

THE UNIVERSITY OF MIAMI

THE SYSTEMATICS AND DISTRIBUTION OF THE DEEP-SEA GENUS  
MUNIDOPSIS (CRUSTACEA, GALATHEIDAE) IN THE WESTERN ATLANTIC OCEAN

by

Barbara Shuler Mayo

"

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Subject

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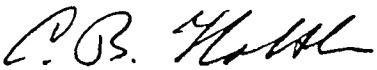
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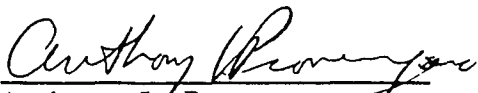
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## INTRODUCTION

Extensive collections of deep-sea decapod crustaceans were made during cruises of the R/V GERDA and the R/V JOHN ELLIOTT PILLSBURY as part of a long-term faunal survey of the tropical western Atlantic Ocean by the University of Miami. The GERDA (May 1962 - August 1970) worked principally in the Straits of Florida, the Bahamas and adjacent waters as far south as Arrowsmith Bank in the Caribbean. Although the PILLSBURY (May 1964 - July 1971) made important expeditions to West African waters, Bermuda and the Gulf of Panama, a large part of her work was done in the Caribbean: off Yucatan, Honduras and Panama, along the north coast of South America from Colombia to Surinam, in the Lesser Antilles from Trinidad to the Virgin Islands, and from Puerto Rico to Haiti and Jamaica.

The material of the benthic galatheid genus Munidopsis collected during cruises of these vessels in the western Atlantic is the basis for this study. Of 48 species of Munidopsis now known from the western Atlantic, 35 species are represented in the GERDA and PILLSBURY collections. In this paper, an account is given of each of these species, including complete synonymies, diagnoses, detailed descriptions, figures and distribution charts as well as information about sexual dimorphism, parasites, bathymetric range, habitat and coloration when available. In addition, locality records found in the literature are presented. The relationships of each species to other western Atlantic species and to species of Munidopsis from other regions are discussed. Accounts of the 13 western Atlantic species not collected by the GERDA and PILLSBURY are not included here, but will appear in the final report of the genus. The present location of the holotype is noted in the cases where it

could be determined. Most of the type material is housed at the Museum of Comparative Zoology of Harvard University, Cambridge, Massachusetts, and at the National Museum of Natural History, Smithsonian Institution, Washington, D. C.

## REVIEW OF THE LITERATURE

J. F. Whiteaves began the history of the genus Munidopsis in the western Atlantic with his description of Munidopsis curvirostra (1874: 212-213) as a new genus and species. Whiteaves' report of M. curvirostra from the Gulf of St. Lawrence in 180-220 fm was repeated by S. I. Smith (1879:54) in his account of the Stalk-Eyed Crustaceans of the Atlantic Coast of North America, north of Cape Cod.

The variety of galatheid crustaceans in the tropical western Atlantic was indicated in A. Milne Edwards' (1880) preliminary report on the crustaceans collected by the BLAKE during the first major trawling expeditions into the Gulf of Mexico and Caribbean. In addition to new species of Galathea, Munida, Diptycus and Ptychogaster, A. Milne Edwards named 22 new species which he assigned to four new genera: Galacantha (two species), Galathodes (ten), Elasmonotus (four), and Orophorhynchus (six). All of these new genera have subsequently been combined in the genus Munidopsis. A. Milne Edwards gave only brief descriptions and no illustrations of these animals, and the formal report of the BLAKE galatheids did not appear until several years later (A. Milne Edwards and Bouvier, 1897).

In the meantime, Smith was working on material collected by the BLAKE off the eastern coast of the United States. Smith found the range of Galacantha rostrata A. Milne Edwards extended north to the coast of New England, and that of Munidopsis curvirostra Whiteaves south to the coast of North Carolina (1882:21). He pointed out that the latter species might be identical with one of the ten species of Galathodes described by A. Milne Edwards, but that such synonymy could not be determined from

the brief description alone.

Smith (1883:50-55) published a very detailed description of Anoplo-  
notus politus, new genus and species, complete with drawings of the en-  
tire animal as well as all the mouth parts. This species also has sub-  
sequently been assigned to the genus Munidopsis. Smith indicated that  
he had hesitantly referred this new species to Elasmonotus since A.  
politus agreed well with the brief diagnosis of that genus given by A.  
Milne Edwards (1880:60), but that after seeing figures of Elasmonotus  
vallantii (A. Milne Edwards, 1883: fig. 13) from the eastern Atlantic,  
he decided that politus was generically as well as specifically distinct.

The report of the first galatheids collected by the ALBATROSS during  
its early dredging off the east coast of the United States, was given by  
Smith in 1884. He recorded more specimens of Galacantha rostrata and  
Munidopsis curvirostra, and described a new species, Galacantha bairdii  
from deep water (1497 fm). Smith indicated that the new species was  
more like Munidopsis than Galacantha in some of its characters, and con-  
sidered it possible that the two genera should be united. In a subse-  
quent paper, Smith (1885:493) referred these three species as well as  
two new species, M. crassa and M. similis, to Munidopsis on the basis of  
"a careful examination of the structural characters."

In a more complete report of the ALBATROSS collections, Smith (1886)  
repeated the descriptions and included clear illustrations of M. bairdii,  
M. crassa, M. similis and M. rostrata. Data for the most recent stations  
at which these, M. curvirostra, and M. rostrata were taken were listed  
also. The first part of Smith's paper contained an interesting list of  
decapods collected from this region off the northeastern U. S. coast,  
including the bathymetric range of each and a statement of the nature of

the eyes; the Galatheoidea, represented by these five species of Munidopsis, made up one section of this list.

Henderson (1885), in a preliminary report giving diagnoses of new galatheids collected during the CHALLENGER expedition in the Pacific, synonymized A. Milne Edwards' Galathodes with Munidopsis, and erected a new subgenus, Galathopsis, for species intermediate between those of Munidopsis and Elasmonotus. In the final report of the CHALLENGER Anomura, Henderson (1888:148) united A. Milne Edwards' Orophorhynchus with Munidopsis, and made an important observation about members of the genus which has subsequently been supported by various authors and substantiated by additional material: "The species vary widely among themselves in the form of those parts which in other Crustacea afford generic characters; and yet it is impossible to effect a natural subdivision, or one which is not founded on a single character to the exclusion of others." In the same paper, he suppressed Galathopsis and Anoplnotus as synonyms of Elasmonotus. The genus Galacantha was maintained however, since Henderson disagreed with Smith's union of Munidopsis and Galacantha, and doubted that the species Smith called G. bairdii should be assigned to Galacantha. Henderson reported three western Atlantic species of Munidopsis in this account, and one species of Elasmonotus.

In Faxon's (1893) preliminary descriptions of new species collected by the ALBATROSS off the western coasts of Central and South America, he included Galathodes, Orophorhynchus, Elasmonotus and Anoplnotus in Munidopsis, but treated Galacantha separately.

A. Milne Edwards and Bouvier (1894) attempted to clarify the increasingly confusing situation in this group of galatheids (Galathéens non flagellés) in their paper, "Considérations générales sur la famille



des Galathéides. All four of A. Milne Edwards' original genera were maintained, although they were greatly modified; species were rearranged among these, and many species were referred to Munidopsis. The BLAKE material served as the basis for their study, along with that collected by the TRAVAILLEUR and the TALISMAN mainly from the eastern Atlantic. The classification used in their account differed from that in current use mainly in the rank of the taxa. In A. Milne Edwards and Bouvier's paper, the family Galathéides was divided into three subfamilies: the Galathéines, the Diptycinés, and the Agléinés. The first subfamily included two tribes: the Galathéens and the Porcellaniens. The Galathéens were then divided into sections: the Galathéens flagellés (Galatea, Munida and Pleuroncodes) and the Galathéens non flagellés (Galacantha, Munidopsis, Galathodes, Elasmonotus and Orophorhynchus). Keys to all known species were given for each genus, and a quantity of general information about morphology and taxonomy was presented along with bathymetric and zoogeographical considerations. The redistribution of West Indian species into genera, and the inclusion of those from the northeast coast of the United States, resulted in two species of Galacantha, seventeen Munidopsis, three Galathodes, four Elasmonotus (one species suppressed, one transferred from Orophorhynchus) and two Orophorhynchus.

The final report by Faxon of the eastern Pacific stalk-eyed crustaceans collected by the ALBATROSS was published in 1895. The account of the genus Munidopsis contained his assessment of the status of Munidopsis, in which he briefly outlined the reasons for uniting the other four genera with Munidopsis, followed by a summary and an appraisal of A. Milne Edwards and Bouvier's (1894) treatment of the

classification. Because of its continued applicability to the problem, part of Faxon's discussion is quoted below:

All of the genera proposed by the senior author in 1880 are retained, although transformed almost beyond recognition by the imposition of new diagnoses and new limitations. Galathodes is restricted to the species characterized by a broad, flat, triangular rostrum, often carinated on its upper side, and armed towards its anterior end with a pair of prominent lateral spines or teeth, in front of which the distal extremity of the rostrum suddenly contracts. This new diagnosis of the genus Galathodes eliminates eight of the ten species upon which the genus was originally based, leaving G. latifrons and G. tridens alone in Galathodes, the other eight being transferred to Munidopsis. So of the six species of Orophorrhynchus (sic) of the original paper three are now transferred to Munidopsis, one to Elasmonotus, one (O. spinosus) is ignored, leaving but one of the original species, O. aries, in Orophorrhynchus, of which genus it becomes the type.

The difficulty encountered by Prof. Milne Edwards in distributing his own species among his own genera would seem clearly to show the artificial nature of the genera proposed, and amply to vindicate the course of those naturalists who have refused to adopt them.

It is true, as Milne Edwards and Bouvier maintain, that the most characteristic of the species ranged by them in the genera Orophorrhynchus and Elasmonotus differ from the more typical species of Munidopsis as much or more than the species

assigned to the genus Galacantha. But there is this difference: the species of Galacantha, although they differ but slightly in structure from Munidopsis, yet form a sharply defined and natural group disconnected from the latter genus in the absence of transitional species. Galathodes, Orophorrhynchus and Elasmonotus, on the contrary, are bound by a perfectly graduated series of numerous connecting forms with the typical species of Munidopsis. . . . (Faxon, 1895:82-83).

A. Milne Edwards and Bouvier in 1897 published the final report of the BLAKE dredgings in the Gulf of Mexico and Caribbean Sea, including some material collected by the HASSLER. Because their report contained more detailed descriptions and illustrations of the majority of western Atlantic galatheids known at that time, it has remained a basic reference for the group. It is unfortunate that many of the plates apparently were prepared with as much or more consideration for their symmetry and artistic appeal than for the taxonomic information they might convey. However, the drawings are useful and, combined with the descriptions, permit the identification of most species of galatheids as well as chirostylids (Diptycinés) known from this area. The classification followed therein was the same as that used in their 1894 publication.

"The Stalk-eyed Crustacea of British Guiana, West Indies and Bermuda" by Charles Yound, was published in 1900. The section on galatheids, with keys and brief descriptions, was the first work in English dealing with the West Indian species. The information appears to be a superficial summary of A. Milne Edwards and Bouvier's work,

with the interesting exception that Galathodes was suppressed, with no explanation, and the two species which the French authors had retained in that genus were assigned to Munidopsis. Eleven species of Munidopsis, four Elasmonotus and one Galacantha were treated, but no new locations and no illustrations were included.

Galatheids taken by the FISH HAWK expedition to Puerto Rico were reported by Benedict (1901), but only one species of Munidopsis, M. platirostris (A. Milne Edwards and Bouvier), was collected on that cruise.

Alcock (1901) agreed with Faxon that Elasmonotus, Galathodes and Orophorhynchus could not be separated into well-defined genera, distinct from each other and from Munidopsis, but he arranged the Indian species of Munidopsis in five groups (the four above plus Bathyankyristes) which he treated as subgenera.

Benedict's major work on galatheids in the collections of the U. S. National Museum was published in 1902. He described 46 new species principally from the expeditions of the ALBATROSS along both American coasts and in the western Pacific. Of the fourteen new species of Munidopsis, six are western Atlantic: of these, three are considered valid and two are treated as synonyms of M. serricornis (= M. tridentata) in this paper. Perhaps Benedict's greatest contribution to the literature is the last part of this 1902 paper, in which he compiled a world list of galatheids presented alphabetically by genus, with synonymies and general remarks about distributions. He submerged Elasmonotus, Galathodes and Orophorhynchus in Munidopsis, and maintained Galacantha as a separate genus. Of seven nominal species of Galacantha, he listed two from the western Atlantic; of 101 nominal

species of Munidopsis, he listed 31 from the western Atlantic.

Doflein and Balss (1913), in their report of the galatheids of the German deep-sea expedition, brought Benedict's list up to date by adding five species of Munidopsis described by various authors, and by describing five new species of Munidopsis and one of Galacantha, none of which are represented in the western Atlantic. Munidopsis, Orophorhynchus, Galathodes and Elasmonotus are ranked as subgenera. They suppressed or ignored some of the species from Benedict's world list, since their tabulations contained only six species of Galacantha and 106 species of Munidopsis (Doflein and Balss, 1913:174). Much consideration was given to bathymetric and zoogeographical distribution in their paper, and a useful compilation of this information for all known species was presented in tabular form. The bathymetric distributions of the 31 West Indian and U. S. east coast species were presented in table VI (p. 177-179) of that paper, but there are several errors in the tabulation which must be pointed out: Munidopsis polita (Smith) was known at that time from material collected off Martha's Vineyard, on the east coast of the U. S., rather than from western Europe, as indicated on p. 177; the geographical locations for M. depressa Faxon (p. 177) and M. tanneri Faxon are incorrectly indicated as West Indian, whereas both of these species are from the Pacific coast of the Americas.

The sexual dimorphism displayed in the abdomen of galatheids was studied in detail by Perez (1927). He gave information about certain characteristics of the telson of many species in the family, including 11 species now recognized as western Atlantic species of Munidopsis.

Other than Lee Boone's (1927) description of a new species of Galacantha collected on the PAWNEE from the Bahamas, no new species were discovered in the western Atlantic for almost 40 years after Benedict's work.

In Schmitt's (1935) report on the macruran and anomuran crustaceans of the Scientific Survey of Porto Rico and the Virgin Islands, only seven species of Munidopsis were treated. A key to their determination was presented, as well as synonymies and a notation of the type locality. The distribution listed for each was based primarily on the BLAKE galatheids rather than on new material, although locations which could not be found elsewhere in the literature were mentioned for two species, M. longimanus and M. platirostris.

The ATLANTIS expeditions in the Bahamas and off the coasts of Cuba in 1938 and 1939 were the next to obtain large collections of galatheids from this region. These were reported in two papers by Chace; a preliminary report in 1939, and the final report in 1942. The latter also included some material taken by the ATLANTIS off the northeast coast of Florida, and supplementary notes on BLAKE specimens in the Museum of Comparative Zoology. Of the 115-120 species of Munidopsis known to him, Chace enumerated 38 from the western Atlantic including three new species. His key to these 38 species was the first comprehensive key limited to but including all species of this geographical area, and thus it has been far more useful than many which preceded it. In his account of Munidopsis, Chace discussed the problems encountered in subdividing the large genus into more manageable genera or subgenera. He reported his unsuccessful attempt to separate Galacantha from Munidopsis based on the presence or absence of epipods on the

ambulatory legs. He concluded that this character must be considered of specific importance only, and he used the arrangement of epipods throughout his key. Chace further analyzed the attempts made by Milne Edwards and Bouvier (1894) to base a division of the genus on the form of the rostrum (Galacantha and Galathodes), the lack of lateral armature of the carapace (Elasmonotus) and the robust form and short chelipeds (Orophorhynchus) of certain species. He agreed that using this system might allow the separation of several groups: Galacantha, with its "abnormal" development of carapacial spines; Galathodes, with a flat tridentate rostrum; Orophorhynchus, with robust and short clawed species; Elasmonotus, with rounded anterolateral angles and carinate abdominal tergites; possibly Anoplomotus; and Bathyanstyristes, with subchelate ambulatory legs. However, he observed that at least six similar groupings would be necessary for other species complexes, which would still leave almost one-third of the old Munidopsis species unaccounted for. Many of these not included in the groups mentioned are unique and would have to be placed in monotypic genera, while others are intermediate between groups, which would make the limits of these taxa questionable. He concluded, therefore, that Smith was probably correct when he suppressed Galacantha in 1894, although most authors have continued to recognize the genus as distinct, and he refers to Faxon's (1895) synopsis (see above). Chace reported new locations near Cuba in the accounts of 21 species.

The only reports of western Atlantic galatheids during the next 30 years were those by Springer and Bullis (1956:15) and Bullis and Thompson (1965:9), all based on identifications by Chace, listing stations made by U. S. Fish and Wildlife vessels, principally the

OREGON, at which Munidopsis were taken.

The galatheoids collected by the ALAMINOS in the Gulf of Mexico were reported by the Pequegnats in 1970. The included information on the distribution of 23 species of Munidopsis known from the Gulf of Mexico, of which the ALAMINOS collected material of 14 species including three new species. Chace's (1942) keys, which unfortunately had become unavailable, were reproduced in their paper with slight modifications to include the new species. Additional material from the Gulf of Mexico and the Caribbean Sea taken in deep water by the ALAMINOS and the OREGON was presented by the Pequegnats (1971) in a paper dealing only with the genus Munidopsis. Chace's key was further modified therein to include the five new species they described and two species not recorded previously from the region, thus bringing the total number of western Atlantic nominal species to 48.

Mayo's (1972) description of a new species from Arrowsmith Bank in the Caribbean is the most recent addition to the genus in the western Atlantic.



## MATERIAL AND METHODS

The material on which this study is based was collected during oceanographic cruises of the research vessels JOHN ELLIOTT PILLSBURY and GERDA of the Rosenstiel School of Marine and Atmospheric Science, University of Miami, Florida. The letters P- and G- in stations numbers refer to the PILLSBURY and GERDA, respectively. Station data are presented in the appendix. The majority of the material was collected using 6-foot, 10-foot and 41-foot otter trawls, although some samples were taken with a 5-foot or 10-foot Blake trawl. Material of a few species was borrowed from the Museum of Comparative Zoology of Harvard University, Cambridge, Massachusetts (MCZ) and the National Museum of Natural History in Washington (USNM) for comparison and study. Much of this collection has been accessioned into the Invertebrate Museum of the Rosenstiel School of Marine and Atmospheric Science (UMML); the remainder has been sent to the USNM and to the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH).

Measurements of specimens were made to the nearest 0.1 mm using Mitutoyo dial calipers. The standard measurement is carapace length, abbreviated cl, and defined as the distance measure from the frontal margin posterior to the eye, excluding the rostrum, directly to the posterior margin (as shown in diagram 1). Carapace width, cw, is measured at the widest point. Cheliped length is measured from the articulation of the basis and coxa to the tips of the fingers. Illustrations were prepared using a Wild M-5 stereomicroscope with camera lucida attachment. Color notes were made from slides taken of fresh material of several species; most of this information is new and is

presented in the species accounts.

The map of the Caribbean, Straits of Florida and Bahama Islands used in the species distribution plots was redrawn from U. S. Naval Oceanographic Chart 410; an approximation of the 100 fm (183 m) contour is indicated by a stippled line. The station locations for each species were plotted on a grid of the appropriate size using a Calcomp 563 plotter and a program for this operation; these points were subsequently transferred to the printed maps.

This project, as originally conceived, was somewhat broader in scope and included consideration of all genera of the galatheoid families Galatheidae and Chirostylidae. One aim of the larger project was an analysis of distributions and occurrences of species collected by the GERDA and PILLSBURY using Recurrent Groups Analysis, a method developed by E. W. Fager (1957). This method has been used to define species groups or benthic assemblages of fishes (Staiger, 1970) and fishes and invertebrates (Bayer, Voss and Robins, 1970), in addition to its first use in dealing with species groups of zooplankton (Fager and McGowan, 1963). A basic operation in this method is the calculation of an index of affinity between species pairs. The index of affinity is defined as the geometric mean of the proportion of joint occurrences, corrected for sample size. Its mathematical expression is  $\left[ \frac{J}{(N_a N_b)^{1/2}} - \frac{1}{2} (N_b)^{1/2} \right]$ , in which J is the number joint occurrences of species a and b;  $N_a$  is the number of occurrences of species a;  $N_b$  is the number of occurrences of species b; and  $N_a$  is less than or equal to  $N_b$  (Fager and McGowan, 1963:454). An IBM 360/65 computer program was used to calculate this index from data obtained for Munida as well as that for Munidopsis, in a preliminary attempt to determine the effectiveness

of the method when used for a relatively limited taxonomic group. Although the study subsequently became restricted to the genus Munidopsis as the need for a complete systematic account of this large group became obvious, the indices of affinity between each pair of species of Munidopsis had been calculated for all species. It is recognized that there are several problems connected with this approach; however, the information expressed by this index is useful, in that species associations suspected after general consideration of joint occurrences are evaluated mathematically. This allows for more objective comparisons and analyses, as well as enabling the observer to predict joint occurrences in some cases. Therefore, indices of affinity between pairs of species of Munidopsis greater than 0.2 are presented in the species accounts.

Munidopsis Whiteaves, 1874

Munidopsis Whiteaves, 1874:212.-- Smith, 1882:21; 1885:493-494; 1886:644.--Henderson, 1885:414; 1888:148.--Faxon, 1893:81 (footnote indicating inclusion of Galatodes (sic), Orophorhynchus, Elasmonotus, and Anoplomotus); 1895:81-83.--Alcock, 1894:328; 1901:247-251, 248 (as subgenus or group), 249-250 (key to species in subgenus or group).--Alcock and Anderson, 1894:166 (key to Indian species).--A. Milne Edwards and Bouvier, 1894:271-276, 275 (key to species); 1897:8 (key), 63-64; 1899:82; 1900:312.--Young, 1900:399(key), 406-407 (key to species).--Benedict, 1901:148; 1902:275-277 (key to species), 315 (list).--Fowler, 1912:574.--Doflein and Balss, 1913:131 (table), 148-149, 174, 177-179 (table of species).--Selbie, 1914:80, 80-81 (key to Irish species).--Schmitt, 1921:167.--Bouvier, 1922:47 (also as subgenus).--Laurie, 1926:139.--Perez, 1927:285.--Yokoya, 1933:66.--Schmitt, 1935:178, 178-179 (key to species).--Makarov, 1938 (1962):80 (key), 96-98.--Chace, 1942:29 (key), 69-72, 72-75 (key to W Atlantic species).--Haig, 1955:39.--Tirmizi, 1966:211(genus), 211 (in key as subgenus), 218 (as subgenus).--Zariquley Alvarez, 1968:268, 268-269 (key to Iberian species).--Glaessner, 1969:R482.--Pequegnat and Pequegnat, 1970:126 (key), 138, 138-140 (key to W Atlantic species); 1971:3, 4-7 (key to W Atlantic species).

Type species: Munidopsis curvirostra Whiteaves, 1874 by monotypy.

Gender: feminine.

Galacantha A. Milne Edwards, 1880:52.--Henderson, 1885:418; 1838:166-167.--Perrier, 1886:294.--A. Milne Edwards and Bouvier, 1894:261,

268-270, 270-271 (key to species); 1897:55-56; 1900:308.--Alcock and Anderson, 1894:173.--Faxon, 1895:78.--Young, 1900:399 (key), 417.--Alcock, 1901:274-275 (key to Indian species).--Benedict, 1902:304 (list.--Fowler, 1912:575.--Doflein and Balss, 1913:131 (table), 147, 174.--Perez, 1927:285.--Tirmizi, 1966:174 (key), 206 (key to Indian species).

Type species: Galacantha rostrata A. Milne Edwards, 1880, by subsequent designation, Fowler (1912:575). Gender: feminine.

Galathodes A. Milne Edwards, 1880:53.--Sars, 1890:162-170, tab. 4 (larvae and juveniles).--Perrier, 1886:294.--A. Milne Edwards and Bouvier, 1894:261, 276-279, 279 (key to species); 1897:94; 1899:83; 1900:331.--Caulley, 1896:390.--Alcock, 1901:249 (as subgenus or group), 250 (key to Indian species in subgenus or group).--Doflein and Balss, 1913:148 (as subgenus).--Bouvier, 1922:48 (as subgenus).--Perez, 1927:287.--Tirmizi, 1966:211 (in key as subgenus), 228 (as subgenus).

Type species: Galathodes erinaceus A. Milne Edwards, 1880, by subsequent designation, Fowler (1912:574). Gender: masculine.

Orophorhynchus A. Milne Edwards, 1880:58.--Perrier, 1886:294.--A. Milne Edwards and Bouvier, 1894:264-267, 283-287, 287 (key to species); 1897:110-111; 1899:85-86; 1900:336.--Alcock, 1901:249 (as subgenus of group), 250 (key to Indian species in subgenus or group).--Benedict, 1901:148 (as subgenus).--Doflein and Balss, 1913:148 (as subgenus).--Perez, 1927:288.--Tirmizi, 1966:211 (in key as subgenus), 216 (as subgenus).

Type species: Orophorhynchus aries A. Milne Edwards, 1880, by subsequent designation, Faxon (1895:82). Gender: masculine.

Elasmonotus A. Milne Edwards, 1880:60.--Henderson, 1885:416; 1888:158-159.--Perrier, 1886:294.--Alcock, 1894:333; 1901:249 (as subgenus or group), 251.--A. Milne Edwards and Bouvier, 1894:262, 264-267, 279-283, 282 (key to species); 1897:98; 1900:333.--Young, 1900:399 (key), 413-414, 414 (key to species).--Doflein and Balss, 1913:148 (as subgenus).--Perez, 1927:288.--Tirmizi, 1966:211 (in key as subgenus), 213 (subgenus, key to Indian species).

Type species: Elasmonotus longimanus A. Milne Edwards, 1880, by subsequent designation, Fowler (1912:574). Gender: masculine.

Anoplomotus Smith, 1883:50.

Type species: Anoplomotus politus Smith, 1883, by monotypy.

Gender: masculine.

Galathopsis Henderson, 1885:417, as a subgenus intermediate between Munidopsis and Elasmonotus.

Type species: Galathopsis laevigata Henderson, 1885 (first species). (Not fixed in original publication, subsequent designation not determined). Gender: feminine.

Bathvankyristes Alcock and Anderson, 1894:173.--Alcock, 1901:249 (subgenus or group), 251 (key to Indian species in subgenus or group).--Doflein and Balss, 1913:148 (as subgenus).--Tirmizi, 1966:211 (in key as subgenus).

Type species: Bathvankyristes spinosus Alcock and Anderson, 1895, by subsequent designation, Fowler (1912:574).

Gender: masculine.

The terminology used herein is in accordance, as far as possible, with that used in the Treatise on Invertebrate Paleontology (Moore, ed, 1969:R401-R418); several terms have been slightly modified from

those of Pike (1940) and A. Milne Edwards and Bouvier (1894).

Diagnosis.--Body not laterally compressed, usually dorsoventrally compressed; integument strongly calcified; transverse ciliated lines on carapace feeble or absent; abdomen and uropods symmetrical; abdominal epimera well developed; abdomen more or less bent under carapace, but not strongly flexed against cephalothorax; second abdominal segment of males with appendages; gill phyllobranchiate, 10 arthrobranchs present in normal position; pleurobranch on fifth pereopods; antenna with 4-segmented peduncle lacking scale; exopod of first maxillipeds without flagellum; third maxillipeds with epipods; first pereopod chelate, second through fourth pereopods not chelate; fifth pereopod differing from third in size, length and shape; last thoracic sternite free.

Description.--Integument of body hard, well-calcified. Carapace usually longer than broad (cw/cl usually 0.80 - 0.95), generally quadrangular; dorsal surface with regions usually well-defined and frequently inflated, particularly gastric region; cervical groove usually distinct centrally posterior to gastric region as short transverse channel curving forward laterally and bifurcating or branching separately into anterior and posterior branches: anterior branch separating hepatic and epibranchial regions (hepatic region herein not equal to hepatic region of Pike, 1940:9; latter equivalent to epibranchial, as used herein), lateral termination marked on lateral margin by notch; posterior branch of cervical groove extending obliquely and posteriorly to lateral marginal notch, or intersecting lateral part of postcervical groove; gastroorbital groove continuing forward from cervical groove to frontal margin, separating gastric and hepatic regions.

Metagastric area prominent (fig. 10) or completely reduced (fig. 23), bordered posteriorly by distinct transverse postcervical groove; lateral extensions of postcervical groove separating mesobranchial from metabranchial regions and often intersecting posterior branch of cervical groove at or near lateral margins. Cardiac region usually somewhat triangular in shape, bounded laterally by branchiocardiac groove and with posterior point close to or approximating transverse marginal groove and adjacent marginal rim. Regions of carapace unarmed, sculptured with tubercles, squamae and/or striae, or armed with spinules, spines or tuberosities; sculpturing, when present, generally symmetrical, often arranged in irregular transverse rows and with associated setae; sculpturing coarser on metabranchial regions; spines, when present, usually consisting of at least one anterior gastric pair, occasionally median gastric spine and/or median or paired spines on anterior ridge of cardiac region.

Front of carapace projected between eyes into rostrum, usually more than  $1/4$  carapace length; shape of rostrum varying from slender or triangular spine to broad, spade shape or trident; rostrum dorsally carinate, excavate or smooth; lateral margins convex, concave, parallel or acuminate, smooth or armed with sharp lateral spines or weakly serrate distally; rostrum horizontal in lateral view, weakly decurved or gently or strongly upturned in distal portion; tip usually acute, but occasionally blunt or rounded. Frontal margin between eye and anterolateral angle smooth or with post-antennal lobe or spine, never with strong supraorbital spine. Anterolateral angle (defined as occurring mesially or anteriorly of lateral termination of anterior branch of cervical groove) usually armed with spine or tooth, or unarmed.



lateral margins nearly straight to distinctly convex, smooth or armed; spines, when present, usually located posterior to carapacial grooves. Posterior marginal rim smooth, beaded, granulate or armed with one or more spines, frequently transversely bicarinate.

Abdomen broad, well-developed, usually flexed with only anterior 3 somites and part of fourth somite visible in dorsal view. First abdominal segment small, usually smooth, partially hidden beneath carapace; postolateral angles projected as articular flanges, latter occasionally sculptured or armed. Second through fourth segments smooth anteriorly, fitting beneath anterior segment with abdomen extended, usually with transverse carinae; carinae sometimes dorsally projected, frequently armed with paired or median spines; occasionally with spine on pleuron. Pleuron of second segment usually broad, pleura of posterior segments frequently narrowed laterally and smooth anteriorly, fitting beneath pleuron of preceding segment with abdomen flexed. Fifth and sixth segments generally smoother.

Sternum usually smooth, occasionally with tubercles and less frequently with small spines on sternite between bases of chelipeds; intersegmental ridges and grooves distinct or obscure, usually with row of short setae; median longitudinal indentation or groove often present, usually more distinct posteriorly. Sternite of fifth pereopods narrow but well-formed, not fused to others but freely articulated.

Eyestalks short, fused to front of carapace and rostrum or freely movable; eyes sometimes partially hidden beneath rostrum; cornea same diameter as eyestalk or inflated, usually chalky white, sometimes translucent or red-orange in life, usually devoid of pigment and faceting; eyes unarmed or eyestalk projected beyond cornea mesially and/or later-

ally to form spine, or cornea with terminal eyespine.

Basal segment of antennular peduncle usually enlarged, with lateral swelling often sculptured, and armed distally with usually 2 sharp spines, one above other. Second and third segments slender, flexed; extended antennule often reaching beyond rostrum.

Antennal peduncle consisting of 4 segments. Basal segment broad, immovable, usually armed with lateral spine and ventromesial projection. Second and third segments usually smaller, frequently armed with lateral or mesial spines. Distal margin of fourth segment usually with dorso-lateral projection. Antennal flagellum short (less than carapace length) of medium length, or extremely long, reaching well beyond chelipeds; flagellum with or without setae.

Exopod of first maxilliped without flagellum.

Endopod of third maxilliped with epipod. Well-developed crista dentata on mesial edge of ischium. Merus serrate, weakly toothed, or with distinct spines on ventral flexor margin and dorsal spine on distal margin. Carpus sometimes armed or sculptured. Propodus and dactylus smooth.

Pereiopods usually sculptured, often spinous, particularly on meral segments. Arrangement of epipods varying from absent on all pereiopods to present on anterior 4 pereiopods; when present on second, third or fourth pereiopod, also present on all preceding pereiopods.

