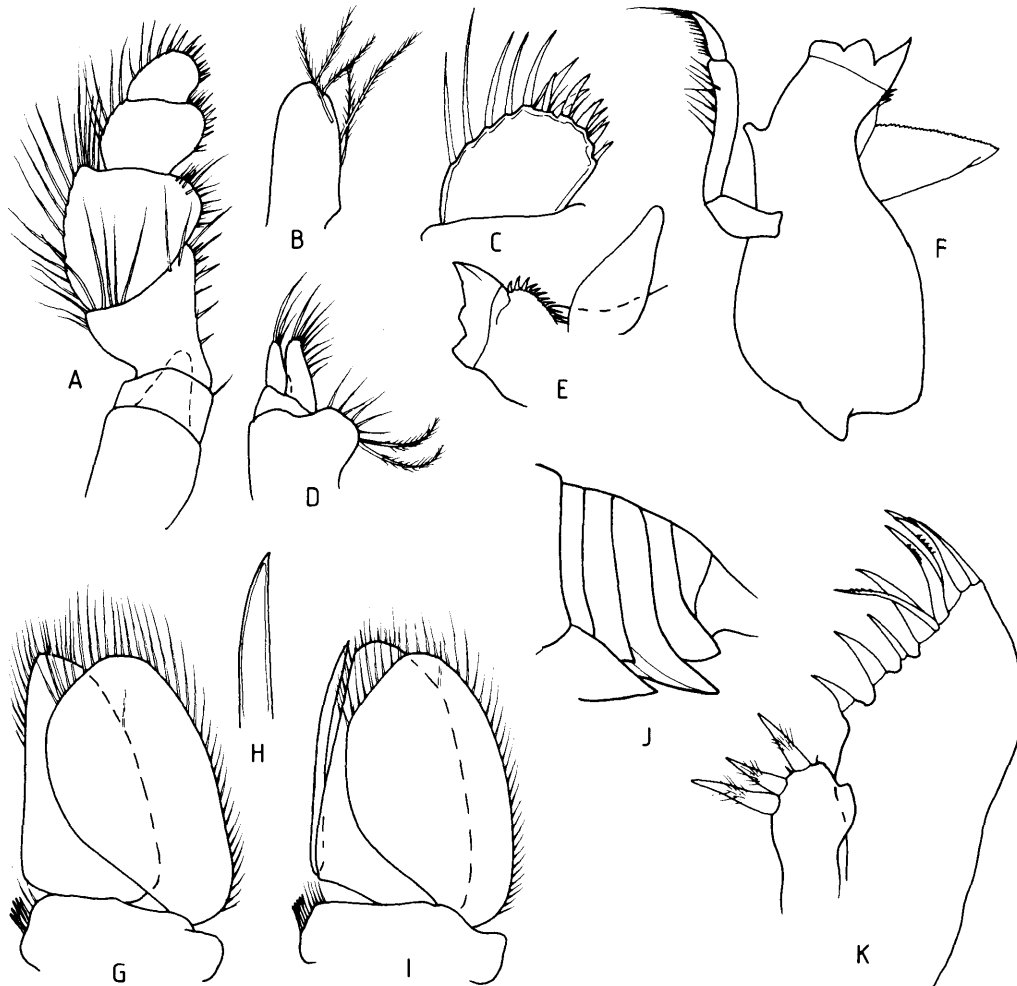


Fig. 39. *Natatolana endota* n. sp., holotype. A, maxilliped; B, maxilliped endite; C, maxilliped palp, terminal article; D, maxilla; E, right mandible, distal part; F, left mandible; G, pleopod 1; H, appendix masculina, apex; I, pleopod 2; J, pleon, lateral view; K, maxillule.

sparsely plumose. Maxilla with 3 and 9 setae on palp and exopod respectively, endopod with 6 simple and 2 long plumose setae. Maxilliped with short setae and spines along medial margin of palp; endite short, with 5 plumose setae and no coupling hooks.

Pereopod 1 with setae along anterior margin of basis; posterodistal angle with group of setae; ischium with anterior margin setose, few setae on posterior margin; merus with 4 large and 5 small spines on posterior margin, anterior margin produced, apex with single stout spine and setae; propodus with 4 small spines on proximal half of palp and single spine opposing dactylus. Pereopods 2 and 3 similar, but with additional spines on all articles except basis; carpus with 2 large spines, row of 4 small spines distal to these; propodus with row of 8 spines on proximal half of posterior margin. Pereopod 7 with remarkably long setae on anterior margin and medial carina of basis, as well as long natatory setae on distal extremity; distal angle of all articles except basis with spines and setae.

Vasa deferentia opening flush to surface of sternite 7.

Appendix masculina not extending beyond apex of endopod. Uropod extending beyond apex of pleotelson, exopod slightly longer than endopod, distal extremity rounded; lateral margin with 5 spines, medial with 4; setae on medial margin very long. Endopod with lateral margin straight, armed with 3 spines amongst marginal setae, medial margin convex, armed with 6 spines and marginal setae.

Female. Similar to male.

Colour. In alcohol, cream.

Size. Up to 13.9 mm.

Remarks. The shape and spination of the pleotelson is unique within the genus. The shape and setation of the uropods is also unusual. Only one species, *N. narica*, has the exopod longer than the endopod, and that species is otherwise very different. The setae on the basis of pereopod 7 are longer, and the number of spines on the propodus of pereopods 2 and 3 is greater than is normal for the genus. In all other species, the propodus of pereopods 2 and 3 have 0–2 spines on the palm, while this species has 8. Only two other species possess long antennal flagellae, *N. vieta* and *N. prolixa*. In the present species, the flagellae are proportionally longer than in *N. vieta*.

The most similar species is *Natatolana prolixa* with which *N. endota* shares numerous points of similarity. Both species have an extremely narrow pleotelson apex, very long antennal flagellum, similar mouthparts, deep coxal plates and a similar pleon morphology.

Distribution. Port Jackson, NSW, and northern Tasmania, in fine sand at 9–23 metres.

Etymology. *Endota* is an Aboriginal word meaning beautiful.

Natatolana prolixa n. sp.

Figs 40, 41

Material examined. Male (21.0 mm), Hay Point, Mackay, Qld, 7 Aug. 1975, fine sand and mud, 15–21 m, coll. Milligan.

Types. Holotype, QM W6738.

Type locality. Off Hay Point, Mackay, Qld, 21°17'S, 149°18'E.

Description of male. Body about 2.5 times as long as wide. Cephalon with small median rostral process; dorsal interocular furrow incomplete. Coxal plates deep, only those of pereonites 2–3 with furrow. Lateral margins of pleonites 1–2 not produced, those of pleonite 3 strongly produced, those of pleonite 4 acute, curving dorsally. Pleotelson totally without spines or setae, lateral margins slightly sinuate, converging rapidly to extremely acute point.

Antennal flagellum extending beyond pleotelson by nearly half its length, composed of about 95 articles. Frontal lamina narrow, pentagonal; clypeus with medial part strongly produced. Mandible moderately narrow, molar process large, with about 78 fine teeth. Maxillule with 12 stout spines on gnathal surface of exopod, endopod with 4 robust, sparsely plumose spines. Maxilliped with medial margins of palp articles 2–5 provided with stiff setae; endite without coupling hooks.

Pereopod 1 with setae along anterior margin of basis and along submarginal furrow; merus with spine at anterodistal angle, and 10 spines, 6 large, along posterior margin; carpus with 2 spines on posterior margin; propodus with 5 short spines on palm, and 6th spine opposite dactylus. Pereopods 2 and 3 similar, with more and larger spines than pereopod 1, except propodus which has only 2 spines on palm. Pereopod 7 with posterior margin of basis convex, anterior margin sinuate, all margins setose, remaining articles generally with few spines.

Vasa deferentia opening flush with surface of sternite 7.

Pleopod 1 peduncle with 8 coupling hooks; appendix masculina straight, tapering gradually towards apex, not extending beyond ramus. Uropod peduncle with medial margin of strongly produced, ventrolateral margin with 4 spines and several setae. Exopod rounded, paddle shaped, lateral margin with 3 small spines, medial margin with 2, all margins setose. Endopod lateral margin nearly straight, with setae along distal two thirds of its length, medial margin smoothly curved, with 6 stout spines set amongst marginal setae.

Female. Not known.

Colour. Pale brown in alcohol.

Size. 21.0 mm.

Remarks. This species is easily identified by the acutely narrow apex of the pleotelson, which totally lacks setae and spines. Other characters that aid in identification of this distinctive species include the extreme length of the antennal flagellum, the shape of the clypeus, frontal lamina and the rounded uropods.

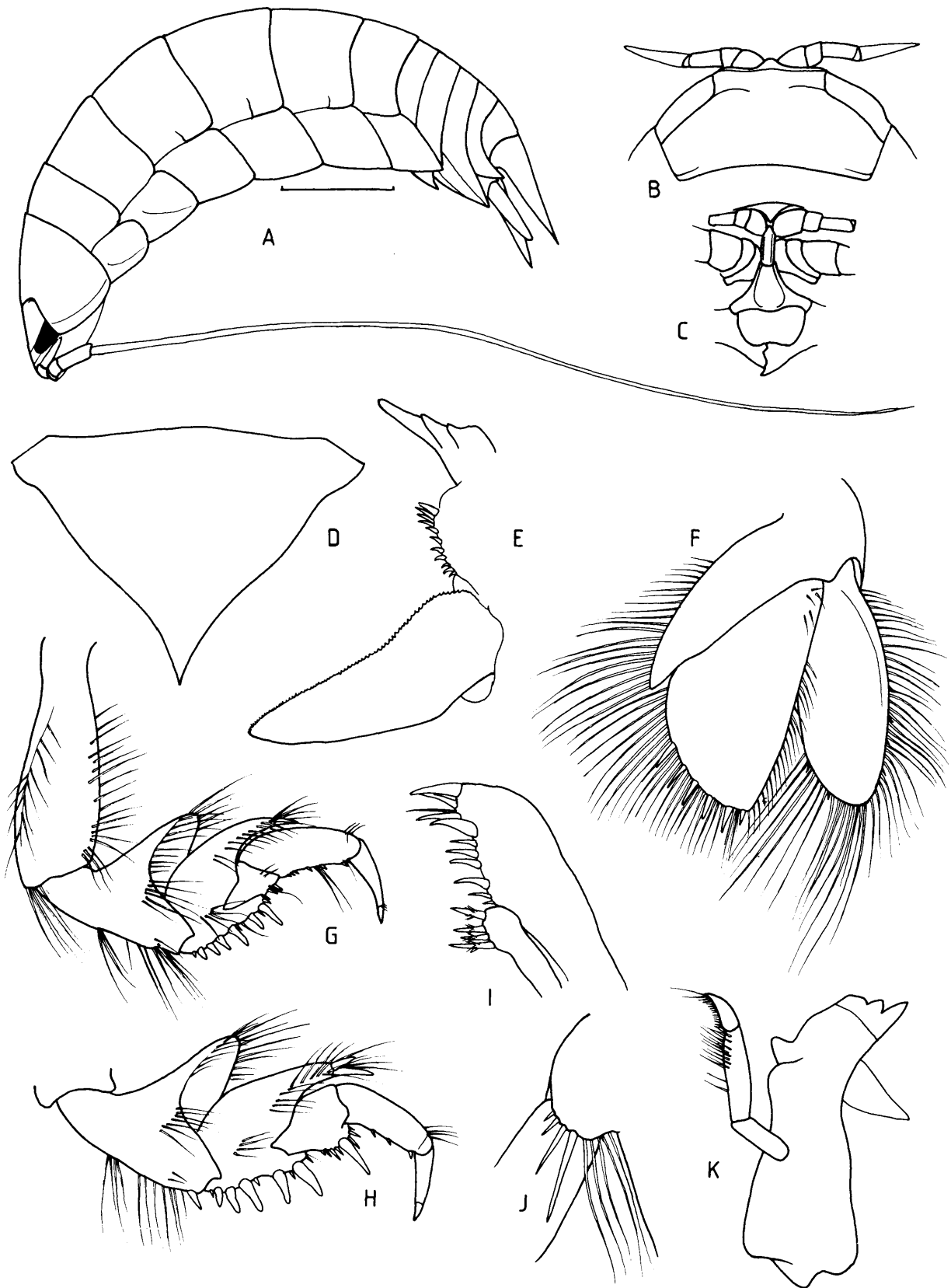


Fig. 40. *Natatolana prolixa* n. sp., holotype. A, lateral view; B, dorsal view, cephalon; C, clypeal region; D, pleotelson; E, mandible, molar process and lacinia mobilis; F, uropod; G, pereopod 1; H, pereopod 2; I, maxillule; J, uropod peduncle, ventral view; K, mandible. Scale 4.0 mm.

Distribution. Known only from the type locality.

Etymology. The epithet is the Latin word meaning long, stretched out, and refers to the length of the antennal flagellum.

Natatolana gorung n. sp.

Figs 42, 43

Material examined. Female (18.6 mm), 33°58'S, 151°17'E, east of Malabar, Sydney, NSW, 26 June 1973, 66 m., coll. AMSBS. Male (14.5 mm), Stn 983, Port Phillip Bay, Vic., 11 Oct. 1971, 19 m, bottom 90% sand, coll. Marine Pollution Studies Group.

Types. Holotype, male, NMV J1340; paratype, AM P24324.

Type locality. Port Phillip Bay, Vic., 38°19'S, 144°47'E.

Description of female. Body about 3 times as long as wide; cephalon with small rostral point, and strongly developed interocular ridge; distinct ridge runs from dorsal surface of each eye, and deflects anteriorly towards mid-point of cephalon. Eyes small, with few ocelli, without pigment. Pereonites 1, 5 and 6 subequal in length and longer than pereonites 2-4 and 7; pereonite 2 with submarginal furrow; coxal plates of pereonites 1-2 each with distinct furrow, those of pereonites 3-6 with furrows; pereonite 7 with partial furrow on coxal plate, part of furrow being indistinct. Pleonites all visible; posterolateral margin of pleonite 3 strongly produced, forming acute point, with 2 longitudinal furrows; posterolateral margin of pleonite 4 rounded. Pleotelson slightly shorter than maximum width, posterior margin angled slightly to form point, provided

with 12 spines set amongst plumose setae.

Antennule short, not reaching anterior margin of pereonite 1. Antenna short, flagellum of about 18 articles, extending midway along pereonite 1.

Frontal lamina narrow, widening distally to rounded anterior margin, clypeus triangular. Maxilliped more setose than in other species, with medial setae and spines more robust than normal, terminal article with pectinate spines.

Pereopod 1 with row of setae along anterior margin of basis; groups of setae on posterodistal angle; anterior margins of ischium and merus produced, that of ischium provided with setae, merus with single terminal spine as well as stiff setae along lateral margin; carpus and propodus without setae; posterior margins of ischium with setae, merus with 6 long, 4 short spines, carpus with 1 long and 2 short spines, propodus with 5 acute spines on proximal half of palm and small spine opposing dactylus. Pereopods 2 and 3 similar but more spinose, with carpus proportionally longer. Pereopod 2 with 2 small spines on proximal part of propodial palm, pereopod 3 with none. Pereopods 5-7 similar, propodus of pereopod 6 longer than 7, basis of pereopod 6 less broad than pereopod 7. Pereopod 7 with basis widest at about two thirds of its length, anterior margin straight with continuous fringe of setae, posterior margin with incomplete fringe of setae; distal part of posterior margin with long plumose setae; ischium and merus with setae on anterior margins, distal angles with spines; carpus subequal in length to propodus, with spines at distal angles and on posterior margin; propodus with medial group of spines on

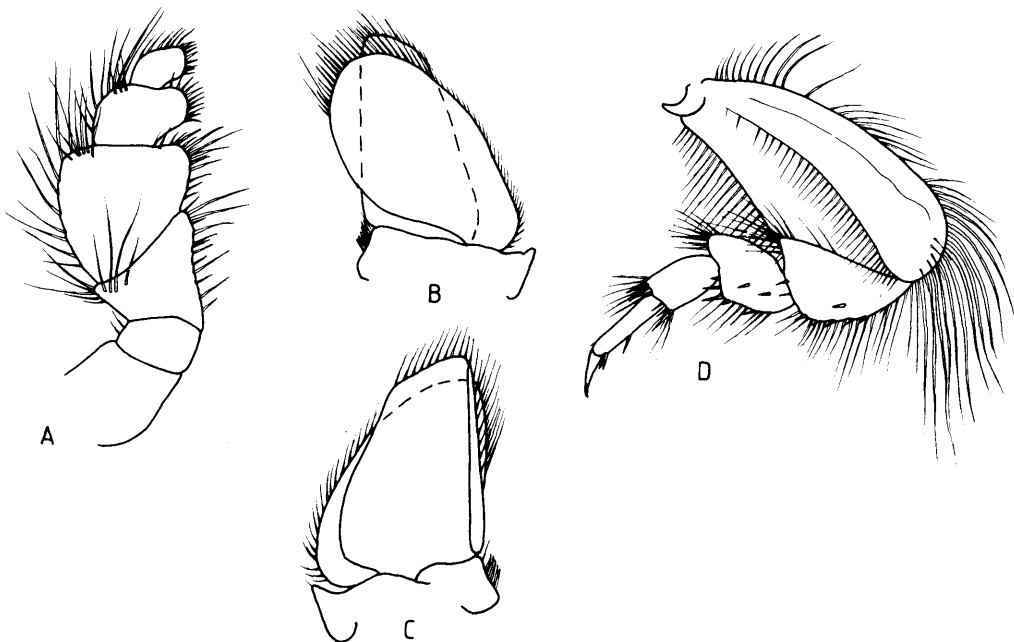


Fig. 41. *Natatolana prolixa* n. sp., holotype. A, maxilliped; B, pleopod 1; C, pleopod 2; D, pereopod 7.

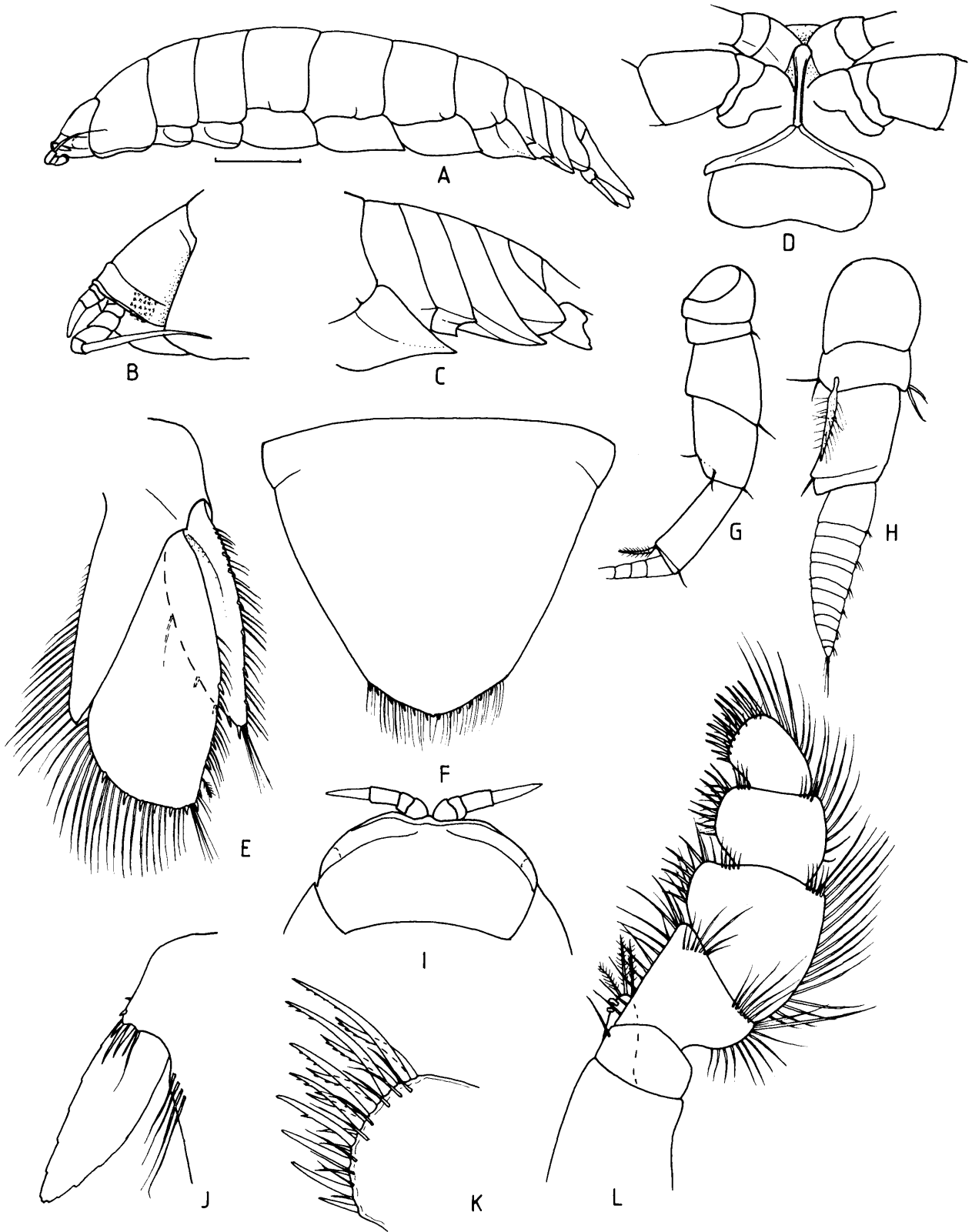


Fig. 42. *Natatolana gorung* n. sp. A-D, I, holotype; remainder male paratype. A, lateral view; B, cephalon, lateral view; C, pleon, lateral view; D, clypeal region; E, uropod; F, pleotelson; G, antennal peduncle; H, antennule; I, cephalon, dorsal view; J, uropod exopod, ventral view; K, maxilliped palp, terminal article; L, maxilliped. Scale 2.0 mm.

posterior margin and 2 spines opposing dactylus.

Pleopod 1 with exopod rounded. Uropod peduncle strongly produced, medial margin provided with fringe of setae; ventral lateral angle with 3 spines and 2 setae, further setae on lateral margin. Exopod three quarters length of endopod, marginal setae along entire length of lateral margin and three quarters of medial margin; lateral margin with 7 spines, medial with 4. Endopod with marginal setae along entire length of medial margins and three quarters of lateral margins; lateral margin angled at midpoint, posterior half very slightly concave; armed with 6 spines and single sensory seta; medial margin rounded with 6 spines.

Male. Lacks penes on ventral surface of sternite 7. Pleopod 2 appendix masculina arising basally, straight sided, bent inwards slightly at apex; not extending beyond apex of inner ramus. In other characters, resembles female.

Variation. The only difference between the two specimens is that the male has 10 spines on the posterior border of the pleotelson, while the larger female has 12.

Colour. Tan to white in alcohol, chromatophores not visible.

Size. Up to 18.6 mm.

Remarks. The most distinctive feature of this species is the development of the ridges on the anterior margin of the cephalon, and the very small pigmentless eyes. The maxilliped is unusual in being far more spinose than is normal for the genus. The furrows on the coxae, the form and details of the uropods and pereopods are further points of difference to other species.

Distribution. Off Sydney at 66 metres, and from almost pure sand sediment in Port Phillip Bay, Vic.

Etymology. *Gorong* is an Aboriginal word meaning the place where the river runs into the sea.

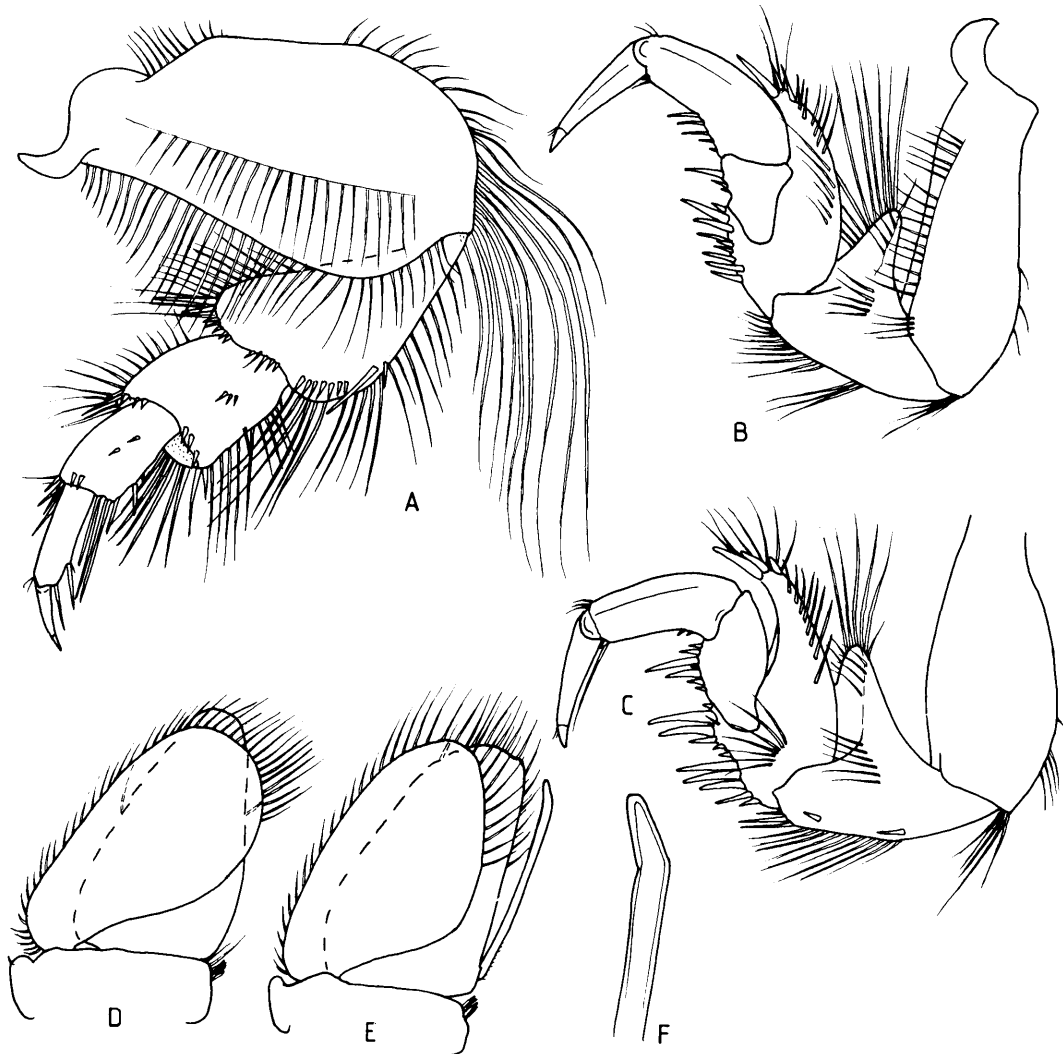


Fig. 43. *Natatolana gorung* n. sp., male paratype. A, pereopod 7; B, pereopod 1; C, pereopod 2; D, pleopod 1; E, pleopod 2; F, appendix masculina, apex.

Natatolana karkarook n. sp.

Figs 44, 45

Material examined. Female (20.8 mm), off Cairns Reef, Cooktown, Qld, 20 June 1973, on sand flats; female (18.2 mm), with mancas, Cairns Reef, Cooktown, Qld, 29 June 1973, coll. I. Lock.

Types. Holotype, female, (20.8 mm) AM P30335; paratype, AM P30336.

Type locality. Cairns Reef, Cooktown, Qld, 15°42'S, 145°33'E.

Description of female. Body about 3 times as long as wide; cephalon with small rostral point. Pereonites 1, 5 and 6 subequal in length, and longer than pereonites 2-4 and 7. Pereonite 1 with lateral furrow; coxae of pereonites 2-3 with partial longitudinal furrows, coxae of pereonites 4-7 without furrows. Pleonites all visible,

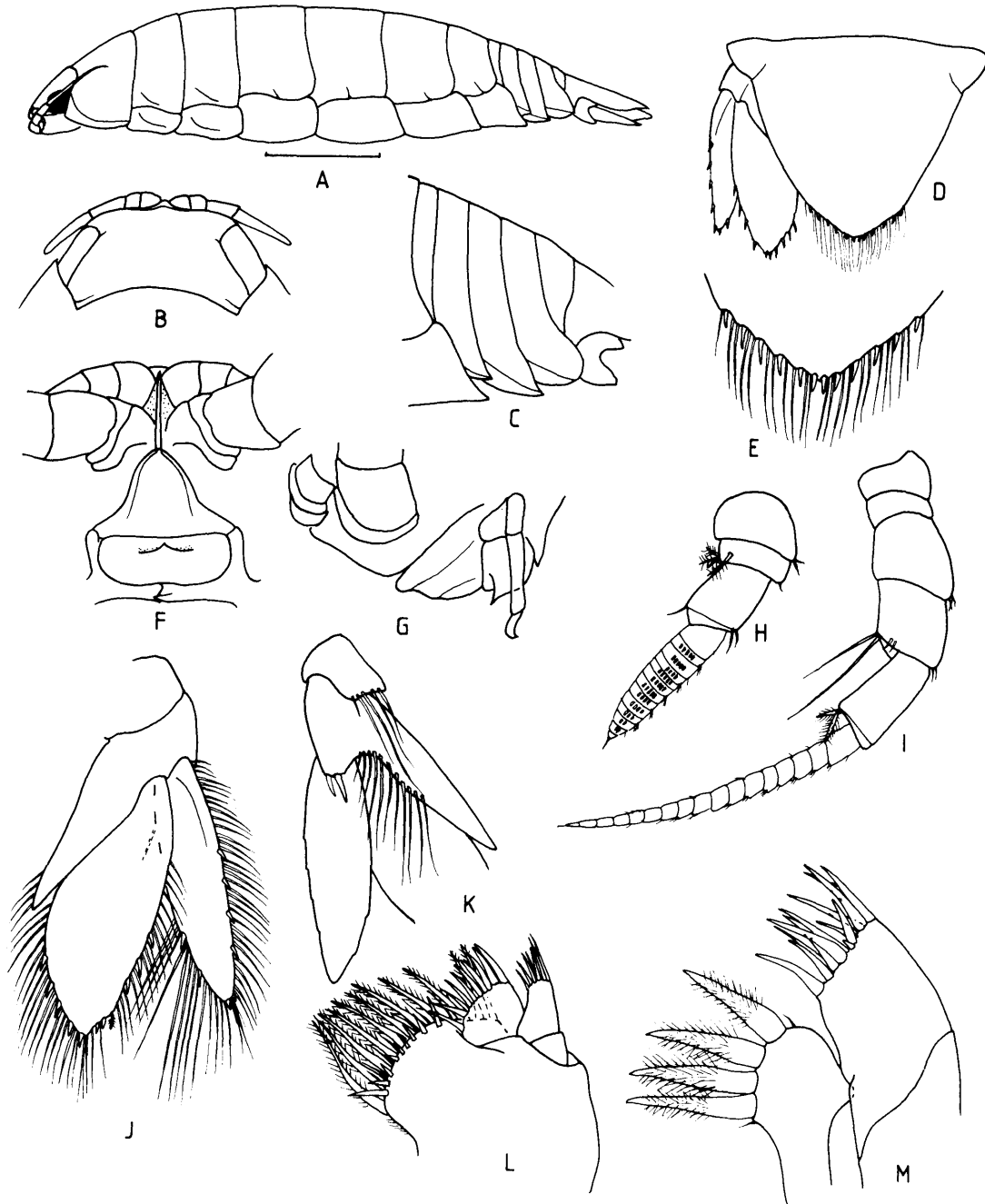


Fig. 44. *Natatolana karkarook* n. sp. A-G, holotype; H-M, paratype. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, pleotelson, dorsal view; E, pleotelson, posterior margin; F, clypeal region; G, clypeal region, lateral view; H, antennule; I, antenna; J, uropod; K, uropod peduncle, ventral view; L, maxilla; M, maxillule. Scale 4.0 mm.

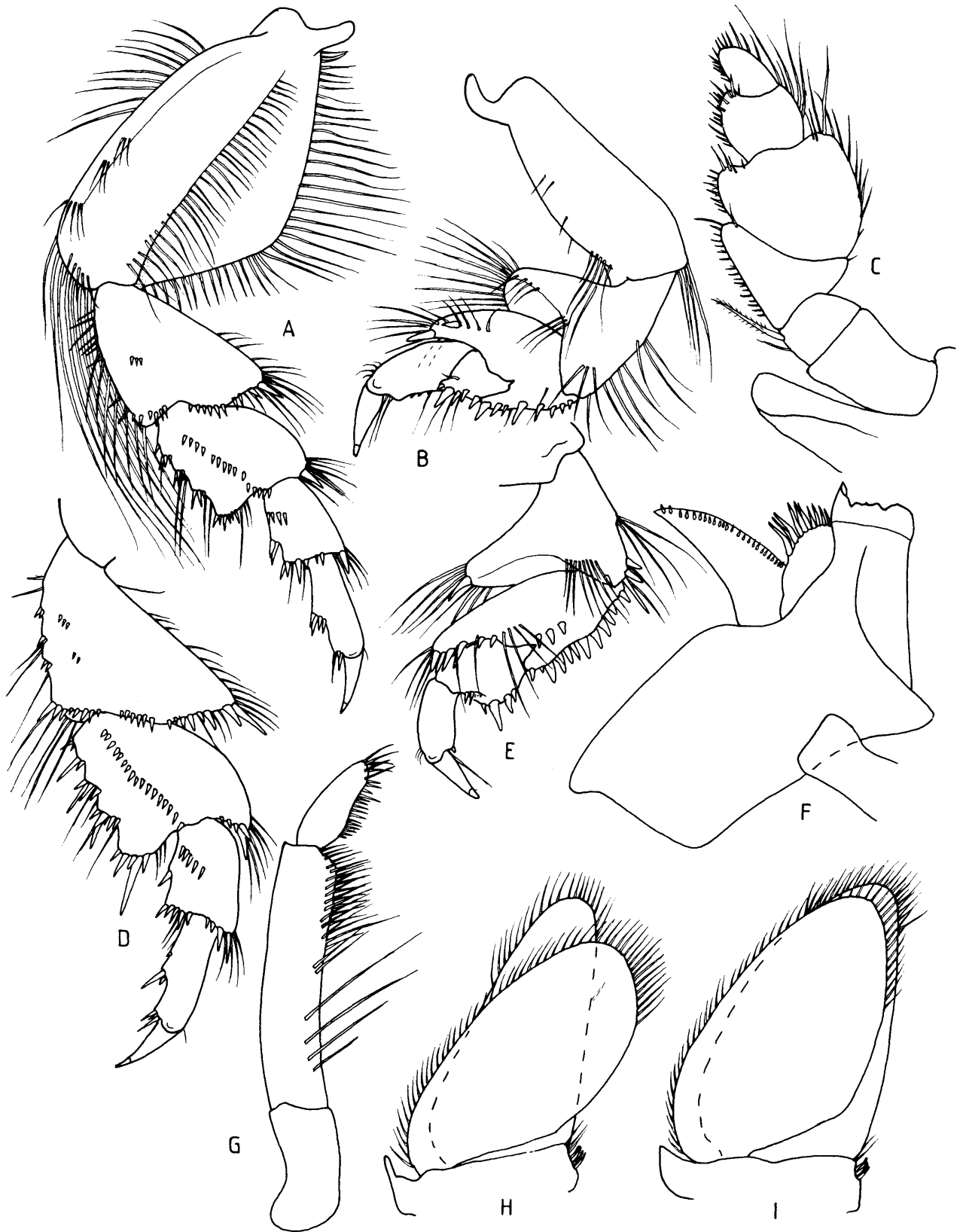


Fig. 45. *Natatolana karkarook* n. sp., paratype. A, pereopod 7; B, pereopod 1; C, maxilliped; D, pereopod 6; E, pereopod 3; F, left mandible; G, mandibular palp; H, pleopod 1; I, pleopod 2.

pleonite 4 with posterolateral margins rounded, those of pleonites 2 and 3 acute; posterolateral margins of pleonites 2-4 with longitudinal furrow. Pleotelson slightly shorter than maximum width, dorsal surface slightly domed, posterior margin with 12 spines set amongst plumose setae; 2 spines set close together at apex of pleotelson, without setae between them.

Antennule extending to posterior margin of eye, peduncle article 3 as long as combined lengths of articles 1 and 2; flagellum as long as peduncle, composed of about 14 articles and provided with numerous aesthetascs. Antenna with 2 stiff setae projecting from posterodistal margin of peduncle article 4, article 5 with 2 sensory setae at posterodistal angle; flagellum composed of about 17 articles, extending about half way along pereonite 1.

Frontal lamina linear, coming to point anteriorly, clypeus projecting strongly forwards, set distinctly away from ventral surface of cephalon; labrum with triangular downwardly projecting process. Mandible incisor narrow, tridentate; molar process and lacinia mobilis normal; palp article 2 greater than twice length of articles 1 or 3, provided with numerous setae. Maxillule exopod relatively slender, provided with about 12 spines on gnathal surface, endopod with 4 large plumose spines. Maxilla palp and exopod reduced, provided with 7 and 10 spines respectively; endopod with row of short simple spines on ventral surface of medial margin and row of 11 large plumose spines. Maxilliped terminal palp article narrow; medial margins of palp with numerous short spines except for article 1 which has 1 large plumose seta and 1 simple seta; lateral margins with marginal setae; endite with 6 short plumose setae and no coupling hooks.

Pereopod 1 with marginal setae on both margins of ischium; merus with 2 spines on anterior margin as well as row of setae, posterior margin with 7 spines; carpus with 5 spines on posterior margin; propodus with 3 spines on palm as well as small spine opposing dactylus, anterodistal angle with row of small setae. Pereopod 2 similar to pereopod 1, but more spinose, and carpus proportionally longer; palm of propodus with only 1 spine opposing dactylus. Pereopod 7 with basis broad, anterior margin angled midway along its length, entire length with marginal setae; posterior margin with proximal row of setae, 3 groups of submarginal setae, and long plumose setae at distal extremity; ischium broad, posterior margin provided with slender spines and setae, distal margin with spines only, anterior margins of merus, carpus and propodus irregular, with groups of spines. Pereopods 5 and 6 similar to 7 but basis more slender, ischium and merus distinctly broader and more spinose. Propodus of all pereopods proportionally shorter, more robust than others of genus.

Pleopod 1 endopod distinctly narrower at apex. Uropods extending beyond posterior of pleotelson. Exopod slightly shorter than endopod; lateral margin setose along entire length, with 5 spines; medial margin with 3 spines, setae present on 0.8 of length. Endopod

lateral margin with setae along 0.75 of lateral margin, armed with 5 spines, medial margin with 5 spines set amongst marginal setae. Peduncle with 2 spines on ventral posterolateral angle, setae along ventrolateral margin.

Male. Not known.

Colour. Brown in alcohol, chromatophores not evident.

Size. Largest female 20.8 mm.

Variation. Both specimens agree closely; the paratype has one uropodal exopod totally devoid of spines.

Remarks. This is a rather atypical member of the genus, and has several unique characters. The pointed projection on the labrum is unique, and not known in any other Cirolanidae. The linear form of the frontal lamina is also distinctive. The mouthparts are all unusual: the mandible has a narrow incisor; the maxillule has a relatively slender exopod and has 4 spines on the endopod rather than the more normal 3; the maxilla has the palp and exopod reduced, and all articles are spinose; the maxilliped lacks coupling hooks on the endite, and on the medial margins short spines replace the usual setae. Of these characters, only the narrow mandible is known to occur elsewhere in the family, in *Neocirolana* Hale. This does not suggest that there is any affinity between species of *Neocirolana* and the present species.

Distribution. Known only from the type locality, presumably an intertidal sandflat dweller.

Etymology. *Karkarook* is an Aboriginal word meaning sand and refers to the habitat from which the specimens were taken.

Natatolana albicaudata (Stebbing)

Figs 46, 47

Cirolana albicaudata Stebbing, 1900: 631, pl. lxxviiB.—Richardson, 1910: 5; Barnard, 1936: 152, fig. 2a-c.

Cirolana albicaudata var. *japonica* Thielemann, 1910: 8, figs 1-4.—Nierstrasz, 1931: 152; Iwasa, 1965: 14.

Natatolana albicaudata.—Bruce, 1981b: 958.

Material examined. Syntypes: 4 males (3.8-5.3 mm), 2 females (3.9, 4.2 mm), 5 manca (2.0-3.8 mm), Barawon, Blanche Bay, New Britain, coll. A. Willey, BM(NH) 1906.4.19: 44-54. 4 males (8.3-8.7 mm), 72 females (6.3-9.8 mm), manca (5.0 mm), Java Is., anchorage, 14 Dec. 1908, coll. H. Richardson, USNM 41490. 2 females (9.2, 6.9 mm), 3 manca (2.7, 3.5, 3.9 mm), Wistari Reef channel, Heron Is., Qld, 6 Sept. 1978, 1830 hrs, night plankton, coll. D. Fisk. Male (7.3 mm), female (7.6 mm), Barrow Is., WA, 2 Sept. 1954, night plankton, 2000 hrs, coll. K. Sheard.

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

Type locality. Blanche Bay, New Britain.

Description of male. Body about 3 times as long as wide. Cephalon with small rostral point; 2 impressed lines run across cephalon, 1 originating from dorsal surface of each eye, and 1 running along anterior margin. Pereonite 1 with lateral longitudinal furrow.

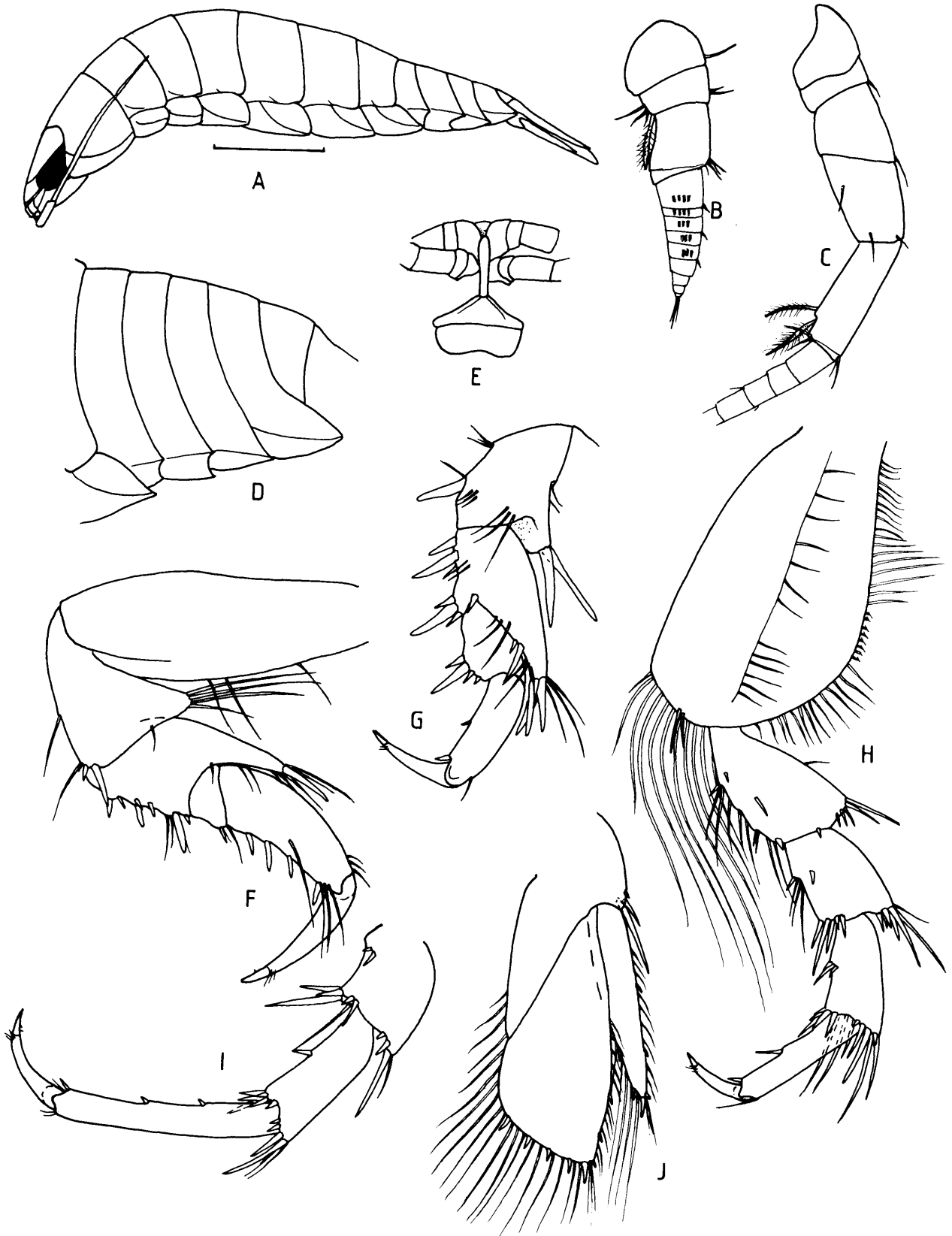


Fig. 46. *Natatolana albicaudata*, male syntype 5.3 mm. A, lateral view; B, antennule; C, antennal peduncle; D, pleon; E, clypeal region; F, pereopod 1; G, pereopod 3; H, pereopod 7; I, pereopod 5, distal article; J, uropod. Scale 1.0 mm.

Coxae of pereonites 2-7 each with diagonal furrows. All pleonites visible, lateral margin of each with longitudinal furrow; posterolateral margins of pleonite 4 coming to point. Pleotelson as long as greatest width, posterior margin slightly angled, provided with 9 or 10 spines set amongst plumose setae; dorsal surface without distinct depression.

Antennule short, just reaching anterior margin of eye; flagellum composed of about 10 articles. Antenna peduncle article 4 slightly longer than 3; peduncle article 5 with 2 conspicuous sensory setae on posterodistal margin; flagellum with about 22 articles, extending to anterior of pereonite 3.

Frontal lamina about 4 times as long as broad, sides parallel, anterior margin rounded; clypeus triangular.

Pereopod 1 with anterodistal angles of ischium and merus provided with setae, merus with single distal spine; posterior margins of ischium with 1 large and 2 small acute spines at distal angle, merus with 3 large and 4 small spines, carpus with single distal spine, and propodus with 3 acute spines and blunt spine opposing dactylus; dactylus long, subequal in length to propodus. Pereopods 2 and 3 similar to pereopod 1 but with carpus

proportionally longer, all articles with more numerous and larger spines; palm of propodus of pereopod 2 with 2 spines, that of pereopod 3 with 1 spine. Pereopod 7 with anterior margin of basis with continuous fringe of setae, posterodistal angle with long plumose setae, posterior margin without setae; anterior margins of ischium, merus, carpus and propodus without setae, but with groups of spines at each distal angle; posterior margin of ischium with spines and setae; posterior margins of merus, carpus and propodus with medial group of spines and further group of spines at each distal angle. Pereopod 6 similar to 7, but basis less broad, and propodus proportionally longer. Similarly, pereopod 5 with basis less broad than 6, and propodus longer than those of pereopods 6 and 7. Pereopods 4-7 progressively decrease in spinosity.

Vasa deferentia opening flush on surface of sternite 7.

Pleopod 2 appendix masculina arising sub-basally, parallel sided, not extending beyond inner ramus of endopod. Uropod exopod 0.75 length of endopod, lanceolate, each margin with 3 spines; endopod lateral margin slightly convex, curving in slightly just before apex, provided with 3 spines, medial margin rounded

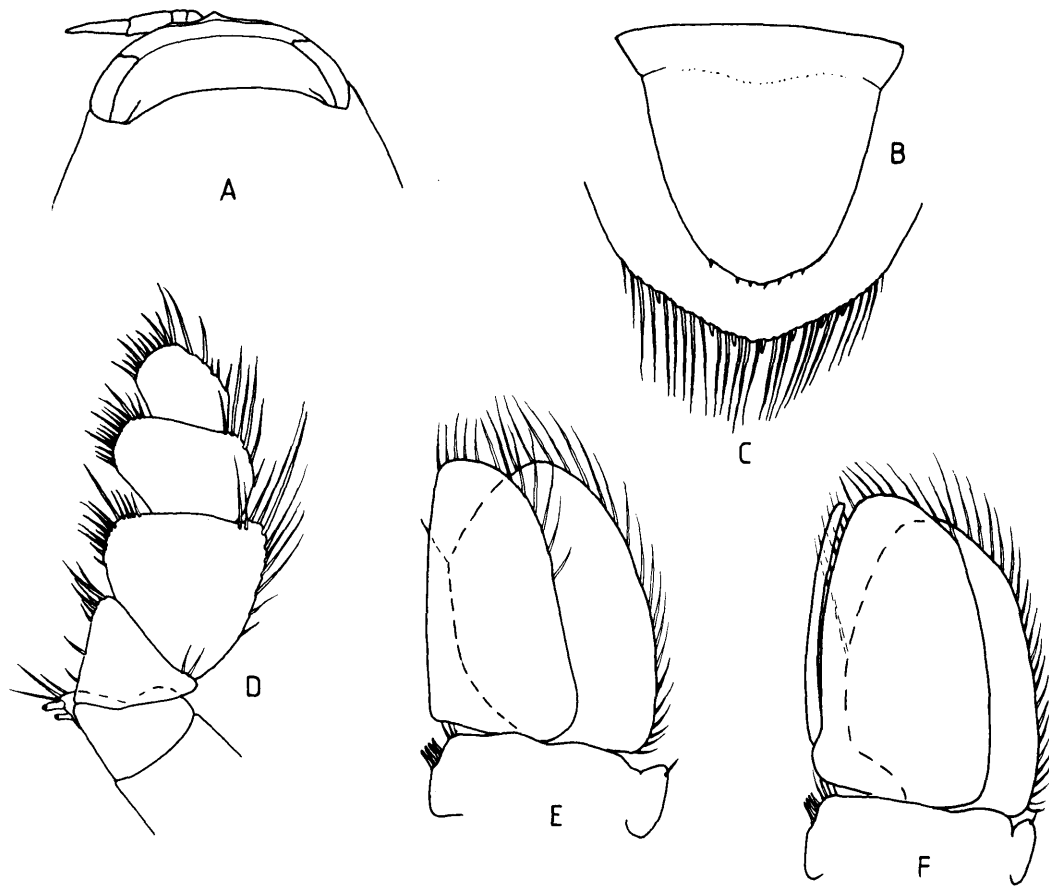


Fig. 47. *Natatolana albicaudata*. A-D, female 9.2 mm, Heron Is.; E, F, male syntype 5.3 mm. A, cephalon, dorsal view; B, pleotelson; C, pleotelson, posterior margin; D, maxilliped; E, pleopod 1; F, pleopod 2.

and provided with 5 spines. All margins with setae. Peduncle with 1 lateral spine, and 2 spines on ventral lateral angle.

Female. Similar to male, but slightly larger.

Variation. In some specimens the antennal flagellum extends to pereonite 5. Stebbing's specimens are all small, and these have a more acute apex to the telson and uropodal endopod. In larger specimens the telson apex is far more distinctly rounded, as are the uropods.

Colour. Tan to brown in alcohol. Freshly preserved specimens show conspicuous and numerous chromatophores.

Size. Type material did not exceed 5.3 mm, but specimens from Heron Island and the Philippines reach 9.8 mm.

Remarks. This species shows several distinctive characters. The chromatophores are obvious, and so too are the conspicuously elongated dactyls, as well as the slender propodus on pereopods 4–6. The combination of frontal lamina, pereopod characters, pleotelson, and uropod characters serve to distinguish this species from others of the genus.

Barnard (1936) recorded this species from Bombay, describing a male with digitiform processes on the flagellum of the antenna. None of the males examined here show this character, and further differences exist between Barnard's figures of the pleotelson, uropods and pereopod 7, when compared to the material treated here. Barnard's (1936) figures and description do not allow a fair assessment to be made of the status of the Bombay material. Thielemann (1910) described the subspecies *Natolana albicaudata japonica*, but the differences seem slight. Thielemann's (1910) subspecies is likely to be the same species as Stebbing's but, as numerous closely similar species exist, this is uncertain.

Distribution. Philippines (Richardson, 1910), Japan (Thielemann, 1910; Iwasa, 1965), east to India (Barnard, 1936). In Australia: Heron Island, Qld; Barrow Island, WA.

Natolana amplocula n. sp.

Fig. 48

Material examined. Female (13.2 mm), Kei Island Expedition, Stn 50, 5°34'S, 132°26'E, 233 m, 4 May 1922, coll. Th. Mortensen.

Type. Holotype, ZMUC.

Type locality. South of Kei Islands, 5°34'S, 132°26'E.

Description of female. Body about 2.5 times as long as wide. Cephalon set deeply into pereonite 1, continuous interocular furrows running from dorsal and anterior margins of eye. Eye conspicuously large, narrower anteriorly. Pereonites 1 and 6 subequal in length, and longer than pereonites 2–5; lateral margins of pereonite 1 with 2 furrows. All coxae with complete furrows. Pleonites all visible; pleonite 3 with posterolateral margins produced posteriorly, acute, dorsal and ventral margins produced beyond posterior margin of pleonite 5, dorsal and ventral margins convex

with 2 carinae, pleonite 4 with posterolateral margins produced beyond posterior margin of pleonite 5, dorsal and ventral margins convex. Pleotelson shorter than greatest width, posterior margin broadly rounded, with small medial projection on either side of which lie 3 spines set amongst plumose setae.

Antennule short, not quite reaching to posterior eye, peduncle article 3 longer than combined lengths of articles 1 and 2; flagellum extending to posterior of pereonite 3, composed of about 22 articles.

Frontal lamina 5 times longer than broad, ventral surface slightly domed, anterior margin rounded; clypeus triangular. Maxilliped endite with 2 coupling hooks.

Pereopod 1 with marginal setae on anterior margin of basis; ischium anterior margin provided with setae, posterior margin with sparse setae; merus anterior margin armed with 3 stout spines and several setae, posterior margin with 3 robust and 5 acute spines; merus with single spine and setae on posterior margin; propodus with row of 5 setae on anterodistal margin, palm with 3 acute spines, and distal spine opposing dactylus. Pereopods 2 and 3 similar to pereopod 1, but with more numerous and larger spines, except propodus with 2 spines on palm. Pereopods 4–6 becoming progressively longer, pereopod 7 slightly shorter than 6. Pereopod 7 with basis posterior margin without setae, except distal extremity which bears long plumose setae; posterior margin with continuous row of setae, further row of setae runs along midline of article; ischium with both margins setose, spines set at distal angle and submarginally on posterior margin; merus and carpus with spines and setae on distal angle and further group on posterior margin; propodus with group of spines midway along palm, and spine opposing dactylus.

Uropods extending slightly beyond apex of pleotelson, exopod distinctly shorter than endopod. Exopod with both margins convex, distal extremity rounded, lateral margin with continuous marginal setae, and 4 small inconspicuous spines, medial margin with 3 spines, 2 close together, third set further apart. Endopod with 2 spines on lateral margin, 6 on medial margin; marginal setae along entire length of medial margin, along half length of lateral margin. Peduncle with 2 spines on ventral external angle.

Male. Not known.

Colour. Pale cream, with scattered reddish brown chromatophores.

Size. Holotype measures 13.2 mm.

Remarks. Two species, *N. curta* Richardson and *N. arcicauda*, possess a broadly rounded pleotelson similar to *N. amplocula*. However, both of these species can be separated from the present species by differences in uropod shape and spination, coxal furrowing, pleon shape and details of the pereopods.

Distribution. Kei Islands, Arafura Sea.

Etymology. The specific epithet is derived by combining the two Latin words *amplus* (= large) and *oculus* (= eye).

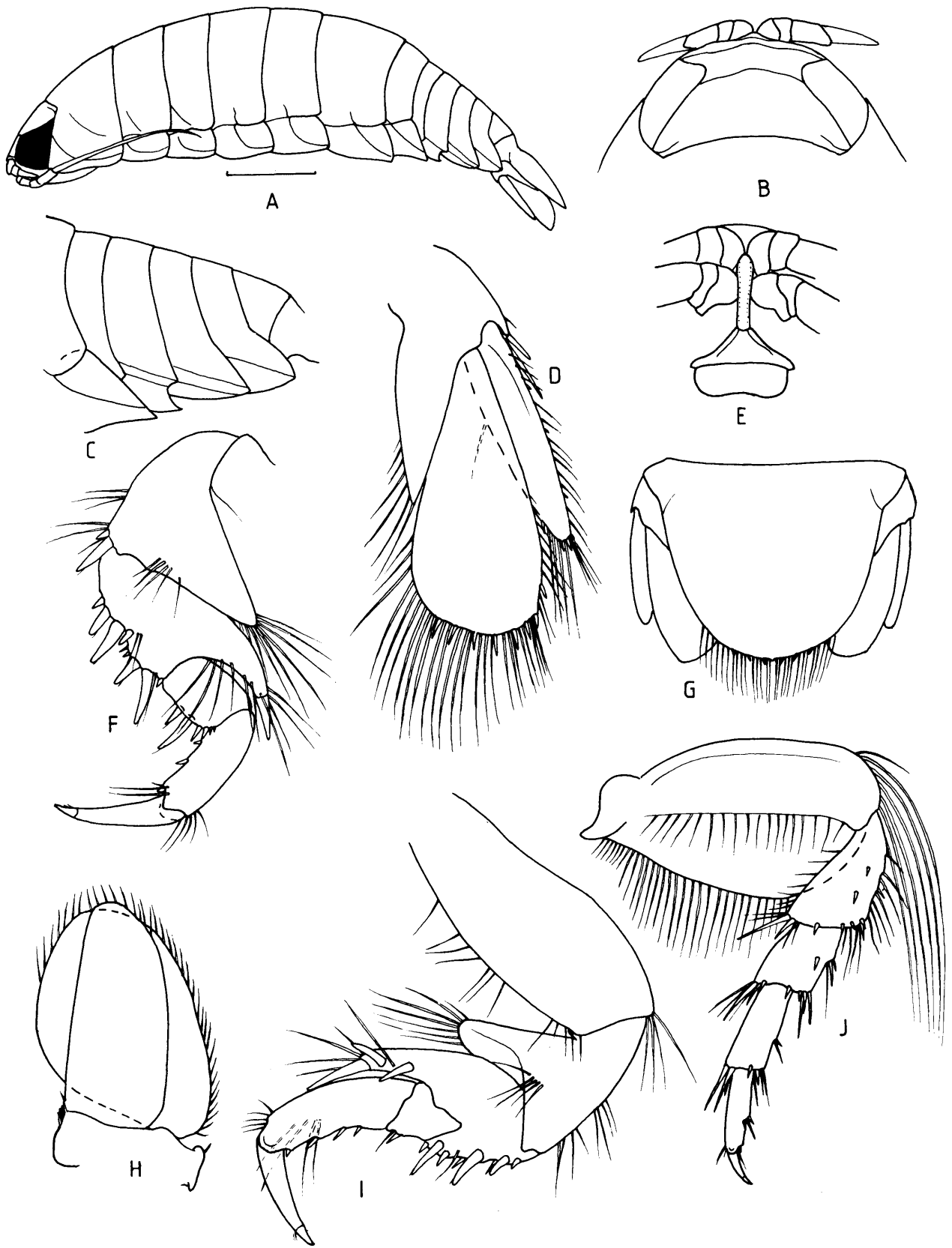


Fig. 48. *Natatolana amplocula* n. sp., holotype. **A**, lateral view; **B**, cephalon, dorsal view; **C**, pleon, lateral view; **D**, uropod; **E**, clypeal region; **F**, pereopod 2 (in situ); **G**, pletelson; **H**, pleopod 1; **I**, pereopod 1; **J**, pereopod 7. Scale 2.0 mm.

Natatolana pellucida (Tattersall)

Figs 49, 50

Cirolana pellucida Tattersall, 1921: 206, pl. II figs 4-10.—

Hurley, 1957: 11; 1961: 267; Nierstrasz, 1931: 158.

Natatolana pellucida.—Bruce, 1981b: 958.

Material examined. Syntypes: male (7.5 mm), 2 females

(11.3, 12.0 mm), "Terra Nova" Expedition, Stn 130, Three Kings Island, New Zealand, BM(NH) Reg. No. 29/11/1921: 22-24. Topotypes, 2 male (7.5, 8.7 mm), 10 females (5.5-10.0 mm), manca (5.0, 5.1 mm), BM(NH) 29/11/1921: 25-44. Female (5.3 mm), Middle Banks, Moreton Bay, Qld, Dec. 1973, coll. S. Cook. Female (5.5 mm), Middle Banks, Moreton Bay, Qld, Sept. 1972. AM SBS series, NSW; female (5.8 mm), east of Malabar, Sydney, 33°58'S, 151°17'E, 30 Aug. 1973, 66

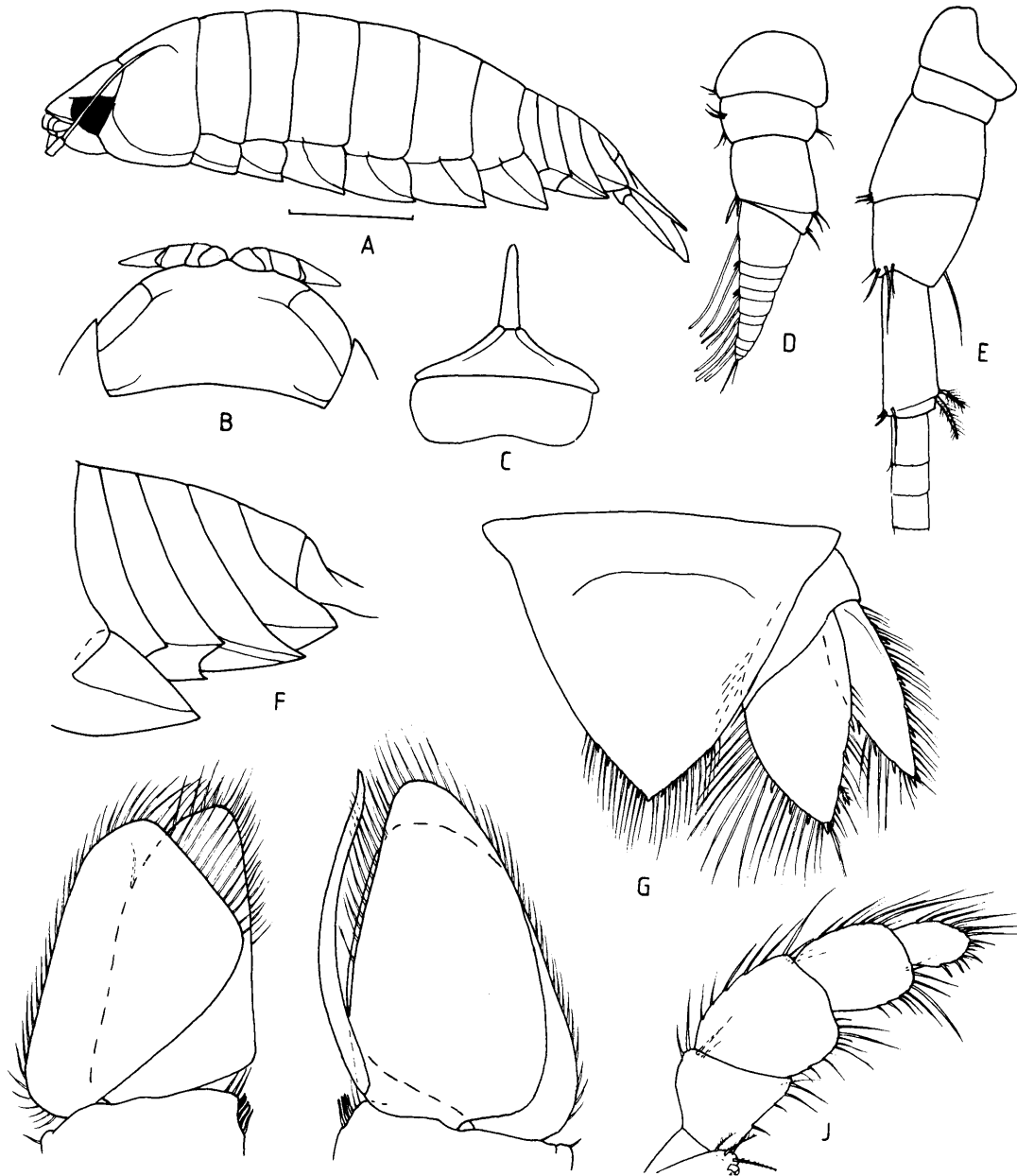


Fig. 49. *Natatolana pellucida*. A-G, female syntype, 11.3 mm; H-J, male topotype 8.7 mm. A, lateral view; B, cephalon, dorsal view; C, clypeal region; D, antennule; E, antennal peduncle; F, pleon, lateral view; G, pleotelson and uropod; H, pleopod 1; I, pleopod 2; J, maxilliped. Scale 2.0 mm.

m; female (7.0 mm), east of Long Bay, Sydney, 33°58'E, 151°17'E, 30 Jan. 1974, 66 m; female (5.6 mm), east of Malabar, Sydney, 33°57'S, 151°19'E, 19 May 1972, 53 m; female (5.6 mm), manca (3.5 mm), east of Malabar, Sydney, 33°57'S, 151°19'E, 1973, 32 m; all coll. AM CSIRO series: male (5.6 mm), 7 females (5.0–10.3 mm), manca (3.5 mm), Stn 92-56-62, off Port Jackson, N.S.W., 18 June 1962, 150 m; male (4.9 mm), Stn G2-35-62, off Port Jackson, NSW, 18 June 1962, 86 m; 3 females (6.9, 5.6, 5.3 mm), off Sydney, NSW, 33°52'S, 150°22'E, 20 June 1962, 150 m, coll. R.L. Thomas; 3 females (5.4, 5.0, 5.6 mm), Stn G2-56-62, off Sydney, NSW, 33°43'S, 151°40'E, 5 Dec. 1978, 156 m, coll. R.L. Thomas; female (6.9 mm), 38°58'S, 151°29'E, 20 June 1962, 152 m, coll. R.L. Thomas; all CSIRO Fisheries. Male (imm. 7.5 mm), 2 mancas (4.4, 5.0 mm), K78-26-02, off Sydney, NSW, 33°43'S, 151°40'E, 5 Dec. 1978, 156 m, coll. B. Rudman, P. Coleman, K. Handley. 3 males (4.0, 5.1, 5.6 mm), manca (3.8 mm), Stn K77-23-01, off Sydney, NSW, 33°47'S, 151°43'E, 5 Dec. 1977, 192 m, coll. FRV *Kapala*. 4 females (5.6, 5.7, 6.9, 5.0 mm), 5 mancas (4.5–5.5 mm), off Port Kembla, NSW, Stn K78-27-11, 13 Dec. 1978, 161 m, coll. B. Rudman, P. Coleman, K. Handley. Female (6.3 mm), 5 mancas (3.0–3.5 mm), 37°05'S, 150°05'E, Bass Strait, 30 Sept. 1914, 55–90 m, Mortensen Expedition. Female (6.0 mm), 4 mancas (3.2–3.7 mm), 39°10'S, 149°05'E, Bass Strait, 17 Sept. 1914, 360–450 m, Mortensen Expedition. Male (7.0 mm), Stn 35, *Kimbla* Cruise 79-K-1, 39°28.4'S, 148°41.8'E, Bass Strait, 28 Mar. 1979, 110 m, coll. G. Poore. 2 males (8.5, 8.2 mm), Stn 32, *Kimbla* Cruise 79-K-1, 39°41.7'S, 148°39.5'E, 27 Mar. 1979, 115 m, coll. G.C.B. Poore. Male (7.0 mm), Stn 21, off Point Sorrell, northern Tas., 10 June 1971, 30 m, coll. Sea Fisheries Division. Female (5.0 mm), Stn 24, N. of Northdown, northern Tas., 11 June 1971, 37 m, coll. Sea Fisheries Division. Female (9.5 mm) Margate Beach, southeastern Tas., 1978, coll. T. Walker. 2 mancas (3.2, 5.1 mm), Point Davis, Perseverance Harbour, Campbell Is., 52°34'S, 169°13'E, 7 Feb. 1980, 23 m, coll. J.K. Lowry.

Types. Syntypes held by the British Museum (Natural History).

Type locality. Three Kings Island, New Zealand.

Description of female. Body suboval in shape, little more than 2 times as long as wide; cephalon with small rostral point; anterior margin of cephalon with interocular impressed line, dorsal surface with impressed line running from the top of each eye. Pereonite 1 longest, 2 and 3 shortest, 5–6 becoming progressively longer. Pereonite 1 with single lateral impressed line. Coxae all with entire impressed line; posteroventral angles of coxal plates formed into small point. Pleonites all visible, lateral margin of pleonites 3 and 4 produced posteriorly, those of pleonite 3 forming acute points, those of pleonite 4 slightly rounded; lateral margins of pleonite 3 with 2 impressed lines, pleonite 4 with 1. Pleotelson lateral margins converging smoothly to point, at which lies minute projection; posterior margin with 10 spines set amongst plumose setae; anterodorsal surface with distinct depression.

Antennule short, reaching to mid point of eye; flagellum with about 10 articles, each article provided with aesthetascs. Antennal peduncle article 5 with 2 conspicuous sensory setae on posterior margin; flagellum reaches pereonite 2, composed of about 18 articles.

Frontal lamina narrow, broader basally, narrowing to acute point, clypeus triangular with anterior margin formed into ridge. Maxilliped with 1 or 2 coupling hooks.

