

Further Observations on  
*Oratosquilla*, with Accounts of Two  
New Genera and Nine New Species  
(Crustacea: Stomatopoda: Squillidae)

RAYMOND B. MANNING

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## ABSTRACT

Manning, Raymond B. Further Observations on *Oratosquilla*, with Accounts of Two New Genera and Nine New Species (Crustacea: Stomatopoda: Squillidae). *Smithsonian Contributions to Zoology*, number 272, 44 pages, 25 figures, 1978.—Six species of the Indo-West-Pacific stomatopod genus *Oratosquilla* Manning are redescribed from type-specimens: *O. anomala* (Tweedie, 1935), *O. gonypetes* (Kemp, 1911), *O. inornata* (Tate, 1883), *O. perpensa* (Kemp, 1911), *O. quinquedentata* (Brooks, 1886), and *O. woodmasoni* (Kemp, 1911). *Oratosquilla tweediei* Manning, 1971 is synonymized with *O. woodmasoni* and *O. jakartensis* Moosa, 1975 also is shown to be identifiable with that species. Syn-types of *Squilla affinis* var. *intermedia* Nobili, 1903, are identified with four different species. Nine species are described as new: *O. asiatica*, *O. gravieri*, *O. hindustanica*, *O. pentadactyla*, *O. sollicitans*, *O. stephensoni*, *O. striata*, *O. subtilis*, and *O. turbata*. Species groups in *Oratosquilla* are reexamined; two are redefined and five are recognized. Two new genera are proposed for species previously assigned to *Oratosquilla*, which now includes 31 nominal species.

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# Further Observations on *Oratosquilla*, with Accounts of Two New Genera and Nine New Species (Crustacea: Stomatopoda: Squillidae)

*Raymond B. Manning*

## Introduction

This report was initiated after examination of material during visits to several European museums in 1971 revealed the possibility that each of several supposedly common species of the Indo-West-Pacific genus *Oratosquilla* Manning, 1968 might actually be made up of more than one species. This possibility also was supported by examination of material from a variety of sources.

In 1972 I visited the Zoological Survey of India, Calcutta, with the primary aim of redescribing type-specimens of several species originally named by S. W. Kemp (1911, 1913); most of Kemp's material, which formed the basis for the first and only monograph of the Indo-West-Pacific stomatopods, had been deposited in the Zoological Survey. Inasmuch as Kemp's accounts and illustrations are still in use as the primary source of identification of Indo-West-Pacific stomatopods today, reexamination of his material was particularly important. That examination revealed that each of the accounts of three of the common species of *Oratosquilla* reported by Kemp, *O. gonypetes* (Kemp, 1911), *O. quinquedentata* (Brooks, 1886), and *O. perpensa* (Kemp, 1911), were based on more than

one species. The confusion has been compounded by later authors, including Chopra (1939), Holthuis (1941), and Manning (1966), among others. These three species are redescribed herein, and new species, based at least in part on material identified with these species by Kemp, are newly described. Some material of these species from other collections, especially that incorrectly identified in the literature, also is reported here. A fourth species described by Kemp (1911), *O. woodmasoni*, is redescribed, and *O. tweediei* Manning, 1971, and *O. jakartensis* Moosa, 1975, are shown to be its synonyms.

In addition, I have been able to examine type-specimens of three other species: *Squilla affinis* var. *intermedia* Nobili, 1903; *Squilla inornata* Tate, 1883; and *Squilla anomala* Tweedie, 1935. Nobili's variety *intermedia* is preoccupied by *Squilla intermedia* Bigelow, 1893, and was considered by Kemp (1913:58) to be unrecognizable; apparently material of four different species was included by Nobili under this name. *Squilla inornata* and *S. anomala*, both of which have been confused in the past with *Squilla oratoria* var. *perpensa* Kemp, are redescribed herein; they appear to be distinct species. In all, six species are redescribed below and nine species are newly described.

EXPLANATION OF TERMS.—All of the species of the *gonypetes* and *perpensa* groups described below

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share certain features which have been omitted from the descriptions to avoid repetition. These include: the anterior margin of the ophthalmic somite is flattened or medially emarginate, unarmed; the ocular scales are subquadrate or truncate in shape, are inclined laterally, and are separate medially; the mandibular palp and four epipods are present; there are eight carinae on each of the anterior five abdominal somites; there is a spinule or tubercle ventrolaterally on each side of the sixth abdominal somite, anterior to the articulation of the uropod; there are three pairs of marginal teeth, the submedians with fixed apices, as well as prelateral lobes on the telson.

*Oratosquilla woodmasoni* differs from the other species described below in having the anterior margin of the ophthalmic somite broadly rounded and usually armed with a median spinule. It resembles the other species described herein in the other features listed above and these features are not repeated in its description.

The spine formula for the abdominal somites, indicating on which somite the carinae are armed posteriorly, is shown as follows: submedian 5-6, intermediate 4-6, lateral (1-2)3-6, marginal 1-5. This formula shows that posterior spines are found on the submedian carinae of the fifth and sixth somites, the intermediate carinae of the fourth through sixth somites, the lateral carinae of the third through the sixth and occasionally on the first and second also, and the marginal carinae of the anterior five somites.

A denticular formula of 3-4, 7-9, 1, for marginal denticles of the telson, indicates that on each side of the midline there are three to four submedian, seven to nine intermediate and one lateral denticles.

Size descriptors used in the text, such as moderate or large, are based on the following scale developed for descriptive accounts of adult stomatopods: very small, total length less than 30 mm; small, total length 31 to 50 mm; moderate, total length 51 to 150 mm; large, total length greater than 150 mm.

Size descriptors for eyes, based on observed range of corneal indices (carapace length divided by cornea width  $\times 100$ ), are as follows: very small, corneal index greater than 500; small, index 400-499; moderate, index 300-399; large, index less than 299. In any given species, the indices tend to be smaller in juveniles and larger in adults.

Range of total lengths given in the section on measurements is based on material reported herein and does not necessarily reflect the overall size range of the species.

Unless otherwise noted, color notes are based on preserved specimens.

Total length (TL) is measured on the midline, from the anterior margin of the rostral plate to a line between the apices of the submedian teeth of the telson. Carapace length (CL) is measured on the midline; it does not include the length of the rostral plate. The prelateral lobe is measured from the anterolateral angle of the telson to the apex of the lobe. The segments of the uropodal exopod are measured dorsally. All measurements are in millimeters (mm).

Wherever possible, localities have been verified by reference to U.S. Board of Geographic Names' Gazetteers. Alternate spellings and coordinates obtained from those gazetteers are entered in brackets when used. If this information is given under "Material," it is not duplicated under "Distribution."

Original depth data are given throughout. Fathoms are converted to meters by multiplying by 1.83, and given in parentheses.

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Fenner A. Chace, Jr., Smithsonian Institution, took time to go through a draft of the manuscript



in his welcome critical manner, for which I thank him.

REPOSITORIES.—Institutions in which the material reported herein is deposited are identified by the following abbreviations:

|      |   |
|------|---|
| AM   | Australian Museum, Sydney   |
| BMNH | British Museum (Natural History), London  |
| MCSN | Museo Civico di Storia Naturale, Milan  |
| MNHN | Muséum National d'Histoire Naturelle, Paris   |
| QM   | Queensland Museum, Brisbane   |
| RMNH | Rijksmuseum van Natuurlijke Historie, Leiden  |
| SAM  | South Australian Museum, Adelaide   |
| USNM | National Museum of Natural History, Smithsonian Institution, Washington (abbreviation refers to former United States National Museum) |
| ZMA  | Zoologisch Museum, Amsterdam  |
| ZMB  | Zoologisches Museum, Berlin   |
| ZMBS | Zoologische Staatssammlung, Munich  |
| ZSI  | Zoological Survey of India, Calcutta  |

#### Characters in *Oratosquilla*

Like most squillids, the species of *Oratosquilla* are relatively rich in differentiating characters, and many different features are available for species discrimination. In spite of the numbers of characters, however, there is a rather remarkable uniformity in a series of specimens of any given species from one locality, as in those of *O. perpensa* and *O. hindustanica* examined during this study.

The major features such as eye size and shape, shape of rostral plate, shape of the lateral processes of the exposed thoracic somites, spination of the abdominal carinae, and shape and size of the lobe between the spines of the basal prolongation of the uropod, show no significant variation. In general, there is not enough material of any species to demonstrate the extent of variation in different parts of the range of each species.

Characters that should be examined in any study of *Oratosquilla* include the following.

**General:** Nature of texture of body surface, whether smooth, as in *O. woodmasoni*, or variously pitted and eroded, as in several species. This is best determined when the surface is dried.

**Eyes:** Shape and size, particularly as reflected in corneal indices; eyes tend to be relatively larger in small specimens of any species.

**Anterior Margin of Ophthalmic Somite:** Truncate or medially emarginate in most species, but anteriorly rounded, usually with a median point, in *Woodmasoni* group.

**Antennular Processes:** Overall shape as seen in dorsal view; they are usually unarmed (although they may appear sharp in dorsal view) but are produced into distinct spines in *O. gravieri*, described below.

**Rostral Plate:** Length/width proportions; shape, whether trapezoidal, triangular, or rectangular; shape of apex, rounded or flattened; and presence or absence of a median carina.

**Carapace:** Condition of median carina, whether entire or interrupted, and of anterior bifurcation of carina, whether present, indistinct (position indicated by pigment), or absent; relative length of anterolateral spines, especially whether these overreach the base of the rostral plate, as in *O. anomala*; relationship of anterolateral width to median length.

**Claw:** Number of teeth on dactylus; shape of outer margin of dactylus, whether sinuate, flattened, or evenly curved; presence of a distal spine or projection on the propodus, as in *O. anomala*; condition of the carpal crest, whether uninterrupted or tuberculate; presence of spine at infero-distal angle on outer face of merus.

**Lateral Processes of Thoracic Somites:** Shape and relative size of lobes; shape of anterior lobe of process of sixth somite (triangular in *O. perpensa*, rectangular in *O. sollicitans*) is particularly important.

**Spination of Abdominal Carinae:** Patterns of spination often are specific characters; submedian carinae of fourth somite rarely spined (variable in *O. woodmasoni*); extent of spination of lateral carinae also important (unarmed on anterior three somites in some species, e.g. *O. quinquentata*).

**Telson:** Presence of dorsal carinae in addition to median carina and carinae of marginal teeth, as in *O. striata*; length of prelateral lobe in relation to length of lateral tooth; relative length of some carinae of marginal teeth, as in *O. striata* versus *O. gonypetes*; number and shape of marginal denticles.

**Uropod:** Relative length and slenderness of exopod segments, as in *O. subtilis* versus *O. gonypetes*; shape and size of lobe between spines of basal prolongation of uropod; this latter feature is variable in at least *O. hesperia* (Manning, 1968b) and *O. woodmasoni*, in which it tends to be a spine in young specimens, a bluntly angled or

rounded lobe in adults and may vary geographically.

Other information, which probably is extremely important but which is generally unavailable, is the color in life and the habitat, including depth range. Series of all of the species recorded below accompanied by observations on color and habitat will be required before some of the systematic problems can be worked out.

### Species Groups in *Oratosquilla*

*Oratosquilla* Manning, 1968(a), was recognized for a group of comparatively large squillids from the Indo-West-Pacific region, the equivalent there of the Atlantic-East-Pacific genus *Squilla* Fabricius, 1787. In 1971 I distinguished eight species groups in *Oratosquilla*, primarily as an aid to the recognition of the 23 species then assigned to the genus, secondarily to emphasize the diversity of the species then included in it. Since 1971, two new genera containing species previously assigned to *Oratosquilla* have been named: *Areosquilla* Manning, 1976, for species of the *indica* group, and *Busquilla* Manning, 1978, for *Oratosquilla quadraticauda* (Fukuda, 1911) and a related new species from Madagascar. Two new genera are recognized herein, one for the species assigned to the *investigatoris* group and one for those assigned to the *mikado* group by me in 1971.

At the present time, five species groups can be recognized in *Oratosquilla*: the *nepa* group (two nominal species), the *oratoria* group (four nominal species), the *woodmasoni* group (three nominal species), the *gonypetes* group (nine nominal species), and the *perpensa* group (13 nominal species). This report is concerned with representatives of the latter three groups, and the *gonypetes* and *perpensa* groups are redefined.

Since 1971 the following species of *Oratosquilla* have been described: *O. arabica* Ahmed, 1971 (*perpensa* group), *O. birsteini* Makarov, 1971 and *O. vietnamica* Blumstein, 1974 (*gonypetes* group), and *O. jakartensis* Moosa, 1975 (*woodmasoni* group). The latter species appears to be a synonym of *O. woodmasoni*, and it is discussed below under the account of that species.

RELATIONSHIPS OF SPECIES GROUPS.—Although there are no clear indications of relationships of the species groups within the genus, for we can

only guess about whether or not a character is primitive or derived, some very limited generalizations can be made. One of the characteristics of the squillids in general is the well developed body carination, which in *Oratosquilla* appears to have been retained in its most "complete" condition only in the *oratoria* and *nepa* groups. In those groups the median carina of the carapace is entire throughout its length anterior to the cervical groove and it terminates anteriorly in a distinct median bifurcation.

Of these two groups, the *Oratoria* possibly reflects the oldest stem of *Oratosquilla* development. The carination of the body is well developed, the eyes are relatively large and a distinct meral spine is present on the claw. The species of the *oratoria* group exhibit a relict distribution pattern within the Indo-West-Pacific region, with two species in China and Japan, one in Hawaii, and one in the western Indian Ocean.

The *nepa* group, comprising two species, possibly represents an early offshoot of the main stem in the genus. As in the *oratoria* group, the median carina of the carapace terminates anteriorly in a well developed bifurcation, but the bifurcation differs from that found in any other squillid in that it opens anterior to the dorsal pit. The eyes are much smaller in members of this group than those of any other group and the meral spine is present.

The *woodmasoni* group possibly also represents another early offshoot of the main stem. Representatives are distinguished by the broadly rounded, usually armed anterior margin of the ophthalmic somite, which is flattened or medially emarginate in the other species of the genus, and the broad, smooth carapace on which the median carina usually lacks a distinct bifurcation; the strong meral spine also is characteristic of members of this group, which occurs from Indo-Malaya westward through the Indian Ocean; two of the species are found only in the western Indian Ocean.

