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ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 5

NUMBER 4

THE STOMATOPODS OF THE WEST COAST  
OF AMERICA

Based on Collections Made by the Allan Hancock Expeditions, 1933-38  
(33 TEXT FIGURES)

by

WALDO L. SCHMITT

CURATOR OF MARINE INVERTEBRATES  
U.S. NATIONAL MUSEUM



THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA  
1940

REPORTS ON THE COLLECTIONS OBTAINED BY ALLAN HANCOCK PACIFIC EXPEDITIONS OF  
VELERO III OFF THE COAST OF MEXICO, CENTRAL AMERICA, SOUTH AMERICA, AND GALA-  
PAGOS ISLANDS IN 1932, IN 1933, IN 1934, IN 1935, IN 1936, IN 1937, AND IN 1938.

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# THE STOMATOPODS OF THE WEST COAST OF AMERICA<sup>1</sup>

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Curator of Marine Invertebrates, U.S. National Museum

## FOREWORD

The stomatopods of the Hancock Expeditions (1933-38) form as interesting a collection of crustacea as ever I have had the pleasure of studying. With a sense of lasting gratitude, I dedicate this paper to Captain Allan Hancock, of Los Angeles and Santa Maria, California, who made possible the expeditions on which these stomatopods were collected and the publication of this report upon them.

## INTRODUCTION

Until now, 5 genera and 17 species<sup>2</sup> of stomatopods had been reported from the Pacific shores of American and adjacent islands. As a result of the investigations of the Hancock Expeditions, it is now possible to add to that number: (a) a genus and species by virtue of the discovery of the rare Atlantic *Coronida bradyi* in the Galapagos Islands, where it seems fairly abundant; (b) a common Indo-west-Pacific stomatopod, *Lysiosquilla maculata*, for the first time taken east of the Hawaiian or Marquesas Islands, at La Libertad, Ecuador; (c) 6 new species and what appears to be a new subspecies of an already known species taken by the Hancock Expeditions; (d) 2 species newly named which are based on formerly merely lettered varieties of an old species; and (e) a seventh new species described from material collected by Dr. S. F. Hildebrand at Panama. This species is introduced here with Captain Hancock's kind permission, in order to render this account of west American stomatopods as complete as possible for the purpose of encouraging and facilitating further studies upon them. To that end, rather complete

<sup>1</sup> Published by permission of the Secretary of the Smithsonian Institution.

<sup>2</sup> Not counting two which in the past have been known only as lettered varieties of *Squilla panamensis* (see *Remarks* under this species, p. 167).

diagnostic keys to genera and species have been prepared, and pertinent bibliographic references, figures wherever possible, and a brief recapitulation of the recorded distribution are given for each species.

The 5 genera and 17 species previously known from eastern Pacific waters are:

I.	SQUILLA . . . . .	p. 139
	1. <i>aculeata</i> Bigelow . . . . .	p. 158
	2. <i>armata</i> H. Milne-Edwards . . . . .	p. 150
	3. <i>biformis</i> Bigelow . . . . .	p. 165
	4. <i>dubia</i> H. Milne-Edwards . . . . .	p. 155
	5. <i>gracilipes</i> Miers . . . . .	p. 151
	6. <i>panamensis</i> Bigelow . . . . .	p. 166
	7. <i>parva</i> Bigelow . . . . .	p. 168
	8. <i>polita</i> Bigelow . . . . .	p. 146
II.	PSEUDOSQUILLA . . . . .	p. 170
	9. <i>lessonii</i> (Guérin) . . . . .	p. 175
	10. <i>oculata</i> (Brullé) . . . . .	p. 173
III.	HEMISQUILLA . . . . .	p. 181
	11. <i>stylifera</i> (H. Milne-Edwards) . . . . .	p. 182
IV.	LYSIOSQUILLA . . . . .	p. 184
	12. <i>decemspinosa</i> Rathbun . . . . .	p. 189
	13. <i>desaussurei</i> Stimpson . . . . .	p. 193
	14. <i>digueti</i> Coutière . . . . .	p. 194
	15. <i>polydactyla</i> von Martens . . . . .	p. 187
V.	GONODACTYLUS . . . . .	p. 208
	16. <i>festae</i> Nobili . . . . .	p. 220
	17. <i>oerstedii</i> Hansen . . . . .	p. 211

The 2 species and one genus here added to the known stomatopod fauna of the eastern Pacific are:

VI.	CORONIDA . . . . .	p. 202
	18. <i>Coronida bradyi</i> (A. Milne-Edwards) . . . . .	p. 202
	19. <i>Lysiosquilla maculata</i> (Fabricius) . . . . .	p. 190

The 2 formerly lettered varieties of *Squilla panamensis* specifically named in this paper are:

	20. <i>Squilla bigelowi</i> (for variety <i>A</i> Bigelow) . . . . .	p. 156
	21. <i>Squilla tiburonensis</i> (for variety <i>B</i> Bigelow) . . . . .	p. 165

The species described as new in this paper are:

22. <i>Squilla hancocki</i> . . . . .	p. 160
23. <i>Squilla hildebrandi</i> . . . . .	p. 152
24. <i>Squilla swetti</i> . . . . .	p. 146
25. <i>Pseudosquilla veleronis</i> . . . . .	p. 176
26. <i>Lysiosquilla mccullochae</i> . . . . .	p. 197
27. <i>Gonodactylus bahiahondensis</i> . . . . .	p. 217
28. <i>Gonodactylus stanschi</i> . . . . .	p. 215

The apparently new subspecies is:

<i>Gonodactylus festae lalibertadensis</i> . . . . .	p. 223
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The foregoing list comprises 6 genera, 28 species, and one subspecies. All 6 genera, 17 of the species, and the one subspecies are included in the material collected by the Hancock Expeditions.

#### GALAPAGOS STOMATOPODS

Although the fact seems generally to have escaped notice because no one seems ever to have taken the trouble to look up the precise position indicated by Bigelow,<sup>3</sup> he was the first to record stomatopods from the Galapagos Islands, 3 specimens of *Pseudosquilla lessonii*. These were townnetted about 10 miles approximately N.W. of Wreck Point, Chatham Island, April 15, 1888.

Including *Pseudosquilla lessonii*, which ranges from southern California to Chile, the Hancock Expeditions have so far been able to turn up but 4 species of stomatopods from the waters of the archipelago. The other 3 are: (1) *Pseudosquilla oculata*, a widely distributed species found in the Atlantic as well as in the central and west Pacific, and now, as the result of Captain Hancock's efforts, on the coasts of Panama and Colombia, and adjacent islands; (2) *Gonodactylus oerstedii*, common in the south temperate and tropical west Atlantic and in the temperate and tropical eastern Pacific from La Plata Island, Ecuador, and the Galapagos northward into the Gulf of California; (3) *Coronida bradyi*, a most unexpected discovery. This rare Atlantic form, at least in the adult stage, has heretofore been known from only 5 specimens from the Cape Verde Islands, from which it was described, and one

<sup>3</sup> *Albatross* "Surface station 29 in S. Lat. 00° 46' 00", and W. Long. 89° 42' 00". Proc. U.S. Nat. Mus., Vol. 17, p. 502, 1894.

other from the Spanish island of Annobon (Anno Bom) in the Gulf of Guinea.

The discovery of *C. bradyi* in the Galapagos is closely paralleled by that of the hydroid, *Streptocaulus pulcherrimus* Allman, in the same archipelago by Fraser in the course of the same Hancock Expedition, 1934. The type locality of the hydroid, like that of the stomatopod, lies in the Cape Verde Islands. This coincidental distribution has also been referred to on page 202 under *C. bradyi*.

#### ZOOGEOGRAPHIC NOTES<sup>4</sup>

Twenty-one (+ one subspecies) of the 28 (+ one subspecies) species of stomatopods recorded from the eastern Pacific are known from that region only.<sup>5</sup>

Of the remaining 7 species: 3, *Squilla armata*, *Pseudosquilla oculata*, and *Lysiosquilla maculata*,<sup>6</sup> occur in the Atlantic, as well as in the Indo-Pacific (Indo-west-Pacific, Ekman<sup>7</sup>); 3 others, *Squilla dubia*, *Coronida bradyi*, and *Gonodactylus oerstedii*, are found in the Atlantic but not in the Indo-Pacific; and one, *Hemisquilla stylifera*, is otherwise found in the Indo-Pacific from New South Wales, Australia, only.<sup>8</sup>

In his discussion of *Gonodactylus oerstedii* and its varieties, Bigelow<sup>9</sup> states, "It is not surprising to find the same species of similar forms with slight differences on the two sides of the Isthmus of Panama, a land barrier that arose during the upper Miocene Period.<sup>10</sup> Similar results were obtained from the study of the species of *Squilla* (Bigelow, 1894<sup>11</sup>). *Squilla intermedia* is an Atlantic form, and two closely related species, *S. panamensis* and *S. biformis*, are probably entirely confined to the Pacific Coast of America (cf. Calman, 1917, p. 140<sup>12</sup>). The wide stretch

<sup>4</sup> See also Balss, Bronns Klassen und Ordnungen des Tierreichs, Vol. 5, Abt. 1, Book 6, Pt. 2, Stomatopoda, p. 127, 1938.

<sup>5</sup> The 28 (+ one subspecies) species are enumerated on pages 130-131.

<sup>6</sup> The occurrence of the species proper in the Atlantic should be corroborated; however, the variety *sulcirostris* is reported by Monod (see p. 192).

<sup>7</sup> Tiergeographie des Meeres, pp. xii + 542, Leipzig, 1935.

<sup>8</sup> There is also an old, but as yet uncorroborated, record of this species from the Hawaiian Islands.

<sup>9</sup> Bull. Mus. Comp. Zool., Vol. 72, No. 4, p. 122, 1931.

<sup>10</sup> "There may have been a narrow connection between the Atlantic and the Gulf of California during the Pliocene." Vaughan, U.S. Nat. Mus. Bull. 103, p. 611, 1919.

<sup>11</sup> Proc. U.S. Nat. Mus., Vol. 17, No. 1017, pp. 509-543.

<sup>12</sup> Brit. Antarct. ("Terra Nova") Exped., Nat. Hist. Rep., Zool., Vol. 3, No. 5, 1910.

of the open sea between the archipelagoes of the southern Pacific and the shores of America seems to be a more efficient barrier than a comparatively recent land mass like the Isthmus of Panama. Thus, we have *G. chiragra* and its variety *platysoma* occupying a wide area in the Indo-Pacific region, but unknown in Hawaii and on the shores of the American Continent. In the same way, *G. oerstedii* and its varieties *festae*<sup>13</sup> and *spinulosus* occupy similar stations in the western Atlantic, West Indies, and Pacific shores of tropical America."

Ekman<sup>14</sup> and Balss<sup>15</sup> are wholly in accord with this view, which seems to have the weight of evidence in its favor. As noted above, there are 3 eastern Pacific stomatopods that are also found in the Atlantic and not in the Indo-Pacific, and only one<sup>16</sup> found in the Indo-Pacific that is not found in the Atlantic.

Balss gives the following list of comparable, closely related, yet not identical species from the Pacific and Atlantic sides of America, remarking also that Hansen (see *Remarks* on p. 193) holds that *Lysiosquilla desaussurei* from the west coast of Mexico and *L. scabricauda* from the West Indies are identical:

<i>Pacific</i>	<i>Atlantic</i>
<i>Squilla panamensis</i> Bigelow <sup>17</sup>	<i>S. brasiliensis</i> Calman
<i>Squilla aculeata</i> Bigelow	<i>S. empusa</i> Say
<i>Squilla polita</i> Bigelow	<i>S. quadridens</i> Bigelow
<i>Lysiosquilla decemspinosa</i> Rathbun	<i>L. armata</i> Smith

"On the other hand," says Balss, "the relationships of the West American to the Indo-Pacific fauna are not very pronounced, due to

<sup>13</sup> The fact that *G. festae* has been restored to full specific rank in this paper in no wise alters Dr. Bigelow's argument. There are spiny or spinulose forms of the *G. oerstedii* complex on both sides of America: *G. oerstedii* var. *spinulosus* (Schmitt, Univ. Iowa Studies Nat. Hist., Vol. 10, p. 96, pl. 5, fig. 5, 1924) and var. *curacaoensis* (Schmitt, Bijdr. Dierkunde, Amsterdam, Vol. 23, p. 80, pl. 8, fig. 6, 1924) in the Atlantic, and *G. bahiahondensis*, *G. festae* and its subspecies, *lalibertadensis*, and *G. stanschi* in the Pacific, to say nothing of the Pacific and Atlantic forms of *G. oerstedii* proper which show some differences not yet deemed constant enough or sharply enough drawn to warrant definite taxonomic distinction.

<sup>14</sup> Tiergeographie des Meeres, p. 56, 1935.

<sup>15</sup> Bronns Klassen und Ordnungen des Tierreichs, Vol. 5, Abt. 1, Book 6, pt. 2, Stomatopoda, p. 141, 1938.

<sup>16</sup> *Hemisquilla stylifera*; the Indo-Pacific (Australia only) representatives may yet prove to be different; in the Atlantic there is for this species the closely related (analogous species) *H. brasiliensis* (Moreira).

<sup>17</sup> See also Bigelow's quoted remarks on the "species of *Squilla*" above, p. 132.



the general zoogeographic position of the American west coast (cf. Ekman, 1935). *Lysiosquilla digueti* Cout. from the Gulf of California has as its nearest relative *L. vicina* Nobili from the Red Sea and the Philippines. *Pseudosquilla lessonii* Guérin (Chile to California) is related to *P. dofleini* Balss from Japan and *Hemisquilla stylifera* (H.M.-Edw.) (Chile to California) has otherwise been found only in New South Wales."

The stomatopods described as new or which have been given new names in this paper fit comfortably into such a distribution pattern. There can be no question regarding the Atlantic affinities of the several *Gonodactylus* forms, *G. bahiahondensis*, *G. festae lalibertadensis*, and *G. stanschi*; or of *Squilla bigelowi*, *S. hancocki*, and *S. tiburonensis*. The Indo-Pacific ties of *Lysiosquilla maccullochae* to *L. latifrons* (Japan, Australia, New Zealand), of *Pseudosquilla veleronis* to *P. pilaensis* (China, Indian Ocean, Red Sea), and of *Squilla swetti* to *S. fasciata* (Japan, China, and Indian Ocean) or *S. miles* (Australia), are very much less significant, and therefore throw into all the more striking relief the near identity of *Squilla hildebrandi* from Panama to *S. hieroglyphica* which, although without definite locality, is most assuredly of Indo-Pacific origin.<sup>18</sup>

Whether *Squilla hildebrandi* is a relict, or has evolved from a relict of a formerly widespread Pacific fauna, or is the descendant of a member of a drift fauna transported to the shores of America by some current similar to or stronger than the relatively weak Pacific equatorial countercurrent, is impossible to say. Of more than passing interest in this connection was the discovery of the Indo-Pacific coral gall crab, *Hapalocarcinus marsupialis*, at Port Utria, Colombia, and in the Secas Islands, Panama, by the Hancock Expedition of 1935,<sup>19</sup> and that of the first *Thalamita* from the Western Hemisphere, *T. roosevelti*, at Clipperton Island during the Presidential Cruise of 1938.<sup>20</sup> At the same time, at Clipperton Island, I also found a terrestrial amphipod almost specifically identical with one described from the Marquesas Islands. A number of Polynesian mollusks, or near relatives of such shells, have been reported

<sup>18</sup> *S. hieroglyphica* in turn is closely related to *S. laevis* Hess from Australia (Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 49, pl. 3, figs. 35-37, 1913). The other Indo-Pacific species mentioned are also to be found in Kemp.

<sup>19</sup> Exploration and Field-work of the Smithsonian Inst. in 1935, p. 34, fig. 36, 1936, and Rathbun, Bull. U.S. Nat. Mus., No. 166, p. 259, pl. 79, figs. 3-9, 1937.

<sup>20</sup> Smithsonian Misc. Coll., Vol. 98, No. 6, p. 16, fig. 2, 1939.

from eastern Pacific waters by Hertlein<sup>21</sup> and by Bartsch and Rehder,<sup>22</sup> as well as at least one echinoderm of similar significance by Austin H. Clark.<sup>23</sup>

#### EXPLANATIONS AND ACKNOWLEDGMENTS

All stomatopods in the Hancock collections, 1933-1938, are here reported upon with the exception of larval specimens and juveniles too young for satisfactory specific determination.

Indispensable to any stomatopod study is Kemp's "Account of the Crustacea Stomatopoda of the Indo-Pacific Region based on the Collection in the Indian Museum," Mem. Indian Mus., Vol. 4, No. 1, 1913. Equally useful to any student of the west coast forms is Bigelow's "Report upon the Crustacea of the Order Stomatopoda collected by the Steamer Albatross between 1885 and 1891, and on other Specimens in the U.S. National Museum," Proc. U.S. Nat. Mus., Vol. 17, No. 1017, 1894.

In the synonymy under each species, in addition to the citation of the original description, reference has been made to both Kemp and Bigelow wherever possible, along with other pertinent papers, and any that have come to my attention since Kemp's monograph was published.

In place of the diagnoses usually given, especially for new species, in taxonomic works of this sort, rather detailed keys to the west coast species have been introduced for the purpose of facilitating identification. Many keys, striving for conciseness, become altogether too brief. I hope I have not erred in the other direction. The added information, printed in smaller, eight-point type, was found very useful in the more careful comparison of closely related species, and may again prove so to those who may have occasion to use this paper. In all instances the terminal tooth or spine of the raptorial dactylus has been included in the count of the teeth arming its inner margin.

Notes on color, unless otherwise stated, are based on alcoholically preserved specimens. These notes chiefly concern color markings that have proved to be more or less permanent and which, therefore, may be of some use in the recognition of certain species. This is especially true of a number of the *Squilla* species, including specimens of some described by Bigelow nearly half a century ago. On the other hand, color, as a

<sup>21</sup> Proc. Amer. Philos. Soc., Vol. 78, pp. 303-312, pl. 1 and map, 1938.

<sup>22</sup> Smithsonian Misc. Coll., Vol. 98, No. 10, pp. 1-18, pls. 1-5, 1939.

<sup>23</sup> Smithsonian Misc. Coll., Vol. 98, No. 11, pp. 1-18, pls. 1-5, 1939.

general rule, does not seem to be specifically linked in the *Gonodactylus* forms, although I have found very characteristic markings in an Atlantic variety of *G. oerstedii*.<sup>24</sup>

The drawings illustrating this paper, unless otherwise credited, are the work of Miss Jane Roller, with the exception of figures 10*d*, 17*b*, 17*c*, 19, 21, and 24, which were made by Mr. Andrew Pizzini. Miss Roller has also checked the drawings against the text and the legends accompanying the figures, and has usefully assisted me in other ways.

The magnification of the illustrations may be derived from a line one millimeter in length that has been drawn beside each figure.

<sup>24</sup> *G. o.* var. *spinulosus*, Schmitt, Univ. Iowa Studies in Nat. Hist., Vol. 10, No. 4, pp. 96-98, 1924.

## SYSTEMATIC DISCUSSION

## Order STOMATOPODA

## Family Squillidae

Key to the Genera of Stomatopods Known from the  
West Coast of America<sup>25</sup>

- A<sup>1</sup>.** Articulation between the merus and ischium<sup>26</sup> of the raptorial claw terminal (normal); merus grooved inferiorly for the reception of the propodus throughout its length; propodus finely pectinate, or with a series of fixed spines along outer margin of dorsal surface; dactylus not inflated at base, except in the one genus *Coronida*.
- B<sup>1</sup>.** Carapace with well-marked carinae; cervical groove defined across dorsum of carapace; first 5 abdominal somites with longitudinal carinae; raptorial dactylus armed with teeth on inner margin. . . . . *Squilla*, p. 139
- B<sup>2</sup>.** Carapace without carinae;<sup>27</sup> cervical groove not extending across dorsum of carapace;<sup>27</sup> first 5 abdominal somites without longitudinal carinae.<sup>27</sup>

<sup>25</sup> This key is largely that of Kemp (Mem. Indian Mus., Vol. 4, No. 1, p. 16, 1913). Only two of the known genera of stomatopods do not appear in the key here given, *Coronidopsis* and *Odontodactylus*.

The former is known only from the unique type, *C. bicuspis* Hansen (Siboga Exped., Monog. 35, Lief. 105, p. 19, pl. 1, fig. 7a-g, 1926), 43 mm. in length, from Buton Strait, between Celebes and Flores, Dutch East Indies. Classified near *Coronida*, it is at once distinguished by "its remarkable rostral plate which is anteriorly divided by a rather deep incision into two long, acute teeth." The raptorial dactylus is not inflated at the base, and is armed with four teeth, including the terminal one.

*Odontodactylus* (see Kemp, Mem. Indian Mus., Vol. 4, No. 1, pp. 133 and 204, 1913) is known from several species from the Indo-west-Pacific and one from the Atlantic. This genus stands close to *Gonodactylus* and, if found on the west coast of America, it would have appeared in the following key in Section A<sup>2</sup> along with *Gonodactylus*. Unlike *Gonodactylus*, the raptorial dactylus is armed with teeth on its inner margin. As in that genus, the raptorial dactylus is inflated at the base.

<sup>26</sup> This articulation is given by some authors (see Balss, Bronns Klassen und Ordnungen des Tierreichs, Vol. 5, Abt. 1, Book 6, Pt. 2, Stomatopoda, p. 21, 1938) as between the basis and the ischiomerus, the question being whether the basis is wanting, as Kemp believes, or whether the basis is present and the ischium and merus fused to account for the 6-jointed thoracic legs of stomatopods as compared with the 7-jointed ones of other Malacostraca.

<sup>27</sup> Except in the Mediterranean *Pseudosquilla ferussaci* (Giesbrecht, Fauna u. Flora d. Golfes v. Neapel, Monog. 33, Stomatopoden, p. 34, pl. 4, figs. 37-48, 1910). Kemp states, "It seems to combine the telson of a *Pseudosquilla* with many of the characteristic features of *Squilla*, but is perhaps rather more nearly allied to the former genus than to the latter."

- C<sup>1</sup>.** Abdomen usually compressed, rarely noticeably flattened (as in *Pseudosquilla veleronis*); telson with a well-marked, usually sharp, median carina, and (in adults) usually with one or more additional carinae either side; submedian teeth with movable tips or spines; no submedian denticles (at least in adults).
- D<sup>1</sup>.** Raptorial dactylus armed with teeth; usually with 3 or 4, counting the terminal one, sometimes with as many as 7 or 8 (*P. veleronis*). . . . *Pseudosquilla*, p. 170
- D<sup>2</sup>.** Raptorial dactylus unarmed except for terminal tooth. . . . *Hemisquilla*, p. 181
- C<sup>2</sup>.** Abdomen depressed, noticeably flattened; telson without true or definite median carina; submedian denticles may or may not be present, present in most species.
- D<sup>1</sup>.** Raptorial dactylus as in preceding genera, not inflated at base; armed with 4 or more teeth, including the terminal one; telson smooth or scabrous and without submedian spinules or denticles, or with a transverse row or circlet of spines and submedian spinules or denticles on its posterior margin. . . . *Lysiosquilla*, p. 184
- D<sup>2</sup>.** Raptorial dactylus inflated at base; armed with not more than 4 teeth, including terminal one;<sup>28</sup> telson closely studded with small spines or fine spinules, or large tubercles; with or without a pair of submedian carinae. . . . *Coronida*, p. 202
- A<sup>2</sup>.** Ischiomerale articulation of raptorial claw situated at a point anterior to proximal end of merus, which consequently extends backward considerably beyond the joint; ventral surface of merus grooved and hollowed out for reception of propodus for not more than  $\frac{3}{4}$  its length; raptorial dactylus inflated at base and unarmed except for terminal tooth. . . . *Gonodactylus*, p. 208

<sup>28</sup> In the 17 mm. long, unique specimen of *Coronida sinuosa* Edmondson (Occ. Paps. Bishop Mus., Vol. 7, No. 13, p. 295 [17], fig. 2, 1921), one raptorial dactylus is armed with 4 teeth, including the terminal one, the other with 5. Its placement in *Coronida* should at best be considered only tentative, for, as Dr. Edmondson himself comments, "There is no certainty that the individual described is mature." The telson is not spined or tuberculated; its dorsal surface is "marked by numerous linear, curved, and scroll-like carinae which lack symmetry on the two sides except in the medial region, where it is maintained in a slight degree."

Genus *SQUILLA* Fabricius, 1787

In view of Dr. B. Chopra's<sup>29</sup> discussion of the use of the name *Squilla* for this genus and his discovery that *Clorida* Eydoux and Souleyet<sup>30</sup> and not *Chloridella* Miers<sup>31</sup> would have to be adopted if the International rules of Zoological Nomenclature are to be strictly adhered to, I have been moved to recede from the stand which was taken by Dr. Mary J. Rathbun<sup>32</sup> in favor of *Chloridella* and which I have strongly supported in the past.

Moreover, Dr. Charles Wardell Stiles, formerly Secretary of the International Commission for Zoological Nomenclature, with whom I again went over the entire matter a few months ago, has a memorandum from Dr. Rathbun, written in response to his request for her opinion on Dr. Bigelow's<sup>33</sup> petition for a suspension of the Rules in behalf of *Squilla*. She expressed her approval of it.

In literature, correspondence, and conversation, by far the greater number of carcinologists are strongly in favor of a suspension of the Rules and the retention of *Squilla*. At the next meeting of the International Commission the petition will undoubtedly be favorably acted upon, and so, in the interest of uniformity in stomatopod literature, I shall in this paper and future ones give *Squilla* precedence, until such time as the Commission may rule otherwise.

We do not yet know our stomatopods well enough always to determine young, or small, and immature specimens. The adult, mature characters upon which the following keys and descriptions of species are chiefly based are to be found only in specimens of fair or good size for the species. Specimens less than 40 mm. in length and sometimes even larger individuals present difficulties: the lateral processes of the free thoracic somites are rarely sufficiently well developed for satisfactory specific determination, especially in forms which have spinous or at least acutely angled processes in the adult; the expected posterior spines of the submedian carinae of certain of the abdominal somites may also be yet

<sup>29</sup> Rec. Indian Mus., Vol. 36, Pt. 1, p. 18, 1934. See also Balss, Bronns Klassen und Ordnungen des Tierreichs, Vol. 5, Abt. 1, Book 6, Pt. 2, Stomatopoda, p. 127, 1938.

<sup>30</sup> Voyage autour du Monde sur *La Bonite*, Zool., 1, Crust., p. 264, 1841.

<sup>31</sup> Ann. Mag. Nat. Hist. (5), Vol. 5, p. 12, 1880.

<sup>32</sup> Proc. U.S. Nat. Mus., Vol. 26, p. 54, 1903.

<sup>33</sup> Bull. Mus. Comp. Zool., Vol. 72, No. 4, pp. 175-177, 1931. See also Stiles, Science, Vol. 83, No. 2162, p. 552, 1936; Zool. Anz., Vol. 115 (3/4), p. 110, 1936.

unformed in the young of certain species; and, likewise, the spines of the anterolateral angles of the carapace in the young of species in which they are normally spined in fully developed or mature specimens may appear blunt or merely rounded off in juvenile specimens.

The characteristic coloration of the uropods in small *Squilla* is not always well developed or so complete as in adults.

#### Key to Species of *Squilla* Known from the Pacific Coast of America

- A<sup>1</sup>.** No median carina on carapace anterior to level of cervical groove; no intermediate carinae; and laterals, if present, placed well back on carapace, often inconspicuous.

Lateral margins of 6th and 7th thoracic somites not bilobed. Submedian carinae present on 6th abdominal somite, posteriorly spined. No mandibular palp. Epipodites on first 4 thoracic limbs only (for *S. gracilipes* the count is not known). Telson without trace of pre- (or second) lateral lobe or angle.

- B<sup>1</sup>.** Raptorial dactylus with 4 teeth or spines, counting the terminal one.

Cornea placed obliquely on eyestalk. Lateral margins of 6th and 7th thoracic somites rounded. No submedian carinae on somites anterior to 6th abdominal.

