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of the Genus *Solenocera*
with Description of a New Species
(Crustacea: Decapoda: Penaeidae)

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and

HARVEY R. BULLIS, JR.

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SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 153

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SMITHSONIAN INSTITUTION PRESS

City of Washington

1973

ABSTRACT

Pérez Farfante, Isabel, and Harvey R. Bullis, Jr. Western Atlantic Shrimps of the Genus *Solenocera* with Description of a New Species (Crustacea: Decapoda: Penaeidae). *Smithsonian Contributions to Zoology*, number 153, 33 pages, 19 figures, 1973.—Five species of the genus *Solenocera* occur in the western Atlantic, one of which is described as new: *S. acuminata*, new species, *S. atlantidis*, *S. geijskesi*, *S. necopina*, and *S. vioscai*. A key for their separation, references, disposition of types, locality records, diagnosis, detailed description, and illustrations for each species are presented; variations of several morphological and morphometric characters are assessed; and affinities of each species are indicated. Their geographic distributions and depth-temperature relationships are discussed; the range of *S. vioscai* was discovered to be limited to North American waters; in contrast, that of *S. acuminata*, new species, its close relative, to be restricted to the Bahamas, the Caribbean, and the Atlantic coast of northeastern South America. *Solenocera necopina* is newly reported in the Caribbean and the South Atlantic, off Uruguay, about 11,000 km southward of its previously known limit; *S. atlantidis* is recorded in the coastal waters of São Paulo, which represents an extension of about 7500 km of the range of the species southward, and the range of *S. geijskesi* was found to extend into the Caribbean as far north as Isla Mujeres, and along the north coast of Brazil to Ceará.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year*. SI PRESS NUMBER 4819. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress Cataloging in Publication Data

Pérez Farfante, Isabel, 1916-

Western Atlantic shrimps of the genus *Solenocera*.

(Smithsonian contributions to zoology, no. 153)

1. *Solenocera*. 2. Shrimps—Atlantic Ocean. I. Bullis, Harvey R., 1924- joint author. II.

Title. III. Series: Smithsonian Institution. Smithsonian contributions to zoology, no. 153.

QL1.S54 no. 153 [QL444.D3] 591'.08s [595'.3843] 73-1967

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
Price 65 cents domestic postpaid or 45 cents GPO Bookstore

Western Atlantic Shrimps of the Genus *Solenocera* with Description of a New Species (Crustacea: Decapoda: Penaeidae)

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Introduction

In reviewing the genus *Solenocera* of the western Atlantic—part of a long-range study of benthic panaeid shrimps obtained during cruises of the *Oregon*—it became obvious that a collective study of the species of the genus was needed. Examination of the large collections at our disposal, which also included many samples taken by fourteen other exploratory vessels, revealed the presence of an undescribed species. Furthermore, several additional features became evident that proved to be diagnostic for the western Atlantic members of *Solenocera*, and it was also found that a greater range of variation than had been previously suspected exists among many characters currently utilized in distinguishing the species. The terminology employed for many structures by previous authors varies, and the literature is so scattered that there is a real need for uniform descriptions of the species found in the region.

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Smith (1885) gave the first general account of the external morphology of western Atlantic *Solenocera*. His material consisted of three females from the Gulf of Paria, Trinidad, which he identified as "*Solenocera siphonocera* Miers" [= *S. membranacea* (Risso, 1816)], a widespread species in the eastern Atlantic and the Mediterranean; actually one of the specimens is *S. atlantidis* Burkenroad, and the others are *S. acuminata*, new species. Burkenroad (1936) based the original description of *S. vioscai* on females only; the male was treated by him (1939) when he also described *S. atlantidis*, based on both males and females, and *S. necopina*, of which he had only females. Characters of the male of the latter species were presented two years later by Lindner and Anderson (1941). Holthuis (1959) described the fourth western Atlantic species, *S. geijskesi*, and, recently, Roberts and Pequegnat (1970) discussed a few morphological differences between *S. vioscai* and *S. necopina*.

Presented herein is a key for separation of the five species of *Solenocera*, which are described in detail, and for which complete distributional data are given.

ACKNOWLEDGMENTS.—In addition to the collections in the National Museum of Natural History,

Smithsonian Institution (under the specimen numbers of the former United States National Museum: USNM), type-material and other specimens were obtained on loan from the following institutions: American Museum of Natural History (AMNH), through H. S. Feinberg; Institute of Marine Sciences, University of Miami (UMML), through G. L. Voss; Institute of Marine Sciences, University of North Carolina (UNC-IMS), through A. B. Williams; Instituto Oceanográfico, Universidade de São Paulo (IOUSP), through M. Iwai; Muséum National d'Histoire Naturelle, Paris (MNHN), through J. Forest; National Marine Fisheries Service, Galveston Biological Laboratory (NMFS-GBL), through R. F. Temple; Peabody Museum of Natural History, Yale University (YPM), through W. D. Hartman; Universidade Federal do Rio de Janeiro (UFRJ), through H. Rodrigues da Costa. We wish to express our gratitude to the above-mentioned individuals for their cooperation.

Thanks are also due H. H. Hobbs, Jr., of the Smithsonian Institution, for invaluable advice and assistance during the course of the study; L. B. Holthuis, of the Rijksmuseum van Natuurlijke Historie in Leiden, for generously sharing collections and furnishing suggestions to taxonomic problems; F. A. Chace, Jr., of the Smithsonian Institution, and A. B. Williams, of the National Marine Fisheries Service, Systematics Laboratory, for critically reading the manuscript. A. C. Jones, of the National Marine Fisheries Service, Southeast Fisheries Center, provided us with photographs of *Solenocera acuminata*, new species, on which the description of the color of the species is based. M. M. Diéguez executed the drawings.

PRESENTATION OF DATA.—The c.l. (carapace length—linear distance between orbital margin and midposterior margin of carapace) is measured to the nearest 0.5 mm. Ratios are given to the nearest 0.05. Ocean depths have been recorded to the nearest meter. Scales accompanying the illustrations are in millimeters. Finally, most of the terminology utilized in the descriptions has been discussed and illustrated by Pérez Farfante (1969).

Genus *Solenocera* Lucas, 1849

Solenocera Lucas, 1849a:149 [nomen nudum].

Solenocera Lucas, 1849b:300; 1850:219.—Kubo, 1949:223.

[Type-species, by monotypy: *Solenocera philippii* Lucas, 1849, new name for *Peneus siphonoceros* Philippi, 1840=*Peneus membranaceus* Risso, 1816=*Solenocera membranacea* (Risso, 1816). Gender: feminine. Placed on the Official List of Generic Names in Zoology as Name No. 1444, International Commission on Zoological Nomenclature (1966), Opinion 611.]

Parasolenocera Wood-Mason, 1891:276. [Type-species, by monotypy: *Parasolenocera annectens* Wood-Mason, 1891.]

DIAGNOSIS.—Rostrum relatively short, strongly compressed laterally, and armed only with dorsal teeth. Postorbital, antennal, and hepatic spines present; pterygostomial or branchiostegal spines present or absent. Cervical sulcus long, reaching, or almost reaching, middorsum of carapace; hepatic sulcus well marked. Abdomen carinate dorsally. Telson with median sulcus, and usually with conspicuous pair of fixed lateral spines, occasionally lacking spines. Prosartema present. Antennular flagella longer than carapace, lamellate, broad ventral pair forming trough covered by narrower dorsal flagella, four together constituting respiratory siphon. Mandibular palp two-segmented, distal segment subtriangular. First maxilla with unsegmented palp. First pereopod with spine on basis and ischium; second pereopod usually armed with spine on basis. Exopods on all maxillipeds and pereopods. Petasma with heavily sclerotized lateral lobe, bearing terminal process on distal extremity of dorsolateral lobule; endopod of second pleopod in males bearing appendices masculina and interna, and with lateral wall of basal sclerite produced distally into ventrolateral ("posterior") spur. Telycum of "open type," not enclosing seminal receptacle. Zygocardiac ossicle with two or three principal teeth, and row of smaller teeth progressively decreasing in size posteriorly. Pleurobranchiae on somites IX to XIV; anterior and posterior arthrobranchiae on somites VII to XIII, those on VII rudimentary; podobranchia on second maxilliped; epipods on maxillipeds and four anterior pairs of pereopods (slightly modified from Kubo, 1949).

Key to the American Atlantic Species of *Solenocera*

1. Rostral + epigastric teeth 8-11, modally 9. Postrostral carina extending almost to posterior margin of carapace, high and sharp along entire length, and deeply notched at level of cervical sulcus. Petasma with ventrolateral lobule considerably surpassing distally dorsomedian lobule and produced into subelliptical tongue-like lamella 2
Rostral + epigastric teeth 4-8. Postrostral carina low or absent posterior to cervical sulcus, if present only slightly depressed, if at all, at level of cervical sulcus 3
2. Stylocerite relatively short, length 0.55-0.65 distance between its proximal end and base of distolateral spine of antennule, and produced into short to moderately long spine. Paired thelycal protuberances on sternite XIV convergent, occasionally with mesial margins subparallel distally *S. vioscai* Burkenroad, 1934
Stylocerite long, length 0.65-0.75 distance between its proximal end and base of distolateral spine of antennule, and produced into long spine. Paired thelycal protuberances on sternite XIV with mesial margins slightly to strongly divergent distally .. *S. acuminata*, new species
3. Anterior part of carapace glossy. Scaphocerite long, exceeding antennular peduncle by more than 10 percent of its own length. Pterygostomian spine relatively large, with broad base, dorsal margin joining carapace in gentle curve. Petasma with ventrolateral lobule considerably surpassing distally dorsomedian lobule, and ending in broad, subcircular to suboval lamella. Thelycum with median, longitudinal ridge on anterior part of sternite XIII *S. necopina* Burkenroad, 1939
Anterior part of carapace setose. Scaphocerite short, extending only to distal end of antennular peduncle, or exceeding it by not more than 10 percent of its own length. Pterygostomian spine small, with narrow base, dorsal margin joining carapace at about right angle. Petasma with ventrolateral lobule barely, if at all, surpassing dorsomedian lobule, or if considerably overreaching it, ending in narrow, pointed lamella. Thelycum lacking median ridge on anterior part of sternite XIII 4
4. Rostral + epigastric teeth 4-7, modally 6. Prosartema short, not reaching distal end of first antennular segment. Petasma with ventrolateral lobule short, barely, if at all, surpassing dorsomedian lobule, and lacking distal lamella. Thelycum with posterior part of sternite XIII, in advance of fourth pereopods, evenly convex or produced to central elevation, sometimes bearing knob *S. atlantidis* Burkenroad, 1939
Rostral + epigastric teeth 7-8. Prosartema long, conspicuously surpassing distal end of first antennular segment. Petasma with ventrolateral lobule considerably exceeding dorsomedian lobule, and produced into narrow, pointed lamella. Thelycum with posterior part of sternite XIII, in advance of fourth pereopods, forming strong, transverse ridge, its anterior wall sloping dorsally, giving rise to median platelike structure *S. geijskesi* Holthuis, 1959

Solenocera vioscai Burkenroad

FIGURES 1A, B, 2, 3, 18, 19

Solenocera vioscai Burkenroad, 1934 (part): 65, figs. 1-4 [holotype: ♀, AMNH 6698; type-locality: about 5 miles (8 km) off Pass a L'outre, Louisiana, "15 fathoms" (27 m)].—Burkenroad, 1939:13, figs. 12-15.—Lindner and Anderson, 1941:186.—Hildebrand, 1954:270.—Voss, 1955:9, fig. 3.—Springer and Bullis, 1956:8.—Roberts and Pequegnat, 1970:27.—Pequegnat and Roberts, 1971 (part): 8.—Brusher, Renfro, and Neal, 1972:75.—Franks, Christmas, Siler, Combs, Waller, and Burns, 1972:54. [Not *Solenocera vioscai* Burkenroad, 1936:122.]

MATERIAL.—UNITED STATES. North Carolina: 1 ♀, USNM, off Cape Lookout, 174-183 m, 13 March 1961, *Silver Bay* sta 2931.

Florida: 1 ♂, USNM, off Flagler Beach, 51 m, 12 January 1965, *Oregon* sta 5167. 1 ♂ 6 ♀, USNM,

off Cocoa Beach, 146 m, 2 February 1961, *Silver Bay* sta 2732. 1 ♀, USNM, S of Dry Tortugas, 110 m, 30 October 1960, *Silver Bay* sta 2429. 1 ♀, USNM, S of Dry Tortugas, 110 m, 30 October 1960, *Silver Bay* sta 2429. 1 ♀, USNM, S of Fort Walton, 219 m, 15 June 1964, *Oregon* sta 4945. 2 ♀, USNM, S of Santa Rosa I, 128 m, 1 March 1955, *Oregon* sta 1253.

Alabama: 20 ♂, YPM, off Mobile Bay, 128 m, 21 March 1937, *Atlantis* sta 2814. 1 ♂ 5 ♀, USNM, off Mobile Bay, 183 m, 12 December 1963, *Oregon* sta 4583.

Louisiana: 10 ♂ 60 ♀, USNM, E of Mississippi Delta, 229 m, 26 June 1948, *Oregon* sta 2203. 1 ♀, USNM, E of Mississippi Delta, 46 m, 12 January 1970, *Oregon II* sta 10864. 1 ♂ 1 ♀, USNM, E of

Mississippi Delta, 68 m, 23 August 1950, *Oregon* sta 88. 1 ♂ 1 ♀, YPM, E North Pass, 64 m, 9 April 1937, *Atlantis* sta 2853-3. 7 ♂ 2 ♀, YPM, off Pass a L'outré, 82-88 m, 10 April 1937, *Atlantis* sta 2853-13. 1 ♀, YPM, off Pass a L'outré, 138 m, 10 April 1937, *Atlantis* sta 2853-14. 5 ♂ 7 ♀, USNM, NE of Pass a L'outré, 51 m, 22 October 1953, *Oregon* sta 843. 3 ♀, USNM, off Blind Bay, 75 m, 8 August 1950, *Oregon* sta 72. 1 ♀, USNM, off Blind Bay, 73 m, 3 February 1938, *Pelican* sta. 7. ♀, holotype, AMNH 6698, about 8 km off Pass a L'outré, "15 fm" [27 m], March 1931, M. D. Burkenroad. 1 ♀, paratype, YPM 4389, off Pass a L'outré, "15 fm" [20 fm=37 m], March 1931, M. D. Burkenroad. 6 ♀, USNM, 24 km E of Pass a L'outré, 73 m, May 1956, H. R. Bullis. 2 ♂ 8 ♀, YPM, E of Pass a L'outré, 79 m, 10 April 1937, *Atlantis* sta 2853-7. 6 ♀, UMML, off Southeast Pass, 91 m, 9 November 1952, *Oregon* sta 687. 2 ♂ 1 ♀, YPM, off Southeast Pass, 80 m, 10 April 1937, *Atlantis* sta 2853-6. 3 ♂ 8 ♀, YPM, E of South Pass, 80-110 m, 9 April 1937, *Atlantis* sta 2853-5. 1 ♂ 1 ♀, YPM, E of South Pass, 110-128 m, 10 April 1937, *Atlantis* sta 2853-11. 1 ♂ 1 ♀, YPM, E of South Pass, 55 m, 10 April 1937, *Atlantis* sta 2853-12. 1 ♂, USNM, S of Mississippi Delta, 155 m, 21 May 1959, *Oregon* sta 2509. 9 ♀, USNM, off Southwest Pass, 79 m, 7 May 1951, *Oregon* sta 340. 1 ♀, USNM, off Southwest Pass, 79 m, 7 May 1951, *Oregon* sta 342. 1 ♀, USNM, off Southwest Pass, 97 m, 24 October 1953, *Oregon* sta 847. 3 ♀, USNM, off Shell I, 68 m, 13 September 1950, *Oregon* sta 107. 4 ♀, USNM, S of Grand Terre Is, 183 m, 23 September 1955, *Oregon* sta 1421. 5 ♀, USNM, S of Timbalier I, 73-70 m, 20 February 1964, *Oregon* sta 4694. 1 ♂ 1 ♀, YPM, S of Isles Dernieres, 51 m, 25 March 1937, *Atlantis* sta 2838. 22 ♂ 14 ♀, YPM, S of Caillou Bay, 55 m, 25 March 1937, *Atlantis* sta 2840. 2 ♀, USNM, off Marsh I, 183 m, 6 March 1964, *Oregon* sta 4750. 1 ♀, USNM, off Marsh I, 77-80 m, 13 September 1962, *Oregon* sta 3782. 1 ♀, USNM, S of Cameron, 91 m, 17 January 1964, *Oregon* sta 4603.

Texas: 2 ♀, USNM, S of Port Aransas, 55 m, 21 May 1961, H. Compton. 1 ♀, USNM, off Padre I, 78 m, 30 January 1939, *Pelican* sta 112-3. 1 ♀, NMFS-GBL, off Texas coast, May 1965, NMFS-GBL staff. 1 ♂, NMFS-GBL, SE of Colorado River, 110 m, 20 December 1961, *Belle of Texas*.

MEXICO. Tamaulipas: 2 ♀, USNM, S of Matamoros, 46 m, 25 September 1962, *Oregon* sta 3932. 1 ♀, USNM, NE of Barra Soto La Marina, 73 m, 13 October 1952, *Oregon* sta 662. 1 ♀, USNM, off Tampico, 10 June 1959, E. Ramírez and F. Aguilar.

Tabasco: 1 ♂ 7 ♀, USNM, off Laguna Machona, 64 m, 16 May 1954, *Oregon* sta 1060. 1 ♂ 8 ♀, USNM, NW of Punta Frontera, 65 m, 8 June 1970, *Oregon* II sta 10981. 3 ♀, USNM, NW of Punta Frontera, 66 m, 9 June 1970, *Oregon* II sta 10982. 1 ♂ 4 ♀, USNM, off Paraíso, 71 m, 7 June 1970, *Oregon* II sta 10975.

DIAGNOSIS.—Rostral + epigastric teeth 8-11, usually 9. Anterior part of carapace naked; postrostral carina almost reaching posterior margin of carapace, high and notched at level of cervical sulcus. Stylocerite short, length 0.55-0.65 of distance between its proximal end and base of distolateral spine, and produced into short spine. Petasma with ventrolateral lobule distally produced into subelliptical lamella, considerably overreaching dorsomedian lobule. Thelycum with high median ridge on sternite XIII; paired protuberances on sternite XIV convergent, occasionally with distomesial margins subparallel.

