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A SYSTEMATIC STUDY OF PARASITIC BOPYRID ISOPODS IN THE WEST INDIAN FAUNAL REGION

BY

John C. Markham

A DISSERTATION

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Doctor of Philosophy

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A dissertation submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

Subject

A systematic study of parasitic
bopyrid isopods in the West Indian faunal region

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INTRODUCTION

The isopod fauna of the West Indian region has been largely neglected despite rather intensive studies of other crustacean groups, such as decapods and copepods, in the region. This neglect has been especially marked in the case of the epicaridean isopods, all of which are parasitic on other crustaceans. Although many of these isopods have been collected in the area in recent years, most of the specimens have lain unstudied in museums. It is possible that carcinologists considered such animals to be the proper concern of parasitologists and vice versa, so no one gave them adequate attention.

This study deals with the systematics of the largest and least modified epicaridean family, the Bopyridae. The original intention was to describe and illustrate all of the bopyrids from the West Indian faunal region and to study the biology of some of them. This project seemed to be of reasonable scope in light of the number of species which published accounts indicated probably would be found there. It was not until I had gone fairly deeply into the study that it became evident that there was a tremendous amount of basic systematic work to be done, because most of the species encountered were undescribed. Thus I restricted the study to the description of species found and eventually had to limit that project as well. Because of the complex problems involved, I have excluded detailed consideration of the genus *Pseudione*, which probably contains at least 20 species in the area, and the subfamily Bopyrinae, which is comprised of 6 to 10 species here. Effective studies of these 2 taxonomic units would require examination of numerous specimens from several places in the world and possibly complex rearing experiments, the techniques for which are not yet worked out. It is to be hoped, however, that this report will lay the groundwork for future studies of the Bopyridae of the region and indicate the true scope of the size and distribution of the family there. Further, throughout this study, I have tried to relate the local bopyrid fauna to that of the rest of the world.

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This research was made possible only through the cooperation and assitance of many people, some of whom I have never met personally. First of all, I wish to express my sincerest thanks to the members of my dissertation committee, especially Drs. Lowell P. Thomas and Patsy A. McLaughlin, for much helpful advice and guidance throughout, and, perhaps as importantly, for letting me proceed unhindered when no help was needed. Numerous people, fellow students, faculty and staff, at the Rosenstiel School of Marine and Atmospheric Science of the University of Miami, provided and often identified parasitized decapods which they had collected. Among them are Lawrence Abele, Thomas Biffar, Julio García-Gómez, Robert Gore, Edward Hatfield, Gary Hendrix, Christian Hoberg, Edwin Iversen, Barbara Mayo, Patsy McLaughlin, Fay Mucha, Raoul Rehrer, Durbin Tabb and Anton Teytaud. Curators who freely made material in their museum collections available to me are Drs. Thomas Bowman and Fenner Chace, Jr. of the National Museum of Natural History, Smithsonian Institution, Willard Hartman of the Peabody Museum of Natural History, Yale University, Herbert Levi of the Museum of Comparative Zoology, Harvard University, Linda Pequegnat of Texas A. and M. University, S. Pinkster of the Zoologisch Museum, Amsterdam, and Torben Wolff of Universitetets Zoologiske Museum, Copenhagen. Mr. Richard Heard provided much material which he had collected in the Carolinas, Georgia, Florida and Mississippi, Dr. Austin Williams allowed me to examine specimens he had collected off the coast of North Carolina, Mr. Wesley Rouse made available his collections from the Everglades, and Dr. Kenneth Smith provided material from the Sargasso Sea. Dr. Lipke Holthuis identified and provided to me many of the deep-water host decapods collected during cruises of of the University of Miami's ships R/V John Elliott Pillsbury, R/V Gerda and R/V Columbus Iselin and made numerous helpful suggestions on my manuscripts. The staff of the library of the Rosenstiel School of Marine and Atmospheric Science, particularly Rose Beck, Kathryn Eberhard and Irma Thornhill, provided invaluable aid in procuring interlibrary loans. Furnishing reprints of their own publications on the Bopyridae and numerous helpful comments were Drs. R. Bourdon of Roscoff, France, Thomas Bowman of Washington, D. C., A. J. Bruce of Mombassa, Kenya, Charles Danforth of Glendale, California, Richard Pike of Wellington, New Zealand, and Sueo Shiino of Shima, Japan. During the course of this study, I was financially supported by a Robert E. Maytag Fellowship and a teaching assistantship, while funds necessary for travel came from the Bissett-Berman Corporation and the Office of Academic Programs of the Smithsonian Institution.

GENERAL BIOLOGY OF BOPYRID ISOPODS

The most important aspect of the biology of the Bopyridae is that all members of the family are parasitic on decapod crustaceans as adults, and probably all are parasitic on copepods during most of their larval development. The requirements of a parasitic mode of life are imprinted upon all other facets of the lives of these animals. First, their distribution is dependent upon the presence of suitable hosts. Second, their entire lives must be coordinated with those of their hosts in that the larvae must be released when the host copepods are available; also, they must find their definitive hosts when the latter are suitable for infestation, and even their molting cycles must be coordinated with those of their hosts. Finally, these animals are morphologically specialized for a parasitic existence. Sexual dimorphism is extreme. The males resemble free-living isopods, while the females, which may be several times their size, are modified to varying degrees. Characters of the females clearly related to a parasitic existence are a completely noncalcified exoskeleton, a curved longitudinal body axis (possibly in response to the confines imposed by the host's body shape), partial to complete loss of eyes, mouths adapted for piercing and sucking, a tremendously enlarged brood pouch which occasionally encloses most of the body, and greatly reduced pereopods sometimes adequate for clinging but never for locomotion.

The life history of bopyrids, at least so far as it has been studied, is quite simple but still rather remarkable. As in all peracaridans, the eggs develop into free-swimming larvae within a ventral brood pouch or marsupium formed of lamellar outgrowths of the female's pereopodal coxae called oostegites. All of the larvae of a single brood mature synchronously and are released simultaneously when they have reached the stage known as the microniscan larva (also called epicaridium, microniscus or microniscid). The microniscan attaches externally to a calanoid copepod, on which it undergoes 6 molts and becomes a cryptoniscan (also called cryptoniscus and cryptoniscid). Dropping off its copepod host, it seeks out a decapod as a definitive host. Though the start of infestation only rarely has been observed (Pike, 1954), it is probable that it always occurs when the host is in the earliest post-larval stage. Indirect evidences for this assumption are that some decapods are known to harbor bopyrids only when small and that where a considerable range in the size of the infested hosts is observed, there is an excellent correlation with the sizes of their parasites. Classical studies by Reinhard (1949) and Reverberi (1947a) have shown that sex in the Bopyridae is epigamically determined, the cryptoniscan which arrives first becoming a female and the second, by neoteny, a male. This bopyrid life history is succinctly summarized by Baer (1951).

A pheromonal system may operate to attract a potential male to a female, but such has not been established. It is, however, rather rare for a female to be found unaccompanied by a male. In the studies cited above, it was shown that the female, probably by hormonal control, suppresses the development of the next-arriving larva, causing it to develop into a functional male, but not allowing it to undergo the further morphological and physiological changes by which it would become female. This sort of sex determination is probably comparable to that exhibited by cymothoid isopods (Teissier, 1960).

Pike (1960) observed the development of some British bopyrids and concluded that they lived on their definitive hosts approximately 9 months, during which they produced 3 or 4 broods of larvae. It is probable that the male fertilzes the eggs of each brood separately.

With the possible exception of the aberrant Entophilus omnitectus Richardson, found under the middorsal region of its host's carapace, all members of the Bopyridae are undisputed ectoparasites. Most of them occupy the gill chambers of their hosts, using the hosts' branchiostegites to hold them in place; others attach to the abdomens of their hosts, although it is possible that most or even all of these, too, start out as temporary branchial parasites (Pike, 1960). The distribution of types of infestation is correlated with the marked morphological differences discussed below.

The effects of the parasites on their hosts are variable. The most obvious result of infestation is the slight to great swelling of the host's branchiostegite. Despite the appearance of this swelling, it is doubtful whether the physical presence of the parasite seriously harms the host. Personal observations indicate that it causes a reduction in the host's respiratory efficiency, which generally becomes significant only if the host is subjected to lowered oxygen levels, as in a poorly aerated aquarium. Those bopyrids which attach to the ventral parts of their hosts' abdomens interfere with the attachment of eggs to the pleopods, but they probably cause little direct harm to the hosts. Several studies dealing with parasitic castration by bopyrids (e. g. Giard, 1887a, b, 1888a, b, Baffoni, 1947) have shown that it is partial to complete, at least in certain cases. Other studies (e. G. Holthuis, 1952b, Mistakidis, 1957, Reverberi, 1947b) show sex reversals or incomplete development of copulatory appendages of the hosts, though some of the host species involved normally undergo protandry, which parasitism may partly disrupt. Pike (1954, 1960) reports that hosts which have outlived their parasites resume normal reproductive capabilities, so the parasites' effect could be considered temporary parasitic sterilization. Bruce (1968) records abdominal parasites on hosts which were bearing normal eggs. Examples of all of these conditions have turned up in the present material. There appears to be no interference with molting or other metabolic functions of the hosts, and it is possible that suppression of reproduction results from diversion of energy stores to the parasite rather than from hormonal control or other chemical means. Reinhard (1956) has summarized these effects, as reported by several authors, and has compared them with the effects of rhizocephalan barnacles, which are more damaging to the same species of hosts.

The evolutionary history of the Bopyridae has been the subject of some speculation. Since they are not calcified, the bopyrids have left no direct fossil record (Bachmayer, 1948) but morphological characters and circumstantial evidence have shed some light on their past. Giard and Bonnier (1887a) presented the first indication of a possible phylogeny, based on larvae alone. Considering the morphology of the adults of both sexes, Nierstrasz (1931) pointed out the probable lines which evolution has taken among the epicarideans, starting with the bopyrids, which are the least specialized. Shiino (1952, 1965, 1966), dealing with the Bopyridae alone, pointed out that the genus Pseudione, on the basis of its generalized morphology, variability and wide host selection, represents the ancestral form from which all other bopyrids are monophyletically derivable; except for its modified mouth parts, Pseudione is also quite similar to a typical cymothoidean and so provides a link between the epicarideans and other isopods. Using a different approach, one can apply Fahrenholz's rule for ectoparasitism as propounded by Eichler (1949): the ancestors of extant parasites infested the ancestors of their hosts. Numerous galatheid species are among the several different hosts of living Pseudione spp. Similarly, Glaessner (1969) notes that the branchial carapace swellings indicative of bopyrid infestations are more common among fossil galatheids, dating back to the Jurassic, than among other fossil species. Among living galatheids, species of Munida alone bear representatives of at least 12 bopyrid genera, including Pseudione and close relatives. Thus one may consider the bopyrids to illustrate well the rules of Eichler (1949), who has stated, in paraphrase, that the longer a group of hosts has been infested, the more diverse are its parasites.

MORPHOLOGICAL TERMS USED IN DESCRIBING BOPYRID ISOPODS

Morphological terms are still less standardized than desirable for isopods in general, and the Bopyridae is no exception. Over many years, a considerable body of literature dealing with the Bopyridae has been written in many different languages. Many authors were primarily specialists in other groups who freely applied terms from decapods, for example, to isopods. Some writers have tried to establish their own conventions without regard to what was already in use, and occasionally an author has used a single term in more than one sense. In some cases, an appropriate term was not available in English, but a good term existed in French, etc. The accompanying labeled views of a hypothetical female and male (Fig. 1) present the terminology used in this report. Although there is not always one word preferable to all others for a given structure, I have tried to select those which at least some authorities have used previously and to avoid any terms against which there are valid arguments. I have followed the reasoning used by Wolff (1956) for tanaidacean body regions in selecting the terms "pereon" and "pleon." In the following glossary, a few definitions are modified from those of Moore and McCormick (1969). One must remember that these definitions are intended to apply specifically to bopyrid isopods, so several of them are different from the definitions the same terms would have if applied to crustaceans in general.

Anal cone: Tapered projection beyond body surface, extending dorsally in females, ventrally to posteriorly in males, bearing anus.

Antennae: Anterior paired appendages of head, both uniramous in adults,

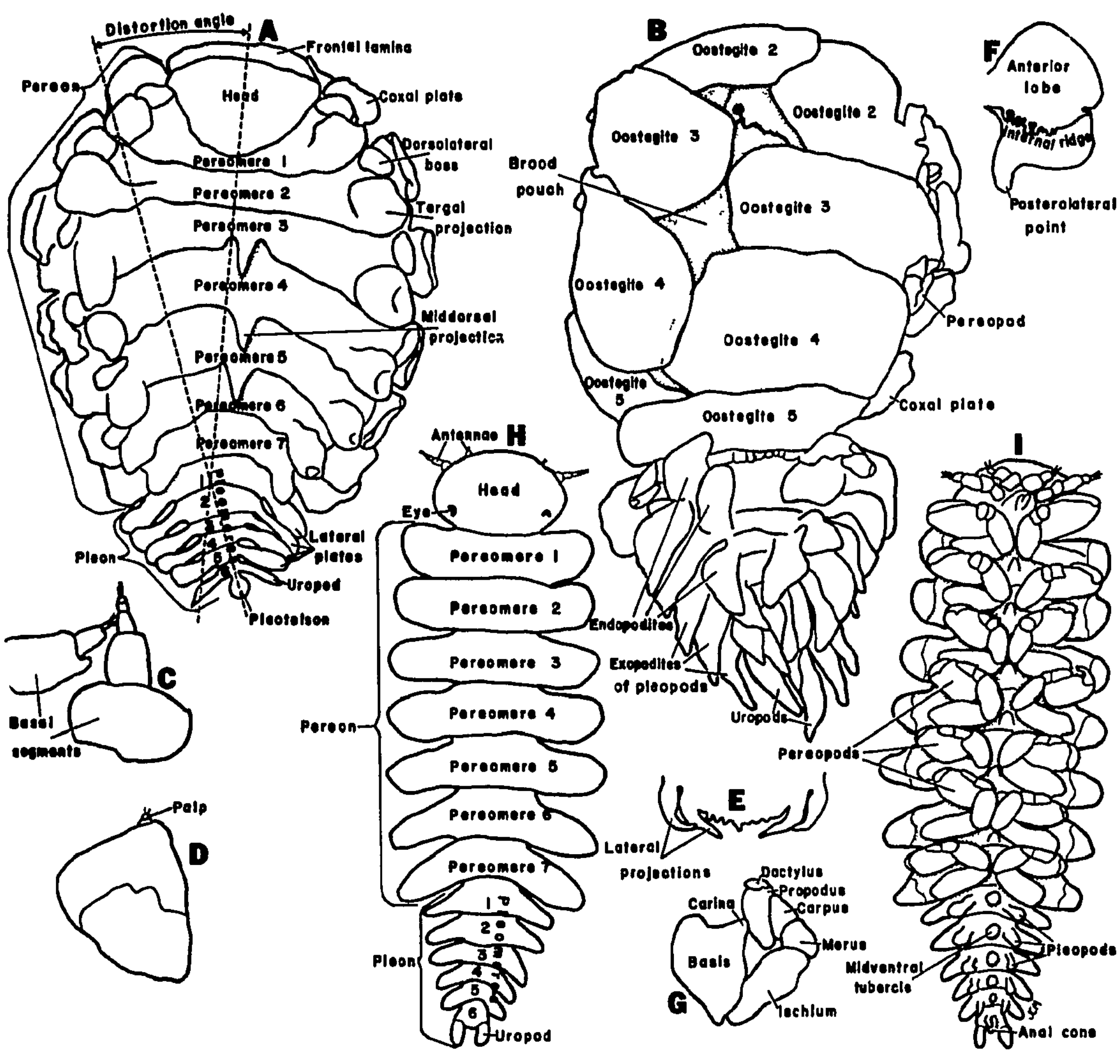

Fig. 1. Composite bopyrid isopods illustrating morphological characters. A-G: Female. H-I: Male. A. Dorsal. B. Ventral. C. Antennae. D. Maxilliped. E. Posteroventral border of head. F. Oostegite 1, internal. G. Pereopod. H. Dorsal. I. Ventral.

first reduced and usually of 3 segments, second larger and usually of 5 segments.

Brood pouch: Ventral region of pereon more or less enclosed by oostegites and containing eggs and developing larvae. Synonym, marsupium.

Coxal plate: Lateral expansion of pereopodal coxa covering lateral edge of pereomere partly or completely.

Cryptoniscan: Final larval stage, one infesting definitive decapod host and developing into mature adult.

Dextral: With body axis distorted so right side longer; among branchially infesting bopyrids, dextral females found in right branchial chambers of hosts.

Distortion: Angle formed by intersection of lines drawn along longitudinal axes of head and pleon of female.

Dorsolateral boss: Rounded knoblike process on anterolateral dorsal surface of pereomere.

Endopodite: Inner (or ventral) ramus of pleopod.

Exopodite: Outer (or dorsal) ramus of pleopod.

Eye: More or less circular sessile dark pigment spot or colorless depression on dorsal surface of head.

Frontal lamina: Flaplike outgrowth of head extending anteriorly and sometimes anterolaterally from head.

Head: Most anterior body region, unsegmented and bearing eyes, mouth, antennae and maxillipeds. [In isopods as well as other peracaridans, it is comprised of the protomalacostracan head plus the first thoracic segment.] Synonym, cephalon.

Lateral plate: Lateral extension of pleomere, often closely resembling pleopodal ramus.

Maxilliped: Paired mouth appendage, usually covering ventral surface of head in females, reduced to tiny flap in males.

Maxilliped palp: Anteromedial projection of maxilliped, often distinctly articulated.

Microniscan: Earliest larva, form released from female's brood pouch.

Middorsal boss: Rounded to pointed process arising from central dorsal region of pereomere.

Midventral tubercle: Conical projection arising from midventral region of pereomere and occasionally from pleomere or anterior region of pleon.

Oostegite: Medially directed lamella arising from pereopodal coxa of female, enclosing brood pouch ventrally.

Pereomere: One of 7 somites or segments of pereon.

Pereon: Middle body region divided into 7 pereomeres (first one often fused with head), each originally bearing pair of isomorphic grasping or locomotory pereopods and, in female, bearing brood pouch ventrally.

Pereopod: Appendage of pereomere, originally of 7 pairs, though 1 or more often missing in females of Hemiarthrinae; primitively of 7 segments, some of which occasionally lost by fusion.

Pleomere: Somite or segment of pleon, primitively 6 in number, often several lost by fusion.

Pleon: Most posterior body region, consisting of up to 6 pleomeres (often fused into single piece in males) generally bearing paired pleopods and uropods. Synonym, abdomen.

Pleopod: Paired appendage of one of first 5 pleomeres, flaplike and reduced to elongate and digitate, occasionally modified for respiration.

Pleotelson: Structure formed by fusion of 1 or more pleomeres with telson, that portion of final pleomere extending beyond bases of uropods.

Sinistral: Opposite in all respects of dextral, q. v.

Tergal projection: Pointed process on posterodorsal surface of pereomere.

Uropod: Paired appendage of terminal pleomere, often similar to pleopodal rami.

HISTORICAL RÉSUMÉ OF FAMILY BOPYRIDAE

The first record of a bopyrid isopod is apparently that of Deslandes (1724), who noted a parasite infesting a shrimp in France and considered it to be the larva of a sole. The next record was that of Fougeroux de Bondaroy (1772), who identified the parasite more accurately as an "insecte" and presented an acceptible description and drawings, which André (1940) reproduced for their historical interest. This same species was finally named Monoculus crangorum by Fabricius (1798) and subsequently made the type-species of Bopyrus by Latreille (1802), who considered the specific name inappropriate because it was based on the wrong host name and so changed it to squillarum. Montagu (1808) followed this with the description of Oniscus thoracicus (soon made the type-species of Ione Latreille) infesting Cancer subterraneus (now Callianassa subterranea) in England. The next species described were two from Nice, which Risso (1816) designated Bopyrus palaemonis and Ergyne cervicornis.

The first bopyrid reported from outside Europe was Kepon typus, which Duvernoy (1841) described from Mauritius. Rathke (1843) described the first parasites found on the abdomens of decapods, both of which he assigned to his new genus Phryxus, namely P. abdominalis and P. paguri. Agassiz (1848) soon reported this generic name to be preoccupied, but it has persisted in the literature nearly up to the present. [See Markham (1972a) for a discussion of the history of this name.] The next species described was the first known from North America, Argeia pugettensis, which Dana (1852) found in Puget Sound. Shortly thereafter, Leidy (1856) described Cepon distortus, a parasite of a fiddler crab, Gelasimus (now

Uca) pugilator in New Jersey. [The name Cepon is a misspelling of Kepon evidently attributable to Agassiz (1846); this spelling confusion has persisted not only in this name but also in several generic names derived from it, such as Dactylokepon and Cancricepon.] Stimpson (1857) soon described the second Puget Sound bopyrid, Phyllodurus abdominalis.

The first attempt at revising the systematics of the Bopyridae appeared when Cornalia and Panceri (1861) described Gyge branchialis from Venice, created the new genus Leidya with Cepon distortus as type-species and reviewed the 10 species (including one now assigned to a different family) known to them. The same year, Hesse (1861) established the genus Athelges for the hermit-crab-infesting parasite A. cladophorus. Müller (1871) recorded the first bopyrid from South America, Bopyrus resupinatus (now the type-species of Anathelges) and proposed a systematic scheme for the family. During the next several years, there appeared numerous publications on the biology and systematics of bopyrids, mostly in Europe, such as those by Kossmann (1881a, b, c), Giard and Bonnier (1887b, 1888a, 1890) and Sars (1898), culminating in the magnificent monograph by Bonnier (1900).

Subsequent works on the Bopyridae have been more reduced in scope, covering either the fauna of a specified region or dealing with the collections of a single expedition. Among these are the papers which laid the basis of the study in the region covered by this report. The first of Richardson's several carefully written papers dealing with bopyrids, especially of North America, was published in 1899 and her last in 1912. Most notable was her monograph on the isopods of North America (Richardson, 1905). Pearse wrote several papers including accounts of bopyrids from this region, but his work was much less careful, often suffering from misidentifications, inadequate descriptions and poor drawings. Several of his type specimens were improperly preserved, so many of his species remain unidentifiable. Nierstrasz and Brender à Brandis (1925, 1929, 1931) described many of the species of this region; their work was accurate, but often their descriptions were excessively brief. Schultz (1969) has recently published a semipopular update of Richardson's monograph, including coverage of the Bopyridae.

Elsewhere, Chopra (1923, 1930) did the first work on the Bopyridae of India, while Nierstrasz and Brender à Brandis (1923) made the first major contribution to knowledge of the family in the western Pacific to be followed by the excellent studies of Shiino from 1933 to the present. Modern European work has been done by Codreanu and Bourdon; the most valuable contribution of the latter is a monograph of much of the family in Europe (Bourdon, 1968). At several other scattered places there are currently a few authors putting out short reports, some of the highest quality, mostly consisting of descriptions of a few new species at a time.

By my count, the family Bopyridae at present consists of 119 genera, some of which are surely invalid, containing approximately 400 described species. This is a vast change from the situation of a century ago, when fewer than a dozen species were known, and those were considered rare curiosities. Because the number of undescribed species in the West Indian faunal region was much larger than expected, and because there are other tropical regions of the world even less well known faunistically, the total number of species of bopyrids may actually be up to twice that now known.

MATERIAL AND METHODS

The material examined in this study came from 3 main sources. Most shallow-water and intertidal material was collected by the author and other graduate students and research personnel at the University of Miami's Rosenstiel School of Marine and Atmospheric Science. The bulk of the deep-water species came from the collecting cruises of the University of Miami's ships R/V Gerda and R/V John Elliott Pillsbury. Several specimens were in the collection of the National Museum of Natural History, Smithsonian Institution. Other museums, ships' collections and individuals provided numerous small lots.

Drawings were made with camera lucida attachments on a Wild M-5 dissecting microscope and a Wild M-20 compound microscope at magnifications of 6X to 400X. Measurements were made directly with a calibrated ocular micrometer of indirectly by scaling off drawings of known magnification; all lengths and widths are recorded exclusive of oostegites and uropods.

The West Indian faunal region, for purposes of this report, is considered to be that part of the western Atlantic Ocean extending from the eastern border of French Guiana along the South and Central American coasts to the northeastern tip of the Yucatán Peninsula, through the Florida Keys and along the east coast of Florida to about Cape Canaveral, taking in the Bahamas, West Indies and Lesser Antilles, and, because of the warming and transporting effects of the Gulf Stream, including Bermuda. When a species found within this area also occurs beyond its limits, I have included all of the records; I have also discussed those parasites known only from outside the West Indian region when their hosts are known to occur within it. Thus most of the bopyrids recorded from as far north as North Carolina are also included.

The species considered in detail are all the local members of the subfamilies Hemiarthrinae, Athelginae and Ioninae as well as most of the Pseudioninae. Due to the numbers of species involved, the pressure of time and the complexities of systematic problems, the genus Pseudione and the whole subfamily Bopyrinae, which are well represented in this area, are not dealt with in detail.

The material examined was in or has been assigned to several museum collections, indicated thus: AHF, Allan Hancock Foundation, University of Southern California; MCZ, Museum of Comparative Zoology, Harvard University; RMNHL, Rijksmuseum van Natuurlijke Historie, Leiden; UMML, Rosenstiel School of Marine and Atmospheric Science, University of Miami; UNCIFR, Institute of Fisheries Research, University of North Carolina; USNM, National Museum of Natural History, Smithsonian Institution; YPM, Peabody Museum of Natural History, Yale University; ZMA, Zoologisch Museum, Amsterdam; and ZMC, Universitetets Zoologiske Museum, Copenhagen.

CLASSIFICATION OF FAMILY BOPYRIDAE

As mentioned above, the first recorded bopyrid was considered an insect, when that term included the present Insecta and most groups of small crustaceans. As modern concepts of the classification of the Crustacea evolved, especially through the 19th century, the bopyrids were always grouped as relatives of the free-living Isopoda. Though I have been unable to trace the familial name Bopyridae, Dr. Lipke B. Holthuis (personal communication) has informed me that it comes from the term "Bopyria" employed by Rafinesque (1815), and that the first use of the proper familial form "Bopyridae" was that by White (1847). Stebbing (1910) gave a synonymy for the family name and listed Dana (1852) as the first to use it, though this is clearly erroneous. At one time, the family included all isopods parasitic on crustaceans, but it since has been split up so that now it contains only those externally infesting decapods. The others belong in various other families of the isopod suborder Epicaridea (also occasionally designated Bopyroidea). One early division was into families Bopyriens and Ioniens by Milne Edwards (1840), corrected to Bopyridae and Ionidae by White (1847). Bate and Westwood (1868) pointed out that this was untenable and recombined these two. Giard and Bonnier (1887b) created some confusion by redividing the family Bopyridae into subfamilies Bopyrinae and Ioninae and then speaking of families Bopyriens, Ioniens and Phryxiens. Sars (1898) recognized 4 epicaridean families, Dajidae, Cryptoniscidae, Entoniscidae and Bopyridae. Bonnier (1900) established 2 "ensembles" (tribes?), Cryptoniscinae, containing 8 families, and Bopyrinae, containing Dajidae, Phryxidae, Bopyridae and Entoniscidae. Nierstrasz and Brender à Brandis (1931) recognized various "groups" within the Bopyridae but did not give them formal rank. Caullery (1950) divided the Epicaridea into 5 families, the same 4 used by Sars plus Phryxidae, and subdivided the Bopyridae into subfamilies Bopyrinae and Ioninae, while Codreanu and Codreanu (1956) subdivided the Phryxidae into Phryxinae and Athelginae, the former corresponding to the Phrixinae of Caroli (1949). Shiino (1952, 1965) first presented and then refined a clear picture of the organization of the genera in the Bopyridae, but instead of using subfamilial names, he designated 6 generic groups. Codreanu (1967) finally assembled all the records of subfamilial designations and erected some new subfamilies in the Bopyridae, which he interpreted in the same broad sense as Shiino (1952, 1965) had, and as it is handled here. He also recognized 9 other families in the Epicaridea. Bourdon (1968) separated the Phryxidae and Bopyridae and then treated generic groups in the latter family. Although the point is still arguable, I feel that only 1 family is warranted because all members of it can be distinguished from members of all other epicaridean families in having similar life histories, being equally modified for parasitic life and infesting the same phylogenetic groups of hosts in comparable manners. Thus I have used the classification drawn up by Codreanu (1967) except for replacing Phryxinae with Hemiarthrinae (Markham, 1972a). The complete classification of the Bopyridae, with the higher categories as presented by Moore and McCormick (1969) and the lower ones following Codreanu (1967) is as follows:

Phylum Arthropoda

Superclass (or class) Crustacea

Class (or subclass) Malacostraca

Subclass (or series) Eumalacostraca

Superorder Peracarida

Order Isopoda

Suborder Epicaridea (or Bopyroidea)

Family Bopyridae

Subfamily Pseudioninae

Subfamily Ioninae

Subfamily Entophilinae

Subfamily Bopyrinae

Subfamily Orbioninae

Subfamily Athelginae

Subfamily Bopyrophryxinae

Subfamily Hemiarthrinae

FAMILY BOPYRIDAE RAFINESQUE, 1815

Characters of family (modified after Sars, 1898, and Richardson, 1905).-- Female: Distinctly segmented, slightly to greatly asymmetrical, flattened dorsally. Head occasionally fused with first pereomere, sometimes enclosed by frontal lamina; antennae rudimentary; eyes, if present, small irregular dorsal pigment spots; maxilliped of 2 segments, often with anteromedial palp, which may be articulated; posteroventral border of head usually with 1 or 2 lateral projections on each side. Pereon generally with all 7 pereomeres distinct; pereopods reduced, generally of 7 pairs, though up to 6 occasionally absent from 1 side; pereopods prehensile, dorsal to lateral, isomorphic; 5 pairs of oostegites (tiny rudiments of sixth and seventh in Pleurocryptella) loosely fringing to completely concealing ventral surface, first oostegite of 2 distinct segments divided by external groove and internal ridge, at least posterior segment covered by second oostegite. Pleon of 3 to 6 pleomeres; sides of pleomeres often produced into lateral plates resembling pleopodal rami; pleopods usually present on all but last pleomere, though some posterior pairs occasionally absent; pleopods rudimentary or modified for respiration, uniramous or biramous, isomorphic; uropods, when present, terminal, uniramous or biramous, often of same form as pleopods. Male: Much smaller than female, at least twice as long as wide, symmetrical, distinctly segmented. Head rounded anteriorly, occasionally fused with first pereomere; antennae often prominent; eyes as in female. Pereon of 7 distinct pereomeres; pair of ventral prehensile pereopods on each pereomere, generally isomorphic except first and sometimes second occasionally conspicuously larger than others. Pleon of 1 to 6 pleomeres; if unisegmented, lacking appendages; if multisegmented, often with unisegmented uniramous pleopods or paired tubercles on each pleomere but last; uropods, if present, uniramous, terminal. Ectoparasitic on decapod crustaceans.

Key to subfamilies of family Bopyridae, based on mature females.

1. Brood pouch not extending much beyond sides of pereon, enclosed to varying degrees by 5 pairs of loosely overlapping stiff oostegites, none greatly larger than others; pleopods and lateral plates, when present, not pedunculate; infesting hosts thoracically only......2.

-- Brood pouch large flaccid sac extending slightly to far beyond 1 or both sides of pereon, tightly enclosed by flexible oostegites, usually fewer than 5 pairs well developed, often 1 much larger than others; pleopods and, when present, lateral plates set off from pleomeres by peduncles; infesting hosts at least partly abdominally...6.

2. Coxal plates well developed on all 7 pereomeres; lateral plates reflexed over ventral surfaces of pleomeres and largely concealing pleopods ventrally; infesting hosts under carapace....Entophilinae.

-- Coxal plates well developed on 4 or fewer pereomeres, sometimes completely absent; lateral plates not concealing pleomeres ventrally; infesting hosts branchially.....................................3.

3. Brood pouch open, entire ventral surface of pereon exposed; pleomeres often fused to varying degrees; infesting carideans......Bopyrinae.

-- Brood pouch closed or, occasionally when full of eggs, slightly open; pleomeres always distinctly separated..........................4.

4. Lateral plates and pleopodal rami always present, elongate with tuberculate to digitate margins; at least first lateral plates direc-

ted forward; usually infesting brachyurans................Ioninae.

-- Lateral plates sometimes absent, at most ovate; pleopodal rami ovate to lanceolate; both with smooth margins; no lateral plates directed forward..5.

5. Body somewhat elongate; coxal plates little developed; frontal lamina not extending to sides; usually infesting anomurans...Pseudioninae.

-- Body oval; coxal plates greatly developed; frontal lamina extending far to sides; infesting penaeids.......................Orbioninae.

6. Body often nearly symmetrical; brood pouch formed by oostegites on both sides of body, extending equally to both sides of pereon; infesting paguroids dorsoabdominally.....................Athelginae.

-- Body highly asymmetrical; brood pouch formed by oostegites on 1 side of body only, extending far to that side........................7.

7. Brood pouch far from pleon; all pereomeres distinct; all pereopods present on both sides; infesting paguroids simultaneously branchially and abdominally.............................Bopyrophryxinae.

-- Brood pouch in contact with pleon; pereomeres often variously fused; often 1 or more pereopods absent on long side of body; infesting carideans, usually ventroabdominally................Hemiarthrinae.

SUBFAMILY PSEUDIONINAE R. CODREANU, 1967

Type-genus, Pseudione Kossmann, 1881

Diagnosis (adapted from Codreanu, 1967).-- Female: Of rather primitive structure, all body segments separate; frontal lamina, coxal plates and tergal projections usually moderately developed; oostegites completely enclosing brood pouch; some or all of pleopods biramous; uropods usually present, either uniramous or biramous. Male: Head separated from pereon or lateral indententations indicating former separation; all pereomeres distinct, often with midventral tubercles; pleon of 1 to 6 pleomeres, some often with midventral tubercles; if multisegmented, pleon usually bearing tuberculiform to flaplike pleopods on all but final pleomere; uropods present only in most primitive genera. Branchial parasites of anomurans and rarely of carideans and brachyurans.

Remarks.-- There are currently 33 genera described in the Pseudioninae containing a total of 129 recognized species, more than 1/3 of which (47) belong to Pseudione. The 33 genera include all of those listed by Shiino (1965) plus 8 others; 6 of the others have been described since then, and 2 were listed in the Bopyrinae by Shiino. In the present report, I have considered 15 genera containing 18 species. Two of these species were already known before this research began, a third I am raising from subspecific to specific rank, and the other 15 species were unknown, 3 of them belonging to genera also described as new. This brings the total number of pseudionine genera to 36 and species to 147. I have not dealt with the genus Pseudione in detail; 3 species of Pseudione have been recorded from this area and a fourth, known from both north and south of it, is to be expected here. There are also approximately 20 other undescribed species of Pseudione in this area, mostly parasites of the galatheids Munida spp. and Munidopsis spp., which I have examined but have not had the opportunity to describe. The genus Pseudione is badly in need of world-wide revision; until such time as this can be done, I am reluctant to deal with the local species other than noting their presence.

The great majority pseudionines infest anomurans, especially galatheids, pagurids and porcellanids, but representatives of many other families as well. One genus which provides exceptions to this host selection is Gigantione, all species of which infest brachyurans, especially xanthids. This host selection as well as certain distinctive morphological characters may implicate Gigantione as a link between Pseudioninae and Ioninae. Another exeption to the infestation of anomurans is Pseudione affinis Sars, which is known from several species of the caridean family Pandalidae in European waters.

The geographical distribution of the Pseudioninae appears to be fairly uniform worldwide, insofar as collections have been made. Most genera which are not monotypic are very widespread. Of the 15 genera herein recorded from the West Indian region, the 3 new genera are monotypic, but the other 12 genera are otherwise represented in widely diverse localities. One of them, Anuropodione, is elsewhere known only from western Africa, but all of the others have been recorded from the western Pacific, and several also have species in Europe. This pattern is probably the result of speciation in the Tethyan pantropical ocean, and the fact that it is most striking in this subfamily is probably correlated with its primitiveness. As the bopyrids evolved into more specialized subfamilies, I believe they became more restricted geographically.

Key to 15 genera of Pseudioninae in West Indian faunal region, based on mature females.

1\. Pleon of 5 pleomeres.................................Balanopleon.

-- Pleon of 6 pleomeres..2.

2\. Uropods absent....................................Anuropodione.

-- Uropods present, either uniramous or biramous.....................3.

3\. Maxilliped palp of 2 distinctly articulated segments...............4.

-- Maxilliped palp of only 1 distinct segment, or fused with maxilliped or absent..5.

4\. Seven pairs of oostegites, last 2 pairs rudimentary..Pleurocryptella.

-- Five pairs of oostegites.......................Parapleurocryptella.

5\. Pereopodal propodi produced into large flat sections with depressions into which sharp dactyli fit........................Asymmetrione.

-- Pereopodal propodi not produced into large flat sections...........6.

6\. Body nearly circular; final pleomere deeply embedded into preceeding one...Gigantione.

-- Body more or less elongate; final pleomere at least somewhat extended..7.

7\. Final pleomere elongate, produced into bulbous or terete pleotelson.. ....8.

-- Final pleomere not markedly longer than others, not as pleotelson..9.

8\. Uropods with both rami well developed and about equal in size........ ....Munidion.

-- Uropods with endopodites reduced or absent............Aporobopyrina.

9\. Uropods biramous...Bonnieria.

-- Uropods uniramous...10.

10. Pleopodal endopodites well developed anteriorly, but reduced to small knobs posteriorly..................................Argeia.

-- Pleopodal endopodites all well developed........................11.

11. Pleopodal endopodites lanceolate, extending mostly medially.........
....New Genus B.

-- Pleopodal endopodites more or less ovate, extending mostly posteriorly...12.

12. Dorsolateral bosses and lateral plates absent...........New Genus A.

-- Dorsolateral bosses and coxal plates present, though latter often reduced..13.

13. Frontal lamina short anteriorly but produced into conspicuous lateral points; lateral plates rudimentary or absent.......Aporobopyrus.

-- Frontal lamina slightly to moderately developed, not produced into lateral points; lateral plates slightly to greatly developed....14.

14. Coxal plates lamellar................................Pleurocrypta.

-- Coxal plates reduced....................................Pseudione.

PLEUROCRYPTELLA BONNIER, 1900

Type-species, by monotypy, Pleurocryptella formosa Bonnier, 1900. Gender, feminine.

Total number of species, 4. Geographical distribution: Canary Islands; Porcupine Bank; Kangean Island, Indonesia; Tosa, Japan; Jamaica; Cuba; Gulf of Panamá.

Generic diagnosis.-- Female: Body only slightly distorted; frontal lamina well developed; lamellar coxal plates on all pereomeres; dorsolateral bosses on anterior pereomeres; brood pouch partly open; sixth and seventh oostegites present as rudiments; 6 pleomeres; lateral plates; pleopods biramous, foliaceous; uropods uniramous, prominent, leaf-like. Male: All body regions and segments distinct; head and pleon abruptly narrower than pereon; first 2 pereopods with much longer and sharper dactyli than others; 6 pleomeres, first 4 frequently with midventral tubercles; pleopods large, uniramous, tuberculiform to club-shaped; uropods leaf-like, uniramous.

Remarks.-- Bonnier (1900) established the genus Pleurocryptella to include the single species P. formosa, a parasite of the chirostylid Ptychogaster formosus A. Milne Edwards [now called Gastroptychus formosus (A. Milne Edwards)], collected near the Canary Islands. Earlier, Giard and Bonnier (1888b) had mentioned the same specimens under the name Pleurocrypta formosa without a description. Bonnier (1900) first published a complete description and figures, and, though he attributed it to Giard and Bonnier, I agree with Bourdon (1968) that it should properly be attributed to Bonnier, the earlier reference being considered a nomen nudum. Tattersall (1905) later reported the only other discovery of this species collected on the Porcupine Bank west of Ireland (53°07' N, 14°50'W), where it infested the same host species. Nierstrasz and Brender à Brandis (1923) recorded and described the second known species of the genus, Pleurocryptella infecta, which parasitized Munida militaris Henderson near Kangean Island in the East Indies. Shiino (1937) found and described additional material of this species, including the first known male, from M. japonica Stimpson at Tosa, Japan. Recently, Bourdon (1972b) described Pleurocryptella wolffi, a parasite of Munidopsis antonii (A. Milne Edwards) in the Gulf of Panamá.

Upon establishing this genus, Bonnier (1900) presented a brief diagnosis, which Nierstrasz and Brender à Brandis (1923) dismissed as unintelligible and self-contradictory ("Wie dies zu verstehen ist, bleibt uns dunkel!"). Strangely, they failed to present an alternative diagnosis even though they clearly accepted the validity of the genus, and there is no doubt that Pleurocryptella infecta and P. formosa are congeneric.

Markham (1974) described the first species of Pleurocryptella known from the western Atlantic, P. fimbriata, a parasite of Munida constricta A. Milne Edwards near Jamaica and Cuba.

Shiino (1965) considered the genus Pleurocryptella to be the most primitive of the Bopyridae because it is the only one whose females retain the sixth and seventh oostegites and one of the few pseudionines whose males still have uropods.

West Indian faunal region species: only 1, Pleurocryptella fimbriata.

Pleurocryptella fimbriata Markham, 1974

Figs. 2-5

Pleurocryptella fimbriata Markham, 1974, pp. 639-646, figs. 18-21. (Type locality, S of Jamaica.)

Material examined.

Infesting Munida constricta A. Milne Edwards. Pillsbury Sta. P-1256, S of Jamaica, 17°27'N, 78°10'W, 605-655m, 14 July 1970; 1♀, holotype, USNM 141603, 1♂, allotype, USNM 141604, 1♀, 1♂, paratypes, USNM 141605. Pillsbury Sta. P-1261, S of Jamaica, 17°16'N, 77°48'W, 720m, 15 July 1970; 1♀, paratype, UMML 32.4520.

Infesting Munida miles A. Milne Edwards. Harvard-Havana Expedition Atlantis Sta. 2936D, Bahía de Cochinos, Cuba, 22°07'N, 81°08'W, 400-500m, 25 Feb. 1938; 1♀, 1♂, paratypes, MCZ.

Description of holotype female (Figs. 2, 3).

Length 7.5mm, maximal width 4.7mm, head length 1.3mm, pleon length 1.7mm. Distortion, head-pereon 17°, pereon-pleon 13°, body bent twice so axes of head and pleon nearly parallel. Body ovate, border rather smoothly rounded; body regions and segments distinct, without abrupt changes in width (Figs. 2A, B).

Head somewhat trapezoidal, anterior edge broadest. Antenna 1 (Fig. 2C) of 3 segments decreasing in size distally; distal segment with cluster of terminal setae. Antenna 2 (Fig. 2C) of 7 segments decreasing in size distally; distal segment with some terminal setae. No distinct eyes (though scattered anterior pigment spots may represent them). Maxilliped bearing 2-segmented palp (Fig. 2D) on anteromedial corner. Pos-

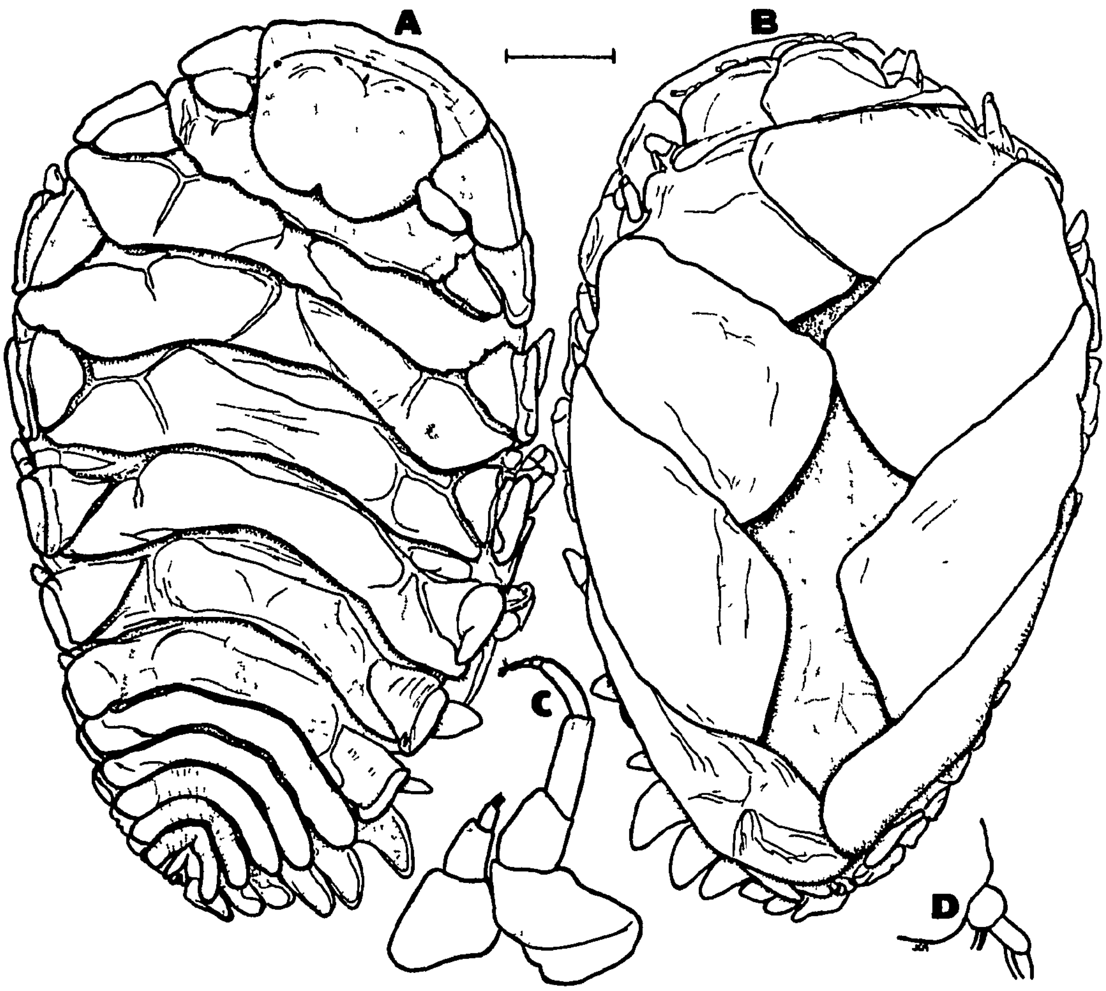

Fig. 2. Pleurocryptella fimbriata Markham, holotype female. A. Dorsal. B. Ventral. C. Left antennae. D. Palp of right maxilliped. Scale: 1.0mm for A, B; 0.25mm for C; 0.2mm for D.

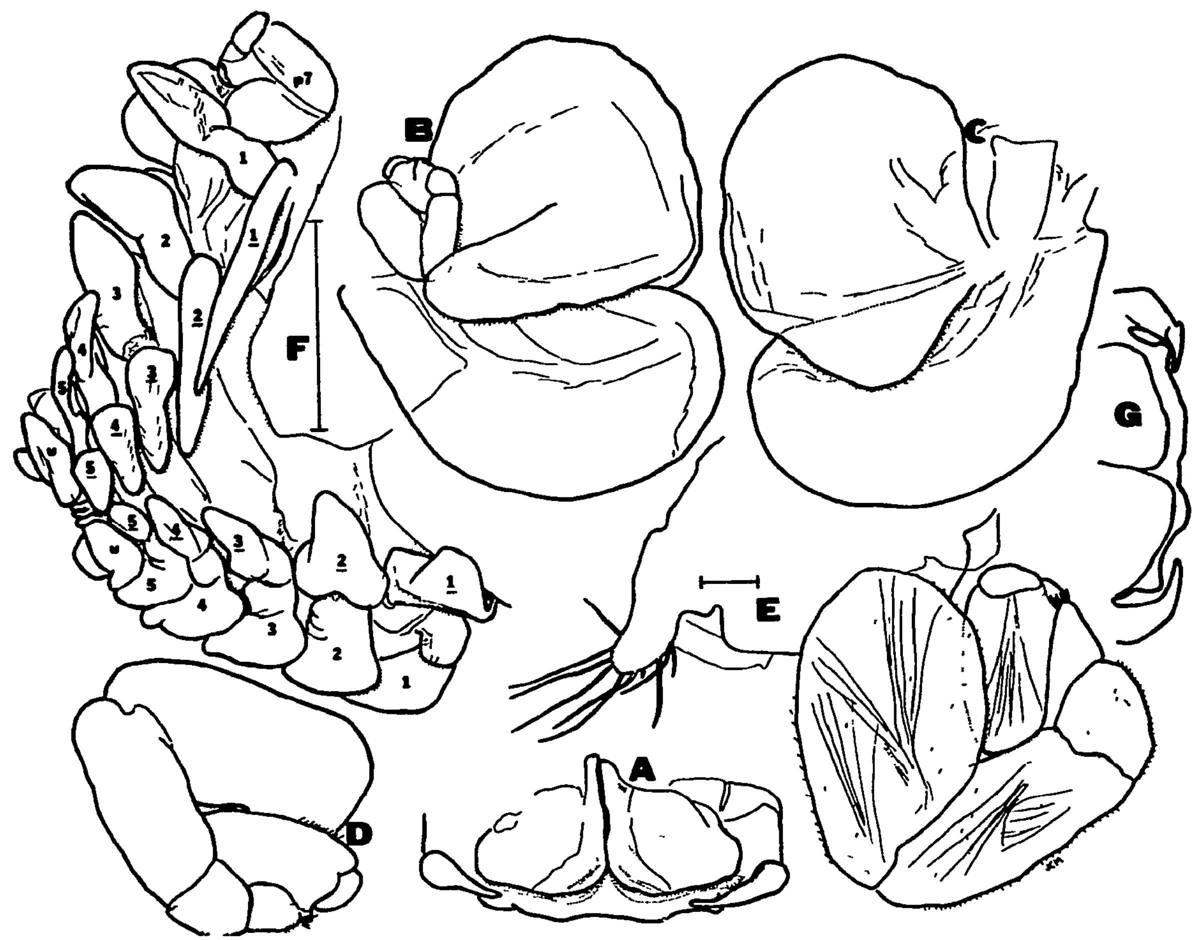

Fig. 3. Pleurocryptella fimbriata Markham. A-F, holotype female; G, paratype female. A. Posteroventral border of head. B. Right oostegite 1, external. C. Same, internal. D. Right pereopod 1. E. Right pereopod 7 with attached oostegite. F. Pleon, ventral (p7, pereopod 7; 1-5, pleopodal exopodites 1-5; 1-5, pleopodal endopodites 1-5; u, uropod). G. Posteroventral border of head. Scale at F: 1.0mm for A, F, G. Scale at E: 0.1mm for B-E.

teroventral border of head (Fig. 3A) with 2 long pointed lateral processes and triangular protuberances immediately medial to them on each side.

Pereon broadest across third pereomere. Coxal plates on lateral margins of all pereomeres. Dorsolateral bosses on all pereomeres. First 5 oostegites fully developed, incompletely enclosing brood pouch; oostegite 1 (Figs. 3B, C) with small external medial flap partly covering pereopod and prominent toothless internal ridge, posterior margin rounded; rudimentary oostegites 6 and 7 (Fig. 3E) present beneath oostegite 5. Pereopods (Figs. 3D, E) nearly alike in structure, slightly larger posteriorly, all fringed with fine setae.

Pleon of 6 distinct pleomeres, each with small lateral plates. Foliaceous biramous pleopods (Fig. 3F) on first 5 pleomeres decreasing in size posteriorly, exopodites larger than respective endopodites but extending little or none beyond lateral plates. Uniramous uropods on last pleomere similar to pleopodal exopodites. Posterior margin of final pleomere with several indentations.

Variations.

The other 3 females examined are very similar to the holotype. Two of them lack the double distortion of the body, one has a larger frontal lamina pointed at each edge, and another bears slightly longer inner processes on the posteroventral border of the head.

Description of allotype male (Figs. 4, 5).

Length 3.6mm, maximal width 1.3mm, head length 0.5mm, pleon length 0.9mm. Body slender, posteriorly pointed (Fig. 4). All body regions and

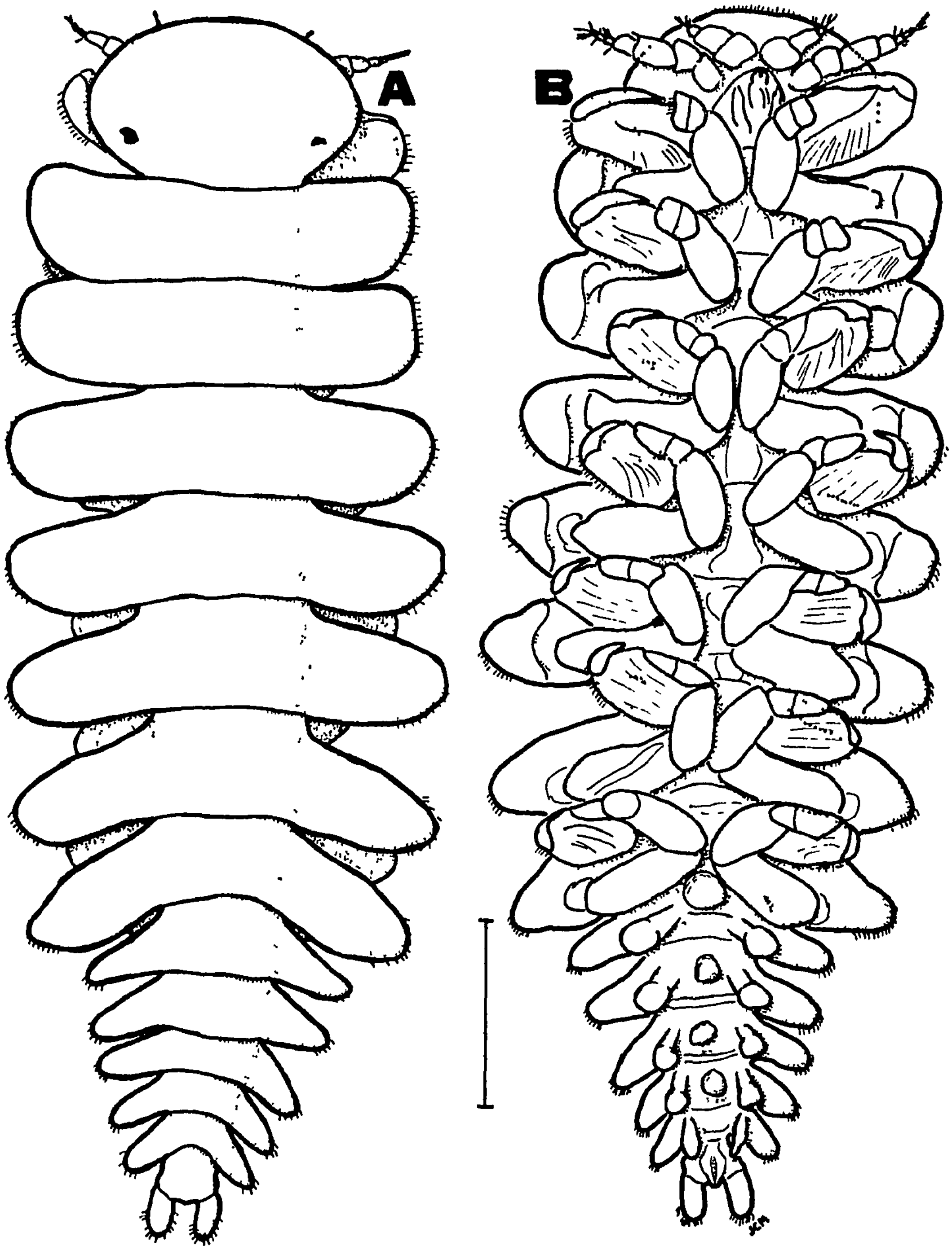

Fig. 4. Pleurocryptella fimbriata Markham, allotype male. A. Dorsal. B. Ventral. Scale: 0.5mm.

Fig. 5. Pleurocryptella fimbriata Markham, allotype male. A. Right antennae. B. Right maxilliped. C. Right pereopod 1. D. Right pereopod 7. E. End of pleon, ventral. Scale: 0.2mm for A, C, D; 0.1mm for B, E.

segments distinct and separated by deep lateral incisions. Sides of pereon nearly parallel, but head and pleon abruptly narrower. All parts of body and pereopods fringed with fine setae.

Head ellptical, broader than long. Small black irregularly shaped eyes near posterolateral margins. Antenna 1 (Fig. 5A) of 4 segments decreasing in size distally; segments, from distal to proximal, bearing respectively 5, 8, 11, 2 setae and proximal segment with a scattering of minute setae. Antenna 2 (Fig. 5A) of 7 segments, third from base largest; segments bearing respectively 6, 6, 3, 4, 3, 1, 0 setae. Maxilliped (Fig. 5B) long and narrow, slightly broader basally with 2 terminal setae.

Pereon slightly broadest across fourth and fifth pereomeres. Posterior borders of first 2 pereomeres nearly straight, all others progressively more concave posteriorly. Anterolateral margins of pereomeres 3 to 7 deeply incised. Poorly defined midventral tubercles on all pereomeres. Pereopods (Figs. 5C, D) all of nearly same size but of highly varying proportions: first pereopod (Fig. 5C) with long pointed dactlus, short broad carpus and merus; pereopod 2 with only slightly shorter dactylus; other pereopods with considerably shorter dactyli and longer carpi and meri.

Pleon of 6 distinct pleomeres; first 5 of same shape as seventh pereomere with distolateral corners produced into blunt points; first pleomere abruptly narrower than final pereomere, others progressively narrower. Pleomeres 1-4 with distinct midventral tubercles, first one most prominent. Conspicuous unsegmented uniramous clublike pleopods on first 5 pleomeres (Fig. 5B). Final pleomere (Fig. 5E) bearing uniramous uropods; anus on elevated cone slightly exceeding posterior margin.

Variations.

One of the other males has more reduced eyes and somewhat more prominent midventral pereonal tubercles. The other one differs from the allotype in that its head is longer relative to its body.

Discussion.

Pleurocryptella fimbriata differs from *P. formosa* and *P. wolffi* in several respects, but it is closely similar to *P. infecta*. Characters distinguishing *P. formosa* and *P. wolffi* from *P. fimbriata* are as follows. Female: broader and more rounded, head broader and more deeply embedded in pereon; proximal segment of first antenna smaller; posteroventral border of head with longer inner processes; dorsolateral bosses only on first 4 pereomeres; posterodorsal margins of pereomeres produced into more prominent lobate processes. Male: more elongate; eyeless; pleon as broad anteriorly as pereon and much shorter; pleomeres less separated laterally, lacking midventral tubercles. Characters which distinguish *P. infecta* from *P. fimbriata* are that in the former the female's head is more nearly square, it bears dorsolateral bosses on only the first 4 pereomeres, and its uropods are much more posteriorly directed; the male of *P. infecta* is relatively broader and has less extended pleopods.

One of the females of *P. fimbriata* had its brood pouch filled with microniscan larvae which seemed quite distinctive in having their pleons enlarged into saclike structures.

BONNIERIA NIERSTRASZ AND BRENDER À BRANDIS, 1923

Type-species, by montypy, Bonnieria indica Nierstrasz and Brender à Brandis, 1923. Gender, feminine.

Total number of species, 2. Geographical distribution: Flores Sea, Indonesia; Guyana.

Generic diagnosis.-- Female: Body subovate, slightly distorted; all segments distinct; eyes absent; well developed frontal lamina; coxal plates on all pereomeres; oostegites not covering brood pouch; 6 pleomeres; pleopods biramous, each ramus flat, simple, pressed tightly against pleon; uropods unequally biramous, their small rami extending straight back from large basal segment; lateral plates present but reduced. Male: All segments and body regions distinct; midventral tubercles on pereomeres and some pleomeres; 6 pleomeres; pleopods and uropods all present as uniramous tubercles.

Remarks.-- Nierstrasz and Brender à Brandis (1923) created the genus Bonnieria with B. indica as the type-species, which they described on the basis of a single pair of parasites found infesting Munida militaris Henderson in the Flores Sea north of Sumbawa, Indonesia. The present material consisting of 2 pairs of parasites of Munida microphthalma A. Milne Edwards off the coast of Guyana is only the second record of the genus, which is still known only as a parasite of Munida spp. The presence of biramous pleopods and uropods in the female and 6 pleomeres and uropods in the male identifies Bonnieria as one of the most primitive genera of the Bopyridae, only slightly more evolved than Pleurocryptella.

West Indian faunal region species: only 1, Bonnieria americana.

Bonnieria americana Markham, 1974

Figs. 6-9

Bonnieria americana Markham, 1974, pp. 614-620, figs. 1-4. (Type locality, near Guyana.)

Material examined.

Infesting Munida microphthalma A. Milne Edwards, B. S. Mayo, det. of hosts. Pillsbury Sta. P-689, off coast of Guyana, 08°40'N, 57°38'W, 1220-1440m, 15 July 1968; 1♀, holotype, USNM 141592, 1♂, allotype, USNM 141593, 1♀, 1♂, paratypes, USNM 141594.

Description of holotype female (Figs. 6, 7).

Length 8.6mm, maximal width 5.2mm, head length 1.3mm, pleon length 2.1mm. Distortion, head-pereon 24°, pereon-pleon reverse 17°. Body nearly oval, both ends reflexed dorsally, body axis bent twice, so axes of head and pleon nearly parallel. All segments quite distinct (Figs. 6A, B).

Head subquadrate with posterior edge slightly concave. Well developed frontal lamina. No eyes. Antenna 1 (Fig. 7A) 3-jointed; distal segment much smaller than others, none bearing evident setae; antenna 2 of 5 indistinct segments, distal one with some short setae. Maxilliped (Fig. 7B) nearly ovate, without palp. Posteroventral border of head (Fig. 7C) with 1 lateral digitate projection on each side, central border produced into 3 slight convexities.

Pereon broadest across pereomere 4. All pereomeres bearing coxal plates covering lateral edges. Slightly crenulate tergal projections along concave side of all 7 pereomeres. Oostegites reduced, surrounding but not covering brood pouch; oostegite 1 (Figs. 6C, D) nearly circular,

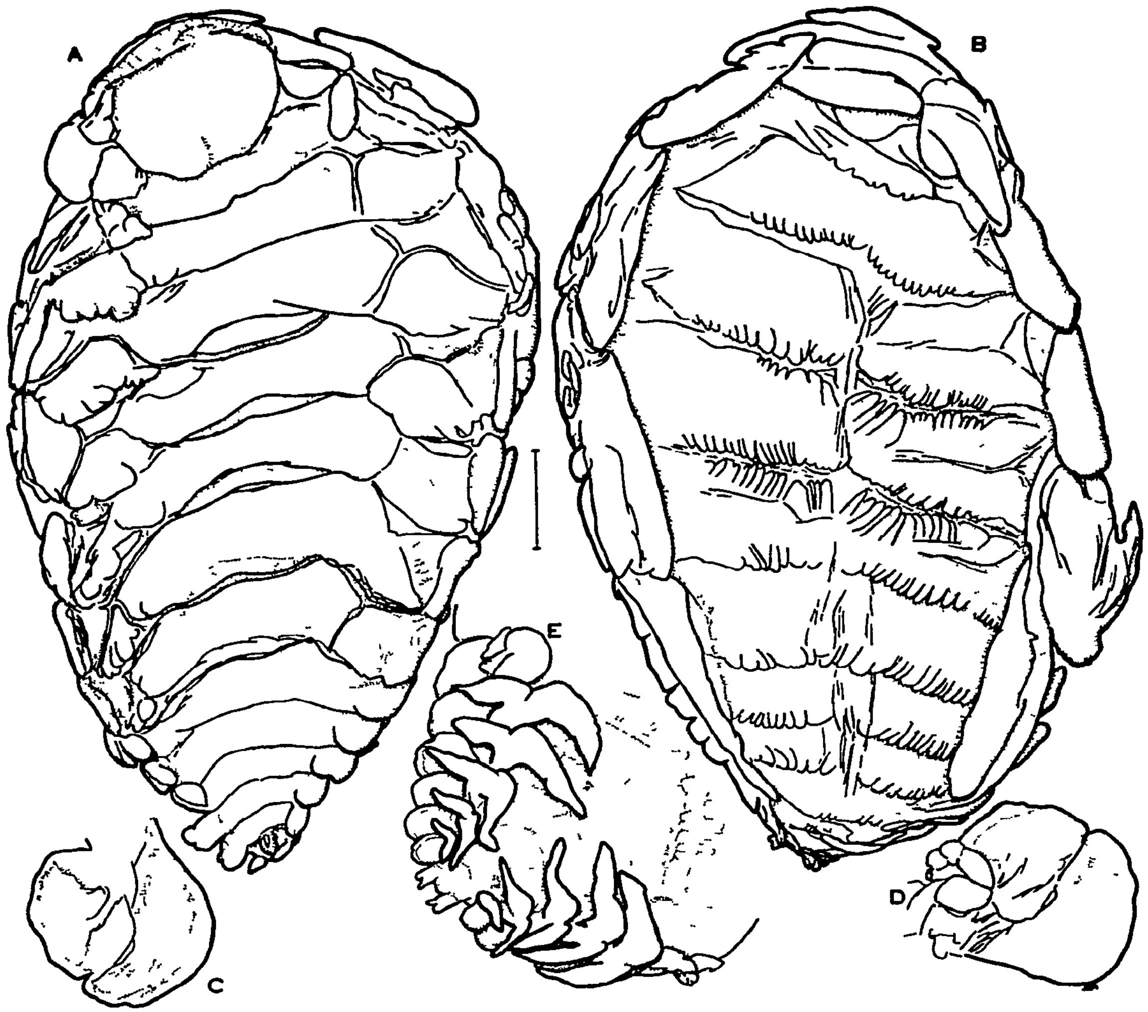

Fig. 6. Bonnieria americana Markham, holotype female. A. Dorsal. B. Ventral. C. Right oostegite 1, internal. D. Same, external. E. Pleon, ventral. Scale: 1.0mm.

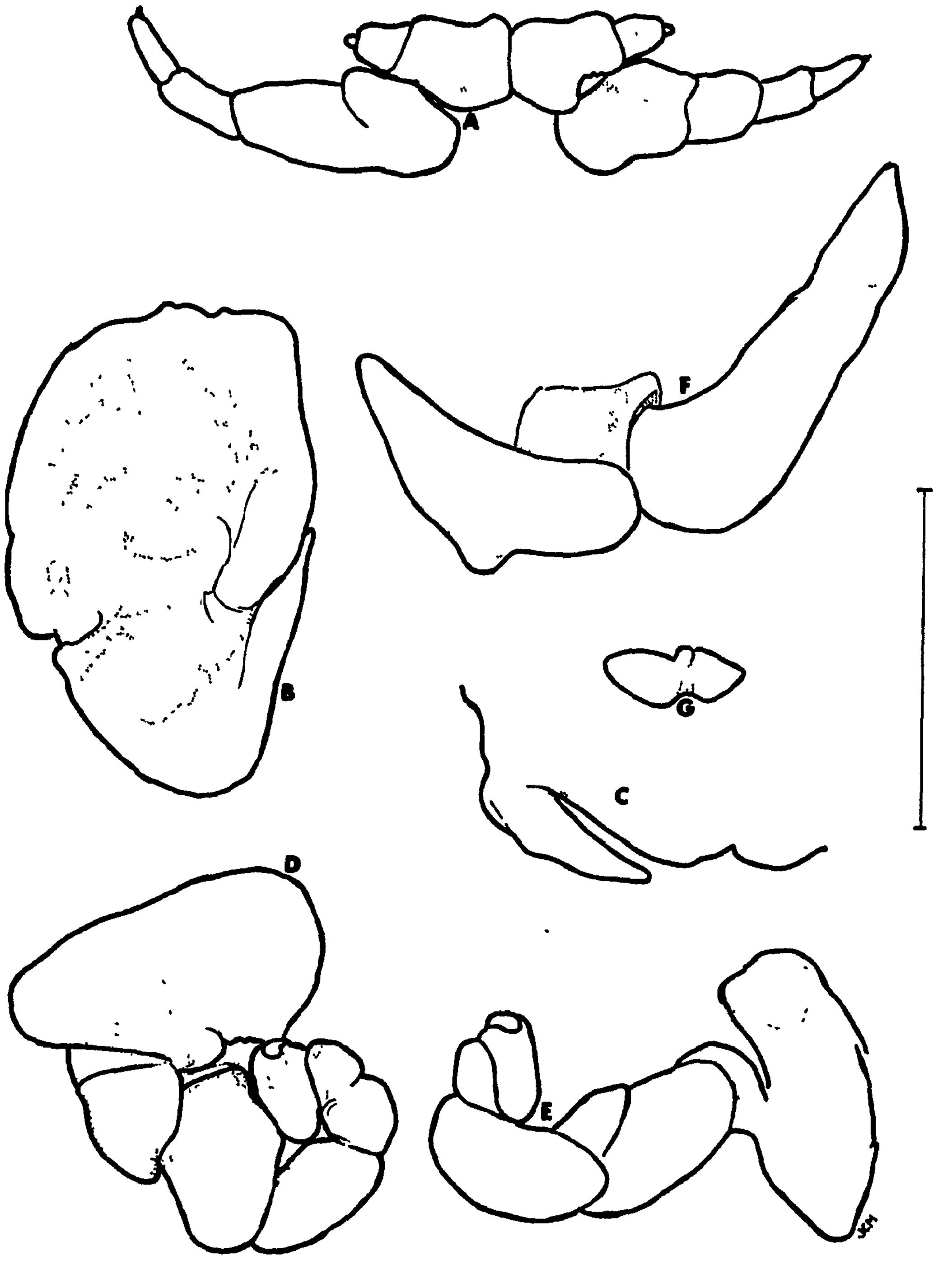

Fig. 7. Bonnieria americana Markham, holotype female. A. Antennae. B. Right maxilliped. C. Posteroventral border of head. D. Right pereopod 1. E. Left pereopod 6. F. Left pleopod 1. G. Left pleopod 5. Scale: 1.0mm.

lacking posterior point. Pereopods (Figs. 7D, E) isomorphic.

Pleon (Figs. 6A, E) about 4/5 as long as broad, rounded posteriorly, of 6 distinct pleomeres. Each of first 5 pleomeres with ovoid lateral plate extending to each side. Pair of biramous pleopods (Figs. 7F, G) on each of first 5 pleomeres, each of pointed flat endopodite extending medially and smaller similar endopodite extending laterally. Posterior pleopods and lateral plates progressively smaller. Pleomere 6 with pair of posteriorly projecting biramous uropods with endopodites slightly narrower and longer than exopodites, both much smaller than basal segment, neither ornamented. Anus in center of prominent anal cone.

Variations.

The paratype female appears identical with the holotype in all respects.

Description of allotype male (Figs. 8, 9).

Length 3.0mm, maximal width 1.3mm, head length 0.4mm, pleon length 0.7mm. Body ellipsoid, both ends smoothly rounded, no abrupt shanges in width (Fig. 8). Pleon reflexed ventrally.

Head rounded except for marked central convexity posteriorly. Antenna 1 (Fig. 9A) of 3 segments markedly longer proximally, distal segment with 8 terminal setae. Antenna 2 (Fig. 9B) of 4 segments; distal one nearly triangular, with 10 terminal setae. Lateral margins of both antennae, especially first, densely covered with fine setae. No eyes.

Pereon broadest across pereomere 5. All pereomeres with slightly rounded lateral edges. Pereopods (Figs. 9C, D) of nearly same size and shape, but dactyli progressively smaller posteriorly; each pereopod with

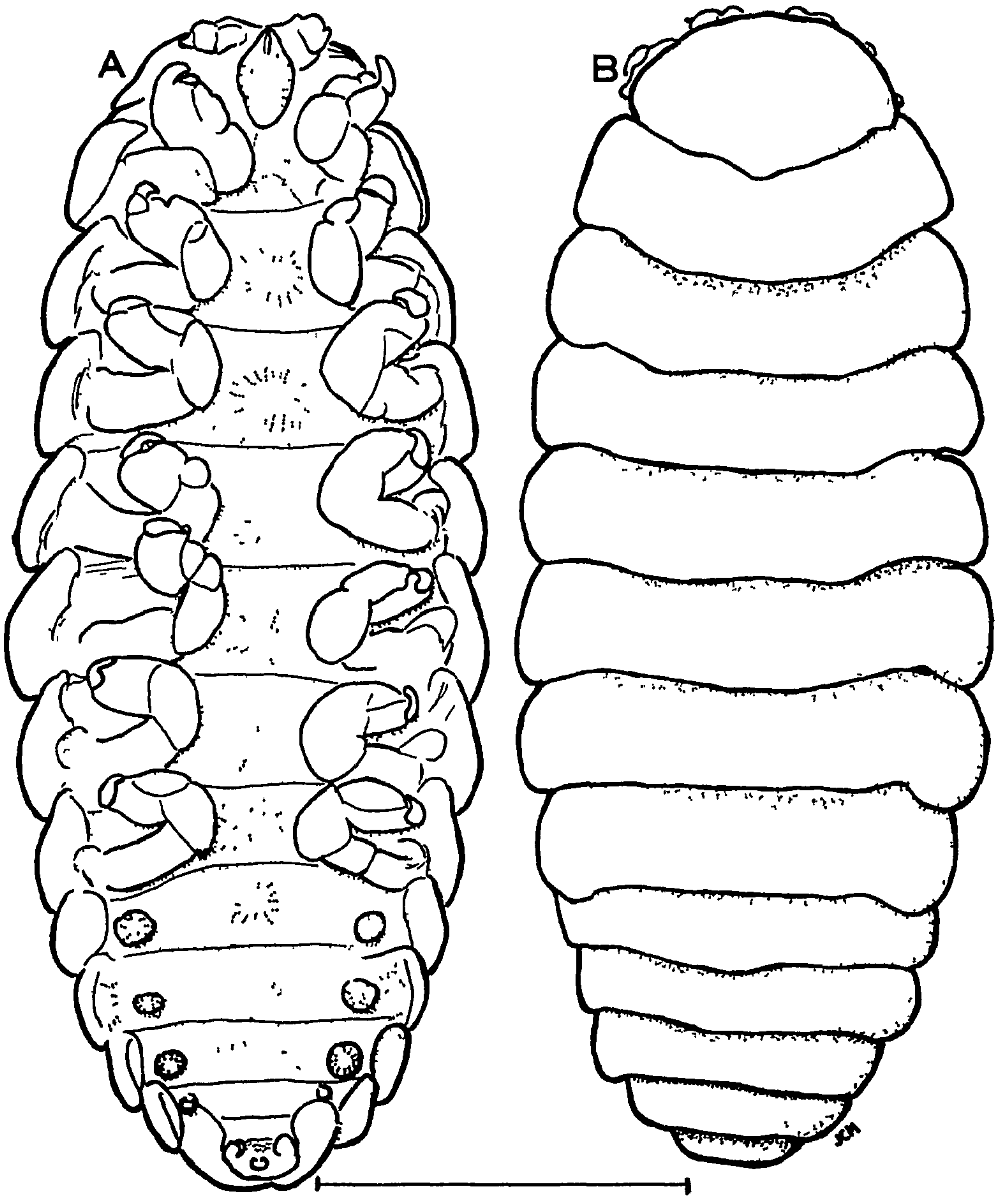

Fig. 8. Bonnieria americana Markham, allotype male. A. Ventral. B. Dorsal. Scale: 1.0mm.