Pereopod 1 with anterodistal angles of ischium and merus produced, that of merus with single stout spine, both with abundant long setae; posterior margin of merus with 7 spines, carpus with 1 and propodus with 4, including blunt spine opposing dactylus. Pereopods 2 and 3 similar to pereopod 1, but palm of propodus lacks spines, and spines on merus and carpus more numerous and larger. Pereopod 4 intermediate in condition between 1–3 and 5–7. Pereopods 5–7 similar, pereopod 6 being the longest. Pereopod 7 with basis relatively narrow, posterior margin sparsely setose, except distal portion which bears long setae; anterior margin with dense row of plumose marginal setae; anterior margin of ischium to propodus without spines or setae, except distal portion which bears long setae; anterior margin with dense row of plumose marginal setae; anterior margin of ischium to propodus without spines or setae, except distal angles; posterior margin of ischium with long marginal setae and submarginal spines; merus, carpus and propodus with spines on posterior margins distal angle.

Pleopod 1 distal margin of exopod markedly truncate. Uropods extending little beyond apex of pleotelson, both rami lanceolate; exopod shorter than endopod, with about 7 spines on lateral margin, 4 on medial margin; endopod with 4 spines on lateral and medial margins. Setae present on entire length of medial margin of endopod, lateral margin of exopod, and distal two thirds of lateral margin of endopod and medial margin of exopod.

Male. Male very similar to female, differing primarily in development of conspicuous elongated spines on pereopods 1–6. On pereopods 1–3 these spines develop on merus, on pereopods 4–5 they occur on merus and carpus. Male appendix masculina sinuate, bending out at apex; little longer than endopod. Flattened penes present on sternite 7.

Variation. Mancas are essentially the same as the females, but may be less spinose. The development of the long pereopodal spines is probably associated with maturity. In some smaller males, these are only feebly developed. The two males from Three Kings Island do not show the same degree of pereopod spine development as Australian males of similar size, these spines occurring only on pereopods 4 and 5.

Colour. Tan to white in preserved specimen. Eyes red, pereon and pleon with sparse chromatophores in live material.

Size. Largest female 12.0 mm, largest male 8.7 mm, largest manca 5.1 mm, smallest adult female 4.1 mm.

Remarks. This species closely resembles *N. corpulenta* and *N. longispina*. It can be distinguished from the former by the lack of chromatophore banding, by never possessing sinuate margins to the pleotelson, and by having the frontal lamina narrowing anteriorly.

Natatolana longispina is even more similar, and *N. pellucida* is separated by the less rounded posterolateral margins of pleonite 4, by having much shorter lateral pereonite furrows, and by having the pleotelson and uropods less rounded.

It is worth noting that these species have apparently disjunct distributions. *Natatolana pellucida* has a depth range from 23 metres to at least 450 metres, with only 3 samples from less than 50 metres. *Natatolana corpulenta* occurs in depths 6–23 metres. *Natatolana*

longispina has not been taken outside the Western Port and Port Phillip Bay systems.

Distribution. Originally described from Three Kings Islands, off the northernmost tip of New Zealand (Tattersall, 1921), the range is now extended along the eastern seaboard of Australia, north to Moreton Bay, with records from Tasmania, off Sydney, off the Hunter River district, and from Bass Strait; two manca were taken at Campbell Island. Specimens have been recorded at depths of 23–450 metres.

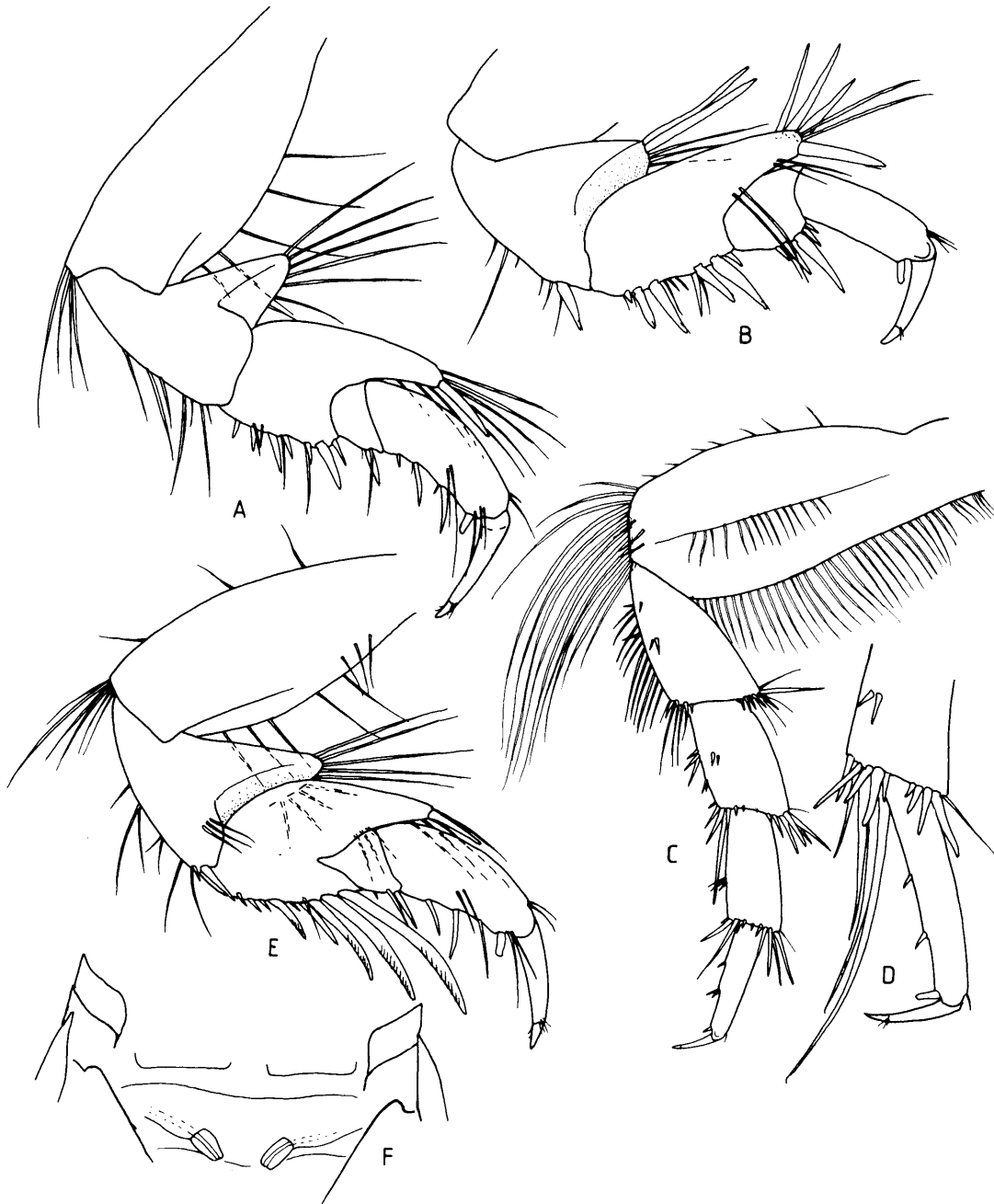


Fig. 50. *Natatolana pellucida*. A–D, F, male topotype, 7.5 mm. A, pereopod 1; B, pereopod 3; C, pereopod 7; D, pereopod 5, distal articles; E, pereopod 1, male 7.0 mm, Bass Strait; F, penes, in situ.

Natolatana corpulenta (Hale)

Figs 51-53

Cirolana corpulenta Hale, 1925: 134, fig. 3.—1929b: 248, fig. 239; 1940: 289; Nierstrasz, 1931: 157; Poore et al., 1975: 33. *Natolatana corpulenta*.—Bruce, 1981b: 958.

Material examined. Female (12.0 mm), holotype, SAM C275; paratypes, 2 males (6.8, 6.5 mm), 16 females (5.1–11.3 mm), 18 manca (3.8–5.5 mm). AM Hunter District Water Board Survey series: female (6.3 mm), east of Stockton Beach, NSW 32°54'S, 151°47'E, 30 Nov. 1975, 6 m; male (7.2 mm), east of Stockton Beach, NSW, 32°54'S, 151°47.5'E, 20 July 1975, 15 m; manca (6.3 mm), east of Merewether Beach, NSW, 32°57'S, 151°45'E, 30 Nov. 1975, 15 m; manca (6.3 mm), east of Dudley Beach, NSW, 32°59'S, 151°44'E, 20 July 1975, 10 m; female (7.6 mm), east of Belmont Beach, NSW, 33°02.5'S, 151°42'E, 16 Dec. 1975, 23 m; male (6.3 mm), manca (5.9 mm), east of Belmont Beach, NSW, 33°02.5'S, 151°41'E, 20 Sept. 1975, 22 m; male (7.5 mm), east of Belmont Beach, NSW, 33°02.5'S, 151°41'E, 31 Oct. 1975, 18 m; female (5.4 mm), east of Belmont Beach, NSW, 33°02.5'S, 151°41'E, 29 Nov. 1975, 14 m. 3 females (9.5, ovig., 11.3, 10.7 mm), Point Leo, Vic., 57/01/69, MSGWPT Survey. Female (10.4 mm) with embryos, damaged specimen, 10 mm), Point Leo, Vic., 50/01/69, MSGWPT Survey.

Types. Held at the South Australian Museum, Adelaide.

Type locality. Port Willunga, SA.

Supplementary description of female. Hale (1925) gave a detailed description of the female holotype. A supplementary description is given here, based on the Point Leo specimens. Coxae with posteroventral angle produced to small point, coxae of pereonites 2–4 rectangular in shape, 3–7 with posterior margin produced; all coxae with complete diagonal furrow terminating above posterior ventral point. Pleotelson posterior margin armed with 10 spines, and marginal plumose setae. Dorsal surface of pleotelson with distinct depression, anterior margin of which is distinct, with medial excision; small setae project into dorsal depression.

Antennule peduncle articles short, article 2 with sensory setae; flagellum composed of 10 articles, first of which is longest; 2–9 arranged in form of long article followed by short article, then long again; numerous aesthetascs present; anterodistal angle of long articles with group of short, close set setae. Antenna peduncle article 4 with row of setae on posteroventral margin, and shorter than 5. Article 5 with 2 terminal sensory setae. Flagellum extends to pereonite 2, composed of about 16 articles.

Frontal lamina narrow, slightly dilated anteriorly, where it meets bases of antennular articles; clypeus with central depressed area, with anterior marginal ridges. Maxillule with about 12 robust spines on gnathal surface of exopod; endopod with 3 robust plumose spines. Maxilliped slender, numerous long setae on lateral margins of palp articles; palp articles 3–4 with medial margins scarcely produced. Endite with single coupling hook and 5 plumose setae.

Pereopod 1 with anterodistal angles of ischium and

merus produced and provided with numerous long setae; anterior margin of merus also with single spine; posterior margin of ischium with 2 groups of setae, and single spine; that of merus slightly sinuate, armed with about 13 acute spines of various lengths; merus short, with single acute spine and setae on posterodistal angle; propodus with row of about 9 setae on distal half of anterior margin, posterior margin with 4 acute spines and single robust spine opposing dactylus; lateral surface with 2 groups of setae; dactylus slender, at base of primary unguis lie 2 slender, recurved spiniform processes. Pereopods 2–4 without spines on palm of propodus other than terminal spine opposing dactylus. Pereopod 3, carpus is longer and spines on posterior surface of ischium on merus also longer than pereopod 1; anterodistal angle of ischium more strongly produced than in pereopod 1, with single long spine; anterodistal angle of merus also more produced, armed with about 14 long spines. Pereopods 5–7 similar, pereopod 6 longer than pereopod 7. Pereopod 7 with margins of basis with plumose setae; basis widens slightly distally, twice as long as greatest width; margins of ischium and merus similarly with marginal setae, and additional spines; carpus with 3 setae on anterior margin and single spine on posterior margin; propodus with single spine on posterior margin as well as spines around base of dactylus.

Pleopods with exopod of pleopods 3–5 with complete transverse suture. Uropods not extending beyond apex of pleotelson; rami subequal in length; lateral and medial margins of endopod forming an angle of 35° at apex, entire margin of both rami fringed with plumose setae. Endopod with 4 spines on medial margin, 6 on lateral; exopod with 4 spines on medial margin, 9 on lateral; peduncle with 3 spines and 3 setae on ventral lateral angle.

Male. Similar to female in most respects, but with long spines on pereopods 1–4. Appendix masculina curved, apex recurved, extending slightly beyond apex of endopod. Penes present on sternite 7.

Colour. White with transverse band of black chromatophores across pereon segments, and lateral margin of pleon and pleotelson.

Size. Females 5.1–12.0 mm, males 6.3–7.5 mm, manca 5.9–6.3 mm.

Remarks. The broad oval body shape, the narrow hind margin of the pleotelson and the distinct depression on the telson serves to separate this species from others. Other characters useful in identifying this species are the shape of the uropodal endopod, the characters of the frontal lamina and clypeus, and the presence of coxal points.

Similar species include *N. longispina* and *N. pellucida*. Pleotelson shape immediately separates these species.

Distribution. Port Willunga, SA; Point Leo, Vic.; Sydney, NSW; at depths of 6–23 metres.

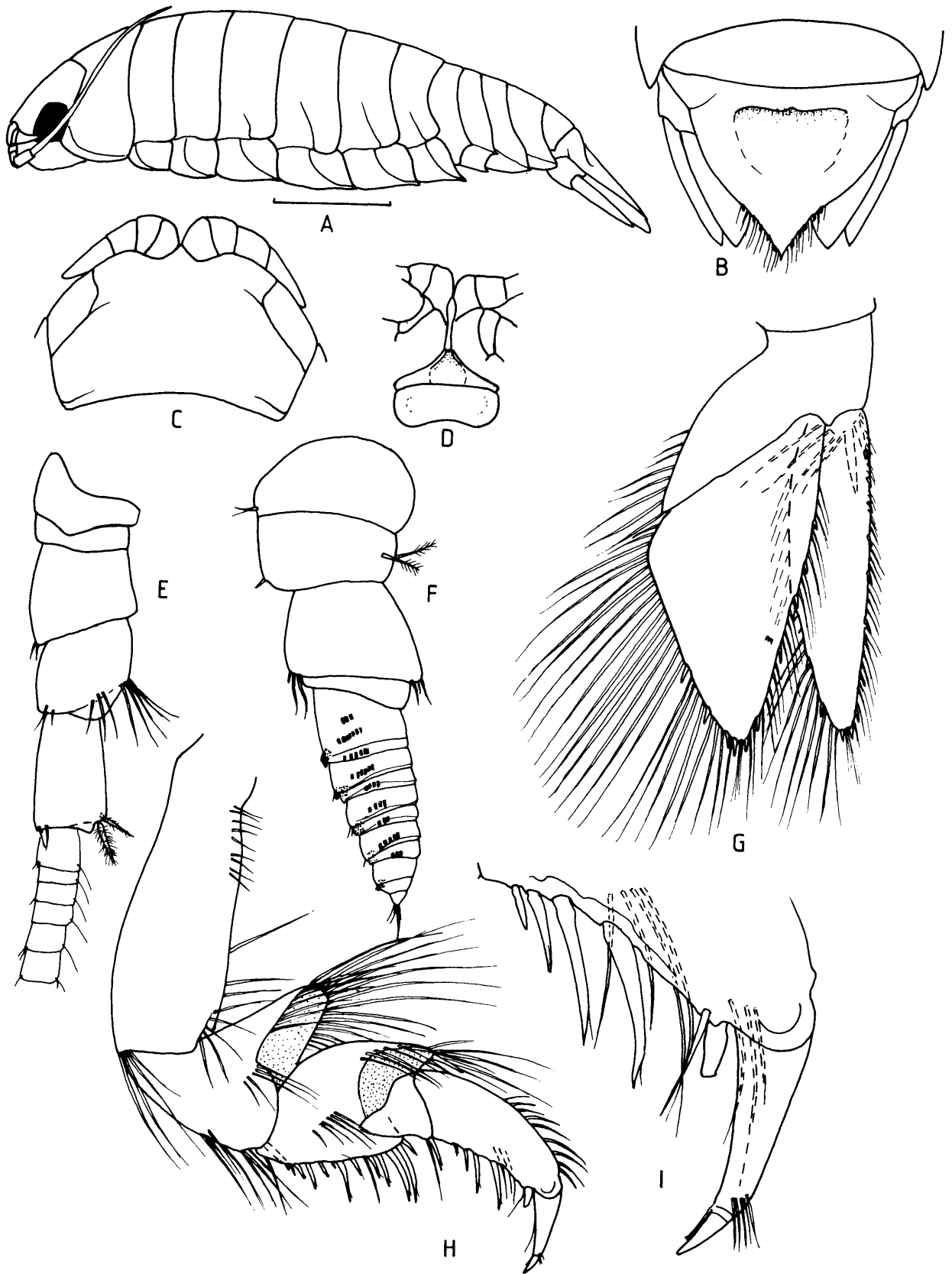


Fig. 51. *Natatolana corpulenta*, female 11.3 mm, Point Leo, Vic. A, lateral view; B, pleotelson, dorsal view; C, cephalon, dorsal view; D, clypeal region; E, antennal peduncle; F, antennule; G, uropod; H, pereopod 1; I, pereopod 1, palm of propodus. Scale 2.0 mm.

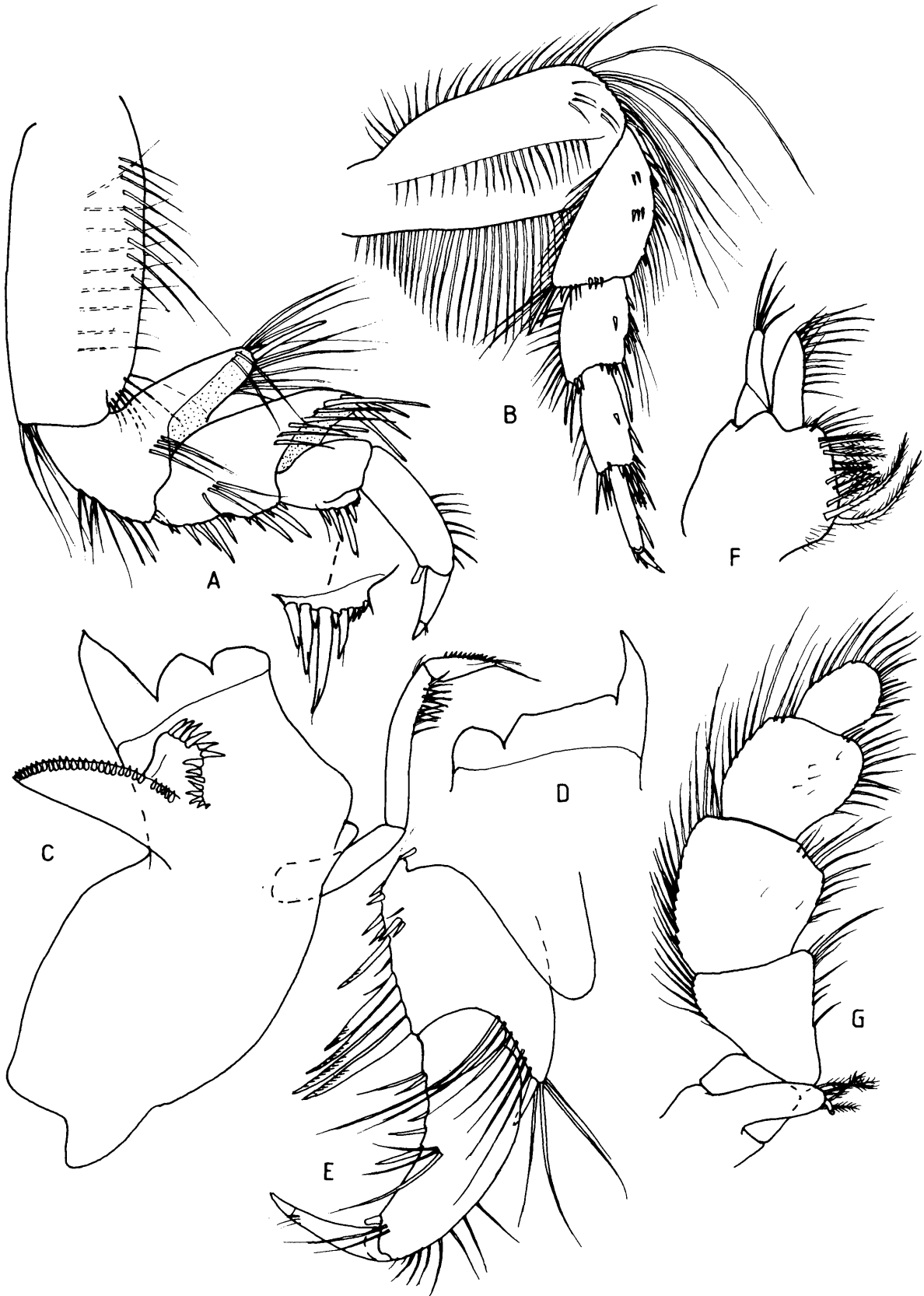


Fig. 52. *Natatolana corpulenta*. A, B, female 11.3 mm; C–G, damaged female, Point Leo, Vic. A, pereopod 3, and detail; B, pereopod 7; C, right mandible; D, left mandible, incisor; E, pereopod 1, male paratype; F, maxilla; G, maxilliped.

Natatolana longispina n. sp.

Figs 54, 55

Material examined. Crib Point Benthic Survey, Western Port, Vic., CPBS Stns: A1/2, male (8.8 mm), female (9.8 mm, non-ovig.); 355, 2 females (8.5, 10.0 mm, non-ovig.); 25N/2, 5 females (5.9–7.8 mm, all non-ovig.), manca (5.6 mm); 25N, male (7.5 mm), 2 females (10.5, 6.9 mm); 1727, female (12.7 mm); 22S/1, male (7.5 mm); 35S, 2 females (10.0, 11.9 mm); 25N/4, 3 males (8.0, 7.5, 6.8 mm), 4 females (8.5, 8.2, 6.9, 6.7 mm); 300/2, 2 males (7.0, 6.3 mm), 4 females (10.7, 7.7 non-ovig., 6.9 with mancas, 5.0 mm); 345, male (7.0 mm), female (10.5 mm), 2 mancas (2.0, 3.0 mm). Port Phillip Bay, Vic., PPS Stns: 946/2, 2 females (8.0, 9.8 mm); 982/2, male (7.8 mm), 2 mancas (2.7–4.2 mm); 980/5, female (8.2 mm); 980/4, male (8.5 mm). Note: This is selected material from about 300 specimens, all from Western Port and Port Phillip Bay, Vic.

Types. Holotype, male 8.8 mm, NMV J1770. Paratypes NMV J1771–J1783; AM P32371–P32374; USNM 190977–190989.

Type locality. Western Port, Vic. 38°27'S, 145°14'E.

Description of male. Body about twice as long as wide, broadly suboval in shape. Cephalon with acute median point; anterior margin partially raised to form

ridge; slightly impressed line runs to slightly beyond anterior dorsal surface of eye. Pereonite 1 longest; pereonite 4 longer than remainder, which progressively decrease in length away from pereonite 4. All coxae with distinct oblique carina running to point just above posteroventral angle. Pereonite 1 and all coxae with posterior ventral angle formed into point. Lateral margins of all pereonites with impressed line. Pleonites all visible, lateral margins of pleonites 3–4 produced, with impressed line. Pleotelson slightly shorter than greatest width, broadly rounded; anterodorsal area with distinct depression, anterior margin of which is clearly delimited, with median excision; posterior margin with 10 spines set amongst marginal setae.

Antennule short, not reaching pereonite 1; posterior angle of peduncle article 2 with conspicuous sensory seta; article 3 with fused 4th peduncular article; flagellum with 11 articles, each with several aesthetascs. Antenna peduncle article 4 with single seta on posterior margin, article 5 with 2 conspicuous sensory setae at distal end, flagellum composed of about 17 articles.

Frontal lamina narrow, slightly narrower at anterior end, clypeus with central depressed area, anterior margin forming into ridge. Mandible, maxillule, maxilla

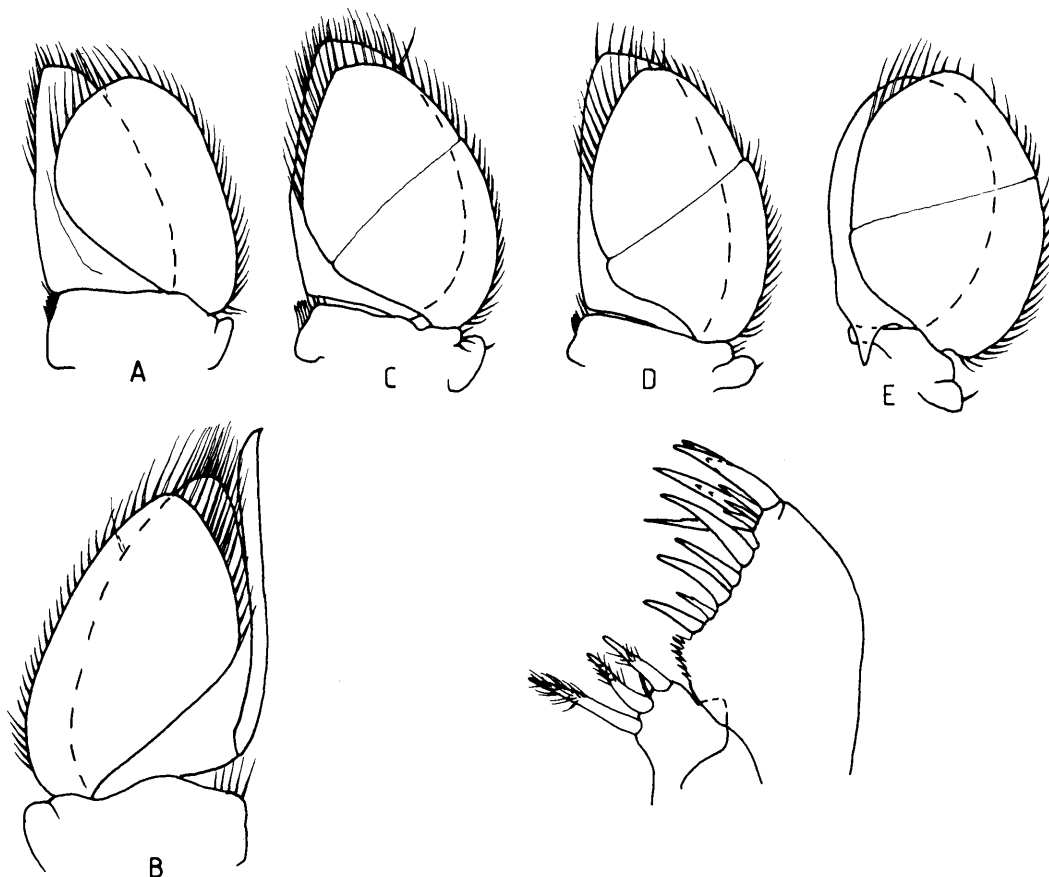


Fig. 53. *Natatolana corpulenta*, male 7.2 mm, Stockton Beach, NSW. A–E, pleopods 1–5 respectively; F, maxillule, female, Point Leo.

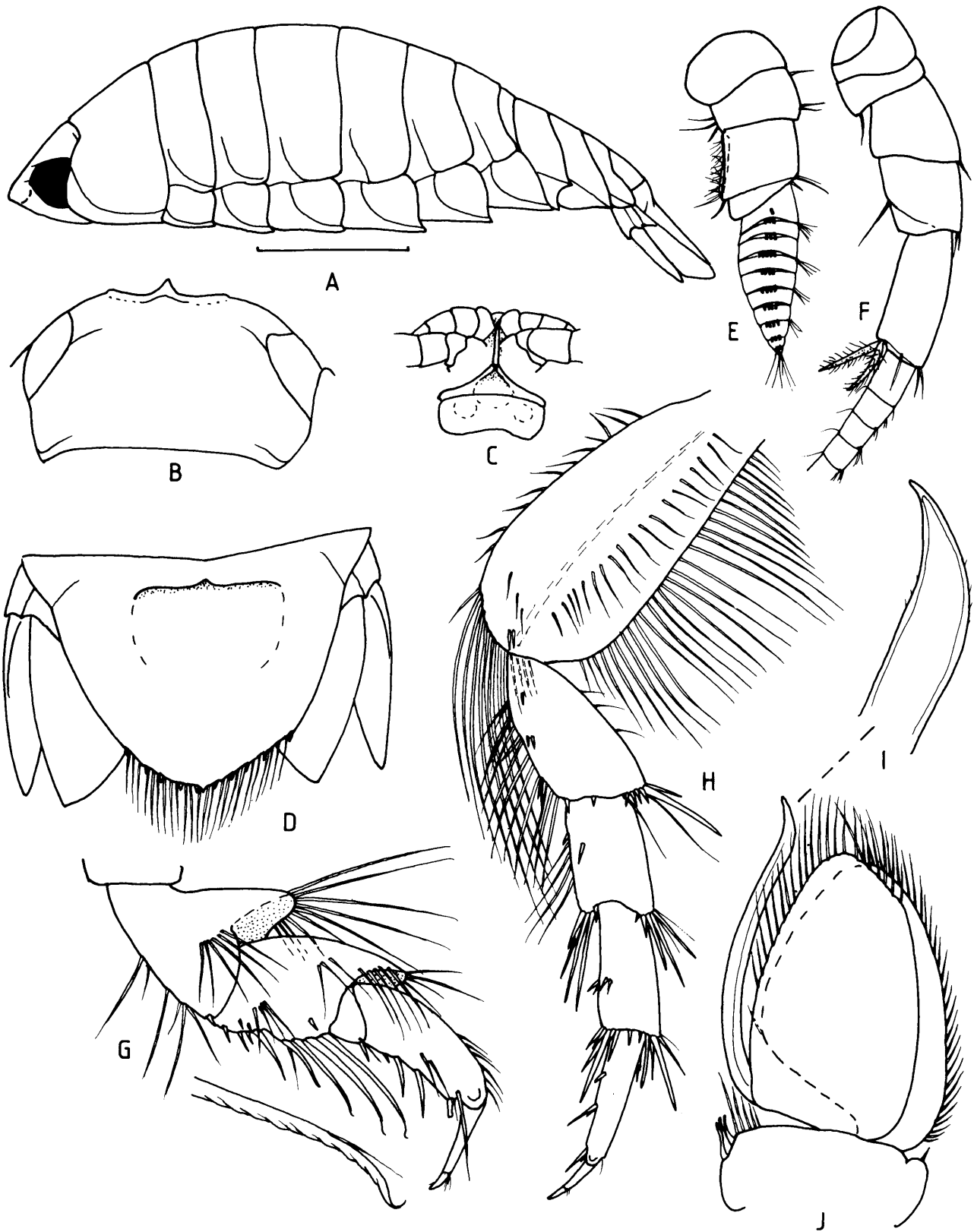


Fig. 54. *Natatolana longispina* n. sp. A-D, holotype; remainder male paratype 8.8 mm. A, lateral view (antennule and antenna removed); B, cephalon, dorsal view; C, clypeal region; D, pleotelson; E, antennule; F, antennal peduncle; G, pereopod 1; H, pereopod 7; I, appendix masculina, apex; J, pleopod 2. Scale 2.0 mm.

and maxilliped not differing from *N. corpulenta*.

Pereopod 1 ischium and merus with anterodistal angles produced, with setae but no spines; posterior margin of merus with about 5 small spines, longest of these extending to midway along palm of propodus; carpus short, with single spine and seta on posterodistal angle; propodus with 3 spines and fourth robust spine opposing dactylus. Pereopods 2 and 3 similar to 1 but palm of propodus without spines, carpus longer with additional spines, and anterodistal angle of merus with about 13 spines. Pereopod 4 with long spines arising at distal angle of carpus and extending beyond dactylus. Pereopods 4-7 similar, pereopod 6 being longest. Pereopod 7 with all margins of basis setose, slightly less than twice as long as greatest width; ischium with 3 setae

on anterior margin; carpus, merus and propodus without setae on anterior margins; ischium and merus with setae on posterior margin; carpus and propodus without setae on posterior margin; groups of spines present at distal angles of ischium, merus, carpus and along posterior margin of all articles except basis. Penes present on sternite 7, angled medially.

Pleopods the same as *N. corpulenta*. Pleopod 2 appendix masculina arising basally, extending beyond inner ramus, tip curved away from ramus. Uropods extending slightly beyond apex of pleotelson. Exopod narrow, lanceolate, little shorter than endopod, lateral margin with 7 spines and numerous setae, medial margin with 4 spines set amongst long plumose setae. Endopod with both margins slightly convex, setae along their

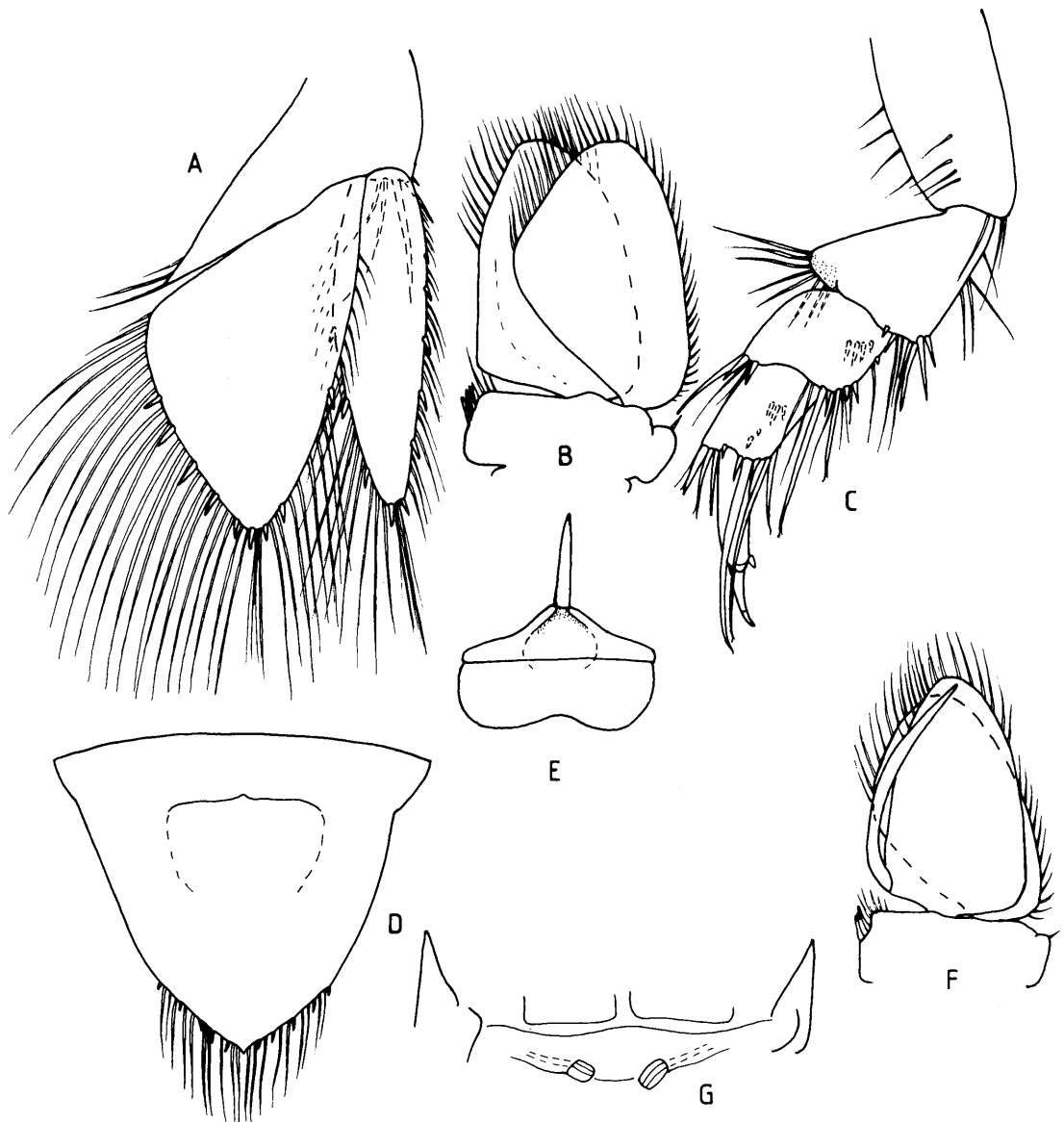


Fig. 55. *Natatolana longispina* n. sp. A-C, male paratype 8.8 mm; D, F, G, PPB male 6.8 mm. A, uropod; B, pleopod 1; C, pereopod 4; D, pleotelson; E, clypeus, frontal lamina PPB male 7.8 mm; F, pleopod 2; G, penes, in situ.

entire length; lateral margin with 3 spines, medial with 6. Peduncle with 3 spines and 2 setae on posterolateral angle.

Female. Males and females very similar but females lack elongate pereopod spines, and appear to have only 1 coupling hook on maxilliped endite whereas males have 2.

Variation. Smaller specimens lack the coxal points, and the anterior part of the pleotelsonic depression may not be as clearly defined. Small males do not have the appendix masculina apex turned out, and may also lack the characteristic long spines.

Colour. Preserved specimens are white to translucent, a few specimens show small black chromatophores which are arranged in bands.

Size. Largest specimen examined was an ovigerous female at 12.7 mm, largest male 8.8 mm; largest immature specimen 5.6 mm.

Remarks. This species shows many points of similarity to *N. corpulenta*, particularly in the form of the mouthparts, pereopods, pleopods, and pereon and pleon segments. Points of distinction include the broad rounded pleotelson, the slightly broader uropodal endopod, which extends beyond the pleotelson apex, the narrow frontal lamina, and details of spination and setation of the pereopod articles. The fifth article of the antennal peduncle is longer, the fourth article lacks the row of setae of *N. corpulenta*.

Distribution. Port Phillip Bay and Western Port, Vic.

Etymology. The specific epithet is derived from the combination of the Latin words *longus* (= long) and *spina* (= spine), and alludes to the presence of long pereopodal spines in the male.

Natatolana laewilla n. sp.

Figs 56, 57

Material examined. Male (7.5 mm), female (8.2 mm), manca (5.1 mm), 33°32'S, 152°08'E, 892–900 m; female (8.2 mm, ovig.), 33°38'S, 152°03'E, 880–900 m; male (9.5 mm), 33°36'S, 152°05'E, 1090–1125 m. All east of Port Jackson, NSW, 10 Dec. 1980, sledge dredge, coll. R. Springthorpe & P. Coleman.

Types. Holotype, female, AM P33551. Paratypes AM P33550, 33552.

Type locality. East of Port Jackson, NSW, 33°36'S, 152°05'E.

Description of female. Body about 2.25 times as long as wide. Eyes vestigial, impressed line running behind anterior margin, and along medial margin of each eye. Coxae without furrows. Pleonite 2 with lateral margins not produced; pleonite 3 posterolateral margins slightly produced, ventral margin sinuate. Pleotelson with acute dorsal depression; lateral margins converging smoothly to apex, provided with 10 spines set amongst marginal plumose setae.

Antennule peduncle article 2 shortest; flagellum short, not reaching pereonite 1, composed of 10 articles, first long, remainder short. Antenna peduncle article 5

longest; flagellum extending to pereonite 2, composed of about 18 articles.

Frontal lamina narrow, lateral margins sinuate, apex acute; anterior ventral surface recessed; frontal lamina and labrum similar to others of group and other mouthparts similar to those of *N. corpulenta*.

Pereopod 1 with setae on anterior margin of basis; ischium without spines; merus with 1 spine at anterodistal angle, posterior margin with 11 acute spines; carpus with 1 acute spine; propodus with 4 acute spines on palm, and robust spine opposing dactylus. Pereopods 2 and 3 similar to 1, but propodus slightly shorter; posterodistal margin of ischium with slender spines; merus and carpus with more and larger spines than pereopod 1; propodus without spine on palm. Pereopods 6 and 7 similar, but pereopod 6 markedly longer and more slender than 7; propodus of pereopod 6, 1.5 times length of carpus, and propodus of pereopod 7, 1.26 times length of carpus. Pereopod 7 basis about 2.25 times longer than greatest width, anterior margin very nearly straight, with continuous fringing setae; posterior margin convex, with few setae except for long plumose setae at posterodistal angle; anterior margins of ischium to propodus without setae; posterior margin of ischium setose; merus, carpus and propodus without setae.

Pleopods similar to those of *N. corpulenta*; distal margin of pleopod 1 exopod broadly rounded. Uropods extending slightly beyond pleotelson apex. Exopod shorter than endopod, both margins converging smoothly to apex; lateral margin with 3 spines and medial margin with 3. Endopod lateral margin very nearly straight, with few setae and 4 spines; medial margin with continuous fringing setae and 3 spines.

Male. Penes present as 2 flattened, well separated lobes on sternite 7. Pleopod 2 appendix masculina strongly bent laterally, apex bluntly rounded, attached basally. Otherwise similar to female. Coxae on pereonite 7 have faint trace of diagonal furrow.

Colour. Creamy white in alcohol, chromatophores not apparent. Ocelli white, except one male whose eye is more distinct and ocelli are tan.

Size. Largest male 7.5 mm, largest female 9.5 mm.

Remarks. This species is an unequivocal member of the *N. pellucida* complex of species. The species is easily separated from others in this complex by the lack of eyes and coxal furrows. The male is easily identified by the appendix masculina and position of the penes.

Distribution. Off Port Jackson, NSW, at depths of 880–1125 metres.

Etymology. The specific epithet is derived from *laewill*, an Aboriginal word for a club that is bent at an angle, and alludes to the appendix masculina shape.

Natatolana galathea n. sp.

Fig. 58

Material examined. Female (7.0 mm, with embryos), Gulf of Carpentaria, 10°37'S, 139°19'E, 27 Sept. 1951, 57 m, *Galathea* Stn 503.

Types. Holotype, ZMUC.

Type locality. Gulf of Carpentaria, 10°37'S, 139°19'E.

Description of female. Body about 2.5 times as long as wide. Cephalon with anterior margin slightly

projecting, with median rostral point; furrow runs from dorsal anterior surface of each eye. Eyes large, with large ocelli. Pereonites 2 and 4 with distinct oblique furrow, pereonites 2-5 with indistinct vertical furrow to posterior of segment; coxae of pereonites 2-7 with complete furrow. Pleonites all visible, pleonite 3 with posterolateral margin produced, with 2 carinae, pleonite 4 with posterolateral margin produced, with 2 carinae, pleonite 4 with posterolateral margin produced, with 2 carinae, pleonite 4 with posterolateral margin moderately narrow, but rounded. Pleotelson two thirds

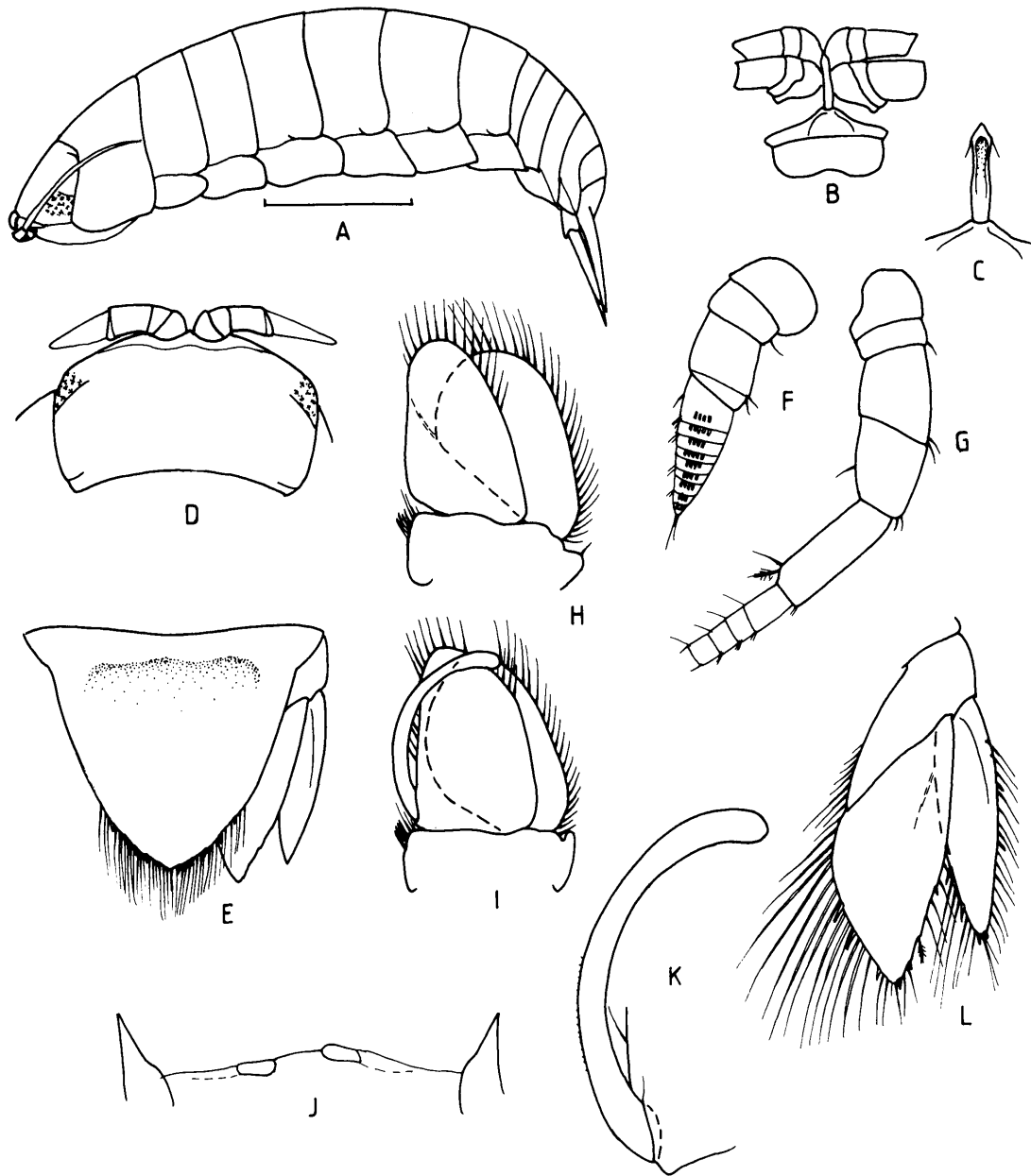


Fig. 56. *Natatolana laewilla* n. sp. A-E, holotype; F, G, L, female paratype; H-K, male paratype. A, lateral view; B, clypeal region; C, clypeus, detail; D, cephalon; E, pleotelson; F, antennule; G, antenna, peduncle; H, pleopod 1; I, pleopod 2; J, sternite 7, penes; K, appendix masculina; L, uropod. Scale 2.0 mm.

as long as greatest width, posterior margin slightly excavate, with 8 spines, each spine set within distinct notch, making posterior margin appear distinctly serrate; 2 setae placed between each spine.

Antennule short, peduncle article 3 slightly shorter than combined lengths of articles 1 and 2, flagellum slightly shorter than peduncle, composed of about 10 articles, reaching to mid-point of eye. Antenna flagellum reaching pereonite 2.

Frontal lamina narrow, anterior slightly expanded to rhomboidal shape. Clypeus triangular.

Pereopod 1 with few setae on basis; ischium with setae on anterodistal margin and along posterior margin; merus with single spine at apex of anterior margin, and about 8 stiff setae on anterolateral margin, posterior margin bisinuate, with about 10 spines; carpus with single seta and spine at posterodistal angle; propodus with 3 acute spines on palm and distal robust spine opposing dactylus. Pereopod 7 basis little more than twice as long as broad, both margins setose, anterior margin slightly sinuate, posterior margin slightly convex; anterior margins of merus, carpus and propodus with few setae; distal angles of all these articles

with groups of spines, posterior margins with additional spines, that of ischium with row of marginal setae. Pereopod 6 similar, slightly longer.

Pleopod 1 exopod with distal margin distinctly truncate. Uropods barely extending beyond apex of pleotelson. Exopod shorter than endopod, lanceolate in shape, lateral margin with 6 spines set amongst marginal setae, medial margin with 4. Endopod triangular, lateral margin with 4 spines and sensory seta, medial with 4 spines; both margins setose.

Male. Not known.

Size. 7.0 mm.

Colour. Cream in alcohol. Chromatophores not apparent.

Remarks. This species is another member of the *N. pellucida* group of species. It can be immediately distinguished from these species by the distinctive serrated posterior border of the pleotelson. The furrowing of the pereonites is also distinctive.

Distribution. Known only from the type locality, in the Gulf of Carpentaria, between the tip of Cape York and Arnhem Land.

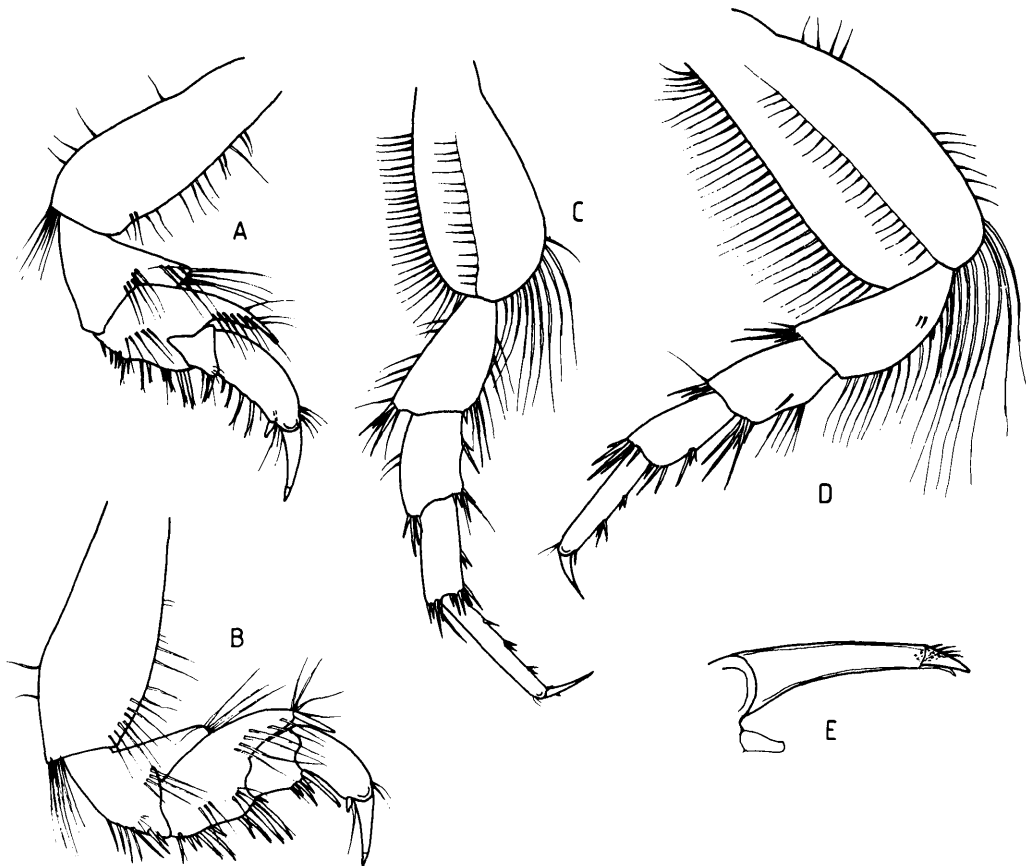


Fig. 57. *Natatolana laewilla* n. sp., female paratype, except C, male paratype. A, pereopod 1; B, pereopod 2; C, pereopod 6; D, pereopod 7; E, pereopod 1, dactylus.

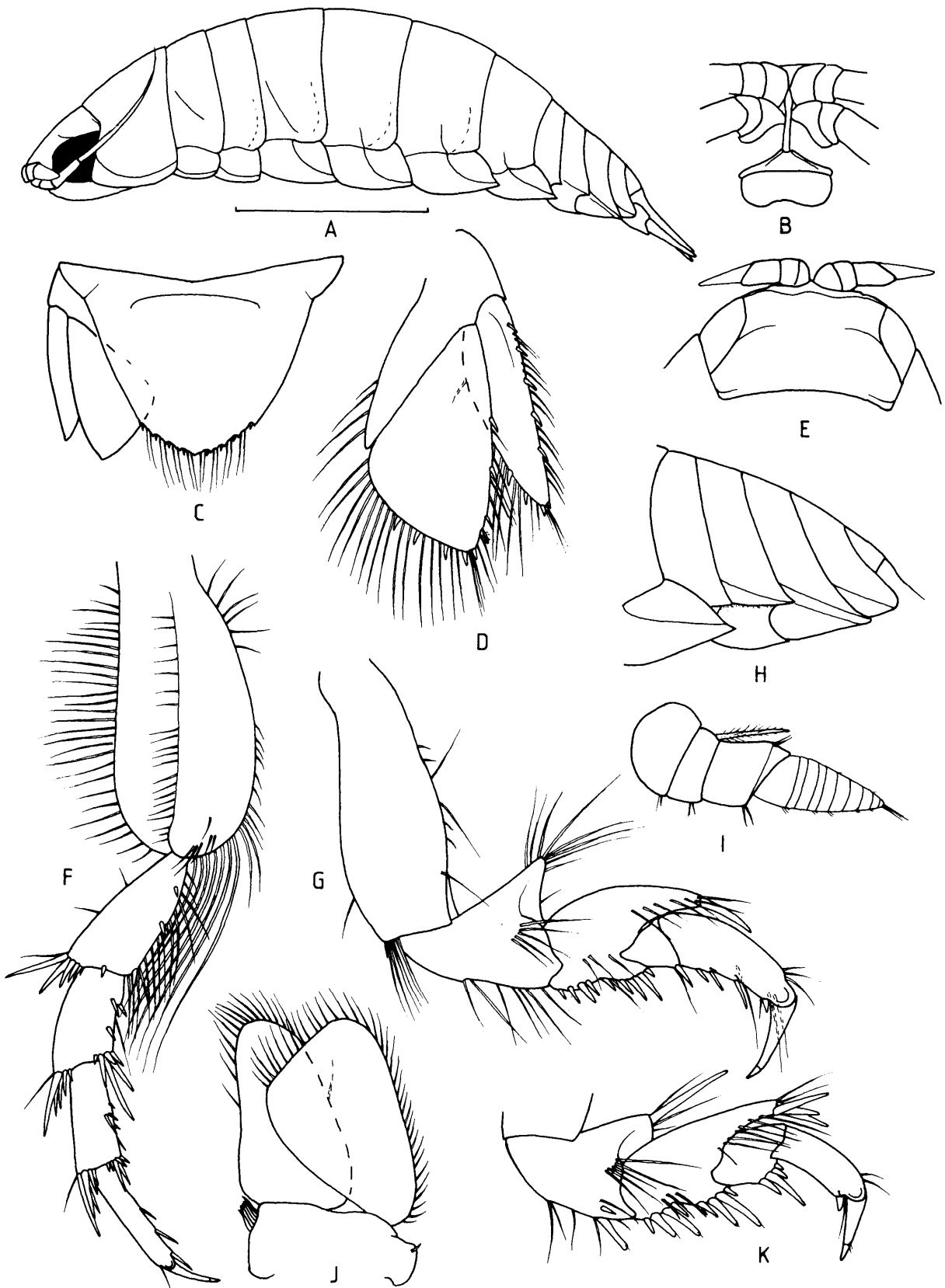


Fig. 58. *Natatolana galathea* n. sp., holotype. **A**, lateral view; **B**, clypeal region; **C**, pleotelson and uropod; **D**, uropod; **E**, cephalon, dorsal view; **F**, pereopod 7; **G**, pereopod 1; **H**, pleon, lateral view; **I**, antennule; **J**, pleopod 1; **K**, pereopod 3. Scale 2.0 mm.

Etymology. The name honours the research vessel *Galathea* from which the specimen was taken.

Natatolana arcicauda (Holdich, Harrison & Bruce)
Fig. 59

Cirolana arcicauda Holdich, Harrison & Bruce, 1981: 563, fig. 14. [Part *Cirolana woodjonesi*.—Hale, 1940: 288. Misidentification, not *N. woodjonesi* (Hale, 1924)].
Natatolana arcicauda.—Bruce, 1981b: 958.

Material examined. Female (11.3 mm), holotype (QM W6335), male (10.5 mm), allotype (QM W6336), Cleveland Bay, Townsville, Qld. Male (9.5 mm), Northwest Island, Capricorn Group, Qld, 9 Dec. 1919, 40 m, brought up on bait while line fishing.

Types. Held by the Queensland Museum.

Type locality. Cleveland Bay, Townsville, Qld.

Remarks. The specimen from the Capricorn group agrees entirely with the original description (Holdich et al., 1981), with the exception of the posterior border of the pleotelson, which is more distinctly angled. The anterior lobe of the merus of pereopod 7 is produced, and has a single spine.

The characters that best separate this species from others of the genus are the form of furrowing on the dorsal surface of the cephalon and on the coxae, the shape of the frontal lamina, uropods, the basis of pereopod 7, and the form of the lateral margin of the pleonites. The appendix masculina is simple, and does not extend beyond the inner ramus.

Hale (1940) recorded *Cirolana woodjonesi* from the Capricorns. The specimens do not belong to that species, but to two species, the one dealt with here, the other being *N. bulba*.

Distribution. Queensland: Townsville, Northwest Island, Capricorns at depths of 2.7–40 metres.

Natatolana valida (Hale)
Fig. 60

Cirolana valida Hale, 1940: 200, fig. 2.
Natatolana valida.—Bruce, 1981b: 958.

Material examined. Holotype, female (31.0 mm), AM E4814.

Types. Holotype held at the Australian Museum.

Type locality. East of Flinders Island, Bass Strait, 400–600 metres.

Supplementary description of female. Hale (1940) mentioned the presence of a 'minute, downbent, median process, not separating the first antennae'. This process does not constitute the rostral point as shown by all other species of the genus.

Coxae of pereonites 4–7 without impressed lines. Posterolateral margins of pleonite 3 with longitudinal carinae, pleonite 4 without. Pleotelson posterior margin slightly more angled than shown by Hale, with 8 spines on either side of small median projection (Hale records a total of 20 spines, some may have since rubbed off).

Frontal lamina straight sided, apex acute, ventral surface carinate; clypeus with central portion strongly produced.

Pereopod 1 with single stout spine on anterodistal angle of merus, as well as setae; posterior margin of merus with 31 spines, carpus with 3, and propodus with 6 and robust spine opposing dactylus. Pereopods 2 and 3 similar to 1, but carpus proportionally longer. Pereopod 2 with single spine on anterodistal angle of merus, and 4 spines on palm of propodus. Pereopod 3 has single spine on anterodistal angle of ischium, 3 on merus; posterior margin of merus with 10 spines and 2 submarginal spines, carpus with 2 long and 1 short spine, propodus with 3 spines.

Pleopods not examined in detail. Uropod exopod slightly shorter than endopod, lateral margin with about 11 spines, medial with 5; setae extend along full length of margin. Endopod with 7 spines each on medial and lateral margins; outer margin with setae on distal one third of its length.

Male. Not known.

Colour. Greyish white in alcohol.

Size. 31.0 mm.

Remarks. The diagnostic points of this species are the lack of a rostral point, lack of impressed lines on coxae 4–7, the straight sided carinate frontal lamina, and the large number of spines (16–20) on the posterior margin of the pleotelson.

The most similar species is *N. thurar*, also from Bass Strait. That species differs in the number of spines on the pleotelson (8 for *N. thurar* and 16–20 for *N. valida*), the shape of the posterolateral margins of pleonite 5, the lack of rostral point, and the coxal carinae.

Distribution. Known only from the type locality.

Natatolana lurur n. sp.
Fig. 61

Material examined. Male (18.9 mm), female (15.8 mm), 27°40'S, 113°03'E, north-west of Bluff Point, Geraldton, WA, 22 July 1963, 150 m, coll. CSIRO.

Types. Holotype, female, WAM 46-80. Paratype, WAM 20-80.

Type locality. Northwest of Bluff Point, Geraldton, WA, 27°40'S, 113°03'E.

Description of female. Body about 3 times as long as wide. Cephalon with 2 entire interocular furrows, and distinct rostral point. Coxae of pereonites 2, 3 and 7 with furrows, those of pereonites 4–6 without; pereonite 1 with single horizontal furrow. Pleonites all visible; posterolateral margins of pleonites 3 and 4 acute, backwardly produced. Pleotelson slightly shorter than wide, posterior margin slightly angled, provided with 10 spines set amongst plumose setae.

Antennule peduncle article 3 slightly longer than combined lengths of articles 1 and 2; flagellum composed of about 14 articles, not reaching anterior margin of pereonite 1. Antenna flagellum of about 28

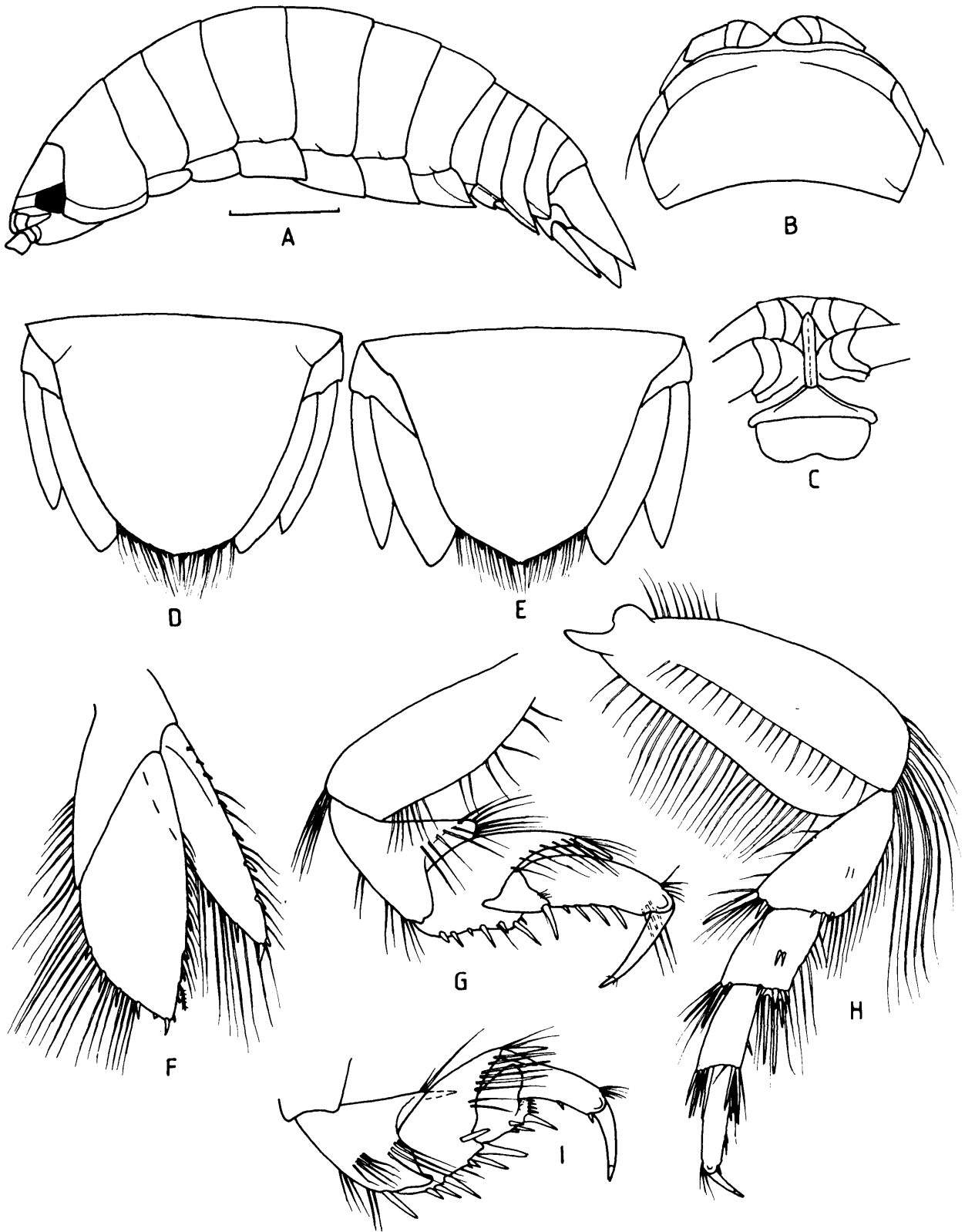


Fig. 59. *Natatolana arcicauda*. A-D, female holotype; E-I, female Northwest Is. A, lateral view; B, cephalon, dorsal view; C, clypeal region; D, pleotelson and uropods; E, pleotelson and uropods; F, uropod; G, pereopod 1; H, pereopod 7; I, pereopod 3. Scale 2.0 mm.

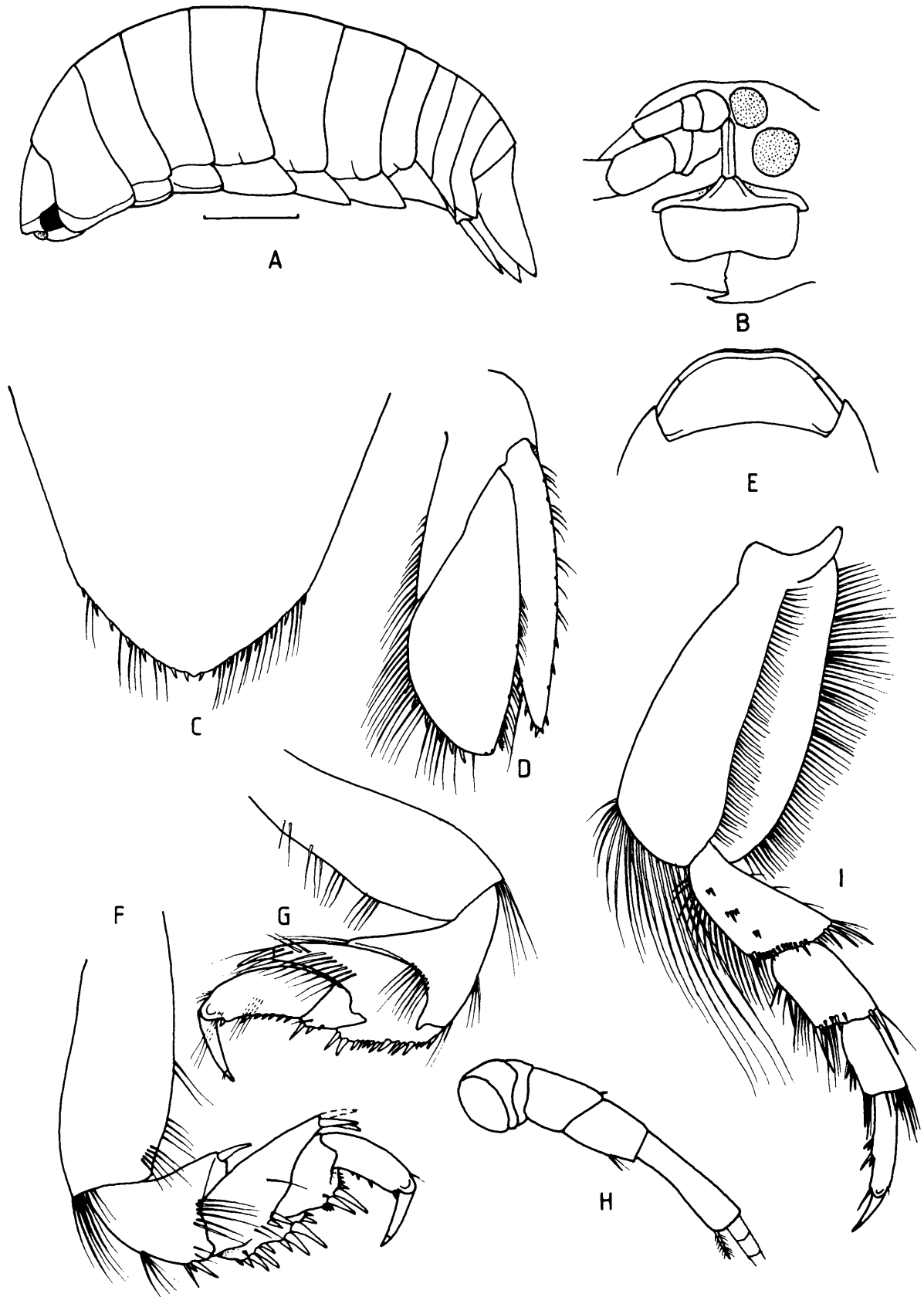


Fig. 60. *Natatolana valida*, holotype. A, lateral view; B, clypeal region; C, pleotelson; D, uropod; E, cephalon, dorsal view; F, pereopod 3; G, pereopod 1; H, antennal peduncle; I, pereopod 7. Scale 5.0 mm.

