ZOOLOGISCHE MEDEDELINGEN

UITGEGEVEN DOOR HET

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE TE LEIDEN

(MINISTERIE VAN CULTUUR, RECREATIE EN MAATSCHAPPELIJK WERK)

Deel 52 no. 9 17 november 1977

DESCRIPTION OF A NEW WESTERN ATLANTIC SPECIES OF *ARGEIA* DANA WITH A PROPOSED NEW SUBFAMILY FOR THIS AND RELATED GENERA (CRUSTACEA ISOPODA, BOPYRIDAE)

by

JOHN C. MARKHAM

Bermuda Biological Station for Research, Inc., St. George's West, 1-15, Bermuda

(With 2 text-figures)

INTRODUCTION

Recently, material representing an undescribed species of the genus *Argeia* Dana in the western Atlantic, the first record of that genus from this ocean, became available to me. The previous records of *Argeia* are of 4 species in the Pacific, including one whose range extends around the entire northern Pacific, and one from the Indian Ocean. Two of the species, though, represented systematic problems which it was necessary to resolve. At the same time, 4 other genera, *Parargeia* Hansen, *Bopyrosa* Nierstrasz & Brender à Brandis, *Stegoalpheon* Chopra and *Argeiopsis* Kensley, are clearly related to *Argeia,* but it has been difficult to assign any of them to currently recognized bopyrid subfamilies. Thus a new subfamily containing these 5 genera is proposed herein.

ACKNOWLEDGMENTS

Prof. Dr. L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie, Leiden (RMNHL), identified and provided to me the parasitized specimens of *Sclerocrangon jacqueti* which had been collected by the University of Miami's R/V "Columbus Iselin". He also arranged for me to borrow a further specimen of the same species which had been taken by the Michael Sars Expedition and was housed in the Zoological Museum of the University of Bergen, Norway (designated ZMBU), and he tried to locate the type-material of *Bopyrosa phryxiformis* for me. Further, he provided a list of the currently accepted names for all of the recorded host species. Dr. W. Lee of the California Academy of Sciences, San Francisco (CAS) allowed me to examine specimens in his collection assigned to *Argeia pauperata,* and Dr. F. G. Hochberg of the Santa Barbara Museum of Natural History, California (SBMNH) allowed me to examine specimens

from his collection and furnished collection data for them. Dr. T. E. Bowman of the National Museum of Natural History, Smithsonian Institution (USNM) provided information about material housed there and made helpful comments on the manuscript. Dr. R. W. Ingle of the British Museum (Natural History) located an obscure paper by Yü. This report was prepared under National Science Foundation Grant DEB 76-20102 administered through the Bermuda Biological Station for Research, Inc., of which this is scientific contribution number 717.

Subfamily ARGEIINAE nov.

Diagnosis. — Female: Body rounded, from triangular to nearly circular; distortion up to only 20°, either dextral or sinistral within species; all body regions and usually all segments distinct, none abruptly narrowing or extending out; head much broader than long, oval to fusiform (exclusive of rare frontal laminae), posteroventral border always with 2 or 3 points on each side, otherwise unornamented; maxilliped with articulated palp or at least tuft of setae indicating palp; pereopods generally reduced; brood pouch usually wide open; pleon of 6 pleomeres, first 5 bearing prominent lateral plates, pleomere 6 with uniramous uropods of essentially same size and shape as lateral plates; pleopods uniramous, usually 5 pairs, decreasing in size posteriorly and occasionally only first 3 or 4 pairs present, tuberculiform to shape of small oval flaps. Male: All body regions and pereomere distinct; head only about 1/10 of total body length, much shorter than broad, but markedly narrower than pereon; sides of pereon nearly parallel or diverging posteriorly; pleon fused, as broad anteriorly as final pereomere, semicircular to subtriangular, with no indication of lost segmentation; all pleonal appendages completely absent. Infestation: Branchial parasites of natantian shrimps of family Crangonidae and genera *Alpheus, Eualus* and *Stenopus*.

Discussion. — Up to now 8 subfamilies of the family Bopyridae have been described, but the 5 genera herein placed in the new subfamily Argeiinae could not be assigned satisfactorily to any of them. Shiino (1965) placed 4 of the genera in the "*Bopyrus*-group" of genera (= Bopyrinae), but they could have as justifiably been included in the Pseudioninae. The Argeiinae share characters with 4 of the other subfamilies. Thus the females' outlines (often nearly circular) are like those of the Orbioninae, but they lack the huge coxal plates, frontal laminae and biramous pleopods. Males of the Argeiinae strongly resemble those of the Orbioninae and Hemiarthrinae. The hosts of both the Argeiinae and the Hemiarthrinae are natantians, but in the latter infestation is nearly always abdominal, never branchial, and the females of the 2 subfamilies differ in virtually all systematic characters. In both sexes, mode of attachment and selection of hosts, the Argeiinae are closest to the Bopyrinae and probably represent a link in the evolution of

that subfamily from the more generalized Pseudioninae. Important distinctions between the Argeiinae and Bopyrinae are that in the females of the latter the head is never oval or fusiform and is frequently fused with the pereon, the body outline is oblong to deltoid, some or all of the pleomeres are often fused at least on 1 side, the lateral plates and uropods are greatly reduced or absent, and the pleopods, though not usually all present, are generally biramous. Among the males, those of the Bopyrinae have bodies broadest anteriorly and pleons usually of more than 1 pleomere or with coalesced pleomeres indicated marginally and often bearing tuberculiform pleopods. The Argeiinae are also close to the Pseudioninae. The hosts of the most generalized pseudionines, such as *Pseudione affinis* (Sars), are natantians, although the vast majority of pseudionines infests anomurans. The females of both the Argeiinae and Pseudioninae, especially the most primitive ones, are closely similar, but in the latter the brood pouch is fully enclosed, the lateral plates are reduced or absent, and the pleopods are usually biramous. Males of the Argeiinae closely resemble those of some of the most highly evolved pseudionine genera in having fused appendageless pleons, but most pseudionine males have numerous pleomeres or at least marginal indications of them, and they usually have pleopods and, in primitive genera, uropods. Pseudionine males differ from all argeiinines in being more or less fusiform to oblong, having relatively larger heads and never having the anterior pleonal margin as broad as the final pereomere.

In light of the morphology of both sexes and the selection of hosts, the subfamily Argeiinae may represent an evolutionary link between the most generalized subfamily, Pseudioninae, and the Bopyrinae. It would also be reasonable to regard it as a possible link from the Pseudioninae to the Orbioninae. This interpretation supports and somewhat refines the evolutionary sequence of the family Bopyridae proposed by Shiino (1965).