The remaining two species groups, each of which appear to represent a different line of development, differ from those discussed above in that the structure of the median carina of the carapace has been modified so that it is interrupted at the base of the anterior bifurcation, and, in some species, the branches of the anterior bifurcation are poorly developed or absent. Members of the *perpensa*

group have the meral spine whereas those of *gonypetes* group lack it. It seems likely that it has been suppressed in members of this latter group.

Relationships of *Oratosquilla* to the other squillids will be explored in detail in a review of higher taxa of stomatopods now in preparation.

**Revised Key to Species Groups in *Oratosquilla***

(Modified from Manning, 1971)

1. Anterior bifurcation of median carina of carapace opening posterior to dorsal pit. Cornea very small, corneal index 600 or more in adults (TL 100 mm or more), set obliquely on stalk ..... *nepa* group
- Anterior bifurcation of median carina of carapace, when present, opening anterior to dorsal pit. Cornea small to large, corneal index less than 600 in adults, set obliquely on stalk.....2
2. Median carina of carapace entire, with well formed anterior bifurcation [Anterior margin of ophthalmic somite medially flattened or emarginate, unarmed. Dactylus of claw with 6 teeth. Surface of body punctate] ..... *oratoria* group
- Median carina of carapace interrupted at base of bifurcation, or branches of bifurcation indistinct or absent .....3
3. Surface of body smooth, appearing highly polished. Anterior margin of ophthalmic somite rounded, often with median spinule [Anterior width of carapace greater than half median length of carapace. Dactylus of claw with 6 teeth]..... *woodmasoni* group
- Surface of body minutely or coarsely punctate. Anterior margin of ophthalmic somite medially flattened or emarginate, unarmed .....4
4. Inferodistal angle on outer face of merus of claw unarmed [Abdomen usually with dark dorsal patch(es) on fifth abdominal somite] ..... *gonypetes* group
- Inferodistal angle on outer face of merus of claw produced into distinct spine [Abdomen lacking dorsal pigmented area on fifth somite] ..... *perpensa* group

**The *gonypetes* and *perpensa* Species Groups of *Oratosquilla***

DISCUSSION

In 1971 I distinguished the *gonypetes*, *perpensa*, and *woodmasoni* species groups primarily by the condition of the anterior bifurcation of the median carina of the carapace and the number of teeth on the dactylus of the claw. A comment by Holthuis (1967:12), that material of *O. simulans* without chelae would be difficult to distinguish from *O. gonypetes* also lacking chelae, led me to reexamine characteristics of these three groups. In 1971 I had placed *O. gonypetes*, which has five teeth on the dactylus of the claw, in the *gonypetes* group and *O. simulans*, which has six, in the *perpensa* group. Further, I had later examined material of a species near *O. gonypetes* in which the carapace was relatively broad, the anterior width being more than half the median length (but less than half the length of the carapace and rostral plate combined), and on that feature would key out in my earlier key to species groups (Manning, 1971:2) to the *woodmasoni* group, in spite of its obvious

affinities with *O. gonypetes*.

Although the broad carapace is one of the characteristics of the *woodmasoni* group, there are species in other groups, such as *O. striata*, described below, in which the carapace also is relatively broad. Members of the *woodmasoni* group are unusually smooth species, with a broad carapace on which the carinae are poorly developed, and in all of the species assigned to the group, the anterior margin of the ophthalmic somite is obtusely pointed or rounded, almost always with a median spinule; it is not medially emarginate or flattened as in the members of the *gonypetes* and *perpensa* groups.

Although I stressed the importance of the number of teeth on the claw as a characteristic of the species groups in 1971, the present study has convinced me that other features are more important. The *gonypetes* group as redefined herein now comprises two sections, one with species that have five teeth on the claw, the *gonypetes* complex, and one with six, the *imperialis* complex. Members of both of these complexes share relatively small size and a roughened surface, which appears pitted and corroded under magnification. In both the inferodis-

tal angle of the merus of the claw is unarmed, and, at least in the species for which color pattern has been described, the fifth abdominal somite is ornamented dorsally with a median patch or submedian patches of dark pigment. As noted above, the anterior margin of the ophthalmic somite is medially emarginate or flattened and unarmed.

The *perpensa* group, like the *gonypetes* group, includes species with five or six teeth on the claw, a coarse surface on the body, and a medially emarginate anterior margin on the ophthalmic somite. Members of this group all have a strong spine on the inferodistal angle of the merus of the claw and all lack distinctive dark spots or patches on the fifth abdominal somite. Four species complexes are recognized in the *perpensa* group: the *quinquedentata* complex, including two species with five teeth on the claw; the *interrupta* complex, those species in which the ridge on the carpus of the claw is tuberculate, not smooth; and two complexes of species in which the carpus of the claw is undivided: the *perpensa* complex including species with a relatively short, broad rostral plate, and the *inornata* complex, species with a relatively long, slender rostral plate.

*Oratosquilla imperialis* (Manning, 1965) and *O. ornata* Manning, 1971 are here transferred from the *perpensa* group to the *gonypetes* group. Both lack the spine on the merus of the claw, and *O. imperialis*, at least, has the dark dorsal patch on the fifth abdominal somite.

In 1971 I suggested that *O. simulans* (Holthuis, 1967) from the Red Sea was conspecific with *O. imperialis* (Manning, 1965) from Japan. Although I suspect that they are conspecific, until material from the two areas can be compared I believe that both species should be recognized. A recently-described species of the *gonypetes* group, *O. vietnamica* Blumstein, 1974, from the Gulf of Tonkin, is very similar to and may prove to be identical with *O. ornata* Manning, 1971, from off Hong Kong. It also seems certain that another nominal species of the *perpensa* group, *O. arabica* Ahmed, 1971, from the Arabian Gulf, is conspecific with *O. interrupta* (Kemp, 1911), a widely distributed species which also occurs in the Arabian Gulf. Like *O. interrupta*, Ahmed's species has a convex lobe on the outer margin of the inner spine of the basal prolongation of the uropod. The other features

used by Ahmed (1971:251) to distinguish *O. arabica* from *O. interrupta* include (1) the first segment of the antennular peduncle armed with six spines, (2) a dorsal spine on the antennal peduncle, (3) the presence of an oval pit in the articulation between the carapace and the rostral plate, (4) the anterior width of the carapace is more than half its median length, (5) the ocular scales are cordiform, (6) the outer margin of the intermediate carina on the sixth abdominal somite with a small pointed lobe, (7) the presence of a transverse lobe anterolaterally on the telson, and (8) a denticular formula of 2-3, 6-8, 1. The first two of these, based on ornamentation of the antennular and antennal peduncles, have not been studied in any detail in stomatopods; they may prove to have value as specific characters but are not now in use as such. There is always a gap of varying size between the articulation of the rostral plate and the carapace. The anterior width of the carapace is shown to be much less than half the median length in Ahmed's illustration (fig. 1), and the ocular scales are more or less subquadrate and inclined laterally as in all species of the genus. The interrupted lobe on the intermediate carina of the sixth abdominal somite and the short, transverse ridges on the telson are found in most if not all species of the genus. Finally, the denticular formula falls within the range of that reported for *O. interrupta* in the literature, 2-4, 6-9, 1. Ahmed's species probably should be considered as a synonym of *O. interrupta*.

Another lesson from this study is that in the stomatopods, at least, we have not progressed beyond that stage in systematics in which type-specimens are of primary importance. The types of older species all should be restudied. Most of the species characterized below could not have been recognized without studying Kemp's types, and Kemp's accounts were, even by present standards, quite good. Hansen (1926:1) noted that "Kemp's book is in reality one of the best systematic works ever used by me. It is difficult to find any useful specific or generic character not used by him." However, it seems apparent that Kemp's species concept was very conservative.

Nominal species in the *gonypetes* and *perpensa* species groups are listed below. Authors and dates for each species will not be repeated in discussions of individual species.

## LIST OF NOMINAL SPECIES

(numbers preceding taxa are those assigned to species described herein)

- I. Inferodistal angle on outer face of merus of claw unarmed (*gonypetes* group)
  - A. Dactylus of claw with 5 teeth (*gonypetes* complex)
    3. *O. gonypetes* (Kemp, 1911)
    13. *O. subtilis*, new species
    14. *O. turbata*, new species
  - B. Dactylus of claw with 6 teeth (*imperialis* complex)
    - O. birsteini* Makarov, 1971
    - O. imperialis* (Manning, 1965)
    - O. ornata* Manning, 1971
    - O. simulans* (Holthuis, 1967) (= *O. imperialis*?)
    12. *O. striata*, new species
    - O. vietnamica* Blumstein, 1974 (= *O. ornata*?)
- II. Inferodistal angle on outer face of merus of claw armed (*perpensa* group)
  - A. Dactylus of claw with 5 teeth (*quinquedentata* complex)
    7. *O. pentadactyla*, new species
    9. *O. quinquedentata* (Brooks, 1886)
  - B. Dactylus of claw with 6 teeth
    - i. Ridge on carpus of claw tuberculate (*interrupta* complex)
      - O. arabica* Ahmed, 1971 (= *O. interrupta*?)
      2. *O. asiatica*, new species
      - O. fabricii* (Holthuis, 1941)
      - O. interrupta* (Kemp, 1911)
    - ii. Ridge on carpus of claw smooth, undivided
      - a. Rostral plate short (*perpensa* complex)
        1. *O. anomala* (Tweedie, 1935)
        8. *O. perpensa* (Kemp, 1911)
        11. *O. stephensoni*, new species
      - b. Rostral plate long (*inornata* complex)
        4. *O. gravieri*, new species
        5. *O. hindustanica*, new species
        6. *O. inornata* (Tate, 1883)
        10. *O. solicitans*, new species

## Systematic Accounts

1. *Oratosquilla anomala* (Tweedie, 1935)

## FIGURES 1-3

*Squilla affinis* var. *intermedia* Nobili, 1903:39 [part; not specimens from Nias = *O. pentadactyla*, new species; preoccupied by *Squilla intermedia* Bigelow, 1893].

*Squilla oratoria* var. *perpensa*.—Parisi, 1922:98 [part; specimen from Singapore only; not *Squilla oratoria* var. *perpensa* Kemp, 1911].

*Chloridella oratoria*.—Schmitt, 1931:147 [part; not *Squilla oratoria* de Haan, 1844].

*Squilla anomala* Tweedie, 1935:45.—Moosa, 1973:147.

MATERIAL.—Tsimei [Chi-Mei, Fukien Province; 24°34'N,

118°06'E], China; 25 Jun 1923: 3 ♀, TL 83–87 mm (USNM 62188). Siglap [01°19'N, 103°56'E], Singapore, Malaysia; littoral; M.W.F. Tweedie, leg.; Jun 1934; holotype of *Squilla anomala* Tweedie: 1 ♂, TL 85 mm (BMNH 1935.12.16.7). Data same; paratypes of *Squilla anomala* Tweedie: 1 ♂, TL 69 mm; 1 ♀, TL 82 mm (RMNH 248S). Singapore [01°17'N, 103°51'E], Malaysia; syntype of *Squilla affinis* var. *intermedia* Nobili: 1 ♂, TL 66 mm (MCSN).

DESCRIPTION.—Size moderate, total length of adults less than 100 mm. Body appearing rough, surface pitted and irregular.

Eye (Figures 1*b*, 2*b*, 3*a*) very small to small, cornea bilobed, set obliquely on stalk. Eyes extending almost to end of first segment of antennular peduncle. Corneal indices 399–527.

Antennular peduncle shorter than carapace. Dorsal processes of antennular somite rounded, unarmed anteriorly.

Rostral plate (Figures 1*a*, 2*a*, 3*a*) broader than long, trapezoidal, apex truncate. Median carina absent.

Anterior width of carapace about half median length, less than half length carapace and rostral plate combined. Anterolateral spines (Figures 1*a*, 2*a*, 3*a*) strong, often extending beyond base of rostral plate. Median carina interrupted at base of anterior bifurcation, branches of bifurcation distinct. Intermediate carinae turning toward but not meeting laterals, not extending to anterior margin.

Dactylus of claw with 6 teeth, outer margin sinuate. Dorsal ridge of carpus (Figure 1*c*) undivided. Inferodistal angle of outer face of merus with sharp spine.

Exposed thoracic somites (Figures 1*d*, 2*c*, 3*b*) each with unarmed submedian and intermediate carinae, intermediates of fifth somite short, irregular. Lateral process of fifth somite bilobed, anterior lobe a slender spine, directed anterolaterally or almost anteriorly, posterior lobe slender, triangular, apex rounded, directed laterally. Lateral process of sixth somite bilobed, anterior lobe large but smaller than posterior, slender subrectangular, apex rounded or subtruncate, posterior lobe larger, triangular, apex acute but not sharp. Lateral process of seventh somite strongly bilobed, anterior lobe slender, more triangular than that of sixth somite, posterior lobe broader, posterior margin sinuous, apex acute but not sharp.

