

The isopod parasites (Crustacea: Isopoda: Bopyridae) of decapod Crustacea of Queensland, Australia, with descriptions of three new species

John C. MARKHAM

Arch Cape Marine Laboratory, Arch Cape, Oregon 97102-0133, USA. Email: jmarkham@seasurf.net

Citation: Markham, J.C. 2010 12 30. The isopod parasites (Crustacea: Isopoda: Bopyridae) of decapod Crustacea of Queensland, Australia, with descriptions of three new species. In, Davie, P.J.F. & Phillips, J.A. (Eds), Proceedings of the Thirteenth International Marine Biological Workshop, The Marine Fauna and Flora of Moreton Bay, Queensland. *Memoirs of the Queensland Museum — Nature* 54(3): 151-197. Brisbane. ISSN 0079-8835.

ABSTRACT

Thirty species of Bopyridae in 25 genera and six subfamilies are listed for Queensland, of which 13 represent new state records, and eight are new to the Australian fauna. Of these, three new species are described: *Scyracepon australiana* sp. nov., infesting the crab *Australoplax tridentata* (A. Milne Edwards); *Athelges ankistron* sp. nov., infesting the hermit crab *Diogenes pallescens* Whitelegge; and *Diplophryxus negrimaculatus* sp. nov. infesting the palaemonid shrimp *Phycomenes zostericola* Bruce. Five previously described species are new records for Australia: *Pagurion tuberculata* Shiino, 1933; *Pseudione magna* Shiino, 1951; *Dactylokepon richardsonae* Stebbing, 1910; *Megacepon choprai* George, 1946; *Eophrixus kuboii* (Shiino, 1939). New Queensland records are: *Anuropodione australiensis* Bourdon, 1976; *Aporobopyrina lamellata* Shiino, 1934; *Parathelges aniculi* (Whitelegge, 1897); *Pseudostegias dulcilacuum* Markham, 1982; *Diplophryxus jordani* Richardson, 1904. Eleven species are recorded from Moreton Bay. *Parabopyrella barnardi australiensis* (Bourdon, 1980) is formally raised to full species status. *Parathelges weberi* Nierstrasz & Brender à Brandis, 1923, and *P. whiteleggei* Nierstrasz & Brender à Brandis, 1931, are considered junior synonyms of *Parathelges aniculi* (Whitelegge, 1897). An earlier record of *Pseudostegias setoensis* Shiino, 1933, from Queensland is re-identified as *P. dulcilacuum* Markham, 1982. Seventeen new bopyrid hosts are recorded. All species newly collected in Queensland waters are illustrated, and most are partially or completely described. Synonymies are complete except where otherwise noted, and are presented for all species known to occur in Queensland. □ *Bopyridae, new species, Queensland, Australia, Moreton Bay, taxonomy, parasitism, Decapoda*

Nine species of Bopyridae were collected during field work associated with the Thirteenth International Marine Biological Workshop on the Marine Fauna and Flora of Moreton Bay, Queensland, during February 2005. While that material forms the core of this report, the opportunity has been taken to review the bopyrid fauna of Queensland as a whole. Accordingly, other collections in the Queensland Museum were examined, and these were supplemented, as necessary, by examination of types and material from other Australian and European museums. In their

catalogue of the Isopoda of Australia, Poore *et al.* (2002) list 31 species of 26 genera in 8 subfamilies of Bopyridae, including 17 species of 12 genera in 5 subfamilies from Queensland. The total for Queensland is here raised to 30 species in 25 genera in 6 subfamilies, and the Australian total is consequently raised to 39 species. Table 1 gives a full listing of the species dealt with in this paper and a summary of their host records and localities in Australian waters.

Abbreviations: AM, Australian Museum, Sydney; QM, Queensland Museum; ZMA, Zoological

Table 1. Queensland Bopyridae. Species new to the Queensland fauna are marked ^[QR], new Australian records as ^[AR], and new host records ^[HoR].

Subfamily/Species	Australian Hosts	Australian Localities
Pseudioninae		
<i>Albunione australiana</i> Markham & Boyko, 1999	<i>Albunea microps</i>	Rudder Reef, off Mossman, Qld
<i>Anuropodione australiensis</i> Bourdon, 1976 ^[QR]	<i>Pisidia dispar</i>	Moreton Bay
<i>Aporobopyrina lamellata</i> Shiino, 1934 ^[QR]	<i>Petrolisthes scabriculus</i> ^[HoR] <i>Petrolisthes lamarckii</i>	Heron Island
<i>Pagurion tuberculata</i> Shiino, 1933 ^[AR]	<i>Dardanus arrosor</i> ^[HoR] <i>Dardanus hessii</i> ^[HoR]	Capricorn Channel, SE Qld Gulf of Carpentaria
<i>Pseudione magna</i> Shiino, 1951 ^[AR]	<i>Heterocarpus sibogae</i>	Capricorn Channel, SE Qld
Bopyrinae		
<i>Bopyrina ocellata</i> (Czerniavsky, 1869)	<i>Hippolyte</i> sp.	Moreton Bay
<i>Parabopyrella australiensis</i> (Bourdon, 1980)	<i>Alpheus richardsoni</i> ^[HoR] ?	Moreton Bay
<i>Parabopyrella indica</i> (Chopra, 1923)	<i>Synalpheus</i> sp.	Sandy Strait, Qld
<i>Parabopyrus kiiensis</i> Shiino, 1934	<i>Athanas</i> sp.	Bustard Bay, Qld
<i>Probynia obstipa</i> Bourdon & Bruce, 1983	<i>Periclimenaeus hecate</i> <i>Typton wasini</i>	Great Barrier Reef; Moreton Bay
<i>Schizobopyrina andamanica</i> (Chopra, 1923)	<i>Periclimenes</i> & <i>Periclimenaeus</i> species	off NE coast of Qld
<i>Schizobopyrina lobata</i> (Bourdon & Bruce, 1983)	<i>Tozeuma</i> sp.	Bribie Passage, off Caloundra, Moreton Bay
<i>Schizobopyrina platylobata</i> (Bourdon, 1983)	<i>Anchistus custos</i>	Port Denison, N. Qld; Moreton Bay
Ioninae		
<i>Allokepon tiariniae</i> (Shiino, 1937)	<i>Tiarinia</i> sp.	Lizard I., Qld
<i>Dactylokepon richardsonae</i> Stebbing, 1910 ^[AR]	<i>Charybdis anisodon</i> ^[HoR]	Cape York
<i>Megacepon choprai</i> George, 1946 ^[AR]	<i>Perisesarma erythodactyla</i>	Susan R., Hervey Bay, SE Qld
<i>Scyracepon australiana</i> , sp. nov. ^[AR]	<i>Australoplax tridentata</i> ^[HoR]	Moreton Bay
Orbioninae		
<i>Epipenaeon ingens</i> Nobili, 1906	<i>Penaeus semisulcatus</i> <i>P. merguensis</i> <i>P. indicus</i>	N Australia from Darwin, NT to Maryborough, SE Qld
<i>Orbione halipori</i> Nierstrasz & Brender à Brandis, 1923	<i>Metapenaeopsis rosea</i> ^[HoR]	Cairns
<i>Parapenaeon expansa</i> Bourdon, 1979	<i>Penaeus indicus</i> <i>P. latisulcatus</i> , <i>P. longistylus</i> , <i>P. merguensis</i> , <i>P. monodon</i> , <i>P. plebjus</i>	Widespread across northern Australia and eastern Qld south to Moreton Bay
<i>Parapenaeonella lamellata</i> Bourdon, 1979	<i>Metapenaeus ensis</i> <i>M. endeavouri</i>	Gulf of Carpentaria, Qld

continued ...

Table 1 (continued)

Subfamily/Species	Australian Hosts	Australian Localities
Athelginae		
<i>Athelges ankistron</i> sp. nov. ^[AR]	<i>Diogenes pallescens</i> ^[HoR]	Moreton Bay
<i>Parathelges aniculi</i> (Whitelegge, 1897) ^[QR]	<i>Clibanarius</i> sp. ^[HoR] ? <i>Dardanus</i> sp. ^[HoR] ?	Cape York Peninsula; Great Barrier Reef
<i>Pseudostegias dulcilacuum</i> Markham, 1982 ^[QR]	<i>Clibanarius taeniatus</i> <i>Clibanarius virescens</i>	Gulf of Carpentaria; nr Rockhampton, E Qld
<i>Pseudostegias setoensis</i> Shiino, 1933	<i>Diogenes pallescens</i> ^[HoR]	Gulf of Carpentaria
Hemiarthrinae		
<i>Diplophryxus jordani</i> Richardson, 1904 ^[QR]	<i>Palaemon serenus</i> ^[HoR] <i>Periclimenes sarkanae</i> ^[HoR]	Moreton Bay; Townsville
<i>Diplophryxus negrimaculatus</i> sp. nov. ^[AR]	<i>Phycomenes zostericola</i> ^[HoR]	Gold Coast
<i>Eophryxus kuboi</i> (Shiino, 1939) ^[AR]	<i>Periclimenaeus obscurus</i> ^[HoR] <i>Periclimenes sarkanae</i> ^[HoR]	Moreton Bay
<i>Filophryxus dorsalis</i> Bruce, 1972	<i>Periclimenes hertwigi</i>	off coast of SE Qld
<i>Metaphryxus intutus</i> Bruce, 1965	<i>Periclimenes</i> (?) <i>grandis</i> <i>Palaemonella rotumanus</i> <i>Periclimenes platycheles</i>	John Brewer Reef, Qld; Darwin Harbour, NT; Northern Great Barrier Reef

Museum, Amsterdam; ZMUC, Zoological Museum, University of Copenhagen.

SYSTEMATICS

BOPYRIDAE Rafinesque, 1815

PSEUDIONINAE Codreanu, 1967

Albunione Markham & Boyko, 1999

Type-species: *Ione indecora* Markham, 1988, by original designation.

Remarks. *Albunione* was originally placed in the Ioninae as the only representative of that subfamily in Australia (Poore *et al.* 2002), but Markham & Boyko (2003) have since reassessed its relationships and moved it to the Pseudioninae.

Albunione australiana Markham & Boyko, 1999

Albunione australiana Markham & Boyko, 1999: 1, 5–7, figs 3, 4 [Type-locality: Rudder Reef, off Mossman, Qld, 16°11'S, 145°40'E; infesting *Albunea microps* Miers]; Boyko, 2002: 253; Poore, 2002: 2; Poore *et al.*, 2002: 124; Markham & Boyko, 2003: 1, 4–6.

Remarks. *Albunione australiana* is known only from the type specimens from Queensland.

Anuropodione Bourdon, 1967

Type-species: *Anuropodione senegalensis* Bourdon, 1967, by original designation.

Anuropodione australiensis Bourdon, 1976
(Figs 1, 2)

Anuropodione australiensis Bourdon, 1976: 166, 233–236, 241, figs 41, 42 [Type-locality: Cockburn Sound, Western Australia; infesting *Pisidia dispar* (Stimpson)]; Poore *et al.*, 2002: 127.

Material Examined. QM-W10272, ♀, ♂, infesting *Pisidia dispar* (Stimpson, 1858) from unidentified sponge, intertidal seagrass flats, Polka Point, Dunwich, North Stradbroke I., Moreton Bay, Qld, 27°29.6' S, 153°23.9' E, 14.07.1980, T.S. Hailstone. QM-W29063, ♀, ♂, in unidentified grey sponge, same locality, 09.02.2005, J.C. Markham.

Remarks. This is only the second discovery of *Anuropodione australiensis*, and a new record for Queensland. Its host, *Pisidia dispar*, is the same as previously reported for the type from Cockburn Sound, Western Australia. In both sexes, there is notable variation from the types, but this only extends the considerable intraspecific variability already illustrated and commented on by Bourdon (1976). In the females, the body outline and general aspect are quite similar,

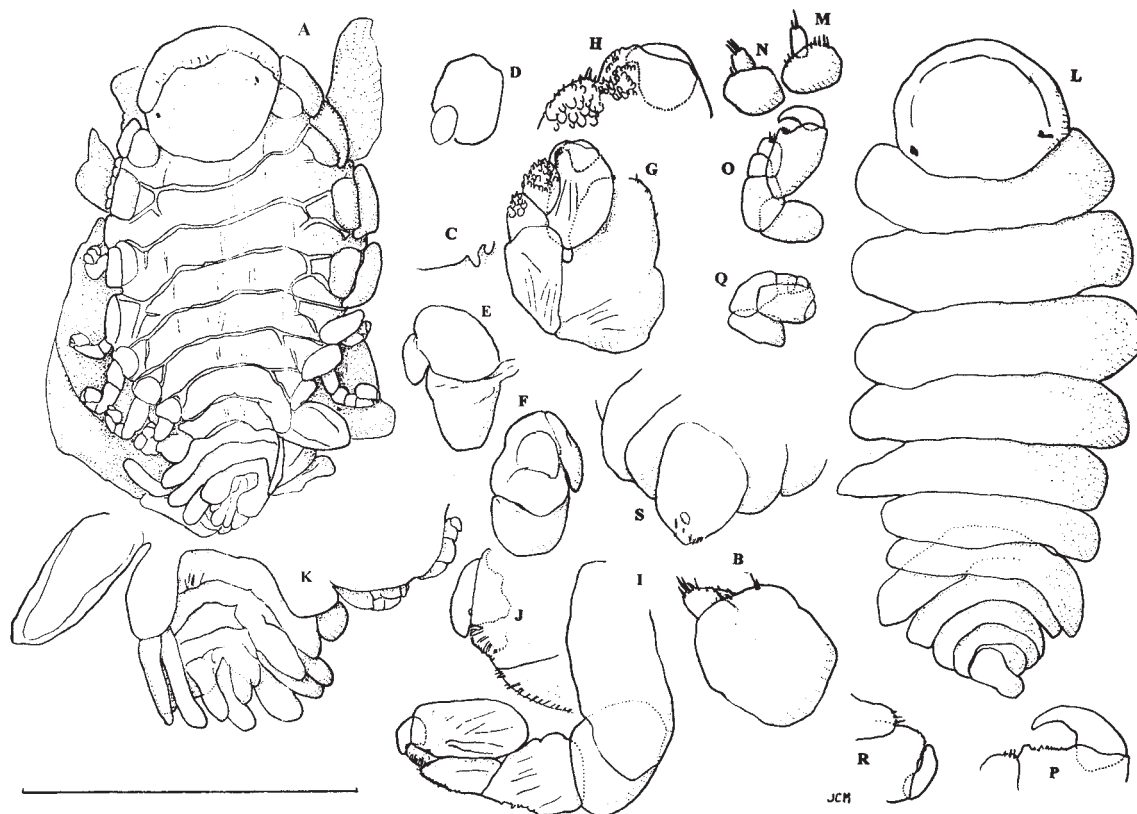


FIG. 1. *Anuropodione australiensis* Bourdon, 1976. A-K female; L-R male, QM-W10272 A, dorsal view. B, right antenna 1. C, left side of barbula. D, right maxilliped, external view. E, right oostegite 1, external. F, same, internal. G, right pereopod 1. H, distal region of same. I, right pereopod 7. J, distal region of same. K, pleon, ventral. L, dorsal view. M, right antennae. N, left pereopod 1. O, distal region of same. P, left pereopod 7. Q, distal region of same. R, posterior end of pleon, ventral. Scale: 1.84 mm for A, C-F; 1 mm for K; 0.32 mm for B, G, I, L, O, Q; 0.16 mm for H, J, M, N, P, R, S.

though the present females lack the distinctive falcate posterolateral point on the first oostegite (Fig. 1E, F); the markedly corneous surfaces of the propodi, carpi and meri (Fig. 1G, H) of the first pereopod were not previously mentioned. Males (Fig. 1K-Q, Fig. 2) are quite similar except for their pleons, previously reported to be highly variable within this species (Bourdon 1976). All of the newly examined specimens have distinct eyes, in contrast with the types, but those specimens probably lost their eyes during lengthy preservation prior to examination.

Aporobopyrina Shiino, 1934

Type-species: *Aporobopyrina lamellata* Shiino, 1934, by original designation.

Aporobopyrina lamellata Shiino, 1934

(Figs 3-5)

Aporobopyrina lamellata Shiino, 1934: 263-265, 267, fig. 3 [Seto, Japan; infesting *Petrolisthes pubescens* Holmes (identification corrected to *P. coccineus* (Owen) by Bourdon, 1976a)]; Shiino, 1936a: 161 [Shimoda, Japan; infesting *P. hastatus* Stimpson]; 1952: 39; 1972: 8; Bourdon, 1972: 114; 1976: 166, 215-219, 240, 241, figs 31, 32 [Madagascar, infesting *Petrolisthes penicillatus* (Heller) and *P. lamarckii* (Leach); and Mindanao, Philippines, infesting *P. lamarckii*]; 1983: 851 [Moluccas, Indonesia, infesting *P. hastatus*]; Ghani, 1974: 71, 72, figs C, D [Northern Arabian Sea, infesting *Pachycheles tomentosus* Henderson]; Markham, 1980: 623, 624-625, figs 3-5 [Karachi, Pakistan, infesting *P. rufescens* Heller]; 1985b: 3, 10-12, 62, fig. 4, table 1 [Phuket, Thai-

land, infesting *P. lamarckii*]; Harada, 1991: 199; Schotte, 1995: 117 [Karachi and Manora Islands, Pakistan, infesting *P. rufescens*]; Kazmi & Bourdon, 1997: 59; Saito *et al.*, 2000: 35; Hussain, 2001: 65; Kensley, 2001: 222; Kazmi *et al.*, 2002: 59.

? '*A. microniscus*' – Lester, 2005: 142, fig. 4.8 [Heron I.; larva infesting unident. copepod].

Material Examined. QM-W16924, ♀, ♂, infesting *Petrolisthes scabriculus* (Dana, 1852), Wistari Reef, Heron I., Qld, 23°27'S, 151°55'E, 15.02.1990, J.D. Shields & F.S. Wood. QM-W16925, ♀, infesting *Petrolisthes lamarckii* (Leach, 1820), beach rock, Heron I., Qld, 23°27'S, 151°55'E, 14.09.1989, J.D. Shields.

Remarks. The new material is the first record of *Aporobopyrina lamellata* from Australia. *Petrolisthes lamarckii* was previously recorded as its host, but *P. scabriculus* is a new record. *P. scabriculus* is known to host two other species of pseudoinines in the Philippines and Moluccas belonging to different genera (Bourdon 1976a, 1983). The female infesting *P. lamarckii* (Fig. 5) is more similar to those previously recorded, than is the female from *P. scabriculus* (Fig. 3), the latter being proportionately more slender and having a distinct palp on the mandible. Both show well the strongly carinate basis of the seventh pereopod.

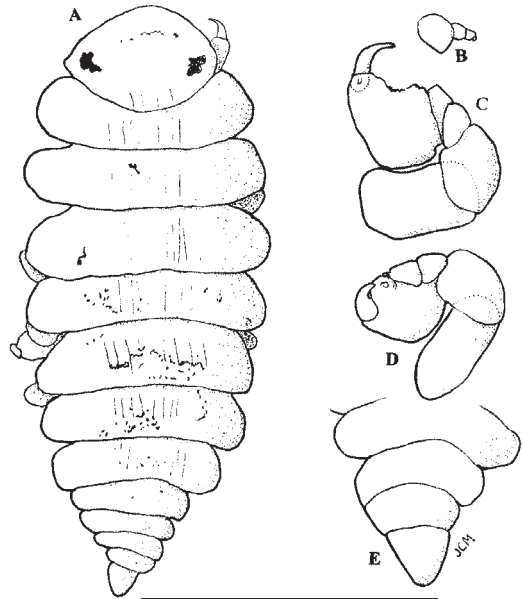


FIG. 2. *Anuropodione australiensis* Bourdon, 1976, male, QM-W29063. A, dorsal view. B, left antenna 1. C, right pereopod 1. D, end of pleon, ventral. Scale: 0.5 mm for A; 0.25 mm for B-E.

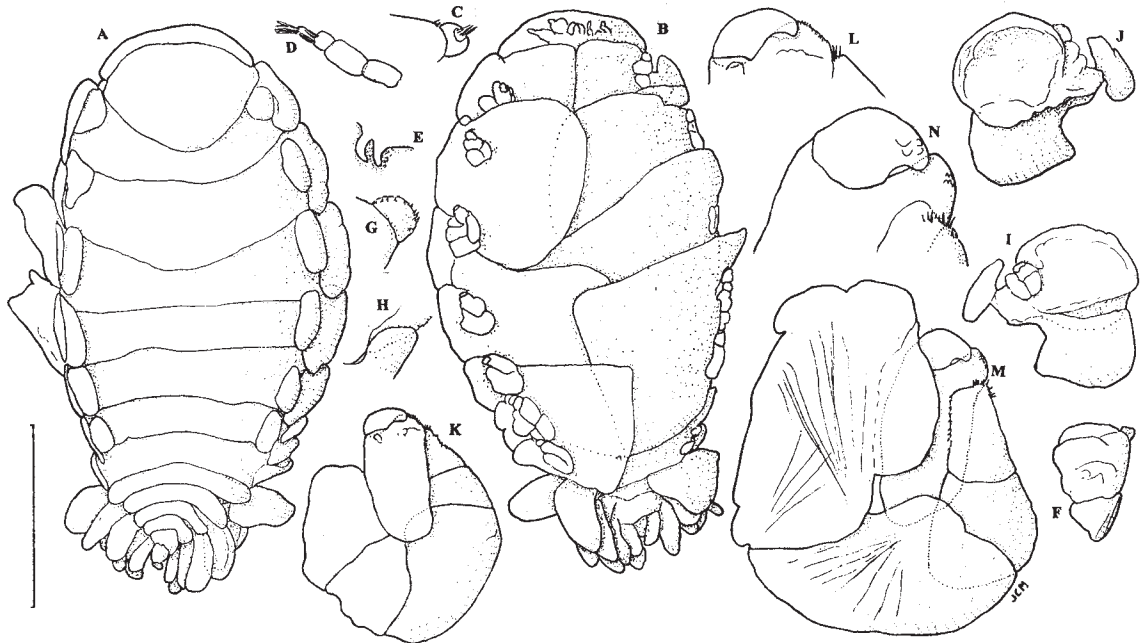


FIG. 3. *Aporobopyrina lamellata* Shiino, 1934, female. QM-W16924. A, dorsal view. B, ventral view. C, right antenna 1. D, right antenna 2. E, right side of barbula. F, right maxilliped. G, palp of same. H, plectron of same. I, right oostegite 1, external, J, same, internal. K, right pereopod 1. L, distal region of same. M, right pereopod 7, N, distal region of same. Scale: 1 mm for A, B, E, F, I, J; 0.43 mm for G, H; 0.22 mm for C, D, K, M; 0.1 mm for L, N.

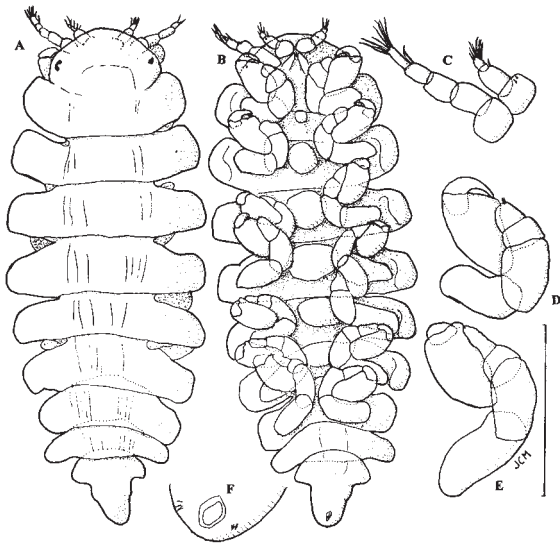


FIG. 4. *Aporobopyrina lamellata* Shiino, 1934, male. QM-W16924. A, dorsal view. B, ventral view. C, right antennae. D, right pereopod 1. E, right pereopod 7. Scale: 0.4 mm for A, B; 0.2 mm for C-E; 0.1 mm for F.

The male (Fig. 4) is closely similar to those seen before; its outline is most like that of the male from Thailand (Markham 1985b), while its pleon, which appears to be quite variable in this species, is most like that of the male shown by Bourdon (1976a). *Aporobopyrina lamellata* is now known to range far, from Australia and Thailand through Japan and Indonesia across the Indian Ocean to Pakistan. All six host species belong to the porcellanid genus *Petrolisthes*.

Lester (2005) shows a photograph of a micronesian larva from Heron I., where the present studied material was collected. That larva could belong to *Aporobopyrina lamellata*, but it could as easily belong to almost any other species of Australian bopyrid.

Pagurion Shiino, 1933

Type-species: *Pagurion tuberculata* Shiino, 1933, by monotypy.

Pagurion tuberculata Shiino, 1933

(Figs 6, 7)

Pagurion tuberculata Shiino, 1933: 254–256, fig. 2 [Tanabe Bay, Japan, infesting *Pagurus watasei* Terao (=

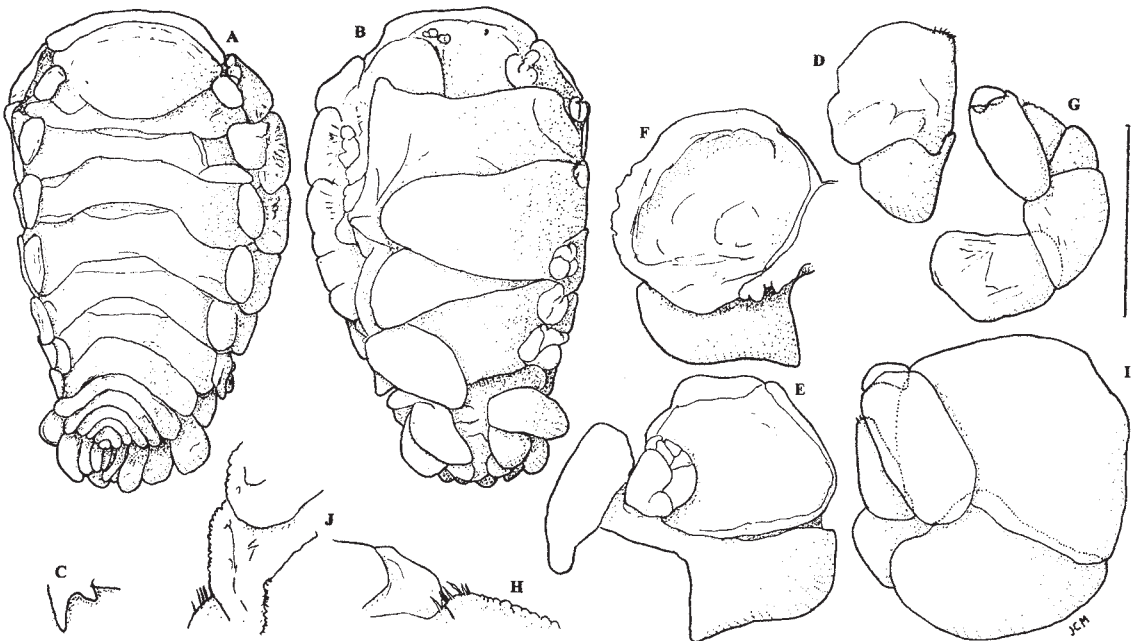


FIG. 5. *Aporobopyrina lamellata* Shiino, 1934, female. QM-W16925. A, dorsal view. B, ventral view. C, right side of barbula. D, right maxilliped. E, right oostegite 1, external. F, same, internal. G, right pereopod 1. H, distal edge of same. I, right pereopod 7. J, distal edge of same. Scale: 2.0 mm for A, B; 1 mm for C-F; 0.36 mm for G, I; 0.09 mm for H, J.

