

Remarks: The decision to combine material collected by Agassiz and Orcutt and described by Rathbun as *Mithrax (Mithrax) orcutti* with the specimen collected much earlier by Verreaux and described by Saussure as *Mithrax armatus* results from a growing conviction that there is but one large intertidal *Mithrax* species on the west coast of Mexico and Central America. This species has now been taken three times at Mazatlan: by A. Agassiz and the writer, in addition to Verreaux. Its range has been extended northward to Los Frailes by the *Velero IV* and southward to Corinto by the *Zaca*.

Rathbun (1925, p. 399) knew her species to be very near to *Mithrax armatus*, but could not reconcile it with the entirely smooth palm and the greater carapace width opposite the third, rather than the fourth, lateral spine in Saussure's species. In a female the size of Saussure's type (1¾ French inches) the tubercle on the outer surface of the manus would be an insignificant feature; its position even in large males is such as to leave the major portion of the surface of the manus unbroken. With respect to the apparent greater width anteriorward, this might be a matter of parallax, since the spines are at a higher level than the swollen lateral margin; in any event, too much reliance should not be placed upon the accuracy of the scientific art of this period (1853).

*Mithrax (Mithrax) sinensis** Rathbun

Plate V, Fig. 5; Plate 41, Fig. 1

Mithrax sinensis Rathbun, 1892, p. 266, pl. 38, fig. 2; 1898, p. 579; 1923b, p. 635.

Mithrax (Mithrax) sinensis, Rathbun, 1925, p. 419, pl. 151, figs. 3, 4; pl. 260. Crane, 1937, p. 60. Garth, 1948, p. 29.

Type: Male holotype, U.S.N.M. No. 16065, length 9.2 mm, width 8.9 mm.

Type locality: Off San José Island, Gulf of California, Mexico, 17 fathoms, *Albatross* station 3002.

Localities subsequently reported, with collectors: Gulf of California, Mexico: San Esteban Island, *Albatross* (Rathbun, 1923b); off Santa Cruz and off Cerralvo Island, 7-10 fathoms, *Albatross* (Rathbun, 1898); Gorda Banks, 20-30 fathoms, *Zaca* (Crane). Colombia: Hum-

*The species name is derived from "*sinus*," a gulf or bay, not "*Sina*," China according to Rathbun (1898, p. 579, footnote).

boldt Bay, *Askoy* (Garth). Ecuador: off Esmeraldas, *Askoy* (Garth).

Atlantic analogue: Possibly *Mithrax* (*Mithrax*) *pleuracanthus* Stimpson.

Diagnosis: Rostral lobes broad and arcuate, each with three supplementary spinules. Four anterolateral protuberances, the last acute and single, the others subdivided into two or three spines each. Three spines on basal segment of antenna. Manus of male inflated, smooth. Tip of male first pleopod pointed, a soft subterminal flap folding inward, forming a groove.

Description: Carapace ovate, a little longer than broad, covered with low tubercles, some bearing one or two granules; cervical and cardiac groove deep. Edge of marginal prominences granulate. Rostral lobes short, broad, arcuate, separated by a narrow U-shaped sinus. Besides the preorbital lobe, the orbit having two small teeth above, a well-marked outer lobe and two strong teeth below, outside the antenna. Anterolateral protuberances behind the orbit four, the last one at the lateral angle, simple and acute, the others lobiform with subacute tips, but subdivided into two or three; the first or hepatic lobe the most prominent, the next lobe the widest. A postlateral tubercle present. In a dorsal view, a row of subbranchial spines partially visible.

Basal antennal article tridentate, all the teeth visible from above, the two outer teeth subequal, the one at the outer angle well behind the rostrum, the tooth at base of second article small. Two subhepatic granules.

Chelipeds of adult male much longer and heavier than legs. Merus tuberculous and spinous, three or four spines along the inner margin, five or six along the outer, two rows of spines or tubercles on upper surface, one row on outer surface. Carpus granulate. Manus smooth, inflated. Fingers short, stout, gape of male short, a small, acute tooth near base of dactyl, both fingers crenulate, the propodal finger throughout, the dactyl from tip to tooth. Legs furnished with fine, scattered hairs and with spines above. (Rathbun, 1925)

Material examined: 99 specimens from 34 stations. (See Table 73) From Puerto Refugio, Angel de la Guarda Island, to San Lorenzo Channel in the Gulf of California; Socorro Island, Mexico; and from Secas Islands, Panama, to La Plata Island, Ecuador.

Measurements: Largest specimen, male: length 16.6 mm, width including spines 15.9 mm, without spines 14.4 mm, rostrum 1.8 mm, width 3.0 mm, cheliped 19.8 mm, chela 9.5 mm, dactyl 3.9 mm, height

of palm 2.5 mm, ambulatory legs 21.3, 18.4, 17.0, and 14.0 mm, respectively. Oviparous female: length 13.2 mm, width including spines 12.0 mm, without spines 11.1 mm.

Color in life: Carapace and eyes dull Eugenia red. Merus and carpus of cheliped orange red, hand and fingers bright chrome orange, fading on finger tips. Ambulatory legs pale orange with tiny blotches of red. Ventral side brilliant Eugenia red on frontal portion fading to olive buff on superior areas. (Petersen, of a specimen from Puerto Refugio, Angel de la Guarda Island, Gulf of California) Uniformly bright carmine. Chelipeds and ambulatory legs a little lighter than carapace. Fingers white tipped. Eyes garnet brown. Abdomen and sternum cream buff; pterygostomian region and maxillipeds light carmine. (Petersen, of a specimen from San Gabriel Bay, Espiritu Santo Island, Gulf of California)

Habitat: Sand and shell, shell, broken coral. (Rathbun) Sandy bottom. (Crane) A primary breakdown of the 34 Hancock expeditions stations shows 10 rock, 10 sand, 6 mud, and 8 organic (coral, nullipore, and coralline) bottom. Shell was present with sand on 4 occasions and nullipore with rock on 3 occasions.

Depth: Low tide level to 40 fathoms; exceptionally (off Panama) to 50 fathoms.

Size and sex: The extensive series contains young from 2.5 mm, males from 5.4 to 16.6 mm, females from 5.8 to 14.3 mm, oviparous females from 8.4 to 13.2 mm. In this species the largest specimens are not from the Gulf of California, the male and female measured above coming from Colombia and Panama, respectively.

Breeding: Egg-bearing females were encountered in the Gulf of California in February, off Panama in February and March, off Colombia in January, and off Ecuador in February.

Remarks: It will be noted that the single specimen from Socorro Island has been placed with typical *Mithrax (Mithrax) sinensis* rather than with specimens from Clarion Island, here considered a subspecies of *M. (M.) sinensis*. Specimens from Piñas Bay, Panama, and Port Utria and Gorgona Island, Colombia, might also be segregated from those occurring from northern Panama northward on the basis of their greater spinulosity, specimens from the Gulf of California, in particular those from stations 513-36 and 515-36, being quite smooth. Records for the species along the mainland from Lower California to northern Panama are lacking.

***Mithrax (Mithrax) sinensis clarionensis* Garth**

Plate V, Fig. 6; Plate 41, Fig. 3

Mithrax (Mithrax) clarionensis Garth, 1940, p. 63, pl. 15, figs. 1-3.

Type: Female holotype, U.S.N.M. No. 78777, length 12.9 mm, width 12.5 mm.

Type locality: Sulphur Bay, Clarion Island, Mexico, 57 fathoms; *Velero III* station 137-34.

Diagnosis: Areoles of carapace finely tuberculate. Anterolateral prominences sharply compound-tuberculate. Base of hand paved with rounded granules. Otherwise as in the parent species.

Description: Differing from typical *Mithrax (Mithrax) sinensis* in the following particulars: Carapace paved with much finer tubercles and granules, there being approximately twice as many raised prominences on any area chosen for close examination, as, for example, the gastric shield. Protuberances of anterolateral margin, excepting the last, subdivided into as many as five spines each, the last single. Largest of basal antennal spines acute and incurving. Manus of cheliped with flattened granules proximally. Of the other distinctions mentioned in the original description, the greater breadth of the carapace a character associated with the female sex, and the third interorbital spine absent in about half of the specimens, especially in the young.

Material examined: 14 specimens from 4 stations, all Clarion Island, Mexico. (See Table 74)

Measurements: Male: length 10.4 mm, width including spines 10.3 mm, without spines 10.0 mm, rostrum 0.7 mm, width 2.1 mm, cheliped 16 mm, chela 8.0 mm, dactyl 3.4 mm, height of palm 2.8 mm, ambulatory legs 15.5, 14, 12.5, and 9 mm, respectively. Female holotype: length 12.9 mm, width including spines 12.9 mm, without spines 12.5 mm.

Color in life: See Garth (1940, p. 64).

Habitat: Sand, coral, and nullipore bottom.

Depth: 15-57 fathoms.

Size and sex: Males in the series are from 6.2 to 10.4 mm, females from 5.7 to 12.9 mm, ovigerous females from 5.8 to 10.0 mm. The small size of the breeding females, 5.8 and 7.5 mm, should be noted in comparison to the breeding range of the mainland form, as it presents another racial characteristic.

Breeding: The three ovigerous female paratypes were obtained by the *Velero III* in March.

Remarks: The decision to reduce *Mithrax (Mithrax) clarionensis* from a full species to a subspecies and to relate it to *M. (M.) sinensis* is the result of pleopod studies. As will be seen by a comparison of Plate V, figures 5 and 6, the male first pleopod of the two forms is identical. Retention of *clarionensis* as a geographical race appears justified on the basis of the general characters indicated in the diagnosis and description above, which are clear-cut, and because the two forms, in view of the isolation of Clarion Island from the mainland, do not interbreed, although they may potentially be able to do so.

***Mithrax (Mithrax) pygmaeus* Bell**

Plate V, Fig. 7; Plate 41, Fig. 4

Mithrax pygmaeus Bell, 1835b, p. 172; 1836, p. 55, pl. 11, figs. 3, 3f-h.

A. Milne Edwards, 1875, p. 104. Miers, 1886, p. 86. Rathbun, 1910, p. 574. Finnegan, 1931, p. 624. Crane, 1947, p. 73.

Mithrax (Mithrax) pygmaeus, Rathbun, 1925, p. 406, pl. 262, figs. 1-4. Garth, 1946, p. 391; 1948, p. 29.

Types: Two males, cotypes, the measured cotype 6.4 mm in length and width, originally deposited in the Museum of the Zoological Society [London] and the Bell Museum, no longer extant.

Type locality: Panama, 10 fathoms, sand; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Costa Rica: Port Parker and Port [Puerto] Culebra, Zaca (Crane). Panama: Taboga Island, *St. George* (Finnegan); Perlas Islands: S. W. Garman (Rathbun, 1925), Contadora and Saboga Islands, *Askoy* (Garth, 1948). Colombia: Utria Bay [Port Utria] and Gorgona Island, *Askoy* (Garth). Ecuador: Galapagos Islands, *St. George* (Finnegan); off Esmeraldas, *Askoy* (Garth).

Atlantic analogue: None. A Bay of Panama endemic species.

Diagnosis: Rostral lobes short and broad, subarcuate to subtruncate. Anterolateral spines in two rows, with the inner containing about six, the outer about nine. Basal antennal article broad, two marginal teeth. Chelipeds and ambulatory legs, especially in male, greatly elongated. Antennal flagellum long and slender. Male first pleopod with a pointed tip and a subterminal swelling. A small species.

Description: Carapace depressed, subovate, regions rather distinct, surface smooth, lateral margin armed with two rows of spines, the upper row of six beginning at the outer orbital angle, the outer row of about nine, partly submarginal, beginning at the lower orbital tooth and meeting the first row at the posterolateral angle. Frontal lobes short, broad,

margins slightly arcuate, or subtruncate, sinus V-shaped. Orbits with a minute preocular tooth and two small teeth above, one at outer angle and one below. Eyes large, prominent. Basal article of antennae very broad, with two marginal teeth; movable portion cylindrical, nearly half as long as body. [Maxillipeds with the ischium subquadrate, the merus emarginate at anterointernal angle.]

Chelipeds nearly twice as long as carapace; arm and wrist with a few minute tubercles; hand robust, smooth; dactylus with a large tubercle in the middle of the gape. Legs slender, shorter than cheliped, having a few spinules on merus and carpus, propodus smooth. (Rathbun, after Bell)

As shown by a total of 66 specimens examined, the minute preocular tooth may be entirely wanting, and the walking legs are generally more spinulose than described, rather than less. Bell's figures, referred to by Rathbun (1925) in connection with the outer maxilliped, are not too reliable.

Material examined: 44 specimens from 15 *Velero III* stations. (See Table 75) From Isabel Island, Nayarit, Mexico, to La Plata Island, Ecuador, including Socorro Island of the Revilla Gigedo Islands. In addition to the above, 22 specimens from 5 *Askoy* expedition stations (Garth, 1948), plus two from one Hamburg Museum station.

Measurements: Largest specimen, male: length 10.3 mm, width including spines 12.0 mm, without spines 11.4 mm, rostrum 0.5 mm, width 2.0 mm, cheliped 25.3 mm, chela 13.5 mm, dactyl 5.0 mm, height of palm 3.0 mm, ambulatory legs 17.4, 15.0, 13.6, and 9.7 mm, respectively. Oviparous female: length 8.4 mm, width including spines 9.3 mm, cheliped 11.5 mm.

Color: Pale brownish above, reddish beneath; hands a red brown. (Bell)

Habitat: Sand. (Bell) Shore pools, corals. (Finnegan) In *Pocillopora* coral. (Crane) *Velero III* specimens were cracked from *Pocillopora* coral in 6 instances, dredged from among nullipores in 6 more, and taken on bottoms of shell, sandy mud, and coralline once each.

Depth: Low tide level to 25 fathoms.

Size and sex: In the present series young range upward from 2.0 mm, males from 6.3 to 10.3 mm, females from 4.8 to 8.4 mm, oviparous females from 5.2 to 8.4 mm. A 6.4 mm male has a well-developed cheliped.

Breeding: The large number of oviparous females encountered at Taboga Island in May (12 out of 12) indicates a breeding cycle culminating in early summer.

Remarks: A great deal more is known about this species than in 1925, when Rathbun was able to list, in addition to the non-extant type from Panama, only 2 males and 2 females collected in the Perlas Islands by Garman in 1875. The range of the species has been extended successively to Gorgona and the Galapagos Islands by the *St. George*, to Ecuador by the *Askoy*, and north to Port Parker, Costa Rica, by the *Zaca*. For all this, it remains restricted to the Bay of Panama, broadly defined to include Pacific Colombia and Ecuador to Punta Santa Elena, which, together with the Galapagos Islands, forms the southern half of the Panamic faunal province.

The elongated chelipeds of the adult male and the truncate front make it impossible to confuse this small species with any other *Mithrax*. However, the large eyes, long antennae, and reduced orbital teeth make it easy to confuse it with *Teleophrys cristulipes*, which occupies the same range and ecological niche, the *Pocillopora* colony. The cristate legs of the latter and the almost smooth legs of *Mithrax (Mithrax) pygmaeus* will serve to differentiate these two when a glance at the carapace alone might not suffice.

Mithrax (Mithrax) spinipes (Bell)

Plate V, Fig. 8; Plate 42, Fig. 1

Pisa spinipes Bell, 1835b, p. 171; 1836, p. 50, pl. 9, figs. 6, 6s-u.

Nemausa spinipes, A. Milne Edwards, 1875, p. 82.

Mithrax (Nemausa) spinipes, Miers, 1886, p. 85. Rathbun, 1892, p. 259.

Mithrax spinipes, Rathbun, 1910, p. 575.

Mithrax (Mithrax) spinipes, Rathbun, 1925, p. 391, pl. 136, figs. 3, 4; pl. 262, fig. 5. Boone, 1927, p. 154, fig. 48. Sivertsen, 1933, p. 12. Crane, 1937, p. 60. Garth, 1946, p. 388, pl. 65, figs. 5, 6.

Mithrax (Mithrax) mexicanus Glassell, 1936, p. 213; type locality, 3 mi. NE of Cape Pulmo, Gulf of California; male holotype, N.Y.Z.S. No. 36,712. Crane, 1937, p. 60, pl. 3, figs. 10, 11.

Types: Male, length 16.9 mm, width 8.5 mm, and female, cotypes, originally in the Museum of the Zoological Society [London] and the Bell Museum, respectively, no longer extant.

Type localities: Galapagos Islands, 16 fathoms; Santa Elena, Ecuador, 6 fathoms; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Gulf of California, Mexico: Off San José Island, 33 fathoms, *Albatross* (Rathbun, 1892); Arena Bank, 2.5-4.5 fathoms, *Zaca* (Crane); 3 miles northeast of Cape Pulmo, 50 fathoms, *Zaca* (Glassell, Crane, as *Mithrax (Mithrax)*

mexicanus). Galapagos Islands, Ecuador: Hood Island, *Arcturus* (Boone); Charles Island, A. Wollebaek (Sivertsen); Albemarle Island, and to 160 fathoms, *Velero III* (Garth).

Atlantic analogue: Mithrax (Mithrax) acuticornis Stimpson.

Diagnosis: Rostral horns long and divergent. Five lateral spines, the last postlateral; hepatic and first branchial spines single. A pair of mesogastric spines or spinules. Tip of male first pleopod truncate. A small species.

Description: Carapace pyriform, tumid, setose, much longer than wide; lateral margins without an angle. Six median spines, none very prominent, except the posterior marginal spine. Of the five anterolateral spines the hepatic the most prominent, the other four being small; a subhepatic spinule; a prominent posterolateral spine, about half the size of the hepatic spine, located above the level of the anterolateral spines; a pair of epibranchial spines paralleling the anterolateral spines; a pair of spines on the metabranchial region paralleling the anterolateral margin. Rostral horns nearly one-fourth the body length, diverging, regularly tapering. Suborbital margin armed with two spines, the median large, the distal largest and prominent in dorsal view; supraorbital margin having three spines, postorbital, preorbital, and median, the latter the smallest. Antennae nearly as long as the width of the carapace. Buccal area widest anteriorly.

Chelipeds small, not as long as the first ambulatory leg; merus with a spine at upper distal end, another just proximal to this; carpus with three or four small dull spines; hands smooth, cylindrical; fingers not gaping.

First ambulatory leg nearly as long as the carapace; legs tomentose and setose; merus armed with a distal spine on upper carpal articulation.

Terminal segment of abdomen longer than wide, sides converging, tip arcuate; not as wide as penultimate segment. (Glassell, modified, of *Mithrax (Mithrax) mexicanus*)

In the very young a series of spinules replaces the five lateral spines, the lateral angle is not apparent, and the paired mesogastric spinules may be wanting. The male first pleopod examined was from a 15 mm specimen.

Material examined: Three specimens from as many stations. (See Table 76) From the southern part of the Gulf of California, Mexico, and from Cocos Island, Costa Rica. In addition to the above, 3 specimens from 3 Galapagos Islands stations (Garth, 1946), plus 1 male from Gardner Bay, Hood Island, 25-35 fathoms, station 201-34, not recorded.

Measurements: Largest specimen, female: length 20.0 mm, width including spines 17.2 mm, without spines 14.7 mm, rostrum 4.5 mm, width 2.5 mm, cheliped 17.5 mm, chela 7.6 mm, dactyl 3.3 mm, height of palm 2.0 mm, walking legs 21, 19, 18, and 15 mm, respectively. Male specimen: length 14.8 mm, width including spines 11.0 mm, without spines 9.6 mm.

Color in life: Carapace and chelipeds violet pink; ambulatories faintly pink above; ventral surface grayish white. (Crane) See also Garth (1946, p. 389).

Habitat: Sandy mud. (Bell) Sand and rock; in a piece of coral (*Pocillopora ligulata*); muddy bottom. (Crane) Sand, sand and shell, and "rock, coral, nullipore, and bryozoa." (Garth)

Depth: Shore to 50 fathoms; in the Galapagos Islands to 160 fathoms.

Size and sex: It would be necessary to gather together in one place all specimens extant of which measurements are known in order to have a representative series. Males would measure 8 mm (Sivertsen), 10.1 mm (Crane), 11.3 mm (Garth), 13 mm (Rathbun), 14.8 mm (above), and 16.2 mm (Glassell); females 17.5 mm (Crane) and 20.0 mm (above).

Breeding: An ovigerous female is yet to be recorded.

Remarks: From a consideration of specimens examined and those described in the literature it is apparent first, that *Mithrax (Mithrax) spinipes* is based upon immature specimens, and second, that Galapagan and mainland material, here united for convenience and because of the general similarity of all mithracine young, is not strictly comparable and may require separation as adults of the two forms become known. To which group to refer the 6 mm male from Cocos Island is problematical at present. The inference in Garth (1946, p. 391) that *M. (M.) spinipes* might be the young of *M. (M.) orcutti* Rathbun, here considered a synonym of *M. (M.) armatus* Saussure, is invalidated by the discovery of the distinctive young of the latter species.

Mithrax (Mithrax) belli Gerstaecker

Mithrax ursus Bell, 1835b, p. 171; 1836, p. 52, pl. 10, figs. 2, 2c-e, 3. White, 1847, p. 7. A. Milne Edwards, 1875, p. 103. Miers, 1886, p. 86. (Not *Cancer ursus* Herbst.)

Mithrax bellii Gerstaecker, 1857, p. 112. Rathbun, 1902b, p. 284; 1907, p. 74; 1910, p. 574; 1924b, p. 153.

Mithrax (Mithrax) bellii, Rathbun, 1925, p. 403, pls. 142, 143. Boone, 1927, p. 155, fig. 49. Garth, 1946, p. 389, pl. 66, figs. 1, 2.

Mithrax belli, Hult, 1938, p. 11.

Types: Two adult females, cotypes, length and width about 50.8 mm, and young of both sexes, originally deposited in the Museum of the Zoological Society [London] and the Bell Museum, no longer extant.

Type locality: Galapagos Islands, 6 fathoms; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Galapagos Islands: Albemarle Island, Hopkins-Stanford Expedition (Rathbun, 1902b); Chatham Island, *Albatross* (Rathbun, 1907); Eden Island, *Noma* (Rathbun, 1924b); Hood Island, *Arcturus* (Boone); Indefatigable Island, R. Blomberg (Hult); also Charles, Barrington, Seymour, Tower, James, and Onslow Islands, *Velero III* (Garth). Not Chile (Miers). (See *Remarks* below.)

Atlantic analogue: *Mithrax (Mithrax) verrucosus* Milne Edwards.

Diagnosis: Rostral lobes tuberculiform. Lateral margins of carapace with numerous lumpy projections. Basal antennal article with a knob similar to rostral tubercle. Carapace densely paved with close-set granules. Wrist tuberculate above. Male abdomen broad; male first pleopod consisting of a swollen basal portion and a long tubular extension with the opening at the tip. A large species.

Description: Carapace convex, broadly ovate [correction for ornate], a little broader than long. Surface covered with flattened granules and very unequal tubercles, closely crowded and forming a continuous pavement. Margins thick, projections coarsely rounded. Rostrum with two thick, rounded horns separated by a V-shaped space, and two pairs of dorsal tubercles. Knob at the angle of the basal antennal article curved, larger than either rostral horn and on a higher level. Preorbital lobe tuberculiform, not prominent. Orbital margin with two other, smaller tubercles above, one, not prominent, at outer angle, and one below, besides a submarginal tubercle or blunt spine on the basal antennal article, conspicuous in dorsal view. Just behind and between the orbits two longitudinal rows of two or three tubercles each, and further back a transverse, sinuous line of five tubercles. On the lateral margin six tubercles, the first and second large and bearing an accessory, anterior tubercle, the first hepatic, the second largest of all, the third largest of the simple tubercles, the fourth smallest, the sixth postlateral. Further back on the postlateral margin a row of minor tubercles. On the subbranchial, subhepatic, and suborbital regions a row of tubercles, some visible in dorsal

view. On the anterior margin of the merus of the outer maxilliped a strong, depressed spine, pointing obliquely inward. Pterygostomian ridge tuberculate.

Chelipeds of male strong; arm tuberculate above, two blunt spines or tubercles on inner margin and six of the same on outer margin; wrist covered with low knobs, inner margin with a row of five knobs; hands elongate, arcuate above, concave below; fingers moderately gaping, tips with edges finely crenulate, a strong tooth near base of dactyl, edge of fixed finger finely denticulate part way in the gape. Legs stout, three principal articles tuberculate above, especially on margins; dactyls dark colored for nearly a third of their length.

Abdomen of male very wide, last segment with concave sides. (Rathbun, 1925, modified)

The young present such a different aspect from the adult that they might easily be mistaken for another species. The carapace is narrower; the width may be less than the length. The body and legs, but not the chelae, are everywhere covered with a furry hair. The protuberances are all sharp-pointed; the rostral horns curve toward each other; the pair of spines at the base of the horns are nearly as long as the horns and are divergent, while the next pair is very small. (Rathbun, 1907)

Material examined: 76 specimens from 28 Galapagos Islands stations. (See Garth, 1946)

Measurements: Male: length 37.6 mm, width including lateral spines 37.3 mm, without spines 34.8 mm, rostrum 3.8 mm, width 3.8 mm, cheliped 40.5 mm, chela 18.5 mm, dactyl 8.2 mm, height of palm 5.7 mm, ambulatory legs 40, 37.5, 33.5, and 27.5 mm, respectively. Ovigerous female: length 53.7 mm, width including spines 56.6 mm, cheliped 60.0 mm, chela 28.9 mm. Neither is as large as the 63.6 x 65.4 mm male measured by Rathbun (1902b).

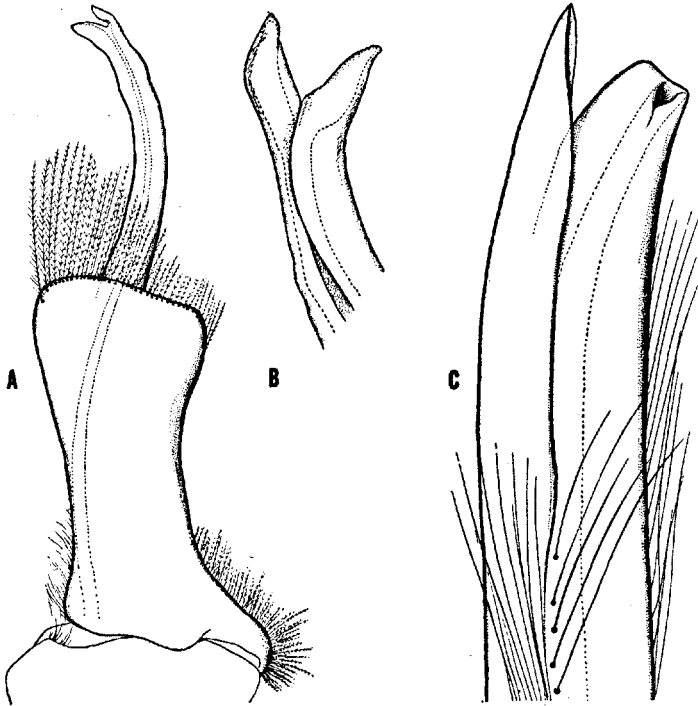
Color in life: See Garth (1946, p. 391).

Habitat: In rock pools. (Rathbun, 1924b) Rocky shore. (Garth) Young invariably sponge incrustated. (Garth)

Depth: Intertidal. A single recovery by the *Velero III* from 5 fathoms lends credence to Bell's original record of 6 fathoms for the species.

Size and sex: The series includes young from 4.6 mm, males from 11.1 to 37.6 mm, and females from 12.3 to 60.7 mm. Of these only the 53.7 mm specimen measured above was ovigerous.

Breeding: The single ovigerous female was encountered by the *Velero III* in the month of February.



9. Anomalous male first pleopods of Galapagos *Mithrax* species. A. *Mithrax* (*Mithrax*) *belli*, 37.6 mm male (*Velero III* Sta. 163-34), \times 4.05. B. Same, terminal portion, \times 12.5. C. *Mithrax* (*Mithraculus*) *nodosus*, 38.2 mm male (*Velero III* Sta. 42-33), \times 13.75.

Remarks: The unusual male first pleopod (see text-figs. 9A, B) deserves special comment. The heavy basal portion appears to be correlated with the very wide abdomen noted by Rathbun above. The tubular extension which serves as an intromittent organ, unlike anything so far encountered in the family, would at first appear to indicate separate descent. However, the characters which relate the species to the genus *Mithrax*, the subgenus *Mithrax*, and the superspecies represented by *M. (M.) verrucosus* in the Atlantic and by *M. (M.) belli* in the Pacific are so many and detailed that there is no thought of erecting a separate group on the basis of this aberrant gonopod alone. Rather, it would appear to represent a mutation which has spread to an entire insular population and which would serve as an effective species isolating mechanism should opportunity for interbreeding with mainland species occur.

Miers' Chilean record has been traced by means of White's (1847) List of Crustacea in the British Museum to a young specimen from the Bell collection. If this were one of the type series, as seems probable, the Chilean locality is in error and *Mithrax (Mithrax) belli* has always been a Galapagos endemic species.

Subgenus *Mithraculus* White

Mithrax (Mithraculus) Rathbun, 1925, p. 421.

Description: Carapace with conspicuous, smooth, oblique, branchial sulci. Rostral horns very short, shorter than wide, truncate. Minor teeth of orbit tuberculiform, inconspicuous. (Rathbun)

With the uniting of *Mithrax areolatus* Lockington with *M. denticulatus* Bell by Crane (1947, p. 73), there are now but two species in the eastern Pacific belonging to this, the smaller subdivision of the genus.

Mithrax (Mithraculus) denticulatus Bell

Plate V, Fig. 9; Plate 42, Fig. 2

Mithrax denticulatus Bell, 1835b, p. 172; 1836, p. 54, pl. 11, figs. 2, 2c-e. Miers, 1886, p. 87. Rathbun, 1892, p. 272; 1907, p. 74; 1910, p. 575. Nobili, 1901, p. 31. Crane, 1947, p. 73.

Mithraculus denticulatus, White, 1847, p. 7. Stimpson, 1860b, p. 187. A. Milne Edwards, 1875, p. 109; 1878, pl. 23, figs. 4, 4a-c. Bouvier, 1895, p. 8.

Mithrax areolatus Lockington, 1877c, p. 71; type locality, Port [Puerto] Escondido and San José Island, Gulf of California; types not extant. Miers, 1886, p. 87. Rathbun, 1910, p. 575. Steinbeck and Ricketts, 1941, p. 467, pl. 29, fig. 1.

Mithraculus areolatus, Streets and Kingsley, 1877, p. 104. Kingsley, 1879a, p. 146.

Mithraculus areolatus, Cano, 1889, pp. 102, 186.

Mithrax (Mithraculus) denticulatus, Rathbun, 1925, p. 428, pl. 154, figs. 2, 3. Boone, 1927, p. 161, fig. 51. Garth, 1946, p. 395. Buitendijk, 1950, p. 274.

Mithrax (Mithraculus) areolatus, Rathbun, 1925, p. 433, pl. 154, fig. 1. Crane, 1937, p. 61.

Type: Bell's type material consisted of the figured female and an unspecified number of cotypes; length of measured cotype 10.6 mm, width 12.7 mm; these were originally deposited in the Museum of the Zoological Society [London] and in the Bell Museum, but are no longer

extant, according to Dr. I. Gordon of the British Museum (Natural History). In view of this fact, and in accordance with the Copenhagen Decisions on Zoological Nomenclature, a male specimen from Manta, Ecuador, A.H.F. No. 353, collected by the *Velero III* on January 19, 1935, at station 400-35, is hereby designated neotype.

Type locality: As stated in the second paragraph under *Remarks* below, the Galapagos Islands type locality, correct for *Mithrax (Mithraculus) nodosus* Bell, is in error with respect to *M. (Mithraculus) denticulatus*, subsequent collecting having shown the ranges of the two species to be mutually exclusive. The corrected type locality for *M. (Mithraculus) denticulatus* Bell is Manta Bay, Ecuador, one of Cuming's mainland localities from which Hancock expeditions obtained material.

Localities subsequently reported, with collectors: Extralimital: California: San Diego (locality supposed correct), San Diego Society of Natural History (Rathbun, 1925, as *Mithrax (Mithraculus) areolatus*). Mexico: Lower California: L. Diguët (Bouvier); Cape San Lucas, John Xantus (Stimpson); Gulf of California: [Los] Coronados Islands, Pt. Lobos of Espiritu Santo Island, El Mogote, east of La Paz, and Pulmo Reef, Steinbeck and Ricketts (Steinbeck and Ricketts, as *Mithrax areolatus*); Port [Puerto] Escondido and San José Island, W. J. Fisher, types of *Mithrax areolatus* (Lockington); Arena Bank, *Zaca* (Crane, 1937, as *Mithrax (Mithraculus) areolatus*). Mexico south of Cape Corrientes: Chamela Bay, Sihuatenejo, Port Gatulco, and Tangola Tangola Bay, *Zaca* (Crane, 1947); Manzanillo, F. Bonet, and Acapulco, Escuela Nacional (Buitendijk, 1950). Costa Rica: Port Parker, Port Culebra, Piedra Blanca Bay, and Uvita Bay, *Zaca* (Crane, 1947); Cocos Island, *Arcturus* (Boone). Panama: Capt. John Dow (Rathbun, 1892); Bahia Honda, *Zaca* (Crane, 1947); Flamenco Island, E. Festa (Nobili); Perico Island, *Albatross* (Rathbun, 1907); Perlas Islands, *Vettor Pisani* (Cano). Ecuador: Santa Elena Bay, E. Festa (Nobili); extralimital: Guayaquil, A. Sinclair (White).

Atlantic analogue: *M. (Mithraculus) coryphe* (Herbst).

Diagnosis: Oblique branchial sulci strong. Two lobes and a forward curving spine on anterolateral margin; a postlateral spine followed by a dorsal row of tubercles. Inner edge of carpus only of cheliped laminate, lamina faintly bilobed. Carapace wide, breadth exceeding length by nearly one-half. Male first pleopod with broadly pointed tip and two rounded flanges.

Description: Carapace naked, depressed, deeply areolate, areolations less broken than in *Mithrax sculptus*, punctate, a transverse [row] of five tubercles on the gastric region and two more acute ones on the outer posterior portion of each branchial region, two prominent tubercles at the base of the rostrum, one on each side of the median line. Rostrum short, bifid, outer margins of horns arcuate, inner straight. Orbits with one distinct fissure above, inner angle prominent, rounded; outer also rounded but less prominent; external hiatus a rounded opening. Anterolateral margin with three teeth besides the external angle of the orbit, first and second teeth stout, prominent, obtuse, the second the larger; third tooth slender, acute, hooked forward; a small acute tooth on the posterolateral margin behind the lateral angle. A tubercle on the subhepatic region beneath the first tooth of the anterolateral margin. An oblique row of rounded tubercles running backward from the palatal region. Basal article of antenna with two short blunt teeth.

Chelipeds small; posterior margin of merus four-toothed, upper surface with one tooth, inner margin with a single rounded tubercle; carpus prominently tuberculate; hand smooth, inflated, cristate above at the base, a small depressed tubercle on the outer surface at the articulation with the carpus; fingers moderately gaping, denticulated at the extremity, a basal tooth on the dactylus in both sexes, but larger in the male. Ambulatory [legs] with spinous tubercles on the basal [articles], becoming obsolete on the distal ones; dactyli strongly arcuate. (Kingsley, of Gulf of California specimens sent by Lockington)

Material examined: 483 specimens from 37 stations. (See Table 77) From Agua Verde Bay, Gulf of California, Mexico, to Manta Bay, Ecuador. Absent from Revilla Gigedo and Galapagos Islands collections.