Submedian carinae slightly divergent on fifth abdominal somite. Abdominal carinae spined as

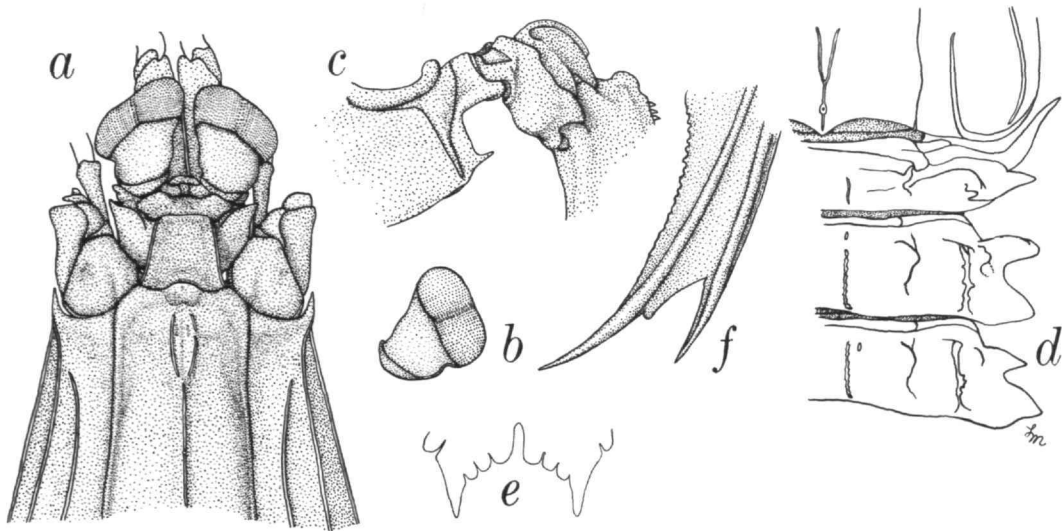


FIGURE 1.—*Oratosquilla anomala* (Tweedie, 1935), female, TL 83 mm, China: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

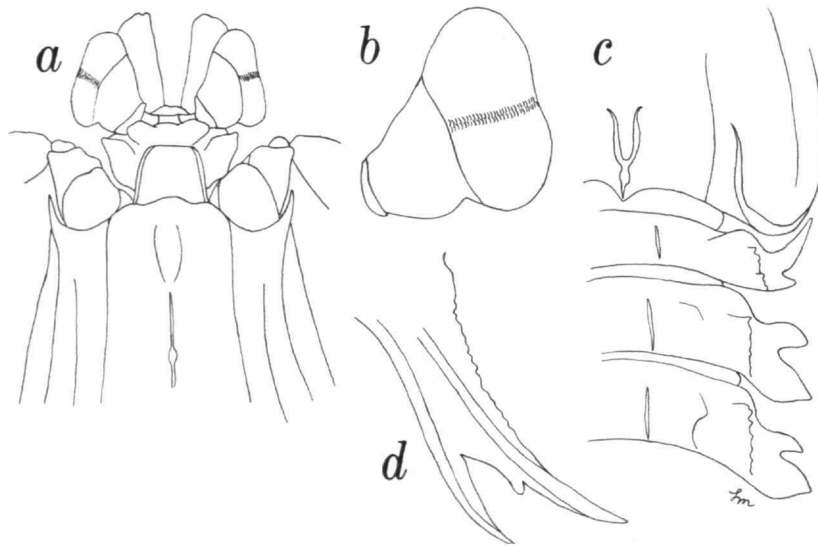


FIGURE 2.—*Oratosquilla anomala* (Tweedie, 1935), male holotype, TL 85 mm, Singapore: *a*, anterior part of body; *b*, eye; *c*, lateral processes of fifth, sixth, and seventh thoracic somites; *d*, basal prolongation of uropod, ventral view.

follows: submedian 5-6, intermediae 4-6, lateral 3-6, marginal 1-5.

Telson flattened, slightly broader than long. Pre-lateral lobe longer than margin of lateral tooth.

Denticles (Figures 1*e*) rounded or subquadrate, 3-4, 7-8, 1. Ventral surface of telson with postanal keel.

Uropod rather broad, proximal segment of exo-

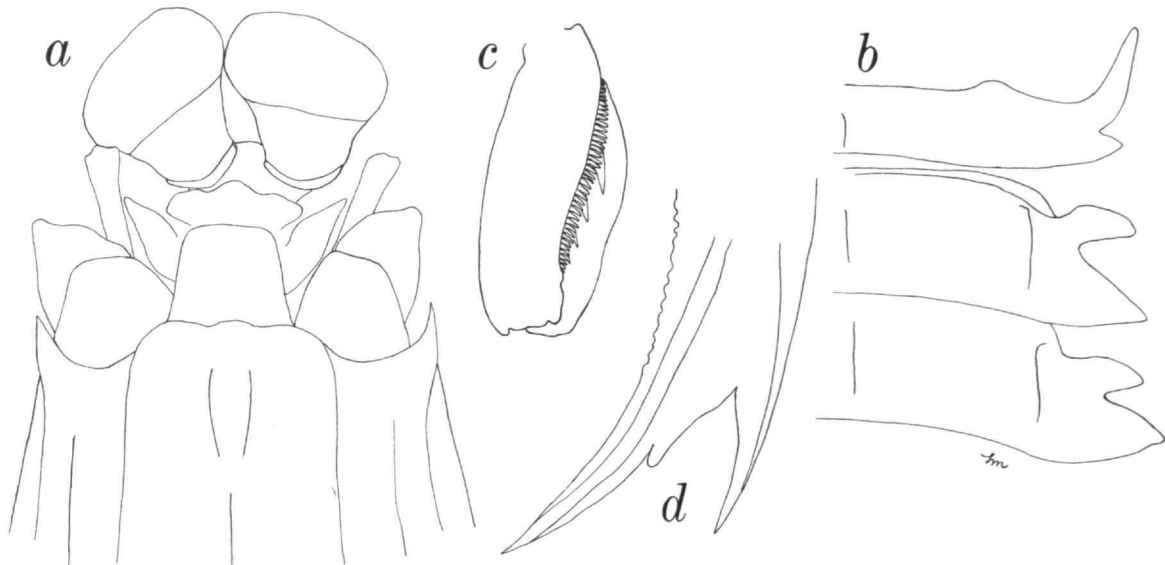


FIGURE 3.—*Oratosquilla anomala* (Tweedie, 1935), male syntype of *Squilla affinis* var. *intermedia* Nobili, 1903, TL 66 mm, Singapore: *a*, anterior part of body; *b*, lateral processes of fifth, sixth, and seventh thoracic somites; *c*, propodus of claw; *d*, basal prolongation of uropod, ventral view.

pod shorter than distal, with 8–9 movable spines on outer margin, distalmost not extending to mid-length of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figures 1*f*, 2*d*, 3*d*) small, narrower than adjacent spine, margin concave, apex rounded.

**COLOR.**—Faded in the material reported here. Tweedie (1935:48) noted: "Distal segment of the exopodite of the uropod similar to that of *S. interrupta*, but with a little more black suffusion; the inner half is never entirely blackish, as in *S. oratoria inornata*."

**MEASUREMENTS.**—Males, TL 66–85 mm; females, TL 82–87 mm. Tweedie (1935) reported four males and five females ranging from 58 to 91 mm long. Other measurements of a female, TL 83 mm: CL 18.3, anterior width 9.3; cornea width 3.5; antennular peduncle length 15.6; rostral plate length 2.2, width 3.4; telson length 15.3, width 16.4.

**REMARKS.**—Examination of type-series of *O. anomala* in the collection of the British Museum (Natural History) and the Rijksmuseum van Natuurlijke Historie clearly demonstrated that I was in error in synonymizing Tweedie's species with *O. perpensa* in 1966. These species, two of the

three representatives of the *perpensa* complex in the *perpensa* group, share a roughened body, a short rostral plate, a broad carapace with relatively long anterolateral spines, and a claw with an undivided carpus and six teeth on the dactylus, features which characterize the *perpensa* complex and serve to distinguish these species from all others in the genus. *Oratosquilla anomala* closely resembles *O. perpensa*, but differs in having a shorter rostral plate, a broader, more rectangular anterior lobe on the lateral process of the sixth thoracic somite, and a smaller lobe between the spines of the basal prolongation of the uropod. The best distinguishing feature is the broader anterior lobe on the lateral process of the sixth thoracic somite; that lobe is distinctly more slender and triangular in *O. perpensa*. *Oratosquilla anomala* differs from *O. stephensoni*, the third representative of the *perpensa* complex, in having a distinctly concave lobe between the spines of the basal prolongation of the uropod; *O. anomala* also is a smaller species.

It is somewhat surprising to learn that part of the material assigned by Nobili (1903) to *Squilla affinis* var. *intermedia* and considered by some earlier authors (Kemp, 1913:58) to be unidentifi-

able actually can be identified with *O. anomala*, a species also unrecognizable until the types were examined. One of Nobili's specimens, that from the collection of the Museo Civico di Storia Naturale, Milan, identified by Parisi (1922) with *O. perpensa*, is shown in Figure 3 for comparison with one of the types of *O. anomala*, shown in Figure 2. Nobili (1903) recorded 23 specimens of *S. affinis* var. *intermedia* from Singapore and two from Nias. Those from Nias are assigned below to *O. pentadactyla*, new species. The collection of the Museo ed Istituto di Sistematica della Università di Torino included only two specimens of the type-series from Singapore. One is clearly identifiable with *O. interrupta* and the other with *O. woodmasoni* (Kemp). I was not able to locate the remainder of Nobili's type-series.

Another feature of *O. anomala* which may prove to be diagnostic is the presence of a distal spine or angled projection on the extensor (outer) margin of the propodus of the claw (Figure 3c). This projection is present in Nobili's specimen from Singapore as well as in the three females from China (USNM 62188). Not all of the material of this species was examined at the same time, so the occurrence of this projection was not determined in all specimens. This character could prove to be invaluable for quick recognition of this species, but much more material will have to be studied before its worth can be established. The projection has not been observed in any of the material of other species of *Oratosquilla* that I have seen, but it may have been overlooked.

The specimens from China listed above had been identified with *Oratosquilla oratoria* (de Haan) by Schmitt (1931) (as *Chloridella oratoria*).

Paratypes of *Squilla anomala* also are in the collection of the University of Singapore, where they were transferred from the National Museum of Singapore (Moosa, 1973).

Apparently the ranges of *O. anomala* and *O. perpensa* overlap in the Indo-Malayan area. So far as is known, they both are more northern in range than is the related *O. stephensi*, described below.

**DISTRIBUTION.**—Known only from Tsimei, Fukien Province, China (Schmitt, 1931), and from Siglap, Singapore and Morib [02°45'N, 101°26'E], Selangor, Malaysia (Tweedie, 1935; Moosa, 1973); Singapore, Malaysia (Nobili, 1903). Apparently it occurs in shallow water; some of the types were taken in

the littoral zone and Tweedie (1935) noted that some specimens came from fishermen's nets.

## 2. *Oratosquilla asiatica*, new species

### FIGURE 4

**MATERIAL.**—Keeling [Chilung] River, N Formosa [Taiwan]; Haberer, leg.; May 1903; paratypes: 1 ♂, CL 17.3 mm, 1 ♀, CL 20.5 mm (ZMBS). Anping [An-P'ing or Ampin, 23°00'N, 120°09'E], S Formosa; Haberer, leg.; Jun 1903; paratypes: 1 ♂, TL 81.5 mm, 1 ♀, TL 85.5 mm (ZMBS). Pandan, Panay Island, Antique Province, Philippine Islands; from trap at mouth of tidal stream; D. G. Frey, leg.; 7 Apr 1946; holotype: 1 ♂, TL 93 mm (USNM 125064). Humboldt Bay [Teluk Jos Sudarso, 02°30'S, 140°50'E], near the mouth of the Tami River, West New Guinea [West Irian], Indonesia; 25 Jun 1955; paratype: 1 ♀, TL 97 mm (RMNH 342S).

**DESCRIPTION.**—Size moderate, total length of adults less than 100 mm. Body appearing smooth, coarsely pitted under magnification.

Eye (Figure 4b) moderate to small, cornea bilobed, set obliquely on stalk. Eyes extending almost to end of first segment of antennular peduncle. Corneal indices 376–422.

Antennular peduncle about  $\frac{9}{10}$  as long as carapace. Dorsal processes of antennular somite produced into unarmed triangular lobes, directed anterolaterally.

Rostral plate (Figure 4a) slightly broader than long, lateral margins converging on flattened apex. Short median carina present.

Anterior width of carapace slightly more than half median length, less than half length carapace and rostral plate combined. Anterolateral spine (Figure 4a) strong but not extending to base of rostral plate. Median carina scarcely interrupted (holotype) or distinctly interrupted (other specimens) at base of anterior bifurcation, branches of bifurcation distinct. Intermediate carinae not extending to anterior margin.

Dactylus of claw with 6 teeth, outer margin sinuate. Dorsal ridge of carpus (Figure 4c) irregular, with 2–3 rounded tubercles distally. Inferodistal angle of outer face of merus with sharp spine.

Exposed thoracic somites (Figure 4d) each with unarmed submedian and intermediate carinae, intermediates irregular, short on fifth somite. Lateral process of fifth somite bilobed, anterior lobe a slender spine, directed anterolaterally, posterior lobe slender, almost spiniform, directed laterally. Lateral



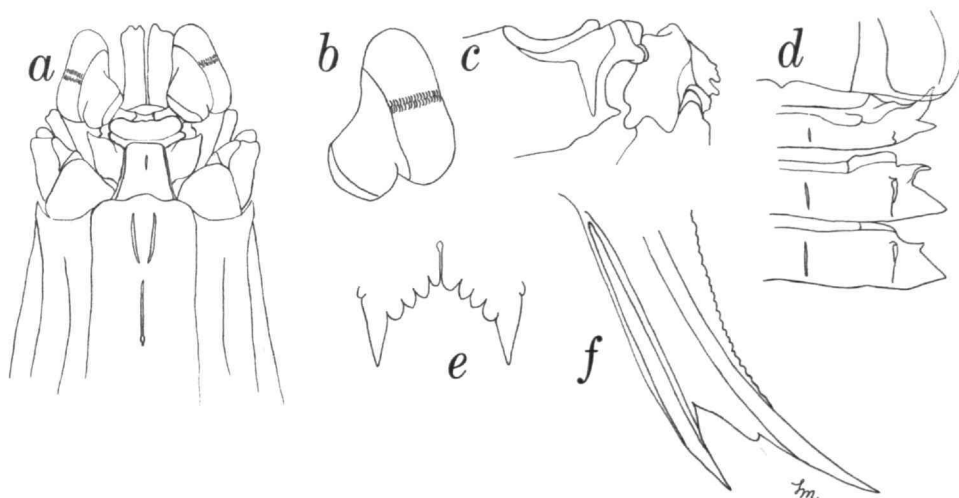


FIGURE 4.—*Oratosquilla asiatica*, new species, male holotype, TL 93 mm, Philippine Islands: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

process of sixth somite bilobed, anterior lobe very small, slender, posterior lobe much broader, apex obtusely angled, unarmed. Lateral process of seventh somite scarcely bilobed, posterior lobe similar to that of sixth somite, with low, obtuse prominence on anterior edge.

Submedian carinae slightly divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 4–6, intermediate 3–6, lateral (1) 2–6, usually 1–6, marginal 1–5.

Telson flattened, slightly broader than long. Pre-lateral lobe shorter than or slightly longer than margin of lateral tooth. Denticles (Figure 4*e*) rounded or subtriangular, 3–4, 9, 1. Ventral surface of telson with postanal keel.

Uropod rather broad, proximal segment of exopod slightly shorter than distal, with 8–9 short movable spines on outer margin, distalmost not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 4*f*) low, narrower than adjacent spine, margin concave, apex rounded.

