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. brevirostris* 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 brevirostris* 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 panaeoid 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 information 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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Manuscript accepted April 1984.
FISHERY BULLETIN: VOL. 83, NO. 1, 1985.

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

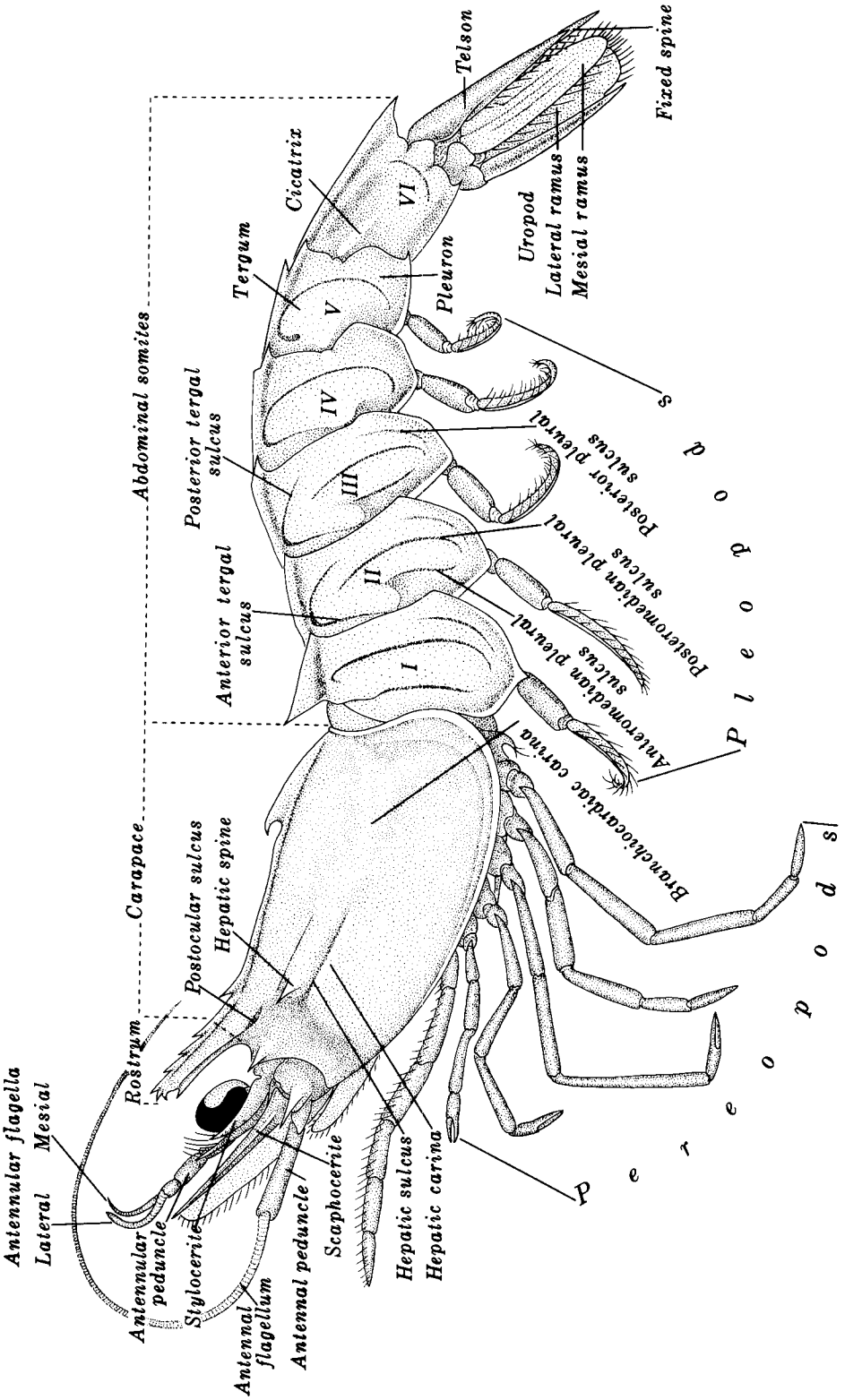
Sicyonia H. Milne Edwards 1830:339 [type-species, by monotypy: *Sicyonia sculpta* H. Milne Edwards 1830:340 (= *Cancer carinatus* Brünnich 1768:102)]. H. Milne Edwards 1837:408. De Haan 1849:187. Heller 1863:290. Bate 1888:292. A. Milne Edwards and Bouvier 1909:243. Balss 1914:14. Burkenroad 1945:1. 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 pterygostomian 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; prosartema (Fig. 4*F-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. 4*A*) three-jointed, proximal article small and short, distal article large, much larger than penultimate one, and roughly


Antennular flagella
Lateral
Mesial
Antennular peduncle
Stylocerite
Antennal flagellum
Antennal peduncle
Scaphocerite
Hepatic sulcus
Hepatic carina
Rostrum
Carapace
Postocular sulcus
Hepatic spine
Abdominal somites
Anterior tergal sulcus
Posterior tergal sulcus
Tergum
Cicatrix
Telson
Fixed spine
Uropod
Lateral ramus
Mesial ramus
Pleuron
Posterior pleural sulcus
Posteromedian pleural sulcus
Anteromedian pleural sulcus
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I
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Pleopods
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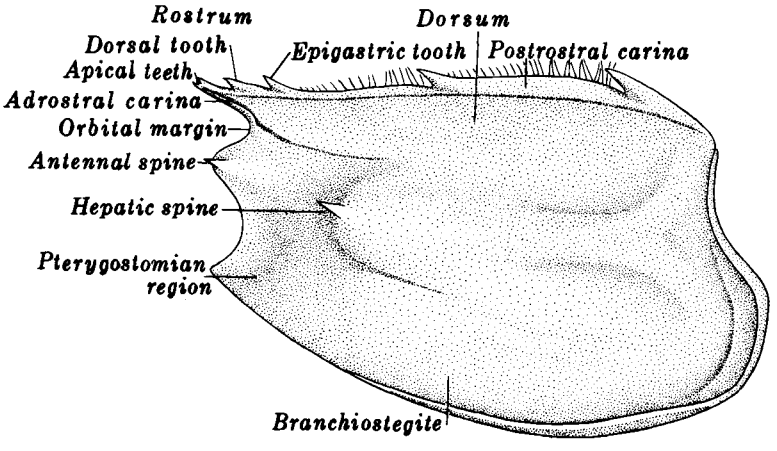


FIGURE 2.—Lateral view of carapace of *Sicyonia* showing terms used in descriptions.

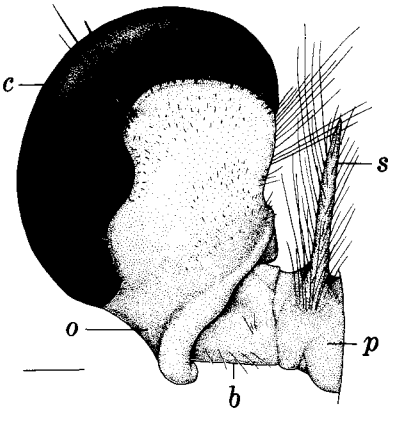


FIGURE 3.—*Sicyonia disedwardsi* Stimpson, ♀ 30 mm cl, Golfo de Panamá, Panama. Eye, dorsal view: *b*, basal article; *c*, cornea; *o*, optic calathus; *p*, ocular plate; *s*, ocular stylet. Scale = 1 mm.

trapezoidal; first maxilla (Fig. 4*B*) with broad palp unjointed and not produced distally; second maxilla (Fig. 4*C*) with basipodite lacking proximal gnathal lobule; first maxilliped with flagellum quite short (Fig. 4*D*); second maxilliped as illustrated (Fig. 4*E*). 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. 5*A*) 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. 5*B*) 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)

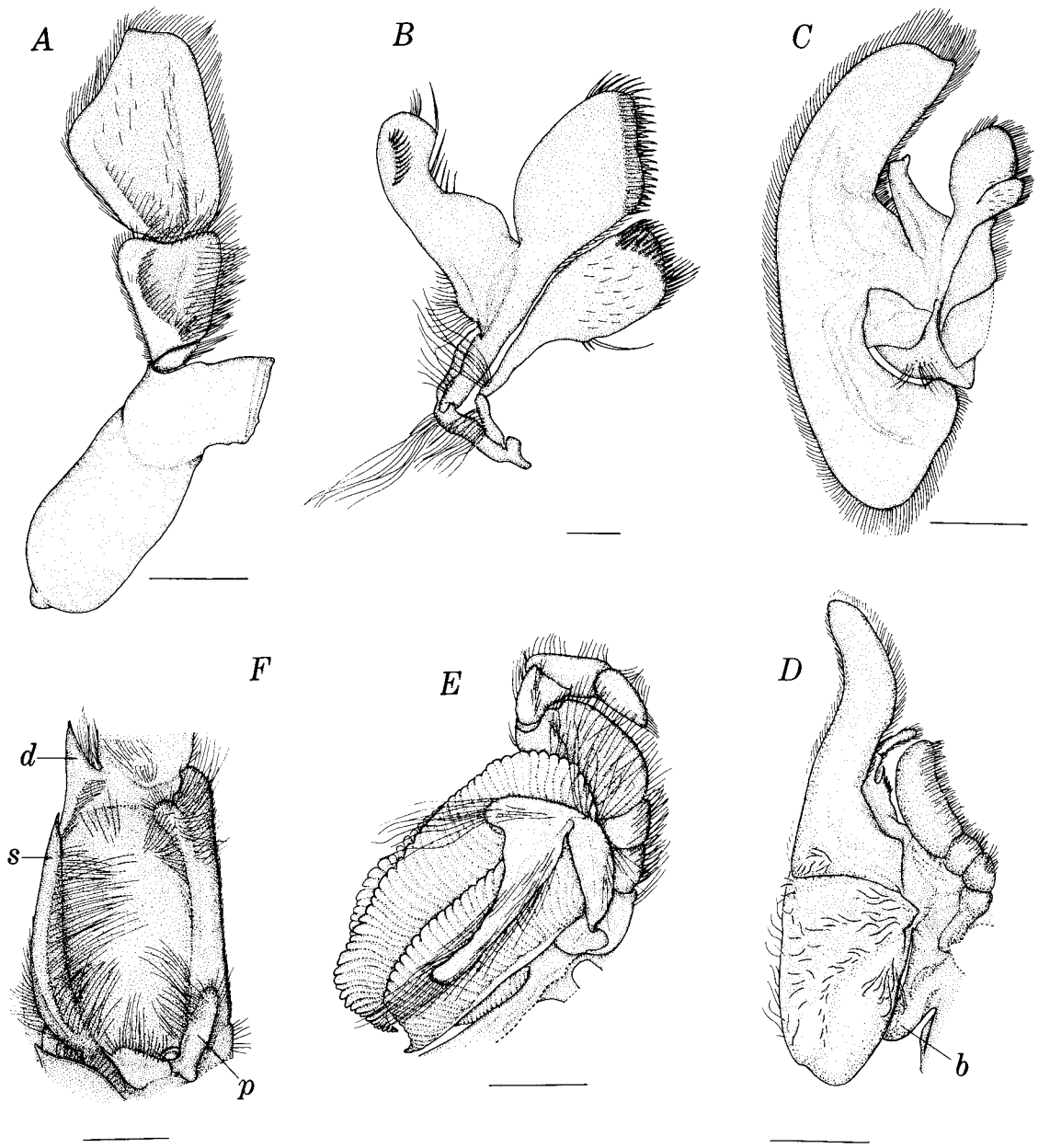


FIGURE 4.—*Sicyonia ingentis* (Burkenroad 1938), ♀ 38 mm cl, off Bahía de San Quintín, Baja California Norte, Mexico. *A*, Mandible. *B*, First maxilla. *C*, Second maxilla. *D*, First maxilliped—*b*, branchial rudiment (arthrobranchia). *E*, Second maxilliped. *F*, First article of antennular peduncle—*d*,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

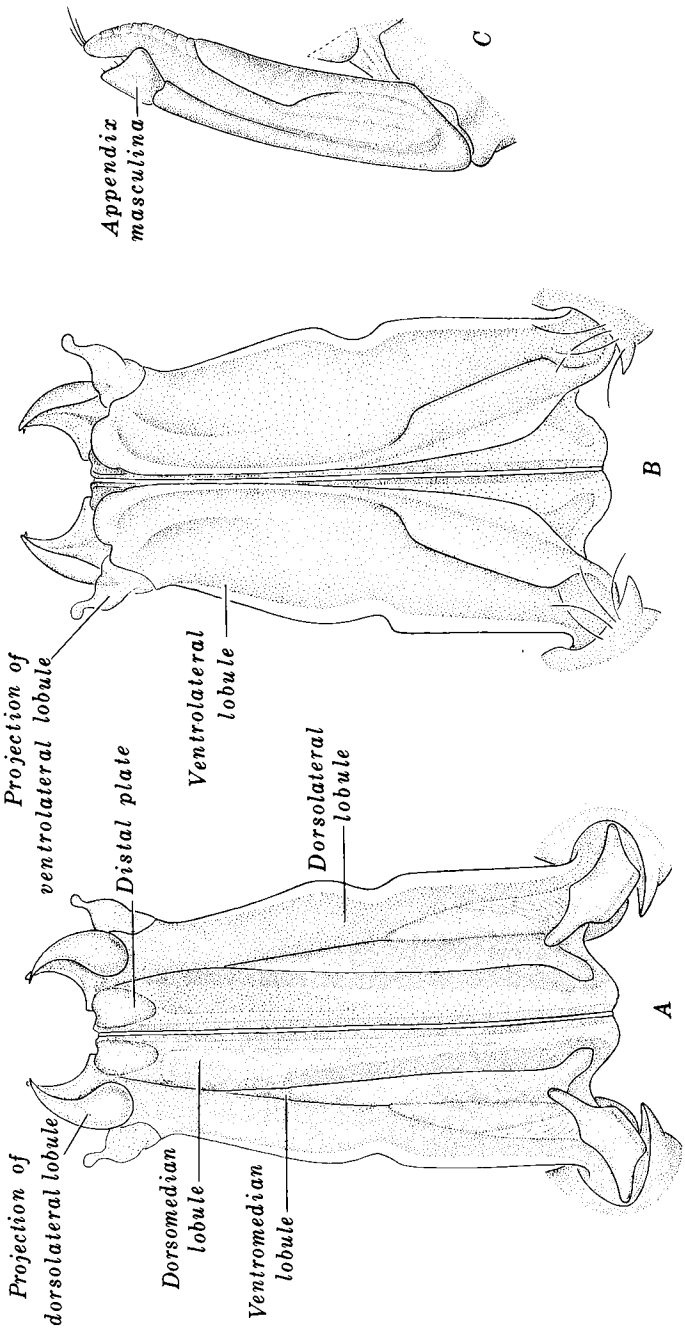


FIGURE 5.—*Sicyonia disparri* (Burkenroad 1934), ♂ 6 mm cl, Canal de San Lorenzo, Baja California Sur, Mexico. *A*, Dorsal view of petasma showing terms used in descriptions; *B*, ventral view of same; *C*, dorsolateral view of appendix masculina on second pleopod.

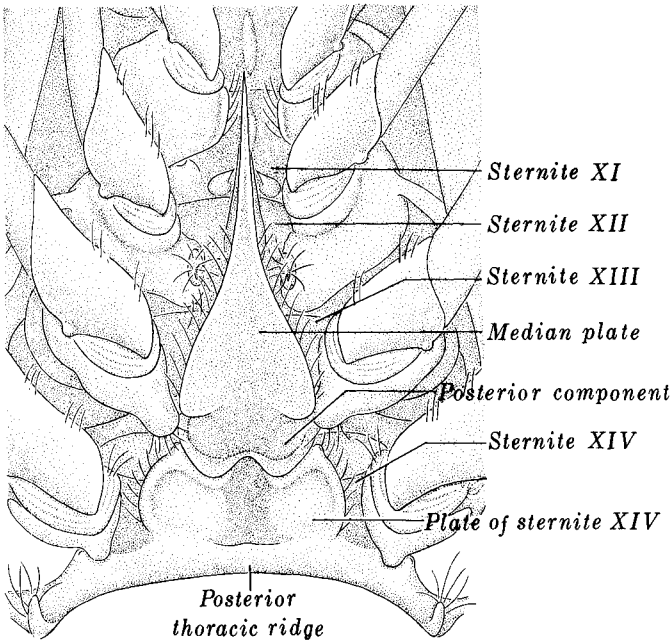


FIGURE 6.—Thelycum of *Sicyonia* showing terms used in descriptions.

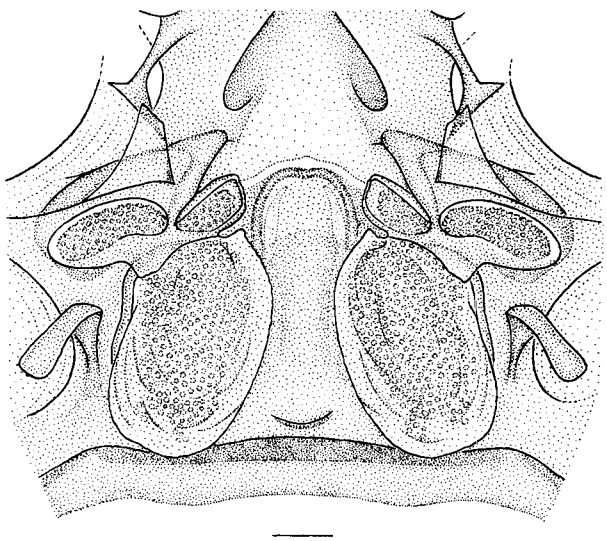


FIGURE 7.—*Sicyonia disedwardsi*, ♀ 30 mm cl, Golfo de Panamá, Panama. Dorsal view of sperm receptacles. Scale = 1 mm.