Measurements: Male neotype: length 14.3 mm, width including spines 20.2 mm, without spines 16.9 mm, rostrum 0.5 mm, width 2.5 mm, cheliped 24.0 mm, chela 12.9 mm, dactyl 7.6 mm, height of palm 6.8 mm, ambulatory legs *ca.* 19.0, 17.8, 16.5, and 15.0 mm, respectively. Ovigerous female: length 12.5 mm, width including spines 16.8 mm, without spines 14.6 mm.

Color in life: Carapace mottled chocolate brown and dull olive green; eyes chocolate brown; chelipeds and legs like carapace; hairs olive; distal half of chelae flesh pink; sternum and maxillipeds plain olive; abdomen white with segments brownish; underside of ambulatories greenish white. (Crane, of Costa Rican specimens)

Habitat: Under stones at low water. (Bell) At low tide under stones and coral. (Lockington) In tidepools among short weed and in *Pocillopora* coral. (Crane, 1947) Sluggish, tightly gripping, small spider crab found abundantly in interstices of coral. (Steinbeck and Ricketts)

Depth: Intertidal, with the exception of two stations in the Tres Marias Islands, Mexico, where it was dredged in from 3-5 and 13 fathoms, respectively.

Size and sex: Males in the Hancock series are from 4.6 to 14.8 mm, females from 4.6 to 12.5 mm, ovigerous females from 6.7 to 12.5 mm. Young of from 2.5 to 3.8 mm are commonly cracked from coral heads. Although the largest specimens are from the Gulf of California, a 14.3 mm male (the neotype) was obtained at Manta, Ecuador.

Breeding: Females with ova in August in the Gulf of California. (Lockington)

Remarks: In synonymizing *Mithrax (Mithraculus) areolatus* Lockington to *M. (M.) denticulatus* Bell, the writer has been anticipated only by Crane (1947, p. 73), although Rathbun was earlier aware that this was in order, judging from a pencil note in her hand discovered at the U. S. National Museum. If one were restricted to the Gulf of California and the other to the Bay of Panama, they might be segregated as geographical races or subspecies; but even the meager records available until recently included stations in the vicinity of Cape San Lucas and Panama for both. Now these widely separated places are connected by a series of stations from intermediate localities, including those of the *Zaca* as well as the *Velero III*. There remains only the question of local variation, covered also by Crane, who states that specimens from the same place differ from one another as to the relative advance of the antennal spines, and that individual specimens are sometimes asymmetrical in this respect. The remarkable thing about *M. (M.) denticulatus*, including also specimens formerly referred to *M. (M.) areolatus*, is not how different, but how much alike are specimens from localities separated by thousands of miles.

Now that the provenience of *Mithrax (Mithraculus) denticulatus* is firmly established as the west coast of America from Cape San Lucas (and possibly San Diego) to Ecuador, it seems timely to dispose of the question of type locality. To begin with, of 850 specimens of *Mithrax (Mithraculus)* collected by the *Velero III* at 57 Galapagos stations, all were the endemic *M. (Mithraculus) nodosus*, and not one the mainland *M. (M.) denticulatus*. Moreover, no *M. (M.) denticulatus* were obtained at Clarion or Socorro islands, either by intertidal collecting or

from *Pocillopora* coral. This is evidence that the species does not travel far from the mainland, the most remote locality on record being Cocos Island (Boone, 1927). Finally, Cuming, the collector, is known to have visited Santa Elena Bay, Manta Bay, and the Bay of Panama, the latter two being localities from which *M. (M.) denticulatus* has been obtained in recent years. It is also known that Cuming kept no written records, but trusted to his voluminous memory for scientific data. It seems clear to the writer, therefore, that the types of *Mithrax denticulatus* were obtained at one of Cuming's mainland localities, and not in the Galapagos Islands, where it was said by Bell (1836, p. 55) to be "found by Mr. Cuming in considerable numbers with the former [*M. nodosus*]." The type locality of *M. (M.) denticulatus* is hereby corrected to Manta Bay, Ecuador, and a neotype is established for the species.

Mithrax (Mithraculus) nodosus Bell

Mithrax nodosus Bell, 1835b, p. 171; 1836, p. 53, pl. 11, figs. 1, 1a, 1b. Miers, 1886, p. 87. Rathbun, 1892, p. 273; 1898, p. 579; 1902b, p. 284; 1910, p. 575. Schmitt, 1939, p. 25. Meredith, 1939, p. 107 (figured).

Mithraculus nodosus, White, 1847, p. 7. A. Milne Edwards, 1875, p. 108; 1878, pl. 23, figs. 5, 5a-d.

Mithraculus ruber, Cano, 1889, pp. 102, 185. (Not *Mithraculus ruber* Stimpson.)

Mithrax (Mithraculus) nodosus, Rathbun, 1925, p. 429, pl. 155, text-fig. 127. Boone, 1927, p. 158, fig. 50. Finnegan, 1931, p. 625. Sivertsen, 1933, p. 12. Hult, 1938, p. 12. Garth, 1946, p. 392, pl. 68, fig. 1; 1957, p. 31.

Type: Bell's type material consisted of the figured male and one or more cotypes; length of measured cotype 25.4 mm, width 31.7 mm; these were originally deposited in the Museum of the Zoological Society [London] and in the Bell Museum, but are no longer extant.

Type locality: Galapagos Islands; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Galapagos Islands: Floreana [Charles] Island, *Vettor Pisani* (Cano, as *Mithraculus ruber*); Chatham Island, W. H. Jones (Rathbun, 1892); Hood and Duncan Islands, *Albatross* (Rathbun, 1898); Albemarle Island, Hopkins-Stanford Expedition (Rathbun, 1902b); Indefatigable Island, R. Blomberg (Hult); James and Narborough Islands, *Houston* (Schmitt); Barrington, Seymour, Tower, Bartholomew, and Marchena [Bindloe] Islands, *Velero III* (Garth). Not Chile (Miers).

Atlantic analogue: None. A Galapagos Islands endemic species.

Diagnosis: Oblique branchial sulci faintly indicated, especially in large specimens. Three anterolateral marginal lobes, with the last, situated at the lateral angle, narrowest. Entire inner edge of cheliped to middle of manus laminate. Male first pleopod fringed with hair, a sheath extending beyond terminal opening.

Description: Carapace widened, much depressed; front composed of two very short frontal horns, obtuse, very close together. Preorbital angles tuberculiform. External angle of the basal article of the antenna prolonged into an obtuse point surpassing the preorbital angle. Lobulations of the carapace less strong than in [related species]. Four tubercles arranged transversely occupying the gastric region. Another line of larger tubercles following the posterior margin above. Anterolateral margins provided with three rounded expansions: the first, or hepatic, smaller than the two following; a small spine placed behind the last. Development of lateral expansions varying a great deal; more considerable in young females than in adult males. External maxillipeds differing a great deal from those of other *Mithrax*. Merus broader than long, a little notched on the inside for the insertion of the palp, palp with articles broad and flattened. Posterior margin very concave on the outside [inside, according to Milne Edwards's figure] for the insertion of the second article. External branch, or exognath, little widened.

Chelae provided above with a crest occupying the posterior portion of their margin. Another crest bordering the forearm on the inside. Arm bearing several tubercles, its anterior margin advanced in a lamellate and rounded prolongation, very broad in adult males, only spiniform in females. Ambulatory legs spiniform, short and heavy. (A. Milne Edwards, modified)

Material examined: 850 specimens from 57 Galapagos stations. (See Garth, 1946, pp. 392-395)

Measurements: Largest specimen, male: length 30.1 mm, width including lateral lobe 38.1 mm, without lobe 33.6 mm, rostrum 1.4 mm, width 4.0 mm, cheliped 57 mm, chela 31 mm, dactyl 18.2 mm, height of palm 13.4 mm, ambulatory legs 40, 35.5, 31, and 26.5 mm, respectively. Female: length 23.5 mm, width including lateral lobes 28.1 mm, without lobes 24.4 mm.

Color in life: Uniform purplish brown. Hairs on legs and about antennae yellow, in sunlight yellow green. (Garth)

Habitat: Under stones at low water. (Bell) Shore pool. (Finnegan) In coral. (Garth)

Depth: Intertidal; exceptionally to 12 fathoms. (Finnegan)

Size and sex: Males in the extensive Hancock series are from 5.5 to 30.1 mm, females from 6.8 to 23.5 mm, ovigerous females from 10.6 to 23.5 mm, with young as small as 3.7 mm.

Breeding: Ovigerous females were encountered by the *Velero III* in December, January, and February.

Remarks: Even more remarkable than the unusual third maxilliped, described by Bell as "irregularly semilunar" in form, is the anomalous male first pleopod mentioned in the diagnosis above. (See text-fig. 9C) For while the maxilliped has its counterpart in certain other majid genera (notably *Stilbognathus*), a pleopod similarly enclosed in a protective sheath extending beyond its truncate tip has not been met with in the family. The remarks made concerning *Mithrax* (*Mithrax*) *belli* apply here as well, except that the relationship of *Mithrax* (*Mithraculus*) *nodosus* to any particular mainland species is not as close as that of *M.* (*Mithrax*) *belli* to *M.* (*Mithrax*) *verrucosus*.

The Chilean record (Miers, 1886) has been traced through White (1847) to specimens from Bell's collection, in all probability from the type series.

Genus TELEOPHRYS Stimpson

Teleophrys Stimpson, 1860a, p. 133; 1860b, p. 190. Rathbun, 1925, p. 440.

Type: *Teleophrys cristulipes* Stimpson, by monotypy.

Description: Allied to *Mithrax* proper, but distinguished by the character of its orbits, which have the superior and exterior margins entire, and not armed with tubercles or spines. Sometimes an indication of a [closed] superior fissure, but no trace of an exterior one. Basal [segment] of the external antennae rather narrow for the group to which this genus belongs, tapering anteriorly, armed with a slight tooth at the anteroexterior angle and another still smaller at the middle of the outer margin. Merus of the external maxillipeds broader than the ischium and three-fourths as long, and notched at the internal angle for the reception of the palpus. (Stimpson, 1860b)

Carapace ovate, legs cristate, and abdomen seven-segmented in both sexes.

Range: From Santa Maria Bay, Lower California, and Agua Verde Bay, Gulf of California, Mexico, to Independencia Bay, Peru. In the Caribbean at Curaçao, and in the Atlantic from Fernando Noronha Island to Maceio Reef, Alagoas, Brazil. Shore-70 fathoms.

KEY TO THE PACIFIC SPECIES OF *Teleophrys*

- 1a. Second free antennal segment long and cylindrical; front low to medium height, arching, lobes widely separated; anterior branchial region prominent and crowded forward toward smaller hepatic region; propodus without a lateral flange, sometimes with a small tubercle or spine. Tip of male first pleopod short and stout, subterminal lobe pointed . . . *cristulipes*
- 1b. Second free antennal segment short and broad; front elongated, rostral horns closely approximated; anterior branchial region not prominent nor crowded forward toward hepatic region; propodus with a lateral flange. Tip of male first pleopod elongate and pointed, subterminal lobe rounded . . . *tumidus*

***Teleophrys cristulipes* Stimpson**

Plate W, Fig. 1; Plate 42, Fig. 3

Teleophrys cristulipes Stimpson, 1860a, p. 133; 1860b, p. 190, pl. 2, fig. 2. Rathbun, 1902b, p. 284; 1910, p. 536, pl. 46, fig. 2 (part: not the Peruvian or the Brazilian specimens); 1925, p. 441, pl. 159, figs. 1, 2, and 7; pl. 262, fig. 7. Finnegan, 1931, p. 625. Glassell, 1934, p. 453. Crane, 1937, p. 61; 1947, p. 73. Meredith, 1939, p. 106 (figured). Schmitt, 1939, pp. 22, 25. Steinbeck and Ricketts, 1941, p. 467. Garth, 1946, p. 369, pl. 68, figs. 5, 6; 1948, p. 29. Buitendijk, 1950, p. 271.

Mithrax (Mithraculus) cristulipes, A. Milne Edwards, 1875, p. 113 (subgenus *Mithraculus*, section *Teleophrys*).

Mithrax (Teleophrys) cristulipes, A. Milne Edwards, 1875, pl. 19, figs. 2, 2a-e. Pocock, 1890, p. 508 (part: the Cape San Lucas specimen).

?*Mithrax cristulipes*, Miers, 1886, p. 87.

Mithrax cristulipes, Moreira, 1901, pp. 63, 134 (part: not the Brazilian specimens). Not Rathbun, 1892, p. 273.

Teleophrys diana Boone, 1927, p. 162, fig. 52; type locality, Hood Island, Galapagos; male and female, types, in Mus. N.Y.Z.S. Sivertsen, 1933, p. 13. Hult, 1938, p. 12.

Teleophrys tumidus, Boone, 1927, p. 166, fig. 53. Not *T. tumidus* Cano.

Type: 3 males, 6 females (3 ovigerous), cotypes, M.C.Z. No. 1226; male cotype length 7.6 mm, width 8.1 mm; also a specimen in the British Museum, Reg. No. 6144.

Type locality: Cape St. [San] Lucas, Lower California, Mexico; John Xantus, collector. (Stimpson, 1860b)

Localities subsequently reported, with collectors: Gulf of California, Mexico: El Mogote, Steinbeck and Ricketts (Steinbeck and Ricketts); Arena Bank, *Zaca* (Crane, 1937). Mexico south of Cape Corrientes: Clarion Island, Chamela Bay, and Port Guatulco, *Zaca* (Crane, 1947); Acapulco, M. Cárdenas (Buitendijk); [To France:] Clipperton Island, *Houston* (Schmitt). Costa Rica: Port Parker, Port Culebra, Jasper Island, and Uvita Bay, *Zaca* (Crane, 1947). Panama: Bay of Panama, F. H. Bradley (A. Milne Edwards); Taboga Island, *St. George* (Finnegan); Pearl [Perlas] Islands, S. W. Garman (Rathbun, 1925); Guayabo Chiquito, *Askoy* (Garth, 1948). Colombia: Humboldt Bay, Utria Bay [Port Utria], *Askoy* (Garth, 1948); Gorgona Island, *St. George* (Finnegan), *Zaca* (Crane, 1947), *Askoy* (Garth, 1948). Ecuador: La Plata Island, *Askoy* (Garth, 1948). Galapagos Islands: Albe-marle Island, Hopkins-Stanford Expedition (Rathbun, 1902b); Hood Island, *Arcturus*, types of *Teleophrys diana* (Boone); Floreana [Charles] Island, A. Wollebaek (Sivertsen, as *T. diana*); Indefatigable Island, R. Blomberg (Hult, as *T. diana*); James Island, *Houston* (Schmitt); Barrington, Duncan, Seymour, Tower, and Bartholomew Islands, *Velero III* (Garth, 1946).

Atlantic analogue: *Teleophrys pococki* Rathbun.

Diagnosis: Second free antennal segment long and cylindrical. Front low to medium height, arching, lobes widely separated. Anterior branchial region prominent and crowded forward toward smaller hepatic region. Propodus without a lateral flange, sometimes with a small tubercle or spine. Tip of male first pleopod short and stout, subterminal lobe pointed.

Description: Carapace subtriangular and heavy, but little convex; rounded on the sides and behind. Front narrow, the rostrum very short and bifid. Preorbital angle rounded. Basal article of the external antennae narrowed in front, and bearing two tubercles, one occupying its antero-external angle; a third tubercle on the carapace a little behind the inner orbital margin. Supraorbital margin entire; however, with traces of two small fissures. Carapace a little nodose; the projecting portions bearing scattered granulations or a few tubercles. Anterolateral margins cut into four teeth, teeth, with the exception of the last, rounded and tuberculi-form, last tooth smaller and more pointed than the preceding ones.

Merus of the external maxilliped truncate at its internal angle to receive the palp; its external angle dilated; the exognath broad. Finally,

the movable flagellum of the external antennae longer than is usual in *Mithrax*.*

Chelae less developed than usual. In the male, hand compressed, carinate above and below, and smooth; a single tubercle on its external surface, near the carpal articulation. Forearm slightly tuberculate and prolonged on the inside. Arm nodose and tuberculate. Ambulatory legs nearly glabrous and covered with lamelliform spines or with sometimes imbricate crests. (A. Milne Edwards, modified, of a Bay of Panama specimen)

Considerable variation was observed in the extensive series examined. This was of two sorts: *individual*, within a given local population, and *geographical*, from one population to the next. Individual variation was found to be concerned almost entirely with the amount of spinulation of the lateral margins of the carapace and the degree of roughness of the ambulatory legs. The former could be almost smooth or bristling with spinules; the latter might be almost devoid of cristae or fairly limbed. Geographical variation was apparent as a series of parallel clines for a number of characters, some of which have been used heretofore to separate *Teleophrys cristulipes* from the related *T. tumidus* of Peru. (Cf. Garth, 1946, p. 400)

In specimens from near the type locality in the Gulf of California and from the Revilla Gigedo Islands, the rostrum is of moderate length and widely and deeply cleft; in specimens from Panama south to Ecuador the rostrum is short, the shallow lobes remaining well separated. Similarly, while northern specimens have the anterior branchial region (mistakenly called the hepatic) enlarged and crowded toward the smaller hepatic region, southern specimens have the anterior branchial region less strongly developed. Finally, while in northern specimens the propodus is devoid of *lateral* ornamentation, in southern specimens a lateral tubercle or spine may be present; however, this is never broadened into a flange, as in *Teleophrys tumidus*.

Material examined: 328 specimens from 52 Hancock stations. (See Table 78) From Santa Maria Bay, Lower California, and Agua Verde Bay, Gulf of California, Mexico, to La Plata Island, Ecuador, including Socorro and Clarion Islands of the Revilla Gigedo group. In addition to the above, 55 specimens from 5 *Askoy* stations (Garth, 1948, p. 29), and 1,231 specimens from 62 Hancock Galapagos stations (Garth, 1946,

*A. Milne Edwards considered *Teleophrys* to be a section of *Mithrax* (*Mithraculus*).

p. 396), to which should be added 6 specimens from 5 stations, of which station 25-33 was not previously recorded.

Measurements: Largest mainland specimen, male: length 12.3 mm, width including spines 14.5 mm, without spines 13.8 mm, rostrum 0.6 mm, width 1.7 mm, cheliped 20.5 mm, chela 11.7 mm, dactyl 6.2 mm, height of palm 5.3 mm, ambulatory legs 16.5, 14.8, 13.5, and 12.1 mm, respectively. Female: length 9.0 mm, width including spines 9.8 mm, without spines 9.2 mm. Largest Galapagos specimen, male: length 16.1 mm, width including spines 18.6 mm, without spines 17.9 mm, rostrum 1.0 mm, width 2.4 mm, cheliped 28.4 mm, chela 16.6 mm, dactyl 9.6 mm, height of palm 8.0 mm, ambulatory legs 21.5, 18.2, 17.5, and 14.4 mm, respectively. Ovigerous female: length 12.4 mm, width including spines 13.9 mm, without spines 13.2 mm.

Color in life: In general olivaceous. (Crane) See also Garth (1946).

Habitat: Rock pools and among corals. (Finnegan) Shore and tide-pool collecting. (Schmitt) In coral and under stones at low tide. (Garth, 1948) Always in *Pocillopora* coral except for one specimen in a tide pool and another at low-tide level in dead pearl oyster. (Crane, 1947) Hancock mainland specimens were taken most frequently in *Pocillopora* coral (22 stations), often intertidally on rocky shore (17 stations), and infrequently by dredging (10 stations).

Depth: Intertidal and subtidal; generally 1-10 fathoms, once to 20 fathoms; once in the Galapagos 40-70 fathoms.

Size and sex: Gulf of California series: Males are from 5.5 to 6.9 mm, females from 3.5 to 6.2 mm, ovigerous females from 4.5 to 6.2 mm. Bay of Panama series: males are from 4.0 to 12.3 mm, females from 3.6 to 9.3 mm, ovigerous females from 4.2 to 9.3 mm. Both series have many young under 3.0 mm cracked from coral heads. The larger size of Galapagos Islands specimens, with ovigerous females from 5.7 to 12.4 mm, should be noted. (See *Measurements*)

Breeding: Ovigerous females were encountered by the *Velero III* off Lower California in March, in the Gulf of California in February and March, in the Revilla Gigedo Islands in January and June, off southern Mexico in February and March, off Costa Rica in February, off Panama in January, February, March, and May, off Colombia in January and February, off Ecuador in January, and in the Galapagos Islands from December to February.

Remarks: It should not be concluded from the paragraph on variation above that because a cline exists with respect to certain characters heretofore found useful in separating *Teleophrys cristulipes* from *T. tumidus*,

these species merge one into the other. With respect to the rostrum, for example, the situation is the reverse of that which would occur were the two species but one: the *T. tumidus* of Peru has a longer rostrum than that of the *T. cristulipes* from the Gulf of California, while the *T. cristulipes* of the Bay of Panama has short rostral horns. Furthermore, the rostral horns of *T. cristulipes*, whether long or short, are widely separated, whereas those of *T. tumidus* are closely approximated. Again, while Galapagos and Gorgona Island specimens may exhibit a lateral propodal tubercle, it is never elongated into a crest, as in Peruvian *T. tumidus*.

With the extension of range of *Teleophrys cristulipes* southward to La Plata Island, Ecuador, by the *Askoy* (Garth, 1948), and the discovery of *T. tumidus* at Zorritos Light, Peru, by the *Velero III*, it becomes possible to define the ranges of the two species more precisely. While individuals of either species from Santa Elena Bay, Ecuador, are still lacking, it may be said that all specimens examined from north of Punta Santa Elena are *T. cristulipes*, while all from south of this promontory are *T. tumidus*, with no mixed populations.

Teleophrys tumidus (Cano)

Plate W, Fig. 2; Plate 42, Fig. 4

Mitraculus tumidus Cano, 1889, p. 186, pl. 7, fig. 7.

Teleophrys cristulipes, Rathbun, 1910, p. 536 (part: not the San Lucas locality nor pl. 46, fig. 2). (Not *T. cristulipes* Stimpson).

Mithrax tumidus, Rathbun, 1910, p. 575.

Teleophrys tumidus, Rathbun, 1925, p. 442, pl. 159, figs. 8, 9, text-fig. 128 (part: not the Galapagos specimen). Not *T. tumidus* Boone, 1927, p. 166, fig. 53.

Type: Male holotype, length 13 mm, width 14 mm; originally in Naples Museum, believed no longer extant.

Type locality: Payta, Peru; collected by the *Vettor Pisani*.

Localities subsequently reported, with collectors: Peru: Sechura Bay, half way between Bayovar and Matababalla, 5-6 fathoms, R. E. Coker (Rathbun, 1910, as *Teleophrys cristulipes*); Payta, Hassler (Rathbun, 1925).

Atlantic analogue: None; a Peruvian endemic species.

Diagnosis: Second free antennal segment short and broad. Front elongated, rostral horns closely approximated. Anterior branchial region not prominent or crowded forward toward hepatic region. Propodus

with a lateral flange. Tip of male first pleopod elongate and pointed, subterminal lobe rounded.

Description: Compared to *Teleophrys cristulipes*, carapace relatively longer, lateral angle more pronounced, making the carapace less rotund and more triangular; the surface having more granules and fewer tubercles and spines. Crescentic branchial elevation either side of the cardiac region wider and more swollen. Only two anterolateral marginal spines, one at the lateral angle and one in front of it; this spine exceptionally replaced by a tubercle. Anterior branchial spine and the hepatic spine of *T. cristulipes* replaced by tubercles. Posterolateral spine of good size; in front of it a tubercle forming a parallelogram with the three marginal spines.

Front more triangular than in *Teleophrys cristulipes*; space between the horns a narrow slit. Upper margin of orbit with two slight emarginations. Outer margin of basal article of antenna subentire and nondentate, although posteriorly curving outward slightly in a shallow lobe. Second free article short and stout, less than twice as long as its greatest or distal width. Inner distal angle of merus of maxilliped deeply notched.

Chelipeds less rough than in *Teleophrys cristulipes*. Tubercle at the proximal end of the palm higher up or nearer the middle. Fingers of the well-developed male, while similar to those of *T. cristulipes*, a little less slender, and tapering gradually from base to tip; in *T. cristulipes* of more even width throughout. Ambulatory legs stouter than in *T. cristulipes*, especially the propodus; this article having a lobe on the posterior surface as well as on top; dactylus shorter, stouter and more curved than in the allied species. (Rathbun, 1925, modified)

Material examined: From Hancock Foundation collections: 55 specimens from 6 stations, all Peruvian. From U. S. National Museum collections: 155 specimens from 4 localities, all in the vicinity of Paita, Peru, Waldo L. Schmitt, collector. (See Table 79)

Measurements: Largest Hancock specimen, male: length 15.3 mm, width including spines 17.0 mm, without spines 15.3 mm, rostrum 1.4 mm, width 2.2 mm, cheliped 24 mm, chela 13.7 mm, dactyl 7.4 mm, height of palm 6.6 mm, ambulatory legs 16.3, 14.8, 13.5, and 11.5 mm, respectively. Largest Schmitt specimen, male: length 18.6 mm, width including spines 20.6 mm, without spines 18.7 mm, rostrum 1.8 mm, width 2.1 mm, cheliped 31.8 mm, chela 19.2 mm, dactyl 10.7 mm, height of palm 9.3 mm. Largest Hancock female: length 14.1 mm, width including spines 14.7 mm, without spines 12.8 mm.

Color in life: Not known.

Habitat: Intertidal, on rocky shore; when dredged, on sand or shell bottom.

Depth: Shore to 10 fathoms.

Size and sex: Males in the combined series are from 4.7 to 18.6 mm, females from 6.3 to 16.1 mm, ovigerous females from 7.3 to 16.1 mm.

Breeding: Ovigerous females were encountered by the *Velero III* in January and February, and by W. L. Schmitt in October, when 22 of 24 females from one station were found to be gravid.

Remarks: The range of the species has been extended southward to Independencia Bay and northward to Zorritos Light, Peru. (See also *Remarks* under the preceding *Teleophrys cristulipes*.)

Genus MICROPHRYS Milne Edwards

Microphrys Milne Edwards, 1851, p. 251. A. Milne Edwards, 1875, p. 59. Rathbun, 1925, p. 488.

Milnia Stimpson, 1860b, p. 179; type: *Pisa bicornuta* Latreille, 1825 = *Microphrys bicornutus* (Latreille), by original designation.

Omalacantha Streets, 1871, p. 238; type: *O. hirsuta* Streets, 1871 = *Microphrys bicornutus* (Latreille), by monotypy.

Eumilnia Kingsley, 1879a, p. 145; type: *Microphrys error* Kingsley, 1879 = *Microphrys platysoma* Stimpson, by monotypy.

Type: Microphrys weddelli Milne Edwards, type of *Microphrys* Milne Edwards by subsequent designation of Milne Edwards (1851, p. 291).

Description: Carapace broadly pyriform, somewhat depressed, dorsal surface uneven and tuberculate or nodose, a small marginal spine or tubercle at lateral angle of branchial region; preocular spine usually developed. Orbits small, circular, with closed fissures. Eyes small. Rostral horns moderate or small, divergent. Basal segment of antenna considerably dilated, armed with a sizable spine at the anteroexternal angle, visible in dorsal view; the movable segments of the peduncle and of the flagellum not concealed by the rostrum. Merus of outer maxillipeds distally truncated, the anteroexternal angle somewhat produced and rounded and the anterointernal angle emarginate.

Chelipeds larger than ambulatory legs, the palm compressed and more or less enlarged. Fingers hollowed at tip and in the male gaping. Legs diminishing rapidly in length from first to fourth pair, the merus and carpus usually armed with spines; dactyli slightly curved.

Abdomen of both sexes with seven separate segments. (Rathbun, 1925)

Range: Eastern Pacific from Punta Eugenia, Lower California, and from Puerto Refugio, Angel de la Guarda Island, Gulf of California, Mexico, to Caldera, Chile; Clarion Island, Mexico; Cocos Island, Costa Rica; Galapagos Islands, Ecuador. Western Atlantic from Beaufort, North Carolina, to Desterro, Brazil; Bermudas. Shore to 50 fathoms.

KEY TO THE PACIFIC AMERICAN SPECIES OF *Microphrys*

- 1a. Two flattened lobes on the side walls of the carapace, one hepatic, one branchial
- 2a. Lateral lobes rimmed or collared. Carapace much longer than broad, granules many, two spines in a transverse line at widest part of branchial region. Margin of basal antennal article with an outer lobe *platysoma*
- 2b. Lateral lobes beveled and polished. Carapace little longer than broad, granules few and tufted with hairs, four long spines on each branchial region, three of these in a transverse line. Margin of basal antennal article without an outer lobe.
- Peru and Galapagos *aculeatus*
- 1b. No flattened lobes on side walls of carapace, but spines or granules sometimes present
- 3a. Two long spines on branchial region near lateral angle. Anterior branchial regions not swollen. Hepatic margin with two short spines. A long spine on the carpus of the first three legs. One tooth or spine on basal antennal segment.
- Peru and Chile *weddelli*
- 3b. A single spine or lobe at lateral angle, anterior branchial regions greatly swollen. Hepatic margins without two short spines, a cluster of granules sometimes present. Three teeth or spines on basal antennal segment
- 4a. Lateral spine sharp and slender, carapace coarsely granulate. Rostral horns, middle antennal spine, and pre-orbital spine elongate. Cheliped of adult male slender, palm not inflated, fingers not widely gaping. Male first pleopod without customary swelling basal to apex *branchialis*

- 4b. Lateral spine blunt and conical, carapace nearly smooth. Rostrum, antennal spine, and preorbital spine shortened. Cheliped of adult male grossly proportioned, palm inflated, fingers gaping widely. Male first pleopod with customary swelling basal to apex.
 Gulf and Galapagos *triangulatus*

Microphrys weddelli Milne Edwards

Plate W, Fig. 3; Plate 43, Fig. 1

Microphrys weddelli Milne Edwards, 1851, p. 291, pl. 10, figs. 1, 2. Rathbun, 1910, p. 574; 1925, p. 496, pl. 271, figs. 2-7. Garth, 1957, p. 30.

Microphrys weddellii, A. Milne Edwards, 1873b, pl. 14, figs. 1-1c; 1875, p. 60. Miers, 1886, p. 83. Nobili, 1901, p. 30.

Type: Two males and two females, syntypes, in Paris Museum. Of these the figured male, length 41 mm, width 40 mm, is hereby selected as lectotype, at the request of Dr. Jacques Forest.

Type locality: Coast of Peru; H. A. Weddell, collector.

Localities subsequently reported, with collectors: Ecuador: Santa Elena Bay, E. Festa (Nobili). Peru: Guérin collection, possibly cotypes; Paraca Bay, Hassler (Rathbun, 1925). Chile: Caldera, Hassler (Rathbun, 1925). "West coast of South America," Möller (Rathbun, 1925). Extralimital: Guadeloupe (A. Milne Edwards).

Atlantic analogue: According to A. Milne Edwards, the species is represented in the Atlantic. (See *Remarks* below)

Diagnosis: Anterior branchial regions not greatly swollen. Two long spines on branchial region near lateral angle. Hepatic region with two short spines. Lateral lobes absent. A long spine on carpal segment of each of first three legs. Basal antennal article with one spine. Male first pleopod with keel encroaching upon tip, separated from it by a minute notch.

Description: Body and legs not very hairy; stiff, hooked hairs covering the rostrum, the projecting parts of the carapace, and the upper part of the legs. Carapace pyriform, greatly broadened at the level of the branchial regions. Regions of the carapace little swollen and bearing on their prominences some feebly marked tubercles. On the postbranchial lobes these tubercles more raised and becoming spiniform. A line of pearl-like granulations extending parallel to the posterior margin to just above the fourth pair of legs.

Front formed of two horns of medium length, pointed and divergent, on each side a strong spine formed by the basal article of the external antennae. Supraorbital margin little advanced and bearing in front a very small spine. Lateral margins bristling with a series of spines. Two very small ones on the hepatic region, three others of the same size occupying the epibranchial lobe, two other large strong ones arming the metabranchial lobe.

In the male, chelipeds very robust, hand greatly elevated and a little compressed, fingers [gaping]. In the female, chelipeds slender and hand nearly cylindrical. In both sexes, arm decorated above with about three spines. Legs short and stout; those of the second pair, longer than the following ones, armed on the merus and carpus with a series of sharp spines, the other legs having them only on the carpus. (A. Milne Edwards, modified, of specimens from Guadeloupe)

Material examined: U. S. National Museum material: 31 specimens from Guayaquil, Ecuador (?), and Paita, Peru, all obtained by Waldo L. Schmitt. (See Table 80)

Measurements: Largest specimen, male: length 33.9 mm, width including spines 32.4 mm, width without spines 27.6 mm, rostrum 6.9 mm, width 4.4 mm, cheliped 45 mm, chela 23 mm, dactyl 11.7 mm, height of palm 9.7 mm, ambulatory legs 32.5, 26, 23, and 19 mm, respectively. Ovigerous female: length 30.4 mm, width including spines 29.3 mm, without spines 26.0 mm.

Color in life: The carapace is a reddish brown; the legs have the same color, tinged with violet. (A. Milne Edwards)

Habitat: Rocky shore.

Depth: Intertidal.

Size and sex: The series contains young from 10.5 mm, males from 12.2 to 33.9 mm, females from 15.7 to 30.4 mm, and ovigerous females from 26 to 30.4 mm.

Breeding: Ovigerous females were taken by W. L. Schmitt at Paita, Peru, in October.

Remarks: Its large size sets *Microphrys weddelli* off at once from its North Pacific congeners, although not from *M. aculeatus*, another Peruvian species found also in the Galapagos Islands. The two hepatic spines, diagnostic of the species, are not large in Peruvian specimens. However, the two branchial spines, the anterior one located at the widest portion of the carapace, are strong and sharp. In large males the manus is swollen, the palm is high, and there is a prominent tooth in the gape not shown in H. Milne Edwards's figure.

In the opinion of the writer, it is exceedingly unlikely that specimens from Guadeloupe in the Paris Museum, referred by A. Milne Edwards to *Microphrys weddelli*, are in reality the Peruvian species. If *M. weddelli* were a warm water species inhabiting the Bay of Panama, an analogous relationship with the Caribbean form might be indicated. However, *M. weddelli* is a cold water species, characteristic of the Humboldt Current littoral, and effectively barred from the Bay of Panama by Punta Santa Elena. Careful scrutiny of the figures of H. and A. Milne Edwards, plus additional evidence from the male first pleopods, may be expected to reveal morphological grounds for separating Peruvian and Atlantic specimens.

Without questioning Nobili's determination of Festa's Santa Elena Bay specimen as *Microphrys weddelli*, it should be stated that a young *Microphrys* dredged by the *Velero III* at this locality and a 9.4 mm male collected intertidally on the south side of Punta Santa Elena both proved to be *M. platysoma*. Schmitt's Ecuadorean specimens, labeled Guayaquil with a question mark, may have been taken at the mouth of the Guayas River.

