

DESCRIPTIONS AND REVISIONS OF SOME SPECIES OF ISOPODA BOPYRIDAE OF THE NORTH WESTERN ATLANTIC OCEAN

by

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Material reported is: *Asymmetrione clibanarii* Markham, 1975 ex *Clibanarius* sp. in Colombia (new host, new locality) and ex *C. tricolor* (Gibbes, 1850) in Colombia (new locality); *A. desultor* Markham, 1975 ex *Pagurus brevidactylus* (Stimpson, 1862) in Colombia and ex *Iridopagurus* sp. in Belize (new hosts, new localities); *Pseudasymmetrione markhami* Adkison & Heard, 1978 ex *Pagurus brevidactylus* and *P. stimpsoni* A. Milne Edwards & Bouvier, 1893 in Colombia (new hosts, new locality); *Progebiophilus upogebiae* (Hay, 1917), new combination, redescribed from North Carolina as a parasite of *Upogebia affinis* (Say, 1818); *Orthione furcata* (Richardson, 1904), new combination, ex *Upogebia affinis* redescribed from North Carolina and Massachusetts (new localities) and reassigned to the new genus *Orthione*; *Pseudione trilobata* Nierstrasz & Brender à Brandis, 1925 redescribed, ex *Pachycheles pilosus* (H. Milne Edwards, 1837) in Curaçao (new host); *Pseudione ampla* spec. nov. ex *Heterocarpus ensifer* A. Milne Edwards, 1881 in the eastern Gulf of Mexico; *Aporobopyrus curtatus* (Richardson, 1904) ex *Petrolisthes politus* (Gray, 1831) and *P. quadratus* Benedict, 1901 (new hosts), *P. armatus* (Gibbes, 1850) and *P. galanthinus* (Bosc, 1802) in Venezuela, Colombia, St. Eustatius and Bonaire (new localities) and Florida, U.S.A.; *Aporobopyrus bonairensis* spec. nov. ex *Petrolisthes marginatus* Stimpson, 1860, *P. quadratus*, and *P. politus* in Bonaire and Colombia; *Pleurocrypta petrolisthis* spec. nov. ex *Petrolisthes galathinus* (Bosc) in Bonaire; *Ione indecora* spec. nov. ex *Albunea paretii* Guérin, 1853 in Jamaica; *Grapsicepon belizeianum* spec. nov. ex *Mithrax (Mithraculus) coryphe* (Herbst, 1785) in Belize; *Probopyrinella heardi* Adkison, 1984 ex *Latreutes parvulus* (Stimpson, 1866) in Colombia (new locality); *Probopyrus pandalicola* (Packard, 1879) ex *Palaemonetes pugio* Holthuis, 1949, and *P. vulgaris* (Say, 1818) in Colombia and ex *Macrobrachium amazonicum* (Heller, 1862) in Rio Orinoco (new localities); *Probopyria alpei* (Richardson, 1900) ex *Alpheus* sp. in Colombia (new locality); *Schizobopyrina urocaridis* (Richardson, 1904) ex *Periclimenes longicaudatus* (Stimpson, 1860) in Colombia (new locality) and *P. iridescens* Lebour, 1949, in Colombia (new host, new locality); *Bopyrina abbreviata* Richardson, 1904, ex *Hippolyte zostericola* (Smith, 1873) in Colombia (new locality); *Bopyrella harmopleon* Bowman, 1956 ex *Synalpheus fritzmulleri* Coutière, 1909 in Colombia (new locality); *Ogyridione caroliniana* gen. nov., spec. nov. ex *Ogyrides hayi* Williams, 1981 in South Carolina; *Synsynella choprae* (Pearse, 1932) ex *Synalpheus pandionis* Coutière, 1909 and *S. brooksi* Coutière, 1909 in Colombia (new locality); *Stegophryxus hyptius* Thompson, 1902 ex *Pagurus maclaughlinae* García-Gómez, 1982 (new host) in Florida, U.S.A.; *Stegias clibanarii* Richardson, 1904 ex *Clibanarius tricolor* in Colombia (new locality); *Parathelges piriformis* Markham, 1972 (host unknown) in Belize (new locality); *Diplophryxus siankaanensis* spec. nov. ex *Alpheus formosus* Gibbes, 1850 in Quintana Roo, Mexico; *Allodiplophryxus floridanus* Markham, 1985 ex *Periclimenes magnus* Holthuis, 1951 in Colombia (new host, new locality); *Eophrixus subcaudalis* (Hay, 1917) ex *Synalpheus bousfieldi* Chace, 1972 (new host) in Quintana Roo, Mexico; *Metaphrixus carolii* Nierstrasz & Brender à Brandis, 1931 ex *Hippolyte curacaoensis* Schmitt, 1924 in Colombia (new host, new locality); *Hemiarthrus synalpei* (Pearse, 1950) (no host recorded) in Colombia (new locality).

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INTRODUCTION

Over several years, bopyrid isopods from many localities and hosts in the northwestern Atlantic Ocean have become available for examination. Although mentioned in a recent report on the bopyrid parasites of caridean shrimps of the region (Markham, 1985a), some of the specimens were not dealt with there. Seven of the species herein considered are described as new

and seven more redescribed, while the other 14 species, mostly from eastern Colombia, are new host or locality records or both.

Two terms used for structures of female bopyrid isopods need replacement, and this is an opportunity to propose new ones. The anteromedial projection of the posterior segment of the maxilliped, which I had started calling the “spur” (Markham, 1985a), I propose to redesignate the “plectron”, a word meaning a point or pointed end. This change will avoid confusion with another different application of the term “maxilliped spur” in the bopyrid literature. Secondly, for the processes which previously (Markham, 1985a) I have designated the “posteroventral border of the head” (an approximate translation of the French phrase “bord postérieur du céphalon” of Bourdon, 1968), I propose the much shorter and less awkward term “barbula”. This Latin word meaning “little beard” is appropriate both because of the appearance of the structure in question and because of its location on what might be considered the “chin” of the animal.

Subfamily Pseudioninae R. Codreanu, 1967

Asymmetrione Codreanu, Codreanu & Pike, 1965

Asymmetrione clibanarii Markham, 1975

(fig. 1)

Stegias clibanarii, Pearse, 1932: 4-5, figs. 22-26 (Dry Tortugas, Florida; infesting *Clibanarius tricolor*); Schultz, 1969: 323, fig. 515. (Not *Stegias clibanarii* Richardson, 1904).

Asymmetrione clibanarii Markham, 1975b: 260-263, 264, 265, figs. 5-6 (Type-locality Miami, Florida, USA; also found elsewhere in southern Florida and Berry Islands, Bahamas; infesting *C. tricolor*); 1978a: 102, 103, 115, tab. 1 (Ascension Island, SE Atlantic; infesting *Clibanarius* sp., aff. *C. tricolor*); 1986: 154.

Asymmetrione no. 2, Bourdon, 1976b: 366.

Material. — All from Tayrona Park, Dept. Magdalena, Colombia, H.-G. Müller coll., J. C. Markham det. of hosts. Infesting *Clibanarius tricolor*. Bahía de Nenguange, ca. 25 km E of Santa Marta, in *Thalassia testudinum*, 0.5 m, 17.i.1986, RMNH Dec. 36778: 1♀, 1♂, RMNH Crust. I. 7041. Bahía Concha, ca. 10 km E of Santa Marta, from brown algae in lower intertidal, 12 February 1986, RMNH Dec. 36790: 2♀, 2♂, RMNH Crust. I. 7064.

Infesting *Clibanarius antillensis* Stimpson, 1858. Bahía Concha, as above, from *Sargassum cymosum* C. Agardh, 2.v.1986, RMNH Dec. 36771: 2♀ (including that in figure 1), 1♂, RMNH Crust. I. 7035.

Discussion. — The specimens of *Asymmetrione clibanarii* differ but little from those previously seen. The five females are 1.34 to 3.50 mm long, the four

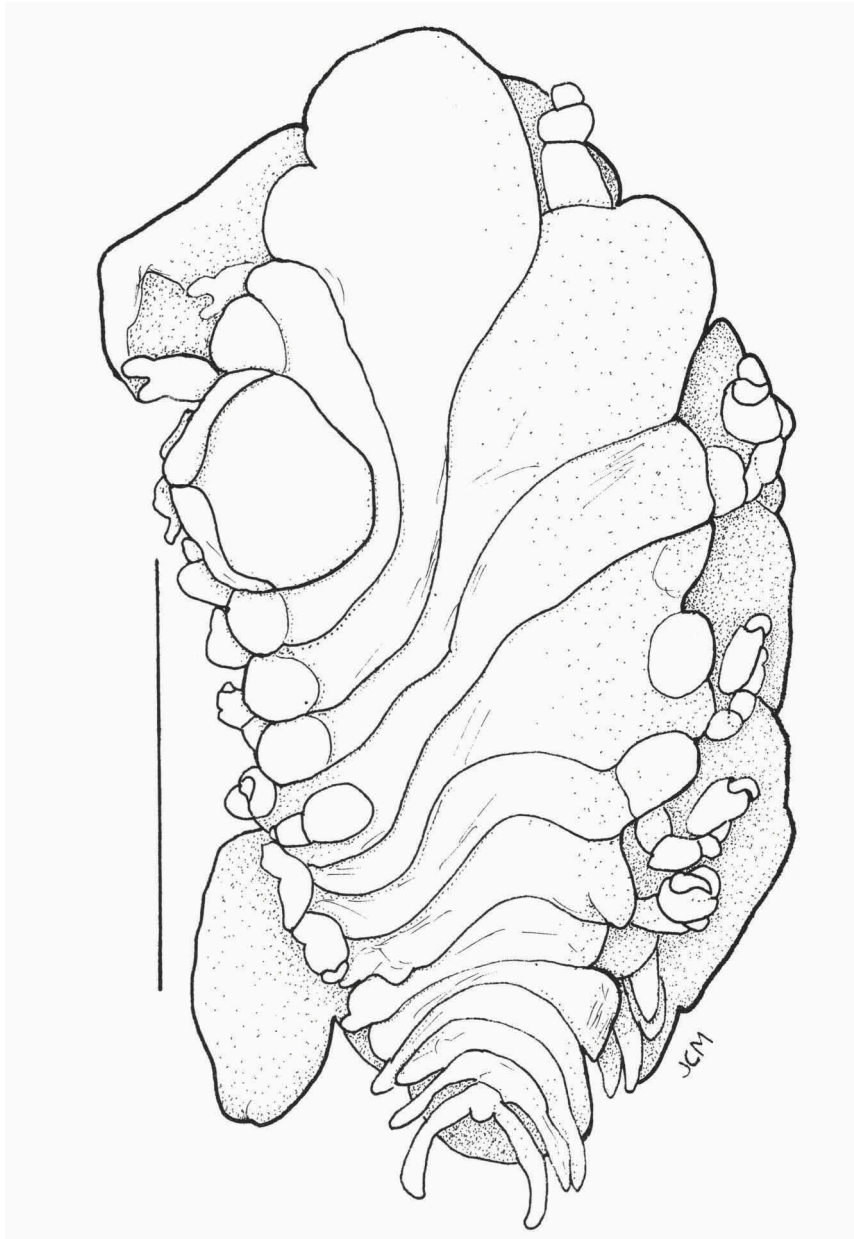


Fig. 1. *Asymmetrione clibanarii* Markham, female from Tayrona Park, Colombia, in dorsal view. Scale: 1.0 mm.

males from 1.34 to 1.96 mm. Three of the females have the anterior angle of the body enlarged into a broadly rounded hump, and three have uropods

developed like those of the paratype rather than of the holotype; the female drawn (fig. 1) shows both of these variations as well as having its head unusually far forward and its frontal lamina enlarged. As is typical for highly distorted species of *Asymmetrione*, they are all dextral, like all previously known specimens. The males show no noteworthy variations. This is the first record of *A. clibanarii* from South America, and the specimens infesting *Clibanarius antillensis* are the first known from any host definitely not *Clibanarius tricolor*.

Asymmetrione desultor Markham, 1975

? "Bopyrien": Forest & de Saint Laurent, 1967: 74 (Abrolhos Bank, Brazil; infesting *Paguristes tortugae* Schmitt, 1933).

Asymmetrione desultor Markham, 1975b: 225-260, 264, 265, figs. 1-4; tab. I (Type-locality Key Biscayne, Florida, infesting *Pagurus simpsoni* (called *P. bonairensis* Schmitt, 1936); also: Morehead Channel, North Carolina; infesting *P. longicarpus* Say, 1817; off Antigua; infesting *P. provenzanoi* Forest & de St. Laurent, 1967; and: Cay Sal Bank; infesting *Pylopagurus* sp.); Markham, 1978: 102, 103, 115, 116, tab. 1 (Curaçao and Bonaire; infesting *P. provenzanoi*); Adkison and Heard, 1978: 408; Bourdon, 1979d: 143-144 (Tentative identification; Abrolhos Bank, Brazil; infesting *Paguristes tortugae*); Markham, 1985b: 108.

Material (H.-G. Müller coll., J. C. Markham det. of hosts, all from Tayrona Park, E of Santa Marta, Dept. Magdalena, Colombia, except as noted). — Infesting *Pagurus brevidactylus*. Bahía Concha, in *Thalassia testudinum* König & Sims. 1.5-2 m, 12.ii.1986, RMNH Dec. 37178: 3♀, 1♂, RMNH Crust. I. 7070. Bahía de Chengue, on coralline algae in *Thalassia*, 2 m, 4.iv.1985, RMNH Dec. 36789: 1♀, 1♂, RMNH Crust. I. 7063.

Bahía de Gairaca, in *Thalassia*, 1-3 m, 24.i.1986, RMNH Dec. 37176: 1♀, RMNH Crust. I. 7068. Bahía de Nenguange, in *Thalassia*, 0-1 m, 5.viii.1985, RMNH Dec. 36793: 1♀, 1♂, RMNH Crust. I. 7067. Near Punta Cañaveral, in *Thalassia*, 1-1.5 m, 25.ii.1986, RMNH Dec. 36772: 1♀, 1♂, RMNH Crust. I. 7036. Bahía Concha, about 10 km E of Santa Marta, in *Thalassia*, 2-3 m, 7.xii.1987, RMNH Dec. 37177: 1♀, 1♂, RMNH Crust. I. 7069.

Infesting *Periclimenes americanus* (Kingsley, 1878). Bahía Concha, in *Thalassia*, 2-3 m, 7.i.1986, RMNH Dec. 36775: 1♀, immature, RMNH Crust. I. 7039.

Infesting *Iridopagurus* sp., ♂ lacking pereopods. Belize-80 Exp., Sta. 4, SW Cays, off Glover Reef, Belize, 16°45.5'N 87°52.0'W, 18.3 m, 23.iii.1980, G. Hendler coll.: 1♀, 1♂, UNSM 229894.

Separated from host. Bahía de Chengue, in *Thalassia* on coral rubble, 1 m, 27.i.1986: 1♀, RMNH Crust. I. 7059.

Discussion. — The ten females range in length from 2.32 to 4.56 mm, the five males from 1.44 to 3.20 mm. Like all previously recorded specimens of *A. desultor*, all are sinistrally distorted. One male has its head and pereon indistinctly separated, and the male from the *Iridopagurus* has no dorsal pigment, less separated peromeres and shorter extensions on the final pleomere; otherwise, all specimens are like the types in all significant characters. This is the first record of *A. desultor* from northern South America or Central America or as a parasite of *Pagurus brevidactylus* or any species of

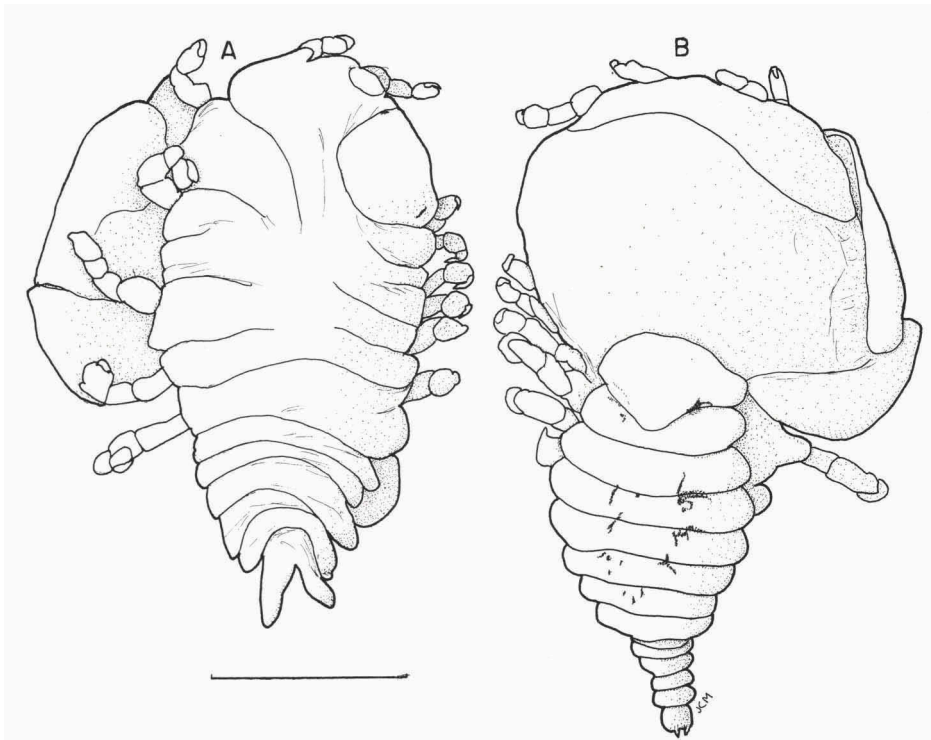


Fig. 2. *Pseudasymmetrione markhami* Adkison & Heard, immature female from Santa Marta, Colombia. A, dorsal view. B, ventral view, with male attached. Scale: 0.5 mm.

Iridopagurus. Elsewhere, *P. brevidactylus* has been recorded as the host of three different abdominal (athelgine) bopyrids, but not previously of any branchial (pseudionine) ones.

***Pseudasymmetrione* Adkison & Heard, 1978**

***Pseudasymmetrione markhami* Adkison & Heard, 1978**

(fig. 2)

“Undescribed genus and species” (in part), Markham, 1978a: 110.

Pseudasymmetrione markhami Adkison & Heard, 1978: 408, 409, 410-415, 416, 417, figs. 1-3 (Type-locality Morehead Channel, North Carolina, USA; infesting *Pagurus annulipes* (Stimpson, 1860); Bourdon, 1979: 141; Bourdon et al., 1981: 496. Overstreet, 1983: 225; Williams, 1984: 211.

Material. — Infesting *Pagurus brevidactylus*. Punta de Betin, Santa Marta, Dept. Magdalena, Colombia, under stones, 1-2 m, 4.ii.1986, RMNH Dec. 36779, H. G. Müller coll.: 2♀, 2♂ [including pair drawn, fig. 2], RMNH Crust. I. 7042.

Infesting *Pagurus stimpsoni*. Punta de la Aguja, ca. 4 km E of Santa Marta, Dept. Magdalena, Colombia, on coral rubble, 17-19 m, 9.i.1986, RMNH Dec. 36787, H. G. Müller coll.: 1♀, RMNH Crust.I. 7058

Discussion. — This is the first report of *Pseudasymmetrione markhami* since the type-collektion in North Carolina, and it thus extends the range of this species greatly. Both hosts are also new records though congeneric with that of the types, *Pagurus annulipes*, which does not occur that far south. *P. stimpsoni* has not previously been recorded as the host of any bopyrid. Like all of the type-specimens, these are all sinistral. The three females range in length from 1.26 to 2.92 mm, and the two males are 1.00 and 1.46 mm long. The female pictured (figure 2) is immature, but it does not differ appreciably from the types; its accompanying male seems fully mature and differs from previously known males in having eyes and a separate head.

Progebiophilus Codreanu & Codreanu, 1963

Progebiophilus upogebiae (Hay, 1917), new combination (fig. 3)

Pseudione upogebiae Hay, 1917: 572-573, pl. 100, figs. 7-12 [Type-locality Beaufort, North Carolina; infesting *Upogebia affinis* North Carolina]; Van Name, 1920: 72; Nierstrasz & Brender à Brandis, 1923: 72; Brian & Darteville, 1941: 350-351; Pearse, 1947: 326 (In part) (Beaufort, North Carolina; infesting *U. affinis*); Shiino, 1951: 32; Catalano & Restivo, 1965: 203; Lemos de Castro, 1965a: 11-14, figs. 1-11 (Barra do Ceará, Fortaleza, Ceará, Brazil; infesting *Upogebia* sp.); Williams, 1965: 104; Schultz, 1969: 325; Lemos de Castro, 1970: 3, 5, pl. III, figs. 15-17 (Barra do Ceará, Fortaleza, Ceará, Brazil; infesting *Upogebia omissa* Corrêa, 1968 and hyperparasitized by *Cabirops pseudioni* sp. n.); Restivo, 1970: 314; Restivo, 1971: 71, tab. 1; Wass, 1972: 147 (Sandy Point, York River, Virginia); Restivo, 1975: 153, Tab; Markham, 1977: 813, 816 (*Phylodurus robustus* Pearse, 1952 placed into synonymy); Kelley, 1978: 169; Lawler, 1978: 310; Williams, 1984: 192; Fox & Ruppert, 1985: 53, 196, 261, 289, 301 (South Carolina localities, infesting *U. affinis*).

Pseudione upogebiae (sic): Hay & Shore, 1918: 408 (Beaufort, North Carolina; infesting *U. affinis*).

Ps. urogebiae (sic): Popov, 1927: 13, 14.

Pseudodione upogebiae (sic): Pearse, 1945: 305 (Beaufort, North Carolina; infesting *U. affinis*).

Phylodurus robustus Pearse, 1953a: 235-237, figs. 131-143 (Type-locality Alligator Point, Florida; infesting *U. affinis*); Lemos de Castro, 1965a: 12; Williams, 1965: 104; Menzel, 1971: 76; Markham, 1977: 813, 816 (Placed into synonymy of *Pseudione upogebiae*); Williams, 1984: 192.

Pseudione urogebiae (sic): Schultz, 1969: fig. 520.

Material. — Infesting *Upogebia affinis*; Beaufort, North Carolina, 17.viii.1915, W. P. Hay, coll.; part of type-collection, 1♀, USNM 48369; Beaufort, North Carolina, 17.vi.1946, A. S. Pearse, coll. 1♀, 1♂, USNM 84051.

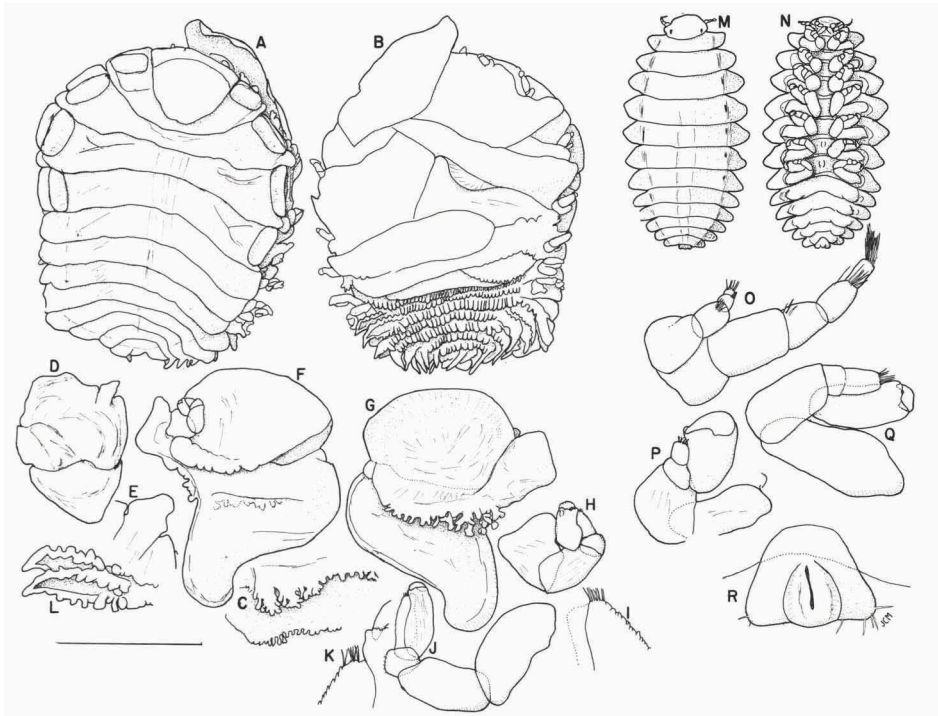


Fig. 3. *Progebiophilus upogebiae* (Hay), comb. nov., from Beaufort, N. C. A-L, female. M-R, male. A, dorsal view. B, ventral view. C, barbula and pereon 2. D, right maxilliped. E, palp of same. F, right oostegite 1, external view. G, same, internal view. H, right pereopod 1. I, carpus of same. J, right pereopod 7. K, ends of carpus, propodus and dactylus of same. L, right pleopod 1. M, dorsal view. N, ventral view. O, left antennae. P, left pereopod. Q, left pereopod 7. R, pleomere 6 in ventral view. Scale: 1.00 mm for E, H, J; 2.17 mm for C, D, F, G, L-N; 4.50 mm for A, B; 0.40 mm for P, Q; 0.20 mm for I, K, O, R.