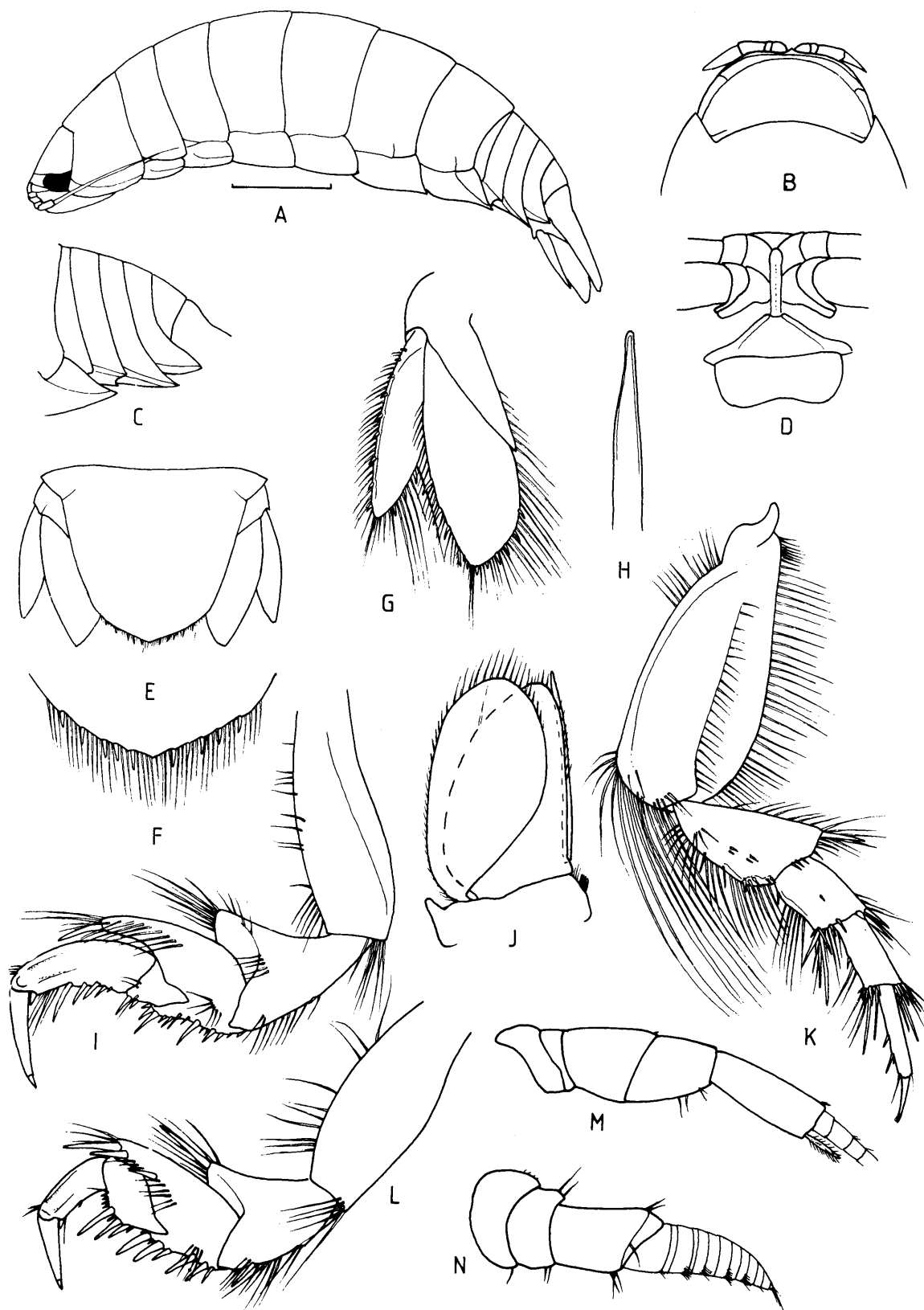


Fig. 61. *Natatolana lurur* n. sp. A-D, holotype; remainder paratype. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, clypeal region; E, pleotelson and uropods; F, pleotelson, posterior margin; G, uropod; H, appendix masculina, apex; I, pereopod 1; J, pleopod 2; K, pereopod 7; L, pereopod 3; M, antennal peduncle; N, antennule. Scale 3.0 mm.

articles, extending to posterior of pereonite 2.

Frontal lamina straight sided, anterior margin slightly dilated, rounded. Clypeus triangular.

Pereopod 1 with setae along anterior margin of basis; ischium with anterior margin setose, posterior margin with setae along distal half and single small spine set half way along; merus anterior margin with single robust terminal spine and row of setae, posterior margin with 14 spines; carpus with 2 spines on posterior margin; propodus with 5 spines on palm, 5th spine opposing dactylus, anterodistal margin with row of 4 setae. Pereopods 2–3 similar to pereopod 1, but antero- and posterodistal margins each with single stout spine; merus with 3 spines on anterior margin; propodus with single spine on palm in addition to spine opposing dactylus. Pereopod 7 basis with continuous row of setae along anterior margin, posterior margin straight, with long natatory setae on distal margin; ischium, merus and carpus with long setae on posterior margin, with groups of spines at distal angles; propodus with 3 groups of spines on posterior margin.

Uropods extending slightly beyond apex of telson. Exopod distinctly shorter than endopod, lateral margin with 9 spines, medial with 3. Endopod with 5 spines and sensory seta on lateral margin, 6 spines on medial margin. Both rami with marginal setae.

Male. Entirely similar to female except for sexual characters. Lacks penes. Appendix masculina arising basally, extending slightly beyond endopod of pleopod 2, apex slightly narrowed, very slightly curved inwards.

Colour. Cream in alcohol.

Size. Longest specimen, 18.9 mm.

Remarks. This species is similar to *N. thurar* from Bass Strait. There are distinct differences in the relative size of the uropodal rami (the exopod of this species being noticeably short), the shape of the frontal lamina, the shape and spination of the pleotelson, and the much more setose posterior pereopods.

Distribution. Known only from off Geraldton, W.A.

Etymology. *Lurur* is an Aboriginal word meaning broken, and refers to the fact that both specimens are damaged.

Natatolana matong n. sp.

Figs 62, 63

Cirolana rossi.—Hale, 1952, 24. [Mis-identification, not *N. rossi* (Miers, 1876)].

Material examined. 4 males (20.2, 24.0, 21.5, 23.9 mm), 8 females (19.5–27.1 mm), west of King Island, N.W. Tas., 21 Oct. 1950, 180 m. Female (26.5 mm), British, Australian, New Zealand Antarctic Research Expedition Stn 113, off Maria Island, Tas., 42°40'S, 148°27'E, 23 Mar. 1931, 155–178 m. Female (18.9 mm) south of Warrnambool, Vic., 14 May 1969, 220–310 m, coll. V. Johnston. Female (24.0 mm), Apollo Bay, Vic., coll. S. O'Connor.

Types. Holotype, male, TM G2543. Paratypes, TM G1293, NMV J920, J1733; SAM C3277, C3921; USNM 109986; BM(NH); AM P33546.

Type locality. Off King Island, North West Tasmania, ca. 40°S, 144°E.

Description of male. Body little more than 3 times as long as wide. Cephalon with blunt rostral point on anterior margin; furrow runs anteriorly from dorsal surface of each eye, curving slightly inwards before terminating; feeble trace of furrow curves anteriorly from point of termination of distinct furrow. Eyes distinctly narrower anteriorly. Pereonites 1, 5 and 6 subequal in length and longer than pereonites 2–4 and 7; pereonite 1 with submarginal furrow, and second lateral furrow. Coxae of pereonites 2–3 with furrows, coxae on pereonite 4 with partial furrow, coxae of pereonite 7 with feeble trace of furrow. All furrows on coxae feebly developed and difficult to see. Pleonites all visible; posterolateral margins of pleonite 3 acute, produced posteriorly, those of pleonite 4 moderately acute, upper margin convex. Pleotelson slightly shorter than long, posterior margin with marginal plumose setae, 6 spines on either side of mid point; central pair of spines set very close.

Antennule extending to mid point of eye, peduncle article 3 as long as combined lengths of articles 1 and 2; flagellum slightly shorter than peduncle, composed of about 15 articles with numerous aesthetascs. Antenna with group of stiff setae at posterodistal angle of peduncle article 4; flagellum composed of about 35 articles, extending to pereonite 3.

Frontal lamina 2.5 times as long as basal width, constricted medially, apex angled to acute point, ventral surface feebly carinate. Frontal lamina with medial half of anterior margin produced forwards. Maxilliped endite with 2 coupling hooks, 10 plumose and 6 simple setae.

Pereopod 1 with setae along anterior margin of basis, and group of setae at posterodistal angle; ischium with single spine at posterodistal angle and setae along anterior and posterior margins; merus with 9 stout spines on posterior margin, anterior margin with 1 stout spine at apex and numerous setae; carpus with 4 spines on posterior margin; propodus with 4 acute spines on palm and 1 opposing dactylus, further short spine set proximally; lateral surface with group of setae. Pereopods 2–3 similar, more spinose; propodus with 3 acute spines on palm, lateral surface with 2 carinae. Pereopods 5–7 similar, pereopod 6 longer than 5 or 7, basis broadest in pereopod 7. Pereopod 7 basis about twice as long as broad, posterior margin slightly convex, provided with continuous row of marginal setae, anterior margin without setae, except distal extremity which has long plumose setae; ischium with stiff setae along posterior margin, anterior margin with slender setae, distal extremities with spines; merus and carpus with spines at distal angles and in groups along posterior margins; propodus with 3 groups of spines on posterior margin, and further group of spines at base of dactylus.

Vasa deferentia opening flush with surface of sternite 7.

Pleopod 2 appendix masculina arising basally, as long

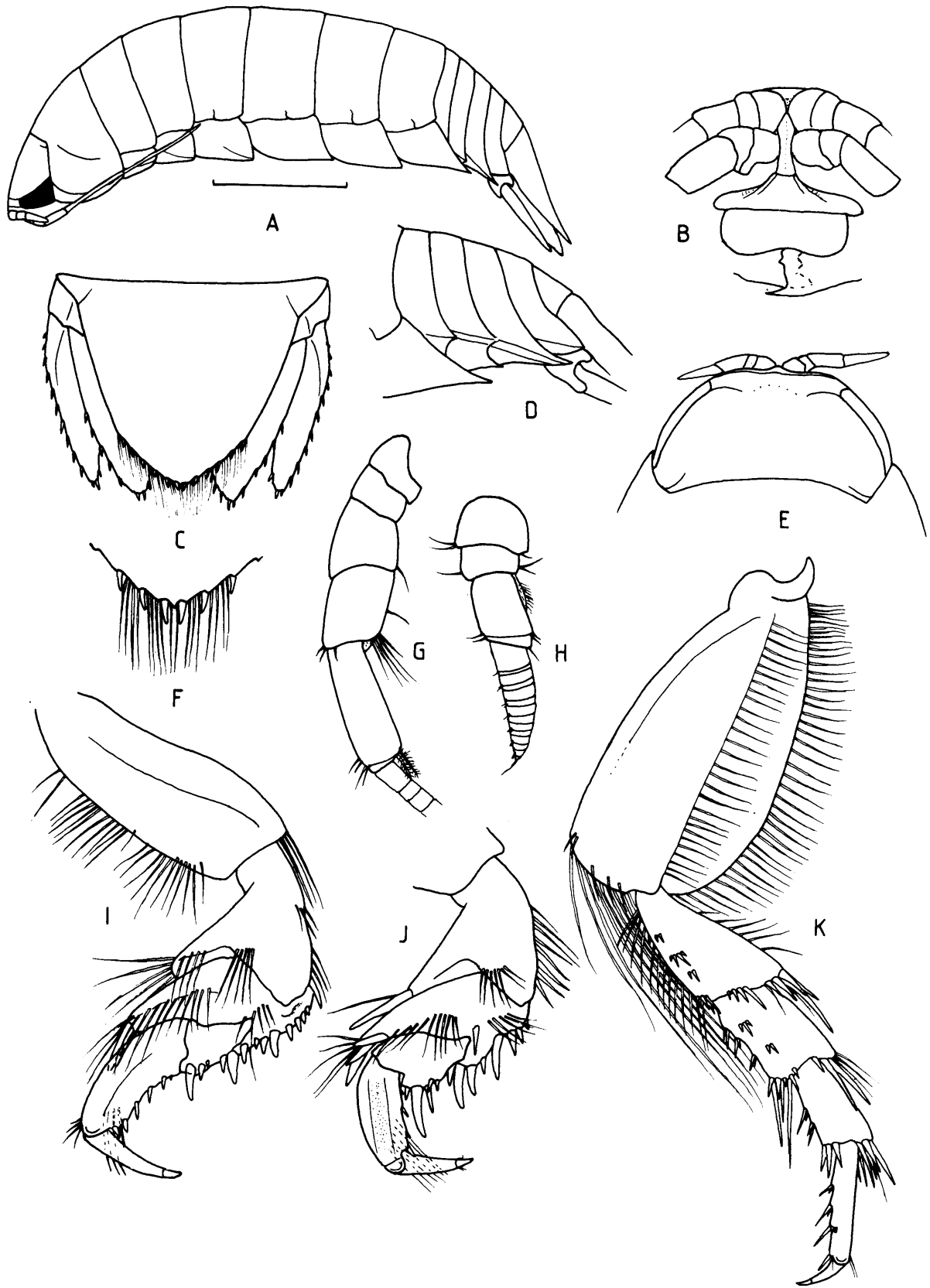


Fig. 62. *Natatolana matong* n. sp. A-C, E, F, holotype; remainder female paratype. A, lateral view; B, clypeal region; C, pleotelson; D, pleon, lateral view; E, cephalon, dorsal view; F, pleotelson, apex; G, antennal peduncle; H, antennule; I, pereopod 1; J, pereopod 3; K, pereopod 7. Scale 5.0 mm.

as inner ramus, straight sided, slender. Uropods extending slightly beyond apex of pleotelson. Exopod slightly shorter than endopod, lateral margin with 11 spines set amongst marginal setae; medial margin with 5 spines and long marginal setae; both margins very slightly convex. Endopod lateral margin very nearly straight, with 7 spines set amongst short setae, medial margin with 7 spines amongst long setae.

Female. Differs from male only in sexual characters.

Variation. All specimens agree closely. The specimen from Apollo Bay does not show the interocular furrows at all clearly.

Colour. Pale tan in alcohol, chromatophores not visible.

Size. Largest female 27.1 mm, largest male, 24.0 mm.

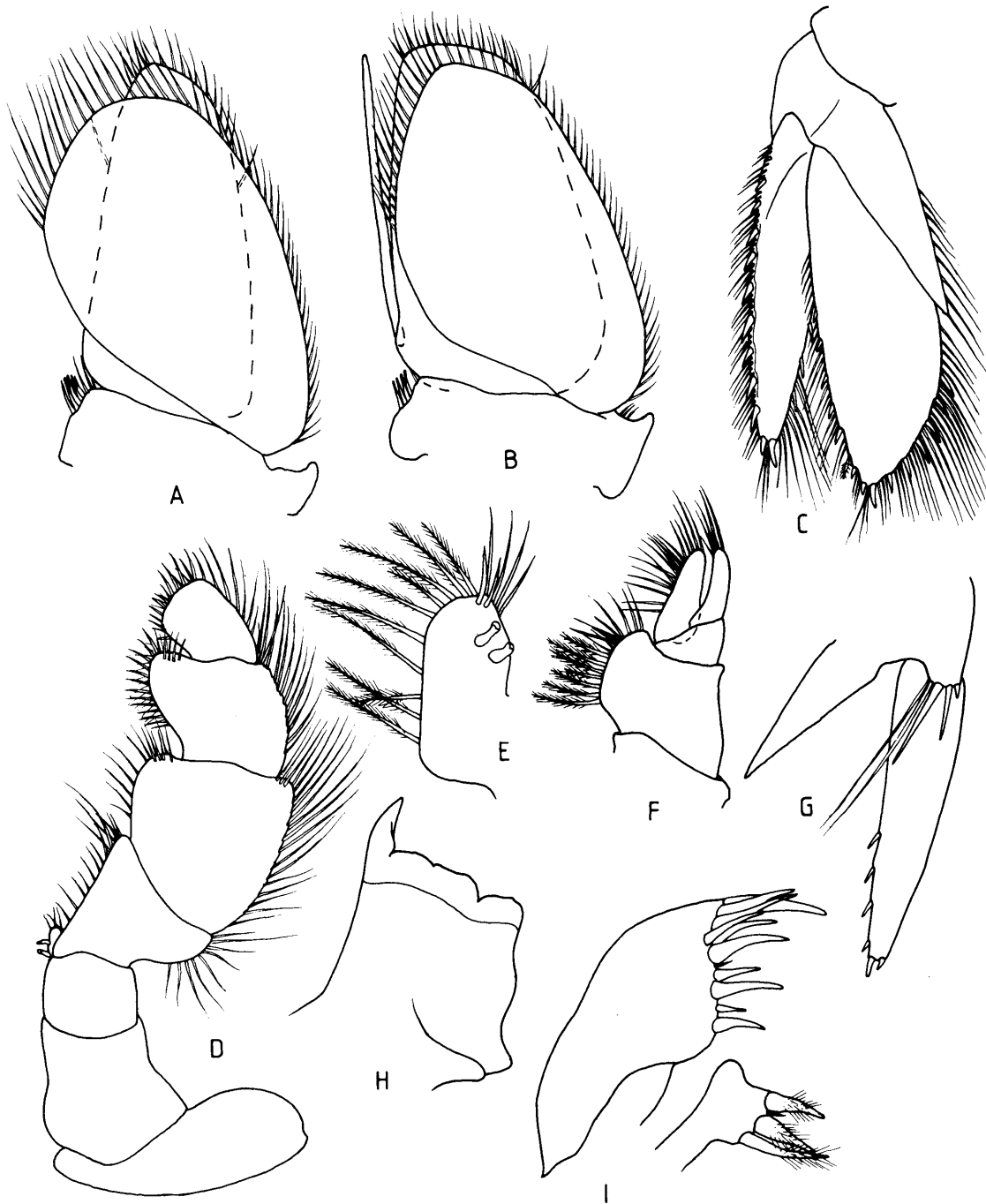


Fig. 63. *Natatolana matong* n. sp. A, B, holotype; remainder female paratype. A, pleopod 1; B, pleopod 2; C, uropod; D, maxilliped; E, maxilliped endite; F, maxilla; G, uropod peduncle, ventral view; H, left mandible incisor, I, maxillule.

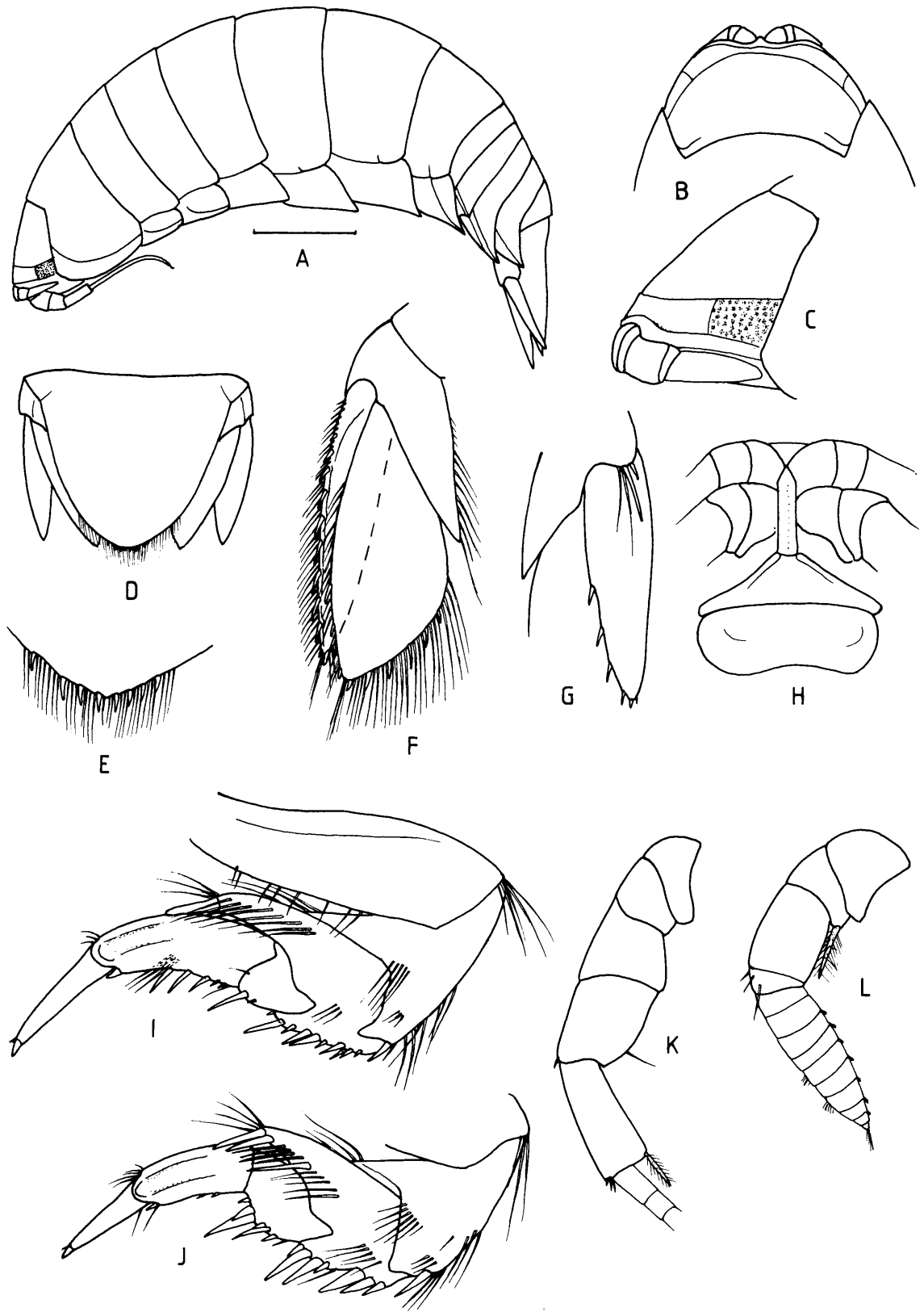


Fig. 64. *Natatolana thurar* n. sp. A-E, H, holotype; remainder paratype. A, lateral view; B, cephalon, dorsal view; C, cephalon, lateral view; D, pleotelson, dorsal view; E, pleotelson, apex; F, uropod; G, uropod peduncle, ventral view; H, clypeal region; I, pereopod 1; J, pereopod 2; K, antennal peduncle; L, antennule. Scale 2.0 mm.

Remarks. This species bears a close similarity to *N. rossi* from New Zealand, but can be readily distinguished as *N. rossi* has a complete interocular furrow, distinct furrows on all coxae, and much broader basis of pereopod 7. At present, *N. rossi* has not been recorded from Australian waters. *Natatolana pastorei* is also similar, but can easily be distinguished from the present species by its more sinuate uropods, and in having the apex of the pleotelson margin strongly produced. *Natatolana hirtipes* from South Africa, another similar species, can be distinguished by having conspicuous coxal furrows, and by differences in shape of the lateral margin of pleonites 3 and 4. *Natatolana valida*, the only other Australian species that approaches *Natatolana matong*, has a narrow straight frontal lamina and lacks a cephalic rostral point.

Distribution. Off Victoria and Tasmania in the Bass Strait area, recorded at depths of 155–310 metres.

Etymology. *Matong* is an Aboriginal word meaning powerful.

Natatolana thurar n. sp.

Figs 64, 65

Material examined. 3 females (15.8, 13.7, 12.6 mm), eastern Bass Strait, 30°35'S, 149°06'E, 20 June 1962, 149 m, coll. CSIRO.

Types. Holotype, female, (15.8 mm) AM P32171. Paratypes, AM P30350.

Type locality. Eastern Bass Strait, 38°35'S, 149°06'E.

Description of female. Body about 3 times as long as wide. Cephalon with 2 complete interocular furrows, and distinct medial rostral point. Eyes rectangular, ocelli feeble, unpigmented. Coxae of pereonites 2, 3 and 7 with furrows, those of pereonites 4–6 without; pereonite 1 with single horizontal furrow. Pleonites all visible, posterolateral margins of pleonites 3–4 acute, those of pleonite 4 with dorsal margin slightly concave. Pleotelson little shorter than greatest width, posterior margin converging smoothly to rounded apex, armed with 8 spines amongst marginal setae.

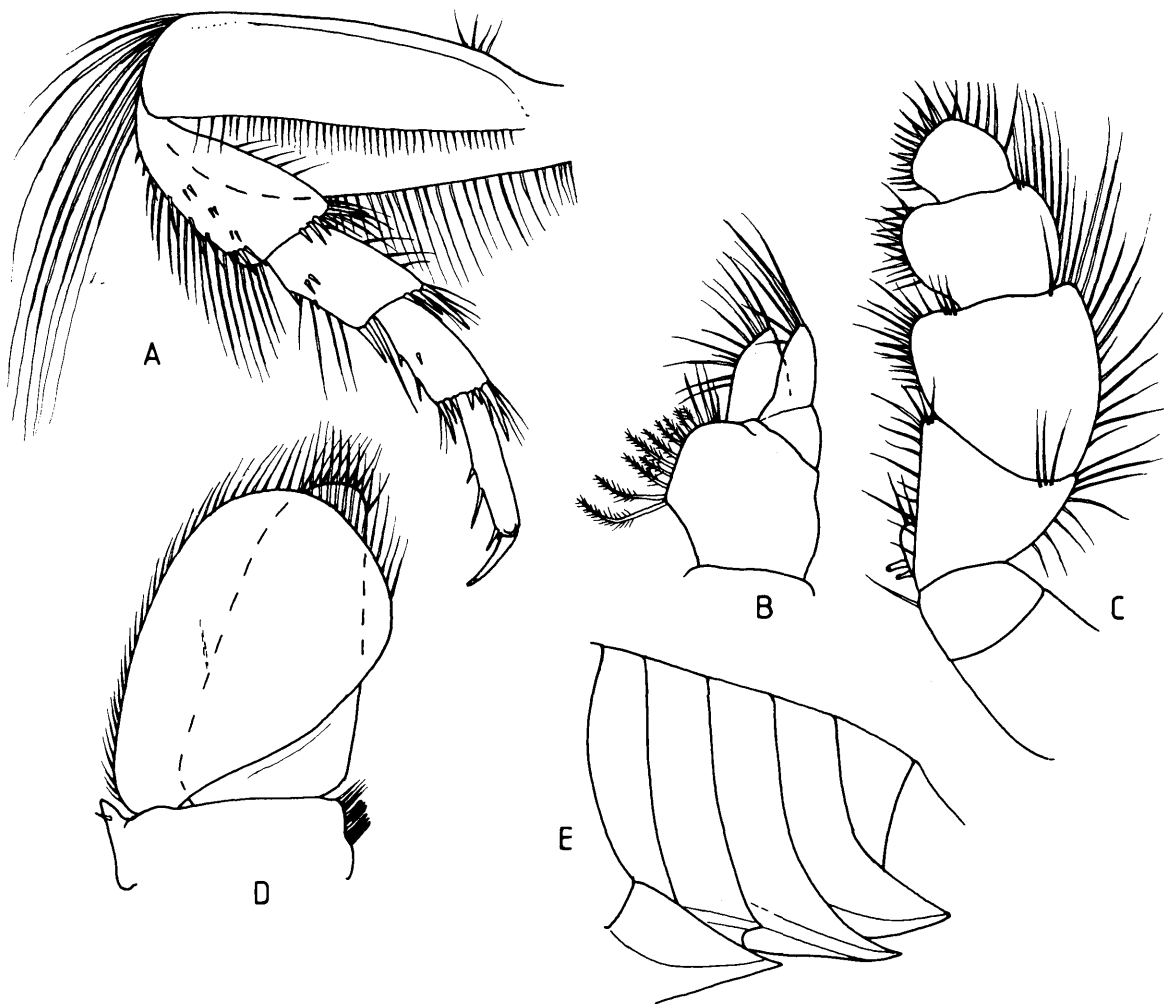


Fig. 65. *Natatolana thurar* n. sp. A–D, paratype. A, pereopod 7; B, maxilla; C, maxilliped; D, pleopod 1; E, holotype, pleon, lateral view.

Antennule short, extending to posterior eye, flagellum subequal to peduncle in length, composed of about 10 articles. Antenna flagellum composed of about 22 articles, extending to pereonite 3.

Frontal lamina straight sided, anterior angled to acute point, clypeus triangular. Maxilla with palp and exopod about twice as long as broad.

Pereopod 1 with few marginal setae along anterior margin of basis; ischium with single spine at posterodistal angle, anterior margin with long setae; merus with 10 spines along posterior margin, anterior margin with single stout spine and setae; carpus with 2 spines; propodus with 5 spines on palm and 6th spine opposing dactylus. Pereopods 2–3 similar to 1, but spines on merus fewer and larger, anterior margin with 2 terminal spines; carpus with 7 spines; propodus with 2 small spines on palm and single spine opposing dactylus. Pereopods 6–7 similar, 6 longer and larger than 7. Pereopod 7 with anterior margin of basis setose, very nearly straight, posterior margin with long setae at distal extremity, ischium with long setae on posterior margin, sparse setae on anterior margin, spine present at distal angles; merus and carpus with spine at distal angles and on posterior margin.

Uropods extending slightly beyond apex of pleotelson. Exopod slightly shorter than endopod, lateral margin with continuous row of setae, armed with 10 spines, medial margin similarly setose, with 5 spines. Endopod with 3 spines on lateral margin, 6 on medial, both margins convex, with marginal setae.

Male. Not known.

Colour. Pale brown in alcohol.

Size. 12.6 mm–15.8 mm.

Remarks. This species is similar to *N. matong* but there are numerous points of difference in the shape and spination of the telson, uropods, the shape of pleonite 4, the frontal lamina, clypeus, and differences in the cephalic furrows. Most noticeably, the eye is much shorter and more rectangular than in *N. matong* and, in all the specimens examined, appears to have feebly developed and unpigmented ocelli. However, the animals are soft, appearing to have been kept in formaldehyde for some time, so the loss of pigment may be associated with a long period of preservation.

Natanolana valida is the most similar species, and is separated from *N. thurar* by differences in the eye, spination of the pleotelson, presence of a rostral point in *N. thurar*, and differences in the shape of pleonite 4.

Distribution. Known only from the eastern Bass Strait.

Etymology. *Thurar* is an Aboriginal word meaning a strait.

Natanolana woodjonesi (Hale)

Figs 66–68

Cirolana woodjonesi Hale, 1924: 71, fig. 2, pl. 2.—1925: 137, fig. 5; 1929b: 248, figs 232, 233, 240; Nierstrasz, 1931: 157; Naylor, 1966: 184; Poore et al. 1975: 33; Holdich, Harrison & Bruce, 1981: 575, fig. 9.

Cirolana woodjonsoni.—Roman, 1970: 167, 192, 195, 197 (*lapsus calami*).

Natanolana woodjonesi.—Bruce, 1981b: 958.

Not *Cirolana woodjonesi*.—Hale, 1940: 288 (Mis-identification).

Material examined. Holotype, male, (13.8 mm), St. Vincent Gulf, SA AM Shelf Benthic Survey series: manca (5.6 mm), off Burwood Beach, NSW, 32°57'S, 151°45'E, 28 Jan. 1976, 26 m; manca (7.1 mm), off Dudley Beach, NSW, 32°59'S, 151°44'E, 30 Nov. 1975, 15 m; female (14.5 mm, ovig.), off Belmont Beach, NSW, 33°02'S, 151°41'E, 18 Mar. 1975, 22 m; 2 mancas (5.6, 6.0 mm), east of Malabar, Sydney, NSW, 33°57'S, 151°19'E, 17 May 1972, 49 m. Female (7.0 mm), off Sydney, NSW, 34°21'S, 151°16'E, 9 July 1962, 82 m, coll. CSIRO. C. 100 males and females (6–18 mm), Mordialloc Pier, Port Phillip Bay, Vic., 12 Apr. 1899, coll. F.N. Baillie. Female (15.1 mm), Hobson Bay, Vic., 10–15 m, Port Phillip Bay, Vic., PPBES Stns: 137, 2 females (11.3, 13.8 mm); 138, 2 males (13.6, 8.8 mm), 2 mancas (5.4, 6.2 mm); 938, immature (6.5 mm), manca (4.5 mm); 986, 2 males (11.5, 12.0 mm), 2 females (12.5 ovig., 14.5 mm); 1231, male (14.2 mm), 3 females (7.5, 8.2, 10.1 mm), 3 mancas (5.6, 7.4, 7.5 mm); 1233, male (11.9 mm); 1236, female (17.0 mm), 3 mancas (5.0, 5.6, 6.3 mm); 1237, 2 females (11.2, 17.5 mm), manca (6.9 mm), Crib Point, Western Port, Vic., CPBS Stns: 24N, female (11.9 mm), 3 mancas (3.8, 6.3, 6.8 mm); 24N/4 male (11.3 mm), 2 females (12.9, 19.9 mm); 24S, female (10.7 mm), manca (4.5 mm). Male (10.5 mm), Bass Strait, 37°55'S, 149°06'E, 20 June 1962, 76 m, coll. CSIRO. 2 males (10.5 mm), 4 females (10.7, 11.0, 11.3 mm), Midway Point, S.E. Tas., 9 Dec. 1973, coll. G. Prestedge and A.J.A. Green. Male (14.5 mm), female (17.6 mm), Koonya, Tasmania Peninsula, Tas., 26 May 1974, in muddy sand, mid littoral, coll. A. Richardson & A.J.A. Green. Material determined by Hale included Elliot Cove, W. Coast, Tas., 10 m, 89 males and females; Bottle and Glass Rocks, Port Jackson, NSW, male (12.6 mm), between tide marks, Oct. 1925; Port Jackson, NSW, 2 females (10.8, 11.5 mm).

Types. Held by the South Australian Museum, Adelaide, C228.

Type locality. Port Willunga, SA.

Descriptive notes. Nearly all characters agree with the description given by Holdich et al. (1981). Differences include: presence of sensory seta on peduncle article 2 of antennule; article 1 of antennule flagellum of Holdich et al. (1981) is in fact the fourth peduncle article, making article 1 of flagellum longest; antenna peduncle articles 1–2 short, 3–4 longer and subequal in length, article 5 is slightly longer than 4, ventrodistal angle with 2 conspicuous sensory setae.

Pereonite 1 with single impressed line. Pleonite 4 with posterolateral margins moderately acute. Pleotelson apex with small protrusion, on each side of which lie 2 spines.

Appendix masculina varies slightly in length from being just shorter than pleopod endopod to just longer; slender, straight sided, and turned outward at tip, width narrows slightly.

Females. Similar to males, but grow to a larger size.

Development. Juveniles and mancas are similar to adults, but may possess fewer spines.

Colour. Tan, kidney red or cream in alcohol.

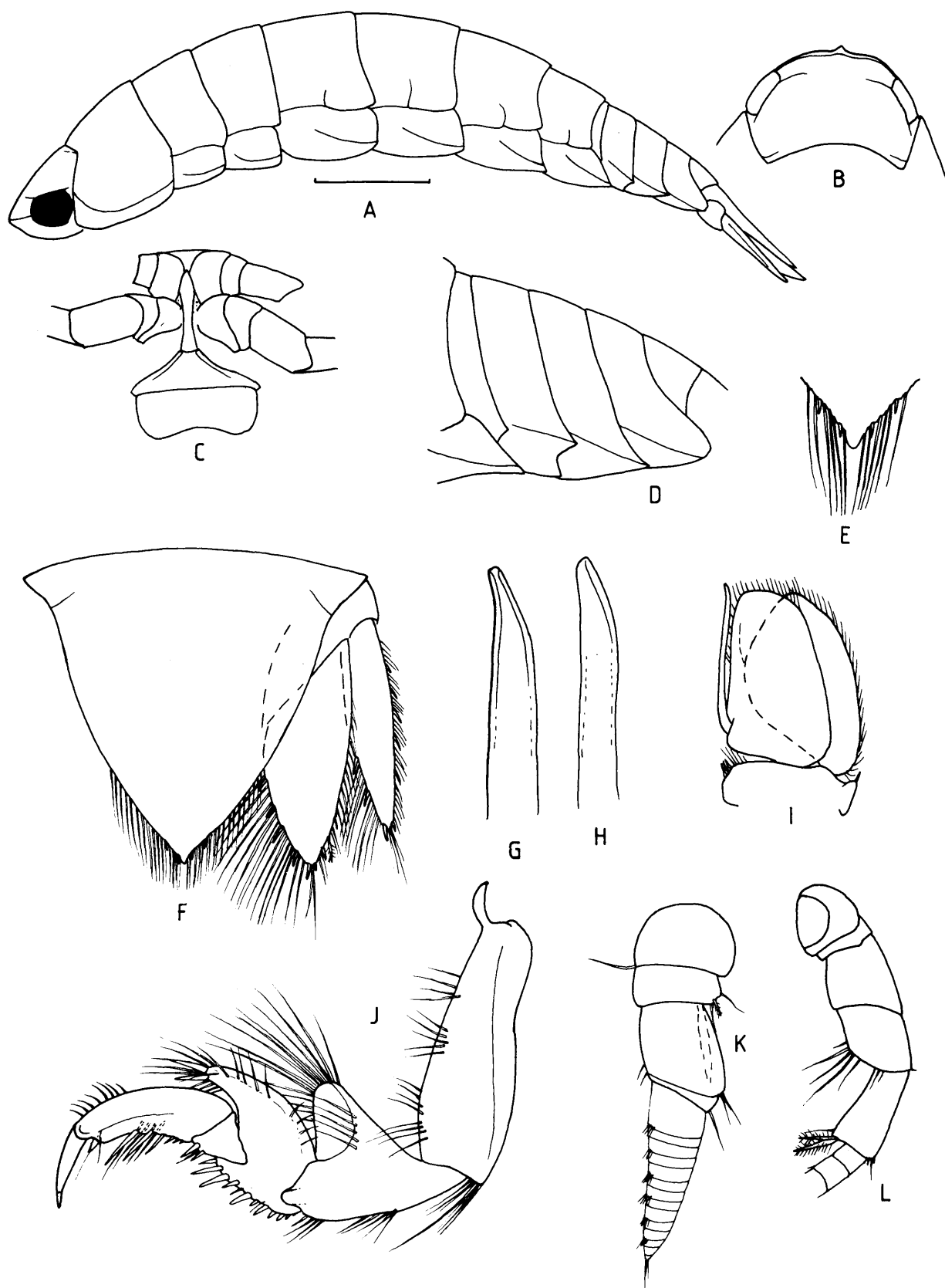


Fig. 66. *Natatolana woodjonesi*. A-D, holotype; E-G, I, male 14.5 mm; J-L, female 13.5 mm, Mordialloc, Vic. A, lateral view; B, cephalon dorsal view; C, clypeal region; D, pleon, lateral view; E, pleotelson, apex; F, pleotelson and uropod; G, appendix masculina, apex; H, appendix masculina, apex, male 14.2 mm, PPB; I, pleopod 2; J, pereopod 1; K, antennule; L, antennal peduncle. Scale 2.0 mm.

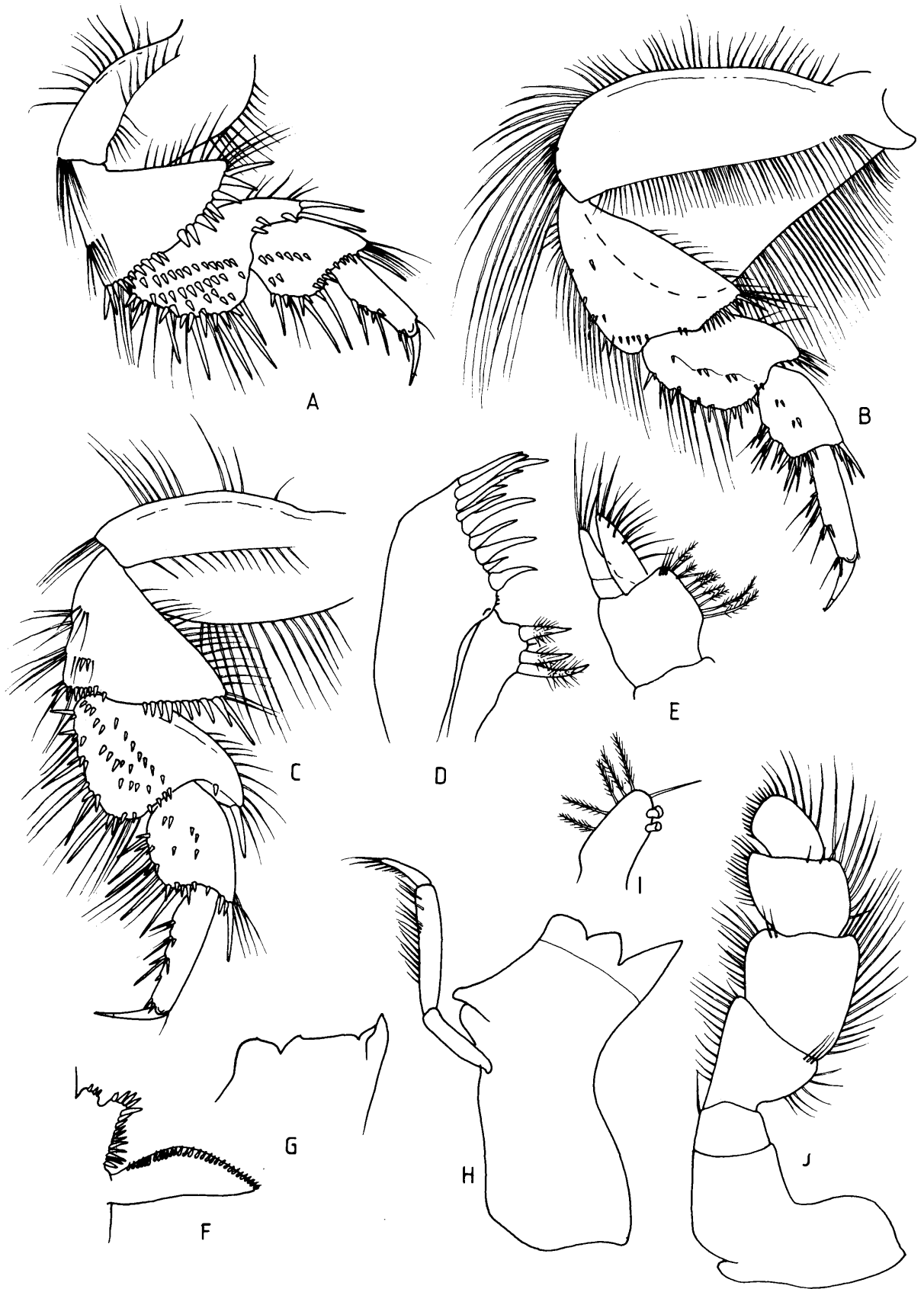


Fig. 67. *Natatolana woodjonesi*, female 13.4 mm, PPB. A, pereopod 4; B, pereopod 7; C, pereopod 5; D, maxillule; E, maxilla; F, lacinia mobilis and molar process; G, left mandible, incisor; H, right mandible; I, maxilliped endite; J, maxilliped.

Size. Largest female 19.9 mm. Hale's (1925) largest size probably referred to *N. wowine* taken from a porpoise.

Remarks. In examining collections from southern Australia, it became apparent that there existed several species that were exceedingly close in appearance to *N. woodjonesi*. All material designated as *N. woodjonesi* was examined, and most specimens proved to belong to this species. The exceptions were those specimens from North West Island, Capricorn Group (Hale, 1940), belonging to the species *N. arcicauda* and *N. bulba*, and amongst the specimens recorded by Hale (1925), those from the porpoise, and those from Portland, Tasmania, are *N. wowine*. The characters that separate *N. woodjonesi* from these other species are the shape of the posterolateral margins of pleonite 4, the arrangement and number of spines on the pleotelson, and also the shape of the pleotelson and uropods. Furthermore, the shapes of the appendix masculina for

N. woodjonesi and *N. wowine* are distinct.

Distribution. A common and widely distributed southern species, extending from off Sydney, N.S.W., in the north, south to Tasmania, and west to Gulf St. Vincent. The greatest depth from which the species has been reliably recorded is 82 metres.

Natatolana luticola (Holdich, Harrison & Bruce)

Fig. 69

Cirolana luticola Holdich, Harrison & Bruce, 1981: 569, fig. 6 (Part).

Natatolana luticola.—Bruce, 1981b: 958.

Material examined. Male (10.4 mm), holotype (QM W6339), Halifax Bay, Townsville, 26 Aug. 1976. Male (13.6 mm), female (6.9 mm), Battery Point, Thursday Island, North Qld, Apr. 1979, beam trawled over turtle grass, coll. P.C. Young. 2 males (9.5, 6.3 mm), 2 manca (6.3, 6.2 mm), Halifax Bay, Townsville, Qld, 25 May 1976–23 Nov. 1976, 10–14 m, coll. JCUNQ, 3 Bays Survey.

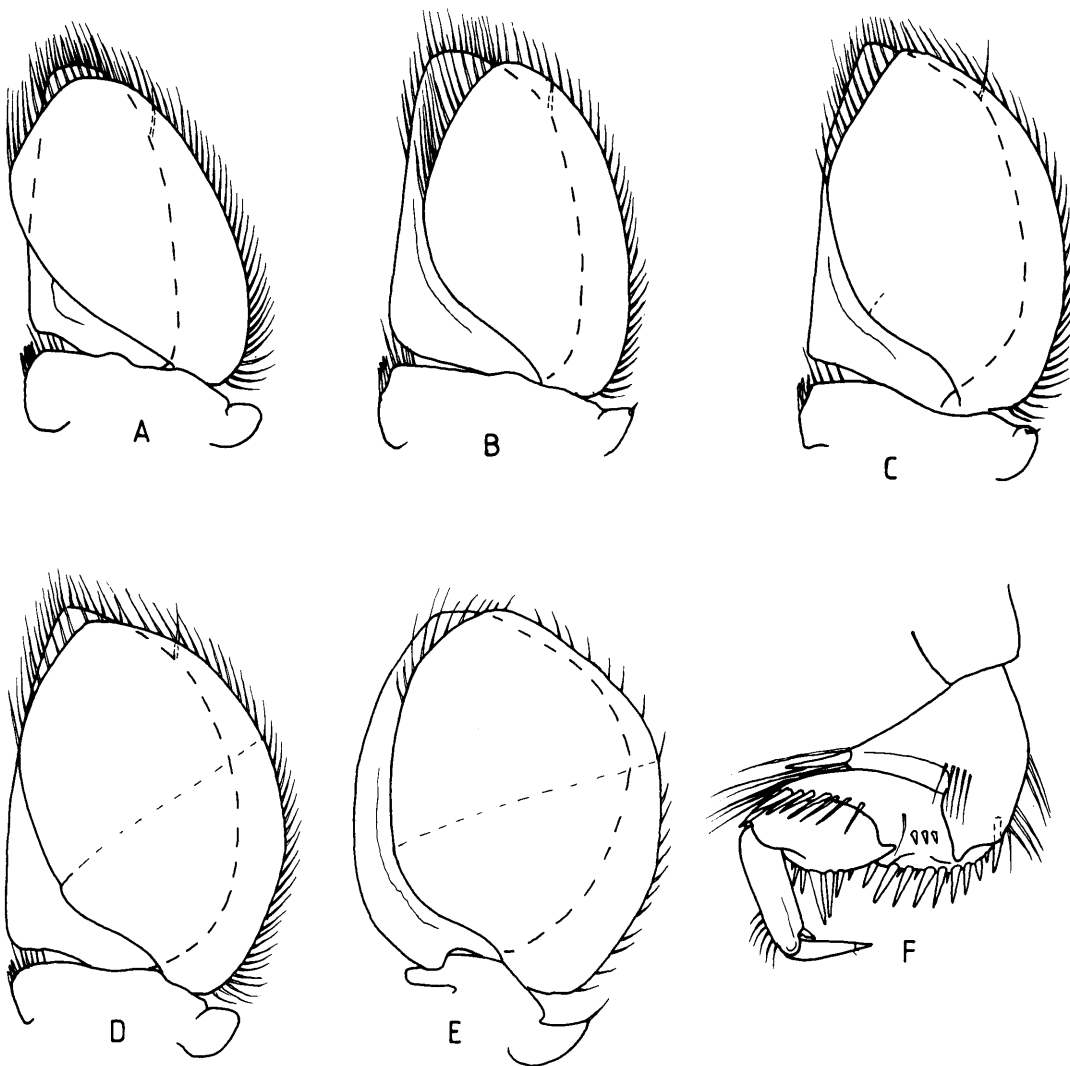


Fig. 68. *Natatolana woodjonesi*, female 13.5 mm, PPB. A-E, pleopods 1-5 respectively; F, pereopod 3.

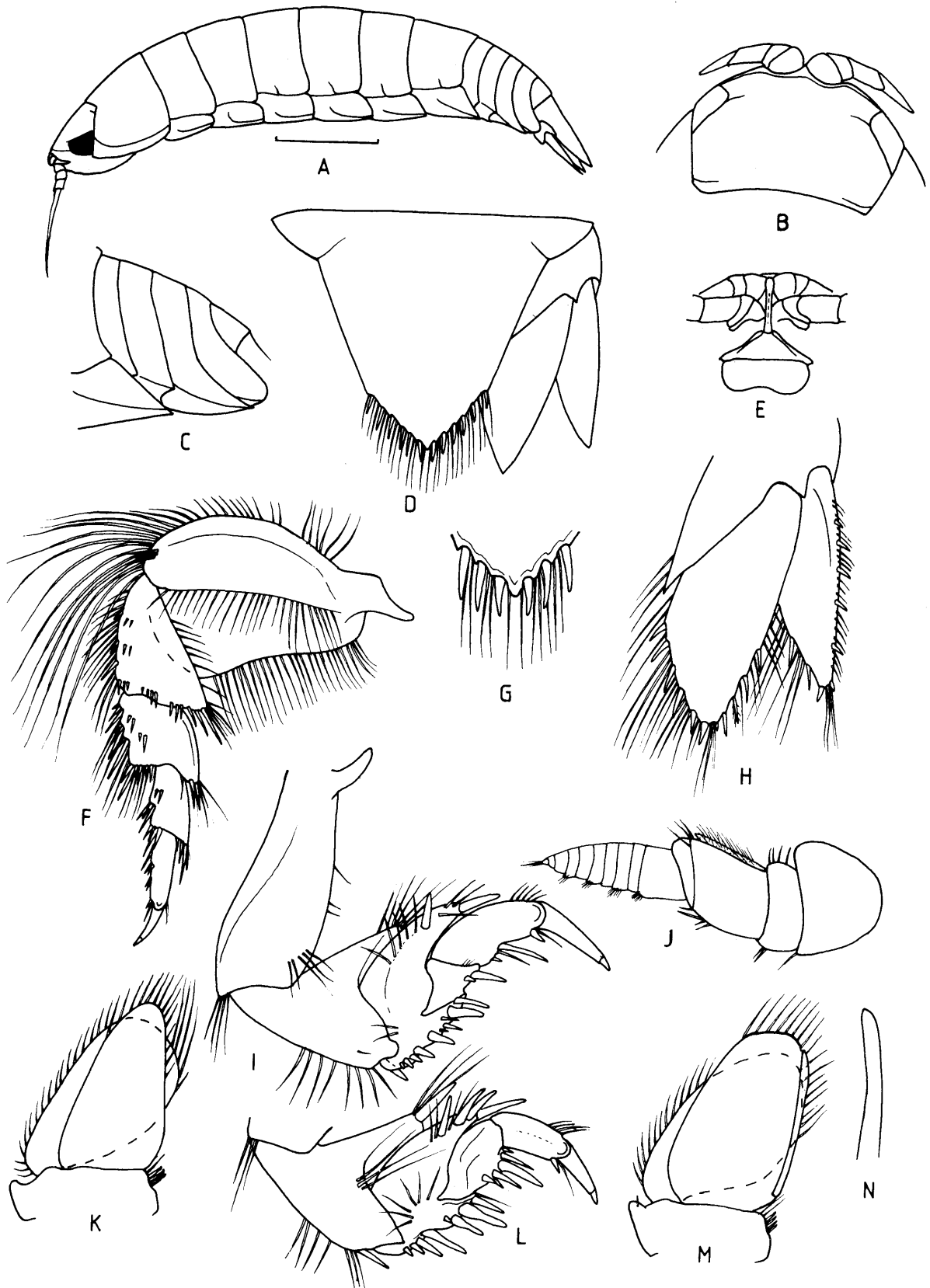


Fig. 69. *Natatolana luticola*. B, C, E, male holotype; remainder male 13.9 mm. A, lateral view; B, cephalon, dorsal view; C, pleon; D, pleotelson; E, clypeal region; F, pereopod 7; G, pleotelson, apex; H, uropod; I, pereopod 1; J, antennule; K, pleopod 1; L, pereopod 3; M, pleopod 2; N, appendix masculina apex. Scale 2.0 mm.

Types. Held by the Queensland Museum, Brisbane.

Type locality. Halifax Bay, Townsville, Qld.

Description of male. Body about 3 times as long as wide, cephalon with small median rostral point. Anterior of cephalon with submarginal furrow; interocular furrow incomplete. Pereonite 1 with horizontal furrow. Coxae each with incomplete furrow. Pleonites all visible, posterolateral margin of pleonite 3 posteriorly produced, acute; posterolateral margins of pleonite 4 rounded. Pleotelson lateral margins straight, narrowing rapidly; posterior margin distinctly angled, provided with 6 long spines on either side of apex; plumose setae present between spines.

Antennule short, peduncle article 3 little shorter than combined lengths of articles 1 and 2; flagellum shorter than peduncle, composed of about 10 articles.

Frontal lamina narrow, feebly carinate, anterior margin very slightly broader. Clypeus triangular.

Pereopod 1 with few setae on basis, ischium with setae along posterior margin and anterodistal angle; merus with 5 large and 6 small spines on posterior margin, anterior margin with 2 spines and row of setae; carpus with 2 spines at posterodistal angle, posterior margin with 2 spines and row of setae; propodus with 1 long and 1 short spine on palm, and stout spine opposing dactylus; propodus relatively short, equal to combined lengths of merus and carpus. Pereopods 2–3 similar to 1 but without spines on palm of propodus, with additional large spines on ischium, merus and carpus. Pereopod 7 basis anterior margin sinuate, posterior margin distinctly convex, all margins with setae; posterior margin of ischium and merus with spines and setae, carpus and propodus with spines only; anterodistal angles of ischium, merus and carpus with spines.

Vasa deferentia opening flush on sternite 7.

Pleopod 2 with simple appendix masculina, not extending beyond ramus. Uropods extending slightly beyond apex of pleotelson, both rami with margins very nearly straight. Exopod shorter than endopod, with 6 spines on lateral margin, 4 on medial. Endopod with 4 spines and sensory seta on lateral margin, 6 spines medial margin.

Female. Similar to male.

Colour. White to tan in alcohol. Eye tan to black.

Size. Largest specimen examined 13.6 mm.

Remarks. Examination of the type material revealed that the variation mentioned in the description (Holdich et al., 1981) was in fact due to there being two species present. None of the figures were of the holotype, and the important features of the dorsal and lateral views, the clypeal region and pereopod 7 were not of the species *N. luticola*. The other species proved to be undescribed, and is here described as *N. angula*. The differences between the species are: *N. luticola* lacks a complete interocular furrow, has a distinctly shorter propodus on pereopods 1–3, has the posterior margin of the basis of pereopod 7 distinctly convex, and has the pleotelson and

uropods far more angular and with far more robust spines.

Distribution. Thursday Island and Townsville, Qld.

Natatolana tenuistylis (Miers)

Figs 70, 71

Cirolana tenuistylis Miers, 1884: 303, pl. 33B.—Hale, 1925: 136, fig. 4; Nierstrasz, 1931: 157; Holdich, Harrison & Bruce, 1981: 572, fig. 7; Ellis, 1981: 123.

Natatolana tenuistylis.—Bruce, 1981b: 958.

Material examined. Male (17.5 mm), north-west of Molle Island, Qld, 19 Nov, 1977, 24 m, coll. F. Rowe & P. Coleman (AM P30377).

Types. Lectotype held at the BM(NH) 1882: 1.

Type locality. Prince of Wales Channel, North Queensland.

Supplementary description of male. As the type has recently been redescribed in detail (Holdich et al., 1981), only a supplementary description is given here. Cephalon with distinct rostral point, interocular furrow running from dorsal margin of each eye. Coxal furrows all incomplete, those on coxae of pereonites 6–7 not extending to posterodistal angle. Pleonite 2 with ventral part of posterolateral margin strongly produced; pleonite 3 with posterolateral margins acute, pleonite 4 with posterolateral margins rounded. Pleotelson with 10 spines on posterior margin set amongst plumose setae.

Antennule short, extending to eye, flagellum composed of about 10 articles, and shorter in length than peduncle. Antenna peduncle article 5 slightly shorter than the combined lengths of articles 3 and 4, flagellum composed of about 28 articles, extending to pereonite 4.

Frontal lamina medially constricted, anterior margin acute.

Pereopod 1 with single spine on posterior margin of carpus; propodus with 3 spines on distal half of posterior margin, 4th spine opposing dactylus; anterior margin with row of 5 setae at distal extremity; pereopods 2–3 similar but spines conspicuously longer, propodus with single spine opposing dactylus.

Pleopod 2 appendix masculina distinctly shorter than inner ramus; apex with distinct acute projection. Uropod exopod distinctly shorter than endopod, lateral margin with 6 spines, medial with 3; endopod with 4 spines on lateral margin, medial with 4.

Female. Not known.

Colour. Brown, no chromatophores.

Size. 17.5 mm.

Remarks. This species was redescribed by Holdich et al. (1981) and the specimen described here agrees closely with the description given by those authors. Two points not mentioned are the dorsal interocular furrow, and the process formed by the ventral posterolateral margin of pleonite 2. These two characters, and the shape of the appendix masculina distinguish *N. tenuistylis* from all others of the genus. The lectotype (kindly examined

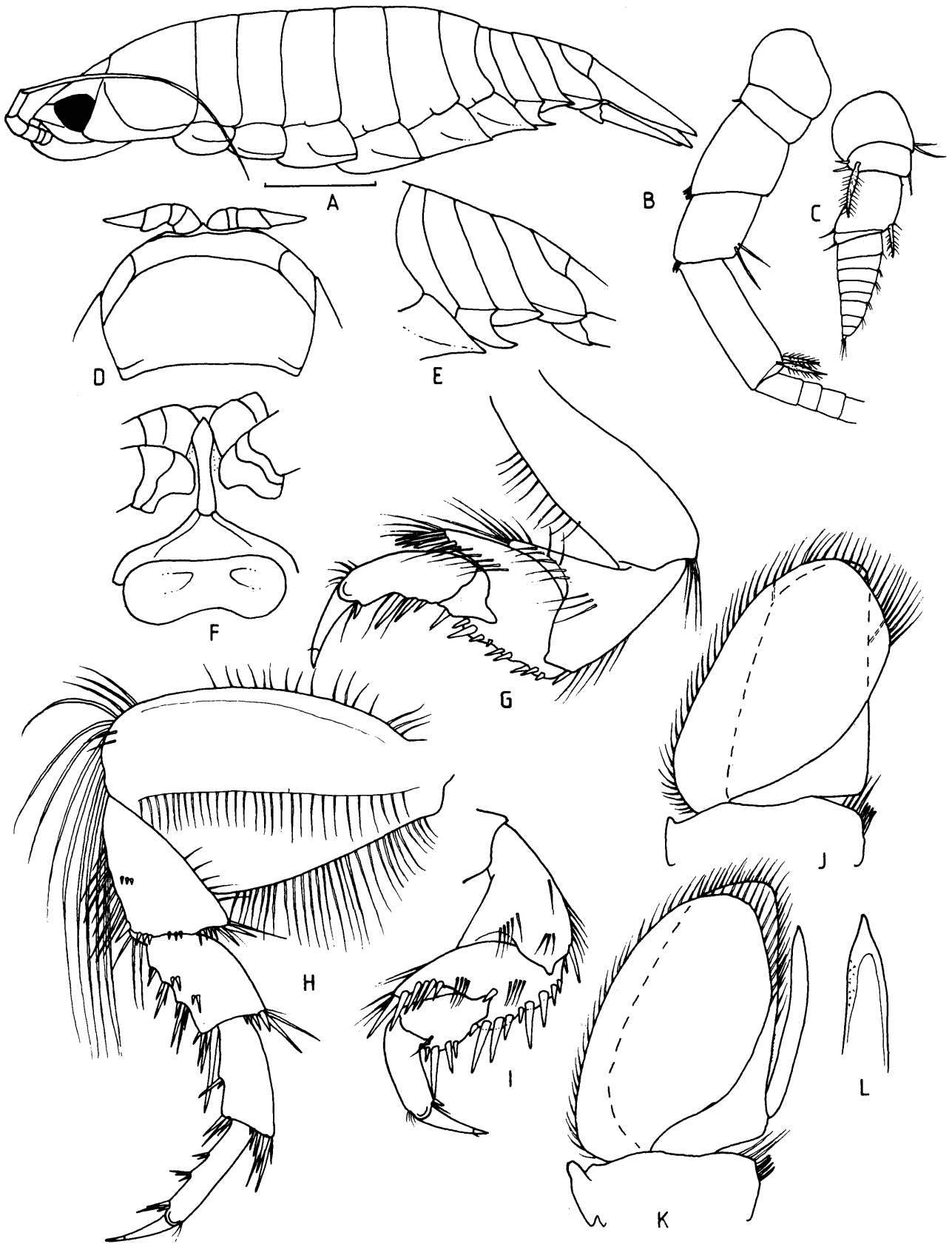


Fig. 70. *Natatolana tenuistylis*, male 17.5 mm, Molle Is. A, lateral view; B, antennal peduncle; C, antennule; D, cephalon, dorsal view; E, pleon, lateral view; F, clypeal region; G, pereopod 1; H, pereopod 7; I, pereopod 3; J, pleopod 1; K, pleopod 2; L, appendix masculina apex. Scale 3.0 mm.

by Dr R.J. Lincoln) was found to show these characters. Other points of distinction include the conspicuously large spines on the anterior pereopods and the coxal furrowing.

The specimen described here is distinctly longer than the syntype (13.9 mm), but agrees in all ways. Two other specimens, from unknown localities, were also designated as types by Miers. One of these, the specimen figured by Hale (1925), is *N. vieta* (Hale, 1925). The second specimen is too badly damaged to be recognizable, but appears likely to be *N. matong*.

Distribution. Prince of Wales Channel, Torres Strait; North Molle Island, Qld.

Natanolana variguberna (Holdich, Harrison & Bruce)

Fig. 72

Cirolana variguberna Holdich, Harrison & Bruce, 1981: 655, fig. 5.

Natanolana variguberna.—Bruce, 1981b: 958.

Material examined. 4 females (7.8–10.8 mm), Knocker Bay, Coburg Peninsula, NT, 11°18'S, 132°7.1'E, 21 June 1981, in trap over sand, 6 m, coll. A.J. Bruce. Female (9.5 mm, ovig.), Battery Point, Thursday Is., Torres Strait, Qld, Apr. 1979,

beam trawl over sea grass, coll. P.C. Young. 2 females (6.5, 7.2 mm), paratypes, Halifax Bay, Townsville, Qld, coll. P. Arnold. Female (10.7 mm), Peel Island, Moreton Bay, Qld, Sept. 1971, coll. Zoology Dept, University of Queensland.

Types. Held at the Queensland Museum.

Type locality. Halifax Bay, Townsville, Queensland.

Descriptive notes. Cephalon anterior margin distinctly recessed on both sides of acute rostral point. In all other points, the material examined agrees with the original description, and presents a constant form throughout its range.

Colour. White to tan in alcohol.

Size. Up to 10.7 mm, larger than previously recorded.

Remarks. This species is immediately recognizable by the unique shape of the uropodal endopod, with the deeply excised endopod lateral margin. Further points of distinction are the shape of the frontal lamina, the posterolateral margins of the pleonites and the shape and furrowing of the cephalon.

Distribution. Coburg Peninsula, NT; Thursday Island, Torres Strait; Townsville and Moreton Bay, Qld. Taken at depths of 2.7–15.5 metres, on various particulate substrata (Holdich et al., 1981).

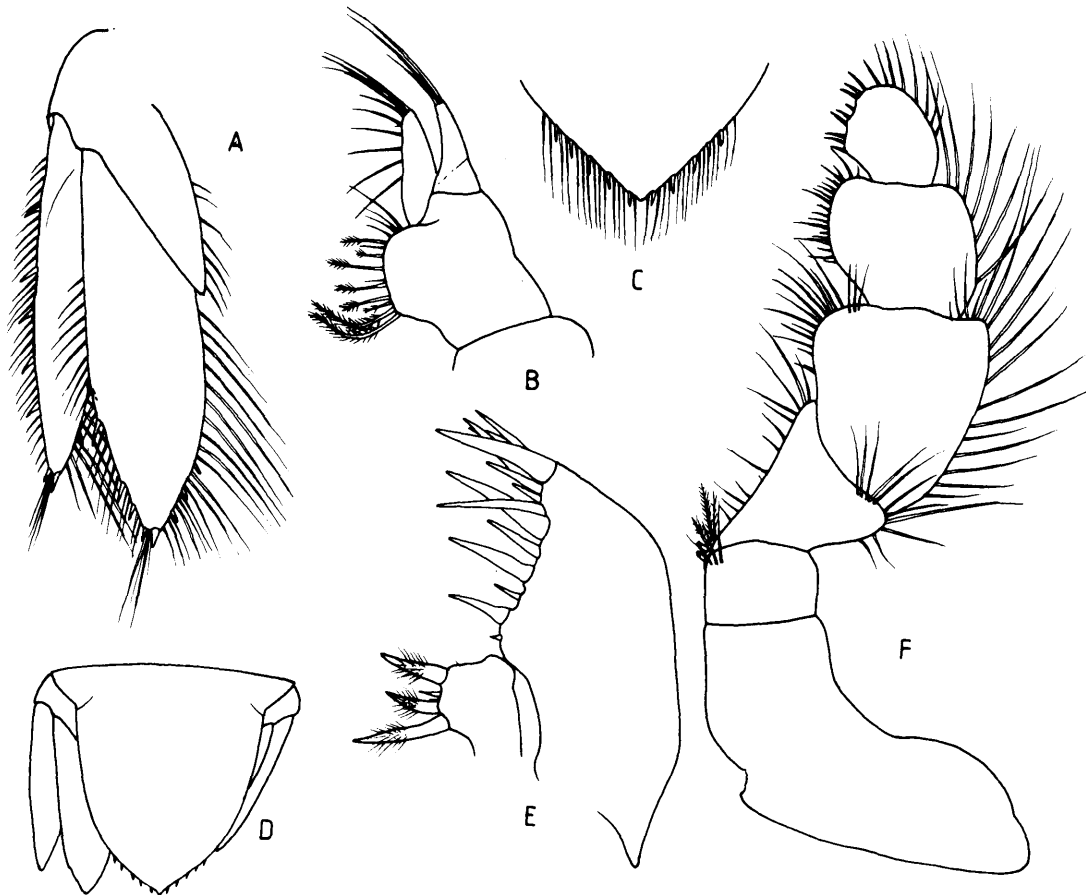


Fig. 71. *Natanolana tenuistylis*, male 17.5 mm, Molle Is. A, uropod; B, maxilla; C, pleotelson apex; D, pleotelson and uropods; E, maxillule; F, maxilliped.

Natatolana angula n. sp.

Fig. 73

Cirolana luticola Holdich, Harrison & Bruce, 1981: 569, fig. 6a-c,h,i,j (Part).

Material examined. 2 females (9.2, 10.7 mm, both ovig.), Dudley Point, Darwin, NT, 13 Nov. 1981, reef flat pools, low water, coll. NTM. Male (10.1 mm), holotype, 24 Feb. 1977, 11 m; female (8.7 mm), 23 Nov. 1976, sand, ca. 4.5 m; female (9.6 mm), manca (5.9 mm), 24 Nov. 1976, muddy sand, 10 m, all from Halifax Bay, Townsville, Qld, coll. JCUNQ. Female (7.9 mm), (allotype of *C. luticola*), Cleveland Bay, Townsville, Qld, 26 Oct. 1974, particulate substrata, 11 m. Male (9.5 mm), 2 females (13.0, 13.5 mm), manca (5.0 mm), Calliope River, Gladstone, Qld, 1975; male (5.3 mm), 2 females (11.3, 6.3 mm), Port Curtis, Gladstone, Qld, 1975, dredged; male (6.8 mm), Port Curtis, Gladstone, Qld, 4 Dec. 1975, dive sample, 7 m, all coll. P. Saenger & J. Moverly.

Types. Holotype, male, QM W9795. Paratypes, QM W9797-W9800; AM P32380; USNM 190721; NTM Cr000237.

Type locality. Halifax Bay, Townsville, Qld, 19°08'S, 146°19'E.

Description of male. Body about 3 times as long as wide. Cephalon with median rostral point, interocular furrow entire, anterior submarginal furrow present. Pereonite 1 with single horizontal furrow. Coxae with furrows on coxae 2, 3 and 7 nearly entire, those of coxae 4-6 incomplete. Pleonite 1 almost entirely concealed by pereonite 7, posterolateral margins of pleonite 4 rounded, slight incision on ventral margin where furrow meets edge of pleonite. Pleotelson with lateral margin convex, converging smoothly to apex; posterior margin with 12 spines, plumose setae set between spines.

Antennule short, peduncle article 3 shorter than combined lengths of articles 1 and 2; flagellum composed of 10 articles, extending to posterior of eye.

Antenna with flagellum extending to pereonite 2.

Frontal lamina narrow, medially constricted, anterior margin forming point, ventral surface feebly carinate. Clypeus triangular. Maxilliped endite with 2 coupling hooks.