DESCRIPTION.—Carapace glabrous except for elongate patch of setae covering portion of rostrum immediately dorsal to adrostral carina, and continuing posteriorly to epigastric tooth. Rostrum reaching as far as distal end of first antennular segment, horizontal or slightly tilted upward, uniform in height along short basal portion, from there tapering to apex, with dorsal margin straight, and ventral margin straight or slightly convex. Rostral + epigastric teeth 8-11, mode 9 (percentage distribution: 8-4, 9-65, 10-30, 11-1; N=200), teeth progressively smaller and closer from epigastric to ultimate, latter placed near apex; fourth tooth at level of orbital margin, epigastric located at about posterior 0.3 of distance from orbital margin to dorsal extremity of cervical sulcus. Adrostral carina extending obliquely from orbital margin to level of ultimate or penultimate tooth; postrostral carina high, long, extending almost to posterior margin of carapace, deeply notched at level of cervical sulcus. Orbital spine short, acute; postorbital spine long; antennal spine relatively small; hepatic spine prominent; pterygostomial spine broad at base, not conspicuously

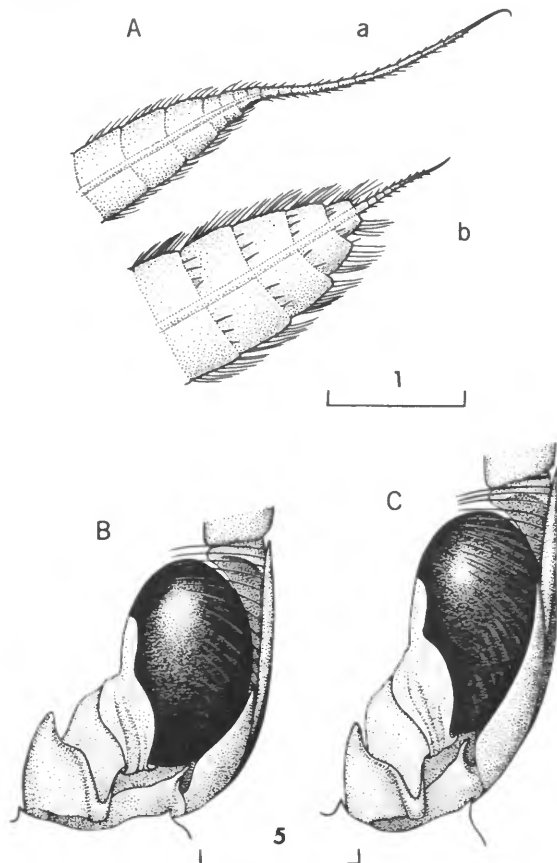


FIGURE 1.—*Solenocera vioscai* Burkenroad. A, Distalmost portion of the antennular flagella: a, dorsal flagellum; b, ventral flagellum, ♀ 23 mm c.l., E of Mississippi Delta, Louisiana. B, Eye and first segment of the antennular peduncle, ♀ 25 mm c.l., off Mobile Bay, Alabama. C, *Solenocera acuminata*, new species: eye and first segment of the antennular peduncle, ♀ 31 mm c.l., off Barranquilla, Colombia.

produced, often slightly inclined ventrally. Cervical sulcus deep, broad, and sinuous, anteriorly convex dorsally, and concave ventrally; cervical carina sharp; hepatic sulcus almost horizontal posteriorly, merging with depressed area below hepatic spine, from there turning anteroventrally, and ending at semicircular, pterygostomian pit; latter continuing with narrow anterior sulcus, parallel to anteroventral margin of carapace.

Antennular peduncle about 0.6 length of carapace; prosartema extending to distal margin of first segment; stylocerite (Figure 1B) relatively short, its length 0.55–0.65 of distance between its prox-

imal end and base of distolateral spine, and produced into relatively short spine; antennular flagella abruptly tapering distally, each bearing terminal filament; that of dorsal about 2.5 times length of ventral (Figure 1Aa, b); flagella (Figure 2) long, dorsal slightly longer than ventral; ratio of length of dorsal flagellum (excluding filament) to length of carapace decreasing from range of 3 to 2.8 in shrimp with 12 mm c.l., to 1.7 in shrimp with 31 mm c.l.; distolateral spine short, reaching or barely surpassing distal margin of first segment.

Sphocerite usually reaching distal end of antennular peduncle, occasionally exceeding it by as much as 0.1 of its own length; lateral rib ending distally in acute spine, falling short of distal margin of lamella; antennal flagella long—although incomplete in all specimens observed—in one with longest, 2.5 times total length of shrimp.

Third maxilliped exceeding antennular peduncle by length of dactyl and 0.5–0.8 that of propodus; first pereopod surpassing carapace by as much as 0.6 length of propodus; second pereopod exceeding antennular peduncle by about length of dactyl; third pereopod overreaching antennular peduncle by length of propodus and as much as 0.5 that of carpus; fourth pereopod extending to distal end of antennular peduncle or exceeding it by as much as 0.5 length of dactyl; fifth pereopod surpassing antennular peduncle by length of dactyl and about 0.7 that of propodus. Spines on basis and ischium of first pereopod long, strongly pointed; second pereopod with long pointed spine on basis. Coxa of fourth pereopod of females produced into short plate directed posteromesially, its excavated posterior margin articulating with notch, located anterior to lateral projection of heavily sclerotized posterior part of sternite XIII; coxa of fifth pereopod bearing blunt spine on anteromesial margin in females, (sometimes barely perceptible or absent), and on anterolateral margin in males.

Abdomen with sharp and high middorsal carina from third to sixth somite; low, rounded carina on posterior half of second somite sometimes present in large specimens; posterodorsal margin of third to fifth somites with median incision; sixth somite bearing sharp spine at posterior end of carina, and pair of posteroventral small spines. Telson with median sulcus deep anteriorly, increasingly shallower posteriorly; fixed lateral spines arising about

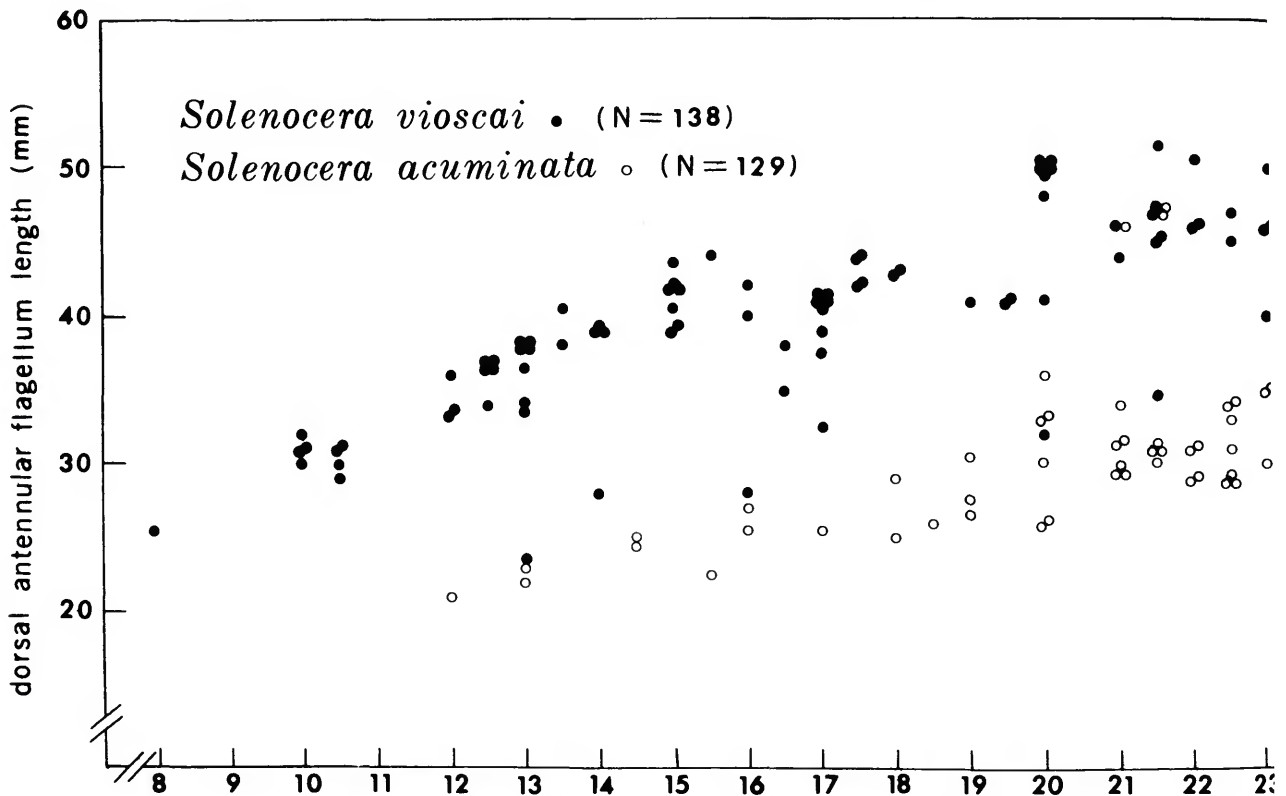


FIGURE 2.—Relationship between length of dorsal antennular flagellum and carapace length in *S. vioscai* and *S. acuminata*.

0.65 length of telson from anterior margin, their length 0.45–0.65 basal width of terminal portion of telson; length of terminal portion 3–3.5 times width at base; tip reaching or almost reaching mesial ramus of uropod, lateral ramus slightly overreaching mesial.

Petasma, appendix masculina, and appendix interna similar to those of *Solenocera acuminata* described below.

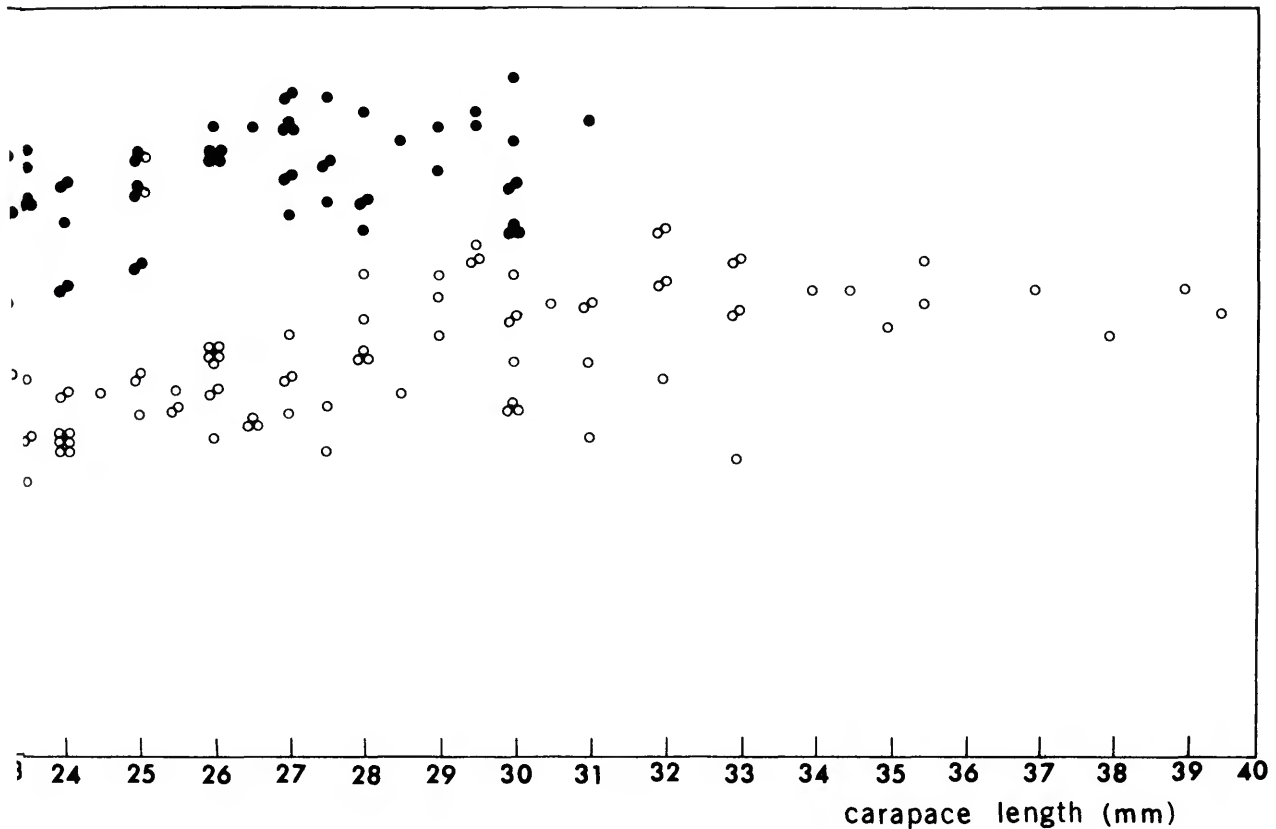
Thelycum (Figure 3A, B) with paired protuberances on anterior part of sternite XIV setose, short to elongate, subconical or distally flattened, convergent, and inclined posteromesially; in larger females protuberances sometimes meeting, and occasionally with their distomesial margins extending parallel and contiguous; anterior part of sternite XIII with sharp, high, and setose median ridge produced into beaklike projection overhanging, and closely appressed to, posterior margin of ster-

nite XII; posterior extremity of sternite XIII with conspicuous median emargination, and produced anterolaterally into hornlike projections.

COLOR.—“In general pale orange interspersed with many translucent areas; the pigment is particularly concentrated on rostrum and antennules, and as bands across the posterior parts of the pleonic terga. There are patches of opaque white on the outer sides of the legs and pleopods, on the uropods, and at the posterior margins of the fourth and fifth pleonic segments” (Burkenroad, 1939).

SIZE.—Males 5–23.5 mm c.l.; females 8–31 mm c.l.

GEOGRAPHIC AND BATHYMETRIC RANGES.—Southeast of Cape Lookout, North Carolina, southward and into the Gulf of Mexico to the Dry Tortugas Islands (Figure 18). Apparently, it is absent along the west coast of Florida to Fort Walton, where it appears again, ranging along the northern and



western waters of the Gulf of Mexico, at least to Tabasco. This species seems to be rare off the southeastern coast of the United States, the three records presented here being the first reported from the area.

Solenocera vioscai has been found at depths of about 35 to 240 m. Burkenroad (1939) reported that in the waters off Alabama and Louisiana this species was present at depths ranging from 37 to 188 m, and was most abundant between 37 to 73 m. In the northern Gulf of Mexico, Hildebrand (1954) found *S. vioscai* to be most common between 57 and 68 m. Along the northwestern Gulf, Brusher et al. (1972) did not catch it at depths of 14 and 27 m, the two shallower stations they investigated, but found it to be abundant at 46 and 64 m, and sparingly present at 82 and 110 m. Franks et al. (1972) reported that in their investigation of the 9–90 m depth zone off the Mis-

issippi coast, this shrimp was taken only at 90 m. The samples we have examined, from North Carolina to Tabasco, were obtained at depths of 37 to 239 m, most within the range of 50 to 80 m.

SUBSTRATES.—Mud (*Oregon* stas 72, 88, 107, 687, 843, and 2203); blue-black mud (*Oregon* sta 662); blue mud (*Oregon* sta 847); gray mud (*Oregon* sta 1060); gray-green mud (*Oregon* sta 1253); mud and sand (*Pelican* sta 112–3); and shells (*Silver Bay* sta 2429).

REMARKS.—*Solenocera vioscai* differs from *S. acuminata*, new species, in that the stylocerite is shorter and produced into a less prominent spine (stylocerite length = 0.55–0.65 of distance between its proximal end and the base of the distolateral spine); the distolateral, postorbital, and pterygostomian spines are relatively shorter; and the thelycal protuberances usually smaller and directed mesially along their entire length. In an occasional

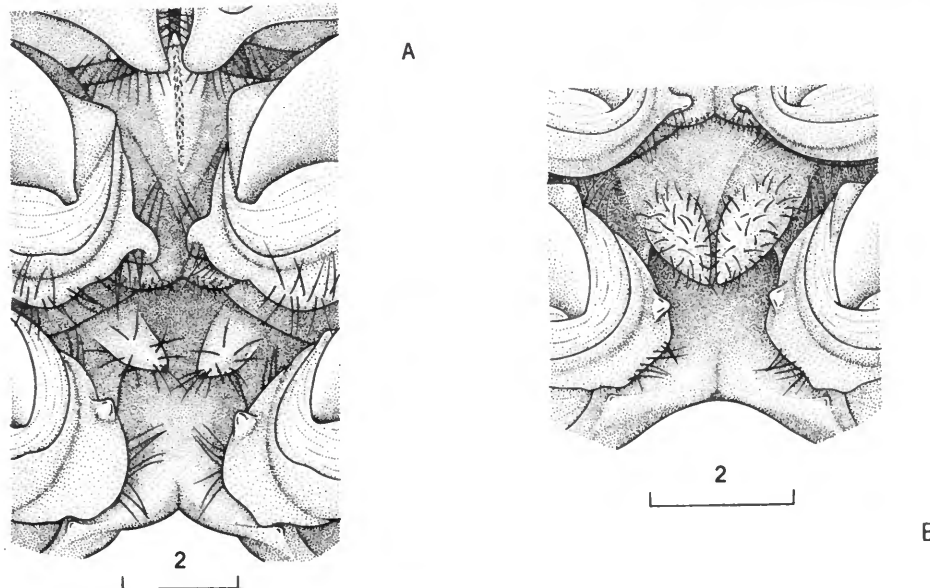


FIGURE 3.—*Solenocera vioscai*, thelyca: A, ♀ 28.5 mm c.l., S. of Grand Terre Is., Louisiana. B, ♀ 30 mm c.l., off Mobile Bay, Alabama.

specimen the distomesial margins of the protuberances extend parallel and contiguous. Furthermore, the antennular flagella are considerably longer in *S. vioscai* than in *S. acuminata*. The petasmata of the two species are virtually identical.

