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ISOPODS OF THE GENUS *EXCORALLANA* STEBBING, 1904 FROM THE GULF OF CALIFORNIA, MEXICO (CRUSTACEA, ISOPODA, CORALLANIDAE)

Paul M. Delaney

ABSTRACT

The four species of *Excorallana* known from the Gulf of California, including two new species, are described and figured: *Excorallana tricornis occidentalis* Richardson, 1905; *Excorallana truncata* (Richardson, 1899); *Excorallana bruscai* n. sp.; and *Excorallana houstoni* n. sp. *Excorallana kathyae* Menzies, 1962, a species previously recorded from the Gulf (Menzies, 1962; Monod, 1969; Schultz, 1969; Brusca, 1980) was recently synonymized with *E. truncata* (Delaney, 1982).

Species of *Excorallana* have previously been distinguished by the morphology of the mouthparts and pereopods (Stebbing, 1904; Richardson, 1905). The presence of a small molar process and lacinia mobilis on the mandibles of *Excorallana tricornis occidentalis, E. truncata* and *E. bruscai,* previously unreported, supports Menzies et al. (1955) and Brusca's (1981) placement of the family Corallanidae between the Cirolanidae and the Aegidae in a proposed phylogenetic lineage of flabelliferan isopods.

A key to all known species of *Excorallana* is presented, along with comments on the ecology and biogeography of the genus.

The genus *Excorallana* Stebbing, 1904 has been reported only from the New World. In this paper the species of *Excorallana* from the Gulf of California, Mexico, are described. Previous authors described two species from the Gulf, *Excorallana tricornis occidentalis* (Richardson, 1905; Steinbeck and Ricketts, 1941; Monod, 1969; Bowman, 1977) and *Excorallana kathyae* (Menzies, 1962; Monod, 1969; Schultz, 1969; Brusca, 1980). *E. kathyae* was recently synonymized with *E. truncata* Richardson (1899), a species originally described from Santa Catalina Island, California (Delaney, 1982). Two new species, *Excorallana bruscai* and *Excorallana houstoni,* are figured and described herein.

The synonymy for *Excorallana* follows, listing only references bearing directly on the taxonomic and nomenclatural history of the genus.

Genus *Excorallana* Stebbing, 1904

Excorallana Stebbing, 1904a: 346; 1904b: 703. Richardson, 1905: 138. Lemos de Castro, 1960: 64; 1964: 3. Menzies and Glynn, 1968: 42. Monod, 1969: 48. Carvacho and Yanez, 1971: 129.
Exocorallana Richardson, 1905: 138 (*lapsus calami*).

Diagnosis.—Corallanidae with eyes well developed, often contiguous or nearly so. Body often with dorsal setae, spines, tubercles or carinae. First antenna with 2–3 peduncular articles, basal article enlarged; second antenna with 5 peduncular articles (articles 4 and 5 elongate). Frontal lamina, clypeus and labrum visible anterior to mandibles, but may be partly obscured by same; frontal lamina narrow, clypeus and labrum very broad and short. Mandible with elongate incisor; molar process and lacinia small or absent. Palp of 3 articles; middle and distal articles with plumose marginal setae. Left and right mandibles interdigitate. Maxilla 1 with lateral lobe forming single, large recurved spine; medial lobe simple. Maxilla 2 apex bilobed, spinose. Maxilliped with 5-segmented palp, middle (antepenultimate) article elongate, often with length twice width. Pereopods I–III subprehensile or prehensile, with short, blunt spines on posterior medial margin of merus

and ischium; pereopods IV–VII ambulatory. Peduncles of pleopods 1–4 with 4–6 coupling spines on medial margin, and group of plumose setae ventral to spines. Peduncle of pleopods 2–5 often with small lobe on lateral margin. All rami of all pleopods setigerous. Male pleopod 2 with rod-like appendix masculina arising from proximal medial margin of endopod.

Type-Species.—Neither Stebbing (1904a; b), Richardson (1905) nor any subsequent author designated a type-species for *Excorallana. Corallana tricornis* Hansen (1890), now *Excorallana tricornis tricornis,* is better known than other species of *Excorallana* and is herein designated as the type-species of the genus.

Remarks.—The most comprehensive treatments of this group have been given by Richardson (1905), Lemos de Castro (1960; 1964), Monod (1969), and by Carvacho and Yanez (1971). A satisfactory diagnosis of the genus has never been given. This paper describes Gulf of California *Excorallana* and draws attention to the need for a thorough revision of the genus.

Bruce et al. (1982) synonymized Excorallanidae with Corallanidae. *Excorallana* is currently separated from other corallanid genera by morphology of the mouthparts and pereopods.

Molar processes and lacinia have previously been unreported from *Excorallana.* I have observed both of these structures on the mandibles of *E. tricornis occidentalis, E. truncata,* and *E. bruscai* (Figs. 2A, B, 9A, B, 12A, C, 16, 17).

Brusca (1981) discusses Menzies et al.'s (1955) "phylogenetic and ecological lineage" of 3 families of flabelliferan isopods. He presented comparative morphological and behavioral data supporting a trend from a general scavenging-predatory lifestyle (in the Cirolanidae), to a micropredator or temporary parasite mode (in the Aegidae), to a parasitic and specialized existence (in the Cymothoidae). Adaptations toward an increasingly parasitic lifestyle seen in the Aegidae include loss of the lacinia and molar process of the mandible, the incisor region forming a blade-like slicing or cutting structure, styliform first maxillae with robust recurved spines, and the prehensile first three pairs of pereopods.

Corallanids have been reported as both free-living and parasitic, and the presence of a small molar process and lacinia on the mandibles of at least some species, along with the possession of the other aegid-like characteristics, supports Brusca's (1981) suggestion that the Corallanidae may occupy a position between the Cirolanidae and Aegidae in an evolutionary lineage.

Species of *Excorallana* have been collected and reported from a variety of habitats. Three species from the Gulf of California have been collected from intertidal coquina limestone reefs—*Excorallana truncata, E. bruscai,* and *E. houstoni. E. bruscai* has been found living inside a colony of the tube-building snail *Serpulorbis margaritaceous* on a coquina reef at Puerto Peñasco, Sonora, Mexico. *E. richardsoni* has been reported from a coral reef off Brazil (Lemos de Castro, 1960). Three species are known as occasional commensals of sponges: *E. bruscai* and *E. tricornis occidentalis* in the Gulf of California, and *E. quadricornis* from a grassy sand flat at the Bogue Islands, Montego Bay, in the western Atlantic (Richardson, 1905). Four species have been collected from mangrove areas (*Rhizophora mangle*): *E. tricornis occidentalis, E. berbicensis* (Monod, 1969), *E. quadricornis* (Lemos de Castro, 1964), and *E. longicornis* (Lemos de Castro, 1960). *E. berbicensis* was found in Rio Berbice, British Guiana; *E. longicornis* in a burrow under mangrove with *Upogebia brasiliensis* Holthuis, *Sphaeroma terebrans* Bate, *Alpheus* sp. and unidentified amphipods. *E. quadricornis* was reported as a commensal in a black ascidian (probably *Ascidia nigra*) on the roots of mangrove (Richardson, 1912). Three species have been reported as parasitic on fish: *E.*

berbicensis, a male of which was taken from the gills, and a female from the pectoral fin of different specimens of *Lycengraulis grossideus* (Cuvier) (Van Name, 1925; Monod, 1969); *E. tricornis occidentalis,* taken from the body surface and nostrils of the Gulf grouper *Mycteroperca jordani* (Jenkins and Evermann), and the jack-crevally *Caranx caninus* Gunther (Bowman, 1977); and *E. tricornis tricornis,* found on *Mycteroperca microlepsis* (Goode and Bean) (Hutton, 1964), on the gills of the spotted eagle ray *Aetobatus narinari* (by Menzies and Glynn, 1968), on the hogfish *Lachnolaimus maximus,* the yellow-tail *Ocyurus chrysurus,* the green parrotfish *Sparisoma viride,* the red snapper *Neomanis aya,* the yellow-jack *Caranx crysos,* in the eye sockets and mouth of the rockfish *Mycteroperca bowersii,* in the gill cavity of *Neomanis aya,* on the French grunt *Haemulon flaviolineatum,* on the gills of the jack *Caranx hippos,* on the barracuda *Sphyraena barracuda,* from the eye sockets and mouth of the blue parrotfish *Scarus caeruleus,* on the lane snapper *Neomanis synagris,* from the gill cavity of the rockhind *Epinephelus adscensionis,* and from the fins of the sea porcupine *Diodon hystrix* (by Richardson, 1912).

Species of *Excorallana* have been collected at depths ranging from 183 m to the intertidal zone.

Sessile loricated peritrichs of the family Vaginicolidae de Fromental, 1874 have been observed on the maxilliped and at the base of the mandibular palp on *Excorallana truncata* and *E. bruscai,* respectively.

Richardson (1905) stated that in *Excorallana tricornis, E. quadricornis,* and *E. sexticornis,* the tubercles of the female cephalon are reduced in size or number. This reduction is seen in *E. bruscai* and *E. tricornis occidentalis*; in a sample of 78 individuals of the latter species found inside an orange sponge at Bahía San Everisto, Baja California Sur, Mexico, 41 males had horns and 37 females had no horns.