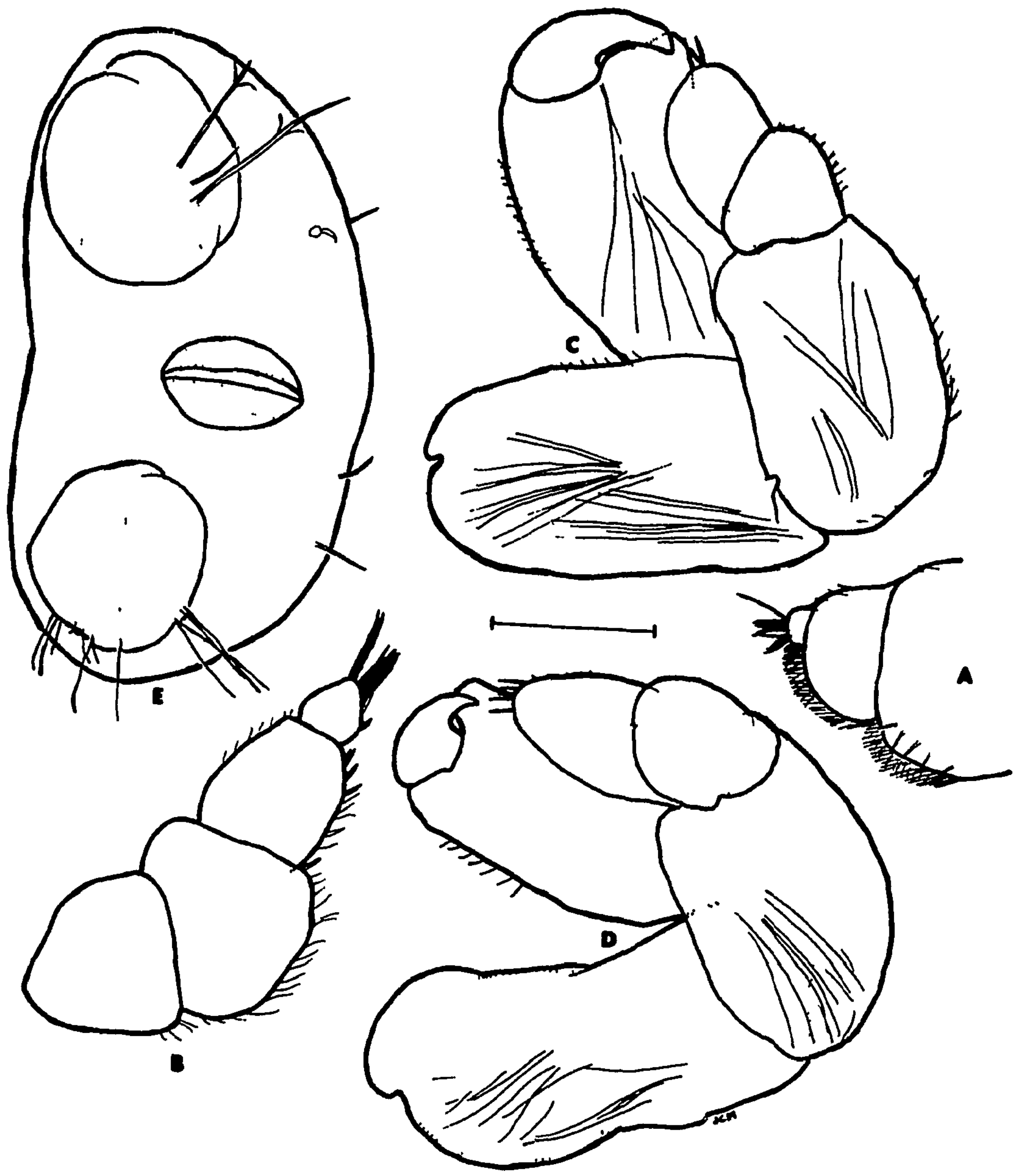

Fig. 9. Bonnieria americana Markham, allotype male. A. Right antenna 1. B. Right antenna 2. C. Right pereopod 1. D. Right pereopod 7. E. Pleomere 6, ventral. Scale: 0.1mm for A-D; 0.05mm for E.

several fine setae along lateral edge of propodus, distal tuft of large setae on carpus, notch in proximal margin of basis. Broad low midventral tubercle on each pereomere.

Pleon of 6 pleomeres. Lateral edges of first 5 curved ventrally. Midventral tubercles on first 2 pleomeres like those on pereomeres. Five pleopods as button-like tubercles. Terminal pleomere surrounded by fifth and bearing pair of tuberculiform uniramous uropods (Fig. 9E). Fringe of sparse setae on posterior border of pleon and uropods.

Variations.

The paratype male differs slightly from the allotype in having a more broadly convex head and colorless eyes; pleomere 6 extends straight back rather than being enclosed by the preceeding pleomere.

Discussion.

The type-species, *Bonnieria indica*, which Nierstrasz and Brender à Brandis (1923) recorded as a parasite of *Munida militaris* Henderson from the East Indies, was hitherto the only known member of the genus. *Bonnieria americana* differs from *B. indica* as follows; The female of *B. americana* has antennal segments differently proportioned and possibly fewer in number, its tergal projections are more crenulate, its oostegites are relatively much smaller, its pleopods have relatively longer rami, and its terminal pleomere is less deeply embedded in the preceeding one. The male of *B. americana* has a head more rounded anteriorly and is broadest across pereomere 4. The genus *Bonnieria* remains known only as parasites of *Munida* spp.

The genus *Paragigantione* Barnard, known only from a single pair of individuals of the type-species, P. papillosa Barnard, which Barnard (1920) recorded from South Africa on Munida sanctipauli Henderson, is similar to Bonnieria in several respects. In the females of both, all segments are distinct, the body is only slightly distorted, the oostegites are reduced, the pleopods and uropods are biramous, and the lateral plates are reduced. In the males of both genera, all segments are distinct, the pereomeres bear midventral tubercles, and the pleopods and uropods are represented by tubercles. The female of Paragigantione differs from those of Bonnieria in that its head is more trapezoidal, it evidently lacks coxal plates, and its final pleomere is produced into a prominent pleotelson. The male of Paragigantione, in contrast with those of Bonnieria, has more prominent antennae, its body is relatively narrower with more nearly parallel sides, all of its segments are more distinctly separated laterally, and its pereomeres are produced into sharper points.

PARAPLEUROCRYPTELLA BOURDON, 1972

Type-species, by original designation, Parapleurocryptella minuta Bourdon, 1972. Gender, feminine.

Total number of species, 2. Geographical distribution: Sumatra; Martinique.

Generic diagnosis (modified from Bourdon, 1972c).-- Female: All segments distinct; maxilliped palp of 2 articulated segments; frontal lamina prominent; 4 anterior pereomeres bearing dorsolateral bosses, all pereomeres with coxal plates; no middorsal bosses or tergal projections; 5 pairs of oostegites nearly closing brood pouch, first one not pointed posteriorly; 6 pleomeres; 5 pairs of reduced biramous pleopods only slightly covering pleomeres ventrally; uniramous uropods. Male: Only about twice as long as wide; all segments distinct; maxilliped palp of 2 articulated segments; pleon of 6 pleomeres with edges reflexed ventrally; 5 pairs of tuberculiform pleopods and similar uropods.

Remarks.-- Bourdon (1972c) created the genus Parapleurocryptella to include 2 species of parasites of galatheoids, P. minuta infesting the chirostylid Uroptychus gracilimanus Henderson near Sumatra and P. elasmonoti infesting the galatheid Munidopsis squamosa (A. Milne Edwards), which he called Elasmonotus squamosus, contrary to the opinion of Chace (1942). Parapleurocryptella is very similar to the primitive Pleurocryptella but differs in that the female of the former has only 5 pairs of oostegites rather than 7.

West Indian faunal region species: only 1, Parapleurocryptella elasmonoti.

Parapleurocryptella elasmonoti Bourdon, 1972

Parapleurocryptella elasmonoti Bourdon, 1972c, pp. 820-822, fig. 3.

(Type locality, near Martinique.)

Material examined.

Infesting holotype ♂ of Munidopsis squamosa (A. Milne Edwards). U. S. Coast Survey Ship Blake Sta. 210, off Martinique, 350m, 1878 or 1879; 1♀, holotype, MCZ.

Description of holotype female (modified from Bourdon, 1972c).

Length 2.1mm, maximal width 1.8mm, pleon length 1.8mm. Distortion, 7°.

Head very broad. Frontal lamina well developed and folded down on head. Evidently no eyes. Antennae 1 and 2 of 3 and 5 segments, respectively. Maxilliped with distinctly 2-segmented palp; external surface of maxilliped covered with minute setae, internal surface with feathery bristles. Posteroventral border of head with single pair of short pointed projections.

First 4 pereomeres with dorsolateral bosses, all pereomeres with well developed coxal plates. Oostegites incompletely enclosing brood pouch; oostegite 1 rounded posteriorly, internal ridge entire. Pereopods nearly equal in size, without basal enlargements.

Pleon of 6 pleomeres, terminal one rather large and evenly rounded posteriorly. Five pairs of reduced biramous pleopods. Uropods uniramous, extending posteriorly prominently.

Male: unknown.

Discussion.

Bourdon (1972c) established this species on the basis of a single damaged female. Although I have seen that specimen, still the only representative of the species known, I do not believe I could contribute to a knowledge of the species by redrawing it. Thus I have adapted the description given by Bourdon and am referring the reader to his careful drawings. Milne Edwards and Bouvier (1897, pl. VII, fig. 4) presented a drawing of the host of the type of *Parapleurocryptella elasmonoti* showing a conspicuously deformed left branchiostegite, but they did not mention that the specimen was parasitized.

This is the first record of a bopyrid parasite of an Atlantic *Munidopsis* which does not belong to *Pseudione*. Elsewhere, however, a Pacific species, *Munidopsis antonii* (A. Milne Edwards) is known as the host of *Pleurocryptella wolffi* Bourdon in the Gulf of Panamá (Bourdon, 1972b).

GIGANTIONE KOSSMANN, 1881

Type-species, by original designation, Gigantione moebii Kossmann, 1881. Gender, feminine.

Total number of species, 8. Geographical distribution: Azores; Canary Islands; Tuamotu Islands; Hawaii; Ishigakashima, Japan; Mauritius; Eniwetok; Salomon Islands; Sagami Bay, Japan; Virgin Islands.

Generic diagnosis.-- Female: Body nearly circular, only slightly distorted; all body regions and usually all segments separated; head large, extending beyond general body outline; frontal lamina very short anteriorly, usually produced into points laterally; coxal plates on most pereomeres; 6 pleomeres; long tapering pointed lateral plates on first 5 pleomeres; final pleomere deeply embedded into fifth pleomere, triangular with posterior edge truncate; uropods biramous, unornamented, arising from base about as long as isomorphic rami. Male: All body segments and regions distinct, but not abruptly narrowing at any point; sides of body smoothly rounded; pereomeres separated by lateral indentations; 6 pleomeres; pleopods flat and flaplike, uniramous or biramous; uropods uniramous or biramous.

Remarks.-- Kossmann (1881a) established the genus Gigantione for the species G. moebii found infesting the xanthid Ruepellia impressa de Haan on Mauritius. Since then, 7 other species, all parasites of xanthids, have been recorded from several localities, mostly tropical or subtropical, around the world. One species, Gigantione bouvieri Bonnier, has been reported from both a xanthid, Pilumnus hirtellus (L.), and a dromiid, Hypoconcha sp., on opposite sides of the Atlantic. The species of Gigantione are evidently the only pseudionines found on brachyurans, a fact which possibly indicates a link between this genus and the subfamily Ioninae, members of which characteristically infest brachyurans.

The presence of 6 pleomeres and biramous uropods in the females and uropods in the males indicates that Gigantione is one of the more primitive genera in the Bopyridae.

West Indian faunal region species: only 1, Gigantione bouvieri.

Gigantione bouvieri Bonnier, 1900

Cepon elegans, Milne Edwards and Bouvier, 1894, pp. 38 (footnote), 40.

[Not Cepon elegans Giard and Bonnier, 1886 = Cancricepon elegans Giard and Bonnier, 1887]

Cépons [sp.], Milne Edwards and Bouvier, 1900, pp. 73, 75.

Gigantione Bouvieri Bonnier, 1900, pp. 61, 64, 169, 221, 278-279, 379. (Type locality, Azores.)

Gigantione bouvieri, Stebbing, 1910, p. 117.-- Nierstrasz and Brender à Brandis, 1923, pp. 64, 66; 1931, pp. 152-153, figs. 7-12.-- Shiino, 1958, p. 48.-- Bourdon, 1968, p. 406.

?Gigantione bouvieri, Bourdon, 1967d, p. 857.

Material examined: none.

Description of female (modified from Bonnier, 1900, and Nierstrasz and Brender à Brandis, 1931).

Body nearly circular, very small, only to 4.5mm long. All segments usually distinct.

Head extending slightly beyond border of pereon. Frontal lamina reduced anteriorly, produced into triangular points laterally. No eyes. Antenna 1 reduced except for large proximal segment. Antenna 2 extending beyond border of head. Posteroventral border of head finely digitate, with single pair of lateral projections and bifurcate median process.

Pereomeres all distinct, separated by irregular margins. Coxal plates lamellar and pointed, on all pereomeres, in some cases covering dorsolateral bosses present on first 4 or 5 pereomeres. Oostegites completely enclosing brood pouch, covering whole ventral surface of pereon and part of pleon.

Pleon of 6 pleomeres, first 2 occasionally partly fused medially. Pleomeres 1-5 produced into long falcately pointed widely separated lateral plates. Five pairs of biramous flaplike pleopods, first pair much better developed than others, often concealing some or all of others, those being reduced crenulate rudiments. Final pleomere triangular, deeply set into fifth pleomere, bearing isomorphically biramous uropods on long broad peduncles.

Description of male (modified from same sources).

Body at least 2-1/2 times as long as wide, tapering smoothly both anteriorly and posteriorly from posterior region of pereon, not abruptly narrowing anywhere. All segments distinct.

Head about twice as wide as long. No eyes.

Pereomeres slightly separated by lateral indentations.

Pleon of 6 pleomeres separated like pereomeres. Pleopods as small flaps pressed against surface of pleomeres, attached medially but unsegmented, only rudimentarily biramous. Uropods oval, larger than any pleopods, extending beyond posterior margin of pleon.

Discussion.

Despite the detailed descriptions which he gave of other new species in his monograph, Bonnier (1900) described Gigantione bouvieri rather briefly and did not illustrate it at all. The material on which he based his description had been collected on the xanthid Pilumnus hirtellus (L.) var. inermis A. Milne Edwards and Bouvier in the Azores and the Cape Verde Islands and previously mentioned by Milne Edwards and Bouvier (1894, 1900). Nierstrasz and Brender à Brandis (1931) recorded this species from St. Thomas, Virgin Islands, parasitizing the dromiid Hypoconcha sp.; their drawings of this species are the only ones known. Because their material came from a distant locality and a host species phylogenetically remote from that of the type, it is somewhat doubtful whether these 2 records are really of the same species, but I have included it in this report on the basis of that record. Nierstrasz and Brender à Brandis (1931) pointed out some distinctions between their specimens and Bonnier's (1900) description which appear to be minor. Since Bonnier presented only a brief description and no figures, however, it is difficult to assess the significance of those variations. Bourdon (1967d) recorded Gigantione bouvieri as a parasite of a Glyphocrangon in the Canary Islands. Once again, he presented neither description nor figures and expressed doubts whether he had identified the parasites correctly. He proposed that it might actually be a species of Bathygyge, which seems probable in light of the identity of the host.

As far as I can determine, this is the only recorded case of bopyrid infestation of a recent dromioid, although Van Straelen (1928) reports 6 fossil dromioids so infested.

ASYMMETRIONE CODREANU, CODREANU AND PIKE, 1965

Type-species, by original designation, Pseudione asymmetrica Shiino, 1933. Gender, feminine.

Total number of species, 7. Geographical distribution: Agadir, Morocco; Western Mediterranean; Red Sea; Madagascar; Tanabe Bay, Japan; SE coast of United States and Bahamas.

Generic diagnosis.-- Female: Body slightly distorted sinistrally or greatly (to 90°) dextrally, according to species, much longer than wide, more or less truncate anteriorly; head oblong, wider than long, deeply embedded in pereon but distinct from it; frontal lamina variable; pereomeres all distinct, borders between them crooked; dorsolateral bosses on most or all pereomeres; at least first pair of pereopods extending beyond head; segments of pereopods variously fused, propodus produced into large flat section with depression to receive sharply pointed dactylus; 6 pleomeres; lamellar lateral plates; pleopods and uropods biramous, more or less foliaceous. Male: Body very elongate, tapering to narrow posterior end; all segments distinct except head occasionally fused with first pereomere; pereopods smaller posteriorly; no midventral tubercles; 6 pleomeres, all with ventrally pointed posterolateral corners; flaplike uniramous pleopods pressed against pleomeres; no uropods, but posterolateral borders of final pleomere slightly to greatly extended, anal cone between them.

Remarks.-- Codreanu et al. (1965) established the genus Asymmetrione for the highly distorted Pseudione asymmetrica Shiino, recorded as a parasite of Clibanarius bimaculatus (de Haan) in Tanabe Bay, Japan by Shiino (1933). They simultaneously described a new subspecies of that species, Asymmetrione asymmetrica shiinoi, a parasite of Clibanarius signatus Heller in the Red Sea. Subsequently, Bourdon (1968) described Asymmetrione dardani, parasitic on Dardanus arrosor (Herbst) at Agadir, Morocco, and more recently he has also found another new species of Asymmetrione infesting an unknown host at Madagascar (personal communication). Bourdon (1968) created the genus Megachelione with M. foresti, a parasite of Paguristes oculatus (Fabricius) in the western Mediterranean as type-species; he distinguished Megachelione from Asymmetrione solely on the basis that the latter is much more asymmetrical. Bourdon (personal communication) has informed me that "...si Megachelione avait été décrit en première, je n'aurais certainement pas hésité à placer Asymmetrione dans ce genre malgré son extrême asymétrie." Although the inclusion of Megachelione in Asymmetrione makes the latter's name inappropriate, there is no question about the priority of Asymmetrione, and I believe that these genera are sufficiently similar to make their separation untenable. In both, the females exhibit a peculiar enlargement of the pereopodal propodi into disks seen in no other genus; the males are clearly congeneric, and those males which are most similar cut across the lines separating the Asymmetrione and Megachelione females. In light of the variation among subsequently described species of Asymmetrione, I find it unreasonable to regard Asymmetrione asymmetrica shiinoi as a subspecies of A. asymmetrica; accordingly, I am redesignating it A. shiinoi Codreanu, Codreanu and Pike. With this change, the incorporation of Megachelione into Asymmetrione and the description of 2 new species below, the total number of species of Asymmetrione becomes 7.

Females of most species of branchially infesting bopyrids occur in both dextral and sinistral forms. Asymmetrione is unusual in that each of its 7 species is either dextral or sinistral but never both. In addition, those 5 species which are dextral are highly distorted, at least 50°, while the 2 species with sinistral females are much less distorted, up to only 40°.

Of those species of Asymmetrione whose hosts are known, 5 infest diogenids, in each case members of a single host species, while the other species, Asymmetrione n. sp. 1, occurs only on pagurids, but it is recorded from 4 different host species.

West Indian faunal region species: 2 species, Asymmetrione n. sp. 1, Asymmetrione n. sp. 2.

Key to West Indian faunal region species of Asymmetrione, based on adult females.

1. Sinistral, body only moderately distorted ..... Asymmetrione n. sp. 1.

-- Dextral, body greatly distorted .... Asymmetrione n. sp. 2.

Asymmetrione n. sp. 1

Figs. 10, 11

Material examined.

Infesting Pagurus longicarpus Say. Morehead Channel, North Carolina, 6 May 1964, R. W. Heard, coll. and det. of hosts; 3♀, 1♂, USNM.

Infesting Pagurus bonairensis Schmitt. In Thalassia bed, Bear Cut, Key Biscayne, Miami, Florida, 22 Oct. 1972, L. G. Abele, coll., P. A. McLaughlin, det. of host; 1♀, holotype, USNM, 1♂, allotype, USNM.

Infesting Pagurus provenzanoi Forest and De Saint Laurent. Pillsbury Sta. P-975, off Antigua, 17°29'N, 61°55'W, 29m, 21 July 1969; P. A. McLaughlin, det. of hosts; 2♀, 2♂, USNM.

Infesting Pylopagurus sp. (probably n. sp.), hosts det. by P. A. McLaughlin. Gerda Sta. G-1301, off Key Largo, Florida, 24°57'N, 80°14'W, 256m, 27 Mar. 1971; 1♀, 1♂, UMML. Gerda Sta. G-1102, Cay Sal Bank, 23° 40'N, 79°33'W, 291-326m, 14 June 1968; 1♀, 1♂, UMML.

Description of holotype female (Fig. 10).

Body length 3.9mm, maximal width 2.2mm, head length 0.7mm, pleon length 0.7mm. Distortion 36°, body sinistral, side of pereomere 2 forming anterior corner (Figs. 10A, B). All body regions and segments distinct.

Head deeply set into pereon, irregularly oval in outline. Antennae (Fig. 10C) of 3 and 7 segments, respectively, both tipped with some setae, some setae on other segments of antenna 2. No eyes. Posteroventral border of head (Fig. 10D) with 2 small flaccid pointed projections on each side.

Pereon narrowest where pereomeres 6 and 7 meet in "waist-like" constriction. Pereomeres all distorted, with irregularly shaped borders. First pereomere bent far around head. Oostegites rather loosely enclosing brood pouch; oostegite 1 (Figs. 10E, F) slightly longer than wide, rather smoothly rounded anteriorly, internal ridge simple flap, posterolateral point bluntly falcate. Ill-defined coxal plates proximal to some pereopods. First 2 pereopods (Fig. 10G) larger than others (Fig. 10H); propodus of each pereopod produced into broad flat depressed disk receiving sharp dactylus.

Pleon of 6 pleomeres. First 3 pleomeres produced into small lateral plates, largest anteriorly. Pleopods biramous, each ramus lanceolate, all about same size. Uropods biramous, similar to pleopods.

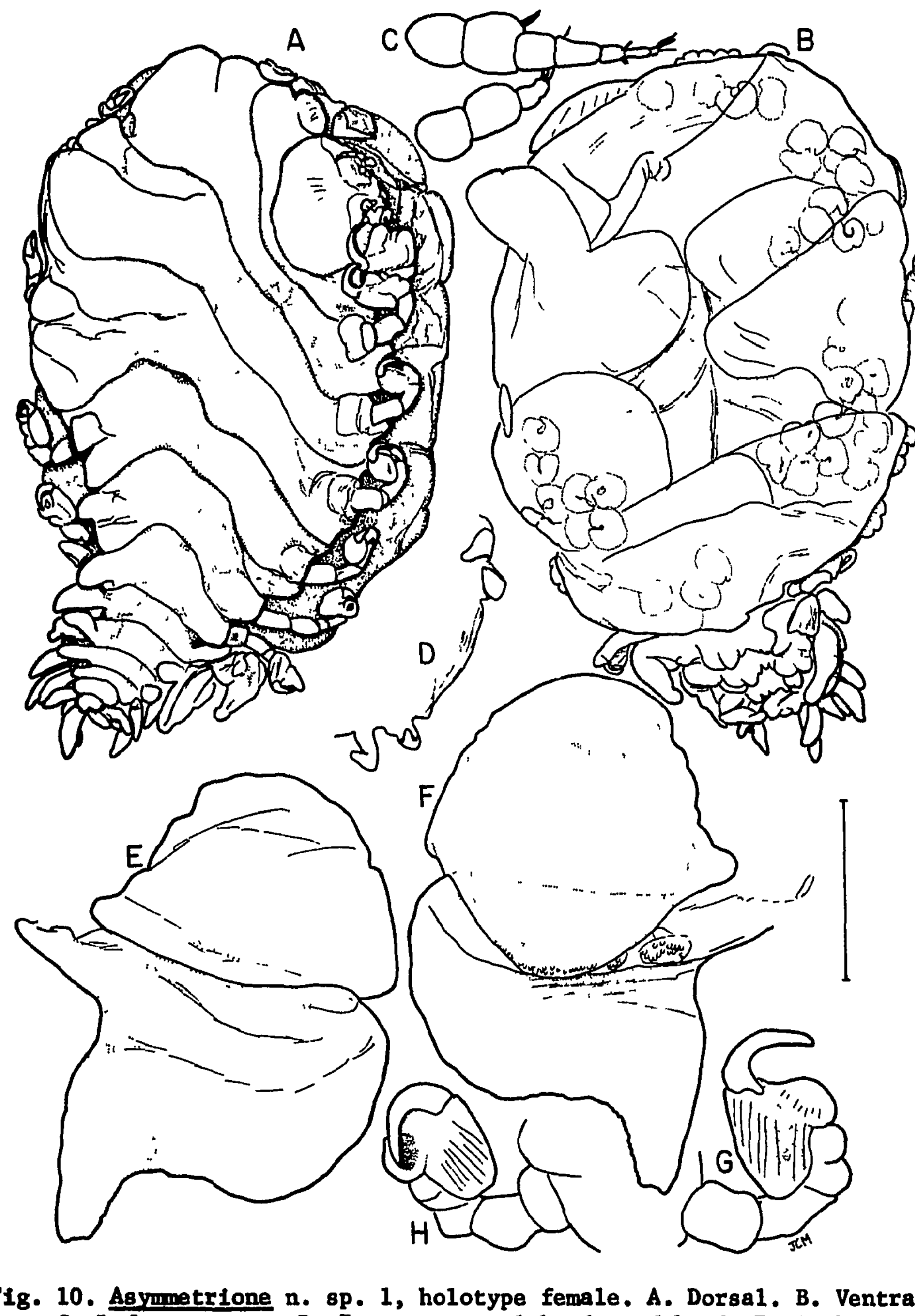

Fig. 10. Asymmetrione n. sp. 1, holotype female. A. Dorsal. B. Ventral. C. Left antennae. D. Posteroventral border of head. E. Right oostegite 1, external. F. Same, internal. G. Right pereopod 2. H. Left pereopod 6. Scale: 1.0mm for A, B; 0.2mm for C; 0.6mm for D; 0.4mm for E-H.

Variations.

One of the paratype females from Pagurus longicarpus exhibits several differences from the holotype. Its distortion is only 26°, the first 6 pereomeres bear prominent coxal plates, and the constriction between the final 2 pereomeres is more pronounced; the posteroventral border of the head bears another pair of broad irregular processes near the center; the posterolateral point of the first oostegite is more strongly curved.

Description of allotype male (Fig. 11).

Length 1.9mm, maximal width 0.6mm, head length 0.3mm, pleon length 0.5mm. Body long and slender, pereon and pleon evenly tapered, but pleon markedly narrower than pereon. Irregular black splotches scattered over most of dorsal surface. All body regions and segments distinct (Figs. 11A, B).

Head oval, half again as wide as long. Eyes large black spots near posterolateral borders. Antennae 1 and 2 (Figs. 11C, D) of 3 and 5 segments respectively, all but proximal segment of antenna 2 bearing setae, especially near distal edges.

Pereon slightly widest across pereomere 2. Pereopods (Figs. 11E, F) all similar in structure and bearing several setae, but anterior ones, especially first 2, much larger than posterior ones.

Pleon of 6 well defined pleomeres. First 5 pleomeres with posterolateral borders reflexed ventrally. Five pairs of flaplike pleopods, each extending onto surface of succeeding pleomere. Final pleomere (Fig. 11G) lacking uropods, but with posterior border produced into 3 lobes, lateral ones long and bearing terminal setae, middle one anal cone about half as long as others.

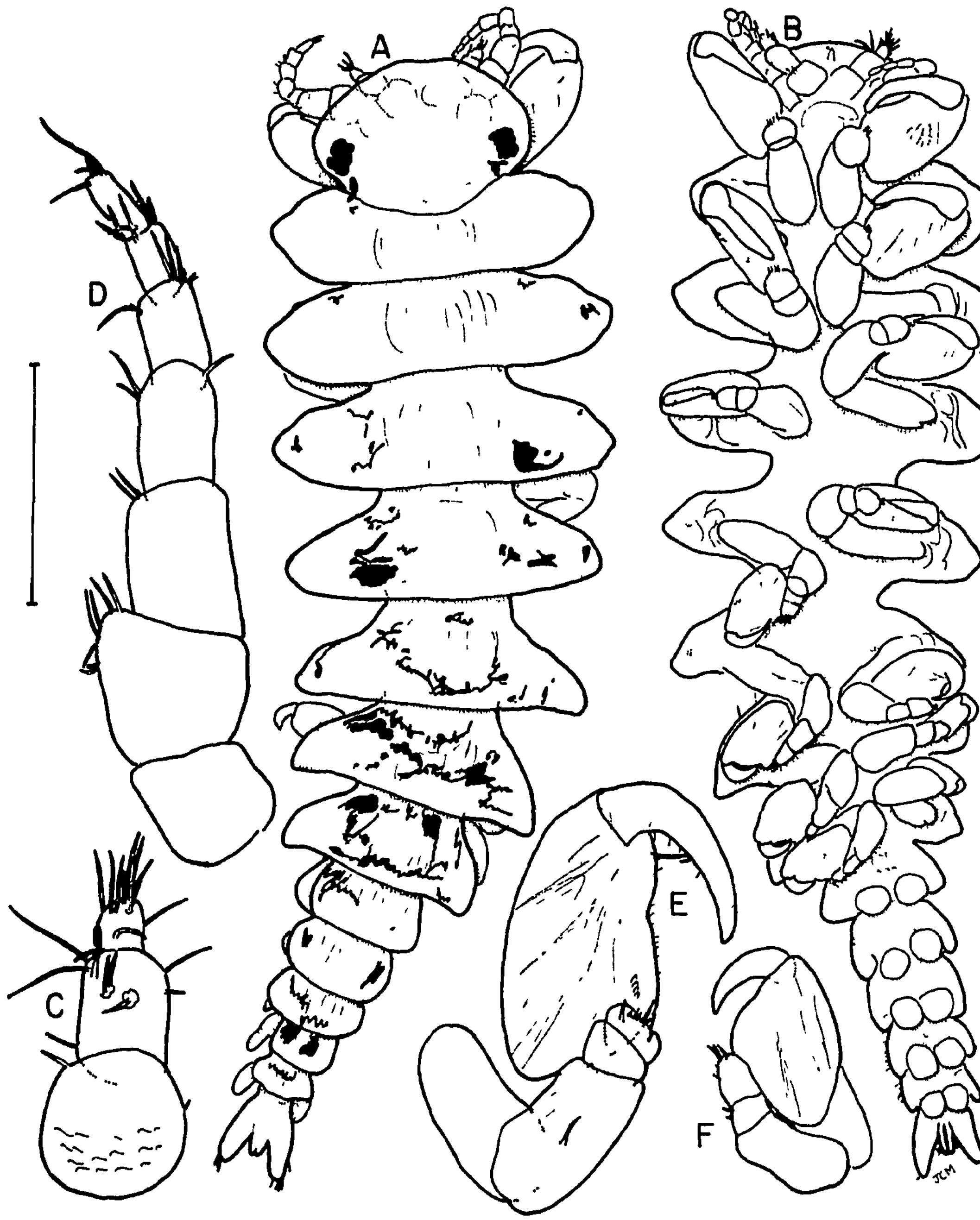

Fig. 11. Asymmetrione n. sp. 1, allotype male. A. Dorsal. B. Ventral. C. Left antenna 1. D. Left antenna 2. E. Right pereopod 1. F. Right pereopod 7. Scale: 0.4mm for A, B; 0.1mm for C, D; 0.2mm for E, F.

Variations.

One of the paratype males from Pagurus longicarpus shows a few variations from the allotype. The head is nearly fused with the pereon; the second antenna has 6 segments; the pereopods vary less in size, although the dactyli of the first two are larger than the others, and the sutures between all meri and carpi are obscured; the pleopods are relatively larger.

Asymmetrione n. sp. 2

Figs. 12, 13

Stegias clibanarii, Pearse, 1932a, pp. 4-5, figs. 22-26.-- Schultz, 1969, p. 323, fig. 515. [Not Stegias clibanarii Richardson, 1904.]

Asymmetrione n. sp., Markham, 1972b, p. 64.

Material examined.

Infesting Clibanarius tricolor (Gibbes), J. C. Markham coll. and det. of hosts except where otherwise indicated. Rock reef, NE corner Key Biscayne, Florida, 15 Apr. 1970, F. L. Mucha, coll.; 1♀, holotype, 1♂, allotype, USNM. Under small rocks, Key Colony Beach, Florida, 2 June 1970; 1♀, 1♂, UMML. Same locality, 13 Sep. 1970; 1♀, USNM. Dry Tortugas, Florida, 15 July 1931, A. S. Pearse, coll. and det. of host; 1♀, 1♂, USNM 65146. Under small rocks, Cistern Cay, Berry Islands, Bahamas, 6 July 1971; 1♀, 1♂, USNM.

Description of holotype female (Figs. 12A-H).

Length 3.5mm, maximal width 1.9mm, head length 0.6mm, pleon length

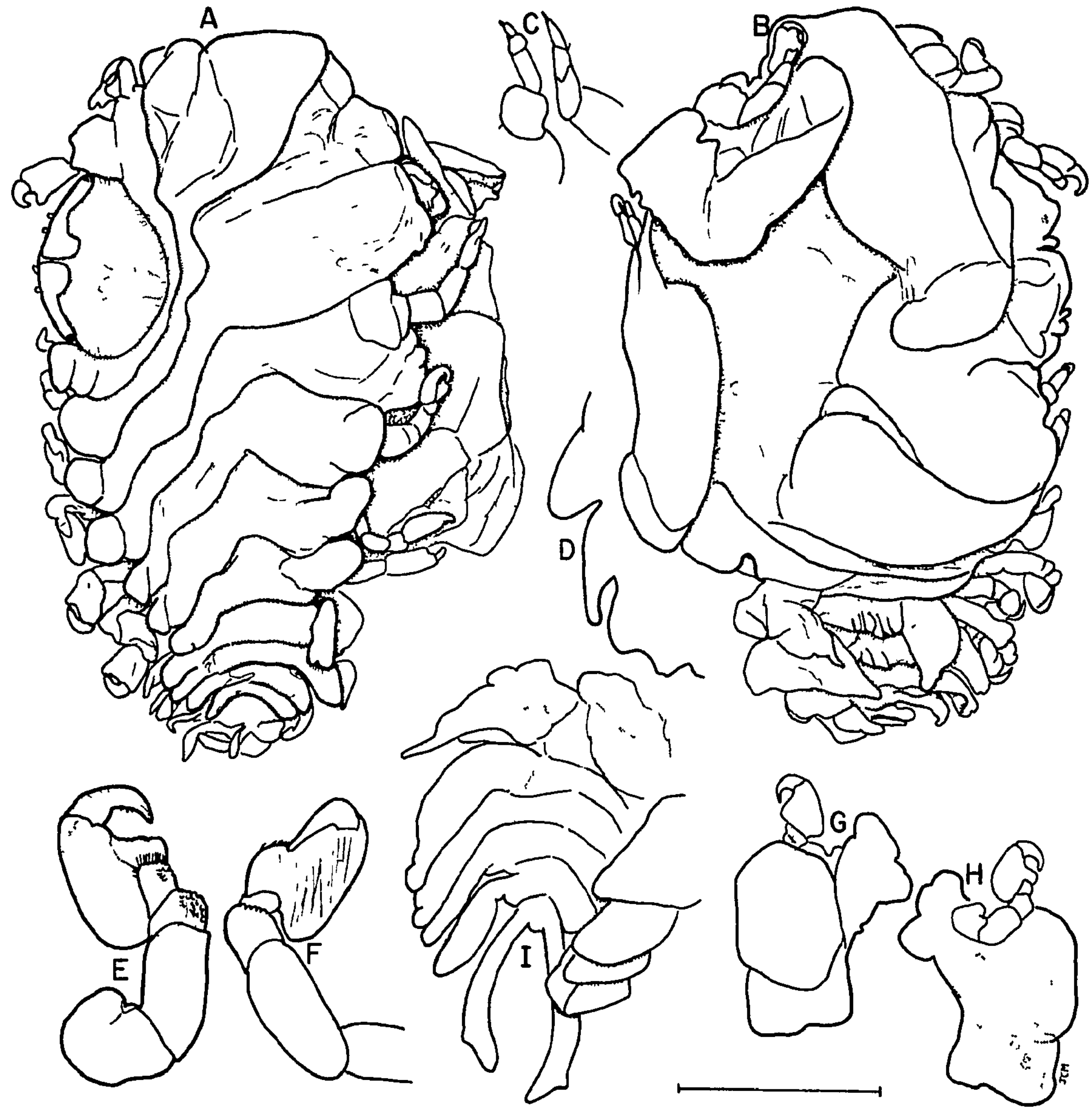

Fig. 12. Asymmetrione n. sp. 2. A-H, holotype female; I, paratype female. A. Dorsal. B. Ventral. C. Left antennae. D. Right posteroventral border of head. E. Right pereopod 1. F. Left pereopod 7. G. Right oostegite 1, internal. H. Same, external. I. Pleon, ventral. Scale: 1.0mm for A, B; 0.4mm for C-F; 0.1mm for G, H; 0.6mm for I.

0.6mm. Distortion 81°, body dextral, side of pereomere 2 at anterior corner. All body regions and segments distinct (Figs. 12A, B).

Head deeply set into pereon, suboval, nearly half again as wide as long. Frontal lamina reflexed over dorsal surface of head in 2 hornlike structures, concealing small eyes at lateral edge of head. Antennae (Fig. 12C) tiny, both of several segments, tipped with setae. Posteroventral border of head (Fig. 12D) with 2 short projections on each side, outer one larger, middle margin irregular.

Most pereomeres with irregular borders. Coxal plates on some pereomeres. Pereopods (Figs. 12E, F) all of about same size, though dactyli smaller posteriorly; propodus of each enlarged into extended plate. Oostegites not completely enclosing brood pouch; oostegite 1 (Figs. 12G, H) subrectangular, internal ridge far back and unornamented, posterior border not pointed.

Pleon of 6 pleomeres, each of first 3 produced into lateral plates. Pleopods biramous, endopodites somewhat smaller, both rami of each pleopod subrecatangular. Uropods biramous (though 1 exopodite apparently missing), rami of nearly equal size, all lanceolate.

Variations.

Most of the variations of the females seem rather minor. One female has both uropods uniramous (Fig. 12I).

Description of allotype male (Fig. 13).

Length 1.8mm, maximal width 0.5mm, head length 0.3mm, pleon length 0.5mm. Body long and narrow, sides of pereon nearly parallel, but pleon tapering slightly. Head nearly completely fused with pereon, all other

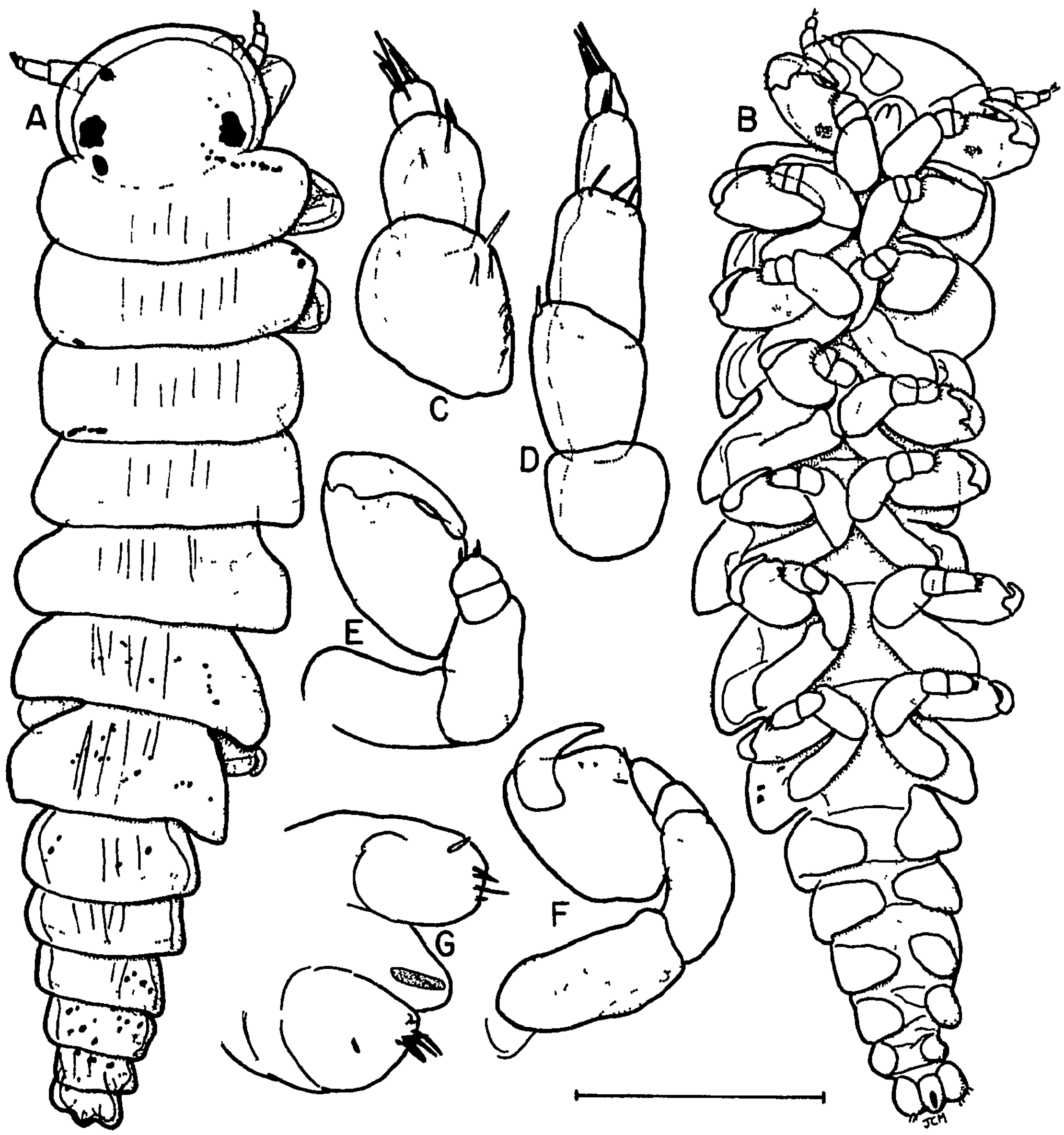

Fig. 13. Asymmetrione n. sp. 2, allotype male. A. Dorsal. B. Ventral. C. Right antenna 1. D. Left antenna 2. E. Right pereopod 1. F. Right pereopod 6. G. Pleomere 6, ventral. Scale: 0.4mm for A, B; 0.1mm for C, D, G; 0.2mm for E, F.

segments distinct (Figs. 13A, B). Small black spots scattered over dorsal surface of several segments.

Head oval, slightly wider than long. Eyes large, irregularly shaped, near posterolateral edges. Antenna 1 (Fig. 13C) of 3 segments decreasing in size distally, each bearing several setae. Antenna 2 (Fig. 13D) of 5 segments, distal one tipped with 5 setae, others except proximal one with some setae on distal margins.

Pereon slightly broadest across pereomere 2. Pereomeres only slightly separated anteriorly, more separated posteriorly. Pereopods (Figs. 13 E, F) of nearly same size, but dactyli progressively smaller posteriorly; each carpus with distal setae.

Pleon of 6 pleomeres decreasing in size posteriorly. Pleopods as small flaps. Terminal pleomere (Fig. 13G) with flap-like uropods exceeded by anal cone, bearing setae on each posterolateral corner.

Variations.

All of the other males examined agree in all details with the type.

Remarks.

This species was first recorded by Pearse (1932a), who considered it to belong to the athelgine species Stegias clibanarii Richardson, discussed below as an abdominal parasite from the same host species. Pearse described the male as the allotype of S. clibanarii, even though his material was not part of the type collection.

Asymmetrione n. sp. 1 is clearly most closely related to A. foresti in that its female is only slightly distorted. It differs in a few characters: the female of the former species has a second antenna of 7 segments, lateral plates on only the first 3 pleomeres and biramous uropods which are longer than the pleopodal exopodites, in contrast to the female of *A. foresti*, which has a second antenna of 5 segments, lateral plates on the first 5 pleome es and uniramous uropods which are shorter than the pleopodal exopodites. The male of *Asymmetrione* n. sp. 1 is most nearly like those of *A. asymmetrica* and *A. shiinoi* but differs from them in having the posterolateral borders of the pleomeres extended rather than reflexed ventrally.

Females of *Asymmetrione* n. sp. 2 are similar to those of the 4 other species with dextral females. In contrast, its females have eyes, in common only with *A. shiinoi*; their second antennae evidently have only 4 segments, fewer than any other species. The fifth and sixth pereomeres have ill-defined coxal plates on the convex side in contrast with *A. dardani*, Their uropods are variably uniramous or biramous, a condition unreported in other species; the pleopods are completely smooth, in contrast to those of the other 4 closely related species, in which the females all have tuberculate pleopods. Males of *Asymmetrione* n. sp. 2 are similar to those of *A. foresti* in lacking long posterolateral points on the terminal pleomere but differ from those males in having the sides of the pereomeres nearly straight instead of pointed and the pleon wider relative to the pereon.

PSEUDIONE KOSSMANN, 1881

Type-species, by monotypy and original designation, Pseudione callianassae Kossmann. Gender, feminine.

Total number of species, at least 47. Geographical distribution: worldwide.

Generic diagnosis.-- Female: Body oval or pyriform, all segments distinct; frontal lamina moderately developed; dorsolateral bosses on all pereomeres; coxal plates reduced; first oostegite with rounded posterolateral point; pleon of 6 pleomeres, first five produced into moderately to greatly developed lateral plates; pleopods biramous, lanceolate; uropods uniramous, lanceolate. Male: Body smoothly tapered anteriorly and posteriorly from midline, not narrowing abruptly; all body regions and segments distinct; no midventral tubercles; anterior pereopods not markedly larger than others; pleon of 6 pleomeres (occasionally aberrant specimens of some species with pleomeres variously fused); pleopods uniramous, tuberculiform to flaplike; no uropods, but posterior border of terminal pleomere slightly to greatly produced into posterolateral points.

Remarks.-- The genus Pseudione had a rather inauspicious origin. Kossmann (1881a, p. 663) cited "... das Mannchen einer...bisher unbeschriebenen Form, die ich vorlaufig Pseudione nennen will..," and presented only a drawing of the ventral view of the head of such a male, which was labeled Pseudione callianassae, n. g. n. sp. in the accompanying caption. According to Bourdon (1968), however, the exact identity of P. callianassae is quite uncertain.

Subsequently, further species of Pseudione were discovered all around the world. Many of these were not adequately described, and few were contrasted with many other known species, so it is uncertain how many are valid. As Shiino (1965) has pointed out, Pseudione is the most generalized bopyrid genus, and many of its species are extremely difficult to distinguish.

Some species of Pseudione which differed conspicuously from most have been removed from the genus and made types of new genera: Codreanu et al. (1965) made P. asymmetrica Shiino the type-species of Asymmetrione; Codreanu and Codreanu (1963) made P. diogeni Popov the type-species of Urocryptella and P. euxinica the type-species of Progebiophilus; and Richardson (1910) made P. paucisecta the type-species of Parione.

Since Pseudione is such a widespread and ill-defined genus, the most effective way of dealing with it would be to examine as many of the currently described species as possible, redescribing them all uniformly, assessing intraspecific variations and thereby deciding how many of the species are valid. This would also make the descriptions of additional new species more reliable.

In the West Indian faunal region, 3 species of Pseudione have been described, a fourth is known from both north and south of here and probably occurs in this region, and a fifth, described from Virginia, is likely to be found here as well. Another species from this region has been recorded and partly illustrated (Menzies and Glynn, 1968) but never named or described. In addition, parasites of 19 other host species from the region are assignable to Pseudione; I am nearly certain that these belong to new species, but whether all of them are different species cannot be determined until they are all described. Consequently, I have only indicated their occurrence without attempting to describe or differentiate them.

West Indian faunal region species: 3 species, Pseudione confusa maxillipedis, P. minimocrenulata, P. trilobata, known; 2 species, P. upogeb-

iae, *P. trilobata*, expected; several others present but undescribed.

Pseudione confusa maxillipedis Bourdon, 1972

Pseudione confusa maxillipedis Bourdon, 1972c, pp. 825-826, fig. 6.

(Type locality, Bahía de Cochinos, Cuba.)

Material examined.

Infesting *Munida stimpsoni* A. Milne Edwards. Harvard-Havana Expedition, Atlantis Sta. 3319, Bahía de Cochinos, Cuba, 22°13'N, 81°10'30"W, 125-215 fm (=230-390m), 4 Apr. 1939, F. A. Chace, Jr., det. of host; 1♀, holotype, MCZ 11483, 1♂, allotype, MCZ 11484. Pillsbury Sta. P-1232, SW of Jamaica, 17°56'N, 77°59'W, 222m, 7 July 1970, B. S. Mayo, det of host; 1♀, 1♂, UMML 32.4545.

Discussion.

Bourdon (1972c) considered these parasites to belong to a new subspecies of *Pseudione confusa* Norman, the type-subspecies of which is known as a parasite of *Galathea dispersa* Bate and *Munida squamosa* Henderson from several European localities (Bourdon, 1968). Since I have not worked out any of the systematic problems of the genus, I do not know whether it would be preferable to retain this as a subspecies of *Pseudione* or to raise it to specific rank.

<u>Pseudione</u> <u>minimocrenulata</u> Nierstrasz and Brender à Brandis, 1931

<u>Pseudione</u> <u>minimo-crenulata</u> Nierstrasz and Brender à Brandis, 1931, pp. 160-163, figs. 22-28. (Type localities, Kei Islands and St. Croix, Virgin Islands).-- Bourdon, 1968, pp. 187, 188; 1972c, p. 825.

<u>Pseudione</u> <u>minimocrenulata</u>, Shiino, 1952, p. 41.

Material examined.

Infesting <u>Munida</u> <u>flinti</u> Benedict, all hosts det. by B. S. Mayo. Pillsbury Sta. P-617, near Glover Reef, British Honduras, 15°46'N, 88° 12'W, 110-119m, 19 Mar. 1968; 1♀, UMML. Pillsbury Sta. P-783, off Colombian coast, 11°21'N, 73°46'W, 143-174m, 31 July 1968; 1♀, 1♂, UMML 32. 4546. Pillsbury Sta. P-785, off Santa Marta, Colombia, 11°18'N, 74°16'W, 165-210m, 31 July 1968; 1 immature ♀, 1♂, UMML. Pillsbury Sta. P-752, off Venezuelan coast, 11°07'N, 68°14'W, 95-132m, 26 July 1968; 1♀, 1♂, UMML 32.4547.

Discussion.

Nierstrasz and Brender à Brandis (1931) described this species on the bases of 2 pairs collected on opposite sides of the world. One pair infested a <u>Munida</u> sp. (subsequently identified as <u>M</u>. <u>incerta</u> Henderson by B. S. Mayo) in the Kei Islands of the East Indies; their description was largely of this pair. The other pair infested a still-unidentified <u>Munida</u> sp. collected at Frederiksted, St. Croix, Virgin Islands. Due to the wide geographic separation and the distinctions which Nierstrasz and Brender à Brandis (1931) pointed out between the 2 pairs which they described, it is highly unlikely they were really dealing with a single species. Since their description was based mostly on the Kei Island material, the West Indian species should receive a new name if it is found to be distinct. The present material extends the range of the species in the West Indian region considerably southward.

Pseudione trilobata Nierstrasz and Brender à Brandis, 1925

Pseudione trilobata Nierstrasz and Brender à Brandis, 1925, pp. 2-3, 7, figs. 7-10. (Type locality, Curaçao).-- Monod, 1933, p. 227.-- Shiino, 1933, p. 271.-- Schultz, 1969, p. 325, fig. 519.

Material examined: none.

Discussion.

This species is known only from the type specimens, which Nierstrasz and Brender à Brandis (1925) described as parasites of the porcellanid Pisosoma angustifrons Benedict in Spaansche Baai, Curaçao.

Pseudione upogebiae Hay, 1917

Pseudione upogebiae Hay, 1917, pp. 572-573, pl. 100, figs. 7-12. (Type locality, North Carolina).-- Van Name, 1920, p. 72.-- Nierstrasz and Brender à Brandis, 1923, p. 72.-- Brian and Dartevelle, 1941, pp. 350-351.-- Pearse, 1947, p. 326.-- Shiino, 1951, p. 32.-- Catalono and Restivo, 1965, p. 203.-- Lemos de Castro, 1965d, pp. 11-14, figs. 1-11; 1970, pp. 3, 5, pl. III, figs. 15-17.-- Williams, 1965, p. 104.-- Schultz, 1969, p. 325, fig. 520.-- Restivo, 1970, p. 314.

Pesudione [sic] upogebiae, Hay and Brown, 1918, p. 408.

Pseudione urogebiae [sic], Popov, 1927, pp. 13-14.

?Phyllodurus robustus Pearse, 1953a, pp. 235-237, figs. 131-143.-- Lemos de Castro, 1965d, p. 12.-- Williams, 1965, p. 104.

Material examined: none.

Discussion.

This species was originally recorded as a parasite of the callianassid Upogebia affinis (Say) in North Carolina by Hay (1917). It has since been found there quite frequently (Williams, 1965). Lemos de Castro (1965d) recorded Pseudione upogebiae from Bazil on a Upogebia which was possibly U. affinis and proposed that the specimens which Pearse (1953) had described as Phyllodurus robustus (even though they clearly are not in the same subfamily as Phyllodurus abdominalis Stimpson) may properly belong to this species, especially since they came from the same host species and locality as the types of Pseudione upogebiae. Since this parasite is known from both north and south of the West Indian region and its host species occurs within that region, I have mentioned Pseudione upogebiae even though it is as yet unknown from West Indian waters. I have examined an infested Upogebia affinis from Venezuela, but its parasite appears to belong to a different species of Pseudione.

Pseudione furcata Richardson, 1904

Pseudione furcata Richardson, 1904a, p. 79, figs. 69-70; 1905, pp. 529-

530. figs. 571-573. (Type locality, off coast of Virginia).-- Fowler, 1912, p. 523.-- Hay, 1917, p. 573.-- Van Name, 1920, p. 72. -- Nierstrasz and Brender à Brandis, 1923, p. 72.-- Schultz, 1969, p. 327, fig. 524.

Pseudione panopei Pearse, 1947, pp. 326-328, figs. 1-11. (Type locality, Beaufort, North Carolina).-- Schultz, 1969, p. 328, fig. 525.

Pseudoione [sic] furcata, Kaestner, 1970, p. 463.

Material examined.

Infesting Clibanarius vittatus (Bosc). On mudflat, Beaufort, North Carolina, 1972, T. Wolff, coll. and det. of host; 1♀, 1♂, ZMC.

Possibly infesting Panopeus herbstii H. Milne Edwards. Beaufort, North Carolina, 22 Aug. 1946, A. S. Pearse, coll. and det. of host; 1♀, 1♂, paratypes of Pseudione panopei, USNM 84049.

Discussion.

Pseudione furcata was originally recorded from the coast of Virginia on an unknown host (Richardson, 1904a) and has not been found since, although Kaestner (1970), without citing a source, says it "... is found on the Gulf Coast." Since this mention occurs only in the English translation of that book and not in the German original (Kaestner, 1967), it is probably attributable to the translators. The specimens collected by Wolff I have assigned to this species with some slight reservations because the first oostegite of the female is differently shaped. The specimens described as Pseudione panopei clearly belong to Pseudione furcata. There are 2 reasons why the identification of the host, which has been separated from the parasites, is doubtful. First, all of the parasitized xanthids, including *Panopeus herbstii*, which I have examined bear the ionine *Cancricepon choprae*, discussed below; second, I know of no other species of *Pseudione* and very few other pseudionines recorded from brachyurans. I have included mention of *Pseudione furcata* here because its host *Clibanarius vittatus* is common within the West Indian faunal region.

Unidentified *Pseudione* spp.

In addition to the named species of *Pseudione* mentioned above, I have found specimens of *Pseudione* infesting individuals of the following 19 host species. It is probable that all of the parasites belong to new species, but I do not know whether all are different or whether 1 species of host may bear more than a single species of *Pseudione*. For each host species, the general locality or localities where it was found infested by a *Pseudione* sp. are indicated.

Clibanarius tricolor (Gibbes): Miami and Keys, Florida; Berry Islands, Bahamas. (Also recorded from Puerto Rico by Menzies and Glynn, 1968.)

Upogebia affinis Say: Cumana, Venezuela.

Heterocarpus ensifer A. Milne Edwards: Gulf of Mexico

Heterocarpus sp. (may = *H. ensifer*): Cay Sal Bank

Paguristes tortugae Schmitt: Veradero and Xanadu, Cuba

Munida longipes A. Milne Edwards: Florida Keys; Quito Sueño Bank.

M. microphthalma A. Milne Edwards: Guyana.

M. miles A. Milne Edwards: Florida Keys; Cay Sal Bank; Caibarién, Cuba; Jamaica; Quito Sueño Bank.

M. simplex Benedict: Grand Bahama Island.

Munidopsis abbreviata (A. Milne Edwards): Jamaica

M. alaminos Pequegnat and Pequegnat: Jamaica; Guadeloupe.

M. erinaceus Pequegnat and Pequegnat: NE Gulf of Mexico; Guadeloupe; Península de la Guajira and Santa Marta, Colombia; Curaçao; Agüide, Venezuela.

M. longimanus (A. Milne Edwards): Florida Keys; Bahía de Cardenas, Cuba; Guadeloupe.

M. nitida (A. Milne Edwards): Campeche Bay.

M. riveroi Chace: Berry Islands, Bahamas; Península de la Guajira, Colombia.

M. robusta (A. Milne Edwards): Cape Canaveral and Marquesas Keys, Florida.

M. spinosa (A. Milne Edwards): SE Gulf of Mexico; Bahía de Santa Clara, Cuba; Jamaica.

M. tridentata (Esmark): Miami, Florida; Jamaica.

Nephropsis aculeata Smith: Delray Beach, Florida.

APOROBOPYRUS NOBILI, 1906

Type-species, by original designation, Aporobopyrus aduliticus Nobili, 1906. Gender, masculine.

Total number of species, 7. Geographical distribution: Japan; Palao; Ryûkyû; Red Sea; Sénégal; North Carolina to Barbados; Brazil; California.

Generic diagnosis.-- Female: Body only slightly distorted; frontal lamina short but produced into conspicuous lateral plates; posteroventral border of head with central point; first 4 pereomeres bearing dorsolateral bosses; coxal plates on all pereomeres; first oostegite rounded anteriorly, falcately pointed posteriorly; 6 pleomeres; lateral plates rudimentary or absent; pleopods biramous, rami similar, lanceolate; uropods uniramous, lanceolate. Male: Head distinct from pereon; first pereopod at least as large as second; 6 distinct pleomeres, terminal one usually much smaller than others; pleopods absent or indicated by slight tuberculiform swellings; no uropods.

Remarks.-- In establishing the genus Aporobopyrus, Nobili (1906, p. 1108) diagnosed it thus: "Femina: Torace con sette lamina pleurali, e quattro gibbosità pleurali. Pleure pleonali rudimentali, tubercoliformi. Pleopodi laminari, biramosi. Uropodi laminari, semplici. Maschio: Segmenti del pleon tutti distinti ed uropodi nulli." This diagnosis, though still applicable to subsequently described species of Aporobopyrus, does not distinguish their females from those of several species of Pseudione and distinguishes the males only by their lack of pleopods. In the examples which I have examined, belonging to Aporobopyrus curtatus, the situation is somewhat ambiguous in that some males have nearly flat ventral surfaces on their pleomeres while others bear quite prominent tubercles, which may or may not be pleopods. In the males of most species of Aporobopyrus, there are clearly no pleonal swellings, but the male of A.

parvus Shiino is shown with quite prominent ones which Shiino (1939a, p. 86) nonetheless says are "...too inconspicuous to be termed as pleopoda." Shiino and Bourdon (personal communications) consider the lack of pleopods in the males of Aporobopyrus to be the single character distinguishing Aporobopyrus from Pseudione, but it is highly variable and subject to interpretation, the distinction between a pleonal tubercle and a rudimentary pleopod being very unclear. In the case of western Atlantic forms, females of both known species of Aporobopyrus can be readily distinguished from all known Pseudione species in that their frontal laminae are produced into long lateral points, and their pleonal lateral plates are greatly reduced. Elsewhere, however, these characters are also present in some species of Pseudione, such as P. orientalis Shiino and P. petrolistheae Shiino. In light of the very slight distinctions of these genera, it seems questionable whether Aporobopyrus can be retained as a separate genus. Since I have not examined many members of the genus and have dealt with a species which had already been assigned to Aporobopyrus, I am reluctant to submerge this genus, but it is a point which should be considered.

Besides ambiguity on the generic level, there is also considerable confusion among the species of Aporobopyrus, and it is likely that not all are valid. Shiino (1939a) described A. ryukyuensis from 2 females and 1 male, but all other species were established on the basis of a single pair of each. In the present case, examination of a large number of specimens has shown that 2 nominal species are really a single highly variable one, and it is probable that some of the 6 other species are synonyms of others. On the other hand, in 2 cases a single species has been recorded from widely separated localities and may actually be separate species. Shiino (1934) originally recorded A. oviformis from Japan and then (Shiino, 1964) from California; A. gracilis has been reported from Sénégal (Nierstrasz and Brender à Brandis, 1929) and Brazil (Lemos de Castro, 1965a).

The distribution of hosts of Aporobopyrus spp. is rather anomalous also. The 7 species have been recorded from a total of 14 host species (all but one a porcellanid). Two of the host species, Petrolisthes armatus and P. galathinus, are now known to bear different species of Aporobopyrus in different parts of their ranges. I have examined specimens identified as A. gracilis collected in Brazil by Lemos de Castro and am satisfied that the females are specifically distinct from any of A. curtatus. The characters of the males of A. curtatus, however, seem to overlap with those of the males of all other species of Aporobopyrus except A. ryukyuensis, so it is impossible to distinguish them from A. gracilis reliably.

West Indian faunal region species: only 1, Aporobopyrus curtatus.

Aporobopyrus curtatus (Richardson, 1904)

Figs. 14, 15

Pseudione curtata Richardson, 1904a, pp. 80-81, figs. 72-75; 1905, pp. 530-531, figs. 574-577. (Type locality, Key West, Florida).-- Nobili, 1906, p. 1108.-- Van Name, 1920, p. 72.-- Nierstrasz and Brender à Brandis, 1923, p. 72; 1925, pp. 3, 7; 1932, p. 169.-- Shiino, 1933, p. 271; 1952, p. 41; 1958, p. 35.-- Menzies and Glynn, 1968, p. 13.-- Schultz, 1969, p. 326, fig. 522. [Not Pseudione curta (sic), Menzies and Frankenberg, 1966, p. 26. (= Bopyrina sp.)]

Aporobopyrus curtatus, Nierstrasz and Brender a Brandis, 1929, p. 12.-- Monod, 1933, p. 227.-- Shiino, 1934, p. 267; 1964, p. 22.

Aporobopyrus johannis Nierstrasz and Brender a Brandis, 1929, pp. 10-11, figs. 9-10. (Type locality, St. John, Virgin Islands).-- Monod, 1933, p. 227.-- Shiino, 1934, p. 267; 1964, p. 22.

Material examined.

Infesting Petrolisthes galathinus (Bosc). Near Indian Key, Florida, 24°53'N, 80°41'W, 7 May 1960; W. A. Starck, II, coll.; 1♀, 1♂, UMML 32. 1690. Key West, Florida, date unknown, H. Hemphill, coll.; 1♀, 2♂, types of Pseudione curtata, USNM 29094. Coral Bay, St. Jan, West Indies (= St. John, Virgin Islands), June 1896; C. Levinsen, coll.; 1♀, 1♂, types of Aporobopyrus johannis, ZMC. No collection data (Florida?); 1 poorly preserved ♀, UMML 32.116.

Infesting Petrolisthes marginatus Stimpson. On coral head, probably at Barbados, 4 June 1918; Barbados Antigua Expedition, coll.; 1♀, 1♂, both badly shriveled, USNM 10140.

Infesting Petrolisthes armatus (Gibbes). St. Vincent's Bar, Apalachicola, Florida, 25 Sep. 1935; A. S. Pearse, coll.; 5♀, 2♂, USNM 86854. NE end Fisher Island, Miami, Florida, 14 Nov. 1970, J. C. Markham, coll.; 1♀, 1♂, MCZ. Rock reef at NE corner Key Biscayne, Miami, Florida, 20 Mar. 1948, H. D. Doochin, coll.; 1♀, UMML 32.2270. Same locality, 15 Apr. 1970, F. Mucha, coll.; 2♀, 2♂, YPM 7121. Same locality, 18 Apr. 1970, J. C. Markham, coll.; 11♀, 11♂, UMML 32.4522. Same locality, 2 May 1970, J. C. Markham, coll.; 6♀, 6♂, USNM 141606. Same locality, May 1971, J. C. Markham, coll.; 5♀, 5♂, RMNHL. Bear Cut Bridge, Virginia

Key, Miami, Florida, 12 Aug. 1951, coll. unknown; 1♀, 1♂, reference specimens, UMML 32.4531. N end Soldier Key, Biscayne Bay, Florida, 25 Apr. 1970, J. C. Markham, coll.; 1♀, 1♂, UMML 32.4535. Off Dinner Key, Miami, Florida, in shallow water, 1 Feb. 1972, E. S. Iversen, coll.; 2♀, 2♂, ZMC. Under concrete slabs at water's edge, S end Bayfront Park, Coconut Grove, Miami, Florida, 1 June 1972, J. C. Markham, coll.; 2♀, 2♂, UMML 32.4537.

Infesting Porcellana sayana (Leach). 20 miles offshore from North Carolina, 20 July 1965, R. W. Heard, coll.; 5♀, 2♂, UMML 32.4532. Off Beaufort, North Carolina, 34°28'N, 76°13'W, 37m, 27 Apr. 1970, R. W. Heard, coll., hosts in gastropod shells occupied by Petrochirus diogenes (L.); 2♀, 2♂, UMML 32.4533. St. John, Virgin Islands, 6 Apr. 1971, A. R. Teyaud, coll., host in gastropod shell occupied by Petrochirus diogenes; 1♂, UMML 32.4534. Pillsbury Sta. P-616, Gulf of Honduras, 16°01' N, 88°43'W, 13m, 9 Mar. 1968, R. H. Gore, det. of host; 1 immature ♀, 1♂, UMML. Pillsbury Sta. P-767, N of Peninsula de la Guajira, Colombia, 12°16'N, 71°03'W, 24-26m, 28 July 1968, R. H. Gore, det. of host; 1♀, 1♂, UMML. Pillsbury Sta. P-761, W of Peninsula de la Paraguaná, Venezuela, 11°52'N, 70°22'W, 35m, R. H. Gore, det. of host, in gastropod shell occupied by Petrochirus diogenes; 1♀, 1♂, UMML.

Description of reference female (Fig. 14).

Length 6.0mm, maximal width 4.3mm, head length 1.7mm, pleon length 1.4mm. Distortion 20°. Body outline smoothly oval, all body regions and segments distinct (Figs. 14A, B).

Head broader than long. Frontal lamina reduced anteriorly but produced into points laterally. No eyes. Terminal segment of each antenna

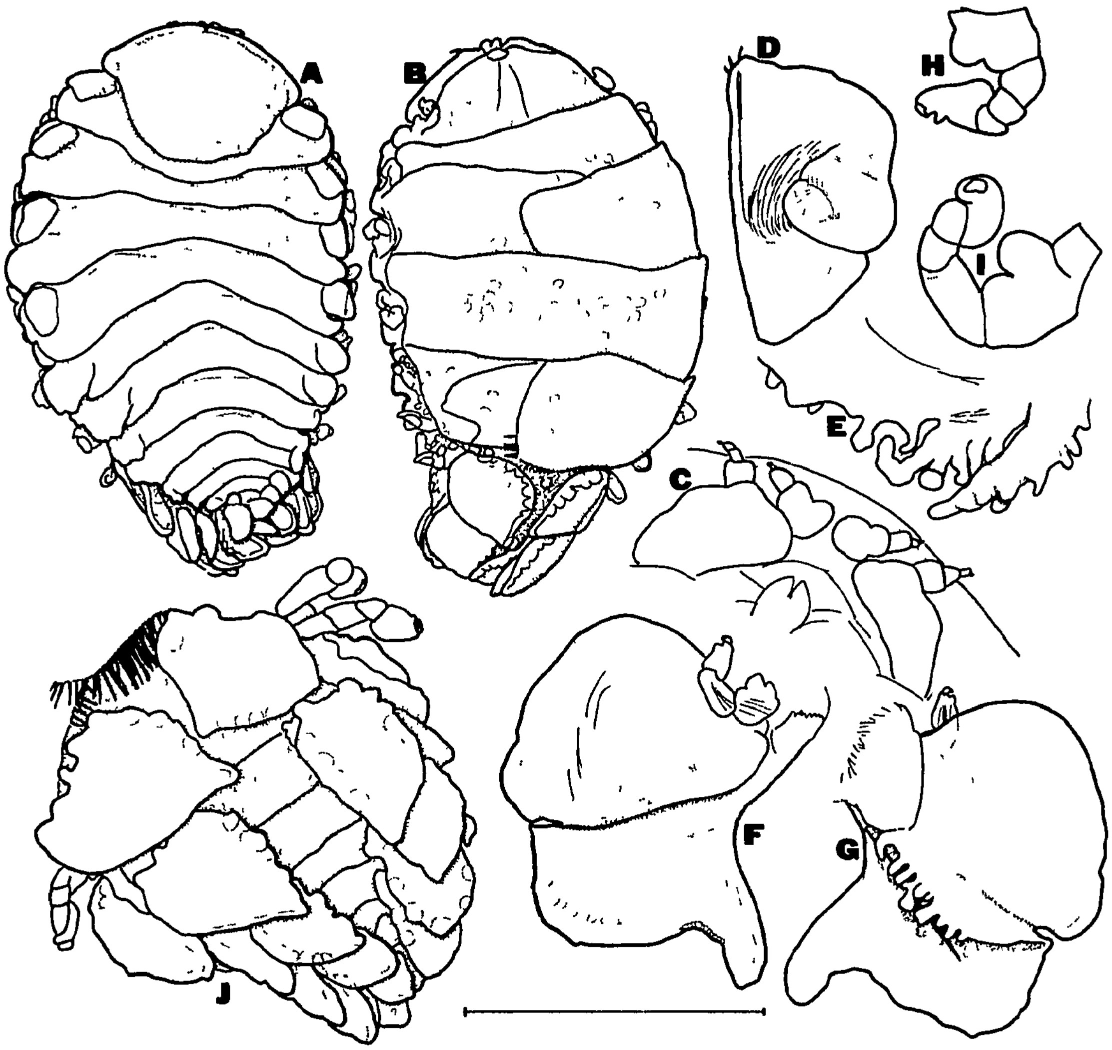

Fig. 14. Aporobopyrus curtatus (Richardson), reference female. A. Dorsal. B. Ventral. C. Antennae. D. Left maxilliped. E. Right posteroventral border of head. F. Left oostegite 1, external. G. Same, internal. H. Left pereopod 1. I. Left pereopod 7. J. Pleon, ventral. Scale: 1.0mm for C, E, H, I; 2.0mm for D, F, G, J; 4.0mm for A, B.

(Fig. 14C) markedly smallest and tipped with some setae; basal segment of antenna 2 greatly enlarged. Maxilliped (Fig. 14D) subtriangular, anteromedial corner produced into nonarticulated palp bearing some long setae. Posteroventral border of head (Fig. 14E) with 2 pairs of long deeply divided projections laterally and smaller processes medially.

Pereon with slightly raised ridge along middorsal surface, broadest across pereomere 3. Pereomere 1 strongly bent around head, pereomere 2 nearly straight across, others progressively more concave posteriorly. Prominent dorsolateral bosses on pereomeres 1-4. Coxal plates greatly reduced. Oostegites tightly enclosing brood pouch; oostegite 1 (Figs. 14 F, G) rounded anteriorly, with digitate projections on internal ridge, fairly sharp, slightly falcate posterolateral point. Pereopods (Figs. 14H, I) slightly larger posteriorly, all with prominent basal carinae and enlarged distal ends on propodi.

Pleon of 6 pleomeres, each produced into tiny lateral plates. Five pairs of biramous pleopods (Fig. 14J) only partly covering ventral surface of pleon; rami of each pleopod nearly equal in size, triangular, with tuberculate margins. Pair of uniramous uropods similar to pleopods.

Variations.

One of the females infesting Porcellana sayana shows several differences from the reference female. Its pereopods completely lack basal carinae, and its pleopods have endopodites which are broader than the corresponding exopodites, all completely lacking tubercles. Another female, from Petrolisthes galathinus, has more setose antennae, a distinctly 2-segmented maxilliped palp, a less digitate posteroventral border of the head and a narrower and rather distorted pleon. Other females examined exhibit many combinations of several of these variations.

Description of reference male (Figs. 15A-F).

Length 2.0mm, maximal width 0.8mm, head length 0.3mm, pleon length 0.5mm. Body smoothly tapered, all body regions and segments distinct (Figs. 15A, B).

Head broader than long, nearly oval in outline. Eyes near posterior border. Antennae (Fig. 15C) both tipped with many setae on distal and subdistal segments, fewer proximally.

Pereon slightly broadest across pereomere 4. Slight middorsal ridge along entire pereon, continuing onto pleon. Pereopods (Figs. 15D, E) slightly smaller posteriorly, only first 2 pairs with well developed dactyli.

Pleon not abruptly narrower than pereon, of 6 distinct pleomeres, all separated laterally. Faint swellings on lateroventral areas, but no pleopods or uropods. Final pleomere (Fig. 15F) partly surrounded by fifth pleomere, its lateral edges directed posteriorly and framing anal cone.

Variations.

In some males, the pereomeres are deeply separated by anterolateral indentations. The terminal pleomere varies considerably, ranging from a prominent 3-pointed structure in the reference male through a small single-pointed one (Fig. 15G) to a tiny knob embedded in the fifth pleomere (Fig. 15H).

Discussion.

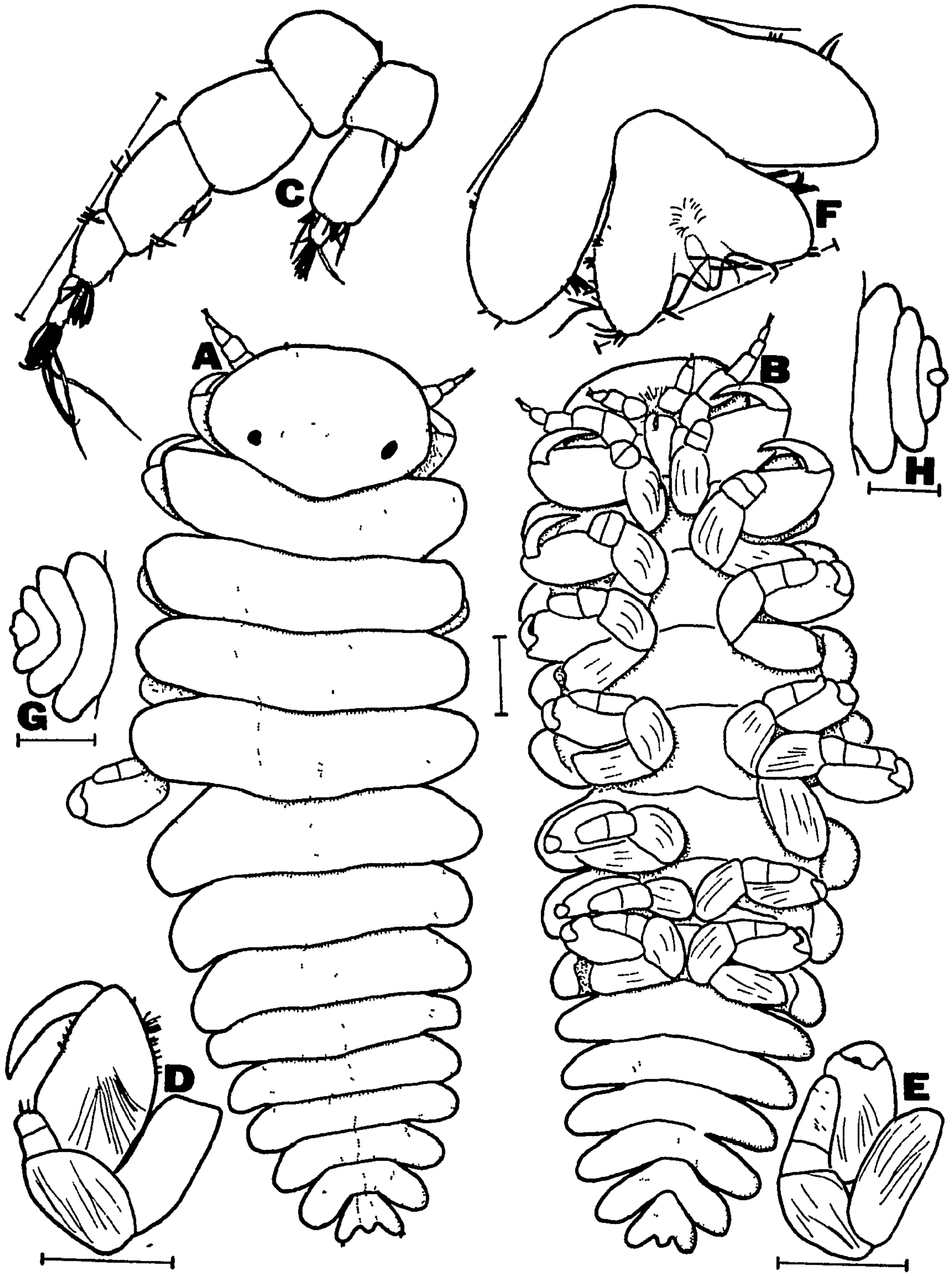

Fig. 15. Aporobopyrus curtatus (Richardson). A-F, reference male; G-H, other males. A. Dorsal. B. Ventral. C. Left antennae. D. Left pereopod 1. E. Left pereopod 7. F. Pleomeres 5-6, ventral. G. Pleomeres 3-6, dorsal. H. Pleomeres 3-6, dorsal. Scales: 0.2mm.

This species, originally referred to *Pseudione* by Richardson (1904a, 1905), has seen considerable confusion in generic placement. Nobili (1906), upon establishing the genus *Aporobopyrus*, first proposed the placement of this species in that genus because he did not know how to distinguish it from the type-species, *A. aduliticus*. Nierstrasz and Brender à Brandis (1923, 1925) at first retained this species in *Pseudione* and then (Nierstrasz and Brender à Brandis, 1929) explicitly agreed with Nobili that it should be in *Aporobopyrus*; later, however (Nierstrasz and Brender à Brandis, 1931) they referred it to *Pseudione* again without comment. Monod (1933) stated clearly that he agreed with earlier opinions that it should be in *Aporobopyrus*. Shiino has seemed rather undecided, placing it alternately in *Pseudione* (Shiino, 1933, 1952) and in *Aporobopyrus* (Shiino, 1934, 1964). Other authors cited above in the synonymy evidently referred only to Richardson's citations without considering further opinions.

