

ADDITIONS TO THE BOPYRID ISOPOD FAUNA OF THAILAND

by

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Previously, scattered accounts recorded 13 species of bopyrid isopods infesting decapod crustaceans in Thailand. Recent collections, mainly at Phuket, on the west coast, have turned up 18 more species in Thai waters. *Asymmetrione asymmetrica* (Shiino) infests *Clibanarius* spec. *Bopyrissa liberorum* spec. nov. infests *C. merguensis* de Man. *Parapagurion calcincola* Shiino infests *Paguristes* spec. *Aporobopyrina lamellata* Shiino infests *Petrolisthes lamarckii* (Leach). *Metabopyrus irregularis* spec. nov., infests *Upogebia* spec. *Probopyrus buitendijki* (Horst) infests *Macrobrachium rosenbergii* (de Man). *P. annandalei* Chopra, recorded for the second time from Thailand, infests *Macrobrachium* spec. *Bopyrella tanytelson* spec. nov., infests *Alpheus* spec. *Parabopyrella essingtoni* (Bourdon & Bruce) infests *Alpheus* spec. *Bopyrinella albida* Shiino infests *Athanas* spec. *Procepon insolitum* Shiino infests an unidentified thalassinidean. *Procepon horridulum* spec. nov., infests *Upogebia* spec. *Upogebione phuketensis* gen. nov. spec. nov., infests *Wolffogebia phuketensis* Sakai. *Allokepon sinensis* (Danforth) infests *Portunus pelagicus* (L.). *Kepon orientalis* spec. nov., infests *Metaplax elegans* de Man and *M. distinctus* H. Milne Edwards. *Trapezicepon thalamitae* spec. nov. infests *Thalamita crenata* (Latreille). *Parapenaemon japonica* (Thielemann) infests an unidentified penaeid. *Pseudostegias setoensis* Shiino infests *Clibanarius padavensis* de Man. *P. dulcilacuum* Markham infests *C. merguensis* de Man. *Diplophryxus jordani* Richardson infests *Palaemon semmelinki* (de Man). For all collected species, the report includes synonymies and illustrations as well as descriptions or redescrptions as needed. A table lists all 31 species now known from Thailand, their hosts and localities.

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INTRODUCTION

Isopods of the epicaridean family Bopyridae, which, as adults, are obligate ectoparasites of decapod crustaceans, have been recorded from the waters of Thailand a few times, but there has never been a catalog of the species known from there. Evidently the number of species reported from Thailand, in scattered literature, is 13. A list of species of animals of Thailand (Suvatti, 1950), in one of the most cryptic references of the entire bopyrid literature, cites only a "*Bopyrus*" from Bung Borapet without mention of its host or any criterion by which one might establish its true identity.

The first Thai specimens I was able to examine were parasites of hermit crabs collected at Phuket and furnished by Susan Brunenmeister. In June 1980, I made collections of my own at Phuket and obtained material already in collections of the Phuket Marine Biological Center.

SYSTEMATIC PART

Family Bopyridae Rafinesque, 1815

Pseudoninae R. Codreanu, 1967

Asymmetrione Codreanu, Codreanu & Pike, 1965

Asymmetrione asymmetrica (Shiino, 1933)

(fig. 1)

Pseudione asymmetrica Shiino, 1933: 249, 273-277, figs. 9, 10 [Tanabe Bay, Japan; infesting *Clibanarius bimaculatus* (de Haan)]; Shiino, 1952: 35, 38, 41; Shiino, 1958: 30 [Shirahama, Japan; infesting *C. bimaculatus*]; Shiino, 1972: 7.

Asymmetrione asymmetrica asymmetrica; Codreanu et al., 1965: 255-227, 234, 242; Bourdon, 1968: 313; Bourdon, 1976b: 366.

Aymmetrione asymmetrica: Markham, 1975: 264, 265.

Material examined. – Infesting *Clibanarius merguensis* de Man. Under intertidal rocks, Ao Tang Khen Beach, Phuket, Thailand, 10 June 1980, J. C. Markham coll., L. B. Holthuis, det. of host: 2♀, 1♂, RMNH Crust I 6640.

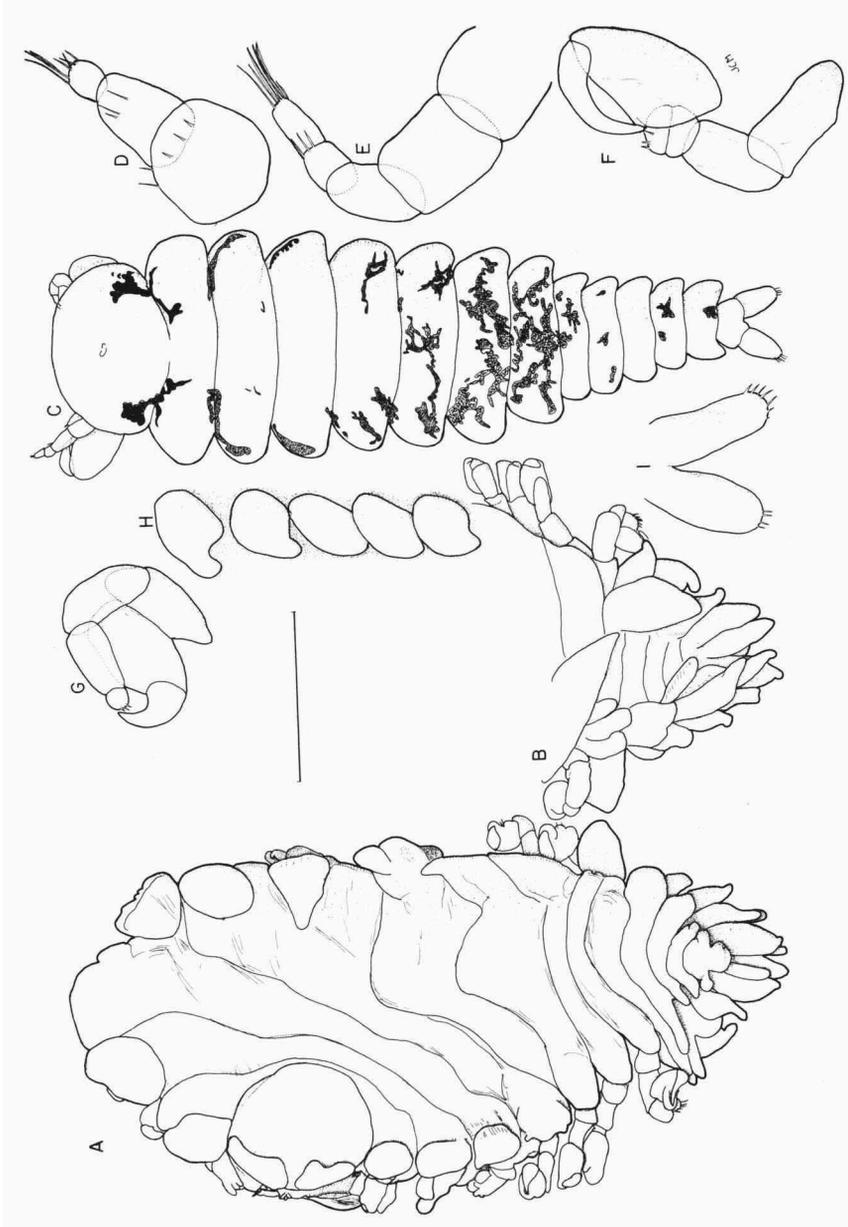


Fig. 1. *Asymmetrione asymmetrica* (Shiino, 1933). A, B, female; C-I, male. A, dorsal view; B, pleon in ventral view; C, dorsal view; D, left antenna 1; E, right antenna 2; F, left pereopod 1; G, right pereopod 1; H, left pereopod 7; I, pleomere 6 in ventral view. Scale: 1.0 mm for A, B; 0.4 mm for C; 0.2 mm for F-I; 0.1 mm for D, E.

Discussion. – The females of *Asymmetrione asymmetrica* differ from those previously known in a few minor details. The second pereomeres are less pointed laterally, and there are no tubercles on any oostegites or lateral plates, but faint tubercles are present on the pleopods. The male, in contrast to that pictured from Japan (Shiino, 1933), is relatively slightly broader, has abundant dorsal pigmentation, and the final pleomere and its extension (considered lateral plates by Shiino, but perhaps really uropods) are demarcated.

Bopyrissa Nierstrasz & Brender à Brandis, 1931

***Bopyrissa liberorum* spec. nov.**

(figs. 2, 3)

Material examined. – Infesting *Clibanarius merguensis* de Man. On shale in rocky intertidal area on grounds of Phuket Marine Biological Center, Phuket, Thailand, 07°50'10''E, 98°24'05''E, 4 July 1974, S. Brunenmeister coll. and det. of host: ♀, holotype, USNM 173468; ♂, allotype, USNM 173469; 1♀, 1♂, paratypes, USNM 173470; ♀, ♂, paratypes, USNM 173471. Ao Tung Khen Beach, Phuket, Thailand, 10 June 1980, J. C. Markham coll., L. B. Holthuis det. of hosts: 3♀, 3♂, paratypes, RMNH Crust I 6643.

Description of holotype female (fig. 2). – Length 3.12 mm, maximal width 1.66 mm, head length 0.60 mm, pleon length 0.70 mm. Body axis doubly distorted, head-pereon distortion 32°, pereon-pleon distortion 7°. All body regions and segments distinct. No pigmentation (fig. 2A, B).

Head nearly rectangular, deeply set into first pereomere, wider than long. Antenna 1 (fig. 2C) of three articles, each much smaller than that proximal to it, all somewhat setose distally; antenna 2 (fig. 2D) extended, of five articles, all about equally long, distal three quite slender and tipped by many setae. Posteroventral border of head (fig. 2E) with single digitate-margined lateral projection on each side, no medial projection. Maxilliped (fig. 2F) nearly semicircular, its tiny palp (fig. 2G) somewhat distant from anteromedial corner, articulating with maxilliped and extended with medially-directed setose tip.

Pereon slightly indented between pereomeres. First four pereomeres laterally divided so tergal projection present posteriorly; no coxal plates. First oostegites (fig. 2H, I) reduced, with gently undulate but nontoothed internal ridge, moderately extended posterior point. Pereopods (fig. 2J, K) all of similar proportions but more than doubling in size posteriorly; all dactyli reduced and not extended; all meri and carpi somewhat setose.

Pleon of five U-shaped pleomeres, each anteriorly and laterally surrounding

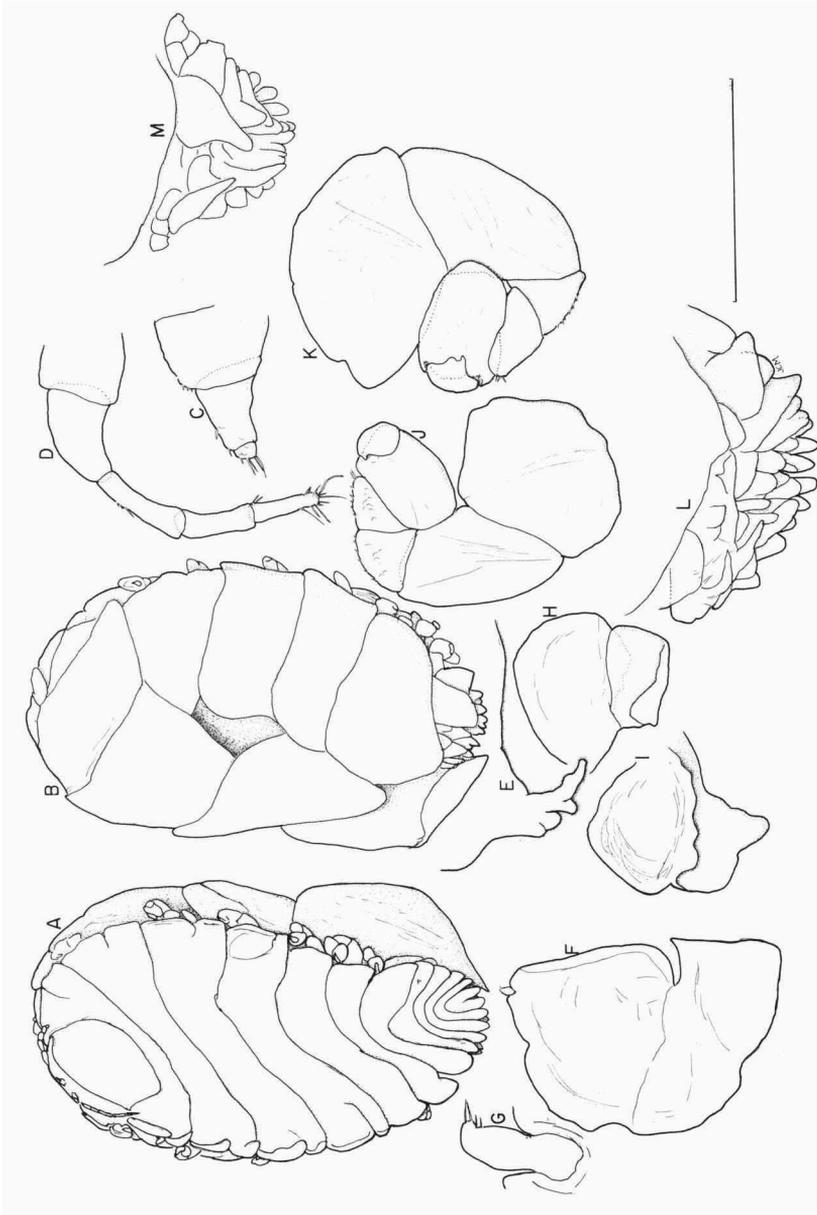


Fig. 2. *Bopyrissa iberorum* spec. nov. A-L, holotype female; M, paratype female. A, dorsal view; B, ventral view; C, left antenna 1; D, left antenna 2; E, right posteroventral border of head; F, right maxilliped; G, palp of same; H, right oostegite 1 in external view; I, same in internal view; J, right pereopod 1; K, right pereopod 7; L, pleon in ventral view; M, pleon in ventral view. Scale: 1.5 mm for A, B, M; 0.25 mm for C, D, J, K; 0.08 mm for E, F, G.

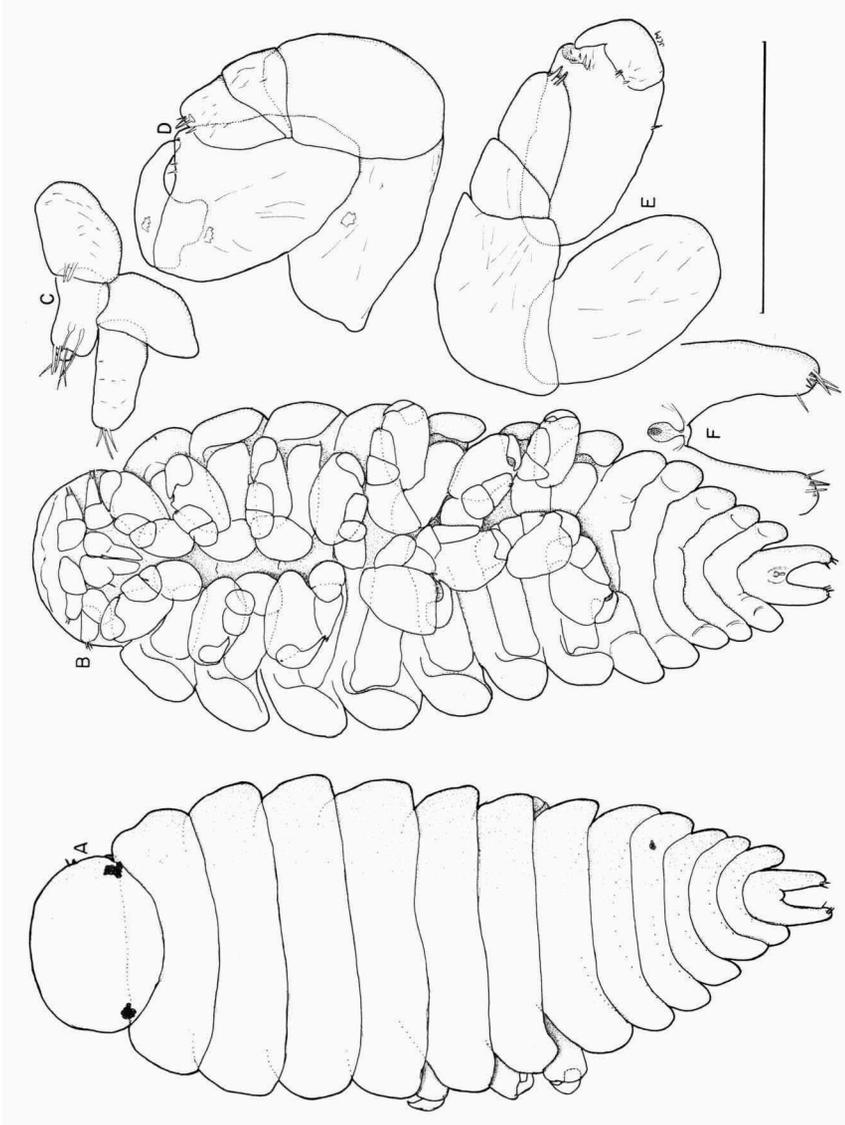


Fig. 3. *Bopyrissa liberorum* spec. nov., allotype male. A, dorsal view; B, ventral view; C, right antennae; D, right pereopod 1; E, left pereopod 7; F, end of pleon in ventral view. Scale: 0.3 mm for A, B; 0.1 mm for C-F.

succeeding one. Ventral surface (fig. 2L) short and completely covered by uniramous lateral plates, biramous pleopods and uniramous uropods, all foliaceous, triangular anteriorly to lanceolate posteriorly.

Description of allotype male (fig. 3). – Length 0.95 mm, maximal width 0.37 mm, head length 0.16 mm, head width 0.21 mm, pleon length 0.29 mm. All body regions and segments distinct (fig. 3A, B); body nearly elliptical in outline.

Head elliptical, well-extended beyond anterior margin of pereon. Prominent eyes next to posterolateral borders. Antennae (fig. 3C) nearly alike in size and structure except first antenna with minute distal article in addition to relatively broad basal article and elongate second article.

Pereomeres slightly separated by small anterolateral notches. No mid-ventral tubercles. Pereopods (fig. 3D, E) all about same size but with progressively reduced dactyli, narrowed propodi and lengthened meri posteriorly; meri and propodi setose distally.

Pleon of six pleomeres, all slightly separated laterally. Anterior margins of pleomeres nearly straight across except for lateral regions abruptly directed posteriorly. Pleopods absent but dorsolateral regions of first five pleomeres slightly swollen. Sixth pleomere produced into slight anal tubercle, extending posteriorly into two long branches though not as true uropods, each branch distally setose.

Variations. – The paratype females are quite similar to the holotype in all respects, and all are dextrally distorted. The pleonal appendages of one are more aligned toward the sides of the pleon, exposing the middle region. Two of the females have only single projections on the posterolateral borders of their heads. Most pereomeres of the paratype males are rather more separated laterally than those of the allotype.

Etymology. – The specific name “*liberorum*”, meaning “of the free”, has been selected to reflect this species occurrence in Thailand, whose name means “land of the free.”

Discussion. – As is typical for species of *Bopyrissa*, all females of *B. liberorum* are distorted dextrally, with the right side the longer. A characteristic feature of *Bopyrissa* females is a reverse distortion, by which the pleonal axis comes to lie nearly parallel to that of the head. Like *B. liberorum*, all six previously known species of *Bopyrissa* are parasites of diogenid hermit crabs in tropical and subtropical waters. *B. dawydoffi* (Codreanu & Codreanu, 1963) from Viet Nam, though only very inadequately described, evidently differs from all other species in having the pleonal lateral plates of the female exceeding the width of the pereon. Females of four species have more extended pleons, so the female of *B. liberorum* most closely resembles *B. wolffi*

Markham (1978), a parasite of two species of *Clibanarius* in the northwestern Atlantic, in this character and in such details as the posteroventral border of the head, the shape of the maxilliped and the proportions of the pereopods. *B. wolffi* females differ in lacking maxilliped palps and having less extended oostegites. The male of *B. liberorum* differs from all other species of *Bopyrissa* in the extension of its final pleomere.

Parapagurion Shiino, 1933

Parapagurion calcinicola Shiino, 1933

Parapagurion calcinicola Shiino, 1933: 257-259, fig. 3 [Seto, Kii, Japan; infesting *Calcinus elegans* (H. Milne Edwards)]; Codreanu & Codreanu, 1963: 285; Shiino, 1972: 7; Markham, 1978: 107, 110, 114.

Material examined. – Infesting *Paguristes* spec. Unreported specific locality, Phuket, Thailand. M. de Saint-Laurent coll., 1976: 1♀, MNHNP Ep. 515.

