

FIGURE 37.—*Sicyonia affinis*, ♀ 17 mm cl, 4.4 km off Isla Manuelita, Costa Rica. Thelycum. Scale = 1 mm.

able, larger male 21.5 mm cl, about 46 mm tl; largest female, 17 mm cl, about 62 mm tl.

Geographic and bathymetric ranges.—Known with certainty only from a restricted area between Isla Manuelita (5°34'N, 87°00'W), Costa Rica, and Isla de Malpelo (3°58'20"N, 81°36'00"W), Colombia (Fig. 38). Chirichigno Fonseca (1970) and Arana Espina and Méndez G. (1978) cited Paita, Peru, as the southern limit of the range of the species. Chirichigno Fonseca did not present a list of her material and Matilde Méndez G.³ found no representative of the species in Peruvian collections, including those of the Instituto del Mar del Perú (IMARPE) from which Chirichigno Fonseca obtained most of her information. Chapa Saldaña (1964) recorded the occurrence of this species in the waters of Chiapas and Sinaloa, Mexico, but again, more recent studies, including the present one based on extensive material, failed to disclose

³Matilde Méndez G., Instituto del Mar del Perú, Callao, Peru, pers. commun., January 1984.

its presence north of Costa Rica. Further investigations are necessary to ascertain the limits of the range of this shrimp both south of Isla de Malpelo and north of Isla Manuelita. *Sicyonia affinis* is one of only four members of the genus that have been recorded from the eastern Pacific off South America.

This species has been found at depths between 79-77 and 205 m, on substrates of rocks or broken shells.

Discussion.—*Sicyonia affinis* is one of the three closely related American Pacific species belonging to Burkenroad's (1934a) "affinis group" of his Division II. He characterized this group (in which he included *S. affinis* and *S. aliaffinis*, and to which

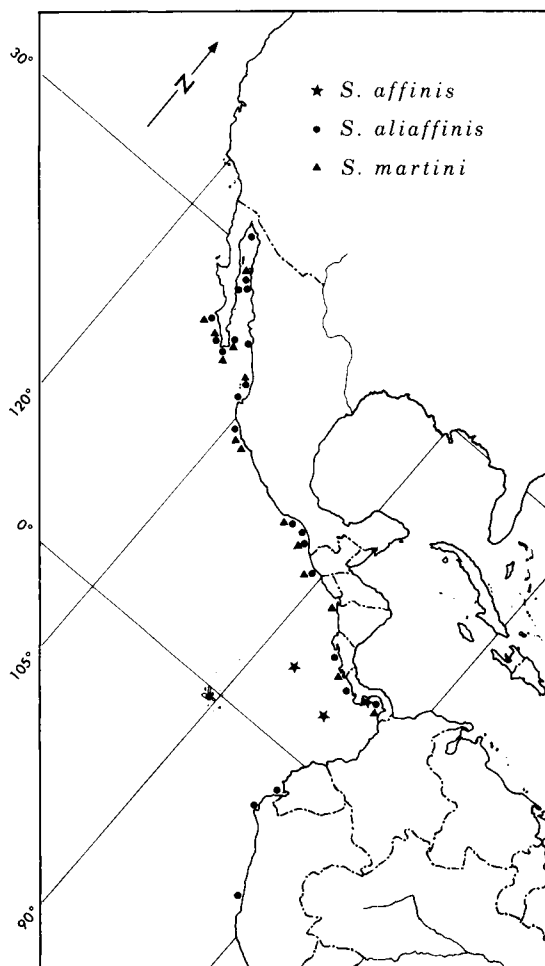


FIGURE 38.—Geographic distribution of *Sicyonia affinis*, *S. aliaffinis*, and *S. martini*.

recently Pérez Farfante and Boothe (1981) added *S. martini* as possessing two teeth posterior to the orbital margin, of which one, that posterior to the level of the hepatic spine, is large. Like all members of Division II, in *S. affinis* the antennal spine is buttressed, but the buttress is barely distinct in contrast to that in *S. aliaffinis* and *S. martini* in which it is well developed. In *S. affinis* the first rostral tooth is situated farther anteriorly, at about the end of the anterior third of the rostral length from the orbital margin, than in the other two species in which it is placed opposite or immediately anterior to the orbital margin.

In *S. affinis* the abdominal surface is punctate but otherwise rather smooth, lacking tubercles, conspicuous ridges, and deep sulci. Also, in *S. affinis* the anteromedian sulcus of the first abdominal somite is not only weak but short, whereas in *S. aliaffinis* and *S. martini* it is deep (except ventrally in *S. martini* in which it is represented by a shallow depression) and long, in *S. aliaffinis* almost reaching the ventral margin of the pleuron. The anteromedian sulci of the second and third somites in *S. affinis* are distinct only ventrally, rather than dorsally as in *S. martini*, or along most of the height of the somite, as in *S. aliaffinis*. The posteromedian sulci of these somites in *S. affinis* extend dorsally only to a point situated at about 0.33 of the height of the somite from the dorsal midline where they turn anteriorly and are marked dorsally by weak longitudinal ridges; these sulci are considerably shorter than the well-incised ones in *S. aliaffinis*, which extend to about the dorsal 0.25 of the height of the somite, and are not accompanied dorsally by longitudinal ridges. In *S. martini* the posteromedian sulci curve anteroventrally at their dorsal ends, defining strong angular ridges.

As Burkenroad (1934a) pointed out, in *S. affinis* the dorsal carina of the fifth abdominal somite does not end in a sharp angle or acute tooth as it does in the other two species; instead its posterior part slopes gradually to the apex of the caudal cleft. In *S. affinis* the tip of the tooth on the first abdominal somite is slightly curved anteriorly whereas in *S. martini* it forms a conspicuous hook, and in *S. aliaffinis* the entire tooth is straight and projects anterodorsally. Furthermore, the anteroventral extremities of the pleura of the first four somites in *S. affinis* are unarmed whereas they bear a small spine in *S. aliaffinis*, and in *S. martini*, although lacking spines, are strongly angular instead of faintly so or rounded as they are in *S. affinis*.

These three species can also be distinguished readily by petasma and thelycal characters. In *S. affinis* the projection of the dorsolateral lobule of the petasma, like that of *S. aliaffinis*, is truncate or shallowly emarginate distally and produced in a simple, dorsally directed, sharp salient, whereas in *S. martini* the projection curves gently to a conspicuously bifurcate, mesially directed tip; on the other hand, in *S. affinis*, as in *S. martini*, the projection of the ventrolateral lobule is flattened and curved or concave dorsally rather than being strongly bulbous as it is in *S. aliaffinis*. In the females of *S. affinis* and *S. martini* the thelycal plate of sternite XIV bears a pair of low but well-marked lateral bulges (longitudinally disposed in the former and transversely so in the latter), whereas in *S. aliaffinis* the plate is almost flat or barely raised in ill-defined elevations. Moreover, in both *S. affinis* and *S. aliaffinis*, the posterior emargination of the median plate of sternite XIII does not embrace a tubercle, as it does in *S. martini*.

Material.—17 specimens from 6 lots.

Costa Rica—3♂ 5♀, AHF, 4.4 km off Isla Manuelita, 146 m, 3 June 1973, *Velero IV* stn 19044. 1♂, syntype, USNM, off Isla del Coco, 95 m, 28 February 1891, *Albatross* stn 3369. 1♂ 1♀, syntypes, MCZ, off Isla del Coco, 183 m, 28 February 1891, *Albatross* stn 3367.

Panama—3♀, USNM, NE of Isla Iguana, 79-77 m, 4 May 1967, *Pillsbury* stn 515.

Colombia—1♀, syntype, MCZ, W of Isla de Malpelo, 95 m, 5 March 1891, *Albatross* stn 3379. 2♀, syntypes, USNM, W of Isla de Malpelo, 205 m, 5 March 1891, *Albatross* stn 3378.

Sicyonia aliaffinis (Burkenroad 1934)

Figures 38-42

Eusicyonia aliaffinis Burkenroad, 1934a:92, fig. 24 [holotype ♂, YPM 4393; type-locality: Pacific coast of southern Mexico (NW of Puerto Madero), 14°48'40"N, 92°54'40"W, 19-30 fm (35-55 m), 9 April 1926, *Paunee*]. Burkenroad 1938:84, fig. 25, 27. Anderson and Lindner, 1945:317.

Eusicyonia sp. Castro, 1966:17 [in part, by implication].

Sicyonia aliaffinis. Chapa Saldaña 1964: 15. Bayer et al. 1970:A97. Chirichigno Fonseca 1970:7, fig. 6. Del Solar 1972: 7. Rodríguez de la Cruz 1977:10. Arana Espina and Méndez G. 1978:25, fig. 6-9.

Anonymous 1980:7. Brusca 1980:256. Sosa Hernández et al. 1980:12. Méndez G. 1981:47, pl. 9, fig. 78-82. Pérez Farfante and Boothe 1981:424. Pérez Farfante 1982:370.

Vernacular names: rock shrimp, target shrimp, Japanese shrimp (United States); camarón de piedra, camarón de roca, camarón japonés, cacahuete (Mexico); camarón conchiduro (Mexico, Panama); camarón de mar, camarón cascaradura (Peru). FAO names: hardhusk rock shrimp (English); camarón cáscara dura (Spanish); boucot noisette (French).

Diagnosis.—Antennal spine well developed and buttressed. Second abdominal somite with dorsomedian carina lacking incision. First pereopod with basis and ischium unarmed. Postrostral carina bearing one tooth posterior to level of hepatic spine and raised in high crest behind posterior tooth. Rostrum short, not overreaching distal margin of eye. Abdomen tuberculate; second and third somites not bearing special inverted V-shaped ridges laterally; fifth somite with dorsomedian carina ending in sharp angle or tooth posteriorly. Petasma with distal projection of dorsolateral lobule compressed distally, its truncate tip produced dorsally in simple, minute spine. Thelycum with plate of sternite XIV lacking anteromedian tubercle and either flat or barely

raised in ill-defined bulges. Branchiostegite bearing large, horizontally disposed 9-shaped color pattern.

Description.—Body relatively short (Fig. 39). Carapace with irregular patches of longer setae on dorsum, in depression delimiting branchiocardiac carina posterodorsally, and on areas anterior to hepatic spine and ventral to hepatic sulcus; one patch also present in dorsolateral depression of sixth abdominal somite. Abdomen rather heavily granulate on first three abdominal somites, usually slightly so on last somites.

Rostrum short, not overreaching distal margin of eye, its length increasing linearly with carapace length (Fig. 40) to about 16 mm cl, then increasing little, not surpassing 6 mm (proportional length decreasing with increasing size from as much as 0.43 to as little as 0.20 cl); subhorizontal or upturned to 30° in males and to 50° in females; armed with two dorsal teeth and three (occasionally two) apical ones, latter disposed on obliquely truncate apex, upper tooth posterior to level of ventral one (occasionally appearing to be third of dorsal series); first dorsal tooth subequal to or, more often slightly smaller than, epigastric and situated opposite or immediately anterior to orbital margin; second tooth variably placed between anterior 0.17 and 0.40 (mean 0.30) rl. Conspicuous adrostral carina, subparallel and near ventral margin, ex-

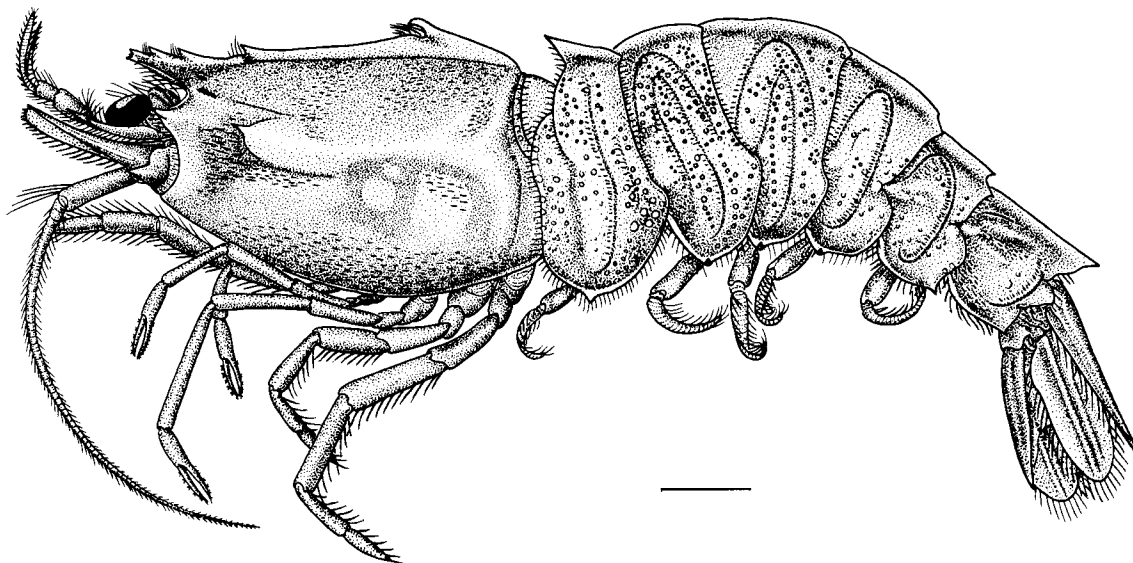


FIGURE 39.—*Sicyonia aliaffinis* (Burkenroad 1934), ♀ 26 mm cl, west of Puerto Madero, Golfo de Tehuantepec, Mexico. Lateral view. Scale = 5 mm.

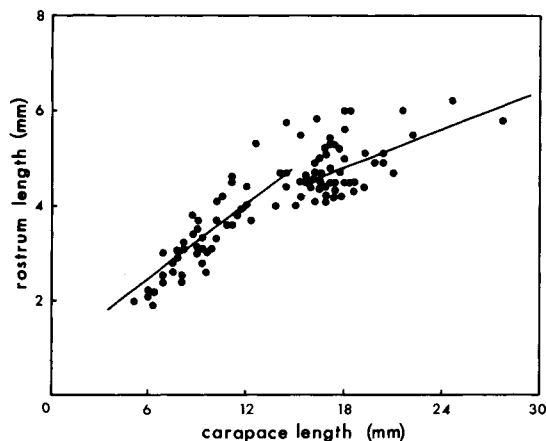


FIGURE 40.—*Sicyonia aliaffinis*. Relationship between rostrum length and carapace length (regression equation for specimens with about 16 mm cl or less, $y = 0.83950 + 0.25635x$; regression equation for those larger, $y = 2.34086 + 0.13665x$).

tending from orbital margin almost to end of rostrum.

Carapace with strong postrostral carina bearing two teeth: 1) epigastric tooth small, subequal to or slightly larger than first rostral tooth, situated opposite or anterior to level of hepatic spine, between 0.15 and 0.22 (mean 0.18) cl from orbital margin; and 2) posterior tooth, much larger, as much as three times higher than epigastric, hooklike, its apical portion acutely pointed and strongly curved anteroventrad; tooth placed well in advance of posterior margin of carapace, between 0.66 and 0.76 (mean 0.71) cl from orbital margin. Postrostral carina slightly elevated just in front of posterior tooth and forming high crest from latter descending gently to posterior margin of carapace. Tuft of setae present at anterior base of each tooth. Antennal spine sharp, projecting from well-marked buttress; hepatic spine acute, larger than antennal, arising from raised area, and situated between 0.19 and 0.26 (mean 0.23) cl from orbital margin. Postocular sulcus deep anteriorly, continuing posteriorly as low groove; hepatic sulcus well marked; branchiocardiac carina distinct but rather low, extending longitudinally from hepatic region almost to posterior margin of carapace, there bifurcating: one branch curving dorsally and other disposed ventrally.

Antennular peduncle with stylocerite produced in long spine, its length about 0.9 distance between lateral base of first antennular article and mesial base of distolateral spine; latter extending to about midlength of second article.

Scaphocerite almost reaching or slightly overreaching distal margin of antennular peduncle; lateral rib produced distally in long, strong spine surpassing distal margin of lamella. Antennal flagellum as much as 2 times as long as carapace.

Abdomen with high dorsomedian carina extending from first through sixth somites, carina on first somite produced in strong triangular tooth as high as, or usually higher (as much as one-third) than, posterior tooth on carapace, its anterior margin straight, subvertical or sloping anterodorsally; carina on fourth somite obliquely truncate posteriorly forming obtuse (rarely almost right angle); that on fifth strongly truncate forming acute posterior tooth; and that on sixth strongly produced in large acute posterior tooth.

First four somites with angular anteroventral extremity bearing small spine; fourth somite with posteroventral extremity broadly angular, occasionally armed with minute spine, and fifth and sixth somites with posteroventral extremity bearing small sharp spine, that of fifth slightly larger.

First somite marked with long anteromedian pleural sulcus joining coalescent posterior tergal-posteromedian pleural sulci near margin of pleuron. Second and third somites with deep anterior and posterior tergal and long, well-incised anteromedian (expanding ventrally) and posteromedian pleural sulci, posteromedian ones extending dorsally to a point located at least at 0.25 of the height of the somite from the dorsal midline. Fourth somite bearing anterior and posterior tergal sulci, posterior one merging with deep, long posteromedian sulcus. Fifth somite marked with anterior tergal sulcus and united posterior tergal-posteromedian pleural sulci. Sixth somite with short anterior tergal sulcus, strongly arched posterior pleural one, and setose, longitudinal depression delimited dorsally by rib and ventrally by usually strong cicatrix.

Telson with pair of small but well-developed fixed spines. Rami of uropod subequal in length, reaching or slightly overreaching apex of telson.

Petasma (Fig. 41) with rigid distal projection of dorsolateral lobule curved mesially, raised proximodorsally in rounded prominence, and compressed distally; its truncate tip with ventral extremity rounded and dorsal extremity sharply produced in minute spine. Fleshy distal projection of ventrolateral lobule with firm, terminal part directed laterally almost at right angle, dorsally bulbous, ventrally flat, and tapering to pointed, ventrally inclined apex.

