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The Bopyridae (Crustacea: Isopoda) of Taiwan

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Christopher B. Boyko (2004) The Bopyridae (Crustacea: Isopoda) of Taiwan. *Zoological Studies* **43**(4): 677-703. This study adds 8 bopyrids to the 5 species previously known from Taiwan. None of the species are new to science, but all are new to the Taiwanese fauna. All of the hosts for the 8 species are new. Four species redescribed herein, *Pseudione retrorsa* Richardson, *Parioninella obovata* Shiino, *Parapenaeon tertium* Nierstrasz and Brender à Brandis, and *Bopyrus stebbingi* Nierstrasz and Brender à Brandis, are reported for the 1st time since their original descriptions, with each representing a substantial range extension. The geographic and depth distributions of 2 additional species, *Bopyroides hippolytes* (Kröyer) and *Athelges takanoshimensis* Ishii, are greatly extended. Two new genera are erected for *P. obovata* and *B. stebbingi*. *Pseudione lenticeps* Shiino is synonymized with *P. retrorsa*, which is transferred to the genus *Aporobopyrus* Nobili. *Parapenaeon coarctatum tuberculata* is raised to the level of full species. Identifications of hosts as cited in older literature are updated to current nomenclature. http://www.sinica.edu.tw/zool/zoolstud/43.4/677.pdf

Key words: Peracarida, Parasitic isopods, Taxonomy, New genera, Marine.

The bopyrid fauna of Taiwan to date includes 5 species (Kensley and Chan 2001 only listed three of the 4 species known up to that time). The earliest records are *Parabopyrella choprai* (Nierstrasz and Brender à Brandis 1929) from *Hippolysmata vittata* Stimpson and *Synalpheus* sp.; *Pseudostegias setoensis* Shiino, 1933, from *Clibanarius striolatus* Dana (Shiino 1958); *Ione taiwanensis* Markham, 1995, from *Callianidea* sp.; and *Lobocepon grapsi* Nobili, 1905 from *Grapsus grapsus* (Linnaeus) (Shiino 1936a). The *Parabopyrella* and *Ione* species are known only from Taiwan, while the *Pseudostegias* was originally described from Japan and the *Lobocepon* from New Guinea. *Albunione yoda* Markham and Boyko, 2003, from *Albunea groeningi* Boyko is the most recent Taiwanese bopyrid to have been described (Markham and Boyko 2003). All of these Taiwanese records were from shallow water, or presumed to be from shallow water based on the identities of the hosts. Examination of parasitized decapods collected by the MUSORSTOM Taiwan 2000 and 2001 cruises yielded an additional 8 bopyrid species new to the fauna of Taiwan; none of the previously reported species were among them. Many of these represent substantial range extensions, 4 are reported for the 1st time since the original descriptions, and 1 exhibits an impressive extension of its depth range.

Over a century has passed since Hansen (1897) lamented the inability to place new bopyrid taxa into existing genera. Despite many species having been described since that time, little seems to have changed with regard to the problems of bopyrid taxonomy at the generic level as evidenced by the 2 monotypic genera erected herein for species that clearly cannot be placed into existing genera. This, as Hansen (1897: 112) said, is "a result with which I am rather dissatisfied." I am aware of the undesirability of increasing the proliferation of monotypic genera in a family which is already overburdened by them. However, it is my belief that many (but surely not all) of these genera are monotypic not from taxonomic error or poor definition, but from the existence of many undiscovered species which, when found, will remove the monotypic status of the genera.

Markham (1986) correctly noted that most of the bopyrid "species-rich" regions (e.g., Japan, India, Indonesia, Europe, and the northwestern Atlantic) are likely the result of higher than average collector effort in those localities. Considering the time elapsed between the 1st description of *Bopyrus stebbingi* Nierstrasz and Brender à Brandis, 1923, and its rediscovery and transferal to its own genus in this work, it is not improbable to think that congeneric species exist but remain uncollected and/or undescribed. Indeed, Hansen (1897) might be relieved if he knew that three of his 4 new genera (*Cryptione*, *Munidion*, *Parargeia*, and *Bathygyge*) are still considered valid today (*Cryptione* is now a synonym of *Pseudione*), but perhaps a little perplexed that two, *Parargeia* and *Bathygyge*, are still monotypic after the passage of more than 100 yr.

All Taiwanese specimens, along with their hosts, are deposited in the Museum National d'Histoire Naturelle [MNHN], Paris, France. The synonymy lists given below are complete for all species except *Bopyroides hippolytes* (Kröyer 1838), for which only a few select references are given. Host names obtained from literature records are corrected to conform to current nomenclature.

The size of the isopods is given as the total length from the anterior cephalon to the posterior of the pleotelson (exclusive of uropods); carapace length (CL) for carideans and galatheoids, and shield length (SL) for paguroids are provided as an indicator of specimen size for the hosts.

TAXONOMY

Family Bopyridae Rafinesque-Schmaltz, 1815
Subfamily Pseudioninae Codreanu, 1967
Genus *Pseudione* Kossmann, 1881
Pseudione tattersalli Nierstrasz and Brender à Brandis, 1923

(Fig. 1)

Pseudione tattersalli Nierstrasz and Brender à Brandis, 1923: 74-76, pl. 5, figs. 8a-d, pl. 9, fig. 36a-c; Bourdon 1972: 108-110, fig. 3.

Materials examined: Taiwan. Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 75, NE coast of Taiwan, 24°56.7'N, 122°01.8'E, 139 m, 7 May 2001, in right branchial chamber of female *Plesionika fimbriata* Chace (28.20 mm CL): brooding dextral female (11.10 mm), male (2.63 mm); in right branchial chamber of female *P. fimbriata* (31.10 mm CL): brooding dextral female (11.40 mm), male (3.08 mm) (MNHN-Ep 939). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 83, NE coast of Taiwan, 24°51.4'N, 121°57.4'E, 75~110 m, 8 May 2001, in left branchial chamber of female *P. fimbriata* (30.95 mm CL): brooding sinistral female (10.50 mm), male (3.00 mm) (MNHN-Ep 938). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 93, NE coast of Taiwan, 24°50.1'N, 121°55.7'E, 66~110 m, 10 May 2001, in right branchial chamber of female *Plesionika* sp. (damaged rostrum) (26.40 mm CL): non-brooding dextral female (12.60 mm), male (3.00 mm); in left branchial chamber of female *Plesionika* sp. (damaged rostrum) (20.30 mm CL): brooding sinistral female (11.85 mm), male (2.85 mm); in left branchial chamber of female *Plesionika* sp. (damaged rostrum) (24.80 mm CL): brooding sinistral female (9.90 mm), male (2.78 mm) (MNHN-Ep 940).

Distribution: Java, Indonesia, ex *Plesionika ensis* (A. Milne Edwards) (Nierstrasz and Brender à Brandis 1923 [host unknown], Bourdon 1972); and Taiwan, ex *P. fimbriata* Chace (herein). Depth = ca. 240~521 m (Indonesia) and 66~139 m (Taiwan).

Remarks: This species was redescribed by Bourdon (1972), but some illustrations are provided for comparative purposes (Fig. 1A-I). Note that the fusion of the head with the 1st pereomere is variable in males (Fig. 1B, D, F, G), and that females can be either dextral or sinistral (Fig. 1A, C). The host is new for this species, but congeneric with the previous record. The only identified host was reported by Bourdon (1972); Nierstrasz and Brender à Brandis (1923) did not know the identity of the hosts of the syntypes. The species was previously only known from specimens collected in the Java Sea. Several of the Taiwanese hosts have badly broken rostrums and are not identifiable beyond the genus level (Crosnier, pers. commun.).

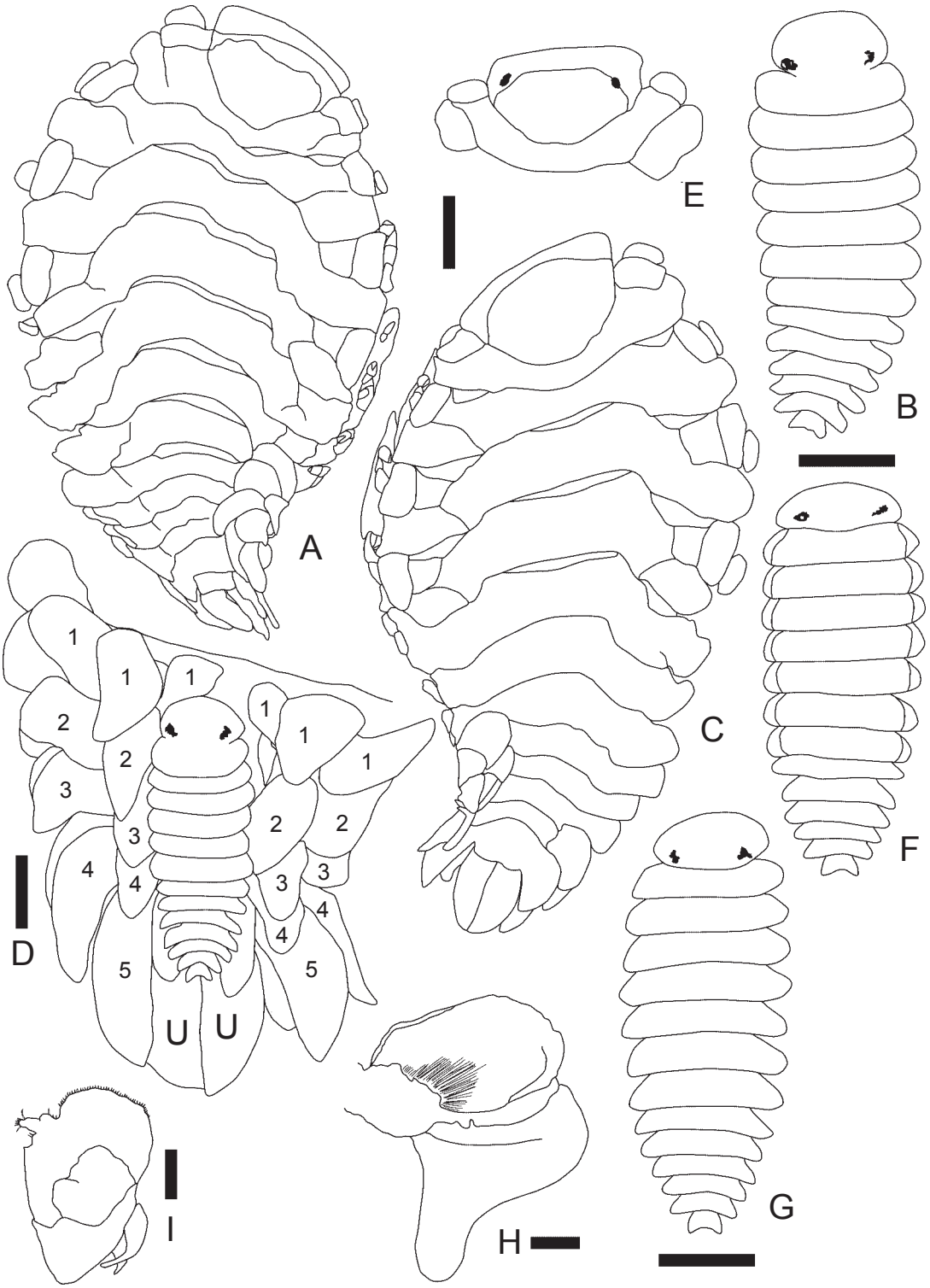

Fig. 1. *Pseudione tattersalli* Nierstrasz and Brender à Brandis, 1923. (a) Female 10.5 mm, dorsal view; (b) male, 3.00 mm, dorsal view (MNHN-Ep 938); (c) female, 11.10 mm, dorsal view; (d) ventral view of pleon with 2.63 mm male in situ; (e) female, 11.40 mm, dorsal view of head and pereomere I (MNHN-Ep 939); (f) male, 2.78 mm, dorsal view; (g) male, 3.00 mm, dorsal view; (h) female, 12.60 mm, left oostegite, internal view; (i) left maxilliped. Numbers, pleopods and lateral plates; U, uropods. Scale bars = 1.5 mm (a, c, e) and 0.75 mm (b, d, f-i).

Genus Aporobopyrus Nobili, 1906 *Aporobopyrus retrorsa* (Richardson, 1910) comb. nov.

(Figs. 2-4)

Pseudione retrorsa Richardson, 1910: 37-38, fig. 35; Nierstrasz and Brender à Brandis 1923: 78 (list); Shiino 1958: 35 (comparison with *P. lenticeps*).

Pseudione lenticeps Shiino, 1958: 34-35, fig. 3; Shiino 1972: 7 (list) (new synonymy).

Aporobopyrus lenticeps, Adkison 1988: 579; Saito et al. 2000: 35 (list).

Materials examined: Taiwan. Taiwan 2001

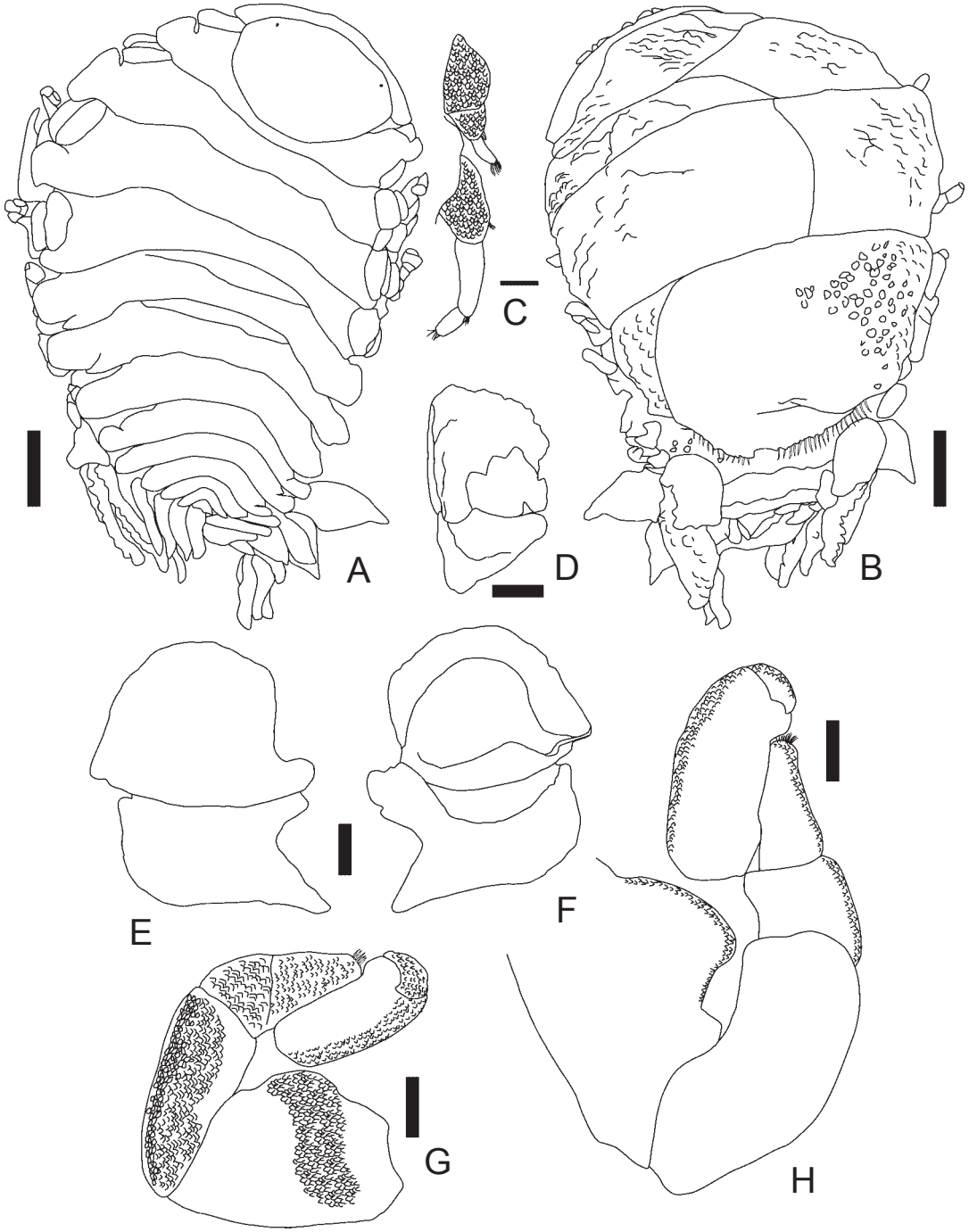

Fig. 2. *Aporobopyrus retrorsa* (Richardson, 1910), female, 9.00 mm. (a) Dorsal view; (b) ventral view; (c) left antenna and antennule; (d) left maxilliped, outer view; (e) left oostegite I, outer surface; (f) left oostegite I, inner surface; (g) left pereopod I; (h) left pereopod VII (MNHN-Ep 947). Scale bars = 1.5 mm (a, b), 0.1 mm (c), 0.75 mm (d-f), and 0.2 mm (g, h).