First pereiopod chelate; length varying from short (slightly less than carapace length) to more than 4 times carapace length. Claw often flattened dorsoventrally, with fingers toothed on opposing margins and spooned distally; more proximal segments subcylindrical or quadrate in cross section; carpus usually armed on distal margin; merus armed dis-

tally and on mesial surface. Second, third and fourth pereopods usually quite similar: dactylus usually terminating in curved brown corneous tip, followed on flexor margin by serration, of which each tooth armed with short stiff seta or corneous spinule. Fifth pereopods chelate, slender, weak; merus and carpus elongate, flexed.

Paired pleopods present on first 5 abdominal somites of male; anterior 2 pairs greatly modified for copulation; posterior 3 pairs usually weak and rudimentary. Paired pleopods present on second through fifth abdominal somites of female.

Fourteen phyllobranchiate gills on each side: 5 pairs of arthrobranchs (on third maxilliped, first through fourth pereopods) and 4 pleurobranchs (on second through fifth pereopods).

Protopod of uropod usually with 2 lobes on posterolateral margin, separated by notch between attachment of exopod and endopod: posterior lobe often with serrate margin, additional notch and/or spines. Exopod usually smooth, exposed surface occasionally with sculpturing in form of tubercles or minute spinules: lateral and posterior margins with long plumose setae and short, closely-spaced spinules, spinules sparser on lateral margin. Endopod with few simple setae on usually straight lateral margin; posterior margin with long plumose setae; exposed surface often with sculpturing.

Telson generally hexagonal, subdivided by lines of weaker calcification into 7 to 10 symmetrical plates (following terms according to Pike, 1940:26, based on Perez, 1927:275): broad medial plate, smaller anterolateral pair of plates, lateral and posterior plates most distinct; often central plate distinct or discernible posterior to medial plate, and small intermediate plates mesial to lateral plates. Margins

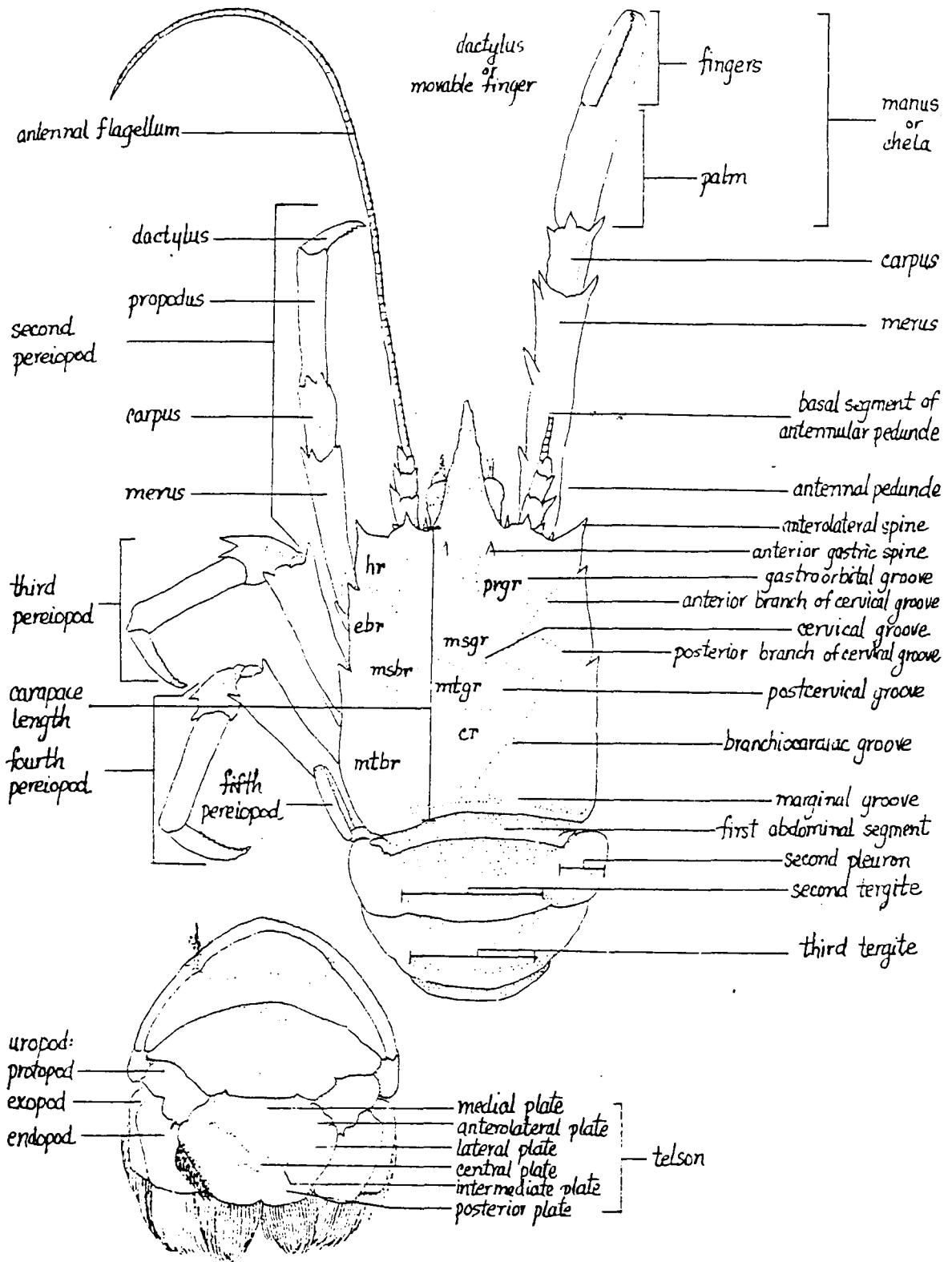


Diagram 1.--Generalized Munidopsis, external morphology. Abbreviations of carapacial regions as follows: prgr, protogastric region; msgr, mesogastric region; mtgr, metagastric region; cr, cardiac region; hr, hepatic region; ebr, epibranchial region; msbr, mesobranchial region; mtbr, metabranchial region.

of lateral plates each usually with fringe, "comb" or tuft of thick setae in males, sometimes deep golden or amber color; marginal setae lacking or sparse, never forming dense fringe, in this location on females. Posterior margin of telson with medial indentation, long, plumose marginal setae.

Geographic range.--Representatives of the genus Munidopsis have been taken from benthic habitats in deep water from the Atlantic, Pacific and Indian Oceans. Of the 48 species now known from the western Atlantic, 6 of the deepest dwelling species can be considered amphi-Atlantic (M. bermudezi Chace, M. crassa Smith, M. livida (A. Milne Edwards and Bouvier), M. serricornis (Lovén) and M. sundi Sivertsen and Holthuis); the first 5 of these are represented in the collection reported herein. In addition, specimens from the Indian Ocean have been identified as M. rostrata and M. tridentata (Esmark) (= M. serricornis).

Material collected in the western Atlantic by the GERDA and PILLSBURY was taken from the Straits of Florida (19 of 35 species), the Bahama Islands (9 species), the Greater Antilles --Cuba, Jamaica, Haiti, Puerto Rico --(20 species), the Lesser Antilles --Virgin Islands to Tobago--(17 species), the north coast of South America (13 species), the coast of Panama and Central America (7 species) and Arrowsmith Bank (3 species). The most thorough collecting was done in the Straits of Florida, and all species previously reported from this area were collected there except one, M. expansa Benedict, the type of which was reported from the north coast of Florida. Only M. riveroi Chace, M. bradleyi Pequegnat and Pequegnat, M. ramahtaylorae and M. serratifrons (A. Milne Edwards) seem to be restricted to the Caribbean, having

neither been collected as far north as the Straits of Florida nor reported thus far from the Gulf of Mexico. M. gilli, known only from the Bahamas and the Straits of Florida to date, M. granulens from Arrowsmith Bank, and M. cubensis from the Straits of Florida and Cuba may have somewhat restricted ranges, but as yet these species are known from too few specimens to conclude much about their actual distribution.

Bathymetric distribution.--Munidopsis is a deep-water genus with most of its species occurring below 500 m. Material in the GERDA and PILLSBURY collections was taken from depths between approximately 150 and 5200 m, although the range of any single species is much narrower. Bathymetric range is expressed in two ways in this paper, to account for the variations in depth sometimes encountered during a single trawl: possible depth range is the maximum possible depth range of the stations from which material was collected, from the least depth at the shallowest station to the greatest depth at the deepest station; calculated depth range is a narrower range, from the greatest depth at the shallowest station to the least depth at the deepest station. The latter depth range is quite significant in that it is certain that the species has been taken between the depths indicated. It must be kept in mind, however, that it is also quite possible that a given species occurs shallower or deeper than this calculated depth range.

The bathymetric ranges of species taken by the GERDA and PILLSBURY are as follows:

<u>Species</u>	<u>Calculated range (m)</u>	<u>Possible range (m)</u>
<u>M. platirostris</u>	207-390	92-842
<u>M. granulens</u>	347-353	same
<u>M. squamosa</u>	366-390	339-395
<u>M. spinifer</u>	421-522	203-604
<u>M. robusta</u>	324-622	same
<u>M. riveroi</u>	431-531	373-686
<u>M. abdominalis</u>	480-622	458-648
<u>M. ramahtaylorae</u>	not determined	408-648
<u>M. bradleyi</u>	not determined	476-711
<u>M. alaminos</u>	558-715	457-842
<u>M. impolita</u>	585-715	585-787
<u>M. polita</u>	134-755	129-807
<u>M. subspinoculata</u>	558-777	457-823
<u>M. serratifrons</u>	770-824	715-897
<u>M. erinaceus</u>	311-827	316-1574
<u>M. spinosa</u>	724-878	597-1050
<u>M. cubensis</u>	not determined	759-869
<u>M. brevismanus</u>	not determined	878-906
<u>M. longimanus</u>	576-1052	408-1281
<u>M. latifrons</u>	677-833	659-1089
<u>M. spinoculata</u>	724-1135	597-1267
<u>M. abbreviata</u>	724-1318	597-1345
<u>M. serricornis</u>	695-1373	570-1446
<u>M. armata</u>	906-1373	796-1446
<u>M. transtridens</u>	1201-1373	1162-1446
<u>M. sigsbei</u>	805-1442	595-1629

<u>Species</u>	<u>Calculated range (m)</u>	<u>Possible range (m)</u>
<u>M. gilli</u>	not determined	1638-1757
<u>M. rostrata</u>	1848-2626	1464-2669
<u>M. similis</u>	1885-2628	1885-2681
<u>M. simplex</u>	1116-3477	1088-3971
<u>M. nitida</u>	1903-3477	1766-3971
<u>M. geyeri</u>	not determined	3111-3496
<u>M. crassa</u>	2532-4415	2514-4415
<u>M. livida</u>	not determined	3111-3496
<u>M. bermudezi</u>	2751-5179	2745-5184

Parasites.--The genus Munidopsis is host to two major groups of crustacean parasites: isopods of the family Bopyridae; and rhizocephalans of the family Peltogastridae.

The isopods are carried in either the left or right branchial chambers, and usually produce a conspicuous swelling on the metabranchial region of the carapace. All of the bopyrids extracted from the GERDA and PILLSBURY material were identified by John C. Markham as belonging to the genus Pseudione. None of these were identified to species and most are probably undescribed, according to Dr. Markham.

The rhizocephalans are attached beneath the abdomen, usually to the second, third or fourth segment. Most of these were identified by the author as belonging to one of three genera: Tortugaster, Galatheascus, and Cyphosaccus. These genera are described by Reinhard (1958) who gives accounts and figures of many of the species encountered. Several Sacculina spp. were found also, and are the first representatives of this genus to be recorded from Munidopsis (see account of M. simplex).



Relationships.--Although the relationships among the species of Munidopsis are complex, as indicated in the Review of the Literature and in individual species accounts, the genus, in the broadest sense, is well defined by the characters listed in the diagnosis. Munidopsis can be distinguished from all other genera in the family, and has been placed in its own subfamily, Munidopsinae Ortmann, 1892 by many authors including Doflein and Balss (1913), Yokoyama (1933) and Chace (1942). The well-calcified integument, usually without distinct transverse striae, and the lack of a flagellum on the exopod of the first maxilliped serve to separate Munidopsis from members of the subfamily Galatheinae, which includes Galathea Fabricius, Baba's (1969) new genera: Liogalathea, Phylladorhynchus, Allogalathea and Sadayoshia, Munida Leach, Pleuroncodes Stimpson, Cervimunida Benedict, and Bathymunida Balss.

While there seem to be too many intermediate forms to allow a subdivision of Munidopsis into genera or even subgenera (Chace, 1942:69-72), several complexes of morphologically similar species are found in the species of Munidopsis taken by the GERDA and PILLSBURY. The Galacantha group, with huge carapacial spines, contains M. spinosa and M. rostrata. The transitional species, M. gilli, M. bradleyi and M. cubensis lead to a pair of robust species closely related to each other, M. geyeri and M. crassa. M. abbreviata is intermediate between M. crassa and two additional groups: one containing the type species of the genus, M. curvirostra (a northern Atlantic species not reported here) along with M. simplex and M. sigsbei, all with a long, simple spine-like rostrum; and another pair, M. robusta and M. riveroi. The latter species, with its hood-like excavate rostrum, provides a smooth transition to the Elasmodonotus group, which is characterized by rounded anterolateral angles and

projected abdominal carinae and which contains M. brevimanus and M. longimanus. M. reynoldsi (not reported here), M. similis, and M. nitida are intermediate between the simplex-sigsbei types and a group of short-clawed species with eyespines containing M. spinocolata, M. subspinocolata, and M. ramahtaylorae. There are similarities between M. ramahtaylorae and M. platirostris, but the latter has been more closely associated with the Orophorhynchus group, which may contain M. livida, and to which M. aries and probably M. sundi belong (latter two species not reported here). M. serratifrons, although quite special, shows some features intermediate between M. robusta and M. alaminos. M. spinifer and M. erinaeus, with spine-like, laterally armed rostra are quite close. Considering primarily the shape of the rostrum, M. latifrons, with the lateral spines of its tridentate rostrum directed anterolaterally, can be viewed as somewhat transitional between the latter pair of species and the western Atlantic species in the Galathodes group: M. serricornis, M. trans-tridens, M. acuminata and M. tridens (latter two species not reported here). M. polita and M. impolita appear to form a group of species having a generally quadrate, unarmed carapace and short rostrum which includes M. espinis and possibly M. gulfensis (latter two species not reported herein), although the chelipeds of the first two species are much longer than those of the latter two; also, the eyes are movable in the first pair of species, and are fused to the carapace in the second pair. M. squamosa and M. barbarae (not reported herein) are also close to each other but seem to lack affinities with other members of the genus, except perhaps with M. granulens, which has the general form of the carapace, rostrum and eyes somewhat similar, although the chelipeds in the latter species are quite different from those of M. squamosa. The

analyses of relationships indicated here are based primarily on the general shape of the carapace, sometimes the nature of the abdominal sculpturing or length of the chelipeds, but, as has been stated previously, an arrangement can not be made which does not rely on a few features to the exclusion of many others which may be equally important and striking.

## KEY TO WESTERN ATLANTIC SPECIES OF THE

GENUS MUNIDOPSIS

1. Abdomen armed . . . . . 2  
 Abdomen lacking distinct spines on any segments . . . . . 20
2. Dorsal surface of carapace with distinct spines on gastric region 3  
 Dorsal surface of carapace with sculpturing on gastric region, but  
 without spines . . . . . 16
3. Fourth abdominal tergite armed with at least one spine . . . . . 4  
 Fourth abdominal tergite unarmed . . . . . 13
4. Rostrum armed laterally with 1 - 3 pairs of spines, or many spinules  
 on dorsal and lateral surfaces . . . . . 5  
 Rostrum unarmed laterally, at most minutely serrate on dorsal and  
 lateral surfaces. . . . . 10
5. Eyestalk with large distal spine on cornea mesially, or several  
 spinules. . . . . 6  
 Eyestalk without large distal spine or spinules on cornea . . . . . 7
6. Eyestalk with large distal spine on cornea mesially; rostrum armed  
 with 1-3 pairs sharp lateral spines . . . . .  
 . . . . . M. colombiana Pequegnat and Pequegnat, 1971  
 Eyestalk without large distal spine on cornea (often with several  
 spinules); rostrum without distinct pairs of lateral spines  
 (but with many spinules on dorsal and lateral surfaces) . . .  
 . . . . . M. alaminos
7. Second, third and fourth abdominal tergites with a single median  
 spine . . . . . 8

- Second, third and fourth abdominal tergites with more than one spine . . . . . 9
8. Huge spine projecting dorsally from posterior gastric region of carapace; cardiac region with 1 sharp spine on anterior ridge . . . . . M. rostrata
- No unusually large spine on posterior gastric region; cardiac region with 2 blunt spines on anterior ridge . . . . . M. gilli
9. Posterior margin of carapace unarmed; 2 pairs of gastric spines; 2 pairs of spines on second, third and fourth tergites . . . . . M. erinaceus
- Posterior margin of carapace with 3-5 pairs of spines; 3 pairs of gastric spines; 3 spines on second and third abdominal tergites, 1 spine on fourth tergite . . . . . M. spinifer
10. Posterior margin of carapace armed . . . . . 11
- Posterior margin of carapace unarmed . . . . . 12
11. Posterior margin of carapace with 1 mesial spine or tooth; second and third abdominal tergites each with only 1 large mesial spine . . . . . M. robusta
- Posterior margin of carapace with 2 sharp spines; second and third abdominal tergites with smaller spine on either side of mesial spine . . . . . M. serratifrons
12. Carapace with huge spine projecting dorsally from posterior gastric region, 2 anterior gastric spines and 3 median cardiac spines . . . . . M. spinosa
- Carapace without unusually large spines, but with denticulate tubercles . . . . . M. abbreviata
13. Rostrum armed laterally with 1 pair of spines . . . . . 14

Rostrum unarmed laterally . . . . . 15

14. Posterior margin of carapace armed with at least 1 pair of spines; gastric region with at least 3 prominent spines; second and third abdominal tergites each with 1 pair of medial spines . . . . . M. bradleyi

p. 92

Posterior margin of carapace unarmed; gastric region with only 1 pair of spines; second and third abdominal tergites each with a single median spine . . . . . M. cubensis

15. Rostrum more than 2/3 carapace length, strongly upcurved; antennal peduncle unarmed . . . . . M. curvirostra Whiteaves, 1874

Rostrum approximately 1/2 carapace length, not strongly upcurved; antennal peduncle spinose . . . . . M. simplex

p. 812

16. Second abdominal segment with distinct spine or protuberance near pleural margin . . . . . 17

Second abdominal segment without distinct spine or protuberance near pleural margin . . . . . 18

17. Rostrum broad and flat, terminally tridentate; third and fourth abdominal tergites unarmed . . . . . M. latifrons

p. 77

Rostrum excavate dorsally, not tridentate; third and fourth abdominal tergites each armed with expanded median tooth . . . . . M. longimanus

p. 130

18. Rostrum dorsally excavate, lateral margins subparallel at base between eyes, tapering distally; no anterolateral or lateral spines on carapace; no epipods on pereopods . . . . . 19

Rostrum not dorsally excavate, lateral margins tapering directly from base; sharp anterolateral spine and lateral spine on carapace; epipods on chelipeds and first 2 pairs of ambulatory

legs . . . . . M. abbreviata  
 (See description; this entrance in key is to account for  
 specimens in which gastric spination is obscure).

19. Dorsal surface of carapace strongly arched transversely; raised  
 portions coarsely tuberculate or scabrous . . . . . M. riveroi
- Dorsal surface of carapace not strongly arched transversely; raised  
 portions only moderately tuberculate or granulate . . . . .  
 . . . . . M. brevimanus
20. Dorsal surface of carapace with distinct spines, or at least 1  
 pair of tubercles on gastric region . . . . . 21
- Dorsal surface of carapace without distinct spines or pair of  
 tubercles on gastric region . . . . . 36
21. Eyestalk and cornea unarmed and without granular overgrowth . . 22
- Eyestalk or cornea with at least 1 spine, protuberance or granular  
 overgrowth . . . . . 25
22. Rostrum tridentate . . . . . 50
- Rostrum not tridentate . . . . . 23
23. Rostrum narrow, simply spine-like or with distal constriction and  
 obtuse teeth at base of constriction; frontal margin of cara-  
 pace without post-antennal spine . . . . . 24
- Rostrum broad, spade-shaped; frontal margin of carapace with post-  
 antennal spine . . . . . M. platirostris
24. Rostrum not simply spine-like, but with distal constriction, often  
 with obtuse teeth at base of constriction; gastric region of  
 carapace without distinct pair of sharp spines, but with pair  
 of obscure tubercles or spinules; lateral submarginal depres-  
 sions distinct on carapace . . . . . M. armata
- Rostrum simply spine-like; gastric region with distinct pair of

sharp spines; no distinct submarginal depressions on carapace  
 . . . . . M. reynoldsi (A. Milne Edwards, 1880)

25. Posterior margin of carapace armed with sharp spines or distinct  
 tubercles . . . . . 26

Posterior margin of carapace not armed with sharp spines or dis-  
 tinct tubercles . . . . . 29

26. Eyestalk with sharp conical spine projection from mesial surface of  
 cornea; no epipods on pereopods . . . . . 27

Eyestalk without sharp conical spine projecting from mesial surface  
 of cornea (but with toothed or squamous protuberance); epipods  
 on chelipeds and first 2 pairs of ambulatory legs . . . . . 28

27. Rostrum without lateral spines; frontal margin of carapace with  
 small post-antennal tooth M. sharreri (A. Milne Edwards, 1880)

Rostrum with 3 pairs of lateral spines; frontal margin without  
 post-antennal spine . . . . . M. bairdi (Smith, 1884)

28. Dorsal surface of carapace covered with regularly arranged, short,  
 sharp spines; frontal margin of carapace with post-antennal  
 spine . . . . . M. barbarae (Boone, 1927)

Dorsal surface of carapace not covered with spines, but with dis-  
 tinctive tuberosities, squamous, sometimes sharply granulate;  
 frontal margin of carapace without post-antennal spine . . .  
 . . . . . M. squamosa

29. Eyestalk with blunt tooth or granular overgrowth on mesial sur-  
 face of cornea . . . . . 30

Eyestalk with sharp conical spine projecting from mesial surface  
 of cornea . . . . . 31

30. Rostrum spade-shaped, constricted between eyes, lateral margins

p. 35b



granulate; granular overgrowth on mesial surface of cornea;  
epipods on chelipeds and first pair of ambulatory legs . . . .  
. . . . . M. granulens

Rostrum broadly triangular, not constricted between barely visible  
eyes, lateral margins serrate; blunt mesial protuberance on  
eyestalk; no epipods on pereopods . . . . .  
. . . . . M. aries (A. Milne Edwards, 1880)

31. Body covered with dense pubescence, or carapace spinulate with no  
prominent gastric spines; cornea small . . . . . 32

Body not covered with unusually dense pubescence; carapace with at  
least 1 distinct pair of gastric spines; cornea not unusually  
small . . . . . 33

32. Carapace not densely pubescent, without distinct gastric spines;  
anterior half of carapace with many small spinules distributed  
evenly over dorsal surface; base of rostrum between eyes broad-  
er than length of rostrum; no epipods on chelipeds . . . . .  
. . . . . M. sundi Sivertsen and Holthuis, 1956

Carapace densely pubescent, with 1 pair distinct gastric spine;  
carapace not spinulate; base of rostrum between eyes narrower  
than length of rostrum; epipods on chelipeds . . M. bermudezi p. 8

33. Carapace relatively smooth except for single pair of gastric  
spines; eyestalks usually with large mesial spine and shorter  
lateral spine on cornea . . . . . 34

Carapace with many spines or flattened, denticulate tubercles; eye-  
stalks usually with mesial spine, but without lateral spine  
on cornea . . . . . 35

34. Carapace with anterolateral spine slightly smaller than post-antennal spine; lateral margin with 4 spines posterior to anterolateral; chelipeds approximately twice carapace length . . . . . M. similis p. 27

Carapace with anterolateral spine much smaller than post-antennal spine; lateral margin with 3 spines posterior to anterolateral; chelipeds approximately same length as carapace . . . M. nitida p. 27

35. Carapace with pair of large anterior gastric spines and several smaller spines; lateral margin with as many as 9 spines posterior to anterolateral spine . . . . . M. crassa p. 27

Carapace with pair of large anterior gastric spines only (other sculpturing on gastric region distinct, but not spinous); lateral margin usually with 4 (1 large and 3 small) teeth posterior to anterolateral spine . . . . . M. geveri p. 144

36. Eyestalks armed with at least 1 conical spine, protuberance or spinule on mesial, distal or lateral surface of cornea . . . 37

Eyestalks not armed with spines, protuberances or spinules on any surface of cornea . . . . . 41

37. Eyespine located centrally on distal surface of cornea . . . . . 38

Eyespine located on mesial or lateral surface of cornea, not centrally . . . . . 40

38. Anterolateral angle of carapace with small tooth or spine; frontal margin with slight rounded projection posterior to antenna, rarely bearing spine; length of eyespine less than 1/2 diameter of cornea; sternum armed with only 1 pair of sharp spines between coxae of chelipeds; second abdominal tergite with 2 transverse carinae . . . . . M. subspinoculata p. 35

Anterolateral angle of carapace without tooth or spine; frontal margin with small sharp post-antennal spine; length of eyespine at least 1/2 diameter of cornea; sternum armed with 2 pairs of sharp spines between coxae of chelipeds; second abdominal tergite with 1 transverse carina . . . . . 39

39. Lateral margins of rostrum straight, tapering directly from base to apex; rostrum with medio-longitudinal carina; carapace with irregular transverse sculpturing, setae arranged in transverse rows; length of eyespine almost equal to diameter of cornea . . . . . M. spinoculata p. 335

Lateral margins of rostrum subparallel proximally, slightly convex distally; rostrum acarinate; carapace smooth, no sculpturing or striae, setae not arranged in distinct transverse rows; length of eyespine approximately 1/2 diameter of cornea . . . . . M. ramahtaylorae p. 237

40. Rostrum bluntly triangular; eyes armed with small lateral protuberance; no epipods on chelipeds . . . . . 48

Rostrum broad, margins subparallel in proximal half, tapering distally; eyes armed with mesial, sometimes bifurcate, spine and lateral spinule; epipods on chelipeds . . . . . M. livida p. 186

41. Rostrum with sharp lateral spines or somewhat constricted in distal portion . . . . . 42

Rostrum without sharp lateral spines (sometimes minutely serrate), usually triangular or spine-like and not constricted in distal portion . . . . . 46

42. Rostrum with pair of sharp laterally-projecting spines; epipods present on first pair of ambulatory legs . . . . .

. . . . . M. expansa Benedict, 1902

- Rostrum without sharp laterally-projecting spines, but constricted in distal portion or tridentate; epipods not present on first pair of ambulatory legs . . . . . 43
43. Rostrum broad and flat, terminally tridentate . . . . . 44
- Rostrum not particularly broad and flat, not terminally tridentate, but constricted in distal portion, with or without teeth at base of constriction . . . . . 45
44. Epipods on chelipeds . . . . . M. acuminata Benedict, 1902
- No epipods on chelipeds . . . . . M. serricornis
45. Rostrum slightly constricted distally; spine lateral to eye beneath frontal margin of carapace almost as long as eyestalk; submarginal depressions not distinct on carapace; second and third abdominal tergites not unusually carinate . . . M. abdominalis
- Rostrum abruptly constricted distally, usually with obtuse teeth at base of constriction; spine lateral to eyes beneath frontal margin of carapace short compared to long eyestalks; lateral submarginal depression distinct on carapace; second and third abdominal tergites with strong rounded transverse carina . . . . . M. armata
46. Rostrum sharp, spine-like; posterior margin of carapace with 3-5 sharp spines; epipods on chelipeds only . . . . . M. sigsbei
- Rostrum bluntly triangular; posterior margin of carapace unarmed; epipods on chelipeds and first 2 pairs of ambulatory legs, or not present on any pereopods . . . . . 47
47. Eyes movable; no epipods on chelipeds or ambulatory legs . . . 48

- Eyes fused to rostrum; epipods on chelipeds and first 2 pairs of ambulatory legs . . . . . 49
48. Rostrum horizontal; antennular spines long, sharp, widely separated in dorsal view; distinct protuberance beneath frontal margin lateral to eye . . . . . M. impolita p. 169
- Rostrum slightly decurved; antennular spines adjacent or overlapping in dorsal view; no distinct protuberance beneath frontal margin lateral to eye . . . . . M. polita p. 22
49. Anterolateral tooth broad, directed anterolaterally, reaching base of rostrum; lateral margin with bifid tooth posterior to anterolateral tooth; dorsal surface of carapace punctate; chelipeds narrow (width approximately 1/10 length). . . . . M. espinis Benedict, 1902
- Anterolateral tooth small, directed anteriorly, not reaching base of rostrum; lateral margin without bifid tooth posterior to anterolateral tooth; dorsal surface of carapace not punctate; chelipeds massive (width 1/5 length) . . . . . M. gulfensis Pequegnat and Pequegnat, 1970
50. Chelipeds usually less than 2 1/2 times carapace length; manus broad with respect to length (length of manus = 4 times width); merus with 1 or 2 mesial spines proximally . . . . . M. tridens (A. Milne Edwards, 1880)
- Chelipeds usually more than 3 times carapace length; manus narrow with respect to length (length of manus = 6 times width); (smaller individuals with shorter, but more slender chelipeds) merus with 3 or 4 mesial spines prximally . . . M. transtridens p. 2

Munidopsis abbreviata (A. Milne Edwards, 1880)

Figures 1, 2

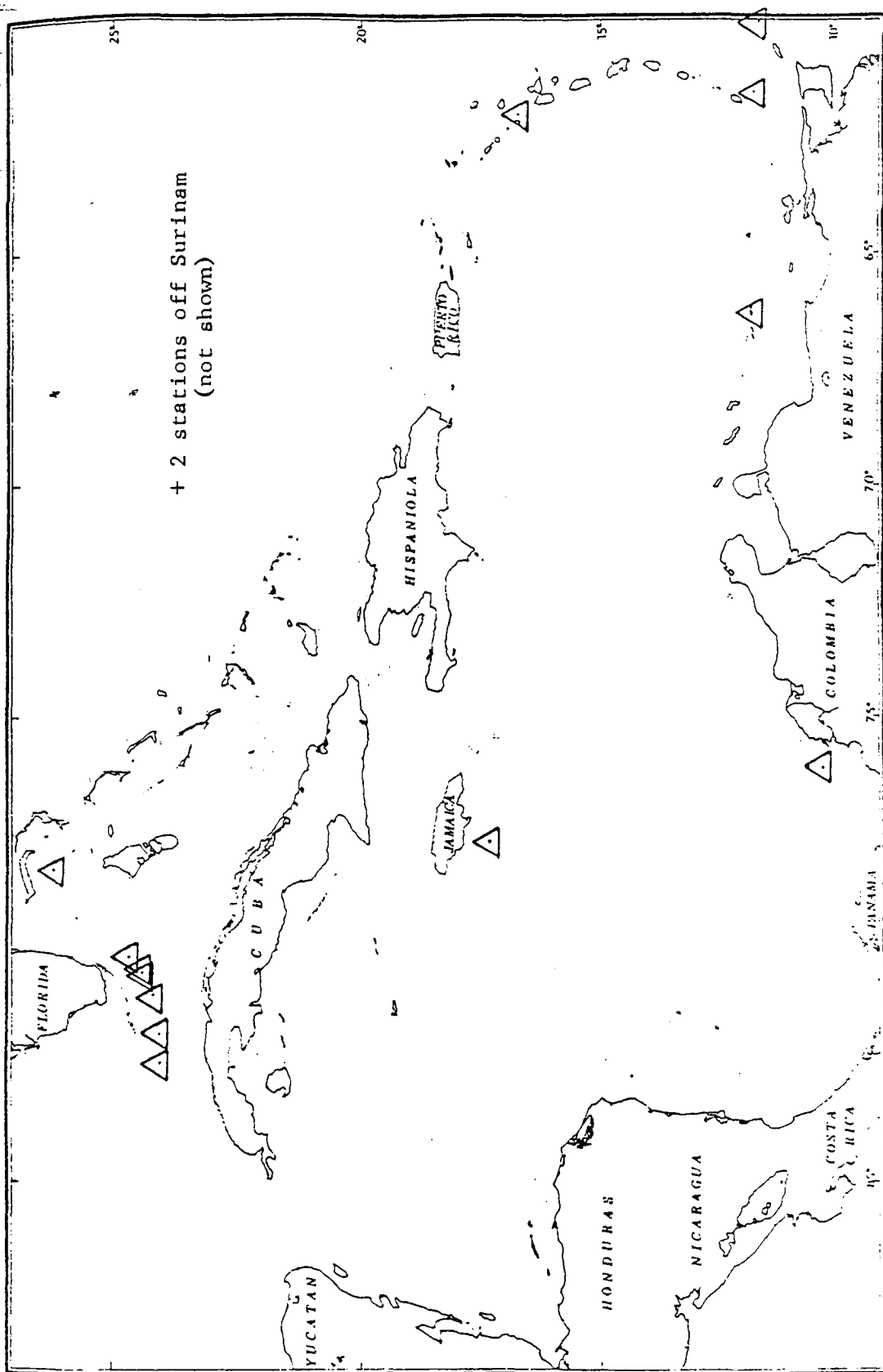
Galathodes abbreviatus A. Milne Edwards, 1880: 55.