Petasmal endopods coupled in males 8.2 mm cl,

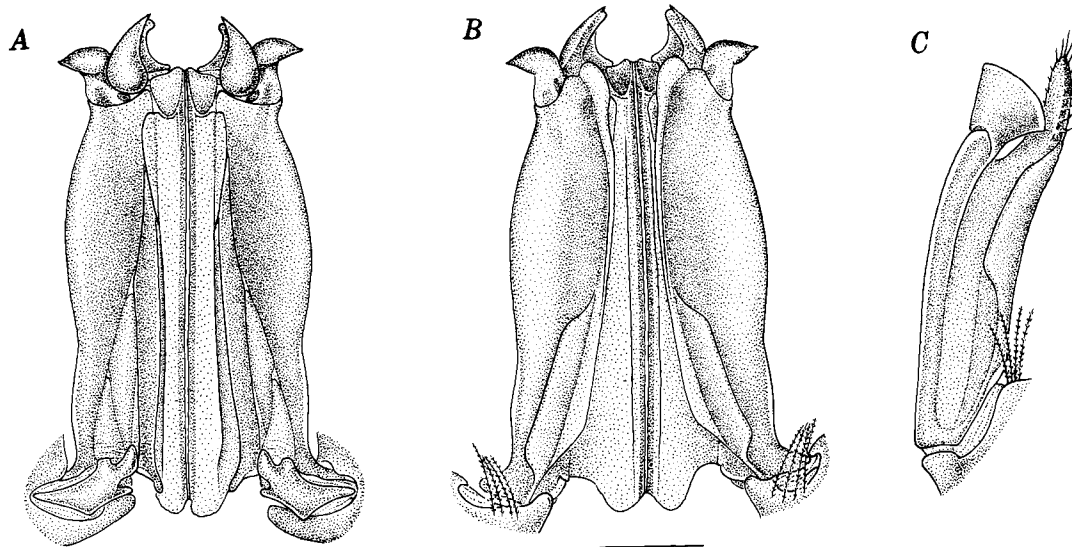


FIGURE 41.—*Sicyonia aliaffinis*, ♂ 16 mm cl, west of Puerto Madero, Golfo de Tehuantepec, Mexico. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scale = 1 mm.

about 27 mm tl, but may not be joined in individuals as much as 11 mm cl, about 36 mm tl.

Appendix masculina as illustrated in Figure 41C.

Thelycum (Fig. 42) with plate of sternite XIV, delimited anterolaterally by strongly convex margins, flat or very slightly raised in paired ill-defined bulges flanking depressed median portion. Median plate of sternite XIII flask-shaped in outline, tapering gradually into long, slender spine reaching as far as distal margin of coxae of anteriorly extended second pereopods; posterior component of plate with posterolateral margins strongly arched and separated by median emargination variable in width. Sternite XI armed posteriorly with paired short spine. Posterior thoracic ridge with weakly concave or virtually straight anteromedian portion slightly elevated, but areas lateral to it merging indistinctly with plate of sternite XIV.

The smallest impregnated female encountered has a carapace of 5 mm, about 23 mm tl.

Color.—Specimens from Peruvian waters were described by Arana Espina and Méndez G. (1978) as follows: dorsum dark, petroleum green; carapace lighter green laterally, exhibiting various shades of gray, green, or pink, and bearing striking dark mark resembling longitudinally disposed "9" on branchial region. Antennae with light and dark

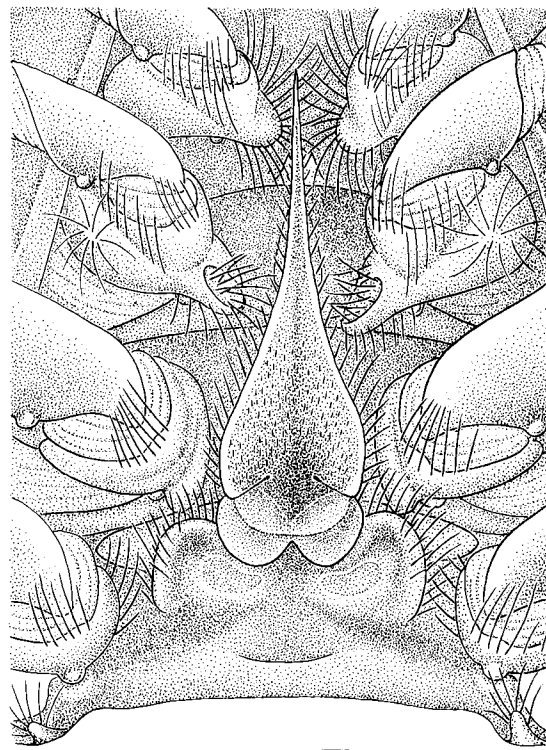


FIGURE 42.—*Sicyonia aliaffinis*, ♀ 25 mm cl, west of Puerto Madero, Golfo de Tehuantepec, Mexico. Thelycum. Scale = 2 mm.

bands. Pereopods and pleopods pink. In addition, spot—dark proximally, intense blue distally—present on lateral ramus of uropods. Sosa Hernández et al. (1980) also presented color notes on specimens from the Golfo de Tehuantepec: body cream, suffused with reddish brown; carapace bearing hook-shaped brown mark on each side; lateral ramus of uropod with violet ventral spot; antennae banded with violet with cream. In Anonymous' (1980) work on the crustacean decapods of the Gulf of California, the "9" is described as purplish brown.

Maximum size.—Male, 22.0 mm cl, 86.6 mm tl; female, 28.5 mm cl, 100.7 mm tl (both recorded by Arana Espina and Méndez G. 1978). Largest individuals examined by me: male, 21.4 mm cl, about 71 mm tl; female, 28 mm cl, about 89 mm tl.

Geographic and bathymetric ranges.—Isla Santa Margarita (24°20'00"N, 111°45'30"W - 24°20'10"N, 111°46'40"W), Baja California Sur, Mexico, to Cabo San Lucas, in the southern part of the Gulf of California along both the east and west coasts, and southward to Bahía Chamela (19°34'00"N, 105°07'24"W), Jalisco. Also from off Salina Cruz (16°10'00"N, 95°00'00"W), Oaxaca, Mexico, to Santa María (12°24'S), Peru, except off middle Central America, Colombia, and most of Ecuador. In the waters of Ecuador, it has been recorded from the Golfo de Guayaquil and Islas Galápagos (Fig. 38). This species has been found at depths between 4-9 and 242 m, mostly at <85 m, on substrates of sand and mud.

The report of the occurrence of this shrimp in Santa María, Peru, (Vélez J., J. Zeballos, and M. Méndez G., in press) is the first from waters south of Bahía Sechura (5°43.1'S, 81°05.0'W), the southernmost record cited by Arana Espina and Méndez G. (1978). These specimens from Santa María were collected at a depth of 10.5 m by A. Robles on 28 June 1983.

Discussion.—The closest relative of *S. aliaffinis* is *S. affinis*. The former, however, reaches a larger size (about 29 mm cl) than *S. affinis*, the largest known specimen of which has only a 17 mm cl. *Sicyonia aliaffinis* also differs from *S. affinis* in having a strongly buttressed antennal spine and in the position of the first dorsal rostral tooth, which is situated opposite or barely anterior to the orbital margin instead of at about the anterior end of the basal third of the rostrum.

Differences in the abdominal characters are even more striking. In *S. aliaffinis* the abdomen is granulose, heavily so on the first three somites, and the transverse sulci are deeply incised whereas in *S. affinis* it is glabrous and bears weak sulci, some of which are incomplete, adding to the smooth appearance of the abdomen. In *S. aliaffinis* the anteromedian sulcus of the first somite is long, and although it becomes shallow ventrally, it extends to near the ventral margin of the pleuron; in *S. affinis*, in contrast, it is short, ending considerably above the ventral margin of the pleuron. The anteromedian sulci of the second and third somites in *S. aliaffinis* are long instead of short, recognizable only on the ventral half of the somites; the posteromedian sulci of these somites in *S. aliaffinis* extend dorsally to a point at least at 0.25 of the height of the somite from the dorsal midline and do not turn anteriorly, whereas in *S. affinis* they extend only to about 0.35 from the dorsal midline and turn anteriorly, delimiting ventrally a weak longitudinal ridge which is absent in *S. aliaffinis*. Also in *S. aliaffinis*, the anterior tooth of the first somite is acute but not curved at the tip as it is in the other species, and the dorsal carina of the fifth somite ends in a sharp angle or more often in a tooth, whereas in *S. affinis* it slopes gradually to the base of the caudal cleft. The anteroventral extremities of the first through fourth pleura in *S. aliaffinis* bear a small spine rather than being unarmed.

Features of the external genitalia also allow a ready separation of these two species. In *S. aliaffinis*, the distal projection of the ventrolateral lobule of the petasma is bulbous dorsally; in contrast, that of *S. affinis* is comparatively thin. The thelycal plate of sternite XIV is flat or very faintly raised laterally in ill-defined elevations in *S. aliaffinis*, whereas in *S. affinis* it bears a pair of low but well-marked ovoid or subelliptical bulges.

In addition to the morphological characters discussed above, *S. aliaffinis* exhibits a striking 9-shaped color pattern on the branchial region which distinguishes it from all of its congeners occurring in the American Pacific.

Discussing the diagnostic characters of *S. aliaffinis*, Burkenroad (1934a) stated that "The carina of the second somite is, although not notched above the juncture of the tergal sulci, shallowly emarginate at this point." I have observed that this carina may be entire or slightly depressed either at the point where Burkenroad noted it or more posteriorly; consequently, in this shrimp the contour of the carina is insignificant.

Remarks.—Arana Espina and Méndez G. (1978) graphed the size distribution of each sex in samples of this shrimp from the Golfo de Guayaquil. They included correlations between carapace length and total length, total weight, and abdominal weight. They determined that the relative growth rate in males is higher than that in females, and that within the size range of the shrimp studied, eight molts occurred with an increase of 7.25% at each molt.

Although Castro (1966) did not cite *S. aliaffinis* by name, he stated that among the specimens of "*Eusicyonia*" collected off Puerto Peñasco and near Isla de San Jorge, Sonora, Mexico, there were some bearing a 9-like shaped spot, which undoubtedly indicates that they belonged to this species.

Commercial importance.—*Sicyonia aliaffinis*, like the other six relatively large species of the genus occurring in the American Pacific, is frequently taken together with other penaeoids of greater economic value. In the Gulf of California it is present in the commercial catches made on the eastern side. In some other areas along its range, e.g., the Golfo de Guayaquil (Arana Espina and Méndez G. 1978), it is found in quantities that might support development of a fishery.

Material.—251 specimens from 27 lots.

Mexico—Baja California Sur: 2♂ 1♀, SIO, SW of Isla Santa Margarita, 29-40 m, 13 November 1964, *Black Douglas*. 1♂, SIO, NW of Todos Santos, 38 m, 9 November 1964, *Black Douglas*. 1♂, YPM, Bahía San Lucas, 24 m, 7 May 1936, *Zaca* stn 135D-26. 1♂ 1♀, USNM, W of Estero de los Algodones, 47 m, 3 April 1978, Toral García. 1♂, YPM, Bahía Santa Inés, 37 m, 10 April 1936, *Zaca* stn 141-D4. Nayarit: 57♂ 38♀, SIO, NE of Isla María Madre, 51 m, 31 March 1973, *Agassiz*. 15♂ 8♀, SIO, NE of Isla María Madre, 55 m, 31 March 1973, *Agassiz*. Jalisco: 1♀, USNM, Puerto Vallarta, 13 April 1937. 2♀, SIO, N part of Bahía Chamela, 15-18 m, 2 April 1973, *Agassiz*. Oaxaca: 13♂ 13♀, USNM, E of Salina Cruz, Golfo de Tehuantepec, 18 m, 10 July 1963, I. Mayés A. 2♂ 1♀, SIO, Golfo de Tehuantepec, 55 m, 6 June 1965, T. Matsui. 1♀, USNM, Laguna Lagartero, Ixhuatán, 25 July 1963, G. Solórzano. Chiapas: 2♂ 1♀, USNM, Puerto Arista, 14 January 1964, I. Mayés A. 8♂ 8♀, SIO, Golfo de Tehuantepec, 46-48 m, 10 April 1973, *Agassiz*. 3♂ 2♀, SIO, Golfo de Tehuantepec, 73 m, 10-11 July 1963, D. Dockins. 1♂, holotype, YPM, off "southern Mexico" [NW of Puerto Madero], 35-55

m, 9 April 1926, *Pawnee*. 17♂ 38♀, SIO, W of Puerto Madero, Golfo de Tehuantepec, 55 m, 10 April 1973, *Agassiz*.

Guatemala—1♂, AHF, off San José light, 42 m, 23 March 1939.

Costa Rica—1♂, USNM, near Quepos, 242 m, 26 April 1973, *Enriqueta*.

Panama—1♂, AHF, Isla Taboga, 4-9 m, 2 May 1939. 1♂, USNM, Bahía Santelino, 1.6 km N of Punta de Cocos, Archipiélago de las Perlas, 9 February 1939. 1♀, USNM, S of Isla del Rey, 44-42 m, 7 May 1967, *Pillsbury* stn 551. 1♀, USNM, SW of Bahía San Miguel, 55 m, 7 May 1967, *Pillsbury* stn 549. 2♂ 1♀, USNM, 12 km NW of Punta Caracoles, Darién, 84 m, L. G. Abele.

Ecuador—1♀, USNM, S of Isla Seymour, Galápagos, 7-13 m, 9 March 1938, F. E. Lewis. 1♀, USNM, off Playas, Golfo de Guayaquil, 16 m, 1976, P. Arana Espina.

Peru—1♂, USNM, off Caleta Cruz, 10-14 m, 1970, E. Valdivia.

Sicyonia martini Pérez Farfante and Boothe 1981

Figures 38, 43-46

Eusicyonia species, Burkenroad 1938:81, fig. 26, 28-30.

Sicyonia martini Pérez Farfante and Boothe 1981:424, fig. 1-4 [holotype ♀, USNM 180235; type-locality: SW of Punta Ana María, Golfo de Panama, 7°50'30"N, 78°49'00"W, 58 m, *Pillsbury* stn 556].

Vernacular names: rock shrimp (United States); camarón de piedra, camarón de roca (Mexico); camarón conchiduro (Mexico, Panama).

Diagnosis.—Antennal spine well developed and buttressed. Second abdominal somite with dorsomedian carina lacking incision. First pereopod with basis and ischium unarmed. Postrostral carina bearing one tooth posterior to level of hepatic spine and raised in high crest behind posterior tooth. Rostrum long, conspicuously overreaching distal margin of eye. Abdomen tuberculate; second and third somites bearing unusual inverted V-shaped ridges laterally; fifth somite with dorsomedian carina sharply truncate posteriorly. Petasma with distal projection of dorsolateral lobe tapering distally to minutely bifurcate tip, arms sharp. Thelycum with plate of sternite XIV bearing anteromedian tubercle. Branchiostegite without 9-shaped color pattern.

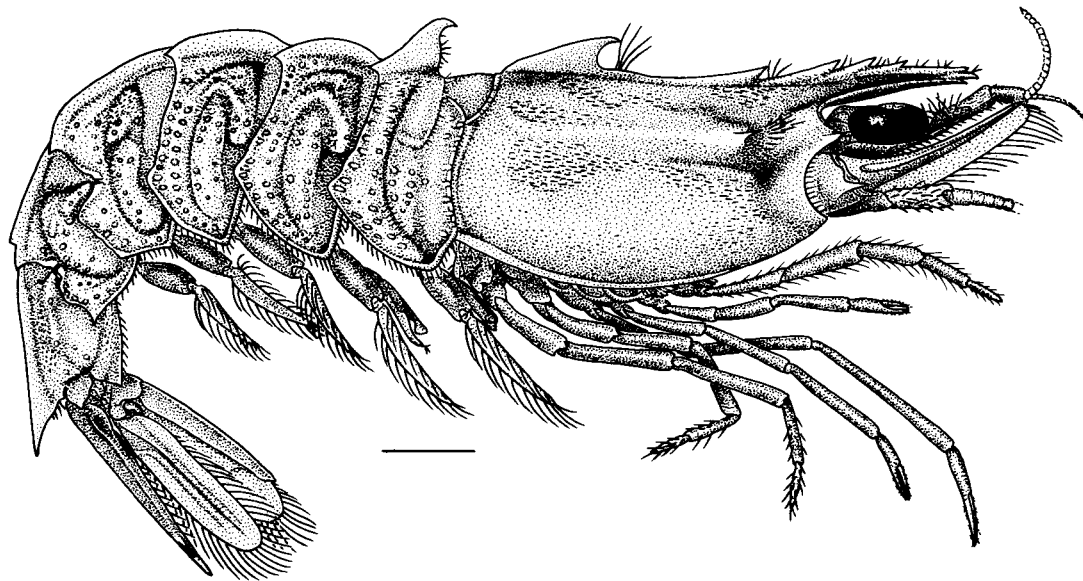


FIGURE 43.—*Sicyonia martini* Pérez Farfante and Boothe (1981), paratype ♂ 19 mm cl, off Puerto Escondido, Golfo de Panamá. Lateral view. Scale = 5 mm.

Description.—Body relatively slender (Fig. 43). Carapace with sparse long setae intermingled with elongate patches of shorter ones situated on dorsum, ventral to hepatic sulcus, posterior to pterygostomian region, and on posterodorsal part of branchiostegite; patches also present on abdominal terga. Abdomen tuberculate, tubercles numerous on first five somites, few on sixth.

