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SCIENTIFIC RESULTS OF THE FIRST OCEANOGRAPHIC
EXPEDITION OF THE "PAWNEE"
1925.

CRUSTACEA FROM TROPICAL EAST AMERICAN SEAS.

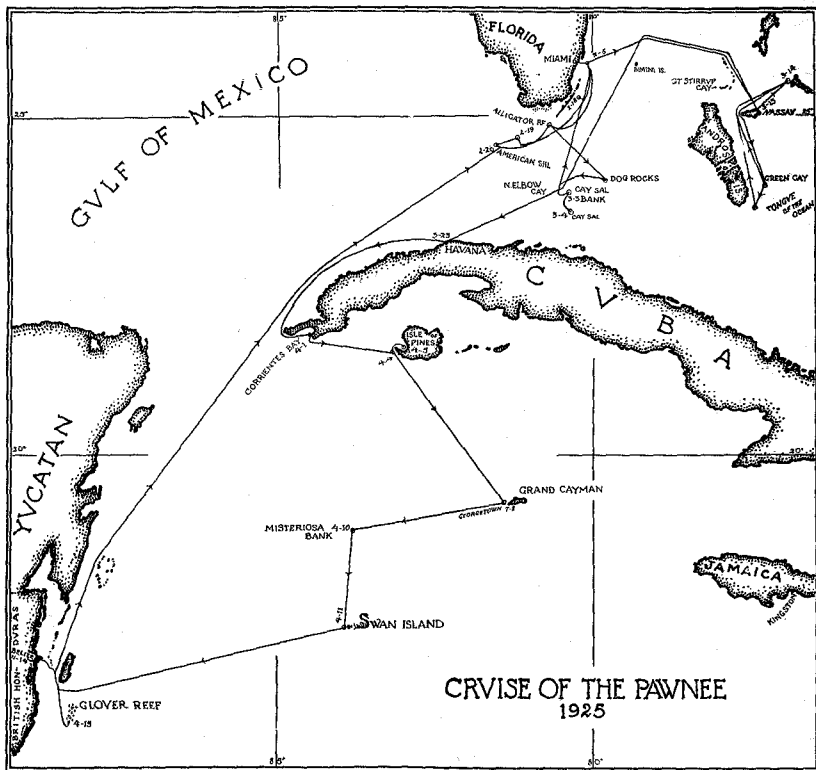
BY LEE BOONE

The Crustaceans taken by the first Bingham Oceanographic Expedition, although secured incidentally to the ichthyological collections, have proven to be a remarkably valuable series. This expedition, undertaken and directed by Mr. Harry Payne Bingham in his yacht 'Pawnee I', because of his personal interest in oceanographic science, involved the exploration of the West Indian-Caribbean regions indicated in the accompanying map. Mr. Bingham's forthcoming report will give a full discussion of the project. Ranging in classification from Copepoda to Stomatopoda, the collection is an excellent synoptic representation of the diversification of crustaceous organisms to be found in this amazingly rich faunal region. The bathymetric distribution of the specimens taken ranges from terrestrial and littoral to deep-sea, *i. e.*, 484 fms.

Præminent in interest are these deep-sea forms, the majority of which were secured from the little-explored region off the coast of British Honduras, and some, equally unique, from the better known region around English Cay. It is extraordinary that despite the many extensive expeditions made previously, nearly fifty *per centum* of the deep-sea species taken by the 'Pawnee I' were new to science, and many of the remainder establish the rediscovery of species hitherto known only from the type specimens or immature forms.

In two dredge hauls made consecutively north of Glover Reef, representatives of twenty deep sea Crustacea were captured in generous numbers. Of these, nine species, *i. e.* seven Decapoda and two Isopoda, are new, two establish the rediscovery of two rare deep-sea forms, a brachyuran and a macruran, not taken since the capture of the type specimens by the 'Blake'; one establishes the first Caribbean record of a cosmopolitan bathypelagic macruran; one establishes

the first record of the symbiosis of a rare deep-sea anomuran with crinoid to be reported from the Atlantic Ocean; four present both sexes of the respective species for the first time; two species present the very young adult, each of which belongs to a well known Caribbean



species, but had been regarded as distinct species; and one presents the record catch of the remarkable primitive isopod *Bathynomus giganteus*. Several species of the deep-sea macrurans and anomurans were taken in greater numbers in these two dredge hauls of the 'Pawnee I,' than they were represented during the entire 'Hassler,' 'Blake,' 'Albatross,' 'Fish Hawk,' 'Challenger' and 'Eolis' explorations. These series of specimens have given valuable data on the growth stages and

thus made it possible to clarify much of the confusion existing in the literature because of paucity of material.

Most conspicuous in this dredge haul were the five strikingly large specimens of *Nephrops binghami* new species, which is the ninth species of this remarkable deep-sea genus and the second species known from American waters, the other species being *N. rubellus* Moreira, from south of the Amazon, South America.

Three specimens of *Nephropsis agassizi* A. Milne Edwards, of varying sizes, serve to connect this species more definitely with its East Indian congener, *N. stewarti* Wood-Mason.

A very large and unusually perfect specimen of *Stereomastis americana* extends the range of this species to the coast of British Honduras.

Aegeon caribbeus new species is the first representative of this curious genus to be recorded from American waters. Of the eleven species and three varieties already known, *A. cataphractus* (Olivi) described in 1792, is known from the Mediterranean and Adriatic Seas, Senegambia, South Africa, Ceylon and the west coast of the Indian Peninsula, and from North Cape, New Zealand; a second species is confined to European waters, and the remaining members of the genus are confined to the Indo-Pacific.

Another valuable trophy of this haul was four practically perfect specimens of *Plesionika longipes* A. Milne Edwards, which species has never been taken since the discovery of the type by the 'Blair' off the island of Barbados, West Indies, 200 fms., 1881. The four specimens taken show the extreme variation in rostral development to be expected in members of this family (Figure 25.).

Two specimens of *Acanthephyra purpurea* establish the first Caribbean record for this widely distributed species. Two specimens of *Acanthephyra anomala* new species add another species to this large genus of bathypelagic macrurans.

The 'Pawnee I' also had the extreme good fortune to secure a specimen of *Gonatonotus crassus* A. Milne Edwards, north of English Cay, in 190 fathoms. This is the first time this species has been recorded since the capture of the type in 1881, off Grenada, Antilles, in 262 fathoms. Since the genotype, which is the only specimen of this genus known, is deposited in the Paris Museum, and was not fully described nor figured, the finding of this second specimen is of unusual value.

Among the Brachyura taken north of Glover Reef, in 484 fms., *Hepthopelta superba* new species is also the first member of its genus to be reported from American waters, the three species of this crab already known being from the Andaman Sea, the waters of the Philippines, and Waru Bay, Ceram, respectively.

The capture of *Goneplax tridentata* (A. Milne Edwards) in the same dredge haul with the above species was of scarcely less interest, for this striking *Goneplacinid* has never been taken since the capture of the type by the 'Blake,' off Barbados, in 7 to 50 fathoms, in March, 1879. According to Prof. A. Milne Edwards, this specimen, which is deposited in the Paris Museum, measures 5 mm. long, 8 mm. wide, while the one taken by the 'Pawnee' measures 20 mm. long, 24 mm. wide.

Pylopagurus exquisitus, from the same station, adds another very beautiful species to this group of deep-sea hermit crabs.

Munida paynei and *M. elfina* add two uniquely ornamental species to the already large number known from tropical American waters.

Galacantha barbarae, new species, from Green Cay, Bahamas, establishes the first West Indian species of this genus.

Uroptychus rugosus Milne Edwards, in symbiosis with a crinoid, establishes the first occurrence of this relation between an anomuran and a crinoid to be reported from the western Atlantic.

Arcturus pawneeana, a new species of isopoda, shared this symbiosis with the same crinoid and likewise the first American record of this relation between an isopod and a crinoid.

Munidion irritans, new species, establishes the second member of this genus of crustaceans which are parasitic on Crustacea, in the West Indies.

Scalpellum rodstromi, new species, commensal with the crinoid, *Stylometra spinifer*, adds another American member to this large genus of deep-sea barnacles.

Among the littoral Crustacea taken, perhaps the most valuable data gleaned are the contributions to the knowledge of the fauna of the Isle of Pines, heretofore only known from casual records, and the substantial additions to our knowledge of the fauna of Swan Island and Glover Reef. Even the much dredged Florida coast has yielded a new species of snapping shrimp, *Alpheus platycheirus* Boone, and a new

spider crab, *Pelia deflecta*. From the Isle of Pines a new crab, *Hexapanopeus hirsutus* and a new burrowing macruran, *Glypturus signanensis* are recorded, while the first new crustacean to be recorded from Swan Island is *Lithadia geometrica* Boone, a tiny shingle crab whose sculpturing is jewel-like in beauty.

ACKNOWLEDGMENTS

In the preparation of this report I have enjoyed full privileges of research in the American Museum of Natural History of New York City, and am indebted to the authorities in charge of the Calcutta Museum, India, the Museum National d'Histoire Naturelle, Paris, the British Museum, the Museum of Comparative Zoology, Cambridge, Mass., and the Princeton University Museum, New Jersey, for kind assistance with reference to various types in these respective depositories.

The drawings for figures 2, 3, 4, 5, 18, 19, 20, 22, 23, 24, 25 and 28 were made by Mr. W. S. Bronson; preliminary sketches of figures 10, 14, 15, 21 and 26 were also made by Mr. Bronson, and corrected and completed by Mrs. Elizabeth M. Fulda, who also made the drawings for figures 1, 6, 7, 9, 12, 16, 30, 32 A, B, and C, and 33; Mrs. Louise Nash made those for figures 8, 13, 17, 27, 29 and 31. Mr. Sadatsune Irie made the drawings for figure 11; all drawings were done under my direction.

I wish to express my appreciation of the kindness of the owner of the collection, Mr. Harry Payne Bingham, in giving me an opportunity for the preparation of this report.

tends upon the carapace to about the urogastric line; the remainder of the leg is bent at right angles to the merus; the carpus is three-fourths as long as the merus, and the propodus is half as long as the merus, the dactyl is hook-like.

The eyes are prominent, bulbous, the cornea being greater than the stalk, and very convex; golden brown.

The external antennæ are 3.5 mm. long, or equal to two-thirds of the median width of the carapace.