**COLOR.**—Carapace and each body segment with dark posterior line. Dark spot present on articulation of segments of uropodal exopod, color diffuse on distal segment, not covering inner half. Distal half of uropodal endopod dark.

**MEASUREMENTS.**—Males, TL 81.5–93 mm; only

intact female, TL 97 mm. Other measurements of male holotype, TL 93 mm: CL 20.2, anterior width 10.7; cornea width 5.1; antennular peduncle length 16.7; rostral plate length 3.0, width 3.5; telson length 17.8, width 18.7.

**REMARKS.**—*Oratosquilla asiatica* is a member of the *interrupta* complex of the *gonypetes* group, those species of the genus in which the claw has a spined inferodistal angle on the merus, a tuberculate ridge on the carpus, and six teeth on the dactylus. It differs from *O. interrupta* and *O. arabica* (if the latter species proves to be distinct) and resembles *O. fabricii* in having spined submedian carinae on the fourth abdominal somite and a concave lobe between the spines of the basal prolongation of the uropod. *Oratosquilla asiatica* differs from *O. fabricii* in having a median carina on the rostral plate, smaller anterolateral spines on the carapace, and much slenderer anterior lobes on the lateral processes of the thoracic somites.

Although little specific ecological information accompanies the few known specimens of this species, several of the specimens were taken near rivers, suggesting that the species may be able to tolerate or may inhabit waters of reduced salinity.

**ETYMOLOGY.**—The name is from the Latin and alludes to the distribution of the species.

**DISTRIBUTION.**—This species is known from local-

ities in the western Pacific Ocean, including northern and southern Formosa, the Philippine Islands, and West New Guinea, Indonesia. Its depth range has not been recorded, but it almost certainly occurs in shallow water.

### 3. *Oratosquilla gonypetes* (Kemp, 1911)

FIGURE 5

*Squilla gonypetes* Kemp, 1911:96 [part]; 1913:54, pl. 4: figs. 42-44 [part].—Kemp and Chopra, 1921:300.—Chopra, 1939:148 [part?; not illustrated specimen].

**MATERIAL.**—Off Kabusa Island [Kabosa Island, 12°49'N, 97°53'E], Lower Burma; 25-35 fms (46-64 m); *Investigator*, leg.: 1 ♀, TL 47 mm (ZSI C320/1). Off Cheduba [Cheduba Island, 18°48'N, 93°38'E], Arakan coast, Burma; 7 fms (13 m); *Investigator*, leg.; lectotype: 1 ♂, TL 39 mm (ZSI 3359/7). Persian Gulf; 26°24'N, 56°02'E; 47 fms (86 m); *Investigator*, leg.; paralectotype: 1 ♀, TL 26 mm (ZSI 4421/10). Gulf of Oman; 25°38'18"N, 56°26'36"E; 73 m; coarse sand and shells; *John Murray* Sta 72; 26 Nov 1933; 2 ♂ (1 broken), TL 55 mm; 1 ♀, TL 50 mm (BMNH).

**DESCRIPTION.**—Size small to moderate, total length of adults to 55 mm. Body appearing smooth, actually lightly pitted under magnification.

Eye (Figure 5b) moderate to small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 358-408.

Antennular peduncle longer than carapace. Dorsal processes of antennular somite produced into acute lobes directed anterolaterally.

Rostral plate (Figure 5a) slightly broader than long, appearing elongate, lateral margins converging on rounded apex. Median carina absent.

Anterior width of carapace less than half median length. Anterolateral spines (Figure 5a) strong, extending almost to, or beyond, base of rostral plate. Median carina interrupted at base of bifurcation, branches of bifurcation usually scarcely discernible. Intermediate carinae slightly turning toward laterals, not extending to anterior margin.

Dactylus of claw with 5 teeth, outer margin broadly curved, sinuous proximally, with obtuse projection basally. Dorsal ridge of carpus (Figure 5c) undivided. Inferodistal angle on outer face of merus unarmed.

Exposed thoracic somites (Figure 5d) each with unarmed submedian and intermediate carinae, intermediates of fifth somite irregular, short. Lateral

process of fifth somite bilobed, anterior lobe a slender spine, directed anteriorly or anterolaterally, posterior lobe much smaller, slender, apex triangular, almost sharp, directed laterally. Lateral process of sixth somite strongly bilobed, anterior lobe large, subrectangular or trapezoidal, apex blunt, posterior lobe triangular, obtusely pointed, apex blunt. Lateral process of seventh somite strongly bilobed, anterior lobe slightly smaller than that of sixth somite, triangular, posterior lobe much larger, triangular, apex obtusely pointed, unarmed.

Submedian carinae divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5-6, intermediate 3-6, lateral (1) 2-6, marginal 1-5.

Telson flattened, slender, appearing elongate, length and width subequal. Prelateral lobe subequal in length to margin of lateral tooth. Dorsal surface of telson occasionally with lines of short carinae or raised tubercles between curved rows of pits in large specimens. Denticles (Figure 5e) usually rounded, 3-4, 6-7, 1, outer submedians and intermediates largest, inner submedians occasionally spine tipped.

Uropod slender, proximal segment of exopod slightly shorter than distal, with 8 movable spines on outer margin, distalmost not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 5f) small, narrower than adjacent spine, margin concave, apex rounded.

**COLOR.**—Eyes with dark patch laterally on stalk. Carinae and grooves of carapace lined with dark pigment; midline of carapace with dark, U-shaped patch, open anteriorly, anterior to cervical groove. Claw with dark dorsal and distolateral patches on merus and distal dark patch on outer face of propodus. Lateral edge of antennal protopod dark. Carinae and posterior margins of posterior 3 thoracic and all abdominal somites dark, each somite with longitudinal line of dark pigment between submedian and intermediate carinae. Lateral processes of sixth and seventh thoracic somites dark posteromesially. Abdominal somites with short, curved line of dark pigment above lateral carina, rectangular middorsal patch on second somite, and 2 square black patches, each lateral to submedian carina, on fifth somite; posterolateral surface of sixth somite dark. Marginal carinae of telson dark. Distal part of proximal segment and inner half of

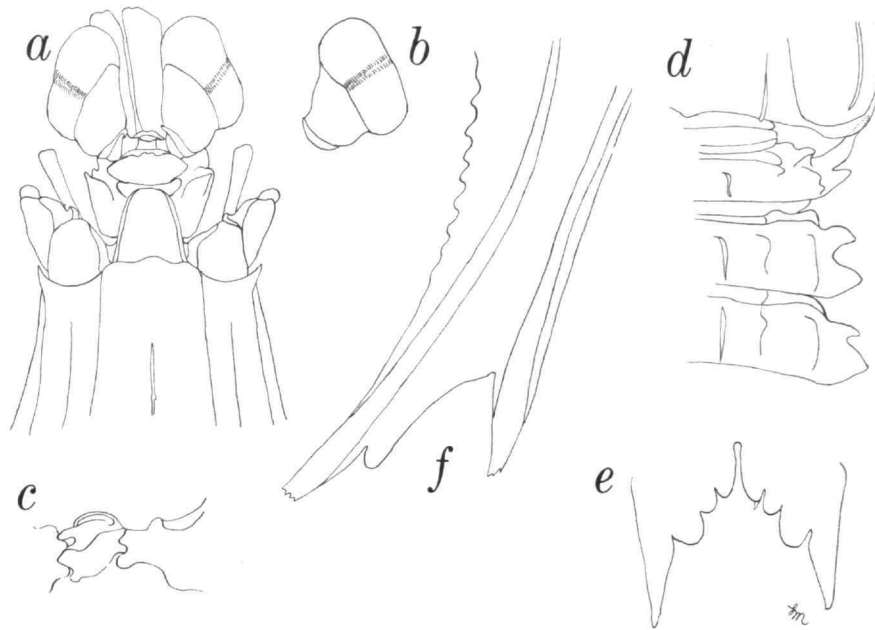


FIGURE 5.—*Oratosquilla gonypetes* (Kemp, 1911), male lectotype, TL 39 mm, Burma: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view, enlarged (apices of spines broken).

distal segment of uropodal exopod dark. Distal half of endopod dark. Basal prolongation of uropod with dark longitudinal line at level of dark pigment of endopod.

MEASUREMENTS.—Males, TL 39–55 mm; females, TL 26–47 mm. Other measurements of female, TL 47 mm: CL 10.6, anterior width 5.0; cornea width 2.6; antennular peduncle length 11.2; rostral plate length 1.6, width 1.7; telson length 8.6, width 8.4.

REMARKS.—In the original description of this species, Kemp (1911) mentioned four specimens from three localities; the same material was reported by him in his more detailed account published in 1913. Because no type designation was made by Kemp, all four specimens are syntypes. Two of the specimens, taken off the Andaman Islands, could not be located by me at the Zoological Survey of India in 1972. Of the two remaining specimens, a male from off Cheduba, Burma (ZSI 3359/7) is here selected as the lectotype; the small female from the Persian Gulf (ZSI 4421/10) is a paralectotype.

In 1913 Kemp identified a female from off

Madras with this species; it is identified with *O. subtilis*, described below. Kemp and Chopra (1921) assigned several specimens from Kabusa Island to this species; one of those specimens was correctly identified, but the others are referred to *O. subtilis*, below.

Although at least part of the material (the illustrated specimen) identified with this species by Chopra (1939) from the *John Murray* collections may be referable to *O. striata*, described below, the three specimens I examined appear to be typical *O. gonypetes*.

Material of this species reported by me from Madagascar (1968) proved to be referable to a third new species, *O. turbata*, described below.

Thus material from various parts of the reported range of *O. gonypetes* can now be referred to four different species, all of which occur in the Indian Ocean. Specimens from the extremes of the range of *O. gonypetes*, Japan and South Africa (Manning, 1965, 1971) should be re-examined.

Three of these four species, *O. gonypetes*, *O. subtilis*, and *O. turbata* comprise the *gonypetes*

complex of the *gonypetes* group of species in *Oratosquilla*, those species with an unarmed inferodistal angle on the merus and only five teeth on the dactylus of the claw. The fourth species, *O. striata*, is referable to the *imperialis* complex of the *gonypetes* group, those species with an unarmed inferodistal angle on the merus of the claw and with six teeth on the dactylus. As Holthuis (1967:12) pointed out, specimens of these species which lack claws are extremely difficult to distinguish. The number of teeth on the claw may prove to be variable, but much more material will have to be available before this can be determined. Series of specimens from a single locality would be most welcome and might help to solve the problem.

*Oratosquilla gonypetes* differs from *O. subtilis* in having more abdominal carinae armed, in having a broader uropod, with the proximal segment of the exopod shorter than the distal, and in having a lower, narrower lobe on the outer margin of the inner spine of the basal prolongation of the uropod; that lobe is broader than the spine in *O. subtilis*, narrower than the spine in *O. gonypetes*. *Oratosquilla gonypetes* differs from *O. turbata* in similar features: the branches of the anterior bifurcation of the median carina of the carapace are less distinct; the posterior lobe of the lateral process of the fifth thoracic somite is slender, triangular; more abdominal carinae are armed; and there are dark triangles rather than squares on the fifth abdominal somite.

In addition to the difference in the armature of the claw, *O. gonypetes* differs from *O. striata* in having a much narrower carapace, with the anterior width less than half the median length, a broader rostral plate, a broader posterior lobe on the lateral process of the fifth thoracic somite, and, when present on the telson, fewer, lower dorsal carinae and tubercles. These dorsal carinae are well developed in *O. striata*. Pigment on the fifth abdominal somite is divided into two submedian squares in *O. gonypetes*; it is not divided in *O. striata*.

**DISTRIBUTION.**—Known with certainty from localities in the Indian Ocean. Records in the literature have suggested that the range is from Japan (Manning, 1965) to southern Africa (Manning, 1971), but these records require verification. Indian Ocean localities include: Kabusa Island, 46–64 m, and off Cheduba Island, 13 m, both Burma (Kemp, 1911, 1913); Persian Gulf, 86 m (Kemp and Chopra,

1921); and Gulf of Oman, 73 m on coarse sand and shells (Chopra, 1939).

#### 4. *Oratosquilla gravieri*, new species

##### FIGURE 6

*Squilla oratoria*.—Gravier, 1937:183 [part].—Dawydoff, 1952:145 [part; not *Squilla oratoria* de Haan, 1844].

**MATERIAL.**—Baie d'Along [Yung Ha Long, 20°55'N, 107°05'E], Gulf of Tonkin, North Viet Nam; Dawydoff, leg.; Oct 1931; holotype: 1 ♂, TL 92 mm (MNHN).

**DESCRIPTION.**—Size moderate, total length less than 100 mm. Body appearing smooth, minutely punctate under magnification.

Eye (Figure 6*b*) of moderate size, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal index 394.

Antennular peduncle almost as long as carapace. Dorsal processes of antennular somite produced into anterolaterally directed spines.

Rostral plate (Figure 6*a*) with length and width subequal, appearing elongate, lateral margins converging on rounded apex. Median carina absent.

Anterior width of carapace less than half median length. Anterolateral spines of carapace (Figure 6*a*) extending to, but not overreaching, base of rostral plate. Median carina interrupted at anterior bifurcation, branches of bifurcation distinct. Intermediate carinae turning toward laterals, not extending to anterior margin.

Dactylus of claw with 6 teeth (one claw of holotype regenerating, with 8 teeth), outer margin sinuous, with low, obtuse projection basally. Dorsal ridge of carpus (Figure 6*c*) undivided. Inferodistal angle on outer face of merus produced into slender spine.

Exposed thoracic somites (Figure 6*d*) each with unarmed submedian and intermediate carinae. Lateral process of fifth somite bilobed, anterior lobe a slender, anteriorly directed spine, posterior lobe smaller, triangular, apex acute but not sharp, directed laterally. Lateral process of sixth somite strongly bilobed, anterior lobe acute, slender, triangular, posterior lobe larger, triangular, apex acute but not spined. Lateral process of seventh somite bilobed, anterior lobe slightly shorter than that of sixth somite, triangular, posterior lobe larger, triangular, apex acute, unarmed.