Excorallana has been characterized as primarily a warm water or tropical genus of isopods (Carvacho and Yanez, 1971). No *Excorallana* has been found at latitudes greater than 40°N, and only one (*E. meridionalis*) has been reported from south of the equator (Fig. 18). There are presently 19 species and subspecies described in this New World genus, including the two new species described herein. Five of the 19 are from the eastern Pacific, 14 from the western Atlantic (Fig. 18). The eastern Pacific group includes *Excorallana meridionalis* Carvacho and Yanez, 1971; *E. truncata* (Richardson, 1899) (including *E. kathyae* Menzies, 1962); *E. tricornis occidentalis* Richardson, 1905; *E. bruscai* n. sp., and *E. houstoni* n. sp. The western Atlantic group consists of two biogeographic components, one a Caribbean-Antillean group: *E. berbicensis* Boone, 1919; *E. quadricornis* (Hansen, 1890) (also found off Brazil); *E. subtilis* (Hansen, 1890); *E. antillensis* (Hansen, 1890); *E. fissicauda* (Hansen, 1890); *E. oculata* (Hansen, 1890); *E. warmingii* (Hansen, 1890); *E. tricornis tricornis* (Hansen, 1890); *E. sexticornis* Richardson, 1905; and *E. mexicana* Richardson, 1905. The second component, from Brazil, consists of *E. longicornis* Lemos de Castro, 1960; *E. angusta* Lemos de Castro, 1960; *E. richardsoni* Lemos de Castro, 1960 (including *E. acuticauda*); *E. costata* Lemos de Castro, 1960; and *E. quadricornis,* redescribed by Lemos de Castro, 1964 (Fig. 18).

Three of five eastern Pacific species may represent analogs of species from the western Atlantic (see following key): *Excorallana tricornis tricornis* and *E. tricornis occidentalis,* compared later in this paper; *E. angusta* and *E. houstoni,* also compared later in this paper; and *E. quadricornis* and *E. meridionalis.* The latter two nominal species resemble each other in the following features: 2 anterior (rostral) cephalic tubercles or horns, 2 posterior tubercles or horns between eyes;

eyes large, extending from anterior to posterior margin of cephalon (but not contiguous along anterior margin); 2 anterior tubercles on pereonite I; similar mandible, maxilliped and first maxilla; triangular pleotelson with subacute apex, lateral incisions, and dorsal setae. The frontal lamina of *E. quadricornis* is rounded anteriorly and narrows to a median point; the frontal lamina of *E. meridionalis* is broadly rounded anteriorly, without a median point.

The relatively large number of *Excorallana* geminate species pairs or Atlantic-Pacific analogs (representing one-third of the genus) is not surprising, as vicariant events in the area doubtless involved fragmentation of the ranges of whole biotas, rather than single species populations. Of 42 species of isopods from the Gulf of California treated by Brusca (1980), 29% are considered temperate in origin, 27% eastern Pacific tropical, 6.5% amphiamerican, 31% Gulf endemics, and 3% widespread in both Californian and Cortezian provinces. The four species of *Excorallana* known from the Gulf are present in the following provinces: *E. bruscai*—Cortezian; *E. houstoni*—Cortezian, Mexican and Galapagan; *E. tricornis occidentalis*—Cortezian, Mexican and Panamanian; and *E. truncata*—Californian, Cortezian, Mexican, Galapagan and Panamanian (Fig. 19). With regard to 935 species of invertebrates from the Gulf of California (excluding insects, spiders, amphipods, and brachiopods), Brusca (1980) states that 4% are amphiamerican, and also states, "Reasonable estimates suggest that 5–40% of the tropical eastern Pacific invertebrate species may have Atlantic analogs (depending on the taxon examined), attesting to the close biological affinity of these regions."

Distributions of *Excorallana* in the New World are the product of various vicariant events and dispersal processes (Fig. 18). The model of circum-Caribbean tectonics proposed by Malfait and Dinkelman (1972) describes formation of the present-day Panamanian isthmus via convergence of the North and South American blocks and northeastward movement of the East Pacific–Caribbean plate during the late Cretaceous and early Tertiary. This relatively recent geological event—formation of the Panamanian isthmus—is clearly related to disruption of a generalized oceanic track connecting the eastern Pacific and the Caribbean (Woodring, 1966; Croizat et al., 1974). Interestingly, the majority of western Atlantic *Excorallana* species occur in the Caribbean-Antillean area, none being known from the Atlantic coast of Florida, Georgia, or the Carolinas (Fig. 18). In contrast, Pacific species range well into the subtropical-warm temperate regions of Baja California and California. More data are needed to determine whether the Brazilian *Excorallana* group, with its affinities to both Caribbean and eastern Pacific, is a reduced element of the Caribbean–East Pacific track, or indicative of other generalized track/s.

Key to the Species of *Excorallana*

Letters in parentheses following species names indicate geographic ranges: WAC, West Atlantic–Caribbean; WAB, West Atlantic–Brazil; EP, East Pacific. This key relies, in part, on the literature, hence it should be considered provisional.

1a.	Cephalon without tubercles or horns	8
1b.	Cephalon with tubercles or horns	2
2a.	Cephalon with 3 tubercles or horns	3
2b.	Cephalon with 2, 4 or 6 tubercles or horns	6
3a.	Cephalon with 1 rostral and 2 posterolateral horns between the eyes	4
3b.	Cephalon with placement of horns not as above	5
4a.	Pleotelson without lateral incisions	*Excorallana berbicensis* (WAC)
4b.	Pleotelson with lateral incisions	*E. tricornis tricornis* (WAC) *E. tricornis occidentalis* (EP)

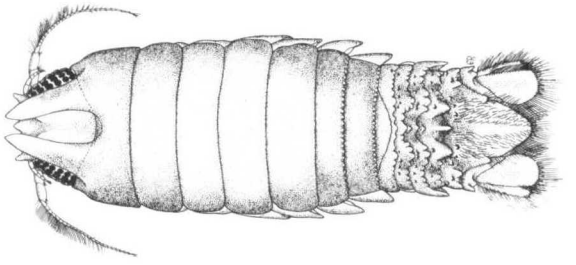


Figure 1. *Excorallana bruscai* n. sp., dorsal view. AHF holotype #6611.

5a. Cephalon with 1 rostral and 2 anterior horns; pereonite I without horns; pleotelson without lateral incisions ..... *E. longicornis* (WAB)
5b. Cephalon with 1 rostral and 2 median horns; pereonite I with 2 large horns; pleotelson with lateral incisions ..... *E. bruscai* new species (EP)
6a. Cephalon with 2 rostral and 2 median horns ..... *E. quadricornis* (WAC, WAB)
E. meridionalis (EP)
6b. Cephalon with 2 or 6 horns 7
7a. Cephalon with 2 small median tubercles between eyes ..... *E. mexicana* (WAC)
7b. Cephalon with 2 rostral and 2 transverse series of 2 horns each, posterior pair larger ..... *E. sexticornis* (WAC)
8a. Pleotelson without lateral incisions 9
8b. Pleotelson with lateral incisions 12
9a. Posterior part of pleotelson widely rounded, with deep, broad median incision; base with median excavation with carina in short fundus ..... *E. fissicauda* (WAC)
9b. Pleotelson triangular, not as above 10
10a. Pleotelson with subacute apex; eyes large, contiguous along anterior margin of cephalon ..... *E. oculata* (WAC)
10b. Pleotelson with rounded apex; eyes contiguous or not contiguous 11
11a. Eyes large, contiguous along anterior margin of cephalon ..... *E. warmingii* (WAC)
11b. Eyes smaller, lateral, not contiguous ..... *E. houstoni* new species (EP) ♀
E. angusta (WAB)
12a. Pleotelson without dorsal setae ..... *E. subtilis* (WAC)
12b. Pleotelson with dorsal setae 13
13a. Pleotelson densely covered with dorsal setae; uropodal exopod and endopod with dorsal spines ..... *E. truncata* (EP)
13b. Pleotelson with setae on either side of median longitudinal area 14
14a. Eyes large, extending from anterior to posterior margin of cephalon (but not contiguous along anterior margin); pleonites 4 and 5 with deep longitudinal excavation in dorsal median line, with carinae and tubercles; frontal lamina narrow, rounded anteriorly ..... *E. antillensis* (WAC)
14b. Pleonites 4 and 5 without deep median excavation 15
15a. Eyes large, extending from anterior to posterior margin of cephalon (not contiguous along anterior margin); without deep median excavation on pleonites 4 and 5; frontal lamina narrow, rounded anteriorly ..... *E. costata* (WAB)
15b. Eyes smaller, lateral; without deep median excavation on pleonites 4 and 5; frontal lamina rectangular ..... *E. richardsoni* (WAB)

Excorallana bruscai new species
Figures 1–4, 14–17, 22

Excorallana sp. Brusca, 1980: 229.