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. 4*D-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 basial and ischial spines on the first pair of pereopods, bear an incision or a notch on the dorsomedian 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 basial 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. Rodríguez de la Cruz 1977:11. Huff and Cobb 1979:67, fig. 38a-d. Rodríguez 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

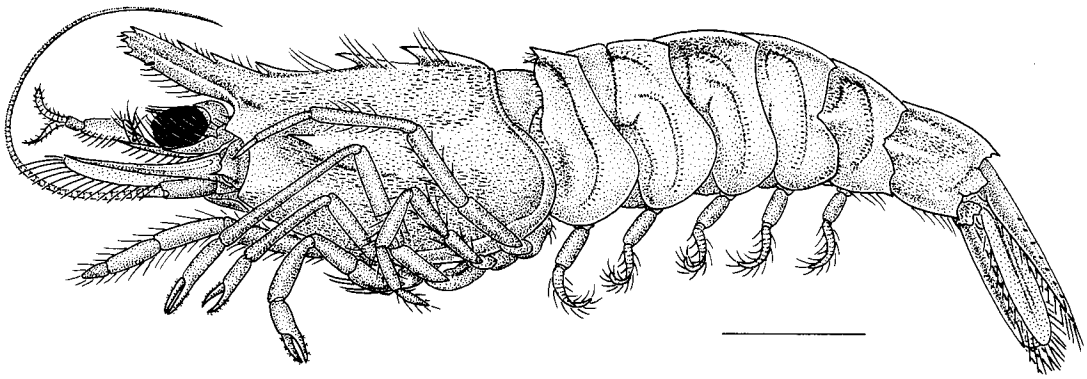


FIGURE 8.—*Sicyonia laevigata*, ♀ 9 mm cl, Punta Paitilla, Panama. Lateral view. Scale = 5 mm.

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. Antennal spine absent or barely perceptible, antennal angle 90° to broadly obtuse, lacking buttress; hepatic spine long, sharply pointed, projecting from low buttress, and situated

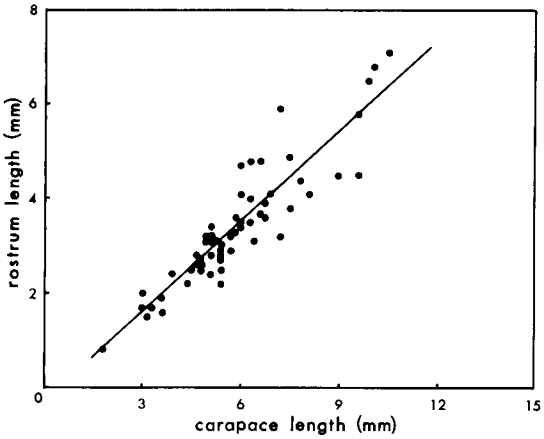


FIGURE 9.—*Sicyonia laevigata*. Relationship between rostrum length and carapace length (regression equation, $y = -0.39153 + 0.64127x$).

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 tergal (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. 10*A*, *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

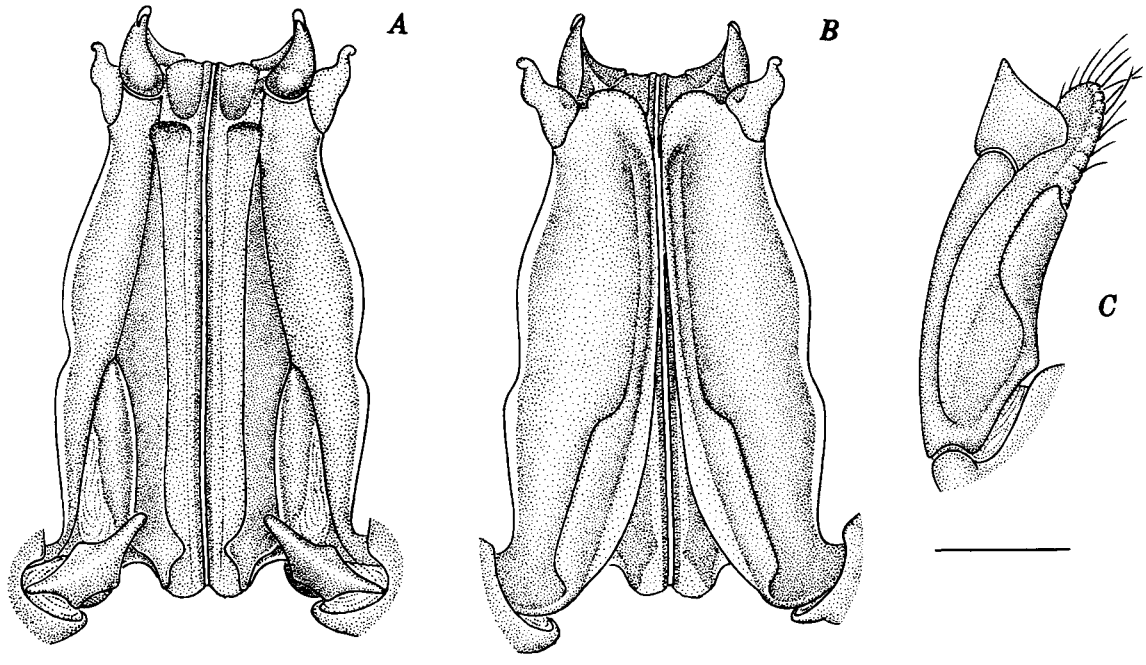


FIGURE 10.—*Sicyonia laevigata*, ♂ 5.7 mm cl, Isla Taboga, Panama. *A*, Petasma, dorsal view; *B*, ventral view; *C*, right appendix masculina, dorsolateral view. Scale = 0.5 mm.

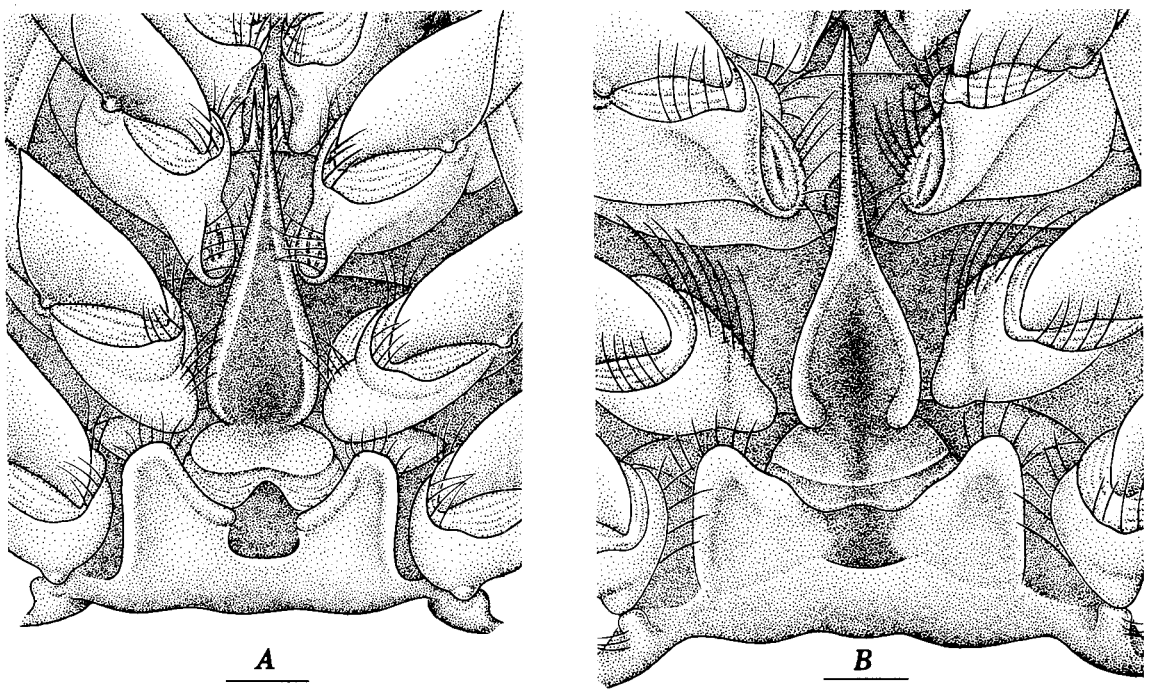


FIGURE 11.—*Sicyonia laevigata*. Thelyca. *A*, ♀ 7 mm cl, Isla San Lucas, Costa Rica; *B*, ♀ 9 mm cl, Punta Paitilla, Panama. Scales = 0.5 mm.

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 10*C*.

Thelycum (Fig. 11*A*, *B*) with plate of sternite XIV produced in elongate, subalate anterolateral lobules, their anteromesial borders strongly divergent; plate flat except for deep, broad, anteromedian 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

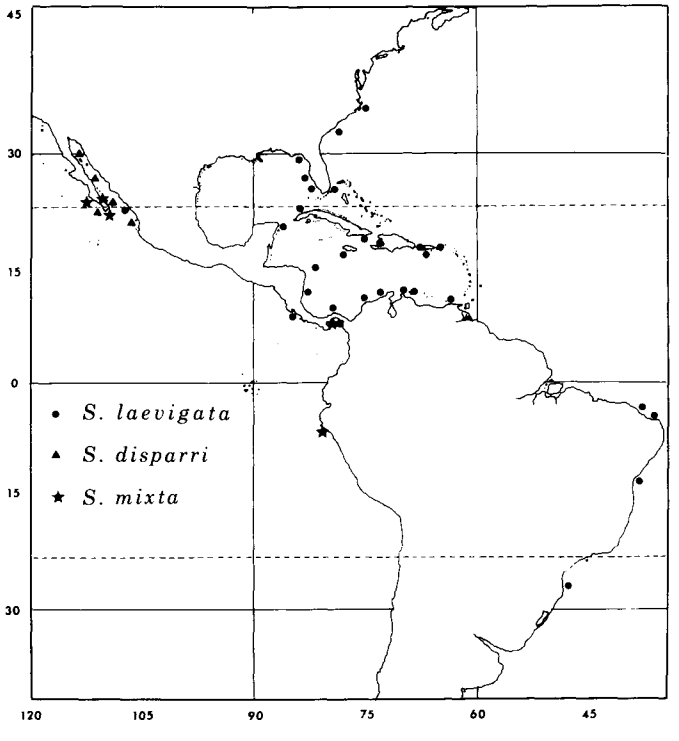


FIGURE 12.—Geographic distribution of *Sicyonia laevigata*, *S. disparri*, and *S. mixta*.

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

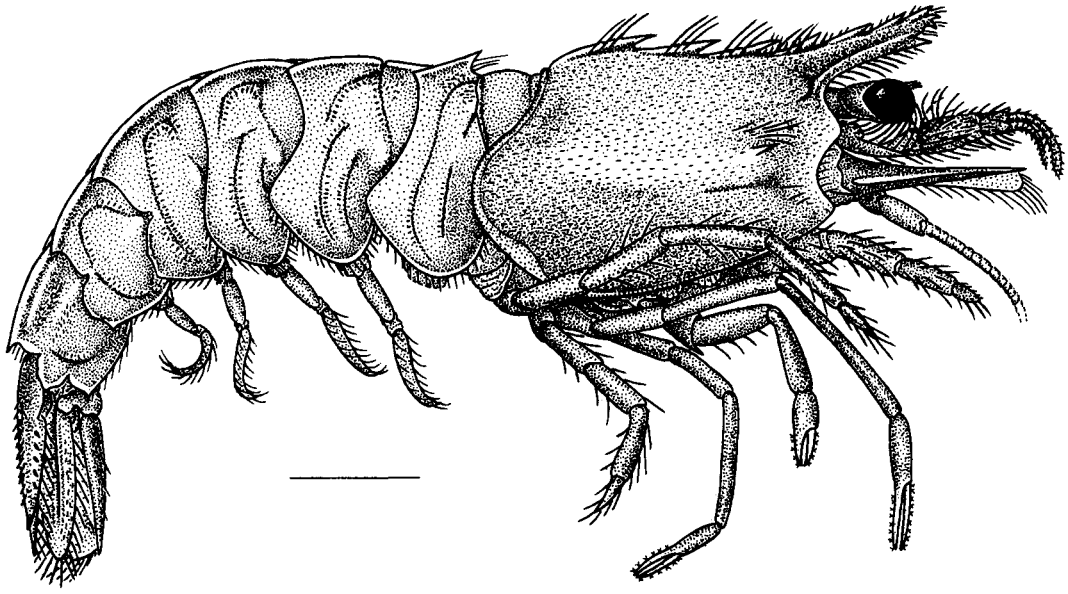


FIGURE 13.—*Sicyonia disparri*, holotype ♀ 10.4 mm cl, Bahia San Luis Gonzaga, Baja California Norte, Mexico. Lateral view. Scale = 5 mm.

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

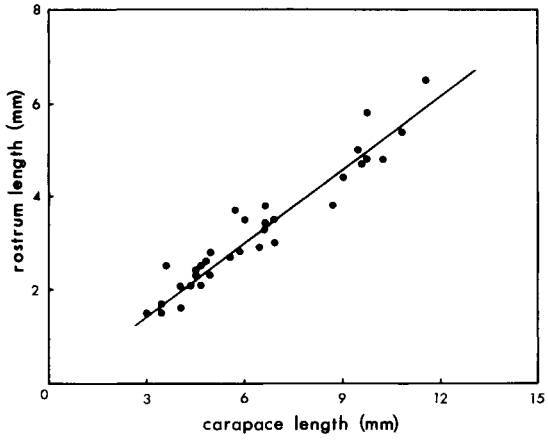


FIGURE 14.—*Sicyonia disparri*. Relationship between rostrum length and carapace length (regression equation, $y = -0.03809 + 0.51152x$).

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. 15*A*) 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.

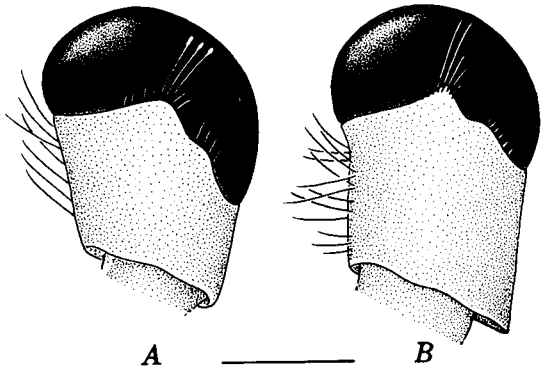


FIGURE 15.—Eyes. *A*, *Sicyonia disparri*, ♀ 9 mm cl, NW of Mantanchen, Nayarit, Mexico. *B*, *S. parri* (Burkenroad), ♀ 10.5 mm cl, east side of Cocoa Point, Barbuda. Dorsal views. Scale = 1 mm.

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, 16*A*, *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

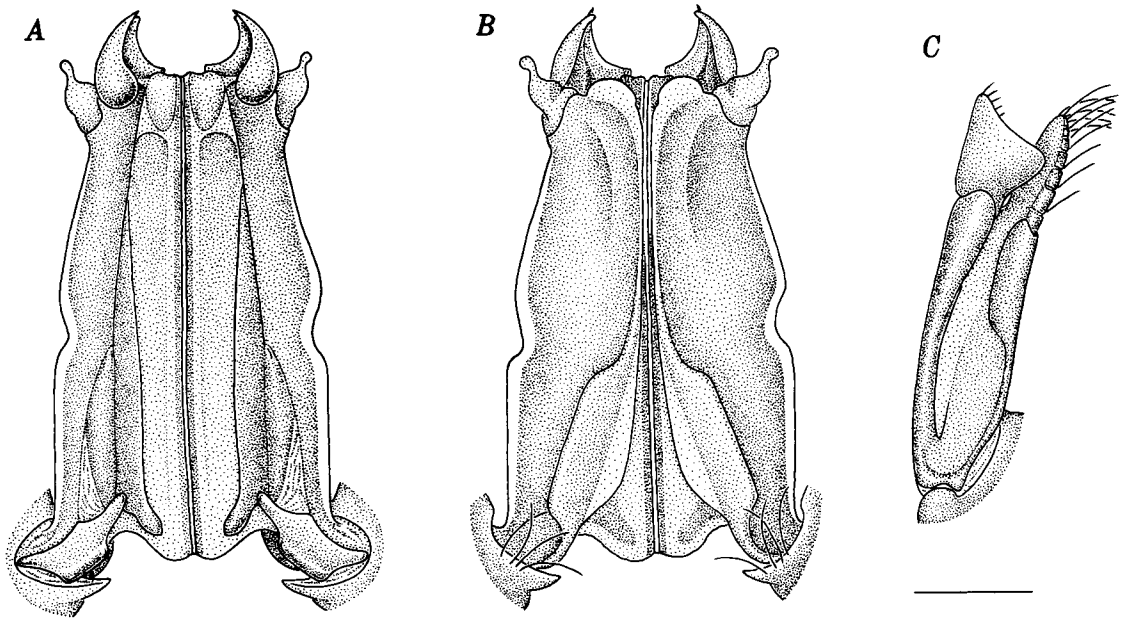


FIGURE 16.—*Sicyonia disparri*, ♂ 6 mm cl, Canal de San Lorenzo, Baja California Sur, Mexico. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scale = 0.5 mm.

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

Appendix masculina as illustrated in Figure 16*C*.

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 posteromedian 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.

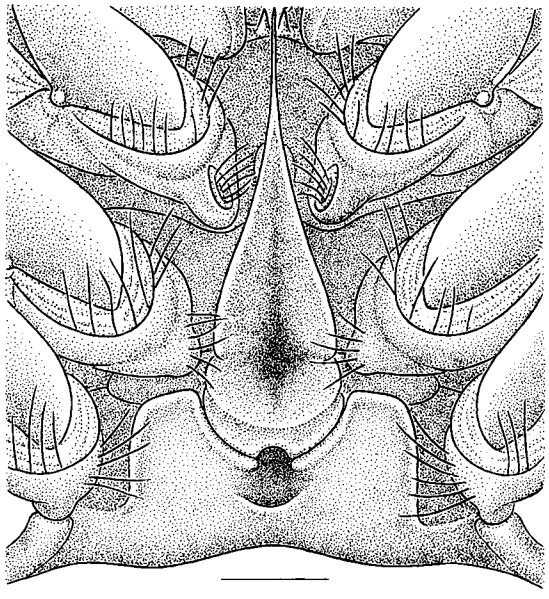


FIGURE 17.—*Sicyonia disparri*, holotype ♀ 10.4 mm cl, Bahía San Luis Gonzaga, Baja California Norte, Mexico. Thelycum. Scale = 1 mm.