Rostrum comparatively long, conspicuously surpassing eye, reaching as far as distal 0.33 of second antennular article, its length, 0.40-0.54 cl, increasing linearly with carapace length (Fig. 44); armed with two or three dorsal teeth and cluster of apical teeth, both groups varying in disposition and number in males and females. In males, rostrum horizontal or directed upward at slight angle of no more than 10°, but weakly decurved at tip, with three dorsal teeth evenly spaced; first rostral tooth situated immediately anterior to orbital margin, last usually separated from upper apical tooth by interval (about 0.33 rl) slightly greater than that between dorsal teeth; apical cluster consisting of three or four teeth (76% and 24%, respectively), with subterminal ventral tooth situated not far from adjacent apical tooth. In females, rostrum strongly elevated at angle of 40°-50°, its ventral margin straight or, more often, strongly convex along midlength, and with two dorsal teeth; first rostral tooth placed distinctly anterior to orbi-

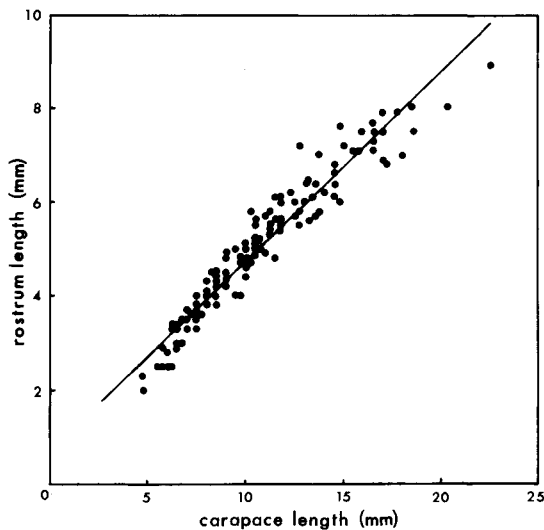


FIGURE 44.—*Sicyonia martini*. Relationship between rostrum length and carapace length (regression equation, $y = 0.76705 + 0.39436x$).

tal margin; interval between second tooth and upper apical tooth slightly shorter than that between first and second; apical cluster consisting of three, four, or five teeth (1, 87, and 12%, respectively), ventral one subterminal, distinctly removed from adjacent apical tooth; teeth of apical

cluster either turned ventrally, or less frequently directed forward. Adrostral carina strong, sometimes sharp, reaching between level of last apical tooth and base of ventral apical one.

Carapace with postrostral carina well-marked, bearing two teeth: 1) epigastric tooth, small, subequal to first rostral tooth, situated opposite or only slightly anterior to hepatic spine; and 2) posterior tooth, placed between 0.63 and 0.73 (mean 0.69) cl from orbital margin, large, about three times as high as epigastric tooth, hooklike at tip; postrostral carina low anteriorly, slightly elevated below apex of posterior tooth, and forming crest from latter descending gently toward ridge on posterior margin of carapace; each tooth preceded by tuft of long setae. Antennal spine small, projecting from rather long buttress; hepatic spine acutely pointed, much longer than antennal, arising from moderately raised area, and situated between 0.14 and 0.20 (mean 0.18) cl from orbital margin. Postocular sulcus short but deep anteriorly, continuing posteriorly as weak groove; hepatic sulcus deep, subhorizontal, accompanying inconspicuous carina. Branchiocardiac carina low but clearly distinct, long, extending from base of hepatic region to near posterior margin of carapace, then curving dorsally toward base of posterior tooth.

Antennular peduncle with stylocerite produced in spine distally, extending about 0.8 distance between lateral base of first antennular article and mesial base of distolateral spine; distolateral spine strong, reaching as far as midlength of second article; antennular flagella short, mesial one slightly shorter than lateral.

Scaphocerite almost reaching (occasionally overreaching) distal end of antennular peduncle; length of antennal flagellum as much as 2.5 times cl.

Third maxilliped slightly stouter than pereopods. Basis and ischium of first pereopod unarmed.

Abdomen with high dorsomedian carina extending from first through sixth somites; carina on first somite produced in large, apically hooked, triangular anterior tooth, more elevated than posterior tooth on carapace; carina of fifth somite abruptly truncate posteriorly; and that of sixth produced in large, acute posterior tooth.

Anteroventral margin of pleuron of first abdominal somite barely to distinctly concave; anteroventral angle 90° - 100° , that of third and fourth 90° or less, with vertex slightly produced anteroventrally; pleuron of fifth roughly pentagonal, an-

teroventral and posteroventral angles with vertices slightly produced, posteroventral one often armed with small spine; posteroventral angle of pleuron of fifth and sixth somites armed with spine, that of fifth larger.

First somite with anteromedian sulcus well defined only dorsally but continuing ventrally as shallow depression joining deep posterior tergal-posteromedian pleural sulcus, ridge often extending posteriorly from ventral portion of anteromedian pleural sulcus to fused posterior sulci. Second and third somites with relatively short, anterior and posterior tergal sulci; short anteromedian pleural sulcus merging ventrally with conspicuous broad depression, latter terminating near anteroventral margin of corresponding pleuron; posteromedian pleural sulcus extending dorsally to about 0.3 height of somite measuring from middorsal line, there curving anteriorly; special inverted V-shaped ridge lying between tergal and pleural sulci. Fourth somite with anterior tergal and long, united posterior tergal-posteromedian pleural sulci; anteroventral part of latter curving dorsally; often short longitudinal ridge present at about 0.3 height of somite from middorsal line. Fifth somite with anterior tergal sulcus continuous with united posterior tergal-posteromedian pleural sulci, anteroventral portion of latter fading as shallow depression; cicatrix extending posteriorly from ventral end of anterior tergal sulcus. Sixth somite with arched posterior pleural sulcus and with shallow setose depression situated dorsal to long but interrupted strong cicatrix.

Telson with pair of small, fixed, subterminal spines. Both rami of uropod reaching, or almost reaching apex of telson.

Petasma (Fig. 45A, B) with rigid distal projection of dorsolateral lobule strongly curved mesially, raised proximodorsally in subhemispheric prominence, and ending in bifurcate apex, both tips sharp. Fleshy distal projection of ventrolateral lobule falling short of adjacent one, and with terminal part truncate and curved dorsally.

Petasmal endopods coupled in males as small as 5.8 mm cl, about 23 mm tl, but may not be joined in individuals as large as 9 mm cl, about 32 mm tl.

Appendix masculina as illustrated in Figure 45C.

Thelycum (Fig. 46A, B) with plate of sternite XIV forming slightly to broadly rounded lateral flanges partly surrounding and merging with roughly semicircular, low mesial bulges; latter separated by median depression bearing oval or, occasionally, subhemispheric anterior tubercle (if

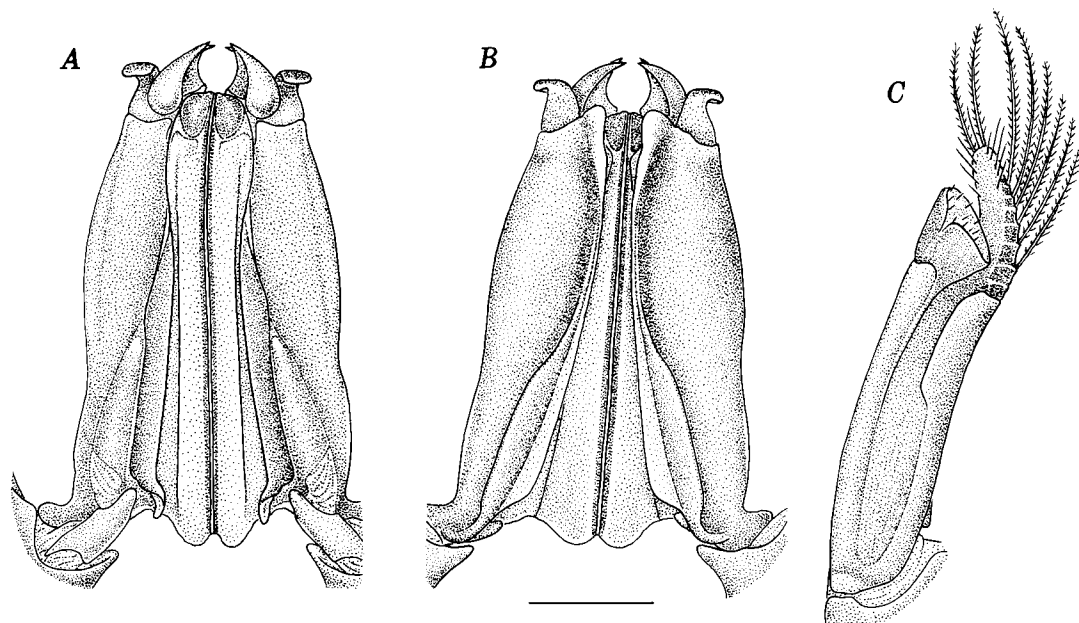


FIGURE 45.—*Sicyonia martini*, paratype ♂ 13.7 mm cl, south of Archipiélago de las Perlas, Golfo de Panamá. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scale = 1 mm.

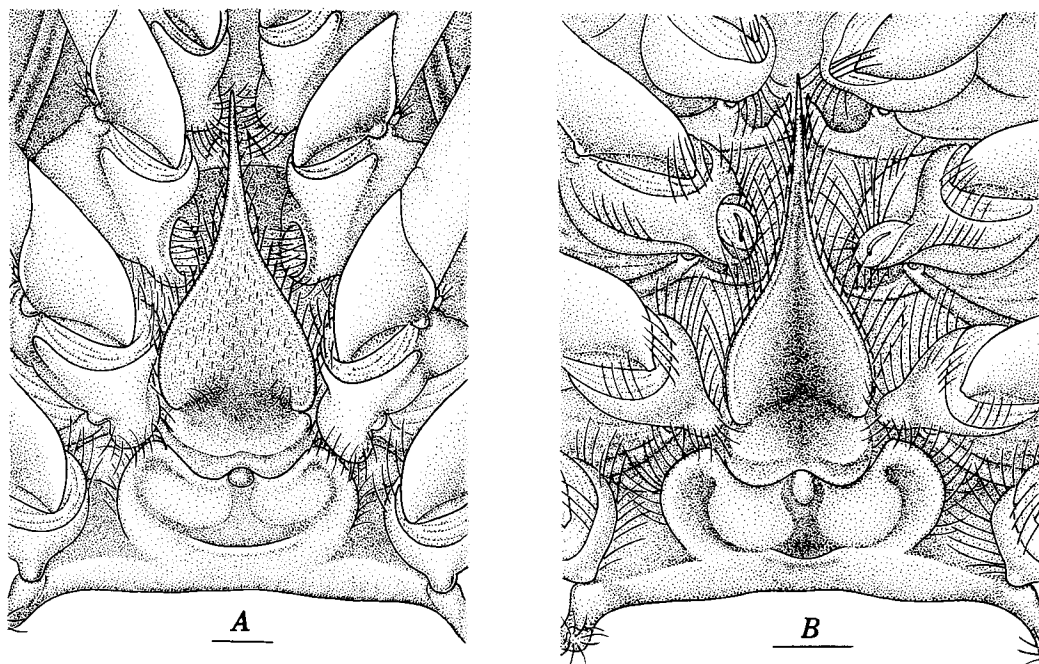


FIGURE 46.—*Sicyonia martini*. A, holotype ♀ 21 mm cl, southwest of Punta Ana María, Golfo de Panamá; B, ♀ 16.5 mm cl, Banco Gorda de Afuera, Baja California Sur. Thelyca. Scales = 1 mm.

oval, long axis disposed either longitudinally or transversely). Median plate of sternite XIII flaskshaped in outline, tapering into long, slender spine reaching between anterior and posterior extremities of coxa of anteriorly extended second pereopods; plate constricted, its ventral surface strongly excavate at level of coxae of fourth pereopods; posterior component of plate, with rounded posterolateral margins and broad shallow, median emargination. Paired, broad based spines projecting anteriorly from posterior margin of sternite XI. Posterior thoracic ridge narrow, with concave, sharp anteromedian margin but merging laterally with preceding plate.

The smallest impregnated females encountered have a carapace of 8 mm, about 31 mm tl.

Color.—Specimens preserved in Formalin⁴ buff with purplish blue markings: antenna, lateral ridge of scaphocerite, postrostral and abdominal carina, and dorsal ribs of telson transversely banded; anterior margin and posterior ridge of carapace, anterior margin of pleuron of first abdominal somite, and posterior margin of all abdominal somites with series of small spots; tip of teeth on rostrum, carapace, and first abdominal somite also purplish blue; lateral ramus of uropod with subterminal spot on lateral ridge and large mesial blotch at same level.

Maximum size.—Males 15.6 mm cl, 60.5 mm tl; females 22.5 mm cl, 87.2 mm tl.

Geographic and bathymetric ranges.—From southwest of Isla Santa Margarita (24°19'48" N, 111°47'06"W - 24°19'36"N, 111°47'06"W), Baja California Sur, Mexico, to southern tip of Baja California Sur and throughout the Gulf of California southward to off Punta Lizardo (18°06'00"N, 102°57'18"W), Michoacán; also from E of Puerto Angel (15°41'00"N, 96°07'30"W), Oaxaca, Mexico, to SW of Punta Ana María (7°50'30"N, 78°49'00"W - 7°50'48"N, 78°48'00"W), Panama (Fig. 38). It has been found at depths between 9 and 242 m, on substrates of sand, rock, mud, and coralline debris.

Discussion.—Although closely allied to *S. affinis* and *S. aliaffinis*, *S. martini* can be distinguished readily from both of them by the length, shape, and armature of the rostrum; the shape of the tooth on

the first abdominal somite; the sculpture of the abdomen; and features of the petasma and thelycum.

In *S. martini* the rostrum is quite long, surpasses the eyes, and almost reaches the distal margin of the second antennular article. In males, the rostrum is straight or upturned at an angle of no more than 10°, and armed with three dorsal teeth and three or four apical teeth, the ventral one of which is occasionally subterminal. In females, the rostrum is strongly elevated (40°-50°), with its ventral margin usually markedly convex in the middle and concave posterior to the base of the subterminal tooth, and bears two dorsal teeth and three to five apical teeth, the ventral one of which lies distinctly posterior to the adjacent tooth. In *S. affinis* and *S. aliaffinis* the rostrum is shorter than in *S. martini*, reaching at most the distal margin of the eye; in both males and females it is upturned at an angle of about 30°, thus more elevated than in males of *S. martini* but less so than in females, and its ventral margin is usually straight or, occasionally, slightly convex basally. Also, in these two species the rostrum is armed with only two dorsal teeth, and the ventral of the two or three apical teeth (four or five have not been observed) is terminal, instead of subterminal as it is in all females and some males of *S. martini*.

The tooth on the first abdominal somite is proportionately higher in *S. martini* than in the other two species; its dorsal margin is sigmoid and it ends in a strong, recurved, hooklike tip. In *S. affinis* and *S. aliaffinis* the dorsal margin of the tooth is gently curved in an arc, and the tooth is inclined more anteriorly than in *S. martini*; in *S. affinis* it ends in a slightly curved tip, and in *S. aliaffinis* the tip is triangular rather than hooklike. Also, the abdominal sculpture of *S. martini* is much stronger than that of its two closest congeners, and exhibits unusual, longitudinally disposed, inverted V-shaped ridges at the ventral end of the dorsal third of the second and third somites, which are absent in the other two species.

In *S. martini*, the projection of the dorsolateral lobule of the petasma is bifurcate apically, the tips sharp. In *S. affinis* and *S. aliaffinis*, the projection is compressed distally with the ventral extremity rounded, the dorsal extremity sharply produced in a simple spine, and the distal margin (immediately ventral to the spine) truncate or slightly emarginate. Furthermore, the projection of the ventrolateral lobule of the petasma of *S. martini*, like that of *S. affinis* but in contrast to that of *S. aliaffinis*, is flattened distally rather than thickened (dorsally) into a subovoid pro-

⁴Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

tubercle. The females of *S. martini* differ from those of all the other *Sicyonia* occurring in the region by possessing a conspicuous tubercle on the anteromedian extremity of the plate of sternite XIV.

In addition to the distinguishing characters cited above, *S. martini* exhibits other features that differ from those of *S. affinis*. The dorsomedian carina of the fifth abdominal somite is abruptly truncate; the abdomen is coarsely tuberculate and the tergal sulci on the third through fifth somites are deep. *Sicyonia martini* also differs from *S. affinis* in the barely to distinctly concave (instead of convex) anterior margin of the pleuron of the first somite; the anteroventral extremity of the four anterior pleura which are markedly angular, forming angles of about 90° or less, rather than being rounded or broadly angular; and the outline of the fourth abdominal pleuron which is subpentagonal and often bears a spine on the posteroventral angle, whereas in *S. affinis* it is subcircular and always unarmed.

Sicyonia martini differs further from *S. aliaffinis* by the presence on the first abdominal somite of a short but conspicuous longitudinal ridge extending posteriorly from the ventral end of the anteromedian pleural sulcus. The anteromedian and posteromedian pleural sulci of the second and third abdominal somites are shorter than in *S. aliaffinis*, extending dorsally only to about a third of the height of the somite from the middorsal line rather than to a fourth, and the posteromedian ones are curved anteriorly at their dorsal extremities. Finally, *S. martini* lacks the conspicuous purplish-brown mark (resembling a longitudinally disposed "9" located posterior to the hepatic sulcus and just ventral to the branchiocardiac carina) present in *S. aliaffinis*.

Material.—193 specimens from 41 lots.

For list of records see Pérez Farfante and Boothe 1981.