- C<sup>1</sup>.** Lateral process of 5th (first free) thoracic somite a prominent, flattened spine or lobe distally more or less rounded off or subacute, with apex directed forward or laterally; a pair of ventral spines also present.

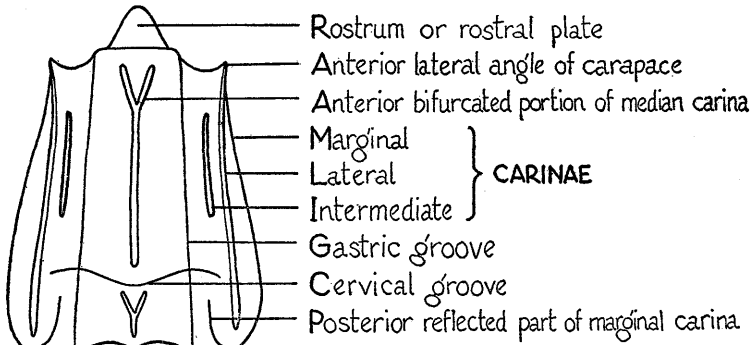
Anterolateral angles of carapace spined. Telson without carinae either side of median one except marginals. Denticles 6, 8-14, 1, all very sharp, spiniform. . . . . *polita*, p. 146

- C<sup>2</sup>.** Lateral margin of 5th thoracic somite in dorsal view appears bilobed, neither lobe forming a conspicuous lateral process: a pair of ventral spines or sharp angles present.

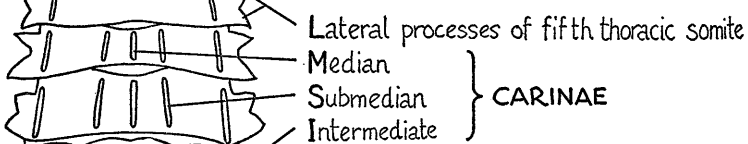
Anterolateral angles of carapace unarmed. Telson with 5 more or less complete longitudinal carinae either side of median one. Denticles 4-5, 9-11, 1. . . . . *swetti*, p. 146

Fig. 1. Diagrammatic sketches of *Squilla*, illustrating terms used in description. *a.* carapace and rostrum, exposed thoracic somites, and first abdominal somite; *b.* 5th and 6th abdominal somites and telson.

**CARAPACE AND ROSTRUM**



**EXPOSED THORACIC SOMITES**

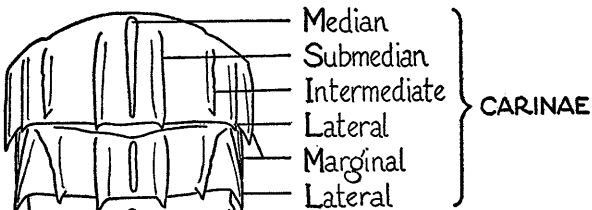


**FIRST ABDOMINAL SOMITE**

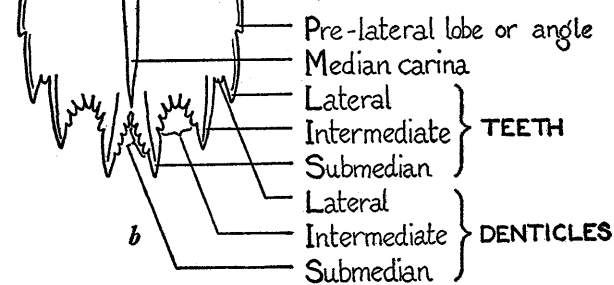


*a*

**FIFTH AND SIXTH ABDOMINAL SOMITES**



**TELSON**



*b*



**B<sup>2</sup>.** Raptorial dactylus with more than 4 teeth.

Anterolateral angles of carapace spined or at least sharp angled. Lateral process of 5th thoracic somite a sharp, laterally directed spine; also a pair of ventral spines.

**C<sup>1</sup>.** Cornea set very obliquely on eyestalk.

Raptorial dactylus with 7 to 9, rarely 6, teeth. Lateral margins of 6th and 7th thoracic somites drawn out at posterolateral angle into a sharp, backwardly directed spine. Submedian carinae present on all abdominal somites, posterior margin of 5th somite either side between submedian and intermediate carinae armed with from 1-4 spines grouped together (found only in this species). Denticles 0, 1-11, 1. Submedian teeth of telson with movable tips. . . . .  
 . . . . . *armata*, p. 150

**C<sup>2</sup>.** Cornea set more or less transversely on eyestalk.

Raptorial dactylus with 8 to 10 teeth. Lateral margins of 6th and 7th thoracic somites rounded. No submedian carinae on somites anterior to 6th abdominal. Denticles 18±, 13±, 1. . . . .  
 . . . . . *gracilipes*, p. 151

**A<sup>2</sup>.** Carapace with well-marked median carina; intermediate and lateral carinae present; anterolateral angles spined, at least in larger, adult or mature specimens.

Submedian carinae present on all abdominal somites. Prelateral lobes or angles of telson at least indicated, usually well marked, spined or unarmed.

**B<sup>1</sup>.** Lateral margin of 5th (first free) thoracic somite, seen in dorsal view, composed of 2 prominent, distinct processes, a more or less antrorse anterior spine and a rounded posterior lobe, no ventral spines, lateral margin of 6th and 7th somites rounded, entire, not bilobed.

Cornea set more or less transversely on eyestalk. Raptorial dactylus with 5 teeth. No trace of mandibular palp. Epipodites on the first 4 thoracic limbs. Submedian carinae on 5th and 6th abdominal somites posteriorly spined. Denticles 3, 10, 1. . . . . *hildebrandi*, p. 152

**B<sup>2</sup>.** Lateral margin of 5th thoracic somite, seen in dorsal view, composed of a single process, spinous or subacute, or of one or two low, inconspicuous lobes; also a pair of ventral spines scarcely or not visible in dorsal view.

Mandibular palp present, except, in some cases at least, in small specimens.

- C<sup>1</sup>. Eyestalks dilated, bottle or flask shaped, distally constricted before cornea; cornea set more or less obliquely on eyestalk, major axis of cornea shorter than the peduncular one extended to anterior margin of cornea.

Raptorial dactylus with 5 or 6 teeth. Median carina of carapace not bifurcate, intermediate carinae fall well short of anterior margin. Lateral process of 5th thoracic somite a sharp spine to side, slightly inclined forward, lateral margins of 6th and 7th angled and medially emarginated, suggestively but not definitely bilobed. Epipodites on first 3 thoracic limbs. Prelateral lobe or angle of telson not spined. Denticles 1-3, 3-4, 1. . . *dubia*, p. 155

- C<sup>2</sup>. Eyestalks triangular or subtriangular, widest distally next to cornea, corneal axis at least as long as, usually longer than, peduncular axis.

Raptorial dactylus with 6 teeth. Lateral margins of 6th and 7th (at least 6th) thoracic somites usually more or less distinctly bilobed.

- D<sup>1</sup>. Prelateral lobe or angle of telson present and spined.

Submedian carinae of 5th and 6th abdominal somites, and usually also 4th in all specimens exceeding 65 mm. in median length exclusive of rostrum and occasional smaller ones, posteriorly spined. Median carina of carapace bifurcate anteriorly and if bifurcate posteriorly before the cervical groove only inconspicuously or incompletely so; intermediate carinae run to or about to anterior margin. Lateral spine of 5th thoracic somite stout, markedly turned forward; posterior lobe of lateral margin of 6th and 7th somites subacute or acute, more or less laterally directed. Cornea set very obliquely on eyestalk. Epipodites present on first 5 thoracic limbs. Denticles 4-6, 7-9, 1. . . . . *bigelowi*, p. 156

- D<sup>2</sup>. Prelateral angle of telson margin, if present, not spined.

- E<sup>1</sup>. Of submedian carinae on the abdomen only those of the 6th somite are posteriorly spined.

- F<sup>1</sup>. Median carina of carapace before level of cervical groove more or less distinctly bifurcate at its anterior and posterior ends; intermediate carinae fall well short of anterior margin.

Cornea set more or less transversely on eyestalk. Lateral spine of 5th thoracic somite stout, curved forward; posterior lobe of lateral margin of 6th and 7th somites acute, sharp pointed, or subacute, directed laterally. Epipodites present on first 4 thoracic limbs. Denticles 2-4, 5-7, 1. . . . . *aculeata*, p. 158

- F<sup>2</sup>.** Median carina of carapace before level of cervical groove not bifurcate anteriorly; if bifurcate posteriorly, only very inconspicuously or incompletely so.

Cornea set definitely obliquely upon eyestalk. Epipodites present on first 5 thoracic limbs.

- G<sup>1</sup>.** Lateral spine of 5th thoracic somite directed more laterally than forward, only slightly inclined forward; posterior lobe of lateral margin of 6th and 7th somites subacute or acute (may be blunt in small specimens), more or less laterally directed, slight if any posterior inclination in 7th somite.

Intermediate carinae of carapace run to or very close to anterior margin. Denticles 3-5, 7-10, up to 14 in some small specimens, 1. Telson more or less rugose or with some small tuberculation either side of median carina; in young specimens the telson is only pitted, as in other species. . . . . *hancocki*, p. 160

- G<sup>2</sup>.** Lateral spine of 5th thoracic somite distinctly curved forward; posterior lobe of lateral margins of 6th and 7th somites drawn out to a sharp point directed posteriorly.

Intermediate carinae of carapace fall well short of anterior margin. Denticles 3-5, 7-10, 1. Telson pitted and eroded. . . . . *tiburonesis*, p. 165

- E<sup>2</sup>.** Submedian carinae of 5th and 6th or 4th, 5th, and 6th abdominal somites posteriorly spined.

Epipodites present on first 5 thoracic limbs.

F<sup>1</sup>. Portion of median carina of carapace before level of cervical groove bifurcate anteriorly and posteriorly.

Lateral process of 5th thoracic somite a well-developed spine.

G<sup>1</sup>. Only 5th and 6th submedian abdominal carinae posteriorly spined.

Lateral spine of 5th thoracic somite curved forward. Posterolateral angle of posterior lobe of 6th and 7th somites directed obliquely backward, usually sharply spinous, seldom only subacute. Intermediate carinae of carapace fall short of anterior margin. Cornea set more or less transversely on eyestalk. Denticles 5-7, 15-19, 1. . . . . *biformis*, p. 165

G<sup>2</sup>. Fourth,<sup>34</sup> 5th, and 6th submedian abdominal carinae posteriorly spined.

Lateral spine of 5th thoracic somite directed more or less laterally, not markedly turned or inclined, forward; posterolateral angle of posterior lobe of lateral margins of 6th and 7th somites rounded off or bluntly pointed, subacute in old, well-developed individuals. Intermediate carinae of carapace running to or about to anterior margin. Cornea set very obliquely on eyestalk. Denticles 5-8, 10-13, 1(-2?). . . . . *panamensis*, p. 166

F<sup>2</sup>. Median carina of carapace before cervical groove not bifurcate at either end; intermediate carinae very short, fall far short of anterior margin.

Lateral process or processes of 5th thoracic somite inconspicuous, low and undeveloped, at most "a very short obtuse spine [if it can even be called that] that is flattened antero-posteriorly and is connected by a ridge with the short acute ventral spine of the same side" (Bigelow). Only 5th and 6th submedian abdominal carinae posteriorly spined. Mandibular palp was found present only in the largest specimen and then only on the right side, palp with 3 joints at most only obscurely indicated. Cornea set more or less obliquely on eyestalk. Denticles 2-5, 6-9, 1 (usually 4, 7-8, 1). . . . *parva*, p. 168

<sup>34</sup> In specimens under 40 mm. in length the 4th abdominal submedians may not be spined.

***Squilla polita* Bigelow**

*Squilla polita* Bigelow, Johns Hopkins Univ. Circ., Vol. 10, No. 88, p. 93, 1891; Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 513, fig. 8, 1894. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 201, 1913 [listed only]. Kemp and Chopra, Rec. Indian Mus., Vol. 22, p. 298, 1926. Bigelow, Bull. Mus. Comp. Zool., Vol. 72, No. 4, p. 182, 1931.

*Distribution:* From Monterey Bay, California, to off Abreojos Point, Lower California, from depths of 23 to 92 fathoms.

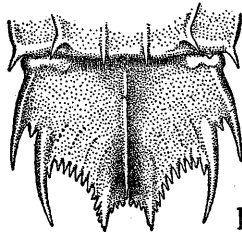


Fig. 2. *Squilla polita*, female, from Santa Rosa Island, California (Albatross Sta. 2902, January 7, 1889). Telson (from Bigelow).

***Squilla swetti*, new species**

*Distribution:* Known only from the female holotype (U.S.N.M. No. 76032) and one male and one female paratype dredged off Petatlan Bay, Mexico, south and west of the White Friars Islands, in 25 fathoms, March 2, 1934 (Hancock Exped. Sta. No. 264-34). This species has been named in honor of Mr. W. Charles Swett, Captain Hancock's former aide and executive officer of the *Velero III*. The holotype is 28 mm. in median length of body exclusive of rostrum, carapace 6.7, rostrum 1.2.

*Description:* A species in many ways reminiscent of *S. fasciata* (de Haan)<sup>35</sup> and *S. miles* Hess,<sup>36</sup> yet differing in several particulars from both. Also related to the first of these is *S. fallax* (Bouvier).<sup>37</sup> Kemp<sup>38</sup>

<sup>35</sup> Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 34, pl. 1, figs. 21-23, 1913, and synonymy.

<sup>36</sup> Kemp, *op. cit.*, p. 36, and synonymy.

<sup>37</sup> Bull. Sci. France et Belgique (7), Vol. 48, Fasc. 3, p. 308, text figs. 39-42, 1915.

<sup>38</sup> Kemp and Chopra, Rec. Ind. Mus., Vol. 22, Pt. 4, No. 22, p. 300, 1921.

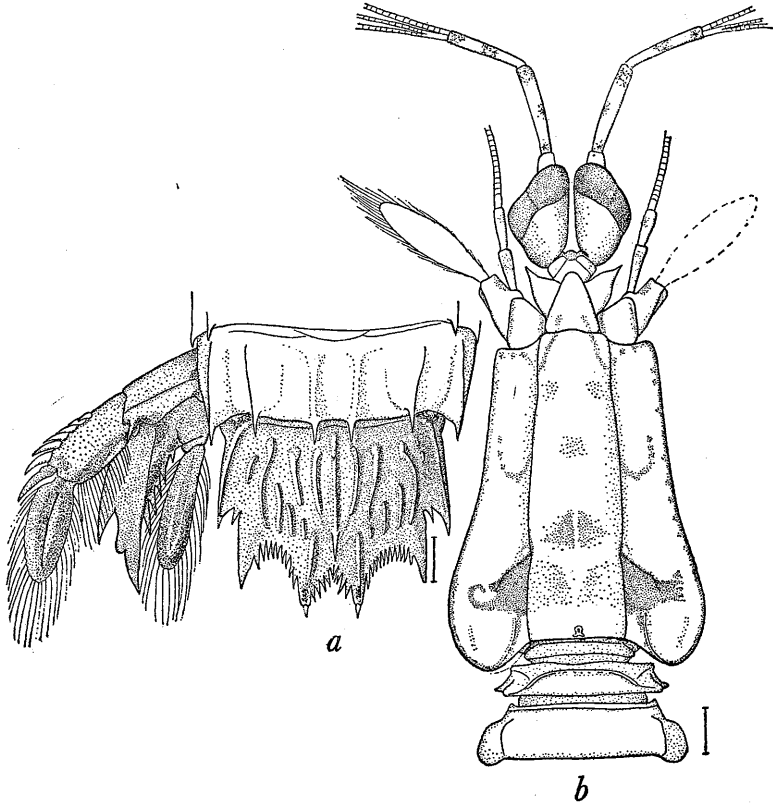


Fig. 3. *Squilla swetti*, female holotype, from off Petatlan Bay, Mexico (Hancock Exped. Sta. 264-34, March 2, 1934). *a.* telson and left uropod; *b.* anterior portion.

says that *fallax*, "apart from the number of teeth [4] on the raptorial dactylus and other characters, differs from *S. fasciata* in the complete suppression of the mandibular palp." This palp is also absent from the species here described.

As in *miles*, the anterolateral angles of the carapace of *S. swetti* are not spined and the rostrum is somewhat longer than broad; in *fasciata* the rostrum is "scarcely broader than long"; in *fallax* the rostrum is quite long and attenuated distally, being about  $1\frac{1}{2}$  times as long as its greatest width.

The dorsal surface of the carapace of *swetti* is smooth and shining. The cervical groove does not cross the median area, although it does interrupt the gastric groove. There are no carinae on the carapace except for the reflexed portions of the marginal carinae, visible in the posterior quarter of the carapace, and within the area bounded by the marginal carina and its reflexed portion there is on either side a faint trace or suggestion of a short bit of what may be taken to represent a posterior remnant of a lateral carina, scarcely more than an angulation in the surface of the carapace that interrupts the reflected light. Just before the mid-point of the posterior margin of the carapace is a small raised ring with 2 posterior oblique, laterally directed rays.

The corneae are obliquely placed on their stalks; their long axis is slightly longer than the median axis of the stalk and the thickness of the cornea taken together. The thickness or perpendicular height of the cornea is about  $\frac{1}{2}$  the median height of the stalk exclusive of the cornea.

The outer inferior angle of the merus of the raptorial leg is rounded; the carpus has a groove and keel above, the latter entire and terminating anteriorly in a rounded-off right angle; the propodus is armed with the usual 3 spines and series of pectinations; the dactylus is armed with 4 teeth, including the terminal one, in this respect like *S. miles* and unlike *S. fasciata*, which has 5 teeth. The outer margin of the dactyl in our species is angled posteriorly and notched just before the angulation. This is also the case in *S. fallax*, but not in *S. fasciata*.

The free thoracic somites are smooth and with carinae on the 6th, 7th, and 8th somites only in line with the intermediates of the abdomen other than the marginals; the 5th somite has a pair of curved carinae almost meeting on the median line anteriorly; lateral processes of this somite consist of 2 low, more or less anteriorly-posteriorly flattened lobes, the upper is somewhat obliquely bent forward and is more prominent on the right than the left side, below on either side of the somite is a ventral spine; lateral margins of the 6th and 7th somites broadly rounded, forming somewhat auriculiform lobes.

No submedian carinae on the abdominal somites except the 6th; intermediate, lateral, and marginal present on all; intermediates and laterals spined on 5th and 6th, marginals spined on 4th and 5th only.

The median carina of the telson is well marked and ends in a prominent spine; it is more or less paralleled either side by 6 thinner carinae (not counting marginal) of various lengths and curvatures; the first pair lie a little within an imaginary line continuing the carinae which

dorsally reinforce the submedian teeth of the telson; these last-named carinae end anteriorly at about the level of the posterior ends of this first pair of carinae on the surface of the telson; the next, 2nd to 4th, carinae either side are more or less equidistant one from the other and lie in the area posteriorly bounded either side by the submedian and intermediate teeth of the telson, the 2nd carina to the left of the median carina is broadly interrupted, that on the right side also but by a shorter, less conspicuous interval nearer its posterior end; the 5th carina either side is more or less in line with the inner margin of the lateral projection or tooth. There is no trace of a prelateral lobe or angle and no ventral carina. The submedian teeth have movable tips, and beneath the terminal spine of the median carina there is a well-marked tubercle; a small one is to be found near the proximal end of this carina forming a small notch, as it were, in lateral view. The denticles number 4-5, 9-11, 1. The bifurcate process of the uropods bears 5 spines on its inner margin; the inner of the 2 projections is about twice the length of the outer; it carries a large lobular tooth on its outer margin.

The greater number of longitudinal carinae, among other characters, will distinguish the new species from *miles*, aside from the presence of the oblique row of tubercles either side of the telson in *miles*; such tubercles are also absent in *S. fasciata*. *S. fasciata* has the telson differently proportioned and has a greater number of longitudinal carinae, differently arranged, and also well-marked prelateral denticles. In *S. fallax* the carinae, except the median carina, the one either side of it, and the marginal ones, have been replaced by more or less regular-irregular rows of tubercles. There are 5 to 7 such rows, according to one's idea of what constitutes a row or line of tubercles; no prelateral lobe or denticle is indicated in Bouvier's figure of the telson.



***Squilla armata* H. Milne-Edwards**

*Squilla armata* H. Milne-Edwards, Hist. Nat. Crust., Vol. 2, p. 251, 1837. Bigelow, Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 515, figs. 9, 10, 1894. Rathbun, Revista Chilena Hist. Nat., Vol. 11, p. 50, 1907. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 41, 1913, and synonymy. Stebbing, Trans. Roy. Soc. Edinburgh, Vol. 50, p. 300, 1914. Balss, Stomatopoden in Michaelson, Beitr. Meeresfauna Westafrikas, Crust. III, p. 51, 1916. Chopra, Rec. Indian Mus., Vol. 22, p. 298, 1921. Parisi, Atti Soc. Ital. Sci. Nat., Vol. 61, p. 93, 1922.

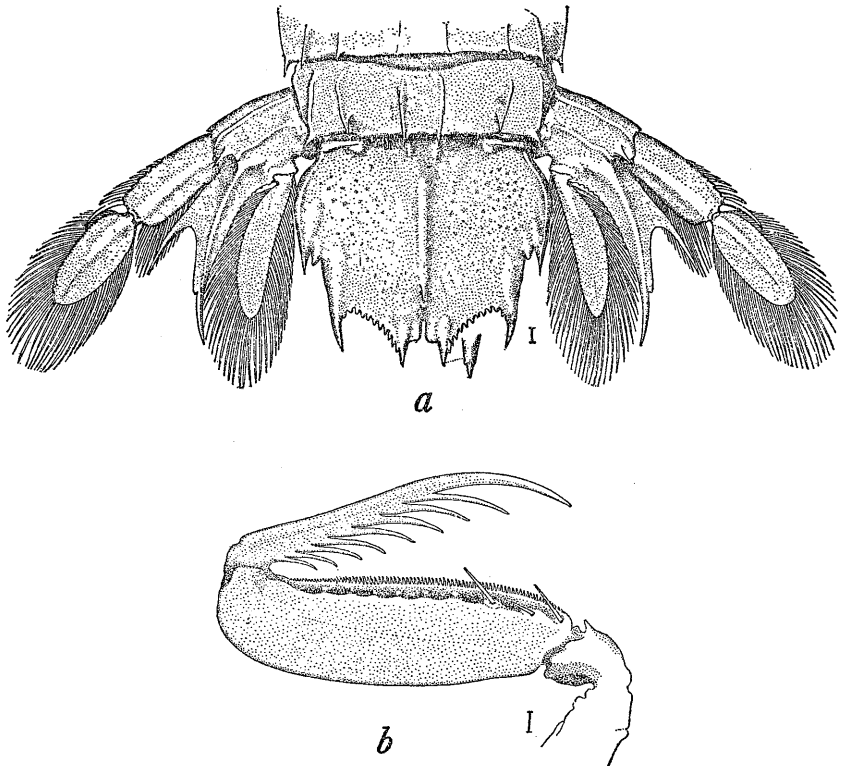


Fig. 4. *Squilla armata*, female, from off southern Chile (*Albatross* Sta. 2783, February 6, 1888). *a*. telson and uropods; *b*. raptorial claw (both from Bigelow).

*Distribution:* Atlantic coast of Patagonia at Gulf of St. George; Cape Horn (Milne-Edwards); coast of Chile, as far north as Valparaiso (Milne-Edwards, Nicolet, Bigelow, Rathbun); New Zealand (Kirk, Chilton); New South Wales (Whitelegge); [German] S.W. Africa (Balss); and off Cape Point Lighthouse, South Africa (Stebbing); from depths of 45 to 122 fathoms.

### *Squilla gracilipes* Miers

*Squilla gracilipes* Miers, Proc. Zool. Soc., 1881, p. 75, pl. 7, fig. 8, 1881. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 200, 1913, and synonymy [listed only]. Parisi, Atti Soc. Ital. Sci. Nat., Vol. 61, p. 93, 1922.

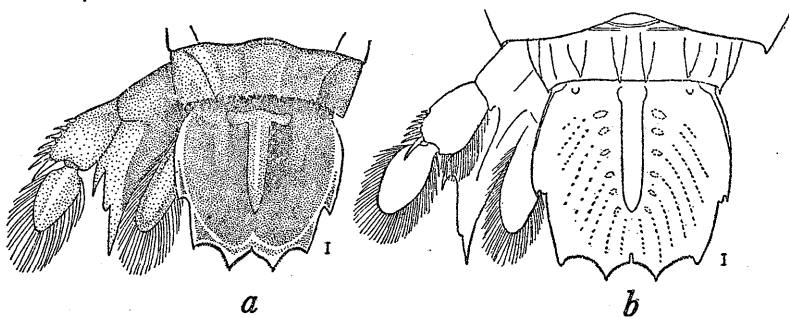


Fig. 5. *Squilla gracilipes*. *a.* telson and left uropod of type, young male from southern Chile ("west coast of Patagonia") (after Miers); *b.* telson and left uropod of male from Valparaiso ("forma larga" after Parisi).

*Distribution:* West coast of Patagonia (Miers); Valparaiso (Parisi).

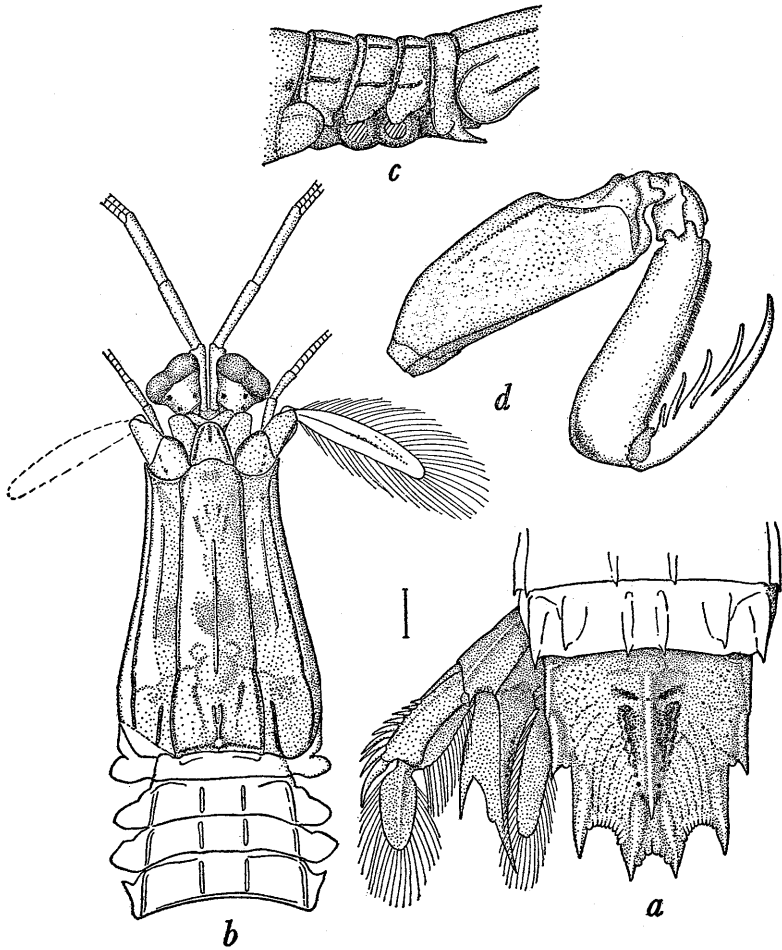
***Squilla hildebrandi*, new species**

Fig. 6. *Squilla hildebrandi*, male holotype, from Fort Sherman, Canal Zone (collected by Dr. S. F. Hildebrand, March 3, 1937).  
*a.* telson and left uropod; *b.* anterior portion; *c.* lateral view of free thoracic somites; *d.* raptorial claw.