Submedian carinae subparallel on fifth abdominal somite. Abdominal carinae spined as follows:

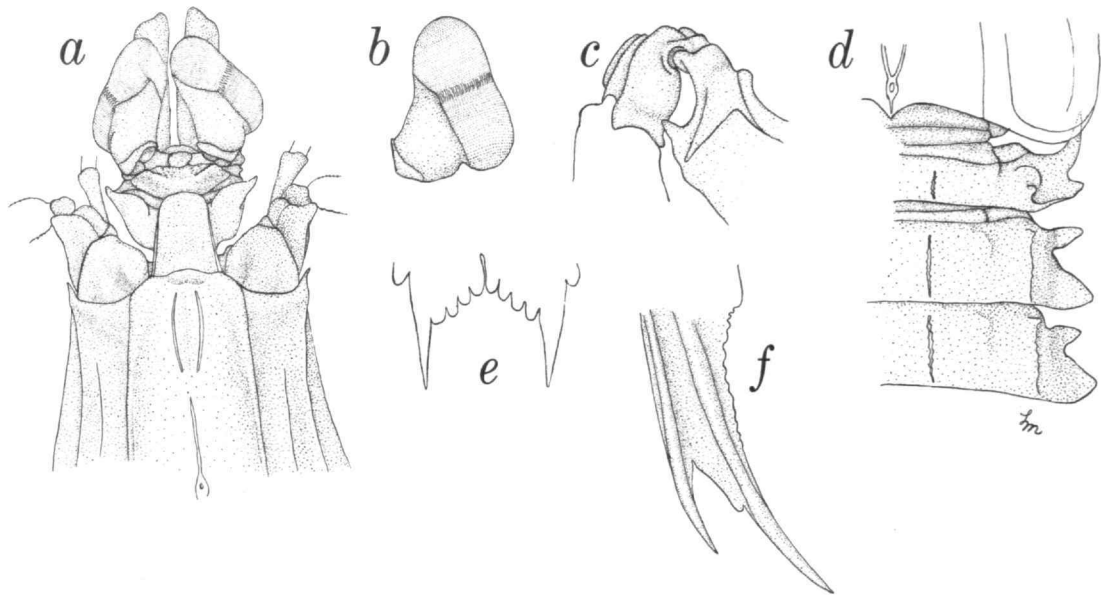


FIGURE 6.—*Oratosquilla gravieri*, new species, male holotype, TL 92 mm, Viet Nam: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

submedian 5–6, intermediate 4–6, lateral 3–6, marginal 1–5.

Telson flattened, longer than broad. Prelateral lobe longer than margin of lateral tooth. Denticles (Figure 6*e*) subquadrate or rounded, unarmed, 4, 5, 1. Ventral surface with short postanal keel.

Uropod broad, proximal segment of exopod subequal in length to distal, with 9 movable spines on outer margin, distalmost short, not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 6*f*) small, narrower than adjacent spine, margin concave, apex rounded.

**COLOR.**—Pattern not distinctive in holotype. Posterior margins of carapace, posterior 3 thoracic and anterior 5 abdominal somites each with line of dark pigment. Bases of marginal teeth of telson dark. Dark spot at articulation of segments of uropodal exopod, pigment extending onto inner half of distal segment, endopod with distal third dark.

**MEASUREMENTS.**—Only specimen examined, male holotype, TL 92 mm. Other measurements of holotype: CL 20.1, anterior width 9.1; cornea width 5.1; antennular peduncle length 19.6; rostral plate length 3.0, width 3.1; telson length 17.4, width 15.7.

**REMARKS.**—This new species belongs to the *inornata* complex of the *perpensa* group of species in *Oratosquilla*, those species with an elongate rostral plate. It differs from all species described so far in having the dorsal processes of the antennular somite produced into sharp spines. The anterior lobe of the lateral process of the sixth thoracic somite is slender, as in *O. perpensa*.

One of the claws of the holotype is regenerating; it bears eight rather than the normal complement of six teeth.

**ETYMOLOGY.**—It seems appropriate to name this species for the French carcinologist Ch. Gravier, who was the first to record it from Viet Nam.

**DISTRIBUTION.**—Known only from the type-locality, the Baie d'Along, Gulf of Tonkin.

##### 5. *Oratosquilla hindustanica*, new species

FIGURES 7, 15*e*

*Squilla oratoria* var. *perpensa* Kemp, 1911:98 [part]; 1913:70 [part; not pl. 5:figs. 57–59].

**MATERIAL.**—Tuticorin [08°47'N, 78°08'E], Madras, Gulf of Manaar, India; J. Hornell, leg.; holotype [paralectotype

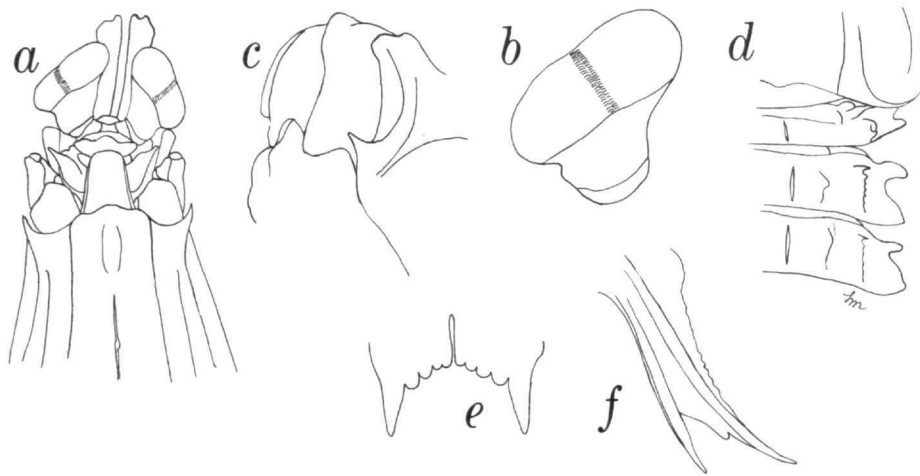


FIGURE 7.—*Oratosquilla hindustanica*, new species, female paratype, TL 69 mm, India: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

of *Squilla oratoria* var. *perpensa* Kemp]: 1 ♂, TL 66 mm (ZSI). Data same; paratypes [paralectotypes of *Squilla oratoria* var. *perpensa* Kemp]: 12 ♂, TL 45–68 mm; 17 ♀, TL 40–75 mm (ZSI 7037–41/10). Data same; paratypes [paralectotypes of *Squilla oratoria* var. *perpensa* Kemp]: 2 ♀, TL 86–95 mm (USNM 125069; ex ZSI 7521–4/10). Data same; paratypes [paralectotypes of *Squilla oratoria* var. *perpensa* Kemp]: 1 ♂, TL 67 mm; 1 ♀, TL 69 mm (USNM 143576).

**DESCRIPTION.**—Size moderate, total length less than 100 mm. Body appearing smooth, minutely punctate under magnification.

Eye (Figure 7*b*) moderate to small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 309–412.

Antennular peduncle as long as, or slightly shorter than, carapace. Dorsal processes of antennular somite produced into acute, slender lobes, sharp but not spined, directed anterolaterally.

Rostral plate (Figures 7*a*, 15*e*) appearing elongate, length and width subequal or width slightly greater, lateral margins converging on broadly rounded apex. Median carina absent.

Anterior width of carapace much less than half median length. Anterolateral spines (Figure 7*a*) strong, extending to or slightly beyond base of rostral plate. Median carina interrupted at base of anterior bifurcation, branches of bifurcation

distinct. Intermediate carinae turning toward but not meeting laterals, not extending to anterior margin.

Dactylus of claw with 6 teeth, outer margin of dactylus faintly sinuous. Dorsal ridge of carpus (Figure 7*c*) undivided. Inferodistal angle on outer face of merus with sharp spine.

Exposed thoracic somites (Figure 7*d*) with unarmed submedian and intermediate carinae, intermediates short, irregular, on fifth somite. Lateral process of fifth somite bilobed, anterior lobe a slender spine, directed almost anteriorly, posterior lobe triangular, apex acute, directed laterally. Lateral process of sixth somite bilobed, anterior lobe broad, apex trapezoidal, truncate or rounded; posterior lobe larger, triangular, apex obtusely pointed, unarmed. Lateral process of seventh somite bilobed; anterior lobe smaller than that of sixth somite, triangular; posterior lobe larger, triangular, apex obtusely pointed, unarmed.

Submedian carinae slightly divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5–6, intermediate 4–6, lateral (2)3–6, usually 2–6, marginal 1–5.

Telson flattened, longer than broad. Prelateral lobe longer than margin of lateral tooth. Denticles (Figure 7*e*) rounded or subquadrate, 4–5, 8–9, 1, outer submedians and outer intermediates largest.

Ventral surface with short postanal keel.

Uropod broad, proximal segment of exopod as long as, or slightly longer than, distal, with 8–9 movable spines on outer margin, distalmost not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figures 7f, 15e) small, low, narrower than adjacent spine, margin concave, apex rounded.

COLOR.—Body light, ornamented with lines and patches of dark chromatophores. Eystalks with numerous dark chromatophores, especially on ventral surface. Basal segments of antennae with dorsal and lateral patches of dark chromatophores. Margins, carinae, and grooves of carapace outlined with dark chromatophores. Dorsal surface of merus of claw with longitudinal dark line, outer surface with dark, distal patch proximal to articulation of carpus. Propodus of claw with distal dark patch. Exposed thoracic and all abdominal somites with dark posterior line, with submedian and intermediate carinae outlined in dark pigment, and with dark chromatophores middorsally. On abdomen, area between intermediate and lateral carinae with curved dark line, convex dorsally. Median area of telson, curved rows of pits, and bases of marginal teeth all dark. Midline of proximal segment of uropodal exopod dark, inner half of distal segment black. Uropodal endopod with margins of distal third dark, midline clear.

MEASUREMENTS.—Males, TL 45–68 mm; females, TL 40–95 mm. Other measurements of male holotype, TL 66 mm: CL 14.9, anterior width 6.6; cornea width 4.2; antennular peduncle length 15.6; rostral plate length 2.4, width 2.5; telson length 13.0, width 11.8.

REMARKS.—This is the common species occurring on the coasts of "British India" that Kemp named *Squilla oratoria* var. *perpensa*, and it is one of several species that Kemp included in the type-series of his variety. Unlike *O. perpensa* sensu stricto, however, *O. hindustanica* has a long, slender rostral plate, a feature that it shares with *O. inornata* and *O. solicitans*, as well as a truncated anterior lobe on the lateral process of the sixth thoracic somite. *Oratosquilla perpensa*, a more eastern species, which was illustrated by Kemp (1913, pl. 5: figs. 57–59), has a very short rostral plate and a slender, triangular anterior lobe on the lateral process of the sixth thoracic somite.

Both this species and *O. solicitans* resemble *O.*

*inornata* but differ from that species in having a much smoother body; *O. inornata*, like *O. perpensa*, has the body surface relatively deeply pitted and eroded.

The rostral plate and basal prolongation of the uropod of this species are similar to those observed in some of the specimens assigned to *O. solicitans* below. They are shown in Figure 15e, in contrast with the same features observed in *O. solicitans*. *Oratosquilla hindustanica* is very similar to *O. solicitans*, differing in having a more tapering rostral plate, a smaller lobe between the spines of the basal prolongation of the uropod, and more divergent spines on the basal prolongation.

The specimens of this species examined, totaling more than 30, are remarkably uniform morphologically; the rostral plates, lateral processes of the exposed thoracic somites, and uropods are basically the same in all of the specimens examined. For the present, I believe it should be considered as a separate species from *O. solicitans*; it may prove to be the westernmost population of that species or it may be that both are represented in the Indo-Malayan region and that the range of the two species overlaps there. Much more material, documented with observations on habitat and color in life, will have to be studied before this can be settled.

The close similarity of the species in the material assigned by Kemp to *O. perpensa* as well as the occurrence in that material of at least two species with elongate rostral plates, led Chopra (1934:24, 25), who compared some of Kemp's material with type-specimens of *O. inornata*, to consider that the two species then being considered, *O. inornata* and *O. perpensa*, to be identical. They are, in fact, separate species which themselves are part of a very confusing species complex.

ETYMOLOGY.—The specific name is derived from an early name, Hindustan, applied to British India.

DISTRIBUTION.—Known with certainty only from the type-locality, Tuticorin, Gulf of Manaar, Madras, India. Its range is yet to be determined.

## 6. *Oratosquilla inornata* (Tate, 1883)

FIGURES 8, 9

*Squilla inornata* Tate, 1883:51, pl. 2: figs. 3a–c.—Manning, 1966:95, fig. 3 [part?].

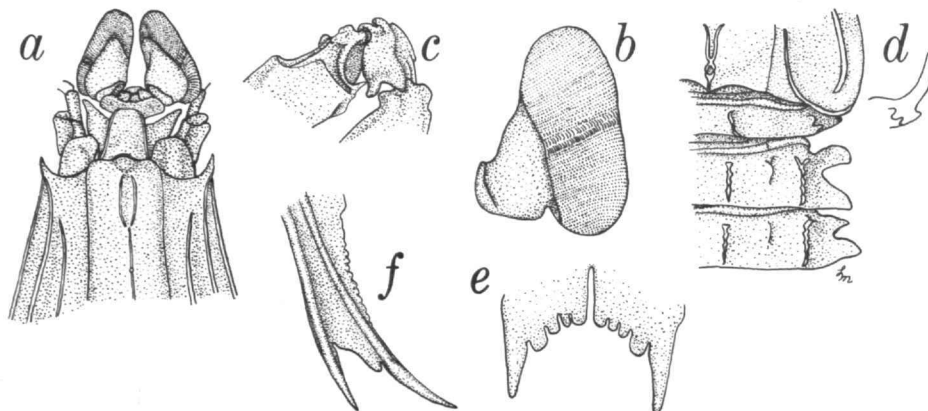


FIGURE 8.—*Oratosquilla inornata* (Tate, 1883), female lectotype, CL 14.3 mm, South Australia: a, anterior part of body; b, eye; c, carpus of claw; d, lateral processes of fifth, sixth, and seventh thoracic somites; e, submedian teeth and denticles of telson, ventral view; f, basal prolongation of uropod, ventral view.

**MATERIAL.**—Gulf of Saint Vincent [35°00'S, 138°05'E], South Australia; lectotype: 1 ♀, CL 14.3 mm (SAM). Data same; paralectotype: 1 ♀, TL 39 mm (SAM). 12 mi NNE of Bowen [20°01'S, 148°14'E], Queensland, Australia; 35–46 m; *Endeavour*, leg.: 1 ♂, TL 91 mm (USNM 111379).

**DESCRIPTION.**—Size moderate, total length of adults 100 mm or less. Body appearing rough, surface coarsely pitted, rugose.

