The Caridean Shrimps (Crustacea: Decapoda) of the *Albatross* Philippine Expedition, 1907–1910, Part 1: Family Stylodactylidae

FENNER A. CHACE, JR.

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY · NUMBER 381

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SMITHSONIAN INSTITUTION PRESS
City of Washington
1983

ABSTRACT

Chace, Fenner A., Jr. The Caridean Shrimps (Crustacea: Decapoda) of the *Albatross* Philippine Expedition, 1907–1910, Part 1: Family Stylodactylidae. *Smithsonian Contributions to Zoology*, number 381, 21 pages, 8 figures, 1983.—The stylodactylid shrimps are reviewed, with keys to the three genera currently recognized. Sixteen species are treated, including three new species of *Stylodactylus*: *S. libratus* from Celebes, Indonesia, *S. licinus* from Palawan Passage, Philippines, and *S. macropus* from north of Samar, Philippines. Examination of male specimens, including the holotype, of *Neostylodactylus amarynthis* revealed that there are four large arthrobranchs in the gill series of males in this, the type-species of the genus, whereas arthrobranchs are quite lacking in females assigned to the same species.

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

Library of Congress Cataloging in Publication Data
Chace, Fenner Albert.
The caridean shrimps (Crustacea—Decapoda) of the Albatross Philippine Expedition, 1907–1910.
(Smithsonian contributions to zoology ; no. 381)
Bibliography: p.
Contents: pt. 1. Family Stylodactylidae.
Supt. of Docs. no.: SI 1.27:381
1. Shrimps—Philippines—Classification. 2. Crustacea—Classification. 3. Crustacea—Philippines—Classification. I. Title. II. Series.
QI1.S54 no. 381 591S[595·3'843] 83-600061 [QL444·M33]

Contents

The Caridean Shrimps (Crustacea: Decapoda) of the *Albatross* Philippine Expedition, 1907–1910, Part 1: Family Stylodactylidae

Fenner A. Chace, Jr.

Introduction

HISTORICAL BACKGROUND.—The Philippine cruise of the U.S. Fisheries Steamer *Albatross* was the longest attempted by that vessel, extending from 12 October 1907, when the Expedition sailed from San Francisco, until 4 May 1910, when it returned to that port. The actual collecting period in the Philippines and Indonesia began 28 November 1907, when the *Albatross* reached Manila, and ended 21 January 1910, when she departed for home, but ship operations did not begin until 2 January 1908, because of a delay in the delivery of stores from New York, and there was a second interruption, from early August to late October 1908, for extensive repairs to the vessel in Hong Kong. During the remainder of the period, the *Albatross* occupied 577 dredging and 41 hydrographic stations; no less important were innumerable shore stations at which reefs were dynamited and shores and freshwater streams seined. A more comprehensive account of the cruise may be found in Anonymous (1910).

Many of the collections amassed during the expedition were described in *United States National Museum Bulletin* 100, issued in 14 volumes (38 separate titles) between 1917 and 1950, under the general title "Contributions to the Biology of the Philippine Archipelago and Adjacent Regions." Included are reports on diatoms, foraminiferans, sponges, coelenterates, bryozoans, mollusks, polychaete worms, chaetognaths, echinoderms, tunicates, and fishes. Only volume 14, part 4, the final issue in the series—a report on the copepods by C.B. Wilson published posthumously in 1950—relates to crustaceans. Some of the *Albatross* Philippine decapods have been mentioned or described in publications other than *Bulletin* 100, but the shrimps have been almost completely ignored since Waldo L. Schmitt sorted them by rostral length, either during his brief appointment as scientific aide in the Division of Marine Invertebrates at the U.S. National Museum in 1910 or after he joined the staff of that Division as assistant curator in 1914. Whenever it was, it is likely that the experience may have represented his first exposure to the decapods that were to command his attention for the remainder of a long career. It is unfortunate that he lacked either the opportunity or the incentive to continue the study of this truly remarkable collection.

About a dozen years ago, I decided that working up this important material so that it could be catalogued and made available to other students would be an acceptable utilization of the remainder of my career, whether or not a detailed report could be completed. The idea of studying speci-

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mens whose age virtually matched my own years intrigued me, especially as I came to realize that, having been collected by dedicated professionals, they are still in far better condition than much of the material received by museums today.

My initial objective was a reasonably comprehensive review of the caridean shrimps of the Philippines and Indonesia, similar to my 1972 report on the West Indian shallow-water shrimps or to the excellent review of the deeper eastern Atlantic species by Crosnier and Forest (1973). With the passage of time, it has finally become clear that the publication of the results of this study in a single report, as planned, cannot be accomplished rapidly enough to avoid restraint of competition or deliberately enough to permit necessary preliminary collaboration. I am therefore reluctantly obliged to issue the report by family groups in a random sequence that, hopefully, will be best suited to the needs of my carcinological colleagues. This decision, unfortunately, not only curtails to some extent the usefulness of the report to noncarcinologists, by eliminating a key to the families and a glossary of taxonomic characters, but it also reduces format efficiency because of the need to repeat the introductory remarks, station data, and bibliographic references. There seems, however, to be no reasonably acceptable alternative.

Collections Studied.—Early in the undertaking, it became clear that only by restricting my attention to the *Albatross* collections was there any hope of completing the study within the limits of mortal constraint. There has been a constant urge to include some of the important collections that have subsequently been received from the Philippines and the Indo-Pacific region in general and thereby expand the report into a monograph that would almost certainly enjoy a longer useful life expectancy, but that temptation has been successfully checked for the most part.

Format Considerations.—There is no consistency in the geographic coverage of the keys to genera and species. When feasible, especially if the taxa are limited in number or have extensive ranges, all known species are included. Otherwise, only those recorded from the Philippines and Indonesia are dealt with, and occasionally, as among some of the freshwater taxa, the coverage is restricted to the Philippines only. The genera and species treated following the keys are those known from the Philippines and Indonesia (sometimes only the Philippines). The taxa represented in the *Albatross* collections are indicated by an asterisk (*). The genera and species are arranged alphabetically and numbered sequentially by order of treatment in the taxonomic portion of the report. The generic entries comprise at least the original reference followed by designation of the type-species and of the gender of the generic name, a diagnosis, and the geographic and bathymetric ranges of the genus. The original reference and range are given in the keys for each extraterritorial species mentioned. There has been no attempt to list all references or even all synonyms under the species headings. Usually the entries are limited to (1) the original reference and type-locality of both senior and junior synonyms, if cited; (2) a reference to an illustration, if possible; (3) a diagnosis; and (4) the range of the species. Under "Material" of species represented in the *Albatross* collections are noted the following particulars, when known: (1) general locality; (2) station number; (3) latitude and longitude; (4) depth in meters (in brackets when estimated); (5) character of the bottom; (6) bottom temperature in degrees Celsius; (7) date and astronomical time intervals (hours between midnight and midnight) that the gear operated at the indicated depth; (8) gear used; and (9) the number and sex of the specimens, with maximum and minimum postorbital carapace lengths in millimeters, in brackets (the numbers and size ranges of ovigerous females are included in the female totals, as well as separately). Additional station data may be available in Anonymous (1910).

Acknowledgments.—For assistance with this initial, stylodactylid part of the series, I am indebted to Armando J.G. Figueira of Ottawa for

reviewing the manuscript; to Jacques Forest of the Muséum National d'Histoire Naturelle, Paris, for examining and illustrating the type specimen of *Stylodactylus rectirostris*; to Ken-Ichi Hayashi of the Shimonoseki University of Fisheries, Japan, for providing sketches of *Stylodactylus multidentatus* and for reading the manuscript; to Brian Kensley, formerly at the South African Museum, Cape Town, for examining and illustrating the type specimen of *Stylodactylus stebbingi* and for reviewing the manuscript; to Lilly King Manning for preparing copies of the illustrations; to Marian H. Pettibone for translating the description of *Stylodactylus tokarensis* from the Russian; to Michèle de Saint Laurent of the Muséum National d'Histoire Naturelle, Paris, for persuading me to issue the report in parts and for critically reviewing the manuscript; and to Michael Türkay of the Forschungsinstitut Senckenberg, Frankfurt, for making the holotype of *Stylodactylus amarynthis* available for study. To these and all others whose contributions may have escaped my memory during the decade since the original draft of this study was completed goes my profound gratitude.

* STYLODACTYLIDAE Bate, 1888

STYLODACTYLIDAE Bate, 1888:481, 850.

DIAGNOSIS.—Rostrum nearly as long as or longer than remainder of carapace and immovably attached to it; eyes well developed, freely movable; antennular flagella simple, undivided; mandible with molar and incisor processes not deeply separated; 2nd maxilliped with 2 distal segments arising, side by side, from preceding segment; 3rd maxilliped and 2 anterior pairs of pereopods longer than 3 posterior pairs of pereopods, without exopods, fringed with remarkably long setae; 2 anterior pairs of pereopods subequal in length, similarly slender, with elongate and virtually unarmed fingers, movable finger nearly as long as fixed finger, palm much reduced, carpus entire, not subdivided; 3 posterior pairs of pereopods with carpus distinctly shorter than propodus.