(Bouchet, Richer de Forges, and Chan) stn. CP 93, NE coast of Taiwan, 24°50.1'N, 121°55.7'E, 66~110 m, 10 May 2001, in right branchial chamber of female *Munida japonica* Stimpson (13.50 mm CL): brooding dextral female (5.70 mm), male (2.70 mm) (MNHN-Ep 948). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 102, NE coast of Taiwan, 24°48.4'N, 122°08'E, 326~331 m, 19 May 2001, in left branchial chamber of female *Munida compressa* Baba (20.70 mm CL): brooding sinistral female (9.00 mm), male (6.68 mm) (MNHN-Ep 947).

The Philippines. MUSORSTOM I stn. 10, 13° 59.8'~14° 00.2'N, 120° 18.2'~120° 20.3'E, 187~205 m, 19 Mar. 1976, in left branchial chamber of "*Paramunida scabra* (Henderson)" (host not in vial): sinistral non-brooding female (6.90 mm) (MNHN-Ep 953). – MUSORSTOM I stn. 11, 13° 59.8'~14°00.9'N, 120°21.5'~120°23.7'E, 217-230 m, 20 Mar. 1976, in right branchial chamber of "*Paramunida scabra*" (host not in vial): dextral brooding female (10.13 mm), male (5.40 mm) (MNHN-Ep 949). – MUSORSTOM I stn. 25, 14°02.0'~14°02.7'N, 120°18.0'~120°20.3'E, 191~ 200 m, 22 Mar. 1976, in right branchial chamber of "*Paramunida scabra*" (host not in vial): dextral brooding female (5.33 mm), male (3.08 mm) (MNHN-Ep 955); in left branchial chamber of "*Paramunida scabra*" (host not in vial): sinistral non-brooding immature female (8.40 mm), male (3.90 mm) (MNHN-Ep 963). – MUSORSTOM I stn. 26, 13°59.5'~14°00.9'N, 120°16.8'~120°18.2'E, 189 m, 22 Mar. 1976, in left branchial chamber of male *Paramunida scabra* (13.50 mm CL): sinistral non-brooding female (6.75 mm) (MNHN-Ep 960); in right branchial chamber of female *Paramunida scabra* (12.30 mm CL): dextral brooding female (8.29 mm), male (4.13 mm) (MNHN-Ep 961). –MUSORSTOM I stn. 34, 13°59.2'~14°01.0'N, 120°15.8'~120°18.8'E, 188~191 m, 23 Mar. 1976, in left branchial chamber of female *Paramunida scabra* (13.50 mm CL): sinistral brooding female (7.80 mm), male (2.18 mm) (MNHN-Ep 954); in right branchial chamber of female *Paramunida*

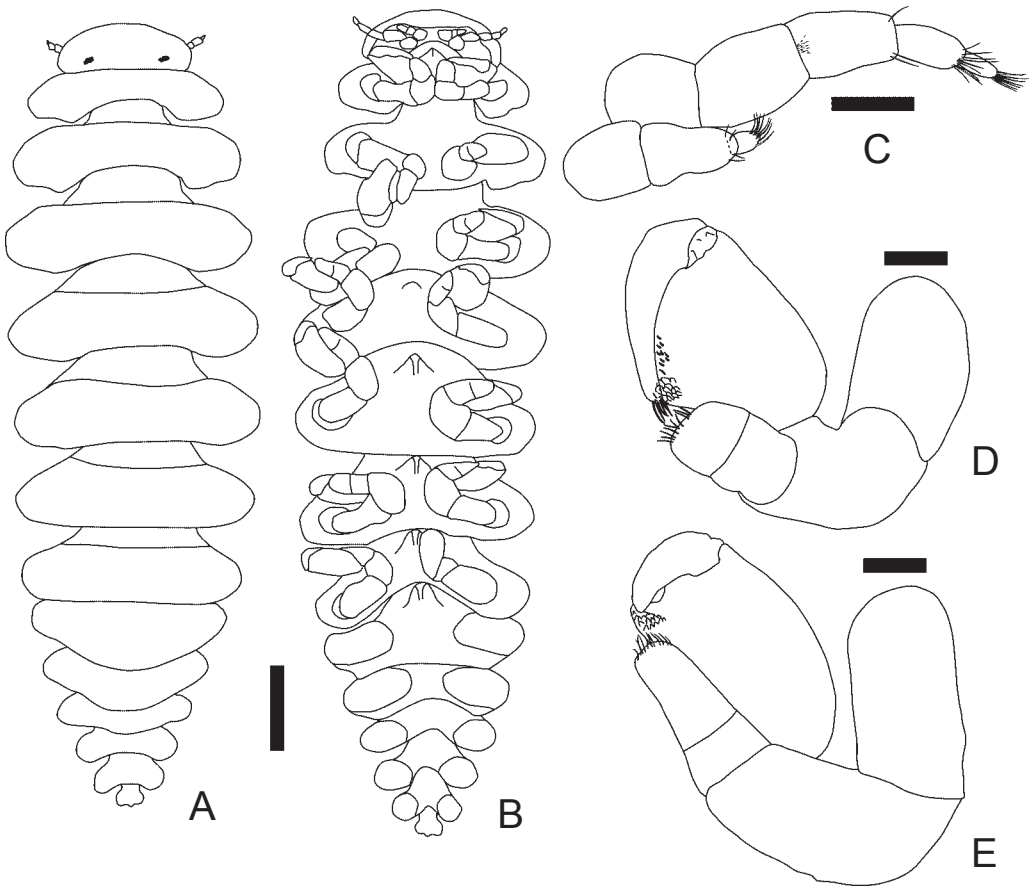

Fig. 3. *Aporobopyrus retrorsa* (Richardson, 1910), male, 6.68 mm. (a) Dorsal view; (b) ventral view; (c) right antenna and antennule; (d) left pereopod I; (e) left pereopod VII (MNHN-Ep 947). Scale bars = 0.75 mm (a, b) and 0.1 mm (c-e).

scabra (10.05 mm CL): dextral *Cabirops*-infested female (5.03 mm) (MNHN-Ep 958); in right branchial chamber of male *Paramunida scabra* (11.55 mm CL): dextral non-brooding female (6.75 mm), male (3.15 mm) (MNHN-Ep 959); in right branchial chamber of female *Paramunida scabra* (13.58 mm CL): dextral non-brooding female (9.41 mm), 2 cryptoniscid males (1.43 and 1.58 mm) (MNHN-Ep 950); in left branchial chamber of female *Paramunida scabra* (9.60 mm CL): sinistral brooding female (3.86 mm) (MNHN-Ep 952); in left branchial chamber of "*Paramunida scabra*" (host not in vial): sinistral non-brooding female (7.50 mm), male (4.13 mm) (MNHN-Ep 957); in left branchial chamber of "*Paramunida scabra*" (host not in vial): sinistral non-brooding female (5.55 mm) (MNHN-Ep 962). – MUSORSTOM II stn. 40, 13°57.4'~13°58.3'N, 120°27.8'~120°29.4'E, 265~287 m, 24 Mar. 1976, in right branchial chamber of "*Paramunida scabra*" (host not in vial): dextral non-brooding female (4.54 mm), male (2.63 mm) (MNHN-Ep 964). – MUSORSTOM II stn. 61, 13°59.7'~14°02.2'N, 120°16.8'~120°18.1'E, 184~202 m, 27 Mar. 1976, in left branchial chamber of "*Paramunida scabra*" (host not in vial): sinistral non-brooding female (8.1 mm) with 10

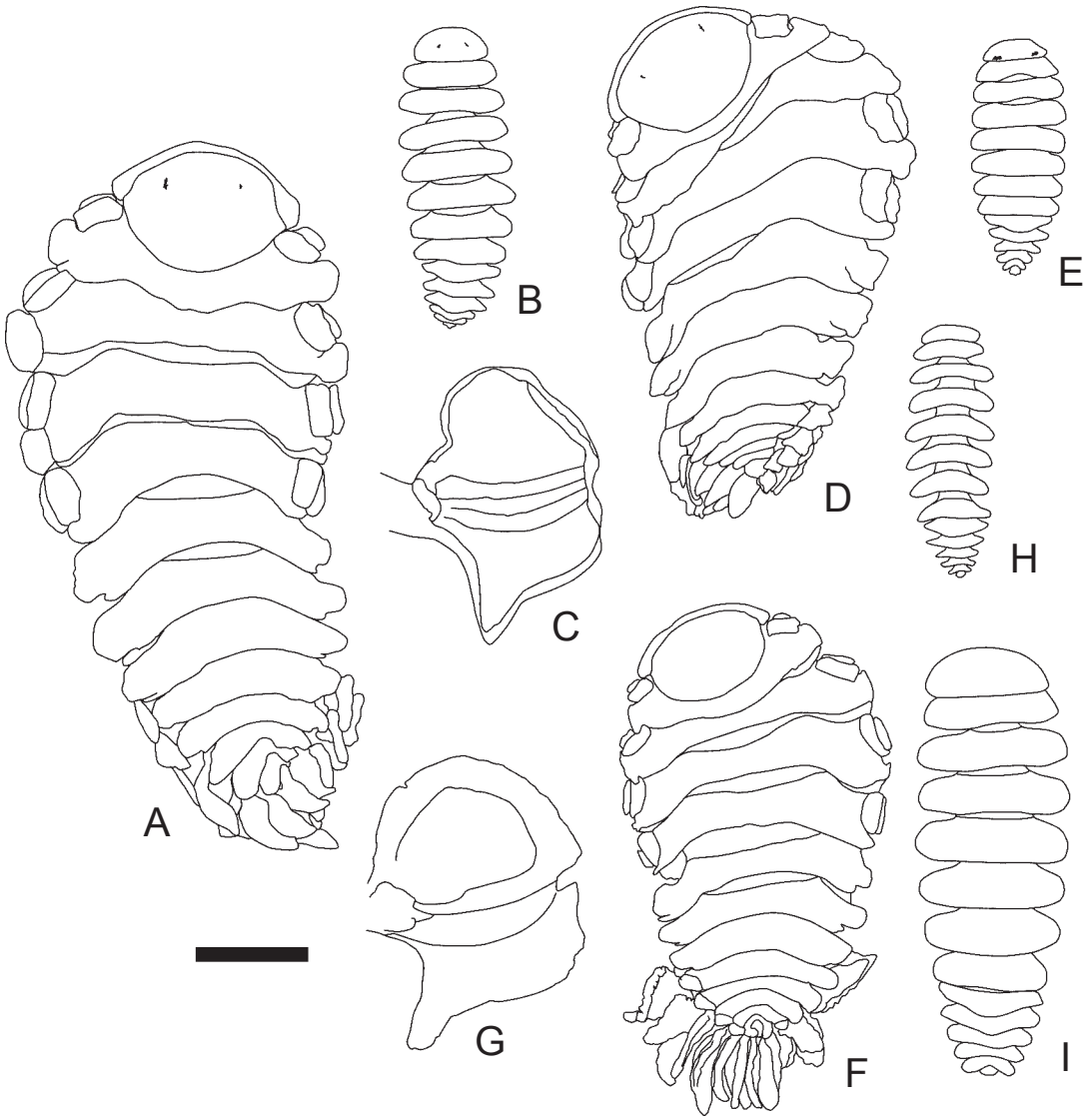

Fig. 4. *Aporobopyrus retrorsa* (Richardson, 1910). (a) Female, 7.65 mm, dorsal view; (b) male, 3.15 mm (MNHN-Ep 956); (c) female, 6.75 mm, oostegite I, inner view (MNHN-Ep 960); (d) female, 5.70 mm, dorsal view; (e) male, 2.70 mm, dorsal view (MNHN-Ep 948); (f) female, 10.13 mm, dorsal view; (g) female, 10.13 mm, oostegite I, inner view (MNHN-Ep 949); (h) male, 3.08 mm, dorsal view (MNHN-Ep 955) (i) male, 2.63 mm, dorsal view (MNHN-Ep 964). Scale bar = 1.5 mm (a-h) and 0.75 mm (i).

male *Cabirops* sp. in marsupium (MNHN-Ep 951). –MUSORSTOM II stn. 63, 14°00.5'~14°0.8'N, 120°15.8'~120°16.3'E, 191~195 m, 27 Mar. 1976, in left branchial chamber of *Paramunida scabra* (host not in vial): sinistral brooding female (7.65 mm), male (3.15 mm) (MNHN-Ep 956).

Description: Female (Fig. 2), based on MNHN-Ep 947. Body length 9.00 mm, maximal width 6.51 mm, head length 2.24 mm, head width 3.03 mm. Pereon deflexed with left side longer and with structures (e.g., coxal plates and dorsolateral bosses) slightly more developed (Fig. 2A). All body regions and pereomeres distinctly segmented.

Head broader than long, strongly produced with frontal lamina equal to approximately 1/10 length of head (Fig. 2A), deeply imbedded medially in pereomere I. Eyes present, minute. Antennae and antennules of 3 articles each (Fig. 2C), with scales on basal segments. Maxilliped (Fig. 2D) with short subacute spur; palp lacking, distolateral margin irregular and crenulated, margins nonsetose. First oostegite proximal lobe helmet-shaped with stout, rounded, proximoventral projection, distal lobe produced and rounded with acute, proximoventrally directed projection, internal ridge with 1 large smooth lobe (Fig. 2E, F).

Pereon composed of 7 pereomeres, broadest across pereomere III, gradually tapering anteriorly and posteriorly; pereomere I with straight posterior margin, II~VII with increasingly concave posterior margins. Pereomeres I~IV strongly bilobed laterally, V and VI weakly bilobed, VII entire. Coxal plates thin, short lobes on pereomeres I~IV, clearly separated from pereomeres. Dorsolateral bosses on pereopods I~IV narrow, oblong, and clearly demarcated with longer side slightly more developed. Tergal projections lacking. Oostegites enclosing marsupium, surfaces faintly crenulated laterally with tubercles on oostegite V. All pereopods with scales on margins of dactylus, propodus, carpus, merus, and projecting lobe of basis; posterior pereopods larger and with more-elongate propodus (Fig. 2G, H). First pair of pereopods surrounding head region, others evenly spaced.

Pleon with 5 distinct pleomeres plus pleotelson; posterior margins of all pleomeres concave (Fig. 2A). Pleomeres I~V with medially broad, distally tapering, biramous pleopods and very short uniramous lateral plates (Fig. 2A); endopodites much smaller than exopodites and posterior pairs slightly smaller and considerably narrower than anterior ones; edges and surfaces of lateral plates smooth, those of pleopods crenulate with tubercles; pleotelson short, with distomedial indentation, uropods approximately as long as pleopod V exopodites.

Male (Fig. 3), based on MNHN-Ep 947. Length 6.68 mm, maximal width 2.12 mm, head length 0.38 mm, head width 1.14 mm, pleon length 1.74 mm. No detectable pigmentation.

Head broadly ovate, widest posteriorly, distinct from 1st segment of pereon (Fig. 3A). Eyes present, moderate size. Antenna of 5 articles, distally setose, extending beyond margin of cephalon; antennules of 3 articles, distally setose (Fig. 3C).

Pereomere IV broadest, pereomeres gradually tapering anteriorly and posteriorly. Pereomeres I and II directed slightly posterolaterally, III~VII directed laterally, distolateral margins of all pereomeres rounded. Pereopods (Fig. 3D, E) I and II with shorter propodi and longer and sharper dactyli than other pereopods, all articles distinctly separated, palm of propodus with low granules and setae, distoventral tip of carpus with tuft of setae, carpus in posterior pereopods more elongate. Midventral tubercles present on pereomeres IV~VII, triangular and subacute on V~VII.

Pleon with 5 segments plus pleotelson. Pleomeres I and II directed laterally with dorsal bulge, pleomeres III directed laterally with faint dorsal bulge, pleomeres IV and V directed posterolaterally, no dorsal bulge, distolateral margins rounded. Pleotelson short, with small lateral lobes and distomedial projection (anal cone). Midventral tubercle present on pleomere I, triangular and subacute. Pleopods present as erect ovate structures laterally; uropods lacking.

Distribution: Philippines, ex "galatheid" [= *Munida andamanica* Alcock fide K. Baba via R. Bourdon] (Richardson 1910), *Paramunida scabra* (Henderson) (herein); Japan, ex *Munida heteracantha* Ortmann (Shiino 1958, Shiino 1972); and Taiwan, ex *Munida japonica* Stimpson and *M. compressa* Baba (herein). Depth = 184~514 m (the Philippines), 50 m (Japan), and 66~331 m (Taiwan).

