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THE ROCK SHRIMP GENUS *SICYONIA*  
(CRUSTACEA: DECAPODA: PENAEOIDEA) IN THE EASTERN PACIFIC

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ABSTRACT

The genus *Sicyonia* is redefined and the 12 species occurring between Monterey Bay, California, and off Pisco, Peru, are treated in detail. A key to species is followed by illustrated species accounts including descriptions, ranges of intraspecific variation with analyses of morphometric data (rostrum to carapace ratio graphically represented for 10 species), and color notes. The size ranges at which males and the minimum sizes at which females attain adulthood are summarized, and ecological notes together with maps illustrating the ranges of the species (six of which have been extended beyond limits previously reported) are included. *Sicyonia disparri* seems to be restricted to the south and gulf coasts of Baja California and waters off Nayarit, Mexico; *S. affinis* to waters off Costa Rica, Panama, and Colombia; and *S. penicillata* occurs on the ocean side of Baja California Sur, Mexico, and from the Gulf of California to Costa Rica. *Sicyonia ingentis* ranges from Monterey Bay to Nayarit, including the Gulf of California. *Sicyonia disedwardsi* and *S. martini* occur along the ocean side of Baja California Sur, in the Gulf of California, and southward to Panama, and four others, *S. aliaffinis*, *S. disdorsalis*, *S. mixta*, and *S. picta*, frequent the same waters, but also reach as far south as Peru. *Sicyonia laevigata* and *S. brevisrostris* are found on both sides of the Continent, the former at the southern end of the Gulf of California and from off Costa Rica to the Golfo de Panamá in the Pacific, and from North Carolina to Santa Catarina, Brazil, in the Atlantic. *Sicyonia brevisrostris* has been recorded from the Golfo de Tehuantepec and from Virginia southward through the Gulf of Mexico to Yucatán, and also from the Bahamas and Cuba. In addition, there is an unverified literature record from Guyana. The treatment of each species is concluded with a comparison of its diagnostic features with those of the most closely allied congeners and a note on its present or potential economic value.

Until a few years ago, members of the genus *Sicyonia*, "rock shrimps", were discarded from the large commercial catches of penaeoid shrimps made in tropical and subtropical waters of the eastern Pacific and western Atlantic. It was commonly thought that because of their hard, stony exoskeleton, they would be rejected by both consumers and the processing industry; however, increased demand for shrimp encouraged the fishermen and dealers to bring the larger species to market, and now production is not only readily absorbed, but some prefer rock shrimps to the thinner shelled species.

The exploitation and comparatively recent recognition of the commercial potential of *Sicyonia*, the most distinctive group within the superfamily Penaeoidea, have motivated this review of members of the genus found in the American Pacific (the western Atlantic species have already been the object of a number of studies, e.g., Chace 1972; Huff and Cobb 1979). For the most part, the infor-

mation available is limited to the original descriptions of the species, which are scattered in works published between 1871 and 1945, and to a limited number of locality records. Of the 12 species occurring in the region, 4 had been recognized prior to the close of the century. No other species were reported from these waters until Burkenroad made his invaluable studies (1934-45) which resulted in the recognition of five new species plus two others previously known to occur only in the western Atlantic. Recently, Pérez Farfante and Boothe (1981) described the 12th member of the genus frequenting the eastern Pacific. Two works have been helpful in the identification of the American *Sicyonia*: one by Anderson and Lindner (1945) which provided a key to the then known species; the other by Arana Espina and Méndez G. (1978) in which was presented an illustrated key, diagnoses, and ranges of the species found in Peruvian and Ecuadorean waters, and an analysis of morphometric relations, with data on the growth and molting pattern of one of the species.

The extensive collections (515 lots containing 4,672 specimens) of *Sicyonia* available from Monterey Bay, Calif., to off Pisco, Peru, and the oppor-

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tunity to examine all except two of the extant type-specimens of the species have made a critical study of the genus in the eastern Pacific possible. The present work includes a definition of the genus and a key to the species occurring in the region. A complete synonymy and usually complete list of references, vernacular names, and a diagnosis precede the detailed description of each species, which includes a discussion of the extensive variation exhibited as well as meristic and morphometric data. In addition, relation of the length of the rostrum to the length of the carapace is graphed for 10 species. Color notes, size range at which males reach adulthood, and minimum size at which females have been observed to be impregnated are given. Geographic and bathymetric ranges are delimited, and ecological data are provided. Analyses of the diagnostic features utilized in the recognition of species and a discussion of their phylogenetic relationships are also presented. Distributional maps as well as illustrations of entire animals, genitalia, and a few other morphological features are included along with a bibliography which is as complete as possible. A statement of their economic importance follows the treatment of the pertinent species, and a list of the specimens examined, with their localities, is appended to each of the 12 species.

The distributional studies have resulted in extensions of both geographic and bathymetric ranges of several species; e.g., of the seven species known to occur both in the Gulf of California and on the ocean side of the peninsula, five have not been previously reported from the latter, and one, which had been recorded only as far north as Point Conception, Calif., was found to reach Monterey Bay (Pérez Farfante and Boothe 1981). Of the 12 species that have been reported from the region, 10 (or 11, in the unlikely event that the presence of *S. affinis* is confirmed) occur in the Gulf of California; of those occurring in the gulf, *S. disparri* appears to be virtually confined to it and only *S. ingentis* extends northward beyond Mexico, along the coast of the United States. Eight of the 10 species range southward to Central America, and of them 4 reach as far as Peru and *S. aliaffinis* also occurs off Islas Galápagos. *Sicyonia brevirostris* has been reported exclusively from the Golfo de Tehuantepec, and *S. affinis* is known with certainty only from Costa Rica to Colombia.

Seven of the species, *S. laevigata*, *S. mixta*, *S. disedwardsi*, *S. penicillata*, *S. aliaffinis*, *S. martini*, and *S. picta*, appear to have disjunct ranges. None has been recorded from stretches variable in

extension within the limits cited herein, and all of the gaps encompass areas off southern Mexico. Perhaps the discontinuities are due to limited exploratory investigations; however, one species, *S. disdorsalis*, has been found to occur virtually continuously from the Gulf of California to Peru. Nevertheless, speculations attempting to explain the apparent gaps in the ranges of these species should await the confirmation of their existence.

Except for records of the occurrence of *S. picta* at 333 m (Faxon 1893) and 369-400 m (Arana Espina and Méndez G. 1978) and *S. brevirostris* at 329 m (Williams 1965), no other species were previously known from depths greater than about 200 m; here six others are reported between about 250 and 300 m, depths considerably greater than their previously known maximum occurrence.

Distributions of members of the genus *Sicyonia* in the eastern Pacific appear to differ strikingly from those of most species of the closely related family Penaeidae in that region. Whereas some species of *Sicyonia* are restricted to comparatively small areas (one confined to the southern and gulf coasts of Baja California and waters immediately south), others range from the Gulf of California to the northern or to the central coasts of Peru. Most of the eastern Pacific species, like their western Atlantic congeners, reveal a marked preference for firm or coarse bottoms.

## PRESENTATION OF DATA

Many characters used in the descriptions are depicted in Figures 1-7. To provide an appreciation of the structure of the eye and the nomenclature employed in its description I have chosen that of *S. disedwardsi*. To illustrate the first article of the antennular peduncle and anterior gnathal appendages, *S. ingentis* was selected. The petasmata have been drawn from specimens stained with fast green. For convenience, both the armature of sternite XI and the shape of the posterior thoracic ridge are presented with the description of the thelycum. Scales accompanying the illustrations are in millimeters. The length of the rostrum (rl) recorded herein is the linear distance from the apex to the orbital margin; length of the carapace (cl) is the distance between the orbital margin and the midposterior margin of the carapace; and the total length (tl) is the distance from the apex of the rostrum to the posterior end of the telson. The geographic distribution of each of the species presented on the maps is based on material personally examined and on published records believed to be

reliable. The names of the countries cited are in English as are the Gulf of California and the Gulf of Mexico; otherwise, all geographic features and localities are in the language of the country in which they occur.

Material examined during this study are in the collections of the following institutions.

|        |  |
|--------|--|
| AHF    | Allan Hancock Foundation, Los Angeles, California, USA                             |
| AMNH   | American Museum of Natural History, New York, New York, USA                        |
| CAS    | California Academy of Sciences, San Francisco, California, USA                     |
| IMARPE | Instituto del Mar del Perú, Callao, Peru   |
| INP    | Instituto Nacional de Pesca, Secretaría de Pesca, México D.F., Mexico              |
| MCZ    | Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA   |
| MP     | Muséum National d'Histoire Naturelle, Paris, France                                |
| SIO    | Scripps Institution of Oceanography, La Jolla, California, USA                     |
| UCR    | Universidad de Costa Rica, San José, Costa Rica                                    |
| UP     | Universidad de Panamá, Panama  |
| USNM   | National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA |
| YPM    | Peabody Museum of Natural History, Yale University, New Haven, Connecticut, USA    |
| ZMB    | Zoologisches Museum der Humboldt-Universität, Berlin, East Germany.                |

### Genus *Sicyonia* H. Milne Edwards 1830

*Sicyonia* H. Milne Edwards 1830:339 [type-species, by monotypy: *Sicyonia sculpta* H. Milne Edwards 1830:340 (= *Cancer carinatus* Brünich 1768:102)]. H. Milne Edwards 1837:408. De Haan 1849:187. Heller 1863:290. Bate 1888:292. A. Milne Edwards and Bouvier 1909:243. Balss 1914:14. Burkenroad 1945:1. Barnard 1950:635. Holthuis 1952:339. Hall 1956:87. Zariquiey Alvarez 1968:57. [Name validated and placed on the Official List of Generic Names in Zoology as Name No. 922 under Plenary Powers of the International

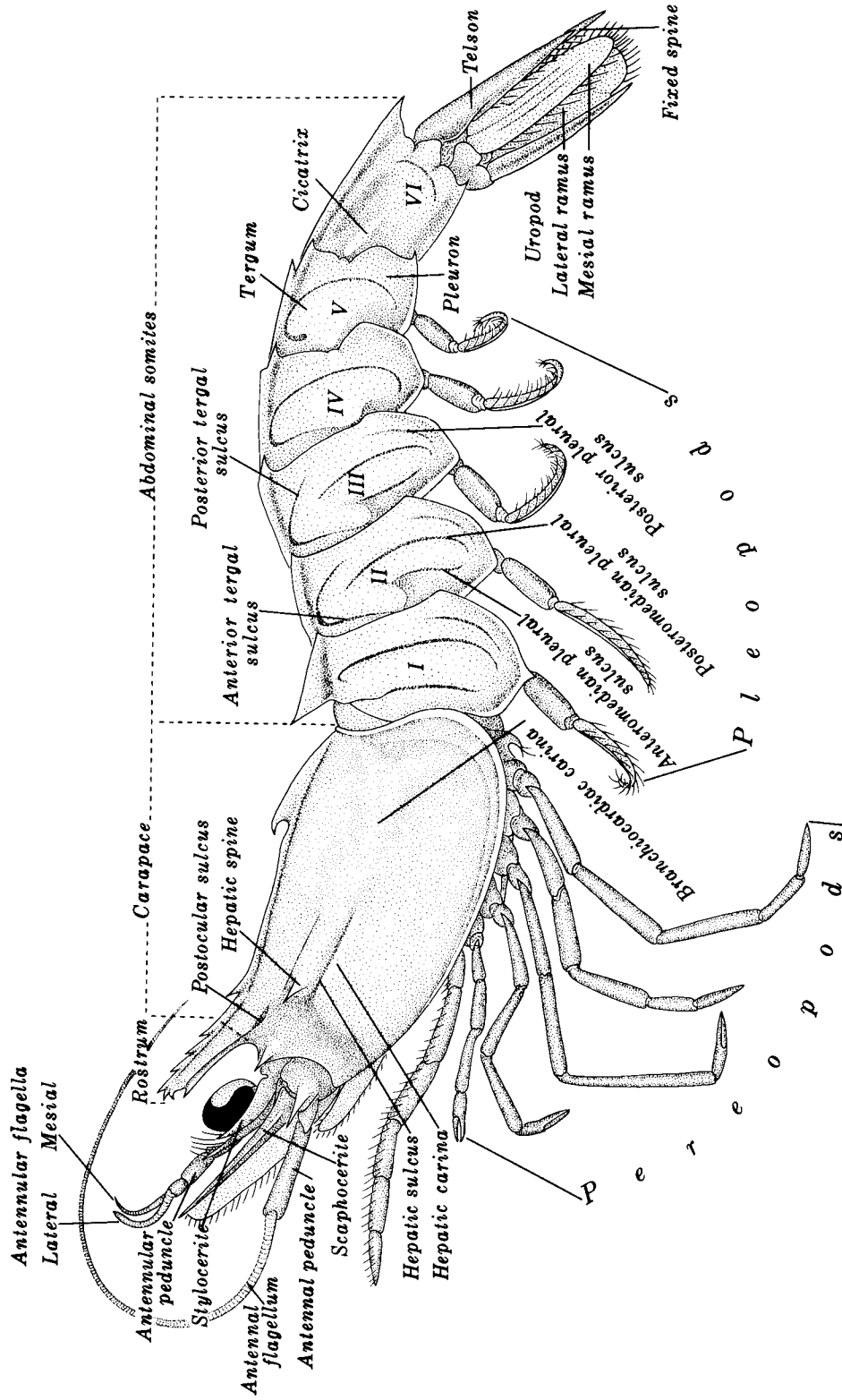
Commission on Zoological Nomenclature, Opinion 382, 1956:45; Hemming 1958:126.] Gender: feminine.

*Ruvulus* de Natale 1850:20 (published as synonym of *Sicyonia* H. Milne Edwards 1830) [type-species, by monotypy for *Sicyonia* H. Milne Edwards: *Sicyonia sculpta* H. Milne Edwards 1830]. Holthuis 1952:339. Hall 1956:87. Gender: masculine.

*Synhimantites* Boeck 1864:189 [type-species, by monotypy: *Synhimantites typicus* Boeck 1864:189]. Burkenroad 1945:1. Holthuis 1952:339. Gender: masculine.

*Eusicyonia* Stebbing 1914:25 (substitute name for *Sicyonia* H. Milne Edwards 1830) [type-species, by monotypy for *Sicyonia* H. Milne Edwards 1830: *Sicyonia sculpta* H. Milne Edwards 1830]. Balss 1925:232. Burkenroad 1934a:70, 1934b:116, 1945:1. Kubo 1949:437. Holthuis 1952:339. Hall 1956:87. Gender: feminine.

*Diagnosis*.—Body with integument rigid, microscopically setose-punctate. Rostrum short, not overreaching distal margin of antennular peduncle, more often falling short of it, and armed with dorsal, and usually apical teeth, lacking ventral ones (Fig. 1). Carapace with postrostral carina bearing epigastric tooth and variable number of teeth more posteriorly; orbital, postorbital, and pterygostomial spines lacking; antennal spine present or absent; hepatic spine well developed; cervical sulcus indistinct; hepatic sulcus usually shallow; hepatic carina weak or indistinct; branchiocardiac carina strong to barely distinct (Fig. 2). Abdomen marked by transverse sulci bordered by closely set setae; dorsomedian carina extending for entire length; carina on first somite usually produced in large anterior tooth, that on second incised or entire, and that on sixth terminating in strong tooth; sixth somite bearing cicatrix. Telson armed with pair of marginal, fixed, subterminal spines. Optic calathus articulated directly to basal article of eyestalk, intermediate article [= Young's (1959) optic stalk] not apparent; ocular stylet projecting from anterolateral margin of ocular plate (Fig. 3). Antennular peduncle about 0.6 cl; proartema (Fig. 4F-p) rudimentary; stylocerite long, produced as sharp spine; antennular flagella short, not exceeding 0.5 cl, mesial flagellum tapering gradually from base, lateral one broad from base to near tip, then tapering rapidly to apex. Mandibular palp (Fig. 4A) three-jointed, proximal article small and short, distal article large, much larger than penultimate one, and roughly



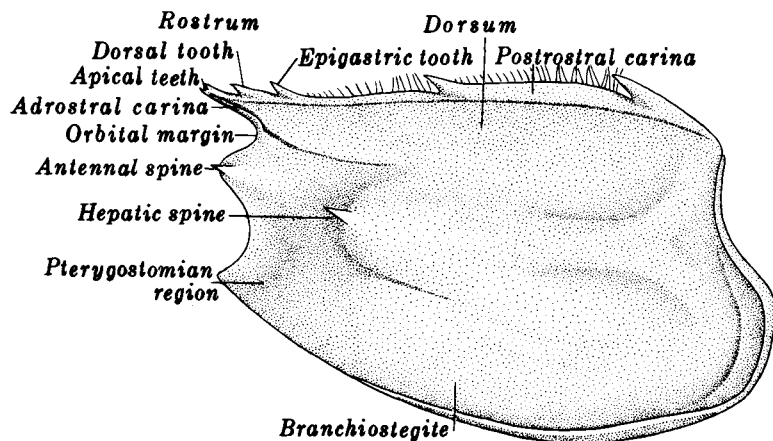


FIGURE 2.—Lateral view of carapace of *Sicyonia* showing terms used in descriptions.

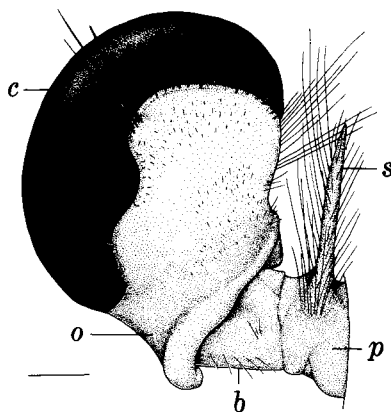


FIGURE 3.—*Sicyonia disedwardsi* Stimpson, ♀ 30 mm cl, Golfo de Panamá, Panamá. Eye, dorsal view: *b*, basal article; *c*, cornea; *o*, optic calathus; *p*, ocular plate; *s*, ocular stylet. Scale = 1 mm.

trapezoidal; first maxilla (Fig. 4B) with broad palp unjointed and not produced distally; second maxilla (Fig. 4C) with basipodite lacking proximal gnathal lobule; first maxilliped with flagellum quite short (Fig. 4D); second maxilliped as illustrated (Fig. 4E). Exopods lacking on second and third maxillipeds and all pereopods. First pereopod unarmed or with mesial spine on basis and ischium. Endopods of pleopods absent except for highly modified ones on first (petasma) and second (bearing appendix masculina) pleopods. Petasma (Fig. 5A) depressed, with dorsolateral

and heavily cornified ventrolateral lobules produced in distal projections, that of former funnel-like, and with ventromesial slit; distal part of dorsomedian lobule bearing short distal plate resembling cusp in ventral aspect. Appendix masculina (Fig. 5B) projecting from free distal part of ridge on dorsomedian margin of endopod, small, roughly bellshaped, but with membranous terminal wall. Male gonopores situated on sternite XIV. Thelycum (Fig. 6) with plate of sternite XIV single, flat or raised in paired, weak or prominent, lateral bulges. Paired seminal receptacles (Fig. 7)

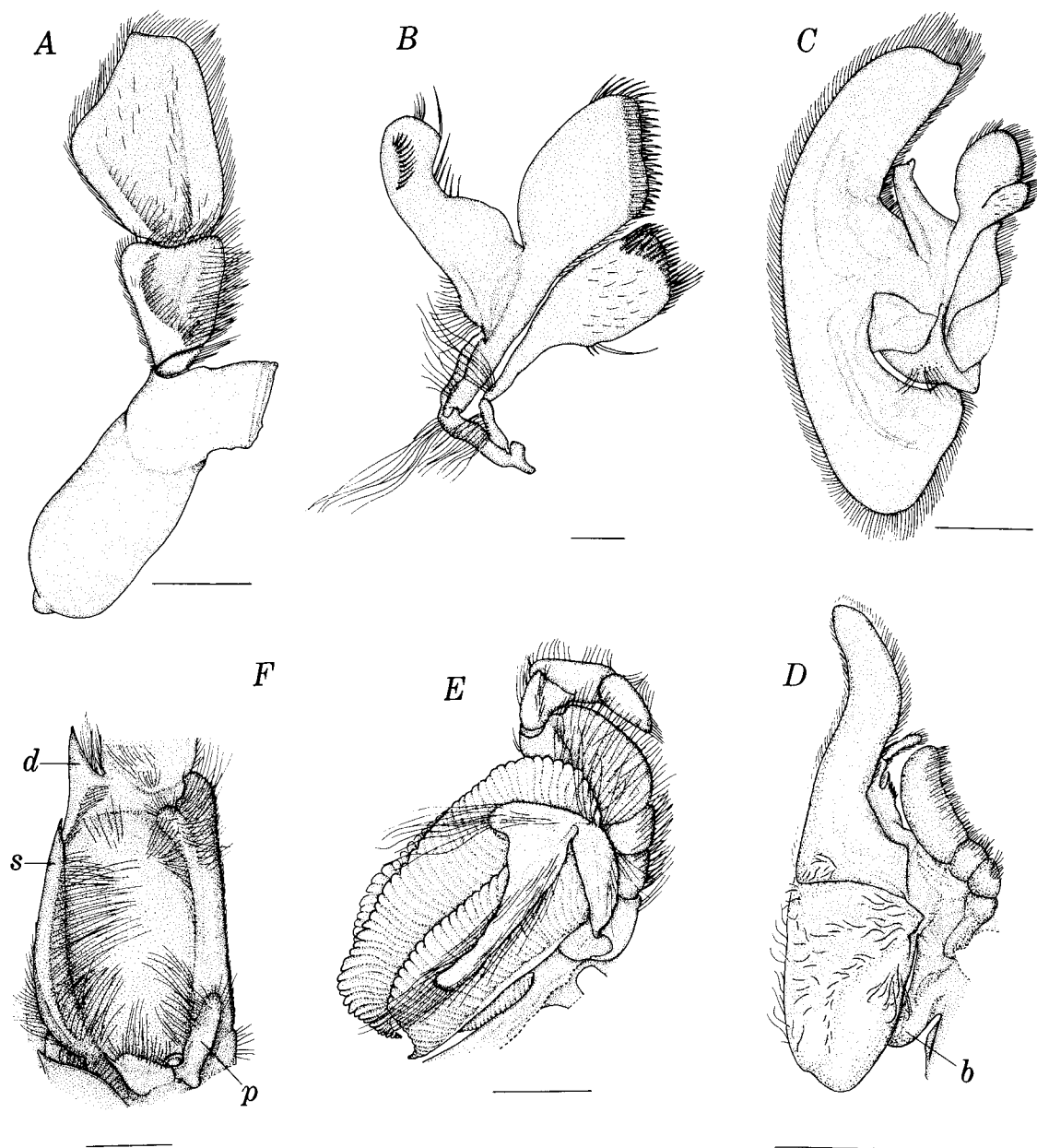


FIGURE 4.—*Sicyonia ingentis* (Burkenroad 1938), ♀ 38 mm cl, off Bahía de San Quintín, Baja California Norte, Mexico. A, Mandible. B, First maxilla. C, Second maxilla. D, First maxilliped—*b*, branchial rudiment (arthrobranchia). E, Second maxilliped. F, First article of antennular peduncle—*d*, distolateral spine; *p*, rudimentary prosartema; *s*, stylocerite. Scales: A, C-E = 3 mm; B = 1 mm; F = 3 mm.

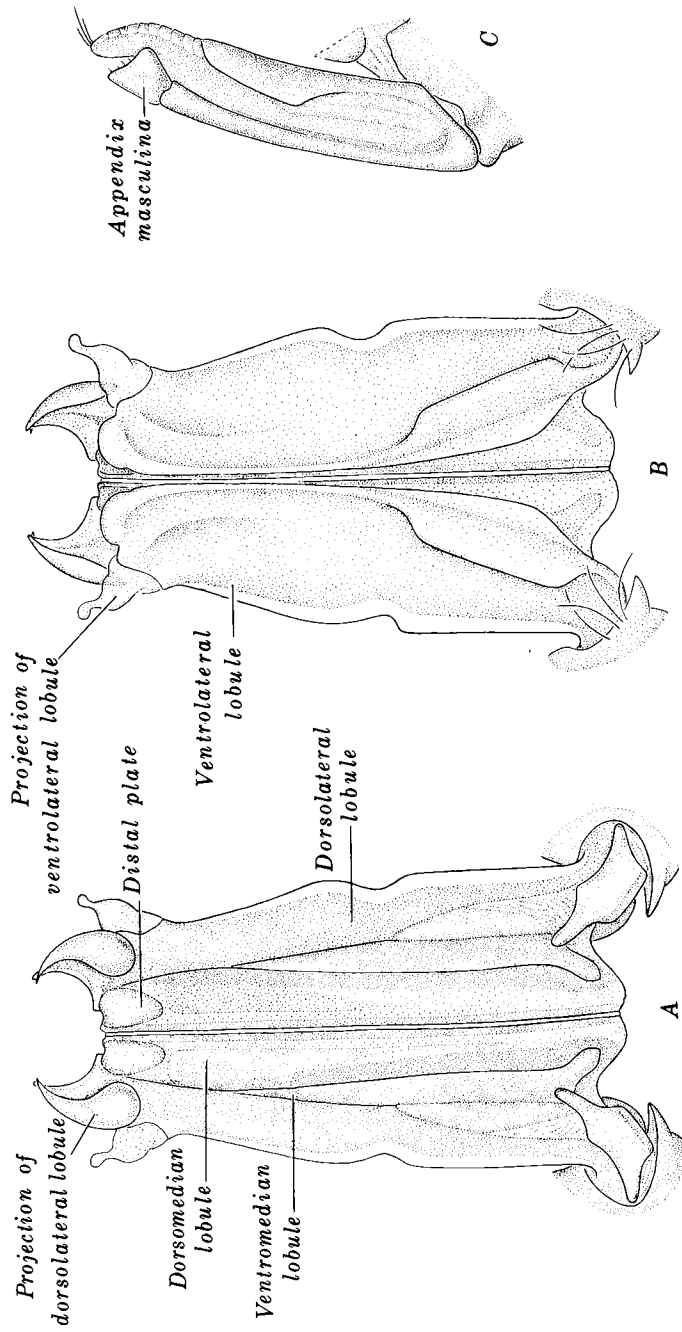


FIGURE 5.—*Sicyonia disparri* (Burkenroad 1934), ♂ 6 mm cl, Canal de San Lorenzo, Baja California Sur, Mexico. A, Dorsal view of petasma showing terms used in descriptions; B, ventral view of same; C, dorsolateral view of appendix masculina on second pleopod.