Heegaard (1966) described specimens of two mysis stages from the eastern coast of Brazil under the name *Solenocera muelleri* (Ortmann). He was convinced that conspecific with them are the larvae from Desterro [Florianópolis], Brazil, referred by Müller (1863:22, pl. 2: figs. 18–22) to the genus *Cryptopus*, and those from off the Bermuda Islands and the northern coast of Brazil, reported by Ortmann (1893:77, pl. 4: fig. 5). Believing his specimens belonged to the same species as those of Müller, Ortmann named it *Opisthocaris muelleri*. Heegaard suggested, if only as a possibility, that the above-mentioned lots of larvae might belong to *Solenocera vioscai* Burkenroad, a species originally thought to occur in the waters off Louisiana and Venezuela [Gulf of Paria]. The range of *S. vioscai* as here restricted, however, is now known to be limited to eastern North America (including the Gulf of Mexico), and that of *S. acuminata* extends from the northern Caribbean south only as far as French Guiana. Both *S. atlantis*,

to which one of the three specimens from Venezuela cited by Burkenroad in the description of *S. vioscai* belongs, and *S. necopina* have ranges that most nearly approximate that of the larvae grouped under *S. muelleri* by Heegaard. Neither the adults of those two species nor those of any other member of the genus have been recorded from the Bermuda Islands; consequently, correlations of the larvae studied by Müller, Ortmann, and Heegaard with adult shrimp must wait further investigations on the larval development of western Atlantic *Solenocera*.

Although Burkenroad (1934) stated that both the holotype and the paratype were taken at "15 fathoms," on the label for the paratype is written "20 fms" in the author's handwriting, whereas on that accompanying the holotype the depth is not recorded.

Solenocera acuminata, new species

FIGURES 1c, 2, 4–6, 18, 19

Solenocera siphonocera Smith, 1885 (part):186 [not *Solenocera siphonocera* (Philippi, 1840)].

Solenocera vioscai Burkenroad, 1934 (part):65, figs. 1–4.—Bullis and Thompson, 1959a:33.—Bullis and Thompson, 1959b:1.—Pequegnat and Roberts, 1971 (part):8.—Naidu

and Boerema, 1972:4. [Not *Solenocera vioscai* Burkenroad, 1936:122.]

?*Solenocera vioscae*.—Bullis and Thompson, 1965:7.

TYPES.—Holotype: ♀, 39 mm c.l.; about 140 mm t.l. Other measurements: rostrum length, 11.5 mm; antennular flagellum length, 39 mm; stylocerite length, 7 mm; proximal extremity of stylocerite-base of distolateral spine distance, 10.5 mm. Type-locality: N of Rivière Organabo, French Guiana, 07°15' N, 53°35' W, 210 m, *Oregon* sta 2022, 9 November 1957, USNM 141462.

Allotype: ♂, 27.5 mm c.l.; about 115 mm t.l.; antennular flagellum length, 34 mm, data as in holotype, USNM 141463.

Paratypes: 6 ♂ 7 ♀, collected with the holotype, USNM 141464.

MATERIAL.—BAHAMA ISLANDS. 1 ♂, USNM, NW Bimini Is, 366–384 m, 2 March 1965, *Gerda* sta 507.

JAMAICA. 4 ♀, USNM, off Great Pedro Bluff, 265 m, 7 July 1970, *Pillsbury* sta 1232. 2 ♂, USNM, off Great Pedro Bluff, 311 m, 16 May 1962, *Oregon* sta 3549.

DOMINICAN REPUBLIC. 11 ♂ 2 ♀, USNM, W of Cabo Isabela, 274–348 m, 14 October 1963, *Silver Bay* sta 5161. 1 ♀, USNM, off Cabo Isabela, 128 m, 14 October 1963, *Silver Bay* sta 5157. 2 ♂ 1 ♀, USNM, off Puerto Plata, 421–549 m, 15 October 1963, *Silver Bay* sta 5166.

PUERTO RICO. 1 ♂, USNM, between Punta Cerro Gordo and Punta Fraile, 274–357 m, 8 March 1933, Johnson-Smithsonian Deep Sea Exped. sta 106. 1 ♂, USNM, NE of San Juan, 366–549 m, 2 February 1933, Johnson-Smithsonian Deep Sea Exped. sta 13. 1 ♀, USNM, NW of Punta María, 439–622 m, 2 February 1933, Johnson-Smithsonian Deep Sea Exped. sta 14.

VIRGIN ISLANDS. 2 ♀, USNM, S of Virgin Gorda, 274 m, 6 October 1959, *Oregon* sta 2648.

LESSER ANTILLES. Saba: 1 ♀, USNM, 348 m, 30 September 1959, *Oregon* sta 2633. St Christopher: 1 ♂ 4 ♀, USNM, 285–249 m, 19 May 1967, *Oregon* sta 6700. Aruba: 1 ♀, USNM, 177 m, 2 October 1965, *Oregon* sta 5645.

TRINIDAD. 2 ♀, USNM, Gulf of Paria, 57 m, 3 February 1884, *Albatross* sta 2121.

WESTERN CARIBBEAN. 2 ♂, USNM, W of Banco Quita Sueño, 201–207 m, 12 February 1967, *Oregon* sta 6460. 2 ♂ 2 ♀, USNM, E of Cayos de Albu-

querque, 192 m, 7 February 1967, *Oregon* sta 6444.

BRITISH HONDURAS. 2 ♂ 3 ♀, USNM, off Belize, 183 m, 24 January 1967, *Oregon* sta 6405.

HONDURAS. 4 ♂ 3 ♀, USNM, NW of Cabo Camarón, 117–124 m, 2 February 1971, *Pillsbury* sta 1368. 9 ♂ 5 ♀, USNM, Puerto Cortés, 106–109 m, 19 March 1968, *Pillsbury* sta 617. 2 ♂ 2 ♀, UMML, Puerto Cortés, 110–112 m, 19 November 1968, *Pillsbury* sta 618.

NICARAGUA. 2 ♀, USNM, off Prinzapolca, 190 m, 5 February 1967, *Oregon* sta 6426.

PANAMA. 2 ♀, USNM, off Bocas del Toro, 91–97 m, 26 January 1971, *Pillsbury* sta 1313. 1 ♂ 1 ♀, USNM, NE of Coclé del Norte, 229 m, 29 May 1962, *Oregon* sta 3590. 1 ♂ 1 ♀, USNM, E of Península Valiente, 247–256 m, 25 May 1962, *Oregon* sta 3585. 2 ♀, USNM, Golfo de los Mosquitos, 366–402 m, 31 May 1962, *Oregon* sta 3598. 3 ♂ 3 ♀, USNM, Golfo de los Mosquitos, 183 m, 30 May 1962, *Oregon* sta 3595.

COLOMBIA. 1 ♀, USNM, Golfo del Darién, 183 m, 27 May 1964, *Oregon* sta 4898. 1 ♀, USNM, N of Punta Caribana, 73 m, 2 November 1970, *Oregon* II sta 11237. 5 ♀, USNM, off Cartagena, 366 m, 24 May 1964, *Oregon* sta 4881. 1 ♀, USNM, off Cartagena, 357–348 m, 24 May 1964, *Oregon* sta 4880. 2 ♂ 2 ♀, USNM, W of Cartagena, 170–150 m, 1 August 1968, *Pillsbury* sta 797. 4 ♂ 2 ♀, USNM, off Sabanalarga, depth unrecorded, 14 October 1965, *Oregon* sta 5716. 2 ♂ 12 ♀, USNM, NE of Barranquilla, 183 m, 16 November 1970, *Oregon* II sta 11282. 1 ♀, USNM, SW of Santa Marta, 402 m, 16 November 1970, *Oregon* II sta 11283. 5 ♂ 10 ♀, USNM, off Barranquilla, 283–293 m, 19 May 1964, *Oregon* sta 4860. 4 ♀, USNM, off Barranquilla, 293 m, 19 May 1964, *Oregon* sta 4858. 6 ♂ 10 ♀, USNM, off Ciénaga, 183 m, 19 May 1964, *Oregon* sta 4856. 1 ♂ 2 ♀, USNM, off Cabo de la Aguja, 176–165 m, 31 July 1968, *Pillsbury* sta 785. 1 ♂ 3 ♀, USNM, off Cabo de San Juan de Guía, 143–174 m, 31 July 1968, *Pillsbury* sta 783. 2 ♂ 13 ♀, USNM, NE of Cabo de la Aguja, 274 m, 5 December 1968, *Oregon* II sta 10289.

VENEZUELA. 3 ♀, USNM, off Puerto Cumarebo, 161–187 m, 27 July 1968, *Pillsbury* sta 757. 1 ♂ 1 ♀, USNM, off Tucacas, 183 m, 10 October 1963, *Oregon* sta 4446. 1 ♂ 1 ♀, USNM, off Tucacas, 183 m, 10 October 1963, *Oregon* sta 4445. 1 ♂ 1

♀, USNM, NE of Puerto Cabello, 210 m, 28 September 1965, *Oregon* sta 5628. 3 ♂ 3 ♀, USNM, off La Guaira, 137–192 m, 22 July 1968, *Pillsbury* sta 738. 9 ♂ 12 ♀, USNM, NE of Punta Aragupiche, 229 m, 3 November 1957, *Oregon* sta 1983.

SURINAM. 1 ♀, USNM, NNE of Paramaribo, 183 m, 24 March 1963, *Oregon* sta 4304. 1 ♂ 1 ♀, USNM, N of Wiawia Bank, 216 m, 16 May 1969, *Oregon* II sta 10623.

FRENCH GUIANA. 2 ♂ 2 ♀, USNM, NW of Rivière Organabo, 135–126 m, 9 July 1968, *Pillsbury* sta 658. 1 ♀, USNM, NNE of Baie d'Oyapock, 183 m, 4 July 1972, *Oregon* II sta 12059.

DIAGNOSIS.—Rostral + epigastric teeth 8–11, usually 9. Anterior part of carapace naked; postrostral carina almost reaching posterior margin of carapace, high, and notched at level of cervical sulcus. Stylocerite long, length 0.65–0.75 of distance between its proximal end and base of distolateral spine, and produced into strongly acuminate spine. Petasma with ventrolateral lobule distally produced into subelliptical lamella, considerably overreaching dorsomedian lobule. Thelycum with high

median ridge on sternite XIII; paired protuberances on sternite XIV strongly curved laterally from base or only slightly divergent distally.

DESCRIPTION.—Body glabrous (Figure 4) except for elongate patch of setae covering portion of rostrum immediately dorsal to adrostral carina, and continuing posteriorly to epigastric tooth. Rostrum reaching as far as distal end of proximal fifth of second antennular segment, horizontal or slightly tilted upward, uniform in height along short basal portion, from there tapering to apex, with dorsal margin straight and ventral margin almost straight to markedly convex, sometimes with subapical concavity. Rostral + epigastric teeth 8–11, mode 9 (percentage distribution: 8–5, 9–75, 10–15, 11–5; N=120), teeth progressively smaller and closer from epigastric to ultimate, latter placed close to apex; fourth or fifth tooth at level of orbital margin, epigastric located rather near dorsal extremity of cervical sulcus, at about posterior 0.3 of distance from orbital margin to sulcus. Adrostral carina extending obliquely from orbital margin to level of ultimate or penultimate tooth. Postros-

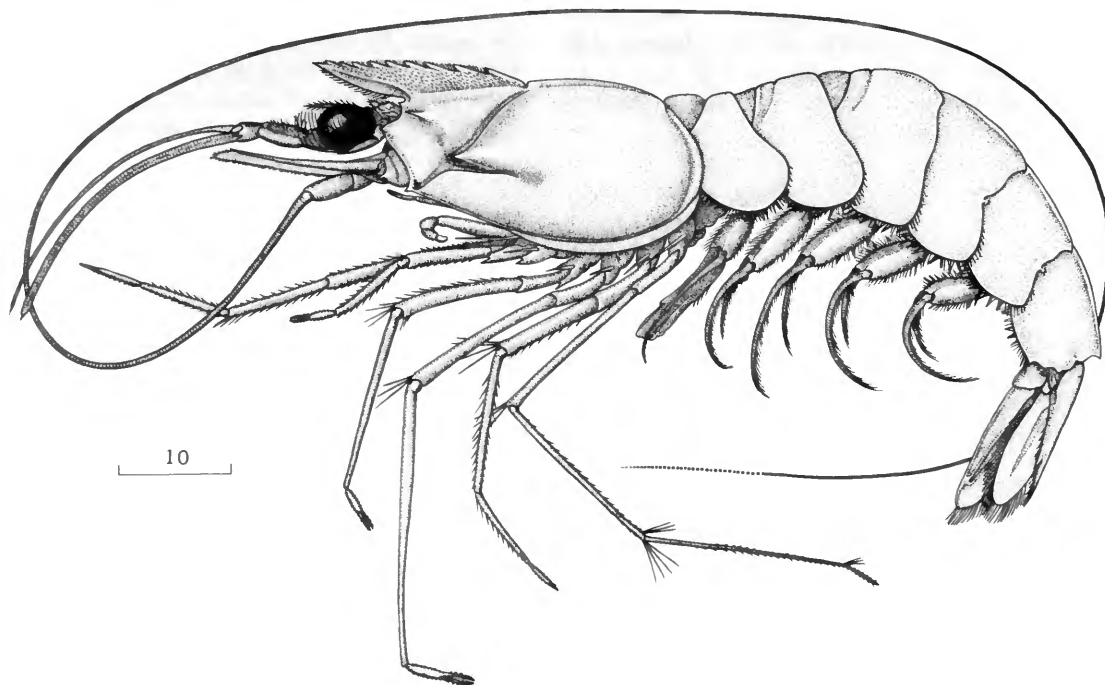


FIGURE 4.—*Solenocera acuminata*, lateral view, ♂ 23.5 mm c.l., W of Cabo Isabela, Dominican Republic.

tral carina high, long, extending almost to posterior margin of carapace, deeply notched at level of cervical sulcus. Orbital spine short, acute; post-orbital spine long, extending almost to orbital margin; antennal spine relatively small; hepatic spine prominent; pterygostomian spine broad at base, strongly produced, and pointed anteriorly. Cervical sulcus deep, broad, and sinuous, anteriorly convex dorsally, and concave ventrally; cervical carina sharp; hepatic sulcus almost horizontal posteriorly, merging with depressed area below hepatic spine, from there turning anteroventrally, ending in roughly semicircular pterygostomian pit; latter continuing with narrow anterior sulcus, parallel to anteroventral margin of carapace.

Antennular peduncle about 0.6 length of carapace; prosartema extending to distal margin of first segment; stylocerite long (Figure 1c), its length 0.65–0.75 of distance between its proximal end and base of distolateral spine, and strongly produced distally into long, sharp spine; antennular flagella abruptly tapering distally, each bearing terminal filament, that of dorsal about 2.5 times length of ventral; flagella (Figure 2) short, dorsal slightly longer than ventral; ratio of length of dorsal flagellum (excluding filament) to length of carapace decreasing from 1.75 in shrimp with 12 mm c.l., to range of 1.0 to 1.3 in shrimp with 31 mm c.l.; distolateral spine relatively long (Figure 1c), conspicuously surpassing proximal margin of second antennular segment.

Scaphocerite usually reaching to distal end of antennular peduncle, occasionally exceeding it by as much as 0.1 of its own length; lateral rib ending distally in sharply pointed spine, falling short of distal margin of lamella; antennal flagellum long—although incomplete in all specimens observed, in one with longest 2.4 times total length of shrimp.

Third maxilliped exceeding antennular peduncle by length of dactyl and by 0.5 to entire length of propodus; first pereopod surpassing carpocerite by as much as entire length of propodus; second pereopod exceeding antennular peduncle by at least length of dactyl, and at most, by entire length of propodus; third pereopod overreaching antennular peduncle by as much as length of propodus and about 0.6 that of carpus; fourth pereopod extending to about distal end of antennular peduncle or exceeding it by 0.8 length of dactyl; fifth pereopod

surpassing antennular peduncle by length of dactyl and 0.5–0.6 that of propodus. Spines on basis and ischium of first pereopod long, strongly pointed; second pereopod with long, acute spine on basis. Coxa of fourth pereopod of females produced posteromesially into short plate, its conspicuously excavated posterior margin articulating with lateral notch, anterior to projection of heavily sclerotized posterior part of sternite XIII; coxa of fifth pereopod bearing blunt spine on anteromesial margin in females (sometimes barely perceptible or absent), and on anterolateral margin in males.

Abdomen with sharp and high middorsal carina from third to sixth somite; low, rounded carina on posterior half of second somite present on larger specimens; posterodorsal margin of third to fifth somites with median incision; sixth somite bearing sharp spine at posterior end of carina and pair of posteroventral small spines. Telson with median sulcus deep anteriorly, increasingly shallower posteriorly; fixed lateral spines arising about 0.65 length of telson from anterior margin, their length 0.45–0.65 basal width of terminal portion of telson; length of terminal portion 2.35–3 times width at base; tip reaching, or slightly surpassing mesial ramus of uropod; lateral ramus slightly overreaching mesial.

Petasma (Figure 5A–C) with lateral lobe and ventromedian lobule heavily sclerotized distally, and considerably surpassing dorsomedian lobule; dorsolateral and ventrolateral lobules distally separated by deep, narrow gap; distal part of ventromedian lobule spatulate, and armed with transverse, marginal spines; distal part of dorsolateral lobule bearing terminal process, campanulate in outline, and margined with spines; distal part of ventrolateral lobule distally produced into narrow, tonguelike lamella, projecting beyond transverse ridge on outer surface, and bearing short, submarginal row of teeth; ridge turning proximally on ventral margin, ending there in strong projection, and armed with row of teeth on distal edge; ventral costa emarginate anterior to mid-length, clublike distally; deep, marginal notch present between costa and projection of transverse ridge; inner surface of costa with row of long, plumose setae proximal to emargination of costa.