Discussion. – The female, which is sinistrally distorted, is 2.44 mm long and 1.50 mm broad, with a head 0.58 mm and pleon 0.46 mm long. It differs slightly from the type female, thus: its frontal lamina is slightly more prominent laterally, its body is relatively narrower, and its maxilliped bears a minute palp near the middle of its anterior edge. (It is possible that the type female also has a similar maxillipedal palp, which was overlooked because of its minuteness.) This is only the second record of *Parapagurion calcinicola*, so this is both a new host and a new locality record.

Aporobopyrina Shiino, 1934

Aporobopyrina lamellata Shiino, 1934

(fig. 4)

Aporobopyrina lamellata Shiino, 1934: 263-265, 267, fig. 3 [Yasaki, Seto, Japan; infesting *Petrolisthes pubescens* Holmes]; Shiino, 1936: 161 [Shimoda, Japan; infesting *Petrolisthes hastatus* Stimpson]; Shiino, 1952: 39; Bourdon, 1972: 114; Shiino, 1972: 8; Markham, 1974: 633, 637-638; Bourdon, 1976a: 166, 215-219, 240, 241, figs. 31, 32 [Tuléar, Madagascar; infesting *Petrolisthes penicillatus* (Heller) and *P. lamarckii* (Leach)]; Santa Cruz, Pavad, Mindanao, Philippines; infesting *P. lamarckii*; Markham, 1980: 623, 624-625, figs. 3-5 [Karachi, Pakistan; infesting *P. rufescens* Heller]; Bourdon, 1983: 851 [Platier de Galala, Moluccas, Indonesia; infesting *Petrolisthes hastatus* Stimpson].

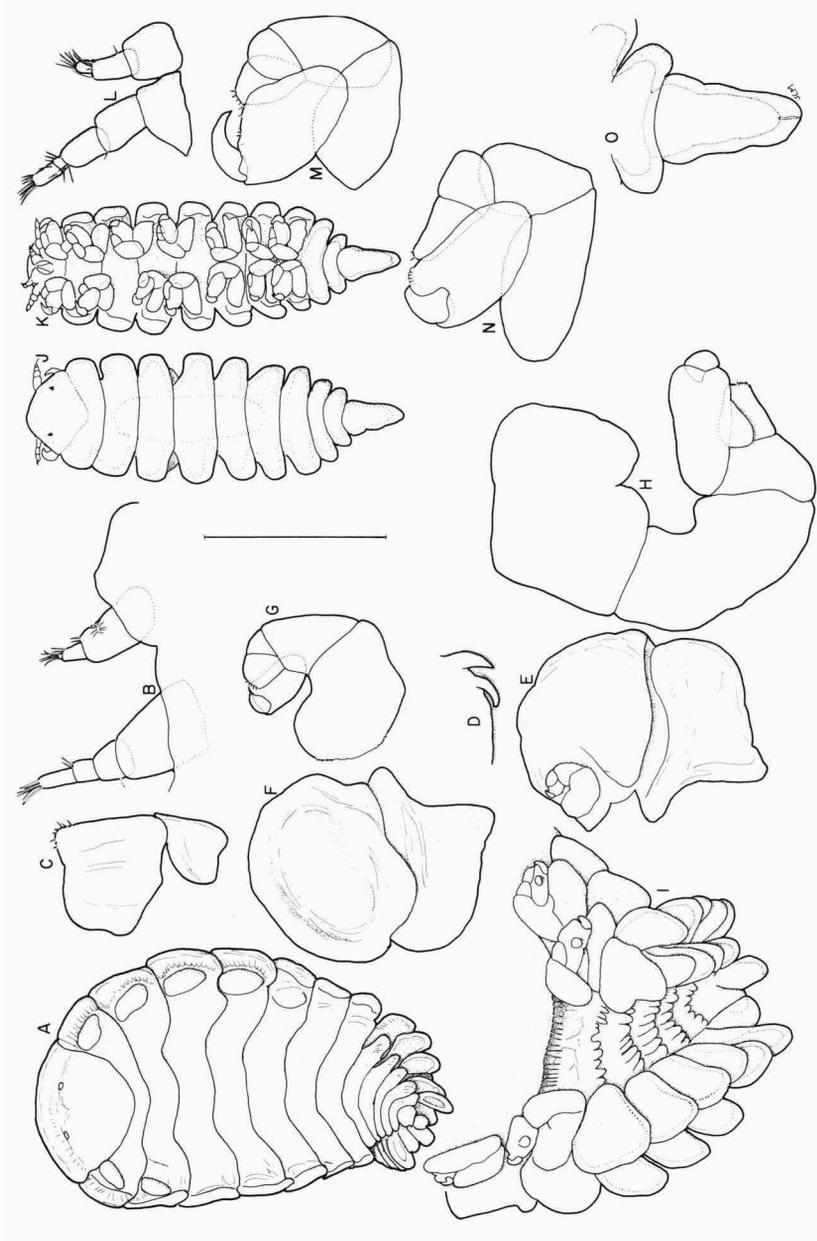


Fig. 4. *Aporobopyrina lamellata* Shiino, 1934. A-I, female; J-O, male. A, dorsal view; B, right antennae; C, right maxilliped; D, left posteroventral border of head; E, right oostegite 1 in external view; F, same in internal view; G, right pereopod 1; H, right pereopod 7; I, pleon in ventral view; J, dorsal view; K, ventral view; L, right antennae; M, right maxilliped; N, right pereopod 1; O, end of pleon in ventral view. Scale: 2.2 mm for A; 1.1 mm for C-F, I; 1.0 mm for J, K; 0.4 mm for G, H, O; 0.2 mm for B, L-N.

Material examined. – Infesting *Petrolisthes lamarckii* (Leach). Ko Hi Island, Phuket, Thailand, 12 June 1972, S. Lundøer coll.: 2♀, 1♂, RMNH Crust I 6641.

Discussion. – As mentioned elsewhere (Markham, 1974, 1980), species of *Aporobopyrina* tend to vary. Thus the present material of *A. lamellata*, while agreeing well enough to be assignable to that species, displays some features not previously mentioned for it. The shape of the female's maxilliped (fig. 4C) is probably only an artifact of its dissection, the posterior segment having been rotated relative to the anterior one. The internal ridge of the first oostegite (fig. 4F) lacks the ornamentation seen previously. The last two pereopods (fig. 4H, I) have posteriorly extended bases, as is typical for *A. lamellata*, but the laterally produced tubercles on the propodi were not previously reported. The other female examined is partly deteriorated and hard to see in detail. Its maxilliped has the usual shape, and its posterior pereopods have propodal tubercles; details of the internal ridge of the first oostegite are not discernible.

Bopyrinae Rafinesque, 1815, emend. R. Codreanu, 1967

Metabopyrus Shiino, 1939

Metabopyrus irregularis spec. nov.

(fig. 5)

Material examined. – Infesting *Wolffogebia phuketensis* Sakai, L. B. Holthuis det. of host. Unrecorded specific locality, Phuket, Thailand, 9 August 1978: ♀, holotype, RMNH Crust I 6644. Mangrove area, Ko Yao Yai, Phuket, Thailand, Anuwat Nateewathana and Pitiwong Tanchodok coll.: 1♀, paratype, RMNH Crust I 6645.

Description of holotype female (fig. 5). – Length 4.58 mm, maximal width 3.30 mm, head length 0.96 mm, head width 1.22 mm, pleon length 1.48 mm, pleon length 2.18 mm; body axis distortion 17°. No pigmentation except for eyes. Body outline smoothly oval. All body regions and segments distinct (Fig. 5A, B).

Head triangular, deeply set into pereon and not extending beyond body margin. Frontal lamina incomplete and obscure. Eyes as scattered minute spots of pigment near anterolateral corners. Antennae (fig. 5C) of two and five articles, respectively, nearly all articles distally setose. Maxilliped (fig. 5D) rounded anteriorly, pointed posteromedially, anterior segment about twice length of posterior one; palp completely absent, spur slightly produced. Posterolateral border of head (fig. 5E) with nine irregularly crenulate projections clear across margin.

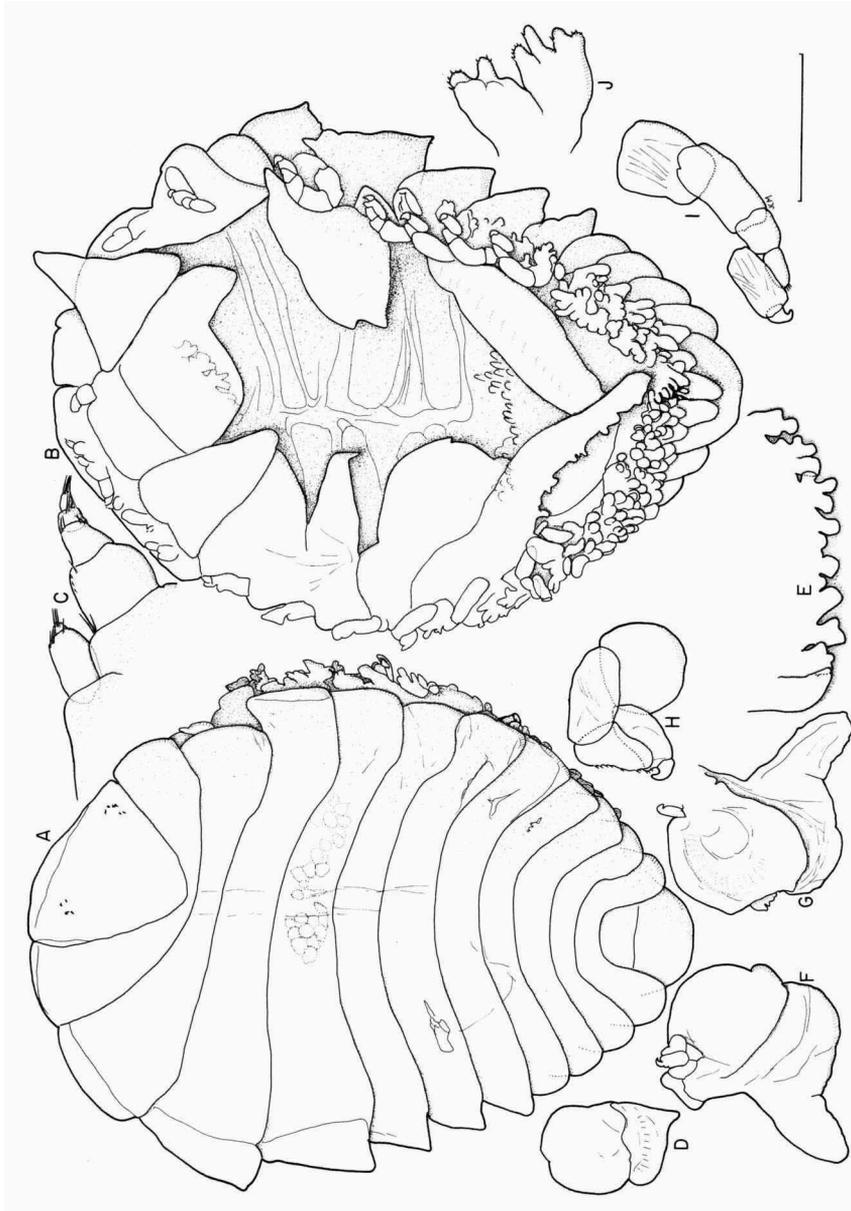


Fig. 5. *Metabopyrus irregularis* spec. nov., holotype female. A, dorsal view; B, ventral view; C, left antennae; D, right maxilliped; E, posteroventral border of head; F, right oostegite 1 in external view; G, right oostegite 1 in internal view; H, right pereopod 1; I, left pereopod 7; J, left pleopod 1. Scale: 1.0 mm for A, B, D, F, G; 0.55-mm for E; 0.32 mm for H-J; 0.16 mm for C.

Outline of pereon uneven, all pereomeres separated by indentations. Well developed coxal plates only on long sides of pereomeres 2-4, though traces present on long side of pereomere 1 and short side of pereomere 3; long sides of pereomeres 5-7 extended into posterolateral points. Oostegites completely surrounding and about two thirds covering brood pouch; oostegite 1 (fig. 5F, G) with unadorned internal ridge and lanceolate posterolateral projection extending far posteriorly but not laterally; most other oostegites irregularly shaped and variously pointed; fifth oostegites very long and slender, crossing posteriorly. Posterior region of brood pouch with cluster of tubercles. Pereopods (fig. 5H, I) quite small, anteriorly some meri and carpi fused; posterior pereopods rather more extended.

Pleon nearly semicircular in outline, of five pleomeres, each largely surrounding succeeding one. Final pleomere as flattened disk with dorsal transverse suture possibly indicating former segmentation. Five pairs of biramous pleopods (fig. 5J) with irregularly crenulate projections and setose margins overlapping each other and forming a continuous strip between opposite seventh pereopods. Uropods evidently uniramous (though dorsally placed tubercles possibly minute rudiments of endopodites), in form of large lanceolate flaps.

Male unknown.

Etymology. — The name *irregularis* reflects the irregular outline of the female's pereon and the shapes of its oostegites.

Discussion. — *Metabopyrus* was heretofore known only from the type-species, *M. ovalis* Shiino (1939), a parasite of *Upogebia major* (de Haan) in Hakata Bay, Kyûsyû, Japan. *M. irregularis* conforms well with the type-species in having a deeply inset head, an oval body, five pleomeres (the final one being quite large) and overlapping biramous pleopods subdivided into crenulate lobes of a structure and placement unique to this genus. The female of *M. ovalis* differs from that of *M. irregularis* in having a quadrangular head, coxal plates on both sides of the first three pereomeres, nearly smooth body margins, oostegites completely enclosing the brood pouch, crenulate uropods and a posteriorly notched fifth pleomere. It is possible that the open condition of the brood pouch of *M. irregularis* reflects immaturity (inasmuch as no eggs were present) rather than a specific character.

Shiino (1939), in erecting the genus *Metabopyrus*, considered it a close relative of *Probopyrus*, but its peculiar pleopods make it very readily distinguishable from that or any other genus. The systematic position of it in fact is questionable; most characters ally it with the Bopyrinae, but others are more typical of the Pseudioninae.

The paratype female of *Metabopyrus irregularis* is very similar to the

holotype. It is dextrally rather than sinistrally distorted. Its head is slightly less pointed posteriorly, and the lateral processes on the ventrolateral border are somewhat more digitate.

Probopyrus Giard & Bonnier, 1888

Probopyrus buitendijki (Horst, 1910)
(figs. 6, 7)

- Palaegyge Buitendijki* Horst, 1910: 67-70, figs. 1-4 [Type-locality Tandjong-Priok, near Jakarta, Java. Indonesia; infesting *Macrobrachium rosenbergii* (de Man)].
- Palaegyge buitendijki*; Chopra, 1923: 417, 419, 484, 489-490, 491, 495, 497, 501, 502, 541 [Khula District in Bangladesh and Hugli District in India; infesting *M. rosenbergii*]; Chopra, 1930: 131, 132, fig. 2a; Nierstrasz & Brender à Brandis, 1923: 91, 93; Banks, 1935a: 357-358 [Mouth of Bintala River, Borneo; infesting *M. rosenbergii*]; Pillai, 1954: 20.
- Probopyrus latilamellaris* Nierstrasz & Brender à Brandis, 1923: 93-94, fig. 19a, b [Type-locality Batu Pangal, Kuteo River, Borneo; infesting *M. rosenbergii*]; Nierstrasz & Brender à Brandis, 1929: 21, 23, figs. 22, 23 [Bangkok, Thailand; infesting *M. rosenbergii*; first account of male]; Nierstrasz & Brender à Brandis, 1932: 36; Chopra, 1923: 541; Lemos de Castro & Brasil Lima, 1974: 211.
- ?*Probopyrus bengalensis*: Nierstrasz & Brender à Brandis, 1929: 24-25 [Bangkok, Thailand; infesting *M. rosenbergii*].
- Palaegyge buytendijki* [sic]: Nierstrasz & Brender à Brandis, 1929: 22.
- Palaegyge latilamellaris*: Chopra, 1930: 128, 130.
- Palaegyge buitendijki* [sic]: Banks, 1935a: 357.
- “Isopod Crustacean”: Banks, 1935b: 359.
- ?“Bopyrid”: Holthuis, 1950: 114, 115 [Corenta River, southwest New Guinea; infesting *M. rosenbergii*].
- ?*Palaegyge bengalensis*: Pillai, 1954: 20 [Travancore, India; infesting *M. rosenbergii*] Robertson, 1983: 36 {in part?} [Magendo, Sepik River, Papua New Guinea; infesting *M. rosenbergii*].
- Probopyrus buitendijki*: Lemos de Castro & Brasil Lima, 1974: 212; Markham, in press [Re-examination of type material, plus material from west New Guinea, east Sumatra, near Malacca, Malaysia, Halmahera, Bang Sorn and Bangkok, Thailand; all infesting *M. rosenbergii*; redescription and systematic history].

Material examined. – Infesting *Macrobrachium rosenbergii* (de Man), C. W. Hart Jr., det. of host. Menam Chao Phya at Bang Sorn, Thailand, 29 August 1925, H. Smith coll.: 1♀, 1♂, USNM. Bangkok Market, Thailand, 26 april 1929: 9♀, 7♂: USNM 516.

Discussion. – In a recently prepared report (Markham, in press), I have considered the synonymy of this species and redescribed it on the basis of the types and other material, including that examined here. *Probopyrus buitendijki* is evidently the only bopyrid parasite of the commercially important species *Macrobrachium rosenbergii*, which in turn is that species' only host.

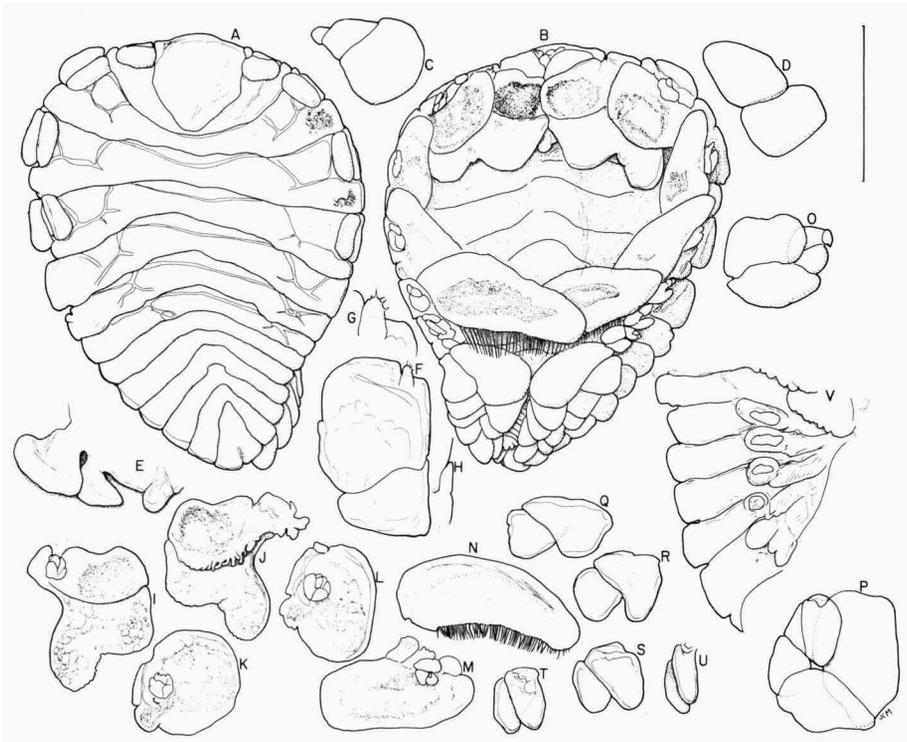


Fig. 6. *Probopyrus buitendijki* (Horst, 1910), female. A, dorsal view; B, ventral view; C, right antenna 1; D, right antenna 2; E, right posteroventral border of head; F, right maxilliped; G, palp of same; H, spur of same; I, right oostegite in external view; J, same in internal view; K-N, right oostegites in external view: K, 2; L, 3; M, 4; N, 5; O, right pereopod 1; P, right pereopod 7; Q-U, right pleopods: Q, 1; R, 2; S, 3; T, 4; U, 5; V, right side of pleon in ventral view with pleopods removed. Scale: 4.5 mm for A, B, I-N, Q-U; 2.4 mm for E, F, V; 1.0 mm for G, H, O, P; 0.4 mm for C, D.

Probopyrus annandalei Chopra, 1923

(figs. 8, 9)

Probopyrus annandalei Chopra, 1923: 417, 508, 510-514, 517, figs. 21-24 [Type locality Tale Sap, east coast peninsular Thailand; infesting probably *Palaemon sundaicus* (Heller) (= *Macrobrachium equidens* (Dana))]; Nierstrasz & Brender à Brandis, 1929: 19, 20; Lemos de Castro & Brasil Lima, 1974: 212.