Redescription of female (based on original description by Hay, 1917, present material and redescription by Lemos de Castro, 1965a) (fig. 3A-L). — Body large, over 10 mm long and 7 mm wide, broadly oval, only slightly distorted (16° to 30°) (fig. 3A, B).

Head set flush with anterior margin of pereon. Frontal lamina moderately long, slightly broader than head, often produced into small anterolateral points. No eyes. Antennae of three and four articles, respectively, each antenna distally setose. Barbula (fig. 3C) with two extended deeply digitate projections on each side and middle region produced into similar but shorter digitate-margined extensions. Maxilliped (fig. 3D, E) bearing extended triangular anteromedially-placed nonarticulating nonsetose palp and very acutely pointed plectron.

Pereon with smoothly curved margins, broadest across pereomeres three and four. Most lateral regions of pereomeres 1-4 with tergal plates and dorsolateral bosses. Ventral margins of pereomeres (fig. 3C) greatly convoluted. Oostegites completely enclosing brood pouch; oostegite 1 (fig. 3F, G) long, produced into bluntly rounded posterolateral point, external ridge prominent and extending posteriorly as overlapping toothed flap, internal ridge elaborately digitate. Peropods (fig. 3H-K) reduced but doubling in size posteriorly, all with basal articles more or less enlarged anteriorly; all carpi distally setose (fig. 3I, K).

Pleon of six pleomeres distinctly demarcated both dorsally and ventrally, not set apart laterally; margins of both sides produced into indistinctly demarcated lateral plates, those on concave side extending farther out; ventral surfaces of all pleomeres covered with numerous prominent longitudinal ridges; final pleomere divided by terminal groove. Pleopods (fig. 3L) biramous, densely overlapping but barely extending beyond lateral margins of pleomeres. Uniramous uropods of same structure as pleopodal rami, they and rami all with raised tuberculate margins and sharp distal points.

Description of male (fig. 3M-R). — Body with regularly oval outline, width more than half of length. All body regions and segments distinctly separated (fig. 3M, N).

Head suboval, much wider than long but still markedly narrower than first pereomere. Pair of distinct small dark eyes near posterior margin. Antennae (fig. 3O) of four and five articles, respectively; antenna 1 less than half as long as antenna 2, with tufts of setae on distal ends of all but basal article; antenna 2 extending far beyond margin of head, its end article densely setose distally, next two articles with sparser setae.

Pereon widest across pereomere 5. All pereomeres sharply pointed laterally. Peropods (fig. 3P, Q) all small and nowhere reaching edges of body, posterior ones with all articles somewhat elongate, all with somewhat obscure separation of meri and carpi; dactyli of first three pereopods longer and sharper than others, propodi enlarged with receptacles receiving ends of dactyli.

Pleon of six distinct pleomeres, first five ending in lateral points like those of pereomeres, sixth one much reduced and embedded in fifth. Poorly developed flaplike pleopods slightly extending beyond posterior margins of pleomeres 1-5. Pleomere 5 (fig. 3R) lacking uropods but with sparse setation on posterior corners; anal cone rising from surface and slightly overreaching posterior edge of pleomere.

Discussion. — Schultz (1969) suggested that *Pseudione upogebiae*, on the basis of its pleopodal structure, might properly belong in a new genus. Because

the limits of *Pseudione* are ill-defined, it is often difficult to decide which species correctly belong to it. In the present case, however, the affinities of *P. upogebiae* clearly lie with *Progebiophilus* Codreanu & Codreanu, 1963. That genus was erected for *Pseudione euxinica* Popov, 1927 originally described as a parasite of *Upogebia pusilla* (Petagna, 1792) in the Black Sea and subsequently (Bourdon, 1968) recorded as a parasite of that host species and *U. deltaura* (Leach, 1815) throughout the northern Mediterranean Sea. The only other described species of *Progebiophilus* is *P. sinicus* Markham, 1982, a parasite of a *Upogebia* sp. in Hong Kong. Characters which all three of these species share are, in the female: prominent head with barbula of deeply digitate projections; maxilliped palp extended and narrow; lateral margins of pereomeres not indented; first oostegite with extended rounded posterolateral point; all oostegites amply enclosing brood pouch; pereopodal meri extending beyond carpal margins and ischia elongate; pleomeres longitudinally ridged ventrally; biramous pleopods slender, sharply pointed, densely overlapping and with strongly tuberculate margins. Males of *P. upogebiae* are quite different from those of *P. euxinica* but closely similar to those of *P. sinicus* in having oval bodies, narrow quadrangular heads, laterally pointed separated pereomeres and very narrow sixth pleomeres. All three species infest hosts in the genus *Upogebia* in warm temperate to tropical waters. Some of the difficulties with the definition of the genus *Progebiophilus* were mentioned by Markham (1982).

Pearse (1947) reported *Pseudione upogebiae* as a parasite of *Upogebia affinis* in North Carolina. I have not seen all of the specimens which he examined, but one lot (USNM 84051) labeled as *P. upogebiae* contained only one pair of that species. The other two pairs belong to *P. furcata* Richardson, 1904, being redescribed as the type-species of the new genus *Orthione* below.

Orthione, gen. nov.

Diagnosis. — Female. Body broadly oval to nearly rectangular, at least $\frac{2}{3}$ as wide as long. Head relatively small, deeply embedded in pereon, with narrow frontal lamina; barbula with only single projection on each side; maxilliped completely lacking palp. Pereomeres not laterally separated, dorsolateral bosses inconspicuous, coxal plates reduced; first oostegite subrectangular, its internal ridge simple and posterolateral point absent; other oostegites generously enclosing brood pouch. Pleon tapering rapidly, with final (sixth) pleomere deeply embedded in posteriorly indented fifth pleomere; five pairs of short slender biramous pleopods almost completely covering ventral surface but barely exceeding margins of pleon; pair of similar uniramous uropods,

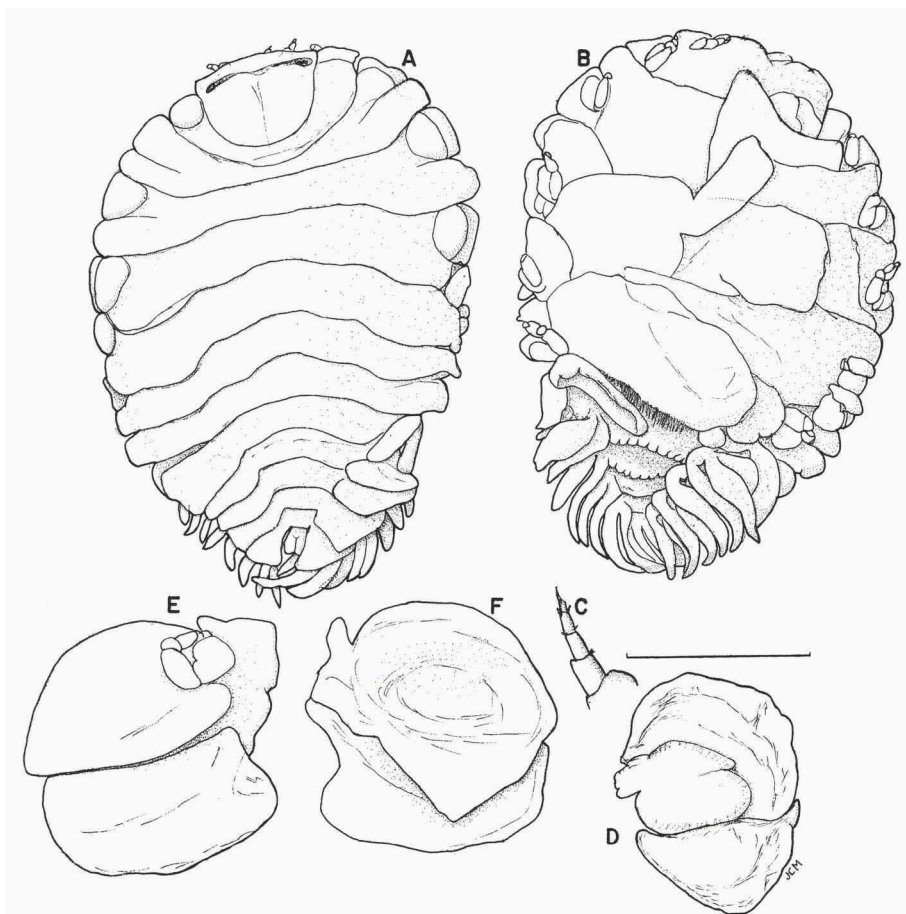


Fig. 4. *Orthione furcata* (Richardson), comb. nov., from type-series. A, dorsal view. B, ventral view. C, right antenna 2. D, right maxilliped. E, left oostegite 1, external view. F, same, internal view. Scale: 1.0 mm for C; 2.0 mm for D-F; 4.0 mm for A, B.

they and pleopods with entire margins. Male. Sides nearly straight and parallel, ends smoothly rounded. Head subsemicircular, distinct from pereon. Pereomeres separated by lateral indentations; pereopods all relatively small, first two with longer dactyli than others. Pleon of five pleomeres, some well separated; five pairs of obscure, flaplike pleopods near posterior margins; prominent uropods extending beyond posterior edge of last pleomere. Hosts in genus *Upogebia*.

Type-species *Pseudione furcata* Richardson, 1904. Gender feminine.

Etymology. — From Greek stem *ortho-* meaning “straight” or “right” in reference to nearly straight sides in both sexes and head of female + *lone*, one of the oldest generic names in the Bopyridae.

***Orthione furcata* (Richardson, 1904), new combination**
(figs. 4-6)

Pseudione furcata Richardson, 1904: 79, figs. 69, 70 (Type-locality shore of Virginia, U.S.A.; male and host unknown); 1905: 529-530, figs. 571-573; Fowler, 1912: 523; Hay, 1917: 573; Van Name, 1920: 72; Nierstrasz & Brender à Brandis, 1923: 72; Schultz, 1969: 327, fig. 524; Gosner, 1971: 476; Wass, 1972: 147; Markham, 1977: 816 (Examination of additional unspecified material; identification of host as *Upogebia affinis*).

Pseudione upogebiae Hay (in part): Pearse, 1947: 326 (Beaufort, North Carolina; infesting *Upogebia affinis*.)

Pseudoione furcata [sic]: Kaestner, 1970: 463 [Reported, without citation, from Gulf of Mexico].

Material. — Infesting *Upogebia affinis*. North shore, Wellfleet Harbor, Cape Cod, Massachusetts, 3.vii.1954, M. H. Pettibone, coll.: 1♀, 1♂, RMNH Crust. I. 1970. Beaufort, North Carolina, 17.vi.1946, A. S. Pearse coll.: 2♀, 2♂, USNM.

Separated from host. From unspecified region of shore of Virginia, prior to 1904, in type-series: 1♀, USNM 29093.

Redescription of female (figs. 4, 5). — Length 11.0 - 13.7 mm, maximal width 7.8 - 10.0 mm, head length 1.9 - 2.2 mm, head width 2.5 - 2.8 mm, pleon length 3.3 - 3.8 mm. Distortion 10° - 18°. Broadly oval to subrectangular, sides nearly parallel (figs. 4A, B; 5A, B).

Head square-cornered anteriorly, deeply embedded in pereon. Frontal

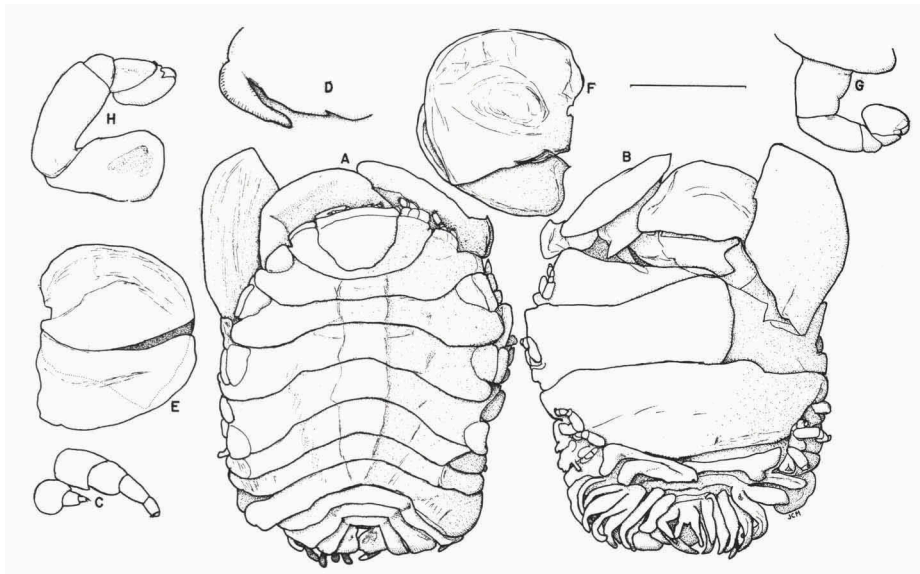


Fig. 5. *Orthione furcata* (Richardson), comb. nov., from Wellfleet Harbor, Massachusetts, female. A, dorsal view. B, ventral view. C, right antennae. D, right side of barbula. E, right oostegite 1, external view. F, same, internal view. G, left pereopod 1. H, left pereopod 7. Scale: 1.0 mm for C, G, H; 2.0 mm for D-F; 4.0 mm for A, B.

lamina short and extending only to sides of head. Barbula (fig. 5D) with only one simple projection on each side, no medial projections. Antennae (fig. 4C, 5C) short and stubby, of three and five articles, respectively. Maxilliped (fig. 4D) nearly oval, completely lacking palp, but with broad plectron.

Pereomeres not deeply divided laterally but with dorsal sutures distinct clear across. Reduced coxal plates and dorsolateral bosses on one or both sides of most anterior pereomeres. First oostegites (fig. 4E, F; 5E, F) subrectangular, not extended into posterolateral point; unadorned internal ridge forming right angle near posterior margin of oostegite; other oostegites completely enclosing brood pouch; posterior margin of oostegite 5 thickly fringed with setae. Pereopods (fig. 5G, H) slightly larger posteriorly, all with bases produced into small protuberances on distal parts of anterior margins.

Pleon of six pleomeres, each much smaller than that preceding. Pleomere 5

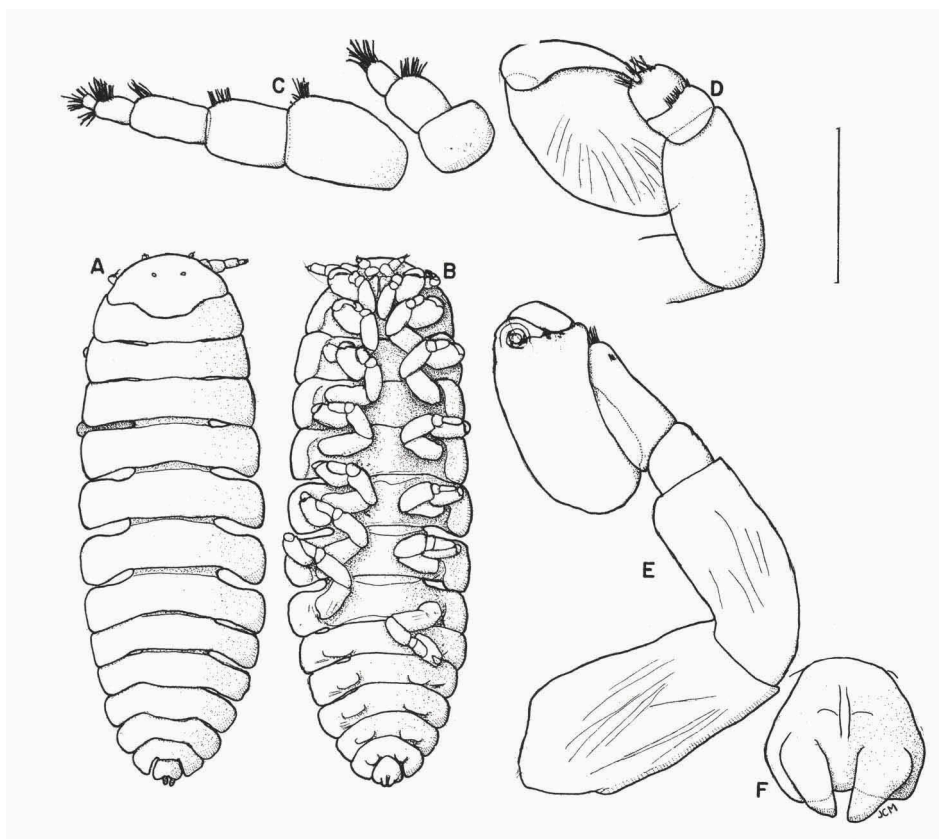


Fig. 6. *Orthione furcata* (Richardson) comb. nov., from Wellfleet Harbor, Massachusetts, male. A, dorsal view. B, ventral view. C, right antennae. D, right pereopod 1. E, right pereopod 7. F, pleomere 6 in ventral view. Scale: 2.00 mm for A, B; 0.32 mm for C-F.

deeply notched posteriorly, pleomere 6 tiny, enclosed in notch, often not visible dorsally. Sides of pleomeres not produced into lateral plates. All pleopods biramous, those of first pair broad and blunt, meeting in middle of pleon just behind brood pouch, other pleopods lanceolate and directed laterally. Pleopods and shorter uniramous uropods lacking ornamentation, almost completely covering ventral surface of pleon but extending very little beyond sides of pleon.

Description of male (fig. 6). — Length 6.0 - 6.8 mm, maximal width 1.9 - 2.5 mm, head length 0.6 - 0.8 mm, pleon length 1.8 - 2.3 mm. Sides of body nearly straight and parallel, both ends rounded. All body regions and segments distinct. Most pereomeres and pleomeres deeply separated by lateral indentations (fig. 6A, B).

Head nearly semicircular except posterior border markedly convex, nearly twice as broad as long. Small unpigmented eyes near center. Antennae (fig. 6C) of three and five articles respectively, nearly all articles of both heavily setose distally.

Pereon broadest, but only slightly so, across pereomere 5. All pereomeres reflexed laterally. No midventral tubercles. Pereopods (fig. 6D, E) equally developed, anterior two with much longer and sharper dactyli than others; lengths of bases, ischia and carpi increasing posteriorly.

Pleon of six distinct pleomeres, first five chevron-shaped, sixth trapezoidal and deeply embedded in fifth. Pleopods as five pairs of nearly sessile obscure flaps mostly extending to posterior edges of pleomeres or indicated only by dark regions on ventral surfaces of pleomeres or completely unindicated. Uropods (fig. 6F) as conspicuous flaps extending beyond posterior margin.

Discussion. — *Pseudione furcata* cannot be retained in *Pseudione* for several reasons. The female is proportionately too broad; its head has too small a frontal lamina; its barbula is too simple; its maxilliped completely lacks a palp; its first oostegite has a uniquely shaped internal ridge and no posterolateral point; its pleon has no lateral plates; its first pleopods are of unique structure, while the other four pairs of pleopods are too short and simple; and finally, the posterior indentation of the fifth pleomere is highly distinctive. The male has an unusual fusiform body, a short and rounded head, often discernible if small pleopods and conspicuous uropods.

The new genus *Orthione* fits among those primitive bopyrid genera designated the Thalassinidean Transition by Markham (1986). Like all members of that group, its subfamilial placement is somewhat questionable because it evidently forms an evolutionary link between the Pseudioninae and the Ioninae, and it is restricted to hosts in the Thalassinidea, in this case in the genus *Upogebia*. Its closest relatives among other genera infesting *Upogebia*

spp. are the monotypic ones *Procepon* Shiino, 1937, whose female is quite similar, and *Gyge* Cornalia & Panceri, 1858, whose male is much like that of *Orthione*. *O. furcata*'s female is like that of *Procepon insolitum* Shiino, 1937 in having a comparably proportioned body, a similarly shaped head with a reduced frontal lamina, and similar lanceolate pleopods are uropods. The female of *P. insolitum* differs from that of *O. furcata* mainly in having large pointed coxal plates, prominent pleonal lateral plates, and no indentation of the fifth pleomere. The males of the two species (and genera) are very different. At the same time, females of *O. furcata* and *Gyge branchialis* Cornalia & Panceri, 1858 (as redescribed by Bourdon, 1968) contrast markedly (both having about the same body shape and indented fifth pleomeres but nothing else in common), while their males resemble each other closely. Both males have nearly fusiform bodies, highly setose antennae, long dactyli only on the first two pereopods, reduced embedded sixth pleomeres and barely visible pleopods. The male of *G. branchialis* is different from that of *O. furcata* in having pereopods with fused meri and carpi and no uropods.

The specimens from North Carolina were catalogued with a pair of *Progebiophilus upogebiae* (discussed above) with which they had been collected from the same host species, *Upogebia affinis*. They were among the material reported under the name *Pseudione upogebiae* by Pearse (1947).

Pseudione Kossmann, 1881

Pseudione trilobata Nierstrasz & Brender à Brandis, 1925

(fig. 7)

Pseudione trilobata Nierstrasz & Brender à Brandis, 1925: 2-3, 7, figs. 7-10 [Type-locality Spaansche Baai, Curaçao, infesting *Pisosoma angustifrons* Benedict, 1901 (= *Neopisosoma angustifrons* (Benedict, 1901))]; Monod, 1933: 227; Shiino, 1933: 271; Schultz, 1969: 325, fig. 519; Bourdon, 1976a: 165, 167-171, 240, 241, figs. 1-3 (Zihuatenejo Bay, west coast of Mexico; infesting *Petrolisthes hians* Nobili, 1901; redescription); Markham, 1978b: 489. "Bopyrid": Haig, 1968: 67.

Material. — Infesting *Pachycheles pilosus* (H. Milne Edwards, 1837). Mouth of Piscadera Bay, Curaçao, Netherlands Antilles, muddy sand, 0.5 m, 5.xii.1956, RMNH Dec. 36767, L. B. Holthuis coll. (sta. 1020) and det. of host; 1♀, 1♂, RMNH Crust. I. 7030.

Discussion. — Because the original description of *Pseudione trilobata* by Nierstrasz & Brender à Brandis (1925) was quite detailed, and Bourdon (1976a) redescribed it well, only a few notes on the present material are needed here. The female (fig. 7A, B) is slightly more slender, with a relatively longer and less rounded head almost completely lacking a frontal lamina; its

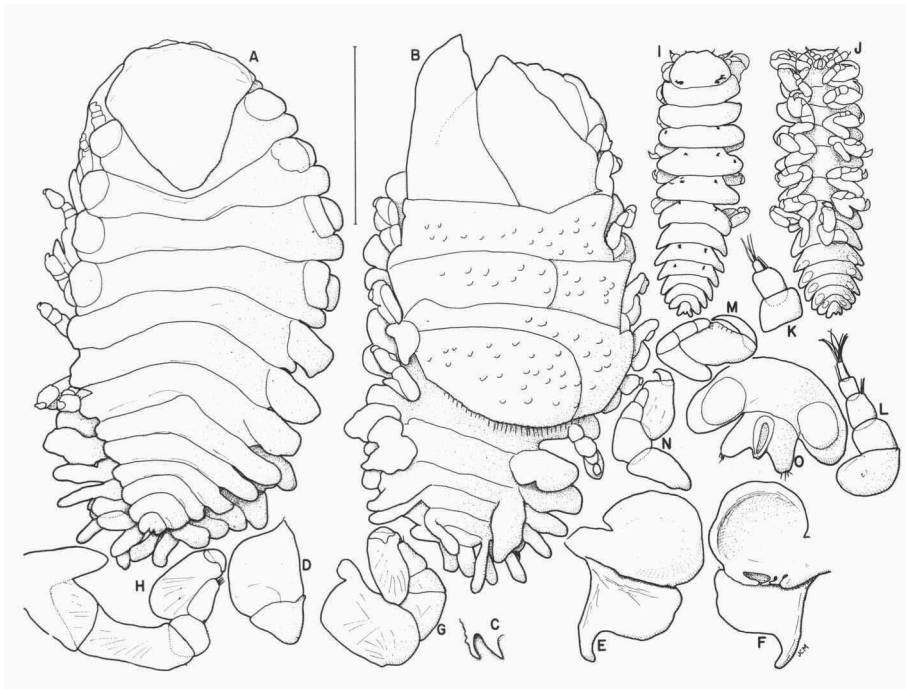


Fig. 7. *Pseudione trilobata* Nierstrasz & Brender à Brandis, 1925, from Curaçao. A-H, reference female. I-O, reference male. A, dorsal view. B, ventral view. C, right side of barbula. D, right maxilliped, external view. E, right oostegite 1, external view. F, same, internal view. G, left pereopod 1. H, right pereopod 7. I, dorsal view. J, ventral view. K, right antenna 1. L, right antenna 2. M, left pereopod 1. N, left pereopod 7. O, pleomers 5, 6, ventral view. Scale: 1.4 mm for A, B; 1.2 mm for C-F, I, J; 0.5 mm for G, H, K-N; 0.25 mm for O.

barbula (fig. 7C) has slightly longer projections than seen by Bourdon (1976a), but the distinctive appearance of the maxilliped (fig. 7D), with its triangular nonarticulating sparsely setose palp matches that of Bourdon well. The falcate posterolateral point of the first oostegite (fig. 7E, F) is like most reported previously. The pereopods (fig. 7G, H) match those illustrated by Bourdon, especially in the long basal carina of pereopod 7, except that in the present case all meri and carpi are separate rather than fused. The male (fig. 7I, J) matches those previously reported except that its head is distinct dorsally, and again its pereopods (fig. 7M, N) have separated meri and carpi; its bilobate final pleomere (fig. 7O) is like that of the type male (Nierstrasz & Brender à Brandis, 1925) and some, but not all, of the specimens reported by Bourdon (1976a).