Appendix masculina (dorsal or lateral blade) elongate, with mesial margin strongly concave, and

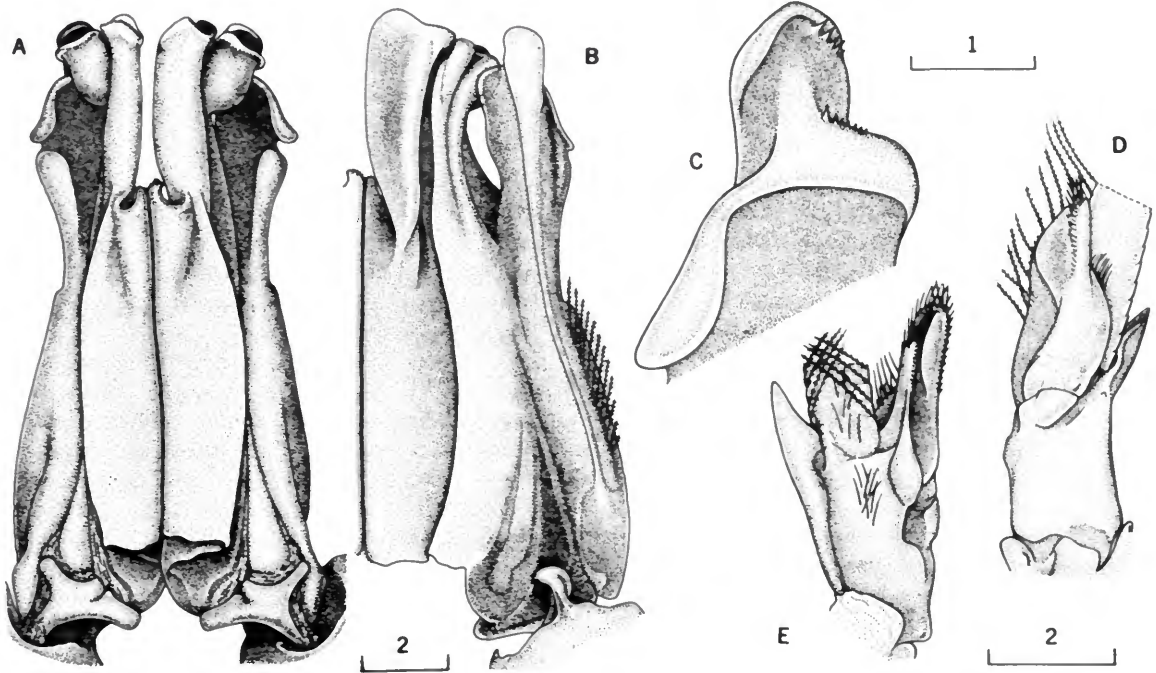


FIGURE 5.—*Solenocera acuminata*: A, Petasma, dorsal view, ♂ paratype, 26.5 mm c.l., N of Rivière Organabo, French Guiana. B, Ventral view of left half of same petasma. C, Distal part of left ventrolateral lobule of same petasma. D, Dorsal view of right appendix masculina and proximal part of endopod, ♂ 27 mm c.l., NE of Punta Araguapiche, Venezuela. E, Ventral view of appendices interna and masculina, same specimen.

distal part produced mesially into large lobe; distal part subtriangular in cross section, with convex distolateral surface (continuing with dorsal surface of proximal part), and slightly excavated dorsomesial and pronouncedly concave ventrolateral surfaces; border delimiting dorsolateral surface armed with closely set setae of various lengths (Figure 5D, E). Appendix interna (ventral or mesial blade) slightly shorter and narrower than appendix masculina, and distally bearing marginal setae, longer ones forming tuft on distolateral portion of margin. Basal sclerite with subvertical lateral wall projecting distally into prominent ventrolateral ("posterior") spur.

Thelycum (Figure 6A, B) with paired protuberances on anterior part of sternite XIV setose, elongate, roughly conical, or flattened and subtriangular, and strongly curved laterally from base or only slightly divergent distally; anterior part of sternite XIII with sharp, high, setose median ridge produced into beaklike projection overhanging,

and closely appressed to, posterior margin of sternite XII; posterior extremity of sternite XIII almost straight, with shallow median emargination, and produced anterolaterally into hornlike projections.

COLOR.—The following notes are based on photographs of freshly caught, although dead, specimens taken north-northeast of Baie d'Oyapock, French Guiana, at *Oregon II* sta 12059: Body translucent, brilliantly colored. Upper part of rostrum, dorsum of carapace, terga of abdomen, and telson deep pinkish orange, fading ventrally over lower part of rostrum, anterior part of carapace, and abdominal pleura; hepatic region light cream; branchiostegite red, with following areas white: pterygostomial region, vertical posthepatic band, and longitudinal band merging with large posterior patch; third to fifth abdominal terga with white band along posterior margin. Antennular peduncle light red, flagella somewhat darker; antennae red basally, rapidly fading and becoming orange dis-

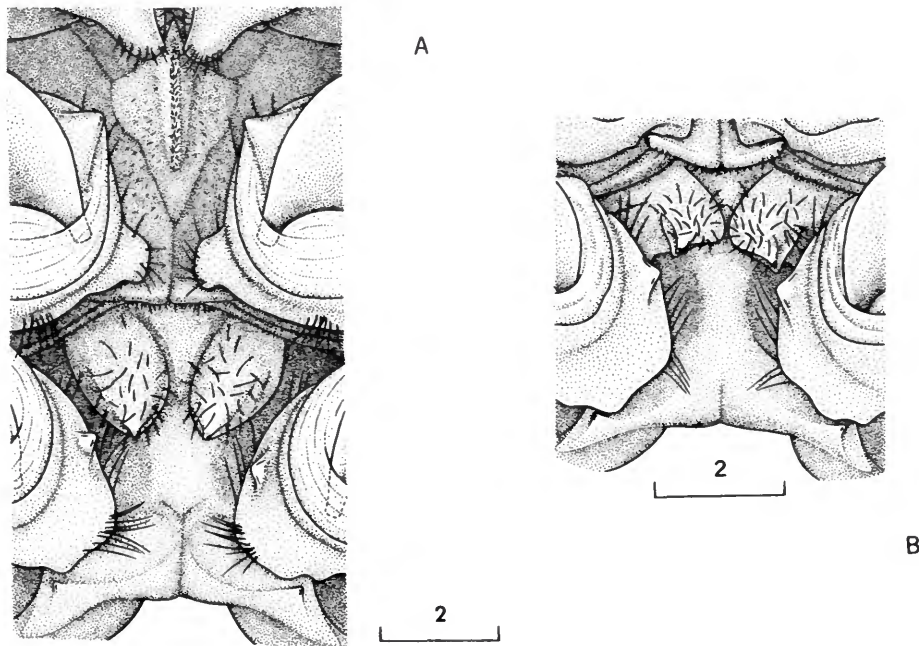


FIGURE 6.—*Solenocera acuminata*, thelyca: A, ♀ 31.5 mm c.l., NE of Cabo de la Aguja, Colombia. B, ♀ 31 mm c.l., off Barranquilla, Colombia.

tally; third maxillipeds white proximally and red distally; pereopods opaque white with conspicuous, broad, red bands. Basis of pleopods white proximolaterally and pinkish orange distomesially; endopods and exopods whitish, with mesial margins pinkish orange, and tips red. Proximal podomere of uropod opaque white, with dark pinkish orange lateral area; both rami of uropods red but with distalmost area white; elongate oval, proximolateral white patch also present on lateral ramus and mesial one near midlength of mesial ramus.

SIZE.—Males, 10.5–31 mm c.l.; females, 6–39.5 mm c.l.

ETYMOLOGY.—From the Latin *acuminatus* (pointed), referring to the strongly produced, sharp spine at distal end of the stylocerite.

GEOGRAPHIC AND BATHYMETRIC RANGES.—Bahamas and Caribbean Sea, from Jamaica to St. Christopher, and from British Honduras to northeastern Venezuela. Also off the Atlantic coast of South America, from the Gulf of Paria to French Guiana (Figure 18). This species has been recorded at depths between 31 m and 622 m; however, most samples were taken below 180 m. Since

many collections have been made in shallow water through the range of *Solenocera acuminata* and only a few specimens have been caught, it seems probable that this species prefers water deeper than does *S. vioscai*, its northern counterpart.

The record of "*Solenocera vioscai*" from off the western part of the Great Bahama Bank, at *Combat* sta 445, reported by Bullis and Thompson (1965), in all probability should be applied to this species, because of the locality and the depth (366 m) in which the collection was made.

SUBSTRATES.—Information on the substrates occupied by *S. acuminata* is extremely meager. This species was found on a mixture of dark slate, coral, and mud at *Albatross* sta 2121, and on coral and sponge at *Oregon* sta 2633.

REMARKS.—*Solenocera acuminata* closely resembles *S. vioscai* from northern waters of the Atlantic and the Gulf of Mexico, but differs in that the stylocerite is longer and produced into a more elongate, strongly pointed spine (stylocerite length = 0.65–0.75 of distance between its proximal end and base of the distolateral spine); the distolateral, postorbital, and pterygostomial spines are more

prominent; and the thelycal protuberances on sternite XIV are usually larger, and their distomesial margins vary from slightly to strongly curved laterally. Too, the antennular flagella are considerably shorter in *S. acuminata* (Figure 2) than in *S. vioscai*; however, in an occasional specimen the antennular flagella of the former are proportionately as long as those in some specimens of *S. vioscai*. Curiously, the very few specimens of *S. acuminata* with antennules as long as in *S. vioscai* from the Gulf of Mexico (which have the longest ones) are not from the adjacent Caribbean area, but from a single locality off Punta Araguapiche, Venezuela. On the other hand, the few specimens examined from the Atlantic coast of the United States possess shorter antennular flagella than do those from the Gulf; these appendages are actually intermediate in length between those of the nominal species in the Gulf and those of *S. acuminata*.

The two species also exhibit marked color differences. *Solenocera vioscai* has been described by Burkenroad (1939) as pale orange, bearing bands of a darker shade along the posterior margins of all of the abdominal terga except the fourth and fifth which possess white patches; similar patches are also present on the lateral sides of the legs. *Solenocera acuminata*, in contrast, has a distinct overall pinkish cast; the antennular flagella are red; the branchiostegite is red with striking opaque white markings; furthermore, the pereopods exhibit alternate red and white transverse bands.

Solenocera vioscai and *S. acuminata* are allopatric, and whereas *S. vioscai* lives mostly at depths less than 200 m, *S. acuminata* is found mainly between 180 and 600 m.

We have examined the three females from the Gulf of Paria, Trinidad, reported by Smith (1885) as "*Solenocera siphonocera*" and by Burkenroad (1934) as *Solenocera vioscai*; the two large specimens belong to *S. acuminata*; the smallest one, however, is *S. atlantidis*, as Burkenroad (1939) suggested when he described the latter species.

Solenocera necopina Burkenroad

FIGURES 7-10, 18, 19

Solenocera vioscai Burkenroad, 1936:122 [not *Solenocera vioscai* Burkenroad, 1934].

Solenocera necopina Burkenroad, 1939:7, figs. 1-4 [holotype: ♀, YPM 4565; type-locality: off Mobile Bay, Alabama,

29°16'N, 87°54'W, 229 m, *Atlantis* sta 2377].—Lindner and Anderson, 1941:186, fig. 1f.—Voss, 1955:9, fig. 5.—Springer and Bullis, 1956:8.—Bullis and Thompson, 1965:7.—Roberts and Pequegnat, 1970:28.—Pequegnat and Roberts, 1971:8.

MATERIAL.—UNITED STATES. North Carolina: 1 ♀, USNM, off Cape Lookout, 174-183 m, 13 March 1961, *Silver Bay* sta 2931.

Florida: 2 ♂, USNM, off Flagler Beach, 229 m, 19 August 1957, *Combat* sta 491. 1 ♂, USNM, off Coronada Beach, 274 m, 11 February 1965, *Oregon* sta 5246. 1 ♂, USNM, off Cocoa Beach, 165-192 m, 25 July 1964, *Pillsbury* sta 90. 1 ♂ 1 ♀, USNM, and 1 ♂, YPM, off Melbourne Beach, 183 m, 30 March 1940, *Pelican* sta 205-5. 1 ♂ 1 ♀, USNM, off Hobe Sound, 220-201 m, 30 June 1963, *Gerda* sta 173. 2 ♂ 1 ♀, USNM, off Miami Beach, 200 m, 31 May 1962, *Gerda* sta 21. 1 ♂ 1 ♀, USNM, off Biscayne Bay, 172-177 m, 7 July 1967, *Gerda* sta 823. 4 ♂ 3 ♀, USNM, off Biscayne Bay, 174-183 m, 22 November 1966, *Gerda* sta 812. 1 ♂ 1 ♀, USNM, off Sands Keys, 174-165 m, 22 November 1966, *Gerda* sta 810. 1 ♀, USNM, SW of Marquesas Keys, 165-160 m, 26 April 1969, *Gerda* sta 1083. 1 ♀, USNM, SW of Marquesas Keys, 188 m, 28 November 1964, *Gerda* sta 431. 1 ♀, USNM, SE of Dry Tortugas, 207-247 m, 25 January 1965, *Gerda* sta 460. 6 ♀, USNM, SW of Dry Tortugas, 348 m, 13 April 1954, *Oregon* sta 1005. 3 ♀, USNM, W of Englewood, 274-320 m, 3 April 1954, *Oregon* sta 954. 2 ♂ 1 ♀, USNM, W of Englewood, 274 m, 22 August 1970, *Oregon* II sta 11181. 9 ♂ 15 ♀, USNM, S of Cape San Blas, 203 m, 14 March 1885, *Albatross* sta 2402. 1 ♂ 2 ♀, USNM, SW of Cape San Blas, 260 m, 14 March 1885, *Albatross* sta 2401. 2 ♀, USNM, SW of Cape San Blas, 201 m, 18 February 1951, *Oregon* sta 273. 1 ♀, USNM, S of Destin, 366 m, 8 February 1970, *Oregon* II sta 10906.

Alabama: ♀, holotype, YPM 4565, off Mobile Bay, 229 m, 24 March 1935, *Atlantis* sta 2377.

BAHAMA ISLANDS. 1 ♂, USNM, S of Settlement Pt. Northwest Providence Channel, 412-421 m, 29 September 1967, *Gerda* sta 929. 1 ♀, USNM, off Great Isaac I, 311-329 m, 2 March 1965, *Gerda* sta 509. 1 ♂, UMML, off Great Stirrup Cay, Berry Is, 198-223 m, 20 July 1965, *Gerda* sta 681. 1 ♂, USNM, Northwest Providence Channel, 311 m, 29 September 1967, *Gerda* sta 924. 8 ♂ 17 ♀, USNM,

Santaren Channel, 384–366 m, 6 November 1960, *Silver Bay* sta 2468. 1 ♂, USNM, W of Bimini Is, 458–531 m, 30 January 1964, *Gerda* sta 242. 1 ♀, USNM, NW of Browns Cay, 329 m, 31 March 1964, *Gerda* sta 276. 1 ♂, USNM, W of Browns Cay, 348–256 m, 30 January 1964, *Gerda* sta 236. 1 ♀, USNM, Nicholas Channel, S of Anguila Is, 457 m, 12 December 1969, *Oregon* II sta 10862. 1 ♂ 1 ♀, YPM, Great Bahama Bank, 274–329 m, 11 March 1938, *Atlantis* 2282–D. 6 ♀, USNM, S of Great Inagua, 287 m, 13 December 1969, *Oregon* II sta 10851. 1 ♂ 3 ♀, USNM, S of Great Inagua, 329 m, 14 December 1969, *Oregon* II sta 10852. 3 ♀, USNM, S of Great Inagua, 311 m, 13 December 1969, *Oregon* II sta 10850.

CUBA. 1 ♀, USNM, off Las Villas, 516 m, 27 June 1970, *Pillsbury* sta 1171. 1 ♀, USNM, off Las Villas, 457 m, 16 July 1965, *Oregon* sta 1343. 1 ♂ 2 ♀, USNM, off Las Villas, 457 m, 15 July 1955, *Oregon* sta 1340. 1 ♀, USNM, off Camagüey, 366–402 m, 7 November 1961, *Silver Bay* sta 3511.

VIRGIN ISLANDS. 2 ♂, USNM, W of Whale Banks, 274 m, 4 March 1933, Johnson Smithsonian Deep Sea Exp. sta 100. 1 ♂ 1 ♀, USNM, NE of Gorda Sound, Virgin Gorda, 402 m, 26 September 1959, *Oregon* sta 2606.

LESSER ANTILLES. 2 ♂, USNM, Guadeloupe Passage, 360–421 m, 15 July 1969, *Pillsbury* sta 944. 1 ♀, USNM, S of Barbados, 320 m, 20 September 1964, *Oregon* sta 5018.

MEXICO (Western Caribbean). Quintana Roo: 2 ♂, USNM, SE of I Mujeres, 348–357 m, 6 May 1967, *Pillsbury* sta 580.

WESTERN CARIBBEAN. 1 ♂, USNM, NE of Banco Gorda, 219 m, 9 June 1964, *Oregon* sta 4933. 1 ♂, USNM, ESE of Banco Gorda, 249–256 m, 31 January 1971, *Pillsbury* sta 1357. 1 ♂ 2 ♀, USNM, NW of Quita Sueño Bank, 296–375 m, 31 January 1971, *Pillsbury* sta 1356. 3 ♂ 5 ♀, USNM, W of Quita Sueño Bank, 192–263 m, 31 January 1971, *Pillsbury* sta 1354. 2 ♀, USNM, W of Quita Sueño Bank, 201–207 m, 12 February 1967, *Oregon* sta 6460. 5 ♀, USNM, W of Isla de Providencia, 289–274 m, 4 February 1967, *Oregon* sta 6423. 1 ♀, USNM, SW of Isla de San Andrés, 201–219 m, 4 February 1967, *Oregon* sta 6424. 1 ♂, USNM, SW of Isla de San Andrés, 190–199 m, 6 February 1967, *Oregon* sta 6443. 6 ♀, USNM, E of Cayos

de Albuquerque, 192 m, 7 February 1967, *Oregon* sta 6444.

BRITISH HONDURAS. 9 ♂ 11 ♀, USNM, off Belize, 329–274 m, 23 January 1967, *Oregon* sta 6404.

NICARAGUA. 1 ♂ 5 ♀, USNM, NE of Islas del Maíz, 192–198 m, 7 February 1967, *Oregon* sta 6448.

PANAMA. 1 ♀, USNM, Golfo de los Mosquitos, 366 m, 25 May 1962, *Oregon* sta 3584. 1 ♂ 10 ♀, USNM, off Punta Manzanillo, 421 m, 19 October 1965, *Oregon* sta 5740.