Description.—Male. Anterior margin of cephalon produced into small median (rostral) horn, with 2 anterolateral horns (Figs. 1, 14). Eyes large, extending entire length of cephalon. First antennae with 3 peduncular articles and 6–8 flagellar articles, reaching midlength of eye. Second antennae with 22–25 flagellar articles,

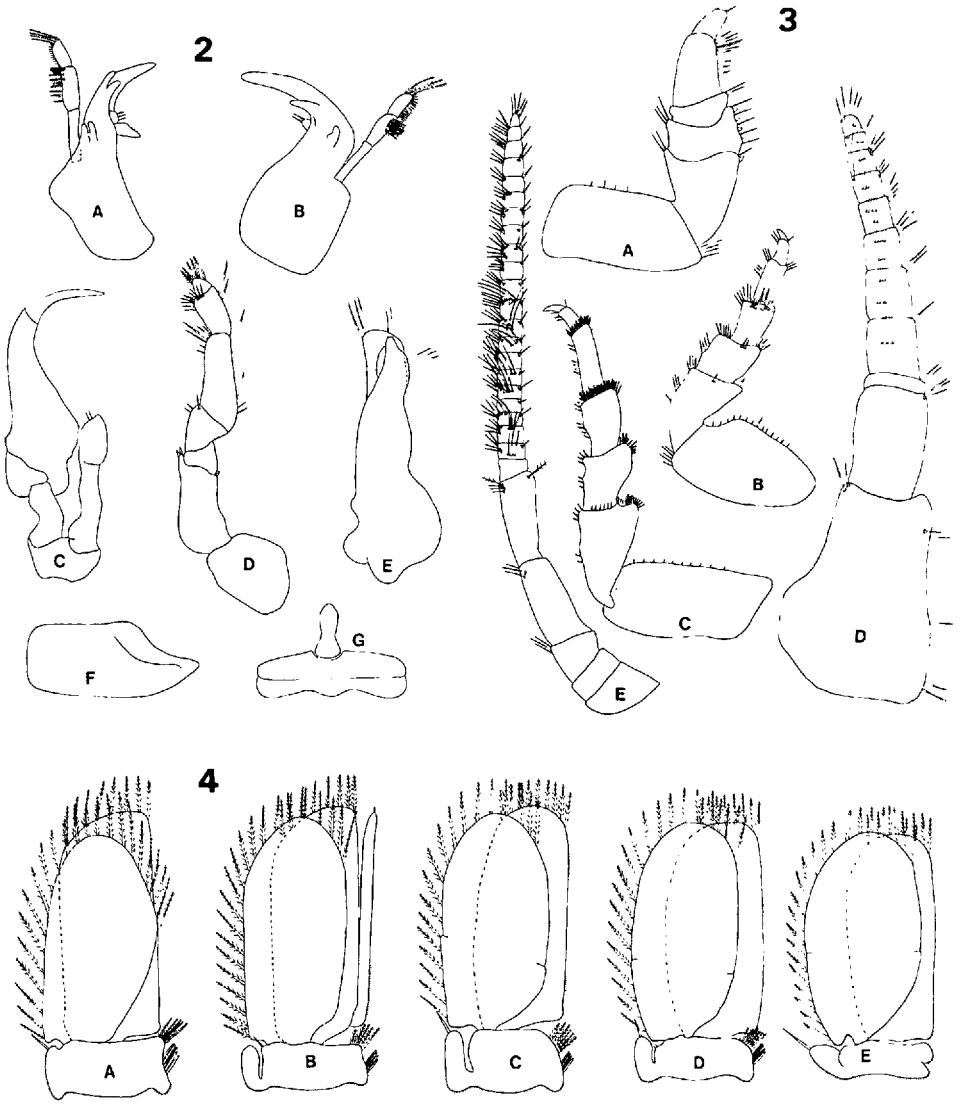


Figure 2. (Left) *Excorallana bruscai* n. sp.: A) left mandible; B) right mandible; C) first maxilla; D) maxilliped; E) second maxilla; F) coxal plate on pereonite VII; G) frontal lamina, clypeus and labrum.

Figure 3. (Right) *Excorallana bruscai* n. sp.: A) pereopod I; B) pereopod IV; C) pereopod VII; D) first antenna; E) second antenna.

Figure 4. (Lower) *Excorallana bruscai* n. sp.: A) left pleopod 1, anterior view; B) left pleopod 2, anterior view; C) left pleopod 3, anterior view; D) left pleopod 4, anterior view; E) left pleopod 5, anterior view.

some setose; reaching midlength of pereonite II (Fig. 3D, E). Frontal lamina with anterior margin narrowing to rounded apex (Fig. 2G). Mandible with 2 (right) or 4 (left) subapical cusps; small molar process present on left but not on right mandible; lacinia represented by small 2 (right) or 3 (left)-spined lobe (Figs. 2A, B; 15; 16; 17).

Table 1. Dispersion analysis of *Excorallana bruscai* n. sp. from a coquina limestone reef at Puerto Peñasco, Sonora, Mexico

Sample	Morisita's Index, I_D	Chi Square	Degrees of Freedom	Highest Confidence Level Exceeded (%)	Number of Isopods
January					
ZI	9.0	8.0	4	90	2
ZII	5.8	24.0	4	99	6
Combined	7.0	42.0	9	99	8
April					
ZI	3.42	19.33	4	99	9
ZII	7.0	12.0	4	97.5	3
Combined	4.46	38.0	9	99	12

Pereonite I produced upward and anteriorly to form 2 horns which extend out over cephalon, and may reach beyond anterior margin of cephalon. Anterolateral angle of pereonite I produced, partly covering posterior part of eyes. Pereonites VI and VII tuberculate on posterior margin. Pereopods I–III weakly prehensile; merus with 4 short, blunt spines on posterior medial margin; ischium with 1 short, blunt spine on posterior medial margin (Fig. 3A).

Pleonite 1 overlapped laterally by pereonite VII. Pleonite 2 with tuberculate posterior margin; pleonites 3–5 with 2 transverse rows of tubercles, posterior (marginal) row larger; largest tubercles in posterior rows located medially and submedially (Fig. 1). Pleotelson triangular with rounded apex; with lateral incisions; with row of 4–6 subbasal tubercles, 1 pair above insertion of uropods, and 6 apical spines; dorsum covered with many long, golden, bifid setae except for median longitudinal area (Fig. 1). Uropods slightly longer than pleotelson, fringed with long golden setae. Uropodal endopod broad, posteriorly subtruncate, distal lateral angles rounded, with 9–12 marginal spines. Uropodal exopod less than ½ width of endopod, narrowing to notch with terminal setae; with 4–6 marginal spines, 2 medial and marginal, others lateral. Pleopods 1–5 fringed with plumose marginal setae as in Figure 4A–E.

Remarks.—The cephalon of this species resembles that of *Excorallana longicornis* Lemos de Castro, 1960, from Brazil, but differs from *E. longicornis* in several characters, including the possession of 2 horns on pereonite I (rather than 2 smaller tubercles), and lateral incisions in the pleotelson.

Excorallana bruscai ranges in length from 4.80–10.13 mm. Females lack horns, appendix masculina and penes.

Material Examined.—Mexico: Cholla Bay, Puerto Peñasco, Sonora, R. C. Brusca, 10 July 1971, AHF #1007-01, 1 male, 6.75 mm, found on muddy sand at low tide in intertidal; 16 Feb. 1968, 1 male, 10.13 mm, UA #68-139. Point Lobos, Sonora, D. A. Thompson and class from University of Arizona, 22 Feb. 1968, AHF #1004-01, AHF holotype #6611, 1 male, 7.88 mm, collected with seine on sand beach in evening. Pelican Point, Puerto Peñasco, Sonora, P. M. Delaney, 29 April 1981, 1 male, 8.63 mm, commensal in white sponge *Leucetta losangelensis* de Laubenfels along with *Paracerceis sculpta* (Holmes) on a coquina reef in low intertidal. Station Beach, Puerto Peñasco, Sonora, P. S. Miles, 22 Feb. 1966, 1 male, 8.25 mm AHF #1006-01, rocky intertidal. Bahía Concepción, Baja California Sur, E. W. Iverson, 18 Aug. 1980, 1 male, 7.5 mm, on subtidal coralline algae. Station Beach, Puerto Peñasco, Sonora, P. Pepe, 26 Jan. 1979, 1 male, 4.8 mm, and 1 female, 5.4 mm, sample #ZI, 129, 49, infauna of coquina reef. Station Beach, Puerto Peñasco, Sonora, P. Pepe, 28 Jan. 1979, 5 males, 8.63, 8.25, 8.4, 7.88 and 7.88 mm, and 1 female, 8.63 mm, sample #ZII, 51, 83, infauna of coquina reef; a 2 male, 1 female group was found inside a tube-building gastropod *Serpulorbis margaritaceous* (Chenu, ex Rousseau, MS) tube. Station Beach, Puerto Peñasco, Sonora, P. Pepe, 23 April 1979, 1 female, 7.5 mm, sample #ZI, 92, 4, infauna of coquina reef. Station Beach, Puerto Peñasco, Sonora,

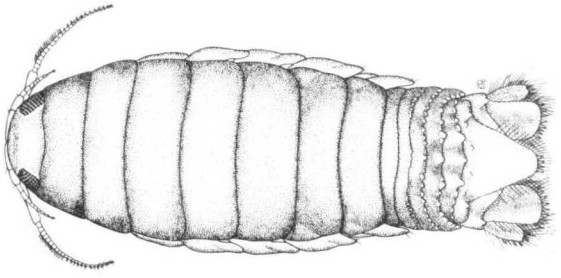
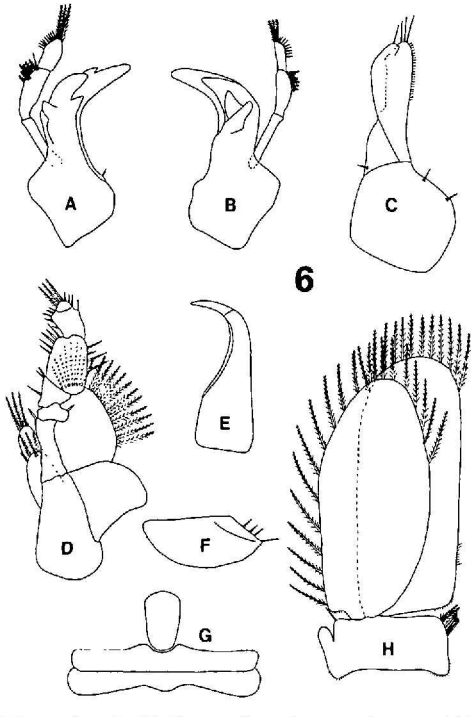


Figure 5. *Excorallana houstoni* n. sp., dorsal view. AHF holotype #807.