Microphrys aculeatus (Bell)

Plate W, Fig. 4; Plate 43, Fig. 2

Pisa aculeata Bell, 1835b, p. 171; 1836, p. 50, pl. 9, figs. 7, 7v.

Milnia aculeata, Stimpson, 1860b, p. 180.

Microphrys aculeatus, A. Milne Edwards, 1875, p. 63. Miers, 1886, p. 83. Nobili, 1901, p. 30. Rathbun, 1910, pp. 536, 574, pl. 45, fig. 4; 1925, p. 500, pl. 271, fig. 1, text-fig. 142. Boone, 1927, p. 169, fig. 55. Sivertsen, 1933, p. 13. Garth, 1946, p. 402, pl. 63, fig. 5.

Microphrys platysoma, Rathbun, 1902b, p. 285 (part: Galapagos specimens); 1910, pp. 535, 574 (part: Peruvian and Galapagan records; not pl. 50, fig. 3). (Not *M. platysoma* (Stimpson).)

Type: Male and female, cotypes; length of measured cotype 16.9 mm, width 14.8 mm; originally deposited in the Museum of the Zoological Society [London] and the Bell Museum, no longer extant.

Type locality: Galapagos Islands, 7 fathoms; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Ecuador: Santa Elena Bay, E. Festa (Nobili). Peru: Lobos de Afuera Islands and north end of Ferrol Bay (Chimbote), R. E. Coker (Rathbun, 1910, at the latter locality as *Microphrys platysoma*). Galapagos Islands: Ecu-

dor: Albemarle Island, Hopkins-Stanford Expedition (Rathbun, 1902b, as *M. platysoma*); Hood Island, *Arcturus* (Boone); Charles Island, A. Wollibaek (Sivertsen); Indefatigable and South Seymour Islands, *Velero III* (Garth).

Atlantic analogue: None. A species endemic to the Humboldt Current littoral.

Diagnosis: Carapace little longer than broad, granules few and tufted with hairs; four long spines on each branchial region, three being in a transverse line. Outer margin of basal antennal article without a lobe. Lateral lobes beveled and polished, not collared. Male first pleopod with keel broadly rounded and imperceptibly separated from bluntly triangular tip.

Description: Carapace shorter and broader than in *Microphrys platysoma*; hairy; with the hairs removed the surface seen to be covered with small pits. Tubercles and granules few; an arch of five tubercles across the gastric region; two tubercles near the outer edge of each branchial region; a row of tubercles above the posterior margin. Some fine granules on the inner areole of the branchial region; granules also on the protogastric regions, with a row of granules leading forward onto each horn. Typically four spines on each branchial region, three of these forming a transverse row with the conical cardiac region, the outer spine of the row being marginal; the fourth spine also marginal but lower and further forward than the third. Between the second and third spines sometimes an additional, smaller, secondary spine. The first or innermost spine (that next the cardiac region) sometimes obsolete and represented only by a low, conical swelling. Each spine and tubercle bearing a tuft of long, curled hairs; a band of similar hairs running along the anterolateral margins and along each side of the gastric region to the tips of the rostral horns. On the anterolateral wall two much raised, oval discs, one hepatic and one branchial; the side of the postorbital cup also flattened. Margin of the basal antennal segment bearing no tooth or lobe behind the slender anterolateral spine.

Arm with three triangular teeth above. First leg with a long spine on the carpus and another near the distal end of the merus; second leg with a spine on the carpus only. (Rathbun, 1925, modified)

Material examined: 30 specimens from 2 stations: Lobos de Afuera Island, Peru, January 17, 1935, shore, station 391-35, 6 males, 8 females (2 ovigerous); same locality, February 14, 1938, shore, station 844-38, 8 males, 8 females (5 ovigerous). In addition to the above: 14 specimens from 9 Galapagos stations (Garth, 1946, p. 403), plus 1 ovigerous female

not previously recorded from Post Office Bay, Charles Island, 4 fathoms, February 6, 1933, *Velero III* station 57-33.

Measurements: Largest specimen, male: length 27.8 mm, width including spines 27.5 mm, width without spines 22.8 mm, rostrum 7.3 mm, width 4.0 mm, cheliped 32.5 mm, chela 16.6 mm, dactyl 7.8 mm, height of palm 5.4 mm, ambulatory legs *ca.* 26.5, 21, 18, and 15.5 mm, respectively. Female specimen: length 18.4 mm, width including spines 15.8 mm, width without spines 14.3 mm.

Color in life: Not available. Color of preserved specimens fuscous. (Bell)

Habitat: Sandy mud. (Bell) Rocky bottom, along shore covered with seaweed. (Rathbun, 1910) Rocky shore. (Garth) Peruvian specimens were sponge covered.

Depth: Intertidal; to 2.5 fathoms (Boone), 7 fathoms (Bell), 25 fathoms (Garth).

Size and sex: Males in the present series are from 13.1 to 27.8 mm, females from 11.2 to 18.4 mm, ovigerous females from 14.2 to 18.4 mm.

Breeding: Ovigerous females were found in Peru by R. E. Coker in March (Rathbun, 1925) and by the *Velero III* in January and February. Females with ova were taken in the Galapagos Islands by A. Wollebaek in September (Sivertsen) and by the *Velero III* in January and February.

Remarks: Judging from the fact that all *Microphrys* collected in Peru by Hancock expeditions were from a single locality, Lobos de Afuera Island, and of a single species, *M. aculeatus*, while all obtained by W. L. Schmitt were from Paita and vicinity and were *M. weddelli*, it would appear that the Peruvian littoral may be dotted with isolated colonies of the two species, separated perhaps by differing ecological requirements.

Microphrys aculeatus is a species having a long rostrum, a long antennal spine, and relatively few tubercles on the carapace. As compared to *M. weddelli*, a species without lateral lobes, *M. aculeatus* bears three crests instead of three spines on the merus of the cheliped. The palms of the adult male are more compressed, and the tooth in the gape is less prominent. As compared to *M. platysoma*, the other species with lobes on the side of the carapace, it is a hairy species, the hairs being particularly noticeable where they arise as tufts from a row of granules running transversely across the posterior portion of the carapace. The hepatic and branchial lobes are smooth and polished and have no tendency to become rimmed. Unlike *M. platysoma*, the anterior branchial spine

does not occur at the widest part of the carapace and is as prominent as the posterior spine. The basal antennal article slopes abruptly from the slightly incurving spine to the orbit without an intervening step.

The above are the species within its Peruvian range from which *Microphrys aculeatus* needs to be distinguished. In the Galapagan portion of its range *M. triangulatus* occurs, *M. weddelli* being absent.

Microphrys platysoma (Stimpson)

Plate W, Fig. 5; Plate 43, Fig. 3

Milnia platysoma Stimpson, 1860b, p. 180.

Microphrys platysoma, A. Milne Edwards, 1875, p. 62. Streets and Kingsley, 1877, p. 103. Bouvier, 1895, p. 8. Rathbun, 1901, p. 72 (part: not the Atlantic specimens); 1910, pp. 535, 574, pl. 50, fig. 3 (part: not the Peruvian or Galapagos specimens); 1924c, p. 379; 1925, p. 479, pl. 176, figs. 1, 2, text-fig. 140. Crane, 1937, p. 63; 1947, p. 74. Steinbeck and Ricketts, 1941, p. 467, pl. 32, fig. 6. Garth, 1946, p. 405, pl. 68, figs. 3, 4; 1948, p. 30.

Pisoides? celatus Lockington, 1877c, p. 66; type localities, La Paz, Mulege Bay, Port [Puerto] Escondido, San José Island, all in the Gulf of California; types not extant.

Microphrys depressa, Streets and Kingsley, 1877, p. 103. Miers, 1886, p. 83. (Not *Fisheria depressa* Lockington.)

Microphrys error Kingsley, 1879a, p. 145; type locality, Lower California; male holotype not extant. Miers, 1886, p. 83.

Microphrys platisoma, Miers, 1886, p. 83.

Type: Holotype, of undesignated sex, length 11.2 mm, width 8.4 mm, originally deposited in the collections of the Smithsonian Institution, no longer extant.

Type locality: Cape St. [San] Lucas, Lower California, Mexico; John Xantus, collector.

Localities subsequently reported, with collectors: Lower California, Mexico: L. Diguet (Bouvier). Gulf of California: Puerto Refugio of Angel de la Guarda Island, Concepción Bay, Coronado[s] Island, San Gabriel Bay and Pt. Lobos of Espiritu Santo Island, El Mogote, and east of La Paz, Steinbeck and Ricketts (Steinbeck and Ricketts); Patos Island anchorage, 4.5 fathoms, F. Baker, California Academy of Sciences Expedition (Rathbun, 1924c); Santa Inez Bay, *Zaca* (Crane, 1937); Mulege Bay, Port [Puerto] Escondido, San José Island, and La Paz,

W. J. Fisher (Lockington, as *Pisoides? celatus*); La Paz Bay, L. Diguët (Rathbun, 1925; these are in all probability the specimens reported earlier by Bouvier without precise locality). Revilla Gigedo Islands, Mexico: Clarion Island, *Zaca* (Crane, 1947). Mazatlan, Mexico, A. Agassiz (Rathbun, 1925). Costa Rica: Port Parker and Uvita Bay, *Zaca* (Crane, 1947). Panama: Bahia Honda, *Zaca* (Crane, 1947); Taboga Island, J. Zetek, and Panama Bay, Meek and Hildebrand (Rathbun, 1925). Colombia: Gorgona Island, *Askoy* (Garth, 1948). Ecuador: Galapagos Islands: Tower Island, 40-70 fathoms, *Velero III* (Garth, 1946).

Atlantic analogue: Microphrys antillensis Rathbun.

Diagnosis: Carapace much longer than broad, granules many; two spines in a transverse line at widest part of branchial region. Lateral lobes rimmed or collared. Margin of basal antennal article with an outer lobe. Male first pleopod with keel rounded and well separated from triangular, pointed tip.

Description: Carapace depressed, tuberculate and granulate; areole at inner angle of branchial region very finely granulate; two laminiform processes on the anterolateral wall, one on the hepatic region, the other on the branchial region, the latter not projecting in an imbricated manner. Surface of hepatic process in one plane, with the anterior end acute and projecting forward; sometimes at the middle of the upper edge a tubercle which projects outward. A spine between the hepatic and branchial processes and below their level; two branchial spines, one on the posterolateral angle and the other farther in but on the same transverse line. On the posterior margin a row of tubercles increasing in size toward the middle, those of the middle pair larger than the others. Rostral horns slender, directed forward, about one-sixth the length of rest of carapace. Antennal spines about half the length of rostral spines; the margin of the antennal segment behind the spine curving outward, forming a shallow lobe; preocular spines acute, half the length of antennal spines.

Arm with a dentate, laminate superior crest; wrist tuberculate; palm less than twice as long as broad; fingers widely gaping, the pollex being strongly curved downward. Legs sparsely hairy and with a few spines and tubercles; propodal segments with a prominent rounded distal laminiform process for articulation of dactylus. (Rathbun, 1925, modified)

Material examined: 93 specimens from 35 stations. (See Table 81) From 10 miles W of Pta. Malarrimo, Lower California, and Puerto Refugio, Angel de la Guarda Island, Gulf of California, Mexico, to Punta Santa Elena, Ecuador, and including Socorro Island of the Revilla Gigedo group.

Measurements: Largest specimen, male: length 19.6 mm, width 16.6 mm, rostrum 3.9 mm, width 2.6 mm, cheliped 21.6 mm, chela 9.8 mm, dactyl 4.5 mm, height of palm 3.2 mm, ambulatory legs *ca.* 22.1, 16.2, 15.0 and 12.5 mm, respectively. Female specimen: length 16.1 mm, width 12.6 mm.

Color in life: Carapace plain tan to reddish brown; chelipeds creamy white above mottled with pink, or red marbled with white, a band of bright red across base of fingers; under parts and ambulatories pale cream, sometimes mottled with pink or red. (Crane, 1937)

Habitat: Under stones at low tide. (Lockington) On sandy bottoms with weed. (Crane, 1937) In tidepools and in *Pocillopora* coral. (Crane, 1947) Among rocks at foot of mangroves. (Steinbeck and Ricketts) White sand and rock bottom. (Garth, 1946) *Velero III* specimens not obtained intertidally on rocky shore were dredged on sand or coralline bottom, or were cracked from coral heads.

Depth: Shore to 13 fathoms. The lesser depth of 40 fathoms, rather than the greater of 70 fathoms, should have been given as maximum for the species in the Galapagos Islands (Garth, 1946, p. 405), since at Tower Island the dredge was pulled outward from the shore at Darwin Bay and dropped off immediately into deeper water.

Size and sex: The present series contains young from 3.8 mm, males from 5.7 to 19.6 mm, females from 5.4 to 16.5 mm, ovigerous females from 11.0 to 16.5 mm. In the smallest specimen examined, a 4 mm young, the lobe on the hepatic region is elliptical or crescentic and has two minute spines pointing downward. In a 5.4 mm specimen the posterior of these spines has disappeared. The anterior spine may persist in the adult, where it becomes the most prominent feature of the collared lobe, such supplementary projections as may be added to the upper margin being secondary. The branchial lobe may have only its anterior margin elevated, or it may be as distinctly rimmed as the hepatic lobe. The spine between the two lobes at a lower level is a constant feature. A sharp inner orbital ridge corresponding to the upper margin of the hepatic lobe is present in a few specimens. When the branchial lobe is also imbricated, the three structures present a remarkable sequence. The laminate crests of the cheliped begin as a row of spinules in the 4 mm young. It is also in the very young that the lobe on the outer margin of the basal antennal article is most apparent.

Breeding: Females with ova were found in the Gulf of California in August by W. J. Fisher (Lockington), in April by the *Zaca* (Crane, 1937), from February to May by the *Velero III*, and in June by Wil-

liam N. Smith II. Ovigerous specimens were also collected by Elinor D. Robson at Changamé, Panama, in May.

Remarks: Prior to the publication of the *Zaca* Expedition report (Crane, 1947), which recorded its occurrence at Port Parker and Uvita Bay, Costa Rica, and Bahía Honda, Panama, *Microphrys platysoma* had not been recorded between Mazatlan, Mexico, and Taboga Island, Panama. The *Zaca* obtained *M. platysoma* at Clarion, the *Velero III* at Socorro Island of the Revilla Gigedo group. Specimens from Socorro Island and the Galapagos Islands are alike in having the branchial spines reduced to inconspicuous tubercles, emphasizing the roundness of the branchial regions. There is no reason, however, for considering them distinct from the mainland stock. A specimen from 10 miles W of Pta. Malarrimo, Bahía Sebastian Vizcaino, Lower California, is atypical in having the spine of the basal antennal article slenderer, the outer branchial spine shorter, and the outer marginal lobe of the basal antennal article wanting.

Microphrys triangulatus (Lockington)

Plate W, Figs. 6, 9; Plate 43, Fig. 4

Mithraculus triangulatus Lockington, 1877c, p. 73.

Mithrax triangulatus, Kingsley, 1879a, p. 149. Miers, 1886, p. 86.

Microphrys triangulatus, Rathbun, 1898, p. 578; 1923b, p. 635; 1925, p. 505, pl. 177, text-fig. 145. Boone, 1927, p. 171, fig. 56. Garth, 1946, p. 403, pl. 63, fig. 6.

Microphrys branchialis, Rathbun, 1902b, p. 285. (Not *M. branchialis* Rathbun, 1898.)

Type: "Several specimens, both sexes," originally deposited in the collection of the California Academy of Sciences, no longer extant; male length 16 mm, width 14 mm, female length 13.5 mm, width 12 mm.

Type locality: Gulf of California; W. J. Fisher, collector.

Localities subsequently reported, with collectors: Gulf of California, Mexico: Agua Verde Bay and San Josef [José] Island, *Albatross* (Rathbun, 1923b); off La Paz Bay, 7-8 fathoms, and off Cerralvo Island, 9.5-10 fathoms, *Albatross* (Rathbun, 1898). Galapagos Islands, Ecuador: Albemarle Island, 12 fathoms, Hopkins-Stanford Expedition (Rathbun, 1902b, as *Microphrys branchialis*); Charles, Indefatigable, James, Chatham, and Hood Islands, 0-40 fathoms, *Velero III* (Garth).

Atlantic analogue: None.

Diagnosis: Carapace nearly smooth, anterior branchial regions greatly swollen, spine at lateral angle blunt and conical. Hepatic margins with-

out spines, sometimes with a cluster of granules. Three blunt teeth on basal antennal article; rostral, antennal, and preorbital spines shortened. Cheliped of adult male greatly enlarged, palm inflated, fingers gaping widely. Male first pleopod with keel evenly rounded and well separated from short, thickened tip, a supplementary lobe visible in the hiatus between them. (Not true of Galapagos specimens; see *Remarks* below.)

Description: Carapace little longer than broad, thick and nodulose, the nodules ornamented sparingly with low granules, appearing almost smooth. The largest nodule the anterior branchial; this nodule oblique, elongate, and overhanging the lateral wall of the carapace. Behind and below this lobe a short blunt spine or lobe at the lateral angle of the carapace. The most prominent granules on the anterior portion of the carapace, namely, two on the summit of each protogastric lobe, a row of three on each epigastric lobe, one or two at base of each preorbital tooth. Two large tubercles on intestinal region, a submarginal line of granules extending outward from each.

Rostrum short, deeply divided; horns broad, inner margin straight, outer margin convex, sinus narrow. Preorbital lobe little advanced, blunt, granulate; postorbital cup also little advanced. Basal antennal segment broad, bearing two broad blunt lobes on the margin, each lobe outwardly arcuate, also a small subacute tooth at the base of the next or movable segment, and a tubercle on the ventral surface near the postero-external angle.

Chelipeds of male very strong, one and two-thirds times as long as carapace. Arm tuberculate on upper margin and inner and outer surfaces; wrist nearly smooth; palm unusually high, its upper length about one and two-thirds times its height; immovable finger a little convex below, a large tooth on the dactyl a little behind middle of gape. Merus segments of legs with [two rows of tubercles and occasional irregular tubercles] some conical and subacute; a few of the same on the carpus, from one to three of these being enlarged; two tubercles on each propodus. (Rathbun, 1925, modified)

Material examined: 72 specimens from 26 stations. (See Table 82) From off Concepción Bay, Gulf of California, to Tres Marias Islands, Mexico; Acapulco, Mexico; Bahia Honda, Panama. In addition to the above, 57 specimens from 12 Galapagos Islands stations. (Garth, 1946, p. 404)

Measurements: Largest specimen, male: length 13.0 mm, width 12.1 mm, rostrum 1.2 mm, width 2.1 mm, cheliped 21.0 mm, chela 10.5 mm, dactyl 4.9 mm, height of palm 4.9 mm, ambulatory legs 12.5, 10.0, 9.5,

and 8.0 mm, respectively. Ovigerous female, length 12.8 mm, width 12.2 mm.

Color in life: Carapace light pomegranate on frontal area; other areas rose. Eye light grape green. Chelipeds olive buff densely overcast with tiny rose colored dots extending to middle of fingers. Ambulatory legs similar to chelipeds. Ventral side pale olive buff with a few scattered spots of rose color. (Petersen, of a specimen from Isabel Island, Mexico)

Habitat: Broken shell, broken coral. (Rathbun) Rock, frequently with red algae attached; rock and sand; coral, nullipore, and rock. (Garth) When dredged, *Velero III* specimens were obtained 6 times on sandy bottom, 3 times on muddy bottom, and 13 times on nullipore or coralline bottom. Shell was present in a third of the sand and mud bottom stations.

Depth: Intertidal to 44 fathoms.

Size and sex: Males are from 4.7 to 13.0 mm, females from 4.5 to 13.3 mm, ovigerous females from 7.8 to 12.8 mm, young from 4.5 mm.

Breeding: Ovigerous females were encountered by Hancock collectors in the Gulf of California in February, March, and May, and by C. L. Hubbs at Acapulco, Mexico, in September.

Remarks: The occurrence of *Microphrys triangulatus*, rather than *M. branchialis*, at Isabel and Tres Marias Islands shows the value of critical determinations in underscoring faunal affinities. Here the relationships are definitely with the Gulf of California, rather than with the open Pacific coastline, for whereas *M. branchialis* is represented abundantly on the open coast from Dewey Channel, Lower California, to La Libertad, Ecuador, and but exceptionally in the Gulf of California, *M. triangulatus* is overwhelmingly present in the Gulf and but sparingly represented elsewhere.

The identification of the Acapulco specimens, two females, was made principally on the strength of the conical lateral spine, and of the Panamanian specimens, a pair, by the greatly enlarged cheliped and broadened palm of the male. The conical spine should not be used without supplementary specific characters in more southerly latitudes, as with Cocos Island specimens, because Galapagos Islands specimens of *Microphrys triangulatus* exhibit a sharp spine like that of *M. branchialis* (see Rathbun, 1925, p. 506). The shortening and widening of the carapace, as compared to *M. branchialis*, and the "shoving up" and "smoothing off" of the branchial prominences, as noted by Rathbun, combine to give the species its triangulate appearance. When seen in life, brightly colored and covered with bryozoan or other encrustation, its resemblance to a coralline alga is striking.

The male first pleopod of *Microphrys triangulatus* (Plate W, figs. 6 and 9) shows a prominent lateral swelling that is lacking in *M. branchialis* (Plate W, figs. 7 and 8). When Galapagan *M. triangulatus* (fig. 9) and Lower Californian *M. branchialis* (fig. 8) are compared, however, the configuration of the apex is seen to be almost identical. Thus the Galapagos Islands population of *M. triangulatus* inclines toward *M. branchialis*, both from the standpoint of the male first pleopod and of the lateral spine referred to in the paragraph above.

***Microphrys branchialis* Rathbun**

Plate W, Figs. 7, 8; Plate 44, Fig. 1

Microphrys, sp., Rathbun, 1892, p. 254.

Microphrys branchialis Rathbun, 1898, p. 577, pl. 41, fig. 5; 1910, p. 574 (part: not Galapagos); 1923b, p. 635; 1925, p. 502, pl. 176, figs. 5, 6; pl. 270, fig. 1; text-fig. 143. Crane, 1937, p. 63. Schmitt, 1939, p. 9. Not Rathbun, 1902b, p. 285.

Type: Male holotype, U.S.N.M. No. 21576, length 15.3 mm, width including spines 14 mm, without spines 11.8 mm.

Type locality: Magdalena Bay, Lower California, Mexico, 12 fathoms; *Albatross* station 2831.

Localities subsequently reported, with collectors: Lower California, Mexico: off Abrejos Point, 48 fathoms, *Albatross* (Rathbun, 1898); Magdalena Bay, 10-15 fathoms, *Houston* (Schmitt); 13.5 fathoms, *Albatross* (Rathbun, 1923b). Gulf of California, Mexico: northwest of Guaymas, Sonora, 22 fathoms, *Albatross* (Rathbun, 1892, 1898); Arena Bank, 35-40 fathoms, *Zaca* (Crane).

Atlantic analogue: *Microphrys interruptus* Rathbun.

Diagnosis: Carapace coarsely granulate, anterior branchial regions greatly swollen, spine at lateral angle sharp and slender. Hepatic margins without spines, sometimes with a cluster of granules. Basal antennal article with three spines, the middle one elongate, as are rostral and preorbital spines also. Cheliped of adult male slender, palm not inflated, fingers not widely gaping. Male first pleopod lacking bulbous swelling at base of apex, keel triangular and continuous anteriorly with bluntly pointed tip.

Description: Carapace triangular. Anterior portion of the branchial region covered by an oblique oblong protuberance, highest on its posterior portion, sloping gradually downward anteriorly and covered with tubercles. Gastric region with three tubercles on the median line, a cluster of

three on each side anteriorly, and a transverse row at the posterior end. One tubercle on the genital region; ten on the cardiac, two being median. Posterior branchial region with several tubercles, the chief of these arranged in two longitudinal rows; posterolateral angle with a spine curving upward. A row of blunt tubercles above the posterior margin. Margin of the hepatic region with only a small tubercle; vertical side of the branchial region with scattered tubercles, and two lines of tubercles continued to the pterygostomian region. Anterior and lateral regions hairy. Rostrum deflexed, with two flattened, triangular, acute horns, pointing directly forward, and separated by a V-shaped sinus reaching one-half the length of the rostrum. Preorbital tooth blunt, denticulate. Two superior orbital fissures on either side of a rounded lobe; postorbital tooth blunt. The basal antennal article bearing at its anterolateral angle a long, broad, blunt spine or tooth, curved inward and upward and with crenulated outer margin; a short, blunt tooth at the base of the second article; a tooth on the outer margin, forming part of the wall of the orbit, and two laminate teeth between the outer sinus and the buccal cavity.

Chelipeds one and one-third times the length of the carapace in the male. Upper surface of the merus and carpus with some scattered tubercles; outer surface of merus with a longitudinal row; also two or three tubercles at the proximal end of the outer lower margin. Palm long and narrow, margins parallel, superior length twice the width and more than one and a half times the length of the dactylus. Pollex not bowed downward as in *Microphrys platysoma* Stimpson. The chelipeds of the female differing in being more slender and about nine-tenths the length of the carapace. First pair of ambulatory legs reaching half the length of the palm of the chelipeds in the male and equaling the chelipeds in the female. Merus of ambulatory legs armed with spines and tubercles on the superior and outer or posterior surfaces; carpus with two or three spines; margins hairy. (Rathbun, 1898, modified)

Material examined: 166 specimens from 34 stations. (See Table 83) From Dewey Channel, west coast of Lower California, and from Angeles Bay, Gulf of California, Mexico, to Santa Elena Bay, Ecuador, including Cocos Island, Costa Rica.

Measurements: Largest specimen, male: length 23.0 mm, width including spines 19.0 mm, width without spines 18.5 mm, rostrum 3.1 mm, width 2.7 mm, cheliped 34.0 mm, chela 17.8 mm, dactyl 8.0 mm, height of palm 5.8 mm, ambulatory legs 23.6, 19.8, 17.1, and 14.5 mm, respectively. Female specimen: length 17.2 mm, width including spines 15.0 mm, width without spines 12.8 mm.

Color in life: Female pinkish olive with manus and dactyls of cheliped pink. (Crane)

Habitat: Yellow mud; sand and broken shell; fine gray sand. (Rathbun) Mud; coarse sand with weed. (Crane) Sandy, weedy bottom. (Schmitt) Of the 33 stations of the *Velero III* and *IV*, 11 were rocky bottom, 11 sandy bottom, 5 muddy bottom, and 6 nullipore, coral, or coralline bottom. In two cases nullipores were present with the rock, and shell was present with the sand.

Depth: 5-50 fathoms. In contrast to *Microphrys triangulatus*, not collected intertidally.

Size and sex: The present series contains young from 4.8 mm, males from 3.6 to 15.8 mm, females from 5.0 to 13.6 mm, ovigerous females from 7.1 to 11.7 mm. The smallest breeding females are from Acapulco, Mexico; the largest are from Cocos Island, Costa Rica.

Breeding: Ovigerous females were encountered off the west coast of Lower California in February, in the Gulf of California in March, at Cocos Island, Costa Rica, in January, and in Mexico in February.

Remarks: An 11 mm male from Dewey Channel, west coast of Lower California, and one of a series of eight, is the most distinctive *Microphrys branchialis* of many seen. The carapace is elongated, the lateral spine slender and strong, and the branchial swellings anteriorly sited. The rostral, antennal, and preorbital spines are long. The tubercles of the carapace are distinct, particularly the row of five across the gastric region. The basal antennal article, when viewed ventrally, is seen to have three spines, the first outstanding. Specimens from the west coast of Lower California are regarded as typical.

The distribution of *Microphrys branchialis* continues to be coastal, avoiding the Mexican islands of Isabel and Tres Marias, where *M. triangulatus* is found, and continuing from Tenacatita Bay southward, including the offshore islands of Cocos, Costa Rica, and La Plata, Ecuador. The extension of range of a species previously known only from the Lower California-Gulf of California region to include all of the Panamic province as herein defined, i. e., Magdalena Bay, Lower California, to Punta Santa Elena, Ecuador, strongly substantiates its designation by Rathbun (1925) as the Pacific analogue of *M. interruptus* of the Caribbean.

The occurrence of *Microphrys branchialis* in the Gulf of California is indubitable, records from Guaymas by Rathbun and Arena Bank by Crane being supported by *Velero III* material from Angeles Bay and Agua Verde Bay. The common *Microphrys* of the Gulf, however, is

M. triangulatus, which has spread via Mexican offshore islands to the Galapagos. The dual role of the Gulf of California in speciation is apparent: it at once serves as a point of origin of autochthonous species and as a recipient of an overflow of Panamic species.

Genus STENOCIONOPS Desmarest

Stenocionops Desmarest, 1823, p. 266; 1825, p. 153. Guérin, 1825a, p. 484. Rathbun, 1925, p. 448.

Pericera Latreille, 1825, p. 699; type: *Cancer furcatus* [by error, *fuscatus*] Olivier, 1791 = *Stenocionops furcata* (Olivier), by monotypy; 1829, p. 58. Rathbun, 1892, p. 243.

Chorilibinia Lockington, 1877c, p. 69; type: *C. angusta* Lockington, 1877, by monotypy.

Type: The Atlantic *Maia taurus* Lamarck, 1818 = *Cancer furcatus* Olivier, 1791, type of *Stenocionops* Desmarest by monotypy.

Description: Carapace subpyriform, rather convex, with dorsal surface uneven, tuberculated or spinous; lateral margins armed with a series of long spines; preocular spine well developed. Rostrum composed of two strong spines not deflexed and divergent from base; orbits tubular, not strongly projecting; eyes small, retractile within orbits. Basal antennal article considerably enlarged, armed with one or two small distal spines or tubercles not visible in a dorsal view. The merus of outer maxillipeds with distal margin truncate, anterointernal angle emarginate, anteroexternal angle rounded or subacute.

Chelipeds in adult male well developed; palm elongate and subcylindrical or somewhat compressed, not dilated or enlarged; fingers either with no or with a moderate intermarginal hiatus at the base when closed. Ambulatory legs moderately elongated, with articles subcylindrical, without spines; dactyli nearly straight.

Abdomen in male distinctly seven-segmented. (Rathbun, 1925)

Range: Eastern Pacific from Abreojos Point, Lower California, and Rocky Point, Gulf of California, Mexico, to Santa Elena Bay, Ecuador; Galapagos Islands. Western Atlantic from Cape Hatteras, North Carolina, to Rio de Janeiro, Brazil. Occurs also off West Africa. Shore-150 fathoms.

KEY TO THE PACIFIC SPECIES OF *Stenocionops*

- 1a. Rostral horns straight, either long and widely divergent, or short and closely approximated, but always closest together at bases

- 2a. Rostrum long, $\frac{1}{6}$ or more carapace length. Five median dorsal spines. Hepatic region with only one spine; two principal lateral branchial spines
- 3a. Rostral horns widely divergent; rostrum from $\frac{1}{6}$ to $\frac{1}{4}$ carapace length. Never more than three lateral spines, one hepatic and two branchial . . . *beebei*
- 3b. Rostral horns moderately divergent; rostrum about $\frac{1}{6}$ carapace length. Usually an incipient anterior branchial spine in addition to the three principal lateral spines *ovata*, under 26 mm
- 2b. Rostrum short, from $\frac{1}{7}$ to $\frac{1}{12}$ length of carapace. Nine median dorsal spines in the adult, with as many as three lacking in adolescent specimens. Hepatic region with two or more spines. Three principal lateral branchial spines, sometimes with accessory spinules . . . *ovata*, over 26 mm
- 1b. Rostral horns curved, arching away from each other, most closely approximated at midpoints *angusta*

***Stenocionops angusta* (Lockington), new combination**

Plate Y, Fig. 1; Plate 45, Fig. 1

Chorilibinia angustus Lockington, 1877c, p. 69.

Chorilibinia angusta, Miers, 1879b, p. 7; 1886, p. 45. Rathbun, 1925, p. 309.

Pericera contigua Rathbun, 1892, p. 247, pl. 32, fig. 2; type locality, Gulf of California, 21 fathoms, *Albatross* station 3005; female holotype, U.S.N.M. No. 16067.

Stenocionops contigua, Rathbun, 1898, p. 577; 1925, p. 451, pls. 162, 163; pl. 266, fig. 2. Crane, 1937, p. 62.

Type: Two males and one female, cotypes; originally deposited in the California Academy of Sciences, no longer extant; male cotype length 20 mm, width 12 mm, female cotype length 23 mm, width 15 mm.

Type locality: Gulf of California, Mexico; W. J. Fisher, collector.

Localities subsequently reported, with collectors: Gulf of California, Mexico: Adair Bay, 11 fathoms, and off San José Island, 21 fathoms, *Albatross* (Rathbun, 1892, as *Pericera contigua*); San Lorenzo Channel, 8 fathoms, and inside Ceralbo Island, 10 fathoms, *Albatross* (Rathbun, 1898); Adair Bay, 11 fathoms, Santa Inez Bay, 30 fathoms, *Zaca* (Crane). West coast of Lower California: Magdalena Bay, *Hassler* (Rathbun, 1925); all the preceding as *Stenocionops contigua*.

Atlantic analogue: *Stenocionops furcata* (Olivier).

Diagnosis: Rostral horns curved, contiguous medially, divergent anteriorly. Three lateral marginal spines, one hepatic, two branchial. Four median dorsal spines. One strong basal antennal spine. Tip of male first pleopod semicylindrical, grooved, doubling back limply; keel narrowly acuminate.

Description: Carapace oblong-ovate, narrower at the orbits than posteriorly; pubescent; armed with three lateral spines, one hepatic, two branchial. Protuberances of the dorsal surface partially concealed and arranged as follows: Three sharp tubercles in a triangle on the gastric region, the posterior one median and highest. On each branchial region two spines or a spine and a tubercle in an oblique line with the posterolateral marginal spine, and a sharp tubercle close to the posterolateral border of the cardiac region. Above the posterior margin a median spine, and in front of it and on either side a tubercle, often sharp. The cardiac region either smoothly rounded or surmounted by a sharp spine; occasionally a spine, large in the old, near the anterior border of the branchial region. Rostral horns curved, contiguous in the middle, separated at base by a buttonhole slit, terminal halves or less moderately divergent. Preocular spine prominent, long pointed; postocular acute. Basal article of antenna broad, armed with one long triangular spine, parallel with the preocular spine and visible in dorsal view.

Chelipeds of medium-sized male a little longer than the carapace and the next pair of legs. In large males the chelipeds much more elongate. Merus armed with five or six stout spines above. In small specimens the ambulatory legs diminishing fairly regularly in length from the first to the last, but in the larger males the first leg very much longer than the second. (Rathbun, 1892, 1925, modified, of *Stenocionops contigua*)

The proportionate length of the rostral horns is greater in young than in adults, males of 33 mm and less having a slender, elongate appearance. The degree of curvature of the opposed and divergent rostral horns may vary from nearly parallel to widely arching. While dorsal spines are usually absent, they are well developed in a male and female of 16 and 20 mm, respectively. A 40.6 mm female has two hepatic spines like *Stenocionops macdonaldi* (= *S. ovata*). A 34.8 mm female, perfect in every other respect, lacks the right lateral spine.