COLOMBIA. 2 ♀, USNM, off Isla de Barú, 366 m, 24 May 1964, *Oregon* sta 4881. 2 ♂ 5 ♀, USNM, off Río hacha, 320–348 m, 31 May 1964, *Oregon* sta 4911. 5 ♀, USNM, NW of Cabo de la Vela, 375 m, 21 November 1970, *Oregon* II sta 11290. 2 ♂ 1 ♀, USNM, W of Cabo de la Vela, 357 m, 20 November 1970, *Oregon* II sta 11289.

VENEZUELA. 1 ♀, USNM, off San Juan de los Cayos, 366 m, 8 October 1963, *Oregon* sta 4434. 1 ♀, USNM, NW of Cabo Cordera, 234–280 m, 23 July 1968, *Pillsbury* sta 739. 2 ♀, USNM, NE of Los Testigos Is, 366–439 m, 24 September 1964, *Oregon* sta 5037.

URUGUAY. 2 ♂ 2 ♀, IOUSP, off Punta del Palmar, 146–160 m, 27 August 1968, M. Iwai.

DIAGNOSIS.—Rostral + epigastric teeth 5–8, usually 6. Anterior part of carapace naked; postrostral carina low or absent posterior to cervical sulcus, if present only slightly depressed at level of sulcus; pterygostomian spine with broad base, its dorsal margin joining carapace in gentle curve. Scaphocerite long, overreaching antennular peduncle by more than 10 percent of its own length. Petasma with ventrolateral lobule distally produced into subcircular to suboval lamella, considerably surpassing dorsomedian lobule. Thelycum with high median ridge on sternite XIII; paired protuberances on sternite XIV elongate, conical, convergent along entire length, or, occasionally, with apical portions strongly curved laterally.

DESCRIPTION.—Body glabrous (Figure 7) except for elongate patch of thickly set setae covering portion of rostrum dorsal to adrostral carina and continuing posteriorly from orbital margin to base of first rostral tooth; short brush of long setae on dorsal border of pterygostomian pit. Rostrum reaching almost as far as distal end of first antennular segment, horizontal or upturned, with dorsal

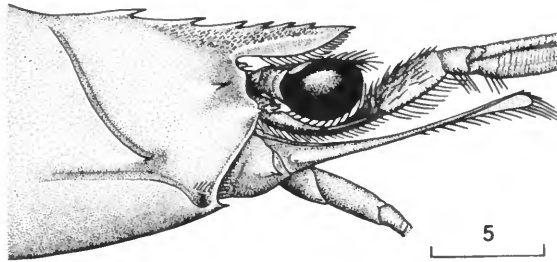


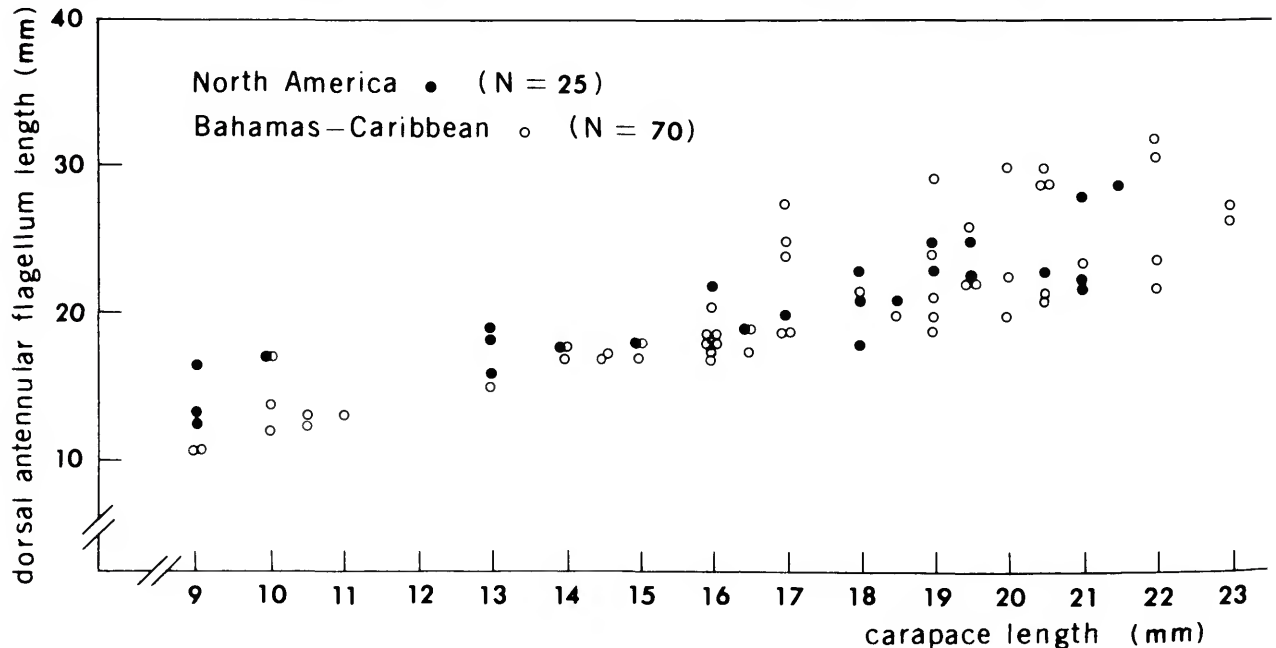
FIGURE 7.—*Solenocera necopina* Burkenroad, anterior region, ♀ 17 mm c.l., SW of Marquesas Keys, Florida.

margin straight, ventral margin markedly convex but almost straight subapically, forming gently tapering tip, or with subapical concavity giving rise to saber-shaped one; tip long, 0.3–0.5 length of rostrum. Rostral + epigastric teeth 5–8, mode 6 (percentage distribution: 5—15, 6—63, 7—20, 8—2; N=100), third tooth at level of orbital margin, epigastric at about posterior 0.45 of distance from orbital margin to level of dorsal extremity of cervical sulcus. Adrostral carina extending obliquely from orbital margin to about level of ultimate tooth; postrostral carina low, rounded, extending almost to posterior margin of carapace, although sometimes (mostly in young) only to level of cervical sulcus, and often depressed there. Or-

bital angle well marked, but orbital spine lacking; postorbital spine slender and long; antennal and hepatic spines relatively short; pterygostomial spine acute, with broad base, its dorsal margin joining carapace in gentle curve. Cervical sulcus rather broad; cervical carina sharp; hepatic sulcus almost horizontal posteriorly, merging with depressed area below hepatic spine, from there turning anteroventrally and ending at semicircular, pterygostomial pit; latter continuing with fine, anterior sulcus, parallel to anteroventral margin of carapace.

Antennular peduncle about 0.6 length of carapace; prosartema extending almost to distal margin of first segment; stylocerite relatively short to long, 0.55–0.75 of distance between its proximal end and base of distolateral spine, and produced into slender spine; antennular flagella relatively short (Figure 8), dorsal slightly longer than ventral; ratio of length of dorsal flagellum to that of carapace decreasing from range of 1.8 to 1.2 in shrimp with 9 mm c.l., to 1.1 in shrimp with 27 mm c.l.; terminal filaments long; distolateral spine slightly overreaching base of second antennular segment.

Scaphocerite very elongate, exceeding antennular peduncle by as much as 0.2 of its own length; lateral rib ending in very elongate spine, reaching, or



almost reaching, distal margin of lamella; antennal flagella broken in all specimens examined.

Third maxilliped exceeding antennular peduncle by at least length of dactyl and propodus and, at most, by length of dactyl, propodus, and 0.2 that of carpus; first pereopod reaching distal end of carapocerite, or surpassing it by as much as length of propodus; second pereopod surpassing antennular peduncle by tip of dactyl, but by as much as length of entire propodus; third pereopod exceeding antennular peduncle by length of propodus and 0.1–0.4 that of carpus; fourth pereopod extending to about mid-length of third antennular segment, or exceeding peduncle by length of dactyl; fifth pereopod overreaching antennular peduncle by dactyl and 0.2–0.7 length of propodus. Spines on basis and ischium of first pereopod long and strongly pointed; second pereopod with sharp, slender spine on basis. Coxa of fourth pereopod in females produced posteromesially into short subrectangular plate, its excavated posterior margin articulating with lateral concavity before hornlike projection of posterior part of sternite XIII; coxa of fifth pereopod bearing spine on anteromesial margin in females (sometimes barely perceptible or absent), and on anterolateral margin in males.

Abdomen with high and sharp middorsal carina

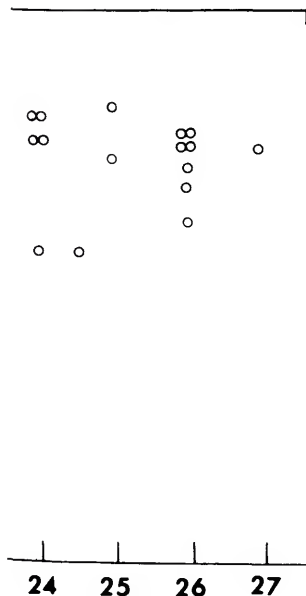


FIGURE 8.—Relationship between length of dorsal antennular flagellum and carapace length in *S. necopina*.

from fourth through sixth somite; low, rounded carina on posterior 0.65 of third somite usually present in large specimens; posterodorsal margin of third to fifth somites with median incision; sixth somite bearing sharp spine at posterior end of carina, and pair of posteroventral, small spines. Telson with median sulcus moderately deep anteriorly, increasingly shallower posteriorly, becoming indistinct before base of terminal portion; fixed lateral spines relatively long, their length 0.7–1.1 basal width of terminal portion of telson; terminal portion length 2.50–2.75 times width at base; tip reaching distal 0.2 length of mesial ramus of uropod; lateral ramus overreaching mesial by about 0.2 of its own length.

Petasma (Figure 9A, B) with lateral lobe and ventromedian lobule considerably surpassing dorsomedian lobule distally; dorsolateral and ventrolateral lobules separated by deep gap; distal part of ventromedian lobule roughly elongate trapezoidal, broadest distally, and armed with transversely arranged, marginal spinules; dorsolateral lobule bearing short, subtriangular terminal process, margined with spinules; distal part of ventrolateral lobule bearing subcircular to suboval lamella (occasionally produced distodorsally), armed with numerous spinules on distal and lateral margins; base of lamella delimited on outer surface by transverse, arcuate ridge, latter turning proximally on ventral (lateral) margin, and ending there in strong projection; ventral costa emarginate at about base of distal third, and bearing distally small, rounded, prominence; narrow notch present between prominence and projection of arcuate ridge; inner surface of costa with submarginal row of long, plumose setae proximal to emargination; row of similar setae present on both inner and outer surface of dorsolateral lobule, former longer, extending proximally onto ventrolateral lobule.

Appendix masculina (Figure 9c) and appendix interna (Figure 9d) essentially identical with those described for *S. acuminata*.

Thelycum (Figure 10) with paired protuberances on anterior part of sternite XIV setose, long, subconical (sometimes flattened dorsoventrally), or roughly subreniform, their disposition varying from convergent, often with distomesial surfaces meeting, to divergent, with tips strongly curved later-

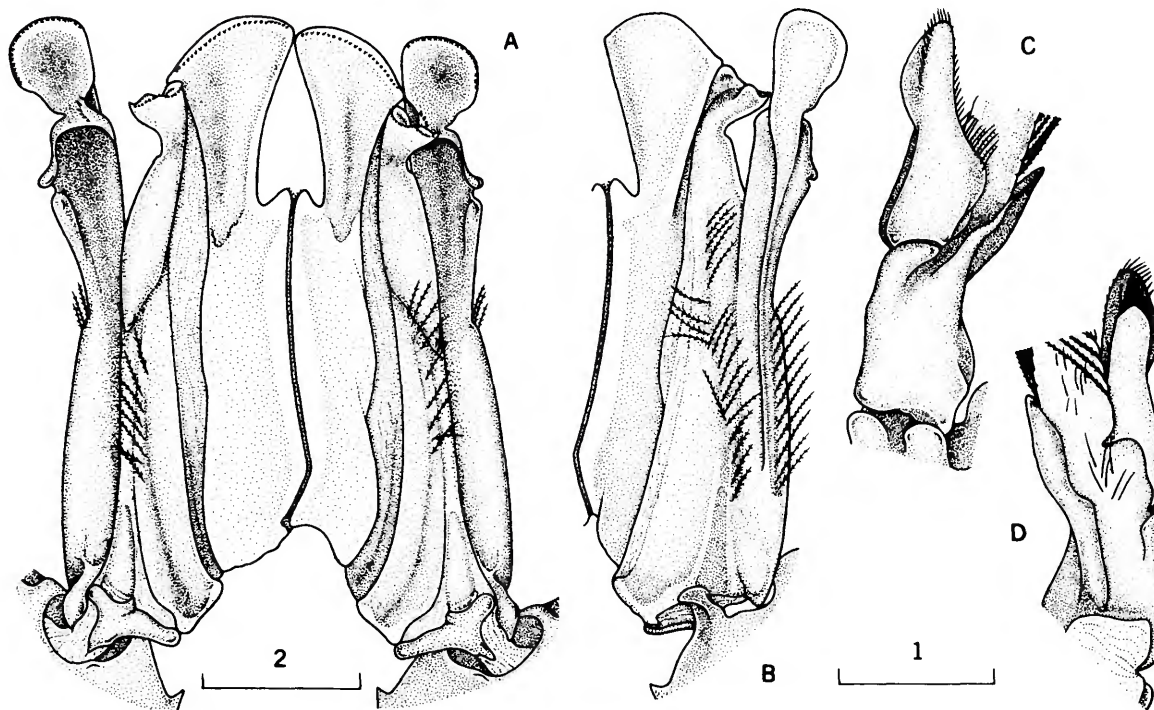


FIGURE 9.—*Solenocera necopina*: A, Petasma, dorsal view, ♂ 14.5 mm c.l., Santaren Channel, Bahamas. B, Ventral view of left half of same petasma. C, Dorsal view of right appendix masculina and proximal part of endopod of same specimen. D, Ventral view of appendices interna and masculina, same specimen.

ally; anterior part of sternite XIII with high, sharp, and setose median ridge produced into toothlike projection, overhanging, and closely appressed to, posterior margin of sternite XII; posterior extremity of sternite XIII with median emargination, and produced anterolaterally into hornlike projections.

COLOR.—According to Burkenroad (1936, under "*Solenocera vioscai*"): "An unpatterned translucent pale orange-red over-all, chiefly produced by small chromatophores. Eyes reddish-brown with greenish reflections. Gastric gland brownish-grey with light yellow-green flecks; gut red (as seen through the overlying tissues)."

The following color notes were made from living specimens caught during a 1969 cruise of *Oregon II* south of Great Inagua Island, Bahamas: Body translucent, with very pale salmon suffusion. Antennular peduncle and gnathal appendages dark

pinkish orange. Second to fifth abdominal terga bearing transverse, opaque white arched marking parallel to posterior margin; base of telson and posterolateral projections of sixth abdominal tergum opaque white, together forming transverse band. Pereopods and pleopods pinkish orange; proximal podomere of uropod with white, median spot; lateral ramus with distalmost portion bearing roughly triangular white spot; mesial ramus with marginal, broad, white band.

SIZE.—Males, 9–17 mm c.l.; females 6–27 mm c.l.

GEOGRAPHIC AND BATHYMETRIC RANGES.—From southeast of Cape Lookout, North Carolina, to south of Florida, and in the Gulf of Mexico, from Dry Tortugas to off the Rio Grande, Texas. Also in the Caribbean—through the West Indies and from Isla Mujeres, Quintana Roo, to Islas Los Testigos, Venezuela—and South Atlantic to Uruguay (Figure 18). The records cited above are the



FIGURE 10.—*Solenocera necopina*, thelycum, ♀ 22.5 mm c.l., Santaren Channel, Bahamas.

first from the Caribbean, where this species is not only present but, apparently, abundant, and the Atlantic of South America. The presence of *S. necopina* off the coast of Uruguay not only represents a southward extension of the range of the species of about 11,000 km, but demonstrates the presence of the genus considerably farther south along the western Atlantic that has been previously reported.

Solenocera necopina lives at depths of about 160 to 550 m, usually below 180 m.

SUBSTRATES.—The various bottoms on which the species has been reported have been described as: gray mud (*Albatross* sta 2402); green mud and broken shells (*Albatross* sta 2401); green mud and shells (*Oregon* sta 273); gray mud and shells (*Oregon* sta 954); green clay and mud (*Oregon* sta 1005); sand and shells (*Oregon* sta 2606); and fine mud, broken shells, dead coral, and broken sea-urchin shells (*Pillsbury* sta 90).

REMARKS.—This species may be readily distinguished from *Solenocera vioscai* and *S. acuminata* by the smaller number of rostral teeth, usually 7 or less, rarely 8; and by the postrostral carina, which terminates at the level of the cervical sulcus, or, of extending posteriorly beyond it, is only slightly depressed at level of the sulcus. *Solenocera necopina* can be differentiated from *S. atlantidis* and *S. geijskesi* in that the anterior part of the carapace is glossy, lacking setae; the pterygostomial spine is larger and its dorsal margin joins the carapace in a gentle curve; and the scaphocerite is much longer, overreaching the antennular peduncle by more than 10 percent of its length. Moreover, the females bear a median ridge on the anterior part of sternite XIII that is lacking in the other two species. Finally, *S. necopina* differs from all other members of the genus in the region by lacking an orbital spine, and in its petasma, which possesses a subcircular or ovate distal lamella that is armed with minute marginal spines.

The original description of *Solenocera necopina* was based on a single young female, 8.8 mm c.l. Burkenroad thus was able to present only the thelycal characters and general features of an animal not fully grown. Later, Lindner and Anderson (1941) described the petasma of the species, and pointed out that in large individuals the postrostral carina reaches almost to the posterior margin of the carapace, not just to the level of the cervical sulcus as Burkenroad had stated. They further indicated that the middorsal carina extends on to the posterior three-fourths of the third abdominal somite, instead of only to the fourth somite. One important feature, however, has apparently remained unnoticed; in females, the median ridge on the anterior part of sternite XIII overlaps the posterior margin of sternite XII and does not end immediately caudal to it, as was originally stated. It also should be mentioned that the dorsolateral lobule of the petasma bears on the outer surface a row of long plumose setae, lacking in the other western Atlantic *Solenocera*.