Because Curaçao is the type-locality for *Pseudione trilobata*, this is not a new geographical record. *Pachycheles pilosus* has never previously been recorded as a bopyrid host, so it is new for this species.



Fig. 8. *Pseudione ampla* spec. nov., holotype female. A, dorsal view. B, ventral view. C, left antenna 1. D, left antenna 2. E, right side of barbula. F, right maxilliped. G, palp of same. H, plectron of same. I, right oostegite 1, external view. J, same, internal view. K, right pereopod 1. L, right pereopod 7. M, end of carpus of same. Scale: 1.00 mm for K, L; 4.50 mm for A, B; 2.17 mm for E, F, I, J; 0.61 mm for C, D, G, H.

***Pseudione ampla* spec. nov.**

(figs. 8, 9)

Pseudione species A: Markham, 1985a: 14, 15 (Eastern Gulf of Mexico and Cay Sal Bank; infesting *Heterocarpus ensifer*).

Pseudione n. sp.: Markham, 1985a: 131.

Material. — Infesting *Heterocarpus ensifer*. USFWS vessel *Oregon Station* 1324, 24°23'N, 83°22'W, Gulf of Mexico, 366 m, trawl: 1♀, holotype; 1♂, allotype, USNM 98677.

Description of holotype female (fig. 8). — Length 11.51 mm, maximal width 9.36 mm, head length 2.30 mm, head width 3.57 mm, pleonal length 3.71 mm. Body ovate, distortion 26°. All body regions and segments distinct (fig. 8A, B).

Head irregularly triangular, with long broad frontal lamina completely enclosing anterior margin. No eyes. Antenna 1 (fig. 6C) of three articles, antenna 2 (fig. 8D) of five articles, neither extending beyond margin of head, both with sparse setae only terminally. Posteroventral border (fig. 8E) with two entire falcate projections on each side, no medial ornamentation. Maxilliped (fig. 8F) roughly quadrilateral, with segments markedly separated; slender palp (fig. 8G) extended, curved, heavily setose, articulating with anterior margin of maxilliped; plectron (fig. 8H) slender, extended and curved.

Pereon quite smoothly curved, with no deep separations. Both sides of pereomeres 1-4 with prominent coxal plates and dorsolateral bosses. Tergal projections on both sides of pereomeres 6 and 7. Indistinct middorsal ridge present. Oostegites completely enclosing brood pouch; oostegite 1 (fig. 8I, J) rounded anteriorly and truncate posteriorly except for long slender tapering posteriorly extended posterolateral point; internal ridge produced into irregularly placed teeth of various sizes. Pereopods (fig. 6K-M) mostly extending beyond sides of pereon; all articles except propodi nearly doubling in length posteriorly; all carpi distally setose (fig. 8M).

Pleon of six pleomeres, first five developed into foliaceous lateral plates, each overlapping that behind. Five pairs of biramous pleopods, their endopodites suboval and nearly covering ventral surface of pleon, their exopodites lanceolate and extending well beyond sides of pleon. Uniramous uropods similar to exopodites, extending far posteriorly. Margins of all pleonal appendages entire.

Description of allotype male (fig. 9). — Length 3.46 mm, maximal width 1.25 mm. head length 0.50 mm, head width 0.82 mm, pleonal length 1.07 mm. Outline lanceolate. All body regions and segments distinct (fig. 9A, B).

Head extended, anteriorly rounded and posteriorly convex. Two distinct small eyespots near middle of head. Antennae (fig. 9C) of three and five articles respectively, both with setae in nearly every article; antenna two overreaching margins of head.

Sides of pereon smoothly rounded though pereomeres all somewhat indented anterolaterally. No midventral tubercles. Pereopods (fig. 9D, E) enlarging slightly posteriorly; dactyli progressively shorter and propodi narrower posteriorly; carpi sparsely setose distally; posterior propodi with indented receptacles for tips of dactyli.

Pleon of six distinct pleomeres, smoothly tapering posteriorly but with all pleomeres separated laterally like pereomeres. No midventral tubercles. Five pairs of moderately extended flaplike pleopods (fig. 9F), though fifth pair very

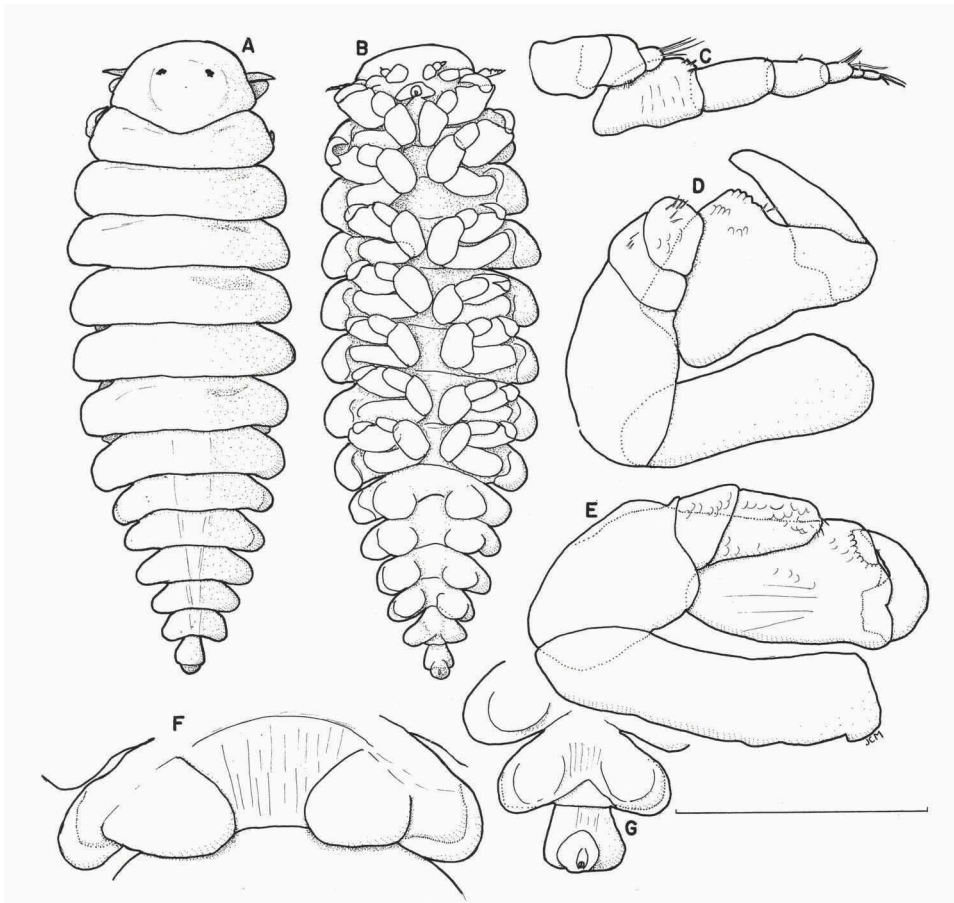


Fig. 9. *Pseudione ampla* spec. nov., allotype male. A, dorsal view. B, ventral view. C, left antennae. D, left pereopod 1. E, left pereopod 7. F, pleomere 1, ventral view. G, end of pleon, ventral view.

indistinct. Sixth pleomere (fig. 9G) extended, lacking uropods but bearing mobile anal cone often reaching beyond posterior margin.

Etymology. — Latin adjective *ampla*, meaning “large”, selected to indicate unusual size of both sexes and to reflect close similarity of this species to *Pseudione magna* Shiino.

Discussion. — *Pseudione ampla* is a very close relative of the western Pacific species *P. magna* Shiino, 1951, the only other recorded bopyrid parasite of a species of the pandalid genus *Heterocarpus*. Shiino (1951) described *P. magna* as a parasite of *Heterocarpus sibogae* de Man, 1917 in Mie Prefecture, Japan, and Danforth (1976) reported it as a parasite of *Heterocarpus ensifer* in Guam.

These two species are among the largest in the genus in both sexes. Females of the two species are alike in shape of body, head, barbula maxilliped and palp, and first oostegite and arrangement of pleonal appendages. The female of *P. magna* contrasts with that of *P. ampla* in having a rather longer head and smaller frontal lamina, dimorphic first oostegites, less completely closed brood pouch, more sharply pointed pleopodal endopodites and lateral plates and exopodites with slightly crenulated margins. Males of both species are alike in body shape and proportions, lateral separation of body segments and shape and structure of antennae and pereopods. The male of *P. magna* differs from that of *P. ampla* in having a relatively shorter head, midventral tubercles on some pereomeres and pleomeres, much smaller pleopods and its final pleomere produced into two posterior extensions.

Aporobopyrus Nobili, 1906

Aporobopyrus curtatus (Richardson, 1904)

- Pseudione curtata* Richardson, 1904: 80-81, figs. 72-75 [Key West, Florida, U.S.A., infesting *Petrolisthes sexspinosus* (Gibbes, 1850) (= *P. galathinus* (Bosc, 1802))]; Richardson, 1905: 530-531, figs. 574-577; Nobili, 1906: 1108; Van Name, 1920: 72; Nierstrasz & Brender à Brandis, 1923: 72; Nierstrasz & Brender à Brandis, 1925: 3, 7; Nierstrasz & Brender à Brandis, 1931: 169; Shiino, 1933: 271; Shiino, 1952: 41; Shiino, 1958: 35; Menzies & Glynn, 1968: 13; Schultz, 1969: 326, fig. 522.
- Aporobopyrus curtatus*: Nierstrasz & Brender à Brandis, 1929: 12; Monod, 1933: 227; Shiino, 1934: 267; Shiino, 1964: 22; Markham, 1975c: 257, 258-265, fig. 1.3 (Infesting *Petrolisthes galathinus* in Florida Keys and St. John, Virgin Islands; *P. marginatus*, probably Barbados; *P. armatus*, Apalachicola and Miami, Florida; *Porcellana sayana* (Leach, 1820), North Carolina and St. John, Virgin Islands; incorporation of *Aporobopyrus johannis* Nierstrasz & Brender à Brandis, 1929, into synonymy; redescription); Bourdon, 1976a: 166, 175-180, 238, 240, 241, figs. 6-9 (Redescription of types; and coast of Brazil at 23°05.5'S, 45°01'W; 26°06'S, 45°29'W; and 24°35.5'S, 45°01'W; infesting *Porcellana sayana*); Camp et al., 1977: 17 (Identity uncertain; Hutchinson Island, Florida, infesting *Petrolisthes armatus*); Lemos de Castro & Brasil Lima, 1980b: 1-4, 6, figs. 1-15 (Infesting *P. armatus* at Rio de Janeiro, São Paulo, Paraíba and Ceará, Brazil; infesting *P. galathinus* at São Paulo, Brazil; infesting *Petrolisthes* sp. at Pernambuco and Pará, Brazil; infesting *Pachycheles ackleianus* A. Milne Edwards, 1880 at Bahia, Brazil; and infesting *P. greeleyi* (Rathbun, 1900) at Paraíba, Brazil); Duarte & Morgado, 1983: 3, 5, 7, 11, fig. 10 (Unspecified locality, Brazil; infesting *Petrolisthes galathinus*).
- Aporobopyrus johannis* Nierstrasz & Brender à Brandis, 1929: 10-11, figs. 9-10 (Type-locality Coral Bay, St. John, Virgin Islands, infesting unknown host (subsequently identified as *Petrolisthes galathinus* by Markham, 1975d)); Monod, 1933: 227; Shiino, 1934: 267; Shiino, 1964: 22.
- Pseudione curta* (sic): Hehre, 1950: 18 (Grand Isle, Louisiana; host unspecified).
- "Bopyrid parasite": Haig, 1966: 355 (Three Brazilian localities cited by Bourdon, 1976a; infesting *Porcellana sayana*).
- ?*Aporobopyrus gracilis*: Lemos de Castro, 1965b: 177-180, figs. 1-10 (São Paulo, Brazil; infesting *Petrolisthes armatus* and *P. galathinus*); Coelho & Koenig, 1972: 256; tab. I (Not *Aporobopyrus gracilis* Nierstrasz & Brender à Brandis, 1929).

Not *Pseudione curta* (sic): Menzies & Frankenberg, 1966: 26 (Coast of Georgia; (= *Synsynella choprae* (Pearse, 1932))).

?“Bopyrid”: Gore, 1970: 963 (Cabo Tiburon, near Golfo de Urabá, Colombia; infesting *Porcellana sayana*).

?“Bopyrid parasites”: Gore, 1974: 715 (unspecified locality, Caribbean Sea; infesting *Porcellana sayana*).

Material. — Infesting *Petrolisthes armatus*. Bear Cut, N. E. tip Key Biscayne, Miami, Florida, U.S.A., on sandy beach with mangrove rock, in tidepools with *Zoanthus* and *Tetraclita*, 0-1 m, 7.ix.1963, RMNH Dec. 36762, P. W. Hummelinck coll. no. 1411: RMNH Crust. I. 7023, 2♀, 2♂. — Bear Cut, north point of Key Biscayne, Miami, Florida, U.S.A., 0-1 m, 6.viii.1966, L. B. Holthuis coll.: RMNH Crust. I. 7024, 3♀, 4♂. — North coast of Virginia Key, Miami, Florida, U.S.A., 12.i.1979, L. B. Holthuis coll.: RMNH Crust. I. 7022, 3♀, 3♂. — North of Estación de Investigaciones Marinas, Punta de Piedras, Margarita, Venezuela, on dead branches of *Rhizophora* trees with balanids, sponges, etc., 0-1.5 m, 12.i.1964, P. W. Hummelinck coll. no. 1448, RMNH Dec. 36760: RMNH Crust. I. 7019, 1♀, 1♂. — Puente de la Restinga, Margarita, Venezuela, east side at entrance of large lagoon, in concrete and rock debris on muddy *Rhizophora* with ascideans and sponges, 0-1 m, 11.i.1964, P. W. Hummelinck coll. no. 1449: RMNH Crust. I. 7027, 2♀, 1♂.

Infesting *Petrolisthes galathinus*. Oyster pond, St. Maarten, Netherlands Antilles, 0.3-0.6 m, 22.vii.1984, RMNH Dec. 36766, P. A. van den Heuvel coll.: RMNH Crust. I. 7029, 1♀, 1♂.

Infesting *Petrolisthes quadratus*. Entrance to Piscadera Bay, Curaçao, on sand and muddy sand with rock and stones, among algae, sponges, etc., 0-1.5 m. November-December 1956, RMNH Dec. 36759, L. B. Holthuis coll.: RMNH Crust. I. 7018, 1♀, 1♂.

Infesting *Petrolisthes politus*. “Luymes”, Saba Bank Expedition Sta. 121, SW coast St. Eustatius, 17°29'N, 62°59'W, 9-10.vi.1972, 0-15 m on sand and turtle grass and coral reef, coll. by divers, RMNH Dec. 36765: RMNH Crust. I. 7028, 1♀, 1♂.

Separated from hosts. All from Dept. Magdalena, Colombia, H. G. Müller coll. Bahía de Cinto, Tayrona Park, ca. 30 km E of Santa Marta, under intertidal stones, 14.iv.1986: RMNH Crust. I. 7060, 1♀, 1♂. Bahía de Nenguange, Tayrona Park, ca. 25 km NE of Santa Marta, under rock, 10.iv.1986: RMNH Crust. I. 7056, 1 immature ♀, 1♂. Playa Oriental, Punta de Betin, Santa Marta, under stones, 1-2 m, 4.ii.1986: RMNH Crust. I. 1♀, immature, of somewhat doubtful identity.

Discussion. — *Aporobopyrus curtatus* has been thoroughly described and illustrated by Richardson (1904, 1905), Markham (1975a), and Bourdon (1976a), to which accounts one should refer for details. The present material is all from within the previously recorded range, though all of the specific localities except Miami, Florida, are new. Further, the host record of *Petrolisthes quadratus*, never previously recorded as the host of any bopyrid, is new. Of the 15 hosts of *A. curtatus* examined, seven were males and eight were females; only 1 female bore eggs, in contrast with the status of female hosts of *A. curtatus* reported earlier (Markham, 1975a). Eight of the females examined are dextral and nine sinistral. Differences between the present material and specimens previously described (Markham, 1975a) are few and minor. The 17 females range in length from 1.46 to 4.80 mm. Three of the females lack tubercles along the edges of the pleopods, and one of those three, an immature specimen, also lacks teeth on the barbula and on the internal ridge of the first

oostegite. The males range in length from 1.24 to 2.40 mm. Eleven of the males bear pigment spots on the anterior edges of most or all pereomeres; such spots are probably normally present but lost after long preservation so not previously seen. Four of the males have quite deeply separated pereomeres, and four have pereopodal propodi produced into triangular flanges meeting the tips of their respective dactyli when reflexed. The dactyli of both pereopods of the first two pairs are reduced in one male, while those on only the right side are reduced in another male; in all other males, the dactyli of the first two pairs are larger than the other five.

There is considerable confusion about the occurrence of *Aporobopyrus curtatus* in Brazil. Lemos de Castro (1965b) reported a parasite of *Petrolisthes armatus* and *P. galathinus* under the name of *Aporobopyrus gracilis* Nierstrasz & Brender à Brandis, 1929, a species previously reported only as a parasite of *Galathea* sp. on the west coast of Africa (Nierstrasz & Brender à Brandis, 1929). In light of its host species, it seemed much more likely that this parasite really was *A. curtatus*. At my request, A. Lemos de Castro sent a specimen for examination and I reported (Markham, 1975a) that "the females are specifically distinct from any of *A. curtatus*" but stated no conclusions about their identity with *A. gracilis*. Bourdon (1976a), in reviewing bopyrid parasites of porcellanids around the world, referred to these specimens as "*Aporobopyrus gracilis*" and regarded them as distinct from the true *A. gracilis*. Reconsidering the earlier identification, Lemos de Castro & Brasil Lima (1980) published a review of *A. curtatus* and stated that the specimens previously reported from Brazil as *A. gracilis* were really *A. curtatus*. It is probable that they were really dealing with an undescribed species of *Aporobopyrus*, and it remains unknown whether *A. curtatus* actually occurs in Brazil. Although they did not cite a source for the information, Lemos de Castro & Brasil Lima (1980) listed the diogenid hermit crab *Petrochirus diogenes* (L. 1758) as a host of *A. curtatus* in the Virgin Islands. This is clearly an error derived from the report by Markham (1975a) of the occurrence of the host porcellanid *Porcellana sayana* as a commensal in the gastropod shell occupied by *Petrochirus diogenes*.

***Aporobopyrus bonairensis* spec. nov.**

(fig. 10)

Material. — Infesting *Petrolisthes quadratus*. SE coast Klein Bonaire, near Bonaire, Netherlands Antilles; rocky beach with coral shingle and sand, 0-0.5 m, 13.iv.1955, RMNH Dec. 36761; P. W. Hummelinck coll. no. 1372, J. S. Zaneveld det. of host: 1♀, holotype; 1♂, allotype, RMNH Crust. I. 7021. S. coast Saba, Netherlands Antilles, windward side to Fort Bay; in surf-zone rock pools, 25.ii.1957, L. B. Holthuis coll. no. 1130: 1♀, paratype, RMNH Crust. I. 7040.

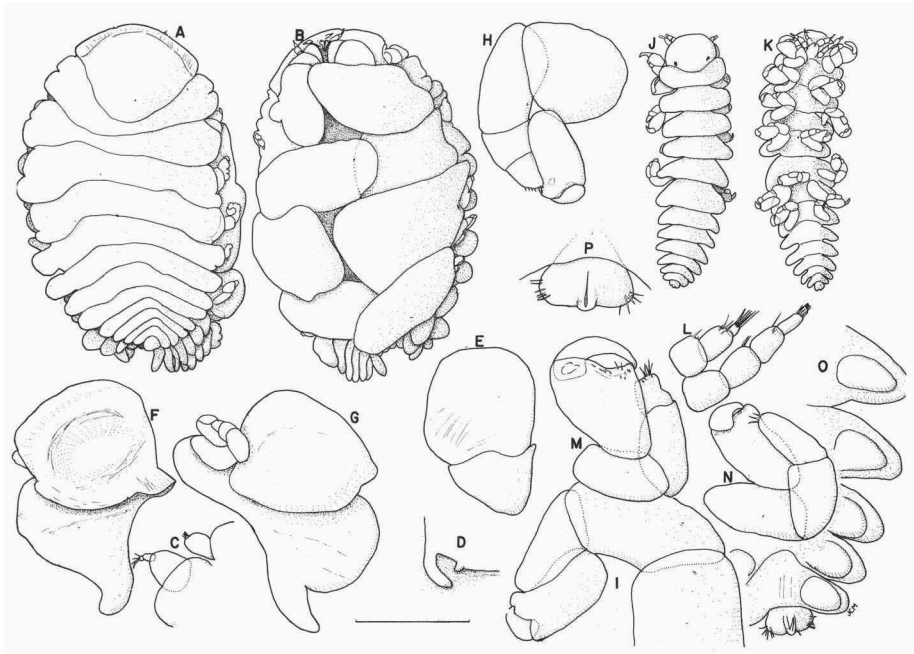


Fig. 10. *Aporobopyrus bonairensis* spec. nov. A-I, holotype female; J-P, allotype male. A, dorsal view. B, ventral view. C, right antennae. D, right side of barbula. E, right maxilliped. F, right oostegite 1, external view. G, same, internal view. H, right pereopod 1. I, right pereopod 7. J, dorsal view. K, ventral view. L, left antennae. M, right pereopod 1. N, right pereopod 7. O, left side of pleon in ventral view. P, final pleomere in dorsal view. Scale: 1.0 mm for A, B; 0.82 mm for J, K; 0.5 mm for D-G; 0.16 mm for C, H, I, L-O; 0.08 mm for P.

Infesting *Petrolisthes marginatus*. Shore near Paloe Lechi, N of Kralendijk, Bonaire, Netherlands Antilles; rockpools with algae, sea anemones, etc. 5.iii.1957, RMNH Dec. 36763, L. B. Holthuis coll. no. 1137 and det. of host: 1♀, 1♂, paratypes, RMNH Crust. I. 7025. E coast Klein Bonaire, Netherlands Antilles; near landing on sandy shore with reef debris, 0-1.5 m, 30.iii.1955, RMNH Dec. 36764; P. W. Hummelinck coll. no. 1049: 1♀, 1♂, paratypes, RMNH Crust. I. 7026.

Infesting *Petrolisthes politus*. Shore near Paloe Lechi, N of Kralendijk, Bonaire, Netherlands Antilles; rockpools with algae, sea anemones, etc., 5.iii.1957, RMNH Dec. 36780, L. B. Holthuis coll. no. 1137 and det. of host: 1♀, 1♂, paratypes, RMNH Crust. I. 7043.

Separated from host. Punta de Betin, Santa Marta, Dept. Magdalena, Colombia, under stones, 1-2 m, 4.ii.1986, H.-G. Müller coll.: 1♀, immature, paratype, RMNH Crust. I. 7061.

Description of holotype female (fig. 10A-L). — Length 2.86 mm, maximal width 1.82 mm, head length 0.85 mm, head width 1.06 mm, pleonal length 0.57 mm. Distortion 19°. All body regions and segments distinct; outline broadly oval (fig. 10A, B).

Head relatively large, rounded both anteriorly and posteriorly, deeply embedded in pereon; broad but rather short frontal lamina extending beyond

both sides of head. No eyes. Antennae (fig. 10C) reduced, of three and four articles respectively, distal articles tiny and terminally setose. Barbula (fig. 8D) of curved slender projection at each side and reduced knob medial to that, no ornamentation in between. Maxilliped (fig. 10E) of rectangular anterior segment and triangular posterior segment, both with rounded corners; no palp or trace of it; plectron somewhat extended.

Pereon of somewhat irregular outline, pereomeres laterally separated, of different widths and most with slight lateral incisions; no coxal plates. Oostegites only loosely enclosing brood pouch; first oostegite (fig. 10F, G) with broadly falcate posterolateral projection, unadorned internal ridge. Pereopods (fig. 10H, I) with nearly all articles larger posteriorly; meri and carpi separated in anterior pereopods but not in posterior ones; no carinae on any bases.