There is nothing by which the types of *Aporobopyrus johannis* can be distinguished from *A. curtatus*; indeed, they are nearly intermediate in the range of characters exhibited by this species. Thus I believe that *A. johannis* is properly considered a junior synonym of *A. curtatus*. Strangely, in describing *A. johannis*, Nierstrasz and Brender à Brandis (1929) did not contrast it with *A. curtatus*, even though, in the same report, they contrasted *A. gracilis* with *A. curtatus*. The only published tabulation of character distinguishing *A. curtatus* and *A. johannis* is that of Shiino (1934), who was misled by errors in the orginal published drawings of *A. johannis*.

The type material of *A. curtatus* is somewhat confusing. In the bottle labeled as types are 2 males, though Richardson (1904a) does not mention this. One male is 2.7mm long, and, to judge from the magnification indicated with the drawing (Richardson, 1904a, fig. 75), this must be the one described. However, it appears that the other male, which is 1.3mm long, was actually the one drawn. The smaller male has eyes, a straight border along the posterior of its head and the final pleomere reduced to a tiny button, all of which are evident in Richardson's drawing. The larger male has no eyes, a posteriorly convex head and an extended final pleomere. Another difference is that the larger male has prominent ventral pleonal "pleopodal" swellings which the other one lacks. All of these variations also occur among other specimens examined.

The host for this species was originally listed as Petrolisthes sexspinosus (Gibbes), which Haig (1956) cites as a junior synonym of P. galathinus, so this is not a new host record. Although the host of the types of Aporobopyrus johannis was not mentioned, it is present in the container with them, and I have identified it as P. galathinus also. The other hosts are new records. P. armatus, previously unrecorded as the host of any bopyrid in the northwestern Atlantic, is occasionally heavily infested, to 40% in the vicinity of Miami. For some reason, the occurrence of the parasites is very patchy. Rouse (1970) collected decapods throughout the Everglades region, starting shortly to the south of Miami, and, though he recorded a number of bopyrids from them, he found none infesting P. armatus, of which he had several hundred specimens. I have examined his material and confirmed that there are no parasites; on this host, the parasite produces a highly conspicuous branchial swelling, so its presence is readily detectible. The collection of 5 parasitized individuals at Apalachicola, Florida, on the Gulf of Mexico, indicates a high local infestation; still, Richard Heard (personal communication) has examined over 100 P. armatus on Mississippi's Gulf Coast without finding any parasites. According to Gore (1972), the range of P. armatus is "..the west coast of Africa, the lower east coast of the United States, and throughout the Caribbean to Brazil...[and] on both sides of the Panamanian isthmus." In 3 parts of this range it is known to be parasitized, each place by a different bopyrid. Lemos de Castro (1965a) records Aporobopyrus gracilis from both Petrolisthes armatus and P. galathinus in Brazil, while I have found A. curtatus on both of these hosts in the West Indian region. In the Pacific, Orbimorphus constrictus Richardson is known from P. armatus off Perú (Richardson, 1911). Gore (1972) has raised the possibilty that the Atlantic and Pacific forms of P. armatus may not be conspecific in light of larval distinctions; this marked difference in parasites may be further evidence, though hardly proof, of such a difference. This is the first record of bopyrid infestation of P. marginatus.

Menzies and Frankenberg (1966) report a bopyrid parasite of "a snapping shrimp" from Georgia, which, they say, "...appears related to Pseudione curta [sic] (Richardson)." Having examined those specimens, which Richard Heard furnished to me, I have identified them as Bopyrina sp. (probably new); the host is Synalpheus minus (Say).

Some infested Petrolisthes armatus were kept alive in an aquarium for over a month, during which several underwent seemingly normal molts, but no female hosts produced eggs. In one instance, newly released cryptoniscans were captured and placed in petri dish with live copepods taken in a plankton tow in Bear Cut, i. e. in the same water mass which flows over the host population on Key Biscayne. Even though both the larvae and the copepods remained alive and active for more than 2 weeks, there was never any evidence of attachment of the larvae to any copepods, so the alternate host of Aporobopyrus curtatus remains unknown. All infested females of Porcellana sayana examined were ovigerous.

NEW GENUS A

Type-species, by original designation, New Genus A n. sp.

Total number of species, 1. Geographical distribution: St. Croix, Virgin Islands.

Generic diagnosis.-- Female: Body smoothly curved; frontal lamina large and broad; pereomeres lacking coxal plates and dorsolateral bosses; 6 pleomeres; pleopods biramous; uropods uniramous. Male: Head separate from pereon; pereopods progressively smaller posteriorly; pleon of 5 pleomeres; no trace of pleopods or uropods.

West Indian faunal region species: only 1 species, New Genus A n. sp.

New Genus A n. sp.

Figs. 16, 17

Material examined.

Infesting _Clastotoechus vanderhorsti_ (Schmitt), hosts identified by R. H. Gore. Beneath _Echinometra lucunter_ (L.) in surf zone on eroded limestone shelf SW of Fredericksted, St. Croix, Virgin Island, 29 Mar. 1970, A. R. Teytaud, coll.; 1♀, holotype, USNM 141589, 2♂, allotype, USNM 141590, paratype, USNM 141591.

Description of holotype female (Fig. 16).

Length 2.0mm, maximal width 1.1mm, head length 0.5mm, pleon length 0.4mm. Distortion 39°. Body rather smoothly rounded, suboval in outline; body regions and segments distinct (Figs. 16A, B).

Head broader than long, whole anterior margin covered by broad frontal lamina. Small eyes near sides of head. Slight depression near anter-

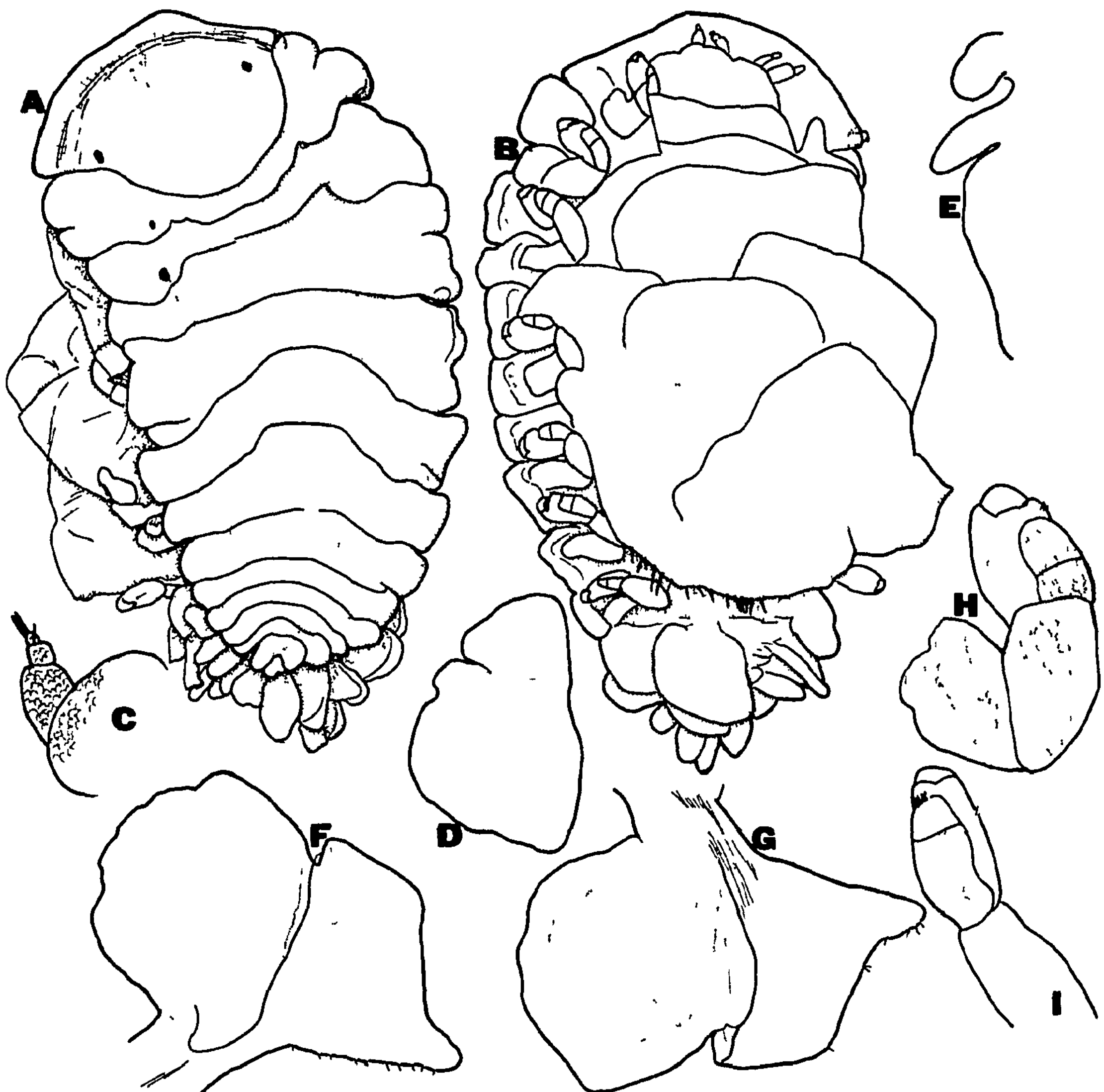

Fig. 16. New Genus A n. sp., holotype female. A. Dorsal. B. Ventral. C. Left antenna 2. D. Right maxilliped. E. Right posteroventral border of head. F. Right oostegite 1, external. G. Same, internal. H. Right pereopod 1. I. Left pereopod 7. Scale: 1.0mm for A, B; 0.6mm for D, F, G; 0.3mm for C, E, I; 0.15mm for H.

ior edge of dorsal surface. Antenna 1 of 5 segments, distal 2 bearing some setae; antenna 2 (Fig. 16C) of 4 sgments, distal one with cluster of terminal setae, second with 1 seta. Maxilliped (Fig. 16D) subtriangular, without palp. Posteroventral border of head (Fig. 16E) with 2 short simple projections on each side.

Pereon broadest across pereomeres 2 and 3. Slightly raised middorsal ridge along whole length. Dorsolateral bosses and coxal plates absent from all pereomeres. Margins of pereon irregular, some pereomeres slightly indented laterally. Oostegites completely enclosing brood pouch; oostegite 1 (Figs. 16F, G) with irregularly rounded anterior region, entire internal ridge, blunt posterolateral point. Pereopods (Figs. 16H, I) all of similar structure, nearly doubling in size posteriorly.

Pleon of 6 pleomeres, all of about same length, but decreasing in width posteriorly. Lateral margins not developed into lateral plates. Five pairs of overlapping biramous pleopods completely covering ventral surface of pleon with pair of uniramous uropods.

Description of allotype male (Fig. 17).

Length 1.4mm, maximal width 0.4mm, head length 0.3mm, pleon length 0.3mm. Sides of body nearly parallel except for posterior taper (Figs. 17A, B). All body region and segments distinct.

Head as broad as pereon, deeply set into it. Prominent black eyespots near posterior border, and similar pigment spots continuing onto pereon. Antenna 1 (Fig. 17C) of 3 segments, each bearing setae. Antenna 2 (Fig. 17D) of 5 segments, distal one with cluster of terminal setae, some on 2 other segments.

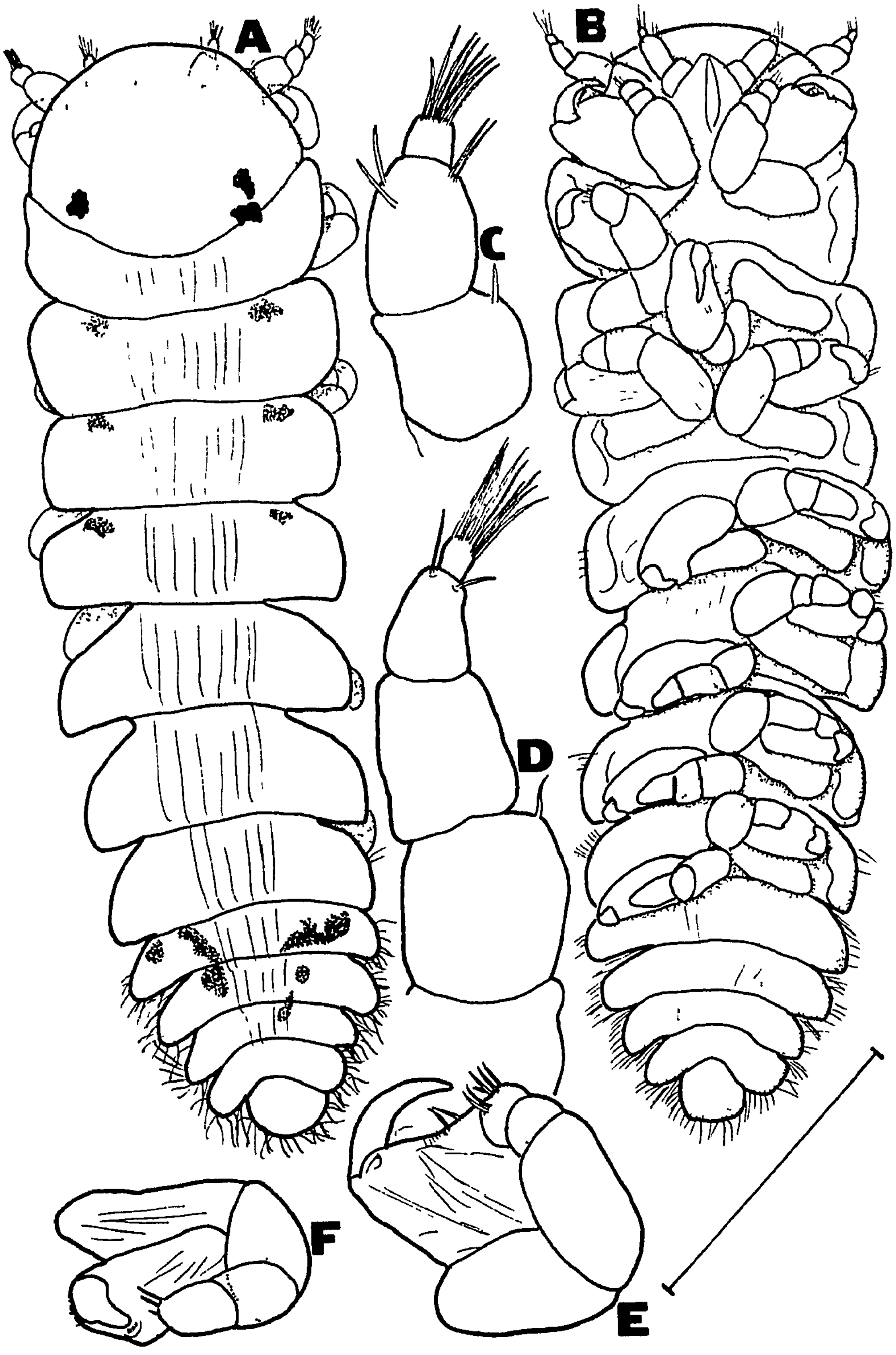

Fig. 17. New Genus A n. sp., allotype male. A. Dorsal. B. Ventral. C. Right antenna 1. D. Right antenna 2. E. Right pereopod 1. F. Left pereopod 7. Scale: 0.4mm for A, B; 0.2mm for E, F; 0.1mm for C, D.

Pereon broadest across pereomeres 1 to 5, others slightly narrower. Most pereomeres separated by lateral indentations. No midventral tubercles. Fine setae on lateral margins of several pereomeres. Pereopods (Figs. 17E, F) progressively smaller posteriorly; dactyli of pereopod 1 long and sharp, others reduced; carpus of each distinctly setose.

Pleon of 5 pleomeres, each of about same length and much shorter than pereomeres; terminal pleomere subcircular, partly surrounded by preceeding one. Entire lateral and posterior borders of pleon fringed with fine setae. No pleopods or uropods.

Variations.

The paratype male has evidently been damaged because it pleon ends abruptly after the third pleomere. Its head is much shorter relative to its width, but there are no other significant differences.

Discussion.

The female of New Genus A n. sp. differs from those of most other closely allied genera in lacking both dorsolateral bosses and coxal plates. In Aporobopyrosa, dorsolateral bosses are absent but coxal plates well developed. Only in Parapseudione females are both absent, but those females also lack frontal laminae and have uniramous fifth pleopods. Among males, New Genus A n. sp., in having 5 pleomeres, is most similar to Parionella, in which the head and pereon are markedly separated, to Upogebiophilus, which has pleopods, and to Aporobopyrina, in which the pleon narrows abruptly posteriorly. The distinctions in both sexes seem adequate to justify the creation of a new genus.

This is the first record of bopyrid infestation of this or any species of Clastotoechus.

PLEUROCRYPTA HESSE, 1865

Type-species, by monotypy, Pleurocrypta galateae Hesse, 1865. Gender, feminine.

Total number of species, 12. Geographical distribution: Western Europe and Britain through Mediterranean to Turkey; Congo; Florida; Kei Islands; East Indies; Misaki, Japan.

Generic diagnosis.-- Female: Head completely distinct from pereon, posteroventral border bearing 2 long lateral projections on each side; Maxilliped with palp or setae indicating trace of palp; pereomeres with lamellar coxal plates; oostegite 1 smoothly rounded anteriorly, slightly pointed posterolaterally; 6 pleomeres with slightly to greatly developed lateral plates; pleopods biramous, more or less lanceolate; uropods uniramous, lanceolate. Male: Head usually fused with pereon; eyes present; sides of body nearly parallel; pleon usually fused; no pleopods or uropods.

Remarks.-- Pleurocrypta is very similar to Pseudione; in several species of the former, frequent aberrations occur, making them resemble species of Pseudione. In his key to European genera of Pseudioninae, Bourdon (1968, p. 151) includes this couplet to distinguish these 2 genera: "-- Jamais de saillies tergales ni de crêtes oostégales; abdomen du ♂ généralement segménté....Pseudione Kossmann.-- Souvent avec saillies tergales ou crêtes oostégales; abdomen du ♂ généralement soudé....Pleurocrypta Hesse." This clearly stresses the frequent unreliability of the characters distinguishing these 2 genera. An additional character which serves to distinguish the males is the complete lack of pleopods in Pleurocrypta, while the males of Pseudione always have at least rudimentary pleopods. Locally, the single species of Pleurocrypta may be distinguished from all species of Pseudione in that its female has much better developed coxal plates, as indicated in the above key to genera.

Species of Pleurocrypta have been found infesting galatheids and porcellanids in Europe and northern Africa (Bourdon, 1968), the Aegean coast of Turkey (Geldıay and Kocataş, 1972) and in the islands of the far western Pacific (Nierstrasz and Brender à Brandis, 1931). The only exception to this host distribution is P. langi Van Name, which infests a Upogebia in the Congo, and which its author, Van Name (1920) placed in this genus rather doubtfully because of some anomalous morphological characters of its female, the only sex known. The new species described below is the first record of the genus in the western Atlantic or from the Americas, but it does not add a new host genus because it infests a Galathea, the genus to which 5 of the hosts of the other currently recognized species of Pleurocrypta belong.

West Indian faunal region species: only 1 species, Pleurocrypta n. sp.

Pleurocrypta n. sp.

Figs. 18, 19

Material examined.

Infesting Galathea rostrata A. Milne Edwards, host identified by B. S. Mayo. Gerda Sta. G-1037, off Alligator Reef, Florida, 24°50'N, 80° 36'W, 42m, 26 Feb. 1969; 1♀, holotype, USNM 141601, 1♂, allotype, USNM 141602.

Description of holotype female (Fig. 18).

Length 4.1mm, maximal width 1.8mm, head length 0.7mm, pleon length 0.9mm. Distortion 23°. Body tapered both ways, quite narrow relative to

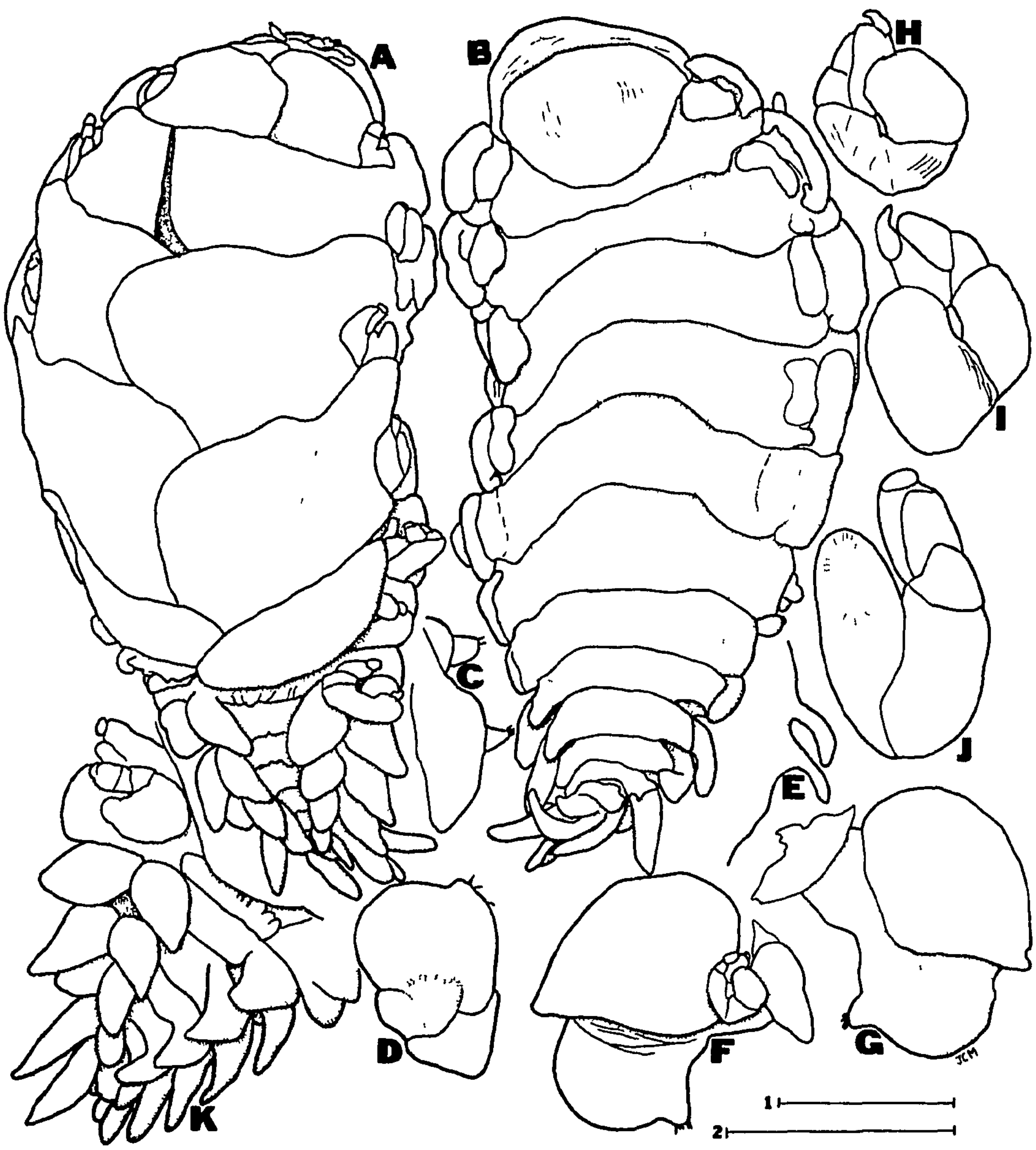

Fig. 18. Pleurocrypta n. sp., holotype female. A. Ventral. B. Dorsal. C. Left antennae. D. Right maxilliped. E. Left posteroventral border of head. F. Right oostegite 1, external. G. Same, internal. H. Left pereopod 1. I. Right pereopod 2. J. Right pereopod 7. K. Pleon, ventral. Scale 1: 1.0mm for A, B; 0.5mm for E. Scale 2: 0.4mm for C, D, F-J; 1.0mm for K.

length. All body regions and segments distinct (Figs. 18A, B).

Head oblong, somewhat broader than long. Large frontal lamina covering anterior edge and sides. No eyes. Antennae (Fig. 18C) reduced, of indeterminate segmentation, tipped with some setae. Maxilliped (Fig. 18D) rather irregularly shaped, lacking palp, but with sparse setae on anteromedial margin. Posteroventral border of head (Fig. 18E) with pair of simple projections on each side.

Pereon irregular in outline, broadest across pereomeres 2 and 3. Well developed coxal plates on all pereomeres; dorsolateral bosses on pereomeres 1-4; no tergal projections. Oostegites lacking crests (cf. Bourdon, 1968), completely enclosing brood pouch; oostegite 1 (Figs. 18F, G) smoothly rounded anteriorly, with unadorned internal ridge, slight posterolateral point. All pereopods (Figs. 18H-J) similar in structure but gradually larger posteriorly; basal segment of each pereopod produced into large carina.

Pleon (Fig. 18K) of 6 pleomeres, first 5 produced into slight lateral plates; pleopods biramous, all about same size; endopodites smaller, elliptical, exopodites more lanceolate. Terminal pleomere produced into bulbous pleotelson with pair of long lanceolate uniramous uropods at base.

Description of allotype male (Fig. 19).

Length 0.8mm, maximal width 0.3mm, head length 0.1mm, pleon length 0.2mm. Sides of body nearly parallel in middle, anterior rounded, posterior pointed. All body regions distinct (Figs. 19A, B).

Head broader than long. Pair of large black eyes near posterior border. Antennae (Fig. 19C) both 3-segmented, segments rapidly decreasing in size distally; both antennae with terminal setae, antenna 1 also bearing several setae on middle segment.

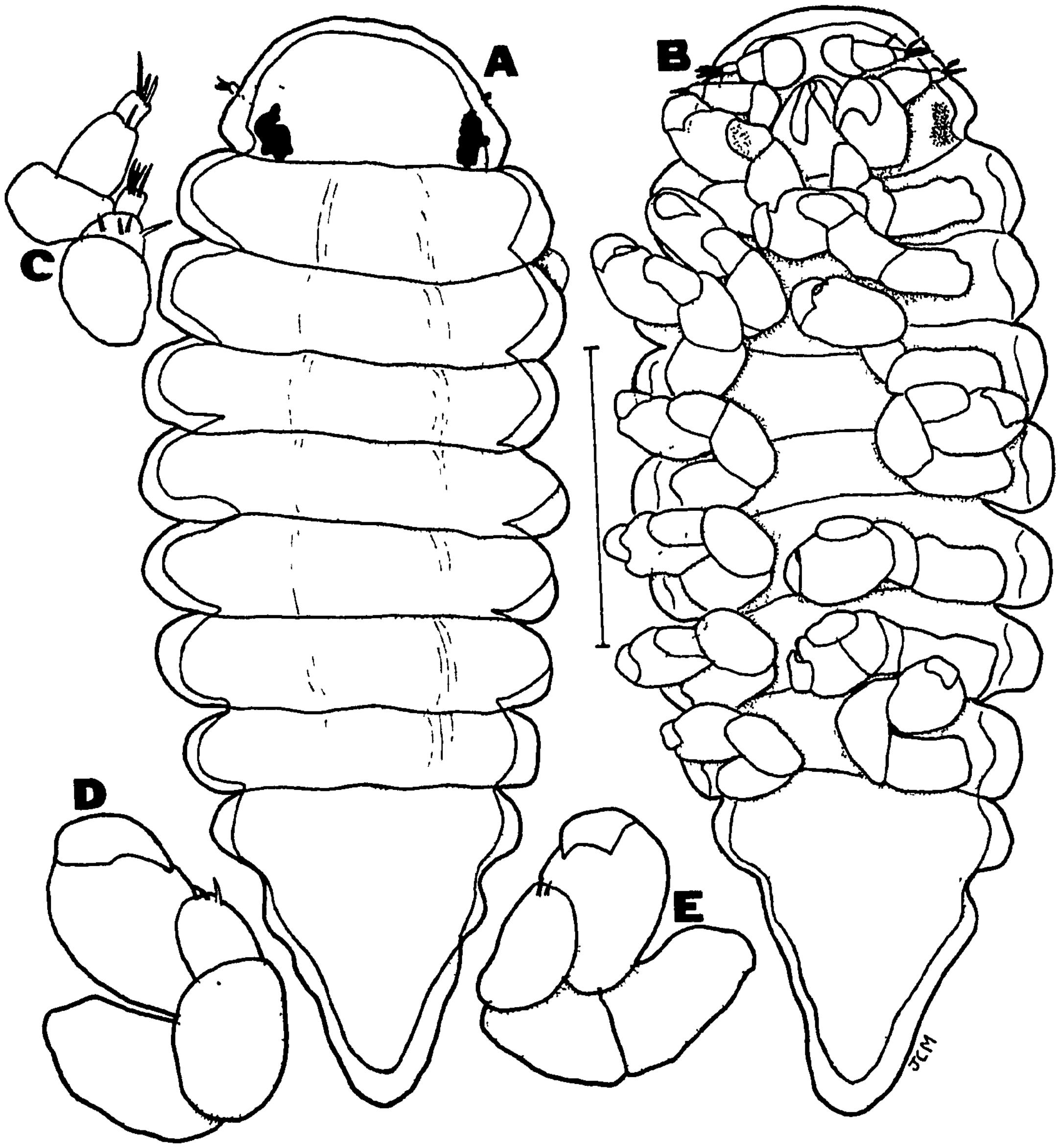

Fig. 19. Pleurocrypta n. sp., allotype male. A. Dorsal. B. Ventral. C. Right antennae. D. Right pereopod 1. E. Left pereopod 7. Scale: 0.2mm for A, B; 0.1mm for C-E.

Pereon slightly broadest across pereomere 4. Pereopods (Figs. 19D, E) essentially alike, dactyli somewhat smaller posteriorly, merus and carpus of each pereopod apparently fused.

Pleon fused, but sinuous margin indicating traces of 3 pleomeres. No pleopods or uropods.

Discussion.

Pleurocrypta n. sp. differs from *P. strigosa* Giard and Bonnier, *P. longibranchiata* (Bate and Westwood) and *P. galateae* Hesse in that its female lacks tergal projections; its female differs from those of *P. piriformis* Bourdon in lacking digitate margins on the lateral projections of the posteroventral border of the head, from those of *P. microbranchiata* in having a much more extended pleon and more prominent lateral projections on the posteroventral border of the head, and from those of *P. porcellanae* in having no maxilliped palp and a much larger pleotelson. Among extra-European species, the female of *P. amphiandra* Codreanu, Codreanu and Pike (1966) differs from that of *Pleurocrypta* n. sp. as follows: very large, with large crenulate coxal plates, uropods rudimentary to absent. *P. keiensis* Nierstrasz and Brender à Brandis (1931) is distinguished from *Pleurocrypta* n. sp. in that its female has a much broader frontal lamina, short coxal plates and fairly large lateral plates. In *P. langi* Van Name, the female has no frontal lamina, more of its pereomeres bear dorsolateral bosses, its coxal plates are shorter, and its lateral plates are longer and more sinuate. The female of *P. macrocephalon* Nierstrasz and Brender à Brandis (1923) has a very large extended head and a greatly reduced pleon. In *P. yatsui* (Pearse, 1930), the female has a very broad frontal lamina, no dorsolateral bosses and fewer coxal plates. In those 10 species whose males are known, there are, in all cases, significant distinctions between them and the male of *Pleurocrypta* n. sp.

MUNIDION HANSEN, 1897

Type-species, by original designation, Munidion princeps Hansen, 1897. Gender, neuter.

Total number of species, 7. Geographical distribution: Java Sea and Philippines; Vancouver I. and Straits of Juan de Fuca; California and Baja California; off Ecuador; S Florida through Cuba to British Honduras and Curaçao.

Generic diagnosis.-- Female: Body moderately distorted, all regions distinct; prominent frontal lamina along whole anterior edge of head; pereopods with blunt point on anterior edge of each basis; lamellar coxal plates covering anterior edges or entire lateral margins of all pereomeres; dorsolateral bosses on at least first 4 pereomeres; petiolate tergal projections on some or all pereomeres in some species; pleon of 6 pleomeres, first 5 bearing narrow to leaf-like lateral plates; pleopods biramous, narrow to leaf-like; terminal pleomere produced into knob-like to lanceolate pleotelson; uropods biramous, like pleopods. Male: Head usually separate from pereon; no part of body narrowing abruptly; pereomeres separated by lateral gaps; often midventral tubercle on each pereomere and anterior region of pleon; pleon fused, subtriangular, lacking appendages.

Remarks.-- Hansen (1897), reporting on isopods collected off the tropical American coasts, recorded the discovery of 5 species of bopyrids, all new, and all but one of which he assigned to new genera, which he characterized only by describing their type-species. Among these was a parasite of Munida refulgens Faxon, which he named Munidion princeps n. gen. n. sp. The validity of M. princeps has not been questioned, but there remained some question about the separate generic status of Munidion. Richardson (1905) presented a brief generic diagnosis based on 2 species, and Shiino (1934), drawing on information from 4 known species, tabulated characters by which Munidion could be distinguished from 9 other genera. Still, Bourdon (1968) and Codreanu (1968) considered Munidion difficult to distinguish from Pleurocrypta.

The second species assigned to Munidion was M. parvum, which Richardson (1904a) described as a parasite of Munida quadrispina Benedict from the Straits of Juan de Fuca, Washington. Richardson (1910) recorded Munidion laterale as a parasite of an unidentified galatheid in the Philippines; recently, Bourdon (1972a) reported it infesting Munida scabra Henderson in the Java Sea. Boone (1927) described Munidion irritans as a parasite of Munida elfina Boone (= Munida irrasa A. Milne Edwards) off the coast of British Honduras. Bourdon (1972b) has recently described Munidion parvum cubensis (which I am raising to specific status as M. cubense) parasitizing Munida stimpsoni A. Milne Edwards from Cuba.

I have examined type specimens of all the known species and have also found representatives of 2 new species of Munidion, one infesting Pleuroncodes planipes Stimpson, the first host not a Munida, off the coasts of California and Baja California, and the other, described herein, infesting 2 different Munida spp. from southern Florida to Cuba. My studies convince me that the genus Munidion is valid and distinguishable from all other genera by the characters listed in the above diagnosis. I also believe that all of the species which have been assigned to Munidion properly belong in it.

Most of the species of Munidion appear to be quite host specific, only 2 of them being known from more than a single host species. The genus is appropriately named since all the species but one infest species of Munida.

West Indian faunal region species: 3 species, Munidion cubense, Munidion irritans, Munidion n. sp.

Key to West Indian faunal region species of Munidion, based on adult females.

1. Pereonal tergal projections prominent, clearly rising above surface of pereon; pleonal lateral plates oval to foliaceous....M. cubense.

-- Pereonal tergal projections reduced or absent, not rising above surface of pereon; pleonal lateral plates reduced, lanceolate.......2.

2. Oostegite 1 with smooth or slightly toothed internal ridge, rounded posterolateral point; carinae on pereopodal bases reduced.......... ....M. irritans.

-- Oostegite 1 with elaborately toothed internal ridge, sharp posterolateral point; carinae on pereopodal bases prominent.Munidion n. sp.

Munidion cubense Bourdon, 1972

Figs. 20, 21

Munidion parvum cubensis Bourdon, 1972c, pp. 827-830, figs. 7, 8. (Type locality, Bahía de Cochinos, Cuba.)

Material examined.

Infesting Munida stimpsoni A. Milne Edwards. Harvard-Havana Expedition, Atlantis Sta. 3319, Bahía de Cochinos, Cuba, 22°13'N, 81°10'30"W, 125-215fm (= 230-390m), 4 Apr. 1939, F. A. Chace, Jr., det. of host; 1♀, holotype (allotype ♂ lost), MCZ 11506.

Infesting Munida flinti Benedict. Pillsbury Sta. P-757, SW of Curaçao, 11°40'N, 69°22'W, 134-161m, 27 July 1968, B. S. Mayo, det. of host; 1♀, 1♂, USNM.

Description of holotype female (Fig. 20).

Length 7.0mm, maximal width 3.5mm, head length 1.3mm, pleon length 1.4mm. Distortion 8°. Body (Fig. 20A) nearly symmetrical, smoothly tapered anteriorly and posteriorly from pereomere 2; all segments distinct.

Head subtriangular, with all 3 corners rounded, deeply set into pereon. No eyes. Antennae indistinctly articulated (Fig. 20B), though probably both 3-segmented; basal segment of antenna 2 greatly enlarged. Maxilliped (Fig. 20C) indented laterally. Posteroventral border of head (Fig. 20D) with 2 long processes and small adjacent knobs on each side, long pointed projection medially.

All pereomeres with well developed coxal plates not quite overlapping each other. Dorsolateral bosses on pereomeres 1-4, tergal projections on all pereomeres, largest on 2 and 3. Oostegite 1 (Figs. 20E, F) with rather bluntly rounded posterolateral point and irregularly crenulate internal ridge lacking dentate processes. Pereopods (Figs. 20G, H) all similar in structure, slightly larger posteriorly.

Pleon (Figs. 20A, I) of 6 pleomeres, tapering smoothly to point. Lateral plates on each of first 5 pleomeres, progressively smaller posteriorly. Five pairs of pleopods with foliaceous subequal rami overlapping and covering about half of ventral surface of pleon, decreasing in size posteriorly. Terminal pleomere bearing biramous uropods of same structure as pleopods, end as narrow lanceolate pleotelson.

Variations.

The other female is slightly more distorted (12°) but agrees in all

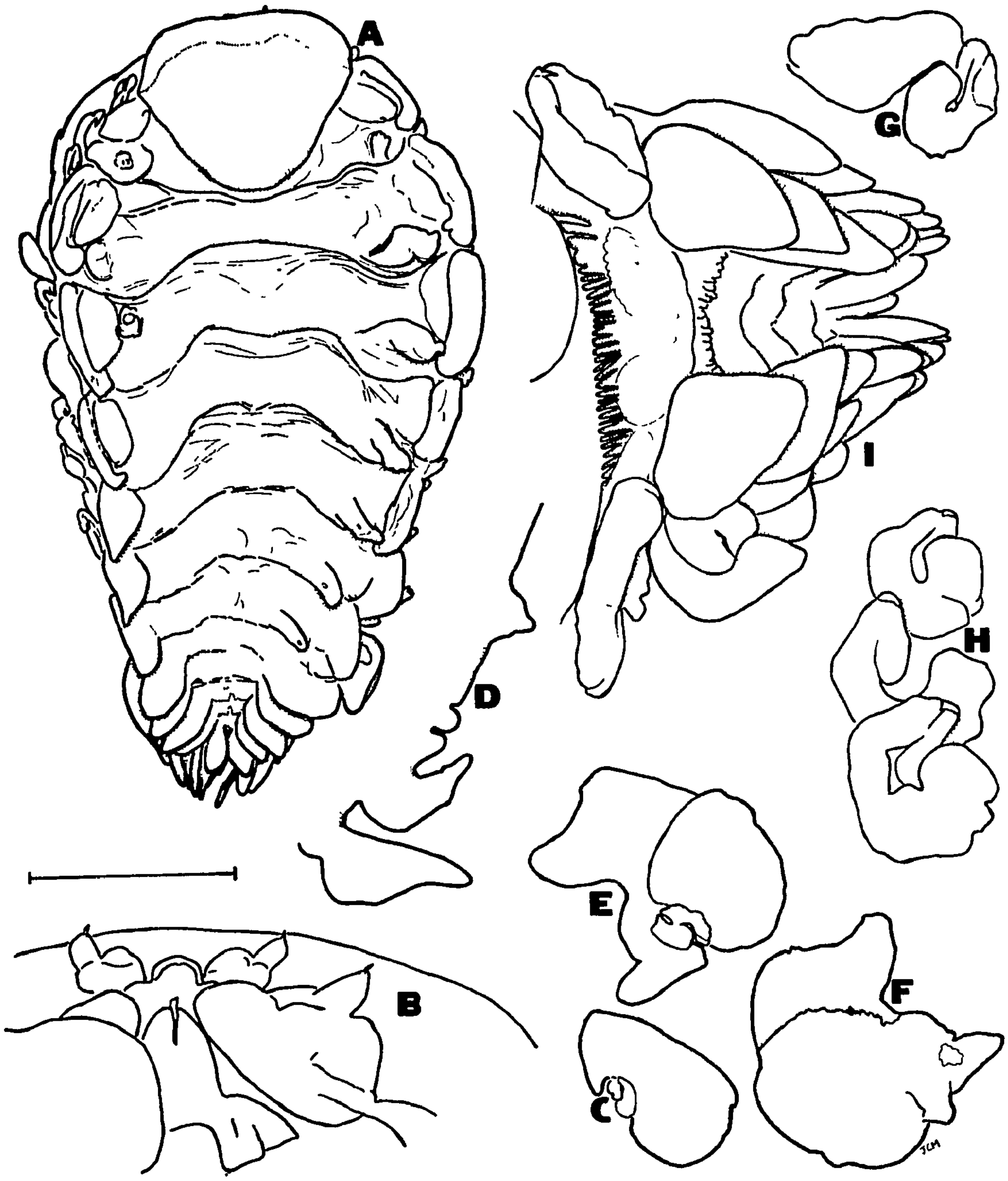

Fig. 20. Munidion cubense Bourdon, holotype female. A. Dorsal. B. Antennae. C. Right maxilliped. D. Posteroventral border of head. E. Oostegite 1, internal. F. Same, external. G. Left pereopod 1. H. Left pereopods 5-7 (top to bottom). I. Pleon, ventral. Scale: 2.0mm for A, C, E, F; 0.5mm for B, D; 1.0mm for G-I.

respects with the holotype.

Description of allotype male (Fig. 21).

(The allotype male has been lost, so I had no opportunity to examine it. Dr. Bourdon has kindly allowed me to reproduce the drawings which he had made of it, and the following description is based on the description written by Bourdon (1972c) and on his figures.)

Length 2.0mm, maximal width 0.7mm, pleon length 0.4mm. Head fused with pereon. Body tapered slightly from middle of pereon, then sharply narrowing at both head and pleon (Fig. 21A).

Head much broader than long. No eyes. Antennae (Fig. 21B) both 3-segmented; terminal segment of each bearing tuft of setae; longer second antenna also bearing single seta on distal edge of middle segment.

Pereomeres all distinctly separated by anterolateral indentations. Pereomeres 3-5 broadest, their sides parallel; other pereomeres slightly narrower and bent away from middle three. All pereopods (Figs. 21C, D) of nearly same size, but dactyli of first three large and sharply pointed, others reduced and blunt. Midventral tubercle on each pereomere.

Pleon fused, subtriangular, but with undulating margins indicating at least 3 coalesced pleomeres, end tapering to rounded point. Anterior region bearing midventral tubercle similar to those on pereomeres. No pleopods or uropods.

Variations.

The male infesting Munida flinti differs from the allotype in several minor respects. The sides of the body are rounded rather than partly parallel. The first antenna bears at least 13 setae terminally and 7

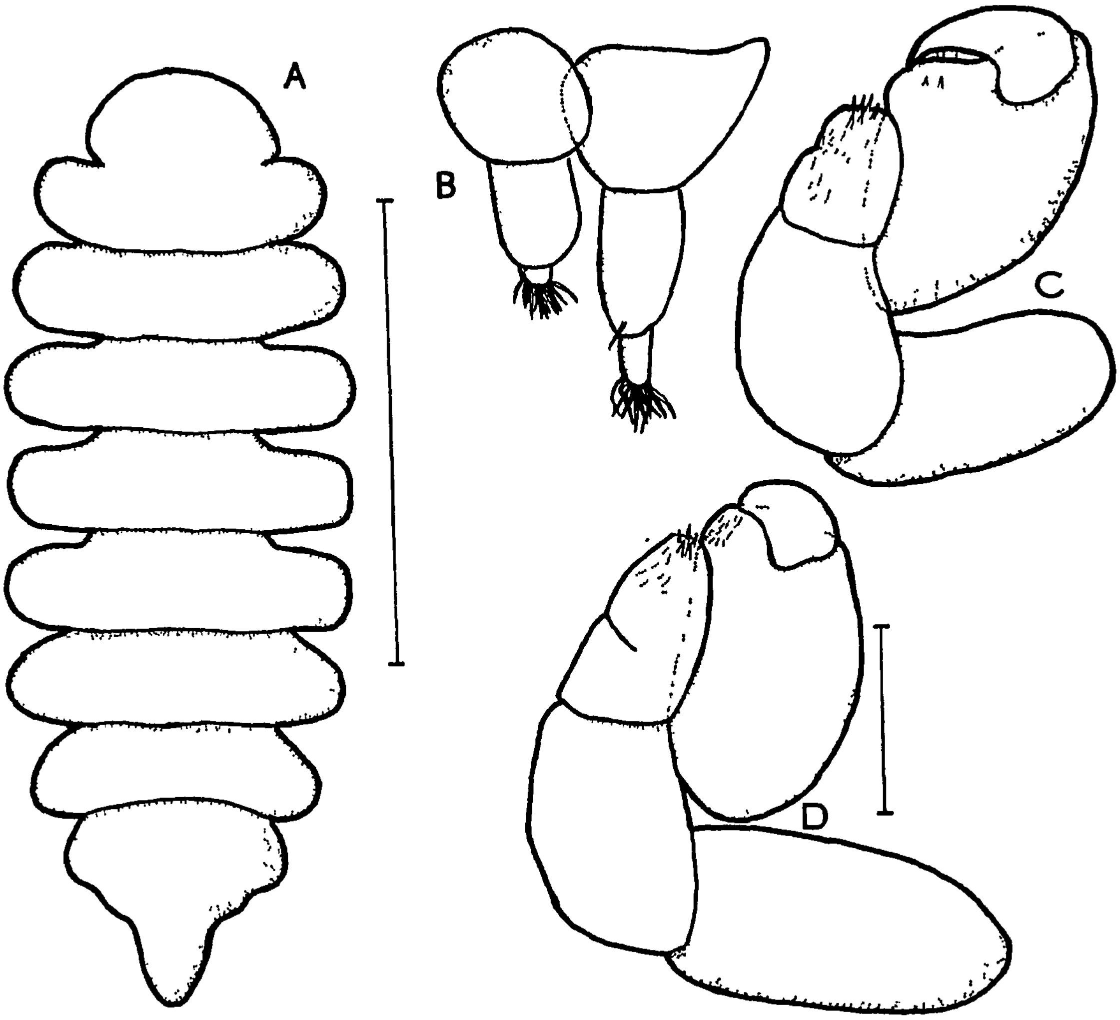

Fig. 21. Munidion cubense Bourdon, allotype male (redrawn after Bourdon, 1972c). A. Dorsal. B. Antennae. C. Pereopod 1. D. Pereopod 7. Scale at A: 1.0mm for A. Scale at D: 0.1mm for B-D.

setae near the distal edge of the middle segment; on the second antenna, the distal segment bears 8 terminal setae and 1 subterminal seta, and the middle segment bears 1 seta near the distal edge. The pereopods are like those of the allotype except that their segmentation is more distinct. The pleon is proportionately longer and narrows less abruptly than that of the allotype.

Discussion.

Bourdon (1972c), in first reporting this species, considered it to be a new subspecies of Munidion parvum. Although the females of these 2 species are similar, they do differ significantly from each other in several important characters. In females of M. parvum, the head is more extended and lacks a medial projection on its posteroventral border, dorsolateral bosses are evident on both sides of all pereomeres, the coxal plates are more foliate, the anterior region of the first oostegite is relatively much longer, and all the pleonal appendages are longer and cover the pleon completely, in contrast to the females of M. cubense. At the same time, the male of M. cubense is more like that of M. laterale than that of M. parvum. Finally, M. cubense occurs in the tropical Atlantic, remote from the known localities of M. parvum in the cold temperate region of the eastern Pacific. Taken together, these characters seem sufficiently different to warrant separate specific status for M. cubense.

Although I have recorded the specimens of Munidion cubense from 2 different host species, Munida stimpsoni and M. flinti, Barbara Shuler Mayo, who identified the latter host, informs me that these 2 species are very similar and may in fact be synonyms.

Munidion irritans Boone, 1927

Figs. 22-24

Munidion irritans Boone, 1927, pp. 143-144, fig. 32. (Type locality, Glover Reef, British Honduras.).-- Bourdon, 1968, p. 222; 1972c, p. 830.

Material examined.

Infesting Munida irrasa A. Milne Edwards. D. de S. Sta. 362, near Islamorada, Florida, 24°48'N, 80°26'W, about 90m, 22 Aug. 1961, D. de Sylva, coll., B. S. Mayo, det. of host; 1♀, 1♂, UMML 32.4518. Gerda Sta. G-589, near Cay Sal Bank, 24°39'N, 80°46'W, 148-152m, 14 Apr. 1965, B. S. Mayo, det. of host; 1♀, 1♂ (reference ♂), USNM. Gerda Sta. G-842, near Cay Sal Bank, 24°38'N, 80°42'W, 179m, 11 July 1967, B. S. Mayo, det. of host; 1♀, 1♂, UMML 32.4519. Gerda Sta. G-1099, S of Dry Tortugas, Florida, 24°12'N, 82°50'W, 620m, 28 Apr. 1969, B. S. Mayo, det. of host; 1♀, USNM. Bingham Oceanographic Foundation ship Pawnee Station, N of Glover Reef, British Honduras, about 16°N, 88°W, 670m, 20 Apr. 1925, L. Boone, det. of host; 1♀, holotype (allotype ♂ lost), YPM 6565.

Description of holotype female (Figs. 22, 23).

Length 4.1mm, maximal width 2.0mm, head length 0.9mm, pleon length 0.8mm. Distortion 20°. Body smoothly rounded, nearly oval except for pleopods. All body regions and segments distinct (Fig. 22).

Head nearly as long as broad, triangular, long slightly rounded posterior point extending deeply into pereon; small frontal lamina across anterior edge. No eyes. Antennae indistinguisable. Maxilliped (Fig. 23A) slightly indented along lateral margin. Posteroventral border of head (Fig. 23A) with 2 blunt-tipped projections on each side, smoothly

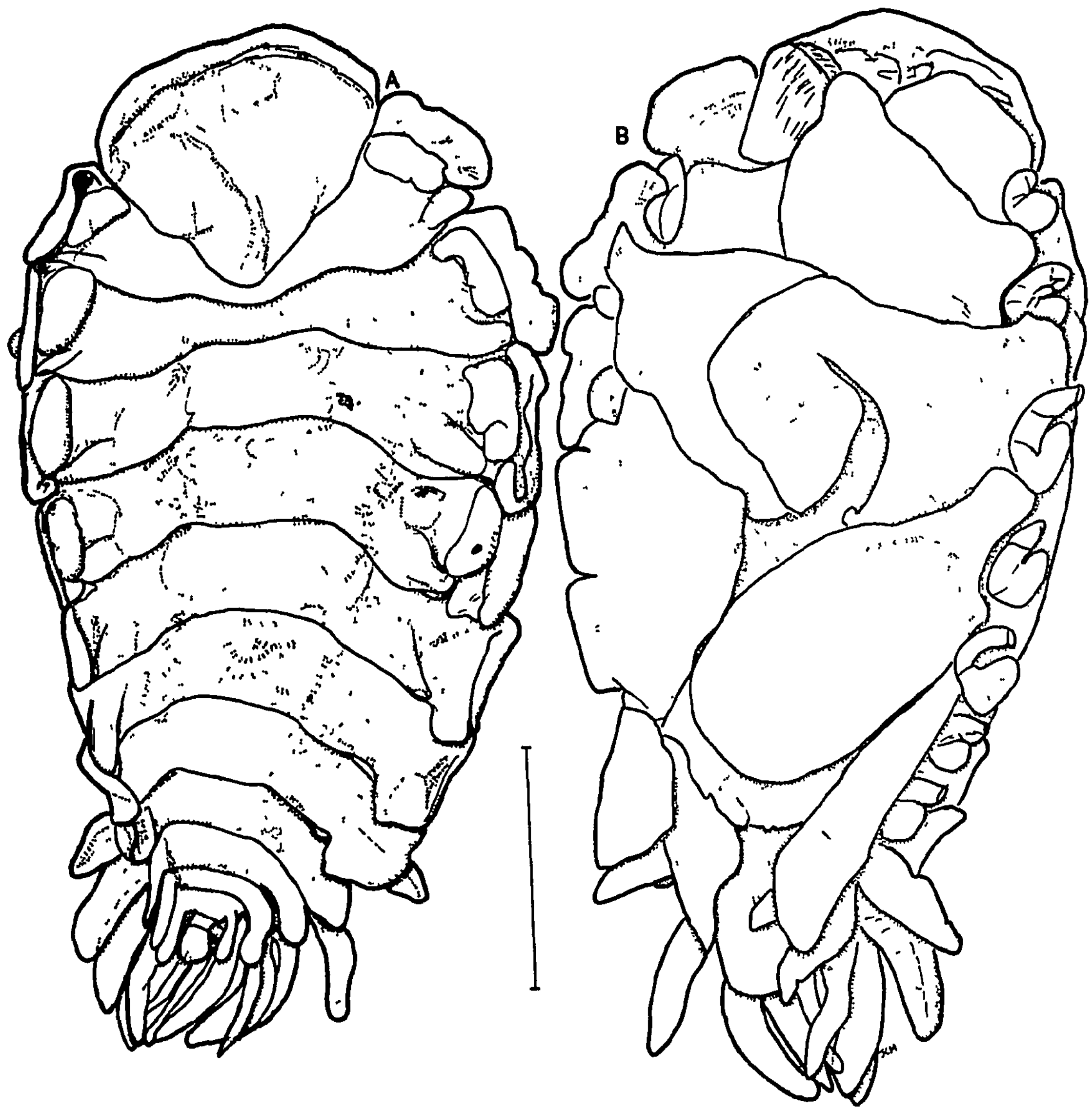

Fig. 22. Munidion irritans Boone, holotype female. A. Dorsal. B. Ventral. Scale: 1.0mm.

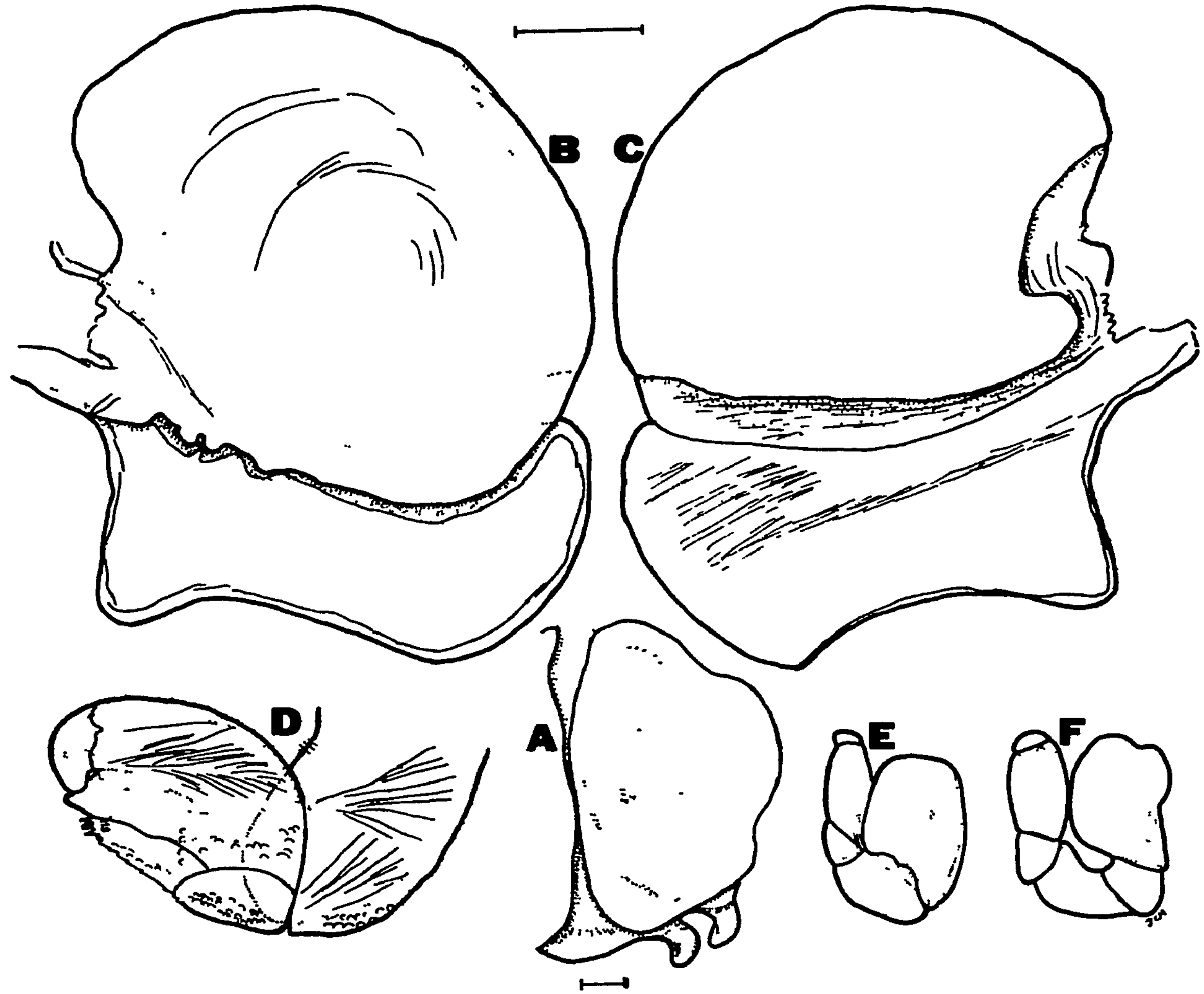

Fig. 23. <u>Munidion irritans</u> Boone, holotype female. A. Left maxilliped and posteroventral border of head. B. Left oostegite 1, internal. C. Same, external. D. Left pereopod 1. E. Left pereopod 6. F. Left pereopod 7. Scale at A: 0.1mm for A, E, F. Scale at B: 0.2mm for B, C; 0.1mm for D.

extended central region.

Pereon broadest across pereomere 3, with slightly raised central ridge along dorsal surface. Coxal plates completely covering margins of each pereomere, posterior ones also partly covering succeeding pereomeres. Dorsolateral bosses occupying approximately 3/4 of anterolateral region of each side of pereomeres 1-4. Tergal projections small and tightly pressed against body, present on all pereomeres. Oostegites enclosing brood pouch; oostegite 1 (Figs. 23B, C) smoothly rounded anteriorly, produced into blunt point posteriorly, with internal ridge slightly toothed near lateral end. Pereopods (Figs. 23D-F) slightly larger posteriorly, otherwise essentially alike.

Pleon of 6 pleomeres. First 5 pleomeres each produced into moderately short lateral plates and bearing long narrow lanceolate biramous pleopods. Terminal pleomere produced into petiolate pleotelson and bearing biramous uropods of same structure as pleopods.

Variations.

The other 4 females of Munidion irritans examined show no significant variations from the type. In one, the pleonal lateral plates are slightly less extended.

Description of reference male (Fig. 24).

Length 1.1mm, maximal width 0.5mm, head length 0.2mm, pleon length 0.4mm. Body smoothly tapered anteriorly and posteriorly (Figs. 24A, B).

Head smoothly rounded anteriorly, nearly semicircular in outline, partly fused with pereon medially and forming continuation of tapering of pereon. No eyes. Antenna 1 (Fig. 24F) 3-segmented, antenna 2 (Fig. 24F) 4-segmented, each antenna with 4 terminal setae on distal segment

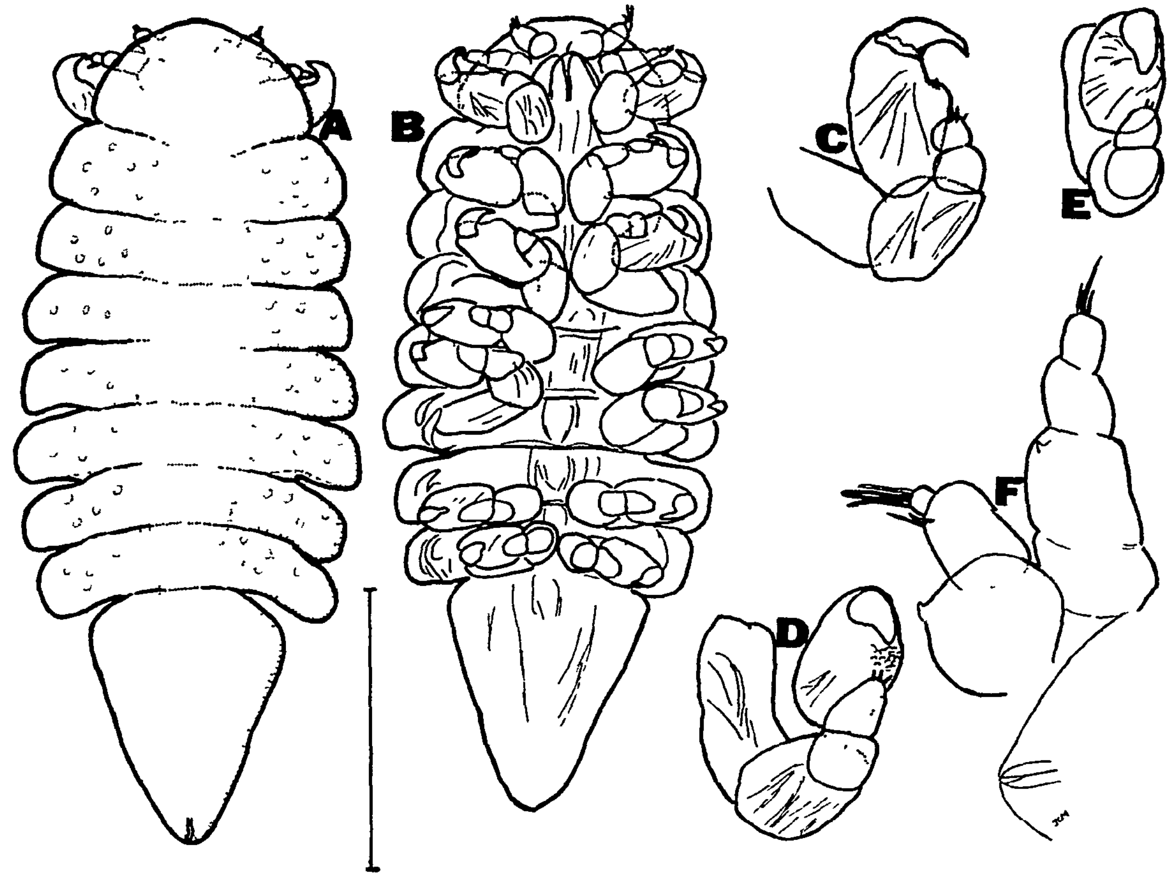

Fig. 24. Munidion irritans Boone, reference male. A. Dorsal. B. Ventral. C. Right pereopod 1. D. Right pereopod 5. E. Left pereopod 7. F. Left antennae. Scale: 0.4mm for A, B, 0.2mm for C-E; 0.1mm for F.

and small tubercle on anterodistal margin of antepenultimate segment; middle segment of antenna 1 also bearing 2 setae distally.

Pereon tapered anteriorly and posteriorly from pereomere 5. Lateral margins of pereomeres separated by shallow clefts. Slightly elevated dorsal ridge centrally. Pereopods (Figs. 24C-E) isomorphic, somewhat larger posteriorly. No midventral tubercles.

Pleon abruptly narrower than pereon and distinctly separated from pereon. Pleon fused, subtriangular, with slightly undulating margins. Central anterodorsal region slightly raised. No pleopods or uropods.

Variations.

Since the allotype male is missing and the original description of it was very brief, I have only been able to compare my material with the single drawing which Boone (1927) presented. According to that drawing, the allotype had eyes, its head was separate from the pereon and there was evidently no central dorsal pereonal ridge. Of the other 2 males examined, one is closely similar to the allotype in body shape and proportions and in having the head separated from the pereon, while the other male more closely resembles the reference male; neither has eyes.

Discussion.

The only previous record of *Munidion irritans* was the type pair, which Boone (1927) recorded parasitizing one of the type specimens of *Munida elfina* Boone. Barbara Shuler Mayo (personal communication) has established that *M. elfina* is a junior synonym of *M. irrasa*, which is thus the only known host species for *Munidion irritans*.

Munidion n. sp.

Figs. 25-27

"Branchial parasite," Chace, 1942, p. 52.

Material examined.

Infesting Munida longipes A. Milne Edwards, all hosts identified by B. S. Mayo. U. S. Bureau of Commercial Fisheries Ship Pelican Sta. 34, off St. Augustine, Florida, 29°59'N, 80°11'W, 265-300m, 24 Apr. 1956; 1♀, USNM. Pelican Sta. 13, off Cape Canaveral, Florida, 28°22'N, 79°53'W, 11 Mar. 1956; 1♀, USNM 99570. Gerda Sta. G-655, N of Palm Beach, Florida, 27°00'N, 79°49'W, 262-287m, 16 July 1965; 2♀, 1♂, UMML. Gerda Sta. off Miami Beach, Florida, 25°45'N, 80°04'W, about 70m, 12 Nov. 1969; 1♀, holotype, USNM 141595, 1♂, allotype, USNM 141596. Gerda Sta. G-465, near Marquesas Keys, Florida, 24°18'N, 82°54'W, 403m, 25 Jan. 1965; 1♀, 1♂, UMML. Gerda Sta. G-969, near Marquesas Keys, Florida, 24°18'N, 82°33'W, 330-400m, 2 Feb. 1968; 7♀, 6♂, USNM. Gerda Sta. G-968, near Marquesas Keys, Florida, 24°17'N, 82°34'W, 394-437m, 2 Feb. 1968; 2♀, 1♂, RMNHL. Gerda Sta. G-435, near Marquesas Keys, Florida, 24°16'N, 82°20'W, 357-417m, 28 Nov. 1964; 2♀, 2♂, UMML. A. A. Bayden collection, Tortugas, Florida, June 1939; 1♀, 1♂, USNM 99568, 1♀, USNM 99569. U. S. Bureau of Commercial Fisheries Ship Oregon II Sta. 10632, SE Gulf of Mexico, 27°01'N, 84°55'W, 500-540m; 2♀, USNM. Oregon II Sta. 10200, off Isla de Providencia, 13°37'N, 81°53'W, 460m, 21 Nov. 1968; 1♀, USNM.

Infesting Munida schroederi Chace. Harvard-Havana Expedition Atlantis Sta. 3393, Cayo Coco, Cuba, 22°36'N, 78°19'W, 405m, 27 Apr. 1939, F. A. Chace, Jr., det. of host; 1♀, 1♂, MCZ.

Description of holotype female (Figs. 25, 26).

Length 13.4mm, maximal width 6.8mm, head length 2.5mm, pleon length 3.1mm. Distortion 15°. Body outline (Figs. 25A, B) essentially pyriform; greatest width across pereomere 2, tapering posteriorly from there. All body regions and segments distinct.

Head smoothly curved anteriorly and posteriorly. Very narrow frontal lamina. No eyes. Antennae difficult to discern. Maxilliped (Fig. 26A) subtriangular, without palp. Posteroventral border of head (Fig. 26B) with 2 thick points on each side, central region sinuous, extending slightly beyond general edge along with 2 small dentate projections.

All pereomeres with epimeral plates covering lateral edges. Prominent dorsolateral boss on each side of pereomeres 1-4, each covering anterior 2/3 to 3/4 of its pereomere. No tergal projections evident. Pereopods (Figs. 25C-F) increasing in size posteriorly; basis of each with prominent carina, posterior ones progressively more pointed. Oostegites not completely enclosing large mass of eggs; oostegite 1 (Figs. 26C, D) with deep groove externally, several digitate processes on internal ridge, moderately sharp posterolateral point; oostegite 2 (Fig. 26E) about half size of oostegite 1, sides approximately parallel and curved with anteromedial corner extending forward.

Pleon of 6 distinct pleomeres. Pleomeres 1-5 with reduced lateral plates progressively narrower and shorter posteriorly. Pleopods biramous, rami short and rather stubby, but covering more than half of ventral face of pleon; both rami of each pleopod equally developed but slightly smaller posteriorly. Pleomere 6 with biramous uropods, exopodites larger; end produced into large bulbous pleotelson.

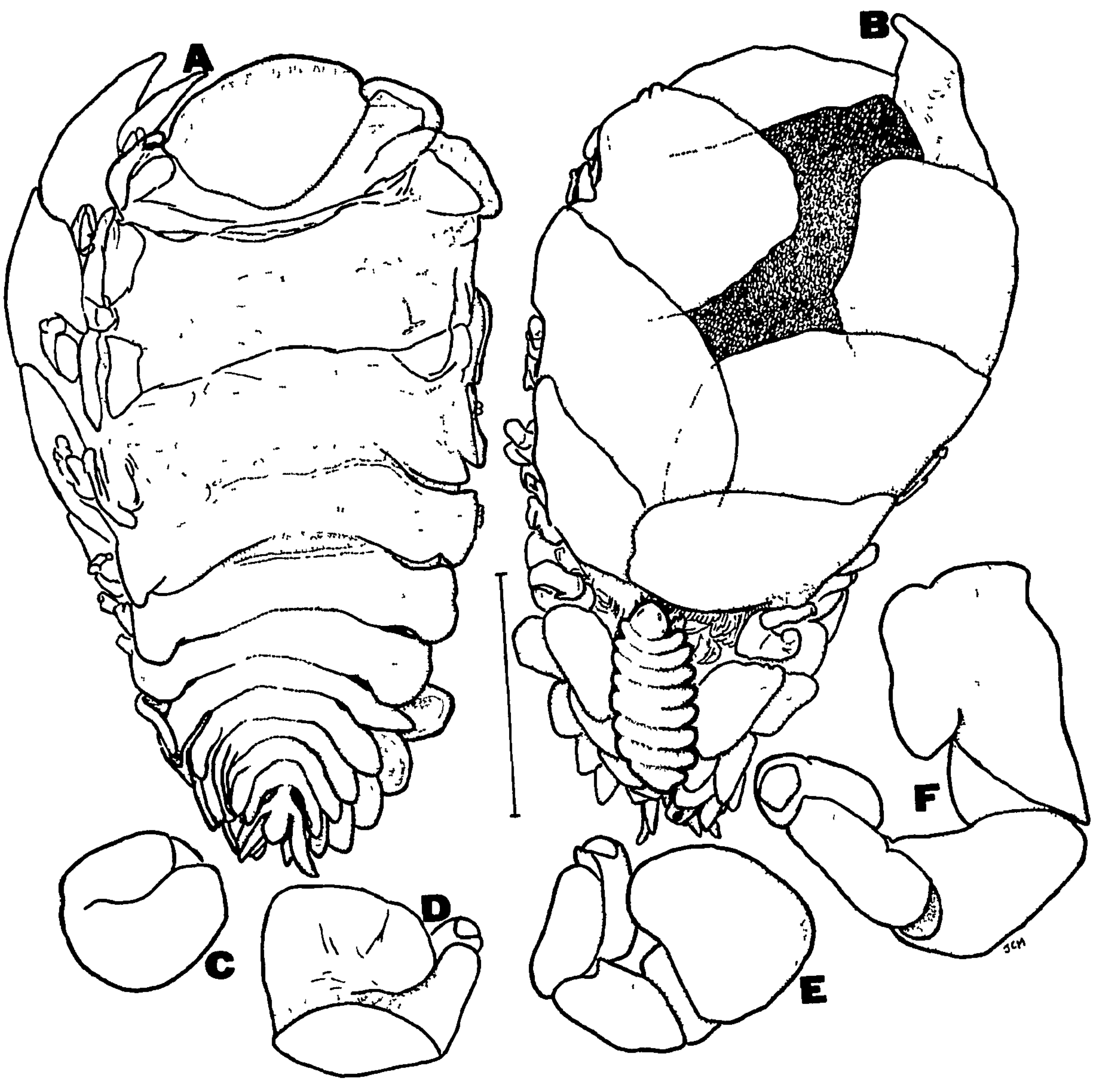

Fig. 25. Munidion n. sp., holotype female. A. Dorsal. B. Ventral. C. Left pereopod 1. D. Right pereopod 2. E. Left pereopod 3. F. Left pereopod 7. Scale: 4.0mm for A, B; 1.0mm for C-F.

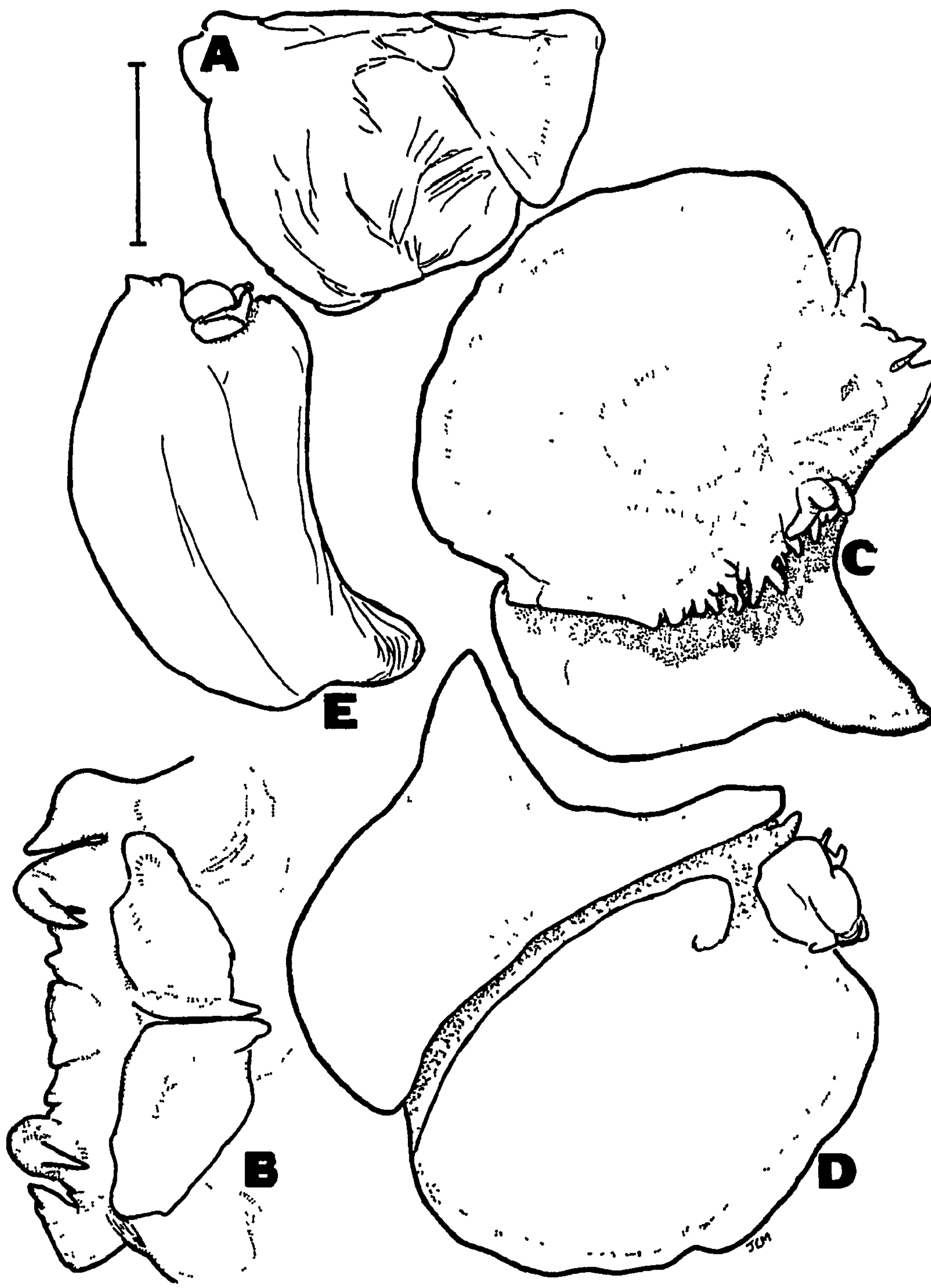

Fig. 26. Munidion n. sp., holotype female. A. Right maxilliped. B. Posteroventral border of head. C. Oostegite 1, internal. D. Same, external. E. Oostegite 2, external. Scale: 1.0mm for A-D; 2.0mm for E.

Variations.

The other females of Munidion n. sp. examined range in length from 8.9mm to 13.3mm and in maximal width from 4.2mm to 6.8mm, making this species second in size to M. princeps. Those females agree well with the holotype except for a few minor variations. In 1 specimen, the postero-ventral border of the head has a more pronounced central point; in a few cases, the internal ridge of oostegite 1 lacks prominent digitate processes; and in several instances, the pleotelson tends to be more lanceolate than in the type. An immature female (Fig. 27F) has a straighter body and a more lanceolate pleotelson.

Description of allotype male (Figs. 27A-E).

Length 4.2mm, maximal width 0.6mm, head length 0.5mm, pleon length 1.1mm. Body regions (Figs. 27A, B) distinct. Body broadest across pereomere 5, sides nearly parallel along pereon but narrowing sharply at ends.

Head semicircular anteriorly, posterior border bluntly V-shaped and extending into pereon. Eyes tiny black streaks near to and parallel to posterolateral margins of head. Antennae (Fig. 27C) both 3-segmented, extending beyond edge of head; antenna 1 shorter, with distal tuft of approximally 20 setae, basal segment with sparse large setae; antenna 2 with about 30 setae distally and 4 setae on anterodistal margin of middle segment.

All pereomeres separated by deep lateral incisions. Pereomere 5 straight across, others progressively more convex toward pereomere 5. Pereopods (Figs. 27D, E) isomorphic, larger posteriorly. Broad midventral tubercles on all pereomeres visible only in lateral view.