P. Pepe, 23 April 1979, 1 female, 9.15 mm (gravid), sample #ZI, 60, 17, infauna of coquina reef. Station Beach, Puerto Peñasco, Sonora, P. Pepe, 23 April 1979, 4 males, 8.63, 8.25, 9.38 and 8.63 mm, and 3 females, 8.63, 9.0 and 6.0 (damaged) mm, sample #ZI, 129, 21, infauna of coquina reef. Station Beach, Puerto Peñasco, Sonora, P. Pepe, 27 April 1979, 3 females, 9.0 (gravid), 8.25 and 6.75 (damaged) mm, sample #ZII, 85, 27, infauna of coquina reef.

Etymology.—*Excorallana bruscai* is named for Richard C. Brusca, who first recognized the existence of this horny creature, and contributed much time and effort to my study of isopods.



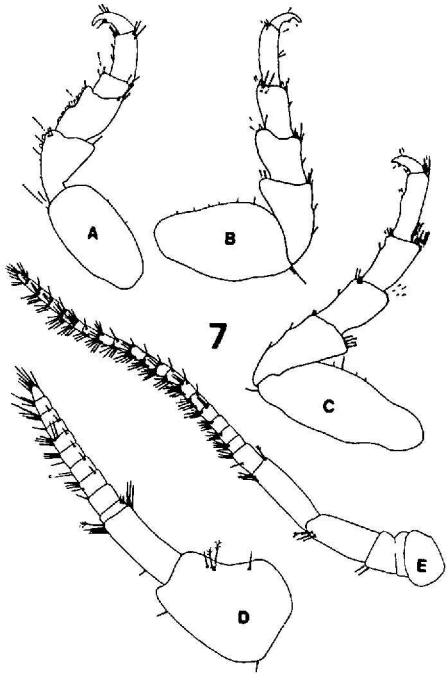


Figure 6. (Left) *Excorallana houstoni* n. sp.: A) left mandible; B) right mandible; C) second maxilla; D) maxilliped; E) first maxilla; F) coxal plate on pereonite VII; G) frontal lamina, clypeus and labrum; H) left pleopod 2, anterior view.

Figure 7. (Right) *Excorallana houstoni* n. sp.: A) pereopod I; B) pereopod IV; C) pereopod VII; D) first antenna; E) second antenna.

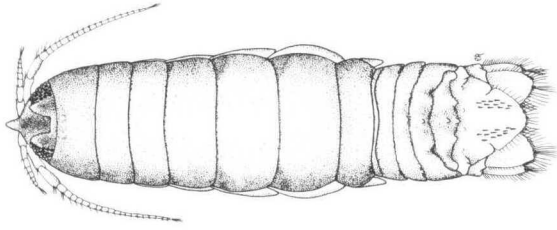
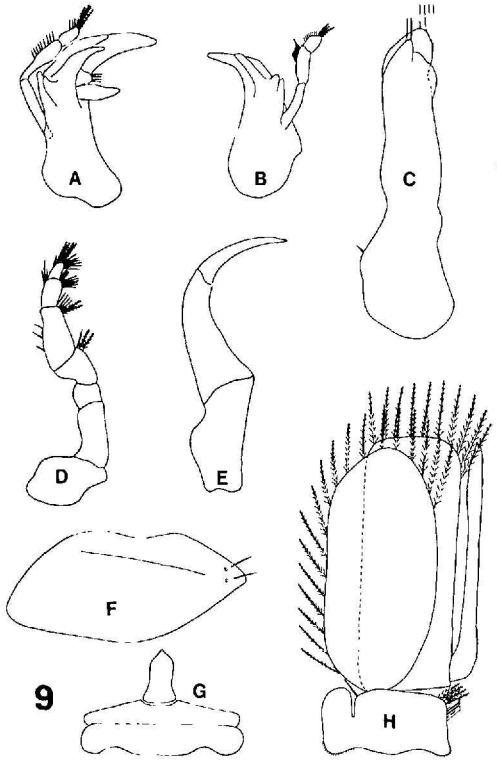


Figure 8. *Excorallana tricornis occidentalis*, dorsal view. USNM #22629.

Type-Deposition. — All samples are located in the collections of the Allan Hancock Foundation, University of Southern California, Los Angeles, CA 90089. Holotype: AHF #6611.

Distribution. — Probably endemic to the Gulf of California; so far known only from the central and northern Gulf.



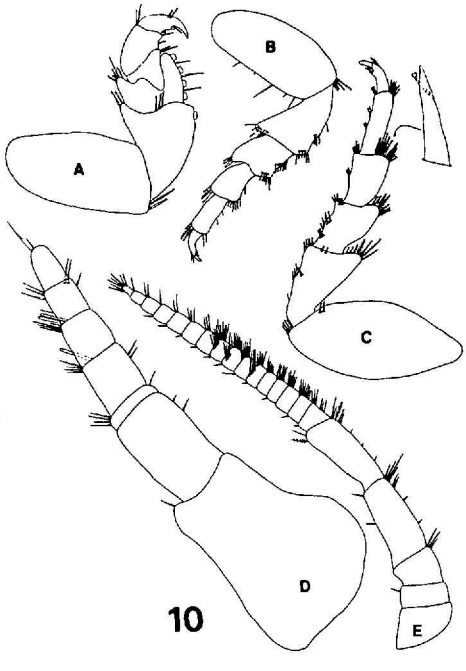


Figure 9. (Left) *Excorallana tricornis occidentalis*: A) left mandible; B) right mandible; C) second maxilla; D) maxilliped; E) first maxilla; F) coxal plate on pereonite VII; G) frontal lamina, clypeus and labrum; H) left pleopod 2, anterior view.

Figure 10. (Right) *Excorallana tricornis occidentalis*: A) pereopod I; B) pereopod IV; C) pereopod VII; D) first antenna; E) second antenna.

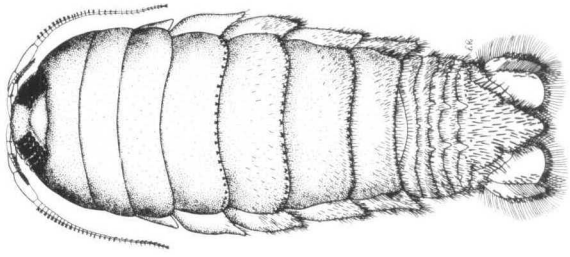


Figure 11. *Excorallana truncata*, dorsal view. USNM #108644.

Ecology.—Intertidal and shallow subtidal benthic habitats, including sand and sandy mud, limestone (coquina) reefs, commensal in calcareous sponges (*Leucetta losangelensis*), tube-building gastropod colonies (*Serpulorbis margaritaceous*), and on coralline algae.

Gravid females have been found in April.