RANGE.—Representatives of the family are known chiefly from tropical and subtropical regions from eastern Africa eastward to Hawaii, northward as far as Korea Strait, southward to South Africa and the vicinity of the Kermadec Islands, as well as in the western Atlantic off the Lesser Antilles and the eastern Atlantic off northwestern Africa; 9–1435 meters.

CLASSIFICATION.—Three genera and 16 species, including the three described below, are currently recognized, but the number of species will surely increase as additional collections are studied.

Key to Genera of Stylodactylidae

1. Stylocerite long, more than 4 times as long as broad, tapering to slender tip overreaching mesiodistal margin of basal segment of antennular peduncle; mandible with 2-jointed palp ..... ***Stylodactylus**
   Stylocerite short and broad, less than 3 times as long as broad, falling far short of distal end of basal segment of antennular peduncle; mandible without palp 2
2. Supraorbital tooth distinct; no fringe of unusually long setae arising from dorsal series of teeth on carapace and base of rostrum; ischium and merus of all pereopods indistinguishably fused; females without arthrobranchs on any pereopodal somites ..... ***Neostylodactylus**
   Supraorbital tooth minute or absent; fringe of unusually long setae arising from dorsal series of teeth on carapace and base of rostrum; ischium and

merus of 4th and 5th pereopods distinct, not fused; arthrobranchs on 4 anterior pereopodal somites in both sexes ..... ***Parastylodactylus**

* Neostylodactylus Hayashi and Miyake, 1968

Neostylodactylus Hayashi and Miyake, 1968:602 [type-species, by original designation: *Stylodactylus amarynthis* De Man, 1902:897; gender: masculine].

DIAGNOSIS.—Supraorbital tooth distinct; no fringe of unusually long setae in dorsal midline of carapace; stylocerite not nearly reaching distal end of basal segment of antennular peduncle, subtruncate mesial to distolateral spine; mandible without palp; female without arthrobranchs on any pereopodal somite.

RANGE.—Andaman Islands to Indonesia, Philippines, and Korea Strait; 9–522 meters.

Key to Species of *Neostylodactylus*

1. Rostrum armed ventrally with 4 or more teeth; abdominal pleura armed with 1 or more marginal teeth, at least on 4th and 5th somites; antennal scale bearing series of spines on lateral margin 2
   Rostrum unarmed ventrally; pleura of 5 anterior abdominal somites without marginal teeth; antennal scale without spines on lateral margin . 3
2. Pleura of 2 anterior abdominal somites without marginal teeth; telson bearing 3 pairs of dorsal spines; lateral spines on antennal scale small, indistinct; uropod with lateral branch armed with 1 fixed and 1 movable distolateral spines, mesial branch normal .... **N. affinis** Hayashi and Miyake, 1968:605 (Korea Strait; 120 meters)
   Pleura of all abdominal somites with marginal teeth; telson bearing 5 pairs of dorsal spines; lateral spines of antennal scale distinct; uropod with lateral branch armed with 2 fixed and 1 movable distolateral spines, mesial branch with pronounced proximal lobe on lateral margin .... *1. **N. amarynthis**
3. Telson bearing 3 pairs of dorsal spines; propodus of 3rd pereopod little more than twice as long as dactyl . **N. investigatoris** (Kemp, 1925:260) (Mergui Archipelago; 73 meters)
   Telson bearing 5 pairs of dorsal spines; propodus of 3rd pereopod more than 4½ times as long as dactyl ..... 2. **N. sibogae**

* 1. Neostylodactylus amarynthis (De Man, 1902)

FIGURES 1–3

Stylodactylus amarynthis De Man, 1902:897, pl. 27: fig. 64a,b [type-locality: Ternate].
Stylodactylus Amarynthis.—De Man, 1920:32, pl. 5: fig. 9a–h.
Neostylodactylus amarynthis.—Hayashi and Miyake, 1968:603, fig. 6.

DIAGNOSIS.—Rostrum armed ventrally with 5–9 teeth; all abdominal pleura with marginal spines; telson bearing 5 pairs of dorsal spines; antennal scale bearing several distinct spines on lateral margin; 3rd pereopod with propodus fully 3 times as long as dactyl.

MATERIAL.—PHILIPPINES. Davao Gulf, Mindanao: sta 5254; 7°05′42″N, 125°39′42″E; 38 m; sand, coral; 18 May 1908 (1426–1431); 6′ Johnston oyster dredge: 1 ovig♀ [?]. Off Jolo Island, Sulu Archipelago: sta 5141; 6°09′N, 120°58′E; 53 m; coral sand; 15 Feb 1908 (0847–0905); 12′ Agassiz beam trawl: 1 ovig♀

FIGURE 1.—*Neostylodactylus amarynthis*, male from *Albatross* sta 5145, carapace length 2.5 mm: *a*, carapace and anterior appendages, right aspect; *b*, abdomen, right aspect; *c*, telson and uropods; *d*, right antennule, dorsal aspect; *e*, right antenna, dorsal aspect; *f*, right mandible; *g*, right 1st maxilla; *h*, right 2nd maxilla; *i*, right 1st maxilliped; *j*, right 2nd maxilliped; *k*, left 1st pereopod; *l*, left 2nd pereopod, coxa and basis; *m*, same, distal segments; *n*, right 3rd pereopod; *o*, right 4th pereopod; *p*, right 5th pereopod; *q*, right 1st pleopod; *r*, same, endopod; *s*, right 2nd pleopod; *t*, same, appendix masculina and appendix interna. (Magnifications: *a*, *b*, *q*, *s*, × 10.8; *c-e*, *g-p*, × 21.5; *f*, *r*, *t*, × 53.4.)

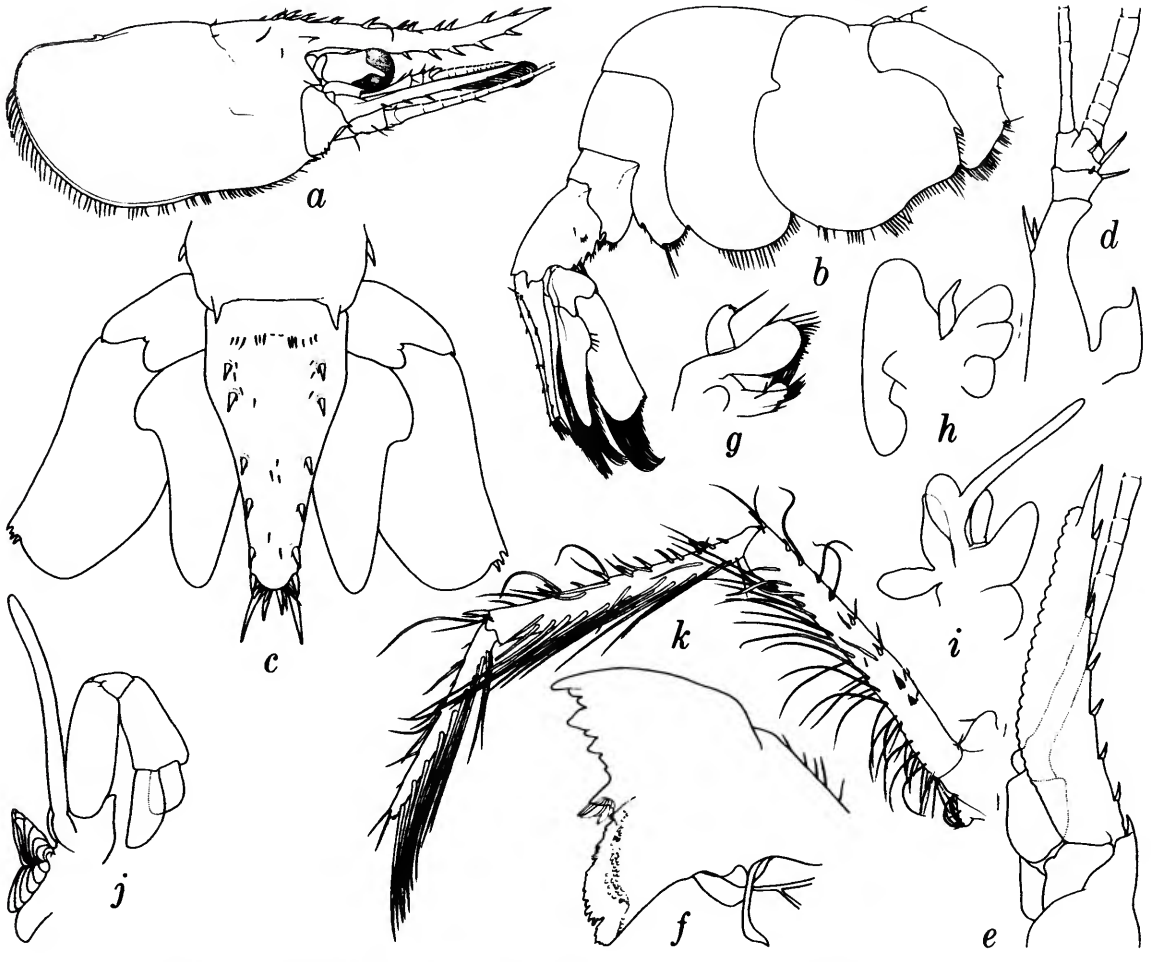

FIGURE 2.—*Neostylodactylus amarynthis*, female from *Albatross* sta 5141, carapace length 2.8 mm: *a*, carapace and anterior appendages, right aspect; *b*, abdomen, right aspect; *c*, telson and uropods; *d*, right antennule, dorsal aspect; *e*, right antenna, dorsal aspect; *f*, right mandible; *g*, right 1st maxilla; *h*, right 2nd maxilla; *i*, right 1st maxilliped; *j*, right 2nd maxilliped; *k*, left 3rd maxilliped. (Magnifications: *a*, *b*, × 10.8; *c-e*, *g-k*, × 21.5; *f*, × 53.8.)