Sicyonia picta Faxon 1893

Figures 47-52

Sicyonia picta Faxon 1893:210 [syntypes: 4♂ 2♀, MCZ 4639, and 2♂ 2♀, USNM 21172, off Golfo de Panamá (7°40'00"N, 79°17'50"W), 127 fm (232 m), 8 March 1891, *Albatross* stn 3387; 1♂, USNM 21171, off Punta Mariato (7°12'20"N, 80°55'00"W), Panama, 182 fm (333 m), 23 February 1891, *Albatross* stn 3355]. Faxon 1895:180, pl. 46, fig. 2, 2a-c. H. Milne Edwards

and Bouvier 1909:244. De Man 1911:112. Bayer et al. 1970:A97. Arana Espina and Méndez G. 1978:27, fig. 10-13. Brusca 1980:256. Méndez G. 1981:47, pl. 10, Fig. 83-86. Pérez Farfante 1982:372.

Eusicyonia picta. Burkenroad 1934a:95, fig. 35, 1934b:126, 1938:87. Anderson and Lindner 1945:318.

Vernacular names: rock shrimp, target shrimp, Japanese shrimp (United States); cacahuete, camarón de piedra, camarón de roca, camarón japonés (Mexico). FAO names: peanut rock shrimp (English), camarón cacahuete (Spanish), boucot cacahouette (French).

Diagnosis.—Antennal spine well developed and buttressed. Second abdominal somite with dorsomedian carina lacking incision. First pereopod with basis and ischium unarmed. Postrostral carina bearing one tooth posterior to level of hepatic spine and raised in high, arched crest behind posterior tooth. Abdomen with tooth on dorsomedian carina of first somite conspicuously larger than posterior tooth on carapace. Petasma with distal projection of dorsolateral lobule slightly curved mesially, its compressed tip produced dorsally in strong, hooklike spine. Thelycum with plate of sternite XIV flat or slightly elevated laterally; posterior component of median plate flat or slightly raised laterally. Branchiostegite with ocellus consisting of red center surrounded by yellow ring.

Description.—Body relatively slender (Fig. 47). Carapace sparsely studded with long setae and bearing patches of shorter setae on dorsum; patch also present anteroventral to hepatic sulcus, another elongate obliquely disposed on branchiostegite, and others on lateral depression and anteroventral part of sixth abdominal somite. Abdomen with few small tubercles on first three somites, most on row behind posterior sulci.

Rostrum short, usually not overreaching distal margin of eye, its length increasing linearly with carapace length (Fig. 48), but proportionately longer in young (0.40-0.25 cl); in males (Fig. 49B), weakly arched, subhorizontal or upturned, usually not more than 25° but occasionally 30°, deep basally, gently narrowing to slender, short tip (Fig. 49A); in females, nearly straight, raised 25°-40°, deep along almost entire length, slightly narrower and truncate apically; in both sexes armed with two to four dorsal teeth and two or three apical

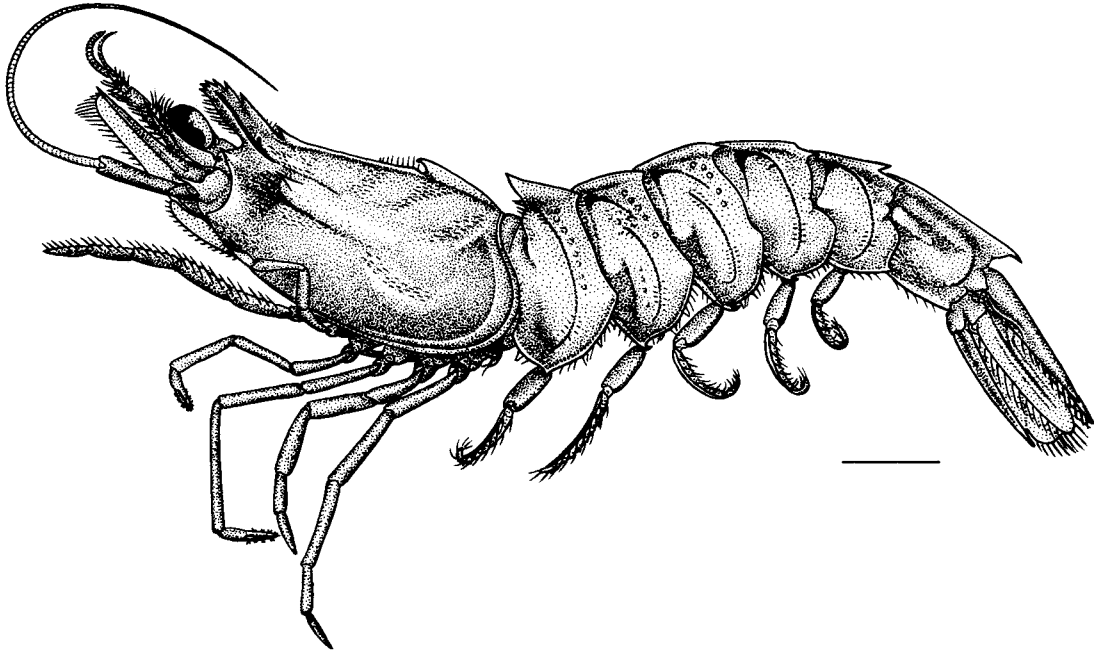


FIGURE 47.—*Sicyonia picta* Faxon 1893. Syntype ♀ 19 mm cl, off Golfo de Panamá. Lateral view. Scale = 5 mm.

ones (3+3, 58%; 4+3, 19%; 4+2, 22%; 3+2, 0.5%; 2+3, 0.5%), dorsal teeth in females often crowded anteriorly with apical ones, about evenly spaced along margin in males. Adrostral carina, subparallel and close to ventral margin, extending to base of apical teeth.

Carapace with well-marked postrostral carina bearing two teeth: 1) epigastric tooth small, subequal to or only slightly larger than first rostral tooth, situated distinctly anterior to hepatic spine, between 0.13 and 0.16 (mean 0.15) cl from orbital margin; and 2) posterior tooth, much larger, four or five times higher, than epigastric, hooklike, its apical portion acutely pointed and strongly curved anteroventrally, situated far posterior to hepatic spine but well in advance of posterior margin of carapace, between 0.60 and 0.68 (mean 0.64) cl from orbital margin. Postrostral carina low anteriorly, slightly elevated just in front of posterior tooth, and forming high crest descending gently from latter to posterior margin of carapace. Tuft of setae present at anterior base of each tooth. Antennal spine sharp, projecting from short, low buttress; hepatic spine considerably larger than antennal, arising from moderately raised area, and situated between 0.18 and 0.24 (mean 0.22) cl from orbital margin. Postocular sulcus deep anteriorly, continuing posteriorly as low groove;

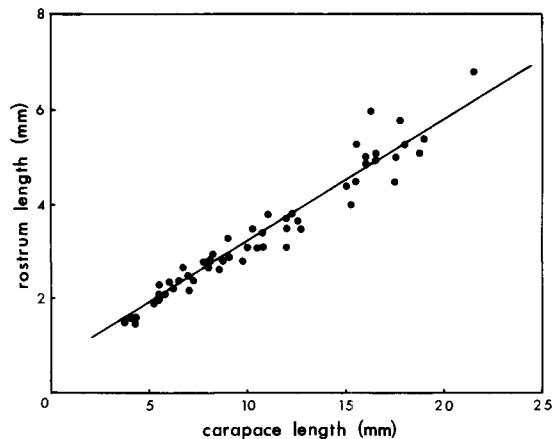


FIGURE 48.—*Sicyonia picta*. Relationship between rostrum length and carapace length (regression equation, $y = 0.51173 + 0.26668x$).

hepatic sulcus deep; hepatic carina indistinct; branchiocardiac carina recognizable only posteriorly, extending for short distance subparallel to slope of posterior tooth, then curving dorsally to posterior margin of carapace.

Antennular peduncle with stylocerite produced in long spine, its length 0.75-0.85 distance between lateral base of first antennular article and

mesial base of distolateral spine; latter, slender and sharp, extending to about midlength of second antennular article; antennular flagella short, mesial one slightly shorter, 0.20-0.30 cl, than lateral, 0.25-0.35 cl.

Scaphocerite extending to midlength of third antennular article or slightly overreaching it. Antennal flagellum about twice as much as twice length of carapace.

Third maxilliped slightly stouter than pereopods. Basis and ischium of first pereopod unarmed.

Abdomen with dorsomedian carina extending from first through sixth somites, carina on first produced in strong, anterodorsally directed tooth tapering to sharp apex and considerably larger than posterior tooth on carapace; carina on fifth produced in conspicuous sharp tooth and that on sixth terminating in strong, acute one.

Anteroventral margin of pleuron of first abdominal somite concave; posteroventral margin of first through fourth somites rounded; anteroventral extremity of pleuron of first through fourth somites ending in spine, that of first directed ventrolaterally, those of second through fourth curved posterolaterally. Pleuron of fifth and sixth somites bearing posteroventral, caudally directed, relatively small spine, that of fifth slightly larger than that on sixth.

First abdominal somite traversed by anteromedian pleural sulcus, deep dorsally and disappearing at about 0.30 height of somite before reappearing ventrally as broad shallow depression merging with united posterior tergal-posteromedian

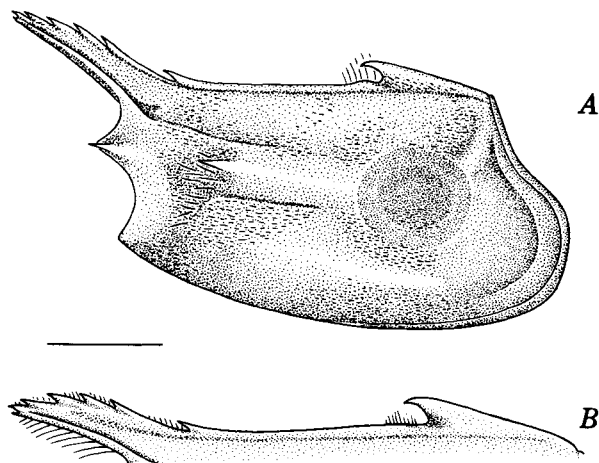
pleural sulci. Second and third somites with anterior tergal and posterior tergal sulci joining anterodorsally; anteromedian pleural sulcus short (not reaching dorsally posteromedian pleural) but deep and merging with shallow anteroventral depression, latter setting off subelliptical prominence dorsally and low ridge posteriorly; posteromedian pleural sulcus long, extending anterodorsally ventral to (not joining) posterior tergal sulcus and curved, united posterior tergal-posteromedian pleural sulci merging. Sixth somite with arched posteromedian pleural sulcus and longitudinal rib situated along base of mid-dorsal carina and delimited ventrally by deep depression lying just dorsal to weak cicatrix.

Telson with median sulcus deep anteriorly, increasingly shallow posteriorly, its terminal portion elongate and sharp, and bearing pair of small fixed subterminal spines. Rami of uropod subequal in length, falling slightly short of or barely overreaching apex of telson.

Petasma (Fig. 50A, B) with rigid distal projection of dorsolateral lobule only slightly curved mesially, raised proximodorsally in rounded prominence and compressed distally, its tip with ventral extremity rounded and dorsal extremity produced in strong, sharp spine directed dorsally. Fleishy distal projection of ventrolateral lobule curving laterally, roughly sickle shaped in outline, with apex directed proximoventrally.

Petasmal endopods coupled in males as small as 6.7 mm cl, about 27 mm tl, but may not be joined in individuals as much as 9 mm cl, about 34 mm tl.

FIGURE 49.—*Sicyonia picta*. A, ♂ 16 mm cl, NW of Isla Monserrate, Baja California Sur, Mexico. Lateral view of carapace. Scale = 5 mm. B, syntype ♂ 15.5 mm cl. Golfo de Panamá. Lateral view of dorsal part of carapace. Scale = 2 mm.



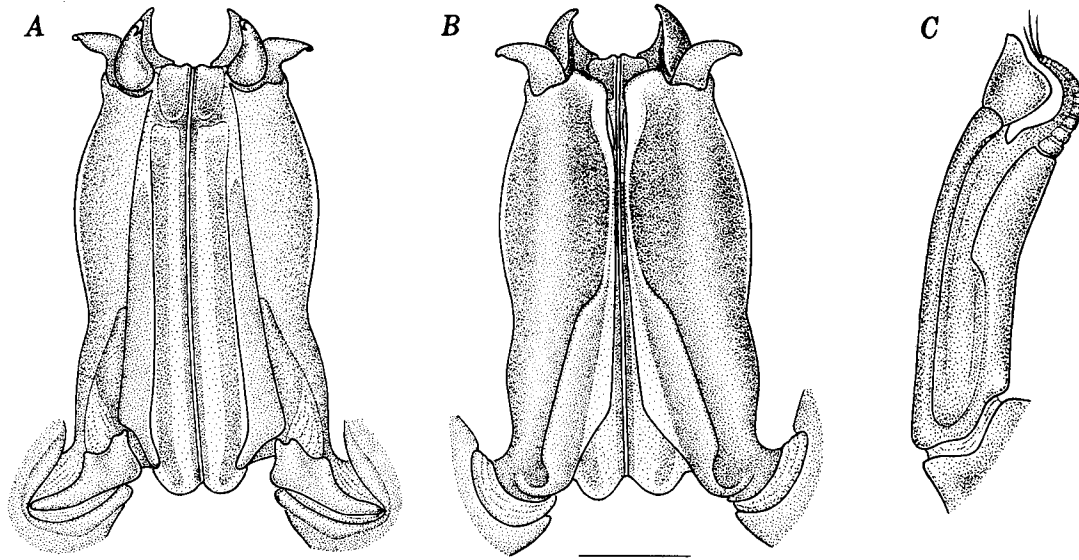


FIGURE 50.—*Sicyonia picta*, syntype ♂ 15.5 mm cl, off Golfo de Panamá. A, Petasma dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scales = 1 mm.

Appendix masculina as illustrated in Figure 50C.

Thelycum (Fig. 51) with plate of sternite XIV flat or slightly elevated laterally, inclined toward broad median depression, and bordered anteriorly and laterally by narrow, sometimes thickened, flange. Median plate of sternite XIII flask-shaped in outline or subtriangular, tapering anteriorly into long, slender spine reaching between proximal end and midlength of basis of anteriorly extended second pereopods; plate at level of fourth pereopods excavate and constricted by pair of shallow, widely separated lateral incisions; posterior component of median plate, often convex laterally, with rather deep median emargination. Paired short spines projecting from posterior margin of sternite XI. Posterior thoracic ridge narrow, with well-marked anteromedian margin but flush with lateral parts of plate of sternite XIV.

The smallest impregnated females encountered have a carapace of 7 mm, about 28 mm tl.

Color.—Méndez G. (1981) described recently caught specimens as follows: body light red or orange red, with white areas on ventral part of abdominal somites; carapace marked by conspicuous ocellus consisting of red center surrounded by yellow ring. Diffuse dark spot on lateral ramus of

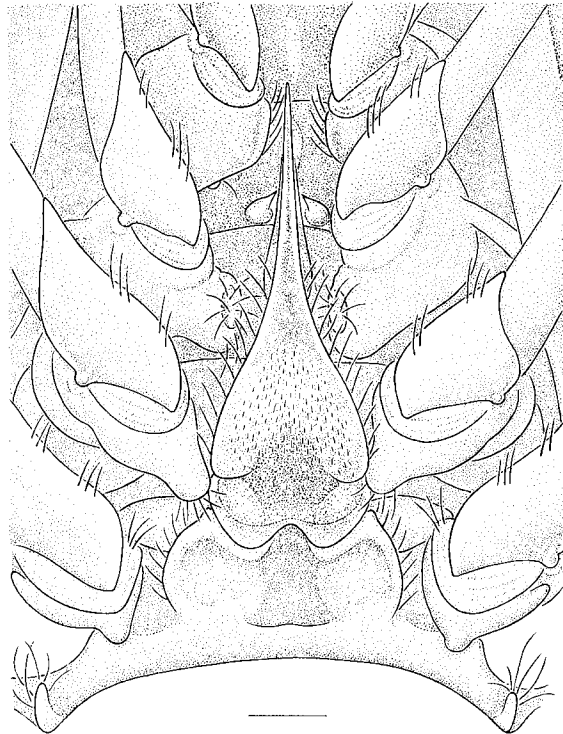


FIGURE 51.—*Sicyonia picta*, syntype ♀ 28 mm cl, off Golfo de Panamá. Thelycum. Scale = 1 mm.

uropod situated distomesially according to her figure 84. Antennae with alternating light and dark red bands. In Formalin, body turns darker red with ring around ocellus, garnet. Faxon (1893, 1895) noted that in specimens preserved in alcohol there is a dark ring on the posterior part of the branchial region and traces of color are present on margins of rostrum, dorsal carinae, and appendages. In most specimens preserved in either agent examined by me, the color pattern described above is still distinguishable.

Maximum size.—Males 17.5 mm cl, about 70 mm tl; females 24 mm cl, 87.9 mm tl (Faxon 1893 and Arana Espina and Méndez G. 1978; corroborated by me).

Geographic and bathymetric ranges.—Bahía Magdalena (24°33'00"N, 112°00'30"W) to southern tip of Baja California Sur, Mexico, throughout the Gulf of California and southward to northeast of Isla María Madre (22°00'N, 106°16'W), Nayarit, Mexico; also from Champerico (13°55'36"N, 92°02'30"W), Guatemala, to Islas Lobos de Afuera (06°45'S, 80°45'W), Peru (Fig. 52). It occurs at depths between 16 and 400 m (shallowest cited by Arana Espina and Méndez G. 1978), but most of the recorded depths are <150 m. It occupies a large variety of bottom types: sand, shell, sand and shell, sand and mud, shell and mud, rock and mud, green, grey and brown mud, broken gravel and shells, and a mixture of mud, rocks, and coralline detritus.