Pereopod 1 with scattered setae on posterior margin of basis, anterodistal angle with group of setae; ischium with anterodistal angle setose, posterodistal angle with single spine; merus with 2 spines; carpus short, posterodistal angle with single spine and seta; propodus with proximal half of palm with 3 spines, and stout serrate spine opposing dactylus. Pereopods 2-3 similar to 1, but carpus longer and with several spines, posterior margin of ischium with fewer, but more robust spines; palm of propodus without spines. Pereopod 7 basis anterior margin feebly sinuate, posterior margin straight; anterior margins of ischium, merus and carpus with group of spines and setae at distal angles; posterior margins of ischium, merus and carpus with spines and setae; propodus with 2 groups of spines on posterior margin.

Vasa deferentia opening flush on sternite 7.

Pleopod 2 appendix masculina with basal half broader, distinctly shorter than ramus. Uropods extending slightly beyond apex of pleotelson, margins slightly convex except lateral margin of endopod which is very nearly straight. Endopod with 6 spines on medial margin, 6 on lateral. All margins fringed with setae.

Female. Similar to male.

Colour. Tan in alcohol. Eyes dark brown or black.

Size. Largest specimen 13.5 mm.

Remarks. Examination of the types of *N. luticola* revealed that the designated holotype and allotype could not be considered one species, there being numerous

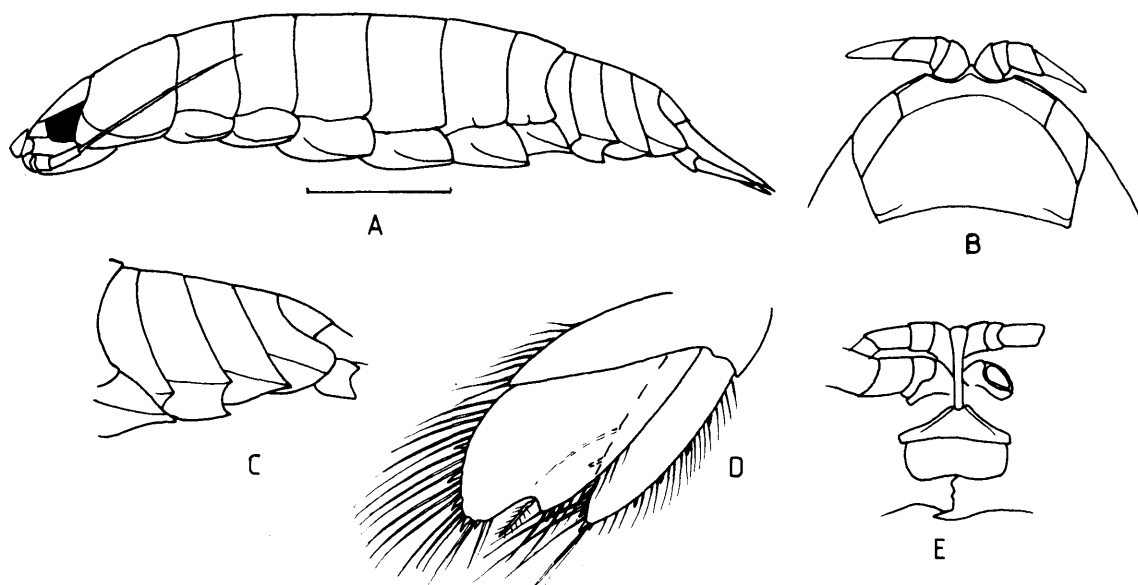


Fig. 72. *Natatolana variguberna*, female, Moreton Bay. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, uropod; E, clypeal region. Scale 2.0 mm.

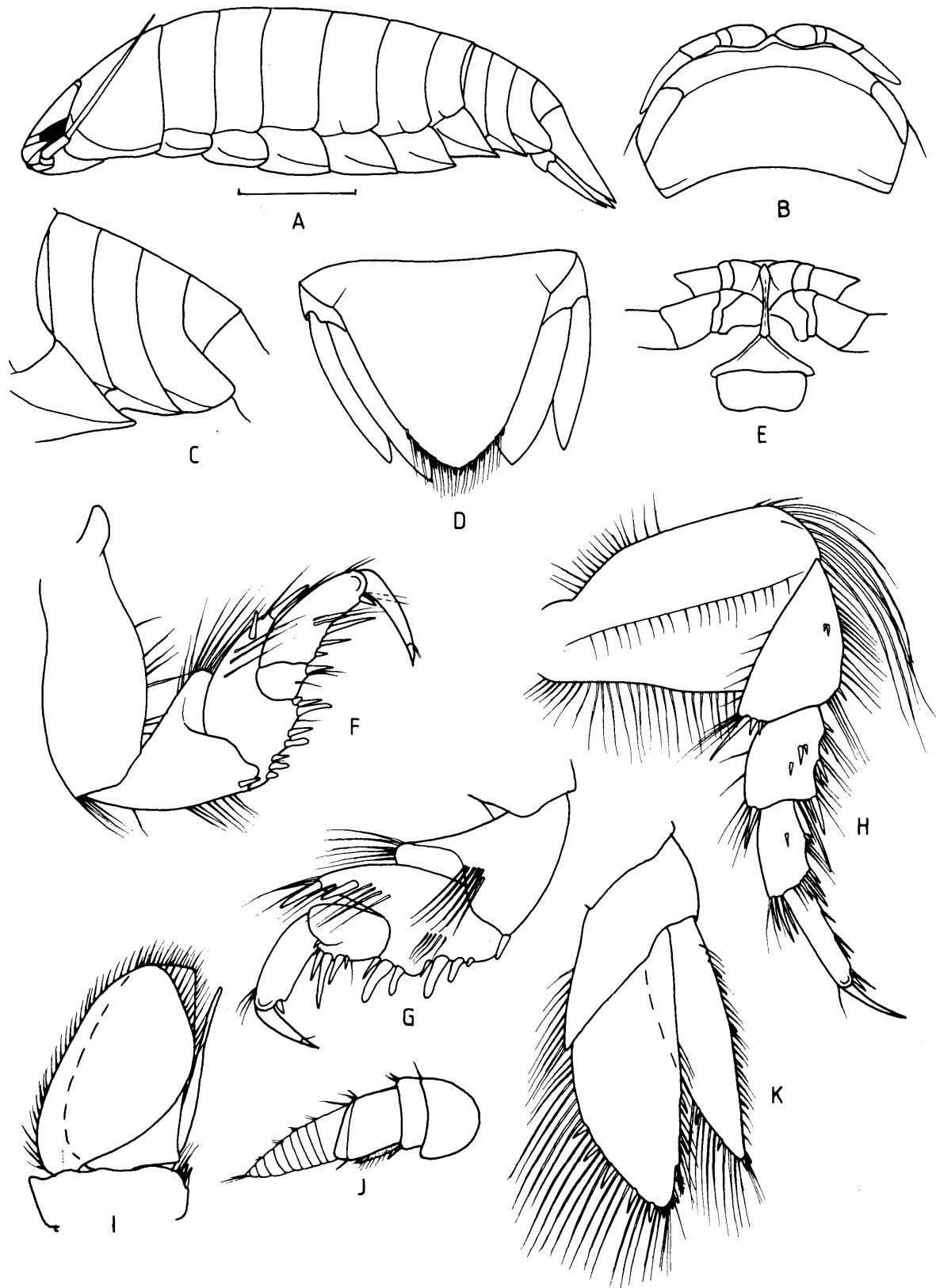


Fig. 73. *Natatolana angula* n. sp. A-E, H, I, holotype; F, G, J, K, male paratype. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, pleotelson and uropods; E, clypeal region; F, pereopod 1; G, pereopod 2; H, pereopod 7; I, pleopod 2; J, antennule; K, uropod. Scale 3.0 mm.

points of distinction. These differences are the furrowing of the cephalon, shape of the frontal lamina, form of the pleotelson and uropods, shape of the basis of pereopod 7, and differences in the anterior 3 pereopods. In *N. luticola* the propodus is noticeably shorter than the present species. *Natatolana wullunya* from off Sydney is similar, and is best distinguished by having only 6 spines on the pleotelson and an incomplete interocular furrow.

Distribution. Halifax Bay, Townsville, and mouth of the Calliope River at Gladstone, Qld, at depths to 11 metres. Darwin, NT.

Etymology. The specific name is derived from the Latin word *angulus* which means bay or gulf, and refers to the place of capture of the specimens.

Natatolana arrama n. sp.

Fig. 74

Material examined. Female (11.1 mm), South of Portland, Vic., 38°52'S, 141°50'E, 26 June 1962, 77 m, coll. CSIRO. Female (12.6 mm, damaged), south-east of Eucla, SA, Australian Bight, 32°42'S, 131°27'E, 4 July 1962, 77 m, coll. CSIRO.

Types. Holotype, female, (11.1 mm) AM P30363. Paratype, AM P30362.

Type locality. South of Portland, Vic., 38°52'S, 141°50'E.

Description of female. Body about 3 times as long as wide. Cephalon anterior margin with small rostral point and submarginal interocular furrow; each eye with short furrow extending medially. Eyes rectangular, not narrower in front. Pereonite 2 with single longitudinal furrow; coxae of pereonites 2-7 each with incomplete furrow; those of pereonite 7 very nearly entire. Pleonites all visible, posterolateral margins of pleonite 3 acute, 4 rounded. Pleotelson as long as broad, converging smoothly to small point on either side of which lie 2 spines and marginal setae.

Antennule short, not extending beyond eye; peduncle article 3 longer than combined lengths of articles 1 and 2, little shorter than flagellum, which has about 11 articles. Antenna with 2 stiff setae on posterior margin of peduncle article 4, peduncle article 5 with 2 simple and 2 sensory setae; flagellum composed of about 14 articles.

Frontal lamina narrow, not dilated anteriorly, clypeus with central half strongly produced. Maxilliped endite with 2 coupling hooks.

Pereopod 1 with anterior margins of ischium provided with setae, merus with terminal spine and row of stiff setae; posterior margin of ischium with 2 short spines, and conspicuous spine at posterodistal angle; posterior margin of merus with 11 marginal and 5 submarginal spines; carpus with 2 setae and single spine; propodus with row of 8 setae on anterodistal margin, palm with 3 acute spines and serrate robust spine opposing dactylus. Pereopods 2-3 similar to 1 but anterior margin of merus with 5 stout spines; posterior margin of carpus with 5 long and 4 short spines; propodus with only single serrate spine opposing dactylus. Pereopod 7 basis with

continuous fringe of setae on both anterior and posterior margins, both of which are strongly convex; setae on posterodistal margin not as long nor as abundant as in most species of genus; ischium and merus broad; posterior margins of ischium, merus, carpus and propodus with abundant marginal and submarginal spines; anterior margins with spines and setae at distal angles only. Pereopod 6 very similar to 7.

Uropods extending slightly beyond telson, both rami lanceolate. Endopod slightly shorter than exopod, lateral margin without spines except for small terminal spine, medial margin with 3 spines; both margins with setae. Endopod with 2 spines, sensory seta and marginal setae on lateral margin, medial margin with 5 spines set amongst marginal setae.

Male. Not known.

Colour. Brown in alcohol.

Size. Up to 12.6 mm.

Remarks. This species belongs to the *N. woodjonesi* complex of species and can easily be separated from others of the assemblage by having the posterior margin of the basis of pereopods 6 and 7 strongly convex, by having shorter and fewer natatory setae on these pereopods, and by the lateral margin of the uropodal exopod being without spines. The spination of the anterior pereopods, the shape of the clypeus and frontal lamina, and the length of the peduncular articles of the antennule also serve to distinguish this species.

Distribution. Bass Strait, and off Portland and Eucla, SA.

Etymology. The epithet is the Aboriginal word *arrama*, and means louse.

Natatolana bulba n. sp.

Fig. 75

Part *Cirolana woodjonesi*.—Hale, 1940: 288 [mis-identification, not *N. woodjonesi* (Hale, 1924)].

Material examined. Male (9.5 mm), 8 females (6.9-12.9 mm), off North West Island, Capricorn Group, Qld, 9 Dec. 1919, brought up on bait while line fishing, 40 m.

Types. Holotype, male, AM P32174. Paratypes AM E4843.

Type locality. North West Island, Capricorn Group, Southern Great Barrier Reef, Qld, 23°17.5'S, 151°42.0'E.

Description of male. Body about 3 times as long as wide. Cephalon with rostral point, 2 furrows running from dorsal anterior margin of each eye, another furrow runs posterior to anterior margin. Pereonite 1 with single horizontal furrow. Coxae of pereonites 2-7 with partial furrows. Pleonites all visible; posterolateral margins of pleonites 2-4 with horizontal furrows; posterolateral margins of pleonite 3 not strongly produced, those of pleonite 4 acute. Pleotelson about as long as greatest width, shield shaped, lateral margins converging smoothly to small produced tip, on either side of which lie 2 spines set amongst marginal setae.

Antennule short, peduncle article 3 shorter than combined lengths of articles 1 and 2; flagellum shorter

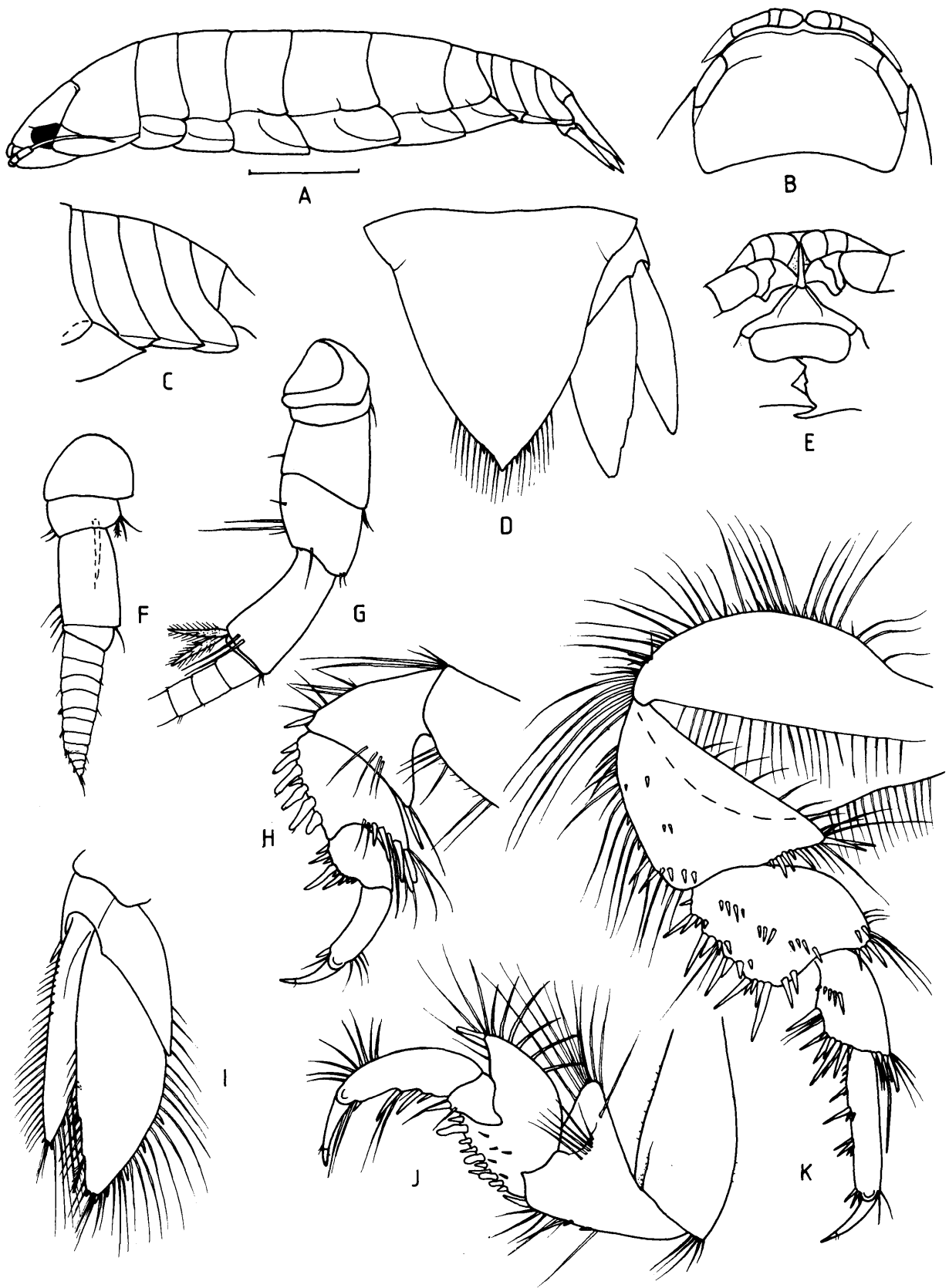


Fig. 74. *Natatolana arrama* n. sp. A-E, holotype; remainder paratype. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, pleotelson and uropod; E, clypeal region; F, antennule; G, antennal peduncle; H, pereopod 3; I, uropod; J, pereopod 1; K, pereopod 7. Scale 2.0 mm.

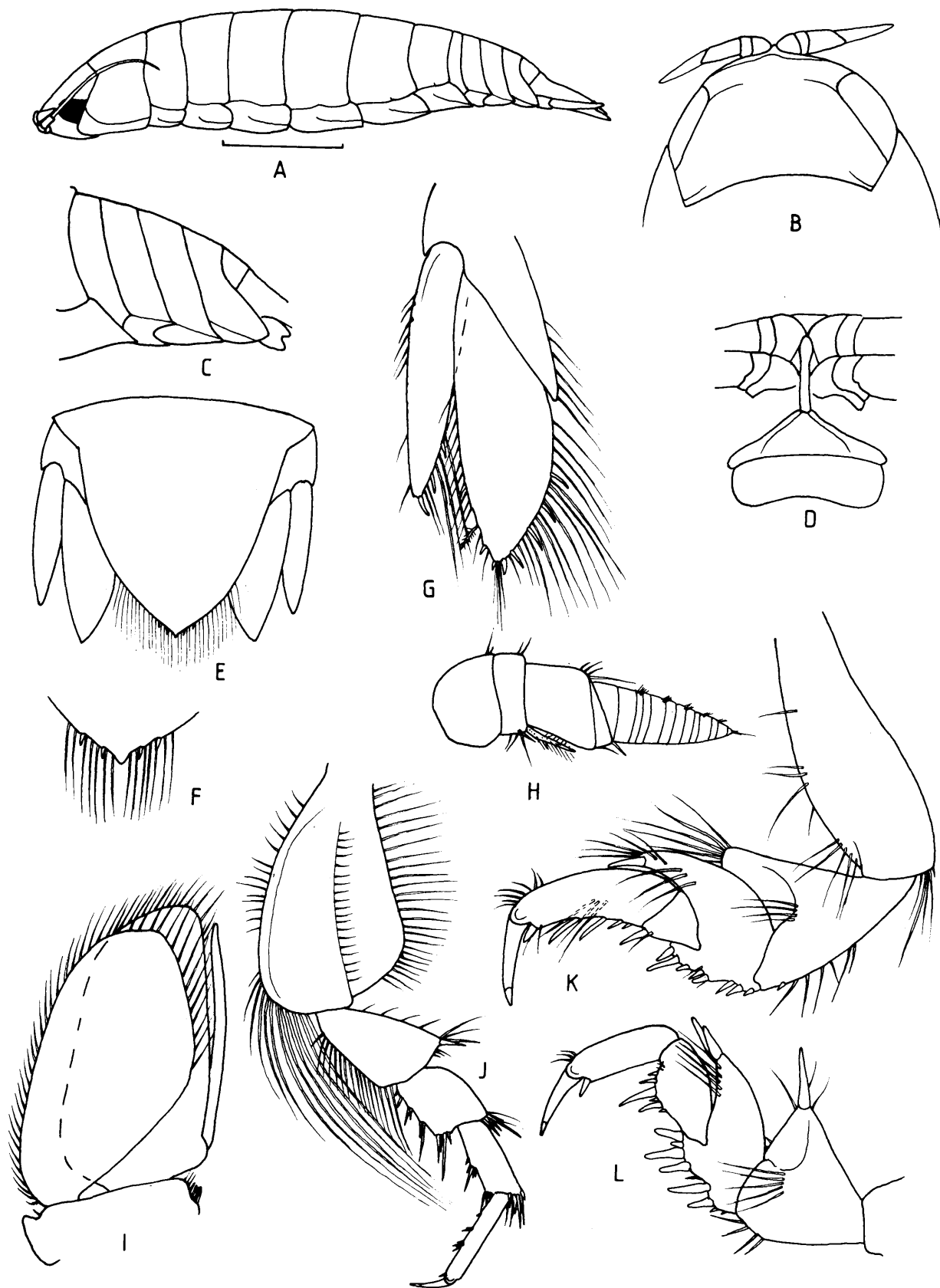


Fig. 75. *Natatolana bulba* n. sp. A-D, I, holotype; E-H, J-L, female paratype 12.9 mm. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, clypeal region; E, pleotelson and uropods; F, pleotelson, apex; G, uropod; H, antennule; I, pleopod 2; J, pereopod 7; K, pereopod 1; L, pereopod 3. Scale 2.0 mm.

than peduncle, composed of about 14 articles, not reaching pereonite 1. Antenna flagellum extending to pereonite 3.

Frontal lamina narrow, anterior slightly swollen, anterior margin rounded; clypeus triangular.

Pereopod 1 with few setae on anterior margin and at posterodistal angle of basis; ischium with marginal setae and single spine on posterior margin, anterior margin produced, with long setae; merus with posterior margin sinuate, armed with 8 spines, anterior margin with single spine at distal angle, setae on lateral margin; carpus with single seta and spine at posterodistal angle; propodus with 4 spines on palm, distal pair longest, and 5th spine opposing dactylus, anterodistal margin with row of about 7 setae. Pereopods 2–3 similar to pereopod 1, but spines on posterior margin of merus much larger, and additional spine present on anterior margin; merus with 6 spines on posterior margin, 2 of which are large; posterior margin of propodus only with spine opposing dactylus. Pereopods 5–7 similar, 6 longer than 7. Pereopod 7 basis with marginal setae along anterior and posterior margins; anterior margin of ischium with few setae, posterior margin of merus, carpus and propodus without setae, with spines at anterodistal angles of ischium; posterior margins without seta except for ischium, group of spines present, and at distal angles.

Vasa deferentia opening flush with surface of sternite 7.

Pleopod 2 appendix masculina arising sub-basally, apex slightly turned out, not extending beyond inner ramus. Uropods extending slightly beyond apex of pleotelson, rami lanceolate in shape. Exopod shorter than endopod, lateral margin entirely without spines, except for small apical spine, medial margin with 3 spines; both margins setose. Endopod with 3 spines on lateral margin, 5 on medial, both sides with marginal setae.

Female. Similar to male, reaching slightly larger size.

Colour. Brown in alcohol.

Size. Females up to 12.9 mm, male specimen 9.5 mm.

Remarks. This species was identified as *Cirolana woodjonesi* by Hale (1940). In fact, amongst Hale's specimens from North West Island are two species, neither of which are *N. woodjonesi*. *Natolana bulba* can be separated from all but one of the *N. woodjonesi* group by its lack of spines on the outer margin of the exopod. Although the specimens are in a rather poor state, examination showed this to be true for all of them. The other species that has this character, *N. arrama*, can be distinguished by having a narrow frontal lamina and far more convex margins to the basis of pereopod 7 than *N. bulba*.

Distribution. North West Island, Capricorn Group, southern Great Barrier Reef.

Etymology. *Bulba* is an Aboriginal word meaning island.

Natolana kahiba n. sp.

Fig. 76

Material examined. 2 females (8.8, 8.2 mm), off Cape Byron, NSW, 29°57'S, 153°24'E, 11 Nov. 1951, *Galathea* Stn 545, muddy sand, 75 m.

Types. Holotype, female (8.2 mm) ZMUC. Paratype, AM P32175.

Type locality. Off Cape Byron, NSW, 29°57'S, 153°24'E.

Description of female. Body about 2.5 times as long as wide. Cephalon with minute rostral point, with furrows extending from anterodorsal angle of each eye, another running just posterior to anterior margin. Pereonite 1 with single horizontal furrow. Coxae of pereonites 2–7 with incomplete oblique furrows; posterior margins of coxae 2–5 distinctly rounded. Pleonites all visible, posterolateral margins of pleonite 3 only slightly produced, those of pleonite 4 rounded. Pleotelson slightly shorter than long, shield shaped; posterior margin setose, with small medial point on either side of which lie 2 spines.

Antennule and antenna not differing significantly from *N. woodjonesi*.

Frontal lamina medially constricted, anterior margin acute. Clypeus triangular, posterior margin very slightly raised.

Pereopod 1 with few setae on basis; ischium with setae along distal half of posterior margin and along anterodistal margin; merus with single spine on anterodistal extremity, posterior margin with 12 spines; carpus with single spine and seta on posterior margin; propodus with 4 acute spines (2 long, 2 short) on palm, serrate spine opposing dactylus, anterior margin with row of 8 setae on distal extremity. Pereopods 2–3 similar to 1, but carpus longer; merus and carpus far more spinose, spines larger; propodus of pereopod 2 with 2 spines on palm, pereopod 3 with 1. Pereopod 7 with basis similar to *N. woodjonesi*, but anterior margin less sinuate; anterior margins of ischium, merus, carpus and propodus without setae, except at distal angles; posterior margin of ischium and merus with setae and spines, merus and carpus with clusters of spines, but few setae.

Uropods extending slightly beyond apex of telson, rami with slightly convex margins. Exopod distinctly shorter than endopod, both margins with continuous row of setae and 3 spines. Endopod with 3 spines and sensory setae on lateral margin, medial margin with 5 spines.

Male. Not known.

Colour. Cream in alcohol.

Size. 8.8 mm.

Remarks. The characters that separate *N. kahiba* from *N. woodjonesi* are the less acutely narrowed pleotelson, the rounder coxal plates, and the frontal lamina having a more acute anterior margin. The appendages differ in that the anterodistal extremity of the merus of pereopod 1 bears 1 spine (2 in *N. woodjonesi*), the palms of pereopods 2–3 have 2 spines

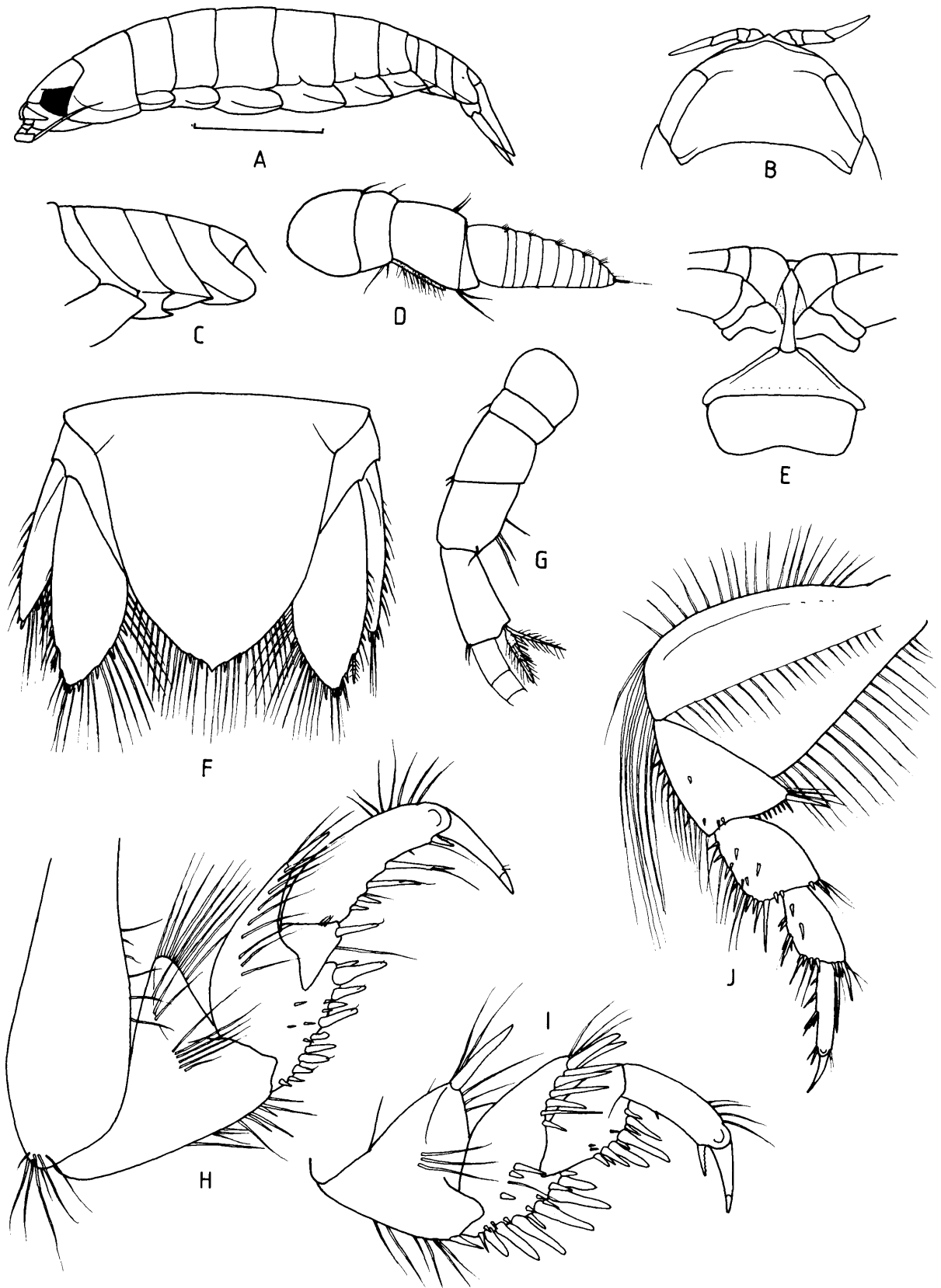


Fig. 76. *Natatolana kahiba* n. sp. A-C, E, F, holotype; remainder paratype. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, antennule; E, clypeal region; F, pleotelson and uropods; G, antennal peduncle; H, pereopod 1; I, pereopod 3; J, pereopod 7. Scale 2.0 mm.

and 1 spine each (without spines in *N. woodjonesi*) and the spines are more robust. Pereopod 7 differs in having the anterior margin less sinuate than in *N. woodjonesi*. The uropods differ in having a shorter exopod, and in having fewer spines.

Distribution. Known only from the type locality.

Etymology. *Kahiba* is an Aboriginal word meaning eager.

Natatolana nammuldi n. sp.

Figs 77, 78

Material examined. Crib Point, Western Port, Vic., CPBS Stns: 21N, 4 manca (5.0, 6.0, 6.5, 6.9 mm); 22N, 2 females (20.2 ovig., 21.8 mm); 300/865, female (15.5 mm); 300/1270, female (12.6 mm); 31N/1, female (13.6 mm); 31N/770, female (17.9 mm); 31N/867, female (24.5 mm); 31S, 2 female (19.9, 18.5 mm); 32N, 4 manca (5.0, 6.9, 6.9, 7.0 mm).

Types. Holotype, female (20.2 mm) NMV J1718. Paratypes NMV J1719-J1722, J1753; AM P32363-P32365; USNM 190722.

Type locality. Western Port, Vic., 38°27'S, 145°14'E.

Description of female. Body about 3 times as long as wide, sides subparallel. Cephalon with small median rostral point; impressed line behind anterior margin, 2 further lines run from dorsal surface of each eye. Pereonites 1, 5 and 6 subequal in length and longer than pereonites 2-4 and 7; pereonite 1 with lateral impressed lines, the lower of which runs entire length of segment; pereonites 2-7 with short impressed line running from centre of each segment. Coxae each with impressed line, running 0.75 length of coxae; coxae extending beyond posterior border of pereonite except for pereonites 6-7. Pleonites all visible; posterolateral margins of pleonites 2-4 with impressed line; lateral margins of pleonite 4 produced posteriorly, dorsal side of projection gently rounded, ventral side nearly straight. Pleotelson narrows smoothly to point, on either side of which lie 4 spines, set amongst fringing setae.

Antennule short, extending posteriorly to middle of eye, peduncle article 2 shortest, article 3 as long as combined lengths of articles 1 and 2; article 2 with large sensory seta; flagellum of about 12 articles, provided with numerous aesthetascs. Antenna peduncle article 5 little longer than article 3-4, posterior margin of article 4 with 3 setae; posterodistal margin of article 5 with 2 large sensory setae; flagellum extends to posterior of pereonite 2 composed of about 23 articles.

Frontal lamina medially constricted, widening anteriorly, forming gently rounded point. Maxilliped endite with 2-3 coupling hooks.

Pereopod 1 basis with group of setae on posterodistal angle, setae along anterior margin; ischium anterodistal margin without spines; merus with 6 blunt and 3 small acute spines on posterior margin and single robust spine at anterodistal angle; carpus with 2 spines on posterior margin; propodus with setae on anterodistal margin, palm with 4 long acute spines and distal serrate spine opposing dactylus, further groups of stiff setae lie

submarginally on lateral surface. Pereopods 2-3 similar to 1, but increasingly spinose; carpus becomes progressively longer, palm of propodus without spines. Pereopod 4 with ischium, merus and carpus armed with numerous stout spines, propodus with spines on posterior margin. Pereopod 6 longer than 5 and 7. Pereopod 7 basis greatly expanded; anterior margin with proximal two thirds slightly concave, entire length of margin with plumose setae; lateral surface with medial row of setae; posterior margin with short setae, except distal angle which has long plumose setae; posterior margins of ischium and merus with spines and setae, anterior margins with setae only; distal angles of ischium, merus and carpus with groups of spines, propodus with 2 groups of spines on posterior margin, and third group opposing dactylus.

Uropods extend very slightly beyond telson apex. Exopod narrow, slightly shorter than endopod, lateral margin very slightly concave, provided with 5 spines set amongst continuous fringe of setae, medial margin with 3 spines and continuous fringe of setae. Endopod lateral margin with setae extending distal two thirds of its length, armed with 4 spines and sensory seta, medial margin slightly convex, with 6 spines set amongst marginal setae. Ventrolateral angle of peduncle with 2 stout spines.

Male. Not known.

Colour. Preserved specimens are deep salmon or pale tan.

Size. Largest specimen 24.5 mm, largest manca 7.0 mm.

Remarks. *Natatolana nammuldi* is distinguished from *N. woodjonesi* by having more acute uropodal rami, a longer uropodal exopod, less acute posterolateral margins of pleonite 4, and by having 8 marginal spines on the pleotelson (not 4 as in *N. woodjonesi*). *Natatolana wowine* is also very similar, but the present species can be separated by the far more acute telson and uropods and by the difference in shape of the lateral margins of pleonite 4, which in *N. wowine* are broadly rounded.

Distribution. Known only from Western Port, Vic.

Etymology. *Nammuldi* is an Aboriginal word meaning hidden, and alludes to the fact that this species was "hidden" within *N. woodjonesi*.

Natatolana thalme n. sp.

Figs 79, 80

Material examined. Series of specimens, all labelled 'Middle Banks, Moreton Bay, South East Queensland, coll. S. Cook & S. Newlands', collected between Mar. 1972 and Jan. 1976, comprising 10 males (5.0-6.9 mm), 20 females (5.5-9.5 mm) and 21 manca (2.0-6.0 mm). No other data.

Types. Holotype, male QM W6292. Paratypes, QM W6288, W6291-W6293, W9848-W9852; AM P32382.

Type locality. Middle Banks, Moreton Bay, Qld, 27°06'S, 153°16'E.

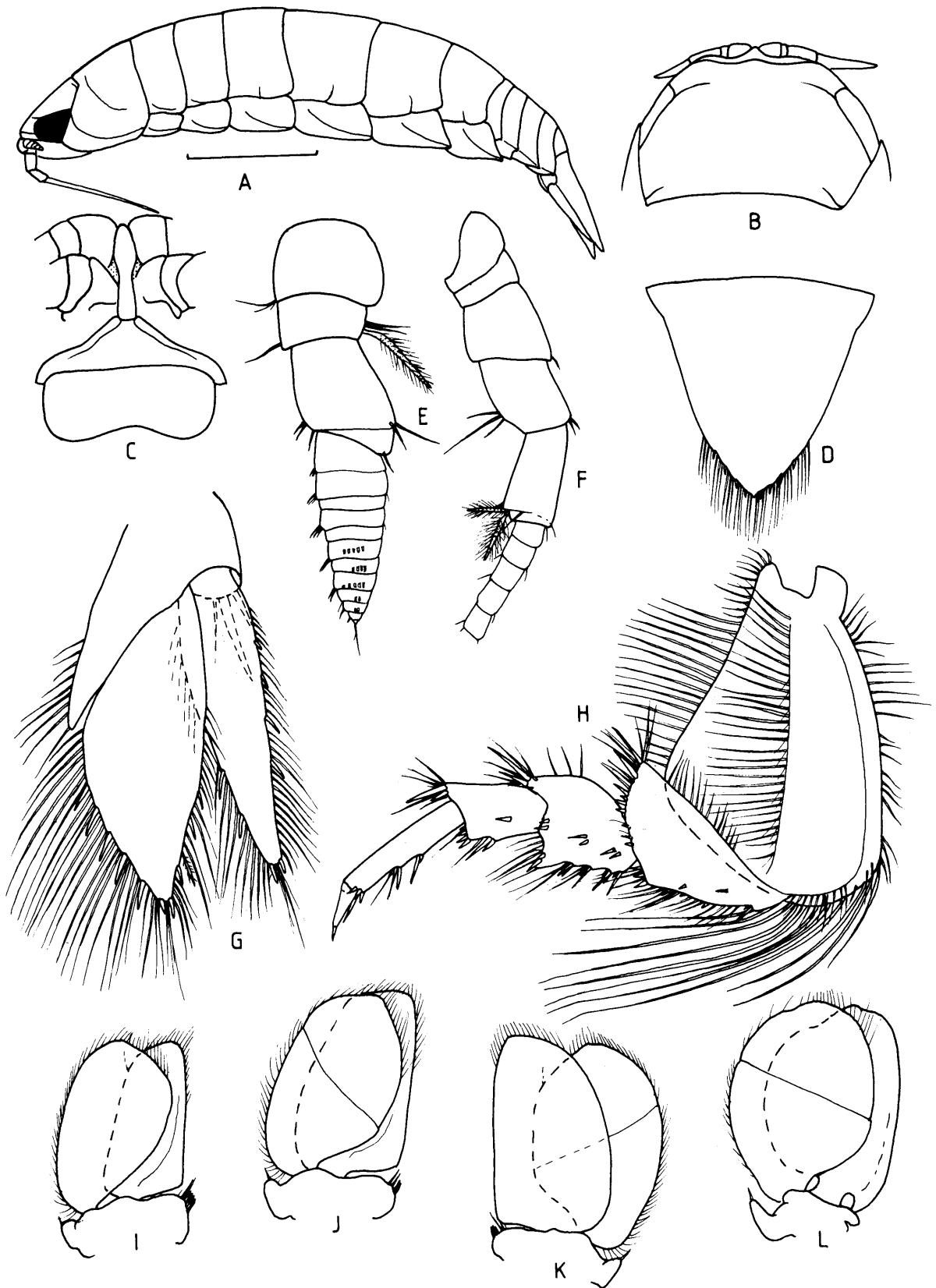


Fig. 77. *Natatolana nammuldi* n. sp. A-D, female holotype 20.2 mm; E-L, female paratype 19.9 mm. A, lateral view; B, cephalon, dorsal view; C, clypeal region; D, pleotelson; E, antennule; F, antennal peduncle; G, uropod; H, pereopod 7; I, pleopod 1; J, pleopod 3; K, pleopod 4; L, pleopod 5. Scale 4.0 mm.

Description of male. Body about 3 times as long as wide. Cephalon with small rostral point, anterior margin with interocular furrow, additional furrow extends from top of each eye. Eye large, narrower anteriorly. Pereonite 1 with 2 longitudinal furrows. Coxae of pereonites 2-7 each with partial diagonal furrow. Pleonite 3 with posterolateral margins acute, those of pleonite 4 rounded. Pleotelson slightly longer than greatest width, apex produced to small point on either side of which lie 2 spines, and marginal plumose setae.

Antennule short, extending to mid point of eye, flagellum slightly shorter than peduncle; peduncle article

2 with large sensory plumose seta set at distoventral angle. Antenna extending to posterior of pereonite 2, flagellum composed of about 20 articles; peduncle article 5 with 2 large sensory setae set at distoventral angle.

Frontal lamina narrow, about 4.5 times as long as greatest width, constricted about two thirds of way along its length, anterior margin bluntly rounded; clypeus triangular.

Pereopod 1 with group of setae at posterodistal angle of basis, scattered setae along anterior margin; ischium with stiff setae on distal half of posterior margin,

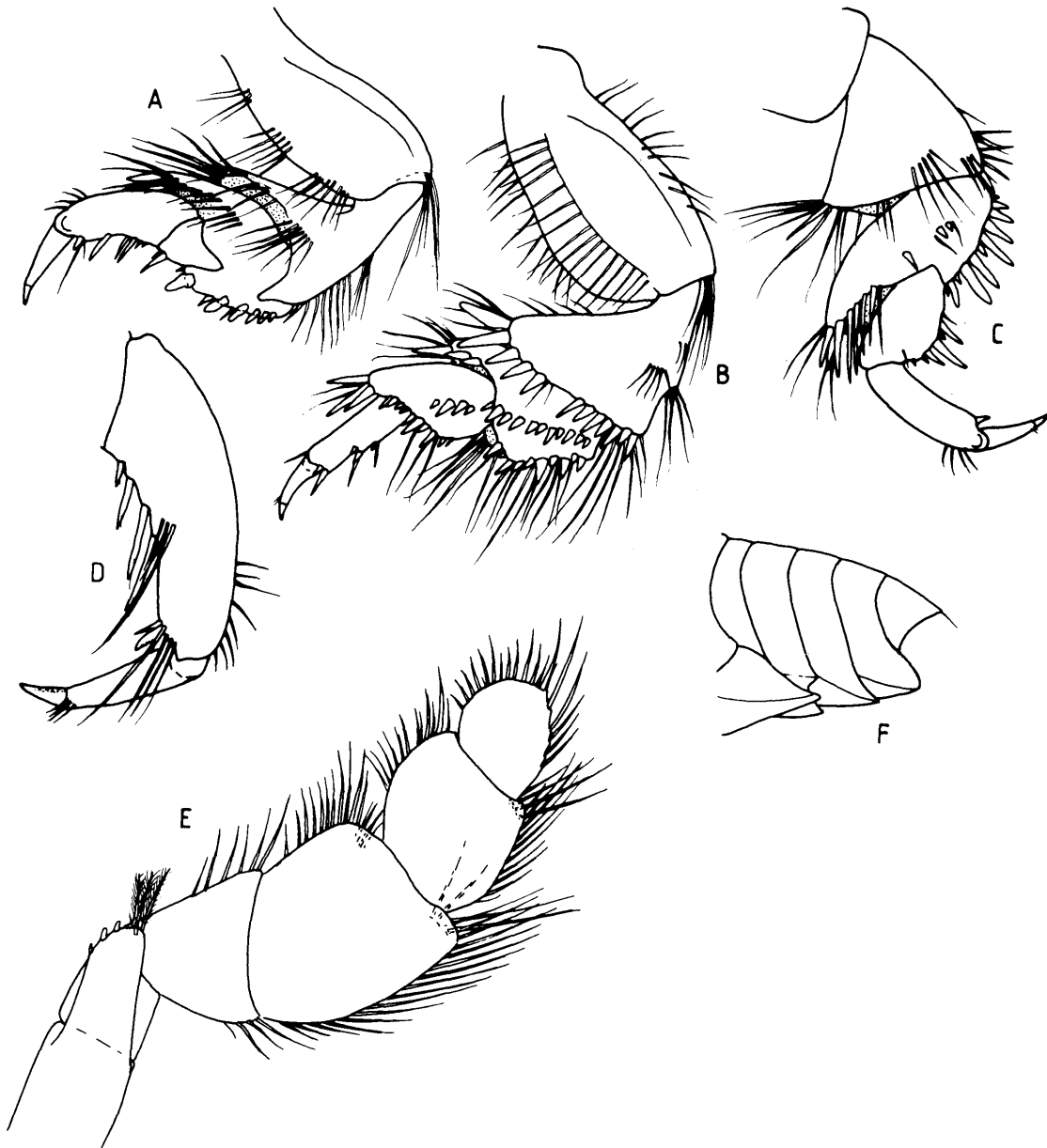


Fig. 78. *Natatolana nammuldi* n. sp., female 19.9 mm. A, pereopod 1; B, pereopod 4; C, pereopod 3; D, pereopod 1, propodus; E, maxilliped; F, pleon, lateral view.

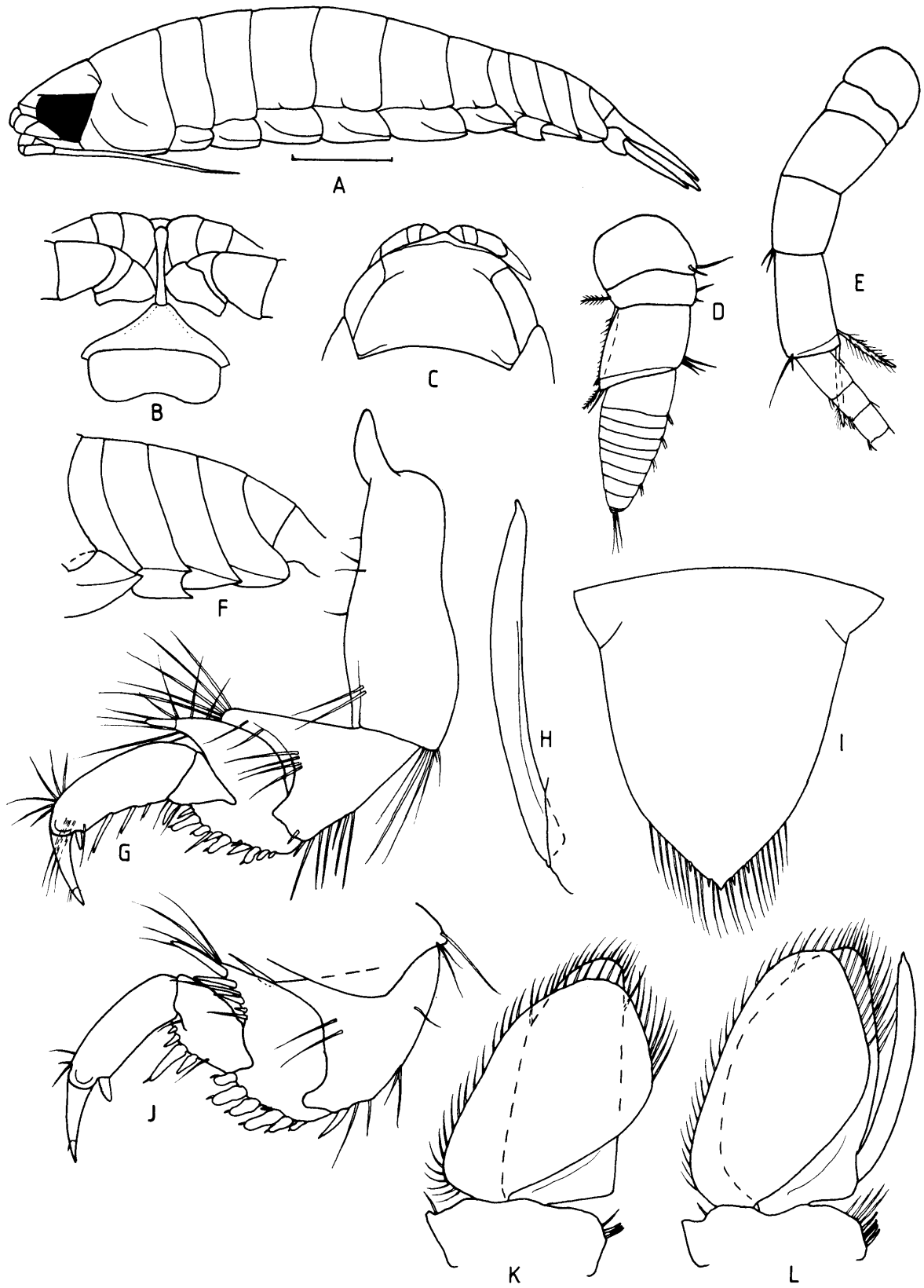


Fig. 79. *Natatolana thalme* n. sp. A-C, H, J-L, holotype; D, E, G, I, male paratype; F, female paratype. A, lateral view; B, clypeal region; C, cephalon, dorsal view; D, antennule; E, antennal peduncle; F, pleon, lateral view; G, pereopod 1; H, appendix masculina; I, pleotelson; J, pereopod 2; K, pleopod 1; L, pleopod 2. Scale 1.0 mm.

anterior margin setose; merus with single stout spine at anterodistal extremity as well as setae, posterior margin with 6 blunt and 4 acute spines; carpus with single spine and 2 setae on posterior margin; propodus palm with 3 slender spines and robust serrate spine opposing dactylus, distal margin with row of 6 setae. Pereopods 2-3 similar to pereopod 1, but palm of propodus without spines, carpus proportionally longer and with larger and more numerous spines; merus with fewer spines, but these are conspicuously more robust; basis shorter and more robust than pereopod 1. Pereopod 7 with basis little shorter than twice its greatest width, anterior margin with continuous row of setae, posterior margin sparsely setose, except distal extremity which bears long plumose setae; anterior margins of ischium, merus, carpus and propodus with spines, and setae at

distal angles, posterior margins with groups of spines; ischium with continuous row of setae along posterior margin. Pereopods 5-6 similar to 7, but pereopod 6 longer than 7.

Vasa deferentia opening flush on surface of sternite 7.

Pleopod 2 appendix masculina arising sub-basally, gently recurved, with small projection at apex; not extending beyond inner ramus. Uropods extending slightly beyond apex of pleotelson, rami moderately slender. Exopod with 4 spines on lateral margin and continuous row of setae, medial margin with 3 spines. Endopod with 3 spines and sensory seta on lateral margin, which is slightly indented towards the apex; medial margin with 4 spines set amongst long marginal setae.

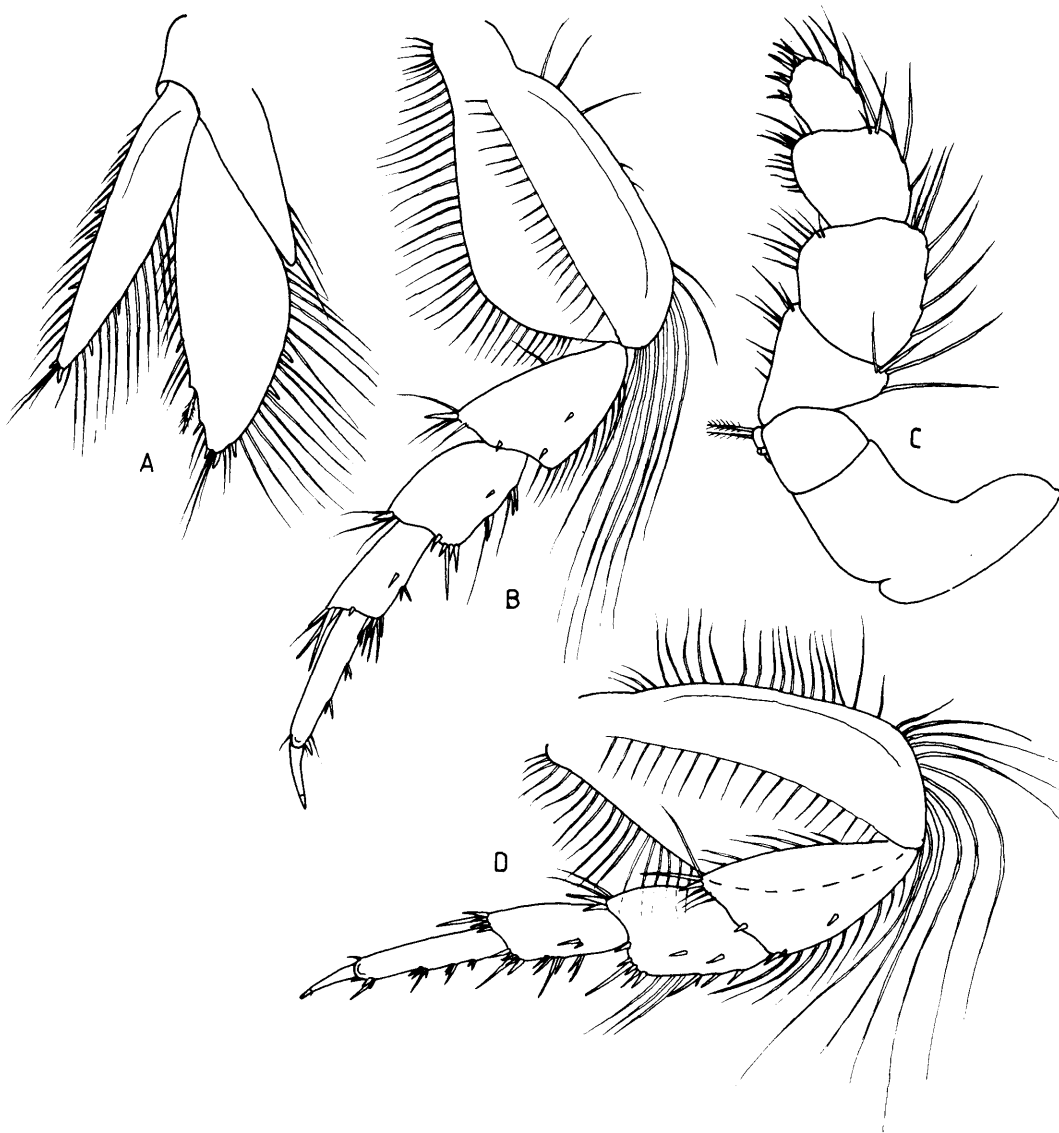


Fig. 80. *Natatolana thalme* n. sp. A, C, female paratype; B, D, male paratype. A, uropod; B, pereopod 7; C, maxilliped; D, pereopod 7.

Female. Agrees closely to description of male, but with more setae and spines on pereopods.

Variation. Larger specimens have more spinose pereopods. The differences in pereopod spination and setation between sexes may be a reflection of size difference.

Colour. All brown in alcohol. Eye dark brown to red.

Size. Largest male, 6.9 mm, largest female 9.5 mm, manca up to 6.0 mm.

Remarks. This species is very similar to *N. woodjonesi*, but has an obviously distinct appendix masculina, as well as larger eyes. Other differences are a narrower basis to pereopod 7, more robust spines on pereopods 2–3, and a narrow frontal lamina which has the anterior margin more blunt than in *N. woodjonesi*. *Natatolana tenuistylis* is also similar and can be separated by having a shorter appendix masculina, and more numerous spines on the posterior margin of the pleotelson. This last factor also serves to distinguish *N. thalme* from *N. nammuldi* and *N. wowine*.

Distribution. Known only from the type locality.

Etymology. Specific epithet is the Aboriginal word *thalme*, meaning bay, and refers to the type locality, known locally as 'The Bay'.

Natatolana wowine n. sp.

Figs 81, 82

Part *Cirolana woodjonesi*.—Hale, 1925: 137 [misidentification, not *N. woodjonesi* (Hale, 1924)].

Material examined. Crib Point, Western Port, Vic., CPBS Stns: 21S, 21 males (7.8–11.5 mm), 19 females (7.5–14.8 mm), 58 manca (5.0–8.0 mm); 31N, 2 females (14.3, 17.6 mm); 31S/466, male (10.7 mm), 3 females (12.6, 14.7, 16.0 mm); 31S/866, 2 females (14.3, 17.6 mm), manca (5.6 mm); 32N/367, female (19.5 ovig.); 32N/1767, male (11.3 mm); 51N, female (11.5 mm). Port Phillip Bay, Vic., PPBES Stns: 906, 2 males (10.7, 12.6 mm), 6 females (12.5, 12.9, 13.0, 14.5, 14.7, 17.6 mm ovig.), manca (6.9 mm); 921, 3 females (7.2, 7.5, 15.8 mm ovig.); 942, 3 females (11.3, 14.2, 14.8 mm); 1252, female (15.1 mm), manca (5.6 mm); 1730, female (11.5 mm), Stn. 8, off Burnie, W. Tas., 10 Feb. 1970, 40 m, coll. males and females off Cape Portland, N.E. Tas., 10–20 m, over sand, covering fish baits on lines at night; from porpoise, 18 males and females, these from Hale, (1924). Female (18.2 mm), Stn. 8, off Burnie, W. Tas., 10 Feb. 1970, 40 m, coll. N.W. Acid Plant Survey. 5 males (14.5–18.0 mm), 3 females (12.6, 12.0, 11.9 mm), Mondarin Is., Recherche Archipelago, WA, 6 Feb. 1960, in craypot, 20–40 m, coll. R.W. George.

Types. Holotype, male NMV J1723. Paratypes, NMV J1724–J1731; AM P9592, P9594, P32366–P32370; WAM 18–80.

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

Description of male. Body smooth, 3 times as long as wide, sub-parallel in shape. Cephalon with small rostral point, furrow runs just behind anterior margin; second furrow extends along medial margin of each eye, extending anteriorly. Pereonite 1 longest, pereonite 7 shortest; pereonites 2–5 becoming progressively longer,

6–7 progressively shorter. Lateral margins of pereonite 1 with submarginal furrow extending length of segment, shorter furrow more dorsally placed. Coxae of pereonites 2–7 each with oblique furrow, extending from posterior angle to 0.75 of distance to dorsal edge. Pleonite 1 almost entirely concealed by pereonite 7, posterolateral margins of pleonite 3 produced, those of pleonite 4 rounded, both with 1 longitudinal furrow. Pleotelson slightly domed, about as long as broad, lateral margins converging smoothly to apex; 8 spines set amongst setae of posterior margin.

Antennule short, peduncle article 2 half as long as 1, article 3 slightly longer than combined lengths of articles 1 and 2; article 2 with long sensory setae at distoventral margin; flagellum of 10 articles, extending to middle of eye. Antenna peduncle article 3 shorter than article by 0.25 of its length, article 5 longest; flagellum extends to pereonite 2.

Frontal lamina 3 times longer than greatest width, dilated anteriorly; clypeus with 2 marginal ridges.

Pereopod 1 with anterodistal angles of ischium and merus armed with setae; merus with single conspicuous spine; posterior margins of ischium with setae and single distal spine, merus with 9 spines and carpus with 1; propodus with 3 spines on palm and single spine opposing dactylus. Pereopod 2 with anterodistal angle of ischium with large spine, 2 spines on posterodistal angle, and 2 submarginal spines; merus with 2 truncate spines on anterodistal angle, posterior margin with 5 large truncate spines and 4 acute spines, further group of 4 spines on lateral surface; carpus longer than in pereopod 1, with 6 spines on posterior margin; propodus without spines on palm except for spine opposing dactylus. Pereopod 7 with greatest width of basis more than half its length; posterior margin with plumose setae, distal group extending as far as merus; anterior margin with continuous fringe of setae, and further median line of setae on lateral surface; ischium with 2 spines at anterodistal angle, posterior margin with continuous row of setae; distal angles of merus and carpus provided with spines and setae; propodus with 3 groups of spines on posterior margin.

Vasa deferentia opening flush with ventral surface of pereonite 7.

Pleopod 2 appendix masculina extending little beyond inner ramus, apex falcate. Uropods extending slightly beyond pleotelson. Endopod with lateral and medial margins gently rounded, about 2–4 times longer than broad; medial margin with 6 spines, lateral with 3. Exopod slightly shorter than endopod, lateral margin with continuous fringe of setae amongst which are set 6 spines; medial margin with 3 spines. Posterolateral margin of peduncle with 2 spines.

Female. Not differing significantly from male. Tends to be larger in size, and ovigerous females may be slightly broader.

Variation. There is variation in the degree of roundness of the pleotelson, which sometimes approaches the shape of that of *N. woodjonesi*. Variation also exists in the number of spines on the

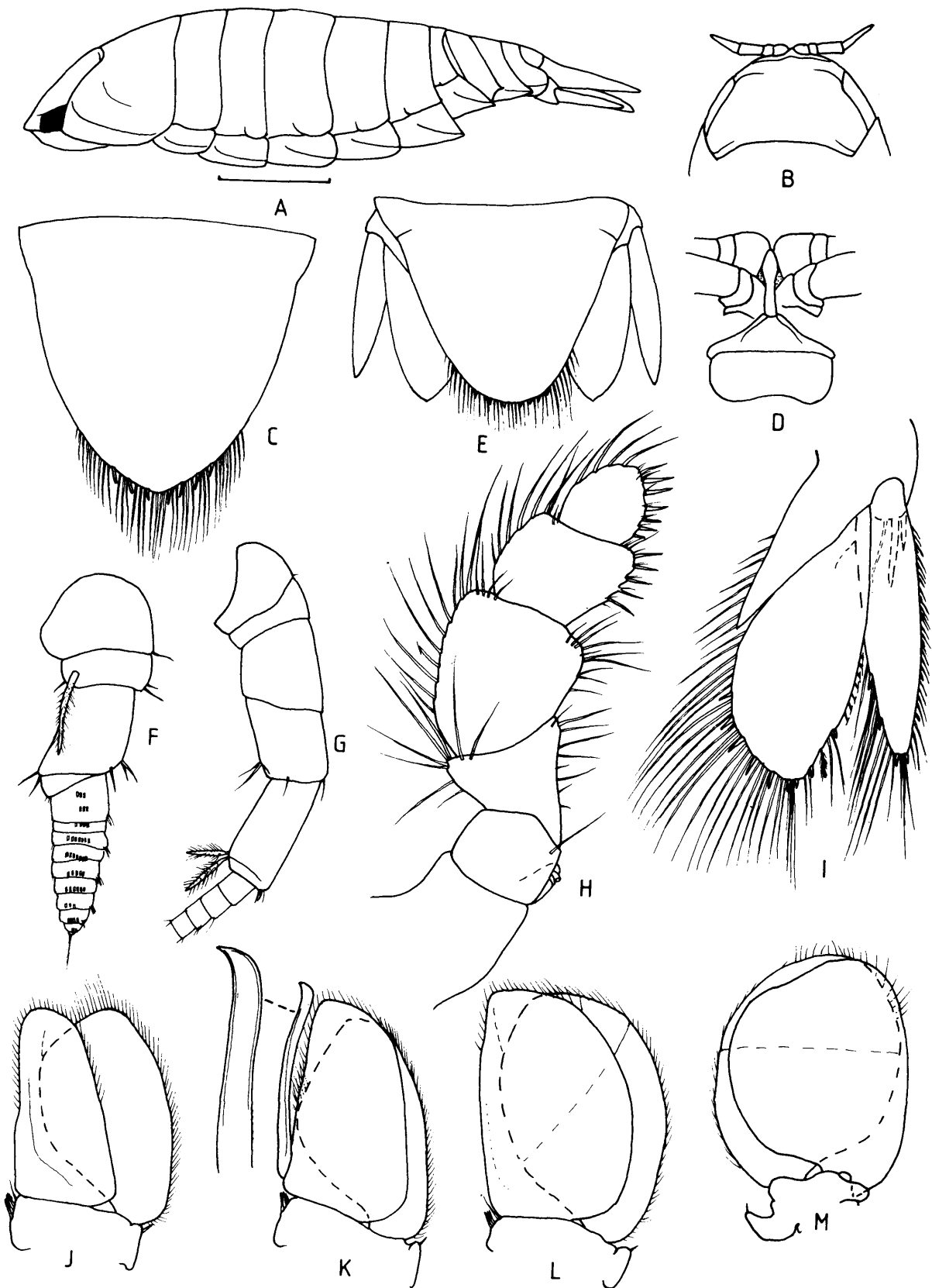


Fig. 81. *Natatolana wowine* n. sp. A-D, male holotype; F-M male paratype, 11.2 mm. A, lateral view; B, cephalon, dorsal view; C, pleotelson, dorsal view; D, clypeal region; E, pleotelson and uropods, male 14.2 mm; F, antennule; G, antennal peduncle; H, maxilliped; I, uropod; J, pleopod 1; K, pleopod 2; L, pleopod 4; M, pleopod 5. Scale 4.0 mm.

posterior margin of the pleotelson. All the Port Phillip Bay and Western Port material had 7 or 8 spines, most specimens from other areas had 6, or occasionally 8.

Colour. In preserved specimen, varies from cream to dark tan.

Size. Largest male 19.0 mm, largest female 17.6 mm, largest manca, 8.0 mm.

Remarks. This species differs from *N. woodjonesi* principally in the shape of the pleotelson and pleonite 4. However, there are other differences which include the spination of pereopod 2, which in this species possesses truncate spines, the shape of the uropods which are more rounded, and the difference in appendix masculina shape which, in *N. wowine*, is broader than in *N. woodjonesi*, and has a smoothly falcate apex. Lastly, *N. woodjonesi* has only 4 pleotelson spines.

Distribution. A southern coast distribution, from north-eastern Tasmania, Western Port and Port Phillip Bay, Vic., and the Recherche Archipelago, WA. The distribution overlaps with that of *N. woodjonesi*, and specimens from Portland and from porpoises identified by Hale (1925) as *N. woodjonesi* are this species.

Etymology. *Wowine* is an Aboriginal word meaning alike, and refers to this species' similarity to *C. woodjonesi*.

Natatolana wullunya n. sp.

Fig. 83

Material examined. Female (11.3 mm), off Sydney, NSW, 33°58'S, 151°29'E, 18 Nov. 1962, 150 m, coll. CSIRO.

Types. Holotype, AM P30364.

Type locality. Off Sydney, NSW, 33°58'S, 151°29'E.

Description of female. Body about 2.5 times as long as wide. Cephalon with rostral point; furrows extending from dorsal anterior angle of each eye, one running behind anterior margin. Pereonite 1 with single horizontal furrow; coxae of pereonites 2-7 each with partial furrow. Pleonites all visible, pleonite 3 with posterolateral margins moderately produced, pleonite 4 with posterolateral margins rounded, each with single longitudinal furrow. Pleotelson slightly shorter than wide, shield shaped, posterior margin with setae, 3 spines on either side of small apical projection.

Antennule peduncle article 3 slightly shorter than combined lengths of articles 1 and 2; flagellum shorter than peduncle, composed of about 12 articles, extending to posterior of cephalon. Antenna flagellum extending to pereonite 2.

Frontal lamina very narrow, anterior very slightly expanded; posteroventral surface raised to form ridge; clypeus triangular, posterior slightly raised.

Pereopod 1 with few setae on anterior margin and posterodistal angle of basis; ischium with anterior

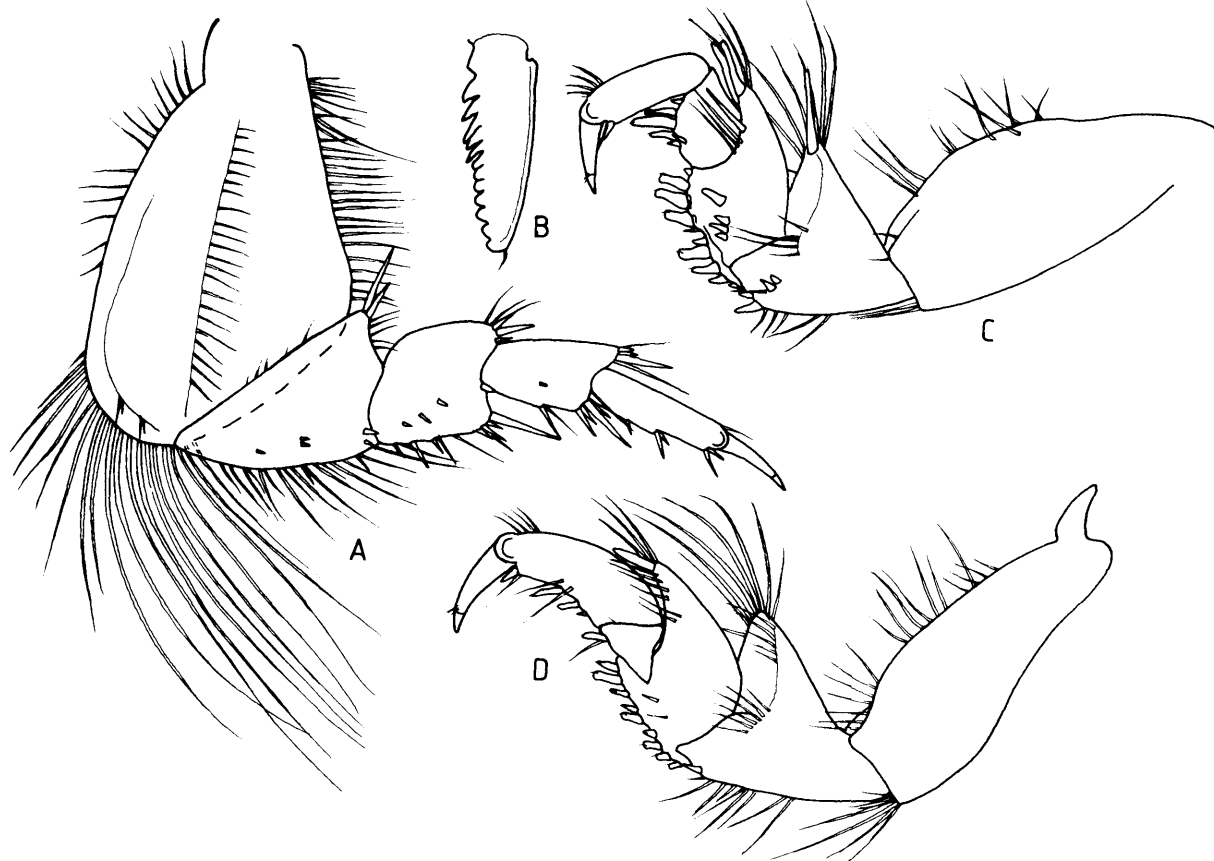


Fig. 82. *Natatolana wowine* n. sp., male paratype 11.2 mm. A, pereopod 7; B, pereopod 2, distal propodial spine; C, pereopod 2; D, pereopod 1.