Munidopsis abbreviata: A. Milne Edwards and Bouvier, 1894b: 275 (key);  
 1897: 91-93, pl V, fig. 1.--Young, 1900: 407 (key), 410.--Benedict,  
 1902: 277 (key), 315 (list).--Doflein and Balss, 1913: 174 (list),  
 177 (table).--Chace, 1942: 72 (key), 77-78.--Pequegnat and Peque-  
 gnat, 1970\* 138 (key), 140, table 5-2; 1971: 4 (key).\*

Munidopsis abbreviatus: Perez, 1927: 287.

Material examined.--Bahama Islands: G-193, 1190-1080 m, 1 ♀, 6.5 mm,  
 (USNM).--Straits of Florida: G-222, 824 m, 1 ♀, 12.6 mm, UMML 32:5207;  
 G-225, 805 m, 1 ♀, 17.6 mm, (USNM); G-226, 802-805 m, 1 ♀, 15.2 mm,  
 (RMNH); G-443, 729-829 m, 1 ♂, 20.0 mm, (USNM); G-860, 755-724 m, 2 ♀,  
 14.9, 19.0 mm, (RMNH); G-870, 807-755 m, 1 ♂, 21.5 mm, 1 ♀, 12.7 mm,  
 UMML 32:5208.--Off Atlantic coast of Colombia: P-381, 724-597 m, 2 ♂,  
 18.4, 31.8 mm, 1 ovigerous ♀, 18.7 mm, (USNM).--Off Surinam: P-675,  
 1235-1272 m, 1 ♂, 17.8 mm, (RMNH); P-682, 1318-1345 m, 1 ♀, 18.8 mm,  
 (USNM).--Off Venezuela (S of Orchilla): P-741, 1052-1067 m, 1 ♂, 20.7 mm,  
 (RMNH).--Off Tobago: P-847, 733-1281 m, 2 ♂, 14.3, 11.8 mm, 1 ♀, 16.2 mm,  
 UMML 32:5209; P-850, 800-924 m, 1 ♀, 5.0 mm, UMML 32:5210.--Off Guade-  
 loupe: P-946, 733-833 m, 2 ♂, 10.5, 13.6 mm, 1 ovigerous ♀, 21.7 mm,  
 UMML 32:5211.--S of Jamaica: P-1262, 805-1089 m, 1 ♂, 8.6 mm (with bran-  
 chial parasite), UMML 32:5212. See distribution plot 1.

Diagnosis.--Rostrum long, triangular, spine-like, slightly upturned dis-  
 tally; gastric region of carapace with several pairs of tubercles ar-



Distribution plot 1.--*Munidopsis abbreviata* (A. Milne Edwards) collected by the GERDA and PILLSBURY.

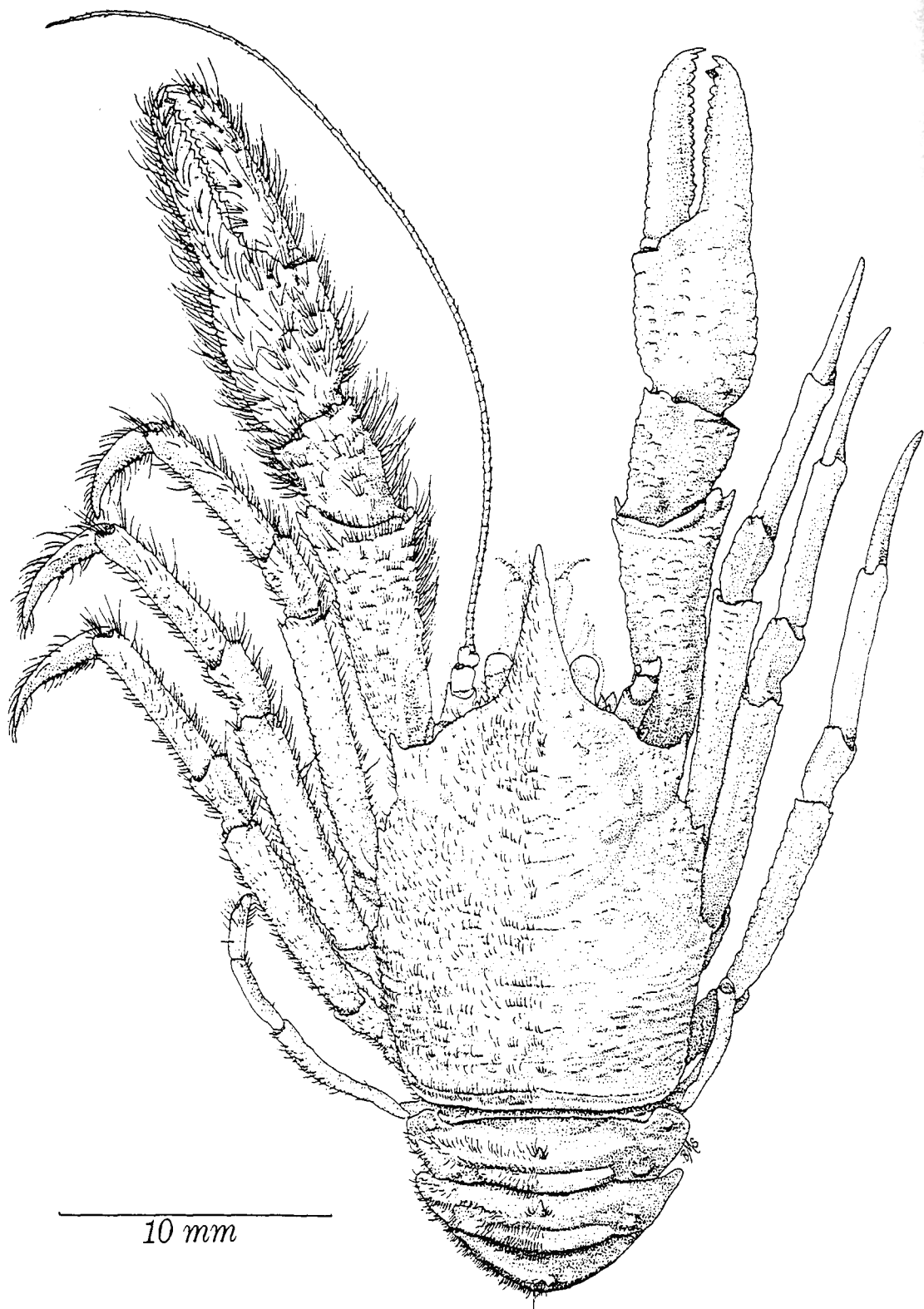


Figure 1. --*Munidopsis abbreviata* (A. Milne Edwards, 1880), ♂, cl. 14.3 mm, P-847, dorsal view.



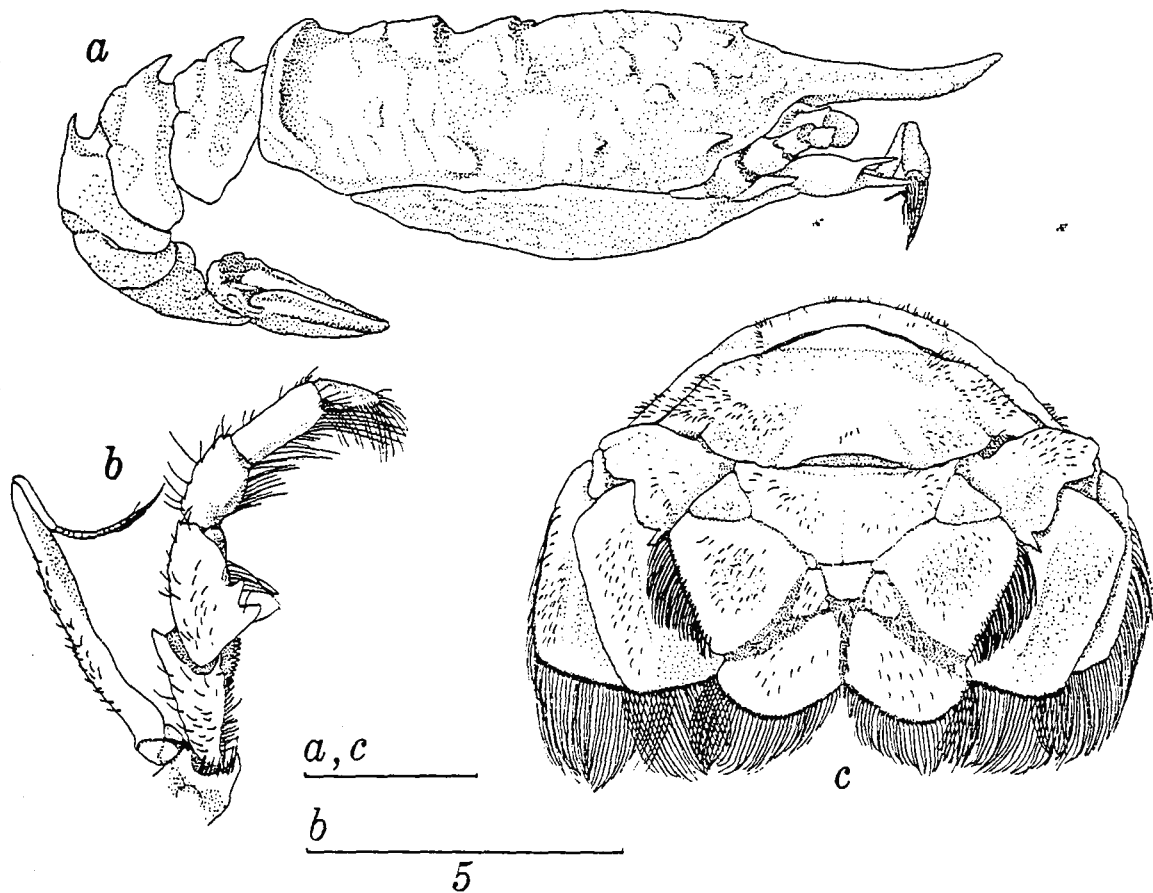


Figure 2. --Munidopsis abbreviata (A. Milne Edwards, 1880). ♂, cl. 14.3, P-847: a, lateral view of carapace and abdominal tergites, setae not shown; b, right third maxilliped. ♂, cl. 20.7 mm, P-741: c, posterior abdominal tergites, uropods and telson. Scales in mm.

anged symmetrically; frontal margin unarmed; anterolateral spine sharp; 1 spine and 1 tubercle on lateral margin; posterior margin unarmed; second, third and fourth abdominal tergites each with sharp median spine on anterior edge of first transverse carina; eyestalk without eyespines; epipods on chelipeds and first 2 pairs of ambulatory legs.

Description.--Carapace longer than broad ( $cw/cl = 0.85-0.90$ ); gastric region inflated, defined posteriorly by broad cervical groove extending across central  $1/2$  of carapace; postcervical groove shorter, slightly\* more distinct, separating metagastric and cardiac regions centrally; branchiocardiac grooves less distinct; anterior margin of cardiac region with raised ridge. Anterior gastric region with 1 pair of small tubercles at base in front of swelling followed by several small tubercles on front part; largest pair of widely-spaced tubercles anteriorly, occasionally developed into small spines; 3 or 4 other pairs arranged around gastric region; 1 distinct protuberance near center of each metabranchial region; occasionally tubercles and spines obscure or absent (especially on larger specimens); sculpturing variable, usually many short transverse striae, minutely tuberculate, more distinct in branchial regions near lateral margins. Rostrum approximately  $1/3$  carapace length, broad at base, with rounded dorsal carina often extending posteriorly onto gastric region; rostrum tapering distally with obscure constriction at slight upturn about  $2/3$  distance to apex, slightly sinusoidal in lateral view. Frontal margin without prominent spine between base of rostrum and anterolateral spine, irregularly and minutely dentate behind antenna. Lateral margin with 1 spine between branches of cervical groove, and protuberance behind lateral termination of posterior branch. Anterior margin

of raised posterior rim minutely tuberculate but otherwise unarmed.

Short setae arranged evenly over most surfaces.

Second, third and fourth abdominal tergites with sharp median spine on anterior transverse carina; second and third tergites with additional transverse carina; fifth and sixth tergites and posterior part of fourth tergite smooth; short setae on most surfaces, particularly edges and margins of carinae. Anterior lobe of plueron of second tergite with small rounded protuberance; similar, larger protuberance mesial to this near posterior margin of second, third and fourth segments.

Sternum unarmed; short setae on distinct intersegmental ridges and scattered evenly on segments.

Eyestalks movable, unarmed; slightly broader at base; cornea not inflated; short setae dorsally near base of cornea.

Sharp conical tooth projecting anteriorly from intersection of bases of eyestalk, antennule and antenna.

Basal segment of antennular peduncle with lateral swelling, scattered small protuberances on anterior part of swelling, 2 sharp spines, 1 above the other, projecting from dorsolateral surface of segment anteriorly, most dorsal spine more slender, often with slight inward curve, distal ventromesial margin dentate. Antennular peduncle when extended reaching just beyond tip of rostrum.

Basal segment of antennal peduncle broad with blunt triangular ventromesial tooth projecting forward. Second segment with blunt conical lateral spine on distal margin, and small lobe mesiad. Distal margin of third segment dentate dorsoventrally and mesially. Fourth segment with dorsolateral projection and ventrolateral margin dentate. Antennal flagellum nearly 3 times carapace length.

Carpus of endopod of third maxilliped with several setae associated with low rounded protuberances on extensor margin. Merus with 2 sharp teeth on proximal flexor margin, distal and extensor margins with low rounded protuberances. Dorsal and ventral angles at distal margin of ischium sharp, but not expanded into prominent teeth; mesial margin dentate.

Pereiopods with low sculpturing similar to that of carapace. Epiopods on chelipeds and first 2 pairs of ambulatory legs.

Chelipeds 1 1/2 to 2 times carapace length. Dactylus more than 1/2 length of manus. Fingers straight, abutting or nearly abutting dorsally along entire margin in all but largest males, toothed on opposing margins, teeth increasing in size distally; palm slightly inflated, broader than width of fingers, mesial surface with small tuberculate crests, lateral edge with several small protuberances, but no distinct spines. Carpus approximately 1/3 length of chela; distal margin with sharp triangular tooth at ventral articulation; dorsal surface usually with 1 small tooth or spine in center of short tuberculate ridge on dorsal surface between sharp mesial and lateral spines; dorsomesial edge slightly inflated, moderately sculptured, small protuberance on dorsolateral surface, Merus slightly more than twice length of carpus, shorter than chela; sharp spine at each of 4 angles near distal margin: 1 sharp spine ventromesially near middle of segment. Ischium with dorsal protuberance near distal margin.

Second, third and fourth pereiopods similar. Tip of dactylus of second pereiopod reaching to fingers of chela; dactylus of third and fourth pereiopods each reaching beyond distal margin of propodus of preceding leg. Dactylus gently curved with corneous tip; 8 or 9 small

teeth on proximal half of flexor margin with corneous spinule or short stiff seta emerging from distal edge of each tooth, decreasing in size proximally. Propodus only slightly longer than dactylus, somewhat laterally compressed; distal ventral margin with 2 small movable spines emerging from pair of lobes, small protuberances arranged over all surfaces of segment, but no spines. Carpus approximately 1/2 length of propodus; single sharp dorsal spine on each distal margin of second and third pereopods, reduced to minute tooth or absent on fourth pereopod, dorsal and dorsolateral edges raised slightly. Merus longer than propodus; distal margin with mesial toothed crest, smooth dorsal lobe and lateral tooth (less distinct on fourth pereopod). Second and third pereopod each with blunt projection dorsally on distal margin of ischium.

Fifth pereopods with merus slightly expanded; exposed surface sculptured with small protuberances.

Uropod with posterolateral margin of protopod scalloped, small notch and sharp tooth posteriorly. Posterior margins of endopod and exopod with denticles at bases of marginal setae.

Telson consisting of 10 plates, smooth, maximum width greater than length.

Color.--The color of a large ovigerous female before preservation was generally light yellowish tan on the dorsal surface of the carapace, at the lateral edges of the abdominal segments and on the tailfan. The rostrum and all pereopods were orange-tan. The anterior edges of the tergites (which fit beneath preceding segment) and the ventral surface of the thorax were white. The eggs were deep translucent orange.

Size.--Specimens collected by the GERDA and PILLSBURY had the following size ranges: ♂, cl. 8.6 - 31.8 mm,  
 ♀, cl. 5.0 - 21.7 mm, and  
 ovigerous ♀, cl. 18.7 - 21.7 mm.

Specimens reported previously, collected by the BLAKE and ATLANTIS fall within these ranges.

Sexual dimorphism.--Large males (cl. greater than 10 mm) have the characteristic row of thick golden setae on the margin of the lateral plates of the telson, while small males and females have few, in any, regular marginal setae in this location. Perez (1927:287) mentioned a female having a fringe of plumose setae (the row of thick setae on males of other species is referred to as a "comb" in his work). The smallest male, cl. 8.6 mm, examined has no setae on this margin; a larger one, cl. 10.5 mm, has a row of short thick setae; on the largest males, the setae are thick, dense and longer.

While most males and females have the fingers of the cheliped abutting along their entire margins (no gape), the 2 largest males (cl. 31.8, 21.5 mm) have the fingers slightly gaped at the base; a smaller male (cl. 20.7 mm) has no gape, nor does the largest female specimen (cl. 21.7 mm).

Habitat.--At stations in the Straits of Florida where M. abbreviata was taken, the bottom type was pteropods, shells and rocks with alcyonarians and sponges. The bottom was fine white mud at the GERDA station in the Bahamas, and green-brown mud at the PILLSBURY station near Colombia.

Types.--Deposition of the holotype not determined; perhaps at Paris

Museum. ♀, one of syntypes, cl. 11 mm (from lit.).

Type locality.--BLAKE station 195, Martinique, 917 m (first station listed).

Geographic range.--Munidopsis abbreviata is known in the western Atlantic from the Straits of Florida and the Bahamas south to Surinam, in the Caribbean along the north coast of South America, and in the northwestern Gulf of Mexico.

In addition to the type locality and the locations listed for the material examined, M. abbreviata has been reported in the literature from the following localities: off Guadeloupe (A. Milne Edwards and Bouvier, 1897:93); north coast of Cuba (Chace, 1942:77); and from the northwestern Gulf of Mexico (Pequegnat and Pequegnat, 1970:140).

Bathymetric range.--The possible depth range for material in this collection is 597-1345 m; calculated range is 724-1318 m. The possible range recorded previously was 917-1347 m.

Parasites.--A small male specimen taken at PILLSBURY station 1262 had a small bopyrid parasite in the left branchial cavity. This was identified as Pseudione sp., similar (but not identical) to P. galacanthae Hansen.

Associates.--Munidopsis abbreviata was taken at 15 stations by the GERDA and PILLSBURY, and at 6 of these stations Munidopsis sigsbei was also collected.

Relationships.--Munidopsis abbreviata bears some resemblance to M. simplex also from the western Atlantic, but the latter is a much smaller

species with sharp dorsal spines on the carapace, a narrower rostrum and no epipods on the pereopods. M. abbreviata shares several characters with M. gilli from the Bahamas: epipods on the chelipeds and first 2 pairs of ambulatory legs, a central spine on the second, third and fourth abdominal tergites, and irregular armature of the carapace. M. gilli is a larger species having the rostrum more strongly upturned with distinct lateral spines; however, M. abbreviata may be more closely related to M. gilli and some other species with 3 pereopodial epipods (M. cubensis and M. camelus) than to the superficially more similar species having different arrangements of the epipods (M. abbreviata has the rostrum upturned and occasionally armed see remarks ).

M. abbreviata also looks somewhat like M. chuni Doflein and Balss from the west coast of Africa, but the latter has sharp carapacial spines rather than denticulate tubercles.

A. Milne Edwards and Bouvier (1897:93) and Faxon (1895:87) have referred to the apparent close relationship of M. abbreviata and M. villosa Faxon from the Gulf of Panama. Faxon listed the differences between the 2 species as follows: in Munidopsis villosa

"...the tubercles and ridges of the carapace are more pronounced and the whole surface of the animal more hairy. The frontal border is armed on each side with a sharp spine, which is wanting in M. abbreviata. The median dorsal spine on the fourth abdominal somite is obsolete, while the fifth somite bears a well-developed acute spine, like those on the second and third somites. In M. abbreviata the fifth somite is unarmed. The distal half of the rostrum is curved upward much more strongly in M. villosa than



it is in M. abbreviata.

"Munidopsis villosa is represented by a single specimen in the "Albatross" collection. It is very much larger than the type specimen of M. abbreviata from the "Blake" dredgings, and it is possible that the peculiarities above specified may be due to age or individual variation. But I think it more probable that we have to do with two closely allied or representative species "on the Atlantic and Pacific sides of the continent."

A large specimen (cl. 31.8 mm) of M. abbreviata in this collection demonstrates that the above differences are not due to age, but are consistent between the species.

Remarks.--The degree of upturn of the rostrum varies among the individual specimens from nearly horizontal to distinctly flexed distally. This character does not appear to be related consistently to size or sex. A few specimens have a small spine on one side of the rostrum near the upturn.

The size and nature of the gastric tubercles also varies among individuals from a pair of small distinct gastric spines to obscure tubercles; the pair of tubercles or knobs on the front slope of the gastric swelling are more constant.

Munidopsis abdominalis (A. Milne Edwards, 1880)

## Figure 3

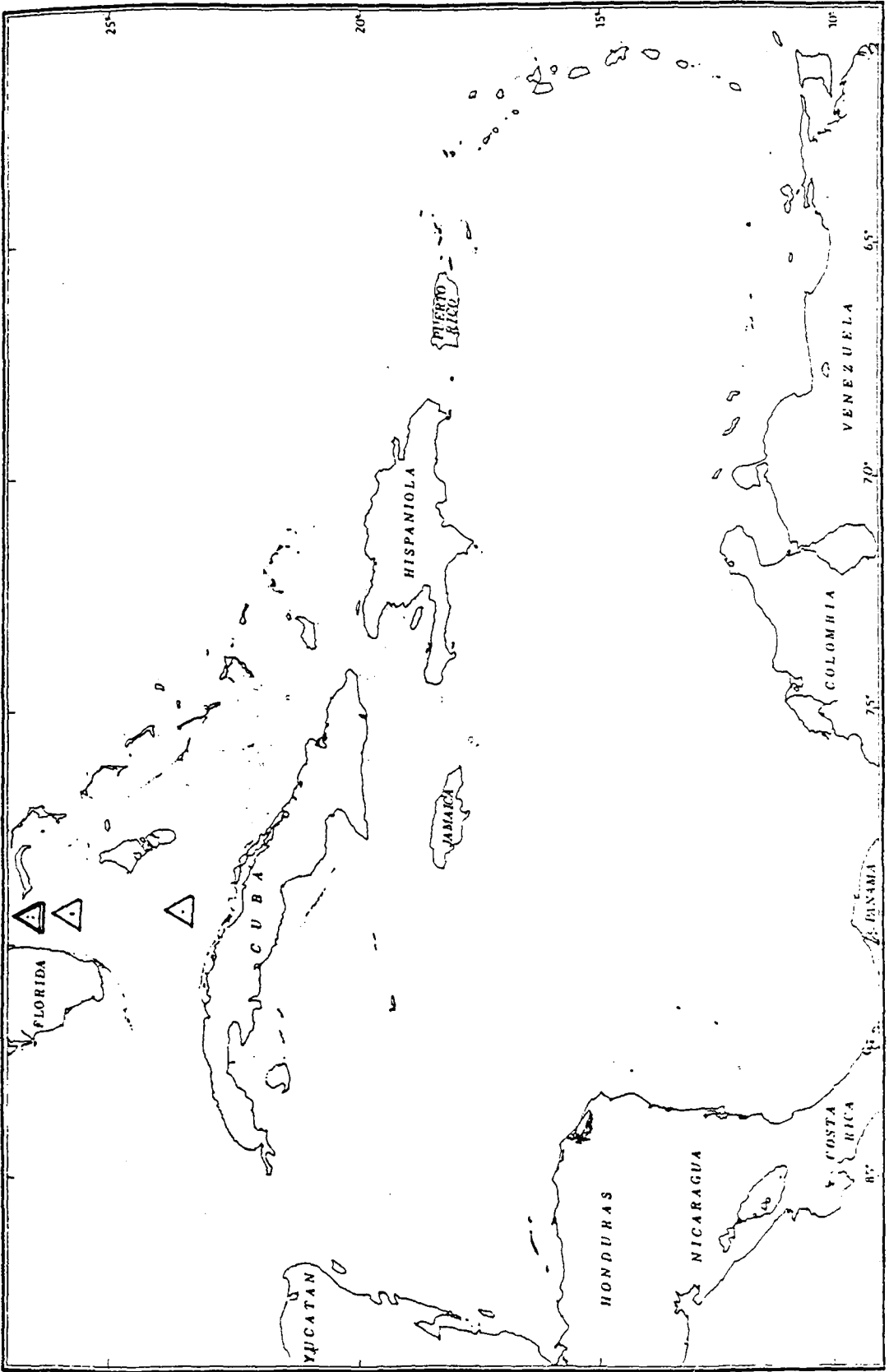
Elasmonotus abdominalis A. Milne Edwards, 1880: 61.--A. Milne Edwards and Bouvier, 1894b: 280, 281, 282 (key); 1897: 101-103, pl. VIII, figs. 7-10.--Young, 1900: 414 (key), 415.--Perez, 1927: 288.

Munidopsis abdominalis: Benedict, 1902: 315 (list).--Doflein and Balss, 1913: 174 (list), 177 (table).--Chace, 1942: 75 (key), 98-99.--Pequegnat and Pequegnat, 1970: 140 (key); 1971: 6 (key).

Material examined.--Straits of Florida: G-158, 531-540 m, 1 ♂, 8.5 mm, 3 ovigerous ♀, 7.0-9.8 mm, UMML 32:5213; G-301, 622-648 m, 1 ♀, 5.7 mm, UMML 32:5214; G-635, 458-480 m, 1 ♀, 6.7 mm, UMML 32:5215.--Santaren Channel: G-1015, 516-525 m, 1 ♀, 4.0 mm, UMML 32:5216. Distribution plot 2.

Diagnosis.--Rostrum long, unarmed, spine-like, broad basally with distal constriction and sharp point, slightly upturned distally; gastric region of carapace unarmed; frontal margin unarmed but with long spine beneath frontal margin between eyestalk and antenna; anterolateral spine small but distinct; lateral and posterior margins unarmed; abdomen unarmed; eyestalks unarmed; no epipods on chelipeds or ambulatory legs.

Description.--Carapace length approximately equalling maximum width, generally quadrangular, slightly wider anteriorly; dorsal surface densely granulate or tuberculate, height of tubercles varying, tubercles frequently with dentate anterior edge; transverse grooves not distinct across carapace, more visible near lateral margins; regions of carapace discernible but not well-defined; gastric, metagastric and cardiac



Distribution plot 2.--*Munidopsis abdominalis* (A. Milne Edwards, 1880) collected by the GERDA.

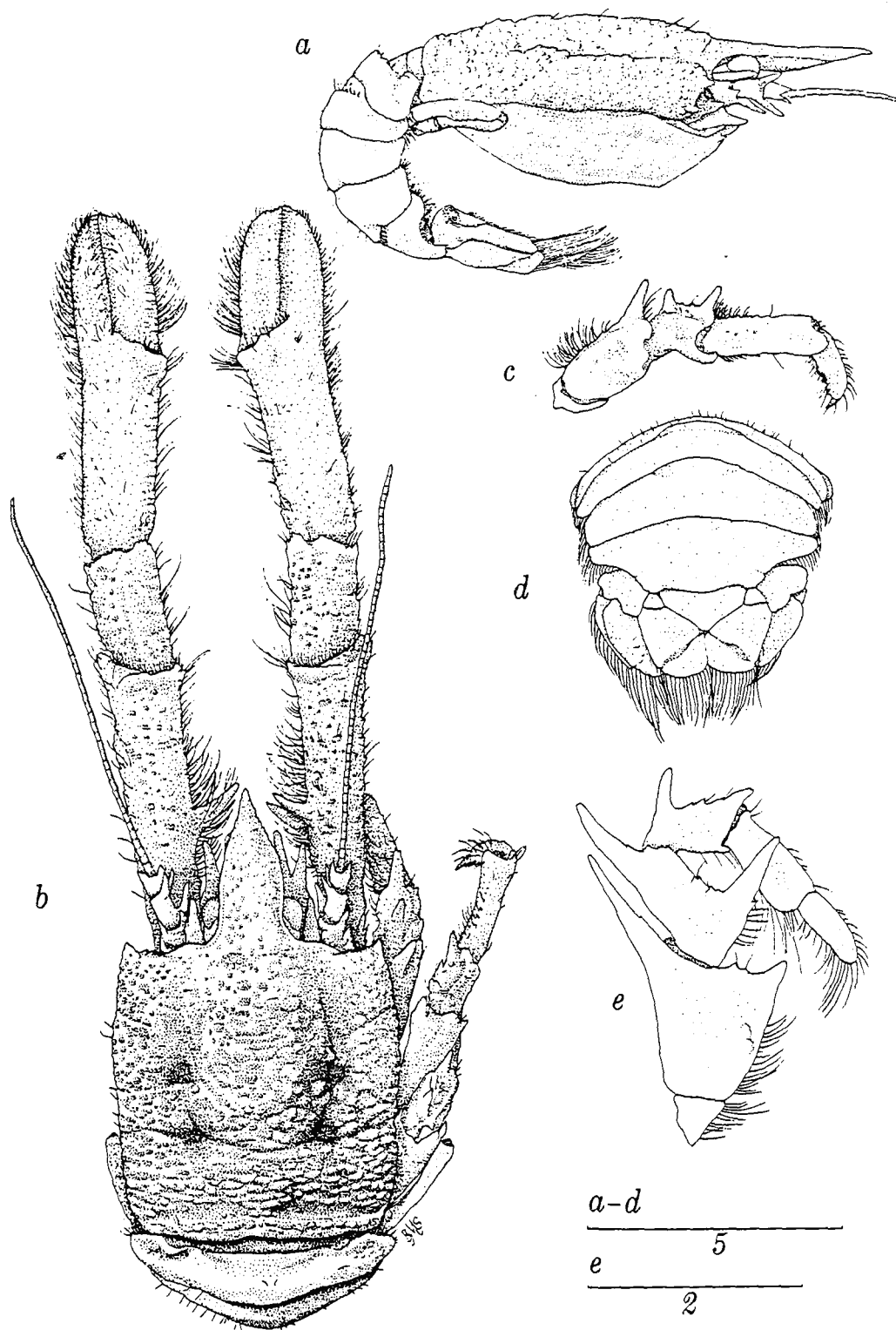


Figure 3. --Munidopsis abdominalis (A. Milne Edwards, 1880). ♀, cl. 5.7 mm, G-301: a, lateral view of carapace and abdominal tergites; b, dorsal view; c, right third pereopod, lateral view; d, posterior abdominal tergites, uropods and telson. ♀, cl. 7.0 mm, G-158: e, endopod of right third maxilliped. Scales in mm.

regions slightly inflated, appearing as continuous medial convexity; 4 rounded deep depressions without sculpturing in surface of carapace: 1 on either side of posterior mesogastric region, and 1 on either side of mesogastric region; depressions giving slightly swollen appearance to surface of carapace lateral and posterior to them; smooth areas preceding posterior margin on either side of midline. Rostrum approximately  $\frac{2}{3}$  carapace length; width at base slightly more than  $\frac{1}{4}$  carapace width, lateral margins smooth, parallel to slightly concave in proximal half; lateral margins denticulate in distal half tapering to acute apex, with smooth gentle upward flexure, more pronounced in females and larger specimens; upper surface with flattened tubercles in proximal half, becoming slightly carinate toward apex; ventral surface smooth with low rounded carina. Frontal margin curving smoothly from base of rostrum to behind antenna, unarmed, but with long sharp immovable spine emerging from between bases of antenna and eyestalk; this spine curved mesially, with denticle on lateral surface  $\frac{1}{2}$  distance to apex; lateral  $\frac{1}{4}$  of frontal margin forming sharp denticulate edge. Anterolateral tooth small, distinct; surface beneath and behind spinulate. Lateral margins rounded, sculptured but unarmed, nearly straight except for obscure indentations at lateral terminations of cervical grooves. Posterior margin slightly concave, sculptured but unarmed; transverse ridge interrupted at midline.