Ten 0.25 m^2 stratified random samples, five in each of two zones (0′ to +2′ and

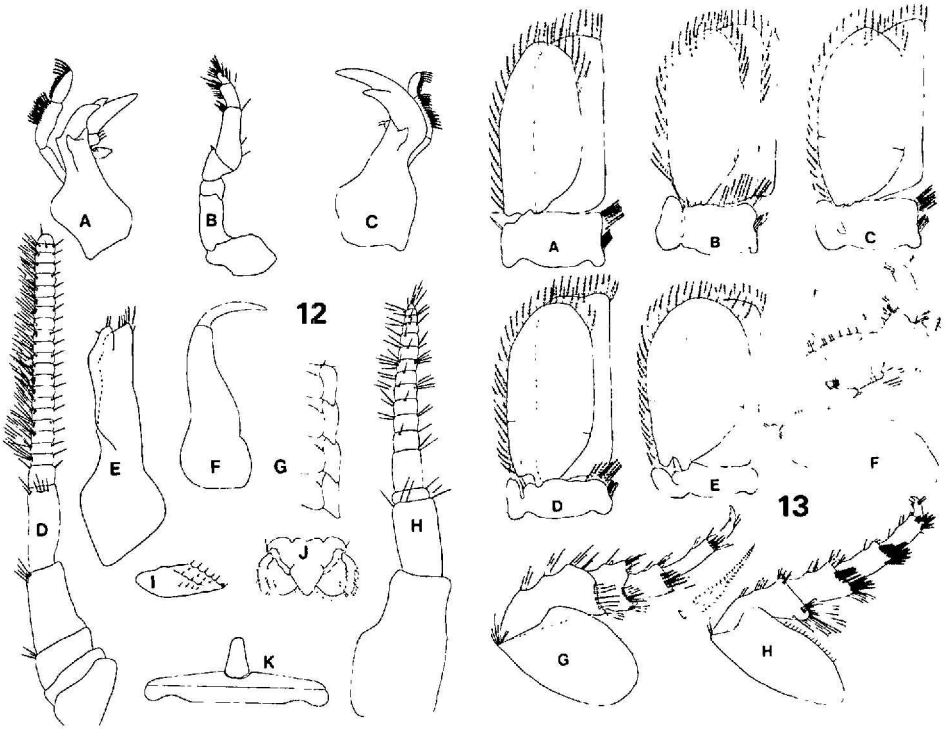


Figure 12. (Left) *Excorallana truncata*: A) left mandible; B) maxilliped; C) right mandible; D) second antenna; E) second maxilla; F) first maxilla; G) dorsal view of coxae IV–VII; H) first antenna; I) coxal plate on pereonite VII, lateral view; J) dorsal view of pleotelson and uropods, setae not figured; K) frontal lamina, clypeus and labrum.

Figure 13. (Right) *Excorallana truncata*: A) left pleopod 1, anterior view; B) left pleopod 2, anterior view; C) left pleopod 3, anterior view; D) left pleopod 4, anterior view; E) left pleopod 5, anterior view; F) pereopod I; G) pereopod IV; H) pereopod VII.

0′ to −2′), were taken in January and April on the limestone (coquina) reef at Puerto Peñasco, Sonora, Mexico. These showed *Excorallana bruscai* to have an aggregated dispersion pattern (Table 1).

Excorallana houstoni new species
Figures 5–7, 20, 21

Description.—Female. Cephalon devoid of tubercles; eyes small, lateral. First antennae with 3 peduncular articles and 7–8 flagellar articles, reaching midlength of pereonite I (Fig. 7D). Antennae 2 with 20–23 flagellar articles, some setose; reaching slightly beyond posterior margin of pereonite II (Fig. 7E). Frontal lamina rounded anteriorly (Fig. 6G). Mandible with 3 (right) or 4 (left) subapical cusps; lacinia and molar process lacking (Fig. 6A, B).

Pereonites I–VII without dorsal tubercles or setae. Anterolateral angle of pereonite I weakly produced, partly covering posterior part of eyes. Coxae on pereonites VI and VII bear setae (not figured); coxae VII with spines on posterior margin (Fig. 6F). Pereopods I–III prehensile, merus with 5 short, blunt spines on posterior medial margin; ischium with 2 short, blunt spines on posterior medial margin (Fig. 7A).

Pleonites 2–5 tuberculate on posterior margins, largest tubercles located medially and submedially. Pleonite 5 may have 1–2 setae on either side of large median tubercle. Pleotelson subtriangular with rounded apex, without lateral incisions or notches; with row of 6 subbasal tubercles and 4–6 apical spines; apical half of pleotelson fringed with long setae (Fig. 5). Uropods fringed with long setae, with tubercle above insertion of exopod; endopods broad, posteriorly subtruncate with distal lateral angles rounded; slightly longer than pleotelson, with 8–10 marginal spines (Fig. 5); exopod less than ½ width of endopod, and shorter than pleotelson, with 4–5 lateral marginal spines and 3 medial marginal spines. Pleopods 1–5 fringed with plumose marginal setae (Fig. 6H).

Remarks.—Length 1.88–8.25 mm. No males have been collected.

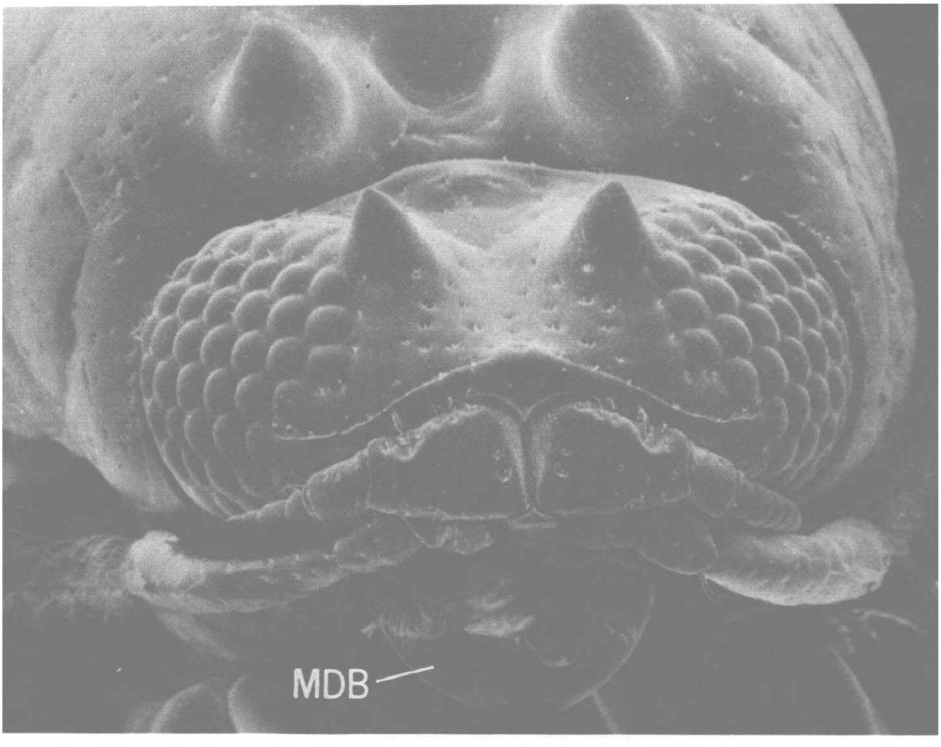
This species resembles *Excorallana angusta* from the western Atlantic (Brazil), as follows: both lack cephalic horns or tubercles at least in the ♀; both have a subtriangular pleotelson with a rounded apex, without lateral incisions or notches; in both the eyes are small and lateral; both bear 4–6 apical spines on the pleotelson. The frontal lamina of *E. angusta* (as figured by Lemos de Castro, 1960) narrows to a rounded apex with a median point, but the frontal lamina of *E. houstoni* has a broadly rounded apex without a median point.

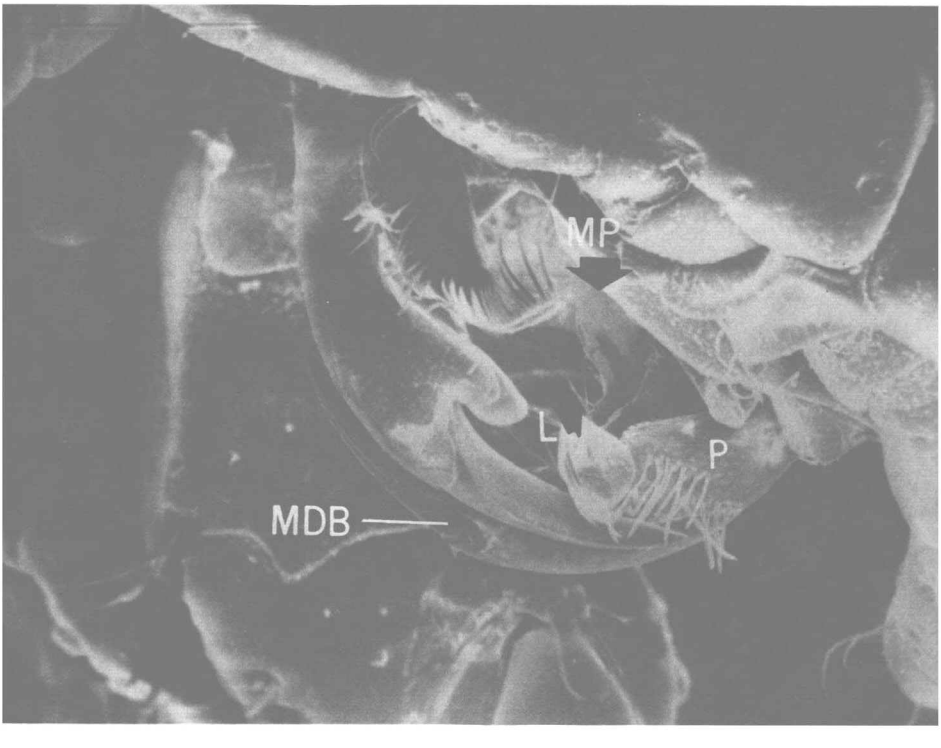
Material Examined.—Mexico: Bahía Concepción, Baja California Sur, E. W. Iverson, 16 Aug. 1980, EWI-4, 5 females, 7.88 (gravid), 6.38 (gravid), 5.63, 6.0 and 1.88 mm, AHF holotype #807, formalin washing of intertidal rocks with oysters and barnacles. Bahía Audiencia, Manzanillo, Colima, R. C. Brusca, B. Wallerstein, P. Pepe, and A. M. Mackey, 4 Sept. 1976, 1 female, 5.25 mm, formalin wash of barnacles, air temp = 28°C, surf temp = 30°C. Near the Galapagos Islands: 00°44′36″S, 90°13′51″W, 21 May 1966, R/V ANTON BRUUN #661-22, cruise #16, 1 female, 8.25 mm, taken with diving gear.