Material examined: 38 specimens from 26 Hancock stations. (See Table 84) From off Rocky Point, Sonora, to San Lorenzo Channel in the Gulf of California, and from Magdalena and Almejas Bays, west coast of Lower California, Mexico.

Measurements: Largest specimen, male: length 63.5 mm, width including spines 47.7 mm, without spines 43.5 mm, rostrum 13.0 mm, basal width 7.7 mm, width at midpoint 3.6 mm, cheliped 118 mm, chela 56 mm, dactyl 21.7 mm, height of palm 13 mm, ambulatory legs 75, 53, 46, and 38 mm, respectively. Female: length 40.6 mm, width including spines 30.5 mm, without spines 25.0 mm.

Color in life: Not recorded.

Habitat: Sand, shell, broken shell, coralline. (Rathbun) Coarse shelly sand and weed. (Crane) Of the 26 stations of the *Velero III* and *Velero IV* at which the species was collected, 13 were sand bottom, 6 were coralline, 4 were mud bottom, and 3 were rock bottom. Shell was present with sand in 3 instances, sand with mud in 2, and sand with rock in one instance.

Depth: Taken once intertidally; otherwise from 2 to 30 fathoms.

Size and sex: Males are from 7.3 to 63.5 mm, females from 8.0 to 40.6 mm, the single ovigerous female 17.7 mm. The cheliped of the 63.5 mm male at 118 mm is almost as long as the 120 mm cheliped of the 72 mm male recorded by Rathbun (1925, p. 455) and compares in development with that of the 66.4 mm specimen figured by Rathbun (*op. cit.*, pls. 162, 163). The merus, however, has but four spines above, not five or six as in the description above. The distal broadening of the palm to enclose a digital tooth within a considerable gape apparently occurs only in the very old, for the next smaller specimen, a 42.7 mm male, has the cheliped elongate but slender.

Remarks: Reasons for considering *Chorilibinia angusta* Lockington, known only from the original description, to be identical with *Stenocionops contigua* (Rathbun) rather than with *Libinia mexicana* Rathbun, as Rathbun (1925, p. 310) herself suggested, are as follows: (1) The orbits are said to be salient and composed of two acute spines. This is true of *Stenocionops* but not of *Libinia*, the orbit of which is not salient and is composed of a spine and a cup. (2) The external antennal spine is said to be long and visible in dorsal view in front of the pre-orbital spine. This is true neither of *Libinia mexicana*, the antennal spine of which is not external, nor of *Stenocionops ovata* or *S. beebei*, the antennal spines of which are too short to be seen in dorsal view. (3) The chelipeds are said to be slender and about the same length as the first walking legs, the merus provided with four tubercles above, the manus smooth and slender. In *Libinia mexicana* the chelipeds are considerably shorter than the first walking legs (in the 25 mm size range), the merus unarmed, the manus not tapering nor as rough as the other segments.

(4) The rostrum is said to be long, emarginate at the tip, the bifurcation extending only one-third its length. In *Libinia mexicana* of this size the bifurcation is less than one-third; in *Stenocionops ovata* the rostrum is short, while in *S. beebei* it is long but divergent from its base. Thus, of the possible known Gulf of California species, only the one heretofore known as *S. contigua* Rathbun meets Lockington's description of *Chorilibinia angusta*. (In the above comparisons, specimens of both sexes and in the size range of Lockington's 20 mm male and 23 mm female types were used.)

With the transfer of its type species, *Chorilibinia angusta*, to *Stenocionops*, *Chorilibinia* Lockington falls automatically to *Stenocionops* Desmarest; this in spite of the fact that its description calls for "eyes concealed beneath the rostrum, as in *Chorinus* and its allies." Actually, the eyes of *Chorinus* are not concealed beneath the rostrum, nor could the eyes of Lockington's species be so concealed if the orbits be salient as described. The fate of the orphaned species from Papua and north Australia and from the Andamans that have been referred to Lockington's genus is beyond the scope of this revision. Perhaps the name *Chorilibinia* Haswell can be used.

Stenocionops ovata (Bell)

Plate Y, Fig. 2; Plate 44, Fig. 2

Pericera ovata Bell, 1835b, p. 173; 1836, p. 60, pl. 12, figs. 5, 5o-q.
A. Milne Edwards, 1875, p. 59. Miers, 1886, p. 76.

Libinia macdonaldi Rathbun, 1892, p. 238, pl. 29; type locality, Gulf of California, 71 fathoms, *Albatross* station 3011; male holotype, U.S.N.M. No. 16071.

Pericera triangulata Rathbun, 1892, p. 246, pl. 32, fig. 1; type locality, Gulf of California, 29 fathoms, *Albatross* station 3014; female holotype, U.S.N.M. No. 16066.

Stenocionops triangulata, Rathbun, 1898, p. 577; 1923b, p. 635; 1925, p. 461, pl. 165, fig. 1; pl. 266, fig. 1. Garth, 1946, p. 401, pl. 67, figs. 1, 2; pl. 68, fig. 2.

Stenocionops ovata, Rathbun, 1910, p. 574; 1925, p. 459, pl. 264, figs. 5-7. Boone, 1927, p. 167, fig. 54; 1938, pp. 201, 220, pls. 79, 80. Garth, 1946, p. 402.

Stenocionops macdonaldi, Rathbun, 1925, p. 460, pl. 268. Crane, 1937, p. 62.

Types: Two females, cotypes, originally deposited in the Museum of the Zoological Society [London] and the Bell Museum, no longer extant. Length of measured cotype 25.4 mm, width 12.7 mm.

Type locality: Galapagos Islands, 6 fathoms; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Lower California, Mexico: off Abreojos Point, 48 fathoms, *Albatross* (Rathbun, 1898, as *Stenocionops triangulata*); Magdalena Bay, 13.5 fathoms, *Albatross* (Rathbun, 1923b, as *S. triangulata*); off Redondo Point, 47 fathoms, *Albatross* (Rathbun, 1925, as *S. triangulata*); Gulf of California, Mexico: off Cape Lobos, 76 fathoms, northwest of Tiburon Island, 145 fathoms, and northwest of Guaymas, 71 fathoms, type locality of *S. macdonaldi*, *Albatross* (Rathbun, 1892, as *Libinia macdonaldi*); southwest of Tiburon Island, 29 fathoms, *Albatross*, type locality of *Stenocionops triangulata*, and inside San José Island, 33 fathoms, *Albatross* (Rathbun, 1892, as *Pericera triangulata*); Arena Bank, 45-55 fathoms, *Zaca* (Crane, as *Stenocionops macdonaldi*).

Panama: Banco Hannibal, Isla Coiba, 40 fathoms, *Alva* (Boone, 1938); Bay of Panama, 51.5 fathoms, *Albatross* (Rathbun, 1898, as *Stenocionops triangulata*), 33 fathoms, *Albatross* (Rathbun, 1925, as *S. macdonaldi*).

Ecuador: Galapagos Islands: Wenman, Chatham, Indefatigable, Albemarle, and Hood Islands, 12-150 fathoms, *Velero III* (Garth, 1946, as *Stenocionops triangulata*).

Atlantic analogue: *Stenocionops spinimana* (Rathbun).

Diagnosis: Adult: Rostral horns short, from one-seventh to one-twelfth carapace length. Five lateral marginal spines, two hepatic, three branchial, the latter often with accessory spinules. Nine median dorsal spines. Tip of male first pleopod convoluted, opening concealed beneath fold; triangular keel little advanced but greatly broadened.

Description: Adult: [Carapace rotund and spinous,] hepatic region separately prominent, the after part of the carapace subspherical. Hairy covering a very thick and dense pile. Spines conical, blunt or subacute. Median spines nine: four gastric, one genital, two cardiac, two intestinal, none on posterior margin. Of the lateral spines, two hepatic (exceptionally an additional spinule), the anterior the smaller; three anterolateral branchial spines, the middle one the largest; and two above the posterolateral margin, the last one the smaller and sometimes absent. From the first of these a row of six low spines extending to the middle of the hepatic region. Another small hepatic spine nearer the margins, some-

times absent. Two large branchial spines, the hinder one in a transverse line with the anterior cardiac spine and with the spine at the postero-lateral angle; a smaller, epibranchial spine; one or two small branchial spines opposite the interval between the two cardiac spines; a spine either side of the anterior gastric spine; one or two pairs of small spines between the orbits. A small subbranchial spine invisible from above and a few pterygostomial spines. Rostral horns short, triangular, outer margins slightly converging. [Orbital spines short, orbital opening narrow.] Basal antennal article with two anterior spines; a spine near outer angle of buccal cavity.

Four spines and a few tubercles on upper margin of merus of cheliped; at subequal distances three other rows of tubercles. (Rathbun, 1925, of *Stenocionops macdonaldi*, revised to omit comparative references to *S. spinimana*)

Young: Carapace triangular-ovate, broadened behind. Median spines nine, distributed as in the adult, none on the posterior margin; spines unequal, the largest the anterior cardiac, the two posterior, and the penultimate gastric. Lateral marginal spines three, large, one hepatic (hepatic region not enlarged), two branchial, with the spine at the posterolateral angle the largest and pointing obliquely backward. Two large spines on the elevated portion of the branchial region; a low spine in front of each; a spine on either side of the anterior median spine. Rostral horns widely divergent, at nearly a right angle, regularly tapering to slender tips. Orbital spines narrow. (Rathbun, 1925, of *Stenocionops triangulata*)

Material examined: 10 specimens from 9 stations. (See Table 85) From Tiburon Island, Gulf of California, Mexico, to Santa Elena Bay, Ecuador. In addition to the above, 8 specimens from 6 Galapagos stations. (Garth, 1946, of *Stenocionops triangulata*)

Color in life: Pink with olive brown pubescence. Chelae dark brown. (Crane, of *Stenocionops macdonaldi* from the Gulf of California)

Habitat: Coral sand. (Bell) Green, brown, and yellow mud; fine gray and yellow sand; broken shell and sponge. (Rathbun) Coarse shelly sand with weed. (Crane) *Velero III* specimens were taken three times on sand and shell bottom, twice on sandy mud or mud bottom, once on rocky bottom, and once on coralline bottom.

Depth: 8 to 55 fathoms; in the Galapagos to 150 fathoms; in the Gulf of California to 145 fathoms. (Rathbun)

Size and sex: Males are from 15.5 to 66 mm, females from 11.5 to 73 mm, and young from 5.6 mm. Crane (1937) records ovigerous females from 69.5 to 81.5 mm.

Breeding: Gulf of California in April. (Crane)

Measurements: For convenience in comparison, measurements of the largest male and female examined are given in tabular form: (in millimeters)

	Male	Female
Length, including rostrum	66	73
Width, including spines	60	67
Width, without spines	54	58
Length of rostrum	8.0	9.0
Width of rostrum	8.2	8.5
Cheliped	70	70
Chela	30	31.5
Dactyl	13.1	13
Height of palm	5.8	5.6
First ambulatory leg	82	82
Second ambulatory leg	70	—
Third ambulatory leg	62	—
Fourth ambulatory leg	52	—

Remarks: Evidence has been accumulating to support the suggestion of Rathbun (1925, p. 461 ff.) that specimens formerly identified as *Stenocionops triangulata* are actually the young of *S. macdonaldi*. In recording 12 females measuring 61.5 to 81.5 mm and a single male measuring 37.5 mm, Crane (1937, p. 62) suggested that a still smaller specimen be secured before the two species were synonymized. *Velero III* specimens bridge at regular intervals the gap between the 30 mm *S. triangulata* and the 93 mm *S. macdonaldi* for which measurements were given by Rathbun (*op. cit.*). A 73 mm female from Bahia Honda, Panama, has the two principal hepatic spines but lacks the supplementary hepatic spinule of the 88 mm holotype of *S. macdonaldi*. Its rostrum is equal to one-eighth the carapace length, instead of one-twelfth. A 66 mm male from Panama has also two hepatic spines and a rostrum equal to one-eighth of the carapace length. In a 43 mm female from Panama the anterior hepatic spine is but half the size of the posterior or principal hepatic spine, and the rostrum is between one-sixth and one-seventh the length of the carapace.

Coming to specimens within the size range formerly assigned to *Stenocionops triangulata*, a 30 mm female from the Gulf of California has the required nine median spines, but some of them are reduced to mere tubercles and the row of six spines trending diagonally inward from the postbranchial lacks all but the first and last. A 22.5 mm female and a 15.5 mm male from Port Culebra, Costa Rica, have seven and five median spines, respectively, and the anterior of the three lateral branchial spines makes its appearance as a small spine between the now single hepatic and median branchial spine. An 11.5 mm female from La Libertad, Ecuador, shows five median spines also; but a 5.6 mm young from Cocos Island has no median branchial spines and only three lateral spines. It is apparent that spines are added with age, that lateral spines appear earlier than median, and that of the two hepatic and three branchial spines of the adult, the anterior branchial and anterior hepatic are later additions.

The final question, that of following Boone (1938, p. 220) in synonymizing both *Stenocionops triangulata* and *S. macdonaldi* to *S. ovata* (Bell), has been approached by a careful review of Galapagos Islands material previously referred to *S. triangulata* (Garth, 1946) in the light of Hancock mainland material previously discussed, and of such additional specimens as have become available for study. A detailed comparison of the 40 mm Wenman Island male, referred with a question mark to *S. triangulata* (Garth, 1946, pl. 67), with a 43 mm female from Jicarita Island, Panama, shows no differences which might be considered specific, although supernumerary spines are present on all areas in the Galapagos specimen. The retention of the name *S. ovata* for a postulated Galapagos endemic species having exactly eight median and four or five lateral spines becomes academic in view of the demonstrated acquisition of median and lateral spines with age in mainland specimens. The difficulty of reconciling the external maxilliped with Bell's illustration can be met only by allowing the artist the liberties which he is known to have taken in other instances.

Stenocionops beebei Glassell

Plate Y, Fig. 3; Plate 45, Fig. 2

Stenocionops beebei Glassell, 1936, p. 214. Crane, 1937, p. 61, pl. 4, figs. 13-15.

Type: Female holotype, N.Y.Z.S. No. 36,714, length 56 mm, width including spines 45 mm, without spines 38 mm.

Type locality: 1.5 miles northeast of Cape Pulmo, Lower California, Mexico; 50 fathoms; *Zaca* station 136.

Localities subsequently reported, with collectors: Gulf of California, Mexico: Arena Bank, 35-45 fathoms, *Zaca* (Crane).

Atlantic analogue: None. A Gulf of California endemic species.

Diagnosis: Rostral horns straight, diverging widely; rostrum between one-fourth and one-fifth length of carapace. Three lateral marginal spines, one hepatic and two branchial. Five median dorsal spines. Basal antennal article distally biconcave, median ridge spine-tipped, trending obliquely forward and outward. Tip of male first pleopod elongated, fleshy, recurving; keel erect, little broadened.

Description: Carapace triangular-ovate; regions tumid, covered with thick, spongelike pubescence and groups of curve-tipped setae. Rostral horns widely diverging, at an angle of nearly 78° , regularly tapering to slender, slightly incurving tips. Supraorbital spine heavy, upturned; pre-orbital spine separated from supraorbital by a long narrow sinus. Median spines five, the anterior very small, the rest large, stout, cylindrical, blunt; three large, conical, upward-pointing, lateral spines, the hepatic joined to the smaller subhepatic by a ridge; a pair of stout upward-pointing, mesobranchial spines, one of them opposite the cardiac region; forming, with the proximal anterolateral spines and the cardiac spine, a transverse line of five heavy spines across the carapace at this point; the other branchial spines with the median lateral spines forming a transverse row of four spines across the carapace at the metagastric region.

Chelipeds almost as long as first ambulatory leg; merus armed on upper crest with four large spines and a distal lobe; carpus roughened with a few low tubercles; manus long, cylindrical, tapering, armed with a single proximally placed tubercle on upper margin; fingers long, tapering, slightly gaping proximally. Ambulatory legs stout, pubescent; dactyli pubescent, curved. (Glassell, modified)

In the largest specimen examined, a 36.2 mm female, the rostrum is longer than in the holotype, being one-fourth, instead of one-fifth, the total carapace length. There are but four median carapace spines rather than five. A 29.2 mm male has but three median spines, the fourth being represented by a tubercle. From the growth sequence in the related and better known *Stenocionops ovata*, it may be concluded that the fourth tubercle of the 29 mm specimen becomes the fourth spine of the 36 mm specimen, while an inconspicuous fifth tubercle on the 36 mm specimen might in time develop into the fifth spine of the 56 mm holotype.

Material examined: In addition to the holotype in the collections of the New York Zoological Society, 8 specimens from 6 stations of the *Velero III*, all but one in the Gulf of California. (See Table 86) From Puerto Refugio, Angel de la Guarda Island, to Puerto Escondido in the Gulf of California, and off Santa Maria Bay, Lower California, Mexico.

Measurements: Comparative measurements of the largest male and female are as follows: (in mm)

	Male	Female
Length of carapace	30.0	36.2
Width of carapace, including spines	25.5	30.5
Width of carapace, without spines	17.5	21.8
Length of rostrum	9.5	9.5
Width of rostrum	4.7	5.5
Cheliped	28	31
Chela	11.6	13
Dactyl	4.2	5.0
Height of palm	2.3	2.4
First ambulatory leg	31	34.5
Second ambulatory leg	23.5	27
Third ambulatory leg	21.3	24
Fourth ambulatory leg	18	20.5

Color in life: Dull pink. (Crane) In alcohol, spines bright pink, fingers brown, tips white. (Glassell)

Habitat: On sandy and muddy bottoms. (Crane) *Velero III* specimens were taken on sandy bottoms in four instances, on shell bottom in one instance. As with the *Zaca* specimens, these were decorated with sponge, hydroids, and algae.

Depth: 15-30 fathoms; to 50 fathoms. (Glassell)

Size and sex: Males in the present series are from 29.2 to 30 mm, females from 12 to 36.2 mm. The *Zaca* series included six males measuring from 9.5 to 20 mm, in addition to the 56 mm female holotype.

Breeding: Oviparous females of the species are unknown.

Remarks: The range of the species has been extended northward in the Gulf of California to Angel de la Guarda Island, and on the Pacific side of Lower California to Santa Maria Bay.

Specimens from Tiburon Island, station 566-36, were taken to the New York Zoological Society for comparison with the type. A male paratype and three metatypes are in the collection of the San Diego Society of Natural History.

Genus **MACROCOELOMA** Miers

Pericera Milne Edwards, 1834, p. 334 (part). A. Milne Edwards, 1873b, p. 49.

Macrocoeloma Miers, 1879c, p. 665. Rathbun, 1925, p. 463.

Type: The Atlantic *Pisa trispinosa* Latreille, 1825, type of *Macrocoeloma* Miers by original designation.

Description: Carapace subpyriform or suboblong, but broadened anteriorly by projecting orbits; dorsal surface unarmed, or tuberculated, or with a few long spines; margins without a series of elongated lateral spines, but often with a strongly developed lateral epibranchial spine, preceded by some smaller spines. Spines of rostrum well developed. Eyes retractile within roomy, projecting, tubular orbits. Antennae having the basal article considerably enlarged and armed distally with one or two spines; the mobile portion sometimes concealed by the rostrum, sometimes exposed. Merus of external maxillipeds broader than ischium and notched at internal angle for insertion of palp.

Chelipeds in the male with the palms enlarged and the fingers either arched and meeting only at tip or in contact throughout. Ambulatory legs rather short. (Rathbun, modified)

Abdomen with seven separate segments in both sexes.

Range: From Santa Inez Point, Gulf of California, Mexico, to Bay of Guayaquil, Ecuador, in the eastern Pacific. From Cape Fear, North Carolina, to Bahia, Brazil, in the western Atlantic. Fiji Islands (A. Milne Edwards). Shore to 31 fathoms; in the Atlantic to 163 fathoms.

KEY TO THE PACIFIC AMERICAN SPECIES OF *Macrocoeloma*

- 1a. Carapace with fewer than seven spines on posterior half. Rostrum not deflexed, horns long. Basal antennal spine directed forward or obliquely outward
 - 2a. Rostral horns subparallel, separated at bases by a narrow interspace. Posterolateral spines acute, directed backward and upward. Four dorsal bosses or tubercles arranged in a diamond. Male first pleopod with an erect, slender keel, tip elongate *maccullochae*
 - 2b. Rostral horns diverging from bases. Posterolateral spines blunt, directed outward in young specimens, forward in adults. Carapace between posterolateral spines deeply sculptured or areolated. Male first pleopod with a bluntly triangular keel, tip of moderate length *villosum*
- 1b. Carapace with seven strong spines on posterior half. Rostrum strongly deflexed, horns short. Basal antennal spine directed downward *heptacanthum*

Macrocoeloma maccullochae Garth

Plate Y, Fig. 4; Plate 46, Fig. 1

Macrocoeloma maccullochae Garth, 1940, p. 65, pl. 16, figs. 1-4.

Type: Male holotype, A.H.F. No. 372, length 31.3 mm, width including spines 20 mm, without spines 17 mm. (See also revised measurements below.)

Type locality: Isabel Island, Mexico, 10-18 fathoms, *Velero III* station 747-37.

Additional localities reported: Costa Rica: Playa Blanca [error for Port Parker], *Velero III* (Garth). Ecuador: La Libertad, *Velero III* (Garth).

Atlantic analogue: *Macrocoeloma trispinosum* (Latreille).

Diagnosis: Posterolateral spines acute, directed backward and upward. Rostral horns subparallel, separated at bases by a narrow interspace. Basal antennal spine pointing obliquely outward. Carapace with four dorsal bosses or tubercles arranged in a diamond. Male first pleopod little constricted below apex, keel erect, slender; tip elongate, semicylindrical, channeled, recurving.

Description: Carapace distended, subpyriform, broadened anteriorly at the orbital level, and covered with a dense, woolly pile interspersed with longer, yellow, hooked hairs. Gastric, cardiac, and branchial regions swollen, each surmounted by a large boss or tubercle, the four forming a perfect diamond. Carapace constricted at the hepatic level; two small epigastric tubercles. Two strong, cylindrical, acuminate postlateral spines, directed obliquely outward, backward, and upward. A smaller spine on the posterior border at the mid-point, in front of it a boss or tubercle at the intestinal level. A total of eight major prominences; with the two epigastric, ten. Rostral spines long, cylindrical, tapering, not flattened, contiguous from bases almost to tips; tips sharply divergent, except in young specimens; length of rostrum about four-fifths times the distance between the preorbital spines. Orbits tubular, protruding beyond margins of carapace, postorbital spine extending beyond preorbital. Upper orbital margin deeply incised, spines separated by a fissure fused distally but open proximally and extending on to the hepatic region.

Basal antennal article broad, bearing an obliquely directed spine. Flagellum long, reaching four-fifths the length of the rostrum, its first two movable segments appreciably thickened. A tubercle at the level of the green-gland opening; a similar pterygostomial tubercle. Merus of third maxilliped irregular in outline, anterointernal angle sharply produced,

anteroexternal angle broadly lobate, merus inserting at a point considerably below the distal extremity of the ischium.

First ambulatory leg much the longest in the male, the remaining legs gradually diminishing; those of the female rather short; legs cylindrical, pubescent, somewhat nodose. Carpus slightly inflated and grooved superiorly; dactylus with lower borders spinulose, tip yellow and incurving. (Garth, 1940)

Supplementary description: Male cheliped considerably longer than carapace, including rostrum; merus reaching middle of rostrum, bearing four equidistant superior spines; carpus nodose; manus cylindrical, scarcely tapering; dactylus less than one-third length of propodus, fingers lightly banded at base, gaping proximally, a low tooth in gape, tips evenly denticulate and slightly incurving.

Male abdomen seven-segmented, a low setose tubercle at middle of first three or four somites. Male first pleopod with keel similar to, and nearly as long as, channeled tip, giving apex a distinctly bifid appearance. (See Plate Y, fig. 4)

The young of the species are very slender in proportion to their width, the slenderness being accentuated by the elongate rostrum and the produced posterior portion of the carapace. The four bosses arranged in a diamond are not apparent in the smallest specimens.

Material examined: 10 specimens from 6 stations. (See Table 87) Isabel and Maria Magdalena Island, Mexico; Port Parker, Costa Rica; and Santa Elena Bay, Ecuador.

Measurements: Male holotype: length 28.6 mm plus 3.3 mm (broken tip of rostrum), width without spines 18.6 mm, rostrum (including broken tip) 9.0 mm, basal width 3.7 mm, cheliped 35.5 mm, chela 15.5 mm, dactyl 5.0 mm, height of palm 2.5 mm, ambulatory legs 29.5, 20.8, 17.0, and 16.0 mm, respectively. Female specimen, rostrum damaged: length 28.5 mm, width with spines 19.6 mm, without spines 16.0 mm.

Color in life: Not recorded.

Habitat: Dredged once on rocky bottom, once on sand and shell bottom, and three times on coralline bottom.

Depth: 10 to 30 fathoms.

Size and sex: The type series, exclusive of a male and female paratype sent to the U. S. National Museum unmeasured, contains young from 6.4 mm, males from 9.8 to 31.9 mm, and females from 22.3 to 28.5 mm.

Breeding: A 21.9 mm ovigerous female from Maria Magdalena Island, Mexico, has been found since the species was described. It was obtained by the *Velero III* in May, and is smaller than the nonovigerous female from Port Parker, Costa Rica, which, if perfect, would measure well over 30 mm.

Remarks: The slight differences noted in the original description with respect to specimens from Port Parker, Costa Rica, and La Libertad, Ecuador, now appear to be inconsequential and, but for their remoteness from the type locality, Isabel Island, Mexico, these specimens, together with a 14.6 mm male from La Libertad collected by the Fred E. Lewis ship *Stranger*, might well have been designated paratypes.

Macrocoeloma heptacanthum (Bell)

Pericera heptacantha Bell, 1835b, p. 173; 1836, p. 61, pl. 12, figs. 6, 6r-u. A. Milne Edwards, 1873b, p. 55. Not White, 1847, p. 10.

Macrocoeloma heptacantha, Miers, 1886, pp. 79, 81.

Macrocoeloma heptacanthum, Rathbun, 1898, p. 576; 1925, p. 473, pl. 173, fig. 1; pl. 269, figs. 8-11, text-figs. 133, 134.

Type: Male, originally deposited in the Museum of the Zoological Society [London], and female, originally deposited in the Bell Museum, cotypes; neither type is extant. Length of measured cotype 36 mm, width including spines 40.2 mm.

Type locality: Puerto Portrero, Central America [Potrero Bay, Costa Rica?], 13 fathoms; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Lower California, Mexico: off Cape San Lucas, 31 fathoms, *Albatross* (Rathbun, 1898). Panama: Panama Bay, 18 fathoms, *Albatross* (Rathbun, 1898).

Atlantic analogue: *Macrocoeloma septemspinusum* (Stimpson).

Diagnosis: Carapace with seven strong spines on its posterior half, postlateral spine directed slightly backward. Rostral horns short, strongly deflexed. Basal antennal spine pointing downward, not visible dorsally. Male first pleopod undescribed.

Description: Carapace suboblong, relatively wide behind the orbits and narrow across the posterolateral angles [as compared to other species, but still narrower anteriorly than posteriorly]. The seven spines of the hinder half not very unequal, and five of them, the two pairs of branchial spines and the cardiac spine, forming a nearly transverse line across the carapace. Of the three median spines the gastric and the cardiac erect, the intestinal spine curved and directed upward and a little backward.

The inner branchial spine pointing upward, outward, and backward; the posterolateral spine pointing slightly backward in a horizontal plane. Anterior half of carapace including rostrum sloping steeply downward from the gastric spine; horns short, acute, and widely divergent. . . . Orbits turned outward and a little forward; upper and lower margins deeply incised, anterior and posterior teeth acute . . . Subhepatic spine, not visible in dorsal view, directed downward and a little outward.

On the basal antennal segment, outside the insertion of the next segment, a slender-pointed spine not visible from above, on account of the inclination of the front. On the ventral surface of the carapace, just outside the posteroexternal angle of the basal segment, a small spine and behind it a spine at the angle of the buccal cavity. These three spines in the same longitudinal line.

Arm of the cheliped having a slender spine at either end of the outer margin; wrist rough with small, low tubercles. (Rathbun, 1925, modified)

Material examined: None. A very young specimen so labeled by Rathbun from among Schmitt Ecuadorean material proved to be a *Microphrys* with a "heptacanth" sponge covering.

Measurements: Bell's male type measured 38 by 43 mm, a young female measured by Rathbun 10.6 by 10.6 mm.

Color in life: Unknown. In preservative the color is light brown, covered with darker hair; the chelipeds reddish. (Bell)

Habitat: On sand. (Bell) Rocky; gray sand and broken shell. (Rathbun)

Depth: 13 to 31 fathoms.

Remarks: Rathbun (1925, p. 473) calls attention to the discrepancy between the two small specimens at hand and Bell's figure, which shows a good-sized marginal hepatic spine not mentioned in his description. This may represent only the difference between young and adult, or it may be a distortion in perspective of the subhepatic spine alluded to by Rathbun in the above description.

***Macrocoeloma villosum* (Bell)**

Plate Y, Fig. 5; Plate 46, Fig. 2

Pericera villosa Bell, 1835b, p. 173; 1836, p. 59, pl. 12, figs. 4, 4k-n.

A. Milne Edwards, 1875, p. 59. Nobili, 1901, p. 30.

Pericera fossata Stimpson, 1860b, p. 181; type locality, Cape San Lucas, Lower California, Mexico; female holotype not extant. A. Milne Edwards, 1873b, p. 53. Bouvier, 1895, p. 7.

Macrocoeloma villosa, Miers, 1886, p. 79 (synonymy includes *Pericera fossata* Stimpson).

Macrocoeloma villosum, Rathbun, 1910, pp. 574, 616; 1925, p. 482, pl. 269, figs. 4-7, text-fig. 135. Crane, 1937, p. 63, pl. 3, fig. 12.

Type: Male, originally deposited in the Museum of the Zoological Society [London], and female, originally deposited in the Bell Museum, cotypes; neither type is extant. Length of measured cotype 40.2 mm, width including spines 40.2 mm.

Type locality: Bay of Guayaquil, Ecuador, 11 fathoms; Hugh Cum-
ing, collector.

Localities subsequently reported, with collectors: Lower California, Mexico: L. Diguët (Bouvier); Cape San Lucas, John Xantus (Stimpson, as *Pericera fossata*). Gulf of California, Mexico: Santa Inez Point, Zaca (Crane). Ecuador: Santa Elena Bay, E. Festa (Nobili).

Atlantic analogue: *Macrocoeloma subparallelum* (Stimpson).

Diagnosis: Posterolateral spines blunt, directed outward in young, forward in adults. Rostral horns diverging from bases. Basal antennal spine pointing forward. Carapace without dorsal spines but covered with dense pile, posteriorly sculptured or areolated. Male first pleopod stout, slightly constricted at base of bluntly triangular keel, tip channeled, moderately elongate, little recurving.

Description: Surface everywhere covered with a uniform short, dense, closely-adhering pubescence. A few curled setae on the rostrum, and on the concave anterolateral slopes of the carapace. Lateral processes long, blunt, and a little curved forward. Regions of the carapace protuberant and separated by very deep sinuous pits or channels, appearing somewhat as if eaten out; but the protuberances themselves not vermiculated. Rostrum as long as the distance between the eyes; horns diverging, the distance between their tips equaling about two-thirds that between the orbits. Spine of the basal [article] of the antennae slender, and reaching considerably beyond the preorbital tooth.

Abdomen in the female showing a deep, vermiculated furrow on each side of the median rounded ridge, also channelled sutures. (Stimpson, modified, of *Pericera fossata*)

A 16.1 mm male from Agua Verde Bay, Gulf of California, resembles the 9.6 mm male from near Santa Inez Point (Crane, 1937, pl. 3, fig. 12) in having the postlateral spines directed slightly backward instead of forward. Comparison with a 20.7 mm male from Salinas (U.S.N.M. No. 70942), smallest in the Ecuadorean series, shows this to be the normal condition in the young. The Agua Verde Bay specimen, how-

ever, differs from all Ecuadorean specimens in the elongate rostrum, which is over one-fourth the total carapace length, the close approximation of the rostral horns, and the more posteriorly placed lateral spine. If these characters persist in the adult, as suggested in Stimpson's description of a female from the Gulf of California, given above, his *Pericera fossata* should be withdrawn from synonymy and applied to the northern species.

Material examined: Allan Hancock expeditions material: 3 specimens from 3 stations. (See Table 88) Agua Verde Bay, Gulf of California, Mexico, and Manta, Ecuador. U. S. National Museum material: Salinas, Ecuador, September 12-14, 1926, Waldo L. Schmitt, collector, 3 males and 1 female.

Measurements: Largest specimen, male: length 40.6 mm, width including spines 41.5 mm, width without spines 31 mm, rostrum 10.0 mm, width 9.0 mm, cheliped 51.5 mm, chela 23 mm, dactyl 9.5 mm, height of palm 6.5 mm, ambulatory legs 41, 32, 29, and 26.5 mm, respectively. Female specimen: length 24.1 mm, width including spines 24.2 mm, width without spines 17.5 mm.

Color in life: Not known. In preservative the male is a brown red, the red predominating on the outer surface; the female is a darker brown without any admixture of red. (Bell) Dark buff, inclining to brownish. (Stimpson, of *Pericera fossata*)

Habitat: Sandy mud. (Bell) From floating weed. (Crane) *Velero III* specimens were obtained once intertidally on a sand and rock beach, once from a reef over which the surf was breaking, and once by means of a clam rake from a protected shore. The Schmitt specimens are believed to have been shore collected.

Depth: Intertidal. To 11 fathoms. (Bell)

Size and sex: Males in the present series are from 16.1 to 40.6 mm; the single female measures 24.1 mm and is without ova.

Remarks: *Macrocoeloma villosum* is another species of which Rathbun (1925) possessed no specimen for illustration. Previously known specimens included Bell's 43 mm male type from the Bay of Guayaquil, Stimpson's 33.5 mm female from Cape San Lucas, and Nobili's 45.5 mm male and 35 mm female from Santa Elena Bay, Ecuador. Of these only Nobili's specimens are extant. The situation has been remedied as of late by the collecting activities of Waldo L. Schmitt, the *Zaca*, and the *Velero III*. However, the fact that specimens continue to come from two widely separated localities, Ecuador and the Gulf of California, and that these show consistent variation, may indicate that two species should be recognized, rather than one, as at present.

Genus HEMUS A. Milne Edwards

Hemus A. Milne Edwards, 1875, p. 88. Rathbun, 1901, p. 62; 1925, p. 345.

Type: The Atlantic *Hemus cristulipes* A. Milne Edwards, 1875, by monotypy.

Description: Carapace thick and swollen; longer than broad. Rostrum small; no preorbital spines; orbit incomplete below. The second and third [first and second movable] articles of the external antennae remarkably expanded and flattened, resembling an external maxilliped; the multiarticulate flagellum inserted at the external angle of the third [second movable] article. Merus of the external maxillipeds long and little dilated outwards; exognath very broad in its basilar and middle portion, and narrowing near its extremity. Chelipeds small, fingers slightly gaping, strongly turned inwards near their extremity, but scarcely spoon-shaped. Ambulatory legs short, but very strong; merus decorated with cristiform extensions; dactyls large, very much curved, but devoid of denticulations below. (A. Milne Edwards, modified)

Dilated legs fitting together in such a way that with the antennal peduncle and the deflexed rostrum, they form a large cavity underneath the body. (Rathbun, 1925)

Abdomen seven-segmented in both sexes.