Tribe *ANOMURA*.

Group *HETEROMACRURA* A. E. Verrill, 1908.

Superfamily *GALATHEIDEA* Henderson.

Family **GALATHEIDAE**.

Subfamily *GALATHEINES*.

Genus **Munida** Leach, 1821.

Munida Leach, Art. Galatheidea, in Dict. Sci. Nat., vol. 18, p. 50, 1821.

Munida miles A. Milne Edwards, 1880.

Munida miles A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, no. 1, p. 51, 1880; Mem. Mus. Comp. Zool., vol. 19, no. 2, and vol. 35, p. 35, Pl. 3, fig. 1-4, 1897.

Material examined: The first haul of the dredge north of Glover Reef, April 20, 1925, yielded one young specimen of this species from a depth of 366 fathoms, while the second haul from the same locality, but from a depth of 484 fathoms, brought up 24 representatives of this species. This series presents an excellent example of the stages of growth of the species, ranging in size from a very small young one to large adults.

Distribution: The type of the species was taken by the United States Coast Survey Steamer 'Blake' at station 274, Barbados, in 204 fms., and additional material was secured by this expedition at other stations in the West Indies and the Gulf of Mexico, at depths varying from 37 to 320 fathoms. It was also recorded by the 'Challenger' expedition off Pernambuco, at 350 fathoms.

Technical description: The largest specimen of the series captured measures 27.5 mm. long from the tip of the rostrum to the posterior margin of the carapace and 18 mm. wide, the rostrum is 7 mm. long. The carapace is subquadrate, decidedly convex from side to side, and crossed by numerous prominent striæ which are composed of pearly granules; the cervical and urogastric grooves are even deeper than the grooves between the striæ. The frontal border bears a pair of sharp submedian spines, one on each side of the rostrum, which are

each half as long as the rostral spine; there are also a pair of sharp branchiostegal spines which are three-fourths as long as the submedian pair; the anterolateral angle is armed with a minute spine, and there are five (rarely six) spines placed subequally along lateral margin, posterior to the anterior termination of the cervical groove. A series of four minute spines form a transverse row across the median part of the anterior gastric region just behind the rostrum. There is a longitudinal row behind the rostrum and between the innermost pair of gastric spines, composed of two single tubercles, one behind the other and a pair of tubercles behind these. The carapace is crossed by eighteen transverse striae which are composed of rows of pearly granules. Anterior to the first of these striae, there is a transverse row of 14 spines across the median part of the anterior gastric region. The submedian pair of these spines is quite small, the next pair, situated behind the preocular spines, are the largest of the series; the third pair of spines are subequal to the first, or submedian, pair, while the fourth to seventh pairs inclusive are subequal, smaller, the outermost pair being just inside the anterior branch of the cervical groove. The most anterior of the eighteen transverse striae is broken into a small median and two larger outer sections which terminate inside the cervical groove; the second and third striae also terminate inside this groove; there is a single, sharp, forward-pointing spine just above the cervical groove and behind the outer termination of the second striation; the fourth striae is only three-fourths as long as the third, while the fifth striation is longer and more prominent than any of the preceding; the sixth to ninth striae inclusive are successively shorter, reaching one-third or less the width of the carapace and defined posteriorly and laterally by the curving cervical groove; behind the cervical groove there are nine prominent striae composed of pearly granules extending quite across the carapace; the deep urogastric groove and related depressions somewhat interrupt the continuity of the anterior three of these striae; the eighth striation is more strongly accentuated than its associates. All eighteen of the striae are heavily fringed along the anterior margin with long silky setae which lay close to the carapace. Between some of the striae there are arc-like designs composed of granules.

The first abdominal segment is visible only in the median area; the second segment is four millimeters long and has the epimera rounded; it is crossed by two complete transverse striae made up of granulations between which there are several arc-like designs of granules; the epimera are especially ornamented with granules; the striation forming the anterior margin is fringed with a band of forward-directed setae and also bears a row of eight subequally spaced spinules. The third abdominal segment is similar to the second but has the epimera more tapering and bears only a single pair of spinules; the fourth segment is similar to the third segment but has the epimera narrower and is devoid of spinules; the fifth segment is longer than the fourth and has the epimera with the lateral margins truncate; the sixth segment is as long in the

median region as the fifth but has its lateral parts tapering, the anterior and posterior margins convergent towards the narrow epimeral border. The lateral regions of the fourth segment, also the fifth and sixth segments, are ornamented with flattened squamæ which have the posterior margins rounded and fringed with long setæ; these squamæ are arranged in a pattern forming a beautiful design on that part of the abdomen which is normally bent under. The telson, inner blade of the uropoda and that part of the outer blade which is exposed in the folded fan, are also ornamented with these squamæ which give a beautifully sculptured effect. These squamæ are much smaller on the posterior part of the telson and on the uropoda.

The chelipeds are subequal, 50 mm. long, or as long as the body of the animal, from the tip of the rostrum to the tip of the telson; rather stout, the meral carpal and propodal joints each being about 5.5 mm. wide and robust; the merus is nearly twice as long as the carpus and is armed on all its surfaces with sharp spines set approximately in longitudinal rows; these spines are fewer and smaller on the ventral surface and strongest on the distal dorsal region, there being a very long spine at the inner distal dorsal angle, another at the outer distal angle, also a similar but shorter pair at the ventral distal angles; on the carpus and propodus the spines are more definitely arranged in three rows on the dorsal surface, one row along each lateral margin and a median row; the ventral face of the carpus has a few spinules, but that of the palm is usually devoid of spines, but has numerous small squamæ; the dactyls are nearly as long as the palm and are slender, tapering to a curved acuminate tip; the tip of the propodal finger has at the base of the distal tooth a subdistal tooth into which the tip of the hinged finger fits. There is a sub-basal tooth on the outer margin of each finger; the cutting edges of both fingers are filled with rounded or serrate teeth; the hinged finger has a row of tufts of long stiff setæ on the outer margin just above the teeth; there is also a submarginal carina on the dorsal surface of each finger.

The first, second and third pairs of ambulatories are successively shorter, the first pair reaching to midway the propodus of the chelipeds; the merus and carpus of the first and second pairs of ambulatories are armed with spines and long setæ along the inner lateral margin, the distal spines of each joint being quite long; the outer lateral margins are roughened; the propodal joint has no spines but has the outer surface set with many squamæ which give the outer lateral margin a roughened aspect; the dactyl is as long as the propodus and furnished with a few fine hairs on the inner margin.

The fifth pair of legs is characteristically slender, three-fourths as long as the preceding pair; the distal article is furnished with a dense pilosity which may possibly be utilized in caring for the eggs and embryos. It is much more developed in the females than in males of the same size.

The eye is well developed but not extremely large for a member of this genus; the stalk is short; the cornea dilated, shining black; the expanded rounded

dorsal portion of the stalk next to the cornea is furnished with many fine hairs and a fringe of these hairs border the base of the cornea.

The external maxillipeds have the inner distal angle of the outer face of the ischium armed with a sharp, short spine; there is a much longer sub-proximal spine and a shorter distal spine in the inner margin of the merus; the ventral and lateral faces of the ischium and merus are covered with squamæ; the inner lateral margins are fringed with setæ; the distal ends of the first and second joints of the palp and the entire margin of the distal joint are heavily fringed with setæ.

The inner antennæ have the peduncular article dilated basally, armed on the outer ventral surface near the middle with a squamosity which is fringed on the rounded distal border with long setæ; there is also a sharp forward-pointing spine at the outer distal margin of this wider basal part of the article, and a second, very long, upward-pointing spine just a little in advance of the first spine, also a third long, forward-pointing spine at the outer distal angle of the joint; a slightly shorter spine is placed at the opposite inner distal angle; the second and third joints are subequal, very long and slender, the distal one supporting the minute biramose flagellum which extends to about midway the carpal joint of the chelipeds.

The external antennæ have the basal peduncular article armed at the inner and outer distal angle with a spine, that at the inner distal angle being the longer; the second and third joints are successively smaller; the multiarticulate flagellum extends slightly beyond the tips of the chelipeds.

***Munida paynei*, new species.**

Figure 11.

Name: This species is named for H. Payne Bingham, Jr., the young son of the leader of the expedition.

Type: The type, an ovigerous female and four additional specimens, were taken North of Glover Reef, dredge haul no. 2, depth 484 fms., and are deposited in the Bingham Oceanographic Collections.

Material examined: Five large specimens of *Munida paynei* were taken in the second dredge haul north of Glover Reef, from a depth of 484 fms., April 20, 1925, by the 'Pawnee I.'

Distribution: Known only from the type locality.

Technical description: Carapace subquadrate, moderately convex, 19 mm. long, 18 mm. maximum width; crossed by numerous transverse striations. The frontal margin is ornamented by a sharp rostral spine which extends as far forward as the cornea; there are a pair of subrostral spines, one on each side of the rostrum which are divergent and slightly longer than the rostrum; the anterolateral angle is armed with a single small spine, of less than one-third the size of the submedian pair; behind the anterolateral spine on the lateral