Pleon fused, but remnants of 5 pleomeres indicated laterally by square-cornered steps in margins, ending in blunt terminal point. No

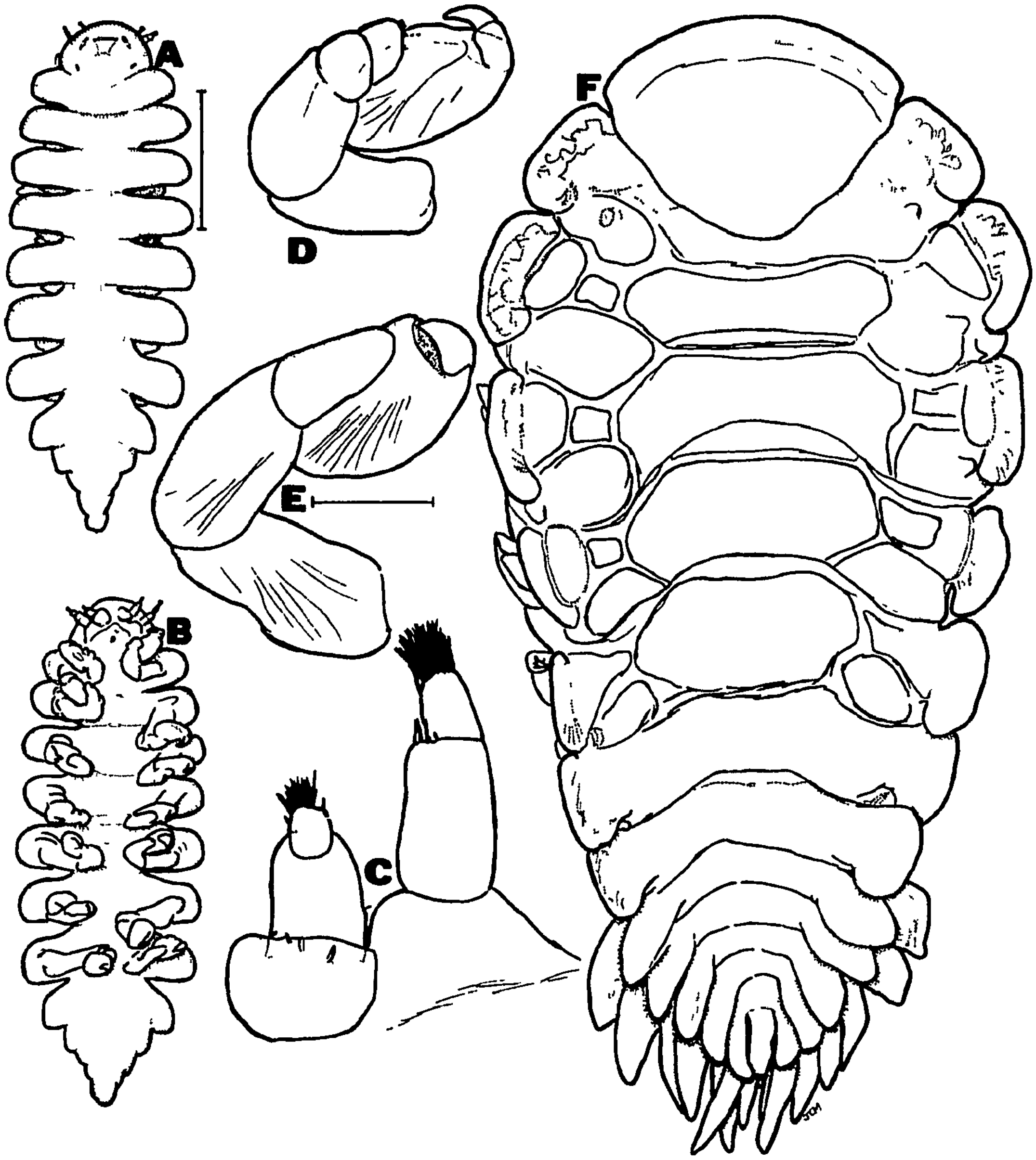

Fig. 27. Munidion n. sp. A-E, allotype male; F, immature female. A. Dorsal. B. Ventral. C. Right antennae. D. Right pereopod 1. E. Right pereopod 7. F. Dorsal. Scale at A: 1.0mm for A, B, F. Scale at E: 0.2mm for D, E.

trace of any pleonal appendages.

Variations.

The other males of Munidion n. sp. examined are like the allotype except that some of them lack eyes, and a few of them have far fewer terminal setae on the antennae.

Discussion.

The female of Munidion n. sp. is very similar to that of M. laterale, especially in lacking well developed tergal projections on several pereomeres, but the 2 species differ from each other in numerous characters, especially the structure of the oostegites and pleotelson. The male of Munidion n. sp., on the other hand, closely resembles that of M. irritans except that its pleon is distinctly different in outline.

ARGEIA DANA, 1852

Type-species, by monotypy, *Argeia pugettensis* Dana, 1852. Gender, feminine.

Total number of species, 6. Geographical distribution: Japan; Korea; Andaman Islands; Bahamas; Bering Sea to S California.

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; no eyes; maxilliped palp set off 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; oostegite surrounding but not covering brood pouch; first oostegite usually bearing large rounded posterolateral point; pleon of 6 pleomeres lacking lateral plates; pleopods all biramous, exopodites extending far to sides, oval to lanceolate, endopodites often reduced to knobs on ventral surface, especially posteriorly; uropods uniramous, of same size and shape as pleopodal exopodites. Male: Body about 3 times as long as wide; head generally much narrower than pereon; eyes small or absent; pereomeres distinctly separated, all of nearly same width; pleon fused, triangular, terminating in broadly to sharply rounded point; no pleonal appendages.

Remarks.-- Dana (1852) described the type-species, *Argeia pugettensis*, the first bopyrid known from North America, from Puget Sound; it has since been found from the Bering Sea to southern California on a large number of crangonid shrimp host species (Hatch, 1947), and Richardson (1909) also recorded it from Japan and Korea. Stimpson (1857) recorded a second species from San Francisco Bay, though there remains some doubt whether it is distinct from *A. pugettensis*. Chopra (1923) described the first species of Argeia known from the Indian Ocean, A. lowisi, which infested an Alpheus sp. in the Andaman Islands. Shiino (1958) later found Argeia lowisi infesting another Alpheus sp. in Osaka Bay, Japan, and described a second species infesting an alpheid at Mie, Japan. The name, but possibly not the description of a fifth species, evidently from the western Pacific, has been published in an abstract which remains unavailable to me. The new species recorded below is the first known from the Atlantic.

Shiino (1965) placed Argeia in the Bopyrinae. Although I am treating it here as a member of the Pseudioninae, I am not entirely satisfied that it belongs in this subfamily. Argeia probably represents a link between these 2 subfamilies, both in morphology and host selection.

West Indian faunal region species: only 1, Argeia n. sp.

Argeia n. sp.

?"Bopyrid Isopod," Sivertsen and Holthuis, 1956, p. 40.

Material examined.

Infesting Sclerocrangon jacqueti (A. Milne Edwards), host identified by L. B. Holthuis. Columbus Iselin Sta. CI-54, Tongue of the Ocean, Bahamas, 23°54'N, 77°12'W, 1298-1335m, 26 Feb. 1973; 1♀, 1♂, USNM.

Discussion.

These specimens came to my attention too late for me to treat them in detail. I have examined them sufficiently to establish that they represent an undescribed species of Argeia. The unidentified bopyrid recorded from the same host species southeast of Newfoundland by Sivertsen and Holthuis (1956) probably belongs to this species also.

ANUROPODIONE BOURDON, 1967

Type-species, by monotypy, *Anuropodione senegalensis* Bourdon, 1967. Gender, feminine.

Total number of species, 4. Geographical distribution: Gulf of Siam; Gulf of Mexico; North Carolina; Sénégal and Congo.

Generic diagnosis.-- Female: All body regions and segments distinct; maxilliped without palp; coxal plates on most or all pereomeres; dorsolateral bosses on at least first 4 pereomeres (none in *A. dubia*); 6 pleomeres, most or all with lamellar lateral plates; 5 pairs of pleopods, at least first 4 biramous; uropods absent. Male: Head separate from pereon; eyes absent or colorless; pleon usually fused (but aberrant males with up to 5 pleomeres), lacking appendages.

Remarks.-- Bourdon (1967) erected the genus *Anuropodione* for *A. senegalensis*, which he recorded as a parasite of a *Munida* subsequently identified (Bourdon, 1968) as *M. speciosa* Von Martens taken near Dakar, Sénégal. Bourdon (1972c) then reported more specimens of *Anuropodione senegalensis* collected from the same host species near Pointe Noire, Congo, and transferred *Probopyrus dubius* Nierstrasz and Brender à Brandis (1929), a parasite of *Galathea* sp. in the Gulf of Siam, to *Anuropodione*. Markham (1974) described the first species reported from the western Atlantic, *A. carolinensis* and *A. megacephalon*, discussed below. Although neither of those species is yet known from the West Indian faunal region, both infest host species which occur in the area, so they are expected. *Anuropodione* is known only from hosts belonging to the Galatheidae, each of the 4 species infesting a different host species.

West Indian faunal region species: none known, but 2 species, *Anuropodione carolinensis*, *Anuropodione megacephalon*, expected.

Key to western Atlantic species of Anuropodione, based on adult females.

1. All 5 pairs of pleopods biramous....................A. carolinensis.

-- First 4 pairs of pleopods biramous, fifth pair lacking exopodites.... ....A. megacephalon.

Anuropodione carolinensis Markham, 1974

Figs. 28-30

Anuropodione sp., Williams and Brown, 1972, p. 307.

Anuropodione carolinensis Markham, 1974, pp. 620-624, figs. 5-8. (Type locality, off North Carolina.)

Material examined.

Infesting Munida iris iris A. Milne Edwards. Duke University Marine Laboratory's ship R/V Eastward Otter Trawl Sta. 9888, off coast of North Carolina, 35°05'N, 75°12'W, 220-260m, 28 June 1968, A. B. Williams, det. of hosts; 1♀, holotype, USNM 141582, 1♂, allotype, USNM 141583, 4 other ♀, including 1 immature, 3 other ♂, paratypes, USNM 141584, 2♀, UNCIFR 2095.

Description of holotype female (Figs. 28, 29).

Length 11.9mm, maximal width 7.1mm, head length 2.3mm, pleon length 3.1mm. Distortion 6°. Body nearly ovate; all segments and body regions distinct (Fig. 28).

Head with fairly large frontal lamina produced into points beside head. Anterior margin of head smoothly rounded, posterior somewhat pointed. No eyes. Antennae (Fig. 29A) reduced, each of 2 stubby proximal

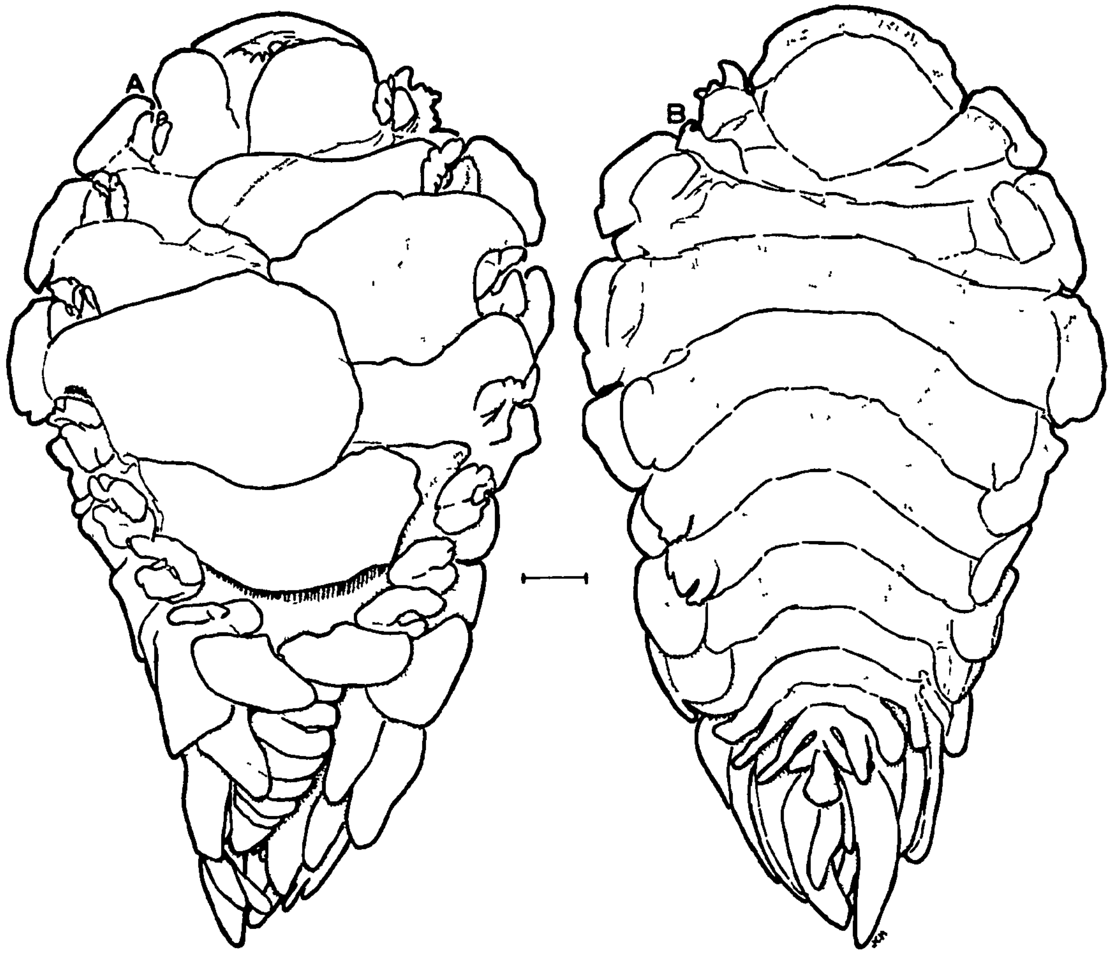

Fig. 28. Anuropodione carolinensis Markham, holotype female. A. Ventral. B. Dorsal. Scale: 1.0mm.

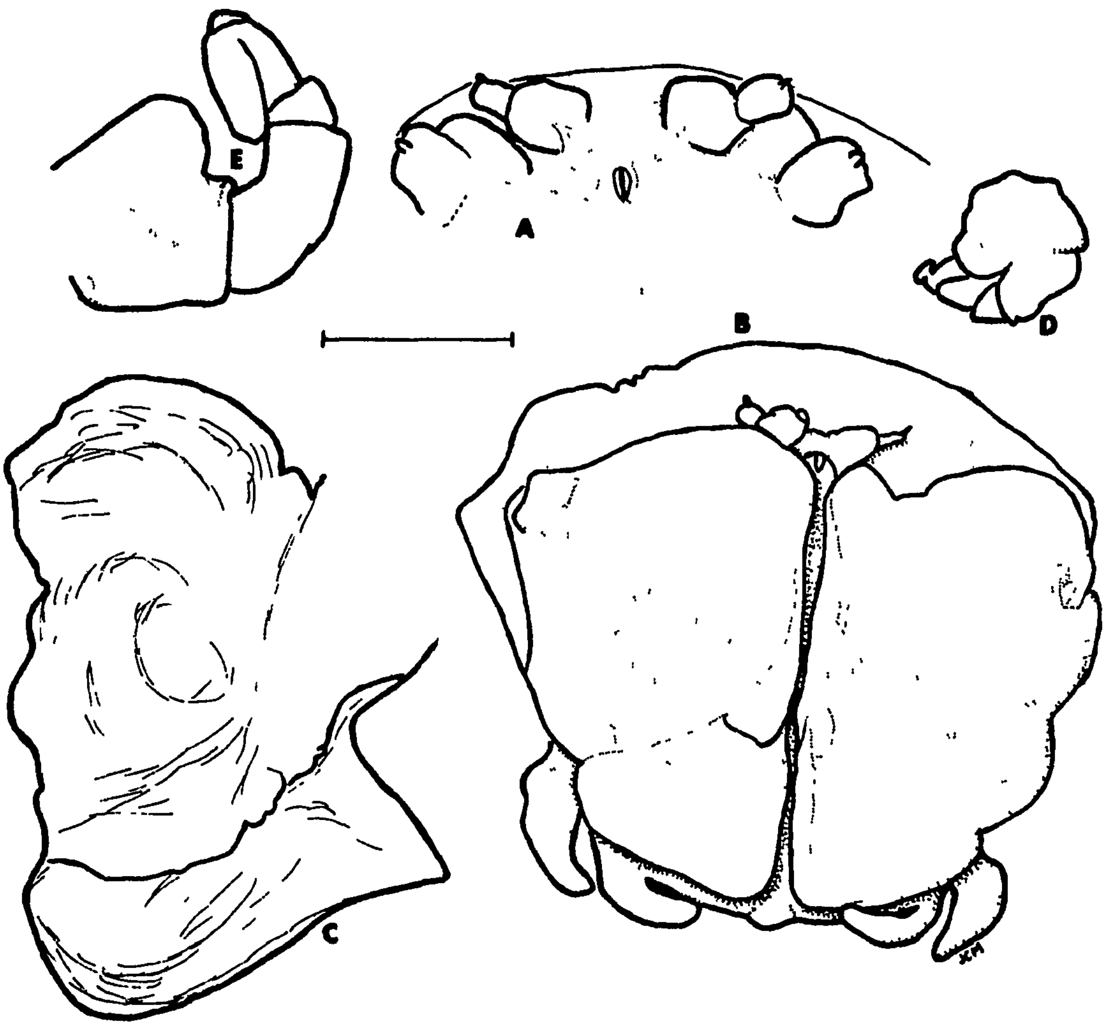

Fig. 29. Anuropodione carolinensis Markham, holotype female. A. Antennae. B. Head, ventral. C. Right oostegite 1, internal. D. Left pereopod 1. E. Right pereopod 7. Scale: 0.5mm for A; 0.1mm for B-E.

segments and tiny pointed distal segment. Maxilliped (Fig. 29B) with undulate lateral edges. Posteroventral border of head (Fig. 29B) with 2 long processes on each side, central margin straight except for bluntly rounded central point.

Pereomeres well defined. Coxal plates on all lateral margins, covering them almost completely. Greatest width across pereomere 3. Dorsal surface with central ridge narrowing posteriorly. Dorsolateral bosses prominent on pleomeres 1-4, obscure on others. Oostegites overlapping and completely enclosing brood pouch. Oostegite 1 (Fig. 29C) with posterolateral corner extending only slightly beyond posterior border; internal ridge with 2 irregular denticles. Pereopods (Figs. 29D, E) nearly doubling in size from first to seventh; prominent blunt carina on basis of each.

Pleon sharply narrowing, of 6 pleomeres. Lateral edges of each of first 5 pleomeres produced into narrow lateral plates extending straight out from sides. Terminal pleomere produced into bulbous pleotelson. Foliaceous biramous lanceolate pleopods on first 5 pleomeres nearly covering ventral surface of pleon. No uropods.

Variations.

Some of the other females show a number of minor variations from the holotype. These include the posteroventral border of the head, which bears several small central points in 1 case, the internal ridge of oostegite 1, which is variously toothed, and the pleotelson, which ranges from a bulbous shape to being produced into sharp lateral points.

Description of allotype male (Fig. 30).

Length 3.8mm, maximal width 1.4mm, head length 0.3mm, pleon length

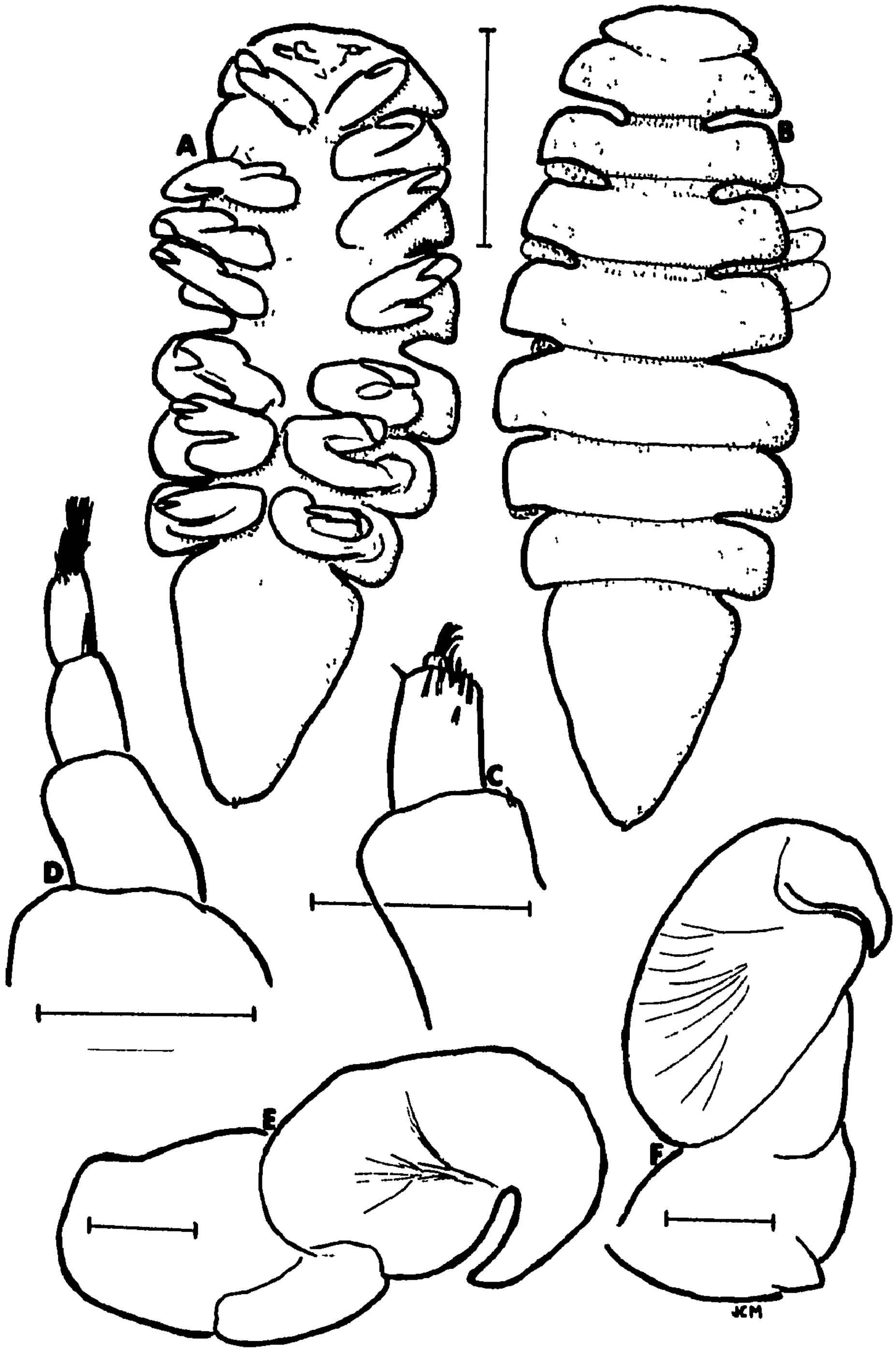

Fig. 30. Anuropodione carolinensis Markham. A, B, E, F, allotype male; C, D, paratype male. A. Ventral. B. Dorsal. C. Right antenna 1. D. Right antenna 2. E. Right pereopod 1. F. Right pereopod 7. Scales: 1.0mm for A, B; 0.1mm for C-F.

1.1mm. Body smoothly rounded, all body regions and segments distinct (Figs. 30A, B).

Head sharply bent ventrally. No eyes. Antenna 1 (Fig. 30C) of 3 segments, ultimate one with 4 terminal setae, middle one with 8 setae along distal edge and 1 subterminal seta, proximal segment with 2 reduced setae anterolaterally; segments smaller distally. Antenna (Fig. 30D) of 5 segments, distal one bearing 9 terminal setae, next segment with 1 distal seta. (The antennae of the allotype are obscured, so the foregoing description and accompanying drawings are based on another specimen.)

Pereon widest across pereomere 5. Pereomeres with truncate edges, set apart by deep lateral indentations. Dorsal surface of pereon slightly raised medially. Pereopods (Figs. 30E, F) nearly equal in size and proportions.

Pleon fused, triangular, lacking appendages; terminal edge produced into tiny anal tube.

Variations.

The other 3 males present vary from the allotype in a few details. The number of antennal setae ranges from 4 to 8. Two males have large colorless eyes. One male has the lateral pleomere edges rounded rather than truncate.

Discussion.

Williams and Brown (1972) first recorded _Anuropodione carolinensis_ in a discussion of a large number of specimens of the host species, _Munida iris iris_ collected in a single trawl haul off North Carolina. All of the individuals of _Anuropodione carolinensis_ known came from there.

Anuropodione megacephalon Markham, 1974

Figs. 31-33

Anuropodione megacephalon Markham, 1974, pp. 624-629, figs. 9-11. (Type locality, NE Gulf of Mexico.)

Material examined.

Infesting Munida pusilla Benedict (paratype). U. S. Fish Commission Steamer Albatross Sta. 2405, NE Gulf of Mexico, 28°48'N, 85°02'W, 30 fm (= 54m), 15 Mar. 1885; 1♀, holotype, USNM 141585, 1♂, allotype, USNM 151586.

Description of holotype female (Figs. 31, 32).

Length 2.9mm, maximal width 1.8mm, head length 0.7mm, pleon length 0.7mm. Distortion 7°. Body ovate, with no abrupt changes in size; all body regions and segments distinct (Figs. 31A, B).

Head deeply set into pereon. Moderately developed frontal lamina extending short distance back along sides. No eyes. Antennae (Fig. 31C) both 3-segmented, very similar in appearance, with terminal tufts of setae. Maxilliped (Fig. 31E) with smooth outline. Posteroventral border of head with 2 moderately pointed lateral projections on each side (Fig. 31E).

Pereon broadest across pereomere 2. Pereomere 1 curved around head, pereomere 2 nearly straight across, others progressively more concave posteriorly. Large reflexed coxal plates completely covering lateral margins of all pereomeres. Prominent dorsolateral bosses on all pereomeres, much larger anteriorly. Oostegites completely covering ventral surface. Oostegite 1 (Figs. 32A, B) evenly rounded anteriorly, slightly pointed

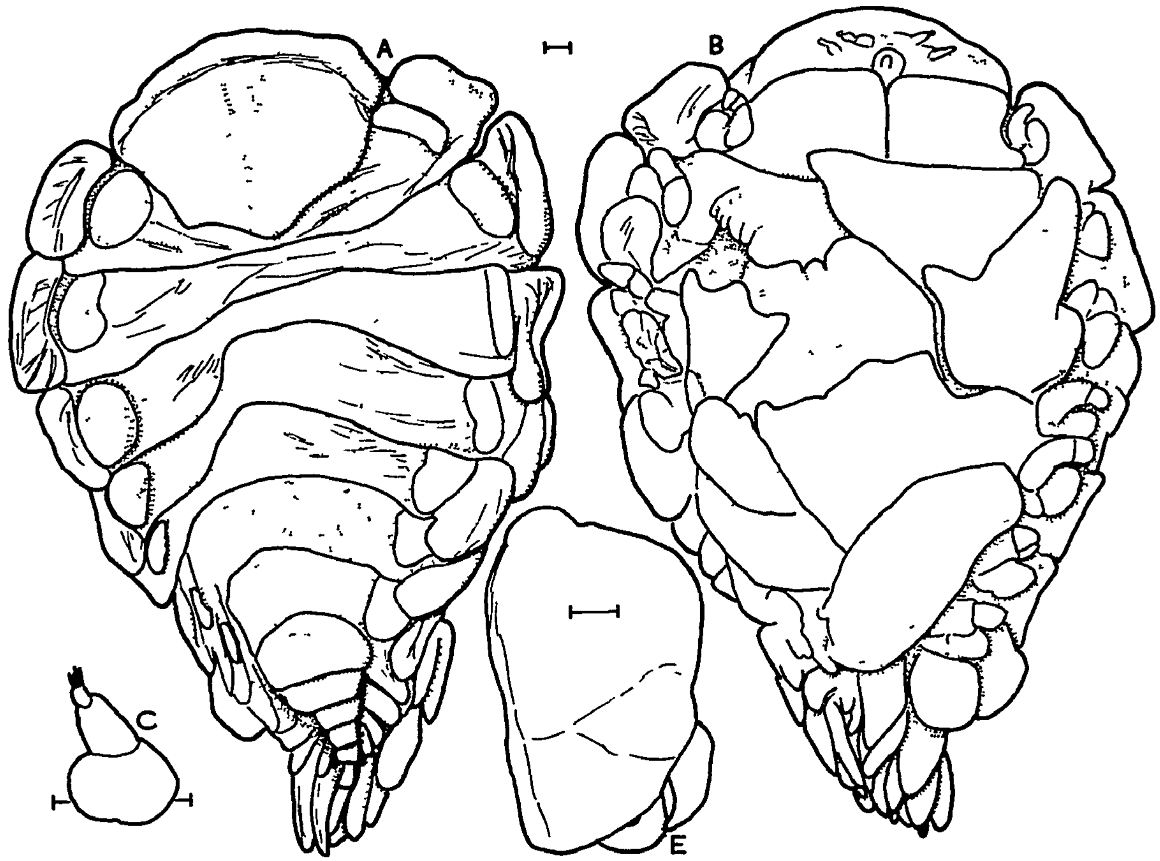

Fig. 31. Anuropodione megacephalon Markham, holotype female. A. Dorsal. B. Ventral. C. Left antenna 1. D. Left antenna 2. E. Left maxilliped and posteroventral border of head. Scales: 0.1mm.

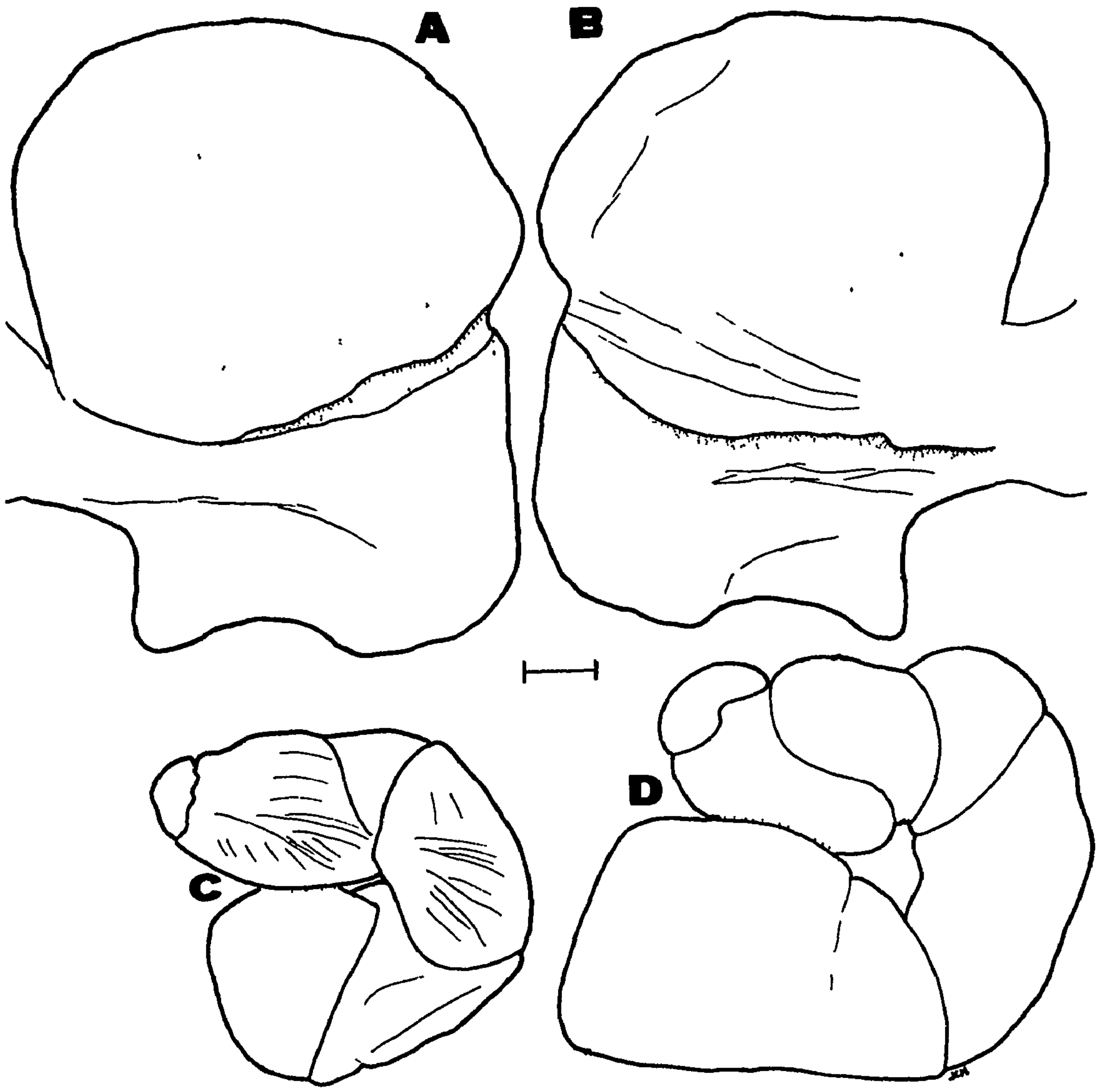

Fig. 32. Anuropodione megacephalon Markham, holotype female. A. Right oostegite 1, external. B. Same, internal. C. Right pereopod 1. D. Right pereopod 7. Scale: 0.1mm.

posterolaterally with nearly smooth internal ridge. Pereopods (Figs. 32C, D) essentially alike, slightly larger posteriorly.

Pleon nearly twice as long as wide, tapering sharply. Each pleomere shorter and narrower than preceeding one except terminal (sixth) one longer than all but first. Lateral plates on pleomeres 1-5, very reduced posteriorly. Long lanceolate pleopods, first 4 biramous, fifth uniramous. Uropods absent.

Description of allotype male (Fig. 33).

Length 0.8mm, maximal width 0.3mm, head length 0.2mm, pleon length 0.2mm. Body regions distinct; sides of body nearly parallel, tapering only at head and pleon (Figs. 33A, B).

Head large relative to body, extending deeply into pereon. Colorless round eyes near center of head. Antenna 1 (Fig. 33C) 3-segmented, segmentation of antenna 2 obscure, both tipped with some setae, antenna 1 also with some distal setae on middle segment.

Pereon slightly broadest across pereomere 6, pereomeres unevenly separated laterally. Pereopods (Figs. 33D, E) of same size, but with blunter dactyli posteriorly.

Pleon triangular, completely fused, but with remnants of 3 pleomeres indicated dorsally. No pleonal appendages.

Discussion.

The most immediately obvious difference between _Anuropodione megacephalon_ and _A. carolinensis_ is that the former is much smaller. This is also true for their respective hosts, which are closely similar, differing mainly in that _Munida pusilla_ attains a considerably smaller size than _M. iris_.

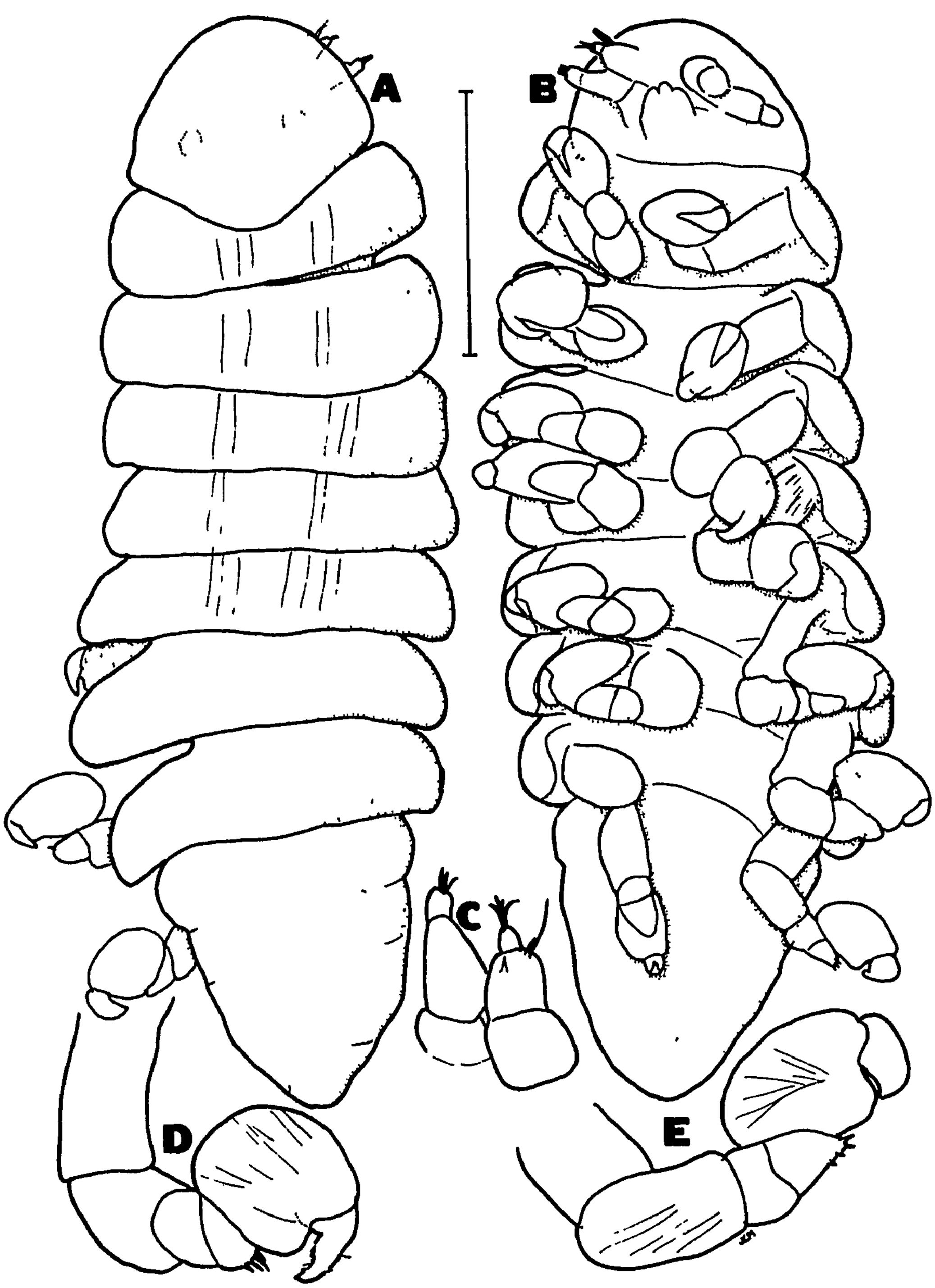

Fig. 33. Anuropodione megacephalon Markham, allotype male. A. Dorsal. B. Ventral. C. Right antennae. D. Right pereopod 1. E. Left pereopod 7. Scale: 0.2mm for A, B; 0.1mm for C-E.

NEW GENUS B

Type-species, by original designation, New Genus B n. sp.

Total number of species, 1. Geographical distribution: Caribbean coast of Colombia.

Generic diagnosis.-- Female: Body slightly distorted; all body regions and segments distinct; maxilliped with prominent but nonarticulated palp; coxal plates on concave side of first 4 pereomeres only; oostegites nearly enclosing brood pouch, first one produced into fairly sharp posterolateral point; 6 pleomeres; no lateral plates; pleopods biramous, with elongate endopodites extending far across pleon, smaller ovate exopodites not exceeding edges of pleomeres; terminal pleomere as reduced recessed knob bearing uniramous uropods. Male unknown.

Remarks.-- This genus is most similar to *Parapagurion* Shiino, known only from its type-species, *P. calcinicola* Shiino (1933). The major distinctions are the well developed maxilliped palp and the greatly reduced projections on the posteroventral border of the head of the female in the new genus.

West Indian faunal region species: only 1 species, New Genus B n. sp.

New Genus B n. sp.

Fig. 34

Material examined.

Infesting *Parapagurus* sp. (probably new), identified by P. A. McLaughlin. Pillsbury Sta. P-770, off Península de la Guajira, Colombia, 13°00'N, 71°44'W, 1225-1420m, 28 July 1968; 1♀, holotype, 1 cryptoniscan larva, USNM.

Description of holotype female (Fig. 34).

Length 4.8mm, maximal width 2.9mm, head length 1.1mm, pleon length 1.2mm. Distortion 16°. Body smoothly tapered, subovate in outline except for truncated posterior border. All body regions and segments distinct (Figs. 34A, B).

Head nearly square, deeply set into first pereomere. Prominent antennae (Fig. 34C) of 3 and 6 segments respectively, situated far forward on anterior edge of head, each tipped with some setae. Posteroventral border of head (Fig. 34D) with blunt central point, greatly reduced single lateral projection on each side. Maxilliped (Fig. 34E) with prominent nonarticulated palp bearing several long setae on distomedial margin; adjacent anteromedial corner of maxilliped bearing similar setae.

Pereon broadest across pereomere 3. First 4 pereomeres bearing coxal plates on concave sides. Oostegites almost completely enclosing brood pouch, several bearing sparse setae on medial margins; oostegite 1 (Figs. 34F, G) slightly rounded anteriorly, with unornamented internal ridge, straight and rather sharp posterolateral point. Pereopods (Figs. 34H, I) slightly larger posteriorly, otherwise essentially alike.

Pleon of 6 pleomeres, first 4 of nearly equal width, fifth abruptly narrower, sixth greatly reduced and deeply embedded in fifth, making pleon truncate posteriorly; sides of pleomeres not produced into lateral plates. All 5 pleopods (Fig. 34J) biramous, progressively smaller posteriorly; endopodites lanceolate, elongate, extending medially, almost completely covering ventral surface of pleon in imbricate pattern; exopodites ovate, extending laterally, not exceeding margins of pleon. Terminal pleomere bearing pair of ovate uniramous uropods of structure very similar to that of pleopodal exopodites.

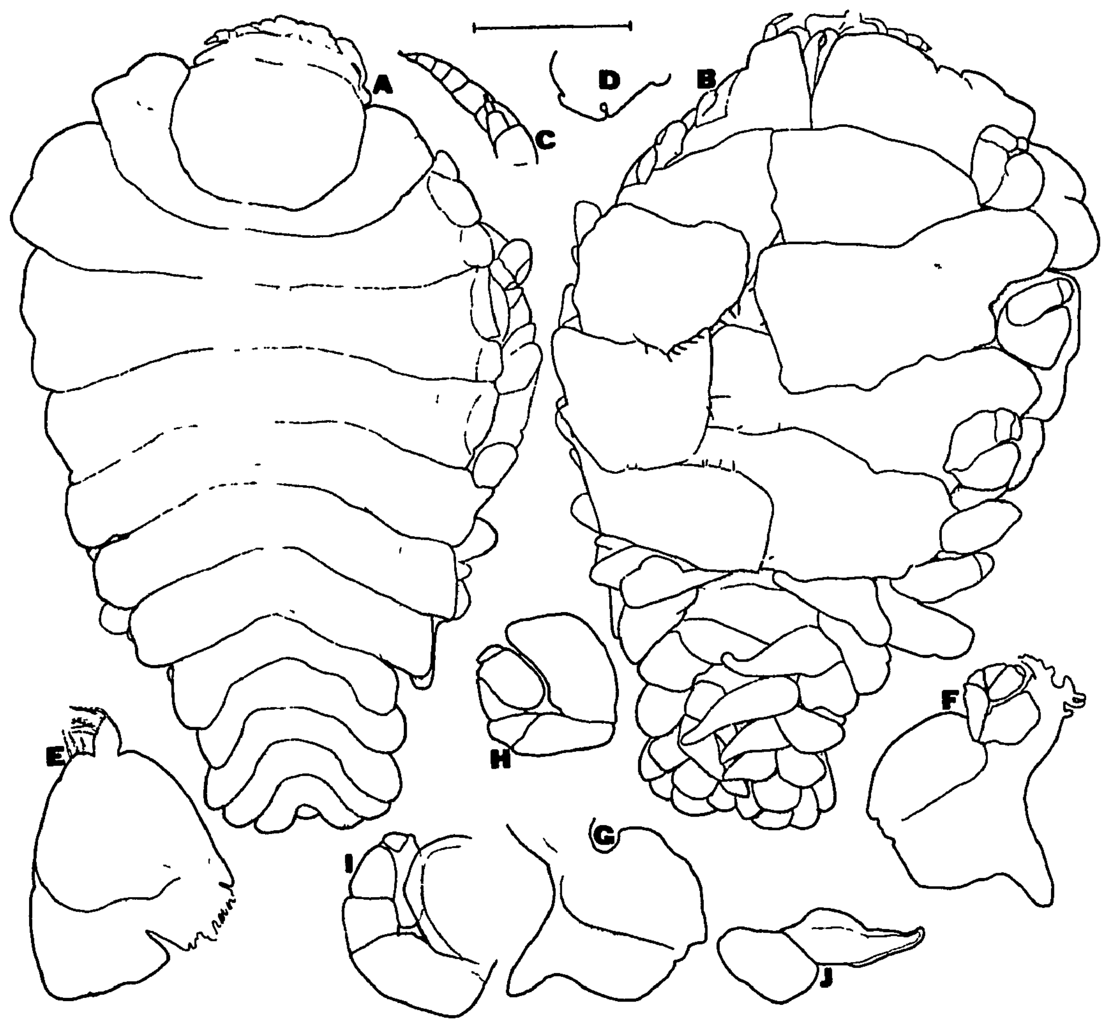

Fig. 34. New Genus B n. sp., holotype female. A. Dorsal. B. Ventral. C. Left antennae. D. Right posteroventral border of head. E. Left maxilliped. F. Left oostegite 1, externa]. G. Same, internal. H. Left pereopod 1. I. Left pereopod 6. J. Right pleopod 1. Scale: 1.0mm for A, B, D, F, G, J; 0.5mm for C, E, H, I.

Male unknown.

Discussion.

The holotype female was accompanied by a cryptoniscan larva which would probably have become a mature male at the next molt; unfortunately, it has no adult characters, so I cannot describe it as the male of this species. The new species is distinguished from other species by the characters listed above to differentiate the genus from its closest relative, *Parapagurion*.

The only other species of the deep-water genus *Parapagurus* known to harbor a bopyrid is *P. monstrosus* Alcock, host of *Bopyrophryxus branchiabdominalis* Codreanu (1965) in the Kei Islands. There is, however, no possibility that this new species, an indisputable pseudionine, is congeneric with *B. branchiabdominalis*, which is the type of its own subfamily, Bopyrophryxinae.

APOROBOPYRINA SHIINO, 1934

Type-species, by monotypy, Aporobopyrina lamellata Shiino, 1934. Gender, feminine.

Total number of species, 3. Geographical distribution: Seto and Shimoda, Japan; Java Sea; Gulf of Mexico through Marquesas and Dry Tortugas to Colombia.

Generic diagnosis.-- Female: Body slightly distorted; head distinctly extended, bearing prominent frontal lamina along anterior edge; coxal plates lamellar; 6 pleomeres; small lateral plates; large foliaceous biramous pleopods; uropods with endopodites reduced or absent; final pleomere produced into nonpetiolate pleotelson. Male: Sides of body smoothly rounded; head separated from pereon or trace of such separation indicated by lateral indentations; pereomeres distinctly set apart; midventral tubercles on all pereomeres and anterior region of pleon; pleon elongate and distinctly pointed, fused or of up to 5 pleomeres; no pleonal appendages.

Remarks.-- The first 2 species of Aporobopyrina described came from the western Pacific. A. lamellata Shiino (1934) infests the porcellanids Petrolisthes pubescens Holmes at Seto, Japan, and P. hastatus Stimpson at Shimoda, Japan (Shiino, 1936a), while Aporobopyrina javaensis Bourdon (1972a) is a parasite of the galatheid Munida andamanica Alcock in the Java Sea. The third species, A. anomala Markham (1974) is the only one reported from the Atlantic, where it is known as a parasite of Munida valida Smith from the Gulf of Mexico to Colombia. Both Bourdon (1972a) and Markham (1974) assigned their species to Aporobopyrina with some reservations because of their considerable variability, discussed below, although both of these species have characters which indicate that this is their proper placement.

West Indian faunal region species: only 1 species, Aporobopyrina anomala.

Aporobopyrina anomala Markham, 1974

Figs. 35-37

Aporobopyrina anomala Markham, 1974, pp. 633-639, figs. 15-17. (Type locality, Península de la Guajira, Colombia.)

Material examined.

Infesting Munida valida Smith. Texas A & M University's ship R/V Alaminos Sta. 68-A-13-21, NW Gulf of Mexico, 27°38'N, 95°22'W, 490-640m, 19 Nov. 1968, L. H. Pequegnat, det. of hosts; 2♀, 2♂, MCZ. Alaminos Sta. 68-A-13-23, NW Gulf of Mexico, 27°35'N, 95°23'W, 730m, 20 Nov. 1968, L. H. Pequegnat, det. of hosts; 3♀, 3♂, UMML 32.4526. Gerda Sta. G-1099, S of Dry Tortugas, Florida, 24°12'N, 82°50'W, 622m, 28 Apr. 1969, B. S. Mayo, det. of host; 1♀, 1♂, UMML 32.4524. Gerda Sta. G-122, S of Marquesas Keys, Florida, 24°07'N, 82°00'W, 686-715m, 19 June 1963, B. S. Mayo, det. of host; 1♀, 1♂, UMML 32.4523. Gerda Sta. G-680, S of Marquesas Keys, Florida, 24°06'N, 81°44'W, 720-750m, 29 Aug. 1967, B. S. Mayo, det. of host; 1♀, 1♂, YPM. Alaminos Sta. 70-A-10-40, off Península de la Guajira, Colombia, 12°40'N, 72°00'W, 620-660m, 18 July 1970, L. H. Pequegnat, det. of hosts; 1♀, holotype, USNM 141587, 1♂, allotype, USNM 141588, 1 immature ♀, UMML 32.4525.

Description of holotype female (Figs. 35, 36).

Length 12.7mm, maximal width 6.7mm, head length 2.4mm, pleon length 3.4mm. Distortion 29°. Body smoothly rounded, all body regions and seg-

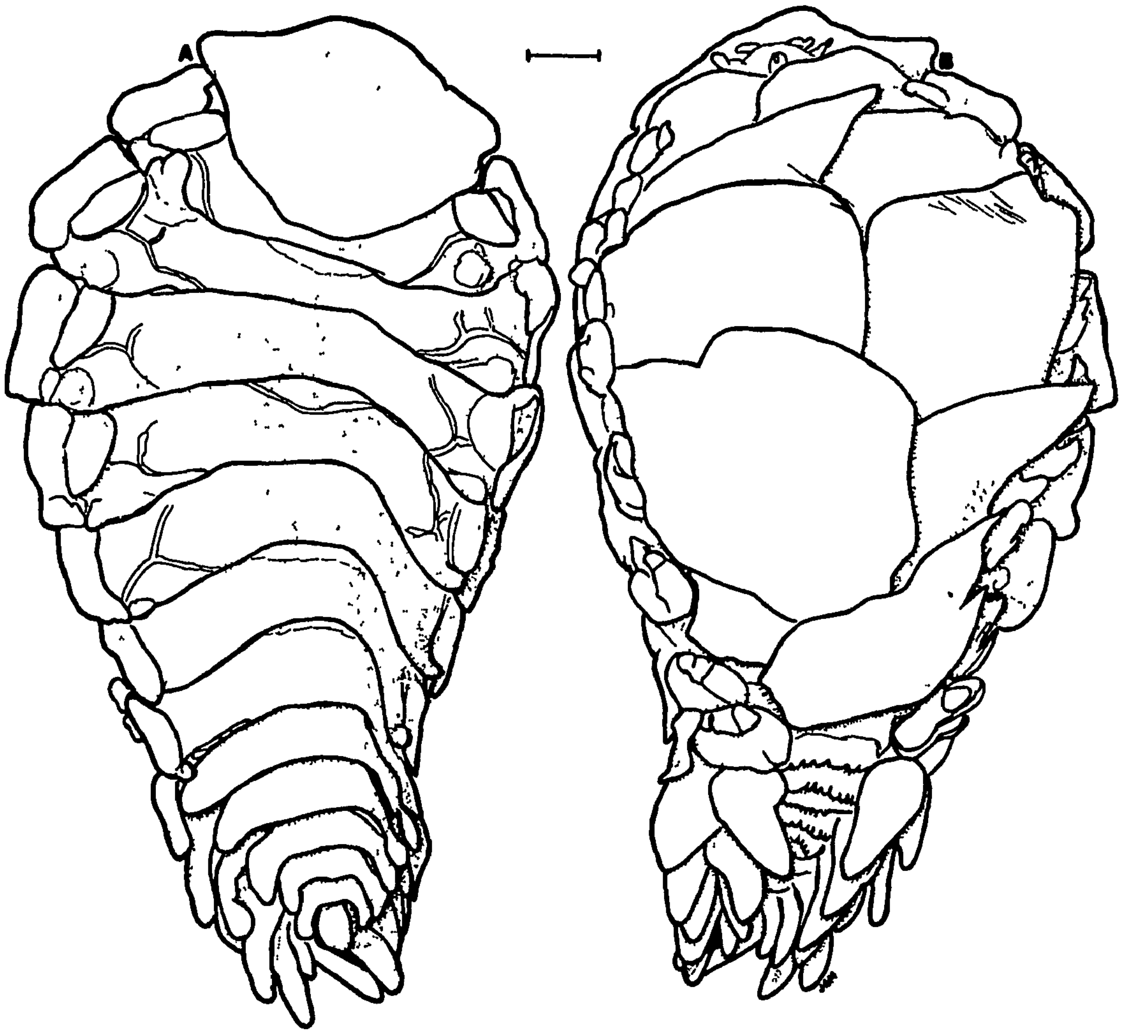

Fig. 35. Aporobopyrina anomala Markham, holotype female. A. Dorsal. B. Ventral. Scale: 1.0mm.

ments distinct (Fig. 35).

Head rounded anteriorly and posteriorly. Large frontal lamina covering entire anterior edge and extending far to each side. No eyes. Antenna 1 3-segmented, antenna 2 4-segmented, setation uncertain (Fig. 36 A). Posteroventral border of head (Fig. 36B) with 2 long lateral digitate projections, central region with single broad blunt medial point.

Pereon broadest across pereomere 3. Coxal plates on all pereomeres, covering lateral edges of each, and, on more posterior ones, extending onto edges of succeeding pereomeres. Dorsolateral bosses on pereomeres 1-4. Fairly long tergal projections on posterolateral corners of first 6 pereomeres. Oostegites completely enclosing brood pouch; oostegite 1 (Figs. 36C, D) with small squarish posterolateral point, nontoothed internal ridge. Pereopods (Figs. 36E, F) more than doubling in size posteriorly, basal segment of each with large rounded projection.

Pleon of 6 pleomeres, first 5 with small lateral plates and large foliaceous biramous pleopods nearly covering ventral surface of pleon (Fig. 36G). Endopodite of each pleopod smaller than its exopodite, all progressively smaller posteriorly. Terminal pleomere produced into large bulbous pleotelson and bearing pair of biramous uropods, their endopodites considerably smaller than exopodites.

Variations.

Other females show a great deal of variation from the holotype, some of it in important characters. Of the 10 females examined, 4 have clearly biramous uropods, one has only minute traces of uropodal endopodites, and the uropods of the others lack endopodites entirely. There are also minor variations in such details as the number of tergal projections and the relative sizes of the pereopods.

Fig. 36. Aporobopyrina anomala Markham, holotype female. A. Left antennae. B. Left posteroventral border of head. C. Left oostegite 1, internal. D. Same, external. E. Left pereopod 1. F. Left pereopod 7. G. Pleon, ventral (p7, pereopod 7; 1-5, pleopodal exopodites 1-5; 1-5, pleopodal endopodites 1-5; u, uropodal exopodite; u, uropodal endopodite; pt, pleotelson). Scales: 1.0mm.

Description of allotype male (Figs. 37A-F).

Length 3.7mm, maximal width 1.4mm, head length 0.4mm, pleon length 1.4mm. Body nearly lanceolate in outline, with no abrupt narrowing (Figs. 37A, B). Head and pereon nearly fused but pleon distinct.

Head nearly straight along anterior edge, somewhat convex posteriorly. Colorless eyes near anterior edge. Antenna 1 (Fig. 37C) of 3 segments; ultimate one with terminal tuft of 7 setae, middle one encircled by fringe of several subterminal setae. Segmentation of antenna 2 (Fig. 37D) indistinct, ultimate segment with terminal tuft of 4 to 7 setae, next segment with some setae near distal edge.

Pereon widest across pereomere 4. Lateral edges of all pereomeres bent ventrally. Prominent midventral tubercle on each pereomere, largest on fourth. Pereopods (Figs. 37E, F) of essentially same size, dactyli smaller and blunter posteriorly.

Pleon of 4 pleomeres. Fourth pleomere partly separated into 2 parts dorsally but not ventrally, lateral indentations indicating traces of yet another pleomere. Pleomere 1 with midventral tubercle like those on pereomeres. No pleopods, though indistinct lateral ventral swellings on first pleomere possibly indicating traces of them. Pleon terminating in blunt point. No uropods.

Variations.

Males of Aporobopyrina anomala vary as much as the females do, especially in the structure of the pleon. In all cases, the pleon is long, acutely pointed and devoid of appendages, but the degree of fusion varies greatly. At one extreme, all pleomeres are fused; in 2 cases, 3 separate pleomeres are distinguishable, the end being fused (Figs. 37G, H); 3 males besides the allotype have 4 pleomeres; 1 male has 5 pleomeres; the

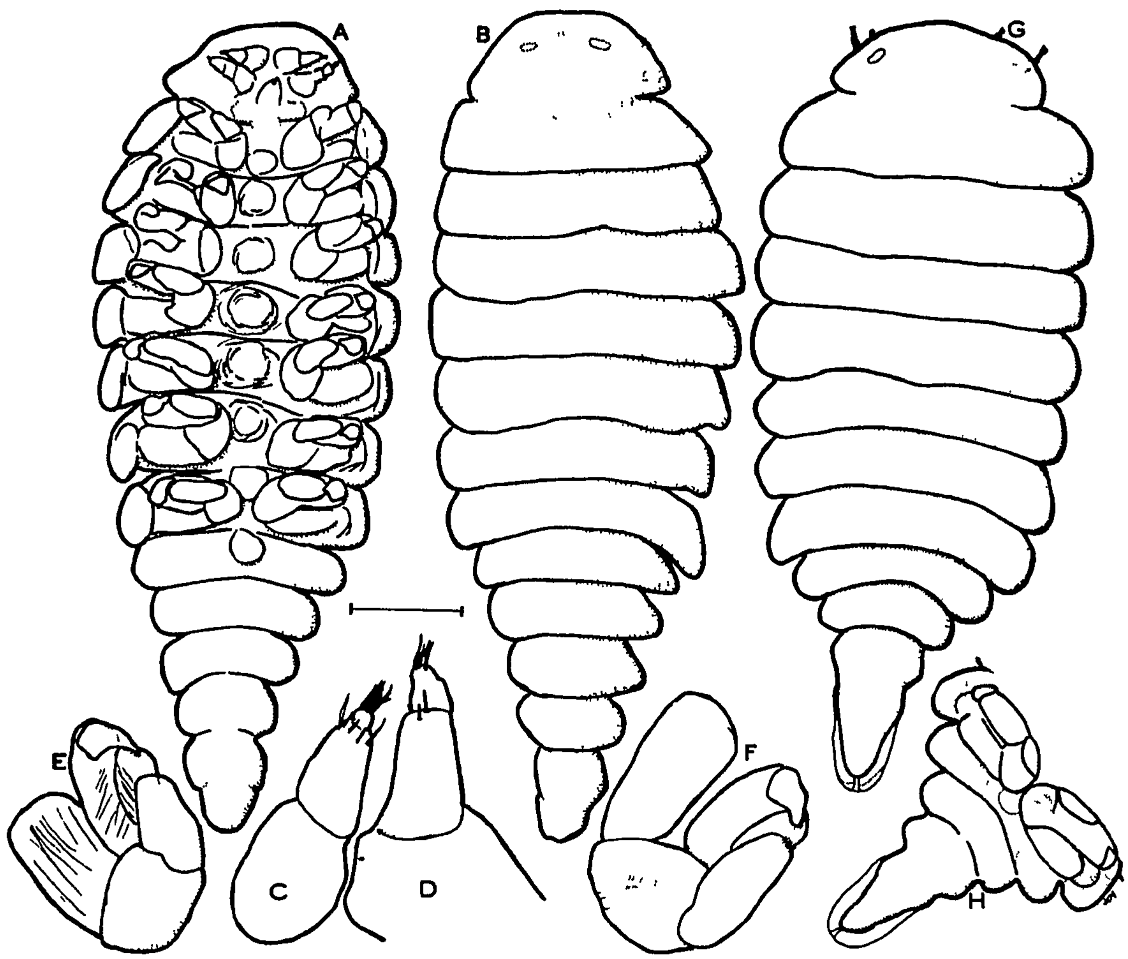

Fig. 37. Aporobopyrina anomala Markham. A-F, allotype male; G-H, paratype male. A. Ventral. B. Dorsal. C. Right antenna 1. D. Right antenna 2. E. Right pereopod 1. F. Right pereopod 7. G. Dorsal. H. Pleon, ventral. Scale: 0.5mm for A, B; 0.1mm for C, D; 0.2mm for E, F; 0.4mm for G, H.

final male has a damaged pleon, the segmentation of which is uncertain.

Discussion.

Aporobopyrina anomala exemplifies nearly all of the variability known in its genus, but both of the other described species of Aporobopyrina vary in characters generally considered to be of significance at the generic level in the Bopyridae. Some of the females of A. anomala have biramous uropods and others have the uropodal endopodites reduced or absent, while the only known female of A. javaensis has 1 uropodal endopodite reduced and the other absent. Similarly, the variation in the pleons of the males of A. anomala is reflected elsewhere in the genus. Though Shiino (1934) cited 4 pleomeres in the male as being diagnostic for the genus, he pictured the pleon of a male of A. lamellata which clearly had an incipient fifth pleomere. Further, the only known male of A. javaensis has 5 pleomeres, and Bourdon (1972a), in discussing his assignment of that species to Aporobopyrina, commented that too much emphasis has been placed on the number of pleomeres in the males as a systematic character. That it varies so much among the males which evidently belong to a single species indicates that it is indeed of little systematic value in the present case.

BALANOPLEON MARKHAM, 1974

Type-species, by original designation, *Balanopleon tortuganus* Markham, 1974. Gender, masculine.

Total number of species, 1. Geographical distribution: Venezuela.

Generic diagnosis.-- Female: Body strongly distorted so large head displaced to anterolateral corner; pleon reduced, of 5 pleomeres; 4 pairs of biramous pleopods; uniramous uropods; lateral plates reduced on pleomeres 1-3, absent on others; pleomere 5 produced into bulbous pleotelson. Male: All body regions and pereomeres distinct; pleon short, acorn-shaped, of 2 pleomeres, without appendages.

Remarks.-- Markham (1974) created the genus *Balanopleon* for the species *B. tortuganus*, still the only species known, a parasite of the galatheid *Munida simplex* Benedict collected off the coast of Venezuela. In both sexes, it appears most closely related to *Orbimorphus* Richardson (1911).

West Indian faunal region species: only 1 species, *Balanopleon tortuganus*.

Balanopleon tortuganus Markham, 1974

Figs. 38-40

Balanopleon tortuganus Markham, 1974, pp. 629-633, figs. 12-14. (Type locality, near Tortuga I., Venezuela.)

Material examined.

Infesting *Munida simplex* Benedict. Pillsbury Sta. P-734, off W end La Tortuga I., N of Venezuela, 11°02'N, 65°34'W, 60-68m, 22 July 1968,

B. S. Mayo, det. of host; 1♀, holotype, USNM 141599, 1♂, allotype, USNM 141600.

Description of holotype female (Figs. 38, 39).

Length 3.5mm, maximal width 2.4mm, head length 1.0mm, pleon length 1.0mm. Distortion 30°. Body ovate; head markedly displaced to concave side; all body regions and segments distinct (Fig. 38).

Head nearly oval, smoothly rounded both anteriorly and posteriorly. No eyes. Both antennae (Fig. 39A) of 3 segments, proximal one largest, middle one much smaller, distal one only tiny stub. Posteroventral border of head (Fig. 39B) with single long digitate process at each side, slight rounded projection immediately medial to each process, central region straight.

Pereon widest across pereomere 3. Broad middorsal ridge along pereon. Coxal plates barely covering borders of all pereomeres. Dorsolateral bosses moderately developed on first 5 pereomeres, absent on final two. Oostegites enclosing brood pouch; oostegite 1 (Figs. 39C, D) rounded anteriorly, produced into acute point posterolaterally, with deep central cleft externally reflected by prominent irregular dividing line internally. Pereopods (Figs. 39E, F) nearly doubling in size from first to seventh.

Pleon (Figs. 39G, H) with border starting with same contour as pereon, then tapering rapidly to round point, about 3/4 as long as wide. Five pleomeres, first three with reduced lateral plates. Pleopods foliaceous, biramous, exopodites somewhat smaller than endopodites. Uropods uniramous. Pleomere 5 produced into bulbous pleotelson.

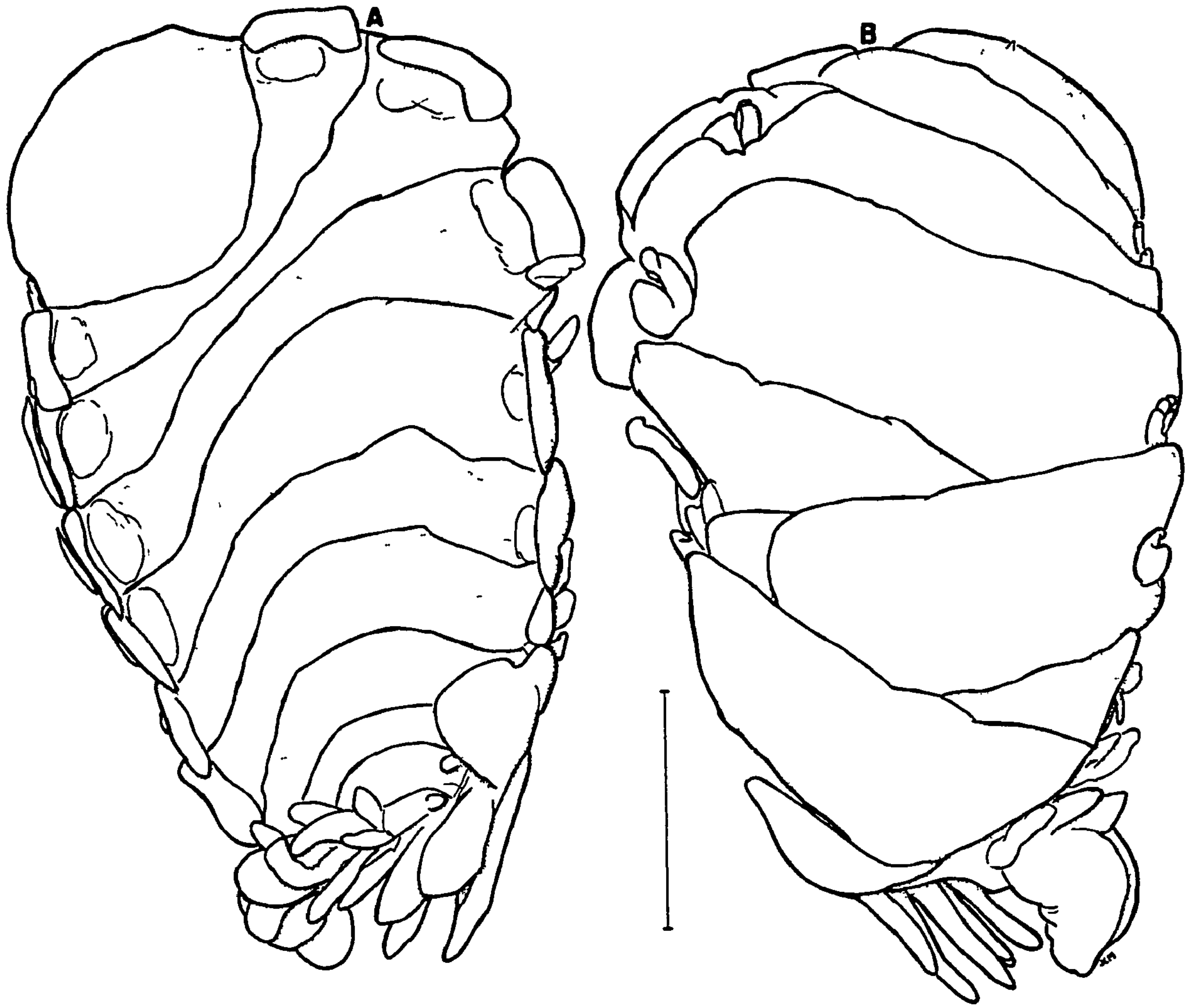

Fig. 38. Balanopleon tortuganus Markham, holotype female. A. Dorsal. B. Ventral. Scale: 1.0mm.

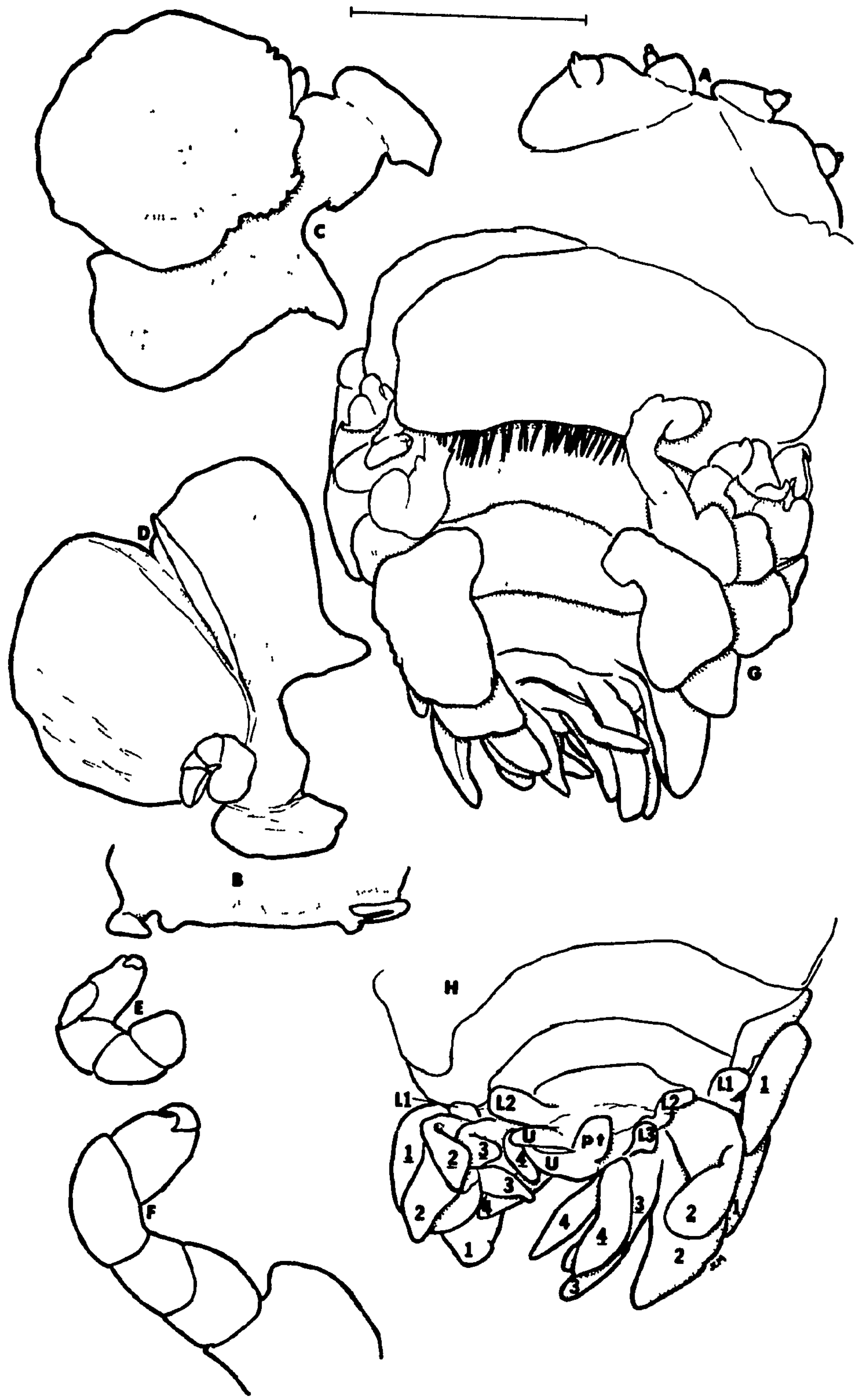

Fig. 39. Balanopleon tortuganus Markham, holotype female. A. Antennae. B. Posteroventral border of head. C. Left oostegite 1, internal. D. Same, external. E. Left pereopod 1. F. Left pereopod 7. G. Pleon, ventral. H. Pleon, dorsal (L1-L3, lateral plates 1-3; 1-4, pleopodal exopodites 1-4; 1-4, pleopodal endopodites 1-4; U, uropod; pt, pleotelson). Scale: 0.5mm for A, E, F; 1.0mm for B, C, D, G, H.

Description of allotype male (Fig. 40).

Length 1.5mm, maximal width 0.6mm, head length 0.2mm, pleon length 0.3mm. Sides of body nearly parallel, narrowing abruptly at both head and pleon (Figs. 40A, B). Body regions distinct.

Head with anterior edge nearly semicircular except for medial cleft, posterior edge with slight convexity. Eyes near posterolateral borders, each consisting of several scattered black pigment spots. First antenna (Fig. 40C) of 3 segments; ultimate one with 6 terminal setae, middle one with 3 terminal setae, proximal one with terminal pointed tubercle. Antenna 2 (Fig. 40C) of 4 segments; ultimate one with 6 terminal setae, next one with 1 terminal seta.

Pereomeres clearly separated by deep lateral clefts. Pereomeres nearly equally broad. Pereopods (Figs. 40D, E) all nearly of same size, though dactyli smaller and blunter posteriorly.

Pleon acorn-shaped, divided into 2 pleomeres, distinctly separated only dorsally. No trace of pleopods or uropods.

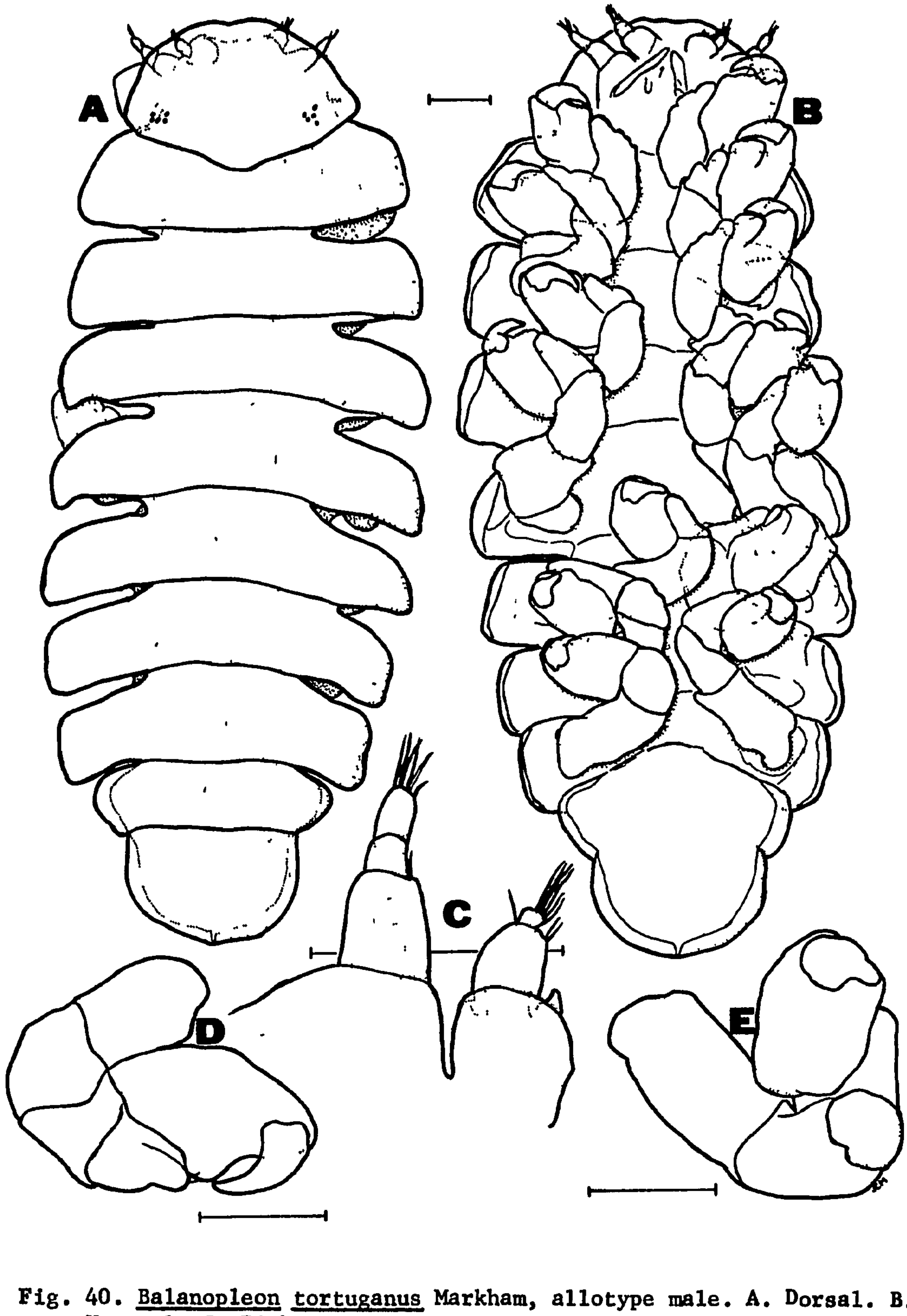

Fig. 40. Balanopleon tortuganus Markham, allotype male. A. Dorsal. B. Ventral. C. Right antennae. D. Right pereopod 1. E. Right pereopod 7. Scales: 0.1mm.