Key to species of subfamily Argeiinae, based on mature females

1. Coxal plates present on at least pereomeres 1 to 4, or those pereomeres divided laterally; pereopods reduced; body ovoid, ovate or subtriangular 2
— Coxal plates absent, no pereomeres prominently divided laterally; pereopods prominent; body nearly circular . . . . . *Argeiopsis inhacae*
2. Body longer than broad 4
— Body broader than long . . . . . *Stegoalpheon* 3
3. Pereonal dorsolateral bosses indistinct; pleopodal endopodites linear . . . *S. kempi*
— Dorsolateral bosses prominent; endopodites lamellar . . . . . *S. choprai*
4. Brood pouch open; lateral plates not extending farther to sides than width of pereon 5
— Brood pouch almost completely enclosed; lateral plates extending farther to sides than width of pereon . . . . . *Parargeia ornata*
5. Length of lateral plates and of uropods not exceeding width of first pleomere *Argeia* 6

— Length of at least final lateral plates and of uropods exceeding width of first pleomere . . . . . *Bopyrosa phryxiformis*
6. Oostegite 1 produced into posterolateral point 8
— Oostegite 1 rounded posterolaterally, not extended 7
7. Pereopodal bases produced into carinae . . . . . *A. pugettensis*
— Pereopodal bases not produced into carinae . . . . . *A. atlantica*
8. Oostegite 1 completely covering head ventrally; uropods lanceolate . . . *A. lowisi*
— Oostegite 1 only partly covering head ventrally; uropods ovate . . *A. nierstraszi*

Argeiopsis Kensley, 1974

Argeiopsis Kensley, 1974: 259 [Type-species, by original designation, *Argeiopsis inhacae* Kensley, 1974; gender feminine].

Generic diagnosis. — Female: Body outline nearly circular, body axis almost straight, all body regions and segments distinct; head fusiform, much broader than long; all pereopods extending prominently to sides, lacking coxal plates; oostegites only partly enclosing brood pouch; long falcate non-articulated lateral plates on pleomeres 1 to 5; pleopods uniramous, first two, especially on convex side, much larger than others and lanceolate, pleopods 3 to 5 tiny and linear. Male: Unknown.

Argeiopsis inhacae Kensley, 1974

Argeiopsis inhacae Kensley, 1974: 259-261, fig. 1 [Type-locality, Inhaca Island, Mozambique; infesting *Stenopus hispidus* (Olivier)].

Discussion. — *Argeiopsis inhacae* is the only bopyrid known to infest a species in the natantian section Stenopodidea. Its host, *Stenopus hispidus,* is very widespread, ranging from the Red Sea to the southern Pacific and throughout the Caribbean Sea (Chace, 1972), so *Argeiopsis inhacae* may really be much more widespread than the single record would indicate.

Stegoalpheon Chopra, 1923

Stegoalpheon Chopra, 1923: 462-464 [Type-species, by original designation, *Stegoalpheon kempi* Chopra, 1923; gender neuter].

Generic diagnosis. — Female: Ovate, about 3/4 as long as broad (exclusive of pleonal appendages), body axis moderately distorted (about 20°), all body regions and segments distinct; head with prominent frontal lamina, otherwise fusiform, much wider than long; pereopods small and closely pressed to body, first 4 with coxal plates; oostegites 1 produced into prominent posterolateral falcate points extending far to sides, oostegites surrounding brood pouch but leaving it wide open; pleon of 6 pleomeres, first 5 bearing large oblong lateral plates, those on convex side larger; pleopods uniramous, of 5 pairs of oblong exopodites much smaller than lateral plates; uropods uniramous, similar to lateral plates. Male: Head

much narrower than pereon; body broadest near posterior end of pereon; pleon about 1/5 as long as whole body, semicircular or triangular. Hosts: *Alpheus* spp.

Stegoalpheon kempi Chopra

Stegoalpheon kempi Chopra, 1923: 416, 420, 462, 464-467, text fig. 8, pl. 13 figs. 1-7 [Type-localities, Vizagapatam, India, and Andaman Islands, Bay of Bengal; infesting *Alpheus* prox. *crassimanus* Heller]; Shiino, 1951: 26-29, figs. 1, 2 [Tôsizima Island, Mie Prefecture, Japan; infesting *Alpheus rapax* (Fabricius)]; Pillai, 1954: 20; 1966: 188-190, figs. 12-20 [Kerala State, southern India; infesting *Alpheus* sp.]; Shiino, 1958: 61 [Osaka Bay, Japan; infesting *A. rapax*]; Rao & Ramaprasad, 1964: 588-589, figs. 1, 2 [Vellar estuary, India; infesting *Alpheus malabaricus* (Fabricius)]; Kannupandi, 1976: 87-93, figs. 1-3, tabs. 1-4 [Vellar estuary, India; infesting *A. malabaricus*].

Stegoalpheen [sic] *kempi*. — Rao & Ramaprasad, 1964: 589.

Stegoalpheon choprai Pillai, 1954

Stegoalpheon choprai Pillai, 1954: 20 [Type-locality, Travancore, India; infesting *Alpheus paludicola* Kemp]; Rao & Ramaprasad, 1964: 588.

Discussion. — Pillai (1954) described *S. choprai* in only 4 brief sentences, mainly by citing distinctions between it and *S. kempi*. In light of the known range of *S. kempi*, there remains some doubt whether *S. choprai* really is a distinct species.

Parargeia Hansen, 1897

Parargeia Hansen, 1897: 120 [Type-species, by original designation, *Parargeia ornata* Hansen, 1897; gender feminine].

Generic diagnosis. — Body (exclusive of lateral plates) subtriangular, broadest anteriorly, only slightly distorted; all body regions and segments distinct; head much wider than long; pereopods small, not extended, first four with coxal plates; oostegites almost completely enclosing brood pouch; pleon of 6 pleomeres; very long subrectangular lateral plates on sides of pleomere 1 to 5, extending far laterally; 5 pairs of uniramous oval pleopods, smaller on concave side; uniramous uropods of same size and structure as lateral plates. Male: Elongately trapezoidal, progressively broader posteriorly; all body regions distinct, though head-pereon junction somewhat obscure; head about twice as broad as long, convex posteriorly; distinct emarginations between pereomeres; pleon semicircular, straight at anterior edge, bearing middorsal tubercle anteriorly.

Parargeia ornata Hansen, 1897

"Bopyrid". — Faxon, 1895: 136.