*Distribution:* Known only from the unique holotype (U.S.N.M. No. 76068), a male 47 mm. in median length of body exclusive of rostrum, carapace 12, rostrum  $1\frac{1}{2}$  mm. long, from Fort Sherman, Canal

Zone, collected March 3, 1937, by Dr. S. F. Hildebrand, for whom I take pleasure in naming the species.

*Description:* A species with strong Indo-Pacific affinities, inasmuch as it is in many particulars very close to *S. hieroglyphica* Kemp<sup>39</sup> and, like that species, near *S. laevis*<sup>40</sup> Hess. As in both these species, the mandibular palp is entirely missing.

Of the several Pacific-American species here dealt with, it has, next to *S. panamensis*, the most roughly surfaced carapace. This, although to all appearances smooth and shining, is finely pitted or punctate, eroded much as in *S. panamensis*, but not as coarsely so, yet more so than the other west coast species of *Squilla*.

The anterior width of the carapace is nearly  $\frac{1}{2}$  its median length exclusive of the rostrum, much as it is in *hieroglyphica*,<sup>41</sup> where the anterior width equals  $\frac{1}{2}$  the median length; in *laevis* the carapace is stouter, the anterior width being half the length of the carapace including the rostrum. The lateral margins of the carapace are not angulated before the rounded posterolateral angles. The median carina is distinct before the dorsal pit but, as in *hieroglyphica*, not bifurcate, while in *laevis* it is bifurcate; the intermediate carinae are distinct but short, anterolateral spine present, of good size.

The rostrum is wider than its median length and in shape more or less intermediate between *laevis* and *hieroglyphica*; it is carinated as in the latter, but the median carina runs closer to the tip, where a small gap intervenes between the anterior ends of the marginal carinae and also the end of the median carina.

As in *hieroglyphica* and also *S. aculeata*, the cornea is more or less transversely placed on its triangular stalk; in our species the eyestalks are of a rich golden brown color; each stalk, as in *hieroglyphica*, carries 3 prominent spots arranged in the form of a triangle.

As in *hieroglyphica* also, there is no spine at the distal end of the inferior margin of the propodus as in *laevis*; and, like the former species, ours has the raptorial dactylus armed with 5 teeth, including the terminal; in *laevis* there are 4.

The lateral processes of the 5th thoracic somite are in size, shape, and direction more or less intermediate between *hieroglyphica* and *laevis*;

<sup>39</sup> Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 51, pl. 3, figs. 38-41, 1913.

<sup>40</sup> Kemp, *op. cit.*, p. 49, pl. 3, figs. 35-37, and synonymy.

<sup>41</sup> Not including the rostrum, as in Kemp's text, for in his figure the anterior width equals about  $\frac{1}{2}$  the median length exclusive of the rostrum.

the anterior lobes of the 6th and 7th somites are slightly or scarcely marked, the posterior lobes are again intermediate in size and direction, more or less intermediate between those of the 2 nearly related species.

The submedian carinae of the 5th and 6th abdominal somites are posteriorly spined, as are the intermediates of the 4th, 5th, and 6th, the 3rd to 6th laterals inclusive, and all the marginals.

Denticles of the telson are 3, 10, 1; there is no prelateral denticle, the prelateral carina runs little more than halfway to the tip of the lateral tooth; at about this halfway point the carina that is continued to the extremity of the lateral tooth begins; the marginal teeth of the telson are of good size and sharp, with laterals a little exserted and about as long as submedians and both a little shorter than the intermediate teeth, and thus, except for the prelateral angle or spine of the latter, more like *laevis* than *hieroglypha*. At about  $\frac{3}{4}$  the length of the median carina of the telson from the extremity of the terminal tooth or spine, a small, shallow punctation more or less inconspicuously interrupts the crest of the carina.

*Color:* In coloration or arrangement of the chromatophores our species is not unlike *hieroglypha*. The chromatophores, although generally sparsely scattered, are on the carapace aggregated in a line along the median carina, the gastric grooves, the proximal half of the intermediate carinae, the whole of the lateral carinae, and the reflexed portions of the marginal ones, as well as along the posterior margins of all the free somites behind the 5th thoracic, except the 6th abdominal. On the telson the chromatophore arrangement bears a striking resemblance to that found in *hieroglypha*, which Kemp says is unlike any other species; however, *hieroglypha*, as figured, has neither the 2 pairs of isolated spots either side of the median carina of the telson near its posterior extremity nor the little band of 6 more or less coalescent chromatophores around the hinder end of the median carina beneath the terminal spine, the latter appears also to have been somewhat dark colored toward its tip in life in our species.

***Squilla dubia* H. Milne-Edwards**

*Squilla dubia* H. Milne-Edwards, Hist. Nat. Crust., Vol. 2, p. 522, 1937. Bigelow, Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 518, 1894. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 200, 1913, and synonymy [otherwise only listed]. Kemp and Chopra, Rec. Indian Mus., Vol. 22, p. 298, 1921. Lunz, Jour. Elisha Mitchell Sci. Soc., Vol. 51, No. 1, p. 157, fig. 5, 1935.

*Squilla rubrolineata* Dana, Crust. U.S. Explor. Exped., Pt. 1, p. 618, 1852, pl. 41, fig. 2, 1855.

*Squilla alba* Boone, Bull. Vanderbilt Mar. Mus., Vol. 2, p. 35, pl. 5, 1930 (I have examined the type).

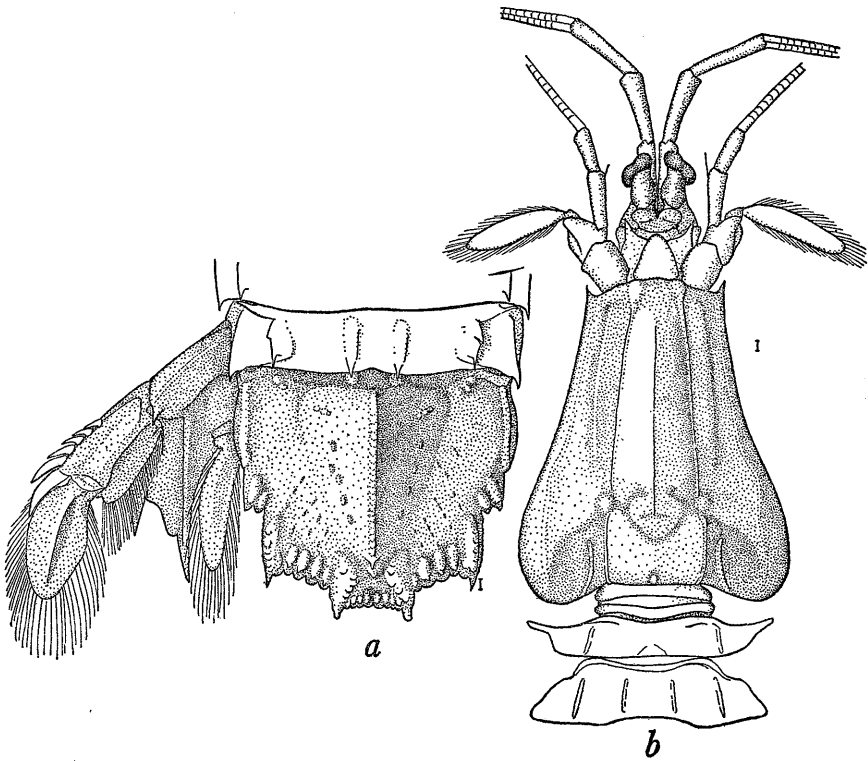


Fig. 7. *Squilla dubia*, female, from salt lake near Guayaquil, Ecuador (collected by Dr. W. H. Jones, U.S.N., December 19, 1884). *a*. telson and left uropod; *b*. anterior portion.

*Distribution:* East coast of America from Charleston, South Carolina, to Rio de Janeiro, Brazil, including Georgia, British Honduras, Cuba, Santo Domingo, Trinidad, and Limon Bay, Panama; west coast from El Triunfo, El Salvador, to Rio Tumbes, Peru, including Punta Arenas, Costa Rica, Guayaquil, Ecuador, from a salt lake back of town, and a male specimen in the National Museum collections just determined which was found on the mud at low tide at the Pacific entrance to the Panama Canal by the Marsh-Darien Expedition, July, 1924.

*Remarks:* The identity of Dana's *Squilla rubrolineata* with the present species hitherto questioned, I believe, may be accepted. The few discrepancies that are to be noted do not seem to be of sufficient moment to warrant the continued doubt. The eyestalks, as drawn in Dana's Atlas, perhaps are not what they should be. They are different from the more usual "Squilla" type of eye and do more or less resemble the eyes of *S. dubia*; also the transverse axis of their corneae is oblique to, and not longer than, the longitudinal axis of the ocular peduncle. The median keel of the telson in smaller specimens of *dubia* is always sharper than in older and more developed specimens; the latter usually have the margins of the telson very much thickened.

### *Squilla bigelowi*, new name

*Squilla panamensis* variety A Bigelow, Johns Hopkins Univ. Circ., 1891; Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 529, 1894.

? *Squilla panamensis* "Variety B" Boone, Bull. Vanderbilt Mar. Mus., Vol. 2, p. 39, pl. 6, 1930.

*Chloridella panamensis* "Variety A" Lunz, Bull. Bingham Oceanog. Coll., Vol. 5, Art. 5, p. 11, fig. 4, 1937.

*Distribution:* Of this species I have seen no material other than that listed by Bigelow. This was taken by the *Albatross* in the Gulf of California. Within the Gulf the species has been collected from Angeles Bay (Lunz) and off Cape Lobos northward to Point San Fermin, Diggs Point, and Consag Rock, 12-76 fathoms. The bottom where recorded, with one exception, was mud of some description, brown, green, and gray; the exceptional case was at one of two stations off Consag Rock (12 fathoms) on gray (green?) sand; the other station off this rock (33 fathoms) had the bottom given as brown mud.

*Type:* A male dredged in 76 fathoms off Cape Lobos, on the east side of the Gulf of California, March 24, 1889 (*Albatross* Sta. 3016), has been selected as the type (U.S.N.M. No. 18462). It measures, in median length exclusive of the rostrum, 96 mm.; the rostral plate  $3\frac{1}{2}$  mm.; the carapace 21; abdomen and telson together 75; telson alone 19.

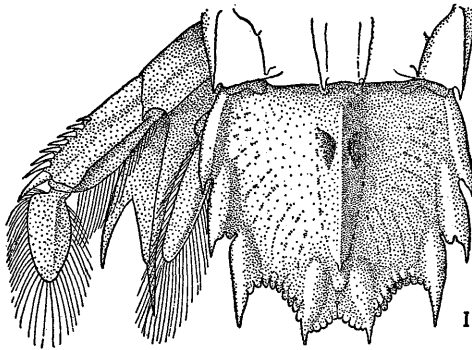


Fig. 8. *Squilla bigelowi*, male holotype, from off Cape Lobos, Gulf of California (*Albatross* Sta. 3016, March 24, 1889). Telson.

*Remarks:* Three specimens from Punta Arenas, Costa Rica, which Miss Boone identified with "*Squilla panamensis* variety B," may belong here, for the illustration which she furnishes has the prelateral angles or lobes of the telson spined. Lunz called attention to this fact. However, the raptorial dactyli of Miss Boone's specimen, as drawn, are armed each with 5 teeth, including the terminal one, while the submedian carinae of the 2nd and 3rd abdominal somites are represented in both the figure and text as being posteriorly spined, as well as those of the 4th, 5th, and 6th somites. In none of the Gulf of California specimens that I have had the opportunity to examine are there less than 6 teeth on the raptorial dactylus, nor are the submedian carinae of the 2nd and 3rd abdominal somites posteriorly spined.



*Squilla aculeata* Bigelow

*Squilla aculeata* Bigelow, Johns Hopkins Univ. Circ., Vol. 12, No. 106, p. 101, 1893; Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 523, figs. 15, 16, 1894. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 200, 1913 [listed only]. Lunz, Bull. Bingham Oceanog. Coll., Vol. 5, Art. 5, p. 8, 1937.

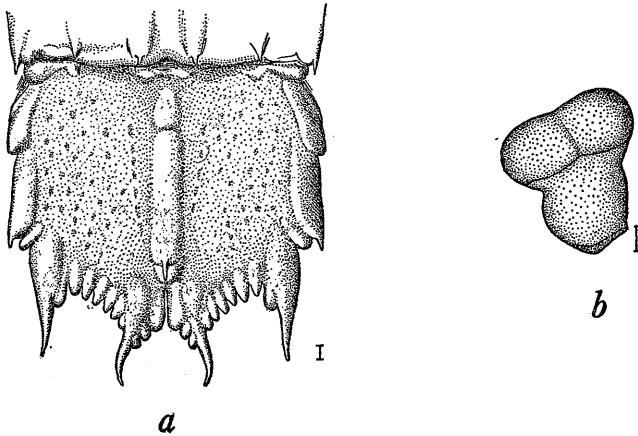


Fig. 9. *Squilla aculeata*, male holotype, from Iquique, Chile (collected by Dr. W. H. Jones, U.S.N., January, 1885). *a*. telson (from Bigelow); *b*. eye.

The magnification of the telson as originally figured by Bigelow is actually  $1\frac{1}{2}$  times natural size and not  $\frac{2}{3}$  natural size as stated under his figure (Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 524, fig. 16, 1894). Also, as the cornea does not appear to me to be quite as transverse as Bigelow depicts it (his fig. 15), the eye has been redrawn.

*Distribution:* Teacapan, Sinaloa, Mexico; Panama; and Iquique, Chile. In addition to the 2 specimens which Bigelow examined, the National Museum now possesses a female 110 mm. in length, taken at Teacapan, Sinaloa, Mexico, by Sr. Carlos Stansch, Direccion Forestal y de Caza y Pesca, Mexico, and 8 others collected by Dr. S. F. Hildebrand, of the U.S. Bureau of Fisheries, in 1937, in tide pools at Panama: 6♀, mostly small (the only large specimen in the lot is 100 mm. long), on the

San Francisco Reef, February 13; and 1 ♂ 1 ♀, respectively, about 68 and 36 mm. long, at Venado Beach, February 26.

*Color:* The color markings of alcoholic specimens still retaining them in general resemble those of *panamensis*, inasmuch as the hind border of the carapace and the following somites of the body are dark margined, except the 1st free thoracic and the 6th abdominal. The telson, however, lacks the pair of small, outwardly turned dark-colored crescents placed one either side of the median carina near its base; also the greater part of the penultimate joint of the outer branch of the uropod is dark colored, while in *panamensis* there is some indication of color only toward the hinder margin of this joint and along its median ridge; the terminal joint in *aculeata* is practically without color, there being only a very small bit along the proximal and proximal inner margin; in *panamensis* the longitudinal  $\frac{2}{3}$  of its expanse next the inner margin is dark colored; the outer third is whitish or without color; the blade of the endopod is about  $\frac{2}{3}$  dark colored.

There is a narrow band of dark color across the dorsum of the second abdominal somite in *aculeata* between the submedian carinae and extending laterally for about  $\frac{1}{4}$  its transverse length to either side beyond the submedian carinae. I do not particularly notice a comparable band of color in *panamensis*, although it is indicated in some small, rather fresh specimens taken by the Hancock Expeditions off Cabita Bay, Colombia. The marginal lobes of the 6th and 7th thoracic somites are almost wholly dark colored, while they seem to be without color in *panamensis*, except for some isolated chromatophores found scattered everywhere in both species.

The carinae of the carapace, except the median, are indicated with fine lines of color. The last 2 joints of the antennular peduncles of *aculeata* are with little color except toward their distal margins; the reverse is true in *panamensis*, in which the greater part of these joints is dark colored and the distal margins light or without color; the antennular flagella in both species show little or no color.

*Remarks:* The marginal teeth of the telson of the figured type have perhaps attained their extreme development; the transverse fissure across the median carina of the telson, near its base and so plainly marked in the figured type, is already indicated in specimens of only 25 mm. in length, and becomes more evident with increase in size; in the corresponding place on the median carina of even good-sized *panamensis* there is only a very slight indentation.

### *Squilla hancocki*, new species

*Distribution:* Known from 25 fathoms off Petatlan Bay, Mexico, from Tangola-Tangola Bay, Mexico, 15-20 fathoms, and from Cape San Francisco, Ecuador, 20 fathoms, muck bottom.

*Type:* The largest of 4 females from off Petatlan Bay (Hancock Exped. Sta. 264-34) has been selected as the type (U.S.N.M. No. 76074). It measures in median length, exclusive of the rostrum, 60 mm., the carapace 13.2, the rostrum 2. This species is named for Captain Allan Hancock, a generous patron of science and a true and good friend of those who have had the great pleasure of going exploring with him.

*Description:* A species in general appearance and markings very like *S. tiburonensis* (= var. *B.* of *S. panamensis* Bigelow). Surface of carapace and abdomen smooth and shining. The anterior width of the carapace is a little more than half its median length exclusive of the rostrum; the median carina before the cervical groove is not bifurcate at either end; the intermediates continue anteriorly to the anterior margin. The rostral plate is more or less subquadrate, slightly tapering, and broadly rounded distally; in *tiburonensis* the rostral plate, though distally rounded off, is elongated triangular with the lateral margins a little convex. In the latter species the rostral plate is margined with color, in *hancocki* it is all colored except for a relatively small semicircular area at the middle of the basal or proximal margin. The corneae are set obliquely on their stalks. The raptorial dactylus, as in the other *panamensis* relatives, is armed with 6 teeth.

The lateral spine of the 5th thoracic somite extends more or less straight out to the side, much as in typical *S. panamensis*, with but slight forward inclination; in *S. tiburonensis* the corresponding spine is distally noticeably turned forward. The lateral margins of the posterior lobes of the 6th and 7th thoracic somites more or less subacute, in any case with tips or lateral extensions with only slight if any posterior inclination: in *tiburonensis* these posterior lobes are sharply and acutely pointed, and these spinous processes are definitely posteriorly directed.

Of the submedian carinae of the abdomen only those on the 6th somite are posteriorly spined; the (3rd?), 4th, 5th, and 6th intermediates are spined, 3-6 laterals inclusive, and all the marginal carinae.

The denticles of the telson number 3-5, 7-10, 1. In this respect, the telson resembles that of *tiburonensis*, and in other respects also it resembles that species, as well as other related *panamensis* forms; yet it differs

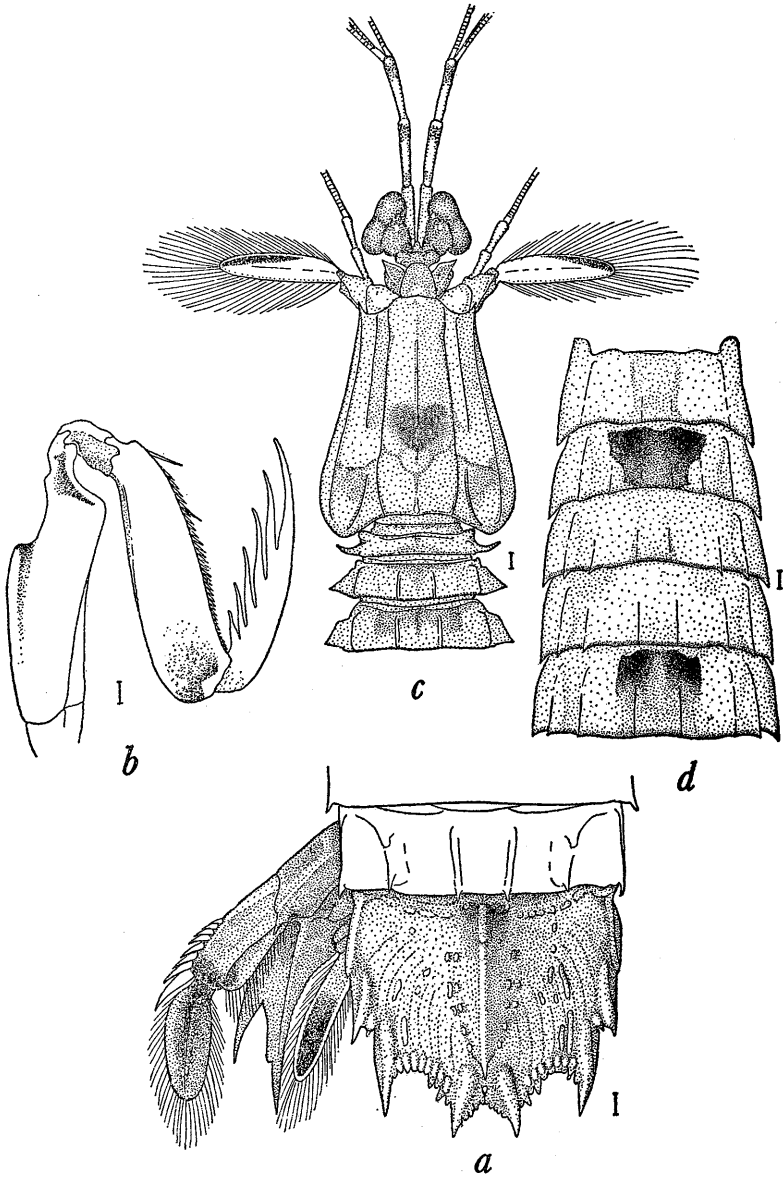


Fig. 10. *Squilla hancocki*, female holotype, from off Petatlan Bay, Mexico (Hancock Exped. Sta. 264-34, March 2, 1934). *a*. telson and left uropod; *b*. raptorial dactylus; *c*. dorsal view of anterior portion; *d*. dorsal view of first 5 abdominal somites to show color markings.

strikingly from all these in having a more or less tuberculous, rugose dorsal surface instead of a pitted and punctate one, as in the other species. Either side of the prominent median carina are 6 or more longitudinal, low, rounded rugae, anteriorly more or less tuberculous; the tubercles are somewhat longitudinally elongated, 2 rows more or less paralleling the anterior end of the median carina, the other rows of tubercles anteriorly curve more or less toward the median line. The rugae may be seen in even very small specimens, but the tuberculations do not appear in specimens of less than 44 mm. in median length exclusive of the rostrum; even at this size occasionally one or two or very few tuberculations may be observed; at 47 mm. they increase in number and are plainly to be seen. In the specimens of *S. panamensis* from off Petatlan Bay there are one or two low, blunt tuberculations on the surface of the telson, but I have not otherwise noticed any in the Bigelow material of *S. panamensis*. The inner spine of the bifurcate process of the uropod is twice as long as the outer, the lobular tooth on its outer margin is well marked; its inner margin is serrate, not spined; the basal segment of the exopod carries 8 movable spines on outer margin.

*Color:* In color pattern alcoholic specimens of *S. hancocki* and *S. tiburonensis* are almost identical. The median carina is the mid-line of a narrow, lanceolate area on the middorsum of the telson; this area is much darker marginally, and especially proximally where it forms 2 more or less rectangular areas, one either side of the base of the median carina. A pair of medially placed dark-colored or blackish roughly rectangular areas are located on the dorsum of the 2nd, as well as the 5th, abdominal somites. The somites from the 6th thoracic to the 5th abdominal inclusive have dark-edged posterior margins. The distal end of the penultimate segment of the exopod of the uropods is dark colored, as is also practically the whole of the terminal segment or blade, except for a brief narrow portion of the outer distal margin; not quite as much as the distal half of the terminal blade of the endopod is also dark colored or blackish all over. In *tiburonensis* the blade of the endopod is also distally blackish, but the distal half of the blade is not wholly black, as it is traversed by a longitudinal white or colorless strip. This occupies at least a fourth of the width of the blade just inside the median line, and sometimes is even wider than this.

*Remarks:* In its rugose or ridged telson *S. hancocki* would appear to approach *S. rugosa* Bigelow,<sup>42</sup> but except for this passing similarity the 2 species are very distinct.

<sup>42</sup> *Squilla rugosa* Bigelow, Johns Hopkins Univ. Circ., Vol. 12, No. 106, p. 102, 1893; Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 541, figs. 23, 24, 1894.

In *S. rugosa* a prelateral lobe or angle is not even indicated; in *hancocki*, although blunt, it is well marked. On either side of the median crest of the telson of the former there is a low, but well-defined, convex, bowed-out carina paralleled by a row of longitudinally elongated tubercles; in *S. hancocki*, instead of a carina and one parallel row of tubercles, there are 2 rows of tubercles paralleling each other either side of the median carina. The 5th submedian carinae of the abdomen are not spined posteriorly in *S. hancocki*; in *S. rugosa* they are well spined; otherwise, the carinae of the abdomen seem to be spined alike. The type of *S. rugosa*, between the submedian and intermediate carinae of the 5th and 6th abdominal somites, has the posterior margin of these somites armed with a series of spinules; on the 6th somite, 3 on either side, in the greater interspace between the more medially placed 2 of these spinules is a low, tiny, inconspicuous "button" or bead indicative perhaps of a potential 4th spinule; on the 5th somite there are 4 spinules on the left side and 3 on the right; these spinules are placed nearer their respective intermediate carinae than the submedians; to the outside of each of these groups of spinules on the posterior margin of the 5th somite there is a small, low, spiniform denticle, an incipient spinule. There are no such marginal spinules in *S. hancocki*.

The intermediate carinae of the carapace which run to or just about to the anterior margin in *S. hancocki* fall well short of it in *S. rugosa*.

The lateral spine or process of the 5th thoracic somite appears to have a slightly backward trend in *S. rugosa*, inasmuch as the anterior margin is longer than the posterior beyond the angulations that give this process its somewhat lance-shaped form, while the spines into which the lateral margins of the 6th and 7th somites are drawn out point almost directly backward; in *S. hancocki* the lateral spine of the 5th somite is directed laterally and only slightly inclined or curved forward; the posterolateral angles of the 6th and 7th thoracic somites, although forming an acute angle, are less sharply and attenuatedly spinelike; moreover, the apices of the broader and more flattened lateral spines are directed more or less sideways and with no particular posterior inclination.

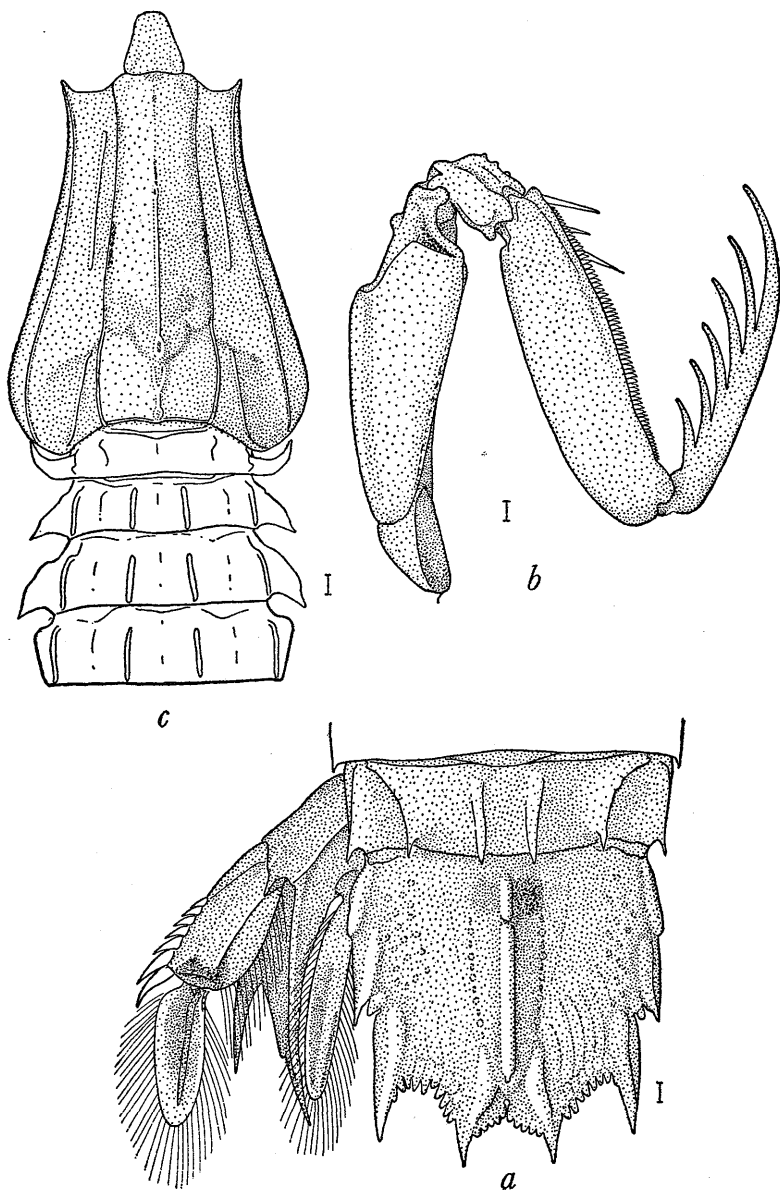


Fig. 11. *Squilla tiburonensis*, female holotype, from S.E. of Tiburon Island, Gulf of California (*Albatross* Sta. 3014, March 23, 1889). *a*. telson and left uropod; *b*. raptorial dactylus; *c*. dorsal view of anterior portion.