FIGURE 6.—Thelycum of *Sicyonia* showing terms used in descriptions.

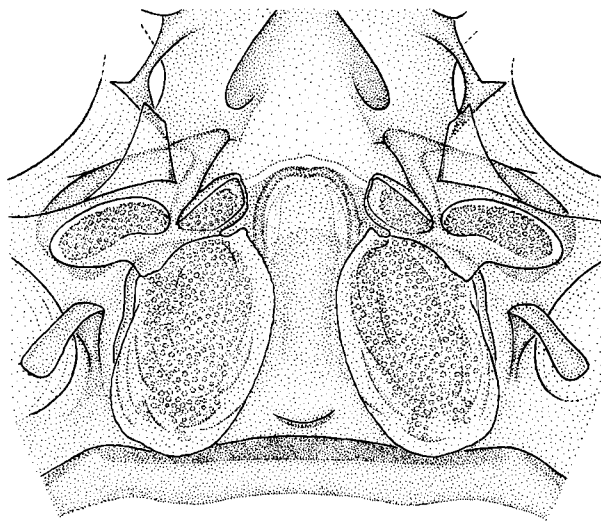
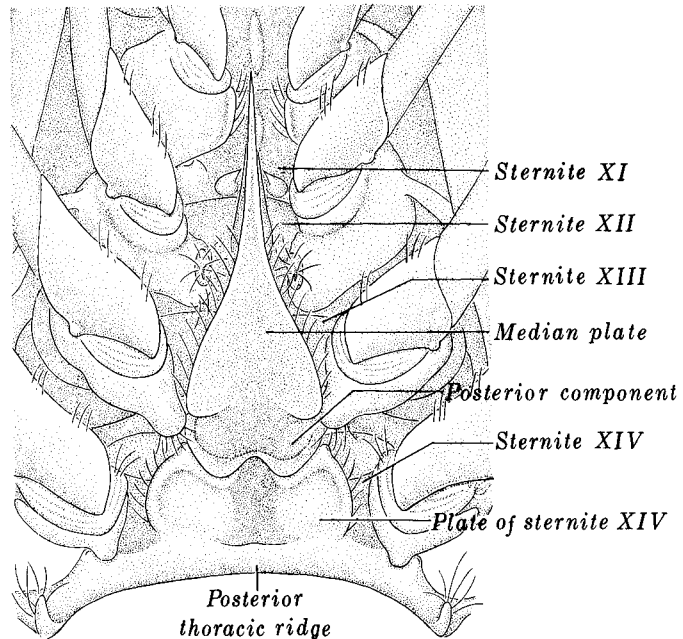


FIGURE 7.—*Sicyonia disedwardsi*, ♀ 30 mm cl, Golfo de Panamá, Panamá. Dorsal view of sperm receptacles. Scale = 1 mm.

consisting of trilobed membranous sacs: large, longitudinally disposed, mesial lobe, extending to posterior margin of sternite XIV, and two small anterior lobes, one directed anteriorly and the other laterally; receptacles opening by transverse slits at anterolateral margins of plate of sternite XIV. Median plate of sternite XIII (supported by buttress of sternite XII) large, triangular or flask-shaped, tapering anteriorly in long, sharp

spine; plate bearing well-defined lateral constrictions setting off posterior component. Sternite XI armed posteriorly with paired spines of variable size. Branchial components consisting of pleurobranchia on somite IX; single arthrobranchia on somite VII (lamellar rudiment; Fig. 4D-b); anterior and posterior arthrobranchiae on somites VIII through XIII, anterior member of VIII very small and that of XIII vestigial; and podobranchia



on second maxilliped. Epipod on first and second maxillipeds and on first through third pereopods. [Modified from Burkenroad (1934a, b) and Kubo (1949).]

The species of this genus (about 55), the only one encompassed in the family Sicyoniidae, occur in tropical, subtropical, and temperate waters. They are marine, some invading brackish waters, and abundant at shallow to moderate depths; a number of them also range across the continental shelf onto the upper slope, reaching depths of several hundred meters.

Members of *Sicyonia* exhibit a wide range of intraspecific variation. The number and position of the dorsal and apical rostral teeth and the arrangement of teeth on the postrostral carina vary as do the depth, extension, and form (continuous or interrupted) of the abdominal sulci. Although the number of the latter almost always provide a reliable diagnostic character for specific identification, the posterior pleural sulcus may be present or absent in some species. Furthermore, in females the contour and sculpture of the thelycal plate of sternite XIV and the shape of the posterior margin of that of XIII also vary as pointed out in the accounts for most of the species. In contrast, the petasma of each of the members of the genus is virtually invariable and thus useful for specific recognition, and the appendix masculina is almost constant in shape in all of the species.

In the females, sternite XI is armed with a pair of spines which vary considerably in length, ranging from quite small, as in all members of *Sicyonia* occurring in the eastern Pacific, to extremely long, as in the western Atlantic *S. olgae* Pérez Farfante 1980. The posterior thoracic ridge varies but within a range that does not prevent its having at least limited diagnostic value.

Species of *Sicyonia* also exhibit various morphological changes with increasing size. The shape of the anteroventral margin of the pleuron of the first abdominal somite may change gradually from straight in juveniles to pronouncedly concave in adults, and the anteroventral extremities of the pleura of the first three or four abdominal somites, from rounded to sharply acute. The pleural armature, too, undergoes modifications with age; as Burkenroad (1934a) stated, "A rounded angle usually precedes an unarmed but acute angle, and this a veritable tooth, in the course of individual development"; likewise, the abdominal sculpture is altered, the sulci usually becoming deeper as the animal grows. The foregoing statements indicate that abdominal features

which are diagnostic for the identification of adults have scant systematic usefulness in identifying juveniles.

Another characteristic of the genus is the wide range in size among the species; whereas some are small (the eastern Pacific *S. disparri* reaches a maximum total length of about 44 mm), others are quite large (*S. ingentis* and *S. brevirostris* attain a total length of about 133 and 153 mm, respectively).

In the genus *Sicyonia* there are two series of species the contrasting characters of which would appear to justify their separation into two genera. The members of one series (occurring on both sides of the Atlantic, in the Mediterranean and Indo-Pacific, and represented in the eastern Pacific by *S. disparri* and *S. laevigata*) lack or occasionally exhibit a very minute antennal spine, are armed with basal and ischial spines on the first pair of pereopods, bear an incision or a notch on the dorso-medial carina of the second abdominal somite, and usually display a conspicuous notch on the lateral margin of the petasma. The members of the other series (restricted to American waters) have a well-developed, buttressed, antennal spine, lack basal and ischial spines on the first pair of pereopods, have no incision on the carina of the second abdominal somite, and never bear a notch on the lateral margin of the petasma. These two series, representing extremes of the range of variation in members of the genus, were first recognized by Burkenroad (1934a) as Division I and Division II, respectively. Both in 1934a and 1945, he stated that there are species or series of species in which some of these characters are interchanged. Certain species (all from the Indo-Pacific) that lack an antennal spine and in which the first pair of pereopods are armed exhibit an entire carina on the second abdominal somite (the first two are characters of Division I, and the last of Division II). At least one species (also occurring in the Indo-Pacific) lacks an antennal spine and has armed first pereopods (both characters of Division I) but bears an unnotched carina (a feature of Division II). Another species (the eastern Pacific *S. mixta*) that possesses an antennal spine and has armed first pereopods exhibits a clearly distinct depression on the carina of the second abdominal somite which seems to correspond to the notch characteristic of Division I.

Burkenroad (1934a) also divided his Division II into species-groups, each named for one of the species belonging to it. They were characterized by the number, size, and position of the teeth on the

postrostral carina. The complex intergradation of the characters that have been used to recognize these "Divisions" and "groups" of *Sicyonia* seems to demonstrate that there are no superspecific disjunctions that will justify their being accorded subgeneric or generic rank. In the present work, occasionally, reference is made to these subdivisions.

Key to the American Pacific species of  
*Sicyonia*

- 1a. First abdominal somite lacking tooth on dorsomedian carina ..... *S. mixta*
- 1b. First abdominal somite bearing anterior tooth on dorsomedian carina ..... 2
- 2a. Antennal spine absent or exceedingly weak and without buttress; second abdominal somite with perpendicular incision in anterior half of dorsal carina; first pereopod with short distomesial spine on basis and ischium ..... 3
- 2b. Antennal spine well developed and buttressed; second abdominal somite not incised; first pereopod with basis and ischium unarmed ..... 4
- 3a. Postrostral carina armed with 3 subequal teeth, anterior (epigastric) one as large, or almost as large, as posterior 2 teeth; anteromedian sulcus of first abdominal somite well marked to near ventral margin of pleuron; posteroventral extremity of fourth abdominal somite distinctly angular ..... *S. disparri*
- 3b. Postrostral carina armed with 3 unequal teeth, anterior one conspicuously smaller than posterior 2 teeth; anteromedian sulcus of first abdominal somite short, often obscure, ending well above ventral margin of pleuron; posteroventral extremity of fourth abdominal somite never distinctly angular ..... *S. laevigata*
- 4a. Postrostral carina with 2 or 3 teeth posterior to level of hepatic spine ..... 5
- 4b. Postrostral carina with 1 tooth posterior to level of hepatic spine ..... 7
- 5a. Postrostral carina almost always with 3 teeth posterior to level of hepatic spine, occasionally anterior one of these at level of or slightly anterior to hepatic spine ..... *S. brevirostris*
- 5b. Postrostral carina with 2 teeth posterior to level of hepatic spine, never with tooth at level or slightly anterior to hepatic spine ..... 6
- 6a. Rostrum bearing 2 dorsal teeth; petasma with distal projections short and stout; thelycum with plate of sternite XIV raised in low (sometimes indistinct) bulges and with posterior component of median plate traversed by weak suture; branchiostegite with large ocellus consisting of well-defined yellow center surrounded by purplish brown ring ..... *S. disedwardsi*
- 6b. Rostrum usually bearing 1 dorsal tooth (rarely 2); petasma with distal projections extremely long and slender; thelycum with plate of sternite XIV raised in strong bulges and with posterior component of median plate traversed by deep groove; branchiostegite with moderately large, purplish brown spot sometimes bearing poorly defined but diffuse yellow center ..... *S. penicillata*
- 7a. Postrostral carina behind posterior tooth high, conspicuously elevated in arched crest ..... 8
- 7b. Postrostral carina behind posterior tooth low, not elevated in high crest ..... 11
- 8a. Fifth abdominal somite without tooth or sharp angle at posterior end of dorsomedian carina; anteroventral extremity of pleuron of fourth abdominal somite broadly obtuse and unarmed ..... *S. affinis*
- 8b. Fifth abdominal somite with tooth or sharp angle at posterior end of dorsomedian carina; anteroventral extremity of pleuron of fourth abdominal somite sharply angular or armed with spine ..... 9
- 9a. Rostrum long, conspicuously surpassing distal margin of eye; anteroventral angle of second through fourth abdominal somites unarmed, lacking spine; petasma with projection of dorsolateral lobule distinctly bifurcate apically ..... *S. martini*
- 9b. Rostrum short, falling short of, or infrequently barely surpassing distal margin of eye; anteroventral angle of second

through fourth abdominal somites armed with curved spine; petasma with projections of dorsolateral lobule simple . . . . . 10

- 10a. Rostrum armed with 2 dorsal teeth; abdomen heavily tuberculate; anteromedian pleural sulcus of first abdominal somite well marked to near ventral margin of pleuron; anteromedian pleural sulcus of second and third somites reaching dorsally posteromedian pleural sulcus; branchiostegite with horizontally disposed 9-shaped, brown mark . . . . . *S. aliaffinis*
- 10b. Rostrum armed with 3 or 4 dorsal teeth; abdomen with very few tubercles; anteromedian pleural sulcus of first abdominal somite well marked only dorsally; anteromedian pleural sulcus of second and third somites not reaching dorsally posteromedian pleural sulcus; branchiostegite with ocellate mark, consisting of red center surrounded by yellow ring . . . . . *S. picta*
- 11a. Dorsomedian carina of first abdominal somite produced in tooth considerably larger than posterior tooth on carapace, that of fifth truncate or produced in spine at posterior end; petasma with distal projections of dorsolateral lobules turned mesially and lacking terminal filament; thelycum with posterior component of median plate flat or slightly raised posterolaterally, not bearing short bosses cut by transverse suture . . . . . *S. disdorsalis*
- 11b. Dorsomedian carina on first abdominal somite produced in tooth smaller or only slightly larger than posterior tooth on carapace, that of fifth sloping gradually to posterior end; petasma with distal projections of dorsolateral lobules divergent and produced in short filament; thelycum with posterior component of median plate bearing paired short lateral bosses cut by transverse suture . . . . . *S. ingentis*

*Sicyonia laevigata* Stimpson 1871  
 Figures 8-12

*Sicyonia laevigata* Stimpson 1871: 131 [type not extant; type-locality: Charleston, S.C.]. Kingsley 1878:69, 1880:426. Rathbun 1901: 103 [part]. De Man 1911:11. Bouvier 1918:6.

Hay and Shore 1918:379, pl. 25, fig. 1. Rathbun 1920:319. Burkenroad 1945:5. Lunz 1945:4, fig. 1. Pearse and Williams 1951: 143. Wass 1955:142. Menzel 1956:41. Hutton et al. 1959:6. Wells 1961:248. Williams 1965:33. Fausto Filho 1966a:32, 1966b:47, fig. 8. Eldred et al. 1965:32. Joyce and Eldred 1966:24. Fausto Filho 1968:73. Rouse 1969:136. Bayer et al. 1970:41. Lyons et al. 1971:28. García Pinto 1971:5. Chace 1972:11. Camp et al. 1977:23. Rodriguez de la Cruz 1977:11. Huff and Cobb 1979:67, fig. 38a-d. Rodriguez 1980:70. Pérez Farfante 1980:773. Greening and Livingston 1982:151. Coen and Heck 1983:206. Williams 1984:47.

*Sicyonia sculpta* var. *americana* De Man 1907:450.  
*Sicyonia carinata* De Man 1907:451. [Not *Cancer carinatus* Brünnich 1768 = *Sicyonia carinata*.]  
*Sicyonia carinata* var. *americana* De Man 1911:10.  
*Eusicyonia laevigata*. Burkenroad 1934a:76, fig. 21, 26, 32, 1934b:117. Schmitt 1935:132. Burkenroad 1938:80. Lunz 1945:4, fig. 1.  
*Sicyonia carinata americana*. Burkenroad 1934a:76.

Vernacular names: rock shrimp, hardback, coral shrimp (United States); camarón de piedra, cacahuete (Mexico); camarón conchiduro (Mexico, Panama); camarão-da-pedra (Brazil).

*Diagnosis*.—Antennal spine absent or barely distinct and lacking buttress. Second abdominal somite with perpendicular incision on dorsomedian carina. First pereopod armed with short spine on basis and ischium. Postrostral carina bearing three unequal teeth, epigastric one considerably smaller than posterior two teeth. Anteromedian sulcus of first abdominal somite, if distinct, short, ending well above margin of pleuron; posteroventral extremity of fourth abdominal somite not distinctly angular. Petasma with distal projection of dorsolateral lobule almost straight but with apical part curved dorsally. Thelycum with plate of sternite XIV produced in elongate anterolateral lobules, their anteromesial borders strongly divergent.

*Description*.—Body moderately robust (Fig. 8) and lacking tubercles. Carapace with patches of short setae on dorsum, as well as ventral and anterior to posterodorsal part of branchiocardiac carina; extremely long setae flanking base of, and between, teeth of postrostral carina.

Rostrum long, reaching as far as distal end of

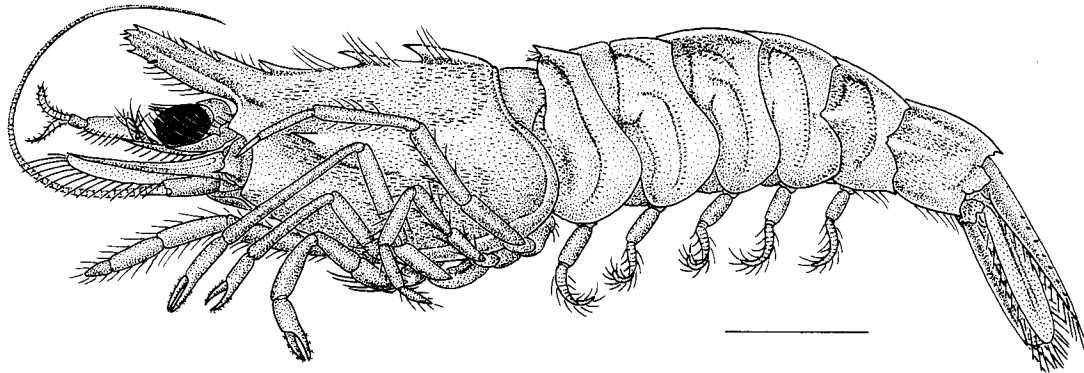


FIGURE 8.—*Sicyonia laevigata*, ♀ 9 mm cl, Punta Paitilla, Panama. Lateral view. Scale = 5 mm.

antennular peduncle, its length (0.40-0.77 cl) increasing linearly with carapace length (Fig. 9); relatively deep, usually with dorsal and ventral margins straight and subparallel; subhorizontal or upturned to as much as 35°; armed with two (25%), three (72%), or four (3%) dorsal teeth and two (5%), three (33%), or four (62%) apical teeth, additional rudimentary one present between two ventral ones; ventralmost tooth, largest of apical cluster, subterminal, directed anteriorly or curved upward, and distinctly removed from adjacent one. Position of first dorsal tooth ranging between 0.09 and 0.30 (mean 0.18) rl from level of orbital margin, and that of second tooth between 0.42 and 0.60 (mean 0.45) rl; third tooth, when present, between 0.76 rl and tip of rostrum (mean 0.87); and fourth, rarely present, located at tip. Two, occasionally one or three, minute but rather heavy movable spinules (often absent in adults) flanking ventral margin of rostrum, just posterior to apical teeth. Adrostral carina, subparallel to ventral margin of rostrum, extending to base of apical cluster.

Carapace with postrostral carina, barely distinct between teeth, bearing three unequal, acutely produced teeth: 1) epigastric tooth, situated between 0.06 and 0.16 (mean 0.12) cl from orbital margin, subequal to or only slightly larger than first rostral and conspicuously smaller than more posterior teeth; 2) middle tooth, placed between 0.35 and 0.50 (mean 0.45) cl from orbital margin; and 3) posterior tooth positioned between 0.68 and 0.80 (mean 0.72) cl from orbital margin, well in advance of posterior margin of carapace. Antennular spine absent or barely perceptible, antennal angle 90° to broadly obtuse, lacking buttress; hepatic spine long, sharply pointed, projecting from low buttress, and situated

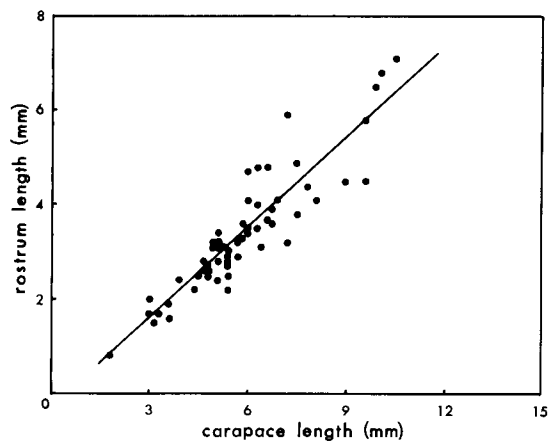


FIGURE 9.—*Sicyonia laevigata*. Relationship between rostrum length and carapace length (regression equation,  $y = -0.39153 + 0.64127x$ ).

between 0.22 and 0.30 (mean 0.25) cl posterior to orbital margin. Postocular sulcus short; hepatic sulcus shallow, subhorizontal; hepatic carina lacking; branchiocardiac carina barely evident.

Ocular calathus broad and bearing conspicuous tuft of setae on dorsolateral extremity; ratio of length of lateral margin to width (across base of cornea) 0.54-0.65 (mean 0.60) and ratio length of lateral margin to cl 0.11-0.15 (mean 0.13).

Antennular peduncle with stylocerite produced in acute spine reaching 0.65-0.75 of distance between lateral base of first antennular article and mesial base of distolateral spine; latter extending only to about proximal 0.40 of second antennular article. Antennular flagella short, mesial one, about 0.7 as long as lateral; latter, about 0.4 cl.

Scaphocerite almost reaching or slightly sur-

passing distal end of third antennular article; lateral rib produced in long, slender spine slightly overreaching lamella. Antennal flagellum as much as 3 times as long as carapace.

Third maxilliped much stouter than pereopods. Basis and ischium of first pereopod armed with short but well-developed sharp spine projecting from distomesial margin.

Abdomen with dorsomedian carina low anteriorly, increasing in height posteriorly; carina on first somite produced in rather small, anteriorly directed tooth, smaller than posterior tooth on carapace; carina on second somite conspicuously incised (just dorsal to juncture of tergal sulci) and that on sixth terminating in short, sharp tooth.

Anteroventral extremity of pleuron of first three somites rounded; pleuron of fourth with posteroventral extremity angular or subangular, always unarmed; posteroventral extremity of fifth and sixth somites produced in very small, caudally directed, sharp tooth.

First somite with short anteromedian pleural sulcus (usually well marked but sometimes obscure dorsally, obsolete, or represented by shallow depression ventrally) and long, united posterior tergal-posteromedian pleural sulci. Second and third somites marked by 1) long anterior ter-

gal (extending to base of pleuron) and short posterior tergal sulci; 2) anteromedian pleural sulcus, extending to near ventral margin on second somite but restricted to dorsal part on third, in both somites delimiting anterior shallow depression setting off weak prominence dorsally; and 3) posteromedian pleural sulcus, its dorsal extremity curving anteriorly ventral to (not joining) posterior tergal sulcus. Fourth and fifth somites with anterior tergal sulcus (that of fourth obliterated about midlength), merging with united posterior tergal-posteromedian pleural sulci. Sixth somite marked by weak, arched posteromedian pleural sulcus and bearing shallow longitudinal depression between low dorsolateral ridge and elongate cicatrix.

Telson with pair of short but strong fixed spines and two longitudinal rows of movable spinules on each side of median sulcus. Rami of uropod reaching or barely overreaching apex of telson.

Petasma (Fig. 10A, B) with rigid distal projection of dorsolateral lobule bulbous proximally, almost straight but with terminal part strongly curved dorsally; fleshy distal projection of ventrolateral lobule directed distolaterally, broad basally, and with slender but blunt terminal part curved proximally. Lateral margin of petasma

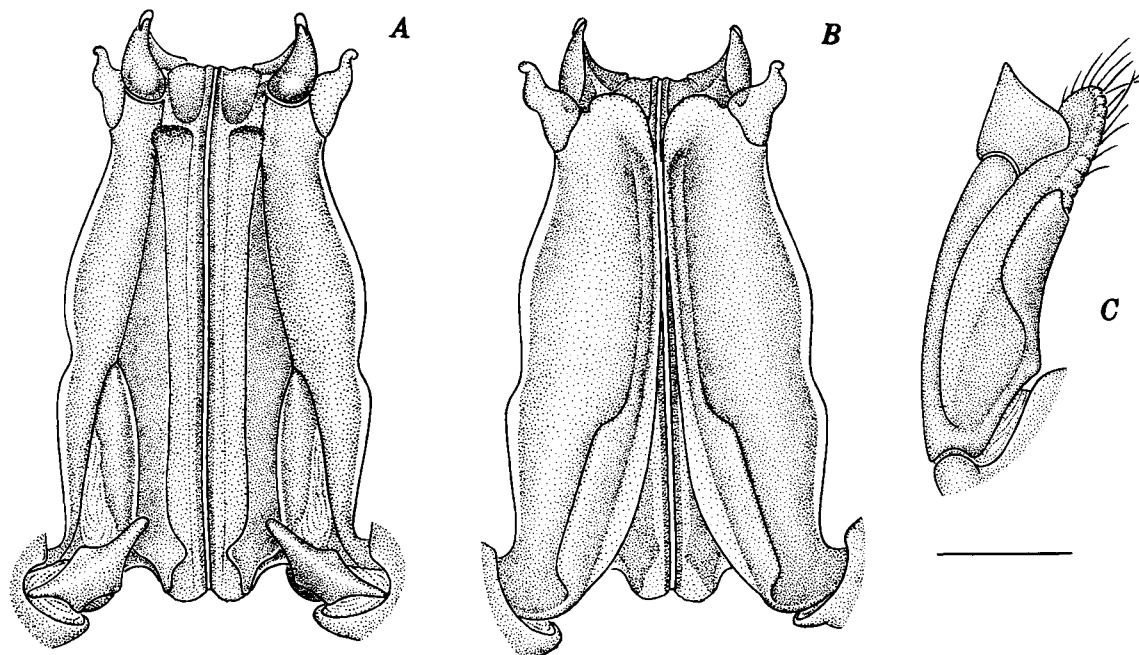


FIGURE 10.—*Sicyonia laevigata*, ♂ 5.7 mm cl, Isla Taboga, Panama. A, Petasma, dorsal view; B, ventral view; C, right appendix masculina, dorsolateral view. Scale = 0.5 mm.