Range: Eastern Pacific from Puerto Refugio, Angel de la Guarda Island, Gulf of California, Mexico, to Bay of Santa Elena, Ecuador. Western Atlantic from Cape San Blas, Florida, to Curaçao, Netherlands West Indies. Shore to 32 fathoms.

KEY TO THE PACIFIC SPECIES OF *Hemus*

- 1a. Tips of rostrum closely approximated. Cardiac region high, encroaching on branchial and intestinal regions. Two lateral teeth. Meral shields narrow, surfaces convex. Second free antennal segment small, oblique. Male first pleopod simple *analogus*
- 1b. Tips of rostrum widely separated. Cardiac region high, but not extending onto branchial and intestinal regions. Three lateral teeth. Meral shields wide, surfaces concave. Second free antennal segment larger, transverse. Male first pleopod doubly flanged. *finneganae*

Hemus analogus Rathbun

Plate Y, Fig. 6; Plate 47, Fig. 1

Hemus analogus Rathbun, 1898, p. 573; 1925, p. 347, pl. 124, figs. 2, 3.

Not Finnegan, 1931, p. 623.

Type: Female holotype, U.S.N.M. No. 21573, length 8.2 mm, width 6.5 mm.*Type locality*: Southern part of Gulf of California, Mexico, 10 fathoms, *Albatross* station 2828.*Localities subsequently reported, with collectors*: Known only from the southern part of the Gulf of California, in the vicinity of Latitude 24° N. Specimens from Taboga Island, Bay of Panama, reported by Finnegan, are believed to belong to the following new species.*Atlantic analogue*: Not the Pacific analogue of *Hemus cristulipes* A. Milne Edwards, as stated by Rathbun (1925, p. 345), but a Gulf of California endemic species.*Diagnosis*: Front narrow, sides arched, tips approximated. Orbits raised, not deeply indented, no preorbital granule. Cardiac region high, encroaching on branchial and intestinal areas; two indistinct lateral teeth. Meral shields narrow, convex, margins weakly denticulate. Second movable antennal segment small, oblique. Male first pleopod without lateral flange.*Description*: Carapace widest at branchial level, hepatic margins parallel, gastroducardiac ridge irregularly sculptured, cardiac region grossly protuberant, encroaching upon adjacent branchial and intestinal regions, carapace otherwise smooth and microscopically punctate. Front small, triangular, deflexed, edges slightly convex, a median granulate ridge, the terminal granule forming, with two closely approximated outer granules, a minute tridentate tip. Orbits swollen, considerably elevated above front, margins not deeply indented, anterior angles rectangular, a closed superior fissure. First movable antennal segment longer than broad, outer margin arching parallel to margin of front, finely crenulate, and hairy; second movable article small and obliquely directed; of the flagellar articles only the first cylindrical and swollen. Hepatic regions smooth, concave, not prominent, anterior portion of carapace, as outlined by the orbits and the anterolateral margins, rectangular. Gastric region elevated, roughly triangular with backward-pointing apex, contour broken by a complex series of sculptured ridges extending onto the high and dominant cardiac region. On either side of the narrowest point of the gastroducardiac ridge a slight depression, laterally a branchial ridge leading to the larger of two marginal prominences. A similar but smaller ridge

extending from the sides of the cardiac elevation to the smaller marginal tooth, postlateral in position. No anterior lateral protuberance. A ridge of granules defining the intestinal region.

Basal antennal article broad, produced anteroexternally, and terminating in a granule resembling a tooth. External maxilliped with merus longer than ischium, outer external angle greatly expanded and rounded, palp appearing to arise from midpoint of concave inner surface. Palpus with first segment broadened slightly, second cylindrical, third insignificant; all three segments hairy.

Male cheliped weak, manus slightly compressed, tapering distally, fingers slender, incurving, denticulate, tips almost spooned. Ambulatory legs short, decreasing regularly in length from first to last; meral segments but moderately broadened for the genus; posterior margins of lamellae differing from anterior only by their coarser denticulation, a median granulate ridge extending the length of each merus; carpi similarly ridged; propodi likewise ridged but without granules; denticles strongly curved, tips corneous.

Male abdomen with seven free segments, the last four slender; tip narrowly triangular. Male first pleopod slender, tapering to a blunt point extending little beyond aperture, lateral flanges not present. (See Plate Y, fig. 6)

Material examined: 14 specimens from 6 stations, all but one in the Gulf of California. (See Table 89) From Isla Partida to San Gabriel Bay, Espiritu Santo Island, Gulf of California; Tenacatita Bay, Jalisco, Mexico.

Measurements: Male specimen: length 8.0 mm, width 6.4 mm, length of rostrum 0.9 mm, width 1.2 mm, cheliped 5.0 mm, chela 2.2 mm, dactyl 0.85 mm, height of palm 0.55 mm, walking legs 6.5, 6.0, 5.5, and 4.8 mm, respectively. Female specimen: length 8.4 mm, width 7.0 mm.

Color in life: Unrecorded.

Habitat: Mud with shell and sand; rock with sand.

Depth: 1-35 fathoms.

Size and sex: Males in the present series range from 4.7 to 8.0 mm, females from 5.0 to 8.7 mm, ovigerous females from 6.4 to 8.0 mm.

Breeding: Ovigerous females were encountered by the *Velero III* in May and by the *Velero IV* in March in the Gulf of California.

Remarks: It is believed that the above redescription is warranted in view of the fact that the original description, based upon the erroneous assumption that *Hemus analogus* was the Pacific analogue of *H. cris-*

tulipes A. Milne Edwards, gives only comparative differences between the two species. Now that the true analogue from the Bay of Panama is known, Rathbun's species takes its rightful place as a Gulf of California-northwest Mexico endemic species, and as such is deserving of independent description. It is the Panamanian species which needs point by point comparison with its Atlantic counterpart.

***Hemus finneganae*, new species**

Plate X, Figs. 1-6; Plate Y, Fig. 7; Plate 47, Fig. 2

Hemus analogus Finnegan, 1931, p. 623. Not *H. analogus* Rathbun.

Type: Male holotype, Cat. No. 100918, U. S. National Museum, from off South Viradores Islands, Puerto Culebra, Costa Rica, 10 fathoms, February 25, 1934, *Velero III* station 257-34; ovigerous female, allotype, same locality, 3-10 fathoms, February 24, 1934, *Velero III* station 254-34. See also *Material Examined* below.

Measurements: Male holotype: length 6.7 mm, postorbital width 3.3 mm, branchial width 6.0 mm, frontal length 0.7 mm, frontal width 1.1 mm, length of first meral shield 2.6 mm, width 1.6 mm. Female specimen (not allotype): length 9.4 mm, width 8.9 mm.

Diagnosis: Front broad, sides straight, tips well separated. Orbits low, deeply indented, a preorbital granule or granules. Cardiac region high, but not encroaching on adjacent areas; three distinct lateral teeth. Meral shields broad, concave, margin strongly denticulate. Second movable antennal segment large, transverse. Male first pleopod with a double lateral flange.

Description: Carapace distended, cardiac and gastric regions prominent, widest at postbranchial level, constricted at hepatic level, microscopically punctate, and roughly granulate. Rostrum broad, little deflexed, truncate-triangulate, its straight sides culminating in a pair of well-separated bead granules, a shallow sulcus inside each margin and a row of minute granules on either side of a slight median groove. Orbits deeply indented, a closed fissure on superior border, margins granulate, two larger granules at the obtuse anterior angle in place of a preorbital tooth or spine. First movable article of antenna almost as broad as long, flaring posteriorly, and outwardly fringed with hairs. Second movable article inserting at anterointernal angle of, and bent at right angles to, first, the cylindrical, multiarticulate flagellum appearing to arise from its lateral, rather than its anterior, margin. Gastric and cardiac regions elevated, joined by an hourglass constriction, opposite on either side a reniform depression containing anteriorly a hair-tipped papilla and pos-

teriorly a cluster of hooked hairs. Hepatic areas concave, margins anteriorly converging, edges granulate, a prominent constriction between hepatic and branchial regions. Branchial areas wide, relatively low, the few tubercles arranged in patterns accentuating the relief. Three lateral prominences, the median by far the largest, subacute, and located at the widest portion of the carapace, the posterior similar but smaller, the anterior little more than a tubercle. Carapace arching broadly posteriorly, intestinal region with a few clustered granules disposed transversely. The cardiac region, although high, not encompassing any of the branchial or intestinal area, as in *Hemus analogus*.

Basal article of antenna broader than long, produced anteriorly and externally to form a partial floor for the orbit; orbit incomplete beneath. External maxilliped slender, merus equaling ischium in length, narrow proximally, broadening distally and outwardly into an arc forming the anterior as well as the exterior border and extending well forward of the insertion of the cylindrical, 3-segmented palp, each article of palp bearing a medial, distal tuft of hair. Exognath of maxilliped, especially basal portion, more robust than endognath.

Chelipeds feeble in both sexes, tips of fingers incurving, denticulate, with little or no gape. Walking legs robust, decreasing regularly in length from first to fourth, the meri broadened above by means of a granulate ridge and below by means of a lamellate projection, the edge irregularly serrate and denticulate. Superior surfaces of lamellae slightly concave and superficially smooth, not convex and ridged as in *Hemus analogus*, with microscopic surfacing similar to that of the depressed regions of the carapace. Each successive merus fitting snugly against the preceding, that of the first leg conforming with the contour of the hepatic margin. Carpi continuing above the granulate ridge and below the denticulate lamella of the merus and carrying distally a protuberance repeated medially on the longer and similarly ornamented propodi. Dactyli stout and strongly curved, the tip of each with a corneous ridge beneath in place of denticles.

Male abdomen with seven free segments, the first three ornamented with granules, broadest at segment three, last segment narrowly triangular. Male first pleopod with a double lateral flange, opening terminal. (See Plate Y, fig. 7)

Material examined: 18 specimens from 16 stations. (See Table 90) Although the species ranges from Angel de la Guarda Island, Gulf of California, and Puerto San Carlos, Sonora, Mexico, to Santa Elena Bay, Ecuador, including the Revilla Gigedo Islands, only specimens from the type locality, Costa Rica, and from adjacent northern Panama

are designated paratypes. This includes material from stations 249-34, 478-35, 457-35, and 959-39.

Color in life: Carapace vinaceous purple. Legs purplish gray, lighter towards dactyls. Ventral side dull purple gray. Eggs scarlet red. (Peter-
sen, of a female from Taboga Island, Panama)

Habitat: Of the 13 stations for which bottom data are available for the species, *Hemus finneganae* was recovered 5 times from rock, 3 times from sand, once from mud, and 4 times from organic (coral, coralline, and nullipore) bottom. Shell was present with both the rock and the sand.

Depth: Shore to 32 fathoms.

Size and sex: Male specimens range from 4.0 to 6.7 mm (the holotype), females from 4.5 to 10.0 mm, ovigerous females from 5.7 to 8.0 mm. The largest specimens are not from the Gulf of California, as is usually the case, but were obtained at Bahia Honda, Panama, station 959-39.

Breeding: Ovigerous females were encountered by the *Velero III* at Clarion Island, Mexico, in January, in Costa Rica and Ecuador in February, and in Panama in May.

Remarks: A critical reexamination of the Hancock series of *Hemus* revealed two Pacific species: the one, which is the true *H. analogus* Rathbun, apparently restricted in range to the peninsular side of the Gulf of California, and Tenacatita Bay, Mexico, the other, here proposed as a new species, ranging widely from northern Mexico to Ecuador, but most abundant in the Bay of Panama. Out of purely geographical considerations the latter species, rather than the former, would appear to be the strict analogue of the Atlantic *H. cristulipes* A. Milne Edwards; but fortunately this relationship is supported by morphological resemblance, as indicated by further refinement in key and diagnostic characters over those given by Rathbun for separating *H. analogus* from *H. cristulipes*.

The proposed new species appears to surpass either of its congeners in elaborateness, the lamellate projections of the meral segments of the ambulatory legs being strongly crenulate and denticulate, as shown by the accompanying illustration (Pl. X, fig. 1). Other valid distinctions are apparent in the three lateral projections of *Hemus finneganae* as against two in *H. cristulipes*, and the prolongation and arching of the merus of the third maxilliped in the new species. The male first pleopod of *H. finneganae* has a double lateral flange as distinguished from the simple pleopod of *H. analogus*; the pleopod of *H. cristulipes* differs radically from either.

Genus **THOE** Bell

Thoe Bell, 1835b, p. 170. A. Milne Edwards, 1878, p. 120. Rathbun, 1925, p. 347.

Platytes Lockington, 1877b, p. 41; type: *P. edentata* Lockington, 1877 = *Thoe sulcata* Stimpson, by monotypy.

Type: *Thoe erosa* Bell, by monotypy.

Description: Carapace little elongate, depressed, its surface lobulate; interorbital region broad; rostrum scarcely advanced, no preorbital spines; supraorbital border without spines. Basal article of the external antennae short and extremely broad; second article somewhat flattened, nearly reaching the extremity of the rostrum, and inserted at the sides of the latter at a great distance from the orbit. External article of the outer maxillipeds, or exognath, much broadened in its middle portion. Sternal plastron nearly circular.

Chelipeds of the male long and strong. Manus laterally compressed; the fingers, excavated into a spoon shape, leaving between them, when close together, a more or less considerable space varying according to sex and age. In young individuals and in females the fingers in contact for most of their length.

Ambulatory legs heavy; merus decorated with longitudinal crests; propodus and dactylus remarkably small and bearing some nodosities. Second pair of legs [first ambulatories] notably longer than the others; the fifth pair [fourth ambulatories] very small. (A. Milne Edwards, modified)

Abdomen seven-segmented in both sexes. (Bell)

Range: Eastern Pacific from Tepoca Bay, Sonora, Mexico, to Santa Elena Bay, Ecuador; Revilla Gigedo and Galapagos Islands. Western Atlantic from Key West, Florida, to Curaçao, Netherlands West Indies. Shore to 2.5 fathoms.

KEY TO THE PACIFIC SPECIES OF *Thoe*

- 1a. Only one anterior tooth or lobe on the basal antennal article. Tooth in gape of mature male cheliped bicuspid. A double row of deep excavations on the arm *erosa*
- 1b. Two anterior teeth or lobes on the basal antennal article
 - 2a. Tooth in gape of mature male cheliped simple. A superior row of spinules on meri of walking legs. Outer row of excavations on arm deep as inner row . . . *sulcata sulcata*

- 2b. Tooth in gape of mature male cheliped tricuspid. Spines of meri of walking legs reduced to granules or wanting. Outer row of excavations on arm obsolescent
 *sulcata panamensis*

Thoe erosa Bell

Thoe erosa Bell, 1835b, p. 171; 1836, p. 48, pl. 9, fig. 4, 4k-o. Nobili, 1901, p. 30. Rathbun, 1910, p. 575 (part: not Panama); 1925, p. 351, pl. 249, figs. 1-6. Boone, 1927, p. 149, text-fig. 145. Garth, 1946, p. 386.

Type: Syntypes of both sexes, originally deposited in the Museum of the Zoological Society [London] and Bell Museum, no longer extant. Length of measured syntype 10.6 mm, width 8.5 mm.

Type locality: Galapagos Islands, 7 fathoms, sandy mud; Hugh Cuming, collector.

Localities subsequently reported, with collectors: Ecuador: Santa Elena Bay, E. Festa (Nobili).

Atlantic analogue: None.

Diagnosis: Only one anterior tooth or lobe on basal antennal article. A double row of deep excavations on arm. Fingers strongly arched; gape entire except for one tooth on dactyl.

Description: Carapace somewhat triangular, longer than broad, rounded behind, depressed, horizontal, covered with low tuberosities; the lateral margin without teeth, perpendicular. Rostrum minute, tapering to the point, point slightly divided. Orbits nearly round, without teeth, with three small fissures, one above the inner canthus, another at the outer angle, and the third beneath. Eyes subretractile, globose, smaller than the base of the peduncle. [Antennules] lodged in a fossa, anteriorly divided by a tooth projecting backwards and longitudinally excavated. [Antennae] with the basilar [article] very broad, produced forward and backwards, the movable portion three times as long as the rostrum and ciliated on the inner side. External [maxillipeds] with the [exognath] expanded at the outer margin; [ischium] of [endognath] nearly rhomboidal, with entire margins, ciliated on the inner margin; [merus] without any emargination for the insertion of the palp.

[Chelipeds] in the male longer and much more robust than the [ambulatory legs]. The arm with a [double] series of quadrilateral excavations on the upper and outer surfaces diminishing backwards. Hands smooth, carinated beneath, the fingers meeting only at the point,

not excavated or serrated, but with a single tubercle near the middle of the moveable finger: [walking legs] flattened above, longitudinally rugose, the sides furnished with rather long hairs.

Abdomen in both sexes seven-segmented. In the male, the third to the sixth segments scarcely broader than the first and second. (Bell, modernized terminology)

Measurements: Type specimen, length 6 lines (13.5 mm), width 5 lines (11.3 mm). (Bell) Santa Elena Bay male: length 10 mm, width 8.75 mm. (Nobili)

Color: Light yellowish brown above, paler beneath. (Bell)

Habitat: Sandy mud.

Depth: 7 fathoms.

Remarks: While the writer has not seen Nobili's Santa Elena Bay specimens, a specimen of Schmitt's from Salinas, Ecuador, on Santa Elena Bay, is unhesitatingly placed as *Thoe sulcata panamensis*. It would appear to follow, then, that the Nobili specimens are also referable to that species and subspecies. This leaves only the question of whether Bell's *Thoe erosa* should be retained for a hypothetical Galapagos endemic species having (1) a bicuspid tooth on the dactyl, (2) a double row of deep excavations on the merus of the cheliped, and (3) but one anterior tooth or lobe on the basal antennal article. From the discussion on geographic variability under *T. sulcata panamensis* (which see) it is apparent (1) that mature males from the Bay of Panama show the bicuspid tooth, (2) that, while the double row of deep excavations is usually associated with mature males of *T. s. sulcata*, well developed pits are found in males from isolated populations as far south as Nicaragua, and (3) in the opinion of the writer, the accuracy of Bell's drawings is not such that the absence of a second tooth or lobe on the basal article of the antenna can be depended upon. In the continued absence of specimens of *Thoe* from the Galapagos Islands, it becomes increasingly apparent that Cuming's *T. erosa* may have been taken somewhere in the Bay of Panama, perhaps at Santa Elena Bay, in which event Bell's name, rather than Stimpson's or Nobili's, would be applicable to the mainland species.

Thoe sulcata sulcata Stimpson

Plate Y, Fig. 8; Plate 47, Fig. 3

Thoe sulcata Stimpson, 1860b, p. 177. A. Milne Edwards, 1875, pl. 19, figs. 5-5e; 1878, p. 121. Streets and Kingsley, 1877, p. 104. Rathbun, 1910, p. 575 (part: not the Panama Bay locality); 1923b, p.

635; 1924c, p. 379; 1925, p. 349, pl. 125, figs. 3, 4. Crane, 1937, p. 59. Steinbeck and Ricketts, 1941, p. 466, pl. 24, fig. 2.

Platytes edentata Lockington, 1877b, p. 41; type locality, Mazatlan, Mexico; type, originally in C.A.S., no longer extant; 1877c, p. 65.

Thoe sulcata sulcata, Crane, 1947, p. 71, text-fig. 2B.

Type: 9 males, 3 females, cotypes, M.C.Z. No. 1222. Length of measured cotype 22.8 mm.

Type locality: Cape St. [San] Lucas, Lower California, Mexico; John Xantus, collector.

Localities subsequently reported, with collectors: Mexico: Gulf of California: Tepoca Bay, Sonora, Fred Baker (Rathbun, 1924c); San Francisquito Bay, *Albatross* (Rathbun, 1923b); Pt. Lobos of Espiritu Santo Island, El Mogote, La Paz, and Pulmo Reef (Steinbeck and Ricketts); Arena Bank, 2.5 fathoms, *Zaca* (Crane, 1937). Revilla Gigedo Islands: Clarion Island, *Zaca* (Crane, 1947). Mainland south of Cape Corrientes: Mazatlan, Hy. Edwards (Lockington, as *Platytes edentata*); A. Agassiz (Rathbun, 1925); Chamela Bay, Tenacatita Bay, and Sihuatenajo, *Zaca* (Crane, 1947); Puerto Angel, C. R. Orcutt (Rathbun, 1925).

Atlantic analogue: *Thoe puella* Stimpson. [This more strictly of the following *T. s. panamensis* than of the parent species.]

Diagnosis: Merus of chelipeds with two longitudinal rows of deep excavations; meri of walking legs with a superior row of spines. Two anterior marginal lobes on basal antennal article. Dactylar tooth in gape of manus slender, cylindrical. Male first pleopod without subterminal spur.

Description: Of larger size than *Thoe puella*; anterolateral margins more convex; areolations and berry-like tubercles less strongly marked. Rostral horns contiguous, tips beadlike. The basal article of the external antennae exposed from above, and bearing two anterior teeth or lobes; separated from the fronto-orbital region by a deep suture or pit, and with a deep pit on the upper surface of the spine or tooth at its exterior angle; below, a shallow groove running parallel with the outer margin. The first two movable articles of the antennae broad and pitted; the remainder very slender.

Merus of the chelipeds with two longitudinal but not contiguous rows of deep excavations; hands carinate beneath; in the adult male the fingers very slender, the excavate tips shorter than in *Thoe puella*, and the large tooth of the dactylus near its middle and slender, as long as wide. Both fingers more or less denticulate within. Merus of legs deeply

bisulcate longitudinally by blunt ridges and armed along superior margin with a series of strong, short spines not concealed by the thick hair; the proximal spine of the row out of line and situated on the posterior surface instead of on the margin and a conspicuous feature in the legs of the first three pairs; lower limb of merus narrower than in *T. puella* and with thickened margin; both margins fringed with hair. Superior margin of carpus thick, arcuate, inferior margin unilobate. (Rathbun, 1925, modified)

Material examined: 143 specimens from 37 stations. (See Table 91) From Puerto Refugio, Angel de la Guarda Island, Gulf of California, and Puerto San Carlos, Sonora, to Tangola Tangola Bay, Oaxaca, Mexico; Clarion and Socorro Islands, Revilla Gigedo Islands.

Measurements: Largest specimen, male: length 15.8 mm, width 15.3 mm, rostrum 1.8 mm, width 2.0 mm, cheliped 22.3 mm, chela 12.0 mm, dactyl 6.5 mm, height of palm 4.7 mm, of gape 1.6 mm, ambulatory legs 17.4, 14.7, 12.5, and 10.9 mm, respectively. Largest female: length 13.1 mm, width 11.5 mm.

Color in life: See color notes for the subspecies, *Thoe sulcata panamensis*.

Habitat: In coral (*Pocillopora ligulata*). (Crane) On sponge mass below 0.0' tide level. (Steinbeck and Ricketts) Eight of the 36 *Velero* stations were coral, with 24 stations ordinary rocky shore collecting at low tide. Serpulids.

Depth: To 2.5 fathoms. (Crane, 1937) Apart from recoveries from coral, all Hancock expeditions specimens were obtained intertidally.

Size and sex: Males are from 4.5 to 16.0 mm, females from 4.7 to 13.8 mm, ovigerous females from 8.5 to 13.8 mm, and young from 3.6 mm. The smallest specimens were cracked from coral and resemble *Hemus* in the lamellate extension of the inferior margins of the meri of the walking legs.

Breeding: Ovigerous females were encountered by the *Velero III* in the Gulf of California in March, at Clarion Island in January and March, and off southern Mexico (Oaxaca) in March, and by William N. Smith II at Tiburon Island in June.

Remarks: The Hancock series of *Thoe* contains an even more impressive array of specimens than the 28 plus 67 obtained by the *Zaca* on which Crane (1947, p. 71) based her reduction of *T. panamensis* Nobili to a subspecies of *T. sulcata* Stimpson. Included are specimens from critical areas, such as the Gulf of Tehuantepec (Tangola Tangola), not represented in the *Zaca* collections. However, the additional evidence

tends to support, rather than refute, the conspecificity of the two forms, all stages of intergradation between them having been found. It is further believed that the single character on which Crane based her retention of *T. panamensis* as a subspecies, namely, the subterminal spur visible on the male first pleopod of specimens from Nicaragua south, but not on specimens from Guerrero north, may itself be subject to geographical variation. If this be true, a perfect cline would exist and *T. panamensis* might well be relegated to complete synonymy. Its retention here is largely a matter of convenience, the gap between the two series being more apparent than real, and reflecting either the lack of collections from Chiapas and Guatemala, or the absence of rocky shore and colonies of *Pocillopora* coral from this region.

Thoe sulcata panamensis Nobili

Plate Y, Fig. 9; Plate 47, Fig. 4

Thoe erosa, A. Milne Edwards, 1875, pl. 19, figs. 4-4d; 1878, p. 121 (not synonymy). Rathbun, 1907, p. 74. (Not *T. erosa* Bell)

Thoe edentata, Cano, 1889, pp. 101, 183. (Not *Platytes edentata* Lockington)

Thoe panamensis Nobili, 1901, p. 30. Rathbun, 1910, pp. 575, 618 (part: not the Ecuadorean locality); 1925, p. 351, pl. 125, figs. 5, 6, text-fig. 113. Finnegan, 1931, p. 624.

Thoe sulcata panamensis, Crane, 1947, p. 71, text-fig. 2A. Garth, 1948, p. 28.

Type: 1 male, length 10 mm, width 8.5 mm, and 1 female, cotypes, in Turin Museum.

Type locality: Flamenco Island, Bay of Panama; Enrico Festa, collector.

Localities subsequently reported, with collectors: Nicaragua: Corinto, *Zaca* (Crane). Costa Rica: Port Parker, Port [Puerto] Culebra, Piedra Blanca, Jasper Island, Gulf of Nicoya, and Uvita, *Zaca* (Crane). Panama: Bahia Honda, *Zaca* (Crane); "Panama," Dr. Sternberg, A. Agassiz; Taboga Island, J. Zetek (Rathbun, 1925); Taboguilla Island and Perico Island, *Albatross* (Rathbun, 1907); Pearl [Perlas] Islands, *Vettor Pisani* (Cano, 1889). Colombia: Humboldt Bay, *Askoy* (Garth); Gorgona Island, *St. George* (Finnegan), *Askoy* (Garth).

Atlantic analogue: *Thoe puella* Stimpson.

Diagnosis: Merus of chelipeds with outer row of excavations tending to become obsolete; spines of anterior margin of meri of walking legs reduced to granules or wanting. Large tooth in gape of manus of chelipeds tridentate. Male first pleopod with a subterminal spur.

Description: Panama specimens differ from more northern ones in the above characters chiefly. However, the obsolescence of the outer row of excavations on the arm is not altogether constant. The old male in *Thoe panamensis* has widely gaping fingers, as in *T. sulcata*, but the tooth on the dactyl at the middle of the gape is broader than long, its edges tridentate or tricrenulate. On the merus of the legs no spines or spinules show among the marginal hairs, nor is there a spine on the posterior surface near its proximal end. (Rathbun, 1925)

For a further discussion of variable characters see *Remarks* below.

Material examined: 79 specimens from 22 stations. (See Table 92)
From Salinas Bay, Costa Rica, to Salinas, Ecuador.

Measurements: Largest specimen, male: length 14.2 mm, width 12.6 mm, rostrum 1.5 mm, width 1.6 mm, cheliped 18.2 mm, chela 9.0 mm, dactyl 4.7 mm, height of palm 3.6 mm, of gape 1.0 mm, ambulatory legs 15.3, 12.6, 11.5, and 10.0 mm, respectively. Female specimen: length 10.8 mm, width 9.4 mm.

Color in life: Basic color dull yellowish brown, except for manus of chelipeds, which is pinkish, and the dactyls which range from deep rose to bright orange, shading distally to white. All underparts white. Females usually more brown, less yellow, than males; young paler yellow than adults, with manus violet, not pink; chelae even at this stage bright orange. (Crane, of Costa Rican specimens)

Habitat: Found at extreme low-tide levels, in tidepools, and in *Pocillopora* coral. Usually well decorated with the shells of *Spirorbis*-like polychaetes, bryozoans, and other growths. (Crane) Hancock expeditions specimens had serpulids, bryozoans, and hydroids.

Depth: Shore to 2.5 fathoms.

Size and sex: Males are from 4.8 to 14.2 mm, females from 7.2 to 11.4 mm, the latter figures applying to ovigerous females as well.

Breeding: Ovigerous females were encountered by the *Velero III* in Costa Rica in February, and in Panama and Colombia in January and February.

Remarks: The following are characters previously used for differentiating *Thoe panamensis* from *T. sulcata*, together with evidence concerning their geographic variability:

1. Spinulation of the legs: Here the *Velero III* series shows complete intergradation from sharp spines to no spines at all. The former condition, typical of *Thoe sulcata sulcata*, is found in specimens from the Gulf of California, specimens from as far north as Tiburon and Angel de la Guarda Islands exhibiting this feature to no greater advantage than

specimens obtained at San Gabriel Bay of Espiritu Santo Island, in the southern part of the Gulf. Specimens from Clarion Island and Socorro Island have the spines truncated or less upstanding, while Costa Rican and Panamanian specimens are obscurely spined, the spines being little more than granules for which one must search among fringing hairs. Specimens from Port [Puerto] Utria are completely smooth, a condition which carries the cline for spinulation to its opposite extremity.

2. Erosion of the merus of the cheliped: Crane (1947, p. 72) found the outer row of pits on the arm completely developed only in the largest males of *Thoe sulcata sulcata*; in smaller males and in females only two or three of the outer excavations were present and these were confined to the distal part of the arm. In a series of *T. s. panamensis* from Nicaragua she found the pits so well developed that the specimens might have been referred to *T. s. sulcata* were it not for the weak spinulation of the meri of the ambulatory legs, while in a series from Port Parker, Costa Rica, the pits were so variable as to be taxonomically useless.

3. Denticulation of the dactylus of the male cheliped: Since this character is exhibited only in the largest and most mature males, and since not more than half a dozen of these occur in the Hancock collection, it is not possible to say that a cline for this character exists also. However, the bicuspid digital tooth of several Bay of Panama specimens, a condition intermediate between the cylindrical simple tooth of *Thoe sulcata sulcata* and the broad tricuspid tooth of *T. s. panamensis*, strongly suggests this possibility. Worthy of note in this connection is an overdeveloped male from San Francisco Island, Gulf of California, in which the gape is as exaggerated as that shown in Bell's figure of *T. erosa*, the dactylar tooth, however, remaining simple.

Family *PARTHENOPIDAE*

Parthenopidae Alcock, 1895, p. 257. Borradaile, 1907, p. 480. Rathbun, 1925, p. 510. Flipse, 1930, p. 3.

Eyes usually retractile within small circular well-defined orbits; floor of orbit nearly continued to the front, leaving a hiatus usually filled by the second [article] of the antennary peduncle. Basal antennal [article] small, and deeply imbedded between the inner angle of the orbit and the antennular fossae. Antennules folding a little obliquely. (Alcock)

Chelipeds not specially mobile, usually much longer and heavier than the other legs, and with fingers bent on the hand at an angle toward the side with the fixed finger. Second article of antenna small, short, and not fused with epistome or front. Orbits well made. Hooked hairs almost always wanting. Male openings coxal. Palp of external maxilliped articulated at anterointernal angle of merus. (Borradaile)

The family is divided into two subfamilies, the Parthenopinae and the Eumedioninae. All of the genera represented in American waters belong to the first, which is by far the larger subfamily.

Subfamily **PARTHENOPINAE**

Parthenopinae Miers, 1879c, p. 668. Alcock, 1895, p. 258. Stephensen, 1945, p. 219.

Carapace commonly equilaterally-triangular, sometimes sub-pentagonal or ovate-pentagonal, and sometimes almost semicircular or semi-elliptical in outline; cardiac and gastric regions usually deeply marked off from the branchial regions on either side, making the dorsal surface of the carapace trilobed. Chelipeds vastly longer and more massive than the ambulatory legs. Rostrum simple or obscurely trilobed. (Alcock)

Pleopod 1 varying, more or less stout, apically tapering or not tapering. Pleopod 2 usually short and of usual shape, but in *Platylambrus carinatus* in length equal to pleopod 1. (Stephensen)

**KEY TO THE AMERICAN GENERA AND SUBGENERA OF THE FAMILY
PARTHENOPIDAE**

(Rathbun, modified, after Alcock) (Pacific genera are shown in bold face type and are treated in this volume.)

- 1a. Carapace not laterally expanded
 - 2a. Carapace tuberculate or eroded
 - 3a. Basal antennal article short, not reaching orbital hiatus
 **Parthenope**
 - 4a. Chelipeds more than twice as long as carapace
 - 5a. Carapace ovate-pentagonal, surface little carinate Subgenus **Parthenope**
 - 5b. Carapace broadly triangular, sides rounded, surface carinate or tuberculate
 Subgenus **Platylambrus**
 - 4b. Chelipeds less than twice as long as carapace
 Subgenus **Pseudolambrus**

- 3b. Basal article longer, almost or completely reaching orbital hiatus
 - 6a. Afferent channels deep, bordered above by laminar expansions of hepatic and anterior branchial margins *Tutankhamen*
 - 6b. Afferent channels normal, as in *Parthenope*
 - 7a. Merus of cheliped thigh-shaped, tapering distally *Thyrolambrus*
 - 7b. Merus of cheliped trigonous, not tapering distally *Daldorfia*
- 2b. Carapace smooth, except for a few strong spines
 - 8a. Efferent channels opening at sides of endostome, as customary in the Oxyrhyncha
 - 9a. Carapace high, without a strong lateral spine *Solenolambrus*
 - 9b. Carapace depressed, with a strong lateral spine *Leiolambrus*
 - 8b. Efferent channels opening at middle of endostome, as customary in the Oxystomata *Mesorhoea*
- 1b. Carapace expanded to form a vault, concealing the ambulatory legs
 - 10a. Carapace transversely oval, expanded laterally but not posteriorly. No ridge on pterygostomial region . *Aethra*
 - 10b. Carapace triangular or pentagonal
 - 11a. Carapace expanded both laterally and posteriorly. Pterygostomial region smooth . . . *Cryptopodia*
 - 11b. Carapace expanded laterally only. Pterygostomial region with a ridge *Heterocrypta*

Genus PARTHENOPE Weber

Parthenope Weber, 1795, p. 92. Rathbun, 1904b, p. 171; 1925, p. 511.
Not *Parthenope* Fabricius, 1798.

Lambrus Leach, 1815b, pp. 308, 310; type: *Cancer longimanus* Linnaeus, 1758, by monotypy. Alcock, 1895, p. 259. Flipse, 1930, p. 21.

Type: The Indo-Pacific *Cancer longimanus* Linnaeus, 1758, type of *Parthenope* Weber (not Fabricius) by subsequent designation of Rathbun (1904b, p. 171).

Description: Carapace either broadly triangular or ovate-pentagonal, with front pointed but short. Surface granular, tubercular, or spiny. Eyes enclosed in distinct orbits, a suture above and a hiatus below;

Subgenus *Parthenope* Weber

Lambrus A. Milne Edwards (restricted), 1878, p. 146. Miers, 1886, p. 92 (part). Alcock, 1895, p. 260.