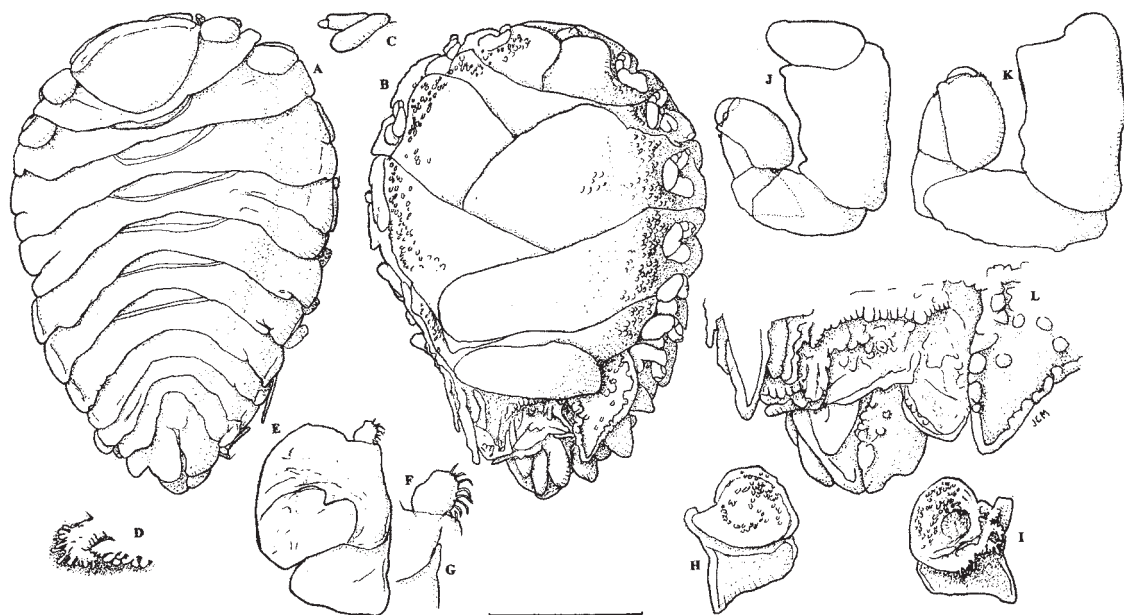


FIG. 6. *Pagurion tuberculata* Shiino, 1933, female, QM-W10843. A, dorsal view. B, ventral view. C, right antenna 1. D, right side of barbula. E, right maxilliped. F, palp of same. G, right oostegite 1, external. H, same, internal. I, right pereopod 1. J, right pereopod 7. K, pleon, ventral view. Scale: 4.35 mm for A, B, H, I; 2.0 mm for D, E, L; 1 mm for C, F, G; 0.9 mm for J, K.

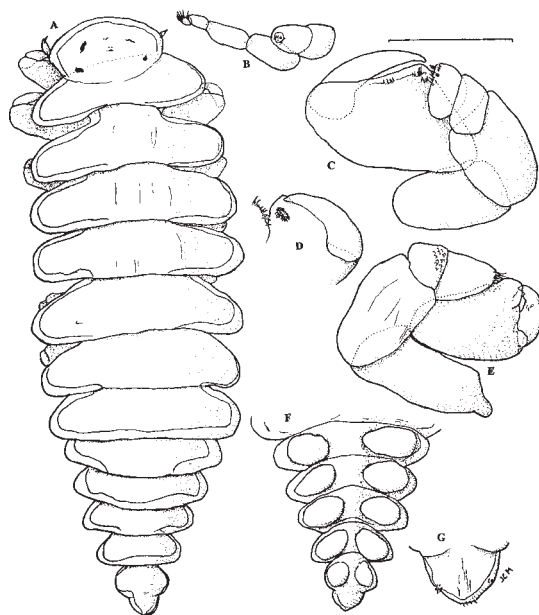


FIG. 7. *Pagurion tuberculata* Shiino, 1933, male, QM-W10843. A, dorsal view. B, right antennae. C, right pereopod 1. D, distal region of same. E, right pereopod 7. F, pleon, ventral. G, end of pleon, ventral. Scale: 1 mm for A, F; 0.36 mm for B-E, G.

Dardanus scutellatus (H. Milne Edwards)); Shiino, 1972: 7; Harada, 1991: 201; Saito *et al.*, 2000: 36; Markham, 2003: 72.

Pagurion — Shiino, 1934: 263; Bruce, 1968: 19.

Material Examined. QM-W10843, ♀, ♂, infesting *Dardanus arrosor* (Herbst, 1796), Craigmin Survey, Capricorn Channel, off SE Qld, 23° 58' S, 152° 45' E, 212 m, 29.09.1980. QM-W17450, ♀, ♂, infesting *Dardanus hessii* (Miers, 1884), CSIRO, F.R.V. *Southern Surveyor*, Stn. 67, Gulf of Carpentaria, Qld, 14° 30.5' S, 140° 42' E, 46 m, dredged, 05.12.1991.

Remarks. This is only the second discovery of *Pagurion tuberculata*, so it constitutes a new record for Australia, as well as for Queensland. *Dardanus arrosor* and *D. hessii* are both new host records, though congeneric with the host of the types in Japan. Both sexes match the types well, the female especially. The maxilliped palp of the type female is not completely separated, while that of the new female (Fig. 6E, F) is separate. The type-female bears four coxal plates on both sides of the body, while the new female (Fig. 6A) shows only two on each side. The new male (Fig. 7A) has a less completely separated head than the type, its body is broadest farther forward, its final two pleomeres are fused together both

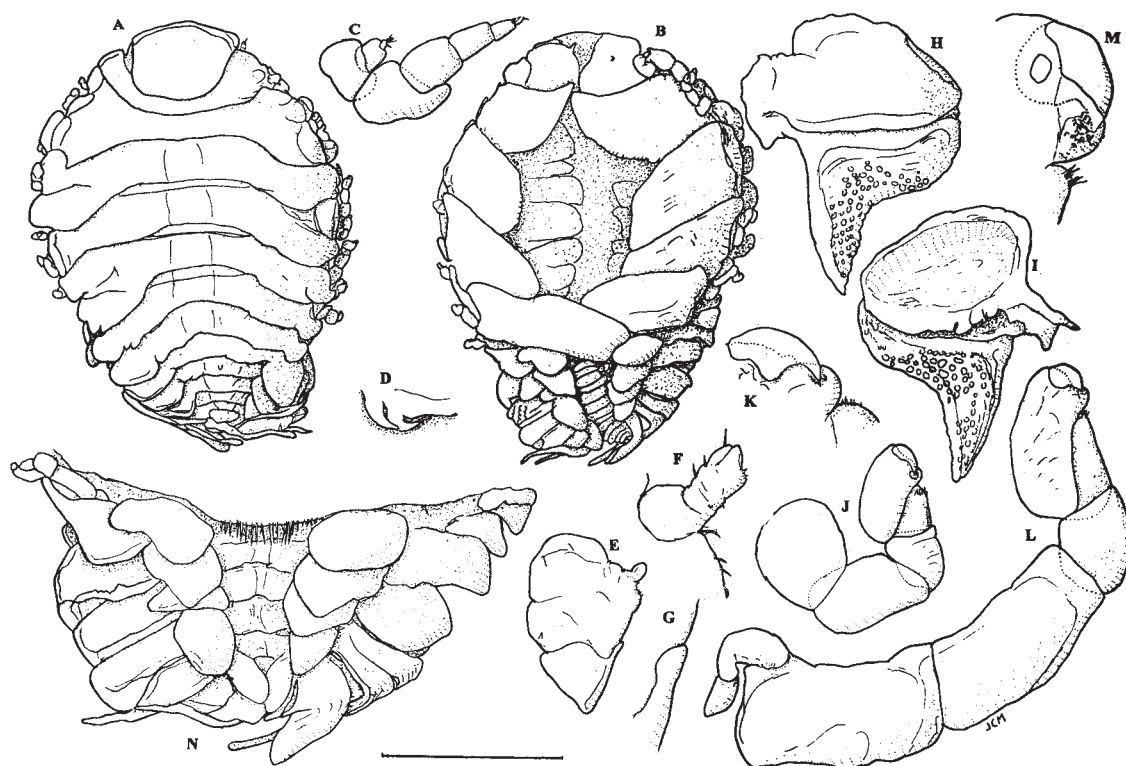


FIG. 8. *Pseudione magna* Shiino, 1951, female, QM-W10840. A, dorsal view. B, ventral view. C, left antennae. D, right side of barbula. E, right maxilliped. F, palp of same. G, plectron of same. H, right oostegite 1, external. I, same, internal. J, right pereopod 1. K, distal edge of same. L, right pereopod 7. M, distal edge of same. N, pleon, ventral. Scale: 8.16 mm for A, B; 4.11 mm for D, E, H, I, N; 1 mm for C, F, G, J, L; 0.36 mm for K, M.

dorsally and ventrally (Fig. 7A, F, G) not separate dorsally, and its pleopods (Fig. 7F) are five pairs of sessile disks, not three pairs of small flaps. A detail of the male not previously noted is that the dactyli of the first two pereopods (Fig. 7C) are long and sharply pointed, while those of the last three pairs (Fig. 7D, E) are small, and those of pereopods 3 and 4 (not illustrated) are intermediate in size.

Pseudione Kossmann, 1881

Type-species: *Pseudione callianassae* Kossmann, 1881, by monotypy.

Pseudione magna Shiino, 1951
(Figs 8, 9)

? 'Epicarid' — de Man, 1920: 163 [Bali Sea, Indonesia, infesting *Heterocarpus gibbosus* Bate].

Pseudione magna Shiino, 1951: 29–32, figs 3, 4 [off Owase, Mie Prefecture, Japan, infesting *Heterocarpus sibogae* de Man]; Şadoğlu, 1969: 197; Danforth, 1976: 79–80 [Guam, infesting *Heterocarpus ensifer* A. Milne Edwards]; Markham, 1988: 21–22; Román-Contreras & Wehrmann, 1997: 242, 247; Saito *et al.*, 2000: 37–38.

Pseudione compressa — Shiino, 1972: 7 [not *Pseudione compressa* Shiino, 1964].

Material Examined. QM-W10840, ♀, ♂, infesting *Heterocarpus sibogae* de Man, 1917, Craigmin Survey, Stn. Cr. 2, shot 1, Capricorn Channel, off SE Qld, 23° 58'S, 153°19'E, 562 m, 20.09.1980.

Remarks. The present material closely resembles the types in both sexes. The head of the type-female tapers posteriorly, unlike that of the present female (Fig. 8A), and its first oostegite is evidently not tuberculate, unlike that examined herein (Fig. 8G, H). There was no mention of the pereopods of the holotype, but those of the present

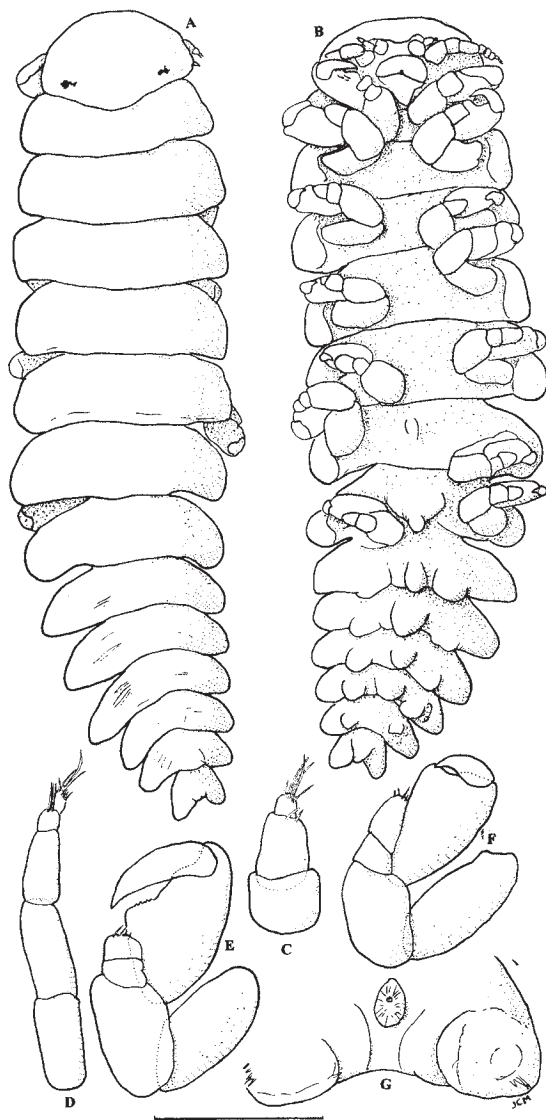


FIG. 9. *Pseudione magna* Shiino, 1951, male, QM-W10840. A, dorsal view. B, ventral view. C, left antenna 1. D, left antenna 2. E, left pereopod 1. F, left pereopod 7. G, end of pleon, distal. Scale: 1 mm for A, B; 0.36 mm for E, F; 0.18 mm for C, D, G.

female (Fig. 8I, K) are markedly larger posteriorly; all of them have reduced dactyli (Fig. 8J, L). The present male has a slightly longer head (Fig. 9A) and rather more extended tuberculi-form pleopods and has midventral tubercles on the first four pleomeres, like that from Guam

(Danforth 1976), while the type has such tubercles on only the first three pleomeres. Danforth (1976) reported that the female from Guam had fewer coxal plates than the type; the present female has still fewer. The male from Guam showed fusion of the head and first pereomere, while there is distinct separation in both the present male and the type.

The present material represents a new Australian and Queensland distributional record for *Pseudione magna*. *Heterocarpus sibogae* is the same host that bore the type-specimens, so it is not a new host record. *H. sibogae* has also been reported to host *Discorsobopyrus stebbingi* (Nierstrasz & Brender à Brandis) in Indonesia and near Taiwan (Boyko 2004). One of these two species of bopyrids was probably the parasite found infesting *Heterocarpus gibbosus* in the Bali Sea by de Man (1920), though that material is evidently long lost, so its identity cannot be determined. The other known host of *P. magna*, *Heterocarpus ensifer*, reported by Danforth (1976) at Guam, also hosts the closely similar species *Pseudione ampla* Markham, in the western Atlantic Ocean (Markham 1988).

BOPYRINAE Rafinesque, 1815

Bopyrina Kossmann, 1881

Type-species: *Bopyrus virbii* Walz, 1881, by monotypy.

Bopyrina ocellata (Czerniavsky, 1869)

(Fig. 10)

Abbreviated synonymy (only original descriptions, detailed synonymies, alternate names, redescrptions and Australian records included).

Bopyrus ocellatus Czerniavsky, 1869: 79; pl. VI, figs 1–3 [Pontus, shore of Black Sea, infesting *Virbius gracilis* Heller (= *Hippolyte longirostris* (Czerniavsky))].

Bopyrus virbii – Walz, 1881: 159–164 [Trieste and Naples, Italy, infesting *Virbius viridis* Heller (= *Hippolyte inermis* Leach)]; Kossmann, 1881: 667 [made type of *Bopyrina*]; Walz, 1882: 200 [synonymised with *Bopyrus ocellatus*].

Bopyrina ocellata forma *pontica* (typica) Czerniavsky, 1881: 529 [new name for original material, above]; Bourdon, 1968: 388 [synonymised with *Bopyrina ocellata*].

Bopyrina ocellata forma *mediterranea*; Czerniavsky, 1881: 529 [new name for *Bopyrus virbii*]; Bourdon, 1968: 388 [synonymised with *Bopyrina ocellata*].

Bopyrina ocellata – Giard & Bonnier, 1890: 383 [synonymy and summary of records]; Bonnier, 1900: 48, 61, 221, 369–370, 381, fig. 60 [Gulf of Yalta, Black Sea, infesting *Virbius gracilis* (= *Hippolyte longirostris*); synonymy and summary of records]; Bourdon, 1968: 188, 388–409, figs 183–190, tables 64–68, graphs 27–30 [France and Britain, infesting *Hippolyte varians* (Leach), *H. inermis*, *H. longirostris* and *H. longirostris armoricana* Sollaud; complete summary of European records and synonymy to date]; Bourdon & Bruce, 1983b: 99 [Moreton Bay, Qld, infesting *Hippolyte* sp. and *H. cf. ventricosa* H. Milne Edwards; and Port Curtis, Qld, infesting *Hippolyte* sp.; and Heron I., Qld, infesting *H. cf. commensalis* Kemp]; Lester & Sewell, 1989: 120, 125 [summary of records at Heron I.]; Humphrey, 1995: table 48 [Australian records]; Poore *et al.*, 2002: 117; Shimomura *et al.*, 2006: 1, 4–7, figs 3, 4 [synonymy, diagnosis, redescription; Seto Inland Sea, Japan, infesting *Hippolyte* sp.]

Bopyrina ocellata var. (sic) *mediterranea* – Giard & Bonnier, 1890: 383 [synonymised with *Bopyrina virbii*].

?*Bopyrina nitescens* Giard & Bonnier, 1890: 383 [nomen nudum].

Bopyrina hippolytes Giard & Bonnier, 1890: 384 [nomen nudum].

Bopyrina giardi Bonnier, 1900: 14, 18, 24–27, 48, 61, 83, 165, 365–368, 372, 382, 471–476; pls XXXIX, XL [Wimereux, France, infesting *Virbius varians* Leach (= *Hippolyte varians* (Leach))].

Bopyrina sullata [sic]; Bonnier, 1900: 382 [list of hosts and localities known].

Bopyrina giardi – Tattersall, 1911: 268, fig. 203; Chopra, 1923: 417, 418, 523–527, 532–534; text fig. 31 [Andaman Islands, India, infesting *Hippolyte ventricosus* H. Milne Edwards; synonymy; redescription]; Motaş & Băleanu, 1937: 164–172, figs 1–6 [Black Sea, Romania, infesting *Hippolyte varians* var. *fascigera* Gosse; redescription]; Bourdon, 1968: 388, 396–397 [synonymised with *Bopyrina ocellata*].

Bopyrina ocellatus [sic] – Chopra, 1923: 542.

Bopyrella [sic] *ocellata* – Restivo, 1971: 153.

?*Bopyrella* (?) *nitescens* – Bourdon, 1980a: 233 [nomen nudum; called possible synonym].

?*Bopyrina ocellata* – Tsukamoto, 1981: 394–401, figs 1–21, table 1 [four Brazilian localities, from 08° S to 24° S, infesting *Hippolyte curacaoensis* Schmitt; probably = *Bopyrina abbreviata* Richardson, 1904; see remarks below].

Material Examined. AM-P21779, ♀, infesting *Hippolyte* sp., Myora Springs, North Stradbroke I., Moreton Bay, Qld, 27°40.8'S, 153°24.6'E.

Remarks. The female illustrated (Fig. 10) is one of those examined by Bourdon & Bruce (1983). Being minute, it is difficult to illustrate in detail, but because no specimen collected in Australia

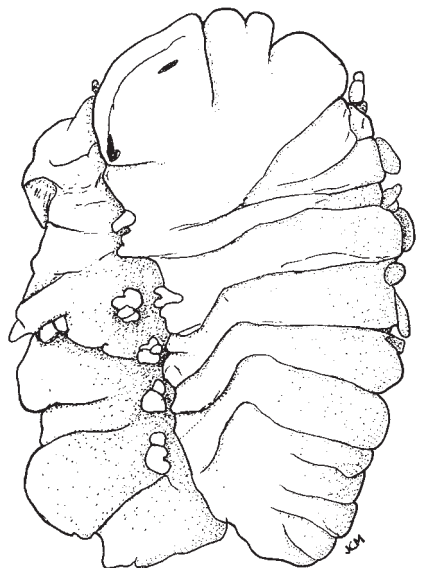


FIG. 10. *Bopyrina ocellata* (Czerniavsky, 1869), female, AM P 21779. dorsal view. Scale: 1 mm.

was previously illustrated, it seemed advisable to present at least this one drawing to confirm the identification for the species there. Hiraiwa (1933) remarked that *B. ocellata* is the smallest bopyrid known, and the material examined herein certainly bears out that observation.

The synonymy presented above contains only a small fraction of the published citations of *B. ocellata*. Approximately 100 more, including additional original discoveries in European waters are known. All reported hosts of *B. ocellata* throughout its very wide known range, from Britain thorough the Mediterranean and Black Sea, to India, Japan and Australia, are in the hippolytid genus *Hippolyte*.

The record by Tsukamoto (1981) listed in the synonymy above from Brazil probably should have been for the closely similar *B. abbreviata* Richardson, which that author considered a possible synonym. Markham (1985) examined a sizable amount of material of *B. abbreviata* collected along much of its extensive range in the western Atlantic and presented evidence that it is properly considered distinct from *B. ocellata*, though it is indeed very similar.

Parabopyrella Markham, 1985

Type-species: *Bopyrella mortenseni* Nierstrasz & Brender à Brandis, 1929, by original designation.

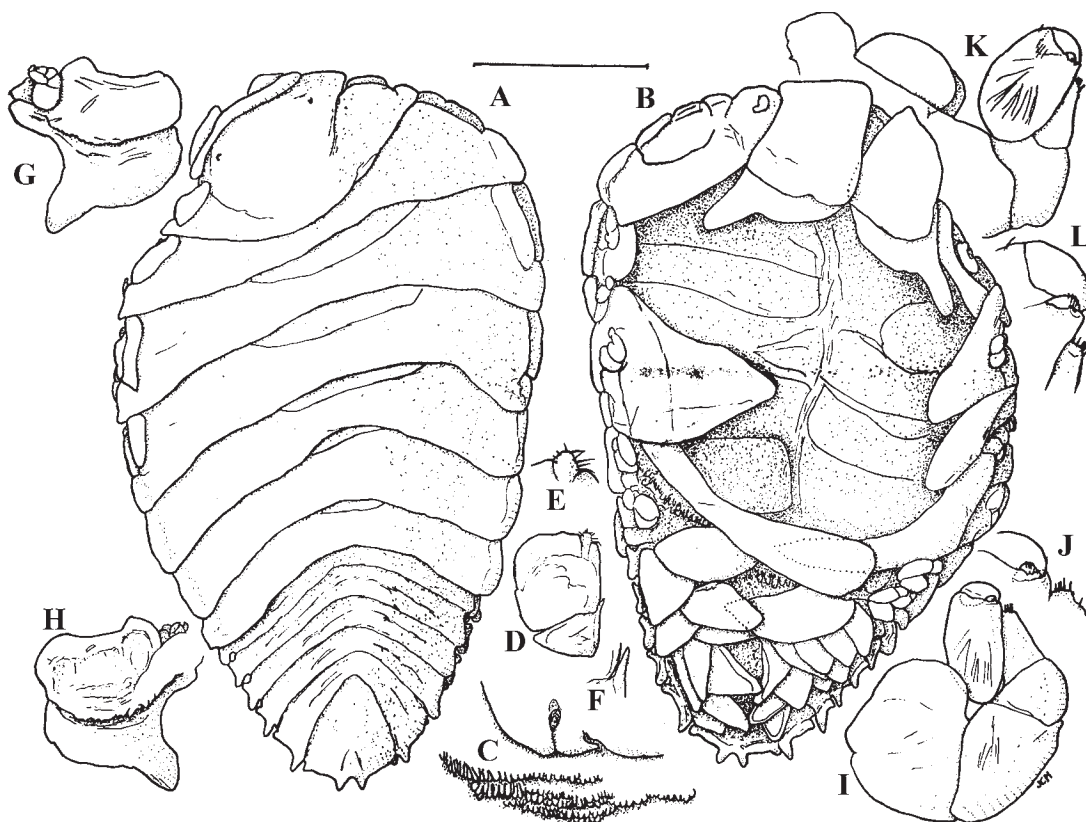


FIG. 11. *Parabopyrella australiensis* (Bourdon, 1980), new status, female, QM-W29064. A, dorsal view. B, ventral view. C, right side of barbula and adjacent region of pereon. D, right maxilliped. E, palp of same. F, plectron of same. G, right oostegite 1, external. H, same, internal. I, right pereopod 1. J, distal region of same. K, right pereopod 7 with attached vestigial oostegite. L, distal region of same. Scale: 2.0 mm for A, B, D, G, H; 1.0 mm for C, E, F; 0.36 mm for I, K; 0.18 mm for J, L.

Parabopyrella australiensis (Bourdon, 1980)
(Figs 11, 12)

Bopyrella barnardi australiensis Bourdon, 1980a: 187, 192–194, 197, fig. 3 [Port Curtis, Qld, 23°51'S, 151°15'E, infesting *Alpheus* sp.]; Bourdon & Bruce, 1983b: 96.

Parabopyrella barnardi australiensis — Markham, 1985a: 67 [transferred to *Parabopyrella* by implication]; Poore *et al.*, 2002: 118.

Material Examined. QM-W29064, ♀, ♂, infesting *Alpheus euphrosyne richardsoni* Yaldwyn, 1971, in intertidal seagrass, Amity Point, North Stradbroke I., Qld, 27 23.7'S, 153 26.8'E, 20.02.2005, X. Li.

Remarks. This is only the second discovery of *Parabopyrella australiensis*, which was previously found in Queensland as a parasite of a congeneric host. Although Bourdon (1980a) consid-

ered this to be a subspecies of *Bopyrella barnardi* Nierstrasz & Brender à Brandis, 1931, I believe that it differs sufficiently from that species to be regarded as separate, so I am hereby raising it to full species status as *Parabopyrella australiensis* (Bourdon, 1980). In particular, the male, in having a fused and anteriorly enlarged pleon, is very different from that of *Bopyrella* (now *Parabopyrella*) *barnardi*, which is shown tapered and with at least five distinct pleomeres (Nierstrasz & Brender à Brandis 1931). The two females differ sufficiently in the shapes of their first oostegites and other characters presented in Table 1 of Bourdon (1980a) to justify such a separation as well. Differences from the type female seen in the present material include the less indented anterior edge of the head (Fig. 11A),

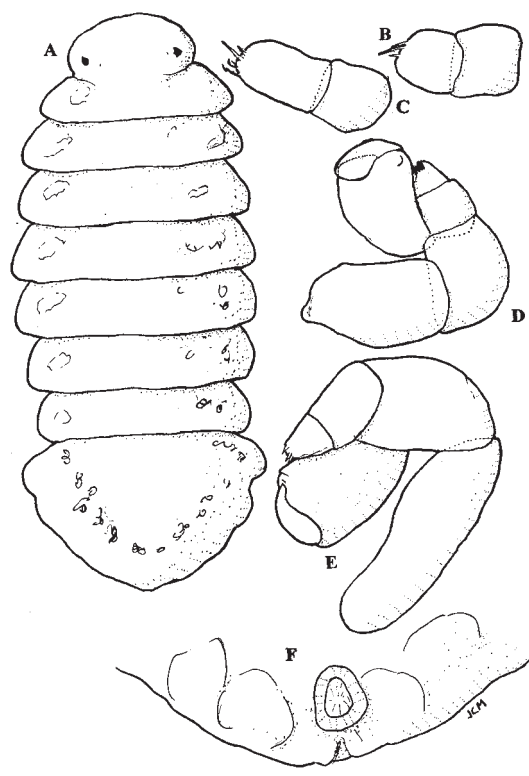


FIG. 12. *Parabopyrella australiensis* (Bourdon, 1980), new status, male, QM-W29064. **A**, dorsal view. **B**, left antenna 1. **C**, left antenna 2. **D**, right pereopod 1. **E**, right pereopod 7. **F**, posterior edge of pleon, ventral. Scale: 1 mm for A; 0.32 mm for D-F; 0.16 mm for B, C.

the lack of a tubercle on the pleotelson and the extension of that segment into two sharp points; the beaded appearance of the anterior ventral region of the pereon (Fig. 11C) was not mentioned previously. The present male (Fig. 12), in contrast with the type, has a slightly more rounded body, a proportionately smaller head and proportionately shorter and wider pleon.

Parabopyrella indica (Chopra, 1923)

Limited synonymy, restricted to newly collected material, changes of name and Australian records. 'A subspecies of Hay's *B. deformans*' — Chopra, 1922: 70.

Bopyrella deformans indica Chopra, 1923: 470–473; text-fig. 9; pl. XIV, figs 1–6 [Karachi (Pakistan) and Madras, India, infesting *Synalpheus hululensis* Coutière; and northeast of Ceylon, infesting *S. nilandensis* Coutière]; Nierstrasz & Brender à Brandis,

1929: 38, fig. 48 [Hong Kong, infesting *Synalpheus* sp.].

Bopyrella deformans var. *indica* — Monod, 1933: 155 [Egyptian coast of Red Sea, infesting unidentified alpheid].

Bopyrella indica — Bourdon, 1979a: 501–503, fig. 21 [Tulear, Madagascar, infesting *Synalpheus* sp.]; 1980a: 187, 208–210, fig. 10 [full synonymy; Hong Kong, infesting *Synalpheus* sp.; Kei Islands, Indonesia, infesting *Synalpheus* sp.; New Caledonia, infesting *S. gravieri* Coutière; Deep Hole, Tyron Roads, Sandy Strait, Qld, infesting *Synalpheus* sp.; unnamed locality, infesting *S. gravieri*].

Bopyrella distincta [sic] — Bourdon, 1980a: 210.

Synynella deformans var. *indica* — Shiino, 1949a: 49. *Parabopyrella indica* — Markham, 1982: 345; Kazmi *et al.*, 2002: 61, fig. 18. [unspecified locality, northern Arabian Sea, infesting *Synalpheus tumidomanus* (Paulson)]; Poore *et al.*, 2002: 119.

Remarks. No new material examined.

Parabopyrus Shiino, 1934

Type-species: *Parabopyrus kiiensis* Shiino, 1934, by monotypy.

