

ON THE STOMATOPOD CRUSTACEA COLLECTED BY THE
BENGAL PILOT SERVICE OFF THE MOUTH OF THE RIVER
HUGHLI, TOGETHER WITH NOTES ON SOME OTHER FORMS.

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Since the publication of the paper entitled "Notes on Stomatopoda"¹ by Kemp and myself in 1921, a considerable number of specimens have accumulated in the collection of the Zoological Survey of India, and as a large number of these have been collected by members of the Bengal Pilot Service at the Sandheads, off the mouth of the Hughli River, it has been thought desirable to publish a short note on this collection. Most of these specimens belong to species already known to live in this area, but there are some that are being recorded from this locality for the first time. Though none of the latter records materially extend the geographical range of the species, those of the comparatively rarer forms are of interest. Opportunity has also been availed of to include observations on some other species (pp. 31-43), examples of which have recently been acquired by the Zoological Survey of India. Most of these have been collected by the R. I. M. S. "Investigator" in the Bay of Bengal. No mention is made of the commoner forms in this collection; only those species being noticed that are either somewhat rare, or the fresh records of which are remarkable from the point of distribution, etc. I have also examined two small collections sent to me for identification by the Raffles Museum, Singapore. These, for the most part, consist of very common species, chiefly belonging to the *nepa* group of *Squilla*, which do not require any special mention, but one rather uncommon form, *Squilla lirata* Kemp and Chopra, has been noticed.

The physical conditions prevailing at the Sandheads have been briefly mentioned in an earlier paper². This area lies roughly in 21°N. and 88°E., and though for all practical purposes is a part of the open sea, the salinity is somewhat lower than that of the outlying parts of the Bay of Bengal. The depth in most places is about 20 fathoms, and the bottom consists of soft mud, or, in some places, of sand and mud.

Several species of Stomatopoda have already been recorded from the Sandheads by Wood-Mason³ and Kemp⁴. All these species belong to the genus *Squilla*; none of the other genera have been collected, until recently, in this locality. The following species are mentioned in Kemp's memoir as having been obtained at the Sandheads:—

Squilla latreillei (Eydoux and Souleyet).

Squilla scorpio var. *immaculata* Kemp.

Squilla nepa Latreille.

¹ Kemp and Chopra, *Rec. Ind. Mus.* XXII, pp. 297-311 (1921).

² Chopra, *Rec. Ind. Mus.* XXXV, pp. 25, 26 (1933).

³ Wood-Mason, *Figs. and Desc. of nine Squillidae*, pp. 1-11, pls. i-iv (Calcutta: 1895).

⁴ Kemp, *Mem. Ind. Mus.* IV, pp. 1-217, pls. i-x (1913).

Squilla holoschista Kemp.

Squilla oratoria var. *inornata* Tate (=var. *perpensa* Kemp).

Squilla interrupta Kemp.

Squilla wood-masoni Kemp.

Squilla raphidea Fabricius.

All these species, with the exception of *Squilla scorpio* var. *immaculata*, are represented in the present collection. Besides these the following species, not hitherto recorded from the Sandheads, are also in the collection :—

Squilla decorata (Wood-Mason).

Squilla gilesi Kemp.

Squilla annandalei Kemp.

Lysiosquilla maculata (Fabricius).

Lysiosquilla acanthocarpus Miers.

The Stomatopod fauna of the Sandheads, as known at present, thus consists of thirteen species ; eleven of these belong to the genus *Squilla*, while two are referable to *Lysiosquilla*. No representatives of *Pseudosquilla* Dana, *Hemisquilla* Hansen, *Gonodactylus* Latreille, *Odontodactylus* Bigelow, *Cornida* Brooks and *Cornidopsis* Hansen have hitherto been collected, and judging from the fact that members of at least the four first mentioned of these genera prefer a rough ground, like oyster beds and coral reefs, it seems probable that they do not inhabit this locality at all. The habits of *Cornida* and *Cornidopsis* are very little known, and it is difficult to say anything about the likelihood or otherwise of the species of these genera ever being collected at the Sandheads. Of the species of *Squilla* that live in this locality *S. interrupta* Kemp is the form most commonly met with, the next two in the order of abundance being *S. raphidea* and *S. nepa*. The remaining eight species are only occasionally met with in this area, and are represented in the collections by one or two examples of each. The two species of *Lysiosquilla* are also, in point of numbers, poorly represented in the collections from the Sandheads, but as members of this genus usually live in deep burrows out of which they do not go very far, it is possible that their scarcity is more apparent than real.

There are two larval forms also included in the collection from the Sandheads, but as I am unable to refer them to their species with any degree of certainty, I have not mentioned them in the following account.

There has been a considerable difference of opinion regarding the advisability of using the generic designation *Squilla* in the Stomatopoda, *Chloridella* Miers having been suggested in its place, chiefly by some American zoologists, headed by the eminent carcinologist Miss Mary Rathbun. The principal argument in favour of abandoning the former name is that the first post-Linnean use of *Squilla* as a generic designation appears to have been in a group other than the Stomatopoda. Even if this view is found to be correct—though most of the recent workers, including Stebbing, Kemp, Hansen and Bigelow, have not subscribed to it—it is difficult to justify the employment of *Chloridella* in place of *Squilla*.

Eydoux and Souleyet¹ in 1841 separated the small-eyed group of *Squillas* under the name of *Clorida* (not *Chlorida*), but as Miers² in 1880 found that the designation *Chlorida* had already been used in the Coleoptera, he suggested the name *Chloridella* to replace the one employed by Eydoux and Souleyet. The reference to the use of *Chlorida* in the insecta is no doubt due to Audinet-Serville³, who, in 1834, had set up a genus of Cerambicidae, with *Chlorida costata* as the type-species. According to Brooks⁴ and all later workers, however, *Chloridella* Miers (or *Clorida* Eydoux and Souleyet) could not be maintained as distinct from *Squilla*, and it, thus, became a synonym of the latter. Miss Rathbun⁵ in 1902 pointed out that as the first use of *Squilla* as a generic name after 1st January, 1758, was for an Amphipod, the retention of this name in the Stomatopoda could not be permitted under Article 26 of the International Code, and suggested the use of Miers' *Chloridella* in its place. But in view of the Recommendations under Article 36 of the Code (see also Opinion 25) *Clorida* cannot be rejected on account of a somewhat similar name, *Chlorida*, having been pre-occupied, and if it was found necessary to discard *Squilla*, the name to replace it should have been *Clorida*, and not *Chloridella*.

Bigelow⁶ has recently given a very clear exposition of the whole case, and I quite agree with him that even though by the strict application of the laws of priority there may be some justification for abandoning *Squilla* as a generic designation in the Stomatopoda, such a course will only result in greater confusion rather than in uniformity. The retention of this name for the present, at any rate, is especially to be commended in view of the fact that Bigelow states that he is presenting a petition to the International Commission on Zoological Nomenclature to declare *Squilla* as a *nomen conservandum*. If by an adverse decision of the Commission this old and well-known name has after all to be given up, *Clorida* Eydoux and Souleyet should, in my opinion, take its place.

In the present paper I have followed the arrangement of species, etc., as given by Kemp⁷ in his well-known monograph on the Indo-Pacific Stomatopoda, which still remains the most standard work on this group. In giving synonymies also I have mostly cited this work alone, giving, wherever necessary, references to some later important works only. Among these may be mentioned Komai's⁸ valuable contribution on the Japanese forms, and Bigelow's⁹ recent masterly work on the Southern and Eastern Pacific Stomatopoda. Hansen's¹⁰ excellent account of the Stomatopods collected by the Siboga Expedition also deserves special mention.

¹ Eydoux and Souleyet, *Voyage "Bonite," Zool. Crust.*, p. 264 (1841).

² Miers, *Ann. Mag. Nat. Hist.* (5) V, p. 13, foot-note (1880).

³ Audinet-Serville, *Ann. Soc. ent. France* III, p. 31 (1834).

⁴ Brooks, *Challenger Stomatopoda* (Zool. XVI), pp. 22, 23 (1886).

⁵ Rathbun, *Proc. U. S. Nat. Mus.* XXVI, p. 54, foot-note (1902).

⁶ Bigelow, *Bull. Mus. Comp. Zool. Harvard* LXXII, pp. 174-177 (1932).

⁷ Kemp, *Mem. Ind. Mus.* IV, pp. 1-217, pls. i-x (1913).

⁸ Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, pp. 307-354, pls. xiii, xiv (1927).

⁹ Bigelow, *Bull. Mus. Comp. Zool. Harvard* LXXII, pp. 103-191, pls. i, ii (1932).

¹⁰ Hansen, *Siboga Exped. Rep.* XXXV, pp. 1-48, pls. i, ii (1926).

***Squilla latreillei* (Eydoux and Souleyet).**

1913. *Squilla latreillei*, Kemp, *Mem. Ind. Mus.* IV, pp. 24-27, pl. i, figs. 1-4.

1927. *Squilla latreillei*, Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, pp 308, 309.

1930. *Squilla latreillei*, Gravier, *Bull. Mus. nat. Paris* (2) II, p. 524.