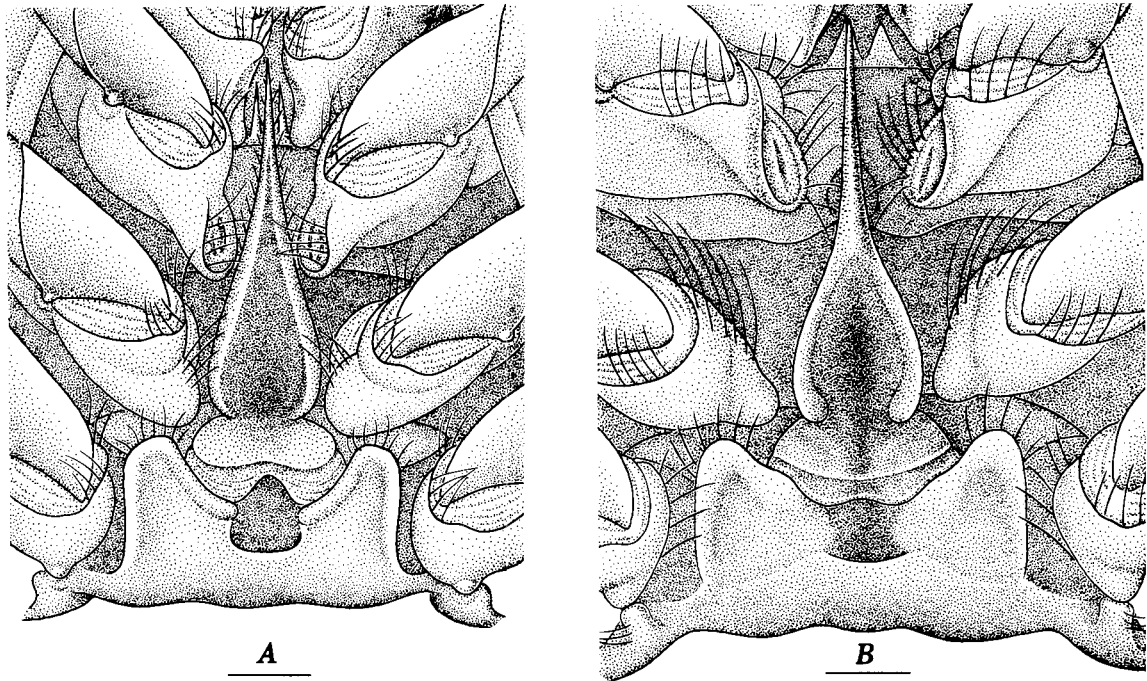


FIGURE 11.—*Sicyonia laevigata*. Thelyca. A, ♀ 7 mm cl, Isla San Lucas, Costa Rica; B, ♀ 9 mm cl, Punta Paitilla, Panama. Scales = 0.5 mm.

slightly to conspicuously notched near midlength.

Petasmal endopods coupled in males with carapace length as little as 2.9 mm, about 13 mm tl, petasma joined in all larger males.

Appendix masculina as illustrated in Figure 10C.

Thelycum (Fig. 11A, B) with plate of sternite XIV produced in elongate, subulate anterolateral lobules, their anteromesial borders strongly divergent; plate flat except for deep, broad, antero-median depression, limited posteriorly by raised margin of posterior thoracic ridge. Median plate of sternite XIII narrow, lanceolate, tapering gently into sharp spine reaching as far as midlength of coxae of extended second pereopods; plate constricted and excavate at level of fourth pereopods; posterior component of plate with posterior margin entire to deeply emarginate and traversed by weak suture. Paired conspicuous spines projecting anteroventrally from posterior margin of sternite XI. Posterior thoracic ridge insensibly fused laterally with plate of sternite XIV.

The smallest impregnated female observed has a carapace length of 5 mm, about 18 mm tl.

*Color*.—Huff and Cobb (1979) presented a detailed

account of the color pattern of this species based on specimens collected on Florida's west central shelf.

*Maximum size*.—Males 7.3 mm cl, about 34 mm tl; females 15 mm cl, about 53 mm tl.

*Geographic and bathymetric ranges*.—In the American Pacific, *S. laevigata* is known from Mazatlán (lat. 23°13'N, long. 106°25'W), Mexico (Rodríguez de la Cruz 1977); Isla San Lucas (9°56'N, 84°54'W), Golfo de Nicoya, Costa Rica; and the Golfo de Panamá, in the latter as far as Punta Paitilla (8°58'N, 79°31'W), Panama. In the western Atlantic this species ranges from off Cape Hatteras (35°08'30"N, 75°10'00"W), N.C., southward and into the Gulf of Mexico to northwest Florida, and off Yucatán. Also, it occurs through the Antilles and around the Caribbean coast of Mexico, Central America, and South America, and along the Atlantic coast of South America to Anse de Zimbros (27°13'S, 48°31'W), Santa Catarina, Brazil (Fig. 12).

In the Pacific, this shrimp has been taken from tide pools to a depth of 4-9 m, but in the Atlantic it occurs from the shore to as deep as 90 m. It occurs

on corals or other firm, rocky or shelly substrates, but occasionally, as reported by Wass (1955), on soft mud.

On the basis of their samplings and the observations made by Lyons et al. (1971), Huff and Cobb (1979) concluded that *S. laevigata* "shows some preference for grass habitats in estuarine and nearshore environments, associating with coarse substrates further offshore where seagrasses are absent."

This species has been found at salinities between 22 and 37‰ (Lyons et al. 1971 and Menzel 1956, respectively) and temperatures between 17° and 32°C (Lyons et al. 1971 and Camp et al. 1977, respectively).

*Discussion.*—*Sicyonia laevigata* is most similar to the Pacific *S. disparri* and the western Atlantic *S. parri*, but it may be readily distinguished from them by the following features. The epigastric tooth in *S. laevigata* is smaller than, instead of almost as large as, the other teeth on the postrostral carina. Also in *S. laevigata* this tooth is always situated anterior to the hepatic spine, between 0.06 and 0.16 (mean 0.12) cl from the orbital margin, whereas in *S. disparri* it is often located opposite or posterior to the hepatic spine but, if

anterior, usually farther from the orbital margin, between 0.12 and 0.25 (mean 0.17) cl. The anteromedian pleural sulcus of the first abdominal somite in *S. laevigata* is short, commonly well defined (sometimes obscure) dorsally, but obsolete, or represented by a shallow depression ventrally; in contrast, in *S. disparri* and *S. parri* it is long, extending to near the ventral margin of the pleuron, although sometimes it is interrupted dorsal to midlength. In *S. laevigata* the posterior pleural sulci are lacking, as they usually are in *S. disparri*, whereas in *S. parri* they are present. Furthermore, in the petasma of *S. laevigata* the distal projection of the dorsolateral lobule is directed distally, its tip curved dorsally, whereas in *S. disparri* and *S. parri* it is strongly curved mesially—but in the latter the tip is bent slightly dorsally. It should be pointed out that *S. parri*, like the other two species, lacks an antennal spine, possesses a spine on the basis and ischium of the first pereopod, and bears a dorsal incision on the dorsomedian carina of the second abdominal somite.

*Remarks.*—In 1980, I stated that the dorsal margin of the rostrum of *S. laevigata* is armed with three teeth, an opinion that was contrary to that of

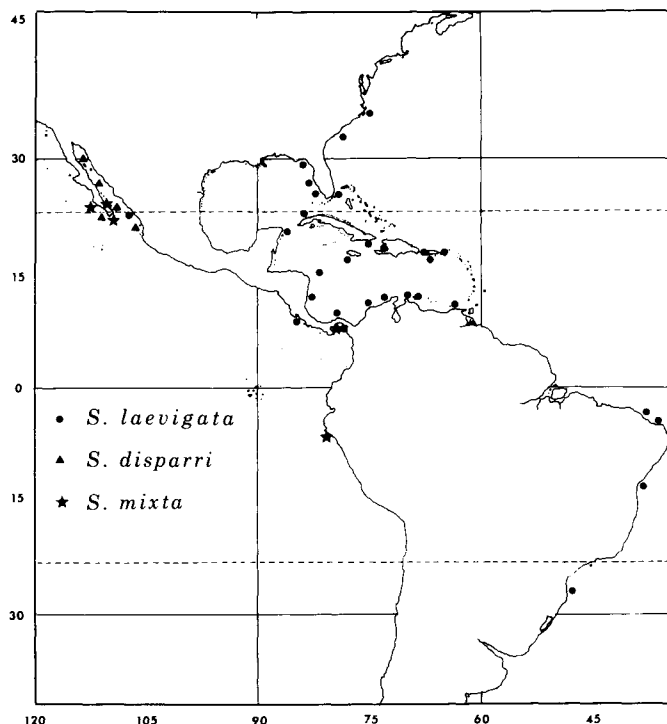


FIGURE 12.—Geographic distribution of *Sicyonia laevigata*, *S. disparri*, and *S. mixta*.

previous authors who noted that it bears only two; I was convinced at the time that they considered the variably situated third tooth, when located subterminally, an apical instead of a dorsal tooth. The study of the extensive collection available to me for the present project has indicated that this species sometimes (25% of the specimens) bears only two teeth, and occasionally four (3% of the individuals).

It should be mentioned that the holotype of this species was lost during the Chicago fire of 1871.

*Material*.—73 specimens from 41 lots.

Eastern Pacific—12 specimens from 6 lots.

Costa Rica—1♀, USNM, Isla San Lucas, 5 January 1930, M. Valerio.

Panama—1♂ 1♀, AHF, Isla Taboga, 4-9 m, 2 May 1939. 3♀, SIO, Isla Taboga, 3 m, 30 March 1967, R. Rosenblatt. 1♀, USNM, Punta Paitilla, intertidal, 1 July 1969, L. G. Abele and J. Graham. 1♀, USNM, Punta Paitilla, intertidal, 17 June 1969, J. Graham. 4♀, USNM, Punta Paitilla, 8 m, 13 April 1972, C. E. Dawson and party.

Western Atlantic—61 specimens from 34 lots.

United States—North Carolina: 1♀, USNM, off Cape Hatteras, 90 m, 17 October 1885, *Albatross* stn 2596. 2♀, USNM, off Morehead City, 14 July 1913, *Fish Hawk*. 3♀, USNM, Boque Sound (off Morehead City), August 1912, *Fish Hawk*. 1♀, USNM, Black Rocks (off New River), 13 m, 8 August 1949, A. S. Pearse. South Carolina: 1♀, USNM, mouth of Bulls Creek, 1891, *Fish Hawk*. 1♂, USNM, Charleston Harbor, 14.5 m, 13 March 1891, *Fish Hawk* stn 1659. 1♀, USNM, off S end of May River, Calibogue Sound, 18 m, 16 January 1891, *Fish Hawk* stn 1651. Florida: 1♀, USNM, Biscayne Bay, 7 July 1960, B. Petskin. 1♀, MCZ, off Key West, J. R. Miller. 1♂ 4♀, USNM, Marco, 2-5.5 m, H. Hemphill. 1♂, USNM, Punta Rassa, 2 m, February 1884, H. Hemphill. 1♀, USNM, Charlotte Harbor, March 1887, W. H. Dall. 2♂ 2♀, USNM, Sarasota Bay, H. Hemphill. 1♂, USNM, St Martin, 5.5 m, 15 January 1902, *Fish Hawk* stn 7222. 1♂ 3♀, USNM, off St Martin's Reef, 5 m, G. F. Moser. 2♂, USNM, off NW end St Martin's Reef, 1887, G. F. Moser. 1♀, USNM, Aucilla, 9 m, 6 November 1901, *Fish Hawk* stn 7148.

Cuba—1♂ 1♀, USNM, off Cayo Levisa, 4-5.5 m, 2 June 1914, *Tomás Barrera* Exped stn 14.

Jamaica—1♂, USNM, SE of Great Pedro Bluff, 27-29 m, 6 July 1970, *Pillsbury* stn 1223.

Haiti—1♀, AMNH, Port-au-Prince, W. Beebe.

Puerto Rico—2♀, USNM, Mayagüez, 23 m, 20 January 1899, *Fish Hawk* stn 6093. 1♂ 3♀, USNM, Mayagüez Harbor, 19-20 January 1899, *Fish Hawk*. 2♀, USNM, off Humacao, 23 m, *Fish Hawk*. 2♂ 2♀, USNM, off Isla Culebra, 27 m, 8 February 1899, *Fish Hawk* stn 6093.

Virgin Islands—St. Thomas: 1♀, USNM, 1884, *Albatross*.

Mexico—Quintana Roo: 1♂, USNM, off Isla Mujeres, 29.5 m, 11 June 1962, *Oregon* stn 3638. 1♂, USNM, SE of Isla Mujeres, 101-275 m, 9 September 1967, *Gerda* stn 880. 1♀, USNM, Bahía de la Ascensión, 17 April 1960, Smithsonian-Bredin Caribbean Exped stn 85-60.

Nicaragua—2♀, USNM, off NE Nicaragua, 55 m, 8 June 1964, *Oregon* stn 4930. 2♀, USNM, off Prinzapolca, 27 m, 28 January 1971, *Pillsbury* stn 1335. 1♀, USNM, E of Isla del Venado, 24 m, 28 January 1971, *Pillsbury* stn 1330. 1♂ 1♀, USNM, SE of Punta de Perlas, 27 m, 28 January 1981, *Pillsbury* stn 1334.

Colombia—1♀, USNM, Sabanilla, 1884, *Albatross*. 1♀, USNM, off Tucuracas, 9 m, 30 July 1968, *Pillsbury* stn 778.

Brazil—Santa Catarina: 1♀, MP, Anse de Zimbros, 5-0 m, 16 December 1961, *Calypso* stn 148.

### *Sicyonia disparri* (Burkenroad 1934)

Figures 5, 12-17

*Eusicyonia disparri* Burkenroad 1934a:83, fig. 27 [holotype: ♀, YPM 4392, Bahía San Luis Gonzaga, Baja California Norte, Mexico, 17 May 1926, *Pawnee*]. Burkenroad 1938:80. Anderson and Lindner 1945:315.

*Sicyonia disparri*. Brusca 1980:256.

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

*Diagnosis*.—Antennal spine absent. Second abdominal somite with perpendicular incision on dorsomedian carina. First pereopod armed with short spine on basis and ischium. Postrostral carina bearing three subequal teeth, epigastric one as large, or almost as large, as posterior two teeth. Anteromedian sulcus of first abdominal somite clearly distinct to near ventral margin of pleuron; posteroventral extremity of fourth abdominal somite markedly angular. Petasma with distal projection of dorsolateral lobule curved me-



sially to apex. Thelycum with plate of sternite XIV produced in elongate anterolateral lobules, their anteromesial borders strongly divergent.

*Description.*—Body moderately robust (Fig. 13) and lacking tubercles. Carapace with short setae scattered over surface and extremely long ones between and flanking base of teeth on postrostral carina.

larger adults) flanking ventral margin of rostrum posterior to apical teeth. Adrostral carina, subparallel and distinctly dorsal to ventral margin, extending almost to base of apical cluster.

Carapace with weak postrostral carina bearing three subequal, acutely produced teeth: 1) epigastric tooth, often larger than first rostral and nearly as large as posterior teeth, situated between 0.12 and 0.25 (mean 0.17) cl from orbital

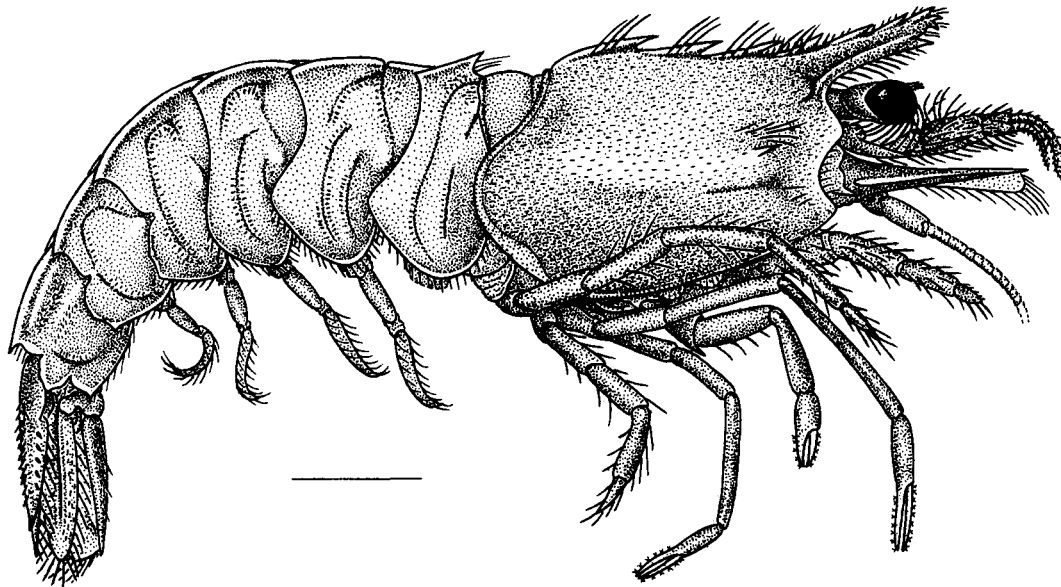


FIGURE 13.—*Sicyonia disparri*, holotype ♀ 10.4 mm cl, Bahia San Luis Gonzaga, Baja California Norte, Mexico. Lateral view. Scale = 5 mm.

Rostrum long, reaching as far as distal margin of second antennular article, its length (0.40-0.70 cl) increasing linearly with carapace length (Fig. 14); relatively deep, with dorsal and ventral margins subparallel; upturned to angle between 15° and 45°; armed with three dorsal teeth and two (7%), three (34%), four (57%), or five (2%) apical teeth, additional rudimentary one present between two ventral ones; ventralmost tooth largest of apical cluster, subterminal, directed anteriorly or curved upward, and distinctly removed from adjacent tooth. Position of first dorsal tooth ranging from slightly posterior to level of orbital margin, to as much as 0.30 (mean 0.18) rl anterior to it; that of second tooth between 0.40 and 0.65 (mean 0.50) rl from orbital margin, and that of third between 0.65 and 0.90 (mean 0.75) rl. Paired minute, movable spinules (sometimes absent in

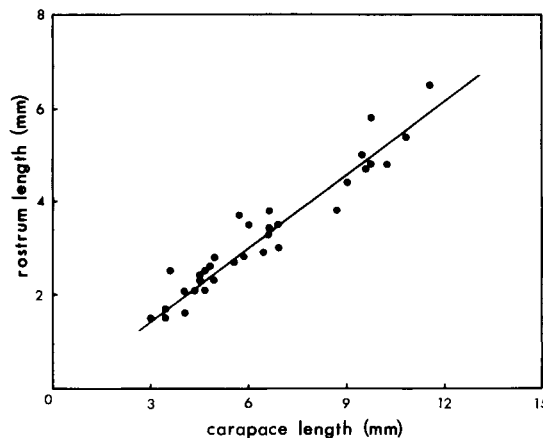


FIGURE 14.—*Sicyonia disparri*. Relationship between rostrum length and carapace length (regression equation,  $y = -0.03809 + 0.51152x$ ).

margin, i.e., anterior, opposite, or posterior to hepatic spine; 2) middle tooth, largest of three, placed between 0.34 and 0.48 (mean 0.42) cl from orbital margin; and 3) posterior tooth, positioned well in advance of posterior margin of carapace, between 0.64 and 0.73 (mean 0.70) cl from orbital margin. Antennal spine absent, antennal angle broadly obtuse or rounded; hepatic spine long, sharply pointed, projecting from low buttress, and positioned between 0.20 and 0.30 (mean 0.25) cl posterior to orbital margin. Postocular sulcus short; hepatic sulcus shallow, subhorizontal; hepatic carina lacking; branchiocardiac carina at most barely evident.

Eye (Fig. 15A) with ocular calathus broad and bearing conspicuous tuft of setae on dorsolateral extremity; ratio of length of lateral margin to width (across base of cornea) 0.50-0.60 (mean 0.54) and ratio length of lateral margin to carapace length 0.08-0.13 (mean 0.11).

Antennular peduncle with stylocerite produced in acute spine reaching 0.65-0.85 of distance between lateral base of first antennular article and mesial base of distolateral spine; latter extending to proximal 0.45 of second antennular article. Antennular flagella short, mesial one about 0.8 as long as lateral; latter about 0.4 cl.

Scaphocerite reaching between midlength and distal end of third antennular article; lateral rib produced in long, slender spine conspicuously overreaching lamella. Antennal flagellum as much as 3 times as long as carapace.

Third maxilliped much stouter than pereopods. Basis and ischium of first pereopod each armed with well-developed sharp spine.

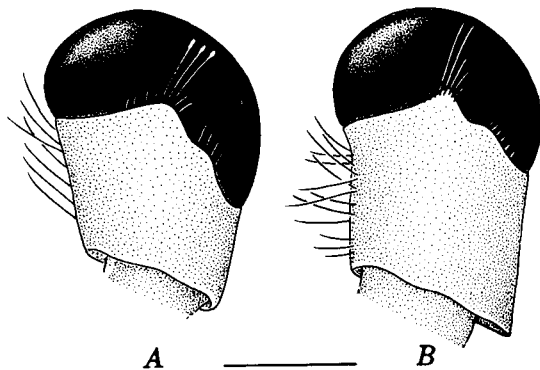


FIGURE 15.—Eyes. A, *Sicyonia disparri*, ♀ 9 mm cl, NW of Mantanchen, Nayarit, Mexico. B, *S. parri* (Burkenroad), ♀ 10.5 mm cl, east side of Cocoa Point, Barbuda. Dorsal views. Scale = 1 mm.

Abdomen with dorsomedian carina low anteriorly, increasing in height posteriorly; carina on first somite produced in rather small, anteriorly directed tooth, usually smaller than posterior tooth on carapace; carina on second somite conspicuously incised, and that on sixth terminating in short, sharp tooth.

Anteroventral extremity of pleura of first three somites rounded; pleuron of fourth with posteroventral margin straight to concave, its posteroventral extremity distinctly angular, occasionally armed with minute tooth; posteroventral extremity of fifth and sixth somites produced in very small, caudally directed, sharp tooth.

First somite traversed by long, sometimes interrupted, deep anteromedian pleural sulcus ending well above ventral margin without meeting long, united posterior tergal-posteromedian pleural sulci. Second and third somites marked by 1) long anterior tergal sulcus and relatively short posterior tergal sulcus; 2) anteromedian pleural sulcus, extending almost to ventral margin on second somite but restricted to dorsal part on third, in both somites delimiting anterior shallow depression setting off rounded prominence dorsally; and 3) posteromedian pleural sulcus, its dorsal extremity curving anteriorly, ventral to (not joining) posterior tergal sulcus. Fourth and fifth somites with anterior tergal sulcus (that of fourth usually obliterated at about midlength) fused with united posterior tergal-posteromedian pleural sulci. Sixth somite marked by strongly arched posteromedian pleural sulcus and bearing shallow, longitudinal depression between dorsolateral ridge and elongate, often ill-defined cicatrix.

Telson with pair of short but well-developed fixed spines and two longitudinal rows of movable spinules on either side of densely setose median sulcus—mesial row extending almost to base of spine. Both rami of uropod almost reaching or barely overreaching apex of telson.

Petasma (Figs. 5, 16A, B) with cornified distal projection of dorsolateral lobule bulbous proximodorsally, curved mesially, and minutely bifid distally; fleshy distal projection of ventrolateral lobule directed distolaterally, expanded basally and with slender but blunt terminal part slightly curved proximally. Lateral margin of petasma conspicuously notched just proximal to midlength, forming shoulder immediately proximal to notch.