***Squilla tiburonensis*, new name**

*Squilla panamensis* variety *B* Bigelow, Johns Hopkins Univ. Circ., Vol. 10, No. 88, p. 94, 1891; Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 529.

*Distribution*: Known only from the Gulf of California, within which its known range extends from Angel de la Guardia Island on the north to Espiritu Santo Island on the south. The type (U.S.N.M. No. 18468) is from S.E. of Tiburon Island (*Albatross* Sta. 3014, March 23, 1889, 29 fathoms).

*Color*: Apart from various morphologic differences, *S. tiburonensis* may be distinguished from *S. panamensis* by its different color markings: basally on the telson, in place of the dark or black crescent either side of the median carina, there is a dark-colored, more or less squarish area. There are also a pair of squarish black areas on the middorsum of the 2nd and 5th abdominal somites. Although most of the articulated somites of the thorax and abdomen have the posterior margin dark edged, the coloration here is not so thick, dense, or conspicuous as it is in *panamensis*. In *tiburonensis* there is very little dark color on the distal margin of the basal (penultimate) segment of the exopod of the uropod, the terminal segment or blade is in its longitudinal outer third more or less white or colorless, in the other two thirds dark colored or black; the distal half of the blade of the endopod is black in its outer half or little more, and white on its inner half except for a narrow longitudinal black line close to the inner margin of the blade. See also color notes on *S. hancocki*, p. 162.

***Squilla biformis* Bigelow**

*Squilla biformis* Bigelow, Johns Hopkins Univ. Circ., Vol. 10, No. 88, p. 94, 1891; Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 532, fig. 20, pl. 21. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 200, 1913 [listed only].

*Distribution*: Known only from specimens secured by the U.S. Fisheries Steamer *Albatross* off La Paz Bay, Gulf of California, 112 to 221 fathoms, March 16, 1889, and in the Bay of Panama, 56 to 259 fathoms, March 9 and 11, 1891.



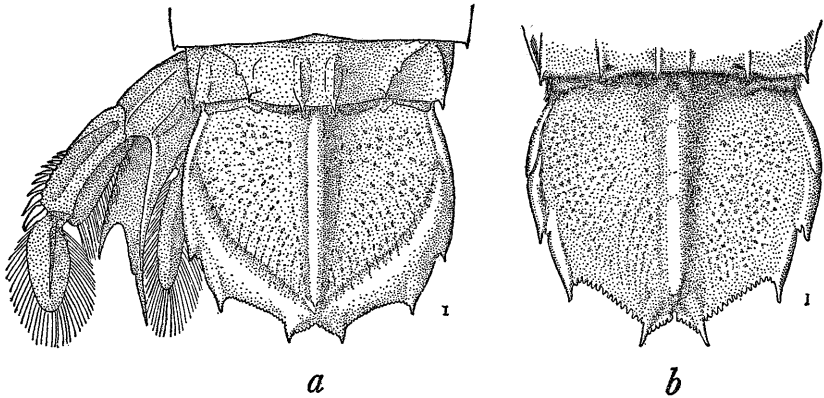


Fig. 12. *Squilla biformis*, from off La Paz Bay, Gulf of California (*Albatross* Sta. 2996, March 16, 1889). *a*. telson of male; *b*. telson of female (from Bigelow).

### *Squilla panamensis* Bigelow

*Squilla Panamensis* Bigelow, Johns Hopkins Univ. Circ., Vol. 10, No. 88, p. 94, 1891.

*Squilla panamensis* Bigelow, Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 526, figs. 17, 18, 1894. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 201, 1913 [part; listed only]. Kemp and Chopra, Rec. Indian Mus., Vol. 22, p. 298, 1921. Parisi, Atti Soc. Ital. Sci. Nat., Vol. 59, p. 92, 1922 [listed only].

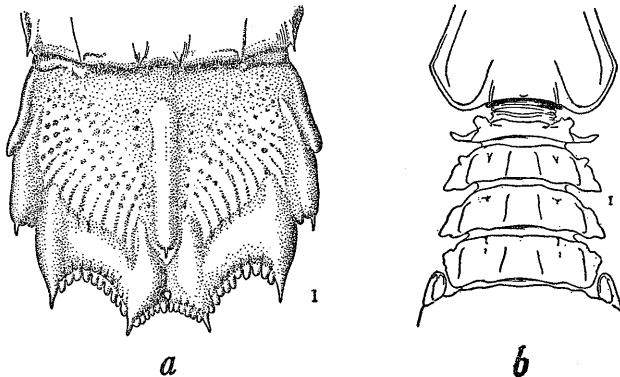


Fig. 13. *Squilla panamensis*, male cotype, from Panama Bay (*Albatross* coll., March, 1888). *a*. telson; *b*. free thoracic somites (both from Bigelow).

*Distribution:* Heretofore known only from the Bay of Panama from a green mud bottom in from 26 to 47 fathoms (*Albatross* Sta. 2799, 2803, 2804), but now also, as a result of the Hancock Expeditions, from much farther north, off Petatlan Bay, Mexico, in 25 fathoms, and farther south, off Cape Corrientes, Colombia, mud bottom, in 10 fathoms.

*Color:* Among the more prominent markings of *S. panamensis* are a pair of outwardly turned, dark-colored or black crescents or arcs of small circles, placed one either side of the proximal end of the median carina of the telson; similar crescents occur in *S. bigelowi* (p. 156), but were not drawn into Bigelow's figure of his *panamensis* telson reproduced here (fig. 13a); the terminal joint or blade of the exopod of the uropod has its inner, longitudinal  $\frac{2}{3}$  dark colored, the outer  $\frac{1}{3}$  white or colorless; the terminal blade of the endopod for the greater part of its inner margin and for more than half its outer margin is dark colored.

The posterior margins of all free somites from the 6th thoracic to the 5th abdominal inclusive are margined with a very conspicuous, though narrow, band of dark color, as are also the anterior and posterior margins of the carapace; 2 lines of color also mark the gastric grooves. The antennal scale has its inner or fore edge also dark colored. There is also a conspicuous spot of dark color on the upper margin near the anterior end of the merus of the raptorial claw.

*Remarks:* The several lettered varieties, *A*, *B*, and *C*, differentiated by Bigelow from among his *S. panamensis* material all seem worthy of specific rating.

Already in 1917 Calman (British Antarctic "Terra Nova" Expedition, 1910, *Zoology*, Vol. 3, No. 5, p. 139, fig. 1-3) described *S. brasiliensis*, which he believed, and which I feel certain, is identical with Bigelow's "variety *C*." The characters stressed by Calman hold for Bigelow's specimen from off Cabo Frio, Brazil, also the type locality of Calman's material, 4♂ 3♀, 40 fathoms, May 2, 1913 (Sta. 42). Bigelow's specimen was dredged in 59 fathoms, December 30, 1887 (*Albatross* Sta. 2762, blue mud). Further, Hansen (*Ark. Zool.*, Vol. 13, No. 20, p. 7, 1921) records a male of *S. brasiliensis* taken off the coast of Uruguay, 80 meters, December 12, 1901 (blackish gray clay).

Variety *A*, in this paper, has been named for Dr. Bigelow in recognition of his most helpful and valuable contributions to the literature of stomatopods. Variety *B* is named *S. tiburonensis* for its place of origin, Tiburon Island, Gulf of California. Variety *B*, aside from other characters, can at once be distinguished from typical *S. panamensis* by its dif-

ferent color markings; variety *A*, on the other hand, is perhaps closer to *S. panamensis* in this respect than any other species.

The carapace of *S. panamensis*, though appearing fairly smooth and shining when wet, on closer examination is quite rough, pitted and finely eroded, so that when dry it is rather dull and mat surfaced when compared with any of its near relatives, especially the median area of the carapace either side of the median carina. In the several "varieties" the median area of the carapace is smooth and shining even when dry, with but few, if any, punctae.

### *Squilla parva* Bigelow

*Squilla parva* Bigelow, Johns Hopkins Univ. Circ., Vol. 10, No. 88, p. 94, 1891; Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 518, figs. 11, 12, 1894. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 201 [listed only].

*Distribution*: Originally described from the Bay of Panama, 7-16 fathoms, green mud, March 30, 1888, and recorded with a reservation from off Manzanillo, Mexico, 117 fathoms, brown mud, April 26, 1888, this species has since been taken by the Hancock Expeditions at Tangola-Tangola Bay, in 15-20 fathoms; off Petatlan Bay, Mexico, in 25 fathoms; and off Cape San Francisco, Ecuador, in 20 fathoms, muck bottom.

*Measurements*: The largest *parva* I have seen is a male 53 mm. long.

*Color*: The animal preserved in alcohol is symmetrically more or less marbled and mottled, but between the lateral and marginal carinae the abdominal somites are without color, except on their anterior and posterior margins; however, the lateral lobes of the free thoracic somites are colored. The penultimate joint of the other branch of the uropods is distally dark colored, and likewise the inner half, approximately, of the terminal joint. The hinder margin of the carapace and all free somites of the body except the 4th thoracic are heavily limned with dark color (black in the alcoholic specimens), as is also the anterior margin of each somite, though less heavily, except in its middorsal portion, where there is a thin and not particularly noticeable line of chromatophores.

These color notes are based on Hancock Expedition material. All markings, though still faintly discernible, are much faded in the type specimen collected over fifty years ago.

*Remarks*: The rostral plate in juvenile parvas is quite triangular. Their coloration sets them apart from *S. hancocki*, with which I have found them associated, and they may also be distinguished by the reduced

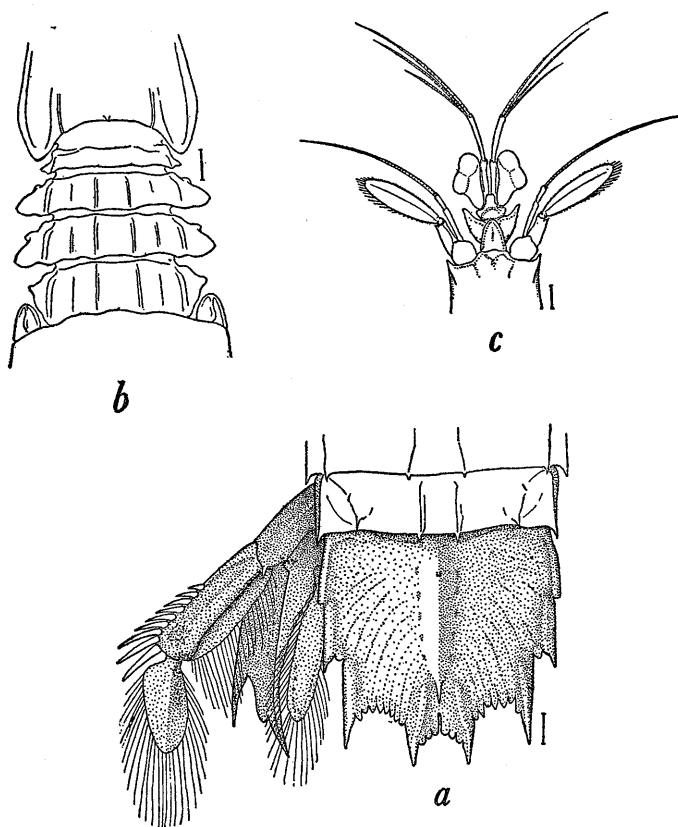


Fig. 14. *Squilla parva*, male holotype, from Bay of Panama (*Albatross* Sta. 2802, March 30, 1888). *a.* telson and left uropod; *b.* free thoracic somites; *c.* frontal region (*b* and *c* from Bigelow).

number of submedian denticles, which also, in even the smallest specimens, are bluntly rounded off distally, at least those nearest the submedian teeth. I have seen one juvenile which had not yet developed the spine this species carries on each of the anterolateral angles of its carapace. No juvenile specimen seemed to have the median carina of the carapace bifurcate at either end, nor did the intermediate carinae run to the anterior margin; none showed what might be designated as a lateral spine on the 5th thoracic somite; all but the specimen with the unarmed anterolateral angles had the 5th abdominal submedian carinae posteriorly spined.

The raptorial carpus in the adult, or largest specimen noted above, has a noticeably high, thin crest.

Genus **PSEUDOSQUILLA** Dana, 1852

Many species of *Pseudosquilla* and *Lysiosquilla* seem to have much in common. As similar-appearing species ascribed to one or the other of these genera are examined, it becomes evident that the presence of a rather distinct median longitudinal crest or carina on the telson, coupled with the absence of denticles or, rather, spinules<sup>43</sup> between a pair of movable submedian spines or "teeth" on the hind margin of the telson in the adult, is the chief character distinguishing representatives of the former from those of the latter which most resemble them (*i.e.*, *Lysiosquillas* of the second type of Kemp).

The *Pseudosquillas* seem to fall quite naturally into 2 groups on the basis of the number of joints comprising the shorter ramus of the 6th, 7th, and 8th pairs of thoracic legs. This shorter ramus is composed of 2 joints in *P. lessonii*, *cerisii*, *ferussaci*, *pilaensis*, *veleronis*, and I believe also in *P. dofleini*, of which I have seen no specimen, but which its author considered morphologically intermediate between the first 2 species. It will be observed that this grouping also corresponds with the **B** section (p. 96) of the key in Kemp's Monograph.

In the other group, the shorter ramus is composed of but a single joint or segment and here belong *P. ciliata*, *ornata*, *oculata*, *megalophthalma*, and perhaps also *oxyrhyncha*, which also I have not seen. However, the last-named species, on the basis of Komai's remarks,<sup>44</sup> is no doubt a synonym of *P. ornata* and so may not need to be further considered. These species all belong to the **A** section of Kemp's key. There is a very interesting character that the species in this group or section possess in common. That is the structure which Kemp mentions as occurring in *Pseudosquilla ciliata* and its immediate allies, a curious process springing from the dorsal aspect of the antennal protopodite. "This consists of a flat, elongated plate [more or less channeled in some species], directed forwards, and provided inferiorly with a deep vertical keel."

<sup>43</sup> Submedian spinules persist in some species of *Pseudosquilla*, at least until the so-called first littoral stage. In certain species of *Lysiosquilla*, species of the first type (Kemp, Mem. Indian Mus., Vol. 13, No. 4, p. 109, 1913) such as *L. maculata*, without dorsal spines on the telson, but which have the posterior margin of the telson unarmed or cut into a few large, blunt teeth, there are neither submedian spines nor teeth, nor submedian spinules distinguishable as such on the hinder margin.

<sup>44</sup> Mem. Coll. Sci. Kyoto Imper. Univ., Ser. B, Vol. 3, No. 3, Art. 4, p. 324, pl. 14, figs. 2-2b, 1927; Annot. Zool. Jap., Vol. 7, Nos. 3, 4, p. 268, 1938.

These several species also seem to have a more pronouncedly subcylindrical body as compared with the group first listed, in which, indeed, some have very much flattened, depressed bodies.

*Pseudosquilla empusa* has uropods which place it in the **B** section of Kemp's key, and so may have 2 joints to the shorter ramus of the posterior thoracic limbs, but this point needs to be verified. Komai (*op. cit.*) is the first to have seen any specimens of this rare species since originally described by de Haan, but he fails to describe the thoracic limbs other than the raptorial one. His color figure regrettably does not clearly show the structure of the shorter ramus of the 6th to 8th pair.

Although the shorter ramus of the 6th, 7th, and 8th thoracic limbs of *Pseudosquilla* may be composed of one or two segments, in *Lysiosquilla* the number of segments is always 2, as it is also in *Coronida* and *Gonodactylus*; in *Hemisquilla* there is but one; in *Squilla* "the shorter ramus of the last three thoracic appendages is unjointed, or with an imperfect suture separating short basal and long linear distal parts" (Kemp).

In all the species examined the mandibular palp was composed of 3 segments.

The *Lysiosquilla plumata* and *maiaguesensis* of Bigelow<sup>45</sup> are at best immature forms, very small, which unfortunately at some time or other must have dried out completely. They are now preserved in alcohol. The telson of each has an evident median carina and has no submedian spinules; the uropods are of types admissible to the genus *Pseudosquilla*, that of *maiaguesensis* very clearly so. However, I find no trace of a mandibular palp in either species; the shorter ramus of the posterior thoracic limbs is somewhat broadened, narrow bladelike rather than merely linear and seems, moreover, to consist of but the one joint.

As a result of the foregoing remarks and of the species here assigned to the genus, the very excellent generic definition given by Kemp for *Pseudosquilla* needs to be emended: in the first place, the number of teeth on the raptorial dactylus can no longer be limited to 3 or 4, including the terminal one. It should be merely stated (as with *Chloridella*, or *Squilla*) that the raptorial dactylus is toothed. Then, the shorter ramus of the last 3 thoracic limbs is composed of one or two segments. Finally, the basal or ventral process of the uropods may consist of only 2 spines, of which either the inner or outer may be the longer,<sup>46</sup> or of 2 spines with

<sup>45</sup> Bull. U.S. Fish Comm., Vol. 20, Pt. 2, p. 156, figs. 5-9 and 158, figs. 10-13, respectively, 1900 (1901).

<sup>46</sup> Kemp had it that the inner spine was the longer in those *Pseudosquillas* in which the ventral process of the uropod consisted of but 2 well-formed spines. In *P. oculata* the outer spine is much the longer.

an additional spine, or spine and spinules (or denticles) on the inner margin.

*Pseudosquilla*, now *Hemisquilla*, *braziliensis* (Moreira)<sup>47</sup> is an interesting species, inasmuch as it is the Atlantic analogue of the Pacific *H. stylifera*, p. 182.

Key to Species of *Pseudosquilla* Known from the  
Pacific Coast of America

- A<sup>1</sup>.** Basal process of uropod terminating in 2 large spines only, of which the outer is the longer; inner margin of process otherwise with at most a little offset or low rounded angulation proximal to base of inner of the 2 spines.

Shorter ramus of last 3 thoracic limbs composed of a single segment. An elongated platelike process arising from dorsal aspect of antennal protopodite. Telson with 4 carinae either side of median crest. Submedian carinae of the 6th abdominal somite dorsally flattened, rounded, anteriorly wide, each tapering sharply to a strong acute posterior spine overhanging the telson; intermediate and lateral spines also present. Eyestalk subtriangular; cornea set transversely on stalk, not overhanging lateral margins, although with median band not bilobed. Rostrum a short, wide, subcordiform plate, anterolateral margins broadly rounded, median spine or point short, subacute. Anterior margin of carapace either side of rostral plate lightly convex, passing directly over into broadly rounded anterolateral angles of carapace. Raptorial dactylus with 3 teeth, including terminal one. Body compressed, subcylindrical; ground color usually quite dark, more or less maculated with numerous medium to small light-colored subcircular spots; maculations on raptorial protopodus, carpus and merus large. . . . . *oculata*, p. 173

- A<sup>2</sup>.** Basal process of uropod composed of 3 sharp spines, of which one is much the longest and strongest.

This may be either the outermost or the middle one of the three. Shorter ramus of last 3 thoracic limbs consisting of 2 segments. No dorsal process on dorsal aspect of the antennal protopodite.

- B<sup>1</sup>.** Outermost spine of basal process of uropod the largest.

Telson with 5 well-marked, prominent and entire, nondenticulated carinae either side of median crest. Submedian carinae of 6th abdominal somite well marked, strongly keeled, posteriorly long spined; intermediate and lateral spines also present. Eyestalk subtriangular;

<sup>47</sup>Lavoura, Bol. Soc. Nac. Agri. Brasileira (N.S.), Vol. 7, p. 60 [5 of separate], 1903. Arch. Mus. Nac. Rio de Janeiro, Vol. 13, p. 5, pls. 1, 2, 1905 [1906 on cover of separate].

cornea bilobed and set very obliquely on stalk and projecting considerably beyond outer lateral margin of stalk, obliquity the reverse of that usually found, the inner margin of the stalk shorter than the outer. Narrow, transverse, subrectangular rostral plate armed with 3 sharp spines, a long, keeled, anterior median one reaching about as far forward as the corneae and one at each anterolateral angle, directed laterally.<sup>48</sup> Anterior margin of carapace either side of rostral plate straight, sloping toward corresponding anterolateral angle of carapace, anterolateral angles rounded. Raptorial dactylus with 3 teeth, including terminal one. Body subcylindrical, not as much compressed as in preceding species, carapace somewhat more flattened; maculations, when present, large and irregular, on carapace more or less confined to posterolateral portions. . . . . *lessonii*, p. 175

**B<sup>2</sup>.** Middle spine of the 3 forming the basal process of uropod the largest.

Telson, other than the lateral marginal carina, has one smooth-crested carina either side of median one, and at least 2 or 3 pairs of feebler denticulated carinae or rows of tubercles in addition. Submedian carinae of 6th abdominal somite not particularly indicated except for a pair of submedian spines on the posterior margin of the somite, intermediate and lateral spines also present. Eyestalk cylindrical, cornea set very obliquely on stalk, with median band but not bilobed, projecting very little beyond outer lateral margin of stalk. Rostral plate triangular to subcordiform, wider than long, apically subacute. Anterior margin of carapace either side of rostral plate slightly concave, anterolateral angles blunt. Raptorial dactylus with 7 to 8 teeth, including the terminal one. Body depressed, flattened; mottled to some degree, perhaps, but not maculated, prominent blackish eyespot at each posterolateral angle of 5th abdominal somite. *veleronis*, p. 176

### *Pseudosquilla oculata* (Brullé)

*Squilla oculata* Brullé, in Webb and Berthelot, Hist. Nat. Iles Canaries, Zool., Vol. 2, Pt. 2, Crust., p. 18, fig. 3 on accompanying plate, 1835-44.

*Pseudosquilla oculata* Rathbun, Proc. Wash. Acad. Sci., Vol. 2, p. 155, 1900. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 102, 1913, and synonymy. Bigelow, Bull. Mus. Comp. Zool., Vol. 72, No. 4, p. 165, fig. 8, 1931, and synonymy. Edmondson, Occas. Paps. Bishop Mus., Vol. 7, No. 13, p. 290, fig. 1*b*, 1921.

<sup>48</sup> These laterally directed anterolateral spines of the rostral plate are only well developed in large specimens. In medium-sized and small ones these angles, though they may be laterally but little produced and subspiniform, are very rarely only indicated, usually acute.



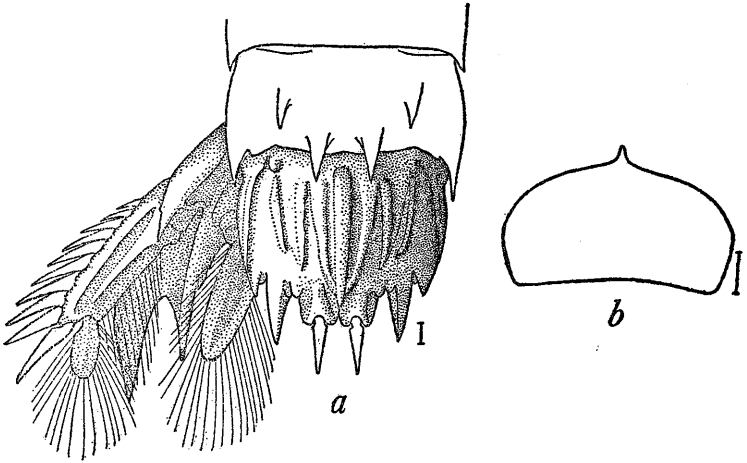


Fig. 15. *Pseudosquilla oculata*, male, from Gardner Bay, Hood Island, Galapagos (Hancock Exped. Sta. 30-33, February 26, 1933). *a*. telson and left uropod; *b*. rostral plate.

**Distribution:** A widely distributed species. Atlantic Ocean: Canary Islands, Madeira, Cape Verde Islands, and Maceio, Alagoas, Brazil. Indian Ocean: Chagos Islands and Mauritius. Pacific Ocean: Bonin Islands, China Sea (Macclesfield Bank), Gilbert Islands, Laysan, Hawaiian Islands, Samoa, Society Islands, Clarion Island (Mexico) (Rathbun, Kemp, Edmondson, Bigelow).

To the foregoing Pacific localities may be added the Tres Marias Islands, Mexico, from which a single female was obtained by Dr. Carlos Stansch, of the Direccion Forestal y de Caza y Pesca, in 1927, and a number of specimens taken by the Hancock Expeditions on the Pacific coast of the Republic of Panama and Colombia and in the Galapagos Islands.

**Size:** Most of the specimens in the collection are quite small, but there is one large female from Osborn Island in Gardner Bay, Hood Island (Sta. 30-32), which appears to be the largest known representative of the species. In median length inclusive of the rostral plate, it is about 86.5 mm. long, the carapace measures 17.1, the rostral plate  $3\frac{1}{2}$ ; if measured over the movable submedian spines, the total length would approach 89 mm. As far as I have been able to ascertain, the next specimen in point of size is that seen by Miers<sup>49</sup> in the British Museum. It is also a female, and measures " $3\frac{1}{4}$  inches in length" (not quite 83 mm.).

<sup>49</sup> Ann. Mag. Nat. Hist. (5), Vol. 5, No. 9, p. 110, 1880.

***Pseudosquilla lessonii* (Guérin)**

*Squilla lessonii* Guérin, Voy. Coquille, Crust., pl. 4, fig. 1, 1830 [in accompanying text on p. 40 given as *S. cerisii*].

*Squilla marmorata* Lockington, Proc. Calif. Acad. Sci., Vol. 7, p. 33 [6], 1877.

*Pseudosquilla lessonii* Bigelow, Proc. U.S. Nat. Mus., Vol. 17, No. 1017, pp. 499, 502, 1894.

*Pseudosquilla lessoni* Porter, Revista Chilena Hist. Nat. Vol. 7, No. 5-6, p. 274, 1903.

*Pseudosquilla lessoni* Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 202, 1913, and synonymy [otherwise listed only]. Parisi, Atti Soc. Ital. Sci. Nat., Vol. 61, p. 104, 1922.

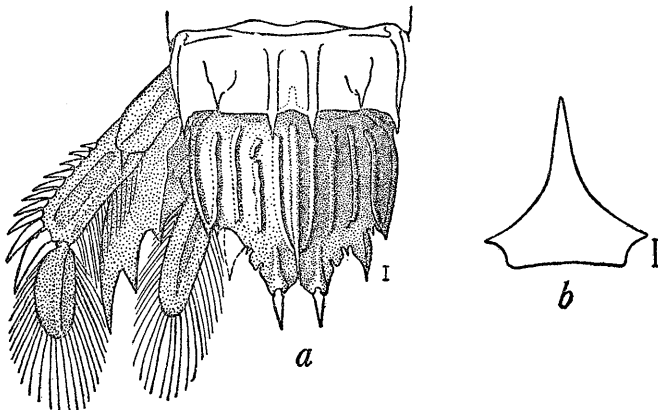


Fig. 16. *Pseudosquilla lessonii*, male, from Black Beach Anchorage, Charles Island, Galapagos (Hancock Exped. Sta. 32-33, January 26, 1933). *a.* telson and left uropod; *b.* rostral plate.