Second abdominal tergite with smooth transverse carina extending nearly to lateral margins, anterior half of pleuron with spiniform granules. Transverse carina on anterior part of third tergite not as distinct; pleura smooth. Fourth, fifth and sixth tergites smooth.

Sternum unarmed, tuberculate on anterior projection between bases of chelipeds; intersegmental grooves distinct.

Eyes small, colorless, movable; cornea no wider than eyestalk.

Basal segment of antennular peduncle with 2 long spines distolaterally and 2 short small spines ventromesially on distal edge. Several denticles on ventrolateral surface. Extended flagellum barely reaching apex of rostrum.

Basal segment of antenna with short lateral spine and long ventral projection. Second segment with short lateral spine and long ventromesial spine. Third segment longer, with long ventral and dorsomesial spines. Last segment with shorter ventromesial and dorsolateral spines. Antennal flagellum longer than carapace, usually reaching to articulation of carpus and manus of cheliped.

Carpus of endopod of third maxilliped with conical spine dorsally near distal margin, longer spine near articulation with merus and mesial tuft of setae. Merus with long distal spine on extensor margin; ventral (flexor) margin with long sharp spine basally and several denticulate tubercles distally and on ventrolateral surface, occasionally 1 tubercle developed into major or minor spine. Ischium with long slender spine at dorsal angle of distal margin, broader spine at ventral angle; mesial margin dentate; ventroalteral surface with several low denticulate tubercles near ventral angle.

Pereiopods with denticulate tubercles, sculpturing more distinct on dorsal and lateral surfaces and on proximal segments. No epipods on chelipeds or ambulatory legs.

Chelipeds 2 to 3 1/2 times carapace length, slightly flattened dorsoventrally. Width of manus in male more than 1/3 length; width in female approximately 1/4 length at widest point near articulation with dactylus. Dactylus less than 1/2 length of manus. Fingers toothed on

opposing margins with slight gape proximally, but abutting most of length dorsally in female; gape pronounced in male; fingers hollowed out ventrally, tips curved, strongly spooned, dense fringe of short setae on lateral margins of fingers. Manus and carpus sculptured but unarmed, projection on carpus at articulation with propodus distinctly dentate in male. Carpus approximately  $1/3$  length of chela. Merus approximately same length as carapace, distal margin with small sharp ventromesial tooth; proximal part of mesial surface with many long setae and 1 to 6 or 7 (frequently 3) sharp conical spines, often extending in irregular row along dorsal edge of segment. Ischium with heavy dorsal tooth; sharp spine on ventral projection often followed by smaller spines or teeth proximally.

Second, third and fourth pereopods similar, short, broad. Dactylus almost as long as propodus, curved, with corneous brown tip followed on ventral margin by series of blunt teeth with broad corneous spinules projecting from anterior edge of each; longitudinal marginal band of short plumose setae. Propodus tuberculate on extensor surface; flexor margin with dense band of short plumose setae originating near distal end of segment, becoming thicker proximally; setae extending over much of mesial surface of second pereopod. Tuft of similar setae on distoventral lobe of carpus; carpus approximately  $1/2$  length of propodus, with prominent spine near distal end on dorsal (extensor) margin; second prominent spine near proximal end with several spinulate tubercles between spines and several more proximal to second spine; longitudinal denticulate ridge lateral to dorsal edge. Merus approximately same length as propodus, with prominent distal spine on expanded dorsal edge followed by series of small teeth decreasing in size to obscurity proximally; lateral

surface rounded, with denticulate tubercles.

Merus of fifth pereopods expanded ventrally, exposed surface tuberculate.

Uropods with posterolateral margin of protopod scalloped, surface smooth. Endopod and exopod with low tubercles and/or short immovable calcified setae on exposed surfaces.

Telson consisting of 7 plates, smooth, obscurely punctate; posterior margin with deep medial indentation.

Color.--The specimens examined were preserved in alcohol and had no traces of pigment. No records of color for this species were found in the literature.

Size.--Specimens collected by the GERDA showed the following sizes:

♂, cl. 8.5 mm,

♀, cl. 4.0-9.8 mm, and

ovigerous ♀, cl. 7.0-9.8 mm.

Sexual dimorphism.--The male examined (cl. 8.5 mm) has the characteristic "comb" of thick golden setae on the lateral margins of the telson; setae are sparse and slender in this location on the females. (Perez, 1927:288, described the females as having flexible plumose setae in this location; he had not seen males). The cheliped of the male is broader and generally more setose than those of the females; the fingers are distinctly gaped basally in the male, while they are in contact along most of their length dorsally in females. The male and the 2 smallest females (cl. 4.0, 5.7 mm) have the rostrum nearly straight, while the larger females have the rostrum gently flexed upward.



Habitat.--The bottom at 2 of the stations where M. abdominalis was collected was characterized by sea urchins at one, and corals and alcyonarians at the other.

Types.--One of the ovigerous female syntypes is housed at the MCZ; the deposition of the other was not determined, but it is probably at the Paris Museum. One of the syntypes has cl. approximately 8.0 mm.

Type locality.--BLAKE sta. 291, Barbados, 366 m (200 fm).

Geographic range.--Munidopsis abdominalis is known in the western Atlantic from the Straits of Florida south to St. Kitts, and in the Caribbean off Cuba and the Lesser Antilles.

The only records of this species besides the type locality and the locations of the material presented herein are those given by Chace (1942:98-99) based on material from near the north and south coasts of Cuba and off St. Kitts.

Bathymetric range.--The possible depth range for material in this collection is 458-648 m; calculated range is 480-622 m which extends the range somewhat deeper than previous reports of 366-458 m.

Parasites.--None of the material examined showed any external evidence of branchial or abdominal parasites. No records of such parasites on this species were found in the literature. The male specimen (cl. 8.5 mm) from G-158 had several epizoans attached to the third maxilliped and tip of the cheliped; these were identified as hydrozoans, probably belonging in the family Campanulariidae.

Associates.--Munidopsis abdominalis was collected by the GERDA at only

4 stations; no significant association was observed between this and other species of Munidopsis.

Relationships.--A. Milne Edwards and Bouvier (1897:103) mention close affinity between M. abdominalis and M. miersii (Henderson) from Fiji in the western Pacific, but they point out that the latter species has a shorter rostrum, gastric tubercles and different armature on the merus of the third maxilliped. The arrangement of epipods in M. miersii could not be determined from the literature.

Among western Atlantic species, M. abdominalis superficially resembles M. granulens Mayo, but the latter can be distinguished easily by the shorter, differently-shaped rostrum, sculptural differences, the presence of epipods on the pereopods and many other characters.

Remarks.--Chelipeds are equal in all 4 complete specimens examined (in contrast to those of the female described by A. Milne Edwards and Bouvier, 1897:102).

The ovigerous females carried the following numbers of eggs:

cl. 9.8 mm, approximately 40 eggs, all about 1 mm in diameter,

cl. 9.2 mm, approximately 25 eggs, all smaller than 1 mm,

cl. 7.0 mm, with 9 eggs, all smaller than 1 mm in diameter.

Munidopsis alaminos Pequegnat and Pequegnat, 1970

Figures 4, 5

Munidopsis alaminos Pequegnat and Pequegnat, 1970: 140 (key), 142-145, figs. 5-1, 5-5 - 5-7, tables 5-2, 5-4; 1971: 6 (key), 18, fig. 11.

Material examined.--Off Atlantic coast of Panama, Gulfo de los Mosquitos:

P-447, 657-673 m, 1 ♂, 9.2 mm, 1 ovigerous ♀, 11.2 mm, UMML 32:5221.--

Off Yucatan, Mexico: P-607, 715-787 m, 2 ♂, 4.5, 8.6 mm, 1 ovigerous ♀, 9.9 mm, (USNM).--Off Guadeloupe: P-920, 531-733 m, 3 ♀, 5.9-7.5 mm. (2

with branchial parasites, 1 with abdominal parasite), UMML 32:5217.--

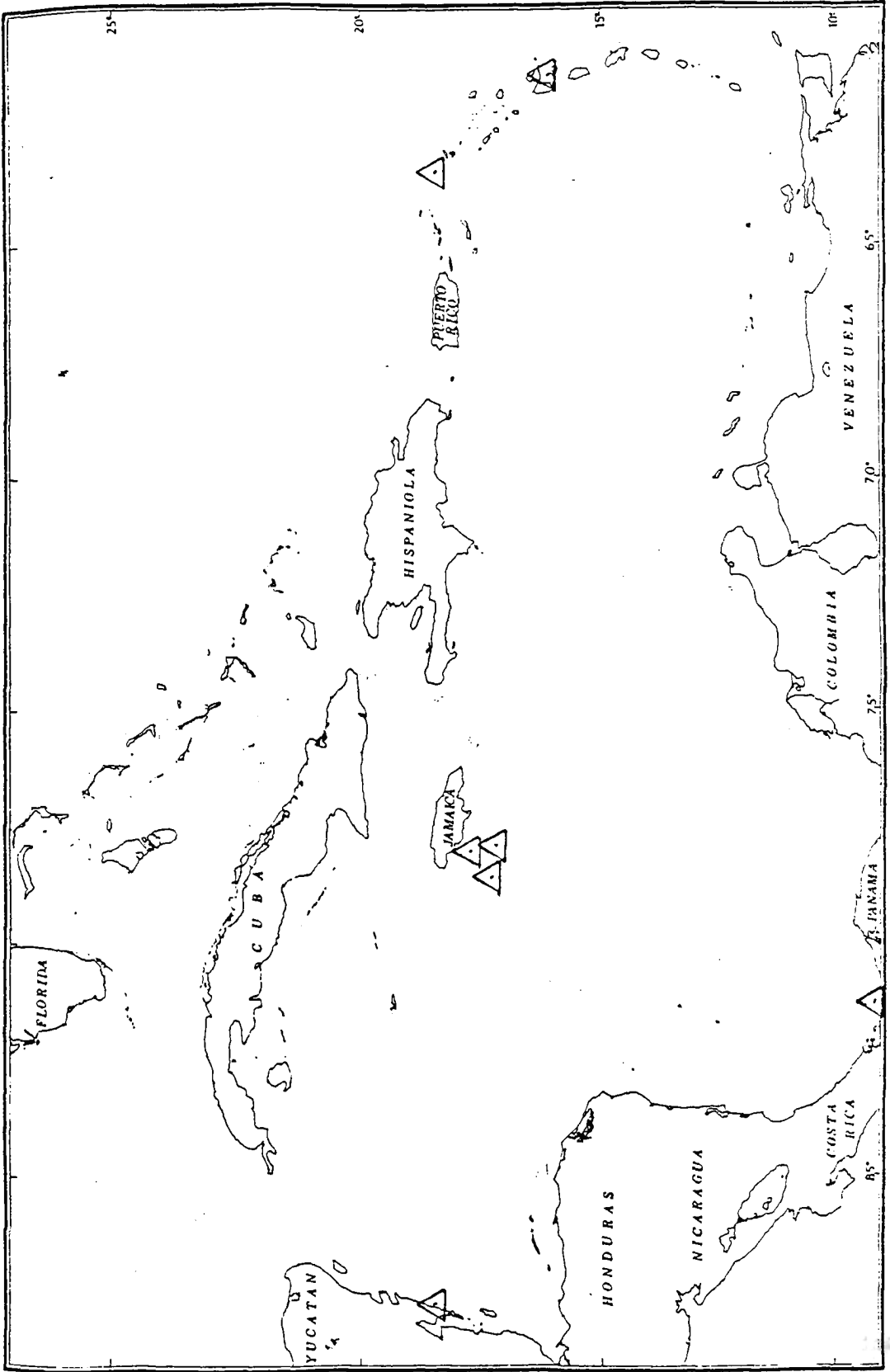
NW of Anguilla: P-988, 686-724 m, 2 ♂, 7.0, 418 mm (with abdominal parasite), 1 ♀, 8.2 mm (with abdominal parasite), UMML 32:5218.--S of Jamai-

ca: P-1225, 457-558 m, 1 ovigerous ♀, 7.5 mm, UMML 32:5219; P-1255, 622-823 m, 1 ♀, 7.9 mm, (RMNH); P-1261, 595-824 m, 1 ♀, 10.0 mm (RMNH).

See distribution plot 3.

Diagnosis.--Rostrum horizontal; triangular, armed with many spinules or denticles on dorsal and lateral surfaces; dorsal surface of carapace with many sharp spinules; frontal margin with spinulate lobe behind antenna, but no large spine; posterior margin spinulate; abdominal segments spinulate, second and third each with medial expansion; eyestalks with several spinules, cornea small; no epipods on chelipeds or ambulatory legs.

Description.--Carapace slightly longer than broad ( $cw/cl = 0.90$ ), generally quadrangular, dorsal surface spinulate; gastric and cardiac regions inflated, with central conical swellings; smooth transverse depression anterior to gastric region accentuating irregular transverse swellings on either side of midline in anterior gastric region; hepatic and



Distribution plot 3.--Munidopsis alaminos Pequegnat and Pequegnat, 1970 collected by the PILLSBURY.

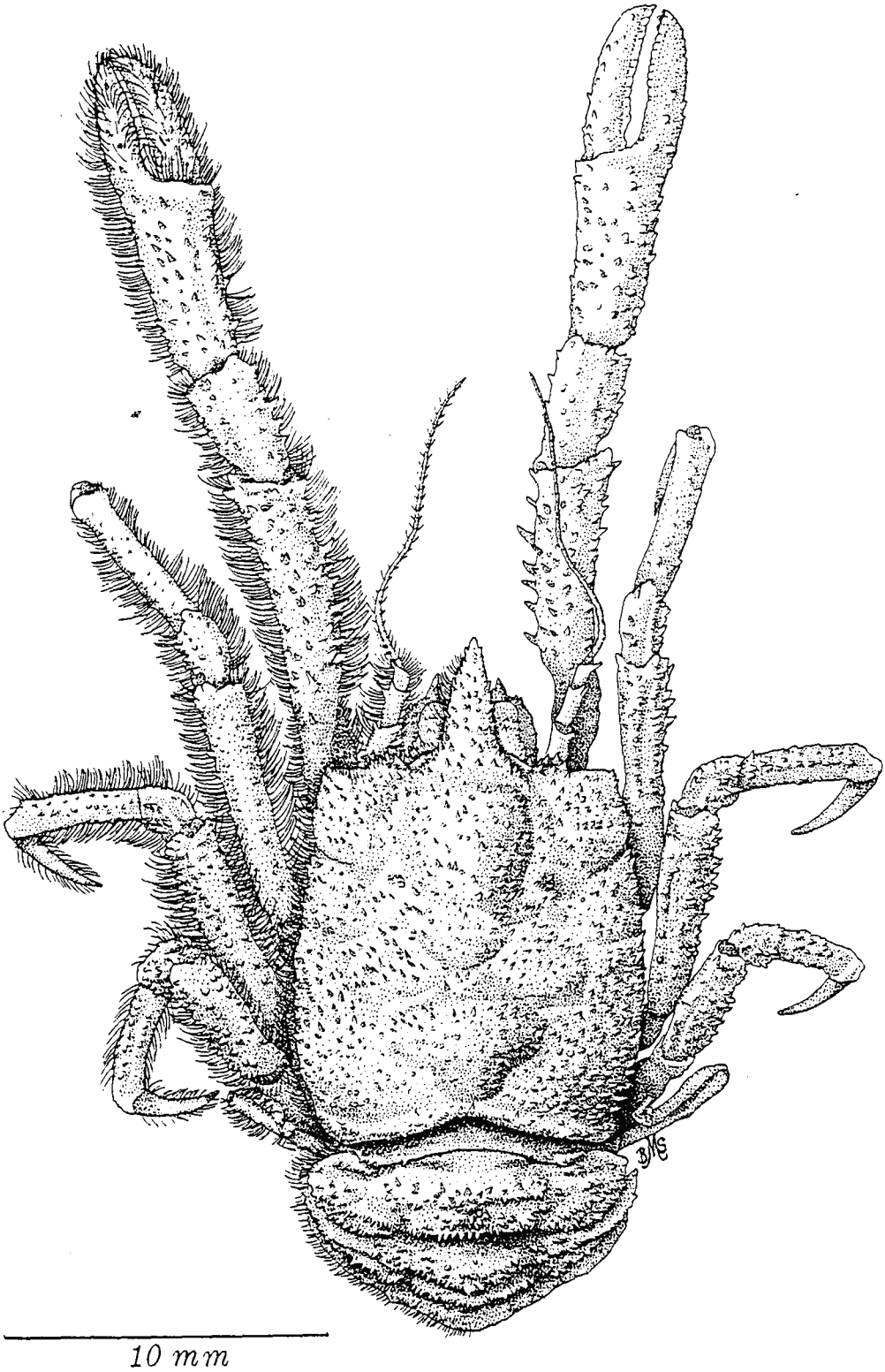


Figure 4. --Munidopsis alaminos Pequegnat and Pequegnat, 1970, ovigerous ♀, cl. 11.2 mm, P-447, dorsal view.

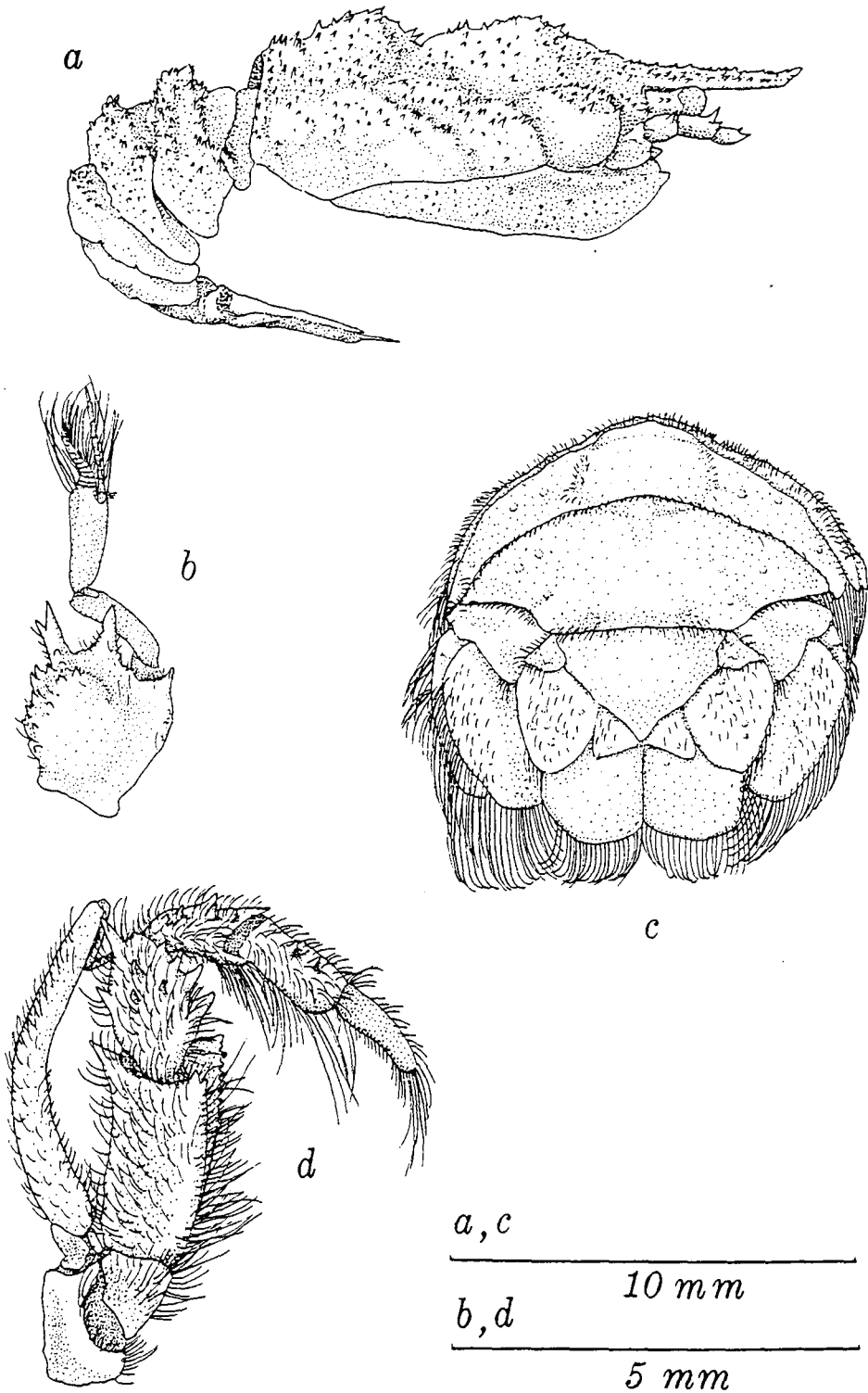


Figure 5. --Munidopsis alaminos Pequegnat and Pequegnat, 1970. ♂, cl. 9.2 mm, P-447: a, carapace and abdomen, lateral view, setae not shown; d, right third maxilliped, ventrolateral view. Ovigerous ♀, cl. 11.2 mm, P-447: b, right antennular peduncle, ventrolateral view; c, posterior abdominal tergites, uropods and telson, not all setae shown.

metabranhial regions inflated to lesser degree than central swellings; lateral branches of cervical groove more distinct than central portion; depressions distinct on either side of metagastric region and anterolateral to cardiac inflation. Rostrum in shape of isosceles triangle, apex frequently somewhat rounded; horizontal or slightly upturned distally; lateral margins rounded, spinulate with fringe of fine setae. Frontal margin with small expanded lobe behind antenna, spinulate but without larger, distinct post-antennal spine. Spinule at anterolateral angle of carapace frequently larger or broader than others. Lateral margins straight or slightly convex posteriorly, spinulate. Narrow posterior rim slightly raised or not at all inflated, spinulate, slightly concave with medial indentation.

Carapace and appendages with dense covering of fine setae on most surfaces.

First abdominal tergite smooth centrally, posterolateral projection with several spinules; 2 transverse swellings indistinct across second and third tergites with median spinulate knob or lobe projecting slightly forward; swollen pleura sculptured, knobs at lateral termination of transverse swelling spinulate; pleura narrowing laterally. Fourth tergite with 1 transverse swelling anteriorly, spinulate on forward edge, posterior surface smooth. Fourth and fifth tergites with smooth inflation, sixth flattened. Fifth and sixth segments with 2 or 3 small, widely-set punctations on lateral part of segment.

Thoracic sternites smooth, intersegmental depressions barely visible with indistinct rows of fine setae behind them.

Eyes colorless, movable, small; cornea reaching approximately 1/2 length of rostrum, often smaller in diameter than eyestalks; eyestalks

with scattered spinules, mesial surface concave.

Basal segment of antennular peduncle with lateral swelling spinulate, terminating in 2 sharp distal spines: 1 above and slightly laterad; spines occasionally bifurcate or with accessory spinule. Distal margin of swollen ventromesial projection serrate. Peduncle reaching beyond tip of rostrum.

Small conical tooth emerging from between bases of eyestalk and antenna.

Basal segment of antennal peduncle with blunt ventral projection. Second segment with sharp lateral spinule on distal margin. Third segment with sharp dorsal and lateral spine on distal margin. Fourth segment with dorsolateral projection. Antennal flagellum short, reaching beyond merus of cheliped.

Exopod of third maxilliped with long second segment broader at base. Endopod with ischium terminating in sharp tooth dorsally, blunter tooth ventrally. Merus with 2 to 4 broad teeth on ventral margin, basal tooth largest; dorsal spine distally. Carpus and propodus with several scattered granules or spinules on lateral surfaces. Dactylus slender.

Lateral setae on pereopods longer, many plumose, forming fringe. No epipods on chelipeds or ambulatory legs.

Chelipeds approximately twice carapace length, maximum width  $1/8$  to  $1/10$  cheliped length. Dactylus approximately  $1/2$  length of manus, fingers not widely gaped on dorsal margin; opposing margins abutting in small specimens, slightly apart in larger ones. Tips spooned, toothed along dorsal opposing margins; manus slightly compressed dorsoventrally, especially in males. Dorsal surface of manus evenly spinulate or spinate, spines sharp, arranged in indistinct longitudinal rows. Carpus



less than 1/2 length of manus, also spinulate. Merus approximately equal in length to propodus, spinate; spines on mesial surface larger, more distinct. Ischium with large conical tooth dorsally, spinate ventral projection. Ventral surfaces relatively smooth or sparsely granulated.

Second, third and fourth pereopods similar: dactylus approximately 1/2 length of propodus, with very sharp corneous tip, otherwise unarmed. Propodus with 3 or 4 indistinct longitudinal rows of spines, carpus and merus with similar spination. Carpus approximately 1/3 length of propodus. Merus approximately same length as propodus in second and third pereopods, proportionately shorter and with more spines in fourth. Ventral and mesial surfaces of these appendages rounded, smooth than dorsal and lateral surfaces. Merus of fifth pereopods expanded, exposed lateral surface spinulate, setose.

Uropods and telson smooth, flat, unarmed, with dense covering of fine short setae.

Telson consisting of 9 plates; small anterolateral plate with central punctation, similar to those on posterior abdominal segments; several other punctae arranged symmetrically on telson.

Color.--The specimens examined are preserved in alcohol and are devoid of color except for the pale brown tips on the ambulatory legs and, in some specimens, the pale golden translucent corneae and yellowish thicker setae.

Size.--The following size ranges were found in the PILLSBURY material:

♂, cl. 4.5-9.2 mm,

♀, cl. 5.9-11.2 mm, and

ovigerous ♀, cl. 7.5-11.2 mm.

Sexual dimorphism.--The most striking difference between mature males and females is the size and shape of the chelipeds; males have longer, broader chelipeds with a noticeable gape between the fingers, while females have shorter, more slender chelipeds, often spinier, with only a slight gape.

Males also have the comb of short stiff golden bristles on the lateral margins of the telson, which is reduced to a fringe of fine setae in females.

In the material examined, a greater swelling of the anterolateral regions of the carapace in males (as stated by Pequegnat and Pequegnat, 1970, figure 5-6) was not apparent; in fact, the females seemed to have this area slightly more inflated. The median swellings in the gastric and cardiac regions, however, were more pronounced and sharper in males than in females.

The differences in degree of spination and pubescence, and in breadth of rostrum between individual specimens were not consistent with the sexes.

Habitat.--The bottom type was observed at one of the seven PILLSBURY stations where M. alaminos was captured, as rubble with pteropod shells.

Types.--Holotype, ♂, cl. 11 mm, USNM 128810; allotype, ovigerous ♀, USNM 128811.

Type locality.--NW Gulf of Mexico, ALAMINOS Sta. 68-A-13-4, 25°38.4'N, 96°18.3'W, 512 m (280 fm).

Geographic range.--This species is known from near Anguilla south to French Guiana in the western Atlantic, from the Gulf of Mexico and the

Caribbean Sea. Previous records include: NW and N Gulf of Mexico (Pequegnat and Pequegnat, 1970:142); and off Dominica and French Guiana (Pequegnat and Pequegnat, 1971:18).

Bathymetric range.--Possible depth range for specimens collected by the PILLSBURY is 457-842 m; calculated range is 558-715 m. Previously known range is 504-828 m; calculated range based on previous reports is 512-810 m.

Parasites.--The abdominal parasites on specimens from station P-920 and P-988 are peltogastrid rhizocephalans, tentatively identified as Tortugaster fistulatus Reinhard.

The branchial parasite on another specimen from P-920 is a bopyrid isopod, identified as Pseudione sp., probably an undescribed species.

Also epizoans were found on this species --mainly hydrozoans and foraminiferans.

Associates.--No significant associations between M. alaminos and other species of Munidopsis were observed.

Relationships.--Munidopsis alaminos most closely resembles M. townsendi Faxon from the southeastern Pacific: they agree in general armature, body shape and proportion, however the latter species has the carapace tuberculate rather than spinulate, and several larger protuberances on the carapace; also M. alaminos has a greater number of smaller spinules on the pereopods. The other Pacific species having a quadrate carapace, M. quadrata Faxon and M. carinipes Faxon, show some similarities to M. alaminos, but the rostrum is broader at the base in these species, the

decoration on the carapace is either tuberculate or granulate rather than spinulate, and the abdominal segments have a larger median projection than in M. alaminos.

Among western Atlantic species, M. alaminos has its greatest affinities with M. riveroi Chace, M. longimanus (A. Milne Edwards) and M. brevimanus (A. Milne Edwards); all the latter three have the broader rostrum excavated to some degree, and lack the carapacial spinulation, in addition to many other differences.

Munidopsis armata (A. Milne Edwards, 1880)

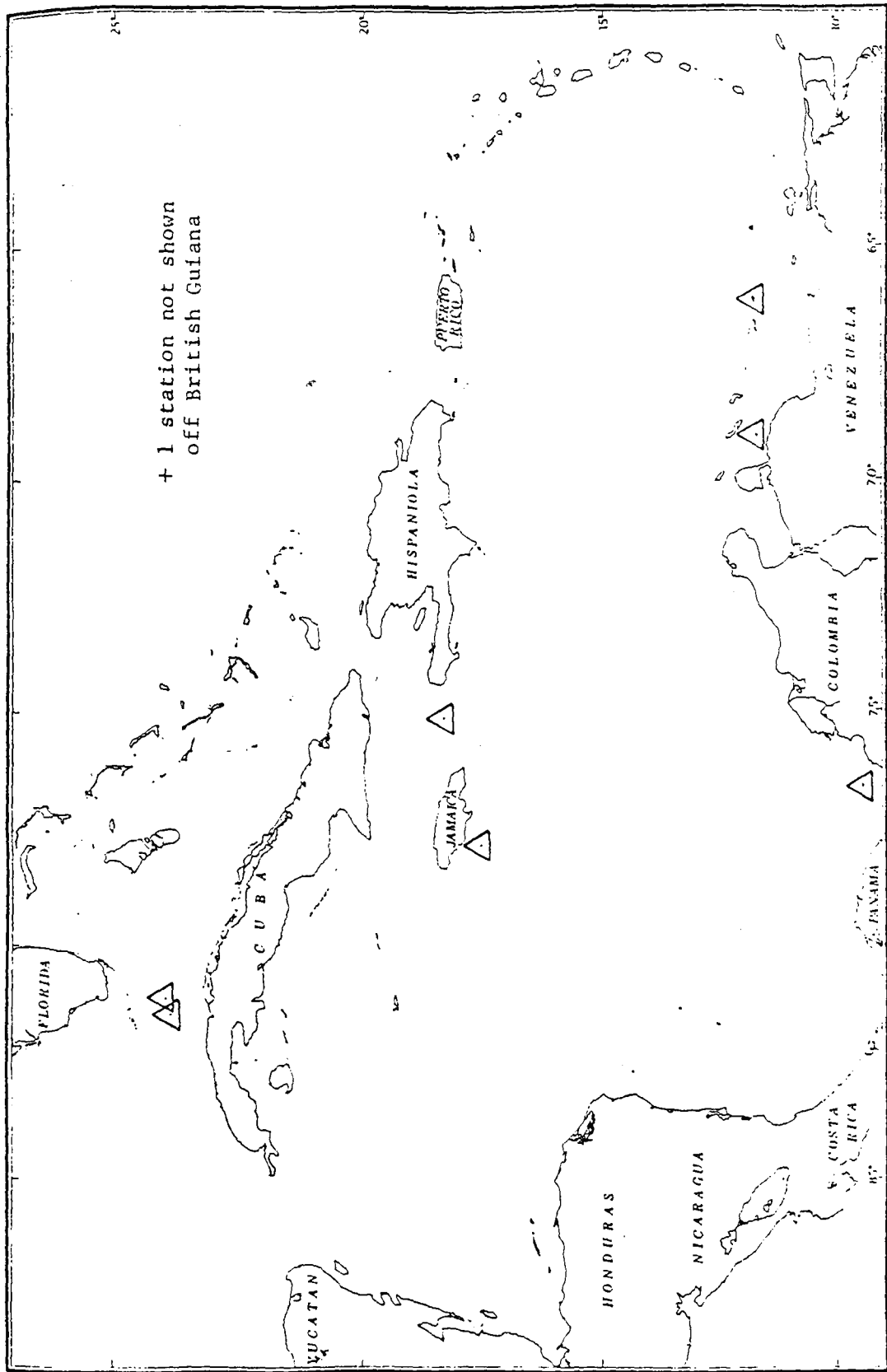
Figures 6, 7

Elasmonotus armatus A. Milne Edwards, 1880:61.--Handerson, 1888:159, pl. XIX, fig. 5.--A. Milne Edwards and Bouvier, 1894b:263, 281, 282 (key), fig. 33; 1897:104-106, pl. VIII, figs. 11-14.--Young, 1900: 414 (key), 415-416.