Parabopyrus kiiensis Shiino, 1934

Parabopyrus kiiensis Shiino, 1934: 268–269, fig. 5 [Yusaki and Shisojima, Seto, Japan, infesting *Hippolysmata* sp. (= *Lysmata* sp.)]; 1972: 8; Bourdon & Bruce, 1983a: 314, 316, table I; Bourdon & Bruce, 1983b: 101–102, fig. 4 [Bustard Bay, Qld, infesting *Athanas* sp.]; Harada, 1991: 201; Saito *et al.*, 2000: 41; Poore *et al.*, 2002: 119.

Remarks. No new material examined.

Probynia Bourdon & Bruce, 1983

Type-species: *Probynia obstipa* Bourdon & Bruce, 1983, by original designation.

Probynia obstipa Bourdon & Bruce, 1983

(Fig. 13)

Probynia obstipa Bourdon & Bruce, 1983a: 310, 311–316, figs 1–6 [Heron I., Great Barrier Reef, Qld, infesting *Periclimenaeus hecate* (Nobili) and *Typton wasini* Bruce]; Bourdon & Bruce, 1983b: 96; Lester & Sewell, 1989: 119, 120, 125 [summary of records from Heron I.]; Humphrey, 1995: table 48 [summary of Australian records]; Bruce, 2000: 99; Poore *et al.*, 2002: 119.

Material Examined. QM-W29065, ♀, infesting *Periclimenaeus hecate* (Nobili, 1904), Shag Rock, North Stradbroke I., Moreton Bay, Qld, 27°24.9'S, 153°31.6'E, 10 m, 18.02.2005, X. Li.

Remarks. *Probynia obstipa* was previously known only from the types collected from Heron Island,

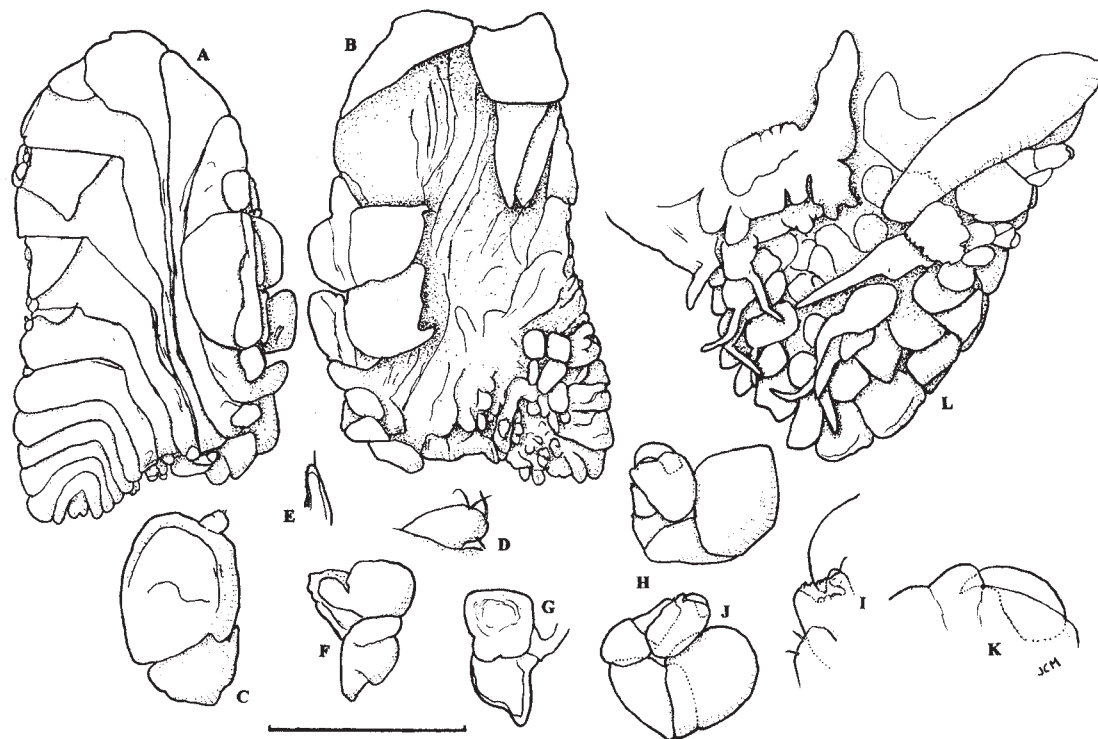


FIG. 13. *Probynia obstipa* Bourdon & Bruce, 1983, female, QM-W29065. A, dorsal view. B, ventral view. C, right maxilliped. D, palp of same. E, plectron of same. F, right oostegite 1, external. G, same, internal. H, right pereopod 1. I, distal region of same. J, right pereopod 7 distal region of same. Scale: 2.0 mm for A, B, F, G; 1 mm for C, L; 0.36 mm for D, E, H, J; 0.09 mm for I, K.

so this is only the second record. Its host is the same as that of one of the type specimens. The female examined differs in some details from those previously seen. The sides of its greatly distorted body are more nearly parallel; its head is farther back on the short side of its body; its maxillipedal palp is slightly less prominent; and its pleopods are somewhat longer and less regularly shaped. The two females of the type-lot, however, varied more from each other than this female does from the holotype. Unfortunately, the present material did not contain a male.

Schizobopyrina Markham, 1985

Type-species: *Bopyrina urocaridis* Richardson, 1904, by original designation.

Schizobopyrina andamanica (Chopra, 1923)

Bopyrina andamanica Chopra, 1923: 525–531, 542–543; text figs 27, 28; pl. XX, figs 1–6 [Port Blair, Andaman Islands, Indian Ocean, infesting *Periclimenes*

elegans Paulson]; Monod, 1933: 230; Shiino, 1939a: 597–601 [Palau, infesting *Anchistus miersi* (de Man)]; Shiino, 1942: 440; Danforth, 1970b: 462; Bourdon & Stock, 1979: 211; Bourdon, 1983: 868, 869.

Schizobopyrina andamanica — Markham, 1985a: 46; 1990a: 55, 59–61, figs 4–5 [New Caledonia, infesting *Periclimenes* n. sp. and *Periclimenaeus bidentatus* Bruce]; Bruce, 1991: 250–254 [New Caledonia, infesting *Periclimenes tenuirostris* Bruce and *Periclimenaeus bidentatus* Bruce]; Kensley, 2001: 226; Poore *et al.*, 2002: 120 [off NE coast of Qld, 200 m; host not mentioned]; Williams & Boyko, 2004: 444.

Schizobopyrina andamanica [sic] — Campos & Campos, 1990: 640, 641, table 1.

Remarks. No new material examined.

Schizobopyrina lobata (Bourdon & Bruce, 1983)

Bopyrina lobata Bourdon & Bruce, 1983b: 100–101, 106, fig. 3 [Bribie Passage, Coral Sea, off Caloundra, Qld, c. 26°50'S, 153°10'E, infesting *Tozeuma* sp.].

Schizobopyrina lobata — Markham, 1985a: 46; Campos & Campos, 1990: 633, 634, 640, 641, table 1; Poore *et al.*, 2002: 120; Williams & Boyko, 2004: 444.

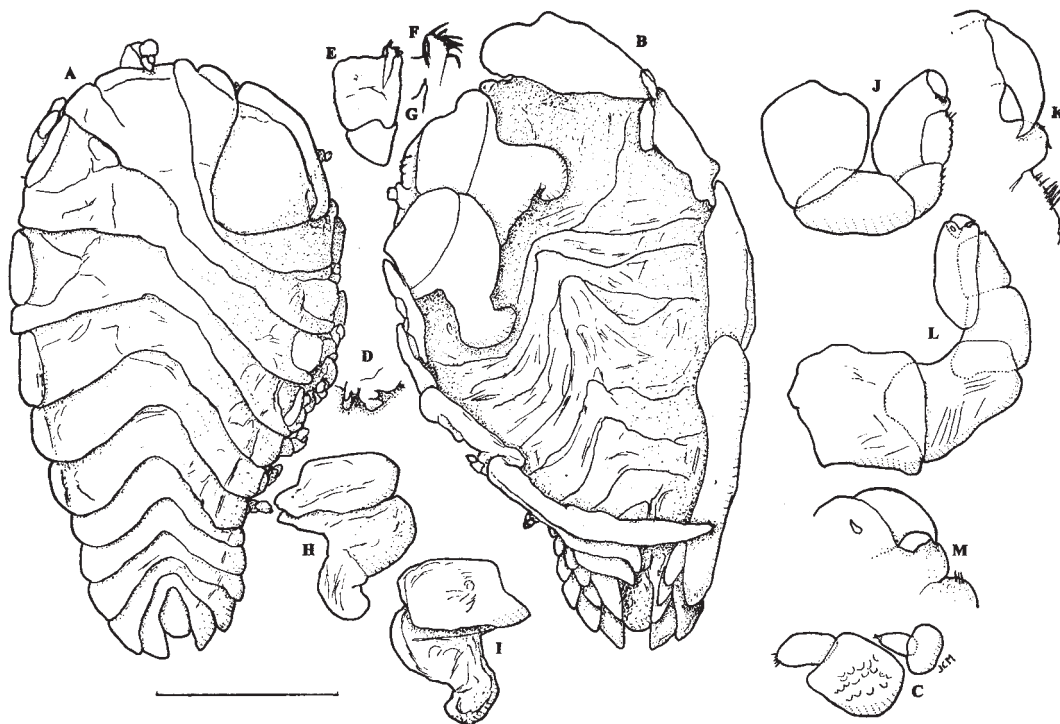


FIG. 14. *Schizobopyrina platylobata* (Bourdon, 1983), female, QM-W29066. A, dorsal view. B, ventral view. C, right antenna. D, right side of barbula. E, right maxilliped. F, palp of same. G, plectron of same. H, right oostegite 1, external. I, same, internal. J, right pereopod 1. K, distal edge of same. L, right pereopod 7. M, distal edge of same. Scale: 2.0 mm for A, B, D, E, H, I; 1.00 mm for F, G; 0.36 mm for C, J, L; 0.09 mm for K, M.

Schizobopyrina (?) *lobata* – Campos & Campos, 1990: 638.
Non *Bopyrina lobata* – Humphrey, 1995: table 48
[cited as synonym of *Schizobopyrina platylobata*
(Bourdon, 1983) below].

Remarks. No new material examined. Both Campos & Campos (1990) and Williams & Boyko (2004) expressed the opinion that this species does not properly belong in the genus *Schizobopyrina*, but neither proposed an alternative placement. Having examined no material of the species, I am venturing no opinion on the matter.

Schizobopyrina platylobata (Bourdon, 1983)
(Figs 14, 15)

Bopyrina platylobata Bourdon, 1983: 867–869, fig. 13
[Seram, Moluccas, Indonesia, infesting *Anchistus australis* Bruce].

Bopyrina platylobae [sic] – Bourdon & Bruce, 1983b: 99 [Port Denison, Qld, infesting *Anchistus custos* (Forskål)].

Schizobopyrina platylobata – Campos & Campos, 1990: 633, 634, 637, 640, 641, table 1; Poore *et al.*, 2002: 120; Humphrey, 1995: table 48 [Queensland record].

Bopyrina lobata – Humphrey, 1995: table 48 [cited as synonym of *S. platylobata*; non *Bopyrina lobata* Bourdon & Bruce, 1983 (= *Schizobopyrina lobata* (Bourdon & Bruce, 1983), see above)].

[B]opyrid – Li, 2008: 235 [Moreton Bay, material examined herein, infesting *Anchistus custos*].

[P]arasite – Li, 2008: 235, fig. 2 [same material as above].

Material Examined. QM-W29066, ♀, ♂, infesting *Anchistus custos* (Forskål, 1775), in shell of *Pinna bicolor* Gmelin, 1791, intertidal seagrass flat, Amity Point, North Stradbroke I., Qld, 27°23.6'S, 153°26.4'E, X.Li & J.C. Markham. QM-W28020, ♀, ♂, infesting *Vir* sp. (nov. ?), on scleractinian *Plerogyra sinuosa* (Dana, 1846), Tomini Bay, Molucca Sea, Gorontalo Province, Sulawesi, Indonesia, ca. 00°N, 122°E, 16 m, 14.04.2006, R. Wadley.

Remarks. The only published illustrations of *Schizobopyrina platylobata*, those of Bourdon (1983), were incomplete, so some details of the species are uncertain. The present female from *Anchistus custos* (Fig. 14) matches the type well in such details as body shape and proportions,

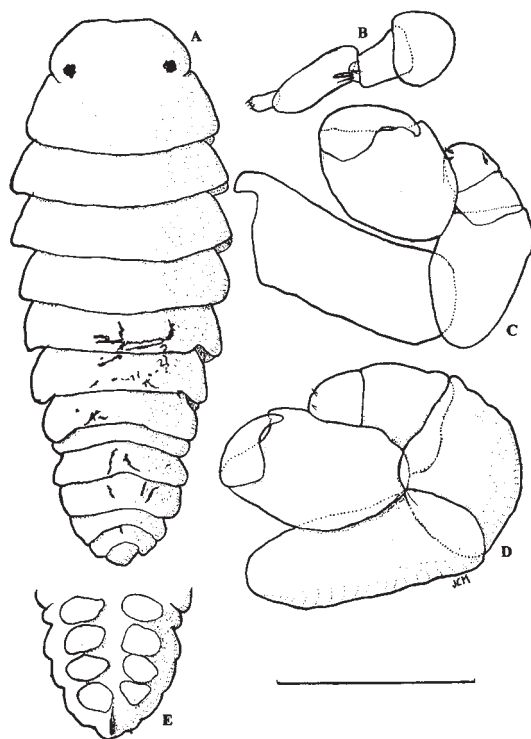


FIG. 15. *Schizobopyrina platylobata* (Bourdon, 1983), male, QM-29066. **A**, dorsal view. **B**, right antennae. **C**, right pereopod 1. **D**, right pereopod 7. **E**, posterior edge of pleon, ventral. Scale: 0.40 mm for A; 0.2 mm for E; 0.1 mm for B-D.

nature of maxilliped palp and shape of first oostegite. In contrast, its head and first pereomere are separated, and its pleomeres are much more completely distinct dorsally (Fig. 14A). Each antenna (Fig. 14C) has only two articles (Bourdon, 1983, called their segmentation 'non apparente'). The accompanying male (Fig. 15) is also clearly similar to the type male except that its pleomeres are distinct dorsally, while those of the type were fused.

The host of the new material from Queensland, *Anchistus custos*, is the same one already reported to bear *Schizobopyrina platylobata* in that state (Bourdon & Bruce, 1983b). Although from outside of the intended geographical scope of this report, the individuals from Sulawesi are included because they became available as this report was being prepared. Their host, *Vir* sp., is the first record in that genus for any bopyrid parasite. A.J. Bruce, who

identified the host to genus and kindly furnished the material to me, states (pers. comm.) that the genus *Vir* is in need of revision, with the result that the exact identity of the species here involved cannot be established.

IONINAE H. Milne Edwards, 1840

Remarks. Poore *et al.* (2002) list *Albunione australiana* and *Portunicepon tiariniae* as the only members of the subfamily Ioninae known from Queensland. The former species has now been transferred to the Pseudioninae, above, and the latter is now considered to belong to the genus *Allokepon*. The other species discussed in this section are new to Queensland and to Australia as a whole.

Allokepon Markham, 1982

Type-species: *Portunicepon hendersoni* Giard & Bonnier, 1888, by original designation.

Allokepon tiariniae (Shiino, 1937)

Portunicepon tiariniae Shiino, 1937b: 486–489, figs 6–8 [Seto, Japan, infesting *Tiarinia cornigera* (Latreille)]; Shiino, 1942b: 71 [Seto, Japan, infesting *T. cornigera*]; Shiino, 1958: 68 [Seto, Japan, infesting *Menaethius monoceros* (Latreille)]; Shiino, 1972: 9; Markham, 1982: 357; Shields & Ward, 1998: 595 [Lizard I., Great Barrier Reef, Qld, infesting *Tiarinia* sp.]; Saito *et al.*, 2000: 42–43; Poore *et al.*, 2002: 124.

Allokepon tiariniae – Boyko, 2003: 5, 10 [transferred to *Allokepon*].

Remarks. No new material examined.

Dactylokepon Stebbing, 1910

Type-species: *Dactylokepon richardsonae* Stebbing, 1910, by subsequent designation.

Dactylokepon richardsonae Stebbing, 1910 (Figs 16, 17)

? *Bopyrus* sp – de Man, 1881: 94 [Near Jeddah, Saudi Arabia, Red Sea, infesting *Trapezia cymodoce* (Herbst)].

? 'Bopyride' – Nobili, 1901: 15 [Eritrea, infesting *Trapezia cymodoce*].

Dactylokepon richardsonae Stebbing, 1910: 85, 113; pl. 11C [Seychelles, infesting *Trapezia cymodoce*]; Nierstrasz & Brender à Brandis, 1923: 83; Shiino, 1942: 444, 447; Markham, 1975c: 61, 64–66, table 1 [designated type-species of genus]; Bourdon, 1983: 855–857 [Marsegu I., Moluccas, Indonesia, infesting *Trapezia cymodoce*]; Markham, 1991: 289, 291–294, fig. 2 [Bangkok Bight, Thailand, infesting *Portunus tuberculatus* (A. Milne Edwards)]; redescrrip-

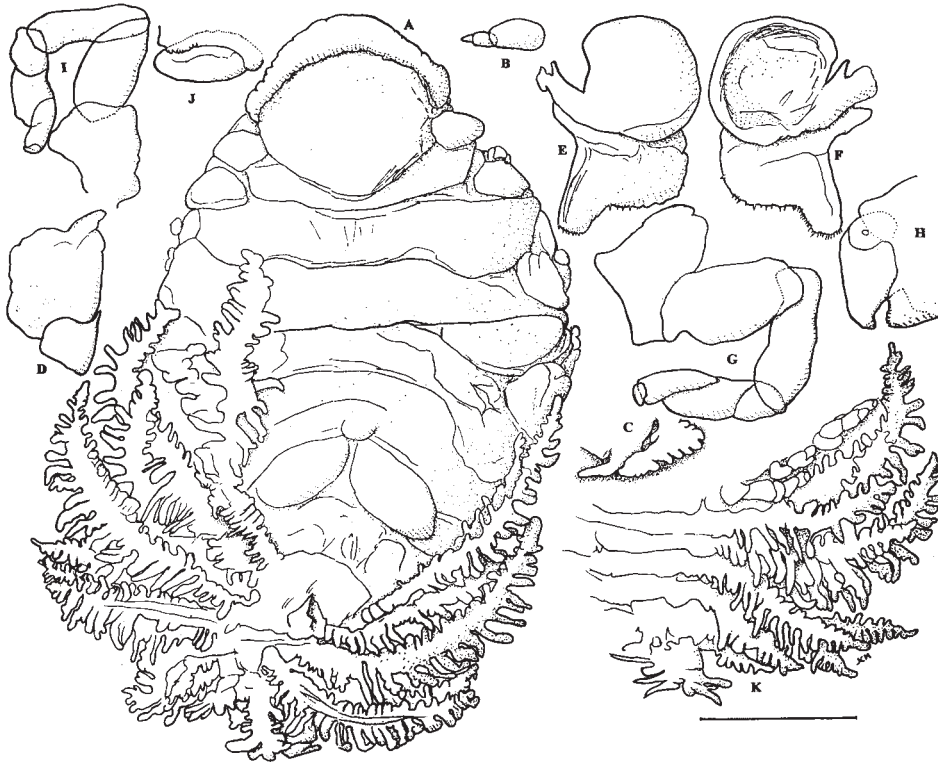


FIG. 16. *Dactylokepon richardsonae* Stebbing, 1910, female. QM-W12025. A, dorsal view. B, right antenna 1. C, left side of barbula. D, right maxilliped. E, right oostegite 1, external. F, same, internal. G, right pereopod 1. H, distal edge of same. I, right pereopod 7. J, distal edge of same. K, left side of pleon, ventral. Scale: 2.0 mm for A, D-F, K; 1 mm for B, C; 0.89 mm for G, I; 0.18 mm for H, J.

tion]; Kensley, 2001: 223; An *et al.*, 2007: 2063, 2064-2066, 2068, fig. 1 [Nansha, China; infesting *Portunus argentatus* (White); synonymy, descriptive notes].

Dactylokepon richardsonae – Bourdon, 1967a: 122; 1980b: 243; 1983: 856, fig. 7.
? 'C ponien' – Bourdon, 1980b: 243.

Material Examined. QM-W12025, 2 ♀♀, ♂, bilaterally infesting male *Charybdis anisodon* (de Haan, 1850) (carapace length 15.7 mm), Embly River, south of Weipa, western Cape York, Qld, 12°44'S, 141°56'E, 16.11.1981, L. Owens.

Remarks. *Dactylokepon richardsonae* shows some variation among the collections so far made, but the present material appears to lie well within that range. The female illustrated (Fig. 16) matches the type the least, but the drawing of Stebbing (1910) appears somewhat diagrammatic, and his description was quite brief. Its general body shape and proportions, head (Fig. 16A) and pleon (Fig. 16A, K) are most like those reported

from Thailand (Markham 1991); its barbula (Fig. 16C) most similar to that of the type (Stebbing, 1910); and its first oostegite most resembles that of the female from the Moluccas (Bourdon, 1983). The female from China (An *et al.* 2007) uniquely has tubercles on the frontal lamina and on the tergal projections of the second pereomere, the processes on its barbula are shorter and broader, and its first oostegite is more sharply pointed. All males known (there being none in the type material) share diagnostic characters, namely the prominent antennae (Fig. 17C); large first pereopods (Fig. 17D) ending in sharp slender dactyli bearing long setae on their retractor margins and having their meri and carpi fused; and the nearly sessile flaplike pleopods each extending posteriorly over the front of the following pleomere. The present male is shaped and proportioned like that from Thailand (Markham 1991) but lacks its fusion of the head and first pereop-

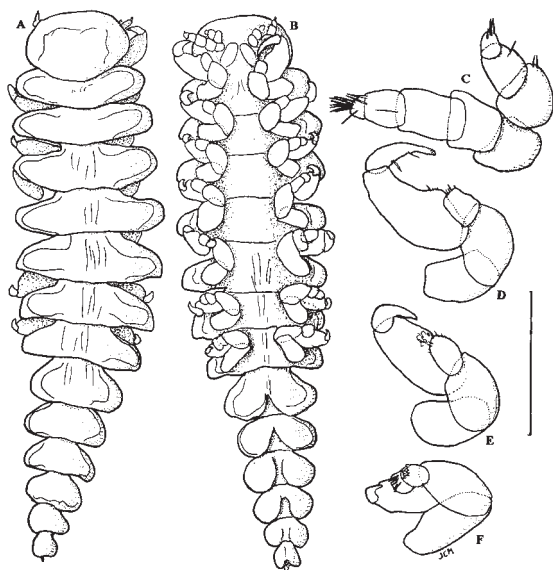


FIG. 17. *Dactylokepon richardsonae* Stebbing, 1910, male, QM-W12025. **A**, dorsal view. **B**, ventral view. **C**, right antennae. **D**, right pereopod 1. **E**, right pereopod 2. **F**, right pereopod 7. Scale: 1 mm for A, B; 0.36 mm for D-F; 0.18 mm for C.

mere and its midventral pereonal tubercles; in the latter characters, it agrees with the male from the Moluccas (Bourdon 1983), which is proportionately much shorter. The male from China (An *et al.* 2007) is also quite similar except for having midventral tubercles on all pereomeres.

Charybdis (*Charybdis*) *anisodon* is a new host record for this or any bopyrid, and Queensland (and Australia) is a new geographical record for *Dactylokepon richardsonae*. It is highly unusual for a single host specimen to be bilaterally infested by bopyrids, but such was the case. Interestingly, An *et al.* (2007), report that bilateral infestation by another species of *Dactylokepon*, *D. barbudadigitus* An, Yu & Williams, 2007, was common in the material they examined from Chinese localities. The right branchial chamber contained both female and male specimens, the ones drawn. Opposite, there was only a female. Aside from being a mirror image of the female illustrated, it differs slightly in lacking setae on the posterior margin of the first oostegite and in having no middorsal projection on the first pleomere.

Megacepon George, 1946

Type-species: *Megacepon choprai* George, 1946, by original designation.

Megacepon choprai George, 1946

(Fig. 18)

Megacepon choprai George, 1946: 385–390, figs 1–3 [Adyar River near Madras, India, infesting *Sesarma tetragonum* (Fabricius) (= *Muradium tetragonum* (Fabricius))]; Shiino, 1958: 65–68, figs 20–21 [River Asahi, Okayama, Japan, infesting *Sesarma (Holometopus) dehaani* A. Milne Edwards (= *Chiromantes dehaani* (A. Milne Edwards))]; Shiino, 1972: 9; Bourdon & Stock, 1979: 216, 217, table II; Markham, 1980: 623, 625–630, figs 6–7 [Samat Sakan, Thailand, infesting *Sesarma mederi* H. Milne Edwards (= *Episesarma mederi* (H. Milne Edwards))]; 1982: 361; 1990b: 555, 560 [Hong Kong, infesting *Sesarma (Chiromanthes) maipoensis* Soh (= *Perisesarma maipoensis* (Soh))]; 1992b: 299, table 1; 2002: 335, table 1; Bourdon, 1981a: 105–106, 107; Saito *et al.*, 2000: 48; Kensley, 2001: 224; Mizoguchi *et al.*, 2002: 81; Li, 2003: 140, 154, 158, tables 1, 3.

Megacepon choprae [sic] — Bourdon & Bowman, 1970: 422.

Metacepon [sic] *choprai* — Huang, 1994: 530.

Material Examined. QM-W7451, ♀, infesting *Perisesarma erythodactyla* (Hess, 1865)(QM-W7450), Kangaroo I., Susan R., Hervey Bay, Qld, 25°15'S, 152°40'E, 25.07.1975, P. Davie.

Remarks. This is the fifth reported collection of *Megacepon choprai*, and the first from Australia. *M. choprai* is now known to be widespread, ranging from eastern Asia and eastern Australia across the Indian Ocean. In each collection, the host was a different species, but all are members of the intertidal crab family Sesarmidae.

The most diagnostic features of the female of *M. choprai* are the extended head bearing a reflexed frontal lamina incompletely covering its anterior margin, the broad extended middorsal projection on the first pleomere and the distinctive shapes, proportions and margins of the pleonal appendages. The original drawings of the species (George 1948) are highly diagrammatic and hard to interpret, but the present female conforms well with the other drawings published. In particular, its maxilliped and first oostegite are very similar to those seen in the Japanese material (Shiino 1958). Its middorsal pereonal tubercles are much more reduced than those of the Thai material (Markham 1980)



FIG. 18. *Megacepon choprai* George, 1946, female, QM-W7451. A, dorsal view. B, right antenna 1. C, left antenna 2. D, right side of barbula. E, right maxilliped. F, right and left oostegites 1. G, right oostegite 1, external. H, same, internal. I, left pereopod 1. J, left pereopod 7. Scale: 4.11 mm for F; 2.0 mm for A, E, G, H; 1 mm for D; 0.36 mm for B, C, I, J.

but better developed than those of the type (George, 1948) and the Japanese female (Shiino 1958). Regrettably, there was no male in the present collection.

Scyracepon Tattersall, 1905

Type-species: *Scyracepon tuberculosa* Tattersall, 1905, by monotypy.

Scyracepon australiana sp. nov.

(Fig. 19)

Material Examined. HOLOTYPE: QM-W5008, ♀, infesting *Australoplax tridentata* (A. Milne Edwards, 1873) (Ocypodidae), Serpentine Creek, Anabranch, 2.1 km from mouth, SE Qld, 27° 24'S, 153°06'E, 03.12.1973, B. Campbell *et al.*

Description. Female. Length 5.35 mm, maximal width 2.94 mm, head length 1.00 mm, head width 0.72 mm, pleon length 1.56 mm, body distortion 15°. All body regions and segments distinct. Body outline smoothly suboval. Unpigmented except for small eyespots. (Fig. 19A).

Head broadly oval, its anterior margin completely covered by prominent slightly askew ornamented frontal lamina. Reduced dark eyespots slightly forward of lateral corners. Antennae indiscernible. Barbula (Fig. 19B) with pair of simple slender sharply pointed projections on each side. Maxilliped (Fig. 19C) about twice as long as wide, produced anteromedially into small nonarticulating palp, with prominent plectron.