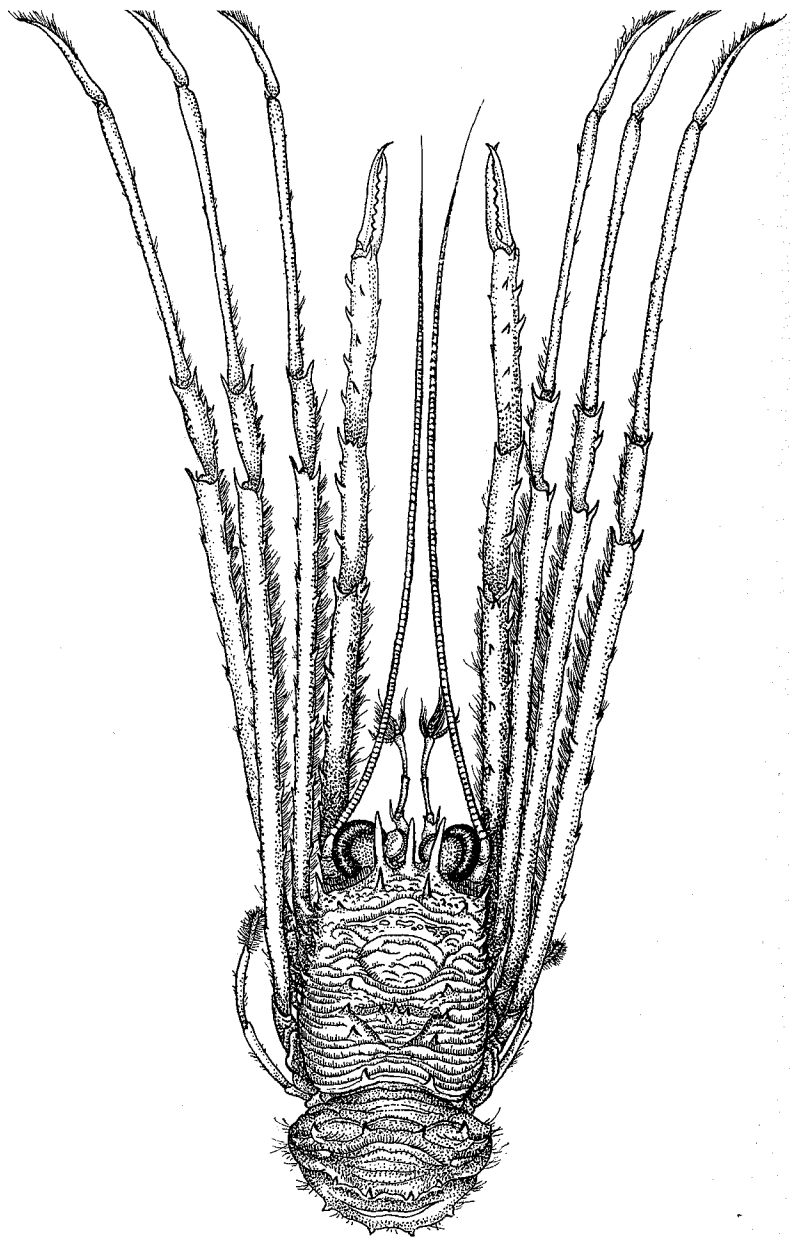


Fig. 11.—*Munida paynei*, female, \times about $1\frac{1}{3}$.

margin of the hepatic lobe, there is a spinule and behind it in the cervical sulcus is another spinule, which in turn is followed by three spinules placed rather high on the lateral margin of the branchial region. Inward from the hepatic spinule, situated on the inner border of the hepatic lobe, almost in the cervical groove, there is another spinule. There are two spines on each side of the gastric region, each of about the same size as the anterolateral spine and placed approximately in line with the long submedian spines. There is a single forward-curved spine on the apex of the cardiac region and immediately behind this spine there are a pair of smaller spines, the three forming a little triangle. There are two pairs of spines on the inner margin of the branchial region, the anterior pair being placed near the curve of the cervical groove, while the posterior pair are approximately in line with the posterior pair on the cardiac region. There are a pair of forward-curved spines on the posterior margin of the carapace. The cervical groove is very deep, bifurcating and circumscribing the hepatic region. The depressions defining the cardiac region are also deep. The rostral and paired submedian spines are covered with fine granules which are also present on frontal region of the carapace. Numerous rather fine transverse striations, composed of small, pearly granules and having the anterior margins fringed with short setæ, ornament the carapace, smaller arc-shaped striæ occurring on the anterior region.

There are four forward-directed, subequally spaced spines on the anterior part of the second abdominal segment; the inner pair are submedian and the outer pair are in the median lateral region. Four similarly placed spines occur on the anterior margin of the third abdominal segment; on the anterior margin of the fourth abdominal segment there are also four spines, in line with those of the preceding segments, but the inner pair of spines of the fourth segment are longer than those of the other segments. The anterior margins of the second, third and fourth segments also have prominent transverse granulose striation; the median posterior region of each of these segments is embossed and margined anteriorly by similar prominent transverse striæ; the intermediate areas and epimera are paved with rows of finer granules, some of which form arcs. On the fifth and sixth segments and caudal fan, the transverse striæ are replaced by finer squamæ which form small arcs having the posterior margin fringed with setæ; these squamæ become smaller and the related setæ longer on the posterior part of the telson. All of the epimera are decidedly tapering; those of the third, fourth and fifth segments, being very acuminate. The caudal fan is broad, the telson and uropoda being truncate distally and fringed with long setæ.

The eyes are very large, kidney-shaped, the long diameter being approximately equal to the long submedian spine; the greatest short diameter equal to two-thirds of the length; the dorsal surface of the distal end of the eyestalk is very setigerous, a fringe of long lashes bordering the cornea.

The inner antennæ have the basal article enlarged and flattened beneath the

cornea, the outer rounded margin of this portion being furnished with a single small spine, also with very long setæ which protect the eye; beyond the expanded part the basal article narrows and is armed distally with a short sharp spine at the inner margin and a very long sharp spine at the outer margin; the second article is about as long as the dorsally visible portion of the basal article and is very slender, cylindrical; the third article is similar to the second, but a trifle longer, has the dorsal and lateral surfaces armed with three approximate rows of spinules, the distal end a little dilated, set with a ring of long setæ and supporting the flagellum, the longer branch of which consists of about 34 short annulations and bears a heavy brush on its inferior margin and the shorter branch which consists of nine annulations, but is about half as long as the long branch.

The external antennæ have an exceedingly slender flagellum which extends a little beyond the longest pair of legs. The peduncle of the antennæ consists of three stocky, successively smaller articles.

The external maxillipeds are very narrow and heavily fringed with setæ; the ischium is long, armed with a spine at the inner distal angle; the merus is three-fifths as long as the ischium and is armed with a spine on the inner lateral margin about two-fifths of the length from the base.

The chelipeds are subequal, very long and slender, 70 mm. long, the basal three joints being small; the merus is 28 mm. long; the carpus is 11 mm. long, the propodus is 25 mm. long, the finger comprising 9 mm. of this total. There are a median and two lateral rows of spines on the merus, the remaining upper surface being paved with small squamæ; on the carpus, the outer lateral row of spines disappears, except the distal spine and squamæ become much larger and are fringed with setæ; on the propodus this is likewise true; the fingers are similar, furnished with numerous teeth along the entire cutting edge; the tips curved, that of the upper finger fitting upon the subdistal accessory tooth of the propodal finger.

The first pair of ambulatories is 80 mm. long, the second pair is 76 mm. long and the third pair is 90 mm. long, while the dwarfed fourth legs are only 20 mm. long. Each of the first three pairs of legs has the exposed surface paved with squamæ; the merus is very long, armed on both lateral margins with a row of spines; the carpus is short, usually with a row of spines on the inner lateral margin and a single spine at the outer distal angle; the propodus is very long and slender, usually devoid of spines, but rarely with a series of weak spines on the inner lateral margin; the dactyl is blade-like, one-third the length of the propodus.

The last pair of legs are quite slender and reflexed; when extended they reach to the cornea; the distal joint is furnished with a heavy brush of setæ; the female have a much heavier brush than the male.

The above described specimen is an ovigerous female, carrying approximately

a thousand small yellow eggs which are attached to the setæ of the pleopoda and entirely concealed beneath the folded abdomen.

The present species is nearest to *Munida longipes* Milne-Edwards, from which it is distinguished by having the carapace broader in proportion to its length and by the following differences in the ornamentation with spines: (a) there is a single spine situated on the inner border of the hepatic lobe almost in the cervical groove, and in line with the hepatic spine of the lateral series; (b) there are two spines, each of about the same size as the anterolateral spine and placed on each side of the gastric region one behind the other approximately in line with the long submedian spines; (c) there is a single forward-curved spine on the apex of the cardiac region and immediately behind this there are a pair of smaller spines, the three forming a little triangle; (d) there are four spines on the anterior margin of the fourth thoracic segment, in line with those of the preceding segments, but the inner pair on the fourth segment are longer than those of the preceding segments. The spines on the lateral margins of the chelipeds and ambulatories are much stronger on all the specimens at hand than are those on the specimens of *Munida longipes* figured by Prof. Milne Edwards.*

***Munida elfina*, new species.**

Figure 12.

Type: The type and two additional specimens, one of which is infested with a *Bopyrid* isopod in the right branchial cavity, were taken by the 'Pawnee I,' north of Glover Reef, dredge haul, no. 1, depth 366 fms., April 6, 1925, and are deposited in the Bingham Oceanographic Collection.

Distribution: Known only from the type locality.

Technical description: Rostrum about twice as long as the eye, slender, acuminate, carinate on the lateral margins, median dorsal line finely acuminate, only half as long as the eye. Six spines form a transverse row on the anterior gastric region, the innermost pair being approximately twice as long as the other two pairs. The single long spine at the anterolateral angle is nearly equal to the supraorbital spines and is followed by a series of six smaller spines, placed one behind the other on the dorsolateral margin. There are two spines on each side along and just above the anterior fork of the cervical suture and three on each side along the posterior curve of the cervical suture, while each outer third of the transverse striations which is continuous with the median curve of the cervical suture, is armed with four spinules on each side. The transverse striæ of the carapace are very distinct; with the exception of the anterior three they are relatively unbroken, except those which are interrupted by the cervical suture. Each striation is fringed on the anterior margin with exquisitely

* *Munida longipes* Milne-Edwards and Bouvier, Mem. Mus. Comp. Zool., vol. 19 no. 2, p. 44, Pl. 3, fig. 9-13, 1897.

iridescent setæ which extend forward about one-third the length of the space between two striae. The side walls of the carapace likewise have prominent striae which are continuous proximally with those of the carapace and curve forward toward the anterior ventral margin. These striae have very heavy