**Distribution:** A west American species ranging from California (Wilmington, San Pedro, and Catalina Island) to Chile; Juan Fernandez (Porter). First recorded from the Galapagos Islands by Bigelow, *Albatross* Surf. Sta. 29, Lat.  $0^{\circ} 46' S.$ , Long.  $89^{\circ} 42' W.$ , off west side Chatham Island, 1 ♂ 2 ♀, from surface tow, depth at this point 271 fathoms (this surface station was made at the same time and position as *Albatross* Dredge Sta. 2817). This species has since been taken by the Hancock Expeditions at Albemarle and Charles Island, Galapagos; La Plata Island, Ecuador; and Independencia Bay, Peru.

*Size:* The largest specimen I have seen is one from Callao, Peru, secured by Dr. R. E. Coker in 1907 while fisheries advisor to the Peruvian government. This specimen, a male, measures, median length exclusive of rostral plate, approximately 125 mm.; carapace 28; rostral plate 6.5. The largest of which I have seen mention is the one in the British Museum, which Miers<sup>50</sup> said was "nearly 5½ inches" long (close to 140 mm.). It is probably one of the several specimens from Chile. The largest Hancock specimen is a male from Independencia Bay, Peru, which measures, median length exclusive of rostral plate, 104 mm., carapace 20, rostral plate 5.

*Color:* Notes taken on a male from Charles Island, in life: burnt sienna × tawny, with naples to buff yellow flecks; appendages a golden brown, nearly orange in effect; fringing hairs of tail-fan aster purple, of antennal scale and pleopods rose purple (colors from Ridgway, Nomenclature of Colors . . . , 1886).

### ***Pseudosquilla veleronis*, new species**

*Distribution:* Known only from material dredged by the Hancock Expeditions: Angeles Bay, Gulf of California; Chacahua Bay, Oaxaca, Mexico; and off Petatlan Bay, south and west of the White Friars Islands, Oaxaca, Mexico, the type locality (Hancock Exped. Sta. 264-34, 25 fathoms, March 2, 1934).

*Type:* A female of perhaps maximum size for the species has been selected as the type (U.S.N.M. No. 76398). In median length exclusive of the rostrum, it measures about 40 mm., carapace 7, rostrum not quite 2. A large male, of which the anterior portion of the body and the raptorial claw is figured, measures about 35 mm., carapace 6.5, rostrum 1.5.

This species has been named for Captain Hancock's personally designed motor cruiser, the *Velero III*, the excellence of which has contributed so much to the success of the expeditions undertaken by Captain Hancock since the year of her launching, 1932.

*Description:* Of the *Pseudosquillas* perhaps an extreme form in the direction of flattened body, trianguliform rostral plate, transversely wide telson, and number of teeth on the raptorial dactylus.

Body depressed, flattened, with no suggestion of the subcylindrical form characterizing most of the *Pseudosquillas*. Greatest width of carapace little more than median length, exclusive of rostral plate, anterior

<sup>50</sup> Ann. Mag. Nat. Hist. (5), Vol. 5, No. 9, p. 113, 1880.

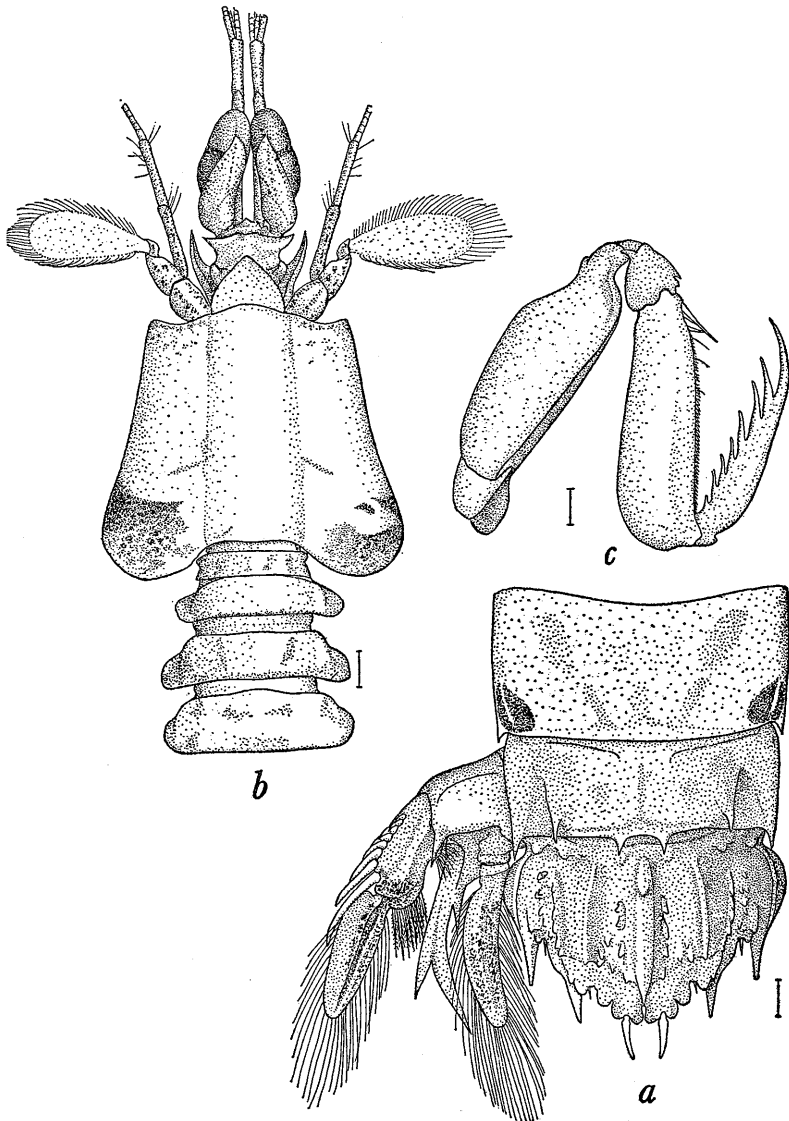


Fig. 17. *Pseudosquilla veleronis*, from Petatlan Bay, Mexico (Hancock Exped. Sta. 264-34, March 2, 1934). *a*. telson, left uropod, and last 2 abdominal somites of female holotype; *b*. anterior portion of male paratype; *c*. right raptorial claw of same.

width perhaps  $\frac{4}{5}$  the length (as drawn, fig. 17*a*, the posterior portion of the carapace has been spread out so that the greatest width of the posterior portion appears relatively greater than it actually is); anterolateral angles rounded; rostral plate triangular to subcordiform, wider than long, apically subacute and showing a slight keeling near the tip. The eyestalks appear more or less cylindrical because of great obliquity of cornea, which sits on the stalk at an angle of  $45^\circ$  or more.

Raptorial dactylus armed with from 7-8 teeth, including the terminal one; near the base of the external margin there is a well-marked, rounded tooth or lobe.

Posterolateral angles of 5th thoracic somite inconspicuous, more or less flattened and distally rounded; below there is a flattened, downwardly projecting lobe, or blunt process, either side which is situated below and more or less between the anterolateral and posterolateral angles of the somite, but not visible in dorsal view; lateral margins of 6th and 7th somites rounded.

Posterolateral angles of 5th and 6th abdominal somites produced into spines; posterior margin of 6th somite armed with a pair of submedian spines, but there are no evident submedian carinae; intermediate carinae low and rounded, each ending posteriorly in a sharp spine; above the lateral margin there is a low longitudinal swelling suggestive of a lateral carina—at any rate it converges with the lateral margin to end in the spined posterolateral angle of the somite.

The telson carries a strong, well-marked median carina with rounded crest ending in a short spine; either side and parallel to the median carina is a longitudinal row of low blunt teeth; above and a little distance back from (anterior to) the inner base of each intermediate tooth of the hind margin of the telson a bluntly crested carina runs forward, converging a little toward the proximal end of the median carina; posteriorly, each of these carinae ends in a small, low, rounded tubercle; inside each of these carinae and about in line with their posterior ends is a second little rounded tubercle, anterior to which there may be another smaller and more pointed, though still blunt, one. In a slight outwardly bowed line running from the intermediate spine of the 6th abdominal somite to the intermediate tooth of the hinder margin of the telson is a fairly sharply ridged, but, at irregular intervals, nodulated or blunt-toothed carina, the hinder portion of which may be discontinuous; this posterior portion ends behind in a blunt tooth; between the anterior end of each of these carinae proper and nearer the anterior margin of the telson than the end of the

carina is a distinct, though blunt and rounded, beadlike tubercle. More or less paralleling each of the foregoing carinae along their respective outer sides and turning in toward their posterior ends is a row of individual or separate rounded beadlike tubercles which decrease in size and prominence from the most anterior to the posterior one. In this row there may be from 2 to 5 or more little tubercles. They may be considered as representing a carina, which, however, is not otherwise in evidence; some of these tubercles are paired or twinned laterally. More or less in line with and above and before the lobule, which is itself more or less swollen or tuberculiform, at the inner side of the base of the lateral tooth is a short, low, blunt carina about half as long as the free portion of the lateral tooth of the telson. This carina has a tuberculiform posterior extremity about the size of, or a little larger than, the lobule behind it on the margin of the telson. Beneath, the telson is smooth.

The basal prolongation or process of the uropods is composed of 3 more or less slender, sharp spines, of which the middle one is much the strongest and longest, being 2 or more times as long as the outermost spine, which, in turn, is stouter than, but not as long as, the innermost of the 3. This last-mentioned spine is placed high up on the inner margin of the basal process.

*Color:* There is a light, more or less symmetrical pattern of chromatophores over the carapace and abdomen. Near the posterolateral angles of the carapace in some specimens (usually males) there is a darker patch. In all specimens there is a distinctive and characteristic black, subcircular eyespot with a light-colored longitudinal band through the middle ornamenting the dorsum of each posterolateral angle of the 6th abdominal somite. In only one specimen, a male of average size, is there a second pair of black spots, more or less triangular in this instance, on the abdomen, placed one to each side of the first abdominal somite at its posterior margin and just above its epimeral portion. In this specimen, too, the posterior pair of black eyespots are more nearly elongate rectangular, with rounded corners, than roughly subcircular as in the other specimens. The inner, longitudinal  $\frac{2}{3}$  of the distal joint of the exopod of the uropods is dark colored, as is also the distal, transverse 4th or 5th of the preceding joint; the distal  $\frac{2}{3}$  of the terminal joint or blade of the endopod is also dark colored, while on the telson proper there is a small patch of dark color laterally near the base of each lateral spine, and also a similarly colored area before the base of each of the pairs of movable submedian spines either side of the median carina and fading out anteriorly just past the middle of the length of the telson.

*Remarks:* The species here described as a representative of the genus *Pseudosquilla* certainly is properly accredited to this genus on the basis of the character of the telson alone, irrespective of the number of teeth on the raptorial dactylus. In character, the telson of our species shows some resemblance to *Pseudosquilla pilaensis* de Man<sup>51</sup> from the Indo-Pacific, which is the only *Pseudosquilla* heretofore known with more than 3 teeth on the raptorial dactylus, counting the terminal one.

The body of *P. veleronis* is very much flattened like many of the *Lysiosquillas*, yet, in contradistinction to them, exhibits no trace whatsoever of even one soft papilla on the ventral surface of the antennal protopodite. At least one papilla in this position is probably to be found in the adult of every species of *Lysiosquilla*.

In addition to the 5 species of *Lysiosquilla* already examined by Kemp for these papillae, I have observed their presence in ten other species of *Lysiosquilla*.<sup>52</sup>

*L. armata* Smith  
*L. biniensis* Bigelow  
*L. digueti* Coutière  
*L. eusebia* (Risso)  
*L. excavatrix* Brooks

*L. glabriscula* (Lamarck)  
*L. latifrons* de Haan  
*L. mccullochae* Schmitt  
*L. polydactyla* von Martens  
*L. scabricauda* (Lamarck)

<sup>51</sup> Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 105, 1913. Schmitt, Lingnan Sci. Jour., Vol. 8, p. 140, pl. 19, figs. 12-14, 1929.

<sup>52</sup> See also under Genus *Lysiosquilla*, page 184.

Genus **HEMISQUILLA** Hansen, 1895<sup>53</sup>

The genus comprises at least 2 species, *H. stylifera* (M.-Edw.), 1837, described from the coast of Chile, and *H. braziliensis* (Moreira), 1905, from the coast of Brazil. The substitution of the name of *bigelowi* Rathbun, 1910, for *stylifera* M.-Edw. because of conflict with *stylifera* Lamarck, 1818 [= *Pseudosquilla ciliata* (Fabr.), 1787] within the genus *Pseudosquilla* needs no longer to be taken into account, since the first-named *stylifera* is now the type of *Hemisquilla*.

Although the Hemisquillas from Australia, California, and the west coast of South America are so very much alike in practically all particulars, as Kemp says, "it is not improbable that distinct races of [*H.*] *stylifera* exist on the coasts of Australia and America, but this cannot be established with any certainty without the examination of large numbers of specimens from the two localities."

I am inclined to believe that the difference in the number of lobes in the interval between the submedian and intermediate teeth is of more significance than may seem justified at present. Despite the fact that the number of lobes in this position was not mentioned by Whitelegge<sup>54</sup> in commenting upon the 3 specimens he had from 28-40 fathoms from Newcastle Bight, New South Wales, it is known that the specimens from the west coast of America do differ from certain Australian ones in the manner figured by Kemp for one of his two specimens of *stylifera* from Disaster Bay, Victoria.

Kemp's Australian specimens have 2 rounded lobes between the submedian and intermediate spines of the telson, while his specimen from Coquimbo, together with Miers'<sup>55</sup> from the same place, and his additional one from Chile without more specific designation, like Milne-Edwards'<sup>56</sup> figured one, have but one lobe between the submedian and intermediate spines. This is also true of the specimen Bigelow had from San Pedro, and one in the National Collections from "southern California."

*H. braziliensis* (Moreira)<sup>57</sup> from the east coast has also but a single

<sup>53</sup> Hansen, *Ergebn. Plankton Exped.*, Vol. 2 [Pt.] G. c., p. 72, 1895, type *H. stylifera* (M.-Edw.). Kemp and Chopra, *Rec. Indian Mus.*, Vol. 22, Pt. 4, No. 22, p. 307, 1921.

<sup>54</sup> *Mem. Australian Mus.*, Vol. 4, No. 2, p. 198, 1900.

<sup>55</sup> *Ann. Mag. Nat. Hist.* (5), Vol. 5, p. 112, 1880.

<sup>56</sup> *Hist. Nat. Crust.*, Vol. 2, p. 530, pl. 27, figs. 9-14, 1837.

<sup>57</sup> Lavoura, *Bol. Soc. Nac. Agri. Brasileira*, Vol. 7, Nos. 1-3, p. 60, 1903 [p. 5 in reprint with 2 text figures]; *Arch. Mus. Nac. Rio de Janeiro*, Vol. 13, p. 5, pls. 1, 2, 1906 [1905].



lobe in the same position, but this lobe is armed with a small spine or well-developed spinule upon its "postero-distal" angle; another such spinule on a small lobular swelling or base is situated in the sinus between the intermediate lobe and the intermediate spine, and still another of approximately the same size and conformation intervenes between the intermediate and lateral spine of the margin of the telson. In the positions corresponding to the last 2 spinules named, the telson of the west American and Australian *stylifera* has a tiny unarmed and dorsally well-nigh inconspicuous swelling or lobule; in these Pacific forms, also, the intermediate lobes are posteriorly unarmed, without spines or spinules.

Kemp's remarks on the segmentation of the mandibular palp of his specimens are also of interest. His Chilean specimen has mandibular palps composed of 3 segments, his Australian specimens, of but 2. No doubt the right and left palp of each specimen was examined. Yet in our one specimen from southern California the palp of the left side is composed of 2 segments and the one on the right of 3. The reverse of this count occurs in the male cotype of *H. braziliensis*, the female has both palps 3-segmented, while the 3rd specimen of the species at hand, a male from Ilha Rosa, Rio de Janeiro, has palps of only 2 segments each. This variation in the number of segments in the mandibular palps of even the one species may be rather the exception among stomatopods, but, nevertheless, in the genus *Hemisquilla* it renders the palp unavailable for specific characterization.

### ***Hemisquilla stylifera* (H. Milne-Edwards)**

*Gonodactylus styliferus* H. Milne-Edwards, Hist. Nat. Crust., Vol. 2, p. 330, pl. 27, figs. 9-14, 1837. Porter, Revista Chilena Hist. Nat., Vol. 7, No. 5-6, p. 274, 1903.

*Pseudosquilla bigelowi* Rathbun, Proc. U.S. Nat. Mus., Vol. 38, No. 1766, p. 608, 1910.

*Pseudosquilla stylifera* Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 106, one text fig., pl. 7, figs. 84-85, 1913, and synonymy.

*Pseudosquilla bigelowi* Hilton, Jour. Ent. Zool., Pomona College, Vol. 7, No. 2, p. 77, text figs., 1915; and Third Rept. Laguna Mar. Lab., Pomona Coll., Art. 20, text and figure as in the Journal for November, 1915.

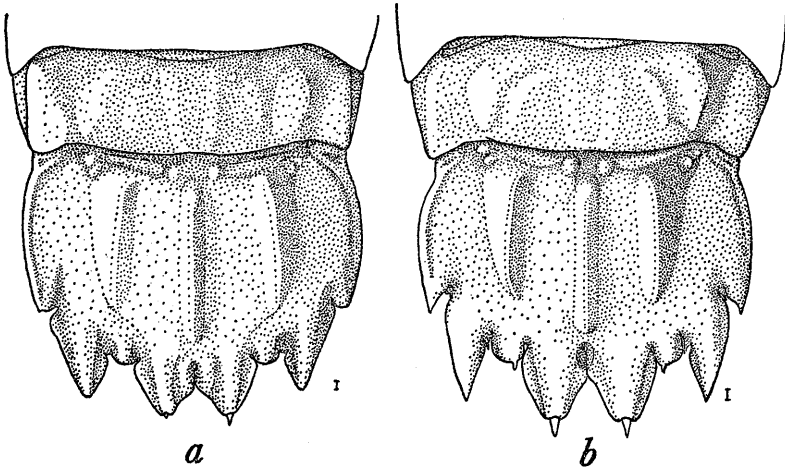


Fig. 18. *a. Hemisquilla stylifera*, male from southern California, telson, and last abdominal somite; *b. H. braziliensis* from Ilha Rosa, Estado Rio de Janeiro, Brazil, telson and last abdominal somite.

*Distribution:* As summarized by Kemp, this species "has been recorded from Chili (Milne-Edwards, Nicolet, Miers), from California (Bigelow, Holmes), from the Hawaiian Islands (Randall),<sup>58</sup> and from Newcastle Bight, New South Wales (Whitelegge). It is strange that the species has not been found on the New Zealand coast." It has also been recorded from Juan Fernandez (Porter).

<sup>58</sup> Balss believes (Bronns Klassen und Ordnungen des Tierreichs, Vol. 5, Abt. 1, Book 6, Pt. 2, Stomatopoda, p. 138, 1938) that this old record of Randall's, still uncorroborated, is based on a mistaken identification of *P. ciliata*, common in the Islands.

Genus **LYSIOSQUILLA** Dana, 1852

The genus has been fully defined by Kemp. With regard to the soft elongated papillae found on the antennal protopodite, Kemp remarks that they are found perhaps in all species of the genus. He says, "These are well developed in *L. maculata* and are three in number, one situated antero-dorsally and curved backwards and inwards towards the rostrum and two on the ventral surface at the base of the endopod, a long one directed forwards and a much shorter one pointing backwards. In *L. acanthocarpus*, *L. multifasciata*, *L. spinosa*, and *L. insignis* only one of these processes is found placed on the ventral surface and pointing outwards or backwards." To this list of species having just one of these processes ventrally placed may be added *L. biminiensis* Bigelow and *L. digueti* Coutière, which have the process long and slender, and *L. latifrons* de Haan, in which the process is short and really papillalike. *L. excavatrix* Brooks seems to have at least one small papillalike process below; the larger of the 2 small specimens which I have had available for examination is in very poor condition, while the smaller one is too young apparently to have developed the papilla. *L. decemspinosa* Rathbun, of which there are several specimens in the National Collections, is perhaps a juvenile or late larval form, all of the specimens are quite small, and I have not been able to discover any papillalike structures in any of them. *L. polydactyla* von Martens has 2 papillalike processes below.

Three species may be placed alongside *L. maculata* in possessing 3 elongated papillae more or less comparably placed: *L. glabriscula* (Lamarck), *L. scabricauda* (Lamarck), and *L. armata* Smith.

Two other species, *L. eusebia* (Risso) and *L. mccullochae*, described below have 4 processes, 2 below, of which the anterior is the longer, and 2 on the inner margin of the protopodite, both inclined obliquely forward and visible from above as well as from below.

In *Lysiosquilla* the inner ramus of the 6th, 7th, and 8th thoracic limbs seems always to be composed of 2 segments; in *Pseudosquilla* it may be composed of one or of two segments (see *Pseudosquilla*, p. 170).

In *Lysiosquilla* the size, number, and arrangement of the marginal spines or teeth and the spinules or denticles between them when these are present<sup>59</sup> vary to such an extent that it is difficult to find a formula that would clearly express the number and relationship of the various elements

<sup>59</sup> In *Lysiosquillas* of the second type of Kemp (Mem. Indian Mus., Vol. 13, No. 4, p. 109, 1913).

constituting the marginal or submarginal armature of the telson. Therefore, in the key to species below, the count of the submedian denticles on only one side of the median notch is given.

Key to the Species of *Lysiosquilla* Known from the Pacific Coast of America

A<sup>1</sup>. Telson without a transverse row of posteriorly directed dorsal spines above or anterior to posterior margin.

Shorter ramus of 6th and 7th thoracic limbs linear.

B<sup>1</sup>. Telson armed above near posterior margin with a pair of subconical blunt tubercles or low teeth, one either side of a low, short, flattened, median tonguelike projection; telson itself convex.

Eyes large, stalk somewhat subtriangular, cornea not noticeably bilobed, but median band is well marked. Rostral plate elongate triangular, longer than broad at the base, anterolateral margins lightly convex. Raptorial dactylus armed with about 18-20 teeth, including the terminal one. Submedian denticles 12-13. . . *polydactyla*, p. 187

B<sup>2</sup>. Telson unarmed above, without prominent processes, tubercles, or teeth on upper surface.

C<sup>1</sup>. Dorsum of telson smooth, very convex, inflated to the extent that the true posterior margin of the telson and the spinules arming it, except sometimes their extreme tips, are concealed from dorsal view.

Eyestalks more or less cylindrical, cornea subglobular. Rostral plate transversely quadrangular oblong, about 5/6 as long on median line as wide, median point a moderately produced acute triangular spine or tooth, anterolateral angles a little produced, almost rectangular, anterior margin slightly excavate or concave either side of median projection. Raptorial dactylus with 11 teeth, including the terminal one. Submedian denticles 9. . . . . *decemspinosa*, p. 189

C<sup>2</sup>. Dorsum of telson more or less flattened, only moderately convex in either direction, marginal spines or teeth not concealed, plainly visible in dorsal view.

Eyestalks subtriangular, cornea with transverse axis much greater than longitudinal axis of stalk extended across cornea; cornea bilobed and noticeably overhanging lateral margins of stalk.

Rostral plate cordiform, not longer than broad. Submedian spinules or denticles comparable to those of the preceding species or *L. mccullochae*, below, wanting.

- D<sup>1</sup>. Surface of telson smooth and punctate; median area only slightly raised above general surface; of the marginal spines or teeth only the lateral pair is ever acute, submedians and intermediates often no more than low lobes; no denticles; hind margin entire except for shallow median notch.

Posterior margins of 5th and 6th abdominal somites smooth, unarmed. Rostral plate not longer than greatest width, sometimes shorter. Raptorial dactylus armed with 9-17, usually 10, teeth, including the terminal one; female dactylus exhibits secondary sexual characters. . . . . *maculata*, p. 190

- D<sup>2</sup>. Upper surface of telson roughened, scabrous, tuberculated, or even spiny to some extent; median area somewhat raised posteriorly to form a low, broad, blunt elevation or tooth conforming with backward slope of telson; 6 pairs of marginal spines or teeth well developed, subacute to spiniform; submedian denticles well marked, though broad, and more or less coalesced.

Posterior margins of 5th and 6th abdominal somites spinulated. [Rostral plate, if like *scabricauda* (Lamarck), about  $\frac{2}{3}$  as long as greatest breadth.] Raptorial dactylus armed with 11 teeth, counting the terminal one. . . . . *desaussurei*, p. 193

- A<sup>2</sup>. Telson with a transverse row of dorsal spines in addition to those of posterior margin.

Ultimate segment of shorter ramus of 6th if not 7th thoracic limb more or less broadly ovate. Submedian spines of telson movable.

- B<sup>1</sup>. Five more or less subequal and equidistant dorsal spines in transverse row on telson.

Telson rather evenly convex before transverse row of spines. Rostral plate more or less squarish-rectangular, median projection and anterolateral angles each produced to form a prominent acute spine, the 3 spines more or less subequal. Eystalks more or less cylindrical, cornea subglobular. Raptorial dactylus with 8 teeth, counting terminal one. Submedian denticles 3. . . . . *diguetti*, p. 194

- B<sup>2</sup>. At least 9 dorsal spines in transverse row on telson.

Raised median area of telson obscurely tricarinate, each carina ending in a simple acute spine; next dorsal carina either side ending

posteriorly in 3 small spines; next 2 carinae in order ending in simple posterior spine. Rostral plate broadly cordiform, more or less subrectangular, median projection broadly triangular, acute; anterolateral angles broadly rounded, median length about  $\frac{3}{4}$  greatest width. Eystalks flattened cylindrical to subtriangular; cornea bilobed and set more or less transversely on stalk. Raptorial dactylus with 4 teeth, including terminal one. Submedian denticles 8-9. . . . .  
 . . . . . *mccullochae*, p. 197

### ***Lysiosquilla polydactyla* von Martens**

*Lysiosquilla polydactyla* von Martens, Sitzb. Ges. naturf. Fr. Berlin, p. 92, 1881. Bigelow, Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 504, 1894 [in key only]. Doflein and Balss, Mitt. Nat. Hist. Mus. Hamburg, Vol. 29, p. 40, 1912. Kemp, Mem. Indian Mus., Vol. 4, No. 1, 1913, p. 203 [listed only].

*Distribution:* Very few specimens of this species have ever come to light and those only with not altogether certain locality data. The unique type was found unlabeled among a lot of material consisting of well-known Peruvian and Chilean species, while the 3 listed by Doflein and Balss were included in a collection made by the late Dr. Fredrico T[eobaldo] Delfin in Chilean waters, and are believed quite certainly to have been secured in Orange Bay, Hoste Island, south of Tierra del Fuego.

*Size:* The length of the type from tip of rostral projection is about 95 mm., carapace 21. The Doflein and Balss specimens are all three males. Measured on the median line, exclusive of rostral plate, they are approximately as follows: 63 mm. long, carapace 11.2, rostrum 4; 69.5 mm. long, carapace 12.2, rostrum 4; 69.5 mm. long, carapace 12.4, rostrum 4.5; this last is the specimen figured here.

*Remarks:* Through the exceeding kindness of Dr. A. Panning, Custodian of the Hamburg Museum, I have been enabled to examine the 3 specimens recorded by Doflein and Balss.