Munidopsis armata: Benedict, 1902:276 (key), 316 (list).--Doflein and Balss, 1913:175 (list), 177 (table).--Schmitt, 1935: 179 (key).--Chace, 1942: 74 (key), 90.--Pequegnat and Pequegnat, 1970: 140 (key) 145, table 5-3; 1971: 6 (key).

Material examined.--Straits of Florida: G-130, 1021 m, 2 ♂, 8.1, 8.8 mm, 1 ♀, 8.7 mm UMML 32:5222; (?)G-132, 275-302 m (see Remarks), 1 ♂, 6.5 mm, (RNMH); P-636, 1003-1336 m, 1 ♂, 11.4 mm, UMML 32:5224.--Off Atlantic coast of Colombia: P-364, 924-950 m, 4 ♀, 6.5-13.5 mm, UMML 32:5223.--Off British Guiana: P-689, 1373-1446 m, 1 ♀, 11.1 mm, 1 ovigerous ♀, 10.8 mm, (USNM).--Off Venezuela (S of Orchilla): P-741, 1052-1067 m, 1 ♂, 6.2 mm, with abdominal parasite, (USNM); (S of Curacao): P-755, 796-1006 m, 1 ♀, 9.15 mm, UMML 32:5225.--W of Haiti: P-1187, 1034 m, 3 ♂, 5.2-10.9 mm, 1 ♀, 8.7 mm, UMML 32:5226.--S of Jamaica: P-1224, 878-906 m, 1 ♀, 11.5 mm, (RNMH). See distribution plot 4.

Diagnosis.--Rostrum nearly horizontal, with abrupt constriction distally, with obtuse teeth at base of constriction; dorsal surface of carapace unarmed; distinct submarginal depressions laterally; frontal and posterior margins of carapace unarmed; second and third abdominal segments with strong rounded transverse carina; eyes unarmed; no epipods on



Distribution plot 4. -- *Munidopsis armata* (A. Milne Edwards, 1880) collected by the CERDA and PILLSBURY.

pereiopods.

Description.--Carapace longer than broad (cw/cl approximately 0.88); lateral margins raised, forming prominent rim, convex, broadest just behind middle; gastric region inflated, with pair of obscure tubercles anteriorly; cervical groove visible centrally behind gastric region, obscure laterally; broad, smooth postcervical groove separating metagastric and cardiac regions. Well-defined patterns of curved setae on very smooth dorsal surface of carapace: over entire gastric region except for bare area on either side of midline, in triangular area posterior to hepatic region laterally, in transverse row on ridge behind cervical groove; smooth area anterior to cardiac region followed by many short transverse rows of setae, tubercles at bases laterally; extensive smooth area anterior to posterior margin except for several groups of setae along midline; posterior margin with 2 or 3 rows of setae. Rostrum  $1/2$  to  $3/4$  carapace length, slightly upturned, margins subparallel, slightly convex laterally with lateral fringe of short curved setae in basal portion; distal half constricted, tapering to apex; obtuse or small teeth at base of constricted portion. Frontal margin curved behind antenna, no post-antennal spine; notch mesial to sharp anterolateral spine.

First abdominal tergite barely visible beneath posterior margin of carapace. Posterior margin of second and third tergites with strong transverse carina projected triangularly to medial crest, usually rounded, but not spined; forward edge of crest with row of curved setae on central third. Fourth, fifth and sixth tergites smooth, not carinate; fourth and fifth with curved setae; setae extending onto sixth tergite as patches on either side of midline.

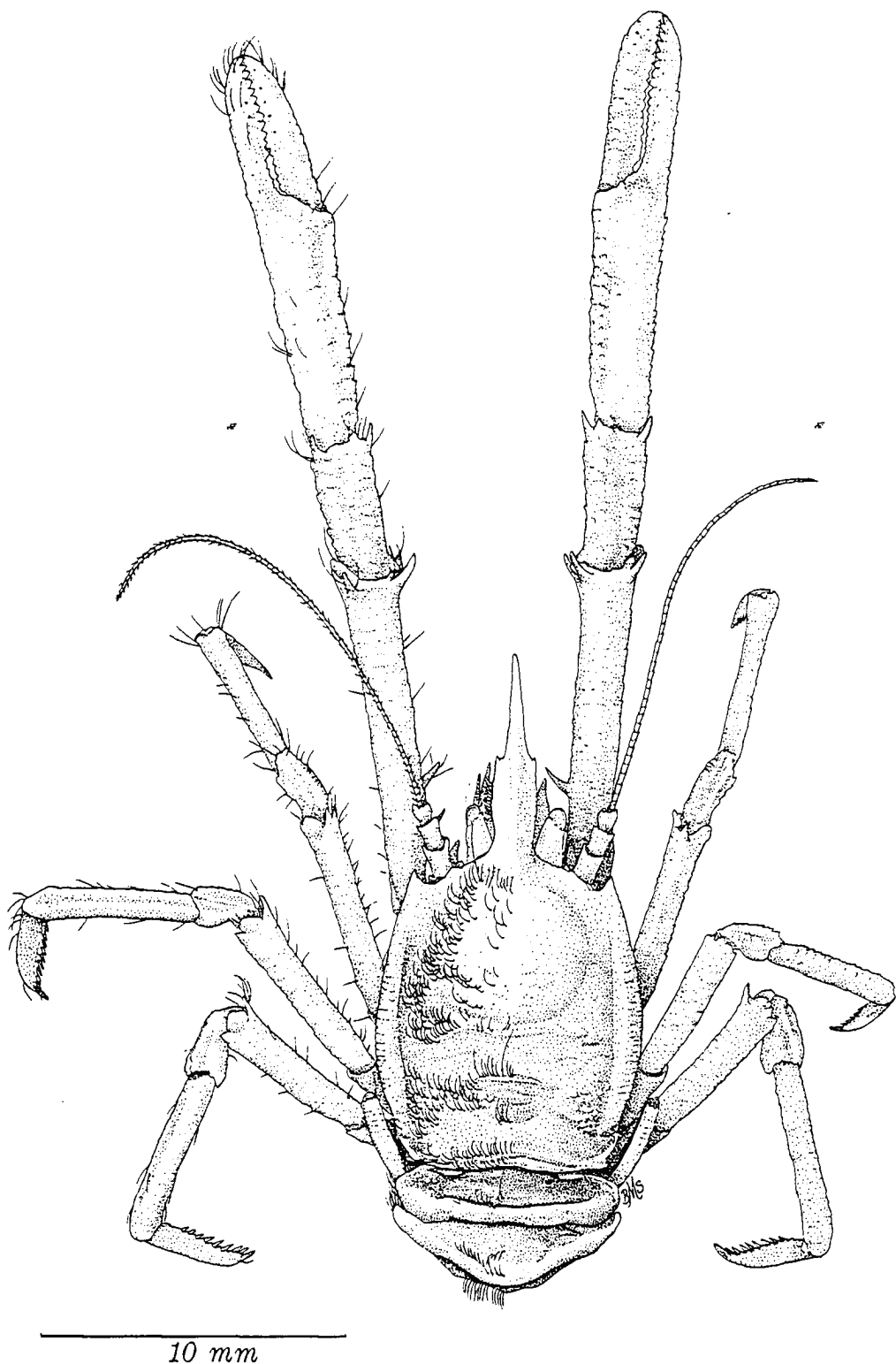


Figure 6. --Munidopsis armata (A. Milne Edwards, 1880), ♀, cl. 9.5 mm, P-755, dorsal view, setae on right side omitted.



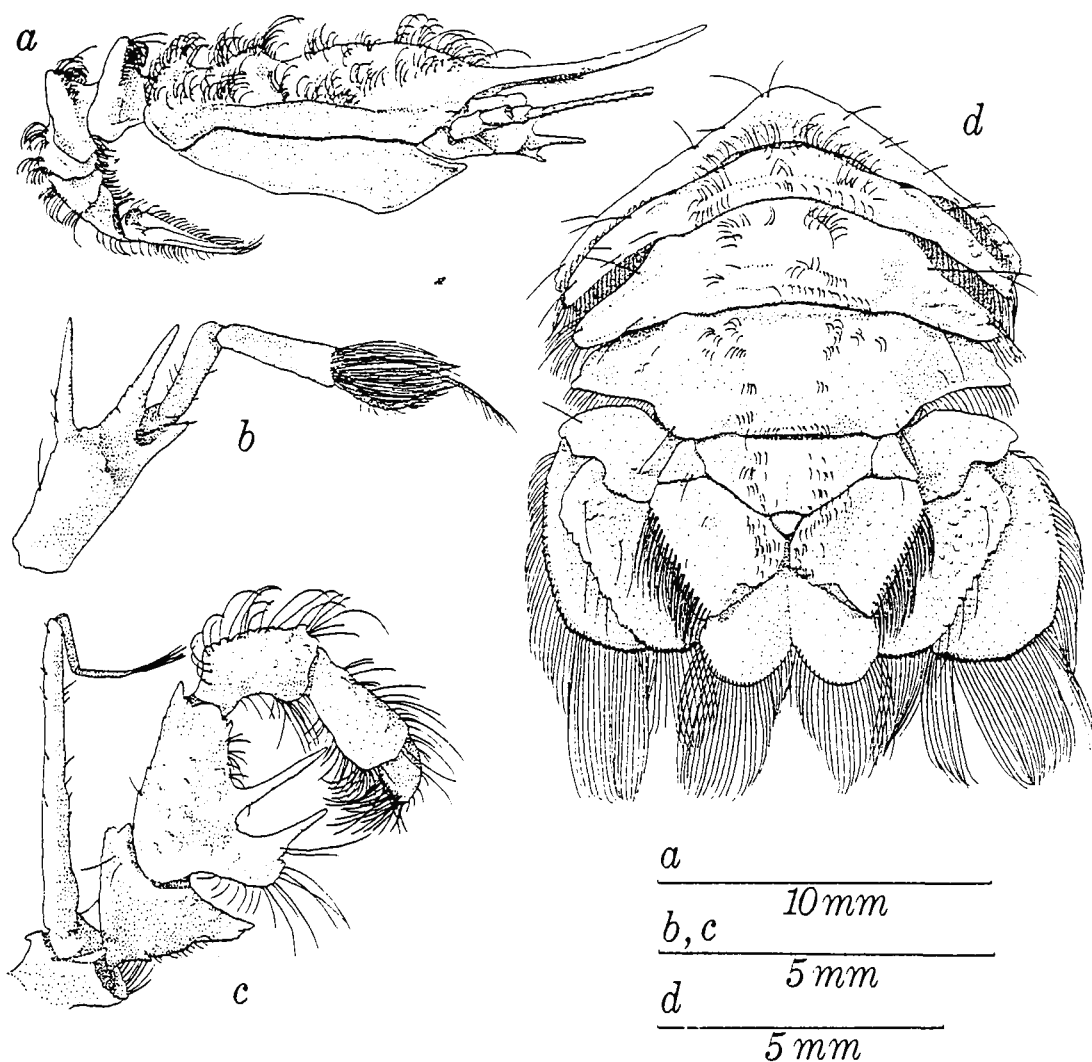


Figure 7. --*Munidopsis armata* (A. Milne Edwards, 1880). ♀, cl. 9.5 mm, P-755: a, carapace and abdomen, lateral view. ♀, cl. 13.5 mm, P-364: b, right antennular peduncle, ventrolateral view; c, right third maxilliped, ventrolateral view. ♂, cl. 11.4 mm, P-636: d, posterior abdominal tergites, uropods and telson.

Sternum unarmed; intersegmental ridges and grooves distinct.

Eyes unarmed; long movable eyestalks wider at base; cornea slightly elongate, small, diameter not greater than diameter of eyestalk, reaching approximately  $1/3$  length of rostrum.

Small irregular projection beneath frontal margin emerging from intersection of bases of eyestalk, antennule and antenna.

Basal segment of antennular peduncle with rounded ventrolateral swelling, armed with long slender dorsal spine and more distally with 1 dorsolateral spine; distal margin with small ventromesial and mesial projections; extended antennular peduncle reaching nearly to end of rostrum.

Basal segment of antenna with small lateral projection and large triangular ventral projection. Second segment with blunt lateral tooth. Third segment with distal margin slightly projected mesially. Distal segment with dorsolateral projection distally. Antennal flagellum reaching well beyond distal margin of carpus of cheliped.

Ischium of endopod of third maxilliped with short triangular tooth dorsally on distal margin, large curved flattened tooth ventrolaterally. Merus with short dorsal tooth on distal margin; flexor margin with 2 large sharp spines, proximal spine broadest, with setae along curved lower margin. Carpus with several curved setae on extensor margin.

No epipods on chelipeds or ambulatory legs.

Chelipeds 3 to 4 times carapace length; sculpturing and dentate tubercles on most surfaces, fine setae associated with some tubercles. Manus not quite  $1/2$  length of cheliped, width of manus approximately  $1/4$  length. Dactylus less than  $1/2$  length of manus; mesial margins roughened with short denticulate ridges, but no major spines; both

dactylus and fixed finger toothed along opposing margins, teeth large at spooned tips; dorsal opposing margins nearly abutting in females and small males, distinct gape in larger males; dactylus of larger males with several rounded teeth on inner margin near base extending into gape; fixed finger with outward flexure at base forming gape, minutely toothed on inner margin of gape; ventral surface of manus and carpus smoother than other surfaces. Carpus approximately  $1/3$  length of manus; distal margin with at least 2 distinct spines: 1 dorsolateral spine, 1 dorsomesial spine, usually with denticulate projection mesial to dorsomesial spines, occasionally similar projection mesial to dorsomesial spine; dorsal surface with smoother shallow longitudinal depression centrally, with denticulate projections along either side. Merus approximately same length as dactylus; distal margin with large sharp spine at ventromesial, dorsomesial and dorsolateral angles; ventrolateral angle with smooth lobular projection; often smaller spine adjacent to distal margin beneath dorsoalteral spine; merus smoother than more distal segments, except for 2 sharp spines on ventromesial margin proximally. Ischium with small conical spine dorsally.

Second, third and fourth pereopods similar. Tip of dactylus of second pereopod reaching distal margin of carpus of cheliped; third and fourth pereopods slightly shorter. Tip of dactylus curved, corneous; bluntly toothed flexor margin with short corneous spinule projecting from forward edge of each tooth. Dactylus approximately  $1/2$  length of propodus. Propodus unarmed except for calcified setae on ventral margin near distal end. Carpus with denticles and low tubercles on dorsal margin in longitudinal rows, and small distal tooth or projection, but no large spines. Merus longer than propodus with sharp dorsal spine

on distal margin. Exposed surface of merus of fifth pereopod punctate with 2 small tubercles on leading edge.

Uropod with posterolateral margin of protopod scalloped, no distinct teeth. Notch at insertion of endopod followed by minutely denticulate lobe. Lateral margin of endopod denticulate.

Telson consisting of 8 plates, narrowed posteriorly, with deep median indentation in posterior margin.

Color.--Specimens examined were preserved in alcohol and devoid of pigment except for the golden color of larger setae and the corneous brown tips of the ambulatory legs. No color records were found in previous reports.

Size.--Specimens collected by the GERDA and PILLSBURY show the following size ranges:

- ♂, cl. 5.2-11.4 mm,  
 ♀, cl. 6.5-13.5 mm, and  
 ovigerous ♀, cl. 10.8 mm.

Sizes reported for specimens collected by the BLAKE and the CHALLENGER fall within these ranges.

Sexual dimorphism.--The chela is broader and gaped in larger males (the smallest male with a gape had cl.=8.1 mm; the largest male with ungaped chelae had cl.=6.7 mm). The characteristic fringe of thicker golden setae was present on the lateral margins of the telson of all males except the very smallest (cl. 5.2 mm).

Habitat.--The bottom types and characteristic epifauna at several PILLSBURY stations where Munidopsis armata was collected were varied: sponges,

mud and rubble, hard brown mud covered by siliceous sponges and branching madreporarians. Henderson (1888:159) reported pteropod ooze as the bottom type at the two CHALLENGER stations where this species was taken.

Type.--Holotype, ♀, cl. approximately 10 mm, MCZ 4758.

Type locality.--Fredericksted (St. Croix, Virgin Islands), BLAKE Sta. 137, 1144 m (625 fm).

Geographic range.--*Munidopsis armata* is known from the Caribbean and from the Straits of Florida south to British Guiana in the western Atlantic. In addition to the type locality and localities listed herein for material examined, *M. armata* has been reported in the literature from off Sombrero and Culebra Island, West Indies (Henderson, 1888:159), and from the north coast of Cuba and Martinique (Chace, 1942:90).

Bathymetric range.--The possible depth range for material in this collection is 796-1446 m; calculated range is 906-1373 m. One damaged specimen is labeled as collected at G-132 (275-302 m), but this is excluded from consideration here because of the likelihood of contamination from G-130 (1021 m), the poor condition of the specimen, and the great gap between the depth at G-132 and all other bathymetric records for this species. The possible depth range recorded previously was 677-1217 m (370-665 fm); the calculated range, based on earlier records, is 715-979 m (390-535 fm).

Parasites.--A small female collected by the PILLSBURY at station 741 has a large peltogastrid rhizocephalan parasite attached to the under-

side of the abdomen. This was tentatively identified as belonging to the genus Galatheascus, but the species was undetermined and may be new.

Associates.--Munidopsis armata was collected at 8 stations by the GERDA and PILLSBURY; at 6 of these stations, Munidopsis sigsbei was also collected. The index of affinity, based on these data, between M. armata and M. sigsbei is 0.25.

Relationships.--The shape of the rostrum, the raised rims on the lateral margins, and the carinae on the second and third abdominal tergites serve to separate this species from all described species. It bears little similarity to any other species which have, from time to time, been placed in the genus Elasmonotus. A. Milne Edwards and Bouvier (1897:106) suggested an affinity between M. armata and both M. abdominalis (A. Milne Edwards) and M. quadrata Faxon, but M. abdominalis lacks prominent carinae, M. quadrata has a blunt medial spine, the rostra are different in all three, and neither of the latter two have the raised marginal rims characteristic of M. armata.

Remarks.--The size of the gastric tubercles varies from small but distinct spines on several of the smaller specimens to very obscure swellings, frequently hidden by curved setae. Occasionally there is a distinct spine beneath the anterolateral spine of the carapace.

The proximal spines on the merus of the cheliped are consistently 2 in number, with the single exception of one large female with 3 spines in that location.

Some variation exists in the projection of the transverse abdominal carinae; in some specimens, the expansion is somewhat triangular, while

in others it is more rounded. This seemed to be unrelated to sex, size or the depth at which the specimen was taken.

Although the stiff curved setae are often broken off from body surfaces, the patterns usually remain quite distinct on the carapace and abdominal tergites.

Munidopsis bermudezi Chace, 1939

## Figure 8

Munidopsis bermudezi Chace, 1939: 46; 1942: 73 (key), 83-85, figs. 29-30.--Sivertsen and Holthuis, 1956: 44, pl. IV, fig. 3.--Pequegnat and Pequegnat, 1970: 139 (key), figs. 5-1, 5-8, table 5-2; 1971: 5 (key) 22.

Munidopsis: Murray and Hjort, 1912: 420.

Material examined.--Bahama Islands, S of Acklins Island: P-1138, 2745-2751 m, 1 ♂, 13.3 mm, UMML 32:5229.--Atlantic Ocean, N of Virgin Islands: P-1376, 5179-5184 m, 1 ♀, 31.5 mm (with abdominal parasites, (USNM).

Diagnosis.--Rostrum nearly horizontal, unarmed; anterior gastric region of carapace with 1 pair of heavy spines (occasionally reduced to tubercles in large specimens); frontal margin with post-antennal spine; posterior margin unarmed; abdominal tergites unarmed; eyes armed with large blunt spine on mesial surface of small cornea; epipods on chelipeds but not on ambulatory legs.

Description.--Carapace longer than broad ( $cw/cl = 0.90-0.95$ ), slightly convex transversely, densely covered with short curved setae, most plumose, on dorsal surface except for 2 pairs of depressed areas at muscle attachment; gastric region with 1 pair triangular spines anteriorly; mesogastric region slightly more inflated with several inconspicuous swellings arranged symmetrically. Cervical groove distinct across center of carapace and in both anterior and posterior branches. Slightly inflated metagastric region with distinct striation centrally; postcervical groove separating metagastric and cardiac regions, latter with



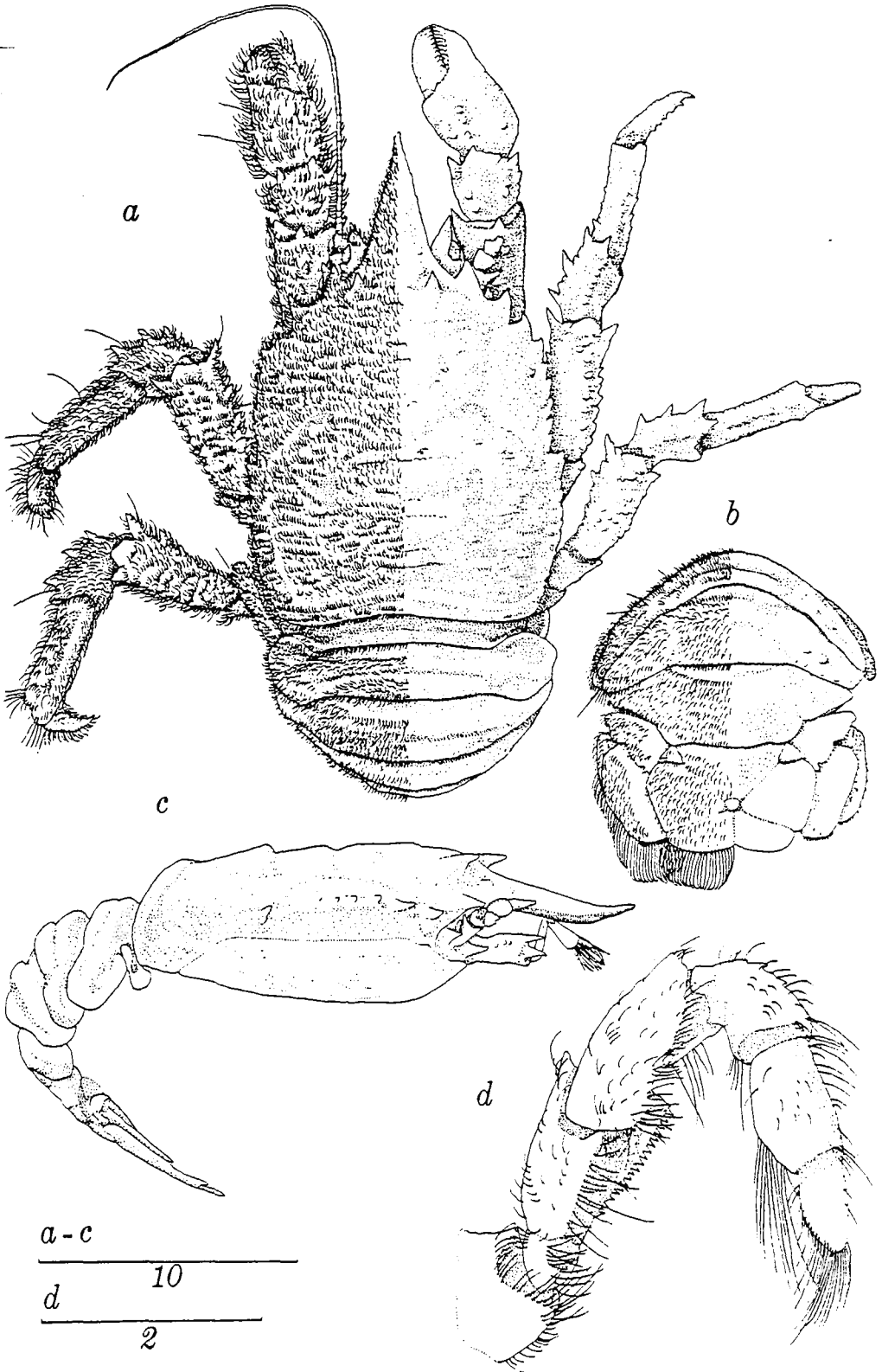


Figure 8. --Munidopsis bermudezi Chace, 1939, juvenile ♂, cl. 13.3 mm, P-1138: **a**, dorsal view, both second pereopods missing, setae on right side omitted; **b**, posterior abdominal tergites, uropods and telson, setae on right side omitted; **c**, lateral view, setae shown on antennular flagellum only; **d**, right third maxilliped, lateral view. Scales in mm.

similar striation on ridge anteriorly; branchial regions depressed to margins, several striations and small tubercles in this region and on or near raised lateral margins. Rostrum more than  $1/3$  length of carapace, nearly horizontal, slight upturn distally, broad at base, tapering evenly to apex, forming isosceles triangle with blunt median carina; 2 pairs of low tubercles near base. Frontal margin with triangular post-antennal tooth. Anterolateral angle with large tooth just in front of termination of anterior branch of cervical groove; another slightly smaller tooth posterior to this followed by 4 or 5 much smaller spinules; larger spine just behind posterior branch of cervical groove. Raised rim of posterior margin unarmed.

Abdomen unarmed, pubescent; second, third and fourth tergites each with 2 rounded transverse carinae, more distinct on anterior tergites; fifth and sixth tergites flattened. Pubescence lacking on anterior part of pleura of third through sixth tergites.

Sternum unarmed, not pubescent; setae only along intersegmental striae.

Eyes colorless, practically immovable; cornea very small; eyestalk short, extended distally over dorsomesial margin of cornea forming large sharp spine; lateral margin unarmed or with small obscure tooth.

Basal segment of antennular peduncle with several rounded tubercles on forward edge of lateral inflation; dorsal margin with rounded carina terminating in sharp distal spine, larger conical spine projecting beneath; mesial carina terminating in small blunt tooth; distoventral margin projecting slightly; distal margin of segment bearing flagellum when extended not reaching apex of rostrum; flagellum short, barely reaching beyond tip of rostrum.

Basal segment of antenna with expanded ventromesial tooth and smaller lateral tooth. Distal margin of second segment with broad lateral spine and small mesial spine. Third segment with setae on distal margin but no spines. Fourth segment with broad dorsolateral spine and small ventrolateral lobe distally. Antennal flagellum approximately same length as carapace.

Merus of endopod of third maxilliped with 2 or 3 teeth on ventral margin; 1 small distal tooth on dorsolateral margin. Ischium with ventral carina terminating in triangular tooth, dorsolateral margin with small blunt tooth at distal corner; serrate mesial margin without distal tooth or spine.

Epipods on chelipeds but not on ambulatory legs.

Chelipeds approximately same length as carapace and  $3 \frac{1}{2}$  times maximum width of manus; short curved plumose setae distributed densely over all surfaces except ventral surface of propodus and carpus; longer setae on mesial surfaces. Length of manus slightly less than twice maximum width; dactylus approximately  $\frac{1}{2}$  length of manus. Tips of fingers spooned, dentition extended on tips and along abutting margins dorsally; margins of fingers rounded and gaped ventromesially. Propodus with longitudinal crest of several teeth on lateral margins near distal end and small blunt tooth on mesial margin; dorsal surface with several tubercles. Carpus less than  $\frac{1}{2}$  length of manus; distal margin with 4 spines or teeth: 1 conical dorsomesial spine, 1 smaller dorsal tooth, 1 triangular lateral spine, and 1 large triangular spine ventrally; lateral spine followed by several rounded tubercles on dorsolateral surface; several similar tubercles dorsomesially. Merus approximately same length as manus; distal margin with 4 spines: 1 dorsal, 1 dorsomesial, 1 ventro-

mesial and 1 ventrolateral ; 4 spines in dorsal row posterior to distal spine, decreasing in size proximally; small sharp spine on mesial margin proximal to ventomesial spine; lateral and ventral surfaces with several rounded tubercles. Ischium with 1 dorsolateral spine and 1 spine immediately posterior to ventromesial projection on distal margin.

Second pereopods missing on specimen examined. Chace's (1942: fig. 29) illustration of the holotype shows second and third pereopods similar, with propodus armed with 2 small sharp spines on dorsomesial ridge, and carpus armed with 4 or 5 sharp spines decreasing in size proximally.

Third and fourth pereopods similar. Ventral margin of dactylus with 6 to 8 spines behind curved, tan-colored corneous tip; each spine with short stiff seta projecting from distal edge. Propodus of third pereopod with sharp spine and tubercle on dorsomesial edge; row of tubercles on dorsolateral and ventrolateral edges and 2 movable spines on small ventral lobes near distal edge of third and fourth pereopods. Propodus of fourth pereopod without dorsal spination. Carpus more than 1/2 length of propodus; dorsomesial edge with 3 or 4 sharp spines including 1 on distal margin; small spine or tubercle between most proximal and next spine; smaller spine lateral to this on distal margin followed by longitudinal row of tubercles on dorsal ridge; several denticles on distal edge of ventrolateral lobe. Distal margin of merus with large sharp spine on either side of dorsal lobe; spine followed on dorsomesial edges by longitudinal row of 5 or 6 spines, decreasing in size proximally; several low tubercles in line between these spines; several spines following dorso-lateral tooth, reduced to tubercles on fourth pereopod; ventral surface with scattered tubercles. Ischium short with small dorsal tooth and several scattered tubercles.

Fifth pereopods with setae, but no distinct sculpturing or spines.

Protopod of uropod with posterolateral margin scalloped and with sharp spine posteriorly. Exopod with several widely-spaced movable spinules on surface near lateral margin; similar spinules on lateral and posterior margins; endopod with few spinules on exposed surface near posterior margin; posterior margin bordered with spinules. Exposed surfaces of uropods pubescent.

Telson consisting of 8 plates, broader than long; posterior margin with medial indentation; pubescent, but no distinct spinules.

Color.--The specimens examined were preserved in alcohol and had no traces of color. There are no records of color for this species.

Size.--The 2 specimens in this collection are a male, cl. 13.3 mm, and a female, cl. 31.5 mm.

Size ranges for specimens reported previously are:

♂, cl. 23 to approximately 30 mm (cl. + rostrum = 69 mm),

♀, cl. 10 to approximately 30 mm (cl. + rostrum = 40.2 mm), and

ovigerous ♀, cl. 28.0 mm.

The male collected by the PILLSBURY is the smallest male recorded thus far.

Morphological differences between the large and small specimen are discussed in the Remarks section.

Sexual dimorphism.--The small male does not have the characteristic fringe of golden setae on the lateral margins of the telson, but this may be due to its size and apparent immaturity. The 2 specimens examined were so different in size that no attempt was made to relate differences in morphology to sex.

Habitat.--The bottom at the station where M. bermudezi was collected in the Bahamas was characterized by sponges and a few solitary corals; the bottom type north of the Virgin Islands was clay.

Type.--The holotype is an ovigerous ♀, cl. 28.0 mm, cl. + rostrum = 37.7 mm; MCZ 10231.

Type locality.--South coast of Cuba, ATLANTIS Sta. 2976 B, 2434-3020 m.

Geographic range.--This species is known from both the east and west sides of the Atlantic Ocean. Apart from the locations reported here and that of the holotype, the following records are found in the literature: Caribbean Sea: N coast of Cuba (Chace, 1942: 83); eastern Atlantic Ocean: N of Azores (Sivertsen and Holthuis, 1956: 44); Gulf of Mexico (Pequegnat and Pequegnat, 1970: 145; 1971: 22).

Bathymetric range.--The depths from which M. bermudezi has been collected by the PILLSBURY are approximately 2750 and 5180 m (from the Bahamas and north of the Virgin Islands, respectively). The possible range, based on previous records was 2434-3300 m; calculated range was 2654-3300 m.