Pleon reduced and ventrally obscured by oostegites. Six pleomeres, of which first five chevron-shaped, each deeply embedded in that anterior to it; pleomere 6 button-like and tiny. Sides of pleomeres not produced into lateral plates. Five pairs of entire-margined biramous pleopods, all with rather extended lanceolate exopodites and smaller lobate endopodites. Uropods uniramous, of structure like that of exopodites.

Description of allotype male (fig. 10J-P). — Length 1.80 mm, maximal width 0.50 mm, head length 0.27 mm, head width 0.37 mm, pleonal length 0.45 mm. All body regions and segments distinct. Sides of body nearly parallel except at ends (fig. 10J, K).

Head subcircular, conspicuously extended, narrower than first pereomere. Small dark eyespots near posterior margin of head. Antennae (fig. 10L) of three and five articles respectively, both with setae on distal edge of nearly every article.

Pereon slightly broadest across pereomere 2. All pereomeres of nearly same length and width, deeply separated laterally. No midventral tubercles. Pereopods (fig. 10M, N) mostly extending beyond sides of body, all of about same size; first two with long sharp dactyli and broad propodi, next two with those articles reduced, last three with them reduced still further; all meri and carpi fused, all carpi and some propodi distally setose.

Pleon extended, of six pleomeres. Five pairs of pleopods (fig. 10O) as obscure sessile disks visible only under high magnification. Final pleomere truncate posteriorly except for extended medial anal cone. No uropods but numerous setae on corners of final pleomere.

Etymology. — Name *bonairensis* from Bonaire, the type-locality.

Discussion. — Of the other four females examined, one is sinistral, like the holotype, and the others dextral. Their lengths are 1.88 to 3.96 mm, their

widths 0.94 to 2.28 mm. Two females are in poor condition and their details obscure; a second is like the holotype except for having very slight teeth on the internal ridge of oostegite 1; the others have more square-cornered maxillipeds. The males are 1.66 to 1.90 mm long and 0.60 to 0.62 mm wide. One male is proportionately slightly broader and with pereomeres a little more separated than the allotype; the head of another is relatively broader and shorter.

It is possible that some of the specimens earlier attributed to *Aporobopyrus curtatus* (Richardson) (Markham 1975a) actually belonged to *A. bonairensis*, but I have been unable to confirm this.

The genus *Aporobopyrus* at present contains eight described species worldwide, all but one of them parasites of porcellanid anomurans. All females have broadly oval bodies, proportionately very large heads and slender pleopods extending beyond the pleonal margins. Males of *Aporobopyrus* have broad prominently extended heads, nearly parallel-sided pereons, strongly separated pereomeres and pleomeres, large dactyli on only the first two pereopods, and at most only obscure nearly sessile flaplike pleopods. Some species of porcellanid parasites currently assigned to *Pseudione* may also properly belong in *Aporobopyrus*.

Of the described species of *Aporobopyrus*, the one whose female is most similar is *A. dollfusi* Bourdon, 1980 (Bourdon, 1980b), a parasite of *Aliaporcellana suluensis* (Dana, 1852) and *A. quadrilobata* (Miers, 1884) in the Gulf of Suez. Females of the latter species differ from those of *Aporobopyrus bonairensis* in having anterolateral points on their maxillipeds, much reduced posterior points of their first oostegites, and broader pleopodal endopodites. The male of *A. dollfusi* is very different. The male which most closely resembles *A. bonairensis* is that of *A. muguensis* Shiino, 1965, a parasite of *Pachycheles rudis* Stimpson, 1858 in California; the main differences are that the male of the latter species has a shorter but broader head and final pleomere extended into two posterior lobes.

The only other species of *Aporobopyrus* known to occur in the same range as *A. bonairensis* is *A. curtatus*, discussed above. It also infests the same host species as *A. bonairensis*. Females of these two species may be distinguished in that that of *A. curtatus* has an elaborately toothed barbula, a deeply digitate internal ridge on the first oostegite, a palp or at least a tuft of setae on the maxilliped, and much broader pleopodal endopodites whose margins are often lobate. Males of *A. curtatus* are proportionately broader, and they have more separated heads and no evident pleopods.

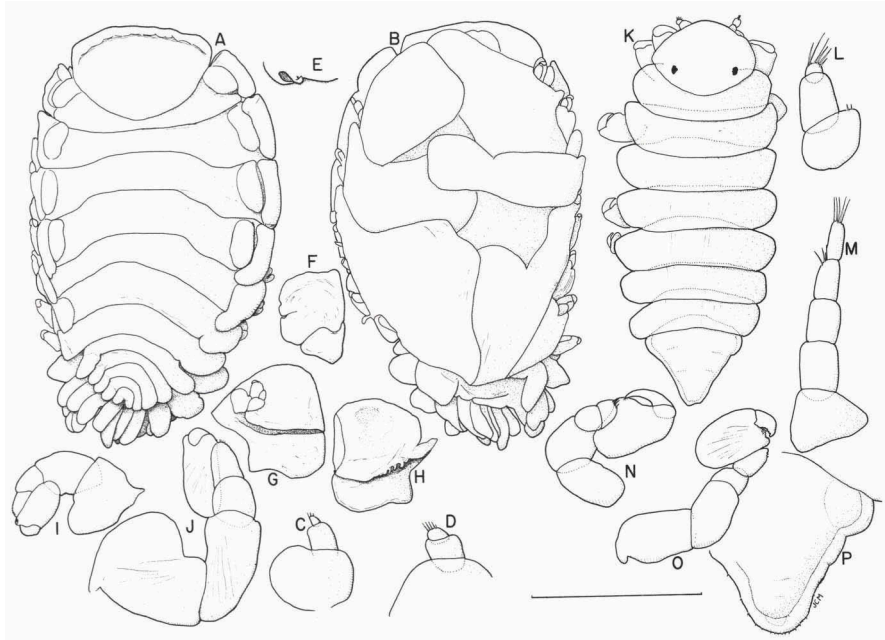


Fig. 11. *Pleurocrypta petrolisthis* spec. nov. A-J, holotype female; K-P, allotype male. A, dorsal view. B, ventral view. C, left antenna 1. D, right antenna 2. E, right side of barbula. F, right maxilliped. G, right oostegite 1, external view. H, same, internal view. I, right pereopod 1. J, right pereopod 7. K, dorsal view. L, right antenna 1. M, left antenna 2. N, left pereopod 1. O, right pereopod 7. P, pleon in ventral view. Scale: 1.54 mm for A, B, E-H; 0.50 mm for I-K; 0.25 mm for C, D, N-P, 0.125 mm for L, M.

Pleurocrypta Hesse, 1865
Pleurocrypta petrolisthis spec. nov.
 (fig. 11)

Material. — Infesting *Petrolisthes galathinus*. Lac, east coast of Bonaire, Netherlands Antilles; under rocks on shore, 6.iii.1957, RMNH Dec. 36758, L. B. Holthuis, coll. no. 1138: 1♀, holotype; 1♂, allotype, RMNH Crust. I. 7017.

Description of holotype female (fig. 11A-J). — Length 3.42 mm, maximal width 2.25 mm, head length 0.81 mm, head width 1.27 mm, pleonal length 0.62 mm; distortion 19° outline oval; all body regions and segments distinct (fig. 11A, B).

Head nearly semicircular, deeply embedded in pereon. Weakly separated short frontal lamina extending clear across front of head. No eyes. Antennae (fig. 9C, D) both reduced, of three articles a piece, with sparse setae only terminally. Barbula (fig. 9E) with two slender falcate projections on each side,

no central projections. Maxilliped (fig. 9F) with anterior segment much larger than posterior one, not bearing distinct palp or setae, but anteromedial corner produced into small angled projection; plectron long and slender but not extended outward.

Pereon broadest across pereomere three, tapering slightly both ways from there. Pereomeres not separated laterally; first six with coxal plates on both sides, those on convex side of body somewhat larger; dorsolateral bosses on both sides of first five pereomeres. Oostegites fully enclosing brood pouch; first oostegite (fig. 11G, H) subrectangular, slightly rounded anteriorly, truncate posteriorly, with only trace of posterolateral projection; internal ridge laterally elaborated into four or five small teeth. Pereopods (fig. 11I, J) more than doubling in size posteriorly, each with all articles distinct, dactyli small, carpi slightly setose distally, and bases produced into large carinae.

Pleon short and rapidly tapering, of only five dorsally visible pleomeres. Pleomeres all of about same length, each only about half as long as any pereomere; all set apart, especially first one from last pereomere, though not produced into distinct lateral plates. Five pairs of lanceolate biramous pleopods extending far beyond edges of pleon, their margins entire. Uniramous uropods of same structure as pleopodal rami.

Description of allotype male (fig. 11K-P). — Length 1.12 mm, maximal width 0.47 mm, head length 0.22 mm, head width 0.31 mm, pleonal length 0.22 mm. All body regions distinct but pleon completely fused (fig. 11K).

Head oval, extended from pereon and much narrower than first pereomere. Small dark eyespots near posterolateral margins. Antennae (fig. 9L, M) of three and five articles, respectively, each with some terminal setae and scattered setae elsewhere.

Pereomeres all of nearly same size and length, none with midventral tubercles. Pereopods (fig. 11N, O) all of about same size, though dactyli shorter and less pointed and bases longer posteriorly.

Pleon (fig. 11P) entirely fused, triangular with acute point posteriorly; lateral swelling indicating trace of original first pleomere. No remnants of any appendages. Posterior edge of pleon fringed with tiny setae.

Etymology. — Specific name *petrolisthis*, genitive form of host's generic name *Petrolisthes*.

Discussion. — The genus *Pleurocrypta* contains 11 described species worldwide, all of them parasites of galatheids and porcellanids. (*P. langi* Van Name, 1920, a parasite of a *Upogebia*, does not belong in the genus.) Characters which the female of the new species shares with other species of *Pleurocrypta* are its general body shape, reduced frontal lamina and antennae, prominent coxal plates, nonextended first oostegite, and its lanceolate and extended

pleopodal rami and uropods. Its male is like that of other species of *Pleurocrypta* in having nearly parallel sides, all pereopods of nearly the same size, and a completely fused pleon lacking all indication of appendages. The only previous record of *Pleurocrypta* in the western Atlantic was the description of *P. floridana* Markham 1974, a parasite of *Galathea rostrata* A. Milne Edwards, 1880 near Florida, U.S.A. *P. floridana* appears to be most closely related to *P. petrolisthis*, but its female differs in having a narrower and tapered body, a more extended head, a setose maxilliped and much longer pleon. The male of *P. floridana* differs from that of *P. petrolisthis* in having larger eyes, pereopods with fused meri and carpi and marked marginal outlines of the first two lost pleomeres. Because these differences for both sexes are minor, and each species is known from only its types, further collecting could conceivably reveal that the two are a single species. However, because no other species of *Pleurocrypta* is known to infest both galatheid and porcellanid hosts, such a synonymy is unlikely.

Subfamily Ioninae H. Milne Edwards, 1840, emend. R. Codreanu, 1967

Ione Latreille, 1817

Ione indecora spec. nov.

(figs. 12, 13)

Material. — Infesting *Albunea paretii*, J. Haig, det. of host. Rio Bueno Bay, Jamaica, August 1942. Attached to posterior dorsolateral corner of carapace of host. 1♀, holotype, 1♂, allotype, AHF 1653-02.

Description of holotype female (Fig. 12). — Length 9.93 mm, maximal width 7.63 mm, head length 2.22 mm, pleonal length 2.74 mm. Distortion 7°. Body outline broadly ovate; all body regions and segments distinct, nowhere abruptly tapering (fig. 12A, B).

Head triangular, with very broad foliate frontal lamina extending far to both sides. No eyes. Antennae (fig. 12C, D) of three and five articles respectively, both with large proximal articles and small, densely setose distal articles. Barbula (fig. 12E) with two long slender crenulate-margined processes on each side, unornamented midregion. Maxilliped (fig. 12F) with highly separated articles, irregularly shaped anteromedially placed nonsetose nonarticulating palp and prominent slender falcate plectron (fig. 12G).

Pereomeres distinct dorsally. Coxal plates on first pereomere (fig. 12A, B, H) large and extended considerably beyond margins of body; pereomeres 2-7 all completely covered laterally by coxal plates on longer side, some also bearing reduced coxal plates in opposite side; dorsolateral bosses also on both

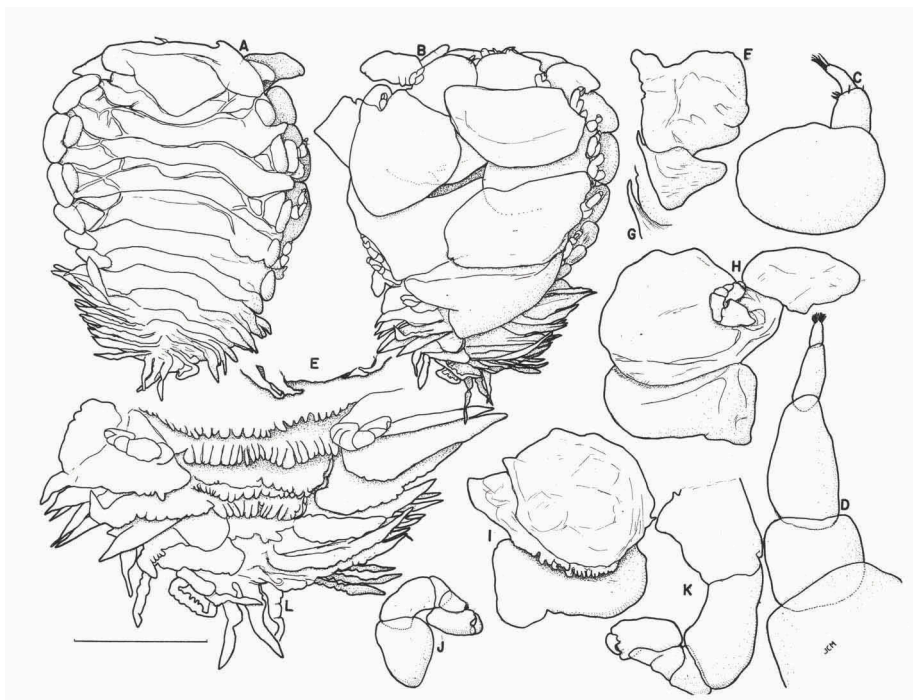


Fig. 12. *Ione indecora* spec. nov., holotype female. A, dorsal view. B, ventral view. C, right antenna 1. D, right antenna 2. E, barbula. F, left maxilliped. G, plectron of same. H, left oostegite 1 and coxal plate, external view. I, same, internal view. J, left pereopod 1. K, left pereopod 7. L, pleon in ventral view. Scale: 4.16 mm for A, B; 2.00 mm for E, F, H, I, L; 1.00 mm for G; 0.89 mm for J, K; 0.35 mm for C, D.

sides of most pereomeres. Oostegites generously enclosing brood pouch, first one (fig. 12H, I) subquadrate, with digitate convex internal ridge and very slightly extended square-cornered dorsolateral point. Pereopods (fig. 12J, K) doubling in size posteriorly, with all articles distinct.

Pleon (fig. 12L) of six pleomeres somewhat obscurely separated dorsally but with deeply crenulate posterior margins ventrally. Long lanceolate lateral plates and similar uniramous pleopods extending laterally and completely covering sides of pleon, anterior pleopods with broader bases than posterior ones. Biramous uropods similar to pleopods but extending posteriorly.

Description of allotype male (Fig. 13). — Length 3.88 mm, maximal width 1.29 mm, head length 0.44 mm, head width 0.82 mm, pleonal length 1.20 mm. All body regions and segments deeply separated. Body fusiform and smoothly tapering until fourth pleomere (fig. 13A, B).

Head semicircular anteriorly, centrally convex posteriorly. Reduced but distinct eyes near posterior margin. Antennae (fig. 13C, D) extending far

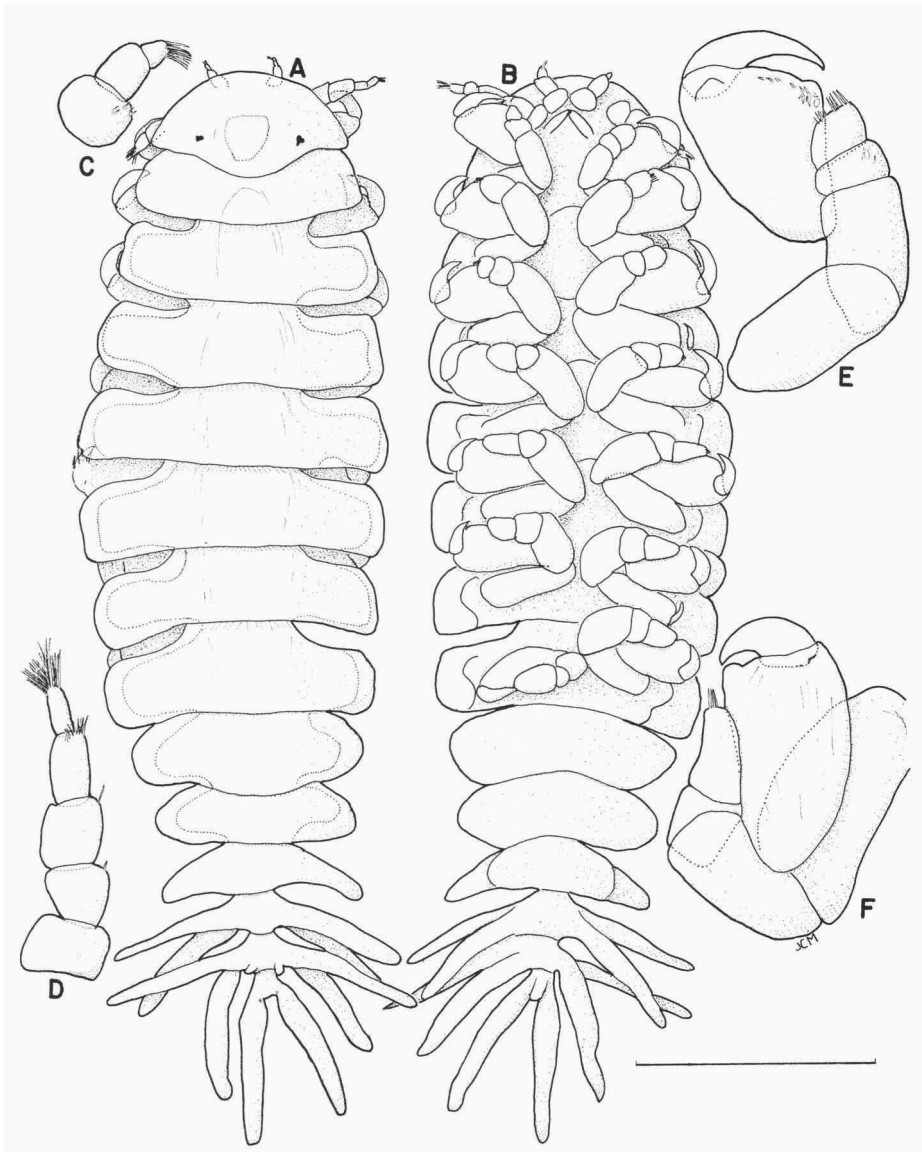


Fig. 13. *Ione indecora* spec. nov., allotype male. A, dorsal view. B, ventral view. C, right antenna 1. D, right antenna 2. E, right pereopod 1. F, right pereopod 7. Scale: 1.00 for A, B; 0.35 mm for C-F.

beyond margin of head, of three and five articles respectively, both densely setose distally.

Pereon broadest across pereomeres 4 and 5. All pereomeres deeply indented anterolaterally. No midventral tubercles. Pereopods relatively large, all of

about same size except dactyli progressively smaller posteriorly; all articles distinct.

Pleon of six pleomeres, first two similar in shape to pereomeres, third one extending into slender lateral projections, next two pleomeres extended into even longer and more slender projections, terminal pleomere similarly extended posteriorly; final three pleomeres connected by only very narrow midpieces. No midventral tubercles. Pleomeres 4 and 5 bearing lanceolate pleopods like lateral extensions. No uropods (unless extensions of pleomere 5 so interpreted).

Etymology. — Name *indecora* meaning “improper” or “wrong” selected in reference to this species’ occurrence in a latitude, on a particular host and in a location on its host, which were previously unknown or at least are atypical for its genus.

Discussion. — There are at present six other recognized described species of *Ione*, none of them recorded from the western Atlantic. All of those whose hosts are known are branchial parasites of thalassinideans, either *Upogebia* spp. or *Callianassa* spp. With but one exception, they occur only in cold temperate waters. Thus the occurrence of *I. indecora* in the tropics (unusual for its genus), on the outside of its host’s carapace (almost unique for the Bopyridae) and infesting an anomuran (unique for the Ioninae) is noteworthy.

Characters which *I. indecora* shares with other species of *Ione* are numerous and distinctive. In the female, the body is only slightly distorted, the very broad frontal lamina extends far over the first pereomere, the barbula consists of two pairs of simple projections, the coxal plates of at least the first pereomere overreach the body margin, the posterior segment of the first oostegite is much shorter than the anterior one and not produced into a posterolateral point, the pleomeres are short but produced into prominent lateral plates and uniramous or biramous pleopods extending far to each side, and the uropods extend far posteriorly. In the male, the body is more than twice as long as wide, the short broad head is separate from the pereon, the antennae are extended and densely setose distally, the pereomeres are deeply separated laterally, the pereopods are relatively quite large, and there are six distinct pleomeres, at least some of which are produced into slender lanceolate extensions reaching far to the sides.

Ione indecora is immediately distinguishable from all other species of *Ione* in that its female lacks subdivisions of all pleonal appendages and in the male the first two pleomeres are not extended laterally.

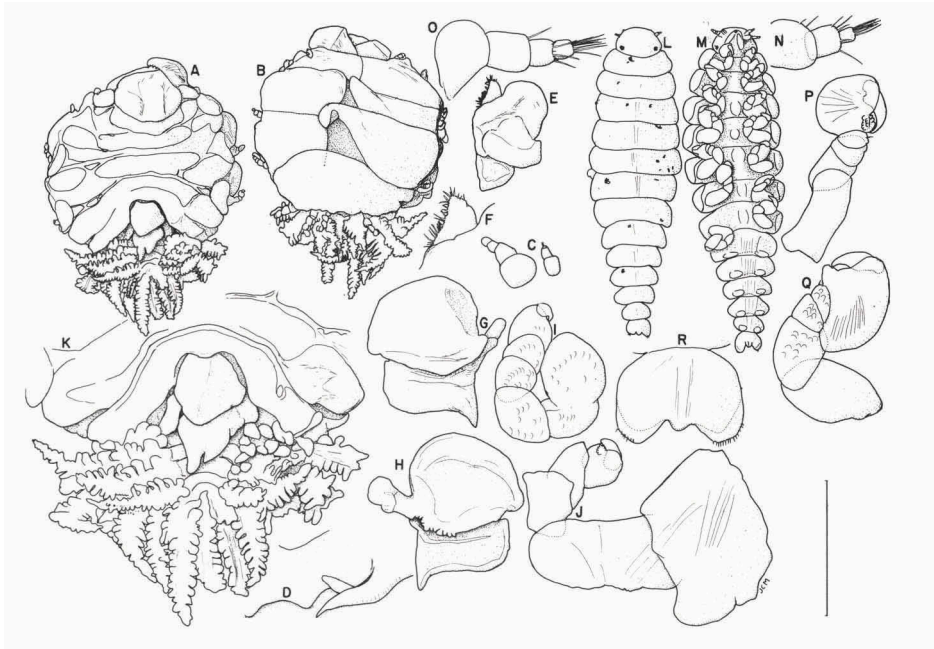


Fig. 14. *Grapsicepon belizeianum* spec. nov., A-K, holotype female; L-R, allotype male. A, dorsal view. B, ventral view. C, left antennae. D, right side of barbula. E, left maxilliped. F, palp of same. G, left oostegite 1, external view. H, same, internal view. I, left pereopod 1. J, left pereopod 7. K, pereomeres 4-7 and pleon in ventral view. L, dorsal view. M, ventral view. N, left antenna 2. P, right pereopod 1, Q, right pereopod 7. R, pleomere 6 in dorsal view. Scale: 1.00 mm for L, M; 4.50 mm for A, B; 2.17 mm for E, G, H, K; 0.40 mm for I, J; 0.20 mm for P-R; 0.10 mm for N, O.

Grapsicepon Giard & Bonnier, 1887

Grapsicepon belizeianum spec. nov.

(fig. 14)

Material. — Infesting *Mithrax (Mithraculus) coryphe*. On *Porites porites* (Pallas) < 1 m, on back reef of Carrie Bow Cay, Belize, at night, 12.vii.1985, L. D. Coen coll.: 1♀, holotype, USNM 229895; 1♂, allotype, USNM 229896; 1♀, 1♂, paratypes, USNM 229897.

Description of holotype female (fig. 14A-K). — Length 7.00 mm, maximal width 6.29 mm, head length 1.71 mm, pleonal length 1.57 mm, distortion 9°. All body regions set off, but some pereomeres only obscurely separated; body outline oval (fig. 14A, B).