Discussion.—*Sicyonia picta* is most similar to *S. disdorsalis*; both are of moderate size and in addition bear a small epigastric tooth, a large posterior tooth on the postrostral carina, and a strongly developed one on the first abdominal somite. These shrimps can be readily separated by their color pattern and a number of morphological characters. In *S. disdorsalis* an ocellus is lacking on the posterior part of the branchiostegite, the rostrum is slender throughout its entire length, and less elevated than in *S. picta*, its inclination not exceeding 20°; the epigastric and posterior teeth on the postrostral carina are situated closer to the orbital margin, between 0.06 and 0.12 (mean 0.10) cl and 0.55 and 0.65 (mean 0.60) cl, respectively; and the posterior tooth rises from a uniformly low postrostral carina.

The two species also differ in sculpture of the abdomen. In *S. disdorsalis* the first abdominal somite is traversed by a short anteromedian sul-

cus which is not represented ventrally by a depression; the posterior tergal and posteromedian pleural sulci of the second and third somites are coalescent; the anteroventral extremities of the second through fourth are unarmed or are produced in a small, ventrally projecting spine; and the posteroventral extremities of first through fourth somites are angular, that of the fourth bearing a well-developed spine, and that of the fifth, an extremely long one (instead of small as in *S. picta*) in adults.

In both species the petasma and the thelycum also exhibit distinctive features. In *S. disdorsalis* the distal projection of the distolateral lobule of the petasma terminates in an acute tip rather than being compressed laterally and produced in a

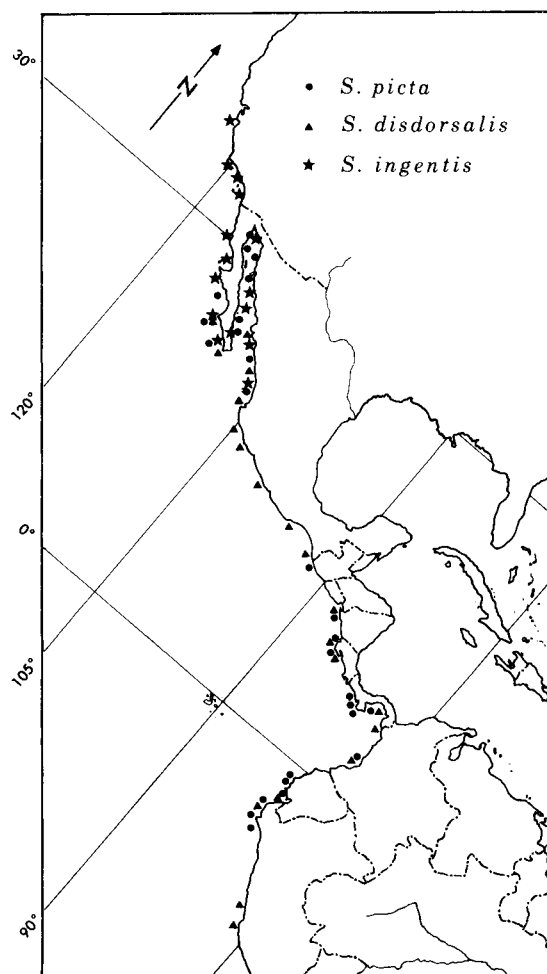


FIGURE 52.—Geographic distribution of *Sicyonia picta*, *S. disdorsalis*, and *S. ingentis*.

dorsally directed salient as it is in *S. picta*. Furthermore, the distal projection of the ventrolateral lobule in *S. disdorsalis* is laminar, bifurcate laterally, and bears a proximal plate bordered by a transverse rib; in *S. picta*, it is roughly sickle shaped in outline, tapering laterally to a sharp proximoventrally directed apex. Finally, the thelycal plate of sternite XIV in *S. disdorsalis* is raised in a low but well-defined pair of lateral protuberances instead of being flat or slightly raised laterally as it is in *S. picta*.

In the field, *S. picta* may be distinguished from its sympatric congeners by the striking yellow ocellus with a red center located on the branchiostegite.

Burkenroad (1938) discussed in detail the features that distinguish *S. picta* from the western Atlantic *S. stimpsoni* Bouvier 1905. Actually, features cited by him for *S. stimpsoni* also apply to *S. burkenroadi*, another western Atlantic species which was not recognized until described by Cobb in 1971. *Sicyonia picta* differs from *S. stimpsoni*, but resembles *S. burkenroadi*, in bearing strongly curved spines on the anteroventral angles of the second through fourth abdominal pleura. It, in turn, can be separated from *S. burkenroadi*, but resembles *S. stimpsoni*, in lacking a posterior tooth on the tergal carina of the fourth abdominal somite.

Remarks.—Arana Espina and Méndez G. (1978) presented an illustration (Fig. 11) in which the posterior tergal and posteromedian sulci of the second and third abdominal somites appear coalescent. The disposition of the posteromedian sulcus seems to be in error because, as stated above, the two sulci in this shrimp do not merge; instead the posteromedian one extends anterodorsally, ventral to the posterior tergal sulcus.

In addition to citing many new localities, this paper contains the first records of the species from the ocean side of Baja California Sur, Mexico, as far north as Bahía Magdalena.

Material.—602 specimens from 61 lots.

Mexico—Baja California Sur: 1♀, AHF, 5.5 km W of mouth of Bahía Magdalena, 64 m, 8 March 1949, *Velero IV*. 1♀, USNM, off Isla Santa Margarita, 86 m, 8 April 1889, *Albatross* stn 3039. 1♂ 2♀, SIO, off Punta Márquez, 64 m, 9 November 1964. 2♀, SIO, Bahía de la Paz, 82-119 m, 12 January 1968, *Thomas Washington*. 2♂ 6♀, SIO, Bahía de la Paz, 119-128 m, 24 July 1965, R. Rosenblatt. 1♂, AHF, entrance to Bahía Agua

Verde, 42-48 m, 17 March 1949, *Velero IV*. 6♂ 11♀, SIO, NW of Isla Monserrate, 170-192 m, 11 July 1965, *Horizon*. 2♀, AHF, NW of Isla Danzante Primero, 44-73 m, 18 March 1949, *Velero IV*. 1♂, YPM, Bahía de Santa Inés, 101 m, 17 March 1926, *Pawnee*. 4♀, SIO, off Santa Rosalía, 35-26 m, 25 March 1960, R. Parker. Baja California Norte (all in Gulf of California): 1♀, YPM, Bahía de los Angeles, 31-42 m, 13 May 1926, *Pawnee*. 3♂ 1♀, AHF, Puerto Refugio, Isla Angel de la Guarda, 143-165 m, 28 January 1940. 3♀, AHF, N of Isla Angel de la Guarda, 104 m, 28 January 1940. 6♂ 11♀, SIO, SE of San Felipe, 75-86 m, 19 January 1968, *Washington*. 1♂, YPM, Bahía San Luis Gonzaga, 17 May 1916, *Pawnee*. 1♂ 1♀, USNM, off Punta San Fermín, 55 m, 27 March 1889, *Albatross* stn 3035. 1♀, SIO, SE of San Felipe, 120 m, 19 January 1968, *Washington*. Sonora: 2♂ 2♀, USNM, off Cabo Tepoca, 65 m, 24 March 1889, *Albatross* stn 3018. 26♂ 29♀, USNM, SW of Cabo de Lobos, 139 m, 24 March 1889, *Albatross* stn 3016. 1♂, USNM, NW of Isla Tiburón, 265 m, 24 March 1889, *Albatross* stn 3015. 4♂ 1♀, AHF, 3 km W of Tastiota, 60 m, 21 December 1978, A. Kerotitch. Sinaloa: 3♂ 2♀, USNM, off Punta Santo Domingo, 135 m, 10 April 1889, *Albatross* stn 3043. 1♀, USNM, off Peninsula de Quevedo, 67 m, 30 March 1978, Toral García. Nayarit: 2♂ 4♀, SIO, NE of Isla María Madre, Islas Tres Marías, 82-88 m, 30 March 1973, *Agassiz*.

Guatemala—1♀, SIO, Champerico, 91-104 m, 13 April 1973, *Agassiz*.

Nicaragua—2♀, SIO, off N of Nicaragua, 53-59 m, 17 April 1973, C. Hubbs and S. Luke.

Costa Rica—1♂ 1♀, USNM, Golfo del Papagallo, 2 April 1978, D. Hedgecock. 1♂, SIO, Punta Guiones, 104 m, 19 April 1973, C. Hubbs and S. Luke. 150♂ 150♀, SIO, Golfo de Nicoya, 86 m, 22 April 1973, *Agassiz*. 6♂ 1♀, SIO, off Cabo Blanco, 60 m, 18 April 1973, *Agassiz*. 1♀, UCR, off Cabo Blanco, 249 m, 28 April 1973, *Enriqueta*. 7♂ 14♀, SIO, off Cabo Blanco, 137-144 m, 19 April 1973, C. Hubbs and S. Luke. 1♀, USNM, off Cabo Blanco, 247 m, 27 April 1973, *Enriqueta*.

Panama—1♂ 1♀, AHF, Islas Secas, 46-48 m, 27 March 1939. 2♂ 6♀, AHF, off Isla Medidor, 55-64 m, 28 March 1939, *Velero III*. 2♂ 8♀, UP, 25 km S of Isla Cebaco, 256 m, 8 August 1972, *Canopus*. 1♂, syntype, USNM, off Punta Mariato, 333 m, 23 February 1891, *Albatross* stn 3355. 1♂ 1♀, USNM, E of Isla Iguana, 79-77 m, 2 May 1967, *Pillsbury* stn 502. 3♀, USNM, NE of Isla Iguana, 79-77 m, 4 May 1967, *Pillsbury* stn 515. 4♂ 2♀, MCZ, and 2♂ 2♀, USNM, syntypes,

off Golfo de Panama, 232 m, 8 March 1891, *Albatross* stn 3387. 1♂ 2♀, USNM, S of Isla San José, 84 m, 6 May 1967, *Pillsbury* stn 529. 5♂ 6♀, USNM, S of Isla San José, 99 m, 7 May 1967, *Pillsbury* stn 553. 1♀, USNM, SE of Isla San José, 68 m, 7 May 1967, *Pillsbury* stn 555. 2♂ 3♀, USNM, SE of Isla San José, 60 m, 5 March 1888, *Albatross* stn 2797. 2♂, USNM, S of Isla del Rey, 44-47 m, 7 May 1967, *Pillsbury* stn 551. 1♂ 1♀, USNM, S of Isla del Rey, 59 m, 8 May 1967, *Pillsbury* stn 556. 1♂ 5♀, USNM, SW of Golfo de San Miguel, 64-60 m, 7 May 1967, *Pillsbury* stn 550.

Colombia—Cali: 2♂, USNM, off Bahía de Buenaventura, 80 m, 16 September 1966, *Anton Bruun*, 18B, stn 783.

Ecuador—Manabí: many ♂ and ♀, USNM, off Cabo Pasado, 93 m, 12 September 1966, *Anton Bruun*, 18B, stn 778. 1♂ 3♀, USNM, off Bahía de Manta, 120-150 m, 12 September 1966, *Anton Bruun*, 18B stn 776. 3♂ 3♀, USNM, off Cabo San Lorenzo, 185 m, 12 September 1966, *Anton Bruun*, 18B, stn 775. 1♂ 1♀, AHF, off Isla La Plata, 82-101 m, 10 February 1934. El Oro: 2♂, USNM, SW of Isla Santa Clara, depth unrecorded, 10 September 1966, *Anton Bruun*, 18B, stn 769-D. 27♂ 67♀, USNM, SW of Puerto Bolívar, 80 m, 10 September 1966, *Anton Bruun*, 18B, stn 769.

Peru—Tumbes: 11♂ 8♀, USNM, off Casitas, 90 m, 8 September 1966, *Anton Bruun*, 18B, stn 764. Piura: 4♂ 4♀, USNM, Bahía de Paita, 70-69 m, 8 September 1966, *Anton Bruun*, 18B, stn 762-A. 2♂ 4♀, USNM, Bahía de Paita, 118-133 m, 2 June 1966, *Anton Bruun*, 16, stn 625-A. 1♂, USNM, SW of Isla Foca, 120 m, 7 September 1966, *Anton Bruun*, 18B, stn 761. 4♂ 10♀, USNM, off Punta Negra, 100 m, 4 June 1966, *Anton Bruun*, 16, stn 631-A. Lambayeque: 1♂ 1♀, IMARPE, Islas Lobos de Afuera, 360-400 m, 1977, R. Marquina.

Sicyonia disdorsalis (Burkenroad 1934)

Figures 52-56

Eusicyonia disdorsalis Burkenroad 1934a:96, fig. 25, 36 [syntypes: 1♂ 1♀, YPM 4391, 5♂ 6♀ (not 4♂ 7♀ as originally cited), YPM 5075, and 1♂ 1♀, YPM 4391, Pearl Islands (Archipiélago de las Perlas), 8°29'40"N, 78°52'30"W, Golfo de Panamá, 19-24 fm (35-44 m), 31 March 1926, *Pawnee*; 5♂ 5♀ (not 6♂ 4♀), YPM 5079, and 1♀, YPM 5078, Golfo de Panamá, 1868, F. H. Bradley. 1♂ 3♀, YPM 5076, and 1♂, YPM 5077, west coast of Central America, 1872, Capt. Dow].

Burkenroad 1938:87. Anderson and Lindner 1945:318.

Sicyonia disdorsalis. Chirichigno Fonseca 1970:7, fig. 4. Bayer et al. 1970:A97. Del Solar et al. 1970:18. Rosales Juárez 1976:41, pl. 1, fig. 3. Rodríguez de la Cruz 1977:11. Arana Espina and Méndez G. 1978:29, fig. 14-17. Brusca 1980:256. Paul and Hendrickx 1980:110. Sosa Hernández et al. 1980:14. Méndez G. 1981:48, pl. 10, fig. 87-90. Pérez Farfante 1982:370.

Vernacular names: rock shrimp (United States); camarón conchiduro (Mexico, Panama); camarón duro (Ecuador, Peru); langostino cáscara dura, camarón cáscara dura (Peru). FAO names: keeled rock shrimp (English), camarón carenado (Spanish), boucot carène (French).

Diagnosis.—Antennal spine well developed and buttressed. Second abdominal somite with dorsomedian carina lacking incision. First pereopod with basis and ischium unarmed. Postrostral carina bearing one tooth posterior to level of hepatic spine and low throughout its entire length, not raised in crest behind posterior tooth. Abdomen with tooth on dorsomedian carina of first somite considerably larger than posterior tooth on carapace. Petasma with distal projection of dorsolateral lobule curved mesially, tapering to apex, and lacking filament. Thelycum with plate of sternite XIV raised in pair of lateral bulges; posterior component of median plate flat or slightly raised laterally. Branchiostegite lacking large spot or ocellus.

Description.—Body relatively slender (Fig. 53). Carapace bearing patches of short setae on dorsum, anteroventral to hepatic spine, and ventral to hepatic sulcus; patches of setae also present on dorsal extremity of abdominal sulci and in depression of sixth abdominal somite. Abdomen with numerous tubercles on first three somites.

Rostrum relatively short, rarely overreaching eye, its length increasing linearly with carapace length (Fig. 54) to about 18 mm cl, then increasing little, not surpassing 6.2 mm (proportional length decreasing with increasing size from as much as 0.36 to as little as 0.21 cl); slender but occasionally moderately deep; in males subhorizontal with tip strongly decurved, in females upturned as much as 20° with tip slightly decurved; armed with three, occasionally two, dorsal teeth and two or three apical teeth (2+2, 2%, 3+2, 92%, 3+3, 6%);

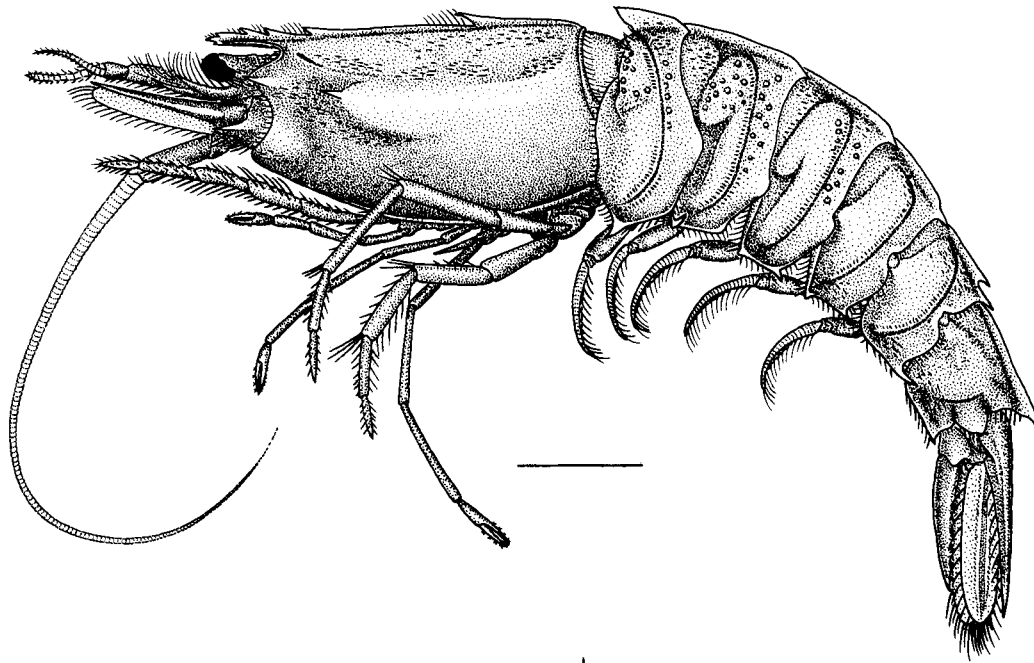


FIGURE 53.—*Sicyonia disdorsalis* (Burkenroad), ♀ 25 mm cl, Golfo de Fonseca, El Salvador. Lateral view. Scale = 10 mm.

ventral apical tooth smaller than dorsal and placed almost at same level or, more often, posterior to it. First rostral tooth located well in advance of orbital margin, between 0.18 and 0.33 (mean 0.25) rl; second tooth from 0.45 to 0.70 (mean 0.58) rl; and third from 0.75 to 0.96 (mean 0.81) rl. Adrostral carina extending to near tip, relatively far from ventral margin, often slightly arched either along middle or less often anteriorly, and occasionally directed anterodorsally.