Parthenope Rathbun, 1910, p. 319; 1925, p. 513.

Type: Cancer longimanus Linnaeus, 1758, by subsequent designation of Rathbun (1904b).

Description: Carapace ovate-pentagonal, with the surface granulate or pustular and but little carinate in the adult. Rostrum exceedingly short. (Alcock)

Parthenope (Parthenope) hyponca (Stimpson)

Plate Z, Figs. 1, 1a; Plate 48, Fig. 1

Lambrus hyponcus Stimpson, 1871a, p. 100. A. Milne Edwards, 1878, p. 153, pl. 30, figs. 3-3b.

Parthenope (Parthenope) hyponcus, Rathbun, 1910, p. 576.

Parthenope (Parthenope) hyponca, Rathbun, 1925, p. 514, pl. 275, figs. 4-6. Garth, 1948, p. 30.

Type: Female holotype, length 15.2 mm, width 17.3 mm, merus of cheliped 15.2 mm, not extant.

Type locality: Panama; Capt. J. M. Dow, collector.

Localities subsequently reported, with collectors: Mexico: Mazatlan (A. Milne Edwards). Panama: Piñas Bay, *Askoy* (Garth). Ecuador: off Esmeraldas (01° 07' N, 79° 53' W) and W of Cape Santa Elena, *Askoy* (Garth).

Atlantic analogue: Parthenope (Parthenope) agona (Stimpson).

Diagnosis: Carapace broadly ovate, little carinate; front triangular, deflexed. Meri of ambulatory legs denticulate above. A capitate tubercle ventrally at base of each cheliped. Male abdomen with a median tubercle on sixth segment. Male first pleopod cylindrical, of uniform diameter from base to tip, a few setae at mid-point of closed groove; setae otherwise marginal and terminal. Male second pleopod with a blunt tip and a subterminal swelling in place of a tooth.

Description: Carapace subrhomboidal in shape, the posterior region being well developed and prominent. . . One low tubercle on the gastric region, two large, prominent ones on the cardiac [region], one small, spiniform one on the posterior margin at the median line, and two rather large ones on the branchial region, the posterior one the taller, and situated close to the posterolateral margin. Besides these tubercles, several other minute ones, roughly arranged in eight or ten longitudinal

rows, and the general surface covered with punctures, crowded together. Two or three small pits in the depression between the branchial and gastric regions. The anterolateral margin behind the cervical sulcus armed with eight triangular, denticulated teeth, the posterior one being a little longer, the others equal in size. Front smooth. Rostrum of moderate size, subtriangular, deflexed; sides slightly concave, unarmed; apex obtuse.

Chelipeds long; surface smooth above, except the merus, merus with a median, tuberculated ridge; edges of merus, carpus, and [manus] armed with small teeth, spiniform on the superior edge of the merus; outer edge of [manus] with sixteen teeth alternating in size. Below, chelipeds smooth and glabrous except the tuberculated inner edges, the tubercles being small. Sternum with a strongly prominent, almost capitate tubercle on each side at the base of the chelipeds, chelipeds also bearing a small tubercle on the basal [segment]; these four tubercles somewhat flattened at the top and bent forward.

In the female abdomen the segments each armed with a transverse ridge, more or less developed; on the second and third [segments] this ridge strongly toothed, and on the penult [segment] appearing in the form of a median tubercle. (Stimpson, modified)

In the male abdomen the segments each armed with a transverse ridge, more or less developed; on the second and particularly the third segment this ridge strongly toothed, and on the penult segment appearing in the form of a median tubercle.

Material examined: Sixteen specimens from 10 stations. (See Table 93) From Tenacatita Bay, Jalisco, Mexico, to Salango Island, Ecuador. In addition, 3 specimens from 3 *Askoy* stations, previously reported. (Garth, 1948)

Measurements: Largest specimen, female: length 20.4 mm, width 23.3 mm, rostrum 1.7 mm, width 2.4 mm, cheliped 58 mm, merus 20.5 mm, manus 27.2 mm, dactylus 10.6 mm, height of palm 8.5 mm. Male specimen: length 10.7 mm, width 12.3 mm, rostrum 1.5 mm, width 1.7 mm, cheliped 26 mm, merus 9.5 mm, manus 13.2 mm, dactylus 5.0 mm, height of palm 4.5 mm.

Color in life: Carapace light pinkish lilac, small area between gastric and cardiac regions light pink orange, crest of branchial regions purplish lilac. Eyes dusky yellowish brown. Chelipeds white with a strong lavender hue. Inside of hand and base of fingers red orange. Ambulatory legs cream color with a brown band on middle of merus and base of carpus and propodus. Ventral side grayish white. (Petersen, of a specimen from Tenacatita Bay, Mexico)

Habitat: Gray sandy mud. (Garth, 1948) *Velero III* specimens were dredged 6 of 9 times in sand, with shell present with the sand on two occasions. The remaining three dredge hauls were in mud. The single shore collection was from shale.

Depth: 9-41 m. (Garth, 1948) Hancock expeditions specimens were dredged in from 3-25 fathoms, with one intertidal collection.

Size and sex: Males are from 6.0 to 11.3 mm (*Askoy* specimen), females from 6.2 to 20.4 mm, young from 4.0 mm.

Breeding: The female holotype was said by Stimpson to be sterile. None of the females taken subsequently have been ovigerous.

Remarks: *Parthenope (Parthenope) hyponca* is the sole representative in the eastern tropical Pacific of the typical subgenus, which is represented in the tropical western Atlantic by *P. (Parthenope) agona*. The species was known to Rathbun by description of Stimpson and figures of A. Milne Edwards only, there being no specimens in the collection of the U. S. National Museum as recently as 1937. The first males to be reported were obtained by the *Askoy* (Garth, 1948), which also extended the range of the species from Panama south to Cape Santa Elena, Ecuador. *Velero III* material again establishes its presence in northern Mexico, although at Tenacatita Bay rather than Mazatlan, which was A. Milne Edwards's locality. The species was not encountered by the *Velero III* in the Gulf of California, nor at any of the offshore islands, such as Clarion or Galapagos, nor has it been taken by the *Velero IV*, which has made but one brief cruise south of Cape Corrientes, Mexico.

Subgenus *Platylambrus* Stimpson

Platylambrus Stimpson, 1871b, p. 129. A. Milne Edwards, 1878, p. 146.

Alcock, 1895, p. 261. Rathbun, 1925, p. 516.

Enoplolambrus A. Milne Edwards, 1878, p. 147; type: *Lambrus carinatus* (emendation of *carenotus*) Milne Edwards, 1834, by monotypy.

Lambrus Miers, 1886, p. 92 (part).

Type: The Atlantic *Lambrus crenulatus* Saussure, 1858 = *Lambrus serratus* Milne Edwards, 1834, type of *Platylambrus* Stimpson by subsequent designation of Rathbun (1925).

Description: Carapace carinated or tuberculated, broader than long, broadly triangular with rounded sides and a broad but acute and projecting rostrum; no postocular constriction. Chelipeds with the mero-podite and palm straight, the former [segment] prismatic, the latter sharply trigonal, the anterior and posterior borders of both [segments] sharply lacinate or serrate, as also the outer edge of the carpus. (Alcock)

Parthenope (Platylambrus) exilipes (Rathbun)

Plate Z, Figs. 3, 3a; Plate 48, Fig. 2

Lambrus (Parthenolambrus) exilipes Rathbun, 1893b, p. 234.*Lambrus hassleri* Faxon, 1893, p. 152; type localities, *Albatross* stations 3368 and 3427; cotypes, U.S.N.M. No. 20599, M.C.Z. No. 4481; 1895, p. 14, pl. 3, figs. 1, 1a.*Lambrus exilipes*, Rathbun, 1898, p. 581.*Parthenope (Platylambrus) exilipes*, Rathbun, 1925, p. 523, pls. 184, 185; pl. 277, figs. 1, 2. Boone, 1927, p. 172, fig. 57. Crane, 1937, p. 64. Garth, 1946, p. 409, pl. 69, fig. 2.*Type*: Male holotype, U.S.N.M. No. 17365, length 10 mm, width 13 mm, cheliped 25 mm.*Type locality*: Off San Domingo Point, Lower California, Mexico, 74 fathoms, *Albatross* station 3043.*Localities subsequently reported, with collectors*: Lower California, Mexico: off Cape San Lucas, 31 fathoms, *Albatross* (Rathbun, 1898), Gulf of California, Mexico: Arena Bank, 20-50 fathoms, and Gorda Banks, 40-75 fathoms, *Zaca* (Crane); off Tres Marias Islands, 80 fathoms, *Albatross* station 3427 (Faxon, 1893, as *Lambrus hassleri*). Costa Rica: Cocos Island, 66 fathoms, *Albatross* station 3368 (Faxon, 1893, as *Lambrus hassleri*). Panama: Bay of Panama, 51.5 fathoms, *Albatross* (Rathbun, 1898). Ecuador: off Charles Island, Galapagos Islands, 78.5 fathoms, *Albatross* (Rathbun, 1898). For an additional 12 Galapagos stations see Garth (1946, p. 409).*Atlantic analogue*: *Parthenope (Platylambrus) pourtalesi* (Stimpson).*Diagnosis*: Carapace high, tuberculate; interregional depressions shallow; hepatic and interbranchial pits deep. Tooth at lateral angle largest of marginal teeth. Four prominent median and one large branchial tubercle. Rostrum channeled, trilobate. Propodi and dactyli furred. Male first pleopod stout, tapering to tip; tip truncate and twisted; a cluster of setae on lip of groove; other short setae lateral and terminal. Male second pleopod nearly as long as first, sinuous, tip elongate, slender, a subterminal denticulate tooth.*Description*: Carapace about one-third broader than long; narrow at the hepatic regions, spreading at the branchial regions; a cavity near the margin between the branchial and the small hepatic region; a large cavity between the branchial and the cardiac and gastric regions. Median tubercles four, one large on the posterior portion of the gastric region, one small on the genital, one large on the cardiac, and one small on the

intestinal. A prominent tubercle at the summit of the branchial region, also a few low tubercles on the branchial region and on the gastric ridges leading to the rostrum. Anterolateral margin convex, about eight-toothed; teeth denticulate, becoming smaller anteriorly, the row continued on the subhepatic region; tooth at the lateral angle the largest. Posterolateral margin concave, arched upward, with five small teeth and a large upturned spine at the summit of the arch. Posterior margin slightly convex, tuberculate. The supraorbital arch bearing a prominent tubercle. Rostrum channeled, subtriangulate, deflexed at an angle of about 45° . . . Sternum, abdomen, and merus of external maxillipeds tuberculate.

Chelipeds long, irregularly dentate on the margins, teeth denticulate, a stout tooth on the lower side of the first [segment]; faces of merus with tubercles arranged more or less longitudinally; hand with a distinct ridge on the lower face, outer face somewhat tuberculous, inner face smooth; dactyl dentate on the outside near the base; both fingers dentate on prehensile edges; white at tips, in the right cheliped gaping at base, in the left in contact. Ambulatory legs very short, narrow, flattened; meral, carpal, and propodal [segments] with a denticulate crest above; meral [segments] with a narrow, longitudinal groove below, edges of groove denticulate; last two [segments] densely hairy underneath. Surface pubescent.

Male abdomen with seven segments. (Rathbun, 1893b)

Material examined: 56 specimens from 17 stations. (See Table 94) From Boca de la Trinidad, Gulf of California, Mexico, to Lobos de Afuera Island, Peru, including Socorro Island of the Revilla Gigedo Islands. For an additional 100 specimens from 12 Galapagos Islands stations, see Garth (1946).

Measurements: Largest specimen, female: Length 26.5 mm, width including spines 37.3 mm, rostrum 1.5 mm, width 1.6 mm, exorbital width 9.6 mm, cheliped 75 mm, merus 28.7 mm, manus 32.5 mm, dactyl 14.2 mm, height of palm 12.2 mm. Male specimen: length 15.6 mm, width 21.1 mm, rostrum 1.3 mm, width 1.3 mm, exorbital width 6.0 mm, cheliped 42.5 mm, merus 15.0 mm, manus 20.1 mm, dactyl 6.8 mm, height of palm 6.2 mm.

Color in life: Frontal regions white, with greenish blue tint on center and purplish tint on sides. Cardiac and branchial regions hazel; marginal teeth xanthine orange; intestinal region dull yellowish white. Eye light greenish yellow, eyestalk white. Cheliped hazel with reddish xanthine orange becoming lighter on teeth. Movable finger violet carmine to

middle, fading abruptly to white, tips dull ochre; a spot of violet carmine on fixed finger. A streak of grayish white on merus, outer distal portion of carpus white with bluish lilac tint, a band of same color near distal end of hand. Ambulatory legs same as cheliped but lighter, dactyl white with dull ochraceous tint. (Petersen, of a specimen from Lobos de Afuera Island, Peru)

Frontal, gastric, and cardiac regions dark deep olive buff speckled with capucine yellow and garnet brown. Anterior branchial regions and all spines capucine yellow; rest of carapace deep olive buff speckled with yellow-white and garnet brown. Eye dark sulphur yellow. Chelipeds same as carapace but lighter, with large white patches on merus, carpus, and distal surface of manus; fingers white except for reddish yellow at base. Ambulatory legs deep olive buff banded with light garnet brown; dactyl pale cream color. (Petersen, of a specimen from Secas Islands, Panama)

Habitat: Sand, either alone or mixed with mud, shell, or coral. (Garth, 1946) Of 15 dredge stations from which the species was recovered by Hancock expeditions, 9 were sand bottom, with shell present in 2 and coralline in 3; 2 were mud bottom, with sand present in one; 4 were rock bottom, with mud, coralline, shell, and nullipore variously present. One of the two shore stations was *Pocillopora* coral.

Depth: Hancock expeditions mainland specimens were dredged in from 12-95 fathoms, or, on two occasions, collected intertidally.

Size and sex: Males were from 7.0 to 15.6 mm, females from 6.8 to 26.5 mm, ovigerous females 23.0 and 25.4 mm, and young from 4.5 mm.

Breeding: The only ovigerous females encountered were the two specimens taken at Lobos de Afuera Island, Peru, in mid-February, which is southern hemisphere summer.

Remarks: The widespread distribution of *Parthenope* (*Platylambrus*) *exilipes* is well illustrated by Hancock collections. Although no specimens were obtained from the west coast of Lower California, from which the species had been reported previously, *P. (P.) exilipes* was found in the Gulf of California, at Socorro Island of the Revilla Gigedo Islands, in the Bay of Panama, the Galapagos Islands, in Colombia, and northern Peru. The latter two localities represent an extension of range from the Bay of Panama southward along the mainland coast.

The young male from Socorro Island is very ornate. The determination of this specimen is by Mary J. Rathbun.

Parthenope (Platylambrus) depressiuscula (Stimpson)

Plate Z, Figs. 4, 4a; Plate 49, Fig. 1

Lambrus depressiusculus Stimpson, 1871a, p. 101. A. Milne Edwards, 1878, p. 155.

Parthenope (Platylambrus) depressiuscula, Rathbun, 1925, p. 524, pl. 188. Garth, 1948, p. 31.

Type: Male holotype, length 21.6 mm, width including spines 29.2 mm, length of manus 29.2 mm; not extant.

Type locality: Manzanillo, Mexico; John Xantus, collector.

Localities subsequently reported, with collectors: Panama: Henry A. Ward, purchased (Rathbun); Isla Bayonetta, Perlas Islands, 8-9 m, Askoy (Garth). Colombia: Málaga Bay, 4-9 m, Askoy (Garth).

Atlantic analogue: *Parthenope (Platylambrus) guerini* (Brito Capello).

Diagnosis: Carapace depressed, constricted behind orbits, branchial regions broadly expanded. Tubercles small, sharp, scattered. Largest of anterolateral spines at lateral angle; a larger spine at end of branchial ridge. Rostrum small, trilobate, horizontal. Fingers bent at right angles to hand. Male first pleopod long, slender, tapering, tubular, opening terminal; densely and finely pubescent at base, a line of stouter setae proximally on lip of groove, a line of finer setae extending the length of groove as well as other lines marginally. Male second pleopod less than half as long as first, sinuous, basally broadened, terminally pointed, a subterminal denticle.

Description: Body depressed, though much less so than in *P. (P.) serrata*. Carapace two-fifths broader than long, regions moderately prominent, the cardiac region most so; surface covered with scattered, berried tubercles, irregular in size. Branchial region broadly expanded. Lateral margin armed with 14 or 15 spiniform, granulated teeth; two of these in front of the cervical suture, and five on the postlateral margin; of the latter, the second longest of all, recurved, and at the end of the branchial ridge. The spine at the lateral angle, at the widest part of the carapace, a little longer than those on either side of it. Intestinal region broad, projecting but little beyond line of posterolateral angles; bordered by seven tubercles, the end ones the largest and the two on either side of the median one next in size. Frontal region concave; rostrum small, triangular or trilobate, horizontal. Subhepatic and pterygostomian regions moderately guttered.

Upper surface of merus of cheliped armed with a row of about five unequal tubercles; margins of merus and manus armed with numerous

spiniform teeth, 10 or 11 of these on outer margin of hand; teeth granulated like those of carapace but not ramose; beneath, the hands ornamented with longitudinal rows of small, smooth tubercles, largest along inner edge and fading out toward exterior margin. Legs slightly compressed, not cristate, smooth and unarmed; last two and a half [segments] furred.

A small, slender spine on penult [segment] of male abdomen; female abdomen furred. (Stimpson, as modified by Rathbun)

Material examined: 28 specimens from 13 stations. (See Table 95) From Isabel Island, Mexico, to Santa Elena Bay, Ecuador.

Measurements: Largest specimen, female: length 21.6 mm, width 29.0 mm, rostrum 2.1 mm, width 2.4 mm, exorbital width 9.0 mm, cheliped (right) 51 mm, merus 17.4 mm, manus 22.7 mm, dactylus 10.5 mm, height of palm 9.4 mm. Male specimen: length 19.0 mm, width 25.0 mm, rostrum 1.8 mm, width 2.5 mm, exorbital width 8.9 mm, cheliped 51 mm, merus 18.5 mm, manus 26 mm, dactylus 10.0 mm, height of palm 8.0 mm.

Color in life: Carapace and chelipeds acajou red. Eye light olive green with tiny red spots. Fingers pinkish white, tips yellowish ochre red. Ambulatory legs same as carapace but lighter, fading to pale yellow on dactyl. Ventral side grayish white. (Petersen, of a specimen from Isabel Island, Mexico)

Habitat: Sand, black mud, and gray sand. (Garth, 1948) Of the 11 *Velero III* stations for which data on bottom type are available, 4 were mud, with sand and rock present twice each; 2 were sand, with nullipore present in one; 2 were rock with shell present in one; 2 were coralline; and one was shell bottom.

Depth: Hancock expeditions specimens were obtained in from 2-30 fathoms.

Size and sex: Males are from 6.5 to 19.0 mm, females from 7.2 to 21.6 mm, ovigerous female 13.6 mm, and young from 3.5 mm.

Breeding: The single ovigerous female was obtained at Bahia Honda, Panama, in late February.

Remarks: The series is remarkably uniform, no geographical variation being detectable throughout the range, which has been extended northward from Manzanillo to Isabel Island, Mexico, and southward from Málaga Bay, Colombia, to La Libertad, Ecuador.

Subgenus **Pseudolambrus** Paulson

Pseudolambrus Paulson, 1875, p. 9. Rathbun, 1925, p. 528.

Parthenolambrus A. Milne Edwards, 1878, p. 148; type: *Parthenope tarpeius* Adams and White, 1849, by subsequent designation of Rathbun (1925). Alcock, 1895, p. 275.

Parthenopoides Miers, 1879c, p. 672 (part); type: *Lambrus massena* Roux, 1830, by original designation.

Type: The Indo-Pacific *Parthenope calappoides* Adams and White, 1849, type of *Pseudolambrus* Paulson by monotypy.

Description: Carapace semielliptical or semicircular, with a nearly straight posterior margin, the posterolateral angles being strongly produced. Chelipeds of no great length, never sharply serrate, and with the hands and arms indefinitely contorted. Rostrum more or less deflexed. (Alcock)

Parthenope (Pseudolambrus) triangula (Stimpson)

Plate Z, Figs. 2, 2a; Plate 49, Fig. 2

Lambrus triangulus Stimpson, 1860b, p. 201. A. Milne Edwards, 1878, p. 152, pl. 31, figs. 1-1c.

Parthenope (Pseudolambrus) triangula, Rathbun, 1925, p. 528, pl. 278, figs. 1-3. Crane, 1937, p. 65, pl. 5, fig. 18. Garth, 1946, p. 410, pl. 69, fig. 1.

Type: Female holotype, length 14.0 mm, width 17.5 mm; not extant.

Type locality: Cape San Lucas, Lower California, Mexico; John Xantus, collector.

Localities subsequently reported, with collectors: Lower California, Mexico: San Lucas Bay, 3 fathoms, *Zaca* (Crane). Ecuador: Galapagos Islands, 2-70 fathoms, *Velero III* (Garth).

Atlantic analogue: None. The subgenus is excluded from the western Atlantic.

Diagnosis: Carapace an equilateral triangle; branchial regions produced to cover meri of ambulatory legs. Rostrum obtuse, deflexed. Base of movable part of antenna protected on each side by an over-arching tooth. Relatively few (8 or 9) teeth on upper margin of manus. Male first pleopod stout, cylindrical, basally angled, terminally capitate, groove open throughout length, a row of short marginal setae, a few longer setae on marginal lip, and many longer setae on rounded terminal portion. Male second pleopod about three-fifths length of first, sinuous, tip corneous, denticulate, a subterminal denticulate tooth.

Description: Carapace an equilateral triangle, the posterior margin being nearly straight, and scarcely exceeding the anterolateral [margins] in length, resulting from the strong projection of the dentated posterior corners of the branchial regions, almost concealing the ambulatory [legs]. Anterolateral margin with about twelve very small granulated teeth, three on the small rounded hepatic region. Surface ornamented with conical tubercles variable in number and size. Rostrum prominent, obtuse, triangular. Base of the movable part of the external antennae protected on each side by an over-arching tooth, one arising from the lower margin of the orbit, the other from the anterior corner of the epistome. In the outer maxillipeds the ischium granulated, the merus tuberculated.

Chelipeds rather short, strongly angular and dentated; hand granular below, but nearly smooth above between the high and unevenly eight- or nine-toothed crests; the teeth denticulated, the middle one largest. Ambulatory [legs] perfectly smooth and glabrous; dactyli pubescent. (Stimpson, modified)

Male abdomen constricted between fifth and sixth somites, sixth somite with a prominent proximal median tooth, seventh somite broader than long, sides slightly concave. Female abdomen granulate and hairy, lacking prominent ridges or tubercles, middle portion set off from lateral portions by shallow longitudinal sulci.

Material examined: 47 specimens from 17 stations. (See Table 96) From Magdalena Bay, Lower California, and Puerto Escondido, Gulf of California, Mexico, to off La Plata Island, Ecuador, including Socorro and Clarion of the Revilla Gigedo Islands, but excluding the mainland from Mexico to Ecuador. In addition to the above, 44 specimens from 17 Galapagos Islands stations (Garth, 1946).

Measurements: Largest specimen, male: length 13.7 mm, width including spines 17.7 mm, rostrum 1.7 mm, width 2.5 mm, exorbital width 5.9 mm, cheliped (right) 24.0 mm, merus 8.0 mm, manus 13.1 mm, dactylus 6.0 mm, height of palm 6.9 mm. Female specimen: length 12.0 mm, width including spines, ca. 15.0 mm (spine broken).

Color in life: See Garth (1946, p. 411).

Habitat: Sand with rock and coral; rock. (Garth, 1946) Of the 17 stations from localities other than Galapagos, bottoms were sand in 10 cases, with nullipores, algae, and coralline algae present in descending order of frequency in more than half; rock in 3 cases, with nullipores in 2; and organic bottoms in 4 cases, with shell, coralline algae, and

nullipores represented, the latter with weed. Mud bottoms are conspicuously absent.

Depth: 3-40 fathoms, the above series. 2-70 fathoms (Garth, 1946).

Size and sex: Males are from 5.7 to 13.7 mm, females from 5.1 to 12.0 mm, ovigerous female 10.6 mm, young from 3.2 mm. A small species, maturing at 5 mm.

Since the Galapagos Islands series contains almost as many specimens as the mainland series, and from fully as many stations, it has been reexamined with the following results: males are from 5.7 to 17.5 mm, females from 6.3 to 17.0 mm, and young to 4.2 mm. While none of the females is ovigerous, specimens from 9.7 to 17.0 mm are post-puberal and show the widening of the abdomen that comes with the puberty molt. Galapagos specimens, then, appear to run larger than those from the mainland.

Breeding: The single ovigerous female was obtained in the southern part of the Gulf of California in early April.

Remarks: The unusual range, west coast of Lower California, Gulf of California, Socorro, Clarion, Galapagos, and La Plata Islands, suggests that the species has indeed used island "stepping stones" in reaching the coast of Ecuador.

Parthenope (Pseudolambrus) excavata (Stimpson)

Plate Z, Figs. 5, 5a; Plate 50

Lambrus excavatus Stimpson, 1871a, p. 98. A. Milne Edwards, 1878, p. 154.

Parthenope (Pseudolambrus) excavata, Rathbun, 1925, p. 529, pl. 189. Crane, 1937, p. 65, pl. 5, figs. 16, 17.

Type: Female (of two specimens) syntype, length 30.5 mm, width 35.0 mm, merus of cheliped 17.3 mm, hand 30.5 mm; not extant.

Type locality: Manzanillo, Mexico; John Xantus, collector.

Localities subsequently reported, with collectors: Gulf of California, Mexico: Santa Inez Bay, 29 fathoms, Zaca (Crane). Panama: Panama, Capt. J. M. Dow (Rathbun).

Atlantic analogue: None.

Diagnosis: Lateral margins angled. Angle of deflection of rostrum 90°. Dorsal tubercles low, granulate; interspaces, 5 on the anterior half of the body, deeply excavated. Chelipeds concave above, surface between crests smooth. Three paired, flat sternal spines. Ambulatory legs crested above. Male first pleopod cylindrical, little tapering, tip emarginate, a

few setae on lip of groove, a row of subterminal setae. Male second pleopod three-fourths as long as first, sinuous, tip blunt, a subterminal cluster of denticles.

Description: Carapace irregularly hexagonal, and one-sixth broader than long. Anterolateral margin concave, forming an angle with the outer lateral margin, this margin nearly straight and parallel with the axis of the body, and terminating posteriorly in a strongly projecting angle. Posterolateral margins slightly concave, and forming a very obtuse angle with each other because of the slight projection of the intestinal region. Periphery armed with teeth, short, triangular, and regularly approximated on the anterolateral and outer lateral margins, but longer, more spiniform, and irregularly arranged on the posterolateral margins. On the upper surface, besides the usual depression between the cardiac and branchial regions, four deep excavations in front of the latter region: two separating it from the hepatic, and two, somewhat larger, from the gastric region. A deep concavity on the frontal region, continued posteriorly for a short distance on the gastric region. Rostrum large, regularly triangular, and deflexed to a right angle with the general level of the gastric region; margin unarmed, or only obscurely toothed. Surface of the protuberant parts of the carapace covered with low, granulated tubercles.

Chelipeds much shorter and stouter than in typical [*Parthenope*], and deeply concave above, the concavity being smooth or nearly so, and defined by prominent marginal crests, strongly toothed except on the carpus. Merus of the cheliped particularly short; its anterior crest armed with three or four teeth, its superior one with only two large teeth, the outer one much the largest. In the hand, the crest of the superior margin armed with six unequal, approximated, triangular teeth; and that of the outer margin with two conical distant teeth, besides the knob at each extremity. Lower surface of the hand ornamented with four or five rows of granulated tubercles, those of the middle row being largest and most conspicuous; inner margin serrated with granulated teeth. Ambulatory [legs] much compressed, and crested above.

In the female abdomen each segment armed with short setose tubercles, there being a larger ridge-like one . . . in the middle, and four or five small ones on each side. (Stimpson, modified)

In the male abdomen the larger ridge-like tubercles restricted to segments 2 through 6, the smaller lateral ones to segments 2 through 4 only.

Material examined: 6 specimens from 5 stations. (See Table 97) From Angel de la Guarda Island, Gulf of California, Mexico, to Taboga Island, Panama.

Measurements: Largest specimen, female: length 25.7 mm, width 30.1 mm, rostrum (tip) 1.6 mm, width 2.1 mm, exorbital width 9.7 mm, major cheliped 46 mm, merus 14.7 mm, manus 26.6 mm, dactylus 14.5 mm, height of palm 15.4 mm. Male specimen: length 18.6 mm, width 21.5 mm, rostrum (tip) 1.8 mm, width 1.75 mm, exorbital width 7.6 mm, right cheliped 31.6 mm, merus 11.2 mm, manus 17.2 mm, dactyl 8.8 mm, height of palm 9.7 mm.

Color in life: Carapace light cinnamon with a large purplish brown spot on each side, between gastric and cardiac regions; a few scattered maroon spots. Chelipeds dark pinkish cinnamon fading on fingers to cream color. Ambulatory legs pale Rosellin purple, fading on dactyls to cream buff. Ventral side pale gray with orange hue; last segment of abdomen spotted red-purple. (Petersen, of a female from Taboga Island, Panama)

Habitat: Dredged three times on sand bottom with shell, coralline, or nullipore also present, once on mud and sand bottom, and once on coralline bottom.

Depth: 2-25 fathoms.

Size and sex: Males 7.5 to 18.6 mm, females — to 25.7 mm (smaller female not found).

Breeding: None of the females was ovigerous.

Remarks: While examining the extensive series of specimens initially referred to *Parthenope (Pseudolambrus) excavata* it became apparent that two species, rather than one, were represented. Originally made on the basis of the striking difference in the male pleopods (compare figs. 5 and 6 of Plate Z₂), the separation was supported by external morphological characters as well. The larger part of the series, therefore, was withdrawn from Stimpson's species and is described herewith.

***Parthenope (Pseudolambrus) stimpsoni*, new species**

Plate Z, Figs. 1-6; Plate Z₂, Figs. 6, 6a

Type: Male holotype, Cat. No. 100919, and female allotype, Cat. No. 100920, U. S. National Museum, from Secas Islands, Panama, 12 fathoms, February 5, 1935, *Velero III*, station 448-35. For additional material see below.

Measurements: Male holotype: length 16.4 mm, width 18.6 mm, rostrum 1.7 mm, width 3.0 mm, cheliped (right, major) 31.6 mm, merus 9.8 mm, manus 15.8 mm, dactylus 8.3 mm, height of palm 8.2 mm. Female allotype: length 16.0 mm, width 19.0 mm.

Diagnosis: Lateral margins broadly arcuate. Angle of deflection of rostrum less than 90° . Dorsal tubercles prominent, erect, interspaces not deeply excavate. Chelipeds convex above, surface between crests tuberculate. Three paired sternal spines obsolescent. Ambulatory legs not conspicuously crested. Male first pleopod truncate, a tuft of long golden hairs terminally crossing midline to mesh with those of opposite pair.

Description: Carapace broader than long, dorsum of irregular relief with high tubercles and shallow depressions alternating. Anterolateral margins continuous with posterolateral, together forming a broad arc terminating in a strong spine at the end of the branchial ridge. Front triangular, minutely tridentate, and moderately deflexed, the angle formed with the general gastrocardiac level being somewhat less than a right angle. Two thickened supraorbital ridges separated by a shallow median sulcus. Gastric region high, surmounted by an anterior pair of tubercles and a smaller posterior median tubercle. Cardiac region consisting of a single raised tubercle well isolated from gastric and branchial regions by depressed areas similar to those of *P. (P.) excavata* but not so deep and appearing to be more nearly confluent with one another anteriorly as well as extending posteriorly to the margins of the carapace. Branchial regions high, swollen, separated anteriorly from hepatic regions by an oblique groove and posteriorly from the postlateral spine by a slight sulcus, each bearing a posterior tubercle in addition to the postlateral spine. Hepatic region with a subacute tooth, the outer margin making a near right angle with the anterior branchial margin and together with it outlining a depressed area second only to that of the dorsal portion of the carapace in size. Posterior margins small toothed except for a slightly larger tooth closer to the postlateral spine than to the midline. (*P. (P.) excavata* has two, equally spaced.)

Basal article of antennules broad, anteriorly rimmed. First free antennal segment lodged in orbital hiatus. External maxillipeds granulate and tuberculate, merus broadly produced at outer angle to conceal end of exognath, interiorly notched to receive 3-jointed palpus, the first article of palpus compressed in a plane nearly perpendicular to that of the merus. Sternum smooth and almost devoid of tubercles anteriorly; posterior to the chelipeds the three spines in a row noticeable in *P. (P.) excavata* present as inconspicuous tubercles.

Chelipeds longer than those of *P. (P.) excavata*, yet compatible with the subgenus. Merus with three tuberculate spines on inner and three on outer margins, between the former accessory spines, three berried tubercles, the distal the largest, in an oblique row. Carpus irregularly

tuberculate, uncrested, the chief prominence at the internal angle. Merus elongate, outer margin with two, inner margin with six tuberculate teeth, intervening surface convex rather than concave, and bearing two or more tubercles in a linear row nearer the outer than the inner margin, and often a second row of flattened granules. Palms completely roughened with rows of low berried tubercles, the second from the superior border best developed. Fingers massive, granulate, tapering abruptly to sharp, recurved tips, dactyl serrate, pollex deflexed, two larger basal teeth. Chelipeds (right and left) characteristically of different size in specimens examined.

Male abdomen 7-segmented, segment 2 trituberculate, segments 3-5 fused, each bearing a transverse ridge to which sediment clings, segment 6 with a sharp spine. Male first pleopod cylindrical, sinuous, not tapering, tip truncate; a row of about a dozen stout setae on prominent lip of groove proximally, another row on convex margin; a tuft of longer setae terminally and on concave margin. Male second pleopod about three-fifths as long as first, similarly bent, a double row of denticles on concave margin of corneous tip. (See Plate Z₂, fig. 6)

Material examined: 26 specimens from 12 stations. (See Table 98) From Isabel Island, Gulf of California, Mexico, to Gorgona Island, Colombia.

Color in life: Carapace dark Eugenia red, tip of rostrum white. Eyestalks white with touch of red, eye dark brownish yellow. Cheliped lighter than carapace, fingers light pinkish cinnamon, tips cadmium orange. Ambulatory legs same as carapace but lighter, fading to cadmium orange at mid-propodus. Ventral side creamish white with Eugenia red on distal portion of maxilliped and on pterygostomian region and a few red dots on abdomen. (Petersen, of a specimen from Isabel Island, Mexico)

Habitat: Most frequently dredged on rock bottom, but with sand, mud, coral, nullipore, or shell secondarily present; less frequently dredged on sand, with shell or nullipore present; twice dredged on coralline bottom.

Depth: 2-30 fathoms.

Size and sex: Males in the present series are from 6.8 to 16.4 mm, females from 5.5 to 16.0 mm, ovigerous females from 11.0 to 14.4 mm.