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 southward along the east coast of the peninsula, to Isla Santa Magdalena (24°55′N, 112°15′W), Islas Tres Marías, 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 breath 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. 15*B*) 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, Paraiba, 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 Marías, 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

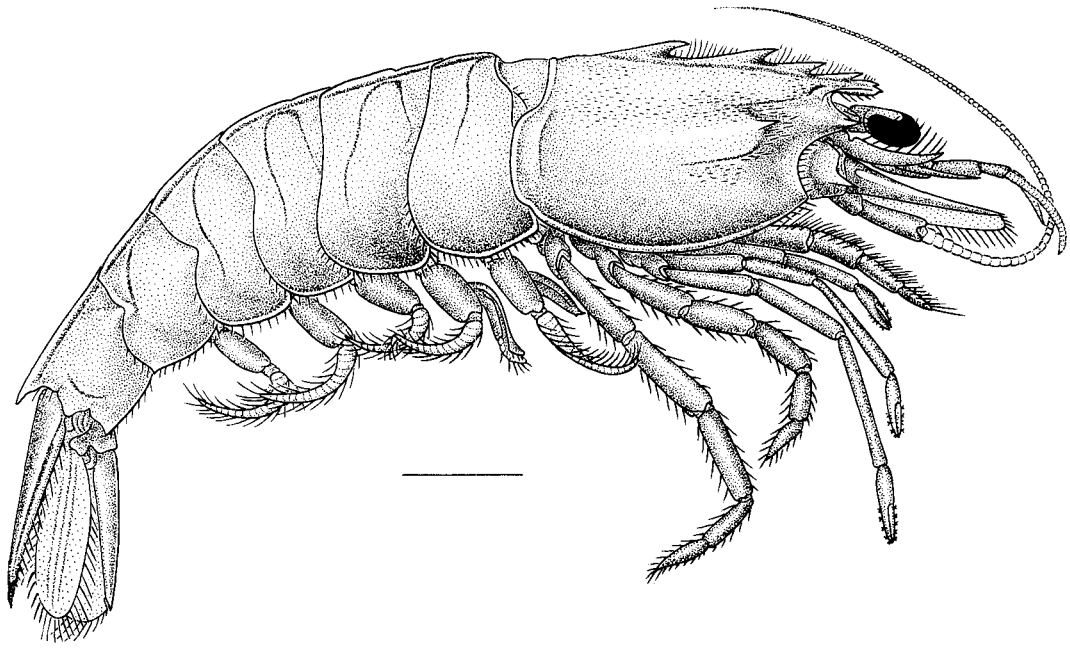


FIGURE 18.—*Sicyonia mixta* Burkenroad, 1946, ♂ 12 mm cl, off Cabo San Lucas, Baja California Sur, Mexico. Lateral view. Scale = 5 mm.

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

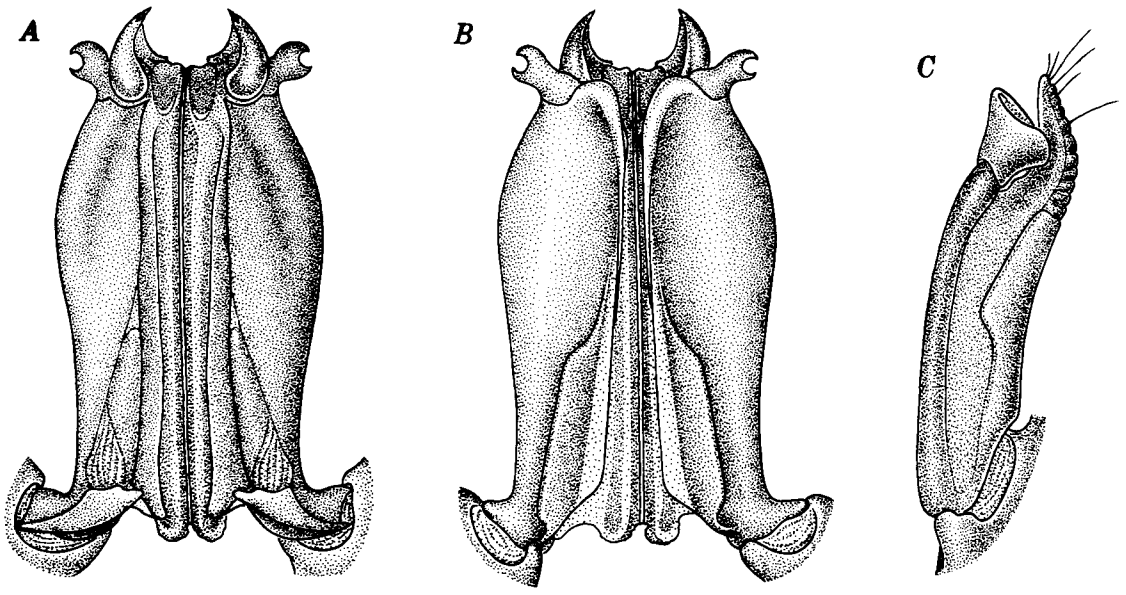


FIGURE 19.—*Sicyonia mixta*, ♂ 12 mm cl, off Cabo San Lucas, Baja California Sur, Mexico. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scale = 1 mm.

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. 19*A*, *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 19*C*.

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-

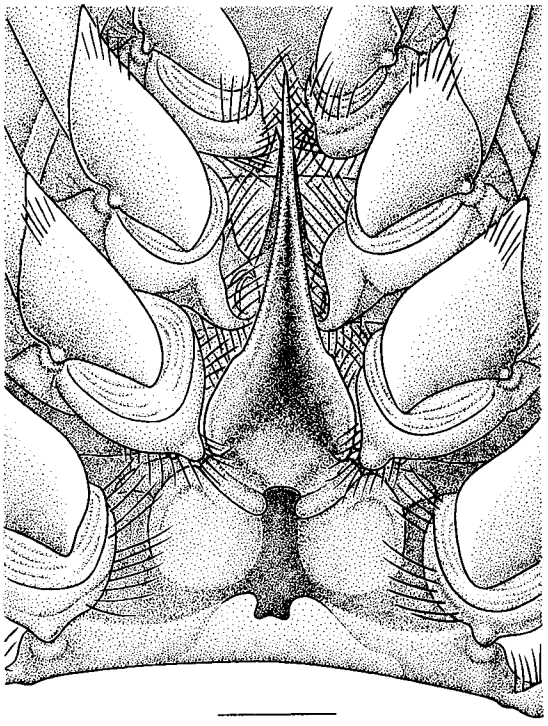


FIGURE 20.—*Sicyonia mixta*, ♀ 13 mm cl, off Isla Taboga, Golfo de Panamá, Panama. Thelycum. Scale = 1 mm.

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. Ñiquen 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 basial 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 lobule 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. Ñiquen, *Humboldt*, stn 8304, haul 175.

Sicyonia brevirostris Stimpson 1871

Figures 21-25

Sicyona 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 ovetgernade (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

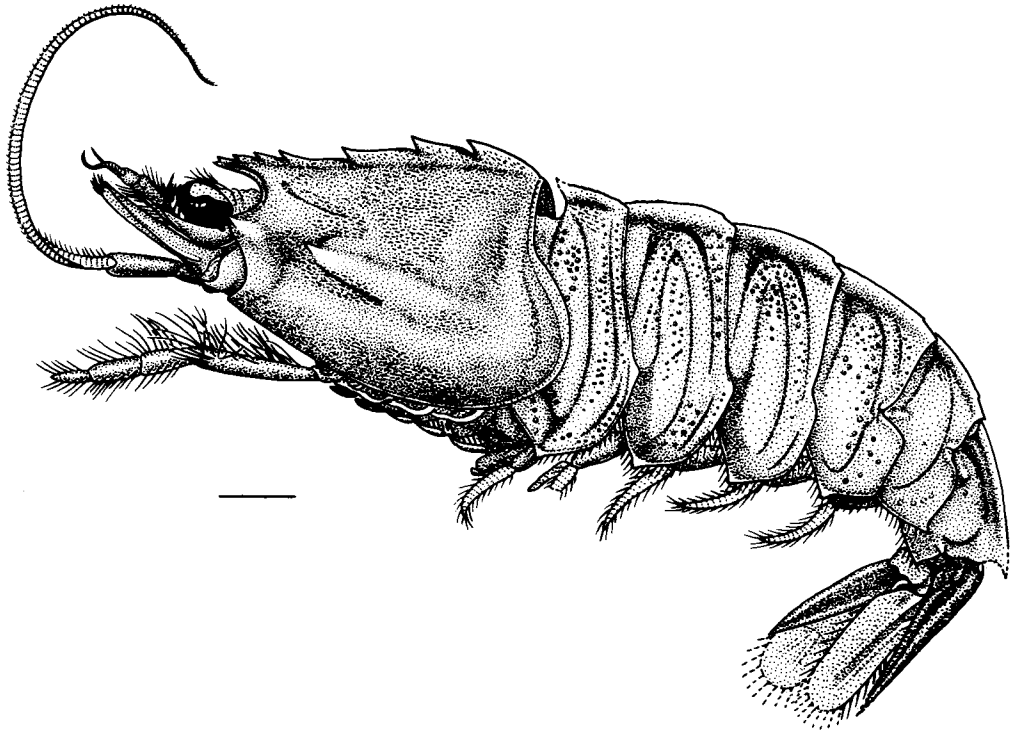


FIGURE 21.—*Sicyonia brevirostris* Stimpson, ♂ 18.1 mm cl, off Puerto Madero, Chiapas, Mexico. Lateral view. Scale = 5 mm.

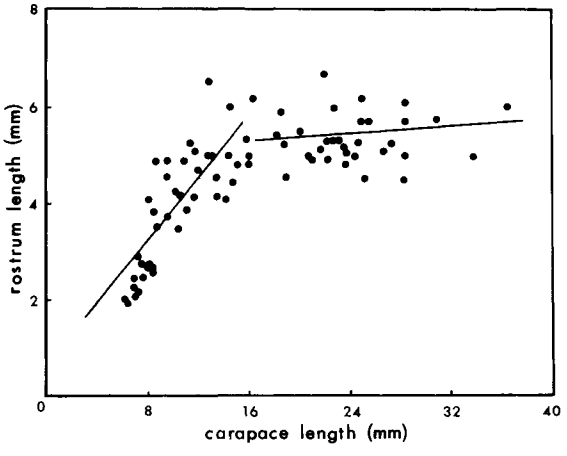


FIGURE 22.—*Sicyonia brevirostris*. Relationship between rostrum length and carapace length (regression equation for specimens with carapace length less than about 16 mm, $y = 0.52372 + 0.33342x$; regression equation for those larger, $y = 5.06145 + 0.01211x$).

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; branchiocardiac 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. 23*A, B*) with rigid distal projection of dorsolateral lobule raised proximodorsally in rounded prominence, strongly curved dorsomesially, 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 23*C*.

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

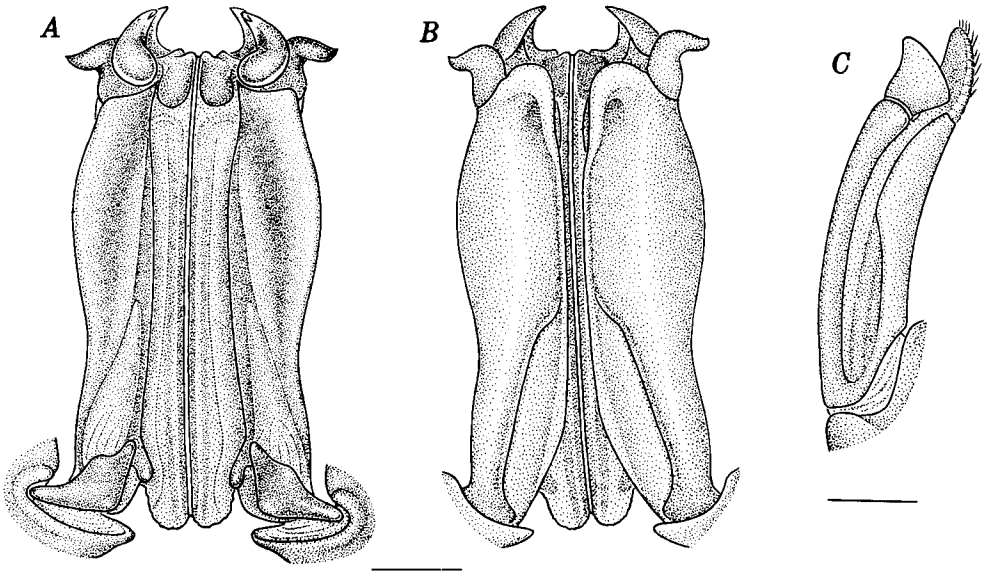


FIGURE 23.—*Sicyonia brevirostris*, 18.1 mm cl, off Puerto Madero, Chiapas, Mexico. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scales = 1 mm.

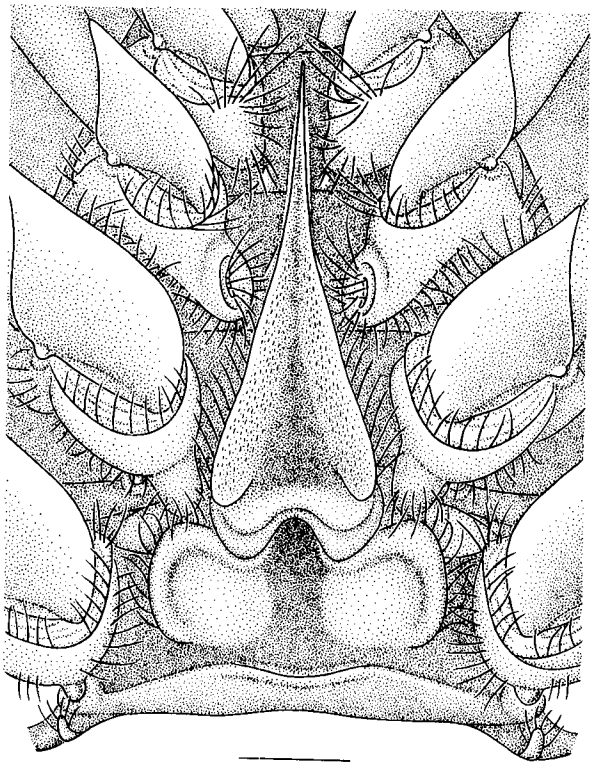


FIGURE 24.—*Sicyonia brevirostris*, ♀ 26.3 mm cl, off Cape Lookout, North Carolina, USA. Thelycum. Scale = 2 mm.

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; Williams 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-

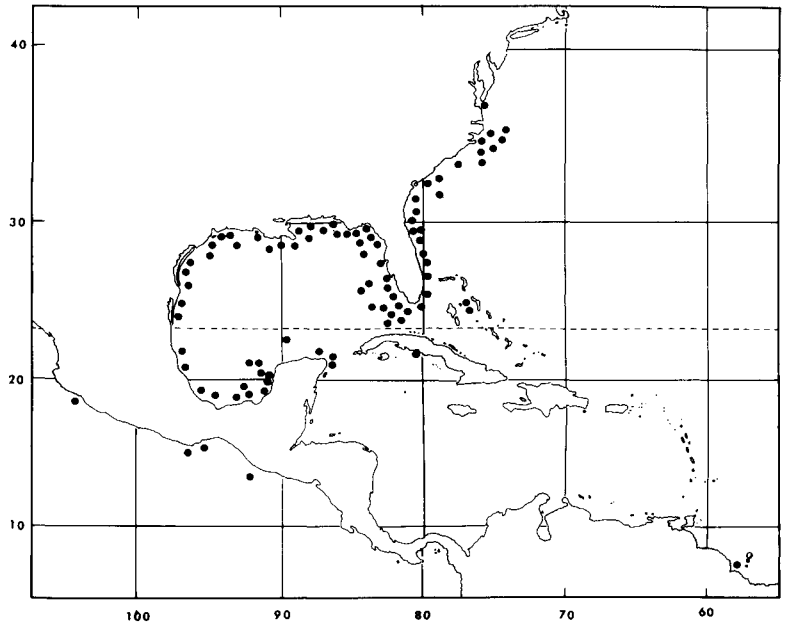


FIGURE 25.—Geographic distribution of *Sicyonia brevirostris*.

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. brevirostris* 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. brevirostris* 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. brevirostris* 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 brevirostris* by areas and their values for 1982.[1]

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

[1]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[2]). 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♀,

[2]Concepción Rodríguez de la Cruz, Instituto National de Pesca, Secretaría de Pesca, México, D.F., Mexico, pers. commun., May 1983.

USNM, off Flagler Beach, 40 m, 7 November 1963, *Silver Bay* stn 5201. 2♂ 8♀, USNM, off Edgewater, 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 Paraíso, 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); cacahuete, 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.