Parargeia ornata Hansen, 1897: 120-122, pl. 6 fig. 1-1i [Type-locality, off Acapulco,

Mexico; infesting *Metacrangon procax* (Faxon)]; Richardson, 1899a: 869; Richardson, 1899b: 338; Bonnier, 1900: 48, 61, 222, 329-332, 381, fig. 56; Richardson, 1904a: 64; Richardson, 1905b: 551-553, fig. 598; Nierstrasz & Brender à Brandis, 1923: 89; Schultz, 1969: 324, fig. 518.
Parargeia. — Kensley, 1974: 261.

Discussion. — *Parargeia ornata* has not been collected since the type material was taken. Its type-locality, off the west coast of Mexico, seems to be rather poorly sampled, so it may be more common than the single record would indicate.

Argeia Dana, 1852

Argeia Dana, 1852: 803 [Type-species, by monotypy, *Argeia pugettensis* Dana, 1852; gender feminine].

Generic diagnosis. — Female: Body ovoid, about 3/4 as wide as long, only slightly distorted, all body regions and segments distinct; head subrectangular, wider than long; maxillipedal palp articulated or not, but always setose; posteroventral border of head with 2 or 3 short points on each side; pereomeres either bearing coxal plates or prominently divided laterally; oostegites surrounding but not covering brood pouch, first oostegite usually with large rounded posterolateral point; pleon of 6 pleomeres, first 5 produced into prominent oval to lanceolate lateral plates; pleopods all uniramous, exopodites often reduced to knobs on ventral surface, especially posteriorly; uropods uniramous, of same size and shape as lateral plates. Male: Body about 3 times as long as wide; head generally much narrower than pereon; pereomeres distinctly separated, all of nearly same width; pleon triangular, ending in broadly to sharply rounded point. Hosts: Family Crangonidae (except one species infesting *Alpheus* spp.).

Argeia pugettensis Dana, 1852

Argeia pugettensis Dana, 1852: 804-805, pl. 53 fig. 7a-d [Type-locality, Puget Sound, Washington; infesting *Metacrangon munitus* (Dana)]; Stimpson, 1857: 511 [Puget Sound; infesting *M. munitus*]; Cornalia & Panceri, 1861: 86, 116; Stebbing, 1893: 415; Calman, 1898: 281; Richardson, 1899a: 868; Richardson, 1899b: 336, 337; Bonnier, 1900: 48, 61, 171, 221, 327-328, fig. 55; Gerstaecker & Ortmann, 1901: 185; Richardson, 1904a: 45, 60-64, figs. 35-40 [Japan; infesting *Crangon propinquus* Stimpson]; Richardson, 1904c: 858; Richardson, 1905a: 220; Richardson, 1905b: 544-550, figs. 586-597 [From Bering Sea to San Diego Bay, California; infesting *Argis ovifer* (Richardson), *A. lar* (Owen), *A. alaskensis* (Kingsley), *A. crassa* (Rathbun), *A. dentata* (Rathbun), *Crangon nigromaculata* Lockington, *C. franciscorum angustimanus* Rathbun, *C. dalli* Rathbun, *C. communis* Rathbun, *C. propinquus* Stimpson, *C. alaskensis* Lockington, *C. alaskensis elongata* Rathbun, *C. alba* Holmes, *Metacrangon munita* (Dana)]; Richardson, 1909: 122 [Japan and Korea; infesting *Argis* sp.]; Chopra, 1923: 476, 477, 478, 480; Nierstrasz & Brender à Brandis, 1923: 87; Nierstrasz & Brender à Brandis, 1926: 16 [La Jolla, California; infesting *Crangon* sp.]; Fee, 1926: 40 [Departure Bay, British Columbia; infesting *Crangon stylirostris*

Holmes, *Metacrangon munitus* (Dana)]; Fraser, 1932: 64; Hiraiwa, 1933: 53; Shiino, 1933: 277-279, fig. 11 [Probably Tanabe Bay; host unknown]; Gurjanova, 1936a: 219-221, fig. 138 [Kamchatka Peninsula and Bering Sea; infesting *Crangon* spp. and *Argis* spp.]; Gurjanova, 1936b: 258; Shiino, 1937a: 299 [Asamusi, Japan; infesting *Crangon affinis* de Haan]; Ricketts & Calvin, 1939: 185, 281; Baer, 1946: 65; Hatch, 1947: 164, 224, pl. 9 figs. 110-112; Ricketts & Calvin, 1948: 185, 320; Baer, 1951: 69-70; Ricketts & Calvin, 1952: 239, 438; Shiino, 1952: 34; Menzies & Miller, 1954: 141, 153, fig. 65c, d; Shiino, 1958: 56, pl. 3 fig. 8 [Several localities, Japan; infesting *Crangon affinis* de Haan, *Argis lar* (Owen), *Crangon sagamiensis* Balss]; Oguro, 1961: 43-47, figs. 1-3, 5-7 [Akkeshi Bay, Japan; infesting *Crangon affinis* de Haan]; Sindermann & Rosenfield, 1967: 351; George & Strömberg, 1968: 253 [San Juan Archipelago, Washington; infesting *Crangon alaskensis* Lockington, *C. communis* Rathbun, *C. franciscorum* Stimpson, *Metacrangon munita* (Dana), *Mesocrangon munitella* (Walker), *Argis dentata* (Rathbun), *Eualus suckleyi* (Stimpson)]; Ricketts & Calvin, 1968: 286, 488; Schultz, 1969: 323-324, figs. 516, 517; Sindermann, 1970: 171; Kozloff, 1974: 148; Miller, 1975: 285, 287, 305, pl. 64 fig. 18.

Argeia pauperata Stimpson, 1857: 511 [Type-locality, San Francisco Bay, California; infesting *Crangon franciscorum* Stimpson]; Stebbing, 1893: 415; Calman, 1898: 281; Bonnier, 1900: 61, 171, 221, 328, 381; Gerstaecker & Ortmann, 1901: 185, 266; Richardson, 1905b: 551; Chopra, 1923: 476-478; Nierstrasz & Brender à Brandis, 1923: 87; Schultz, 1969: 323; Strömberg, 1971: 28; Miller, 1975: 287, 305.

?*Bopyrus* sp. — Bate, 1888: 485 [Iyo Sea, Japan; infesting *Crangon affinis* de Haan].

Argeia sp. — Calman, 1898: 261, 281 [Puget Sound, Washington; infesting *C. affinis*].

Argeia depauperata [sic]. — Richardson, 1899a: 868; Richardson, 1899b: 336, 337; Richardson, 1900: 308.

Argeia (?) [spp.]. — Bonnier, 1900: 221.

Argeia Calmani Bonnier, 1900: 171, 221, 329, 381 [Nomen nudum; type-locality, Puget Sound, Washington; infesting *Crangon affinis* de Haan].

?*Argeia Pingi* Yü, 1935: 52-53 [Type-localities, Hopei and Shantung Provinces, China; infesting *Crangon cassiope* de Man].