I refer to this species one female specimen collected by the Pilot Vessel "Lady Fraser" at the Sandheads in 1923. It agrees very closely with Kemp's description of the species, as also with named examples in the collections of the Indian Museum. The carapace, as mentioned by Kemp, and as shown in the figures given by Eydoux and Souleyet¹ and Wood-Mason² is of a triangular shape. In the Sandheads example the length of the carapace, excluding the rostrum, is 7.8 mm., while its breadth at the antero-lateral angles, which are produced into sharp spines, is only 4.2 mm. The carapace is, however, broadest a little in front of the rounded postero-lateral angles, where the breadth equals almost exactly the length. In some other examples in the Museum collection that I have examined the proportions are also more or less similar. The carinae on the carapace are very poorly developed, and are as described by Kemp.

In the specimen from the Sandheads the raptorial claw of one side is missing, the dactylus of the other side has only four teeth, including the terminal one.

The telson is as described and figured by Kemp and other authors, but the tubercles and ridges on the dorsal surface are almost as well developed as shown in Kemp's figure of the Persian Gulf female, and not like those shown in Wood-Mason's figure. Of the two other females from the Sandheads in the Museum collection, one, acquired after the publication of Kemp's memoir, has the tubercles well developed, while in the other the condition is like that shown in Wood-Mason's figure.

The colour of the specimen is as described by Komai, except for the fact that the mottling on the carapace is more extensive and the posterior border of the fifth thoracic somite is not bordered with black. The black border on the posterior margin of the last abdominal somite is very inconspicuous.

The species was originally described from Singapore, and besides the localities mentioned by Kemp, has now been recorded from the coast of Annam and Nagasaki in Japan. The species has thus a very wide range of distribution, having been met with in the Persian Gulf on the west to as far east as the south of Japan. At the Sandheads it appears to be not uncommon, having been collected there on four different occasions. The single specimen in the present collection is registered as under:—

C 1652/1	Sandheads, off the mouth of	"Lady Fraser",	1 ♀, 46 mm. ³
	the Hughli River.	5.xi.1923.	

¹ Eydoux and Souleyet, *Voyage "Bonite"*, Zool. Crust., p. 265, pl. v, figs. 2-5 (1841).

² Wood-Mason, *Figs. and Desc. of nine Squillidae*, pl. iv, figs. 6-13 (Calcutta: 1895).

³ The length of specimens given is from the tip of the rostrum to the posterior extremity of the telson.

***Squilla decorata* (Wood-Mason).**

1913. *Squilla decorata*, Kemp, *Mem. Ind. Mus.* IV, pp. 27, 28, pl. i, figs. 13-16.

One large female specimen from the Sandheads is referred to this rather rare species.

C 1653/1 Sandheads, off the mouth of "Lady Fraser", 1 ♀, 77 mm.
the Hughli River. June, July, 1927.

Except for one or two minor differences the present specimen agrees closely with the mutilated type-specimen and with other named examples in the Museum collection. In the Sandheads specimen the following carinae end in spines :—

Carinae.	Abdominal somites.
Submedian	6.
Intermediate	2, 3, 4, 5, 6.
Lateral	3, 4, 5, 6.
Marginal	2, 3, 4, 5.

It is thus seen that in the Sandheads specimen more carinae end in spines than is typically the case. In other examples in the Indian Museum collection, as shown in the table given by Kemp, the intermediate carina of the second abdominal somite never ends in spine, while that of the third sometimes does so ; in the Sandheads example the intermediate carina terminates in spine on both these somites. Similarly the lateral and the marginal carinae of the third and the second abdominal somites respectively end in distinct spines in my specimen from the Sandheads.

As mentioned by Kemp and shown in his figure, as also in those given by Wood-Mason¹, the marginal teeth of the telson are without any serrations on their edges. In the example from the Sandheads the outer edge of the intermediate tooth on the margin of the telson is distinctly serrate. The serrations are not quite so well developed as those in *Squilla latreillei*, but they can be seen quite distinctly, especially on the basal half of the tooth. Another specimen in the Museum collection, from off the Irrawady Delta, also shows faint indications of similar serrations.

Squilla decorata is so far known from the Bay of Bengal only. The type-specimen, from which Wood-Mason described the species, was collected in the Andamans, and Kemp recorded three other examples from off the Burma coast. One of the latter, from off Akyab, was included in the species somewhat doubtfully. Another specimen from Jack and Una Island, Mergui Archipelago, was referred to the species by Kemp and myself² in 1921. All the specimens so far known are females.

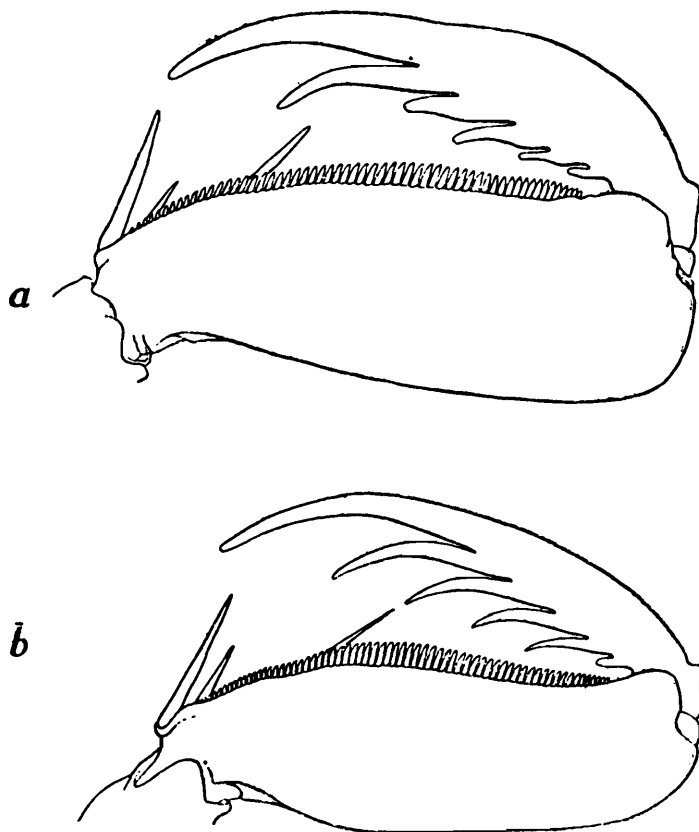
¹ Wood-Mason, *Figs. and Desc. of nine Squillidae*, p. 9, pl. iv, figs. 14-17 (Calcutta : 1895).

² Kemp and Chopra, *Rec. Ind. Mus.* XXII, p. 295 (1921).

***Squilla gilesi* Kemp.**

1913. *Squilla gilesi*, Kemp, *Mem. Ind. Mus.* IV, pp. 39, 40, pl. ii, figs. 25-27.

As pointed out by Kemp, *Squilla gilesi* resembles very closely *Squilla lata* Brooks¹, but with the help of the characters given by Kemp the two can be specifically distinguished without much difficulty. In *S. gilesi* the submedian carinae are present on the last thoracic and all the abdominal somites, and the inner margin of the bifurcate process of the



TEXT-FIG. 1.—*Squilla gilesi* Kemp.

Two terminal segments of raptorial claw of

a. male, b. female.

uropod bears only a series of serrations, instead of the well-developed spines that are present in Brooks' species; these two characters alone, apart from the others mentioned by Kemp, are sufficient to recognise the present species.

¹ As pointed out by Kemp it is somewhat doubtful whether the Indian specimens referred by him to *S. lata* Brooks really belong to this species. The Indian examples show some fairly important differences from Brooks' description of the species, and if these are found to be constant on an examination of further material, it will probably be necessary to give a new name to the Indian form. Komai [*Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, pp. 310, 311, pl. xiv, fig. 1 (1927)] has recently shown that in a Japanese example that he referred to Brooks' species, the mandibular palp is completely suppressed, the post-anal carina is absent, and, as in Brooks' examples, none of the carinae on the thoracic and first four abdominal somites (first five in the case of Brooks' specimens) ends in a spine. If Komai's example has been correctly identified, the Indian specimens certainly represent a distinct species. A re-examination of the Challenger material with reference to the mandibular palp and the post-anal carina can only clear this point.

I refer to this species three specimens from the Sandheads :—

C 1654/1 Bay of Bengal, between Pilot Ridge Light Vessel and Eastern Channel Light Vessel; 10 miles N. and S. of Eastern Channel Light Vessel. "Fraser", Nov., 1923. 1 ♂, 82 mm.

C 1655/1 Sandheads, off the mouth of the Hughli River. "Lady Fraser", Feb., March, 1928. 1 ♂, 1 ♀, 66 and 68 mm.

The smaller male is without raptorial claws, but the secondary sexual characters on the telson, mentioned by Kemp, are very clearly seen. The proximal tooth on the dactylus of the raptorial claw is greatly reduced in both the other examples, and the claw in the male shows the secondary characters very distinctly.

Squilla gilesi is so far known from the Indian waters only, from both the Bay of Bengal and the Arabian Sea. The types, from off the Madras coast, were collected at a depth of 80-110 fathoms.