[2.8]; sta 5145; 6°04′30″N, 120°59′30″E; 42 m; coral sand, shells; 15 Feb 1908 (1344–1359); 12′ Agassiz beam trawl, mud bag: 1♂ [2.5].

RANGE.—Andaman Islands, Indonesia, Philippines, and off Kyushu, Japan; 9–300+ meters.

REMARKS.—Thanks to the cooperation of Michael Türkay of the Forschungsinstitut Senckenberg, I have been able to compare the male specimen from station 5145 with the holotype of *Stylodactylus amarynthis*, a male with a carapace length of 2.2 mm, and there seems to be agreement in all presumably essential characters. A most unexpected discovery, however, is the presence of large arthrobranchs on the four anterior pereopodal somites of both specimens, as in the genus *Stylodactylus* but in contradiction to the

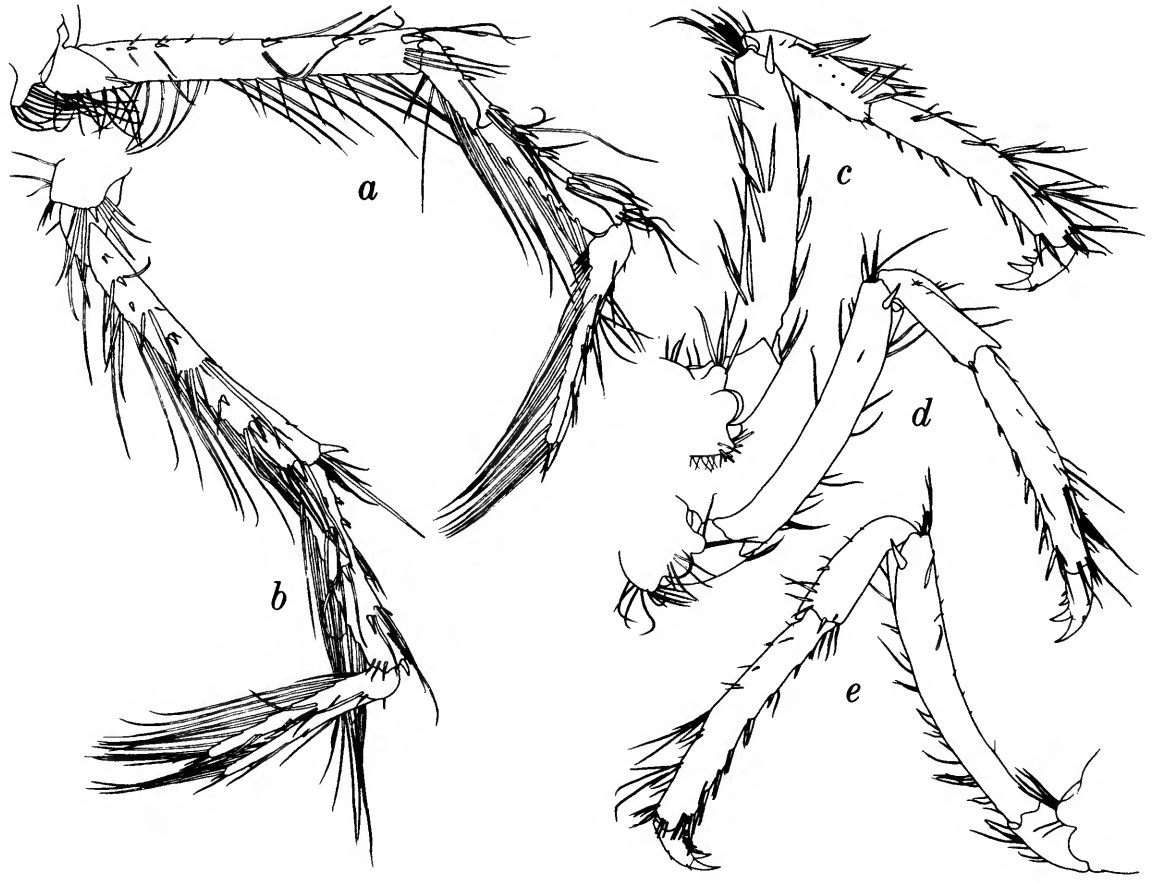

FIGURE 3.—*Neostylodactylus amarynthis*, female from *Albatross* sta 5141, carapace length 2.8 mm: *a*, right 1st pereopod; *b*, right 2nd pereopod; *c*, right 3rd pereopod; *d*, right 4th pereopod; *e*, left 5th pereopod. (Magnifications: all × 21.5.)

condition in the females of *S. amarynthis*, which led to the establishment of the genus *Neostylodactylus*. If the numerous females, lacking arthrobranchs, that have been identified as *N. amarynthis* really do belong to this species, the obvious conclusion is that an extreme case of sexual dimorphism is displayed in this genus. The only explanation that comes to mind to account for the loss of arthrobranchs in females is that the pronounced cap formed by the third abdominal somite in that sex restricts movement of the abdomen and may indicate that the females are more sedentary than the males and that they can therefore survive with more limited respiratory equipment.

There is little doubt that the ovigerous female from station 5254 belongs to this species, even though it is in poor condition from having dried out at some time, but there is less certainty about the ovigerous female from station 5141 (Figures 2, 3). The less distinct marginal dentition on the abdominal pleura of the latter specimen, as well as the somewhat broader telson without a poster-omedian spine and the slightly broader antennal scale, led me to consider the possibility that it might be specifically distinct, but the fact that it

came from the same general locality and depth as the male suggests that it is probably just an aberrant specimen of the same species.

2. *Neostylodactylus sibogae* (De Man, 1918)

Stylodactylus Sibogae De Man, 1918:159 [type-locality: Sulu Sea northwest of Tawitawi Island; 5°43.5′N, 119°40′E; 522 meters]; 1920:38, pl. 5: fig. 10a–c.

Stylodactylus sibogue.—Estampador, 1937:490 [erroneous spelling].

N[eostylodactylus] sibogae.—Hayashi and Miyake, 1968:602, 603.

DIAGNOSIS.—Rostrum unarmed ventrally; abdominal pleura without marginal spines; telson bearing 5 pairs of dorsal spines; antennal scale with lateral margin unarmed; 3rd pereopod with propodus more than 4½ times as long as dactyl.

RANGE.—Known only from the unique holotype from the Sulu Sea.

*Parastylodactylus Figueira, 1971

Parastylodactylus Figueira, 1971:2, 3 [type-species, by original designation: *Stylodactylus bimaxillaris* Bate, 1888:855; gender: masculine].

DIAGNOSIS.—Supraorbital tooth minute or absent; series of unusually long setae arising from among teeth in dorsal midline of carapace and base of rostrum; stylocerite not nearly reaching distal end of basal segment of antennular peduncle, less that 3 times as long as broad; mandible without palp; both sexes with arthrobranchs on 4 anterior pereopodal somites.

RANGE.—Eastern Africa to the Bismarck Archipelago and northward to Korea Strait; 106–481 meters.

Only one species is currently recognized.

*3. *Parastylodactylus bimaxillaris* (Bate, 1888)

FIGURE 4

Stylodactylus bimaxillaris Bate, 1888:855, pl. 138: fig. 3 [type-locality: off Admiralty Islands, Bismarck Archipelago; 1°54′00″S, 146°39′40″E; 274 meters].—Hayashi and Miyake, 1968:599, fig. 5.

DIAGNOSIS.—Single branchiostegal spine; rostrum with 5–9 ventral spines; telson slender, about 3¾ times as long as broad basally, bearing 5 pairs of dorsal spines; antennal scale with lateral margin unarmed, about 10 times as long as broad; 3rd pereopod with propodus nearly 4½ times as long as dactyl.

MATERIAL.—PHILIPPINES. Albay Gulf, east of southern Luzon: sta 5454, 13°12′N, 123°50′30″E; [280 m] ; 7 Jun 1909 (1046–1107); 12′ Agassiz beam trawl; 2 ovig·♀ [6.7, 7.1]. Western Mindanao Sea: sta 5516, 8°46′N, 123°32′30″E; 320 m; globigerina; 12.4°C; 9 Aug 1909 (1021–1041); 12′ Tanner beam trawl: 1♂ [5.4]. Off Jolo Island, Sulu Archipelago: sta 5135, 6°11″50°N, 121°08′20″E; 294 m; fine coral sand; 14.1°C; 7 Feb 1908 (1450–1510); 12′ Tanner beam trawl, mud bag: 1♀ [4.8]; sta 5547, 6°09″20″N, 121°13′40″E; 284 m; fine sand; 13.5°C; 15 Sept 1909 (1351–1411); 9′ Tanner beam trawl: 1 ovig ♀ [6.2]; sta 5549, 6°01′15″N, 120°44′20″E; 481 m; sand, globigerina, other foraminiferans; 11.3°C; 17 Sep 1909 (0936–0957); 9′ Tanner beam trawl, mud bag: 1 ovig·♀ [6.9].