Eye (Figures 8b, 9b) moderate to small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 349–414.

Antennular peduncle shorter than carapace. Dorsal processes of antennular somite produced into acute but blunt lobes directed anterolaterally.

Rostral plate (Figures 8a, 9a) with length and width subequal or length slightly greater, appearing elongate, lateral margins converging on flattened apex. Median carina absent.

Anterior width of carapace less than half median length. Anterolateral spines of carapace (Figures 8a, 9a) strong, extending to but not overreaching base of rostral plate. Median carina interrupted at base of anterior bifurcation, branches of bifurcation distinct. Intermediate carinae turning toward but not meeting laterals, not extending to anterior margin.

Dactylus of claw sinuous, outer margin sinuous, with 6 teeth. Dorsal ridge of carpus (Figures 8c, 9c) undivided. Inferodistal angle on outer face of merus with sharp spine.

Exposed thoracic somites (Figures 8d, 9d) each with unarmed submedian and intermediate carinae, intermediates short, irregular, on fifth somite. Lateral process of fifth somite bilobed, anterior lobe a slender spine, directed anteriorly, posterior lobe smaller, triangular, apex acute but blunt, directed laterally. Lateral process of sixth somite bilobed, anterior lobe broad, apex rounded, posterior lobe much larger, triangular, apex acute, unarmed. Lateral process of seventh somite bilobed, anterior lobe smaller and more triangular than that of sixth somite, apex acute, unarmed, posterior lobe larger, triangular, apex acute, unarmed.

Submedian carinae parallel on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5–6, intermediate 4–6, lateral 2–6 (3–6 in young female), marginal 1–5.

Telson flattened, longer than broad. Prelateral lobe shorter than margin of lateral tooth. Denticles (Figures 8e, 9e) subquadrate or rounded, 4, 7–9, 1. Ventral surface with short postanal keel.

Uropod broad, proximal segment of exopod subequal in length to distal, with 9 movable spines on outer margin, distalmost not extending to mid-length of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figures 8f, 9f) of uropod distally erect, narrower than adjacent spine, margin concave, apex rounded.

**COLOR.**—Pattern faded in all specimens examined.



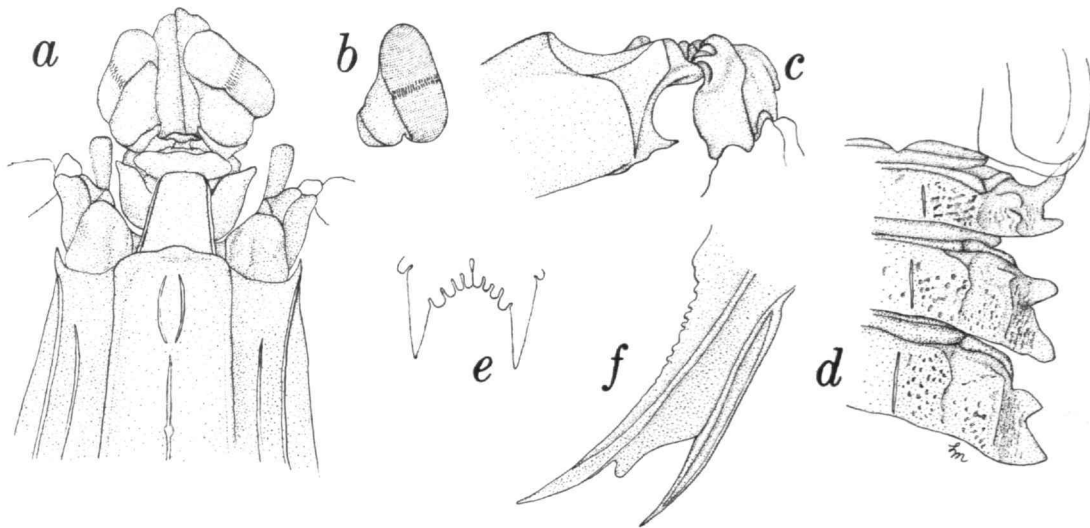


FIGURE 9.—*Oratosquilla inornata* (Tate, 1883), male, TL 91 mm, Queensland: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

**MEASUREMENTS.**—Only male examined, TL 91 mm; only intact female, a juvenile, TL 39 mm. Other measurements of damaged female lectotype: CL 14.3, anterior width 6.6; cornea width 4.1; antennular peduncle broken; rostral plate length 2.4, width 2.0; telson length 12.5, width 11.6.

**REMARKS.**—*Oratosquilla inornata* is the most rugose of the species of the *inornata* complex. Its distinctive features include the rugose surface of the body, the elongate rostral plate with a flattened apex, the relatively broad anterior lobe on the lateral process of the sixth thoracic somite, and the erect, projecting lobe between the spines of the basal prolongation of the uropod. In an otherwise very poor figure, Tate (1883, pl. 2: fig. 3*b*) illustrated the relatively broad anterior lobe on the lateral process of the sixth thoracic somite.

It is likely that most records of *O. inornata* in the literature are based on other, similar species, especially *O. hindustanica* or *O. solicitans*. *Oratosquilla inornata* is known with certainty from localities off southern and eastern Australia; its range may not extend northward to Indo-Malaya or westward to India.

The larger of the two female syntypes, a damaged adult female, is here selected as the lectotype. Both the lectotype and the smaller female paralectotype

are in the collections of the South Australian Museum.

Also occurring off Queensland is the species identified as *O. anomala* by Stephenson (1952) and others and which is named for Stephenson below. The concave lobe between the spines of the basal prolongation of the uropod in *O. inornata* will serve to distinguish it from *O. stephensoni* in which that lobe is straight or almost convex, as in *O. interrupta*.

Specimens from other eastern Australian localities from the *Endeavour* collection (Manning, 1966) probably are referable to *O. inornata*; their identity should be verified.

**DISTRIBUTION.**—Known only from Bowen, Queensland, in 35–46 m, and from the Gulf of Saint Vincent, South Australia.

## 7. *Oratosquilla pentadactyla*, new species

FIGURE 10

*Squilla affinis* var. *intermedia* Nobili, 1903:39 [part, specimens from Nias only; preoccupied by *Squilla intermedia* Bigelow, 1893].

*Squilla quinqueidentata*.—Kemp, 1913:195 [addendum, not p. 52].—Holthuis, 1941:244 [not *Squilla quinqueidentata* Brooks, 1886].

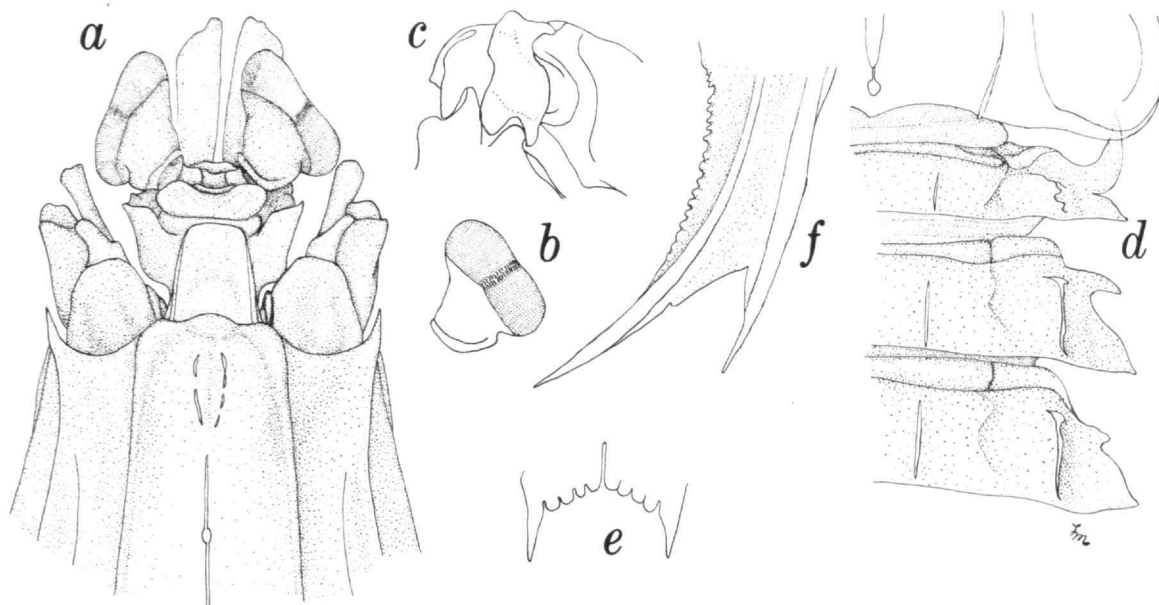


FIGURE 10.—*Oratosquilla pentadactyla*, new species, male paratype, TL 122.5 mm, India: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

**MATERIAL.**—Luaha Gundre, Nias, Indonesia; Modigliani, leg.; syntypes of *Squilla affinis* var. *intermedia*; paratypes: 2 ♀, TL 56–89 mm (MNHNP). Nias [Pulau Nias, 01°05'N, 97°35'E], Indonesia; Kleiweg de Zwaan, leg.; holotype: 1 ♀, TL 124 mm (ZMA). Telok Dalam [Telukdalam, 00°34'N, 97°49'E], Nias, Indonesia; Kleiweg de Zwaan, leg.; paratype: 1 ♂, TL 90 mm (ZMA). Data same; paratype: 1 ♀, TL 76 mm (USNM 155309). Goenang Sitoli [Gunung Sitoli, 01°17'N, 97°36'E], Nias, Indonesia; Kleiweg de Zwaan, leg.; paratype: 1 ♀, TL 138 mm (ZMA). Simaloer [Pulau Simeulue, 02°35'N, 96°05'E], W coast of Sumatra, Indonesia; E. Jacobson, leg.; Aug 1922; paratype: 1 ♂, TL 121 mm (ZMA). Kilakarai [09°14'S, 78°47'E], Ramnad District, S India; S. W. Kemp, leg.; from fishermen's nets; 17 Feb 1913; paratype: 1 ♂, TL 122.5 mm (ZSI 8107/10).

**DESCRIPTION.**—Size moderate, total length less than 150 mm. Body appearing smooth, lightly pitted under magnification.

Eye (Figure 10*b*) small to very small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 413–521.

Antennular peduncle about  $\frac{4}{5}$  as long as carapace. Dorsal processes of antennular somite produced into blunt lobes directed anterolaterally (occasionally sharp in dorsal view).

Rostral plate (Figure 10*a*) slightly longer than broad or with length and width subequal, appearing elongate, lateral margins converging slightly on flattened apex. Median carina absent.

Anterior width of carapace less than half median length. Anterolateral spines (Figure 10*a*) strong, extending to or beyond base of rostral plate. Median carina interrupted at base of bifurcation, branches of bifurcation low, scarcely visible in some specimens. Intermediate carinae turning towards laterals anteriorly, not extending to anterior margin.

Dactylus of claw with 5 teeth, outer margin sinuous. Dorsal ridge of carpus (Figure 10*c*) undivided. Inferodistal angle on outer face of merus with sharp spine.

Exposed thoracic somites (Figure 10*d*) each with unarmed submedian and intermediate carinae. Lateral process of fifth somite bilobed, anterior lobe a sharp, anteriorly directed spine, posterior lobe smaller, triangular, sharp, apex directed laterally or inclined posterolaterally. Lateral process of sixth somite bilobed, anterior lobe very slender, posterior lobe broader, apex acute, sharp. Lateral process of seventh somite distinctly bilobed, ante-

rior lobe much smaller than obtusely pointed posterior lobe, latter broader than that of sixth somite.

Submedian carinae divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5–6, intermediate (3)4–6, lateral (1)2–6, marginal 1–5, usually 5–6, 3–6, 1–6, 1–5.

Telson flattened, slightly broader than long. Prelateral lobe subequal in length to margin of lateral tooth. Denticles (Figure 10e) rounded or subquadrate, 4, 8–9, 1. Ventral surface with strong postanal keel.

Uropod broad, proximal segment of exopod shorter than distal, with 8 short movable spines on outer margin, distalmost not extending to mid-length of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 10f) low, much narrower than adjacent spine, margin concave, apex rounded.

COLOR.—Pattern not distinctive in preservative. Carapace, posterior 3 thoracic and all abdominal somites with dark posterior line. Bases of marginal teeth of telson dark. Inner and distal margin of proximal segment and inner half of distal segment of uropodal exopod dark, distal half of uropodal endopod dark. No trace of dark pigment at each end of median carina of telson as in *O. quinquedentata*.

MEASUREMENTS.—Males, TL 90–122.5 mm; females, TL 56–138 mm. Other measurements of female holotype, TL 124 mm: CL 27.0, anterior width 12.8; cornea width 5.2; antennular peduncle length 20.8; rostral plate length 4.0, width 3.7; telson length 23.1, width 24.9.

REMARKS.—This new species closely resembles *O. quinquedentata*, and together they comprise the *quinquedentata* complex of the *perpensa* group of species in *Oratosquilla*. Specimens of *O. pentadactyla* were referred to *O. quinquedentata* by both Kemp (1913) and Holthuis (1941) and probably by other authors as well.

*Oratosquilla pentadactyla* differs from *O. quinquedentata* in having larger eyes, a narrower carapace, a slenderer anterior lobe on the lateral process of the seventh thoracic somite, and armed intermediate and lateral carinae on the abdomen anterior to the fourth somite, and it further differs in lacking the dark anterior and posterior patches on the median carina of the telson.

Holthuis (1941) reported on some of the material listed above and noted some of the differences be-

tween the two species, especially those concerned with the spination of the abdominal carinae. The specimen from Bombay identified by Kemp (1913) with *O. quinquedentata* is correctly identified; his material from South India is referable to *O. pentadactyla*.

Apparently the two specimens from Nias which Nobili (1903) identified with *Squilla affinis* var. *intermedia* were forwarded to the Muséum National d'Histoire Naturelle at Paris in 1906; they are syntypes of Nobili's species. Another specimen from Nobili's syntypic series is identifiable with *O. anomala*, and is discussed above under the account of that species.

ETYMOLOGY.—The specific name is from the Greek *pente* ("five") plus *dactylos* ("finger"), alluding to the armature of the claw.

DISTRIBUTION.—Known from localities in Indonesia and from southern India. The depth range for the species has not been recorded, but it apparently lives in relatively shallow water.