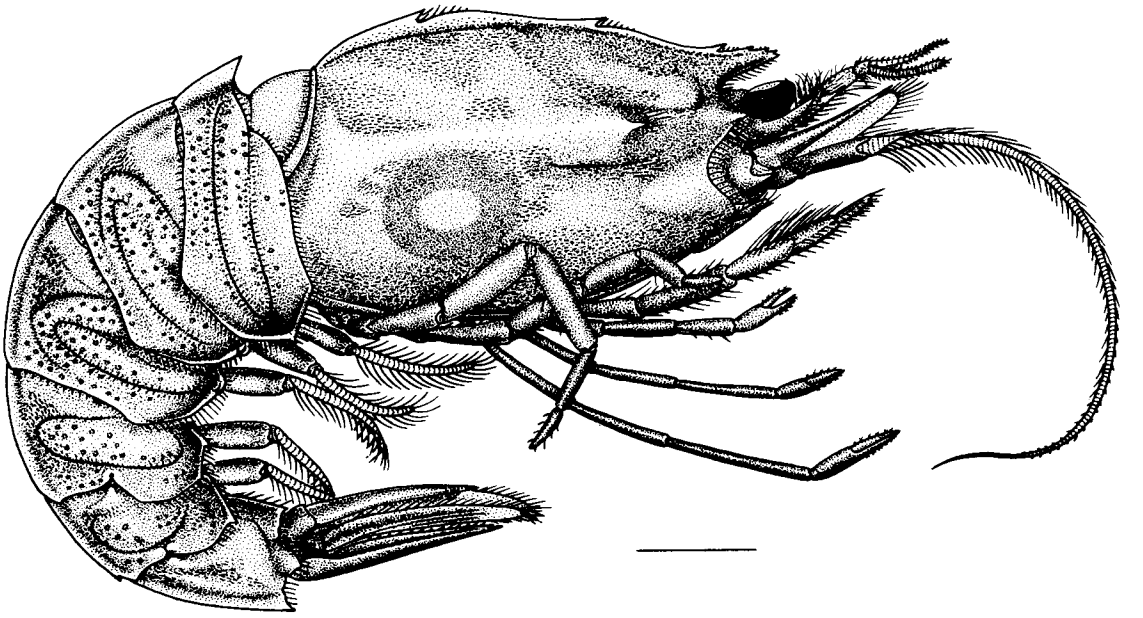


FIGURE 26.—*Sicyonia disedwardsi* (Burkenroad 1934), ♀ 34 mm cl, Golfo de Panamá, Panama. Lateral view. Scale = 10 mm.

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-

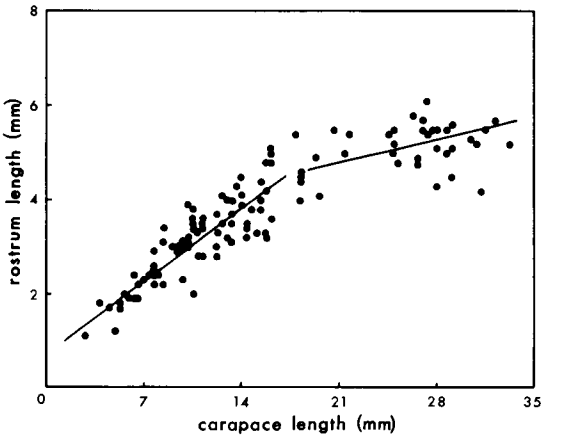


FIGURE 27.—*Sicyonia disedwardsi*. Relationship between rostrum length and carapace length (regression equation for specimens with about 20 mm cl or less, $y = 0.74318 + 0.21740x$; regression equation for those larger, $y = 3.81074 + 0.04939x$).

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-

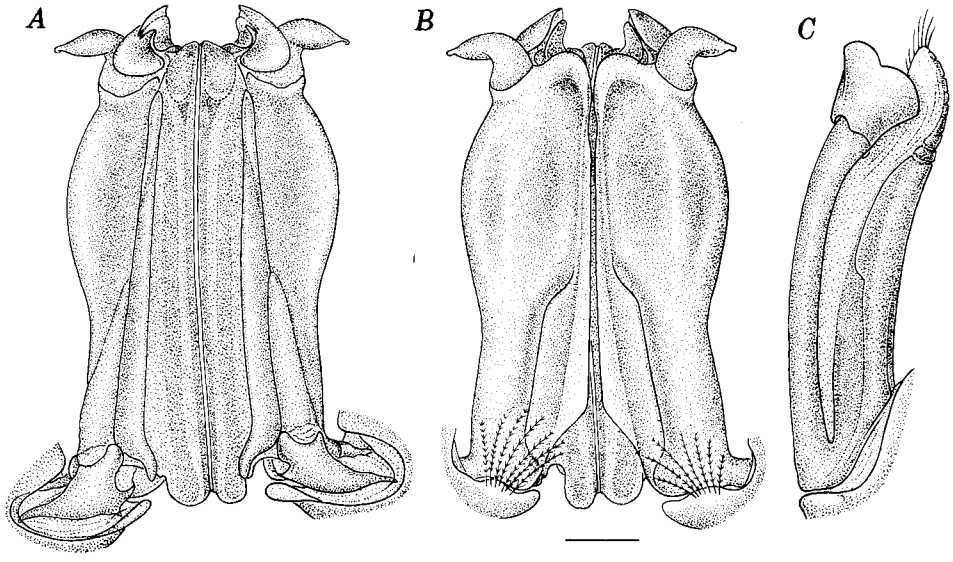


FIGURE 28.—*Sicyonia disedwardsi*, ♂ 23.5 mm cl, Golfo de Panamá, Panama. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scale = 1 mm.

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. 28*A, 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 proximoventrally.

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 28*C*.

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,

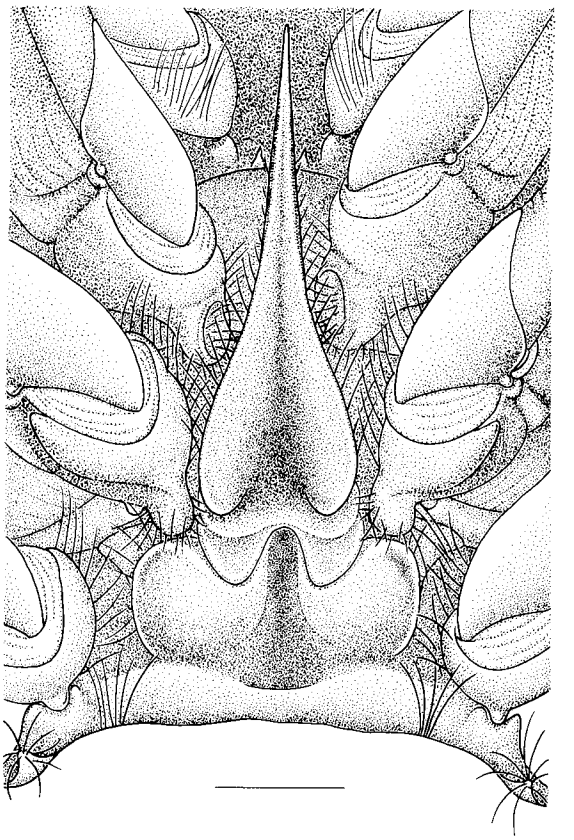


FIGURE 29.—*Sicyonia disedwardsi*, ♀ 21.3 mm cl, off Punta Gorda, Baja California Sur, Mexico. Thelycum. Scale = 2 mm.

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 similar 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.

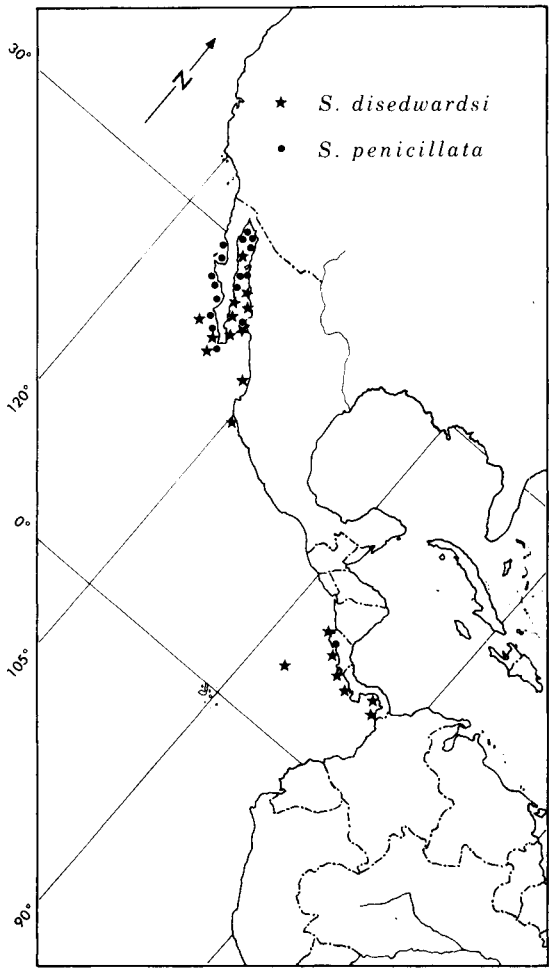


FIGURE 30.—Geographic distribution of *Sicyonia disedwardsi* and *S. penicillata*.

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. brevirostris* 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. Hatziolos. 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 Chamela, 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 [syntypes (not extant): "Bolinas 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-

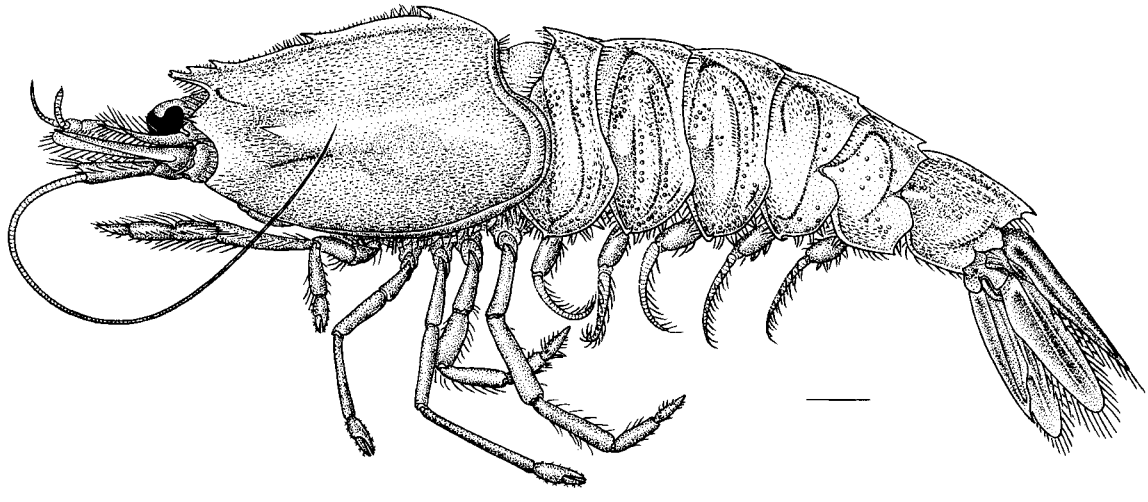


FIGURE 31.—*Sicyonia penicillata* Lockington, ♀ 23 mm cl, west of Punta Tasca, Isla Santa Margarita, Baja California Sur, Mexico. Lateral view. Scale = 5 mm.

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-

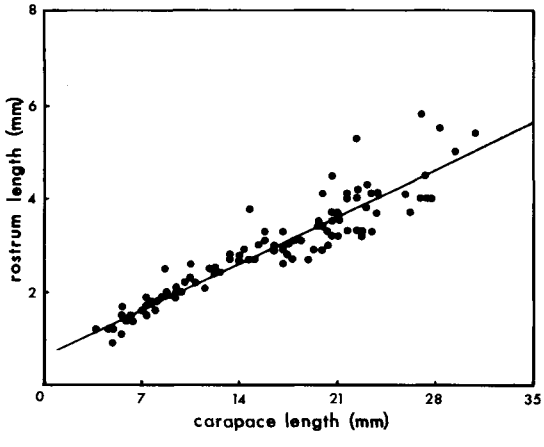


FIGURE 32.—*Sicyonia penicillata*. Relationship between rostrum length and carapace length (regression equation, $y = 0.65537 + 0.13963x$).

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. 33*A*, *B*) with short distal plate of dorsomedian lobule bearing distolaterally small, scalelike process bent inwardly (posteroventrally). 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, bladelike 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 33*C*.

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-

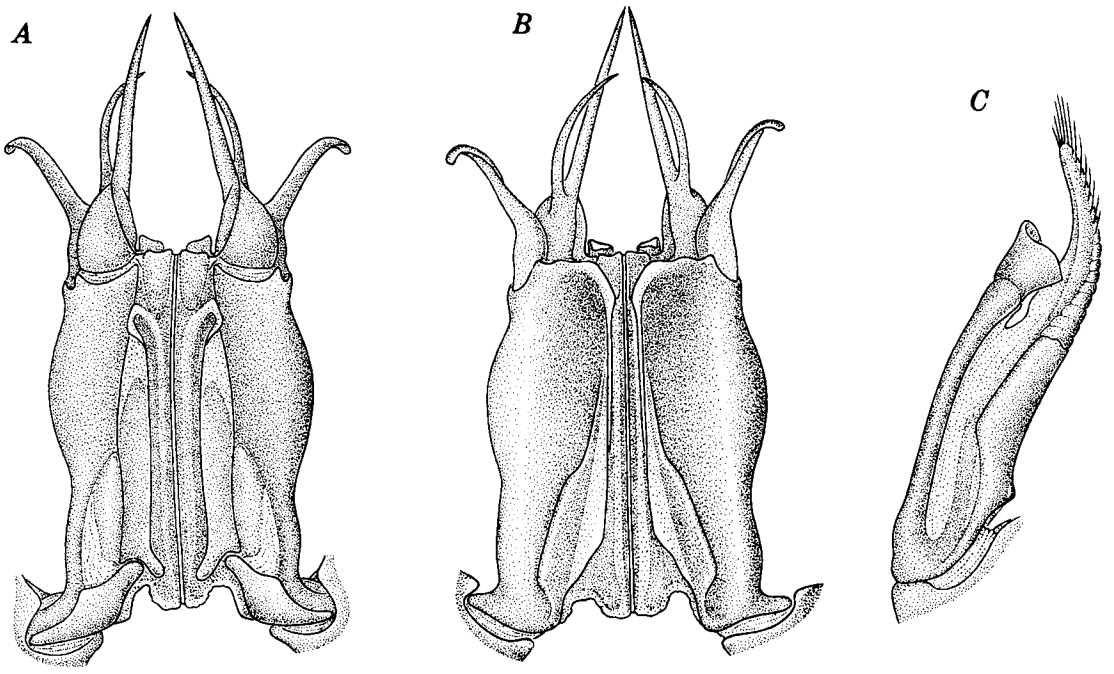


FIGURE 33.—*Sicyonia penicillata*, ♂ 21.5 mm cl, west of Punta Tasca, Isla Santa Margarita, Baja California Sur, Mexico. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scale = 1 mm.

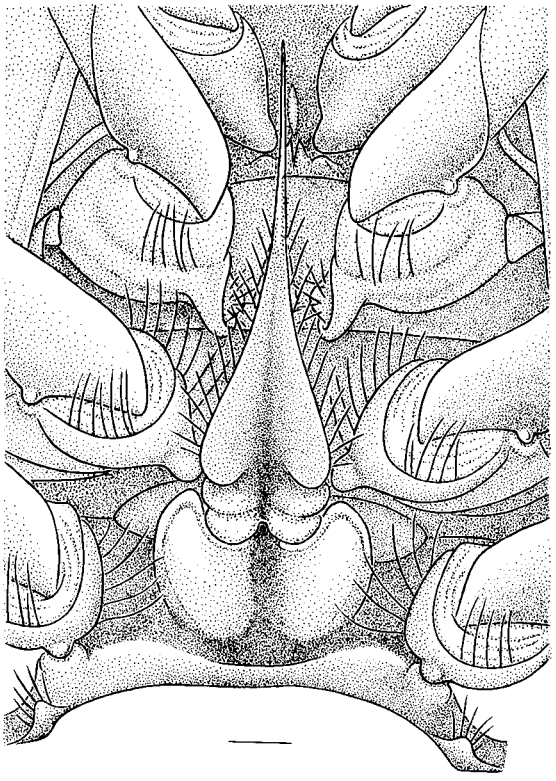


FIGURE 34.—*Sicyonia penicillata*, ♀ 23 mm cl, west of Punta Tasca, Isla Santa Margarita, Baja California Sur, Mexico. Thelycum. Scale = 1 mm.

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 postrostral 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, "Bolinas 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 "Bolinas". 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 "Bolinas 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 Bolinas 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, Colombia, 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

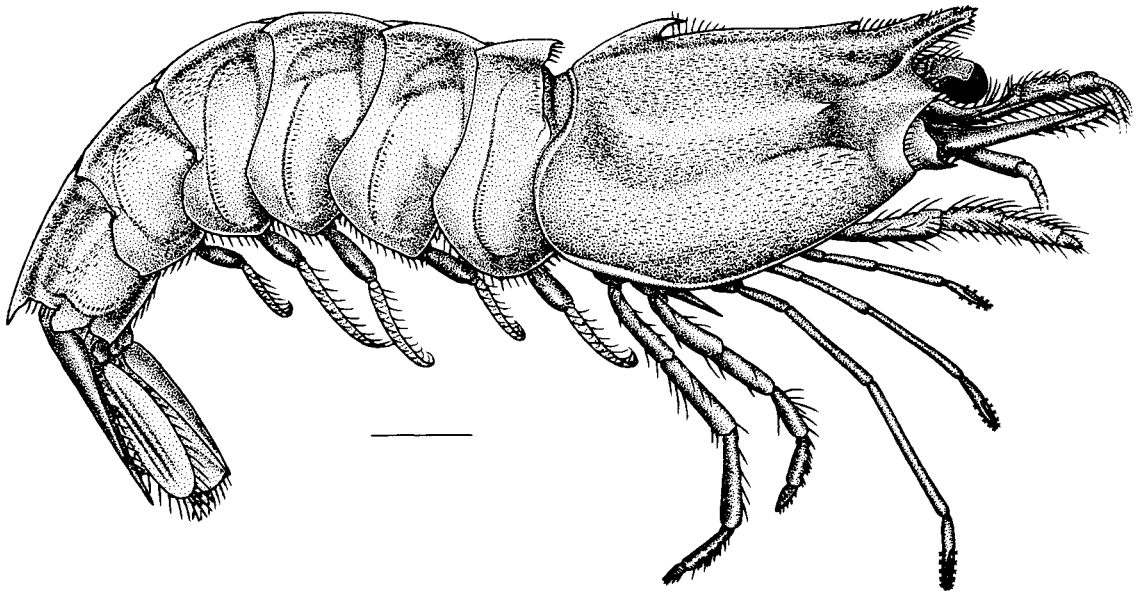


FIGURE 35.—*Sicyonia affinis* Faxon, ♀ 17 mm cl, 4.4 km off Isla Manuelita, Costa Rica. Lateral view. Scale = 5 mm.