RANGE.—The species has been recorded from rather widely scattered localities from southern Japan and the East China Sea to the Bismarck Archipelago in the east and off the east coast of Africa from Zanzibar to South Africa in the west, in depths of 106 to 463 meters; the *Albatross* material extends the bathymetric range to 481 meters.

* *Stylodactylus* A. Milne-Edwards, 1881

Stylodactylus A. Milne-Edwards, 1881:11 [type-species, by monotypy: *Stylodactylus serratus* A. Milne-Edwards, 1881:11; gender: masculine].

DIAGNOSIS.—Supraorbital tooth present or absent; no fringe of unusually long setae in dorsal midline of carapace; stylocerite overreaching mesial limit of basal segment of antennular peduncle, more than 4 times as long as broad; mandible with 2-jointed palp; both sexes with arthrobranchs on 4 anterior pereopodal somites.

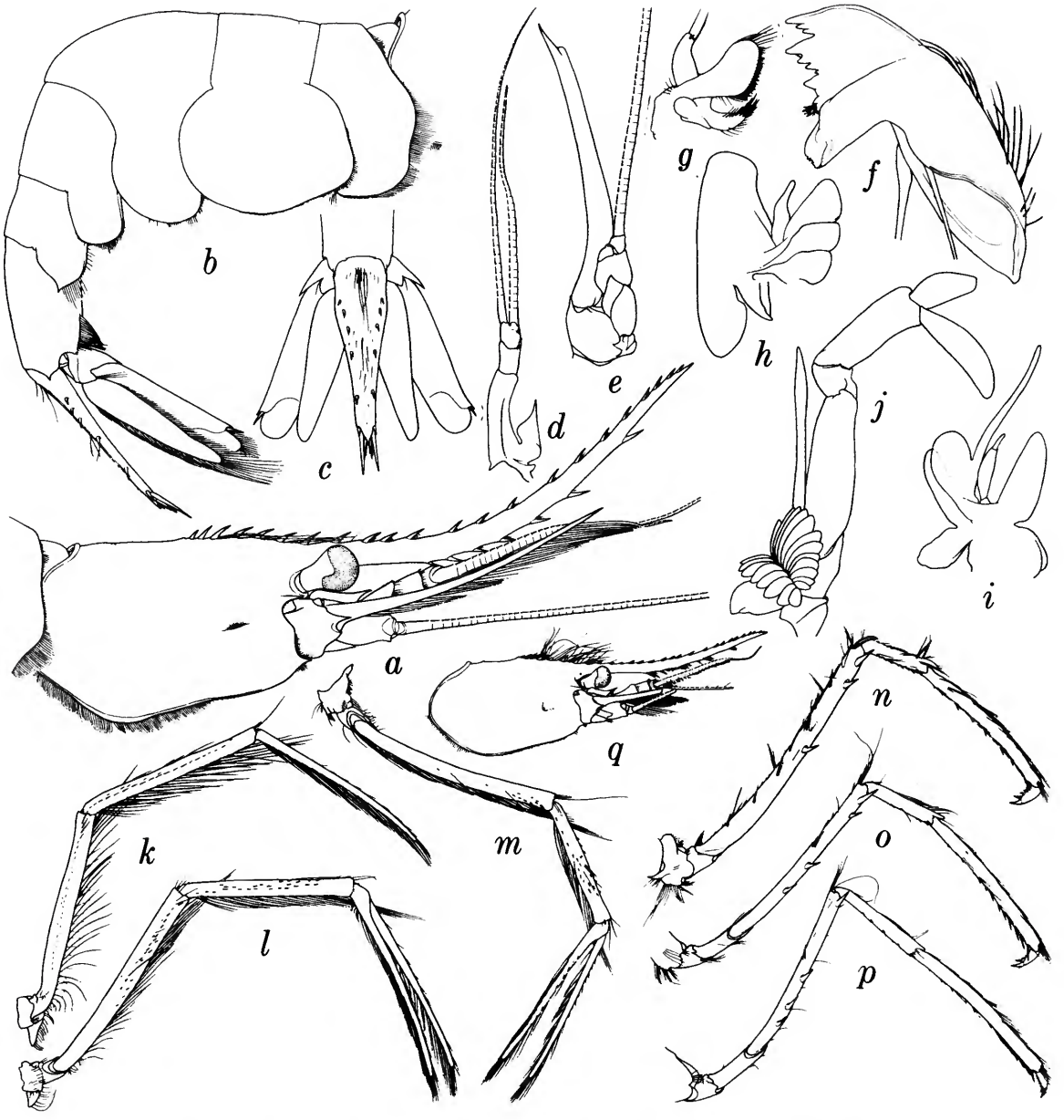

FIGURE 4.—*Parastylodactylus bimaxillaris*, *a-p*, ovigerous female from *Albatross* sta 5549, carapace length 6.9 mm; *q*, ovigerous female from *Albatross* sta 5454, carapace length 7.1 mm: *a*, carapace and anterior appendages, right aspect; *b*, abdomen, right aspect; *c*, telson and uropods; *d*, right antennule, dorsal aspect; *e*, right antenna, ventral aspect; *f*, right mandible; *g*, right 1st maxilla; *h*, right 2nd maxilla; *i*, right 1st maxilliped; *j*, right 2nd maxilliped; *k*, right 3rd maxilliped; *l*, right 1st pereopod; *m*, right 2nd pereopod; *n*, right 3rd pereopod; *o*, right 4th pereopod; *p*, right 5th pereopod; *q*, carapace and anterior appendages, showing anterodorsal fringe, right aspect. (Magnifications: *q*, × 2.6; *a-e*, *k-p*, × 5.2; *g-j*, × 10.8; *f*, × 21.5.)

RANGE.—South Africa, Indonesia, Philippines, East China Sea, southern Japan, vicinity of Kermadec Islands, Hawaii, Lesser Antilles, and off Spanish Sahara; 122–1435 meters.

Key to Species of *Stylodactylus*

1. Pleura of 4th and 5th abdominal somites acutely produced posteroventrally; telson 3 or more times as long as broad. (Carapace armed anteroventrally with single branchiostegal spine; antennal scale without spines on lateral margin.) 2
   Pleura of all abdominal somites rounded, not acutely produced; telson seldom more than 2½ times as long as broad 5
2. Carapace without supraorbital spine; telson bearing 8–10 pairs of dorsal spines; antennal scale 3½ times as long as broad, distolateral spine not overreaching distomesial angle of blade ..... **S. major** Hayashi and Miyake, 1968:590 (East China Sea southwest of Kyushu; 122–124 meters)
   Carapace with small supraorbital spine; telson bearing 4–6 pairs of dorsal spines; antennal scale 6 or more times as long as broad, distolateral spine far overreaching distal margin of blade 3
3. Rostrum armed ventrally with 7 teeth; 3rd pereopod with propodus less than 3 times as long as dactyl ..... **S. tokarensis** Zarenkov, 1968:58 (East China Sea west of Tokara Kaikyo northern Ryukyu Islands; 820 meters)
   Rostrum armed ventrally with 16–25 teeth; 3rd pereopod with propodus at least 4 times as long as dactyl 4
4. Rostrum dorsally concave; 4th pereopod, like 3rd, with ischium and merus indistinguishably fused ..... *6. **S. licinus**, new species
   Rostrum dorsally straight or convex; 4th pereopod like 5th, with ischium and merus distinct, not fused ..... **S. stebbingi** Hayashi and Miyake, 1968:595 (South Africa; 348–549 meters)
5. Carapace armed with at least 2 spines on anteroventral margin instead of single branchiostegal spine; antennal scale bearing spines on lateral margin 6
   Carapace armed with single branchiostegal spine; antennal scale unarmed on lateral margin proximal to distolateral spine. (Supraorbital spine minute or absent; rostrum armed ventrally with more than 10 spines.) 9
6. Telson with distinct median spine on posterior margin; antennular peduncle with 2nd segment no longer than 3rd, measured on mesial margin; dactyls of 3 posterior pereopods relatively short, that of 4th rarely more than ⅕ as long as propodus. (Rostrum armed ventrally with no more than 10 spines; antennal scale bearing long spines on lateral margin.) 7
   Telson without distinct median spine on posterior margin; antennular

peduncle with 2nd segment nearly or quite twice as long as 3rd, measured on mesial margin; dactyls of 3 posterior pereopods longer, that of 4th about ⅓ as long as propodus. (Carapace with strong supraorbital spine.) 8

7. Carapace without supraorbital spine; marginal spine ventral to branchiostegal spine minute ..... **S. kauaiensis** Figueira, 1971:3 (Hawaii; 421–463 meters)

Carapace with strong supraorbital spine; marginal spine ventral to branchiostegal spine well developed .....*5. **S. libratus**, new species

8. Rostrum armed ventrally with 14–23 spines; antennal scale bearing very small, indistinct spines on lateral margin ..... *8. **S. multidentatus**

Rostrum armed ventrally with fewer than 10 spines; antennal scale bearing long spines on lateral margin ....**S. rectirostris** A. Milne-Edwards, 1883 (Off Saint Lucia, Lesser Antilles; 230 meters)

9. Supraorbital spine absent; telson little more than twice as long as broad; 2nd maxilliped with terminal segment on flexor side shorter than one on extensor side; dactyl of 3rd pereopod nearly as long as propodus .. ..*7. **S. macropus**, new species

Supraorbital spine present but minute; telson fully 2½ times as long as broad; 2nd maxilliped with terminal segment on flexor side longer than one on extensor side; dactyl of 3rd pereopod no more than ¼ as long as propodus 10

10. Rostrum armed ventrally with 14 or 15 spines ..... 4. **S. discissipes**

Rostrum armed ventrally with 20–25 spines .... **S. serratus** A. Milne-Edwards, 1881:11 (Lesser Antilles and off Spanish Sahara; 613–1435 meters)

4. Stylodactylus discissipes Bate, 1888

Stylodactylus discissipes Bate, 1888:851, pl. 138: fig. 1 [type-locality: north of Kermadec Islands; 28°33′S, 177°50′W; 1097 meters].—Balss, 1933:84.—Crosnier and Forest, 1973:131, 132, fig. 36g, h.