In *S. necopina*, the range of variation in the length of the antennular flagella associated with a given carapace length is similar in animals from both North American waters and from the Bahamas to northern South America. Variations in the petasma and the thelycum, too, are within

approximately the same limits throughout the range of the species, except for unique features exhibited by some members of the southwestern Caribbean population. The distal lamella of the ventrolateral lobule of the petasma varies from subcircular to suboval throughout the range of the species; however, in occasional males from the southwestern Caribbean the lamella is produced distolaterally, becoming irregular in shape. The thelycal protuberances on sternite XIV vary as well as in disposition; typically, they are directed mesially, and, if they meet, their distomesial margins are contiguous and extend parallel to each other, but again, in the southwestern Caribbean, females are found in which the protuberances are curved laterally.

Solenocera atlantidis Burkenroad

FIGURES 11-14, 18, 19

Solenocera siphonocera Smith, 1885 (part):186 [not *Solenocera siphonocera* (Philippi, 1840)].

Solenocera vioscai Burkenroad, 1934 (part):65.

Solenocera atlantidis Burkenroad, 1939:10, figs. 5-10 [holotype: ♀, YPM 4562; type-locality: off Mobile Bay, Alabama, 29°45'N, 88°11'W, "19 fathoms" (20 fm, 37 m), *Atlantis* sta 281].—Lindner and Anderson, 1941:185, 186.—Hildebrand, 1955:190.—Voss, 1955:9, fig. 4.—Springer and Bullis, 1956:8.—Holthuis, 1959:54, fig. 3.—Bullis and Thompson, 1965:7.—Williams, 1965:14, fig. 5.—Fausto Filho, 1968a:43.—Fausto Filho, 1968b:70.—Brusher et al., 1972:75.

Solenocera ?geijskesi.—Nomura and Fausto Filho, 1966:21 [not *Solenocera geijskesi* Holthuis, 1959].

MATERIAL.—UNITED STATES. North Carolina: 1 ♂, UNC-IMS, off Oregon Inlet, 33 m, 3 December 1968, *Eastward* sta 11046. 1 ♀, off Cape Lookout, 64 m, 21 June 1957, *Combat* sta 396. 2 ♀, UNC-IMS, S of Diamond Shoals, 84 m, 19 December 1962, M. Gerame-Vivas. 5 ♂ 7 ♀, USNM, off Cape Lookout, 59 m, 18 October 1885, *Albatross* sta 2605. 1 ♀, UNC-IMS, SE of Cape Lookout, 35 m, 1 July 1966, *Eastward* sta 4942. 2 ♀, USNM, off Cape Lookout, 73 m, 21 June 1957, *Combat* sta 397. 1 ♀, USNM, Onslow Bay, 27 m, 2 August 1962, *Silver Bay* sta 4196.

South Carolina: 8 ♀, USNM, off St Helena Sound, 42 m, 1 November 1956, *Combat* sta 167.

Georgia: 1 ♀, USNM, off Savannah, 68-91 m, 14 December 1961, *Silver Bay* sta 3658. 1 ♀, USNM, off Savannah, 73 m, 12 March 1956, *George*

M. Bowers sta 54. 1 ♀, UNC-IMS, E of Cumberland I, 37 m, 31 October 1966, *Combat* sta 159.

Florida: 1 ♀, USNM, off St Augustine, 75 m, 24 April 1966, *Oregon* sta 6044. 1 ♂, USNM, off St Augustine, 40 m, 5 September 1962, *Silver Bay* sta 4340. 1 ♀, USNM, off Oak Hill, 55 m, 9 May 1961, *Silver Bay* sta 3147. 1 ♀, USNM, N of Melbourne Beach, 64 m, 30 March 1940, *Pelican* sta 205-3. 1 ♀, USNM, off Sebastian, 73 m, 28 September 1963, *Silver Bay* sta 5107. 1 ♀, USNM, off Vero Beach, 37 m, 3 October 1962, *Silver Bay* sta 4378. 4 ♀, USNM, SE of Old Rhodes Key, 49 m, 24 October 1960, *Silver Bay* sta 2354. 1 ♂ 1 ♀, UMML, off Islamorada, 40-44 m, 26 February 1969, *Gerda* sta 1038. 2 ♂ 9 ♀, off Islamorada, 37 m, 14 April 1965, *Gerda* sta 594. 22 ♂ 28 ♀, USNM, off Islamorada, 37-42 m, 26 February 1969, *Gerda* sta 1037. 1 ♂, USNM, off Key West, 82 m, 15 January 1885, *Albatross* sta 2318. 3 ♂ 3 ♀, USNM, N of Dry Tortugas, 46 m, 7 March 1970, *Gerda* sta 1236. 1 ♀, USNM N of Dry Tortugas, 46 m, 7 March 1970, *Gerda* sta 1237. 1 ♂ 4 ♀, USNM, NW of Dry Tortugas, 55 m, 18 June 1956, *Oregon* sta 1553. 1 ♀, USNM, 48 km NE of Loggerhead Key, Dry Tortugas, 35 m, 3 December 1954, G. H. Eubank. 1 ♂, USNM, W of Naples, 44 m, 21 March 1889, *Grampus* sta 5109. 2 ♀, USNM, SW of Sanibel I, 49 m, 19 March 1885, *Albatross* sta 2412. 4 ♂ 7 ♀, USNM, W of Sanibel I, 49 m, 18 March 1885, *Albatross* sta 2411. 2 ♀, USNM, off Englewood, 55-57 m, 5 September 1958, *Silver Bay* sta 729. 1 ♂ 13 ♀, USNM, off Edgewater, 51-55 m, 24 August 1965, *Oregon* sta 5603. 3 ♀, USNM, S of St George I, 64 m, 7 March 1954, *Oregon* sta 896. 2 ♀, USNM, S of Dog I, 31 m, 8 March 1954, *Oregon* sta 898. 1 ♂ 5 ♀, USNM, off Gulf Beach, 27 m, 8 December 1953, *Oregon* sta 872.

Alabama: 7 ♀, USNM, off Orange Beach, 27 m, 8 December 1953, *Oregon* sta 871. ♀, holotype, YPM 4562, off Mobile Bay, 20 fm [depth recorded in the log of the *Atlantis*], 37 m, 20 March 1937, *Atlantis* sta 2813. 168 ♂, YPM 4561, 203 ♀, YPM 4560, and 1 ♂ 1 ♀, USNM 76182, paratypes, collected with the holotype.

Texas: 1 ♀, NMFS-GBL, SSE Galveston, 27-37 m, 21-22 March 1960, NMFS-GBL staff. 3 ♀, USNM, off Galveston I, 46 m, 31 July 1961. 1 ♀, NMFS-GBL, SE Freeport, 51 m, 31 May 1960, NMFS-GBL staff.

BAHAMA ISLANDS. 1 ♂, USNM, NE of Little Bahama Bank, 183 m, 25 October 1961, *Silver Bay* sta 3466. 1 ♂, USNM, off Great Stirrup Cay, 198–223 m, 20 July 1965, *Gerda* sta 681. 1 ♂, USNM, W of Great Exuma, 66 m, 12 April 1886, *Albatross* sta 2649.

JAMAICA. 3 ♀, USNM, Pedro Bank, 46–48 m, 14 July 1970, *Pillsbury* sta 1251.

DOMINICAN REPUBLIC. 1 ♂, USNM, off Barahona, 48–50 m, 20 July 1970, *Pillsbury* sta 1294.

LESSER ANTILLES. Saba Bank: 4 ♀, USNM, 16–18 m, 19 July 1929, *Pillsbury* sta 963.

TRINIDAD-TOBAGO. Tobago: 1 ♀, USNM, W of Plymouth, 70 m, 21 September 1964, *Oregon* sta 5023. 3 ♀, USNM, W of Plymouth, 60 m, 13 March 1966, *Oregon* sta 5961. 2 ♂, USNM, E of Scarborough, 68 m, 1 July 1969, *Pillsbury* sta 842. 3 ♀, USNM, W of Canaan, 73–88 m, 21 September 1964, *Oregon* sta 5025.

Trinidad: 1 ♀, USNM, Gulf of Paria, 57 m, 3 February 1884, *Albatross* sta 2121.

HONDURAS. 4 ♀, USNM, NE of Cayos Viborillas, 101 m, 21 August 1957, *Oregon* sta 1864.

NICARAGUA. 1 ♂ 2 ♀, USNM, off Punta de Perlas, 27 m, 28 January 1971, *Pillsbury* sta 1335. 1 ♀, USNM, off Islas del Matz, 40–73 m, 2 June 1962, *Oregon* sta 3605.

COLOMBIA. 1 ♂, USNM, off Cartagena, 64–27 m, 1 August 1968, *Pillsbury* sta 795. 5 ♂ 6 ♀, USNM, NE of Cartagena, 29–26 m, 1 August 1968, *Pillsbury* sta 793. 6 ♂ 12 ♀, USNM, off Puerto Colombia, 44–42 m, 1 August 1968, *Pillsbury* sta 791. 1 ♂ 2 ♀, USNM, off Puerto Colombia, 55 m, 22 May 1964, *Oregon* sta 4864. 1 ♂, USNM, off Puerto Colombia 37–40 m, 31 July 1968, *Pillsbury* sta 790. 1 ♀, USNM, E of Barranquilla, 64–73 m, 17 May 1964, *Oregon* sta 4847. 4 ♀, USNM, NE of Punta Gallinas, 73 m, 25 September 1963, *Oregon* sta 4392.

VENEZUELA. 1 ♀, USNM, off Islas Los Monjes, 97 m, 6 September 1963, *Oregon* sta 4400. 1 ♀, USNM, Gulf of Venezuela, 29–35 m, 9 November 1958, Woods Hole Oceanographic Institution staff. 1 ♂, USNM, Gulf of Venezuela, 35 m, 27 July 1968, *Pillsbury* sta 761. 1 ♂ 3 ♀, USNM, NW of Puerto Cabello, 22–26 m, 25 July 1968, *Pillsbury* sta 750. 2 ♂ 7 ♀, USNM, off Puerto Cabello, 44–46 m, 26 July 1968, *Pillsbury* sta 751. 3 ♂ 8 ♀, USNM, off Puerto Cabello, 59 m, 25 July 1968, *Pillsbury* sta 749. 3 ♂

1 ♀, USNM, off Cabo Cordera, 60–73 m, 22 July 1968, *Pillsbury* sta 737. 1 ♀, USNM, E of Río Chico, 57–60 m, 22 July 1968, *Pillsbury* sta 731. 1 ♀, USNM, NW of Isla de Margarita, 59 m, 20 October 1963, *Oregon* sta 4476. 8 ♂ 12 ♀, USNM, off Península de Paria, 27–24 m, 19 July 1968, *Pillsbury* sta 712. 1 ♀, USNM, E of Punta Araguapiche, 29–37 m, 30 June 1969, *Pillsbury* sta 835.

GUYANA. 1 ♀, USNM, off Georgetown, 64–55 m, 31 August 1958, *Oregon* sta 2248. 1 ♂ 5 ♀, USNM, off Hackney, 55–49 m, 31 August 1958, *Oregon* sta 2249.

SURINAM. 18 ♂ 19 ♀, USNM, NNE mouth of Courantyne River, 55–59 m, 14 July 1968, *Pillsbury* sta 684. 1 ♀, USNM, N of Potosi Bank, 53 m, 26 April 1969, *Oregon* II sta 10525. 1 ♀, USNM, N mouth of Coppename Rivier, 46 m, 2 September 1958, *Oregon* sta 2267. 5 ♀, USNM, N of Bear's Rump, 44 m, 20 June 1957, *Coquette* sta 26. 1 ♂ 2 ♀, USNM, NNE of Bear's Rump, 46 m, 26 June 1957, *Coquette* sta 281–282. 21 ♀, USNM, off Mouth Coppename Rivier, 35 m, 3 September 1958, *Oregon* sta 2277. 9 ♀, USNM, NW of Paramaribo, 42 m, 25 June 1957, *Coquette* sta 276. 1 ♂ 8 ♀, USNM, NW of Paramaribo 42 m, 25 June 1957, *Coquette* sta 274. 4 ♀, USNM, NW of Paramaribo, 42 m, 20 June 1957, *Coquette* sta 260. 3 ♂ 2 ♀, USNM, N of Paramaribo, 64 m, 11 July 1968, *Pillsbury* sta 671. 4 ♀, USNM, N of Wiawia Kreek, 44 m, 21 July 1957, *Coquette* sta 353.

FRENCH GUIANA. 2 ♂ 2 ♀, USNM, NE of Pointe Isère, 135–126 m, 9 July 1968, *Pillsbury* sta 658. 2 ♂ 2 ♀ USNM, N of Îles du Salut, 60 m, 8 July 1968, *Pillsbury* sta 652. 2 ♀, USNM, NE of Cayenne, 64 m, 23 February 1963, *Oregon* sta 4202.

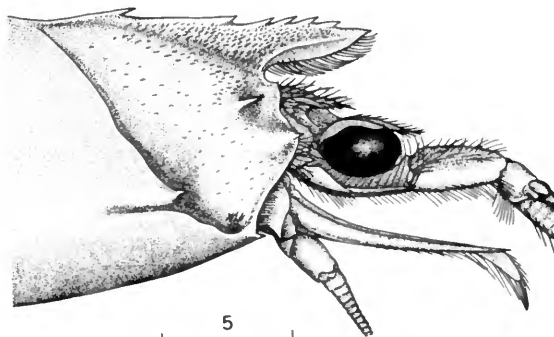
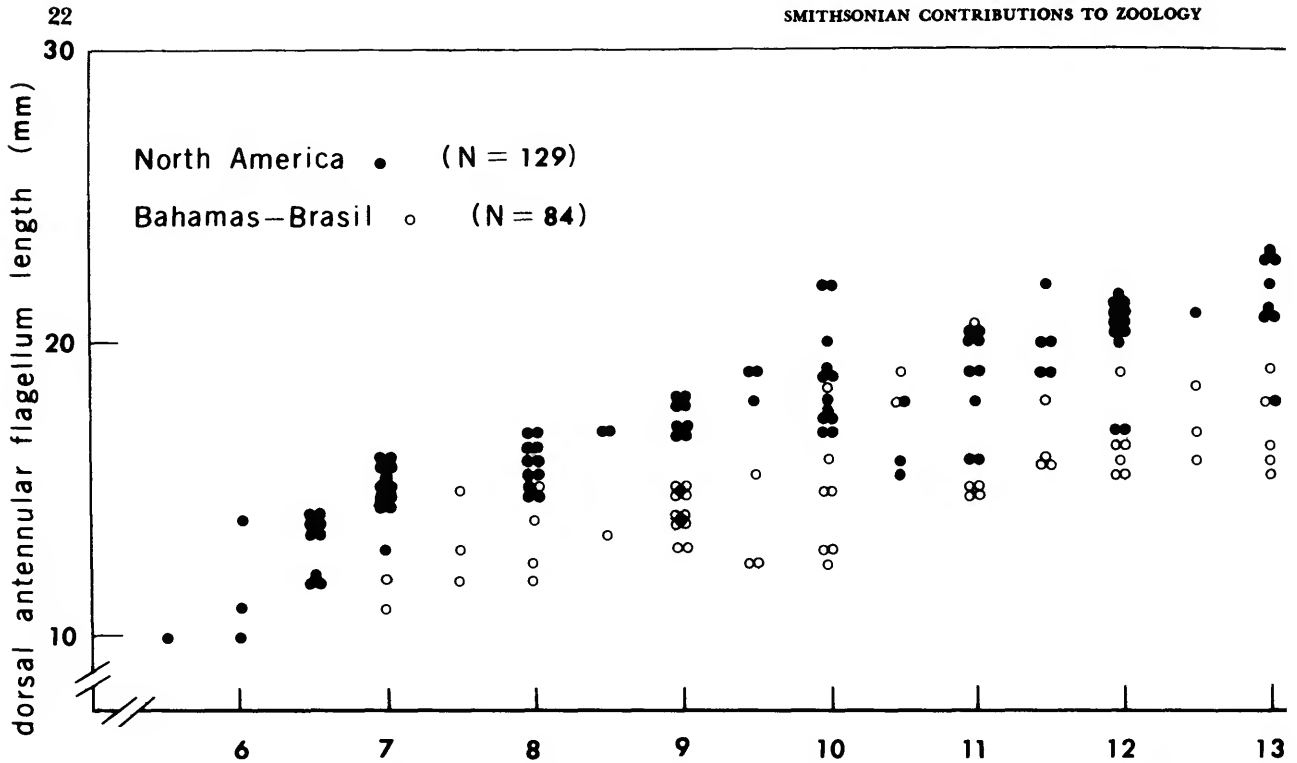


FIGURE 11.—*Solenocera atlantidis* Burkenroad, anterior region, ♀ 18.5 mm c.l., off Edgewater, Florida.



BRAZIL. Maranhão: 1 ♂, USNM, N of Paulino Neves, 66 m, 10 March 1963, *Oregon* sta 4231.

Ceará: 1 ♀, USNM, off Camocim, 40 m, 12 March 1963, *Oregon* sta 4251.

São Paulo: 1 ♀, USNM, off Cananéia, 97-100 m, 11 December 1961, *Calypso* sta 138.

DIAGNOSIS.—Rostral + epigastric teeth 4-7, usually 6. Anterior part of carapace with short setae; postrostral carina ending at level of cervical sulcus; pterygostomian spine with narrow base, its dorsal margin joining carapace at about right angle. Prosartema extending, at most, to distal end of first antennular segment. Scaphocerite short, not exceeding antennular peduncle by more than 10 percent of its own length. Petasma with ventrolateral lobule lacking distal lamella, and extending only as far as, or only slightly surpassing, dorsomedian lobule. Thelycum with sternite XIII lacking anteromedian ridge, and with posterior portion, just in advance of fourth pereopods, forming convex or pointed elevation; paired protuberances on sternite XIV widely separated, low, and rounded to subconical.