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. 36*A*, *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 ventrolateral lobule fleshy, with terminal part flattened (dorsal surface not bulbous) and curving dorsally.

Appendix masculina as illustrated in Figure 36*C*.

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-

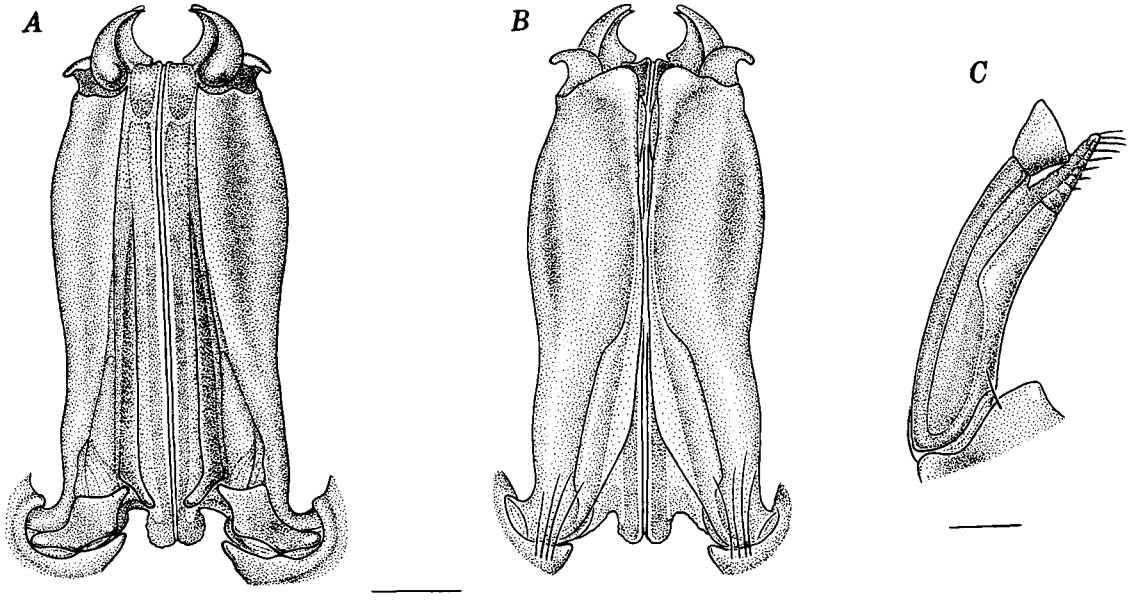


FIGURE 36.—*Sicyonia affinis*, ♂ 21.5 mm cl, 4.4 km off Isla Manuelita, Costa Rica. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scales = 1 mm.

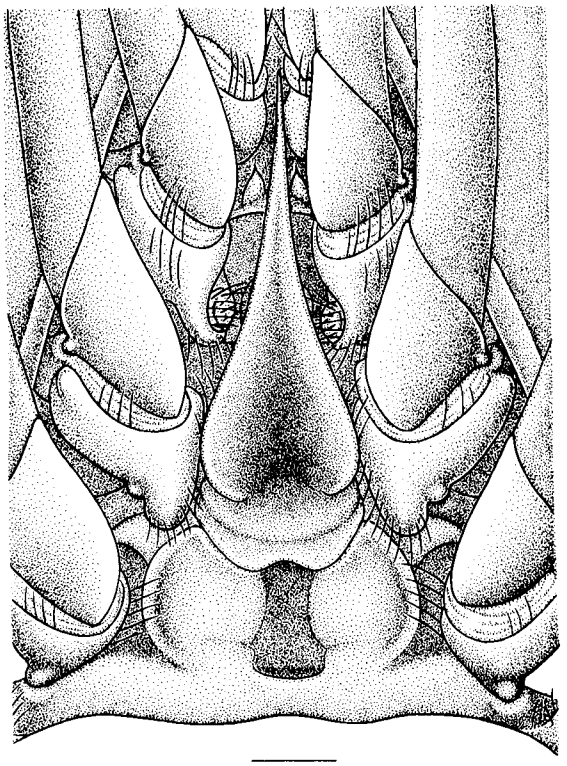


FIGURE 37.—*Sicyonia affinis*, ♀ 17 mm cl, 4.4 km off Isla Manuelita, Costa Rica. Thelycum. Scale = 1 mm.

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

Geographic and bathymetric ranges.—Known with certainty only from a restricted area between Isla Manuelita (5°34′N, 87°00′W), Costa Rica, and Isla de Malpelo (3°58′20″N, 81°36′00″W), Colombia (Fig. 38). Chirichigno Fonseca (1970) and Arana Espina and Méndez G. (1978) cited Paita, Peru, as the southern limit of the range of the species. Chirichigno Fonseca did not present a list of her material and Matilde Méndez G.[3] found no representative of the species in Peruvian collections, including those of the Instituto del Mar del Perú (IMARPE) from which Chirichigno Fonseca obtained most of her information. Chapa Saldaña (1964) recorded the occurrence of this species in the waters of Chiapas and Sinaloa, Mexico, but again, more recent studies, including the present one based on extensive material, failed to disclose its presence north of Costa Rica. Further investigations are necessary to ascertain the limits of the range of this shrimp both south of Isla de Malpelo and north of Isla Manuelita. *Sicyonia affinis* is one of only four members of the genus that have been recorded from the eastern Pacific off South America.

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

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

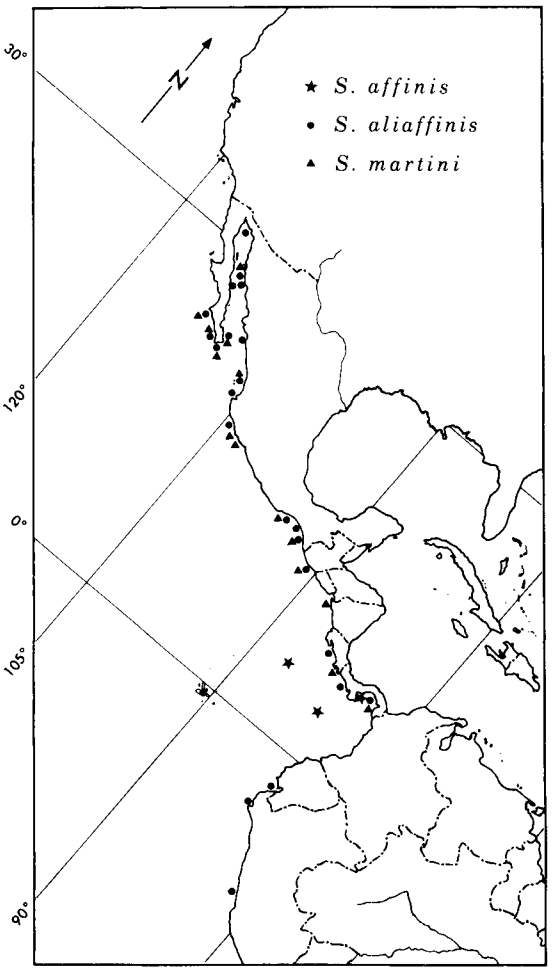


FIGURE 38.—Geographic distribution of *Sicyonia affinis*, *S. aliaffinis*, and *S. martini*.

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

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

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

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

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

Material.—17 specimens from 6 lots.

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

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

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

Sicyonia aliaffinis (Burkenroad 1934)

Figures 38-42

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

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

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

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

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

Diagnosis.—Antennal spine well developed and buttressed. Second abdominal somite with dorsomedian carina lacking incision. First pereopod with basis and ischium unarmed. Postrostral carina bearing one tooth posterior to level of hepatic spine and raised in high crest behind posterior tooth. Rostrum short, not overreaching distal margin of eye. Abdomen tuberculate; second and third somites not bearing special inverted V-shaped ridges laterally; fifth somite with dorsomedian carina ending in sharp angle or tooth posteriorly. Petasma with distal projection of dorsolateral lobule compressed distally, its truncate tip produced dorsally in simple, minute spine. Thelycum with plate of sternite XIV lacking anteromedian tubercle and either flat or barely raised in ill-defined bulges. Branchiostegite bearing large, horizontally disposed 9-shaped color pattern.

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

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

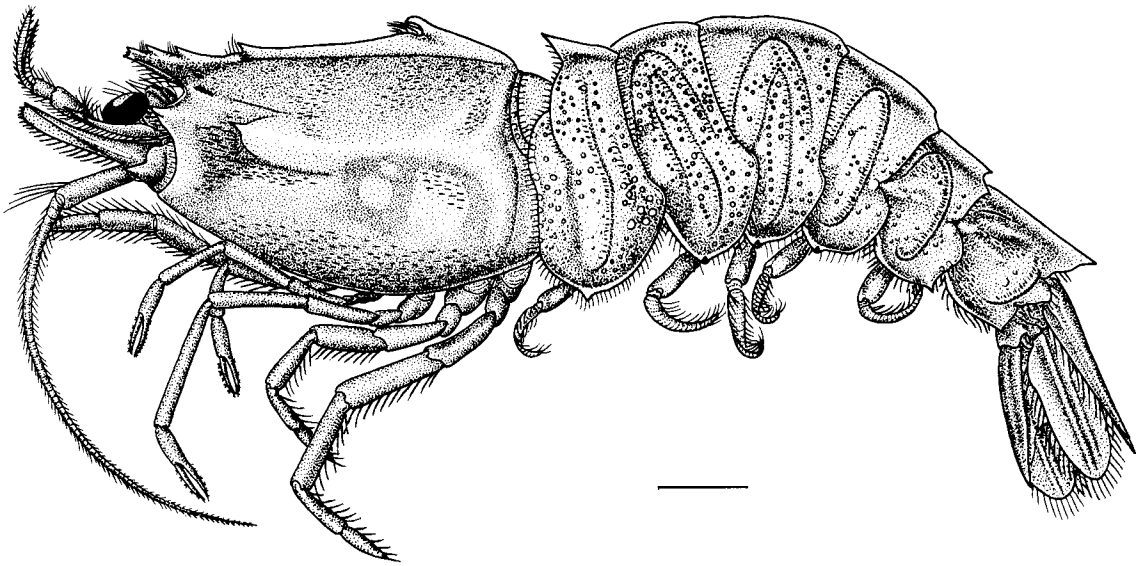


FIGURE 39.—*Sicyonia aliaffinis* (Burkenroad 1934), ♀ 26 mm cl, west of Puerto Madero, Golfo de Tehuantepec, Mexico. Lateral view. Scale = 5 mm.

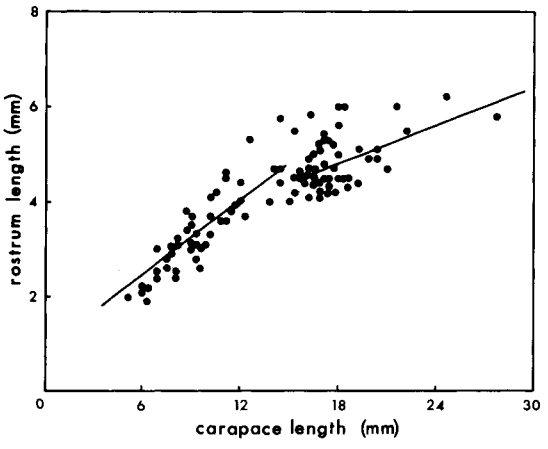


FIGURE 40.—*Sicyonia aliaffinis*. Relationship between rostrum length and carapace length (regression equation for specimens with about 16 mm cl or less, $y = 0.83950 + 0.25635x$; regression equation for those larger, $y = 2.34086 + 0.13665x$).

tending from orbital margin almost to end of rostrum.

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

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

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

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

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

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

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

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

Petasmal endopods coupled in males 8.2 mm cl,

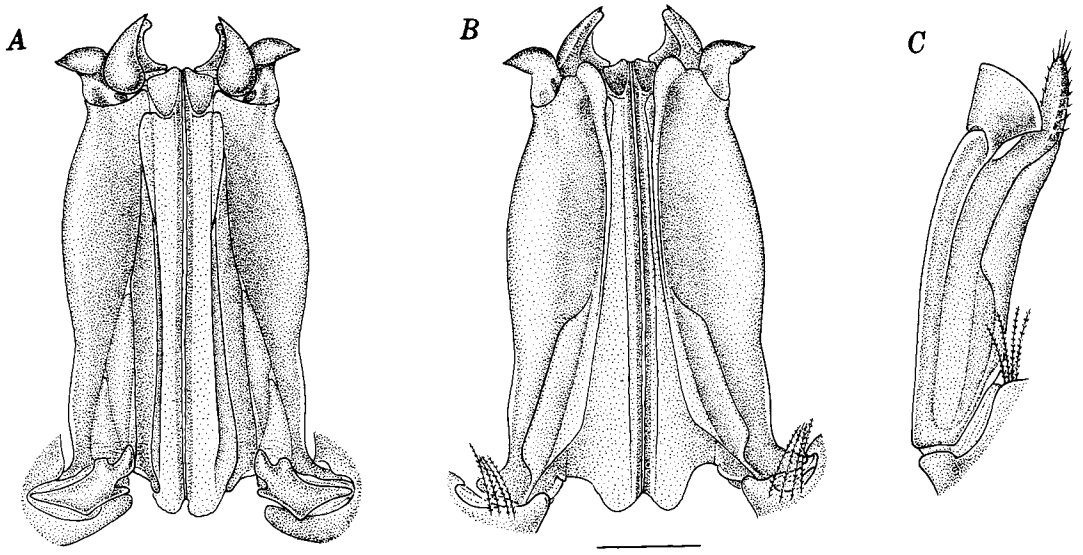


FIGURE 41.—*Sicyonia aliaffinis*, ♂ 16 mm cl, west of Puerto Madero, Golfo de Tehuantepec, Mexico. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scale = 1 mm.

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

Appendix masculina as illustrated in Figure 41*C*.

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

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

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

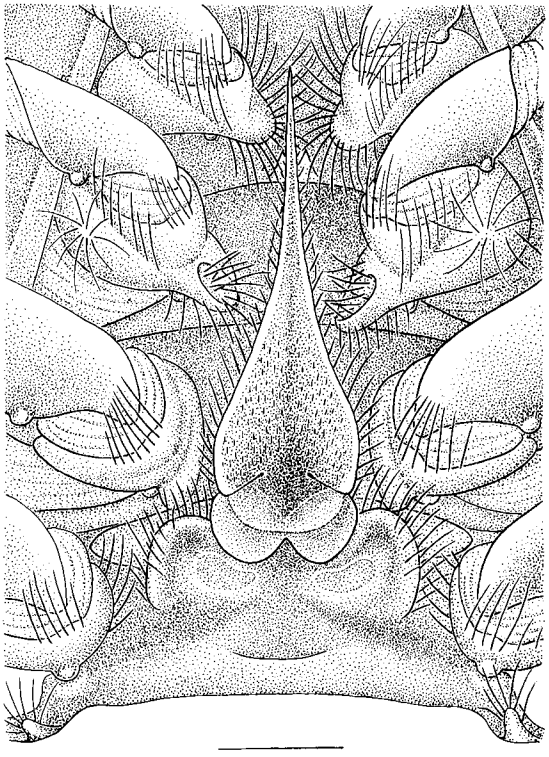


FIGURE 42.—*Sicyonia aliaffinis*, ♀ 25 mm cl, west of Puerto Madero, Golfo de Tehuantepec, Mexico. Thelycum. Scale = 2 mm.

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

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

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

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

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

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

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

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

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

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

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

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

Material.—251 specimens from 27 lots.

Mexico—Baja California Sur: 2♂ 1♀, SIO, SW of Isla Santa Margarita, 29-40 m, 13 November 1964, *Black Douglas*. 1♂, SIO, NW of Todos Santos, 38 m, 9 November 1964, *Black Douglas*. 1♂, YPM, Bahía San Lucas, 24 m, 7 May 1936, *Zaca* stn 135D-26. 1♂ 1♀, USNM, W of Estero de los Algodones, 47 m, 3 April 1978, Toral García. 1♂, YPM, Bahía Santa Inés, 37 m, 10 April 1936, *Zaca* stn 141-D4. Nayarit: 57♂ 38♀, SIO, NE of Isla María Madre, 51 m, 31 March 1973, *Agassiz*. 15♂ 8♀, SIO, NE of Isla María Madre, 55 m, 31 March 1973, *Agassiz*. Jalisco: 1♀, USNM, Puerto Vallarta, 13 April 1937. 2♀, SIO, N part of Bahía Chamela, 15-18 m, 2 April 1973, *Agassiz*. Oaxaca: 13♂ 13♀, USNM, E of Salina Cruz, Golfo de Tehuantepec, 18 m, 10 July 1963, I. Mayés A. 2♂ 1♀, SIO, Golfo de Tehuantepec, 55 m, 6 June 1965, T. Matsui. 1♀, USNM, Laguna Lagartero, Ixhuatán, 25 July 1963, G. Solórzano. Chiapas: 2♂ 1♀, USNM, Puerto Arista, 14 January 1964, I. Mayés A. 8♂ 8♀, SIO, Golfo de Tehuantepec, 46-48 m, 10 April 1973, *Agassiz*. 3♂ 2♀, SIO, Golfo de Tehuantepec, 73 m, 10-11 July 1963, D. Dockins. 1♂, holotype, YPM, off "southern Mexico" [NW of Puerto Madero], 35-55 m, 9 April 1926, *Pawnee*. 17♂ 38♀, SIO, W of Puerto Madero, Golfo de Tehuantepec, 55 m, 10 April 1973, *Agassiz*.