Remarks: This species has never been reported subsequent to the original description by Richardson (1910) based on a syntypic Philippine pair obtained from a specimen of *Munida andamanica* (listed by Richardson 1910 only as a "galatheid" but subsequently identified to species by K. Baba). The Taiwanese specimens therefore represent both geographic and depth range extensions, as well as 2 new hosts for the species. Several lots of *P. retrorsa* from the Philippines are also reported for the 1st time herein, from an addi-

tional new host. There is considerable variation in the overall shape of the males and females. The females can be elongate or rather compact (Fig. 4A vs. 4D, F) and the same is true of the males, but this may be only an artifact of preservation (Fig. 4B, H vs. 4E). As all other characters of these specimens are very similar, including the oostegite I shape (Fig. 4C, G), this variation in shape may be related to the size and shape of the host's branchial cavity and is considered intraspecific. Richardson (1910) indicated that the male lacked pleopods, but this is incorrect as they are present, albeit as low elongate lobes.

Pseudione lenticeps Shiino, 1958, was distinguished from *P. retrorsa* by the "much smaller pleopoda and uropods" of the female and by the male having "thoracic segments... contiguous at least on the midline and the proportional size of abdomen to the body" which was said to be smaller (Shiino 1958: 34-35). In fact, the pleopods and uropods are not smaller in *P. lenticeps* than in *P. retrorsa*, they only appear that way when compared to Richardson's (1910) rather diagrammatic illustration, and they have essentially identical shapes in both type females. The male of *P. lenticeps* only differs from that of *P. retrorsa* in that the segments are tightly bunched together, as seen in one of the Taiwanese males (Fig. 4E) and several Philippine males. The male of *P. retrorsa* illustrated by Richardson (1910) shows elongated segments, as does the other Taiwanese male (Fig. 3A) and several Philippine males (Fig. 4B). Both the "short-form" and "long-form" males show dorsally inflated pleomeres I and II, but Richardson (1910) neglected to illustrate this adequately. *Pseudione lenticeps* is herein considered a synonym of *P. retrorsa*.

Adkison (1988) transferred *P. lenticeps*, along with 3 other species, to the genus *Aporobopyrus* based primarily on their shared possession of small dorsolateral bosses, reduced to absent pleonal lateral plates, and pleopods visible in dorsal view. He did not consider *P. retrorsa*, but this species also possesses these same characteristics and is, in fact, the senior synonym of *P. lenticeps*. Accordingly, *P. retrorsa* is herein transferred from *Pseudione* to *Aporobopyrus*.

Ovoionella gen. nov.

Parioninella, Shiino 1958: 43 (not *Parioninella* Nierstrasz and Brender à Brandis 1930).

Aporobopyrosa Shiino, 1942: 441-442 (in part) (not *Aporobopyrosa* Shiino 1942 = *Parioninella* Nierstrasz and Brender à Brandis 1930).

Type species: *Parioninella obovata* Shiino, 1958.

Etymology: From the Latin *ovalis*, egg-shaped, for the shape of the male, combined with *ionella*, a common suffix in the Bopyridae. The gender is feminine.

Diagnosis: Female, 1 side of pereon only slightly longer than other; head broad, strongly produced with strong anterior lamina having lateral tapered projections. Maxilliped with short subacute spur; palp triangular, produced and non-articulating. First oostegite proximally helmet-shaped, distal lobe subrectangular with deep ventral indentation, tapering and rounded, internally with several stout lobes. Pereon composed of 7 pereomeres, broadest across pereomere III. Coxal plates well developed on both sides, all elongate. Dorsolateral bosses well developed. First 3 pereomeres with tergal projections. Oostegites nearly completely enclosing marsupium. Basis of all pereopods bearing pronounced rounded medial boss. Pleon with 5 pleomeres plus pleotelson; pleomeres I~V with biramous pleopods and uniramous, rounded, lateral plates; posterior lateral plates becoming progressively concave; edges and surfaces of all lateral plates smooth; pleopodal exopodites and endopodites smooth, uropods lacking.

Male head oblong, distinct from 1st segment of pereon. Body shape ovate; pereomere IV broadest; 1st 4 pereomeres directed slightly anterolaterally, 5th laterally directed, last 2 directed slightly posterolaterally. Pereopods all subequal. Pleon with 4 segments; last one with indication of fusion laterally and tapered pleotelson tip. Midventral tubercles on all pereomeres, pleopods as very low swellings, uropods lacking.

Systematic position: This genus is morphologically similar to both *Parioninella* Nierstrasz and Brender à Brandis, 1930, and *Anuropodione* Bourdon, 1967, in that the females of all 3 genera have well-developed frontal laminae, dorsolateral bosses, and large, elongate coxal plates (Bourdon 1967 1976, Markham 1974). Females of *Parioninella* are notably less elongate than those of either *Anuropodione* or *Ovoionella*, and have pereomeres that are weakly concave medially, poorly developed lateral plates on the pleon, and uniramous uropods; while females of *Ovoionella* and *Anuropodione* are more elongate, have strongly medially concave pereomeres and well-developed lateral plates, and lack uropods. Females of *Anuropodione* are morphologically similar to *Ovoionella* but lack the lateral projections of

the frontal lamina and have more laterally distinct and tapered lateral plates on the pleomeres. Males of these genera show more-obvious differences than the females in that males of *Parioninella* and *Ovoionella* typically have only 4 pleonal segments with low ovate pleopods and no uropods, while males of *Anuropodione* have 1 pleonal segment lacking both pleopods and uropods. Males of *Parioninella* are elongate, have a nearly circular head, laterally tapered and separated pereomeres and pleomeres, and a broadly rounded pleotelson tip, while those of *Ovoionella* have an oblong head, laterally rounded and contiguous pereomeres and pleomeres, and a tapered pleotelson tip. Males of *Ovoionella* have a round body shape and have midventral tubercles on the pereomeres and 4 pleomeres with low uropods on the anterior 3 segments, while males of *Anuropodione* are elongate in body shape, lack midventral tubercles, and have a single fused pleomere lacking uropods. The only other genus in the Pseudioninae with females that lack uropods is *Kolurione* Markham, 1978, but females of *Kolurione* have only 5 pleomeres. Males of *Kolurione* have all pleomeres fused into a single segment, as found in males of *Anuropodione*. Although males of *Ovoionella* are quite distinctive, females of *Ovoionella* and *Anuropodione* are more similar than those of any other genus, and the 2 genera are likely closely related.

Ovoionella obovata **(Shiino, 1958) comb. nov.**
(Figs. 5, 6)

"[An] undeterminable male" Shiino, 1936a: 13-14, fig. 5.
"[A] male with 3 abdominal segments" Shiino, 1942: 441-442.
Parioninella obovata Shiino, 1958: 43-45, pl. 3, fig. 4 [sic for fig. 2]; Bourdon 1967: 111 (comparison to *Anuropodione*); Shiino 1972: 8 (list); Bourdon 1976: 224 (discussion of generic placement); Saito et al. 2000: 36 (list).

Materials examined: Taiwan. Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 116, NE coast of Taiwan, 24°55'N, 122°00.4'E, 100 m, 21 May 2001, in left branchial chamber of male *Munida japonica* Stimpson (19.50 mm CL): non-brooding sinistral female (5.40 mm), male (1.73 mm) (MNHN-Ep 946).

Description: Female (Fig. 5). Body length 5.40 mm, maximal width 4.02 mm, head length 1.41 mm, head width 1.39 mm. Pereon deflexed with right side longer but with subequal development of all structures (Fig. 5A). All body regions and pereomeres distinctly segmented.

Head length and width subequal, strongly produced with frontal lamina equal to approximately 1/10 length of head (Fig. 5A), deeply imbedded medially in pereomere I; barbula (Fig. 5C) with 2 small pairs of subequal, unadorned, lateral projections. Eyes lacking. Antennae and antennules of 3 articles each, basal article short and stout, medial article of approximately 1/3 width, distal article minute (Fig. 5D). Maxilliped (Fig. 5E) with short subacute spur; palp triangular and produced, not articulated, distolateral margin gently rounded and produced, margin with numerous non-setose papillae. First oostegite proximal lobe helmet-shaped, dorsolaterally swept back, distal lobe subrectangular with deep ventral indentation, internal ridge with 5 stout lobes proximally (Fig. 5F, G).

Pereon composed of 7 pereomeres, broadest across pereomeres III and IV, gradually tapering anteriorly and posteriorly; pereomere I with convex posterior margin, II~VII with concave posterior margins. Coxal plates as thin, elongate lobes on pereomeres I~IV, clearly separated from pereomeres. Dorsolateral bosses on pereopods I~IV large, oblong, and clearly demarcated with left and right sides subequal. Lateral lobes on pereomeres V~VII similar in shape to coxal plates of I~IV, not medially demarcated but curled. Tergal projections poorly developed. Oostegites enclosing marsupium. Posterior pereopods larger (Figs. 5H, I), margin of carpus with area of scales and distal tip with patch of setae, dorsodistal margin of propodus with short setae, basis with large lobe. First pair of pereopods surrounding head region, others evenly spaced.

Pleon with 5 distinct pleomeres plus pleotelson; posterior margins of all pleomeres concave (Fig. 5A). Pleomeres I~V with irregularly ovate, biramous pleopods and short, broad, uniramous lateral plates (Figs. 5B); endopodites only slightly smaller than exopodites and posterior pairs slightly smaller than anterior ones; edges and surfaces of lateral plates and pleopods smooth; pleotelson thin, elongate, uropods lacking (Fig. 5J).

Male (Fig. 6). Length 3.63 mm, maximal width 2.11 mm, head length 0.47 mm, head width 1.12 mm, pleon length 0.92 mm.

Head broadly ovate, widest posteriorly, distinct from 1st segment of pereon (Fig. 6A). Eyes present, minute. Antennae of 3 articles, distal two distally setose, extending beyond margin of cephalon; antennules of 3 articles, proximal article with dorsal lobe bearing 2 stout setae (Fig. 6C), distal two distally setose.

Pereomeres IV and V broadest, gradually tapering anteriorly and posteriorly. Pereomere I

directed slightly anterolaterally, II~VII directed laterally, distolateral margins of all pereomeres rounded. No detectable pigmentation. Pereopods (Fig. 6D, E) subequal, all articles distinctly separated, distoventral tip of carpus with scales and tuft of setae. Midventral tubercles lacking.

Pleon with 3 segments plus pleotelson. Pleomere I directed laterally, pleomeres II and III directed slightly posterolaterally, distolateral margins rounded. Pleotelson composed of fused pleomeres IV, V, and VI with indistinct segmentation indentation near anterior margin, anal cone present. Midventral tubercles lacking. Pleopods present laterally as low ovate lobes; uropods lacking (Fig. 6B).

Distribution: Japan and Taiwan on *Munida japonica* Stimpson (Shiino 1936a 1958 1972, herein). Depth = 100 m (Taiwan); depth of Japanese specimens unknown.

Remarks: Shiino (1936a) described and fig-

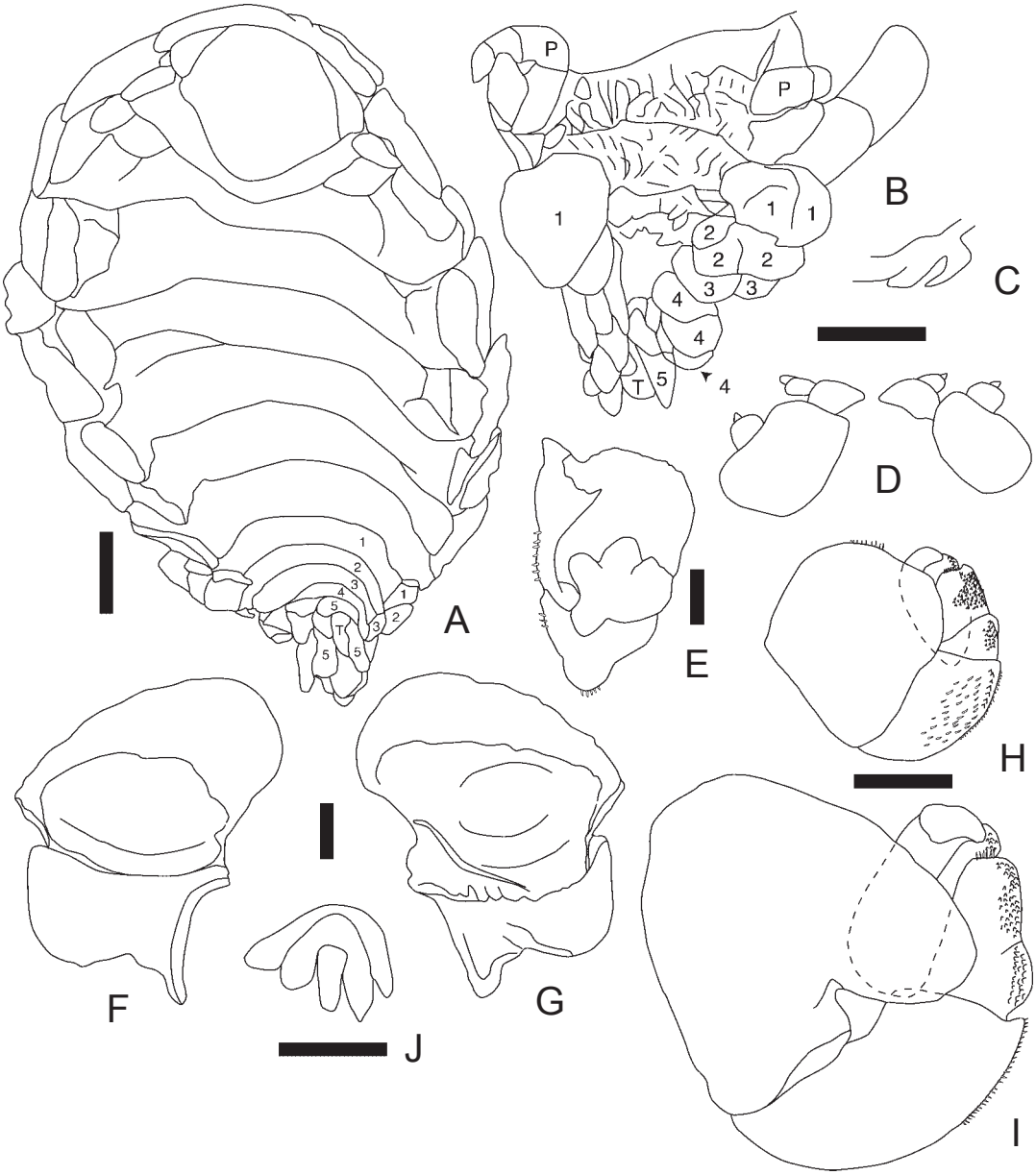

Fig. 5. *Ovoionella obovata* (Shiino, 1958) comb. nov., female, 5.40 mm. (a) Dorsal view; (b) pleon, ventral view; (c) left barbula; (d) antennae and antennules; (e) left maxilliped, outer view; (f) left oostegite I, outer surface; (g) left oostegite I, inner surface; (h) right pereopod I; (i) left pereopod VII; (j) pleomeres IV and V plus pleotelson (MNHN-Ep 946). Numbers, pleomeres, lateral plates, and pleopods; P, pereopods; T, pleotelson. Scale bars = 0.75 mm (a-c, j), 0.375 mm, and (d-g), 0.2 mm (h, i).

ured a male extracted from *Munida japonica* Stimpson collected from Nagasaki, Japan, and indicated his belief that it might represent a new genus, but as the female was lacking, he deferred its generic assignment. Shiino (1942) also described a new genus and species, *Aporobopyrosa pacifica*, from a porcelain crab collected at Palau, and assigned the Japanese "undeterminable" male to this new genus, but without specific assignment. Still later, Shiino (1958) described a new species, *obovata*, which he referred to *Parioninella* Nierstrasz and Brender a Brandis, 1930, "with some doubt" as the female lacked uropods. Bourdon (1976) recognized that *Aporobopyrosa* was synonymous with *Parioninella*, but maintained the 2 taxa (*astridae* Nierstrasz and Brender à Brandis, 1930, and *pacifica*) as distinct from each other. Bourdon (1976) did not comment on the "undeterminable male" of Shiino (1936a) but did note that there was some question as to whether *obovata* belonged in *Parioninella* although he provided no reasons why he believed this to be so.