Head subcircular, only slightly extended beyond body margin. Frontal lamina short but extending to both sides of head. Antennae (fig. 14C) reduced and only sparsely setose, of three and four articles respectively. Barbula (fig. 14D) with two slender falcate points on each side, undulate central region.

Maxilliped (fig. 14E) with greatly reduced posterior segment; large triangular articulating palp (fig. 14F) large, anteromedially placed but not extending beyond front of maxilliped, its margin lined with numerous setae; plectron not evident.

First five pereomeres indistinctly separated dorsally, last two bearing prominent middorsal projections arising from depressed surface, that on pereomere 7 terminally bifid. Obscure coxal plates along both sides of pereomeres 1-4. Oostegites amply enclosing brood pouch; oostegite 1 (fig. 14G, H) with subcircular anterior segment, fairly short posterior segment produced into moderately extended slender dorsolateral projection, internal ridge with some lobulate teeth near lateral end. Pereopods (fig. 14I, J) small and inconspicuous anteriorly, doubling in size posteriorly.

Pleon of six pleomeres, first five laterally lined with large lateral plates and biramous pleopods, final pleomere ending in similar biramous uropods; all pleonal appendages with digitately divided margins.

Description of allotype male (fig. 14 L-R). — Length 2.28 mm, maximal width 0.70 mm, head length 0.22 mm, head width 0.33 mm, pleonal length 0.84 mm. Outline fusiform. All body regions and segments distinct. Small pigment spots widely scattered on dorsal surface (fig. 14L, M).

Head suboval, extending considerably from body. Small dark eyes near posterolateral corners. Antennae visible beyond margins of head, first one (fig. 14O) of three articles, second one (fig. 14P) of four articles, both bearing setae on three distal articles, with dense tufts terminally.

All pereomeres distinct but margins not indented. Faint midventral tubercles on pereomeres 3-7. Small pereopods (fig. 14P, Q) all about same size, but most articles more robust posteriorly; propodi distally produced into comblike surfaces receiving tips of dactyli.

Pleomeres progressively narrower posteriorly, all slightly more separated than pereomeres. Obscure sessile oval pleopods near posterior margins of pleomeres 1-5. Pleomere 6 (fig. 14R) lacking uropods but with posterior edge produced into two lobes, each tipped with short setae.

Variations. — The paratype female is 6.75 mm long and 5.50 mm wide. It is like the holotype except that the middorsal projection on the seventh pereomere is not bifurcate. The paratype male is damaged, its last three pleomeres being absent; otherwise it is like the allotype.

Discussion. — Although ten species have been previously assigned to *Grapsicepon*, only five are still considered to belong to it. All occur in warm-temperate to tropical waters, where they infest crabs in the families Majidae, Grapsidae and Xanthidae. Bourdon (1971) designated a “groupe *Can-cricepon*” of “Céponiens” [= subfamily Ioninae], which he defined by “+ avec

bosses médio-dorsales, endopodite des pleopods rudimentaire et 1^{er} oostégite normal.” His first couplet leads to *Grapsicepon* through the choice “Plaques latérales du pléon finement digitées; lame frontale à bords tronqués, étalée en avant.” This is evidently the only effort which has been made to distinguish *Cancricepon* from the closely similar genera *Tylokepon* Stebbing, 1904, *Cancricepon* Giard & Bonnier, 1887, *Scyracepon* Tattersall, 1906 and *Paracepon* Nierstrasz & Brender à Brandis, 1931 also included in Bourdon’s key. Characters which all species of *Grapsicepon*, including *G. belizeianum*, share are: Female: Body broadly oval, head relatively large but not extended, not swollen into lobes dorsally, with prominent frontal lamina generously covering front and sides of head, maxilliped palp large and usually very setose, articulating or not, barbula of two simple processes; well-developed middorsal projections on pereomeres 6 and 7 only, coxal plates present on at least some pereomeres, oostegites fully enclosing brood pouch, first one with internal ridge at most only slightly adorned; pleopods with reduced endopodites, they and similar lateral plates and uniramous uropods with deeply digitate margins. Male: At least twice as long as broad, fusiform; head suboval, extending out from pereon, bearing small eyes posterolaterally; pereomeres not deeply separated laterally, at least some with midventral tubercles; six pleomeres, sometimes fused middorsally, five pairs of sessile to slightly lobate pleopods, final pleomere usually produced into two small lobate extensions but not true uropods.

Of the five species of *Grapsicepon*, all have been well-described except *G. messoris* (Kossmann, 1877), collected only once as a parasite of *Metopograpsus messor* Forskål, 1775 in the Red Sea. The female of *G. belizeianum* can be distinguished from that of *G. messoris* by its articulating maxilliped palp and its broader and less-deeply digitate pleopodal endopodites; it differs from females of the other species in having a shorter frontal lamina, less advanced maxilliped palp, more sharply pointed first oostegite and broader middorsal projections. The male of *G. belizeianum* differs from all known males of the genus in lacking a midventral tubercle on the first pleomere. The only other reported species of *Grapsicepon* in the western Atlantic is *G. edwardsii* Giard & Bonnier (described in detail by Bonnier, 1900), a parasite of the *Sargassum*-inhabiting grapsid *Planes minutus* (L.). *G. edwardsii* is distinguishable from *G. belizeianum* in that its female, in addition to the characters cited above, has a nonarticulating maxilliped palp and pleonal appendages which are much longer, narrower and more deeply digitate and some directed forward; the male of *G. edwardsii* has midventral tubercles on the first three pleomeres, somewhat extended pleopods and terminal lobes extending more laterally than posteriorly.

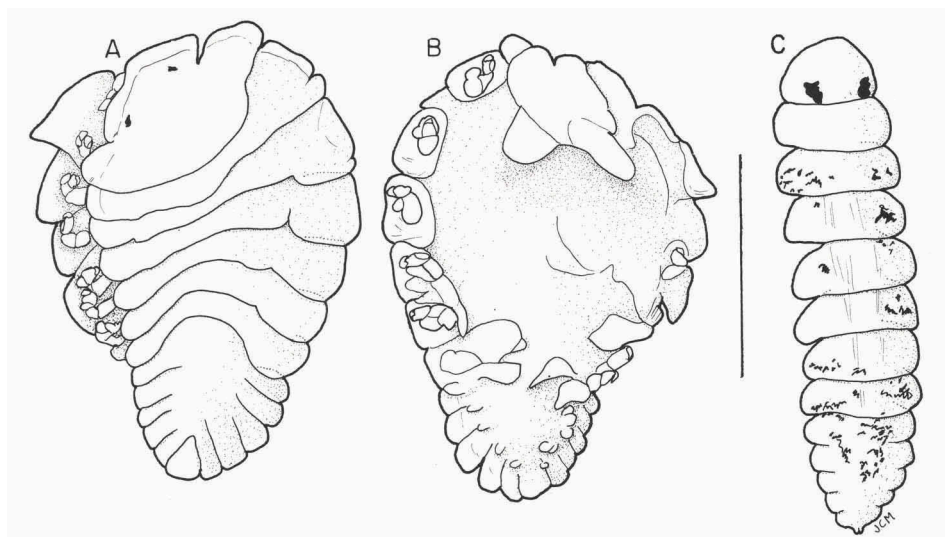


Fig. 15. *Probopyrinella heardi* Adkison from Tayrona Park, Colombia. A, female in dorsal view. B, female in ventral view. C, male in dorsal view. Scale: 1.00 mm for A, B; 0.37 mm for C.

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

Probopyrinella Nierstrasz & Brender à Brandis, 1929

Probopyrinella heardi Adkison, 1984

(fig. 15)

Bopyridae sp. A: Camp et al., 1977: 17 (Hutchinson Island, Florida, U.S.A.; infesting *Latreutes parvulus*).

Branchial bopyrid: Camp et al., 1977: 27 (Same collection as above).

Bopyrina abbreviata: Lemos de Castro & Brasil Lima, 1980a: 1-6 (in part), figs. 1-10 (Ubatuba, São Paulo, and Santa Cruz, Espírito Santo, Brazil; infesting *L. parvulus*); Christofferson, 1982: 96 (Praia do Lambert, Bahia, Brazil; infesting *L. parvulus*). (Not *Bopyrina abbreviata* Richardson, 1904).

Probopyrinella heardi Adkison, 1984: 550, 551-554; figs. 1, 2 (Type-locality Cabbage Island, Pass Warsaw Sound, Georgia, U.S.A.; infesting *L. parvulus*; also coasts of Georgia, Mississippi and eastern Florida, U.S.A.; infesting *L. parvulus*).

Material. — Infesting *Latreutes parvulus*, hosts det. by J. C. Markham. All from Dept. Magdalena, Colombia, H.-G. Müller coll. Punta de Betín, Santa Marta, on coral rubble, 22-27 m, 7.xii.1985, RMNH Dec. 36782: 1♀, 1♂ RMNH Crust. I. 7050.

Bahía de Gairaca, Tayrona Park, ca. 20 km NE of Santa Marta, in *Thalassia testudinum* König & Sims, 1-2 m, 17.i.1986, RMNH Dec. 36783; all hosts ovigerous; 3♀, 3♂: RMNH Crust. I. 7051. Near Punta Cañaveral, Tayrona Park, 40 km E of Santa Marta, in *Thalassia*, 1.0-1.5 m, 25.ii.1986, 1♀, RMNH Crust. I. 7044.

Discussion. — The new material is closely similar to that already recorded for this species and infests the only host species known for *Probopyrinella*

heardi. Of the five females, two are sinistral and three dextral, and their lengths range from 1.30 to 2.08 mm; the four males range from 0.64 to 0.88 mm long. Nearly all of the specimens are colored by numerous tiny red-brown pigment spots. Those specimens from Bahía de Gairaca illustrated (fig. 15) are noteworthy in that the female has pleomeral separation intermediate between that of the holotype and paratype figured by Adkison (1984) and a much smaller fifth oostegite, and the male is proportionately more slender and with more separated segments than the types.

It is clear from their illustrations that what Lemos de Castro & Brasil Lima (1980) considered to be aberrant specimens of *Bopyrina abbreviata* infesting a new host in Brazil were actually representatives of the then undescribed species *Probopyrinella heardi*; the parasites they reported as parasites of *Hippolyte curacaoensis* were, however, evidently correctly identified as *B. abbreviata*. Christofferson (1982) probably identified his material by reference to that paper. In drawing up the description of *P. heardi*, Adkison was unaware of the misidentifications of the Brazilian specimens, so he did not realize that his new species has a much greater range than he reported, around the southeastern United States. The present material, still from the same host species, constitutes a new record for northern South America, in the middle of the total range now known.

Probopyrus Giard & Bonnier, 1888
Probopyrus pandalicola (Packard, 1879)

Abbreviated synonymy:

Bopyrus pandalicola Packard, 1879: 308-310, fig. 262 (Type-locality somewhere on Atlantic coast of United States; infesting *Palaemonetes vulgaris* (Say, 1818)).

Probopyrus pandalicola: Richardson, 1905: 553-555; figs. 599-601; Markham, 1985a: 27-35, figs. 7-10 (Extensive synonymy, combining *Probopyrus palaemoneticola* (Gissler, 1882), *P. bithynis* Richardson, 1904, *P. floridensis* Richardson, 1904, *P. meeki* (Richardson, 1912), *P. panamensis* Richardson, 1912, *P. oviformis* Nierstrasz & Brender à Branqis, 1929, *P. creaseri* Pearse, 1936 and *P. papaloapanensis* Rioja, 1949 reported infesting *Macrobrachium* spp., *Palaemon* spp., *Palaemonetes* spp. and *Periclimenes* spp. from New Hampshire, U.S.A. to Buenos Aires, Argentina).

Material. — Infesting *Macrobrachium amazonicum*. Río Orinoco, Venezuela, no other data: 2♀, 2♂, USNM 229892.

Infesting *Palaemonetes pugio*, J. C. Markham, det. of host. Near Cali, Colombia, R. G. Ramos-Tafur coll., RMNH Dec. 36792: 2♀, 1♂, RMNH Crust. I. 7046.

Infesting *Palaemonetes vulgaris*. (J. C. Markham, det. of host. Near Cali, Colombia, R. G. Ramos-Tafur coll.: 2♀, 1♂, RMNH Crust. I. 7045.

Discussion. — This material, which conforms to the known variations of this species, is here recorded from three host species previously known to bear it. These are evidently new, but predictable, localities.

Probopyria Markham, 1985
Probopyria alpei (Richardson, 1900)

Abbreviated synonymy:

Bopyrus alpei Richardson, 1900: 158, 159, figs. 3, 4 (Type-locality Rio Parahyba do Norte, Brazil; infesting *Alpheus heterochaelis* Say, 1818).

Probopyria alpei: Markham, 1985a: 42-45, figs. 15, 16 (Extensive synonymy including *Capitetrangonia asperotibialis* Pearse, 1952; infesting *Alpheus heterochaelis* *A. normanni* Kingsley, 1878, *A. viridari* (Armstrong, 1949) and *Alpheus* sp. from North Carolina to western Florida, U.S.A., Antigua and Rio Parahyba, Brazil).

Material. — Infesting *Alpheus* sp., damaged specimen missing most appendages. Near Cali, Colombia, R. G. Ramos-Tafur coll.: 1♀, RMNH Crust. I. 7047.

Discussion. — Because of loss of appendages, the host was not identifiable to species, but as a parasite of many species of *Alpheus* in the western Atlantic, *Probopyria alpei* is to be expected on this host. This is the first record of its occurrence in northern South America, in the middle of its previously known range. The single female examined is like the holotype except that its pleomeres are separated ventrally.

Schizobopyrina Markham, 1985
Schizobopyrina urocaridis (Richardson, 1904)

Abbreviated synonymy:

Bopyrina urocaridis Richardson, 1904: 73, 74, figs. 60-62 (Type-locality Punta Rassa, Florida; infesting *Periclimenes longicaudatus*).

Schizobopyrina urocaridis: Markham, 1985a: 46-52, figs. 17-21 (Synonymy, including *Bopyrina pontoniae* Wells & Wells, 1966; infesting *Pontonia margarita* Smith, 1869 in North Carolina, U.S.A.; *Periclimenes longicaudatus* in North Carolina and western Florida, U.S.A.; and unknown host near Belize City, Belize).

Material. — Infesting *Periclimenes longicaudatus*, L. B. Holthuis det. of host. Bahía de Chengue, Tayrona Park, ca. 15 km NE of Santa Marta, Dept. Magdalena, Colombia, in *Sargassum* sp., 7-9 m, 31.v.1985, H. -G. Müller coll., RMNH Dec. 36769: 1♀, 1♂, RMNH Crust. I. 7032.

Infesting *Periclimenes iridescens*, L. B. Holthuis det. of host. Punta de Betin, Santa Marta, Dept. Magdalena, Colombia, on detritus-covered hydroids, 22-27 m, 15.ix.1985, H. -G. Müller coll.: RMNH Crust. I. 7033.

Discussion. — This represents a new host record and a considerable extension of range into South America for *Schizobopyrina urocaridis*. The specimens (one dextral and one sinistral) conform well with those previously seen and illustrated by Markham (1985a) except that they are more highly pigmented, both females having eyespots, one female with brown speckles on all oostegites, and both males with large irregular brown splotches dorsally.

Bopyrina Kossmann, 1881
Bopyrina abbreviata Richardson, 1904

Bopyrina abbreviata Richardson, 1904: 71-73, figs. 56-59 (Type-locality Punta Rassa, Florida; infesting *Hippolyte zostericola*); Richardson, 1905: 563-564, figs. 620-623; Chopra, 1923: 419, 523, 525, 542; Nierstrasz & Brender à Brandis, 1923: 98, 100, 102; Nierstrasz & Brender à Brandis, 1925: 7; Nierstrasz & Brender à Brandis, 1929: 40; Chopra, 1930: 145, 146; Shiino, 1934: 270; Shiino, 1939: 95, 96; Pearse, 1953b: 619 (Off Beaufort, North Carolina, U.S.A.; infesting *H. pleuracanthus* (Stimpson, 1871)); Hutton & Sogandares-Bernal, 1960: 287 (Maximo Point, Boca Ciega Bay, Florida, U.S.A.; infesting *Hippolyte* sp.); Hutton, 1964: 447; Menzies & Glynn, 1968: 13; Schultz, 1969: 334; fig. 538; Rouse, 1970: 135 (Southwest Florida; infesting *H. pleuracanthus*); Bourdon & Markham, 1980: 229; Lemos de Castro & Brasil Lima, 1980a: 1-6 (in part), figs. 11-16 (not figs. 1-10) (Ubatuba, São Paulo, and Florianópolis and Caiciras da Barra do Sul, Santa Catarina, Brazil; all infesting *H. curacaoensis*); Tsukamoto, 1981: 394, 395, 400-401; Markham, 1985a: 54-59, 132; figs. 22-24; tab. 3 (North Carolina and both coasts of Florida, U.S.A.; infesting *H. pleuracanthus*; and Tobago; infesting *H. curacaoensis*).

?*Probopyrinella latreuticola*: Nierstrasz & Brender à Brandis, 1929: 26 (in part, Coral Bay, St. John, Virgin Islands; infesting *H. pleuracanthus*).

Branchial bopyrid: Chace, 1972: 111 (Tobago, West Indies; infesting *H. curacaoensis*).

Not *Bopyrina abbreviata*: Lemos de Castro & Brasil Lima, 1980a: 1-6 (in part), figs. 1-10; Christofferson, 1982: 96 (= *Probopyrinella heardi*; discussed above).

Material. — Infesting *Hippolyte zostericola* J. C. Markham det. of host. Near Cali, Colombia, R. G. Ramos-Tafur coll. RMNH Dec. 36781: 2♀, 2♂, RMNH Crust. I. 7048.

Discussion. — Both of the females examined are dextral, and a third shrimp in the lot had its right branchial chamber swollen, so its parasite, though lost, would have also been dextral. All of the hosts appeared to have been desiccated at some time, but the parasites were still in good condition. Earlier (Markham, 1985a) I listed no hosts examined as *Hippolyte zostericola* and discussed opinions concerning its status as separate from *H. pleuracanthus*. Williams (1984) presents criteria for reliably distinguishing these species, by which all hosts examined here keyed to *H. zostericola*. Probably some of the hosts of *Bopyrina abbreviata* cited earlier as *H. pleuracanthus* were actually *H. zostericola*, as was the host of the types, so this is not a new host record. This is the first report of *B. abbreviata* from northern South America. The material shows well the previously known characters of *B. abbreviata* except that the head of one male is separate from its person.

Bopyrella Bonnier, 1900
Bopyrella harmopleon Bowman, 1956

Bopyrella harmopleon Bowman, 1956: 1-3, figs. 1 (Type-locality Gran Roque, Venezuela; infesting *Synalpheus brevicarpus* (Herrick, 1891; also Los Roques, Venezuela; infesting *S. fritzmulleri*; and La Salle and Gran Roque, Venezuela; infesting *S. hemphilli* Coutière, 1908;

Lemos de Castro, 1965b: 283, figs. 1-5 (Ilha de São Sebastião, São Paulo, Brazil; infesting *Synalpheus* sp.); Sadoğlu, 1969: 197; Schultz, 1969: 332, fig. 534(b); Christoffersen, 1979: 334 (Praia do Segredo, São Paulo, Brazil; infesting *S. brevicarpus*); Bourdon, 1980a: 187, 227, 229, 230, tab. V; Duarte & Morgado, 1983: 3, 5, 7, 11, fig. 9 (Unspecified locality, Brazil; infesting *S. brevicarpus*); Sassaman et al., 1984: 651; Markham, 1985a: 66, 129.

Material. — Infesting *Synalpheus fritzmuelleri*, ovigerous ♀, J. C. Markham coll. and det. of host. Near Punta Allen, Bahía de la Ascensión, Quintana Roo, Mexico, in sponge among mangroves, 1-2 m, 11.vi.1986: 1♀, 1♂, CIORO Mus.

Discussion. — This is not a new host record for *Bopyrella harmopleon*, but it is the first time it has been recorded from North America, other records being from Venezuela and Brazil. The female, which is dextral, differs from those previously known in having very regularly aligned pleopods and traces of pleomeral separation on the short side of the body. The head of the male is slightly better defined than usual.

Ogyridione, gen. nov.

Diagnosis. — Female: Body broadly oval but nearly truncate posteriorly, only very slightly distorted, with body regions separate but some pereomeres and pleomeres partly fused. Head long and narrow, deeply set into pereon, with only obscurely delineated frontal lamina; barbula of two simple blunt processes on each side; maxilliped subrectangular, with short incompletely articulating palp. Pereomeres bearing only few small coxal plates; oostegites surrounding but not covering brood pouch, first oostegite produced into extended tapering posterolateral point and lacking ornamentation on internal ridge; pereopods all equally small. Pleon of six incompletely separated pleomeres; pleopods reduced, only partly covering surface of pleon and nearly sessile, all on convex side biramous, some on concave side often uniramous; no uropods. Male: Nearly three times as long as broad, with all body segments distinct. Head subcircular and extending out from pereon; antennae reduced, of few articles. Pereomeres separated laterally; no midventral tubercles; pereopods all equally large. Pleon of six distinct pleomeres; pleopods as nearly indiscernible sessile swellings; no uropods or extensions of terminal pleomere. Known hosts: In ogyridid genus *Ogyrides*.

Etymology. — Name derived from generic name of host, *Ogyrides*, + old bopyrid genus name *Ione*; gender feminine. Type-species *Ogyridione caroliniana*, new species.

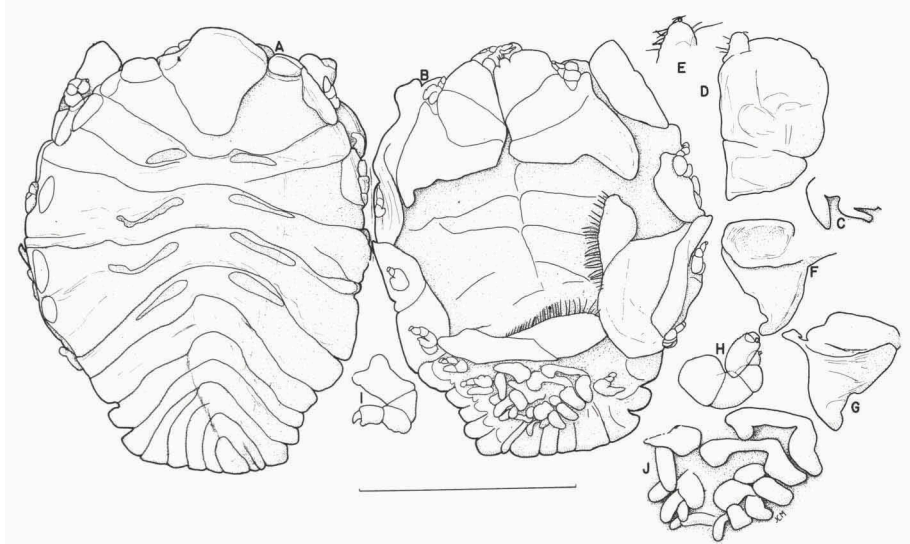


Fig. 16. *Ogyridione caroliniana* spec. nov., holotype female. A, dorsal view. B, ventral view. C, right side of barbula. D, right maxilliped. E, palp of same. F, right oostegite 1 internal view. G, same, external view. H, right pereopod 1. I, left pereopod 7. J, pleopods. Scale: 2.00 mm for F, G; 1.82 mm for A, B; 1.00 mm for D, J; 0.64 mm for E, H, I.

***Ogyridione caroliniana* spec. nov.**

(figs. 16, 17)

“Bopyridae sp. A”: Fox & Ruppert. 1985: 40, 115, 261, 288, 300, 317 (South Carolina localities; infesting *Ogyrides hayi* Williams).

Material. — Infesting *Ogyrides hayi*, R. S. Fox coll. of all material and det. of hosts. Stn. RF 83-101, intertidal high energy beach, Folly Beach, South Carolina, USA, 8.viii.1983, RMNH Dec. 36768: 1♀, holotype, 1♂, allotype, RMNH Crust. I. 7031; Same locality, 1985, RMNH Dec. 36791: 1♀, 1♂, paratypes, RMNH Crust. I. 7066. Stn. RF 83-83, intertidal medium energy outer beach, Hunting Island, South Carolina, 1983: 1♀, 1♂, paratypes, RMNH Crust. I. 7020.

Description of holotype female (fig. 16). — Length 3.73 mm, maximal width 2.91 mm, head length 0.89 mm, head width 0.93 mm, pleon length 1.18 mm. Distortion 18°. Outline suboval but nearly truncate posteriorly; all body regions distinct but some segments variously fused (fig. 16A, B).