Material examined. — Infesting *Macrobrachium lanchesteri* (de Man), L. B. Holthuis det. of host. Buriram. Province, Thailand, 30 March 1980: 7♀, 6♂, including reference specimens, RMNH Crust I 6642.

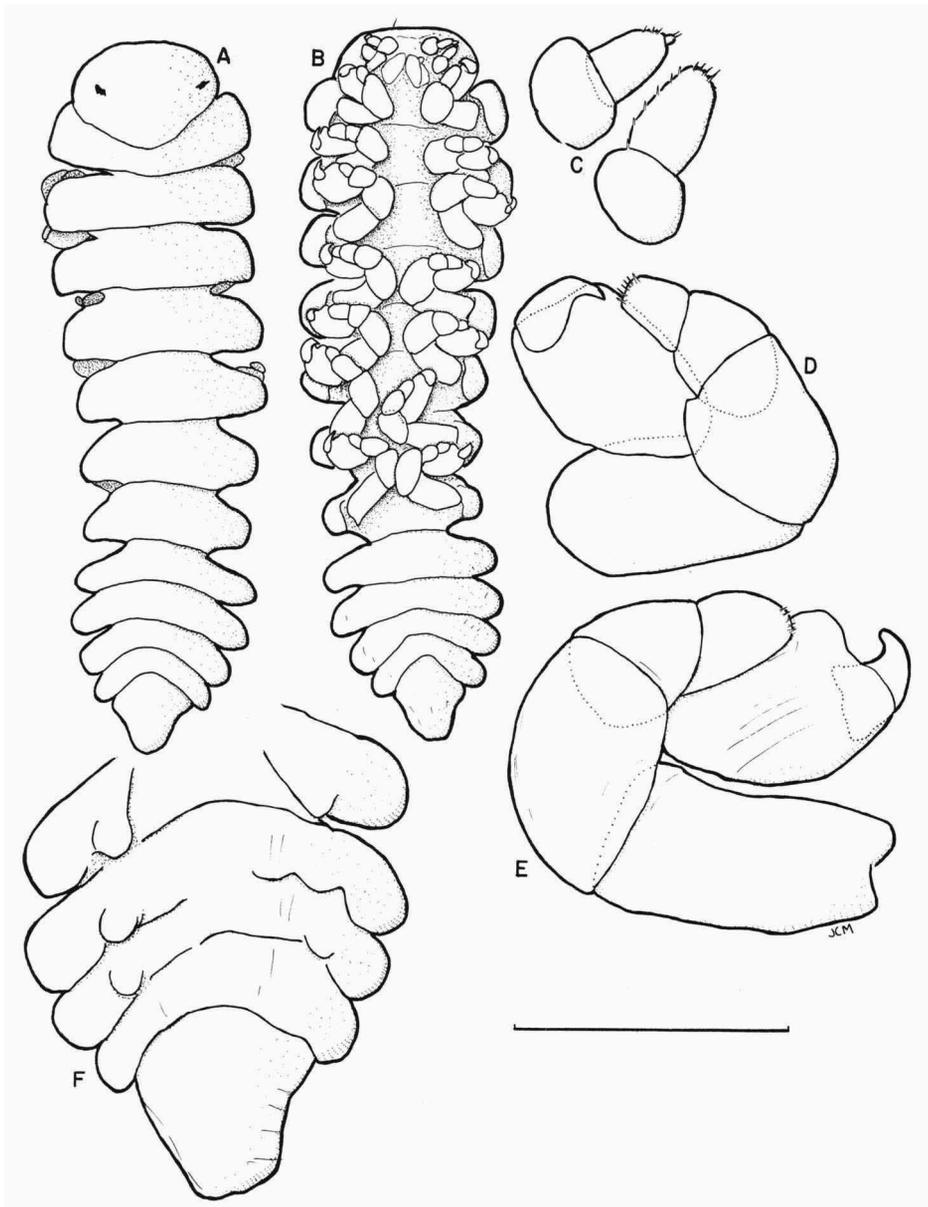


Fig. 7. *Probopyrus buitendijki* (Horst, 1910), male. A, dorsal; B, ventral; C, left antennae; D, right pereopod 1; E, left pereopod 7; F, pleon in ventral view. Scale: 0.9 mm for A, B; 0.4 mm for F; 0.2 mm for C, D, E.

Infesting *Macrobrachium* spec., (probably spec. nov., L. B. Holthuis det.). In fresh water near Ubon Ratchathani, eastern Thailand, ca. 15°15'N, 105°E, 1 April 1984, P. Naiyanetr and L. B. Holthuis colls.: 1♀, 1♂, RMNH Crust I. 7009.

Discussion. — Chopra (1923) presented a thorough and accurate description of *P. annandalei* on the basis of the type female and male, the only individuals hitherto recorded. His drawings, though well done and valuable, were incomplete. The new material agrees very well with the original description except for a few minor points. In the reference female (fig. 8), the coxal plates are less prominent; each antenna (fig. 8C, D) has three articles; the maxilliped palp (fig. 8E, F) extends medially rather than anteriorly; the internal ridge of the first oostegite (fig. 81) is lobulate rather than entire; and the pleomeres are distinct dorsally, not fused in the middle. In the reference male (fig. 9), the body is proportionally broader; the antennae (fig. 9C) are of three and two articles respectively, not of five apiece; all pleomeres are distinct, the final two not fused; and the pleopods are tuberculiform, not irregularly shaped extended flaps.

Other specimens examined differ from the reference specimens in a few minor details. The females range in length from 4.28 to 7.33 mm, in width from 3.16 to 5.67 mm; the males range in length from 1.26 to 1.98 mm and in width from 0.44 to 0.78 mm. The posteroventral border of the head of one female has an extended central point. In one male, the pereomeres are more separated, in a second the pleon is broader than the pereon, and in a third there are fifth pleopods.

The two species of *Probopyrus* most frequently collected in Thailand are easily distinguishable. Most conspicuously, the female of *P. buitendijki* has a split final pleomere (though not in every case – see Markham, in press), while that of *P. annandalei* is entire. Also, females of *P. buitendijki* have very broad lateral projections and central processes on their posteroventral head-borders, digitate rather than lobate processes on the internal ridges of their first oostegites, and proportionately larger pleopods. In males of *P. buitendijki*, bodies are proportionally more slender, heads are more extended, and pleopods are very inconspicuous. Finally, the only known host of *P. buitendijki* is *Macrobrachium rosenbergii*, while *P. annandalei* infests only other species of *Macrobrachium*. This is the first record of bopyrid infestation of *M. lanchesteri*, a species of potentially considerable commercial value (Holthuis, 1980).



Fig. 8. *Protopyrrus annandalei* Chopra, 1923, female. A, dorsal view; B, ventral view; C, palp of the right maxilliped; D, right antenna 1; E, right antenna 2; F, right maxilliped; G, right maxilliped in external view; H, right oostegite 1 in external view; I, right oostegite 1 in internal view; J-M, right oostegites in external view: J, 2; K, 3; L, 4; M, 5; N, right pereopod 1; O, right pereopod 7. Scale: 2.0 mm for A, B, H-M; 1.0 mm for E, F; 0.4 mm for G, N, O; 0.2 mm for C, D.

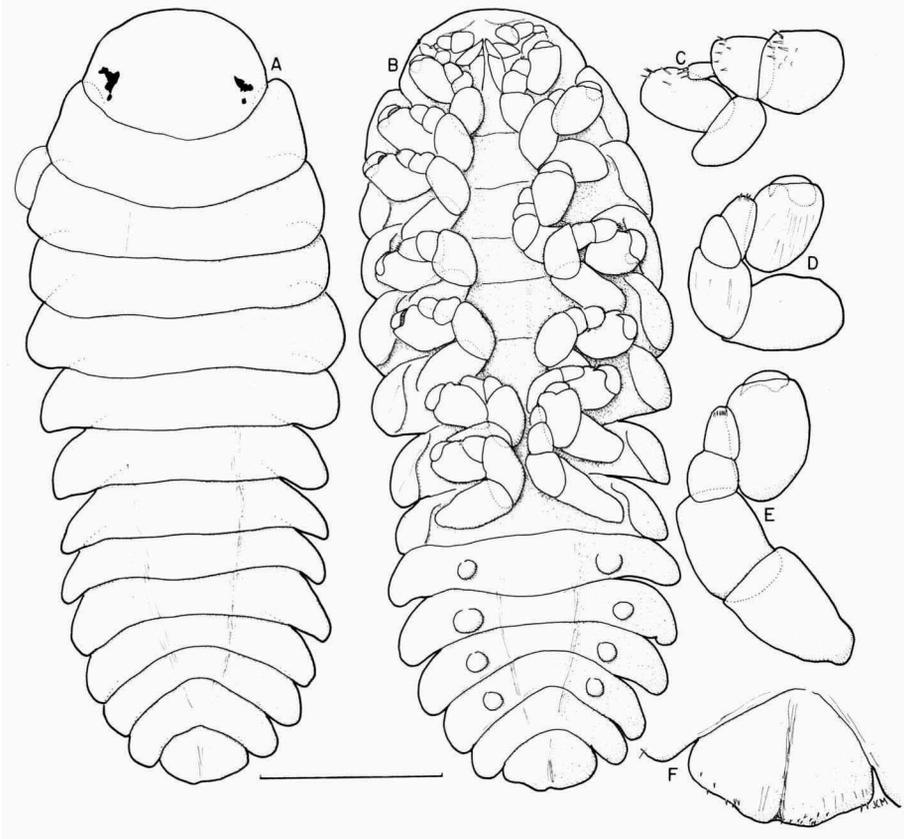


Fig. 9. *Probopyrus annandalei* Chopra, 1923, male. A, dorsal view; B, ventral view; C, right antennae; D, left pereopod 1; E, right pereopod 7; F, pleomere 6 in ventral view. Scale: 0.4 mm for A, B; 0.2 mm for D-F; 0.1 mm for C.

Bopyrella Bonnier, 1900

Bopyrella tanytelson spec. nov.

(fig. 10)

Material examined. – Infesting *Alpheus* sp. Fifth Thai-Danish Expedition. Sta. 23, south of Krabi, western Thailand, 07°55'22"N, 98°49'49"E, 13-18 m, 14 February 1966, trawl, Gallardo coll.: ♀, holotype USNM; ♂, allotype, USNM.

Description of holotype female (fig. 10A-L). – Length 3.04 mm, maximal width 1.74 mm, head length 0.70 mm, pleonal length 0.82 mm. Body distortion 50° (fig. 10A, B).

Head deeply set into pereon and completely fused with first pereomere, so

its shape uncertain. Long frontal lamina clear across front. Small dark eyes near anterolateral corners. Posteroventral border (fig. 10D) nearly as broad as long, with broad non-articulating setose palp (fig. 10E), deeply set into middle of anterior margin and posterior segment produced into blunt spur (fig. 10F).

Second pereomere greatly enlarged on convex side into broad anterior angle. Coxal plates on convex sides of pereomeres 3-5, dorsolateral bosses on pereomeres 2 and 3. Oostegite 1 (fig. 10G, I) subrectangular (fig. 10H); internal ridge completely unornamented. Oostegites completely surrounding but not enclosing brood pouch; fifth oostegites long, slender and lanceolate, crossing at posterior edge of brood pouch. Pereopods reduced, all about same size (figs. 10J, L); anterior pereopods with all articles distinct, posterior ones with meri and carpi nearly fused, all with short blunt dactyli; region of propodus of pleopod 1 (fig. 10K) receiving end of dactylus bearing minute corneous plates; basis of pereopod 1 swollen, that of pereopod 7 produced into large knob.

Pleomeres defined only on convex side except for last one, that markedly extended. Prominent crease along most of length of pleon along convex side. Five pairs of well-developed biramous subcircular to oval pleopods overlapping each other and about half covering pleonal surface.

Description of allotype male (fig. 10M-U). — Length 0.85 mm, maximal width, 0.38 mm, head length 0.18 mm, pleonal length 0.21 mm. A1; 1st body regions distinct, though head-pereon separation rather faint (fig. 10M, N).

Head semi-circular anteriorly, markedly narrower than pereomere 1 and partly set into it. Eyes of scattered red pigment spots near posterolateral corners. Antennae (fig. 10O, P) both of three articles, setose distally, antenna 1 also with distal setae on proximal two articles.

Pereomeres all well separated, first five of nearly same width, last two slightly narrower. Pereopods (fig. 10Q, R) of same size and nearly same proportions, with all meri and carpi fused; dactyli proportionally slightly shorter posteriorly.

Pleon of 5 pleomeres distinct laterally but incompletely separated dorsally and ventrally. All pleomeres shorter than pereomeres. First pleomere broader than last pereomere, others progressively narrower, giving pleon triangular outline. Five pairs of sessile pleopods, first ones (fig. 10S) largest, Terminal pleomere (fig. 10T, U) extended, posteriorly truncate, lacking uropods.

Etymology. — The specific name *tanytelson*, from Greek words meaning “long telson”, reflects the prominently extended final pleomere of the female and, to a lesser degree, of the male of this species.

Discussion. — *Bopyrella tanytelson* is most similar to *B. malensis* Bourdon (1980) in both sexes. The latter species infests *Synalpheus biungulatus* Cou-

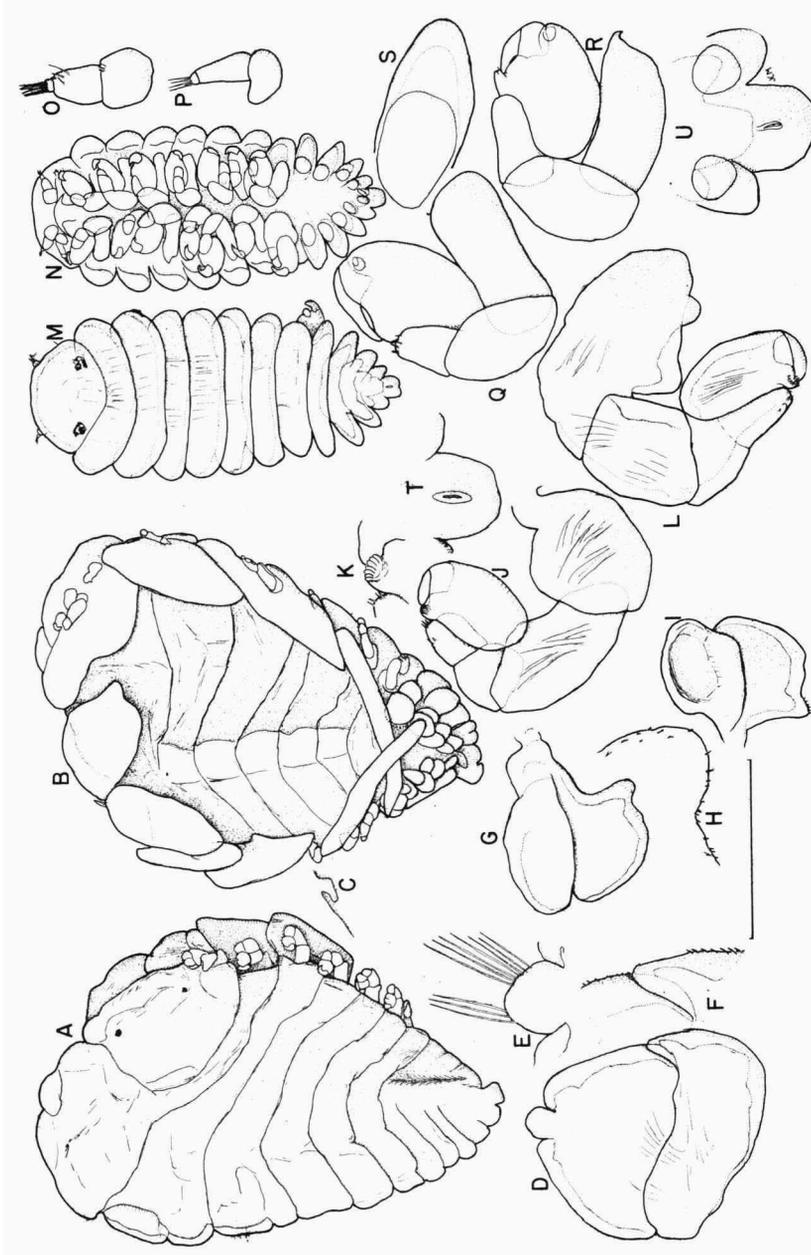


Fig. 10. *Bopyrella tanyielsoni* spec. nov. A-L, holotype female; M-U, allotype male. A, dorsal view; B, ventral view; C, left posteroventral border of head; D, right maxilliped; E, palp of same; F, spur of same; G, left oostegite 1 in external view; H, posteromedial corner of same; I, same in internal view; J, left pereopod 1; K, end of propodus of same; L, left pereopod 7; M, dorsal view; N, ventral view; O, right antenna 1; P, right antenna 2; Q, left pereopod 1; R, left pereopod 7; S, left side of pleomere 1; T, end of pleon in dorsal view; U, same in ventral view. Scale: 1.14 mm for A-C, G, I; 0.4 mm for D, M, N; 0.2 mm for E, F, G, H, J, L; 0.1 mm for K, O-U.

tière in the Maldives. Females of both species are of similar shape, and have first oostegites with unadorned internal ridges, anteriorly placed nonarticulating setose maxilliped palps and blunt pereopodal dactyli. The female of *B. malensis*, in contrast with that of *B. tanytelson*, has no eyes, two projections on each side of the posteroventral border of the head, a more elongate first oostegite and a less extended final pleomere. The crease in the pleon of the holotype female of *B. tanytelson* is probably an anomaly and not of systematic importance. The male of *B. malensis* has no eyes, a two-articled second antenna, the first three pleomeres dorsally separate and only three pairs of pleopods.

Parabopyrella Markham,

Parabopyrella essingtoni (Bourdon & Bruce, 1983) comb.nov. (fig. 11)

Bopyrella essingtoni Bourdon & Bruce, 1983: 96-99, figs. 1-2 [Type-locality Coral Bay, Port Essington, Cobourg Peninsula, Northern Territory, Australia; infesting *Alpheus bucephalus* Coutière].

Material examined. – Infesting unidentified alpheid shrimp. Fifth Thai-Danish Expedition, Sta. 5. Coral reef flat, Phuket, Thailand, 4 Februari 1966, Gallardo coll.: 1♀, 1♂, USNM.