Squilla nepa Latreille.

1913. *Squilla nepa*, Kemp, *Mem. Ind. Mus.* IV, pp. 60-64, pl. iv, fig. 49.

1926. *Squilla nepa*, Hansen, *Siboga Exped. Rep.* XXXV, pp. 10, 11.

1927. *Squilla nepa*, Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, p. 314.

Squilla nepa appears to be a fairly common species at the Sandheads, 14 specimens of it, collected between the years 1923 and 1932, having been brought back by members of the Bengal Pilot Service. Of these five are males and nine females, and, excluding a very young female 23 mm. long, range in size from 51 to 76 mm. Besides these there are a number of specimens from the same locality in the older collections also.

The species occurs commonly in Indian coastal waters, having been extensively met with both in the Arabian sea and the Bay of Bengal. It has a very wide range of distribution over the Indo-Pacific area, extending, according to Kemp, from Honolulu to Madagascar and Durban. Komai has recorded it from Formosa, which he believes "may be almost the northern limit of distribution of the species". The occurrence of this species in brackish waters, as recorded by Kemp¹ and Komai, is of interest.

Squilla holoschista Kemp.

1913. *Squilla holoschista*, Kemp, *Mem. Ind. Mus.* IV, pp. 64, 65, pl. iv, figs. 50-53.

1921. *Squilla holoschista*, Kemp and Chopra, *Rec. Ind. Mus.* XXII, p. 301.

I refer to this species four specimens from the Sandheads. Of these two are males and two females, and in size range from 64 to 77 mm.

Except for the specimens recorded by Sunier² from the Sunda Straits, the species is so far known to occur only along the east coast of India, where it is met with extensively from the Delta of the Ganges to Ceylon.

¹ Kemp, *Mem. As. Soc. Bengal* VI, p. 297 (1918).

² Sunier, *Contrib. Faune Indes Neerland.* IV, p. 69 (1918).

***Squilla oratoria* var. *inornata* Tate.**

1883. *Squilla inornata*, Tate, *Trans. Roy. Soc. S. Aust.* VI (for 1882), p. 51, pl. ii, figs. 3a, b, c.
 1913. *Squilla oratoria*, var. *perpensa*, Kemp, *Mem. Ind. Mus.* IV, pp. 66-68, pl. v, figs. 57-59.
 1924. *Squilla oratoria*, var. *inornata*, Hale, *Rec. S. Aust. Mus.* II, pp. 495, 496.
 1926. *Squilla oratoria*, var. *perpensa*, Hansen, *Siboga Exped. Rep.* XXXV, p. 11.
 1927. *Squilla oratoria*, var. *perpensa*, Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, pp. 318, 319.

From an examination of Tate's type-specimens, preserved in the South Australian Museum, Hale came to the conclusion that the varietal form separated by Kemp, under the name of *perpensa*, from typical examples of *Squilla oratoria* could not be distinguished from Tate's species. This view does not appear to have been accepted by later workers, as Kemp's name still continues to be extensively employed for this form. Through the courtesy of Mr. H. M. Hale, Curator, South Australian Museum, I have been able to examine one of the two type-specimens from which Tate originally described this species. This specimen, though broken in two parts, is in a good state of preservation, and shows clearly all the important characters. On comparing this specimen with the types of Kemp's *perpensa* from Tuticorin, South India, preserved in the collection of the Indian Museum, no doubt is left in my mind that Kemp's form is identical with *S. inornata*, and that the name of *perpensa* employed by him should, therefore, give place to the earlier designation of Tate. The two characters emphasized by Kemp for the separation of his variety from the *forma typica*, namely, the interrupted median carina of the carapace, and the presence of a sharp, elevated carina on the dorsal aspect of the raptorial carpus, terminating abruptly before reaching the anterior margin, are very clearly seen in the specimen from South Australia that I have seen. The median carina of the carapace is wholly absent for a short distance at the base of the anterior bifurcation and the carpus of the raptorial claw has a very distinct unbroken dorsal carina, exactly as in the type-specimens of Kemp's variety, and as shown in his figure (Plate V, fig. 58). In other characters also Tate's specimen agrees closely with the Indian Museum examples.

There are, however, a few minor differences between the Australian specimen and the Indian examples. In the former the margins of the rostrum are somewhat more upturned than is usually the case, and the carinae of the carapace, especially the median, are a little more upraised. These differences may, however, be due to the Australian specimen being dry. The rostrum is also truncate anteriorly, as is the case in some of the Indian Museum types, though in a large number of these, the anterior border is more or less rounded; further it is also slightly longer and narrower than is generally the case. The shape of the anterior lateral lobe of the sixth thoracic somite appears to be somewhat variable in the variety; in some cases it is almost straight and rather sharply pointed terminally, in others it is distally curved and bluntly pointed, while in some specimens it is almost truncated. In the Australian example it is somewhat curved and bluntly pointed.

Another point worth mentioning is that in the Australian type the lateral carina of the second abdominal somite ends on each side in a small, but distinct spine. In his description of the variety *perpensa* Kemp gives the following spine-formula :—

Carinae.	Abdominal somites.
Submedian	5, 6.
Intermediate	4, 5, 6.
Lateral	3, 4, 5, 6.
Marginal	1, 2, 3, 4, 5.

An examination of the large type-series has, however, shown that though in a number of specimens the lateral carinae of the second abdominal somite do not end in spines, as described by Kemp, in others a distinct spine can be seen on each side.

It is thus seen that the few differences that have been noticed between Tate's type of *inornata* and Kemp's types of *perpensa* are of a very minor importance and do not justify the retention of Kemp's variety as distinct from Tate's form.

The Australian specimen that I have examined is a female and is approximately 65 mm. long. It was collected, along with the second syntype, in the Gulf of St. Vincent in South Australia, and is registered under number C180 in the registers of the South Australian Museum.

I refer to this variety two small female examples, 45 and 52 mm. long, collected by "Lady Fraser" at the Sandheads in 1928. One of these has both the raptorial claws missing, but the other characters mentioned by Kemp and Komai for the recognition of the variety are very clearly seen¹.

The variety has a very wide range of distribution over the Indo-Pacific area. The types are from the Gulf of St. Vincent in South Australia; its northern range does not appear to extend beyond Formosa, while on the west it has been collected in the Persian Gulf. In the Indian waters the variety has been met with very extensively to the total exclusion of the *forma typica*.

***Squilla interrupta* Kemp.**

1913. *Squilla interrupta*, Kemp, *Mem. Ind. Mus.* IV, pp. 72-74, pl. v, figs. 63-65.

1927. *Squilla interrupta*, Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, p. 319.

1929. *Chloridella interrupta*, Schmitt, *Lingnan Sci. Journ.* VIII, p. 140.

As stated by Kemp, *Squilla interrupta* is one of the commonest species of *Squilla* in the Indian waters; at the Sandheads also this species appears to be the most abundant, there being 47 specimens of it from this locality. Of these 21 are males and 26 females, and these range in size from 50 to

¹ One large specimen sent to me by the Raffles Museum, Singapore, while agreeing with typical examples of *S. oratoria* var. *inornata* in most characters, differs from these in having the median carina of the carapace entire and uninterrupted. In this respect it resembles the *forma typica*, but in having the dorsal carina of the raptorial carpus entire, as also in all the other characters mentioned by Komai, the specimen appears to be referable to Tate's variety.

105 mm. They agree in every respect with typical examples of the species in the Museum collection. One specimen, a male 77 mm. in size, is, however, abnormal, in so far as the basal process of the uropod of one side has a large spine arising from near its base. The spine runs outwards and somewhat backwards and bifurcates into two in its distal portion, more or less like the bifurcate process of the basal segment itself. The other uropod is quite normal, as is also the specimen itself in every other respect.

The colour of this species has been described by Schmitt, as observed by Dr. S. F. Light in living specimens. In the Indian examples, that are all preserved in spirit, the chocolate-brown and red-brown noted by Dr. Light, is not seen, but in freshly-preserved specimens the posterior margins of the last two thoracic and all the abdominal tergites are streaked with green, as are also most of the carinae on the carapace and the submedian and the intermediate carinae of the abdominal somites. The median carina of the telson and the bases of the lateral spines are also green. The patch at the proximal end of the median carina of the telson appears to be, as remarked by Komai, a very constant character of the species. The tips of the bifurcate process of the uropod are pink in comparatively fresh examples.

Squilla interrupta has a wide range of distribution over the Indo-Pacific region, having been recorded from several localities from Formosa to the Persian Gulf. Its occurrence in the brackish waters at Talé Sap¹, Siam, is noteworthy.

***Squilla wood-masoni* Kemp.**

1913. *Squilla wood-masoni*, Kemp, *Mem. Ind. Mus.* IV, pp. 74-76, pl. v, figs. 63-65.

1926. *Squilla wood-masoni*, Hansen, *Siboga Exped. Rep.* XXXV, p. 12.