Discovery of a 2nd pair of specimens referable to *Parioninella obovata* collected in Taiwan allows the characteristics of the species as given by Shiino (1958) to be verified; the host for these specimens was also *Munida japonica*. There was

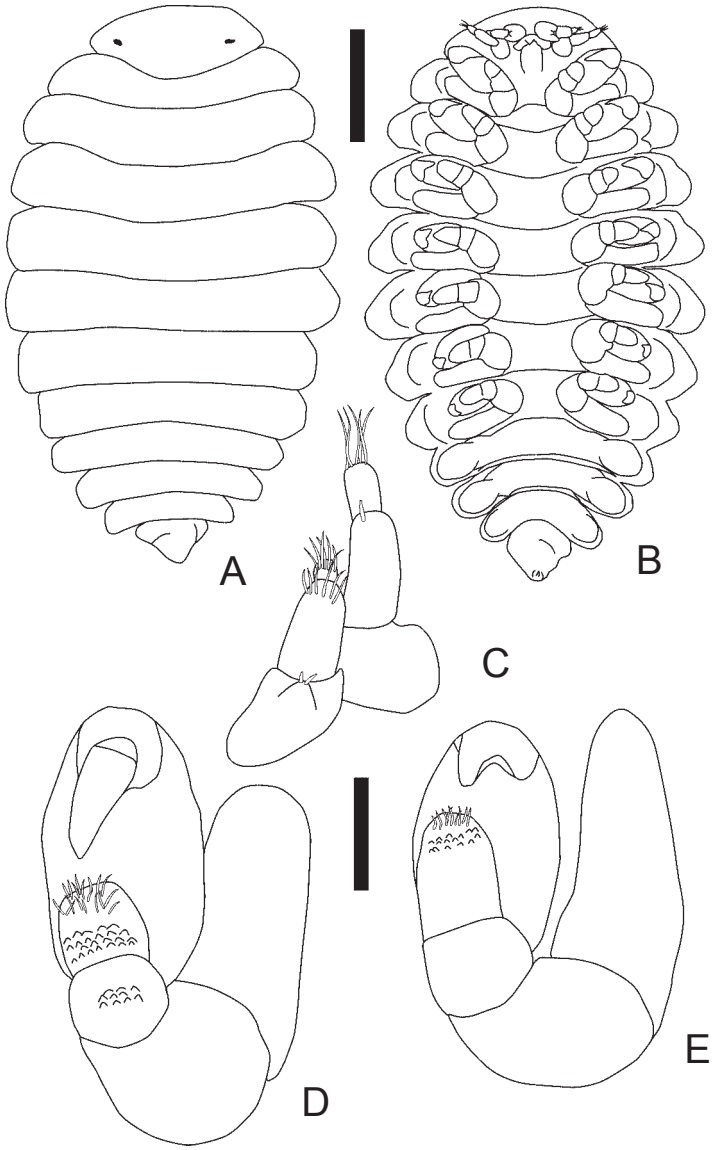

Fig. 6. *Ovoionella obovata* (Shiino, 1958) comb. nov., male, 1.73 mm. (a) Dorsal view; (b) ventral view; (c) left antenna and antennule; (d) left pereopod I; (e) left pereopod VII (MNHN-Ep 946). Scale bars = 0.375 mm (a, b) and 0.01 mm (c-e).

little variation noted in these new specimens as compared to the types, although the pleotelson of the female is more slender. The Taiwanese male has 4 segments with lateral indentations showing fusion of the 4th and 5th segments into a single unit, as is seen in the illustrations of the Japanese male by Shiino (1958). Comparison of the illustrations of Shiino (1936a) and Shiino (1958) with the Taiwanese specimen shows that the "undeterminable male" of Shiino (1936a) is a specimen of *Ovoionella obovata* with fusion of the last 3 pleomeres into essentially a single unit, as can be seen from the 2 lateral undulations on each side of that specimen (Shiino 1936a: fig. 5). However, neither the male of Shiino (1936a) nor the other specimens of *obovata* can be referred to *Parioninella*, as discussed above under *Ovoionella*. The female agrees with the holotype in all aspects while the male differs from the allotype only in the absence of midventral tubercles, which appears to be a much more variable character than considered by other authors (e.g., Shiino 1934: fig. 8F vs. Shiino 1939: fig. 13A, for *Portunicepon goetici* Shiino, 1934 [= *Megacepon goetici* fide Boyko 2003], Boyko, pers. obs.).

Subfamily Orbioninae Codreanu, 1967
Genus *Minicopenaeon* Bourdon, 1981
***Minicopenaeon crosnieri* (Bourdon, 1979)**
(Fig. 7)

Parapenaeon crosnieri Bourdon, 1979: 486-488, figs. 8-10.
Minicopenaeon crosnieri, Bourdon 1981: 256, fig. 16.

Materials Examined: Taiwan. Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CC 66, NE coast of Taiwan, 24°53.6'N, 122°03.1'E, 546 m, 5 May 2001, in left branchial chamber of female *Metapenaeopsis provocatoria longirostris* Crosnier (34.20 mm CL): brooding sinistral female (11.70 mm), male (3.98 mm) (MNHN-Ep 941).

Distribution: Madagascar, on *Metapenaeopsis scotti* Champion (Wood-Mason) [Bourdon 1979, as *M. andamanensis* (Wood-Mason)]; the Philippines, on *M. angusta* Crosnier (Bourdon 1981, as "*Metapenaeopsis* proche mais distinct de *M. andamanensis*"); and Taiwan, on *M. provocatoria longirostris* Crosnier (herein). Depth range from 160~210 m (Madagascar), 217~407 m (the Philippines), and 546 m (Taiwan).

Remarks: The female specimen (Fig. 7A)

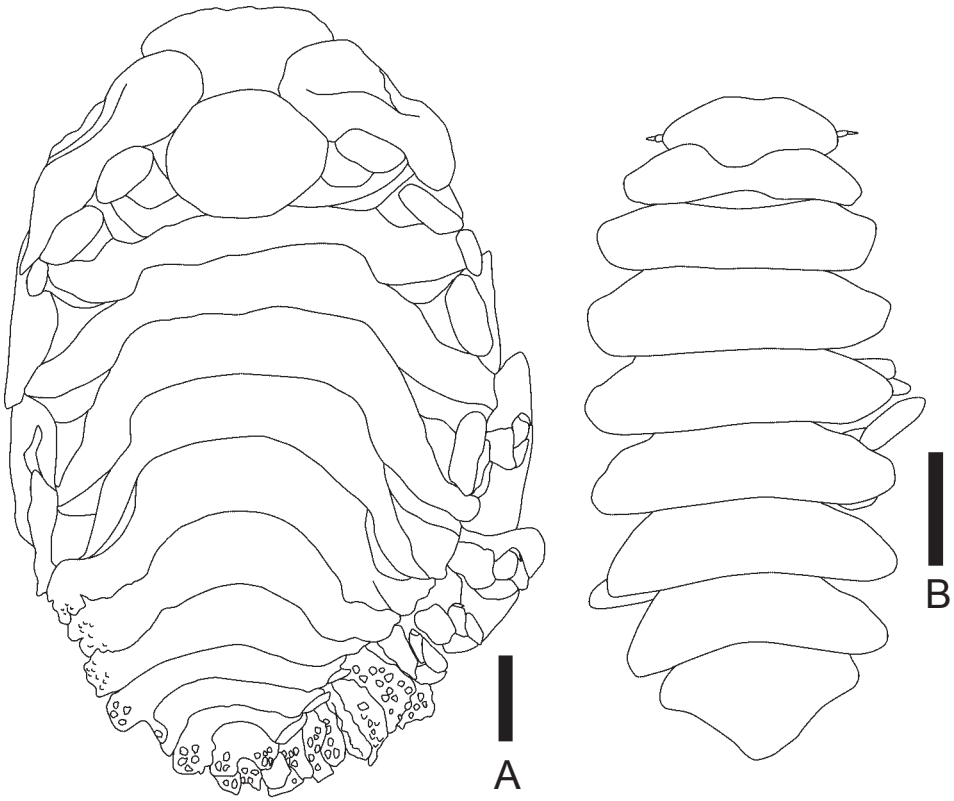

Fig. 7. *Minicopenaeon crosnieri* (Bourdon, 1979). (a) Female, 11.70 mm, dorsal view; (b) male, 3.98 mm, dorsal view (MNHN-Ep 941). Scale bars = 1.5 mm (a) and 0.75 mm (b).

shows the generic characteristic of the reduced coxal plate on the short side of the 2nd pereomere, and both specimens correspond well to the description of *M. crosnieri* given by Bourdon (1979 1981), except that there are a few small tubercles on the dorsal surface of the female's lateral plates as well as on the surfaces of the pleopods. The female resembles the one illustrated by Bourdon (1981) more than that of Bourdon (1979), although all appear conspecific. The male (Fig. 7B) shows no substantive differences from those previously reported.

The taxonomy of *Metapenaeopsis* has been revised since the original citations of this species by Bourdon (1979 1981), and the identities of the hosts are corrected herein (cf. Crosnier 1987). Although the host identifications of the Philippine material cited by Bourdon (1981) were changed to *M. angusta* on the specimen labels by Crosnier, the hosts are no longer with the parasites, and these identifications cannot be verified but are very likely correct (Crosnier, pers. commun.). Most of the hosts for the Madagascan material are in the vials with the parasites, and their identifications have been verified as *M. scotti*, a Malagasy endemic (Crosnier, pers. commun.).

Bourdon (1979) described this species from 23 females and 20 males collected off Madagascar. The catalog numbers of those specimens were not cited by Bourdon (1979), but are recorded in the MNHN catalog book for Epicaridea as MNHN-Ep 265~279 and 282~287. Bourdon (1979) selected a holotype female and allotype male, but none of the vials now in MNHN contains indication of a type selection, nor does the MNHN catalog book give any information in this regard. Two vials (MNHN-Ep 267 and 273) cannot be located in the collection, and it is possible that one of these 2 vials contains the holotype and allotype. However, given the lack of annotation as to the type status of any of these specimens in the MNHN catalog book, it is also possible that the holotype was never adequately labeled and is therefore not recognizable among the other type material. This matter must remain unresolved in the absence of the 2 missing vials.

Genus *Parapenaeon* Richardson, 1904
Parapenaeon tertium Nierstrasz and Brender à Brandis, 1932
(Figs. 8, 9)

Parapenaeon tertium Nierstrasz and Brender à Brandis, 1932: 93-94, figs. 5, 6; Bourdon 1979: 484 (discussion).

Materials examined: Taiwan. Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CC 66, NE coast of Taiwan, 24°53.6'N, 122°03.1'E, 546 m, 5 May 2001, in left branchial chamber of female *Metapenaeopsis provocatoria longirostris* Crosnier (19.20 mm CL, lacking rostrum): brooding sinistral female (12.15 mm), male (4.2 mm) (MNHN-Ep 942).

Description: Female (Fig. 8). Body length 12.15 mm, maximal width 8.76 mm, head length 3.37 mm, head width 2.50 mm. Pereon approximately straight and with subequally developed structures (e.g., coxal plates and dorsolateral bosses) (Fig. 8A). All body regions and pereomeres distinctly segmented.

Head slightly longer than wide, tapering posteriorly, strongly produced with frontal lamina equal to approximately 1/3 length of head (Fig. 8A) and crenulate along margin, strongly overlapping pereomere I medially; barbula (Fig. 8F) with 1 pair of lateral projections, margin of projections and posterior margin of head with numerous irregular lobes. Eyes lacking. Antennae and antennules of 4 articles each (Fig. 8C). Maxilliped (Fig. 8D) with short acute spur; palp lacking, distolateral margin produced into irregularly rounded lobe. First oostegite proximal lobe egg-shaped, distal lobe proximal 1/2 subtriangular and directed laterally, distal 1/2 subrectangular, both with rounded margins, internal ridge with numerous short, stout projections (Fig. 8E).

Pereon composed of 7 pereomeres, broadest across pereomere III, gradually tapering anteriorly and posteriorly; pereomeres I~VII with medially straight and laterally concave posterior margins. Coxal plates as large lobes on pereomeres I~IV, clearly separated from pereomeres and with crenulate edges; coxal plates on pereomeres I and II large, long and ovate with median acute projection on margin (some only as trace projections), coxal plates on III and IV long and ovate but thinner and without median acute point. Dorsolateral bosses on pereopods I~IV oblong and clearly demarcated with left and right sides subequal, much smaller than coxal plates. Pereomeres I~VII with partly demarcated tergal projections bearing low crenulations on 1 side. Pereomeres V~VII with expanded lateral lobes similar to lateral plates of pleomeres. Oostegites enclosing marsupium. Posterior pereopods larger and with more-elongate propodus (Fig. 8G, H), margins with area of scales, basis with projecting lobe, larger in posterior pairs. First pair of pereopods surrounding head, others evenly spaced.

Pleon with 5 distinct pleomeres plus pleotelson; posterior margins of all pleomeres concave (Fig. 8A). Pleomeres I~V with biramous pleopods and uniramous lateral plates (Figs. 8B); lateral plates of pleomere I~IV short and broad, those of V thin and elongate; posterior pleopods narrower; edges and surfaces of all lateral plates irregular but not tuberculate; edges and surfaces of pleopods strongly tuberculate; uropods uniramous, tuberculate, lamellar and subequal to posterior pleopods.

Male (Fig. 9). Length 4.20 mm, maximal width 1.87 mm, head length 0.44 mm, head width 1.03 mm, pleon length 0.73 mm.

Head ovate, widest posteriorly, with anterior medial indentation, distinct from 1st segment of pereon (Fig. 9A). Eyes lacking. Antennae of 6 articles distally setose, extending beyond margin of cephalon; antennules of 3 articles distally setose (Fig. 9C).

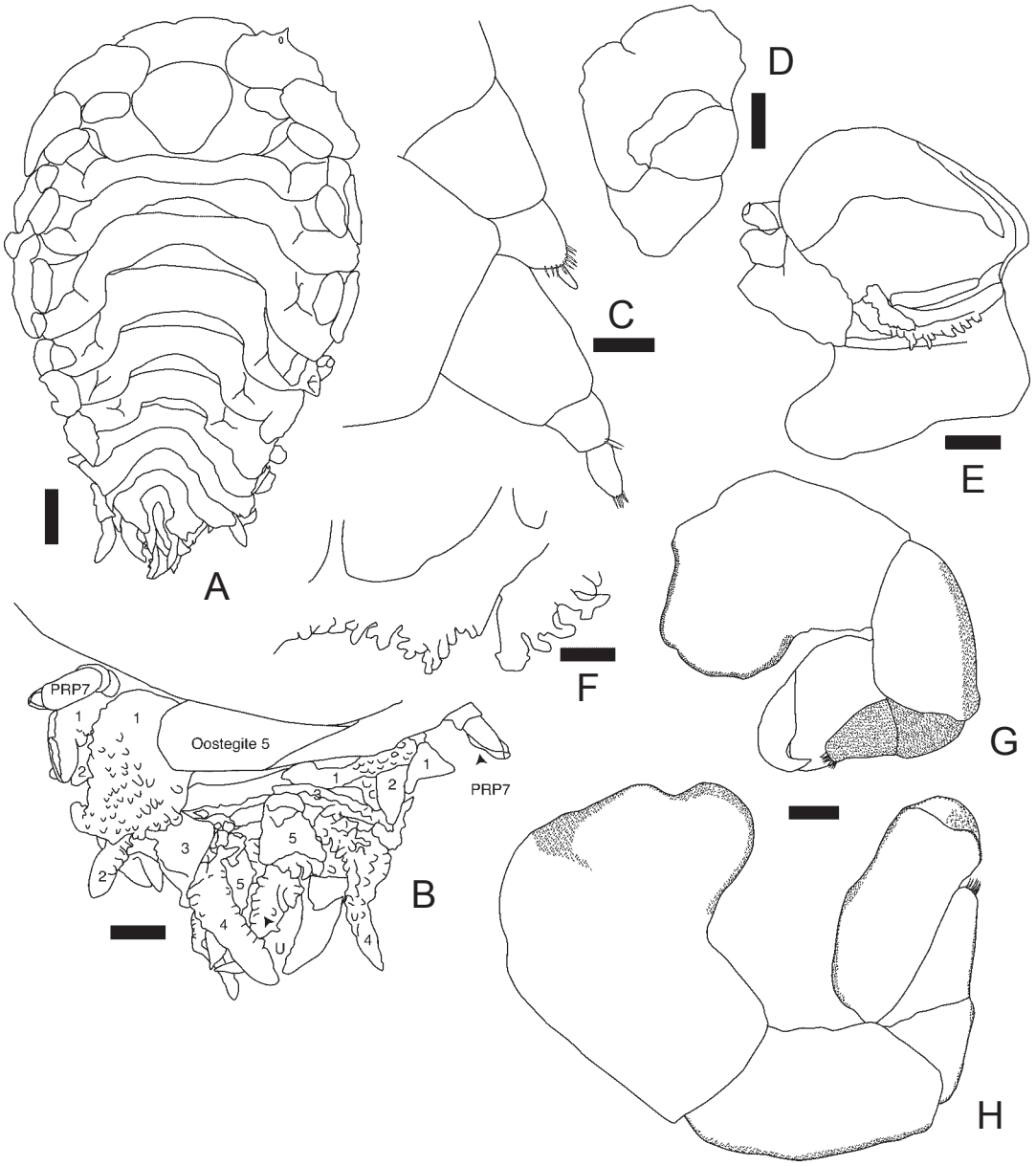

Fig. 8. *Parapenaeon tertium* Nierstrasz and Brender à Brandi, 1932, female, 12.15 mm. (a) Dorsal view; (b) ventral detail of abdomen; (c) left antenna and antennule; (d) left maxilliped, outer view; (e) left oostegite I, inner view; (f) barbula; (g) left pereopod I; (h) left pereopod VII (MNHN-Ep 942). Numbers, pleopods and lateral plates; PRP, pereopod. Scale bars = 1.5 mm (a), 0.75 mm (b, d, e), 0.1 mm (c), 0.375 mm (f), and 0.2 mm (g, h).