Breeding: Ovigerous females were taken in Costa Rican waters in late February, and at Tres Marias Islands, Mexico, in early May.

Remarks: The affinities of the proposed new species are with *Parthenope* (*Pseudolambrus*) *excavata* Stimpson, to which it has been com-

pared in the description above. Decidedly, *P. (P.) simpsoni* is not a crested species, the margins of the chelipeds and of the walking legs being thickened rather than compressed. Individual teeth on the new species appear as if inflated rather than as if hammered out as in *P. (P.) excavata*. Some difference in basic proportion is also evident, particularly in the cheliped, the individual segments of which appear to be longer and narrower than in *P. (P.) excavata*. The totally different male first pleopod is perhaps the most striking character separating the two species. It was while examining the male copulatory appendages that the species was recognized as new.

Genus **THYROLAMBRUS** Rathbun

Thyrolambrus Rathbun, 1894b, p. 83; 1925, p. 531. Balss, 1935, p. 128.

Parthenomerus Alcock, 1895, p. 280; type: *P. efflorescens* Alcock, 1895, by monotypy.

Parthenopoides Miers, 1879c (part), in Bouvier, 1915, p. 52. Flipse, 1930, p. 85.

Type: The Atlantic *Thyrolambrus astroides* Rathbun, 1894, type of *Thyrolambrus* Rathbun by monotypy.

Description: Carapace broader than long, deeply eroded. Frontal and anterolateral regions strongly deflexed. Surface covered with irregular pits. Basal [segment] of antenna elongate, reaching or nearly reaching level of inferior orbital hiatus. Maxillipeds broad, fitting close together and filling the buccal cavity; ischium subrectangular posteriorly, inner anterior angle produced; merus broader than long, first [segment] of palpus fitting transversely a slight notch at anterointernal angle; remainder of palpus concealed by merus. Chelipeds of moderate length; manus less stout than merus and armed on inner side with two rows of spines or long tubercles continued on the fingers. (Rathbun, 1925, modified)

According to Balss (1935, p. 128): "The type of the subgenus *Parthenopoides* Miers (1879c, p. 672) is *Lambrus massena* Roux, which, however, belongs to the subgenus *Pseudolambrus* Paulson 1875, which was founded four years previously. *Parthenopoides* accordingly becomes a synonym of *Pseudolambrus* and can not, as Bouvier would have it, be used, according to the international rules of nomenclature, for other species. Bouvier's two species *Parthenopoides erosus* Miers and *P. cariei* Bouvier therefore belong to the genus *Thyrolambrus* Rathbun." Since the name *Thyrolambrus erosus* (Miers, 1879) had priority over *T.*

erosus Rathbun (1898), Balss also proposed a new name, *T. rathbunae*, for the latter species. Unfortunately, the name that he proposed is also unavailable, having been used previously, with but a difference in termination due solely to gender, by De Man (1903). It therefore becomes necessary to propose still another name for the Rathbun species.

Range: Eastern Pacific from Magdalena Bay, Lower California, and San Marcos Island, Gulf of California, Mexico, to Esmeraldas, Ecuador; Clarion Island, Mexico. Western Atlantic off Havana, Cuba. Indian Ocean: Mauritius, Andaman Sea, western Australia.

***Thyrolambrus glasselli*, new name**

Plate Z_a, Figs. 8, 8a; Plate 51, Fig. 1

Thyrolambrus erosus, Rathbun, 1898, p. 579, p. 42, fig. 1; 1925, p. 533, pl. 197; pl. 281, fig. 2. Garth, 1948, p. 31. Not *T. erosus* (Miers), 1879 (*Parthenopoides*).

Parthenope erosa, Flipse, 1930, p. 12, footnote; p. 85.

Thyrolambrus rathbunae Balss, 1935, p. 128 (name substituted for *T. erosus*, preoccupied). Not *T. rathbuni* De Man (1903).

Type: Female (of 2 males, 2 females) holotype; U.S.N.M. No. 21577; length 18.4 mm, width 25 mm, cheliped 29.3 mm.

Type locality: Off Cape San Lucas, Lower California, Mexico, 31 fathoms, *Albatross* station 2829.

Localities subsequently reported, with collectors: Gulf of California, Mexico: San Lorenzo Channel, 8 fathoms, and off Ceralbo Island, 10 fathoms, *Albatross* (Rathbun, 1898). Ecuador: off Esmeraldas, 9-27 m, *Askoy* (Garth).

Atlantic analogue: *Thyrolambrus astroides* Rathbun.

Diagnosis: Margins of carapace thick; hepatic and branchial regions swollen, prominent. Merus of cheliped short, inflated; manus with six triangular, acute teeth on lower border; middle tooth of upper margin largest; fingers short and stout. Resemblance to coralline algae striking. Male first pleopod cylindrical, strongly bent in terminal fourth, tapering abruptly beyond, flaring again before emarginate tip; a double row of stout setae on lip of groove, scattered short setae elsewhere. Male second pleopod about three-fourths as long as first, base swollen, tip short, blunt, with a denticulate concavity.

Description: Carapace about three-fourths as long as wide, pentagonal in outline, slightly wider at posterolateral than at anterolateral angles; lateral and posterior margins thick and lobate, the posterolateral margin nearly transverse and furnished with seven unequal lobes; antero-

lateral angle strongly obtuse, margin sub-entire, hepatic region rounded, prominent. Larger depressions as follows: a deep hollow between orbits continued backward as a shallow sulcus on the mesogastric region, a deep depression at each inner branchial angle, and a less profound linear furrow on either side of the small, isolated cardiac region. Between these depressions the reticulating ridges smooth, consisting of rounded tubercles covered with depressed granules. Rostrum rounded in dorsal view, produced downward at the middle as a smaller lobe approximating the inter-antennular septum. Orbits small, circular. Anterointernal angle of basal antennal article not reaching front. A row of six or seven acute tubercles on endognath of external maxilliped, the posterior tubercle much the largest. Sternum without a large spine at base of cheliped, and in the male deeply hollowed in front of abdomen.

Protuberances of cheliped, except those of dactylus, rounded lobes or tubercles. Arm short and stout proximally; the largest tubercles the one near distal end of outer-upper border, and one near proximal end of inner-lower border. Of the tubercles on the manus, the middle one of the upper row by far the largest. Fingers short, stout, curving inward, and gaping in the large cheliped; dactylus armed on inner surface with three or four small spines or sharp-pointed tubercles. Lower border of propodus armed with six triangular, acute teeth. Legs with surface only slightly rough save on dactylus; marginal prominences either lobes or tubercles except on lower edge of propodus and on dactylus, there sharp denticles. (Rathbun, modified and revised to eliminate the comparative references to *Thyrolambrus astroides*)

The sternal pit, not mentioned in the original description, but clearly shown in Rathbun's figure of a male specimen (1925, pl. 197, fig. 2), is often present in the female, concealed by the more extensive abdomen, as a double pit or series of small pits.

Material examined: 38 specimens from 22 stations. (See Table 99) From Magdalena Bay, Lower California, and E of San Marcos Island, Gulf of California, Mexico, to Gorgona Island, Colombia, including Clarion Island of the Revilla Gigedo Islands.

Measurements: Largest specimen, female: length 15.9 mm, branchial width 20.7 mm, hepatic width 14.3 mm, exorbital width 5.9 mm, cheliped 21.3 mm, merus 6.3 mm, manus 9.8 mm, dactylus 5.4 mm, height of palm 5.4 mm. Male specimen: length 14.1 mm, branchial width 18.9 mm, hepatic width 11.6 mm, exorbital width 5.8 mm, cheliped 28.7 mm, merus 8.3 mm, manus 13.4 mm, dactylus 6.7 mm, height of palm 8.1 mm.

Color in life: Not recorded.

Habitat: Of the 21 stations from which *Thyrolambrus glasselli* was obtained by dredging, 10 were sand bottom, with shell, nullipore, and coral present in two each; 3 were rock, with nullipore present in 2; 3 were coral, with sand present in 2; 2 were shell, with nullipore in one; and one each were coralline, algae (weed), or nullipore alone. The species was never taken on mud bottom.

Depth: 2-35 fathoms, with one shore record from a reef.

Size and sex: Males are from 5.5 to 14.1 mm, females from 7.4 to 15.9 mm. An 8.0 mm female is ovigerous.

Breeding: The single ovigerous female was obtained at Clarion Island, Mexico, in early June.

Remarks: Although the *Askoy* record (Garth, 1948) from off Esmeraldas, Ecuador, is the southernmost for the species, *Velero III* collections extend the range north from the vicinity of La Paz Bay to San Marcos Island in the Gulf of California and fill in the tremendous gap between Cape San Lucas and Ecuador with records from the mainland of Mexico, Costa Rica, Panama, and Colombia. A portion of a cheliped from Cocos Island, Costa Rica, station 108-33, is tentatively referred to this species, which, while found at Clarion, was not encountered in the Galapagos Islands.

That the name *Thyrolambrus rathbuni* De Man (1903) should be changed to *T. rathbunae* in accordance with the recommendations of the Fourteenth International Congress of Zoology (Copenhagen Decisions, 1953) is apparent from the author's statement of intent: "Diese niedliche, kleine Krabbe, welche ich mir erlaube der eifrigen, amerikanischen Carcinologin, Miss Mary J. Rathbun in Washington zu widmen . . ." This emendation, effected herewith, makes *T. rathbunae* Balss (1935) a junior homonym of De Man's species, and as such it cannot be used for the species described as *T. erosus* Rathbun (1898). Informed of the circumstances, Dr. Balss has generously left the choice of a new name to the writer, who takes pleasure in naming it for the late Steve A. Glassell, whose perceptiveness in separating from a mixed series of *T. glasselli* a then unknown parthenopid made possible the description of the following species of *Daldorfa*.

Genus **DALDORFIA** Rathbun

Parthenope Fabricius, 1798, p. 352. Miers, 1879c, p. 668. Alcock, 1895, p. 279. Flipse, 1930, p. 57. Not *Parthenope* Weber, 1795.

Daldorfia Rathbun, 1904b, p. 171 (name substituted for *Parthenope* Fabricius, preoccupied). Garth, 1946, p. 412.

Type: The Indo-Pacific *Cancer horridus* Linnaeus, 1758, type of *Parthenope* Fabricius (not Weber) by subsequent designation of Milne Edwards (1837).

Description: Sharply separated from *Lambrus* [*Parthenope* Weber, 1795] through the strong development of the basal article of the antenna, almost completely separating the basal segment of the antennule from the orbital hiatus. A complete separation found in [*Thyrolambrus*] and *Oethra*. Carapace very rough, but little pitted. Rostrum very short and bent off vertically. Legs spiny. (Flipse)

Range: Eastern Pacific from Cape San Lucas, Lower California, Mexico, to Octavia Bay, Colombia; Galapagos Islands. Eastern Atlantic at Cape Verde Islands. Indo-Pacific from Red Sea to Japan and east to Hawaii.

Daldorfia garthi Glassell

Plate Z₂, Figs. 7, 7a; Plate 51, Fig. 2

Parthenope (*Pseudolambrus*) *excavata*, Boone, 1927, p. 173, fig. 58.

Not *Lambrus excavatus* Stimpson.

Daldorfia garthi Glassell, 1940, p. 67, pl. 17, figs. 1-11. Garth, 1946, p. 412, pl. 55, figs. 1-11; Crane, 1947, p. 74.

Type: Male holotype, A.H.F. No. 3811, length 31 mm, width 47 mm, merus of cheliped 29 mm.

Type locality: Sullivan Bay, James Island, Galapagos Islands; *Velero III* station 796-38.

Localities subsequently reported, with collectors: Mexico: Cape San Lucas, Lower California (Glassell). Costa Rica: Port Parker, *Zaca* (Crane). Nicaragua: off Nicaragua, *Stranger* (Glassell). Galapagos Islands, Ecuador: James Island and Charles Island, *Velero III* (Glassell).

Atlantic analogue: None. Relationships are with the Indo-Pacific fauna.

Diagnosis: Carapace triangular, deeply eroded, anterolateral margins spined, posterolateral margins straight. Meri of ambulatory legs with overlapping teeth, propodi with bidentate lower margins. Chelipeds massive, unequal. A semiovoid sternal pit. (Garth, 1946) Male first pleopod

cylindrical, coiled, scarcely tapering, groove open throughout most of length; a double row of stout setae at lip of groove basally, surface elsewhere with scattered short setae. Male second pleopod of a length greater than the first; corneous tip greatly elongated, its concave surface channeled.

Description: Carapace subtriangular, about five-eighths as long as wide, rostrum bluntly rounded and deflexed. Protogastric regions high, median sulcus eroded; mesogastric region less high, semiconical posteriorly, a wide deep pit on each side. . . . Cardiac region depressed, outlined with erosions and mushroomlike tubercles. Posterior border eroded, a depressed tooth on each side of first abdominal segment. Ridge joining frontal and branchial regions with two closed sutures. Hepatic region obliquely vertical, projecting downward in a broadly triangular lobe. Anterolateral margin with eleven or twelve granulated, serrate-edged teeth, those on the posterior half largest. Posterolateral margins tangent to anterolateral, teeth similar but interlaced and coalesced to form a subentire line.

Chelipeds about twice the length of carapace; merus roughly trigonous, three quarters the length of carapace, upper surface depressed, punctate, and lobed, inner margin with three or four granulate lobes, outer proximal margin with three or four eroded spines, a small median lobe and a larger subdistal lobe; carpus with two or three inner marginal lobes, outer surface lumpy; manus subequal in length to carapace, triangular in cross section, three large lobes on upper, inner margin, the median largest and projecting over palm, distal upper end of hand raised and lumpy, outer surface of palm with four longitudinal rows of granulous lobes, the upper two rows largest, the remaining rows smaller and extending onto the pollex. Pollex on major hand deflexed, short, stout, tip subbifid, unarmed, inner edge forming a right angle within gape; dactyl granulous, slightly curved, and armed with three inner lobes, the proximal largest; fingers widely gaping. Pollex of minor hand subhorizontal, outer surface tuberculate, subtriangular from base to apex, cutting edge sharp and denticulate; dactyl nearly straight on prehensile margin, an upper proximal granulous lobe, outer surface tuberculous and eroded, fingers not gaping.

Outer maxillipeds eroded and tuberculate, with longitudinal sulci, distal anterior margin of merus produced. Sternal pit semioval in male, the abdomen not intruding; sternal pit in female more circular, a continuation of sternal trench, entered by bent tip of abdomen. Sternum eroded and granulate.

Ambulatory legs with meri compressed, the teeth on upper crest partly overlapping, leaving interstices between, lower surface excavate between sutured side margins; carpus crested; propodus with two projections on posterior margin; dactyli slightly curved and granulous to corneous tips.

Abdomen in both sexes seven-segmented, deeply eroded with a regular pattern, the third segment widest, the sixth longest. (Glassell, condensed)

Material examined: 9 specimens, plus fragments of a 10th, from 7 mainland stations. (See Table 100) From Playa Blanca, Costa Rica, to Octavia Bay, Colombia. In addition, 1 male specimen from Tower Island, Galapagos Islands, station 782-38, shore, January 16, 1938, not previously reported. For an additional 11 specimens from 4 Galapagos stations see Garth (1946, p. 412).

Measurements: Male holotype: length 31.2 mm, width 48.6 mm, exorbital width 10.5 mm, cheliped 70 mm, merus 23.7 mm, manus 37.7 mm, dactylus 16.5 mm, height of palm 20.0 mm. Female paratype: length 29.3 mm, width 45.4 mm, exorbital width 10.5 mm, cheliped 52 mm, merus 16.9 mm, manus 30.0 mm, dactylus 13.0 mm, height of palm 16.8 mm.

Color in life: Not recorded.

Habitat: Under rocks at extreme low tide. (Garth, 1946, of Galapagos specimens) The Octavia Bay specimen was obtained from coral.

Depth: Shore to 12 fathoms. (Glassell) Three of the 7 mainland stations were dredge stations.

Size and sex: Males in the mainland series are from 10.0 to 25.1 mm, females from 8.2 to 18.2 mm, ovigerous female 18.2 mm.

Breeding: The single ovigerous female was encountered in Colombia in late January.

Remarks: Omitted from the list of material examined are specimens from Cape San Lucas and from Nicaragua in the collection of the late Steve A. Glassell, as well as additional specimens from stations listed in the original description that were retained by him. These were seen at one time by the writer, but are not now available for purposes of measurement, comparison, and analysis. Measurements of holotype and female paratype above do not agree in entirety with those published in the original description, probably because of differences in methods used by Glassell and by the writer. They are consistent with other measurements given in this volume.

This large and striking species is the American representative of a genus represented in the Indo-Pacific region by *Daldorfia semicircularis* (Flipse) and *D. horrida* (Linnaeus). The latter species occurs as far eastward as Hawaii (Edmondson) and has been reported recently from Japan (Sakai). It is most likely to be confused among Pacific American species with *Thyrolambrus glasselli* Garth (= *T. erosus* Rathbun), from which it may be distinguished by the ham-shaped merus of the cheliped, the cristate chelae, the presence of a sternal pit in the female, the denticulate anterolateral margins, and the "eyed" margins of the ambulatory legs.

Genus SOLENOLAMBRUS Stimpson

Solenolambrus Stimpson, 1871b, p. 132. Rathbun, 1925, p. 534.

Pisolanbrus A. Milne Edwards, 1878, p. 157; type: *P. nitidus* A. Milne Edwards, 1878 = *Solenolambrus tenellus* Stimpson, 1871, by monotypy.

Type species: The Atlantic *Solenolambrus typicus* Stimpson, 1871, type of *Solenolambrus* Stimpson by original indication.

Description: Carapace pentagonal, and more or less broader than long. Posterior side of the pentagon much the shortest, the other four sides about equal. Margin acute on all sides, forming a slight crest. Upper surface naked, glossy, strongly convex, and bearing four protuberances, one gastric, one cardiac, and two branchial. Gastric and cardiac protuberances more or less triangularly pyramidal, and branchial protuberance armed with an acute ridge, running obliquely to the posterolateral margin of the carapace. Frontal region slightly convex, and no protuberance on the orbital region. Rostrum short and blunt, or faintly tridentate. Orbits round, with the upper margins entire and smooth. Basal [article] of the external antennae about as long as the next [article]. . . . Epistome concave. From the anteroexternal angle of the buccal area a sharp, elevated, crenulated ridge extending to the outer base of the cheliped, separating the pterygostomian from the subhepatic region, the latter also concave and channel-like. When retracted, the extremity of the hand of the cheliped covering the pterygostomian region, forming the afferent passage. External maxillipeds fitting accurately the buccal area, and closely against each other within, and the exognath concave, forming part of the wall of the afferent channel, this channel defined within by a slight, elevated ridge on the outer side of the ischium of the endognath; merus with a prominent anteroexternal angle,

and its surface concave toward the anterointerior angle, no notch for the insertion of the palpus; palpus, except at its origin, concealed beneath the other [segments] of the endognath.

Chelipeds resembling those of [*Parthenope*], except with the fingers very small, and the dactylus generally at right angles with the palm when retracted. Terminal [segments] of the ambulatory [legs] acuminate.

Third, fourth, and fifth [segments] of the male abdomen [fused]. (Stimpson, modified)

Range: Eastern Pacific from Tepoca Bay, Gulf of California, Mexico, to Santa Elena Bay, Ecuador; Revilla Gigedo Islands; Galapagos Islands. Western Atlantic from off Cape St. George, west coast of Florida, to Barbados; Panama. In the Pacific, 1.5 to 60 fathoms; in the Atlantic to 338 fathoms.

Solenolambrus arcuatus Stimpson

Plate Z, Figs. 9, 9a; Plate 52, Fig. 1

Solenolambrus arcuatus Stimpson, 1871a, p. 101. A. Milne Edwards, 1878, p. 162. Rathbun, 1910a, p. 576; 1925, p. 538. Finnegan, 1931, p. 625. Garth, 1946, p. 413, pl. 69, figs. 3, 4; 1948, p. 31.

?*Solenolambrus typicus*, Cano, 1889, pp. 102, 187. Not *S. typicus* Stimpson.

Type: Female holotype, length 10.2 mm, width 13.2 mm, merus of cheliped 7.9 mm, length of hand 9.4 mm; not extant.

Type locality: Panama, Capt. J. M. Dow, collector.

Localities subsequently reported, with collectors: Panama: Panama, *Vettor Pisani* (Cano, as *Solenolambrus typicus*); St. Elmo Bay [Bahia Santelmo], Isla del Rey, Perlas Islands, 6-9 fathoms, *St. George* (Finnegan) and 11-14 m, *Askoy* (Garth, 1948). Colombia: Málaga Bay, 4-9 m, *Askoy* (Garth, 1948). Ecuador: Hood and Albemarle Islands, Galapagos Islands, 10-60 fathoms, *Velero III* (Garth, 1946); Cape Pasado, 18 m, *Askoy* (Garth, 1948).

Atlantic analogue: *Solenolambrus typicus* Stimpson.

Diagnosis: Two erect prominences on midline of carapace, one cardiac, one gastric; a smaller tooth at mid-point of branchial ridge. Superior crests of manus 9-toothed, surface between crests smooth; retracted dactyl at right angles with palm. Sternum between chelipeds smooth, concave. Male first pleopod short, thick, thigh-shaped; groove open basally, lip of groove produced, plumosely setose, a dense covering of

plumose setae elsewhere. Male second pleopod three-fourths as long as first, tapering, tip corneous, concavity denticulate.

Description: Carapace short and broad, with projecting lateral angles. Surface punctate, much more finely than in *Solenolambrus typicus*. Anterolateral margin long and convex, armed with eleven scarcely projecting, tridenticulate teeth, the middle ones broadest. The two anterolateral margins together forming a regular arc [except] for the projection of the rostrum. The posterolateral margin concave, [and] the posterior margin short and slightly convex. Protuberances of carapace like those of *S. typicus*, but stronger, their ridges crenulated. Gastric and cardiac protuberances very tall, with strongly projecting apices, almost spini-form but not acuminate. Ridge of branchial region convex forward and crenulated, with a larger toothlet at the middle. Basal [article] of the external antennae shorter than the next [article]. Eyes very small. Afferent and subhepatic channels very deep, the ridge separating them being prominent and very thin and sharp. No supplementary ridge on the subhepatic region. External maxillipeds with hairy margins, and with a tubercle near the inner summit of the ischium; anteroexternal angle of the merus less acute and prominent than in *S. typicus*; merus with three or four strong tubercles on the external oblique ridge. Sternum between the chelipeds concave, without tubercles.

Chelipeds rather short; merus seven-toothed before and behind; carpus with five denticulated crests; hand with nine strong, subspini-form teeth on the superior crest and the same number of tuberculiform teeth on the outer and the inner edge of the lower surface; on the inner edge the teeth minute toward the base, but large on the outer half of the hand. Surface of the hand between the toothed crests smooth; the inferior surface and the interstices of the teeth of all three of the crests pubescent. Hand expanded in width at the distal extremity, and the dactylus when retracted exactly at right angles with the palm. Ambulatory [legs] compressed, glabrous; meri with acute, sparsely ciliated superior edge; merus of the posterior pair obtuse below, without crest.

Abdomen smooth. (Stimpson, modified)

Material examined: 151 specimens from 42 stations. (See Table 101) From Tepoca Bay, Gulf of California, Mexico, to Santa Elena Bay, Ecuador, including Socorro Island of the Revilla Gigedo Islands. In addition to the above, 5 specimens from 4 Galapagos Islands stations (Garth, 1946).

Measurements: Largest specimen, female: length 11.2 mm, width 14.6 mm, rostrum 0.6 mm, width 1.6 mm, cheliped 22.7 mm, merus 8.8

mm, manus 11.5 mm, dactylus 3.1 mm, height of palm 4.4 mm. Male specimen: length 10.7 mm, width 13.7 mm, rostrum 0.7 mm, width 1.8 mm, cheliped 23.8 mm, merus 9.3 mm, manus 12.0 mm, dactylus 3.1 mm, height of palm 4.1 mm.

Color in life: For the description of a specimen from Isabel Island, Mexico, see Garth (1946, p. 413).

Habitat: Sand bottom in 21 of 40 dredge stations, with shell present in 7 and coralline, weed, or nullipore represented in 3 more; mud bottom in 10 stations, with sand present in 6 and shell in 2 more; rock bottom in 3 stations, with mud or shell present in 2; coralline in 3 stations, with nullipore in one; shell in 2 stations, with sand in one; and coral in a single station.

Depth: 1.5 to 30 fathoms. In the Galapagos, to 60 fathoms. (Garth, 1946)

Size and sex: Males 4.9 to 10.7 mm, females 4.7 to 11.2 mm, ovigerous females 8.9 to 10.3 mm, young from 3.5 mm. Specimens from Colombia and Ecuador tend to run small; specimens from the Gulf of California and Mexico tend to run large; however, minimum length of ovigerous females from the two extremes of range differs by only 0.1 mm.

Breeding: Ovigerous females were encountered by the *Velero III* at Socorro Island, Mexico, and at Salango Island, Ecuador, in January, off Costa Rica and Panama in February, off Costa Rica and in the Gulf of California in March, and in the Bay of Panama in May.

Remarks: In view of the exceeding abundance of *Solenolambrus arcuatus*, and the great variety of habitats in which it has been taken, not only by the *Velero III* but by the *St. George* and the *Askoy* as well, it seems incredible that Rathbun did not have a single specimen with which to illustrate the species as recently as 1925. Specimens sent to her for identification prior to 1937 were returned as either *Mesorhoea belli* (A. Milne Edwards) or *Solenolambrus typicus* (Stimpson), the Atlantic species. The range of *S. arcuatus* has been extended by the *Velero III* from Panama to Tepoca Bay, Sonora, Mexico, on the north, and from Cape Pasado, where it was taken by the *Askoy*, south to Cape Santa Elena, Ecuador. The insular localities of Socorro and Galapagos Islands have been added.

Genus **LEIOLAMBRUS** A. Milne Edwards

Leiolambrus A. Milne Edwards, 1878, p. 148. Rathbun, 1925, p. 543.

Type: Parthenope punctatissima Owen [by error *spinosissima*], by original designation.

Description: Carapace smooth as that of *Solenolambrus*, but gastric and cardiac regions not elevated in form of a pyramid. Exognath of the external maxillipeds presenting on the outside a border of serrate hairs covering the afferent channel of the branchial chamber. Fingers of the chelae larger than those of *Solenolambrus*. (A. Milne Edwards, modified)

Carapace hexagonal, considerably broader than long, with a strong spine near middle of its lateral margin. Surface depressed, smooth, or nearly so, with three low longitudinal elevations, one median, the others branchial. Front subtruncate, with a minute median point. Orbits with a closed fissure above, a large V-shaped fissure below toward outside, and an inner hiatus lodging the antenna. Basal [article] of antenna very small. Antennules folding almost longitudinally. Buccal frame narrowing a little forward, loosely covered by external maxillipeds; these last having an anteriorly tapering ischium, a merus with a semicircular anteroexternal outline, anterointernal angle rectangularly notched; merus and ischium of the endognath bordered with long hairs forming a ventral covering to the afferent channels of the branchiae; exognath concealed above endognath.

Chelipeds very long, trigonal, somewhat subequal; marginal teeth small and numerous. The fingers gaping on the larger claw. First pair of ambulatory legs the shortest. (Rathbun, modified)

Range: Eastern Pacific from Pt. Tosco, Lower California, and Guaymas, Gulf of California, Mexico, to Salango Island, Ecuador. Western Atlantic from Jamaica and Puerto Rico. 12-45 fathoms.

Leiolambrus punctatissimus (Owen)

Plate Z₈, Figs. 10, 10a; Plate 52, Fig. 2

Parthenope punctatissima Owen, 1839, p. 81, pl. 24, fig. 4. Stimpson, 1857b, p. 458.

Parthenope (Lambrus) punctatissima, Lockington, 1877c, p. 78.

Leiolambrus punctatissima, A. Milne Edwards, 1878, p. 148 [*"spinosissima,"* by error], p. 159.

Leiolambrus punctatissimus, Holmes, 1900, p. 46. Rathbun, 1925, p. 543, pl. 198, text-fig. 149. Finnegan, 1931, p. 626. Garth, 1948, p. 32.

Type: Male holotype, length 12.7 mm, width 14.8 mm, not extant.

Type locality: Coast of California; Lieut. Belcher, collector. In all probability, Lower California, as presently recognized. (See *Remarks* below.)

Localities subsequently reported, with collectors: "California" (Copenhagen Museum), (Rathbun, 1925). Gulf of California: Mexico: off Guaymas, 20 fathoms, *Albatross* (Holmes, 1900), and off La Paz Bay, 26.5 fathoms, *Albatross* (Rathbun, 1925). Colombia: Solano Bay, 36-54 m, *Askoy* (Garth); Gorgona Island, 20 fathoms, *St. George* (Finnegan). Ecuador: off Esmeraldas, 36-54 m, *Askoy* (Garth).

Atlantic analogue: *Leiolambrus nitidus* Rathbun.

Diagnosis: Carapace smooth and convex dorsally; gastro-cardiac and branchial areas linear, separated by a longitudinal sulcus. Two pairs of posterior marginal teeth; margins between outer pair and lateral teeth concave; lateral teeth longest. Margins of manus denticulate, hairy; dactyls directed along same axis. Male first pleopod slender, cylindrical, straight, open basally, deeply emarginate distally, a row of setae on lip of groove; other setae in linear rows and in clusters, especially about tip. Male second pleopod only half the length of first, base bulbous, tip bluntly pointed, subterminally denticulate.

Description: Carapace smooth, convex, minutely punctate, the median and cardiac regions forming a nearly continuous longitudinal elevation, bounded on either side by a conspicuous, longitudinal depression. Front truncated, having a small, median tooth, behind this the upper surface marked with a short, longitudinal groove. Postorbital angle acute. Anterolateral margins long, slightly arcuated, and furnished with teeth becoming very small toward the anterior end. Sides of the carapace produced into a prominent, triangular tooth. Two teeth on the posterior margin near the middle line; external to these a pair of larger marginal teeth; the margins between the external pair and the lateral angles of the carapace concave. The whole posterior margin of the carapace marked with a delicate, raised, jagged line; another fine raised line running upon the branchial regions from the external tooth of the posterior margin. Maxillipeds smooth, the ischium slightly narrowed distally, the anterointernal angle produced forward into a rounded lobe; merus broadly rounded at the anteroexternal angle and produced below the articulation of the palp.

Chelipeds [long]; merus with the angles denticulated, the anterior edge bearing several rough teeth; carpus with the angles denticulated, the outer margin acute and dentate; hand longer than the merus, the margins denticulated, the upper margin upturned near the end; pollex nearly longitudinal and almost straight, the inner margin dentate; dactyl curved and provided on the external portion of the base with two converging, denticulated ridges meeting and forming a crest on the distal portion. Ambulatory legs smooth, compressed, and subequal in length; dactyls slender, lanceolate, longer than the propodi, and flattened in a plane at right angles to that of the preceding [articles]. (Holmes, modified, of a specimen from Guaymas, U.S.N.M.)

Transverse elements of the first three segments of the abdomen finely denticulate and produced at the extremities in a tooth. (Rathbun, 1925)

Material examined: 12 specimens from 6 stations, including one Askoy station. (See Table 102) From off Point Tosco, Lower California, Mexico, to Salango Island, Ecuador.

Measurements: Largest specimen, male: length 19.0 mm, width including spines 25.0 mm, rostrum 0.1 mm, width 0.6 mm, cheliped 52.0 mm, merus 21.0 mm, manus 25.0 mm, dactylus 8.4 mm, height of palm 5.7 mm. Female specimen: length 11.3 mm, width including spines 16.2 mm, rostrum 0.1 mm, width 1.8 mm, cheliped 24.9 mm, merus 9.3 mm, manus 12.2 mm, dactylus 4.0 mm, height of palm 3.4 mm.

Color in life: Not recorded.

Habitat: Dredged twice in green mud, once in sand, and once in rock with sand.

Depth: 20-26.5 fathoms. (Garth) 12-45 fathoms.

Size and sex: Males are from 6.5 to 19.0 mm, females from 6.6 to 11.3 mm, young from 4.3 mm.

Breeding: None of the females is ovigerous.

Remarks: With newly established perimeters of range at Point Tosco, Lower California, and Salango Island, Ecuador, *Leiolambrus punctatissimus* takes its rightful place as a tropical American west coast species, as indeed its analogous position with *L. nitidus* of the Caribbean would imply. The type locality, "California," already questioned by Rathbun (1925), becomes extralimital and in all probability, erroneous, with Lower California the most acceptable alternative. Lower California, therefore, may be considered the corrected type locality. The earlier reported Guaymas locality is not inconsistent with this analysis, for while Guaymas, at 27° N latitude, lies considerable north of Pt. Tosco at 24° N, Panamic species are known to advance much farther up the Gulf of California than up the west coast of Lower California.

Genus MESORHOEA Stimpson

Mesorhoea Stimpson, 1871b, p. 135. Rathbun, 1925, p. 546.

Type: The Atlantic *Mesorhoea sexspinosa* Stimpson [by error, *sexpinosa*], 1871, by monotypy.

Description: This genus bearing an almost exact resemblance to *Solenolambrus* in the form and armature of the carapace, the character of the [legs], and that of the pterygostomial and hepatic channels, except for the latter being deeper; differing, however, very importantly in the afferent channels meeting at the middle of the endostome, and having there a triangular projection and a deep notch in its vertical, laminiform wall. Merus of the external maxillipeds acutely produced forward at its internal angle, and behind it the palpus entirely concealed. Epistome very short. Eyes small, and sometimes retracted into their deep sockets so as to be almost entirely concealed. The basal [article] of the external antenna somewhat shorter than the next [article]. (Stimpson, modified)

Range: Eastern Pacific from San Juanico Bay, Lower California, and Georges Island, Gulf of California, Mexico, to off Esmeraldas, Ecuador; Galapagos Islands. Western Atlantic from off Pensacola, Florida, to Flannegan Passage, West Indies; Puerto Rico. 4.5 to 90 fathoms.

Mesorhoea belli (A. Milne Edwards)

Plate Z, Figs. 11, 11a; Plate 54, Fig. 1

Solenolambrus bellii A. Milne Edwards, 1878, p. 163, pl. 29, figs. 6-6d.

Mesorhoea gilli Rathbun, 1893b, p. 235; type locality, Gulf of California; type, U.S.N.M. No. 17370; 1898, p. 581.

Mesorhoea bellii, Rathbun, 1925, p. 548, pl. 201; pl. 280, figs. 1-4.

Crane, 1937, p. 65. Garth, 1946, p. 414, pl. 69, figs. 5, 6; 1948, p. 32.

Type: Female holotype, length 14 mm, width 18 mm, length of manus 13 mm, of merus of cheliped 11 mm; in Paris Museum.

Type locality: Mexico.