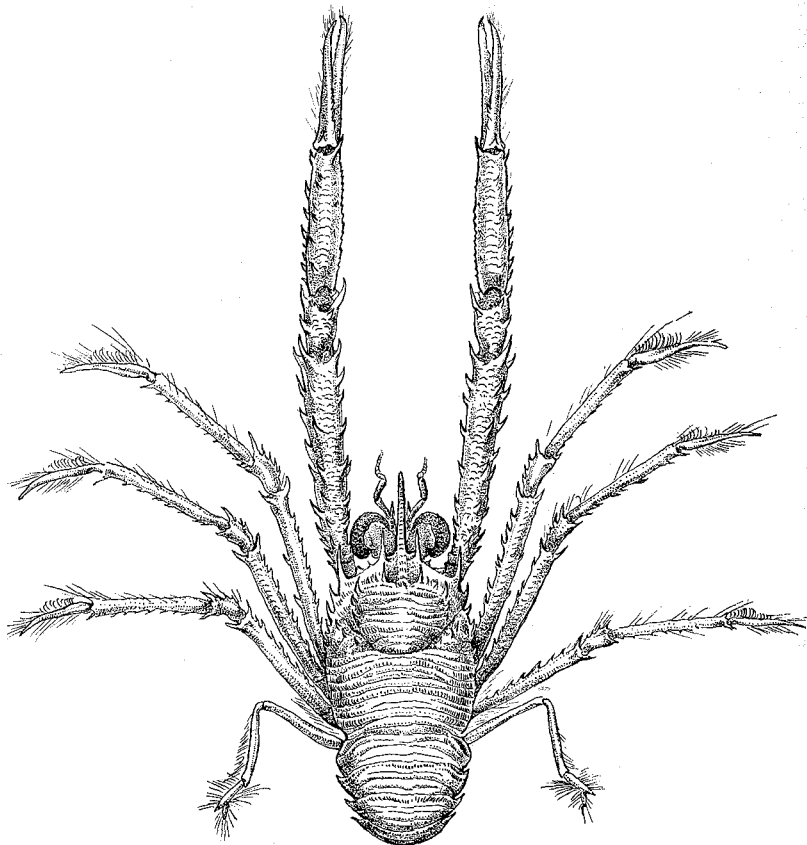


Fig. 12.—*Munida elfina*, $\times 3$.

rows of iridescent setæ, the more ventral of which are much longer than the others. The carapace is longer than wide, 6 mm. long in the median line; 5.2 mm. maximum width, which is just behind the cervical groove. The lateral margins of the carapace are arcuate, narrowing at the anterior and posterior lateral angles.

The first to fourth abdominal segments inclusive are visible in a dorsal view, the posterior part of the fourth and the remaining abdominal segments are bent under. The first six abdominal segments are each traversed by several

clearly defined striae. The frontal and epimeral margins of each segment are bordered by iridescent cilia. The telson and uropoda are ornamented with large squamæ which are arranged with the curved border distal. The distal border of the uropoda and telson are fringed with plumose setæ which are quite as long as the supporting articles.

The eyestalk is small, close-set; the cornea is very large, kidney-shaped, approximately half as long as the rostrum.

The antennulæ have the basal peduncular article flattened beneath the cornea, and armed at the inner distal angle with a very long spine which projects almost as far forward as the rostrum; a second spine three-fifths as long as the inner one is situated at the outer postlateral angle, and a third much smaller spine occurs about midway the outer lateral border of the basal joint; the second and third articles are slender, elongate, the distal one bearing a minute flagellum of eight or nine articles, which is surrounded by a rather dense tuft of long setæ.

The external antennæ have the first and second peduncular articles each small and tipped at the inner distal angle with a single spine; the remaining articles of the antennæ are broken off.

The external maxillipeds are armed with a single sharp spine at the external distal angle of the ischium, and a second similar spine at the external distal angle of the merus.

The chelipeds are 23 mm. long, the merus being 9 mm. long, the propodus is 10.5 mm. long, the propodal finger being 5 mm. long, or nearly one-half the length of the propodus. The cheliped is scalarous, especially on the lower surfaces and is armed on the inner and outer upper lateral margins and lower outer lateral margin, with a longitudinal row of spines on the merus, and outer lateral row of spines on the carpus, but with the other two rows represented by distal spines; there are two outer lateral rows of spines on the propodus; the tips of the fingers are curved, the unidentate upper finger fitting in the bifid apex of the propodal finger.

The second, third and fourth pairs of legs are similar; each has the inner and outer lateral margins of the merus, carpus and propodus armed with spinules, the ones at the distal angles of the carpus and merus being more prominent; the dactyl is quite two-thirds as long as the propodus and has the distal third tapering, slightly curved. The small fifth pair of legs have the merus quite long, arched, crossed by regularly spaced striae, each of which is fringed with iridescent cilia; the carpus is four-fifths as long as the merus, and the propodus is two-thirds as long as the carpus; the propodal finger is spoon-shaped with the tip rounded and is separated from the dactyl by an elliptical hiatus; the hinged finger is similar to the propodus but slenderer; both are covered with a series of long setæ, some of which are very curved, like fish hooks.

The branchial Bopyrid isopod parasitic on one of the cotypes of this *Munida* is *Munidion irritans* new species, described on page 143, of the present report.

Genus **Munidopsis** Whiteaves, 1874.

Munidopsis Whiteaves, Amer. Journ. Sci. (3) vol. 7, p. 212, 1874; genotype. *Galathodes*, A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, no. 1, p. 58, 1880.—A. Milne Edwards and Bouvier, Mem. Mus. Comp. Zool., vol. 35, p. 63, 1897. (*And synonymy*).

Munidopsis erinacea (A. Milne Edwards) 1880.

Galathodes erinacea A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, no. 1, p. 53, 1880; Mem. Mus. Comp. Zool., vol. 19, no. 2, 35, p. 67, Pl. 7, fig. 9-12, 1897.

Type: Prof. Milne-Edwards designated as the type a male specimen taken at "Blake" Sta. 222, Santa Lucia, depth 222 fms.; and deposited in the Museum National d'Histoire Naturelle, Paris.

Material examined: The 'Pawnee I' secured six specimens of this species north of Glover Reef from a depth of 484 fathoms. This is the greatest depth from which *erinacea* has been recorded. All of the specimens are quite perfect; the smallest of the series is a female measuring 11.5 mm. from the tip of the rostrum to the posterior margin of the telson, and 5.5 mm. maximum diameter of the carapace. This specimen is carrying one large egg, which is spherical and measures 1.8 mm. wide. It is attached to the setæ of the pleopoda and is in a very early stage of development.

The largest specimen of the series is a male with the carapace measuring 18 mm. long, 9 mm. maximum width; the entire body is 32 mm.; the chelipeds are 40 mm. long, and have the fingers with a wide basal gape which is less pronounced in the two smaller male specimens and entirely absent in the three females which are approximately as large as the smallest males. The largest male is also covered with a much more conspicuous fur than are the younger specimens.

It is interesting to note that each of the five specimens at hand are ornamented with the exact number of spines and spinules identically distributed as is possessed by the specimen figured by Prof. Milne Edwards.

Distribution: Taken by the "Blake" at five stations in the West Indies, i.e. Santa Lucia, 422 fms., and 151 fms.; Frederickstadt, 451 fms.; St. Vincent, 424 fms.; Nevis, 356 fms.; and by the "Challenger" off Pernambuco, Brazil.

Genus **Ptychogaster** A. Milne Edwards, 1880.

Ptychogaster A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, no. 1, p. 63, 1880.—Henderson, Anomura, Challenger Zool., vol. 27, p. 170, 1888.—A. Milne Edwards and Bouvier, Ann. Sci. Nat. Zool. ser. 7, vol. 16, p. 301, 1894.—E. L. Bouvier, Bull. Soc. Ent. France, vol. 65, p. 312, 1896.—A. Milne Edwards and Bouvier, Mem. Mus. Comp. Zool., vol. 19, no. 2, 35, p. 118, Pl. 9, figs. 16-22, Pl. 10, figs. 4-16, May, 1897.

Genotype: *P. spinifer* A. Milne Edwards, from seven 'Blake' stations in the West Indies.

Chirostylus A. Ortmann, Zool. Jahrb. (Syst.), Band 6, p. 244, 1892.

Gastroptychus M. Caullery, Result. Scient. des Camp. du Caudan, Fasc. 2, p. 390, 1896.

***Ptychogaster spinifer* A. Milne Edwards, 1880.**

Ptychogaster spinifer A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, no. 1, p. 64, 1880; Mem. Mus. Comp. Zool., vol. 19, no. 2, 35, p. 118, Pl. 9, fig. 16-22, Pl. 10, figs. 4-16, 1897.—Benedict, Proc. U. S. Nat. Mus., vol. 26, p. 334, 1902.

Type: A female taken by the "Blake" at Station 167, Guadeloupe, 183 fms., is designated by Dr. Milne Edwards as the type and is deposited in the Museum National d'Histoire Naturelle, Paris.

Material examined: An unusually fine series consisting of twenty-two specimens of this species, ranging in size from very young, semitranslucent forms to a very large old adult, were taken by the 'Pawnee I' in a single dredge haul north of Glover Reef, from a depth of 366 fms., April 20, 1925. The largest female bears a cluster of about thirty eggs; the next largest female carries about fifteen embryos in a somewhat more advanced stage of development, the eyespots and segment lines being visible through the outer integument, while a third female carries twelve very large ova, and the fourth and smallest of the ovigerous females bears nine ova which are in about the same stage of development as those of the largest female. It is interesting to note that the young eggs are borne in grape-like clusters, the eggs being piled on top of each other, while the more developed embryos are spread out so that they scarcely touch one another.

The largest female taken by the 'Pawnee I' exceeds the size of Prof. Milne Edwards' type, while the smallest specimen of the series taken by the 'Pawnee I' appears to be the smallest representative of the species so far recorded. They give the following measurements: Largest specimen: length of carapace, from base of rostrum, which latter is broken, to posterior margin 23 mm. long; width 16 mm.; total length of body from base of broken rostrum to posterior margin of telson 54 mm.; length of great cheliped 144 mm.; length of first ambulatory legs 102 mm. Diameter of egg 2 mm.

The smallest specimens measures: Carapace 4 mm. long from tip of rostrum to posterior margin; 2.5 mm. maximum width; total length of body from tip of rostrum to tip of telson 9 mm.; length of great cheliped 23 mm.; length of first pair of ambulatory legs 14 mm.

Not only the largest and smallest specimens, but all of the intermediate sizes in the series, present an identity of ornamentation in the number and arrangement of spines on the animal. The smaller animals are of course

more transparent and exhibit an exquisite fragility, but the largest specimens are also semi-translucent.

Distribution: Frederickstadt, 180 fms.; Guadeloupe, 183 fms.; Santa Lucia, 154 fms.; Grenadines, 127 fms.; Caricou, 163 fms.; Barbados, 123 fms. (Blake).

Uroptychus rugosus (A. Milne Edwards).

Diptychus rugosus A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, p. 63, 1880.—A. Milne Edwards and E. L. Bouvier, Mem. Mus. Comp. Zool., vol. 19, no. 2, p. 124, Pl. 11, figs. 4-14.—Benedict, Proc. U. S. Nat. Mus., vol. 26, no. 1311, p. 333, 1902.