Argaeia [sic] *pugettensis*. — MacGinitie & MacGinitie, 1949: 266 [Unspecified locality, west coast of United States; infesting *Crangon alaskensis elongata* Rathbun]; MacGinitie & MacGinitie, 1968: 265-266.

Material examined.

Infesting *Crangon alaskensis* Lockington, L. B. Holthuis, coll. and det. of host. San Juan Islands, Washington, July 1952: 1♀, 1♂, RMNHL.

Infesting *C. edentata* (Rathbun), L. B. Holthuis, coll. and det. of host. San Juan Islands, Washington, July 1952: 1♀, 1♂, RMNHL.

Infesting *C. resima* Rathbun, L. B. Holthuis, coll. and det. of host. San Juan Islands, Washington, July 1952: 1♀, 1♂, RMNHL.

Infesting *C. franciscorum* Stimpson, San Juan Islands, Washington, L. B. Holthuis, coll. and det. of host, July 1952: 1♀, 1♂, RMNHL. San Francisco Bay, California, M. E. Gibson, coll. and det. of hosts, January 1972: 3♀, 3♂, CAS.

Infesting *C. alaskensis elongata* Rathbun, hosts det. by M. K. Wicksten, all specimens collected by ship "Searcher". Sta. 188, 2 miles southwest of Point Delgrado, Humboldt County, California, 46 m, 6 August 1971: 4♀, 3♂, SBMNH. Sta. 190, 2 miles south of Shelter Cove, Humboldt County, California, 27 m, 7 August 1971: 3♀, 3♂, SBMNH. Sta. 191, 3 miles south of Shelter Cove, Humboldt County, California, 31 m, 7 August 1971: 1♀, 1♂, SBMNH. Sta. 195, 4.5 miles north of Fort Bragg, Mendocino County, California, 73 m, 7 August 1971: 2♀, 2♂, SBMNH. Sta. 196, 6 miles north of Fort Bragg, Mendocino County, California, 55 m, 7 August 1971: 2♀, 2♂, SBMNH.

Discussion. — Richardson (1905b) described *Argeia pugettensis,* including juvenile and aberrant forms, in exhaustive detail and presented a large series of illustrations, so further description here is unnecessary. The type-specimen of *A. pauperata* seems to be lost (if, indeed, it was ever accessioned), but the published description of the female (the only sex known), although excessively brief, places *A. pauperata* within the morphological range of the quite variable species *A. pugettensis.* I have examined specimens identified as *A. pauperata* collected at the type-locality, San Francisco Bay (which is well within the known range of *A. pugettensis*) and infesting *Crangon franciscorum,* the host species of the type female. I am satisfied that *Argeia pauperata* is assignable to *A. pugettensis.*

The record of Bate (1888) of "*Bopyrus*" probably refers to this species since it is from a known host species within its known range. Unfortunately, Bate failed to characterize his specimen in any way, and I have been unable to find it.

The material described by Yü (1935) as *Argeia Pingi* may belong to *A. pugettensis* but since it is from a different host species and a different (although likely) locality than known for *A. pugettensis,* its identity remains questionable. It is also possible that if Yü did not have a distinct species, his material belonged to *A. nierstraszi* Shiino, mentioned below. The type-material of *A. Pingi* is unspecified and probably completely untraceable, even if extant. The description is such as to indicate that it does indeed refer to a species of *Argeia* but without distinguishing it from any other species of that genus. The text of Yü's (1935) paper, in full, is "The species has a wide distribution along the coasts of Hopei and Shantung. A large number of specimens were collected from various localities. Through careful investigation they were found to be of one and the same species which has not been described by former specialists. Its specific characters are briefly described given as follows. *Argeia Pingi* sp. nov. Female — head not fused with first thoracic segment; abdominal segments more or less distinct; thoracic processes not totally absent; posterior lobe of first postegite [sic] absent; pleural lamellae on abdominal segments absent; pleopod biramous, inner armi [sic] in form of broad lamellae like outer; uropod always present as a pair of large lamellae. Male — abdominal segments fused completely, never furnished with appendages."

Of the 5 host species from which I examined material of *Argeia pugettensis,* three have previously been recorded as hosts for this parasite. The other two, *Crangon edentata* and *C. resima,* however, have not been reported as hosts for any bopyrid until now.

Argeia atlantica new species (figs 1-2)

"Bopyrid Isopod". — Sivertsen & Holthuis, 1956: 40.

Material examined.

Infesting *Sclerocrangon jacqueti* (A. Milne Edwards), hosts det. by L. B. Holthuis. R/V "Columbus Iselin" Sta. CI-54, Tongue of the Ocean, Bahamas, 23°54'N 77°12'W, 1298-1335 m, 26 February 1973, 10-foot Isaacs-Kidd midwater trawl: 1 ♀, holotype, USNM 150716; 1 ♂, allotype, USNM 150717. R/V "Columbus Iselin" Sta. CI-111, Tongue of the Ocean, Bahamas, 23°37.9'N 77°14.7'W, 1342 m, 22 September 1973, 41-foot otter trawl: 1 ♀, 1 ♂, paratypes, RMNHL I 5495. "Michael Sars" Expedition Sta. 70, south-east of Newfoundland, 42°59'N 51°15'W, 1100 m, 30 June 1910: 1 ♀, 1 ♂, ZMBU 40881.

Description of holotype female (figs. 1, 2A-F). Length 7.4 mm, maximal width 5.7 mm, head length 1.2 mm, pleonal length 2.6 mm. Distortion 16°, dextrally. Body outline ovate, nowhere narrowing abruptly. All body regions and segments distinct (fig. 1).

Head trapezoidal, broader than long, indistinctly bilobate, deeply embedded in pereon. Antennae greatly reduced, inconspicuous. Maxilliped (fig. 2A) smoothly rounded at both ends, bearing small setose 1-articled palp (fig. 2B). Posteroventral border of head (fig. 2C) with 2 small pointed projections on each side, margin entire medially.

Pereon broadest across pereomere 3. Coxal plates on first 3 pereomeres; small rounded depressions near anterolateral margins of pereomeres 2 to 4 dorsally. Oostegite 1 (fig. 2D) truncate posteriorly, with non-ornamented internal ridge; oostegites 2 to 5 covering only perimeter of brood pouch, all with setae on medial margins. Pereopods (fig. 2D) reduced, all of essentially same shape and structure, with propodi extending far beyond carpal insertions.