In general appearance and coloration, *L. polydactyla* resembles *L. maculata* and *L. scabricauda*, but nevertheless is somewhat intermediate between these forms with dorsally unarmed telson and those that carry a transverse row of dorsal spines, inasmuch as the submedian spines of the telson are movable. The median raised area of the telson of *L. polydactyla* ends in a broad tonguelike projection, while the single, flattened, obsolescent carina either side ends in a small, blunt, tuberculiform tooth. In large specimens of *L. scabricauda*, at least occasionally behind the median

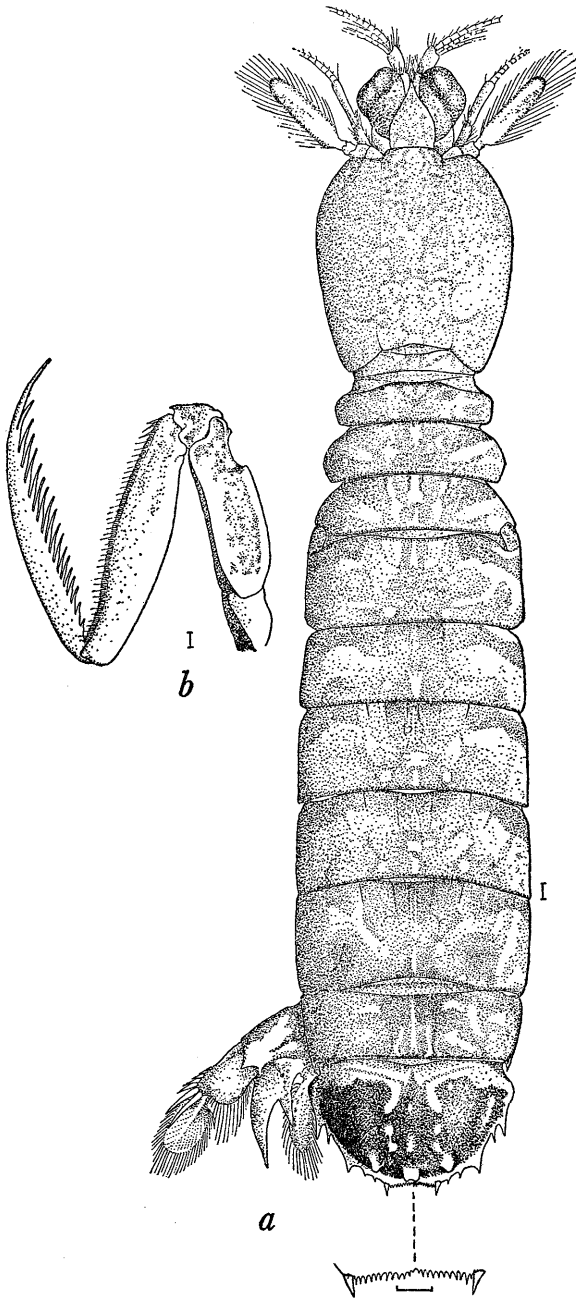


Fig. 19. *Lysiosquilla polydactyla*, male, probable origin: Orange Bay, Hoste Island, south of Tierra del Fuego. *a*. dorsal view; *b*. raptorial dactylus, magnification not noted, indication given with figure is tentative only.

raised area, there may be found a single low tubercle in advance of the median notch; otherwise, the scattered small tuberculi on the dorsal surface of the telson are its only armature that in no way are analogous to or represent the transverse row of spines carried in the *Lysiosquillas* having dorsal spines on the telson. In *L. maculata* behind the scarcely elevated median area there may be a small low swelling, but this in no sense is tuberclelike.

*L. polydactyla* has very short, stout, and somewhat curved, but nevertheless movable, submedian teeth or spines on the posterior margin of the telson; the intermediate and lateral teeth are somewhat smaller. Between the submedian and lateral teeth either side are 2 tiny and widely spaced denticles or rather spinules which arise from the under side of the telson; a single one occurs between the lateral and submedian, while the number of tiny spiniform denticles on either moiety of the posterior margin between the movable submedian teeth is 12-13. Beneath, the telson is smooth and unarmed.

The ventral bifurcate process of the uropods of *L. polydactyla* is composed of 2 stout flattened spines, of which the outer is much stronger and broader and fully  $\frac{2}{3}$  longer than the inner one.

### *Lysiosquilla decemspinosa* Rathbun

*Lysiosquilla decemspinosa* Rathbun, Proc. U.S. Nat. Mus., Vol. 38, No. 1766, p. 566, pl. 53, fig. 3, 1910. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 203, 1913 [listed only].

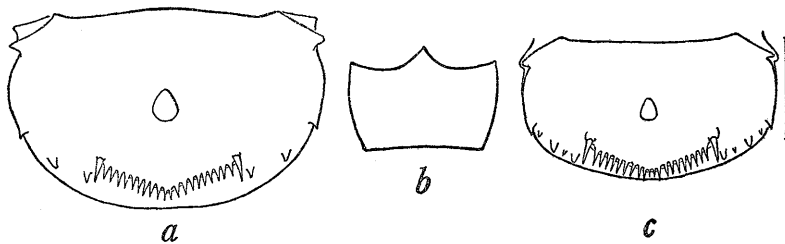


Fig. 20. *Lysiosquilla decemspinosa*. a. ventral view of type female from Capon, Peru; b. rostral plate of same; c. ventral view of telson, male, from Playa Blancas, Costa Rica (Hancock Exped. Sta. 460-35, February 8, 1935) (*a*, *b*, and *c* magnified alike).



*Distribution:* Originally described from Capon, Peru, where the 4 specimens of the type lot were collected from vertical holes in muddy sand of the inside beach at Capon, January 30, 1908, by Dr. R. E. Coker, at that time fishery expert to the Peruvian government. The species has since been taken at the island of San Lucas, Gulf of Nicoya, Costa Rica, by M. Valerio, January 15, 1930; and again at Playa Blancas, Costa Rica, by the Hancock Expeditions, February 8, 1935.

*Size:* The type is about 24 mm. long, the specimen from the Gulf of Nicoya a few mm. shorter, while the one from Playa Blancas is smaller, measuring 18.2 mm. long exclusive of the incomplete rostral plate.

*Remarks:* From the appearance of the telson, I believe that this species may be founded on the first littoral stage of a *Lysiosquilla*.

The Playa Blancas specimen, regrettably, is mutilated. It lacks the greater part of its frontal appendages, the eyes and anterior portion of the rostral plate, and all but the most proximal portion of the antennal peduncles. The raptorial dactylus is armed with 11 teeth including the terminal one, as it is also in the type of the species, where the terminal one was not included in the original count on which the name of the species was based. This Playa Blancas specimen, although smaller than the type, has a small spiniform denticle intervening between each pair of the first 3 teeth or spines of the hinder margin of the telson counting from the lateral margin, as represented in the accompanying sketch of the underside of its telson. It is a male; the type is of the opposite sex; whether this fact or the relative age or development of the 2 specimens accounts for the difference in armature, I am unable to say.

### ***Lysiosquilla maculata* (Fabricius)**

*Lysiosquilla maculata* Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 111, pl. 8, figs. 86-91, 1913, and synonymy. Kemp, Philippine Jour. Sci., Vol. 10, No. 3, Sec. D, p. 174, 1915. Sunier, Contrib. Faune Indes Néerl., Vol. 1, fasc. 4, p. 72, fig. 4, 1918. Edmondson, Occas. Paps. Bishop Mus., Vol. 7, No. 13, p. 292, figs. 1c, 1d, 1921. Roxas and Estampador, Nat. App. Sci. Bull., Univ. Philippines, Vol. 1, No. 1, p. 110, 1930. Komai, Annot. Zool. Jap., Vol. 17, Nos. 3, 4, p. 269, 1938.

*Distribution:* A shallow-water species with "a wide Indo-Pacific distribution extending from Japan and Oceanica to South Africa"

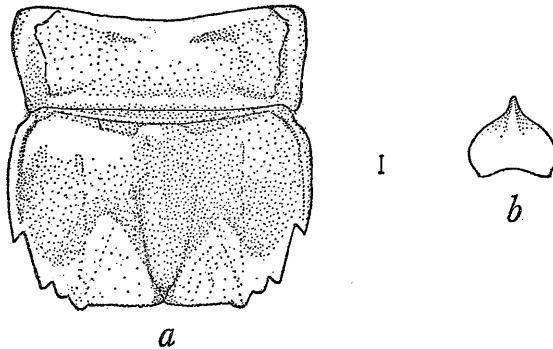


Fig. 21. *Lysiosquilla maculata*, female, from La Libertad, Ecuador (Hancock Exped. Sta. 17-33, January 20, 1933). *a*. telson and 6th abdominal somite; *b*. rostral plate (*a* and *b* magnified alike).

(Kemp); Atlantic (Stebbing [?]; and Monod as the var. *sulcistrotris* Kemp). Although not previously found east of the Marquesas or Hawaiian Islands, it is here recorded from La Libertad, Ecuador, where 2 specimens, male and female, were dipped from the surface by Mr. Fred Ziesenhenné while using an electric light off the ship's gangway, January 20, 1933 (Hancock Exped. Sta. 17-33).

The "foot long" specimen which Stebbing<sup>60</sup> received from Antigua, B.W.I., has all the earmarks of a large specimen of *L. scabricauda*, especially as regards the spinulation of the hind margin of the 5th abdominal somite, and both anterior and posterior margins of the 6th, in the marginal armature of the telson, and "in not having the rostral point produced." Whether the surface of the telson was scabrous or not is not mentioned. Some specimens of *L. scabricauda* have the surface of the 6th abdominal somite almost wholly smooth except for some low, not particularly conspicuous, granulations toward either posterior lateral portion of the dorsum, and the telson not conspicuously roughened, although granulated for a considerable part of its surface like posterior parts of the 6th somite; the median raised area of the telson is always smooth, even in otherwise very scabrous specimens of *scabricauda*. I am inclined to think that Stebbing's specimen is a rather smooth-telsoned specimen of *scabricauda* instead of one of *L. maculata*. The marginal spinulation of the 5th

<sup>60</sup> South African Crust., Part 2, p. 48, 1902.

and 6th abdominal somites and the short median point of the rostral plate are just as distinctly specific of *L. scabricauda* as the scabrous telson.

Monod,<sup>61</sup> however, is very definite about his record of the occurrence of *L. maculata* in the Atlantic off the west coast of Africa, in the form of the variety *sulcirostris* Kemp.<sup>62</sup> In all, I have seen 19 specimens from the Hawaiian Islands, Samoa, the South- and Indo-Pacific, and La Libertad, Ecuador, but never a specimen from Atlantic waters, from which the National Museum representation of crustacea is extensive.

*Size:* This species attains a considerable size. Roxas and Estampador record a Philippine specimen of 385 mm. (15.16 inches) in length. The specimens from La Libertad, Ecuador, are, exclusive of rostral plate, about 90 and 100 mm. long on the median line for the female and male, respectively.

*Remarks:* Both La Libertad specimens have 11 teeth on the raptorial dactylus, including the terminal one; the first or proximal tooth of each of the dactyls is very small and inconspicuous and, with increase in size and maturity, very likely disappears. The submedian portions of the hinder margin of the telson in these specimens are finely crenulate, scarcely denticulate. The dorsum of the telson is eroded or pitted in its hinder lateral portions, but the prominence of these markings varies; as Kemp has it, "on either side is a large oval patch of more or less regularly disposed pits which are in some cases scarcely visible, but usually are specially conspicuous in the neighborhood of the lateral and antero-lateral margins." Laterally, the dorsum of the 6th abdominal somite is somewhat wrinkled or shallowly sculptured, with a slight nodular swelling either side toward the posterolateral angles of the somite. In the female these swellings are a little better developed than in the male, the one on the left side even to the extent of forming a small, low, blunt, yet not very noticeable, tubercle.

Typical *maculata* will have from 9 to 11 (usually 10, very rarely 9) teeth on the raptorial dactylus. The specimen of least size in the National Collections is one of 114 mm. in median length and, like the Ecuadorian specimens, it has 11 dactylar teeth, but the submedian portion of the hind margin of the telson is smooth and entire. Any crenulation of the hinder margin is most likely due either to individual variation or to the degree of maturity attained by the specimen in question, rather than of varietal significance.

<sup>61</sup> Bull. Soc. Sci. Nat. Maroc, Vol. 5, No. 3, pp. 88, 91, 1925.

<sup>62</sup> Mem. Indian Mus., Vol. 4, No. 1, p. 116, pl. 8, figs. 92, 93, 1913.

**Lysiosquilla desaussurei** Stimpson

*Squilla scabricauda* de Saussure, Rev. Mag. Zool. (2), Vol. 5, No. 8, p. 367, 1853.

*Lysiosquilla desaussurei* Stimpson, Boston Jour. Nat. Hist., Vol. 6, p. 503, 1857. Miers, Ann. Mag. Nat. Hist. (5), Vol. 5, p. 8, 1880. Bigelow, Proc. U.S. Nat. Mus., Vol. 17, No. 1017, p. 504, 1894 [in key only]. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 203, 1913 [listed only].

*Distribution:* The species was based on a specimen from Mazatlan, Sinaloa, west coast of Mexico, and seems never to have been taken again.

*Size:* No measurements of the unique original specimen were ever published.

*Remarks:* This species, if distinct, is very close to *L. scabricauda*. It may not, after all, be different.

De Saussure, upon comparing the specimen which Stimpson later named for him with some individuals of *L. scabricauda* in the Paris Museum, remarked that the raptorial dactylus was armed with 11 teeth, including the terminal one, and not 8, as in the Paris material. This difference is not unlike that found between males and large, well-developed females of the Indo-Pacific species of *L. maculata*.<sup>63</sup> Here the males will have 9-11 (usually 10) teeth, including the terminal one, on the raptorial dactylus, while the mature females will show but 7-8 nicks along the inner margin, in addition to the terminal tooth. However, Miers (*loc. cit.*) has already remarked that there are no secondary sex differences in *L. scabricauda*. There is nothing especially different in the armature of the raptorial dactylus between the sexes; the teeth seem to be somewhat longer and stronger in well-developed males; the propodi, however, are relatively shorter in the females. The length of the carapace, exclusive of the rostrum, in the male is not more than  $\frac{2}{3}$  the length of the raptorial propodus, while in the female the length of the carapace is  $\frac{4}{5}$  that of the propodus or more. Stated another way, in well-developed males of *L. scabricauda* the length of the longitudinal axis of the raptorial propodus is as long as the carapace plus twice the length of the rostral plate, while in the female it is rarely longer than the carapace and rostrum taken together. When longer than this, the raptorial dactylus in the female does not exceed the length of the carapace plus, at most,  $1\frac{1}{3}$  times

<sup>63</sup> Kemp, Mem. Ind. Mus., Vol. 4, No. 1, p. 111, pl. 8, figs. 86-91, 1913, and synonymy.

the length of the rostral plate. In one large female of about 198 mm. in median length, exclusive of the rostrum, the raptorial propodus was shorter than the carapace exclusive of the rostrum. This specimen, by the way, had, including the terminal one, 8 teeth on the left raptorial dactylus and 13 on the right!

I have never seen or heard of a specimen of *L. scabricauda* from other than the east coast of America, from Florida to Brazil (except a small postlarval specimen from the surface of Vineyard Sound, Massachusetts). Balss<sup>64</sup> records its occurrence on the west coast of Africa at Toto Lome and mentions also São Thomé (Osorio) and Boutry (Guinea) (Herklots), this last, however, with the comment that he could not find this place on any chart. Thus, *L. desaussurei*, its Pacific analogue, apparently, for want of evidence to the contrary, must still be regarded as a distinct species, even though the evidence in its favor is meager. H. J. Hansen<sup>65</sup> believed *desaussurei* to be no more than a synonym of *L. scabricauda*. It seems strange that no specimens of either have ever been turned up somewhere on the Pacific coast of America.

#### *Lysiosquilla digueti* Coutière

*Lysiosquilla Digueti* Coutière, Bull. Soc. Philom. (9), Vol. 7, p. 174, figs. 1-7, 1905.

*Lysiosquilla digueti* Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 203, 1913 [listed only].

*Distribution:* The unique male type was collected by L. Diguët in the Bay of La Paz, Lower California. It was found living as a commensal in the burrow of a *Balanoglossus*, along with a polynoid worm, *Lepidasthenia digueti* Gravier.<sup>66</sup> The species apparently has never been seen again since the original discovery, until taken by the Hancock Expeditions, first in 1936, when a much broken, very immature male specimen, apparently in the so-called first littoral stage, was dredged on March 16 in Puerto Escondido, west side of the Gulf of California, 90 to 100 miles north of the type locality (Hancock Exped. Sta. 595-36); and again in 1938 on January 11, off San Jose Light, Guatemala, the first female specimen (Hancock Exped. Sta. 770-38).

<sup>64</sup> Crust. III: Stomatopoda, in Michaelsen, Beitr. Kennt. Merresfauna Westafrikas, Vol. 11, p. 51, 1916.

<sup>65</sup> Ergebn. Plankton Exped., Vol. 2, [Pt.] G. c., p. 79 [first paragraph], 1895.

<sup>66</sup> Bull. Soc. Philom. (9), Vol. 7, p. 160, 1905.

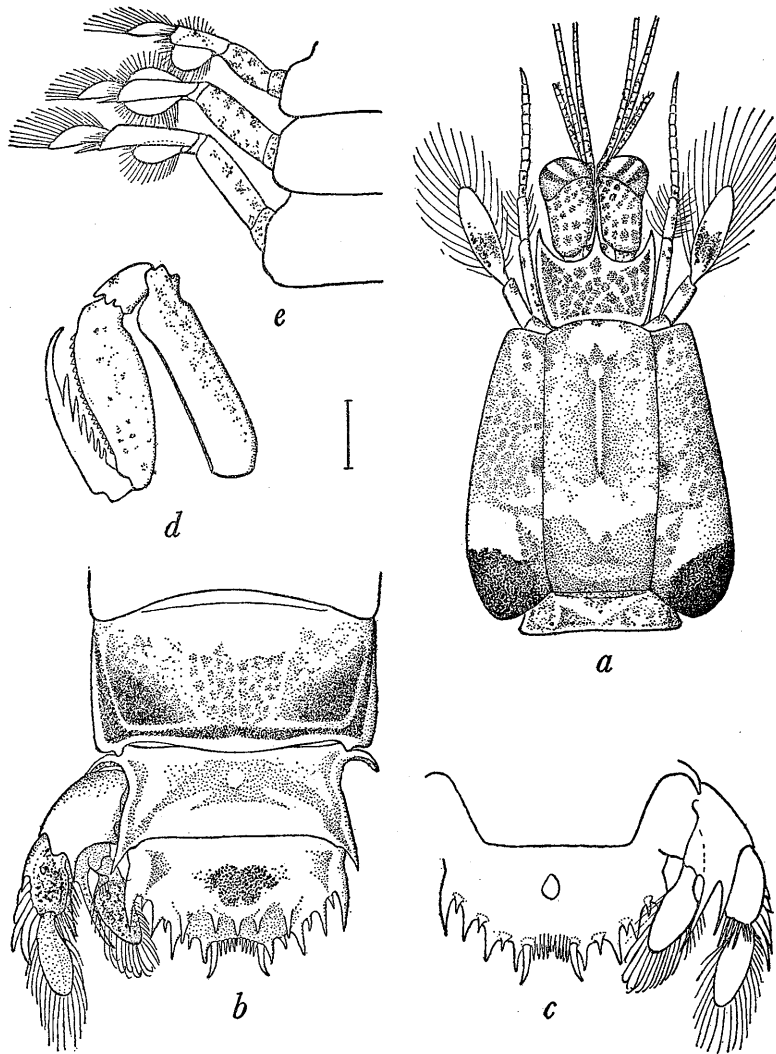


Fig. 22. *Lysiosquilla digueti*, female, from off San Jose Light, Guatemala (Hancock Exped. Sta. 770-38, January 11, 1938). *a.* anterior portion; *b.* posterior portion; *c.* ventral view of telson; *d.* left raptorial limb; *e.* last 3 thoracic limbs of left side.

In *a* the eyestalks, as compared with Coutière's representation of the type, seem to be a bit unnaturally extended, as their bases plainly show beyond the anterior margin of the rostral plate and as their corneae exceed the antennular peduncle; in the type and in the immature male from the Gulf of California the reverse is true.

This is the first indication that the species may be more widely distributed along the west coast of Mexico and Central America, from the Gulf of California at least as far south as Guatemala. As a result of its subterranean mode of life, the capture of any specimens not specifically sought for in *Balanoglossus* burrows must be very accidental.

*Color:* Coutière remarked that this *Lysiosquilla* was especially noteworthy because of the conspicuous similarity of its coloration to that of its co-commensal [*Lepidasthenia*], above whose elongated body it moves about in the *Balanoglossus* burrow in which it lives. The spots of pigment on the carapace, and particularly those of the 5th abdominal segment, imitate with great fidelity the elytrae of the polynoid in question.

*Size:* The type is 30 mm. long from the tip of the median rostral projection to the posterior extremity of the telson and is so far the largest known specimen. The broken male specimen from Puerto Escondido is a little over 20 mm. in length, rostral plate 1.1, carapace 3, abdomen and telson together 16.2 mm.; the female from Guatemala is very little larger than the juvenile male, yet the adult characters seem to be fully developed; it measures 23 mm. long, rostral plate 1.4, carapace 4, abdomen 15.7, telson 2.

*Remarks:* The female is very like the type in all particulars, and seems to differ from it only in certain minor details. All spines are sharper and more slender, especially those on the telson; also those arming the posterolateral angles of the 6th somite and the 3 rostral ones. The spines of the row of 5 spines across the dorsum of the telson above the posterior margin are more or less subequal; the median spine and those at either end of the row are about equal in size and a little stronger than the pair interposed between the outermost and median spines. There are 5 submedian denticles, or rather spinules, either side of the median line; of these 10 spinules, the median pair is less than half the size of the next adjacent pair. In the type of the species there are 3 submedian spinules either side of the median line, and the median pair, as figured, appears subequal in size to the next adjacent pair.

The dactyl of the left raptorial claw is armed with 7 spines including the terminal one, the right 6, whereas in Coutière's type, including the terminal spine, both right and left raptorial dactylus is armed with 8 spines.

The coloration of this specimen approximates that of the type very closely. The rostral plate and eyestalks are darker, being more thickly

crowded with chromatophores. The uropods have the terminal blade of the endopod well sprinkled with chromatophores, though well spaced and distinct; in the figured type these blades are without chromatophores. The dense black median area figured by Coutière is not much in evidence, although the telson has a medially placed dark patch of aggregated chromatophores. Not apparent in the type, the posterior median portion of each of the abdominal somites except the last carries a subrectangular patch of black chromatophores, in contact with the black posterior margin of each somite and extending forward from  $\frac{1}{2}$  to  $\frac{2}{3}$  the median length of the somite; before this squarish patch the middorsum of each somite is without color markings.

There are differences in the armature of the telson of the broken young male due to its immaturity. There are a greater number of low projections across the postdorsum of this specimen than there are spines in the corresponding area in the type and in the female, which is like the type in this respect. The submedian spinules of this "littoral stage" of the male between the movable submedian spines arising from the under side of the telson are 14 in number. In some ways this transverse row of submedian spines is reminiscent of that in *L. decemspinosa*, a stomatopod probably in the littoral stage. Aside from other differential characters, the two may at once be distinguished by the conformation and spination of their rostral plates. The raptorial claws of this juvenile male seem to be identical with those of the figured type. The lateral rostral teeth are slightly shorter than the median one. The shorter rami of the 7th thoracic legs are the most broadly oval, the 6th next in width, and the 8th the narrowest; in the type the shorter rami of the 8th pair of thoracic legs also appear to be the narrowest of the 3 pairs and the 7th broadly oval or subcircular.

### ***Lysiosquilla mccullochae*, new species**

*Distribution:* Known only from the unique female holotype dredged from a coralline algal bottom in 30 fathoms off San Francisco Island, Gulf of California, February 24, 1936 (Hancock Exped. Sta. 513-36).

*Size:* The type measures on the median line, exclusive of rostrum, about 32 mm., carapace 7, rostrum 1.9.

*Description:* Carapace smooth, anterolateral angles broadly rounded; the slight depressions at about  $\frac{2}{5}$  the length of the carapace from its



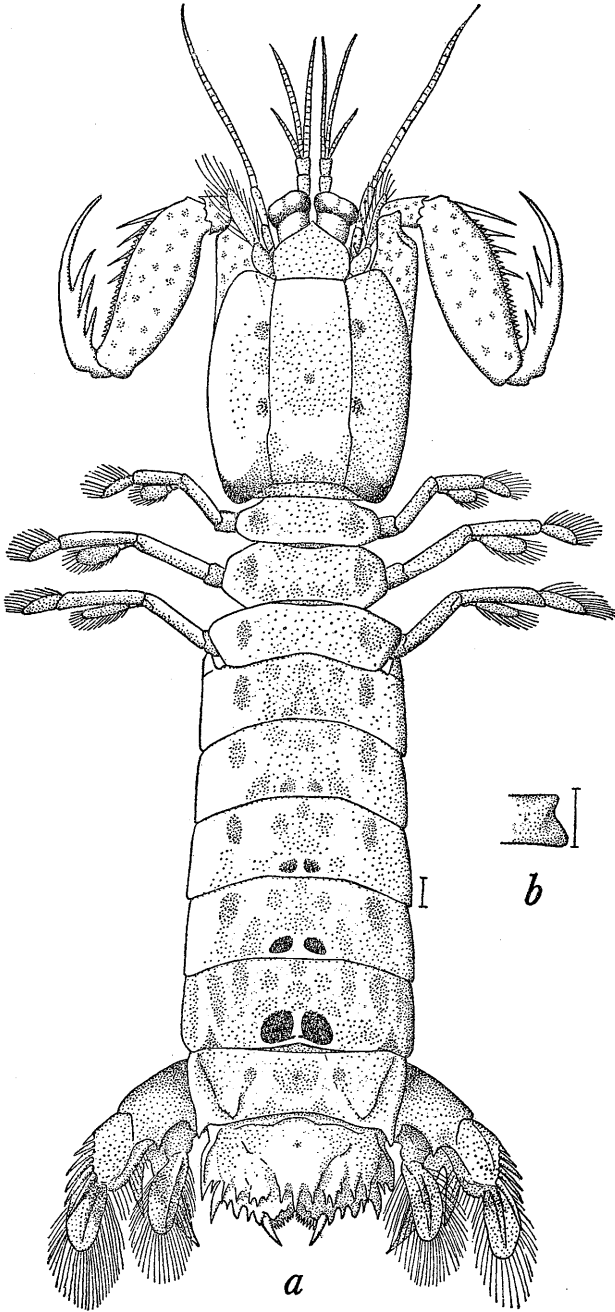


Fig. 23. *Lysiosquilla mcullocha*, female holotype, from 30 fathoms off San Francisco Island, Gulf of California (Hancock Exped. Sta. 513-36, February 24, 1936). *a*. dorsal view; *b*. right lateral margin of 5th thoracic somite in dorsal view.

posterior margin in the distinct gastric grooves are suggestive of indications of a cervical groove of which, however, there is no trace across the middorsum of the carapace. The cornea is large, wide, somewhat obscurely bilobed, and set more or less transversely on its stalk; its transverse axis is about as long as the visible portion of the median longitudinal axis of the stalk if continued across the cornea; the cornea overhangs the inner and outer borders of the stalk.

Median length of rostral plate about  $\frac{3}{4}$  its greatest width. Antennal peduncle and antennal scale each exceeding cornea and reaching about as far forward as the proximal border of the terminal segment of the antennular peduncle. Mandibular palp 3-segmented.

Upper border of the raptorial carpus not carinate, but dorsal margin terminates anteriorly in a more or less acute spine; on the inner side of the propodus below the pectinate margin are 4 movable spines, the first and longer 2 are near the carpal end, the somewhat shorter 3rd and 4th are situated at about the carpal ends of the pits in which the penultimate and antepenultimate dactylar teeth become concealed when the dactylus is tightly closed against the propodus. The dactylus is armed with 4 teeth, including the terminal one; at its base externally there are 2 lobes of which the first, or proximal one, forms almost a blunt right angle, the second is broadly rounded off. The chelae of the 3rd thoracic limbs are perhaps  $\frac{2}{3}$  the size of the 4th, while those of the 5th pair are scarcely  $\frac{1}{4}$  the size of the 3rd pair.

In dorsal view, the lateral margin of the 5th thoracic somite is plainly bilobed; the lobe at the anterolateral angle appears almost tuberculiform, while the posterolateral angle, on the other hand, is seemingly drawn out to a blunt point directed laterally downward; the margin of the 6th and 7th somites laterally are squared off. The distalmost of the 2 joints of the shorter ramus of the 5th and 6th pairs of thoracic feet is somewhat broadly ovate, the 6th more so than the 5th, while the 7th is more linear, yet bladelike, though parallel sided.