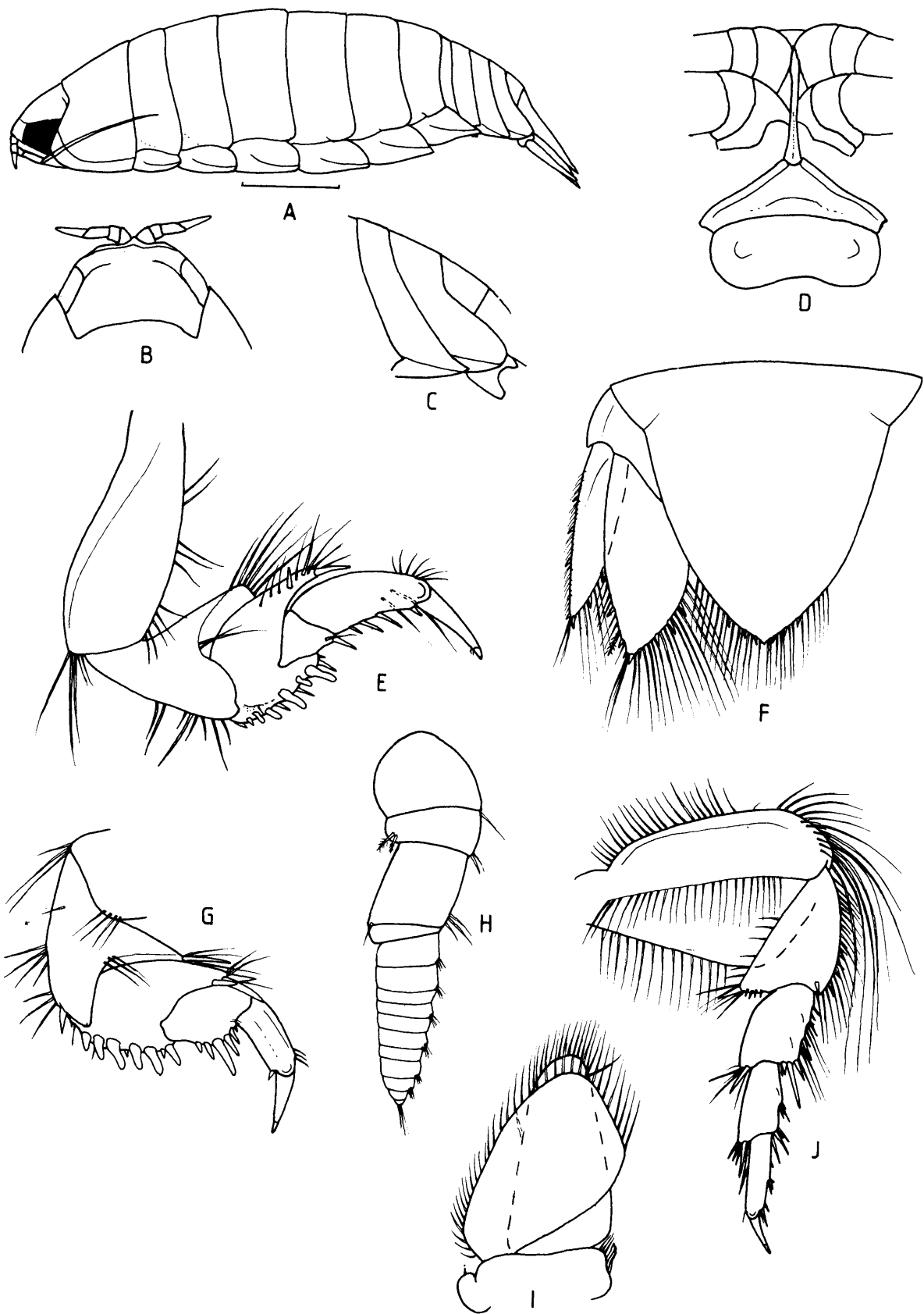


Fig. 83. *Natatolana wullunya* n. sp., holotype. **A**, lateral view; **B**, cephalon, dorsal view; **C**, pleonites 3 to 5, lateral view; **D**, clypeal region; **E**, pereopod 1; **F**, pleotelson and uropod; **G**, pereopod 3; **H**, antennule; **I**, pleopod 1; **J**, pereopod 7. Scale 2.0 mm.

margin setose, posterior margin with stiff setae on distal half; merus with 2 spines on anterior margin as well as setae, posterior margin with 5 blunt and 6 acute spines; carpus with single spine and seta at posterodistal angle; propodus with 3 acute spines on palm and spine opposing dactylus, row of 7 setae on anterodistal margin. Pereopods 2–3 similar to 1, but possess additional spines on anterior margins of ischium and merus; posterior margin of merus with 6 large blunt spines; posterior margin of carpus with 5 spines; propodus with spine opposing dactylus. Pereopods 5–7 similar, 6 longer than 7. Pereopod 7 with setae along both margins of basis; anterior margin straight to point of inflection, posterodistal margin with long natatory setae; ischium posterior margin setose, anterior margin with 6 short setae; anterior margins of merus, carpus and propodus without setae; merus and carpus each with cluster of spines at distal angles; posterior margins of merus, carpus and propodus with groups of spines; merus with few setae between spine groups.

Uropods extending slightly beyond apex of pleotelson. Exopod shorter than endopod, lateral margin with 4 spines, medial with 3, both margins with setae. Endopod with setae on distal half of lateral margin, and with 3 spines; medial margin with 5 spines, setose along entire length.

Male. Not known.

Colour. Brown in alcohol. Chromatophores not visible.

Size. 11.3 mm.

Remarks. This species is at once separated from all others of the group but one by its narrow frontal lamina. *Natatolana arrama* has a similar frontal lamina but differs in the shape of clypeus, pereopod 7, and lack of spines on the outer margin of the uropodal exopod. *Natatolana woodjonesi* also appears similar, but again the frontal lamina of the two species differ, as do the number of spines on the posterior margin of the pleotelson and on the outer margin of the uropodal exopod. The shape of the basis of pereopod 7 of both species is distinct, the anterior margin of which is somewhat sinuate in *N. woodjonesi*.

Distribution. Known only from the type locality.

Etymology. *Wullunya* is an Aboriginal word meaning to swim.

Dolicholana n. gen.

Type species. *Cirolana elongata* Milne-Edwards, 1840, original designation. Types held by the Muséum Nationale d'Histoire Naturelle, Paris.

Diagnosis. Antennule peduncle articles 1–3 subequal in length. Antenna peduncle articles 4–5 subequal in length, article 5 longest. Frontal lamina ventral surface excavate, posterior part produced to form downwardly projecting lobe. Maxilliped endite elongate with 2 coupling hooks. Pereopods 1–3 with anterodistal margins of ischium and merus strongly produced.

Pereopods 5–7 with article, flattened, long natatory setae on basis, ischium and merus. Pleopod 1 endopod greater than half width of exopod; pleopods 3–5 endopods without setae; appendix masculina inserted sub-basally.

Additional characters. Body about 3 times as long as wide; cephalon with anterior margin recessed, without rostral point; eyes lateral. Pereonite 1 slightly longer than pereonite 2. Pleonites 1–2 with lateral margins not produced, those of 3–4 broad; lateral margins of pleonite 5 encompassed by pleonite 4.

Antennule flagellum articles short; antenna peduncle articles 1–2 short, 3–4 longer, subequal in length, article 5 equal to combined lengths of articles 3–4. Clypeus and labrum flat. Mouthparts similar to *Natatolana*; maxilliped endite extending to palp article 3. Pereopod dactyls all unungiculate. Pleopods 3–5 exopods with complete suture. Uropod peduncle only moderately produced.

Remarks. There are several features shown by *Dolicholana elongata* that prevent its inclusion in other genera. The form of the antennule flagellum, antenna, mouthparts and particularly the pereopods suggest a close affinity with *Natatolana*. Differences in the morphology of the antennule peduncle, frontal lamina, and in the pleopod setation prevent its inclusion in *Natatolana*. As other genera are even less similar, a new genus is established.

Barnard (1936) described the species *Cirolana porcellana* which, from his figures and description, appears to belong to this genus. Examination of the type specimens would be necessary for confirmation.

Etymology. The genus name is obtained by coupling the Greek word *dolichos* (= long) and the ending *-lana* to indicate family affinity. Gender is feminine.

Dolicholana elongata (Milne-Edwards)

Figs 84, 85

Cirolana elongata Milne-Edwards, 1840: 236.—Hansen, 1890: 345, pl. III figs 4, 4a–e; Thielemann, 1910: 14; Nierstrasz, 1931: 151; Monod, 1934: 8, pl. VA, VI, VII; Iwasa, 1965: 13; Bruce, 1981b: 961.

Cirolana pumicea Hale, 1925: 130, fig. 1.—Nierstrasz, 1931: 157.

?*Cirolana elongata*.—Hesse, 1866: 262 (identity uncertain).

Material examined. Female (13.2 mm), Capricorn Channel, Qld, 14 Dec. 1977, *Kimbla* Stn 22, 310 m, coll. P. Terrill. Manca (7.5 mm), east of North West Island, Capricorn Group, Qld, 23°15.2'S, 152°24.1'E, 14 Dec. 1977, 284 m, coll. P. Terrill. Also material described by Hale (1925).

Description of female. Body about 4 times as long as wide. Cephalon dorsal surface irregular, anterior margin with median depression and submarginal furrow; ventromedial margin of eye with long setae; pereonite 1 slightly longer than others; pereonites 2–7 with distinct carinae on coxae. Pleon broad, with horizontal impressed line on posterolateral margins of pleonites 3–4. Pleotelson with fused 6th pleon segment

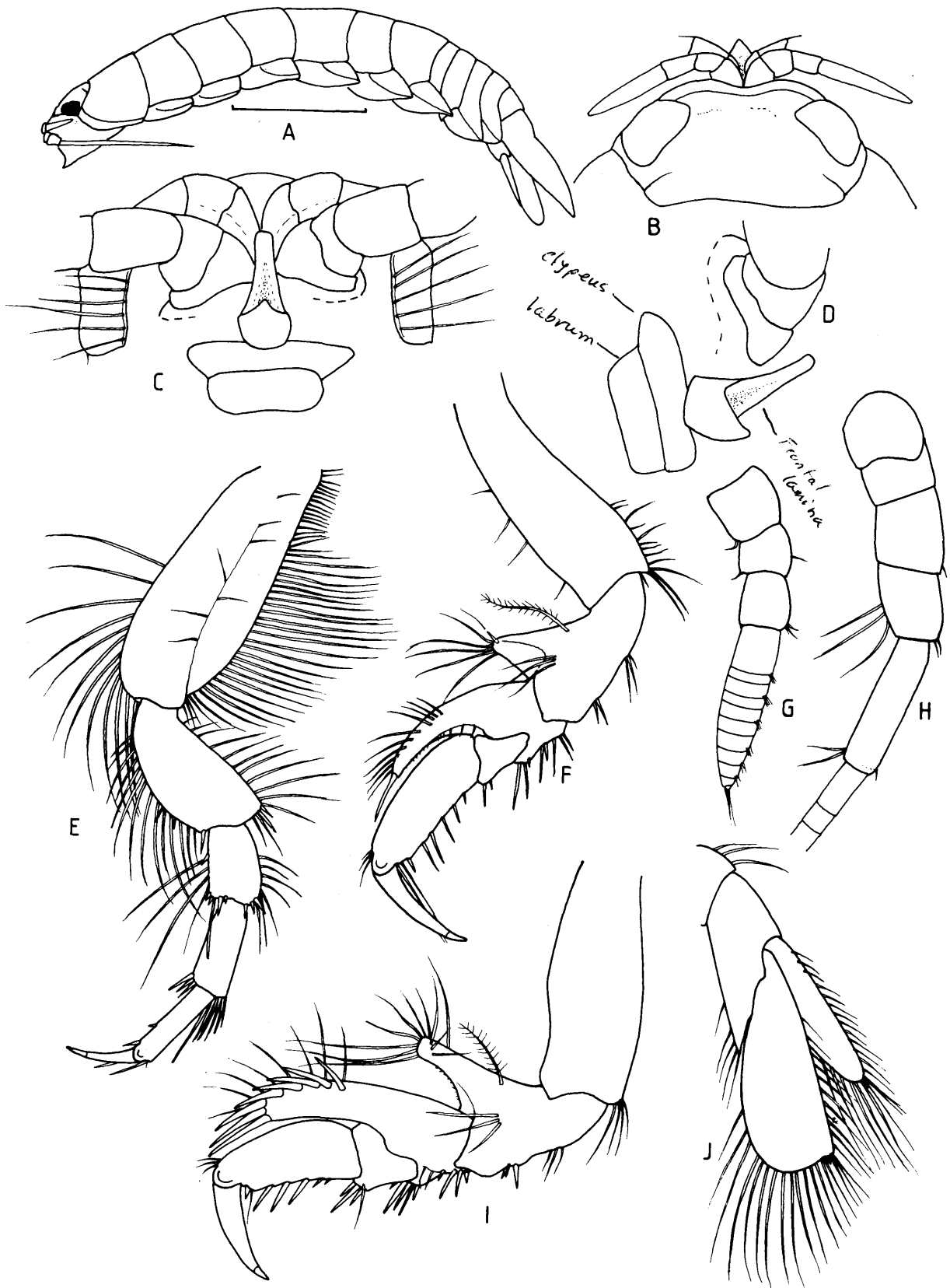


Fig. 84. *Dolicholana elongata*, female 13.2 mm. A, lateral view; B, cephalon, dorsal view; C, clypeal region; D, clypeal region, perspective; E, pereopod 7; F, pereopod 1; G, antennule; H, antennal peduncle; I, pereopod 2; J, uropod. Scale 3.0 mm.

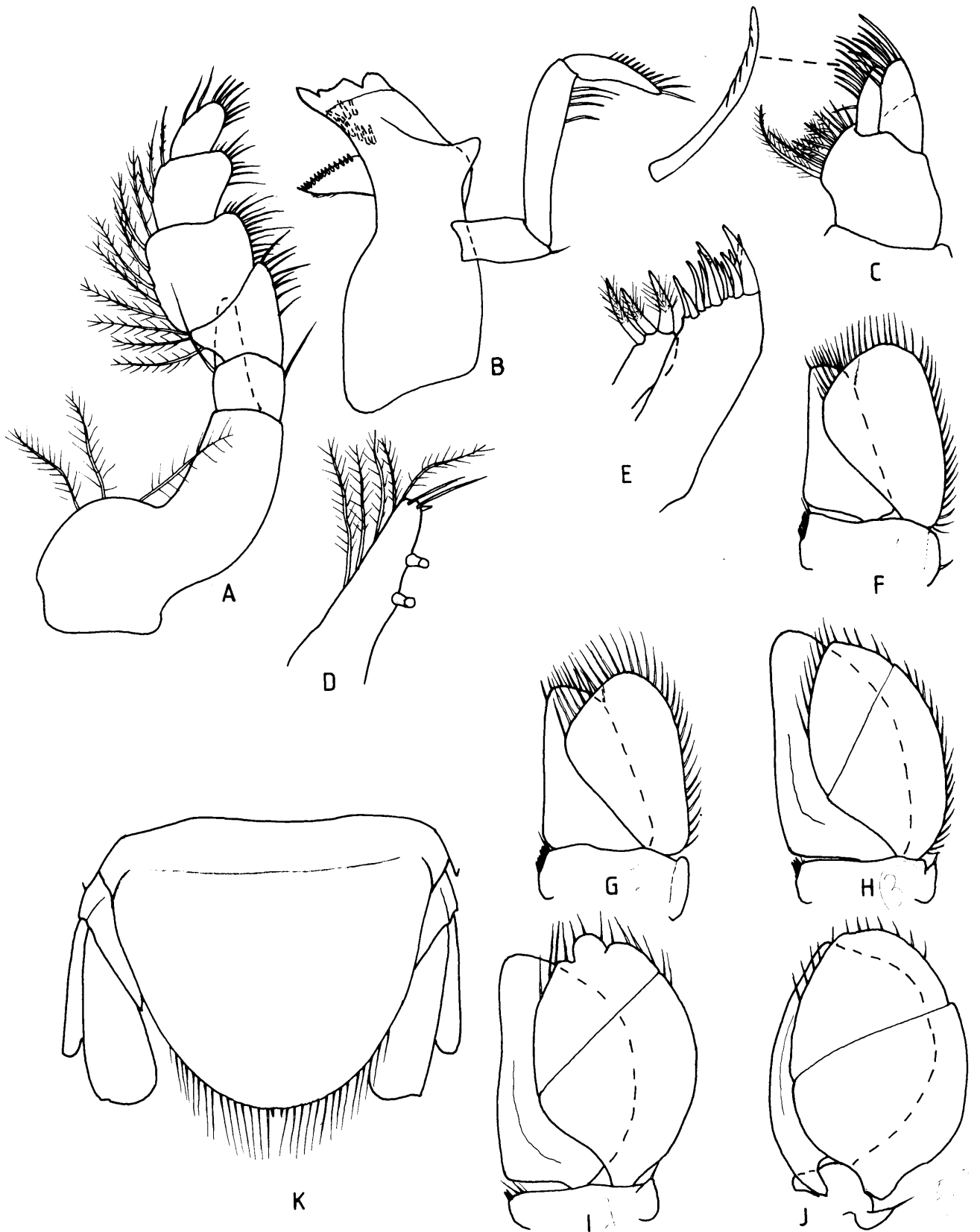


Fig. 85. *Dolicholana elongata*, female 13.2 mm. A, maxilliped; B, mandible; C, maxilla; D, maxilliped endite; E, maxillule; F-J, pleopods 1-5 respectively; K, pleotelson and uropods.

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 densely 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 tridentate 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 sub-medially.

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.

Bathynomus.—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. decemspinus* 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

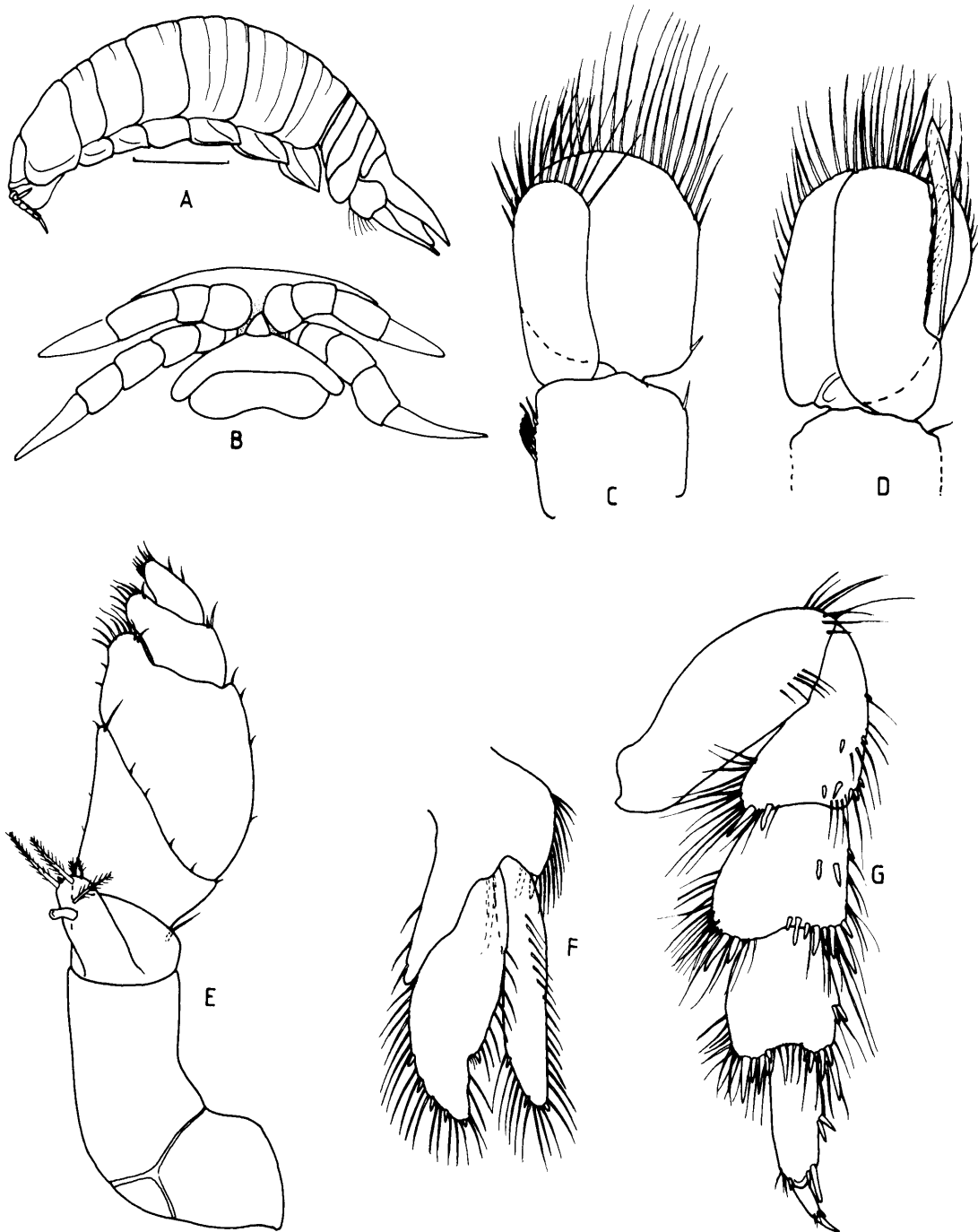


Fig. 86. *Orphelana perplexa*. A, lateral view; B, clypeal region; C, pleopod 1; D, pleopod 2; E, maxilliped; F, uropod; G, pereopod 7. Scale 2.0 mm.



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. decemspinus* 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

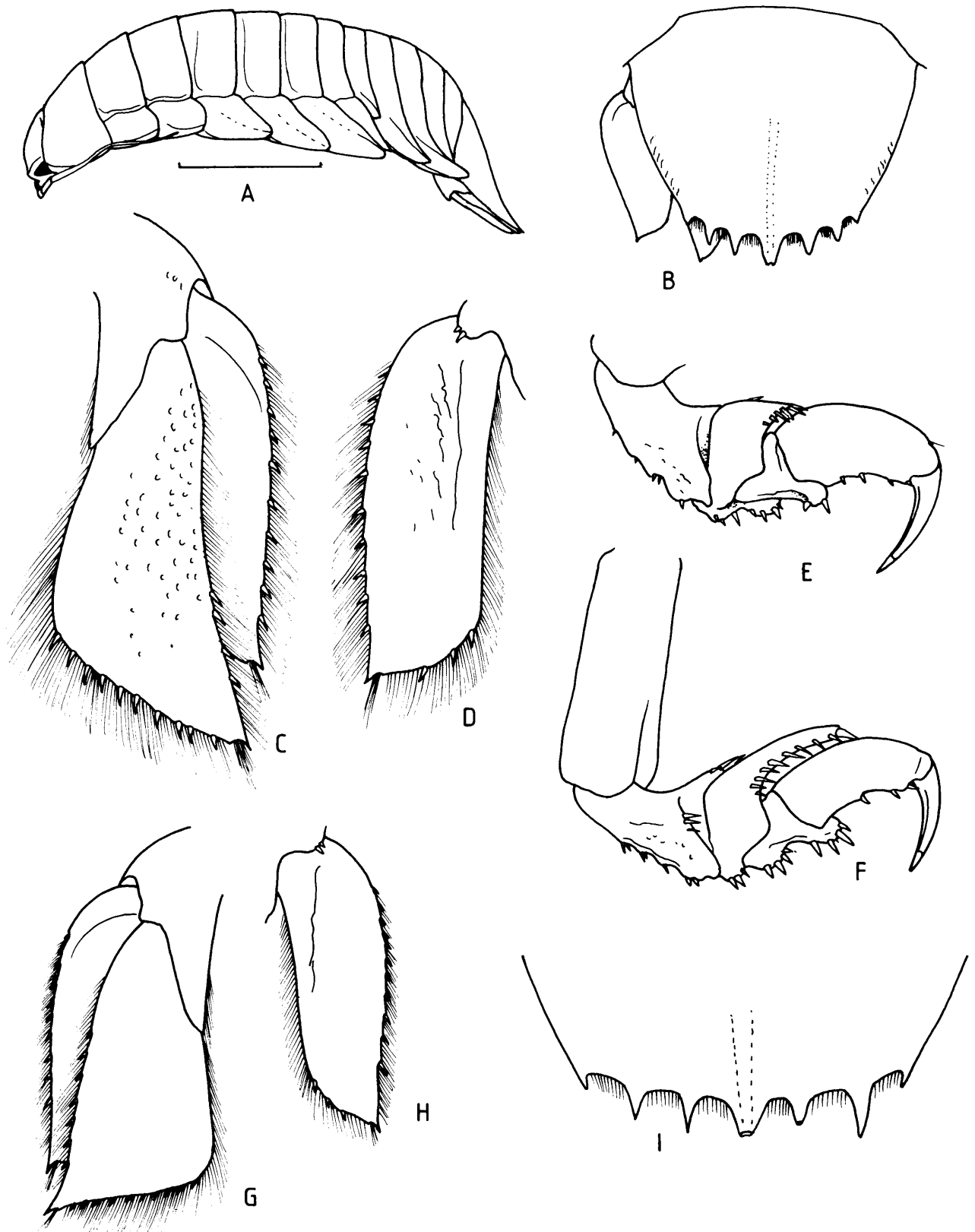


Fig. 88. A-F, *Bathynomus kapala*, female paratype: A, lateral view; B, pleotelson, dorsal view; C, uropod, dorsal view; D, uropod exopod, ventral view; E, pereopod 1; F, pereopod 2. G-I, *Bathynomus decemspinus*, holotype: G, uropod dorsal view; H, uropod exopod, ventral view; I, pleotelson, posterior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

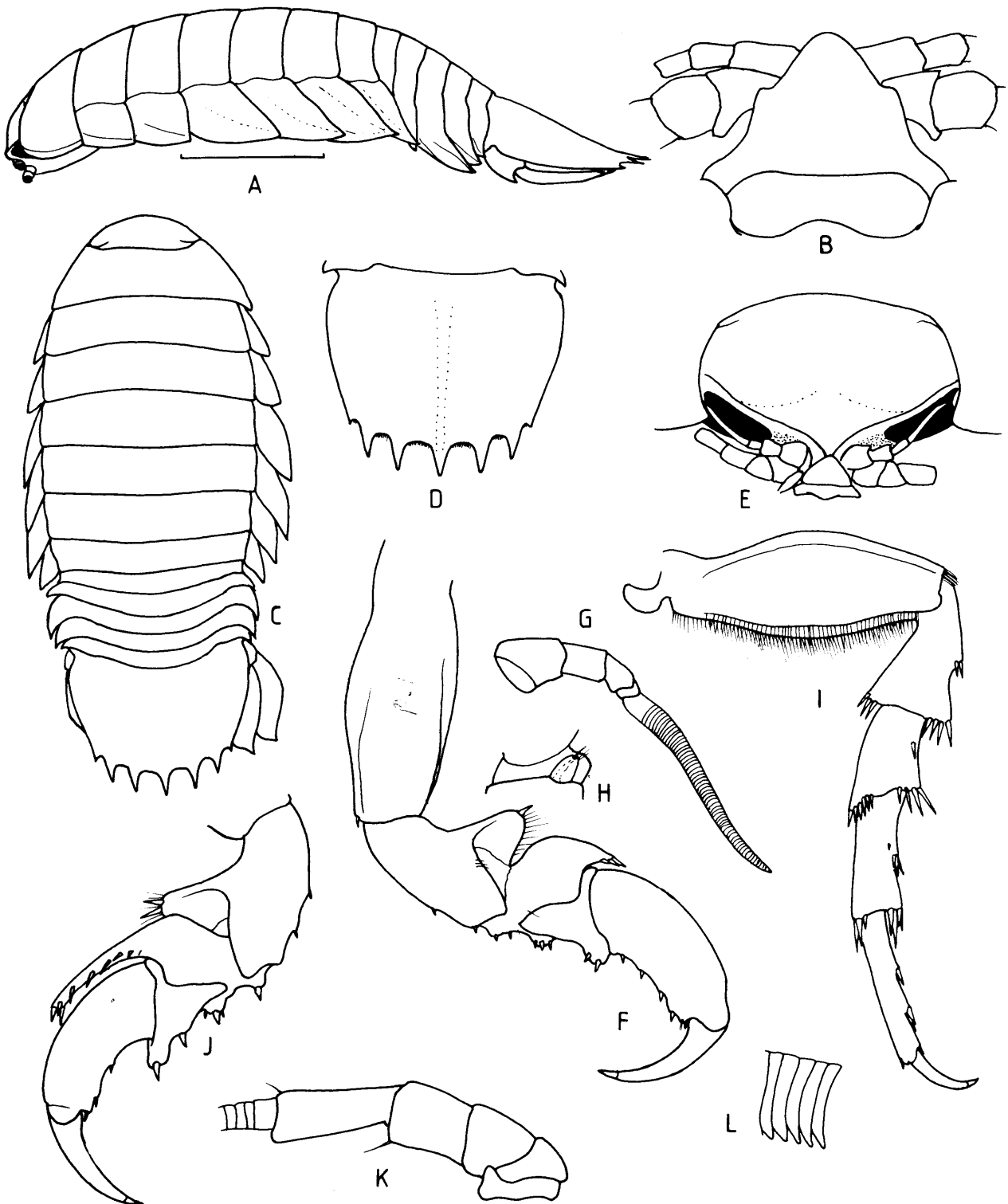


Fig. 89. *Bathynomus immanis* n. sp. A-E, male holotype; remainder male paratype 110 mm. A, lateral view; B, clypeal region, ventral view; C, dorsal view; D, pleotelson, dorsal view; E, cephalon, anterior view; F, pereopod 1; G, antennule; H, antennule exopod on peduncle article 3; I, pereopod 7; J, pereopod 2; K, antennal peduncle; L, antennule, flagellar articles 20-24. Scale 30 mm.

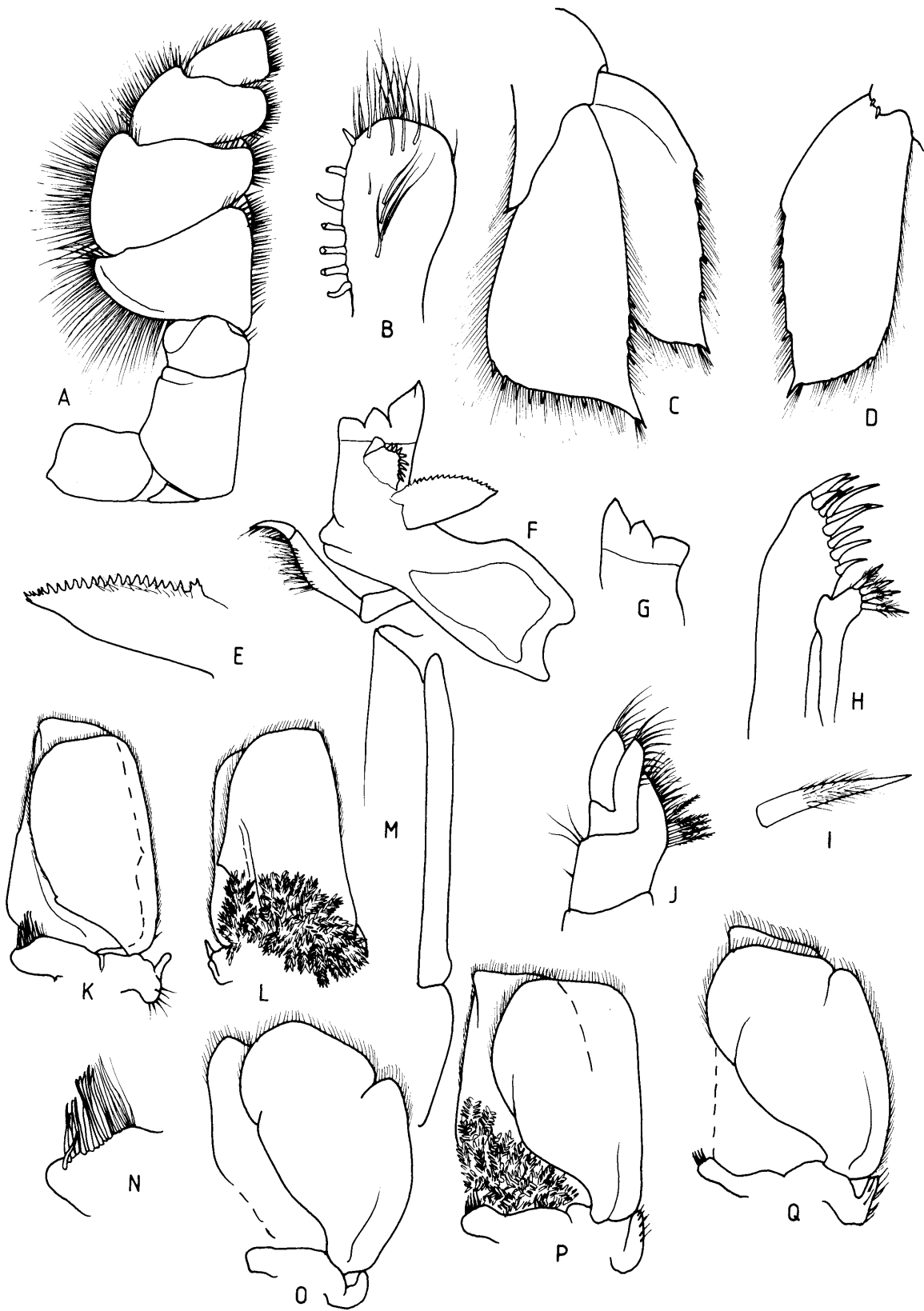


Fig. 90. *Bathynomus immanis* n. sp., male paratype 100 mm, except M, female paratype 165 mm. A, maxilliped; B, maxilliped endite; C, uropod, dorsal view; D, uropod exopod, ventral view; E, mandible, molar process; F, left mandible; G, right mandible, incisor; H, maxillule; I, maxillule endite, distal 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. McGroutier 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.

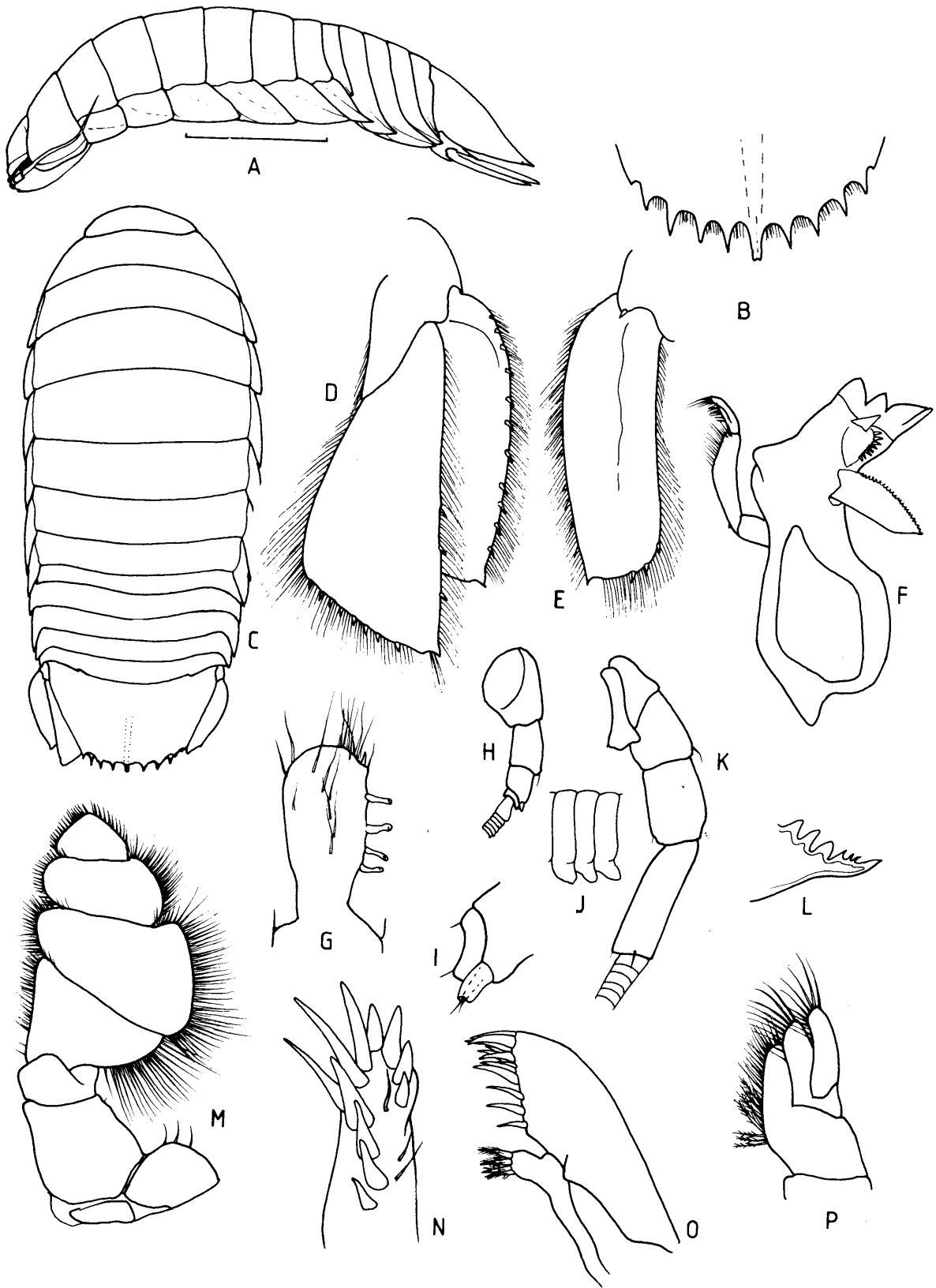


Fig. 91. *Bathynomus pelor* n. sp. A-C, holotype; remainder male 118 mm. A, lateral view; B, pleotelson, dorsal view; C, dorsal view; D, uropod, dorsal view; E, uropod exopod, lateral view; F, mandible; G, maxilliped endite; H, antennule peduncle; I, antennule exopod; J, antennule flagellum, articles 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.

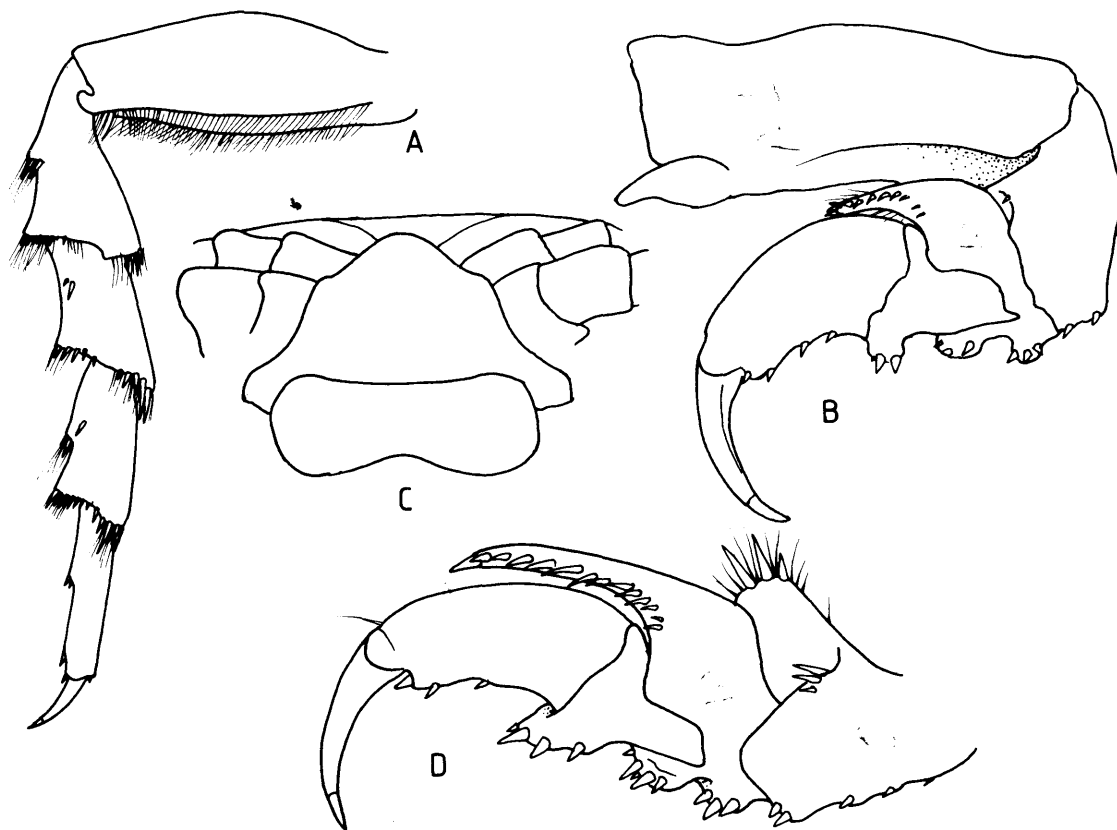


Fig. 92. *Bathynomus pelor* n. sp., male paratype 118 mm. A, pereopod 7; B, pereopod 1; C, clypeal region; D, pereopod 2.

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 biungulate 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 sub-medial 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 manca (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.

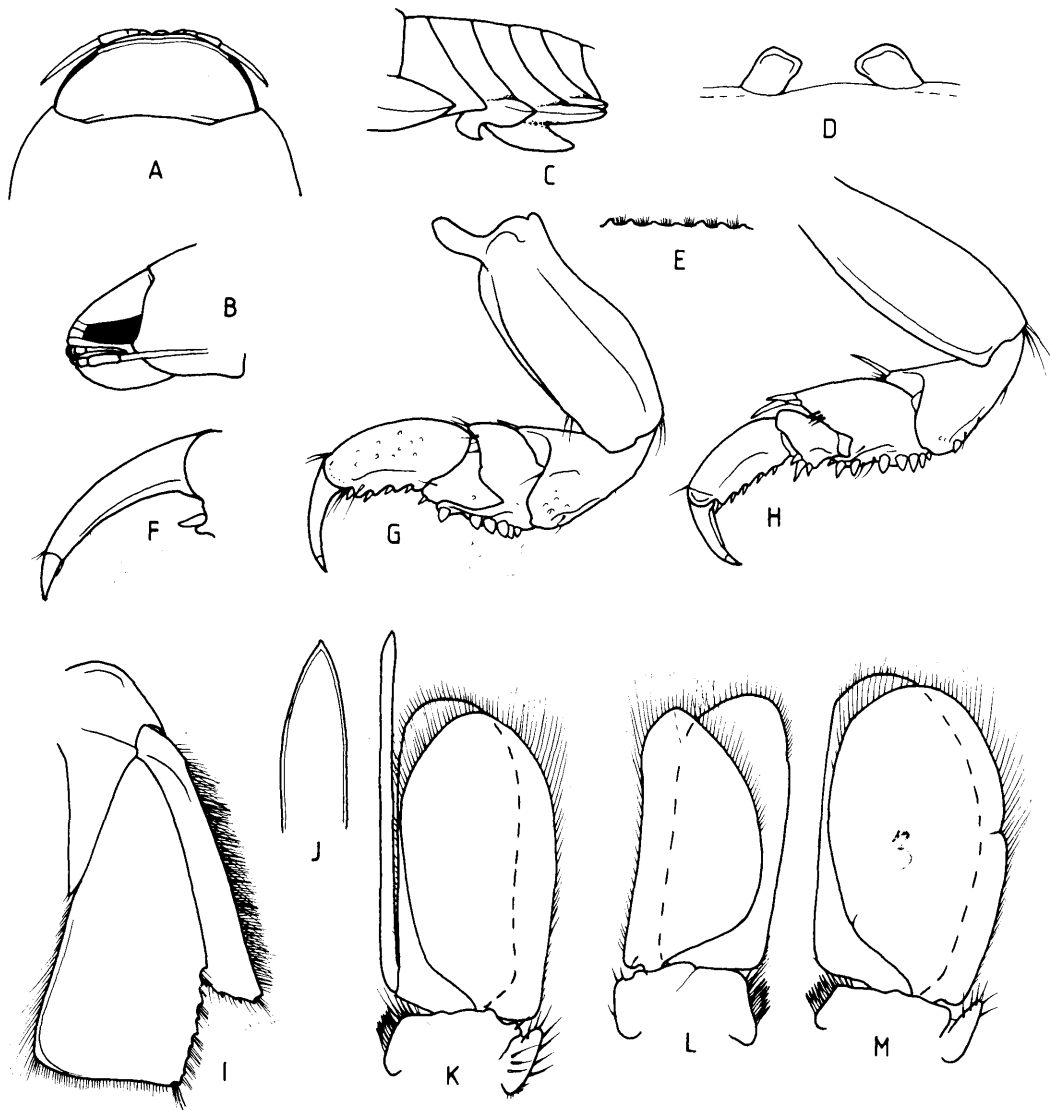


Fig. 93. *Booralana bathynella*, male 32.2 mm, except E, female 36.6 mm. A, cephalon, dorsal view; B, cephalon, lateral view; C, pleon, lateral view; D, penes, in situ; E, pleotelson, median point, posterior margin; F, pereopod 1, dactylus; G, pereopod 1; H, pereopod 2; I, uropod; J, appendix masculina,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

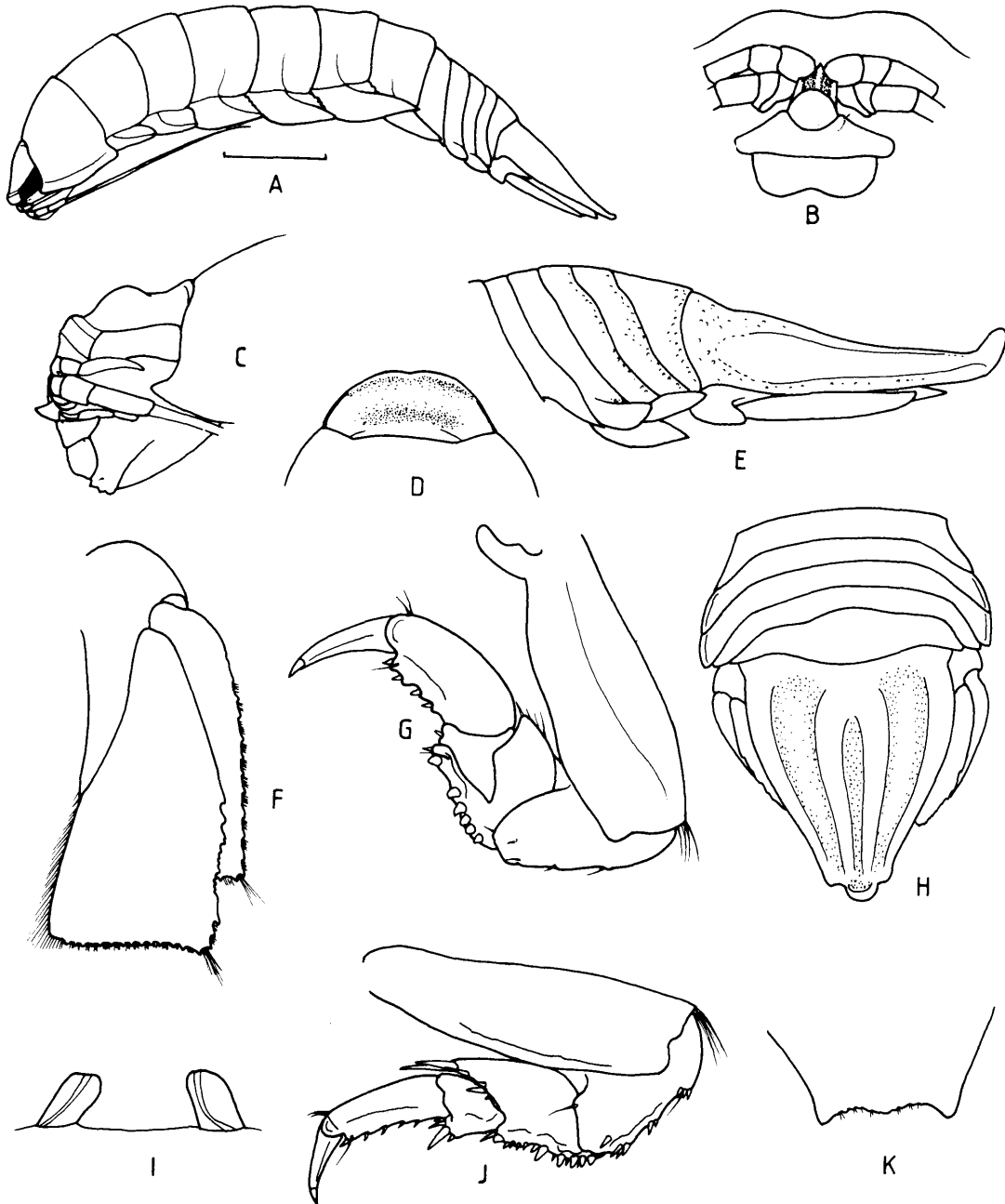


Fig. 94. *Booralana wundurra* n. sp. B, C, E, holotype; remainder paratypes: A, male 31.6 mm; K, female 12.0 mm; I, male 42.0 mm. A, lateral view; B, clypeal region; C, cephalon, lateral view; D, cephalon, dorsal view; E, pleon and pleotelson; F, uropod; G, pereopod 1; H, pleon and pleotelson, dorsal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

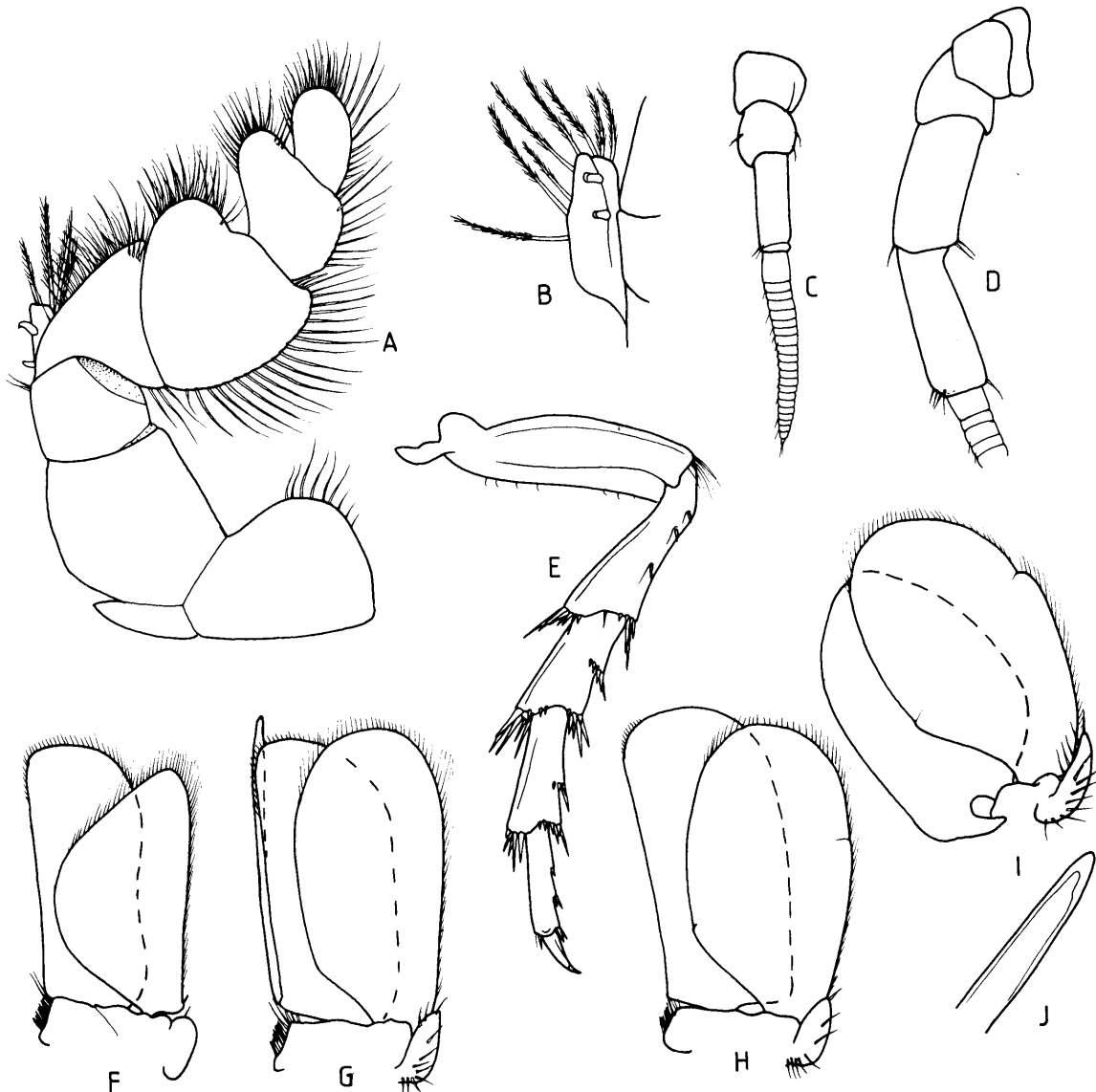


Fig. 95. *Booralana wundurra* n. sp., paratype male 42.0 mm. A, maxilliped; B, maxilliped endite, medial view; C, antennule; D, antennal peduncle; E, pereopod 7; F-I, pleopods 1, 2, 3 and 5 respectively; J, appendix masculina, apex.

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 masculina 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 enough 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. sulcicauda*, *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. arafuriae*
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 tubercles. 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 lanceolate, 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 closely 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,

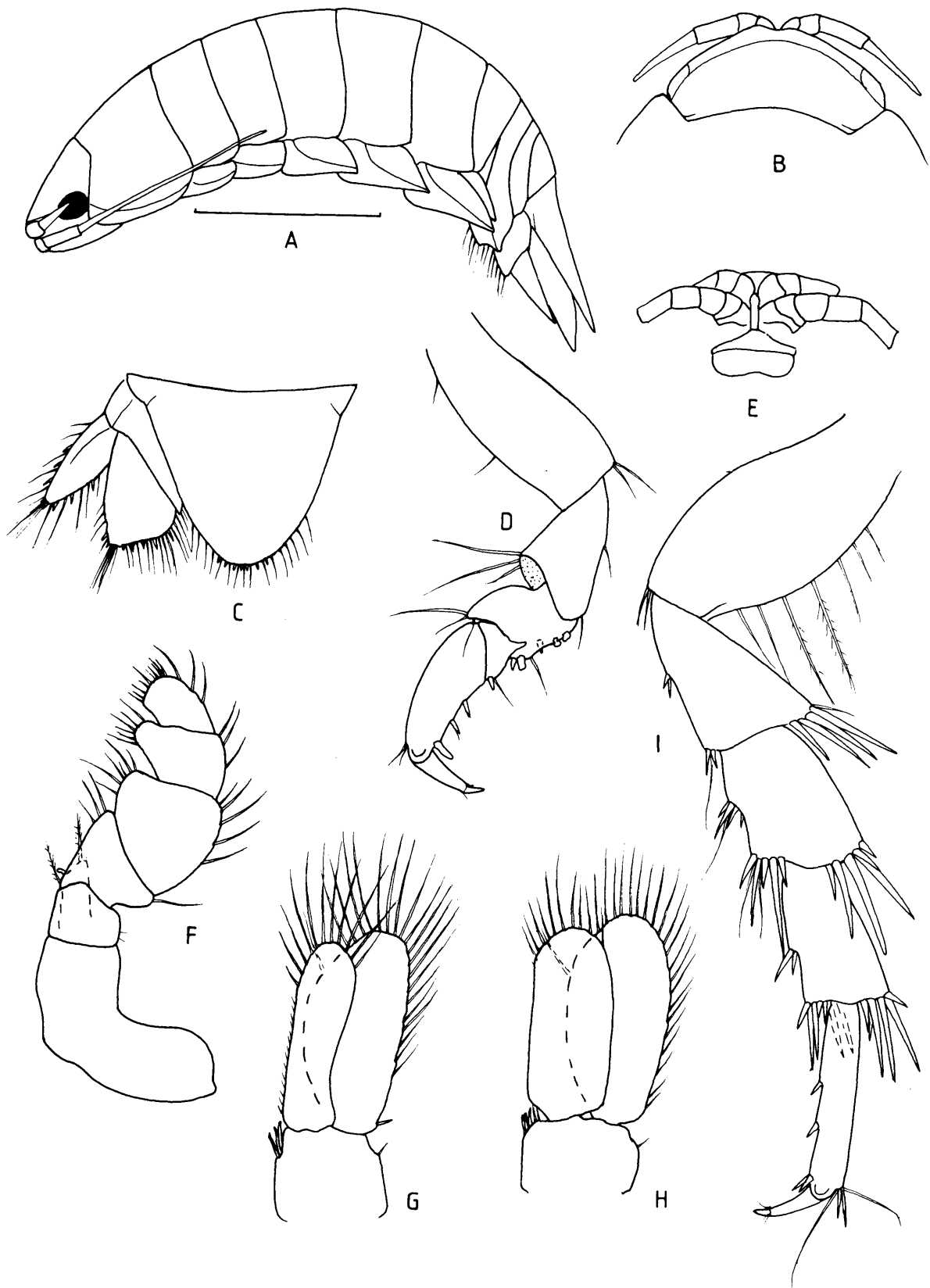


Fig. 96. *Cirolana* sp. A, lateral view; B, cephalon, dorsal view; C, pleotelson and uropod; D, pereopod 1; E, clypeal region; F, maxilliped; G, pleopod 1; H, pleopod 2; I, pereopod 7. Scale 1.0 mm.

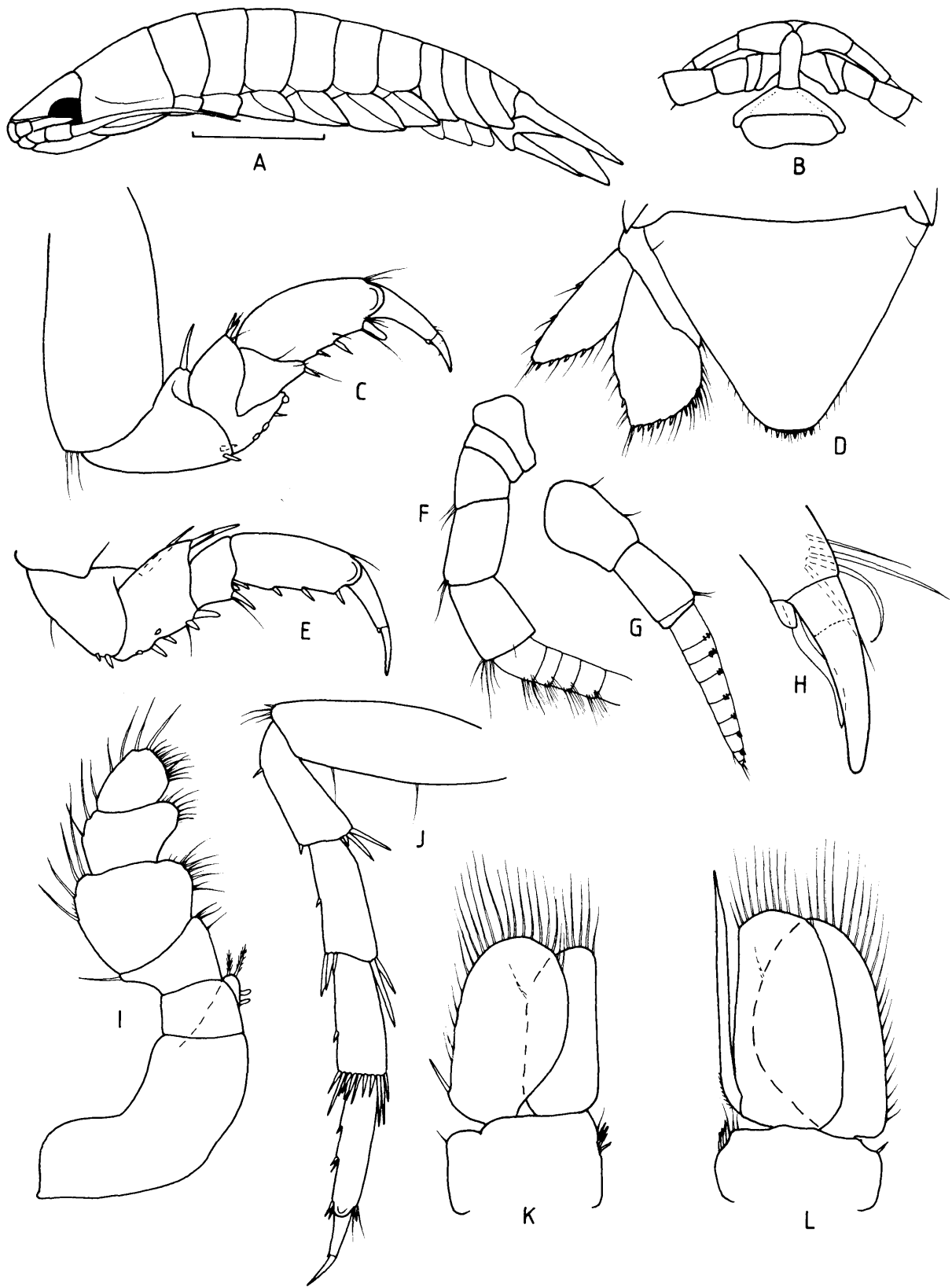


Fig. 97. *Cirolana cooma* n. sp., holotype. **A**, lateral view; **B**, clypeal region; **C**, pereopod 1; **D**, pleotelson and uropod; **E**, pereopod 2; **F**, antennal peduncle; **G**, antennule; **H**, pereopod 1, dactylus; **I**, maxilliped; **J**, pereopod 7; **K**, pleopod 1; **L**, pleopod 2.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

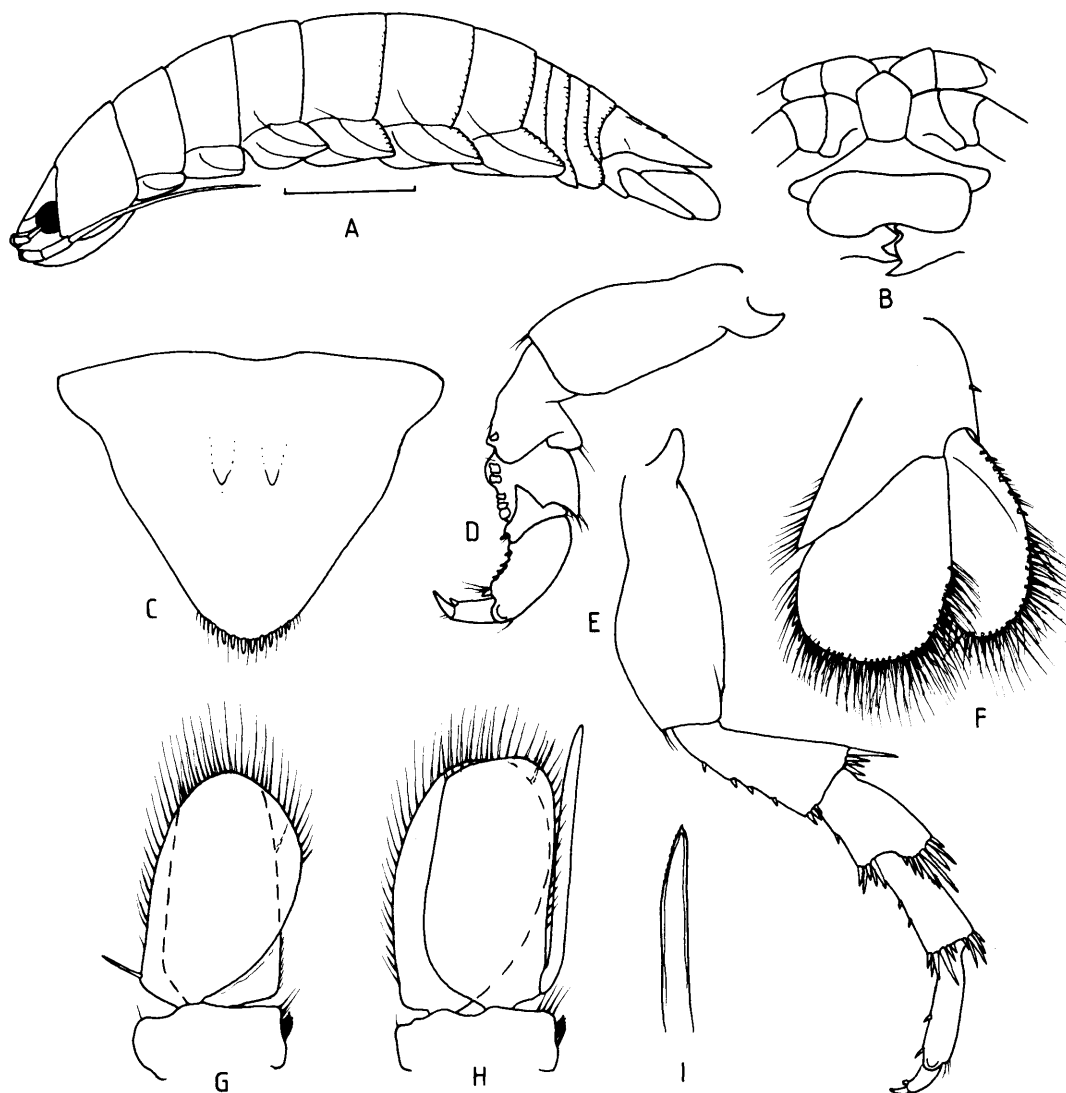


Fig. 98. *Cirolana harfordi*, male 14.4 mm, Fremantle. A, lateral view; B, clypeal region; C, pleotelson; D, pereopod 1; E, pereopod 7; F, uropod; G, pleopod 1; H, pleopod 2; I, appendix masculina, apex. Scale 3.0 mm.

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,

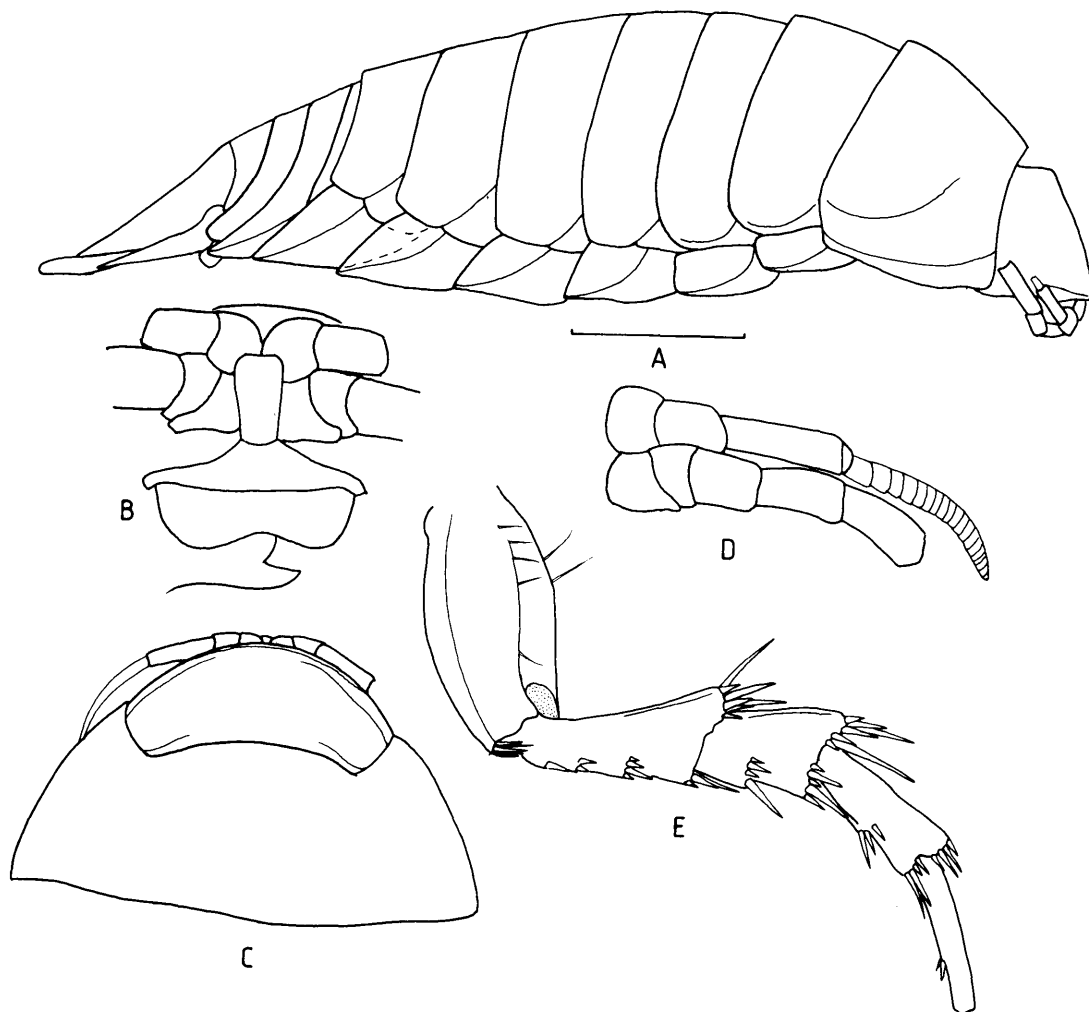


Fig. 99. *Cirolana lata*, holotype. A, lateral view; B, clypeal region; C, cephalon and pereonite 1, dorsal view; D, antennule, antenna, in situ; E, pereopod 6, in situ. Scale 3.0 mm.