Type: The type was taken by the U. S. Steamer 'Blake' at station 177, Dominica, depth 118 fms. and is deposited in the Museum National d'Histoire Naturelle, Paris.

Material examined: Two specimens, commensal with a crinoid, near English Cay, depth 190 fms., deposited in the Bingham Oceanographic Collections.

Distribution: In addition to the type locality, Dominica, this species was also taken by the 'Blake' at station 231, St. Vincent, 95 fms.; station 238, Grenadines, 127 fms., and at station 299, Barbados, 240 fms. It was taken by the 'Pawnee I' near English Cay, 190 fms., commensal with a crinoid.

This latter fact is of unusual interest because *Uroptychus rugosus* is the first member of the family Galatheidæ, and of the genus *Uroptychus* to be recorded as a semiparasitic commensal of a crinoid from the Caribbean.

The three members of this family previously recorded as semiparasitic commensals of crinoids are members of the genus *Galathea*, namely, *G. elegans* Adam and White, listed by White in 1847, as commensal, from specimens brought home to the British Museum by H. M. S. 'Samarang' from Corregidor, Luzon and Unsang, Borneo. This was figured in the account of the voyage of the 'Samarang' by Adam and White in 1848, without description of the species.

The naturalist of the United States Exploring Expedition, Prof. James D. Dana, figured and described in 1852 a new species, *G. longirostris*, which was found on a comatulid dredged at Fiji in 10 fms. In 1906, Mr. T. Southwell recorded three specimens of *G. longirostris*, with well defined color markings, which were found clinging to individuals of *Cenometra herdmani* taken in the Gulf of Martaban, Ceylon, in shallow water and at a depth of 7 to 9 fathoms. In 1913 Dr. Heinrich Balss recorded *G. longirostris* from the Bonin Islands and doubtfully referred a single male from near Boschu, Sagami Bay, Japan, in 120 meters, to *G. elegans*, which latter species he states, apparently occurs on comatulids. In 1920, Lt. Potts placed Prof. Dana's species as a synonym of *G. elegans*, as he also does *G. deflexifrons* Haswell. This latter species was described in 1882 by Prof. William A. Haswell from a single specimen taken by H. M. S. 'Alert' in Albany Passage, Torres Straits, living on a comatulid.

In 1884, Miers placed Haswell's species in the synonymy of *G. elegans* and recorded, with annotations, several specimens of the latter taken by the 'Alert.'

As noted by Dr. Austin H. Clark (Monograph of the existing Crinoids, vol. I, part 2, p. 631, 1921), *Galathea elegans* has been recorded from Madagascar, Tuticorin, in the Madras Presidency, India, Gulf of Martaban, Ceylon, Port Molle and Port Curtis, Queensland, Albany Island, Albany Passage, Murray Islands, Holborn Island, and off Mabinag, Torres Strait, Amboina, Moluccas, New Britain, Singapore, Unsang, Borneo, Corregidor, Luzon, Philippines, Bonin Islands and Sagami Bay, with a bathymetrical range from littoral down to 100 fathoms.

Galathea inflata Potts, the second crinoid commensal of this genus, was found on *Comanthus annulatus* in the littoral zone, Murray Islands, Torres Straits, and the third species, *G. minuta* Potts was found on the same species of crinoid and was taken at Mabuiag Island, Torres Straits, in 4 fms.

Thus it is seen that *Uroptychus rugosus*, which comes from a depth of 190 fms., is the first deep sea Galatheid to be recorded as commensal on a crinoid, as well as the first commensal species to be recorded from the Atlantic.

Habits: This remarkable little Galatheid was taken intertwined in the arms of a crinoid, just above the central disk. The ambulatory legs of the crustacean closely resemble the cirri of the crinoid, while the chelipeds mimic the stouter radials, the fingers resembling pinnules and the button-like carapace is not unlike the central disk of the crinoid, so that it is exceedingly difficult to distinguish the crustacean from its host. Unfortunately, color notes are lacking, both of the crinoid and the crustacean; in the preserved specimen both have faded to a deep age-yellowed ivory tint.

Also inhabiting the crinoid in close association with this *Uroptychus* were two other crustaceans, *Arcturus pawneeianus* Boone, an eccentric isopod whose entire anatomy imitates that of an arm of the crinoid; and several small pedunculate barnacles, of the new species *Scalpellum rostromi* Boone.

The position occupied by *Uroptychus rugosus* upon its host would suggest that it may possibly belong to that group of parasites which secure their food by diving within the mouth of the host and feeding upon the accumulated food. However, confirmation of this must await further collecting of the species.

Technical description: This species more closely resembles *Anomalthir*, a genus of crabs, in general appearance than it does any other species of *Uroptychus*. The abdomen is so entirely concealed that even in a ventral view the illusion of a crab is preserved; only the minute fifth pair of legs give a clue to the real identity of *Uroptychus*, and these are effectively concealed in the specimen at hand.

Rostrum slightly more than one-half as long as the carapace, triangular, produced to an acuminate point, dorsal surface concave, lateral margins finely serrulate. Carapace depressed pyriform, sharply defined; hepatic; branchial and cardiac regions tumid, cardiac region circumscribed; urogastric groove

very deep; pitted depressions on each side between the cardiac and branchial regions; cervical groove clear cut on inner half, less distinct near margin of carapace. The entire dorsal surface of the carapace is covered with long, slender spines which are much longer on the anterior and lateral regions where they tend to point outward or forward, while the shorter spines on the more central parts of the carapace point direct upward. These spines are rather equally distributed and are spaced approximately as far from each other as the length of one of the average sized spines. The carapace is also covered with numerous very long, slender hairs, each of which has the distal third curved over like a fish hook and barbed along the curve with minute setae. The rostrum is 2.7 mm. long from apex to base; the carapace is 5 mm. long from the base of rostrum to posterior margin, it has a maximum width of 5.2 mm. across the posterior cardio-branchial region.

The first abdominal segment is short, about 5 mm. long in median line and narrows toward each lateral region; the second abdominal segment is longer and wider, with the lateral margins curved; the first, second and a small anterior part of the third segment are visible dorsally; the greater part of the third segment, and all of the fourth, fifth and sixth segments are ventral in position, with the seventh segment and appendages forming the inner second fold of the carapace, characteristic of members of this genus. The third and fourth segments are similar, subcrescentic with the tips of the arc pointing backward; the fifth segment is longer than the fourth and has its epimera broadly rounded; the sixth segment is a little longer than the fifth and has its lateral and posterior margins forming a single curve which fits closely against the sternal plate between the second pair of ambulatory legs. The telson is short, with a pair of incisions in the lateral margins near the base, wide, translucent, broadly rounded; folded under the bent abdomen. The uropoda are much elongated, and wider distally than basally. They are also translucent and are heavily fringed with long curling setae. The first, second, and dorsal half of the third abdominal segments are set with spines; the ventral part of the third, also the fourth, fifth and sixth segments are coarsely punctate; all are furnished with long hairs.

The eyestalk is short, stout, cylindrical, close-set; the cornea is terminal, hemispherical, black.

The antennulae extend about two-thirds of the length of the rostrum, the basal article is short; the second and third articles are longer, subequal, cylindrical; the flagellum is only about half as long as the distal peduncular article and is composed of five or six tapering rings which bear a tuft composed of long finely barbed setae, each of which is much longer than the entire flagellum.

The antennae arise beneath the cornea and have the basal peduncular article short, armed at the outer distal angle with a spine which reaches almost to the distal border of the next peduncular article, and at the inner distal angle with a spine not quite so long as the one at the external angle; the acicule is lance-like

and reaches quite to or a bit beyond the distal border of the second peduncular article; the second article is longer than the first and is armed at the superior and inferior external distal angles each with a very sharp spine. The third peduncular article is similar to but longer than the second and is armed on both lateral margins as well as at the tip with sharp spines, the one at the inferior distal angle being much the longest of the series; the flagellum is composed of four longish articles, the distal one of which is tipped with a solitary, very long hair.

The external maxillipeds are long, pediform, when extended reaching almost to the distal end of the merus of the great cheliped. The proximal article of the exognath is rather slender and reaches to midway the third joint of the endognath; the flagellum is not quite as long as its base.

The endognath is six-jointed; the penultimate joint being the longest; the third joint is set with spines on its outer surface; the terminal joint is almost as long as the penultimate joint and is cylindrical with the distal end rounded and furnished with a tuft of radiating setæ.

The chelipeds are subequal, each measures 21 mm. long, or nearly three times as long as the carapace, including the rostrum. The coxæ and bases are very small, the ischium is somewhat longer and is produced to a point on the inferior distal margin; the merus is two and one-half times as long as the ischium, gradually dilated distally and is armed with four longitudinal rows of fine spines, and additional spinules, the distal spine in each of the dorsal and ventral lines projecting beyond the merus; the carpus is about one-fourth longer than the merus; is subcylindrical and decidedly fluted longitudinally, the distal end is of slightly greater diameter than the proximal portion and is armed on the outer side with two sharp spines, one at the distal dorsal angle and one at the distal ventral angle; the propodus, including the finger, is as long as the merus and carpus taken together, and has the palm decidedly dilated; its greatest width which occurs at the base of the fingers, is 3 mm. or one and one-half times the width of the proximal part; the inner and outer faces of the hand are moderately convex; the fingers comprise about two-fifths of the entire length of the propodus, are decidedly curved, meeting only at the tips and being separated from each other by an elliptical hiatus whose short diameter is almost twice the width of the proximal part of the hinged finger. The fingers are subequal, slender, decidedly curved, meeting at the tips which are furnished with a protruding fringe of long setæ, arranged fan-wise. Similar long setæ fringe the outer surfaces of both fingers. The hinged finger has a single large tooth not quite one-third of the length from the base.