Parasites.--The large female specimen was heavily parasitized by rhizocephalans of the family Peltogastridae, probably an undescribed species of Cyphosaccus Reinhard, 1958.

Associates.--There were no other galatheid crustaceans collected with M. bermudezi by the PILLSBURY. The literature reviewed did not indicate that other specimens have been taken with this species in the same sample.

Relationships.--Munidopsis bermudezi appears to belong in the Atlantic

deep-water complex of species including M. crassa and M. geveri. These species are large, heavily calcified galatheids with short chelipeds, a triangular rostrum, distinct eyespines, gastric spines, an unarmed abdomen and epipods on the chelipeds. M. bermudezi is more pubescent than the others, and its corneae are quite small, each with a long blunt mesial tooth. The carapacial spination and sculpturing on M. bermudezi is different from that of M. crassa and M. geveri: the latter two have many spines or flattened denticulate tubercles in addition to the distinct pair of gastric spine; M. bermudezi usually has only the gastric spines distinct and other rounded tubercles, but no additional spines. (The large female presents a slightly different pattern, with gastric spines reduced to tubercles, and other tubercles, particularly marginal ones, enlarged and sometimes pointed). M. similis, also from the western Atlantic, is somewhat similar but in that species the chelipeds are longer than in M. bermudezi and they lack epipods; the cornea is not as small, and there is usually a small lateral eyespine in M. similis.

Chace (1942:85) pointed out the similarity between M. bermudezi and the figure of M. ceratophthalma Alcock from the Indian Ocean, but said that the lateral spine behind the posterior branch of the cervical groove is much larger in the ATLANTIS specimens and the gastric spines are lacking in Alcock's (1901) species. In addition, the shape of the rostrum and chelipeds is different in the two species.

Munidopsis aculeata Benedict from the Indian Ocean and M. subcucumosa Henderson from Japan are also in this species complex and thus are somewhat similar to M. bermudezi. Both have a greater number of distinct gastric spines, more carapacial sculpturing and more slender chelipeds.

Munidopsis barnardi Kensley from South Africa is related to these

species, but has more spines on the gastric region of the carapace and the rostrum more upwardly directed than does M. bermudezi.

Remarks.--The large female specimen is different from the juvenile male as follows: on the female there is no distinct pair of gastric spines on the carapace, rather several scattered tubercles; spines on the lateral margin are directed laterally, and pubescence, although present, does not obscure sculpturing on body surfaces; the rostrum is broader at the base and has a slight distal upturn.

There is some question as to whether this female specimen belongs to M. bermudezi since it differs from the original description of that species as indicated above and was collected from considerably deeper water (approximately 5000 m) than other specimens (approximately 3000 m). It is necessary to compare this with the other specimens of similar size before finally deciding whether or not it is specifically distinct. For the present, the differences from the other specimens are considered only to be individual or phenotypical, possibly due to depth.

The juvenile male is closer to the description of the holotype, and has been used as the basis for the redescription.



Munidopsis bradleyi Pequegnat and Pequegnat, 1971

Figures 10, 11

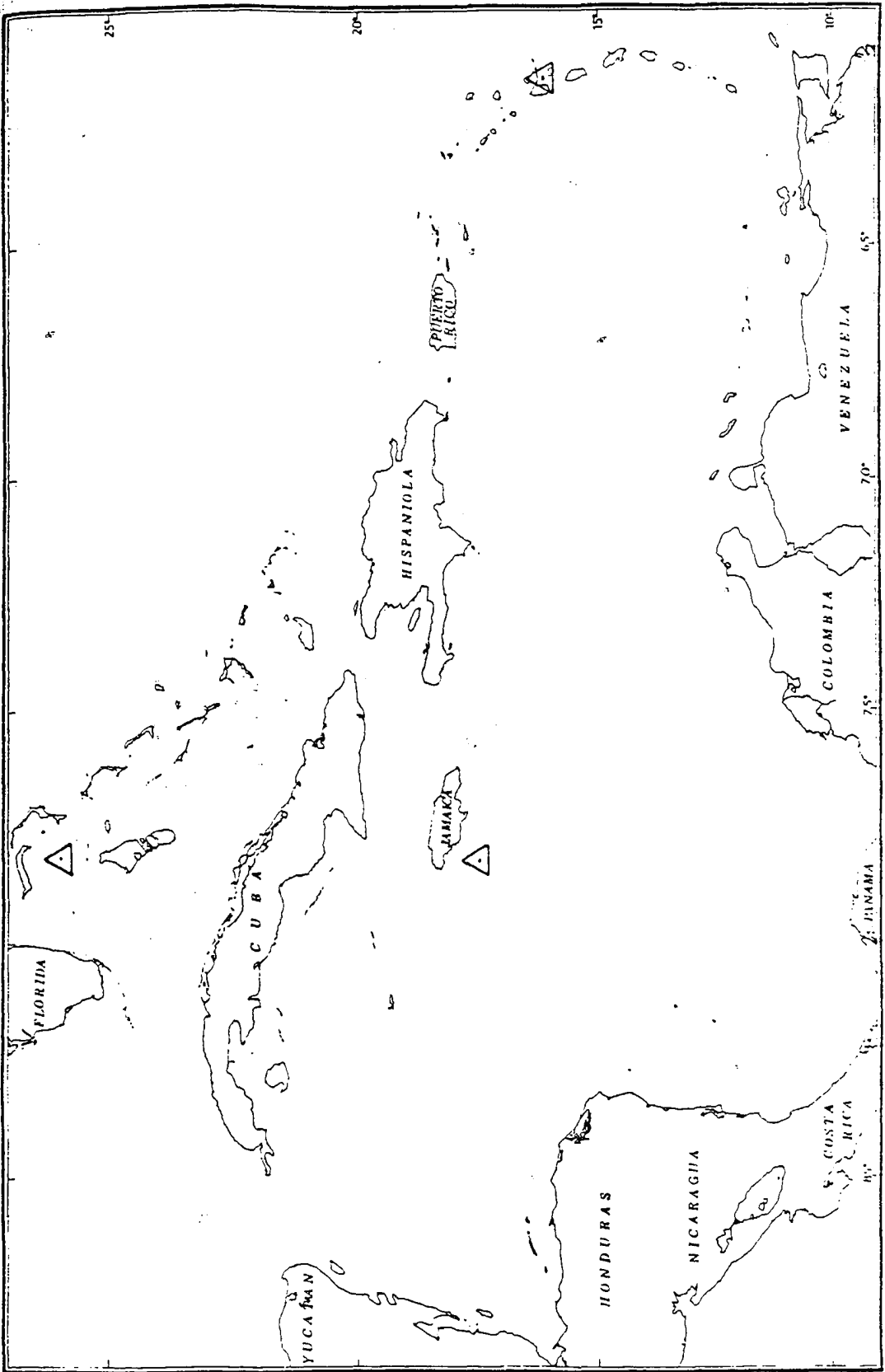
Munidopsis bradleyi Pequegnat and Pequegnat, 1971: 6 (key), 7-9, figs.

1, 2.

Material examined.--Bahama Islands: G-679, 595-711 m, 1 ♂, 12.6 mm, UMML 32:5227.--Off Guadeloupe: P-923, 476-686 m, 1 ♀, 20.0 mm, (RMNH).--S of Jamaica: P-1256, 521-658 m, 1 ♂, 6.1 mm UMML 32:5228. Distribution plot 5.

Diagnosis.--Rostrum nearly horizontal, armed with 1 pair anterolaterally-projecting spines; gastric region with 1 pair spines anteriorly followed by at least 1 median spine; frontal margin with prominent post-antennal spine; posterior margin of carapace with at least 1 pair of spines near midline; second and third abdominal tergites with median pair of spines; fourth tergite without spines; eyes unarmed; epipods on chelipeds but not on ambulatory legs.

Description.--Carapace longer than broad ( $cw/cl = 0.90-0.95$ ), vaulted transversely; mediolongitudinal swelling interrupted by 2 transverse channels: cervical groove posterior to mesogastric region extending to lateral margins of carapace; postcervical groove separating metagastric and cardiac regions; anteriorly-projecting ridges posterior to grooves each with 1 distinct median spine, smaller rounded tooth lateral to spines; anterior gastric region with 1 pair of large spines; posterior on midline, 2 well-marked spines, 1 behind other, with minute rounded tooth laterally at bases of spines (total of 4 distinct median spines on carapace). Dorsal surface elsewhere with scattered granules, symmetrically arranged, frequently with anterior edge moderately serrate; metabranchial regions



Distribution plot 5.--*Munidopsis bradleyi* Pequegnat and Pequegnat, 1971 collected by the GERDA and PILLSBURY.

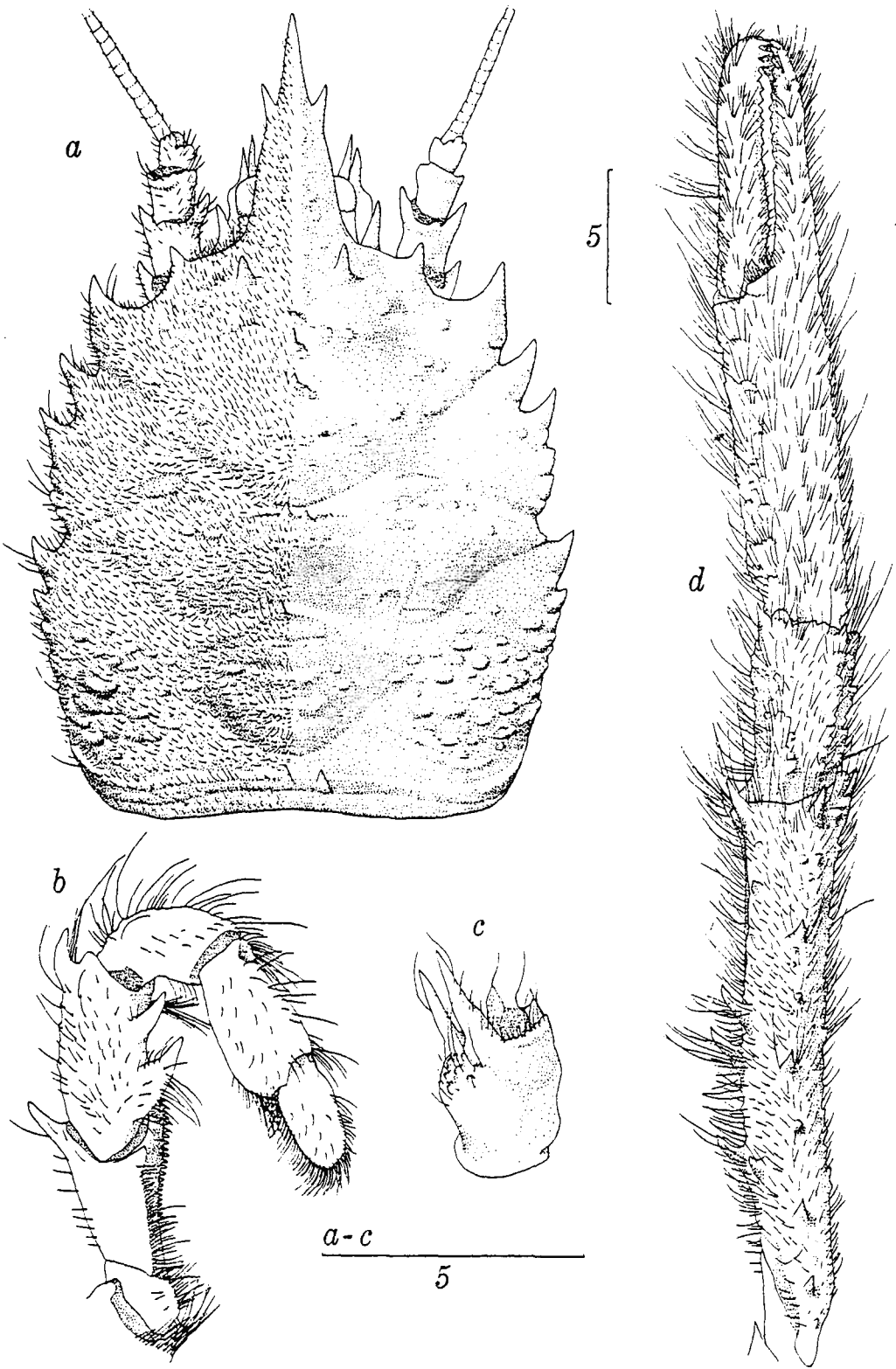


Figure 10. --Munidopsis bradleyi Pequegnat and Pequegnat, 1971, ♀, cl. 20.2 mm, P-923: a, dorsal view of carapace; b, ventrolateral view of right third maxilliped; c, lateral view of right antennule; d, dorsal view of right cheliped. Scales in mm.

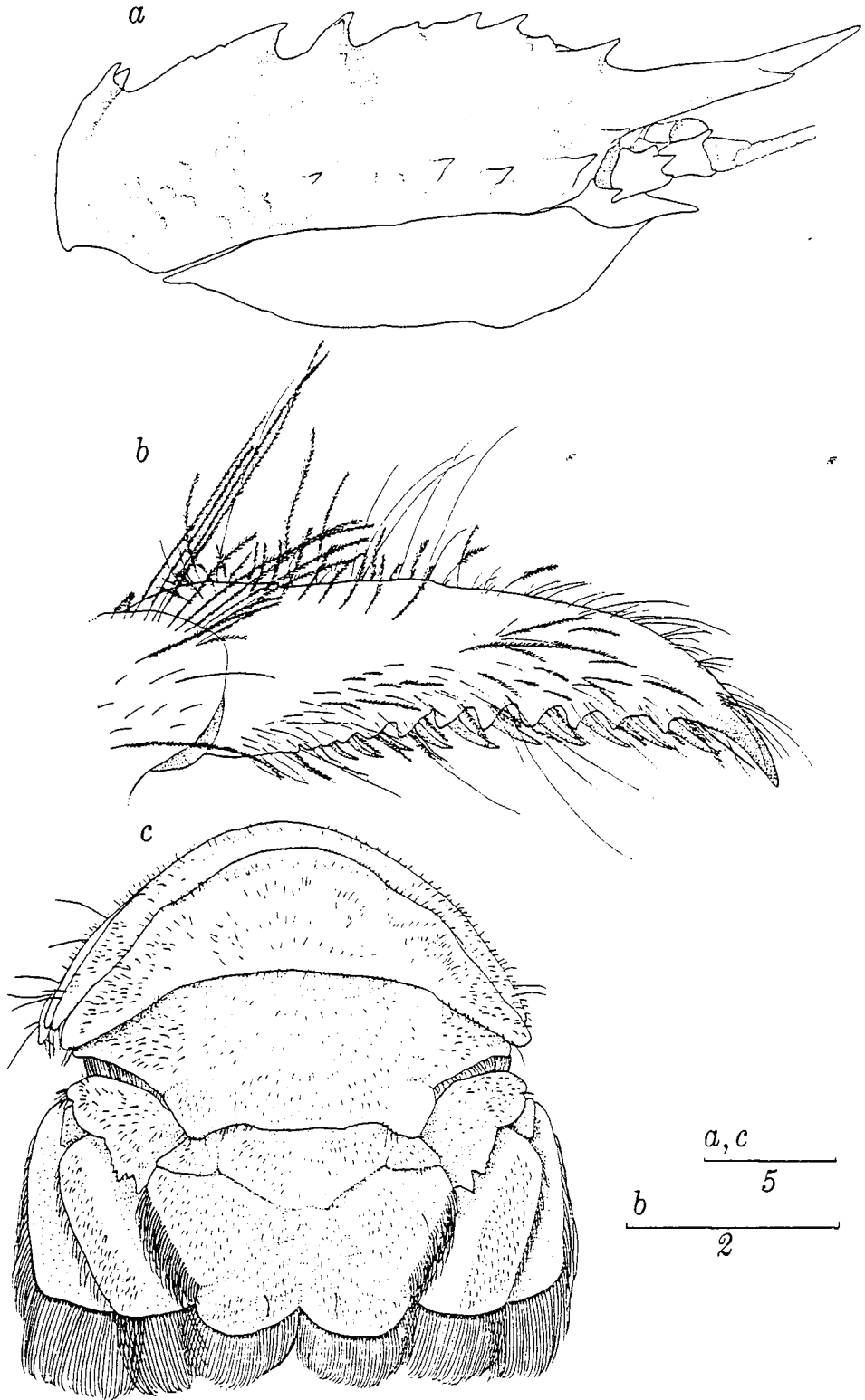


Figure 11. --Munidopsis bradleyi Pequegnat and Pequegnat, 1971. ♀, cl. 20.2 mm, P-923: a, lateral view of carapace; b, dactylus of second pereiopod, lateral view. ♂, cl. 22.4 mm, OREGON Sta. 10844: c, posterior abdominal tergites, uropods, and telson. Scales in mm.

of carapace rugose with such protuberances. Short fine setae over most dorsal and exposed surfaces. Rostrum nearly horizontal, between  $1/3$  and  $1/2$  carapace length, broad at base, tapering distally, slightly carinate with pair of anterolaterally-projecting spines approximately  $1/3$  distance from distal end. Frontal margin with distinct post-antennal spine. Lateral margin with 4 large curved spines, anterolateral spine slightly larger; posterior lateral spine with 1 much smaller spine behind it and several minute teeth diminishing in size posteriorly. Ridge bordering posterior margin of carapace with median pair of spines.

Abdomen with median pair of spines on transverse ridges of second and third tergites; transverse groove behind ridge; fourth tergite with 1 anterior transverse ridge; last 2 segments smooth.

Sternum unarmed and smooth; intersegmental ridges distinct.

Eyes colorless, unarmed and movable; cornea very slightly larger than eyestalk.

Sharp conical spine projecting from beneath carapace emerging from intersection of bases of antennule, antenna and eyestalk; base of spine partly fused to basal segment of antenna.

Basal segment of antunnular peduncle inflated, swelling with several tubercles; 2 distolateral spines, most distal spine slightly longer.

Basal segment of antenna broad with 2 large spines: 1 lateral, 1 ventromesial. Second segment with 1 lateral and 1 mesial spine distally; small lobe just mesial to lateral spine on dorsal edge; transverse indentation in dorsal surface of segment. Third segment with distal margin slightly raised. Distal segment with small denticulate projection dorso-laterally. Flagellum extending beyond cheliped distally by approximately  $1/3$  length of flagellum.

Merus of endopod of third maxilliped armed with 1 distinct dorsolateral spine near distal margin; 2 large spines on ventral margin, proximal spine slightly larger. Ischium with ventral carina terminating in spine, mesial border serrate, large distal spines on dorsolateral margin.

Pereiopods slightly sculptured, usually with tubercles, some denticulate; most surfaces covered with scattered setae of various lengths, many plumose. Epipods on chelipeds but not on ambulatory legs.

Chelipeds measured from articulation of coxa and basis, less than 2 1/2 times as long as carapace, excluding rostrum. Maximum length of dactylus less than 1/2 length of propodus; length of chela approximately 6 times maximum width. Propodus oval in cross section, devoid of spines; tips of fingers spooned, dentate, teeth continuing proximally along abutting margins. Carpus less than 1/3 length of propodus; 3 small spines on distal margin: 2 dorsal, 1 ventral. Merus approximately same length as propodus, 4 spines arranged around distal margin; 4 equal spines in longitudinal row behind dorsodistal spine; 3 spines in row behind distal spine on dorsomesial margin, alternately spaced with those in dorsal row, first and third very small, second approximately same size as dorsal spines; frequently tubercles or denticle between spines: 2 strong spines mesioventrally on proximal half of segment forming row with distal spine; ventrolateral surface of merus unarmed. Ischium with dorsal spine at articulation with merus.

Second, third and fourth pereiopods similar. Dactylus of second pereiopod reaching distal margin of carpus of cheliped; dactylus of third and fourth pereiopods each reaching distal margin of propodus of preceding leg. Dactylus with corneous brown tip; row of 7 to 9, usually 8, denticles on ventral margin, diminishing in size to small denticulate

tubercles proximally; thick corneous spinule, gold-colored in preservation, projecting from anterior edge of each denticle or tubercle, 12 to 14 spinules on each dactylus. Distal margin of propodus with row of minute blunt teeth, ventrally divided by median gap with 1 larger denticle near each end resembling very short calcified seta; otherwise, propodus unarmed. Carpus less than  $1/2$  as long as propodus, with single dorsal spine on distal margin; low, slightly tuberculate longitudinal ridge dorsolaterally and shallow concavity. Merus slightly longer than propodus; 3 spines on distal margin: 2 dorsal, 1 ventral; expanded lobe between dorsal spines; second and third pereopods with longitudinal row of 4 spines and 1 tubercle on proximal half of raised dorsal margin behind mesial dorsal spine; only 3 spines in this location on fourth pereopod, with tubercle lateral, and slightly anterior, to 2 proximal spines; frequently tubercles in line between spines, particularly on distal half of segment; longitudinal row of tubercles and/or small spines behind dorsolateral spine; ventrolateral margin with scattered denticulate tubercles. Distal margin of ischium with 1 dorsal spine and ventrolateral serration.

Fifth pereopods with merus expanded, external surface tuberculata.

Protopod of uropod with posterior margin notched, spinule and smaller denticles on each side of notch. Exopod and endopod with granular denticles on lateral margins; similar denticles on surface of exopod between raised area and lateral margin, and on surface of endopod at posterolateral corner; surfaces appearing very smooth.

Telson consisting of 10 plates, central and intermediate plates often indistinct; posterior margin deeply scalloped.

Color.--All specimens examined were preserved in alcohol and showed no

traces of color except for the corneous brown tips of the ambulatory legs and the golden color of thicker setae.

Size.--Specimens examined in this collection have the following sizes:

♂, cl. 6.1-12.6 mm,

♀, cl. 20.0 mm.

The largest male recorded is 31 mm cl.; the largest female (ovigerous) is 33 mm cl. (Pequegnat and Pequegnat, 1971: 9).

Sexual dimorphism.--The only apparent sexually dimorphic character in this species is the dense fringe of golden setae on the lateral margins of the telson in males; females have only a few shorter fine setae in this location.

Habitat.--The bottom type of GERDA Sta. 679 in the Bahamas was composed of soft mud and cinders with debris bottles and copper pieces. Data were not available for other stations at which Munidopsis bradleyi was collected.

Type.--The holotype is an ovigerous ♀, cl. 33 mm, USNM 138227.

Type locality.--Caribbean Sea off Colombia, OREGON Sta. 4854, 11°10.8'N, 74°28.5'; 549 m.

Geographic range.--This species is known in the western Atlantic from the Bahamas south to Guadeloupe in the Lesser Antilles, and in the Caribbean Sea. In addition to the type locality, records in the literature included the following localities: north coast of Haiti, and the Lesser Antilles from St. Barthélemy to Dominica (Pequegnat and Pequegnat, 1971: 7).



Bathymetric range.--The possible depth range for specimens in this collection is 476-711 m; calculated range could not be determined. The previously recorded possible range was 549-914 m; calculated range was 549-860 m.

Parasites.--There is no external evidence of parasitism in any of the specimens examined.

Associates.--At 2 or the 3 GERDA and PILLSBURY stations where M. bradleyi was taken, M. erinaceus was also collected.

Relationships.--Munidopsis bradleyi can be distinguished easily from all species described from the western Atlantic. Of these, it appears to be most closely related to M. cubensis Chace, M. gilli Benedict, and M. expansa Benedict. The median and lateral spines on the carapace, relatively horizontal rostrum (not strongly upturned), paired spines on the abdominal segments, chelipeds twice as long as the carapace, and lack of epipods on the ambulatory legs serve to distinguish this species from M. cubensis. M. expansa and M. gilli have epipods on the first pair, and first and second pairs of ambulatory legs, respectively, have the rostrum upturned, and do not have paired spines on the second and third abdominal segments. There are some similarities between M. bradleyi and M. trifida tomentosa (Benedict) from the western Pacific redescribed by Baba (1969), but the latter lacks medial spination on the carapace and abdomen. M. bradleyi is extremely close to M. camelus (Ortmann) from Japan. The specimens of M. bradleyi examined are identical in morphology to that redescribed for M. camelus by Miyake and Baba (1967) except that M. camelus has epipods on the chelipeds and first 2 pairs of ambulatory legs,

1 pair of small spines behind the bifurcation of the cervical groove (instead of none), a mesial as well as a lateral spine distally on the second segment of the antennal peduncle; the proximal spine on the merus of the third maxilliped is much stronger than the distal spine, and there are 2 rows of small spines rather than 1 on the carpus of the cheliped. There appear to be other minor differences, particularly in the spination of the pereopods, but using the literature available on M. camelus, it was not possible to compare details of this spination.

Discussion.--Chace (1942) pointed out that the genus Galacantha must be merged with Munidopsis due to several factors, one of which is the unreliability of the Galacantha-like rostrum as a primary character. M. bradleyi and M. camelus, in addition to M. gilli, M. expansa and M. cubensis mentioned by Chace, have the rostrum intermediate between the Galacantha-type rostrum of M. spinosa and M. rostrata and the horizontal rostrum present in most other species of Munidopsis. The close similarities between M. bradleyi and M. camelus, despite the quite different arrangement of pereopodial epipods, point out the apparent variability of the latter character among species. This renders the arrangement of epipods less useful in determining relationships above the species level.

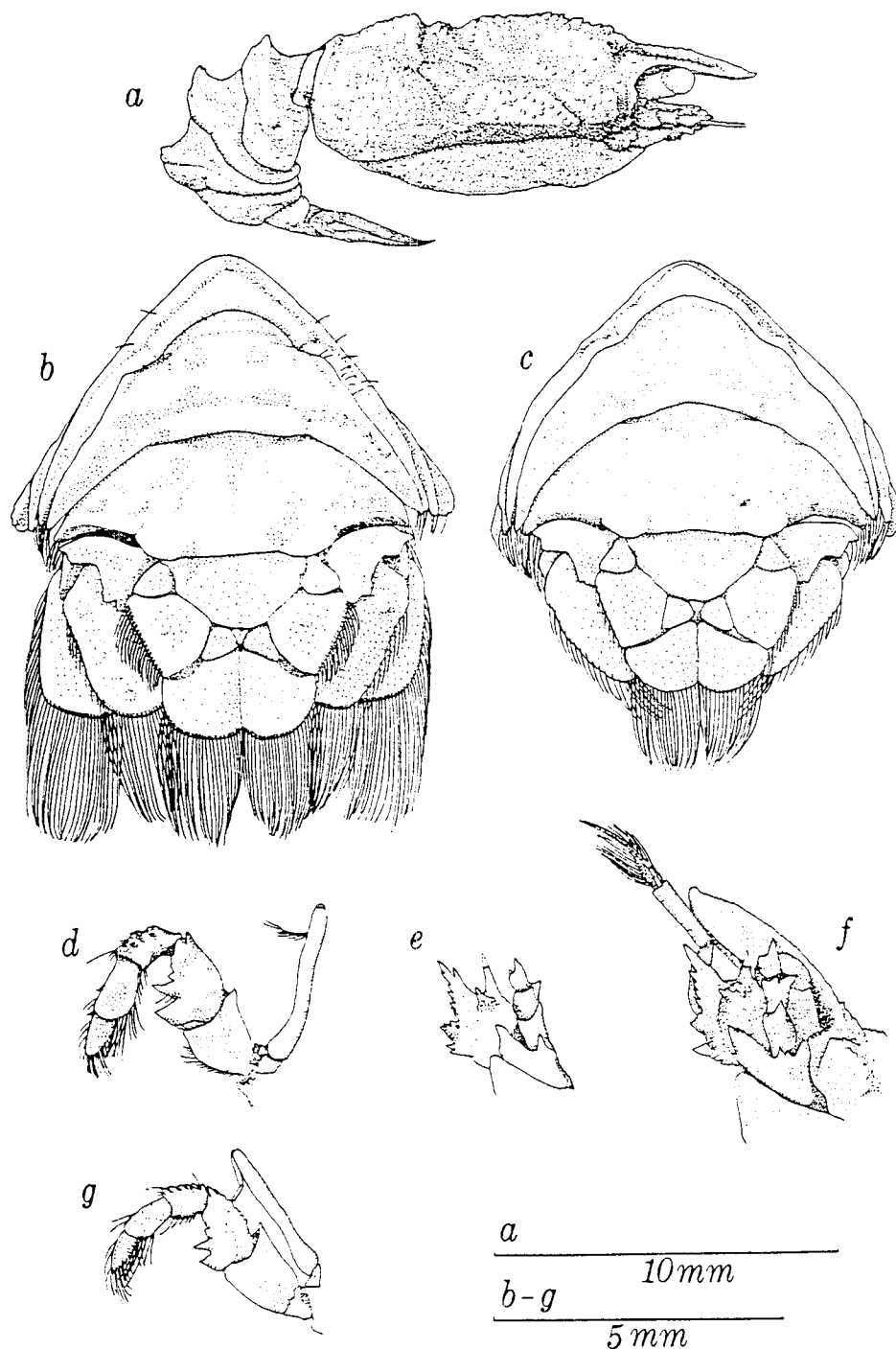


Figure 13. --*Munidopsis brevimanus* (A. Milne Edwards, 1880). ♂, cl. 9.0 mm, P-1224: a, carapace and abdomen, lateral view; b, posterior abdominal tergites, uropods and telson; d, left third maxilliped, ventrolateral view; f, left antennule, antennal peduncle beneath rostrum and eye, ventrolateral view. ♂, cl. 7.3 mm, BLAKE Sta. 291, (holotype): c, posterior abdominal tergites, uropods and telson; e, left antennular peduncle, ventrolateral view; g, left third maxilliped, ventrolateral view.

well-defined, appearing centrally as depression separating meso- and metagastric regions; lateral termination of anterior branch distinct as sharp oblique groove behind anterolateral angle of carapace; posterior branch less distinct; postcervical groove broader and deeper between small metagastric region and swollen cardiac region.

Dorsal surface of carapace with 4 depressions: 1 on either side of posterior mesogastric region, and 1 slightly more mesial on either side of metagastric region; shallow depression extending obliquely posterior to lateral margins from anterior depression (posterior branch of cervical groove), narrow sharper groove extending obliquely forward to lateral margins, terminating at same point. Gastric region elongate inflation, bordered anteriorly by pair of transverse depressions; anterior gastric region with granulation more distinct on either side of midline, but with neither spines nor distinct pair of gastric tubercles. Rostrum broad at base, tapering to apex; lateral margins vaguely sinusoidal, slightly convex anterior to corneae, tip drawn out slightly to moderate point; dorsal surface with medial concavity, low granules scattered near lateral margins. Base of rostrum curving smoothly to depressed dentate lobe on frontal margin. Anterolateral angle rounded, granulate, but unarmed. Lateral margins rounded, granulate, with notch anteriorly at termination of anterior cervical groove, convexity noticeable between notch and indentation at termination of posterior cervical groove. Posterior margin smoothly concave, rim raised only slightly, sculpturing obscure.

First abdominal tergite with smooth knob at articulation with second tergite. Second tergite with small dorsal projection at midline

on raised anterior transverse rim; large rounded tubercle at lateral termination of rim; pleuron with transverse row of several tubercles near margins; most lateral tubercles well-developed. Third tergite slightly more projected dorsally with triangular tubercle at midline similar to that on second tergite. Third and fourth tergites similar; pleura narrowed laterally and curved forward. Fifth tergite with 2 pairs of obscure depressions arranged around broad center; pleura narrowed laterally, with several tubercles on dorsal surface. Sixth tergite smooth, with slight longitudinal median depression; posterolateral lobe distinct.

Sternum unarmed except for several obscure granules anteriorly between bases of chelipeds; obscure sculpturing centrally on either side of midline; sternites punctate laterally near margins; distinct intersegmental ridges following groove.

Eyes small, unarmed, movable; usually partially concealed beneath rostrum; cornea not wider than eyestalk; eyestalk sometimes with small obscure swellings laterally.

Small minutely tuberculate projection emerging from between bases of eyestalk and antenna.

Basal segment of antennular peduncle with several conical tubercles on anterior part of lateral projection, largest one slightly dorsal, ventrolateral surface of enlarged portion flattened; anterior sharp spine with several spinules on ventral margin; larger projection, spines or tubercles more proximally on segment; occasionally accessory spinule on dorsal edge of spine. Extended flagellum reaching beyond rostrum.

Basal segment of antenna with large ventral projection terminating in 2 spinules, often with another spinule ventral to them; small lateral

projection with spine. Second segment with sharp lateral spine and mesial distal margin slightly projected. Third segment with conical lateral and dorsal spines and smaller mesial spine. Fourth segment with small dorsolateral tooth-like projection and smaller dorsomesial projection.