## 8. *Oratosquilla perpensa* (Kemp, 1911)

### FIGURE 11

*Squilla oratoria* var. *perpensa* Kemp, 1911:98 [part]; 1913:70, pl. 5: figs. 57–59 [part].

*Squilla oratoria* var. *inornata*.—Holthuis, 1941:248 [part; not *Squilla inornata* Tate, 1883].

*Squilla perpensa*.—Lee and Wu, 1966:49.

MATERIAL.—Tung Kang, S Formosa [Tung Chiang, Taiwan]; trawled; S. Lee nos. 97, 169; 5 Sep 1965: 1♂, TL 68 mm, 1♀, TL 82 mm (RMNH 517S). Same loc.; Lee and Wu no. 180; 9 May 1965: 1♀, TL 66 mm (USNM 125061). Hong Kong [Hong Kong Island, 22°15'N, 114°11'E]; G. Dennys, leg.; lectotype: 1♀, TL 97.5 mm (ZSI). Data same; paralectotypes: 13♂, TL 73–93 mm, 13♀, TL 77–97 mm (ZSI 4851–72/9). Data same; paralectotypes: 1♂, TL 92.5 mm, 1♀, TL 88 mm (USNM 143577). Java, Indonesia; Bleeker, leg.: 1♂, TL 70 mm (RMNH 70S). Off Irrawaddy delta, Burma; 15°20'N, 94°55'E; 20 fms (37 m); *Investigator*, leg.; paralectotypes: 1♂, TL 64 mm, 1♀, TL 63 mm (USNM 143575).

DESCRIPTION.—Size moderate, total length of adults less than 100 mm. Body appearing smooth, actually very rugose when dried or viewed under magnification.

Eye (Figure 11b) moderate to small, cornea bilobed, set obliquely on stalk. Eyes not extending beyond end of first segment of antennular peduncle. Corneal indices 363–429.

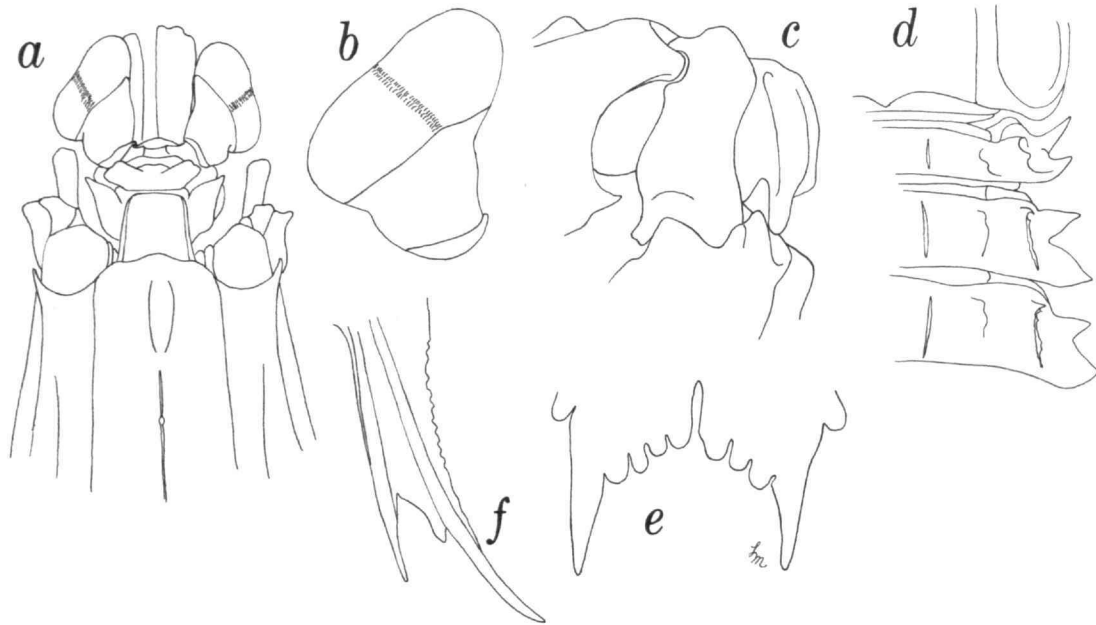


FIGURE 11.—*Oratosquilla perpensa* (Kemp, 1911), male paralectotype, TL 92.5 mm, Hong Kong: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

Antennular peduncle almost as long as carapace. Dorsal processes of antennular somite produced into acute, occasionally spiniform lobes directed anteriorly.

Rostral plate (Figure 11*a*) broader than long, quadrate or trapezoidal in shape, appearing short, apex flattened. Median carina absent.

Anterior width of carapace about half median length, not so long as carapace and rostral plate combined. Anterolateral spines (Figure 11*a*) strong, extending to or slightly beyond base of rostral plate. Median carina interrupted at base of anterior bifurcation, branches of bifurcation distinct. Intermediate carinae turning toward but not meeting laterals anteriorly, not extending to anterior margin.

Dactylus of claw with 6 teeth, outer margin strongly sinuous. Dorsal ridge of carpus (Figure 11*c*) undivided. Inferodistal angle on outer face of merus with sharp spine.

Exposed thoracic somites (Figure 11*d*) each with submedian and intermediate carinae, those of fifth somite poorly developed. Lateral process of fifth somite with anterior lobe produced into long, slender

spine, directed anterolaterally, posterior lobe smaller, triangular. Lateral process of sixth somite bilobed, anterior lobe slender, triangular, apex sharp, posterior lobe larger, triangular, apex sharp but not spiniform. Lateral process of seventh somite bilobed, anterior lobe smaller than that of sixth somite, triangular, apex sharp, posterior lobe larger, triangular, apex sharp but not spiniform.

Submedian carinae subparallel on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5-6, intermediate 4-5, lateral 3-6, marginal 1-5.

Telson flattened, slightly longer than broad. Prelateral lobe subequal in length to margin of lateral tooth. Denticles (Figure 11*e*) rounded or subquadrate, unarmed, 3-4, 7-9, 1. Ventral surface with long postanal keel.

Uropod broad, proximal segment of exopod shorter than distal, with 8-11 (usually 9) movable spines on outer margin, distalmost not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 11*f*) small, erect, prominent, narrower than adja-

cent spine, margin concave, apex rounded or angled.

**COLOR.**—Body appearing dusky, with concentration of pigment dorsally. Median carina, gastric grooves, and anterior margin of carapace dark, other carinae outlined by more diffuse lines of dark pigment. Lateral margin of rostral plate dark. Merus of claw with diffuse dark band dorsolaterally, propodus with distal patch of dark chromatophores. Exposed thoracic and all abdominal somites with dark posterior line, submedian and intermediate carinae faintly indicated by lines of dark chromatophores; lateral carinae flanked mesially by curved, dark line. Median carina of telson with anterior and posterior dark patches, bases of marginal teeth dark. Proximal segment of uropodal exopod with middorsal dark line, inner half of distal segment dark. Distal half of endopod dark. Basal prolongation of uropod with longitudinal patch of dark pigment on inner, ventral surface.

**MEASUREMENTS.**—Males, TL 64–93 mm; females, TL 63–97.5 mm. Other measurements of female lectotype, TL 97.5 mm: CL 20.6, anterior width 10.3; cornea width 5.1; antennular peduncle length 19.8; rostral plate length 2.7, width 3.1; telson length 17.8, width 16.3.

**REMARKS.**—Examination of syntypes of *Squilla oratoria* var. *perpensa* Kemp in the collection of the Zoological Survey of India revealed that the series included representatives of more than one species. One is a species from southern India with a long rostral plate which led Chopra (1934) to consider *O. perpensa* to be a synonym of *O. inornata* (Tate); another is a species with a short rostral plate, from Burma and Hong Kong, which Kemp illustrated (1913, pl. 5: fig. 57–59). Although Kemp (1913:70) intended *perpensa* to be used for the population occurring off British India, he illustrated material from Hong Kong. In my opinion less confusion will result from the selection of a specimen from Hong Kong, a female 97.5 mm long, as the lectotype of *S. oratoria* var. *perpensa*, for Kemp's monograph is still widely used to identify Indo-West-Pacific stomatopods. The population from India is named *O. hindustanica*, above. Kemp's syntypes included material of a third species, named *O. solicitans*, below. In all of those new species the rostral plate is elongate; it is short, subquadrate or trapezoidal in *O. perpensa* as restricted herein.

*Oratosquilla perpensa*, one of the three species

in the *perpensa* complex of the *perpensa* group, is a distinctive species, with a relatively rough surface, broad carapace, and small eyes. It differs from *O. anomala*, a second species of the *perpensa* complex, in having shorter anterolateral spines on the carapace and a slender, triangular anterior lobe on the lateral process of the sixth thoracic somite; that lobe is distinctly rectangular in *O. anomala*. *Oratosquilla perpensa* differs from *O. stephensoni*, the third species of the *perpensa* complex, in being much smaller and having a concave rather than a convex or straight lobe between the spines of the basal prolongation of the uropod.

**DISTRIBUTION.**—Known with certainty from localities between southern Taiwan and Burma, including Tung Kang, Taiwan, 40–50 fms (73–91.5 m) (Lee and Wu, 1966); Hong Kong (Kemp, 1911, 1913); Java, Indonesia (Holthuis, 1941); and off the Irrawaddy delta, Burma, 20 fms (37 m) (Kemp, 1913).

### 9. *Oratosquilla quinquedentata* (Brooks, 1886)

FIGURE 12

*Squilla quinquedentata* Brooks, 1886:21, 26, pl. 1: fig. 3, pl. 2: fig. 6.—Kemp, 1913:52 [not addendum, p. 195].—Chhapparg and Sane, 1968:45 [in key].

**MATERIAL.**—Atafura Sea; 09°59'S, 139°42'E; 28 fms (51 m); green mud; *Challenger* sta 188; 10 Sep 1874; holotype: 1 ♂, TL 140 mm (BMNH 94.10.16.6). Gulf of Thailand; P. Naiyanetr, leg.: 1 ♀, TL 119 mm (USNM 125368). Bombay [18°58'N, 72°50'E], India: 1 ♂, TL 103 mm (ZSI 7535/10). Bombay, India; S. R. Sane, leg.; 1964: 1 ♂, TL 59 mm (RMNH 5115).

**DESCRIPTION.**—Size moderate, total length of adults to 140 mm. Body appearing smooth, with large, shallow pits visible under magnification.

Eye (Figure 12b) small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 506–550.

Antennular peduncle more than  $\frac{4}{5}$  as long as carapace. Dorsal processes of antennular somite produced into blunt lobes directed anterolaterally.

Rostral plate (Figure 12a) broader than long, subquadrate or trapezoidal, apex flattened. Median carina absent.

Anterior width of carapace slightly less than half median length. Anterolateral spines (Figure 12a) strong, extending to or beyond base of rostral plate.

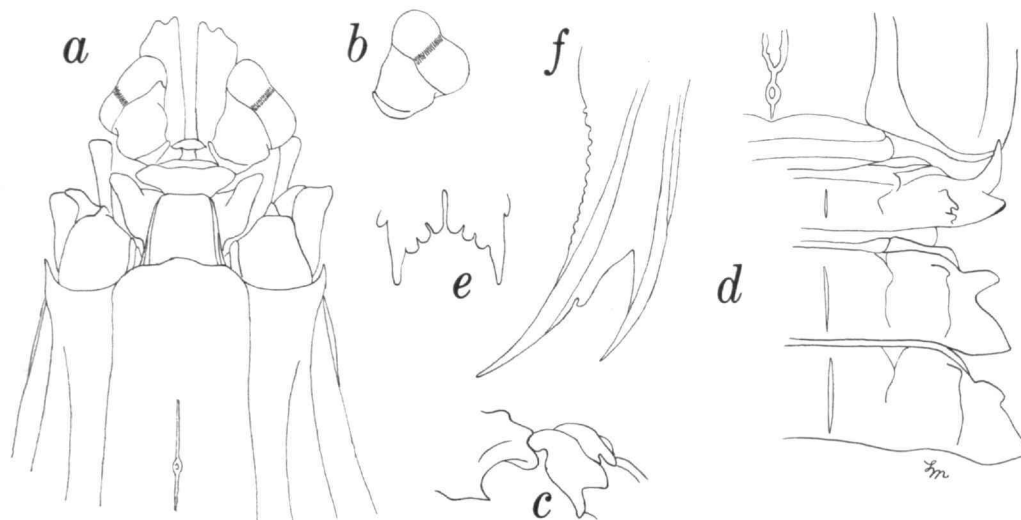


FIGURE 12.—*Oratosquilla quinquedentata* (Brooks, 1886), male, TL 103 mm, Bombay: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

Median carina interrupted anteriorly, branches of bifurcation poorly formed, rarely distinct. Intermediate carinae converging with but not meeting laterals anteriorly, not extending to anterior margin.

Dactylus of claw with 5 teeth, outer margin sinuate. Dorsal ridge of carpus (Figure 12*c*) undivided. Inferodistal angle of outer face of merus with sharp spine.

Exposed thoracic somites (Figure 12*d*) with unarmed submedian and intermediate carinae. Lateral process of fifth somite bilobed, anterior lobe a sharp spine directed almost anteriorly, posterior lobe smaller, broad and triangular, blunt apex directed laterally. Lateral process of sixth somite bilobed, anterior lobe slender, subtriangular or rectangular, posterior lobe broader, triangular, apex bluntly pointed, unarmed. Lateral process of seventh somite distinctly bilobed, anterior lobe low, rounded or subquadrate, much smaller than obtusely pointed posterior lobe.

Submedian carinae divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5-6, intermediate 4-6, lateral 4-6, marginal 1-5.

Telson flattened, longer than broad. Prelateral

lobe longer than margin of lateral tooth. Denticles (Figure 12*e*) rounded, elongate, 3, 7-8, 1. Ventral surface with strong postanal keel.

Uropod broad, proximal segment of exopod longer than distal, with 8-9 movable spines on outer margin, distalmost not extending to mid-length of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 12*f*) well developed but low, narrower than adjacent spine, margin concave, apex rounded.

COLOR.—Overall appearance dusky. Antennules with distal dark band on each segment. Carapace with anterior and posterior margins dark, with irregular band across cardiac region, dark pigment in U-shaped patch medially. Exposed thoracic and abdominal somites with dark posterior line and with diffuse dark pigment dorsally, outlined laterally with dark line lateral to submedian carina and just above lateral carina. Broad band of dark color across posterior half of median carina of telson, extending onto bases of marginal teeth. Anterior part of median carina of telson with subquadrate black spot. Uropod with dark pigment on proximal segment at articulation of exopod segments, and with black pigment on most of distal half of endopod, apex lighter.