Petasmal endopods coupled in males with carapace length as little as 3 mm (about 13 mm tl) but sometimes unjoined in individuals with

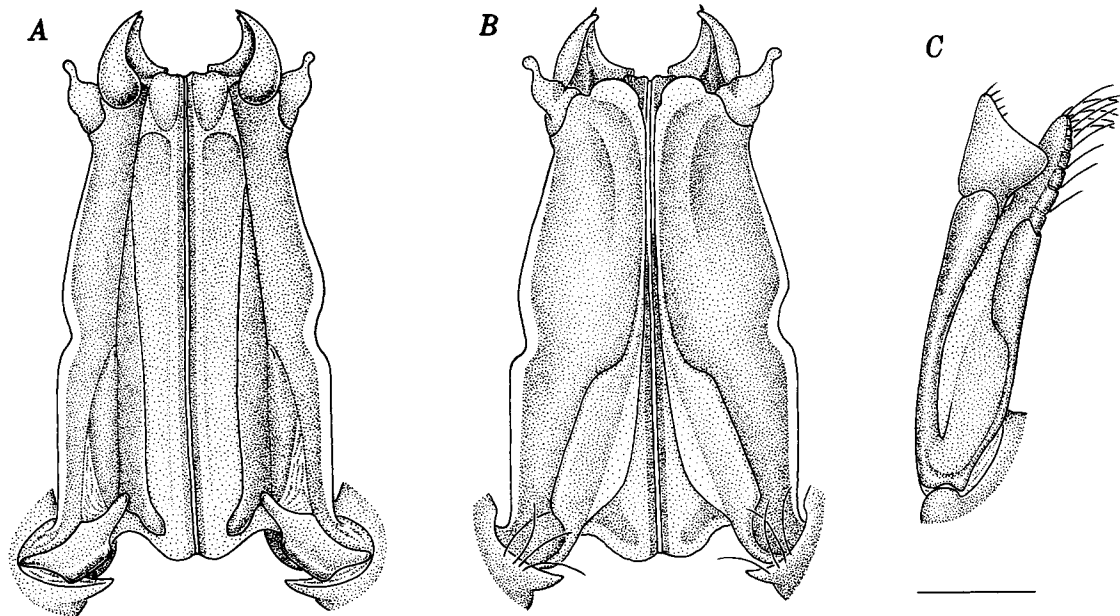


FIGURE 16.—*Sicyonia disparri*, ♂ 6 mm cl, Canal de San Lorenzo, Baja California Sur, Mexico. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scale = 0.5 mm.

carapace length as much as 4.9 mm (about 21 mm tl).

Appendix masculina as illustrated in Figure 16C.

Thelycum (Fig. 17) with plate of sternite XIV, produced in conspicuous anterolateral lobules, flat except for deep, broad, median depression. Median plate of sternite XIII narrow, lanceolate, tapering gently into long, sharp spine reaching as far as proximal 0.25 of basis of extended second pereopods; plate constricted and deeply excavate at level of coxae of fourth pereopods; posterior component of plate with shallow, broad postero-median emargination and well-marked transverse suture. Paired conspicuous spines projecting anteromesially from posterior margin of sternite XI. Posterior thoracic ridge with sharp, concave anteromedian margin but areas immediately lateral to concavity flush with plate of sternite XIV.

The smallest impregnated female encountered has a carapace length of 5 mm, about 21 mm tl.

*Maximum size.*—Males 6.9 mm cl, about 30 mm tl; females 11 mm cl, about 44 mm tl.

*Geographic and bathymetric ranges.*—In the Gulf of California, from Bahía San Luis Gonzaga (29°48'N, 114°22'W), Baja California Norte, and

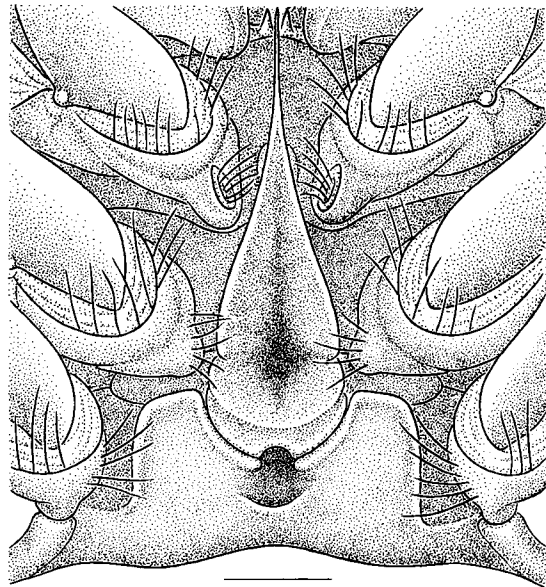


FIGURE 17.—*Sicyonia disparri*, holotype ♀ 10.4 mm cl, Bahía San Luis Gonzaga, Baja California Norte, Mexico. Thelycum. Scale = 1 mm.

southward along the east coast of the peninsula, to Isla Santa Magdalena (24°55'N, 112°15'W), Islas Tres Marias, Nayarit, Mexico; also off Cabo San

Lucas (22°52'23"N, 109°53'23"W), Baja California Sur (Fig. 12). This species occurs at depths between 0.2 and 82 m, mostly at <24 m, and on sandy bottoms: sand, sand and shell, sand and gravel, and a mixture of sand mud, and coral. Among the eastern Pacific rock shrimps, *S. disparri* appears to have one of the most restricted distributions, being virtually confined to the Gulf of California and waters off Nayarit. Its presence south of the Gulf of California is reported here for the first time.

*Discussion.*—This shrimp is very similar to the geminate western Atlantic *S. parri* both in morphology and size. Burkenroad (1934a) first distinguished *S. disparri* by the absence of posterior pleural sulci on the anterior two abdominal somites and by the shorter, deeper, and more upturned rostrum. A few years later (1938), on the basis of three additional specimens, he pointed out other features in which *S. disparri* differed from his two specimens of *S. parri*: the shape of the posteroventral margin and extremity of the fourth abdominal somite, the presence of one or two pairs of movable spinules dorsal to the ventral margin of the rostrum near its anterior end, and the presence of four instead of three teeth on the dorsal margin of the rostrum. He stated that these characters are probably subject to variation and in so doing indicated that they might not be diagnostic. He noted, however, that the size and shape of the ocular calathus and the size and disposition of the cornea might prove to be diagnostic.

My examination of a relatively large collection of *S. disparri* has demonstrated that among the various features that Burkenroad (1934a, 1938) suggested to distinguish this species from *S. parri*, three are diagnostic: 1) the disposition of the rostrum, which is upturned between 15° and 45° in the former, is subhorizontal or inclined not more than 13° in the latter; 2) the shape of the posteroventral extremity of the pleuron of the fourth abdominal somite, which is angular in *S. disparri* and rounded in *S. parri*; and 3) the shape of the ocular calathus and the breadth and disposition of the cornea. In the Pacific shrimp the calathus is broader than in the Atlantic species, the lateral margin ranges from 0.50 to 0.60 (mean 0.54) its width at the base of the cornea and the latter is obliquely disposed. In *S. parri* the lateral margin of the calathus (Fig. 15B) varies from 0.80 to 0.91 (mean 0.85) its width at the base of the cornea, and the latter is almost horizontally disposed. I have confirmed that the ratio of the lateral margin of

the calathus to the length of the carapace is usually smaller in *S. disparri* than in *S. parri*, ranging from 0.08 to 0.13 (mean 0.11) in the former and from 0.13 to 0.17 (mean 0.13) in the latter, but sometimes overlapping.

The absence of posterior pleural sulci is a character that, although not infallible, serves almost always to separate *S. disparri* from *S. parri*, lacking in all specimens of the former except in two small individuals, in one of which traces of them are present in the first three somites, and in the other, in the second somite. In contrast, all individuals of *S. parri* bear such sulci. As Burkenroad anticipated, the shape of the posteroventral margin of the pleuron of the fourth somite, which is usually concave in *S. disparri* and convex in *S. parri*, is variable, sometimes straight in both shrimps.

The length of the rostrum is not a reliable diagnostic character, as previously suggested, only tending to be slightly longer in *S. disparri* than in *S. parri*—the ratio  $rl/cl$  ranges from 0.43 to 0.59 in the former and 0.36 to 0.55 in the latter. It does tend to be deeper, but not consistently, in the Pacific than in the Atlantic species.

Burkenroad (1938) also pointed out the presence of a fourth tooth on the dorsal margin of the rostrum in four of his specimens of *S. disparri*, but he considered this tooth to belong to the apical cluster (as I have in the meristic data presented here) when discussing differences in number of apical teeth between his smaller male and the remaining four shrimps. The number of apical teeth vary in both species; however, more tend to be present in *S. disparri*, 59% of the specimens possess more than three teeth (57% four, 2% five), whereas in *S. parri* 90% of them bear two or three (80% three, 10% two) and only 10% bear four teeth. In *S. disparri* the rostrum seems always to be armed with submarginal, movable spinules; their absence in a few adults is probably due to loss by accident. But among the specimens of *S. parri* I have examined, only one from south of João Pessoa, Paraíba, Brazil, bears a pair of such spinules. Another from Varadero, Cuba, possesses a single, very minute spinule located on the ventral margin of the rostrum, near the base of the ventralmost apical tooth.

The shape of the posteroventral margin of the pleuron of the fourth abdominal somite is variable, as Burkenroad predicted for *S. disparri*, sometimes straight in both species, but, as stated above, the posteroventral extremity is always angular in *S. disparri* and rounded in *S. parri*. In the

holotype of the former this extremity is sharply angular but unarmed, contrary to what was stated in the original description of the species; however, I have examined a few specimens in which the angle is produced in a small spine.

*Sicyonia disparri* is also quite similar to *S. laevigata* but the epigastric tooth is larger than that in the latter, usually almost as large as the other two teeth on the postrostral carina, and is located closer to the level of the hepatic spine, i.e., farther from the orbital margin, 0.12-0.25 (mean 0.17) cl from it rather than 0.6-0.16 (mean 0.12) cl. The anteromedian pleural sulcus of the first abdominal somite is always well defined in *S. disparri* whereas it is absent or, infrequently, rudimentary in *S. laevigata*; and the posteroventral extremity of the fourth abdominal somite in *S. disparri* is angular rather than rounded. Furthermore, whereas the distal projection of the dorsolateral lobule of the petasma is conspicuously curved mesially in *S. disparri*, it is directed distally and curved dorsally at its tip in *S. laevigata*.

The discussion of *S. parri* is based on 34 specimens, including the holotype (YPM 4395) and one male from the Bermudas, which represents the second record of the species from this area. Burkenroad (1938) reported it from the Bermudas, but his record has not been cited by subsequent authors, including me in my 1980 paper on the western Atlantic *Sicyonia*.

*Material*.—62 specimens from 20 lots.

Mexico—Baja California Norte: ♀, holotype, YPM 4392, Bahía San Luis Gonzaga, 17 May 1926, *Pawnee*. 1♀, paratype, YPM, Bahía San Luis Gonzaga, 17 May 1926, *Pawnee*. 1♀, AHF, off Isla Partida, 82 m, 8 March 1936. Baja California Sur: 1♂ 1♀, YPM, Bahía Santa Inés, 55 m, 11 April 1936, *Zaca* stn 142D-1. 6♂ 4♀, AHF, 1.6 km WSW of Punta Perico, Isla Carmen, 13-20 m, 21 March 1949, *Velero IV*. 1♂, AHF, Bahía Salinas, Isla Carmen, 13 m, 20 March 1940, *Velero IV*. 1♀, SIO, Bahía Salinas, Isla Carmen, 0.3 m, 13 July 1965, B. W. Walker. 1♀, CAS, Bahía Balandra, Isla Carmen, 22 May 1921, F. Baker. 1♂, AHF, Bahía Agua Verde, 18 m, 12 February 1940, *Velero III*. 6♂ 8♀, SIO, NW of Isla Santa Cruz, 0-3 m, 10 July 1960, B. W. Walker. 2♂ 2♀, SIO, Isla San José, 3-5 m, 29 March 1967. 1♂ 2♀, AHF, Canal de San Lorenzo, 11-24 m, 14 February 1940. 4♂ 9♀, USNM, off Isla del Espíritu Santo, 15 m, 30 April 1888, *Albatross* stn 2824. 2♀, SIO, off Punta Lobos, 18 m, 26 June 1961, R. Rosenblatt. 1♂ 1♀,

USNM, Bahía La Ventana, 24-27 m, 20 April 1939, *Stranger* stn 38. 1♀, SIO, Ensenada de los Muertos, 9 m, 20 June 1961, R. Rosenblatt. 1♂, YPM, off Punta Arena, "Arena Bank," 64 m, *Zaca* stn 136D-30. 1♂, SIO, E of Cabo San Lucas, 0-6 m, 12 June 1961, R. Rosenblatt. Nayarit: 1♀, AHF, 1.6-3 km NW of Mantanchen, 21 December 1961. 1♀, AHF, Isla Santa Magdalena, Islas Tres Marias, 5.5-9 m, 9 May 1939.

### *Sicyonia mixta* Burkenroad, 1946

Figures 12, 18-20

*Sicyonia mixta* Burkenroad, 1946:3, fig. 1-4 [holotype, ♂, NR (Stockholm) 2527; type-locality: "St. Joseph (probably San José, Lower California). Swedish Eugenie Expedition #818"]. Rodríguez de la Cruz, 1977:11.

*Diagnosis*.—Antennal spine well developed, projecting from short but strong buttress. First abdominal somite with dorsomedian carina uniquely lacking anterior tooth; second abdominal somite with anterior depression on dorsomedian carina limited posteriorly by subvertical wall. First pereopod with basis and ischium unarmed. Rostrum very short, not surpassing midlength of eye, bifid and bearing one dorsal tooth. Petasma with distal projection of dorsolateral lobule straight, but with tip curved dorsally; distal projection of ventrolateral lobule bifid, arms curved inwardly. Thelycum with plate of sternite XIV convex laterally and with deep median depression.

*Description*.—Body moderately robust (Fig. 18) and lacking tubercles. Carapace with long setae on dorsum, arc anterior to hepatic spine, and patch accompanying hepatic sulcus ventrally.

Rostrum very short, not surpassing midlength of eye, its length 0.13-0.16 cl; straight; armed with only one dorsal tooth situated almost at midlength of rostrum, and two minute apical teeth (tip bifid); ventral apical tooth located at same level or distinctly anterior to dorsal apical tooth. Conspicuous adrostral carina, close and subparallel to ventral margin, extending to base of ventral apical tooth.

Carapace with low postrostral carina ending markedly anterior to posterior margin of carapace and bearing three teeth: 1) epigastric tooth, smallest of three but larger than dorsal rostral tooth, placed well in advance of hepatic spine, between 0.05 and 0.08 cl from orbital margin; 2) middle tooth, as large as or slightly larger than posterior

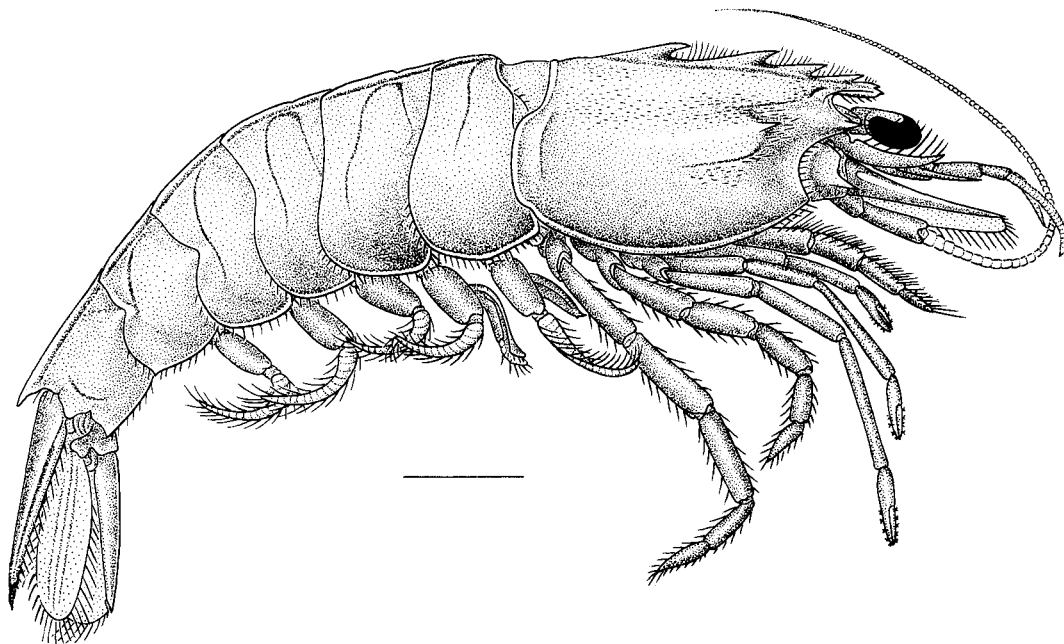


FIGURE 18.—*Sicyonia mixta* Burkenroad, 1946, ♂ 12 mm cl, off Cabo San Lucas, Baja California Sur, Mexico. Lateral view. Scale = 5 mm.

one, but about twice as high as anterior, situated posterior to hepatic spine, between 0.30 and 0.33 cl from orbital margin; and 3) posterior tooth, between 0.60 and 0.63 cl. Tuft of setae present at anterior base of each tooth. Antennal spine well developed, projecting from short buttress; hepatic spine long, sharp, borne on prominent buttress arising from swollen hepatic region; branchiocardiac carina barely distinct, only for short distance behind latter region. Postocular sulcus short and deep anteriorly, continuing posteriorly as well-defined groove; hepatic sulcus well marked, long, extending caudally to about level of apex of posterior tooth.

Antennular peduncle with stylocerite produced in long, acute spine, its length almost or quite equal to distance between lateral base of first antennular article and mesial base of distolateral spine; latter sharp, long, reaching as far as distal margin of second antennular article; flagella relatively elongate, mesial one about 0.20 cl, shorter than lateral, latter about 0.30 cl.

Scaphocerite reaching or surpassing antennular peduncle, sometimes by as much as 0.10 its own length; lateral rib produced distally in long, sharp spine overreaching lamella; antennal flagella incomplete in all specimens examined.

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

Abdomen with dorsomedian carina extending from first through sixth somites, carina weak on first and second, increasing progressively in height through sixth; carina on first somite lacking anterior tooth; on second interrupted by well-marked depression limited posteriorly by abrupt elevation, situated at level of juncture of tergal sulci; on fifth descending gradually instead of truncate posteriorly; and on sixth ending in large, acute, posterior tooth.

Pleuron of first abdominal somite with anteroventral margin slightly concave, anteroventral extremity rounded and unarmed; posteroventral extremity of first four somites also rounded, that of fifth usually bearing minute spine, and that of sixth always produced in small spine.

First somite with very short but deep anteromedian pleural sulcus and relatively weak (similar to most remaining sulci) but long posterior tergal (extending 0.60-0.66 height of somite). Second and third somites bearing short anterior and quite long posterior tergal sulci. Fourth somite with long posterior tergal sulcus, but anterior tergal almost indistinct. Fifth somite with barely distinct anterior tergal and relatively short posterior

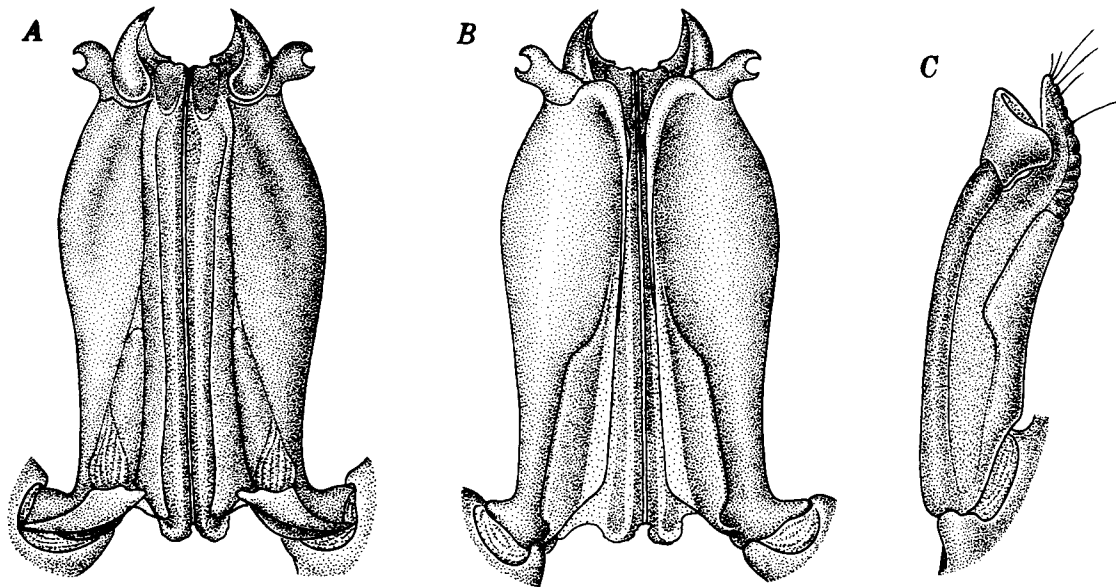


FIGURE 19.—*Sicyonia mixta*, ♂ 12 mm cl, off Cabo San Lucas, Baja California Sur, Mexico. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scale = 1 mm.

tergal, and sixth bearing weak anterior tergal and arched posteromedian pleural sulci.

Telson with paired fixed spines extremely minute (in the only specimen examined by me in which they are present). Rami of uropod, subequal in length, falling slightly short of apex of telson.

Petasma (Fig. 19A, B) with rigid distal projection of dorsolateral lobule bearing rounded proximodorsal prominence, extending almost straight distally but with tip curved dorsally. Distal projection of ventrolateral lobule bifid (arms curved), inclined laterally, and falling considerably short of adjacent projection.

Appendix masculina as illustrated in Figure 19C.

Thelycum (Fig. 20) with plate of sternite XIV, delimited by rounded lateral margins, raised in paired bulges sloping towards deep median depression. Median plate of sternite XIII roughly flaskshaped in outline, tapering into long, slender spine reaching proximal extremity of basis of anteriorly extended second pereopods; posterior component of plate with arched posterior borders flanking shallow to deep, broad median emargination, and traversed by strongly incised suture. Sternite XI armed posteriorly with paired, moderately long, acute spines. Posterior thoracic ridge with sharp, concave, anteromedian margin over-

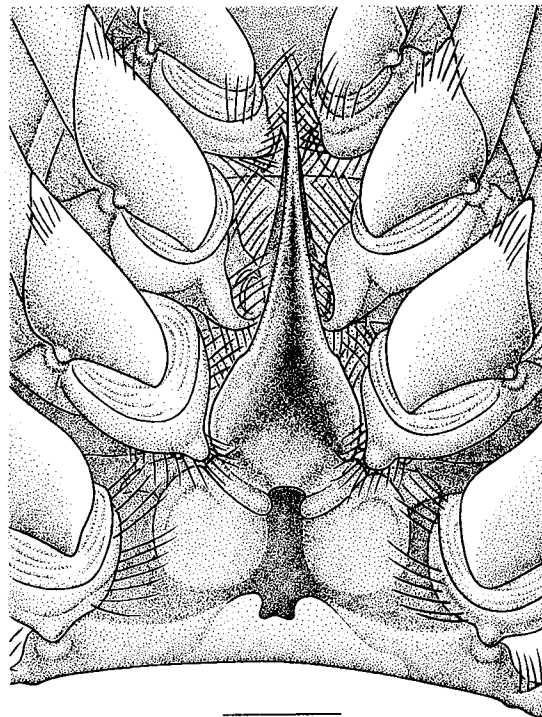


FIGURE 20.—*Sicyonia mixta*, ♀ 13 mm cl, off Isla Taboga, Golfo de Panamá, Panamá. Thelycum. Scale = 1 mm.

lapping plate of sternite XIV but areas immediately lateral to it flush with preceding plate.

*Color.*—The specimen examined by me from Peru exhibits a dark colored mask in the shape of a "2" (the base situated anteriorly), disposed horizontally from the posterolateral part of the carapace onto the anterodorsal part of the first abdominal pleuron.

*Maximum size.*—Male 12.7 mm cl, about 43.5 mm tl; female 20 mm cl, 65.5 mm tl.

*Geographic and bathymetric ranges.*—In addition to the undetermined type-locality, "St. Joseph" (most probably San José, Baja California), it has been found in Bahía Almejas (24°29'18"N, 111°47'24"W) and off Cabo San Lucas, both on the ocean side of Baja California Sur, in Bahía de la Paz, on the eastern side of the latter, off Isla Taboga in the Golfo de Panamá, and off Puerto de Eten (6°22'S, 80°47'W), Peru (Fig. 12). *Sicyonia mixta* occupies shallow water at depths between 11 and 24 m.

The discovery of *S. mixta* first in the Golfo de Panamá and more recently northwest of Puerto de Eten, Peru, was surprising and represented a considerable extension of the range of the species. Previously, it was known only from the waters of Baja California, where the three male types were collected and where, in Bahía de la Paz, five females and a male were found (Rodríguez de la Cruz 1977). The specimen from off Puerto de Eten (a female 20 mm cl, 26.5 mm tl) was collected by M. Niquen from the RV *Humboldt* on 27 April 1983, and is deposited in the IMARPE.

*Discussion.*—As Burkenroad (1946) stated, *S. mixta* is unique in lacking a tooth on the anterior end of the dorsomedian carina of the first abdominal somite. Also this shrimp exhibits two of the basic characters of the species that Burkenroad (1934a) grouped in his Division II (the presence of a well-developed or clearly distinct antennal spine and the absence of basal and ischial spines on the first pereopod) at the same time that the dorsomedian carina of the second abdominal somite, although not incised, is abruptly depressed anteriorly. This depression seems to represent the deep incision or notch typical of the species of his Division I.

Among the American species (excluding those grouped in Division I), *S. mixta*, *S. disedwardsi*, *S. penicillata*, and two western Atlantic species

—*S. typica* (Boeck 1864) and sometimes *S. olgae* Pérez Farfante, 1980—possess three dorsal teeth on the postrostral carina, two of which are situated posterior to the hepatic spine. In *S. mixta*, however, the posterior tooth arises on the postrostral carina considerably in advance of the posterior margin of the carapace, and the carina ends markedly anterior to the margin; in the other species the tooth arises nearer the margin where the carina ends. *Sicyonia mixta* also differs strikingly from the other four in the general sculpture of the abdomen; whereas in *S. mixta* it is not tuberculate and lacks all pleural sulci except the anteromedian on the first somite and the posteromedian on the sixth, in these congeners the abdomen is strongly tuberculate, exhibits deeper sulci, and possesses pleural sulci and all sixth somites. The bifurcate shape of the terminal part of the distal projection of the ventrolateral lobe of the petasma is another character that distinguishes *S. mixta* from the just mentioned relatives.