Sides of pereon smoothly rounded, broadest across pereomere 3, with prominent coxal plates on sides of anterior pereomeres. No middorsal bosses, but irregular dorsal swellings on some pereomeres. Oostegites incompletely enclosing brood pouch; first oostegite (Fig. 19D, E) about twice as long as broad, its sides nearly parallel, its anterior article much shorter than posterior one, internal ridge produced into row of stubby digitate projections. Pereopods (Fig. 19F, G) proportionately small, with all articles distinct,

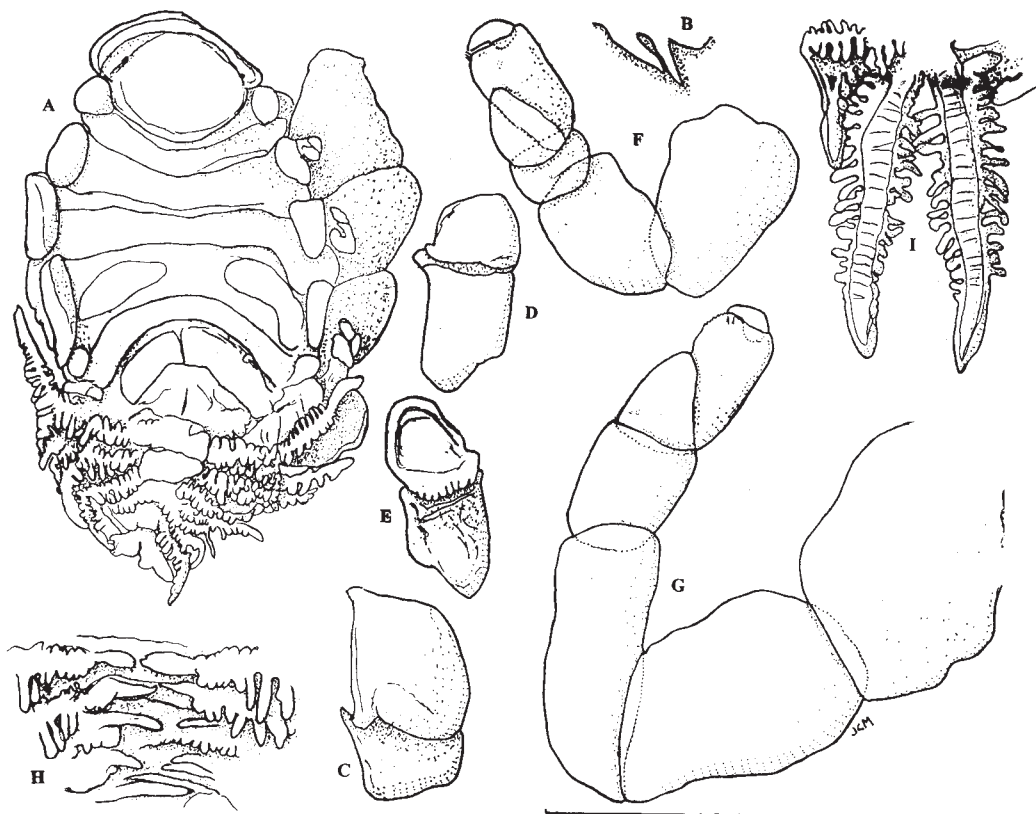


FIG. 19. *Scyracepon australiana*, n. sp., holotype female, QM-W5008. A, dorsal view. B, right side of barbula. C, right maxilliped. D, right oostegite 1, external. E, same, internal. F, right pereopod 1. G, right pereopod 7. H, middle of pleon, ventral. I, uropods. Scale: 2 mm for A, D, E; 1 mm for B, C, H; 0.18 mm for F, G.

meri, carpi, propodi and dactyli all nearly same size and shape; coxae, bases and ischia of posterior pereopods much larger.

Pleon of six pleomeres, margins of first five covered by long slender deeply digitate lanceolate exopodites of biramous pleopods, those of first pair directed anteriorly; endopodites of pleopods (Fig. 19H) medially directed minute versions of exopodites. Pleomere 6 bearing uniramous uropods (Fig. 19I) of structure and digitate margins similar to those of pleopodal exopodites but markedly broader. Male unknown.

Etymology. First declension Latin adjective *australiana* denoting the type-locality.

Remarks. *Scyracepon* has previously included five species, only one of which, *S. tuberculosa*, has been collected more than once. They are *S. hawaiiensis* Richardson, 1911, from Hawai'i infes-

ting *Pilumnoplax cooki* Rathbun [= *Carcinoplax cooki* (Rathbun)] (Carcinoplacidae); *S. levis* Barnard, 1940, from South Africa, infesting *Scyramathis hertwigi* Doflein (Majidae); *S. oceanicum* Shiino, 1942, from Palau, infesting *Eriphia scabricula* Dana (Eriphiidae); *S. quadrihamatum* Shiino, 1936, from Shimoda, Japan, infesting *Maja japonicus* Rathbun (Majidae); and *S. tuberculosa* Tattersall, 1905, from Ireland infesting *Scyramathia carpenteri* (Thompson) (Majidae) (Tattersall 1905), from Congo infesting *Geryon quinquedens* Smith (Geryonidae) (Bourdon 1971), and from the Azores infesting *Rochinia carpenteri* (Norman) (Majidae) (Bourdon 1979b). With the description of *Scyracepon australiana*, the genus is now known to infest crabs belonging to five different brachyuran families.

Females of *Scyracepon australiana* share the following characters with other *Scyracepon*

species: similar proportions of body regions and appendages; head relatively large and somewhat extended and bearing prominent broad slightly reflexed frontal lamina; production of barbula into two slender sharp points on each side; non-articulating maxilliped palp bluntly rounded and slightly curved, plectron prominent; first oostegite with multiple rounded lobes on internal ridge and posterolateral region very broadly pointed; pereopods all with reduced dactyli; pleomeres with fairly short digitate-margined exopodites, tiny endopodites; uniramous uropods similar to exopodites but somewhat larger.

Scyracepon australiana differs from other species in having no evident mid-dorsal pereonal bosses. Also, the pleopodal endopodites of the other species are knoblike, not minute versions of the exopodites. It appears most similar to *S. hawaiiensis*, but the female of that species differs in being somewhat broader, having a small middorsal projection on the seventh pereomere, and in bearing numerous extensions along the margin of the maxillipedal palp and on the posterior edge of the first oostegite (Richardson 1911).

The name *Scyracepon* would appear to be Greek neuter noun, but Tattersall (1905) clearly treated it as feminine in writing the name of the type-species, *S. tuberculosa*, as a feminine adjective. Accordingly, the name of the new species, *S. australiana*, is also presented in the feminine form. This is the first record of bopyrid infestation in the monotypic genus *Australoplax*.

ORBIONINAE Codreanu, 1967

Epipenaeon Nobili, 1906

Type-species: *Epipenaeon ingens* Nobili, 1906, by monotypy

Epipenaeon ingens Nobili, 1906

Synonymy restricted to original names, major reviews and Australian records.

Epipenaeon ingens Nobili, 1906: 1099–1101, 1104, fig. 1 [Red Sea, infesting *Penaeus ashiaka* Kishinouye (= *Penaeus semisulcatus* De Haan)]; Bourdon, 1968: 327–333, figs 145–158 [Mersin, northeastern Mediterranean Sea, Turkey, infesting *P. semisulcatus*; redescription and summary of records]; 1979c: 429, 430 [Port Darwin, Australia, infesting *Penaeus esculentus* Haswell; reexamination of types of *E. nobili* and *E. grande*]; Owens, 1983:

477–480, figs 1, 2, table 1 [southeastern Gulf of Carpentaria, infesting *P. merguensis* de Man]; Nearhos & Lester, 1984: 257–258 [Karumba, Gulf of Carpentaria, Qld, and Maryborough, Qld, infesting *P. semisulcatus*; Karumba, Roselyn Bay, Qld, infesting *P. merguensis*; re-examination of type of *E. grande*]; Owens, 1985: 291; Owens & Glazebrook, 1985a: 105–112, figs 1, 4, tables 2–4 [numerous localities, Gulf of Carpentaria, infesting *P. semisulcatus*, *P. merguensis* and *P. indicus* Milne Edwards]; Owens & Glazebrook, 1985b: 135 [same collection]; Glazebrook *et al.*, 1986: 196, 197, table 5 [summary of occurrence and hosts in Gulf of Carpentaria]; Owens, 1986: iii–iv, x, xi, xvi, 14, 55–60, 71–79, 82, 84–103, tables 2.4.1, 7.1, 8.2, figs 8.2, 8.4 [study of biology in Gulf of Carpentaria]; Lotz & Overstreet, 1990: 110 [summary of Australian records]; Owens, 1990: 35, 37, 38, table 1 [summary and analysis of occurrence in Australia]; Rohde, 1990: 568; Courtney, 1991: 617, 620–621, table 2 [discussion of occurrence in Australia]; Owens & Rothlisberg, 1991: 779–786 [numerous localities, Gulf of Carpentaria, infesting *P. semisulcatus*, *P. merguensis* and *P. indicus*]; Somers & Kirkwood, 1991: 349–365 [Gulf of Carpentaria, infesting *P. semisulcatus*]; Owens, 1993: 381, 383–385, figs 2, 3, 5 [Qld, infesting *P. semisulcatus*]; Humphrey, 1995: 14–1, 14–9, table 48 [summary of Australian records]; Owens, 1987: 119, 120, 122 [summary of Australian records; remarks on range]; Owens & Rothlisberg, 1995: 159–164 [numerous localities, Gulf of Carpentaria; study of larvae]; Lester, 2005: 139, 142, fig. 4.7B [summary of research in Australia].

Epipenaeon nobili Nierstrasz & Brender à Brandis, 1929: 299–302, figs 5–9 [Suez, Egypt, Red Sea, infesting *Penaeus semisulcatus*]; Bourdon, 1979c: 429 [synonymised with *E. ingens*].

Epipenaeon grande Nierstrasz & Brender à Brandis, 1931: 157–158, fig. 18 [Hong Kong, infesting *Penaeus monodon* (Bate) (= *P. semisulcatus*); Bourdon, 1979c: 429 [synonymised with *E. ingens*].

Epipenaeon Nobili – Monod, 1933: 220, 222, 223–224.

? *Epipenaeon* sp. – Tuma, 1967: 73, 77, 78, 83, 84, 85, 87, pl. 2 figs 4–5 [Gulf of Carpentaria, infesting *P. merguensis*]; Kirkegaard *et al.*, 1970: 3, 5; Kirkwood & Somers, 1984: 711; Owens, 1986: 25.

Epipenaeon ingens latifrons Bourdon, 1979c: 425, 429–430, fig. 4 [near Darwin, Northern Territory, infesting unident. penaeid]; Bourdon *et al.*, 1981: 497, 498, 500; Nearhos & Lester, 1984: 257, 258 [synonymised with *E. ingens*]; Poore *et al.*, 2002: 125 [catalog of Australian records].

Epipenaeon ingens ingens: Hansson, 1998: 64

Remarks. No new material examined. *Epipenaeon ingens* has been recorded more times and studied more thoroughly than any other species of bopyrid isopod in Australia, because its

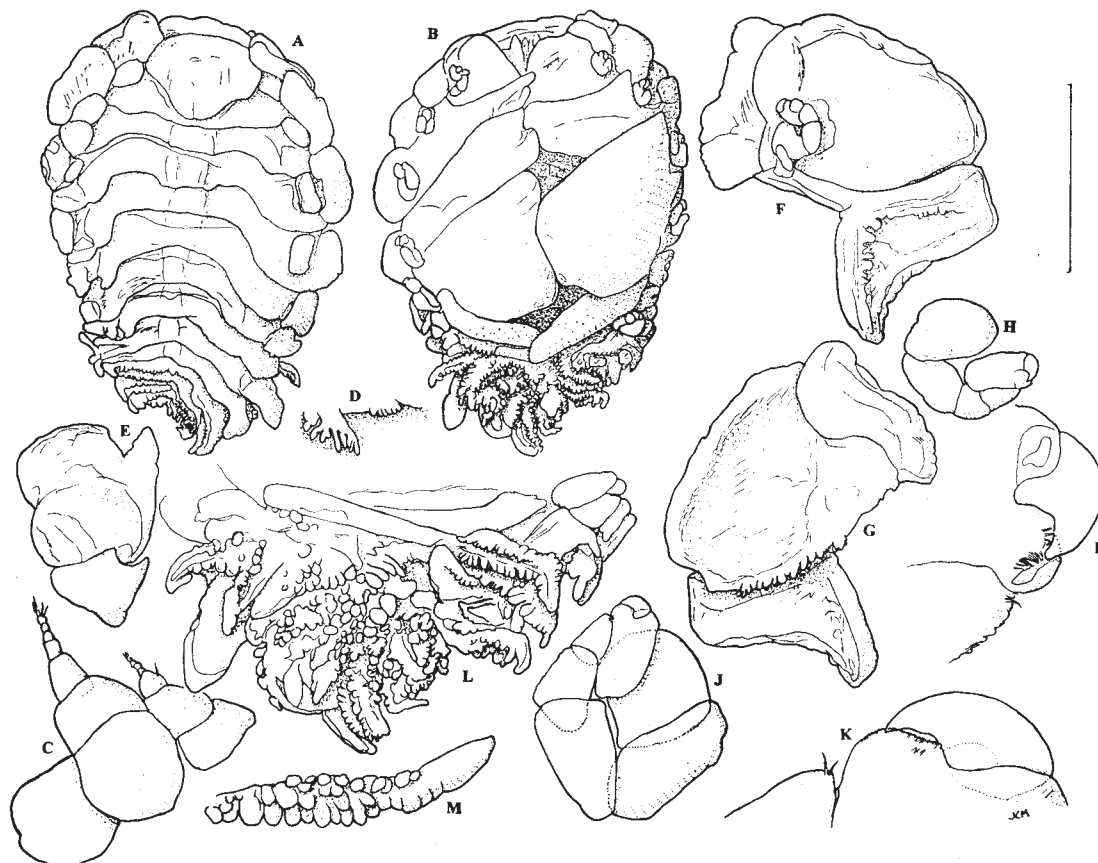


FIG. 20. *Orbione halipori* Nierstrasz & Brender à Brandis, 1923, female, QM-W10842. A, dorsal view. B, ventral view. C, right antennae. D, right side of barbula. E, right maxilliped. F, right oostegite 1, external. G, same, internal. H, right pereopod 1. I, distal edge of same. J, right pereopod 7. K, distal edge of same. L, pleon, ventral view. M, endopodite of pleopod 4. Scale: 4.15 mm for A, B; 2.0 mm for D-G, L; 1.08 mm for H, J; 1 mm for M; 0.43 mm for C; 0.22 mm for I, K.

hosts in Australian waters, especially the Gulf of Carpentaria, belong to three commercially important species of *Penaeus*.

***Orbione* Bonnier, 1900**

Type-species: *Orbione penei* Bourdon, 1900, by monotypy.

***Orbione halipori* Nierstrasz & Brender à Brandis, 1923**
(Figs 20, 21)

Synonymy restricted to original names, major reviews and Australian records.

Orbione halipori Nierstrasz & Brender à Brandis, 1923: 64–65, 66, fig. 2A–H [Paternoster and Kei Islands, Indonesia, infesting *Haliporus sibogae* de Man (= *Haliporoides sibogae* (de Man))]; Bourdon, 1979a:

471–477, 480, figs 1–3 [re-examination of type specimens and those of *Crassione aristaei*; Madagascar, infesting *Hymenopenaeus sibogae madagascariensis* Crosnier; offshore, New South Wales, infesting *Aristeomorpha foliacea* Risso; Madagascar, infesting *Hymenopenaeus halli* Bruce; complete redescription with remarks on variation]; Bourdon, 1979c: 431 [updated synonymy; Mozambique, host unknown; Kei Islands, Indonesia, infesting *Hymenopenaeus lucasi* (Bate); Lorenzo Marques, infesting *H. triarthrus* (Stebbing) (= *Haliporoides triarthrus* (Stebbing))]; Sydney, New South Wales, infesting *Aristeomorpha foliacea*; Markham, 1982: 362–365, 385, figs 21, 22 [synonymy; Hong Kong, infesting *Metapenaeus ensis* (Fabricius)]; Owens & Glazebrook, 1985: 107, table 2; Owens, 1986: 14, 84, 98, table 2.4.1 [Gulf of Carpentaria, infesting *M. ensis*]; Owens, 1987: 117, 118, 122 [summary of

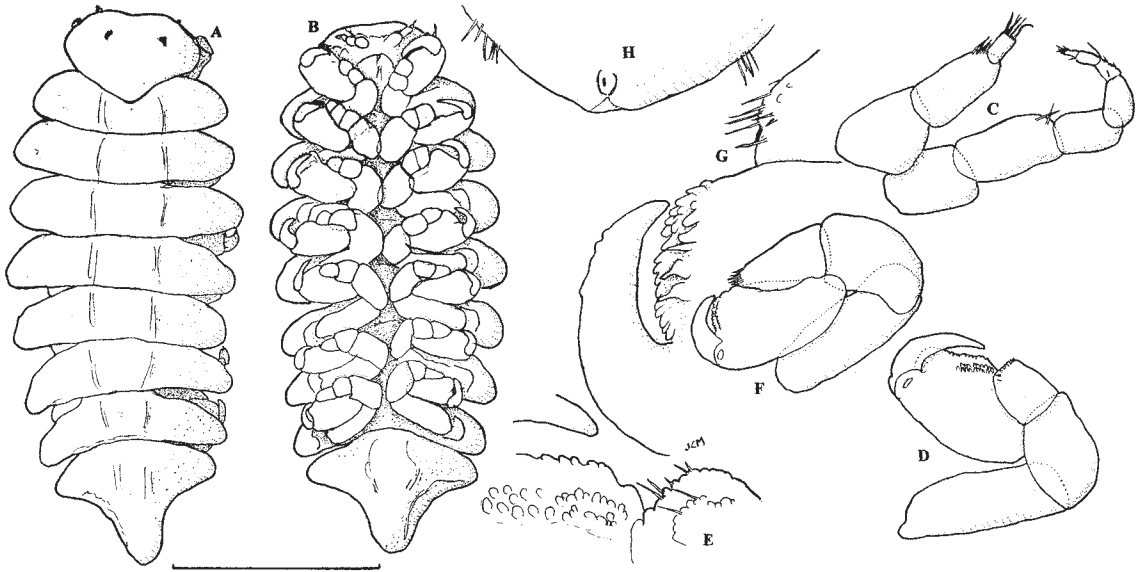


FIG. 21. *Orbiome halipori* Nierstrasz & Brender à Brandis, 1923, male, QM-W10843. A, dorsal view. B, ventral view. C, right antennae. D, right pereopod 1. E, distal region of same. F, right pereopod 7. G, distal region of same. H, end of pleon, ventral. Scale: 1.1 mm for A, B; 1 mm for D, F; 0.2 mm for C; 0.1 mm for E, G, H.

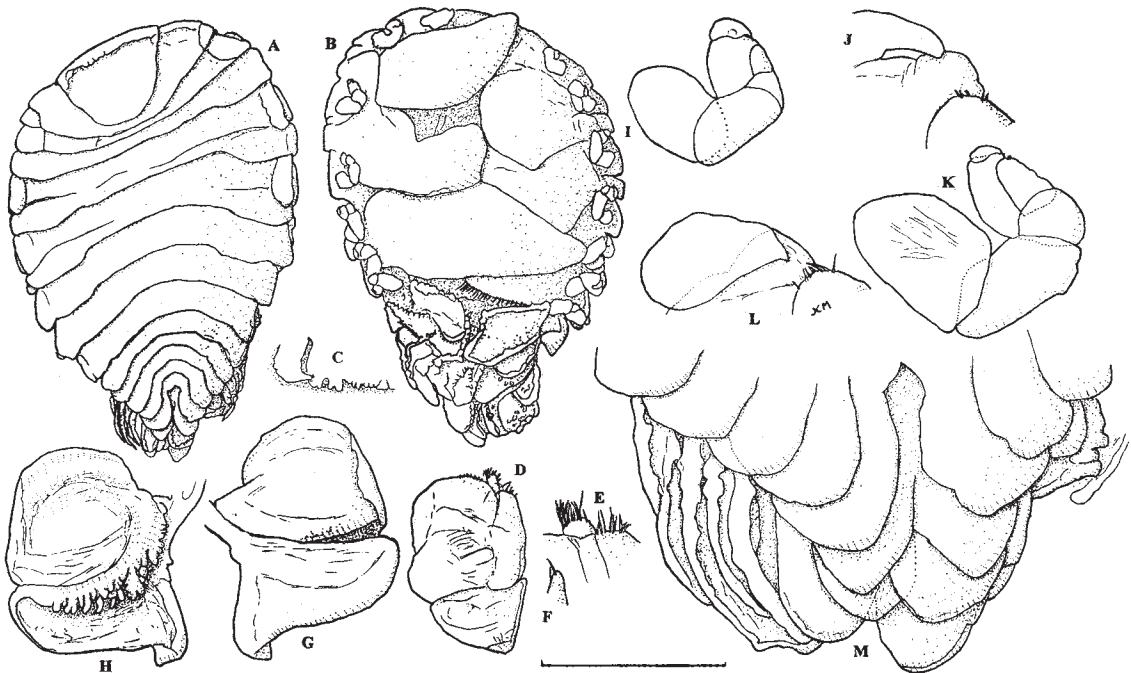


FIG. 22. *Parapenaeon expansa* Bourdon, 1979, female, QM-W17450. A, dorsal view. B, ventral view. C, left side of barbula. D, right maxilliped. E, palp of same. F, plectron of same. G, right oostegite 1, external. H, same, internal. I, right pereopod 1. J, distal edge of same. K, right pereopod 7. L, distal edge of same. Scale: 4.35 mm for A, B; 2.0 mm for C, D, G, H; 1.1 mm for E, F, I, K; 1 mm for M; 0.18 mm for J, L.

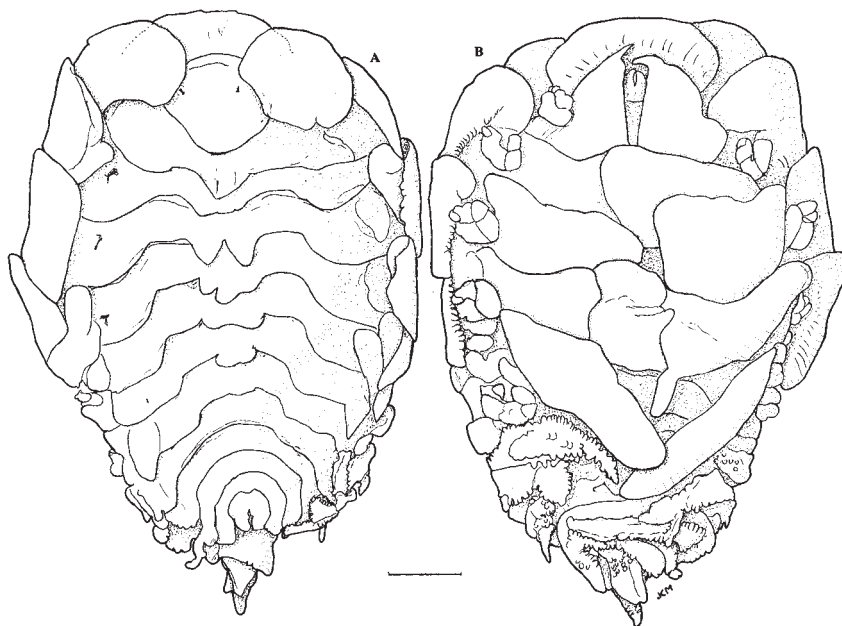


FIG. 23. *Parapenaon expansa* Bourdon, 1979, female, QM-W12031. A, dorsal view. B, ventral view. Scale: 2.0 mm.

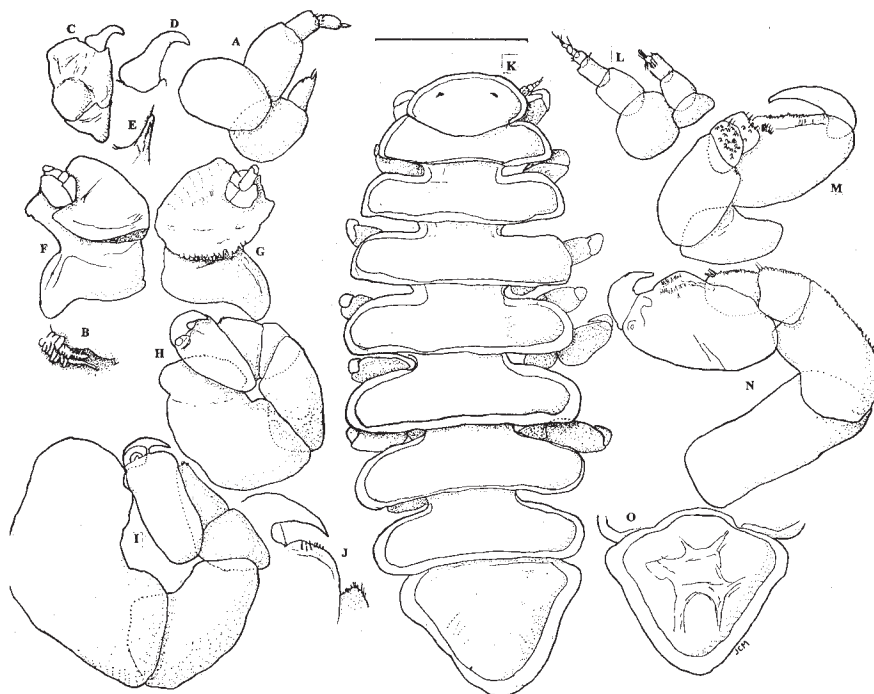


FIG. 24. *Parapenaon expansa* Bourdon, 1979, QM-W12031, A-J, female; K-O, male. A, right antennae. B, right side of barbula. C, right maxilliped. D, palp of same. E, plectron of same. F, right oostegite 1, external. G, same, internal. H, right pereopod 1. I, right pereopod 7. J, distal edge of same. K, dorsal view. L, right antennae. M, right pereopod 1. N, right pereopod 7. O, pleon, ventral. Scale: 4.52 mm for B, C, F, G; 1.82 mm for D; 1 mm for A, H, I; 0.91 mm for E, K, O; 0.4 mm for J, L-N.

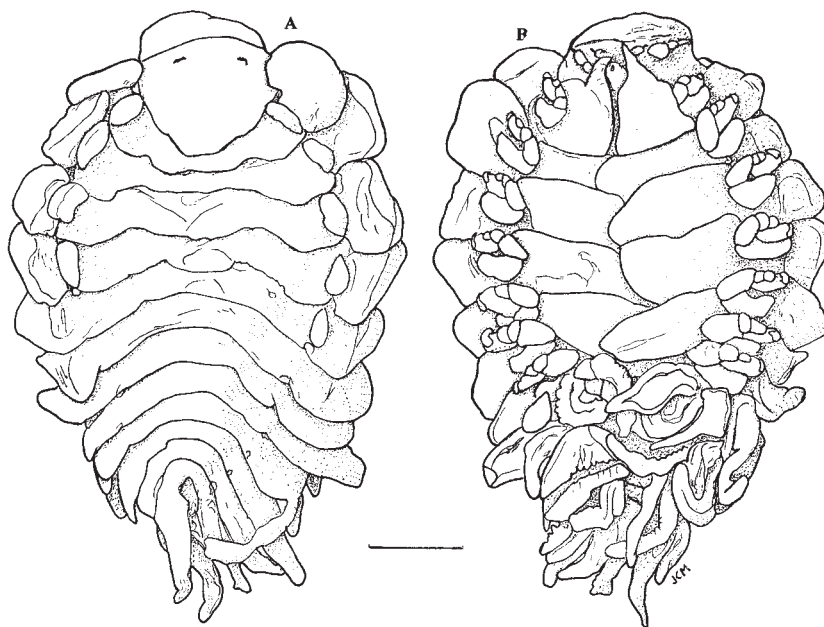


FIG. 25. *Parapenaeon expansa* Bourdon, 1979, immature female, QM-W10442. **A**, dorsal view. **B**, ventral view. Scale: 2.0 mm.

Australian records; remarks on range]; Markham, 1994: 225, 226, 235–237, fig. 6 [synonymy; West of Batangas Province, Luzon, Philippines, infesting *Haliporoides sibogae*]; Chu & Leong, 1996: 835–838, fig. 1 [Hong Kong, infesting *Metapenaenus joyneri* (Miers)]; Leung, 1997: 88, 90, table II [Hong Kong; infesting *Metapenaenus ensis*]; Poore *et al.*, 2002: 125–126 [Australian records].

Crassione aristei Dakin, 1931: 268–272, text-figs 1–9, pl. XIV [off New South Wales, infesting *Aristeus foliaceus* (Risso) (= *Aristaeomorpha foliacea*)]; Bourdon, 1979a: 471, 477 [synonymised with *Orbione halipori*].

Orbione halipori var. *libera* Nierstrasz & Brender à Brandis, 1931: 155 [Moluccas, Indonesia, infesting host subsequently identified as *Hymenopenaenus lucasii*]; Bourdon, 1979c: 431 [synonymised with *Orbione halipori*].