Pereomeres IV and V broadest, but pereomeres III~VII nearly subequal in width. Pereomeres directed laterally, distolateral margins of all pereomeres rounded. No detectable pigmentation. Pereopods (Fig. 9D, E) I and II with slightly larger propodi and longer and sharper dactyli than other pereopods, all articles distinctly separated in anterior pairs, posterior pairs with indistinct separation of carpi and meri, palm of propodus with low granules and setae, distoventral tip of carpus with distal tuft of setae.

Pleon with all segments and pleotelson fused; proximolateral margins convex, distolateral margins slightly concave, tip rounded. Midventral tubercles, pleopods and uropods lacking.

Distribution: Indonesia (Java Sea), on *Parapenaeus longipes* Alcock (Nierstrasz and Brender a Brandis 1923) and Taiwan, on *Metapenaeopsis provocatoria longirostris* Crosnier (herein). Depth range unknown (Indonesia) and 546 m (Taiwan).

Remarks: These specimens can be assigned to *Parapenaeon tertium*, previously known only from the female holotype, in that the female has acute median projections on the margins of the 1st 2 coxal plates on the short side, although the holotype has these projections on only the 1st coxal plate of the short side and on the 1st two on the long side. The oostegite of the Taiwanese female is also identical to that of the holotype and quite different from those of other *Parapenaeon* species. The chief difference between the Indonesian and Taiwanese specimens is that the female from Taiwan has somewhat less developed lateral plates on the pleomeres. The male was previously unknown and is described for the 1st time herein.

This species appears very close to *P. coarctatum* Bourdon, 1981, in overall head and body shape, but differs from that species by the development of the coxal plates on the long side of the body (all well developed in *P. coarctatum*) and the very different shape of oostegite I. The development of the lateral plates of the pleomeres in *P. coarctatum* is intermediate between that of the holotype of *P. tertium* and that of the Taiwanese female and, although the anterior coxal plates of *P. coarctatum* lack the acute medial projections, they do have an indistinct lobe in the same location. Were it not for the obvious differences in coxal plate development and oostegite I shape between

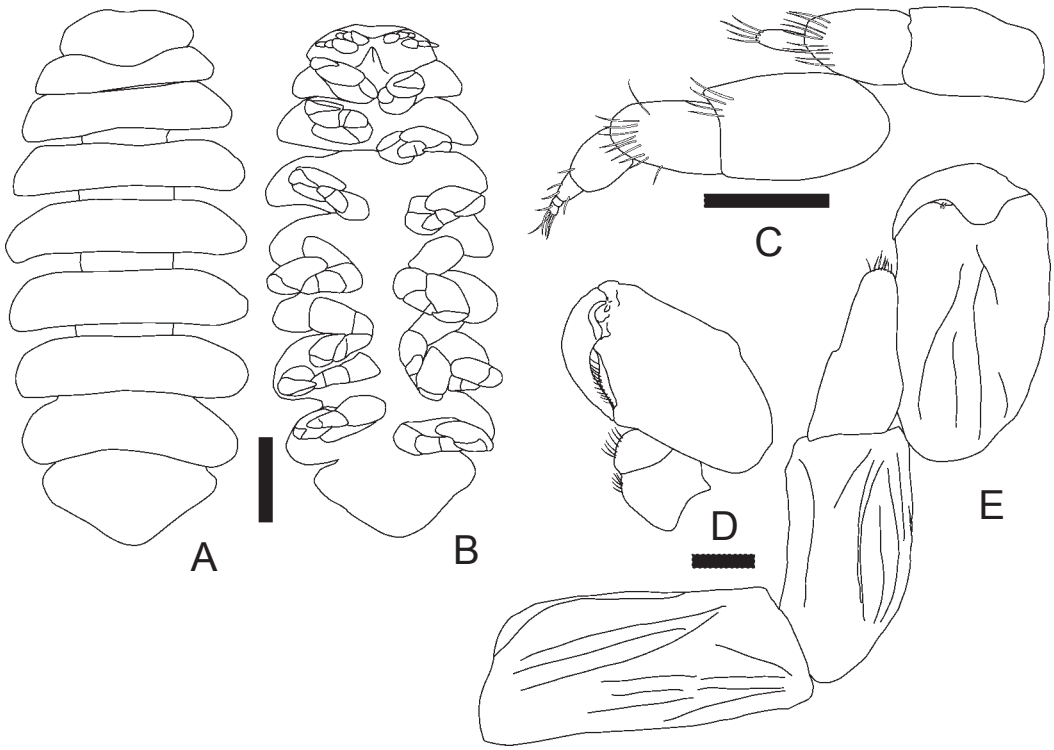

Fig. 9. *Parapenaeon tertium* Nierstrasz and Brender à Brandi, 1932, male, 4.2 mm. (a) Dorsal view; (b) ventral view; (c) left antenna and antennule; (d) left pereopod I; (e) left pereopod VII (MNHN-Ep 942). Scale bars = 0.75 mm (a, b) and 0.1 mm (c-e).

P. tertium and *P. coarctatum*, their synonymy would be suspected. The males of the 2 taxa are also very similar, but males of most *Parapenaeon* species are difficult to separate. A subspecies of *P. coarctatum*, *P. coarctatum tuberculatum* Bourdon, 1981, is herein raised to the species level as there are numerous characters, including coxal plates that are subequal on the 2 sides of the body in contrast to the clear inequality seen in *P. coarctatum*, that separate the taxa.

Subfamily Bopyrinae Rafinesque-Schmaltz, 1815
Genus *Bopyroides* Stimpson, 1864
Bopyroides hippolytes (Kröyer, 1838)
(Fig. 10)

Bopyrus hippolytes Kröyer, 1838: 306-310, 318 (list), pl. 4, fig. 22.

Bopyroides hippolytes, Nierstrasz and Brender à Brandis 1923: 102 (list); Bourdon 1968: 352-359, figs. 158-163 (synonymy); Markham 1985: 52-53 (synonymy); Kim and Kwon 1988: 212-213, fig. 8; Rybakov and Avdeev 1991: 167-168, fig. 1; Saito et al. 2000: 39-40 (list).

not *Bopyroides hipplolytes*, Shiino 1937: 293-296, fig. 1; Shiino 1972: 8 (list) (= *B. shiinoi* Rybakov and Avdeev, 1991).

Materials examined: Taiwan. Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 99, NE coast of Taiwan, 24°53.2'N, 122°04'E, 506~680 m, 18 May 2001, in right branchial chamber of female *Lebbeus* cf. *spinirostris* (Kobjakova) (det. Komai) (8.20 mm CL): brooding dextral female (6.90 mm), male (2.25 mm) (MNHN-Ep 943).

Distribution: Arctic Ocean and boreal regions of Atlantic and Pacific Oceans, along coasts of North America (Alaska, British Columbia, Washington, Maine, Massachusetts), northeastern Asia (Russia, Japan, Korea), and northwestern Europe (Denmark, England, Ireland, Norway) (Bourdon 1968, Markham 1985, Kim and Kwon 1988, Rybakov and Avdeev 1991) on numerous hosts in the Hippolytidae (*Eualus fabricii* (Kröyer), *E. gaimardii* (H. Milne Edwards), *E. pusiolus* (Kröyer), *E. suckleyi* (Stimpson), *Heptacarpus brevirostris* (Dana), *H. herdmani* (Walker), *Hippolyte varians* Leach, *Lebbeus groenlandicus* (J. C. Fabricius), *Lebbeus polaris* (Sabine), *Spirontocaris arcuata* Rathbun, *S. holmesi* Holthuis, *S. lamellicornis* (Dana), *S. lilljeborgii* (Danielssen), *S. murdochi* Rathbun, *S. phippsii* (Kröyer), and *S. spinus* (Sowerby)) and Pandalidae (*Pandalus borealis* Kröyer, *P. goniurus* Stimpson, *P. jordani* Rathbun, *P. montagui* Leach, *Pandalopsis aleutica* Rathbun) (Bourdon 1968, Markham 1985, Kim and Kwon 1988); and Taiwan, on *Lebbeus* sp. cf. *spinirostris* (Kobjakova) (herein). Depth = 506-680 m (Taiwan only; depth of most other records not noted).

Remarks: I can find no differences between these specimens (Fig. 10) and the multitude of published records of *B. hippolytes*, most recently redescribed by Kim and Kwon (1988). The occurrence of this species off Taiwan is of interest not

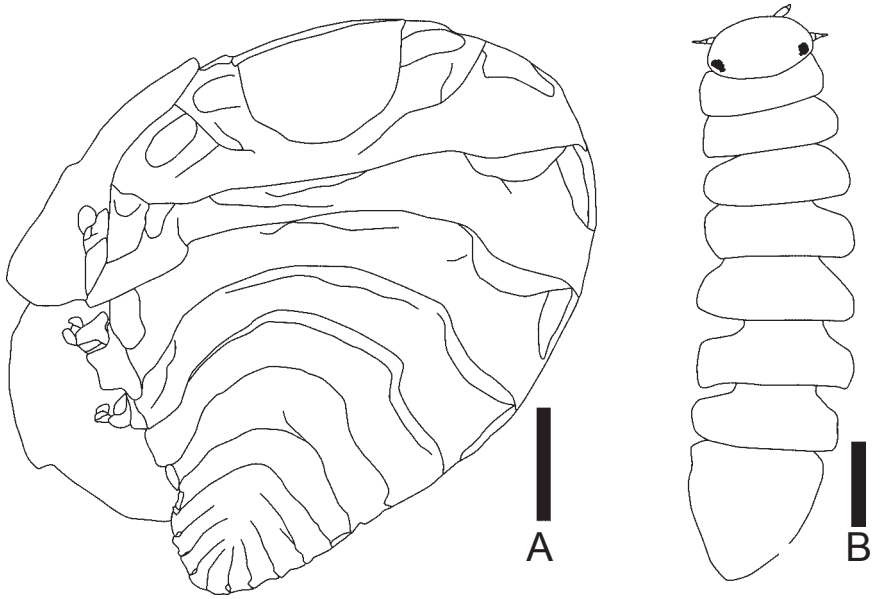

Fig. 10. *Bopyroides hippolytes* (Kröyer, 1838). (a) Female, 6.90 mm, dorsal view; (b) male, 2.25 mm, dorsal view (MNHN-Ep 943). Scale bars = 1.5 mm (a) and 0.375 mm (b).

only as the host is the 3rd species in the genus *Lebbeus* known to be infested with *B. hippolytes*, the others being *L. polaris* (Sabine) (see Bourdon 1968, Markham 1985) and *L. groenlandica* (Fabricius) (see Rybakov and Avdeev 1991), but also because they represent a great extension southward for the parasite in Asian-Pacific waters. The previous southern record for *B. hippolytes* was from Mukho and Kanggu, and various fish markets on the cold-water-influenced eastern side of Korea (ex *Pandalus borealis* Kröyer) at unknown depths (Kim and Kwon 1988). The other southern record of *B. hippolytes* from Asamusi, Mutsu Bay, Honshu, Japan (ex *Heptacarpus pandaloides* (Stimpson)) in 4~5 fathoms (7.3~9.1 m) (Shiino 1937) is actually referable to *B. shiinoi* Rybakov and Avdeev, 1991 (fide Rybakov and Avdeev 1991). *Bopyroides hippolytes* is adapted to cold waters, as all its known hosts are cold-water hippolytid and pandalid taxa. The extension of its range into Taiwanese waters is probably made possible by its infesting a host which occurs in deeper and therefore colder water. It is not expected to occur on shrimp in the warmer nearshore waters around Taiwan.

Genus *Discorsobopyrus* gen. nov.

Bopyrus, Nierstrasz and Brender à Brandis 1923: 43 (part); Chopra 1923: 518, 541-542 (part); Bourdon 1968: 372 (part) (not *Bopyrus* Latreille, 1802).

Type species: *Bopyrus stebbingi* Nierstrasz and Brender à Brandis, 1923.

Etymology: The generic name is a combination of the Latin *discors*, meaning different or unlike in reference to the gross inequality in size between the males and females (females 6~7.75 times larger than males), in combination with the type genus name for the Bopyridae. The name also alludes to the ovate shape of the females (Gr., *diskos*, flat circular plate). The gender is masculine.

Diagnosis: Female, body ovate, 1 side of pereon only slightly longer than other; head triangular, weakly produced with narrow anterior lamina. Antennae and antennules reduced to single segment. Maxilliped with stout distally rounded spur; palp lacking. First oostegite proximal lobe ovate, distal lobe subtriangular, internal ridge smooth. Pereon composed of 7 pereomeres, broadest across pereomere III. Coxal plates well developed on both sides, all elongate. Dorsolateral bosses well developed on some pereomeres, indistinct on others. Tergal projections lacking. Oostegites nearly completely enclosing marsupium. Basis of all pereopods bearing pronounced rounded medial boss; propodus with cup for insertion of dactylus. Pleon with 5 pleomeres plus pleotelson; pleomeres I~V with uniramous elongate pleopods and uniramous, short subquadrate lateral plates (some indistinct); edges and surfaces of all lateral plates smooth; pleopods smooth, uropods lacking.

Male head ovate, fused with 1st segment of pereon. Body shape elongate; pereomere IV broadest; 1st three directed slightly anterolaterally, IV~VI laterally directed, VII directed slightly posterolaterally. Posterior pereopods slightly larger. Pleon with 1 segment; faint lateral indication of segmentation and tapered pleotelson tip. Midventral tubercles on pereomeres II~VII, pleopods and uropods lacking.

Systematic position: The type species was described based on a single damaged female specimen and placed in *Bopyrus* Latreille, 1802, by Nierstrasz and Brender à Brandis (1923). Unfortunately, Nierstrasz and Brender à Brandis (1923) provided no reasons for placing this species in *Bopyrus* and gave an incomplete description of the holotype with few illustrations. Chopra (1923) mentioned the species, but stated only that it "is probably a good species." The only other author to mention this taxon was Bourdon (1968) who commented that it "ne correspond d'ailleurs pas aux diagnoses génériques établies par G. O. Sars (1899) et Chopra (1923) par le dévelloppement des oostégites 2-5 qui recouvrent la presque totalité du thorax et par la fusion partielle de la tête et de la plupart des segments thoraciques." In fact, the new female material from Taiwan and Indonesia shows that the fusion of the posterior border of the cephalon with the medial section of pereomere I is variable, and no specimens lack all traces of segmentation in this region. The presence of well-developed oostegites nearly enclosing the entire marsupium is, however, very unusual in females of species in the Bopyrinae. To this must be added the structure of the antennae and antennules, which are each reduced to a single fleshy lobe that is posteriorly fused with the ventral cephalon, the faint but observable dorsal segmentation of the pleomeres, and in the males, the shape of the pleon that lacks almost all traces of lateral segmentation and all vestiges of pleopods. All of these characters differ strongly from the those of the other 2 species placed in *Bopyrus*, *B. squillarum* Latreille, 1802, and *B.*

bimaculatus Chopra, 1923, which both have open *marsupia*, 2-segmented antennae and antennules not fused with the ventral cephalon, obscure dorsal segmentation of the pleomeres, and in the males, clear lateral indentations along the entire pleon indicating segmentation, and reduced but present pleopods. These differences clearly indicate a need to separate *B. stebbingi* from the other species of *Bopyrus*. A survey of the genera in the Bopyrinae shows that specimens of *Probopyrione plana* Bourdon, 1983 (the sole species of *Probopyrione* Bourdon, 1983), share several important characters with *B. stebbingi*. Females of the 2 taxa have a nearly closed marsupium by virtue of having well-developed oostegites, the shape of the oostegite I is very similar, the antennae and antennules are both reduced to a single segment (although of quite-different shapes in the 2 species), the maxillipeds are very similar, and there are 5 pairs of uniramous long pleopods. The males of the 2 species are nearly identical in overall form, in having a fused pleon with only 1 proximal trace of lateral segmentation, and in lacking pleopods. However, females of *Probopyrione plana* lack any traces of either coxal plates or dorsolateral bosses, which are well developed in *B. stebbingi*. These differences in the latter characters require that *P. plana* and *B. stebbingi* be placed in different but apparently closely related genera, and a new genus is therefore erected for *B. stebbingi*. As the hosts of *Probopyrione* are all alpheid shrimp, this close relationship is rather surprising given that alpheids and pandalids are not closely related families of hosts.