Pleon (fig. 2F) of 6 distinct pleomeres progressively smaller posteriorly. Pleomeres 1 to 5 V-shaped, each with pair of indistinctly separated oblong lateral plates, those on concave side all slightly larger than opposites. Pleomeres 1 to 4 with club-like pleopodal exopodites progressively smaller posteriorly, no endopodites. Slight middorsal ridge along pleomeres 2 to 4. Small midventral tubercles on pleomeres 4 and 5. Pleomere 6 with uniramous uropods identical to lateral plates.

Description of allotype male (fig. 2G-K). — Length 3.2 mm, maximal width 1.1 mm, head length 0.3 mm, pleonal length 0.8 mm. Body sides subparallel, except head markedly narrower than pereon; all body regions distinct (fig. 2G, H).

Head suboval, much wider than long, convex dorsoposteromedially. No eyes. Antennae (fig. 2I) prominent, of 3 and 5 segments respectively, most segments with setae distally.

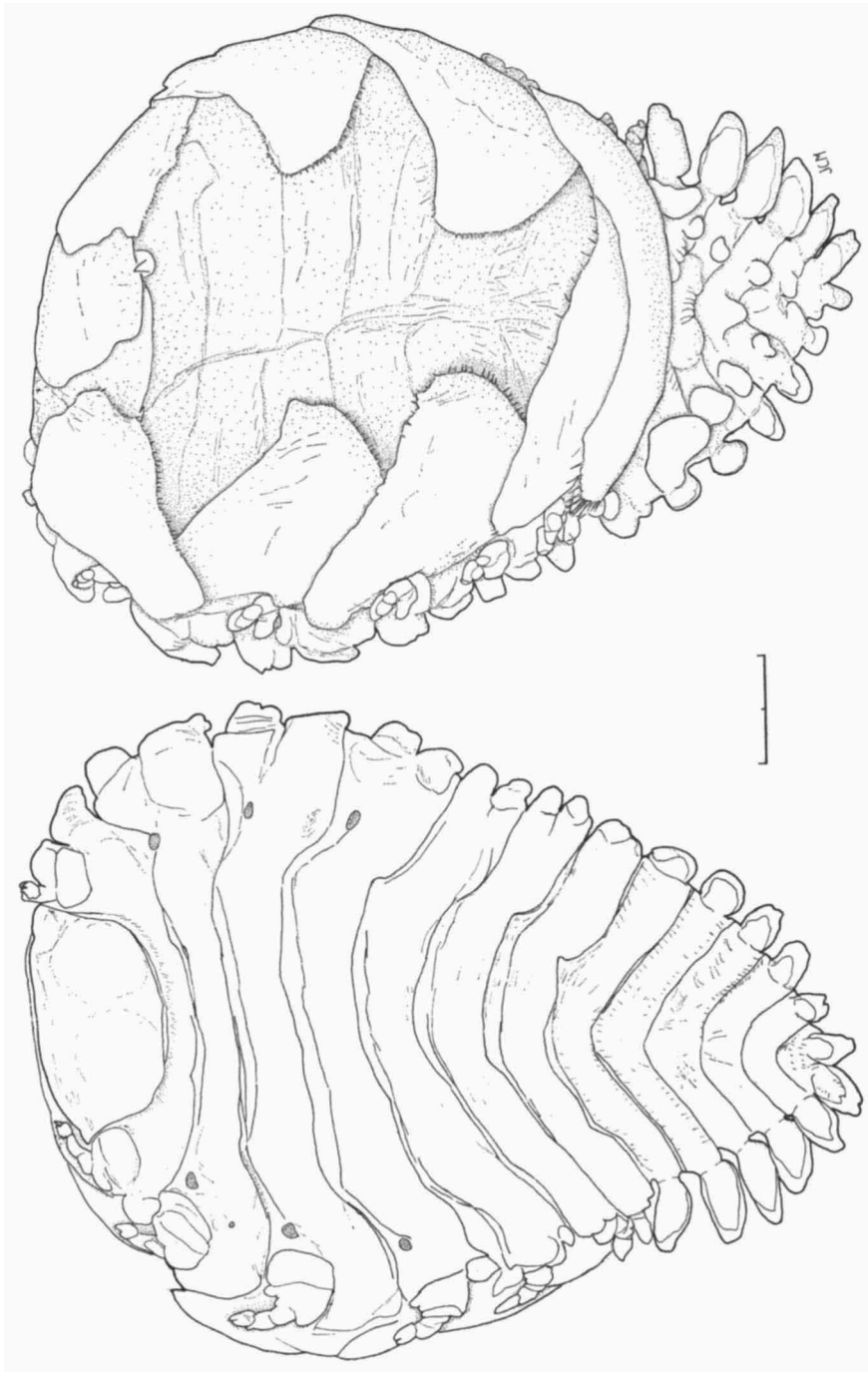

Fig. 1. *Argeia atlantica*, n. sp., holotype female. Dorsal and ventral views. 1.0 mm indicated.