The second, third, and fourth pairs of ambulatory legs are exceedingly prehensile; they are slender and armed with several longitudinal series of fine, forward-pointing spinules; the meral joint of each leg is decidedly the longest of the series and is armed with a longitudinal series of forward-pointing spines arranged in a very prominent row along the anterior lateral margin, a similar

but less prominent row along the posterior lateral margin, and two or three rows of relatively minute spines between these lateral rows on the upper surface; the distal spines in each lateral row are decidedly projecting. The carpus is about three-fifths as long as the merus, narrow proximally, dilating distally, armed along the outer lateral border with a row of sharp spines similar to those of the merus, also with minute spines on the upper surface, but there is no row of spines on the inner lateral margin of the carpus; the propodus is as long as the merus, cylindrical, armed along the proximal half of the outer lateral margin with a few spines, none elsewhere; the dactylus is 1.5 mm. long or about three-fourths as long as the carpus, and is very slender, tapering and curved, scythe-like, with the inner lateral margin armed with a row of eight sharp teeth which successively increase in length toward the distal end of the dactyl, the eighth or subdistal tooth being triangular and quite equal in size to the distal tooth. The entire leg is abundantly set with long hairs, similar to those on the carapace; these hairs are more abundant on the inner lateral margin of the dactyl.

The fifth pair of legs are characteristically reduced; the meral joint is the longest of the series, reaching to the distal end of the basis of the fourth leg; the carpus is similar to but slightly shorter than the merus; the propodus is shorter and distinctly wider than the carpus; the propodal finger is stout, curved, somewhat thicker than the hinged finger, each are furnished along the distal margin with a series of spinose setæ.

Genus **Galacantha** A. Milne Edwards, 1880.

Galacantha, A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, no. 1, p. 52, 1880.—Henderson, Rept. Voyage 'Challenger,' Zool., Anomura, p. 166, 1888.—A. Milne Edwards and E. L. Bouvier, Ann. Sci. Nat., Zool., (7) t. 16, p. 268, 1894.—Walter Faxon, Mem. Mus. Comp. Zool., vol. 18, p. 78, 1895.—A. Milne Edwards and E. L. Bouvier, Mem. Mus. Comp. Zool., vol. 19, no. 2, p. 55, 1897.—Benedict, Proc. U. S. Nat. Mus., vol. 26, p. 243, 304, 1902.

Genotype: Prof. Milne Edwards established this genus for *G. rostrata*, from 'Blake' station 236, Bequia, depth 1591 fms., and *G. spinosa*, from 'Blake' station 185, Dominica, depth 333 fms., but neglected to state which of the two species he regarded as the genotype. Both are deposited in the Museum of Comparative Zoology, Cambridge, Mass.

Galacantha barbarae new species.

Figure 13.

Name: It is a pleasure to name this species for little Miss Barbara Bingham, daughter of the leader of the Expedition.

Type: This species is founded upon a single specimen taken by the 'Pawnee I' at Green Cay, Bahamas, March 17, 1925, which is deposited in the Bingham Oceanographic Collection, New York City.

Galacantha barbarae is at once distinguished from all the other members of the genus by the highly developed armature and sculpturing of the dorsal surface of its body. It is a delicate shade of ivory. Future collecting will be necessary to determine whether this remarkably beautiful animal is as diminutive as the one at hand.

Distribution: Known only from the type locality.

Technical description: The only specimen taken is a small one which measures 13 mm. long from the tip of the rostrum to the posterior margin of the carapace, the rostrum being 2 mm. long; the maximum width of the carapace is 6 mm.; the carapace is decidedly convex from side to side; the cervical, cardiac and urogastric sutures are unusually deep. The frontal margin is produced to a median rostral tooth which is 2 mm. long, triangulate, acuminate, with the dorsal surface bisected by a median longitudinal crest which is armed with eleven or twelve microscopic serrate teeth; the lateral margins of the rostrum are also minutely serrate; the frontal margin on each side of the rostrum is excavate above the eye and produced at the outer margin into a well developed antero-lateral spine which is very acuminate and half as long as the rostrum, below this spine and separated from it by an arc, but quite visible in a dorsal view of the animal, is another sharp but shorter spine; the hepatic lobe is wide, almost right-angled, with the outer distal angle produced into a sharp spine and with smaller sharp spines on the inner distal angle and a series of three spinules on the dorsal surface of the hepatic region. A series of six prominent, acuminate, forward-pointing spines forms a transverse row on the anterior gastric region, which is sharply circumscribed. A second transverse row of eight similar but slightly smaller spines is placed just behind the first row. Slightly farther behind the second row, six spines form an arc with the ends directed posteriorly on the convex area behind the arc. There are a pair of submedian spines, and posterior to this pair a second, smaller pair. In addition to the above-described hepatic spine, there are four large spines and three spinules on the lateral margin; this series successively decreases in size, posteriorly. Just above the lateral spines is a longitudinal series of small spines of which the three spinules on the hepatic region are a part. On that part of the branchial region which lies adjacent to the cardiac region but separated from it by a groove, there are three spines in a row on each side, which continue the curve of the arc on the cardiac region, and behind these three is a row of four spines. The urogastric depression is unusually deep and just behind it is a very prominent complete transverse row composed of fourteen spines in addition to the lateral spinules. Behind this complete row there are two less definitely defined transverse rows of spinules which cover this part

of the dorsal surface. The posterior margin is raised carina-like and ornamented with eighteen slender, sharp, forward-directed spines.

The *linea anomura* is clearly defined; the side-walls of the carapace are covered with squamæ.

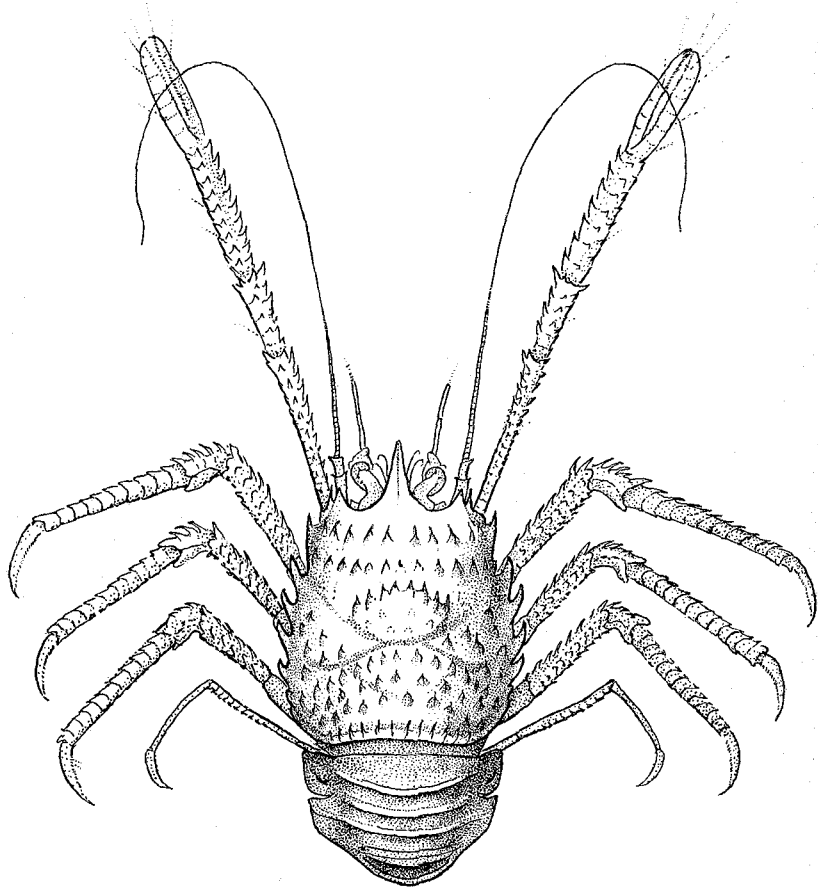


Fig. 13.—*Galacantha barbarae*, $\times 5$.

The first abdominal segment is characteristically small and forms a rounded process on either side which articulates with the second segment; the latter is 1.5 mm. long, with the epimera broadly rounded; the frontal margin is slightly accentuated, the median region and the posterior margin are each produced into a strong sharp carina; the median carina is the longer of the two, extending down to the epimera where a subcircular depression sculpts the surface.

The third abdominal segment is about as long as the second, by which its anterior margin is concealed; the epimera are slightly longer and much narrower than those of the second segment and are rounded and curved forward; two equally prominent transverse carinae occur on this segment also; the anterior one rises slightly behind the anterior margin and is sharply bevelled; it extends almost to the lateral margin of the epimera, curving slightly near the edges; the second carina is less wide and its posterior face slopes directly to the lightly defined posterior margin of the segment. The fourth abdominal segment is a trifle wider in the median dorsal line than the third segment, although it appears narrower in a dorsal view, owing to the fact that the fourth segment is decidedly bow-shaped, forming an oval terminal of the dorsal portion of the abdomen; there is a very prominent median transverse carina on this segment which like that of the preceding segment extends almost to the margin of the epimera, a few long solitary hairs arise from the posterior face of this carina and extend backward; the second carina of the fourth segment extends only across the median third of the segment and appears dorsally as the extreme margin of the visible abdomen; the entire posterior margin of the segment is clearly defined, ventral in position; the epimera are quite narrow, rounded on the anterolateral margin and with the anterior half overlapped by the epimera of the preceding segment. The fifth abdominal segment which is entirely ventral in position is quite smooth, devoid of ornamentation and has its anterior margin decidedly bowed, convex, and its posterior margin similarly concave, the two converging toward the lateral margin which is rounded. The sixth abdominal segment is a little longer than the fifth segment, but narrower; its lateral margins are arcuate, excavate for the reception of the peduncle of the uropoda; the posterior margin is relatively straight but with a pair of incisions, one on each side near the outer edge. The telson has the characteristic formation; the posterior part of sutures are decidedly oblique. The blades of the uropoda are subequal; they and the margins of the telson are fringed with heavy close-set golden setae.

The eyestalks are short, cylindrical and covered on the visible dorsal portion with a calcareous band which is produced at its inner dorsal angle into a large oblique process which is armed with three spinules on its anterior lateral margin and which projects upon the cornea for its entire length; the cornea is large, cylindrical, with the distal end convex, but almost devoid of pigment. The eye extends not quite half the length of the rostrum.

The antennulae are large; they arise beneath the eye-stalk and have the dorsal margin of the first and second visible peduncular segments each produced in a long, sharp spine, that of the second segment reaching almost as far forward as the rostrum does; the penultimate and distal segments are long, slender, cylindrical, subequal, the distal one supports the minute flagellum which is set with tufts of long setae.