Non *Orbione halipori libera* – Shiino, 1934: 258–260, fig. 1 [Tanabe Bay, Japan, infesting *Solenocera distincta* (de Haan); redescription] (= *Orbione* prox. *halipori libera* sensu Shiino).

Non *Orbione* prox. *halipori libera* – Bourdon, 1981c: 239, 240–242, fig. 4 [re-examination of original material; considered member of different genus].

Orbione natalensis Carton, 1970: 47 [nomen nudum; Mozambique Channel, infesting *Hymenopenaenus triarthrus* (= *Haliporoides triarthrus*)]; Poore *et al.*, 2002: 136.

Orbiono (sic) *halipori* – Humphrey, 1995: table 48 [summary of Australian records].

Material Examined. QM-W10842, ♀, ♂, infesting *Metapenaenopsis rosea* Racek & Dall, 1965, off Cairns, Qld, 17°08.7'S, 146°15.2'E, 44 m, Oct. 1979.

Remarks. *Orbione halipori* has been reported many times and thoroughly described and redescribed. The present material lies within the known range of characters in most respects. The new female lacks the frilly margins usually found on the first two coxal plates, and the pleon of the male tapers into a slender point rather than being broadly rounded. This is the first known record of bopyrid infestation of *Metapenaenopsis rosea*, although otherwise previously known from Australia.

Parapenaeon Richardson, 1904

Type-species: *Parapenaeon consolidata* Richardson, 1904, by monotypy.

Parapenaeon expansa Bourdon, 1979

(Figs 22–25)

Parapenaeon expansus Bourdon, 1979a: 494, 495–498, figs 15–17, 18b, c [near Madagascar, infesting *Penaeus teraoi* Kubo]; Nearhos & Lester, 1984: 257, 258 [synonymy; Moreton Bay, Qld, infesting *Penaeus plebejus* Hess; and Karumba, Gulf of Carpentaria, infesting *Penaeus* sp.]; Owens &

Glazebrook, 1985a: 105–112, tables 2–4 [localities in northern Australia, infesting *Penaeus indicus* H. Milne Edwards, *P. merguensis* de Man, *P. longistylus* Kubo]; 1985b: 134–135 [same collection]; Owens, 1986: iv, 15, 84, 85, 91, 92, 95–100, tables 2.4.1, 8.2, 8.4 (a, b) [Gulf of Carpenteria, infesting *Penaeus merguensis*, *P. indicus*, *P. longistylus*; extensive study of biology]; Owens, 1987: 119 [summary of Australian records]; Anderson, 1990: 290; Owens, 1990: 35–39, table 1 [analysis of distribution in Australia; Owens & Rothlisberg, 1991: 779; Owens, 1993: 381, 384, 386 [NE Qld, infesting *Penaeus latisulcatus* Kishinouye]; Humphrey, 1995: table 48 [summary of Australian records]; Owens & Rothlisberg, 1995: 159 [study of larvae in Gulf of Carpenteria]; Poore *et al.*, 2002: 126.

? *Parapenaemon prox expansus* – Bourdon, 1979c: 435 [north of Darwin, NT, infesting ‘tiger prawn’ (= *Penaeus monodon* (Fabricius))]; Courtney, 1991: 615, 617, 620, table 2 [central coast of Qld, infesting *Penaeus longistylus* and *P. latisulcatus*]; Choi *et al.*, 2004: 239.

Parapenaemon expansa – Markham, 1994: 225, 226, 242, 244–245, fig. 14 [New Caledonia, infesting *Metapenaepsis gaillardi* Crosnier; Strait of Makassar, Indonesia, infesting *M. sinica* Liu & Zhong; Seychelles, infesting *M. faouzii* (Ramadan); Madagascar, infesting *M. mogiensis consobrina* (Nobili)]; N. Bruce, 2007: 278.

Material Examined. QM-W12031, ♀, ♂, Brisbane R., Qld, S.P. Nearhos, 12–14.03.1984. QM-W12033, ♀, ♂, infesting *Penaeus plebejus* Hess, 1865 (host, 212 mm long), data as for QM-W12031. QM-W10442, immature ♀, Moreton Bay, Qld, S.P. Nearhos.

Remarks. The material examined is part of that reported by Nearhos & Lester (1984). Heretofore, however, despite frequent collections around the continent, no Australian specimens of *Parapenaemon expansa* have been illustrated, so the female, male and immature female are pictured here. All conform well with previous knowledge of the species. Although Bourdon (1979a), and most subsequent authors, designated the species *Parapenaemon expansus*, I have used the feminine form on grounds that Richardson (1904), in erecting the genus *Parapenaemon*, considered it be feminine, as indicated by her writing the name of the type species with a feminine ending.

Parapenaemonella Shiino, 1949

Type-species: *Parapenaemonella distincta* Shiino, 1949, by monotypy

Parapenaemonella lamellata Bourdon, 1979

Parapenaemonella lamellata Bourdon, 1979c: 425–428, figs 1–3 [west coast of India, infesting *Metapenaemon monoceros* (Fabricius); west coast of Thailand, infesting *M. ensis* (de Man)]; Bourdon, 1981c: 255; Markham, 1982: 365; Miquel, 1982: 94; Owens & Glazebrook, 1985: 107, table 2 [Gulf of Carpenteria, infesting *M. ensis*]; Owens, 1986: 15, 84, 98, tables 2.4.1, 8.2 [Gulf of Carpenteria, infesting *M. ensis*]; Owens, 1987: 118 [summary of Australian records]; Owens, 1990: 35, 37, table 1 [Gulf of Carpenteria, Qld, infesting *M. ensis* and *M. endeavouri* (Schmitt)]; Owens, 1993: 384; Humphrey, 1995: table 48 [summary of Australian records]; Kensley, 2001: 225; Poore *et al.*, 2002: 126 [systematic history; summary of Australian records]; Kazmi *et al.*, 2002: 55, fig. 8.

Parapenaecolla [sic] *lamellata* – Kazmi *et al.*, 2002: 54.

Remarks. No new material examined.

ATHELGINAE Codreanu & Codreanu, 1956

Athelges Hesse, 1861

Type-species: *Phryxus paguri* Rathke, 1843, by subsequent designation.

Athelges ankistrion sp. nov.

(Figs 26, 27)

Material Examined. HOLOTYPE ♀, ALLOTYPE ♂, QM-W29067, (♀ carapace length 3.4 mm, shield length 2.1 mm), infesting *Diogenes pallescens* Whitelegge, 1897, in shallow water seagrass, Myora Springs, North Stradbroke I., Qld, 27°40.8'S, 153°24.6'E, 20.02.2005, J.C. Markham. PARATYPES: QM-W29068, ♀, ♂, same host (♀ shield length 1.7 mm), North Stradbroke I., Qld, 27°28.1'S, 153°25.3 E, 14.02.2005, J.C. Markham.

Description. *Female holotype* (Fig. 26A, C–L). Attached to dorsal surface of host's abdomen, facing posteriorly (Fig. 26A). Length 5.4 mm, maximal width 2.6 mm, head length 0.8 mm, head width 0.8 mm. Body outline nearly rectangular, head–pereon axis straight, but pleon extending sharply to side and reflexed back, barely extending beyond pereon; all body regions and segments distinct (Fig. 26C, D).

Head deeply embedded in pereon, greatly overreached anteriorly by oostegites, subcircular in outline behind antennae. First antenna minute, of 3 articles, second antenna long, of 6 articles, both setose distally (Fig. 26E). Barbula (Fig. 26F) with 2 unadorned lanceolate lateral projections rounded proximally and pointed

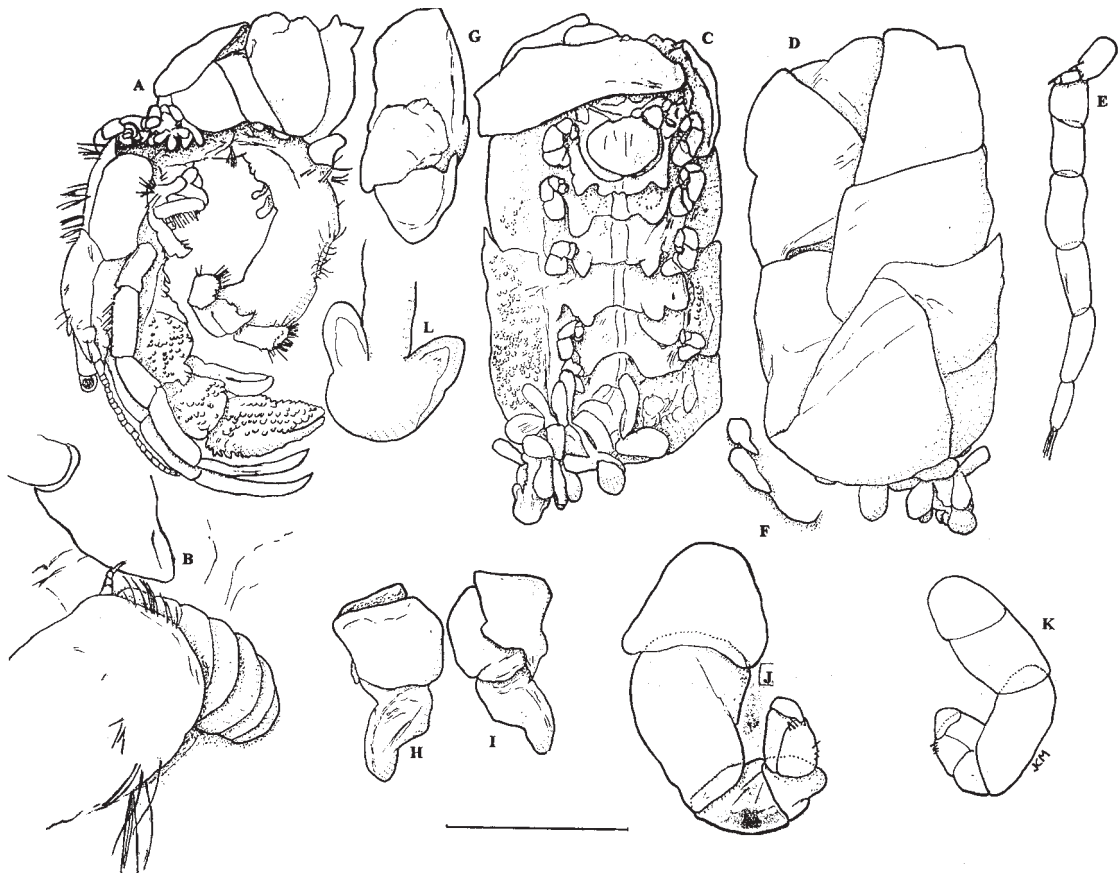


FIG. 26. *Athelges ankistrion* n. sp., A, C-K, holotype female; B, allotype male. QM-W29067. A, in place on abdomen of host. B, in place in gill chamber of host. C, dorsal view. D, ventral view. E, right antennae. F, right side of barbula. G, right maxilliped. H, right oostegite 1, external view. I, same, internal view. J, right pereopod 1. K, left pereopod 6. L, posterior of pleon. Scale: 4.26 mm for A; 2.0 mm for C, D, H, I; 1 mm for B, F, G; 0.56 mm for L; 0.36 mm for E, J, K.

distally. Maxilliped (Fig. 26G) long and slender, its sides nearly parallel, anterior article more than twice as long as posterior one; palp indicated only as short anteromedial point; bluntly pointed plectron prominent, extended straight forward.

Pereon with all 7 pereomeres distinct dorsally, but first one ventrally obliterated by head. Pereomeres 3–5 longest, all of same width. First pereomere wrapped around head, others medially straight across except for paired chevron-like flaps extending posteriorly near sides of pereomeres 2–6. First oostegites (Fig. 26H, I) much smaller than others and completely hidden inside brood pouch, both articles about same length, anterior one broadly rounded, posterior

produced into bluntly falcate points, internal ridge completely unornamented. Other oostegites much larger, all of about same size. Oostegites of second pair arching across and enclosing anterior end of body, others variously fused into fully closed brood pouch. Pereopods (Fig. 26J, K) small but slightly larger posteriorly, all sharply bent. First pair of pereopods hidden beneath oostegite, second through fifth pairs in nearly straight lines on dorsal surface.

Pleon narrow and somewhat extended, sides of first four pleomeres lined with small lanceolate uniramous lateral plates and similarly shaped and sized rami of uniramous pleopods. Final, fifth, pleomere devoid of appendages but produced into prominent reflexed anchor-shaped end.

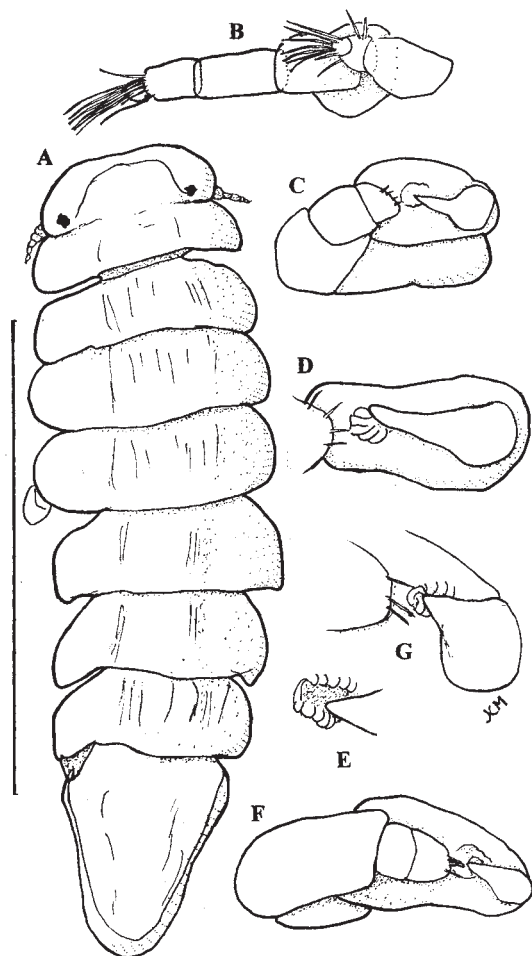


FIG. 27. *Athelges ankistrion* n. sp., allotype male, QM-W29067 A, dorsal. B, right antennae. C, left pereopod 1. D, distal end of same. E, left pereopod 7. F, distal end of same. G, tip of dactylus of same. Scale: 1 mm for A; 0.33 mm for B, C, F; 0.16 mm for D, E, G.

Male allotype (Figs 26B, 27). Partly enclosed in left branchial chamber of host, only posterior half extending out (Fig. 26B). Length 1.7 mm, maximal width 0.5 mm, head length 0.1 mm, head length 0.4 mm, pleon length 0.4 mm. Head fused with first pereomere, pleon fused, all pereomeres separate (Fig. 27A).

Head subrectangular, truncate anteriorly, broadest near posterior edge though slightly narrower than front of first pereomere nearly completely fused with it, anterior corners rounded. Dark circular eyes near posterolateral corners.

Antennae (Fig. 27B) prominent, first of three articles, second of five articles extending well beyond sides of head, distal article of each tipped by thick tuft of long setae, some setae also on penultimate article of each antenna.

Pereon with nearly parallel sides, all pereomeres sharply separated. Pereopods (Fig. 27 C, F) slightly larger posteriorly, all of similar structure and proportions, with all articles distinct; dactyli (Fig. 27D, E, G) somewhat smaller posteriorly, each reflexing into receptacle on surface of propodus surrounded by row of overlapping corneous plates.

Pleon anteriorly nearly as broad as preceding pereomere, slightly widest immediately behind anterior edge, tapering smoothly posteriorly, overall shaped as broadly rounded isosceles triangle. All indication of appendages completely absent.

Etymology. From the Greek *ankistrion* meaning 'anchor', selected in reference to the distinctive shape of the end of the female's pleon; used as a noun in apposition.

Remarks. The new species, *Athelges ankistrion*, matches other species of *Athelges* by the female having: second oostegites crossing over front end of body; no pereomere markedly longer than others; pereopods small and sharply reflexed; pleon abruptly narrower than pereon; two appendages on each side of each of first four pleomeres; final, fifth, pleomere greatly extended, ending in variously enlarged terminal region, lacking all appendages.

Males of the Athelginae are diagnostic for that subfamily, but difficult to distinguish by genus. *Athelges* contains ten currently recognised species found infesting several pagurid and diogenid hosts from Europe through the Indian Ocean to Japan and New Zealand. Some of these have never been fully described. Of those that are well known, the female of *A. ankistrion* is most similar to that of *A. tenuicaudis* Sars, 1898, known to infest three species in the pagurid genus *Anapagurus* from Norway to France (Markham 2003a). Well illustrated by Sars (1898), it has most nearly the same body proportions, orientation of oostegites and shape of 'chevrons' on the dorsal surfaces of the pereomeres. The males of both species are also quite similar, especially in the shapes of their pleons, but only

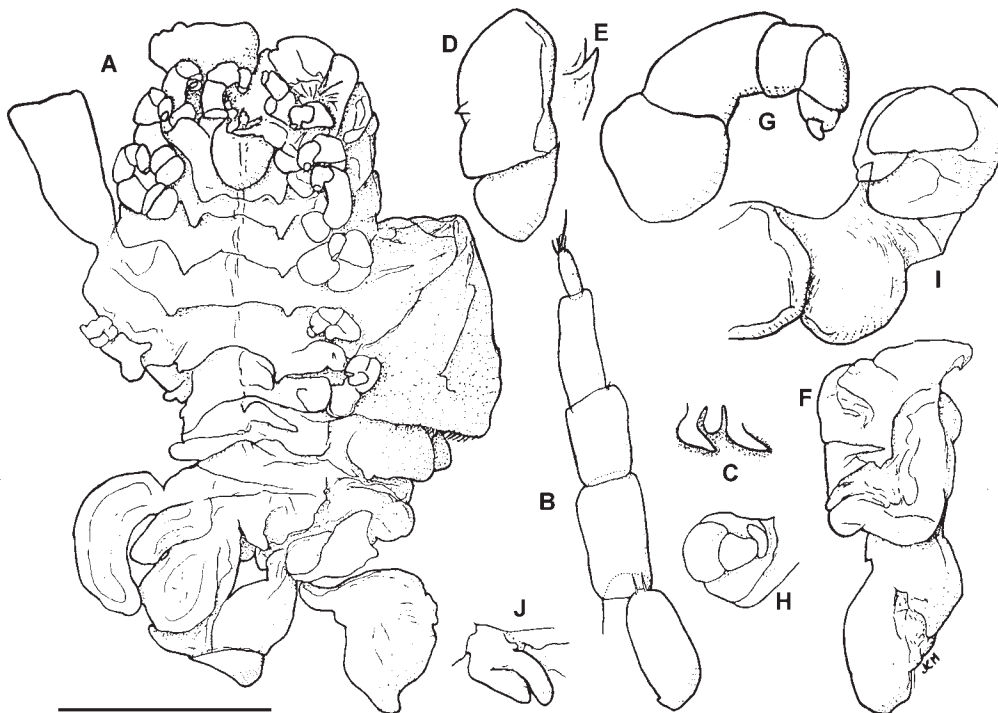


FIG. 28. *Parathelges aniculi* (Whitelegge, 1897), holotype female. AM-G1423. A, dorsal. B, right antennae. C, right side of barbula. D, right maxilliped. E, palp of same. F, right oostegite 1, external view. G, left pereopod 1. H, end of left pereopod 2. I, right pereopod 7. J, Pleotelson, ventral. Scale: 4.69 mm for A; 2.14 mm for C, D, F, J; 1.1 mm for I; 1 mm for G; 0.61 mm for E, H; 0.4 mm for B.

the male of *A. aegyptius* Codreanu, Codreanu & Pike, 1965, shares with the male of *A. ankistron* the fusion of its head with the first pereomere. Two characters of the female of *A. ankistron* sp. nov., the nearly parallel sides of the pereon and the uniquely anchor-shaped end of the pleon, immediately distinguish it from all other known *Athelges*. The paratypes are closely similar to the types described. The female is 4.8 mm long and 6.8 mm broad. It is slightly more pyriform in outline and widest across pereomeres 6 and 7. Contained eggs make its body appear purple. The accompanying male is 1.8 mm long and 0.6 mm wide.

I originally identified the host as *Diogenes gardineri* Alcock, 1905, but Mclaughlin (2002) regards that species as a junior synonym of *D. pallescens* Whitelegge, 1897, and this is thus the name used here.

There are published records of the occurrence of immature females of abdominally infesting

bopyrids in the branchial chambers of their decapod hosts, but it is unusual for males of those species to be found there while their mates are attached in the usual positions. For that reason, I have made particular note of that occurrence here.

On the basis of a preliminary identification that I made, Haig & Ball (1988) reported the presence of an 'undescribed species of *Athelges*' infesting the diogenid hermit crabs *Calcinus* n. sp. and *Trizopagurus strigatus* (Herbst) (names subsequently updated to *Calcinus lineapropodus* Morgan & Forest and *Ciliopagurus strigatus* (Herbst) respectively in Markham, 2003a) in the Banda Sea, Indonesia. Unfortunately, the material of that parasite has subsequently been lost (E. E. Ball, pers. comm.), so it cannot be determined whether it was conspecific with *Athelges ankistron* sp. nov. I have, however, examined another specimen from a different station of the same expedition at the same locality in Indonesia and

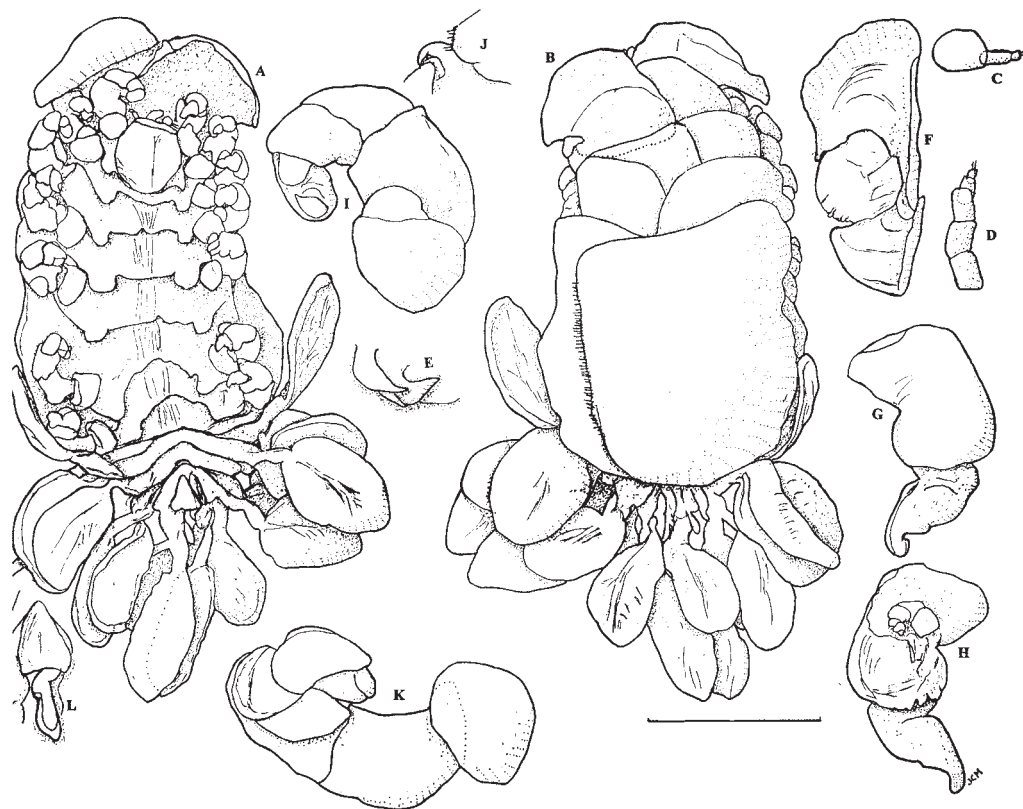


FIG. 29. *Parathelges aniculi* (Whitelegge, 1897), holotype female of *Parathelges whiteleggei* Nierstrasz & Brender à Brandis, 1931, ZMA-CRU8616. **A**, dorsal view. **B**, ventral view. **C**, right antenna 1. **D**, right antenna 2. **E**, right side of barbula. **F**, right maxilliped. **G**, right oostegite 1, external. **H**, same, internal. **I**, right pereopod 1. **J**, distal edge of same. **K**, right pereopod 7. **L**, end of pleon, dorsal view. Scale: 4.26 mm for A, B, G, H; 1.00 mm for C, D, I, K; 0.5 mm for E, F, L; 0.36 mm for J.

also infesting the '*Calcinus* n. sp.'. It is an unaccompanied very immature female clearly in *Athelges*; it probably belongs to *A. takanoshimensis* Ishii, 1914, which is widely known throughout the western Pacific, but its immaturity makes its assignment to species uncertain.

Parathelges Bonnier, 1900

Type-species: *Athelgue aniculi* Whitelegge, 1897, by original designation.

Parathelges aniculi (Whitelegge, 1897)

(Figs 28–31)

Athelgue aniculi Whitelegge, 1897: 149–151, pl. VII, figs 5–5c [Funafuti Atoll, Ellice Archipelago (= Tuvalu), infesting *Aniculus typicus* Dana (= *Aniculus aniculus* (Herbst))]; Bonnier, 1900: 85, footnote [cited as type of *Parathelges*, n. g.].

'Un type voisin...' — Bonnier, 1900: 215 [designated type of *Parathelges*, n. g.].

Parathelges aniculi — Bonnier, 1900: 217, 380; Nierstrasz & Brender à Brandis, 1923: 105; 1929b: 302; 1931: 200–201; Barnard, 1936: 191; Codreanu, 1940: 680–681; 1941: 1125; 1961: 137, fig. 1; Shiino, 1950: 164; Danforth, 1971: 99; Markham, 1972: 58, 59–60, 76, fig. 16; 2003: 73; Jones & Morgan, 2002: 59, unnumbered fig. [from unnamed locality in Australia, infesting *Dardanus megistos* (Herbst)].

Athelges aniculi — Richard, 1900: 72; Markham, 1978: 112 [cited as type-species of *Parathelges*].

Parathelges weberi Nierstrasz & Brender à Brandis, 1923: 105, 107, fig. 28a–d ['Wirt und Fundort leider unbekannt'; somewhere in Indonesia]; 1929b: 302, figs 10–11 [Indonesia; host unspecified; first description of male]; 1931: 200, 201; Barnard, 1936: 191 [Great Coco I., Andaman Islands; host not mentioned]; Codreanu, 1940: 680–681; 1961: 137, fig. 1; Shiino, 1950: 164; Caroli, 1953: 86;

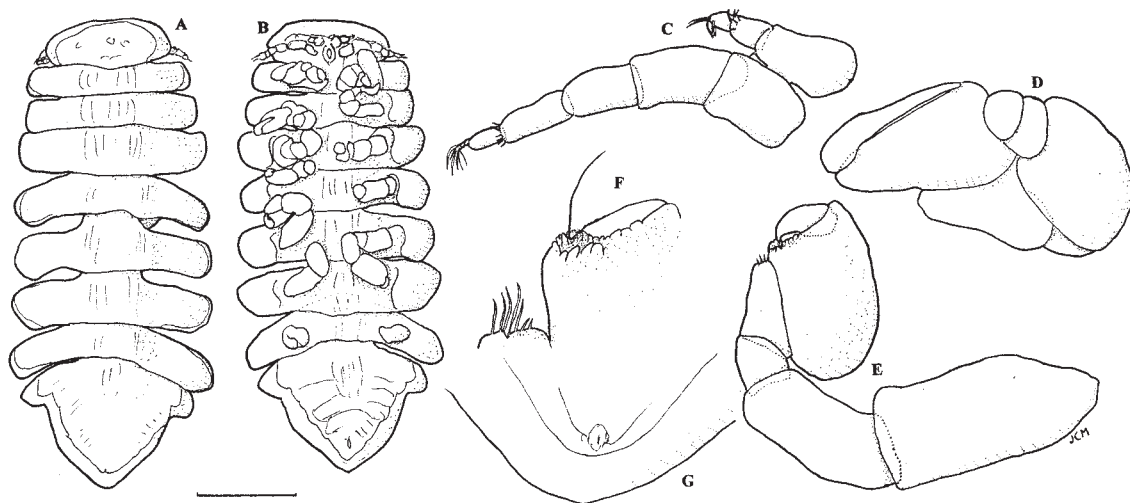


FIG. 30. *Parathelges aniculi* (Whitelegge, 1897), allotype male of *Parathelges whiteleggei* Nierstrasz & Brender à Brandis, 1931, ZMA-CRU8616. A, dorsal view. B, ventral view. C, right antennae. D, right pereopod 1. E, right pereopod 7. F, distal region of same. G, end of pleon, ventral. Scale: 1 mm for A, B; 0.18 mm for C-E, G; 0.05 mm for F.