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

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

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

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

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

Sicyonia martini Pérez Farfante and Boothe 1981

Figures 38, 43-46

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

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

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

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

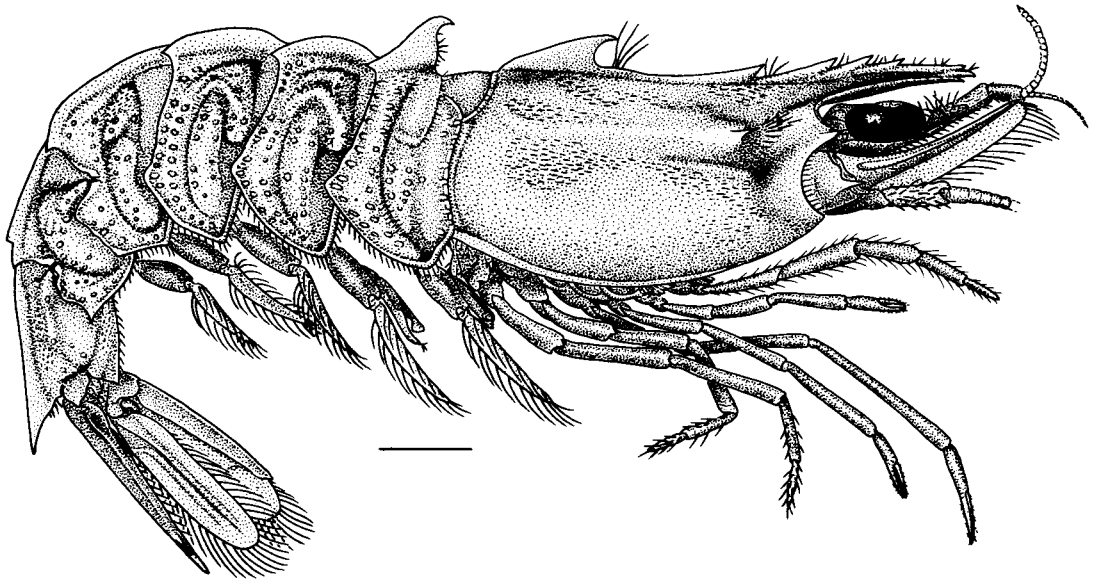


FIGURE 43.—*Sicyonia martini* Pérez Farfante and Boothe (1981), paratype ♂ 19 mm cl, off Puerto Escondido, Golfo de Panamá. Lateral view. Scale = 5 mm.

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

Rostrum comparatively long, conspicuously surpassing eye, reaching as far as distal 0.33 of second antennular article, its length, 0.40-0.54 cl, increasing linearly with carapace length (Fig. 44); armed with two or three dorsal teeth and cluster of apical teeth, both groups varying in disposition and number in males and females. In males, rostrum horizontal or directed upward at slight angle of no more than 10°, but weakly decurved at tip, with three dorsal teeth evenly spaced; first rostral tooth situated immediately anterior to orbital margin, last usually separated from upper apical tooth by interval (about 0.33 rl) slightly greater than that between dorsal teeth; apical cluster consisting of three or four teeth (76% and 24%, respectively), with subterminal ventral tooth situated not far from adjacent apical tooth. In females, rostrum strongly elevated at angle of 40°-50°, its ventral margin straight or, more often, strongly convex along midlength, and with two dorsal teeth; first rostral tooth placed distinctly anterior to orbital margin; interval between second tooth and upper apical tooth slightly shorter than that between first and second; apical cluster consisting of three, four, or five teeth (1, 87, and 12%, respectively), ventral one subterminal, distinctly removed from adjacent apical tooth; teeth of apical

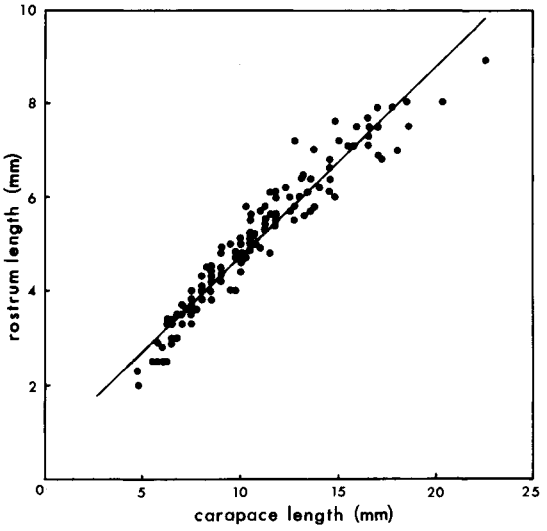


FIGURE 44.—*Sicyonia martini*. Relationship between rostrum length and carapace length (regression equation, $y = 0.76705 + 0.39436x$).

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

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

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

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

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

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

Anteroventral margin of pleuron of first abdominal somite barely to distinctly concave; anteroventral angle 90°-100°, that of third and fourth 90° or less, with vertex slightly produced anteroventrally; pleuron of fifth roughly pentagonal, anteroventral and posteroventral angles with vertices slightly produced, posteroventral one often armed with small spine; posteroventral angle of pleuron of fifth and sixth somites armed with spine, that of fifth larger.

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

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

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

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

Appendix masculina as illustrated in Figure 45*C*.

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

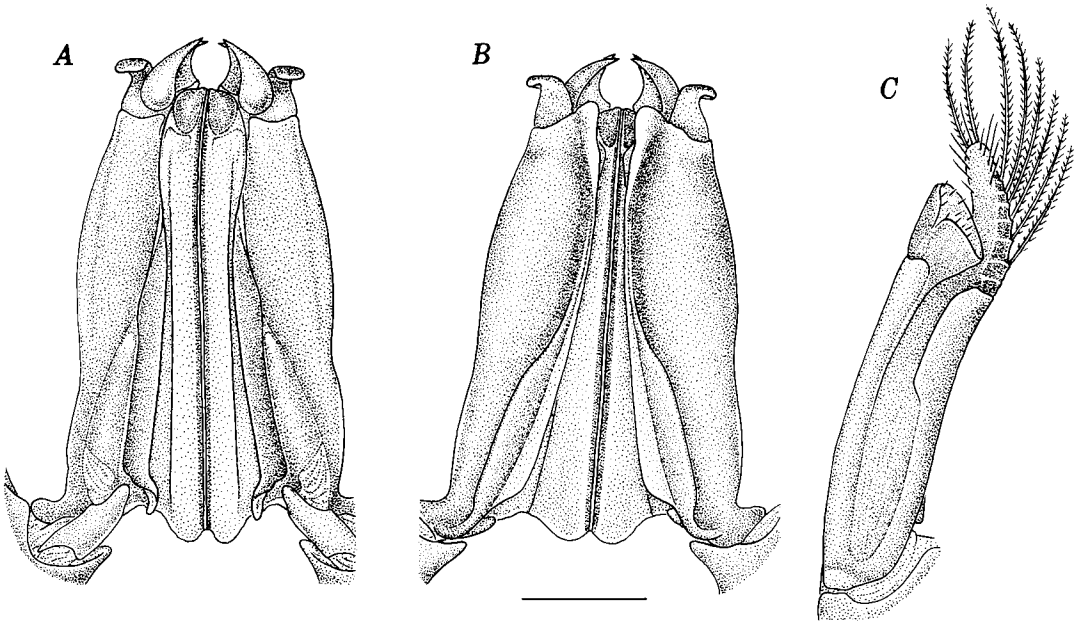


FIGURE 45.—*Sicyonia martini*, paratype ♂ 13.7 mm cl, south of Archipiélago de las Perlas, Golfo de Panamá. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scale = 1 mm.

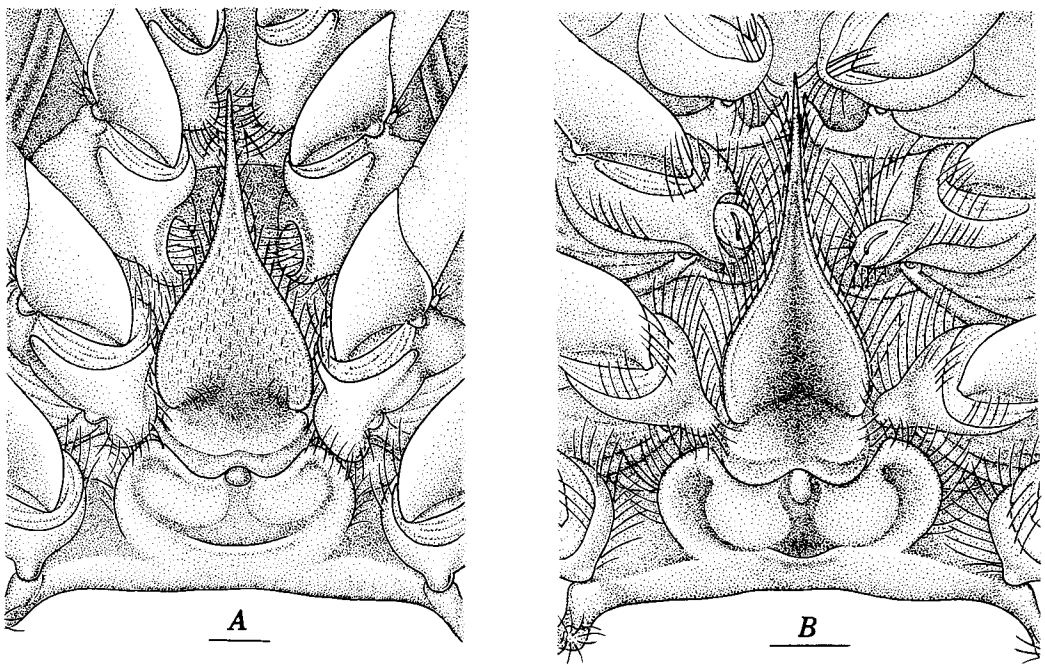


FIGURE 46.—*Sicyonia martini*. *A*, holotype ♀ 21 mm cl, southwest of Punta Ana María, Golfo de Panamá; *B*, ♀ 16.5 mm cl, Banco Gorda de Afuera, Baja California Sur. Thelyca. Scales = 1 mm.

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

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

Color.—Specimens preserved in Formalin[4] buff with purplish blue markings: antenna, lateral ridge of scaphocerite, postrostral and abdominal carina, and dorsal ribs of telson transversely banded; anterior margin and posterior ridge of carapace, anterior margin of pleuron of first abdominal somite, and posterior margin of all abdominal somites with series of small spots; tip of teeth on rostrum, carapace, and first abdominal somite also purplish blue; lateral ramus of uropod with subterminal spot on lateral ridge and large mesial blotch at same level.

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

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

Discussion.—Although closely allied to *S. affinis* and *S. aliaffinis*, *S. martini* can be distinguished readily from both of them by the length, shape, and armature of the rostrum; the shape of the tooth on the first abdominal somite; the sculpture of the abdomen; and features of the petasma and thelycum.

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

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

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

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

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

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

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

Material.—193 specimens from 41 lots.

For list of records see Pérez Farfante and Boothe 1981.

Sicyonia picta Faxon 1893

Figures 47-52

Sicyonia picta Faxon 1893:210 [syntypes: 4♂ 2♀, MCZ 4639, and 2♂ 2♀, USNM 21172, off Golfo de Panamá (7°40′00″N, 79°17′50″W), 127 fm (232 m), 8 March 1891, *Albatross* stn 3387; 1♂, USNM 21171, off Punta Mariato (7°12′20″N, 80°55′00″W), Panama, 182 fm (333 m), 23 February 1891, *Albatross* stn 3355]. Faxon 1895:180, pl. 46, fig. 2, 2a-c. H. Milne Edwards and Bouvier 1909:244. De Man 1911: 112. Bayer et al. 1970:A97. Arana Espina and Méndez G. 1978:27, fig. 10-13. Brusca 1980:256. Méndez G. 1981:47, pl. 10, Fig. 83-86. Pérez Farfante 1982:372.

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

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

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

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

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

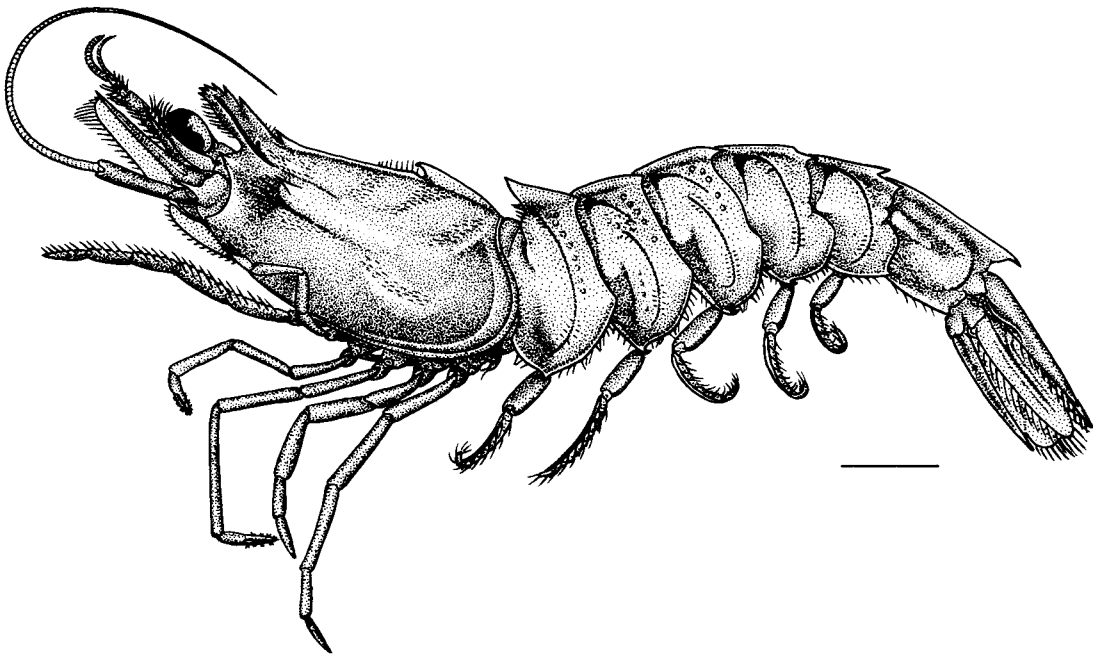


FIGURE 47.—*Sicyonia picta* Faxon 1893. Syntype ♀ 19 mm cl, off Golfo de Panamá. Lateral view. Scale = 5 mm.

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

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

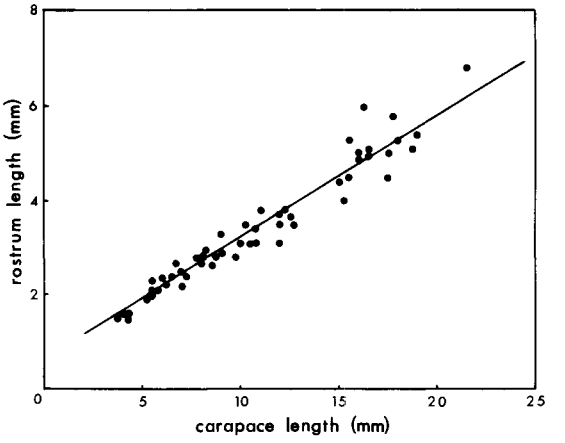


FIGURE 48.—*Sicyonia picta*. Relationship between rostrum length and carapace length (regression equation, $y = 0.51173 + 0.26668x$).

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

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

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

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

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

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

First abdominal somite traversed by anteromedian pleural sulcus, deep dorsally and disappearing at about 0.30 height of somite before reappearing ventrally as broad shallow depression merging with united posterior tergal-posteromedian pleural sulci. Second and third somites with anterior tergal and posterior tergal sulci joining anterodorsally; anteromedian pleural sulcus short (not reaching dorsally posteromedian pleural) but deep and merging with shallow anteroventral depression, latter setting off subelliptical prominence dorsally and low ridge posteriorly; posteromedian pleural sulcus long, extending anterodorsally ventral to (not joining) posterior tergal. Fourth and fifth somites with anterior tergal sulcus and curved, united posterior tergal-posteromedian pleural sulci merging. Sixth somite with arched posteromedian pleural sulcus and longitudinal rib situated along base of middorsal carina and delimited ventrally by deep depression lying just dorsal to weak cicatrix.

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

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

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

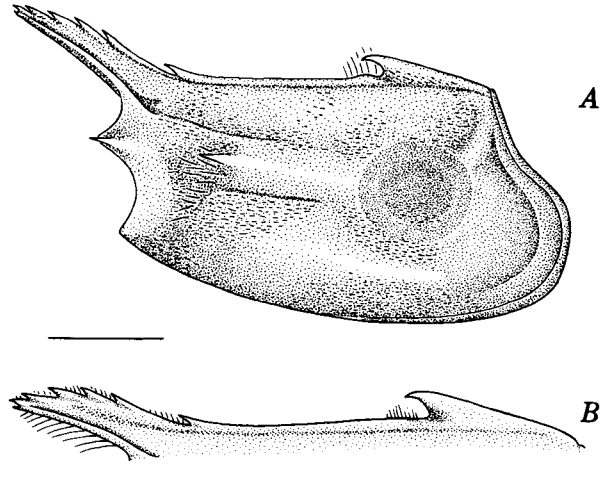


FIGURE 49.—*Sicyonia picta*. *A*, ♂ 16 mm cl, NW of Isla Monserrate, Baja California Sur, Mexico. Lateral view of carapace. Scale = 5 mm. *B*, syntype ♂ 15.5 mm cl. Golfo de Panamá. Lateral view of dorsal part of carapace. Scale = 2 mm.