The antennae arise beneath the anterolateral spine and have the base en-

cupped by the lateral angle of the frontal margin; the first and second peduncular articles are similar, successively smaller distally and armed at the outer distal dorsal angle with a sharp projecting spine; the antennal flagellum is unfortunately broken off, only a few rings remaining.

The external maxilliped is large; the ischium of the exognath is small but as the merus is exceedingly slender and long, extending beyond the endognath to the base of the eyestalk. The ischium of the endognath is well developed, trigonal, its outer surface roughened with rugæ and both its outer and inner distal angles, also the distal angle of the inner face, produced to a spine; the merus is about as long as the ischium, with its outer surface marked with rugæ, its inner lateral margin produced into three sharp spines, one of which is distal; the external distal angle is also armed with a spine; the palp is large, the proximal joint being nearly two-thirds the size of the merus; the second joint is nearly as large as the proximal and is wider distally than basally and fringed on the margins with long setæ; the third article tapers distally to a point and is also heavily fringed with setæ.

The chelipeds are very slender, 15 mm. long, and with the merus, carpus and propodus armed on the upper and lower margins each with a longitudinal row of sharp, forward-pointing spines; a similar median longitudinal of spines occurs on the upper surface of the merus and carpus but not on the propodus; these lines of spines each have one spine on the distal margins of the merus, carpus and palm. The remaining surface of the propodus is covered with squamæ; the fingers are almost as long as the palm, and are slender, with the tips curved inward and furnished with tufts of setæ; the cutting edges meet throughout their length and are finely serrate. The merus and propodus are subequal in length; the carpus is two-fifths as long as the merus.

The second, third and fourth pairs of legs are similar, very slender and with the merus, carpus and propodus armed on the upper surface with the same arrangement of spines as are on the comparable joints of the chelipeds. The outer distal angle of the merus and carpus are each armed with a sharp spine on these three pairs of legs. The merus is quite long, the carpus about one-third as long as the merus, the propodus subequal to the merus and the dactyl a trifle more than half as long as the propodus, tapering with a curved acuminate point; the distal part of the inner lateral margin is finely crenulate and furnished with a row of long hairs.

The small fifth pair of legs are weakly chelate; the merus is exceedingly long and arched, spinous on its upper surface, the carpus is slenderer and three-fourths as long as the merus, the propodus is about one-third as long as the carpus; the fingers are quite one-third the length of the propodus; the hinged finger is slightly heavier than the propodal finger, both are furnished with spinose setæ at the tip.

Family **PAGURIDAE**.Genus **Pylopagurus** A. Milne Edwards and Bouvier, 1893.*Pylopagurus* A. Milne Edwards and Bouvier, Mem. Mus. Comp. Zool., vol. XIV, no. 3, p. 74, 1893.

No genotype specified; six species described in this article.

Pylopagurus exquisitus, new species.

Figure 14.

Type: The type, an ovigerous female, and two additional specimens, were taken by the 'Pawnee I,' north of Glover Reef, off the coast of British Honduras, in 484 fms., and are deposited in the collections of the Bingham Oceanographic Collection.

Distribution: Restricted to the type-locality.

Technical description: Anterior region of the carapace shorter than the posterior region, with the frontal margin evenly rounded in the median region, produced to a pair of submedian blunt points which project forward about the same distance as the median lobe; frontal margin outside the submedian lobe retreating to unite with the lateral margins which converge slightly anteriorly and decidedly so posteriorly; the posterior region of the carapace has a hardened narrow median plate, on either side of which there is a large membranaceous lobe. The abdomen is soft, decidedly coiled, segmentation weakly defined except on the penultimate segment which is small and covered by a rectangular, almost squarish, calcareous plate; the telson has the proximal part similar and subequal to the preceding abdominal segment; the distal section is a trifle longer than the proximal, with the lateral and posterior margins forming a continuous arc, and the dorsal surface decidedly convex; the distal margin is quite dentate; there are also the usual median and paired lateral incisions, but these are brief and obscure, difficult to distinguish from the spaces between the teeth. The uropoda are quite asymmetrically developed, that of the side supporting the giant cheliped being much smaller than the opposite one. The larger branch of each uropod is fringed laterally with cilia, and has a large patch of squamæ on the outer surface; the smaller branch is similar but less than one-third the size of the larger branch. The larger branch of the smaller uropod is scarcely any larger than the small branch of the large uropod, and the small branch of the small uropod is quite rudimentary and obscure, but definitely developed.

The eyestalks are two-thirds as long as the width of the frontal margin of the carapace, rounded, decidedly dilated distally, with a median dorsal longitudinal line of long cilia, the distal ones of which project beyond the cornea for a distance equal to, or exceeding the length of the cornea.

The cornea is terminal, large, wider than long. The ocular scales are small,

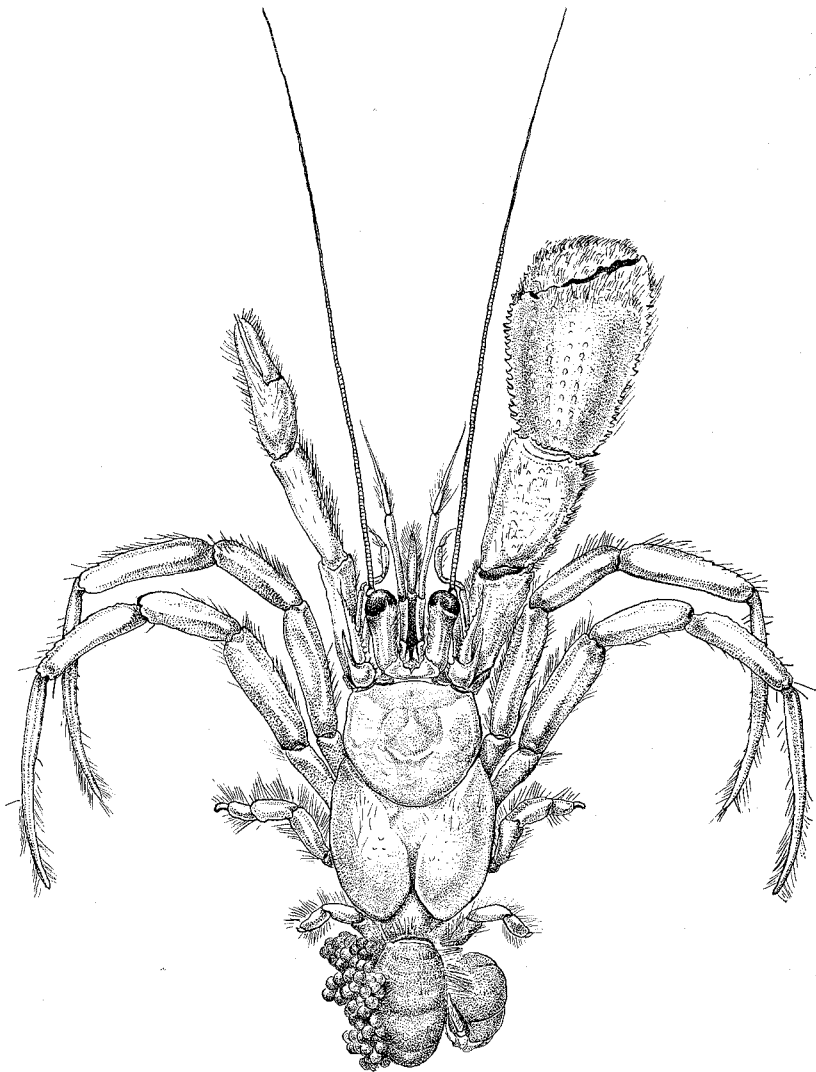


Fig. 14.—*Pytopagurus exquisitus*, female, \times about 3.5.

flat dorsally, with the lateral margins convex, decidedly convergent distally, forming an acuminate spine-like tip, which is half as long as the proximal part of the scale.

The inner antennæ are very slender, the first joint rather stocky and reaching

three-fifths the length of the eyestalk; the second joint is slenderer than the first, but about the same length, extending a trifle beyond the cornea; the third article is about equal to the first two taken together or is slightly longer than the eyestalk, dilated distally and strongly compressed laterally, a distinct longitudinal carina being present on the dorsal and ventral edges, each of which is accentuated by a series of long cilia. The upper branch of the flagellum is composed of twenty-seven annulations, of which the proximal twenty-one are short and of tapering diameters, the distal six being each about three times as long as one of the proximal articles, and of subequal diameter to each other; there is a long fringe of stiff setæ, which arise from the ventral surface of the annuli of the flagellum; the inferior branch of the flagellum is only half as long as the superior branch and of much less diameter; it consists of six annuli, of which the first five are subequal and the sixth is about twice as long as the fifth, and tapers to an acuminate point; a solitary stiff setum arises from the distal upper margin of each annulation and a similar setum from the under margin of the same annulation.

The external antennæ have the proximal part of the basal joint about one-third as long as the eyestalk, with the inner lateral margin convex, and fringed with setæ, the distal angle tipped with small spines; the outer lateral margin is straight, the distal angle being produced into a narrow, acuminate triangle, which is about as long as the proximal part of the joint, or half as long as the acicule; the remaining peduncular joints are small and almost concealed in the brushy cilia of the adjacent parts and beneath the acicule; the second article is short and stout, extending about as far as the tip of the external lateral spine of the first article; the third article is slenderer and longer, extending to just a little beyond the tip of the acicule; the flagellum is very slender and bears many cilia; it extends beyond the tip of the great cheliped for a distance about equal to the length of the propodus; it consists of about ninety-one annuli. Two long cilia arise from the distal margin of each ring, one on the upper and one on the under side. The acicule arises from the inner part of the distal dorsal border and extends a trifle farther forward than the cornea; it is tapering, with the inner lateral margin convex and the outer lateral margin correspondingly concave, the tip curves outward; eleven fine, sharp-curved teeth are subequally spaced on the inner lateral margin.

The external maxillipeds are of generic value only.