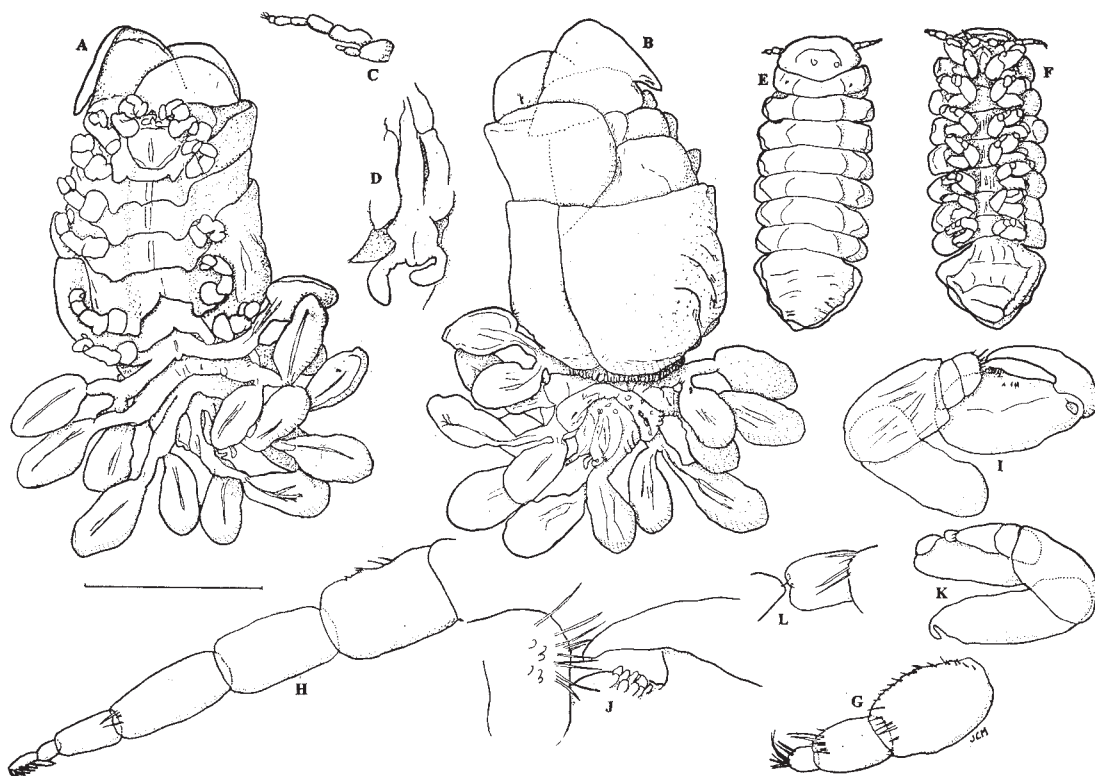


FIG. 31. *Parathelges aniculi* (Whitelegge, 1897), A-D, female; E-L, male, QM-W21541. A, dorsal. B, ventral. C, right antennae. D, end of pleon, dorsal view. E, dorsal. F, ventral. G, right antenna 1. H, right antenna 2. I, right pereopod 1. J, distal region of same. K, left pereopod 7. L, distal region of same. Scale: 4.00 mm for A, B; 2.0 mm for E, F; 1 mm for C, D; 0.36 mm for I, K; 0.18 mm for G, H; 0.09 mm for J, L.

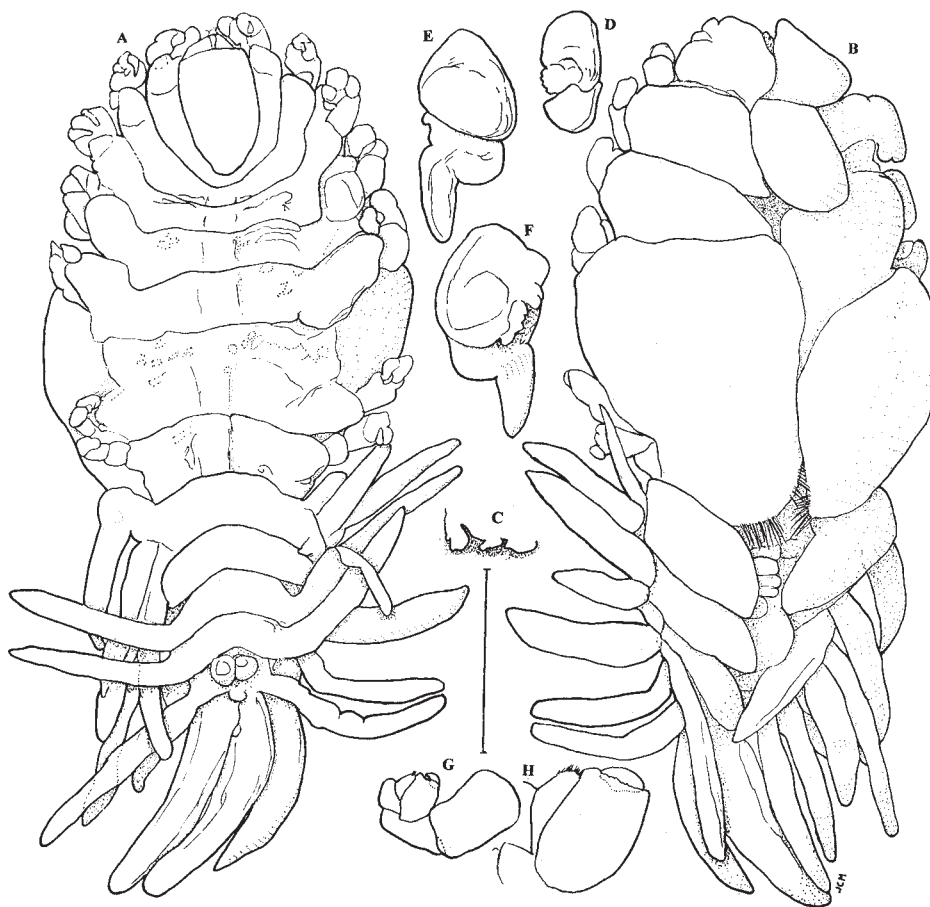


FIG. 32. *Pseudostegias dulcilacuum* Markham, 1982, female, QM-W27088. A, dorsal view. B, ventral view. C, right side of barbula. D, right maxilliped. E, right oostegite 1, external. F, same, internal. G, right pereopod. H, distal region of same. Scale: 2.0 mm for A, B, D-F; 1.1 mm for G; 1 mm for C; 0.43 mm for H.

Barnard, 1955: 77–78; Danforth, 1971: 99, 100, fig. 1A [near Maiwara, New Guinea, infesting *Calcinus laevimanus* (Randall)]; Ball & Haig, 1972: 100 [same material as in Danforth, 1971]; Markham, 1972b: 58, 59, 76, 77, fig. 16; Haig & Ball, 1988: 160 [Banda Sea, south of Irian Jaya, Indonesia, infesting *C. laevimanus*]; Høeg & Rybakov, 1992: 601, table 1.

Parathelges whiteleggei Nierstrasz & Brender à Brandis, 1931: 200–201, fig. 92, pl. I fig. 4 [Java Sea, Indonesia, infesting *Pagurus* sp. (= *Dardanus hessi* (Miers))]; Codreanu, 1940: 681; 1941: 1125; 1961: 137, fig. 1; Shiino, 1950: 164; Caroli, 1953: 86; Barnard, 1955: 77, 78; Danforth, 1971: 99; Markham, 1972b: 58, 70 footnote, 76, 77, fig. 16; 2003a: 73, 74.

Athelge aniculi – Nordenstam, 1946: 2.

Parathelges ? whiteleggei – Haig & Ball, 1988: 173 [Banda I., off Irian Jaya, Indonesia, infesting *Paguristes monoporus* Morgan].

'Bopyridae' – Jones & Morgan, 1994: 59; unnumbered fig. [Same photograph as in Jones & Morgan (2002), above].

Material Examined. *Athelge aniculi*: holotype ♀, AM-G1423, infesting *Aniculus aniculus* (Fabricius, 1787), Funafuti, Tuvalu, south Pacific Ocean, 08°31'S, 179°14'E, coll. prior to 1897 (Fig. 28). *Parathelges whiteleggei*: holotype ♀, allotype ♂, ZMUC-CRU8616, infesting *Dardanus hessi* (Miers, 1884), Java Sea, central Indonesia, 04.12.1910 (Figs 29, 30). QM-W21541, ♀, ♂, infesting *Clibanarius* sp., Portland Roads, Cape York Peninsula, Qld, 12°36'S, 143°25'E, Nov. 1983, K. Lamprell (Fig. 31). QM-W29069, 3 ♀♀, 3 ♂♂, infesting *Dardanus* sp., Wreck I. lagoon, Capricorn Group,

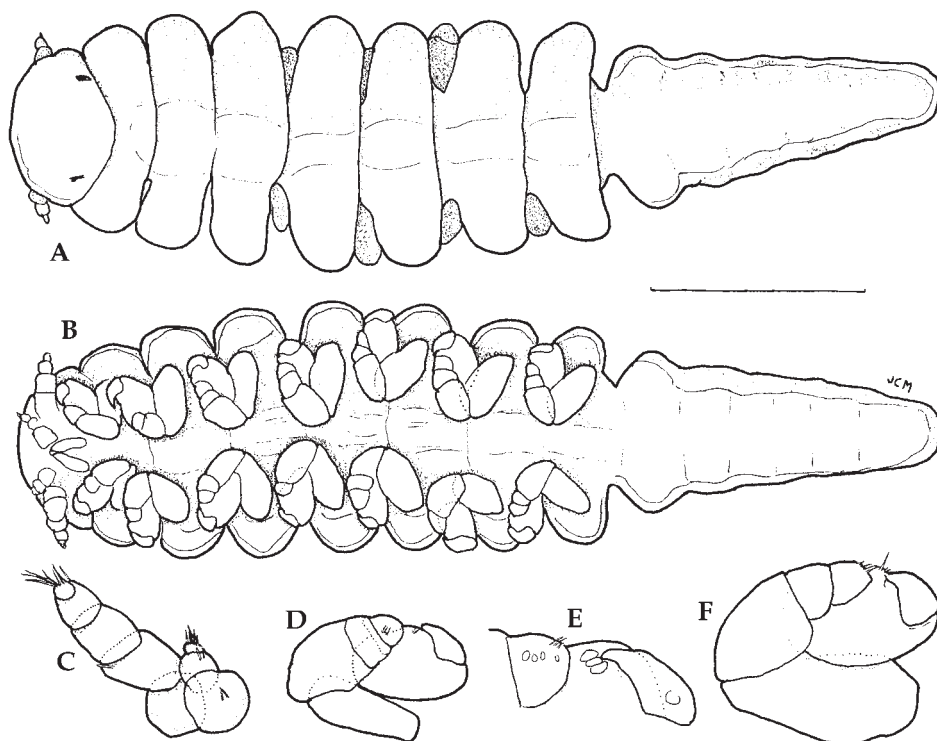


FIG. 33. *Pseudostegias dulcilaecuum* Markham, 1982, male, QM-W27088. **A**, dorsal view. **B**, ventral view. **C**, right antennae. **D**, right pereopod 1. **E**, distal region of same. **F**, right pereopod 7. Scale: 0.59 mm for A, B; 0.20 mm for C, D, F; 0.1 mm for E.

Great Barrier Reef, Qld, 23°19'S, 151°56'E, 0.5 m, 06.12.1979, D. Snow & A.J. Bruce.

Remarks. The original description of *Athelgus aniculi* was incomplete and the illustrations diagrammatic. The type female (Fig. 28), though still extant, is in very poor condition, but I hope that the new figure provided here will provide enough additional information to allow the species to be identified in the future. The types of *Parathelges whiteleggei* (Figs 29, 30), have not previously been adequately described or illustrated (the female being still completely intact), but they remain in excellent condition, so I have illustrated them in considerable detail. The host had also never been properly identified, but as it was still in the container with the types, Dr. P. A. McLaughlin graciously identified it as *Dardanus hessi* (Miers).

I have not examined material referred to *Parathelges weberi*, but the original description by Nierstrasz & Brender à Brandis (1923), in

which those authors considered it to be very similar to *P. aniculi*, seems to show no greater variation than would be expected within a single species. Accordingly, I am hereby incorporating both *P. weberi* and *P. whiteleggei* into the synonymy of *Parathelges aniculi*. There are differences in such characters as the shapes of the 'chevrons' extending from the posterior margins of the pereomeres (Fig. 28A, 29A, 30A), from being sharply pointed to more broadly rounded, and of the maxilliped (Fig. 28D, E, 29F). The shorter middle projection on the side of the barbula of the type female (Fig. 28B) is probably the consequence of general deterioration of that specimen, while the presence of only a single ramus on the uropod of the type of *P. whiteleggei* (Fig. 29L), contrary to the generic diagnosis, is almost certainly an individual anomaly.

The superb photograph of an abdominal parasite of *Dardanus megistos* (Herbst) published

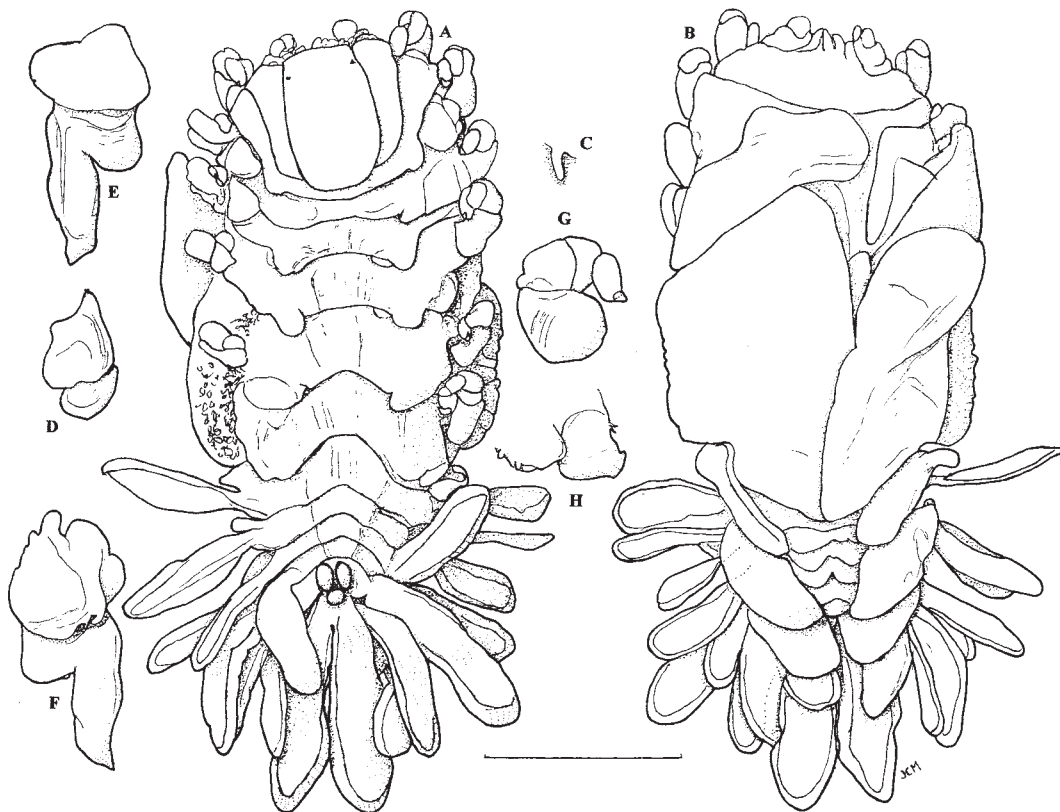


FIG. 34. *Pseudostegias setoensis* Shiino, 1933, female, QM-W25103. A, dorsal view. B, ventral view. C, right side of barbula. D, right maxilliped. E, right ostegite 1, external. F, same, internal. G, right pereopod 1. H, globose fifth lateral plates. Scale: 2.0 mm for A-F; 0.89 mm for G; 0.19 mm for H.

twice by Jones & Morgan (1994, 2002) is clearly referable to *P. aniculi*, as are unpublished photographs of a parasite of the same host emailed to me by Tristan Lougher of Cheshire Wildlife Corporation (pers. comm.). In both cases, however, I have been unable to examine the specimens directly or to learn the localities of their collection.

With the incorporation of two other species into *Parathelges aniculi*, only one other species of the genus, *P. enoshimensis* Shiino, 1950, remains known from the western Pacific. It has been recorded to infest a '*Eupagurus* sp.' in Japan (Shiino, 1950) and two identified species of *Pagurus* in Korea (Kim & Kwon, 1988a). Those authors described and redescribed and illustrated it in excellent detail, so it is very well known. Females of *P. enoshimensis* differ from those of *P. aniculi* by: body narrowing more

strongly forward; projections on sides of barbula relatively longer and sharper; pleonal appendages shorter, more compact and their terminal lobes closer to being circular; uropods slightly smaller. Males of *P. enoshimensis* differ by: head and first pereomere fused; and pleon more deeply separated from last pereomere.

Pseudostegias Shiino, 1933

Type-species: *Pseudostegias setoensis* Shiino, 1933, by monotypy.

Pseudostegias dulcilocuum Markham, 1982 (Figs 32, 33)

Pseudostegias dulcilocuum Markham, 1982: 370-373, figs 25, 26 [Hong Kong, infesting *Diogenes* aff. *edwardsi* (de Haan) — Markham, 1985b: 3, 53-55, 63, figs 26-28, table 1 [Phuket, Thailand, infesting *Clibanarius merguiensis* de Man]; Page, 1985: 201, 203; Kim & Kwon, 1988b: 199, 214-215, 220, 215,

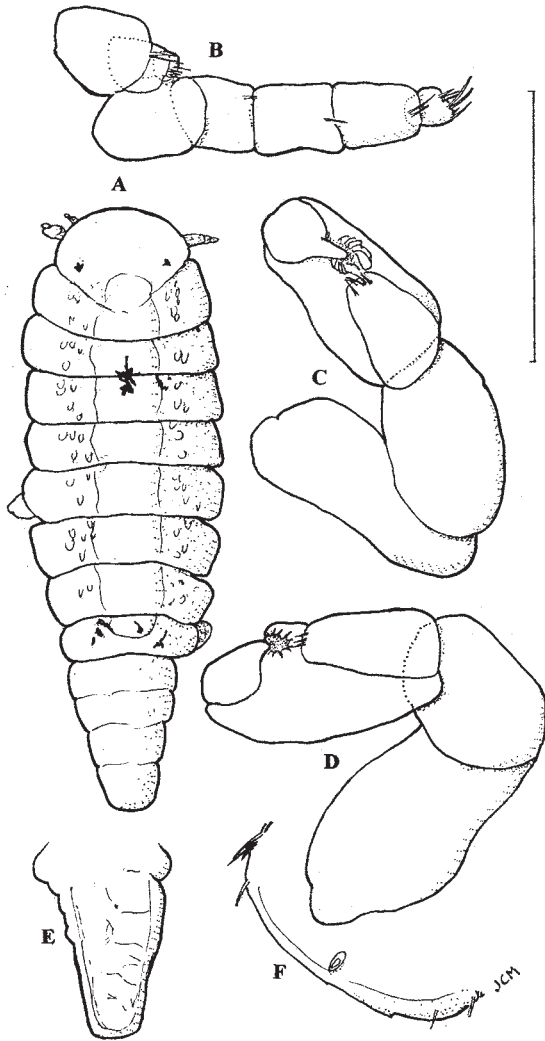


FIG. 35. *Pseudostegias setoensis* Shiino, 1933, male, QM-W25103. **A**, dorsal view. **B**, left antennae. **C**, right pereopod 2. **D**, right pereopod 7. **E**, pleon, ventral. **F**, posterior tip of pleon. Scale: 1.13 mm for A, E; 0.2 mm for B-D.

fig. 9 [west coast of Korea, infesting *Diogenes* sp.]; Markham, 1992b: 299, table 1; Li, 2003: 140, table 2; Morton, 2003: 37, table 2.

Pseudostegias dulcilaeuum [sic] – Page, 1985: 203.

Pseudostegias dulcilaeuum [sic] – Huang, 1994: 530; 2001: 327.

Pseudostegias setoensis – Dunbar & Coates, 2000: 49, fig 1 [South Coe Bay, Qld, infesting *Clibanarius taeniatus* (H. Milne Edwards) and *C. virescens* (Krauss)]; Poore *et al.*, 2002: 116 [non *Pseudostegias setoensis* Shiino, 1933].

Material Examined. QM-W27088, ♀, ♂, infesting *Clibanarius taeniatus* (H. Milne Edwards, 1848), intertidal on rocky shore, Sweers I., SW coast Gulf of Carpentaria, Qld, 17°06'S, 139°36'E, P. Davie, 17.09.2002. QM-W25103, ♀, QM-W25094, ♂, infesting *Clibanarius virescens* (Krauss, 1843), south side of Cooe Bay, Qld, 23°08.5'S, 150°45.7'E, S. Dunbar, 02.11.1998 [material reported by Dunbar & Coates, 2000]. QM-W23187, ♀, ♂, infesting *Clibanarius* sp., in pool on sandy-rocky shore, south side of Cooe Bay, Qld, 23°08.6'S, 150°45.7'E, S. Dunbar, 15.01.1998 [material reported by Dunbar & Coates, 2000].

Remarks. The material reported by Dunbar & Coates (2000), which I had identified for those authors, I have decided, upon reexamination, to represent *Pseudostegias dulcilaeuum* instead. Because most of the material herein examined has already been reported from Queensland, it is not a new geographical or host record. The female of *Pseudostegias dulcilaeuum* can be separated most reliably from *P. setoensis* by the former having a simple, not digitately divided, lateral projection of the barbula (Fig. 32C); nearly parallel, not tapered, posterolateral projection of the first oostegite (Fig. 32E); and oval, not lanceolate, anterior pleonal appendages (Fig. 32A).

Pseudostegias setoensis Shiino, 1933

(Figs 34, 35)

Pseudostegias setoensis Shiino, 1933: 290–293, fig. 16 [Seto, Japan, infesting *Clibanarius bimaculatus* (de Haan)]; Shiino, 1950: 161–162; 1952: 35, 36; 1958: 68 [Wakayama Prefecture, Japan, infesting *C. bimaculatus*; Taiwan, infesting *C. striolatus* Dana]; 1972: 9; Lemos de Castro, 1965: 105, 106–108; Markham, 1982: 369–373, 385 [Hong Kong, infesting *C. bimaculatus* and *C. ransonii* Forest]; Morton & Morton, 1983: 96, 98, 201, fig. 7.5, table 10.2; Markham, 1985: 3, 51–52, 55, 63, fig. 25, table 1 [Phuket, Thailand, infesting *C. padaverensis* de Man]; Page, 1985: 201, 203; Harada, 1991: 202; Markham, 1992: 299, table 1; 1994: 226 [Chesterfield Islands and New Caledonia, infesting '*Trizopagurus*' sp. n. (= *Striopagurus boreonotus* Forest)]; Huang, 1994: 530; Williams & Boyko, 1999: 720; Saito *et al.*, 2000: 45; Kensley, 2001: 226; Kensley & Chan, 2001: 481; Poore *et al.*, 2002: 116; Li, 2003: 140, 155, table 1; Markham, 2003: 72, 73; Boyko, 2004: 677.

Non *Pseudostegias setoensis* – Dunbar & Coates, 2000: 49, fig 1 [South Cooe Bay, Qld, infesting *Clibanarius taeniatus* (H. Milne Edwards) and *C. virescens* (Krauss)]; Poore *et al.*, 2002: 116 [= *Pseudostegias dulcilaeuum* Markham, 1982]; *Pseudostegias* [sic] *setoensis* – N. Bruce, 2007: 278.



FIG. 36. *Diplophryxus jordani* Richardson, 1904, female, QM-W29070, dorsal view (ex *Palaemon serenus*). Scale: 1 mm.

Material examined. QM-W27086, ♀, ♂, infesting *Diogenes pallescens* Whitelegge, 1897. Sweers I., SW coast Gulf of Carpentaria, Qld, 17°06'S, 139°36'E, 22.11. 2002, P. Davie.

Remarks. The material examined conforms well with previous knowledge of *Pseudostegias setoensis*, which has been redescribed several times. Upon reexamination of the material reported by Dunbar & Coates (2000) from mid-eastern Queensland, I have concluded that it should have been assigned to *P. dulcilacuum* Markham, reported and discussed above, so the present material becomes the first confirmed record of *P. setoensis* in Australia. It is also the first record of infestation of *Diogenes pallescens* by *Pseudostegias setoensis*.

HEMIARTHRIINAE Markham, 1972

Diplophryxus Richardson, 1904

Type-species: *Diplophryxus jordani* Richardson, 1904, by monotypy.

Diplophryxus jordani Richardson, 1904

(Fig. 36)

Diplophryxus jordani Richardson, 1904: 50–51, figs 26–28 [Misaki, Japan, infesting *Palaemon serrifer* (Stimpson)]; Thielemann, 1910: 106–107, table 8; Chopra, 1923: 419, 442, 443–444 [Uni I., Mergui Archipelago, Indian Ocean, infesting *Leander serrifer* Stimpson (= *Palaemon serrifer*)]; Chopra, 1930: 114, 119–121, 123, 126–127, pl. IV fig. 1 [Kilkarai, Gulf of Manaar, infesting *Leander tenuicornis* (Say)]; Nierstrasz & Brender à Brandis, 1923: 108; Shiino, 1933: 71 [Noto Peninsula and Sagami Bay, Japan, infesting *Leander serrifer* (= *Palaemon serrifer*)]; and Deto, infesting *L. pacificus* (Stimpson) (= *Palaemon pacificus* Stimpson)]; Pearse, 1950: 43; Yoshida, 1952: 362–365 [Misaki, Japan]; Bruce, 1972b: 357; Shiino, 1972: 9; Shiino, 1974: 553, figs; Bruce, 1975: 123; Bourdon, 1981b: 632; Markham, 1985a: 95; Poore *et al.*, 2002: 122 [Gulf of Carpentaria, Northern Territory, Australia, infesting *Periclimenes spiniferus* de Man].

Diplophryxus jordani – Thielemann, 1910: 78.

Diplophryxus [sic] *jordani* – Noble & Noble, 1964: 535.

[H]emiarthrinid bopyrids [in part] – A. Bruce, 2007: 68 [Moreton Bay, Qld, infesting *Periclimenes sarkanae* Bruce type specimen].

Material Examined. QM-W29070, ♀ infesting *Palaemon serenus* (Heller, 1862), in intertidal seagrass, near Myora Springs, North Stradbroke I., Qld, 27°40.8'S, 153°24.6'E, 12.02.2005, X. Li. QM-W28071, ♀, infesting *Periclimenes sarkanae* Bruce, 2007 (paratype), Fisherman I., mouth of Brisbane River, Moreton Bay, Qld, 27°22'S, 153°10'E, 0.2–0.5 m, netted, P.J.F. Davie.

Remarks. The present two unaccompanied females represent a new record of *Diplophryxus jordani* for Queensland, as well as two new host records for *Palaemon serenus* and *Periclimenes sarkanae*. Because neither female differs significantly from other known representatives of this widespread and well described species, it is not here illustrated or described in detail. The female infesting *Periclimenes sarkanae* was collected with a single female of *Eophryxus kubo* reported from the same host species (see later).

Diplophryxus negrimaculatus sp. nov.

(Fig. 37)

Material examined. HOLOTYPE: QM-W28355, ♀, infesting *Phycomenes zostericola* Bruce, 2008, 1–1.5 m depth, mouth of Loder's Creek, Broadwater, Gold Coast, Queensland, 27°57'15"S, 153°24'39"E, 20.09.2007, J. Haig.