The abdominal somites are all dorsally smooth, with posterolateral angles rounded, except the 6th, which has the posterolateral angles each armed with a sharp spine, and the dorsal surface obsolescently, very shallowly and broadly corrugated longitudinally, most noticeable in the longitudinal depression near each raised-up lateral margin. There is a second, less noticeable pair of depressions, one on each side separated from its deeper corresponding lateral depression by a low, blunt, more or less longitudinal swelling.

The telson is a little more than twice as wide as long. Its dorsal surface is bluntly and obscurely carinated, showing 9 low ridges in groups of 3; a median group of 3 forming a flat subtriangular area, with a more laterally disposed group of 3 either side. The carinae of each group are provided each with a sharp posterior spine of which the longest and most prominent terminates the median carina of the telson; the first, or innermost, low broad carina of the right lateral group of three is itself broad and low and posteriorly trispinose; it is separated either side from the adjacent spines of this transverse series of spines on the dorsum of the telson by a shallow groove or depression, as are, on either side of the telson, the 2 outermost spines from each other by an even less well-marked and shorter groove. The lateral margin of the telson is a bit thickened and entire, ending posteriorly in a stout lateral tooth<sup>67</sup> or spine; one spiniform denticle removed from the lateral tooth is a stout intermediate tooth or spine, the largest and longest of the marginal teeth or spines; one denticle more and there is another spine or tooth several times larger and stouter than the spinous denticle immediately preceding; next in order on the posterior margin, moving toward the median line, are 2 more teeth or denticles, of which the more medially placed one is just external to the long, slender, movable submedian spine; on the inner side of the submedian spine is another spine or denticle, one of 9 arming the left moiety of the median notch, on the right side the corresponding spine is one of 8. Above and to the inside of the base of each submedian spine is a tubercleform swelling, carrying 2 little tuberclelike teeth or projections; the outermost of these tuberclelike teeth is the larger in each case and is itself more or less bidentate. Beneath, the telson is unarmed.

The bifurcate basal process of the uropods is formed of 2 stout, flattened spines, of which the inner is the thicker, being dorsally keeled along its inner margin; it exceeds the outer spine by nearly  $\frac{1}{3}$  of its own length. The outer margin of the basal segment of the exopod is furnished with 6 movable spines; the upper surface of the peduncular segment is flattened and carinated along its anterior or outer edge, as well as its posterior or inner edge of this flattened upper surface; the posterior carina ends distally in a short, subacute, possibly acute spine.

*Color:* Black markings disposed much as indicated in the accompanying figure.

<sup>67</sup> According to Kemp's most useful and convenient system of nomenclature, adhered to in this paper in most instances.

*Remarks:* In some respects this species seems to resemble *L. latifrons* (de Haan)<sup>68</sup> which, however, has a long median spine tipping the rostral plate and which, in a specimen from Nagasaki, Japan, which I have examined, has a wide, more or less evenly rounded convex arc of denticles between the movable submedian spines; this arc carries about 11 teeth to the right of a not very conspicuous median notch and 12 to the left of it; there are 4 denticles between the intermediate and submedian spines, of which one is the spine immediately adjacent to the movable submedian spine; a single denticle intervenes between the lateral and intermediate marginal teeth or spines of the telson. Beneath, the telson of *L. latifrons* has a strong, keeled, and backwardly directed spine behind the anal papilla. On the dorsal surface of the telson of *L. latifrons* the posteriorly trispinose median area is more raised and more plane than in *L. mccullochae*; to either side of the median area there are only 2 low rounded carinae, each posteriorly drawn out into a stout spine; there is also a blunt-pointed tubercle either side of the telson near its proximal margin about in line with the intermediate tooth or spine of the posterior margin. The raptorial dactylus of *L. latifrons* is armed with 6 teeth, including the terminal one.

<sup>68</sup> In von Siebold's Fauna Japonica, Crust., atlas, pl. 51, fig. 3, text, p. 222, 1894. Miers (as *L. latifrons*), Ann. Mag. Nat. Hist. (5), Vol. 5, p. 25, 1880; (as *L. brazieri*), pp. 11, 125, pl. 1, figs. 3-6. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 128, 1913.

Genus **CORONIDA** Brooks, 1886  
**Coronida bradyi** (A. Milne-Edwards)

*Squilla bradyi* A. Milne-Edwards in De Folin and Périer, Fonds de la Mer, Vol. 1, Crust., p. 137, pl. 17, fig. 11, 1869.

*Coronida bradyi* Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 204, 1913, and synonymy [listed only]. Gravier, Bull. Mus. Paris, 1920, p. 115; Stomatopodes, Expéd. Sci. du "Travailleur" et du "Talisman," 1880-1883, (separate), p. 32, pl. 1, figs. 1-9, 1927.

*Distribution:* Since *Coronida bradyi* was first reported by A. Milne-Edwards from the Bay of St. Vincent, Cape Verde Islands, in 1869, no additional material had ever been noticed in literature until 1920, when Gravier described 3 specimens that had been taken by the *Talisman* in 1883, also at the Island of St. Vincent from a depth of 20 meters. He also mentioned 3 other specimens in the collections of the Paris Museum, which had been examined and determined by H. J. Hansen;<sup>69</sup> 2 from the Cape Verde Islands, and one from the island of Annobon (Anno Bom), Gulf of Guinea.

Until now, all records have been from Atlantic waters, but, as a result of the Pacific explorations sponsored by Captain Hancock, the species seems to be not uncommon in the Galapagos Islands where we dredged it off Tagus Cove, north of Charles Island, and off James Bay, James Island, in depths varying from 8 to 70 fathoms, during the month of January, 1934.

A very similar distribution is reported for the hydroid, *Streptocaulus pulcherrimus* Allman, by Dr. C. McLean Fraser in "Distribution of the Hydroids in the Collections of the Allan Hancock Expeditions."<sup>70</sup> This animal, which was originally described from the Cape Verde Islands, was discovered by Dr. Fraser in the vicinity of both Hood and Barrington Islands in the Galapagos.

*Size:* All of the specimens are small, some indeed very small, yet the largest, a female measuring 46 mm. in median length exclusive of the rostral plate and spines on the posterior border of the telson, carapace 8, rostrum about 2.1 mm., is considerably larger than the largest *Talisman* specimen recorded by Gravier, which measured 31 mm. over all, "anterior margin of rostrum to posterior extremity of telson." This is the specimen upon which Milne-Edwards' original description was based.

<sup>69</sup> *Ergebn. Plankton Exped.*, Vol. 2, [Pt.] G. c., p. 83 [third paragraph], 1895.

<sup>70</sup> *Allan Hancock Pacific Expeditions*, Vol. 4, No. 4, p. 170, 1939.

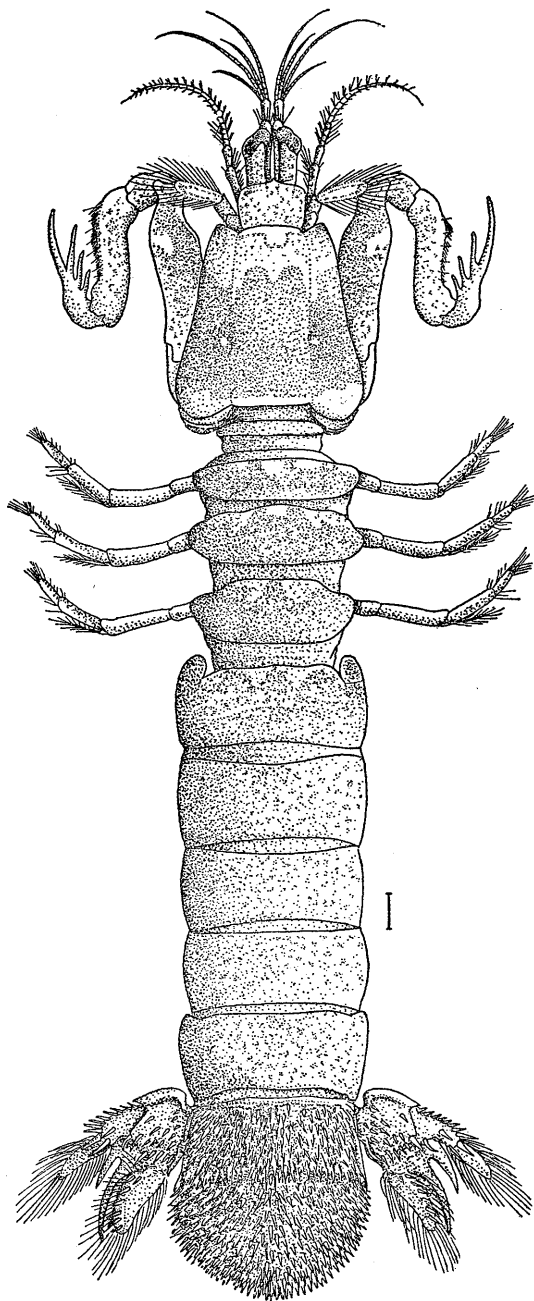


Fig. 24. *Coronida bradyi*, female, from off Tagus Cove, Albarmarle Island, Galapagos (Hancock Exped. Sta. 148-34, January 13, 1934), dorsal view.

The figure has the eyestalks too slender, and the carapace is a little too narrow. The 3 posterior pairs of thoracic legs are stouter, and the abdomen tapers more anteriorly than shown; in the figure the epinera of the first abdominal somite have been turned outward to show their articulated anterolateral lobes.

*Remarks:* The species has been refigured and redescribed by Gravier, who also points out significant differences between it and the closely allied *C. trachura* (von Martens) from the Indo-Pacific. Through the kindness of Dr. Louis Fage, of the Paris Museum, a female specimen from off Tagus Cove was compared with Milne-Edwards' type and found to be specifically identical.

In view of the notable extension of range, in fact, unexpected occurrence of the species in Pacific waters, I have undertaken to contribute a few descriptive remarks on the largest female specimen:

Carapace smooth; gastric grooves well marked; at the end of proximal fifth of length of carapace the gastric grooves are slightly drawn together a little in advance of the faint indication of the cervical groove which does not, however, cross the middorsum of the carapace. Rostral plate subrectangular, about  $1\frac{1}{2}$  times as wide as long on median line, with small median, subacute, triangular projection. Our specimens differ from Gravier's in the distance between the cornea and the anterior margin of the rostral plate. In the Galapagos specimens the distance from the inner angle of the cornea to the anterior margin of the plate equals the distance from the anterior to the posterior margin of the plate.

The anterolateral angles of the carapace are more rounded off than angled; anterior width of carapace a little more than half its median length including rostrum; greatest width almost equals length including rostrum. In the accompanying figure the carapace has been drawn a bit too narrow. In the type the antennal peduncles reach about as far forward as the corneae; second segment of peduncle armed with a small acute spine at the anterointernal angle; antennal scale short, reaching about as far as the antennal peduncle and the corneae or slightly more. The cornea sits obliquely on the eyestalk and in thickness measures about  $\frac{1}{3}$  the visible portion of the longitudinal axis of the stalk—the eyestalks as drawn appear too slender; of the visible portion the width at the middle of the length is about half or slightly more than half the median length of the stalk with the cornea included; the transverse axis, width of the cornea about equals the visible portion of the longitudinal axis of the stalk.

The margin of the propodus opposed to the raptorial dactylus is pectinate for the greater part of its length, at its base the usual 3 movable spines are found; the dactyl is armed with 4 spines including the terminal one, outer margin of the inflated base scarcely or almost imperceptibly notched, before notch the dactyl is inflated much as in *Gonodactylus*. The

raptorial dactyli of small specimens are relatively much more inflated at the base than those of larger specimens; also in these small specimens there is a greater curvature to the thinner distal part of the dactyl which ends in the terminal spine or tooth. The chelae of the 5th pair of legs are roughly  $\frac{1}{4}$  the size of the 4th pair, the 3rd pair perhaps  $\frac{3}{4}$  the size of the 4th pair.

The first free (5th) thoracic somite is little more than a somewhat flattened ring without lateral projections and a smooth dorsal plate. The lateral margins of the smooth and shining dorsa of the 6th, 7th, and 8th thoracic somites are broadly rounded and nonprojecting, stopping short of the articulation of the leg with the somite.

The first 4 abdominal somites are smooth and unarmed; the 5th likewise, except for several small spinules on the posterior margin not far removed from the posterolateral angle; there are 4 more or less equidistant spinules on the left side of the posterior margin of the somite and 6 on the right. These spinules on the right side might be described as 4 more or less equidistant spinules, of which the first and second of the series, counting from the right, are twinned, thus making it possible to account for 6 spinules on the right side. The number of spinules present laterally on the posterior margin of the 5th abdominal somite is less in small than in large specimens, while in very small individuals they may be lacking altogether.

The entire dorsal surface of the 6th abdominal somite and telson is thickly beset with slender spines; a "comb" of small spines arms the anterior margin of the somite. The spines forming the armature of this somite increase in length from before backward, those of the posterior margin being the longest. Slightly less than the dorsal median third of the somite is thickened and raised a bit above the general surface of the somite (of course, beneath its spiny armature); this slightly elevated area is narrower behind than before; the lateral margin of the somite is raised and thickened; at its mid-point the thickened margin forms an angle or blunt tooth, while just anterior to and above the posterolateral angle of the somite the margin runs out into a strong curved spine. A few of the spines arming the somite are twinned, but there are none that can be described as stellate.

The telson beneath the spines is about  $\frac{2}{3}$  as long as wide; it is very convex and very spinous. The spines are arranged, more or less alternately, in longitudinal rows; there is a median row of spines corresponding, I should say, to the median carina of most stomatopods; the last or most posterior of this median row of spines arises from beneath the posterior



margin of the carapace; either side of this spine on the posterior margin are 2 spines followed by a movable submedian spine, I take it to be; this is nearly twice as large as any of the other spines on the telson; beyond the submedians in turn are 4 simple spines, each, as one goes away from the median line, slightly shorter than its predecessor; the next in order is the 5th spine which is twinned on either side, and between each of the twinned spines and the simple spine outside it there is a gap in the marginal series occupied by a small depression, continued on to the ventral surface of the telson as a shallow furrow. Beyond the depression along the margin of the telson are 3 spines in a row, following which the margin of the telson turns forward; around this bend the margin is unarmed, and a bit thickened or carinated; paralleling this "carina" and a bit inside it is a row of 4 spines; next there is another unarmed emargination of the border of the telson a little before the anterolateral angle of the telson; this angle is spine tipped, and just posterior to this spine at the angle is a similar one on the anterior slope of the emargination just referred to, but well back from the margin of the telson at this point.

The ventral surface of the telson is symmetrically grooved; there is a row of spines on the ventral surface at a little distance from the margin of the telson and some additional scattered spines along the sides of the ventral grooves or furrows; the ventral surface otherwise is somewhat regularly lumpy.

A pair of slender spines form the ventral process of the uropods; the outer is about one half as long as the inner and close to it, leaving a very narrow, more or less parallel-sided sinus between the 2 spines.

I observe some differences between the specimens before me and the one figured by Dr. Gravier. The eyestalks of the specimen in his figure extend a shorter distance beyond the distal margin of the rostral plate and appear medially longitudinally grooved; the telson, as depicted by Gravier, seems to have a median dorsal groove or, at least, interspace between the row of spines either side of the median line, instead of a median row of spines as in our specimens,<sup>71</sup> while the difference in relative length of the spines of the ventral process of the uropods does not appear as great nor the sinus between them as parallel sided as in our Pacific material. Never-

<sup>71</sup> A re-examination of the type by Dr. Marc André during a recent absence of Professor Fage from the Paris Museum reveals that this groove shown in the figure does not exist in fact in the type specimen; also the basal joint of the uropod is spined in the type, as in the Galapagos specimens, and not unarmed, as depicted by Gravier.

theless, I believe, as does Professor Fage (by letter), that the Atlantic and Pacific *Coronidas* here discussed are identical.

*Color:* In alcohol some of our specimens are of a uniform straw color (light yellow), others are mottled or more or less banded with aggregations of brown chromatophores.

Genus *GONODACTYLUS* Latreille, 1825

The several forms of *Gonodactylus* dealt with in this paper are all close allies of *G. oerstedii*. This species, in turn, is one of the many near relatives of *G. chiragra* of the Indo-Pacific, with which, indeed, it was identified for many years.

Kemp's discussion<sup>72</sup> of "*Gonodactylus chiragra* and its allies" rather fully covers the difficulties one encounters in any study of the problem of variation and speciation in this *Gonodactylus*-alliance. His remarks are of utmost value in the description of new forms within this section of the genus.

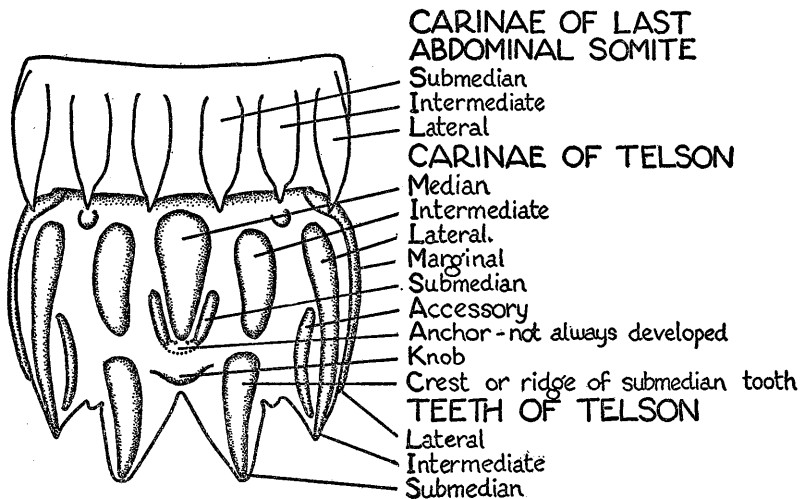


Fig. 25. Diagrammatic *Gonodactylus* telson, illustrating terms used in description.<sup>73</sup>

<sup>72</sup> Mem. Indian Mus., Vol. 4, No. 1, p. 150, 1913.

<sup>73</sup> The so-called anchor is not always formed and is often poorly developed; yet in some species it is unmistakably anchorlike in appearance.

The carina running forward or anteriorly from each submedian tooth of the hind margin of the telson is referred to as the crest, or ridge, of the submedian tooth.

The lobule, so called in the following descriptions, is the rounded, and sometimes spinule-tipped, projection intervening between the submedian and intermediate teeth of the telson margin; it is placed at the top or apex of the sinus between these teeth, when this sinus is in evidence.

The lateral tooth of the telson in many *Gonodactyli* is reduced in size and prominence; in others it may be obsolescent or not even indicated. It is usually referred to as the lateral lobe or angle rather than as a tooth, because of this reduction in size.

Key to Species of *Gonodactylus* Known from the  
Pacific Coast of America

- A<sup>1</sup>. Telson without spines or spinules on upper surface except occasionally a small point or "bead" on the hinder end of the median and intermediate carinae; submedian carinae, if indicated at all, unarmed.

Knob smooth and rounded, low. Crests of submedian teeth of telson without spines or spinules. Ocular plates usually squarish with more or less convex anterior margin, almost subcircular at times. Anterolateral angles of rostral plate rounded off, not angulated.<sup>74</sup> . . . . *oerstedii*, p. 211

- B<sup>1</sup>. Intermediate teeth of telson not sharply set off from submedian teeth, the lobule which typically intervenes between the submedian and intermediate teeth is placed up on outer margin of the submedian spine more or less wholly posterior to the level of the extremity of the intermediate tooth. . . . .  
. . . . . *oerstedii* with Pacific type of telson, p. 211

- B<sup>2</sup>. Intermediate teeth of telson sharply and distinctly set off from submedian teeth by a sinus at bottom or apex of which the lobule separating these pairs of teeth normally occurs.<sup>75</sup> . . . .  
. . . . . *oerstedii* with Atlantic type of telson, p. 211

- A<sup>2</sup>. Upper surface of telson more or less spinulose, armed with spines, spinules, or prickles.

Median, submedian, and intermediate carinae usually armed posteriorly with at least one distinct spine or spinule. Crests of the submedian teeth of telson usually armed with at least one spine or spinule, often more. Anterolateral angles of rostral plate angulated, subacute, acute, or at times even spiniform (as in typical *bahiahondensis*).

<sup>74</sup> Pacific specimens of *G. oerstedii* with an Atlantic-type telson have a rostral plate with angulated, often nearly acute anterolateral angles. In this respect, these specimens approach the west coast species of *Gonodactylus* with spinulose telsons, so much so, in fact, that there is suggested the possibility that they may be a non-spinulose form if not a distinct subspecies of one or another of these species.

All Pacific *oerstedii* forms and relatives of whatever degree differ from Atlantic *oerstedii* by virtue of their usually more angulated and more produced anterolateral angles of the rostral plate. The angles in Atlantic representatives of the species (*s.s.*) are broadly rounded.

<sup>75</sup> Rarely is this sinus reduced, but when tending in this direction the lobule still definitely separates the marginal teeth and is placed so that its posterior margin lies anterior to the level of the posterior extremity of the intermediate tooth.

**B<sup>1</sup>.** Knob not prominent, unarmed.

Accessory carinae never spined, very rarely with even a small nodulation or two. Submedian crests usually armed with one spine or spinule, sometimes 2, rarely unarmed and then on one side only. Ocular plates more or less squarish, anterolateral angles somewhat produced anteriorly in some specimens, but never so markedly as in *G. bahiahondensis*. Anterolateral angles of the rostral plate produced, subacute, but never spiniform. . . . . *stanschi*, p. 215

**B<sup>2</sup>.** Knob usually armed with at least one pair of small spines or spinules (see also under C<sup>1</sup> below on this point).

Accessory carinae usually armed, at least in larger specimens, with one or more spines or spinules.

**C<sup>1</sup>.** Knob armed with no more than 2 spines or spinules, only rarely and in small specimens may these be replaced by small nodules or tubercles; very rarely is there an extra, apparently adventitious, spinule on the knob of this species.

Accessory carinae usually armed with one or 2, rarely 3, spines and then on one side only; very rarely unarmed; may be unarmed, in small specimens. Crests of submedian teeth usually armed with one or two spines. Intermediate carinae usually end in a posterior spine or spinule, usually followed by a second small spinule in line behind it; rarely is the second of the 2 spinules represented by a small bead or nodule, much more rarely does one find both so replaced. Ocular plates have anterolateral angles produced anteriorly; not appearing wider than long. Anterolateral angles of the rostral plate almost always spiniform. . . . .  
. . . . . *bahiahondensis*, p. 217

**C<sup>2</sup>.** Knob typically, and usually, armed with more than 2 spinules, very exceptionally armed with only 2, in such cases there are one or two nodules or small tubercles in addition.

Accessory carinae armed with 3 or more spinules, rarely only 2. Intermediate carinae with several spinules in patch at or just behind posterior extremity; very exceptionally in small specimens are there only 2 spinules so placed.

**D<sup>1</sup>.** Submedian carinae more or less merged posteriorly with median carina to form an anchor posteriorly or, as one might say, a coronet ornamented with from 3, usually more, up to 8 spinules.

Knob also forming a coronet of usually 4 to 6 backwardly directed spinules, rarely only 3, sometimes as many as 7. Acces-

sory carinae usually armed with from 5 to 7 spinules. Crests of submedian teeth of telson usually armed with 4 to 7, occasionally 8 or 9 spinules in 2 rows, rarely in 3 rows. Ocular plates more or less transversely elongate, anterolateral angles laterally produced. Rostral plate with anterolateral angles sharply acute. . . . . *festae*,<sup>76</sup> p. 220

- D<sup>2</sup>.** Submedian carinae of telson usually well marked and, though closely paralleling median carina, not forming so definite an anchor with it posteriorly; median carina armed with posterior spinule, as are also submedian carinae, which, counting the posterior spinule, are armed with 2 or 3 well-separated spinules in a row on the carina.

Fewer spinules in coronet arming knob, 2 to 4 occasionally with not more than one little nodule or tubercle in addition. Crests of submedian teeth of telson armed with from 2 spinules in one row to 4 or 5 in 2 rows. Ocular plates not quite typical of *G. festae* (*s.s.*), sometimes somewhat squarish. Anterolateral angles of rostral plate produced, narrowly angulate, apically blunted. . . . . *festae lalibertadensis*, p. 223

### Gonodactylus oerstedii Hansen

*Gonodactylus oerstedii* Hansen, Ergebn. Plankton Exped., Vol. 2, [Pt.] G. c., p. 65 and footnote, 1895. Bigelow, Bull. U.S. Fish Comm., Vol. 20, Pt. 2, p. 152, figs. 1, 2, 1900 (1901). Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 204, 1913. Kemp and Chopra, Rec. Indian Mus., Vol. 22, Pt. 4, p. 309, 1921. Bigelow, Bull. Mus. Comp. Zool., Vol. 72, No. 4, p. 120, 1931, and synonymy. Lunz, Jour. Elisha Mitchell Sci. Soc., Vol. 51, No. 1, p. 152, fig. 1, 1935; Bull. Bingham Oceanog. Coll., Vol. 5, Art. 5, p. 4, 1937.

*Distribution:* Atlantic: North Carolina and Bermuda to Brazil, including the Bahamas, West Indies, and Gulf of Mexico; also Fernando-Noronha. Pacific: hitherto known only from the Gulf of California, but now also from Socorro, Clarion, and Isabel islands and Tenacatita Bay, Mexico; Puerto Culebra, Costa Rica; Secas Islands and Bahia

<sup>76</sup> This species and its subspecies have a more prickly appearing telson than any of their west coast relatives. Moreover, *G. festae* is the only one in which there is almost invariably a small, sharp, slender spinule in the angle formed by the lateral lobe with the lateral margin of the carapace. There is no such spine in the subspecies, *f. lalibertadensis*.

Honda, Panama; Gorgona Island, Colombia; La Plata Island and the Galapagos Islands, Ecuador.

*Remarks:* Kemp and Chopra first made known the presence of this species in Pacific waters, in the Gulf of California. They "made a close comparison between the California specimens and others from Fernando Noronha and St. Thomas in the West Indies," but were "unable to find any appreciable difference between them."

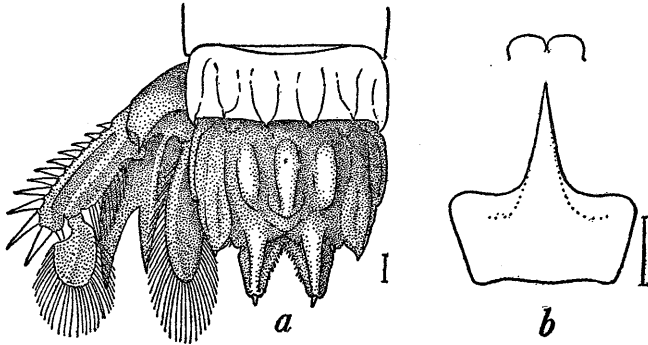


Fig. 26. *Gonodactylus oerstedii*, a female typical of the species proper, from Tortugas, Florida. *a.* telson; *b.* rostral plate and ocular scales.

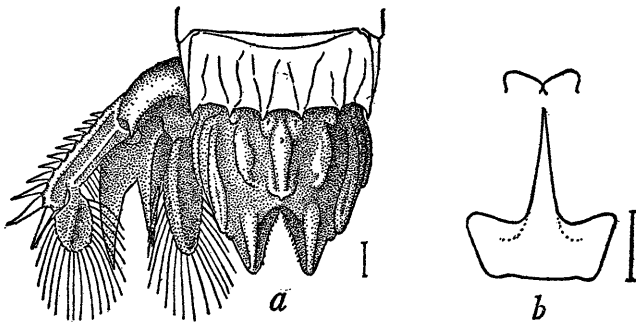


Fig. 27. *Gonodactylus oerstedii*, female with true Pacific type telson, from Darwin Bay, Tower Island, Galapagos (Hancock Exped. Sta. 98-33, February 25, 1933). *a.* telson, x 5; *b.* rostral plate and ocular scales.