Unidentified pseudionine bopyrid 1

Material examined.

Infesting Pachycheles ackleianus A. Milne Edwards, hosts det. by R. H. Gore. Pillsbury Sta. P-895, near St. Lucia, 14°06'N, 61°01'W, 18m, 8 July 1969; 1♀, 1♂, UMML. Pillsbury Sta. P-1283, near Enriquillo, Dominican Republic, 17°31'N, 71°32'W, 18-26m, 19 Aug. 1968; 2♀, 2♂, UMML.

Discussion.

These specimens came to my attention too late to be considered in detail. Both sexes have distinctive characters which place them in an undescribed genus at a rather advanced level in the subfamily.

Unidentified pseudionine bopyrid 2

Material examined.

Infesting Munida irrasa A. Milne Edwards, host det. by B. S. Mayo. Gerda Sta. G-589, NW of Cay Sal Bank, 29°39'N, 80°45'W, 148-152m, 14 Apr. 1965; 1♀, 1♂, UMML 32.4521.

Discussion.

These 2 individuals cannot be assigned to any known genus. The female, which appears damaged, has only 3 pleomeres, while the male, which may still be in a late larval stage, has a uniquely shaped pleon. Since no other similar specimens were available for comparison with these possibly aberrant ones, I am reluctant to describe them and so have only noted their occurrence.

Unidentified pseudionine bopyrids not examined

Two parasites from the West Indian faunal region, which probably belong to the Pseudioninae, have been recorded in published accounts but have remained inaccesible to me. One of these infested *Nephropsis rosea* Bate near Grenada (called *N. aculeata* Smith by Bouvier, 1925, but reidentified by Holthuis, personal communication). The second parasite was recorded infesting *Munida longipes* A. Milne Edwards at 2 Cuban localities by Chace (1942). Because the former species has not otherwise been recorded as the host of a bopyrid, and the latter is recorded above as the host of 2 bopyrids in different genera, I cannot assign the parasites to any species without examining them.

SUBFAMILY IONINAE H. MILNE EDWARDS, 1840, EMEND. R. CODREANU, 1967

Type-genus, Ione Latreille, 1817

Diagnosis (modified after Codreanu, 1967).-- Female: All segments distinct; frontal lamina, coxal plates and dorsolateral bosses variously developed; brood pouch completely closed; often long middorsal projectione on pereon; pleon much narrower than pereon and deeply set into pereon; lateral plates present (except in Phyllodurus), at least first pair directed forward; pleopods biramous or occasionally uniramous; uropods uniramous; all pleopodal appendages elongate and with tuberculate to digitate margins. Male: Head separated from pereon; often midventral tubercles on some or all pereomeres and occasionally on some pleomeres; pleon of 6 pleomeres usually bearing tuberculiform pleopods; uropods present or absent. Branchial parasites (except for Phyllodurus) of brachyurans and rarely of anomurans and palinurans; world-wide distribution.

Remarks.-- This subfamily currently contains 28 genera, the greatest number of any bopyrid subfamily; so far there are 73 species known, including one described herein as new. Shiino (1952, 1965) considers the Ioninae, through the aberrant genus Phyllodurus Stimpson, to be ancestral to the Hemiarthrinae and Athelginae. While agreeing that this is a reasonable evolutionary sequence, I believe that Phyllodurus belongs in the Ioninae rather than Athelginae, where Shiino placed it. The single valid species of Phyllodurus, P. abdominalis Stimpson, differs from all other ionines by infesting its host abdominally and by lacking pleonal lateral plates in the female. Nonetheless, its male has 6 pleomeres with rudimentary pleopods, and its host is a callianassid. All other athelgines infest only paguroids, and their males completely lack pleonal segmentation and appendages. The males of all other ionines have 6 pleomeres with traces of appendages, and several of the most primitive ionines, including all species of Ione, the single species of Procepon and 1 species of Hypocepon, infest callianassids. Thus though Phyllodurus appears truly transitional, its affinities seem closest to the Ioninae.

Host selection seems to follow evolutionary lines in the Ioninae. The least specialized members of the subfamily infest anomurans, as do nearly all members of the Pseudioninae, which subfamily is evidently ancestral to the Ioninae. Nearly all of the other ioninines infest brachyurans, and they are the only bopyrids which do so to any important degree. A single species and often several congeneric species infest members of a single genus or family. However, some genera have remarkable host ranges: the 7 species of Dactylokepon, for example, infest members of 3 different brachyuran superfamilies and a palinuran.

Despite the large number of genera and species of ionines worldwide, this subfamily is rather poorly represented in the West Indian faunal region. Only 4 species, belonging to 3 different genera, are definitely known to occur here. Two other species, discussed below, infest host species found in this region, so they may turn up here eventually; I have included them in the following key and presented diagnoses of them.

Key to 4 genera of Ioninae known or expected in West Indian faunal region, based on mature females.

1. No middorsal projections on any pereomeres............. Dactylokepon.
-- Middorsal projections on at least some posterior pereomeres........2.
2. Pleonal appendages with tuberculate margins..............Cancricepon.
-- Pleonal appendages with deeply divided digitate margins............3.
3. Pereonal middorsal projections broad and flat, not pointed....Leidya.
-- Pereonal middorsal projections narrow, pointed..........Grapsicepon.

CANCRICEPON GIARD AND BONNIER, 1877

Type-species evidently never designated. Gender, masculine.

Total number of species, 7. Geographical distribution: English Channel; Dahomey; Eniwetok; Philippines; Georgia and Mississippi through Florida to Curaçao.

Generic diagnosis.-- Female: Body nearly circular in outline; frontal lamina very broad, laterally rounded and more or less turned down on head; posteroventral border of head with 2 pairs of sharply pointed lateral projections; 1 pair of blunt medial ones; 3 to 4 dorsolateral bosses; coxal plates coarsely tuberculate, especially on borders; pointed middorsal projections; tuberculate lateral plates; pleopodal endopodites rudimentary; large uniramous uropods. Male: All segments distinct; body broadest across middle of pereon, tapering gradually anteriorly and posteriorly from there; midventral pereonal tubercles present or absent; pleopods reduced, tuberculiform; uropods absent, but posterior edge of final pleomere produced into 2 small blunt points.

Remarks.-- Giard and Bonnier (1887b) published the first description of the genus *Cancricepon* although they did not indicate it was new. They included 2 species, *Cancricepon elegans* (Giard and Bonnier) and *C. pilula* (Giard and Bonnier), both of which they had previously named without descriptions as species of *Cepon* (Giard and Bonnier, 1886), but they did not designate either as the type-species, nor has anyone so designated any species. Bourdon (1968) pointed out that both *Cepon elegans* and *C. pilula* were nomina nuda, so they should now properly be referred to as *Cancricepon elegans* Giard and Bonnier, 1887, and *Cancricepon pilula* Giard and Bonnier, 1887.

Two other species have been described as members of *Cancricepon*; Bourdon (1971), while describing one of these, *C. anagibbosus*, revised that portion of the Ioninae containing Cancricepon and closely related genera. He incorporated Merocepon Richardson into Cancricepon and transferred Grapsicepon choprae to Cancricepon. Only the type-species of Merocepon, M. xanthi Richardson, was known to Bourdon at the time, but M. knudseni Danforth (1970), which had just been described, would also by implication be transferred, becoming Cancricepon knudseni (Danforth). There are thus 7 currently described species of Cancricepon as well as 2 records of undescribed Cancricepon spp. whose placement in this genus is uncertain.

Despite the wide geographical distribution of Cancricepon, its species are rather restricted in host selection. All species (including the 2 "Cancricepon spp.") infest xanthid crabs, and only the local species, C. choprae, has been recorded from more than 1 host species or from a host which is not a xanthid.

West Indian faunal region species: only 1 species, Cancricepon choprae.

Cancricepon choprae (Nierstrasz and Brender à Brandis, 1925)

Figs. 41, 42

?Leidya distorta, Hay and Shore, 1918, p. 440. [Not Leidya distorta (Leidy, 1855).]

Grapsicepon choprae Nierstrasz and Brender à Brandis, 1925, pp. 4, 7, figs. 11-16. (Type locality, Curaçao).-- Shiino, 1936a, pp. 169-171; 1942, p. 449.-- Schultz, 1969, p. 319, fig. 508.-- Danforth, 1972, pp. 165, 166, 167.

Ergyne rissoi Nierstrasz and Brender à Brandis, 1925, pp. 5, 7, figs.

17-21. (Type locality, Curaçao.); 1926, p. 52.-- Shiino, 1934, p. 276.-- Caroli, 1953, pp. 85-86.-- Schultz, 1969, p. 315, fig. 501. -- Danforth, 1972, p. 165.

"Isopod parasites," Rathbun, 1930, p. 246.

Portunicepon rissoi, Shiino, 1934, p. 276.

Grapsicepon choprai, Bourdon, 1971, pp. 387, 388, 389.

Cancricepon (Grapsicepon) choprai, Bourdon, 1971, p. 389.

Material examined.

Infesting Panopeus herbstii H. Milne Edwards. In brackish water, Isle of Hope River, Chatham County, Georgia, 20 June 1972, R. W. Heard, coll. and det. of host; 1♀, 1♂, USNM. Ossabow Sound, Georgia, 22 July 1972, R. W. Heard, coll. and det. of host; 1 immature ♀, USNM. At edge of canal E of Bayshore Drive, Miami, Florida, 23 May 1970, J. C. Markham, coll. and det. of host; 1♀, 1♂, UMML 32.4528.

Infesting Neopanope packardii (Kingsley), R. J. García-Gómez, coll. and det. of all hosts. Pelican Bank, off Turkey Point, Biscayne Bay, Florida, 29 July 1970; 3♀, 3♂ (including 2 pairs on 1 host, reference specimens), USNM. Near West Arsenicker Key, Biscayne Bay, Florida, 30 July 1970; 2 immature ♀, 1♂ on 1 host, UMML 32.4529. Same locality, 30 Dec. 1970; 1♀, 1♂, ZMC. Shallow water, S side Mangrove Point, Card Sound, Florida, 15 Sep. 1970; 1♀, 1♂, 32.4530. E side Mangrove Point, Card Sound, Florida, 7 Dec. 1970; 1♀, 1♂, RMNHL.

Infesting Micropanope barbadensis Rathbun. In Porites clumps at low tide, Tortugas, Florida, 2 July 1931, W. L. Schmitt, coll., M. J. Rathbun, det. of host; 1♀, USNM 75754.

Infesting Rhithropanopeus harrisi (Gould). Estación de Bustos, Vera

Cruz, México, 22 Dec. 1954, H. Hildebrand, coll., F. A. Chace, Jr., det. of host; 1♀ with hyperparasitic entoniscid, USNM.

Infesting Domecia hispida Eydoux and Souleyet. Caracas Baai, Curaçao, 1920, C. J. van der Horst, coll.; 1♀, holotype of Ergyne rissoi (allotype ♂ missing), ZMA.

Infesting Hexapanopeus angustifrons (Benedict and Rathbun). Mississippi Sound, about 2 miles N of Ship I., Mississippi, 5 Feb. 1973, R. W. Heard, coll. and det. of hosts; 3♀ (including 2 immature), 1♂, 1 cryptoniscan larva, USNM.

Infesting Panoplax depressa Stimpson, White Shoals, Tortugas, Florida, 20 July 1924, W. L. Schmitt, coll. and det. of host; 2♀ on 1 host, USNM.

Description of reference female (Fig. 41).

Body nearly as broad as long, almost circular in outline (Fig. 41A). All segments distinct but not markedly set apart. Pigment spots scattered on dorsal surface. Body axis only slightly distorted.

Head bilobed dorsally, completely encircled anteriorly by large frontal lamina. No eyes. Maxilliped (Fig 41B) suboval, produced into nonarticulate palp anteromedially. Posteroventral border of head (Fig. 41C) with 2 pairs of lateral entire projections and pair of broad blunt medial points.

Pereon broadest across pereomeres 3 and 4. Indistinct dorsolateral bosses on pereomeres 3-5. Slight middorsal ridge along most of pereon and pleon, produced into long pointed middorsal projections on pereomeres 5-7. Oostegites completely covering ventral surface of body and enclosing large brood pouch; oostegite 1 (Figs. 41D, E) rounded anteriorly, acutely pointed posterolaterally, with few large teeth on inter-

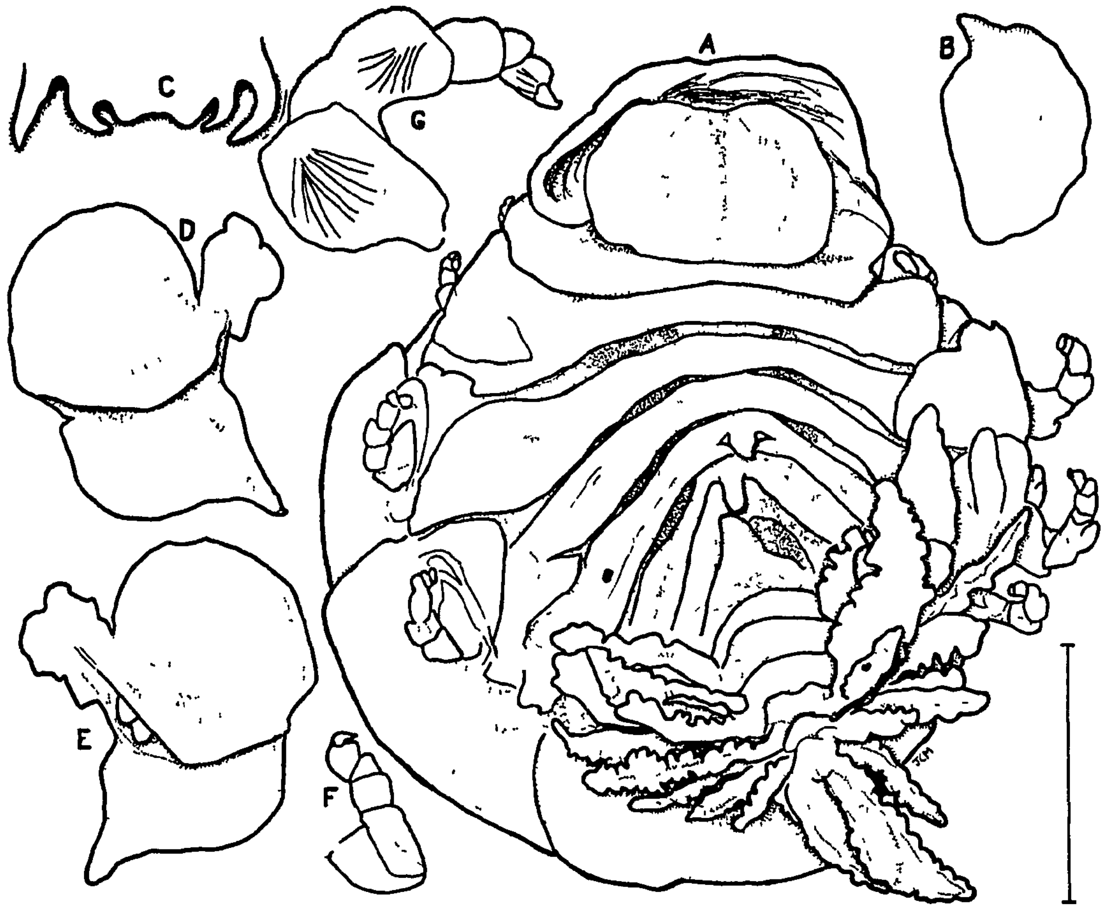

Fig. 41. Cancricepon choprae (Nierstrasz and Brender à Brandis), reference female. A. Dorsal. B. Left maxilliped. C. Posteroventral border of head. D. Left oostegite 1, external. E. Same, internal. F. Left pereopod 1. G. Right pereopod 4. Scale: 1.0mm for A-E; 0.3mm for F, G.

nal ridge. Pereopods 1 and 2 (Fig. 41F) small, pereopods 3-5 (Fig. 41G) very large and prominent. Final 2 pereopods greatly reduced and concealed by pleopods.

Pleon of 6 pleomeres, first 5 produced into large tuberculate lateral plates and bearing large uniramous pleopods closely similar to lateral plates; both lateral plates and pleopods progressively smaller posteriorly. Terminal pleomere bearing tuberculate uniramous uropods of same structure and size as anterior lateral plates.

Variations.

Among the other mature females of Cancricepon choprae examined, some are narrower relative to their length, a few have frontal laminae which extend still farther forward, and in some cases the dorsolateral bosses are much more distinct, as in the holotype. An immature female, in contrast to mature ones, is much narrower relative to its length, lacks middorsal pereonal projections and has rudimentary oostegites and a relatively longer pleon.

Description of reference male (Figs. 42A-F).

Body much longer than broad, all segments distinct, no abrupt narrowing (Figs. 42A, B). Dark persistent pigment spots scattered along body.

Head short, truncate anteriorly. Antenna 1 (Fig. 42C) with each segment bearing several setae distally. Antenna 2 (Fig. 42D) with distal segment bearing tuft of 6 terminal setae, next 2 segments with scattered setae. Eyes dark, distinct, irregularly shaped.

Pereon broadest across pereomere 4, tapering evenly anteriorly and

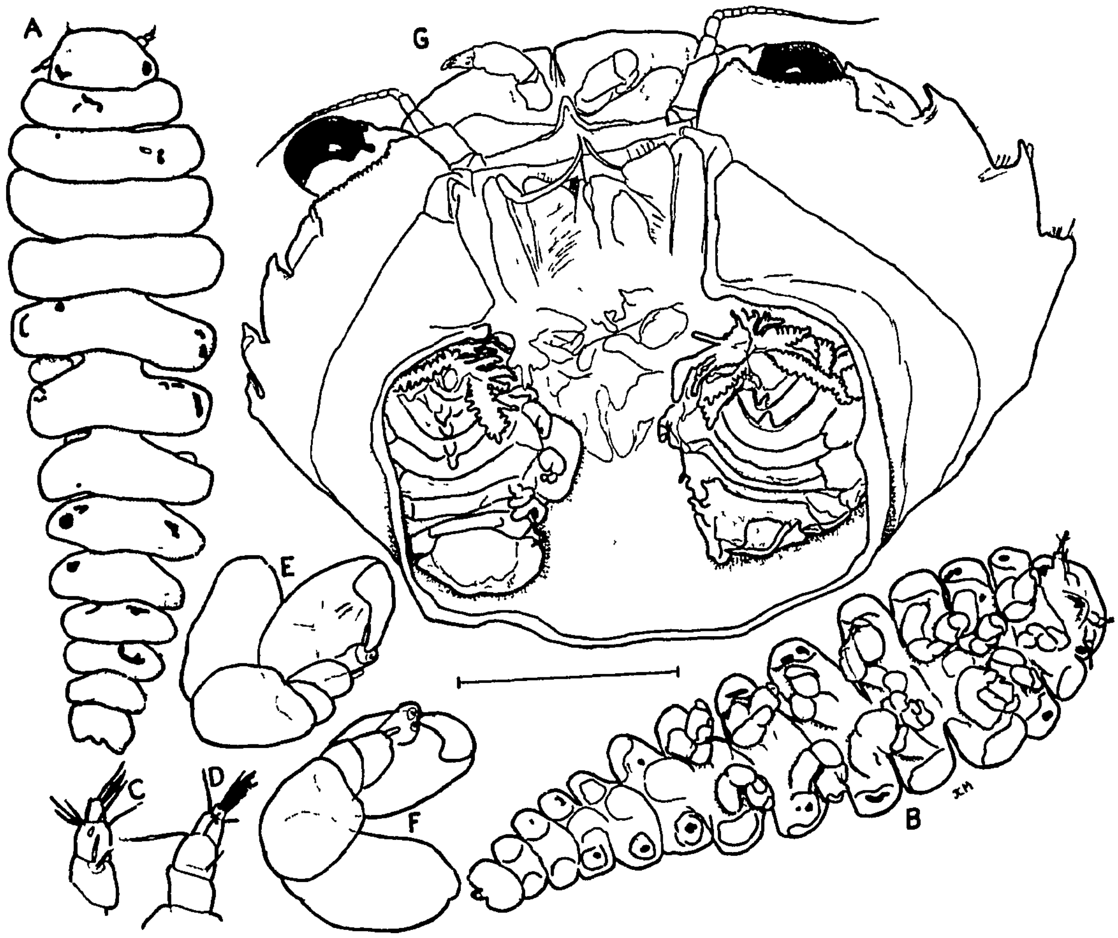

Fig. 42. Cancricepon choprae (Nierstrasz and Brender à Brandis). A-F, reference male. A. Dorsal. B. Ventral. C. Left antenna 1. D. Right antenna 2. E. Right pereopod 1. F. Left pereopod 7. G. Two females bilaterally infesting Neopanope packardii (Kingsley). Scale: 0.4mm for A, B; 0.1mm for C-F; 2.0mm for G.

posteriorly from there. Slight middorsal ridge along some of pereomeres. Pereomeres separated by deep lateral indentations. Pereopods (Figs. 42 E, F) all of nearly same size, dactyli progressively smaller posteriorly.

Pleon of 6 pleomeres, each slightly narrower than that preceeding it. Terminal pleomere produced into 3 blunt posterior points. Pleopods as ill-defined tubercles on first 5 pleomeres. No uropods.

Variations.

Some males are relatively broader with their segments less distinctly separated.

Discussion.

This species was originally described under the name *Grapsicepon choprae* as a parasite of *Liomera dispar* Rathbun by Nierstrasz and Brender à Brandis (1925). Rathbun (1930) established a new combination for the host's name, designating it *Paraliomera dispar* (Stimpson); she also recorded the parasitized individuals which Nierstrasz and Brender à Brandis had examined but assigned no name to the parasites. Bourdon (1971) transferred this species to *Cancricepon*, as discussed earlier.

The hosts of the other 8 species of *Cancricepon* (including the 2 designated *Cancricepon* sp.) are 8 species of xanthid crabs in 6 different genera, each species of parasite being recorded from a single host species. Thus the present record of *C. choprae* from 6 additional host species, none of them congeneric, is unique among species of *Cancricepon*; with its occurrence on the goneplacid *Panoplax depressa*, it also becomes the first species of the genus to be recorded from a host which is not a xanthid.

The occurrence of 2 pairs of parasites on a single host, 1 in each branchial chamber, is unusual among the Bopyridae, but it seems rather common for this species. Rathbun (1930) reports that all 3 parasitized individuals of _Paraliomera dispar_ which she examined were bilaterally infested, and 3 of the 14 hosts examined in the present material also had parasites in both branchial chambers (Fig. 42G). In those cases where the hosts were still present, 10 were males and 3 were females, a statistically significant difference. Occurrence in right and left branchial chambers, where determinable, was equal, 9 in each.

The hyperparasitic entoniscid from the female _Cancricepon choprae_ infesting _Rhithropanopeus harrisi_ appears to be a species of _Danalia_. It is probably _D. fraissei_ Nierstrasz and Brender a Brandis (1925), previously recorded from this species at Curaçao. Unfortunately, the male is missing, so specific identification is difficult.

Hay and Shore (1918) report a parasite from _Eriphia gonagra_ (Fabricius) at Beaufort, North Carolina, which they call "probably _Leidya distorta_." That specimen is unfortunately long since lost, so there is no way to confirm its identity. Bourdon and Bowman (1970) record _L. distorta_ (Leidy) only from various species of the ocypodid genus _Uca_, and Lemos de Castro (1973) records it from another ocypodid, _Ucides cordatus_ (L.). Since _Eriphia gonagra_ is a xanthid, it is highly unlikely that its parasite was _Leidya distorta_ and correspondingly likely that it was _Cancricepon choprae_.

The only other record of a bopyrid-infested xanthid from the western Atlantic is Pearse's (1947) description of _Pseudione panopei_ from _Panopeus herbstii_ at Beaufort, North Carolina. Examination of Pearse's type material shows that that species is definitely assignable to _Pseud-_

ione, but it is uncertain whether the host, which has been removed, was correctly recorded. It therefore remains doubtful whether any xanthid in the western Atlantic bears a bopyrid parasite other than _Cancricepon choprae_.

LEIDYA CORNALIA AND PANCERI, 1861

Type-species, by original designation, Cepon distortus Leidy. Gender, feminine.

Total number of species, 4. Geographical distribution: New Jersey to Bermuda and through Bahamas, Caribbean and Panamá to Brazil; Foochow, China.

Generic diagnosis.-- Female: Head bilobed dorsally, enclosed by prominent frontal lamina; eyes very reduced; prominent coxal plates on at least 4 pereomeres; broad nonpointed middorsal projections on at least some pereomeres; posterior segment of oostegite 1 at least as long as anterior segment; 6 pleomeres, first 5 bearing biramous pleopods, 5 pairs of prominent lateral plates; uropods uniramous, somewhat larger than but similar to pleopodal rami; all pleonal appendages digitate. Male: All segments distinct; body broadest near posterior part of pereon, tapering from there; midventral tubercles on at least first 5 pereomeres; pleopods represented by flat to tuberculiform chitinous disks; uropods filiform, generally at least as long as whole pleon.

Remarks.-- Cornalia and Panceri (1861) established the genus Leidya to included Cepon distortus Leidy, a parasite of the fiddler crab Uca pugilator (Bosc) in New Jersey, which Leidy (1855) had described only briefly and drawn very diagrammatically. The next find of a parasite attributed to Leidya distorta was reported by Richardson (1908), who so named a bopyrid found infesting Pachygrapsus transversus (Gibbes) in Bermuda. At the same time, Richardson (1908) opined that Grapsicepon fritzii Giard and Bonnier, a name assigned without description to a parasite which Müller (1871) had mentioned from a "Grapsus" in Brazil, may belong to this species as well. Next, Pearse (1947) reported Leidya distorta from Beaufort, North Carolina, again as a parasite of Uca pugilator, but he presented no description or figures. Considerable confusion arose when Pearse (1951) described as new the species *Leidya bimini*, a parasite of *Pachygrapsus transversus* in the Bahamas, evidently without being aware of Richardson's (1908) earlier record from the same host; he failed to mention any characters by which *L. bimini* could be reliably distinguished from *L. distorta*. It was not until Bourdon and Bowman (1970) published a report of a large number of specimens from many different hosts collected along much of the Atlantic coast of the United States and the Caribbean that it became clear that these 2 reported species of *Leidya* are distinct. Markham (1972c) then enlarged the host and geographic records for *L. bimini*. It now appears that the parasite of *Uca* spp. in the northwestern Atlantic is always *Leidya distorta*, while that of grapsid crabs in the same region is *L. bimini*, these 2 species being distinguishable by a few reliable but rather subtle distinctions.

The only other described species of *Leidya* are two which Pearse (1930) reported from Foochow, China. One of these, *L. sesarmae*, infested a *Sesarma*, while the other, *L. ucae*, came from a species of *Uca*, so it is possible that the same division between parasites of *Uca* spp. and grapsids occurs in the western Pacific as in the western Atlantic; unfortunately, the only known female of *L. sesarmae* appears immature, and *L. ucae* was described only from a male, so, until more material turns up, it is impossible to judge whether those 2 species really are separate. In any event, they do appear to belong to *Leidya*.

It is possible that another species of *Leidya* exists in southern California. Hilton (1917) reported several parasites of *Pachygrapsus crassipes* Randall from Laguna Beach, but all of his specimens, never identified, have evidently been lost, so their true identity is unknown.

West Indian faunal region species: 2 species, *Leidya bimini*, *Leidya distorta*.

Key to West Indian faunal region species of *Leidya*, based on adult females.

1. Pleopodal exopodites on convex side much longer than lateral plates; pleopodal endopodites well developed..................*L. distorta*.

-- Pleopodal exopodites on convex side only slightly longer than lateral plates; pleopodal endopodites rudimentary...............*L. bimini*.

Leidya distorta (Leidy, 1855)

Cepon distortus Leidy, 1855, p. 150, pl. XI, figs. 26-32. (Type locality, New Jersey).-- Harger, 1873, p. 573; 1879, pp. 157, 164; 1880, pp. 311, 433.-- Cornalia and Panceri, 1861, p. 86.-- Verrill, 1873, pp. 457, 459.-- Kossmann, 1877, pp. 122, 123; 1881c, pp. 178, 182. -- Gissler, 1882a, p. 8, footnote.-- Giard and Bonnier, 1887b, p. 12.-- Richardson, 1900, pp. 308-309.

Leidya distorta, Cornalia and Panceri, 1861, pp. 114-115.-- Giard and Bonnier, 1887b, pp. 63, 68-69, fig. 12.-- Stebbing, 1893, p. 412. -- Bonnier, 1900, pp. 48, 61, 169, 222, 255-257, 379, fig. 45.-- Richardson, 1901, p. 579; 1904a, pp. 74-75; 1905, pp. 511-512, figs. 559-560.-- Gerstaecker and Ortmann, 1901, pp. 183, 267.-- Giard, 1906, p. 705.-- Fowler, 1912, pp. 247-248, 523, 640, pl. 76. -- Nierstrasz and Brender à Brandis, 1923, p. 84; 1931, p. 189.-- Pearse, 1942, pp. 247-248, fig. 339; 1947, p. 326.-- Schultz, 1969,

p. 317 (pro parte; see remarks above), fig. 505.-- Bourdon and Bowman, 1970, pp. 409-418, 419, 421-422, figs. 1-5.-- Markham, 1972c, pp. 190, 191.-- Lemos de Castro, 1973, pp. 1-3, figs. 1-3.

Cepes distortus, Van Beneden, 1976, p. 145.

Phryxus distortus, Walz, 1882, p. 183.

Not Leidya distorta, Richardson, 1908, pp. 23-26, figs. 1-5.-- Verrill, 1908, p. 323, footnote.-- Williams, 1965, p. 218.-- Bourdon, 1968, p. 406. [= Leidya bimini Pearse, 1951].

?Leidya distorta, Hay and Shore, 1918, p. 440. [? = Cancricepon choprae (Nierstrasz and Brender à Brandis, 1925)].

Leidyi distorta, Miner, 1950, p. 451, pl. 145.

Material examined: none.

Description of female (Adapted from Bourdon and Bowman, 1970).

Body ovate. Head set into pereon. All segments distinct.

Head distinctly bilobed dorsally. Frontal lamina covering anterior edge and about half of each side of head. No eyes. Antennae very reduced. Posteroventral border of head variable, bearing at least 1 pair of lateral projections, often 2 pairs of such projections frequently extending far back on pereon.

Pereomeres separated by deep grooves dorsally. Undivided middorsal projections on 4-6 pereomeres, of variable prominence, forming carina usually displaced to 1 side. Prominent coxal plates on all pereomeres. Pereopods all essentially alike except posterior ones much larger, dactyli greatly reduced. Oostegites tightly enclosing brood pouch; first oostegite with internal ridge bearing tubercles to long digitate processes, and with posterior portion often greatly elongate and irregularly crenulate along posterior margin; fifth oostegite bearing long setae on posterior margin.

Pleomeres distinctly set apart. First 5 pleomeres produced into long digitate lateral plates. Five biramous pleopods with exopodites much longer than respective lateral plates, endopodites more slender and up to half as long as respective exopodites; all rami digitate like lateral plates. Uniramous digitate uropods similar in structure to lateral plates and pleopodal rami but much broader than any of them.

Description of male (Adapted from Bourdon and Bowman, 1970).

All body regions and segments distinct. Sides of body evenly tapered anteriorly and posteriorly from posterior region of pereon.

Head abruptly narrower than pereon. Antenna 1 of 3 segments; antenna 2 of 5-8 segments; both bearing some setae on distal segments. Conspicuous elongate eyes on posterolateral regions of head.

Pereomeres separated by slight lateral indentations. Midventral tubercle on each pereomere. Pereopods all of nearly same size, with scales on posterior carpal and propodal margins.

Pleon of 6 pleomeres, first two with midventral tubercles. Pleopods tuberculiform, bearing peculiar chitinous ornamentation. Uropods long and tapering, extending far beyond end of body. Prominent anal tube at posterior edge.

Discussion.

Bourdon and Bowman (1970) carefully described and illustrated a large series of specimens of *Leidya distorta*. They also first recorded *L. distorta* from the West Indian faunal region, specifically from Guadeloupe and Trinidad, although most of their material came from Georgia and North Carolina, i. e. outside the area under under consideration. I have not examined their material and do not believe it would be possible to improve on the work which they have done, so there are no illustrations of L. distorta included here, and the above descriptions are adapted from those of Bourdon and Bowman (1970).

Bourdon and Bowman (1970) report Leidya distorta from the following hosts: Uca pugilator (Bosc) in North Carolina, U. pugnax (Smith) in Georgia, U. minax (Le Conte) in Georgia, Uca sp. in Georgia and Guadeloupe and U. vocator (Herbst) in Trinidad. This is the only bopyrid known from any species of Uca in the western Atlantic. Reexamination of the material from Pachygrapsus transversus (Gibbes) in Bermuda attributed to Leidya distorta by Richardson (1908) proved that it belonged to L. bimini instead, so L. distorta is so far known only from Uca spp. in the northwestern Atlantic. Lemos de Castro (1973), in the first Brazilian record of this species, reported it as a parasite of Uca pugnax and the ocypodid Ucides cordatus (L.). The latter species is common throughout the West Indian region (Chace and Hobbs, 1969), but it has never been recorded as the host of a bopyrid there.

Leidya bimini Pearse, 1951

?[Bopyrus sp.], Muller, 1871, p. 82.

?Grapsicepon Fritzii Giard and Bonnier, 1887b, pp. 63, 70 [nomen nudum]. -- Bonnier, 1900, p. 266.

?Grapsicepon fritzii, Stebbing, 1893, p. 413.-- Richardson, 1904a, pp. 67-68, 88; 1908, p. 23.-- Nierstrasz and Brender à Brandis, 1923, p. 83.-- Mouchet, 1931, p. 506.-- Shiino, 1936c, p. 169; 1942, p. 442.-- Danforth, 1972, p. 165.

"A parasite," Rathbun, 1918, p. 245.

Leidya [sp.], Rathbun, 1918, p. 248.

Leidya distorta, Richardson, 1908, pp. 23-24, figs. 1-5.-- Verrill, 1908, p. 323, footnote.-- Williams, 1965, p. 218.-- Bourdon, 1968, p. 406.-- Schultz, 1969, p. 317 (pro parte; see remarks above). [Not Leidya distorta (Leidy, 1855).]

Leidya bimini Pearse, 1951, pp. 368-369, figs. 77a-i. (Type locality, Bimini, Bahamas).-- Schultz, 1969, p. 318, fig. 506.-- Hartnoll, 1965, pp. 135, 138. Bourdon and Bowman, 1970, pp. 409-410, 419-422, fig. 6.-- Markham, 1972c, pp. 190-192, fig. 1.-- Lemos de Castro, 1973, p. 2.

Material examined.

Infesting Pachygrapsus transversus (Gibbes). Pier of School of Marine and Atmospheric Science, University of Miami, Virginia Key, Miami, Florida, Oct., Nov. 1969, J. C. Markham, coll. and det. of hosts; 3♀, 2♂, UMML. Among rocks near water-line, west jetty, Safe Harbor, Stock Island, Key West, Florida, 24 Mar. 1970, J. C. Markham, coll. and det. of hosts; 3♀ (including 1 immature), 2♂, USNM. Just below tide line on bottom covered by Laurencia sp., Galeta I., Panamá, 26 Oct. 1970, L. G. Abele, coll. and det. of host; 1♀, 1♂, USNM.

Infesting Sesarma ricordi H. Milne Edwards. In shallow water, Coconut Grove (? = Matheson Hammock), Miami, Florida, Nov. 1923, J. Silver, coll., L. G. Abele, det. of hosts; 2♀, 2♂, USNM 58430.

Description of female (Adapted from Bourdon and Bowman, 1970).

Body outline and segmentation like those of L. distorta.

Head bilobed dorsally, frontal lamina along front of head but not on either side. Antennae very reduced. Eyes absent. Posteroventral border of head as in *L. distorta*.

First 5 or 6 pereomeres bearing middorsal bosses, generally much broader than those of *L. distorta*; at least final bosses bifid, two or three other posterior bosses usually bifid as well. Pereopods and coxal plates relatively smaller than in *L. distorta*, oostegites as in that species.

Pleopodal endopodites nearly same length as corresponding lateral plates, exopodites greatly reduced. Uropods as in *L. distorta*. All pleonal appendages with markedly digitate margins.

Description of male (Adapted from Bourdon and Bowman, 1970).

Like *L. distorta* in all respects except midventral tubercles better developed and present on first 5 pleomeres rather than only on first two.

Discussion.

With *Leidya bimini*, as with *L. distorta*, there is little which can be contributed to its description beyond what Bourdon and Bowman (1970) have done very well. Thus I have also omitted drawings of this species and adapted the above descriptions from that report.

Leidya bimini is so far known only from the West Indian faunal region, where it ranges from Bermuda through the Bahamas, southern Florida and the Caribbean to Panamá. In all localities it infests *Pachygrapsus transversus*. In Miami, it is now also known from *Sesarma ricordi*, and it is probable that the immature female reported from *Cyclograpsus integer* H. Milne Edwards in Jamaica by Hartnoll (1965) also belongs to this species.

Müller (1871) reported, without any trace of description, a parasite collected near Florianópolis, Brazil, infesting a "*Grapsus* (*Leptograpsus rugulosus*?)," which, by implication, he placed in the genus *Bopyrus*. Giard and Bonnier (1887b) assigned the name *Grapsicepon Fritzii* to this parasite and considered the host to be *Pachygrapsus transversus*, of which *Leptograpsus rugulosus* H. Milne Edwards is a synonym (Rathbun, 1918). Richardson (1908) considered the parasite to be a probable synonym of *Leidya bimini* (which she called *L. distorta*), and it may well be so. Unfortunately, the original material is lost, and no further specimens of that parasite have been found, so its identity remains unknown. Since the range of *Pachygrapsus transversus* is not only along much of the western Atlantic coast but also along the tropical Pacific American coast and from western Africa through the Mediterranean (Chace and Hobbs, 1969), it is likely that *Leidya bimini* will eventually be found to have a much wider range than is now known for it.

DACTYLOKEPON STEBBING, 1910

Type- species evidently never designated. Gender, masculine.

Total number of species, 7. Geographical distribution: Amirante; Seychelles; Palao; Gulf of Aqaba; Sénégal; North Carolina; Caribbean.

Generic diagnosis.-- Female: Frontal lamina well developed; maxilliped with curved, pointed, nonarticulated palp; deeply divided lateral projections on posteroventral border of head; all but terminal pereomere with coxal plates, no midventral projections, nontuberculate dorsolateral bosses; 5 pairs of digitate lateral plates; 5 pairs of digitate biramous pleopods; large uniramous digitate uropods. Male: All segments distinct; eyes present; no midventral pereonal tubercles; first 2 pairs of pereopods with much better developed dactyli than others; pleon of 6 pleomeres; pleopods tuberculiform; uropods absent, though possibly indicated by 2 blunt posterior points on terminal pleomere.

Remarks.-- Stebbing (1910) established the genus Dactylokepon and simultaneously described 2 species from the Indian Ocean, D. richardsonae and D. catoptri, but he did not designate either as the type-species; because D. richardsonae was described first and in greater detail, it would be the appropriate choice to be type-species.

The 7 species of Dactylokepon are distributed around the world, all but D. hunterae being from the tropics, on a remarkable variety of hosts. Only 2 species are known from more than 1 host species, but no 2 species infest hosts in the same genus; indeed, their 7 host genera belong to 5 different families (Portunidae, Pinnotheridae, Leucosiidae, Xanthidae and Scyllaridae) in 4 different superfamilies. D. holthuisi Bourdon (1967a) even infests a palinuran, making this the only bopyrid genus to have representatives on both palinurans and brachyurans.

West Indian faunal region species: 1 known, Dactylokepon n. sp., 1 expected, Dactylokepon hunterae.

Key to known and expected West Indian faunal region species of Dactylokepon, based on adult females.

1. Body narrow, nearly twice as long as broad; uropods longer than pleon...Dactylokepon n. sp.

-- Body rounded, more than 2/3 as broad as long; uropods much shorter than pleon...D. hunterae.

Dactylokepon n. sp.

Figs. 43, 44

Material examined.

Infesting Iliacantha subglobosa Stimpson. Pillsbury Sta. P-1387, offshore of SE coast of Dominican Republic, 18°21'N, 69°09'W, 130-165m, 9 July 1971; 1♀, paratype, USNM 143657, 1♂, allotype, USNM 143656. Pillsbury Sta. P-1395, same general locality, 18°21'N, 69°12'W, 166m, 10 July 1971; 1♀, holotype, USNM 143654, 1♂, paratype, USNM 143655.

Infesting Iliacantha liodactyla Rathbun. Pillsbury Sta. P-1315, 09°36'N, 82°32'W, off Río Sixaolo on Costa Rican-Panamanian border, 27-29m, 26 Jan. 1971; 1 immature ♀, RMNHL.

Description of holotype female (Fig. 43).

Length 7.8mm, maximal width 3.2mm, head length 1.4mm, pleon length 1.9mm. Distortion 6°. All body regions and segments distinct (Figs. 43 A, B).

Head oval, bordered by prominent frontal lamina anteriorly. No

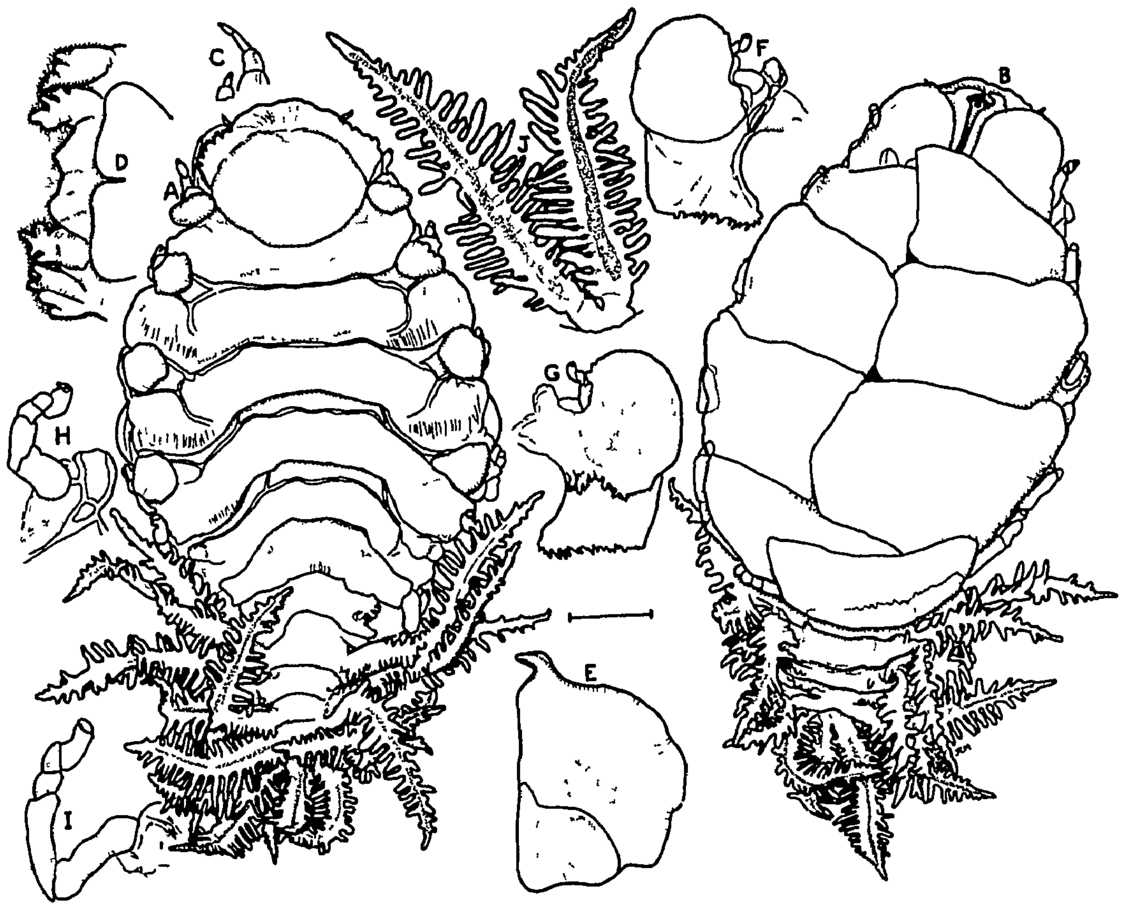

Fig. 43. Dactylokepon n. sp., holotype female. A. Dorsal. B. Ventral. C. Left antennae. D. Posteroventral border of head. E. Left maxilliped. F. Left oostegite 1, external. G. Same, internal. H. Left pereopod 1. I. Left pereopod 7. J. Uropods. Scale: 1.0mm for A, B, F, G; 0.5mm for C-E, H-J.

eyes. Antennae (Fig. 43C) of 3 and 5 segments, respectively, bearing no evident setae; antenna 2 extending well beyond border of head. Postero-ventral border of head (Fig. 43D) with pair of broad digitate lateral projections on each side, broad cleft medially. Maxilliped (Fig. 43E) nearly semicircular, with acutely pointed nonarticulated palp.

Pereon broadest across pereomere 3, tapering evenly anteriorly and posteriorly from there. No midventral ridge or projections. Prominent dorsolateral bosses on pereomeres 1-4, Oostegites not quite enclosing brood pouch; oostegite 1 (Figs. 43F, G) smoothly rounded anteriorly, with digitate margins internally and posteriorly, no posterolateral point. Pereopods (Figs. 43H, I) progressively longer posteriorly.

Pleon of 6 pleomeres, first 5 bearing elongate digitate lateral plates and biramous pleopods, terminal pleomere with large uniramous uropods of same structure (Fig. 43J).

Variations.

The paratype female agrees in all respects with the holotype except that the posterior border of the first oostegite is entire rather than being digitate. The female infesting Iliacantha liodactyla is immature, to judge from its empty brood pouch. Despite its immaturity and reduced size, it caused considerable swelling of its host's carapace, as did the other 2 pairs. Due to its immaturity, some of the characters of this female are obscured, although the discernable characters agree with those of the other 2 females. Its body is sharply reflexed along a mid-dorsal line, leaving the brood pouch greatly reduced. The pleopods reach much farther forward, but this may be due to the relatively smaller body.

Description of allotype male (Fig. 44).

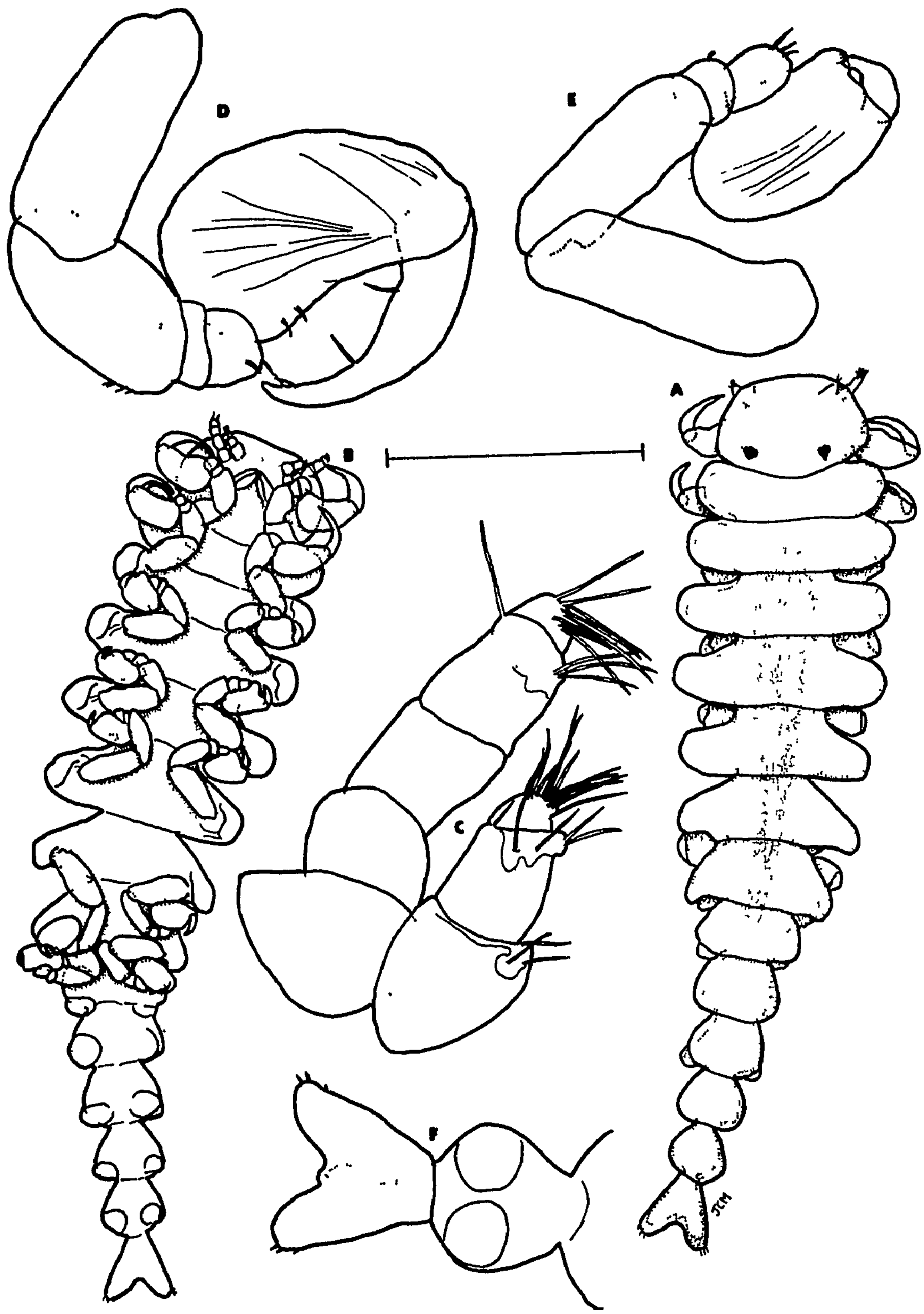

Fig. 44. Dactylokepon n. sp., allotype male. A. Dorsal. B. Ventral. C. Right antennae. D. Right pereopod 1. E. Right pereopod 7. F. Pleomeres 5-6, ventral. Scale: 1.0mm for A, B; 0.1mm for C; 0.2mm for D, E; 0.4mm for F.

Length 3.3mm, maximal width 0.8mm, head length 0.4mm, pleon length 1.2mm. All body regions and segments set off by deep indentations, not abruptly narrower at any point (Figs. 44A, B).

Head pentagonal, about 2/3 as long as wide. Fairly large dark eyes near posterior border. Antenna 1 (Fig. 44C) with about 11 terminal setae on distal segment, 5 on middle segment, 3 on basal one; segments decreasing in size distally; middle segment bearing protuberance on distal edge. Antenna 2 (Fig. 44C) with distal tuft of about 10 setae, subterminal segment bearing 4 setae on distal edge.

Pereon broadest across pereomeres 3 and 4, tapering gradually anteriorly to head and posteriorly through pereomere 5. Pereopods (Figs. 44D, E) smaller posteriorly, dactyli much larger and propodi attached more proximally on first 2 pereopods than on others.

Pleon (Fig. 44F) of 6 pleomeres, first 5 with tuberculiform pleopods, terminal pleomere produced into 2 rounded divergent points, each bearing some setae posteriorly. No uropods.

Variations.

The paratype male differs in having much larger eyes, less setose antennae and a relatively broader pleon.

Discussion.

Dactylokepon n. sp. appears most closely similar to D. richardsonae Stebbing (1910), the male of which is unknown. The female of D. richardsonae differs from that of the new species in having a broader body, a smoother and more extended frontal lamina, a longer head, no conspicuous dorsolateral pereonal bosses and shorter uropods. A second species which is similar to Dactylokepon n. sp. is D. hunterae Wells and Wells (1966), the female of which has a narrower and straighter frontal lamina, a relatively broader body, pereopods broader relative to their length, uropods smaller relative to pleopods, and the posteroventral border of the head and the first oostegite differently shaped; the male of D. hunterae differs from that of Dactylokepon n. sp. in having less distinctly separated segments, smaller eyes, smaller pleopods and more convex lateral edges on the terminal pleomere.

This is the first record of bopyrid infestation of any leucosiid in the western Atlantic or of any species of Iliacantha in the world. Other leucosiids known as hosts of bopyrids are Pseudomyra mbizi Capart, infested by Dactylokepon marchadi Bourdon (1967) in Sénégal, and Philyra pisum de Haan, infested by Apocepon pulcher Nierstrasz and Brender à Brandis (1930) in Tsingtau, China, several localities in Japan, the Kyûsyûs and Amakosas (Shiino, 1936a, b, 1939a, 1958).

Dactylokepon hunterae Wells and Wells, 1966

Dactylokepon hunterae Wells and Wells, 1966, pp. 53-57, figs. 1, 2. (Type locality, Core Banks, North Carolina).-- Schultz, 1969, p. 317, fig. 504.

Material examined: none.

Description of female (adapted from Wells and Wells, 1966).

Body slightly asymmetrical, ovate, convex ventrally, flat dorsally.

Head oval, 1.5 times as wide as long, bilobed. Frontal lamina covering anterior margin, not extending to sides. Eyes small. Antennae prominent, of 4 and 5 segments respectively. Posteroventral border of head with pair of digitate lateral projections on each side.

Pereomeres bearing small coxal plates, first 4 pereomeres with dorsolateral bosses. Oostegites enclosing brood pouch; oostegite 1 with blunt posterolateral point.

Pleon twice as long as wide, of 6 pleomeres, first five bearing elongate digitate lateral plates and biramous pleopods. Uniramous uropods less digitate than lateral plates and pleopodal rami, shorter than pleon and any lateral plates.

Description of male (adapted from Wells and Wells, 1966).

Sides of body slightly tapered from pereomere 4. Head somewhat narrower than pereon, pleon markedly narrower than pereon.

Head rounded anteriorly, slightly truncate posteriorly, 1.4 times as broad as long. Small eyes posterior to midregion. Antennae 1 and 2 of 3 and 4 segments, respectively, all but proximal segment of antenna 1 bearing distal tufts of setae.

Pereomeres separated by lateral incisions, lateral margins rounded. Pereopods typical for genus.

Pleon of 6 pleomeres, first five with rather obscure tuberculiform pleopods. Terminal pleomere markedly convex laterally, produced into 2 posterolateral points, each bearing some setae posteriorly; anal tube prominent on medial posterior border. No uropods.

Discussion.

Dactylokepon hunterae is so far known only from the type material, 2 pairs found infesting *Pinnotheres maculatus* Say off Core Banks, North Carolina, which I have not examined. Rathbun (1918) reports *P. maculatus* from several localities in the Caribbean, so it is likely that *Dactylo-*

kepon hunterae will be found in the West Indian faunal region eventually. Since Wells and Wells (1966) described *D. hunterae* very well, I have chosen to adapt their description rather than drawing up an original one.

GRAPSICEPON GIARD AND BONNIER, 1887

Type-species, by monotypy, *Cepon messoris* Kossmann. Gender, masculine.

Generic diagnosis.-- Female: Frontal lamina large anteriorly, truncate laterally; middorsal pereonal projections present; pleonal lateral plates finely digitate; pleopodal endopodites rudimentary. Male: All segments distinct; sides of body subparallel; midventral tubercles on all pereomeres and at least first 2 pleomeres; pleopods tuberculiform to knoblike; no uropods.

Remarks.-- The genus *Grapsicepon* had the same origin as *Cancricepon* in that Giard and Bonnier (1887b) first established it with 2 nominal species without designating either as the type-species. One of these was *Grapsicepon fritzii*, a nomen nudum discussed above as a possible synonym of *Leidya bimini*, while the other was *G. messoris* (Kossmann). The latter species was originally named *Cepon messoris* by Kossmann (1877), who described the mouth parts but little else of the female of that parasite of *Metopograpsus messor* (Forskål) from the Red Sea. Thus *Grapsicepon messoris* is the type-species by monotypy, even though it is only poorly known. Giard and Bonnier (1888b) named but did not describe *G. Edwardsi* and *G. amicorum*. The former, a parasite of *Planes minutus* (L.) in the Sargasso Sea, was described and illustrated in minute detail by Bonnier (1900), who simultaneously described the latter species and assigned it to *Trapezicepon*. Both of these species are thus attributable to Bonnier (1900), the earlier references being nomina nuda. The 4 other valid species of *Grapsicepon* currently known infest a variety of hosts in the western Pacific.

West Indian faunal region species: none known, but 1 species, *Graps-*

icepon edwardsi, expected.

Grapsicepon edwardsi Bonnier, 1900

Grapsicepon Edwardsii Giard and Bonnier, 1888b, pp. 45, 46, 47 [nomen nudum]; 1890, p. 376.-- Hansen, 1895, p. 43.

Grapsicepon Edwardsi, Stebbing, 1893, p. 413 [nomen nudum].

Grapsicepon Edwardsi Bonnier, 1900, pp. 48, 61, 70, 114, footnote, 169, 221, 263-266, 269, 379, 411-414, pls. VIII, IX. (Type locality, Azores.)

Grapsicepon edwardsii, Richardson, 1905, pp. 513-518, figs. 561-562.-- Hay, 1917, p. 570.-- Menzies and Glynn, 1968, p. 13.

Grapsicepon edwardsi, Richardson, 1908, p. 23.-- Tattersall, 1911, pp. 239-242, figs. 133-138.-- Nierstrasz and Brender à Brandis, 1923, p. 83; 1925, pp. 4, 7.-- Shiino, 1936c, pp. 169, 171, 172; 1942, p. 449.-- Bourdon, 1968, p. 406.-- Danforth, 1972, pp. 165, 166, 167.

Grapsicepon Edwardsii, Norman, 1905, p. 17.

Cancricepon edwardsi, Zimmer, 1927, p. 710, fig. 749.

?Bopyrus squillarum, Adams, 1960 [not Bopyrus squillarum Latreille, 1802].

Grapsicepon edwardii [sic], Schultz, 1969, p. 318, fig. 507.

Material examined.

Evidently infesting Planes minutus (L.). Talisman Sta., at surface, Sargasso Sea [Azores], 10 Aug. 1883, from Paris Museum, H. Richardson, det.; 1 badly shrivled ♀, USNM 42168.

Description of female (adapted from Richardson, 1905).

Body oval in outline. All segments distinctly set apart. Head deeply immersed in pereon.

Head enclosed by large sharply bent frontal lamina continuing half way along sides of head. Antennae 1 and 2 of 3 and 5 segments, respectively. No eyes. Posteroventral border of head with pair of bluntly pointed lateral projections of nearly equal size on each side.

First 4 pereomeres with large dorsolateral bosses; final 2 pereomeres produced into long pointed middorsal projections. Oostegites completely enclosing brood pouch; oostegite 1 with rounded anterior portion, irregularly digitate internal ridge, entire posterior border not extended into posterolateral point. Pereopods nearly equal in size, basal segment of each enlarged.

Pleon of 6 pleomeres, each of first five produced into long lateral plates and bearing slightly shorter pleopodal exopodite, except on pleomere 5, where exopodite much larger than lateral plate; pleopodal endopodites reduced and knoblike. Terminal pleomere bearing uniramous uropods much longer than any other appendages. Lateral plates, pleopodal exopodites and uropods all with deeply digitate margins.

Description of male (adapted from Richardson, 1905).

All segments distinct. Body tapering slightly anteriorly and posteriorly from posterior region of pereon.

Head broader than long. Antennae 1 and 2 of 3 and 5 segments respectively, several segments setose.

Pereomeres deeply separated laterally, each bearing large round midventral tubercle. Pereopods all alike, with sharply pointed dactyli.

Pleon of 6 distinct pleomeres, first three bearing midventral tubercles like those on pereomeres but smaller. Tuberculiform pleopods on first 5 pleomeres. No uropods, but posterior border of terminal pleomere bearing tufts of setae.

Discussion.

Bonnier (1900) described and illustrated both sexes of Grapsicepon edwardsi in superb detail. Richardson (1905) reproduced Bonnier's drawings and quoted his description in full, both in French and in English translation. The type locality was listed as the Sargasso Sea. The host was Planes minutus (L.) (called Nautilograpsus minutus), collected by the Talisman in August 1883, evidently in the Azores, according to Milne Edwards and Bouvier (1900). The only other records of this species are those of Hansen (1895), who reported it "im Floridastrome (39,4° N. Br.) [and about 58° W]," and also mentioned 6 other specimens of Grapsicepon edwardsi from 20°40'N to 32° N and 28°30'W to 55° W in the collection of the Copenhagen Museum. Thus this species clearly extends across the middle northern Atlantic, though it is not yet reported in the West Indian fauna. The collection of the Smithsonian Institution contains but a single damaged female also from the Talisman collections and presumably taken in the Azores. Chace (1951) reports that Planes minutus is rather common off the Atlantic coast of Florida and in the Bahamas, but I have found it only rarely there and never infested. Kenneth Smith of Woods Hole, Massachusetts, has found numerous specimens of P. minutus between Woods Hole and Bermuda, but none was parasitized (personal communication).

Since I had no suitable material on hand and certainly could not have improved on the original description by Bonnier (1900), I have only abstracted the salient points of that description, as presented in translation by Richardson (1905).

SUBFAMILY ENTOPHILINAE RICHARDSON, 1903

Type-genus, *Entophilus* Richardson, 1903

Diagnosis (modified from Richardson, 1903).-- Female: Body nearly symmetrical, segmented; all pereopods present; coxal plates covering edges of all pereomeres; 5 pairs of overlapping oostegites enclosing brood pouch; pleon of 5 pleomeres, each covered dorsally, laterally and partly ventrally by lateral plates; 5 pairs of reduced biramous pleopods nearly concealed by lateral plates; no uropods. Male: Pleon elongate, of 6 pleomeres; 5 pairs of foliaceous pleopods; uniramous uropods. Parasitic under middorsal carapace of galatheid, but possibly nonetheless true ectoparasites somewhat displaced from branchial chamber.

Remarks.-- There is only 1 known representative of this subfamily, *Entophilus omnitectus* Richardson, which was found infesting several specimens of *Munida normanni* Henderson in rather deep water in Hawaii (Richardson, 1903). Rather than infesting its hosts branchially or abdominally like other bopyrids, *Entophilus omnitectus* was found beneath its host's carapaces in the middorsal region.

The proper placement of this rather enigmatic subfamily is difficult to determine, because its single representative illustrates a confusing combination of primitive and advanced characters. It is possibly an offshoot of a relatively primitive pseudionine or ionine stock. There is no evidence that the Entophilinae gave rise to any other subfamily.

The subfamily Entophilinae is unknown in the West Indian faunal region.

SUBFAMILY BOPYRINAE H. MILNE EDWARDS, 1840, EMEND. R. CODREANU, 1967

Type-genus, Bopyrus Latreille, 1802

Diagnosis (modified from Codreanu, 1967).-- Female: Frontal lamina usually absent; coxal plates and dorsolateral bosses reduced; pereomeres usually distinct, though first one occasionally fused with head and/or second pereomere; oostegites surrounding but not at all covering brood pouch; all pereopods present but greatly reduced; pleomeres separate or variously fused, often defined on only 1 side; lateral plates and uropods absent; pleopods reduced, posterior ones often absent. Male: Pleon partly to completely fused, pleomeres never separated, though often distinguishable at least laterally; no pleonal appendages. Branchial parasites of caridean shrimps; world-wide distribution.

Remarks.-- There are at present 18 genera containing 76 currently recognized species in the Bopyrinae. The 18 genera include those listed by Shiino (1965) except that Bonnieria and probably Argeia (both discussed above) belong in the Pseudioninae, and I consider Prosynsynella to be a synonym of Synsynella.

This subfamily is well represented in the West Indian faunal region, where 10 nominal genera have been recorded, although probably no more than six of them are valid. I have examined a number of specimens of several bopyrine species, but inadequate time has prevented the extensive work needed to sort out the labyrinthine problems present among the local species. So far, I am uncertain how to characterize the genera of this region and so have used currently accepted names for the known species. The following account of the Bopyrinae lacks keys and generic diagnoses as well as specific descriptions. I have drawn up tentative synonymies which include only the first mention of each name; these synonymies are based on my work to date, and should not necessarily be considered as final. Despite the incompleteness of my treatment of the subfamily Bopyrinae, I believe that its inclusion in this report is essential to report the work which has been done and to emphasize the need for further study of the subfamily in this area.

Certain members of the subfamily Bopyrinae are the only bopyrids known from fresh water. In most cases, including those species which I have seen, they occur close to salt water, but at least 2 species have been recorded from far inland: Giard and Bonnier (1888d) recorded *Probopyrus ascendens* (Semper) from an elevation of 4000 feet in a river in the Philippines, and Mackin and Hubricht (1938) have reported finding *P. bithynis* Richardson in the Mississippi River in Missouri.

BOPYRELLA BONNIER, 1900

Type-species, by original designation, *Bopyrella thomsoni* Bonnier, 1900. Gender, feminine.

Total number of species, 22. Geographical distribution: Japan; Thailand; Indonesia; Nicobars and Taiwan Strait; Kyûsyû; Tonga; Bay of Bengal; Andamans; Gulf of Manaar; Eniwetok; Gulf of Suez; North Carolina; Virgin Islands; Venezuela; Brazil; California.

West Indian faunal region species: 4 species, *Bopyrella harmopleon*, *Bopyrella lata*, *Bopyrella mortenseni*, *Bopyrella thomasi*.

Bopyrella harmopleon Bowman, 1956

Bopyrella harmopleon Bowman, 1956, pp. 1-4, fig. 1. (Type locality, Los Roques Islands, Venezuela.)

Material examined: none.

Discussion.

Bowman (1956) described *Bopyrella harmopleon* as a parasite of *Synalpheus brevicarpus* (Herrick) (synonymized with *S. minus* (Say) by Chace, 1972) from Gran Roque, Venezuela, *S. fritzmuelleri* Coutière from Los Roques, Venezuela, and *S. hemphilli* Coutière from La Salle and Gran Roque, Venezuela. Lemos de Castro (1965b) made the only other discovery of *Bopyrella harmopleon*, when he found it infesting *Synalpheus* sp. near São Paulo, Brazil. Chace (1972) listed some unidentified parasites of *Synalpheus minus* from the West Indies; those which I have seen are *Bopyrina* sp., but others may belong to *Bopyrella harmopleon*.

Bopyrella lata Nierstrasz and Brender à Brandis, 1929

Bopyrella lata Nierstrasz and Brender à Brandis, 1929, pp. 34-35, fig. 43. (Type locality, Virgin Islands.)

Material examined.

Infesting Alpheus normanni Kingsley. Card Sound, Florida, in shallow water, 16 and 18 Oct. 1970, 29 Mar. 1972, J. García-Gómez, coll. and det. of hosts; 3♀, 2♂, UMML. Looe Key Reef, Florida, 1.5-2m, 11 Oct. 1969, coll. and det. unknown; 1♀, UMML.

Discussion.

Nierstrasz and Brender à Brandis (1929) originally recorded Bopyrella lata as a parasite of an unidentified alpheid in the Virgin Islands, then Lemos de Castro (1965b) reported it infesting Alpheus sp. in Baía de Guanabara, Brazil. The latter author also identified a parasite of Upogebia affinis (Say) from São Paulo, Brazil, as Bopyrella lata, though that record seems highly unlikely.

Bopyrella mortenseni Nierstrasz and Brender à Brandis, 1929

Bopyrella mortenseni Nierstrasz and Brender à Brandis, 1929, pp. 30-31, 34, figs. 34-37. (Type locality, St. Thomas, Virgin Islands.)

Bopyrella Mortenseni, Monod, 1933, p. 235.

Bopyrella Mortensni [sic], Qazi, 1959, pp. 60-61; ?not p. 62-B, figs. 7, 8 (see discussion).

Probopyrus sp., Van Arman and Smith, 1970, pp. 133-135, figs. 1, 2.

Material examined.

Infesting Lysmata wurdemanni (Gibbes). Biscayne Bay, Florida, 1969?; 1♀, 1♂, collection of J. A. Van Arman. S of Alligator Light, Florida, 11m, 4 Aug. 1965, E. Maynard, coll., R. B. Manning, det. of host; 1♀, 1♂, USNM 120094.

Infesting Lysmata rathbunae Chace. Bahía de Turiamo, Aragua, Venezuela, in sponges, 9m, Oct. 1960, P. R. Morales, coll., F. A. Chace, Jr., det. of host; 1♀, USNM 107092.

Discussion.

Bopyrella mortenseni was originally recorded as a parasite of Hippolysmata wurdemanni (Gibbes) from St. Thomas, Virgin Islands (Nierstrasz and Brender a Brandis, 1929). Van Arman and Smith (1970) recorded it from the same host species, but they identified the parasite, which I have examined, as Probopyrus sp. Chace (1972) incorporated Hippolysmata into Lysmata, thereby making a new combination for the host's name. The specimen infesting Lysmata rathbunae was recorded in the original description of the host species by Chace (1970).

Qazi (1959) considered Bopyrella nierstraszi Chopra (1930) to be a synonym of B. mortenseni. B. nierstraszi infests another species of Lysmata in the Andaman Islands. Because of the distance between records, it is extremely unlikely for these 2 species to be the same; a careful redescription of each would probably reveal characters by which they could be reliably distinguished.

Bopyrella thomasi Nierstrasz and Brender à Brandis, 1929

Bopyrella thomasi Nierstrasz and Brender à Brandis, 1929, pp. 32-33, figs. 39-40. (Type locality, St. Thomas, Virgin Islands.)

Material examined: none.

Discussion.

Nierstrasz and Brender à Brandis (1929) described Bopyrella thomasi as a parasite of Tozeuma carolinense Kingsley at St. Thomas, Virgin Islands. It has not been recorded since even though the host species is a common grass-flat inhabitant throughout the West Indian region.

BOPYRINA KOSSMANN, 1881

Type-species, by monotypy, Bopyrus ocellatus Czerniavsky. Gender, feminine.

Total number of species, 19. Geographical distribution: Kyûsyû; Gulf of Siam; Indonesia; Palao; Andaman Island; Nicobar Islands; Adriatic Sea; France; Black Sea; North Carolina; Florida; California.

West Indian faunal region species: 3 species known, Bopyrina abbreviata, Bopyrina thorii, Bopyrina sp.; 2 species expected, Bopyrina pontoniae; Bopyrina urocaridis.

Bopyrina abbreviata Richardson, 1904

Bopyrina abbreviata Richardson, 1904a, pp. 71-73, figs. 53-56. (Type locality, Punta Rassa, Florida.)

"Branchial bopyrid," Chace, 1972, p. 111.

Material examined.

Infesting Hippolyte pleuracanthus (Stimpson). Beaufort, North Carolina, in grass beds, 25 July 1970, R. W. Heard, coll. and det. of hosts; 1♀, 1♂, USNM. Dinner Key, Miami, Florida, in shallow water, 1 Dec. 1971, J. García-Gómez, coll. and det. of hosts; 5♀, 5♂, UMML. Card Sound, Florida, in shallow water, Mar. to Dec. 1970. J. García-Gómez, coll. and det. of hosts; 16♀, 10♂, UMML.

Infesting Hippolyte curacaoensis Schmitt. Smithsonian-Bredin Expedition Sta. 4-59, W of Pigeon Point, Tobago, 4 Apr. 1959, F. A. Chace, Jr., det. of host; 1♀, USNM.

Infesting Hippolyte sp. Maximo Point, Boca Ciega Bay, Florida, 17 Apr. 1958, Springer and Sogandares-Bernal, coll., T. E. Bowman, det.;

1♀, 1♂, USNM 101836.

Discussion.

Bopyrina abbreviata has been quite frequently collected, nearly always from the same host species, Hippolyte pleuracanthus. Some of the published records list the hosts as H. zostericola (Smith), but Julio García-Gómez (personal communication) has confirmed the suspicions of Chace (1972) that these 2 species are synonymous. Chopra (1923) proposed that Bopyrina abbreviata may be a synonym of B. giardi Bonnier (1900), known from the coast of France, but this is not likely; Bourdon (1968), who synonymized B. giardi with B. ocellata (Czerniavsky), did not consider B. abbreviata to be the same species. It is possible that the parasite of Hippolyte pleuracanthus at St. John attributed to Probopyrinella latreuticola (Gissler) by Nierstrasz and Brender à Brandis (1929) belongs to Bopyrina abbreviata; that report is the only record of a Hippolyte sp. bearing a bopyrine other than Bopyrina abbreviata or of Probopyrinella latreuticola (discussed below) occurring on a host other than Latreutes fucorum (Fabricius).

Bopyrina thorii Richardson, 1904

Bopyrina thorii Richardson, 1904a, p. 74, fig. 63. (Type locality, Key West, Florida.)

Bopyrina thoris, Nierstrasz and Brender à Brandis, 1923, pp. 98, 100, 102.

Bopyrinella antillensis Nierstrasz and Brender à Brandis, 1925, pp. 6-7, figs. 22-25. (Type locality, Curaçao.)

Bopyrinella antilensis, Shiino, 1936a, pp. 159, 161.

"Branchial bopyrid," Chace, 1972, p. 136.

Material examined.

Infesting *Thor floridanus* Kingsley. Card Sound, Florida, in shallow water, June to Dec. 1970, J. García-Gómez, coll. and det. of hosts; numerous ♀ and ♂, UMML. Smithsonian-Bredin Expedition Sta. 77-60, N end Bahía de la Ascensión, Quintana Roo, México, 15 Apr. 1960, F. A. Chace, Jr., det. of host; 1♀, USNM.

Discussion.

Although I have not examined the types of either species, it is highly likely that *Bopyrina thorii* and *Bopyrinella antillensis* are synonyms. Richardson (1904a) described the female of *Bopyrina thorii* as a parasite of *Thor floridanus* at Key West, but she did not have a male. Nierstrasz and Brender à Brandis (1925) described both sexes of *Bopyrinella antillensis* infesting the same host species at Curaçao and made it the type-species of their new genus *Bopyrinella*, which they differentiated from *Bopyrina* solely because the female of *Bopyrinella antillensis* bore fifth pleopods. All of the specimens I have examined from south Florida, which should be expected to correspond to Richardson's species, correspond instead to that of Nierstrasz and Brender à Brandis. The fifth pleopod, however, is an extremely rudimentary structure, whose true nature is subject to interpretation; it is possible that Richardson's type female, which seems identical in other respects, also bears such structures but that she overlooked it. Because of these "pleopods," this species may not properly belong in *Bopyrina*. I have placed it here for now because the senior synonym is in *Bopyrina*.

Shiino (1936a) described what he called *Bopyrinella antilensis* var.

nipponica infesting a *Spirontocaris* in Japan; I do not know the status of that variety.

Bopyrina pontoniae Wells and Wells, 1966

Bopyrina pontoniae Wells and Wells, 1966, pp. 57-60, figs. 3, 4. (Type locality, Core Banks, North Carolina.)

Material examined: none.

Discussion.

Bopyrina pontoniae is so far known only from the type specimens, which infested the palaemonid *Pontonia margarita* Smith in North Carolina. The host species is known from Florida (Chace, 1972), so I have mentioned its parasite as a possible member of the West Indian fauna.

Bopyrina urocaridis Richardson, 1904

Bopyrina urocaridis Richardson, 1904a, pp. 73, 74, figs. 60-62. (Type locality, Punta Rassa, Florida.)

Material examined: none.

Discussion.

Richardson (1904a) originally recorded *Bopyrina urocaridis* as a parasite of *Urocaris longicaudata* Stimpson at Punta Rassa; the currently accepted name for the host species is *Periclimenes longicaudatus*, according to Chace (1972). Although *Bopyrina urocaridis* has since been collected at several localities in North Carolina and on the Gulf coast of Florida, it has never been recorded from any other host species. (Schultz, 1969, who was citing undocumented published records, lists the host as Pontonia margarita Smith, but this is clearly erroneous, possibly a line of type which belonged under the entry for Bopyrina pontoniae.) Unfortunately, I have been unable to locate the specimens collected in the Everglades by Rouse (1970) for examination, although his assignment of them to Bopyrina urocaridis is quite probably correct.

Bopyrina sp. (?or spp.), probably new

?"Bopyrid," Coutière, 1909, p. 52.

Pseudione curta [sic], Menzies and Frankenberg, 1966, pp. 26-27, 73, fig. 7 [not Aporobopyrus curtatus (Richardson, 1904)].

"Branchial bopyrid," Chace, 1972, pp. 95, 104.

Material examined.