Description. Holotype female (Fig. 37). Length 2.12 mm, maximal width 1.84 mm, head length

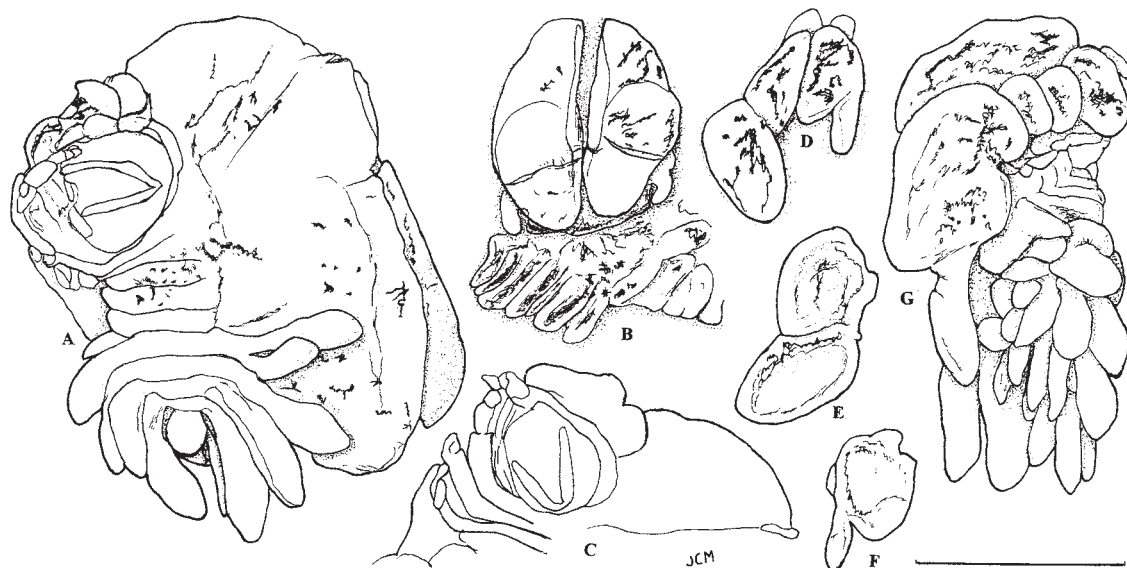


FIG. 37. *Diplophryxus negromaculatus*, sp. nov., holotype female. **A**, dorsal view. **B**, maxillipeds, barbula and anteromedial region of pereon, ventral view. **C**, head and adjacent region of pereon, dorsal. **D**, first oostegites in place, external view. **E**, right oostegite 1, internal view. **F**, left oostegite 1, internal view. **G**, left side of body showing left oostegites and pleonal appendages. Scale: 1 mm.

0.55 mm, head width 0.58 mm, pleon length 0.58 mm. Head and pleon distinctly set off from pereon, some pereomeres incompletely separated but all pleomeres distinct. Body outline irregularly ovate. Body distortion 97°, dextral. Dark pigment splotches widely scattered over body (Fig. 37 A).

Head nearly circular, completely embedded in pereon. First antennae (Fig. 37A, C) unsegmented flaps on anterior edge, second antennae (Fig. 37A, C) forming V-shape across nearly entire length of dorsal surface of head. Each maxilliped (Fig. 37B) with anterior article more than twice as long as posterior one, outline long and slender, convex laterally, nearly straight medially, roundly angled anteriorly without palp, lacking plectron, medial margin of anterior article reflexed over external face. Barbula (Fig. 37B) with bluntly pointed short process on each side, midregion unornamented.

Pereon incompletely segmented, first two pereomeres sharply curved around head and extending beyond it, their medial regions obscured by head. Dorsally, pereomeres 3 and 4 incomplete, pereomeres 5–7 mostly separate; ventrally, all 7 pereomeres medially distinct

(Fig. 37B). Inflated closed brood pouch (Fig. 37A) extending far forward, laterally and posteriorly beyond margins of head and pleon, formed of fused right oostegites 2–5. Right oostegite 1 (Fig. 37D, E) separate, both articles of about same size, posterior one extending far laterally, no evident internal ridge. Left oostegite 1 (Fig. 37D, F) much smaller than its mate, its posterior article reduced to slender flap. Internal ridges of both first oostegites unornamented. Left oostegites 2–5 (Fig. 37G) all separate and aligned, fifth one much larger than those preceding it, its posterior article somewhat shorter and much more slender than anterior one. Pereopods of first two pairs large and complete, beside or in front of head; third pereopod of long (right) side represented only by scar on brood pouch and others on that side absent; pereopods 3–6 of short (left) side reduced and tightly clumped, seventh absent.

Pleon of five distinct pleomeres, first four produced into long slender biramous lateral plates (Fig. 37A) and completely covered ventrally by similar but smaller biramous pleopods (Fig. 37G). Final (fifth) pleomere in form of simple bulbous pleotelson lacking appendages.

Male unknown.

Etymology. Species name *negrimalaculatus* ("black-spotted") selected to denote spots of black pigment scattered over much of female's body.

Remarks. *Diplophryxus* contains six previously described recognised species, of which three are known from the western Pacific, one from the Indian Ocean and one each from western Europe and the western Atlantic. *D. negrimaculatus* is placed in the genus because its female has the following characters: body greatly distorted, typically 60° to 100°; head deeply embedded in pereon and surrounded by first two pleomeres; second antennae as v-shaped line across dorsal surface of head; only two complete pereopods on long side of body, third one as basal scar far out on brood pouch; pleon

of five pleomeres, first four with both lateral plates and pleopods biramous, fifth pleomere as bulbous pleotelson lacking appendages.

The female of *D. negrimaculatus* is most similar to those of *D. jordani* Richardson (discussed above) and *D. kemp* Chopra, from both of which it differs in having the body axis more distorted and no oostegite reflexed over the head; the female of *D. kemp* has a proportionately much larger brood pouch extending far beyond the pleonal appendages (Chopra 1930).

Diplophryxus species infest a wide variety of caridean hosts. This is the first record of any bopyrid infestation in the newly described pontoniine genus *Phycomenes* and the first record of a species of *Diplophryxus* infesting a host in the subfamily Pontoniinae of the family Palaemonidae.



FIG. 38. *Eophrinx kubo* (Shiino, 1939), female, QM-W29062. A, dorsal view. B, left antennae. C, right antenna 1. D, left maxilliped. E, left oostegite 1, external. F, same, internal. G, right oostegite 1, external. H, same, internal. I, right pereopod 1. J, distal region of same. K, right pereopod 4 with oostegite attached. L, distal region of same. M, left pereopod 5. N, distal region of same. O, pleon, ventral. P, pleotelson, ventral. Scale: 1 mm for A, D-H, O; 0.36 mm for I, K, M; 0.18 mm for B, C, P; 0.09 mm for J, L, N.

Diplophryxus alpheus Shiino (Shiino 1934; Barnard 1956) infests species of *Alpheus* (family Alpheidae), as do *D. alveolatus* Bourdon (Bourdon 1981b), *D. siankaanensis* Markham (Markham 1988a) and *D. alphei* Shiino (Shiino 1934; Barnard 1956); *D. gracilis* Markham is recorded from a host subsequently reidentified as *Leander urocardella* Holthuis (family Palaemonidae, subfamily Palaemoninae) (Markham 1989); *D. jordani* infests species of the palaemonine genera *Palaemon* and *Leander* (see synonymy for *D. jordani* above); and *D. kemp* Chopra, infests a species of *Gnathophyllum* (Gnathophyllidae) (Chopra 1930).

***Eophrixus Caroli*, 1930**

Type-species: *Phrixus (Eophrixus) lysmatae* Caroli, 1930, by monotypy.

***Eophrixus kuboi* (Shiino, 1939)**

(Figs 38, 39)

'Bopyrid isopods' – Kubo, 1936: 48–50; pl. 14A [Inland Sea, Japan, infesting *Periclimenes (Ancylocaris) akiensis*, n. sp. (= *Kemponia akiensis* (Kubo, 1936)); material subsequently described by Shiino, 1939b, below].

Hypophryxus kuboi Shiino, 1939b: 17–20, figs 1, 2 [Inland Sea, Aki Prefecture, Japan, infesting *Periclimenes (Ancylocaris) akiensis* Kubo (= *Kemponia akiensis*)]; Pillai, 1966: 185; Bruce, 1968: 18–19; Shiino, 1972: 9; Saito *et al.*, 2000: 46.

Hypophryxus kuboi – Caroli, 1949: 234 [called member of *Eophrixus*].

Eophrixus kuboi – Caroli, 1949: 234; Markham, 1972: 53.

Anisarthrus kuboi – Codreanu & Codreanu, 1956a: 119; 1956b: 577; Codreanu, 1961: fig. 1.

[H]emiarthrinid bopyrids [in part] – Bruce, 2007: 68 [Moreton Bay, Qld, infesting *Periclimenes sarkanae* Bruce].

Material Examined. QM-W29071, ♀, (Fig. 38), ♂ (Fig. 39), infesting *Periclimenaeus obscurus* Kemp, 1922, intertidal seagrass flats, Polka Point, Dunwich, North Stradbroke I., Qld, 27°29.6' S, 153°23.9' E, 11.02.2005, X. Li. QM-W29062, ♀, infesting *Periclimenes sarkanae* Bruce, 2007 (paratype), Fisherman I., mouth of Brisbane River, Moreton Bay, Qld, 27°22'S, 153°10'E, 0.2–0.5 m, netted, P.J.F. Davie. QM-W25712, ♀, infesting *Periclimenes terangeri* Bruce, 1998, Townsville, Qld, 19°16'S, 146°49.0'E.

Remarks. *Eophrixus kuboi* was previously known only from the type material from Japan; thus these are the first records for Australia, as well as the first records of bopyrid infestation of *Periclimenaeus obscurus* and *Periclimenes terangeri*;

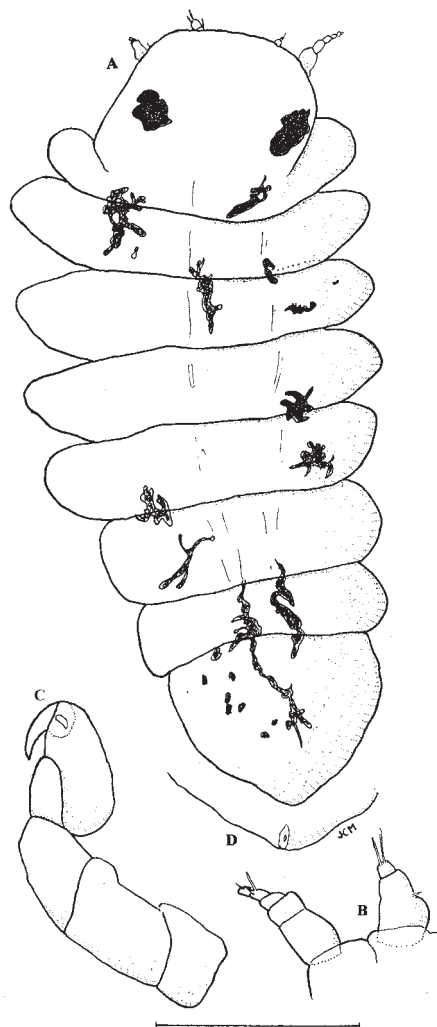


FIG. 39. *Eophrixus kuboi* (Shiino, 1939), male, QM-W29071. **A**, dorsal view. **B**, left antennae. **C**, right pereopod 3. **D**, end of pleon, ventral. Scale: 0.2 mm for A; 0.1 mm for B–D.

it is also the first record of hemarthrine infestation of any species of *Periclimenaeus*, though two other species of the genus are known to bear (branchial) bopyrine parasites. *E. kuboi* has been transferred twice to other genera since its original description, but I accept its placement in *Eophrixus*, to which Caroli (1949) reassigned it. The material infesting *Periclimenaeus obscurus* differs from the types in some details, but this seems to be the correct identification. The type female (Shiino 1939b) has a more pyriform than

rectangular head, pigment in a better defined belt-like band, pleonal lateral plates more constricted proximally and a larger pleotelson. The present female (Fig. 38) corresponds with it in general body shape, placement of head, proportion of brood pouch in front of head, presence of a conspicuous band of dark pigment around the pereon, size, shape and placement of pereopods, and structure and proportions of the rami of the pleopods. The present, minute, male (Fig. 39) corresponds with the type (Shiino, 1939b) in having the head fused with the first pereomere and antennae markedly extended, though its eyes are proportionately larger; the sides of its body less regular; its dorsal surface more highly pigmented; and its pleon proportionately shorter. The second female infesting *Periclimenes sarkanae*, which was collected with a single female of *Diplophryxus jordani* reported from the same host species above, is quite similar.

Filophryxus Bruce, 1972

Type-species: *Filophryxus dorsalis* Bruce, 1972, by original designation.

Filophryxus dorsalis Bruce, 1972

Filophryxus dorsalis Bruce, 1972b: 351–358, figs 1–8 [off coast of Qld, 26°32'S, 153°50'E, 275 m, infesting *Periclimenes hertwigi* Balss]; 1973: 522; 1975: 124; Ross, 1983: 167, table 1; Markham, 1990a: 55, 68 [New Caledonia, infesting *Periclimenes uninguiculatus* Bruce]; Trilles, 1999: 322, fig. 8.39D, E; Poore *et al.*, 2002: 122; N. Bruce, 2007: 278.

Remarks. No new material examined. *Filophryxus dorsalis* is distinctive for being found attached to the dorsal surface of its host's abdomen both times it was collected, rather than on the ventral surface, as is typical for hemiarthrines.

Metaphrixus Nierstrasz & Brender à Brandis, 1931

Type-species: *Metaphrixus carolii* Nierstrasz & Brender à Brandis, 1931, by monotypy.

Metaphrixus intutus Bruce, 1965

Metaphrixus intutus Bruce, 1965: 385–390, figs 1–3 [Zanzibar, infesting *Palaemonella vestigialis* Kemp]; 1972a: 445, 450; 1972b: 351; 1973: 523; 1979: 217 [Singapore, infesting *Palaemonella rotumanus* (Borradaile)]; 1986: 213 [John Brewer Reef, Qld, infesting *Periclimenes* sp. (probably = *P. grandis* (Stimpson))]; Darwin Harbour, Darwin, Northern Territory,

infesting *Palaemonella rotumanus*]; 1992: 64 [Eagle I. and Lizard I., Qld, infesting *Periclimenes platycheles* Holthuis]; Bourdon, 1967b: 173–174; Trilles, 1999: 322, fig. 8.39A.

Metaphrixus intutus — Markham, 1972: 40, 54, table II; 1985a: 113; 1989: 145; 1990a: 64–65; Kensley, 2001: 224; Bruce, 2002: 292; Poore *et al.*, 2002: 123; Shimomura *et al.*, 2006: 4.

'Hemiarthrinid bopyrid' — Bruce, 1992: 62.

Remarks. No new material. *Metaphrixus intutus* has been collected several times, including from three localities in Queensland. Like *Filophryxus dorsalis*, it has a distinctive mode of attachment, but it occurs on the side of its host's abdomen, not dorsally or ventrally.

ACKNOWLEDGMENTS

Thanks are extended to Peter Davie (Queensland Museum) for his role in organising and conducting the Thirteenth International Marine Biological Workshop, making material in his museum's collection available to me (with the assistance of Olga Varloková), providing names for selected crustacean hosts, and collection information about museum material; to Ian Tibbetts (Centre for Marine Studies, University of Queensland) and the Directors and staff of the Moreton Bay Research station, for the great facilities and ready assistance during the Workshop; to Niel Bruce (Museum of Tropical Queensland, Townsville) and Eldon Ball, Jr. (Australian National University, Canberra) for providing information about material they had collected; to James Lowry and Penny Barents (Australian Museum, Sydney) for arranging the loan of the type material of *Athelges aniculi*; to Jørgen Olesen (Zoologisk Museum, Copenhagen, Denmark) for arranging the loan of the types of *Parathelges whiteleggei*; to Xinzhen Li (Marine Biological Museum, Chinese Academy of Sciences, Qingdao, China) for assistance in collecting intertidally and by scuba diving and for providing names for caridean hosts; to Brian Morton for help in collecting; to A.J. Bruce (Queensland Museum) for providing material he had collected and information about it; to Akira Asakura (Natural History Museum and Institute, Chiba, Japan) for providing the correct name for *Pagurus watasei*; to Patsy McLaughlin (Western Washington University, Anacortes, Washington, USA) for identifying the host of the types of *Parathelges whiteleggei*; and to Susan Gilmont,

Judy Mullen and Janet Webster (Oregon State University, Newport, Oregon), Christopher Boyko (American Museum of Natural History, New York) and Leigh Owens (James Cook University, Townsville) for locating and providing needed references.

LITERATURE CITED

- An, J., Yu, H. & Williams, J.D. 2007. Four new records and a new species of *Dactylokepon* Stebbing, 1910 (Epicaridea: Bopyridae: Ioninae) from Chinese waters. *Journal of Natural History* **41**(33–36): 2063–2079.
- Anderson, G. 1990. Postinfection mortality of *Palaemonetes* spp. (Decapoda: Palaemonidae) following experimental exposure to the bopyrid isopod *Probopyrus pandalicola* (Packard) (Isopoda: Epicaridea). *Journal of Crustacean Biology* **10**: 284–292.
- Ball, E.E., Jr., & Haig, J. 1972. Hermit crabs from eastern New Guinea. *Pacific Science* **26**: 87–107.
- Barnard, K.H. 1936. Isopods collected by the R. I. M. S. "Investigator." *Records of the Indian Museum* **38**(2): 147–191.
1940. Contributions to the crustacean fauna of South Africa. 12. Further additions to the Tanaidacea, Isopoda and Amphipoda, together with keys for the identification of hitherto recorded marine and fresh-water species. *Annals of the South African Museum* **32**: 381–543.
1955. Additions to the fauna list of South African Crustacea and Pycnogonida. *Annals of the South African Museum* **43**(1): 1–107.
1956. Further additions to the crustacean fauna-list of Portuguese East Africa. *Memórias do Museu Dr. Alvaro de Castro* **4**: 3–23, figs 1–7.
- Bonnier, J. 1900. Contribution à l'étude des Épicarides. Les Bopyridae. *Travaux de l'Institut Zoologique de Lille et du Laboratoire de Zoologie Maritime de Wimereux* **8**: 1–478.
- Bourdon, R. 1967a. Sur trois nouveaux Bopyrides de Sénégal. *Bulletin de l'Institut Française d'Afrique Noire* (A) **29**: 107–122.
- 1967b. Sur deux nouveaux épicarides (Isopoda) parasites de crustacés décapodes. *Zoologische Mededelingen* **42**(17): 167–174.
1968. Les Bopyridae des mers Européennes. *Mémoires du Muséum National d'Histoire Naturelle de Paris, Nouvel Série* (A) **50**(2): 77–424.
1971. Épicarides nouveaux pour la côte occidentale d'Afrique équatoriale. *Bulletin de l'Institut Français d'Afrique Noire* (A) **33**: 371–391.
1972. Epicaridea de Java, Ile Maurice et Afrique du Sud (Crustacea, Isopoda) *Steenstrupia* **2**(7): 105–119.
- 1976a. Les bopyres des porcellanes. *Bulletin du Muséum National d'Histoire Naturelle, Paris* (3) no. 359, *Zoologie* **252**: 165–245.
- 1979a. Bopyridae de la campagne Biaçores (Isopoda Epicaridea). *Bulletin du Muséum National d'Histoire Naturelle, Paris* (Section A) **1**(2): 507–512.
- 1979b. Épicarides de Madagascar. II. *Bulletin du Muséum National d'Histoire Naturelle, Paris* (Section A) **1**(2): 471–506.
- 1979c. Sur la taxonomie et l'éthologie de quelques Orbioninés (Isopoda Epicaridea). *Internationale Revue der gesamten Hydrobiologie* **64**(3): 425–435.
- 1980a. Les espèces du genre *Bopyrella* J. Bonnier (Crustacea, Isopoda, Bopyridae). *Bulletin du Muséum National d'Histoire Naturelle, Paris* (Section A) **2**(1): 185–236.
- 1980b. *Aporobopyrus dollfusi* n. sp. (Crustacea, Epicaridea, Bopyridae) parasite de la Mer Rouge. *Bulletin du Muséum National d'Histoire Naturelle, Paris* (Section A) **2**(1): 237–244.
- 1981a. Sur une nouvelle espèce de Céponien (Isopode Bopyridé), parasite du crabe *Varuna litterata* (Fabricius). *Verhandlungen der Naturforschungs-gesellschaft Basel* **91**: 101–107.
- 1981b. Bopyriens nouveaux pour la faune européenne de l'Atlantique (Isopoda Epicaridea). *Bulletin du Muséum National d'Histoire Naturelle, Paris* (Section A) **3**(2): 615–634.
- 1981c. Crustacés Isopodes. I. Bopyridae parasites des Pénéides. Résultats des Campagnes MUSOR-STOM. I. Philippines (18–28 mars 1976). *Mémoires d'ORSTOM* **91**: 237–260.
1983. Expédition Rumphius II (1975). Crustacés parasites, commensaux, etc. (Th. Monod, éd.) VIII. Crustacés Isopodes (3^e partie; Épicarides Bopyridae). *Bulletin du Muséum National d'Histoire Naturelle, Paris* (Section A) **5**(3): 845–869.
- Bourdon, R. & Bowman, T.E. 1970. Western Atlantic species of the parasitic genus *Leidyia* (Epicaridea: Bopyridae). *Proceedings of the Biological Society of Washington* **83**(36): 409–424, figs 1–6.
- Bourdon, R. & Bruce, A.J. 1983a. On *Probynia*, a new genus of bopyrid (Isopoda, Epicaridea) parasitic on pontoniine shrimps from the Great Barrier Reef, Australia. *Crustaceana* **44**(3): 310–316.
- 1983b. Six bopyrid shrimp parasites (Isopoda, Epicaridea) new to the Australian fauna. *Crustaceana* **45**: 96–106.
- Bourdon, R., d'Hondt, J. L. & Veillet, A. 1981. Note préliminaire sur les microsetes et les "fentes céphaliques" chez les bopyriens (Crustacés Épicarides). *Bulletin de la Société zoologique Français* **105**(4): 495–504.

- Bourdon, R. & Stock, J. H. 1979. On some Indo-West Pacific Bopyridae (Isopoda, Epicaridea) in the collections of the Zoölogisch Museum, Amsterdam. *Beaufortia* **28**(351): 205–218.
- Boyko, C.B., 2002. A worldwide revision of the recent and fossil sand crabs of the Albuneidae Stimpson and Blepharipodidae, new family (Crustacea: Decapoda: Anomura: Hippoidea). *Bulletin of the American Museum of Natural History* **272**: 1–396.
2003. New host and distribution records for *Leidyia bimini* Pearse, 1951 in the Gulf of Mexico, with comments on related taxa and a redescription of *Cardiocepon pteroides* Nobili, 1906 (Crustacea: Isopoda: Bopyridae: Ioninae). *Gulf and Caribbean Research* **15**: 5–11.
2004. The Bopyridae (Crustacea: Isopoda) of Taiwan. *Zoological Studies* **43**: 677–703.
- Bruce, A.J. 1965. An interesting new phryxid (Epicaridea) parasitic on a pontoniid shrimp. *Annals and Magazine of Natural History* (13) **8**: 285–390.
1968. A new species of *Hypophryxus* (Isopoda, Bopyridae) from an Indo-Pacific pontoniid shrimp. *Crustaceana* **14**(1): 13–20.
- 1972a. *Orophryxus shiinoi* gen. nov., sp. nov., an unusual phryxid (Crustacea, Isopoda, Bopyridae) parasitic upon a pontoniid shrimp from Zanzibar. *Parasitology* **64**: 445–450.
- 1972b. *Filophryxus dorsalis* gen. nov., sp. nov., an unusual bopyrid parasite from eastern Australia. *Parasitology* **65**: 351–358.
- 1973a. *Mesophryxus ventralis* gen. nov., sp. nov., a phryxid bopyrid parasitic upon the pontoniid shrimp *Harpilopsis beaupressi* (Audouin). *Parasitology* **66**: 515–523.
1975. Further information on the unusual bopyrid parasite *Orophryxus shiinoi* Bruce (Isopoda, Epicaridea). *Crustaceana* **28**: 121–124.
1979. Records of some pontoniine shrimps from the South China Sea. *Cahiers de l'Indo-Pacifique* **1**: 216–247.
1986. *Metaphryxus intutus* Bruce (Crustacea: Isopoda), a bopyrid parasite new to the Australian fauna. *The Beagle* **3**: 213.
1991. Shallow-water palaemonid shrimps from New Caledonia (Crustacea: Decapoda). In, Richer de Forges, B. (Ed.), Le benthos des fondes meubles des lagons de Nouvelle-Caledonie, 1. *Études et Thèses, Paris: ORSTOM*: 221–279.
1992. Two new species of *Periclimenes* (Crustacea : Decapoda: Palaemonidae) from Lizard Island, Queensland, with notes on some related taxa. *Records of the Australian Museum* **44**: 45–84.
2000. *Typton manningi* and *T. capricorniae*, new species, new pontoniine shrimps from northern Queensland, with a review of the Indo-West Pacific species of *Typton* Costa (Decapoda: Palaemonidae). *Journal of Crustacean Biology*, Special Number **2**: 87–100.
2002. Notes on some Indo-Pacific Pontoniinae, XLVI. *Palaemonella foresti* sp. nov., a new pontoniine shrimp from Western Australia (Decapoda, Palaemonidae), with a review of the Indo-West Pacific species of the genus *Palaemonella* Dana, 1852. *Crustaceana* **75**: 277–298.
2007. *Periclimenes sarkanae* sp. nov. a new pontoniine shrimp from Moreton Bay, Queensland (Crustacea: Decapoda: Palaemonidae). *Zootaxa* **1393**: 61–68.
- Bruce, N.L. 2007. Provisional list of the marine and freshwater isopods (Crustacea) of New Caledonia. Pp. 275–279. In, Payri, C.E., & Richer de Forges, B. (Eds) Compendium of marine species of New Caledonia. *Document in Science and Technology* **117**.
- Campos, E. & Campos, A.R. de 1990. Taxonomic remarks on *Schizobopyrina* Markham, 1985, with the description of *S. bruscai* (Crustacea: Isopoda: Bopyridae). *Proceedings of the Biological Society of Washington* **103**(3): 633–642.
- Caroli, E., 1949. Breve rassegna dei Bopiridi addominali parassiti di Caridei. *Pubblicazioni della Stazione Zoologica di Napoli* **21**: 232–235.
1953. Rassegna degli Epicaridei parassiti di Epicaridei finora noti, e notizia preliminare di uno nuovo (*Paracabirops marsupialis* n. g., n. sp.) del Golfo di Napoli. *Pubblicazioni della Stazione Zoologica di Napoli* **24**: 84–91.
- Carton, Y. 1970. Le genre *Paranicothoe*, un nouveau représentant de la famille des Nicothoidae. *Journal of Parasitology* **56**(4) Section 11(1): 47–48.
- Choi, J., Jamieson, H.G., Han, K.H. & Hong, S.Y. 2004. *Parapenaenon consolidatum* (Isopoda: Bopyridae) and the relative growth and reproduction of *Metapenaenopsis dalei* (Decapoda: Penaeidae) in South Korea. *Journal of Shellfish Research* **23**: 237–242.
- Chopra, B., 1922. Preliminary note on Isopoda of the family Bopyridae parasitic on Indian Decapoda Macrura. *Journal of the Asiatic Society of Bengal (Calcutta)* (new series) **18**: 69–71.
1923. Bopyrid isopods parasitic on Indian Macrura. *Records of the Indian Museum* **25** (5): 411–550.
1930. Further notes on bopyrid isopods parasitic on Indian Decapoda Macrura. *Records of the Indian Museum* **32**(2): 113–147.
- Chu, K.H. & Leong, L.S. 1996. Occurrence and influence of *Orbione halipori* Nierstrasz and Brender à Brandis (Isopoda: Bopyroidea) on *Metapenaenopsis joyneri* (Miers) from the Zhujiang estuary, China. *Journal of Natural History* **30**: 835–839.