Discorsobopyrus stebbingi (Nierstrasz and Brender à Brandis, 1923) comb. nov.

(Figs. 11-13)

Bopyrus stebbingi Nierstrasz and Brender à Brandis, 1923: 97-98, pl. 7, fig. 23a-c; Chopra 1923: 518, 541-542; Bourdon 1968: 372.

Materials examined: Taiwan. Taiwan 2000 (Bouchet, Richer de Forges, and Chan) stn. CP 27, South China Sea, 22°13.3'N, 120°23.5'E, 326 m, 30 July 2000, in left branchial chamber of female *Heterocarpus sibogae* De Man (45.00 mm CL): brooding sinistral female (14.55 mm), male (2.25 mm) (MNHN-Ep 945). Indonesia. KARUBAR (N/O "Baruna Jaya I") stn. CP 33, Kai Is., 06°05'S, 132°38'E, 307~311 m, 27 Oct. 1991, in left branchial chamber of female *H. sibogae* (49.92 mm CL): brooding sinistral female (18.90 mm), male (2.44 mm); in right branchial chamber of female *H. sibogae* (45.90 mm CL): brooding dextral female (11.70 mm), male (1.95 mm); in right branchial chamber of female *H. sibogae* (41.20 mm CL): brooding dextral female (12.45 mm), male (2.03 mm) (MNHN-Ep 944).

Description: Female (Fig. 11), based on Taiwanese specimen. Body length 14.55 mm, maximal width 12.28 mm, head length 3.40 mm, head width 3.80 mm. Pereon slightly deflexed with 1 side longer and subequal structural (coxal plates and dorsolateral bosses) development (Fig. 11A). All body regions and pereomeres segmented, some indistinctly.

Head broader than long, triangular and tapering posteriorly, weakly produced with frontal lamina equal to approximately 15% length of head (Fig. 11A), strongly overlapping pereomere I medially; barbula (Fig. 11C) with 2 pairs of smooth subequal lateral projections, tapering distally and overlapping. Eyes lacking. Antennae and antennules of 1 broad article each, lacking setae (Fig. 11D). Maxilliped (Fig. 11C) with short rounded spur; palp lacking, distolateral and distomesial margins produced into lobes, distolateral lobe with numerous small projections bearing thin setae. First oostegite proximal lobe irregularly ovate, distal lobe ovate-triangular with acute ventrolateral projection, internal ridge smooth (Fig. 11E, F).

Pereon composed of 7 pereomeres, broadest across pereomere III, gradually tapering anteriorly and posteriorly; pereomere I with convex posterior margin, II and III nearly straight, IV~VII with progressively concave posterior margins. Coxal plates as thin, elongate lobes on pereomeres I~IV, clearly separated from pereomeres. Dorsolateral bosses on pereopods I~IV oblong, and clearly demarcated with left and right sides subequal, dorsolateral bosses on pereomeres V~VII lateral and similar in size and shape to coxal plates. Tergal projections lacking. Oostegites nearly enclosing marsupium. Pereopods with produced lobe on basis and cuplike structure on distoventral margin of carpus for insertion of dactylus (Fig. 11G, H), posterior pairs larger and with larger basal lobes. First pair of pereopods surrounding head region, others evenly spaced.

Pleon with 5 distinct pleomeres plus pleotelson; posterior margins of all pleomeres strongly concave (Fig. 11A). Pleomeres II~VII with ovate midventral tubercles. Pleomeres I~V with broad, ovate, uniramous pleopods and short, subquadrate, uniramous lateral plates similar in shape to coxal plates but smaller (faint demarcation of

lateral plates on pleomere V) (Fig. 11B); edges and surfaces of all lateral plates smooth; uropods lacking.

Male (Fig. 12), based on Taiwanese specimen. Length 2.25 mm, maximal width 1.02 mm, head length 0.29 mm, head width 0.45 mm, pleon length 0.50 mm.

Head ovate, widest posteriorly, fused with pereomere I (Fig. 12A). Eyes present. Antennae of 2 articles, proximal 1 globular and fused with ventral margin of cephalon, distal 1 distally setose, extending beyond margin of cephalon; antennules of 1 thin article fused with ventral cephalon, tapering distally (Fig. 12C).

Pereomere IV broadest. Pereomeres I~III directed slightly anterolaterally, IV~VI directed laterally, VII directed posterolaterally; distolateral margins of all pereomeres rounded. Large midventral tubercles on all segments (Fig. 12B). No detectable pigmentation. Posterior pereopods

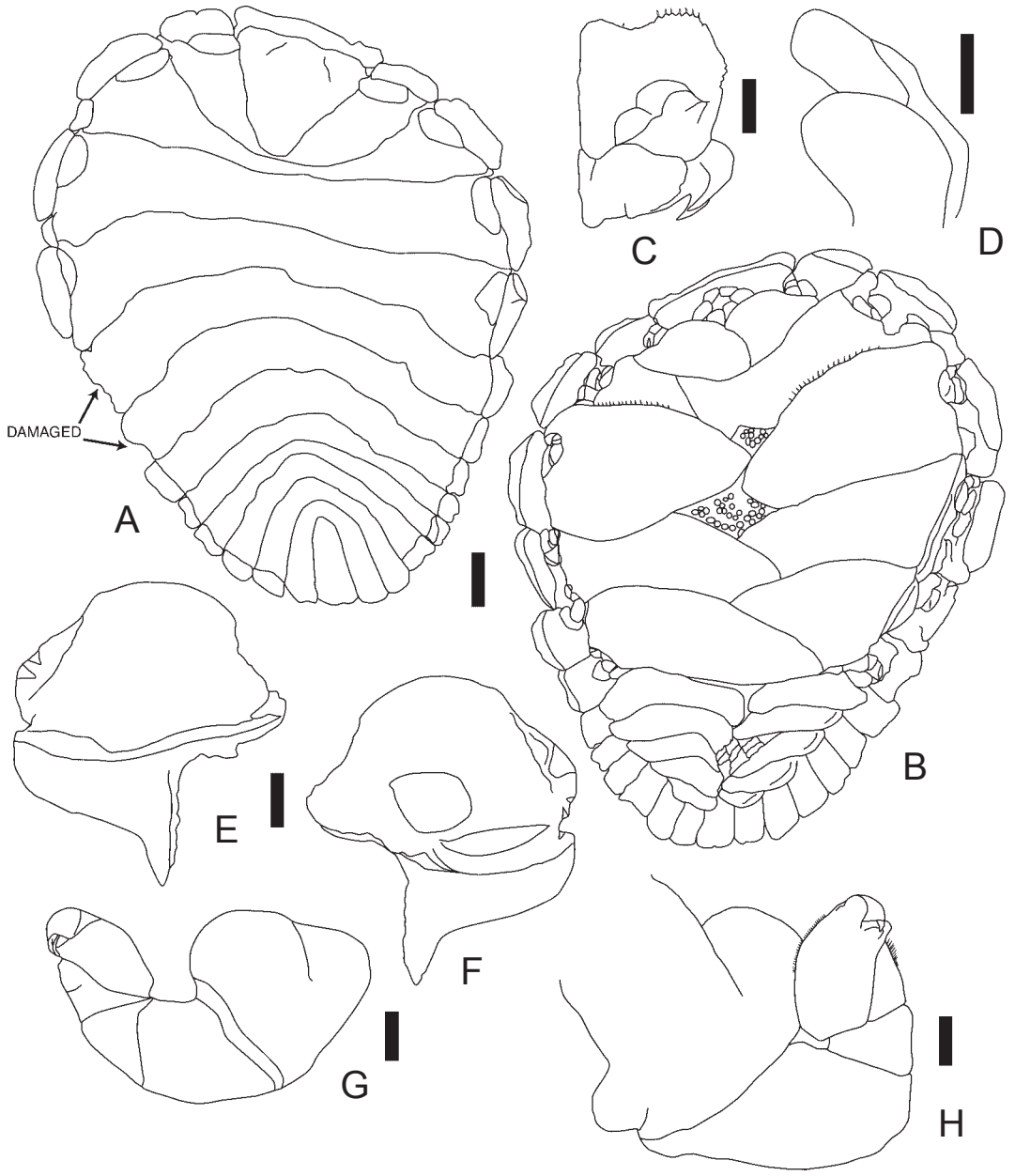

Fig. 11. *Discorsobopyrus stebbingi* (Nierstrasz and Brender à Brandis, 1923), female, 14.55 mm. (a) Dorsal view; (b) ventral view; (c) left maxilliped with lateral barbula; (d) left antenna and antennule; (e) left oostegite I, outer surface; (f) left oostegite I, inner surface; (g) left pereopod I; (h) left pereopod VII (MNHN-Ep 945). Scale bars = 1.5 mm (a, b), 0.75 mm (c, e, f), 0.375 mm (d), and 0.2 mm (g, h).

(Fig. 12E) slightly larger than anterior pairs (Fig. 12D), all articles distinctly separated, distoventral tip of carpus with distal tuft of setae.

Pleon with all segments fused into 1 pleomere. Proximolateral margins convex, distolateral margins slightly concave, tip rounded. No midventral tubercles, pleopods, or uropods (Fig. 12B).

Distribution: Indonesia, ex *Heterocarpus sibogae* De Man (Nierstrasz and Brender à Brandis 1923 [host unknown] and Taiwan, ex *H. sibogae* De Man (herein). Depth = 307~397 m (Indonesia) and 326 m (Taiwan).

Remarks: This is the 1st record of this species since its original description by Nierstrasz and Brender à Brandis (1923) from a single damaged female obtained from an unknown host. All of the specimens examined are from slightly shal-

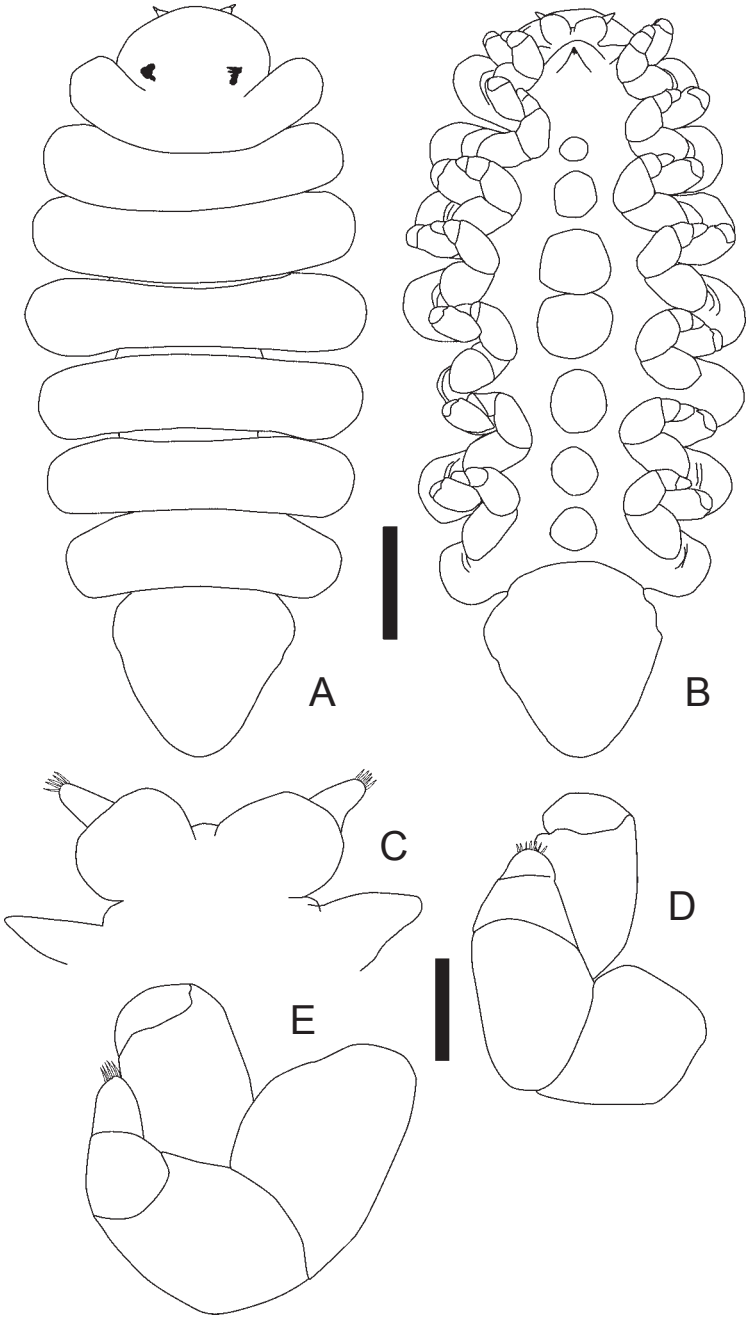

Fig. 12. *Discorsobopyrus stebbingi* (Nierstrasz and Brender à Brandis, 1923). (a) Male, 2.25 mm, dorsal view; (b) ventral view; (c) antennae and antennules; (d) left pereopod I; (e) left pereopod VII (MNHN-Ep 945). Scale bars = 0.375 mm (a, b) and 0.1 mm (c-e).

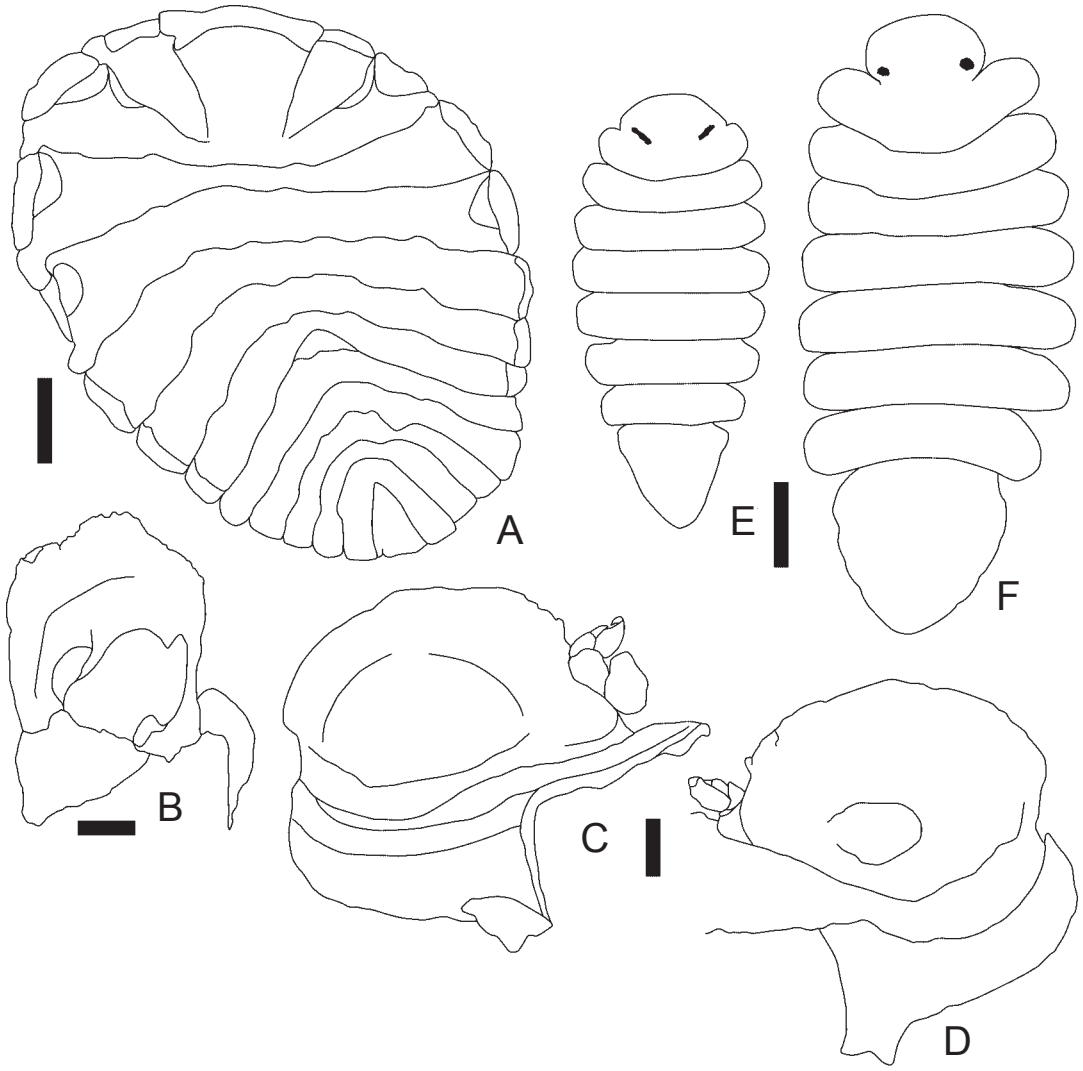

Fig. 13. *Discorsobopyrus stebbingi* (Nierstrasz and Brender à Brandis, 1923), female, 18.90 mm. (a) Dorsal view; (b) left maxilliped with 1 lobe of barbula; (c) left oostegite I, outer view; (d) left oostegite I, inner view; (e) male, 1.95 mm, dorsal view; (f) male, 2.44 mm, dorsal view (MNHN-Ep 944). Scale bars = 3.0 mm (a), 0.75 mm (b-d), and 0.375 mm (e, f).

lower waters than the holotype thus suggesting that the type was taken from a *Heterocarpus*, perhaps the same species as the host of the material cited above. The Indonesian material (Fig. 13A-F) was obtained from very close to the type locality (05°26.6'S, 132°32.5'E), and the Taiwanese specimens are the 1st record of this species outside of Indonesia. The male was not known to Nierstrasz and Brender à Brandis (1923) and is described for the 1st time herein, along with a redescription of the female, as the only previously known specimen was incomplete.