DESCRIPTION.—Carapace with short setae on anterior part, and brush of long setae on dorsal bor-

der of pterygostomian pit (Figure 11); elongate patch of thickly setae covering portion of rostrum dorsal to adrostral carina, and continuing posteriorly from orbital margin to epigastric tooth. Rostrum reaching as far as 0.9 length of first antennal segment, horizontal, deep, its dorsal margin straight and ventral margin pronouncedly convex, usually with subapical concavity producing saber-shaped tip; latter rather short, 0.2-0.3 length of rostrum. Rostral + epigastric teeth 5-7, mode 6 (percentage distribution: 5-6, 6-80, 7-14; N=200); second rostral tooth at level of orbital margin; epigastric situated at about posterior 0.35 of distance from orbital margin to level of dorsal extremity of cervical sulcus, and separated from first rostral by interval much larger than spaces between remaining teeth. Adrostral carina extending obliquely from orbital margin to ultimate tooth; postrostral carina short, extending only to level of cervical sulcus, sometimes delimited posteriorly by shallow depression. Orbital spine minute; postorbital spine slender and long; antennal and hepatic spines relatively short; pterygostomian spine small, with narrow base, its dorsal margin joining carapace at about right angle, spine some-

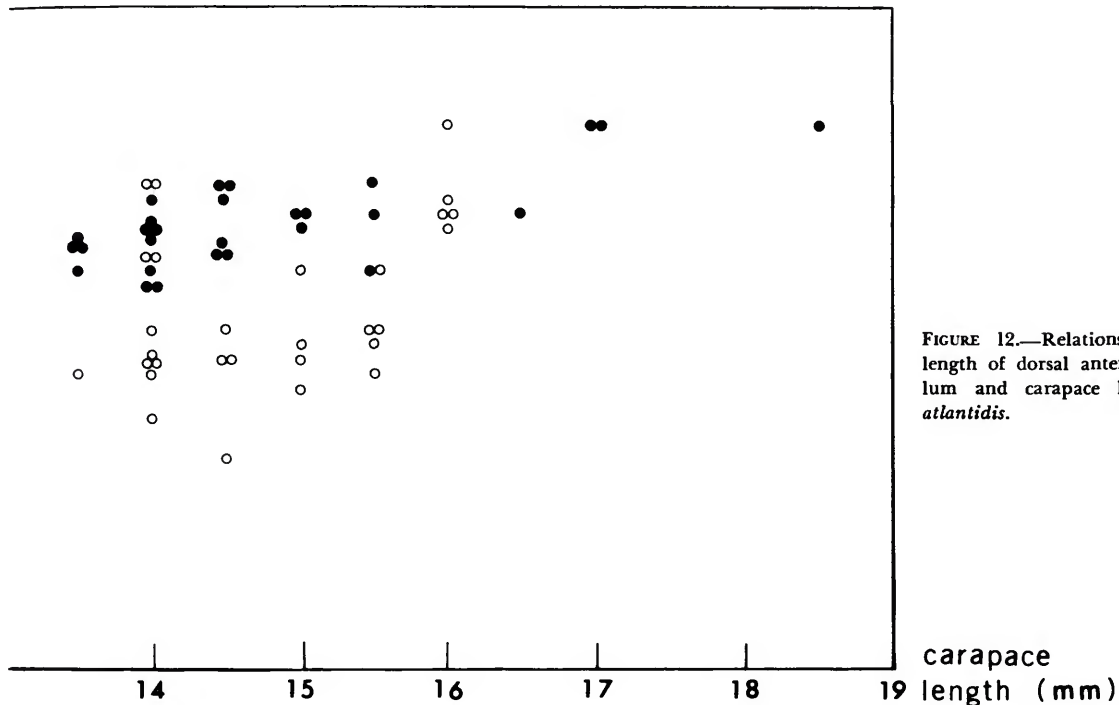


FIGURE 12.—Relationship between length of dorsal antennular flagellum and carapace length in *S. atlantidis*.

times doubled. Cervical sulcus rather broad, and ending at postrostral carina without crossing it; carinal carina sharp; posterior portion of hepatic sulcus almost horizontal, merging with depressed area below hepatic spine, from there turning anteroventrally and ending at semicircular pterygostomian pit; latter continuing with narrow, anterior sulcus parallel to anteroventral margin of carapace.

Antennular peduncle about 0.6 length of carapace; prosartema relatively short, extending almost to, but not reaching, distal end of first segment; stylocerite moderately long, its length 0.60–0.65 of distance between its proximal end and base of distolateral spine, and produced into short spine; antennular flagella moderately long in North American population, short in West Indian-Central American-South American population (Figure 12); ratio of length to dorsal flagellum to length of carapace in former decreasing from range of 2.1 to 1.9 in shrimp with 7 mm c.l. to 1.5 in shrimp with 16 mm c.l., and in latter this ratio decreasing from range of 1.9 to 1.5 in shrimp with 7 mm c.l. to range of 1.4 to 1.1 in shrimp with 16 mm c.l.; terminal filaments short; distolateral spine short, at

most reaching base of second antennular segment.

Scaphocerite usually reaching distal end of antennular peduncle, occasionally surpassing it by at most, 0.1 of its own length; lateral rib ending distally in slender spine, overreached by lamella; antennal flagellum about 4.5 times total length of shrimp.

Third maxilliped exceeding antennular peduncle by length of dactyl and 0.2–0.5 that of propodus; first pereopod reaching to distal end of carapocerite, or surpassing it by as much as length of propodus; second pereopod exceeding antennular peduncle by at least length of dactyl, but by as much as length of propodus and 0.1 that of carpus; third pereopod surpassing antennular peduncle by length of propodus and 0.1–0.3 that of carpus; fourth pereopod exceeding carapocerite by 0.5 length of dactyl or by dactyl and 0.3 length of propodus; fifth pereopod surpassing antennular peduncle by length of dactyl and 0.3 that of propodus. Spines on basis and ischium of first pereopod long, and strongly pointed; second pereopod with slender, acute spines on basis. Coxa of fourth pereopod in females produced posteromesially into short subrectangular plate; coxa of fifth pereopod bearing

prominent spine on anteromesial margin in females and on antero-lateral margin in males.

Abdomen with middorsal carina from third through sixth somites, carina low and rounded on third, rather high and sharp from fourth posteriorly; posterodorsal margin of third to fifth somites with median incision; sixth bearing small spine at posterior end of carina, and pair of posteroventral minute spines. Telson with median sulcus deep anteriorly, increasingly shallower posteriorly; fixed lateral spines variable in length, 0.7–1.3 basal width of terminal portion of telson; terminal portion rather short, length 2.5–3.3 times width at base; tip reaching about distal 0.2 of mesial ramus of uropod; lateral ramus overreaching mesial by about 0.25 of its own length.

Petasma (Figures 13A–C) with ventrolateral lobule barely reaching, or only slightly surpassing, distomedian lobule; dorsolateral and ventromedian lobules extending distally much beyond dorso-

median lobule; dorsolateral and ventrolateral separated by deep gap; ventromedian lobule broadened distally, roughly trapezoidal, with distomesial portion produced into elongate, narrow process, and distolateral portion produced into rounded one, both processes bearing marginal spines, and sometimes reflexed over outer surface; dorsolateral lobule bearing mushroomlike, terminal process, reflexed over outer surface, and armed with marginal spines; deep lateral emargination present at base of process; ventrolateral lobule with distal part subtriangular, ending in strong, obliquely inclined ridge, its proximal base joining ventral (lateral) margin at about right angle; ventral costa subdistally emarginate, forming elongate notch with base of subtriangular part; submarginal row of long plumose setae present on inner surface of costa, immediately proximal to notch.

Thelycum (Figure 14) with paired protuberances on anterior part of sternite XIV setose, relatively

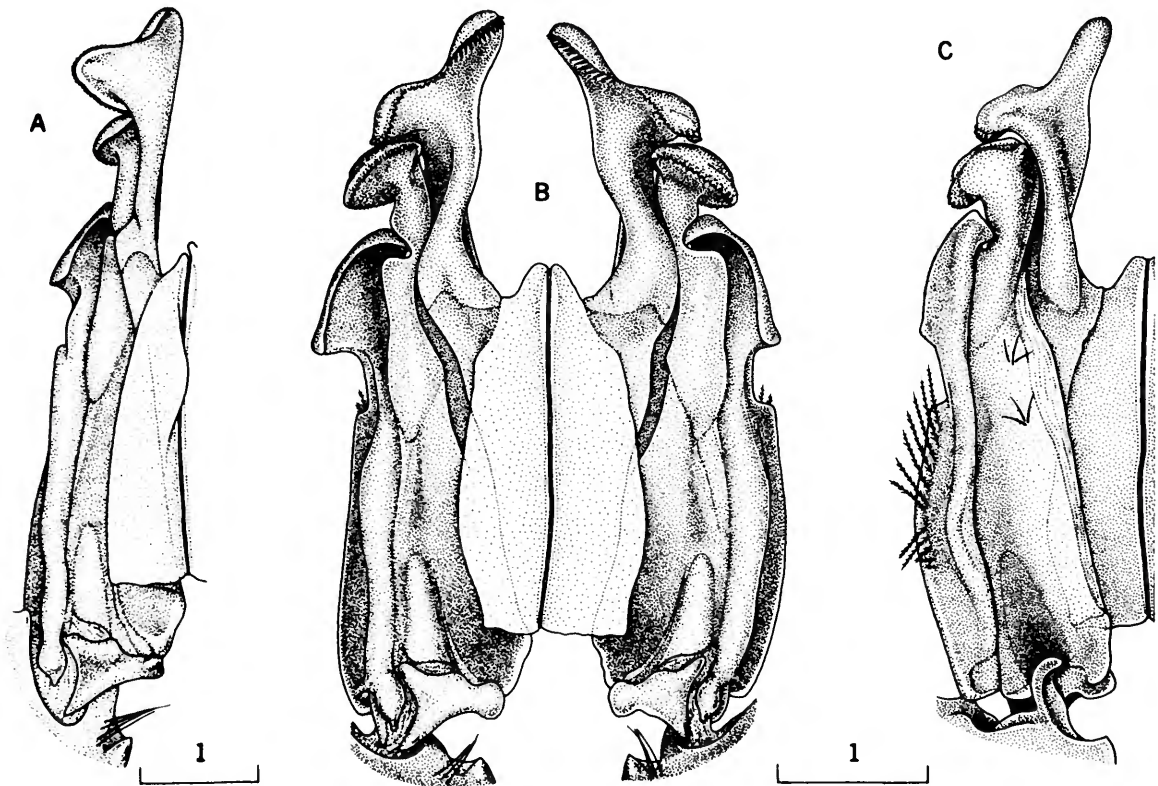


FIGURE 13.—*Solenocera atlantidis*, petasmata: A, Dorsal view of left half of petasma, ♂ 8.5 mm c.l., off Pass a L'outré, Louisiana. B, Dorsal view, ♂ 7 mm c.l., E of Maranhão, Brazil. C, Ventral view of right half of same petasma.

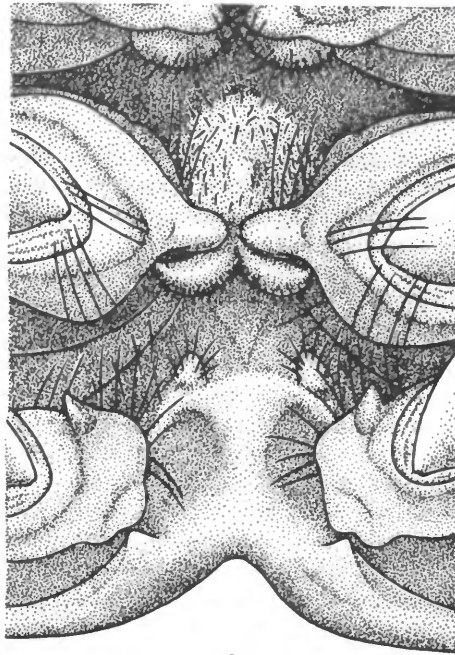


FIGURE 14.—*Solenocera atlantidis*, thelycum, ♀ 17 mm c.l., off Savannah, Georgia.

low, rounded to subconical, sometimes flattened dorsoventrally, and occasionally bearing minute apical tubercle, protuberances subvertical to inclined mesially, and implanted rather far apart, immediately anterior to conspicuous transverse rib; anterior part of sternite XIII lacking median ridge; posterior part, just in advance of coxae of fourth pereopods, with convex elevation, sometimes pointed, and occasionally bearing knob; posterior extremity of same sternite rather deeply emarginate, forming paired convexities produced anterolaterally into hornlike projections.

COLOR.—"On the freshly-captured specimens, the pigmentation is orange-red; the color is most concentrated as bands across the posterior parts of the pleonic tergites" (Burkenroad, 1939).

SIZE.—Males 2.2–8.9 mm c.l.; females 3.8–18.5 mm c.l.

GEOGRAPHIC AND BATHYMETRIC RANGES.—*Solenocera atlantidis* is found from the latitude of Oregon Inlet, North Carolina, to southern Florida, and in the Gulf of Mexico from Dry Tortugas Islands,

along the Gulf coast of the United States and Mexico to Campeche; also through the waters of the West Indies and the Caribbean coast of Central America and South America, and the Atlantic coast of South America as far as Cananéia, São Paulo (Figure 18). The previously known southernmost record for the species was about 2° N, off Cabo Maguari, Pará, originally reported by Nomura and Fausto Filho (1966) for "*Solenocera* ? *geijskesi* Holthuis"; later Fausto Filho (1968b) indicated that the specimen on which this record was based is *S. atlantidis*. Thus the record from Cananéia cited above not only extends the southern limit of the known range of the species some 7500 km, but also is the only record of an adult of any member of the genus *Solenocera* from the east coast of Brazil.

Solenocera atlantidis is a shallow-water species; by far the majority of the specimens were collected at less than 75 m, and in the extensive collections available to us, only six were recorded in vessel logs as taken in water deeper than 125 m.

SUBSTRATES.—The various bottoms on which the present species has been taken are described as follows: gray mud and shells; mud; mud, shells, and coral; mud and fine shells; shells and coral; mud, sponges, and shells (at *Coquette* stations; data from Holthuis, 1959); dark slate, coral, and mud (*Albatross* sta 2121); gray mud (*Albatross* sta 2318); fine white sand and black specks (*Albatross* sta 2411); fine gray sand, black specks, and broken shells (*Albatross* sta 2412); white sand and black specks (*Albatross* sta 2605); coral sand (*Albatross* sta 2649); mud (*Calypso* sta 138 and *Oregon* sta 2267); green mud (*Combat* sta 119); sand (*Combat* stas 396, 397, and *Oregon* stas 871, 872); sand and shells, gray mud and coral (*Oregon* sta 1864); shells, mud, and coral (*Oregon* sta 2248); sand and shells (*Silver Bay* sta 729).

REMARKS.—*Solenocera atlantidis* and *S. geijskesi* share several rather conspicuous features: numerous setae are present on the anterior part of the carapace; the shape of the pterygostomian spine is almost identical; and the relative lengths of the pereopods are similar. *Solenocera atlantidis* may be distinguished from *S. geijskesi* by the shorter rostrum, which has fewer than 8 teeth, and the shorter prosartema; neither the rostrum nor the prosartema extend so far as the distal end of the

first antennular segment. The most striking differences between the two species, however, are in the external genitalia. In *S. atlantidis* males, the ventrolateral lobule of the petasma reaches, or barely surpasses, the dorsomedian lobule, and is truncated distally, lacking a distal lamella; the terminal process of the dorsolateral lobule is expanded distally, mushroomlike in appearance; and finally, the mesial process of the ventromedian lobule is directed distally instead of mesially. In females, the median posterior part of sternite XIII, (that just in advance of the coxae of the fourth pereopods) is raised into a convex or pointed elevation, instead of forming a transverse ridge distinctly delimited from the anterior part of the sternite by a concavity. Too, the paired protuberances on sternite XIV are usually set far apart, immediately anterior to a prominent transverse rib which, although present in *S. geijskesi*, is rather inconspicuous.

We have found that the population of *S. atlantidis* along the Atlantic coast of North America and the Gulf of Mexico tends to have longer antennular flagella than that from the Bahamas to Brazil. Furthermore, in males of the former population the spines on the mesial process of the ventromedian lobule of the petasma are consistently minute (Figure 13A), whereas in males of the latter the spines are long (Figure 13B); the variations of other petasmas as well as thelycal characters in the two populations overlap.

Solenocera geijskesi Holthuis

FIGURES 15-18

Solenocera geijskesi Holthuis, 1959:56, figs. 4, 5 [holotype: ♀, Leiden Museum 11248; type-locality: 32 km off the coast of Surinam, between the Nickerie and Coppename Riviers, 27 m, 15-20 April 1957, *Coquette*].

MATERIAL.—MEXICO (Western Caribbean). Quintana Roo: 1 ♀, USNM, SE of I Mujeres, 458-37-284 m, 23 May 1967, *Pillsbury* sta 582.

SURINAM. 1 ♀, USNM, off Mouth Coppename Rivier, 35 m, 3 September 1958, *Oregon* sta 2277. 1 ♀, paratype, USNM 103099, NW of Paramaribo, 42 m, 20 June 1957, *Coquette* sta 260. 1 ♂, paratype, USNM 103100, off Surinam. 1 ♀, USNM, N of Metappica Kreek, 18 m, 13 May 1957, *Coquette* sta 44. 2 ♀, USNM, N of Wiawia Kreek, 31 m, 15 September 1958, *Oregon* sta 2327.

FRENCH GUIANA. 1 ♂ 10 ♀, USNM, N of Îles du Salut, 60 m, 8 July 1968, *Pillsbury* sta 652. 1 ♀, USNM, N of Cayenne, 60 m, 12 September 1958, *Oregon* sta 2311. 1 ♀, USNM, NE of Cayenne, 64 m, 23 February 1963, *Oregon* sta 4202.

BRAZIL. Maranhão: 1 ♂, USNM, N of Ilhas de São João, 44 m, 26 April 1968, Exped. N-NE II sta 1887. 1 ♂, UFRJ, off Maranhão [?2085 m], 4 April 1968, Exped. N-NE II sta 1883.

Ceará: 2 ♀, USNM, off Camocim, 40 m, 12 March 1963 *Oregon* sta 4251.

DIAGNOSIS.—Rostral + epigastric teeth 7-8. Anterior part of carapace with short setae; postrostral carina ending at level of cervical sulcus; pterygostomian spine with narrow base, its dorsal margin joining carapace at about right angle. Prosartema long, conspicuously overreaching distal end of first antennular segment. Scaphocerite short, not exceeding antennular peduncle by more than 10 percent of its own length. Petasma with ventrolateral lobule distally produced into narrow, pointed lamella, armed with lateral spines, and considerably surpassing dorsomedian lobule. Thelycum with sternite XIII lacking anteromedian ridge, and with posterior portion, just in advance of coxae of fourth pereopods, sloping dorsally, giving rise to median-platelike structure; paired protuberances on sternite XIV rounded to subelliptical in outline, and bearing apical tubercle.