Head subtriangular, somewhat convex anteriorly, bluntly pointed posteriorly; trace of only one eye; antennae reduced and very obscure; barbula (fig. 16C) with two stubby entire flaps on each side, no ornamentation medially; maxilliped (fig. 16D) subquadrate, its segments incompletely separated, posterior one short and only slightly produced posteromedially; palp (fig. 16E)

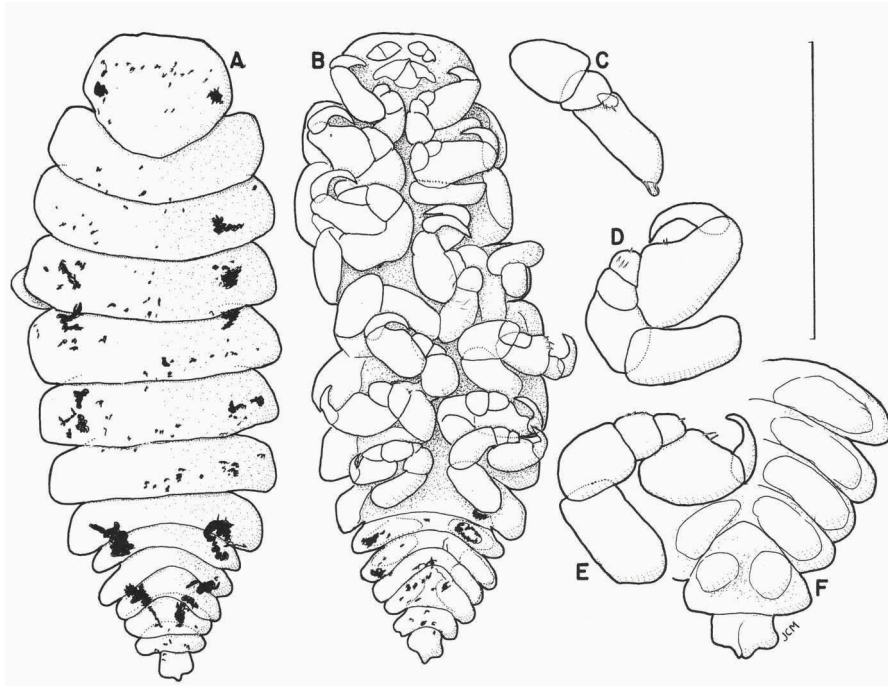


Fig. 17. *Ogyridione caroliniana* spec. nov., allotype male. A, dorsal view. B, ventral view. C, left antennae. D, left pereopod 1. E, left pereopod 7. F, pleon in ventral view. Scale: 0.5 mm for A, B; 0.25 mm for D-F; 0.125 mm for C.

broad, short, barely extending, incompletely, articulating, with setose margin.

Pereon incompletely separated. Pereomeres 2 and 4-6 with paired transverse middorsal depressions. Coxal plates and dorsolateral bosses irregularly distributed on some pereomeres. Brood pouch surrounded but not all enclosed by oostegites; first oostegite (fig. 16F, G) with slender falcate point, unadorned internal ridge; fifth oostegite with long setae along anterior margin. Pereopods (fig. 16H, I) reduced, all of about same size; all articles present anteriorly, but meri and carpi fused posteriorly, all bases slightly carinate, dactyli almost subchelate posteriorly.

Pleon markedly distorted, posteriorly truncate, of six incompletely separated pleomeres, last one deeply embedded in preceding. Pleopods (fig. 16J) uniramous on one side, biramous on other, far from margins of pleon. No uropods.

Description of allotype male (fig. 17). — Length 1.09 mm, maximal width 0.43 mm, head length 0.21 mm, head width 0.26 mm, pleon length 0.26 mm. All body regions and segments distinct. Outline suboval. Many large and small splotches dorsally (fig. 17A, B).

Head nearly circular except for truncate anterior margin, more than half of length extending beyond pereon. Irregular eyes near sides. Antennae (fig. 17C) reduced, posterolaterally directed, distal articles tiny.

Pereomeres distinctly but not deeply separated laterally; no midventral tubercles. Pereopods (fig. 17D, E) relatively large, covering ventral surface, all articles present and similar, though dactyli somewhat shorter posteriorly, all carpi and propodi slightly setose.

Pleon (fig. 17F) triangular and tapering rapidly, all pleomeres shorter than any pereomeres, each pleomere narrower than that before it, final pleomere extended. Pleopods as only indistinct swellings, first four transversely elongate, fifth circular. No uropods.

Variations. — The paratype female from Hunting Island, 2.42 mm long and 1.84 mm wide, is like the holotype in all details except that its pleomeres are more distinct; the other, sinistral, female, 3.08 mm long and 2.42 mm wide, differs from the holotype in having less sharply pointed first oostegites, no evident dorsal pereomeral depressions and all biramous pleopods. One of the paratype males is 0.64 mm long and 0.26 mm wide and matches the allotype, even in pigmentation; the other one, only 0.26 mm long and 0.07 mm wide, proved impossible to examine in detail, but it was also heavily pigmented.

Discussion. — In its overall suite of characters, the new genus *Ogyridione* is unlike any other of the Bopyrinae, but it shares several characters with *Probopyrus* Giard & Bonnier, but it also differs in some important respects. Females of both genera have slight distortion, separate heads with small frontal laminae and two pairs of projections on their barbulae, short maxilliped palps, pointed first oostegites, and biramous pleopods. The female of *Ogyridione* differs from those of *Probopyrus* in its general body shape (especially the truncated posterior margin), the wedge-shaped head, the absence of several coxal plates, the peculiar fusion of some pereomeres and pleomeres, the strong distortion of the pleon, the placement of the pleopods and the frequent presence of uniramous pleopods. Males of both genera have separate and extended heads, six pleomeres and very reduced or partly absent pleopods; the male of *Ogyridione* differs from those of *Probopyrus* in having the head connected to the pereon at a point behind its greatest width, all pleomeres narrower than any pereomeres, and the final pleomere not at all embedded in the preceding one. The structure and variability, but not the number, of the female's pleopods are reminiscent of *Bopyrina abbreviata* Richardson; otherwise, those species are very different.

This is the first species of bopyrid described from any species of shrimp in the small family Ogyrididae, but Christoffersen (1979) mentioned an unidentified branchial parasite of *Ogyrides occidentalis* (Ortmann, 1893) (= *O. alpha-*

erostris (Kingsley, 1880)) at Rio Grande do Sul, Brazil. It is possible that that was also a species of *Ogyridione*, perhaps *O. caroliniana*.

Synsynella Hay, 1917

Synsynella choprae (Pearse, 1932)

Abbreviated synonymy:

Bopyro choprae Pearse, 1932: 1-3, figs. 1-14 (Dry Tortugas, Florida, U.S.A.; infesting *Synalpheus brooksi*).

Synsynella choprai: Bourdon, 1981b: 1154-1157, figs. 4, 5 (Haiti; infesting *Synalpheus* sp.); Bourdon et al, 1981: 498, 500.

Synsynella choprae: Markham, 1985a: 85, 86, 89-93, 129, 132, figs. 42-44; tabs. 2, 3 (Synonymy, tentatively including *Prosynsynella hayi* (Nierstrasz & Brender à Brandis, 1929). Gulf of Mexico and Tampa Bay; infesting *Synalpheus brooksi*. Virgin Islands and Georgia, U.S.A.; infesting *S. minus* (Say, 1818). Gulf of Mexico, infesting *S. pandionis*. Gulf of Mexico and Haiti; infesting *Synalpheus* spp.)

Material (All collected by H.-G. Müller, Dept. Magdalena, Colombia; all hosts determined by J. C. Markham). — Infesting *Synalpheus brooksi*. Punta de Betin, Santa Marta, on coral rubble, 30 m, 10.ii.1986, RMNH Dec. 36786: 1♀, 1♂, RMNH Crust. I. 7055.

Infesting *Synalpheus pandionis*. Bahía de Nenguange, Tayrona Park, ca. 25 km NE of Santa Marta, on coral rubble, 11-16 m, 23.ix.1985, RMNH Dec. 36785: 1♀, RMNH Crust. I. 7053.

Separated from hosts. Punta de la Aguja, ca. 4 km E of Santa Marta, on coral rubble, 18 m, 2.x.1985: 1♀, RMNH Crust. I. 7049. Bahía de Gairaca, Tayrona Park, ca. 20 km E of Santa Marta, in *Thalassia*, 2-3 m, 4.xii.1985: 1♀, immature, RMNH Crust. I. 7052.

Discussion. — *Synsynella choprae* has previously been recorded from North Carolina around Florida and the Bahamas to the eastern Gulf of Mexico and Haiti (Markham, 1985); this material from Colombia is the first recorded from South America. Neither host species is a new record. The specimens, three dextral and one sinistral, differ but little from those previously known: one male bears eyes and a black pigment spot on each side of nearly every pereomere.

Subfamily Athelginae Codreanu & Codreanu, 1956

Stegophryxus Thompson, 1902

Stegophryxus hyptius Thompson, 1902

Synonymy exclusive of text-book citations:

Stegophryxus hyptius Thompson, 1902: 53-56, pls. 9, 10 (Type-locality Woods Hole, Massachusetts, U.S.A.; infesting *Pagurus longicarpus*); Richardson, 1904: 59; Sumner et al., 1913a: 136 (Woods Hole; host unspecified); Sumner et al., 1913b: 611 (Edgartown and Cataumet Harbor, Massachusetts; infesting *P. longicarpus*); Nierstrasz & Brender à Brandis, 1931: 197, 198, Reinhard et al., 1947: 70-72 (Woods Hole; infesting *P. longicarpus*); Reinhard, 1949: 17-31

(Same locality and host); Reinhard & Buckeridge, 1950: 131 (Same locality and host); Caullery, 1952: 76; Bowman, 1964: 105, 107, 108, 109; pl. 14; fig. 22; Schultz, 1969: 321; Gosner, 1971: 476; Markham, 1972: 73; Markham, 1974: 33-35, 38, 40; figs. 1-3 (Southern Florida; infesting *Pagurus bonairensis* (= *P. stimpsoni*). Miami, Florida; infesting *P. miamensis* Provenzano, 1959 (*P. brevidactylus*). Georgia and Massachusetts, U.S.A.; infesting *P. longicarpus*. Beaufort, North Carolina, U.S.A.; infesting *P. annulipes*; Adkison & Heard, 1978: 408; Markham, 1978a: 102, 111, 114, 115, 116, 117, tab. 1 (Off Portomaribaai, Curaçao; infesting *P. provenzanoi* and *Iridopagurus* sp. (= *I. margaritensis* García-Gómez, 1983). St. Petersburg, Florida, and Mississippi, U.S.A.; infesting *P. annulipes* (?); García-Gómez, 1983: 22, 37 (Sanibel Island, Florida; infesting *I. caribbensis* (A. Milne Edwards & Bonnier, 1893). Off Portomaribaai, Curaçao, same material as above); Overstreet, 1983: 225.

Stegophryxus hyptias (sic): Miner, 1950: 450; pl. 145.

Stegophryxus: Baffoni, 1950: 437; Kaestner, 1967: 1161; Kaestner, 1970: 425; Markham, 1986: 159.

? "Male bopyrid isopod": Lemaitre et al., 1982: 697; fig. 7C (Buttonwood, Florida; infesting *Pagurus maclaughlinae*).

Material examined. — Infesting *Pagurus maclaughlinae*. Virginia Key, Miami, Florida, 0-1 m, J. García-Gómez, coll. 1♀, 1♂, USNM.

Discussion. — This material conforms well with the characters previously recorded for *Stegophryxus hyptius*. Its occurrence at Miami, Florida, is not new, but this is the first authenticated record of infestation of *Pagurus maclaughlinae*. Previously, *S. hyptius* has been recorded from five species of *Pagurus* and two of *Iridopagurus* (see synonymy above), some of which were originally incompletely identified or incorrectly named; this report provides an opportunity to correct those errors. The only previous mention of bopyrid infestation of *Pagurus maclaughlinae* is the citation and drawing of a "male bopyrid isopod" (probably really a cryptoniscan larva) by Lemaitre et al. (1982), which might have belonged to *S. hyptius*. It is possible that some of the hosts of *S. hyptius* earlier reported from southern Florida were actually misidentified specimens of *P. maclaughlinae*.

Stegias Richardson, 1904

***Stegias clibanarii* Richardson, 1904**

(fig. 18)

Stegias clibanarii Richardson, 1904: 59-60, fig. 34 (Type-locality Bermuda, infesting *Clibanarius tricolor*); Richardson, 1905: 536-537, fig. 580; Verrill, 1908: 448, fig. 64 (Same locality and host); Nierstrasz & Brender à Brandis, 1923: 107; Nierstrasz & Brender à Brandis, 1931: 200; Menzies & Glynn, 1968: 13, 18-19, 83, fig. 3A-D (Near Boca de Cangrejos, San Juan, Puerto Rico; infesting *C. tricolor*); Schultz, 1969: 322, fig. 514; Markham, 1972: 64-65; McDermott, 1974: 2; Markham, 1975b: 225-230, figs. 1, 2 (Redescription of holotype female, description of allotype male); Markham, 1975b: 260, 263; (Cadwallader), 1976: 3; Markham, 1978a: 102, 111-112, 115, 116, fig. 10; tab. 1 (Bermuda; infesting *C. tricolor*); Markham, 1979: 523, 526, 527; Schultz, 1986: 371, 372; pl. 123.

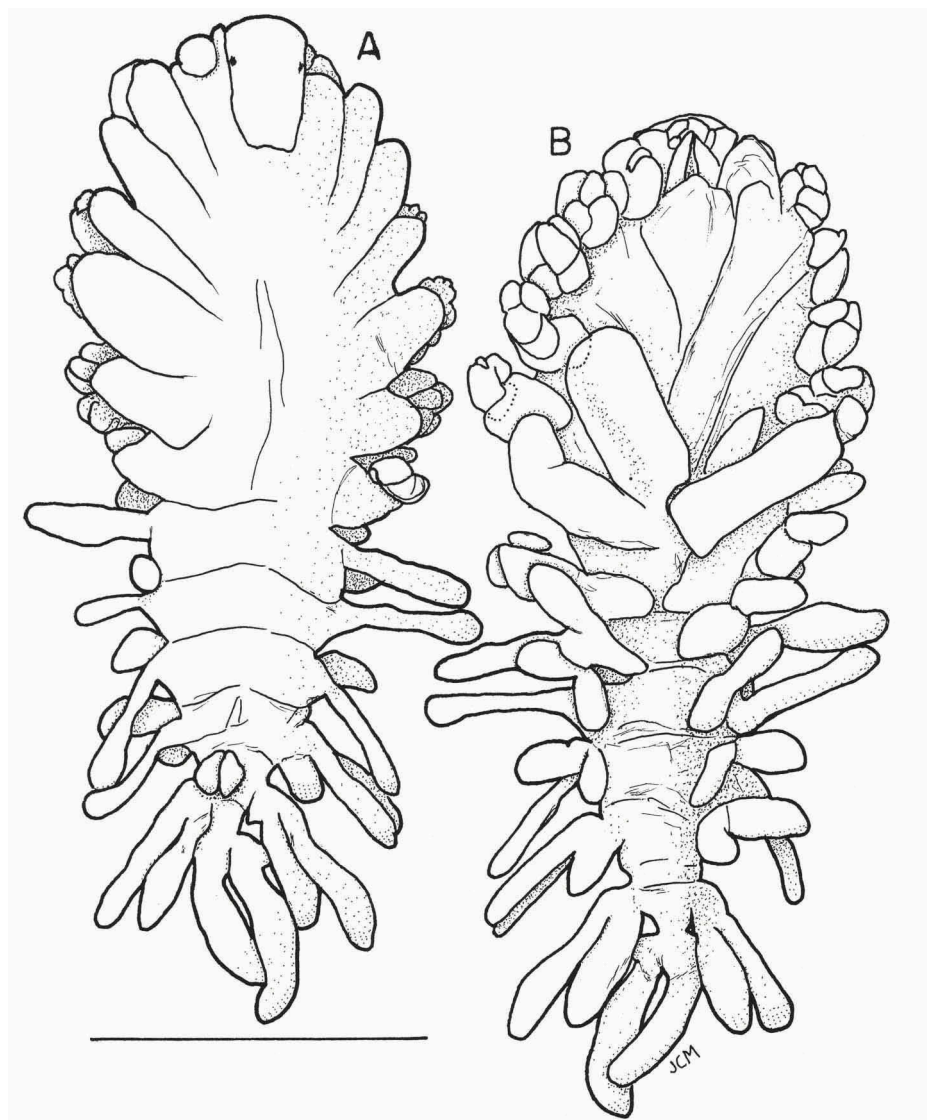


Fig. 18. *Stegias clibanarii* Richardson, immature female from Tayrona Park, Colombia. A, dorsal view. B, ventral view. Scale: 1.00 mm.

Not *Stegias clibanarii*: Pearse, 1932: 4-5, figs. 22-26; Schultz, 1969: 323, fig. 515 (= *Asymmetrione clibanarii* Markham).

Material. — All collected by H.-G. Müller, Tayrona Park, Dept. Magdalena, Colombia. Infesting *Clibanarius tricolor*, J. C. Markham det. Bahía de Nenguange, ca. 25 km E of Santa Martha, in *Thalassia*, 0.5 m, 17.i.1986, RMNH Dec. 36773: 1♀, immature, RMNH Crust. I. 7037.

About 10 km E of Santa Marta, from brown algae in lower intertidal, 12.ii.1986, RMNH Dec. 36790: 1♀, 1♂, RMNH Crust. I. 7065.

Separated from host. Bahía Concha, ca. 10 km E of Santa Martha, lower intertidal, on alga *Digenia simplex* (Wulfen) C. Agardh, 2.v.1985. 1♀, 1♂, RMNH Crust. I. 7057.

Discussion. — The adult specimens conform well with the characters previously recorded for *Stegias clibanarii*. As is typical for the species, but otherwise unrecorded for the Bopyridae, the male was found inside the female's brood pouch. The immature female (fig. 18) differs from the adults in having a much more slender body, distinct eyes, less separated pereomeres, very reduced oostegites and relatively longer pleopods. All of these characters are attributable to its immaturity. Discovery of this specimen has caused me to reconsider the specimens from Puerto Rico attributed to *S. clibanarii* by Menzies & Glynn, 1968. Despite my earlier opinion (Markham, 1975b, 1978a) that they were not dealing with this species, I now believe that they had a female of *S. clibanarii* only slightly more mature than that shown here and a male which was still a cryptoniscan larva. The female's characters, rather than excluding it from *S. clibanarii*, are intermediate between the very immature female examined here and the typical adult; the peculiar "seta" which Menzies & Glynn (1968) depicted, is almost certainly part of the host's pleopod tightly clutched in the female's pereopod and ripped off the host. It is also significant that Menzies & Glynn (1968) reported that the male occurred in the female's brood pouch, a condition evidently uniquely characteristic of *S. clibanarii*, and which even caused the allotype to be long overlooked and thus not included in the original description. Thus *S. clibanarii* can no longer be regarded as endemic to Bermuda, having been found in Puerto Rico and, for the first time on the South American continent, in Colombia. Its only recorded host, however, remains the very common intertidal hermit crab *Clibanarius tricolor*. Schultz (1986), in reporting *S. clibanarii* as a member of the Bermuda biota, stated that its male was unknown, and that it infests its host branchially. The reasons for these erroneous assertions are unclear.

Parathelges Bonnier, 1900

Parathelges piriformis Markham, 1972

Parathelges piriformis Markham, 1972: 71-73, 76, 77, figs. 11-12, 16 (Type-locality Bermuda; infesting *Pagurus miamensis* (= *P. breviductylus*)); Markham, 1978a: 102, 114, 115, tab. 1 (Andros Island, Bahamas, infesting *P. provenzanoi*, Off Colombia; infesting *Paguristes oxyphthalmus* Holthuis, 1959); Markham, 1979: 523, 526; Schultz, 1986: 371, 372, pl. 123.

Material. — Separated from host. Belize-80, sta. 22. Coast of Belize, 16°48.2'N, 88°04.5'W, 36 m, 29.iii.1980, G. Hendler coll.: 1♀, USNM 229893.

Discussion. — This is the first record of *Parathelges piriformis* in Central America, close to the middle of its known range. The host was unrecorded. The present female differs from the holotype in having first oostegites with broader posterolateral points and pleopods whose endopodites are all greatly reduced to tiny knobs on the sides of the peduncles.

In listing *P. piriformis* as a member of the fauna of Bermuda, Schultz (1986) inexplicably says it occurs “in the gill chamber of the hermit crab *Pagurus brevidactylus*”. Like all athelgines, it is an abdominal parasite.

Subfamily Hemiarthrinae Markham, 1972

Diplophryxus Richardson, 1904

Diplophryxus siankaanensis spec. nov.

(figs. 19, 20)

Abdominal bopyrid parasite: Chace, 1972: 67 (Bahía de la Ascension, Quintana Roo, Mexico; infesting *Alpheus formosus*).

Diplophryxus, new species: Markham, 1985a: 96, 129 (Above material. Warsaw Sound, Georgia, and Indian River, Florida, U.S.A.; infesting *Alpheus* sp. indet.).

Material. — Infesting *Alpheus formosus*, ovigerous, F. A. Chace, Jr., det. Smithsonian-Bredin Expedition Station 85-60, near Punta Solimán, Bahía de la Ascensión, Quintana Roo, Mexico, among intertidal rocks and pools, 17.iv.1960, Schmitt, Daiber, Bousfield, Rehder colls.: 1♀, holotype, USNM 154607.

Infesting *Alpheus* sp. Pass Warsaw Sound, Chatham County, Georgia, U.S.A., 4.6 m, on shelly mud, R. W. Heard, coll.: 1♀, 1♂, unassigned.

Description of holotype female (fig. 19). — Length 7.18 mm, maximal width 5.73 mm, head length 1.41 mm, head width 1.18 mm, pleonal length 1.57 mm, distortion 60°. Head distinct but other body regions and segments obscure; brood pouch extended far forward and completely dominating anterior part of body. No pigmentation (fig. 19A).

Trapezoidal head deeply embedded in pereon, tapering posteriorly. First antennae indicated by bifurcating scar on top of head; second antennae as unsegmented anterior flaps. No eyes. Barbula (fig. 19B) with two blunt simple processes on each side, no middle ornamentation. Elongate maxilliped (fig. 19C) with anterior segment much longer than posterior one, incompletely separated; no palp and very reduced plectron.

Pereomeres very obscurely separated. Ventral surface of pereomere 2 (fig. 19B) with transverse line of digitate processes. On convex side, pereopods 1, 2 (fig. 19D) tiny, close to head, pereopod represented only by large basal scar in middle of brood pouch, others missing; on concave side, pereopod 1 large and



Fig. 19. *Diplophryxus siankaanensis* spec. nov., holotype female. A, dorsal view. B, right side of barbula and pereomere 2. C, right maxilliped. D, left pereopod 1 and right pereopod 2. E, left pereopod 7. F, right oostegite in internal view. G, same in external view. H, left pereopods 5-7 and pleon in ventral view. Scale: 2.0 mm for A-D, F-H; 0.5 mm for E.

extended (fig. 19A, D), pereopods 2-7 (fig. 19E) reduced and tightly bunched next to pleon; all pereopods incompletely segmented. First oostegites (fig. 19F, G) similar to each other, but that on convex side larger, incompletely separated posterior segment greatly extended laterally but not posteriorly, lacking ornamentation on internal ridge. Both second oostegites arching far beyond anterior margins and tightly pressed against dorsal surface of pereon next to head. Oostegites 2-4 on convex side fused into closed brood pouch, oostegite 5 of that side and 2-5 of opposite side as separate tiny flaps inside brood pouch.

Pleon of four indistinctly separated pleomeres (fig. 19H), each bearing lateral plates and biramous pleopods; each lateral plate, endopodite and exopodite subdivided into two parts, those long and lanceolate. No uropods (unless lateral plates and pleopods of last pleomere so interpreted).

Description of male (fig. 20). — Length 1.77 mm, maximal width 0.56 mm, head length 0.22 mm, head width 0.35 mm, pleonal length 0.63 mm. All body regions and pereomeres distinct. No pigmentation (fig. 20A, B).

Head suboval, attached behind broadest point, extending prominently from pereon. Antennae (fig. 20C) moderately extended, of three and four articles, respectively, distal two articles of each setose.

Pereon slightly broadest across pereomere three, all pereomeres separate but not deeply indented laterally. Pereopods (fig. 20D, E) all of about same size, with all articles distinct; dactyli of pereopods 1 and 2 much larger than others.

Pleon of single fused suboval piece attached before broadest point, completely lacking all trace of appendages.

Etymology. — The specific name *siankaanensis* refers to the Biosphere Preserve of Sian Ka'an in southeastern Quintana Roo, Mexico, the type-locality for this species.

Discussion. — Because the male from Georgia, herein described, has not been assigned to a recognized museum, and it is uncertain what has become of it, it is not designated the allotype, but it seemed advisable to describe it to make the record of this species as complete as possible. Earlier (Markham, 1985a), I mentioned that I expected this species to be described elsewhere, but because that description has not appeared, it is timely to include it here. Variation of the other females is unrecorded.