Carapace with postrostral carina well marked but low throughout its entire length, bearing two teeth: 1) epigastric tooth small, subequal to or slightly larger than first rostral tooth and situated well in advance of hepatic spine, between 0.06 and 0.12 (mean 0.10) cl from orbital margin; and 2) posterior tooth, as large as or larger, sometimes as much as three times higher, than epigastric, acutely pointed, strongly inclined anteriorly, and placed considerably in advance of posterior margin of carapace, between 0.55 and 0.65 (mean 0.60) cl from orbital margin (both teeth farther anterior in large individuals than in young). Tuft of setae present at anterior base of each tooth. Antennal spine moderately long, sharp, buttressed; hepatic spine long, conspicuously larger than antennal, projecting from raised area, and situated between 0.19 and 0.24 (mean 0.22) cl from orbital margin.

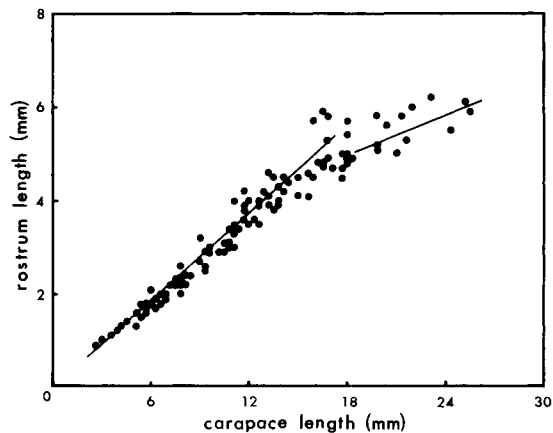


FIGURE 54.—*Sicyonia disdorsalis*. Relationship between rostrum length and carapace length (regression equation for specimens with about 18 mm cl or less, $y = -0.03933 + 0.30998x$; regression equation for those larger, $y = 2.33498 + 0.14502x$).

Postocular sulcus deep anteriorly, continuing posteriorly as very shallow arched groove; hepatic sulcus subhorizontal; hepatic carina indistinct; branchiocardiac carina weak.

Antennular peduncle with stylocerite produced in long, sharp spine, its length 0.75-0.85 distance between lateral base of first antennular article and

mesial base of distolateral spine; latter long, reaching as far as distal 0.25 of second antennular article; antennular flagella short, mesial one, more slender and shorter than lateral, 0.20-0.30 as long as carapace; lateral flagellum 0.25-0.35 as long.

Scaphocerite surpassing antennular peduncle by no more than 0.1 its own length; lateral rib ending distally in long, acute spine conspicuously overreaching margin of lamella. Antennal flagellum about twice as long as carapace.

Third maxilliped stouter than pereopods. Basis and ischium of first pereopod unarmed.

Abdomen with dorsomedian carina extending from first through sixth somites, carina on first produced in strong, anteriorly inclined tooth, tapering suddenly near end to minute, sharp apex (usually broken and thus appearing blunt); tooth considerably larger than posterior one on carapace; carina on fifth somite abruptly truncate or produced in sharp tooth posteriorly, and that on sixth terminating in strong, acute posterior tooth.

Anteroventral margin of pleuron on first abdominal somite concave in adults, sometimes nearly straight in juveniles, its extremity ending in strong spine, that of second through fourth (in adults) often projecting slightly or forming ventrally pointed spine; posteroventral extremity of third through sixth somites sharply angular, that of third often, but in last three always bearing caudally directed spine, that of fifth and sixth

largest and smallest, respectively; additional spine occasionally present immediately dorsal to posteroventral one on fourth somite.

First abdominal somite marked with short, deep anteromedian pleural sulcus and long, united posterior tergal-posteromedian pleural sulci; short, longitudinal ridge extending between anteromedian pleural and posterior sulcus. Second and third somites with anterior tergal sulcus joining united posterior tergal-posteromedian pleural sulci dorsally, and with anteromedian pleural sulcus represented by shallow depression setting off elevation at dorsal extremity. Fourth and fifth somites bearing curved, united posterior tergal-posteromedian pleural sulci; sometimes fourth also with faint anterior tergal sulcus. Sixth somite often marked by weak, sometimes indistinct, arched, posteromedian sulcus and bearing conspicuous cicatrix frequently divided in two.

Telson with median sulcus well defined only along anterior 0.65 of its length and armed with pair of minute, fixed, subterminal spines; latter clearly developed in juveniles but vestigial or lacking in adults. Rami of uropod subequal in length, falling slightly short of or barely overreaching apex of telson.

Posterior spine on first abdominal sternite with wide base and usually concave but sometimes straight lateral margins.

Petasma (Fig. 55A, B) with cornified distal projection of dorsolateral lobule raised in prox-

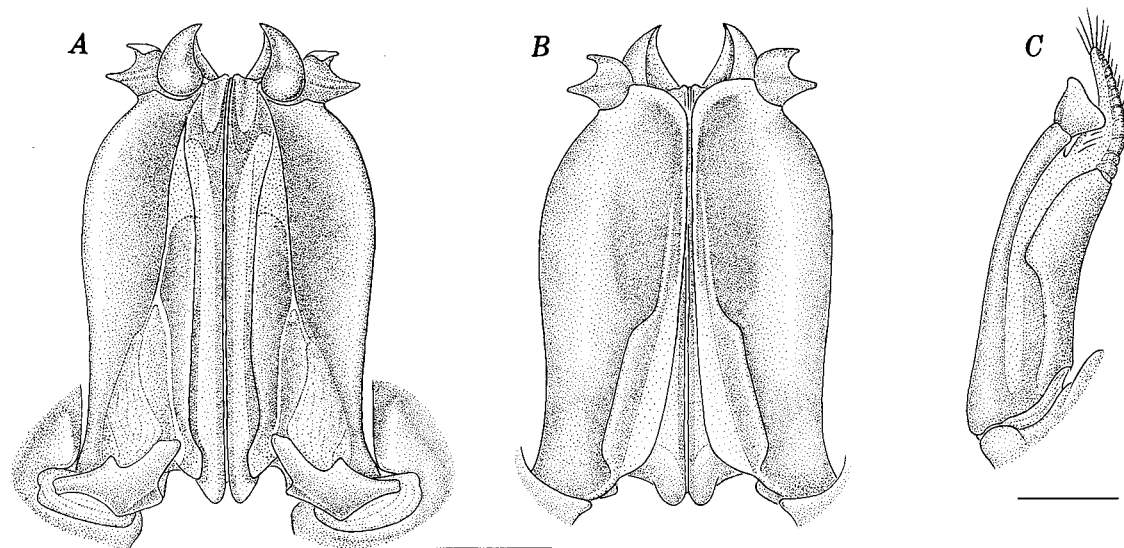


FIGURE 55.—*Sicyonia disdorsalis*, ♂ 17 mm cl, off Balboa, Panama. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scales = 1 mm.

imodorsal rounded prominence and ending in acute tip curved mesially. Distal projection of ventrolateral lobule, falling short of projection of dorsolateral lobule, laminar, bifurcate laterally, and thickened proximally forming plate bordered distally by transverse rib; latter supporting long proximal salient of bifurcation; terminal part of projection truncate and curved dorsally.

Petasmal endopods joined in males as small as 3 mm cl, about 13 mm tl, but may be unjoined in individuals with as much as 8.4 mm cl, about 21 mm tl.

Appendix masculina as illustrated in Figure 55C.

Thelycum (Fig. 56) with plate of sternite XIV bearing pair of low protuberances bordered laterally (in adults) by narrow flanges, and separated by moderately deep median depression. Median plate of sternite XIII flask-shaped in outline, tapering into long, slender spine reaching between base and about midlength of basis of extended second pereopod; plate set off from posterior component by shallow incisions, flat or concave posterolaterally, and with broad median depression (broader than areas and incisions flanking it); posterior component of median plate flat or slightly raised laterally, with posteromedian margin straight or convex. Paired short spines projecting anteroventrally from posterior margin of sternite XI, spines broad basally, sharp and sometimes produced in fine needle apically. Posterior thoracic ridge narrow, with well-marked anteromedian margin.

The smallest impregnated females encountered have a carapace of 5.3 mm, about 25 mm tl.

Color.—Arana Espina and Méndez G. (1978) described specimens from the waters of Peru as follows: Dorsum greenish gray, lighter-gray to pink laterally. Antennae red. Pereopods and pleopods pink; merus of third maxilliped and pereopods with red and yellow bands (toward distal end according to their figure 15). Subdistal striking ornamentation on lateral ramus of uropod consisting of oval deep blue blotch bordered in yellow. In contrast, Sosa Hernández et al. (1980) found that the specimens from southeast of Salina Cruz, Golfo de Tehuantepec, Mexico, were cream with orange hues.

My observations, based on a large number of live specimens taken off Panamá Viejo, Panama, indicate a color pattern much, but not exactly, like that noted by Arana Espina and Méndez G. Dorsum of carapace gray with broad transverse dark

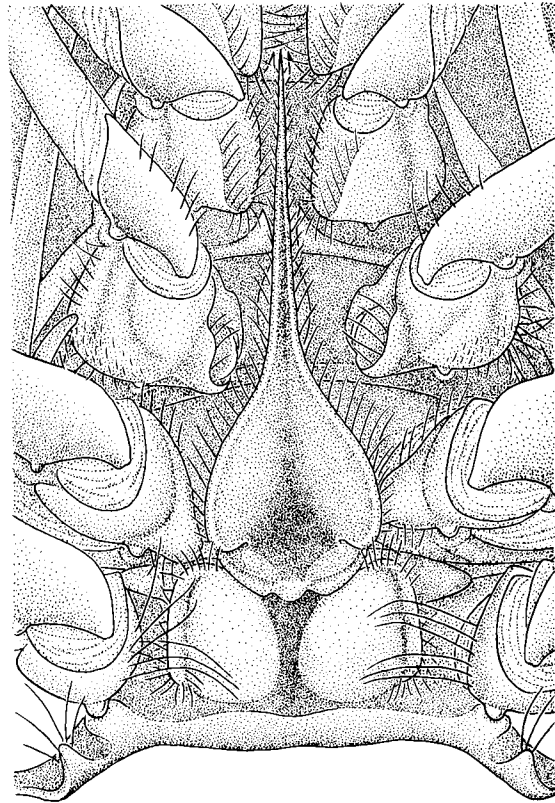


FIGURE 56.—*Sicyonia disdorsalis*, ♀ 16 mm cl, off Punta Calabazo, Panama. Thelycum. Scale = 2 mm.

purplish band extending across epigastric tooth and produced anteriorly in roughly pentagonal spot reaching base of first rostral tooth. Branchiostegite varying from dark purplish pink (in most specimens) to milky white, sometimes with grayish white longitudinal stripe along junction of branchiostegite and dorsum. Abdomen gray with middorsal carina banded: transverse dark gray ones alternating with buff bands; large tooth projecting from carina on first somite purplish pink. Anterior margin of pleuron of first three somites bordered by white vertical stripe and posteroventral areas of third and fourth somites also white. Tergum of fifth somite bearing purplish pink V-shaped (vertex anterior) marking posteriorly. Telson and uropod gray with densely set yellow chromatophores. Lateral ramus of uropod bearing large garnet marking subdistally preceded by yellow patch, and contiguous to buff dot lying against its mesial extremity. Antenna dark garnet. Third maxilliped and pereopods pink, former with two contiguous transverse bands, orange red one on

distal third of merus, followed by bright yellow band crossing merus and proximal part of carpus; fourth and fifth pereopods marked with orange red band flanked by yellow ones extending across merus and proximal part of carpus. Pleopods mostly pink, lateroventral part of basis white.

Maximum size.—Males 21 mm cl, 88.8 mm tl; females 28 mm cl, 98.7 mm tl (Arana Espina and Méndez G. 1978). Largest specimens examined by me: males 20 mm cl, females 25.7 mm cl.

Geographic and bathymetric ranges.—Bahía Santa María (24°42'48"N, 112°13'54"W), to the tip of Baja California Sur, Mexico, and from southern Sonora, Gulf of California, southward to Pisco (13°55'S), Peru (Fig. 52).

This species has been found between 5 and 139-93 m, but rarely in water deeper than 65 m; contrary to most of its congeners from the American Pacific, it does not seem to range beyond the continental shelf. It occurs on bottoms of mud, detritus, fine sand, and rock and coral, seemingly with no preference.

Abundant in the southeastern part of the Gulf of California (Paul and Hendrickx 1980), it has not been reported off northern Sonora or along the east coast of Baja California; the present records from these latter areas are the first for the species north of Bahía San Lucas, a locality cited by Burkenroad (1938). The southern limit, Pisco, Peru, given here is also the first report of the presence of this shrimp in waters south of San Lorenzo (12°0.5'S), Peru, the southernmost locality cited by Arana Espina and Méndez G. (1978). The record from Pisco is based on specimens collected by M. Méndez G. and J. Zeballos, at 5.5-13 m, on 5 November 1983 (Matilde Méndez G. footnote 3).

Discussion.—Burkenroad (1938) was the first to point out some of the differences that separate this species from its closest relative *S. ingentis*. *Sicyonia disdorsalis* can be distinguished from the latter by having 1) a sparsely setose carapace, 2) a less elevated postrostral carina, 3) a weak, almost indistinct branchiocardiac carina, 4) a posteriorly truncate carina on the fifth abdominal somite that is sometimes produced in a spine, 5) an anteromedian pleural sulcus on the first abdominal somite which ends abruptly far from the ventral margin, and does not continue ventrally as a shallow depression, 6) a strong spine on the anteroventral extremity of the pleuron of the first abdominal somite, 7) angular posteroventral

pleural margins on the first two abdominal somites, 8) minute telsonic spines in juveniles and vestigial or indistinct ones in adults, and 9) short uropodal rami that fall short of or barely surpass the apex of the telson.

Various features of the genitalia also allow the separation of *S. disdorsalis* from *S. ingentis*. The distal projection of the dorsolateral lobule of the petasma is curved distomesially instead of extending distolaterally, and is not produced in a short, apical filament; and the distal projection of the ventrolateral lobule does not extend so far distally as the projection of the dorsolateral lobule, is bifurcate laterally, and bears a conspicuous transverse rib. In the thelycum, the breadth of the flat or concave posterolateral areas of the median plate, as well as the depth of the delimiting incisions are much less than the depressed area between them. Furthermore, the posterior component of the median plate is sometimes slightly raised posterolaterally but not forming well-defined lateral bosses traversed by a suture as in *S. ingentis*.

The differences between *S. disdorsalis* and the geminate western Atlantic *S. dorsalis* Kingsley 1878, were discussed in detail by Burkenroad (1934a).

Commercial importance.—Throughout its range, *S. disdorsalis* is present in the commercial catches of other penaeoid shrimps. It was recorded by Rosales Juárez (1976) in those off the coast of Sinaloa, in the Gulf of California, and more recently, on the basis of its abundance in the shrimp bycatch from the waters off Sinaloa and Nayarit, Paul and Hendrickx (1980) suggested that this shrimp has a possible commercial value in that area. Arana Espina and Méndez G. (1978) recorded that in 1977 it made up to 5.8% of the total catches made in northern Peru, a notable increase from that of previous years in which it constituted <0.5%. This species is considered by them to have a significant economic potential.

Material.—1054 specimens from 85 lots.