Discussion. – This material, originally identified by R. Bourdon, clearly belongs to this highly distinctive species, even though it shows some variations from the types. The female (fig. 11A-J) is 5.81 mm long by 3.22 mm broad and has a pleon 1.91 mm long. Both its head and its pleomeres (fig. A, B) are more distinct than those of the type. Minute eyes are present; the projections on the posteroventral border of the head (fig. 11D) are more pointed; the first oostegite (fig. 11G, H) is relatively broader; and the pleopodal rami (fig. 11B) are more triangular than lanceolate. The male (fig. 11K-Q), which was too damaged for either measurements or toto drawings, seems to differ from the type only in having slightly broader pereopodal propodi (fig. 11L, M) and rather more separation of the pleomeres (fig. 11N, O). The degree of fusion of the head with the first pereomere, complete in the type, is unknown in the present material. Characters seen in both samples and diagnostic for this species are, in the female, the fusion of the head and pereon, the general body shape, the structure of the lateral projection on the posteroventral border of the head, the broad, rounded highly setose maxilliped palp, the shape of the first oostegite and the row of four teeth on its internal ridge, and the bosses on the bases of the pereopods, especially the seventh ones (fig. 11J). In the male,

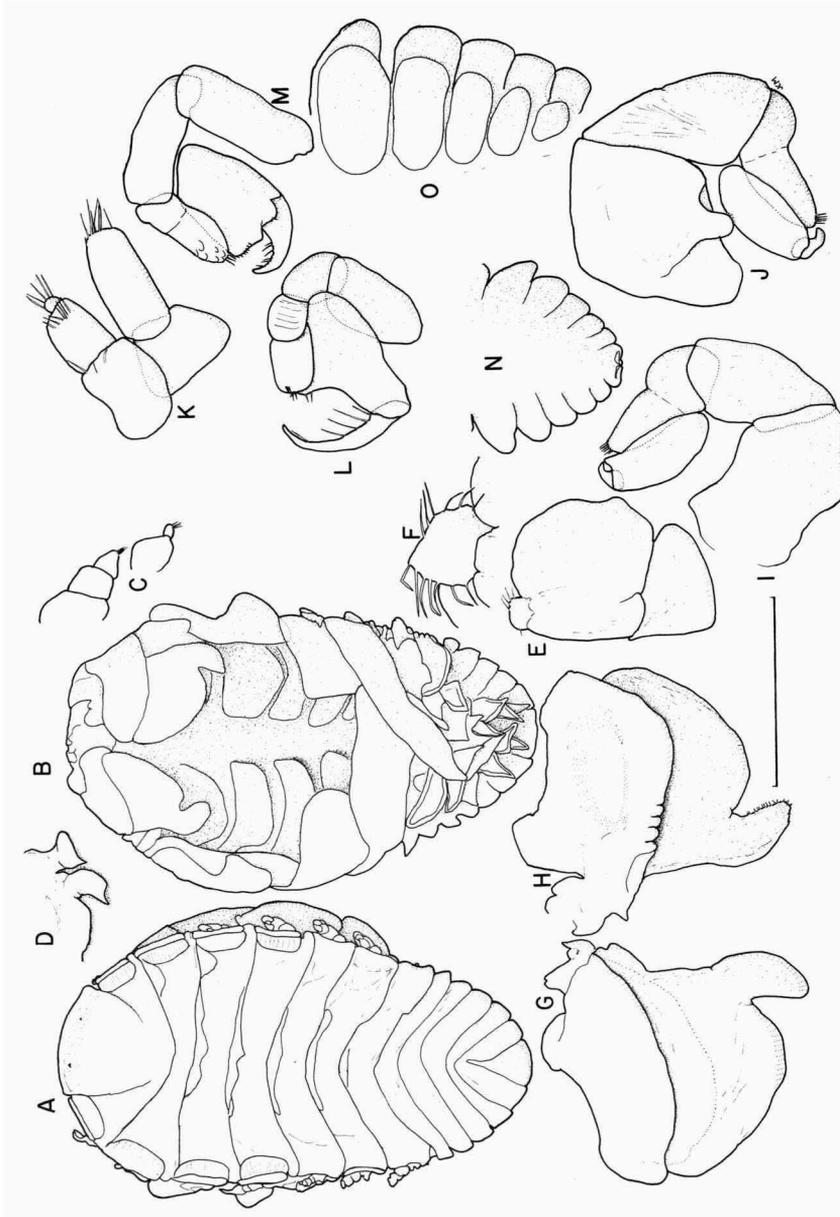


Fig. 11. *Parabopyrella essingtoni* (Bourdon & Bruce, 1983). A-J, female; K-O, male. A, dorsal view; B, ventral view; C, right antenna; D, left posteroventral border of head; E, left maxilliped; F, palp of same; G, left oostegite 1 in external view; H, same in internal view; I, left pereopod 1; J, left pereopod 7; K, left antenna; L, right pereopod 1; M, right pereopod 7; N, pleon in dorsal view; O, left percomeres 1-5 in ventral view. Scale: 2.28 mm for A, B; 1.14 mm for D, E, G, H; 0.4 mm for C, F, I, J, N; 0.2 mm for L, M, O; 0.1 mm for K.

diagnostic characters are the long scimitar shaped setose dactylus and the deeply excavated propodus of the first pereopod (fig. 11L), the shape and fusion on the pleon (fig 11N) and the sizes and shapes of the sessile pleopods (fig. 110).

Because of the distinct delineation of both sides of all of the female's pleomeres, this species is being transferred from *Bopyrella* to *Parabopyrella*. The characters of both sexes, however, are so distinctive that it may properly belong in a genus of its own.

This is only the second record of *Parabopyrella essingtoni*, quite far from its type-locality. The parasite was separated from its host, which therefore could not be identified beyond the preliminary record as an alpheid, thus at least in the same family as the host of the types.

Bopyrinella Nierstrasz & Brender à Brandis, 1925

Bopyrinella albida Shiino, 1958

(fig. 12)

Bopyrinella albida Shiino, 1958: 62-63, fig. 17 [Kominato, Chiba Prefecture, Tokyo Bay, Japan; infesting *Athanas kaminatoensis* Kubo]; Shiino, 1972: 8.

Material examined. – Infesting *Athanas dimorphus* Ortmann, L. B. Holthuis det. of host. Leam Pan Wa, Phuket, Thailand, on sand, under intertidal boulders, at waterfront of Phuket Marine Biological Station, 11 June 1980, J. C. Markham coll.: 1♀, 1♂, RMNH Crust I 6633.

Description of female (fig. 12A-K). – Length 3.19 mm, maximal with 1.68 mm, head length 0.47 mm, head width 0.65 mm, pleon length 1.07 mm, pleon width 0.82 mm. Distortion 77°. Body falcate and truncate posteriorly, sides quite smooth; head and pereomere 1 fused, though remnant of suture indicated by lateral furrows; pleomeres fused medially but distinct laterally (fig. 12A, B).

Head irregularly triangular, deeply set into and fused with pereomere 1. Well-developed frontal lamina along all of anterior margin. No eyes. Antennae (fig. 12C) reduced, first one of three articles, distal article reduced and sparsely setose, second antenna of one non-setose article. Maxilliped (fig. 12D) with much larger anterior than posterior segment, truncate anteriorly, completely lacking palp.

Pereon with smoothly rounded sides, all pereomeres distinct dorsally and laterally. Long sides of pereomeres 1-4 and short side of pereomere 1 incised to differentiate tergal projections; ill-defined coxal plates on some pereomeres.

First oostegites highly dimorphic; that on short side (fig. 12E, F) with short truncate anterior segment, long and pointed posterior segment, and unadorned internal ridge; opposite first oostegite (fig. 12G, H) much shorter but quite broad, with segments of about equal length, posterior one not pointed, internal ridge simple. Other oostegites greatly reduced, not enclosing or even fringing brood pouch, extending nearly straight down from body so as to be very difficult to see in ventral view; tiny oostegites 6 and 7 (fig. 12I) present as well as first five pairs. Pereopods (fig. 12J, K) of nearly same size, though posterior one proportionally more slender except for basal segments.

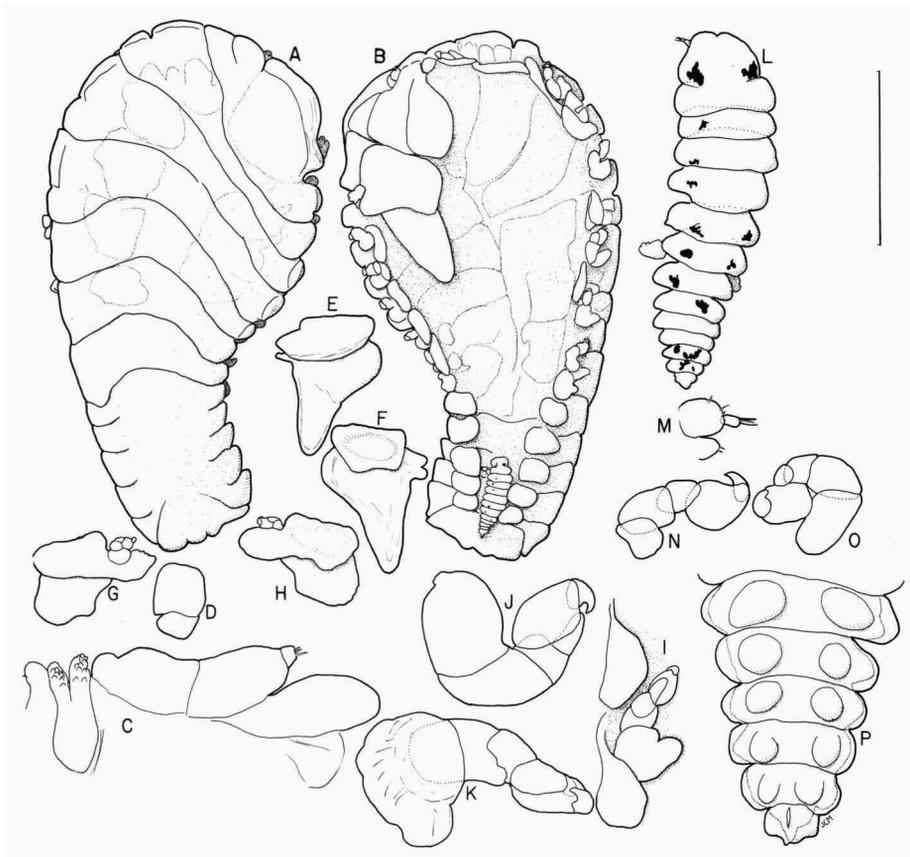


Fig. 12. *Bopyrinella albida* Shiino, 1958. A-K, female; L-P, male. A, dorsal view; B, ventral view; C, oral cone and left antenna; D, right maxilliped; E, right oostegite 1 in external view; F, same in internal view; G, left oostegite 1 in external view; H, same in internal view; I, left oostegites 6 and 7; J, left pereopod 1; K, left pereopod 7; L, dorsal view; M, left antennae; N, left pereopod 2; O, right pereopod 7; P, pleon in ventral view. Scale: 1.0 mm for A, B, D-H; 0.4 mm for I; 0.2 mm for J-L; 0.1 mm for C, M-P.

Pleon narrowing very little from pereon, nearly rectangular in outline, straight across posterior margin except for slight undulations; no lateral plates. Pleon fused medially, but six pleomeres indicated laterally by indentations and short sutures. Five pairs of flat flaplike subrectangular uniramous pleopods, those of second and third pairs somewhat longer than others. Most of ventral surface of pleon exposed. No uropods.

Description of male (fig. 12 L-P). – Length 0.38 mm, maximal width 0.12 mm, head length 0.05 mm, pleon length 0.10 mm. Head and first pereomere medially fused, but body segmentation otherwise distinct. Irregularly shaped dark eye-spots and similar dorsal splotches along most of body (fig. 12L).

Head nearly semi-circular, with anterior notch. Eye-spots near posterolateral margins. Antennae (fig. 12M) of two and one articles, respectively, each article distally setose.

Sides of pereon nearly straight, tapering only slightly posteriorly. Pereomeres separated by deep indentations. Pereomeres (fig. 12N, O) of nearly same size and similar structure, though dactyli sharper anteriorly; meri and carpi of some anterior pereopods fused.

Pleon as isosceles triangle, much longer than broad. All six pleomeres slightly separated laterally (fig. 12P). Five pairs of uniramous subcircular tuberculiform pleopods. Posterior margin of final pleomere with irregular shape but lacking uropods.

Discussion. – The only previously known specimen of *Bopyrinella albida* is the type female, which infested *Athanas kominatoensis* Kubo in Tokyo Bay. The present material has been described in detail because the female differs in several respects from the type, which was not completely illustrated, and because the male was unknown. The type female has the first oostegites alike rather than dimorphic and other oostegites better developed; its pleopods are larger and more elaborate. These differences may be important enough to warrant the description of a new species, but, because so far only two females and one male are known, it is impossible to conclude that this variation is not intra-specific. The host of the Thai material, *Athanas dimorphus*, is congeneric with that of the type in Japan.

Two other species have been assigned to the genus *Bopyrinella* elsewhere. The type-species, *B. thorii* (Richardson), is a parasite of the hippolytid shrimp *Thor floridanus* Kingsley throughout much of the Caribbean Sea. Like *B. albida*, *B. thorii*'s female has dimorphic first oostegites and greatly reduced following oostegites (though there are evidently no sixth or seventh oostegites, present in both known females of *B. albida*). In both species, the head and pereon are fused, as are the pleomeres; both females have flaplike uniramous pleopods but no uropods. The first and second antennae of both females are of

respectively three and one articles. Differences between the females of the two species are that *B. thorii* has eyes, its body is relatively broader, its maxilliped bears a prominent palp, its pleopods overlap each other, and its final pleomere is rounded and extended, all in contrast with the female of *B. albida*. The male of *B. albida* is like that of *B. thorii* in having the head and pereon medially fused, large irregular eyes and tuberculiform pleopods. The male of *B. thorii*,

in contrast, is relatively much wider, its pereomeres are less separated laterally, and all of its pleomeres are fused except at the margins. The other species tentatively assigned to *Bopyrinella* is *B.(?) stricticaudata*, reported by Monod (1933) from the Gulf of Suez. It probably does not belong in *Bopyrinella*, so comparisons with it are of little value.

Ioninae H. Milne Edwards, 1840, emend. R. Codreanu, 1967
Procepon Shiino, 1937

Procepon insolitum Shiino, 1937

(fig. 13)

Procepon insolitum Shiino, 1937: 484-486, figs. 4-5 [Type-locality Hatakeshima, Tanabe Bay, Japan; infesting *Upogebia major* de Haan]; Shiino, 1958: 33, 49-50, figs. 11 [Sugashima, Mie Prefecture, Japan; infesting *U. issaefi* Balss]; Shiino, 1972: 8.

Material examined. — *Upogebia* spec. (close to but distinct from *U. lincolni* Ngoe-Ho), A. B. Williams det. Fifth Danish-Thai Expedition, tidal flat, Phuket Fishery Station, Phuket, Thailand, 5 February 1966, hand collecting: 1♀, 1♂, USNM.

Discussion. — This material, originally identified by R. Bourdon, agrees well with the material of *Procepon insolitum* previously known. Drawings of appendages of the female (fig. 13A-G) and male (fig. 13H-K) are presented to supplement the drawings published by Shiino (1937, 1958): In the female, the posteroventral border of the head (fig. 13A) bears two irregularly crenulate projections on each side, the maxilliped (fig. 13B) lacking a palp but with a prominent slender spur (fig. 13C). The first oostegite (fig. 13D, E) is about as long as wide, with a slightly extended falcate posterolateral projection and an internal ridge lacking ornamentation except for two teeth near the lateral end. The pereopods (fig. 13F, G) more than double in size posteriorly, and all have anteriorly enlarged bases. The male has a three-articled first antenna (fig. 13H) and a markedly extended five articled second antenna (fig. 13I); both are distally setose. Its pereopods (fig. 13J, K) are all of nearly the same size, with sharp dactyli and fused meri and carpi.

This is the first record of *P. insolitum* outside of Japan. Unfortunately, it is unknown whether the host species is the same as it was there.

***Procepon horridulum* spec. nov.**
(figs. 14, 15)

Material examined. – Infesting *Wolffoebia phuketensis* Sakai, L. B. Holthuis, det. of host: Phuket, Thailand (other collection details unknown): ♀, holotype, ♂, allotype, RMNH Crust I 6638.

Description of holotype female (fig. 14). – Length 6.86 mm, maximal width 3.80 mm, head length 1.21 mm, pleonal length 2.82 mm, distortion 13° (fig. 14A, B). No pigmentation except for eye-spots. Body outline irregular.

Head subquadrangular, somewhat wider at front than back, extending

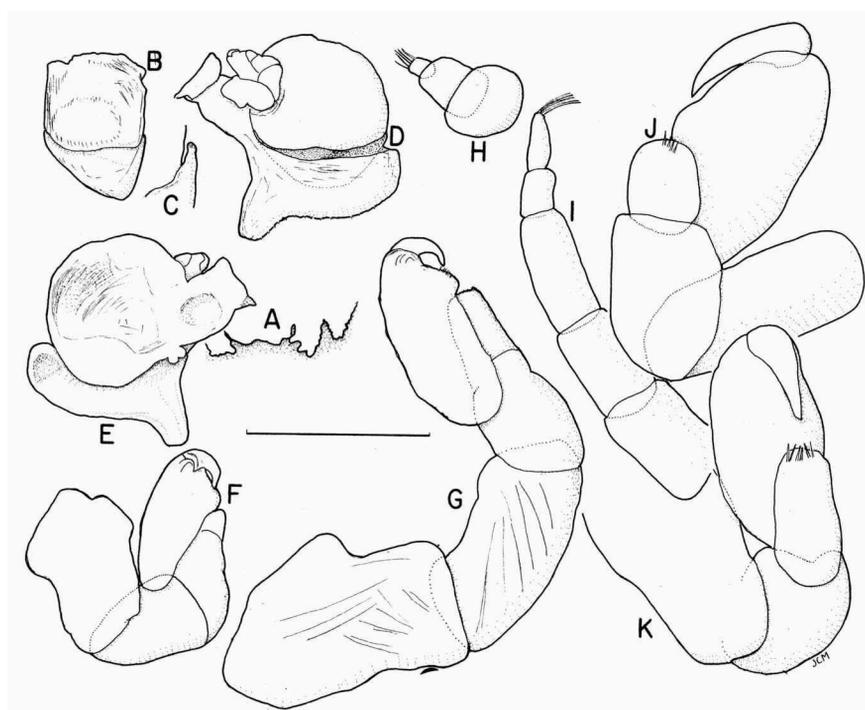


Fig. 13. *Procepon insolitum* Shiino, 1937. A-G, female; H-K, male. A, posteroventral border of head; B, right maxilliped; C, spur of same; D, right oostegite 1 in external view; E, same, internal view; F, right pereopod 1; K, right pereopod 7. Scale: 1.0 mm for A, B, D, E; 0.35 mm for C, F, G; 0.18 mm for H-K.

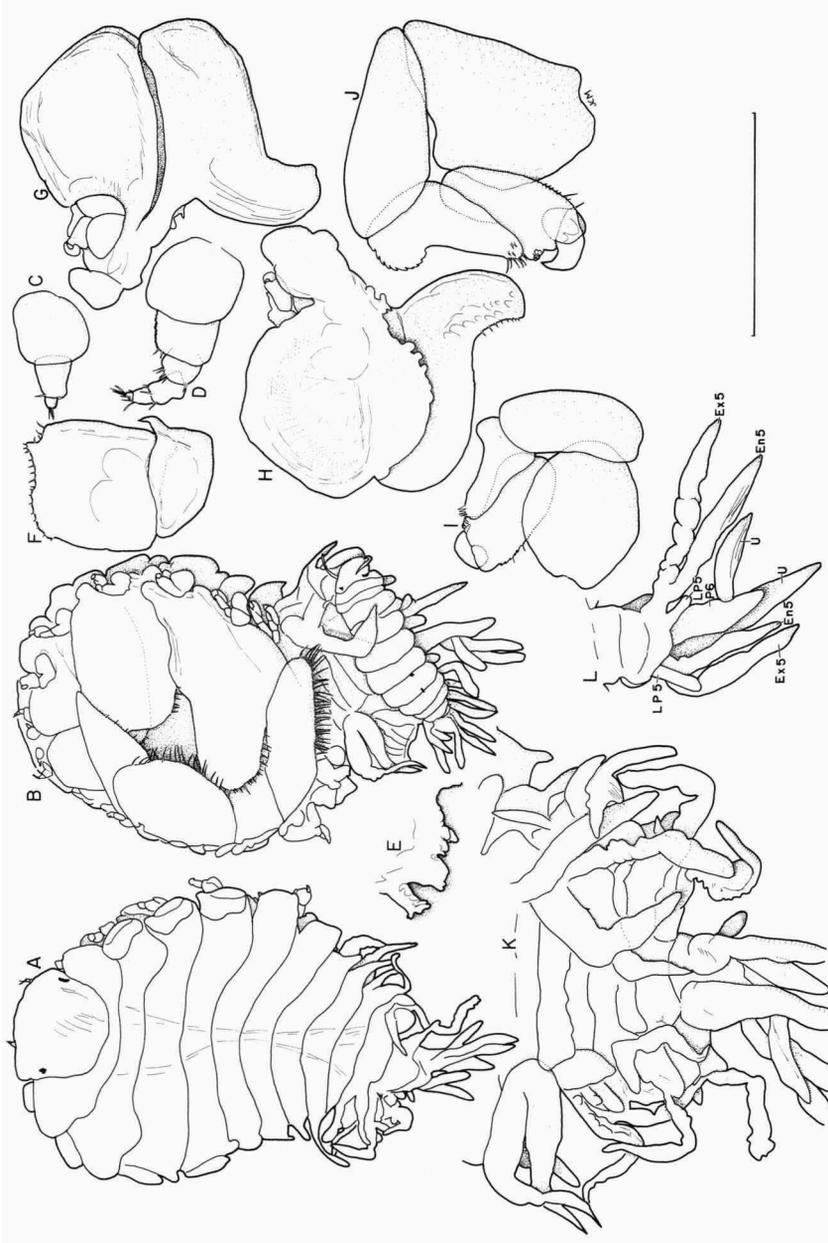


Fig. 14. *Procepon horridulum* spec. nov., holotype female. A, dorsal view; B, ventral view; C, left antenna 1; D, right antenna 2; E, right posteroventral border of head; F, right maxilliped; G, right oostegite 1 in external view; H, same in internal view; I, right pereopod 1; J, right pereopod 7; K, pleon in ventral view; L, end of pleon in dorsal view (En = endopodite, Ex = exopodite, LP = lateral plate, P = pleomere, U = uropod). Scale: 3.0 mm for A, B; 1.5 mm for E-H, K, L; 0.5 mm for C, D, I, J.

slightly out from pereon. Small distinct eye-spots near sides of head about one third of distance behind front. First antenna (fig. 14C) of three articles, second antenna (fig. 14D) of 5 articles, each with all but basal article distally setose. Postero-ventral border of head (fig. 14E) with branched outer projection and irregularly shaped process in between. Maxilliped (fig. 14F) of nearly square anterior segment and short tapered posterior segment. Triangular palp present, somewhat displaced from anteromedial corner, not articulating with maxilliped; it and rest of anterior margin of maxilliped setose. Posterior segment of maxilliped produced anteromedially into prominent extended falcate spur.