Etymology.—*Excorallana houstoni* is named for Roy S. Houston, marine biologist, astronomer, and ardent natural historian of the Gulf of California.

Type-Deposition.—All samples are located in the collections of the Allan Hancock Foundation. Holotype: AHF #807.

Distribution.—Known from 3 localities—central Gulf of California, western Mexico, and Galapagos Islands; apparently wide-ranging throughout the tropical Eastern Pacific Zoogeographic Region (Brusca and Wallerstein, 1979).


MDB


MP
L
P
MDB

Ecology.—A rocky intertidal and shallow subtidal species. Gravid females (Figs. 20, 21) have been collected only in August.

Excorallana tricornis occidentalis Richardson, 1905
Figures 8–10

Corallana tricornis Hansen, 1890: 379. Richardson, 1901: 495. Moore, 1902: 169. Richardson, 1904: 30.

Excorallana tricornis Stebbing, 1904: 704. Richardson, 1905: 138. Steinbeck and Ricketts, 1941: 424. Lemos de Castro, 1960: 61. Hutton, 1964: 447. Lemos de Castro, 1964: 4. Menzies and Glynn, 1968: 11. Monod, 1969: 50. Carvacho and Yanez, 1971: 130. Moreira and Sadowsky, 1978: 107.

Exocorallana tricornis occidentalis Richardson, 1905: 138. Steinbeck and Ricketts, 1941: 424 (*lapsus calami*).

Excorallana tricornis occidentalis Richardson, 1905: 138. Monod, 1969: 50. Bowman, 1977: 657.

Description.—Male. Cephalon with 3 horns; anterior margin produced into median horn (rostral tubercle) and 2 posterolateral horns between eyes (Fig. 8). Eyes large, lateral. First antennae with 3 peduncular and 4–7 flagellar articles, some setose; reaching slightly beyond posterior margin of cephalon. Second antennae with 16–21 flagellar articles, some setose; reaching beyond posterior margin of pereonite III (Fig. 10D, E). Frontal lamina with anterior margin produced into median point (Fig. 9G). Mandible with 3–4 (right) or 4 (left) subapical cusps; small molar process present on left but not on right mandible; lacinia represented by small 3–4 (right) or 4 (left)-spined lobe (Fig. 9A, B).

Pereonite I with 2 small anterior tubercles. Anterolateral angle of pereonite I weakly produced, partly covering posterior part of eyes. Pereonites II–VII without dorsal setae or tubercles. Coxal plate on pereonite VII with spines on posterior margin (Fig. 9F). Pereopods I–III prehensile, merus with 4 short, blunt spines on posterior medial margin; ischium with 1 short, blunt spine on posterior medial margin (Fig. 10A).

Pleonites 2–5 with tuberculate posterior margins, largest tubercles located medially and submedially (Fig. 8). Pleotelson triangular with rounded apex; with lateral incisions, row of 6 subbasal tubercles, and 4–6 apical spines; dorsum setose except for median longitudinal area (Fig. 8). Uropods slightly longer than pleotelson, fringed with long setae; endopod broad, posteriorly subtruncate with rounded distal lateral angles; with 9–12 marginal spines; exopod less than ½ width of endopod, with 4–6 marginal spines. Pleopods lamellate, fringed with plumose marginal setae (Fig. 9H).

Remarks.—Richardson (1905) distinguished *Excorallana tricornis occidentalis* as a distinct subspecies of *E. tricornis* by virtue of the larger pleonal tubercles in the former. Bowman (1977) stated that pleonal tuberculation was variable in both the specimens he examined from the Gulf of California and Richardson's specimens; this is also the case with specimens examined in this study. Bowman, however, retained the subspecific distinctions based on the following: the lateral

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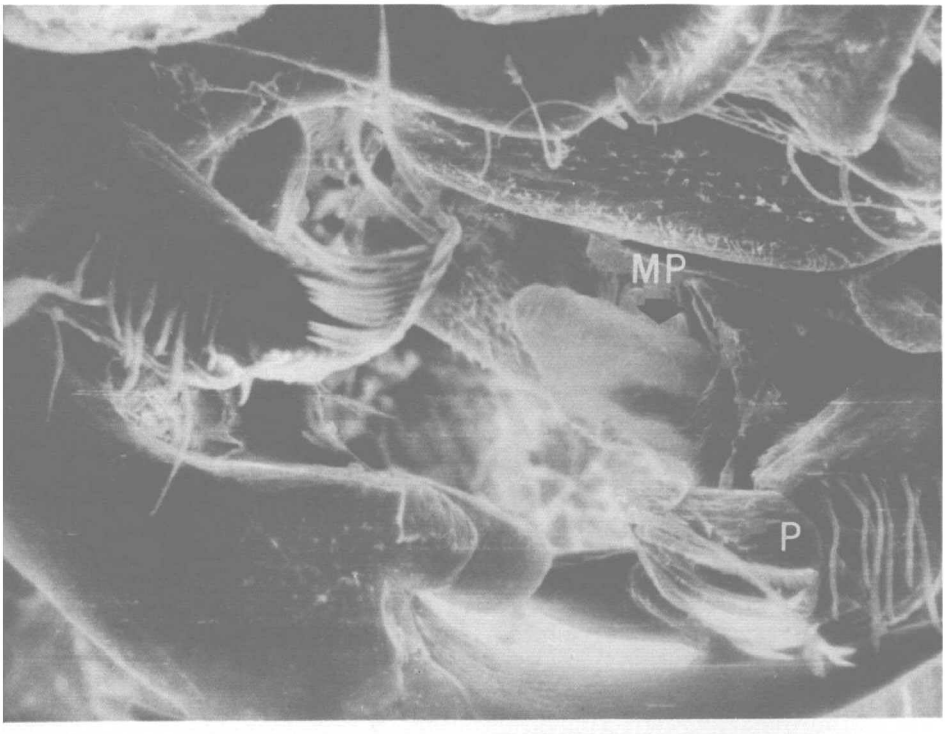
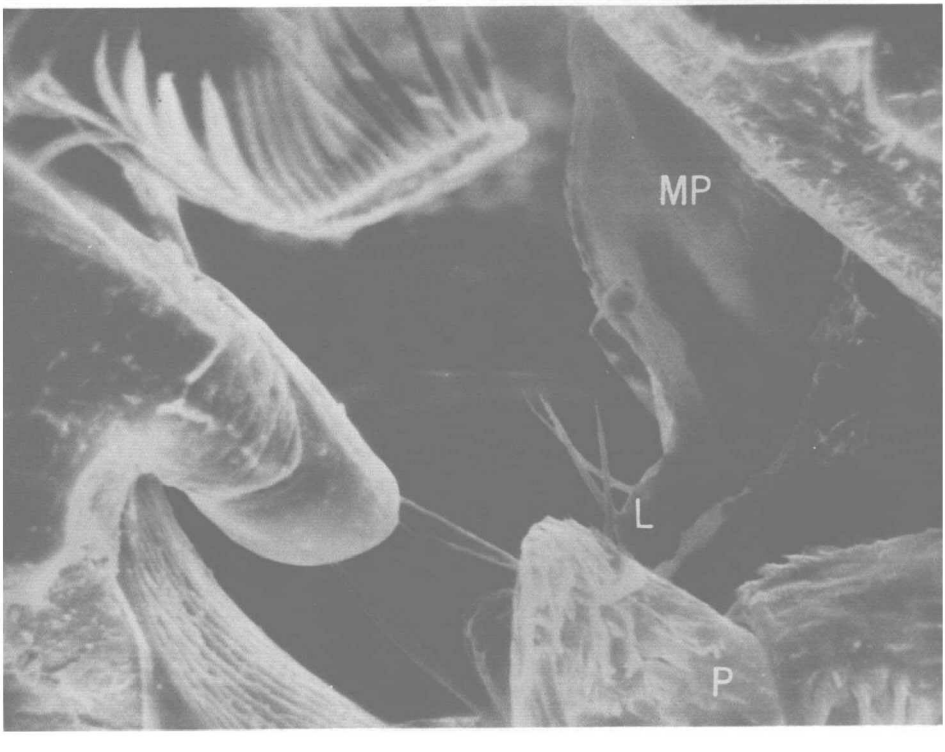
Figure 14. (Upper) *Excorallana bruscai* n. sp. (top): Scanning electron micrograph, anterior view of cephalon, pereonite I and mandibles (MDB), 45×. All biological materials in micrographs with ~300 Å gold-palladium coating.

Figure 15. (Lower) *Excorallana bruscai* n. sp. (bottom): SE micrograph; anterolateral view of mandibles (MDB), mandibular palp (P), lacinia (L), and molar process (MP), 88×.