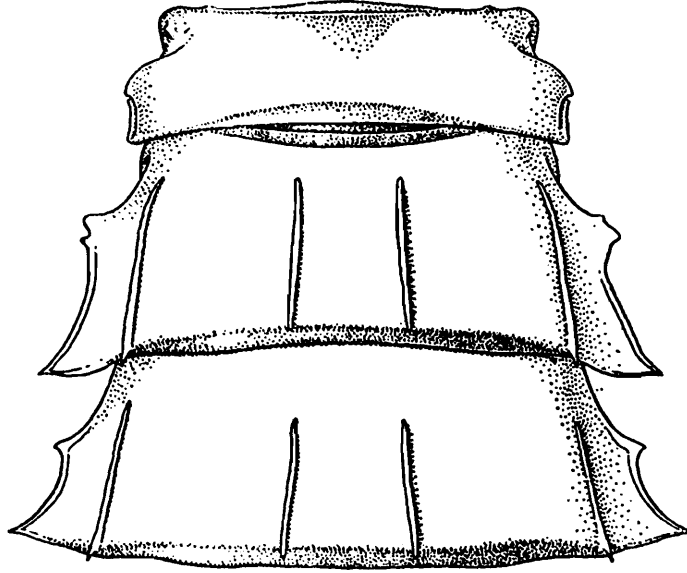
1927. *Squilla wood-masoni*, Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, p. 320.

I refer to this species one female specimen about 80 mm. long, collected by the "Lady Fraser" at the Sandheads in May, 1928. It agrees closely with the type-specimens of the species in the Indian Museum collection. A few minor differences are, however, seen when the specimen is compared with Kemp's description of the species. In the Sandheads example the anterior lateral process of the fifth thoracic somite, though shorter than in the allied species *S. oratoria*, with its variety *inornata* and *S. interrupta*, is proportionately longer than it is shown in Kemp's figure 63. Further, the lobe on the outer face of the longer spine of the bifurcate process of the uropod is also better developed than is shown by Kemp. In most of the examples of this species in the Museum collection, including a number of type-specimens also, the anterior process of the fifth somite and the lobe of the bifurcate process of the uropod, however, show a condition very similar to that in the specimen from the Sandheads². The anterior bifurcate portion of the median carina of the carapace is, as stated by Kemp, obsolete in this

¹ Kemp, *Mem. As. Soc. Bengal* VI, p. 297 (1918).

² Three examples of this species from Singapore, that I have examined for the Raffles Museum, also differ from Kemp's description and figures in these particulars.

Museum collection. The anterior lateral process of the sixth thoracic somite is, as mentioned by Kemp, prominent and acute in this species, but there appears to be a tendency for this to become secondarily bilobed. In two of the specimens from the Gulf of Martaban in the Museum collection there are slight indications of this bilobing visible; on one side of each of these specimens the anterior lateral process of the sixth somite has a minute projection on its anterior face, while on the other side of one of these, two small lobes can be somewhat indistinctly made



TEXT-FIG. 2.—*Squilla annandalei* Kemp.

Dorsal view of fifth, sixth and seventh thoracic somites of specimen from Sandheads.

out. In the example from the Sandheads there are two distinct lobes seen on the left side, while on the right also a minute lobe can be made out on the anterior edge of the lateral process.

The colour of the species has been briefly described by Kemp. The posterior borders of the last three thoracic and all the abdominal somites are prominently edged with dark brown. This is clearly seen in the type-specimen, as also in one or two other examples in the collection. The dark transverse patch, sometimes broken into four separate spots, on the second abdominal somite, and the two black spots near the proximal edge of the telson are very characteristic of the species.

Squilla annandalei is known from the Java Sea, Mergui Archipelago, Gulf of Martaban, and mouth of the Hughli River.

Lysiosquilla maculata (Fabricius).

1913. *Lysiosquilla maculata*, Kemp, *Mem. Ind. Mus.* IV, pp. 111-116, pl. viii, figs. 86-91.
 1926. *Lysiosquilla maculata*, Hansen, *Siboga Exped. Rep.* XXXV, p. 18.
 1927. *Lysiosquilla maculata*, Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, p. 330.
 1932. *Lysiosquilla maculata*, Bigelow¹, *Bull. Mus. Comp. Zool. Harvard* LXXII, pp. 169-173.

I refer to this species two male examples from the Sandheads, measuring 117 and 142 mm. in length. They agree in every detail with

¹ For references subsequent to the publication of Kemp's memoir in 1913 Bigelow's work may be consulted.

Kemp's description of the species and also with named examples in the Museum collection.

Monod¹ and Bigelow have suggested that the single male individual on which Kemp² based his variety *sulcirostris* probably represents only an abnormal individual of the typical form. Kemp gives two important characters by which his variety may be distinguished from typical examples of *L. maculata*. The rostrum in the variety "is triangular, widest at the base, and is produced to a much sharper point than in typical *L. maculata*", also in the anterior part it has "on each side a sharply-defined and deep groove running parallel to the lateral margin". Also the dactylus of the raptorial claw has eight teeth instead of 9-11 that characterise the *forma typica*. Both these characters, especially the shape of the rostrum, appear to be somewhat variable in specimens of *L. maculata*. In a male example from off the Atlantic Coast of Africa, examined by Monod, and referred by him to Kemp's variety, the rostrum is more or less like that of *sulcirostris*, but the dactylus has 11 teeth. In the nine specimens from Samoa and Honolulu, seen by Bigelow, the rostrum shows a considerable range of variation (p. 171, fig. 9-A, 9-B), from a shape more or less like that of a typical *L. maculata* to almost the shape of *sulcirostris*. The number of teeth on the dactylus also varies in most specimens from 9 to 11, though in one large female there are only eight short, stout teeth. It seems likely, therefore, that these two characters, as suggested by Monod, vary independently.

I have taken this opportunity to re-examine all the specimens of *L. maculata* in the collection of the Indian Museum, with special reference to the shape of the rostrum and the number of teeth on the raptorial dactylus. Most of the specimens have 10 or 11 teeth, but the rostrum shows a considerable range of variation from a typical condition as figured by Kemp to a shape almost like that seen in Kemp's variety. In some specimens with a rostrum like that of *sulcirostris*, faint grooves can also be made out on either side of the median carina. The shape of the rostrum approaching the *sulcirostris*-type is, as already suggested by Bigelow, seen in most of the male specimens only. It may, however, be noted that in no specimen of the typical form in the Museum collection is the shape of the rostrum exactly like that in the variety, in so far as in the latter the greatest breadth of the rostrum is at the base, while in the *forma typica* the rostrum is broadest a little in advance of the base. In the single specimen seen by Monod, as also in those examined by Bigelow, the rostrum is not widest at the base. The rostral grooves are also much better developed in the variety than in any of the examples of the typical form that I have examined.

Komai³ has recently obtained two male specimens from Japan that appear to agree exactly with Kemp's description of *sulcirostris*. The rostrum in these specimens is, according to Komai, triangular in shape, has well-defined grooves, and there are only eight spines on the dactylus of the raptorial claw. The association of the *sulcirostris*-type of rostrum with a smaller number of teeth on the claw is noteworthy.

¹ Monod, *Bull. Sci. Nat. Maroc* V, pp. 88, 89, pl. xxi, figs. B-F (1925).

² Kemp, *Mem. Ind. Mus.* IV, p. 116, pl. viii, figs. 92, 93 (1913).

³ Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, pp. 330, 331 (1927).

It thus seems fairly evident that even though the shape of the rostrum alone may not afford a very satisfactory character for the separation of Kemp's variety from typical examples of *L. maculata*, the association of the shape of rostrum as seen in Kemp's type-specimen of the variety *sulcirostris* with the presence of only eight teeth on the raptorial dactylus should be sufficient to distinguish between the two. The only specimen of *L. maculata* with eight teeth on the raptorial claw so far recorded is one of the two females from Samoa mentioned by Bigelow, but in this the rostrum is of the typical kind.

The pale eye-spot in the dark band close to the anterior margin of the carapace, mentioned by Bigelow and shown in his figure 9, is present in the Sandheads specimens and the other examples in the collection of the Indian Museum. In other respects the colour of my examples agrees with Kemp's account of it.

Lysiosquilla maculata is one of the most widely distributed species of Stomatopoda. It has been recorded from a large number of widely-separated localities over the entire Indo-Pacific area, and has also been collected in one or two places in the Atlantic.

***Lysiosquilla acanthocarpus* Miers.**

1913. *Lysiosquilla acanthocarpus*, Kemp, *Mem. Ind. Mus.* IV, pp. 120-122.

1927. *Lysiosquilla acanthocarpus*, Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, pp. 231, 232.

1930. *Lysiosquilla acanthocarpus*, Komai and Tung, *Annot. Zool. Japon.* XIII, pp. 14, 15.

One specimen of this somewhat uncommon species has been collected at the Sandheads. It agrees in almost every particular with Kemp's excellent and very detailed description of the species, as also with examples named by him and preserved in the collection of the Indian Museum.