All pereomeres distinct, forming irregular outline. No middorsal projections or any trace of them. Coxal plates on left side of pereomere 1 and on both sides of pereomeres 2-4. Oostegites almost completely enclosing brood pouch. First oostegite (fig. 14G, H) of two nearly equally long segments; internal ridge with some rounded teeth; posterior point extending straight back, curved and only slightly tapered, setose along medial margin. Pereopods (fig. 14I, J) all of similar shape and proportions, but much larger posteriorly; in each, merus and carpus fused and proximally extended into large lobes, distally setose; each propodus setose dorsally, scaly where sharp tip of dactylus contacts it.

Pleon (fig. 14K, L) of six pleomeres, all distinct only ventrally. Five pairs of uniramous extended lanceolate lateral plates and similar biramous pleopods. Pair of similar but larger uniramous uropods extending from pleomere 6. All abdominal appendages extending in different directions and variously overlapping each other. Ventrally, middle region of pleon exposed.

Description of allotype male (fig. 15). – Length 2.77 mm, maximal width 0.79 mm, head length 0.41 mm, pleonal length 0.33 mm. All body regions and segments distinct. Margins of head and pereon setose (fig. 15A, B).

Head five-sided, well extended, shorter than broad, considerably narrower than pereon. Distinct dark eye-spots near posterior margin. First antenna (fig. 15C) of three articles, distal two setose. Second antenna (fig. 15D) elongate and extending far beyond margins of head, of four articles, of which distal one much longer than others, all articles bearing many setae.

Pereon broadest across pereomeres 2-4, tapering slightly both ways from there. Irregular pigment spots scattered on dorsal surface of last three pereomeres. All pereomeres separated by indentations. No midventral tubercles. Pereopods (fig. 15E, F) all about same size, though dactyli smaller posteriorly; each pereopod of only five articles, evidently either ischium or carpus fused with merus.

Pleon of six distinct pleomeres, each much narrower than that before it.

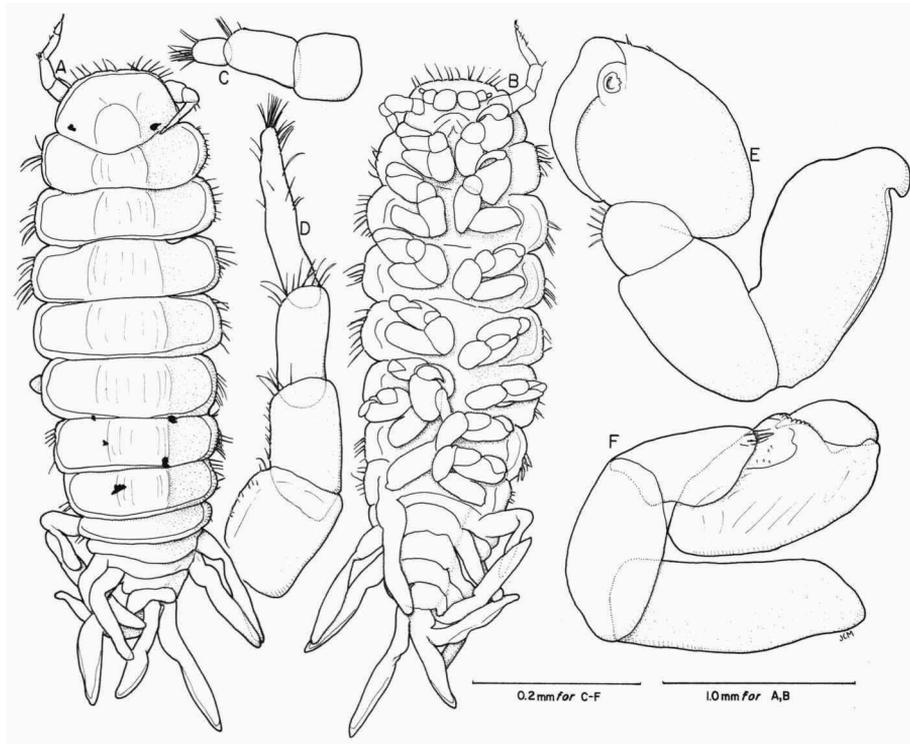


Fig. 15. *Procepon horridulum* spec. nov., allotype male. A. dorsal view; B, ventral view; C, right antenna 1; D, left antenna 2; E, left pereopod 1; F, left pereopod 7.

Pleomeres 1-5 produced into elongate lanceolate irregularly disposed lateral plates, with uropods of similar structure extending from terminal pleomere. No pleopods.

Etymology. — The specific name *horridulum*, meaning “disheveled” or “unkempt”, has been selected in reference to the appearance of the pleopodal appendages of both sexes.

Discussion. — The genus *Procepon* contains only the type-species, *P. insolitum*, discussed above, and the new species, *P. horridulum*. In both species, females lack mid-dorsal projections, have prominent heads, and their pleomeres are produced into long lanceolate lateral plates and similar biramous pleopods and uniramous uropods; males of both species have all segments distinct, greatly extended second antennae and six pleomeres with long lanceolate lateral plates and uropods. The only other genus whose males have comparable lateral plates is the closely related *Ione*, but its lateral plates are much more regular. Females of *Ione* have finely divided lateral plates and

pleopods and thickened uropods which are of quite different appearance.

P. horridulum differs from *P. insolitum* in that the female of the latter has a relatively broader head, its coxal plates are extended into sharp points, and its oostegites and pleonal appendages are slightly tuberculate; the male of *P. insolitum* has small midventral tubercles on pereopods 2-7, all articles of all pereopods are distinct, and it bears lanceolate pleopods as well as lateral plates. The hosts of both species are in closely related genera, *Upogebia* and *Wolffogebia*.

Upogebione gen. nov.

Type-species: *Upogebione phuketensis* spec. nov.

Generic diagnosis. – Female: All body regions and segments distinct, axis only moderately distorted (to 45°). Body suboval. Head only about one third as wide as body, smoothly rounded, almost semi-circular posteriorly, slightly convex anteriorly, extending out from pereon. Maxilliped with extended palp and sharply pointed spur. Coxal plates slightly to greatly developed on both sides of at least pereomeres 1-4. First oostegite extended into long slender curved postero-lateral process, at most only slightly digitate internal ridge; oostegites nearly to completely enclosing brood pouch. Pleon of 6 well-developed pleomeres, first 5 produced into slender pointed lateral plates extending at least somewhat posteriorly. Pleopods biramous; all rami long and lanceolate, extending beyond sides of pleomeres but not covering middle of pleon. Final pleomere bearing lanceolate uniramous uropods of structure similar to lateral plates.

Male: Body generally somewhat truncate at both ends. Head slightly extended. All segments distinct. Greatest width usually across anterior region of pleon. All pereopods equally developed. Pleon of 5 or 6 pleomeres, fifth (and sixth) much reduced, button-like. Pleopods absent or as sessile swellings. Uropods absent. Hosts in family Upogebiidae.

Distribution. – Known distribution eastern and western Thailand and Brazil.

Etymology. – The generic name *Upogebione* (gender feminine) reflects the occurrence of representatives of the genus as parasites of upogebiid hosts.

***Upogebione phuketensis* spec. nov.**
(figs. 16, 17)

Material examined. – Infesting *Wolffoebia phuketensis* Sakai, L. B. Holthuis, det. of host. All collections at Phuket, Thailand, exact localities unknown; 10 November 1978: ♀, holotype, ♂, allotype, RMNH Crust I 6647; 9 November 1978: 1♀, 1♂, paratypes, RMNH Crust I 6646; 9 November 1978: 1♀, 1♂, paratypes, RMNH Crust I 6648. 10 November 1978: 1♀, 1♂, RMNH Crust I 6649.

Description of holotype female (fig. 16). – Length 3.63 mm, maximal width 2.54 mm, head length 0.72 mm, head width 0.81 mm, pleonal length 1.14 mm. Distortion 42°. All body regions and segments distinct. No pigmentation (fig. 16A, B). Body outline nearly oval.

Head semi-circular, extended slightly beyond body margin anteriorly. Short frontal lamina clear across anterior margin. Antennae (fig. 16C) of three and

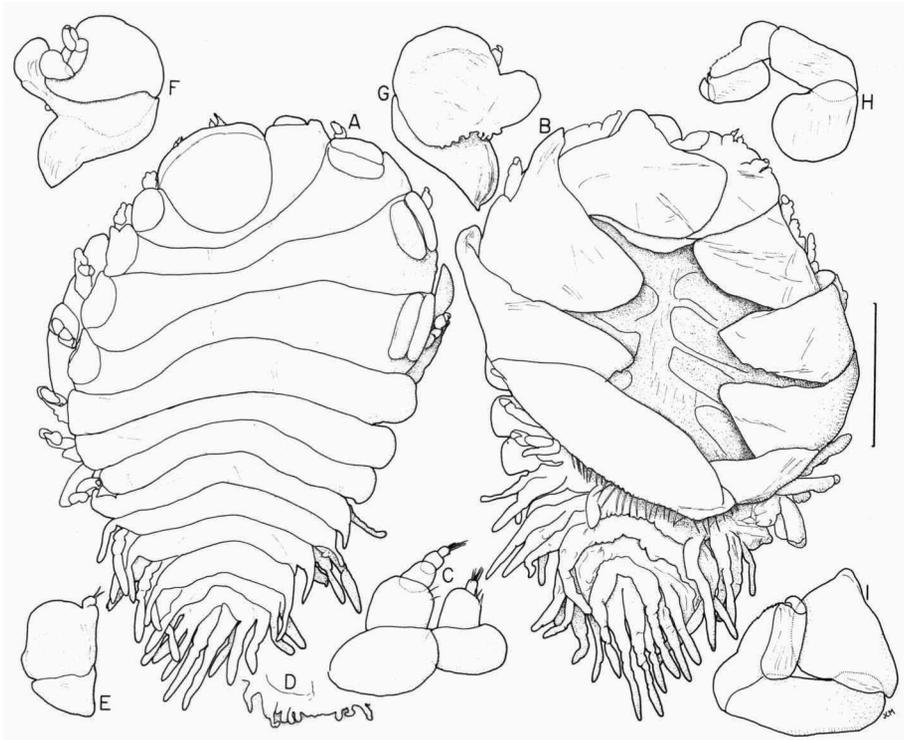


Fig. 16. *Upogebione phuketensis* spec. nov., holotype female. A, dorsal view; B, ventral view; C, right antennae; D, posteroventral border of head; E, right maxilliped; F, right oostegite 1 in external view; G, same in internal view; H, right pereopod 1; I, left pereopod 7. Scale: 1.0 mm for A, B, D-G; 0.18 mm for H, I; 0.09 mm for C.

five articles respectively; all articles quite short, basal ones relatively broad, distal ones densely setose. Posteroventral border (fig. 16D) bearing several irregularly digitate processes near each side. Maxilliped (fig. 16E) with nearly square anterior segment and short posterior segment; semiarticulating sparsely setose palp at anteromedial corner; spur inconspicuous.

Pereon broadest across pereomeres 3 and 4, rounded both ways from there. Coxal plates on long sides of pereomeres 1-4; dorsolateral bosses on short sides of pereomeres 1-4 and long sides of pereomeres 2-4. Oostegites completely surrounding and nearly enclosing brood pouch, extending out ventrally from body; first oostegite (fig. 16F, G) small, about as long as wide, with segments of nearly equal length; internal ridge with some small irregular teeth, posterolateral point short, curved and extending somewhat posteriorly into point. Other oostegites about equal in size, fifth ones posteriorly setose. Pereopods (16H, I) slightly larger posteriorly; merus and carpus of each fused; bases of posterior pereopods large and extended.

Pleon of six pleomeres, each broader than that behind it. All pleomeres produced into lateral plates, anterior ones small, posterior ones progressively larger, slender and lanceolate. Five pairs of long, slender, laterally placed biramous pleopods. Uropods uniramous, of structure similar to pleopods and lateral plates, somewhat longer and broader.

Description of allotype male (fig. 17). – Length 1.59 mm, maximal width (across pleon) 0.69 mm, head length 0.16 mm, head width 0.35 mm, pleonal length 0.36 mm. Body tapering slowly forward and abruptly backward from first pleomere. All body regions and segments distinct (fig. 17A, B).

Head broad and short, indented anteriorly. Irregularly shaped eyes present in posterolateral regions. Antennae (fig. 17C) of two and four articles, respectively, second antenna very much longer, both setose distally.

Pereon with irregular margin, notches separating all pereomeres. No mid-ventral tubercles. Pereopods about half covering ventral surface; each with all articles distinct; anterior pereopods (fig. 17D) somewhat smaller than posterior ones (fig. 17E), but dactyli smaller posteriorly; carpus of each setose distally.

Pleon of 5 pleomeres, outline of pleon semicircular; each pleomere much narrower than that before it; final pleomere (fig. 17F) reduced to tiny knob embedded in fourth pleomere. Pleopods as sessile flaps covering about one fourth of ventral surface of each pleomere. Final pleomere somewhat extended, though not into uropods. Some pleonal margins sparsely setose.

Etymology. – The specific name *phuketensis* refers to the type-locality, Phuket, Thailand.

Variation. – The paratype females, which range in length from 4.00 to 4.80

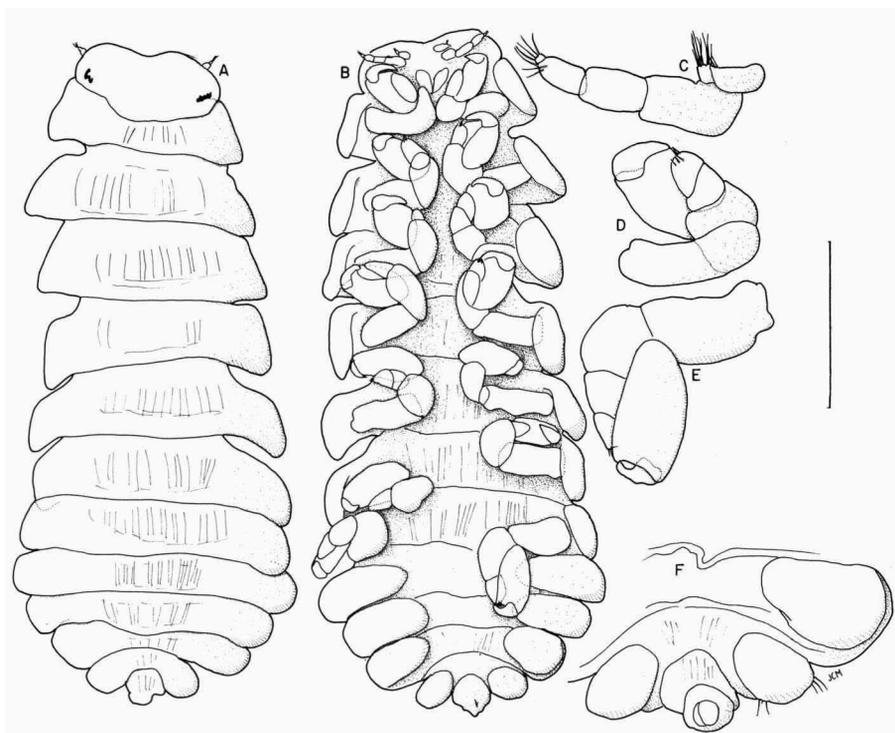


Fig. 17. *Upogebione phuketensis* spec. nov., allotype male. A, dorsal view; B, ventral view; C, right antennae; D, right pereopod 1; E, left pereopod 7; F, end of pleon in ventral view. Scale: 0.4 mm for A, B; 0.2 mm for D-F; 0.1 mm for C.

mm, vary slightly from the holotype. Two have tiny eyes at the sides of their heads and all have reduced pereopodal bases; one has the palp closer to the middle of the anterior of the maxilliped, and one has indentations on its sixth pleomere. Similarly, the paratype males, ranging in length from 1.96 to 2.20 mm, differ but little from the allotype. All are more oval with pereomeral margin closer together; one has a relatively narrower head, and another has the final pleomere somewhat more extended.

The new genus *Upogebione* is closely similar to *Upogebiophilus* Nobili and *Progebiophilis* Codreanu & Codreanu, whose species are also parasites of upogebiids. The single species of *Upogebiophilus*, *U. rhadames* Nobili (1906) is known only from Djibouti. Its female has a much broader head, more nearly circular body and no pleonal lateral plates. Its male differs greatly in having five pairs of prominent flaplike pleopods. The two species of *Progebiophilus*, one from the Mediterranean and Black Sea (Bourdon, 1968) and the other from Hong Kong (Markham, 1982) differ, in the females, in that their pereopods have all articles distinct, their lateral plates are only very slightly

produced, and their pleopods, while biramous, are broader and shorter and placed ventrally rather than laterally. Males of the two species of *Progebiophilus*, though quite different from each other, both differ from that of *Upogebione phuketensis* in having heads much narrower than their pereons, greatest body width across their pereons, and fifth pleomeres well-developed.

The new genus *Upogebione*, as diagnosed above, comprises three species, two of which have been previously described in different genera. Lemos de Castro & Brasil Lima (1975) described *Parione tropica*, a parasite of *Upogebia omissa* Corrêa from Brazil. That species is sufficiently different from other species of *Parione* Richardson, all of which infest galatheids, that it cannot be retained in the genus. Another species, *Hypercepon ovale* Nierstrasz & Brender à Brandis (1931) was described as a parasite of *Upogebia* sp. in the Gulf of Thailand. It differs markedly from the type-species of *Hypercepon* Nierstrasz & Brender à Brandis, *H. enoensis*, a parasite of a pinnotherid.

Upogebione phuketensis is most similar to *U. tropica* (Lemos de Castro & Brasil Lima). Females of both species have similar shapes (though *U. tropica* is relatively broader), maxillipeds without completely articulating palps, first oostegites curved in the same manner, and pleopods, lateral plates and uropods of very similar structure (the pleopods of *U. tropica* being somewhat shorter and broader). Males of both species have very short heads (that of *U. tropica* being much narrower than the first pereomere), greatest width across their first pleomeres, no midventral pereonal tubercles and only five pleomeres, the final pleomere being reduced to a tiny button. The male of *U. tropica* has a peculiar bifid midventral projection of the first pleomere and lacks all trace of pleopods. Less clear is the affinity of *U. phuketensis* with *U. ovalis* (Nierstrasz & Brender à Brandis), the other species being transferred to *Upogebione*. Females of both species are very similar (insofar as the excessively brief description of *U. ovalis* allows it to be known), having nearly identical heads, body outlines, first oostegites, lateral plates and uropods. The female of *U. ovalis*, in contrast, has pleopodal endopodites markedly smaller than its exopodites. The male of *U. ovalis*, however, is quite different from that of *U. phuketensis* and *U. tropica* in that its head is nearly circular, its body is broadest across the third pereomere, and it has six pleomeres, both the fifth and sixth being reduced to knobs. Other characters of the male of *U. ovalis* are unknown.

The closely related genus *Progebiophilus*, as earlier noted (Markham, 1982), is somewhat difficult to define for both sexes, and the same is true for *Upogebiphilus* and *Ubogebione*. The present arrangement of six species in these three genera may well be subject to subsequent revision, especially as other species become better known.

Allokepon Markham, 1982***Allokepon sinensis*** (Danforth, 1972)

(figs. 18, 19)

Grapsicepon sinensis Danforth, 1972: 163-167, fig. 1 [Type-locality Hong Kong; infesting *Lissocarcinus orbicularis* Dana].

Allokepon sinensis: Markham, 1982: 357-359, 385; fig. 19 [Re-examination of type-female; re-assignment to genus *Allokepon*].

Material examined. – Infesting *Portunus pelagicus* (L.). Sandflat, Ko Yao Yai, Phuket, Thailand, 6 August 1979, Pitiwong Tantichodok et al, colls.: 1♀, ♂, RMNH Crust I 6632.