The great cheliped has the proximal articles small, the merus is triquetral, small proximally, dilated distally; the inner lateral face is separated from the outer one by a narrow corneous linear margin; the outer lateral and ventral faces are confluent, the lower third of the outer lateral face is ornamented with a series of small, round tubercles which tend to spiniform apices on the lower row and at the distal border; the upper distal margin of the merus is cuffed with close-set setæ; the carpus is about one-fourth longer than the merus and is substantially larger; the dorsal proximal margin is banded with a thick

corneous substance, beyond which the calcareous coating begins. The dorsal surface of the carpus is convex and is set with irregular squamosities which are replaced by spinulose tubercles near and on both lateral margins; the underside of the carpus is also set with spinulose tubercles; all the carpal surfaces are densely covered with long, finely plumose, close-set cilia; the propodus is about as long as the carpus, widening distally, the width at the base of the finger being about one and one-half times as great as the proximal width; the lateral margins are convex, that of the hinged finger being continuous with that of the uropodal margin, thus completing the ovate contour. The outer face of the propodus is paved with flat irregularly shaped squamæ which are scarcely raised above the level of the propodal surface, being defined by the whiter surface. The propodus is rather convex in the median longitudinal region, on either side of which it definitely slopes toward the lateral margins which are slightly but distinctly bent upward. A longitudinal band composed of three rows each consisting of nine spiniform tubercles extends from the proximal border down the approximate center of the propodus almost to the margin of the base of the propodal finger; these tubercles are not quite equally spaced. The inferior lateral margin is cut into eighteen acuminate, triangulate teeth and the lateral margin of the propodal finger bears seven small teeth, the distal ones of which are merely indicated. The superior lateral margin bears twelve acuminate spines which are bent outward from the base; three similar spines in line with those of the propodal margin are on the median proximal line of the hinged finger. The propodus is thick on the upper surface and rather definitely covered with spiniform tubercles which occur behind or inside the above-described margined row. Some of these tubercles which are less spiniform, extend down to near the middle of the inner face of the propodus. The lower half of the propodus is thin and its inner surface is paved with irregular flat squamæ, similar to those on the outer face. The propodal finger is short and stout; its cutting edge is divided into four, large, irregularly triangulate teeth, the fourth of which is distal, forming the apex of the finger and curved inward. The hinged finger which swings obliquely, fits across the distal end of the propodus; the outer margin of the hinged finger is armed with eighteen spinose teeth; the cutting edge is divided into three shallow, rounded teeth and the apex is stout, triangular; the outer face of the finger is moderately convex; the inner face is angulated along a median carina, from which one side slopes down to the teeth, while the side also slopes downward but much more abruptly, and the wide, thin area beyond is bent and flares outward. All surfaces of the carpus and outer and lateral surfaces of the propodus and dactyl are densely covered with long, plumose setæ, which almost or entirely, conceal the squamæ, tubercles and spines of the propodus and dactyl.

The small cheliped extends to the base of the propodus and is only slightly more robust than the first ambulatory leg; the merus is small, flattened on the outer side, convex on the inner, and extends as far forward as does the merus

of the adjacent ambulatory leg; the carpus is longer than the merus, and extends as far forward as the merus of the ambulatory, and is only slightly more robust than the latter; the upper distal margin is armed on each side with a spine-like tooth and a few small vague squamæ occur on the upper surface; the propodus is not quite as long as the carpus; the palm is cylindrical, with a very few small squamæ on the upper surface; the fingers are quite as long as the palm and are slightly incurved at the tip; the propodal finger is wider through the proximal half than is the hinged finger; the cutting edges of both fingers are devoid of dentition and meet throughout their entire length. The merus, carpus, propodus and dactyli are abundantly furnished with setæ.

The first and second pairs of ambulatory legs are subequal and the right and left legs of each pair are also equal. Each pair is slightly longer than the great cheliped and is quite slender; the basis is small, the ischium somewhat longer; the merus is 4 mm. long, the carpus is 4.1 mm. long; the propodus is 5 mm. long and the dactyl is 9.5 mm. long.

The fourth pair of legs are small and arched, but extend as far forward as one-third the length of the merus of the second ambulatory; the ischium is visible in a dorsal view; the merus is 2 mm. long, flattened and dilated slightly, with a heavy brush of cilia on the upper lateral margin; the carpus is 1.5 mm. long, narrow basally and wider distally, with a heavy fringe of setæ on the upper margin; the propodus is 1.5 mm. long, and 1.5 mm. median width, stout, but rather flattened, with the distal angles rounded, the outer half of the dorsal surface is covered with squamæ, and both margins are fringed with setæ; the dactyl arises from the inner two-thirds of the distal propodal border, and is about as long as the propodus, strong, slender and curved, fringed on all margins, with only setæ which are spread fan-wise.

The fifth legs are small, characteristically bent, chelate; the merus is 2 mm. long, 1 mm. wide, cylindrical; the carpus is the same length but slenderer; the propodus is 2 mm. long, with the distal margin truncated and produced slightly to a short curved finger, upon which the longer, more curved dactyl closes; the outer half of the propodal surface is covered with coarse squamæ and the margins are heavily set with fan-like setæ. The dactyl arises from the outer half of the distal margin and swings obliquely across the end of the propodus, its apex projecting slightly beyond that of the propodal finger.

The female pleopoda are four in number, one each on the second, third, fourth and fifth segments, on the left side only. The first three pairs each consist of a basal joint which supports two distal articles, the anterior of which is the longer, both are heavily setigerous, the eggs, approximately 500 in number, being attached to the setæ. The fourth pleopod has only one distal blade, and this, though well developed, does not support any eggs.

Paguristes spinipes A. Milne Edwards.

Paguristes spinipes A. Milne Edwards, Bull. Mus. Comp. Zool., vol. 8, p. 44, 1880.—A. Milne Edwards and Bouvier, Mem. Mus. Comp. Zool., vol. 14, no. 3, p. 33, Pl. 3, figs. 1-13, 1893.—Benedict, Bull. U. S. Fish Com., vol. 20, part 2, p. 143, Pl. 4, fig. 5, 1901.

Paguristes visor J. R. Henderson, Rept. Voyage 'Challenger,' Zool., Anomura, vol. 27, p. 78, Pl. 8, fig. 3, 1888.

Material examined: One small adult specimen was taken by the 'Pawnee I' at Royal Island, Bahamas, at night with electric light, March 14, 1925.

Distribution: Porto Rico, 'Albatross' station 2354, 130 fms.; Pernambuco, 'Challenger' station 122; "Antilles," Royal Island, Bahamas.

Genus **Calcinus** Dana, 1852.

Calcinus Dana, U. S. Explor. Exped., vol. 13, p. 456, 1852; genotype *C. tibicen* (Herbst), a widely distributed Indo-Pacific species.

Calcinus sulcatus (H. M. Edwards).

Pagurus sulcatus H. M. Edwards, Hist. Nat. des Crust., vol. 2, p. 230, 1837.

Calcinus sulcatus Hilgendorf, Monatsber. d.k. Preuss. Akad. d. Wiss. Berlin, p. 823, 1878.—Henderson, Voyage 'Challenger' Rept. Zool., vol. 27, Anomura, p. 61, 1886.—Benedict, Bull. U. S. Fish. Comm., vol. 20, part 2, p. 141, 1901.

Material examined: One specimen was taken at Glover Reef, off the coast of British Honduras by the 'Pawnee I,' April 1925. It was wearing a beachworn shell of *Nerita peloronta*.

Distribution: *Calcinus sulcatus* is the only species of the genus so far reported from the West Indies. Prof. H. Milne Edwards established the species in 1837, and it has since been taken repeatedly from Southern Florida, throughout the West Indies and as far south as Abrolhos Islands, Brazil.

Genus **Petrochirus** Stimpson.

Petrochirus Stimpson, Proc. Acad. Nat. Sci. Phila., p. 233, 1858; genotype *P. granulatus* Oliv.—H. Milne Edwards = *bahamensis* (Herbst), locality *Mari Atlantico Occidentale*.

Petrochirus bahamensis (Herbst).

Cancer bahamensis Catesby, Nat. Hist. Fla. and Carolinas, p. 34, Pl. 34;—Herbst, Krabben und Krebse, II, p. 30, 1792.

Pagurus granulatus H. Milne-Edwards, Hist. Nat. des Crust., vol. II, p. 225, 1837.

Petrochirus granulatus Stimpson, Proc. Acad. Sci. Philadelphia, p. 233, 1858.—
Benedict, Bull. U. S. Bur. Fish., vol. 20, part 2, p. 140 (excellent description).

Material examined: One specimen of moderate size was taken in the shell of *Strombus gigas* at Green Cay, Bahamas, March 17, 1925, by the 'Pawnee I.'

This species, which is probably the largest member of the Paguridae found in the waters of the reefs of Florida and the West Indies, is the hermit usually found inhabiting shells of the huge "fighting conch," *Strombus gigas*.

Genus **Clibanarius** Dana, 1852.

Clibanarius Dana, U. S. Explor. Exped., Crustacea, vol. 13, part 1, p. 461, 1852; genotype *C. vulgaris*.

Clibanarius tricolor (Gibbes).

(Little Blue Hermit).

Pagurus tricolor Gibbes, Proc. Amer. Assoc. Adv. Sci., vol. 3, p. 189, 1850.

Clibanarius tricolor Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 234, 1858.—
Rankin, Ann. New York Acad. Sci., vol. 11, p. 239, 1900; *op. cit.*, vol. 12, p. 535.—Benedict, Bull. 20, part 2, U. S. Bur. Fish., p. 142, Pl. 6, fig. 2, 1901. (*Description of species*).—Verrill, Trans. Conn. Acad. Arts and Sci., vol. 13, p. 447, figs. 61, 62, 63, 1908. (*Excellent color notes*).

Material examined: This exquisite little tricolored hermit was found in Siguanea Bay, Isle of Pines, depth 12 ft., and also at Glover Reef, April 18, 1925, by the 'Pawnee I.'

Distribution: *C. tricolor* is known from Florida, the Bahamas, Porto Rico, Bermudas and the 'Pawnee' material extends this distribution southward to the Isle of Pines, and Glover Reef, off the coast of British Honduras.

Suborder NATANTIA.

Tribe **MACRURA**.

Family **PENAEIDAE**.

Subfamily **PENAEINAE** Alcock, 1901.

Genus **Haliporus** Spence Bate, 1881.

Haliporus Spence Bate, Ann. and Mag. Nat. Hist. ser. 5, vol. 8, p. 185, 1881; genotype not specified, four species described in this article.—Challenger, Report Zool. Crust. Macrura, vol. 24, part 1, p. 284, 1888.

Hymenopenaeus S. I. Smith, Bull. Mus. Comp. Zool., vol. 10, p. 91, 1882.

Pleoticus Spence Bate, *op. cit.*, p. 217, 1888.