Stylodactylus orientalis Bate, 1888:854, pl. 138: fig. 2 [type-locality: some as cited above for *S. discissipes*].

DIAGNOSIS.—Supraorbital spine minute; no secondary spine below branchiostegal; rostrum curving slightly dorsad, with 14 or 15 ventral spines; all abdominal pleura rounded; telson 2½ times as long as broad, armed with posteromedian tooth and 4 or 5 pairs of dorsal spines; antennal scale unarmed along lateral margin proximal to distolateral spine; 2nd maxilliped with terminal segment on flexor side longer than one on extensor side.

RANGE.—See "Remarks" (below).

REMARKS.—The male holotype of *S. discissipes* and the female holotype of *S. orientalis* were taken at the same *Challenger* station; according to Crosnier and Forest (1973:131), the second specimen is probably also the paratype cited under the first species. The male specimen recorded by Balss (1933) from an unknown depth off the Java Sea coast of Java seems to be the only other possibly valid evidence of the species, the Hawaiian specimen cited by Rathbun (1906:927) having become the holotype of *S. kauaiensis* Figueira (1971:3). The Java Sea specimen should be reexamined in the light of current knowledge of the genus before *S. discissipes* is positively accepted as a member of the Indonesian fauna.

*5. *Stylodactylus libratus*, new species

FIGURE 5

DIAGNOSIS.—Supraorbital spine large, prominent; 2 secondary spines below branchiostegal; rostrum nearly horizontal, with 8 ventral spines; all abdominal pleura rounded; telson about twice as long as broad, armed with short posteromedian spine and 4 pairs of dorsal spines; antennal scale armed with series of long spines on lateral margin; 2nd maxilliped with terminal segment on flexor side longer than one on extensor side; dactyls of 3rd and 4th pereopods about ⅙ as long as propodi; 4th pereopod with ischiomeral articulation.

DESCRIPTION.— Rostrum (Figure 5*a*) nearly horizontal, slightly longer than carapace; dorsal margin armed with 31 movable spines increasing in length to near middle of series then decreasing again, those of posterior half of series flanked by setae slightly longer than spines, posterior 7 or 8 spines situated on carapace posterior to level of orbital margin; ventral margin armed with 8 rather widely spaced movable spines decreasing in length anteriorly, each spine longer than opposing spine of dorsal series. Carapace with distinct hepatic depression flanked dorsally by subvertical row of about 5 setae. Antennal spine unusually long, reaching about to level of midlength of stylocerite. Branchiostegal spine also long and slender but little more than ½ as long as antennal; 2 marginal spines ventral to branchiostegal, dorsal one about ½ as long as branchiostegal, ventral one very short. Abdomen (Figure 5*b*) with all pleura broadly rounded, 3rd somite not produced posterodorsally, 6th somite not sharply produced posteroventrally but with submarginal tubercle. Telson (Figure 5*c*) about twice as long as broad, armed with short posteromedian spine and 4 pairs of dorsal spines, not including pair arising above bases of longest pair of posterior spines.

Eyes with unusually large cornea and relatively short stalk.

Antennular peduncle (Figure 5*d*) with stylocerite overreaching midlength of 2nd segment, 2nd and 3rd segments subequal in length along mesial margins.

Antennal scale (Figure 5*e*,*f*) about 4½ times as long as broad, slightly overreaching antennular peduncle, armed on lateral margin with about 6 long and few short movable spines, distolateral spine strong, far overreaching distal margin of blade.

Mouthparts as illustrated (Figure 5*g-l*). Second maxilliped with terminal segment on flexor side much longer and narrower than one on extensor side. Third maxilliped overreaching antennal scale by combined lengths of 2 distal segments.

First pereopod (Figure 5*m*) overreaching antennal scale by slightly more than combined lengths of chela and carpus. Second pereopod (Figure 5*n*) overreaching antennal scale by length of chela and nearly all of carpus. Third pereopod (Figure 5*o*) overreaching antennal scale by slightly more than combined lengths of dactyl and propodus, propodus nearly 6 times as long as dactyl. Fourth pereopod (Figure 5*p*) overreaching antennal scale by length of dactyl and ⅞ of propodus, propodus fully 6 times as long as dactyl, ischium and merus clearly articulated. Fifth pereopod (Figure 5*q*) overreaching antennal scale by lengths of dactyl and ⅝ of propodus, propodus more than 8 times as long as dactyl.

Endopod of 1st pleopod of male (Figure 5*r*, *s*) with distolateral angle excised. Appendix masculina (Figure 5*t*, *u*) slender, nearly as long as appendix interna. Lateral branch of uropod (Figure 5*c*) with lateral margin noticeably flared distally.

SIZE.—Carapace length 13.5 mm.

MATERIAL.—INDONESIA. Selat Butung, Celebes: sta 5645; 5°29′06″S, 122°36′06″E; 377 m; 16 Dec 1909 (0954–0955); 12′ Agassiz beam trawl: 1♂ [13.5] holotype, USNM 196081.

TYPE-LOCALITY.—Selat Butung, Celebes; 5°29′06″S, 122°36′06″E; 377 meters.

RANGE.—Known only from the unique holotype from Selat Butung, Celebes; 377 meters.

REMARKS.—Jacques Forest of the Muséum National d'Histoire Naturelle, Paris, compared the illustrations of the single specimen of this species