Infesting Synalpheus minus (Say). Bear Cut, Miami, Florida, G. Y. Hendrix, coll. and det. of host; 1♀, 1♂, UMML. Pier of School of Marine and Atmospheric Science, Miami, Florida, 11 Jan. 1971, H. B. Moore, coll.; 1♀, 1♂, UMML. Shark River Delta, Everglades National Park, Florida, Jan. 1965, D. C. Tabb, coll. and det. of host; 1♀, USNM. Sapelo Island, Georgia; 1♀, 1♂, in collection of R. W. Heard. Card Sound, Florida, in shallow water, 12 Mar. 1971, 29 May 1972, J. García-Gómez, coll. and det. of hosts, including 1 bilaterally infested; 4♀, 4♂, UMML. Smithsonian-Bredin Expedition Sta. 31-59, W of Pigeon Point, Tobago, on sand flats off beach, 10 Apr. 1959; 1♀, 1♂, USNM. Smithsonian-Bredin Expedition Sta. 8-59, Buccoo Reef, Tobago, 5 Apr. 1959; 1♀, USNM.

Infesting Synalpheus pectiniger Coutière, hosts det. by G. Y. Hendrix, all from sponges. Pillsbury Sta. P-1283, off Enriquillo, Dominican Republic, 17°35'N, 71°25'W, 18-27m, 19 July 1970; 2♀ (including 1 hyperparasitized by cryptoniscid Danalia fraissei Nierstrasz and Brender à Brandis), 1♂, UMML. Pillsbury Sta. P-1249, SW of Jamaica, 17°23'N, 78°39'W, 25m, 13 July 1970; 3♀, 3♂, UMML.

Infesting Synalpheus townsendi Coutière. Smithsonian-Bredin Expedition Sta. 82-60, Bahía de la Ascensión, Quintana Roo, México, 0.5-1.5m, 16 Apr. 1960, F. A. Chace, Jr., det. of host; 1♀, USNM.

Discussion.

The material examined appears to belong to at least 2 species, probably new ones. Some of the specimens have characters intermediate between those of Bopyrina abbreviata and B. pontoniae.

Coutière (1909) records an unknown bopyrid from Synalpheus brevicarpus (Herrick) collected at an unspecified locality. Chace (1972) considers S. brevicarpus to be a synonym of S. minus, the most common host species of Bopyrina sp., so its parasite in that case might also have belonged to this species. Menzies and Frankenberg (1966) reported the parasites from Sapelo Island under the name Pseudione curta [sic]. Chace (1972) recorded the parasites collected by the Smithsonian-Bredin Expeditions infesting Synalpheus minus and S. townsendi; he also mentioned a parasite infesting S. pectiniger at Mustique. Although I have not seen the latter specimen, it may also belong to Bopyrina sp.

BOPYRO PEARSE, 1932

Type-species, by monotypy, *Bopyro choprae* Pearse. Gender, masculine.

Total number of species, 1. Geographical distribution: North Carolina; Florida; Bimini; Tobago.

West Indian faunal region species: only 1 species, *Bopyro choprae*.

Bopyro choprae Pearse, 1932

Bopyro choprae Pearse, 1932a, pp. 1-3, figs. 1-14. (Type locality, Dry Tortugas, Florida.)

Bopyro sp. , Pearse, 1932c, p. 122.

Bopyrus chopre, Carvalho, 1942, p. 128.

Bopyrina crangona Pearse, 1953b, pp. 619-620, figs. 2-7. (Type locality, Beaufort, North Carolina.)

"Branchial bopyrid," Chace, 1972, p. 92.

Material examined.

Infesting *Synalpheus brooksi* Coutière. NE side Soldier Key, Biscayne Bay, Florida, in *Spheciospongia vesparia* (Lamarck), shallow water, 25 Apr. 1970, J. C. Markham, coll.; 1♀, 1♂, UMML. Dry Tortugas, Florida, in *Spheciospongia vesparia*, 27 June 1931, A. S. Pearse, coll.; more than 35♀, most with ♂, paratypes, USNM 65145. Smithsonian-Bredin Expedition Sta. 30-59, E of Pigeon Point, Tobago, in unidentified sponge in *Thalassia* beds, 10 Apr. 1959, T. E. Bowman, coll., F. A. Chace, Jr., det. of host; 1♀, 1♂, USNM.

Infesting *Alpheus formosus* (Gibbes). Shackelford Banks, off Beaufort, North Carolina, 10 July 1952, A. S. Pearse, coll. and det. of host; 1♀, 1♂, types of *Bopyrina crangona* Pearse, USNM 95120, 95121.

Discussion.

Although the type specimens of *Bopyrina crangona*, which were mounted on slides, are badly decomposed, enough characters of the male are discernible to indicate that that species is a synonym of *Bopyro choprae*. I am not certain whether the genus *Bopyro* is valid, but I am retaining it for the present. This species has been recorded infesting *Synalpheus brooksi* in the Dry Tortugas (Pearse, 1932a) and Bimini (Pearse, 1951) and infesting *S. longicarpus* (Herrick) and *S. minus* Say in North Carolina (Pearse, 1950). Chace (1972) lists specimens of *S. longicarpus* and *S. minus* from the West Indies bearing "branchial bopyrids." I have been unable to locate those specimens for examination, but their parasites may belong to *Bopyro choprae*.

PROBOPYRINELLA NIERSTRASZ AND BRENDER À BRANDIS, 1929

Type-species, by original designation, Bopyroides latreuticola Gissler. Gender, feminine.

Total number of species, 1. Geographical distribution: Middle Atlantic; North Carolina; Florida; Texas; Florida Current; Bermuda; central Caribbean; Hispaniola; Tortola; near Azores.

West Indian faunal region species: only 1 species, Probopyrinella latreuticola.

Probopyrinella latreuticola (Gissler, 1882)

Bopyrus squillarum, Goodsir, 1845, pp. 74, 75, pl. VII, figs. 7-11 [not Bopyrus squillarum Latreille, 1802].

Bopyroides latreuticola Gissler, 1882b, pp. 591-594, figs. 1-3. (Type locality, Beaufort, North Carolina.)

Bopyrus latreutis Bate, 1888, p. 584. (Type locality, near Azores.)

Bopyrina latreuticola, Bonnier, 1900, pp. 61, 114, footnote, 169, 221, 370-373, 382, fig. 61.

Probopyrus latreuticola, Richardson, 1905, pp. 560-561, figs. 614-616.

Probopyrinella latreuticola, Nierstrasz and Brender à Brandis, 1929, p. 26.

Bopyrella asymmetrica Nierstrasz and Brender à Brandis, 1929, pp. 35-36, figs. 44-45. (Type localities, Sargasso Sea and Virgin Islands.)

"Branchial parasite," Staiger and Voss, 1971, p. 33.

"Branchial bopyrids," Chace, 1972, p. 121.

Material examined.

Infesting Latreutes fucorum (Fabricius), collected at surface among floating Sargassum plants. Woods Hole Oceanographic Institution ship M/V Chain, cruise 25, Sta. 474, western North Atlantic, 29°N, 65°W, 1♀, 1♂, USNM. Woods Hole Oceanographic Institution collection, western North Atlantic, 27°15'N, 70°31'W, Apr. 1972, E. Carpenter and K. L. Smith, coll. and det. of hosts; 12♀, 10♂, UMML. Between Soldier Key and Fowey Rocks, Biscayne Bay, Florida, 2 Apr. 1948, H. Doochin, coll. and det. of hosts; 2♀, 1 immature ♂, UMML. About 12 miles WSW of Bimini, Bahamas, in Florida Current, 26 June 1970, J. C. Markham, coll. and det. of hosts; 5♀, 5♂, UMML. Offshore from Miami, Florida, in Florida Current, 30 July 1970, J. C. Markham, coll. and det. of hosts; 10♀ (including 1 evidently hyperparasitized), 10♂, UMML. Pillsbury Sta. P-1248, W of Jamaica, 18° 25'N, 78°25'W, 13 July 1970; 1♀, UMML. Pillsbury Sta. P-1267, SW of Jamaica, 17°53'N, 71°59'W, 17 July 1970; 3♀ (including 1 immature), 1♂, UMML. Smithsonian-Bredin Expedition Sta. 7-58, between Tortola and Guano Islands, 27 Mar. 1958, J. F. G. Clarke, coll., F. A. Chace, Jr., det. of host; 2♀, 1 immature ♂, USNM. T. N. Gill Cruise 2 Sta. 19, details unknown; 1♀, 2 cryptoniscan larvae, USNM.

Discussion.

Probopyrinella latreuticola has undergone considerable generic shuffling since its original description as a species of Bopyroides. I have not studied the Bopyrinae in sufficient detail to be certain of the validity of the genus Probopyrinella, but I am retaining it for the present in accordance with the opinion of Bourdon (1968).

Although I have not seen any of the types involved, I am certain that Bopyrella asymmetrica is a synonym of Probopyrinella latreuticola, because the published descriptions of these 2 species vary so little that it is usually impossible to assign a specimen under study to the former or latter species. I am concurring with the opinion of Richardson (1905) in calling Bopyrus latreutis Bate (which was never meaningfully described) a synonym of Probopyrinella latreuticola and with the opinion of Bourdon (1968) that the reference to Bopyrus squillarum by Goodsir (1845) really concerned this species. Probopyrinella latreuticola is thus the only bopyrid known to infest Latreutes fucorum.

Of the 34 females of Probopyrinella latreuticola examined, 16 are dextral and 18 sinistral, the numbers thus being nearly equal.

PROBOPYRUS GIARD AND BONNIER, 1888

Type-species, by original designation, Bopyrus ascendens Semper. Gender, masculine.

Total number of species, 34. Geographical distribution: East Indies; Japan; Philippines; Malaya; Thailand; India; West Indies; Mexico; Panamá; Venezuela; Brazil.

Remarks.-- Probopyrus is one of the most confused genera of the family Bopyridae. It and Palegyge (usually emended to Palaegyge) were both established by Giard and Bonnier (1888a), who did not adequately characterize either genus. Chopra (1923, 1930) tried to distinguish the 2 genera by the presence or absence of a notch in the terminal pleomere of the female and, accordingly, switched several previously described species from 1 genus to the other. Following Nierstrasz and Brender à Brandis (1929) and Van Name (1936), I am regarding Palegyge as a junior synonym of Probopyrus. Altogether, 46 different species have been assigned to Probopyrus (including Palegyge), 12 of which have subsequently been reassigned elsewhere. Of the remaining 34 species, at least 2 have been synonymized and several others probably shoud be. Several of the species have been inadequately described, and there is evidently much intraspecific variation within the genus. Thus the total number of valid species may be less than half the 34 currently recognized. Regardless of how many of the remaining species are synonyms of others, all but two seem to belong to the genus Probopyrus. The 2 exceptions are P. aberrans Nierstrasz and Brender à Brandis (1932), a parasite of the hippolytid Spirontocaris phippsi Krøyer in Japan, and P. alphei (Richardson, 1900), discussed below, a parasite of Alpheus spp. in the western Atlantic. With their removal, Probopyrus is not only more homogeneous in morphological characters, but also its hosts are all in the family Palaemonidae. It will take further study of several species before a generic diagnosis of *Probopyrus* becomes possible. In her key to genera of the Bopyridae, Richardson (1905) stated that the males of *Probopyrus* have fused pleons, but in all the specimens which I have examined, including the types of Richardson's species, the pleons of the males are distinctly segmented. The only exception is *P. alphei*, which, for other reasons, I do not believe properly belongs in *Probopyrus*.

In the region of this study, *Probopyrus* is as confused as it is on a world-wide basis. Richardson (1905) presented the only key to local species ever published, but most specimens of *Probopyrus* which I have examined cannot be identified by means of that key because their characters are either intermediate between those of alternates in a couplet or 1 character matches a choice while another contradicts that same choice. Schultz (1969), acknowledging the difficulty of reliably distinguishing the local species of *Probopyrus* if not considering some of them invalid, presented no key to the species of the genus even though he otherwise keyed out all species discussed. Van Name (1936) is so far the only author who has considered any local species to be synonymous. He placed several other nominal species in synonymy with *P. bithynis* Richardson, although he did not say what material he had examined. In view of my findings, discussed below, I believe that all of the species synonymized by Van Name, and possibly others, are in turn synonyms of *P. pandalicola*.

West Indian faunal region species: 2 species, *Probopyrus alphei*, *Probopyrus pandalicola*.

Probopyrus alphei (Richardson, 1900)

[Bopyrus sp.], Müller, 1871, p. 68.

Bopyrus? alphei Giard and Bonnier, 1890, p. 369 [nomen nudum].

Bopyrella sp., Bonnier, 1900, p. 169.

Bopyrus alphei Richardson, 1900a, pp. 158-159, figs. 3, 4. (Type locality, Rio Parahyba do Norte, Brazil.)

Gyge sp., Wilson, 1900, p. 353.

Bopyrella (?) alphei, Bonnier, 1900, pp. 221, 352, 381 [nomen nudum].

Probopyrus alphei, Richardson, 1904a, pp. 67-68, figs. 44, 45.

Bopyrella richardsonae Nierstrasz and Brender à Brandis, 1929, pp. 33-34, figs. 41, 42. (Type locality, Virgin Islands.)

Capitetragonia asperotibialis Pearse, 1953a, pp. 234-235, figs. 122-130. (Type locality, Alligator Harbor, Florida.)

Bopyrella alphei, Lemos de Castro, 1965b, pp. 283, 287, figs. 14-23.

"Branchial bopyrid(s)," Chace, 1972, pp. 62, 73.

Material examined.

Infesting Alpheus armillatus H. Milne Edwards. Smithsonian-Bredin Expedition Sta. 123-58, English Harbour, Antigua, 3 May 1958, F. A. Chace, Jr., det. of host; 1♀, 1♂, USNM.

Infesting Alpheus formosus Gibbes. Th. Mortensen Expedition, Virgin Islands, 15 Dec. 1911, host det. by J. G. de Man; 1♀, holotype of Bopyrella richardsonae Nierstrasz and Brender à Brandis, ZMC (allotype ♂ evidently lost).

Infesting Alpheus heterochaelis Say. Beaufort, North Carolina, prior to 1900, H. V. Wilson, coll. and det. of host; 1♀, 1♂, called Gyge sp., USNM 25069. Beaufort, North Carolina, 29 July 1946, A. S. Pearse, coll. and det.; 1♀, 1♂, USNM 20954. Card Sound, Florida, in shallow water, 10 Mar. 1970, 8 Apr. 1970, J. García-Gómez, coll. and det. of hosts; 2♀ (including 1 hyperparasitized by cryptoniscid Danalia fraissei Nierstrasz and Brender à Brandis), 1♂, UMML. Buttonwood Canal, Flamingo, Florida, 30 June 1965, D. C. Tabb, coll. and det. of host, 1♀, 1♂, USNM. Branner-Agassiz Expedition, Rio Parahyba do Norte, Brazil, on mangroves, 21 June 1899, A. W. Greely, coll.; 1♀, 1♂, types of Bopyrus alphei Richardson, USNM 23759.

Infesting Alpheus normanni Kingsley. Alligator Harbor, Florida, A. S. Pearse, coll. and det.; 1♀, 1♂, types of Capitetragonia asperotibialis Pearse, USNM 93720. Card Sound, Florida, in shallow water, 28 Oct. 1970, 9 Dec. 1970, 14 Jan. 1971, 15 Jan. 1971, J. García-Gómez, coll. and det. of hosts; 4♀ (including 1 with unidentified hyperparasite), 3♂, UMML.

Infesting Alpheus sp. S of Loggerhead Key, Dry Tortugas, Florida, 180m, 10 Apr. 1964, B. Benton, coll.; 1♀, 1♂, UMML. [Collection data possibly erroneous.]

Discussion.

Probopyrus alphei differs from other species of Probopyrus in several important respects and should be placed in a new genus. The pleomeres of the female are separated by distinct lateral notches and the pleon of the male is fused; further, all of the hosts belong to the alpheid genus Alpheus, while the hosts of other species of Probopyrus are palaemonids. Until I can make a more critical study of the Bopyrinae, however, I am retaining this species in Probopyrus. The most common branchial parasites of Alpheus spp. are species of Bopyrella. Lemos de Castro (1965b) reassigned Probopyrus alphei to Bopyrella, but the female's head is distinctly separated from the first pereomere, in contrast to the main diagnostic character of Bopyrella.

The type specimens of Capitetragonia asperotibialis were mounted on microscope slides, and the mounting medium had dissolved them, so they are difficult to study. In light of what remains discernible of them, the drawings published by Pearse (1953a) and the recorded host, I have concluded that Capitetragonia asperotibialis is a synonym of Probopyrus alphei. The holotype female of Bopyrinella richardsonae is indistinguishable from Probopyrus alphei, and the published drawing of the male of that species (Nierstrasz and Brender à Brandis, 1929) is unmistakably similar to males of P. alphei, so I regard that species as another synonym of P. alphei. Wilson's (1900) record of Gyge sp. was based on specimens which I have examined and found clearly assignable to Probopyrus alphei.

Probopyrus pandalicola (Packard, 1879)

Bopyrus sp., Smith, 1878, p. 37.

Bopyrus [sp.], Leidy, 1879, pp. 198-199.

Bopyrus pandalicola Packard, 1879, pp. 308-310, fig. 262. (Type locality unspecified, evidently somewhere on Atlantic coast of United States.)

Bopyrus manhattensis Gissler, 1881, p. 151, figs. 1, 2. (Type locality, Atlantic coast of United States.)

Bopyrus palaemoneticola Gissler, 1882a, pp. 6-12, text-figs. 1, 2, pls. I-II. (Type locality, Atlantic coast of United States.)

Probopyrus palaemoneticola, Giard and Bonnier, 1888a, p. 305.

Probopyrus bithynis Richardson, 1904a, pp. 68-70, figs. 46-51. (Type locality, New Orleans, Louisiana.)

Probopyrus floridensis Richardson, 1904a, pp. 70-71, figs. 52-55. (Type locality, St. Johns River, Florida.)

Probopyrus pandalicola, Richardson, 1905, pp. 553, 554-555, figs. 599-601.

Palaegyge meeki Richardson, 1912, pp. 521-522, figs. 1-4. (Type localities, Panamá and Canal Zone.)

Probopyrus panamensis Richardson, 1912, pp. 523-524, figs. 5-8. (Type locality, Pariso, Canal Zone.)

Probopyrus sp., Beebe, 1925, p. 59.

Probopyrus floridensis var. gigas Nierstrasz and Brender à Brandis, 1925, pp. 5-6, 7. (Type locality, Curaçao.)

Probopyrus bithynis var. gigas Nierstrasz and Brender à Brandis, 1929, pp. 20-21. (Type locality, Essiquibo, Guyana.)

?Probopyrus oviformis Nierstrasz and Brender a Brandis, 1929, pp. 22-24, 25, fig. 24. (Type locality, St. Croix, Virgin Islands.)

Probopyrus meeki, Nierstrasz and Brender à Brandis, 1929, p. 23.

?Palaegyge oviformis, Chopra, 1930, p. 128.

Probopyrus creaseri Pearse, 1936, pp. 51, 52, figs. 16-21. (Type locality, Yucatán, México.)

?Probopyrus papaloapanensis Rioja, 1949, pp. 169-174, figs. 1-5. (Type locality, SE México.)

Probopyrus pandicola [sic], Schultz, 1969, figs. 529, 530.

Probopyrus species, Kaestner, 1970, p. 463.

"Branchial bopyrid parasite," Chace, 1972, p. 21.

Material examined.

Infesting Macrobrachium acanthurus (Wiegmann). Unknown locality, Cuba, J. H. Walsh, Jr., coll., J. O. Maloney, det. of host; 1♀, 1♂, USNM 63309. Petit Bourg, Martinique, 3 Mar. 1968, coll. unknown; 1♀, 1♂, USNM. Paraiso, Canal Zone, in small creek, 1911, S. E. Meek and S. F. Hildebrand, coll.; 2♀, 2♂, types of Probopyrus panamensis Richardson, USNM 43503.

Infesting Macrobrachium ohione (Smith). U. S. Bureau of Fisheries steamer Albatross Sta., Mississippi River near Exposition Grounds, New Orleans, Louisiana; 5♀, 3♂, types of Probopyrus bithynis Richardson, USNM 29089.

Infesting Macrobrachium olfersi (Wiegmann). Río Niqua, near San Cristóbal, Dominican Republic, prior to 1941, P. J. Bermudez, coll., F. A. Chace, Jr., det. of host; 1♀, 1 cryptoniscan larva, MCZ 11656.

Infesting Macrobrachium sp. [? = M. digueti (Bouvier)]. Pacific drainage, coastal streams of Barica Peninsula, S of Río Chiriqui Basin, Panamá, elevation 30m, 15 Apr. 1962, H. Loften and E. Tyson, coll.; 3♀, 2♂, UMML.

Infesting Palaemon (Palaeander) northropi (Rankin). Smithsonian-Bredin Expedition Sta. 65-60, near Punta Nicchehabin Light, Bahía de la Ascensión, Quintana Roo, México, 13 Apr. 1960, F. C. Daiber, coll., F. A. Chace, Jr., det. of host; 1♀, 1♂, USNM 128466. Laguna Grande, Gulf of Cariaco, Sucre, Venezuela, around mangrove roots, 12 Dec. 1960, R. Martínez, coll.; 2♀, 2♂, USNM 107049.

Infesting Palaemonetes (Palaemonetes) intermedius Holthuis. Matheson Hammock, Miami, Florida, in Thalassia bed, June 1961, C. R. Child, coll., J. García-Gómez, det. of host; 1♀, 1♂, UMML. Same locality, 15 Dec. 1972, J. C. Markham, coll., J. García-Gómez, det. of host; 1♀, 1♂, UMML. Card Sound, Florida, in shallow water, 27 July 1970, J. García-Gómez, coll. and det. of hosts; 2♀, 2♂, UMML. West Lake, Everglades National Park, Florida, 16 Jan. 1959, D. C. Tabb and R. B. Manning, coll., R. Rehrer, det. of host; 1♀, 1♂, UMML. Bear Lake, Everglades National

Park, Florida, 27 Jan. 1959, D. C. Tabb and R. B. Manning, coll., R. B. Manning, det. of host; 1♀, 1♂, UMML. East Whitewater Bay, Everglades National Park, Florida, 16 Apr. 1959, D. C. Tabb and R. B. Manning, coll., R. B. Manning, det. of host; 1♀, 1♂, UMML.

Infesting _Palaemonetes_ _(Palaemonetes)_ _paludosus_ (Gibbes). Satsuma Island, near St. Johns River, Florida, date and coll. unknown; 1♀, 1♂, types of _Probopyrus_ _floridensis_ Richardson, USNM 29090. 6.5 miles NW of Jensen Beach, Florida, N of Rim Ditch, 4 July 1954, J. D. Kilby et al., coll., H. H. Hobbs, det. of host; 1♀, 1♂, USNM 99874. 8.1 miles N of Coot Bay Pond, Everglades National Park, Florida, 11 Mar. 1959, D. C. Tabb and R. B. Manning, coll., R. B. Manning, det. of hosts; 2 immature ♀, UMML.

Infesting _Palaemonetes_ _(Palaemonetes)_ _pugio_ Holthuis. Wakulla River, SW of Wakulla, Florida, 16 Apr. 1941, L. Hubricht, coll. and det. of hosts; 4♀, 4♂, USNM 108673. La Quinta Channel, SSW of Ingleside, Texas, 16-24 Oct. 1972, S. L. H. Fuller and R. R. Grant, Jr., coll. and det. of host; 1♀, UMML.

Infesting _Palaemonetes_ _(Palaemonetes)_ _vulgaris_ (Say). Isla Cerro, Cienaga, near Progreso, Yucatán, México, 1 Aug. 1932, A. S. Pearse, coll., E. P. Creaser, det. of host; 1♀ 1♂, types of _Probopyrus_ _creaseri_ Pearse, USNM 98375.

Infesting _Periclimenes_ _americanus_ (Kingsley). Card Sound, Florida, in shallow water, 31 May 1970, J. García-Gómez, coll. and det. of hosts; 2♀, 1♂, 1 cryptoniscan larva, UMML.

Discussion.

Among the several nominal species included in the synonyny of _Probopyrus_ _pandalicola_ above, there is a great deal of variation, especially among the type specimens, but most other specimens are intermediate in several characters. Where I could assign individuals to species, their host and geographical records often overlapped randomly. Thus, at least in light of the work which I have done to date, this synonymy appears justified. The type specimens of P. creaseri are clearly identical with those of P. panamensis. I have not examined the type female of P. oviformis, which appears to be immature according to the published drawing, or of P. papaloapanensis, which appears closely similar to the typical P. bithynis. With the synonymizing of the above species, the known range of P. pandalicola is thus from New Hampshire to São Paulo, Brazil, the greatest of any western Atlantic bopyrid. Holthuis (1952b) points out that there is a distinct differentiation between species of Macrobrachium from the Pacific and Atlantic sides of the Americas, but the single parasite of a Pacific side (of Panamá) species of Macrobrachium was indistinguishable from other, Atlantic, specimens of Probopyrus pandalicola.

In addition to the hosts and localities cited above, the following records of P. pandalicola have been published, all host names being corrected in accordance with the opinions of Holthuis (1952b) and Chace (1972); the name originally used for the parasite is indicated in each case. Infesting Macrobrachium acanthurus: Escondido River, Nicaragua (Probopyrus bithynis, Richardson, 1905). Infesting M. amazonicum (Heller): Kartabo, Guyana (P. bithynis, Van Name, 1925); Essiquibo, Guyana (P. bithynis var. gigas, Nierstrasz and Brender à Brandis, 1929); Curaçao (P. floridensis var. gigas, Nierstrasz and Brender à Brandis, 1925). Infesting M. carcinus (L.): Panamá and Canal Zone (types of Palaegyge meeki, Richardson, 1912). Infesting M. olfersi: Santa Marta, Colombia (P. bithynis, Pearse, 1915); Vera Cruz, México (P. bithynis, Pearse, 1911); Guacos, Cuba (P. panamensis, Rathbun, 1912). Infesting Macrobrachium (close to M. acanthurus): Papaloapan River, México (types of P. papaloapanensis, Rioja, 1949). Infesting Palaemon sp.: St. Croix, Virgin Islands (type of P. oviformis, Nierstrasz and Brender à Brandis, 1929). Infesting Palaemonetes paludosus: Pinellas County, Florida (P. floridensis, Hutton, 1964). Infesting P. pugio: Texas Gulf coast (P. pandalicola, Pearse, 1952). Infesting P. vulgaris: New Hampshire to Florida (P. pandalicola, Richardson, 1905). Infesting unidentified palaemonid: São Paulo, Brazil (P. floridensis, Carvalho, 1942).

SYNSYNELLA HAY, 1917

Type-species, by original designation, Synsynella deformans Hay. Gender, feminine.

Total number of species, 3? (2 of which may be synonymous). Geographical distribution: Hong Kong; Ceylon; Pakistan; Madras, India; Gulf of Suez; North Carolina; Virgin Islands.

West Indian faunal region species: 1 known, Synsynella hayi, 1 expected, Synsynella deformans, which may be single species.

Synsynella hayi (Nierstrasz and Brender à Brandis, 1929)

Prosynsynella hayi Nierstrasz and Brender à Brandis, 1929, pp. 36-37, figs. 46, 47. (Type locality, Virgin Islands.)

Prosynsynella Hayi, Monod, 1933, pp. 236, 238.

Material examined.

Infesting Synalpheus minus (Say), host det. by J. García-Gómez. Th. Mortensen Expedition, Virgin Islands, 1911; 1♂, allotype, ZMC.

Discussion.

The holotype female has regrettably been lost. The host, which Nierstrasz and Brender à Brandis (1929) identified only as Synalpheus sp., was still with the allotype male, and Julio García-Gómez has kindly identified it for me. It is possible that some of the infested specimens of S. minus reported from the Smithsonian-Bredin expeditions by Chace (1972) bore Synsynella hayi, but I was unable to locate most of them. The single infested Synalpheus minus from those collections which I did examine bore an unidentified species of Bopyrina, recorded above.

Nierstrasz and Brender à Brandis (1929), in establishing the genus *Prosynsynella*, of which *P. hayi* is the type-species, stated that the female was indistiguishable from those of *Synsynella*, while the male could be distinguished only in that its head was separated from the first pereomere. Although I have not seen any specimens of *Synsynella deformans*, Hay (1917) reports and illustrates the head of the male as being only partly fused; this much variation, and more, is common within several bopyrid genera and even species, so I see little reason for separating genera on the basis of it in this case. It is possible that *Synsynella hayi* is a synonym of *S. deformans*; since I have examined only the male of the former, which appears to differ in some significant details from the published figures of the male of *S. deformans*, I am not ready to consider them synonymous. Possibly examination of a large collection of *S. deformans* would reveal enough variation to make the retention of *S. hayi* as a separate species untenable.

Synsynella deformans Hay, 1917

Synsynella deformans Hay, 1917, pp. 570, 571-572, 574, pl. 99, figs. 13-18. (Type locality, Onslow Bay, North Carolina.)

Synsynella [sp.], Nierstrasz and Brender à Brandis, 1923, p. 102.

Bopyrella deformans, Chopra, 1922, p. 70.

?*Bopyrella deformans*, Chopra, 1923, pp. 416, 468, 469, 470-473, 541, text-fig. 9, pl. XIV, figs. 1-6.

?*Synsynella deformans*, Monod, 1933, pp. 227-232, 234, figs. 50, 51.

Material examined: none.

Discussion.

Hay (1917) described Synsynella deformans as a parasite of Synalpheus longicarpus (Herrick) collected off the coast of North Carolina. Unfortunately, his description was somewhat difficult to interpret, and his only figures were rather unclear photographs. No one has since described any specimens of S. deformans, even though Williams (1965) reports that it is common in the Carolinas. I have not examined Hay's types in order to be able to assess their characters. So far this species is not definitely known from the West Indian faunal region, though some of the Smithsonian-Bredin parasites mentioned by Chace (1972) may belong to it, and Synsynella hayi, recorded from the Virgin Islands, may be a synonym, as discussed above.

Chopra (1923) transferred Synsynella deformans to Bopyrella and described a new subspecies, B. deformans indica from India. Subsequent authors have returned this species to Synsynella. I find it difficult to believe that Chopra's subspecies belongs to Synsynella deformans, especially in light of the characters Chopra (1923) cited to distinguish it from the typical subspecies. At one time Chopra (1927) expressed the opinion that Bopyrella deformans indica may be a synonym of B. intermedia Nierstrasz and Brender a Brandis (1923), otherwise known only from the East Indies.

PROBABLE BOPYRINAE RECORDED BUT NOT IDENTIFIED

Chace (1972) records several unidentified branchial parasites of caridean shrimps collected during the Smithsonian-Bredin Expeditions in the Caribbean. Some of those parasites I have examined and discussed above, while others were unavailable to me, so I can only surmise that they belong to the Bopyrinae. The host species and their localities are: *Alpheus armillatus* H. Milne Edwards, Antigua; *Alpheus viridari* (Armstrong), Antigua; and *Synalpheus longicarpus* (Herrick), Mustique. No identified bopyrina has been recorded from either of these 2 species of *Alpheus*, while 2 bopyrine species are known from *Synalpheus longicarpus*.

SUBFAMILY ORBIONINAE CODREANU, 1967

Type-genus, Orbione Bonnier, 1900

Diagnosis (modified from Codreanu, 1967).-- Female: Body oval, discoidal in appearance; segments mostly distinct; frontal lamina, coxal plates and lateral plates excessively developed and foliaceous; brood pouch almost completely closed; pleopods biramous. Male: Head and pereomeres separate; pleon unsegmented, lacking appendages. Branchial parasites of Indo-West Pacific penaeid shrimps.

Remarks.-- The subfamily Orbioninae contains 5 genera with a total of 26 described species. Shiino (1965) also includes Bathygye in this subfamily, but I believe it belongs in the Pseudioninae for reasons discussed above in the remarks on that subfamily. The distribution of the Orbioninae is quite peculiar. If one removes the monotypic Bathygyge, all species are known only from the Indian and western Pacific Oceans. (Bourdon, 1968, records Epipenaeon ingens Nobili from the eastern Mediterranean, but that species clearly came with its host through the Suez Canal from the Red Sea, where it was originally found.) The species all infest penaeid shrimps, sometimes very heavily; infestation in Indonesia occasionally reaches 50% (Purwito, personal communication). In other subfamilies of the Bopyridae, several species in a single genus occur in the western Atlantic and Indo-West Pacific and infest hosts in a single genus. The Orbioninae, however, is strictly Indo-West Pacific even though several of its species infest shrimps which are congeneric with western Atlantic species. Indeed, Hutton et al. (1959) report that no arthropod parasites are known from any penaeid in the western Atlantic. Because of their commercial value, penaeids have been intensively studied in the western Atlantic, so such records should be reliable. It is possible that this subfamily is so recently exolved that it came into being after its hosts had achieved their present distribution. As a corollary fact, Shiino (1965), using morphological characters alone, concluded that the Orbioninae is the most highly evolved subfamily of branchially infesting bopyrids, being derivable from a primitive ionine stock. So far it has not given rise to any other bopyrid subfamily.

The subfamily Orbioninae is unknown in the West Indian faunal region.

SUBFAMILY BOPYROPHRYXINAE CODREANU, 1965

Type-genus, Bopyrophryxus Codreanu, 1965

Diagnosis (modified from Codreanu, 1967).-- Female: Body highly asymmetrical, with brood pouch as large closed sac far out on 1 side of body, not adjacent to pleon; pereomeres distinct; all pereopods present, but unequally developed; 6 pleomeres; 5 pairs of uniramous pleopods; uniramous uropods. Male: Elongate; all segments distinct; 6 pleomeres; 5 pairs of pleopods; uniramous uropods. Branchial and abdominal parasite of paguroid.

Remarks.-- There is only 1 known representative of this subfamily, Bopyrophryxus branchiabdominalis Codreanu (1965), described from a single pair of parasites of Parapagurus monstrosus Alcock in the Kei Islands. Due to certain morphological characters and the mode of infestation, this species seems to link the subfamilies Pseudioninae and Hemiarthrinae. Specifically, Bourdon (personal communication) considers it intermediate between the genera Asymmetrione and Hemiarthrus. He acknowledges that it would be more logical if it led to the Athelginae, all members of which are exclusively parasitic on paguroids, as are all the species of Asymmetrione and Bopyrophryxus, while no hemiarthrine infests a paguroid. The female of Bopyrophryxus closely resembles those of several athelgines and hemiarthrines. The male, however, is remarkably similar to those of Asymmetrione in having 6 pleomeres, pleopods and uropods, all primitive characters. All athelgine and hemiarthrine males have fused pleons lacking appendages, a condition considered to indicate an advanced evolutionary position among the Bopyridae (Shiino, 1965).

The subfamily Bopyrophryxinae is unknown in the West Indian faunal region.

SUBFAMILY ATHELGINAE CODREANU AND CODREANU, 1956

Type-genus, Athelges Hesse, 1861

Diagnosis (modified from Codreanu, 1967).-- Female: Body often nearly symmetrical, segmentation often obscured; head deeply set into pereon, at least first 2 pereomeres extending around it; oostegites forming flaccid sac-like brood pouch completely covering ventral and lateral surfaces except for posterior part of pleon and often dorsally concealing some pereopods; first oosteigtes elongate, often extending far beyond head; all 7 pairs of pereopods present, posterior ones occasionally larger than others; 6 pleomeres, some occasionally fused medially; 5 pairs of flap-like pleopods, some or all biramous, often similar lateral plates; pleopods and lateral plates pedunculate; uropods variable. Male: Pleon fused, though indications of up to 3 pleomeres frequently present; no pleonal appendages. Dorsoabdominal parasites of paguroids; world-wide distribution.

Remarks.-- There are 7 genera described in the Athelginae, distributed widely throughout the world. Shiino (1965) includes Phyllodurus Stimpson in this subfamily and states that it is ancestral to the other athelgines. It is probably correct to regard Phyllodurus as a link between the Ioninae and the Athelginae, but I believe that its characters, though anomalous for any subfamily, indicate slightly closer affinities to the Ioninae, so I choose to group it there, as discussed above in the remarks on that subfamily. All athelgines except 1 species attach dorsally to the abdomens of hermit crabs, to which they cling only loosely, depending upon their hosts' protective gastropod shells to hold them in place. For most species, host selection is quite nonspecific, 1 species often infesting several different host species, even members of different families (Markham, 1972b). In several cases the host species are unknown because the parasites are easily dislodged and separated from them in collection and subsequent handling.

The distributions of athelgines follow several differeent patterns. The 2 largest genera, Athelges Hesse and Parathelges Bonnier, with 11 species apiece, are prime examples. Athelges is unknown in the Western Hemisphere but ranges from northern Norway through Europe, around Africa and Asia to New Zealand (Codreanu et al., 1965); Parathelges is essentially pantropical, being known from Japan and the East Indies, the Black Sea and the Mediterranean and the West Indian region (Markham, 1972b). Stegophryxus hyptius ranges far along the Atlantic coast of the United States, infesting intertidal sand-inhabiting pagurids through its range, while a new species of Stegophryxus from off California occurs in water deeper than 69m only. Local abundance also varies greatly for different species. Many species are known from a single female or pair, including some from regions where much collecting has been done. On the other hand, Stegophryxus hyptius is so common in Massachusetts that Reinhard et al. (1947) and Reinhard (1949) had sufficient material to perform classical studies of the effect it has on its host and its sex determination.

The athelgines are the largest bopyrids relative to their hosts, a female frequently being longer than the cephalothorax of its host. Despite their size, they apparently cause no alteration of the fat content or sexual characters of their hosts, at least in the case of S. hyptius, the only one studied (Reinhard et al., 1947).

The subfamily Athelginae is represented in the West Indian faunal region by 6 species in 3 genera. The following key distinguishes the local genera.

Key to 3 genera of Athelginae in West Indian faunal region, based on mature females.

1. Head fused posteriorly with first pereomere; first pair of oostegites extending only slightly beyond head.......................*Stegias*.

-- Head separated from first pereomere; first pair of oostegites extending at least as far beyond head as head length..................2.

2. Pereomere 6 markedly longest; brood pouch produced into posterior sac on right side; pleomeres 1-5 with lateral plates......*Stegophryxus*.

-- No pereomere markedly longest; brood pouch not produced into posterior sac; no lateral plates.............................*Parathelges*.

STEGOPHRYXUS THOMPSON, 1902

Type-species, by original designation, Stegophryxus hyptius Thompson. Gender, masculine.

Total number of species, 3. Geographical distribution: Massachetts to south Florida; California and Baja California; Valparaíso, Chile.

Generic diagnosis.-- Female: Head separate from pereon; first 3 pairs of oostegites arched far over head; fifth oostegites much larger than others, extending brood pouch into posterior sacs; sac on right side reaching slightly to greatly posteriorly; pereomere 6 markedly longest; 5 pairs of long biramous pleopods and lateral plates on common peduncles; uniramous bulbous uropods. Male: Head short, set off from pereon or with lateral indentations indicating former separation; pereomeres separated by deep lateral incisions; pleon much narrower than terminal pleomere.

Remarks.-- Two species of Stegophryxus have been described, and a new species occurs on the coasts of California and Baja California. The distribution and host selection of the 3 species of Stegophryxus are quite different. S. hyptius infests only species of Pagurus occurring on intertidal or shallow subtidal sandy bottoms throughout its range, from about 26°N to 42°N along the Atlantic coast of the United States, under conditions varying from nearly arctic to subtropical. The California species infests only species of Parapagurodes in deep water (69-391m). Though its recorded range of latitude is from 26°17'N to 36°27'N, there is little variation in temperature at the depths in question (Sverdrup et al., 1941). The third species, Stegophryxus thompsoni, which Nierstrasz and Brender à Brandis (1931) described from a single damaged pair collected at Valparaíso, Chile, came from an unknown host and unrecorded depth and has not been found since, so no remarks on its occurrence are possible. Stegophryxus is evidently the only bopyrid genus found only on both sides of the Americas.

West Indian faunal region species: only 1 species, Stegophryxus hyptius.

Stegophryxus hyptius Thompson, 1902

Figs. 45, 46

Stegophryxus hyptius Thompson, 1902, pp. 53-56, pls. 9, 10. (Type locality, Woods Hole, Massachusetts.).-- Richardson, 1904a, pp. 59-60; 1905, pp. 532-535, figs. 578, 579.-- Rathbun, 1905, p. 48.-- Sumner et al., 1913a, p. 136; 1913b, p. 661.-- Kunkel, 1918, p. 236.-- Reinhard et al., 1947, pp. 70-72.-- Reinhard, 1949, pp. 17-31; 1956, p. 101.-- Reinhard and Buckeridge, 1950, p. 131.-- Caullery, 1950, p. 97; 1952, p. 76.-- Reverberi, 1952, p. 292.-- von Brand, 1952, pp. 256, 271, Tab. 41; 1966, p. 222, Tab. 38.-- Florkin, 1960, p. 405.-- Noble and Noble, 1964, pp. 392, 393, figs. XVI-5A, 5B, 5C.-- Smith, 1964, p. 105.-- Kaestner, 1970, p. 463.-- Bourdon, 1968, p. 133.-- Schultz, 1969, pp. 321-322, fig. 513.-- Markham, 1972b, p. 73.

Stegophryxus hyptias [sic], Miner, 1950, pp. 450, 453, pl. 145.

Stegophrixus hyptius, Nierstrasz and Brender à Brandis, 1931, pp. 197-198.

Stegophryxus [sp.], Baffoni, 1953, p. 437.-- Reinhard, 1956, p. 93.-- Kaestner, 1967, p. 1161; 1970, pp. 425, 463.

Material examined.

Infesting _Pagurus longicarpus_ Say. Woods Hole, Massachusetts, date and coll. unknown, M. J. Rathbun, det. of host, 1♀, 1♂, USNM 54777. Tidepool, Sapelo Beach, Georgia, August 1969, R. W. Heard, coll., 1 immature ♀, 1♂, USNM 143660.

Infesting _Pagurus annulipes_ Stimpson, all hosts det. by P. A. McLaughlin. Morehead Channel, North Carolina, 3 Mar. 1967, R. W. Heard, coll., 4♀, 4♂, 2 cryptoniscan larvae, RMNHL. Lacking collection data (probably North Carolina), 1♀, UMML 32.4540. Beaufort, North Carolina, 1969 or 1970, C. Kellogg, coll., 1♀, 1♂, AHF. Same, 1♀, 1♂, both damaged, UMML 32.4541. Bulkhead Channel, Beaufort, North Carolina, 22 June 1970, C. Kellogg, coll., 1♀, 1♂, AHF. Same, 1♀, 1♂, UMML 32.4542. Beaufort Harbor, North Carolina, 1969 or 1970, C. Kellogg, coll., 1 damaged ♀, AHF.

Infesting _Pagurus miamensis miamensis_ Provenzano. In _Thalassia_ bed, shallow water, NW side Virginia Key, Miami, Florida, 28 June 1972, E. B. Hatfield, coll., P. A. McLaughlin, det. of host, 1♀, 1♂, UMML 32.4539.

Infesting _Pagurus bonairensis_ Schmitt. Bear Cut, Virginia Key, Miami, Florida, 9 Feb. 1958, A. J. Provenzano, Jr., coll., 1♀, 1♂, USNM 101762. In _Thalassia_ bed, shallow water, NW side Virginia Key, Miami, Florida, 25 Mar. 1969, J. C. Markham, coll., 1♀, 1♂ (reference ♂), USNM 143658. Same locality, 8 Nov. 1972, E. B. Hatfield, coll., 1♀, 1♂, AHF. Same locality, 12 Feb. 1973, E. B. Hatfield, coll., 1♀ (reference ♀), 1♂, USNM 143659. Shallow subtidal, off West Arsenicker Key, Card Sound, Florida, 25 Oct. 1972, E. B. Hatfield, coll., 1♀, 1♂, UMML 32.4538.

Description of reference female (Fig. 45).

Length 4.3mm, maximal width (excluding oostegites) 1.9mm, head length 0.7mm, pleon length 1.5mm. Distortion 59° (Figs. 45A, B).

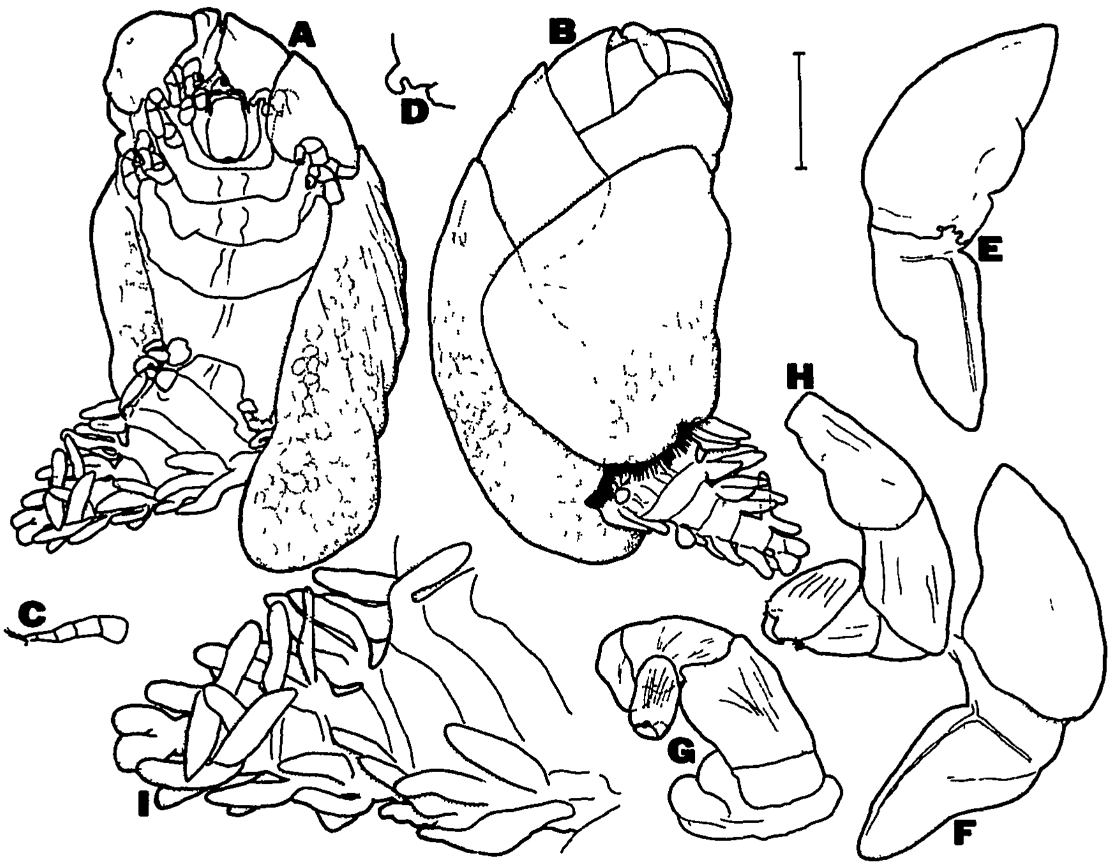

Fig. 45. Stegophryxus hyptius Thompson, reference female. A. Dorsal. B. Ventral. C. Left antenna 2. D. Right posteroventral border of head. E. Right oostegite 1, internal. F. Same, external. G. Right pereopod 1. H. Left pereopod 7. I. Pleon, dorsal. Scale: 1.0mm for A, B; 0.5mm for D-F; 0.2mm for C, G, H.

Head twice as long as wide, produced into anterior point. Antenna 1 of 3 segments, directed laterally, antenna 2 (Fig. 45C) of 7 segments, directed posteriorly. Eyes deeply set into sides of head. Posteroventral border of head (Fig. 45D) with single blunt lateral projection on each side.

All pereomeres set apart, first closely surrounding head and nearly obliterated in middle by head; pereomeres 2-5 concave anteriorly, each bent around preceeding pereomere; pereomere 6 longest, concave, pereomere 7 convex anteriorly. Oostegite 1 (Figs. 45E, F) nearly 3 times as long as wide, bluntly pointed both anteriorly and posteriorly, extending, with oostegites 2 and 3, far beyond head; oostegite 5, especially right one, largest, enclosing more than half of brood pouch, produced into slight posterior pocket on left side and large pocket on right. Pereopods (Figs. 45G, H) essentially alike, first five clustered forward, last two far back.

Pleon (Fig. 45I) of 6 pleomeres. Slender lateral plates and biramous pleopods arising from common peduncles on first 5 pleomeres. Large bulbous uniramous uropods on terminal pleomere.

Variations.

All of the mature females examined were very similar. In one, the head was quite broad relative to its length, and in a second, the body was less distorted. In the immature females, the body was nearly straight, the brood pouch more open, the pleon more than half the total body length, and all pleonal appendages relatively much larger.

Description of reference male (Figs. 46A-G).

Body with nearly parallel sides, all segments distinct, both head

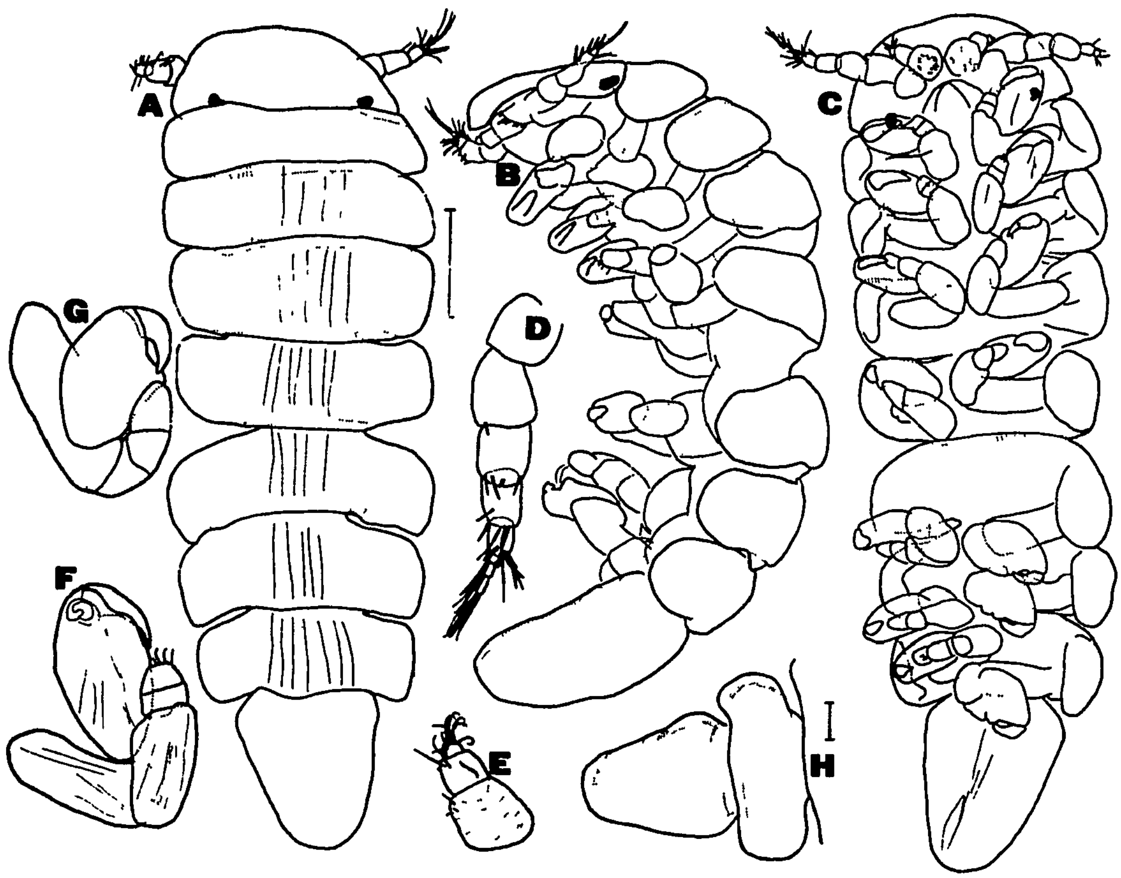

Fig. 46. Stegophryxus hyptius Thompson. A-G, reference male; H, other male. A. Dorsal. B. Lateral. C. Ventral. D. Right antenna 2. E. Left antenna 1. F. Right pereopod 1. G. Left pereopod 7. H. Pereomere 7 and pleon, dorsal. Scale at B: 0.2mm for A-C; 0.1mm for D-G. Scale at H: 0.1mm for H.

and pleon somewhat flexed ventrally (Figs. 46A-C). Body length 1.8mm, maximal width 0.5mm, head length 0.3mm, pleon length 0.4mm.

Head nearly as broad as pereon. Prominent eyes near posterior border. Antenna 1 (Fig. 46E) of 3 segments, antenna 2 (Fig. 46D) of 8 segments, both antennae with many terminal setae and several subterminal setae.

Pereon broadest across pereomere 2, then tapering slightly. Pereopods (Figs. 46F, G) essentially alike, except propodi somewhat shorter posteriorly.

Pleon markedly narrower than last pereomere, subtriangular, ending in rounded point.

Variations.

In 1 case (Fig. 46H) the pleon was considerably broader. Some other males bore conspicuous scattered black pigment spots on the pereon or pleon.

Discussion.

Previous records of Stegophryxus hyptius are only from Rhode Island and Woods Hole, Massachusetts. At the latter locality it is so common that Reinhard et al. (1947) studied its effects on its host, which was always Pagurus longicarpus, and Reinhard (1949) used it in a classical study to demonstrate sex determination in the Bopyridae. The new records add a considerable extension of range, down to southern Florida, and several new host records, all species of Pagurus.

Of the parasites examined, 17 were still with their hosts. Five of these hosts were males and 12 females, a statistically significant difference.

Two of the host Pagurus annulipes, in addition to bearing mature pairs of Stegophryxus hyptius on the abdomen, also bore cryptoniscan larvae on the thorax. On 1 P. annulipes there were 2 cryptoniscans, 1 attached to the carapace, the other to a pereopod; on the other host, 3 cryptoniscans were clinging to the carapace and a fourth was inside the branchial chamber. These larvae agree in all respects with those which Thompson (1902) described, even though he found them with the male in the brood pouch of the female Staegophryxus hyptius rather than on the host crab's body.

STEGIAS RICHARDSON, 1904

Type-species, by monotypy, *Stegias clibanarii* Richardson. Gender, feminine.

Total number of species, 3. Geographical distribution: Bermuda and possibly Puerto Rico; Putarenas, Costa Rica; Sumbawa.

Generic diagnosis.-- Female: Head fused with pereomere 1 posteriorly; pereomere 5 longest, its pereopods slightly larger and its oostegites much larger than others; 6 pleomeres, first five bearing long lanceolate lateral plates and similar pleopods; first 3 pleopods biramous, others uniramous; uropods long and lanceolate, usually uniramous. Male: Head fused with pereomere 1 or deeply set into it; pleon with slight lateral indication of remnant of first pleomere, blunt posterior point.

Remarks.-- Richardson (1904a) established the genus *Stegias* for *S. clibanarii*, a parasite of *Clibanarius tricolor* (Gibbes) in Bermuda. Most of her characterization of the genus consisted of contrasts with *Stegophryxus*. Later, Nierstrasz and Brender à Brandis (1923) described *Stegias andonophorus* in Sumbawa and *S. angusta* at Puntarenas, Costa Rica (Nierstrasz and Brender à Brandis, 1931). Though Richardson did not find the male of *S. clibanarii* and thus did not describe it, Nierstrasz and Brender à Brandis were easily able to assign their 2 species to *Stegias* by the females alone. With the description of the male of *S. clibanarii* herein, it becomes even clearer that all three of the species are indeed congeneric. The distribution of *Stegias* thus appears to be a Tethyan tropical relict, being on both sides of North America and in Indonesia.

West Indian faunal region species: only 1 species, *Stegias clibanarii*.

Stegias clibanarii Richardson, 1904

Figs. 47, 48

"A Bopyrid," Richardson, 1902, p. 299.

Stegias clibanarii Richardson, 1904a, pp. 59-60, fig. 34 (Type locality, Bermuda); 1905, pp. 536-537, fig. 580.-- Verrill, 1908, p. 448, fig. 64.-- Nierstrasz and Brender à Brandis, 1923, p. 107; 1931, p. 200. -- Menzies and Glynn, 1968, pp. 13, 18-19, 88, 93, fig. 3 (see discussion).-- Schultz, 1969, p. 322, fig. 514.-- Markham, 1972b, pp. 64-65.

Not Stegias clibanarii, Pearse, 1932a, pp. 4-5, figs. 22-26.-- Schultz, 1969, p. 323, fig. 515. [= Asymmetrione n. sp. 2]

"Unidentified bopyrid," Markham, 1972b, p. 65.

Material examined.

Infesting Clibanarius tricolor (Gibbes). Unknown specific locality, Bermuda, 1876 or 1877, G. B. Goode, coll.; 1♀, holotype, 1♂, allotype, YPM 3226.

Description of holotype female (Fig. 47).

Length 8.5mm, maximal width (excluding oostegites) 3.6mm, head length 1.7mm, pleon length 1.7mm, pleon length 2.5mm. Distortion 10°. Body suboval in outline, tapering gradually anteriorly and posteriorly. Head posteriorly fused with pereomere 1, all other segments distinct but not set apart (Figs. 47A, B).

Head subrectangular but narrower anteriorly. Antenna 1 (Fig. 47C) of 3 segments, distal two much reduced; antenna 2 of 5 segments, sharply reflexed back along side of head. No eyes. Posteroventral border of head

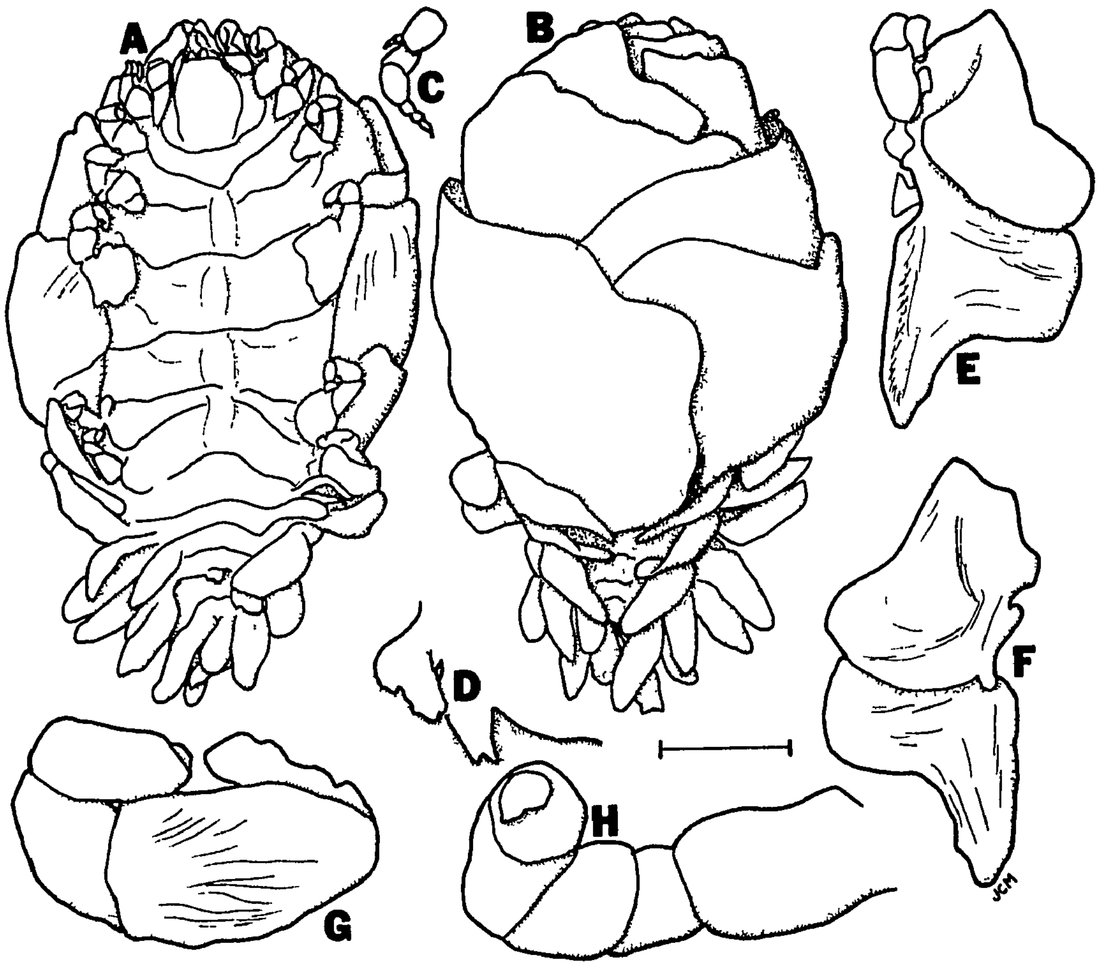

Fig. 47. Stegias clibanarii Richardson, holotype female. A. Dorsal. B. Ventral. C. Left antennae. D. Right posteroventral border of head. E. Right oostegite 1, external. F. Same, internal. G. Right pereopod 1. H. Left pereopod 7. Scale: 2.0mm for A, B; 0.5mm for C, D; 1.0mm for E, F; 0.25mm for G, H.

(Fig. 47D) with 2 irregularly shaped lateral projections on each side.

Pereomeres 1 and 2 surrounding head. Pereomere 5 slightly broader and much longer than others. Oostegites completely enclosing brood pouch and covering lateral surfaces of head and pereon. Oostegite 1 (Figs. 47 E, F) more than twice as long as wide, extending beyond head, bearing blunt anterior point, sharp posterolateral point, prominent entire internal ridge. Oostegite on pereomere 5 much larger than others, half covering pereon ventrally and laterally. Pereopods (Figs. 47G, H) of nearly same size except fifth pair much larger; all pereopods except seventh pair sharply reflexed.

Pleon tapering to rounded point, of 6 pleomeres. Pleomeres 1-5 produced into lateral plates. Pleopods 1-3 biramous, other two uniramous. Pleomere 6 with pair of uropods, one of them biramous, other evidently having lost 1 ramus. Lateral plates, pleopods and uropods all similarly long, lanceolate and nearly equal in size, all extending laterally except pleopodal exopodites, those reflexed over ventral surface.

Description of allotype male (Fig. 48).

Length 2.6mm, maximal width 0.9mm, pleon length 0.8mm. Body elongate, sides nearly parallel except for anteriorly rounded head and posteriorly pointed pleon (Figs. 48A, B). Head partly fused with pereomere 1, all other segments distinctly separated.

Head nearly oval, broader than long. Antenna 1 (Fig. 48C) of 3 segments, decreasing in size distally, terminal segment tipped with 6 setae; antenna 2 of 5 segments, basal one far larger than next, others decreasing slightly in size distally, terminal segment tipped with tuft of about 13 setae, some setae on distal margins of next 2 segments. Eyes evident-represented by tiny obscure spots near anterior edge.

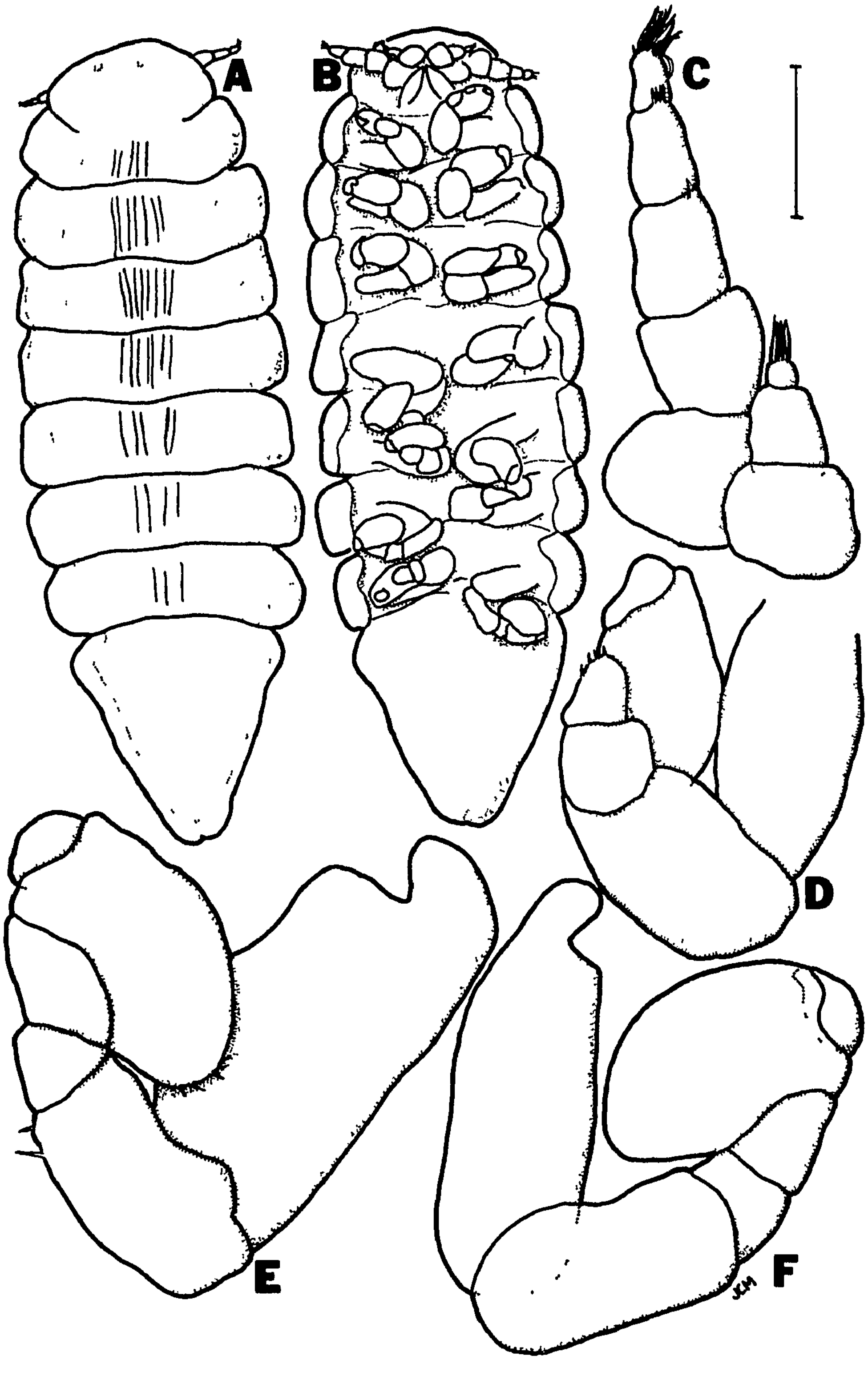

Fig. 48. Stegias clibanarii Richardson, allotype male. A. Dorsal. B. Ventral. C. Right antennae. D. Left pereopod 1. E. Right pereopod 4. F. Left pereopod 7. Scale: 0.3mm for A, B; 0.1mm for C-F.

Slightly broadest across pereomeres 5 and 6. All pereomeres reflexed ventrally at lateral edges; no midventral tubercles. All pereopods (Figs. 48D-F) of similar structure and proportions, with notched basal segments and reduced dactyli; pereopod 4 largest, others decreasing in size anteriorly and posteriorly.

Pleon fused, nearly triangular in outline except for slight anterior enlargement indicating vestigial segment; small indentation on posterior margin. No appendages.

Discussion.

Despite her usual careful work, Richardson (1904a) evidently examined the holotype of _Stegias clibanarii_ incompletely. Her drawings depict only the intact animal, without details of appendages, and she failed to find the male, which was enclosed in the brood pouch with several immature eggs. There is no evidence that anyone subsequently examined the holotype. Pearse (1932a) later found some parasites on the same host species in the Dry Tortugas, one of which he described, incorrectly, as the allotype of _S. clibanarii_. Though the site of attachment of _S. clibanarii_ was not recorded, it presumably infested its host abdominally like all other athelgines. I have examined those specimens, which Pearse (1932a) clearly recorded as branchial parasites. The male and the female accompanying it belong to an undescribed species of _Pseudione_; the other specimen is a female of _Asymmetrione_ n. sp. 2, described above. Both of these species are pseudionines and have been previously recorded (Markham, 1972b) as parasites of _Clibanarius tricolor_.

The only other record of a parasite referred to _Stegias clibanarii_ is from the same host species in Puerto Rico (Menzies and Glynn, 1968);

Those specimens have not been available for my examination, but from the illustrations presented by Menzies and Glynn (1968, fig. 3), both sexes appear to be very immature, the male still being a cryptoniscan larva.

PARATHELGES BONNIER, 1900

Type-species, by original designation, Athelges aniculi Whitelegge. Gender, masculine.

Total number of species, 11. Geographical distribution: Mediterranean and Black Seas; Honshu; Java Sea; Funafuti; Bermuda; S Florida; Bahamas; Jamaica; Caribbean coasts of Colombia and Venezuela; Curaçao.

Generic diagnosis.-- Female: Always sinistral; head distinct from pereon; first pair of oostegites anterior to head; pleon broad flat half-disk, not abruptly narrower than final pereomere; 6 pleomeres, some or all occasionally fused medially, pleomere 5 greatly reduced and lacking pleopods; 4 pairs of biramous pleopods not enclosing pleon; no lateral plates; uropods prominent, uniramous. Male: Pereopods 1 and 2 with long pointed dactyli, others with reduced blunt dactyli; pleon occasionally enlarged anteriorly, ending in blunt to sharp, never rounded posteriorly.

Remarks.-- Bonnier (1900) erected the genus Parathelges with Athelges aniculi as the type-species because he considered it to differ from all other known species of Athelges in that the pleon of the female is as broad as the pereon. Nierstrasz and Brender à Brandis (1923) described a second species, P. weberi, from the East Indies and pointed out some further distinctions between the females of Parathelges and Athelges. Nierstrasz and Brender à Brandis (1929) later found a second specimen of P. weberi and published the first description of a male of the genus and then described a third species, P. whiteleggei (Nierstrasz and Brender à Brandis, 1931) also in the East Indies. The first species found outside the western Pacific was P. racovitzai, which Codreanu (1940) described from the Black Sea and later (Codreanu, 1961) from the Mediterranean. Shiino (1950) described a fourth western Pacific species, P. enoshimensis, after which Codreanu (1968) described 2 more Mediterranean species,

P. *carolii* and P. *cardonae*. More recently, Markham (1972b) described 4 new species from the western Atlantic and discussed means of distinguishing both males and females of *Parathelges* from those of *Athelges*.

The genus *Parathelges* has a nearly pantropical distribution, now being known from all tropical regions but the eastern Pacific. All of the documented records of *Parathelges* are from shallow water, mostly in or near the intertidal zone. The greatest depth for any species is 60m. The 11 species of *Parathelges* are known from 17 different host species in 9 genera of the families Paguridae and Diogenidae.

West Indian faunal region species: 4 species, *Parathelges occidentalis*, *Parathelges tumidipes*, *Parathelges piriformis*, *Parathelges foliatus*.

Key to West Indian faunal region species of *Parathelges*, based on adult females.

1. Basal segments of pereopods 5-7 with large posterior knobs..P. *tumidipes*.

-- Basal segments of pereopods 5-7 without large posterior knobs......2.

2. Pleomeres completely fused or only indistinctly separated..P. *piriformis*.

-- Pleomeres distinctly separated..................................3.

3. Pleopodal exopodites on peduncles at least half total appendage length..P. *foliatus*.

-- Pleopodal exopodites on peduncles less than half total appendage length..P. *occidentalis*.

Parathelges tumidipes Markham, 1972

Figs. 49, 50

Parathelges tumidipes Markham, 1972b, pp. 66-71, figs. 10, 11. (Type locality, near Jamaica.)

Material examined.

Infesting Dardanus fucosus Biffar and Provenzano. Pillsbury Sta. P-1252. SW of Jamaica, 17°09'N, 78°57'W, 26m, 14 July 1970, T. A. Biffar, det. of host; 1♀, holotype, USNM 139178, 1♂, allotype, USNM 139179.

Description of holotype female (Fig. 49).

Length 9.2mm, maximal width 3.6mm, head length 1.7mm, pleon length 2.8mm. Distortion 10°. Body only slightly concave dorsally, broadest across pereomeres 5-7 (Fig. 49A).

Head nearly circular in outline. Antennae 1 and 2 of 3 and 5 segments respectively, setation of first uncertain, second with at least 4 terminal setae. Posteroventral border of head (Fig. 49B) with 2 sharply pointed lateral projections on each side.

Pereon with indistinct segmentation. Oostegite 1 (Fig. 49C) without anterolateral point, bearing rather prominent external ridge; Posterolateral point quite acute. Pereopods 5-7 distinctly different (Fig. 49D): coxal segments with conspicuous raised areas and distal blunt points; basal segments with posterior border produced into large round knobs.

Pleon (Figs. 49A, E) flat fused plate with segmentation only superficially indicated, except terminal pleomere distinct dorsally but not ventrally. Exopodites of pleopods only slightly larger than endopodites, all rami oblong-lanceolate. Lanceolate uropods distinctly separated by minute medial terminal point.

Description of allotype male (Fig. 50).

Lenth 2.8mm, maximal width 1.3mm, head length 0.4mm, pleon length

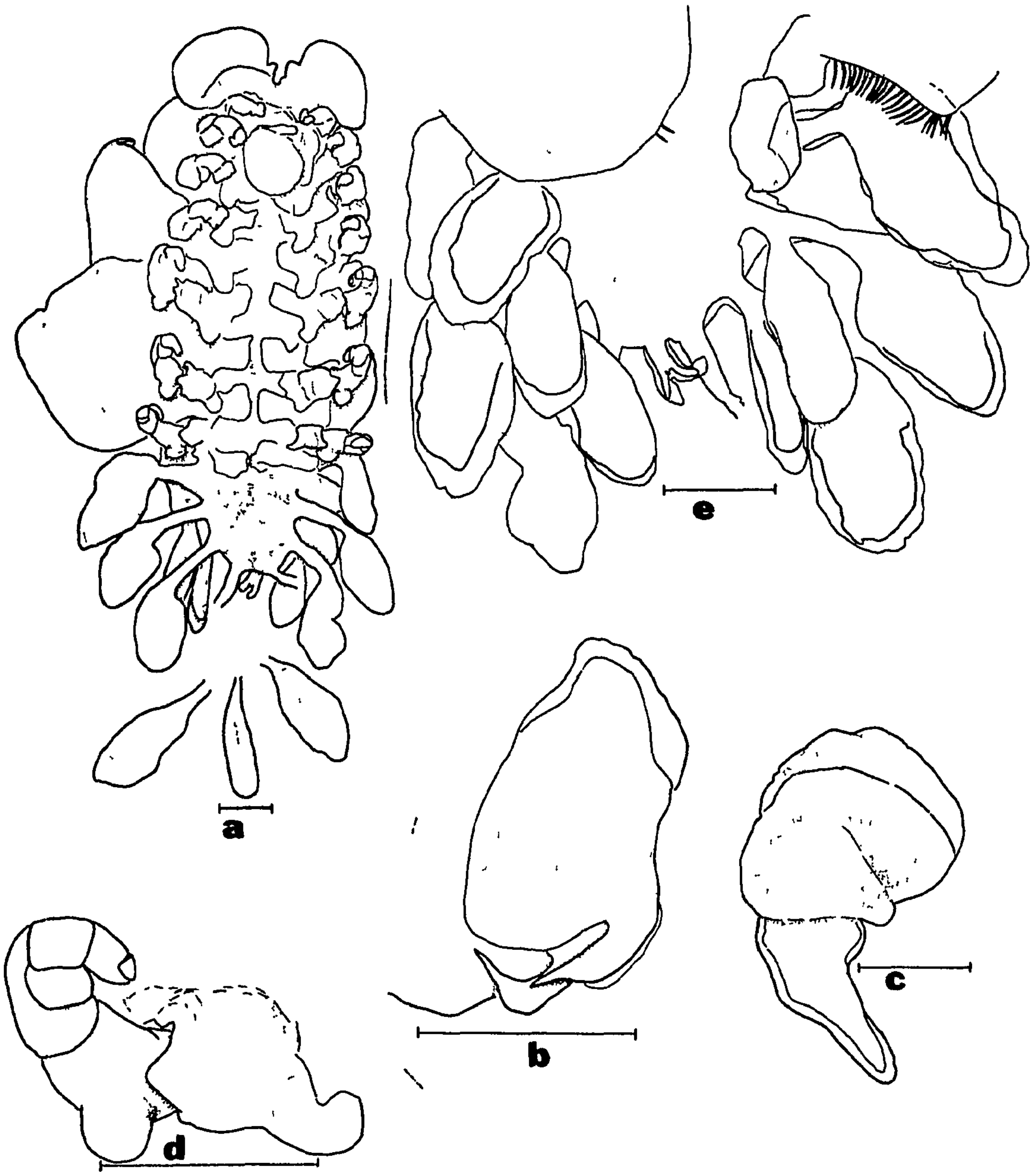

Fig. 49. Parathelges tumidipes Markham, holotype female. A. Dorsal. B. Head, left side, ventral. C. Left oostegite 1. D. Right pereopod 6. E. Pleon, ventral. Scales: 1.0mm.