Ischium of endopod of third maxilliped with sharp dorsal spinule on distal margin; ventral angle sharp, terminating bluntly or in sharp right angle or triangle, but without projected spine. Flexor margin of merus with large flattened tooth with rounded ventral edge near base of segment, adjacent sharp spine with 1 or 2 additional spinules more distally; distal margin with 1 or 2 dorsal spines or teeth, sometimes several spinules along extensor margin. Carpus with several (6 or 7) spinules on dorsal (extensor) surface.

Pereiopods with slightly more sculpturing (rounded or flattened tubercles) on meral segments than on other segments. No epipods on chelipeds or ambulatory legs.

Chelipeds approximately  $3 \frac{1}{2}$  times carapace length in male, less than  $2 \frac{1}{2}$  times carapace length in females. Manus dorsoventrally flattened; dorsal surface quite smooth in male, female with several tubercles; width of manus in male approximately  $\frac{1}{4}$  length; width of manus slightly less than  $\frac{1}{3}$  length in females. Dactylus approximately  $\frac{1}{3}$  length of manus in male; dactylus of female proportionately longer; mesial margin flattened, straight, hollow at base on mesial margin, followed by straight row of teeth. Fixed finger of male with outward curve near base forming gape; fingers abutting only in distal  $\frac{1}{4}$ ; fingers of female without curve or gape; fingers toothed and abutting along entire margin; tips spooned, dentate, gaped ventrally. Lateral

and mesial edges of manus with scattered rounded tubercles, extending onto fixed finger as sharp longitudinal ridge on lateral margin. Carpus short, dorsomesial edge tuberculate, terminating in denticulate triangle; dorsal surface smooth with irregular longitudinal rows of tubercles dorsolaterally; lateral surface with flattened tubercles; ventral surface smooth. Merus shorter than manus; evenly-spaced conical tubercles on all surfaces; mesial surface slightly flattened distally; distal margin with sharp ventromesial spine and spinulate or spinate lateral projection behind distolateral lobe; short transverse tuberculate ridge near distal margin dorsally. Ischium with conical dorsal projection; ventromesial margin with series of spines decreasing in size proximally.

Second, third and fourth pereopods similar, short; tip of dactylus of second pereopod reaching approximately middle of merus of cheliped. Dactylus approximately 1/2 length of propodus; sharp tip curved, corneous, followed on flexor margin by series of 6 or 7 triangular teeth, decreasing in size proximally each with slender corneous spinule on anterior edge; setae of various lengths scattered about surfaces. Propodus with extensor margin slightly flattened, mesial edge with irregular row of short conical spines, dorsal edge with projections less prominent; lateral surface with 2 irregular rows of tubercles on proximal 2/3 of segment, becoming larger proximally; ventromesial surface smooth, rounded; 2 corneous spinules on either side of notch at distal flexor margin. Carpus short, broad, with crest of conical tubercles on expanded extensor margin, most distal tubercle triangular, prominent, spine-like on second pereopod; ridge of smaller rounded tubercles laterally and irregular area of larger tubercles below. Extensor

margin of merus expanded into sharp dorsal crest, obscurely dentate in distal portion; longitudinal depression on lateral surface below crest, ventrolateral edge with irregular row of conical tubercles and smaller tubercles above; mesial surface with longitudinal concavity below dorsal crest, mesial surface relatively smooth with several scattered tubercles; fourth pereopod with more tubercles on merus. Short ischium with several tubercles on distal margin and on dorsolateral surface.

Fifth pereopods not present in male specimen examined. Females with several irregular rows of conical tubercles on expanded area on distal 2/3 of segment.

Protopod of uropod with conical anterolateral tooth followed by rounded lobe; posterior projection with notch between 2 small rounded processes.

Telson as broad as long, narrowing posteriorly; anterior plate with rounded posterior margin, small triangular central plate separated from anterior plate by fissure; lateral plates with obscure small swelling centrally; endopod with several similar swellings on exposed surface; posterior margin of telson indented.

Color.--All specimens examined were preserved in alcohol and were devoid of pigment. No records of color were found in the literature.

Size.--The specimen collected by the PILLSBURY at station 1224 is the first male of this species to be recorded, and it is the largest specimen reported thus far, cl. 9.0 mm. The two females examined are ovigerous and have cl. 6.5 mm (ATLANTIS Sta. 3435) and 7.3 mm (holotype). There are no other records of sizes or measurements in the literature.



Sexual dimorphism.--The male specimen has the characteristic fringe of thick golden setae on the lateral margins of the telson; marginal setae in this location on females are short, very fine and sparse. Females have shorter chelipeds (Cheliped length / cl. = 2.3, 2.1) than does the male (3.6), and slightly narrower, although they are broader with respect to length. The females have the abdominal tergites slightly more rounded than the male, and the carinae are not as strongly projected in the females.

Habitat.--The bottom type has not been noted at any of the locations from which this species has been collected.

Type.--The holotype is an ovigerous ♀, cl. 7.3 mm, MCZ 2630.

Type locality.--Off Barbados, BLAKE Sta. 291, 366 m (200 fm).

Geographic range.--Munidopsis brevimanus has been collected infrequently from scattered locations in the western Atlantic: from the north coast of Cuba, Jamaica and Barbados. All locations reported previously are listed under Material examined.

Bathymetric range.--The depth at which the single specimen of M. brevimanus in our collection was taken was 878-906 m. The previously recorded possible depth range was 366-549 m; calculated previous depth range was 366-466 m (200-255 fm). Calculated depth range based on current and previous records remains 366-878 m.

Parasites.--There have been no reports of parasites on M. brevimanus.

Associates.--No statement is made concerning associated species due to

the single occurrence of M. brevimanus in this collection.

Relationships:--Munidopsis brevimanus is a member of the Elasmonotus group containing M. alaminos Pequegnat and Pequegnat, M. riveroi Chace and M. longimanus (A. Milne Edwards) also from the western Atlantic. Of these, it is most closely related to M. longimanus; these two are quite similar morphologically, and identification of specimens belonging to either species must be made with care using relative characters. M. brevimanus has the abdominal tergites less strongly projected dorsally than does M. longimanus, the rostrum broader, slightly shorter, less triangular and more acuminate at the tip; in addition, M. brevimanus has slightly shorter, broader and less ornate chelipeds, the lateral margins of the carapace are more convex, the posterior margin less concave and the rim less prominent. Also the antennal peduncle is broader with more distinct spines in M. brevimanus, the antennular peduncle is more ornate, the pleura of the second abdominal tergite are not as ornate, and the telson has the posterior medial projection of the central anterior plate separated or articulated with the main part of the plate. Of the other closely related species, M. alaminos has the carapacial sculpturing spinulate, the rostrum narrower and not excavate, and the chelipeds shorter; M. riveroi is more robust with the carapace more convex and coarse sculpturing on raised areas, the chelipeds narrower and longer, and the rostrum more distinctly excavate dorsally and sinuous. Pacific species with some relationship to this group include M. quadrata Faxon, M. carinipes Faxon and M. miersii Henderson. All three of these have the rostrum drawn out to a sharper point than M. brevimanus; the first two have narrower chelipeds, and

there is medial armature on the abdominal carinae; M. miersii has prominent gastric tubercles and only faint abdominal carination.

Remarks.--As Chace mention (1942: 98), the rostrum of the holotype is more attenuate, less rounded than in the ATLANTIS specimens; also, the abdominal carinae are more prominent in the holotype. Chace illustrated the holotype (1942: fig. 33); one of the ATLANTIS females is figured in this paper as well as the telson, antennular and antennal peduncles of the holotype.

Discussion.--Chace (1942) revived the name Munidoosis brevimanus after it had disappeared from the literature subsequent to Faxon's suggestion (Milne Edwards and Bouvier, 1894b: 283) that Elasmonotus brevimanus might be only the female of E. longimanus. A. Milne Edwards and Bouvier pointed out at that time that they had examined a male and a female of E. longimanus and found them almost identical except that the female had the chelipeds shorter and more slender than the male, whereas the female specimen Milne Edwards had described as E. brevimanus had the chelipeds shorter and broader than those of E. longimanus. Despite this observation, Milne Edwards and Bouvier followed Faxon's opinion, and their final report of the BLAKE material (1897) did not include E. brevimanus. Chace felt that the holotype of M. brevimanus and a series of specimens taken by the ATLANTIS showed differences from Milne Edwards and Bouvier's figure of M. longimanus which were "not entirely sexual." Chace (1942: 97-98) went on to specify that

"In M. brevimana the carapace is broader (despite Milne Edwards statement to the contrary) and the lateral margins are more

convex, not subparallel as in M. longimana; the rostrum is slightly shorter and broader, less triangular and less rounded at the tip, although in the two "Atlantis" specimens it is not drawn out to a sharp point as in the figured type; the carinate lobes on the second, third and fourth abdominal somites are not so narrowly and strongly produced outwards, although this character is somewhat variable; and the chelipeds are shorter and stouter. . . ."

Now that males and females of both species have been examined, it is possible to further substantiate Milne Edwards' original suspicion and Chace's opinion that two species are involved. The two species present some problems however, since their characters overlap and are somewhat variable. Although the abdominal carinae of females of M. longimanus are not quite as prominent as those of males, males and females both have these carinae more prominent than either sex of M. brevismanus. Both males and females of M. longimanus have the chelipeds longer and narrower than males and females of M. brevismanus.

Correct spelling of the species name.--Benedict (1902), in his list of species, incorrectly feminized the species name of M. brevismanus. The species name is a noun, not an adjective, and as such the ending does not change with a change in gender of the generic name. Thus M. brevismanus as well as M. longimanus are the correct spellings.

Munidopsis crassa Smith, 1885

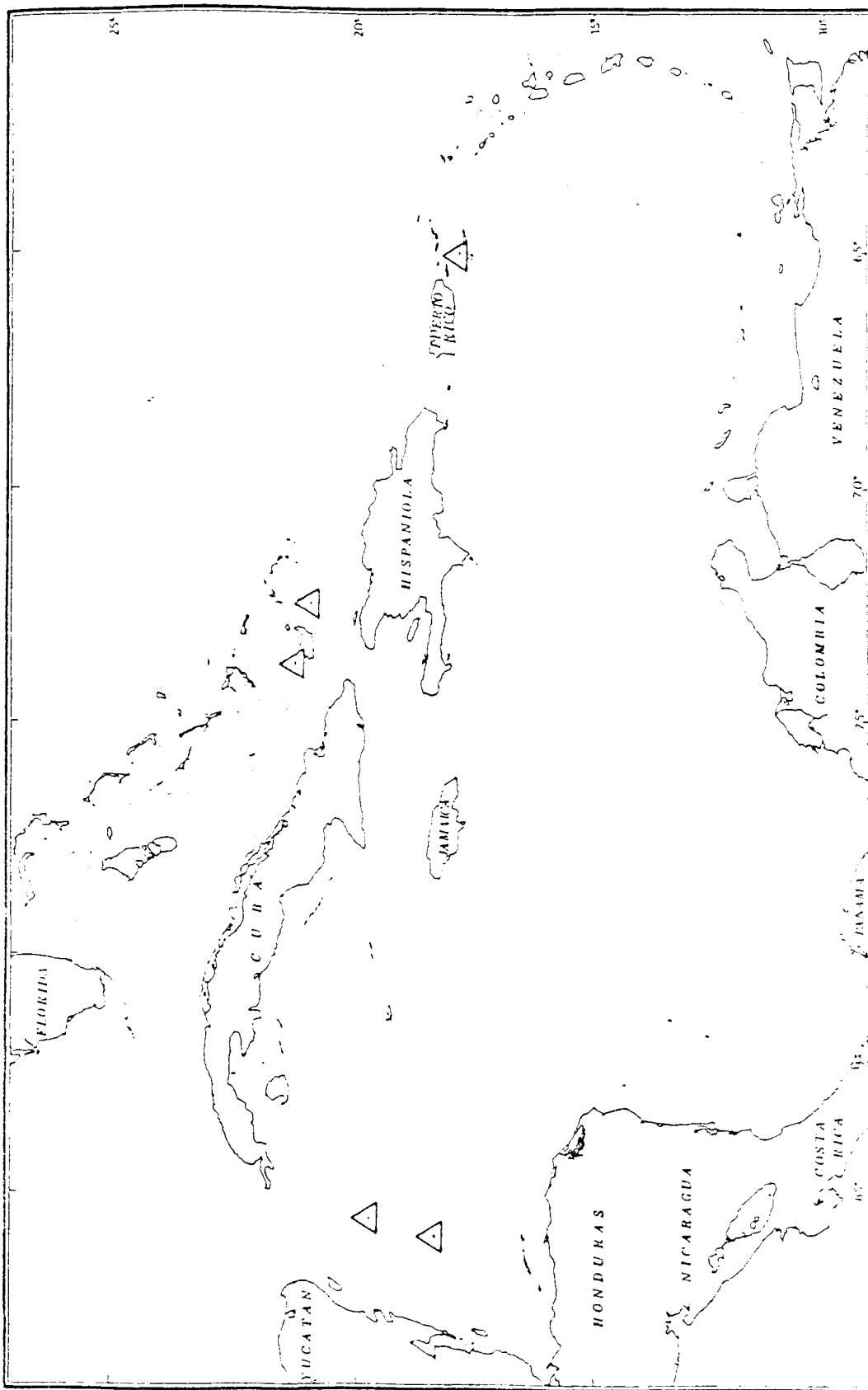
Figures 14, 15

Munidopsis crassa Smith, 1885: 494-496; 1886: 645-647, pl. 4.--A. Milne Edwards and Bouvier, 1894b: 275 (key); 1899: 82.--Benedict, 1902: 276 (key), 318 (list).--Murray and Hjort, 1912: 62, (as "chalk-coloured crab").--Doflein and Balss, 1913: 176 (list), 177 (table).--Chace, 1942: 73 (key).--Gordon, 1955: 237-245, text figs. 1A, 2A, 2A', 3A, pl. 1.--Sivertsen and Holthuis, 1956: 46-47, pl. IV, fig. 1.--Zariquiey Alvarez, 1968: 268 (key), 269-271, fig. 95b.--Miyake and Baba, 1970: 93-94 (list).--Pequegnat and Pequegnat, 1970: 139 (key); 1971: 5 (key), 18-19.--Fowler, 1912: 574.

Munidopsis Munidopsis crassa: Bouvier, 1922: 47-48, pl. I, fig. 5.--Nobre, 1936: 117.

Material examined.--Western Caribbean Sea: NW of Swan Island, P-631, 4355-4393 m, 1 ovigerous ♀, 36.3 mm, UMML 32:5232; S of Yucatan Channel, P-577, 4415 m, 1 ♂, 18.1 mm, UMML 32:5231.--St. Croix Basin, Virgin Islands: P-1401, 4226-4133, 1 ♂, 23.0 mm, (USNM).--Southern Bahama Islands: S of Caicos, P-1426, 3965-4096 m, 2 ♂, 33.0, 36.0 mm, 2 ♀, 30.0 mm (with rhizocephalan parasite), 23.7 mm, UMML 32:5233; W of Great Inagua, P-1429, 2532-2515 m, 1 ♀, 17.5 mm, (RMNH). See distribution plot 6.

Diagnosis.--Rostrum unarmed, nearly horizontal with slight distal upturn; gastric region of carapace with 1 pair of sharp spines anteriorly and several smaller spines; frontal margin with distinct post-antennal spine; posterior margin and abdominal tergites unarmed; eyes with sharp conical spine extending from dorsomesial surface of cornea; epipods on



Distribution plot 6. -- *Munidopsis crassa* Smith, 1885 collected by the PILLSBURY.

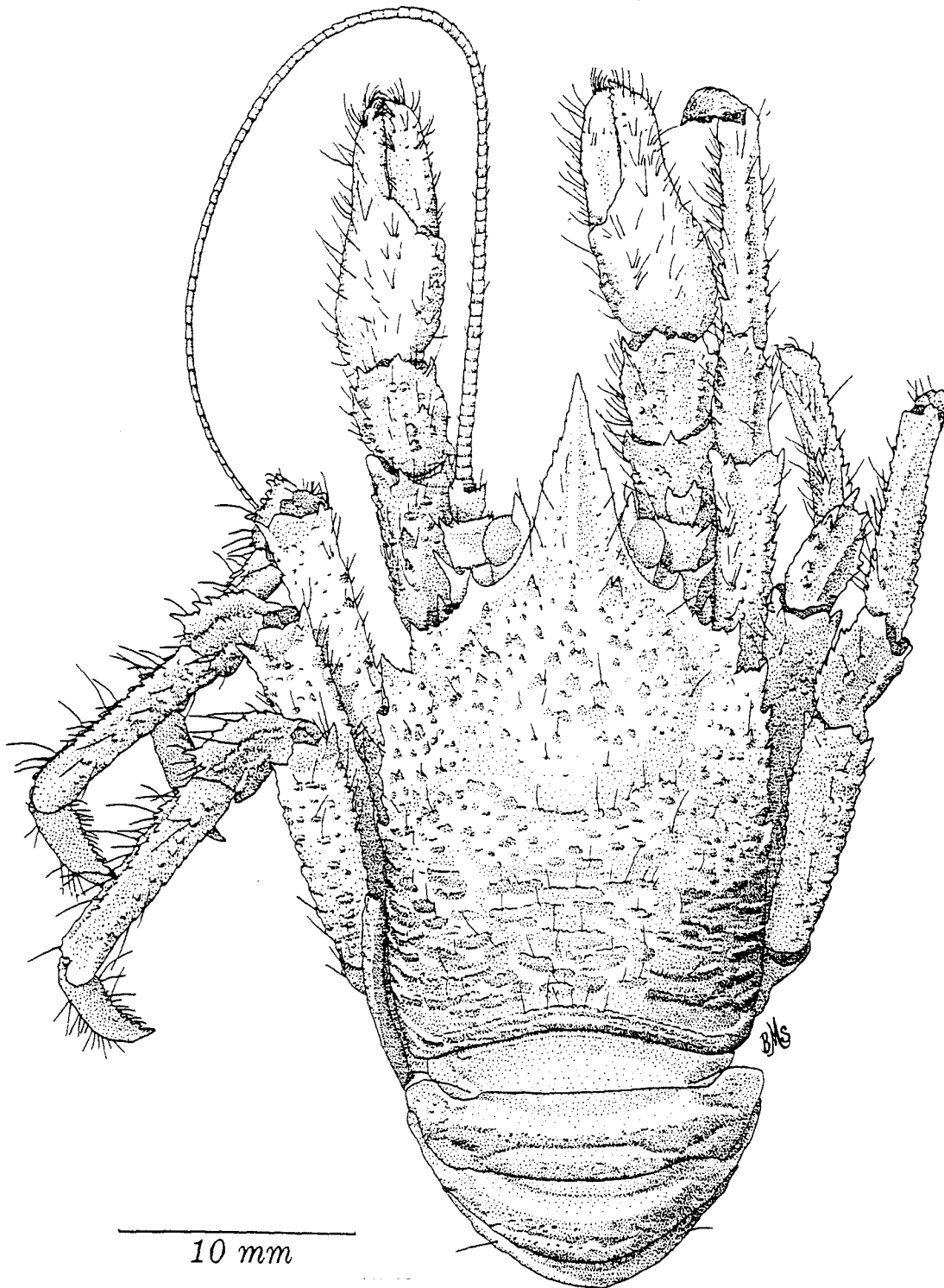


Figure 14. --*Munidopsis crassa* Smith, 1885, ♂, cl. 18.1 mm, P-577, dorsal view.

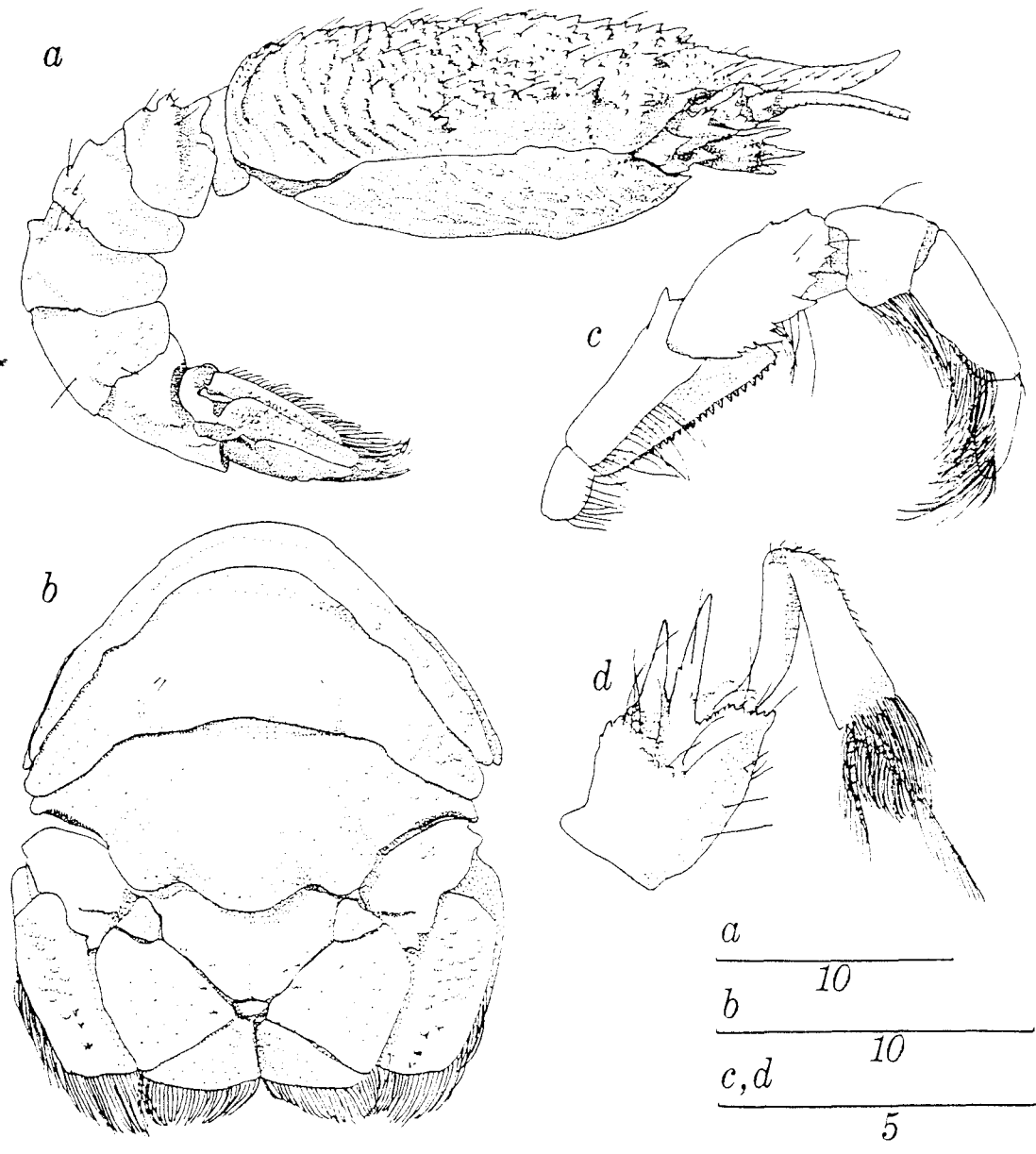


Figure 15. --*Munidopsis crassa* Smith, 1885, ♂, cl. 18.1 mm, P-577:  
a, lateral view of carapace and abdominal tergites; b, posterior abdominal tergites, uropods and telson; c, right third maxilliped, ventrolateral view; d, right antennule. Scales in mm.



chelipeds but not on ambulatory legs.

Description.--Carapace slightly longer than broad (cw/cl - 0.80-0.85); transversely convex; lateral margins nearly parallel. Cervical groove smooth, conspicuous behind mesogastric region, anterior and posterior lateral branches distinct. Slightly curved postcervical groove distinct between cardiac and metagastric region. Anterior gastric region with 2 sharp conical spines slightly larger than others, 1 on each side of midline; remainder of prominent gastric region, epibranchial lobes, metagastric region and mesobranchial region armed with many sharp spines and tubercles, arranged somewhat symmetrically; cardiac and metabranchial regions with interrupted crenulate or spinulate transverse rugae; smooth areas between rugae; several short setae scattered along raised forward edge of sculpturing, edge often projected to form toothed ridge. Posterior carapacial margin raised, with crenulate crest on anterior edge and transverse row of tubercles posteriorly. Rostrum broad, tapering to triangle; length, from base of eyestalk, about 1/2 of maximum carapace width; rostrum nearly horizontal, distal part slightly upcurved, more so in larger specimens; dorsal side with strong mediolongitudinal carina, surface roughened with small tubercles; distolateral margins sharp, with several minute spines; ventral side smooth. Frontal margin with 1 sharp spine immediately over base of antenna; another sharp spine at anterolateral angle; epibranchial lobe projecting beyond this laterally, armed at anterior angle with large, toothlike spine, and slightly upcurved; several spines posterior to this on anterior half of lateral margin, decreasing in size posteriorly except for prominent spine at anterior angle of metabranchial region.

Abdomen unarmed; second and third abdominal tergites somewhat similar, each with 2 roughened transverse crests rising behind smooth anterior part of segment; fourth tergite with 1 distinct ridge; fifth and sixth tergites without transverse ridges, sixth with prominent median lobe projecting from posterior margin and smaller lobe on each side; exposed parts of all pleura with scattered tubercles, second pleuron broadest, with anterior edge turned up to form convexity anterior to lateral extension of transverse crest.

Sternum unarmed; anterior edge at insertion of chelipeds serrate; area between chelipeds with several tubercles and tufts of setae; similar but less distinct sculpturing on each segment near lateral margins; intersegmental indentations distinct, ridges prominent.

Eyes colorless, barely movable, armed on dorsomesial edge with sharp conical spine projecting from eyestalk beyond cornea; mesial surface of spine often with minute denticle near tip or more proximally beneath rostrum; protuberance on ventromesial surface of eyestalk infrequently with small tubercle or tooth.

Basal segment of antennular peduncle with lateral tuberculate inflation, tubercles often spinulate; 2 sharp distolateral spines, dorsal spine slightly shorter; ventromesial part of distal margin projected, spinulate. Extended flagellum barely reaching tip of rostrum.

Basal segment of antenna broad, with large dentiform process ventromesially and sharp ventrolateral spine. Second segment with large sharp conical spine distolaterally; adjacent dorsal surface with smaller rounded projection with apical denticle; ventromesial toothed protuberance often with smaller adjacent teeth. Third segment with 4 teeth

or groups of small teeth around distal margin; mesial and lateral teeth most prominent. Toothed lobe on mesial and dorsolateral margins of dissegment. Flagellum long, approximately 3 times length of carapace.

Merus of endopod of third maxilliped armed with 4 to 6 teeth on ventral margin, middle or proximal 2 usually larger, occasionally with small tooth between; usually small tooth dorsolaterally on distal margin. Ischium with ventral carina; mesial carina serrate; spine on distal dorsolateral margin.

Pereiopods evenly sculptured with tubercles, projections and spines; setae sparsely scattered over most surfaces. Epipods on chelipeds, but not on ambulatory legs.

Chelipeds, measured from ischial fracture, approximately same length as carapace including rostrum. Length of dactylus approximately 1/2 length of propodus. Tips of dactylus and propodus spooned, dentate; teeth continuing proximally along upper edge of abutting margins; narrow gape proximally. Longitudinal ridge along lateral edge of fixed finger distally; sculpturing sparse on dorsal surface of propodus, several protuberances, some with denticles, on mesial and lateral edges of flattened palm arranged in indistinct longitudinal rows. Carpus less than 1/2 length of chela; several spines on distal margin: mesial spine sharp, conical, followed by 3 similar spines in oblique row; 2 other rows of spines on dorsolateral and lateral edges with tubercles scattered in between. Merus shorter than chela; 4 spines on distal margin; conspicuous row of similar spines on dorsal edge of segment; other rows of spines and tubercles around segment, particularly following large distal spines. Ischium with prominent dorsal spine, ventromesial ridge with spines.

Second, third and fourth pereiopods similar. Dactylus of second pereiopod reaching beyond cheliped; dactylus of third pereiopod almost reaching tips of cheliped fingers. Dactylus with corneous brown tip, unarmed except for serrate ventral margin and tufts of setae in rows on dorsal edge. Propodus with 4 longitudinal sculptured ridges: dorsomesial ridge with 6 to 10 conspicuous spines, increasing in size proximally; spines on other ridges reduced; lateral 2 ridges close together; surface with distinct longitudinal groove. Carpus less than 1/2 length of propodus; dorsolateral surface with 3 longitudinal ridges: most dorsal ridge with row of approximately 6 sharp spines including spine on distal margin: spines reduced on middle ridge; third row of protuberances laterally less distinct. Merus approximately same length as propodus; surfaces angulated, with rows of low tubercles and spines separating faces; dorsal ridge with sharp spines terminating in large spine distally; another spine distolaterally; lateral surface with tubercles and spines in indistinct rows. Ischium with dorsal spine and ventrolateral serration on distal margin of second and third legs; fourth pereiopods unarmed.

Fifth pereiopod with merus expanded, external surface roughened; several small protuberances on ventrolateral edge, medial one conspicuous.

Prctopod of uropods with posterolateral margin notched, with sharp spinules mesially and serrations laterally.

Telson broader than long, consisting of 8 plates; telson and uropods with tubercles scattered over surfaces, some posterior tubercles with short calcified setae.

Color.--The specimens examined are preserved in alcohol and are chalky white with no traces of pigment. Bouvier (1922: 48) described the color of a living specimen of M. crassa as milky white with a rusty tint on the legs, and Murray and Hjort (1912: 62) described the specimen collected by the 1910 MICHAEL SARS Expedition as a "chalk-coloured crab."

Size.--Specimens in this collection have the following sizes:

♂, cl. 18.1-36.0 mm,  
♀, cl. 17.5-36.3 mm, and  
ovigerous ♀, cl. 36.3 mm.

All specimens previously reported fall within these ranges, with the exception of the ovigerous female holotype with cl. approximately 45 mm.

Sexual dimorphism.--The males of this species have a distinct row of short golden setae on the lateral margins of the telson; this fringe is completely lacking in females. These setae in M. crassa are not as distinctive as the fringe of thick, often long, setae found on males of many other species of Munidopsis. The chelipeds do not differ appreciably between the males and females; both sexes have the opposing toothed margins abutting along their entire length dorsally.

The difference in curvature of the rostrum and ocular spination between males and females mentioned by Bouvier (1922: 47) appear to be individual variations rather than sexual ones.

Habitat.--The bottom at 2 of the stations where M. crassa was collected was characterized by sponges at one and coral and cinders at the other. The bottom type at stations of the type series ranged from Globigerina

ooze to gray mud and sand.

Type.--The holotype is an ovigerous female with cl. approximately 45 mm; USNM 8563.

Type locality.--Western North Atlantic, ALBATROSS Sta. 2224, 4710 m.

Geographic range.--Munidopsis crassa is known from both sides of the North Atlantic, from the eastern, southern and western Caribbean Sea, and from the Bahama Islands. Records in the literature include the following: western North Atlantic, off coast of United States (Smith, 1885: 494); eastern North Atlantic: between Portugal and the Azores (A. Milne Edwards and Bouvier, 1899: 82), north of Canary Islands (Gordon, 1955: 239), and Bay of Biscay (Sivertsen and Holthuis, 1956: 46); middle North Atlantic, west of mid-Atlantic ridge (Bouvier, 1922: 47); Caribbean Sea, Yucatan Basin and Colombian Basin (Pequegnat and Pequegnat, 1971: 18).

Bathymetric range.--Calculated depth range for material in this collection is 2532-4415 m. One station (P-1429) at depths of 2514-2532 m is the shallowest record for M. crassa. All previous depth records fall within the calculated depth range of the type series, 3188-4795 m.

Parasites.--One female specimen from P-1426 was parasitized by many pelto-trid rhizocephalans of the genus Cyphosaccus, probably an undescribed species related to C. chacei Reinhard.

There are no reports of parasitism on other specimens of M. crassa.

Associates.--Munidopsis crassa is the only galatheid crustacean collected from PILLSEBURY stations listed for it. Munidopsis geveri was collected with M. crassa in the Colombia Basin (Pequegnat and Pequegnat, 1971: 19).