To date, six other species have been assigned to the genus *Diplophryxus*; after the removal of two (Markham, 1985a), four remain, from widely separate localities. Two of them, like *D. siankaanensis*, infest species of *Alpheus*, while the others infest members of different caridean families. All of the females conform well to the generic diagnosis of great distortion, first anten-

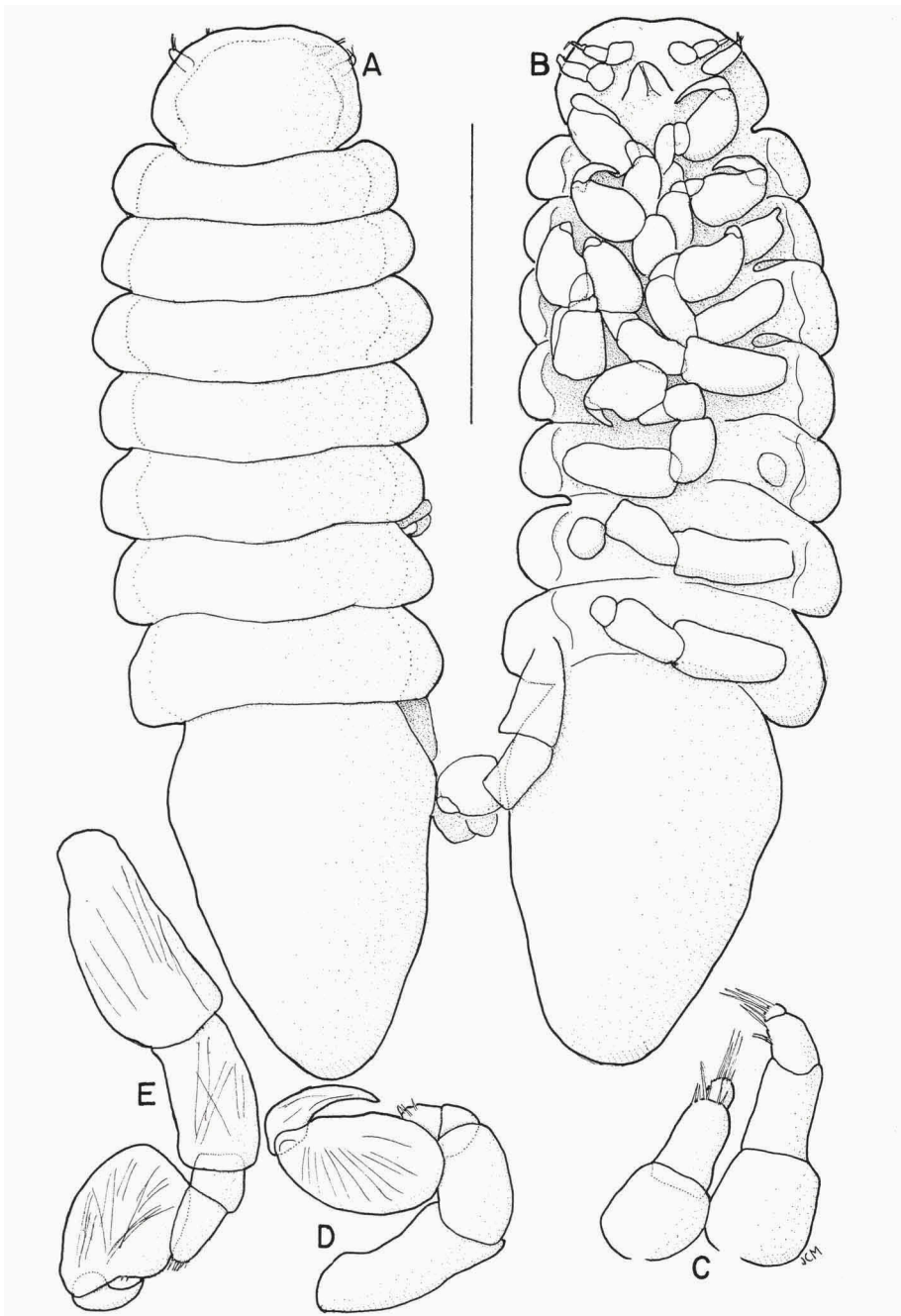


Fig. 20. *Diplophryxus siankaanensis* spec. nov., male. A, dorsal view. B, ventral view. C, left antennae. D, right pereopod 1. E, right pereopod 7. Scale: 0.5 mm for A, B, 0.25 mm for D, E, 0.125 mm for C.

nae in a dorsal groove, one or both second oostegites extending over to the dorsal surface, only two complete pereopods on the convex side and multi-divided pleopodal rami. The males are indistinguishable from those of several other hemiarthrine genera. The female of *D. siankaanensis* differs from those of *D. jordani* Richardson, 1904 from Japan and *D. alveolatus* Bourdon, 1981 from the Bay of Biscay, France, in having no pigment on any oostegites and a much less extended pleon. It differs from females of *D. jordani* and *D. alpei* Shiino, 1934 from Seto, Japan, in having both second oostegites visible dorsally and from the latter species in having lanceolate rather than oval pleonal appendages. The most closely similar female is that of *D. kempfi* Chopra, 1930, a parasite of *Gnathophyllum fasciolatus* Stimpson, 1860 in the Andaman Islands, which differs in having the head widest posteriorly, only one second oostegite extending to the dorsal surface, and pleopodal rami more pointed. The male of *D. kempfi* is the only one of the genus to differ markedly from that of *D. siankaanensis* in that it is relatively very narrow (its head especially so) and its pereomeres are deeply separated laterally.

Allodiplophryxus Markham, 1985

Allodiplophryxus floridanus Markham, 1985

Allodiplophryxus floridanus Markham, 1985a: 97-100, 128, figs. 45, 46 (Type-locality west coast of Florida, U.S.A.; infesting *Periclimenes longicaudatus*).

Material. — Infesting *Periclimenes magnus*, J. C. Markham det. of host. Punta de Betin, Santa Martha, Dept. Magdalena, Colombia, on coral rubble, 22-27 m, 7.xii.1985, RMNH Dec. 36770, H.-G. Müller coll. 1♀, 1♂, RMNH Crust. I. 7034.

Discussion. — The female, 2.32 mm long, and the male, 0.62 mm long, conform well with the type-specimens, the only representatives of *Allodiplophryxus floridanus* heretofore known. This represents a considerable extension of range for this species, from Anclote, Florida, to Colombia; it is also a new host record and the first account of any bopyrid parasite of *Periclimenes magnus*.

Eophrixus Caroli, 1930

Eophrixus subcaudalis (Hay, 1917)

Phryxus subcaudalis Hay, 1917: 569-570; pl. 98, figs. 1-6 (in part; type-locality off coast of North Carolina, U.S.A.; infesting *Synalpheus longicarpus* (Herrick, 1891); Hay & Shore, 1918: 383; Pearse, 1950: 43; Williams, 1965: 64; Williams, 1984: 105.

Hemiarthrus subcaudalis: Chopra, 1923: 419, 429, 433, 435, 436, 439, 440; Schultz, 1969: 313, fig. 497; Kelley, 1978: 169.

Phrixus (Paraphrixus) subcaudalis: Caroli, 1930: 259-263.

Paraphrixus subcaudalis: Nierstrasz & Brender à Brandis, 1931: 205; Westinga & Hoetjes, 1981: 141; tab. 1 (Bonaire and Curaçao; infesting unspecified alpheids).

Hemiarthrus schmitti Pearse, 1932: 4, figs. 16, 17, 19-21 (in part; among type-material of *Hemiarthrus schmitti* Pearse; Tortugas, Florida, U.S.A.; infesting *Synalpheus brooksi*); Schultz, 1969: fig. 499b.

“Abdominal bopyrid”: Chace, 1972: 92 (Isla Mujeres, Quintana Roo, Mexico: infesting *S. brooksi*).

“Bopyrid isopods”: Hoetjes et al., 1976: 33 (in part; Curaçao; infesting unidentified alpheid).

Eophrixus subcaudalis: Markham, 1985a: 100-107, 126, 129, 130, 132, figs. 47-51, tab. 3 (Gulf of Mexico, SE Florida and Quintana Roo; infesting *S. brooksi*. Gulf of Mexico; infesting *S. goodei* Coutière, 1909. Haiti; infesting *S. hemphilli*. Gulf of Mexico, North Carolina, U.S.A., and Los Roques, Venezuela; infesting *S. longicarpus*. Near Key West, Florida; infesting *S. mcclendonii* Coutière, 1910. Gulf of Mexico; infesting *S. pandionis*. Off Dominican Republic; infesting *S. pectiniger* Coutière, 1907. Haiti, Curaçao and Belize; infesting *Synalpheus* spp. Gulf of Mexico and Haiti; separated from hosts).

Material. — Infesting *Synalpheus bousfieldi* (including three ovigerous), J. C. Markham coll. det. of hosts. Puerto Morelos, Quintana Roo, Mexico, in *Sphaciospongia vesparia* (Lamarck) on piling of fishing pier, 1-2 m, 3.vi.1986. 4♀, 2♂, CIQRO Museum collection.

Discussion. — The new material (three females dextral and one sinistral) displays characters previously recorded for *Eophrixus subcaudalis*, all specimens of both sexes matching the ‘variants’ drawn by Markham (1985a). Quintana Roo is not a new locality for *E. subcaudalis*, but *Synalpheus bousfieldi* is a new host for it, congeneric with the 6 other species of identified hosts.

Metaphrixus Nierstrasz & Brender à Brandis, 1931

Metaphrixus carolii Nierstrasz & Brender à Brandis, 1931

Abbreviated synonymy:

Metaphrixus carolii Nierstrasz & Brender à Brandis, 1931: 206-207, figs. 100-102 (Type-locality Christiansted, St. Croix, Virgin Islands; host unrecorded); Markham, 1985a: 108, 113-115; fig. 54 (Complete synonymy. Southern Florida; infesting *Hippolyte pleuracanthus*).

Material. — Infesting *Hippolyte curacaoensis*, H. -G. Müller coll., J. C. Markham det. Bahía de Cinto, Tayrona Park, ca. 30 km E of Santa Marta, Dept. Magdalena, Colombia, under stones, 14.iv.1986, RMNH Dec. 36774: 1♀, 1♂, RMNH Crust. I. 7038. Same locality, dredging in *Thalassia* and *Syringodium*, 3-5 m, 14.xi.1985, RMNH Dec. 36788, 1♀, 1♂, RMNH Crust. I. 7062.

Discussion. — Both the females (2.00 and 2.76 mm long, one dextral, one sinistral) and the males (1.86 and 1.90 mm long) match the illustrations of this species presented by Markham (1985a) except that one female is relatively longer with larger and more rounded pleopods, and the posterior borders of the males’ heads are strongly convex but not deeply extended into the pereons. This is the first record of *Metaphrixus carolii* from South America (all previous

collections but the types being from southern Florida) or infesting any host but *Hippolyte pleuracanthus*. Strangely, most records of *Metaphrixus carolii* have failed to note its host, so it is possible that it has previously been found infesting *H. curacaoensis* but not so recorded.

Hemiarthrus Giard & Bonnier, 1887
Hemiarthrus synalpei (Pearse, 1950)

Phryxus subcaudalis Hay, 1917 (in part; in type-material of *Phryxus* (= *Eophrixus*) *subcaudalis*; off coast of North Carolina, U.S.A.; infesting *Synalpheus longicarpus*).

Diplophryxus synalpei Pearse, 1950: 41-43, figs. 3-7 (Type-locality New River, North Carolina; infesting *S. fritzmulleri*); Schultz, 1969: 314, fig. 500(a); Kelley, 1978: 169; Bourdon, 1981a: 632 footnote.

Hemiarthrus synalpei: Markham, 1985a: 116, 118-122, 129, 130, 132, figs. 55-57, tab. 3 (Re-examination of types. Gulf of Mexico and off Onslow Bay, North Carolina; infesting *S. longicarpus*. Golfe de Gonâve, Haiti; infesting *Synalpheus* sp. or spp.)

Material. — Separated from host. Isla del Morro near Santa Marta, Dept. Magdalena, Colombia, on coral rubble, 18 m, 9.x.1985, H. -G. Müller coll.: 1♀, 1♂, RMNH Crust. I. 7054.

Discussion. — The sinistral female (5.50 mm long) and the male (1.32 mm long) correspond well with the specimens examined and illustrated by Markham (1985a). This is the first record of *Hemiarthrus synalpei* from South America.

SUMMARY AND CONCLUSIONS

With the description of seven new species, the total number of species of bopyrid isopods now known from the northwestern Atlantic Ocean is 86, belonging to six subfamilies. These species, their host genera and the zoogeographic regions (modified after Williams, 1984) of their occurrence are listed in table 1.

Table 1. Species of bopyrid isopods currently known from the northwestern Atlantic Ocean, from 90° to Equator. NBB: Nierstrasz & Brender à Brandis. 1: North Pole to Cape Cod. 2: Cape Cod to Cape Hatteras. 3: Cape Hatteras to Cape Canaveral. 4: Sanibel Island to Rio Grande. 5: Bermuda. 6: Cape Canaveral to Sanibel Island, including Bahamas. 7: Rio Grande to Cabo Catoche. 8: Caribbean Sea and Antilles. 9: Trinidad to Amazon River. A: Atlantic Ocean > 200 m. B: Gulf of Mexico > 200 m. C: Caribbean Sea > 200 m. +: Also occurring outside northwestern Atlantic.

Species	Host genus or genera	Locality
Subfamily Pseudioninae		
<i>Anuropodione carolinensis</i> Markham	<i>Munida</i>	A
<i>A. megacephalon</i> Markham	<i>Munida</i>	B

<i>Aporobopyrina anomala</i> Markham	<i>Munida</i>	B, C
<i>Aporobopyrus curtatus</i> (Richardson)	<i>Petrolisthes, Porcellana</i>	3, 6, 8, +
<i>A. bonairensis</i> Markham	<i>Petrolisthes</i>	8
<i>Astalione cruciaria</i> Markham	<i>Clastoetochus</i>	8
<i>Asymmetrione clibanarii</i> Markham	<i>Clibanarius</i>	6, 8, +
<i>A. desultor</i> Markham	<i>Pagurus, Iridopagurus</i>	3, 6, 8, +?
<i>Balanopleon tortuganus</i> Markham	<i>Munida</i>	C
<i>Bopyrissa wolffi</i> Markham	<i>Clibanarius</i>	3, 4, 5, 6
<i>Castrione longicaudata</i> Brasil Lima	<i>Marcusiaxus,</i>	
	<i>Meticonaxus</i>	9
<i>Kolourione premordica</i> Markham	<i>Pachycheles</i>	6, 8
<i>Munidion cubense</i> Bourdon	<i>Munida</i>	C
<i>M. irritans</i> Boone	<i>Munida</i>	A, C
<i>M. longipedis</i> Markham	<i>Munida</i>	A, C
<i>Orthione furcata</i> (Richardson)	<i>Upogebia</i>	2, 3
<i>Paragigantione americana</i> (Markham)	<i>Munida</i>	A
<i>Parapagurion imbricata</i> Markham	<i>Parapagurus, Paguristes</i>	8
<i>Parapleurocryptella elasmonti</i> Bourdon	<i>Munidopsis</i>	C
<i>Pleurocrypta floridana</i> Markham	<i>Galathea</i>	6
<i>P. petrolisthis</i> Markham	<i>Petrolisthes</i>	8
<i>Pleurocryptella fimbriata</i> Markham	<i>Munida</i>	C
<i>Pontobopyrus abyssorum</i> Markham	<i>Pontophilus</i>	A
<i>Progebiophilus upogebiae</i> (Hay)	<i>Upogebia</i>	2, 4, +
<i>Pseudasymmetrione markhami</i> Adkison & Heard	<i>Pagurus</i>	3, 8
<i>Pseudasymmetrione</i> sp.	<i>Iridopagurus</i>	8
<i>Pseudione affinis</i> (Sars)	<i>Plesionika</i>	A
<i>P. ampla</i> Markham	<i>Heterocarpus</i>	A
<i>P. cognata</i> Markham	<i>Pontophilus</i>	6
<i>P. minimocrenulata</i> NBB	<i>Munida</i>	C
<i>P. panopei</i> Pearce	Uncertain	3
<i>P. tridentata</i> NBB	<i>Pisosoma, Pachycheles</i>	8
<i>Pseudione</i> sp.	<i>Parapandalus</i>	B
<i>Pseudione</i> sp.	<i>Munida</i>	A
Subfamily Ioninac		
<i>Cancricepon choprae</i> (NBB)	<i>Rhithropanopeus, Neo-panope Panopeus, Hexapanopeus, Domecia, Panoplax, Eriphia?</i>	3, 4, 5?, 6, 7, 8
<i>Dactylokepon sulcipes</i> Adkison	<i>Callidactylus</i>	B
<i>D. caribaeus</i> Markham	<i>Iliacantha</i>	C
<i>D. hunterae</i> Wells & Wells	<i>Pinnotheres</i>	3
<i>Gigantione mortenseni</i> Adkison	<i>Dromidia, Hypoconcha</i>	4, 8
<i>G. uberlackerae</i> Adkison	<i>Axiopsis</i>	4
<i>Grapsicepon edwardsi</i> Giard & Bonnier	<i>Planes</i>	3, 6
<i>G. belizeianum</i> Markham	<i>Mithrax</i>	8
<i>Ione indecora</i> Markham	<i>Albunea</i>	8
<i>I. thompsoni</i> Richardson	<i>Callianassa</i>	2
<i>Leidya bimini</i> Pearce	<i>Pachygrapsus, Cyclograpsus, Sesarma</i>	5, 6, 8
<i>L. distorta</i> (Leidy)	<i>Uca, Ucides</i>	3, 8, +
Subfamily Bopyrinae		

<i>Bathygyge grandis</i> Hansen	<i>Glyphocrangon</i>	A, +
<i>Bopyrella harmopleon</i> Bowman	<i>Synalpheus</i>	8, +
<i>Bopyrina abbreviata</i> Richardson	<i>Hippolyte</i>	3, 6, 8, +
<i>Bopyrinella thorii</i> (Richardson)	<i>Thor</i>	6, 8
<i>Bopyrione synalpheii</i> Bourdon & Markham	<i>Synalpheus</i>	6, 8
<i>Bopyroides hippolytes</i> (Krøyer)	<i>Pandalopsis, Spiron-</i> <i>tocharis, Pandalus</i>	1, +
<i>Ogyridione caroliniana</i> Markham	<i>Ogyrides</i>	3
<i>Ovobopyrus alphezemiotis</i> Markham	<i>Alpheus</i>	4
<i>Parabopyrella lata</i> (NBB)	<i>Alpheus</i>	6, 8
<i>P. mortenseni</i> (NBB)	<i>Lysmata</i>	4, 6, 8
<i>P. richardsonae</i> (NBB)	<i>Alpheus</i>	4, 8
<i>P. thomasi</i> (NBB)	<i>Tozeuma</i>	8
<i>Parabopyriscus stellatus</i> Markham	<i>Alpheus</i>	4
<i>Probopyria alpei</i> (Richardson)	<i>Alpheus</i>	3, 4, 6, 8, +
<i>Probopyrinella heardi</i> Adkison	<i>Latreutes</i>	3, 4, 6, 8, +
<i>P. latreuticola</i> (NBB)	<i>Latreutes</i>	3, 4, 5, 6, 8, +
<i>Probopyrus pandalicola</i> (Packard)	<i>Macrobrachium, Pal-</i> <i>aemon, Palaemonetes,</i> <i>Periclimenes</i>	6, 7, 8, 9, +
<i>Prosynsynella hayi</i> NBB [?]	<i>Synalpheus</i>	8
<i>Schizobopyrina urocaridis</i> (Richardson)	<i>Periclimenes, Pontonia,</i> <i>Brachycarpus</i>	3, 4
<i>Synsynella choprae</i> (Pearse)	<i>Synalpheus</i>	3, 4, 5, 8
<i>S. deformans</i> Hay	<i>Synalpheus</i>	3, 4, 8
<i>S. integra</i> Bourdon	<i>Synalpheus</i>	3, 4
<i>Urobopyrus processae</i> Richardson	<i>Processa, Ambidexter</i>	4, 9, +
Subfamily Argeiinae		
<i>Argeia atlantica</i> Markham	<i>Sclerocrangon</i>	A
Subfamily Athelginae		
<i>Parathelges foliatus</i> Markham	<i>Clibanarius, Pagurus</i>	8
<i>P. occidentalis</i> Markham	<i>Clibanarius,</i> <i>Iridopagurus,</i> <i>Pylopagurus</i>	3, 6, 8
<i>P. piriformis</i> Markham	<i>Pagurus, Paguristes</i>	5, 8
<i>P. tumidipes</i> Markham	<i>Dardanus, Allodardanus</i>	5, 8
<i>Stegias clibanarii</i> Richardson	<i>Clibanarius</i>	5, 8
<i>Stegophryxus hyptius</i> Thompson	<i>Pagurus, Iridopagurus</i>	2, 6, 8
Subfamily Hemiarthrinae		
<i>Allodiplophryxus floridanus</i> Markham	<i>Periclimenes</i>	4, 8
<i>Azygopleon schmitti</i> (Pearse)	<i>Synalpheus</i>	4, 6
<i>Dicropoleon periclimenis</i> Markham	<i>Periclimenes</i>	8
<i>Diplophryxus siankaanensis</i> Markham	<i>Alpheus</i>	3, 6, 8
<i>Eophryxus subcaudalis</i> (Hay)	<i>Synalpheus</i>	3, 4, 6, 8
<i>Hemiarthrus abdominalis</i> (Krøyer)	<i>Eualus, Spirontocaris,</i> <i>Pandalus, Dichelopan-</i> <i>dalus</i>	1
<i>H. synalpheii</i> (Pearse)	<i>Synalpheus</i>	3, 4, 8
<i>Hyperphryxus castrensis</i> Markham	<i>Periclimenes</i>	4
<i>Loki circumsaltanus</i> Markham	<i>Thor</i>	6, 8
<i>Metaphryxus carolii</i> NBB	<i>Hippolyte</i>	6, 8

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REFERENCES

- Adkison, D. L., 1984. *Probopyrinella heardi* n. sp. (Isopoda: Bopyridae) a branchial parasite of the hippolytid shrimp *Latreutes parvulus* (Decapoda: Caridea). — Proc. Biol. Soc. Washington 97: 550-554, figs. 1-2.
- Adkison, D. L. & R. W. Heard, 1978. Description of a new genus and species of Pseudioninae (Isopoda: Bopyridae) parasite of the hermit crab *Pagurus annulipes* (Stimpson) from North Carolina. — Proc. Biol. Soc. Washington 91: 408-417, figs. 1-3, tab. 1.
- Baffoni, G. M., 1950. La castrazione parassitaria da *Ione thoracica* (Montagu) e da *Parthenope subterranea* Kossmann in *Callianassa laticauda* Otto. — Arch. oceanogr. limnol. Roma 6: 213-224, figs. 1-5.
- Bonnier, J., 1900. Contribution à l'étude des épicarides. Les Bopyridae. — Trav. Stat. Zool. Wimereux 8: 1-476, text-figs. 1-62, pls. I-XLI.
- Bourdon, R., 1968. Les Bopyridae des mers Européennes. — Mém. Mus. natl. Hist. nat. Paris (N. S.) (A) 50 (2): 77-424, figs. 1-190, tabs. 1-68, graphs 1-30.
- Bourdon, R., 1971. Épicarides nouveaux pour la côte occidentale d'Afrique équatoriale. — Bull. Inst. fond. Afr. Noire (A) 33: 371-391, figs. 1-7.
- Bourdon, R., 1976a. Les bopyres des porcellanes. — Bull. Mus. natl. Hist. nat. Paris (3) 359, Zool. 252: 165-245, figs. 1-44.
- Bourdon, R., 1976b. Épicarides de Madagascar. I. — Bull. Mus. natl. Hist. nat. Paris, (3): 371, Zool. 259: 353-392, figs. 1-23.
- Bourdon, R., 1979. Campagne de la Calypso au large des côtes Atlantiques de l'Amérique du Sud (1961-1962). I. 32. Crustacés Isopodes: Bopyridae parasites de *Pagurus*. — Résultats scientifiques des Campagnes de la Calypso 9: 139-144, figs. 1-2.
- Bourdon, R., 1980a. Les espèces du genre *Bopyrella* J. Bonnier (Crustacea, Isopoda, Bopyridae). — Bull. Mus. natl. Hist. nat. Paris (4) 2 (Sect. A) (no. 1): 185-236, figs. 1-19, tabs. I-V.
- Bourdon, R., 1980b. *Aporobopyrus dollfusi* n. sp. (Crustacea, Epicaridea, Bopyridae) parasite de porcellanes de la Mer Rouge. — Bull. Mus. natl. Hist. nat. Paris (4) 2 (Sect. A) (no. 1): 237-244, figs. 1-2, tabs. I.
- Bourdon, R., 1981a. Bopyriens nouveaux pour la faune européenne de l'Atlantique (Isopoda, Epicaridea). — Bull. Mus. natl. Hist. nat. Paris (4) 3 (Sect. A) (no. 2): 615-634, figs. 1-10, tab. I.