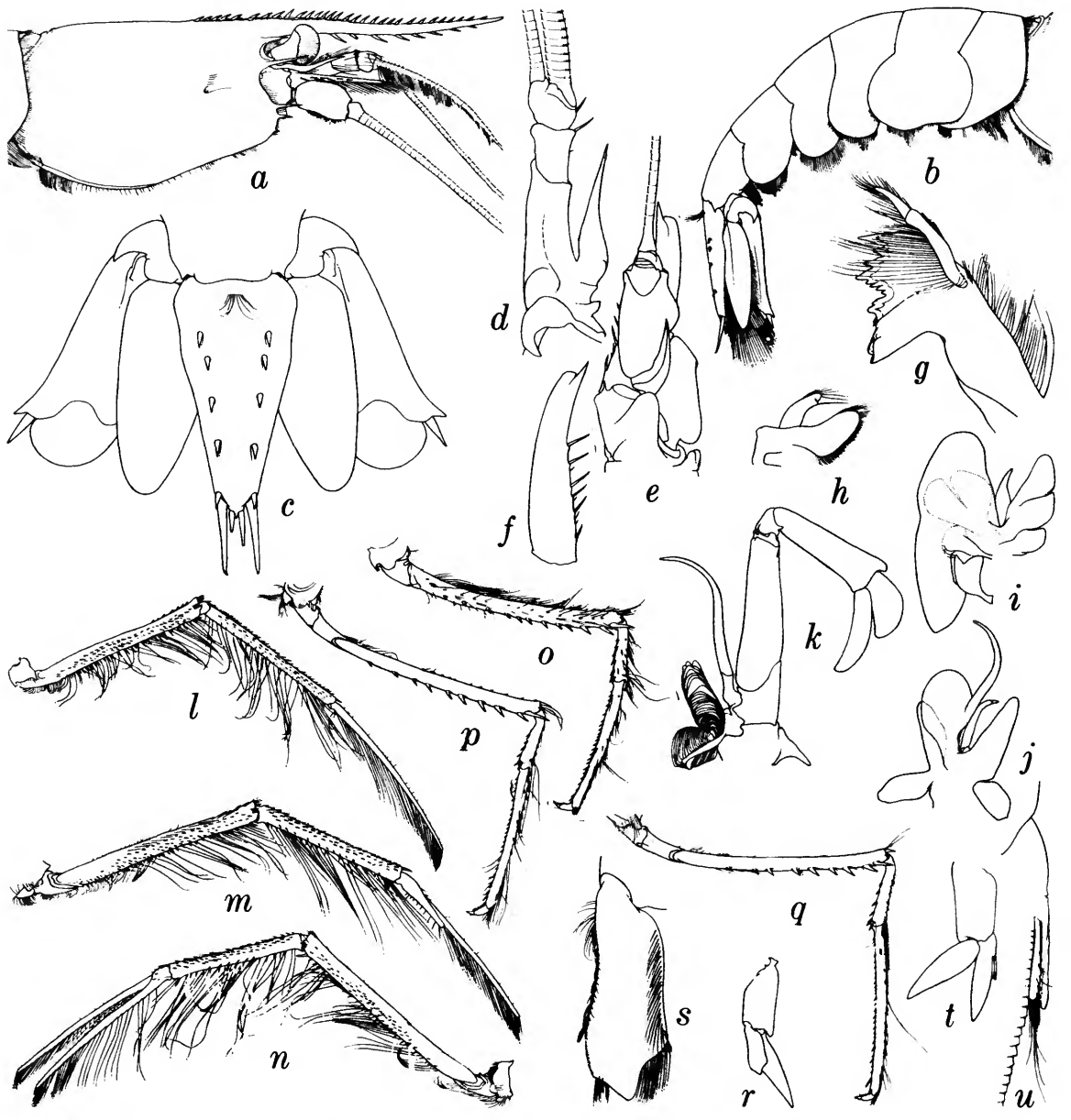

FIGURE 5.—*Stylodactylus libratus*, new species, male holotype from *Albatross* sta 5645, carapace length 13.5 mm: *a*, carapace and anterior appendages, right aspect; *b*, abdomen, right aspect; *c*, telson and uropods; *d*, right antennule, dorsal aspect; *e*, right antenna, ventral aspect; *f*, same, antennal scale, dorsal aspect; *g*, right mandible; *h*, right 1st maxilla; *i*, right 2nd maxilla; *j*, right 1st maxilliped; *k*, right 2nd maxilliped; *l*, right 3rd maxilliped; *m*, right 1st pereopod; *n*, left 2nd pereopod; *o*, right 3rd pereopod; *p*, right 4th pereopod; *q*, right 5th pereopod; *r*, right 1st pleopod; *s*, same, endopod; *t*, right 2nd pleopod; *u*, same, appendix masculina and appendix interna. (Magnifications: *a*, *b*, *l-r*, *t*, × 2.6; *c-f*, *h-k*, × 5.2; *g*, *s*, *u*, × 10.8.)

(Figure 5 herein) with the holotype of *S. rectirostris* from off St. Lucia, Lesser Antilles. That specimen, an ovigerous female with a carapace length of 9.2 mm, is much more like the Indonesian male described above than is indicated by the figure for *S. rectirostris* published by A. Milne-Edwards (1883), especially in regard to the number of spines on the anterior margin of the carapace, the sinuous rather than regularly convex lateral margins of the telson, the lateral spination on the antennal scale, and the flared rather than straight distal portion of the lateral margin of the lateral branch of the uropod. The Indonesian specimen, however, seems to be specifically distinct; the third, fourth, and fifth pereopods are noticeably more slender and the dactyls of those appendages are distinctly shorter than they are in *S. rectirostris*; in *S. libratus*, the propodus is about six times as long as the dactyl in both the third and fourth pereopods, whereas, in *S. rectirostris*, it is little more than three times as long. It is possible, of course, that these differences represent sexual dimorphism, but it seems best to regard the Indonesian and western Atlantic populations as distinct until additional material becomes available.

ETYMOLOGY.—The Latin name *libratus* (horizontal) was suggested by the nearly horizontal rostrum.

* 6. Stylodactylus licinus, new species

FIGURE 6

Stylodactylus tokarensis Zarenkov, 1968:60, fig. 3 [?part; paratype only].

Stylodactylus stebbingi.—Toriyama and Hayashi, 1982:90, 92, 95, 105. [Not *S. stebbingi* Hayashi and Miyake, 1968:595.]

DIAGNOSIS.—Supraorbital spine small but distinct; no secondary spines below branchiostegal; rostrum curving somewhat dorsad, with about 16–21 ventral spines; pleura of 4th and 5th abdominal somites with sharp posteroventral angles; telson fully 3½ times as long as broad, armed with distinct posteromedian spine and 5 pairs of dorsal spines; antennal scale without spines on lateral margin; 2nd maxilliped with terminal segment on flexor side longer than one on extensor side; dactyl of 3rd pereopod less than ¼ as long as propodus, of 4th pereopod ⅐ as long as propodus; 4th pereopod with merus and ischium indistinguishably fused.

DESCRIPTION.—Rostrum (Figure 6*a*) distinctly curved dorsad in anterior ⅔ of length, about 1¾ times as long as carapace; dorsal margin armed with about 40 movable spines, posterior 4 or 5 increasing in length to maximum size above orbit and decreasing slightly and very gradually in length from level of distal margin of eye to tip, without apparent flanking setae, 8 spines situated on carapace posterior to level of orbital margin; ventral margin armed with at least 16–18 movable spines decreasing in length anteriorly, each spine not much longer than corresponding spine of dorsal series. Carapace with indistinct hepatic depression. Antennal spine prominent but not unusually long. Branchiostegal spine small but distinct, without marginal spines ventral thereto but with prominent bulge in anterior margin of carapace dorsal to branchiostegal spine. Abdomen (Figure 6*b*) with pleura of 4th and 5th somites sharply pointed posteroventrally, 3rd somite somewhat produced posterodorsally to form semblance of cap, 6th somite armed with small, sharp posteroventral tooth. Telson (Figure 6*c*) fully 3½ times as long as broad, armed with rather strong posteromedian tooth and 5 pairs of dorsal spines, not including pair arising above bases of longest pair of posterior spines.

Eyes with moderately large cornea and short stalk.

Antennular peduncle (Figure 6*d*) with stylocerite falling slightly short of midlength of 2nd segment, 2nd segment nearly twice as long as 3rd, measured along mesial margins.

Antennal scale (Figure 6*e*) nearly 7 times as long as broad, overreaching antennular peduncle by nearly ½ length of scale, lateral margin unarmed, distolateral spine strong, far overreaching distal margin of blade.

Mouthparts as illustrated (Figure 6*f–k*). Second maxilliped with terminal segment on flexor side considerably longer than one on extensor side. Third maxilliped overreaching antennal