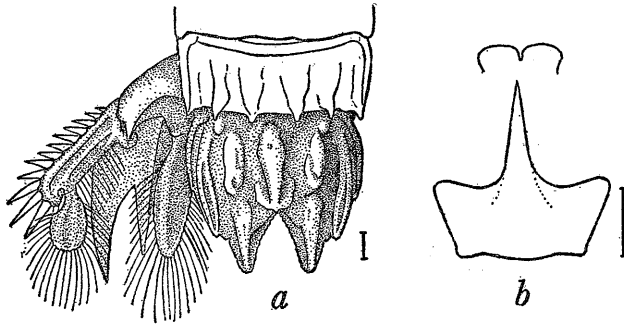


Fig. 28. *Gonodactylus oerstedii*, female, with a Pacific type telson that tends toward being intermediate between the Pacific and Atlantic type telsons, from San Gabriel Bay, Espiritu Santo Island, Gulf of California (Hancock Exped. Sta. 638-37, March 7, 1937). *a.* telson; *b.* rostral plate and ocular scales.

It is to be noted that in this specimen the lobules between the submedian and intermediate teeth of the telson are still, in part at least, posterior to the extremities of the intermediate teeth and that the axes, extended, of the submedian and intermediate teeth lie closer together than in the true Atlantic type telson. The majority of the Lower California specimens are of the true Pacific type (Fig. 27*a*) rather than of this uncommon intermediate form.

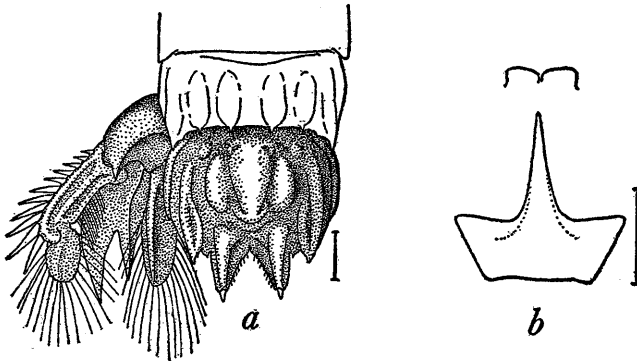


Fig. 29. *Gonodactylus oerstedii*, male, with Atlantic type telson from Academy Bay, Indefatigable Island, Galapagos (Hancock Exped. Sta. 168-34, January 20, 1934). *a.* telson; *b.* rostral plate and ocular scales.

The median carina of this specimen is more swollen than in the Tortugas specimen (Fig. 26*a*) with which it may be compared, but swelling or inflation of the carinae is of very common occurrence in all species of *Gonodactylus* (cf. Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 150, 1913).



Atlantic and Pacific specimens of *G. oerstedii* are much alike. Yet, in an extensive series from both oceans, the vast majority, with rare exceptions, of the Pacific representatives of the species has a common type of telson which, for purposes of reference, is here distinguished as the Pacific type, as compared with an Atlantic type. Rarely does any Atlantic representative of *G. oerstedii* tend to exhibit any inclination toward developing the Pacific type of telson. However, there are enough specimens, although very few with the opposite type in the waters of each ocean, to preclude, at least in the light of our present knowledge, giving them a more definite nomenclatorial status than here attempted.

The Atlantic type of telson has been well figured and described by Bigelow (1901, p. 152, fig. 1). There is a distinct, wide, V-, almost U-shaped notch or interval between the submedian and intermediate teeth of the telson margin; in the apical angle of this notch there is a well-developed lobule anterior to the level of the extremity of the intermediate spine. Very rarely is the posterior margin of this lobule on, or does it approach, the level of the extremity of the intermediate tooth. In these rare cases the notch or interval between the submedian and intermediate teeth tends to become more or less obliterated, and the outer margin of the submedian tooth and the inner of the intermediate tooth where they proximally approach one another are separated by little more than the width of the intervening lobule. In all cases, however, there is always a noticeable offset or separation between the major (longitudinal) axes of both teeth, even though the trend of both may be more or less parallel. In no case is the lobule situated up on the outer margin of the submedian tooth wholly behind or posterior to the level of the extremity of the intermediate one.

In the Pacific type of telson, the interval between the intermediate and submedian teeth is wanting and the lobule that separates the intermediate from the submedian tooth in the Atlantic forms is less distinct and scarcely more, in many cases, than an irregularity of the outer margin of the submedian tooth just before it passes over into the outer margin of the rudimentary intermediate tooth. This reduced lobule is so placed that it is situated posterior to the level of the extremity of the intermediate tooth. I have seen one Pacific specimen in which a part, but not the whole, of this lobule seemed to be behind the level of the extremity of the intermediate tooth, but this is no doubt of exceedingly rare occurrence. A lobule which is part before and part behind the intermediate tooth is also to be seen in some of the small and near juvenile Atlantic specimens of *G. oerstedii*. Thus we see in some of the small specimens on both coasts some conver-

gence, but here again Kemp's remarks, cited under the generic heading above (p. 208), are in a measure applicable. These "convergent" specimens do differ in the relative perpendicular distance between the parallels formed by the major axes of the submedian and intermediate teeth extended.

The major (longitudinal) axis of the intermediate tooth in the Pacific type telson, if extended, runs very close to that of the submedian spine, and is removed from it usually by not more than the width of its crest or carina at the level of the lobule. In the Atlantic type of telson the perpendicular distance between the lines extending the axes of the submedian and intermediate teeth is about as great as half the width of the entire submedian tooth, crest included, at the level of the posterior margin of the intermediate lobule, or more.

The relation that the Pacific type telson bears to the Atlantic type is very like that borne to *G. demani* by its variety *spinus* in which the intermediate teeth of the telson are rudimentary as compared with those of the species proper.

#### *Gonodactylus stanschi*, new species

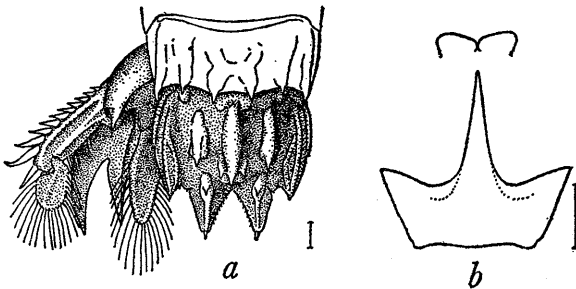


Fig. 30. *Gonodactylus stanschi*, female holotype, from Tangola-Tangola, Mexico (Hancock Exped. Sta. 261-34, March 1, 1934).  
a. telson; b. rostral plate and ocular scales.

*Distribution:* From the Gulf of California, Angel de la Guardia Island, to Tangola-Tangola Bay, Mexico, including Isabel and Tres Marias Islands.

The existence of this species was first brought to my attention in 1926 by specimens collected that year by Dr. Carlos Stansch, inspector in the

service of the *Direccion Forestal y de Caza y Pesca*, Mexico, for whom I take pleasure in naming it. Dr. Stansch secured 2♂ from coral banks in the vicinity of the lighthouse, Tres Marias Islands, and 1♀ from oyster beds at Teacapan, state of Sinaloa. Otherwise, the species is known only from specimens collected by the Hancock Expeditions.

*Type:* The second largest specimen, a female of 38 mm. in median length exclusive of the 3 mm. rostrum, from Tangola-Tangola Bay, Mexico, March 1, 1934 (Hancock Exped. Sta. 261-34), has been selected as the type (U.S.N.M. No. 76355).

*Description:* One of the *Gonodactylus oerstedii*-group with dorsally spined or spinulose telson, but differing at once from its near allies by the complete absence of spinules on the accessory carinae, by the unarmed and relatively inconspicuous knob more or less underneath the hinder end of the median carina, and by the fact that the intermediate carina normally and usually ends posteriorly in a single spine; rarely is the spine terminating this carina followed by a second and smaller one. Occasionally one or the other, more rarely both, of the accessory carinae show one or two small nodulations, but never spines.

Only the posterior portions of the submedian carinae are developed; they form, as it were, the flukes of the anchor of which the median carina forms the stock (not so well marked as in some species); the median and submedian carinae are posteriorly spined (the "anchor" is thus trispinose); the spines terminating the submedian carinae are often strongly exerted and upturned, while the median spine, always the larger of the three, is inclined downward. The spines terminating the intermediate carinae are typically larger and stouter than those on the submedian carinae and about the size of the one arming the median carina.

The submedian and intermediate marginal teeth of the telson are well separated by a distinct notch, as are the corresponding teeth in specimens of *G. oerstedii* with the typical Atlantic type telson.

The crests or carinae of the submedian teeth of the telson are typically armed with but a single spine; in perhaps a fourth of the specimens there are 2 spines on one of a pair of submedian crests, the other having but a single spine or the faint indication in one instance of a slight nodulation, and in another 2. In all other specimens a single spine armed this crest, paired in almost every instance with another single spine on the corresponding crest of the opposite side of the telson; in 3 specimens one of these spines was represented by a small nodule, and in only one specimen was there a nodule on each side instead of a spine.

In some of the smaller specimens the lateral tooth or lobe is obsolescent or but barely indicated; in the larger specimens at hand it is well marked but blunt.

The anterolateral angles of the rostral plate, although more prominent and angulated than in *G. oerstedii* with Pacific type telson, are nevertheless somewhat blunt in many of the specimens; in a number, as for instance the specimen taken for the holotype, they are subacute, but never spiniform as in *G. bahiahondensis*.

The ocular plates, dorsal processes of the ophthalmic somite, somewhat resemble those of *G. bahiahondensis*, but appear to be more squarish. They do not seem to be particularly distinctive of the species, nor do I find anything especially characteristic about the uropods that would assist in specific differentiation.

#### *Gonodactylus bahiahondensis*, new species

*Gonodactylus oerstedii* var. *festae* Bigelow, Bull. Mus. Comp. Zool., Vol. 72, No. 4, p. 124, pl. 2, figs. 3, 4, 1931 (part, all but synonymy, and reference to specimens pertaining to works cited in the synonymy).

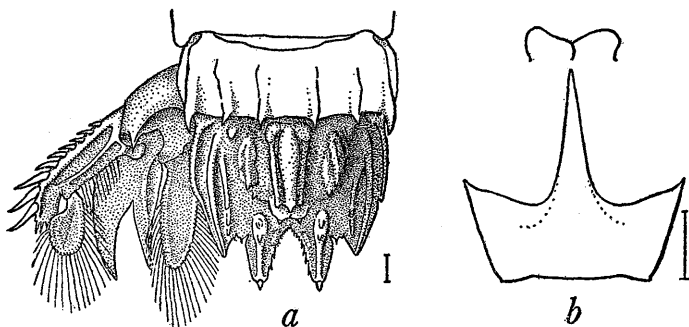


Fig. 31. *Gonodactylus bahiahondensis*, female holotype, from Puerto Culebra, Costa Rica (Hancock Exped. Sta. 258-34, February 25, 1934). *a*. telson; *b*. rostral plate and ocular scales.

*Distribution*: Puerto Culebra, Costa Rica; Bahia Honda, Secas and Perico Islands, Panama; Port Utria and Gorgona Island, Colombia; and Cape San Francisco, Ecuador. Except for a single specimen taken by

the *Albatross* October 26, 1904, at Perico Island, Panama, all of the foregoing records are based on material taken by the Hancock Expeditions.

*Type:* The largest specimen seen of this species, a female from Puerto Culebra, Costa Rica, February 25, 1934 (Hancock Exped. Sta. 258-34), has been selected as the type (U.S.N.M. No. 76349). This specimen measures 43 mm. in median length exclusive of rostrum, rostrum 3, carapace 10. This new species was first detected among the stomatopods taken the year before at Bahia Honda, Panama, and in recognition of that discovery is given its name, although the larger, better-developed specimen from Puerto Culebra has been made the type.

*Description:* A species standing close to *G. festae* Nobili, but differing from it in several characters to a degree warranting, it is believed, specific designation. Most distinctive perhaps of these characters of *bahiahondensis* are the nearly always spiniform anterolateral angles of the rostral plate and the forwardly produced anterolateral angles of the ocular plates, or dorsal processes of the ophthalmic somite.

The "knob," as we have called it, behind the median carina of the carapace, is armed with no more than 2 small spines or spinules; one in not quite a third of the specimens; in only 2 specimens were the spinules replaced by a small nodule, or pair of nodules.

The median carina of the telson is posteriorly armed with a single spine; rarely is this represented by a small beadlike or blunted protuberance. The submedian carinae, as a rule, are distinctly present and are posteriorly armed, either one or both, in the larger (half the) specimens with a single small spine; they are usually unarmed in the smaller specimens.

The intermediate carinae are posteriorly spined in nearly all the specimens; in about 4 out of the entire lot the carina is posteriorly more or less blunted off or furnished with a small "bead"; in more than two thirds of the specimens below and behind the usually spined posterior end of the intermediate carina there is a second and smaller spine, or at least, and more rarely, a small nodule (in 3 or 4 specimens) on one side or the other, usually on both sides; in only 2 specimens is the posterior terminal spine of the intermediate carina not followed by a spinule or nodulation.

The crest of the submedian tooth of the telson is armed with one or two spines; only one of the 2 crests in but one specimen was found without armature of any kind, while, on the other hand, in only 3

specimens was one of the crests armed with as many as 3 spinules, the corresponding crest of the pair having one spine in one instance and 2 in each of the others. Sometimes, in the case of 5 individual carinae among 20 odd specimens, the spine (single) arming this crest of the intermediate marginal tooth is followed by a small nodular swelling, perhaps representing an incipient or undeveloped 2nd spine; otherwise not less than half the total number of specimens had 2 spines on at least one of the two crests.

The accessory carinae are usually, or perhaps typically, armed with 2 spinules. Only in one instance did I observe an accessory carina in this species armed with 3 spinules, and then on one side of the telson only. Sometimes there may be 2 spinules followed by a nodule, or only one spinule and a nodule. In 9 specimens the accessory carinae are unarmed; these are all small specimens scarcely, if at all, exceeding 30 mm. in median length exclusive of rostrum.

The lateral teeth or lobes of the telson are blunt, in no case spined, and only wanting, or not much more than indicated, in four instances.

The anterolateral angles of the rostral plate are more truly or more nearly spiniform than in any of the species of *Gonodactylus* dealt with in this account; in only 2 specimens out of the lot are they not spiniform, subacute to acute, in only one blunt; one specimen has one angle spiniform, the other rounded, the only rounded angle found in any of the material.

The ocular plates are quite different from those of *festae*, inasmuch as the anterolateral angles are produced more or less forward instead of laterally, thus making these prominences appear no wider than long; in *G. festae* they are plainly wider than long because of the noticeably laterally produced anterolateral angles. At first I believed *bahiahondensis* represented a variety or subspecies of *festae*, but the almost invariably consistent difference in the ocular plates of the 2 forms has led me to consider them specifically distinct.

*Remarks:* On the basis of the character of the ocular plates alone, the Perico Island, Bay of Panama, specimen which Dr. Bigelow had considered representative of *G. festae* is a good *bahiahondensis*. Also, it has a two-spined "knob," and distinct submedian carinae; the crests of the submedian teeth of the telson are each armed with one spine plus the indication of a second, while the accessory carinae are armed on the one side with 2 spines or spinules and on the other with a spine and the indication of a second.

### *Gonodactylus festae* Nobili

*Gonodactylus festae* Nobili, Boll. Mus. Zool. Anat. Univ. Torino, Vol. 16, No. 415, p. 53, 1901. Kemp, Mem. Indian Mus., Vol. 4, No. 1, pp. 153, 204, 1913.

*Gonodactylus oerstedii* var. *festae* Bigelow, Bull. Mus. Comp. Zool., Vol. 72, No. 4, p. 124, 1931, synonymy only (description of specimen and figs. 3, 4, pl. 2, have in the present paper been referred to *G. bahiahondensis*).

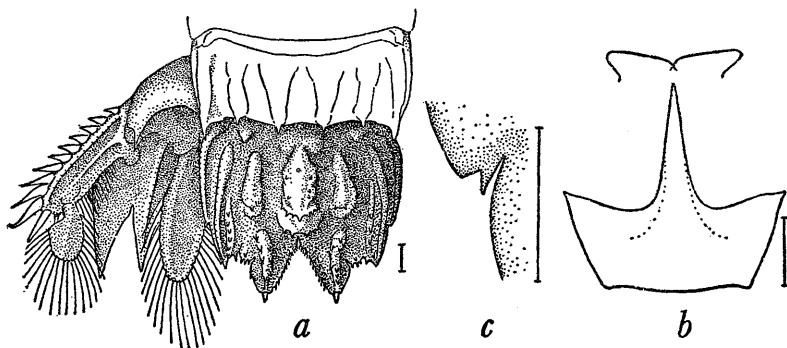


Fig. 32. *Gonodactylus festae*, female, from Salinas Bay, Costa Rica (Hancock Exped. Sta. 474-35, February 10, 1935). *a.* telson; *b.* rostral plate and ocular scales; *c.* underside of right lateral tooth or lobe to show spinule typically occurring in angle formed by the lobe with the lateral margin of the carapace, much enlarged.

**Distribution:** Nobili's original type material consisted of 2 specimens from Darien [Gulf of San Miguel, Panama],<sup>77</sup> one from Punta Santa Elena, and one from the Bay of Santa Elena, Ecuador. Since then, specimens have been obtained from as far north as Salinas Bay, Costa Rica, but not farther south than Santa Elena Bay. From between these extremes I have seen specimens both on the San Francisco Reef, Panama City, and on Taboga Island (S. F. Hildebrand, coll., February 13 and March 31, 1937, respectively); and from Bahia Honda, Panama; Port Utria and Cabita Bay, Colombia; and south of Manta, La Libertad, and Santa Elena Point, Ecuador (Hancock Expeditions).

<sup>77</sup> Boll. Mus. Zool. Torino, Vol. 12, No. 280, p. 1, 1897.

*Original description (translated from the Italian):* "This new species is related to *oerstedii* and like it has the accessory carina which distinguishes it from *chiragra*. From this and *oerstedii* [the new species] is easily distinguishable by the presence of spinules on the carinae of the telson. On the three medial carinae and on the anchor (that is found in this species as in [both] *oerstedii* and typical *chiragra*) the spinules are variable, in the two specimens from Darien reduced to tubercles, in the specimen from Punta Santa Elena very distinct. Those on the carinae [or crests] that terminate in the two [sub-] median projections [or marginal teeth or spines] of the telson, and on the accessory carinae of Hansen are most distinct, and in the case of the first named carinae form a double series.

"The rostral plate in *G. chiragra* has the external [the antero-lateral] angles muticous (f. *typica* de Man = var. A Borradaile) or acute and anteriorly produced (var. *acutirostris* de Man = var. C Borradaile);<sup>78</sup> *G. oerstedii* from St. Thomas has the external [antero-lateral] angles muticous and 'plain-like.' In *G. festae* these angles are acute, 'slender,' and anteriorly produced."

*Measurements:* The largest specimen of the species I have seen is a specimen contained in a lot collected by Dr. S. F. Hildebrand from tide pools on the San Francisco Reef, near Panama City. It is female of 49 mm. in median length exclusive of the rostrum; rostrum nearly 4, carapace 12. The figured specimen is 43 mm. long on the median line.

*Remarks:* Several of the close allies of *G. oerstedii* are known to have a spinulose telson, but none perhaps so spinulose a telson as *G. festae*, at least on the Pacific side of America. *G. oerstedii* var. *spinulosus* from Barbados and Antigua in the Atlantic most nearly approximates *G. festae* in this respect. The latter, nevertheless, is very close to *G. oerstedii* (*s.s.*) in the conformation of the rostral plate, the anterolateral angles of which are broadly rounded in both forms. In *G. festae*, on the other hand, they are sharply angulated and acutely pointed, although in some smaller specimens only subacute. Nevertheless, I do not know just what Nobili had in mind when he spoke of them as slender, "esili," unless he meant to indicate that in contrast to true *oerstedii* the anterolateral angles were narrowly acute or drawn out to a sharp point, as they are. All of the West American relatives of *G. oerstedii* with spinulose or dorsally spined telsons have the anterolateral angles of the rostral plate more angulated and often acute; only in *bahiahondensis* are they truly spiniform.

<sup>78</sup> In A. Willey's Zool. Res., Pt. 4, p. 401, 1899; now *G. acutirostris*, see Kemp, Mem. Indian Mus., Vol. 4, No. 1, p. 163, 1913.



Nobili's statement that the spinules arming the crest atop the submedian teeth of the telson are arranged in a double series very definitely sets his species apart from its Pacific congeners. In all but 3 (about 17 mm. in median length exclusive of rostral plate) of the specimens of *G. festae* taken by the Hancock Expeditions these spinules, numbering from 2 plus 2 nodules to 8 or 9 spinules, are arranged in 2 rows. In one of the 3 exceptions noted one crest has 7 spinules in a more or less triple series, the corresponding crest has 4 in 2 rows; the 2nd specimen has 3 spinules and a nodule in 2 rows on the one side and 5 spinules, apparently, in one row on the other; the 3rd specimen has 2 spinules in a single row on one crest, and 4 in 2 rows on its mate. In the Atlantic *oerstedii* var. *spinulosus* the spinules on these crests usually seem to be organized into 3 rows, the total number of spinules on either crest running from 5 to 7.

The accessory carinae in *G. festae* are usually armed with 4 to 7 spinules in a row, most often 4 or 5, rarely 2 or 3 plus a nodule or two; only in one instance (one carina) is there one spinule plus 2 nodules.

The knob forms a coronet armed with from 4-7 spinules or prickles—in general, prickly is the characterization one instinctively gives a *G. festae* telson. Its near relatives may have the telson spined or spinulose, but in *G. festae*, in well-developed specimens, it is definitely prickly looking, only in a very few of the smaller specimens are just a few prickles observable, but in these specimens the characters otherwise are unmistakably those of *G. festae*.

The submedian carinae of *G. festae* (*s.s.*) never seem to get beyond the anchor-fluke stage, not very long flukes at that, and very much confluent with the hinder end of the median carina. The anchor, submedians plus the median carina, is armed with 5 to 9 spinules, rarely and perhaps only abnormally less. There are also one or more little prickles, or indications of them, on either side of the median carina in advance of the anchor.

The intermediate carinae of the telson almost without exception end in a little patch of from 3 to 6 spinules or prickles in 2 or 3 short rows, just a patch of them as it were; only in some of the smallest specimens are there fewer of these tiny spinules.

Just inside the lateral tooth or lobe of the telson typically there is inserted next to the lateral margin of the telson a small but readily observable spinule. In the largest specimen the lateral lobe is wanting on the left side, and the spinule is wanting within the lobe on the right side; in only one other specimen of *G. festae* (*s.s.*) is the lateral lobe

or tooth lacking, the one on the left side; the right lobe in this case is accompanied by the usual spinule; both lobes of one small specimen lack the spinules completely; another specimen with well-developed lateral lobes has only one of the lobes spined; 10 other specimens of *festae* (*s.s.*) that I have seen have both lobes developed and each with the characteristic spinule. In the larger specimens either side of the median notch near its apex or origin is a tiny tubercle topped or armed with a small spinule.

Characteristic of this species are the ocular plates which have their anterolateral angles produced laterally and so appear definitely transversely elongated in contrast to those of *G. bahiahondensis*.

The one lot of specimens from La Libertad, Santa Elena Bay, Ecuador, closely related to *G. festae* yet showing some deviations from the more typical form are described below as a subspecies.

#### *Gonodactylus festae lalibertadensis*, new subspecies

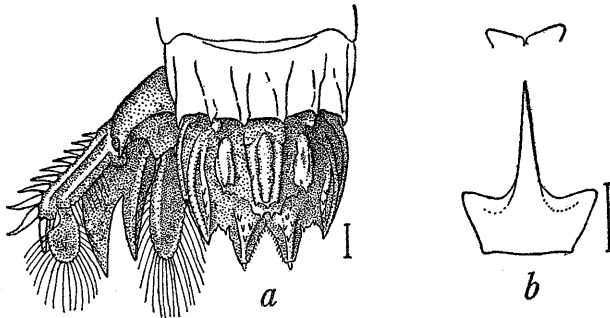


Fig. 33. *Gonodactylus festae lalibertadensis*, female holotype, from La Libertad, Ecuador (Hancock Exped. Sta. 12-33, January 19, 1933). *a.* telson; *b.* rostral plate and ocular scales.

**Distribution:** Subspecific designation is given 8 specimens, 1 ♂ 4 ♀ 3 juv., taken off La Libertad, Santa Elena Bay, Ecuador, January 19, 1933; oyster dredge in 1-2 fathoms (Hancock Exped. Sta. No. 12-33).

**Material examined:** Of these 8 La Libertad specimens the largest, a male of about 34 mm. in median length exclusive of the rostrum, does not appear quite normal, for the subspecies at least. This specimen is discussed under *Remarks* below. Three juvenile specimens under 18 mm. in

length will not otherwise be referred to. Of the remaining 4 females ranging from about 29 to 18 mm. in length, the second largest, 20 mm. in median length exclusive of the rostrum, has been selected as the type, U.S.N.M. No. 76394, as it best illustrates our concept of this subspecies.

*Description:* In the better definition and greater length of the submedian carinae of the telson this subspecies diverges from *G. festae*, and though to a small degree suggestive of *G. bahiahondensis*, it in no way resembles that species in distinctness and keeling of its carinae. In only one specimen are there as few as 2 spinules on the knob. The submedian ridges do not to the same extent go over into the formation of an anchor with the median carina as in typical *festae*. Unlike *bahiahondensis*, the submedian ridges have several spines, usually 3 in a row in the length of each submedian ridge; in the type 2.

In *bahiahondensis* the submedian carinae are armed with but a single posterior spine and have none on the ridge of the carinae in advance of the terminal one. In a number, practically all the small specimens of *bahiahondensis*, the submedian carinae are without any armature, while in no case in *lalibertadensis* do the submedian carinae have less than 2 teeth.

The knob with but one exception is armed with a coronet of spinules or prickles, as in the species proper, from 3 plus a nodule, as in the type, to 4, and 4 plus a nodule; the single exception, a small specimen, has the knob armed with but 2 spinules. The intermediate carinae have off their posterior ends, much as in typical *festae*, from 2 spines, more or less behind one another, to 5 in an irregular patch; the crests on the submedian teeth also resemble *festae*, having as many as 5 spinules in 2 rows on one side only of one specimen to as few as 2 in one row on each side; the accessory carinae were armed with 2 or 3 spinules, occasionally plus an extra nodule. There were about as many specimens of one count as the other.

In no instance was a lateral lobe or tooth furnished with a spinule, as in *festae*; in the largest of the 5 specimens discussed the right lateral lobe is wanting.

The ocular plates have some resemblance to those of *festae*, but yet were not quite typical. One of the smallest specimens, indeed, has plates somewhat resembling those of *bahiahondensis*, but it must be remembered that the characters of small and juvenile *Gonodactyli* often appear to be in the formative stage and so are not particularly positive in their specific indications.

The rostral plate is similar to that of *G. stanschi*; the anterolateral angles are anteriorly produced, somewhat narrowly angulate and apically blunt.

*Remarks:* The largest specimen of this lot of specimens from La Libertad has the median and intermediate carinae much swollen and "blown up" looking, so much so that the submedian carinae of the other specimens representing the subspecies have been completely merged in the somewhat elongated inflated structure that forms the median carina. This is armed with 3 small spinules or remnants of spinules behind, and has at least one other on either side a little behind the middle of the carina. Of the intermediate carinae each ends in a spinule and has 2 other small ones in a row behind the terminal one.

The knob has 2 spines on the left half of its posterior margin and the remains of 2 others, it appears, on the right half.

The crests of the submedian teeth are each armed with 4 spinules in 2 rows. The right lateral lobe or tooth of the margin of the telson is scarcely indicated; the left one is small and not spined.

The ocular plates of this specimen are typical of *G. festae*.

The specimen may well be an exaggerated and perhaps somewhat abnormal type of *G. festae* or else of the subspecies. It is more like *festae* than the other specimens here assigned to this subspecies and may, perhaps, be considered a transitional form linking the subspecies to the species proper.