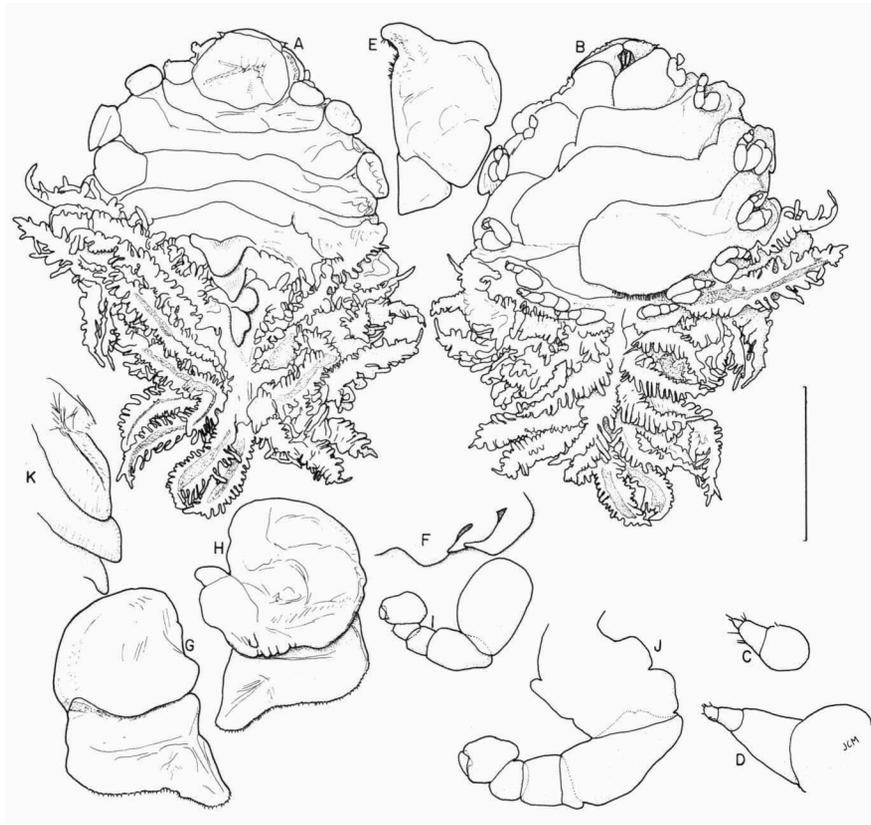


Fig. 18. *Allokepon sinensis* (Danforth, 1972), female. A, dorsal view; B, ventral view; C, left antenna 1; D, left antenna 2; E, right maxilliped; F, left posteroventral view; I, left pereopod 1; J, left pereopod 7; K, mid-dorsal processes on pereomeres 5-7 from left side. Scale: 4.0 mm for A, B; 2.0 mm for E-H, K; 1.09 mm for I, J; 0.36 mm for C, D.

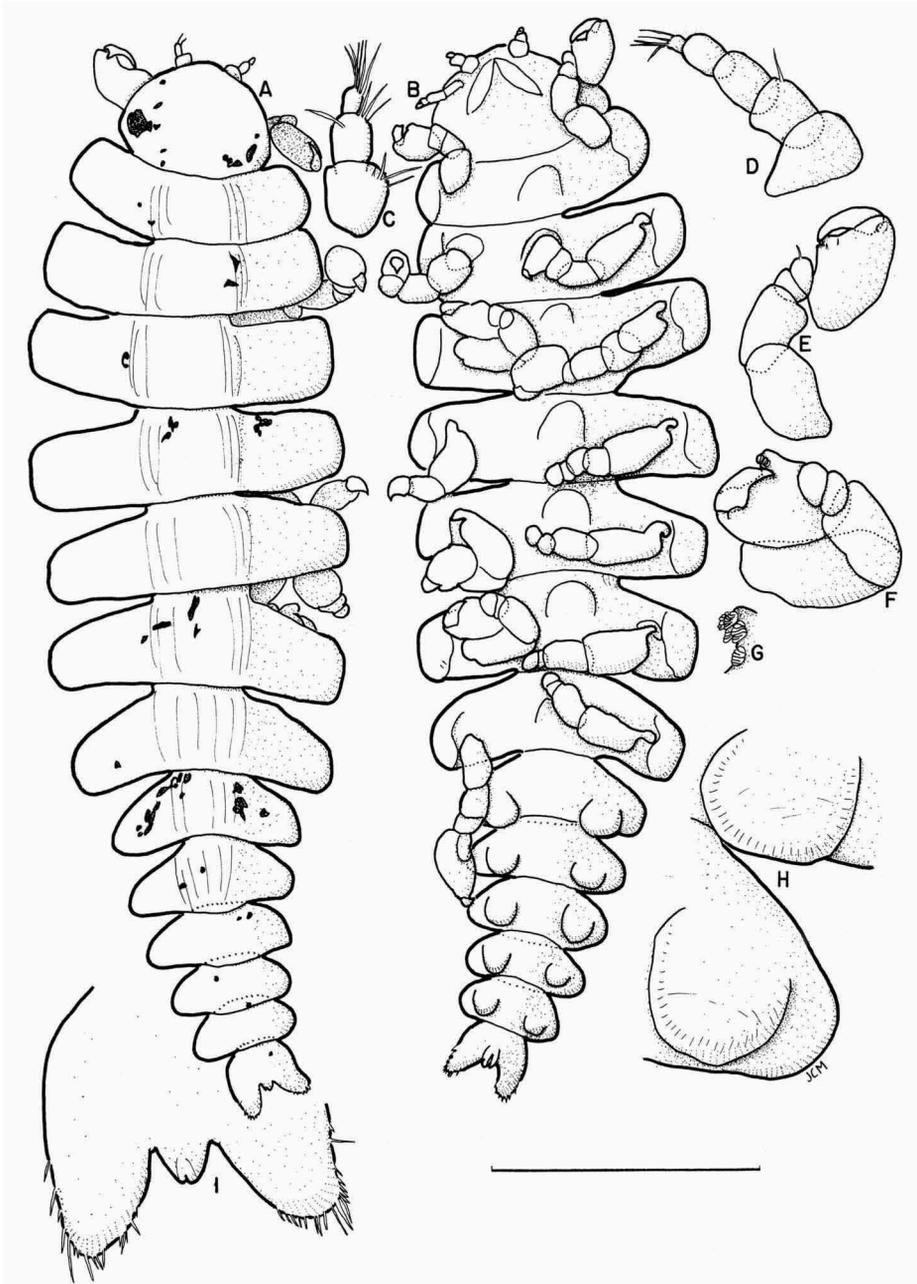


Fig. 19. *Allokepon sinensis* (Danforth, 1972), male. A, dorsal view; B, ventral view.; C, right antenna 1; D, right antenna 2; E, left pereopod 1; F, left pereopod 6; G, scaly cones on distal margin of propodus of same; H, left pleopods 2 and 3; I, pleomere 6 in dorsal view. Scale: 0.4 mm for A, B; 0.2 mm for E, F; 0.1 mm C, D, G-I.

Remarks on female (fig. 18). — Like holotype (see Danforth, 1972; Markham, 1982) except: Maxilliped (fig. 18E) with more regularly tapering palp and swollen spur. Oostegite 1 (fig. 18G, H) (extended more posteriorly, with setose posterior margin. First pereopod (fig. 18I) with smaller dactylus and basis; seventh pereopod (fig. 18J) with more regular propodus, distinct merus and carpus. Middorsal projections (fig. 18A, K) on pleomeres 1 and 2 as well as on pereomeres 6 and 7.

Description of male (fig. 19). — Length 1.53 mm, maximal width 0.46 mm, head length 0.17 mm, head width 0.22 mm. All body regions and segments distinct. Irregular splotches of pigment on dorsal surfaces of nearly all segments (fig. 19A, B).

Head nearly circular, well set off from pereon. Irregularly shaped eye-spots and several smaller marks scattered on surface. First antenna (fig. 19C) of three articles, all quite setose distally; antenna 2 (fig. 19D) of five articles, terminal one setose, second from base with one seta.

Sides of pereon describing elongate oval, but pereomeres deeply separated by anterolateral indentations. Conical midventral tubercle on every pereomere. Pereopods (fig. 19E, F) rather small, all of about same sizes and proportions, with distinct but small meri and carpi; propodus of each produced anteromedially, produced region setose in anterior pereopods (fig. 19E) and bearing peculiar comblike plates (fig. 19F, G) on posterior pereopods.

Pleon evenly tapered posteriorly, of six well-defined pleomeres. No midventral tubercles. Five pairs of prominent flaplike pleopods, slightly smaller posteriorly (fig. 19B, H). Final pleomere (fig. 19I) produced posteriorly into two short setose lobes and medial anal cone but lacking uropods.

Discussion. — This is only the second record of *Allokepon sinensis*, previously reported from Hong Kong. The host is a new record, in a different genus but the same family, Portunidae. Both sexes agree well with previous descriptions despite some minor distinctions pointed out for the female.

Kepon Duvernoy, 1840**Kepon orientalis spec. nov.**
(figs. 20-22)

Material examined. — Infesting *Metaplax elegans* de Man. Seaward fringe of mangroves. Ko Maphrao, Phuket, Thailand, 5 April 1978, Pitiwong Tantichodok coll.: ♀, holotype; ♂, allotype. RMNH Crust I 6650; 1 ♀ (immature), paratype, RMNH Crust I 6652; 1 ♀, 1 ♂, paratypes. RMNH Crust I 6654.

Infesting *Metaplax distinctus* H. Milne Edwards. Collection details unknown, Phuket, Thailand: 1 ♀, 1 ♂, RMNH Crust I 6653.

Description of holotype female (fig. 20). — Length 4.61 mm, maximal width 3.39 mm, head length 1.19 mm, pleonal length 1.28 mm. Distortion 17°. Head distinct from pereon but deeply set into it; separation of other body regions more obscure, especially laterally (fig. 20A). Body outline nearly oval.

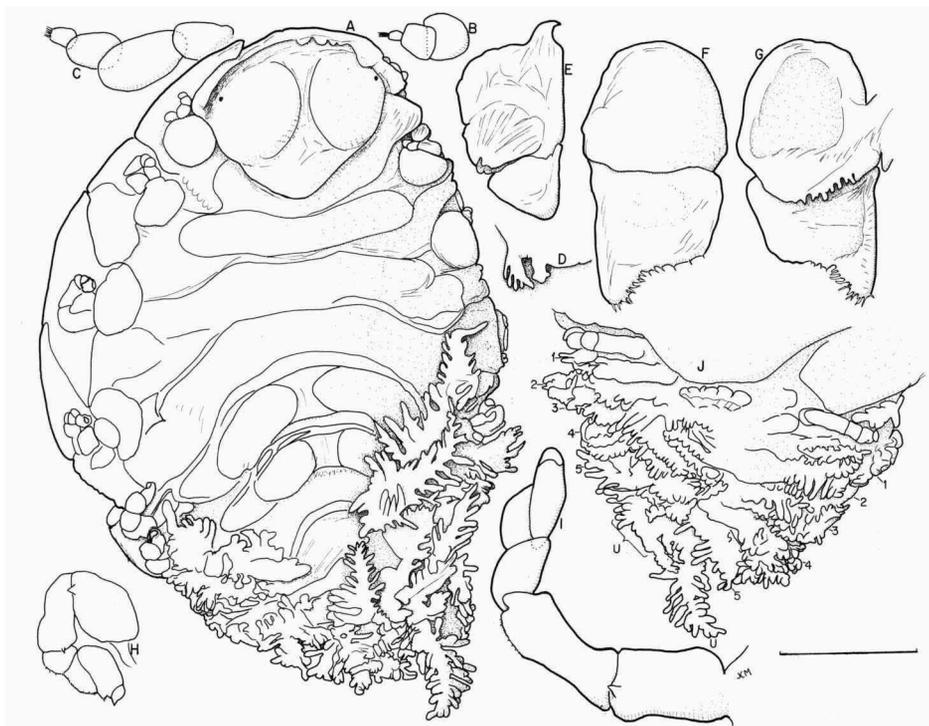


Fig. 20. *Kepon orientalis* spec. nov., holotype female. A, dorsal view; B, right antenna 1; C, right antenna 2; D, right posteroventral border of head; E, left maxilliped; F, right oostegite 1 in external view; G, same in internal view; H, right pereopod 1; I, left pereopod 7; J, pleon in ventral view (lateral plates 1-5 and uropods (u) indicated). Scale: 1.0 mm for A, D-G, J; 0.38 mm for H, I; 0.18 mm for B, C.

Head bilobate, bearing short but broad frontal lamina clear across anterior margin and beyond. Head outline smoothly rounded anteriorly, broadly V-shaped posteriorly. Tiny eye-spots anterolaterally. Antennae (fig. 20B, C) of three and four articles, respectively, each setose only terminally. Postero-ventral border (fig. 20D) with two lateral processes on each side, outer one digitately divided, inner one clubshape and slightly smaller. Maxilliped (fig. 20E) bearing large, knob-like, falcate non-articulating palp set slightly lateral from anteromedial corner; posterior segment relatively small, subtriangular, produced into extended blunt spur.

Pereon greatly expanded laterally, with pereopods displaced dorsally, and lateral separations of pereomeres obscure. Some slight middorsal swellings; that on pereomere 2 very broad and low, those on pereomeres 5 and 6 more raised, doubled, with medial gaps. Pereomeres 1-4 on longer side and at least pereomeres 2 and 3 opposite bearing coxal plates. Oostegites completely enclosing highly vaulted brood pouch. First oostegite (fig. 20F, G) long and slender, of segments nearly equally long; internal ridge with slightly lobulate margin: postero-lateral extension narrow, pointed straight back, it and adjacent posterior margin bearing several irregular setae. Pereopods (fig. 20H, I) with all articles distinct, dactyli small and oddly shaped, basis of each (and ischium of first) bearing sharp short triangular spine overreaching distal margin.

Pleon only obscurely segmented though six pleomeres indicated by appendages. Lateral plates (fig. 20J) elongate, tapered, tightly overlapping, with deeply digitate margins. Biramous pleopods of same structure, anterior ones extending forward. Uropods also of same structure as pleopods and lateral plates, but somewhat larger than all but anterior pleopods.

Description of allotype male (fig. 21). – Length 3.36 mm, maximal width 0.56 mm, head length 0.43 mm, head width 0.64 mm, pleon length 1.23 mm. Head and first pereomere partly fused, otherwise all body segments distinct (fig. 21A, B). Scattered pigment splotches on dorsal surface of middle pereomeres.

Head subrectangular with rounded corner. Small eyes in posterolateral regions. Antennae (fig. 21C) of three and five articles respectively, distal three articles of each terminally setose.

Outline of pereon smoothly tapering posteriorly from second pereomere. Pereomeres somewhat set off laterally. Last two pereomeres with prominent midventral tubercles. Pereopods (fig. 21D, E) with all articles separate, though meri and carpi reduced; first two pairs of pereopods with much broader propodi and longer sharper curved dactyli than others; articles variously setose.

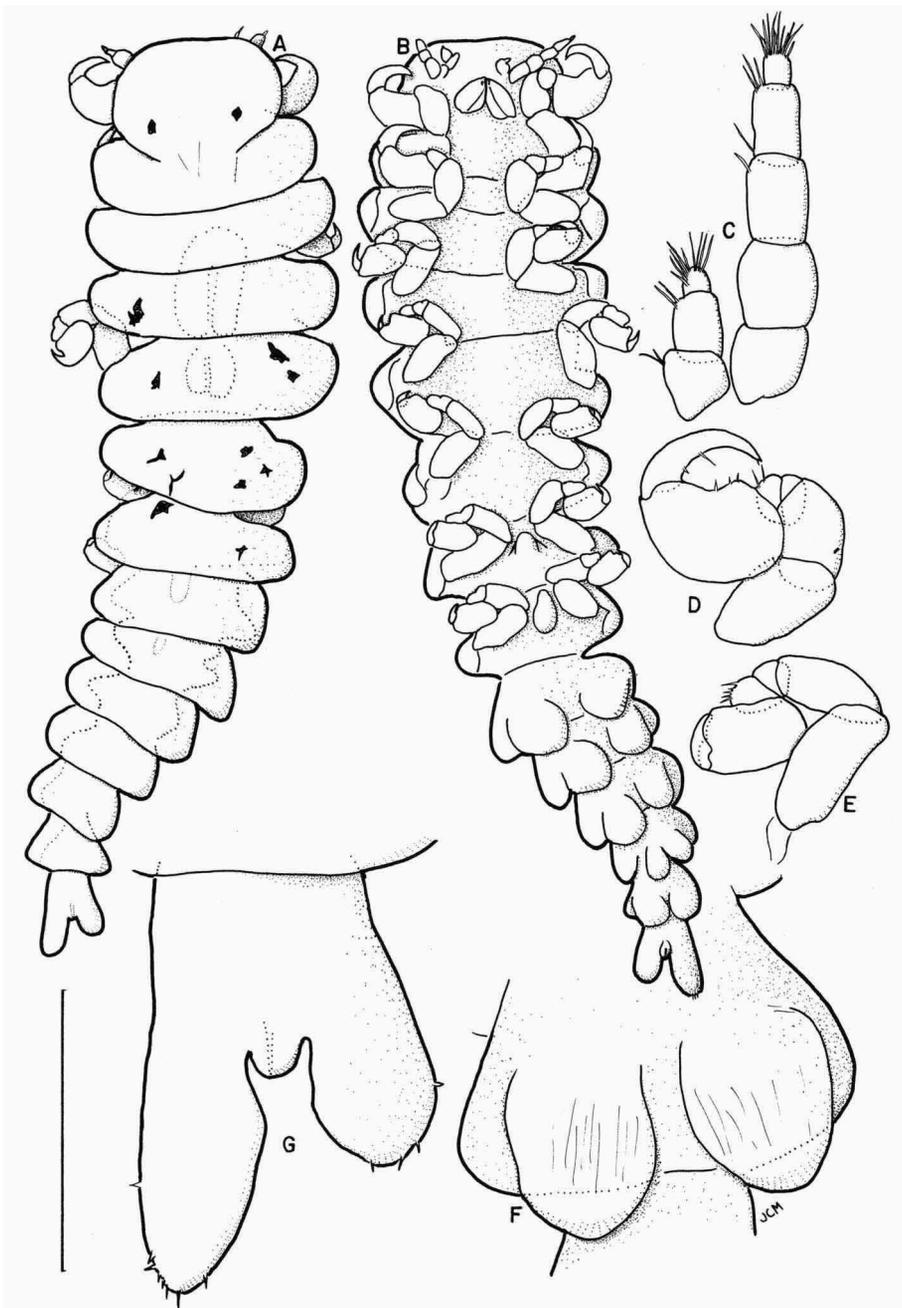


Fig. 21. *Kepon orientalis* spec. nov., allotype male. A, dorsal view; B, ventral view; C, left antennae; D, right pereopod 7; E, detail of a pereopod; F, pleomere 5 in ventral view; G, pleomeres 6 in dorsal view. Scale: 1.0 mm for A, B; 0.4 mm for D, E; 0.2 mm for C, F, G.

Pleon gradually tapering posteriorly, of six pleomeres. Five pairs of large flaplike pleopods (fig. 21F) extending onto surfaces of succeeding pleomeres. Final pleomere (fig. 21G) produced into asymmetrically extending posterior projections, though no true uropods; small anal cone extending posteriorly between them.

Etymology. – The specific name *orientalis* is selected to indicate the most easterly occurrence of any species of *Kepon*.

Variation. – The immature female (fig. 22), unaccompanied by a male, differs in many respects from the holotype female, and it is possible that it does not belong to this species. The general body shape and most characters (fig. 22A, B) are similar to those of the type, but details of the posteroventral border of the head (fig. 22E) and first oostegites (fig. 22G, H) differ. This specimen is assignable to *Kepon* for the same reasons discussed above for the holotype.

The other paratypes are closely similar to the holotype and allotype. The females, two of which are dextral and two sinistral, vary in length from 3.40–4.80 mm and in width from 3.40–3.76 mm. One does not differ noticeably from the holotype; two have slightly longer frontal laminae and the swellings on the last two pereomeres not separated into two lobes; the other female has a less tuberculate frontal lamina and pereomeral swelling only on pereomere 7, where it is unseparated. The paratype males range in length from 2.96–3.20 mm and in width from 0.74–0.84 mm. All have some to much more separation of body segments than the allotype; one has tubercles on the dorsal surfaces of pereomere 4–7 and two males have nearly equally long uropods.