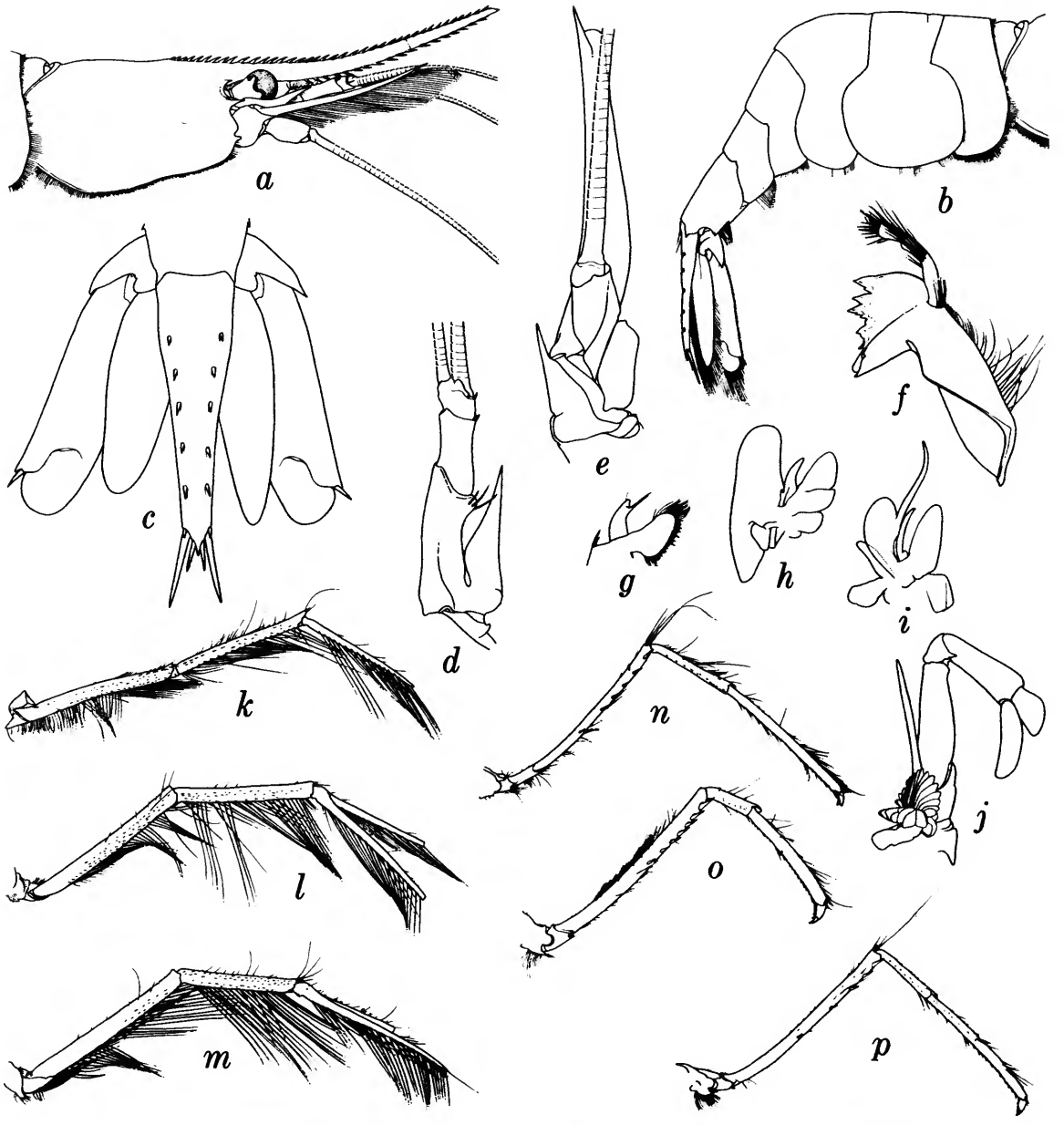

FIGURE 6.—*Stylodactylus licinus*, new species, *a–n*, ovigerous female holotype from *Albatross* sta 5348, carapace length 10.7 mm; *o*, *p*, ovigerous female paratype from same station, carapace length 10.8 mm: *a*, carapace and anterior appendages, right aspect; *b*, abdomen, right aspect; *c*, telson and uropods; *d*, right antennule, dorsal aspect; *e*, right antenna, ventral aspect; *f*, right mandible; *g*, right 1st maxilla; *h*, right 2nd maxilla; *i*, right 1st maxilliped; *j*, right 2nd maxilliped; *k*, right 3rd maxilliped; *l*, right 1st pereopod; *m*, right 2nd pereopod; *n*, right 5th pereopod; *o*, right 3rd pereopod; *p*, right 4th pereopod. (Magnifications: *a*, *b*, *k–p*, × 2.6; *c–e*, *g–j*, × 5.2; *f*, × 10.8.)

scale by slightly more than length of distal segment.

First pereopod (Figure 6*l*) overreaching antennal scale by slightly more than length of chela. Second pereopod (Figure 6*m*) overreaching antennal scale by nearly length of fingers. Third pereopod (Figure 6*o*) overreaching antennal scale by length of dactyl and about ⅓ of propodus, propodus nearly 4½ times as long as dactyl. Fourth pereopod (Figure 6*p*) overreaching antennal scale by nearly twice length of dactyl, propodus 7 times as long as dactyl, ischium and merus indistinguishably fused. Fifth pereopod (Figure 6*n*) overreaching antennal scale by length of dactyl and about ¼ of propodus.

Lateral branch of uropod (Figure 6*c*) with lateral margin nearly straight, not noticeably flared distally.

Eggs rather small and numerous, measuring about 1.0 by 0.7 mm.

SIZE.—Ovigerous female holotype with carapace length of 10.7 mm; ovigerous female paratype, 10.8 mm.

MATERIAL.—PHILIPPINES. Palawan Passage: sta 5348, 10°57′45″N, 118°38′15″E; 686 m; coral, sand; 13.6°C; 27 Dec 1908 (0928–1009); 12′ Tanner beam trawl, mud bag: 2 ovig♀ [10.7, 10.8], smaller is holotype, USNM 196076.

TYPE-LOCALITY.—Palawan Passage, Philippines; 10°57′45″N, 118°38′15″E; 686 meters.

RANGE.—Known from the type-locality in Palawan Passage, Philippines, and from southern Japan (paratype of *S. tokarensis* and female with recently hatched eggs, carapace length 13.0 mm, from Tosa Wan, Shikoku, received from Ken-Ichi Hayashi); 432–686 meters.

REMARKS.—Brian Kensley, then at the South African Museum, Cape Town, compared illustrations of the Philippine specimens with the type series of *S. stebbingi* and furnished sketches of that species. Although the two species seem to be closely related, Kensley confirmed that *S. licinus* may be distinguished by its dorsally concave rostrum, a longer second segment in the antennular peduncle, and the absence of an articulation between the ischium and merus of the fourth pereopod.

As indicated above, examination of a specimen from Tosa Wan, Japan, recorded by Toriyama and Hayashi (1982) as *S. stebbingi*, reveals that it almost certainly belongs to *S. licinus*.

There is little doubt that the Palawan Passage specimens are distinct from the male holotype of *S. tokarensis* from 820 meters in the East China Sea, another species that belongs to that section of the genus in which there is a small supraorbital spine, the pleura of the fourth and fifth abdominal somites are posteroventrally acute, and the telson is three or more times as long as broad. Like *S. stebbingi*, the holotype of *S. tokarensis* differs from *S. licinus* in having the rostrum nearly horizontal, rather than curved dorsad; also, the holotype of *S. tokarensis* has only seven teeth on the ventral margin of the rostrum, rather than 16 or more. I have been unable, however, to distinguish the *Albatross* specimens from the male paratype of *S. tokarensis* that was taken by the *Vitjaz* off southern Japan in 493 to 500 meters. That specimen differs from the holotype and resembles *S. licinus* in having the rostrum curved dorsad and armed with 16 ventral teeth; the only important difference between the *Vitjaz* and *Albatross* specimens seems to depend on the relationship of the merus and ischium of the fourth pereopod, a correlation not mentioned in Zarenkov's description.

ETYMOLOGY.—The Latin name *licinus* (bent or turned upward) was suggested by the shape of the rostrum.

* 7. *Stylodactylus macropus*, new species

FIGURE 7

DIAGNOSIS.—No supraorbital spine; no secondary spines below branchiostegal; rostrum curved slightly dorsad, with 18 ventral spines; pleura of all abdominal somites rounded; telson little more than twice as long as broad, armed with slender posteromedian spine and 5 or 6 pairs of dorsal spines; antennal scale without spines on lateral margin; 2nd maxilliped with terminal segment on flexor side shorter than one on extensor side;

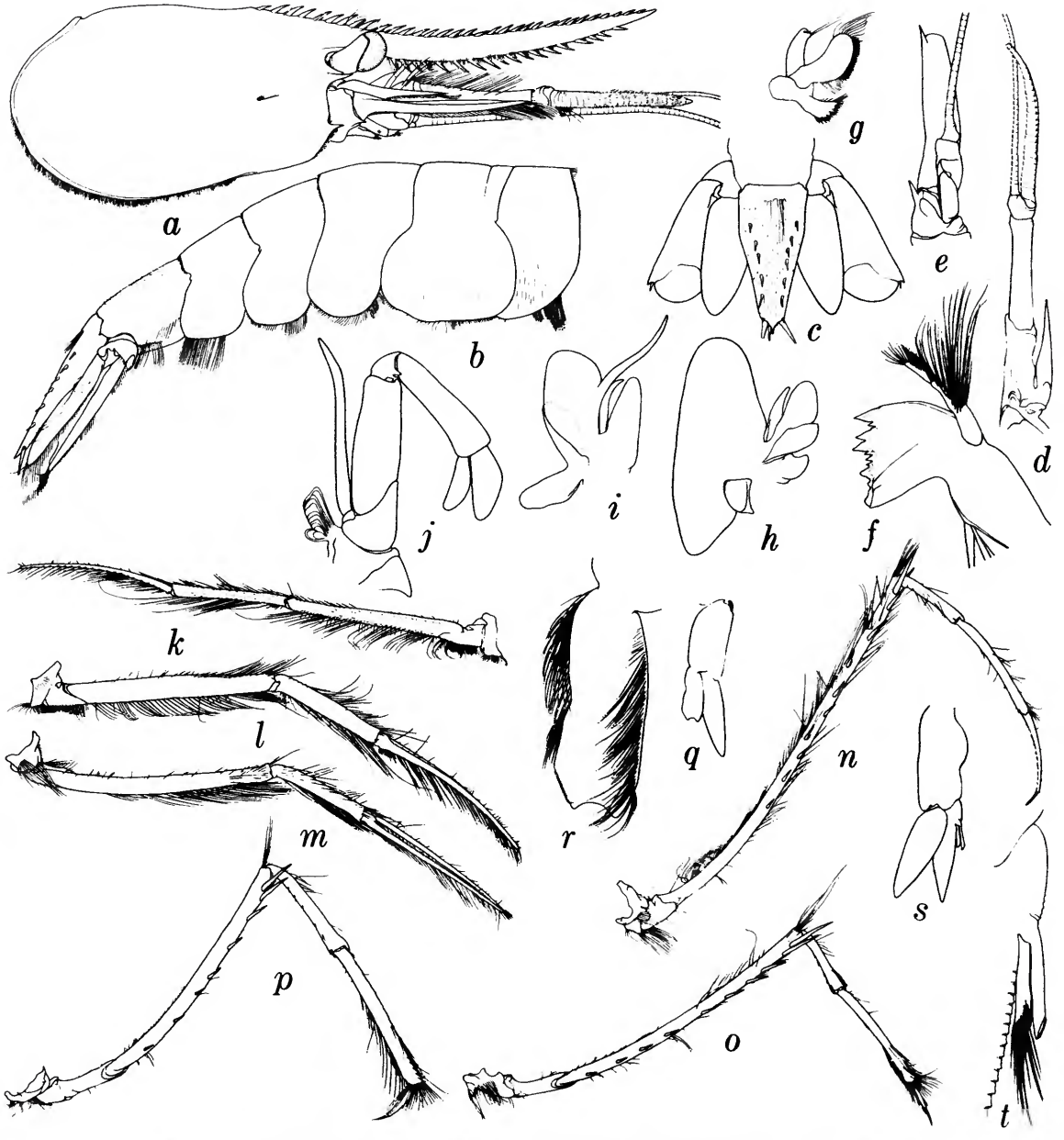

FIGURE 7.—*Stylodactylus macropus*, new species, male holotype from *Albatross* sta 5445, carapace length 15.8 mm: *a*, carapace and anterior appendages, right aspect; *b*, abdomen, right aspect; *c*, telson and uropods; *d*, right antennule, dorsal aspect; *e*, right antenna, ventral aspect; *f*, right mandible; *g*, right 1st maxilla; *h*, right 2nd maxilla; *i*, right 1st maxilliped; *j*, right 2nd maxilliped; *k*, left 3rd maxilliped; *l*, right 1st pereopod; *m*, right 2nd pereopod; *n*, right 3rd pereopod; *o*, right 4th pereopod; *p*, right 5th pereopod; *q*, right 1st pleopod; *r*, same, endopod; *s*, right 2nd pleopod; *t*, same, appendix masculina and appendix interna. (Magnifications: *a–e*, *k–q*, *s*, × 2.6; *g–j*, × 5.2; *f*, *r*, *t*, × 10.8.)