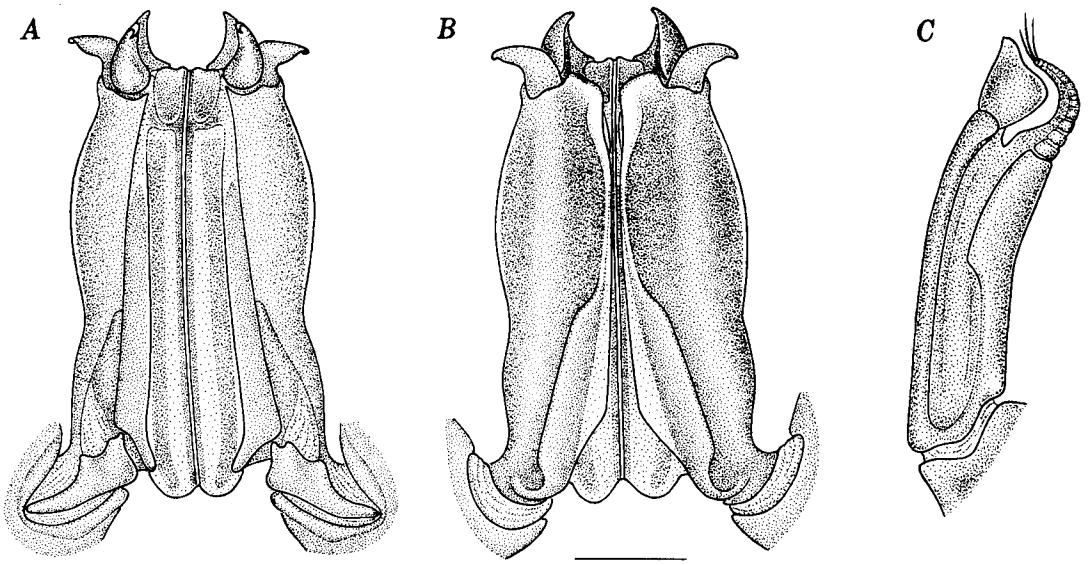


FIGURE 50.—*Sicyonia picta*, syntype ♂ 15.5 mm cl, off Golfo de Panamá. *A*, Petasma dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scales = 1 mm.

Appendix masculina as illustrated in Figure 50*C*.

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

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

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

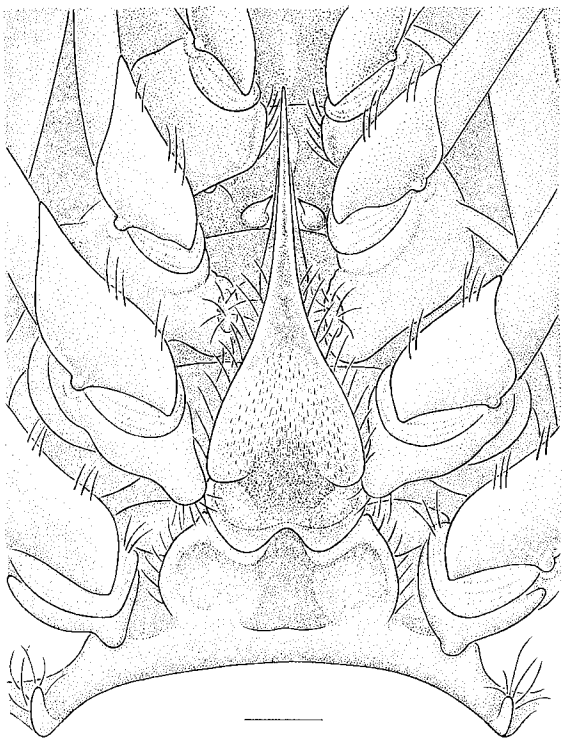


FIGURE 51.—*Sicyonia picta*, syntype ♀ 28 mm cl, off Golfo de Panamá. Thelycum. Scale = 1 mm.

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

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

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

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

The two species also differ in sculpture of the abdomen. In *S. disdorsalis* the first abdominal somite is traversed by a short anteromedian sulcus which is not represented ventrally by a depression; the posterior tergal and posteromedian pleural sulci of the second and third somites are coalescent; the anteroventral extremities of the second through fourth are unarmed or are produced in a small, ventrally projecting spine; and the posteroventral extremities of first through fourth somites are angular, that of the fourth bearing a well-developed spine, and that of the fifth, an extremely long one (instead of small as in *S. picta*) in adults.

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

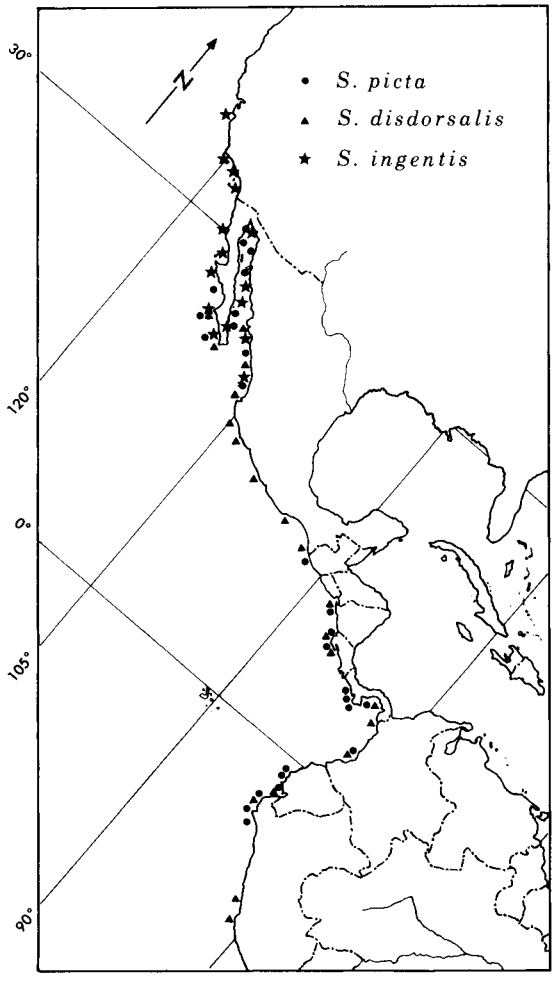


FIGURE 52.—Geographic distribution of *Sicyonia picta*, *S. disdorsalis*, and *S. ingentis*.

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

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

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

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

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

Material.—602 specimens from 61 lots.

Mexico—Baja California Sur: 1♀, AHF, 5.5 km W of mouth of Bahía Magdalena, 64 m, 8 March 1949, *Velero IV*. 1♀, USNM, off Isla Santa Margarita, 86 m, 8 April 1889, *Albatross* stn 3039. 1♂ 2♀, SIO, off Punta Márquez, 64 m, 9 November 1964. 2♀, SIO, Bahía de la Paz, 82-119 m, 12 January 1968, *Thomas Washington*. 2♂ 6♀, SIO, Bahía de la Paz, 119-128 m, 24 July 1965, R. Rosenblatt. 1♂, AHF, entrance to Bahía Agua Verde, 42-48 m, 17 March 1949, *Velero IV*. 6♂ 11♀, SIO, NW of Isla Monserrate, 170-192 m, 11 July 1965, *Horizon*. 2♀, AHF, NW of Isla Danzante Primero, 44-73 m, 18 March 1949, *Velero IV*. 1♂, YPM, Bahía de Santa Inés, 101 m, 17 March 1926, *Pawnee*. 4♀, SIO, off Santa Rosalía, 35-26 m, 25 March 1960, R. Parker. Baja California Norte (all in Gulf of California): 1♀, YPM, Bahía de los Angeles, 31-42 m, 13 May 1926, *Pawnee*. 3♂ 1♀, AHF, Puerto Refugio, Isla Angel de la Guarda, 143-165 m, 28 January 1940. 3♀, AHF, N of Isla Angel de la Guarda, 104 m, 28 January 1940. 6♂ 11♀, SIO, SE of San Felipe, 75-86 m, 19 January 1968, *Washington*. 1♂, YPM, Bahía San Luis Gonzaga, 17 May 1916, *Pawnee*. 1♂ 1♀, USNM, off Punta San Fermín, 55 m, 27 March 1889, *Albatross* stn 3035. 1♀, SIO, SE of San Felipe, 120 m, 19 January 1968, *Washington*. Sonora: 2♂ 2♀, USNM, off Cabo Tepoca, 65 m, 24 March 1889, *Albatross* stn 3018. 26♂ 29♀, USNM, SW of Cabo de Lobos, 139 m, 24 March 1889, *Albatross* stn 3016. 1♂, USNM, NW of Isla Tiburón, 265 m, 24 March 1889, *Albatross* stn 3015. 4♂ 1♀, AHF, 3 km W of Tastiota, 60 m, 21 December 1978, A. Kerotitch. Sinaloa: 3♂ 2♀, USNM, off Punta Santo Domingo, 135 m, 10 April 1889, *Albatross* stn 3043. 1♀, USNM, off Península de Quevedo, 67 m, 30 March 1978, Toral García. Nayarit: 2♂ 4♀, SIO, NE of Isla María Madre, Islas Tres Marías, 82-88 m, 30 March 1973, *Agassiz*.

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

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

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

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

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

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

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

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

Sicyonia disdorsalis (Burkenroad 1934)

Figures 52-56

Eusicyonia disdorsalis Burkenroad 1934a:96, fig. 25, 36 [syntypes: 1♂ 1♀, YPM 4391, 5♂ 6♀ (not 4♂ 7♀ as originally cited), YPM 5075, and 1♂ 1♀, YPM 4391, Pearl Islands (Archipiélago de las Perlas), 8°29'40"N, 78°52'30"W, Golfo de Panamá, 19-24 fm (35-44 m), 31 March 1926, *Pawnee*; 5♂ 5♀ (not 6♂ 4♀), YPM 5079, and 1♀, YPM 5078, Golfo de Panamá, 1868, F. H. Bradley. 1♂ 3♀, YPM 5076, and 1♂, YPM 5077, west coast of Central America, 1872, Capt. Dow]. Burkenroad 1938:87. Anderson and Lindner 1945:318.

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

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

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

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

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

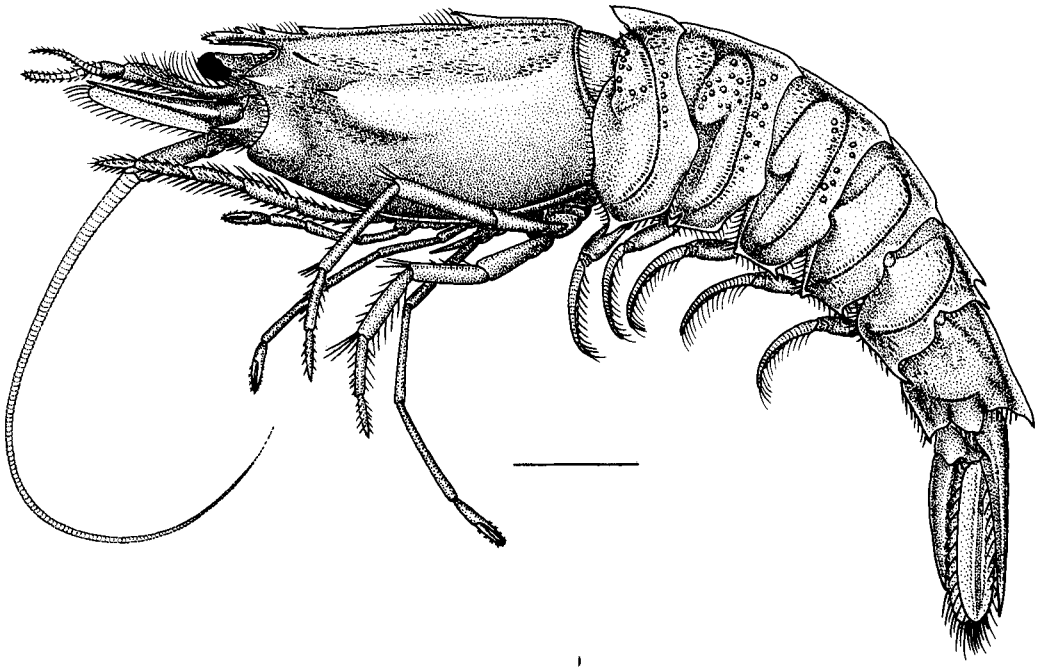


FIGURE 53.—*Sicyonia disdorsalis* (Burkenroad), ♀ 25 mm cl, Golfo de Fonseca, El Salvador. Lateral view. Scale = 10 mm.

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

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

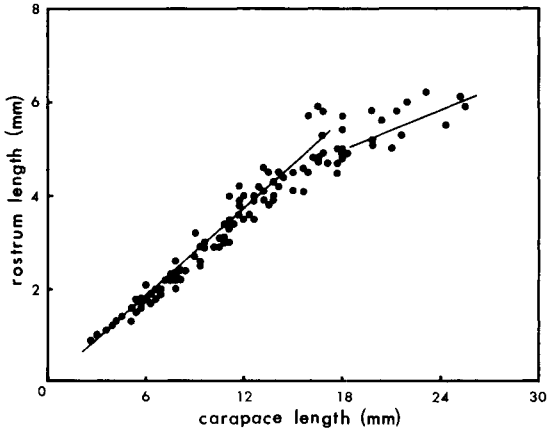


FIGURE 54.—*Sicyonia disdorsalis*. Relationship between rostrum length and carapace length (regression equation for specimens with about 18 mm cl or less, $y = -0.03933 + 0.30998x$; regression equation for those larger, $y = 2.33498 + 0.14502x$).

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

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

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

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

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

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

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

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

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

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

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

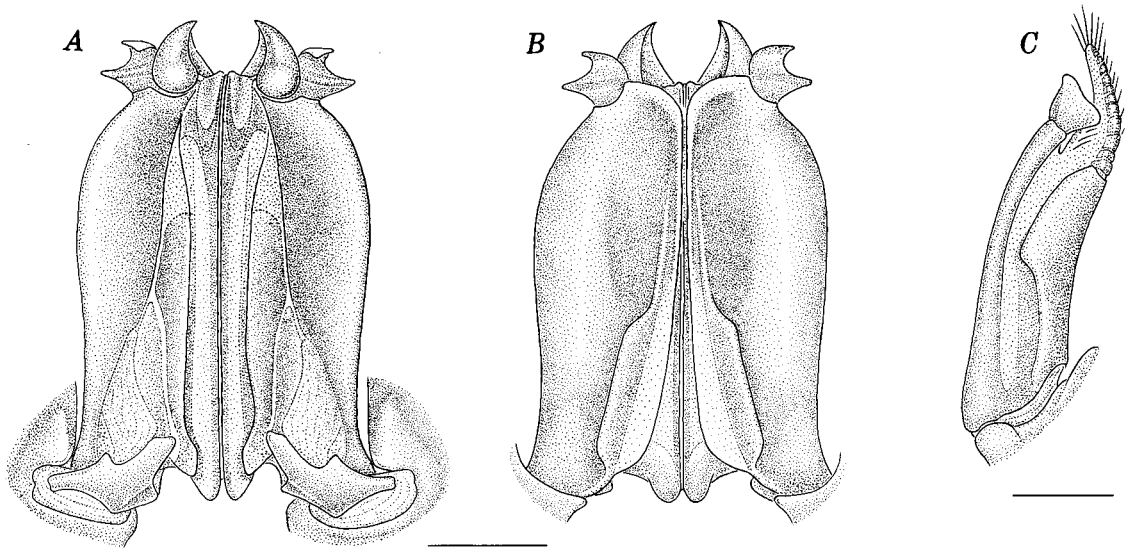


FIGURE 55.—*Sicyonia disdorsalis*, ♂ 17 mm cl, off Balboa, Panama. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scales = 1 mm.

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

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

Appendix masculina as illustrated in Figure 55*C*.

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

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

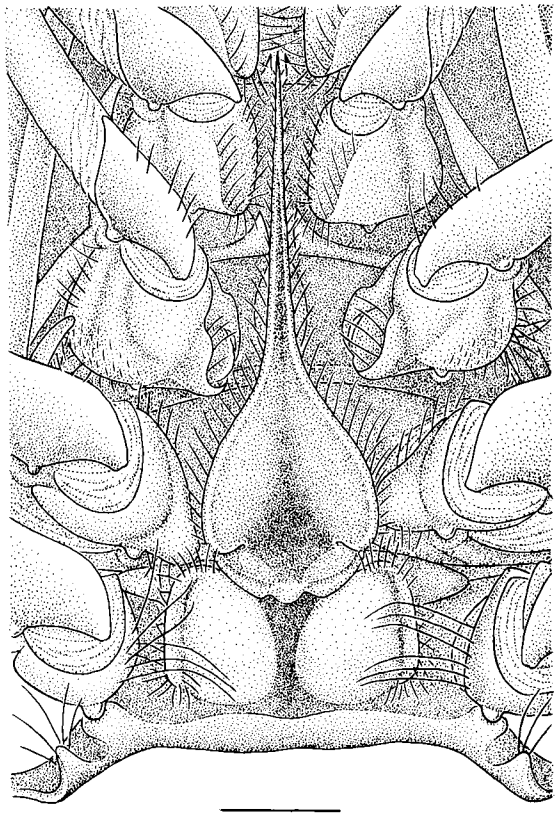


FIGURE 56.—*Sicyonia disdorsalis*, ♀ 16 mm cl, off Punta Calabazo, Panama. Thelycum. Scale = 2 mm.

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

My observations, based on a large number of live specimens taken off Panamá Viejo, Panama, indicate a color pattern much, but not exactly, like that noted by Arana Espina and Méndez G. Dorsum of carapace gray with broad transverse dark purplish band extending across epigastric tooth and produced anteriorly in roughly pentagonal spot reaching base of first rostral tooth. Branchiostegite varying from dark purplish pink (in most specimens) to milky white, sometimes with grayish white longitudinal stripe along junction of branchiostegite and dorsum. Abdomen gray with middorsal carina banded: transverse dark gray ones alternating with buff bands; large tooth projecting from carina on first somite purplish pink. Anterior margin of pleuron of first three somites bordered by white vertical stripe and posteroventral areas of third and fourth somites also white. Tergum of fifth somite bearing purplish pink V-shaped (vertex anterior) marking posteriorly. Telson and uropod gray with densely set yellow chromatophores. Lateral ramus of uropod bearing large garnet marking subdistally preceded by yellow patch, and contiguous to buff dot lying against its mesial extremity. Antenna dark garnet. Third maxilliped and pereopods pink, former with two contiguous transverse bands, orange red one on

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

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

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

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

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

Discussion.—Burkenroad (1938) was the first to point out some of the differences that separate this species from its closest relative *S. ingentis*. *Sicyonia disdorsalis* can be distinguished from the latter by having 1) a sparsely setose carapace, 2) a less elevated postrostral carina, 3) a weak, almost indistinct branchiocardiac carina, 4) a posteriorly truncate carina on the fifth abdominal somite that is sometimes produced in a spine, 5) an anteromedian pleural sulcus on the first abdominal somite which ends abruptly far from the ventral margin, and does not continue ventrally as a shallow depression, 6) a strong spine on the anteroventral extremity of the pleuron of the first abdominal somite, 7) angular posteroventral pleural margins on the first two abdominal somites, 8) minute telsonic spines in juveniles and vestigial or indistinct ones in adults, and 9) short uropodal rami that fall short of or barely surpass the apex of the telson.