Discussion. – Duvernoy (1840) established the genus *Kepon* to contain the first species of bopyrid isopod recorded from outside European waters, *Kepon typus* from an unknown host at Mauritius in the Indian Ocean. Agassiz (1848) introduced the alternative spelling *Cepon* for the genus but regarded it as an error; even so, its frequent use has continued. Giard (1906) identified the host in Mauritius as *Grapsus strigosus* Herbst. Subsequently seven other species have been assigned to *Kepon* (usually written *Cepon*), but only one of these, *K. halimi* Stebbing (1910) remains in the genus, even though its placement has been questioned by Nierstrasz & Brender à Brandis (1931). The host of *K. halimi* was a majid crab, *Halimus* sp., also in the Indian Ocean, at Cargados Carajos. The male of *K. typus* remains unknown, and the descriptions and illustrations of both species are less than desirable. However, it appears that the females of these two species and of *K. orientalis* are congeneric. All three have broadly oval bodies, large bilobate heads, maxillipeds with prominent non-articulating palps, large coxal plates, no middorsal projections, and digitate-margined pleonal appendages including biramous pleopods. The two

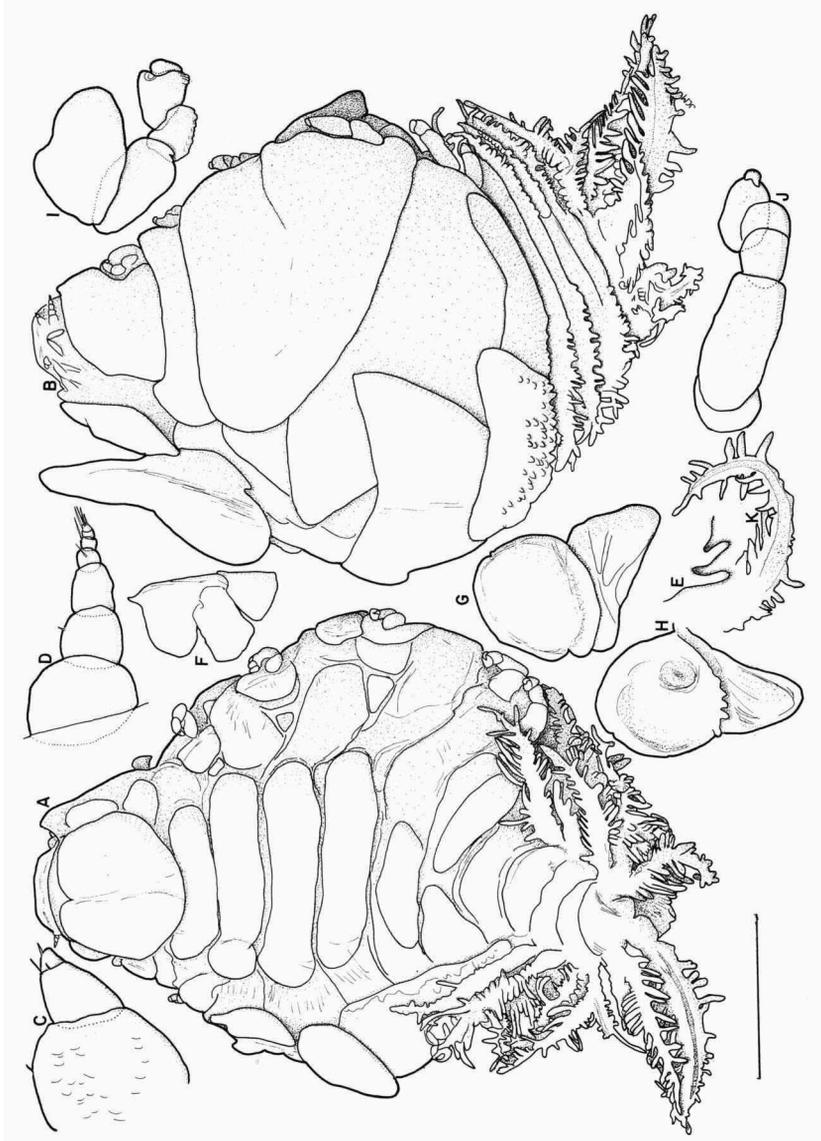


Fig. 22. *Kepon orientalis* spec. nov., paratype female. A, dorsal view; B, ventral view; C, left antenna 1; D, right antenna 2; E, right posteroventral border of head; F, right maxilliped; G, right oostegite I in external view; H, same in internal view; I, right pereopod 1; J, left pereopod 7; K, tip of uropod. Scale: 1.00 mm for A, B, E-H; 0.93 mm for I, J; 0.18 mm for I, J; 0.09 mm for C, D.

males known (those of *Kepon halimi* and *K. orientalis*) are similar in body shape, proportions and segmentation and in having flaplike pleopods. The female of *K. orientalis* is more similar to that of *K. typus* in being very little distorted, but differs in having the coxal plates non-rugose. Its pleonal appendages are more like those of *K. typus* than those of *K. halimi*, which are less digitate. The male of *K. halimi* differs from that of *K. orientalis* in having the head and pereon fully separate and lacking all midventral pereomer al projections. The hosts of *K. orientalis* and *K. typus* are both grapsid crabs. With the description of *K. orientalis*, the range of the genus is extended eastward, but it is still known only from the Indian Ocean.

Trapezicepon Bonnier, 1900

Trapezicepon thalamitae spec. nov.

(figs. 23, 24)

Material examined. — Infesting *Thalamita crenata* (Latreille). Mudflat, Ko Maphrao, Phuket, Thailand, 7 May 1979, Pitiwong Tantichodok, coll. and det. of host: ♀, holotype, ♂, allotype, RMNH Crust I 6636.

Description of holotype female (fig. 23). — Length 12.60 mm, maximal width 12.00 mm, head length 3.04 mm, head width 4.00 mm, pleonal length 2.80 mm. Distortion 11°. Body outline, exclusive of pleonal appendages, almost circular. Some segmentation rather obscure (fig. 23A, B).

Head nearly straight in front, irregularly rounded behind. Short frontal lamina clear across anterior edge. Head indistinctly bilobate. No eyes. Antennae (fig. 23C) of three and five articles respectively, their setation obscure. Posteroventral border (fig. 23D) with two lateral projections on each side, outer one long and tapering to point, inner one much shorter and blunt; middle region of single broad truncate projection. Maxilliped (fig. 23E) subtriangular, its anterior segment much larger than posterior one; long, non-articulating palp (fig. 23F) arising from anterior margin, curved and reflexed on maxilliped, tapering to rounded point; spur (fig. 23G) reduced to tiny acute point.

Pereon smoothly rounded, with projections arising from pereomeres 6 and 7 (fig. 23A, H). Oostegites irregularly overlapping and completely enclosing brood pouch. First oostegite (fig. 23I) nearly as broad as long, rounded anteriorly and truncate posteriorly, completely lacking posterolateral extension; internal ridge with very long slender projections; posterolateral corner divided into slender striplike flaps. Pereopods (fig. 23K, L) greatly increasing in size posteriorly; pereopods 6 and 7 with very broad ischia elongate bases and



Fig. 23. *Trapezicepon thalaitiae* spec. nov., holotype female. A, dorsal view; B, ventral view; C, right antennae; D, right posteroventral border of head; E, right maxilliped; F, palp of same; G, spur of same; H, ventral surfaces of pereomeres 4-7 and pleomeres 1, 2 from right side; I, right oostegite 1 in external view; J, same in external view; K, right pereopod 1; L, right pereopod 7; M, pleon in ventral view; N, right lateral plate 1; O, tip of same. Scale 5.0 mm for A, B, E, H, J, M; 2.5 mm for D, F, G; 1.0 mm for K, L, N; 0.2 mm for O.

large knoblike boss arising between those articles; all propodi ending in blunt to sharp points.

Pleon (fig. 23M) of six pleomeres, each for about two thirds covered by appendages. Lateral plates and biramous pleopods (fig. 23A, M-O) deeply divided and sub-divided, minutely tuberculate and setose, extending far forward and somewhat laterally. Posteriorly extending uniramous uropods similar to and broader than adjacent lateral plates.

Description of allotype male (fig. 24). – Length 5.03 mm, maximal width 1.55, head length 0.42 mm, head length 0.70 mm, pleonal length 1.51 mm. All body regions distinct (fig. 24A, B).

Head nearly trapezoidal, greatly tapered posteriorly, truncate anteriorly. Two small dark eye-spots near posterolateral corners. Antennae (fig. 24C) of three and five articles, respectively, all but basal articles of antenna 2 setose.

Pereon broadest across pereomere 4, smoothly tapered both ways from there. All pereomeres laterally separated by deep anterior indentations. Slight middorsal ridge along all pereomeres. Pereomeres with sharply angled corners and nearly straight sides. Both anterior and posterior margins of pereomeres straight across except posterior margins of final two slightly concave. Round, extended midventral tubercle on each pereomere, Pereopods (fig. 24D, E) all of similar proportions, increasing slightly in size posteriorly; all articles present, though meri and carpi proportionately small; distal margins of carpi and opposing surfaces of propodi and dactyli minutely setose; anterodistal corner of each propodus drawn out into thumb-like angles extending beyond end of dactylus.

Pleon of six pleomeres medially fused but deeply separated laterally. First pleomere markedly broader than last pereomere, others regularly narrower. Five pairs of nearly circular tuberculiform pleopods smaller posteriorly. Sparse setae on some lateral margins (fig. 24F). Final pleomere (fig. 24F) bearing small anal cone and two setose pads possibly indicating remnants of now-absent uropods.

Etymology. – The specific name *thalamitae* is the genitive form of the generic name of the host species, *Thalamita crenata*, selected to reflect the first record of bopyrid infestation of a species of *Thalamita*.

Discussion. – The genus *Trapezicepon* contains three species known from the tropical Pacific and Indian Oceans. Their hosts are two xanthids and a parthenopid. Of these species, one, known from a single juvenile female (Nierstrasz & Brender à Brandis, 1931) was never assigned a specific name, and its adult characters are unknown. A second, *T. domeciae* Danforth (1972) was inadequately described and illustrated, but evidently correctly assigned to *Trapezicepon*. The other species, the type-species *T. amicornum* (Giard &

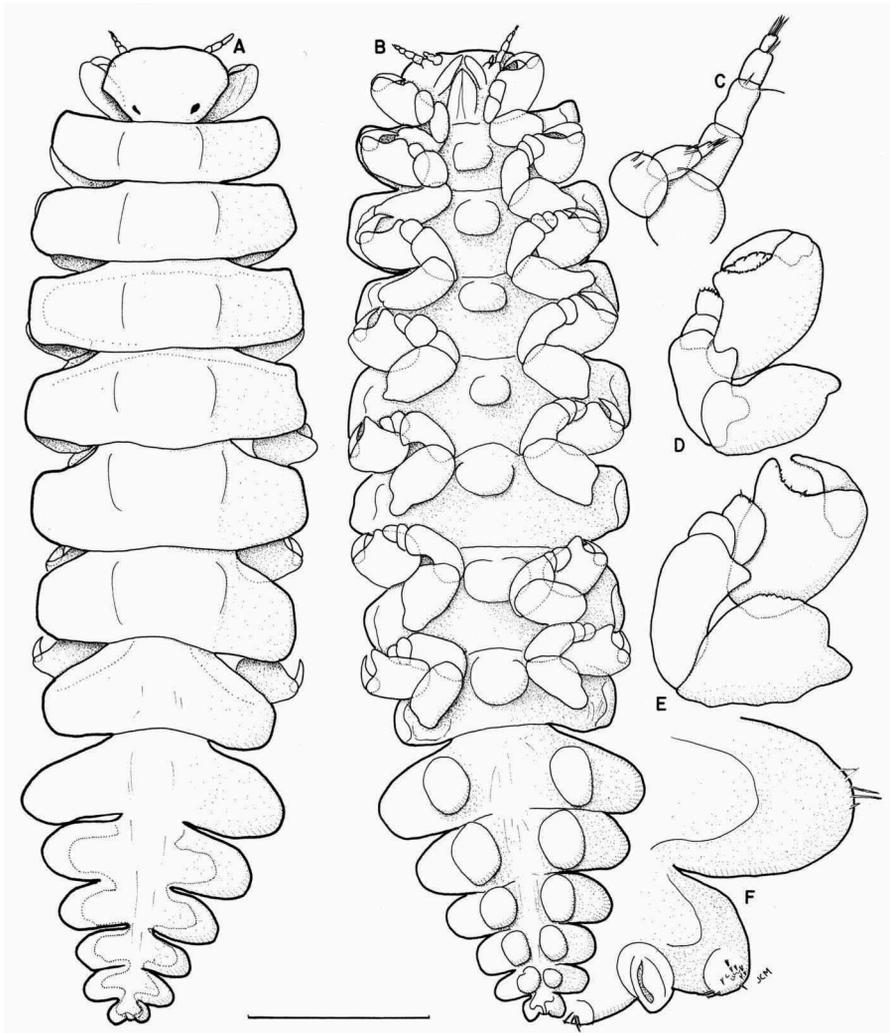


Fig. 24. *Trapezicepon thalamitae* spec. nov., allotype male. A, dorsal view; B, ventral view; C, left antennae; D, left pereopod 1; E, left pereopod 7; F, left side of pleomeres 6 and 7 in ventral view. Scale: 1.0 mm for A, B; 0.4 mm for D, E; 0.2 mm for C,F.

Bonnier, 1888) was redescribed and illustrated by Bonnier (1900), who made it the type-species of the genus. *T. thalamitae* shares several characters with *T. amicum*: the females have pereopods of very similar structure, the same pattern in the posteroventral border of the head, non-articulating maxilliped palps, non-pointed first oostegites and similarly digitate pleonal appendages. The female of *T. amicum* has greatly inflated dorsolateral bosses on the pereomeres, a very large frontal lamina and a much more distorted body. A

distinction between *T. thalamitae* and all other species of *Trapezicepon* is that the female has two middorsal pereonal projections. In light of definitions among genera of the Ioninae, this single character may properly exclude *T. thalamitae* from the genus, but other characters override that consideration. The male of *T. thalamitae*, like that of *T. amicorum*, has seven midventral pereomer tubercles (found also in the male of *T. domeciae*), pereopods of the same structure, tuberculiform pleopods and setose knobs in place of uropods. The male of *T. amicorum* differs from that of *T. thalamitae* in having a midventral tubercle also on the first pleomere, and that segment narrower than the last pereomere. Only the male of *T. thalamitae* has its pleomeres fused medially. In both sexes, *T. thalamitae* is by far the largest species of *Trapezicepon* known, being three to four times as long as the others.

Orbioninae R. Codreanu, 1967

Parapenaeon Richardson, 1904

Parapenaeon japonica (Thielemann, 1910)

- [Synonymy restricted to collection records; see Markham (1982) for complete synonymy.]
Epipenaeon japonica Thielemann, 1910: 7, 79-81, 106-107, 108, figs. 86-87, pl. II fig. 31 [Type-locality Okayama, Japan; infesting "*Penaeus* sp."]; Hiraiwa, 1933: 49-69; figs. 1-23, pl. I [Hiroshima, Japan; infesting *Metapenaepsis barbata* (de Haan), *M. acclivis* (Rathbun) and *M. lamellata* (de Haan)]; Hiraiwa, 1934: 45-62, figs. 1-14 [Same locality; infesting *M. barbata*]; Hiraiwa, 1936: 101-137, pls. 1-7 [Same locality and host]; Nataraj, 1943: 53 [Travancore, India; infesting unidentified penaeid].
Epipenaeon japonica: Barnard, 1925: 408 [Delagoa Bay, Mozambique; infesting *Metapenaeus monoceros* (Fabricius)]; Barnard, 1926: 121 [same locality].
Apopenaenon japonicum: Shiino, 1934: 260-263; fig. 2 [Tanabe Bay, Japan; infesting *Metapenaepsis barbata*]; Shiino, 1939: 80, fig. 1 [Tuyasaki, Hukuoka Prefecture, Kyûsyû, Japan, infesting *M. acclivis*].
Epipenaenon japonicus: Hiraiwa & Sato, 1939: 105-115, 121-122 [Hiroshima, Japan; infesting *M. barbata*].
Apopenaenon japonicum var. *hiraiwai* Shiino, 1950: 151-155, fig. 1 [Type-locality Kutino, Izo, Japan; infesting *M. acclivis*]; Shiino, 1958: 51-53, fig. 13; tab. I, pl. III fig. 7 [Several Japanese localities; infesting *M. acclivis* and *M. barbata*].
Parapenaenon japonicum: Bourdon, 1979a: 480-486, figs. 6, 7 [Le Menabe-en-Magunga, Madagascar; infesting *Metapenaeus monoceros* (Fabricius); Bay of Ambaro, Madagascar; infesting *M. monoceros* and *Penaeus semisulcatus* de Haan]; Bourdon, 1979b: 432 [Gulf of Martaba, Burma; infesting *Parapenaepsis sculptilis* (Heller)].
Parapenaenon japonica: Markham, 1982: 366-369, 385, figs. 23, 24 [Hong Kong, infesting *Penaeus japonicus* Bate].

Material examined. — Infesting *Trachypenaeus fulvus* Dall. Specific locality unrecorded, Chonburi, Thailand, 23 December 1979: 7♀, 3♂, RMNH Crust I 6634.

Discussion. – The specimens examined do not differ notably from those of *Parapenaeon japonica* previously recorded, so they are not described or drawn. The females lengths are 6.9-12.0 mm and their widths 5.2-9.4 mm; males are 2.2-3.0 mm long and 0.9-1.1 mm broad. Five of the females are dextral and two sinistral. The pleopods of 1 female cover its pleon completely, and the pereomeres of 1 male are more widely separated than usual. This is the first record of *P. japonica* from Thailand, but its previously recorded wide distribution indicates that it should be expected there. This is the first recorded bopyrid infestation of *Trachypenaeus fulvus* Dall.

Athelginae Codreanu & Codreanu, 1956
Pseudostegias Shiino, 1933

Pseudostegias setoensis Shiino, 1933
 (fig. 25)

Pseudostegias setoensis Shiino, 1933: 290-293, fig. 16 [Type-locality Seto, Wakayama Prefecture, Japan; infesting *Clibanarius bimaculatus* de Haan]; Shiino, 1950: 161-162; Shiino, 1952: 35, 36; Shiino, 1958: 68 [Same locality and host as types; also Taiwan; infesting *C. striolatus* Dana]; Lemos de Castro, 1965: 105, 106-108; Shiino, 1972: 9; Markham, 1982: 369-370, 372, 373, 385 [Hong Kong; infesting *C. bimaculatus* and *C. ransonii* Forest].

Material examined. – Infesting *Clibanarius padavensis* de Man. Seaward fringe of mangroves, Ko Maphrao, Phuket, Thailand: 1♀, 1♂, RMNH Crust I 6635.

Discussion. – In both sexes, the present material conforms well with the original description. The female is relatively slightly broader, and its pleonal appendages a little shorter and more tightly bunched (fig. 25A, B). The first oostegite (fig. 25G-J) has a slightly different shape and a deeply digitate internal ridge. The peculiar structures which I have interpreted as the fifth pair of lateral plates (Markham, 1982) are enlarged (fig. 25L) as in other species of *Pseudostegias* rather than being small sessile disks, as in the type. The male (fig. 25M, N) differs only in having slightly different proportions. This is the first record of bopyrid infestation of *Clibanarius padavensis* and the first record of the occurrence of *Pseudostegias setoensis* in Thailand.