The relationships of this species are rather puzzling. Except for the distinctly depressed dorsomedian carina of the second abdominal somite, it does not share any other characters of importance with the species of Division I, represented by *S. disparri*, *S. laevigata*, and *S. parri*. Actually, it appears to be much closer to the group represented in the eastern Pacific by *S. disedwardsi* and *S. penicillata*, for in addition to possessing an antennal spine and lacking spines on the basis and ischium of the first pereopod, like them, it is armed with two teeth on the postrostral carina posterior to the hepatic spine. It seems to me that *S. mixta* has had, although remotely, a common origin with the above-mentioned group.

*Remarks.*—Because females of this shrimp have not been known previously, the above description of the thelycum is the first available for this species. In addition to the females cited from the Golfo de Panamá and off northern Peru, two other new records are presented here: one represented by a male from off Cabo San Lucas, Baja California Sur, and the other by a female from Bahía Almejas, Gulf of California. These four specimens, the types, and the six reported by Rodríguez de la Cruz (1977) are the only ones that have been recorded for this shrimp.

The holotype of this species and the paratype, in the Naturhistorisches Museum (Vienna), are the only extant types of the *Sicyonia* treated here that were not examined by me.



*Material*.—5 specimens from 5 lots.

Mexico—1♂ paratype, ZMB 6097, "California. Forrer" (?Ferrer). Baja California Sur: 1♂, SIO, Bahía Almejas, 11-24 m, 30 November 1961, F. H. Berry. 1♂, CAS, off Cabo San Lucas, 6 August 1932, *Zaca* stn D-21R.

Panama—1♀, USNM, off Isla Taboga, Golfo de Panamá, 10 March 1969, H. A. Clarke and A. Rodaniche.

Peru—1♀, IMARPE, off Puerto de Eten, 27 April 1983, M. Niquen, *Humboldt*, stn 8304, haul 175.

*Sicyonia brevirostris* Stimpson 1871

Figures 21-25

*Sicyonia cristata*. de Saussure 1857:306. [Not *Hippolyte cristata* De Haan 1844:194 = *Sicyonia cristata* (De Haan 1844).]

*Sicyonia brevirostris* Stimpson 1871:132 [syntypes not extant; type-locality: S. Florida coast]. Kingsley 1878:69. Faxon 1896:162. De Man 1911:10. Pesta 1915:118. Hay and Shore 1918:380, pl. 25, fig. 4. Hedgpeth 1953:160. Hildebrand 1954:268, 1955:220. Menzel 1956:41. Lunz 1957:4. Anderson 1958:1, fig. 5. Eldred 1959:5. Gunter and McCaughn 1959:1194. Anderson 1962:1, fig. 15. Kutkuhn 1962:2. Chapa Saldaña 1964:4. Joyce 1965:132. Cerame-Vivas and Gray 1966:263. Joyce 1968:254, unnumbered fig. Rouse 1969:136. Bayer et al. 1970:41. Zyznar 1970:87. Brusher et al. 1972:75. Cain 1972:79. Franks et al. 1972:54. Allen 1973:1. Cobb et al. 1973:7, fig. 3, 4A-C. Day et al. 1973:36. Bryan and Cody 1975:1. Brusher and Ogren 1976:158. Hooks et al. 1976:103. Kennedy et al. 1977:1. Pérez Farfante 1978: Sicyoniidae. Huff and Cobb 1979:51. Wenner and Boesch 1979:130. Holthuis 1980:58. Pérez Farfante 1980:772. Soto 1980a:68, 1980b:84. Castille and Lawrence 1981:519. Wenner and Read 1981:4. Arreguín Sánchez 1981:21. Pérez Farfante 1982:370. Wenner and Read 1982:181. Williams 1984:43.

*Eusicyonia edwardsi*. Hay and Shore 1918, pl. 25, fig. 2. [Not *Sicyonia edwardsii* Miers 1881:367 = *Sicyonia typica* Boeck 1864.]

*Eusicyonia brevirostris*. Burkenroad 1934a:84, 1934b:117, 1939:57. Lunz 1945:4. Anderson et al. 1949:16. Anderson 1956:2. McConnell 1960:52.

Vernacular names: rock shrimp, hardback (United States); camarón de piedra, camarón conchiduro, camarón de roca (Mexico). FAO names (Holthuis, 1980): rock shrimp (English); camarón de piedra (Spanish); boucot ovetger-nade (French).

Cobb et al. (1973) and Huff and Cobb (1979) presented extensive bibliographic references to this species, many of which are omitted from the above synonymy.

*Diagnosis*.—Antennal spine well developed and projecting from strong buttress. Second abdominal somite with dorsomedian carina lacking incision. First pereopod with basis and ischium unarmed. Postrostral carina bearing three teeth posterior to level of hepatic spine, rarely anterior one of these at level of or slightly anterior to hepatic spine. Rostrum armed with two dorsal teeth (rarely three). Petasma with distal projection of dorsolateral lobule relatively short, its apical part curved dorsally. Thelycum with plate of sternite XIV almost flat or slightly raised laterally in paired low bulges; posterior component traversed by well-marked suture. Branchiostegite lacking large spot or ocellus.

*Description*.—Body robust (Fig. 21). Carapace with dorsum covered by densely set, short setae; also patches of setae present anterior and ventral to hepatic spine, subjacent to hepatic sulcus and to branchiocardiac carina, and band of smaller setae on ventral part of branchiostegite. Patches also present on terga of abdominal somites. Abdomen heavily or moderately tuberculate, tubercles small, more numerous on first four somites.

Rostrum short, in young not overreaching distal end of second antennular article, in adults falling considerably short of distal margin of eye, its length increasing linearly with carapace length (Fig. 22), to about 16 mm cl, then growing little, rarely surpassing 6 mm (proportional length decreasing with increasing size from as much as 0.49 to as little as 0.15 cl); subhorizontal or upturned as much as 85°, tapering from base to tip, and armed with two (very rarely three) dorsal and two or three (four in one) apical teeth; latter subequal or ventral one extending farther anteriorly than dorsal and often upturned; when two teeth present, knob usually between them. Adrostral carina strong, bordering ventral margin and reaching end of rostrum.

Carapace with postrostral carina high, bearing

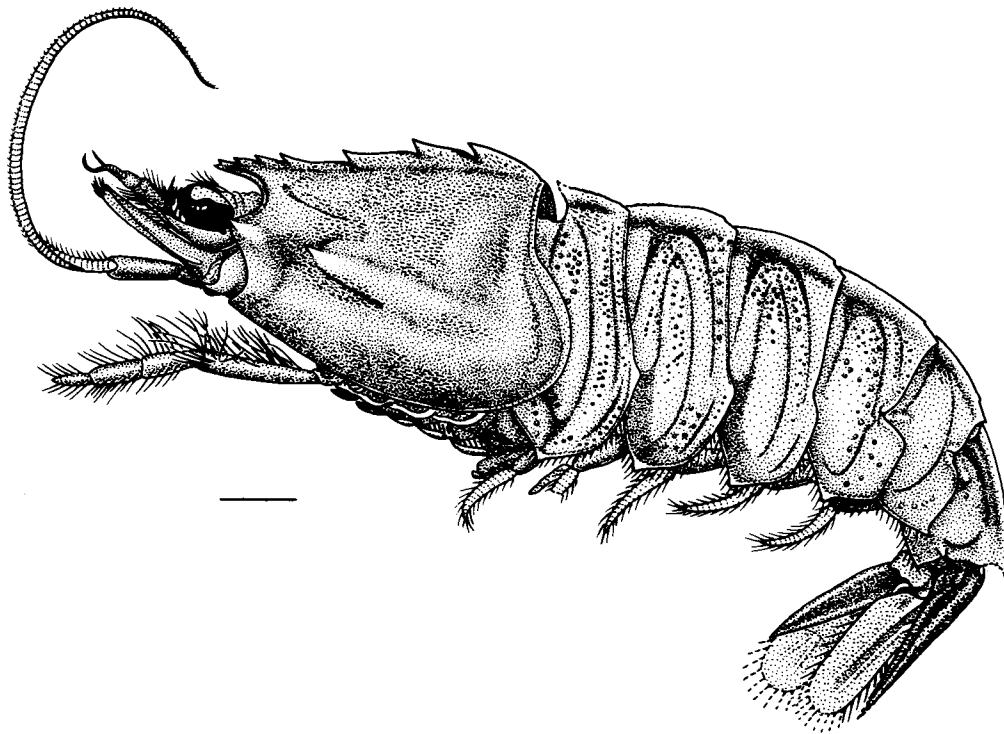


FIGURE 21.—*Sicyonia brevirostris* Stimpson, ♂ 18.1 mm cl, off Puerto Madero, Chiapas, Mexico. Lateral view. Scale = 5 mm.

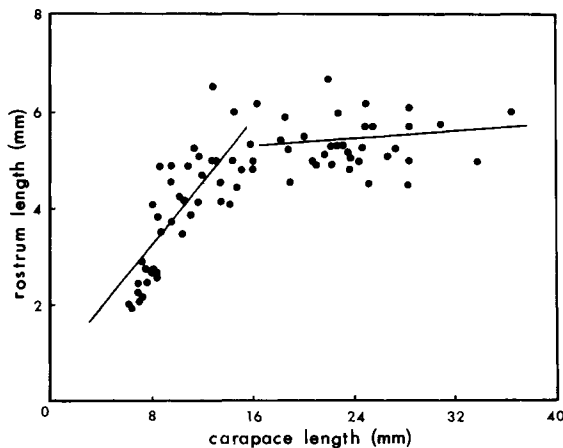


FIGURE 22.—*Sicyonia brevirostris*. Relationship between rostrum length and carapace length (regression equation for specimens with carapace length less than about 16 mm,  $y = 0.52372 + 0.33342x$ ; regression equation for those larger,  $y = 5.06145 + 0.01211x$ ).

four teeth: 1) epigastric tooth only slightly larger than first rostral, situated from anterior to orbital margin to as much as 0.1 cl posterior to it; and 2) three large teeth usually placed posterior to level of hepatic spine, anterior one (level with hepatic spine in only three specimens examined) smallest, situated between 0.20 and 0.28 (mean 0.25) cl from

orbital margin, middle tooth between 0.52 and 0.60 (mean 0.55) cl, and posterior one between 0.74 and 0.79 (mean 0.75) cl. Antennal spine moderately long, projecting from strong buttress; hepatic spine, longer than antennal, acutely pointed and arising from moderately raised area between 0.20 and 0.25 (mean 0.23) cl from orbital margin.

Postocular sulcus with anterior part deep, continuing posteriorly as shallow groove; hepatic sulcus well marked; hepatic carina weak; brachiocardiac carina conspicuous, extending to or almost to transverse ridge near posterior margin of carapace.

Antennular peduncle with stylocerite produced in long, sharp spine, its length 0.85-0.90 distance between lateral base of first antennular article and mesial base of distolateral spine; latter extending as far as distal end of proximal 0.80 of second antennular article; antennular flagella short, mesial antennular flagellum shorter than lateral, 0.15-0.20 as long as carapace, lateral flagellum 0.19-0.23 as long.

Scaphocerite reaching or slightly overreaching distal margin of antennular peduncle; lateral rib ending distally in long, acute spine distinctly 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 high dorsomedian carina extending from first through sixth somites: on first produced in strong anterior tooth, on fourth usually sloping posteriorly but sometimes abruptly truncate, and on fifth and sixth terminating in sharp tooth, latter longer.

Anterolateral margin of pleuron of first abdominal somite concave, anteroventral extremity of first through fourth somites ending in spine, that of first directed anterodorsally, those of second through fourth curved posterolaterally; posteroventral extremity of fourth through sixth somites bearing posteriorly directed, acute spine, that of fifth largest. Pleural spination of first four somites represented by tubercles in juveniles, becoming longer with increasing length of carapace.

First abdominal somite with long anteromedian pleural sulcus ending dorsally at anterior margin of tergum and converging with long posteromedian pleural sulcus ventrally; posterior tergal sulcus long or short, well marked or weak; posterior pleural sulcus well defined. Second and third somites with long anterior and posterior tergal sulci; anteromedian pleural sulcus continuous with anteroventral depression setting off prominence dorsally and ridge posteriorly; posterior pleural sulcus as on first somite. Fourth and fifth somites with anterior tergal joining curved, united posterior tergal-posteromedian pleural sulci dorsally; fourth also with shallow but clearly distinct caudodorsal depression, placed close to posterior margin. Sixth somite marked with faint anterior

tergal and arched posteromedian pleural sulci, also bearing longitudinal ridge along base of dorsomedian carina and lateral depression (thickly covered with setae) dorsal to interrupted cicatrix. All sulci weak in juveniles, becoming deeper with age.

Telson with pair of short, often abraded, fixed subterminal spines. Rami of uropod subequal in length, reaching or slightly overreaching apex of telson.

Petasma (Fig. 23A, B) with rigid distal projection of dorsolateral lobule raised proximodorsally in rounded prominence, strongly curved dorsomedially, its distal part compressed, rounded ventrally, produced dorsally in short, subacute salient; mesial base of projection bearing short, dentiform prominence. Distal projection of ventrolateral lobule with firm terminal part curved laterally, convex dorsally, plane ventrally, and tapering to ventrally directed apex.

Petasmal endopods coupled in males as small as 6.3 mm cl, about 22 mm tl, but in individuals with as much as 13 mm cl, about 48 mm tl, they may not be joined.

Appendix masculina as illustrated in Figure 23C.

Thelycum (Fig. 24) with plate of sternite XIV produced in anterolateral lobules, almost flat or raised in paired low bulges sloping toward anteriorly deep median depression. Median plate of sternite XIII sagittiform, tapering gradually into long, slender spine reaching as far as proximal 0.25 of basis of extended second pereopods; plate strongly excavate and bearing shallow, lateral incisions at level of fourth pereopods; posterior component with deep, broad posteromedian emargination separating paired subtriangular processes limited anteriorly by well-marked transverse suture. Paired spines projecting anteroventrally from posterior margin of sternite XI, spines broad basally, often spiculiform apically. Posterior thoracic ridge narrow, with concave anteromedian margin well marked.

The smallest impregnated females encountered have a carapace length of 10 mm, about 44 mm tl.

*Color.*—The coloration of this shrimp was described in detail from live specimens from the Gulf of Mexico by Burkenroad (1939). Williams (1965) presented notes on the color of materials of North Carolina, and Cobb et al. (1973) recorded observations on individuals from the Yucatán shelf. In the latter, the dorsal part of the body is more reddish than in specimens from the northern Gulf of

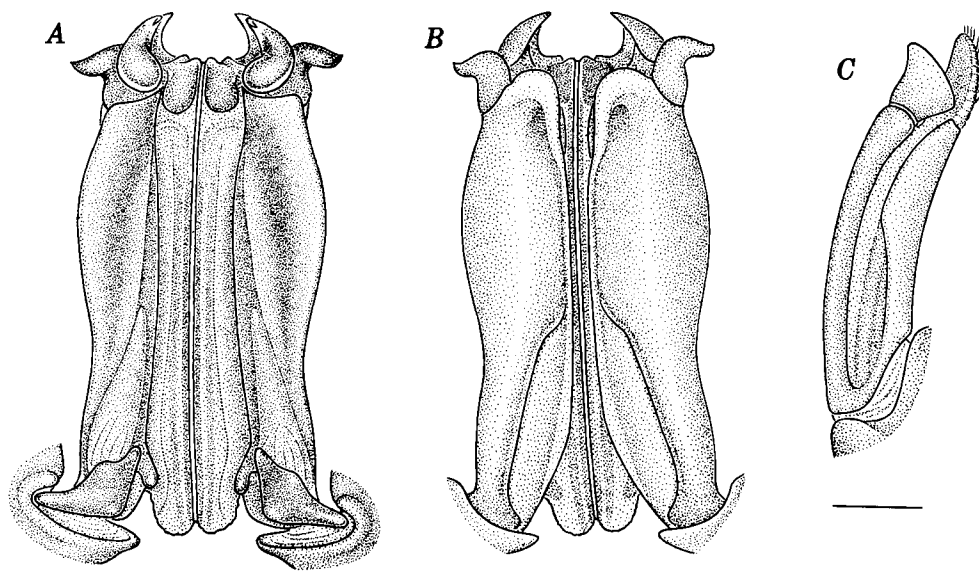


FIGURE 23.—*Sicyonia brevirostris*, 18.1 mm cl, off Puerto Madero, Chiapas, Mexico. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scales = 1 mm.

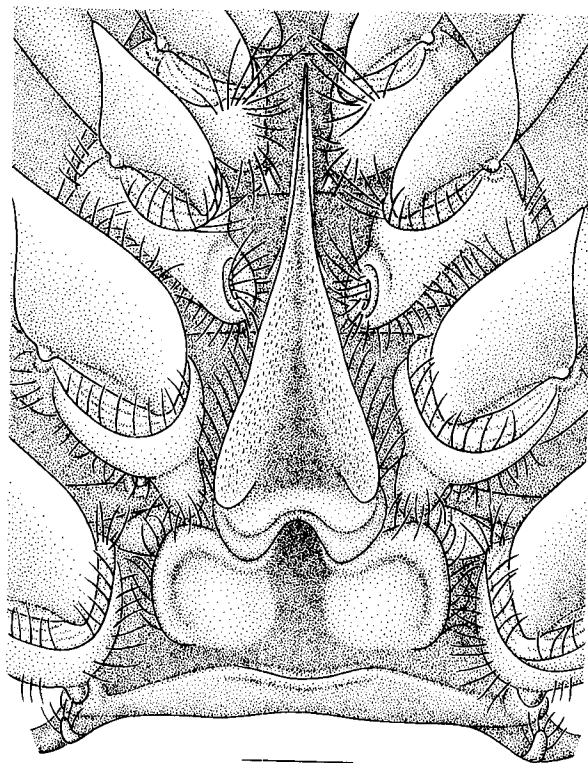


FIGURE 24.—*Sicyonia brevirostris*, ♀ 26.3 mm cl, off Cape Lookout, North Carolina, USA. Thelycum. Scale = 2 mm.

Mexico, which Burkenroad described as having the dorsum brown and the sides white, and also differs from shrimp occurring in North Carolina, in which the ground color is off-white.

*Maximum size.*—According to Holthuis (1980), 153 mm tl. Largest individuals examined by me: males 32 mm cl, about 125 mm tl; females 37 mm cl, about 130 mm tl. The only specimen from the Pacific, a male from off Puerto Madero, Chiapas, Mexico, measures 18.1 mm cl, 70 mm tl (latter from Burkenroad 1934a).

*Geographic and bathymetric ranges.*—In the eastern Pacific, off southern Mexico, from Colima (Chapa Saldaña 1964) to Chiapas (Fig. 25). In the western Atlantic, from Norfolk, Va., along the coast of the United States and the Bahamas to the southern coast of Cuba, and around the Gulf of Mexico from the Florida Keys to off Isla Contoy, Yucatán; perhaps also off Guyana (McConnell 1960). In the western Atlantic it occurs from shallow water to 329 m (Williams 1965), usually between 10 and 110 m, and rarely at depths >190 m. Exploitable populations are found between 34 and 55 m (Huff and Cobb 1979).

This species prefers sand and shell-sand substrates, but occasionally it is found on mud bottoms (Hildebrand 1954, 1955; Menzel 1956; Wil-

liams 1965; Cobb et al. 1973; Kennedy et al. 1977; Huff and Cobb 1979). The depths and substrates with which it was associated in the eastern Pacific were not recorded.

*Discussion.*—*Sicyonia brevirostris* is rather closely related to the western Atlantic *S. typica* and the eastern Pacific *S. disedwardsi*. It differs from both in possessing three, instead of two, large teeth on the postrostral carina posterior to the level of the hepatic spine and a caudodorsal depression on the fourth abdominal somite. It differs further from *S. disedwardsi* in 1) exhibiting well-marked posterior pleural sulci on the first three abdominal somites, which are lacking in the latter shrimp or, if present, weak, often distinct on only one or two somites; 2) having the distal projection of the dorsolateral lobule of the petasma turned dorsomesially, compressed distally, and produced apically in a short, subacute, dorsally directed salient—in contrast, in *S. disedwardsi* the projection is turned mesially and then dorsolaterally, its apical extremity produced in a relatively elongate, acutely pointed, laterally directed salient which often bears a crest; and 3) lacking an ocellus on the posterior part of the branchiostegite rather than bearing a large, brightly colored one such as that in *S. disedwardsi*.

*Sicyonia brevirostris* occupies water of high sa-

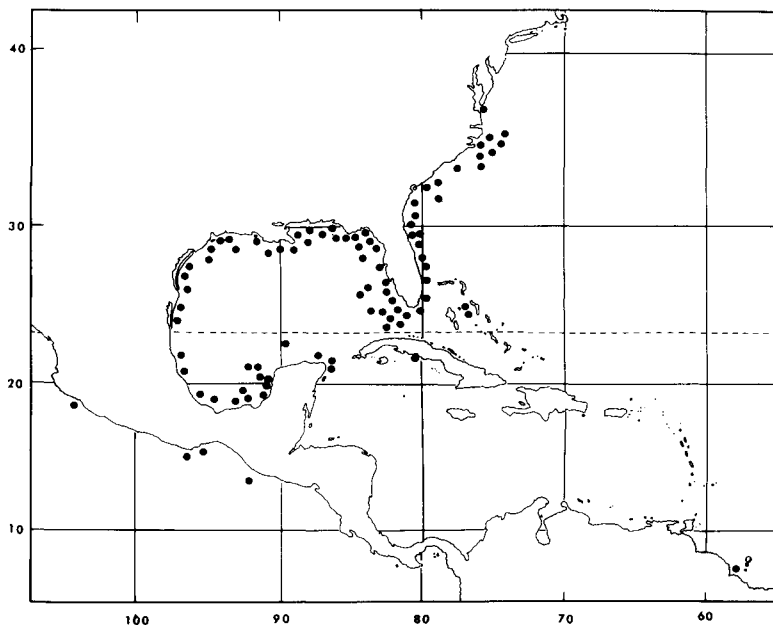


FIGURE 25.—Geographic distribution of *Sicyonia brevirostris*.

linity; recorded off east Florida and off west central Florida in salinities between 32.00 and 36.75‰ and 31.22 and 36.71‰ (Kennedy et al. 1977 and Huff and Cobb 1979, respectively) and off Mississippi between 27.8 and 34.6‰ (Franks et al. 1972). Only once, in the Chatham River, Fla., has it been recorded in an estuarine environment, at a salinity of 24‰ (Rouse 1969). The specimens on which this record is based consisted of larvae and small juveniles, and might have been misidentified, perhaps belonging to one of the other congeners found in that area. This shrimp, unlike other penaeoids, does not depend upon estuarine waters during its life cycle (Eldred 1959; Joyce 1965).

Many investigators (Lunz 1957; Joyce 1965; Brusher et al. 1972; Cobb et al. 1973; Brusher and Ogren 1976; Camp et al. 1977; Kennedy et al. 1977; Huff and Cobb 1979; Wenner and Read 1981) note that this species is predominantly nocturnal. Cobb et al. (1973) suggested that it burrows into the substratum during the day, thereby avoiding predation and capture by trawls.

*Notes on biology and abundance.*—Whereas the other American rock shrimps have been largely neglected, because of its considerable economic value, large size, and ready availability *S. brevis* has been the subject of a number of investigations. Cobb et al. (1973) and Kennedy et al. (1977) studied the reproductive cycle (including ovarian development in detail) of west central and east Florida populations, respectively. They concluded, as did Huff and Cobb (1979) who investigated the former population, that spawning and recruitment seem to occur throughout the year, with a peak of spawning from October to February off the west coast of Florida and during winter and early spring off the northeast coast. Cobb et al. (1973) suggested that a decrease in the daily photoperiod was responsible for the onset of spawning.

Morphometric studies by Kennedy et al. (1977) demonstrated that increase in total length occurs at the same rate in males as in females until they reach 20 mm cl, then the rate of increase of total length in females become less. They also found that the juveniles grow at an average rate of 2-3 mm cl per month whereas the adults grow at 0.5-0.6 mm cl. It was also estimated by them that the life span of this species is 20-22 mo. More recently Arreguín Sánchez (1981) presented biological fishery statistics (length/weight, growth, mortality, etc.) for this species.

Density of this shrimp in various populations fluctuates seasonally. Wenner and Read (1981, 1982) found that *S. brevis* is the dominant species of decapod crustacean on the continental shelf between Cape Fear, N.C., and Cape Canaveral, Fla., and that highest densities occurred in one summer of their 2½-yr study. Lunz (1957) noted a bimodal seasonal abundance off South Carolina, with peaks occurring from September through December and again in May. Kennedy et al. (1977) observed that peak abundance is reached during the fall in the east Florida population. In the Gulf of Mexico, off central Florida (Cobb et al. 1973; Huff and Cobb 1979), maximum abundance was found to exist from late summer through the fall. Off Apalachicola, Fla., (Allen 1973) highest densities seem to occur from June to October; in coastal water of Louisiana (on the basis of maximum production) and Texas (Brusher et al. 1972), from June through January, and in Bahía de Campeche (Hildebrand 1955) this species was more abundant in February than in July. It thus appears that throughout the range of this species maximum abundance occurs from summer through fall, and, in some areas, into early winter.