Mexico—Baja California Sur: 1♂ 2♀, SIO, Bahía Santa María, 0-37 m, 8 December 1962, H. C. Perkins. 1♂, SIO, NW of Punta Márquez, 37 m, 4 December 1962, H. C. Perkins and R. Wisner. 1♂, SIO, NW of Punta Márquez, 18 m, 4 December 1962, H. C. Perkins. 1♂ 2♀, YPM, Bahía San Lucas, 5.5 m, 7 May 1936, *Zaca* stn 135D-20. 2♂, YPM, Bahía San Lucas, 5-17 m, 7 May 1936, *Zaca* stn 135D-18-D19. Sonora: 7♂ 2♀, USNM, Bahía de Lobos (boca sur), 30 m, 18

July 1979, F. Paredes M. Sinaloa: 27♂ 16♀, SIO, Isla Altamura, 21-31 m, 26 May 1965, *El Golfo II* stn 50-6. 2♀, USNM, off San Ignacio, 25 May 1962, R. Bush M. 1♀, USNM, N of Mazatlán, 3.5 km off Mármol, 12 January 1964, A. Villanía and E. Chávez. 3♂ 8♀, SIO, off Boca Teacapan, 55 m, 25 August 1961, F. H. Berry. Nayarit: 8♀, SIO, W of Laguna de Agua Brava, 20 m, 24 August 1961, H. DeWitt. 2♂ 7♀, SIO, SW of Laguna de Agua Brava, 15 m, 24 August 1961, H. DeWitt and H. C. Perkins. 1♂ 15♀, SIO, NE of Isla María Madre, 51 m, 31 March 1973, *Agassiz*. 2♀, SIO, NW of mouth of Río Grande de Soledad, 38-39 m, 24 August 1961, H. C. Perkins and H. DeWitt. 30♂ 30♀, SIO, Bahía de Banderas, 28-33 m, 2 June 1965, *El Golfo II* stn BT-150. 12♂ 14♀, SIO, Bahía de Banderas, 46-55 m, 21 August 1961, F. H. Berry. 1♂ 1♀, SIO, Bahía de Banderas, 5-9 m, 19 August 1961, F. H. Berry. Jalisco: 2♀, USNM, Puerto Vallarta, 13 April 1937. 11♂ 14♀, SIO, Bahía Chamela, 15-18 m, 2 April 1973, *Agassiz*. 6♂ 15♀, SIO, Bahía Chamela, 27-18 m, 2 April 1973, *Agassiz*. 1♂ 3♀, AHF, Bahía Tenacatita, 4-15 m, 8 May 1939. Michoacán: 1♀, CAS, 14.5 km SE of Punta San Telmo (off Maruata), 17 July 1932, *Zaca*. 7♂ 1♀, SIO, Punta Lizardo, 22-24 m, 4 April 1973, *Agassiz*. 21♂ 25♀, SIO, Punta Lizardo, 37-38 m, 4 April 1973, *Agassiz*. Guerrero: 3♀, CAS, 6.5 km SE of entrance of Bahía de Acapulco, 27 m, 5 April 1932, *Zaca*. Oaxaca: 1♂ 1♀, USNM, 24 km off Puerto Angel, 84-57 m, 13 July 1963, I. Mayés A. 8♂ 4♀, SIO, Golfo de Tehuantepec, 55 m, 6 June 1965, *El Golfo II*, stn BT-162. 5♂ 4♀, SIO, SW of Santiago Astata, 54 m, 6 June 1965, *El Golfo II*, stn BT-162. 1♂ 3♀, USNM, 16 km W of Ayutla lighthouse, 54 m, 15 June 1963, I. Mayés A. 7♂ 30♀, SIO, off Salina Cruz, 44 m, 7 June 1965, *El Golfo II*. 5♀, USNM, Salina Cruz, 64 m, 23 August 1963, I. Mayés A. 4♂ 2♀, SIO, off Salina Cruz, 31-35 m, 8 July 1963, D. Dockins. 1♀, SIO, off Salina Cruz, 49-73 m, 8 July 1963, D. Dockins. 44♂ 50♀, SIO, Golfo de Tehuantepec, 22 m, 10 April 1973, *Agassiz*. 5♂ 5♀, INP, off Tangola, 68 m, 10 July 1963, I. Mayés A. 5♂, USNM, off Tangola, 139-93 m, 13 July 1963, I. Mayés A.

Guatemala—1♀, AHF, San José, 4-9 m, 23 March 1939.

El Salvador—3♂ 8♀, SIO, Golfo de Fonseca, 18 m, 17 April 1973, C. Hubbs and S. Luke. 6♂ 4♀, SIO, Golfo de Fonseca, 18 m, 17 April 1973, C. Hubbs and S. Luke. 5♂ 14♀, SIO, Golfo de Fonseca, 24-29 m, 17 April 1973, *Agassiz*.

Nicaragua—1♂ 5♀, USNM, off northern Nicaragua, 53-59 m, 17 April 1973, C. Hubbs and S. Luke.

Costa Rica—3♀, USNM, 3 km off Río Savegre, Puntarenas, 24 m, 2 December 1981, M. Hatzios. 10♂ 14♀, SIO, Cabo Blanco, 60 m, 18 April 1973, *Agassiz*. 5♂ 15♀, SIO, Cabo Blanco, 60 m, 18 April 1973, *Agassiz*. 1♂ 2♀, AHF, Golfo de Nicoya, about 1 km of east end of Islas Negritos Afuera, 64 m, 29 June 1973, *Velero* stn 19132. 30♂ 30♀, USNM, Golfo de Nicoya, 31 m, 22 April 1973, C. Hubbs and S. Luke. 40♂ 40♀, SIO, Golfo de Nicoya, 31 m, 22 April 1973, *Agassiz*.

Panama—1♀, USNM, off Bocas del Toro, 91-97 m, 26 January 1971, *Pillsbury* stn 1313. 5♂ 3♀, SIO, Isla Cavada, Islas Secas, 40 m, 23 September 1970, W. Newman, T. Dana, S. Luke. 4♂ 4♀, USNM, S of Río Hato, 17 m, 1/2 May 1967, *Pillsbury* stn 488. 1♀, USNM, Bahía de Parita, 22-18 m, 2 May 1967, *Pillsbury* stn 490. 1♀, USNM, E of Chitré, 20 m, 2 May 1967, *Pillsbury* stn 491. 2♂ 4♀, USNM, E of Chitré, 18-16 m, 2 May 1967, *Pillsbury* stn 492. 6♂ 6♀, USNM, N of Isla Iguana, 37-33 m, 2 May 1967, *Pillsbury* stn 493. 1♂, USNM, southern end of Bahía Limón, 3 m, 23 July 1966, *Pillsbury* stn 449. 5♂ 5♀, USNM, off Punta Calabazo, 20 m, 1 May 1967, *Pillsbury* stn 486. 2♂, USNM, off Río Hato, 15 m, 1 May 1967, *Pillsbury* stn 485. 1♂, USNM, Ensenada de Chame, *Shimada* stn 48. 2♂ 2♀, USNM, S of Isla Bona, 31-26 m, 1 May 1967, *Pillsbury* stn 484. 18♂ 14♀, USNM, E of Punta Chame, 22 m, 1 May 1967, *Pillsbury* stn 483. 2♂ 1♀, USNM, off Balboa, surface, 9/10 May 1967, *Pillsbury* stn 564. 20♂ 20♀, USNM, off Panamá Viejo, 4 m, 23 February 1973, I. Pérez Farfante. 30♂, USNM, off Juan Díaz, 12-22 m, 15 February 1973, *Patricia*. 1♂ 7♀, USNM, Juan Díaz, 5 m, 4 February 1969, L. G. Abele. 1♂ 1♀, USNM, W of Punta Brujas, 18 m, 6 May 1967, *Pillsbury* stn 536. 1♂ 1♀, syntypes, YPM, Archipiélago de las Perlas, 35-44 m, 31 March 1926, *Pawnee*. 5♂ 6♀, syntypes, YPM, Archipiélago de las Perlas, 35-44 m, 31 March 1926, *Pawnee*. 5♂ 5♀, syntypes, YPM, Golfo de Panamá, 1868, F. H. Bradley. 1♀, syntype, YPM, Golfo de Panamá, 1868, F. H. Bradley. 1♂ 3♀, syntypes, YPM, W coast of Central America, 1872, Capt. Dow. 1♂ 3♀, syntypes, YPM, W coast of Central America, 1872, Capt. Dow.

Colombia—1♀, USNM, Bahía Humboldt, 20 April 1967, *Shimada* stn 76B, haul 1. 2♀, USNM, Bahía Humboldt, 20 April 1967, *Shimada* stn 76B haul 2. 6♀, USNM, off Timbiquí, Cauca,

38-35 m, 16 September 1966, *Anton Bruun* 18B stn 785.

Ecuador—1♀, USNM, Golfo de Guayaquil, 32 m, 11 September 1966, *Anton Bruun* 18B stn 772.

Peru—13♂ 22♀, USNM, off Tumbes, 13 m, 10 September 1966, *Anton Bruun* 18B stn 768. 16♀, USNM, off Caleta Cruz, Tumbes, November 1979, *Promaresa*. 16♂, USNM, off Caleta Cruz, Tumbes, November 1979, *Promaresa*. 16♂, USNM, off Caleta Cruz, Tumbes, November 1979, *Promaresa*. 16♀, USNM, off Caleta Cruz, Tumbes, November 1979, *Promaresa*. 6♀, USNM, off Negritos, 16 m, 2 June 1966, *Anton Bruun* 16 stn 624-B. 2♂ 1♀, USNM, Paita, 1969, J. Sánchez and E. Valdivia. 2♀, USNM, NW of Paita, 40 m, 1977.

Sicyonia ingentis (Burkenroad 1938)

Figures 52, 57-60

Eusicyonia ingentis Burkenroad 1938:88, fig. 31-34 [holotype: ♂, AMNH 12388; type-locality: off east coast of Cedros Island (Isla Cedros), 28°05'N, 115°09'W, Baja California, Mexico, 38 fm (69 m), 27 March 1936, *Zaca* stn 127D-1]. Anderson and Lindner 1945:318. Feinberg 1971:6. Frey 1971:16.

Sicyonia ingentis. Parker 1964:162. Carlisle 1969:239. Longhurst 1970:272. Word and Charwat 1976:19, 3 fig. Holthuis 1980:61. Wicksten 1980:360. Pérez Farfante and

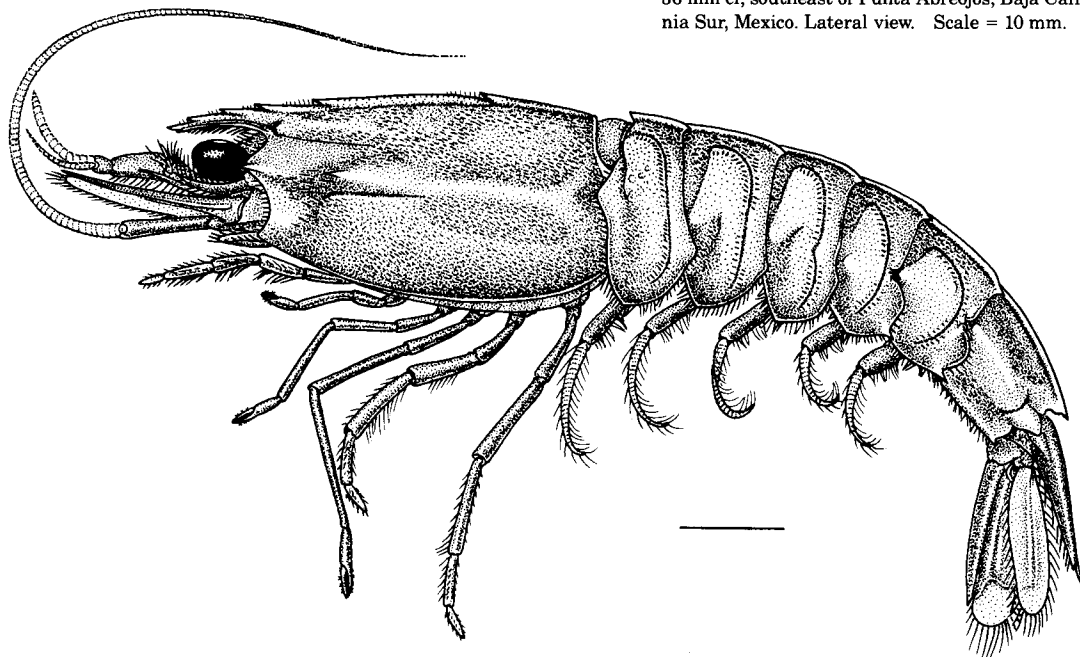
Boothe 1981:424. Pérez Farfante 1982:371. "??*Sicyonia* sp.", Mathews and González, 1975:51. *Sicyonia ringens*. Mathews, 1981:329.

Vernacular names: ridgeback prawn, rock shrimp, Japanese shrimp (United States); camarón de piedra, cacahuete (Mexico). FAO names: Pacific rock shrimp (English); camarón de piedra del Pacífico (Spanish); boucot du Pacifique (French).

Diagnosis.—Antennal spine well developed and buttressed. Second abdominal somite with dorsomedian carina lacking incision. First pereopod with basis and ischium unarmed. Postrostral carina bearing one tooth posterior to level of hepatic spine and low throughout entire length, not raised in crest behind posterior tooth. Abdomen with tooth on dorsomedian carina of first somite smaller or only slightly larger than posterior tooth on carapace. Petasma with distal projections of dorsolateral lobules divergent and bearing short terminal filament. Thelycum with plate of sternite XIV raised in pair of lateral bulges; posterior component of median plate bearing pair of lateral bosses cut by transverse suture. Branchiostegite lacking large mark.

Description.—Body slender (Fig. 57) and lacking

FIGURE 57.—*Sicyonia ingentis* (Burkenroad 1938), ♀ 36 mm cl, southeast of Punta Abreojos, Baja California Sur, Mexico. Lateral view. Scale = 10 mm.



tubercles or occasionally with few on first abdominal somite. Carapace bearing patches of short setae on dorsum, on pterygostomian and anterior part of branchial regions, bordering branchiocardiac carina, and cluster immediately anteroventral to hepatic spine; patches also present on abdomen flanking dorsomedian carina and on anteroventral part of pleuron of first three and sixth somites. Abdomen lacking tubercles or with few on first somite.

Rostrum slender, usually somewhat decurved but sometimes subhorizontal, occasionally with anterior extremity upturned; moderately long, overreaching distal margin of eye (extending as far as basal 0.2 of second antennular article), its length 0.30-0.43 cl, increasing linearly with carapace length (Fig. 58); armed with three dorsal teeth and two (rarely three) apical teeth, ventral one considerably smaller than dorsal and usually placed posterior to it but occasionally at same level or even more anteriorly; first rostral tooth subequal to, or slightly smaller than epigastric and located opposite and anterior to level of orbital margin, second tooth situated between 0.32 and 0.44 (mean 0.37) rl from orbital margin; and third tooth between 0.58 and 0.80 (mean 0.66) rl. Strong adrostral carina, parallel to and rather near ventral margin, extending along entire length of rostrum.

Carapace with postrostral carina low but robust throughout its entire length in adults, weak in juveniles, and bearing two teeth: 1) epigastric tooth small, subequal to or barely larger than first rostral tooth, situated anterior to but relatively near level of hepatic spine, between 0.11 and 0.17 (mean 0.16) cl from orbital margin; and 2) posterior tooth usually slightly, sometimes conspicuously, larger than epigastric and placed well in advance of posterior margin of carapace, between 0.57 and 0.65 (mean 0.63) cl from orbital margin. Tuft of setae present immediately anterior to base of each tooth. Antennal spine moderately long, projecting from sharp, elongate buttress; hepatic spine long, acutely pointed, arising from raised area, and placed between 0.20 and 0.25 (mean 0.22) cl from orbital margin. Postocular sulcus deep anteriorly, continuing posteriorly as long, well-marked arched groove; hepatic sulcus subhorizontal; hepatic carina indistinct; branchiocardiac carina strong, longitudinally disposed but curving dorsally near posterior margin of carapace where also often sending short branch ventrally.

First article of antennular peduncle and gna-

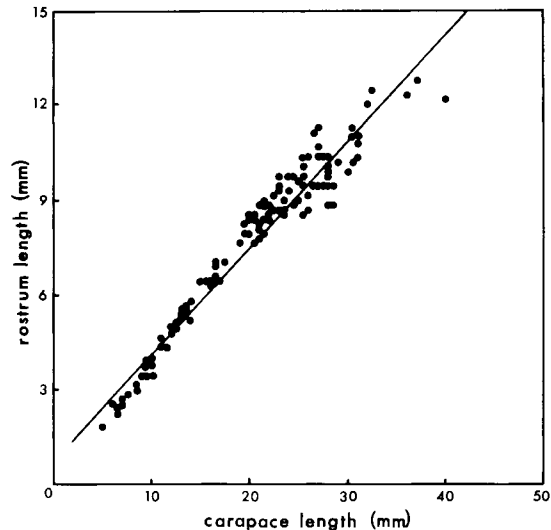


FIGURE 58.—*Sicyonia ingentis*. Relationship between rostrum length and carapace length (regression equation, $y = 0.75763 + 0.33933x$).

thal appendages, except third maxilliped, illustrated in Figure 4.

Antennular peduncle with stylocerite produced in long, sharp spine, its length 0.85-0.95 distance between lateral base of first antennular article and mesial base of distolateral spine; latter reaching as far as midlength of second antennular article; antennular flagella relatively long, mesial one, about 0.4 as long as carapace, longer and more slender than lateral; latter about 0.30 as long as carapace.

Scaphocerite overreaching antennular peduncle by as much as 0.2 of its own length; lateral rib produced distally in long, acute spine considerably surpassing margin of lamella. Antennal flagellum about 2 times as long as carapace.

Third maxilliped about as slender as pereopods. Basis and ischium of first pereopod unarmed.

Abdomen with dorsomedian carina extending from first through sixth somites, carina on first very low and produced in small, stubby, anterior tooth, smaller or only slightly larger than posterior tooth on carapace; carina on first five somites sloping posteriorly, on sixth produced in large acute posterior tooth.

Anteroventral margin of pleuron of first abdominal somite slightly convex, sometimes straight in juveniles; posteroventral margin, similar to that of second and usually third somites, gently curved. Anteroventral extremity of pleuron of first four somites lacking spine, although that of second and

third occasionally projecting slightly or forming small spine. Posteroventral extremity of pleuron of first and second somites rounded, that of third variably angular (sometimes bearing spine), and that of fourth through sixth produced in caudally directed spine.

First somite marked with short anteromedian pleural sulcus continuing as shallow depression to near ventral margin of pleuron, and long, united, posterior tergal-posteromedian pleural sulci. Second through fourth bearing anterior tergal sulcus (that of fourth weak or sometimes lacking), and united posterior tergal-posteromedian pleural sulci; second and third also bearing shallow depression representing anteromedian pleural sulcus. Fifth somite with almost indistinct anterior tergal and strongly arched, united posterior tergal-posteromedian pleural sulci. Sixth somite with arched posteromedian pleural sulcus barely, if at all, distinct, and bearing well-marked, long cicatrix.

Telson with median sulcus deep basally, fading posteriorly, and armed with small but well-defined, fixed subterminal spines. Rami of uropod subequal in length, exceeding apex of telson by as much as 0.25 of their length.

Posterior spine on first abdominal sternite broadly subtriangular with blunt apex and straight or usually convex, instead of concave, lateral margins.