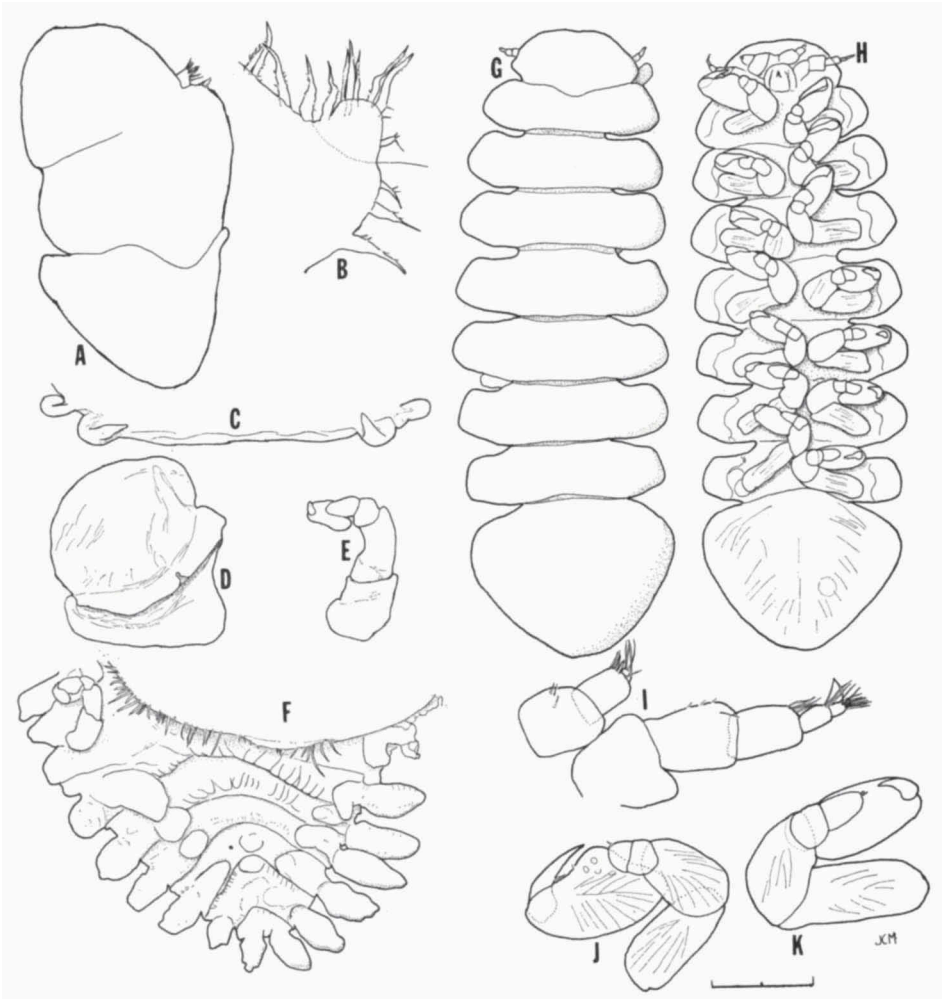

Fig. 2. *Argeia atlantica,* n. sp. A-F, holotype female; G-K, allotype male. A, right maxilliped; B, palp of right maxilliped; C, posteroventral border of head; D, right oostegite 1; E, right pereopod 7; F, pleon, ventral view; G, dorsal view; H, ventral view; I, right antennae; J, right pereopod 1; K, left pereopod 6. 1.0 mm indicated for D, E; 0.5 mm for A, C, F-H; 0.2 mm for I-K; 0.1 mm for B.

Pereomeres all distinctly separated. Pereopods (fig. 2J, K) all of nearly same size, but dactyli and propodi progressively smaller and bases progressively longer posteriorly.

Pleon unsegmented, swollen, of triangular outline; anteroventral region extending over final pereomere. No trace of appendages.

Discussion. — The paratypes agree in all significant respects, including

dimensions, with the holotype and allotype. The female, which is dextral, has a distortion of 20°. The specimens from the "Michael Sars" collection have dimensions only about 2/3 as large as the other specimens of their respective sexes. The female, which is sinistrally distorted, differs from the other females in having a relatively larger swollen head, no dorsal depressions on any pereomeres, the brood pouch somewhat more enclosed by the oostegites and the lateral plates relatively larger; all of these differences are probably attributable to its smaller size and thus lesser maturity. The male from the "Michael Sars" collection does not differ notably from the others.

Argeia atlantica is most similar to *A. pugettensis*. The female of *A. atlantica* differs in lacking posterolateral projections on the convex margins of the pereomeres (although they are occasionally absent in *A. pugettensis* as well, according to Richardson, 1905b), in having no carinae on the pereopodal bases, relatively smaller and less distinctly set-off lateral plates and uropods and slightly less developed pleopods. The male of *A. atlantica* contrasts with that of *A. pugettensis* in having a relatively broader body, the second antenna of 5 segments rather than 4 and the pleon relatively broader, shorter and less pointed.

Argeia lowisi Chopra, 1923

Argeia lowisi Chopra, 1923: 416, 418, 477-480, text-figs. 11, 12, pl. 15 figs. 1-5 [Type-locality, Andaman Islands, Bay of Bengal; infesting *Alpheus* prox. *euphrosyne* de Man]; Shiino, 1958: 56-59, fig. 15 [Sumoto, Awaji Island, Osaka Bay, Japan; infesting *A. rapax* Fabricius or *A. brevirostris* (Olivier)]; Kensley, 1974: 261.

non *Argeia lowisi*. — Nierstrasz & Brender à Brandis, 1929: 16 [Jolo, Indonesia; infesting *Alpheus* sp.] [= *Argeia nierstraszi* Shiino].

Argeia nierstraszi Shiino, 1958

Argeia nierstraszi Shiino, 1958: 59-61 [Type-locality, Mie Prefecture, Japan; infesting *Alpheus bisincisus* de Haan]; Kensley, 1974: 261.

Argeia lowisi. — Nierstrasz & Brender à Brandis, 1929: 16 [Jolo, Indonesia; infesting *Alpheus* sp.] [non *Argeia lowisi* Chopra, 1923].

?*Argeia Pingi* Yü, 1935: 52-53 [Type-localities, Hopei and Shantung Provinces, China; infesting *Crangon cassiope* de Man].

Discussion. — As mentioned above in the discussion of *A. pugettensis*, the placement of *A. Pingi* Yü and its status as a separate species are quite uncertain. Its description (quoted above) sounds slightly more like that of *A. nierstraszi* in that its pleopodal rami (more correctly its pleopodal exopodites and lateral plates) are said to be alike, in contrast to those of *A. pugettensis*. On the other hand, its host selection implies more strongly identity with *A. pugettensis*. Its locality would be an expectable extension of the range of either of these 2 species.

Bopyrosa Nierstrasz & Brender à Brandis, 1923

Bopyrosa Nierstrasz & Brender à Brandis, 1923: 102-103 [Type-species, by monotypy, *Bopyrosa phryxiformis* Nierstrasz & Brender à Brandis, 1923; gender feminine].

Generic diagnosis. — Female: Body outline subovate, distortion slight (about 15°), all body regions distinct; first 3 pereomeres fused medially; coxal plates on pereomeres 1 to 4; pereopods reduced; oostegites surrounding but only peripherally covering brood pouch; pleon of 6 pleomeres, first 5 produced into lanceolate nonarticulating lateral plates becoming very long posteriorly; 5 pairs of uniramous pleopods reduced to tiny flaps on bases of lateral plates; uropods uniramous, similar to lateral plates but longer than any of them. Male: Unknown.

Bopyrosa phryxiformis Nierstrasz & Brender à Brandis, 1923

Bopyrosa phryxiformis Nierstrasz & Brender à Brandis, 1923: 102, fig. 26 [Type-locality, Pearl Bank, Sulu Archipelago, Philippines; host unknown].

Discussion. — Regrettably, far too little is known about this species and hence its genus to be certain of its placement. Neither the host nor male is known, and the single known female, which is evidently not fully mature, was described and illustrated altogether too briefly. Finally, the type seems to be lost, so it was not available for reexamination. Although Nierstrasz & Brender à Brandis in their several papers generally did not state where most of their types were deposited, the type of *Bopyrosa phryxiformis* was collected by the Siboga Expedition and so should be expected to be in the Zoologisch Museum, Amsterdam, where most of the Siboga material is. There is, however, no record that it was ever there, and a search of the collection on my behalf by Dr. S. Pinkster failed to produce it. Prof. Dr. L. B. Holthuis (personal communication) reports that Nierstrasz's personal collection was turned over to the Rijksmuseum van Natuurlijke Historie, Leiden, but that *B. phryxiformis* is not there either. Those characters which can be determined from the published account indicate that *Bopyrosa* belongs in the subfamily Argeiinae, and on that basis I am so assigning it.