Kutkuhn (1962) calculated regression equations for predicting "headless" from "whole" weights and vice versa, and Cobb et al. (1973) presented equations for relating carapace length to total length for males and females, as well as others for carapace length and total weight for males and females, and for both sexes combined. Huff and Cobb (1979) also calculated the relationships of carapace length to total length and carapace length to weight for each sex.

*Commercial importance.*—Commercial fishing for *S. brevis* began in the United States in 1970 (Allen 1973) and since then production has increased noticeably, amounting to 3,351,000 lb, with a value of \$3,222,000 in 1982 (Table 1). The fishing grounds are located off the southeast coast from North Carolina to central Florida (the most

TABLE 1.—Landings of *Sicyonia brevis* by areas and their values for 1982.<sup>1</sup>

| Area         | Pounds (heads-off) | Dollars   |
|--------------|--------------------|-----------|
| Georgia      | 369,000            | 353,000   |
| East Florida | 1,980,000          | 1,869,000 |
| West Florida | 1,001,000          | 999,000   |
| Texas        | 1,000              | 1,000     |
| Total        | 3,351,000          | 3,222,000 |

<sup>1</sup>Data provided by the Southeast Fisheries Center Statistical Survey Division, National Marine Fisheries Service, NOAA, Miami, Fla.

important ones by far being those off Cape Canaveral and Fort Pierce), and in the Gulf of Mexico off the coast of Florida (those off Apalachicola and Pensacola the most productive of the entire region) and western Texas. The production of the Carolinas was insignificant in 1982, last year for which landings are available.

This species is also exploited in Mexico off Isla Contoy, Quintana Roo, and in Bahía de Campeche. Arreguín Sánchez (1981) estimated that until 1978-79 the fishery off Isla Contoy, under optimal conditions, could have produced as much as 450 t (992,070 lb) of heads-on shrimp.

*Remarks.*—This species was first recorded from the eastern Pacific by Burkenroad (1934a). His record was based on a single specimen reportedly taken by the *Pawnee* off southern Mexico, in the Gulf of Tehuantepec, at lat. 14°40'20"N, long. 92°40'30"W. Later, Chapa Saldaña (1964) recorded five lots of this shrimp from the coast of Oaxaca, Golfo de Tehuantepec, which were in the collections of the Instituto Nacional de Investigaciones Biológico-Pesqueras, Mexico. Unfortunately, these specimens are no longer extant (Concepción Rodríguez de la Cruz<sup>2</sup>). Presence of *S. brevirostris* has not been confirmed by subsequent investigations in the region, including that of Sosa Hernández et al. (1980), who conducted a survey of the decapod crustaceans in the general area from which Burkenroad's and Chapa Saldaña's materials were obtained. Furthermore, representatives of the species were not found in the large collections of penaeoids from the Pacific coast of Mexico and Central America examined by me. Because of the large size of this shrimp (it may reach 153 mm), it should have been retained by the commercial shrimp trawls or other gear used off southern Mexico. The surprising fact that it has not been recorded from commercial catches since the appearance of Chapa Saldaña's report nor from collections resulting from exploratory work raises the possibility that the specimens cited above either bear incorrect data (as might be true of the correctly identified specimen examined by Burkenroad) or were misidentified.

McConnell (1960) reported this species from Guyana, but because it has not been recorded in studies (including my own) made of large collections of penaeoids obtained by research vessels and

shrimp trawlers in the waters of that country or in any others south of Cuba, its presence there needs confirmation.

This is the only species for which full bibliographic references are not given. Because of its abundance, accessibility, and economic value, the literature on this shrimp is extensive. As stated above, much of it is cited in the works of Cobb et al. (1973) and Huff and Cobb (1979), consequently, I am including those references in which synonyms were created, articles not cited by them, others which appeared subsequent to their contributions, and all of those cited in the treatment below.

*Material.*—281 specimens from 66 lots.

Eastern Pacific—1 specimen.

Mexico—Chiapas: 1♂, YPM, off Puerto Madero, 9 April 1926, *Pawnee*.

Western Atlantic—280 specimens from 64 lots.

United States—North Carolina: 4♂ 2♀, USNM, off Rodanthe, 49 m, 20 October 1884, *Albatross* stn 2296. 14♂ 12♀, USNM, off Cape Hatteras, 64 m, 21 June 1957, *Combat* stn 396. 1♀, USNM, NE of Cape Hatteras, 55 m, 26 July 1969, *Oregon II* stn 10697. 3♂ 3♀, USNM, off Raleigh Bay, 26 m, 30 July 1969, *Oregon II* stn 10738. 2♂ 6♀, USNM, off Raleigh Bay, 33 m, 27 May 1962, *Silver Bay* stn 4028. 1♂, USNM, SE of Cape Lookout, 37 m, 12 March 1961, *Silver Bay* stn 2913. 3♀, USNM, off Cape Lookout, 43 m, 21 June 1957, *Combat* stn 397. 1♂ 3♀, USNM, Onslow Bay, 46 m, 2 August 1962, *Silver Bay* stn 4196. South Carolina: 2♂, USNM, off Port Royal Sound, 51-44 m, 25 June 1957, *Combat* stn 428. 1♂ 1♀, USNM, off Hilton Head Island, 40-46 m, 7 October 1957, *Combat* stn 514. 3♀, USNM, off Hilton Head Island, 64 m, 14 December 1961, *Silver Bay* stn 3657. Georgia: 3♂, USNM, off Cape Romain, 1941, J. Oney. 1♀, USNM, off Sapelo Island, 42 m, January 1940, *Pelican*. 4♀, USNM, NE of Savannah Beach, 40 m, 4 February 1940, *Pelican*. 6♂ 9♀, USNM, off Jekyll Island, 73 m, 15 March 1940, *Pelican*. Florida: 1♂ 2♀, USNM, NE of Fernandina, 31 m, 2 October 1951, *Combat* stn 505. 1♂ 2♀, USNM, off Fernandina, 42 m, 10 March 1976, *George M. Bowers* stn 37. 3♂ 3♀, USNM, off Ponte Vedra Beach, 24 m, 23 April 1956, *Pelican* stn 32. 4♂ 1♀, USNM, off St. Augustine, 329 m, 16 September 1956, *Combat* stn 119. 1♂, USNM, off Matanzas Inlet, 183 m, 18 November 1965, *Oregon* stn 5741. 13♂ 22♀,

<sup>2</sup>Concepción Rodríguez de la Cruz, Instituto Nacional de Pesca, Secretaría de Pesca, México, D.F., México, pers. commun., May 1983.

USNM, off Flagler Beach, 40 m, 7 November 1963, *Silver Bay* stn 5201. 2♂ 8♀, USNM, off Edge-water, 22 m, 1 December 1961, *Silver Bay* stn 3588. 1♂, USNM, off Cape Canaveral, 25 January 1962, *Silver Bay* stn 3704. 1♀, USNM, off Cape Canaveral, 70 m, 16 January 1966, *Oregon* stn 5860. 3♂, USNM, off Melbourne Beach, 40 m, 23 March 1956, *Pelican* stn 14. 5♂ 5♀, USNM, off Hutchinsons Island, 63 m, 11 November 1963, *Silver Bay* stn 5267. 2♂ 6♀, USNM, NE of St Lucie Inlet, 38-42 m, 21 May 1968, *Gerda* stn 1002. 2♂ 2♀, USNM, off Key Largo, 110-113 m, 26 January 1966, *Gerda* stn 769. 1♂, USNM, S of Islamorada, 49-40 m, 15 September 1965, *Gerda* stn 756. 2♂ 5♀, USNM, S of Pine Island, 170-194 m, 25 February 1969, *Gerda* stn 1023. 1♂ 2♀, USNM, S of Marathon, 57-69 m, 26 February 1969, *Gerda* stn 1030. 1♂ 1♀, USNM, NW of Marquesas Keys, 27 m, 28 May 1952, *Oregon* stn 562. 1♂ 3♀, USNM, SE of Dry Tortugas Islands, 59 m, 13 April 1965, *Gerda* stn 574. 1♂ 8♀, USNM, S of Dry Tortugas Islands, 68 m, 13 April 1954, *Oregon* stn 1004. 2♂ 6♀, USNM, S of Dry Tortugas Islands, 64 m, 12 April 1965, *Gerda* stn 566. 1♂, USNM, SW of Dry Tortugas Islands, 91 m, 8 March 1970, *Gerda* stn 1241. 1♂ 4♀, USNM, NW of Dry Tortugas Islands, 55 m, 18 June 1956, *Oregon* stn 1553. 1♂, W of Dry Tortugas Islands, 37 m, 7 March 1970, *Gerda* stn 1235. 1♂, USNM, off Appalachee Bay, 27 m, 9 March 1954, *Oregon* stn 905. 1♀, USNM, off St George Island, 37-35 m, 26 July 1957, *Silver Bay* stn 88. 2♀, USNM, off St George Island, 68 m, 10 March 1954, *Oregon* stn 916. 1♀, USNM, S of Apalachicola Bay, 64 m, 7 March 1954, *Oregon* stn 896. 1♂, USNM, off Grayton Beach, 43 m, 16 November 1952, *Oregon* stn 707. Alabama: 1♂, USNM, off Orange Beach, 37 m, 24 January 1957, *Oregon* stn 1651. 5♂ 4♀, USNM, off Dauphin Island, 70 m, 9 August 1950, *Oregon* stn 82. Louisiana: 1♂, USNM, off Beeton Sound, 40 m, 21 August 1962, *Oregon* stn 3713. 1♀, USNM, S of Mississippi Delta, 84 m, 12 September 1950, *Oregon* stn 101. 2♀, USNM, off Southwest Pass, Mississippi Delta, 60 m, 14 September 1980, *Oregon* stn 110. 1♂ 1♀, USNM, off Ship Shoal Lighthouse, 37-40 m, 12 September 1962, *Oregon* stn 3186. 1♀, USNM, off Pelican Island, 22 m, 8 March 1957, *Oregon* stn 1755. Texas: 6♂ 6♀, USNM, SE of Galveston, 20 m, 6 May 1938, *Pelican*. 5♀, USNM, S of Galveston, 18 m, 5 May 1938, *Pelican*. 6♀, SW of Galveston, 16 m, 5 May 1938, *Pelican*. 1♀, USNM, NE of Brownsville, 26 m, 5 February 1939, *Pelican*.

Mexico—Tabasco: 1♂ 1♀, USNM, off Paraiso, 35 m, 16 May 1954, *Oregon* stn 1057. 1♀, USNM, off Laguna Machona, 64 m, 16 May 1954, *Oregon* stn 1060. 1♀, USNM, NW of Punta Frontera, 60 m, 8 June 1970, *Oregon II* stn 10981. 3♂ 3♀, USNM, NW of Punta Frontera, 66 m, 9 June 1970, *Oregon II* stn 10982. Campeche: 2♂, USNM, N of Arrecifes Triángulos, 64 m, 17 August 1951, *Oregon* stn 411. 1♂, USNM, W of Cayos Arcas, 66 m, 16 June 1970, *Oregon II* stn 11005. 1♂, USNM, E of Cayos Arcas, 37 m, 11 December 1952, *Oregon* stn 720. 1♀, USNM, NE of Cayos Arcas, R. Ramírez and M. Flores, 48 m, 30 April 1959. 3♂ 1♀, USNM, NE of Cayos Arcas, 42 m, 10 December 1952, *Oregon* stn 719. 1♂ 2♀, USNM, 16 km, NE of Ciudad del Carmen, R. Ramírez and M. Flores, 29-37 m, 29 April 1959. 1♀, USNM, off Campeche, 13 m, 2 May 1959, R. Ramírez and M. Flores.

*Sicyonia disedwardsi* (Burkenroad 1934)

Figures 3, 7, 26-30

*Eusicyonia disedwardsi* Burkenroad 1934a:86, fig. 23, 29, 34 [holotype: ♂, YPM 4394; type-locality: Bahía Concepción, Baja California Sur, 3 May 1926, *Pawnee*]. Burkenroad 1938:82. Anderson and Lindner 1945:317. Castro 1966:17.

*Sicyonia disedwardsi*. Brusca 1973:219. Rosales Juárez 1976:41. Rodríguez de la Cruz 1977:11. Anonymous 1980:6. Brusca 1980:256. Pérez Farfante 1982:371.

Vernacular names: rock shrimp, target shrimp, Japanese shrimp (United States); cacahuate, camarón de piedra, camarón de roca, camarón japonés (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 two teeth posterior to level of hepatic spine. Rostrum armed with two dorsal teeth. Petasma with distal projection of dorsolateral lobule short, stout, curved dorsomesially then laterally. Thelycum with plate of sternite XIV raised in relatively low, sometimes indistinct bulges; posterior component traversed by faint suture. Branchiostegite with large ocellus consisting of well-defined yellow center surrounded by purplish brown ring.



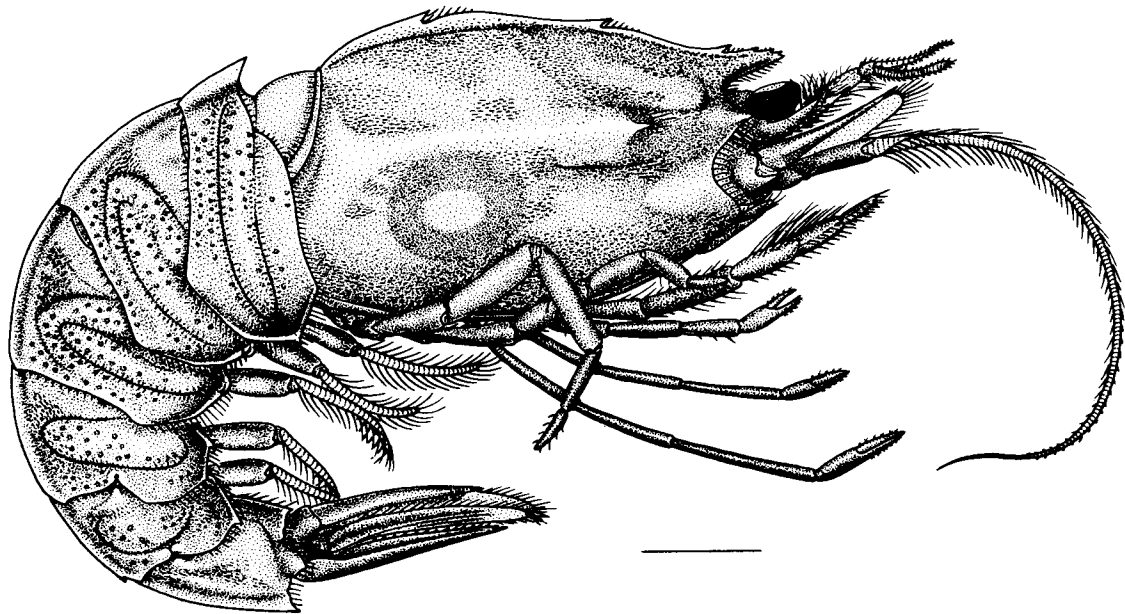


FIGURE 26.—*Sicyonia disedwardsi* (Burkenroad 1934), ♀ 34 mm cl, Golfo de Panamá, Panama. Lateral view. Scale = 10 mm.

**Description.**—Body robust (Fig. 26). Carapace studded with long setae anterior to hepatic spine and in pterygostomian region; patches of densely set shorter setae present on dorsum, in depression anterior to posterodorsal part of branchiocardiac carina, on branchiostegite, and subjacent to hepatic sulcus; patches also on tergum of abdominal somites and in depression just ventral to dorsal ridge of sixth somite. Abdomen bearing numerous tubercles on all somites (especially first three), except few or none on sixth.

Rostrum short, reaching distal margin of eye at most, its length increasing linearly with carapace length (Fig. 27) to about 20 mm cl, then growing little, not surpassing 6 mm (proportional length decreasing with increasing size from as much as 0.43 to as little as 0.13 cl); subhorizontal or upturned to as much as 45° (in young), tapering considerably from base to truncate, sometimes decurved tip; armed with two dorsal and two (96%) or three (4%) apical teeth. Adrostral carina, situated close to ventral margin, extending to end of rostrum.

Carapace with well-marked postrostral carina bearing three teeth: 1) epigastric small, only slightly larger than first rostral, situated from slightly anterior to orbital margin to 0.07 cl behind it; 2) middle tooth, larger than epigastric, placed well posterior to hepatic spine, between

0.29 and 0.38 (mean 0.33) cl from orbital margin; and 3) posterior tooth, larger than middle one, acutely pointed (usually abraded in larger adults), rising almost vertically before turning anteriorly or, more often, strongly inclined anteriorly and situated between 0.68 and 0.80 (mean 0.72) cl from orbital margin; tuft of setae present at anterior base of all three teeth. Postrostral carina increas-

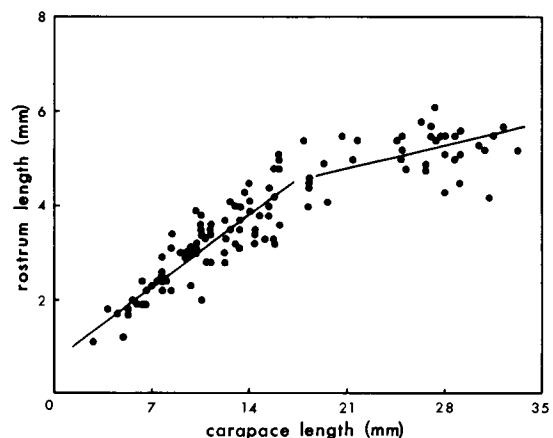


FIGURE 27.—*Sicyonia disedwardsi*. Relationship between rostrum length and carapace length (regression equation for specimens with about 20 mm cl or less,  $y = 0.74318 + 0.21740x$ ; regression equation for those larger,  $y = 3.81074 + 0.04939x$ ).

ing in height from low anterior part (between epigastric and middle teeth) to posterior tooth, descending gradually from it to posterior margin of carapace. Antennal spine relatively long, sharp, and projecting from short buttress; hepatic spine acutely pointed, arising from moderately raised area, and placed between 0.19 and 0.26 (mean 0.22) cl from orbital margin. Postocular sulcus short but deep, continuing posteriorly as barely distinct narrow groove; hepatic sulcus shallow; branchiocardiac carina broad, long, extending longitudinally from hepatic region almost to posterior margin of carapace where bifurcate: one branch curving dorsally and other, short, disposed ventrally.

Eye as illustrated in Figure 3. Ocular stylet with terminal part often bent laterally in young, but usually straight in larger individuals.

Antennular peduncle with stylocerite produced in long spine, its length 0.80 to 0.90 distance between lateral base of first antennular article and mesial base of distolateral spine; latter extending as far as distal 0.3 of second antennular article; antennular flagella short, maximum length 0.25-0.35 cl, mesial flagellum slightly shorter than lateral in young but subequal to or slightly longer in larger adults.

Scaphocerite nearly or quite overreaching antennular peduncle by as much as 0.15 its own length; lateral rib ending distally in long, acute

spine conspicuously surpassing margin of lamella. Antennal flagellum as much as 2.2 times as long as carapace.

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

Abdomen with high dorsomedian carina extending from first through sixth somites, carina on first produced in strong tooth, sometimes disposed almost horizontally, but usually elevated as much as 55°, tooth tapering to sharp apex, and considerably larger than posterior one on carapace; carina on fifth somite produced in small tooth and that on sixth terminating in strong sharp one.

Anterior margin of pleuron of first abdominal somite straight or very slightly concave; anteroventral extremity of pleuron of first through fourth somites ending in spine, that of first usually directed anteroventrally, spines on second through fourth often curved posterolaterally; posteroventral margin of first through third somites rounded, that of fourth broadly angular, sometimes bearing node or minute spine, and that of fifth and sixth sharply angular and armed with small, caudally directed spine. Pleural spination of first four somites barely if at all distinct in juveniles, becoming stronger with increasing length of carapace.

First somite traversed by deep, long anteromedian pleural sulcus (sometimes obsolete along midlength), latter usually converging with united posterior tergal-posteromedian pleural sulci ven-

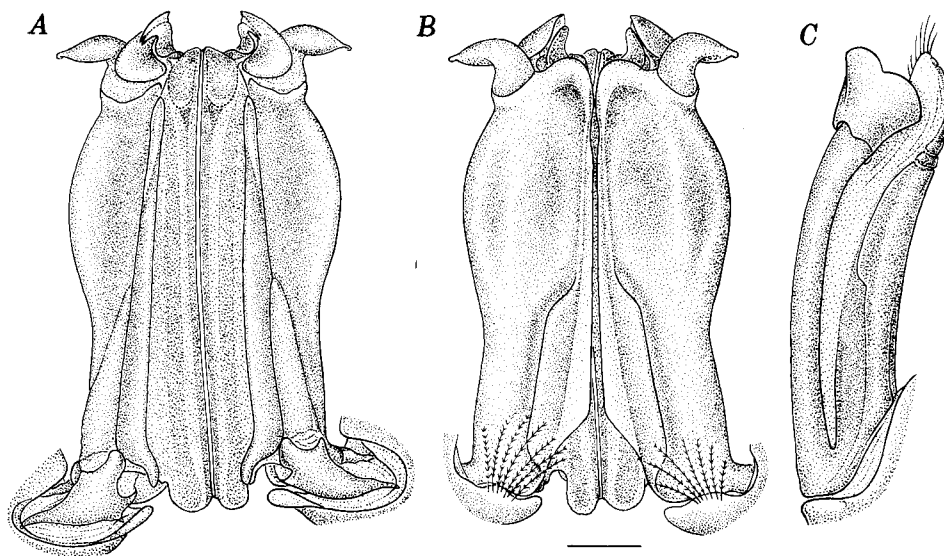


FIGURE 28.—*Sicyonia disedwardsi*, ♂ 23.5 mm cl, Golfo de Panamá, Panamá. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scale = 1 mm.

trally, but its dorsal extremity often not reaching anterior margin. Second and third somites with anterior and often short posterior tergal sulci; anteromedian pleural sulcus frequently joining posteromedian pleural sulcus (sometimes obsolete) dorsally, and continuous with anteroventral depression setting off prominence dorsally and ridge posteriorly. Traces of posterior pleural sulcus occasionally present in one or more of first three somites. Fourth and fifth somites with anterior tergal joining curved, united posterior tergal-posteromedian pleural sulci. Sixth somite with shallow, arched posteromedian pleural sulcus; longitudinal ridge along base of dorsomedian carina delimited ventrally by weak depression lying dorsal to ill-defined cicatrix.

Telson with pair of small but clearly distinct fixed spines. Rami of uropod subequal in length and falling slightly short of or overreaching apex of telson by as much as 0.15 its own length.

Petasma (Fig. 28A, B) with rigid distal projection of dorsolateral lobule mesially inclined (instead of erect), strongly curved dorsomesially then laterally; distal part of projection slightly compressed, often bearing crest, rounded ventrally and produced laterally in elongate, acutely pointed salient. Distal projection of ventrolateral lobule with terminal part strongly curved laterally, bulbous dorsally, plane ventrally, with pointed tip curved proximovertrally.

Petasmal endopods coupled in males with carapace length as little as 5.5 mm (about 22.5 mm tl), but sometimes unjoined in individuals with carapace length as much as 10.5 mm (about 38.5 mm tl). These observations are similar to those noted by Burkenroad (1938).

Appendix masculina as illustrated in Figure 28C.

Thelycum (Fig. 29) with plate of sternite XIV raised in paired, low (sometimes indistinct), relatively short bulges, sloping toward deep, broad, median depression. Median plate of sternite XIII sagittiform, tapering gradually into long, slender spine reaching as far as proximal 0.25 of basis of extended second pereopods; plate deeply excavate and bearing arched lateral incisions at level of fourth pereopods; posterior component with deep, broad posteromedian emargination forming relatively elongate, posterolateral processes marked basally by rather faint transverse suture. Sternite XI armed posteriorly with pair of small, broad based spines. Posterior thoracic ridge either almost flush with plate of sternite XIV or with only anteromedian margin raised (ventrally).

Sperm receptacles as illustrated in Figure 7 (illustration based on specimen treated following method by Monod and Cals (1970)).

The smallest impregnated female encountered has a carapace of 12 mm, about 42 mm tl.

*Color.*—The only observation on color of fresh material from the Gulf of California (Anonymous 1980) indicates that the typical large spot found in the posterior part of the branchiostegite is purplish brown with a yellow center. The conspicuous ocellate spot persists in preserved specimens, appearing like a broad dark ring surrounding a light center.

*Maximum size.*—Male, 29.2 mm cl, about 102 mm tl; female 34 mm cl, about 108 mm tl.