- Bourdon, R., 1981b. Remarques sur le genre *Synsynella* Hay, avec description de *S. integra* n. sp. — Bull. Mus. natl. Hist. nat. Paris (4) 3 (Sect. A): 1143-1162, figs. 1-8.
- Bourdon, R., J.-L. d'Hondt & A. Veillet, 1981. Note préliminaire sur les microsetes et les "fentes céphaliques" chez les bopyriens (Crustacés Epicarides). — Bull. Soc. zool. Franç. 105 (4): 495-504, figs. 1-7, pls. I, II.
- Bourdon, R. & J. C. Markham, 1980. A new genus and species of bopyrid isopod infesting alpheid shrimps of the genus *Synalpheus* in the western Atlantic Ocean. — Zool. Med. Leiden 55 (19): 221-230, figs. 1-3.
- Bowman, T. E., 1956. Una especie nueva de *Bopyrella* (Crustacea: Isopoda) de los Roques, Venezuela. — Nov. Cient., Contr. Occ. Museo. Hist. Nat. La Salle Ser. Zool. no. 19, Apart. No. 681: 1-4, 1 fig.
- Bowman, T. E., 1964. Orders Isopoda and Tanaidacea (Chelifera). In: Smith, R. I., ed. Keys to marine invertebrates of the Woods Hole Region: pp. 102-111, pls. 14-15. Boston.
- Brian, A. & E. Darteville, 1941. Sur un epicaride nouveau du Congo: *Pseudione Brandaoi* n. sp. — Rev. Zool. bot. Afr. Tervuren 34: 348-352, figs. 1-2.
- Cadwallader, J., 1976. NSF grant to study parasitic isopods. — Newsletter, Bermuda Biological Station for Research 5 (2, 3): 3.
- Camp, D. K., N. H. Whiting & R. E. Martin, 1977. Nearshore marine ecology at Hutchinson Island, Florida: 1971-1974. V. Arthropoda. — Mar. Res. Publ. 25: 1-63, figs. 1-12, tabs. 1-41.
- Caroli, E., 1930. Notizia di tre specie nuove ed una poco nota di Bopyridi addominali, parassiti di Caridei del golfo di Napoli. (Contributo alla conoscenza del genere *Phrixus* Rathke). — Boll. Soc. Nat. Napoli 41: 258-269, pl. 9.
- Catalano, N. & F. Restivo, 1965. Ulteriori notizie sulla *Pseudione euxinica*, parassita di *Upogebia littoralis* a Napoli. — Pubbl. Zool. Staz. Napoli 34: 203-210, figs. 1-5.
- Caulery, M., 1952. Parasitism and symbiosis: xii, 340 pp. 80 figs. London.
- Chace, F. A., Jr., 1972. The shrimps of the Smithsonian-Bredin Caribbean Expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). — Smithsonian Contr. Zool. 98: 1-179, figs. 1-61.
- Chopra, B., 1923. Bopyrid isopods parasitic on Indian Decapoda Macrura. — Recs. Indian Mus. 25: 411-550, text-figs. 1-32, pls. XI-XXI.
- Chopra, B., 1930. Further notes on bopyrid isopods parasitic on Indian Decapoda Macrura. — Recs. Indian Mus. 32: 113-147, text-figs. 1-4, pls. 4-6, tab. 1.
- Christoffersen, M. L., 1979. Decapod Crustacea: Alpheoidea. Résultats scientifiques des campagnes de la Calypso au large des côtes Atlantiques de l'Amérique du Sud (1961-1962). I. Number 36. — Ann. Inst. Océan. Monaco (N. S.) 55: 297-377, figs. 1-35, tabs. 1-IV.
- Christoffersen, M. L., 1982. Distribution of warm-water alpheid shrimp (Crustacea, Caridea) on the continental shelf of eastern South America between 23 and 35° Lat. — S. Bol. Inst. Ocean., São Paulo 31: 93-112, figs. 1-6, tab. 1.
- Coelho, P. A. & M. L. Koenig, 1972. A distribuição dos crustáceos pertencentes às orders Stomatopoda, Tanaidacea e Isopoda no Norte e Nordeste do Brasil. — Trab. Ocean. Univ. Fed. Pernambuco 13: 245-259, fig. 1, tab. I.
- Danforth, C. G., 1976. Epicaridea (Isopoda) of Guam. — Crustaceana, 31: 78-81.
- Duarte, L. F. L. & E. H. Morgado, 1983. Crustáceos parasitos de invertebrados associados à esponja *Zygomycala parishii* (Bowerbank) e ao briozoário *Schizoporella unicornis* (Johnston, 1847). — Iheringia (Ser. Zool.) Porto Alegre 62: 3-11, figs. 1-10.
- Forest, J. & M. de Saint Laurent, 1967. Campagne de la Calypso au large des côtes Atlantiques de l'Amérique du Sud (1961-1962). 6. Crustacés Décapodes: Pagurides. — Ann. Inst. Océan. Monaco (N. S.) 45: 47-169, figs. 1-150.
- Fowler, H. G., 1912. The Crustacea of New Jersey. — Ann. Rept. New Jersey State Mus., 1911 (part II): 29-650, pls. 1-150. Trenton, N. J.
- Fox, R. S. & E. E. Ruppert, 1985. Shallow-water marine benthic macroinvertebrates of South Carolina. Species identification, community composition and symbiotic associations. — Belle W. Baruch Library in Marine Science 14: 1-327 + addendum.

- García-Gómez, J., 1983. Revision of *Iridopagurus* (Crustacea: Decapoda: Paguridae) with the description of a new species from American waters. — *Bull. Mar. Sci.* 33: 10-54, tabs. 1-8, figs. 1-6.
- Gore, R. H., 1970. *Pachycheles cristobalensis*, sp. nov., with notes on the porcellanid crabs of the southwestern Caribbean. — *Bull. Mar. Sci.* 20: 957-970, figs. 1-3.
- Gore, R. H., 1974. On a small collection of porcellanid crabs from the Caribbean Sea (Crustacea, Decapoda, Anomura). — *Bull. Mar. Sci.* 24: 700-721.
- Gosner, K. L., 1971. Guide to identification of marine and estuarine invertebrates Cape Hatteras to the Bay of Fundy: xix + 693 pp., figs. New York.
- Haig, J., 1966. Campagne de la Calypso au large des côtes Atlantiques de l'Amérique du Sud (1961-1962). 2. Porcellanid crabs (Crustacea Anomura). — *Ann. Inst. Océan. Monaco (N. S.)* 44: 351-358.
- Haig, J., 1968. Eastern Pacific Expeditions of the New York Zoological Society. Porcellanid crabs (Crustacea Anomura) from the west Coast of tropical America. — *Zoologica* 53: 57-74, figs. 1-2.
- Hay, W. P., 1917. A new genus and three new species of parasitic isopod crustaceans. — *Proc. U. S. Natl. Mus.* 51: 569-574, pls. 98-100.
- Hay, W. P. & C. A. Shore, 1918. The decapod crustaceans of Beaufort, N. C., and the surrounding region. *Bull. U. S. Bur. Fisheries* 35 (Document 859): 369-475, text-figs. 1-20, pls. XXV-XXXIX.
- Hehre, E. H., 1950. Annotated list of the fauna of the Grand Isle region. — *Occas. Paps. Mar. Lab. Louisiana State Univ. Stud. Baton Rouge* 6: 1-66.
- Hoetjes, P., E. Westinga & H. de Kruijf, 1976. The intrasponge fauna of the loggerhead or manjack sponge (Porifera: *Spherospongia vesparia* (Lamarck) Marshall). — Abstracts, Twelfth meeting, Assoc. Isl. Mar. Labs. Caribbean 33-35, figs. 1-2.
- Hutton, R. F., 1964. A second list of parasites from marine and coastal animals of Florida. — *Trans. American Microsc. Soc.* 83: 439-447.
- Hutton, R. F. & F. Sogandares-Bernal, 1960. A list of parasites from marine and coastal animals of Florida. — *Trans. American Microsc. Soc.* 29: 287-292.
- Kaestner, A., 1967. *Lehrbuch der speziellen Zoologie. Band I: Wirbellose, 2. Teil, Crustacea.* 2nd ed.: I-VIII, 849-1242, figs. 661-902. Stuttgart.
- Kaestner, A., 1970. *Invertebrate zoology. Volume III. Crustacea.* xi. + 523 pp., figs. New York.
- Kelley, B. J., Jr., 1978. Order Isopoda. pp. 167-170 in: Zingmark, R. G., ed., *An annotated checklist of the biota of the coastal zone of South Carolina.* Columbia, South Carolina.
- Kossmann, R., 1877. *Malacostraca.* — *Zoologische Ergebnisse einer im Auftrage der Königlichen Academie der Wissenschaften zu Berlin ausgeführten Reise in die Küstengebiete des Rothen Meeres* III: 1-140, pls. IV-XV.
- Lawler, A. R., 1978. A partial list of actual and potential parasites of some South Carolina estuarine and marine fauna. pp. 309-337. in: Zingmark, R. G., ed., *An annotated checklist of the biota of the coastal zone of South Carolina.* Columbia, South Carolina.
- Lemaitre, R., P. A. McLaughlin & J. García-Gómez, 1982. The provenzanoid group of hermit crabs (Crustacea, Decapoda, Paguridae) in the western Atlantic. Part IV. A review of the group, with notes on variations and abnormalities. — *Bull. Mar. Sci.* 32: 670-701, figs. 1-7.
- Lemos de Castro, A., 1965a. Crustáceos Isópodos Epicarídeos do Brasil. II: Notas sobre "Aporobopyrus gracilis" Nierstrasz & Brender à Brandis (Isopoda, Bopyridae). — *Rev. Brasil. Biol.* 25: 177-180, figs. 1-10.
- Lemos de Castro, A., 1965b. Crustáceos Isópodos Epicarídeos do Brasil. III. Genero *Bopyrella* Bonnier (Isopoda, Bopyridae). — *Acad. brasil. cienc. ann.* 37: 283-288, figs. 1-23.
- Lemos de Castro, A., 1965c. Crustáceos Isópodos Epicarídeos do Brasil. IV. Sobre a ocorrência de *Pseudione upogebiae* Hay no litoral nordestino (Isopoda, Bopyridae). — *Arq. Est. Biol. Mar. Univ. Ceará* 5: 11-14, figs. 1-11.
- Lemos de Castro, A., 1970. Crustáceos Isópodos Epicarídeos do Brasil. V. Duas espécies novas de hiperparasitas pertencentes ao gênero *Cabirops* Kossmann (Isopoda, Cabiropsidae). — *Bolet.*

- Mus. Nacion., Rio de Janeiro. (Nova Sér.) Zoologia 277: 1-7, pls. I-IV.
- Lemos de Castro, A. & I. M. Brasil Lima, 1980a. Crustáceos Isópodos Epicarídeos do Brasil. XII. Variações intraespecíficas, hospedeiros e distribuição geográfica de *Bopyrina abbreviata* Richardson. — Bolet. Mus. Nacion., Rio de Janeiro. (Nova Ser.) Zoologia 295: 1-8, figs. 1-16.
- Lemos de Castro, A. & I. M. Brasil Lima, 1980b. Crustáceos Isópodos Epicarídeos do Brasil. XIII. Variações intraespecíficas, distribuição geográfica e hospedeiros de *Aporobopyrus curtatus* (Richardson). — Bolet. Mus. Nacion., Rio de Janeiro. (Nova Ser.) Zoologia 296: 1-8, figs. 1-15.
- Markham, J. C., 1972. Four new species of Parathelges Bonnier, 1900 (Isopoda, Bopyridae), the first record of the genus from the western Atlantic. — Crustaceana, Suppl. 3: 57-78, figs. 1-16.
- Markham, J. C., 1974. Parasitic bopyrid isopods of the amphi-American genus *Stegophryxus* Thompson with the description of a new species from California. — Bull. South. California Acad. Sci. 73: 33-41, figs. 1-8.
- Markham, J. C., 1975a. Bopyrid isopods infesting porcellanid crabs in the northwestern Atlantic. — Crustaceana 28: 257-270, figs. 1-5, tab. 1.
- Markham, J. C., 1975b. Two new species of *Asymmetrione* (Isopoda, Bopyridae) from the western Atlantic. — Crustaceana 29: 255-265, figs. 1-6, tab. 1.
- Markham, J. C., 1977. The status and systematic position of the species of the bopyrid isopod genus *Phyllodurus* Stimpson, 1857. — Proc. Biol. Soc. Washington 90: 813-818.
- Markham, J. C., 1978a. Bopyrid isopods parasitizing hermit crabs in the northwestern Atlantic Ocean. — Bull. Mar. Sci. 28: 102-117, figs. 1-11, tab. 1.
- Markham, J. C., 1978b. A new genus and species of bopyrid isopod parasitic on the western Atlantic porcellanid *Pachycheles ackleianus* A. Milne Edwards. — Proc. Biol. Soc. Washington 91: 483-489, figs. 1-3.
- Markham, J. C., 1979. Epicaridean isopods of Bermuda. — Bull. Mar. Sci. 29: 522-529, figs. 1-2.
- Markham, J. C., 1982. Bopyrid isopods parasitic on decapod crustaceans in Hong Kong and Southern China. — Proc. First Internatl. Mar. Biol. Workshop: The Marine Flora and Fauna of Hong Kong and Southern China [B. S. Morton & C. K. Tseng, eds.]. 1: 325-391, figs. 1-33, tab. 1. Hong Kong.
- Markham, J. C., 1985a. A review of the bopyrid isopods infesting caridean shrimps in the northwestern Atlantic Ocean, with special reference to those collected during the Hourglass Cruises in the Gulf of Mexico. — Mem. Hourglass Cruises 8 (3): 1-156, figs. 1-59, tabs. 1-5.
- Markham, J. C., 1985b. A new species of *Asymmetrione* (Isopoda: Bopyridae) infesting the hermit crab *Isocheles pilosus* (Holmes) in southern California. — Bull. South. California Acad. Sci. 84: 104-108, figs. 1-2.
- Markham, J. C., 1986. Evolution and zoogeography of the Isopoda Bopyridae, parasites of Crustacea Decapoda. In: Gore, R. H. & K. L. Heck, eds., Crustacean issues, crustacean biogeography 4: 143-164, figs. 1-5, tabs. 1-5. Rotterdam.
- McDermott, J. J., 1974. Parasitic isopods of Bermuda. — Newsletter, Bermuda Biological Station for Research 4 (1): 2, 2 unnumbered figs.
- Menzel, R. W., [ed.] 1971. Checklist of the marine fauna and flora of the Apalachee Bay and the St. George's Sound area. third Edition. — Dept. Oceanogr. Florida State Univ. Contr. 61: i-vi, 1-126.
- Menzies, R. J. & D. Frankenberg, 1966. Handbook on the common marine isopod Crustacea of Georgia: 93 pp., 27 figs., 4 pls., 1 tab. Athens, Georgia.
- Menzies, R. J. & P. W. Glynn, 1968. The common marine isopod Crustacea of Puerto Rico: A handbook for marine biologists. — Stud. Fauna Curaçao Caribbean Isls. 27 (104): 1-133, figs. 1-43.
- Miner, R. W., 1950. Field book of seashore life: xv + 888 pp., 251 pls. New York.
- Monod, T., 1933. Tanaidacea et Isopoda. Mission Robert-Ph. Dollfus en Égypt. — Mém. Inst. Égypt 21: 161-264, figs. 1-80.
- Nierstrasz, H. F. & G. A. Brender à Brandis, 1923. Die Isopoden der Siboga-Expedition. II. Isopoda Genuina. I- Epicaridea. — Siboga-Expeditie 32b: 57-121, pls. IV-IX.

- Nierstrasz, H. F. & G. A. Brender à Brandis, 1925. Bijdragen tot de kennis der fauna van Curaçao. Resultaten eener reis van C. J. van der Horst in 1920. *Epicarides*. — *Bijdr. Dierk.*, Amsterdam 24: 1-8, pl. 1.
- Nierstrasz, H. F. & G. A. Brender à Brandis, 1929. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. XLVIII. *Epicaridea*. I. — *Vidensk. Medd. Dansk naturh. Foren. København* 87: 1-44, figs. 1-53.
- Nierstrasz, H. F. & G. A. Brender à Brandis, 1931. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. LVII. *Epicaridea* II. — *Vidensk. Medd. Dansk naturh. Foren. København* 91: 147-226, figs. 1-125, pl. I.
- Nobili, G., 1906. Nuovi bopyridi. — *Accad. Sci. Torino, Atti* 41 (11): 1098-1113, pl. 1.
- Overstreet, R. M., 1983. Metazoan symbionts of crustaceans. Chpt. 4, pp. 155-250, figs. 1-39. In: Provenzano, A. J., Jr., ed. *The biology of Crustacea*, Vol. 6, Pathobiology. New York.
- Packard, A. S., 1879. *Zoology for students and general readers*: viii + 719 pp., 545 figs. New York.
- Pearse, A. S., 1932. New bopyrid isopod crustaceans from Dry Tortugas, Florida. — *Proc. U. S. Natl. Mus.* 81: 1-6, figs. 1-26.
- Pearse, A. S., 1945. Ecology of *Upogebia affinis* (Say). — *Ecology* 26: 303-305, figs. 1-2.
- Pearse, A. S., 1947. Observations on the occurrence of certain barnacles and isopods at Beaufort, N. C. — *J. Washington Acad. Sci.* 37: 325-328, figs. 1-11.
- Pearse, A. S., 1950. Bopyrid isopods from the coast of North Carolina. — *J. Elisha Mitchell Sci. Soc.* 66: 41-32, figs. 1-7.
- Pearse, A. S., 1953b. Parasitic crustaceans from Alligator Harbor, Florida. — *Quart. J. Florida Acad. Sci.* 15 (4): 187-243, figs. 1-143, tab. 1.
- Pearse, A. S., 1953b. Three parasitic isopods (Bopyridae) from the Carolina coast. — *J. Parasitology* 39: 619-620, figs. 1-7.
- Popov, V. K., 1927. [Rhizocephala and Bopyridae of the Bay of Sevastopol.] *Trudy Sevastopol'skoy Biol. Sta. Akad. Nauk. SSSR* 1: 1-26, pl. 1 (In Russian, with English summary).
- Reinhard, E. G., 1949. Experiments on the determination and differentiation of sex in the bopyrid isopod *Stegophryxus hyptius* Thompson. — *Biol. bull.* 96: 17-31, figs. 1-4, tab. 1.
- Reinhard, E. G. & F. W. Buckeridge, 1950. The effect of parasitism by an entoniscid on the secondary sex characters of *Pagurus longicarpus*. — *J. Parasitology* 36: 131-138, tabs. 1-2, fig. 1.
- Reinhard, E. G., T. van Brand & S. F. McDuffie, 1947. The fat content of hermit crabs parasitized by a bopyrid. — *Proc. Helminth. Soc. Washington, D.C.* 14: 69-73, tabs. 1-2, fig. 1.
- Restivo, F., 1970. A new species of *Pseudione* (*Pseudione reverberii*) a parasite of *Callinassa truncata*. — *Pubbl. Staz. Zool. Napoli* 38: 305-315, figs. 1-11.
- Restivo, F., 1971. Su di una nuova specie di *Cabirops* parassiti di *Pseudione*. — *Pubbl. Staz. Zool. Napoli* 39: 70-86, figs. 1-14, tabs. 1-2.
- Restivo, F., 1975. Nuovi dati su *Paracabirops* (n. d. *Cabirops*) *marsupialis* Caroli, parassita di *Gyge branchialis*. — *Pubbl. staz. Zool. Napoli* 39: 150-168, figs. 1-12, tab. 1.
- Richardson, H., 1900. Results of the Branner-Agassiz expedition to Brazil. II. The isopod *Crustacea*. — *Proc. Washington Acad. Sci.* 2: 157-159, figs. 1-4.
- Richardson, H., 1904. Contributions to the natural history of the Isopoda. — *Proc. U. S. Natl. Mus.* 27 (1350): 1-89, figs. 1-92.
- Richardson, H., 1905. A monograph on the isopods of North America. — *Bull. U. S. Natl. Mus.* 54: lii + 727 pp., figs. 1-740.
- Rouse, W. L., 1970. Littoral Crustacea from southwest Florida. — *Quart. J. Florida Acad. Sci.* 32: 127-152, fig. 1, tab. 1-2.
- Šadoglu, P., 1969. Variations in eye degeneration and pigment in some parasitic isopods during their life cycle. — *Pubbl. Staz. Zool. Napoli* 37: 173-209, figs. 1-25, tabs. 1-7.
- Sassaman, C., G. A. Schultz & R. Garthwaite, 1984. Host, synonymy, and parasitic incidence of *Bopyrella calmani* (Richardson) from central California (Isopoda: *Epicaridea*: Bopyridae). — *Proc. Biol. Soc. Washington* 97: 645-654, figs. 1-3, tab. 1.

- Schultz, G. A., 1969. How to know the marine isopod crustaceans: vii + 359 pp., 572 figs. Dubuque, Iowa.
- Schultz, G. A., 1986. Order Isopoda (Pill bugs, wharf lice, fish lice). pp. 366-372, pls. 122, 123. In: Sterrer, W. E., ed. Marine fauna and flora of Bermuda – a systematic guide to the identification of marine organisms. New York.
- Shiino, S. M., 1933. Bopyrids from Tanabe Bay. — Mem. College Sci., Kyoto Imper. Univ. (B) 8 (3, Art. 8): 249-300, figs. 1-12.
- Shiino, S. M., 1934. Bopyrids from Tanabe Bay II. — Mem. College Sci., Kyoto Imper. Univ. (B) 9 (4, Art. 7): 258-287, figs. 1-12.
- Shiino, S. M., 1937. Bopyrids from Tanabe Bay, IV. — Mem. College Sci., Kyoto Imper. Univ. (Ser. B) 12 (3, Art. 18): 479-493, figs. 1-10.
- Shiino, S. M., 1939. Bopyrids from Kyūsyū and Ryūkyū. — Recs. Oceanogr. Works Japan 10: 79-99, figs. 1-13.
- Shiino, S. M., 1951. Some bopyrid parasites found on the decapod crustaceans from the waters along Mie Prefecture. — Rep. Fac. Fish. Pref. Univ. Mie 1: 26-40, figs. 1-8.
- Shiino, S. M., 1952. Phylogeny of the family Bopyridae. — Ann. Rept. Prefectural Univ. Mie (Sect. 2, Nat. Sci.) 1: 33-56, figs. 1-7. (In Japanese with English Summary).
- Shiino, S. M., 1958. Note on the bopyrid fauna of Japan. — Rept. Fish. Mie Univ. 3 (1): 27-73, text-figs. 1-22, pls. III, tab. I.
- Shiino, S. M., 1964. On three bopyrid isopods from California. — Rept. Fac. Fisheries, Pref. Univ. Mie 5: 19-25, figs. 1-2.
- Shiino, S. M., 1965. Phylogeny of the genera within the family Bopyridae. — Bull. Mus. Natl. Hist. nat. Paris (2) 37: 462-465, fig. 1-2.
- Sumner, F. B., R. C. Osburn & L. J. Cole, 1913a. A biological survey of the waters of Woods Hole and vicinity. Section I. Physical and zoological. — Bull. Bur. Fisheries, U.S. Fish Wildl. Serv. 31: 1-441.
- Sumner, F. B., R. C. Osburn & L. J. Cole, 1913b. A biological survey of the waters of Woods Hole and vicinity. Part II, Section III – A catalogue of the marine fauna. — Bull. Bur. Fisheries, U.S. Fish Wildl. Serv. 31: 547-794.
- Thompson, M. T., 1902. A new isopod parasitic on the hermit crab. — Bull. U. S. Fish. Comm. 21 (1901): 53-56, pls. 9-10.
- Tsukamoto, R. Y., 1981. Bopyrina ocellata (Czerniavsky, 1868), isopode parasita assinalada pela primeira vez no Atlantico sur. (Epicaridea, Bopyridae). Morfologia, desenvolvimento e distribuição geográfica. — Cien. Cult. São Paulo 33: 394-401, figs. 1-21, tab. 1.
- Van Name, W. G., 1920. Isopods collected by the American Museum Congo Expedition. — Bull. American Mus. Nat. Hist. 43: 41-108, figs. 1-126.
- Verrill, A. E., 1908. Decapod Crustacea of Bermuda; I. Brachyura and Anomura. Their distribution, variations, and habits. — Trans. Connecticut Acad. Arts. Sci. 13 (6): 299-474, text. figs. 1-68, pls. 9-28.
- Wass, M. L., 1972. A checklist of the biota of lower Chesapeake Bay. — Virginia Inst. Mar. Sci. Rept. 65: i-ix, 1-290.
- Westinga, E. & P. C. Hoetjies, 1981. The intrasponge fauna of *Spheciospongia vesparia* (Porifera, Demospongia) at Curaçao and Bonaire. — Mar. Biol. 62: 139-150, figs. 1-7, tabs. 1-4.
- Williams, A. B., 1965. Marine decapod crustaceans of the Carolinas. — Fish. Bull. 65 (1): i-xi, 1-298, figs. 1-252.
- Williams, A. B., 1984. Shrimps, lobsters, and crabs of the Atlantic coast of the eastern United States, Maine to Florida. Washington, D.C.: xviii + 550 pp., 380 figs. Washington.