Komai in 1927 referred two female examples to the present species. Of these, one from Formosa is said to "agree very well with Kemp's description of the species," though it had seven teeth on the raptorial dactylus, instead of six as is generally the case in the species. The other example from the Pacific coast of Honsyu shows still greater differences. The rostrum is broader than long, there are nine spines on the raptorial dactylus, the tubercle at the base of the dactylus, so characteristic of the species, is obsolete, and there are four marginal spines on one side of the telson and three on the other. From a consideration of these characters it appears almost certain that the Pacific coast specimen at least cannot be referred to Miers' species. The examples from Suruga Bay, a male and a female (Komai and Tung), are referable to the present species.

Excluding the Sandheads example, there are at present nine specimens of this species in the Museum collection; of these there are two males and seven females. In one specimen only are there five teeth on each raptorial dactylus; all the others have six on each side. The rostrum is always longer than broad, the prominence at the base of the dactylus is well marked, and the marginal teeth of the telson are quite normal in number and disposition.

The Sandheads example is a female and is registered as under :—

C 1657/1 Sandheads, mouth of the River "Lady Fraser", 1 ♀, 81 mm.
Hughli. April, May. 1932.

Lysiosquilla acanthocarpus has been recorded from Formosa, North Australia, Penang, Andaman Islands, both the coasts of Peninsular India and Trincomali in Ceylon. Komai's record of the species from the Pacific coast of Japan is, as mentioned above, somewhat doubtful.

*Squilla kemp*i (Schmitt).

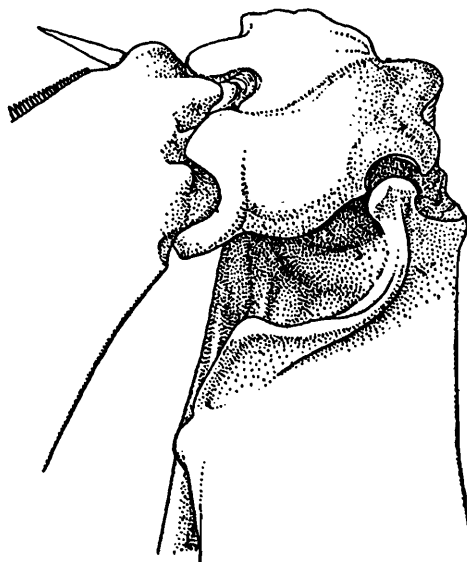
1913. *Squilla oratoria*, Kemp, *Mem. Ind. Mus.* IV, p. 69, pl. v, fig. 56 (*partim*)¹.
1927. *Squilla oratoria*, "Southern forms," Komai, *Mem. Coll. Sci. Kyoto Imp. Univ.* (B) III, pp. 315, 316.
1929. *Chloridella kemp*i, Schmitt, *Lingnan Sci. Journ.* VIII, pp. 135-140, pls. xvii, xviii.

Schmitt, in the paper cited above, described *Squilla kemp*i as a new species from Dr. S. F. Light's collection from Southern China, basing the specific name on the manuscript name given by Dr. Light in honour of the famous carcinologist and monographer of the Indo-Pacific Stomatopoda—Dr. Stanely Kemp. The Light collection, as remarked by Schmitt, was first submitted for study to Dr. Kemp, who was at the time connected with the Indian Museum, but on account of other engagements Dr. Kemp could not complete the work before his taking over charge of the "Discovery" Expedition, and the collection was, therefore, sent on to Dr. Schmitt with all the notes, etc., that Dr. Kemp had already made on the collection. From his correspondence with Dr. Light in this connection, copies of which are on the files of the Zoological Survey of India, it appears that Kemp, in view of the differences that exist between typical specimens of *Squilla oratoria* and those of the form later described by Schmitt as *S. kemp*i, had at first suggested calling the latter as a variety of the former, but on reconsideration he agreed with Dr. Light that the two were specifically distinct. Through the generosity of Dr. Light the Indian Museum possesses two fine specimens, a male and a female, of Schmitt's species, and a careful examination of these has shown that the form is undoubtedly distinct from *S. oratoria*, and the differences between the two warrant a specific distinction. Komai had also noticed these differences, but he separated examples of *S. kemp*i from typical specimens of *S. oratoria* under the name of "Southern forms." Komai's description of this form agrees almost exactly with the specimens of *S. kemp*i that I have examined, as also with Schmitt's description of the species, except for the fact that Komai has omitted to make a mention about the presence or absence of a spine on the outer inferior angle of the raptorial merus. A re-examination of Komai's specimens on this point, as suggested by Schmitt, would be very desirable, though it is likely that the spine would be found wanting. In the same way the two examples from Amoy, belonging to the British

¹ Only the examples from Amoy, described by Kemp, are referable to Schmitt's species.

Museum, that Kemp provisionally included in his account of *Squilla oratoria* are also most likely referable to Schmitt's species; the correspondence referred to above indicates that Kemp, while in England in 1923, re-examined these specimens and found them to be identical with the form later designated as *S. kemp*¹.

As pointed out by Schmitt, *Squilla kemp* resembles *Squilla oratoria* in several important respects, but the table given by Komai for the separation of his "Northern" and "Southern" forms of *S. oratoria* can be very usefully employed for distinguishing the two species. I give below a somewhat amplified table for separating these rather very similar species. The characters mentioned in my table are all included in Schmitt's excellent description of the species, and have been verified by me with the help of the specimens in the Indian Museum collection. The statement made by Dr. Light regarding the anterior bifurcation of the median carina of the carapace—mentioned in Schmitt's description of the species—is not borne out by an examination of the Indian examples. The median carina is entire in both the specimens that I have seen, but in view of Dr. Light's observations, and of the fact that in one of the two Amoy specimens included in Kemp's account of *S. oratoria*, the anterior bifurcation is said to be interrupted, it is likely that there is some variation in the species in this respect. Further the carina on the raptorial carpus also appears to show a considerable range of variation. Out of the three specimens examined by Schmitt only the right carpus of the female type-specimen is said to have three sharply-



TEXT-FIG. 3.—*Squilla kemp* Schmitt.

Raptorial carpus showing the dorsal carina with three weak lobes.

marked tubercles on the dorsal carina; in four of the six carpi examined the tubercles are weak and lobiform; while in the remaining sixth carpus—the left one of the single male example—there is a continuous ridge, more or less like that of the variety *inornata* (= *perpiensa*) of *S.*

¹ Since the above went to the press, Dr. Kemp has, at my request, once again examined these specimens and compared them with Schmitt's description of the species. He has no doubt that the Amoy specimens are referable to *Squilla kemp* and that the latter is a valid species. He has also sent me a list of characters which distinguish *S. kemp* from *S. oratoria*; most of these characters are included in the table on p. 33. I am very grateful to Dr. Kemp for the valuable help he has given me in this matter.

oratoria, but with three small thickenings or tiny tubercles on the outer side. In the two specimens seen by me also the carina of the raptorial carpus shows variation. In the male the carina is broken up into three distinct, though weak, lobes, but in the female it is a more or less continuous ridge, with very slight indications of three lobes; the ridge terminates abruptly before reaching the anterior margin. It thus appears that typically the dorsal carina of the raptorial carpus is broken up into three somewhat weak tubercles or lobes, but sometimes these are more or less obsolete and the carina is practically entire, as in the variety *inornata* of *Squilla oratoria*. It must, however, be pointed out that in typical examples of *oratoria* also the carina, as mentioned by Kemp, shows a considerable amount of variation, and that in large specimens only the tubercles are well developed.

Squilla oratoria

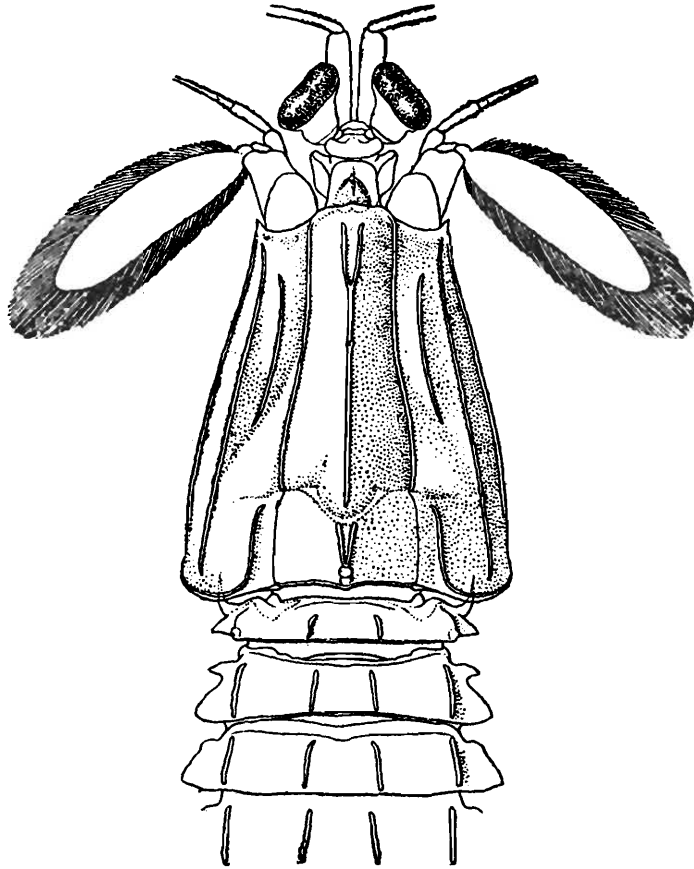
1. Dorsal surface of carapace and abdomen strongly punctate.
2. Median carina of carapace entire.
3. Anterior spine on lateral margin of fifth thoracic somite somewhat curved, the tip pointing forward and outward; posterior spine somewhat bluntly pointed.
4. Anterior lobe on lateral margin of sixth thoracic somite only slightly shorter than posterior and more or less parallel-sided.
5. Anterior lobe of seventh thoracic somite acutely produced.
6. Lateral process of eighth thoracic somite acutely pointed anteriorly.
7. Outer inferior angle of merus of raptorial claw with a distinct spine or a sharply-pointed angle.
8. Dorsal carina of raptorial carpus with 3-5 sharp tubercles.
9. Carina on ventral surface of telson behind anal opening strongly developed.
10. No distinctive colour markings on dorsal surface of body; first segment of exopodite of uropod uniformly light green.