*Geographic and bathymetric ranges.*—Southwest of Isla Santa Margarita (24°19'36"N, 111°46'24"W - 24°19'48"N, 111°47'06"W) to Bahía San Lucas,

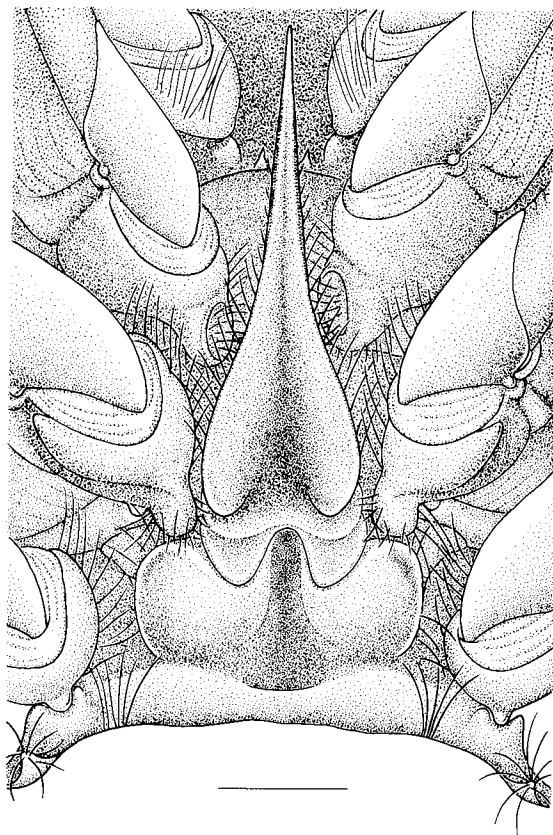


FIGURE 29.—*Sicyonia disedwardsi*, ♀ 21.3 mm cl, off Punta Gorda, Baja California Sur, Mexico. Thelycum. Scale = 2 mm.

Baja California Sur, in the Gulf of California along the central and southern parts of both coasts and southward to Bahía Chamela (19°33'42"N, 105°07'24"W), Jalisco, Mexico. Also from Bahía de Culebra (10°37'00"N, 85°40'00"W), Costa Rica, to northwest of Punta Caracoles (7°45'00"N, 78°24'30"W), Darién, Panama (Fig. 30). It has been found at depths between at least 18 (5-18) and 249 m, but seems to be most abundant at 30-60 m. It occurs on bottoms of shell, mud, fine sand, and rocks.

The occurrence of this shrimp along the west coast of Baja California Sur has not been previously reported.

*Discussion.*—*Sicyonia disedwardsi* is most simi-

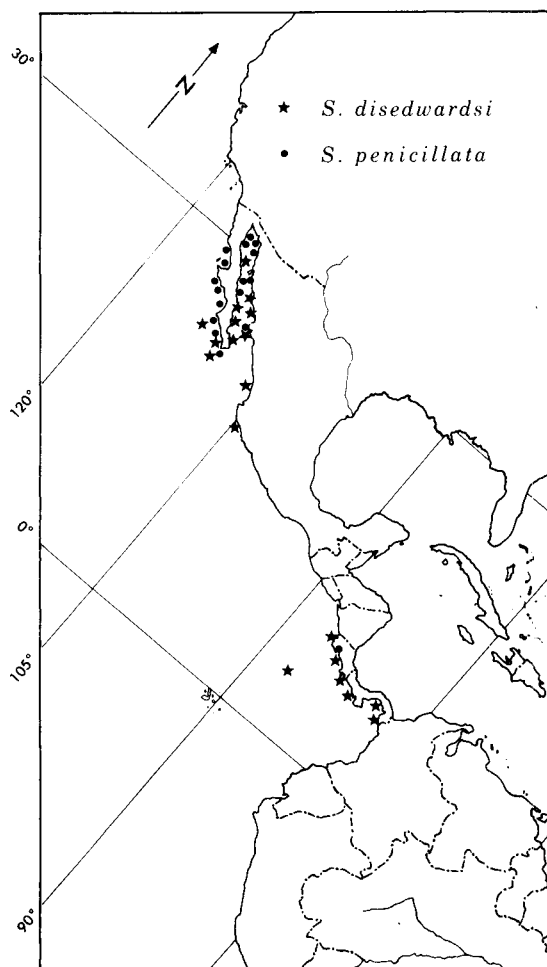


FIGURE 30.—Geographic distribution of *Sicyonia disedwardsi* and *S. penicillata*.

lar to the western Atlantic *S. typica*. As stated above, among the American members of the genus lacking an incision or abrupt depression on the middorsal carina of the second abdominal somite, these two, together with *S. penicillata* and the western Atlantic *S. olgae* bear two relatively large teeth on the postrostral carina posterior to the level of the hepatic spine. The genitalia of *S. disedwardsi* and *S. typica* are so similar that they are almost indistinguishable, but in the petasma of *S. typica* the tip of the projection of the dorsolateral lobule is not so strongly produced and is usually directed dorsally rather than dorsolaterally. These two species, however, differ in the number and extension of abdominal sulci: in *S. typica* the first three somites exhibit well-marked posterior pleural sulci, which are absent or weak in *S. disedwardsi*, and the dorsal extremity of the united posterior tergal-posteromedian pleural sulci of the first somite reaches the anterior margin of the somite, whereas in *S. disedwardsi* the dorsal end usually does not reach the margin. Also in *S. typica*, the anteromedian pleural sulcus of the first somite is unbroken and that of the second joins the posteromedian, whereas in *S. disedwardsi* the former is often interrupted and the median sulci do not merge; in addition, the posterior tergal sulci of the second and third somites are much longer than in *S. disedwardsi*, in which they terminate considerably dorsal to the base of the respective pleuron. Furthermore, the rostrum of *S. disedwardsi* usually bears two teeth on the dorsal margin posterior to the apical teeth, whereas in *S. typica* it is often armed with only one.

*Sicyonia disedwardsi* differs from *S. penicillata* by the same features of the abdomen that distinguish it from *S. typica*, except that in *S. penicillata* the posterior pleural sulci are more frequently present and slightly better marked than in *S. disedwardsi*. Too, the rostrum of *S. penicillata*, like that of *S. typica*, commonly bears only one dorsal tooth and is less elevated and usually shorter than in individuals of same size of *S. disedwardsi*. The two partly sympatric species can be separated readily by the genitalia. The unusually long distal projections of the dorsolateral and ventrolateral lobules in *S. penicillata* are not exhibited by any other of its congeners. Also, whereas in *S. disedwardsi* the thelycal plate of sternite XIV bears paired low (sometimes indistinct) bulges, in *S. penicillata* it is raised in strongly marked and more striking ones; the posterior component of the median plate of sternite XIII in *S. disedwardsi* exhibits a broad and deep posteromedian emar-

gination flanked by elongate processes and is traversed by a faint suture; in contrast, that of *S. penicillata* possesses a shallow emargination, often bearing a small anteromedian notch, and is traversed by a deep groove.

Long after they have been taken from the water, even after years in alcohol, specimens of this species may be readily recognized by a large ocellus, consisting of a well-defined yellow center surrounded by a broad purplish ring, on the branchiostegite. In *S. penicillata*, as in *S. typica*, the branchiostegite does not bear a large marking.

Burkenroad (1938) indicated that all members of *S. disedwardsi* may be distinguished from those of *S. penicillata* by the shape of the ocular stylets which in the former, according to him, diverge at the tip; they are straight in the latter. I have found, however, that although the stylets are laterally inclined distally in most of the young of *S. disedwardsi*, they are straight in some young and in many adults.

*Commercial importance.*—*Sicyonia disedwardsi*, one of the stubbiest of the rock shrimp occurring in the region, is usually taken with other penaeoids by the shrimp fleets operating in various areas from the Gulf of California to the Golfo de Panamá. Because of its size, it appears to have the potential of providing a fishery as has the similarly heavy *S. brevisrostris* in the western Atlantic.

*Material.*—242 specimens from 54 lots.

Mexico—Baja California Sur: 6♂ 6♀, SIO, 3 km SW of Isla Santa Margarita, 48-57 m, 13 November 1964, *Black Douglas*. 5♂ 6♀, SIO, SW of Isla Santa Margarita, 29-40 m, 13 November 1964, *Black Douglas*. 2♂ 1♀, SIO, NW of Punta Márquez, 37 m, 4 December 1962, H. Perkins and R. Wisner. 12♂ 11♀, SIO, NW of Todos Santos, 38 m, 9 November 1964, *Black Douglas*. 3♂ 1♀, YPM, Bahía San Lucas, 15-29 m, 6 May 1936, *Zaca* stn 135 D-1. 1♀, YPM, Bahía San Lucas, 11-37 m, 6 May 1936, *Zaca* stn 135 D-9. 2♂ 2♀, YPM, off Punta Arena, 92 m, 30 April 1936, *Zaca* stn 136 D-24. 1♀, YPM, off Punta Arena, 82 m, 3 April 1936, *Zaca* stn 136 D-1. 4♂ 2♀, YPM, off Punta Arena, 64 m, 1 May 1936, *Zaca* stn 136 D-30. 3♂ 1♀, USNM, Bahía La Ventana, 24-27 m, 20 April 1939, *Strange* stn 38. 2♂ 1♀, SIO, off Punta Gorda, 81-84 m, 2 July 1965, C. Hubbs. 4♂ 3♀, USNM, Canal de San Lorenzo to Isla del Espíritu Santo, 4 April 1960, R. Mercado and G. Preciado. 2♂ 2♀, SIO, Bahía de la Paz, 55-79 m, 6 July 1965, R. Rosenblatt. 3♂ 9♀, SIO, Canal de

San José, 64 m, 8 July 1965, R. Rosenblatt. 4♂ 10♀, SIO, Punta San Telmo, 10 July 1965, W. Baldwin. 8♂ 6♀, SIO, off W of Isla Monserrate, 92-73 m, 12 July 1965, R. Rosenblatt. 2♂, SIO, Bahía Concepción, 4 February 1940, D. Rouch. 1♂, holotype, YPM, Bahía Concepción, 3 May 1926, *Pawnee*. 2♂ 2♀, USNM, 4-6 m, off Punta Concepción, 12 April 1964, F. Rosales Juárez. 1♀, YPM, Bahía Santa Inés, 50 m, 13 April 1936, *Zaca* stn 143 D-1. 2♂ 1♀, YPM, Bahía Santa Inés, 37 m, 10 April 1936, *Zaca* stn 141 D-4. 1♀, YPM, Bahía Santa Inés, 13-16 m, 10 April 1936, *Zaca* stn 141 D-1. 2♂ 3♀, YPM, Bahía Santa Inés, 50 m, 11 April 1936, *Zaca* stn 142 D-1. 8♂, SIO, off Santa Rosalía, 35-26 m, 25 March 1960, R. Parker. 1♂, SIO, S arm of Bahía de los Angeles, 22-37 m, 26 April 1962, R. Rosenblatt. 2♂ 3♀, AHF, Puerto Refugio, Isla Angel de la Guarda, 38 m, 27 January 1940. Sonora: 1♂ 1♀, USNM, off Estero de Lobos, 47 m, 3 April 1978, Toral García. 1♀, USNM, 8 km off Guaymas, 26 m, April 1980, M. Hatzios. 3♂ 5♀, INP, off Punta Rosa, 56 m, 2 April 1978, Toral García. 6♂ 4♀, USNM, SE of Punta Rosa, 54 m, 1 April 1978, Toral García. Sinaloa: 1♂, USNM, off San Ignacio, 25 May 1962, R. Bush M. 2♂, SIO, Isla de Altamura, 22-31 m, 26 May 1965, *El Golfo II* stn 50-6. 1♀, AHF, off Río San Lorenzo, 11-24 m, 14 February 1940. Nayarit: 1♂ 5♀, AHF, off Isla Isabela, 27-46 m, 9 May 1939. Jalisco: 1♂, SIO, Bahía Chameña, 27-18 m, 2 April 1973, *Agassiz*. Colima: 1♀, CAS, off Manzanillo, 17 July 1932, *Zaca*.

Costa Rica—1♂, AHF, Bahía de Culebra, 5-18 m, 24 February 1934. 2♀, AHF, S of Bahía de Culebra, 18 m, 25 February 1934. 1♀, SIO, Cabo Blanco, 60 m, 18 April 1973, *Agassiz*. 1♂, SIO, Cabo Blanco, 137-145 m, 19 April 1973, C. Hubbs and S. Luke. 1♀, UCR, near Cabo Blanco, 245 m, 28 April 1973, *Enriqueta*. 1♂, UCR, near Cabo Blanco, 249 m, 28 April 1973, *Enriqueta*. 1♂, UCR, near Puerto Quedos, 242 m, 26 April 1973, *Enriqueta*. 1♂, AHF, 5 km off Isla Manuelita, 146 m, 3 June 1973, *Velero IV*. 1♀, AHF, Golfo Dulce, 35-88 m, 26 March 1939, *Velero IV*.

Panama—2♂ 2♀, USNM, Golfo de Panamá, *Canopus* stn 670. 5♂ 11♀, USNM, Golfo de Panamá, *Canopus* stn 126. 2♂ 2♀, UP, Archipiélago de las Perlas, 11 December 1970, J. M. del Rosario. 1♂ 1♀, USNM, Isla San José, 64 m, 23 February 1973, fishermen. 3♂ 1♀, USNM, S of Isla del Rey, 44-42 m, 7 May 1967, *Pillsbury* stn 551. 1♀, AHF, Islas Secas, 46-48 m, 27 March 1939. 1♀, AHF, off Bahía Honda, 55-64 m, 1

March 1938. 5♂ 4♀, UP, between Punta Ave María and Ensenada Guayabo, 14 December 1969, staff Dep. Biol. Mar., UP. 3♂ 1♀, USNM, 12 km NW of Punta Caracoles, staff Dep. Biol. Mar., UP.

*Sicyonia penicillata* Lockington 1879

Figures 30-34

*Sicyonia penicillata* Lockington 1879:164 [syn-types (not extant): "Bolínas Bay (?Bahía de Ballenas), Lower California", 14 fm (fathom) (25.6 m); Angeles Bay (Bahía de los Angeles), Gulf of California, W. J. Fisher]. De Man 1911:112. Pesta 1915:118, fig. 7. Schmitt 1924:387. Brusca 1973:219. Rosales Juárez 1976:41. Rodríguez de la Cruz 1977:10. Anonymous 1980:7. Brusca 1980:256. Rodríguez de la Cruz 1981:1. Mathews 1981:329.

*Eusicyonia penicillata*. Boone 1930:115 [part], pl. 36. Burkenroad 1934a:88, figs. 30, 31, 33, 1938:93. Steinbeck and Ricketts 1941:444. Castro 1966:17 [part]. Word and Charwat 1976:22, 2 figs.

*Eusicyonia* sp. Castro 1966:16, 17 [part], fig. 4.

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 two teeth posterior to level of hepatic spine. Rostrum armed with two dorsal teeth (rarely one). Petasma with distal projection of dorsolateral lobule acicular, long and slender. Thelycum with plate of sternite XIV raised in strong bulges; posterior component traversed by deep groove. Branchiostegite with moderately large purplish brown spot bearing poorly defined yellow center.

*Description*.—Body robust (Fig. 31). Carapace studded with long setae anteroventral to hepatic spine and pterygostomian region; patches of densely set shorter setae present on dorsum, in depression anterior to posterodorsal part of branchiocardiac carina, on branchiostegite and along hepatic sulcus; patches also on tergum of abdominal somites and in lateral depression of sixth somite. Abdomen with numerous tubercles on first three somites, fewer on last three.

Rostrum short, not surpassing distal margin of eye, its length increasing linearly with carapace length (Fig. 32) but proportionately longer in young (0.30-0.12 cl); usually straight but occasionally curved, subhorizontal or elevated as much as 45°; tapering, sometimes considerably, from base to truncate tip; and armed with one dorsal (rarely 2) and two (96%) or three (4%) apical teeth. Adros-

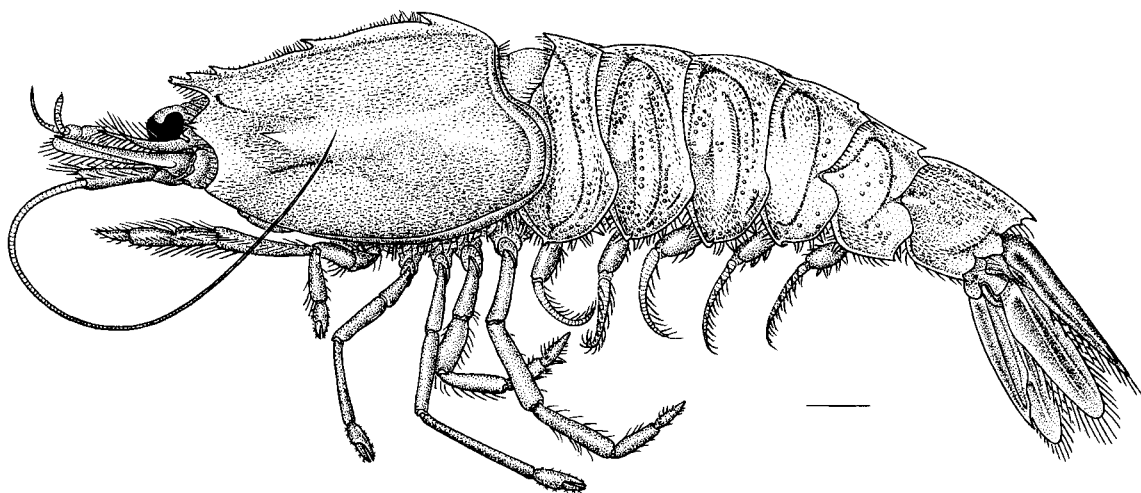


FIGURE 31.—*Sicyonia penicillata* Lockington, ♀ 23 mm cl, west of Punta Tasca, Isla Santa Margarita, Baja California Sur, Mexico. Lateral view. Scale = 5 mm.

tral carina, situated distinctly dorsal to ventral margin, strong and extending to end of rostrum.

Carapace with well-marked postrostral carina bearing three teeth: 1) epigastric tooth small, only slightly larger than first rostral, situated opposite (rarely) to  $<0.1$  cl posterior to orbital margin; 2) middle tooth, larger than epigastric, sharp, placed well posterior to hepatic spine, between 0.33 and 0.40 (mean 0.36) cl from orbital margin; and 3) posterior tooth, larger than middle tooth, acutely pointed, rising almost vertically with only apical part inclined anteriorly or so inclined throughout, and situated between 0.70 and 0.77 (mean 0.74) cl from orbital margin; tuft of setae present at anterior base of all three teeth. Postrostral carina low anterior to middle tooth, high between middle and posterior one, and descending gradually from latter to posterior margin of carapace. Antennal spine relatively long, sharp, and projecting from short buttress; hepatic spine acutely pointed, larger than antennal, arising from moderately raised area between 0.20 and 0.26 (mean 0.22) cl from orbital margin. Postocular sulcus short but deep, continuing as shallow groove; hepatic sulcus well marked; branchiocardiac carina usually low (sometimes barely distinct) but occasionally quite prominent and long, extending to bifurcation near posterior margin of carapace, short branch curving dorsally and longer one ventrally.

Ocular stylet with terminal part straight or, occasionally, turned laterally.

Antennular peduncle with stylocerite produced in long spine nearly or quite reaching mesial base

of distolateral spine; latter slender and sharp, extending as far as proximal 0.70 of second antennular article; antennular flagella short, with maximum length of 0.20-0.30 cl, in juveniles and young adults mesial flagellum slightly shorter than lateral one but in larger adults subequal to or slightly longer.

Scaphocerite reaching distal margin of antennular peduncle or overreaching it by no more than 0.10 of its own length; lateral rib ending distally in sharp spine distinctly surpassing margin of lamella. Antennal flagellum 2.4-2.7 times cl in young, and as much as 2.0 times in larger adults.

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

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

Anterior margin of pleuron of first abdominal somite almost straight; anteroventral extremity of pleuron of first through fourth somites ending in spine, that of first directed anteroventrally but that of second usually curved posterolaterally, resembling strong spines on third and fourth somites; posteroventral margin of first through third somites convex, on fourth broadly angular, and on fifth and sixth sharply so and armed with small caudally directed spine. Pleural spination of first four somites barely, if at all, distinct in juveniles, becoming stronger with increasing length of carapace.

First somite marked by long, anteromedian pleural sulcus converging with united posterior tergal-posteromedian pleural sulci ventrally, dorsal extremity of tergal reaching anterior margin of somite; posterior pleural sulcus weak, but usually clearly distinct. Second and third somites with anterior and posterior tergal sulci long, almost reaching base of pleuron; anteromedian pleural sulcus deep, continuous with anteroventral depression setting off elongate prominence dorsally and ridge posteriorly; posteromedian pleural sulcus also long, extending anterodorsally subparallel to posterior tergal sulcus; shallow posterior pleural sulcus commonly present in both somites. Fourth and fifth somites with anterior tergal and curved, united posterior tergal-posteromedian pleural sulci merging dorsally. Sixth somite marked by arched posteromedian pleural sulcus and bearing longitudinal ridge along base of dor-

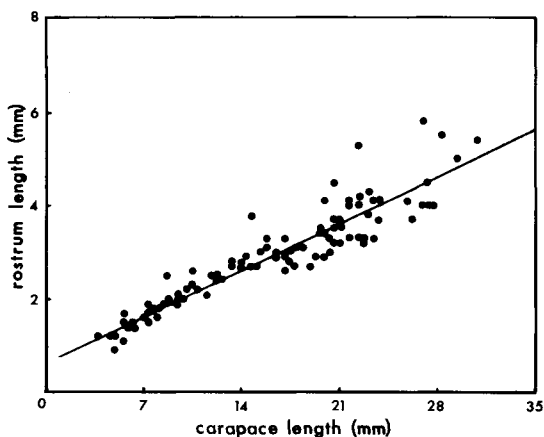


FIGURE 32.—*Sicyonia penicillata*. Relationship between rostrum length and carapace length (regression equation,  $y = 0.65537 + 0.13963x$ ).

somedian carina delimited ventrally by depression lying just dorsal to well-defined cicatrix.

Telson with pair of small but well-developed fixed spines. Rami of uropod subequal in length and falling slightly short of or overreaching apex of telson by no more than 0.10 its own length.

Petasma (Fig. 33A, B) with short distal plate of dorsomedian lobule bearing distolaterally small, scalelike process bent inwardly (posterovertrally). Projection of distolateral lobule acicular, extremely long, about 0.75 as long as body of lobule, with heavily sclerotized triangular plate proximodorsally and flexible flagellum arising from ventrolateral surface; flagellum long, reaching between 0.60 and 0.75 length of projection from level of apex of triangular plate. Projection of ventrolateral lobule also long, about half length of acicular projection, blade-like and flexible, except for sclerotized tip curving proximally.

Petasmal endopods coupled in males with carapace length as little as 5.5 mm, about 22 mm tl, but sometimes unjoined in individuals with carapace length as much as 11 mm, about 39 mm tl.

Appendix masculina as illustrated in Figure 33C.

Thelycum (Fig. 34) with plate of sternite XIV raised in paired, well-marked, elongate bulges sloping toward deep, narrow, median depression. Median plate of sternite XIII lanceolate, tapering gradually into slender spine reaching as far as proximal 0.20 of basis of extended second pereopods; posterior component with relatively shallow posteromedian emargination (occasionally replaced by longitudinal incision) often forming small notch anteriorly, and flanked by short, rounded, posterolateral processes marked basally by deep transverse suture. Sternite XI armed posteriorly with pair of broad based, acute spines. Posterior thoracic ridge with anteromedian margin sharp and raised (ventrally), its lateral margins usually well marked, occasionally flush with plate of sternite XIV.

The smallest impregnated female encountered has a carapace length of 8.5 mm, about 33 mm tl.

*Color*.—Available information based on specimens that had been recently caught in the Gulf of California is limited to a purplish brown spot, with a yellow center not sharply defined, posteroventral to the hepatic spine; sometimes the entire spot is purplish brown (Anonymous 1980). Lock-

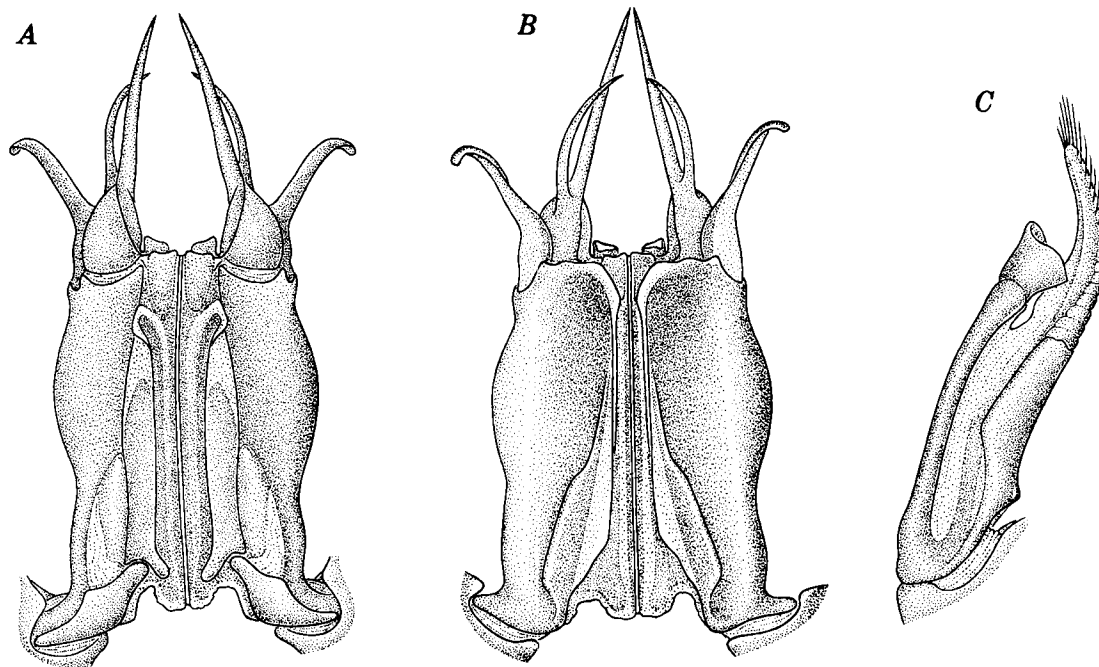


FIGURE 33.—*Sicyonia penicillata*, ♂ 21.5 mm cl, west of Punta Tasca, Isla Santa Margarita, Baja California Sur, Mexico.