Appendix

List of host species of subfamily Argeiinae

Host species	Parasite species
Section Caridea	
Family Alpheidae	
Alpheus bisincisus De Haan	*Argeia nierstraszi* Shiino
A. brevirostris (Olivier)	*A. lowisi* Chopra
A. prox. *crassimanus* Heller	*Stegoalpheon kempi* Chopra
A. prox. *euphrosyne* de Man	*Argeia lowisi* Chopra

A. malabaricus (Fabricius)	*Stegoalpheon kempi* Chopra
A. paludicola Kemp	*S. choprai* Pillai
A. rapax Fabricius	*S. kempi* Chopra; *Argeia lowisi* Chopra
Alpheus sp.	*S. kempi* Chopra
Alpheus sp.	*A. lowisi* Chopra
Alpheus sp.	*A. nierstraszi* Shiino
Family Hippolytidae	
Eualus suckleyi (Stimpson)	*Argeia pugettensis* Dana
Family Crangonidae	
Argis alaskensis (Kingsley)	*A. pugettensis* Dana
A. crassa (Rathbun)	*A. pugettensis* Dana
A. dentata (Rathbun)	*A. pugettensis* Dana
A. lar (Owen)	*A. pugettensis* Dana
A. ovifer (Richardson)	*A. pugettensis* Dana
Argis sp.	*A. pugettensis* Dana
Crangon affinis de Haan	*A. pugettensis* Dana
C. alaskensis Lockington	*A. pugettensis* Dana
C. alaskensis elongata Rathbun	*A. pugettensis* Dana
C. alba Holmes	*A. pugettensis* Dana
C. cassiope de Man	*A. pugettensis* Dana?; *A. nierstraszi* Shiino?
C. communis Rathbun	*A. pugettensis* Dana
C. dalli Rathbun	*A. pugettensis* Dana
C. edentata (Rathbun)	*A. pugettensis* Dana
C. franciscorum Stimpson	*A. pugettensis* Dana
C. franciscorum angustimanus Rathbun	*A. pugettensis* Dana
C. nigricauda Stimpson	*A. pugettensis* Dana
C. nigromaculata Lockington	*A. pugettensis* Dana
C. propinqua Stimpson	*A. pugettensis* Dana
C. resima Rathbun	*A. pugettensis* Dana
C. sagamiensis Balss	*A. pugettensis* Dana
C. stylirostris Holmes	*A. pugettensis* Dana
Crangon sp.	*A. pugettensis* Dana
Mesocrangon munitella (Walker)	*A. pugettensis* Dana
Metacrangon munita (Dana)	*A. pugettensis* Dana
M. procax (Faxon)	*Parargeia ornata* Hansen
Sclerocrangon jacqueti (A. Milne Edwards)	*Argeia atlantica* n. sp.
Section Stenopodidea	
Family Stenopodidae	
Stenopus hispidus (Olivier)	*Argeiopsis inhacae* Kensley
Unidentified hosts	
Unidentified species 1	*Argeia pugettensis* Dana
Unidentified species 2	*Bopyrosa phryxiformis* Nierstrasz & Brender à Brandis

References

Baer, J. G., 1946. Le parasitisme: 1-231. (Rouge et Cie., Paris).

——, 1951. Ecology of animal parasites: i-x, 1-224. (Univ. Illinois Press, Urbana Illinois).

Bate, C. S., 1888. Report on the Crustacea Macrura dredged by H.M.S. Challenger during the years 1873-1876. — Rep. sci. Res. Voy. Challenger, Zool., 24: i-xc, 1-942.

BONNIER, J., 1900. Contribution à l'étude des épicarides. Les Bopyridae. — Trav. Stat. Zool. Wimereux, 8: 1-476.

CALMAN, W. T., 1898. On a collection of Crustacea from Puget Sound (Puget Sound Zoology, Columbia University Contributions no. 9). — Ann. New York Acad. Sci., 11: 259-292.

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 Contrib. Zool., 98: i-x, 1-179.

CHOPRA, B., 1923. Bopyrid isopods parasitic on Indian Decapoda Macrura. — Recs. Indian Mus., 25: 411-550.

CORNALIA, E. & P. PANCERI, 1861. Osservazioni zoologiche ed anatomiche sopra un nuovo genere di Isopodo sedentari (Gyge branchialis). — Mem. R. Accad. Sci., Fis. Mat., Torino, (2) 19: 85-118.

DANA, J. D., 1852. Crustacea. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842..., 13 (2): 691-1018.

FEE, A. R., 1926. The Isopoda of Departure Bay and vicinity, with descriptions of new species, variations and colour notes. — Contr. Canadian Biol. Toronto, (n. ser.) 3 (2): 13-46.

FRASER, C. M., 1932. A comparison of the marine fauna of the Namaimo region with that of the San Juan Archipelago. — Trans. Roy. Soc. Canada, (3) 26 (5): 49-70.

GEORGE, R. Y. & J.-O. STRÖMBERG, 1968. Some new species and new records of marine isopods from San Juan Archipelago, Washington, U.S.A. — Crustaceana, 14: 225-254.

GERSTAECKER, A. & A. E. ORTMANN, 1901. Crustacea, Malacostraca. In: H. G. BRONN (ed.), Klassen und Ordnungen des Thier-Reichs, 5 (1) (2) 1-24: i-viii, 1-688.

GURJANOVA, E. F., 1936a. Isopodes des mers orientales. Crustacées Vol. VII, No. 3. — Faune de l' URSS. (n. ser.) 6: i-xii, 1-278.

——, 1936b. Beiträge zur Kenntnis der Isopodenfauna des Pazifischen Ozeans. IV. Neue Isopodenarten aus dem Japanischen und Beringmeer. — Zool. Anz., 114: 250-265.

HANSEN, H. J., 1897. Reports on the dredging operations off the west coast of Central America ... by the U.S. Fish Commission Steamer "Albatross" during 1891 ... XXII. The Isopoda. — Bull. Mus. Compar. Zool., Harvard Univ., 31: 96-129.

HATCH, M. H., 1947. The Chelifera and Isopoda of Washington and adjacent regions. — Univ. Washington Publs. Biol., 10: 155-274.

HIRAIWA, Y. K., 1933. Studies on a bopyrid, Epipenaeon japonica Thielemann. I. Morphological studies in both sexes. — Journ. Sci. Hiroshima Univ., (Zool.) 2: 49-70.