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

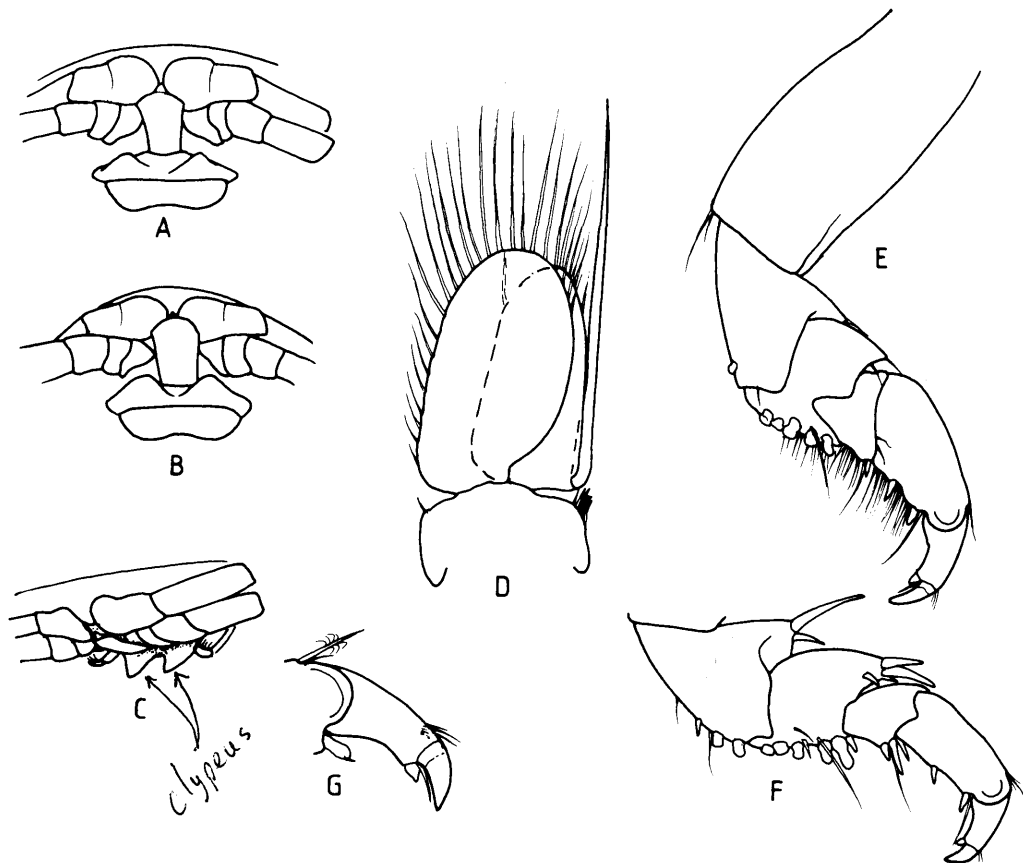


Fig. 100. *Cirolana furcata*, male, Long Reef, Sydney. A–C, clypeal region, different perspectives; D, pleopod 2; E, pereopod 1; F, pereopod 2; G, pereopod 1, dactylus.

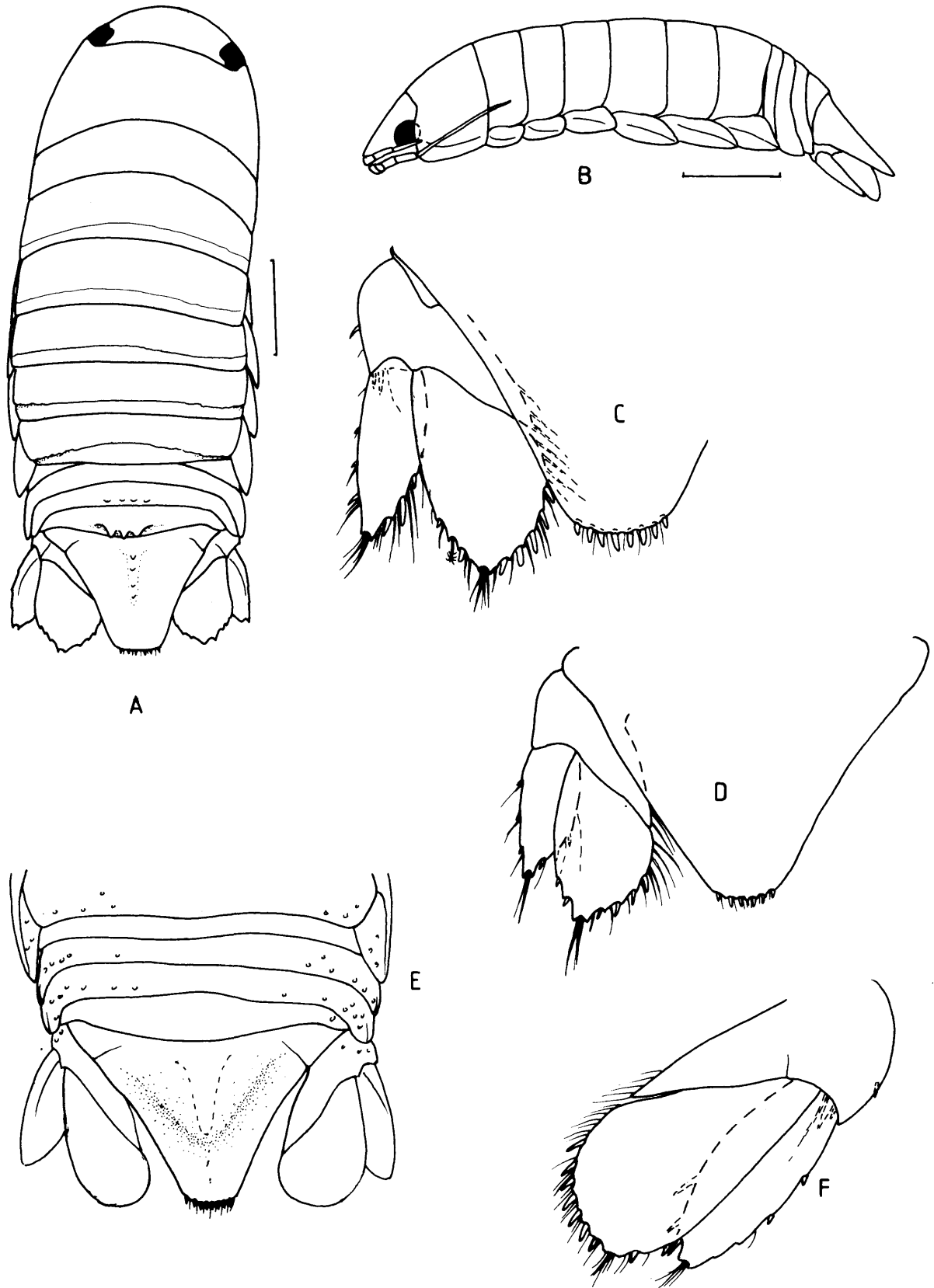


Fig. 101. A, *Cirolana triloba*; B, *Cirolana halei*, lateral view; C, the same, pleotelson and uropod; D, *Cirolana similis*, pleotelson and uropod; E, *Cirolana victoriae*, pleon and pleotelson; F, the same, uropod. Scale 1.0 mm.

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), Bampffield Head, Prince of Wales Island, Thursday Is., Qld., Apr. 1979, coll. P.C. Young. Female (6.5 mm), 2 miles N.E. of Hannibal 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

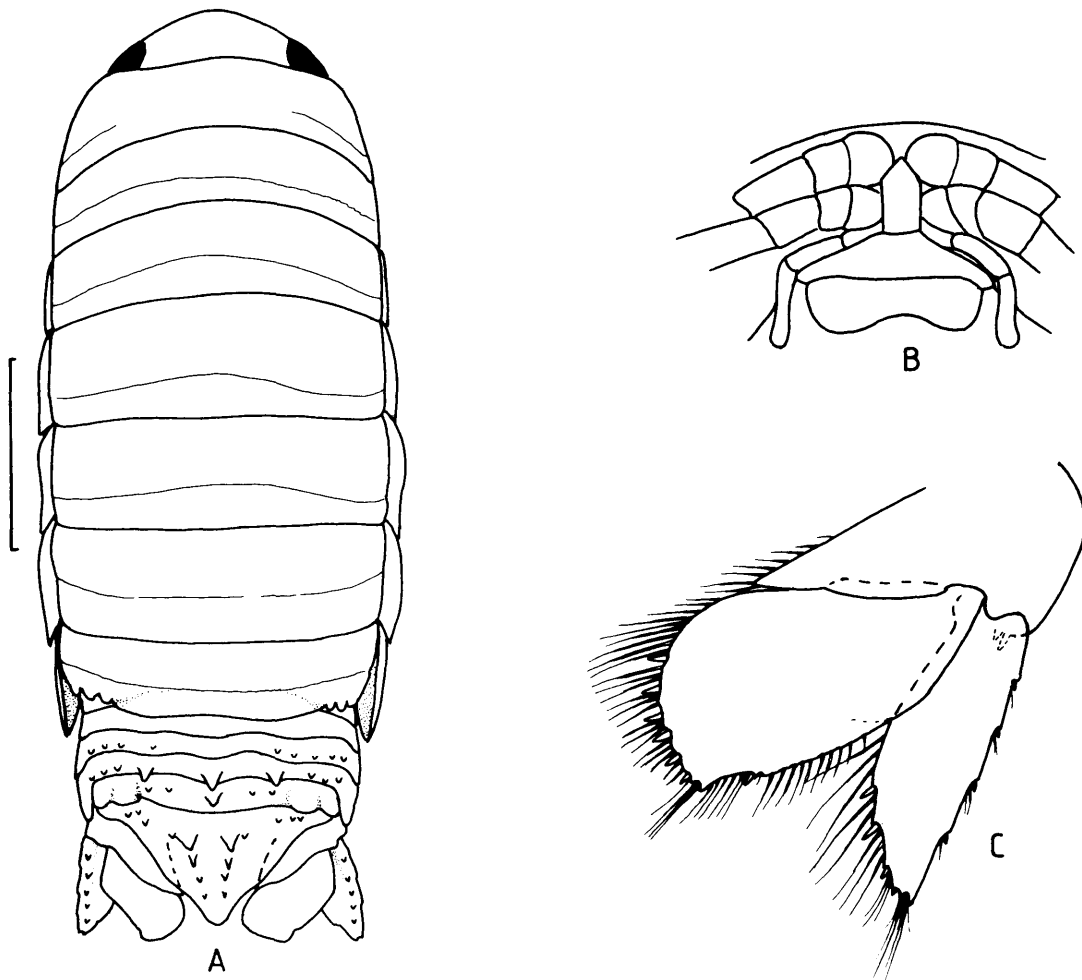


Fig. 102. *Cirolana capricornica* n. sp. A, dorsal view, holotype; B, clypeal region; C, uropod. Scale 2.0 mm.

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 spinules; 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

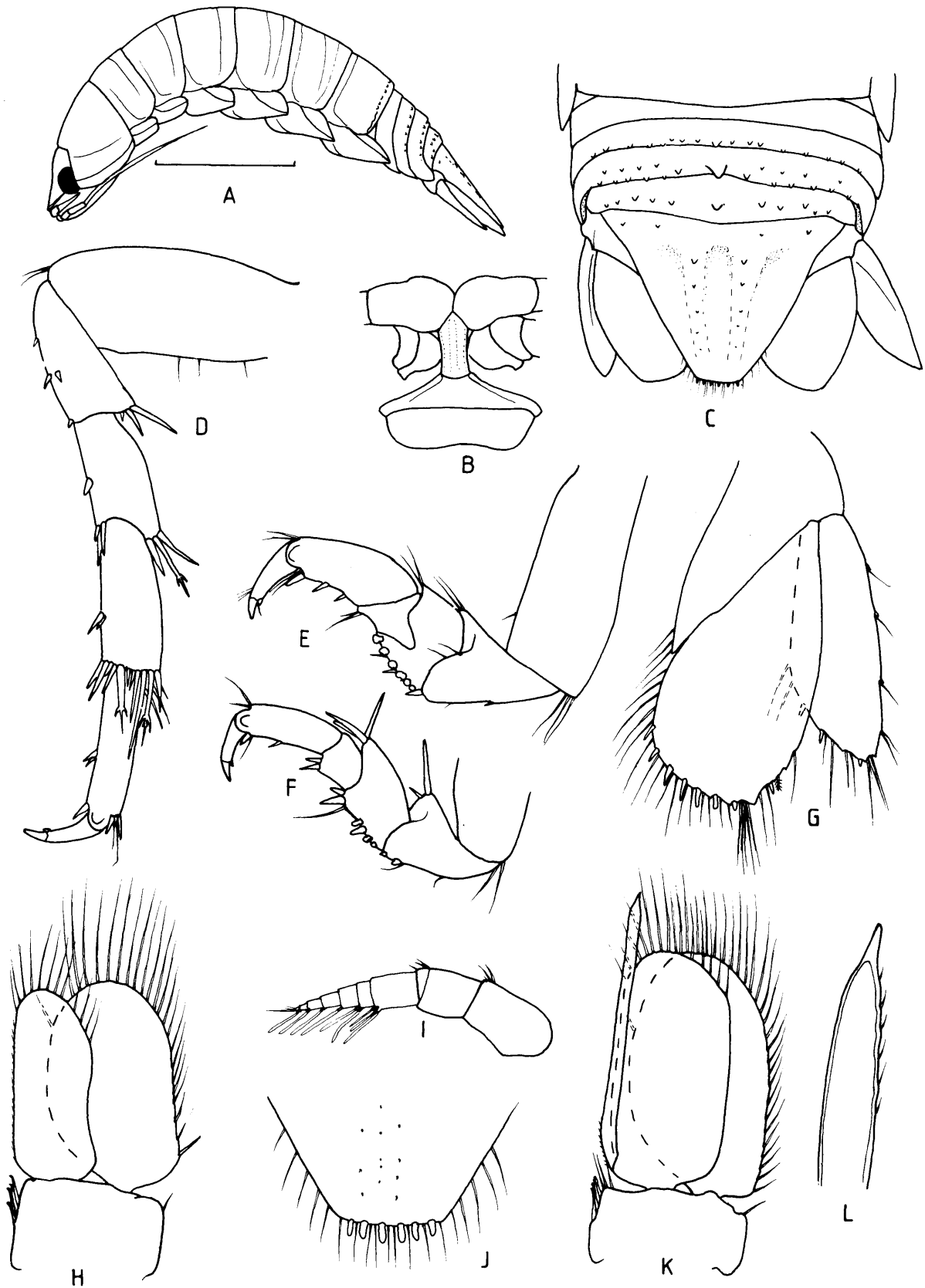


Fig. 103. *Cirolana curtensis* n. sp. A-C, holotype; remainder male paratype. A, lateral view; B, clypeal region; C, pleon and pleotelson; D, pereopod 7; E, pereopod 1; F, pereopod 3; G, uropod; H, pleopod 1; I, antennule; J, pleotelson, apex; K, pleopod 2; L, appendix masculina, apex. Scale 2.0 mm.

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 tubercles. 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 tubercles, 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

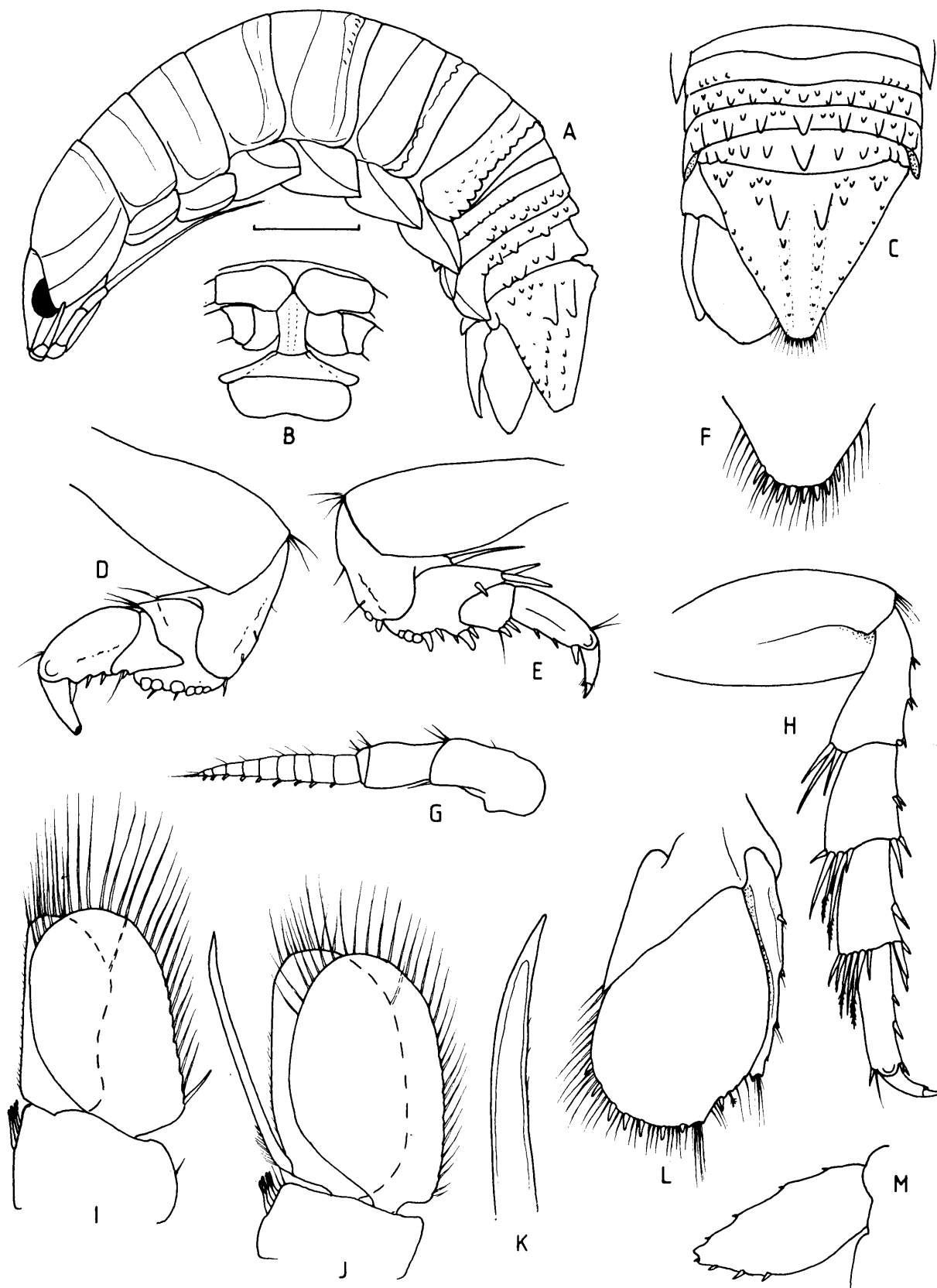


Fig. 104. *Cirolana garuwa* n.sp. holotype. A, lateral view; B, clypeal region; C, pleotelson (reconstruction); D, pereopod 1; E, pereopod 3; F, pleotelson apex; G, antennule; H, pereopod 7; I, pleopod 1; J, pleopod 2; K, appendix masculina, apex; L, uropod; M, uropod endopod, ventral view (setae omitted).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

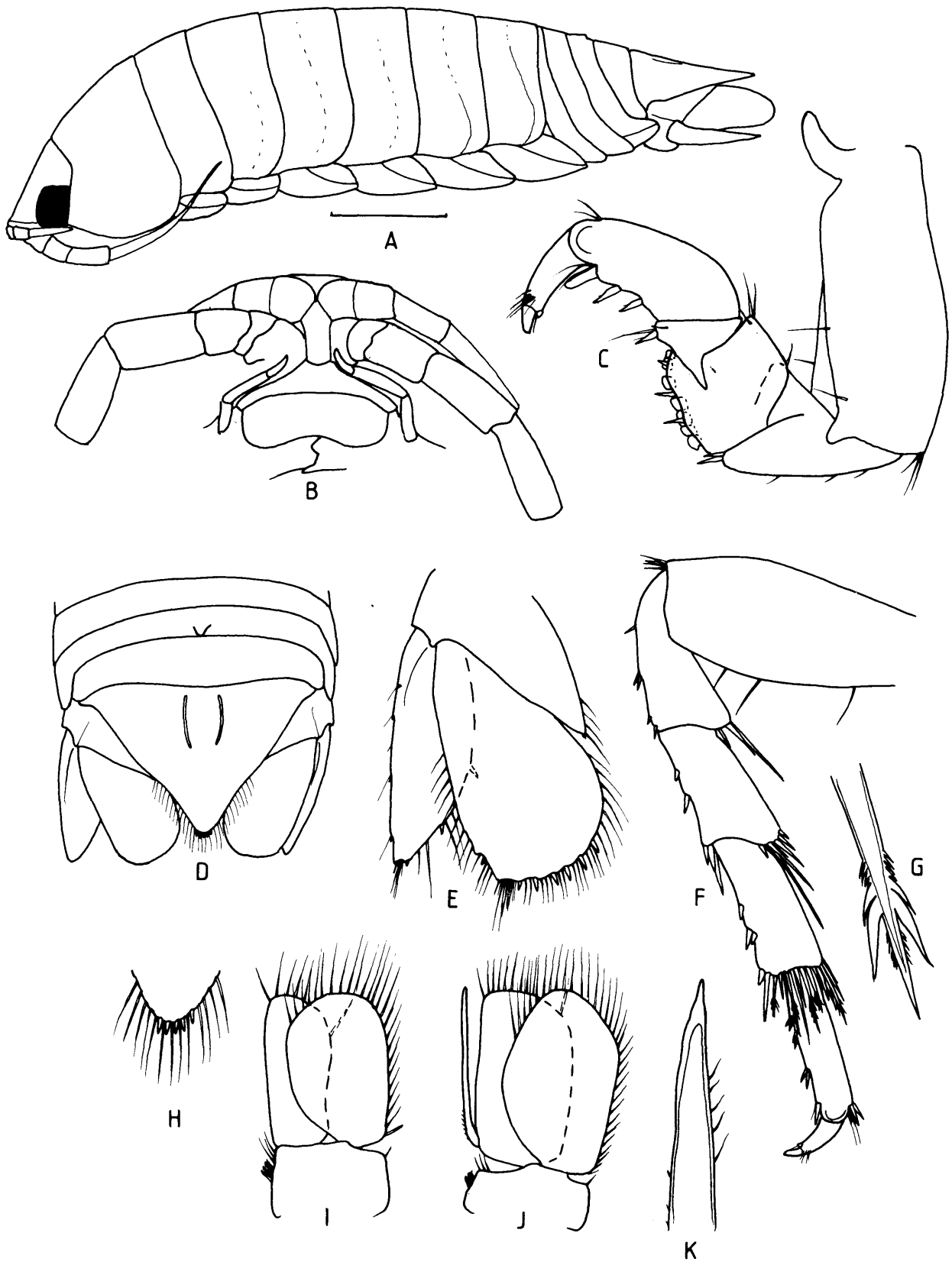


Fig. 105. *Cirolana kendi* n. sp., holotype. **A**, lateral view; **B**, clypeal region; **C**, pereopod 1; **D**, pleon and pleotelson; **E**, uropod; **F**, pereopod 7; **G**, pereopod 7, pectinate spine from carpus; **H**, pleotelson apex; **I**, pleopod 1; **J**, pleopod 2; **K**, appendix masculina,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

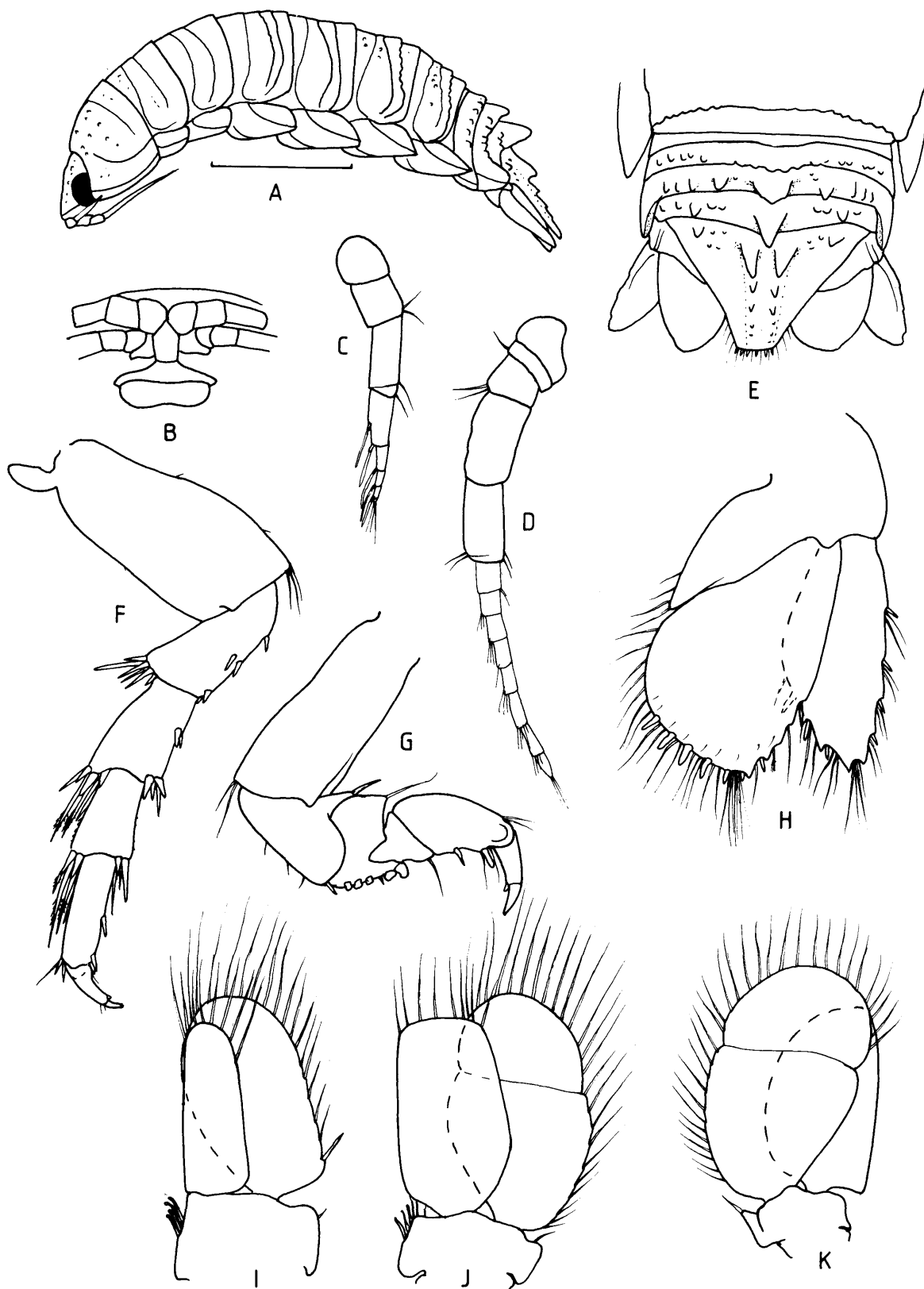


Fig. 106. *Cirolana kombona* n. sp. A, B, E, holotype; remainder paratype. A, lateral view; B, clypeal region; C, antennule; D, antenna; E, pleon and pletelson; F, pereopod 7; G, pereopod 1; H, uropod; I, pleopod 1; J, pleopod 3; K, pleopod 5. Scale 1.0 mm.

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 sulcicauda* 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 sulcicauda* has 3 tubercles 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

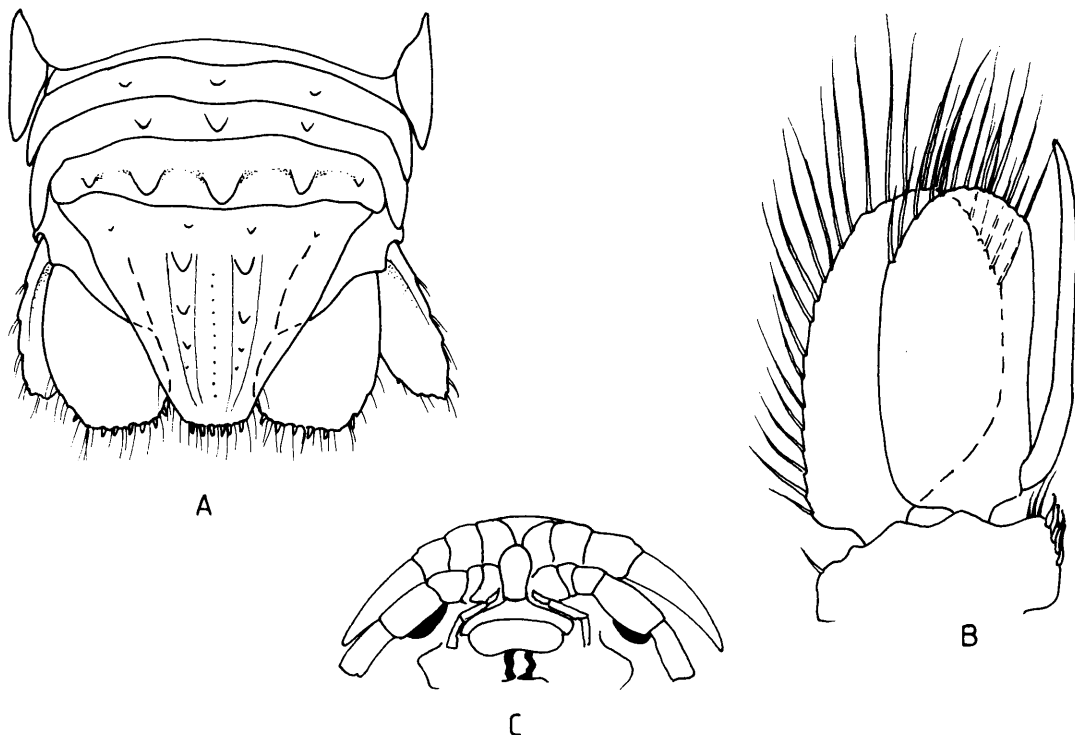


Fig. 107. *Cirolana magdalaina*, holotype. A, pleon, dorsal view; B, pleopod 2; C, clypeal region.

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

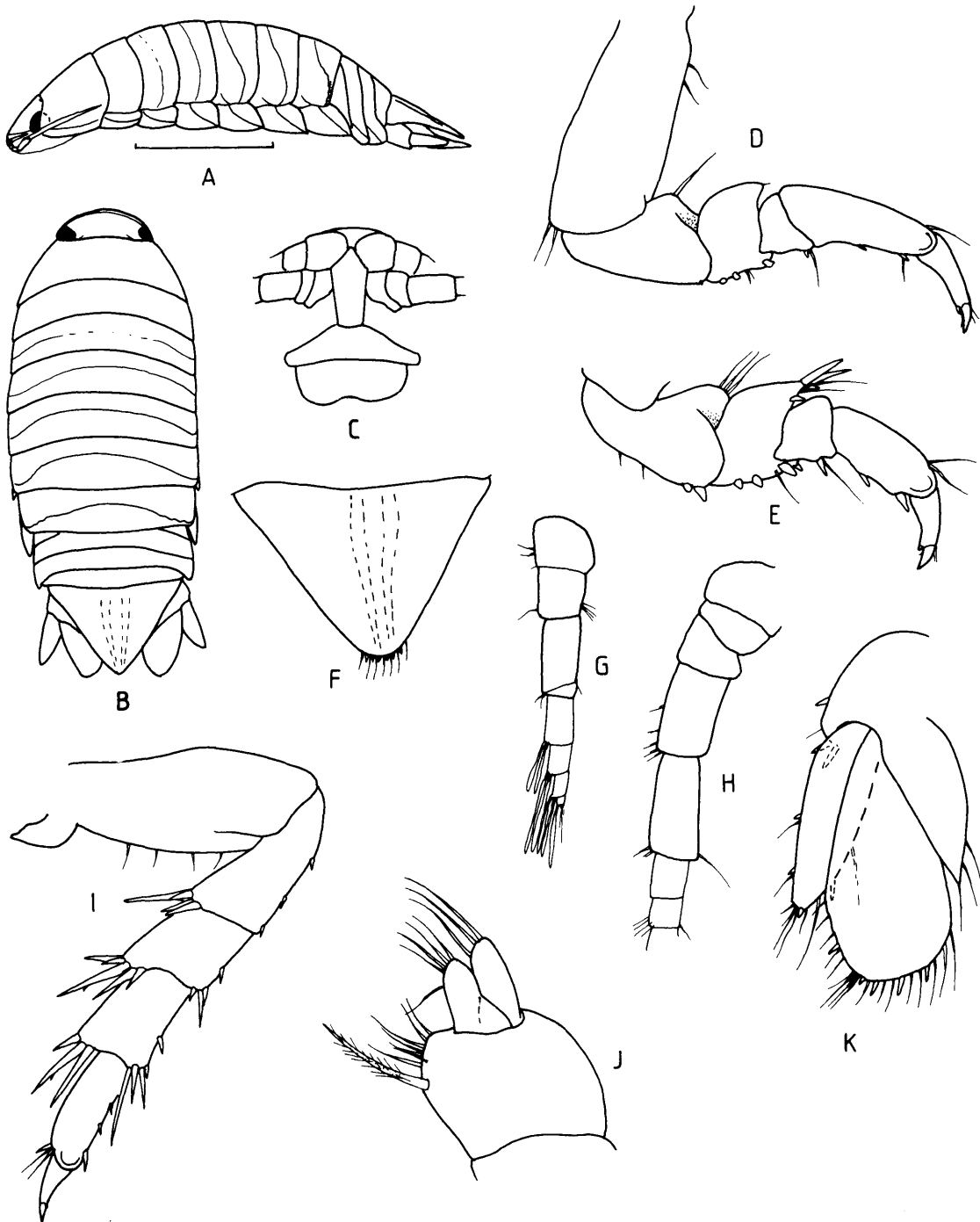


Fig. 108. *Cirolana morilla* n. sp. A-C, F, holotype; remainder female paratype. A, lateral view; B, dorsal view; C, clypeal region; D, pereopod 1; E, pereopod 2; F, pleotelson; G, antennule; H, antennal peduncle; I, pereopod 7; J, maxilla; K, uropod. Scale 1.0 mm.

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 laminae. *Cirolana oreonota* is the only species which has a prominent median tubercle on pleonites 3, 4 and 5, and subequal small lateral tubercles.

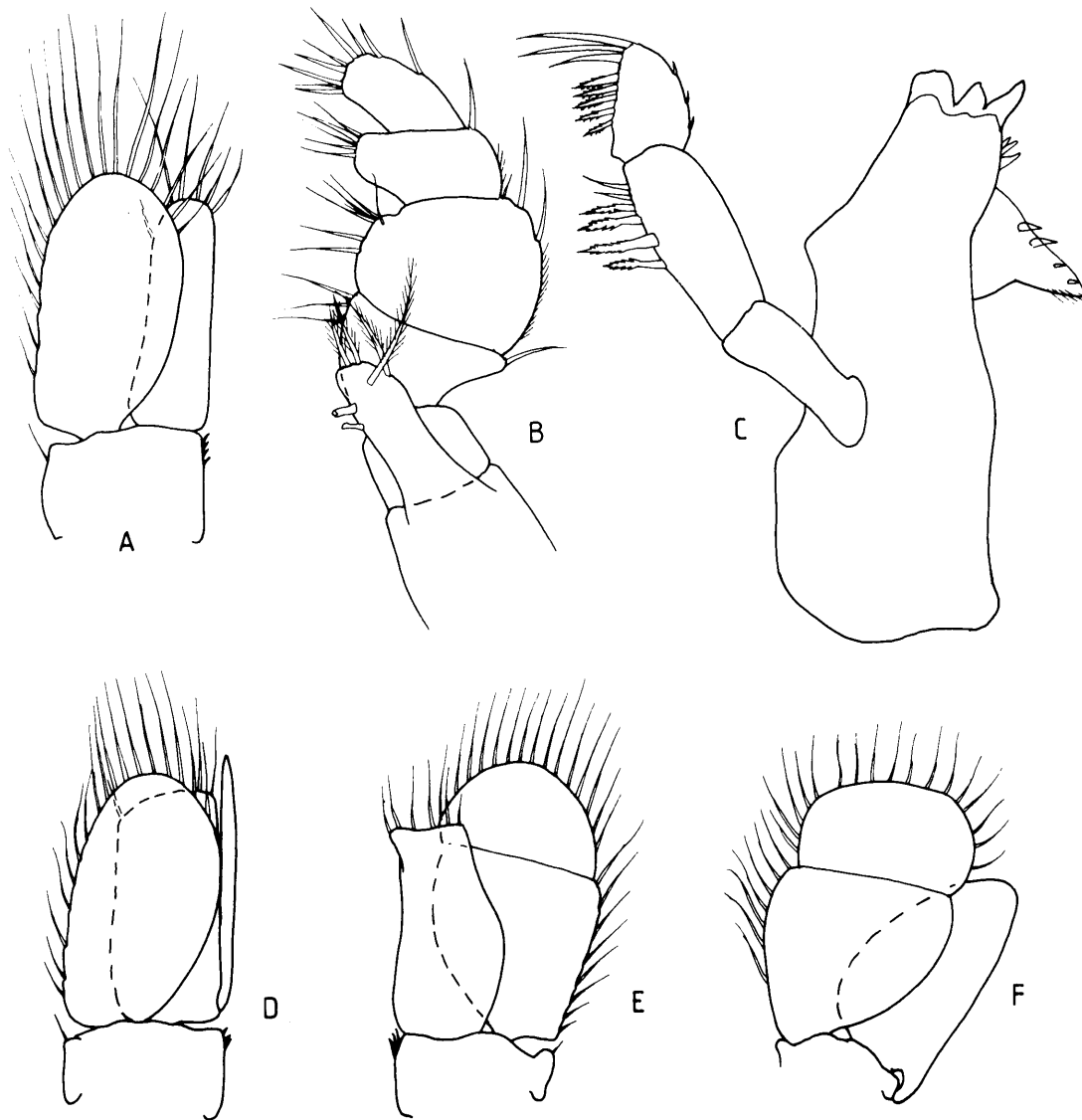


Fig. 109. *Cirolana morilla* n. sp., paratype. A, pleopod 1; B, maxilliped; D-F, pleopods 2, 3, 5 respectively.

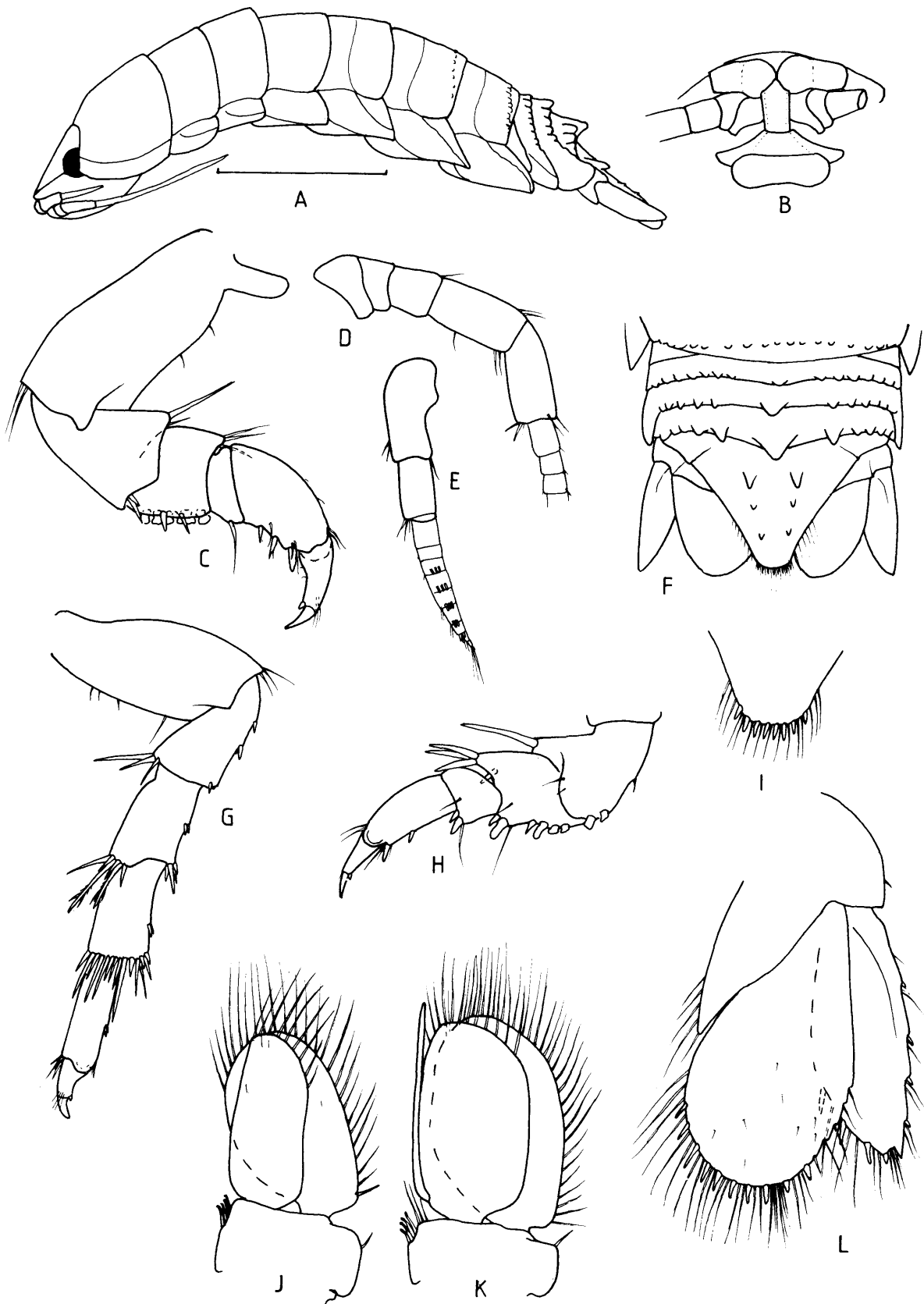


Fig. 110. *Cirolana oreonota* n. sp. A, B, F, I, holotype; remainder male paratype. A, lateral view; B, clypeal region; C, pereopod 1; D, antennal peduncle; E, antennule; F, pleon and pleotelson; G, pereopod 7; H, pereopod 3; I, pleotelson apex; J, pleopod 1, K, pleopod 2; L, uropod. Scale 2.0 mm.

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.

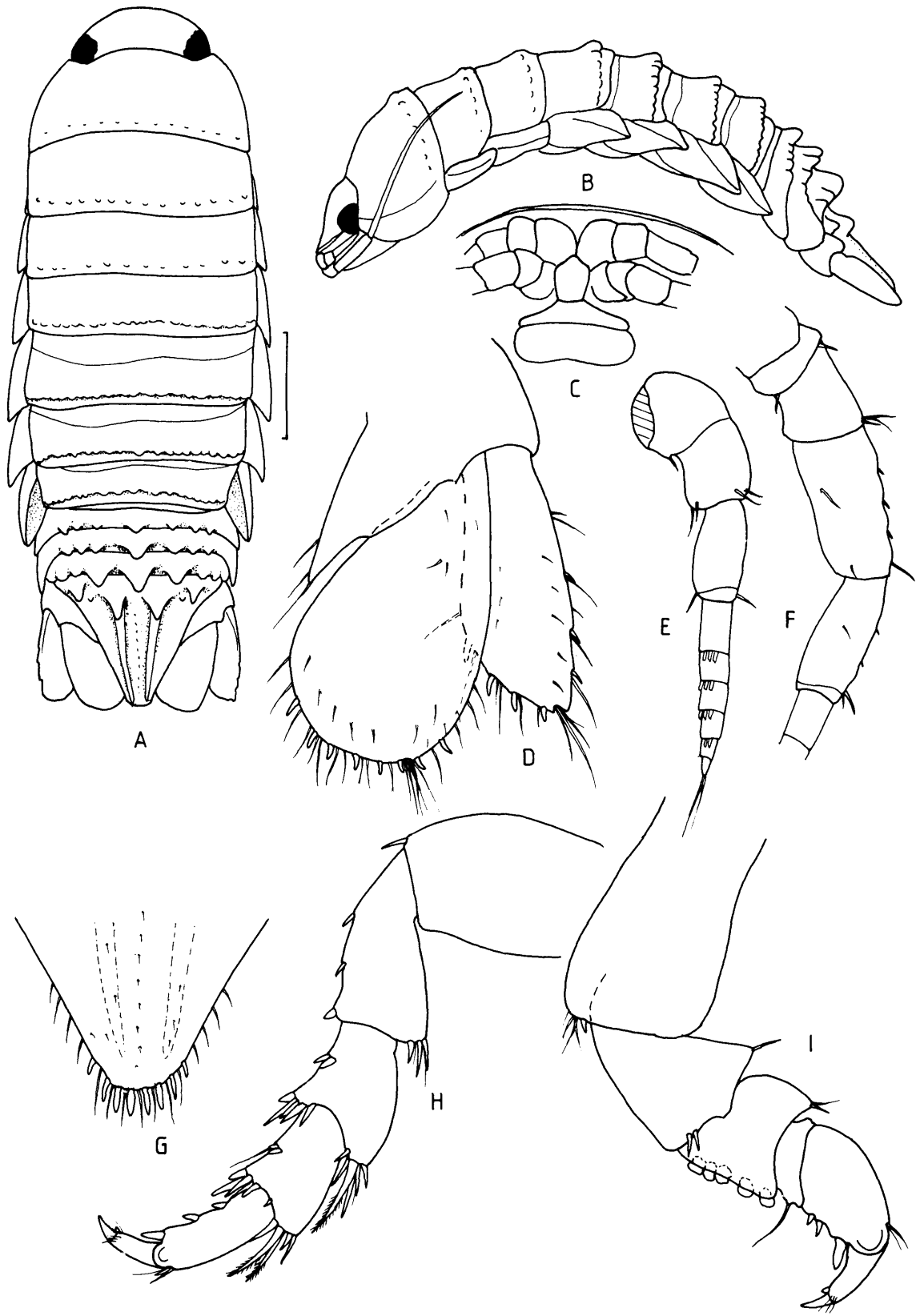


Fig. 111. *Cirolana tuberculosa* n. sp. D, G, female paratype; remainder holotype. A, dorsal view; B, lateral view; C, clypeal region; D, uropod; E, antennule; F, antennal peduncle; G, pleotelson apex; H, pereopod 7; I, pereopod 1. Scale 1.0 mm.

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 manca (3.5, 3.7 mm), Malacoota, Vic., Jan. 1959, coll. W.F. Seed. 2 males

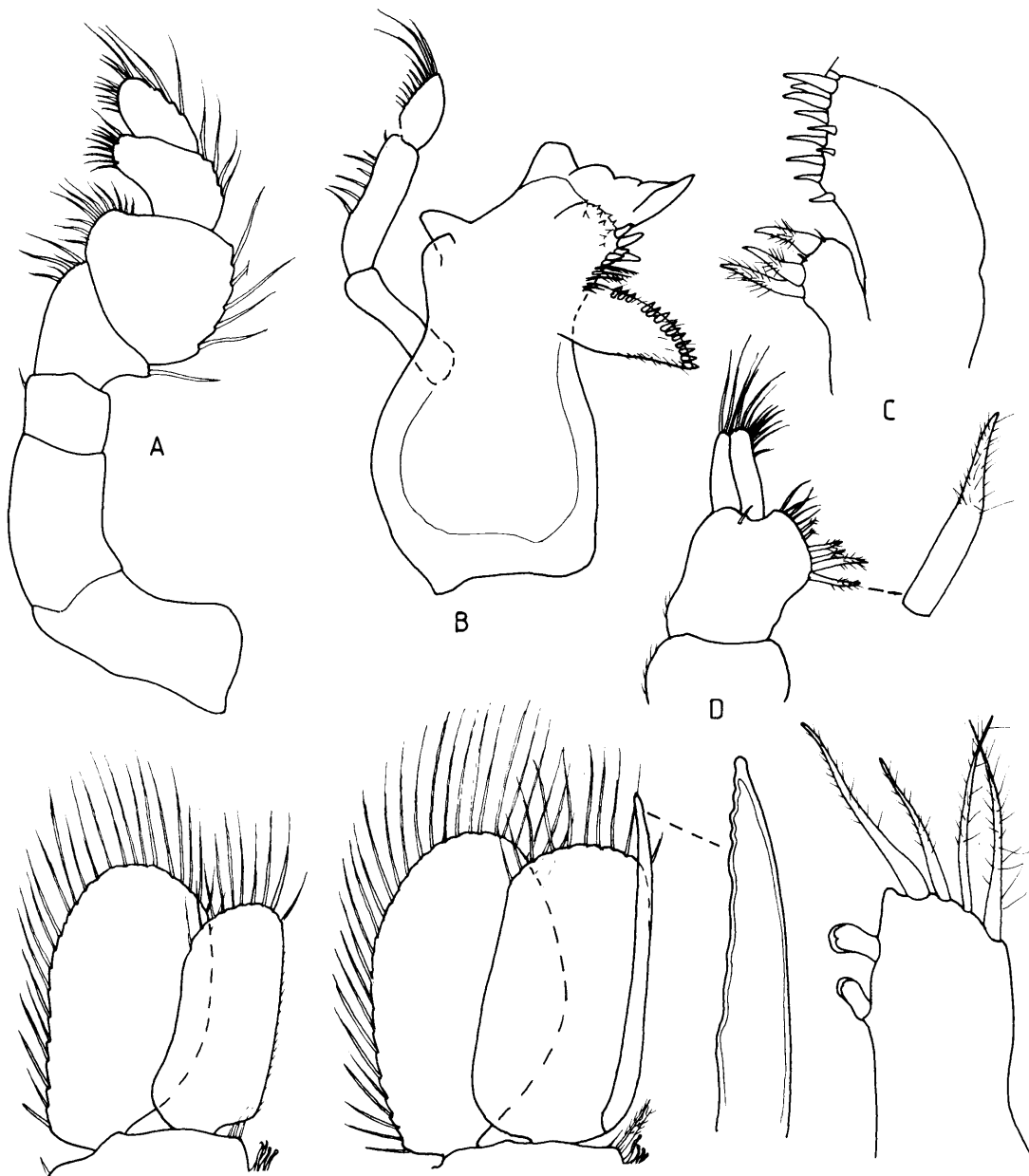


Fig. 112. *Cirolana tuberculosa* n. sp., holotype. A, maxilliped; B, left mandible; C, maxillule; D, maxilla; E, pleopod 1; F, pleopod 2; G, maxilliped endite.

(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 manca), 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

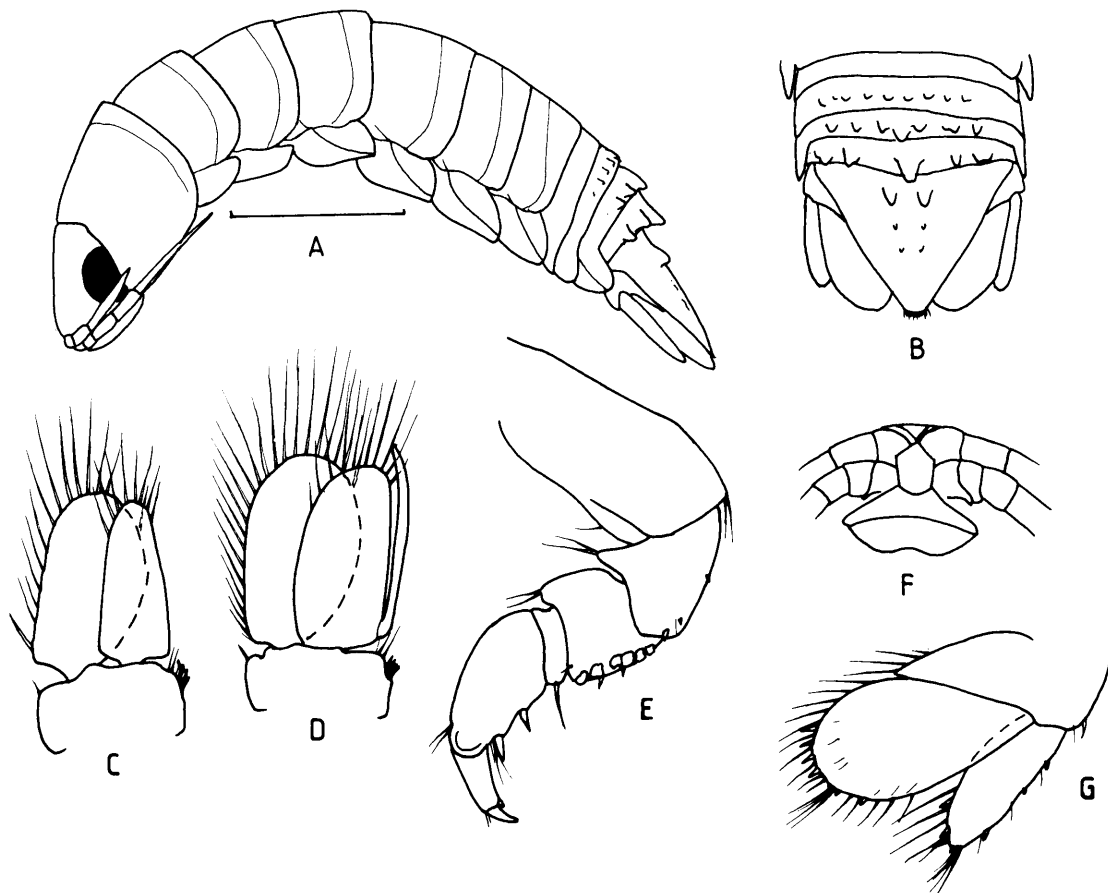


Fig. 113. *Cirolana tumulosa*. A, B, F, holotype; remainder paratype. A, lateral view; B, pleon; C, pleopod 1; D, pleopod 2; E, pereopod 1; F, clypeal region; G, uropod. Scale 1.0 mm.

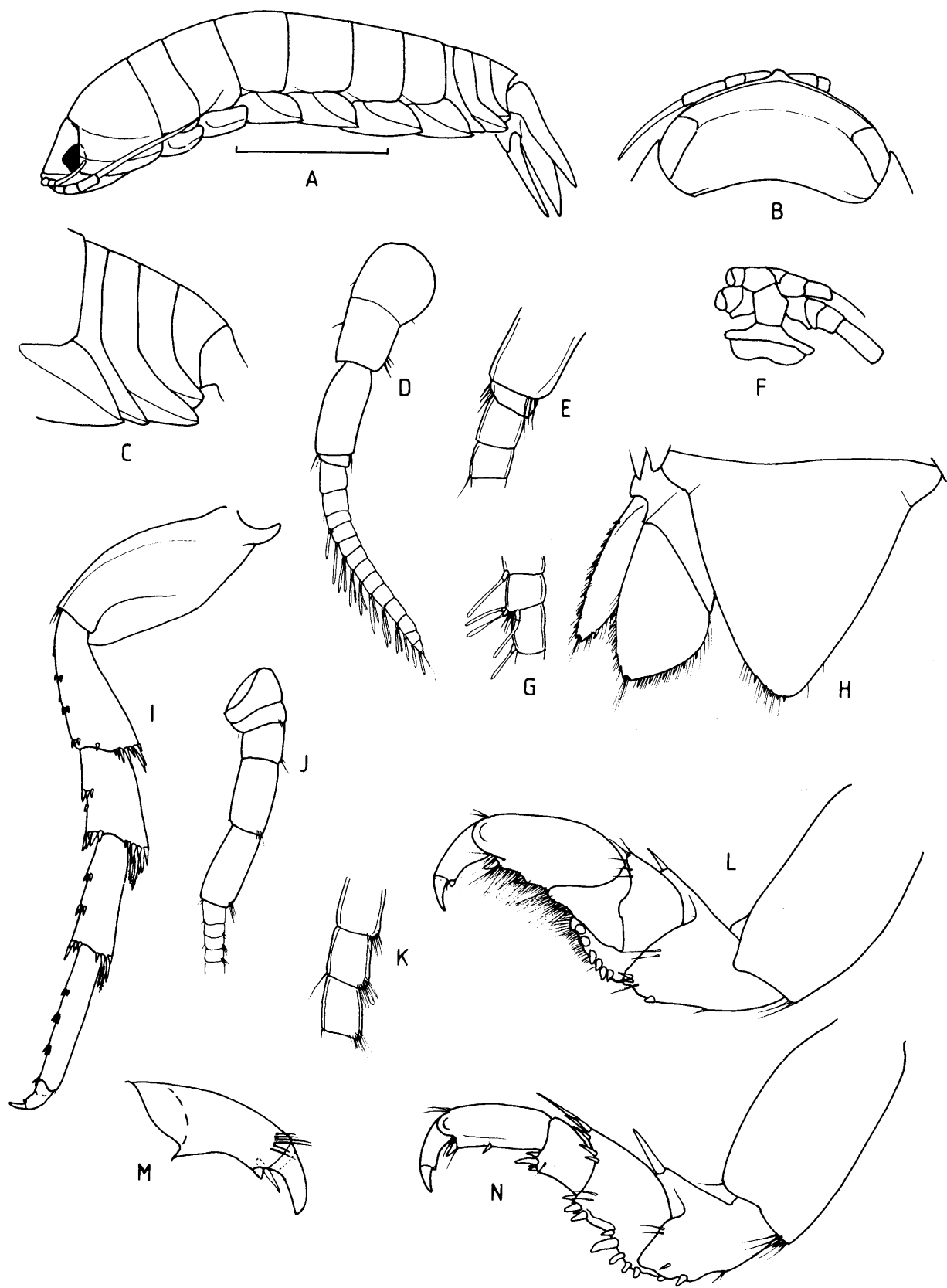


Fig. 114. *Cirolana australiense*. A-C, F, H, holotype; remainder male paratype 11.4 mm. A, lateral view; B, cephalon, dorsal view; C, pleon, lateral view; D, antennule; E, antennule, distal part of peduncular article 3; F, clypeal region; G, antennule, flagellar articles 9-10; H, pleotelson and left 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

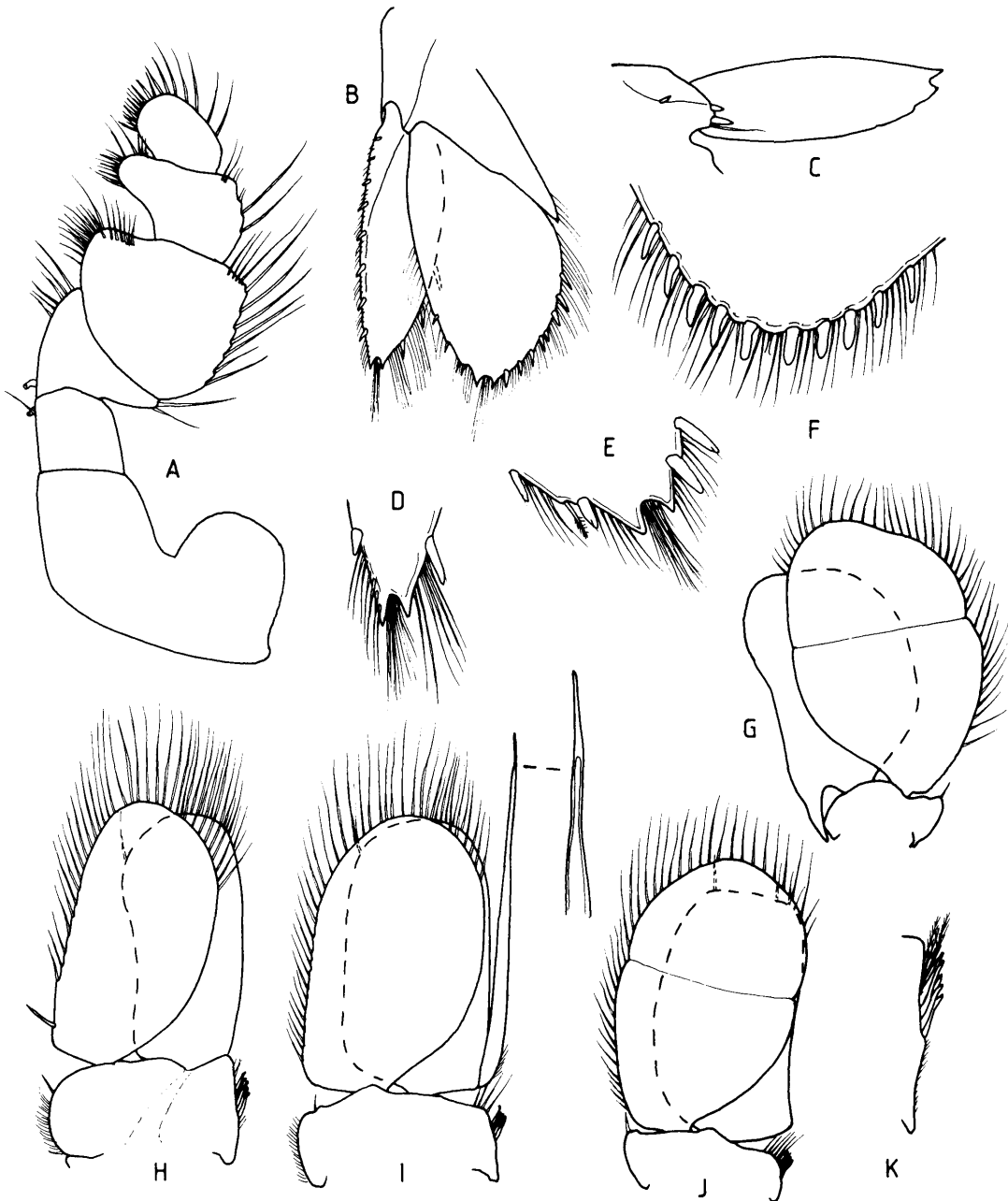


Fig. 115. *Cirolana australiense*, male paratype 11.4 mm. **A**, maxilliped; **B**, uropod; **C**, uropod peduncle, ventral view; **D**, uropod exopod, apex; **E**, uropod endopod, apex; **F**, pleotelson, posterior margin; **G**, pleopod 5; **H**, pleopod 1; **I**, pleopod 2; **J**, pleopod 4; **K**,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

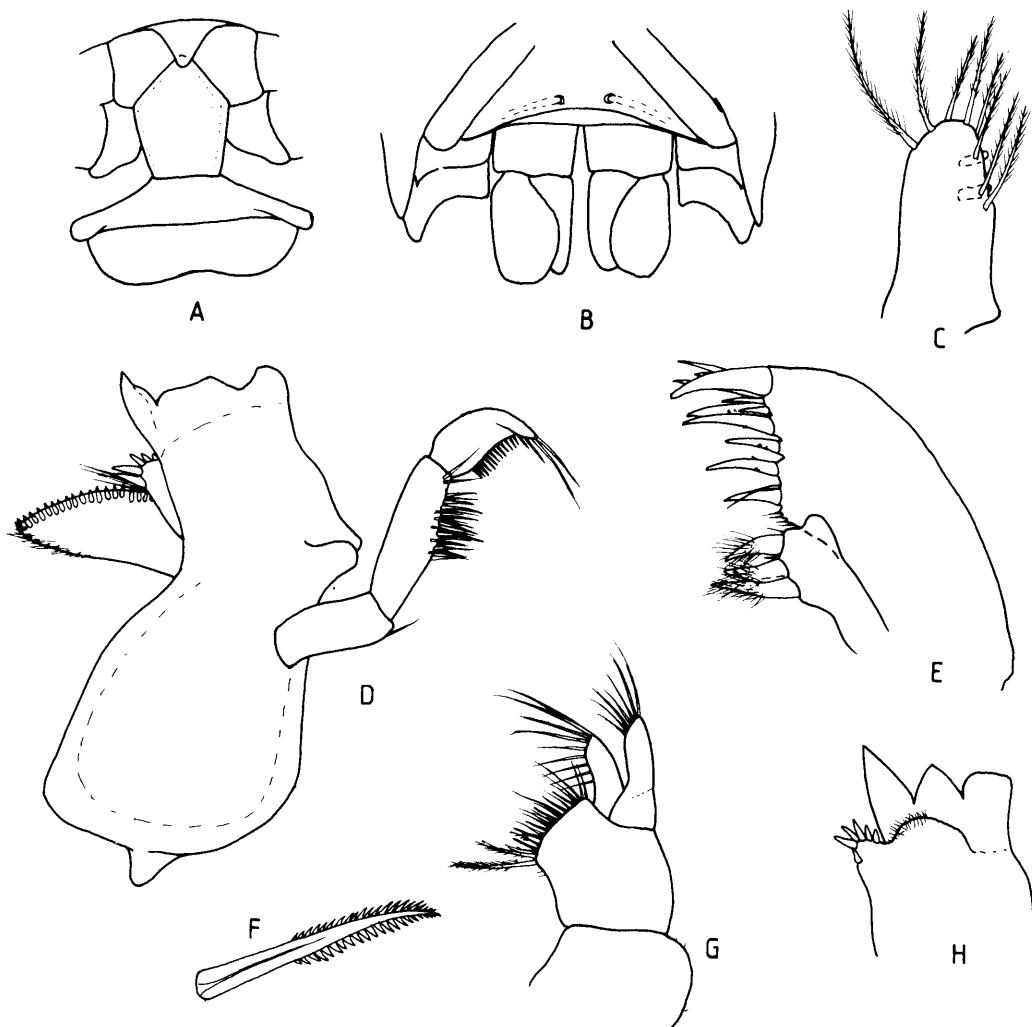


Fig. 116. *Cirolana australiense*. A, clypeal region, male paratype 11.4 mm; B, sternite 7, male Mallacoota; C-H, male 12.3 mm, Tasmania; C, maxilliped endite; D, right mandible, ventral view; E, maxillule; F, seta from maxilliped palp article 2; G, maxilla; H, left mandible, incisor.

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 mancae 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 supernumerary 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 covered 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. Mancae 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 form of the posterolateral margins of the pleonites.

Distribution. South Australia: Port Willunga, Semaphore, St Vincents Gulf, Port Lincoln, Halletts 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 arafuræ 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 mancae (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 mancae (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,

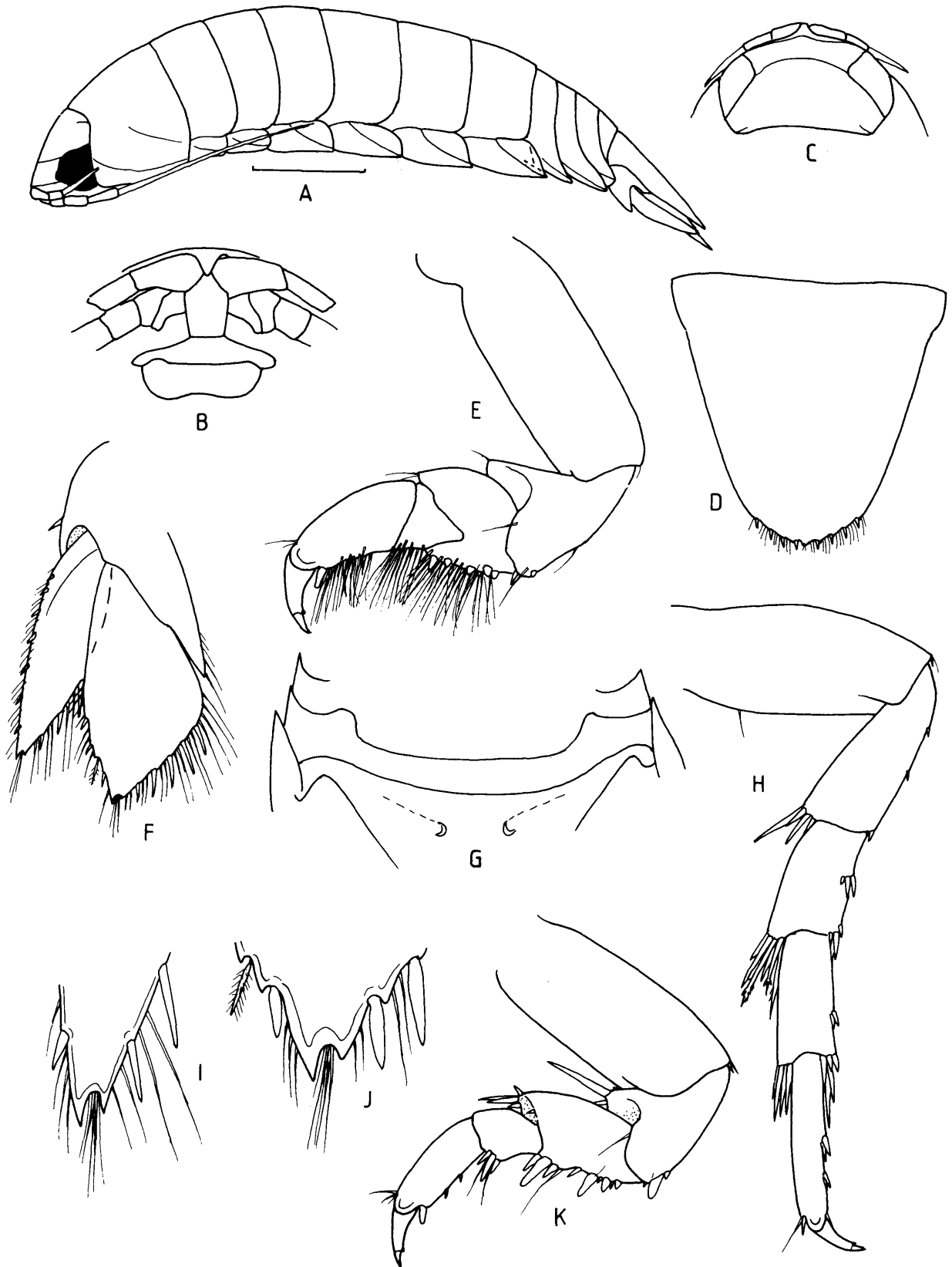


Fig. 117. *Cirolana arafuræ* n. sp. A-D, G, holotype; remainder male paratype. A, lateral view; B, clypeal region; C, cephalon; D, pleotelson; E, pereopod 1; F, uropod; G, vasa deferentia, sternite 7; H, pereopod 7; I, uropod exopod, apex; J, uropod endopod, apex; K, pereopod 2. Scale 1.0 mm.