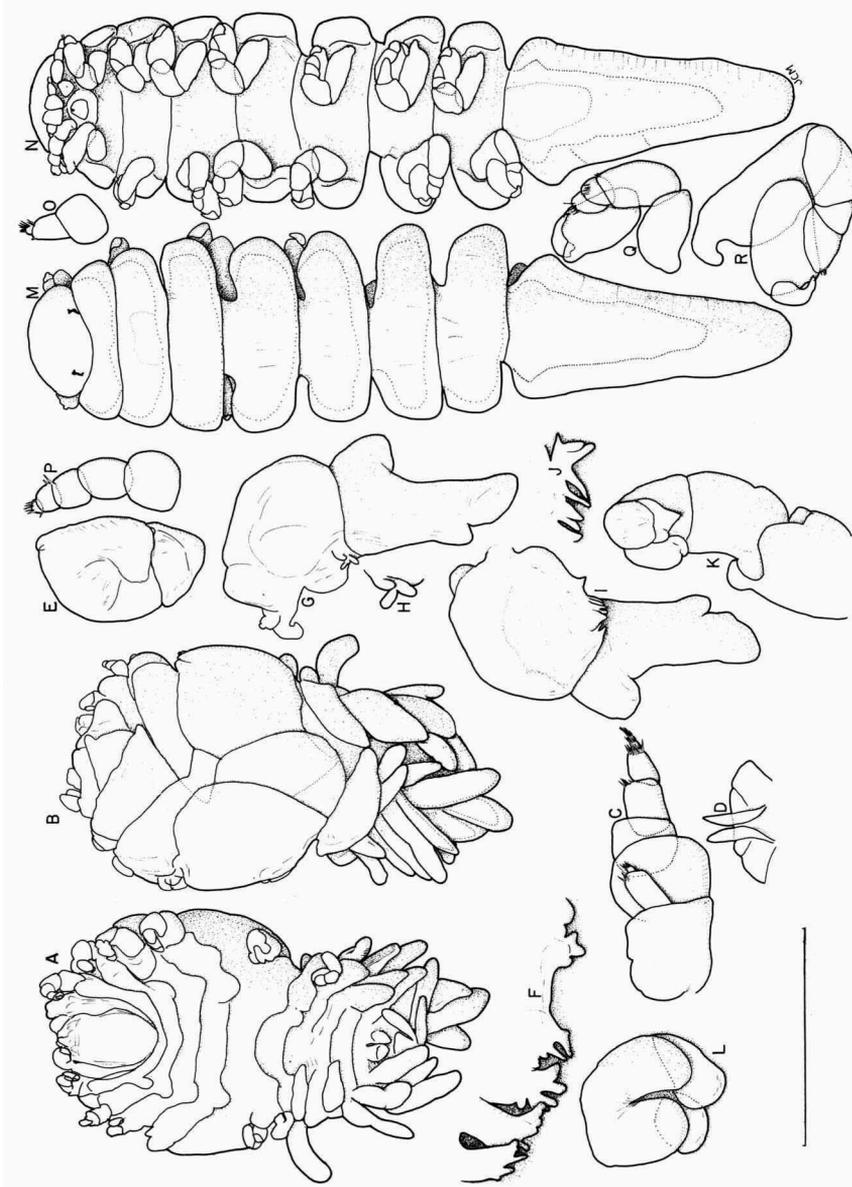


Fig. 25 *Pseudostegias setoensis* Shiino, 1933. A-L, female; M-R, male. A, dorsal view; B, ventral view; C, right antennae; D, oral cone; E, right maxilliped; F, right posteroventral border of head; G, right oostegite 1 in external view; H, same, projections on external midlateral margin; I, same in internal view; J, same lateral end of internal ridge; K, right pereopod 1; L, lateral plates of pleomere 5; M, dorsal view; N, ventral view; O, right antenna 1; P, right antenna 2; Q, right pereopod 1; R, right pereopod 7. Scale: 6.0 mm for A, B; 2.6 mm for E, G, I; 1.3 mm for F, H, J-N; 1.0 mm for C, D, O-R.

***Pseudostegias dulcilacuum* Markham, 1982**
(figs. 26-28)

Pseudostegias dulcilacuum Markham, 1982: 370-373, 385, figs. 25, 26 [Type-locality Tolo Harbour, Hong Kong; infesting *Diogenes* aff. *edwardsii* (de Haan).]

Material examined. – Infesting *Clibanarius merguensis* de Man, Intertidal region, Phuket, Thailand. July 1974. S. Brunenmeister coll.: 1 ♀ (reference ♀), USNM 173472; 4 other ♀ (of which 1 immature), USNM 173474-173477; 1 ♂ (reference ♂), USNM 173473; 3 other ♂, USNM 173475-173477.

Remarks on females (figs. 26, 27). – The reference female (fig. 26) agrees very well with the holotype. Its second oostegites (fig. 26A) extend somewhat



Fig. 26. *Pseudostegias dulcilacuum* Markham, 1982, female. A, dorsal view; B, ventral view; C, left antenna 1; D, left antenna 2; E, right maxilliped; F, left posteroventral border of head; G, left oostegite 1 in external view; H, same in internal view; I, right oostegite 2 in internal view; J, right pereopod 2; K, right pereopod 7; L, fifth lateral plates and end of pleomere 6. Scale: 2.4 mm for A, B; 1.2 mm for E, G-I; 0.6 mm for F; 0.4 mm for J-L; 0.2 mm for C, D.

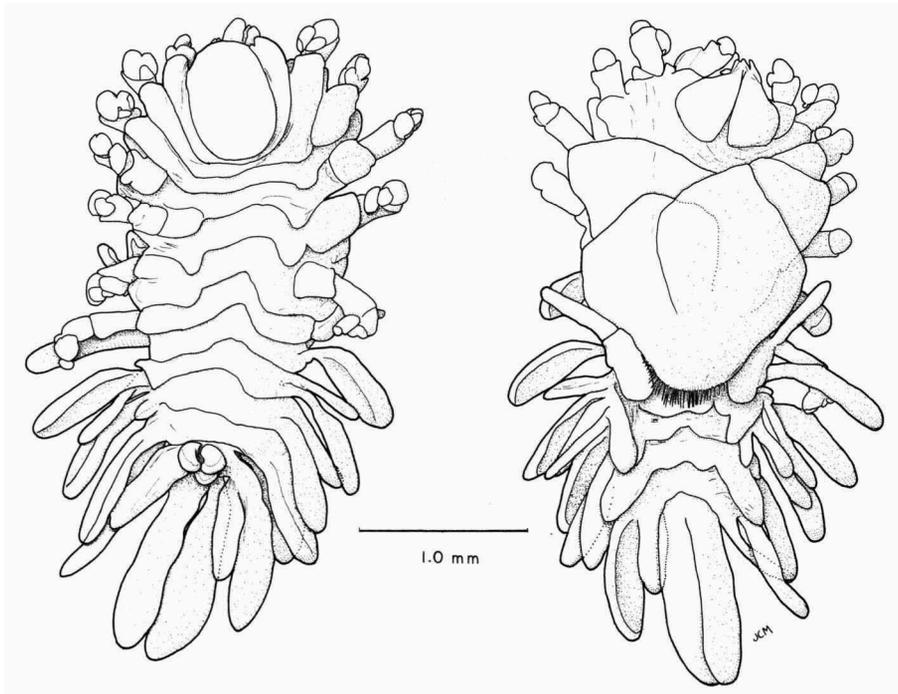


Fig. 27. *Pseudostegias dulcilacuum* Markham, 1982, immature female, in dorsal and ventral views.

farther forward (fig. 26A), and its posterior head margin (fig. 26F) is considerably less elaborate. The immature female (fig. 27) is more advanced than that collected with the holotype (Markham, 1982) and thus conforms better with the mature females, especially in the development of its oostegites.

Description of reference male (fig. 28). – Length 3.55 mm, maximal width 1.27 mm, head length 0.56 mm, head width 0.93 mm, pleonal length 1.21 mm. All body regions distinct (fig. 28A, B).

Head elliptical, rounded equally at both ends. Dark eye-spot just behind midline near each side. Antennae (fig. 28C) of three and seven articles, respectively; nearly all articles, especially terminal ones, distally setose.

Pereon curved and slightly tapered both ways from pereomere 4. Pereomeres all distinct and laterally separated by shallow notches produced by ventral folding of all lateral edges. Pereopods (fig. 28D, E) all of nearly identical size and proportions, all carpi and propodi somewhat setose.

Pleon subtriangular, fused into single piece, but undulate margins indicating traces of six pleomeres. No remnants of appendages. Ventral surface of terminal regions (fig. 28F) produced into slightly raised anal cone.

Discussion. – This is the first account of the male of *Pseudostegias dul-*

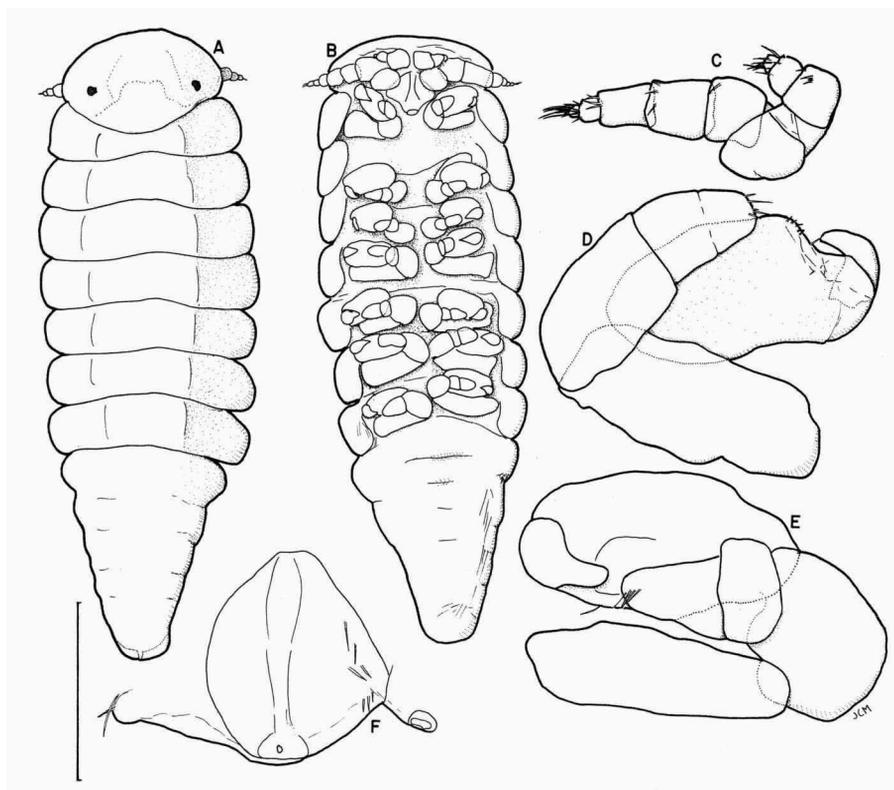


Fig. 28. *Pseudostegias dulcilacuum* Markham, 1982, male. A, dorsal view; B, ventral view; C, right antennae; D, left pereopod 1; E, right pereopod 7; F, tip of pleon in ventral view. Scale: 1.2 mm for A, B; 0.2 mm for C; 0.1 mm for C-F.

cilacuum. It conforms well with the males of the other three described species of *Pseudostegias*. The lateral undulation of the pereon is unique, but the male of *P. setoensis* Shiino has coalesced pleomeres indicated dorsally. Its head is proportionally broader than any species but *P. atlanticus* Lemos de Castro (1965), from which it differs in having no pleonal dorsal keel. The male of *P. hapalogasteri* Shiino (1950) has more deeply separated pereomeres and a relatively much shorter pleon.

Hemiarthrinae Markham, 1972

Diplophryxus Richardson, 1904

Diplophryxus jordani Richardson, 1904

(fig. 29)

Diplophryxus jordani Richardson, 1904: 50-51, figs. 26-28 [Type-locality Misaki, Sagami, Japan; infesting *Palaemon serrifer* (Stimpson) {= *Leander serrifer* Stimpson }]; Thielemann, 1910: 106-107, tab 8; Chopra, 1923: 416, 419, 443-444 [Una Island, Mergui Archipelago; infesting *P. serrifer* (as *Leander spec.*); Nierstrasz & Brender à Brandis, 1923: 108; Chopra, 1930: 114, 119-121, 123, 126-127; pl. IV, fig. 1 [Kilakarai, Gulf of Manaa; infesting *L. tenuicornis* (Say)]; Shiino, 1933: 293-296, fig. 17 [Seto, Japan; infesting *P. serrifer* and *P. pacificus* Stimpson, both assigned to the genus *Leander*]; Shiino, 1934: 280, 281; Pearse, 1950: 43; Yoshida, 1952: 362-365 [Misaki, Japan; infesting *P. serrifer*; study of effects on host]; Shiino, 1958: 71 [Noto Peninsula, Japan Sea, and Sagami Bay, Japan; infesting *P. serrifer*; and Seto, Japan; infesting *P. pacificus*]; Bruce, 1972: 357; Shiino, 1972: 9; Shiino, 1974: 553, unnumbered figs; Bruce, 1975: 123; Bourdon, 1981: 632.

Diplophryxus Jordani: Thielemann, 1910: 78.

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

Material examined. — Infesting *Palaemon semmelinki* (de Man). On bottom, to 0.5 m deep, in closed-off fresh-water stream, on coast between Naklua and Pattaya, about 150 km south of Bangkok, Thailand. 27 December 1982, A. C. J. Burgers and L. B. Holthuis coll. and det. of host: 1 ♀, RMNH Crust I 6639.

Discussion. — *Diplophryxus jordani*, previously known from Japan to India, has not been recorded from Thailand before, but it was certainly to be expected. The host is also a new record. Richardson's (1904) description and illustrations were undesirably brief but adequate to permit sure identification by subsequent authors and in the present case. The most complete drawings are those of Shiino (1933), with which the present material corresponds well, except that the pigment pattern, evidently very persistent and diagnostic in this species, conforms better with the specimen of Chopra (1930). Noteworthy are the shapes and dimorphism of the first oostegites (fig. 29E-H), the fringe on the ventral surface of the second pereomere (fig. 29C) and the marked inequality of the pereopods (fig. 29I, J); all of these characters agree with Shiino's report. The peculiar groove containing the antennae, the first oostegite overlapping the head, the shape of the first oostegites, and the fringe on the second pereomere are all very similar to characters of *Diplophryxus synalpheus* Pearse (1950), a parasite of *Synalpheus* spp. in the western Atlantic. Because of very different, nearly circular biramous pleopods and two pairs of pereopods on the longer side, I have however re-assigned that species to the genus *Hemiarthrus* (Markham, 1985).

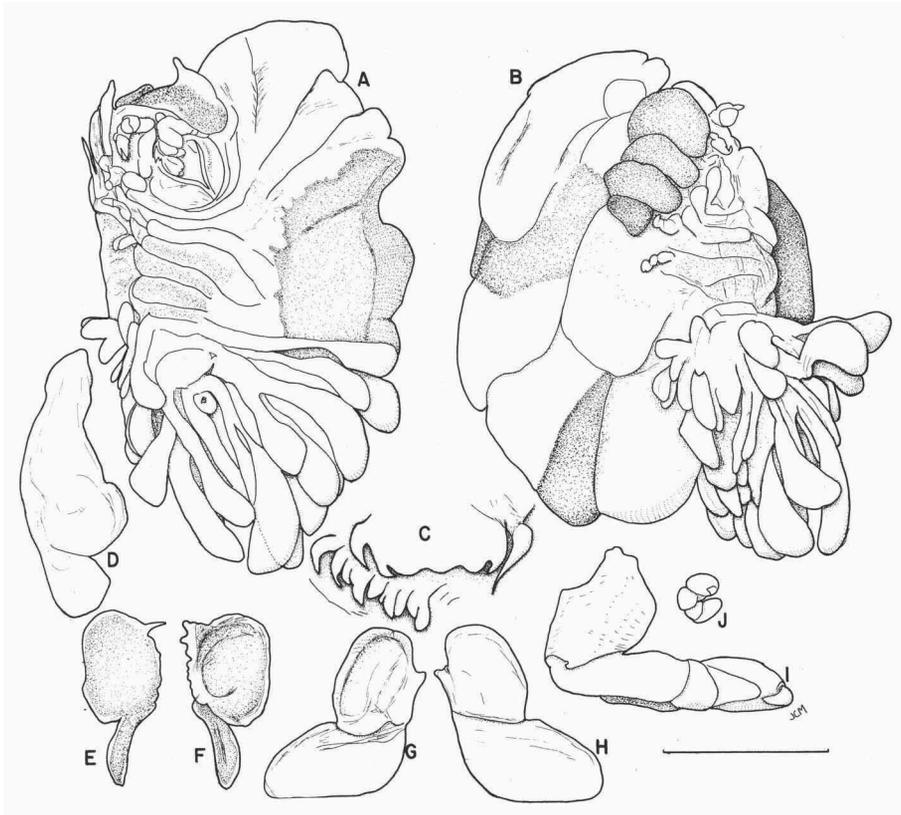


Fig. 29. *Diplophryxus jordani* Richardson, 1904, female. A, dorsal view; B, ventral view; C, posteroventral border of head and surface of pereomere 2; D, left maxilliped; E, left oostegite 1 in external view; F, same in internal view; G, right oostegite 1 in external view; H, same in internal view; I, left pereopod 1; J, left pereopod 7. Scale: 2.0 mm for A, B, E-H; 1.0 mm for C, D; 0.56 mm for I, J.

CONCLUSIONS

Until now there were published records of 13 species of bopyrid isopods from the waters of Thailand, including the Gulf of Thailand (which may actually be Cambodian or Vietnamese localities rather than Thai ones). These belong to four of the ten subfamilies of the Bopyridae. The present paper includes accounts of 19 species of bopyrids, only one of which, *Probopyrus annandalei* Chopra, was previously recorded from Thailand. These species belong to six subfamilies. This brings the total number of bopyrid isopods now known from Thailand to 31. It is virtually certain that far more than these 31

species actually occur in Thailand; the only site of any concentrated collecting is Phuket, and a repeat of that process elsewhere would probably easily triple the total number of Thai species. A list of species now known from Thailand is presented in Table 1.

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Table 1. Species of bopyrid isopods currently recorded from Thailand, including the Gulf of Thailand (Note: NBB stands for Nierstrasz & Brendler à Brandis; GT = Gulf of Thailand.)

Species and author	Host species and author	Locality	Reference
Pseudioninae			
<i>Asymmetrione asymmetrica</i> Shiino	<i>Clibanarius</i> spec.	Phuket	This paper
<i>Bopyrissa liberorum</i> spec. nov.	<i>C. merguensis</i> de Man	Phuket	This paper
<i>Parapagurion calcincola</i> Shiino	<i>Paguristes</i> spec.	Phuket	This paper
<i>Aporobopyrina lamellata</i> Shiino	<i>Petrolisthes lamarckii</i> (Leach)	Phuket	This paper
<i>Pleurocryptosa megacephalon</i> NBB	Porcellanid	Ko Kram, GT	NBB, 1929
<i>Anuropodione dubius</i> (NBB)	<i>Galathea</i> spec.	Ko Rin, GT	NBB, 1929
Bopyrinae			
<i>Metabopyrus irregularis</i> spec. nov.	<i>Upogebia</i> spec.	Phuket	This paper
<i>Probopyrus buitendijki</i> (Horst)	<i>Macrobrachium rosenbergii</i> (de Man)	Bang Sorn; Bangkok	This paper; NBB, 1929
<i>P. annandalei</i> Chopra	<i>M. equidens</i> (Dana); <i>Macrobrachium</i> spec.	Tale Sap Burirrum Prov.	Chopra, 1923 This paper
<i>Parabopyrella essingtoni</i> (Bourdon & Bruce)	Alpheid	Phuket	This paper
<i>Bopyrella megatelson</i> NBB	<i>Alpheus parvirostris</i> Dana	Koh Chang, GT	NBB, 1929
<i>B. barnhardi</i> NBB	<i>Alpheus</i> spec.	Lem Ngob	NBB, 1931
<i>B. tanytelson</i> spec. nov.	<i>Alpheus</i> spec.	W. Thailand	This paper
<i>Bopyrinella albida</i> Shiino	<i>Athanas</i> spec.	Phuket	This paper
<i>Bopyrina choprae</i> NBB	<i>Harpilius</i> spec.	Koh Kram, GT	NBB, 1929
Ioninae			
<i>Procepon insolitum</i> Shiino	<i>Upogebia</i> spec.	Phuket	This paper
<i>P. horridulum</i> spec. nov.	<i>Upogebia</i> spec.	Phuket	This paper
<i>Upogebione phuketensis</i> spec. nov.	<i>Wolffogebia phuketensis</i> Sakai	Phuket	This paper

<i>Hypocepon ovale</i> NBB				NBB, 1931
<i>Coxalione inaequalis</i> Bourdon				Bourdon, 1977
<i>Metucepon leidyae</i> NBB				NBB, 1931
<i>Allokepon sinensis</i> (Danforth)				This paper
<i>Kepon orientalis</i> spec. nov.				This paper
<i>Megacepon choprai</i> George				Markham, 1980
<i>Trapezicepon thalamitae</i> spec. nov.				This paper
Orbioninae				
<i>Orbione thielemanni</i> NBB				NBB, 1931
<i>Epipenaeon oviforme</i> NBB				NBB, 1931
<i>Parapenaeon japonica</i> (Thielemann)				This paper
Athelginae				
<i>Pseudostegias setoensis</i> Shiino				This paper
<i>P. dulcillacuum</i> Markham				This paper
Hemiarthrinae				
<i>Diplophryxus jordani</i> Richardson				This paper
	<i>Upogebia</i> spec.	Koh Chang, GT		
	<i>Laomedia astacina</i> de Haan	Koh Boi Tai		
	<i>Matuta</i> spec.	Mesan, GT		
	<i>Portunus pelagicus</i> (L.)	Phuket		
	<i>Metaplex elegans</i> de Man	Phuket		
	<i>Sesarma mederi</i> H. Milne Edwards	Samut Sakhon		
	<i>Thalassia crenata</i> (Latreille)	Phuket		
	<i>Metapenaeopsis stridulans</i> (Alcock)	Koh Kahdut, GT		
	<i>Penaeus</i> spec.	Lem Ngob		
	Penaeid	Chonburi		
	<i>Clibanarius padavensis</i> de Man	Phuket		
	<i>C. merguensis</i> de Man	Phuket		
	<i>Palaemon semmelinki</i> (de Man)	S. of Bangkok		