KANNUPANDI, T., 1976. A study on the cuticle of Stegoalpheon kempi Chopra (Isopoda: Crustacea) in relation to its parasitic mode of life. — Journ. Exptl. Mar. Biol. Ecol., 25: 87-94.

KENSLEY, B., 1974. Bopyrid Isopoda from southern Africa. — Crustaceana, 26: 259-266.

KOZLOFF, E. N., 1974. Keys to the marine invertebrates of Puget Sound, the San Juan Archipelago, and adjacent regions: i-x, 1-226. (University of Washington Press: Seattle, Washington).

MACGINITIE, G. E. & N. MACGINITIE, 1949. Natural history of marine animals: i-xii, 1-473. (McGraw-Hill, New York).

——, 1968. Natural history of marine animals, (ed. 2): i-xii, 1-523. (McGraw-Hill, New York).

MENZIES, R. J. & M. A. MILLER, 1954. Key to Chelifera and the suborders of the Isopoda. In: S. F. LIGHT, Intertidal invertebrates of the central California Coast, i-xiv, 1-446. (Univ. California Press, Berkeley).

MILLER, M. A., 1975. Phylum Arthropoda: Crustacea, Tanaidacea and Isopoda. In: R. I. SMITH & J. T. CARLTON (eds.), Light's manual. Intertidal invertebrates of the central California coast: i-xvii, 1-716. (Univ. California Press, Berkeley).

NIERSTRASZ, H. F. & G. A. BRENDER À BRANDIS, 1923. Die Isopoden der Siboga-Expedition. II. Isopoda Genuina. I. Epicaridea. Siboga- Expeditie Monogr., 32b: 57-121.

——, 1929. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16. XLVIII. Epicaridea I. Vidensk. Medd. Dansk naturh. Foren., 87: 1-44.

OGURO, C., 1961. On the neurosecretory system of two parasitic isopods, Argeia pugettensis Dana and Athelges japonicus Shiino. Annot. zool. japon., 34: 43-48.

PILLAI, N. K., 1954. A preliminary note on the Tanaidacea and Isopoda of Travancore. Bull. Centr. Res. Inst. Univ. Travancore, 3C: 1-21.

——, 1966. Isopod parasites of south Indian crustaceans. Crustaceana, 10: 183-191.

RAO, K. S. P. B. & T. N. C. RAMAPRASAD, 1964. A note on Stegoalpheon kempi Chopra. Current Sci., 33: 588-589.

RICHARDSON, H., 1899a. Key to the isopods of the Pacific coast of North America, with descriptions of twenty-two new species. Proc. United States Natl. Mus., 21: 815-869.

——, 1899b. Key to the isopods of the Pacific coast of North America, with descriptions of twenty-two new species. Ann. Mag. nat. Hist., (7) 4: 157-187, 260-277, 321-338.

——, 1900. Synopses of North American invertebrates. VIII. The Isopoda. Part II. Asellota, Oniscoidea, Epicaridea. Amer. Natural., 34: 295-309.

——, 1904a. Contributions to the natural history of the Isopoda. — Proc. United States Natl. Mus., 27: 1-89.

——, 1904b. A reply to certain criticisms of Prof. Alfred Giard respecting the bopyrids. — Compt. Rend. Soc. Biol., 56: 856-858.

——, 1905a. Isopods from the Alaska salmon investigation. — Bull. U.S. Bur. Fish., 24: 209-221.

——, 1905b. A monograph on the isopods of North America. — Bull. United States Natl. Mus., 54: i-liii, 1-727.

——, 1909. Isopods collected in the northwest Pacific by the U.S. Bureau of Fisheries Steamer "Albatross" in 1906. — Proc. United States Natl. Mus., 37: 75-129.

RICKETTS, E. F. & J. CALVIN, 1939. Between Pacific tides: i-xxii, 1-320. (Stanford University Press, Stanford, California).

——, 1948. Between Pacific tides, (ed. 2): i-xxvii, 1-365. (Stanford Univ. Press, Stanford, California).

——, 1952. Between Pacific tides, (ed. 3): i-xii, 1-501. (Stanford Univ. Press, Stanford California).

——, 1968. Between Pacific tides, (ed. 4): i-xiv, 1-614. (Stanford Univ. Press, Stanford, California).

SCHULTZ, G. A., 1969. How to know the marine isopod crustaceans: i-vii, 1-359. (Wm. C. Brown, Dubuque, Iowa).

SHIINO, S. M., 1933. Bopyrids from Tanabe Bay. — Mem. College Sci., Kyoto Imper. Univ., (B) 8: 249-300.

——, 1937. Some additions to the bopyrid fauna of Japan. — Annot. zool. japon., 16: 293-300.

——, 1951. Some bopyrid parasites found on the decapod crustaceans from the waters along Mie Prefecture. — Rept. Fac. Fish., Pref. Univ. Mie, 1: 26-40.

——, 1952. Phylogeny of the family Bopyridae. — Ann. Rept. Univ. Mie, (sect. 2, Nat. Sci.) 1: 33-56.

——, 1958. Note on the bopyrid fauna of Japan. — Rept. Fish., Mie Univ., 3: 27-73.

——, 1965. Phylogeny of the genera within the family Bopyridae. — Bull. Mus. Nat. Hist. Natl. Paris, (2) 37: 462-465.

SINDERMANN, C. J. & A. ROSENFIELD, 1967. Principal diseases of commercially important marine bivalve Mollusca and Crustacea. — United States Dept. Interior Fish. Wildl. Wildl. Serv. Bur. Comm. Fish. Bull., 66: 335-385.

SIVERTSEN, E. & L. B. HOLTHUIS, 1956. Crustacea Decapoda (The Penaeidea and Stenopodidea excepted). — Rept. Sci. Res. "Michael Sars" North Atlantic Deep-Sea Exped. 1910, 5 (12): 1-56.

STEBBING, T. R. R., 1893. A history of Crustacea: Recent Malacostraca: i-xvii, 1-466. (Kegan Paul, Trench, Trübner, London).

STIMPSON, W., 1857. On the Crustacea and Echinodermata of the Pacific shores of North America. I. — Boston Journ. Nat. Hist., 6: 444-532.

STRÖMBERG, J.-O. 1971. Contribution to the embryology of bopyrid isopods with special reference to Bopyroides, Hemiarthrus and Pseudione (Isopoda, Epicaridea). — Sarsia, 47: 1-46.

YÜ, S. C., 1935. Notes on a bopyrid isopod parasitic on Crago crago cassiope de Man. — Sci. Conf. Nanning, Kwangsi Prov., Aug. 11-15, 1935, Abstr. of Paps.: 52-53.