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:

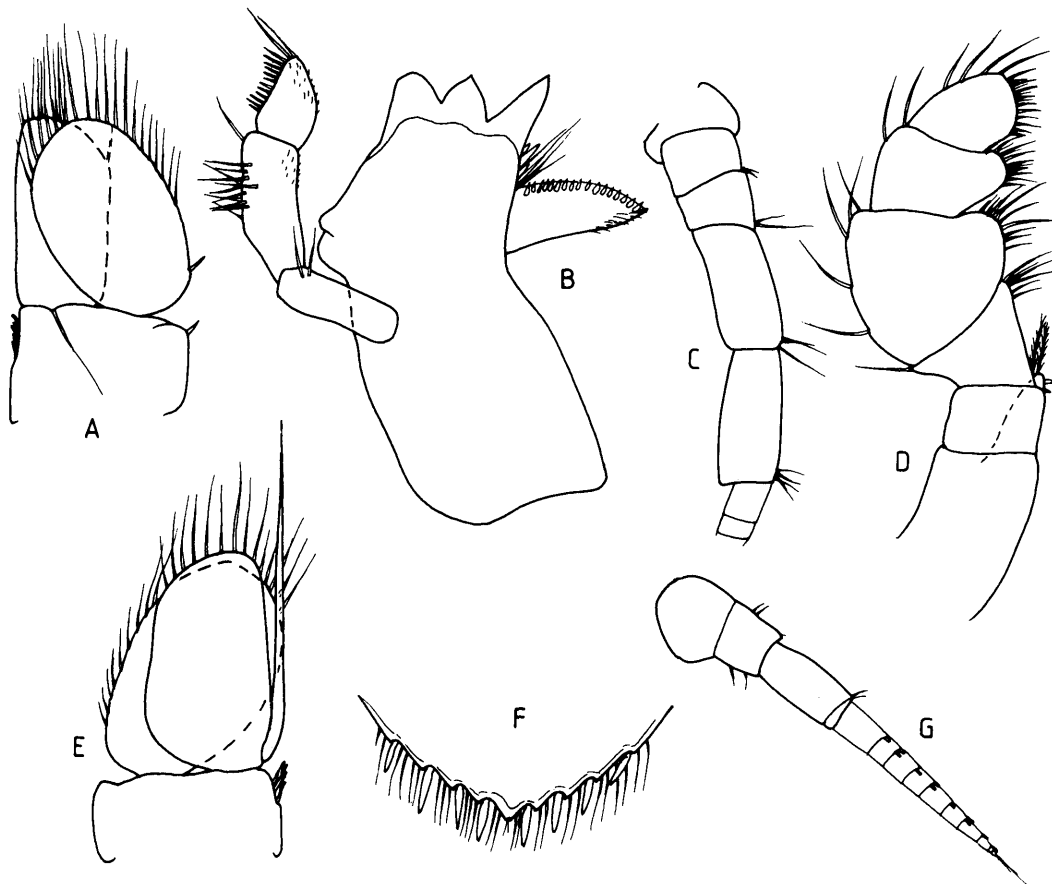


Fig. 118. *Cirolana arafurae* n. sp., male paratype. A, pleopod 1; B, mandible; C, antennal peduncle; D, maxilliped; E, pleopod 2; F, pleotelson, posterior margin; G, antennule.

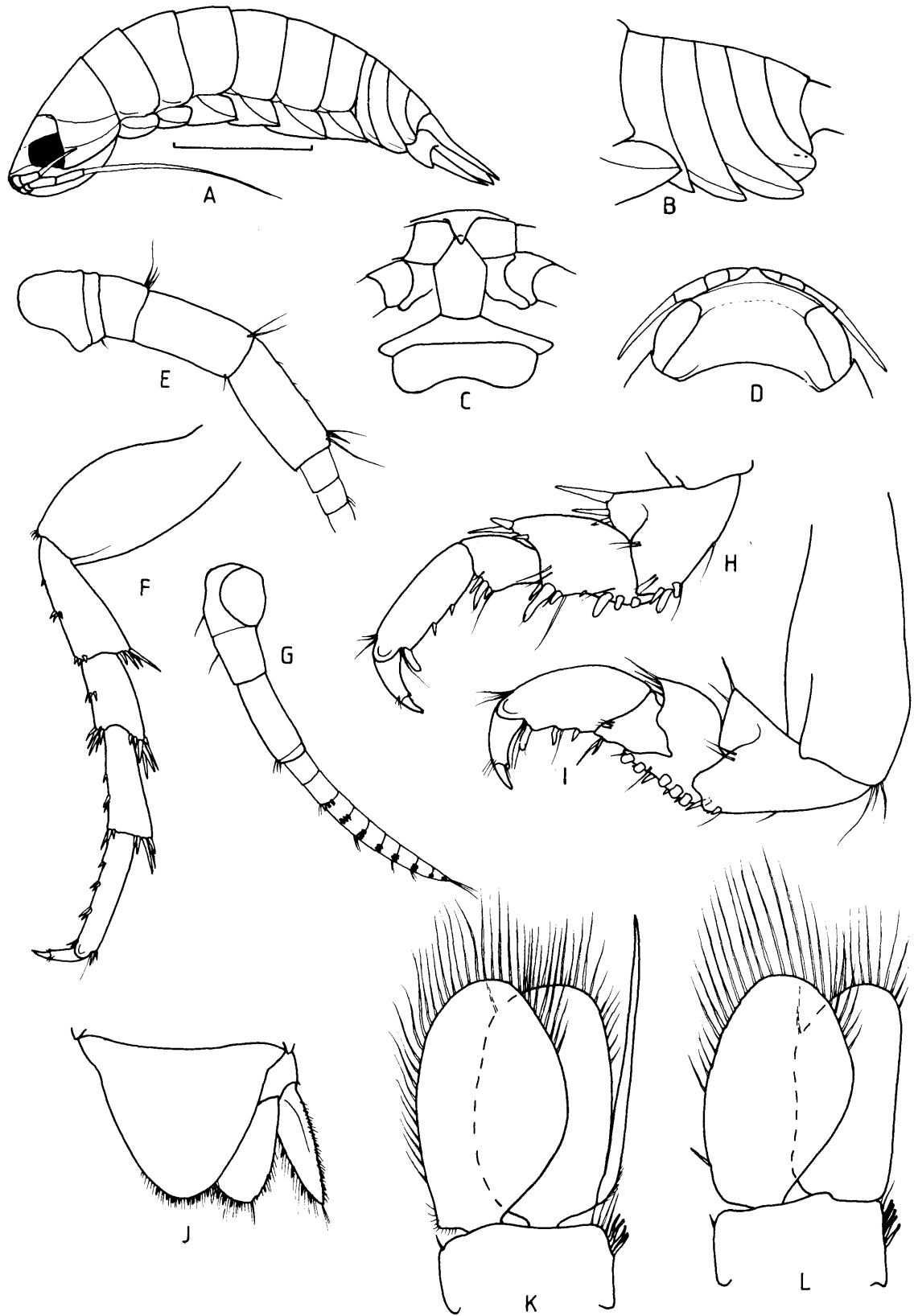


Fig. 119. *Cirolana brocha* n. sp. A-D, J, holotype, male 8.2 mm; remainder male 7.2 mm paratype. A, lateral view; B, pleon, lateral view; C, clypeal region; D, cephalon, dorsal view; E, antennal peduncle; F, pereopod 7; G, antennule; H, pereopod 1; I, pereopod 2 (basis omitted); J, pleotelson and uropod;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

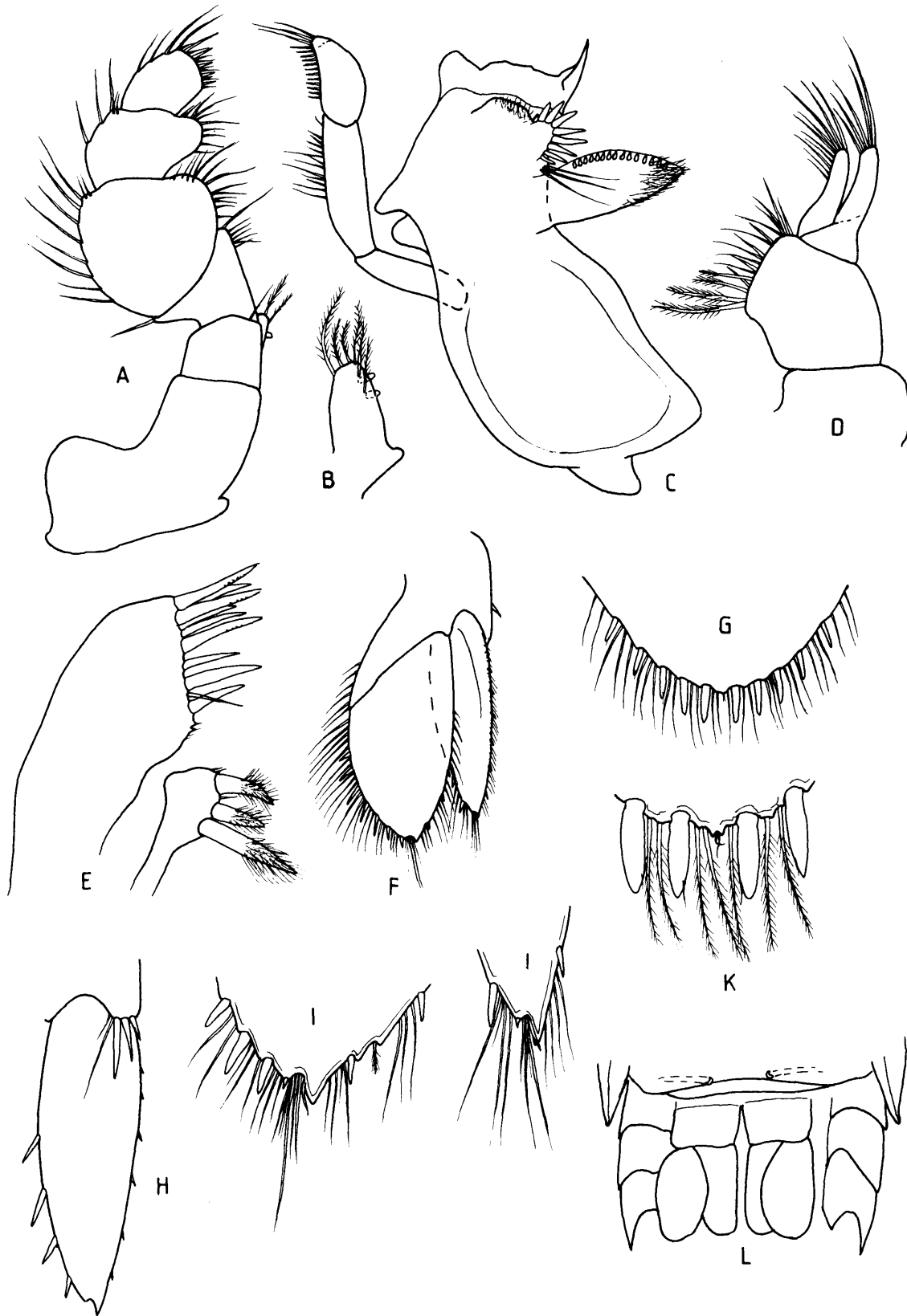


Fig. 120. *Cirolana brocha* n. sp. L, holotype, male 8.2 mm; remainder paratype male 7.0 mm. A, maxilliped; B, maxilliped endite; C, left mandible, ventral view; D, maxilla; E, maxillule; F, uropod; G, pleotelson, posterior margin; H, uropod peduncle and exopod, ventral view showing spines; I, uropod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

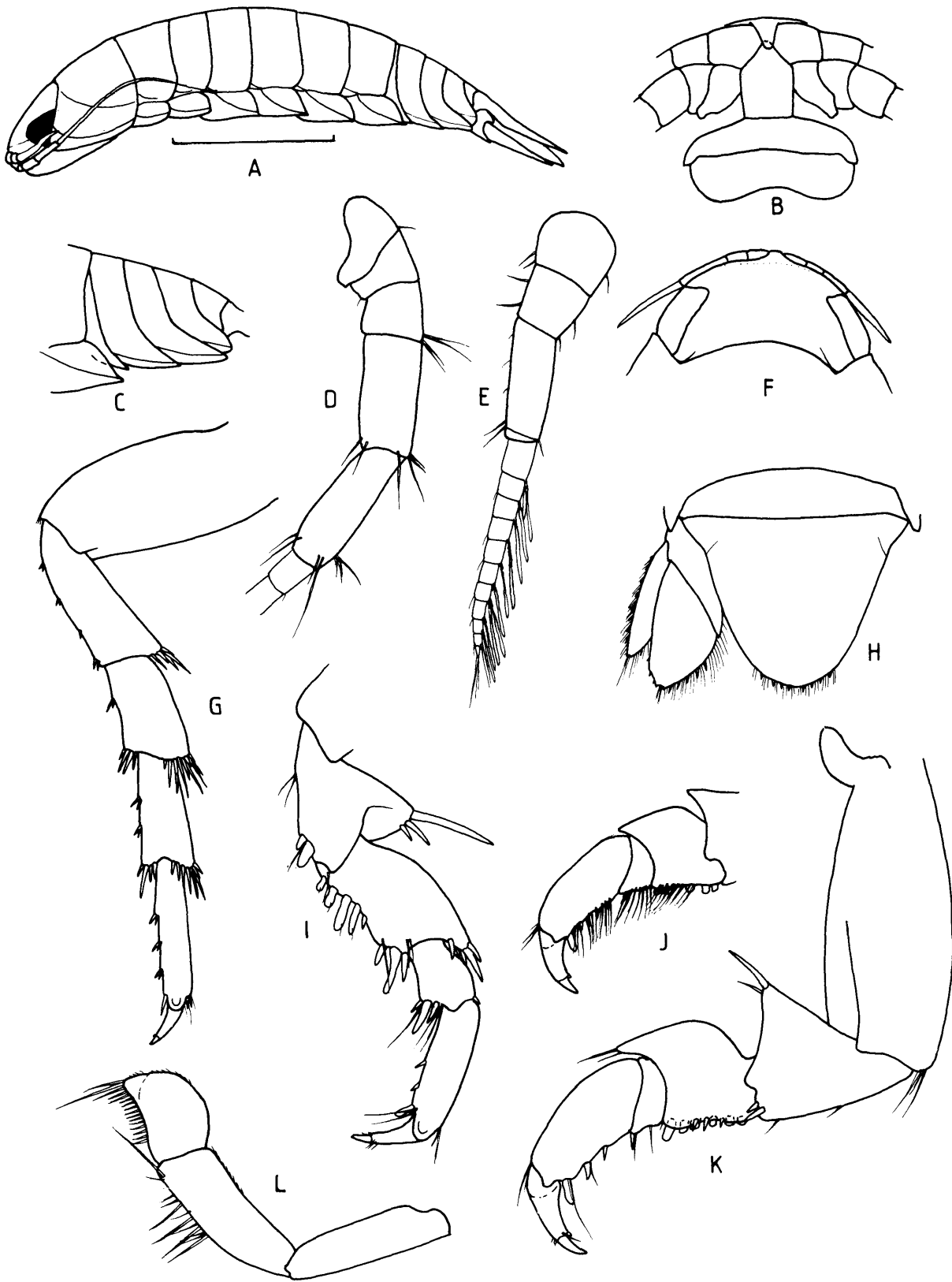


Fig. 121. *Cirolana erodiae* n. sp. A-C, F, holotype, male 6.9 mm; remainder male 7.0 mm paratype. A, lateral view; B, clypeal region; C, pleon, lateral view; D, antennal peduncle; E, antennule; F, cephalon, dorsal view; G, pereopod 7; H, pletelson and uropod; I, pereopod 2; J, pereopod 1, distal articles 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 manca (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 manca (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 manca (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 manca (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 manca (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%

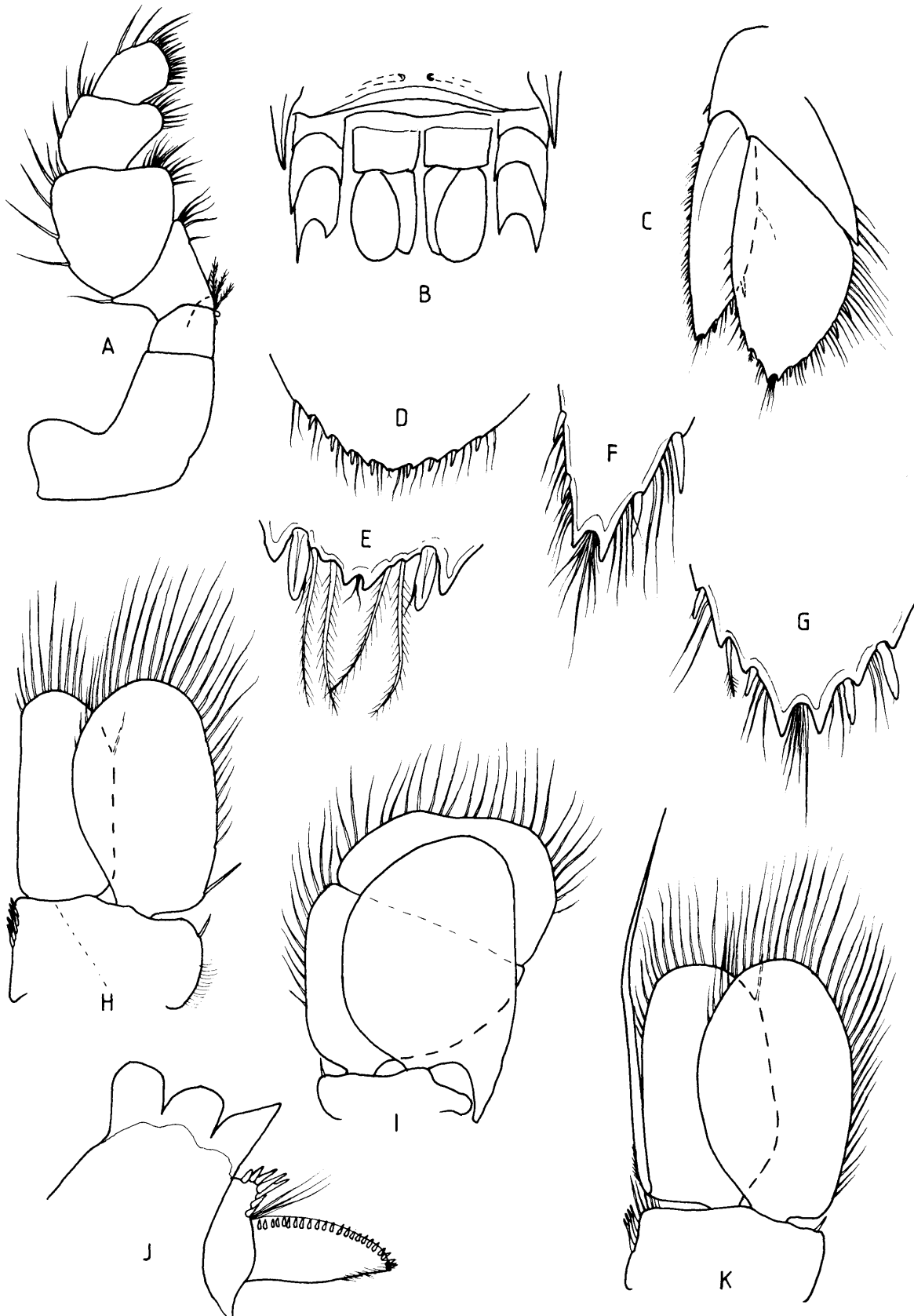


Fig. 122. *Cirolana erodiae* n. sp. A, holotype; remainder male paratype 7.0 mm. A, maxilliped; B, sternite 7; C, uropod; D, pleotelson, posterior margin; E, pleotelson apex; F, uropod exopod, apex; G, uropod endopod, apex; H, pleopod 1; I, pleopod 5; J, mandible, distal part; K, pleopod 2.

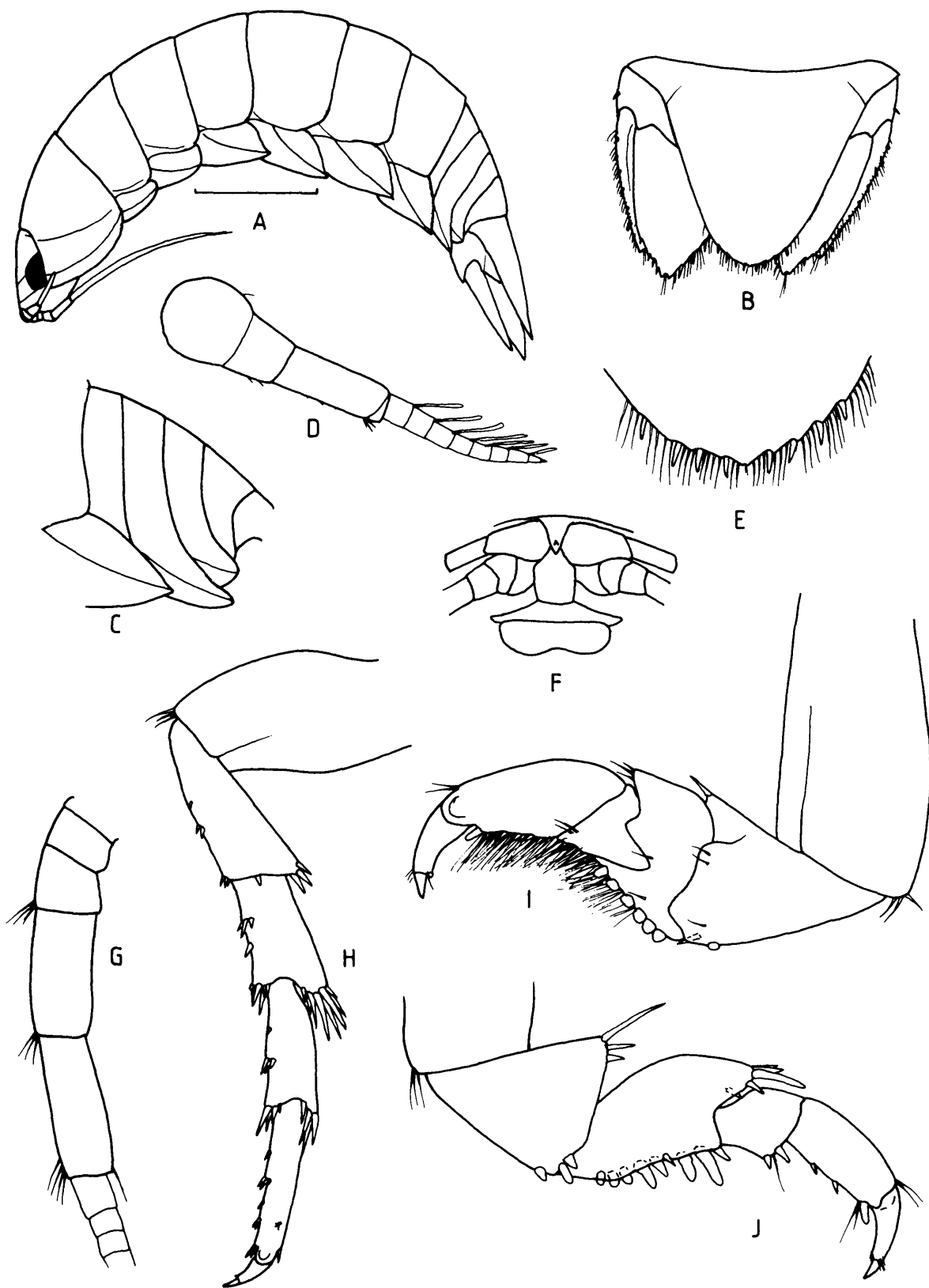


Fig. 123. *Cirolana hesperia* n. sp. A-C, F, 11.3 mm holotype; remainder male paratype 9.5 mm. A, lateral view; B, pleotelson, dorsal view; C, pleon lateral view; D, antennule; E, pleotelson, posterior margin; F, clypeal region; G, antennule peduncle; H, pereopod 7; I, pereopod 1; J, pereopod 2. Scale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

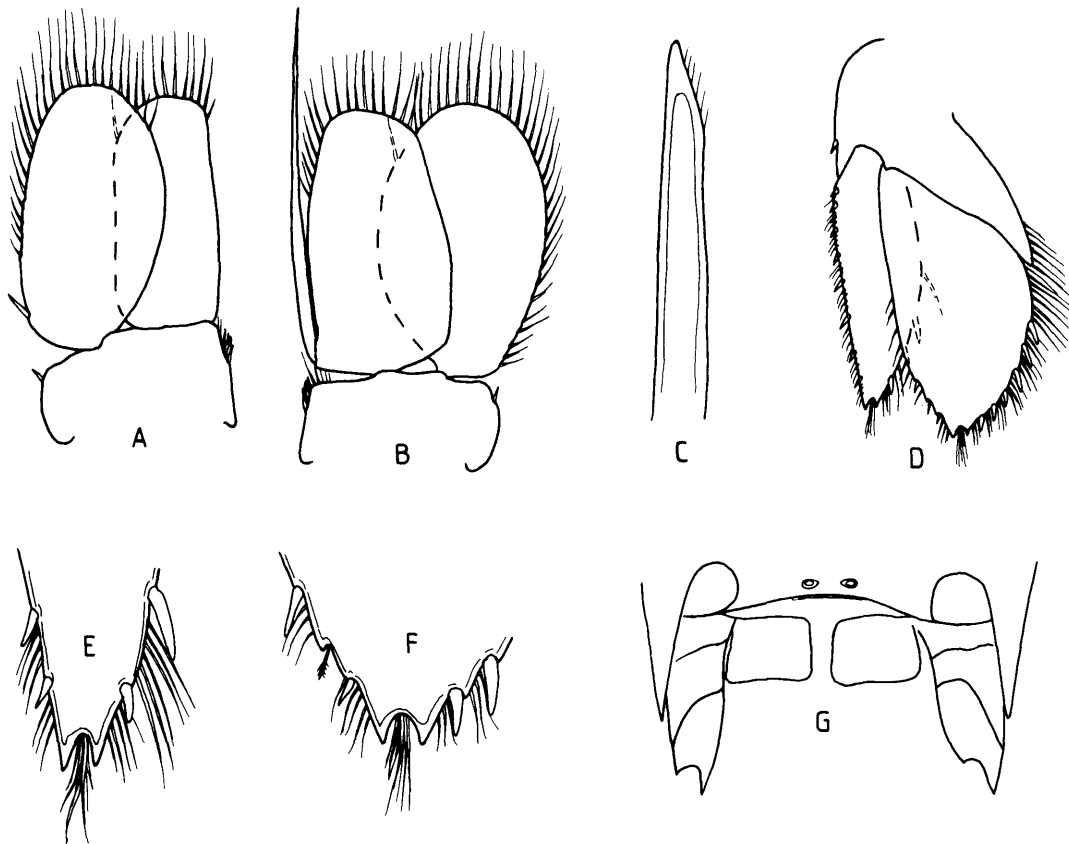


Fig. 124. *Cirolana hesperia* n. sp., male paratype 9.5 mm. A, pleopod 1; B, pleopod 2; C, appendix masculina, apex; D, uropod; E, uropod exopod, apex; F, uropod endopod, apex; G, sternite 7.

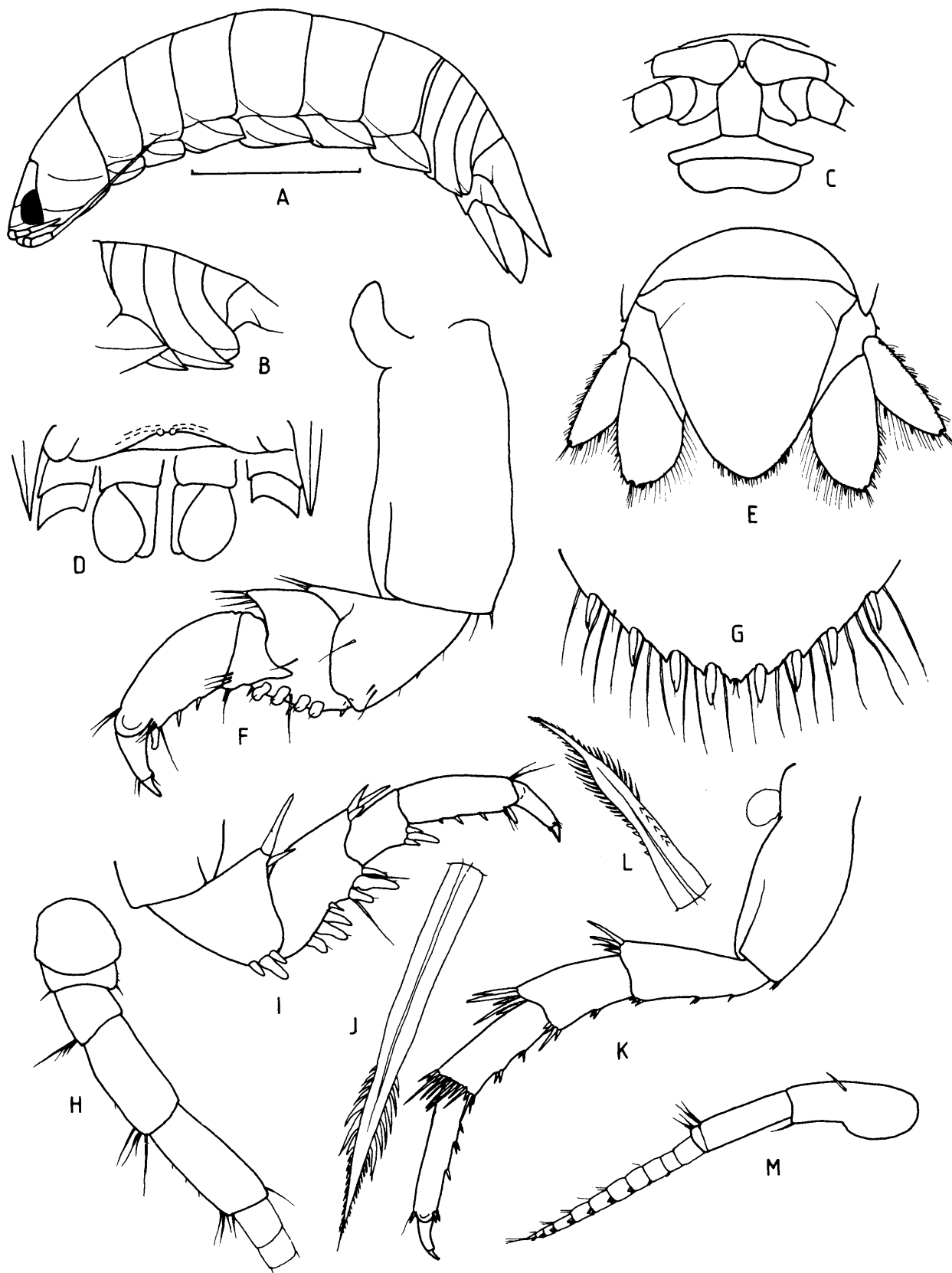


Fig. 125. *Cirolana improceros* n. sp. A-E, holotype; G, female paratype; remainder male paratype. A, lateral view; B, pleon, lateral view; C, clypeal region; D, sternite 7, ventral view; E, pleotelson and uropods; F, pereopod 1; G, pleotelson posterior margin; H, antennal peduncle; I, pereopod 2; J, 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*

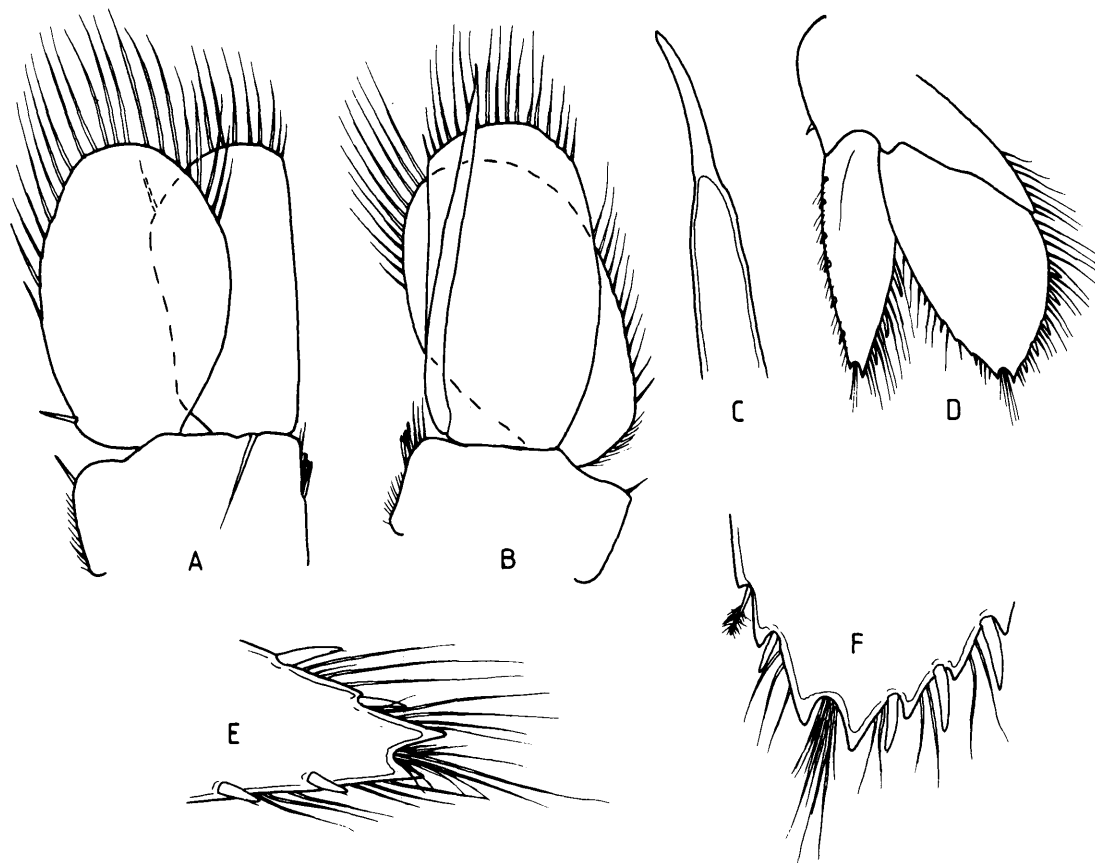


Fig. 126. *Cirolana improceros* n. sp., male paratype. A, pleopod 1; B, pleopod 2; C, appendix masculina, apex; D, uropod; E, uropod exopod, apex; F, uropod endopod, apex.

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 manca (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.

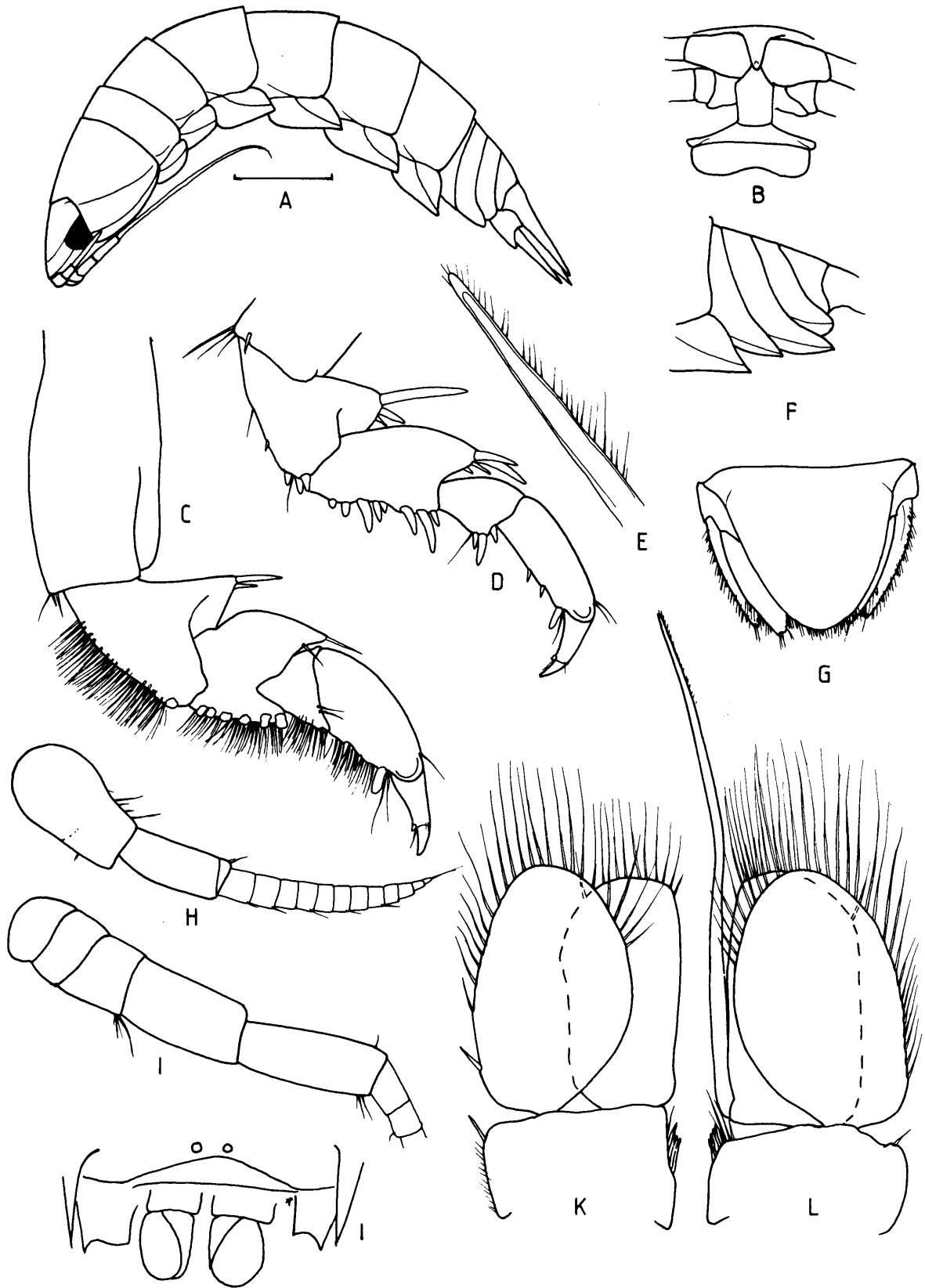


Fig. 127. *Cirolana mekista* n. sp. A-C, E-G, J, L, holotype; remainder female paratype, Cairns. A, lateral view; B, clypeal region; C, pereopod 1; D, pereopod 2; E, appendix masculina, apex; F, pleon lateral view; G, pleotelson, dorsal view; H, antennule; I, antennal peduncle; J, ventral view, sternite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

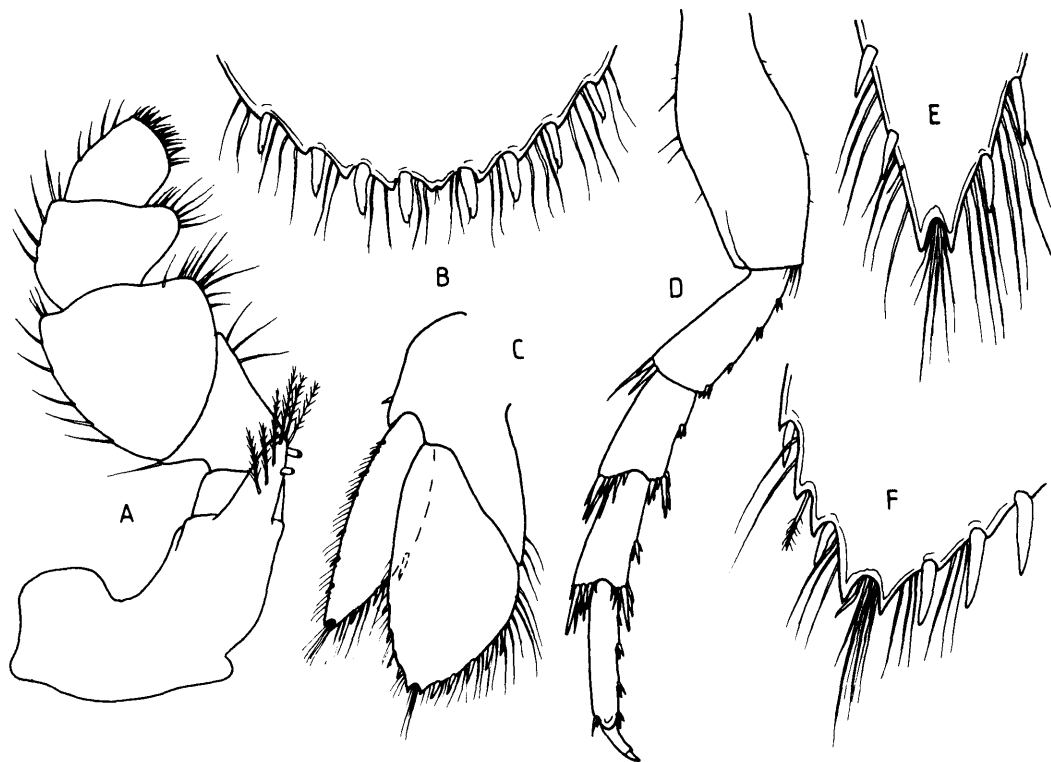


Fig. 128. *Cirolana mekista* n. sp., female paratypes, Cairns. A, maxilliped; B, pleotelson, posterior border; C, uropod; D, pereopod 7; E, uropod exopod, apex; F, uropod endopod, apex.

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

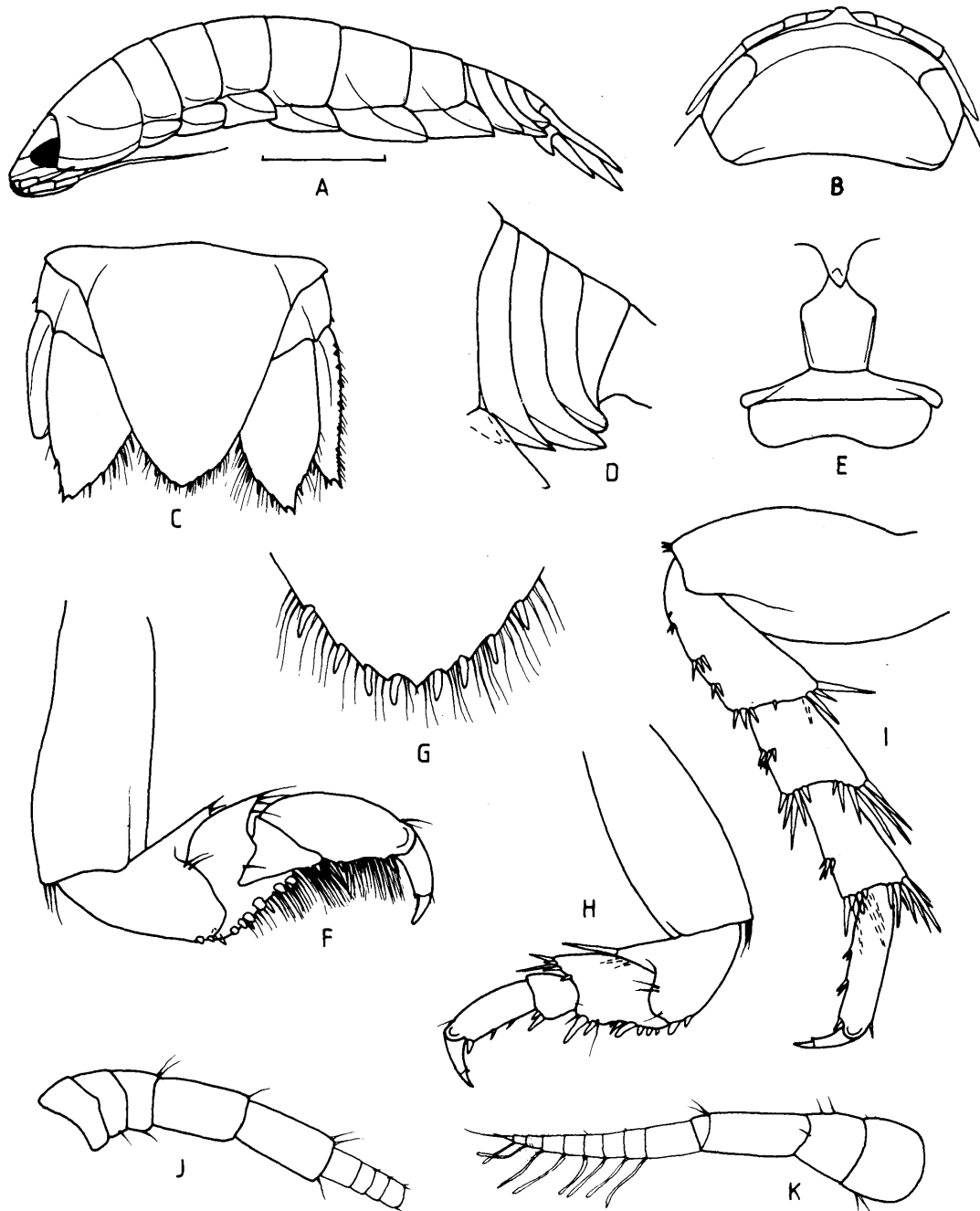


Fig. 129. *Cirolana portula* n. sp. A–C, E, F, holotype; remainder female paratype. A, lateral view; B, cephalon, dorsal view; C, pleotelson and uropods; D, pleon, lateral view; E, clypeal region; F, pereopod 1; G, pleotelson, posterior margin; H, pereopod 2; I, pereopod 7; J, antennal peduncle; K, antennule.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

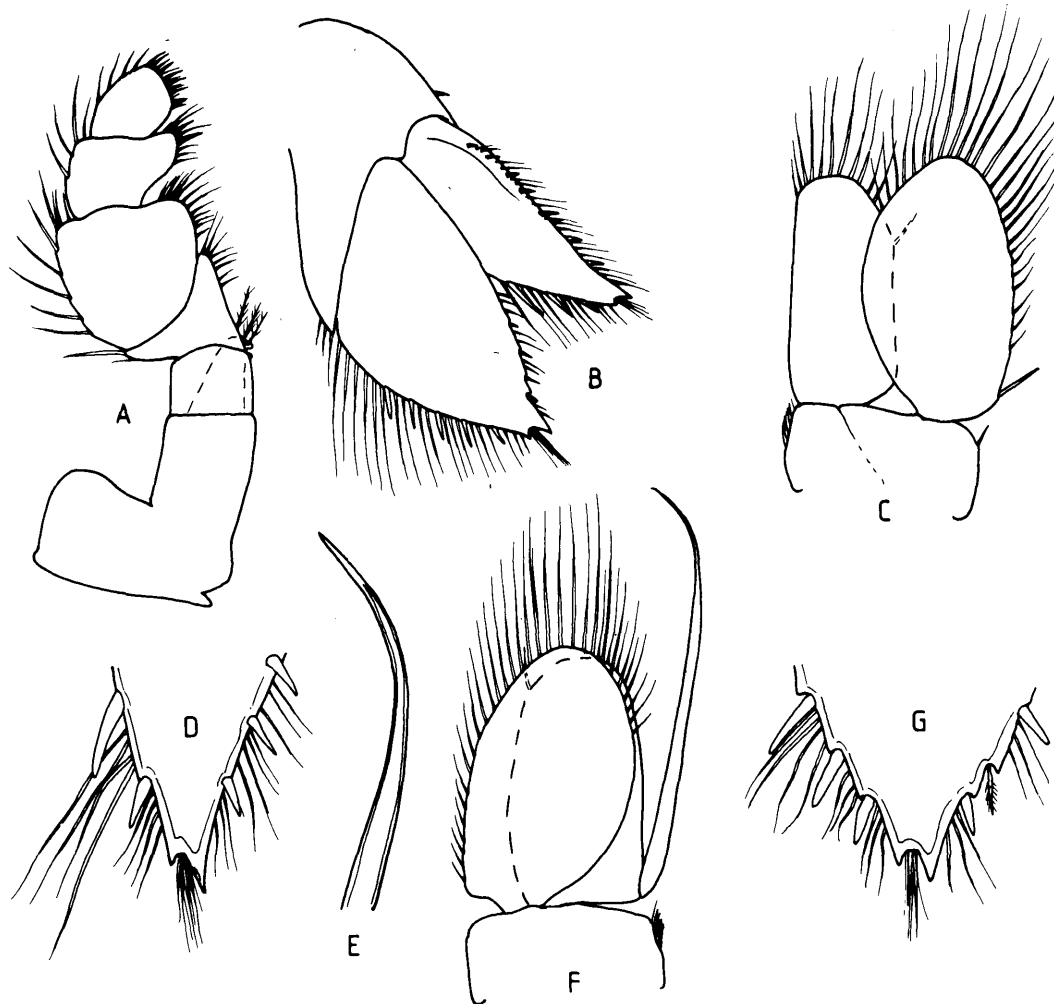


Fig. 130. *Cirolana portula* n. sp. A–D, G, female paratype; E, F, holotype. A, maxilliped; B, uropod; C, pleopod 1; D, uropod exopod, apex; E, appendix masculina, apex; F, pleopod 2; G, uropod endopod, apex.

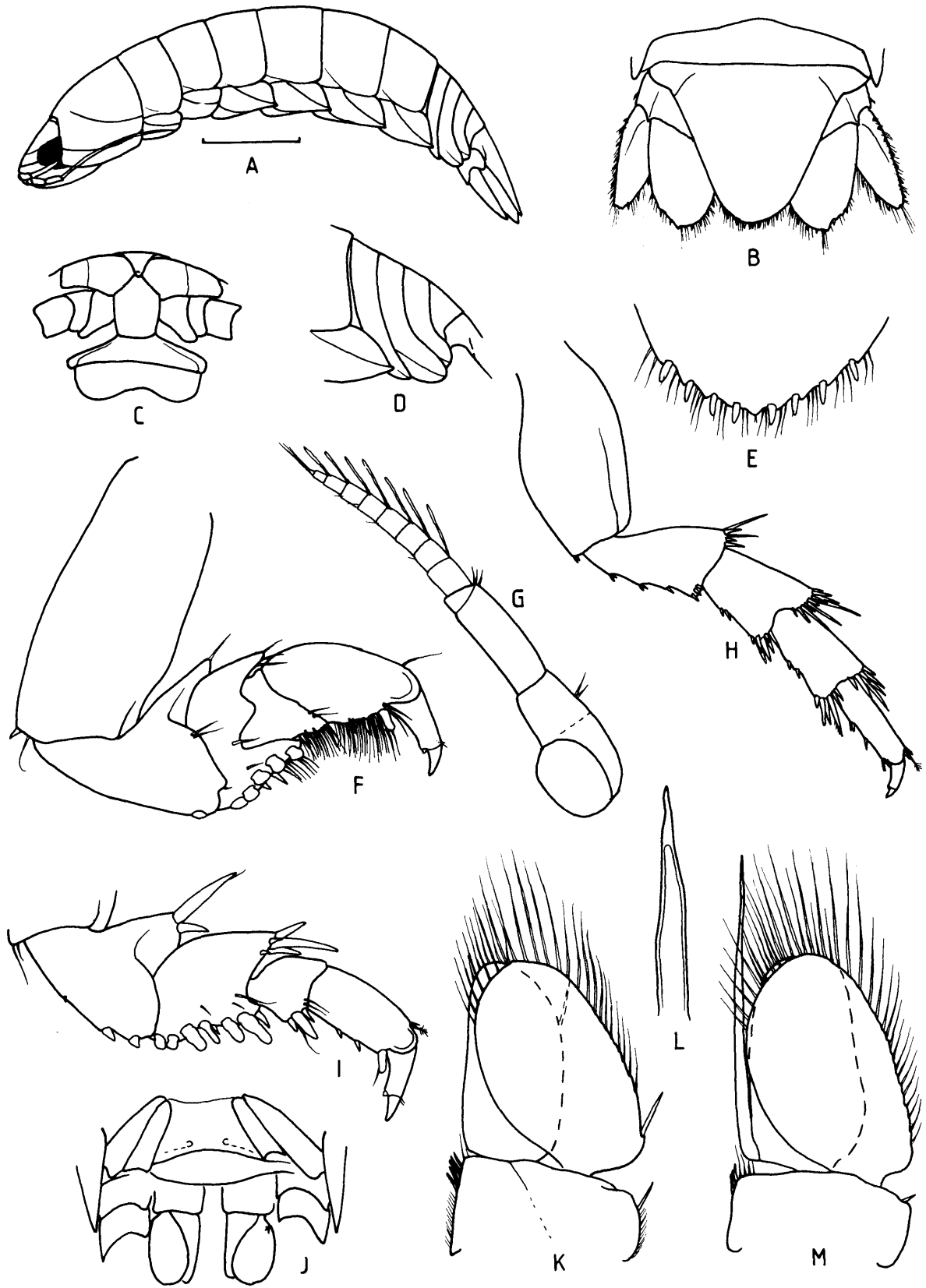


Fig. 131. *Cirolana solitaria* n. sp. A-E, holotype; remainder male paratype. A, lateral view; B, pleotelson, dorsal view; C, clypeal region; D, pleon, lateral view; E, pleotelson, posterior margin; F, pereopod 1; G, antennule; H, pereopod 2; I, pereopod 7; J, ventral view, sternite 7; K, pleopod 1;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

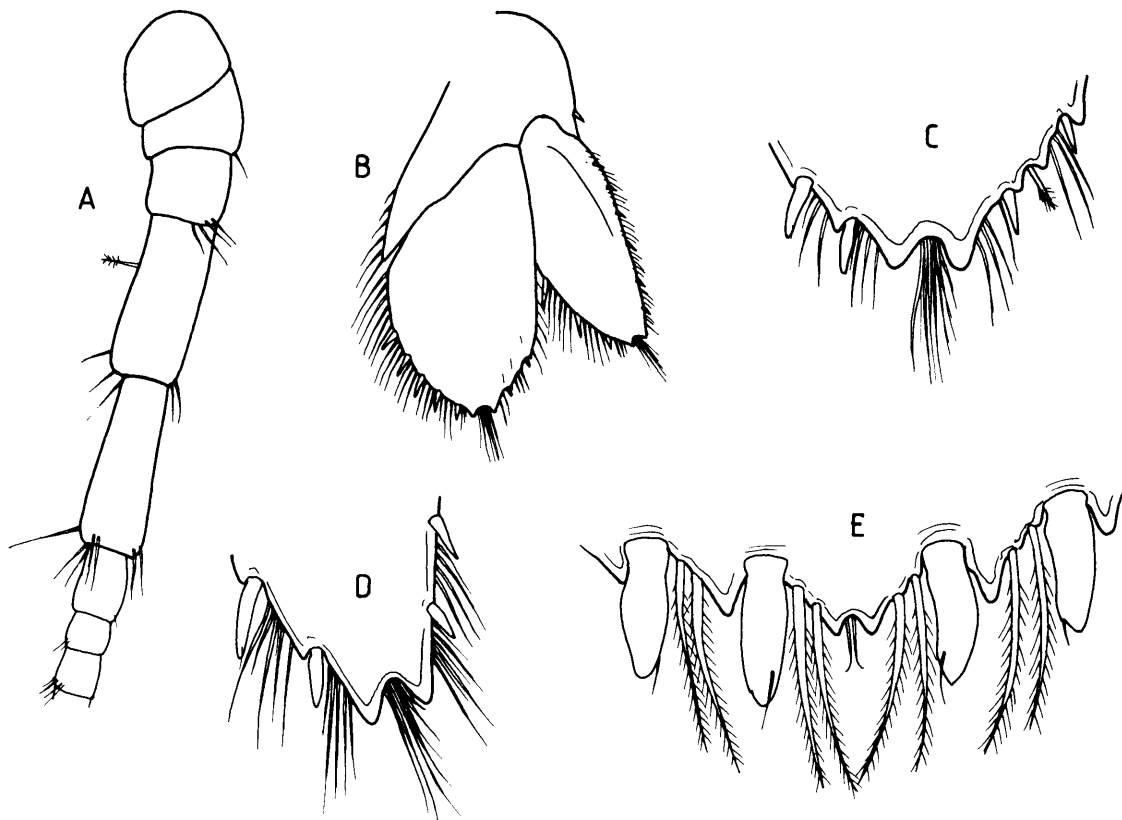


Fig. 132. *Cirolana solitaria* n. sp., male paratype. A, antennal peduncle; B, uropod; C, uropod endopod, apex; D, uropod exopod, apex; E, pleotelson, apex.

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 assisting 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.

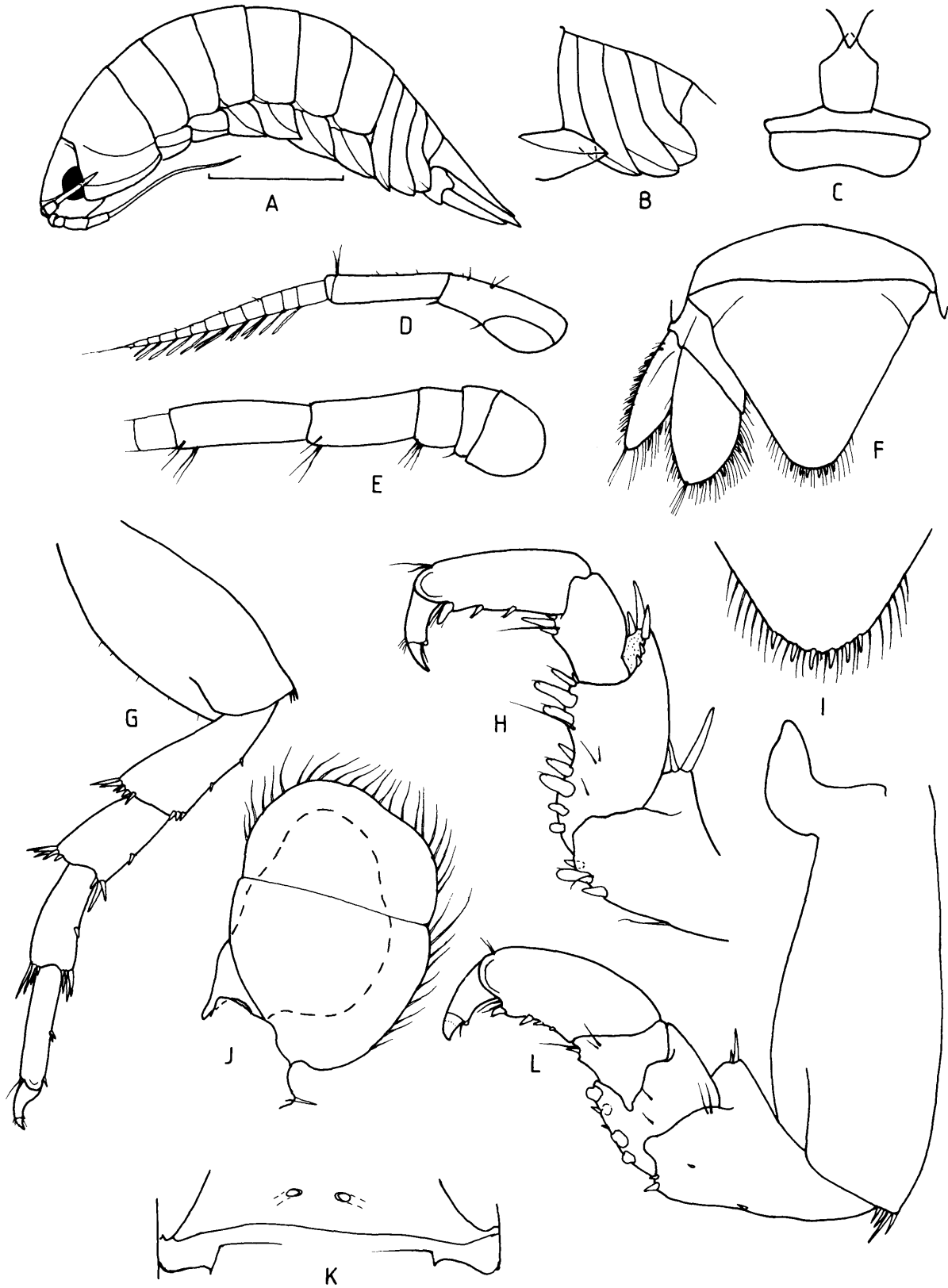


Fig. 133. *Cirolana stenoura* n. sp. A-C, holotype; F, I, J, female paratype, Madang; remainder male paratype 7.5 mm. A, lateral view; B, pleon, lateral view; C, frontal lamina, clypeus and labrum; D, antennule; E, antennal peduncle; F, pleotelson; G, pereopod 7; H, pereopod 2; I, pleotelson apex; J, 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

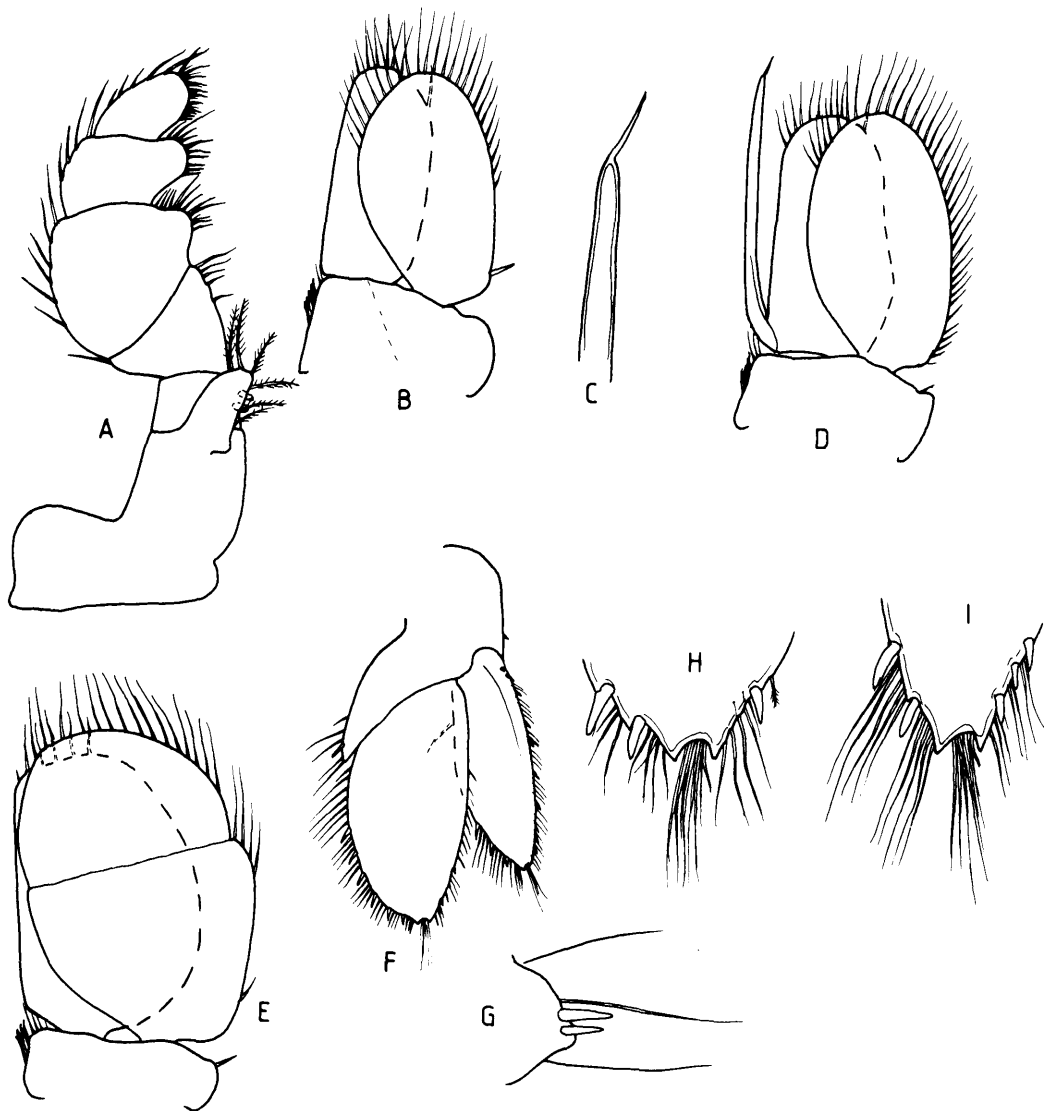


Fig. 134. *Cirolana stenoura* n. sp., male paratype 7.5 mm, except E, female paratype, Madang. A, maxilliped; B, pleopod 1; C, appendix masculina, apex; D, pleopod 2; E, pleopod 3; F, uropods; G, uropod peduncle, ventral distal lateral angle; H, uropod endopod, apex; I, uropod exopod, apex.