MP
P


MP
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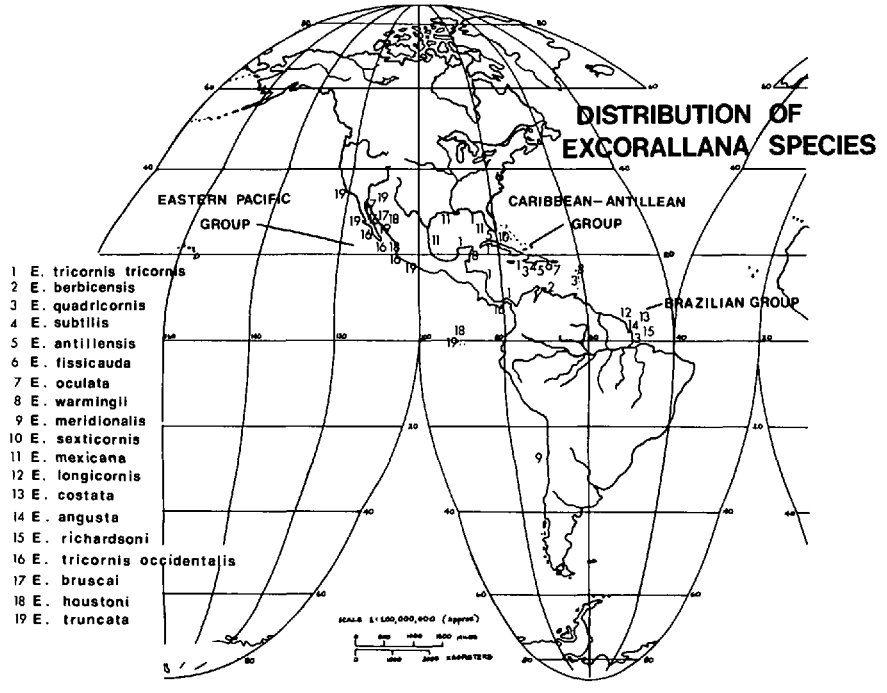

Figure 18. Distribution of *Excorallana* species.

incisions in the pleotelson of *E. t. occidentalis* are not separated by a gap as in *E. t. tricornis*; the wider uropodal endopods of *E. t. occidentalis* have a notch at the terminal end that is shallower (with its medial wall much longer than its lateral wall) than the "nearly symmetrical" notch in *E. t. tricornis*. These differences are corroborated by my examination of specimens from Paitilla Beach, Pacific Panama and Galeta Reef, Atlantic Panama.

Excorallana tricornis occidentalis ranges in length from 3.75–10.88 mm. Females of the species lack horns.

Material Examined.—Mexico: Marcy Channel, Bahía Magdalena, Baja California Sur, 9 March 1949, Velero #1718-49, AHF #1005-01, 1 male, 7.88 mm, 24°30'N, 111°50'W, rock dredge at 23.8 m. Bahía Magdalena, Baja California Sur, R. C. Brusca and A. M. Mackey, 16 Aug. 1976, 1 male, 5.63 mm, and 1 female, 6.15 mm (gravid), fish seine in 3.0 m channel. Puerto Peñasco, Sonora, 29 June 1968, AHF #1010-01, 2 females, 10.88 and 7.65 mm. 5 miles north of Guaymas, Sonora, 10 April 1960, AHF #c2253, BI-60-16, SB-39, 1 male, 8.25 mm, beach intertidal. Mangrove Cove, S.E. side of Bahía Concepción, Baja California Sur, E. W. Iverson, 19 Aug. 1980, EWI-80-14, 1 male, 6.75 mm, subtidal snorkeling over *Porites* reef and sandy area further offshore. Gulf of California, 30 April 1888, ALBATROSS Station #2826, USNM #22629, type-specimens, 1 male, 6.75 mm, and 2 females, 8.63 (gravid) and 7.88 mm (gravid), 24°12'N, 109°55'W. Bahía San Everisto, Baja California Sur, R. C. Brusca and

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Figure 16. (Upper) *Excorallana bruscai* n. sp. (top): SE micrograph; molar process (MP) on left mandible, anterior view; lacinia obscured by mandibular palp (P), 205×.

Figure 17. (Lower) *Excorallana bruscai* n. sp. (bottom): SE micrograph; anterior view of molar process (MP) and lacinia (L) on left mandible; mandibular palp (P), 320×.

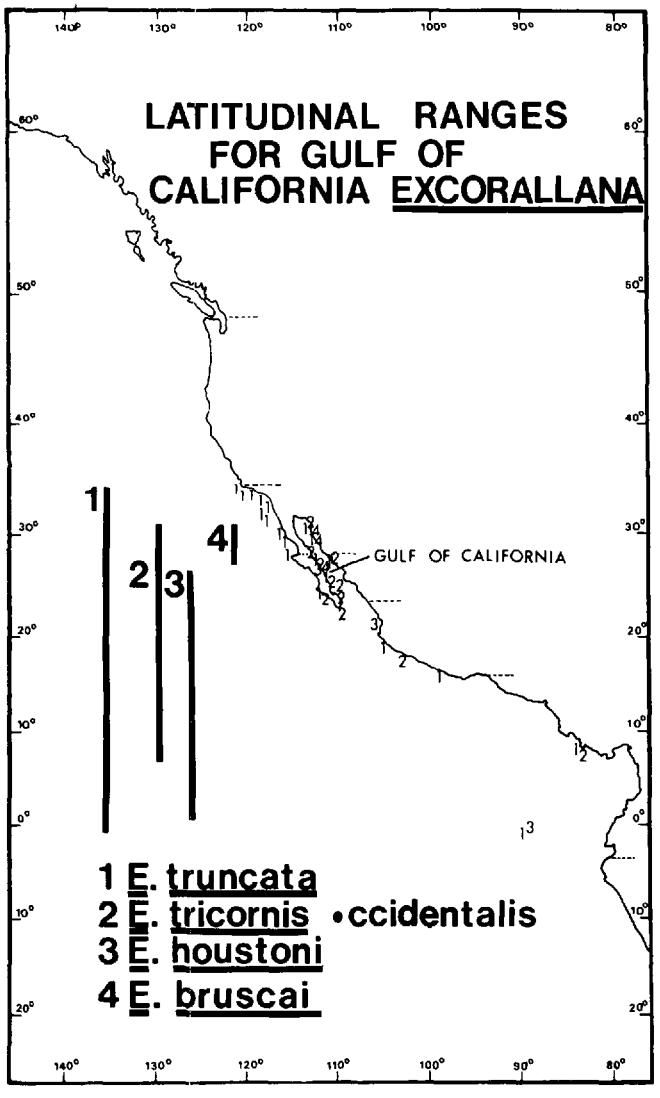
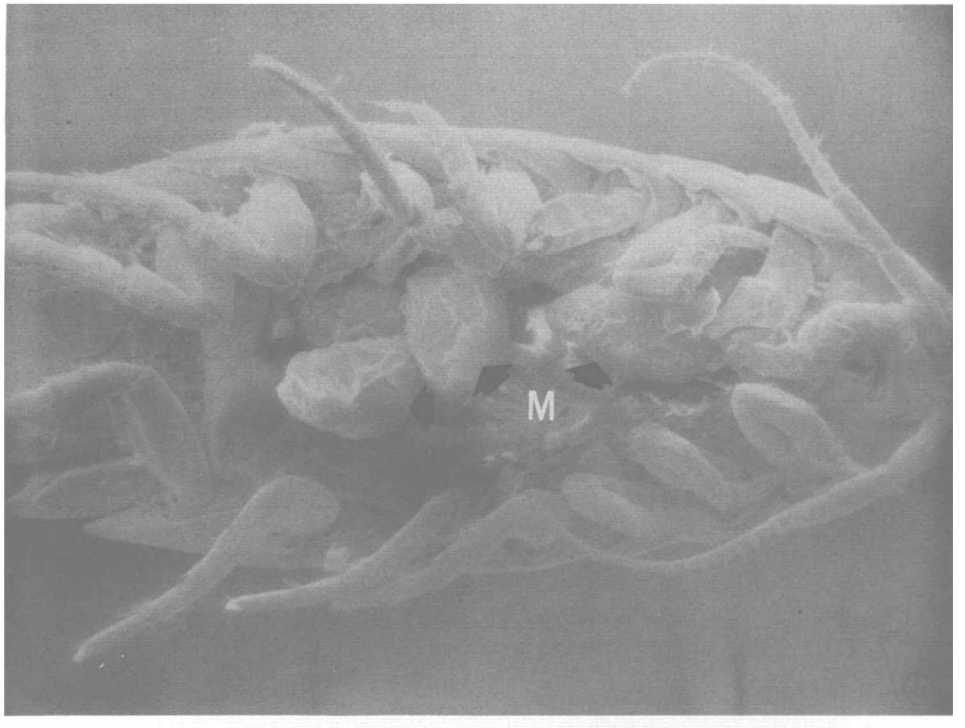


Figure 19. Latitudinal ranges and distribution of *Excorallana* species in the Gulf of California, Mexico.