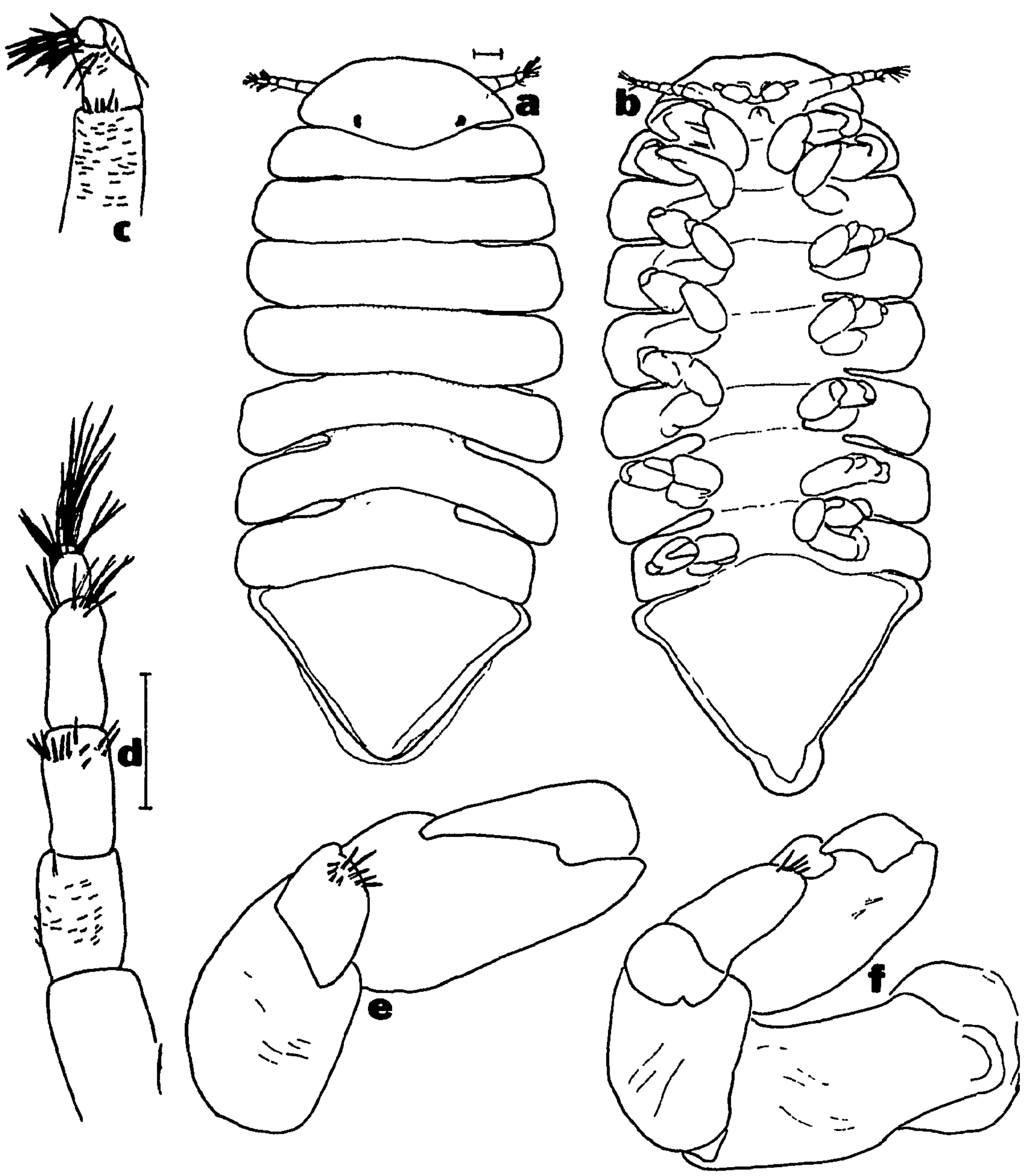

Fig. 50. Parathelges tumidipes Markham, allotype male. A. Dorsal. B. Ventral. C. Left antenna 1. D. Left antenna 2. E. Left pereopod 1. F. Left pereopod 7. Scale at A: 0.1mm for A, B. Scale at D: 0.1mm for C-F.

0.8mm. Sides of body slightly rounded. Body regions distinct (Figs. 50 A, B).

Head convex posteriorly, extending about 1/3 into pereomere 1. Small black eyes near posterior border. Segments of antenna 1 (Fig. 50C) respectively with 3, 11, 5 terminal setae distally to proximally; segments of antenna 2 (Fig. 50D) similarly with 7, 3, 8, 9, 11, 1, 0 terminal setae; minute filaments on proximal 2 segments of each antenna.

Pereon broadest across pereomeres 4 and 5, other pereomeres only slightly narrower. Pereopods (Figs. 50E, F) typical for genus.

Pleon triangular in outline except posterior point somewhat extended and curved ventrally; remnants of vestigial pleomeres possibly indicated by faint dorsal markings.

Discussion.

The type specimens of *Parathelges tumidipes* were not preserved adequately. For this reason, some of the pleonal appendages of the female had fallen off and are depicted separately (Fig. 49A), and the other pleonal appendages are markedly contracted from their skeletons (Fig. 49E).

Parathelges piriformis Markham, 1972

Figs. 51, 52

Parathelges piriformis Markham, 1972b, pp. 71-73, figs. 12, 13. (Type locality, Bermuda.)

Material examined.

Infesting *Pagurus miamensis miamensis* Provenzano. North Rock Reef, Bermuda, 14 Oct. 1958, A. J. Provenzano, Jr., coll. and det. of host; 1♀, holotype, USNM 104134, 1♂, allotype, USNM 139177.

Infesting Pagurus provenzanoi Forest and De Saint Laurent. On coral reef, E side Andros Island, Bahamas, 24°53'N, 77°53'W, 15m, 10 Sep. 1973, J. C. Markham, coll., P. A. McLaughlin, det. of host; 1♀, 1♂, UMML.

Infesting Paguristes oxyophthalmus Holthuis. Pillsbury Sta. P-365, off Golfo de Morrosquilla, Colombia, 09°32'N, 76°16'W, 57m, 13 July 1966, L. B. Holthuis, det. of host; 1♀, 1♂, UMML.

Description of holotype female (Fig. 51).

Length 6.2mm, maximal width 2.5mm, head length 1.2mm, pleon length 1.8mm. Distortion 16°. Slightly concave dorsally. Outline piriform, broadest across pereomere 7 (Fig. 51A).

Head spade-shaped in outline. Antenna 1 (Fig. 51B) of 3 segments, distal two bearing some terminal setae. Antenna 2 of 7 segments, proximal one sharply bent, so antenna directed posteriorly (Fig. 51C); distal segment with 5 terminal setae, some other segments bearing single setae on distal margins. No eyes. Posteroventral border of head (Fig. 51D) with 3 lateral projections on each side.

Pereon distinctly segmented dorsally. Oostegites tightly enclosing ventral surface; oostegite 1 (Figs. 51E, F) with flap-like internal ridge reflected by external ridge, blunt anterolateral point and sharp falcate posterolateral point. Pereopods rather small and widely spaced, longer and narrower posteriorly.

Pleon with segmentation very indistinct except final pleomere distinctly set off dorsally. Pleopodal rami oval. Uropods divergent, subtriangular in outline.

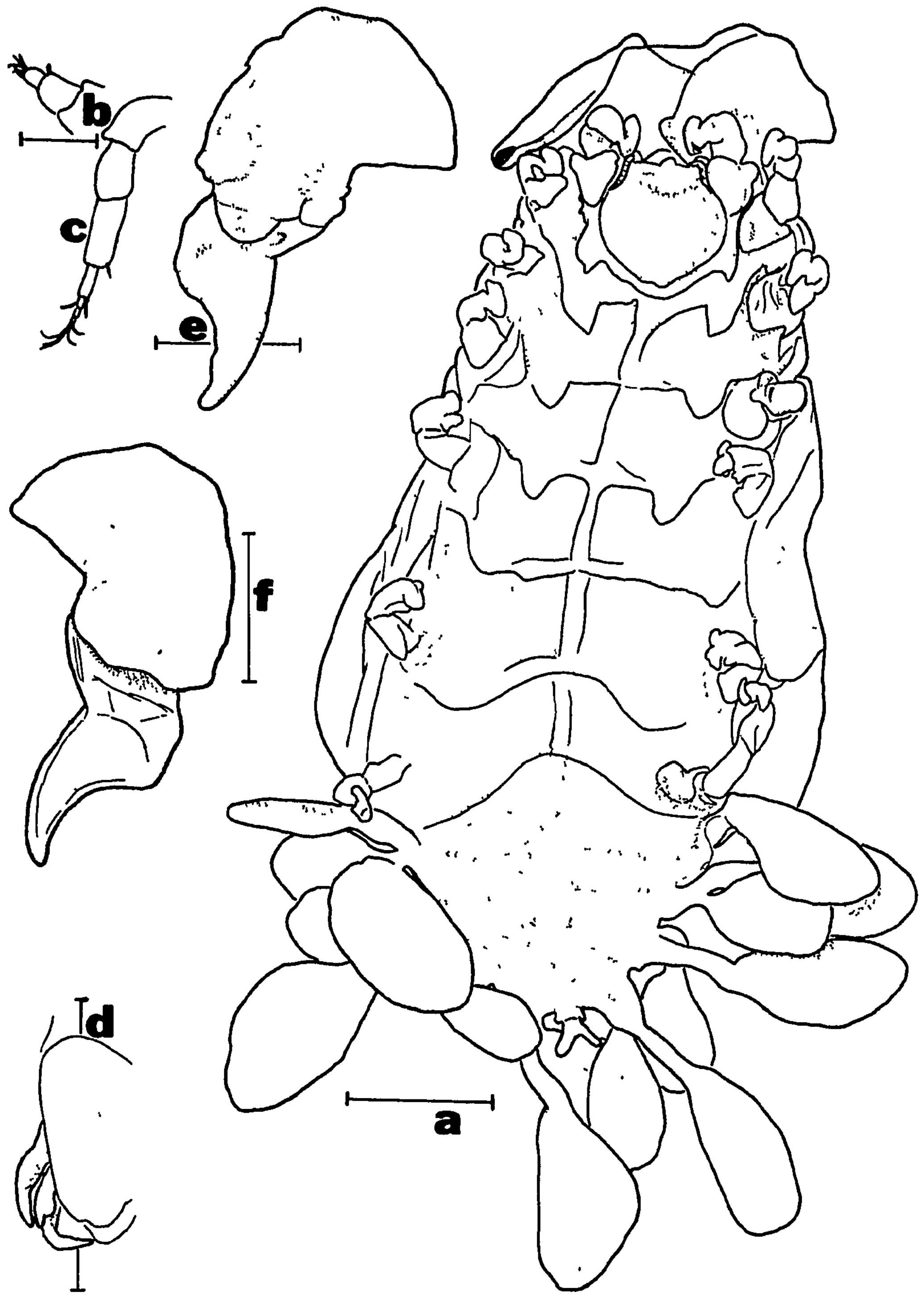

Fig. 51. Parathelges piriformis Markham, holotype female. A. Dorsal. B. Right antenna 1. C. Right antenna 2. D. Right posteroventral border of head. E. Right oostegite 1, internal. F. Same, external. Scales at A, D, E, F: 1.0mm. Scales at B, C: 0.1mm.

Variations.

The other 2 females examined agree in all respects with the holotype except that the one infesting *Pagurus provenzanoi* bore tiny deeply recessed eyes like those of *Parathelges racovitzai* Codreanu, the only other species of *Parathelges* known to have eyes in the female.

Description of allotype male (Fig. 52).

Length 2.3mm, maximal width 1.0mm, head length 0.4mm, pleon length 0.6mm. Sides of body straight and nearly parallel, tapering only slightly; body regions distinctly defined (Figs. 52A, B).

Head nearly as broad as pereon, slightly convex posteriorly. No eyes. Antenna 1 (Fig. 52C) of 3 segments, each bearing 7 terminal setae. Antenna 2 (Fig. 52D) of 7 segments, each of distal 5 segments bearing several setae. Proximal segment of each antenna with many fine filaments.

Pereon slightly broadest across pereomeres 2 and 3. Pereopods (Figs. 52E, F) typical for genus.

Pleon broadly rounded triangle with very blunt tip.

Variations.

As with the female, the male from *Pagurus provenzanoi* bore eyes on top of the head; both males were otherwise like the allotype.

Discussion.

Patsy McLaughlin informs me that the host of the type pair, which had been removed from the container, might have been a misidentified indiviual of *Pagurus provenzanoi* rather than *P. miamensis miamensis*; if that is true, this parasite would be known from only 2 host species.

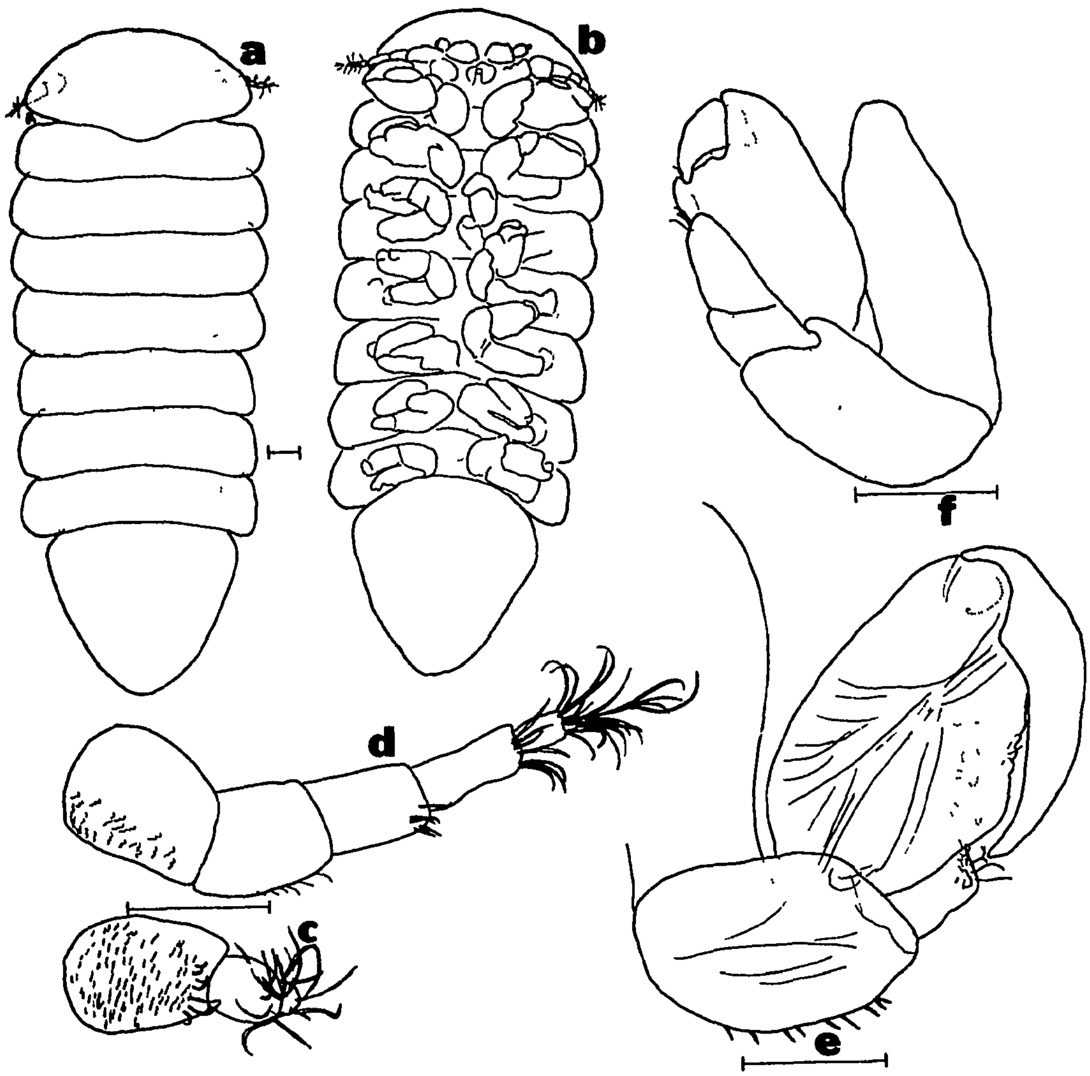

Fig. 52. Parathelges piriformis Markham, allotype male. A. Dorsal. B. Ventral. C. Right antenna 1. D. Right antenna 2. E. Right pereopod 1. F. Left pereopod 7. Scales: 0.1mm.

Parathelges foliatus Markham, 1972

Figs. 53, 54

Parathelges foliatus Markham, 1972b, pp. 73-75, figs. 14, 15. (Type locality, Trinidad.)

Material examined.

Infesting *Clibanarius vittatus* (Bosc). In outfall canal of power station, Port of Spain, Trinidad, Feb. 1970, R. Y. Ash, coll. and det. of host; 1♀, holotype, USNM 139182.

Infesting *Pagurus miamensis miamensis* Provenzano. Exact locality unknown, Curacao, 28 Aug. 1963, B. A. Hazlett, coll., P. A. McLaughlin, det. of hosts; 2♀, 2♂, UMML.

Description of holotype female (Figs. 53, 54).

Length 8.3mm, maximal width, 3.3mm, head length 1.3mm, pleon length 3.6mm. Distortion 6°. Body only slightly concave dorsally (Fig. 53).

Head spade-shaped in outline. No eyes. Posteroventral border of head (Fig. 54A) with 3 long lateral projections on each side ending in fairly sharp points.

Pereon with pereomeres distinct dorsally. Central ridge along entire length of dorsal surface of pereon and part of pleon. Brood pouch tightly closed. Oostegite 1 (Figs. 54B, C) with moderately sharp anterolateral point, prominent external and internal ridges, oblong posterolateral point. Oostegite 2 (Figs. 54D, E) quite short and broad, medioposterior corner produced into curved point. Pereopods (Fig. 54F) essentially all alike, with prominent coxal segments.

Pleon (Figs. 53, 54G) with pleomeres distinct except final two fused. Pleopodal exopodites long and slender, nearly lanceolate, exten-

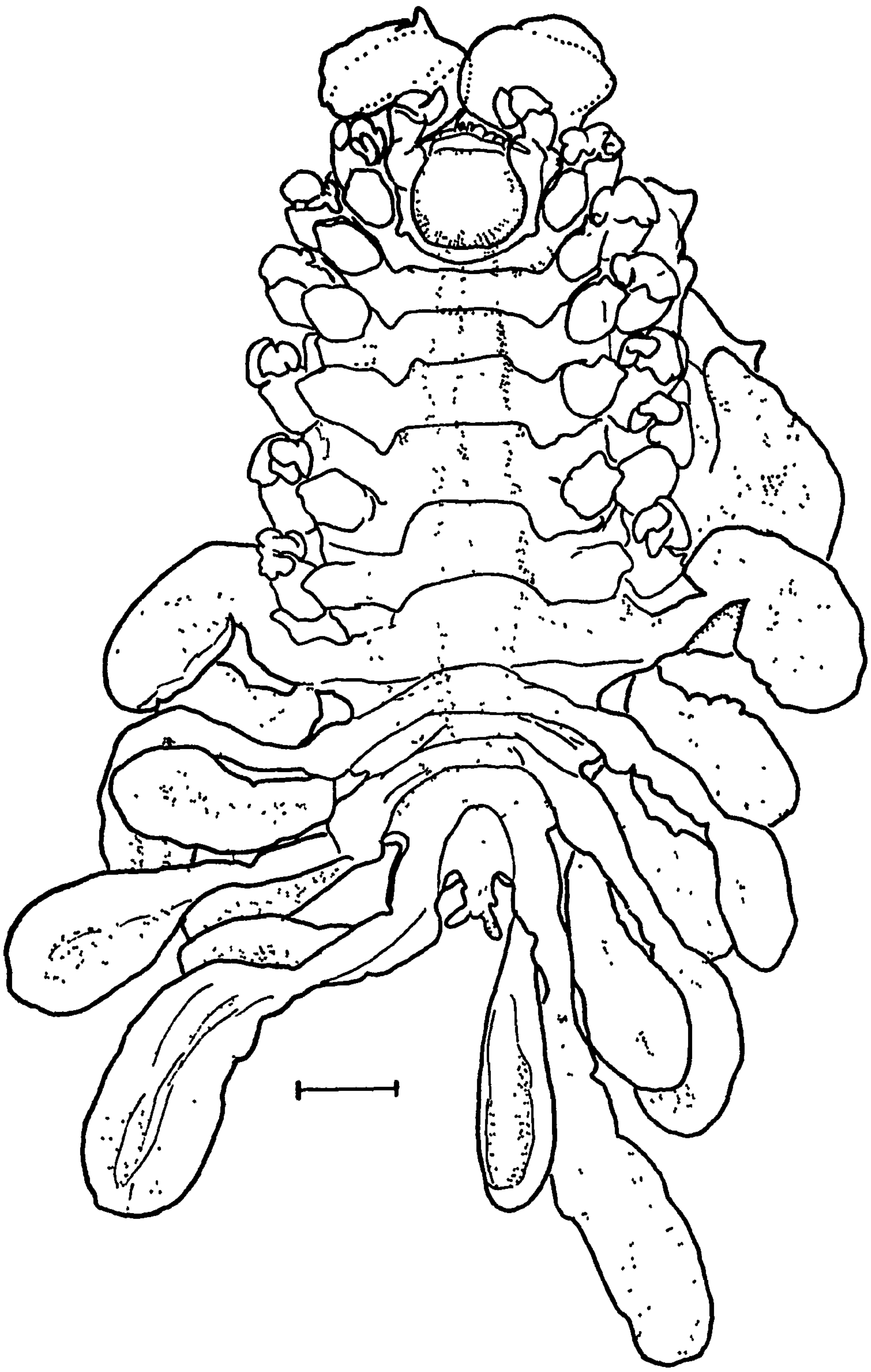

Fig. 53. Parathelges foliatus Markham, holotype female, dorsal. Scale: 1.0mm.

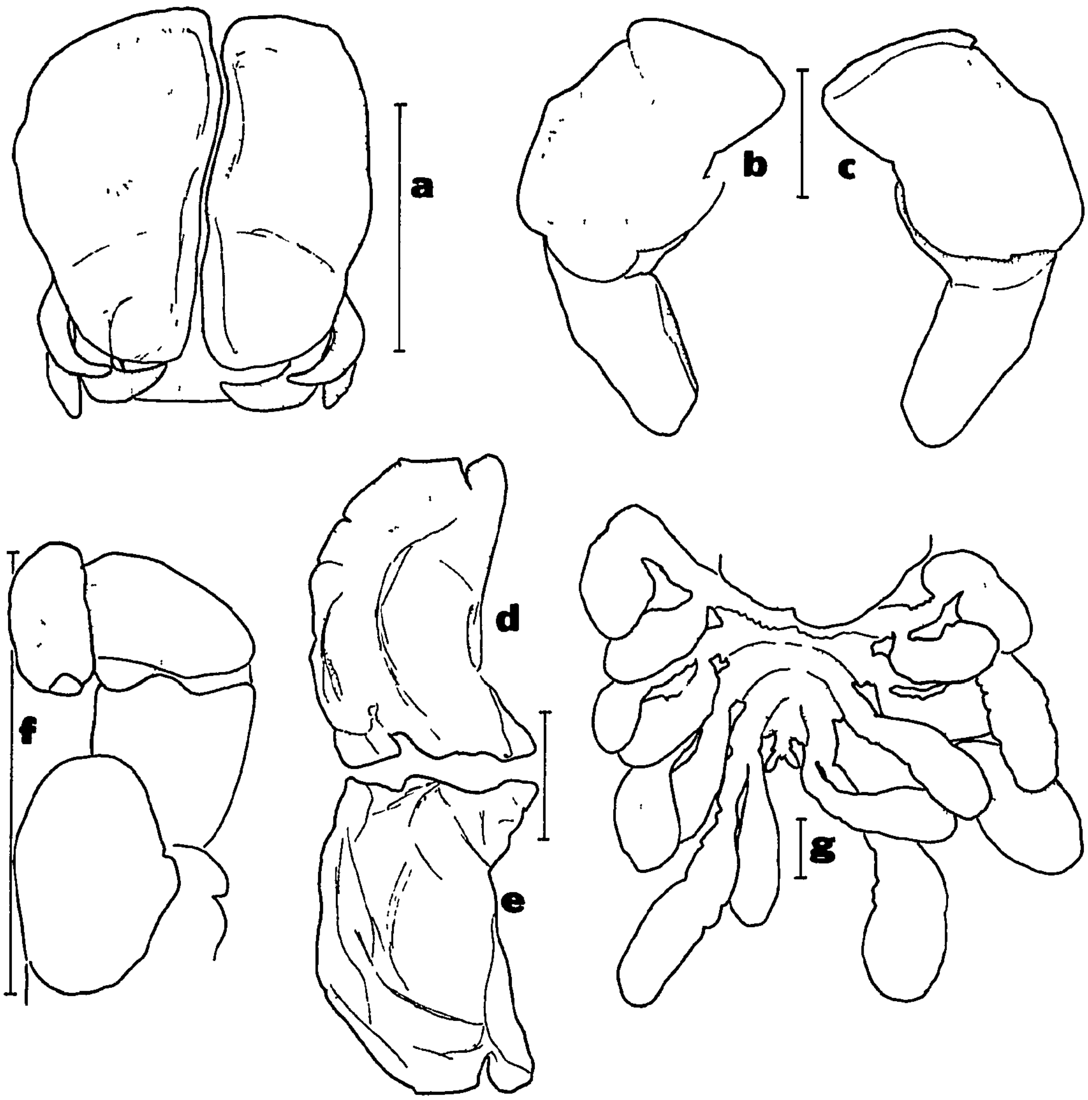

Fig. 54. Parathelges foliatus Markham, holotype female. A. Head, ventral. B. Right oostegite 1, external. C. Same, internal. D. Right oostegite 2, external. E. Same, internal. F. Left pereopod 1. G. Pleon, ventral. Scales: 1.0mm.

ding far beyond body outline on peduncles at least half total length of pleopods; endopodites similar in size and shape but on much shorter peduncles than exopodites. Uropods nearly triangular, separated by small central point.

Male undescribed.

Discussion.

The specimens infesting *Pagurus miamensis miamensis* came to my attention too late for me to examine them in detail. The females show some similarities with *Parathelges occidentalis*, but are nonetheless close enough to the holotype of *P. foliatus* to be assignable to this species. The males are distinct from all those which have been described, as is to be expected.

Parathelges occidentalis Markham, 1972

Figs. 55-57

Parathelges occidentalis Markham, 1972b, pp. 60-69, figs. 1-9. (Type localities, Dry Tortugas, Florida and Berry Islands, Bahamas.)

Material examined.

Infesting *Pylopagurus corallinus* (Benedict). Forty miles off Cape Lookout, North Carolina, 34°07'N, 76°13'W, 87-105m, 2 June 1970; 1♀, 1♂, ZMC.

Infesting *Clibanarius tricolor* (Gibbes), all hosts coll. and det. by J. C. Markham. On rocky bottom in shallow water, NW side Goat Cay, Berry Islands, Bahamas, 2 July 1971; 1♀, USNM 139185, 1♂, allotype, USNM

139184. Under small rocks at entrance to Safe Harbor, Stock Island, Key West, Florida, Mar. 1971; 1♀, RMNHL. In coral rubble just below water line, E side Garden Key, Dry Tortugas, Florida, 4 May 1971; 1♀, holotype, USNM 139183.

Infesting Iridopagurus sp. (probably n. sp.). Pillsbury Sta. P-718, off Isla de Margarita, Venezuela, 11°23'N, 64°09'W, 60m, 28 July 1968, P. A. McLaughlin, det. of host; 1♀, 1♂, RMNHL.

Description of holotype female (Figs. 55, 56).

Length 3.3mm, maximal width 1.3mm, head length 0.7mm, pleon length 1.1mm. Distortion 10°. Body deeply concave dorsally. Greatest width across pereomere 4, tapering gradually anteriorly and posteriorly (Fig. 55).

Head spade-shaped in outline. Antenna 1 (Fig. 56A) of 3 segments decreasing in size distally; distal segment with 5 terminal setae, middle one with 3, proximal one with 1. Antenna 2 (Fig. 56B) of 4 segments bearing, distally to proximally, 5, 4, 2, 0 setae. Posteroventral border of head with 2 fairly sharp lateral projections on each side (Fig. 56C).

Pereon with middorsal ridge along entire length; all segments clearly defined. Oostegite 1 (Figs. 56D, E) arched over head, with sharp anterolateral points, prominent external and internal ridges, posterior region produced into rather blunt oblong projection. Pereopods (Figs. 56F, G) equally developed, posterior ones somewhat longer and less reflexed than others.

Pleon of 6 distinct pleomeres. Pleopods with elongate-oval exopodites, smaller oval endopodites. Terminal pleomere bearing pair of uniramous subtriangular uropods.

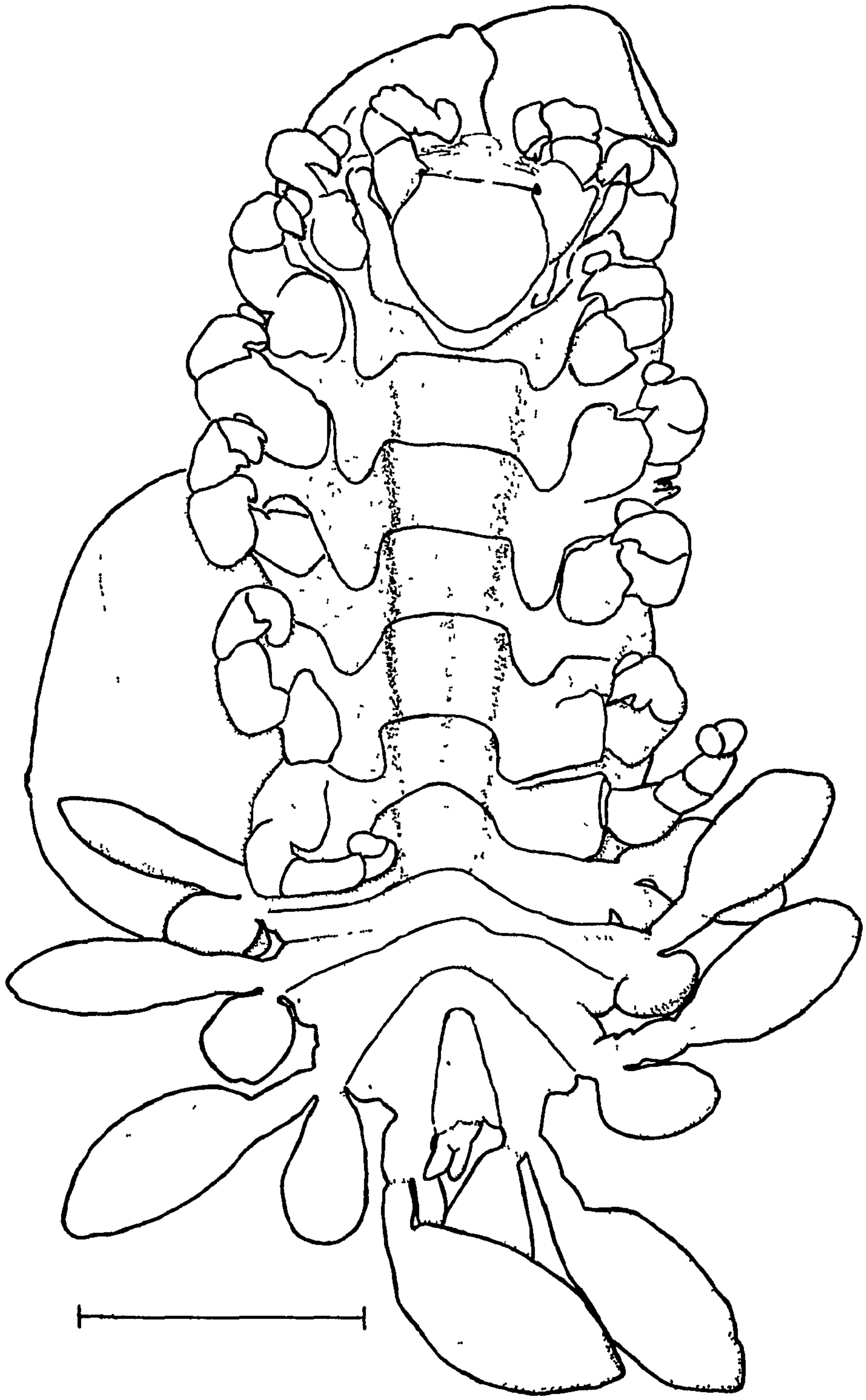

Fig. 55. Parathelges occidentalis Markham, holotype female, dorsal. Scale: 1.0mm.

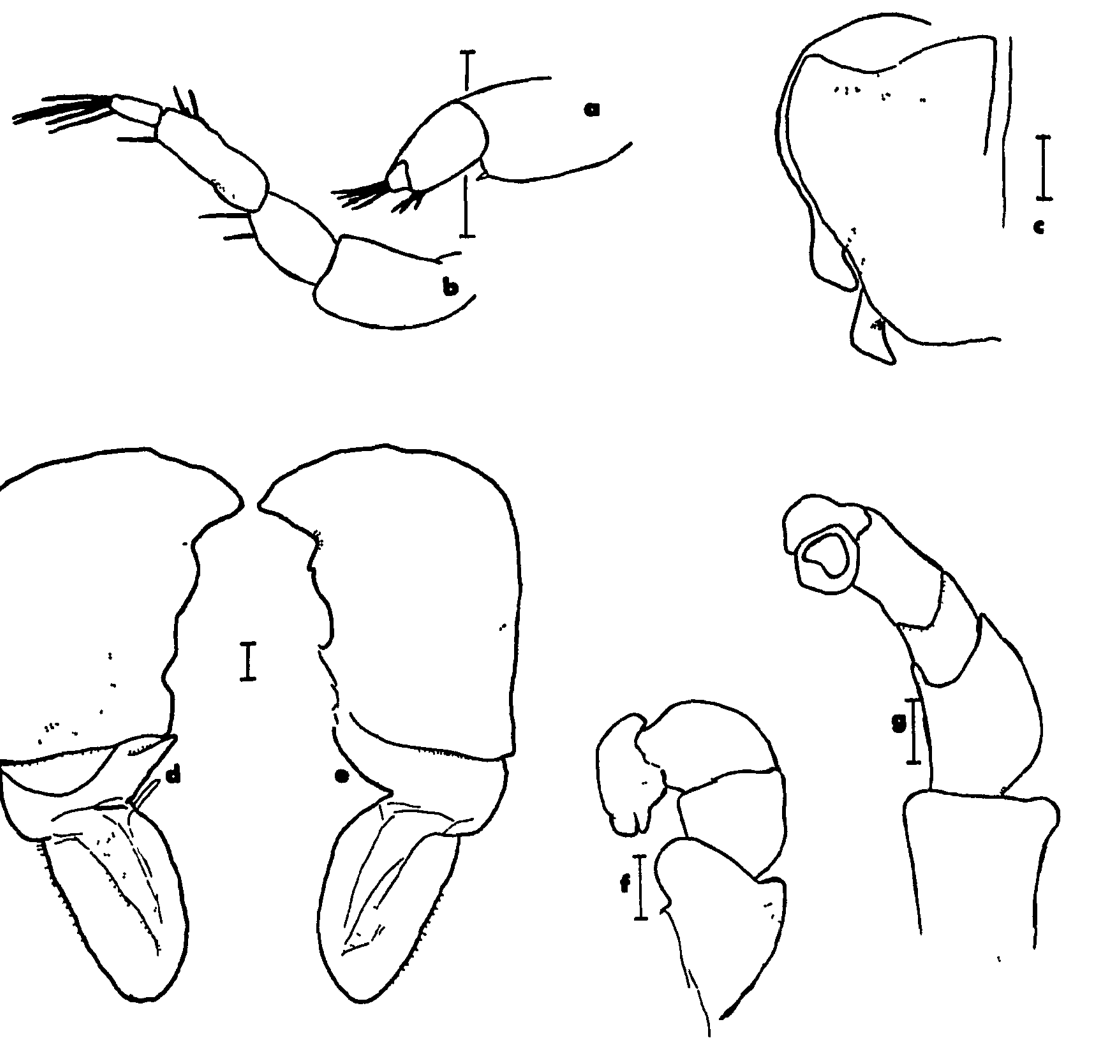

Fig. 56. Parathelges occidentalis Markham, holotype female. A. Left antenna 1. B. Left antenna 2. C. Left side of head, ventral. D. Right oostegite 1, internal. E. Same, external. F. Left pereopod 1. G. Left pereopod 7. Scales: 0.1mm.

Variations.

Of the other 4 females examined, body distortion ranges from 8° to 30°, three have the final 2 pleomeres nearly fused, and in one the head is more concave anteriorly.

Description of allotype male (Fig. 57).

Length 2.5mm, maximal width 0.8mm, pleon length 0.6mm. Head and pereon fused, with only lateral indentations indicating borders. Sides of body nearly parallel (Figs. 57A, B).

Head bearing 2 small eyes near posterior edge. Antenna 1 (Fig. 57C) of 3 segments, distal one tipped with 9 or 10 setae, middle and proximal segments with 7 and 5 setae respectively. Antenna 2 (Fig. 57D) of 7 segments, bearing, distally to proximally, 5, 1, 10, 6, 5, 0, 0 setae. Proximal 2 segments of each antenna bearing cluster of minute filaments.

Pereon slightly broader across pereomere 4 than elsewhere. Pereopods (Figs. 57E, F) nearly alike in all respects.

Pleon almost triangular in outline, straight sides tapering to fairly sharp point.

Variations.

The other 2 males examined were very similar to the allotype except that both were broader relative to their lengths.

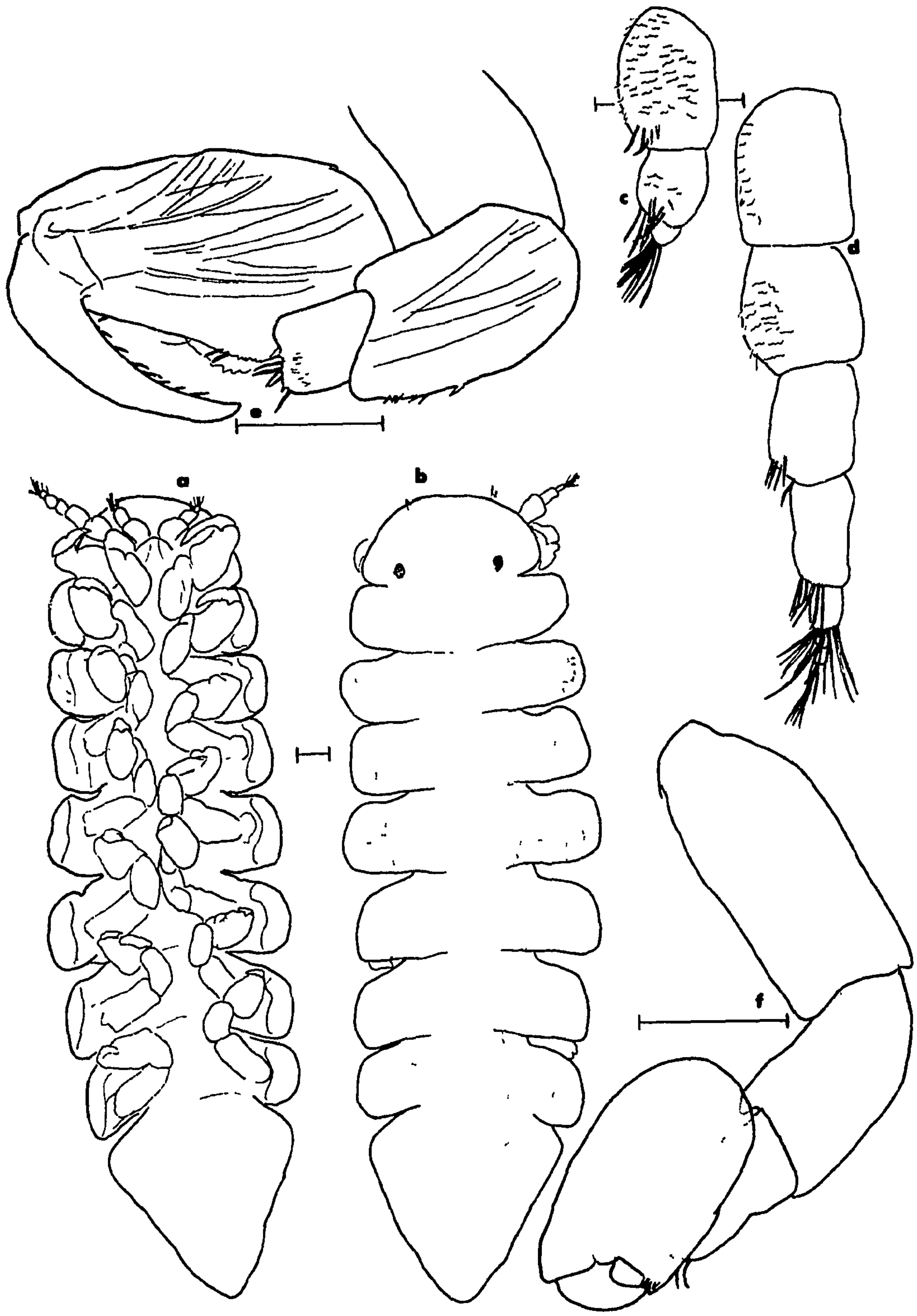

Fig. 57. Parathelges occidentalis Markham, allotype male. A. Ventral. B. Dorsal. C. Right antenna 1. D. Right antenna 2. E. Left pereopod 1. F. Left pereopod 7. Scales: 0.1mm.

UNIDENTIFIED ATHELGINAE

Material examined.

Infesting *Paguristes* sp. (probably n. sp.). Off W end Providenciales Island, Turks and Caicos Islands, 21°50'N, 72°21'W, 20m, on coral reef, 1 Sep. 1973, J. C. Markham, coll., P. A. McLaughlin, det. of host; 1 immature ♀, 1 cryptoniscan larva, UMML.

Infesting *Tomopagurus cokeri* (Hay). Pillsbury Sta. P-594. Off Yucatán Peninsula, México, 21°00'N, 86°23'W, 330m, 15 Mar. 1968, P. A. McLaughlin, det. of host; 1♀, 1♂, both immature, UMML.

Discussion.

These parasites are so immature that there is no way to identify them even to genus, although all of them appear closest to *Parathelges*. The only other athelgine recorded in this area from a species of *Paguristes* is *Parathelges piriformis*, discussed above as a parasite of *Paguristes oxyophthalmus*. No species of *Tomopagurus* is otherwise known as a host of a bopyrid. Due to the low host-specificity of athelgines, it is impossible to judge what the parasites may be by the identity of their hosts.

SUBFAMILY HEMIARTHRINAE MARKHAM, 1972

(= PHRIXINAE CAROLI, 1949)

Type-genus, Hemiarthrus Giard and Bonnier, 1887

Diagnosis (modified from Codreanu and Codreanu, 1956).-- Female: Body generally distorted, sometimes more than 90°; head deeply set into pereon, occasionally obliterating center of first pereomere; pereomeres distinct on concave side, their borders obscured on convex side; brood pouch greatly expanded on convex side, completely closed, covering entire ventral and lateral surfaces of head, pereon and part of pleon as wellas part of dorsal surface of pereon; only first 4 oostegites of convex side contributing to brood pouch, others reduced or absent; pereopods nearly always all present on convex side, 1 (most anterior) to 7 present on concave side; usually 5 pleomeres (1 species with 1, 3 with 4, 1 with 6), usually first four bearing prominent lateral plates; pleopods on all but terminal pleomere (absent in Orophryxus and Filophryxus), variously uniramous or biramous; uropods absent or variously developed. Male: Body at least twice as long as broad; head and first pereomere separate to fully fused, all other pereomeres separate; no midventral tubercles; pleon fused, lacking appendages. Ventral abdominal parasites (with 3 exceptions) of caridean shrimps; world-wide distribution.

Remarks.-- This subfamily was originally designated Phrixinae by Caroli (1949) then Phryxinae by Codreanu and Codreanu (1956), both of which were based on invalid generic names, Phrixus (a junior synonym) and Phryxus (a junior homonym). Markham (1972a) subsequently renamed it Hemiarthrinae, presented a synonymy and discussed the systematic history of the subfamily and its name.

If one includes the extremely aberrant genera Orophryxus Bruce

(1972a) and Filophryxus Bruce (1972b), there are currently 20 nominal hemiarthrine genera, 13 of them monotypic, containing a total of 38 nominal species. The genera have been established on the basis of the number of pereopods on the convex side of the female; I believe that this character should be used in conjunction with the structure of the females' pleons and various characters of the males. Using such a scheme and recognizing that 3 species, including the type-species of a monotypical genus, are nomina nuda, I intend to reorder the subfamily, reassigning 15 species to different genera. With the description of 2 new monotypical genera below, the total number of genera becomes 19 and of species 36.

The West Indian fauna includes 6 species, while a seventh is to be expected, each in a different genus, distinguished by the following key. There is some intraspecific variation among key characters of several of the species, so one should use the generic and specific diagnoses presented in correlation with the following key.

Key to 7 genera of Hemiarthrinae known or expected in West Indian faunal region, based on mature females.

1. Convex side bearing all 7 pereopods..............................2.

-- Convex side bearing only 1-3 pereopods...........................4.

2. All 4 pleopods with endopodites; all 4 lateral plates well developed. ....Eophrixus.

-- No pleopods with endopodites; fourth lateral plates reduced or absent..3.

3. All lateral plates lanceolate; uropods long and slender, usually divergent..Loki.

-- First 3 lateral plates nearly circular; uropods absent but posterior margin of pleon deeply cleft..........................New Genus C.

4\. Convex side with 3 pereopods; body distorted 35° or less; first 3 pleopods with endopodites.............................*Dicropleon*.

-- Convex side with 1 or 2 pereopods; body distorted 80° or more; all pleopods lacking endopodites.................................5.

5\. Only 4 pleomeres, first three lacking appendages on concave side or bearing them only as tiny rudiments...................New Genus D.

-- Five pleomeres, all with appendages on both sides.................6.

6\. Convex side with 1 pereopod; antennae reduced...........*Hemiarthrus*.

-- Convex side with 2 pereopods; antennae as prominent unsegmented flaps ....*Metaphrixus*.

EOPHRIXUS CAROLI, 1930

Type-species, by monotypy, Phrixus (Eophrixus) lysmatae Caroli. Gender, masculine.

Total number of species, 7. Geographical distribution: Inland Sea, Seto and Amakusa, Japan; Kerala, India; Napoli, Italy; Zanzibar; North Carolina.

Generic diagnosis.-- Female: Body slightly (23°) to greatly (80°) distorted; first oostegite on concave side produced into prominent posterolateral point; all pereopods of nearly same size, all 7 fully developed on each side; pleon well extended, of 5 pleomeres; first 4 pleomeres each bearing prominent oval lateral plates on each side; 4 pairs of biramous pleopods (fourth pleopods uniramous in E. subcaudalis), endopodites smaller than exopodites; uropods usually present, never large. Male: Considerably longer than wide; head fused with first pereomere; antennae often extending prominently; pleon usually pointed.

Remarks.-- Caroli (1930) established Eophrixus as a subgenus of Phryxus (which he emended to Phrixus), to include those species whose females bear 7 pereopods on the convex side. He did not designate a type-species, listing 3 species, all of them new, as examples; only 1 of those species, Phrixus lysmatae, was described, the others remaining nomina nuda, so it becomes the type-species by monotypy. Nierstrasz and Brender à Brandis (1931) quickly raised Eophrixus to generic status. Shiino (1934) created the genus Hypophryxus for H. yusakiensis and later (Shiino, 1939b) described H. kuboi. Caroli (1949) pointed out that Hypophryxus should be consided a synonym of Eophrixus, although Pillai (1966) and Bruce (1968) subsequently described new species which they assigned to Hypophryxus. Codreanu and Codreanu (1956) incorporated Eophrixus, including *Hypophryxus*, into *Anisarthrus* Giard. Shiino (personal communication), with whose opinion I concur, agrees that *Hypophryxus* belongs in *Eophrixus*, but believes that it differs too much from *Anisarthrus* for inclusion in it, because the female of the single species of *Anisarthrus*, *A. pelseneeri* Giard (1907), lacks pleopodal endopodites, and its male's head is separate from the first pereomere. Finally, a species which Caroli (1930) assigned to the subgenus *Paraphrixus* on the basis of an erroneous original description, *Phryxus subcaudalis* Hay (1917), I am reassigning to *Eophrixus*, thereby bringing the total number of species in the genus to 7.

West Indian faunal region species: only 1 species, *Eophrixus subcaudalis*.

Eophrixus subcaudalis (Hay, 1917)

Figs. 58, 59

Phryxus subcaudalis Hay, 1917, pp. 569-570, 572, pl. 98, figs. 1-6 (In part; type locality, off coast of North Carolina.).-- Hay and Shore, 1918, p. 383.-- Pearse, 1950, p. 43.-- Williams, 1965, p. 74.

Hemiarthrus subcaudalis, Chopra, 1923, pp. 419, 429, 433, 435, 436, 439, 440.-- Schultz, 1969, p. 313, fig. 497.

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

Paraphrixus subcaudalis, Nierstrasz and Brender à Brandis, 1931, p. 205.

"Abdominal bopyrid," Chace, 1972, p. 92.

Material examined.

Infesting *Synalpheus longicarpus* (Herrick). United States Fisheries Steamer Fish Hawk Sta. 8293. In unnamed sponge, 20 miles off Beaufort, Inlet, Onslow Bay, North Carolina, Aug. 1915, W. P. Hay, coll. and det. of hosts; 1♀, holotype, USNM 48371, 9♀, 4♂, paratypes, USNM 48368. Los Roques, Venezuela, Nov. 1950, F. A. Chace, Jr., det. of host; 1♀, USNM.

Infesting Synalpheus brooksi Coutière. In Spheciospongia vesparia (Lamarck), in shallow water, Soldier Key, Biscayne Bay, Florida, 25 Apr. 1970, J. C. Markham, coll., 1♀, 1♂, UMML. In Speciospongia vesparia, Dry Tortugas, Florida, 27 June 1931, A. S. Pearse, coll. and det. of host; 1♀, called paratype of Hemiarthrus schmitti Pearse, USNM. Smithsonian-Bredin Expedition Sta. 28-60, Mujeres I., Quintana Roo, México, 31 Mar. 1960, F. A. Chace, Jr., det. of host; 1♀, USNM 128462. Smithsonian-Bredin Expedition Stas. 47-60, 48-60, N end Cozumel I., Quintana Roo, México, 8 Apr. 1960, F. A. Chace, Jr., det. of hosts; 3♀, USNM 128463-128465.

Infesting Synalpheus pectiniger Coutière, J. García-Gómez, det. of host. Pillsbury Sta. P-1283, off Enriquillo, Dominican Republic, 17°35'N, 71°25'W, 18-27m, 19 July 1970; 1♀, 1♂, reference specimens, UMML.

Description of reference female (Fig. 58).

Length 5.8mm, maximal width 4.0mm, head length 1.0mm, pleon length 1.3mm. Distortion 80° (Figs. 58A, B).

Head deeply set into pereon. Antennae (Fig. 58C) prominent, first one of 3 segments, second of 5, both bearing some setae distally. No eyes. Posteroventral border of head with single rather short lateral projection on each side.

Pereon greatly distended, with most pereomeres largely obscured. Oostegite 1 of concave side (Fig. 58D) rather elongate and truncate anteriorly, with unadorned internal ridge, narrow posterolateral point. All 7 pereopods present on both sides, nearly alike in size and shape (Figs.

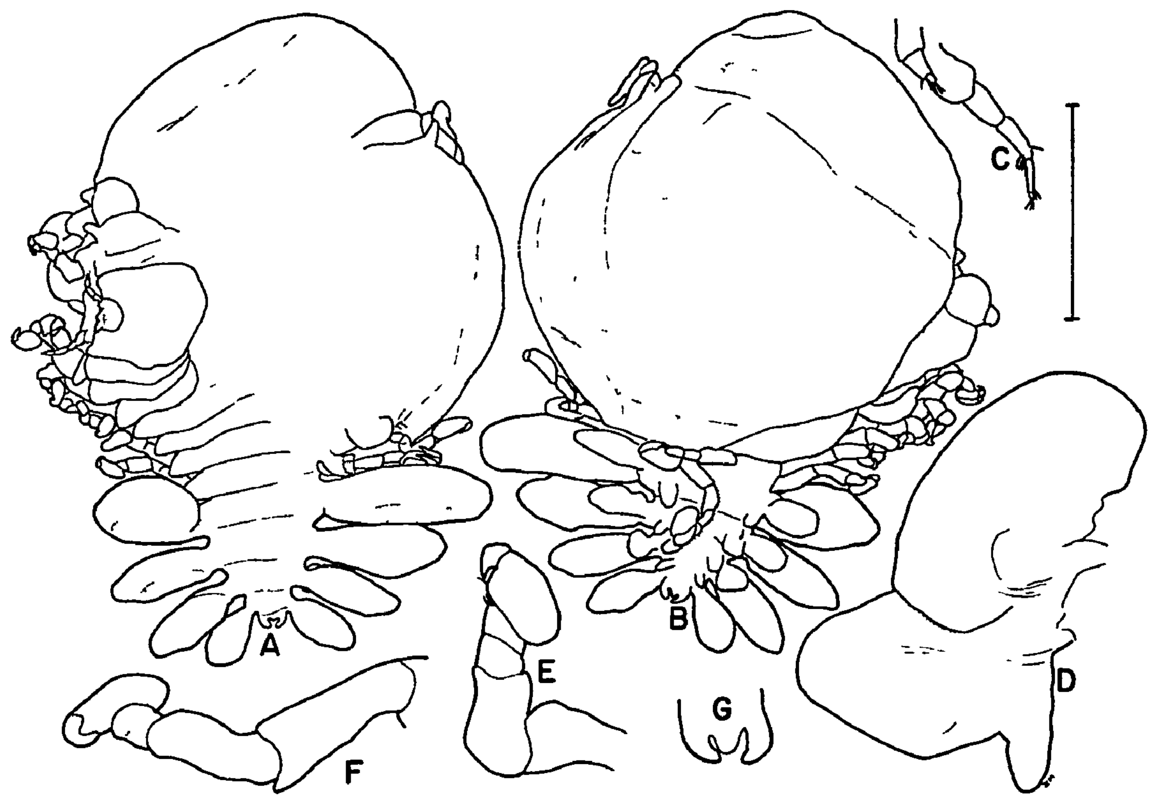

Fig. 58. Eophrixus subcaudalis (Hay), reference female. A. Dorsal. B. Ventral. C. Left antennae. D. Left oostegite 1, internal. E. Right pereopod 1. F. Left pereopod 7. G. Pleomere 5. Scale: 2.0mm for A, B; 0.5mm for C, E-G; 1.0mm for D.

58E, F); on concave side, pereopods 1-2 near head, 3 on far side of brood pouch, 4-5 near posterolateral border of brood pouch, 6-7 at posterior edge of brood pouch and extending over to other side of body.

Pleon elongate and prominent, of 5 pleomeres. First 4 pleomeres produced into conspicuous suboval lateral plates extending far to sides and progressively smaller posteriorly. First 3 pleopods biramous, fourth uniramous, evidently lacking exopodites; exopodites resembling lateral plates but much smaller, endopodites in form of small bumps. Terminal pleomere bearing pair of reduced flap-like uropods surrounding central anal cone (Fig. 58G).

Variations.

The 16 females examined are nearly alike in all details. The holotype has the first 4 pereomeres more complete and bears a bifid point between the uropods. Seven of the females are dextral and 9 sinistral, the numbers thus being nearly equal.

Description of reference male (Fig. 59).

Length 3.3mm, maximal width 0.8mm, pleon length 0.7mm. Sides of body nearly parallel (Fig. 59A).

Head completely fused with pereomere 1. Antennae (Fig. 59B) highly prominent, first of 3 segments, second of 5 segments, both bearing several setae distally. No eyes.

Pereomeres deeply separated laterally. Pereopods (Figs. 59C-E) extremely elongate, especially posterior ones, extending far to sides.

Pleon narrow and extended (Figs. 59A, E), showing slight lateral and dorsal indications of 5 former pleomeres; posterior border produced into 2 points separated dorsally by anal cone.

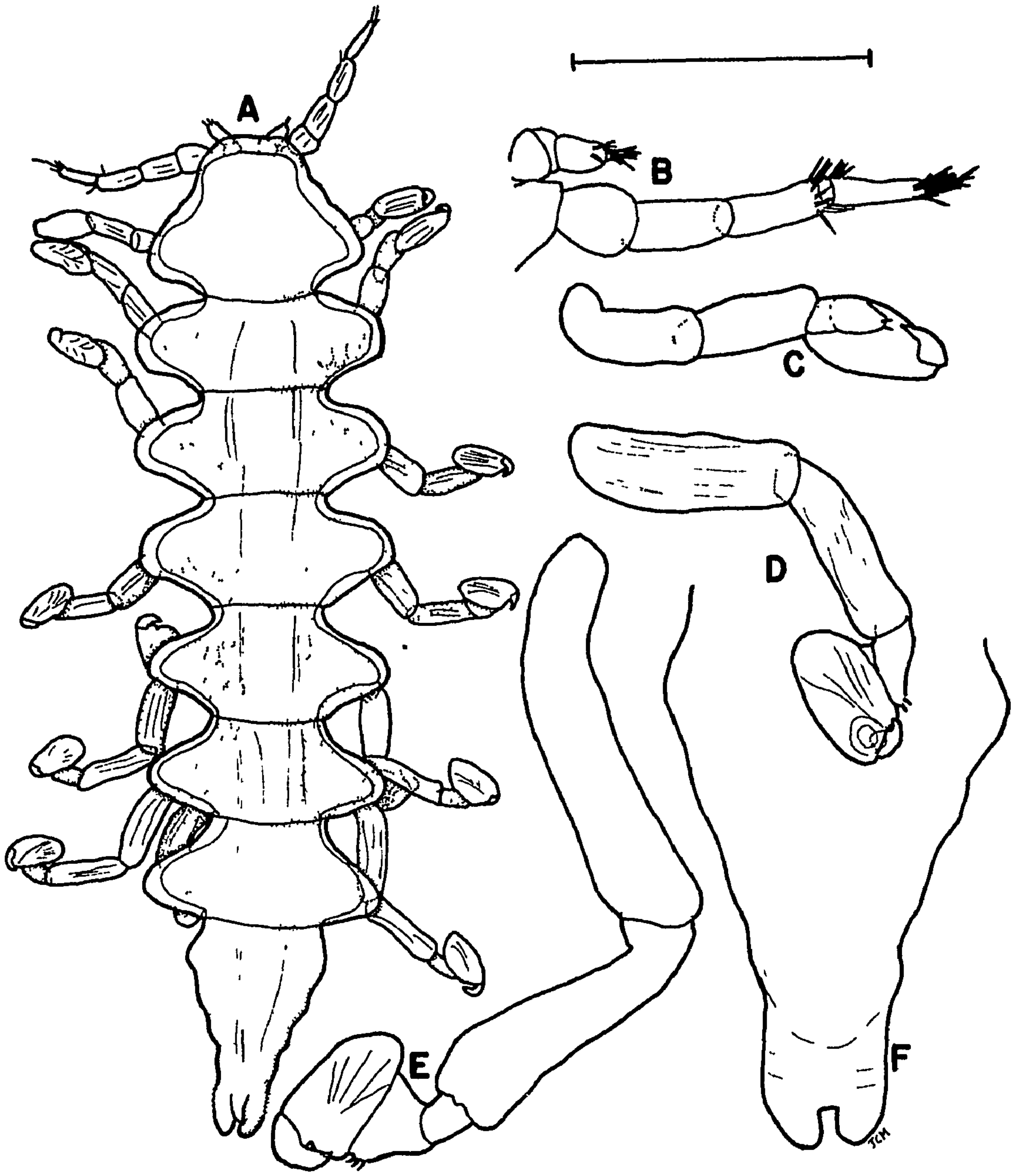

Fig. 59. Eophrixus subcaudalis (Hay), reference male. A. Dorsal. B. Right antennae. C. Right pereopod 1. D. Left pereopod 5. E. Left pereopod 7. F. Pleon, ventral. Scale: 1.0mm for A; 0.4mm for B-F.

Variations.

All of the 5 other males examined match the reference male in all inportant characters.

Discussion.

In his original description of this species, Hay (1917) stated that the female had only 5 pèreopods on the convex side, and on the basis of that report, Caròli (1930) assigned the species to his new subgenus Paraphrixus, which Nierstrasz and Brender à Brandis (1931) then raised to generic rank. Of the 16 females which I have examined, 15, including the holotype, have 7 pereopods on the convex side, while the other female has 6 such pereopods. On the basis of the pereopods and the pleonal appendages, this species clearly seems to belong in Eophrixus, to which genus I am reassigning it. The head of the male is fused with the first pereomere, as is also the case with all other Eophrixus males; the èlongate pereopods and strangely split pleon are distinctive, but they do not necessarily exclude the male from Eophrixus.

Hay (1917) did not designate an allotype male but examined 4 males which he included among his paratypes. His description of the males was extremely brief, including mention of the long pereopods and the split pleon; the only illustration was a photograph of 3 males. In his discussion, he mentioned a fourth male, which, because of its very different characters, he considered as possibly being immature or accessary. In reality, it is a male of Hemiarthrus (now New Genus D) schmitti (Pearse), discussed below, 8 females of which are also among Hay's paratypes. Also among those paratypes are 2 females of Diplophryxus (now Hemiarthrus) synalphei (Pearse), discussed below.

Even though there were 9 females and 4 males in the material on which Hay (1917) based his original description of this species, no one has reported finding any further specimens until now. All of the geographical records outside of North Carolina, south to Venezuela, and the other 2 host records are thus new. Chace (1972) listed the parasites collected by the Smithsonian-Bredin Expeditions as "abdominal bopyrids" infesting Synalpheus brooksi.

NEW GENUS C

Type-species, New Genus C n. sp.

Total number of species, 1. Geographical distribution: near Dry Tortugas, Florida.

Generic diagnosis.-- Female: Body only moderately distorted, but brood pouch extremely large and displaced to 1 side; all 7 pairs of pereopods present on both sides; 5 pleomeres; 4 pairs of large lateral plates; 3 pairs of biramous pleopods; final pleomere deeply divided but lacking uropods. Male: Body to 3 times as long as wide;head and pereomere 1 fused, other pereomeres distinctly separated; pereopods essentially alike; pleon nearly square except posterior border extended into 2 points divided by deep cleft.

Remarks.-- Superficially, this genus appears very similar to _Dicropleon_ Markham, discussed below. Females of both are only moderately distorted, their heads are relatively large, and their pleons are deeply divided posteriorly. The female of New Genus C n. sp. differs from that of _Dicropleon periclimenis_ in having 7 pereopods on the convex side of the pereon instead of 3 and in having 4 pairs of uniramous pleopods instead of 3 pairs of biramous and 1 pair of uniramous pleopods; strangely, the condition of the pereopods is more primitive and that of the pleopods more advanced than in _Dicropleon_. The males of these 2 genera are sufficiently similar that they would easily be considered congeneric were it not for the distinctions in such significant characters of the females.

West Indian faunal region species: only 1 species, New Genus C n. sp.

New Genus C n. sp.

Figs. 60, 61

?*Hemiarthrus schmitti* Pearse, 1932a, p. 4, figs. 16, 17, 19-21 (in part).

-- Schultz, 1969, fig. 499b.

Material examined.

Infesting *Synalpheus mcclendoni* Coutière, in unidentified sponge. Tortugas shrimp grounds, about 50 miles W of Key West, Florida, 24-30m, 14-15 Apr. 1971, J. C. Markham, coll., J. García-Gómez, det. of host; 1♀, holotype, 2♂, allotype, paratype, USNM.

Description of holotype female (Fig. 60).

Length 2.1mm, maximal width 3.4mm, head length 0.7mm, pleon length 1.1mm. Distortion 49° (Fig. 60A).

Head relatively large, deeply set into pereon. Antennae rather prominent. No eyes. Maxilliped (Fig. 60B) lacking palp. Posteroventral border of head (Fig. 60C) with single rather short lateral projection on each side.

Pereon distended, convex side of brood pouch extending far out, more than doubling width of body. Ventral surface of pereomere 2 (Fig. 60B) bearing several irregular processes. First 2 pereomeres surrounding head, dorsal part of pereomere 2 incomplete medially. Oostegite 1 on concave side (Fig. 60D) produced into rather acute posterolateral point; oostegite 1 on convex side (Fig. 60E) with prominent, notched internal ridge, blunt posterolateral point extending alightly laterally. All 7 pairs of pereopods present on both sides; on concave side, first 2 pereopods adjacent to head, final 5 (Fig. 60F) clustered near pleon; pereopods on convex side all displaced, pereopods 1-2 near head, pereopod 3

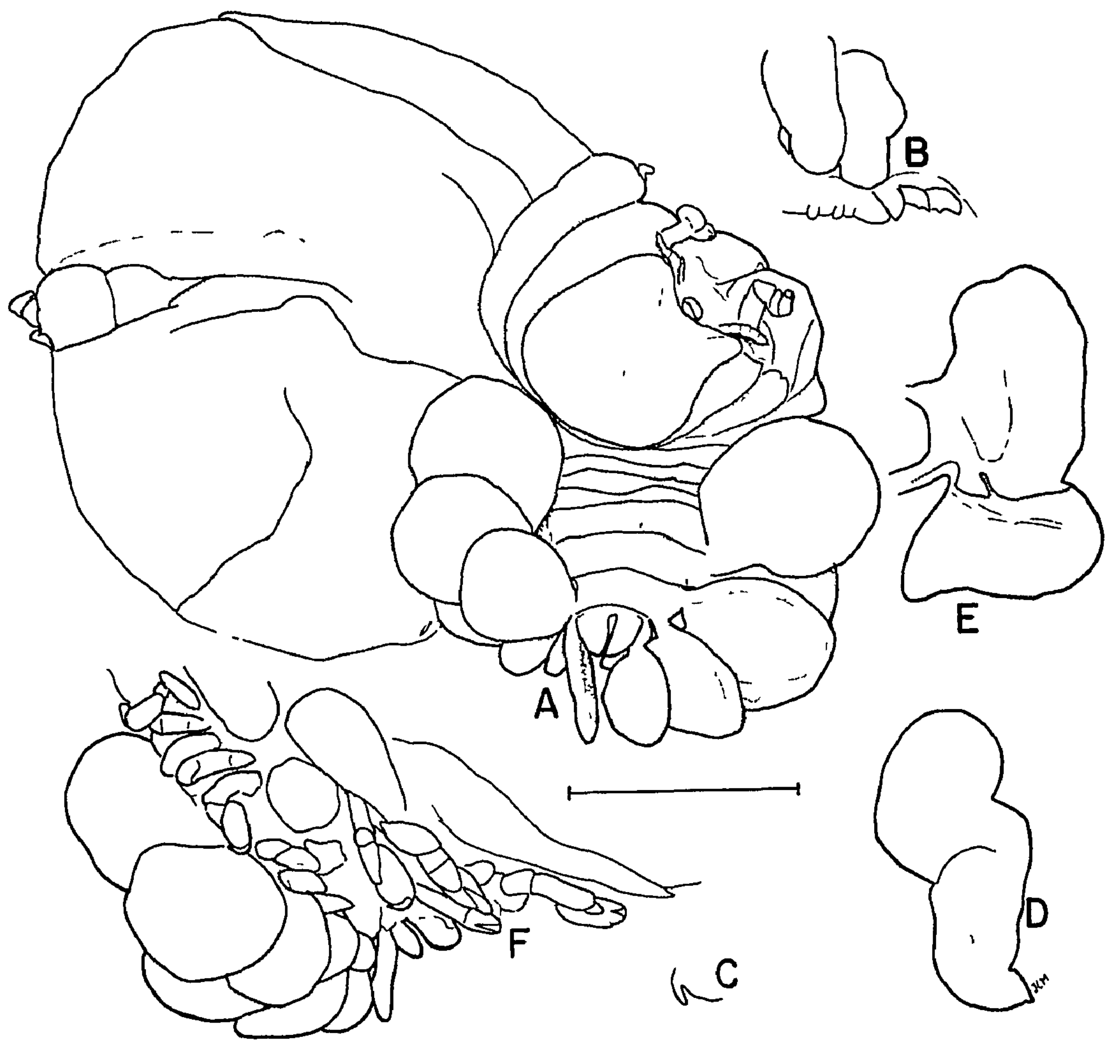

Fig. 60. New Genus C n. sp., holotype female. A. Dorsal. B. Maxillipeds and ventral surface of pereomere 2. C. Left posteroventral border of head. D. Right oostegite 1, internal. E. Left oostegite 1, external. F. Pereopods. Scale: 1.0mm.

displaced to far extremity of brood pouch, pereopods 4-7 (Fig. 60F) near posterior edge of pereon and larger than others.

Pleon of 5 pleomeres, fourth very short. First 4 pleomeres bearing paired oval lateral plates and uniramous pleopods. Terminal pleomere deeply divided posteriorly into 2 lobes, lacking uropods.

Description of allotype male (Fig. 61).

Length 1.9mm, maximal width 0.6mm, pleon length 0.4mm. Sides of body nearly parallel (Figs. 61A, B).

Head completely fused with pereomere 1 with lateral indentation at point of fusion. Antennae (Figs. 61C, D) quite prominent, antenna 1 of 4 segments, antenna 2 of 5 segments, both bearing several setae on distal segments. No eyes.

Pereomeres all distinctly separated, third and fourth slightly widest. Pereopods (Figs. 61E, F) all of nearly same size, but dactyli progressively smaller posteriorly; meri and carpi of all pereopods at least partly fused.

Pleon nearly square except for 2 terminal lobes extending slightly posteriorly and divided by deep cleft.

Variations.

The paratype male is slightly smaller than the allotype, 1.3mm long and 0.4mm wide. It does not differ from the allotype in any significant characters.

Discussion.

This species superficially resembles Dicropleon periclimenis most closely but differ from it in several significant characters, as dis-

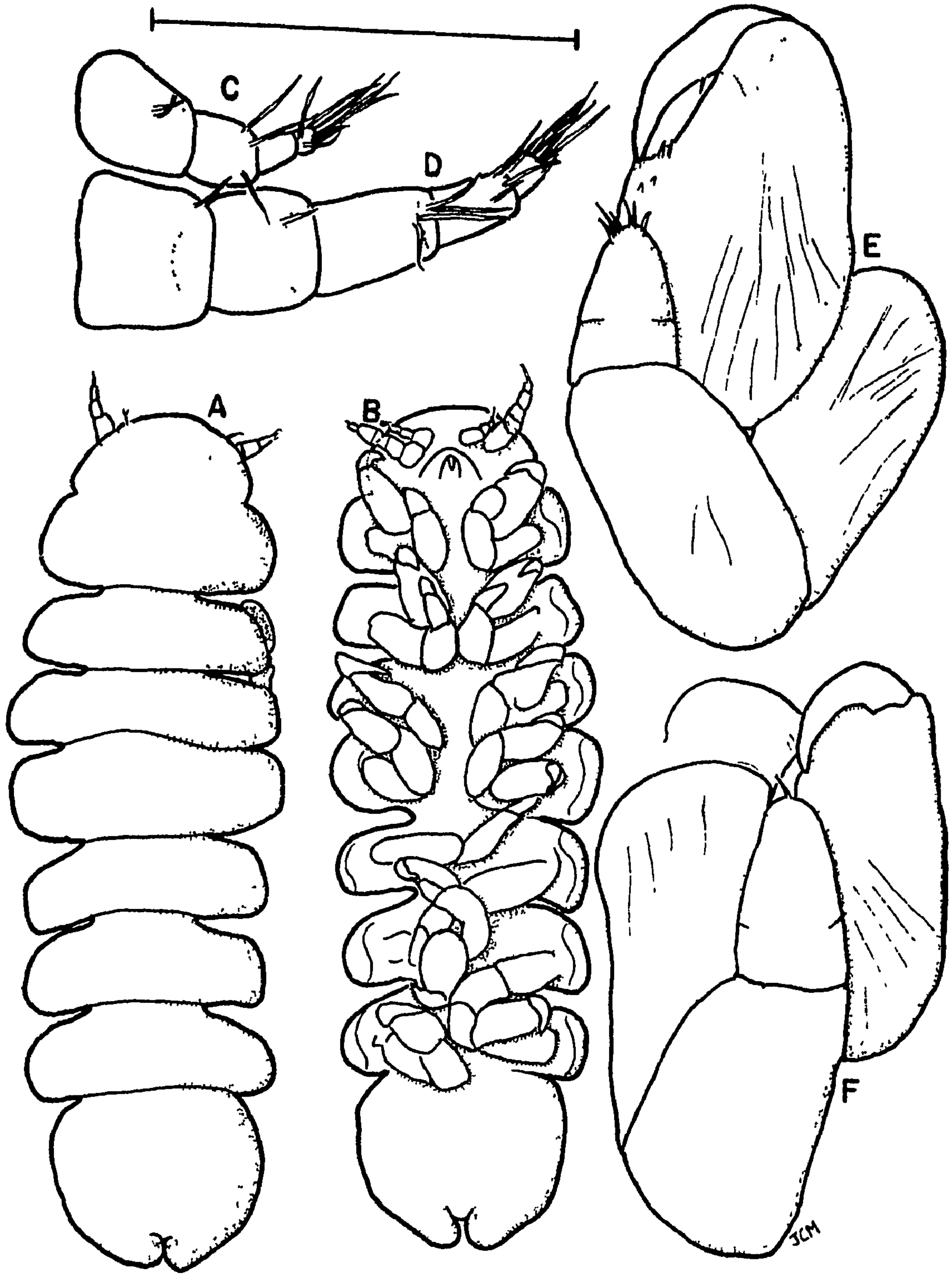

Fig. 61. New Genus C n. sp., allotype male. A. Dorsal. B. Ventral. C. Left antenna 1. D. Left antenna 2. E. Left pereopod 1. F. Right pereopod 7. Scale: 1.0mm for A, B; 0.2mm for C-F.

cussed in the remarks on the genus, above. The structure of the terminal pleomere of the female is open to some interpretation; one can consider it as being divided into large lobes and lacking uropods or bearing lobate uropods. I have chosen the former interpretation because it is reflected in the structure of the male's pleon and because it is in conformity with my description of the similar structures in Dicropleon (Markham, 1972a).

It is possible that Pearse (1932a) really had a male of this species which he described as the allotype of Hemiarthrus (now New Genus D) schmitti. He pictured the pleon of the male with a distinct posterior slit, which I have not found in any males of that species although it is characteristic of New Genus C n. sp. Since both the type specimens of New Genus C n. sp. and a specimen of (Hemiarthrus) schmitti were found infesting members of the same host species in a single sponge, it is known that these 2 species occasionally occur together and thus might have been confused in Pearse's material.

LOKI MARKHAM, 1972

Type-species, by original designation, Loki circumsaltanus Markham. Gender, masculine.

Total number of species, 1. Geographical distribution: S florida and Virgin Islands.

Generic diagnosis.-- Female: Body only moderately distorted; head deeply embedded in pereon; pereomeres poorly defined; all 7 pairs of pereopods present and well developed, on both sides first two extending beyond head, final four clustered near pleon; pereopod 3 on convex side opposite head, that on concave side adjacent to head; 5 pleomeres; lateral plates prominent on pleomeres 1-3, greatly reduced or absent on pleomere 4; uniramous pleopods on pleomeres 1-3; uropods prominent, often divergent. Male: Body less than 3 times as long as wide; head partly fused with pereon; pleon partly fused with pereon, rounded except for anal cone at tip.

West Indian faunal region species: only 1 species, Loki circumsaltanus.

Loki circumsaltanus Markham, 1972

Fig. 62

Metaphrixus carolii [pro parte], Rouse, 1970, p. 135.

"Abdominal bopyrid," Chace, 1972, p. 137.

Loki circumsaltanus Markham, 1972a, pp. 42-49, figs. 1-7, tab. I. (Type locality, SE Florida.)

Material examined.

Infesting Thor floridanus Kingsley. Near Turkey Point Turning Basin, Biscayne Bay, Florida, 25°22'N, 80°19'W, 0.75m, 1 June 1970, R. Rehrer, coll., J. García-Gómez, det. of host; 1♀, holotype, USNM 137391, 1♂, allotype, USNM 137392. S Biscayne Bay and Card Sound, Florida, shallow water, June-Dec. 1970, R. Rehrer, coll., J. García-Gómez, det. of hosts; 49♀, 12♂, paratypes, UMML. Near Murray Key, Florida Bay, Everglades National Park, Florida, 17 May 1964, D. C. Tabb, coll. and det. of hosts; 28♀, USNM. Same locality, 17 June 1964, W. L. Rouse, coll. and det. of hosts; 45♀, 2♂, UMML. Same locality, 2 July 1964, W. L. Rouse, coll. and det. of hosts; 2♀, UMML. Same locality, dates unknown (probably 1964), 7♀, 1♂, UMML. Joe Kemp Channel, SE of Flamingo, Florida, 17 June 1964, W. L. Rouse, coll. and det. of host; 1♀, 1♂, UMML.

Infesting *Thor manningi* Chace. Smithsonian-Bredin Expedition Sta. 23-58, on flats near mangroves at head of bay, Sopers Hole, West End, Tortola, Virgin Islands, 0.5m, 31 Mar. 1958, F. A. Chace, Jr., det. of host; 1♀, USNM 143679.

Description of holotype female (Figs. 62A-E).

Length 3.3mm, maximal width 2.1mm, head length 0.6mm, pleon length 1.0mm. Head distinctly separated from pereon, but other segments rather ill-defined (Fig. 62A). Distortion 42°.

Head deeply embedded in pereon and somewhat deltoid in outline except for cleft in anterior edge. Mouth, short first antenna 1 and long multiarticulate second antennae (Figs. 62B, C) in anterior cleft. No eyes.