Localities subsequently reported, with collectors: Mexico: west coast of Lower California: off Abrejos Point, 48 fathoms, and Magdalena Bay, 12 fathoms, *Albatross* (Rathbun, 1898); Gulf of California: N of Punta San Felipe, 33 fathoms (type locality of *M. gilli* Rathbun), S of Tiburon Island, 29 fathoms, NW of San Pedro Nolasco Island, 71 fathoms, and S of Cabo Haro, outside Guaymas, 20 fathoms, *Albatross* (Rathbun, 1893b); Santa Inez Bay, 18-40 fathoms, *Zaca* (Crane); La Paz Bay, 21 and 26.5 fathoms, and off Ceralbo Island, 9.5-10 fath-

oms, *Albatross* (Rathbun, 1893a, 1898); Arena Bank, 45 fathoms, and San Lucas Bay, 6-20 fathoms, *Zaca* (Crane). Panama: Panama Bay, 51.5 fathoms, *Albatross* (Rathbun, 1898). Ecuador: Daphne Minor, Barrington, and Hood Islands, Galapagos Islands, 9-80 fathoms, *Velero III* (Garth, 1946); off Esmeraldas, 36-54 m, *Askoy* (Garth, 1948).

Atlantic analogue: Mesorhoea sexspinosa Stimpson.

Diagnosis: Four triangular carapace spines: one gastric, one cardiac, and two at the end of each sinuous branchial ridge. A denticle at mid-point of branchial ridge, in advance of this always a cluster of granules. Front short, hairy. A sharp spine at base of cheliped ventrally. A spherical tooth at base of movable finger. Male first pleopod short, stout, cylindrical, constricted before contorted, bifid tip; lip of groove plumosely setose, fine pubescence elsewhere. Male second pleopod three-fourths the length of first, slender, reflexed, tip corneous, acutely pointed; subterminal concavity denticulate.

Description: This species . . . distinguished by the globular form of its carapace, the anterolateral portions swollen instead of depressed. Gastric protuberance little elevated; that of the cardiac region, on the contrary, high and slender. Anterior branchial lobe bearing one or two tubercles, lacking in [*M. sexspinosa*]. Posterolateral angles greatly advanced. Indentations of the anterolateral margin more distinct than usual. Front scarcely surpassing the eyes and continuing the regular curve of the carapace.

Chelipeds strong. Hand armed above with a crest of ten triangular teeth; its external margin and its inferior margin cut into twelve or thirteen tuberculiform teeth. Various surfaces of the hand smooth. Sternum concave in front and devoid of tubercles. (A. Milne Edwards)

Basal antennal [article] with a long trigonal spine below. Ischium of external maxillipeds punctate, outer margin pubescent, inner margin crenulate; merus with surface uneven, pubescent, anterior margin concave; a groove running diagonally forward and outward across the surface; two tubercles on the outside of this groove . . . the inner angle strongly produced and bearing a granular ridge.

Male abdomen with first segment very short; second widest with a transverse denticulate crest, having a larger denticle at the extremities and in the middle; third, fourth, and fifth segments anchylosed; sixth wider than long; seventh very short, triangular. Female abdomen with seven segments; first segment almost concealed under the carapace; second with transverse denticulate crest; third with a similar faint crest not continued to the margins. (Rathbun, 1893a, modified, of *M. gilli*)

Material examined: 54 specimens from 17 stations, including one *Askoy* station. (See Table 103) From San Juanico Bay, Lower California, and off Georges Island, Gulf of California, Mexico, to off Esmeraldas, Ecuador. In addition to the above, 8 specimens from 5 Galapagos Islands stations (Garth, 1946).

Measurements: Largest specimen, female: length 14.9 mm, width 19.6 mm, rostrum 0.2 mm, width 1.5 mm, cheliped 26.6 mm, merus 9.7 mm, manus 15.0 mm, dactylus 4.2 mm, height of palm 6.4 mm. Male specimen: length 13.9 mm, width 18.3 mm, rostrum 0.3 mm, width 1.55 mm, cheliped 24.9 mm, merus 10.0 mm, manus 14.3 mm, dactylus 4.1 mm, height of palm 5.6 mm.

Color in life: Ground color of carapace light ecru drab overcast with light cameo brown, frontal areas and ridges darkest. Eyes speckled dark green and gray. Chelipeds orange yellow with dentations dark red. Ambulatory legs light cream color with touches of orange. Ventral side white. (Petersen, of a specimen from Santa Maria Bay, Lower California) See also Garth (1946, p. 414).

Habitat: In 10 of 15 dredge stations the bottom was sand, with rock, mud, or shell present in one haul each; in 3 stations it was mud, with shell present in one; in one station it was rock; in another it was shell alone.

Depth: 10-40 fathoms; exceptionally to 65 and 90 fathoms.

Size and sex: Males are from 6.5 to 13.9 mm, females from 6.3 to 14.9 mm, ovigerous females 11.0 to 12.2 mm, young from 4.5 mm.

Breeding: Ovigerous females were encountered off Lower California in January, March, and May, and in the Gulf of California in March.

Remarks: The species is definitely larger than *Solenolambrus arcuatus*, the species within its range with which it might most readily be confused. There is a sharp spine at the base of the cheliped ventrally, and a prominent sphere at the base of the dactyl of the manus. Young specimens show a bent branchial ridge, high cardiac and gastric spines, and denticulate margins and ridges.

Genus AETHRA Leach

Aethra Leach, in Latreille, 1816, p. 602. Rathbun, 1925, p. 550.

Oethra Lamarck, 1818, p. 264. Milne Edwards, 1834, p. 370. A. Milne

Edwards, 1878, p. 170. Alcock, 1895, p. 284.

Type: The Indo-Pacific *Cancer scrupeus* Linnaeus, 1764, type of *Aethra* Leach by monotypy.

Description: Carapace oval, embossed, and a little elevated on its periphery. Front little advanced. Eyes very small, lodged in circular orbits. Basal article of the antennae elongated and joined to the front by its internal angle; flagellum small and lodged in the orbital hiatus. Basal article of the antennules broad and almost quadrilateral in form. Buccal cavity narrowed anteriorly, epistome short, and external maxillipeds strongly elongated; their merus truncate anteriorly and outside, presenting no emargination for the insertion of the palpus. Legs, entirely concealable under the margin of the carapace, compressed and having cristiform ridges.

Abdomen of the male divided into five articles; that of the female into seven. (A. Milne Edwards, modified)

Chelipeds about equal in length to the carapace; having . . . sharply prismatic [segments] and large inturned fingers, but concave on the upper surface. (Alcock)

Range: Eastern Pacific at La Paz, Gulf of California, and Mazatlan, Mexico; Galapagos Islands. Indo-Pacific from East Africa to New Caledonia and Fiji Islands; Japan (Sakai).

Aethra scruposa scutata Smith

Plate Z, Figs. 12, 12a; Plate 53

Aethra scutata Smith, 1869b, p. 120; 1869c, p. 230.

Oethra scruposa, var. *scutata*, A. Milne Edwards, 1878, p. 170, pl. 31, fig. 2-2e.

Cryptopodia fornicata, Aurivillius, 1889, p. 60. Not *Cancer fornicatus* Fabricius.

Aethra scruposa scutata, Rathbun, 1925, p. 552, pl. 195. Garth, 1946, p. 415, pl. 70, figs. 1, 2.

Type: Male holotype, length 35.3 mm, width 56.6 mm; in Yale University Museum (Rathbun, 1925).

Type locality: La Paz, Lower California, Mexico; Captain Pedersen, collector.

Localities subsequently reported, with collectors: Mexico: Mazatlan (A. Milne Edwards, Aurivillius). Ecuador: Hood Island and James Island, Galapagos Islands, *Velero III* (Garth).

Atlantic analogue: None. Affinities are with the Indo-Pacific, where *Aethra scruposa* (Linnaeus) occurs. For synonymy and description see Alcock (1895, p. 285).

Diagnosis: Carapace broadly elliptical, front arcuate, lateral margins lamellate, dentate, incised. Chelipeds and walking legs concealed

from dorsal view, crested, and dentate, especially on lower margins. Male first pleopod long, slender, tapering to an acute tip, basally and apically setose. Male second pleopod almost as long as first, corneous extension occupying almost a third of total length, channeled to blunt tip, a sub-terminal projection.

Description: Carapace transversely and regularly elliptical; margins thin, slightly dentate, the denticles separated by broad and very shallow sinuses; posterior margin nearly straight in the middle; anterior margin straight and parallel to the posterior margin for a short space outside the eyes; front projecting horizontally, its margin forming a semicircle; gastric region elevated, with a broad median depression extending to the front; anterior lobe of branchial region large and prominent; the broad space between the branchial region and the anterolateral margin concave; summits of the elevations and a space along the posterior border tuberculous, rest of the upper surface smooth; inferior lateral regions slightly convex and smooth.

Chelipeds fitting closely to the carapace, the angles projecting into dentate crests; outer and inferior surface of the hand coarsely granulate. Ambulatory legs short, the angles projecting into thin, dentate crests. Sternum and abdomen deeply vermiculated. (Smith)

Material examined: None from the American mainland. Four specimens from two Galapagos Islands stations, previously reported (Garth, 1946), constitute the entire Hancock Foundation series.

Measurements: Largest specimen, male: length 63 mm, width 97 mm, cheliped 67 mm, merus 25.4 mm, manus 36.3 mm, dactylus 23.4 mm, height of palm 22.2 mm. Female specimen: length 53 mm, width 85 mm, cheliped 53 mm, merus 20 mm, manus 32.5 mm, dactylus 18 mm, height of palm 18.5 mm.

Color in life: The appearance is that of a much eroded rock encrusted with coralline algae. (Garth, 1946)

Habitat: Beneath rocks at lower low tide. One specimen has serpulids attached.

Depth: Intertidal. Collected with *Daldorfia garthi* Glassell at Sullivan Bay, James Island, Galapagos.

Size and sex: Males are from 47 to 63 mm, females from 39 to 53 mm in length.

Breeding: None of the specimens is ovigerous.

Remarks: The male pleopods figured herewith (see Plate Z₃, fig. 12) further confirm the assignment of this unique genus and species to the Parthenopidae. Pleopod 2 was found to be inserted into pleopod 1

for the greater part of its length and could not be withdrawn without dissection. It is difficult to see how the crab could exert it in life because of the rigidity of the member and its short basal attachment.

Galapagos Islands specimens are quite broad, length to width ratios in males being 1:1.54, in females from 1:1.56 to 1:1.60. In contrast, the male of typical *Aethra scruposa* figured by Sakai (1938, pl. 40, fig. 3) is narrow, having a ratio of only 1:1.50. In this it agrees with the female figured by A. Milne Edwards, on the strength of which specimen that author reduced Smith's *A. scutata* to subspecific rank. The male holotype of *A. scutata*, however, has a length-width ratio of 1:1.60, and is therefore as broad as any of the Galapagos specimens. The ultimate decision as to one species or two should be based on pleopod studies.

Genus CRYPTOPODIA Milne Edwards

Cryptopodia Milne Edwards, 1834, p. 360. Alcock, 1895, p. 281. Rathbun, 1925, p. 553.

Type: The Indo-Pacific *Cancer fornicatus* Fabricius, 1787, by monotypy.

Description: Carapace very broadly triangular, with very large lateral clypeiform vaulted expansions completely concealing the ambulatory legs, and prolonged posteriorly far beyond the base of the abdomen; a large space between the gastric and the cardiac regions triangular and concave. Rostrum nearly horizontal, spatuliform, and very prominent. Pterygostomian regions smooth, not ridged. Orbits very small, nearly circular, with a suture in the superior margin. Epistome well developed; antennular fossae narrow and somewhat oblique. Eyes very small and retractile. Basal antennal [article] slightly dilated and not nearly reaching the internal orbital hiatus, this hiatus filled by the second [article]. Buccal cavity and external maxillipeds small. Ischium of the external maxillipeds not produced at its anterointernal angle; merus distally truncated, with the anteroexternal angle slightly produced, the interior margin notched below the anterointernal angle.

Chelipeds nearly as in [*Parthenope*]; merus having a winglike lobe on the posterior margin near to the distal extremity; palms of the cheliped elongated, tricarinated, and dentated (as in [*Parthenope*]); fingers short. Ambulatory legs slender, decreasing successively but slightly in length, and having the fourth, fifth, and sixth [segments] more or less distinctly carinated; dactyli nearly straight.

Abdomen, in the male, five-[segmented], the third to the fifth segments coalescent. (Alcock, modified)

Range: Eastern Pacific from Santa Maria Bay, Lower California, and Puerto Refugio, Angel de la Guarda Island, Gulf of California, Mexico, to Santa Elena Bay, Ecuador. Western Atlantic from S of Cape San Blas, Florida, to off St. Thomas, West Indies. Indo-Pacific from Red Sea and Persian Gulf to Australia and Japan.

Cryptopodia hassleri Rathbun

Plate 4, Figs. 15, 15a; Plate 54, Fig. 2

Cryptopodia hassleri Rathbun, 1925, p. 554, pl. 202, figs. 1, 2. Garth, 1948, p. 32.

Type: Male holotype, M.C.Z. No. 2074; length 6.3 mm, width 10.2 mm.

Type locality: Magdalena Bay, Lower California, Mexico; *Hassler.*

Localities subsequently reported, with collectors: Colombia: Málaga Bay, 9 m, *Askoy* (Garth).

Atlantic analogue: *Cryptopodia concava* Stimpson.

Diagnosis: Carapace much broader than long. Length and breadth of rostrum subequal. Closed fissures between marginal teeth extending well up on the carapace. (Rathbun) Male first pleopod long, cylindrical, little tapering, a few setae basally, on the lip of the groove, in a marginal row, and in clusters at the blunt tip. Male second pleopod little more than half as long as first, reflexed, a few denticles at base of short, corneous tip.

Description: Carapace much broader than long; anterolateral margins twice as long as posterolateral; angle between anterolateral and posterolateral margins obtusely rounded; posterolateral margins arcuate, little convergent posteriorly; posterior margins straight in female, slightly emarginate in male. Gastrobranchial ridges granulate; branchial ridges straight or slightly sinuous; posterior to these the carapace profoundly depressed except for slightly raised cardiac area. Margins cut into small, truncate teeth separated by closed fissures extending well up on carapace, giving the effect of a fluted border that may be semitransparent. Lateral margins covering all but dactyls of legs when extended. Surface smooth and glabrous. Front narrowly triangular. Merus of third maxilliped triangular, outer angle extended, inner angle truncate. Sternum concave anteriorly; a deep concavity receiving the tip of the abdomen in both sexes; on each side of this a strong crest prolonged to the base of the cheliped.

Upper surface of merus and manus of cheliped dilated toward middle; margins with teeth similar to those of carapace. Fingers meeting without gape, tips crossing; prehensile edge of pollex knifelike. Crests of walking legs denticulate. (Redescription based on figures of the type and Gulf of California specimens of both sexes.)

Closely allied to *C. concava*, from which it is distinguished by its greater breadth (1.6 times its length), narrower rostrum, rounder posterolateral angles, greater extent of the closed fissures between the marginal teeth. (Rathbun)

Material examined: 71 specimens from 21 stations. (See Table 104) From Santa Maria Bay, west coast of Lower California, and Puerto Refugio, Angel de la Guarda Island, Gulf of California, Mexico, to Santa Elena Bay, Ecuador. In addition to the above, 6 specimens from a single *Askoy* station. (Garth, 1948)

Measurements: Largest specimen, male: length 7.6 mm, width 11.8 mm, rostrum 1.2 mm, width 1.2 mm, cheliped 10.6 mm, merus 4.6 mm, manus 6.4 mm, dactyl 3.0 mm, height of palm 2.8 mm. Female specimen: length 5.9 mm, width 9.0 mm.

Color in life: Carapace pinkish buff, rostrum orange red. Dorsal high ridge and broad margin of carapace alizarine pink. Eyes dark brown. Chelipeds creamish buff with touches of pink on teeth and ridges. Ambulatory legs semitransparent with light touches of pink. Ventral side light buff with a few small spots of rose red. (Petersen, of a specimen from Puerto Refugio, Angel de la Guarda Island, Mexico)

Entire dorsal surface cinnamon buff, slightly darker on frontal areas. Eyes brown. Ambulatory legs very light. (Petersen, of a specimen from Parker Bay, Costa Rica)

Habitat: Of the 21 dredge stations, 8 were sand bottom, with shell present in 4 and nullipore in 1; 5 were mud bottom, with sand in 4 and shell in 1; 3 were rock bottom, with mud and sand, shell, and gorgonians in 1 each; 3 were in shell bottom, with sand in 1; and 1 each were coralline and nullipore alone.

Depth: 2-32 fathoms. Once to 48 fathoms.

Size and sex: Males are from 2.85 to 7.6 mm, females from 3.7 to 5.9 mm, the single ovigerous female 3.9 mm. Pleopods may be distinguished in the smallest males.

Breeding: March at Bahia Honda, Panama.

Remarks: The shallow bays and gulfs of Costa Rica and northern Panama appear to provide optimum living conditions for this diminutive

species, which was taken in greater numbers and at more stations than in the Gulf of California or the southern portion of the Bay of Panama.

The range of the species is extended northward to Hughes Point, west coast of Lower California, and the north end of Angel de la Guarda Island, Gulf of California, Mexico, and southward to La Libertad, Ecuador. There remains, however, a large gap in distribution between Isabel Island, Mexico, and Costa Rica. Whether or not because of this isolation, Gulf of California specimens are proportionately wider as compared with length than are Bay of Panama specimens, which approach the Atlantic *Cryptopodia concava* more closely in this regard.

Genus HETEROCRYPTA Stimpson

Heterocrypta Stimpson, 1871a, p. 102. Alcock, 1895, p. 283. Rathbun, 1925, p. 554.

Type: The Atlantic *Cryptopodia granulata* Gibbes, 1850, by original designation.

Description: Differing from *Cryptopodia* in the following characters: posterior border of the carapace slightly overlapping the abdomen, but not distinctly produced; the lateral clypeiform expansions also less produced, legs when even moderately extended seen beyond them. Pterygostomian and subhepatic regions traversed by a granular ridge running parallel to the anterolateral border from the angle of the buccal cavity to the base of the chelipeds. (Alcock, modified)

Range: Eastern Pacific from Drakes Bay, Marin County, California, to Cape Pasado, Ecuador. Western Atlantic from Nantucket Sound, Massachusetts, to St. Thomas, West Indies. 1.5-95 fathoms. Eastern Atlantic; Mediterranean Sea. Indo-Pacific from Red Sea to Japan.

KEY TO THE PACIFIC AMERICAN SPECIES OF *Heterocrypta* (FROM RATHBUN, MODIFIED).

- 1a. Branchial ridge terminating at a point inside lateral angle of carapace
 - 2a. Posterolateral margin deeply concave between terminus of branchial ridge and lateral angle of carapace. Chelipeds elongate, equal *macrobrachia*
 - 2b. Posterolateral margin not deeply concave between terminus of branchial ridge and lateral angle of carapace. Chelipeds short, unequal *colombiana*
- 1b. Branchial ridge terminating at lateral angle of carapace *occidentalis*

Heterocrypta macrobrachia StimpsonPlate Z₄, Figs. 16, 16a; Plate 55, Fig. 1

Heterocrypta macrobrachia Stimpson, 1871a, p. 103. A. Milne Edwards, 1878, p. 167, pl. 29, fig. 3-3b. Rathbun, 1898, p. 581; 1910a, p. 576; 1923b, p. 633; 1925, p. 558, pl. 203, figs. 3, 4; pl. 282, figs. 4, 5. Garth, 1948, p. 33.

Type: Male holotype, length 14.2 mm, width 15.2 mm, merus of cheliped 11.7 mm, hand 14.0 mm; not extant.

Type locality: Panama, Captain J. M. Dow, collector.

Localities subsequently reported, with collectors: Lower California, Mexico: Magdalena Bay, 12 and 51 fathoms, *Albatross* (Rathbun, 1898), 13.5 fathoms, *Albatross* (Rathbun, 1923b). Mexico (A. Milne Edwards). Ecuador: off Cape Pasado, 18 m, *Askoy* (Garth).

Atlantic analogue: *Heterocrypta lapidea* Rathbun.

Diagnosis: Branchial ridges subparallel to anterolateral margins; a deep concavity on posterolateral margin between branchial ridge and lateral angle. Gastric summit marked by a horizontal continuation of the branchial ridges. Fingers not bent at an angle to hand. Male first pleopod stout, cylindrical, regularly tapering to contorted, subacute tip; a few setae on lip of groove, a larger number on groove margin nearer extremity; longer setae subterminally. Male second pleopod of length equal to first, straight, corneous tip elongated, channeled, a subterminal transverse row of denticles.

Description: Body depressed. Carapace narrower and less triangular than that of *Heterocrypta granulata*, but resembling it in its granulated ridges and protuberances. Anterolateral margin regularly convex, and crenulated with fourteen or fifteen teeth, themselves denticulated. Margin between the lateral angle of the carapace and the projecting terminus of the branchial ridge profoundly concave. Posterior margins crenulated like the anterior, with a somewhat larger tooth on each side at the juncture of the posterior with the posterolateral margins. Exognath of the external maxillipeds not tuberculated.

Chelipeds very long, smooth, and naked above, except at crenulated edges. Ambulatory [legs] compressed; merus with sharp, minutely denticulated lower edge. (Stimpson)

A blunt downward-pointing spine on sixth segment of male abdomen. (Rathbun)

Material examined: 132 specimens from 34 stations. (See Table 105) From Santa Maria Bay, west coast of Lower California, and

Rocky Point, Gulf of California, Mexico, to Santa Elena Bay, Ecuador. In addition to the above, 3 specimens from a single *Askoy* station. (Garth, 1948)

Measurements: Male specimen (not largest): length 10.0 mm, width 12.0 mm, rostrum 1.2 mm, width 1.6 mm, cheliped 26.0 mm, merus 9.9 mm, manus 11.9 mm, dactylus 3.9 mm, height of palm 3.2 mm. Female specimen: length 10.2 mm, width 13.4 mm. The largest specimen is a 10.4 mm *Askoy* Expedition male.

Color in life: Yellowish, sometimes with bluish-gray patches on the carapace, and bands of the same color across the chelipeds. (Stimpson)

Dorsal surface of carapace light olive gray with lighter longitudinal stripes, a few blackish brown dots on margin and dorsal ridge. Chelipeds white except for a broad band of mineral gray at the base of merus and a similar band on distal end of propodus and base of movable finger. Ambulatory legs pale olive gray with dark band on base of propodus of fourth leg only. Ventral side white with a few light brown dots. (Petersen, of a specimen from Santa Maria Bay, Lower California, Mexico)

Carapace pale colonial buff with longitudinal stripes of pale purplish avellaneous on which a narrow purple beaded stripe is superimposed. Eye clear with pinkish tinge and bright red tip. Chelipeds and ambulatory legs as carapace; upper surface covered with avellaneous except for a few patches; small marginal teeth red-purple. Movable finger warm buff crested with purple at base. Ventral side pale colonial buff. (Petersen, of a specimen from Parker Bay, Costa Rica)

Habitat: Of 32 stations, bottom was sand in 21, with shell present in 7, coralline in 3, and nullipore, rock, and gravelly mud in 1 each; mud in 5, with shell present in 1; rock in 5, with gorgonians present twice and sand and shell present once each; shell with mud in one instance.

Depth: 2-26 fathoms.

Size and sex: Males are from 5.0 to 10.4 mm, females from 5.7 to 10.2 mm, ovigerous females from 6.6 to 9.0 mm, and young from 4.5 mm.

Breeding: Females with ova were encountered in the Gulf of California and off Ecuador in February, and off Costa Rica in March.

Remarks: The range of the species has been extended northward to include the whole of the Gulf of California from Rocky Point south to Isabel Island, Mexico, and southward from Cape Pasado (*Askoy* record) to La Libertad, Ecuador.

Heterocrypta occidentalis (Dana)

Plate Z., Figs. 14, 14a; Plate 55, Fig. 2

Cryptopodia occidentalis Dana, 1854, p. 430, woodcut. Stimpson, 1857b, p. 458. Lockington, 1877c, p. 78. A. Milne Edwards, 1878, p. 169.

Lambrus frons-acutis Lockington, 1877a, p. 31; type locality, Santa Catalina Island, California; type not extant; 1877c, p. 78.

Heterocrypta occidentalis, Holmes, 1900, p. 44. Rathbun, 1904a, p. 170; 1925, p. 559, pls. 204, 205; 1926, p. 28. Weymouth, 1910, p. 21, pl. 2, figs. 4, 5. Hilton, 1916, p. 71, fig. 7. Nininger, 1918, p. 36, fig. 1. Schmitt, 1921, p. 192, text-fig. 119. Johnson and Snook, 1927, p. 363, text-fig. 316. Ricketts and Calvin, 1939, p. 182, pl. 35.

Type: 31.7 mm wide specimen, sex not stated; probably in Yale Museum. (Rathbun, 1925)

Type locality: Monterey, California; Wm. Rich, collector.

Localities subsequently reported, with collectors: California: Gulf of the Farallones, 33 fathoms, and Monterey Bay, 10-31 fathoms, *Albatross* (Rathbun, 1904a, 1925); Monterey Bay, 10-15 fathoms (Weymouth); Pacific Grove, J. O. Snyder, and off Brockway Point, Santa Rosa Island, 40-45 fathoms, *Albatross* (Rathbun, 1925); Hermosa Beach (Hilton); off Venice and off San Pedro, *Anton Dohrn*; San Pedro, M. Baldrige, H. N. Lowe (Rathbun, 1925); Santa Catalina Island, Henry Hemphill (Lockington, 1877a, 1877c, as *Lambrus frons-acutis*); off Santa Catalina Island, 50 fathoms, and San Clemente Island, H. N. Lowe (Rathbun, 1925); Newport Bay, intertidal (Johnson and Snook; Ricketts and Calvin); Laguna Beach, 12-20 fathoms (Nininger); La Jolla (Johnson and Snook); off San Diego, 22 fathoms, *Albatross* (Rathbun, 1904a, 1925). Lower California, Mexico: off Los Coronados Islands, 36 fathoms, *Albatross* (Rathbun, 1904a, 1925). Gulf of California: Boca de las Piedras, Sinaloa, W. J. Fisher (Lockington, 1877a, as *Lambrus frons-acutis*).

Fossil: California Pleistocene: Rincon del Portrero, Santa Monica (Rathbun, 1926).

Atlantic analogue: None. A distinctive west-coast endemic species.

Diagnosis: Branchial ridges sinuous, terminating at lateral angle, and not continued on gastric region, marked by two ridges coming to a point posteriorly. Fingers short, making a distinct angle, though less than a right angle, with palm. Male first pleopod thick, capitate, contorted, tapering to "neck" then flaring; longer setae on lip of groove, in

two rows in concavity of terminal portion, and marginally. Male second pleopod little more than half the length of first, reflexed, corneous tip marginally denticulate; a subterminal cluster of denticles.

Description: Carapace broadly triangular; median region narrow, the flattened upper surface bounded by two granulated ridges, converging to a point behind. Cardiac region furnished with a three-sided, pyramidal elevation, the edges usually granulated. Posterolateral regions large, and furnished with an S-shaped, granulated crest, extending from near the posterior end of the median region to the acute lateral angles of the carapace; in front of the anterior bend of this crest a pair of minute tubercles. Rostrum triangular, subacute, not depressed. Anterolateral margins straight or slightly concave in front, convex near the middle, the posterior portion passing outwards and backwards, arching over the legs; the teeth on the anterior part small and irregular, but becoming larger posteriorly, there furnished with secondary denticles. Posterolateral margins transverse; posterior margin not produced over the abdominal segments. . . . Ischium of the maxillipeds smooth, the anterointernal angle produced; merus small, the surface concave and bearing near the middle a prominent tooth.

Chelipeds long, trigonal; the sides of the merus convex, the edge sharply granulate to dentate; carpus with three or four granulate lines; hand about as long as the merus, the angles prominent and dentate and the sides concave; pollex short, deflexed; dactyl short, but longer than the pollex, and when closed its outer margin nearly at right angles to the long axis of the hand. Ambulatory legs compressed, strongly carinated above; dactyls narrow, strongly sulcate, and corneous-tipped. (Holmes, modified)

A long triangular concave area extending from the subhepatic region back to the afferent branchial openings, including the exognath and surrounded by a fringe of hair; outside this area, and above the ischium of the cheliped, a raised, level, oval area against which the inner surface of the manus plays, when the cheliped is flexed. (Rathbun, 1925, modified)

Material examined: 922 specimens from 136 stations or localities. (See Table 106) From Drakes Bay, Marin County, California, to Dewey Channel, Lower California, Mexico, including all eight islands of the Channel Islands group; Gulf of California at Outer Gorda Bank.

Measurements: Largest specimen, male: length 21.0 mm, width 34.0 mm, rostrum 1.2 mm, width 1.8 mm, exorbital width 5.0 mm, cheliped

57 mm, merus 25 mm, manus 28.7 mm, dactyl 7.5 mm, height of palm 9.4 mm. Female specimen (not largest): length 17.3 mm, width 26.8 mm.

Color in life: Tips of tubercles white, ridges bearing tubercles light purplish, remainder of carapace mottled with numerous minute spots of white and purplish, giving a pink effect which often closely approaches white. Ambulatory legs usually a light yellow. (Weymouth)

Habitat: Of 89 stations for which data on bottom type are available: 49 were sand, with shell present in 10, algae in 8, gravel in 4, mud in 3, and nullipore in 1; 18 were mud, with sand in 7; 11 were rock, with kelp in 4, mud in 2, and sand, shell, and nullipore present in 1 each; 6 were algae alone; 3 were shell, with mud in 2 and algae in 1; and 2 were coralline, with sand in 1. Sponge, worm tubes, and sea urchin associations are frequently noted in the station data.

Depth: Collected once intertidally. Normally 4-57 fathoms; exceptionally to 69 fathoms (off San Clemente Island), to 77 fathoms (off Santa Cruz Island), and to 95 fathoms (Outer Gorda Bank).

Size and sex: Males are from 6.0 to 21.0 mm, females from 6.0 to 17.3 mm, ovigerous females from 11.6 to 16.6 mm, and young to 3.5 mm. (See *Remarks*)

Breeding: Ovigerous females have been taken in February at San Diego, when 38 of 44 females were with ova, and in April off Newport Beach, when 51 of 51 females were in this condition. Other months and localities include March (Long Beach, Cedros Island), April (Huntington Beach), May (Portuguese Point), July (Long Beach), August (White Cove, Santa Catalina Island; Bechers Bay, Santa Rosa Island; Redondo, El Segundo, Monterey Bay, Half Moon Bay); September (Santa Barbara).

Remarks: The extensive series has not been exhausted of information. Some random observations are these: The species is most abundant off Huntington Beach and in Newport Harbor. There are many large males in the 20 mm range, but none is over 21 mm. In several lots examined, all or nearly all females are ovigerous. Young under 10 mm were considered immature; however, specimens could be sexed to 5 mm. A sharp rostrum occurs frequently. Older specimens show encrustation with barnacles on carapace and chelipeds.

The range of the species is extended southward along the Lower California coast from Los Coronados Islands to Punta Eugenio. The occurrence at Outer Gorda Banks off Cape San Lucas is extralimital and exceptional, as is Lockington's record for Boca de las Piedras, Sinaloa.

Heterocrypta colombiana GarthPlate Z₁₁, Figs. 13, 13a; Plate 54, Fig. 3

Heterocrypta colombiana Garth, 1940, p. 71, pl. 18, figs. 1, 2; 1948, p. 23.

Type: Male holotype, U.S.N.M. No. 78778, length 4.9 mm, width 7.0 mm, length of hand 4.5 mm.

Type locality: Port Utria, Choco, Colombia; *Velero III*.

Localities subsequently reported, with collectors: Costa Rica: Salinas Bay, 1.5 fathoms, *Velero III* (Garth, 1940). Ecuador: off Esmeraldas, 9-27 m, *Askoy* (Garth, 1948).

Atlantic analogue: *Heterocrypta granulata* (Gibbes).

Diagnosis: Rostrum prominent, trilobate. Branchial ridges parallel to anterolateral margins but straighter; no concavity on posterolateral margins between branchial ridge and lateral angle; posterior margin straight. Chelipeds massive; major manus half as high as wide, fingers closing with a gape. Male first pleopod cylindrical, tapering in basal three-fifths, a row of setae on lip of groove, other long setae in rows on outer two-fifths and in clusters about emarginate tip. Male second pleopod little more than half as long as first, straight, a short corneous tip with basal denticles.

Description: Carapace depressed, width nearly one and one-half times length, smooth and microscopically punctate. Branchial ridges consisting of a double row of bead granules parallel to denticulate anterolateral margins but straighter. A short, transverse gastric ridge joining branchial ridges; carapace highest at this point. Cardiac region low, non-granulate, but punctate. Posterior margin almost straight, a pronounced angle at its lateral extensions beyond the branchial ridges. Rostrum broadly elongate, margin granulate, faintly trilobate. Orbit with a closed fissure above.

External maxilliped granulate, merus notched at inner angle for insertion of palpus and produced at external angle to form a concave arc with outer border of ischium. A granular ridge running from angle of buccal cavity to base of cheliped.

Chelipeds short, heavy, and strikingly disproportionate; merus of each widest at mid-point, with two serrate denticles on inner margin and a row of bead tubercles lengthwise on inferior surface; carpus of each with inferior granular ridge continued and three additional lines of granules on superior surface; manus of large claw with a high superior crest faintly angled at mid-point, a more sharply angled median crest on

inner surface, and an outer row of bead granules similar to those on carpus and merus; manus widening distally, greatest height one-half times length; dactyl strongly curving downward, spinulose-ridged, meeting pollex with a wide gape; pollex curving upward, not constricted at base. Minor manus with superior crest toothed at mid-point, widening little distally, lower margin straight; fingers closing without gape, tips crossing.

Abdomen of male with segments 3-5 fused, narrowest at base of sixth segment, seventh segment triangular.

Material examined: In addition to the male holotype from Port Utria, Choco, Colombia, and the female allotype from Salinas Bay, Costa Rica, previously recorded (Garth, 1940), a male from Salinas Bay, Costa Rica, same station and date, from Hancock collections. This specimen, together with the male obtained by the *Askoy* off the coast of Ecuador (Garth, 1948), increases to four the known representation of this rare species. (See Table 107)

Measurements: Male specimen from Costa Rica: length 6.0 mm, width 8.1 mm, rostrum 0.6 mm, width 0.9 mm, exorbital width 2.0 mm, cheliped: merus 4.0 mm, manus 5.3 mm, dactylus 2.2 mm, height of palm 3.0 mm. Female allotype: length 4.5 mm, width 6.7 mm.

Color in life: Not recorded.

Habitat: Coarse sand bottom; rock and corallines.

Depth: 1.5 to 15 fathoms. The "shore" station from which the type specimen was reported is believed to have been shallow water.

Size and sex: Males are from 4.9 (the holotype) to 6.0 mm, the single female (allotype) 4.5 mm in length.

Breeding: An ovigerous female of the species is yet to be found.

Remarks: Had the larger male from Salinas Bay been available at the time of description of the species, it, rather than the male from Port Utria, would undoubtedly have been selected as holotype. This would have avoided the undesirable feature of having holotype and allotype come from separate localities. In such an event the name "colombiana," given for the country of origin of the holotype, would have been inappropriate and some other would probably have been chosen. Such designations, once made, are binding, and rightly so; and it is fortunate that no great harm has resulted therefrom. Features distinguishing *Heterocrypta colombiana* from *Cryptopodia hassleri*, the Pacific parthenopid that it most closely resembles, as well as from *Heterocrypta granulata*, its Caribbean counterpart, are set forth in an earlier paper. (Garth, 1940)

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