Squilla kempii

1. Dorsal surface of carapace and abdomen sparsely and finely punctate, smooth and shining when dry.
2. Median carina of carapace entire, rarely interrupted at base of anterior bifurcation.
3. Anterior spine on lateral margin of fifth thoracic somite more strongly curved, the tip pointing forward and slightly inwards; posterior spine sharply pointed (text-fig. 4).
4. Anterior lobe on lateral margin of sixth thoracic somite much shorter than posterior, and somewhat triangular in shape.
5. Anterior lobe of seventh thoracic somite only a minute rounded projection.
6. Lateral process of eighth thoracic somite rectangular or a little obtuse anteriorly.
7. Outer inferior angle of merus of raptorial claw bluntly rounded, without an indication of a spine or a sharply-rounded angle (text-fig. 3).
8. Dorsal carina of raptorial carpus generally with 3 weak tubercles or lobes; tubercles or lobes sometimes almost obsolescent.
9. Carina on ventral surface of telson behind anal opening rather feebly developed.
10. In spirit specimens second and fifth abdominal somites with conspicuous patches of dark colour; distal part of first segment of exopodite of uropod also coloured black.

Squilla kempii occurs commonly along the coasts of Southern China, Dr. Light having collected numerous specimens of it at Hoihow, Amoy, Dodd Island Lighthouse, Chin Bay and several other localities. It has also been recorded from Foochow (Kellog, see Schmitt), Formosa, Ryûkyû, Kyûshû, Inland Sea and some other places (Komai). It is commonly taken in the company of *Squilla oratoria*, but does not extend to the northern range of this species. It lives in shallow water and prefers a muddy bottom. Dr. Light, in his correspondence with Dr. Kemp,

gives some very interesting particulars about this species. Mentioning the localities from which he collected *S. kempfi*, Dr. Light says: "I have



TEXT-FIG. 4.—*Squilla kempfi* Schmitt.

Dorsal view of the anterior part of the body. The lateral lobes of the fifth, sixth and seventh thoracic somites are very clearly seen.

large series of the typical form (*S. oratoria*) from the same localities and there are no signs of intergradations either in color or in the morphological characters noted. The typical form is generally lighter in color and without any striking color blotches, while the variety under description (*S. kempfi*) is generally browner and has a broad dark chocolate brown band across the centre of the 2nd abdominal segment and an area of the same color marking the distal part of the inner segment of the exopodite of each uropod. It also seems to be typically larger, broader and heavier." Further on he states: "The proportional frequency of the different species of *Squilla* in a collection made from the debris from the shrimp nets¹ at Tsimei may be of interest to you. Of the 233 specimens collected 5 were *S. scorpio*, 2 were *S. faveolata* (more common in Amoy Harbour²; apparently more of an open sea species), 16 were *S. interrupta* and the remaining were *S. oratoria* s. lat., of which 133 were *S. oratoria*, var. *perpensa*, 43 typica, 21 doubtful or intermediate and 13 of the variety I propose to consider *S. kempfi*. The individuals of the last named form reach the largest size of any taken here as yet. They are readily separable at once from any other of the local forms by color and it seems to

¹ Schmitt has given a description of these nets, *vide* p. 129 of the paper cited above.

² There are in the Indian Museum three specimens of *S. faveolata* from Amoy Harbour presented by Dr. Light,

me by shape. The posterior end of the abdomen gives the impression of being considerably broader and flatter than in the case of *S. oratoria typica* and var. *perpensa*."

In the Indian Museum there are two specimens from Tsimei i—

C 955/1 From nets at Tsimei, China. S. F. Light. 1 ♂, 1 ♀, 125 and 88 mm.

As in *S. oratoria* the mandibular palp is well developed and epipodites are present on the first four thoracic limbs. The corneal index in the male specimen I have seen is about 4·8, while in the other example the cornea is proportionately broader and the index is about 3·9 only.

Squilla indica Hansen.

1926. *Squilla indica*, Hansen, *Siboga Exped. Rep.* XXXV, pp. 12-14, pl. i, figs. 4a-4c.

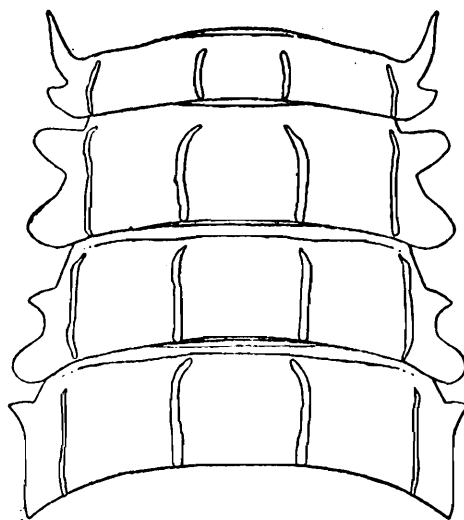
As pointed out by Hansen, *Squilla indica* belongs to the group of species in which *S. oratoria* and its allies are placed, but that it can be easily separated from the other species in this group is clear from Hansen's description of it.

One female specimen, collected by the R. I. M. S. "Investigator" in the Nicobar Islands, agrees very closely with Hansen's description of the species, and is no doubt referable to it.

The median carina of the carapace is altogether obsolete in the anterior part (considerably more so than in Kemp's *Squilla wood-masoni*). The anterior breadth of the carapace at the level of the base of the anterolateral spines is markedly less than half the length of the carapace and rostrum, and is even less than the length of the carapace alone.

The rostrum is as described by Hansen, and is distinctly longer than its breadth at the base. No trace of the median keel is visible in my specimen.

There are seven well-developed, long and slender spines (including the terminal one) on the dactylus of the raptorial claw, but the rounded



TEXT-FIG. 5.—*Squilla indica* Hansen.

Dorsal view of the first four exposed thoracic somites.

protuberance near the base of the dactylus is hardly conspicuous. The outer margin of the dactylus is evenly rounded. The carina on the dorsal

aspect of the carpus is as described by Hansen, and the inferior margin of the merus is angular and does not carry a spine.

The lateral processes of the first three exposed thoracic somites differ considerably from those of the allied species. The anterior lateral process of the fifth somite is a narrow elongated, spine-like structure, strongly curved at the base in a forwardly direction and running more or less parallel with the long axis of the body. The posterior process of this somite is a somewhat large truncate lobe, with the anterior angle rather acute. The margin of the sixth somite has two subequal rounded lobes, the anterior pointing somewhat forwards and the posterior directed slightly backwards. The anterior lobe of the seventh somite is shorter than the posterior, is considerably narrower and is acutely pointed; the posterior lobe is broadly rounded. The 8th somite is provided with a fairly large, more or less acutely-pointed anterior lobe (text-fig. 5).

The carinae on the last three thoracic and all the abdominal somites are well developed. There are four pairs of carinae on the first five abdominal somites and three pairs on the sixth, but most of these do not end in spines. The spines on the abdominal carinae are disposed as follows:—

Carinae.	Abdominal somites.
Submedian	5, 6.
Intermediate	5 ¹ , 6.
Lateral	5, 6.
Marginal	5.

It is thus seen that only the fifth and sixth abdominal somites bear any spines, the other somites being altogether unarmed.

The telson has a high and sharp median carina, with a slight proximal notch, and an overhanging spine at the distal end. The carina, or its posterior spine, does not extend up to the posterior margin of the telson. The marginal teeth are well developed, but on one side the submedian and the intermediate are broken. The marginal denticles are, as observed by Hansen, acutely pointed and somewhat spine-like. On the unbroken side of the telson there are six submedian denticles, of which the proximal five have acute tips—in one or two even bifid; the sixth is very much larger than the others and is broadly rounded. There are eight sharply-pointed intermediate denticles, and one large lobe-like process on the inner side of the intermediate tooth. The single lateral denticle is also acutely pointed. The ventral surface of the telson is smooth.