Pereomeres distinguishable on concave side and medially only. All pereopods displaced by distortion of brood pouch. Pereopods 1-2 (Fig. 62D) on each side flexed in front of head. On concave side, pereopods 3-7 close together. On convex side, pereopod 3 isolated opposite head, others clustered beneath brood pouch, pereopods 5-7 in row with pereopod

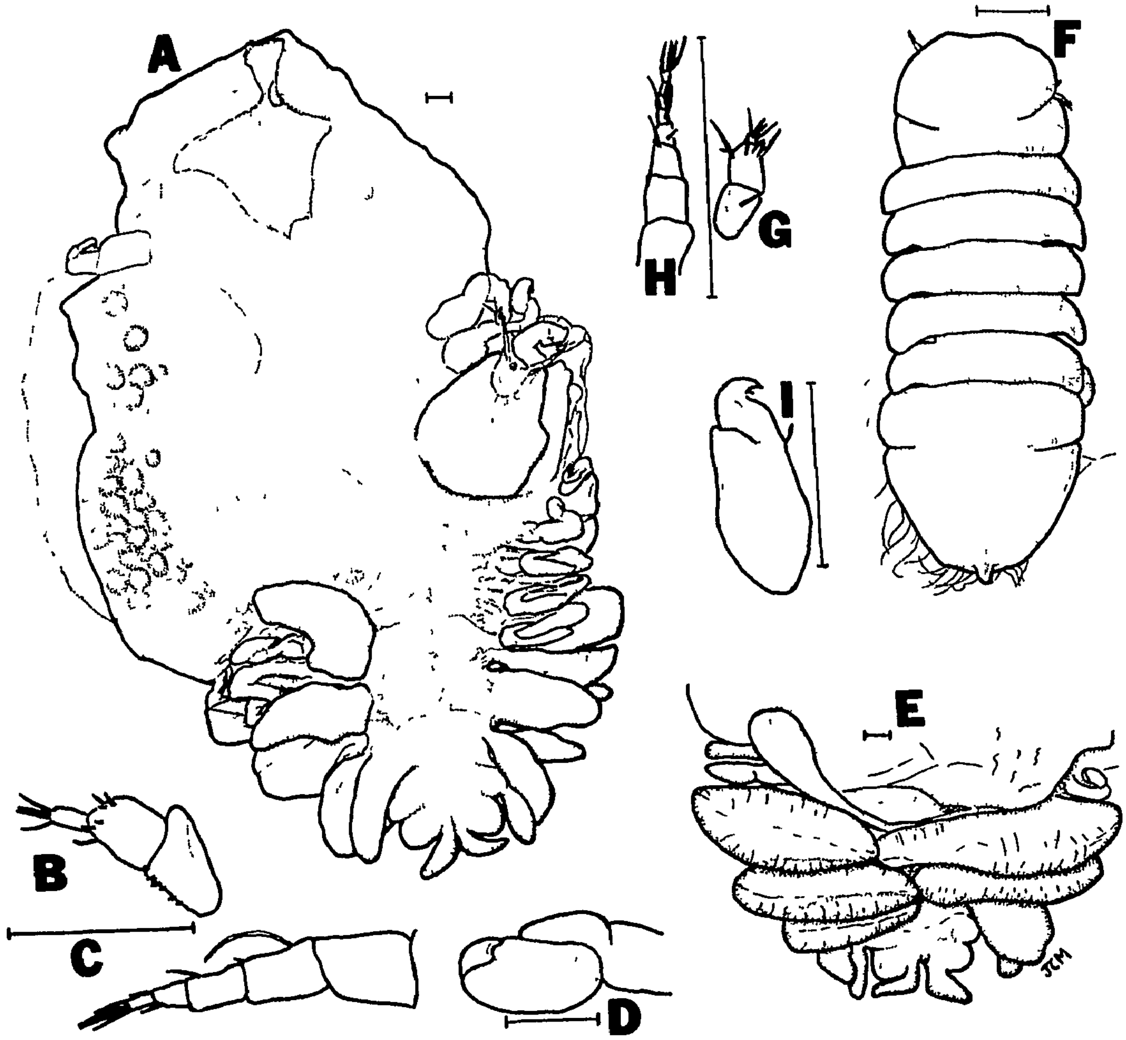

Fig. 62. Loki circumsaltanus Markham. A-E, holotype female; F-I, allotype male. A. Dorsal. B. Left antenna 1. C. Left antenna 2. D. Right pereopod 1. E. Pleon, ventral. F. Dorsal. G. Left antenna 1. H. Left antenna 2. I. Left pereopod 5. Scales: 0.1mm.

4 ventral to them. All 7 pereopods on each side well developed, slightly larger posteriorly. Brood pouch completely closed, covering entire ventral surface of head and pereon.

Pleon (Figs. 62A, E) of 5 pleomeres. Lanceolate lateral plates on both sides of pleomeres 1-3, progressively smaller posteriorly; small lateral plate on concave side of pleomere 4, none on other side. On pleomeres 1-3, pleopods represented by well developed exopodites overlapping medially and covering all but posterior portion of ventral surface of pleon; no pleopods on pleomere 4. All pleopodal endopodites absent, though ill-defined tubercles on some pleomeres possibly representing them. Prominent divergent uropods terminally. Pleomere 5 apparently extending far posteriorly because of absence of pleopods and reduction or absence of lateral plates on pleomere 4.

Variations.

Of the 132 females examined, 58 were dextral, 74 sinistral, a deviation from the expected 1:1 ratio which is not statistically significant. Lateral plates are absent from both sides of pleomere 4 in 51 females, present but reduced on both sides in 60 females and on only 1 side, as in the holotype, in 19 females; pleons of 2 females are damaged, so their condition is uncertain.

Description of allotype male (Figs. 62F-I).

Length 0.8mm, maximal width 0.3mm, All 3 body regions fused together except for lateral indentations. No abrupt change in width, body tapering gradually anteriorly and posteriorly (Fig. 62F).

Head irregularly rounded anteriorly. Eyes absent. Antenna 1 (Fig. 62G) of 3 segments, distal one bearing 4 terminal setae, middle segment with 5 terminal setae, basal segment with 1 subterminal seta. Longer, 8-segmented antenna 2 (Fig. 62H) with 5 terminal setae and others scattered sparsely along 6 distal segments.

Most of pereon of same width. Pereopods (Fig. 62I) all of essentially same size and structure.

Pleon semioval, posterior border produced into conspicuous anal cone medially with several long setae fringing margin.

Variations.

Most of the other males examined lack the pleonal setae present in the allotype but otherwise agree with it well.

Discussion.

Rouse (1970) reported a parasite of *Thor* spp. from southern Florida, which he identified as *Metaphrixus carolii* Nierstrasz and Brender à Brandis. I have examined his material and found that he had a mixture of *M. carolii*, evidently from *Hippolyte pleuracanthus*, and *Loki circumsaltanus*, evidently from *Thor floridanus*. Chace (1972) recorded an unidentified abdominal parasite of *Thor manningi* at Tortola, which I have examined and found to belong to *Loki circumsaltanus*. The hosts collected in Florida are all definitely or probably assignable to *Thor floridanus*, although Chace (1972) also reports 3 other species of *Thor* from there.

The allotype male was attached to a pleopod of the host rather than to the female, an unusual condition for bopyrids. This was the only male which I found so attached, but since only 16 of the 132 females examined were accompanied by males, this may be a common situation for this species, with the result that the males are frequently lost in collecting.

DICROPLEON MARKHAM, 1972

Type-species, by original designation, *Dicropleon periclimenis* Markham. Gender, masculine.

Total number of species, 1. Geographical distribution: St. Lucia.

Generic diagnosis.-- Female: Body only slightly distorted; head relatively quite large; pereopods 1-2 on convex side well developed, third present though markedly reduced, others absent; 5 pleomeres; 4 pairs of lateral plates; 4 pairs of pleopods, first three biramous; terminal pleomere divided into 2 large terminal lobes, lacking uropods. Male: Head and pleon partly fused medially with pereon; pleon triangular, end slit.

Remarks.-- Upon establishing this genus, I (Markham, 1972a) expressed the opinion that *Metaphrixus bifidus* Bourdon (1967b) may belong in it rather than in *Metaphrixus*. I now believe that it belongs in the closely related genus *Apophrixus* Nierstrasz and Brender à Brandis, females of which lack pleopodal endopodites. Thus *Dicropleon* remains monotypic.

West Indian faunal region species: only 1 species, *Dicropleon periclimenis*.

Dicropleon periclimenis Markham, 1972

Fig. 63

"Abdominal bopyrid parasite," Chace, 1972, p. 31.

Dicropleon periclimenis Markham, 1972a, pp. 49-53, 54, tab. II, 55, figs. 8-10. (Type locality, St. Lucia.)

Material examined.

Infesting *Periclimenes americanus* (Kingsley). Smithsonian-Bredin Expedition Sta. 53-59, Marigot Harbor, St. Lucia, Antilles, from waterlogged stump, 14 Apr. 1959, F. A. Chace, Jr., det. of host; 1♀, holotype, USNM 128467, 1♂, allotype, USNM 137393.

Description of holotype female (Figs. 63A-E).

Length 2.5mm, maximal width 2.5mm, head length 0.6mm, pleon length 0.6mm. Distortion 28°. All segments distinct (Fig. 63A).

Head asymmetrical, extending to concave side of body, deeply set into pereon and exceeded by first 2 pairs of pereopods. No eyes. Anterior border of head slightly cleft, resultant concavity filled by antennae. Antennae of both pairs (Fig. 63B) sharply bent; antenna 1 short, lying on top of longer antenna 2; number of antennal segments uncertain because of indistinct sutures.

Pereomere 1 distinct at each side but obscured medially by deeply embedded head extending to pereomere 2. Pereomere 2 well defined dorsally and essentially wrapped around head. Pereomeres 3-7 distinct on concave side but obsolete on other side. Concave side with 7 pereopods, variously displaced: pereopods 1-2 (Fig. 63C) near head; pereopods 3-7 (Fig. 63D) smaller, lined up close to pleon. Convex side with only 3 pereopods: pereopods 1-2 similar in size and location to those on concave side; pereopod 3 far out in furrow on brood pouch, greatly reduced except for large basis.

Pleon of 5 pleomeres. Pleomeres 1-4 each bearing pair of lanceolate lateral plates, posterior ones smaller. Pleopods 1-3 biramous, with slender endopodites (Fig. 63E); fourth pleopods uniramous; pleopods arising from peduncle bearing lateral plates. Terminal pleomere deeply bilobed, without uropods.

Description of allotype male (Figs. 63F-H).

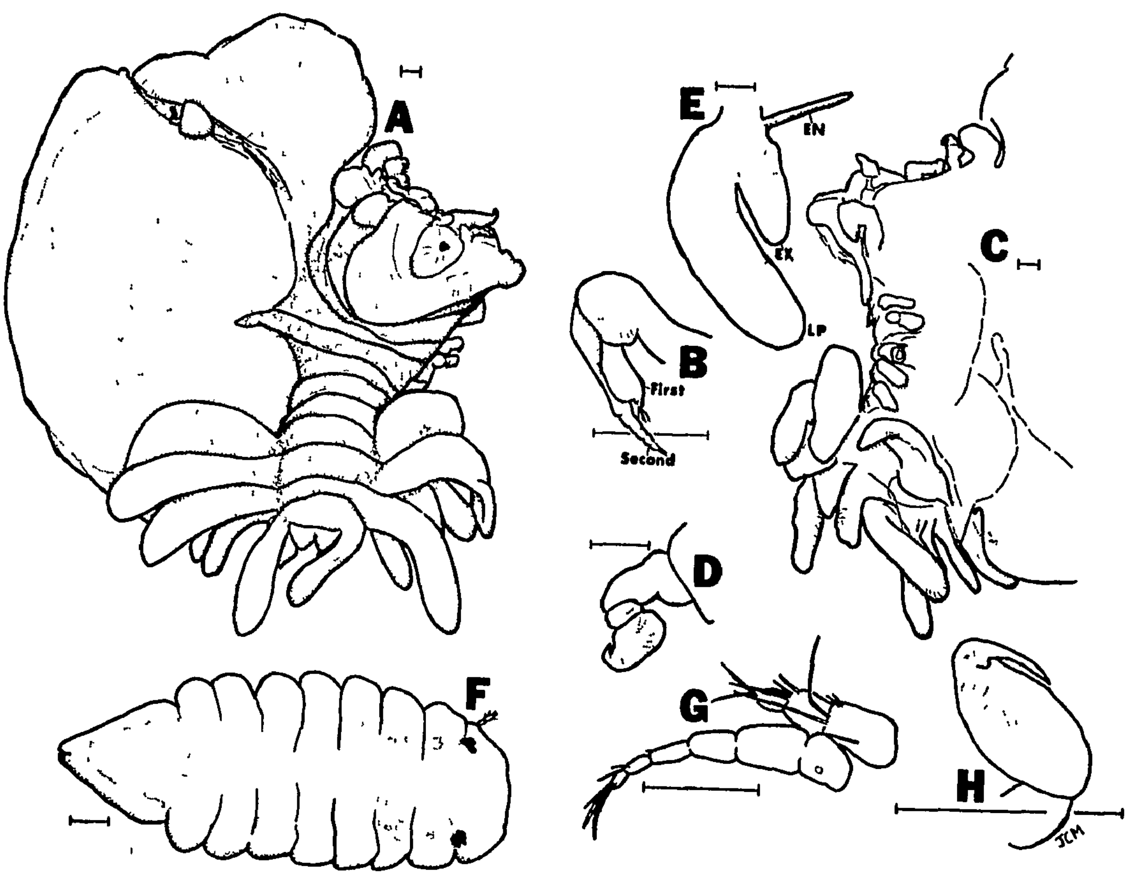

Fig. 63. Dicropleon periclimenis Markham. A-E, holotype female; F-H, allotype male. A. Dorsal. B. Right antennae. C. Right side. D. Right pereopod 2. E. Right pleopod 3 (EX, exopodite, EN, endopodite; LP, lateral plate). F. Dorsal. G. Right antennae. H. Right pereopod 1. Scales: 0.1mm.

Length 0.7mm, maximal width 0.3mm, head length 0.1mm, pleon length 0.3mm. Head and pleon both partly fused medially with pereon (Fig. 63F).

Head rather flatly rounded anteriorly. Distinct irregularly shaped eyes near posterior border. Antenna 1 (Fig. 63G) of 3 segments, each bearing several setae. Antenna 2 of 6 segments; distal 3 segments bearing, from distal one in, 3, 2, 1 setae.

Pereon slightly widest acrss pereomeres 3-4, sides slightly curved. Pereopod (Fig. 63H) somewhat reduced, concealed beneath body, all about same size.

Pleon abruptly narrower than pereon, triangular, with terminal cleft.

Discussion.

Chace (1972) originally recorded the type specimens of *Dicropleon periclimenis*; he also listed another parasitized individual of the host species, *Periclimenes americanus*, collected during a Smithsonian-Bredin expedition at Antigua, but a search at the Smithsonian Institution failed to turn up that individual, so I do not know whether it also bears *Dicropleon periclimenis*. Catherine Engel (personal communication) has collected a parasitized specimen of *Periclimenes yucatanicus* (Ives) in Jamaica, which I have not seen; its parasite may also be *Dicropleon periclimenis*.

METAPHRIXUS NIERSTRASZ AND BRENDER À BRANDIS, 1931

Type-species, by nontypy, *Metaphrixus carolii* Nierstrasz and Brender à Brandis. Gender, masculine.

Total number of species, 2. Geographical distribution: Maldives; St. Croix and S Florida.

Generic diagnosis.-- Female: Body axis greatly distorted, often more than 90°; body outline nearly circular; eyes present; all 7 pereopods of convex side present, in orderly row; only first 2 pereopods present on convex side; 5 pleomeres; prominent lateral plates and uniramous pleopods on pleomeres 1-4; pleomere 5 conspicuously extended, with or without uropods. Male: Body at least twice as long as wide; antennae conspicuous; eyes large; sides of pereon nearly parallel; pereopods small, concealed beneath body; pleon tapering to rather sharp or rounded point.

Remarks.-- There have been 3 different species described as members of *Metaphrixus*, but, as mentioned above, I do not believe *M. bifidus* Bourdon (1967a) should be retained in this genus. Aside from the type-species, *M. carolii*, discussed below, the only species remaining in *Metaphrixus* is *M. intutus* Bruce (1965) from the Maldives. *M. intutus* is highly remarkable because it occurs on the dorsal surface of its host, the palaemonid *Palaemonella vestigialis* Kemp, rather than among the pleopods, as is normal for hemiarthrines.

West Indian faunal region species: only 1 species, *Metaphrixus carolii*.

Metaphrixus carolii Nierstrasz and Brender à Brandis, 1931

Fig. 64

Metaphrixus carolii Nierstrasz and Brender à Brandis, 1931, pp. 206-207, figs. 100-102. (Type locality, St. Croix, Virgin Islands.).-- Bruce, 1965, pp. 385, 389, 390; 1972a, p. 450.-- Rouse, 1970, p. 135 [pro parte].-- Strömberg, 1971, pp. 2, 7.-- Markham, 1972a, pp. 42, 47-48, 54, tab. II.

Metaphryxus carolii, Bourdon, 1967a, pp. 173-174.

Material examined.

Infesting Hippolyte pleuracanthus (Stimpson). Shallow water, Card Sound, Florida, date unknown, J. García-Gómez, coll. and det. of host; 1♀, 1♂, reference specimens, UMML. Same locality, 2 June 1970, J. García-Gomez, coll. and det. of host; 1♀, 1♂, UMML. Near Murray Key, Florida Bay, Everglades National Park, Florida, 17 May 1964, D. C. Tabb, coll. and det. of host; 1♀, USNM. Same locality, 17 June 1964, W. L. Rouse, coll. and det. of hosts; 4♀, 2♂, USNM. Joe Kemp Channel, SE of Flamingo, Florida, 17 June 1964, W. L. Rouse, coll. and det. of hosts; 19♀ (including 4 immature), 10♂, UMML.

Description of reference female (Figs. 64A-H).

Length 2.0mm, maximal width 1.9mm, head length 0.5mm, pleon length 0.6mm. Distortion 92°. Body nearly circular in outline (Figs. 64A, B).

Head nearly rectangular, longer than broad. Antennae (Fig. 64C) both unsegmented flaps. Prominent eyes on anterolateral corners of head. Maxilliped (Fig. 64D) lacking palp. Posteroventral border of head (Fig. 64E) with 2 moderately long pointed lateral projections on each side.

All pereomeres distinct on concave side and medially but not on convex side. Oostegite 1 of concave side (Fig. 64F) bearing rather smooth internal ridge and reduced posterolateral point. All 7 pereopods present

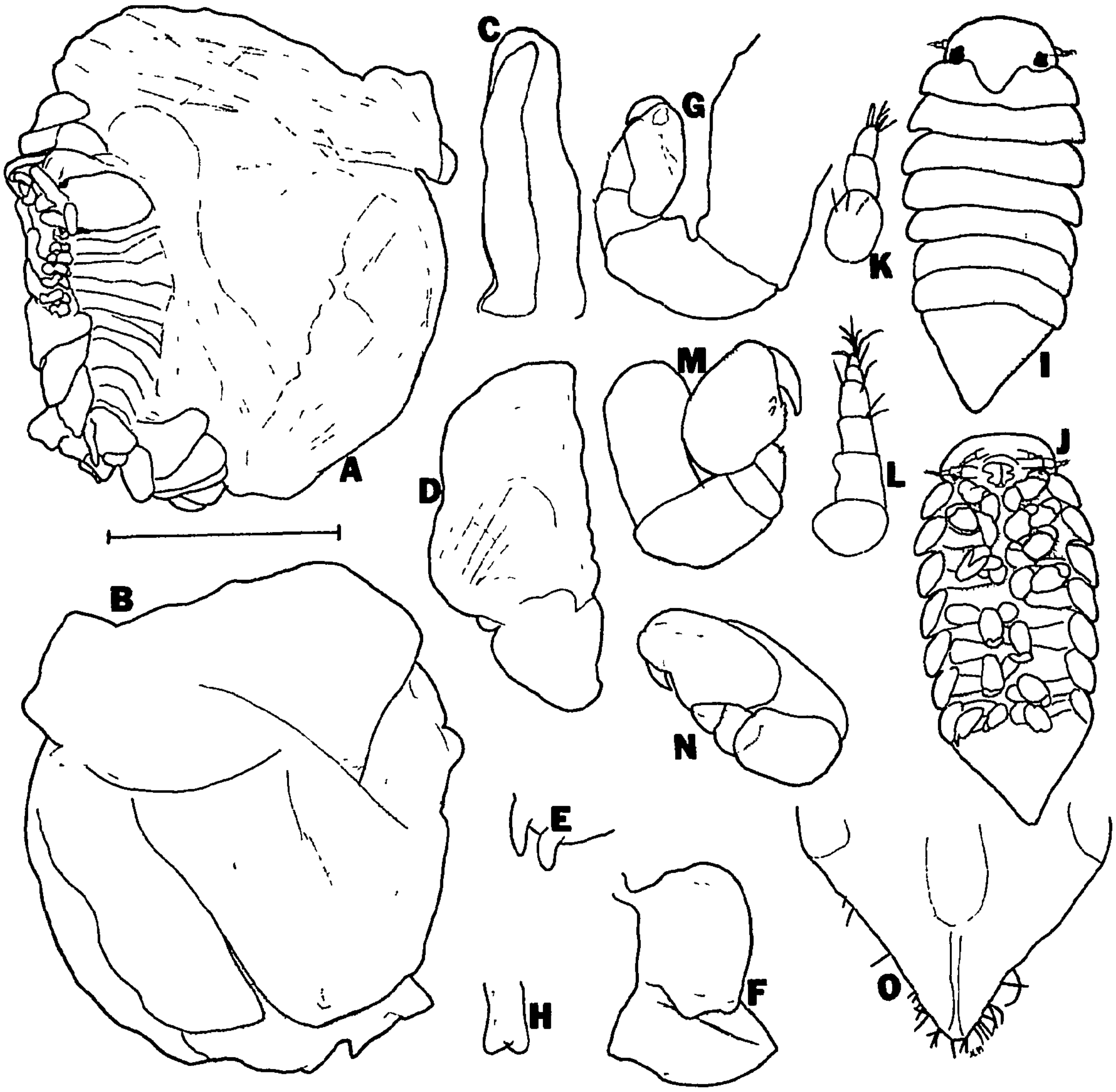

Fig. 64. Metaphrixus carolii Nierstrasz and Brender à Brandis. A-H, reference female; I-O, reference male. A. Dorsal. B. Ventral. C. Right antennae. D. Right maxilliped. E. Right posteroventral border of head. F. Right oostegite 1, internal. G. Right pereopod 1. H. Pleotelson. I. Dorsal. J. Ventral. K. Left antenna 1. L. Left antenna 2. M. Right pereopod 1. N. Right pereopod 7. O. Pleon, ventral. Scale: 1.0mm for A, B, F; 0.2mm for C, G, O; 0.4mm for D, E, I, J; 0.1mm for K-N.

on concave side but reduced, closely grouped together in comblike row along side of pereon. Concex side bearing pereopods on only first 2 pereomeres. Pereopods of convex side (Fig. 64G) nearly 4 times as large as those on other side.

Pleon of 5 pleomeres, first four bearing lanceolate to oval lateral plates and similar uniramous pleopods. Terminal pleomere (Fig. 64H) prominently extended, slightly bilobate posteriorly.

Variations.

Of the 26 females examined, 19 lack uropods, as in the reference female, while 7 bear uniramous uropods. Eleven of the females are dextral and 15 sinistral, a variation from the expected 1:1 ratio which is not statistically significant.

Description of reference male (Figs. 64I-O).

Length 0.7mm, maximal width 0.3mm, head length 0.1mm, pleon length 0.2mm. All body regions distinct, sides of body nearly parallel (Figs. 64I, J).

Head abruptly narrower than pereon, extending deeply into pereomere 1 centrally. Conspicuous black eyes near posterior corners. Antennae (Figs. 64K, L) prominent, first of 3 segments, second of 6, both bearing numerous setae, especially distally.

Pereon slightly widest across pereomeres 3-4. All pereomeres widest at posterior borders, lateral margins rounded inward anteriorly. Pereopods (Figs. 64M, N) of nearly same size and structure, though dactyli progressively smaller posteriorly.

Pleon (Fig. 64O) triangular, lateral and anterior margins of nearly same length. Lateral margins bearing scattered setae.

Variations.

Among the 14 males examined, 9 match the refernce male, while 4 have the pleon more rounded than pointed; a single male has the posterior margin of the head straight rather than extended into pereomere 1.

Discussion.

The host species for Metaphrixus carolii has long been unknown or confused. Nierstrasz and Brender à Brandis (1931) and Stromberg (1971) failed to mention the hosts of the specimens which they examined, and Rouse (1970), who cited the hosts as Thor spp., evidently had confused his material with specimens of Loki circumsaltanus from the same collecting station. All of the material of Metaphrixus carolii which I have seen still with its hosts infested Hippolyte pleuracanthus, which is the only host species certainly known for this parasite.

HEMIARTHRUS GIARD AND BONNIER, 1887

Type-species, by monotypy, Phryxus abdominalis Krøyer. Gender, masculine.

Total number of species, 3. Geographical distribution: Circumpolar, along all arctic and boreal coasts; South Africa; North Carolina.

Generic diagnosis.-- Female: Body moderately distorted (about 35°-60°); anterior edge of head more or less concave; antennae reduced; pereomere 1 complete but occasionally covered medially by head; concave side of pereon bearing 7 pereopods, all nearly same size; convex side bearing only first pereopod; 5 pleomeres; lateral plates prominent, lanceolate to oval, on pleomeres 1-4; pleopods uniramous, in 4 pairs; terminal pleomere tapering to narrow point, lacking uropods. Male: Nearly 3 times as long as broad; eyes tiny; head clearly separated from pereon; sides of pereon nearly parallel; regions between pereomeres deeply indented; pleon tapering to rounded to acute point.

Remarks.-- Giard and Bonnier (1887b, p. 36, footnote) established the genus Hemiarthrus quite incidentally, stating that they were including in it those species of Phryxus Rathke which "...diffèrent beaucoup du type Phryxus, soit dans le sexe femelle, soit dans le sexe mâle qui a tous les anneaux du pléon libres et munis de membres rudimentaires." The only species which they cited for inclusion in their new genus was Phryxus abdominalis Krøyer, which is the type-species of Phryxus. Their action was highly confusing because Giard and Bonnier (1887b) clearly did not regard Phryxus Rathke as an unavailable name, even though Agassiz (1848) had presented evidence that it was a junior homonym, as discussed by Markham (1972a). Bonnier (1900) later disregarded Hemiarthrus and listed several species in Phryxus. Giard (1907) acknowledged that Phryxus Rathke is preoccupied and referred (p. 322) to "...Phryxus abdominalis Kroyer dont nous avon fait le type de notre genre Hemiarthrus."

Numerous names have been included in Phryxus Rathke and several in Hemiarthrus. Several of those are nomina nuda or synonyms of others. Many others were removed when the scope of the genus was restricted as Caroli (1930) divided it into several subgenera, which Nierstrasz and Brender à Brandis (1931) promptly raised to generic rank. I have removed Hemiarthrus schmitti Pearse (1932a) because it clearly belongs in a separate genus (see below) and am reassigning Diplophryxus synalphei Pearse (1950) to Hemiarthrus. The only other species of Hemiarthrus is H. nematocarcini Stebbing (1914), which was so poorly described that its placement in this genus is uncertain.

The distribution of Hemiarthrus abdominalis is quite extensive. That species is known from all of the arctic and boreal coasts of the world, i. e. both coasts of North America, Asia and Europe. It infests a great number of host species in the Hippolytidae, especially in Hippolyte and Spirontocaris (Richardson, 1905). The other 2 species are much more restricted. Hemiarthrus nematocarcini is known only from the type specimens, which infested a species of Nematocarcinus in South Africa, and Hemiarthrus synalphei infests 2 species of Synalpheus in North Carolina.

West Indian faunal region species: none known, but 1 species, Hemiarthrus synalphei, expected.

Hemiarthrus synalphei (Pearse, 1950)

Figs. 65, 66

Phryxus subcaudalis Hay, 1917, p. 570 (In part; type locality, off coast of North Carolina.).

Diplophryxus synalphei Pearse, 1950, pp. 41-43, figs. 3-7 (Type locality, New River, North Carolina).-- Schultz, 1969, p. 314, fig. 500(a).

Material examined.

Infesting Synalpheus fritzmuelleri Coutière, A. S. Pearse, coll. and det. of hosts. Black Rocks, off New River, North Carolina, 3m, 7 July 1949; 1♂, allotype, USNM 90104. Same locality, 10 Aug. 1949, 1♀, holotype, USNM 90103.

Infesting Synalpheus longicarpus (Herrick). United States Steamer Fish Hawk Sta. 8293. In unspecified sponge, 20 miles off Beaufort Inlet, Onslow Bay, North Carolina, Aug. 1915, W. P. Hay, coll. and det. of hosts; 2♀ (including reference ♀), called paratypes of Phryxus subcaudalis Hay, USNM.

Description of reference female (Fig. 65).

Length 3.5mm, maximal width 3.6mm, head length 0.9mm, pleon length 1.4mm Distortion 45°. Body subcircular in outline (Fig. 65A).

Head proportionately quite large, overlapping much of anterior region of pereon. Deep V-shaped groove in dorsal surface of head extending nearly to posterior edge and containing displaced flaplike unsegmented antennae (Fig. 65B). Antenna 1 slender, arising from middle of head, antenna 2 broader, arising near anterior margin. Posteroventral border of head (Fig. 65C) slightly concave medially, produced into 2 pairs of bluntly pointed projections laterally.

All pereomeres distinct on concave side and medially. Oostegite 1 of concave side (Fig. 65D) oval except for long narrow posterolateral point. Oostegite 1 of convex side (Fig. 65E) sharply reflexed over head, faintly tuberculate externally, consisting of 2 suboval segments meeting at angle

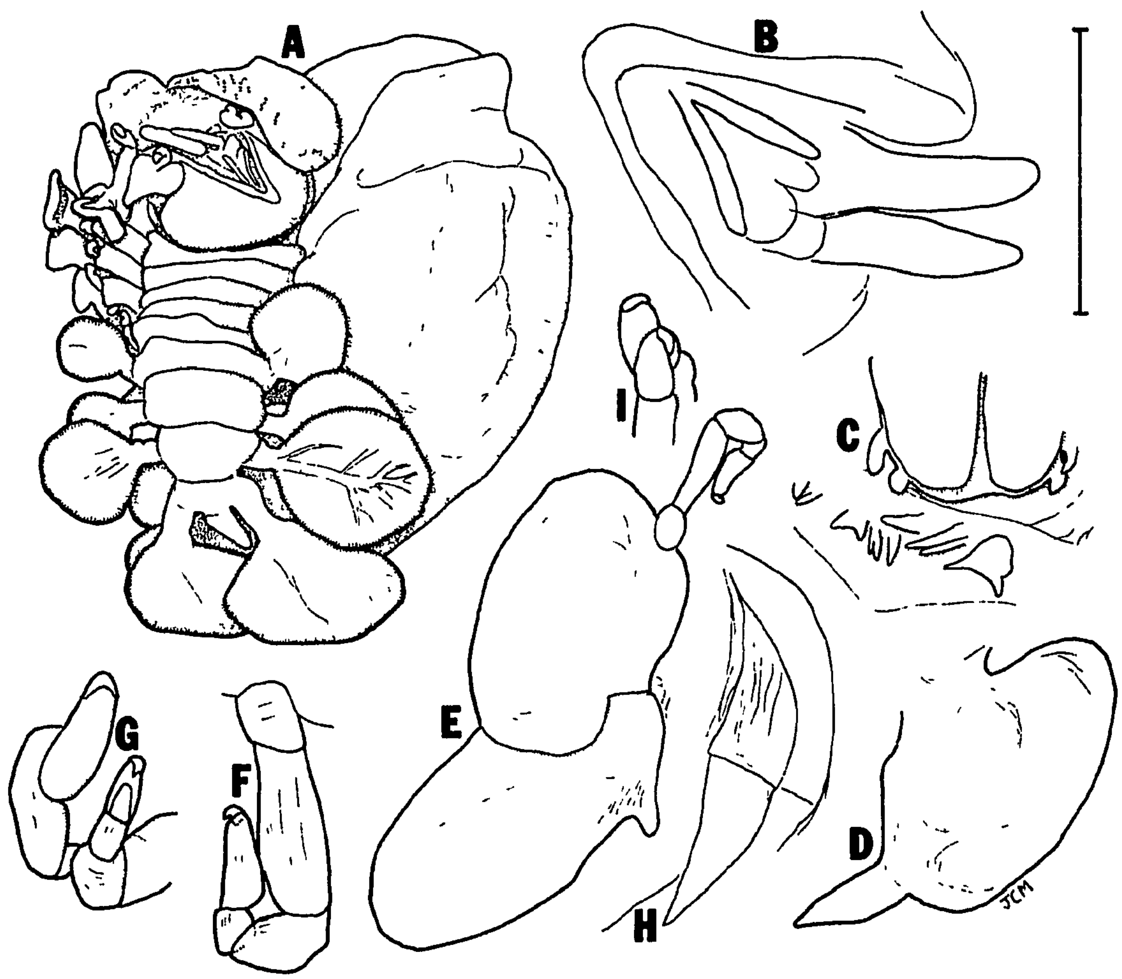

Fig. 65. Hemiarthrus synalphei (Pearse), reference female. A. Dorsal. B. Antennae. C. Posterior part of head and pereomere 2, ventral. D. Left oostegite 1, internal. E. Right oostegite 1, internal. F. Right pereopod 1. G. Left pereopods 1 and 2. H. Coxa of left pereopod 3. I. Left pereopods 6 and 7. Scale: 2.0mm for A; 0.5mm for B, F, I; 1.0mm for C-E, G. H.

of 44° to their long axes; internal ridge entire, posterior section bearing blunt hooked projection. Pereomere 2 bearing several small projecting flaps on ventral surface (Fig. 65C). All 7 pereopods (Figs. 65F-I) present on concave side, decreasing in size posteriorly. Only pereopod 1 present on convex side, scarlike plate on margin of brood pouch (Fig. 65H) indicating coxal segment of pereopod 3 of convex side.

Pleon extending far out from pereon, of 5 pleomeres. Each of first 4 pleomeres with pair of pedunculate nearly circular lateral plates and pair of similar uniramous pleopods. Terminal pleomere produced into extended pleotelson.

Variations.

The other 2 females examined match the reference female in all respects.

Description of allotype male (Fig. 66).

Length 1.6mm, maximal width 0.4mm head length 0.2mm, pleon length 0.5mm. Body slender, with nearly parallel sides (Figs. 66A, B).

Head subquadrate, distinctly extended. Eyes small, irregular, excentrically placed. Antenna 1 (Fig. 66C) of 3 segments, antenna 2 (Fig. 66D) of 4 segments, basal one perpendicular to others.

Pereomeres separated by lateral indentations, pereomeres 3-4 broadest. Pereopods (Figs. 66E, F) of nearly same size and structure, though dactyli smaller posteriorly; nearly all meri and carpi fused.

Pleon fused, subtriangular, with irregular posterior point. Dorsal surface slightly creased.

Discussion.

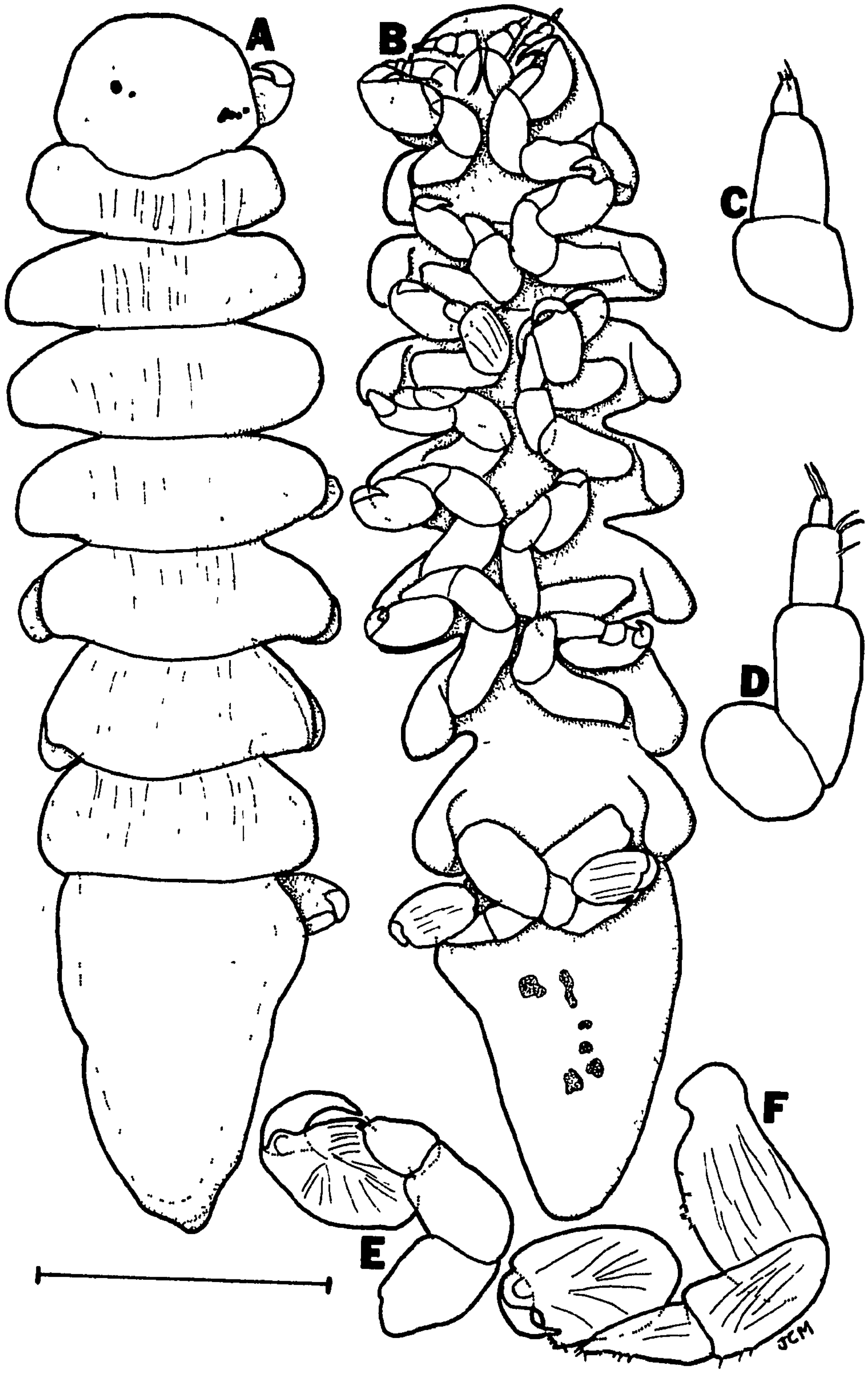

Fig. 66. Hemiarthrus synalphei (Pearse), allotype male. A. Dorsal. B. Ventral. C. Right antenna 1. D. Right antenna 2. E. Right pereopod 1. F. Right pereopod 7. Scale: 0.4mm for A, B; 0.1mm for C, D; 0.2mm for E, F.

Although Pearse (1950) placed this species in Diplophryxus, it does not belong there because the female has no pleopodal endopodites, in contrast with the female of the type-species of that genus, D. jordani Richardson (1904a). At the same time, it conforms with the generic diagnosis of Hemiarthrus, to which genus I am reassigning it. Pearse (1950) reported a 3-segmented pleon in the allotype male, contrary to the subfamilial diagnosis, but he evidently had misinterpreted the strange crease on the dorsal surface as a segmental margin.

Hemiarthrus synalphei differs from H. abdominalis in that the female of the former has dorsal rather than anterior antennae, pereopods markedly smaller posteriorly rather than nearly all the same size, and the terminal pleomere ending in a single point rather than a double one. The male of H. synalphei is longer relative to its width and has a less sharply pointed pleon in contrast to the male of H. abdominalis. The third species of the genus, H. nematocarcini, has been so inadequately described that I do not know how it differs from the others.

NEW GENUS D

Type-species, by original designation, Hemiarthrus schmitti Pearse. Total number of species, 1. Geographical distribution: North Carolina through Florida to Dry Tortugas and Bimini to Dominican Republic.

Generic diagnosis.-- Female: Body greatly distorted (often more than 90°); convex side bearing only 1 pereopod, that much longer and more slender than 7 pereopods on concave side; usually only 4 pleomeres, occasionally minute fifth one present; side of pleon on concave side of body bearing reduced lateral plates and uniramous pleopods on pleomeres 1-3, opposite side with no more than 2 minute lateral plates on one or two of first 3 pleomeres; pleomere 4 bearing large lateral plate and uniramous pleopod on each side. Male: Body long and slender; head distinct from pereon; pereopods reduced; pleon smoothly rounded posteriorly.

Remarks.-- Hemiarthrus schmitti has remained in Hemiarthrus since its original description (Pearse, 1932a). Due to the extreme asymmetry in the pleonal appendages of the female, however, a condition unknown in any other hemiarthrine, I believe it should be placed in a genus of its own.

West Indian faunal region species: only 1 species, New Genus D sp.

New Genus D sp.

Figs. 67, 68

Phryxus subcaudalis Hay, 1917, p. 570 (In part; type locality, off coast of North Carolina.)

Hemiarthrus schmitti Pearse, 1932a, pp. 3-4, figs. 15-21 (Type locality, Dry Tortugas, Florida.); 1932b, p. 107; 1932c, pp. 119-122; 1951, pp. 367-368.-- Schultz, 1969, p. 314, fig. 499.

Material examined.

Infesting Synalpheus longicarpus (Herrick). United States Fisheries Steamer Fish Hawk Sta. 8293. In unidentified sponge, 20 miles off Beaufort Inlet, Onslow Bay, North Carolina, August 1915, W. P. Hay, coll. and det. of hosts; 8♀, 8♂, called paratype of Phryxus subcaudalis Hay, USNM.

Infesting Synalpheus brooksi Coutière, in Sphèciospongia vesparia (Lamarck). Soldier Key, Biscayne Bay, Florida, in shallow water, 25 Apr. 1970, J. C. Markham, coll.; 2♀, 1♂, UMML. Dry Tortugas, Florida, 27 June 1931, A. S. Pearse, coll.; 28♀, 10♂, cotypes, USNM 65144.

Infesting Synalpheus mcclendoni Coutière, in unidentified sponge. Tortugas shrimp grounds, about 50 miles W of Key West, Florida, 24-30m, 14-15 Apr. 1971, J. C. Markham, coll., J. García-Gómez, det. of host; 1♀, 1♂, UMML.

Infesting Synalpheus pectiniger Coutière, in unidentified sponges, J. García-Gómez, det. of hosts. Pillsbury Sta. P-1283, off Enriquillo, Dominican Rèpublic, 17°35'N, 71°25'W, 18-27m, 19 July 1970; 1♀, 1♂, reference specimens, UMML. Pillsbury Sta. P-1249, SW of Jamaica, 17°23'N, 78°39'W, 26m, 13 July 1970; 1♀, 1♂, UMML.

Description of reference female (Fig. 67).

Length 2.5mm, maximal width 3.4mm, head length 0.9mm, pleon length 0.9mm. Distortion 42°. Body nearly square in outline (Fig. 67A).

Head nearly circular, deeply set into pereon. Dorsal surface of head with 3-pointed plate bearing displaced first antennae; second antennae displaced to anterior edge of head; both pairs of antennae (Figs. 67B, C) flaplike and unsegmented. Maxilliped (Fig. 67D) long and slender, without palp. Posteroventral border of head (Fig. 67E) slightly concave medially, with 2 short laterally directed projections on each

Fig. 67. New Genus D sp., reference female. A. Dorsal. B. Antennae 1. C. Antenna 2. D. Maxillipeds. E. Posteroventral border of head. F. Left oostegite 1, internal. G. Right oostegite 1, internal. H. Left pereopod 1. I. Right pereopod 1. Scale: 2.0mm for A; 1.0mm for D-G; 0.4mm for B, H, I; 0.2mm for C.

side.

Pereomeres distinct only on concave side and medially, bunched together tightly. Oostegite 1 of concave side (Fig. 67F) suboval, with rounded triangular internal ridge and similarly shaped posterolateral point. Oostegite 1 of convex side (Fig. 67G) reflexed over head, separated into 2 segments nearly equal in size separated by prominent internal ridge. All 7 pereopods present on concave side, first one (Fig. 67H) much larger than others. Only pereopod 1 present on convex side, very long and slender (Fig. 67I).

Pleon of 4 pleomeres, each of first three bearing lanceolate lateral plate and pleopodal exopodite only on side corresponding to concave side of pereon, none on other side. Each lateral plate larger than accompanying exopodite and each appendage somewhat larger than corresponding one on preceeding pleomere. Terminal pleomere bearing lateral plate and pleopodal exopodite on each side, all 4 appendages lanceolate, of equal size, much larger than any preceeding appendages. No uropods.

Variations.

Of the 41 females examined, 14 are dextral and 27 sinistral; this distribution differs from the expected ratio of 1:1 with a χ^2 value of 4.125, which is significant at the 0.05 level of probabality. In 1 female, the terminal pleomere lacks both appendages on the concave side. One female has tiny eyes. A single female has a minute lateral plate and pleopodal exopodite on the convex side of pleomere 3. Finally, 1 female bears a bump between the exopodites of pleomere 4, which may be a rudimentary pleomere 5.

Description of reference male (Fig. 68).

Length 1.9mm, maximal width 0.4mm, head length 0.1mm, pleon length 0.6mm. Body very long and slender, all body regions and pereomeres distinct (Figs. 68A, B).

Head semicircular, narrower than pereomere 1. No eyes. Antenna 1 (Fig. 68C) of 3 segments greatly decreasing in size distally, all bearing some terminal setae. Antenna 2 (Fig. 68D) of 4 segments, distal one with 1 seta, next segment with 2 setae, antepenultimate segment with 6 setae.

Pereon broadest across pereomere 4. All pereomeres separated by lateral indentations. Pereomeres increasing in length posteriorly, pereomere 7 more than twice as long as pereomere 1. Pereopods (Figs. 68E, F) tiny, all of nearly same size but dactyli smaller posteriorly; meri and carpi of some pereopods fused, all carpi with tufts of setae distally.

Pleon broadest slightly behind anterior edge, tapering posteriorly, much longer than broad, terminating in bluntly rounded point.

Variations.

Of the 21 other males examined, nearly all are like the reference male. Two males have the sides of the pleon nearly parallel rather than tapered, and 3 have relatively shorter pleons.

Discussion.

As discussed above under Eophrixus subcaudalis, the male which Hay (1917) thought might be an immature or accessory male of that species really belongs to New Genus D sp., as do 8 females which Hay considered to be paratypes of the former species. New Genus D sp. was previously known only as a parasite of Synalpheus brooksi.

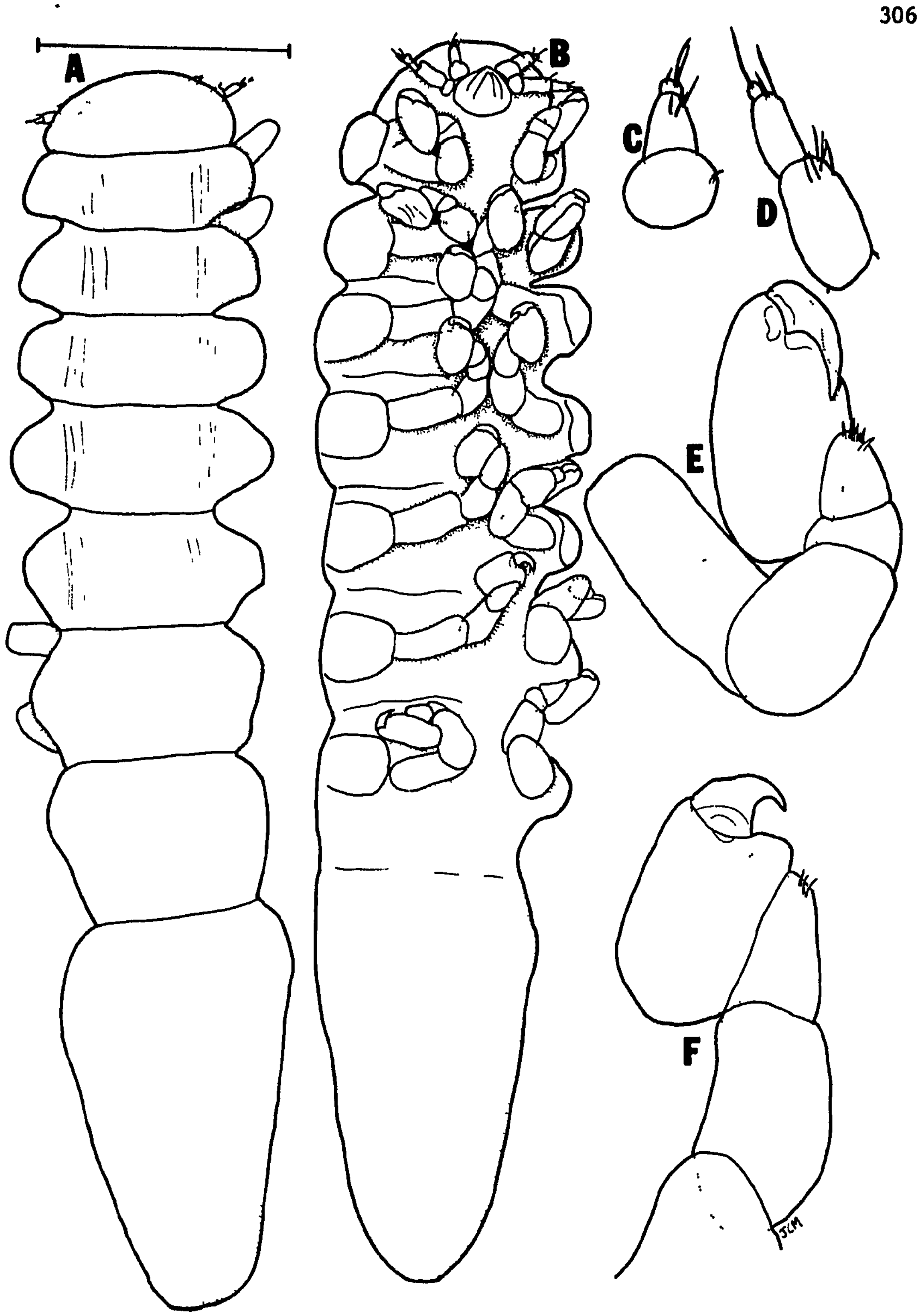

Fig. 68. New Genus D sp., reference male. A. Dorsal. B. Ventral. C. Right antenna 1. D. Right antenna 2. E. Right pereopod 1. F. Right pereopod 6. Scale: 0.4mm for A, B; 0.1mm for C-F.

PROBABLE HEMIARTHRINAE RECORDED BUT NOT IDENTIFIED

Chace (1972) listed the abdominal parasites of carideans taken during the Smithsonian-Bredin Expeditions in the West Indies. Several of those I have idnetified and discussed above, but some of them were unavailable to me. They are undoubtedly hemiarthrines and probably belong to species discussed above, although some may be undescribed. The host species and their localities are: Alpheus formosus Gibbes, Salmoneus ortmanni (Rankin) and Synalpheus pectiniger Coutière, all from Bahía de la Ascensión, Yucatán Peninsula, México; Synalpheus fritzmuelleri Coutière, Antigua and Carriacou Islands; and Synalpheus longicarpus (Herrick), Mustique and Tobago. Since no identified hemiarthrines are known from Alpheus formosus or Salmoneus ortmanni, there is no way to judge what these may be; at least 1 hemiarthrine is known from each of these Synalpheus spp., but, due to the relatively slight host specificity in the Hemiarthrinae, one can only speculate whether the unidentified parasites belong to the same species as the others.

ZOOGEOGRAPHICAL CONSIDERATIONS

In the foregoing discussions, I have mentioned the worldwide distribution of each genus, so only a few summarizing remarks are necessary at this point. The 57 known or probable West Indian faunal region species of bopyrids considered belong to 35 genera. Nine of these genera are monotypic, and all of the monotypic genera but Probopyrinella (whose single species, P. latreuticola, extends across the Atlantic in floating Sargassum) are confied to the central western Atlantic. No genus containing more than a single species is endemic in this region; thus the number of endemic genera known here is eight, or 23% of the total. Of the 35 genera, 26 occur elsewhere as well, showing a definite affinity with the western Pacific fauna. In all, 23 of the 35 central western Atlantic genera (66%) are also represented in the western Pacific, while 14 (40%) of them occur in the Indian Ocean and 14 (40%) are found in the eastern Atlantic, while the eastern Pacific shares 13 genera (37%) with the central western Atlantic. These figures (if not the result of differential collecting) support the conclusion of Ekman (1953) that most of the warm-water elements of the western Atlantic fauna are of western Pacific origin. Of the 23 genera common to this region and the western Pacific, only four are not known from another major region, and 4 others do not show an evident link through the eastern Pacific or the Indian and eastern Atlantic. Thus is appears that, in general, the West Indian bopyrid fauna has undergone an evolutionary migration from the western Pacific, either westward (6 genera), eastward (5 genera) or both (6 genera). Since most of the genera considered are largely or entirely tropical, the migration route was probably along the Tethyan relict sea.

On the specific level, endemism among local bopyrids is much more pronounced. Only Probopyrinella latreuticola is definitely known to cross the Atlantic, though _Grapsicepon_ _edwardsi_, from a different host species in the same _Sargassum_ habitat, is known to extend almost to the American coasts, thus also nearly crossing the Atlantic. Two other species which have been recorded from both the West Indian faunal region and the eastern Atlantic are _Pseudione_ _confusa_ and _Gigantione_ _bouvieri_, but I have strong doubts whether a single species was really involved in either case. The only bopyrid known from both the western Atlantic and the eastern Pacific is _Probopyrus_ _pandalicola_, but since that species is an inhabitant of brackish to fresh water, its distribution is subject to terrestrial conditions and not properly related to marine zoogeography.

SUMMARY

Of the 36 bopyrid genera recognized in this report as known or probable members of the West Indian fauna, 7 have been described as new as the result of work done in the preparation of this report, and an eighth came to my attention too late to be described. This report deals with 57 species of bopyrids, including 21 described as new since this research began and three more listed without being described. Four species are herein assigned to different genera, 2 genera are considered to be junior synonyms of others, and a third genus previously reported from this region is considered not to be represented here. Further, 2 previously described species are synonymized with others. Among the taxa not treated in detail, the genus Pseudione is represented in the West Indian fauna by several, perhaps as many as 20, undescribed species, and in the subfamily Bopyrinae, I have tentatively synonymized 10 species with others and suggested that a new genus is probably needed.

The following lists are tabular summaries of the foregoing report. The first list presents all of the species of bopyrids recorded above, arranged in systematic order, with their respective hosts and localities indicated. The second list includes all of the decapod species known to harbor bopyrids in the West Indian faunal region, those which occur in that region but have been recorded as hosts only outside of it, and those which occur only outside that region but bear parasites recorded from within it. The systematic arrangement of the host species is that presented by Balss (1957) with modifications from Moore and McCormick (1969) and, in minor details, several other sources. The detailed phylogenetic hierarchy is presented to enable one to judge the relative closeness of the hosts of a single species or several closely related species of parasites.

The records of hosts, parasites or localities indicated with an asterisk (*) are derived from published reports of other authors or personal communications and have not been confirmed by my observations. Names followed by question marks represent uncertain identifications; where a host's name is preceded by a question mark, there is uncertainty whether the parasite indicated really came from that host. The subfamilies of the parasites are indicated in the host list by letters in parentheses, thus: A, Athelginae; B, Bopyrinae; H, Hemiarthrinae; I, Ioninae; and P, Pseudioninae. Geographical names, where abbreviated, follow conventional abbreviations.

The total number of host species recorded herein is 117 (including the 14 not identified to species) in 51 genera of 19 families. By way of comparison, Bonnier (1900) compiled a list of all the hosts of epicarideans then known throughout the world; his total number of host species for bopyrids in the whole world was only 100, i. e. fewer than are now known from the central western Atlantic alone.

West Indian bopyrids, their hosts and localities

Species	Host	Locality
Subfamily Pseudioninae		
Pleurocryptella fimbriata	Munida constricta	Jamaica
Bonnieria americana	M. microphthalma	Guyana
Parapleurocryptella elasmonoti	Munidopsis squamosa	Martinique
*Gigantione bouvieri	*Hypoconcha sp.	*St. Thomas
	*Pilumnus hirtellus	*Azores; *Cape Verde Is.
Asymmetrione n. sp. 1	Pagurus longicarpus	N. C.
	P. bonairensis	SE Fla.
	P. provenzanoi	Antigua
	Pylopagurus sp.	Cay Sal
Asymmetrione n. sp. 2	Clibanarius tricolor	SE Fla.; Bahamas
Pseudione confusa maxillipedis	Munida stimpsoni	Cuba; Jamaica
P. minimocrenulata	M. flinti	Glover Reef; Venez.; Col.
	*Munida sp.	*St. Croix
*P. trilobata	*Pisosoma angustifrons	*Curaçao
*P. upogebiae	*Upogebia affinis	*N. C.
	*Upogebia ap.	*Brazil
P. furcata	Clibanarius vittatus	N. C.
	?Panopeus herbstii	N. C.
	*Unknown host	*Va.
Pseudione sp.	Clibanarius tricolor	SE Fla.; Bahamas; *P. R.

Pseudione sp.	Upogebia affinis	Venez.
Pseudione sp.	Heterocarpus ensifer	G. of Mex.
Pseudione sp.	Heterocarpus sp.	Cay Sal
Pseudione sp.	Paguristes tortugae	Cuba
Pseudione sp.	Munida longipes	SE Fla.; Quito Sueño
Pseudione sp.	M. microphthalma	Guyana
Pseudione sp.	M. miles	SE Fla.; Cuba; Jamaica; Quito Sueño
Pseudione sp.	M. simplex	Bahamas
Pseudione sp.	Munidopsis abbreviata	Jamaica
Pseudione sp.	M. alaminos	Jamaica; Guadeloupe
Pseudione sp.	M. erinaceus	NE G. of Mex.; Guadeloupe; Col.; Curaçao; Venez.
Pseudione sp.	M. longimanus	SE Fla.; Cuba; Guadeloupe
Pseudione sp.	M. nitida	Campeche Bay
Pseudione sp.	M. riveroi	Bahamas; Col.
Pseudione sp.	M. robusta	S & E Fla.
Pseudione sp.	M. spinosa	SE G. of Mex.
Pseudione sp.	M. tridentata	SE Fla.; Jamaica
Pseudione sp.	Nephropsis aculeata	E Fla.
Aporobopyrus curtatus	Petrolisthes armatus	NW & SE Fla.
	P. galathinus	SE Fla.; St. John
	P. marginatus	?Barbados
	Porcellana sayana	N. C.; St. John; G. of Hond.; Col.; Venez.
New Genus A n. sp.	Clastotoechus vanderhorsti	St. Croix

Pleurocrypta n. sp.	*Galathea rostrata*	SE Fla.
Munidion cubense	*Munida stimpsoni*	Cuba
	M. flinti	Curaçao
M. irritans	*M. irrasa*	SE Fla.; Cay Sal; Glover Reef
Munidion n. sp. 1	*M. longipes*	E & SE Fla.; SE G. of Mex.; I. Providencia
Argeia n. sp.	*Sclerocrangon jacqueti*	Bahamas
Anuropodione carolinensis	*Munida iris iris*	N. C.
A. megacephalon	*M. pusilla*	G. of Mex.
New Genus B n. sp.	*Parapagurus* sp.	Col.
Aporobopyrina anomala	*Munida valida*	NW G. of Mex.; SE Fla.; Col.
Balanopleon tortuganus	*M. simplex*	Venez.
Unid. pseudionine	*M. irrasa*	Cay Sal
Unid. pseudionine	*Pachycheles ackleianus*	Dom. Rep.
*Unid. pseudionine	*Munida longipes*	*Cuba
*Unid. pseudionine	**Nephropsis rosea*	*Grenada

Subfamily Ioninae

**Leidya distorta*	**Uca pugilator*	*N. C.
	**U. pugnax*	*Ga.; *Brazil
	**U. vocator*	*Trinidad
	**Uca* sp.	*Ga.; *Guadeloupe
	**Ucides cordatus*	*Brazil

L. bimini	*?Cyclograpsus integer	*Jamaica
	Pachygrapsus transversus	Fla.; Panamá; *Bermuda; *Caribbean
	Sesarma ricordi	SE Fla.
Dactylokepon n. sp.	Iliacantha liodactyla	Costa Rica
	I. subglobosa	Dom. Rep.
*D. hunterae	*Pinnotheres maculatus	N. C.
Grapsicepon edwardsi	Planes minutus	Azores; *Central Atlantic
Cancricepon choprae	Domecia hispida	Curaçao
	*?Eriphia gonagra	*N. C.
	Hexapanopeus angustifrons	Miss.
	Micropanopeus barbadensis	S Fla.
	Neopanope packardii	S Fla.
	Panopeus herbstii	Ga.; Fla.
	*Paraliomera dispar	*Curaçao
	Rhithropanopeus harrisi	Vera Cruz, Méx.
	Panoplax depressa	S Fla.
Subfamily Bopyrinae		
*Bopyrella harmopleon	*Synalpheus minus	*Venez.
	*S. fritzmuelleri	*Venez.
	*S. hemphilli	*Venez.
	*Synalpheus sp.	*São Paulo, Brazil

B. lata	Alpheus normanni	SE Fla.
	*Unid. alpheid	*V. I.
	*Alpheus sp.	*Guanabara, Brazil
	*?Upogebia affinis	*São Paulo, Brazil
B. mortenseni	Lysmata wurdemanni	SE Fla.; *V. I.
	L. rathbunae	Venez.
*B. thomasi	*Tozeuma carolinense	*V. I.
Bopyrina abbreviata	Hippolyte pleuracanthus	N. C.; SE Fla.; *V. I.?
	H. curacaoensis	Tobago
	Hippolyte sp.	W Fla.
B. thorii	Thor floridanus	SE Fla.; Yucatán; Curaçao
*B. pontoniae	*Pontonia margarita	*N. C.
*B. urocaridis	*Periclimenes longicaudatus	*N. C.; *W Fla.
Bopyrina sp.	Synalpheus minus	Ga.; SE Fla.; Tobago
Bopyrina sp.	S. pectiniger	Dom. Rep.; Jamaica
Bopyrina sp.	S. townsendi	Yucatán
Bopyro choprae	S. brooksi	SE Fla.; Bimini
	Alpheus formosus	N. C.
Probopyrinella latreuticola	Latreutes fucorum	Atlantic; SE Fla.; Bimini; Jamaica; Tortola; *V. I.
Probopyrus alphei	Alpheus armillatus	Antigua
	A. formosus	V. I.
	A. heterochaelis	N. C.; SE Fla.; Brazil
	A. normanni	NW & SE Fla.
	Alpheus sp.	Tortugas, Fla.

P. pandalicola	Macrobrachium acanthurus	Cuba; Martinique; Panamá; Nicaragua
	*M. amazonicum	*Guyana; *Curaçao
	*M. carcinus	*Panamá
	M. ohione	La.
	M. olfersi	*Vera Cruz; *Cuba; Dom. Rep.; Col.
	Macrobrachium sp.	Panamá
	Macrobrachium sp.	SE Méx.
	Palaemon northropi	Yucatán; Venez.
	*Palaemon sp.	*V. I.
	Palaemonetes intermedius	S Fla.
	P. paludosus	E & S Fla.; *W Fla.
	P. pugio	W Fla.; Tex.
	P. vulgaris	Yucatán; *N. H. to Fla.
	Periclimenes americanus	SE Fla.
	*Unid. palaemonid	*São Paulo, Brazil
Synsynella hayi	Synalpheus minus	V. I.
*S. deformans	*S. longicarpus	*N. C.
*Unid. species	*Alpheus armillatus	*Antigua
*Unid. species	*A. viridari	*Antigua
*Unid. species	*Synalpheus longicarpus	*Mustique

Subfamily Athelginae

Stegophryxus hyptius	Pagurus longicarpus	Mass.; *R. I.; Ga.
	P. annulipes	N. C.
	P. m. miamensis	SE Fla.
	P. bonairensis	SE Fla.
Stegias clibanarii	Clibanarius tricolor	Bermuda; *P. R.?
Parathelges tumidipes	Dardanus fucosus	Jamaica
P. piriformis	Pagurus provenzanoi	Bahamas
	P. m. miamensis	Bermuda
	Paguristes oxyphthalmus	Col.
P. foliatus	Clibanarius vittatus	Trinidad
	Pagurus m. miamensis	Curaçao
P. occidentalis	Clibanarius tricolor	Bahamas; S Fla.
	Iridopagurus sp.	Venez.
	Pylopagurus corallinus	N. C.
Unid. species	Paguristes sp.	Bahamas
Unid. species	Tomopagurus cokeri	Yucatán

Subfamily Hemiarthrinae

Eophrixus subcaudalis	Synalpheus brooksi	SE Fla.; Yucatán
	S. longicarpus	N. C.; Yucatán
	S. pectiniger	Dom. Rep.
New Genus C n. sp.	S. mcclendoni	S Fla.
Loki circumsaltanus	Thor floridanus	SE Fla.
	T. manningi	Tortola
Dicropleon periclimenis	Periclimenes americanus	St. Lucia; *Antigua?

Metaphrixus carolii	Hippolyte pleura-canthus	SE Fla.
	*Unknown species	*St. Croix
Hemiarthrus synalphei	Synalpheus fritz-muelleri	N. C.
	S. longicarpus	N. C.
New Genus D sp.	S. brooksi	S Fla.
	S. longicarpus	N. C.
	S. mcclendoni	Tortugas, Fla.
	S. pectiniger	Dom. Rep.; Jamaica
*Unid. species	*Alpheus formosus	*Yucatán
*Unid. species	*Salmoneus ortmanni	*Yucatán
*Unid. species	*Synalpheus pecti-niger	*Yucatán
*Unid. species	*S. fritzmuelleri	*Antigua; *Carriacou
*Unid. species	*S. longicarpus	*Mustique; *Tobago
*Unid. species	*Periclimenes yuca-tanicus	*Jamaica

Decapod hosts of West Indian bopyrids, their parasites and localities

Host Species	Parasite	Locality
Suborder Natantia		
Infraorder Caridea		
Superfamily Palaemonoidea		
Family Palaemonidae		
Macrobrachium acanthurus	Probopyrus pandalicola (B)	Cuba; Panamá; *Nicaragua; Martinique
*M. amazonicum	*Same	*Guyana; *Curaçao
*M. carcinus	*Same	*Panamá
M. ohione	Same	La.; Mo.
M. olfersi	Same	Dom. Rep.; Méx.; *Col.
*Macrobrachium sp.	*Same?	*SE Méx.
Macrobrachium sp.	Same	Panamá
Palaemon northropi	Same	Yucatán; Venez.
*Palaemon sp.	*Same?	*St. Croix
Palaemonetes intermedius	Same	S Fla.
P. paludosus	Same	Fla.
P. pugio	Same	Fla.; Tex.
P. vulgaris	Same	*N. H. to Fla.; Yucatán
Periclimenes americanus	Same	S Fla.
	Dicropleon periclimenis (H)	St. Lucia
P. longicaudatus	Bopyrina urocaridis (B)	N. C.; Fla.
Pontonia margarita	B. pontoniae (B)	N. C.

*Unid. palaemonid	*Probopyrus pandalicola	*São Paulo, Brazil
Family Alpheidae		
*Alpheus armillatus	*Unid. species (B)	*Antigua
A. formosus	Probopyrus alphei (B)	V. I.; Antigua
	Bopyro choprae (B)	N. C.
	*Unid. species (H)	*Yucatán
A. heterochaelis	Probopyrus alphei	N. C.; Fla.; Brazil
A. normanni	Same	Fla.
	Bopyrella lata (B)	Fla.
*A. viridari	*Unid. species (B)	*Antigua
Alpheus sp.	Probopyrus alphei	S Fla.
*Alpheus sp.	*Bopyrella lata	*Guanabara, Brazil
*Salmoneus ortmanni	*Unid. species (H)	*Yucatán
Synalpheus brooksi	Bopyro ehoprae	Fla.; Tobago; *Bimini, Bahamas
	Eophrixus subcaudalis (H)	Fla.; Yucatán
	New Genus D sp.	N. C.; Fla.; Bimini, Bahamas; Dom. Rep.
*S. fritzmuelleri	*Bopyrella harmopleon (B)	*Venez.
	Unid. species (H)	*Antigua; *Carriacou
*S. hemphilli	*Bopyrella harmopleon	*Venez.
S. longicarpus	*Synsynella deformans	*N. C.
	*Bopyro choprae	*N. C.
	*Unid. species (B)	*Mustique
	Eophrixus subcaudalis	N. C.; Venez.

	Hemiarthrus synalphei (H)	N. C.
S. mcclendoni	New Genus C n. sp. (H)	Tortugas, Fla.
	New Genus D sp. (H)	Tortugas, Fla.
S. minus	*Bopyrella harmopleon	*Venez.
	Bopyrina sp. (B)	Ga.; Fla.; Tobago
	Synsynella hayi (B)	V. I.
S. pectiniger	Bopyrina sp.	Dom. Rep.
	Eophrixus subcaudalis	Dom. Rep.
	New Genus D sp.	Dom. Rep.; Jamaica
	*Unid. species (H)	*Yucatán
S. townsendi	Bopyrina sp.	Yucatán
*Synalpheus sp.	*Bopyrella harmopleon	*São Paulo, Brazil
*Unid. alpheid	*B. lata	*V. I.
Family Hippolytidae		
Hippolyte curacaoensis	Bopyrina abbreviata (B)	Tobago
H. pleuracanthus	Same	N. C.; Fla.
	*Probopyrinella latreuticola? (B)	*St. John
	Metaphrixus carolii (H)	S Fla.
Hippolyte sp.	Bopyrina abbreviata	W Fla.
Latreutes fucorum	Probopyrinella latreuticola	Fla.; Gulf Stream; Sargasso Sea; V. I.; Jamaica; Tortola
Lysmata rathbunae	Bopyrella mortenseni (B)	Venez.
L. wurdemanni	Same	S Fla.; St. Thomas
Thor floridanus	Bopyrina thorii (B)	S Fla.; Yucatán; Curaçao

	Loki circumsaltanus (H)	S Fla.
T. manningi	Same	Tortola
*Tozeuma carolinense	*Bopyrella thomasi (B)	*St. Thomas
Superfamily Palaemonoidea		
Family Pandalidae		
Heterocarpus ensifer	Pseudione sp. (P)	G. of Méx.
Heterocarpus sp.	Pseudione sp.	Cay Sal
Superfamily Crangonoidea		
Family Crangonidae		
Sclerocrangon jacqueti	Argeia n. sp. (P)	Bahamas
Suborder Reptantia		
Infraorder Astacidea		
Family Nephropidae		
*Nephropsis rosea	*Unid. species (P)	*Grenada
N. aculeata	Pseudione sp.	E Fla.
Infraorder Anomura		
Superfamily Thalassinoidea		
Family Callinassidae		
Upogebia affinis	*P. upogebiae (P)	*N. C.; *Brazil
	Pseudione sp.	Venez.
	*Bopyrella lata?	*Brazil
Superfamily Paguroidea		
Family Paguridae		
Iridopagurus sp.	Parathelges occidentalis (A)	Venez.
Pagurus annulipes	Stegophryxus hyptius (A)	N. C.
P. bonairensis	Asymmetrione n. sp. 1 (P)	S Fla.

	Stegophryxus hyptius	S Fla.
P. longicarpus	Asymmetrione n. sp. 1	N. C.
	Stegophryxus hyptius	N. C.
P. m. miamensis	Same	S Fla.
	Parathelges piriformis (A)	Bermuda
P. provenzanoi	Asymmetrione n. sp. 1	Antigua
	Parathelges piriformis	Bahamas
Pylopagurus corallinus	P. occidentalis	N. C.
Pylopagurus sp.	Asymmetrione n. sp. 1	Fla.; Cay Sal
Family Parapaguridae		
Parapagurus sp.	New Genus A n. sp. (P)	Col.
Family Diogenidae		
Clibanarius tricolor	Pseudione sp.	Fla.; *P. R.
	Asymmetrione n. sp. 2 (P)	Fla.; Bahamas
	Parathelges occidentalis	Fla.; Bahamas
	Stegias clibanarii (A)	Bermuda; *P. R.?
C. vittatus	Pseudione furcata (P)	N. C.
	Parathelges foliatus (A)	Trinidad
Dardanus fucosus	P. tumidipes (A)	Jamaica
Paguristes oxyphthalmus	P. piriformis	Col.
P. tortugae	Unid. species (A)	Bahamas
Superfamily Galatheoidea		
Family Galatheidae		
Galathea rostrata	Pleurocrypta n. sp. (P)	S Fla.

Munida constricta	Pleurocryptella fimbriata (P)	Jamaica
M. flinti	Munidion cubense (P)	Venez.
	Pseudione minimocrenulata (P)	Venez.
M. iris iris	Anuropodione n. sp. 1 (P)	N. C.
M. irrasa	Munidion irritans (P)	Fla.; Cay Sal; Brit. Hond.
	Unid. species (P)	Cay Sal
M. longipes	Munidion n. sp. (P)	G. of Mex.; Fla.
	Pseudione sp.	S. Fla.; Caribbean
	*Unid. species (P)	*Cuba
M. microphthalma	Bonnieria americana (P)	Guyana
	Pseudione sp.	Guyana
M. miles	Pseudione sp.	S Fla.; Cay Sal; Cuba; Jamaica
	Pleurocryptella fimbriata	Cuba
M. pusilla	Anuropodione n. sp. 2 (P)	G. of Mex.
M. schroederi	Munidion n. sp.	Cuba
M. simplex	Balanopleon tortuganus (P)	Venez.
	Pseudione sp.	Bahamas
M. stimpsoni	Munidion cubense	Cuba
	Pseudione confusa maxillipedis (P)	Cuba

M. valida	Aporobopyrina anomala (P)	G. of Mex.
*Munida sp.	*Pseudione minimocrenulata	*St. Croix
Munidopsis abbreviata	Pseudione sp.	Jamaica
M. alaminos	Pseudione sp.	Guadeloupe
M. erinaceus	Pseudione sp.	G. of Mex.; Col.; Venez.
M. longicarpus	Pseudione sp.	S Fla.; Cuba; Guadeloupe
M. nitida	Pseudione sp.	Campeche Bay
M. riveroi	Pseudione sp.	Bahamas; Col.
M. robusta	Pseudione sp.	E & S Fla.
M. spinosa	Pseudione sp.	G. of Mex.; Cuba
M. squamosa	Parapleurocryptella elasmonoti (P)	Martinique
M. tridentata	Pseudione sp.	Fla.; Jamaica
Family Porcellanidae		
Clastotoechus vanderhorsti	New Genus B n. sp. (P)	St. Croix
Pachycheles ackleianus	Unid. species (P)	St. Lucia; Dom. Rep.
Petrolisthes armatus	Aporobopyrus curtatus (P)	Fla.
	*A. gracilis (P)	*Brazil
P. galathinus	A. curtatus	Fla.; St. John
	*A. gracilis	*Brazil
P. marginatus	A. curtatus	Barbados

*Pisosoma angustifrons	*Pseudione trilobata (P)	*Curaçao
Porcellana sayana	Aporobopyrus curtatus	N. C.; St. John; Hond.; Col.; Venez.

Infraorder Brachyura

Section Dromiacea

Superfamily Dromioidea

Family Dromiidae

*Hypoconcha sp.	*Gigantione bouvieri (P)	*St. Thomas

Section Oxystomata

Superfamily Calappoidea

Family Leucosiidae

Iliacantha liodactyla	Dactylokepon n. sp. (I)	Costa Rica
I. subglobosa	Same	Dom. Rep.

Section Brachyrhyncha

Superfamily Xanthoidea

Family Xanthidae

Domecia hispida	Cancricepon choprae (I)	Curaçao
*Eriphia gonagra	*Same?	*N. C.
Hexapanopeus angustifrons	Same	Miss.
Micropanope barbadensis	Same	Tortugas, Fla.
Neopanope packardii	Same	S Fla.
Panopeus herbstii	Same	Ga.; Fla.
P. herbstii?	Pseudione furcata	N. C.
*Paraliomera dispar	*Cancricepon choprae	*Curaçao
Rhithropanopeus harrisi	Same	Vera Cruz, Méx.

Family Goneplacidae

Panoplax depressa	Same	Tortugas, Fla.

Family Pinnotheridae		
Pinnotheres maculatus	*Dactylokepon hunterae (I)*	*N. C.
Family Grapsidae		
Cyclograpsus integer	*Leidya bimini? (I)*	*Jamaica
Pachygrapsus transversus	Same	*Bermuda; Fla.; *Caribbean; Panamá
Planes minutus	Grapsicepon edwardsi (I)	Azores; *W central Atlantic
Sesarma ricordi	Leidya bimini	S Fla.
Superfamily Ocypodoidea		
Family Ocypodidae		
Uca pugilator	*Leidya distorta (I)*	*N. C.
U. pugnax	*Same	*Brazil; *Ga.
U. vocator	*Same	*Trinidad
Uca sp.	*Same	*Ga.; *Guadeloupe
Ucides cordatus	*Same	*Brazil

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