Relationships.--Munidopsis crassa is closely related to M. geveri, also from the western Atlantic, but can be distinguished from that species by the carapacial spination: M. crassa has several small spines on the gastric region in addition to the single pair of large spines of M. geveri; there are as many as 9 lateral spines posterior to the anterolateral spine on M. crassa in contrast to usually only 4 lateral spines on M. geveri. M. bermudezi and M. similis are other western Atlantic species which bear some resemblance to M. crassa, but both lack carapacial spines other than a single gastric pair; M. bermudezi is more hirsute, and M. similis lacks epipods on its comparatively longer chelipeds.

Gordon (1955: 244) has discussed in depth the relationship of M. crassa to M. subsquamosa Henderson and its varieties M. subsquamosa aculeata Henderson and M. subsquamosa pallida Alcock from both sides of the Pacific Ocean and from the Indian Ocean. She compared the specimen of M. crassa from the Canary Islands with the CHALLENGER specimens of M. subsquamosa from off Yokohama and M. subsquamosa aculeata from between Marion Island and the Crozets and from west of Patagonia. She states that the specimen of "M. crassa has a longer, more upcurved rostrum, a more pronounced supra-antennal spine and a shorter spine on the eyestalk than in any of the CHALLENGER specimens." Furthermore, she observed that M. crassa and the M. subsquamosa material differ with respect to length of fingers on the chela, spination of the carpus of  $P_1$  and spination on  $P_4$ . She preferred to keep the two species separate, based on material examined, but pointed out the possibility that they might subsequently have to be regarded as one widely distributed and very variable species.

Munidopsis cubensis Chace, 1942

Figures 16, 17

Munidopsis cubensis Chace, 1942: 72 (key), 78-80, fig. 27.--Pequegnat and Pequegnat, 1970: 138 (key); 1971: 4 (key).

Material examined.--Straits of Florida: GERDA Sta. 114, 869-759 m, 1 ♀, 18.2 mm, UMML 32:5234.

Diagnosis.--Rostrum upturned, armed at end of horizontal portion with pair of lateral spines; 1 pair spines on anterior gastric region of carapace; frontal margin unarmed; posterior margin with pair of small spines near midline; second and third abdominal tergites each armed with median spine on anterior ridge, second tergite with smaller median spine on posterior ridge, fourth tergite with slight median tuberosity but no distinct spine; eyes unarmed; epipods on chelipeds and first 2 pairs of ambulatory legs.

Description.--Carapace longer than broad (cw/cl approximately 0.90-0.95); vaulted transversely; gastric region slightly inflated, armed with 1 pair of distinct spines anteriorly, dorsal surface elsewhere transversely rugose and granulate; central gastric ruga ridge-like with median denticle. Cervical groove distinct behind gastric region; postcervical groove separating metagastric and cardiac regions broader than cervical groove; ridges posterior to grooves sharp, serrate, but otherwise unarmed. Short curved setae over most dorsal and exposed surfaces, usually associated with protuberances. Rostrum carinate, approximately 1/2 length of carapace, distal half upturned at angle of approximately 45° from horizontal, tapering distally, armed at end of broader horizontal portion with pair



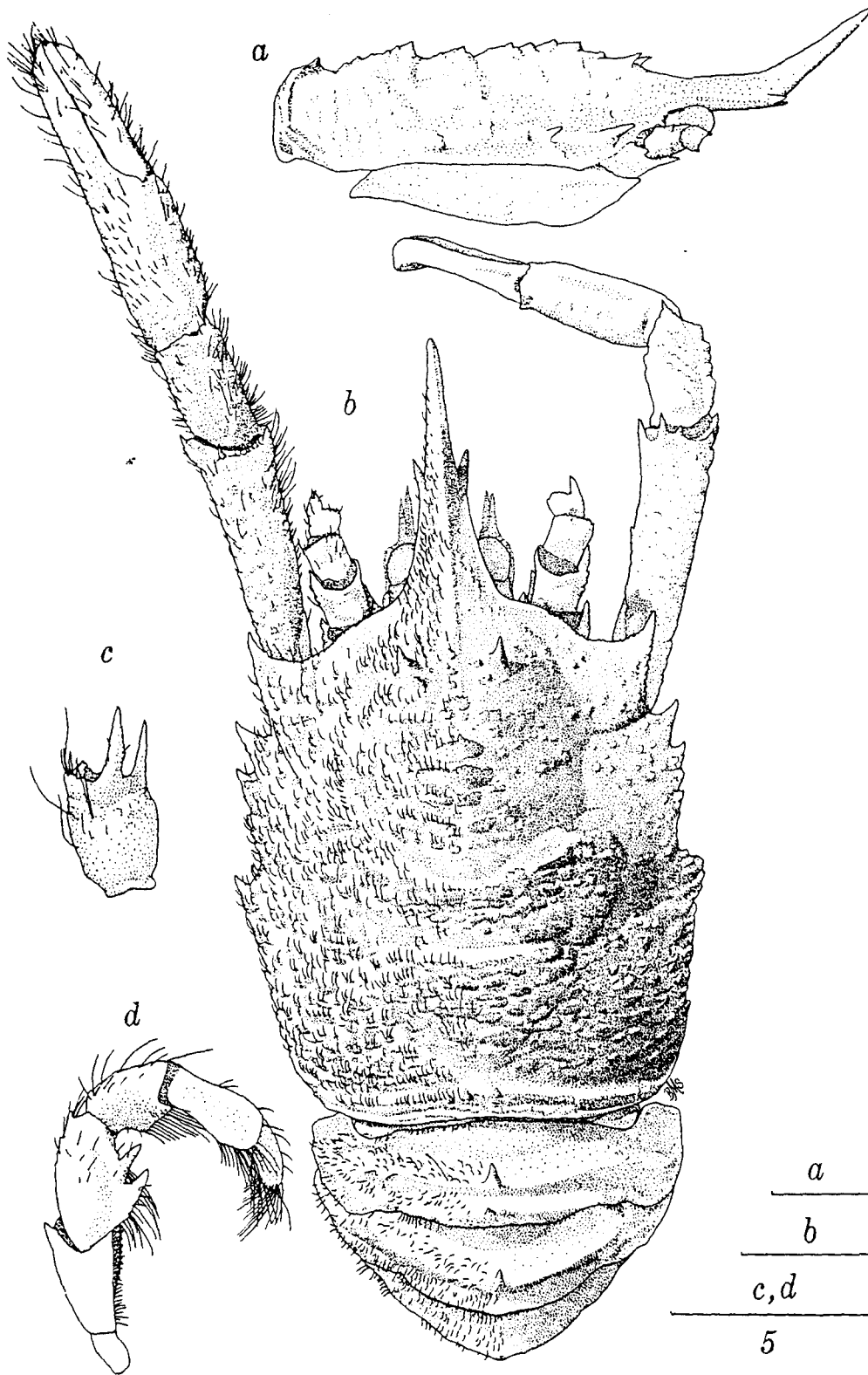


Figure 16. --Munidopsis cubensis Chace, 1942. ♀, cl. 18.2 mm, G-114:  
a, carapace, lateral view, setae omitted; b, dorsal view, setae shown  
on left side only; c, left antennular peduncle, ventrolateral view;  
d, right third maxilliped, ventrolateral view. Scales in mm.

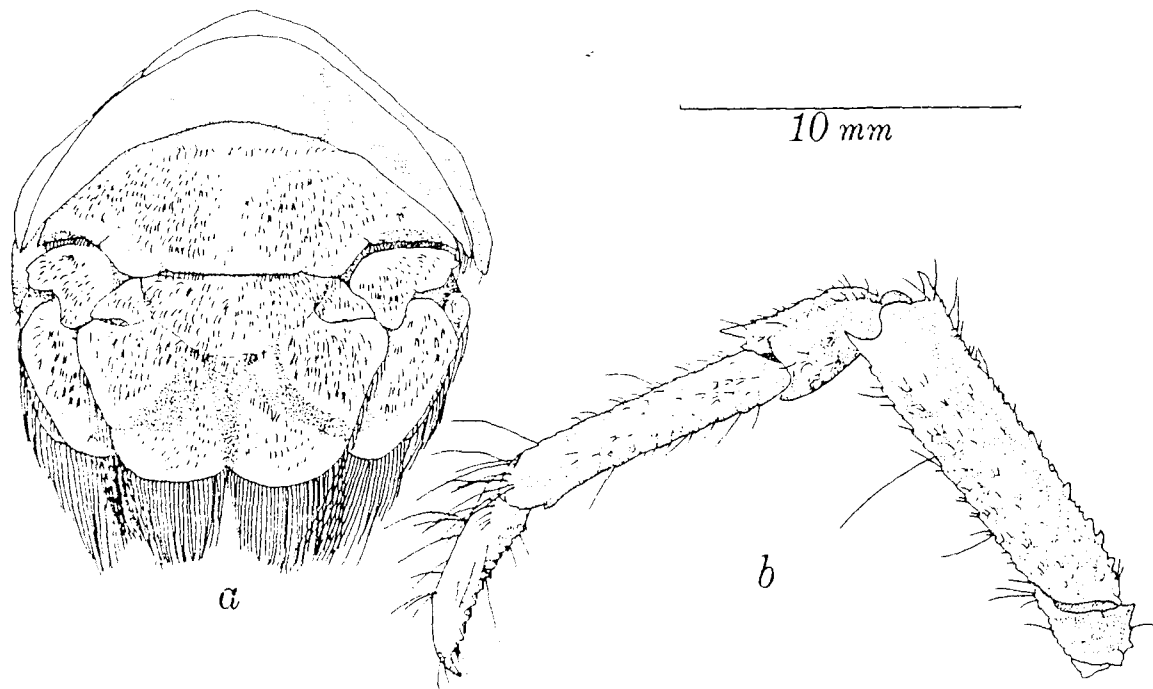


Figure 17. --Munidopsis cubensis Chace, 1942. ♀, cl. 18.2 mm, a, posterior abdominal tergites, uropods and telson; b, left pereiopod.

of spines. Frontal margin minutely serrate but unarmed. Lateral margin with 3 or 4 spines: anterolateral spine largest, broad at base, 1 or 2 smaller spines behind anterior branch of cervical groove; very small spine behind posterior branch. Ridge bordering posterior margin of carapace with small but distinct pair of spines medially and occasionally additional smaller spines or tubercles.

Abdomen with 1 median spine on anterior transverse ridge of second and third abdominal tergites; small median spine on posterior ridge of second tergite; fourth tergite with slight median swelling on anterior ridge; fifth and sixth segments relatively smooth.

Sternum with several low tubercles between bases of chelipeds, obscurely serrate ridges with setae posterior to distinct intersegmental grooves.

Eyes colorless, unarmed and movable; diameter of cornea slightly wider than eyestalk.

Small tuberculate projection emerging from beneath frontal margin at intersection of bases of antenna, antennule and eyestalk.

Basal segment of antennular peduncle inflated; surface of swollen areas lightly sculptured; 2 sharp distolateral spines, most distal spine slightly broader; distal margin minutely serrate with small triangular projection mesially.

Basal segment of antenna broad with expanded triangular tooth ventromesially and small tuberculate lateral tooth. Second segment with sharp lateral spine. Third segment with distal margin serrate, otherwise unarmed. Distal segment with small dorsolateral lobe on distal margin. Flagella missing on specimen examined; flagella exceeding 3 times length of cheliped on drawing of holotype (Chace, 1942: fig. 27).

Merus of endopod of third maxilliped armed with small dorsolateral spine near distal margin; 2 larger spines on ventromesial margin, proximal spine broader at base. Ischium with ventral carina terminating in triangular tooth, mesial border serrate, small distal spine on dorsolateral margin.

Pereiopods with tubercles, often multidentate, over most exposed surfaces, more distinct and heavier on more proximal segments. Epipods on chelipeds and first 2 pairs of ambulatory legs.

Chelipeds approximately 1 1/2 times carapace length. Dactylus slightly longer than 1/2 length of propodus; dactylus slightly longer than 4 times maximum width; tips of fingers slightly broadened, spooned, dentate; opposing margins obscurely toothed, abutting along entire dorsal face of chela, lengthwise excavation between fingers ventrally. Carpus more than 1/3 length of propodus; distal margin with small dorsomesial spine, dorsal serrate ridge and small ventral spine; slight mediolongitudinal swelling on dorsal surface with distinct tubercles. Merus approximately same length as propodus; 4 small spines arranged around distal margin; denticulate tubercles slightly more prominent in lengthwise row along dorsal surface and ventromesial surface; 1 ventromesial spinule. Ischium with dorsal spine at articulation with merus.

Second, third and fourth pereiopods almost identical. Dactylus with corneous brown tip followed by 10 or 11 small triangular spines, each bearing 1 corneous spinule on forward edge. Propodus less than 2 times length of dactylus; distal margin with serrations ventrally, but unarmed except for rows of tubercles on dorsal and lateral surfaces. Carpus less than 1/2 length of propodus, single sharp dorsal spine on distal margin followed by indistinct raised row of tubercles; shallow

concavity lateral to this separating dorsal crest from low tuberculate ridge. Merus slightly longer than propodus; distal margin with sharp dorsal spine; dorsal margin with low tuberculate ridge and several small blunt teeth; ventral spine on distal margin followed by denticulate tubercles; lateral face tuberculate; mesial face smooth. Ischium with small dorsal tooth on distal margin, ventrolateral serration and ventral projection.

Fifth pereopods with merus expanded, exposed surface tuberculate.

Protopod of uropods with indentation in posterolateral margin and 2 small lobes posteriorly. Most exposed surfaces of telson and uropods with short setae, usually small swellings at bases of setae.

Telson with 7 plates distinct; central and intermediate plates less distinct; posterior plates well-separated by non-calcified regions; posterior margin with median indentation.

Color.--The specimen examined is preserved in alcohol and is completely devoid of color except for pale yellow color of thicker setae and cornuous light brown tips of dactyli. No records of color in this species were found.

Size.--♂, cl. 20.0 mm (holotype);

♀, cl. 18.2 mm (material examined).

Sexual dimorphism.--The only difference observed between the description and illustration of the male holotype and the female specimen examined is the heavy, but not conspicuous, fringe of setae on the lateral margins of the telson of the male; this fringe is absent entirely from the female.

Substratum.--There were large rocks on the bottom at station 1-11-1.

Type.--The holotype is a male, cl. 2010 mm; MCE 11731.

Type locality.--Eastern Cuba, ATLANTIS Sea. 3300, northwest of Puerto Cayo Moa, Oriente Province: 20°46'N, 74°59'W; 1144 m.

Geographic range.--The type from off Cuba and the specimen from the Straits of Florida are the only ones thus far recorded.

Bathymetric range.--The depth at which the specimen reported herein was collected was 759-869 m. The depth at which the type was taken was 1144 m.

Parasites.--The specimen examined shows no external evidence of parasitism; no parasites were reported for the type.

Associates.--It is difficult to determine the significance of the single joint occurrence of M. longimanus with M. cubensis.

Relationships.--Of western Atlantic species, Munidopsis cubensis appears to be most closely related to M. expansa Benedict and M. gilli Benedict, both with laterally armed, upturned rostra, but differs from both in having only 1 pair of well-developed gastric spines on the carapace. In addition, M. cubensis and M. gilli both have epipods on the first 3 pairs of pereopods; however M. gilli has 2 large gastric tuberosities, less distinct lateral spination and sculpturing on the carapace, and a distinct median tooth on the fourth abdominal tergite. M. expansa is more heavily sculptured on the carapace, lacks gastric and abdominal spines; and lacks epipods on the third pereopods. M. brasili Pequegnat and

Pequegnat is quite similar to M. cubensis, but has the rostrum less upturned, epipods only on the chelipeds, more gastric spines, and paired abdominal spines.

The morphology of M. cubensis is quite similar to that of the Japanese species, M. camelus Ortmann, with epipods on the first 3 pairs of pereopods, but the latter species has 5 gastric spines, paired abdominal spines and longer chelipeds. Munidopsis trifida tomentosa (Henderson), also from the western Pacific, looks somewhat like M. cubensis, but has no pereopodial epipods, no abdominal spines and longer chelipeds.

Remarks.--The specimen of M. cubensis taken by the GERDA constitutes the first record of a female of the species, and the only record other than the one based on the holotype.

Munidopsis erinaceus (A. Milne Edwards, 1880)

Figures 18, 19

Galathodes erinaceus A. Milne Edwards, 1880: 53-54.

Munidopsis erinacea: Henderson, 1888: 149, pl. 16, fig. 4.--A. Milne Edwards and Bouvier, 1894b: 275 (key); 1897: 67-69, pl.VII, figs. 9-12.--Young, 1900: 407 (key), 411-412.--Benedict, 1902: 77 (key), 320 (list).--Doflein and Balss, 1913: 175 (list), 176 (list), 177 (table).--Schmitt, 1935: 179 (key).--Boone, 1927: 60.--Chace, 1942: 74 (key), 90-91.--Pequegnat and Pequegnat, 1970: 140 (key), 146-147, table 5-2, fig. 5-1.

Munidopsis erinaceus: Perez, 1927: 287.--Pequegnat and Pequegnat, 1971: 6 (key).

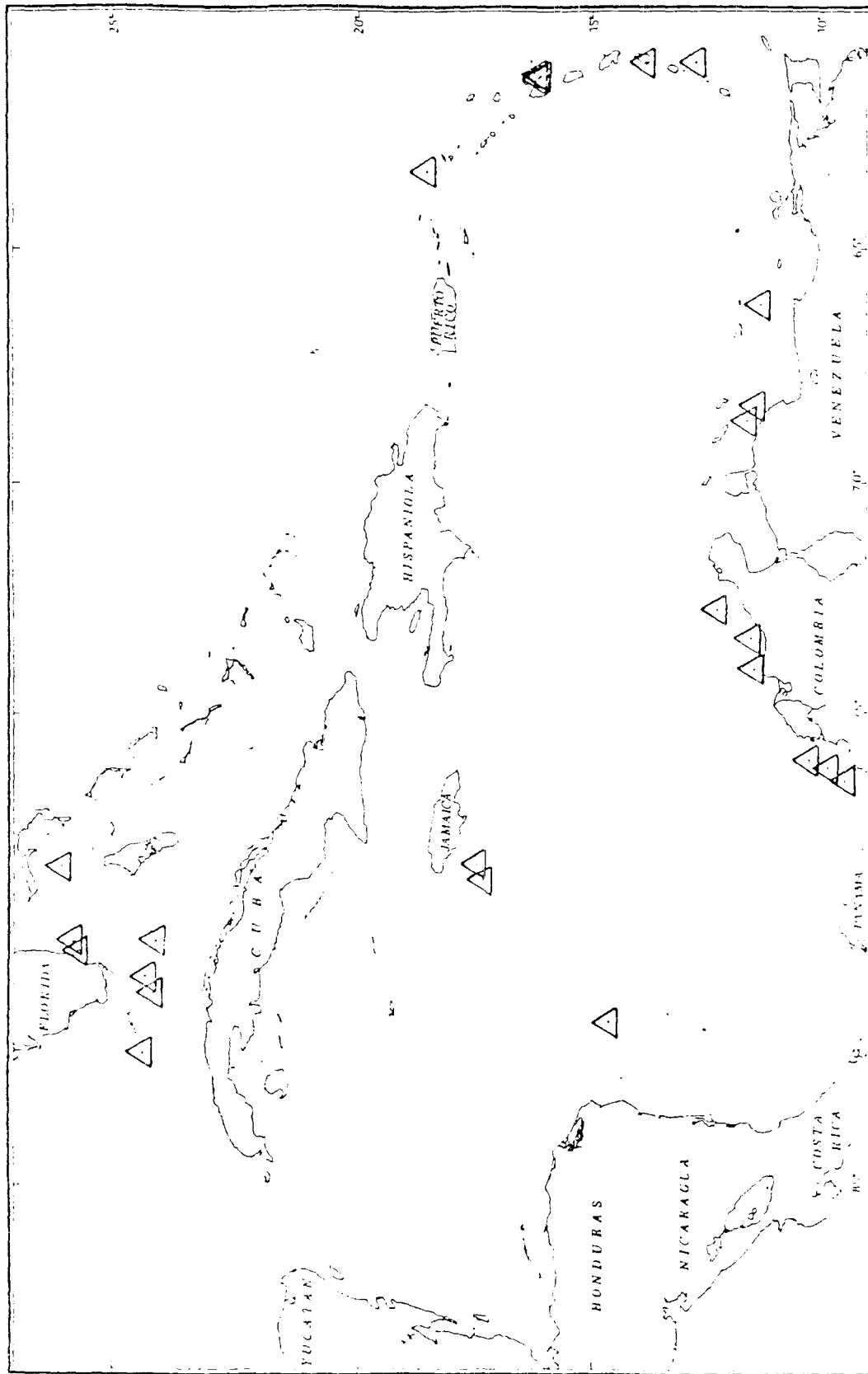
Material examined.--Straits of Florida: G-221, 604-586 m, 2 ♂, 12.0, 13.5 mm (USNM); G-830, 342 m, 1 ♀, 10.7 mm, (USNM); G-870, 807-755 m, 1 ♀, 14.5 mm, 1 ovigerous ♀, 9.5 mm, UMML 32:5235; P-1309, 311 m, 1 ♀, 10. mm (USNM).--Santaren Channel: G-815, 618 m, 1 ♂, 8.4 mm, 1 ♀, 7.5 mm (RMNH).--Northwest Providence Channel: G-917, 659-706 m, 1 ♂, 11.1 mm, 1 ovigerous ♀, 8.1 mm, UMML 32:5236.--Off Atlantic coast of Colombia: P-374, 434-373 m, 2 ovigerous ♀, 813, 12.3 mm (USNM); P-381, 724-597 m, 1 damaged ovigerous ♀, 16 mm, UMML 32:5237; P-394, 416-634 m, 1 ♂, with abdominal parasite, 8.3 mm, 1 ovigerous ♀, 11.0 mm (RMNH); P-776, 408-576 m, 1 ♂, 9.1 mm, 1 ♀ with branchial parasite, 10.4 mm, UMML 32:5241; P-781, 531-567 m, 1 ♀, 14.0 mm (USNM); P-784, 567-715 m, 1 ♂, 13.8 mm, UMML 32:5242.--Off Venezuela (W of Tortuga Island): P-740, 827-924 m, 1 ♂, 18.5 mm, UMML 32:5238; (N of Golfo de Trieste): P-753, 384-607 m, 1 ♂, 9.8 mm with abdominal and branchial parasites, 1 ♀,



12.8 mm with branchial parasite, UMML 32:5239; P-754, 684-1574 m, 1 ♂, 16.8 mm, UMML 32:5240.--E of Grenadine Islands: P-861, 357-586 m, 3 ♂, 6.0-7.5 mm, 1 ovigerous ♀, 10.0 mm, UMML 32:5243.--Off St. Lucia: P-904, 589-439 m, 1 ♂, 14.4 mm, 2 ovigerous ♀, 8.1, 9.3 mm, UMML 32:5244.--Off Guadeloupe: P-919, 683-733 m, 2 ovigerous ♀, 8.1, 9.8 mm (USNM); P-920, 683-733 m, 1 ovigerous ♀, 11.9 mm (RMNH); P-923, 476-686 m, 36 ♂, 9.2-14.5 mm (6 with branchial parasites), 38 ♀, 8.2-13.4 mm (28 ovigerous, 8.4-13.4 mm), 3 of non-ovigerous with branchial parasites, 9.6-10.5 mm (USNM).--NW of Anguilla: P-989, 664-706, 1 ♂, 9.5 mm (RMNH).--S of Jamaica: P-1255, 622-823 m, 1 ♀, 8.7 mm (RMNH); P-1256, 521-658 m, 2 ♂, 9.3, 11.7 mm, UMML 32:5245.--Off Honduras: P-1355, 450-576 m, 8 ♂, 9.1-16.8 mm (16.8 mm with 2 abdominal parasites), 13 ♀, 9.0-16.1 mm (6 ovigerous, 11.2-16.1 mm), 13.1 mm non-ovigerous with 2 abdominal parasites) (RMNH). See distribution plot 7.

Diagnosis.--Rostrum almost horizontal, with 1 pair of divergent lateral spines; gastric region of carapace with 2 pairs of spines; frontal margin with sharp post-antennal spines; posterior margin unarmed; second, third and fourth abdominal tergites armed, but no spines on midline; no eyespines; no epipods on pereopods.

Description.--Carapace longer than broad (cw/cl approximately 0.80), lateral margins slightly convex. Gastric region inflated, armed with 2 pairs of sharp curved spines: anterior pair largest, situated in line with eyes; 2 pairs of spines on cardiac region; (total of 4 pairs of spines on carapace centrally, arranged widest apart anteriorly, rows converging posteriorly). Each metabranchial area with 1, 2 (usually) or 3 spines. Cervical groove narrow, distinct across center of carapace



Distribution plot 7.--*Munidopsis erinaccus* (A. Milne Edwards, 1880) collected by the GERDA and PILLSBURY. 135

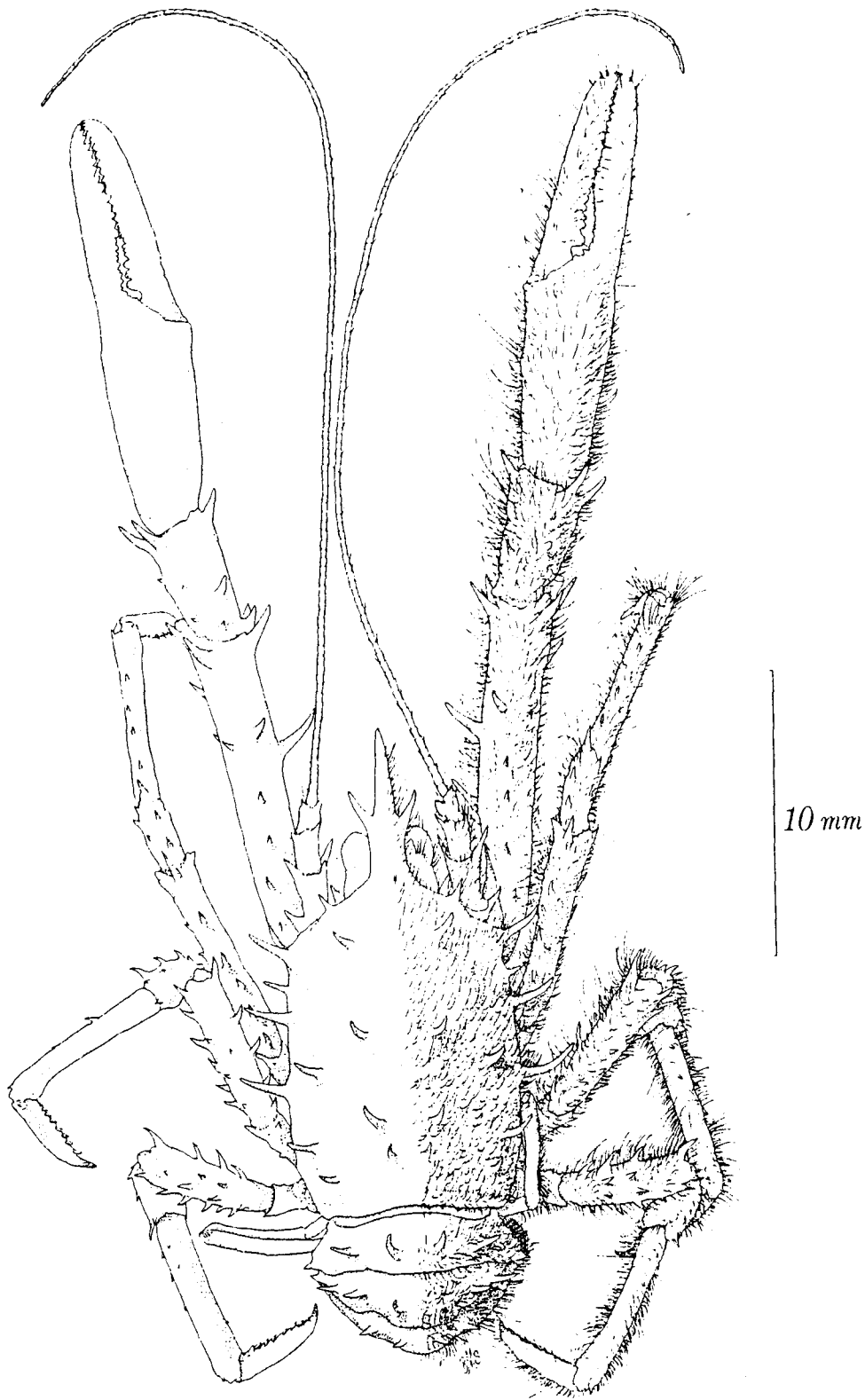


Figure 18. --*Munidopsis erinaceus* (A. Milne Edwards, 1880). Ovigerous ♀, cl. 10.8 mm, P-923, dorsal view, setae shown on right side only.

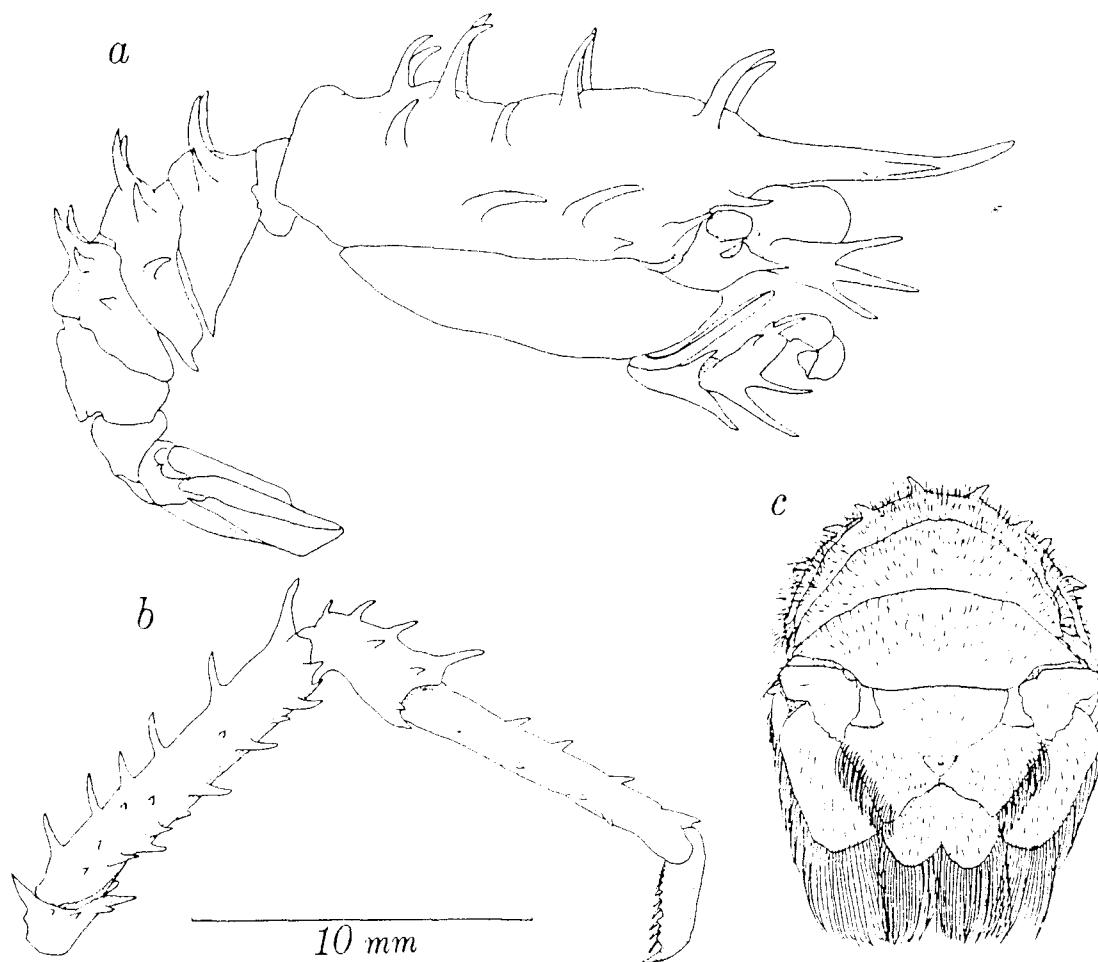


Figure 19. --Munidopsis erinaceus (A. Milne Edwards, 1880). Ovigerous ♀, cl. 13.3 mm, P-1355: a, carapace and abdomen, lateral view, setae not shown. ♀, cl. 14.0 mm, P-1355: b, right second pereiopod, fine dense setae not shown. ♂, cl. 13.5 mm, P-1355: c, posterior abdominal tergites, uropods and telson.