DESCRIPTION.—Carapace with short setae on anterior part, and few, relatively long setae on dorsal border of pterygostomian pit (Figure 15); patch of thickly set setae covering portion of rostrum dorsal to adrostral carina and continuing posteriorly to base of first tooth. Rostrum reaching almost to, or slightly beyond, distal end of first antennular segment, horizontal, moderately deep, its dorsal margin straight and ventral margin pronouncedly convex, sometimes with subapical concavity; tip short. Rostral + epigastric teeth 7-8; second rostral tooth at level of orbital margin, epigastric situated at about posterior 0.45 of distance from orbital margin to dorsal extremity of cervical sulcus, and separated from first rostral tooth by interval much larger than spaces between remaining teeth. Adrostral carina short, extending obliquely from orbital margin to about level of ultimate tooth; postrostral carina short, extending only to level of dorsal extremity of cervical sulcus. Orbital

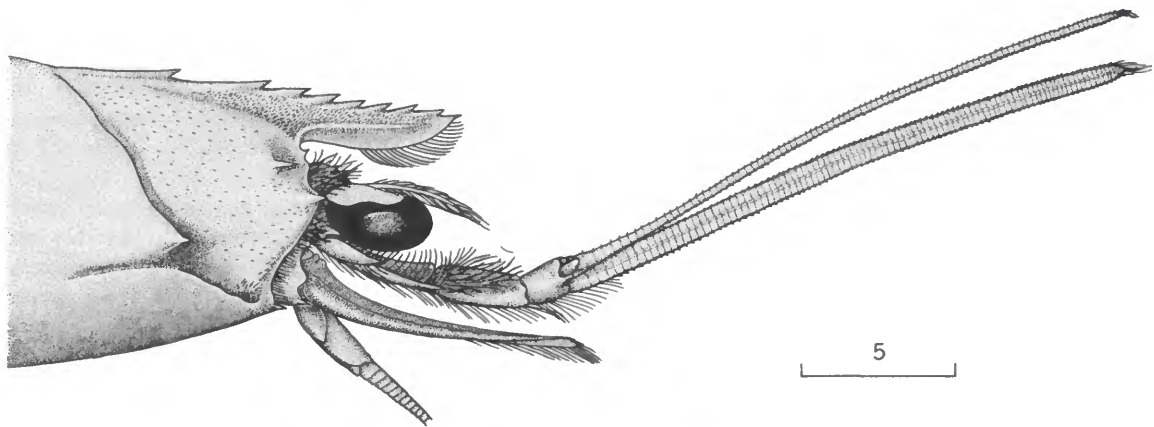


FIGURE 15.—*Solenocera geijskesi* Holthuis, anterior region, ♀ 16 mm c.l., mouth of Copename Rivier, Surinam.

spine small; postorbital spine long, pronouncedly acuminate; antennal and hepatic spines relatively short; pterygostomian spine small, with narrow base, its dorsal margin joining carapace at about right angle. Cervical sulcus ending at postrostral carina, without crossing it; cervical carina sharp; posterior portion of hepatic sulcus almost horizontal, merging with depressed area below hepatic spine, from there turning anteroventrally and ending at pterygostomian pit; anterior sulcus indistinct.

Antennular peduncle about 0.6 length of carapace; prostartema relatively long, extending to proximal part of second segment; stylocerite moderately long, 0.6–0.7 of distance between its proximal end and base of distolateral spine, and produced into acute spine; antennular flagella subequal, moderately long, ratio of length of dorsal flagellum to length of carapace ranging from 2 in shrimp with 13.5 mm c.l. to about 1.5 in shrimp with 18 mm c.l.; terminal filament apparently short; distolateral spine slender and relatively long, conspicuously surpassing distal end of first segment.

Scaphocerite almost reaching, or barely surpassing, distal end of antennular peduncle; lateral rib ending distally in slender spine, overreached by lamella; antennal flagella broken in all specimens examined.

Third maxilliped exceeding antennular peduncle by length of dactyl or by length of dactyl and 0.2

that of propodus; first pereopod extending to about distal end of carpocerite or exceeding it by as much as length of propodus and 0.2 that of carpus; second pereopod reaching to distal end of carpocerite or surpassing it by length of propodus and 0.1 that of carpus; third pereopod overreaching antennular peduncle by at least length of dactyl and at most by length of propodus and about 0.1 that of carpus; fourth pereopod exceeding antennular peduncle by at least 0.5 length of dactyl, and by as much as length of dactyl and 0.2 to 0.3 that of propodus; fifth pereopod surpassing antennular peduncle by length of dactyl and 0.1 to 0.3 that of propodus. Appendages longer in males than in females. Spines on basis and ischium of first pereopod long and strongly pointed; second pereopod with slender, acute spine on basis. Coxa of fourth pereopod of female produced posteromesially into elongate plate; coxa of fifth pereopod bearing prominent spine on anteromesial margin in females and on anterolateral margin in males.

Abdomen with middorsal carina from about anterior 0.35 length of third through sixth somite, carina low and rounded on third, relatively high and sharp from fourth posteriorly; posterodorsal margin of third, fourth, and fifth somites with median incision, sixth bearing small spine at posterior end of carina, and pair of posteroventral, minute spines. Telson with median sulcus deep

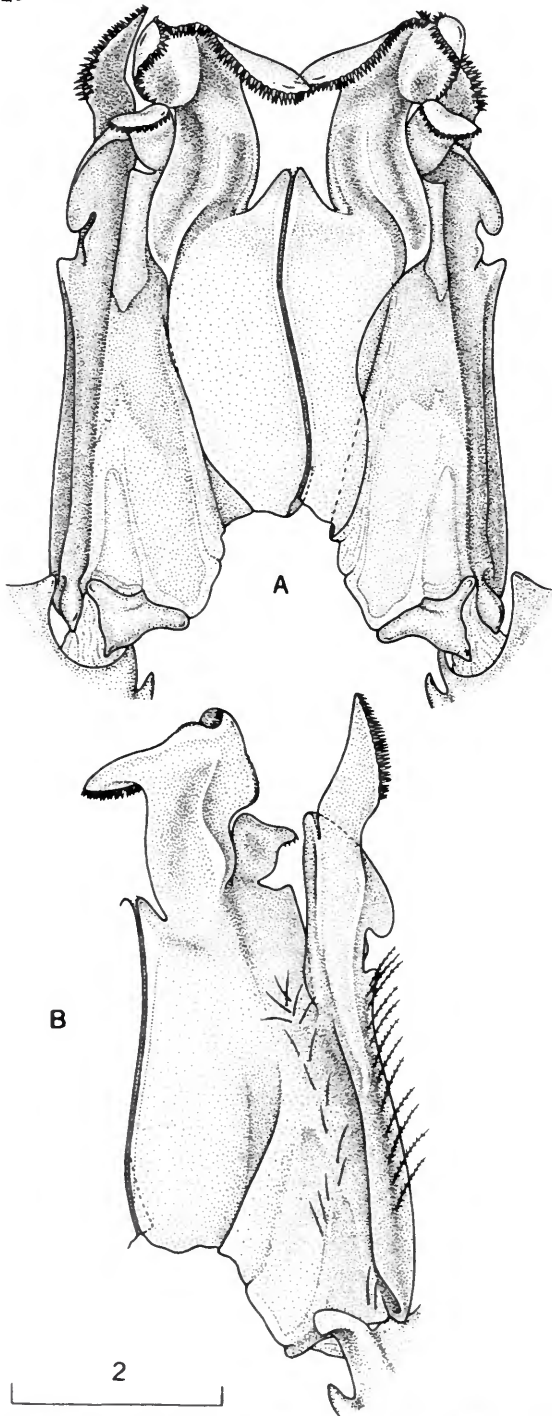


FIGURE 16.—*Solenocera geijskesi*, petasma: A, Dorsal view, ♂ 8.5 mm c.l., N of Îles de São João, Maranhão, Brazil. B, Ventral view of left half of same petasma.

anteriorly, increasingly shallower posteriorly; length of fixed lateral spines 0.6–0.8 basal width of terminal portion of telson; terminal portion rather short, length 2.8 to 3 times width at base; tip reaching about distal 0.2 of mesial ramus uropod; lateral ramus overreaching mesial by about 0.2 its own length.

Petasma (Figures 16A, B) with ventrolateral lobule and ventromedian lobule considerably surpassing dorsomedian lobule distally; dorsolateral and ventrolateral lobules separated by narrow, deep gap; distalmost part of ventromedian lobule considerably broadened, strongly produced mesially into elongate process, and distolaterally into scale-like one, both processes reflexed over outer surface, and margined with conspicuous spines; dorsolateral lobule bearing terminal process, bell shaped in outline, reflexed over outer surface, and armed with marginal spines, deep lateral emargination present at base of process; distal part of ventrolateral lobule bearing narrow, pointed lamella, armed with lateral spines; base of lamella delimited on outer surface by transverse ridge, latter turning proximally on ventral (lateral) margin of petasma, and ending there in subelliptical projection; ventral costa produced into prominent tooth, followed by small, submarginal scale; tooth forming base of elongate notch extending to projection of transverse ridge; inner surface of costa with submarginal row of long, plumose setae, proximal to notch.

Thelycum (Figure 17) with paired protuberances on anterior part of sternite XIV setose, rounded, or elongate and blunt, bearing minute apical tubercle; protuberances implanted rather close to each other and directly mesially; anterior part of sternite XIII lacking median ridge; posterior part, just in advance of fourth pereopods, sloping dorsally, giving rise to posteromedian platelike structure, delimited anteriorly by strong, setose, transverse ridge; posterior extremity deeply emarginate, forming paired, strong convexities, and produced anterolaterally into hornlike projections.

COLOR.—Unknown.

SIZE.—Females, 8–17 mm c.l.; males 7–10 cm c.l.

GEOGRAPHIC AND BATHYMETRIC RANGES.—Isla Mujeres, Quintana Roo, to Camocim, Ceará, Brazil (Figure 18), mostly at depth between 18 and 70 m (latter depth reported by Holthuis, 1959). The

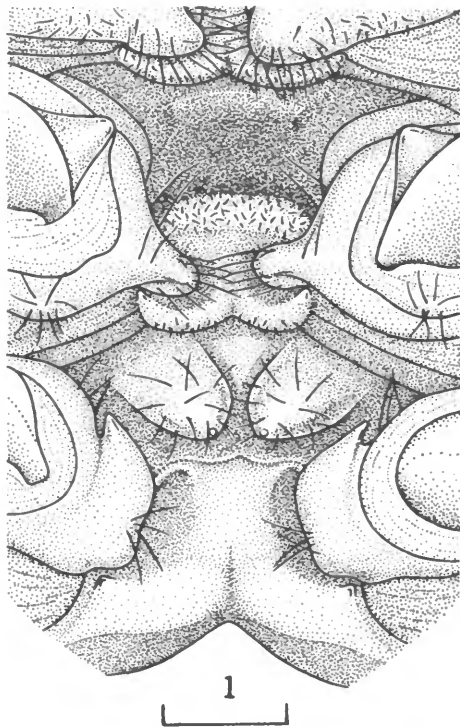


FIGURE 17.—*Solenocera geijskesi*, thelycum, ♀ 16 mm c.l., N of Îles du Salut, French Guiana.

record from Isla Mujeres is the first from the Caribbean. For the first time too, *S. geijskesi* is reported here off Camocim, which represents an extension of about 2000 km southeastward of its limit of distribution, recorded previously from French Guiana (Holthuis, 1959). A single male was taken at a reported depth of 2085 m off Maranhão, during the Brazilian Expedition N-NE II, at sta 1883; the presence of this species in such deep water is doubtful.

SUBSTRATES.—Little is known on the habitats of this shrimp. It has been found on bottoms described as: mud; mud, shells, and coral (at *Cocquette* stations; from Holthuis, 1959); mud and shells (*Oregon* 2327).

REMARKS.—*Solenocera geijskesi* is a small species like *S. atlantidis*, its close relative in the western Atlantic. They are the only two species in the region with setae on the anterior part of the carapace, a pterygostomial spine with its dorsal margin joining the carapace at about right angle, and a long scaphocerite, which exceeds the antennular

peduncle by more than 10 percent its length. *Solenocera geijskesi*, however, may be readily distinguished from *S. atlantidis* by its somewhat longer rostrum, which may overreach the distal end of the first antennular segment and which, moreover, in about 50 percent of the animals bears 8 teeth, and by the longer prosartema, which extends as far as the basal part of the second antennular segment. Furthermore, in *S. geijskesi* males the ventrolateral lobule of the petasma extends considerably beyond the dorsomedian lobule, bearing a distal lamella, which is pointed and armed with prominent spines along the ventral (lateral) margin, and the mesial process of the ventromedian lobule, which is strongly produced mesially or even posteromesially. The females, in turn, possess on the anterior part of sternite XIII, anterior to the coxae of the fourth pereopods, a strong, setose transverse ridge, which gives rise to a platelike structure. Also, the protuberances on sternite XIV are relatively closely set and are implanted just anterior to a low, or almost imperceptible, transverse rib.

The tubercle at the apex of each protuberance is not a unique feature of *S. geijskesi*, as suggested by Holthuis in the original description; it is also often present on *S. atlantidis* and, occasionally, on *S. necopina*.

Solenocera geijskesi is closer to the eastern Pacific *S. florea* Burkenroad, 1938, than to any western Atlantic member of the genus, and may be considered its geminate. The differences between the two were ably presented by Holthuis (1959) when he described the former species.

Distribution and Abundance of *Solenocera* in the Western Atlantic

The areal distribution and temperature-depth relationships for western Atlantic *Solenocera* are presented in Table 1 and Figures 18 and 19. *Solenocera necopina* and *S. atlantidis* are the most widely distributed species, having been found throughout the major geographic units of the region. Two other species also live in the Caribbean, *S. acuminata*, which ranges southward from the Bahamas through the Caribbean to French Guiana, and *S. geijskesi*, with a range extending from the Caribbean to northeastern Brazil (*S. geijskesi* with a depth range of 18 to 70 m, is omitted from Figure 19 as only a single temperature record is available,



FIGURE 18.—Ranges of western Atlantic species of the genus *Solenocera*.

TABLE 1.—Geographic distribution of *Solenocera* in the Western Atlantic

Locality	<i>S. atlantidis</i>	<i>S. vioscai</i>	<i>S. necopina</i>	<i>S. acuminata</i>	<i>S. geijskesi</i>
SE United States	X	X	X		
E Gulf of Mexico	X	X	X		
N Gulf of Mexico	X	X	X		
W Gulf of Mexico	X	X			
S Gulf of Mexico		X			
Bahamas	X		X	X	
W Caribbean	X		X	X	X
S Caribbean	X		X	X	
Greater Antilles	X		X	X	
Lesser Antilles	X		X	X	
Trinidad	X			X	X
NE South America	X			X	X
ESE Brasil	X				
Uruguay			X		

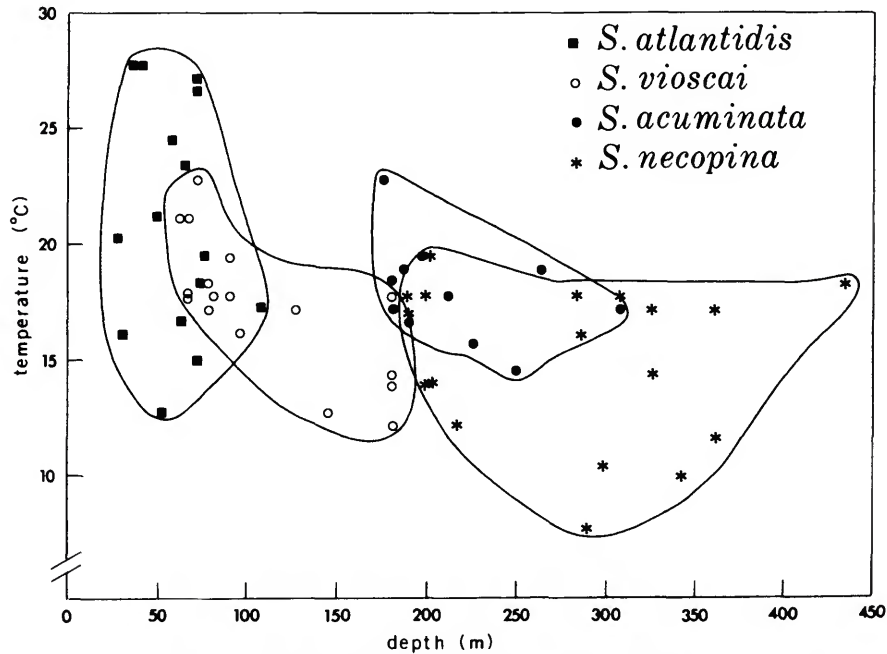


FIGURE 19.—Depth-temperature relationships for four species of *Solenocera* in the western Atlantic (data obtained during cruises of the *Oregon*).

27° at 40 m). *Solenocera vioscai* is confined to the southeastern coast of the United States and the Gulf of Mexico, and it is thus allopatric with *S. acuminata*. *Solenocera atlantidis* is sympatric with *S. vioscai* and *S. geijskesi*, while the latter two species are clearly allopatric. The relationship between *S. acuminata* and *S. necopina* is similarly sympatric in the Caribbean.

During the course of exploratory fishing surveys conducted by the U. S. Government since 1950, there has been some interest in the commercial potential of *Solenocera*, owing to both good flavor and the good marketable size reached by *S. vioscai* and *S. acuminata*. However, catches have been small and on the basis of catch-rate data from 422 localities, it is likely that no significant commercial

concentrations of *Solenocera* occur in the western north Atlantic region. Experimental commercial-scale shrimp trawl catches of five or more pounds per hour were made at only 18 locations and reached 10 or more pounds per hour at only four stations. The largest single catch was only 15 pounds. There have been occasional reports of shrimpers making occasional and sporadic catches

of "broken back" shrimp, which is the common name used for *Solenocera* by the fishermen on the Gulf of Mexico. Reportedly, these catches have been as high as several hundred pounds. Unfortunately, no specimens of samples were retained and attempts to repeat the catches were uniformly unsuccessful.

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