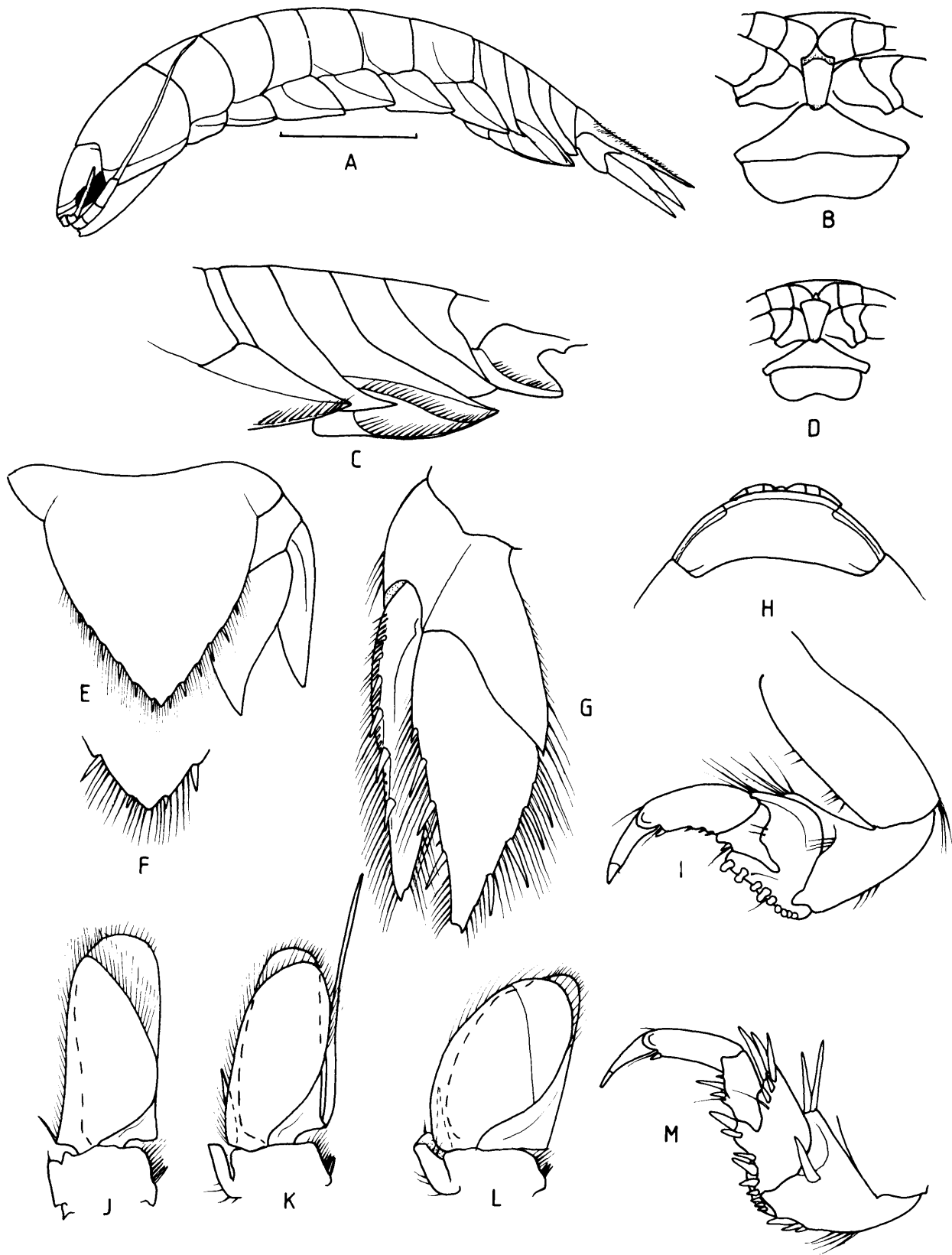


Fig. 135. *Cirolana schioedtei*. A, C, H, male 25.0 mm, Broome; B, female 29.6 mm N.W. Cape; remainder male 17.0 mm Dampier, WA. A, lateral view; B, clypeal region (female 29.6 mm); C, pleon, lateral view; D, clypeal region (male 17.0 mm); E, pleotelson; F, pleotelson, apex; G, uropod; H, cephalon, dorsal 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 extension. 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. Rottneest 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 manca (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 biungulate. 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,

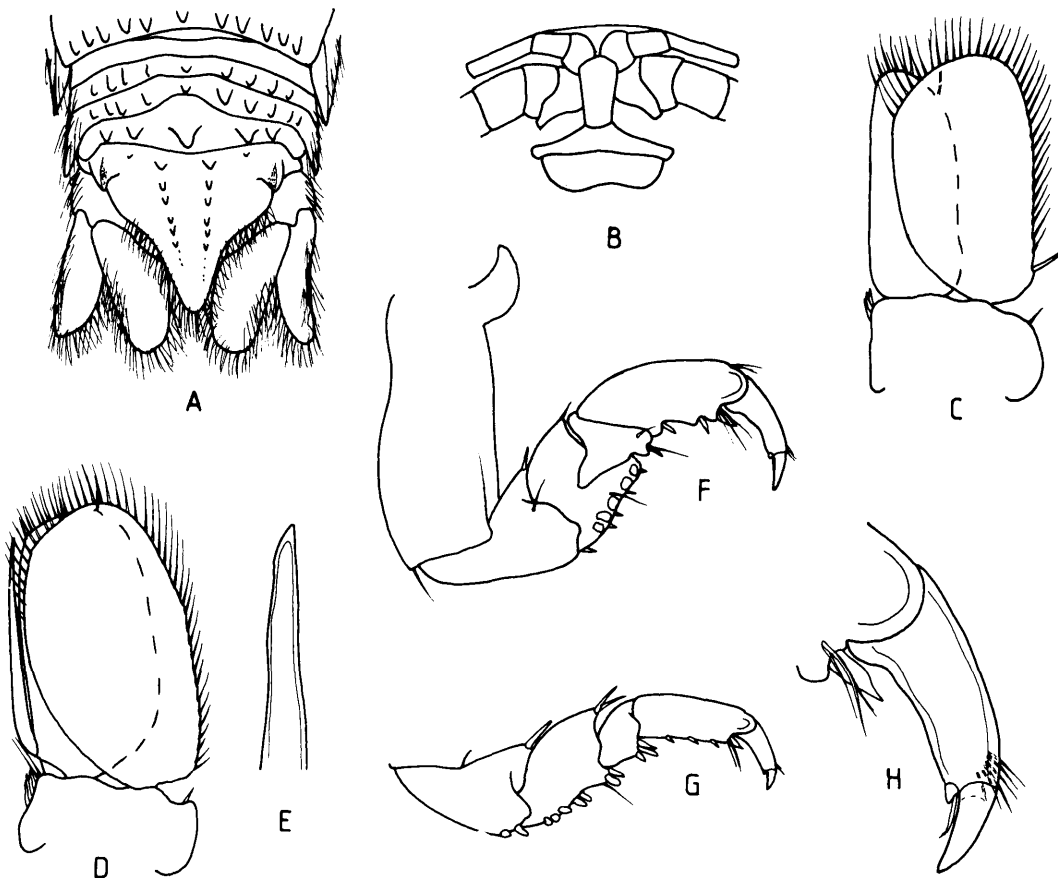


Fig. 136. *Anopsilana pustulosa*, male 10.5 mm, Hinchinbrook Is. A, pleon and pleotelson; B, clypeal region; C, pleopod 1; D, pleopod 2; E, appendix masculina, apex; F, pereopod 1; G, pereopod 2; H, pereopod 1, dactylus.

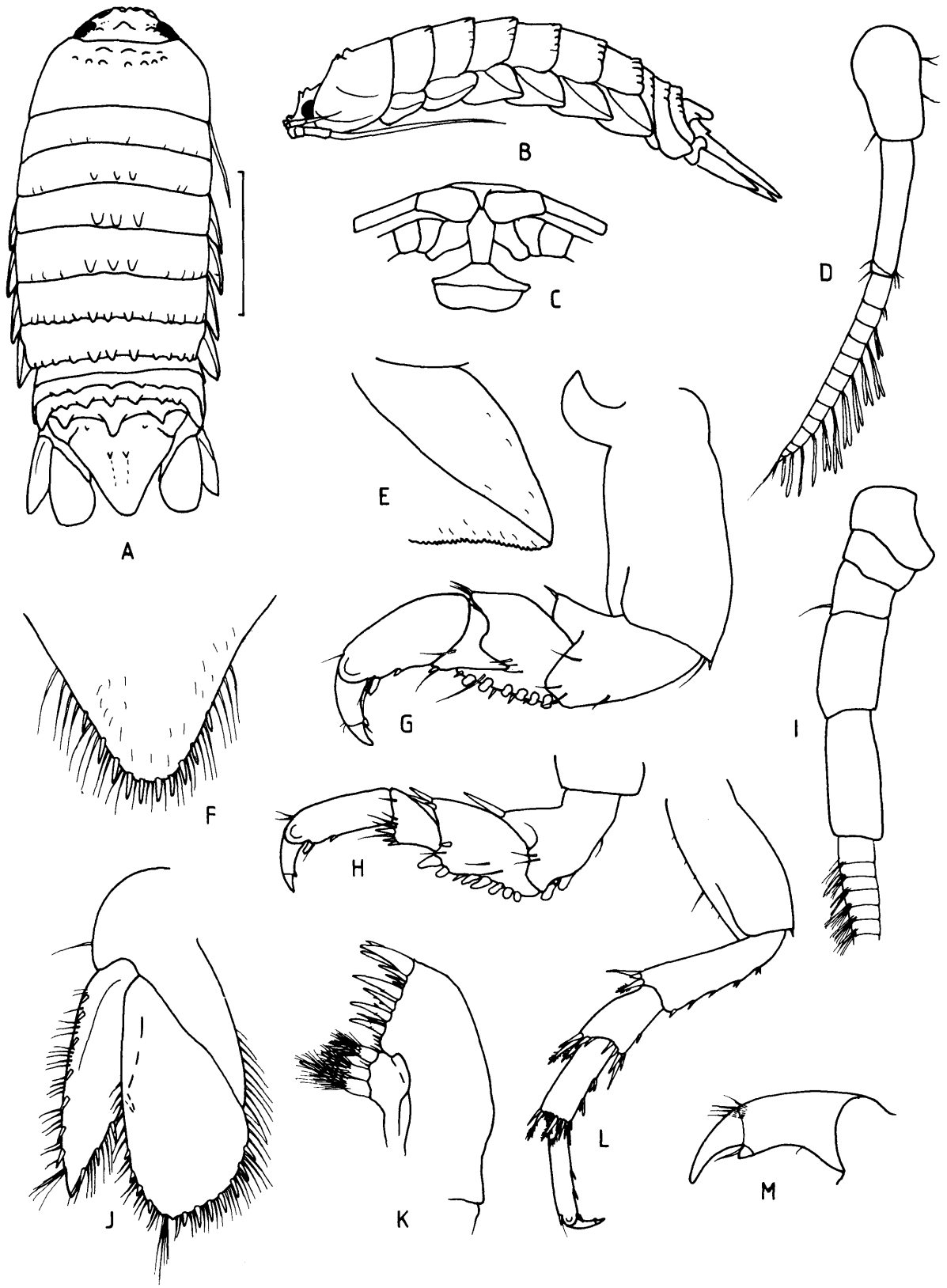


Fig. 137. *Anopsilana willeyi*, male 7.2 mm, Cooktown. **A**, dorsal view; **B**, lateral view; **C**, clypeal region; **D**, antennule; **E**, coxal plate, peronite 7; **F**, pleotelson apex; **G**, pereopod 1; **H**, pereopod 2; **I**, antennal peduncle; **J**, uropod; **K**, maxillule; **L**, pereopod 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 tubercles 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 tubercles; pleonite 4 with 1 median and 2 submedian tubercles prominent, further 2 indistinct tubercles on each side; pleonite 5 with large tubercles. Pleotelson dorsal surface flat, lateral

margins with 2 feeble sub-median carinae, and 2 tubercles; 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 biungulate 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

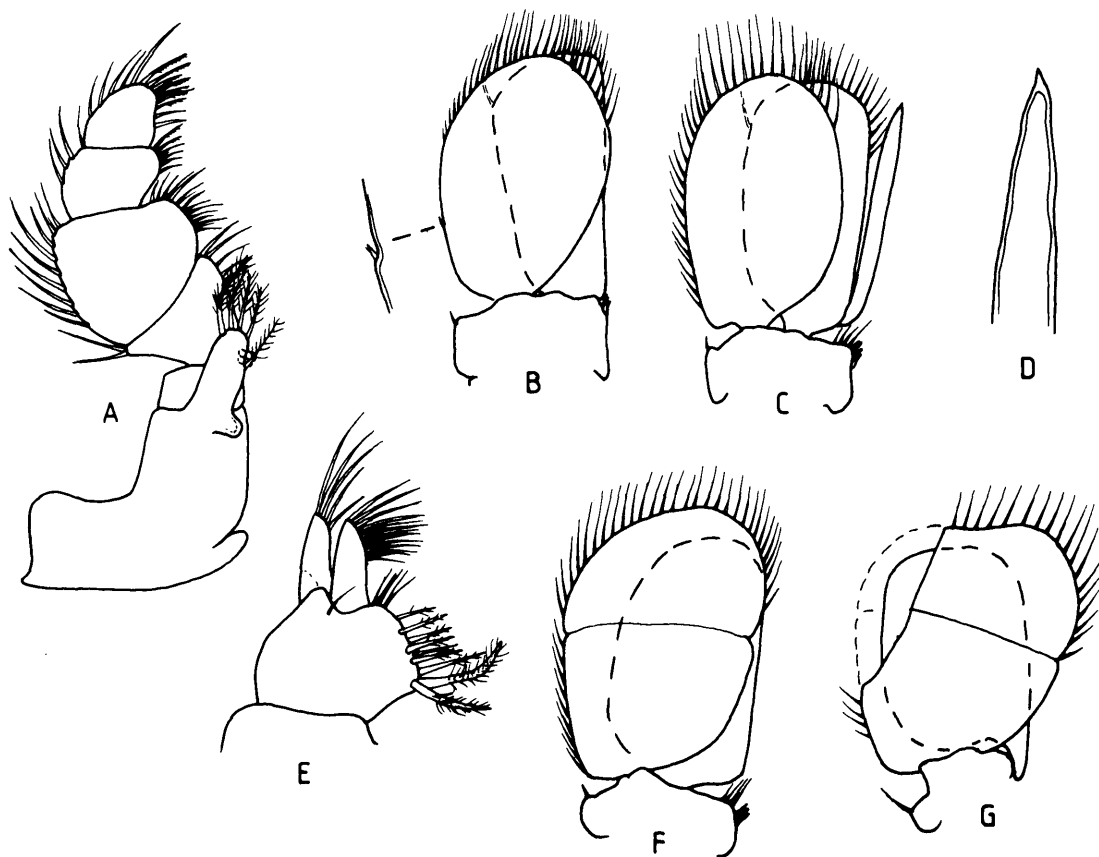


Fig. 138. *Anopsilana willeyi*, male 7.2 mm, Cooktown. A, maxilliped; B, pleopod 1; C, pleopod 2; D, appendix masculina, apex; E, maxilla; F, pleopod 3; G, pleopod 5.

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

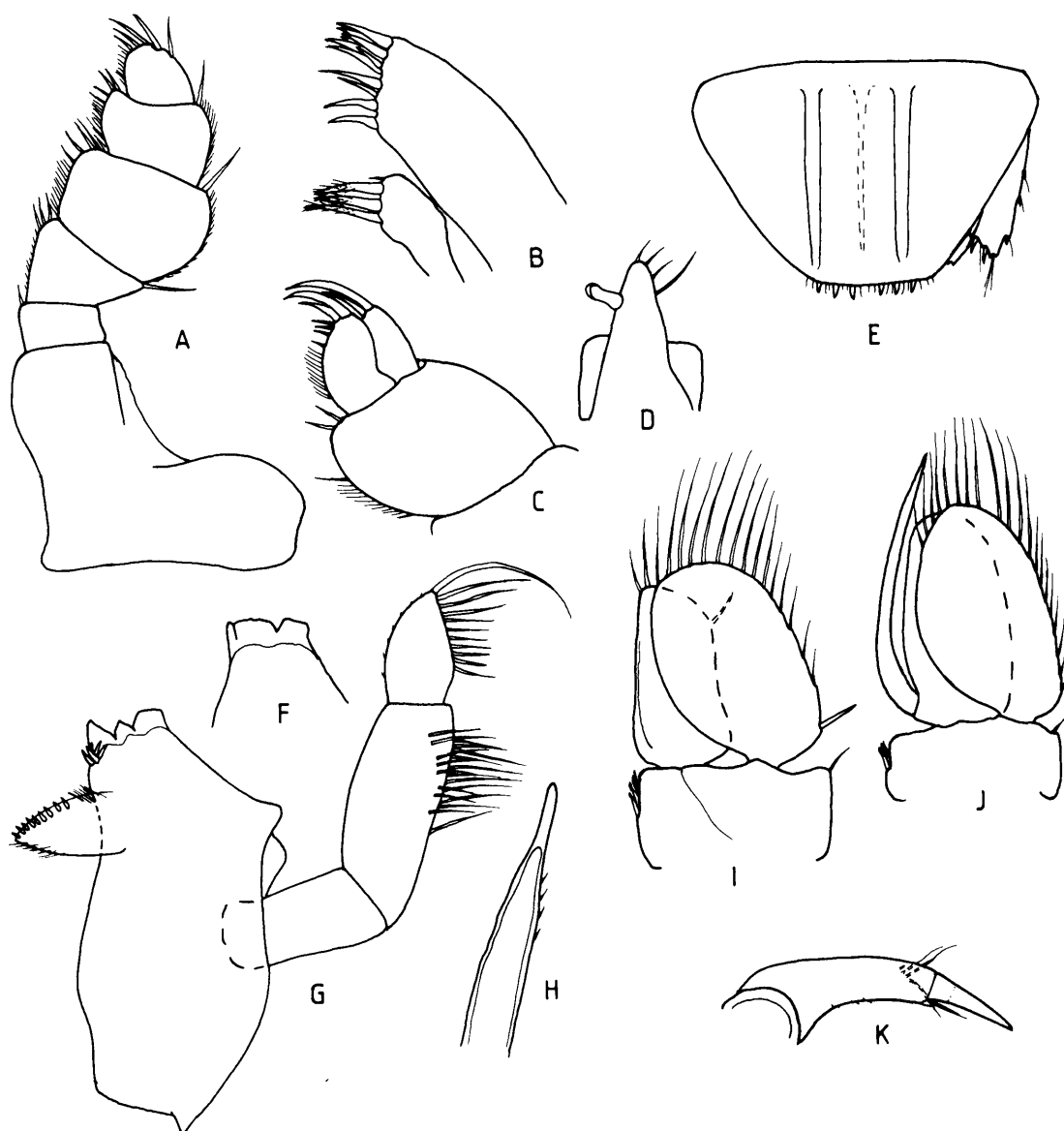


Fig. 139. *Neocirolana bicrista*. 1, J, male paratype; remainder female paratype. A, maxilliped; B, maxillule; C, maxilla; D, maxilliped endite; E, pleotelson; F, left mandible, incisor; G, right mandible; H, appendix masculina, apex; I, pleopod 1; J, pleopod 2; K, pereopod 1, dactylus.

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 bladeliike 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

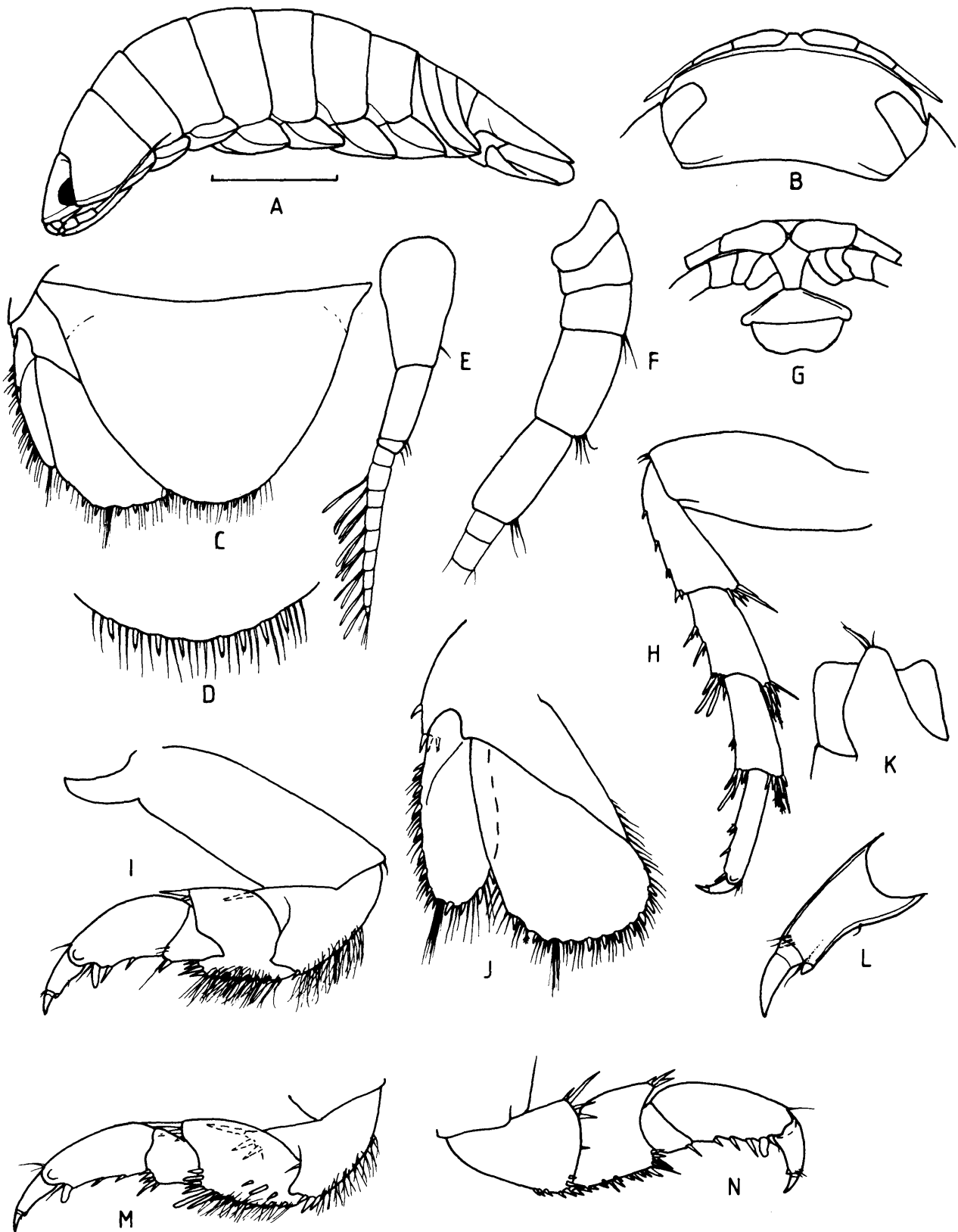


Fig. 140. *Neocirolana hermitensis*. I, K-M, male 8.8 mm; remainder female 8.2 mm, Abrolhos Is. A, lateral view; B, cephalon dorsal view; C, pleotelson and uropod; D, pleotelson, posterior margin; E, antennule; F, antennal peduncle; G, clypeal region; H, pereopod 7; I, pereopod 1; J, uropod; K, maxilliped 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. Svernivig. 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,

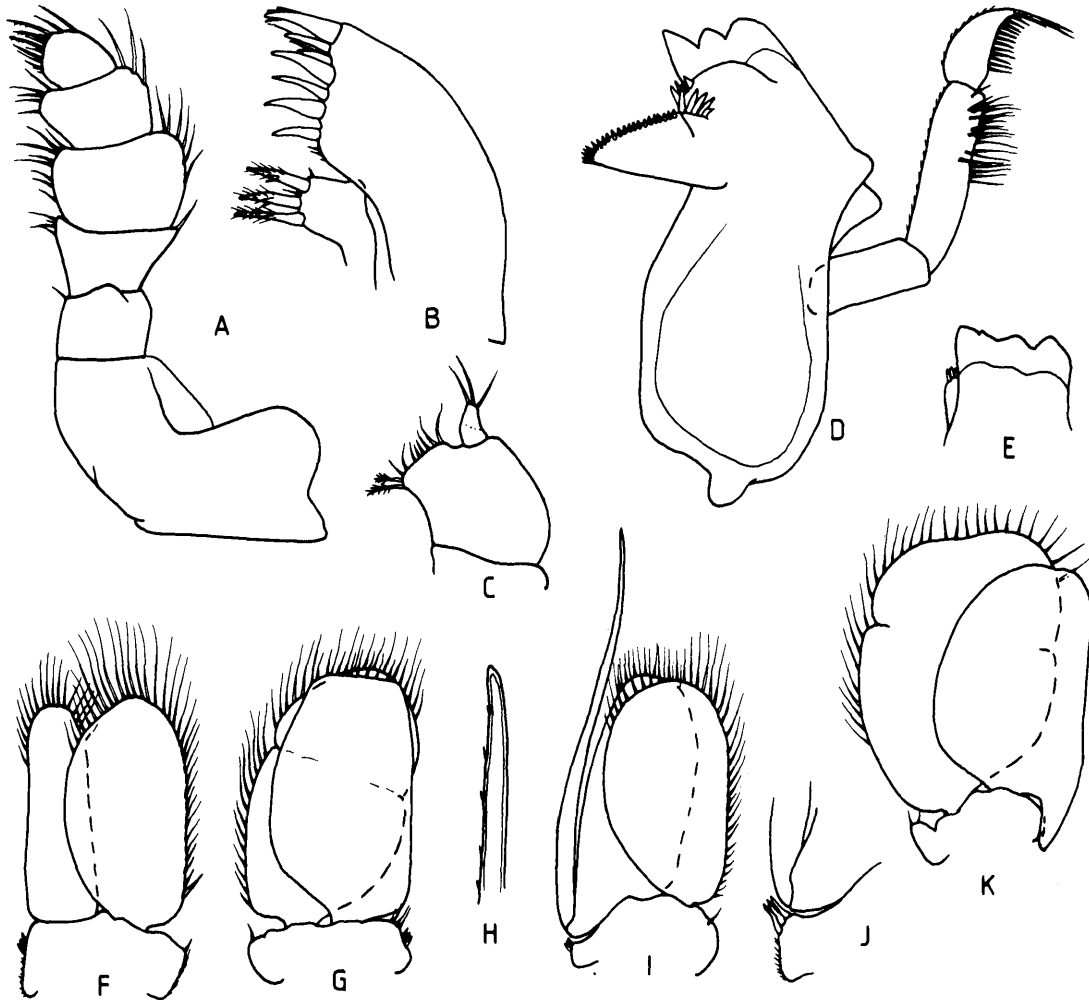


Fig. 141. *Neocirolana hermitensis*. B, G, K, female 8.2 mm; remainder male 8.8 mm. A, maxilliped; B, maxillule; C, maxilla; D, right mandible; E, left mandible, incisor; F, pleopod 1; G, pleopod 3; H, appendix masculina, apex; I, pleopod 2; J, pleopod 2, medial margin of peduncle; K, pleopod 5.

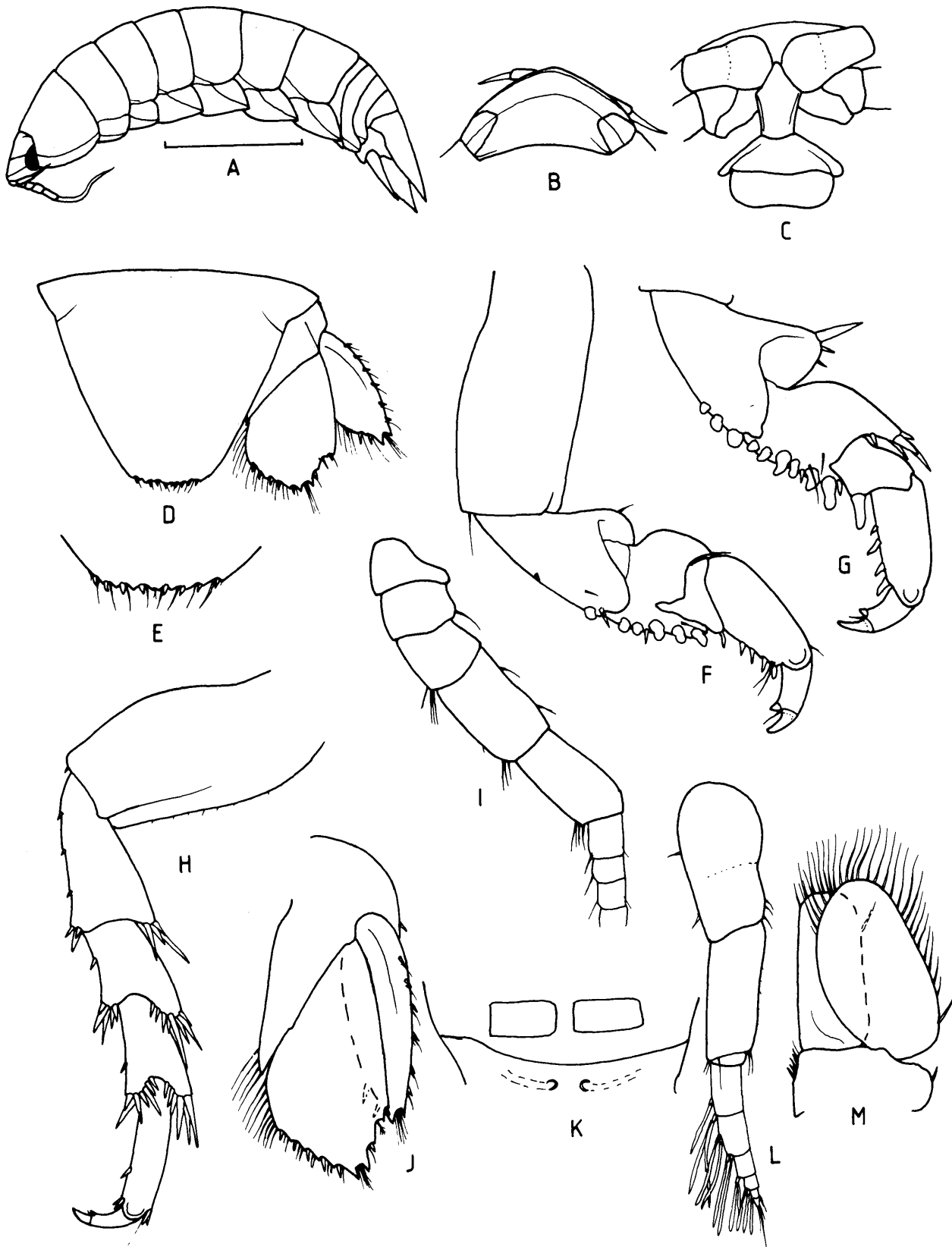


Fig. 142. *Neocirolana obesa*, male 6.9 mm, Stradbroke Is. A, lateral view; B, cephalon, dorsal view; C, clypeal region; D, pleotelson and uropods; E, pleotelson, posterior margin; F, pereopod 1; G, pereopod 2; H, pereopod 7; I, antennal peduncle; J, uropod; K, sternite 7, showing penes; L, antennule;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

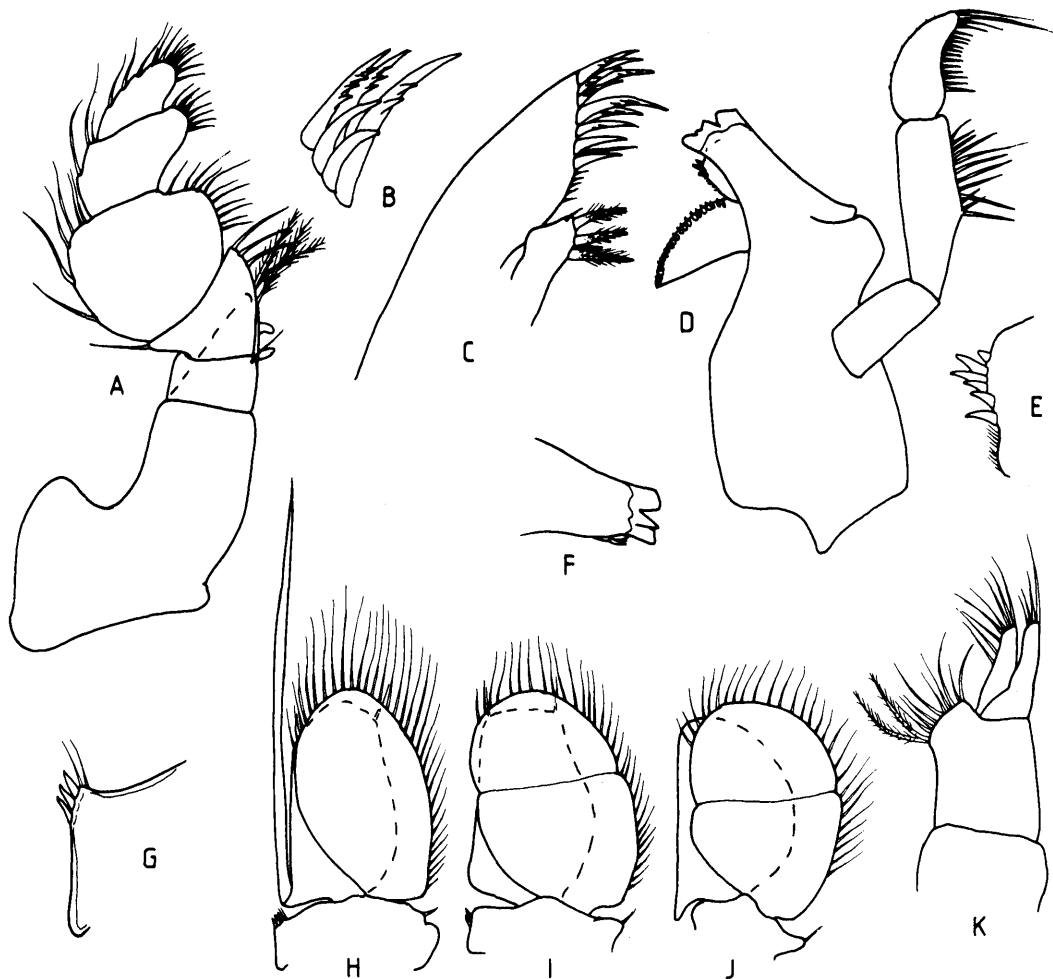


Fig. 143. *Neocirolana obesa*, male 6.9 mm. A, maxilliped; B, maxillule, gnathal spines; C, maxillule; D, left mandible; E, left mandible, lacinia; F, right mandible, incisor; G, pleopod 2, medial margin of peduncle; H, pleopod 2; I, pleopod 4; J, pleopod 5; K, maxilla.

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 biungulate 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

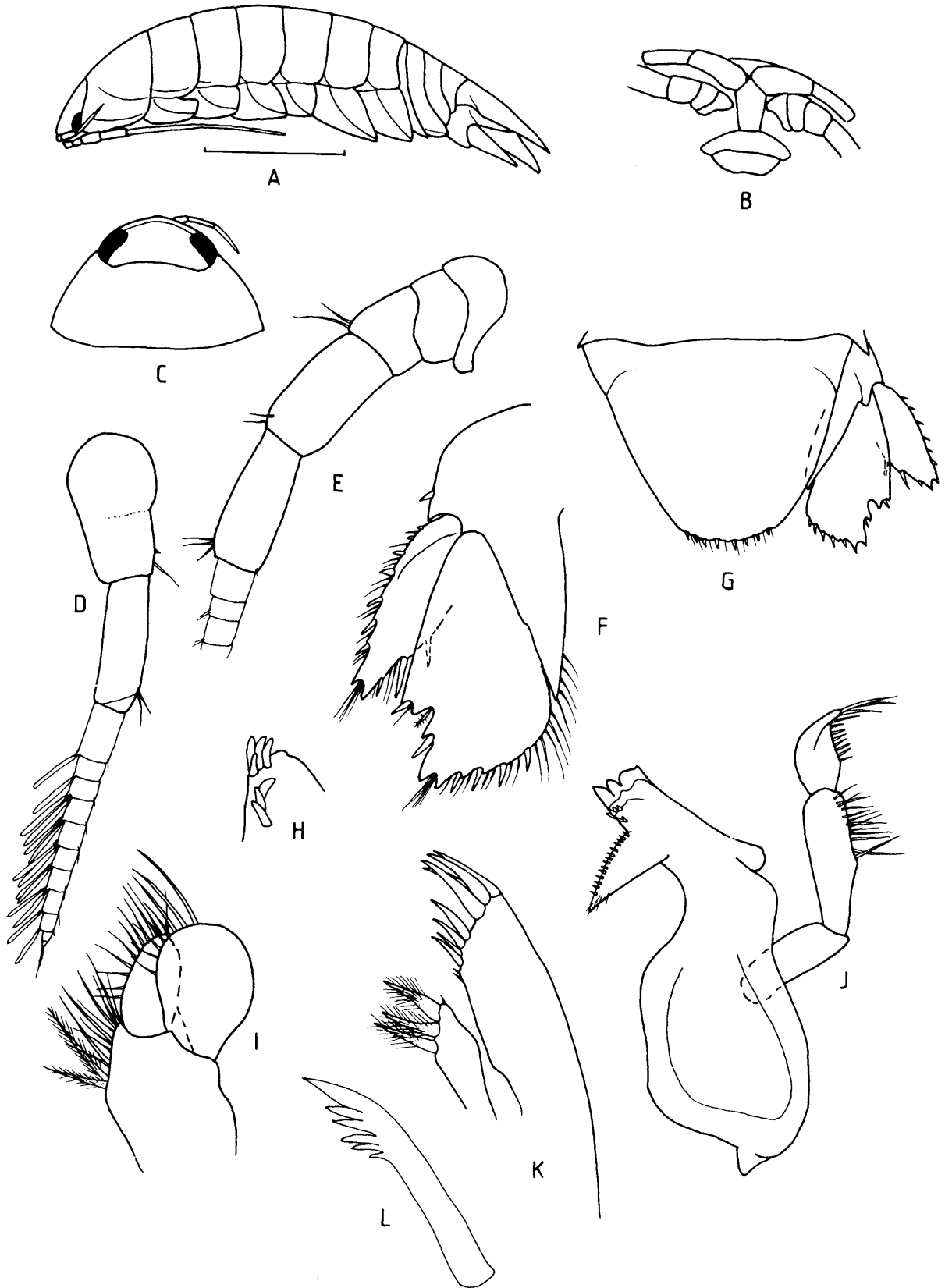


Fig. 144. *Neocirolana excisa*, syntype, except D, E, male, NT. **A**, lateral view; **B**, clypeal region; **C**, cephalon and pereonite 1; **D**, antennule; **E**, antennal peduncle; **F**, uropod; **G**, pleotelson, uropod; **H**, mandibular lacinia; **I**, maxilla; **J**, mandible; **K**, maxillule;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

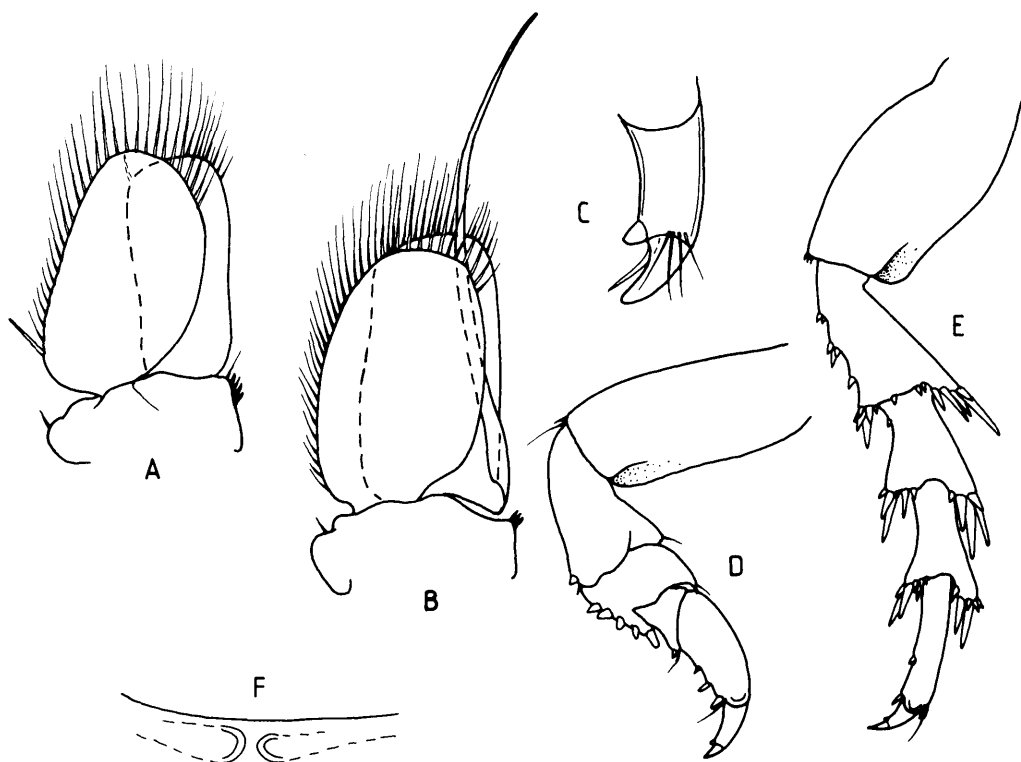


Fig. 145. *Neocirolana excisa*, syntype. **A**, pleopod 1; **B**, pleopod 2; **C**, pereopod 1, dactylus; **D**, pereopod 1; **E**, pereopod 7; **F**, vasa deferentia.

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

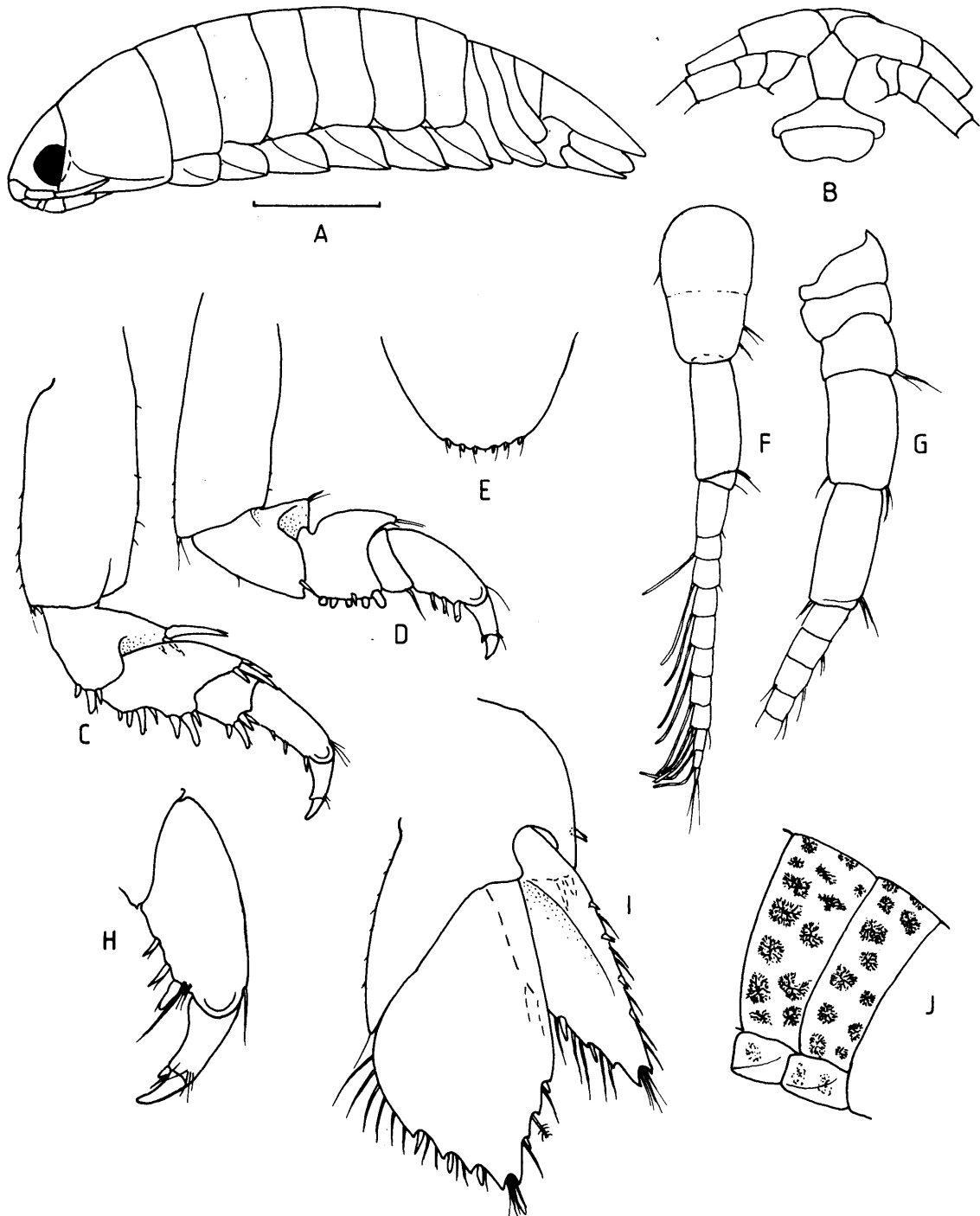


Fig. 146. *Neocirolana maculata* n. sp. A, B, E, holotype; remainder female paratype. A, lateral view; B, clypeal region; C, pereopod 2; D, pereopod 1; E, pleotelson, posterior margin; F, antennule; G, antennal peduncle; H, pereopod 1, propodus; I, uropod; J, pereonites 2 and 3. Scale 1.0 mm.

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.

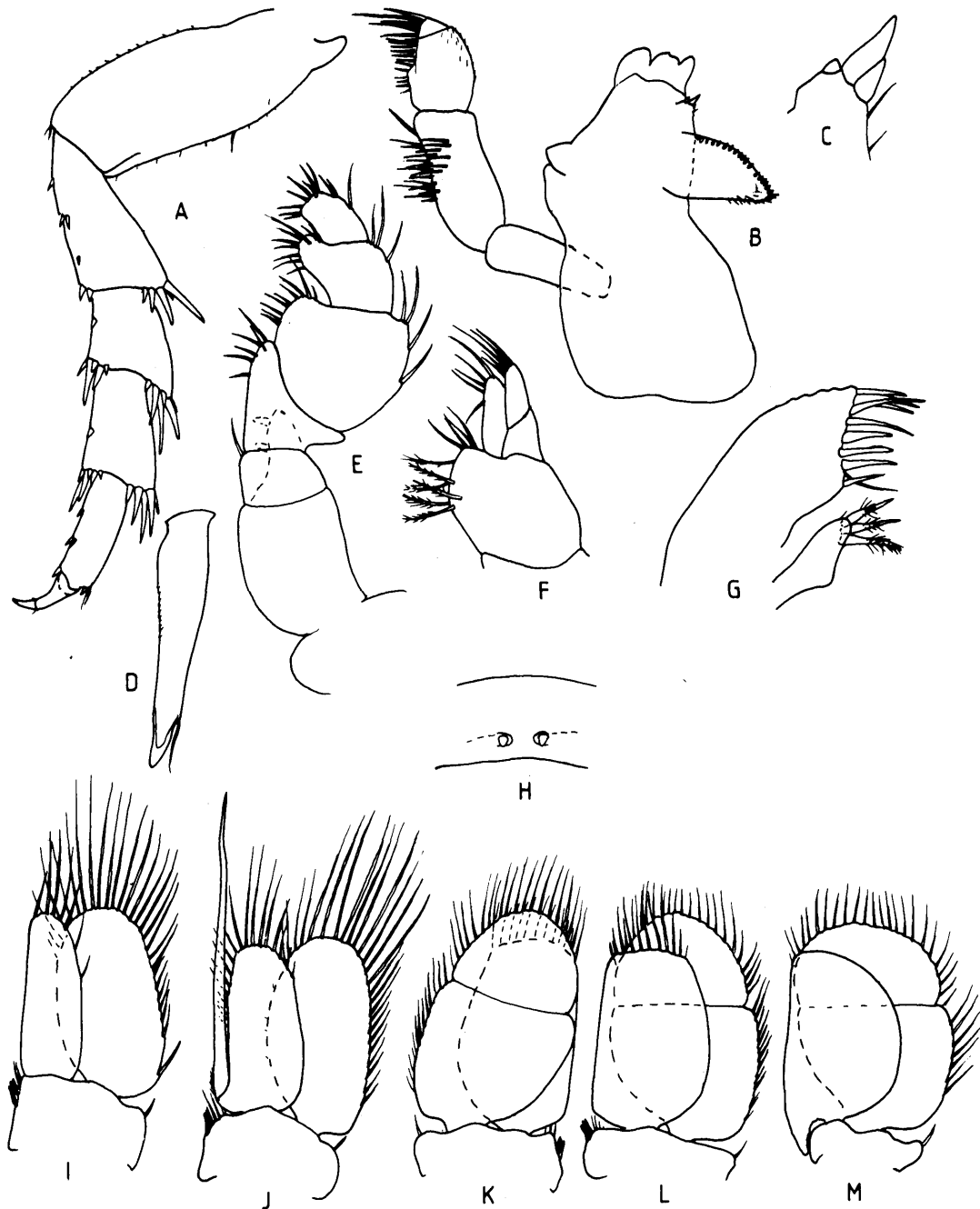


Fig. 147. *Neocirolana maculata* n. sp. H, I, J, holotype; remainder female paratype. A, pereopod 7; B, left mandible; C, lacinia; D, spine from anterodistal angle of ischium, pereopod 7; E, maxilliped; F, maxilla; G, maxillule; H, penes, in situ; I-M, pleopods 1-5 respectively.

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,

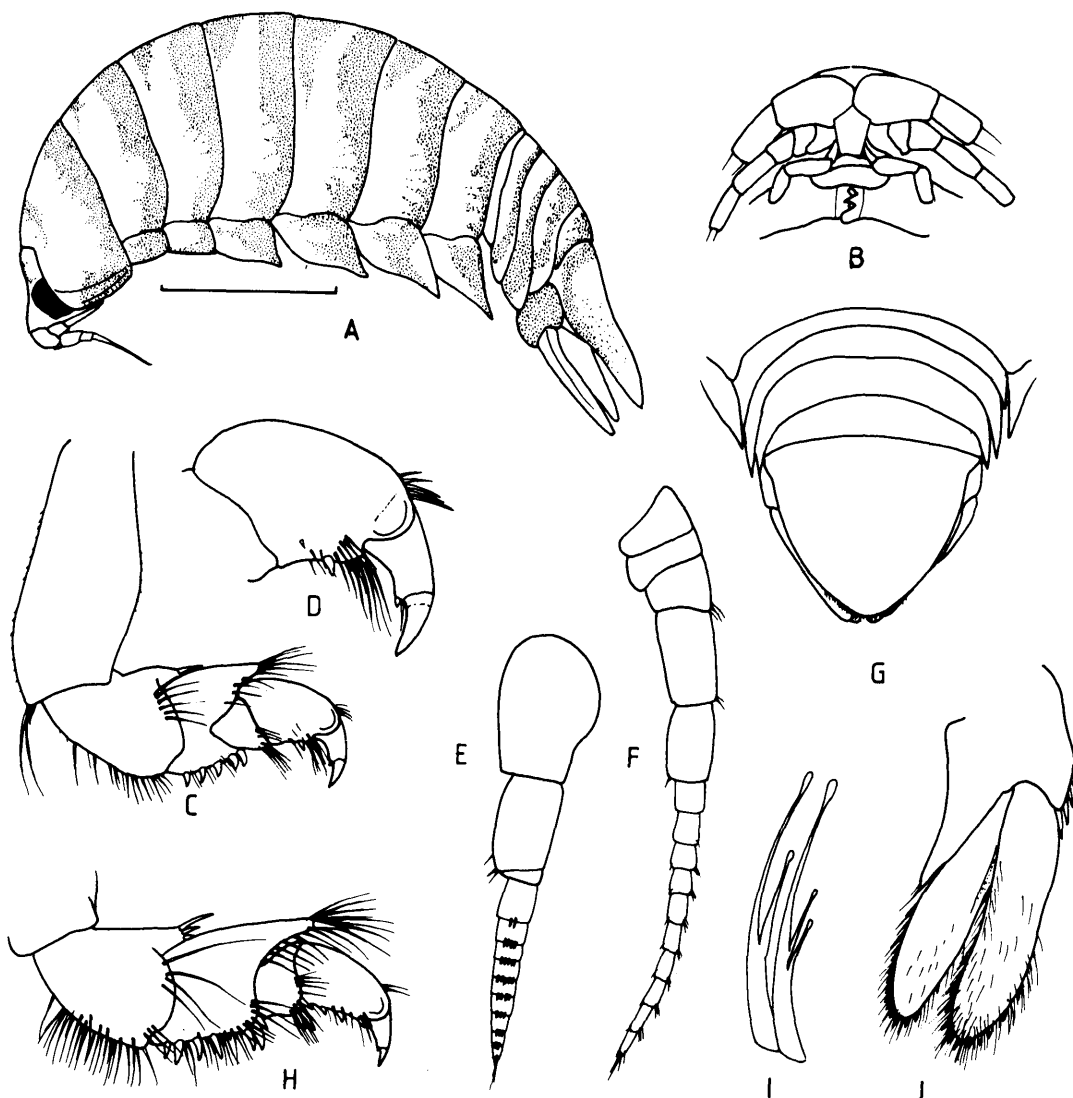


Fig. 148. *Cartetolana integra*. A, female 9.5 mm, One Tree Is.; remainder female 11.3 mm, Hannibal Is. A, lateral view; B, clypeal region; C, pereopod 1, D, pereopod 1, propodus; E, antennule; F, antenna; G, pleon and pleotelson; H, pereopod 2; I, maxillule, spines from gnathal surface of exopod; J,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

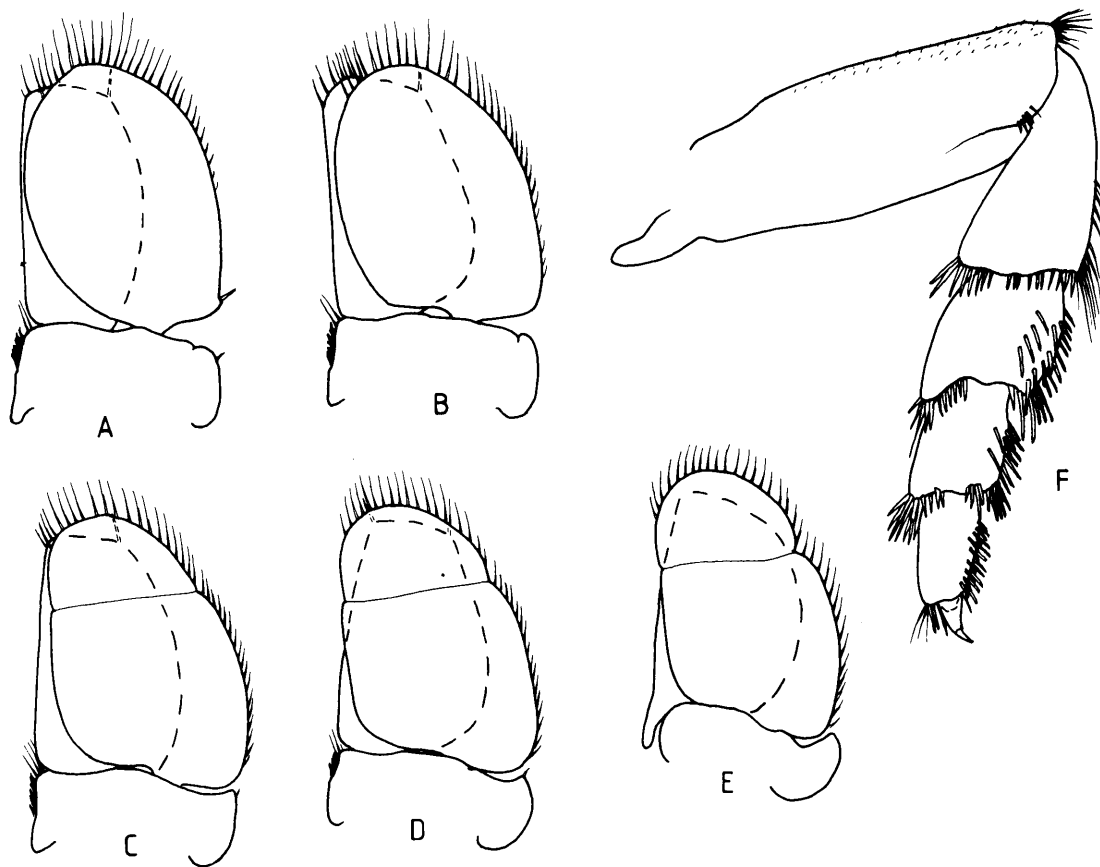


Fig. 149. *Cartetolana integra*, female 11.3 mm, Hannibal Is. A-E, pleopods 1-5 respectively; F, pereopod 7.

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. LXVIII.—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 sub-medially.

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 biungulate 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 derived 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.

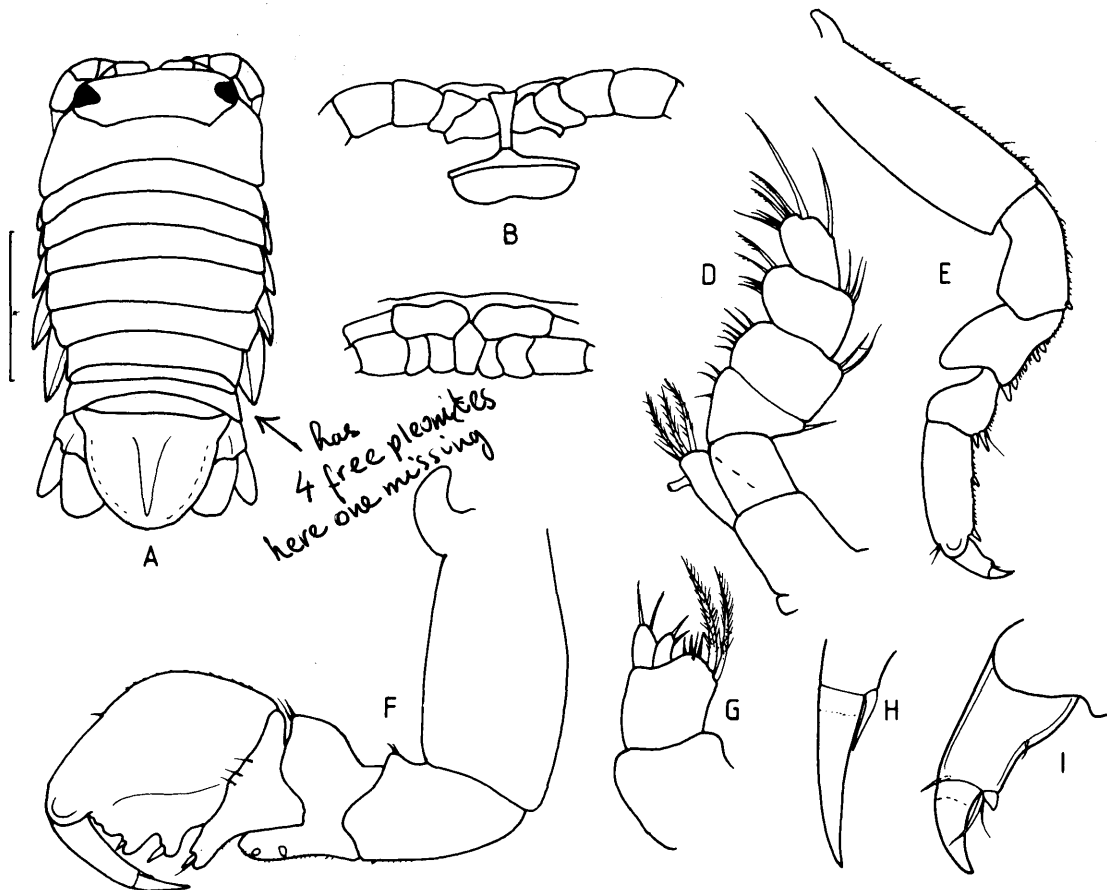


Fig. 150. *Hansenolana anisopous*, manca 3.2 mm, Lizard Is. A, dorsal view; B, clypeal region; C, cephalon, anterior view; D, maxilliped; E, pereopod 2; F, pereopod 1; G, maxilla; H, pereopod 1, dactylus apex; I, pereopod 2 dactylus. Scale 1.0 mm.

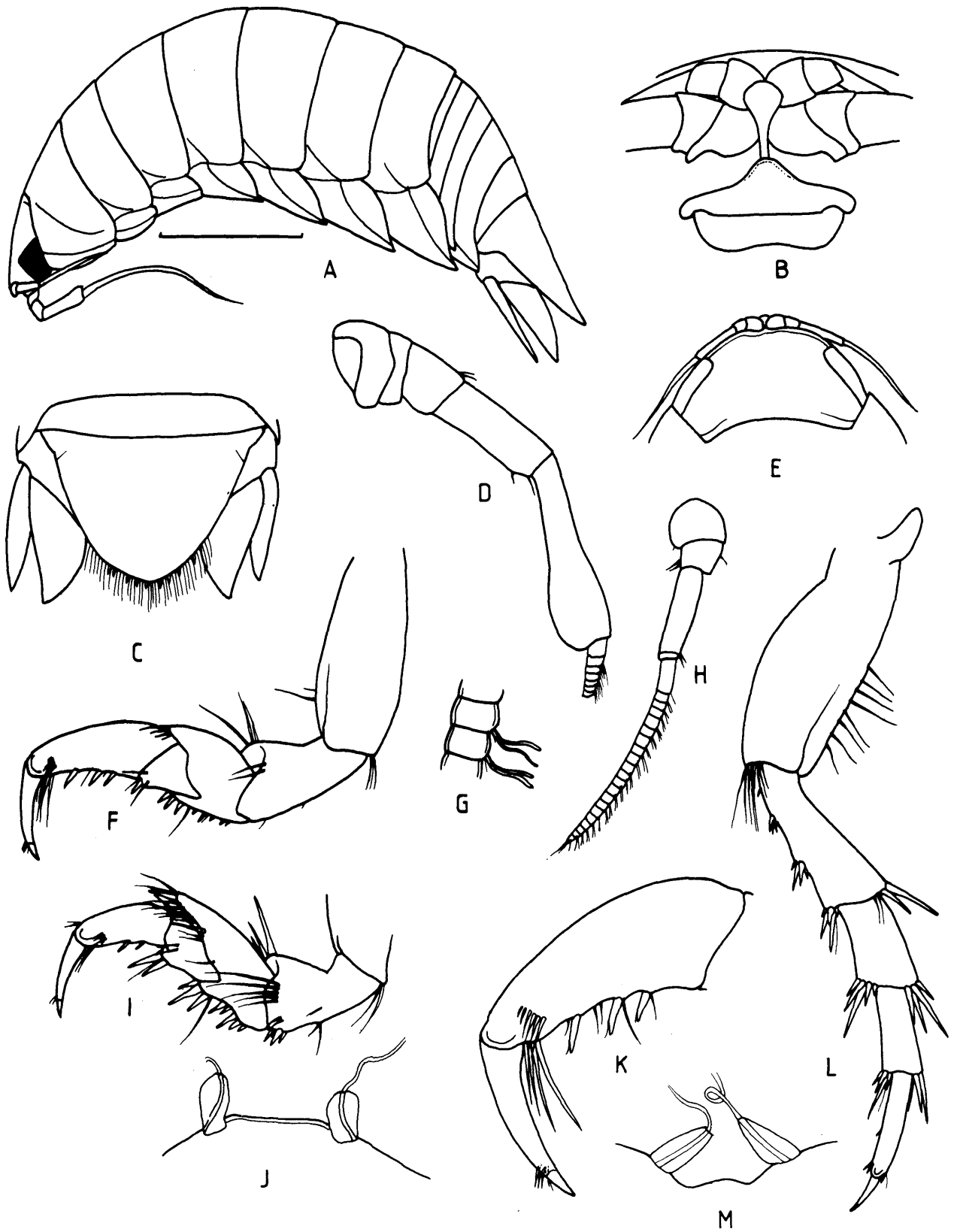


Fig. 151. *Limicolana dinjerra* n. sp. A-C, E, holotype; L, male 11.9 mm; M, male 15.4 mm, NT; remainder male 14.8 mm, Derby. A, lateral view; B, clypeal region; C, pleotelson; D, antennal peduncle; E, cephalon dorsal view; F, pereopod 1; G, antennule, flagellum articles 9, 10; H, antennule; I, pereopod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

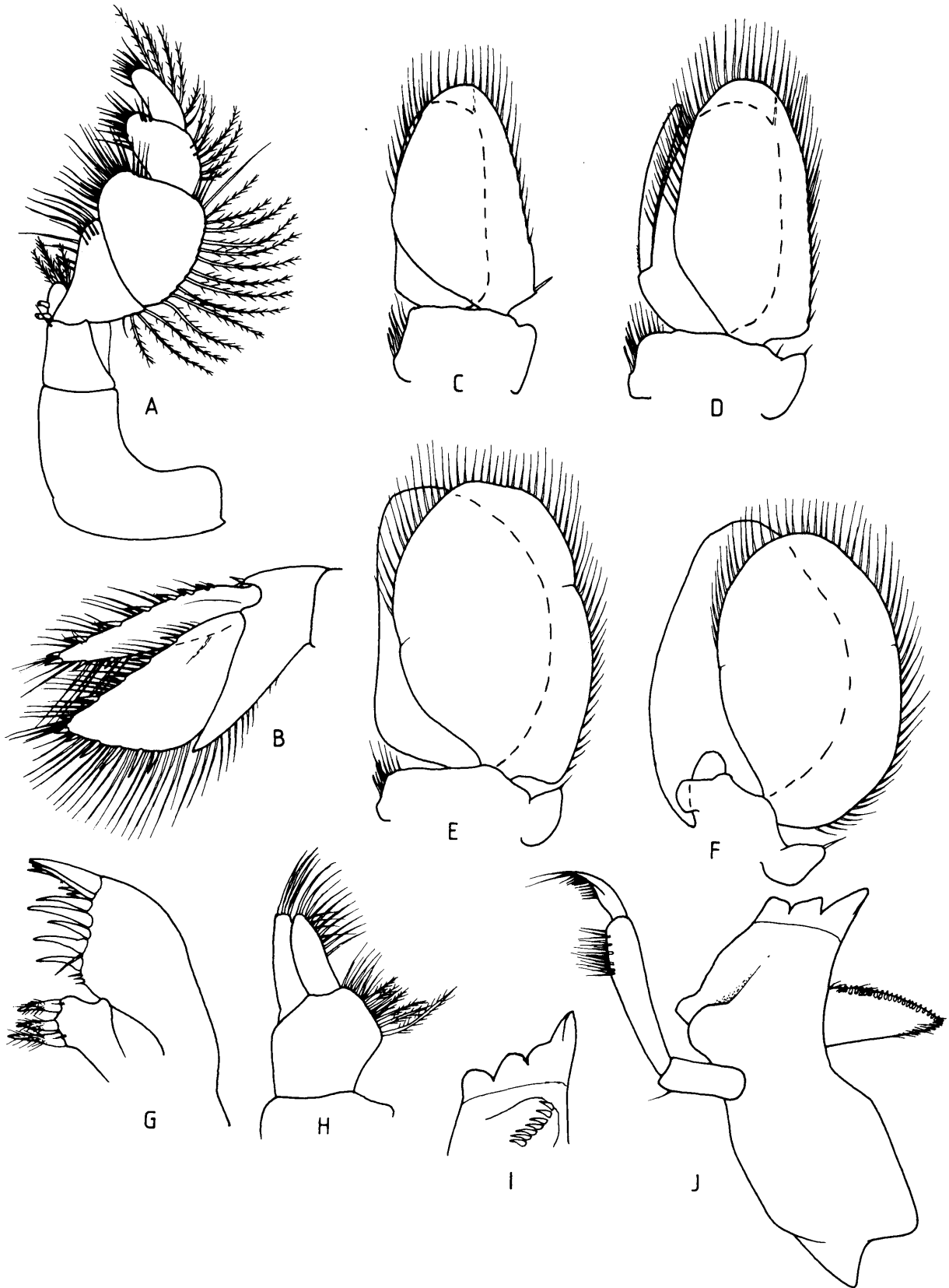


Fig. 152. *Limicolana dinjerra* n. sp. B, male 11.9 mm; remainder male paratype 14.8 mm, Derby. A, maxilliped; B, uropod; C-F, pleopods 1, 2, 4, 5 respectively; G, maxillule; H, maxilla; I, left mandible, incisor; J, right mandible.

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 bathyialis Menzies & George, 1972 (*Metacirolana japonica*).
Cirolana bicarinata Pillai, 1954 (*Cirolana fluviatilis*).
Cirolana bombayensis Joshi & Bal, 1959 (*Excicrolana 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 (*Excicrolana chiltoni*).
Cirolana keopckeii Bott, 1954 (*Excicrolana 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 (*Excicrolana braziliensis*).
Cirolana spinipes Bate & Westwood, 1868 (*Natatolana borealis*).
Cirolana thielemanni 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 (*Exciorolana latipes*).
- Eurydice elengantula* Hansen, 1890 (*Eurydice dollfusi*).
- Eurydice polydendrica* Norman & Stebbing, 1882, *nomen nudum* (*Metacirolana hansenii*).
- 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*.
- Exciorolana bowmani* Jones & Icely, 1981 (*Annina lacustris*).
- Exciorolana japonica* Kussakin, 1979 (*Exciorolana 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 (*Exciorolana*).
- Slabberina* Beneden, 1861 (*Eurydice*).
- Slabberina agata* Beneden, 1861 (*Eurydice pulchra*).
- Slabberina agilis* Sars, 1865 (*Eurydice pulchra*).
- Slabberina gracilis* Bovallius, 1868 (*Eurydice pulchra*).
- Troglaea* 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 (Rioja, 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. radiculicola* (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).
- ~~*Arubolana Brucei* + *Arubolana*~~
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. decemspinus* 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. decemspinus* 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. sulcatauda 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. manovae* 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. vanhoefferi 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 occurring 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. grimaldi 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 (Băcescu, 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. chelifera 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 & Ikehara, 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.

Exciorolana

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. natalensis (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. agaricola 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. schmidtii (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. anophthalma (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.

~~*Nocatolana evocans* 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* Bolívar 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 & Minckley, and *S. affinis* Cole & Minckley. Both species were taken from thermal springs in Mexico.

Sphaeromides Dollfus, 1897. The type species *S. raymondj* 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

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The entire manuscript must be clearly and neatly typewritten, double-spaced, on one side of good quality paper, with 3cm margins all around. Pages should be of even length, spacing and type size. All pages must be numbered consecutively.

When submitting a manuscript on floppy disc, each disc must be split into documents of no more than 50 typed pages. Avoid using tabs and do not justify lines. Never use 'L' or 'I' for the numeral 1.

Each table should be on a separate page. Tables and illustrations should go at the end of the ms, together with the figure captions, which should be all together on one or more pages.

Papers should be arranged as follows: (1) **Title**. The higher classification of the group dealt with should be indicated in the title of zoological papers; in paleontological papers the position of a local formation in the world scheme should be indicated. Series titles should not be used. (2) **Authors' names**, followed by authors' postal address (keyed to the authors' names by superior letters). Current addresses to be indicated by footnotes if necessary. (3) **Abstract**. Generally not to exceed 200 words (or 2% of total length for long papers), and to be intelligible by itself. (4) **Keywords**. To facilitate information retrieval, up to 10 keywords should be chosen to outline the main subjects covered. (5) **Contents list**, if paper is very long. (6) **Introduction**. (7) **Main text**. (8) **Acknowledgements**. (9) **References** (see below). (10) **Index**, if paper is very long.

Footnotes should be avoided unless absolutely necessary. The approximate positions of figures and tables should be noted in pencil in the left-hand margin.

Underlines should only be used to indicate italics (names of genera and species should always be underlined). Unless indicated elsewhere in the text, or where nomenclature follows a generally accepted standard (which should be cited), the authority should be cited when any specific name is used for the first time.

In taxonomic papers the short form (taxon, author, date, page) should be used. In synonymies a period and a dash (-) should separate the name of the taxon and the name of the author except in the case of the reference to the original description. Where new species are described the location of the type material must be indicated and Article 73 and associated recommendations of the International Code of Zoological Nomenclature should be followed.

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Mayr, E., E.G. Linsley & R.L. Usinger, 1953. *Methods and principles of systematic zoology*. McGraw-Hill, New York, pp ix + 328.

Schone, H., 1961. Complex behaviour. In 'The physiology of Crustacea' (ed T.H. Waterman) Vol. 2: 465-520. Academic Press, New York.

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