dactyl of 3rd pereopod nearly as long as propodus, of 4th pereopod nearly ½ as long as propodus; 4th pereopod with ischiomeral articulation.

DESCRIPTION.—Rostrum (Figure 7*a*) directed slightly ventrad in posterior ⅓, slightly dorsad in anterior part, about 1⅓ times as long as carapace; dorsal margin armed with 32 movable spines, decreasing in length very gradually from 2nd or 3rd spine to apex, with few inconspicuous flanking setae in posterior ½ of series, 5 posterior spines situated on carapace posterior to level of orbital margin; ventral margin armed with 18 movable spines decreasing in length anteriorly after posteriormost, each spine noticeably longer than corresponding spine of dorsal series. Carapace with small hepatic depression rather sharply delimited posteriorly and ventrally. Antennal spine strong but not unusually long. Branchiostegal spine stout, without marginal spines ventral to it. Abdomen (Figure 7*b*) with pleura of all somites rather broadly rounded, but that of 5th somite showing faint indication of obtuse angle posteroventrally, 3rd somite not produced posterodorsally, 6th somite with minute tooth near posteroventral angle. Telson (Figure 7*c*) very slightly more than twice as long as broad, armed with slender posteromedian spine and 5 (left) or 6 (right) dorsal spines, not including minute pair arising above bases of longest pair of posterior spines.

Eyes with large cornea and short, broadly conical stalk.

Antennular peduncle (Figure 7*d*) with stylocerite barely reaching end of proximal ¼ of elongate 2nd segment, latter fully 5 times as long as 3rd segment, measured along mesial margins.

Antennal scale (Figure 7*e*) less than 5 times as long as broad, barely reaching distal end of 2nd segment of antennular peduncle, lateral margin sinuous, unarmed, distolateral spine strong, far overreaching distal margin of blade.

Mouthparts as illustrated (Figure 7*f–k*). Second maxilliped with terminal segment on flexor side shorter than one on extensor side. Third maxilliped overreaching antennal scale by about length of distal segment.

First pereopod (Figure 7*l*) overreaching antennal scale by slightly more than length of chela. Second pereopod (Figure 7*m*) overreaching antennal scale by nearly length of fingers. Third pereopod (Figure 7*n*) overreaching antennal scale by slightly more than combined lengths of dactyl, propodus, and carpus; propodus about 1⅕ times as long as 2-jointed dactyl. Fourth pereopod (Figure 7*o*) overreaching antennal scale by length of dactyl and ⅔ of propodus, propodus about 2⅕ times as long as 2-jointed dactyl, ischium and merus clearly articulated. Fifth pereopod (Figure 7*p*) also overreaching antennal scale by length of dactyl and ⅔ of propodus, propodus about 2⅘ times as long as 2-jointed dactyl.

Endopod of 1st pleopod of male (Figure 7*q,r*) with distal margin broadly emarginate. Appendix masculina (Figure 7*s,t*) nearly as long as appendix interna. Lateral branch of uropod (Figure 7*c*) with lateral margin faintly convex, not flared distally.

SIZE.—Carapace length 15.8 mm.

MATERIAL.—PHILIPPINES. North of Samar: sta 5445; 12°44′42″N, 124°59′50″E; 700 m; green mud, sand; 6.8°C; 3 Jun 1909 (1125–1201); 12′ Agassiz beam trawl: 1♂ [15.8] holotype, USNM 196079.

TYPE-LOCALITY.—North of Samar, Philippines; 12°44′42″N, 124°59′50″E; 700 meters.

RANGE.—Known only from the unique holotype from north of Samar, Philippines; 700 meters.

REMARKS.—This species bears a superficial resemblance to *S. multidentatus* in size and in the long, two-jointed dactyls of the three posterior pairs of pereopods. It differs from that species, however, in several characters: (1) the more regularly concave dorsal margin of the rostrum; (2) the absence of supraorbital and supplementary branchiostegal spines; (3) the presence of a median spine on the posterior margin of the telson; (4) the broader cornea and the shorter, subconical rather than subcylindrical eyestalk; (5) the absence of lateral spinules on the antennal scale; (6) the proportions of the distal segments of the second maxilliped; and (7) the more slender three

FIGURE 8.–*Stylodactylus multidentatus*, *a–m*, female from *Albatross* sta 5118, carapace length 16.5 mm; *n*, *o*, female from *Albatross* sta 5371, carapace length 14.0 mm: *a*, carapace and anterior appendages, right aspect; *b*, abdomen, right aspect; *c*, telson and uropods; *d*, right antennule, dorsal aspect; *e*, right antenna, ventral aspect; *f*, right mandible; *g*, right 1st maxilla; *h*, right 2nd maxilla; *i*, right 1st maxilliped; *j*, right 2nd maxilliped; *k*, left 3rd pereopod; *l*, left 4th pereopod; *m*, right 5th pereopod; *n*, left 1st pereopod; *o*, left 2nd pereopod. (Magnifications: *a–e*, *k–o*, × 2.6; *g–j*, × 5.2; *f*, × 10.8.)

posterior pairs of pereopods. The short flexor terminal segment on the second maxilliped is unique among the stylodactylid specimens examined and it might therefore be attributable to injury and incomplete regeneration in the single available specimen of *S. macropus*, except for the fact that the proportions of the terminal segments are identical on both sides of the animal.

ETYMOLOGY.—The name is composed of the Greek prefix *macro-* (long) plus *pus* (foot).

* 8. *Stylodactylus multidentatus* Kubo, 1942

FIGURE 8

Stylodactylus multidentatus Kubo, 1942:34, figs. 4, 5 [type-locality: Kumano Nada, Mie Prefecture, southern Honshu, Japan, about 300 meters].—Hayashi and Miyake, 1968:586, fig. 1.

DIAGNOSIS.—Supraorbital spine large, prominent; usually 1 or 2 secondary spines on margin ventral and posterior to branchiostegal spines; rostrum sinuous, nearly horizontal, with 14–23 ventral spines; all abdominal pleura rounded; telson about twice as long as broad, without sharp posteromedian spine, with 4 pairs of dorsal spines; antennal scale bearing series of denticles on lateral margin; 2nd maxilliped with terminal segment on flexor side longer than one on extensor side; dactyl of 3rd pereopod about ½ as long as propodus, of 4th pereopod slightly more than ⅓ as long as propodus; 4th pereopod with ischiomeral articulation.

MATERIAL.—PHILIPPINES. Balayan Bay, southern Luzon: sta 5116; 13°41′N, 120°47′05″E; 366 m; 10.1°C; 20 Jan 1908 (1513–1533); 12′ Tanner beam trawl, mud bag: 1♀ [15.3]; sta 5118; 13°48′45″N, 120°41′51″E; 291 m; dark green mud; 21 Jan 1908 (1100–1130); 12′ Tanner beam trawl, mud bag: 1♀ [16.5]. Tayabas Bay, southern Luzon: sta 5371; 13°49′40″N, 121°40′15″E; [152 m]; green mud; 24 Feb 1909 (1432–1454); 12′ Agassiz beam trawl, mud bag: 1♀ [14.0].

RANGE.—Southern Japan and southern Luzon, Philippines; 152–366 meters.

REMARKS.—The Philippine material seems to agree satisfactorily with the redescription of *S. multidentatus* by Hayashi and Miyake (1968) and with illustrations of the holotype and other Japanese specimens contributed by Dr. Hayashi, except that the mesial part of the posterior margin of the telson is more truncate and less acute in Philippine specimens than it is in those from Japan. The female from *Albatross* station 5116—like the holotype—has only a single, well-developed spine immediately ventral to the slightly larger branchiostegal spine on each side, while the two other *Albatross* females have a denticle on the ventral margin, in addition to the branchiostegal and the spine ventral to it, on each side (Figure 8*a*); according to Dr. Hayashi, the ventral denticle is even stronger in some Japanese examples.

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