A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scale = 1 mm.



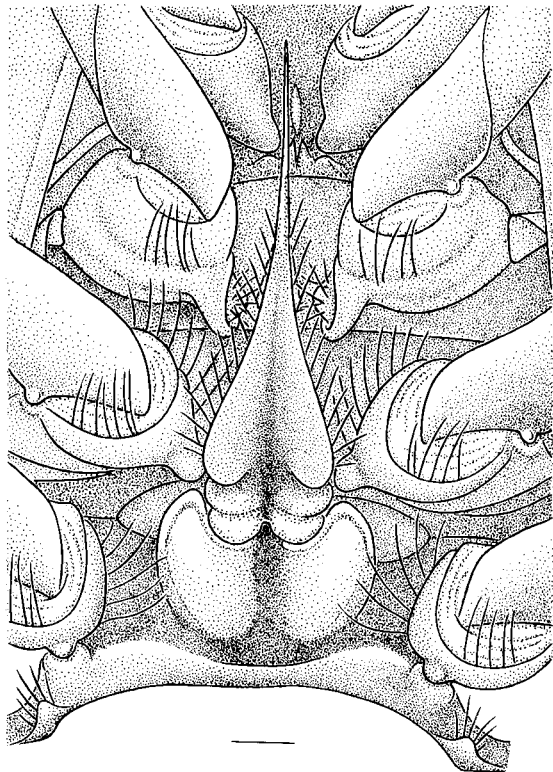


FIGURE 34.—*Sicyonia penicillata*, ♀ 23 mm cl, west of Punta Tasca, Isla Santa Margarita, Baja California Sur, Mexico. Thelycum. Scale = 1 mm.

ington (1879) noted that "Color after two weeks exposure to alcohol, bright red; with a dark red-brown ocellated spot on each side of the carapace. Antennae bluish." In many of the preserved specimens that I have studied, the ocellus appears as a dark circle.

*Maximum size.*—Males 32 mm cl, about 103 mm tl; females 35 mm cl, about 110 mm tl.

*Geographic and bathymetric ranges.*—From southwest of Punta Canoas (29°20'N, 115°02'W), Baja California Norte, Mexico (Fig. 30), southward to Bahía San Lucas, and in the Gulf of California, from the northern end to Bahía Concepción on the west and northern Sinaloa on the east; it seems to be absent from the southernmost part of the Gulf. It has also been found off Puntarenas (9°58'N, 84°50'W), Costa Rica (Boone 1930). This species occurs at depths between 0.60 and 180 m (latter by Boone 1930), mostly at 35-70 m. It has been recorded on sand (fine or coarse) and

mud substrates that are sometimes densely covered with algae.

*Discussion.*—The closest affinities of *S. penicillata* seem to be with *S. disedwardsi* from which it differs most conspicuously in features of the petasma. The extremely long, slender, distal projections of both the dorsolateral (which bears a lateral flagellum) and ventrolateral lobules are far different from the short, stout, and simple projections of the petasma of *S. disedwardsi*, as well as from those of all other species of *Sicyonia*. These two species also exhibit significant thelycal differences. In the thelycum of *S. penicillata* the lateral bulges of the plate of sternite XIV are well defined; the posteromedian emargination of the median plate of sternite XIII is shallow (occasionally replaced by a longitudinal incision), often bears an anterior notch, and is flanked by short posterolateral processes marked basally by a conspicuous transverse groove. In the thelycum of *S. disedwardsi* the bulges are low, often indistinct, the posteromedian emargination of the median plate of sternite XIII is broad and deep, lacks a notch, and is flanked by relatively elongate posterolateral processes which are delimited anteriorly by a weak suture.

The following characters are also helpful but somewhat less reliable for distinguishing between the two species. In *S. penicillata* the rostrum is armed with only one tooth (rarely two) on the dorsal margin, instead of two as in *S. disedwardsi*; the stylocerite reaches the mesial base of the distolateral spine of the first antennular article, whereas in the latter species it often falls short of the base; the dorsal extremity of the united posterior tergal-posteromedian pleural sulci of the first abdominal somite reaches the anterior margin of the somite, whereas in *S. disedwardsi* often it does not; and the clearly defined although shallow posterior pleural sulci are usually present on the first three abdominal somites of *S. penicillata* but are quite weak or, more often, lacking on some or all of the latter.

Fresh material of this shrimp may be identified by a purplish brown spot on the branchiostegite, sometimes bearing a yellow center with diffuse border.

Burkenroad (1934a) presented a detailed discussion of the differences between *S. penicillata* and the western Atlantic *S. typica* (as *Sicyonia edwardsii* Miers, 1881). These species, which share among other characters three teeth on the post-rostral carina and usually one dorsal and two api-

cal rostral teeth, differ strikingly in other features. In *S. typica* the sculpture of the abdomen is stronger than that in the eastern Pacific shrimp, exhibiting a long and deep posterior pleural sulcus on the first four somites instead of ones that are weak or even obsolete, and the telsonic spines are quite inconspicuous, rather than being well developed as they are in *S. penicillata*. Also, in *S. typica* the petasma lacks long slender distal projections as well as accessory flagella, the thelycal plate of sternite XIV is almost flat laterally instead of elevated in strong bosses, and the posteromedian emargination of the posterior component of the median plate is quite broad rather than narrow or even reduced to a longitudinal incision as it is in *S. penicillata*.

*Remarks.*—The types of this species were destroyed in the San Francisco earthquake and fire of April 1906 as were all of Lockington's types which had been deposited at the California Academy of Sciences (Dunn 1982). The locality of one of the syntypes, the one Lockington described in detail, "Bolinás Bay, Lower California," is uncertain. The NIS Gazetteer (Office of Geography, Department of the Interior, 1956) does not include any place or geographic feature under "Bolinás". On the west coast of Baja California Sur is Bahía de Ballenas or "Ballenas Bay" (NIS Gazetteer, p. 50), at 26°45'N, 113°26'W, and it is quite possible that the name of this locality was misspelled on the label accompanying the syntype or that Lockington misread and transcribed it as "Bolinás Bay". There is a bay by this name at 37°53'36"N, 122°39'54"W, in Marin County, California; however, I am inclined to think that Bahía de Ballenas actually is the place where the specimen was obtained because it is well within the range of the species, whereas Bolinás Bay is not only outside "Lower California" but also far beyond the known northern limit of this shrimp—southwest of Punta Canoas, Baja California Norte.

*Commercial importance.*—There is a fishery for rock shrimp in the northern half of the Gulf of California, and the catches are believed to consist largely of *S. penicillata* a very abundant species in that area. This fishery in 1979-80 produced 1,426,541 kg, but in 1981-82 (data recorded in Guaymas by the Instituto Nacional de Pesca, Mexico), the last year for which landings are available, the production declined sharply to 187,786 kg; fishing for rock shrimp is only seasonal, from February to June, with maximum

catches being obtained during March and April (Concepción Rodríguez de la Cruz see footnote 2).

*Material.*—939 specimens from 56 lots.

Mexico—Baja California Norte: 2♀, SIO, SW of Punta Canoas (29°20'N, 115°02'W), 40 m, 6 September 1952, K. S. Norris. 1♂ 2♀, SIO, Bahía Playa María, 11 m, 1 April 1952, K. S. Norris. 3♀, SIO, Bahía Sebastián Vizcaíno, surface, 17 August 1952, *Spencer F. Baird*. 1♂, YPM, E of Isla Cedros, 1-73 m, *Zaca* stn 126D-3. 4♀, SIO, Bahía Sebastián Vizcaíno, 0-2 m, 14 August 1952, K. S. Norris. Baja California Sur: 3♂, SIO, Bahía Sebastián Vizcaíno, 55 m, 11 August 1952, K. S. Norris. 1♂, SIO, E of entrance to Laguna Ojo de Liebre, 2 m, 16 August 1952, K. S. Norris. 7♂ 5♀, SIO, Bahía Tórtolo, 31 March 1962, H. C. Perkins. 1♂ 2♀, SIO, E of Punta Asunción, Bahía Asunción, 15 m, 24 March 1951, R. Wisner and K. S. Norris. 6♂ 9♀, SIO, Bahía Asunción, 40-44 m, 17 November 1964, *Black Douglas*. 13♂ 11♀, SIO, Bahía Asunción, 68-64 m, 17 November 1964, *Black Douglas*. 11♂ 14♀, SIO, Laguna San Ignacio, 1.5 m, 11/12 February 1950, C. Hubbs. 3♂ 8♀, SIO, Bahía de Ballenas, 18 m, 14 February 1948, *Scripps*. 43♂ 50♀, SIO, SE of Punta Abreojos, 55-59 m, 17 November 1964, *Black Douglas*. 24♂ 22♀, SIO, W of Punta Pequeña, 37-40 m, 16 November 1964, *Black Douglas*. 26♂ 21♀, SIO, off Punta Pequeña, 55-51 m, 16 November 1964, *Black Douglas*. 4♂ 10♀, SIO, WSW of Punta Pequeña, 68-73 m, 16 November 1964, *Black Douglas*. 7♂ 5♀, SIO, NW of Santo Domingo del Pacífico, 45-40 m, 19 April 1969, D. Dockins. 26♂ 39♀, SIO, 15 km WSW of Boca de las Animas, 55-57 m, 16 November 1964, *Black Douglas*. 2♂ 3♀, SIO, S of Boca de las Animas, 137 m, 29 January 1964, C. Hubbs. 13♂ 7♀, SIO, between Boca de Santo Domingo and Boca de Soledad, 12 m, 5 February 1964, A. Stover and B. Zahuranec. 1♀, USNM, Boca de Soledad, 26 April 1964, H. Chapa. 1♀, SIO, channel N of Bahía Magdalena, 6 m, 30 January 1964, A. Stover and B. Zahuranec. 48♂ 44♀, SIO, NW of Isla Santa Magdalena, 73 m, 15 November 1964, *Black Douglas*. 3♂ 3♀, SIO, Bahía Santa María, 0-36 m, 8 December 1962, H. C. Perkins. 1♂ 1♀, SIO, Bahía Magdalena, 42-44 m, 29 November 1962, F. H. Berry. 1♀, USNM, Bahía Magdalena, surface, 10 July 1953. 14♂ 9♀, SIO, Bahía Magdalena, 37-40 m, 24 August 1960, F. H. Berry. 8♂ 6♀, YPM, Bahía Magdalena, 0.6-0.9 m, 1936, *Zaca* [unnumbered stn]. 1♀, AHF, Bahía Magdalena, between mainland and Punta Redonda, 15 m, 5

February 1974, *H. G. Moser* stn 13. 7♂, SIO, off Bahía Magdalena, 88 m, 3 February 1964, C. Hubbs. 5♂ 6♀, SIO, Bahía Almejas, 21-24 m, 11 November 1964, *Black Douglas*. 50♂ 50♀, SIO, SW of Isla Santa Margarita, 29-40 m, 13 November 1964, *Black Douglas*. 40♂ 40♀, SIO, 3 km SW of Isla Santa Margarita, 46-57 m, 13 November 1964, *Black Douglas*. 18♂ 8♀, SIO, SW of Isla Santa Margarita, 75-80.5 m, 13 November 1964, *Black Douglas*. 1♂ 5♀, SIO, SW of Isla Santa Margarita, 88-90 m, 13 November 1964, *Black Douglas*. 3♂ 2♀, SIO, W of Punta Tasca, Isla Santa Margarita, 7 July 1955, *Andrés* stn 143. 1♀, SIO, 11 km NW of Punta Márquez, 55 m, F. H. Berry. 2♀, SIO, 14.5 km WNM of Punta Márquez, 92 m, 4 December 1962, F. H. Berry. 1♂, YPM, Bahía San Lucas, 11-37 m, 6 May 1936, *Zaca* stn 135D-11, 12. 1♂, SIO, Bahía Santa Inés, 40-82 m, 14 July 1965, C. Hubbs. 34♂ 22♀, YPM, Bahía Concepción, 3 May 1926, *Pawnee*. 7♂ 2♀, SIO, off Santa Rosalía, 35-36 m, 25 March 1960, R. Parker. Baja California Norte: 1♂ 5♀, SIO, S arm of Bahía de los Angeles, 22-37 m, 26 April 1962, R. Rosenblatt. 5♂ 15♀, YPM, Bahía de los Angeles, 31-46 m, 13 May 1926, *Pawnee*. 1♂ 6♀, SIO, off San Felipe, 2 April 1973, C. Farwell. 4♂ 2♀, YPM, Bahía San Felipe, 19 May 1926, *Pawnee*. 6♂ 5♀, USNM, near northern end of Gulf of California, 9-18 m, February 1949, B. W. Walker. Sonora: 1♂ 1♀, USNM, Bahía de Adair, 46 m, 5 April 1968, Toral-García. 2♂ 3♀, USNM, Bahía de Adair, 29 m, 5 April 1978, Toral-García. 5♂ 13♀, USNM, off Bahía de San Jorge, 26 March 1967, shrimp trawler. 2♂ 1♀, INP, N of Guaymas, 26 April 1961, H. Chapa. 1♂, AHF, Bahía de Guaymas, 4-6 m, 22 January 1940. 1♀, SIO, Bahía de Guaymas, 22 March 1939, M. W. Johnson. 2♂, SIO, Bahía de Guásimas, 32 km S of Guaymas, April 1968, D. Hoese. Sinaloa: 1♂ 1♀, USNM, off Sinaloa, H. Chapa.

*Sicyonia affinis* Faxon 1893

Figures 35-38

*Sicyonia affinis* Faxon 1893:209 [syntypes: 1♂ 1♀, MCZ 4637, off Isla del Coco, Costa Rica, 5°31'30"N, 86°52'30"W, 100 fm (183 m), 28 February 1891, *Albatross* stn 3367; 1♂, USNM 21169, off Isla del Coco, Costa Rica, 5°32'45"N, 86°55'20"W, 52 fm (95 m), 28 February 1891, *Albatross* stn 3369; 2♀, USNM 21170, W of Isla de Malpelo, Colombia, 3°58'20"N, 81°36'00"W, 112 fm (205 m), 5 March 1891, *Albatross* stn 3378. 1♀, MCZ 4638, W of Isla de Malpelo, Co-

lombia, 3°59'40"N, 81°35'00"W, 52 fm (95 m), 5 March 1891, *Albatross* stn 3379]. Faxon 1895:179, pl. 46, fig. 1, 1a-c. A. Milne Edwards and Bouvier 1909:244. De Man 1911:112. ?Chapa Saldaña 1964:9. Chirichigno Fonseca 1970:7, fig. 5. ?Rodríguez de la Cruz 1977:12. Arana Espina and Méndez G. 1978:23, fig. 1-5. Méndez G. 1981:47, pl. 9, fig. 75-77. Pérez Farfante and Boothe 1981:424.

*Eusicyonia affinis*. Burkenroad 1934a:93, 1934b:126, 1938:84, fig. 24. Anderson and Lindner 1945:317.

*Sicyonia penicillata* Boone 1930:115 [part]. [Not *Sicyonia penicillata* Lockington 1879.]

*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 forming high crest behind posterior tooth. Rostrum short, not overreaching distal margin of eye. Abdomen lacking tubercles; second and third somites lacking inverted V-shaped ridges laterally; fifth somite with dorsomedian carina lacking tooth or sharp angle at posterior end. Petasma with distal projection of dorsolateral lobule compressed distally, its truncate tip produced dorsally in simple, minute spine. Thelycum with plate of sternite XIV without anteromedian tubercle and raised in paired low, but well-defined bulges. Branchiostegite lacking large mark.

*Description*.—Body relatively slender (Fig. 35) and lacking tubercles. Carapace studded with numerous short setae, those on anterior part of dorsum forming dense patches. First five abdominal somites with paired broad patches of short setae flanking dorsomedian carina; sixth with one in dorsolateral depression.

Rostrum short, reaching only as far as distal margin of eye, its length 0.25-0.35 cl; upturned to angle between 10° and 40°; armed with two dorsal teeth and three minute apical teeth; latter disposed on truncate apex with ventralmost one either terminal or subterminal; first dorsal tooth located distinctly anterior to orbital margin, second tooth situated at about anterior 0.25 cl of rostrum. Conspicuous adrostral carina, subparallel and distinctly dorsal to ventral margin, extending almost to end of rostrum.

Carapace with well-marked postrostral carina bearing two teeth; epigastric tooth, situated

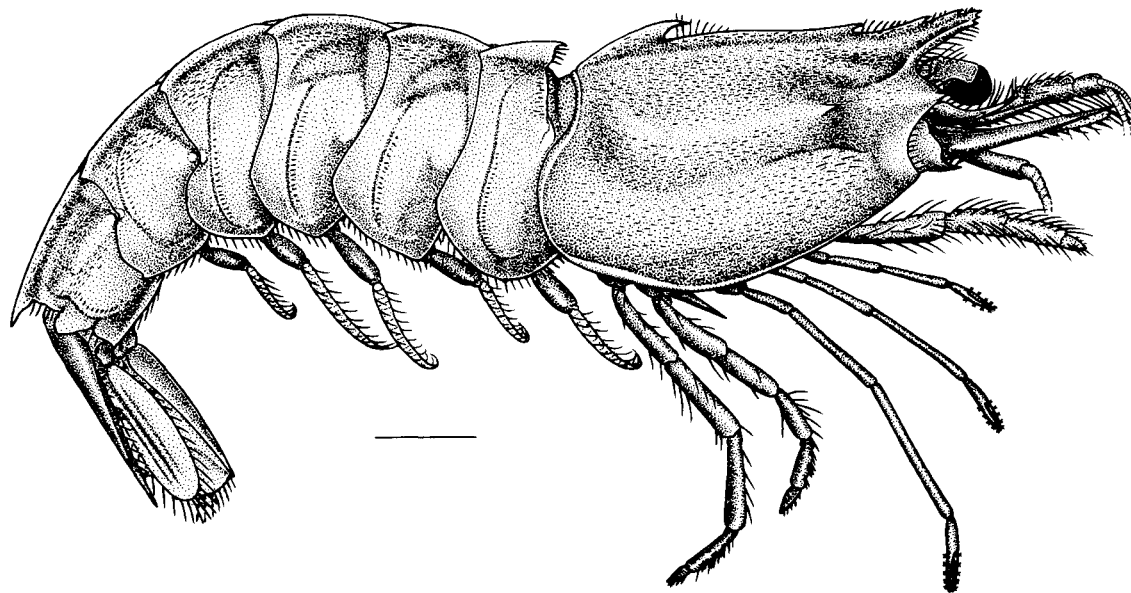


FIGURE 35.—*Sicyonia affinis* Faxon, ♀ 17 mm cl, 4.4 km off Isla Manuelita, Costa Rica. Lateral view. Scale = 5 mm.

slightly anterior to level of hepatic spine at about 0.15 cl from orbital margin, small, subequal to, or only slightly larger than first rostral tooth; and large posterior tooth, considerably larger than epigastric, hooklike, with apical portion acutely pointed and slightly curved anteriorly; tooth placed distinctly in advance of posterior margin of carapace, between 0.65 and 0.75 (mean 0.67) cl from orbital margin. Postrostral carina low anteriorly forming high crest descending gently from posterior tooth to posterior margin of carapace. Tuft of setae present at anterior base of each tooth. Antennal spine small, sharp, projecting from weakly developed buttress; hepatic spine moderately long and acutely pointed, situated at 0.20-0.25 (mean 0.22) cl from orbital margin; hepatic sulcus almost horizontal, accompanying inconspicuous carina; branchiocardiac carina broad, low, longitudinally disposed except for posterior part curving dorsally near posterior margin of carapace.

Antennular peduncle with stylocerite long, almost reaching level of mesial base of distolateral spine, its length about 0.95 distance between lateral base of first antennular article and mesial base of distolateral spine; latter reaching as far as distal 0.25 of second antennular article, antennular flagella short, mesial one more slender and longer, about 0.20 cl, than lateral, 0.16 cl.

Scaphocerite extending to distal end or slightly overreaching antennular peduncle; lateral rib produced distally in long, strong spine, surpassing margin of lamella. Antennal flagellum incomplete in specimens examined.

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

Abdomen with strongly marked dorsomedian carina extending from first through sixth somites, carina on first somite produced anteriorly in strong tooth (slightly more elevated than posterior tooth on carapace), its anterior margin subvertical but apical extremity slightly curved anteriorly; carina deeply cleft posteriorly on first five somites, on fourth and fifth not truncate but sloping gradually to apex of cleft, and on that of sixth somite produced in large, acute, posterior tooth.

First four somites with rounded or broadly angular anteroventral extremity unarmed; fourth somite with posteroventral extremity rounded and lacking spine, and that of fifth and sixth somites bearing minute spine.

First somite marked with short, weak, anteromedian pleural sulcus, its length slightly  $< 0.2$  distance from origin (emargination on anterior margin) to ventral margin of pleuron; united posterior tergal-posteromedian sulci relatively shallow. Second and third somites with weak anterior and posterior tergal sulci joining anterodorsally;

anteromedian pleural sulcus short, extending from slightly below midheight of somite to near ventral margin; posteromedian pleural sulcus with faint dorsal extension directed anteriorly at about 0.33 height of somite from dorsomedian line and just ventral to weak crescent-shaped ridge (latter delimited dorsally by tergal sulcus). Fourth somite with anterior tergal sulcus shallow and posterior tergal and posteromedian pleural sulci coalescent, extending from near base of dorsal carina to curve anteriorly near ventral margin. Fifth somite with united posterior tergal-posteromedian pleural sulci ending well above ventral margin. Sixth somite with strongly arched posterior pleural sulcus and low longitudinal ridge situated between base of middorsal carina and setose depression lying dorsal to weak cicatrix.

Telson with very weak median sulcus and bearing pair of small, fixed subterminal spines. Both rami of uropod extending as far as apex of telson or surpassing it by as much as 0.2 of their own lengths.

Petasma (Fig. 36A, B) 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 acutely produced in acute salient. Distal projection of ven-

trolateral lobule fleshy, with terminal part flattened (dorsal surface not bulbous) and curving dorsally.

Appendix masculina as illustrated in Figure 36C.

Thelycum (Fig. 37) with plate of sternite XIV, delimited by arched or straight lateral edges, rounded anteriorly, its surface raised in low, ovoid bulges separated by broad, median depression. Median plate of sternite XIII flask-shaped in outline, tapering gradually into long, slender spine reaching between midlength of coxae and proximal extremity of bases of second pereopods; plate incised and excavate at level of coxae of fourth pereopods; posterior component of plate with shallow posteromedian emargination. Sternite XI armed with paired short spines. Posterior thoracic ridge with concave anteromedian margin slightly overlapping plate of sternite XIV, ridge then flush with, or separated by shallow, transverse depression from sternite XIV.

*Color*.— "...light greenish yellow, banded with vermilion on the branchial regions and abdomen. Appendages red, antennary flagellum transversely banded with light and dark" (Faxon 1893).

*Maximum size*.— In the meager material avail-

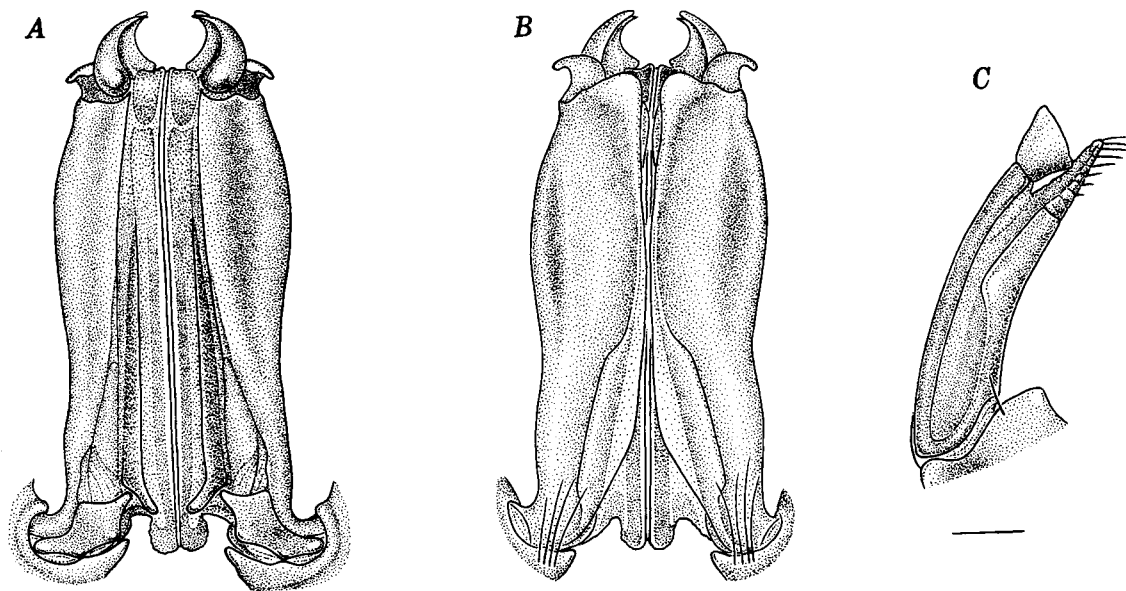


FIGURE 36.—*Sicyonia affinis*, ♂ 21.5 mm cl, 4.4 km off Isla Manuelita, Costa Rica. A, Petasma, dorsal view; B, ventral view of same; C, right appendix masculina, dorsolateral view. Scales = 1 mm.