Petasma (Fig. 59A, B) with cornified distal projection of dorsolateral lobule directed distolaterally, acutely pointed, ending in short filament, and raised in proximodorsal, subhemispheric prominence. Distal projection of ventrolateral lobule reaching as far as projection of dorsolateral lobule, mostly fleshy, blunt, and produced in small lateral tooth just proximal to midlength.

Petasmal endopods joined in males 10.5 mm cl, about 41 mm tl, but in individuals with carapace of as much as 19 mm, about 70 mm tl, they may not be joined.

Appendix masculina as illustrated in Figure 59C.

Thelycum (Fig. 60) with plate of sternite XIV bearing paired strong protuberances bordered laterally by narrow flanges and separated by deep median depression sharply delimiting their posteromesial margins. Median plate of sternite XIII flask-shaped in outline, tapering gradually into long, slender spine reaching between base and midlength of basis of extended second pereopods; plate set off from posterior component by deep incisions and usually raised posterolaterally in paired rounded prominences flanking narrow depression (narrower than prominences); posterior component of median plate bearing paired strong, short bosses separated by deep median depression, each boss cut by transverse suture. Paired short spines projecting anteroventrally from posterior

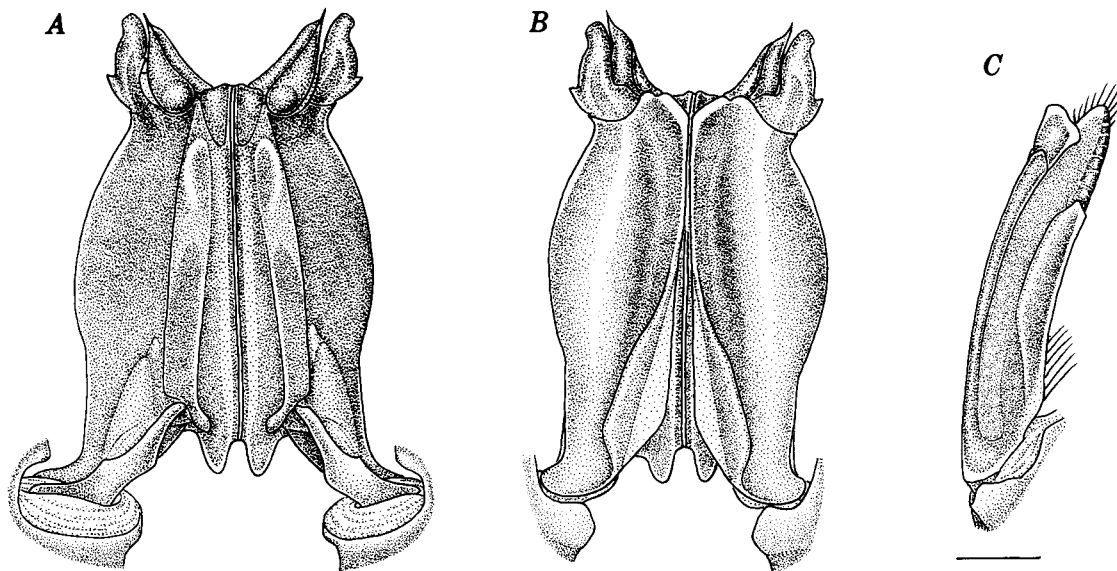


FIGURE 59.—*Sicyonia ingentis*, ♂ 16 mm cl, southeast of Punta Tasco, Isla Santa Margarita, Baja California Sur, Mexico. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scale = 1 mm.

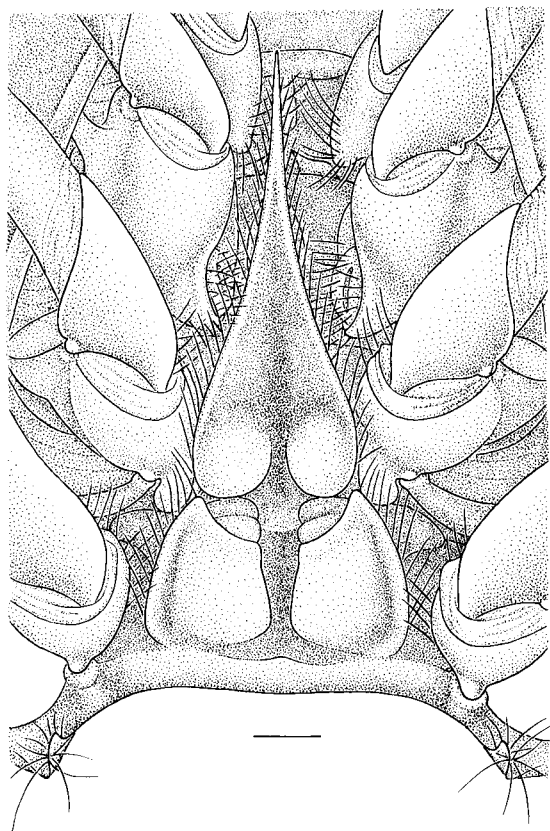


FIGURE 60.—*Sicyonia ingentis*, ♀ 23 mm cl, southeast of Punta Tasco, Isla Santa Margarita, Baja California Sur, Mexico. Thelycum. Scale = 1 mm.

margin of sternite XI, spines broad basally and sharp or sometimes needlelike apically.

The smallest impregnated females encountered had a carapace of 14 mm, about 57 mm tl.

Maximum size.—Males 157 mm tl; females 180 mm tl, measured from "telson to base of antenna" (Herklrath 1977). In my sample: males 31 mm cl, about 112 mm tl; females 40.2 mm cl, about 133 mm tl.

Geographic and bathymetric ranges.—Monterey Bay, 36°50'N, 121°50'W (Pérez Farfante and Boothe 1981), California, southward to Isla María Madre, 22°00'N, 106°16'W, Nayarit, Mexico; in the Gulf of California (Fig. 52) along the central part of the eastern coast; and in the southern part along both coasts. This species has been found between 5 and 293-307 m and is most abundant from 55 to 82 m, at which depth it is commercially fished off Ventura, Calif. (Frey 1971); also most of the many

specimens examined by me were taken within this range. According to Carlisle (1969) it is common at depths between 61 and 183 m. *Sicyonia ingentis* occurs on substrates of sand, shell, and green mud, but seems to prefer sandy bottoms on which commercial concentrations are located.

This species is the only member of *Sicyonia* that has been recorded along the west coast of the United States and north of Punta Canoas, Baja California Sur—about 1,000 km south of Monterey Bay, the northern limit of its range. The record from Isla María Madre, Nayarit, is the first from waters south of the Gulf of California.

Discussion.—*Sicyonia ingentis*, the largest eastern Pacific species in the genus, has its closest affinities with the much smaller, sympatric *S. disdorsalis*. It differs from the latter in possessing 1) a carapace bearing, not lacking, patches of long setae, 2) a robust postrostral carina rather than a slender one, 3) a strong branchiocardiac carina instead of an almost indistinct one, 4) a carina on the fifth abdominal somite which slopes gently to near the posterior cleft rather than being truncate or produced in a spine, 5) an anteromedian pleural sulcus on the first abdominal somite which continues as a shallow depression almost to the ventral margin of the pleuron instead of ending abruptly and well above it, 6) an unarmed anteroventral extremity on the pleuron of the first abdominal somite rather than one armed with a strong spine, 7) curved, instead of angular, posteroventral pleural margins on the first two abdominal somites, 8) well-developed telsonic spines instead of minute or indistinct ones, and 9) long uropodal rami that considerably surpass the apex of the telson instead of falling short of or barely overreaching it.

Sicyonia ingentis also differs from *S. disdorsalis* in characters of the genitalia. The distal projection of the dorsolateral lobule of the petasma is directed distolaterally instead of curving distomesially and is produced in a short apical filament which is lacking in *S. disdorsalis*. The distal projection of the ventrolateral lobule reaches, instead of falls short of, the terminal margin of the dorsolateral lobule; furthermore, it is neither bifurcate laterally nor does it bear a transverse rib. In the thelycum, the median depression on the posterior part of the median plate of sternite XIII is narrower than the usually rounded protuberances flanking it, whereas in *S. disdorsalis* the depression is much broader than the flat or concave areas which occupy the position of the two protuber-

ances. Finally, the paired lateral bosses, representing the posterior component of the median plate and each cut by a transverse suture, are found only in *S. ingentis*.

The "pencil of hairs" that Burkenroad (1938) stated to be located on the dorsal surface of the distal part of the ocular peduncle, near its distolateral margin, actually is placed on the distomesial margin. He distinguished *S. ingentis* from *S. disdorsalis* by, among other characters, the relative length of that tuft of setae, stating that in large adults of the former species it overreaches the eye whereas in *S. disdorsalis* it spans no more than half the cornea. This character does not seem to be a reliable one for, except in occasional specimens of *S. ingentis*, in neither species does the tuft surpass the eye. Burkenroad also considered the disposition of the adrostral rib as a diagnostic feature that would serve to separate the two species. Although in *S. ingentis* the rib lies parallel to the ventral margin of the rostrum, in *S. disdorsalis* its course varies: sometimes it is slightly arched near the anterior end, as Burkenroad described it, but often it is curved along the middle and occasionally is slightly turned anterodorsally. The distance of the rib from the ventral margin in the two shrimps, however, exhibits a slight difference—in *S. ingentis* it extends close to the margin whereas in *S. disdorsalis* it lies more dorsally.

The characters exhibited by *S. ingentis*, *S. disdorsalis*, and *S. picta* suggest that they must have diverged quite early from a common ancestor in the group of species that share two teeth on the postrostral carina.

Notes on biology.—Herkerlath (1977) investigated the temperature tolerance and age-growth and length-weight relationships in this shrimp. He found that within a salinity range of 33-35‰ it exhibits a wide range of tolerance to temperature (4°-30°C). At a stressed salinity (26‰) this tolerance was considerably reduced (7°-25°), and mortality increased proportionately with the duration of exposure, regardless of temperature. His studies indicated that shrimp with a total length of 50-90 mm increased 10 mm per month and also that there is no difference in length-weight ratio between sexes. He also stated that among shrimp "averaging 70 mm or greater in total length, the average length of females was greater than that of males."

Anderson (1983) studied growth rates, molting, and certain aspects of reproduction in a population of *S. ingentis* occurring off Santa Barbara, CA.

She found that spawning takes place far offshore in deep water, about 145 m, and lasts from May through October with the peak during the late summer. She also observed that molt frequency is highest in the winter and spring, that females do not molt during the summer (the reproductive period), and that males exhibit a similar pattern. Size-frequency analyses based on monthly offshore and nearshore sampling indicated that juveniles increased at a monthly rate of about 1-2 mo.

Commercial importance.—There is a fishery for this shrimp between Santa Barbara and Ventura, Calif. According to the California Department of Fish and Game, landings in 1982 amounted to 127,000,956 lb with a value of \$156,000,385. Mathews (1981) stated that "*Sicyonia ringens*" is occasionally fished in Magdalena Bay, which is located on the ocean side of Baja California Sur. I have little doubt that his remark applies to *S. ingentis* and that "*ringens*" is an erroneous spelling. Moreover, it seems to me almost certain that the study of "*Sicyonia* sp." (distribution, abundance, rate of growth, ratio total weight/total length) in Magdalena Bay by Mathew and González (1975), was based on a population of this species, apparently the only abundant rock shrimp in the area. However, because Magdalena Bay is within the range of *S. penicillata*, another species reaching sizes reported by the authors, it is not possible to be certain of the identity of the shrimp studied by them. It is indeed unfortunate that the valuable information presented cannot be definitely associated with a specific shrimp, particularly in view of the fact that so little is known of the biology of any of the eastern Pacific rock shrimps. Although *S. ingentis* is present in the Gulf of California, it is not commercially exploited there.

Material.—946 specimens from 52 lots.

United States—California: 1♀, CAS, 2 km W of Moss Landing, Monterey Bay, 50 m, 23 September 1978, D. D. Chivers. 1♂ 3♀, AHF, 5 km off Point Mugu, 40-59 m, 25 April 1976, *Velero IV* stn 24833. 1♂, AHF, 8.4 km W of Venice, 70-73 m, 22 July 1958, J. L. Baxter. 1♀, SIO, SW of Santa Monica Bay, 22 March 1962, F. H. Berry and H. C. Perkins. 3♀, SIO, San Pedro Bay, 27 m, 20 March 1964, U.S. Fish and Wildlife Service staff. 1♂ 4♂, SIO, N of Dana Point, 53-48 m, 29 March 1974, *Agassiz*. 31♂ 20♀, SIO, off San Onofre, 54 m, 29 March 1974, *Agassiz*. 2♂ 2♀, SIO, off San Onofre,

91 m, 29 March 1974, *Agassiz*. 11♂ 15♀, SIO, off Encinitas, 51 m, 29 March 1974, *Agassiz*.

Mexico—Baja California Norte: 7♂ 5♀, SIO, off Bahía de San Quintín, 57 m, 1 April 1962, Fish and Wildlife Service staff. 15♂ 11♀, SIO, off Bahía de San Quintín, 73 m, 4 December 1960, C. Boyd and D. Dockins. 12♂ 10♀, SIO, off Bahía de San Quintín, 74-77 m, H. C. Perkins. 6♂ 6♀, SIO, off Bahía de San Quintín, 143-148 m, 1 April 1962, H. C. Perkins. 2♂ 5♀, SIO, SE of San Felipe, 120 m, 19 January 1968, *Thomas Washington*. 1♀, SIO, W of Punta Prieta, 23 March 1960, H. C. Perkins. 6♂ 7♀, SIO, Bahía Sebastián Vizcaíno, 88 m, 19 August 1960, W. D. Clarke. 1♀, YPM, E of Isla Cedros, 110 m, 22 May 1936, *Zaca* stn 126D-10. 4♂ 1♀, SIO, between San Benito and Isla Cedros, 247-265 m, 27 May 1971, C. Hubbs and S. Luke. 4♂, YPM, E of Isla Cedros, 80 m, 27 March 1936, *Zaca* stn 125D-1. 24♂ 21♀, USNM, E of Isla Cedros, 80 m, 5 May 1888, *Albatross* stn 2838. 12♂ 19♀, SIO, WSW of Red Rock, Bahía Sebastián Vizcaíno, 113-119 m, 25 November 1961, F. H. Berry. 1♂, YPM, E of Isla Cedros, 73 m, 22 May 1936, *Zaca* stn 126D-4. 4♂ 6♀, YPM, E of Isla Cedros, 69 m, 27 March 1936, *Zaca* stn 126D-2. ♂ holotype, AMNH, off east coast of Isla Cedros, 69 m, 27 March 1936, *Zaca* stn 127D-1. 3♂ 1♀ and 2♂ 2♀ paratypes, AMNH and YPM, respectively, collected with holotype. 3♂ 1♀, YPM, E of Isla Cedros, 70-110 m, 27 March 1936, *Zaca* stn 125D-1. Baja California Sur: 3♂ 1♀, SIO, Bahía Sebastián Vizcaíno, 55 m, 11 August 1952, K. S. Norris. 2♂ 2♀, SIO, Bahía de San Cristóbal, 83-87 m, 2 December 1961, F. H. Berry. 19♂ 17♀, SIO, Bahía Asunción, 68-64 m, 17 November 1964, *Black Douglas*. 20♂ 20♀, SIO, SW of Punta San Hipólito, 6 March 1954, "J.M. and W.H." 13♂ 20♀, SIO, SE of Punta Abreojos, 55-59 m, 17 November 1964, *Black Douglas*. 4♂ 17♀, SIO, SE of Punta Abreojos, 73-79 m, 17 November 1964, *Black Douglas*. 27♂ 21♀, SIO, SE of Punta Abreojos, 91 m, 2 December 1960, C. Boyd and D. Dockins. 20♂ 20♀, SIO, WSW of Punta Pequeña, 68-73 m, 16 November 1964, *Black Douglas*. 2♂ 3♀, SIO, 15 km WSW of Boca de las Animas, 55-57 m, 16 November 1964, *Black Douglas*. 14♂ 6♀, SIO, SW of Santo Domingo del Pacífico, 100 m, 20 April 1969. 19♂ 11♀, SIO, 16 km NW of Isla Magdalena, 99-102 m, 16 November 1964, *Black Douglas*. 23♂ 22♀, SIO, off Bahía Magdalena, 88 m, 3 February 1964, C. Hubbs. 30♂ 30♀, SIO, SW of Isla Santa Margarita, 75-81 m, 13 November 1964, *Black Douglas*. 44♂ 26♀, SIT, SE of Punta Tasco, Isla

Santa Margarita, 102-106 m, 27 June 1965, *Horizon*. 25♂ 25♀, SIO, W of Inocentes, 91-93 m, 10 November 1964, *Black Douglas*. 2♀, SIO, WNW of Punta Lobos, 183-201 m, 9 November 1964, *Black Douglas*. 1♂, SIO, Bahía de la Paz, 82-119 m, 12 January 1968, *Thomas Washington*. Sonora: 1♂ 1♀, SIO, off Hermosillo coast, 289-304 m, 25 March 1960, Curray and R. H. Parker. 1♀, AHF, S of Isla Tiburón, 4-29 m, 25 January 1940. 15♂ 11♀, SIO, off Santa Rosalía, 64-48 m, 25 March 1960, R. H. Parker. 25♂ 25♀, SIO, off Isla San Pedro Mártir, 293-307 m, 21 January 1968, *Thomas Washington*. 1♀, AHF, Bahía de Guaymas, 5 m, 23 March 1949. Sinaloa: 2♂ 1♀, USNM, Puerto de la Punta Altata, 9 May 1962, R. E. Bush. 1♀, USNM, Los Cocos, 42 m, 18 May 1962, R. E. Bush. Nayarit: 24♂ 21♀, SIO, NE of Isla María Madre, Islas Tres Mariás, 82-88 m, 30 March 1973, *Agassiz*.

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