- Codreanu, M. & Codreanu, R. 1956a. Sur l'*Anisarthrus pelseneeri*, Épicaride parasite abdominal de la crevette *Athanas nitescens*; sa présence dans la Mer Noire et la dispersion du genre *Anisarthrus*. *Bulletin Scientifique de la France et de Belgique* **90**(2): 111–121.
- 1956b. Un epicarid abdominal nou pentru Marea Neagră, *Anisarthrus pelseneeri* Giard, 1907, parazit pe creveta *Athanas nitescens* Leach. Revizuirea și răspindirea genului *Anisarthrus*. *Buletin Științific Secția de Biologie și Științe Agricole* **8**(3): 567–584.
- Codreanu, R. 1940. Sur un épicaride nouveau, *Parathelges racovitzai* n. sp., ectoparasite de la Mer Noire. *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences, Paris* **210**: 679–681.
1941. Sur les pagures du littoral roumain de la Mer Noire et leurs crustacés parasites. *Anali Academia Române București* (3) **16**: 1095–1133.
1961. Crustacei paraziți cu afinități indo-pacifice în Marea Neagră. *Hidrobiologia, Academia Republicii Populare Române* **3**: 133–146.
- Codreanu, R., Codreanu, M. & Pike, R.B. 1965. Sur deux bopyriens parasites de pagures recueillis par M. A. Horridge dans la Mer Rouge et sur leur asymétrie. *Crustaceana* **9**(3): 225–244.
- Courtney, A.J. 1991. Occurrence and influence of bopyrid parasites on female penaeid prawns from coastal waters of central Queensland (Australia). *Australian Journal of Marine and Freshwater Research* **42**: 615–623.
- Czerniavsky, V. 1869. Materiala ad zoographiam Ponticam comparatum. *Transactions of the First Meeting of the Russian Naturalists in Saint Petersburg* **1868**: 19–136.
- Czerniavsky, W. 1881. Wissenschaftliche Mittheilungen. 6. Berichtigung. *Zoologischer Anzeiger* **4**(94): 528–529.
- Dakin, W.J. 1931. On a new Bopyrid parasite from the coast of New South Wales. *Proceedings of the Linnaean Society of New South Wales* **56**: 267–272.
- Danforth, C.G. 1970b. Epicarids (Isopoda) of Eniwetok Atoll. *Pacific Science* **24**(4): 462–471.
1971. Two bopyrids (Isopoda) from New Guinea. *Bulletin of the Southern California Academy of Sciences* **70**(2): 99–102.
1976. Epicaridea (Isopoda) of Guam. *Crustaceana* **31**: 78–81.
- Dunbar, S.G. & Coates, M. 2000. Range extension and new host records of the ectoparasite *Pseudostegias setoensis* Shiino, 1933 (Crustacea: Isopoda: Bopyridae). *Transactions of the Royal Society of South Australia* **124**(1): 49.
- George, P.C. 1946. *Megacepon choprai* gen. et sp. nov., a bopyrid isopod from the gill chamber of *Sesarma tetragonum* (Fabr.). *Records of the Indian Museum* **44**(4): 385–390.
- Giard, A. & Bonnier, J. 1890. Prodrome d'une monographie des épicarides du golfe de Naples. *Bulletin Scientifique, Paris* **22**: 367–391.
- Glazebrook, J.S., Owens, L. & Campbell, R.S.F. 1986. Diseases of Crustacea relevant to Australia. Pp. 192–201. In, Humphrey, J. D. & Langdon, J. S. (Eds), *Diseases of Australian fish and shellfish. Proceedings of the First Australian Workshop on Diseases of Fish and Shellfish held at Benalla, Victoria, May 27–30, 1985*. (Australian Fish Health Reference Laboratory: Benalla, Victoria).
- Haig, J. & Ball, E.E. 1988. Hermit crabs from north Australian and eastern Indonesian waters (Crustacea: Anomura: Paguroidea) collected during the 1975 *Alpha Helix* Expedition. *Records of the Australian Museum* **40**: 151–196.
- Hansson, H.G. 1998. NEAT (North East Atlantic Taxa): South Scandinavia marine Crustacea check-list. 84 pp. PDF accessed August 1998 from http://www.tmbi.gu.se/libdb/taxon-pdf/NEAT*Crustacea.pdf.
- Harada, E. 1991. Inventory of zoological type specimens in the Museum of the Seto Marine Biological Laboratory. *Publications of the Seto Marine Biological Laboratory*. **35**(1/3): 171–233.
- Høeg, J.T. & Rybakov, A.V. 1992. Revision of the Rhizocephala Akentrogonida (Cirrepedia), with a list of all species and a key to the identification of families. *Journal of Crustacean Biology* **12**: 600–609.
- Huang, Z. 1994. Isopoda. Pp. 528–532. In, Huang, Z. (Ed.), *Marine species and their distributions on China's Seas*. [In Chinese]. (China Ocean Press: Beijing).
2001. Isopoda. Pp. 325–327. In, Huang, Z. (Ed.), *Marine species and their distribution in China's Seas*. (Krieger Publishing Company: Malabar, Florida).
- Humphrey, J.D. 1995. Australian quarantine policies and practices for aquatic animals and their products: a review for the Scientific Working Party on Aquatic Animal Quarantine. Part 1, Review and annexes. Part 2, Appendixes. Bureau of Resource Sciences, Parkes, A.C.T.
- Hussain, S.M. 2001. Brief report on biodiversity in the coastal areas of Pakistan. Draft publication for Regional Technical Assistance (RETA) of ADB in collaboration with IUCN. 113 pp.
- Jones, D.S. & Morgan, G.J. 1994. *A Field Guide to Crustaceans of Australian Waters*. (Reed: Chatswood, New South Wales). 216 pp.

2002. *A Field Guide to Crustaceans of Australian Waters*. Second Edition. (Reed/New Holland: Sydney). 224 pp.
- Kazmi, Q.B. & Bourdon, R. 1997. A new Bopyrid isopod *Progebiophilus assisi* on the mud shrimp *Upogebia (U.) assisi* Barnard (Thalassinidea) from Pakistan. *Pakistan Journal of Marine Sciences* 6(1&2): 59–67.
- Kazmi, Q.B., Schotte, M. & Yousef, F. 2002. An illustrated key to the Malacostraca (Crustacea) of the northern Arabian Sea. Part – V: Isopoda. *Pakistan Journal of Marine Sciences* 11(1&2): 47–116.
- Kensley, B. 2001. Biogeography of the marine Isopoda of the Indian Ocean, with a check-list of species and records. In, Kensley, B. & Brusca, R.C. (Eds), Isopod systematics and evolution. *Crustacean Issues* 13: 205–264. (Rotterdam: Balkema).
- Kensley, B. & Chan, T.-Y. 2001. Two species of deep-sea flabelliferan isopods from Taiwan (Crustacea: Peracarida: Aegidae, Anuropodidae). *Journal of Natural History* 35: 481–496.
- Kim, H.-S. & Kwon, D.-H. 1988b. Bopyrid isopods parasitic on decapod crustaceans in Korea. *The Korean Journal of Systematic Zoology, Special Issue No. 2*: 199–221.
- Kirkegaard, I., Tuma, D.J. & Walter, R.H. 1970. Synopses of biological data on the banana prawn *Penaeus merguensis* de Man, 1888. CSIRO, Fisheries and Oceanography. *Fisheries Synopsis* No. 8: vi + 31 pp.
- Kirkwood, G.P. & Somers, I.F. 1984. Growth of two species of tiger prawn, *Penaeus esculentus* and *P. semiculatus*, in the Gulf of Carpentaria. *Australian Journal of Marine and Freshwater Research* 35: 703–712.
- Kossmann, R. 1881. Studien über Bopyriden. II. *Bopyrina Virbii*; Beiträge zur Kenntnis der Anatomie und Metamorphose der Bopyriden. *Zeitschrift für Wissenschaftliche Zoologie* 35: 666–680.
- Kubo, I. 1936. Two new littoral macrourous crustaceans from Japan. *Journal of the Imperial Fisheries Institute, Tokyo* 31: 47–54.
- Lemos de Castro, A. 1965. Crustáceos Isópodos Epicarídeos do Brasil. I: Descrição de uma espécie nova do género “Pseudostegias” Shiino (Isopoda, Bopyridae). *Revista Brasileira de Biologia* 25: 105–108.
- Lester, R.J.G. 2005. Isopoda (Isopods). Pp. 138–144, in Chapter 4, Crustacean parasites. In, Rohde, K., (Ed.), *Marine Parasitology*. (CSIRO Publishing: Collingwood, Victoria).
- Lester, R.J.G. & Sewell, K.B. 1989. Checklist of parasites from Heron Island, Great Barrier Reef. *Australian Journal of Zoology* 37: 101–128.
- Leung, S.-F. 1997. The population dynamics of *Metapenaeus ensis* (Crustacea: Decapoda: Penaeidae) in a traditional tidal shrimp pond at the Mai Po Marshes Nature Preserve, Hong Kong. *Journal of Zoology* 242(1): 77–96.
- Li, L. 2003. Hong Kong’s Isopoda. Pp. 137–166. In, Morton, B. (Ed.), Perspectives on marine environment change in Hong Kong and southern China, 1977–2001. *Proceedings of an international Workshop Reunion Conference, Hong Kong 21–26 October 2001*. (Hong Kong University Press: Hong Kong).
- Li, X. 2008. Palaemonid shrimps (Crustacea: Decapoda: Caridea) from Moreton Bay, Queensland, Australia. In, Davie, P. J. F. & Phillips, J. A. (Eds), Proceedings of the Thirteenth International Marine Biological Workshop, The marine fauna and flora of Moreton Bay, Queensland. *Memoirs of the Queensland Museum – Nature* 54(1): 233–267.
- Lotz, J.M. & Overstreet, R.M. 1990. Parasites and predators. Pp. 96–121. In, Chávez, J.C. & Sosa, N.O. (Eds), The aquaculture of shrimp, prawn and crawfish in the world: Basics and technologies. Ikebukuro, Toshima-ku, Tokyo, Japan: Midori Shobo Co., Ltd. [In Japanese]
- Man, J.G. de. 1881. On a new collection of podophthalmous Crustacea presented by Mr. J. A. Kruyt, collected in the Red Sea near the town of Djeddah. *Notes of the Leyden Museum* 3: 93–107.
1920. The Decapoda of the Siboga Expedition. Part IV. Families Pasiphaeidae, Styrodactylidae, Hoplophoridae, Nematocarcinidae, Thalassarcaridae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Glyphocrangonidae and Crangonidae. *Siboga-Expedition Monographie* 39a 3: 1–318.
- Markham, J.C. 1972. Four new species of *Parathelges* Bonnier, 1900 (Isopoda, Bopyridae), the first record of the genus from the western Atlantic. *Crustaceana Supplement* 3: 57–78.
1975. Two new species of *Asymmetrione* (Isopoda, Bopyridae) from the Western Atlantic. *Crustaceana* 29: 255–265.
1980. A new species of *Dicropleon* and new records of three other species of bopyrid isopods from the Indian Ocean. *Bulletin of Marine Science* 30(3): 623–633.
1978. Bopyrid isopods parasitizing hermit crabs in the northwestern Atlantic Ocean. *Bulletin of Marine Science* 28: 102–117.
1980. A new species of *Dicropleon* and new records of three other species of bopyrid isopods from the Indian Ocean. *Bulletin of Marine Science* 30(3): 623–633.
1982. Bopyrid isopods parasitic on decapod crustaceans in Hong Kong and southern China. In, Morton, B.S. & Tseng, C.K. (Eds), *Proceedings of the First International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China* 1: 325–391. (Hong Kong University Press: Hong Kong).

- 1985a. A review of the bopyrid isopods infesting caridean shrimps in the northwestern Atlantic Ocean, with special reference to those collected during the Hourglass cruises in the Gulf of Mexico. *Memoirs of the Hourglass Cruises* 7(3): 1–156.
- 1985b. Additions to the bopyrid fauna of Thailand. *Zoologische Verhandelingen* 224: 1–63.
1988. Descriptions and revisions of some species of Isopoda Bopyridae of the north western Atlantic Ocean. *Zoologische Verhandelingen* 246: 1–63.
1989. Three species of Isopoda Bopyridae new to the fauna of the Philippines. *The Beagle, Records of the Northern Territory Museum of Arts and Sciences* 6(1): 141–148.
- 1990a. Crustacea Isopoda: new records of Bopyridae from New Caledonian waters Resultats des Campagnes MUSORSTOM. *Memoires du Muséum National d'Histoire Naturelle, Paris* 6(A)(145): 55–69.
- 1990b. Further notes on the Isopoda Bopyridae of Hong Kong. Pp. 555–568. In, Morton, B. (Ed.), *Proceedings of the Second International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and southern China, Hong Kong, 1986*. Vol. 2. (Hong Kong University Press: Hong Kong).
1991. Redescriptions and new records of Isopoda Bopyridae (Crustacea) from Thailand. *Raffles Bulletin of Zoology* 39: 289–297.
- 1992b. Second list of additions to the Isopoda Bopyridae of Hong Kong. Pp. 277–302. In, Morton, B. (Ed.), *The marine flora and fauna of Hong Kong and southern China 3. Volume 1: introduction, taxonomy and ecology. Proceedings of the Fourth International Marine Biological workshop: The Marine Flora and Fauna of Hong Kong and Southern China, 11–29 April 1989*. (Hong Kong University Press: Hong Kong).
1994. Crustacea Isopoda: Bopyridae in the MUSORSTOM collections from the tropical Indo-Pacific I. Subfamilies Pseudioninae (in part), Argeiinae, Orbioninae, Athelginae and Entophilinae. In, Crosnier, A. (Ed.), *Résultats des Campagnes MUSORSTOM, Vol. 10. Mémoires du Muséum National d'Histoire Naturelle, Paris* 161: 225–253.
2002. A new species of *Leidyia Cornalia* and *Panceri*, 1861, and the first record of the genus *Lobocepon Nobili*, 1905, both from the eastern Pacific Ocean, with a review of the parasites of grapsid crabs worldwide (Isopoda: Bopyridae: Ioninae). Pp. 329–338. In, Escobar-Briones, E., & Alvarez, F. (Eds), *Modern approaches to the study of Crustacea*. (Kluwer Academy / Plenum Press: New York).
- 2003a. A worldwide list of hermit crabs and their relatives (Anomura, Paguroidea) reported as hosts of Isopoda Bopyridae. *Memoirs of Museum Victoria* 60(1): 71–77.
- Markham, J.C. & Boyko, C.B. 1999. A new genus for *Ione indecora* Markham, 1988, a second record for that species, and a new congeneric species from Australia (Crustacea: Isopoda: Bopyridae: Ioninae). *American Museum Novitates* 3258: 1–7.
2003. A new species of *Albunione* Markham & Boyko, 1999 (Crustacea: Isopoda: Bopyridae: Pseudioninae) from Taiwan. *American Museum Novitates* 3410: 1–7.
- McLaughlin, P.A. 2002. *Diogenes pallescens* Whitelegge, *D. gardineri* Alcock and *D. serenei* Forest (Decapoda: Anomura: Paguroidea: Diogenidae): distinct species or morphological variants? *The Raffles Bulletin of Zoology* 50: 81–94.
- Miquel, J.C. 1982. Le genre *Metapenaeus* (Crustacea: Penaeidae): taxonomie, biologie et pêches mondiales. *Zoologische Verhandelingen* 195: 1–137.
- Mizoguchi, K., Henmi, Y. & Yamaguchi, T. 2002. Parasitic status of epicaridean isopods (Crustacea: Malacostraca) and the effects on their brachyuran crab hosts. *Japanese Journal of Benthology* 57: 79–84.
- Monod, T. 1933. Tanaidacea et Isopoda. Mission Robert-Ph. Dollfus en Égypt. *Mémoires de l'Institut d'Égypt* 21: 161–264.
- Morton, B., 2003. Hong Kong's International Malacological, Wetland and Marine Biological Workshops (1977–1998): Changing local attitudes towards marine conservation. Pp. 31–71. In, Morton, B. (Ed.), *Perspectives on marine environment change in Hong Kong and southern China, 1977–2001. Proceedings of an International Workshop Reunion Conference, Hong Kong 21–26 October 2001*. (Hong Kong University Press: Hong Kong).
- Morton, B. & Morton, J., 1983. *The sea shore ecology of Hong Kong*. (Hong Kong University Press: Hong Kong). xiv + 350 pp.
- Motaş, C. & Băleanu, A, 1937. Notes sur *Bopyrina giardi* Bonnier, épicaride parasite d'*Hippolyte varians* Leach, suivies de quelques observations sur son hôte. *Annales de la Université de Iassy* 23: 164–172.
- Nearhos, S.P. & Lester, R.J.G. 1984. New records of Bopyridae (Crustacea: Isopoda: Epicaridea) from Queensland waters. *Memoirs of the Queensland Museum* 21: 257–259.
- Nierstrasz, H.F. & Brender à Brandis, G.A. 1923. Die Isopoden der Siboga-Expedition. II. Isopoda Genuina. I. Epicaridea. *Siboga Expédition Monographie* 32b: 57–121.
- 1929a. Papers from Dr. Th. Mortensen's Pacific Expedition 1914–16. 48. Epicaridea 1. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i København* 87: 1–44.
- 1929b. Neue Epicaridea. *Zoologischer Anzeiger* 85: 295–302.

1931. Papers from Dr. Th. Mortensen's Pacific Expedition 1914–16. LVII. Epicaridea 2. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i København* **91**: 147–225.
- Nobili, G., 1901. Decapodi e Stomatopodi Eritrei de Museo Zoologico dell'Università di Napoli. *Annuario del Museo Zoologico della R. Università di Napoli (Nuovo Serie)* **1**(3): 1–20.
1906. Nuovi Bopyridi. *Atti della Real Accademia della Scienze di Torino* **41**: 1–18.
- Noble, E.R., & Noble, G.A. 1964. *Parasitology. The biology of animal parasites*. 2nd. Ed. (Lea & Febiger: Philadelphia). 724 pp.
- Nordenstam, Å, 1946. Marine Isopoda from Professor Dr. Sixten Bock's Pacific Expedition, 1917–1918. *Arkiv för Zoologi* **37**(7): 1–31.
- Owens, L. 1983. Bopyrid parasite *Epipenaeon ingens* Nobili as a biological marker for the banana prawn *Penaeus merguensis* de Man. *Australian Journal of Marine and Freshwater Research* **34**: 477–481.
1985. *Polycephalus* sp. (Cestoda: Lecanicephalidae) as a biological marker for banana prawns, *Penaeus merguensis* de Man, in the Gulf of Carpentaria. *Australian Journal of Marine and Freshwater Research* **36**: 291–299.
1986. Parasites as biological markers for banana prawn (*Penaeus merguensis* de Man) stocks in the Gulf of Carpentaria. Ph. D. dissertation. James Cook University of North Queensland. xvii + 126 pp.
1990. Maricultural considerations of the zoogeography of parasites from prawns in tropical Australia. *Journal of Aquaculture in the Tropics* **5**: 35–41.
1993. Prevalence of *Cabirops orbioni* (Epicaridea: Cryptosicidae) in northern Australia: a biocontrol agent for bopyrids. *Australian Journal of Marine and Freshwater Research* **44**: 381–387.
- Owens, L. & Glazebrook, J.S. 1985a. The biology of bopyrid isopods parasitic on commercial prawns in northern Australia. In, Rothlisberg, P.C., Hill, B.J. & Staples, D.J. (Eds), *Second Australian National Prawn Seminar, Cleveland, Queensland* **2**: 105–113.
- 1985b. Sex determination in the Bopyridae. *Journal of Parasitology* **71**: 134–135.
- Owens, L. & Rothlisberg, P.C. 1991. Vertical migration and advection of bopyrid isopod cryptosicid larvae in the Gulf of Carpentaria, Australia. *Journal of Plankton Research* **14**: 779–787.
1995. Epidemiology of cryptosicids (Bopyridae: Isopoda) in the Gulf of Carpentaria, Australia. *Marine Ecology Progress Series* **122**: 159–164.
- Page, R.D.M. 1985. Review of the New Zealand Bopyridae (Crustacea: Isopoda: Epicaridea). *New Zealand Journal of Zoology* **12**: 185–212.
- Pearse, A.S. 1950. Bopyrid isopods from the coast of North Carolina. *Journal of the Elisha Mitchell Scientific Society* **66**: 41–43.
- Pillai, N.K., 1966. Isopod parasites of south Indian crustaceans. *Crustaceana* **10**: 183–191.
- Poore, G.C.B. 2002. Crustacea: Malacostraca Eumalacostraca. Syncaridea, Peracarida: Isopoda, Tanaidacea, Mictacea, Thermosbaenacea, Spelaeogriphacea. Pp. 1–7. In, Houston, W.W.K. & Beesley, P.L. (Eds), *Zoological Catalogue of Australia*. Vol. 19.2A. (CSIRO Publishing: Melbourne).
- Poore, G.C.B., Markham, J.C. & Lew Ton, H.M. 2002. Superfamily: Bopyroidea. Pp. 111–137. In, Poore, G. C. B., Crustacea: Malacostraca: Syncarida, Peracarida: Isopoda, Tanaidacea, Mictacea, Thermosbaenacea, Spelaeogriphacea. In, Houston, W.W.K. & Beesley, P.L. (Eds), *Zoological Catalogue of Australia*. Vol. 19.2A. (CSIRO Publishing: Melbourne).
- Restivo, F. 1971. Su di una nuova specie di *Cabirops* parassiti di *Pseudione*. *Pubblicazioni della Stazione Zoologica di Napoli* **39**: 70–86.
- Richard, J. 1900. Essai sur les Crustacés considérés dans leurs rapports avec l'hygiène, la médecine et la parasitologie. Lille: Le Bigot Frères. 83 pp.
- Richardson, H. 1904. Contributions to the natural history of the Isopoda. *Proceedings of the United States National Museum* **27**: 1–89.
1911. Description of a new parasitic isopod from the Hawaiian Islands. *Proceedings of the United States National Museum* **38**(1770): 645–647.
- Rohde, K. 1990. Marine parasites: an Australian perspective. *International Journal for Parasitology* **20**(4): 565–575.
- Román-Contreras, R. & Wehrtmann, I. 1997. A new species of bopyrid isopod *Pseudione chiloensis* a parasite of *Nauticaris magellanica* A. Milne Edwards, 1891. (Crustacea: Decapoda: Hippolytidae). *Proceedings of the Biological Society of Washington* **110**(2): 242–248.
- Ross, D.M. 1983. Symbiotic relations. Chapter 4, pp. 163–212. In, Vernberg, F.J. & Vernberg, W.B. (Eds), *The biology of Crustacea*, Volume 7, *Behavior and ecology*. (Academic Press: New York).
- Şadoğlu, P. 1969. Variations in eye degeneration and pigment in some parasitic isopods during their life cycle. *Pubblicazioni della Stazione Zoologica di Napoli* **37**: 173–209.
- Saito, N., Itani, G & Nuomura, N. 2000. A preliminary check-list of isopod crustaceans in Japan. *Bulletin of the Toyama Science Museum* **23**: 1–107.
- Sars, G.O. 1898. An account of the Crustacea of Norway with short descriptions and figures of all the species. Volume II. Isopoda. Part XI, XII, pp. 185–232.

- Oniscidae (concluded), Bopyridae, Dajidae. (Bergen Museum: Bergen).
- Schotte, M. 1995. *Gnathia arabica*, n. s. first record of a gnathiid from the Arabian Sea, and new records of isopods (Crustacea: Isopoda) from Pakistan in collections of the Smithsonian Institution. Pp. 111–118. In, Thompson, N. & Tirmizi, N. (Eds), *The Arabian Sea, living marine resources and the environment*. (Vanguard Books: Lahore, Pakistan).
- Shields, J.D. & Ward, L.A. 1998. *Tiarinion texopallium*, new species, an entoniscid isopod infesting majid crabs (*Tianinia* spp.) from the Great Barrier Reef, Australia. *Journal of Crustacean Biology* **18**(3): 590–596.
- Shiino, S.M. 1933. Bopyrids from Tanabe Bay. *Memoirs of the College of Science, Kyoto Imperial University* (B) **8** (3, Article 8): 249–300.
1934. Bopyrids from Tanabe Bay II. *Memoirs of the College of Science, Kyoto University* (B) **9**(4, Article 7): 257–287.
- 1936a. Bopyrids from Shimoda and other districts. *Records of Oceanographic Works in Japan* **8**(1): 161–176.
1937. Bopyrids from Tanabe Bay, IV. *Memoirs of the College of Science, Kyoto Imperial University* (B) **12** (3, Article 18): 479–493.
- 1939a. A bopyrid from Palao. *Palao Tropical Biological Station Studies* **1**: 597–610.
- 1939b. A new phryxid (Epicaridea) from the inland sea. *Annotationes Zoologicae Japonenses* **18**(1): 17–20.
- 1942a. Bopyrids from the South Sea Islands with description of a hyperparasitic cryptoniscid. *Palao Tropical Biological Station Studies* **2**(3): 437–458.
- 1942b. On the parasitic isopods of the family Entoniscidae, especially those found in the vicinity of Seto. *Memoirs of the College of Science, Kyoto Imperial University* (B) **17**(1): 37–76.
- 1949a. On two species of the bopyrid genus *Bopyrella*, found in Japan. *Bulletin of the Biogeographical Society of Japan* **14**(9): 45–50.
1950. Notes on some new bopyrids from Japan. *Mie Medical Journal* **1**(2): 151–167.
1951. Some bopyrid parasites found on the decapod crustaceans from the waters along Mie Prefecture. *Report of the Faculty of Fisheries, Prefectural University of Mie* **1**(1): 26–40.
1952. Phylogeny of the Family Bopyridae. *Annual Report of the Prefectural University of Mie (Section 2, Natural Sciences)* **1**: 33–56.
1958. Note on the bopyrid fauna of Japan. *Report of the Faculty of Fisheries, Prefectural University of Mie* **3**: 29–73.
1972. The Epicaridea (list of species) from Japan. *Kansai Shizenkagaku* **24**: 7–10 [in Japanese]
1974. Isopoda. Pp. 539–555. In, *New illustrated encyclopedia of the fauna of Japan*. (Hokuryu-Kan: Tokyo) [in Japanese].
- Shimomura, M., Ohtsuka, S. & Sakakihara, T. 2006. Two bopyrid isopods infesting caridean shrimp *Hippolyte* sp. in the Seto Inland Sea, western Japan (Crustacea: Peracarida). *Bulletin of the Kitakyushu Museum of Natural History and Human History. Series A (Natural History)* **4**: 1–7.
- Somers, I.F. & Kirkwood, G.P. 1991. Population ecology of the grooved tiger prawn, *Penaeus semisulcatus*, in the northern Gulf of Carpentaria, Australia: growth, movement, age structure and infestation by the bopyrid parasite *Epipenaeon ingens*. *Australian Journal of Marine and Freshwater Research* **42**: 349–367.
- Stebbing, T.R.R. 1910. Isopoda from the Indian Ocean and British East Africa. Reports of the Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr. J. Stanley Gardiner, M. A. *Transactions of the Linnean Society of London. (2, Zoology)* **14**: 83–122.
- Tattersall, W.M. 1905. The marine fauna of the coast of Ireland. Part V. *Isopoda. Fisheries, Ireland, Scientific Investigations*, **1904** (2): 1–90.
1911. Die nordischen Isopoden. *Nordisches Plankton* **VI**: 181–313.
- Thielemann, M. 1910. Beiträge zur Naturgeschichte Ostasiens. Herausgegeben von Dr. F. Doflein. Beiträge zur Kenntnis der Isopodenfauna Ostasiens. *Abhandlungen der mathematisch-physischen Klasse der königlichen bayerischen Akademie der Wissenschaften. Suppl. Bd. 2 (Abhandlung 3)*: 1–109.
- Trilles, J.-P. 1999. Ordre des isopodes sous-ordres des épicarides (Epicaridea Latreille, 1825). In, Forest, J. (Ed.). *Traité de Zoologie. Anatomie, systématique, biologie. Tome VII, Fascicule IIIA. Crustacés Pécaricides. Part 8. Mémoires de l'Institut Océanographique, Fondation Albert 1er, Prince de Monaco* **19**: 279–352.
- Tsukamoto, R.Y., 1981. *Bopyrina ocellata* (Czerniavsky, 1868), isópode parasita assinalada pela primeira vez no Atlântico sul. (Epicaridea, Bopyridae). *Morfologia, desenvolvimento e distribuição geográfica. Ciencia e Cultura São Paulo* **33**(3): 394–401.
- Tuma, D.J. 1967. A description of the development of primary and secondary sexual characters in the banana prawn, *Penaeus merguensis* de Man (Crustacea: Decapoda: Penaeidae). *Australian Journal of Marine and Freshwater Research* **18**: 73–88.
- Walz, R., 1881. Über den Organismus der Bopyriden. Vorläufige Mittheilung. *Zoologischer Anzeiger* **4**: 159–164.
1882. Über die Familie der Bopyriden mit besonderen Berücksichtigung der Fauna der Adria. *Arbeiten*

- aus dem zoologischen Institute der Universität Wien und der zoologischen Station in Triest **4**(20): 125–200.
- Whitelegge, T. 1897. The atoll of Funafuti, Ellice Group: its zoology, botany, ethnology and general structure. VI. The Crustacea. *Memoirs of the Australian Museum* **3**: 127–151.
- Williams, J.D. & Boyko, C.B. 1999. A new species of *Pseudostegias* Shiino, 1933 (Crustacea: Isopoda: Bopyridae: Athelginae) parasitic on hermit crabs from Bali. *Proceedings of the Biological Society of Washington* **112**(4): 714–721.
2004. A new species of *Schizobopyrina* Markham, 1985 (Crustacea: Isopoda: Bopyridae: Bopyrinae) parasitic on a *Gnathophyllum* shrimp from Polynesia, with description of an associated hyperparasitic isopod (Crustacea: Isopoda: Cabiropidae). *Proceedings of the California Academy of Sciences* **55**(24): 439–450.
- Yoshida, M. 1952. On the breeding character of the shrimp *Leander serrifer*, parasitized by bopyrids. *Annotationes Zoologicae Japonenses* **25**: 362–365.