J. L. Barnard, 19 March 1974, AHF #1008-01, 41 males, 6.0–7.88 mm, and 37 females, 4.5–8.63 mm (3 gravid), commensals in orange sponge with juvenile sabellid worm. Cabo Santa Maria, Baja California Sur, D. G. Lindquist, AHF #1009-01, 4 males, 6.0, 6.38, 6.38 and 6.0 mm. North of Isla Partida, Baja California Sur, Feb. 1940, VELERO Station #1081-40, 1 male, 6.75 mm, collected at 100.6–138.0 m on rock. Isla Grande, Guerrero, 10 April 1978, R/V ALPHA HELIX, BI-78-18, AHF #c4135, TEPE 78-18, 1 male, 5.63 mm, and 2 females, 3.75, 5.63 mm, 17°40.3'N, 101°40.4'W, taken with SCUBA at 4.6–6.1 m. Central America, Panama: Paitilla Beach, 26 April 1971, FWQA Project, STRI collections, 1 male, 6.0 mm, taken intertidally, associated with hydroids in "*Abietinaria*-Zone" on andesite rock beach. Galeta Reef, FWQA Project, STRI collections, 1 Nov. 1971, 1 male, 7.13 mm, "Coralline 13."

Type-Deposition.—Type-specimens are deposited with the Smithsonian Institution, USNM #22629. Additional material is deposited in the Allan Hancock Foundation.



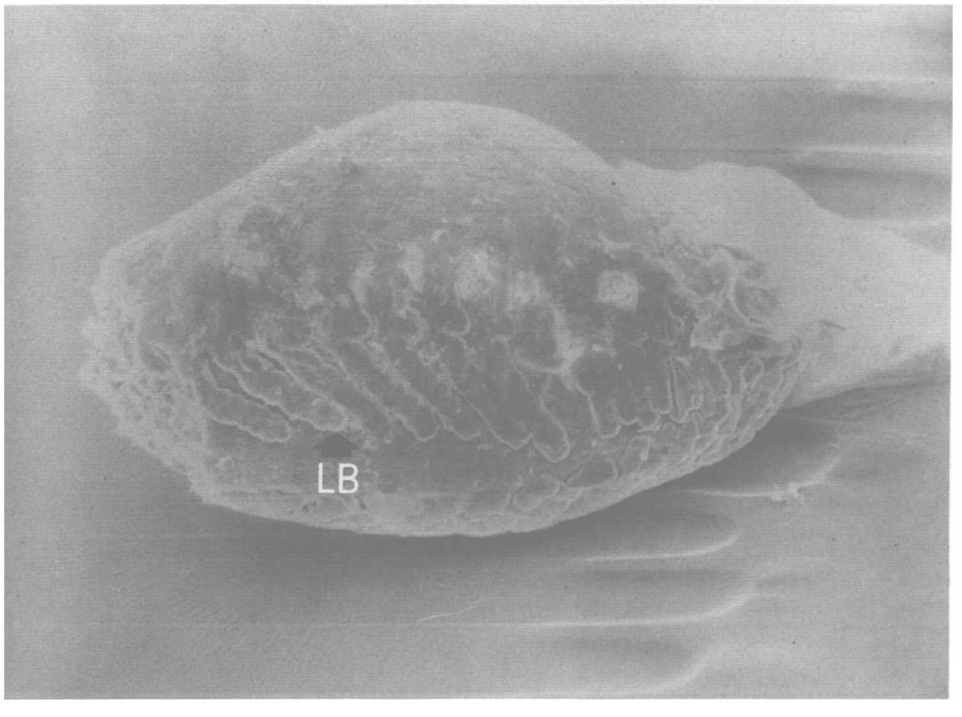


Figure 20. (Upper) *Excorallana houstoni* n. sp. (top): SE micrograph; ventral view of female and mancas (M), oostegites removed, 26×.

Figure 21. (Lower) *Excorallana houstoni* n. sp. (bottom): SE micrograph; lateral view of manca with limb buds (LB), 130×.

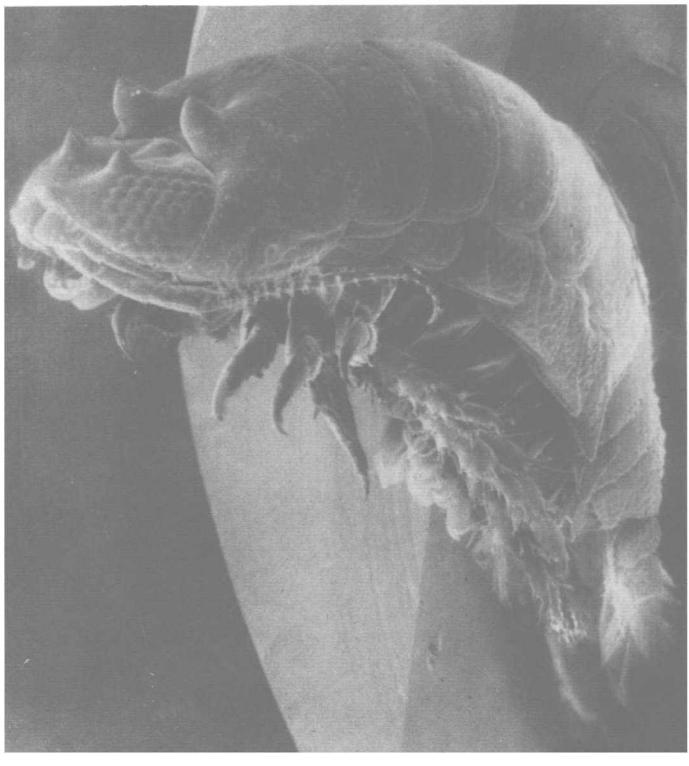


Figure 22. *Excorallana bruscai* n. sp.: SE micrograph, lateral view, 14×.

Distribution.—*Excorallana tricornis occidentalis* is known from 4 localities—the Gulf of California, southwestern Baja California, western Mexico, and Panama; apparently ranging through the Cortezian, Mexican and Panamanian provinces.

Ecology.—*Excorallana tricornis occidentalis* has been collected at depths ranging from 138.0 m to the intertidal zone on rock, sandy beach and mangroves. It has been found as a commensal of an orange sponge along with a juvenile sabellid worm at Bahía San Everisto, Baja California, Mexico; associated with hydroids on an andesite rock beach (Paitilla Beach) in Panama; and reported as parasitic on the Gulf grouper *Mycteroperca jordani* (Jenkins and Evermann), and the jack-crevally *Caranx caninus* Gunther.

Gravid females of this species have been found in March, April and August.

Excorallana truncata (Richardson, 1899)
Figures 11–13

Corallana truncata Richardson, 1899a: 825; 1899b: 165; 1900: 217.
Exocorallana truncata Richardson, 1905: 138 (*lapsus calami*).
Excorallana kathyae Menzies, 1962: 345. Monod, 1969: 50.
Excorallana truncata Lemos de Castro, 1960: 61; 1964: 4. Monod, 1969: 50. Carvacho and Yanez, 1971: 130. Delaney, 1982: 273.

Description.—Male. Cephalon devoid of tubercles. Eyes large, lateral. First antennae with 3 peduncular and 8–13 flagellar articles; reaching posterolateral margin of cephalon (Fig. 12H). Second antennae with 21–30 flagellar articles, reaching

posterior margin of pereonite III (Fig. 12D). Frontal lamina rounded anteriorly (Fig. 12K).

Pereonites I–III without dorsal setae or tubercles. Anterolateral angle of pereonite I weakly produced, partly covering posterior part of eyes. Pereonites IV–VII with dorsal setae and row of small tubercles on posterior margin. Coxal plates IV–VII bear setae; VI–VII bear rows of spines (Fig. 12I). Pereopods I–III prehensile; merus with 5 short, blunt spines on posterior medial margin; ischium with 1 short, blunt spine on posterior medial margin (Fig. 13F).

Pleonite 1 partly overlapped by pereonite VII. All pleonites with rows of setae along posterior margins; pleonites 2–5 with tuberculate posterior margins, largest tubercles located medially and submedially (Fig. 11). Pleotelson triangular with subacute apex; with lateral incisions, row of 6 subbasal tubercles, and 6–10 subapical spines (Fig. 12J). Entire dorsum densely covered with bifid golden setae (Fig. 11). Uropods fringed with long golden setae; endopod broad, posteriorly subtruncate with rounded distal lateral angles, and as long as pleotelson; with 12–15 apical marginal spines, subapical (dorsal) row of 4 spines and lateral (dorsal) row of 6 marginal spines (Fig. 12J). Width of exopod less than ½ width of endopod, with 7–9 lateral marginal spines, 2 medial marginal spines, and row of 4–5 spines on dorsal surface (Fig. 12J). Pleopods fringed with plumose marginal setae as in Figure 13A–E.

Remarks.—Females of the species do not differ significantly from the male.

Type-Deposition.—Type-specimens of *Excorallana truncata* and *E. kathyae* are deposited with the Smithsonian Institution, Washington, D.C. Additional material is deposited in the Allan Hancock Foundation.

Distribution.—*Excorallana truncata* is a widespread member of the tropical Eastern Pacific Zoogeographic Region, and has been recorded from five zoogeographic provinces (Californian, Cortezian, Mexican, Galapagan and Panamanian) (Briggs, 1974; Brusca and Wallerstein, 1979), its range extending from Point Conception, California, to Bindloe Island, Galapagos Islands.

Ecology.—Collected at depths of 183 m to the intertidal zone. Delaney (1982) gives collection data for specimens examined during the present study.

Acknowledgments

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