The cuplike structures on the propodi of the females used for insertion of the dactyli are similar to those seen in *Asymmetrione* spp. (Pseudioninae) parasitic on hermit crabs, but are not as well developed.

Subfamily Athelginae Codreanu and Codreanu, 1956
Genus *Athelges* Gerstaecker, 1862
Athelges takanoshimensis Ishii, 1914
(Figs. 14, 15)

Athelges takanoshimensis Ishii, 1914: 519-529, pl. 7; Nierstrasz and Brender à Brandis 1923: 108 (list); Shiino 1934: 277-278, fig. 9; Shiino 1936b: 186, fig. 5; Shiino 1937: 299; Shiino 1939: 98; Shiino 1958: 68, pl. 3, fig. 10 (sic for 5); Codreanu et al. 1965: 238 (list), fig. 1 (map); Shiino 1965: fig. 1 (part); Shiino 1972: 9; Shiino 1974: 553, fig. 762; Markham 1977: 127; Markham 1982: 373-375, 385, fig. 27; Markham 1986: fig. 1J; Kim and Kwon 1988: 215-217, fig. 10; Markham 1990: 562-563; Markham 1992: 292-

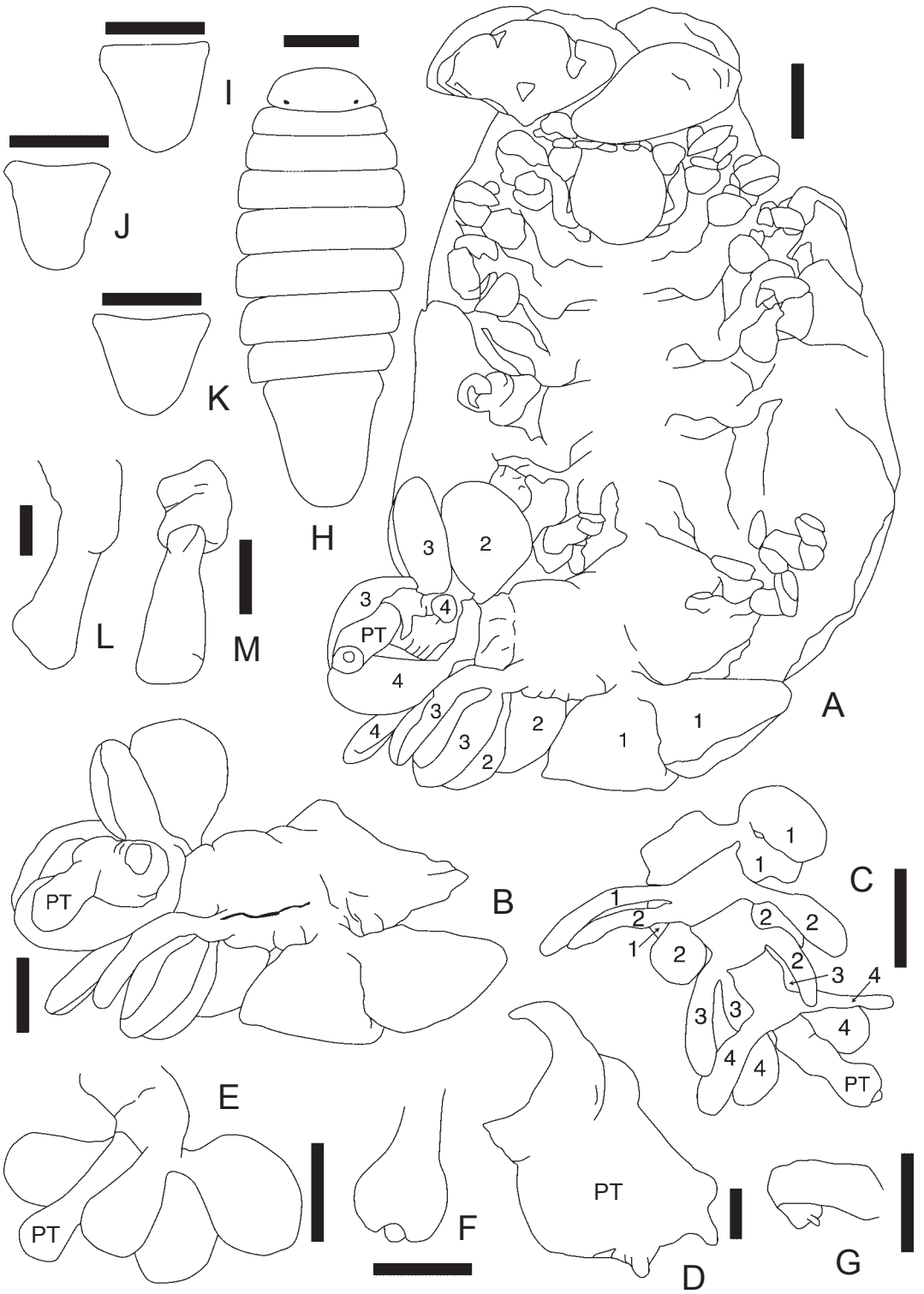

Fig. 14. *Athelges takanoshimensis* Ishii, 1914. (a) Female, 14.25 mm, dorsal view, (b) female, 14.25 mm, pleon (MNHN-Ep 936); (c) female, 8.25 mm, pleon (MNHN-Ep 935); (d) female, 15.00 mm, pleotelson (MNHN-Ep 928); (e) female, 13.95 mm, posterior pleon (MNHN-Ep 931); (f) female, 7.65 mm, pleotelson (MNHN-Ep 925); (g) female, 15.00 mm, pleotelson (MNHN-Ep 937); (h) male, 4.09 mm, dorsal view (MNHN-Ep 936); (i) male, 2.63 mm, pleotelson (MNHN-Ep 925); (j) male, 1.24 mm, pleotelson; (k) male, 2.48 mm, pleotelson (MNHN-Ep 933); (l) female, 18.00 mm, pleotelson (MNHN-Ep 927); (m) female, 14.10 mm, pleotelson (MNHN-Ep 926). Numbers, pleopods and lateral plates; PT, pleotelson. Scale bars = 1.5 mm (a-c, e, g), 0.75 mm (d, f, h, i, k-m), and 0.375 mm (j).

293, fig. 14; Huang 1994: 530; Nagasawa et al. 1996: 4; Saito et al 2000: 44-45 (list); Huang 2001: 326; Williams 2003: 18.

Athelges takanoshimensis var. *tenuibranchiatus* Shiino 1936b: 187-188, fig. 6; Codreanu et al. 1965: 238 (list).

Athelges japonicus Shiino, 1958: 69-71, fig. 22; Pike 1961: 223 (compared to *A. lacertosi* Pike, 1961); Codreanu et al. 1965: 238 (list), fig. 1 (map).

Athelges tahanoshimensis [sic] *tenuibranchiatus*, Shiino 1972: 9.

Atheleges [sic] *takanoshimensis*, Morton and Morton 1983: 98, fig. 9.6.6; Williams 2003: 17, fig. 5.

Athelges takunoshinensis [sic], Wei 1991: 4, 6, 146-147, fig. 109.

Athelgathes [sic] *takanoshimensis*, Nunomura 1995: 227, fig. 21-203B; Imahara 1996: 70.

Not *Athelges takanoshimensis*, Nishimura 1983: 97, unnumbered fig. (= *Parathelges aniculi* (Whitelegge, 1897)).

Materials examined: Taiwan. Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP

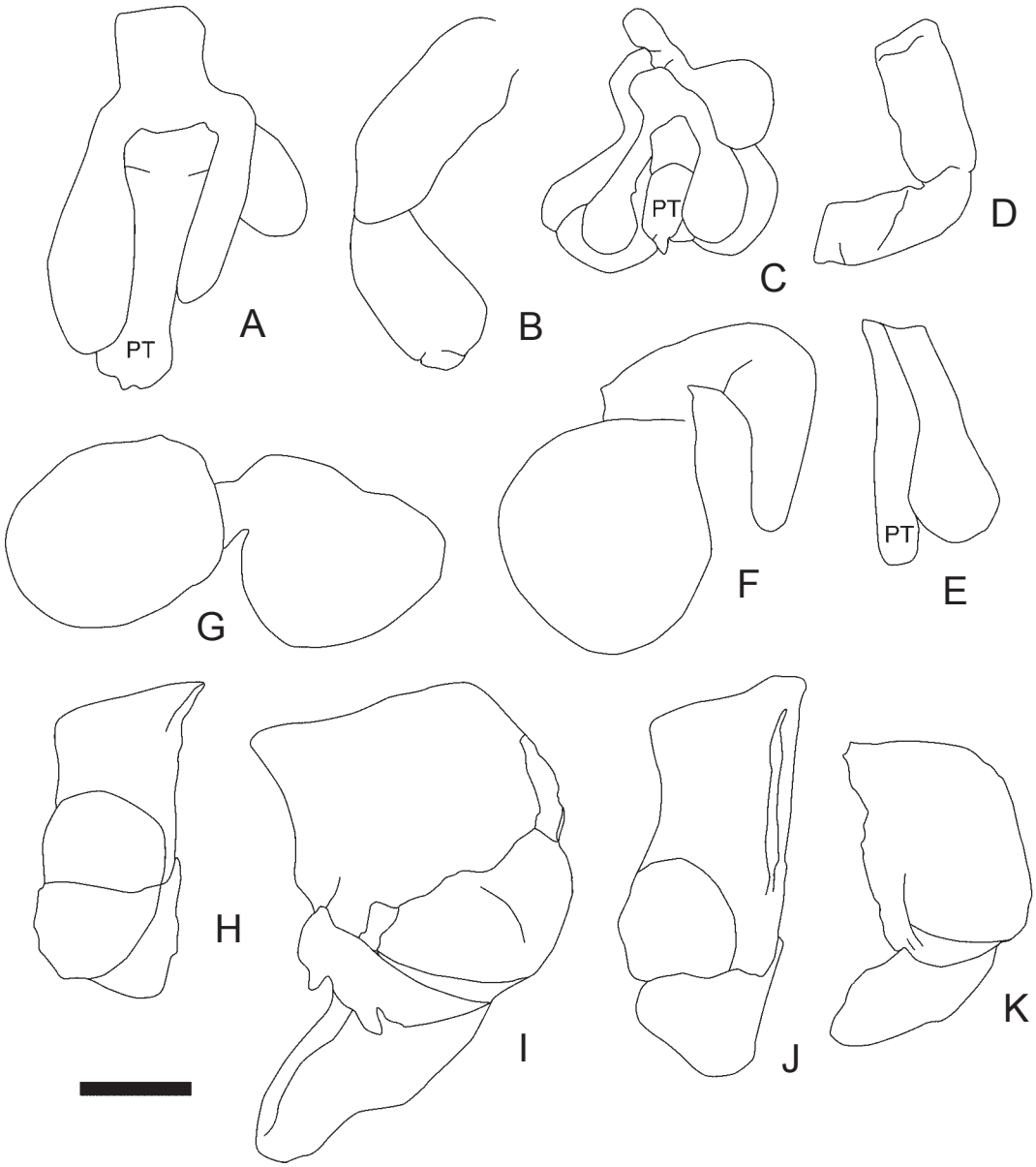

Fig. 15. *Athelges takanoshimensis* Ishii, 1914. (a) Female, 6.90 mm, pleopod IV and pleotelson; (b) female, 10.8 mm, pleotelson (MNHN-Ep 932); (c) female, 12.30 mm, pleon (MNHN-Ep 937); (d) female, 10.65 mm, pleotelson (MNHN-Ep 925); (e) female, 10.35 mm, pleopod IV and pleotelson (MNHN-Ep 933); (f) female, 10.65 mm, right pleopod I (MNHN-Ep 925); (g) female, 10.35 mm, right pleopod II (MNHN-Ep 933); (h) female, 10.65 mm, left maxilliped, inner surface, (i) female, 10.65 mm, left oostegite I, inner surface (MNHN-Ep 925); (j) female, 9.75 mm, left maxilliped, inner surface, (k) female, 9.75 mm, right oostegite I, outer surface (MNHN-Ep 930). Scale bars = 0.75 (a, b, d-j) and 1.5 mm (c, k).

68, NE coast of Taiwan, 24°49.6'N, 122°00.8'E, 370 m, 6 May 2001, on male *Dofleinia doederleini* (Dolflein) (8.55 mm SL): non-brooding dextral female (7.65 mm), male (2.63 mm); on male *D. doederleini* (4.35 mm SL): brooding dextral female (10.65 mm), cryptoniscid male (1.28 mm) (MNHN-Ep 925). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 71, NE coast of Taiwan, 24°52.3'N, 122°03.1'E, 600 m, 6 May 2001, on female *D. doederleini* (4.10 mm SL): brooding dextral female (14.10 mm), male (3.08 mm) (MNHN-Ep 926). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 73, NE coast of Taiwan, 24°52.9'N, 122°01.0'E, 220~330 m, 7 May 2001, on male *D. doederleini* (6.20 mm SL): brooding dextral female (18.00 mm), male (4.28 mm) (MNHN-Ep 927). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 85, NE coast of Taiwan, 24°00.5'N, 122°00.5'E, 255~390 m, 9 May 2001, on female *D. doederleini* (5.10 mm SL): non-brooding dextral female (13.20 mm); on female *D. doederleini* (6.35 mm SL): non-brooding female (15.00 mm), male (3.68 mm) (MNHN-Ep 928). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 89, NE coast of Taiwan, 24° 53.6'N, 122°01.4'E, 310~420 m, 9 May 2001, on male *D. doederleini* (3.40 mm SL): non-brooding dextral female (8.70 mm), male (2.06 mm) (MNHN-Ep 929). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 90, NE coast of Taiwan, 24°53.6'N, 122°01.4'E, 300~330 m, 10 May 2001, on female *D. doederleini* (4.00 mm SL): non-brooding dextral female (9.75 mm) (MNHN-Ep 930). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 92, NE coast of Taiwan, 24°48.0'N, 122°03.9'E, 500 m, 10 May 2001, on female *D. doederleini* (5.85 mm SL): brooding dextral female (13.95 mm), male (3.53 mm) (MNHN-Ep 931). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 95, NE coast of Taiwan, 24°55.8'N, 122°05.7'E, 269~360 m, 18 May 2001, on male *D. doederleini* (6.60 mm SL): brooding dextral female (6.90 mm), male (2.55 mm); on female *D. doederleini* (4.65 mm SL): non-brooding dextral female (10.80 mm), male (3.00 mm) (MNHN-Ep 932). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) Stn. CP 99, NE coast of Taiwan, 24°53.2'N, 122°04.0'E, 506~680 m, 18 May 2001, on female *D. doederleini* (4.50 mm SL): non-brooding dextral female (10.35 mm), 2 males (1.24, 2.48 mm) (MNHN-Ep 933). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 108, NE coast of Taiwan, 24°48.2'N, 122°07.7'E, 295~337 m, 20 May 2001, on female *D. doederleini* (8.55 mm SL): brooding dextral female (11.40 mm), male (3.83 mm) (MNHN-Ep 934). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 112, NE coast of Taiwan, 24°50.8'N, 122°01.9'E, 500~600 m, 21 May 2001, on male *D. doederleini* (4.60 mm SL): non-brooding dextral female (8.25 mm), male (2.18 mm) (MNHN-Ep 935). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 113, NE coast of Taiwan, 24°50.8'N, 121°59.9'E, 281 m, 21 May 2001, on male *D. doederleini* (5.70 mm SL): brooding dextral female (14.25 mm), male (4.09 mm) (MNHN-Ep 936). – Taiwan 2001 (Bouchet, Richer de Forges, and Chan) stn. CP 115, NE coast of Taiwan, 24°53.9'N, 122°02.0'E, 381~440 m, 21 May 2001, on male *D. doederleini* (4.40 mm SL): brooding dextral female (14.10 mm), male (3.08 mm); on female *D. doederleini* (5.0 mm SL): brooding dextral female (12.30 mm), male (4.13); on male *D. doederleini* (5.5 mm SL): brooding dextral female (15.00 mm), male (3.60) (MNHN-Ep 937).