The peduncular segment of the outer uropod is provided with a single spine near its articulation with the exopodite, while the outer margin of the basal segment of the exopod has seven, somewhat flattened and curved movable spines, the last of which is very much larger than the rest and overhangs the basal part of the terminal segment. The inner spine of the bifurcate process is much longer than the outer spine, and has its inner margin serrate. The lobe on the outer margin of this spine is, as described by Hansen, uncommonly large, and the margin anterior to the lobe is deeply concave.

¹ The spine is clearly seen only on one side of this segment.

The colour of the single specimen I have seen is not characteristic, but on the posterior half of the carapace there is a dark patch in the median line. The posterior margins of the last two thoracic and all the abdominal somites are narrowly edged in dark-brown, and there are traces of a patch of the same colour on the dorsal surface of the second abdominal somite. The distal segment of the exopod of the uropod is dusky, and the distal half of the endopod is also similarly bordered.

In the Indian Museum example the mandibular palp is altogether absent, and epipodites are present on the first two thoracic limbs only; the epipodite at the base of the raptorial claw is of about the same size as that of the first leg.

The specimen in my collection has yielded the following measurements:—

Total length of body	..	..	..	41 mm.
Length of carapace (excluding rostrum)		..	..	9.7 mm.
Breadth of carapace at antero-lateral angles			..	4.0 mm.
Length of rostrum			..	1.8 mm.
Breadth of rostrum	..	..	..	1.3 mm.
Breadth of cornea	..	..	..	2.5 mm.
Corneal index	..	..	..	3.88
Breadth of telson	..	..	..	7.2 mm.
Median length of telson (excluding spines)		..	..	6.4 mm.

The Indian example is registered as under:—

C 1658/1 Octavia Bay, Nancoury Harbour, Marine Survey, 22, 1 ♀, 41 mm.
Nicobars; 13 fathoms. 23 Nov., 1922.

Besides the specimen now recorded, the species is known from two examples only, a male and a female, collected by the Siboga Expedition, one in the Celebes Sea and the other in the Buton Straits. Of the two specimens, the male shows some slight differences from the female, which is considered as the type. The Indian example agrees closely with the Siboga female.

Though *Squilla indica* has a superficial similarity with the species in the *nepa* group of the genus, it differs from all the members of this group in a number of very well-marked characters. The total suppression of the mandibular palp, the presence of epipodites on two legs only, and the possession of seven (or eight) teeth on the raptorial dactylus clearly separate this species from all its allies; while the longer and more sharply-pointed rostrum, the different shape of the lateral processes of the thoracic somites and the uncommonly large lobe on the outer face of the longer spine of the bifurcate process of the uropod are all characters that are not shared by any other species in this group. Besides these characters the absence of spines at the posterior extremities of the dorsal carinae on the first four abdominal somites is noteworthy. Within the group, *Squilla indica* shows some resemblance to *S. wood-masoni* Kemp in the, more or less, total suppression of the anterior part of the median carina of the carapace, and the lateral processes of the free thoracic somites show a slight similarity to those of *S. interrupta* Kemp, but the differences enumerated above far outweigh these isolated points of resemblance. *S. indica* thus appears to be a species of very uncertain affinities. The total suppression of the mandibular palp, and the great

reduction in the number of epipodites on the thoracic legs are very remarkable characters of this species, in so far as these characters are not found in any other species of the *nepa* group.

The only Indo-Pacific species known¹ to me that have epipodites present on the first two legs only are *S. gibba* Nobili, *S. supplex* Wood-Mason and *S. scorpio* Latreille (with its variety *immaculata* Kemp), and all these except Wood-Mason's species are further characterized by the total absence of the mandibular palp. *S. indica* also, as stated above, shows these characters, but there does not appear to be any close similarity or affinity between it and the species mentioned above².

The facts stated above lend support to the opinion that Kemp and I³ expressed in 1921 regarding a reduction in the number of epipodites in the genus *Squilla*. From an examination of the large collections preserved in the Indian Museum we were led to remark "that a reduction in the number of epipods has taken place in the genus *Squilla* on several different occasions and that the character, though possessing a definite specific value, cannot be used as a guide to the affinities of the different forms. In this it resembles the mandibular palp, which appears and disappears throughout the genus, apparently without any regard to the affinities of the species concerned."

Squilla lirata Kemp and Chopra.

1921. *Squilla lirata*, Kemp and Chopra, *Rec. Ind. Mus.* XXII, pp. 303-307.

Two fine female specimens of this apparently rare species are in the present collection. They were collected at Singapore by Mr. M. W. F. Tweedie, and have been presented to the Indian Museum by the Raffles Museum, Singapore. The species was described in 1921 from two examples only from Singapore, and does not appear to have been recorded so far from any other locality. The present specimens agree closely with the published description, as also with the type-specimens preserved in the Indian Museum.

The two specimens examined in 1921 differed from one another in the nature of the anterior bifurcation of the median carina of the carapace. In one example the whole of the carina from the mid-dorsal pit to the anterior margin of the carapace was bifurcated, but it was distinctly interrupted at the point of bifurcation; in the other specimen the carina was entire, and was bifurcated for little more than half the distance between the dorsal pit and the anterior margin. In the two specimens now examined the carina is entire, there being no interruption at the point where it divides, but the bifurcation extends for the whole distance from the mid-dorsal pit to the anterior end of the carapace.

Another point worth mentioning is that in the specimens described in 1921 the first two abdominal somites were found to have only three

¹ Kemp and Chopra, *Rec. Ind. Mus.* XXII, p. 298 (1921).

² Bigelow has recently described another species, *S. mauriana*, sp. nov. in which only two pairs of epipodites are present and the mandibular palp is also absent. This species was taken in the Hawaiian group of islands in the Pacific, and does not appear to show any marked similarity or affinity to *S. indica*. For a description of this species see Bigelow, *Bull. Mus. Comp. Zool. Harvard* LXXII, pp. 177-182 (1932).

³ Kemp and Chopra, *Rec. Ind. Mus.* XXII, p. 299 (1921).

carinae between the submedians, thus differing from examples of *S. multicarinata* White, in which there are five such carinae. In the specimens now before me the position is slightly different. On the first somite there are three well-marked carinae between the submedians, as described before, but on either side of the middle one of these three, there is a short low carina on the posterior half of the segment. These low carinae are better developed on the second somite, where they extend on about the three-fourths of the dorsal surface, and though lower than the principal carinae are still quite sharp and are distinctly seen.

Apart from these minor differences the specimens agree in every respect with the types.

O 1659/1 Siglap, Singapore.

M. W. F. Tweedie, 2 ♀♀, 73 and 74 mm.
June, 1933.

The species is so far known from Singapore only.

***Pseudosquilla ciliata* (Fabricius).**

1913. *Pseudosquilla ciliata*, Kemp, *Mem. Ind. Mus.* IV, pp. 96-100.

1932. *Pseudosquilla ciliata*, Bigelow, *Bull. Mus. Comp. Zool. Harvard* LXXII, pp. 152-160.

One specimen is referred to this species :—

O 1660/1 Southern Point, Outram Island, Marine Survey, 1 ♂, 22 mm.
Andamans. 5.ii.1924.

The specimen, though small and with a carapace length (excluding the rostrum) of only 4.2 mm., shows practically all the characters of the adult. The submedian carinae on the telson are, however, absent, and the copulatory organs appear to be somewhat weakly developed. The teeth on the raptorial dactylus are quite large. The postero-lateral angle of the fourth abdominal somite bears a short, but distinct spine. In all other characters the specimen agrees exactly with Kemp's description of the species. A small but distinct spine, as mentioned by Bigelow, can be seen on the distal end of the raptorial propodus. The presence of this spine has not been noticed by Kemp, but it is present in all the specimens in the Indian Museum collection.

The species has a wide range of distribution in the Indo-Pacific and the Atlantic Oceans.

***Pseudosquilla oculata* (Brullé).**

1913. *Pseudosquilla oculata*, Kemp, *Mem. Ind. Mus.* IV, pp. 102, 103.

1921. *Pseudosquilla oculata*, Edmondson, *Occ. Papers Bishop Mus.* VII, pp. 290-292.

1925. *Pseudosquilla oculata*, Edmondson, *Bull. Bishop Mus.* XXVII, pp. 59, 60.

1932. *Pseudosquilla oculata*, Bigelow, *Bull. Mus. Comp. Zool. Harvard* LXXII, pp. 165-168.

One specimen from the Maldive group of islands agrees closely with the published descriptions of the species, as also with the small and somewhat broken example from the Society Island in the Museum collection.

C 1661/1 Reef on the north side of Fuladu Island, Goifurfehendu Atoll, Maldives. Marine Survey, 1 ♂, 42 mm.
10.xii.1923.

The specimen has a carapace length of 10 mm.

P. oculata, like the preceding species, is also known to live both in the Atlantic and the Indo-Pacific Oceans. In the latter its range extends from the Society Islands, Hawaii and Samoa to Mauritius on the western side.

Gonodactylus glabrous Brooks.

1913. *Gonodactylus glabrous*, Kemp, *Mem. Ind. Mus.* IV, pp. 167-169, pl. ix, fig. 113.