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

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

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

Material.—1054 specimens from 85 lots.

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

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

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

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

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

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

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

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

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

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

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

Sicyonia ingentis (Burkenroad 1938)

Figures 52, 57-60

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

Sicyonia ingentis. Parker 1964:162. Carlisle 1969:239. Longhurst 1970:272. Word and Charwat 1976:19, 3 fig. Holthuis 1980: 61. Wicksten 1980:360. Pérez Farfante and Boothe 1981:424. Pérez Farfante 1982:371.

"?Sicyonia sp.", Mathews and González, 1975:51.

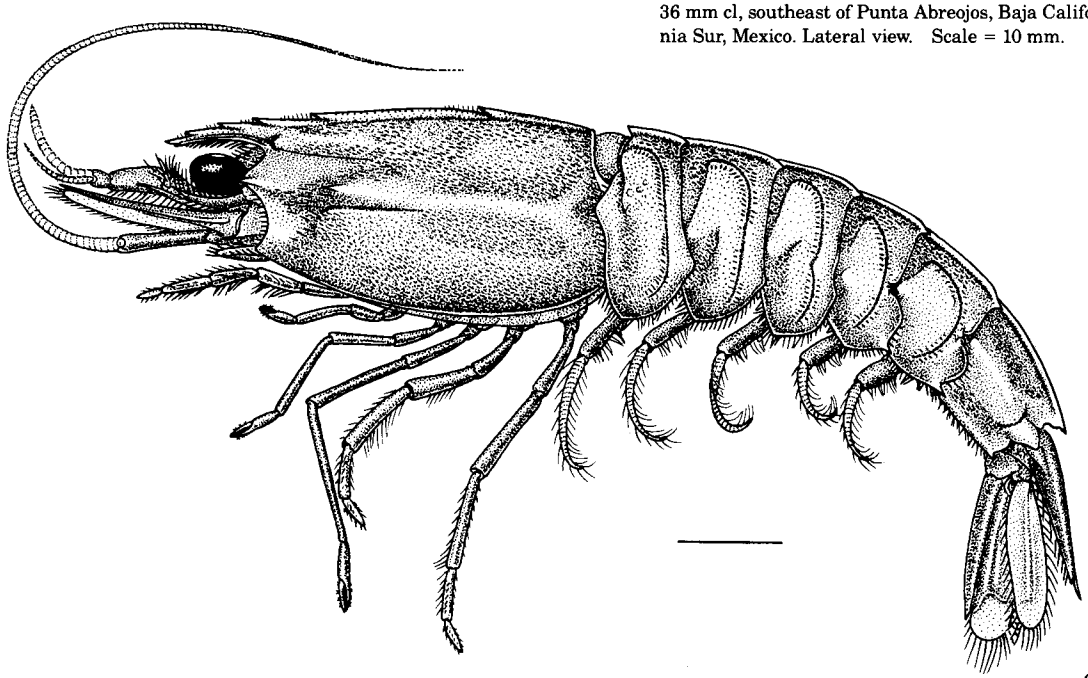
Sicyonia ringens. Mathews, 1981:329.

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

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

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

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



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

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

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

First article of antennular peduncle and gnathal appendages, except third maxilliped, illustrated in Figure 4.

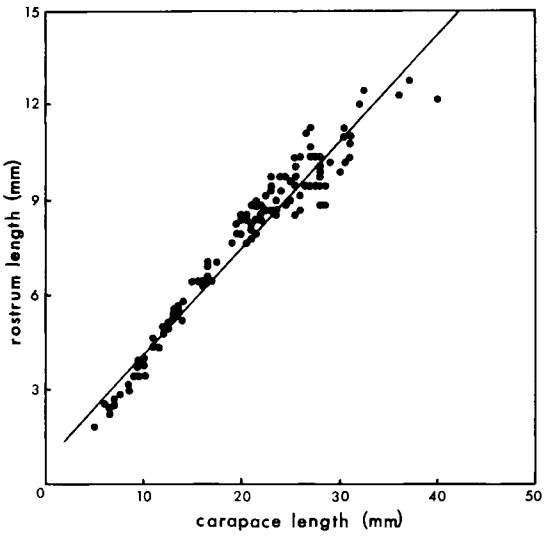


FIGURE 58.—*Sicyonia ingentis*. Relationship between rostrum length and carapace length (regression equation, $y = 0.75763 + 0.33933x$).

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

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

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

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

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

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

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

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

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

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

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

Appendix masculina as illustrated in Figure 59*C*.

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

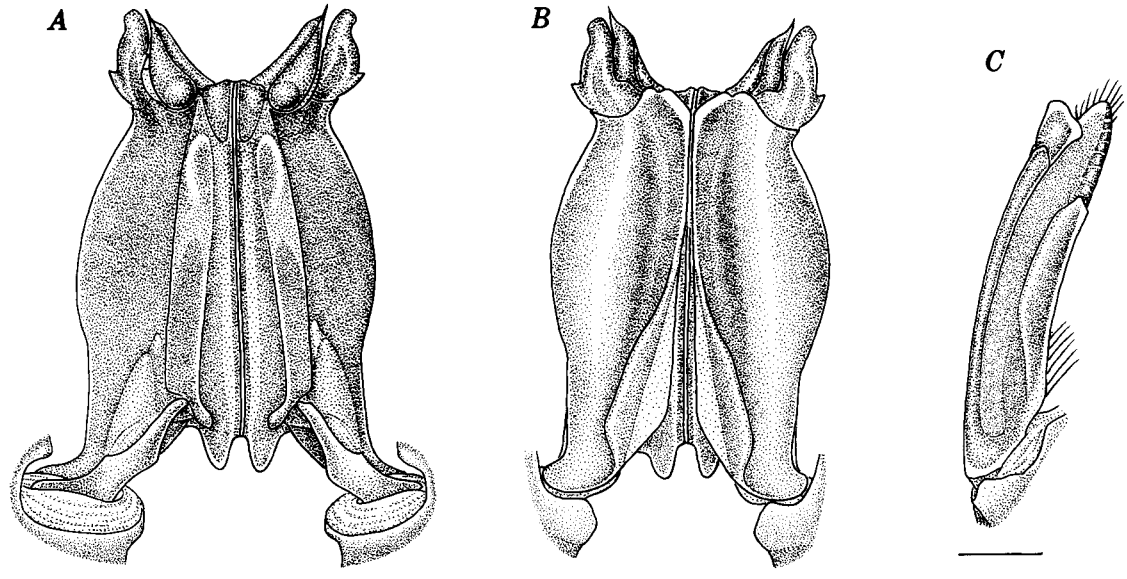


FIGURE 59.—*Sicyonia ingentis*, ♂ 16 mm cl, southeast of Punta Tasco, Isla Santa Margarita, Baja California Sur, Mexico. *A*, Petasma, dorsal view; *B*, ventral view of same; *C*, right appendix masculina, dorsolateral view. Scale = 1 mm.

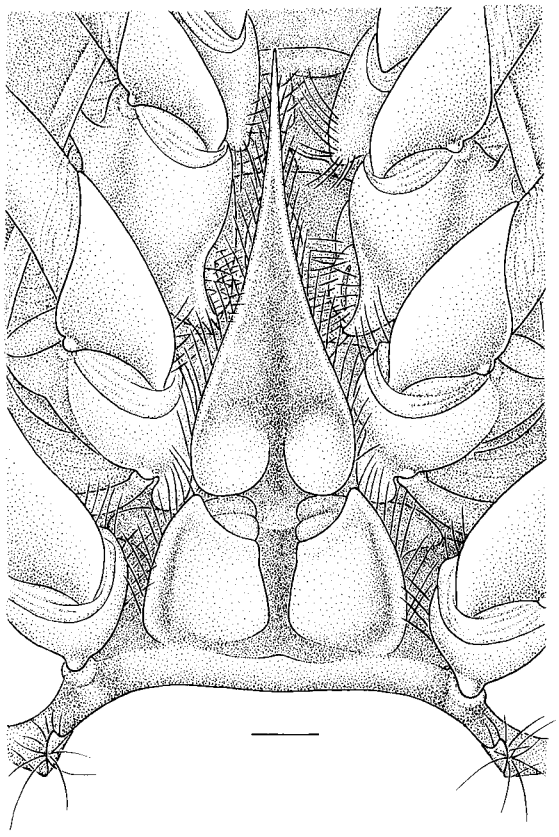


FIGURE 60.—*Sicyonia ingentis*, ♀ 23 mm cl, southeast of Punta Tasco, Isla Santa Margarita, Baja California Sur, Mexico. Thelycum. Scale = 1 mm.

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

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

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

Geographic and bathymetric ranges.—Monterey Bay, 36°50′N, 121°50′W (Pérez Farfante and Boothe 1981), California, southward to Isla María Madre, 22°00′N, 106°16′W, Nayarit, Mexico; in the Gulf of California (Fig. 52) along the central part of the eastern coast; and in the southern part along both coasts. This species has been found between 5 and 293-307 m and is most abundant from 55 to 82 m, at which depth it is commercially fished off Ventura, Calif. (Frey 1971); also most of the many specimens examined by me were taken within this range. According to Carlisle (1969) it is common at depths between 61 and 183 m. *Sicyonia ingentis* occurs on substrates of sand, shell, and green mud, but seems to prefer sandy bottoms on which commercial concentrations are located.

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

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

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

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

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

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

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

Anderson (1983) studied growth rates, molting, and certain aspects of reproduction in a population of *S. ingentis* occurring off Santa Barbara, CA. She found that spawning takes place far offshore in deep water, about 145 m, and lasts from May through October with the peak during the late summer. She also observed that molt frequency is highest in the winter and spring, that females do not molt during the summer (the reproductive period), and that males exhibit a similar pattern. Size-frequency analyses based on monthly offshore and nearshore sampling indicated that juveniles increased at a monthly rate of about 1-2 mo.

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

Material.—946 specimens from 52 lots.

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

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

Mexico—Baja California Norte: 7♂ 5♀, SIO, off Bahía de San Quintín, 57 m, 1 April 1962, Fish and Wildlife Service staff. 15♂ 11♀, SIO, off Bahía de San Quintín, 73 m, 4 December 1960, C. Boyd and D. Dockins. 12♂ 10♀, SIO, off Bahía de San Quintín, 74-77 m, H. C. Perkins. 6♂ 6♀, SIO, off Bahía de San Quintín, 143-148 m, 1 April 1962, H. C. Perkins. 2♂ 5♀, SIO, SE of San Felipe, 120 m, 19 January 1968, *Thomas Washington*. 1♀, SIO, W of Punta Prieta, 23 March 1960, H. C. Perkins. 6♂ 7♀, SIO, Bahía Sebastián Vizcaíno, 88 m, 19 August 1960, W. D. Clarke. 1♀, YPM, E of Isla Cedros, 110 m, 22 May 1936, *Zaca* stn 126D-10. 4♂ 1♀, SIO, between San Benito and Isla Cedros, 247-265 m, 27 May 1971, C. Hubbs and S. Luke. 4♂, YPM, E of Isla Cedros, 80 m, 27 March 1936, *Zaca* stn 125D-1. 24♂ 21♀, USNM, E of Isla Cedros, 80 m, 5 May 1888, *Albatross* stn 2838. 12♂ 19♀, SIO, WSW of Red Rock, Bahía Sebastián Vizcaíno, 113-119 m, 25 November 1961, F. H. Berry. 1♂, YPM, E of Isla Cedros, 73 m, 22 May 1936, *Zaca* stn 126D-4. 4♂ 6♀, YPM, E of Isla Cedros, 69 m, 27 March 1936, *Zaca* stn 126D-2. ♂ holotype, AMNH, off east coast of Isla Cedros, 69 m, 27 March 1936, *Zaca* stn 127D-1. 3♂ 1♀ and 2♂ 2♀ paratypes, AMNH and YPM, respectively, collected with holotype. 3♂ 1♀, YPM, E of Isla Cedros, 70-110 m, 27 March 1936, *Zaca* stn 125D-1. Baja California Sur: 3♂ 1♀, SIO, Bahía Sebastián Vizcaíno, 55 m, 11 August 1952, K. S. Norris. 2♂ 2♀, SIO, Bahía de San Cristóbal, 83-87 m, 2 December 1961, F. H. Berry. 19♂ 17♀, SIO, Bahía Asunción, 68-64 m, 17 November 1964, *Black Douglas*. 20♂ 20♀, SIO, SW of Punta San Hipólito, 6 March 1954, "J.M. and W.H." 13♂ 20♀, SIO, SE of Punta Abreojos, 55-59 m, 17 November 1964, *Black Douglas*. 4♂ 17♀, SIO, SE of Punta Abreojos, 73-79 m, 17 November 1964, *Black Douglas*. 27♂ 21♀, SIO, SE of Punta Abreojos, 91 m, 2 December 1960, C. Boyd and D. Dockins. 20♂ 20♀, SIO, WSW of Punta Pequeña, 68-73 m, 16 November 1964, *Black Douglas*. 2♂ 3♀, SIO, 15 km WSW of Boca de las Animas, 55-57 m, 16 November 1964, *Black Douglas*. 14♂ 6♀, SIO, SW of Santo Domingo del Pacífico, 100 m, 20 April 1969. 19♂ 11♀, SIO, 16 km NW of Isla Magdalena, 99-102 m, 16 November 1964, *Black Douglas*. 23♂ 22♀, SIO, off Bahía Magdalena, 88 m, 3 February 1964, C. Hubbs. 30♂ 30♀, SIO, SW of Isla Santa Margarita, 75-81 m, 13 November 1964, *Black Douglas*. 44♂ 26♀, SIT, SE of Punta Tasco, Isla Santa Margarita, 102-106 m, 27 June 1965, *Horizon*. 25♂ 25♀, SIO, W of Inocentes, 91-93 m, 10 November 1964, *Black Douglas*. 2♀, SIO, WNW of Punta Lobos, 183-201 m, 9 November 1964, *Black Douglas*. 1♂, SIO, Bahía de la Paz, 82-119 m, 12 January 1968, *Thomas Washington*. Sonora: 1♂ 1♀, SIO, off Hermosillo coast, 289-304 m, 25 March 1960, Curray and R. H. Parker. 1♀, AHF, S of Isla Tiburón, 4-29 m, 25 January 1940. 15♂ 11♀, SIO, off Santa Rosalía, 64-48 m, 25 March 1960, R. H. Parker. 25♂ 25♀, SIO, off Isla San Pedro Mártir, 293-307 m, 21 January 1968, *Thomas Washington*. 1♀, AHF, Bahía de Guaymas, 5 m, 23 March 1949. Sinaloa: 2♂ 1♀, USNM, Puerto de la Punta Altata, 9 May 1962, R. E. Bush. 1♀, USNM, Los Cocos, 42 m, 18 May 1962, R. E. Bush. Nayarit: 24♂ 21♀, SIO, NE of Isla María Madre, Islas Tres Marías, 82-88 m, 30 March 1973, *Agassiz*.

ACKNOWLEDGMENTS

Many persons have assisted me throughout the course of this study. Because of the large area covered I was dependent upon many sources for specimens. I am deeply indebted to the following who have lent collections to me, many of which included materials representing new locality records and range extensions: Dustin D. Chivers, California Academy of Sciences; Enrique M. Del Solar, Instituto del Mar del Perú; Harold S. Feinberg, American Museum of Natural History; Jacques Forest, Muséum National d'Histoire Naturelle, Paris; H. E. Gruner, Zoologisches Museum, Humboldt-Universität, Berlin; Janet Haig, Allan Hancock Foundation, University of Southern California; Willard D. Hartman, Peabody Museum of Natural History, Yale University; Leslie W. Knapp, Smithsonian Oceanographic Sorting Center, Smithsonian Institution; Herbert V. Levi and Catharine G. Sibble, Museum of Comparative Zoology, Harvard University; Spencer R. Luke, Scripps Institution of Oceanography; Juan B. del Rosario, Universidad de Panamá; and Mary K. Wicksten, Texas A & M University, formerly of Allan Hancock Foundation.

I have the privilege of drawing on the considerable knowledge of decapod crustaceans systematics of Horton H. Hobbs, Jr., of the Smithsonian Institution, who has given me numerous suggestions during the investigation and has criticized the manuscript. Fenner A. Chace, Jr., of the Smithsonian Institution, and Bruce B. Collette and Austin B. Williams, both of the Systematics

Laboratory, National Marine Fisheries Service, also have read the manuscript and made helpful comments. I acknowledge their assistance with deep appreciation. I am deeply grateful to Matilde Méndez G., Instituto del Mar del Perú, and to Concepción Rodríguez de la Cruz, Instituto de Pesca, Mexico, for the loan of specimens and for invaluable information concerning materials deposited in their respective institutions. Thanks are also extended to Meredith L. Jones, Smithsonian Institution, whose interest and efforts facilitated my field work in Panama; and for making available critical bibliographic references to Lipke B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden; Alexander Dragovich, Southeast Fisheries Center, National Marine Fisheries Service; and to Michel E. Hendrickx, Instituto de Ciencias del Mar y Limnología, Estación Mazatlán, Mexico.

I wish to thank Billy B. Boothe, Jr., who sorted and identified the *Sicyonia* that had been collected among large quantities of penaeoids from the region under investigation and assisted me with the morphometric work. Joseph L. Russo, formerly of the NMFS Systematics Laboratory, helped with statistical analyses and computer work, and Ruth Gibbons also assisted in the analyses and prepared the graphs and distribution maps. María M. Diéguez applied her artistic talent to the preparation of all of the illustrations except Figures 3, 4, and 7 which were ably rendered by Keiko H. Moore. Finally, I also acknowledge with gratitude the assistance of Arleen S. McClain and Virginia R. Thomas, who patiently typed several drafts of the manuscript.

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