Distribution: Japan, on *Pagurus filholi* (De Man) (Ishii 1914, Shiino 1934 1936 1958, Nagasawa et al. 1996), *P. japonicus* (Stimpson), *Lophopagurus* (*Australeremus*) *triserratus* (Ortmann) (Shiino 1936), *P. pectinatus* Stimpson (Shiino 1937), *P. constans* (Stimpson), *P. lanuginosus* (de Haan), *P. middendorfi* Brandt (Shiino 1958), and *P. maculosus* Komai and Imafuku (Nagasawa et al. 1996); Hong Kong, on *Pagurus* aff. *filholi*, *Diogenes edwardsii* (de Haan) (Markham 1982), *P. trigonocheirus* Stimpson, and *Diogenes* sp. (Markham 1992); Korea, on *P. proximus* Komai, *P. pectinatus* Stimpson, *P. middendorfi* Brandt, and *P. dubius* (Ortmann) (Kim and Kwon 1988); and Taiwan, on *Dofleinia doederleini* (Dolflein) (herein). Depth range from intertidal to 600 m, possibly to 680 m.

Remarks: The host species of the Taiwanese specimens was formerly placed in *Catapagurus* A. Milne Edwards, transferred to *Parapagurodes* by Asakura (2001), and subsequently made the type of the genus *Dofleinia* McLaughlin and Asakura (McLaughlin and Asakura 2004). *Pagurus constans* has been returned to *Pagurus* Fabricius after a brief stay in the genus *Parapagurodes* (McLaughlin and Asakura 2004).

All but one of the previous records of this species have been from unspecified depths and are presumed to be from shallow waters as these are the typical habitats of the host species. The sole exception was a recorded depth of 80 fathoms (= 144 m) for the 2 specimens of *A. takanoshimensis* var. *tenuibranchiatus* (Shiino 1936b). The

current specimens extend the range of the species to Taiwan and greatly extend the depth range down to at least 600 m, perhaps to 680 m, as that station had a broad depth range.

The 3.08 mm male from MNHN-Ep 937 has 1 side of the pleotelson smoothly indented along its length, but this is probably a preservation artifact. This indentation greatly resembles that seen on both sides of the pleon of the illustrated male *Pseudostegias atlantica* Lemos de Castro, 1965, and indicates the possibility that the male type of that species was likewise abnormal in appearance. All of the other males show a pleotelson morphology similar to previously described specimens (Fig. 14H-K). The variation in the pleon of the females (Figs. 14A-G, L, M, 15A-G) is not great, as most resemble that illustrated by Shiino (1934), although one from MNHN-Ep 925 is much more slender (Fig. 14F, 15D) and one (MNHN-Ep 928) has a malformed double-pointed abdomen somewhat resembling that of the holotype of *A. lacertosi* Pike,1961, but composed of 2 slender points rather than 2 stout bifid lobes (Fig. 14D). The maxillipeds and 1st oostegites are typical for the species (Fig. 15H-K).

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REFERENCES

Adkison DL. 1988. *Pseudione parviramus* and *Aporobopyrus collardi*, two new species of Bopyridae (Isopoda: Epicaridea) from the Gulf of Mexico. Proc. Biol. Soc. Wash. **101:** 576-584.

Asakura A. 2001. A revision of the hermit crabs of the genera *Catapagurus* A. Milne-Edwards and *Hemipagurus* Smith from the Indo-West Pacific (Crustacea: Decapoda: Anomura: Paguridae). Invertebr. Taxon. **15:** 823-891.

Bourdon R. 1967. Sur trois nouveaux Bopyridae du Sénégal. Bull. Insti. Fondamental Afr. Noire ser. **A 29:** 107-122.

Bourdon R. 1968. Les Bopyridae des mers Européennes. Mém. Mus. Natl. Hist. Nat., n. sér. sér. **A 50:** 77-424.

Bourdon R. 1972. Epicaridea de Java, Ile Maurice et Afrique du Sud (Crustacea, Isopoda). Steenstrupia **2:** 105-119.

Bourdon R. 1976. Les bopyres des porcellanes. Bull. Mus. Natl. Hist. Nat., 3e sér. Zool. **252:** 165-245.

Bourdon R. 1979. Épicarides de Madagascar. II. Bull. Mus. Natl. Hist. Nat. 4e sér. **A 2:** 471-506.

Bourdon R. 1981. Crustacés Isopodes. I. Bopyridae parasites des Pénéides. Résultats des Campagnes MUSORSTOM. I. Philippines (18-28 Mars 1976), volume 1. Mem. ORSTOM **91:** 237-260.

Bourdon R. 1983. Expédition Rumphius II (1975). Crustacés parasites, commensaux, etc. (Th. Monod éd.). VIII. Crustacés isopodes (3e partie: épicarides Bopyridae). Bull. Mus. Natl. Hist. Nat. 5 (Section **A**, no. 3)**:** 845-869.

Boyko CB. 2003. New host and distribution records for *Leidya bimini* Pearse, 1951 in the Gulf of Mexico, with comments on related taxa and a redescription of *Cardiocepon pteroides* Nobili, 1906 (Crustacea: Isopoda: Bopyridae: Ioninae). Gulf Carib. Res. **15:** 5-11.

Chopra B. 1923. Bopyrid isopods parasitic on Indian Decapoda Macrura. Rec. Indian Mus. **25:** 411-550, pls. 11-21.

Codreanu R. 1967. Classificarea evolutiva a bopirienilor, isopode parazite ale crustaceelor decapode si importanta lor biologica generala. Stud. Cercetari Biol. **19:** 203-211.

Codreanu M, R Codreanu. 1956. Sur *l'Anisarthrus pelseneeri*, épicaride parasite abdominal de la crevette *Athanas nitescens*; sa présence dans la Mer Noire et la dispersion du genre *Anisarthrus*. Bull. Biol. France Belg. **90:** 111-121.

Codreanu R, M Codreanu, RB Pike. 1965. Sur deux bopyriens parasites de pagures recueillis par M. A. Horridge dans la Mer Rouge et sur leur asymtrie. Crustaceana **9:** 225-244.

Crosnier A. 1987. Les espéces indo-ouest-pacifiques d'eau profunde du genre *Metapenaeopsis* (Crustacea Decapoda Penaeidae). Bull. Mus. Natl. Hist. Nat. 4e sér. 9, Sect. **A 2:** 409-453.

Gerstaecker A. 1862. Bericht uber die wissenschaftlichen leistungen im gebiete der entomologie wahrend des jahres 1861. Arch. Naturgeschichte **28:** 273-571.

Hansen HJ. 1897. Reports on the dredging operations off the west coast of Central America to the Galapagos, to the west coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U. S. Fish Commission Steamer "Albatross," during 1891, Lieut. Commander Z. L. Tanner, U. S. N., commanding. XXII. The Isopoda. Bull. Mus. Comp. Zool. Harvard Coll. **31:** 95-129, pls. 1-6, 1 map.

Huang Z. 1994. Isopoda. *In* Z Huang, ed. Marine species and their distribution on China's seas. Beijing: China Ocean Press, pp. 528-532. (in Chinese)

Huang Z. 2001. Isopoda. *In* Z Huang, ed. Marine species and their distribution on China's seas (English translation). Malabar, FL: Krieger Publishing Co., pp. 325-327.

Imahara Y. 1996. Catalogue of the invertebrate materials in the Wakayama Prefectural Museum of Natural History, 1 (1982-1992). Bull. Wayakama Prefectural Mus. Nat. Hist. **14:** 41-86. (in Japanese with English summary)

Ishii S. 1914. On a new epicaridean isopod (*Athelges takanoshimensis* sp. nov.) from *Eupagurus samuelis* Stimp. Annot. Zool. Jpn. **8:** 519-530, pl. 7.

Kensley B, TY Chan. 2001. Two species of deep-sea flabelliferan isopods from Taiwan (Crustacea: Peracarida: Aegidae, Anuropidae). J. Nat. Hist. **35:** 481-496.

Kim HS, DH Kwon. 1988. Bopyrid isopods parasitic on decapod crustaceans in Korea. Korean J. Syst. Zool. **Special Issue 2:** 199-221.

Kossmann R. 1881. Studien über Bopyriden. Z. Wissenschaftliche Zool. **35:** 652-665; pls. 32-35.

Kröyer H. 1838. Grönlands amfipoder. Det Kongelige Danske Videnskabernes Selskabs Naturvidenskabelige og Mathematiske Afhandlinger **7:** 229-326; pls. 1-4.

Latreille PA. 1802. Histoire Naturelle, Génerale et Particulière, des Crustacés et Insectes, vol. 3. Paris: F. Dufart, pp. 1-591, pls. 43-57.

Lemos de Castro A. 1965. Crustáceos isópodos epicarídeos do Brasil. I: Descricao de uma espécie nova do gênero "*Pseudostegias*" Shiino (Isopoda, Bopyridae). Rev. Bras. Biol. **25:** 105-108.

Markham JC. 1974. Six new species of bopyrid isopods parasitic on galatheid crabs of the genus *Munida* in the western Atlantic. Bull. Mar. Sci. **23:** 613-648.

Markham JC. 1977. *Athelges* Gerstaecker, 1862 (Crustacea, Isopoda): proposed conservation. Z.N.(S.) 2207. Bull. Zool. Nomencl. **34:** 126-129.

Markham JC. 1978. A new genus and species of bopyrid isopod parasitic on the western Atlantic porcellanid *Pachycheles ackleianus* A. Milne Edwards. Proc. Biol. Soc. Wash. **91:** 483-489.

Markham JC. 1982. Bopyrid isopods parasitic on decapod crustaceans in Hong Kong and southern China. *In* B Morton, CK Tseng, eds. Proceedings of the First International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1980, vol. 1. Hong Kong: Hong Kong Univ. Press, pp. 325-391.

Markham JC. 1985. Additions to the bopyrid isopod fauna of Thailand. Zool. Verhandelingen **224:** 1-63.

Markham JC. 1986. Evolution and zoogeography of the Isopoda Bopyridae, parasites of Crustacea Decapoda. *In* RH Gore, KL Heck, eds. Crustacean issues 4. Crustacean Biogeography. Rotterdam: Balkema, pp. 143-164.

Markham JC. 1990. Further notes on the Isopoda Bopyridae of Hong Kong. *In* B Morton, ed. Proceedings of the Second International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986, vol. 2. Hong Kong: Hong Kong Univ. Press, pp. 555-568.

Markham JC. 1992. Second list of additions to the Isopoda Bopyridae of Hong Kong. *In* BS Morton, ed. The Marine Flora and Fauna of Hong Kong and Southern China III. Proceedings of the Fourth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 11-29 Apr. 1989, vol. 1. Hong Kong: Hong Kong Univ. Press, pp. 277-302.

Markham JC. 1995. Two new species of Isopoda Bopyridae (Crustacea) infesting thalassinideans in the western Pacific. Raffles Bull. Zool. **43:** 83-89.

Markham JC, CB Boyko. 2003. A new species of *Albunione* Markham and Boyko, 1999 (Crustacea: Isopoda: Bopyridae: Pseudioninae) from Taiwan. Am. Mus. Novitates **3410:** 7 pp.

McLaughlin PA, A Asakura. 2004. Reevaluation of the hermit crab genus *Parapagurodes* McLaughlin and Haig, 1973 (Decapoda: Anomura: Paguroidea: Paguridae) and a new genus for *Parapagurodes doederleini* (Doflein, 1902). Proc. Biol. Soc. Wash. **117:** 42-56.

Morton B, J Morton. 1983. The sea shore ecology of Hong Kong. Hong Kong: Hong Kong Univ. Press, xiv + 350 pp., 28 pls.

Nagasawa K, J Lützen, R Kado. 1996. Parasitic Cirripedia (Rhizocephala) and Isopoda from brachyuran and anomuran crabs of the Pacific coast of northern Honshu, Japan. Bull. Biogeogr. Soc. Jpn. **51:** 1-6.

Nierstrasz HF, GA Brender à Brandis. 1923. Die Isopoden der Siboga-Expedition. II. Isopoda Genuina. I. Epicaridea. Siboga-Expeditie **32b:** 57-121, pls. 4-9.

Nierstrasz HF, GA Brender à Brandis. 1929. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. XLVIII. Epicaridea. I. Videnskabelige Meddedelser fra den Dansk Naturhistoriske Forening i København **87:** 1-44.

Nierstrasz HF, GA Brender à Brandis. 1930. Résultats scientifiques du voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Léopold de Belgique. Isopoda Epicaridea. Mém. Mus. Royal Hist. Nat. Belg. Hors Sér. **3:** 12-17.

Nierstrasz HF, GA Brender à Brandis. 1932. Alte und neue Epicaridea. Zool. Anz. **101:** 90-100.

Nishimura S. 1983. [*Athelges takanoshimensis*]. *In* H Utinomi, ed. Gakken illustrated nature encyclopedia. The aquatic lower animals of Japan. Tokyo: Gakken, p. 97.

Nobili G. 1905. Decapodi e isopodi della Nuova Guinea Tedesca raccolti dal Sign. L. Biró. Ann. Hist.-Nat. Mus. Natl. Hung. **3:** 480-507, pls. 12, 13.

Nobili G. 1906. Nuovi bopiridi. Atti Real Accad. Sci. Torino **41:** 1098-1113, pl. 41.

Nunomura N. 1995. Isopoda. *In* S Nishimura, ed. Guide to seashore animals of Japan with color pictures and keys, vol. II. Osaka: Hoikusha Publishing Co., pp. 205-233.

Pike RB. 1961. A new bopyrid parasite collected by the Chatham Islands 1954 Expedition. Bull. NZ Dept. Sci. Industr. Res. **139:** 221-223.

Rafinesque-Schmaltz CS. 1815. Analyse de la nature ou tableau de l'univers et des corps organisés. Palermo, 224 pp.

Richardson H. 1904. Contributions to the natural history of the Isopoda. Proc. US Natl. Mus. **27:** 1-89.

Richardson H. 1910. Marine isopods collected in the Philippines by the U. S. Fisheries steamer Albatross in 1907-8. Bur. Fish. Document **736:** 1-44.

Rybakov AV, VV Avdeev. 1991. Two *Bopyroides* species (Isopoda, Bopyridae) from the far-eastern shrimps. Parazitologiia **25:** 167-172. (in Russian with English summary)

Saito N, G Itani, N Nunomura. 2000. A preliminary checklist of isopod crustaceans of Japan. Bull. Toyama Sci. Mus. **23:** 11-107.

Shiino SM. 1933. Bopyrids from Tanabe Bay. Mem. Coll. Sci. Kyoto Imperial Univ. ser. **B 8:** 249-300.

Shiino SM. 1934. Bopyrids from Tanabe Bay II. Mem. Coll. Sci. Kyoto Imperial Univ. ser. **B 9:** 257-287.

Shiino SM. 1936a. Bopyrids from Shimoda and other districts. Rec. Oceanogr. Works Jpn. **8:** 161-176.

Shiino SM. 1936b. Bopyrids from Misaki. Rec. Oceanogr. Works Jpn. **8:** 177-190.

Shiino SM. 1937. Some additions to the bopyrid fauna of Japan. Annot. Zool. Jpn. **16:** 293-300.

Shiino SM. 1939. Bopyrids from Kyûsyû and Ryûkyû. Rec. Oceanogr. Works Jpn. **10:** 79-99.

Shiino SM. 1942. Bopyrids from the South Sea islands with description of a hyperparasitic cryptoniscid. Palao Trop. Biol. Stn. Stud. **2:** 437-458.

Shiino SM. 1958. Note on the bopyrid fauna of Japan. Rep. Faculty Fish. Prefect. Univ. Mie **3:** 27-74, pl. 3.

Shiino SM. 1965. Phylogeny of the genera within the family Bopyridae. Bull. Mus. Natl. Hist. Nat. ser. **2, 37:** 462-465.

Shiino SM. 1972. The Epicaridea (list of species) from Japan. Kansai Shizenkagaku **24:** 7-10. (in Japanese)

Shiino SM. 1974. Isopoda. *In* New illustrated encyclopedia of the fauna of Japan. Tokyo: Hokuryu-Kan, pp. 539-555.

Stimpson W. 1864. Descriptions of new species of marine Invertebrata from Puget Sound, collected by the naturalists of the North-west Boundary Commission, A. H. Campbell, Esq., Commissioner. Proc. Acad. Nat. Sci. Phila. **16:** 153-161.

Wei C. 1991. Isopoda, Crustacea. *In* C Wei, ed. Fauna of Zhejiang Crustacea. Zhejiang, China: Zhejiang Science and Technology Publishing House, pp. 94-147. (in Chinese)

Williams JD. 2003. The not so lonely lives of hermit crabs: studies on hermit crab symbionts. Hofstra Horizons Fall 2003: 15-18.