1932. *Gonodactylus glabrous*, Bigelow¹, *Bull. Mus. Comp. Zool. Harvard* LXXII, pp. 127-135.

Bigelow, in the paper cited above, gives a very detailed description of the species, mentioning a number of points that had been overlooked by most of the previous workers. The specimens of this species mentioned by Kemp, as also those now examined by me, agree with Bigelow's account in almost every particular, though in a variable species like the present, there are bound to be considerable differences of a minor importance between specimens from different localities. The sexual dimorphism, pointed out by Bigelow, is very clearly seen in the large number of specimens of both sexes that I have examined. In young examples the sculpturing of the sixth abdominal somite and of the telson is similar in both sexes, but in specimens of about 40 mm. and over, one can almost invariably separate the two sexes by examining the keels on the telson and on the last abdominal somite. Another point that I have noticed is that whereas in young examples and in most of the female specimens examined all the six keels on the last abdominal somite and the three central keels on the telson end in spines, in large males generally these spines are missing. In the latter case in several specimens a careful examination reveals signs of the breaking off of the spines, but it is noteworthy that this breaking off seems to take place more often in the males than in the females. I have examined 68 large specimens from our collection with special reference to the presence or absence of these spines, and they have yielded the following results:—

Out of 49 females examined

30 had spines well developed,

13 had spines present on some keels, broken or missing on others,
and

6 had no spines.

Out of 19 males examined

2 had spines well developed,

4 had spines present on some keels, broken or missing on others,
and

13 had no spines.

The uropods in *G. glabrous* present certain peculiar features, which have been fully described by Bigelow. The specimens examined by me closely agree with Bigelow's description. The tip of the dactylus of the raptorial claw is also as described and figured by Bigelow, though a breaking off of the tip is noticeable in several instances.

¹ This paper contains a complete synonymy since the publication of Kemp's monograph.

The colour in comparatively fresh specimens is as described by Kemp. The minute spots on the telson, in addition to those on the sixth somite, that Bigelow has mentioned, are also clearly seen in a large number of the Indian examples.

Gonodactylus glabrous has a very wide range of distribution over the Indo-Pacific area. Kemp and Bigelow have given a number of localities from which the species has been recorded. It is known to occur in the Mediterranean Sea also. The additional specimens now seen by me are mostly from localities already mentioned by Kemp.

One female specimen from the Andamans is abnormal in so far as the median carina of the telson is much shorter than the others, the first submedian carinae are arched and converging posteriorly approximate toward one another in the median line, so as to partly encircle the median carina. The bifurcate process of the uropod of one side in this example is also abnormal, as the spines are very short, and the lobe or tooth at the base of the outer spine is missing. This is perhaps a result of regeneration. The process of the other side is quite normal.

***Gonodactylus pulchellus* Miers.**

1913. *Gonodactylus pulchellus*, Kemp, *Mem. Ind. Mus.* IV, pp. 177-179, pl. x, figs. 117, 118.
 1921. *Gonodactylus pulchellus*, Kemp and Chopra, *Rec. Ind. Mus.* XXII, p. 311.
 1921. *Gonodactylus pulchellus*, Tattersall, *Journ. Linn. Soc. (Zool.)* XXXIV; pp. 364, 365.
 1926. *Gonodactylus pulchellus*, Hansen, *Siboga Exped. Rep.* XXXV, p. 38.
 1929. *Gonodactylus pulchellus*, Hale, *Trans. Roy. Soc. S. Australia* LIII, p. 34.

With the help of the table given by Kemp¹ in 1915, *G. pulchellus* can be easily distinguished from *G. trispinosus*, *G. nefandus* and other allied species, with which it has a very close resemblance. I refer to this species a single specimen collected in the Nicobars in 1922. Even after immersion in spirit during all these years the dark patches of colour mentioned by Kemp in 1913 can be clearly made out.

C 1662/1 East coast of Camorta Island, Marine Survey, 1♀, 34 mm.
 Nicobars. 23.x.1922.

The species is known from a number of localities in the Indo-Pacific region, from North Australia to East Africa.

***Gonodactylus nefandus* Kemp.**

1913. *Gonodactylus nefandus*, Kemp, *Mem. Ind. Mus.* IV, pp. 179, 180, pl. x, figs. 119, 120.
 1921. *Gonodactylus nefandus*, Kemp and Chopra, *Rec. Ind. Mus.* XXII, p. 311.
 1926. *Gonodactylus nefandus*, Hansen, *Siboga Exped. Rep.* XXXV, p. 32.

I refer to this species two specimens that agree closely with Kemp's type-specimens in the Indian Museum.

C 1663/1 Nancoury Harbour, Nicobars: Marine Survey, 1♀, 33 mm.
 19-30 fathoms. 19.xii.1922.
 C 1664/1 Ross Channel, Port Blair, Andaman Islands: 2-9 fathoms. S. W. Kemp, 1♀, 28 mm.
 March, 1921.

¹ Kemp, *Philippine Journ. Sci.* X, p. 185 (1915).

G. nefandus is known to occur commonly in the Andamans; it has also been recorded from the Arakan coast, Malacca Straits, the Philippines (Kemp and Chopra), and a number of localities in the Indian Archipelago (Hansen).

As stated by Kemp, the spirit specimens of *Gonodactylus nefandus* have no characteristic colouration, there being only a dark and inconspicuous mottling on the carapace and abdomen. Fresh examples, however, appear to have a very striking colour. Dr. Kemp has described in his Station Book the colour of the specimen that he collected in the Ross Channel, Andamans (C 1664/1) as follows:—

“Carapace and abdomen dorsally mottled with brown and red on a pale ground, the brown mottling tending to form two transverse bars on carapace. Last somite and telson dull green. A white spot at base of central rostral spine. Antennular flagella red. Thoracic appendages bright red terminally, except raptorial claw, which is mottled at base, with white terminal segments. Uropods red at base, verging to sulphur yellow or orange yellow distally.”

No trace of this colouring can now be seen on this specimen, only an inconspicuous mottling, chiefly on the abdominal somites, being left after long preservation in spirit. On the first abdominal somite a short and broad transverse band can be seen in this example, as also in a number of other specimens.

*Gonodactylus glaber*¹ (Lenz).

1913. *Gonodactylus glaber*, Kemp, *Mem. Ind. Mus.* IV, pp. 182, 183, pl. x, fig. 121.

1915. *Gonodactylus glaber*, Kemp, *Philippine Journ. Sci.* X, p. 186.

I refer to this rather rare species two specimens collected by the R. I. M. S. “Investigator” in the Nicobars. These agree closely with Kemp’s excellent and detailed description of the species, as also with named examples in the Museum collection. The differences noticed by Kemp between his smaller and larger examples are seen in my specimens also. In the smaller example the antero-lateral borders of the carapace are less acute, the eye-stalks are proportionately longer, and the feeble corrugations on the margins of the lateral lobes on the dorsal surface of the telson, that Kemp noticed in the larger example examined by him, cannot be seen.

The greatly reduced inner spine of the bifurcate process of the uropod is very characteristic of this species. The peduncular segment of the uropod terminates in a large dorsal spine, that overhangs the proximal part of the basal segment; the latter also has a small spine on its outer distal angle. Further, the bosses on the telson have a very characteristic appearance, as also the notch near the posterior end of the outer margin of the raptorial dactylus. The inner edge of the dactylus is minutely serrate.

¹ Tattersall’s *Gonodactylus glaber* [*Journ. Linn. Soc. (Zool.)* XXXIV, p. 362 (1921)] is not included in this synonymy; it is really *G. glabrous* (Brooks).

C 1665/1	Camorta Island (west of Jetty), Nicobars.	Marine Survey, 13.xii.1921.	1 ♂, 27 mm.
C 1666/1	Small Coral and Rock Reef on west side of Camorta, north of entrance to Expedition Har- bour, Nicobars.	Marine Survey, 3.iii.1922.	1 ♀, 18 mm.

The following measurements are taken from the two Nicobar specimens, and the large female examined by Kemp :—

		C 1665/1	C 1666/1	2690/7
Total length of body	.. ..	27.0	18.0	26.0
Length of carapace and rostrum	.. ..	8.3	5.0	7.7
Length of carapace	.. ..	6.2	3.5	5.6
Breadth of carapace	.. ..	4.5	3.0	4.2
Length of eye-stalk	.. ..	2.4	1.9	2.3
Length of telson	.. ..	4.1	2.4	4.0
Greatest breadth of telson	.. ..	5.0	3.0	4.6

The smaller specimen from the Nicobars is more or less uniformly pale in colour, but the other example has brownish chromatophores scattered all over its surface, with a tendency, as mentioned by Kemp, to form bands or patches on the posterior part of the carapace, on the sixth and seventh thoracic, and on the first, fourth and fifth abdominal somites.

The species has previously been recorded from the Andamans, Ceylon and Zanzibar. Kemp recorded it from the Philippines also, but the specimens from that locality differed so much from the Indian Museum examples that he had previously examined, that he had some doubts regarding the identity of the Philippine specimens.