MEASUREMENTS.—Males, TL 59–140 mm; only female examined, TL 119 mm. Other measurements of the female: CL 24.8, anterior width 11.8; cornea width 4.9; antennular peduncle length 22.0; rostral plate length 3.2, width 4.0; telson length 21.3, width 19.8.

REMARKS.—This is a relatively large and distinctive species, one of two in the *quinquedentata* complex of the *perpensa* group, those species with a distinct inferodistal spine on the merus and five teeth on the dactylus of the claw. It differs from *O. pentadactyla*, the other species of the *quinquedentata* complex, in having a broader rostral plate and carapace, smaller eyes, a broader anterior lobe on the lateral process of the seventh thoracic somite, and fewer armed carinae on the abdomen. The dark pigment on the telson also is characteristic for the species.

Kemp (1913) recorded this species from Bombay and Kilakarai, India; his material from the latter locality is referable to *O. pentadactyla*, described above.

DISTRIBUTION.—Known with certainty from the Arafura Sea, 51 m (Brooks, 1886), the Gulf of Thailand, and from Bombay, India (Kemp, 1913; Chhapparg and Sane, 1968). Other records in the literature, including those of Sunier (1918), Odhner (1923), and Tweedie (1934), require verification. Their records could be based on *O. pentadactyla*, which has a similar range.

## 10. *Oratosquilla sollicitans*, new species

FIGURES 13, 14, 15a–d

*Squilla oratoria* var. *perpensa* Kemp, 1911:98 [part]; 1913:70 [part, not pl. 5: figs. 57–59].

*Squilla oratoria* var. *inornata*.—Holthuis, 1941:248 [part; not *Squilla inornata* Tate, 1883].

TYPE-MATERIAL.—Sandakan [05°50'N, 118°07'E], Sabah, Malaysia; A. W. Herre, leg.; 30 Jun 1929; holotype: 1 ♀, TL 85 mm (USNM 125743). Singapore [01°17'N, 103°51'E], Malaysia; Stepani, leg.; paratypes: 6 ♂, TL 57–68 mm; 2 ♀, TL 36.5–70 mm (ZMB 12879; 2 ♂ USNM 153951). Singapore, Malaysia; Capt. Hutcheson, leg.; paratype (paralectotype of *Squilla oratoria* var. *perpensa* Kemp): 1 ♀, TL 78 mm (USNM 143578, ex ZSI 2426/1).

OTHER MATERIAL.—Anping [An-P'ing or Ampin, 23°00'N, 120°09'E], S Formosa; Haberer, leg.; Jun 1905: 3 ♂, TL 63–69 mm (ZMBS). Gulf of Thailand; P. Naiyanetr, leg.: 1 ♀, TL 85 mm (USNM 125363). Lem Sing, Mae Nam Chantaburi [Chanthaburi, 12°29'N, 102°04'E] River, Gulf of Thailand, Thailand; 7 May 1927: 1 ♂, TL 68 mm (USNM 125065).

Mae Nam Chantaburi River, Tha Chalaep Harbor [Ban Tha Chalaep, 12°30'N, 102°03'E], Gulf of Thailand, Thailand; anchorage; R. Rofen, leg., sta 134; 24 Dec 1957: 1 ♂, TL 37 mm (USNM 104719). Singapore [01°17'N, 103°51'E], Malaysia; Capt. Hutcheson, leg.; paralectotype of *Squilla oratoria* var. *perpensa* Kemp: 1 ♂, TL 73 mm (USNM 156256, ex ZSI 2426/1). Sandakan [05°50'N, 118°07'E], Sabah, Malaysia; A. W. Herre, leg.; 30 Jun 1929: 1 ♀, TL 96 mm (USNM 168858). N coast of Java, Indonesia; Buitendijk, leg.; 1904: 1 ♀, TL 79 mm (RMNH 116S). Tandjoeng Patjinan [Tandjung Patjinan, 07°36'S, 114°02'E], Java, Indonesia; Nov 1938; paratype: 1 ♂, TL 88 mm (RMNH 118S). Makassar [Makassar, 05°07'S, 119°24'E], Celebes, Indonesia; Piller, leg.; paratype: 1 ♀, TL 82 mm (RMNH 117S). Skroe [Sekru, 02°55'S, 132°14'E], New Guinea, Indonesia; Schädler, leg.; May 1897; paratype: 1 ♂, TL 60 mm (RMNH 115S).

DESCRIPTION.—Size small to moderate, total length of adults less than 100 mm. Body appearing smooth, minutely punctate under magnification.

Eye (Figures 13b, 14b) of moderate size, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 290–412.

Antennular peduncle slightly shorter than carapace. Dorsal processes of antennular somite produced into acute lobes directed almost laterally.

Rostral plate (Figures 13a, 14a, 15a–d) with length and width subequal or width slightly greater, appearing elongate, lateral margins subparallel, apex flattened or broadly rounded. Median carina absent.

Anterior width of carapace less than half median length. Anterolateral spines (Figures 13a, 14a) strong, extending to, but usually not beyond, base of rostral plate. Median carina interrupted at base of anterior bifurcation, branches of bifurcation distinct. Intermediate carinae turning toward but not meeting with laterals, not extending to anterior margin.

Dactylus of claw with 6 teeth, outer margin straight or slightly sinuous. Dorsal ridge of carpus (Figures 13c, 14c) undivided. Inferodistal angle on outer face of merus with sharp spine.

Exposed thoracic somites (Figures 13d, 14d) each with unarmed submedian and intermediate carinae, intermediates very short on fifth somite. Lateral process of fifth somite bilobed, anterior lobe a slender spine, directed almost anteriorly, posterior lobe rounded, directed laterally. Lateral process of sixth somite bilobed, anterior lobe large, broad, apex truncate or slightly trapezoidal, posterior lobe larger, triangular, apex acute, bluntly

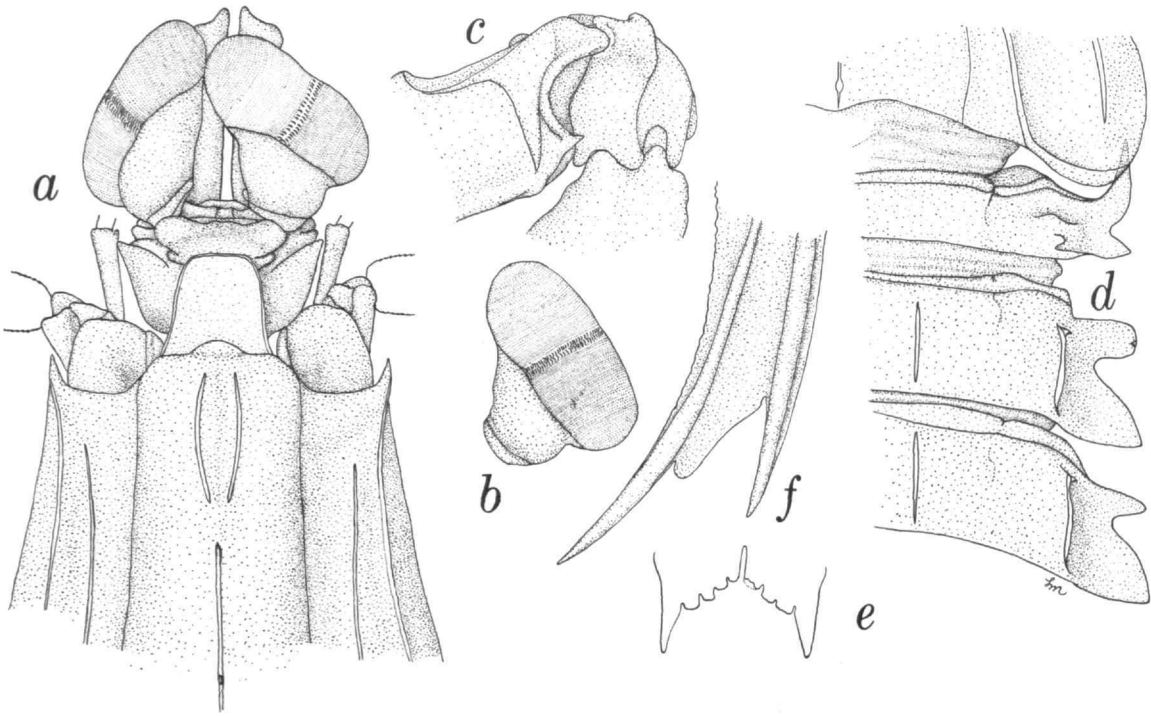


FIGURE 13.—*Oratosquilla sollicitans*, new species, male paratype, TL 64.5 mm, Singapore: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

pointed. Lateral process of seventh somite bilobed, anterior lobe smaller than that of sixth somite, triangular, posterior lobe larger, triangular, apex acute but rounded.

Submedian carinae divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5–6, intermediate 4–6, lateral (1–2) 3–6, marginal 1–5.

Telson flattened, slightly longer than broad. Prelateral lobe longer than margin of lateral tooth. Denticles (Figures 13*e*, 14*e*) subquadrate, 3–4, 7–9, 1. Ventral surface with short postanal keel.

Uropod broad, proximal segment as long as or slightly shorter than distal, with 8–9 movable spines on outer margin, distalmost not extending to mid-length of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figures 13*f*, 14*f*, 15*a–d*) small to large in size, narrower or broader than adjacent spine, margin concave, apex rounded.

COLOR.—Grooves and carinae of carapace and

posterior margins of carapace, posterior 3 thoracic, and all abdominal somites with dark line, narrower at intermediate carinae of first to fifth abdominal somites. Dark pigment distally on propodus of claw and on lateral processes of thoracic somites. Abdominal somites, especially second, each with trace of dark middorsal patch. Telson with dark spot on spine of median carina and at bases of submedian and intermediate marginal teeth. Uropod with dark pigment at articulation of exopod segments, inner third of distal segment of exopod completely dark, distal third of endopod dark.

MEASUREMENTS.—Males, TL 37–88 mm; females, TL 36.5–96 mm. Other measurements of male paratype, TL 64.5 mm: CL 14.2, anterior width 6.5; cornea width 4.1; antennular peduncle length ca. 13.3; rostral plate length 2.2, width 3.3; telson length 11.7, width 11.3.

REMARKS.—If my interpretation of the material listed above is correct, *O. sollicitans* is not only one



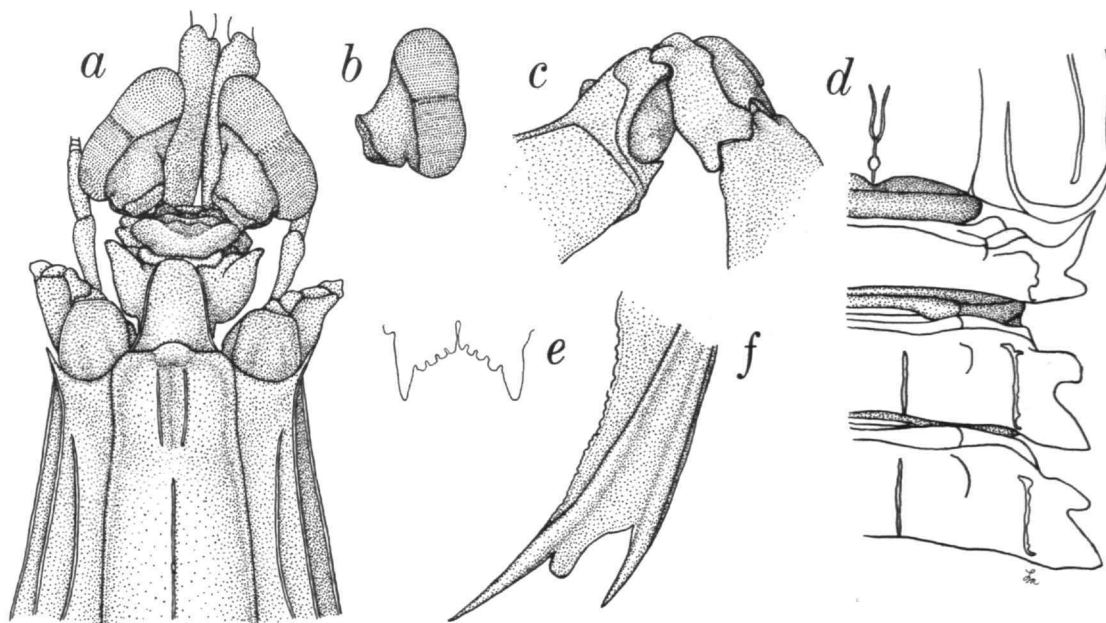


FIGURE 14.—*Oratosquilla solicitans*, new species, female, TL 96 mm, Sabah: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

of the most common species of the genus in the Indo-Malayan area, but also is the most variable in the genus. My original analysis of this material suggested that two species could be differentiated, one with a flattened rostral plate and one with a broadly rounded rostral plate, and, in both, the lobe between the spines of the basal prolongation of the uropod was significantly larger than that found in the very similar *O. hindustanica* from India. Indeed, one of the lots examined, from Sabah, originally contained two females which could be separated immediately on the shape of the rostral plate (Figures 13*a*, 14*a*, 15*a,b*) and this same difference was found in two specimens (syn-types of *S. oratoria* var. *perpensa* from the same lot from Singapore in the collection of the Zoological Survey of India which had been sent to me on exchange on two different occasions. Further study indicated variation in these features in other specimens from Indo-Malayan localities. Because of the distinct possibility that more than one (as many as four) species are represented in my limited material, I have restricted the type-series to the form

with the distinctly flattened anterior margin on the rostral plate and the enlarged lobe between the spines of the basal prolongation of the uropod, illustrated in Figure 13. The specimen shown in Figure 14 represents the form with the rounded anterior margin on the rostral plate and the enlarged lobe on the basal prolongation.

The rostral plate and basal prolongation of the uropod are shown for each of the four forms of *O. solicitans* in Figure 15*a-d* and for *O. hindustanica* in Figure 15*e*. As noted above, there appear to be four distinct forms in *O. solicitans*, one with a rounded rostral plate and a large uropod lobe (Figure 15*a*), one with a flattened rostral plate and a large uropod lobe (Figure 15*b*) (*solicitans* sensu stricto), one with a rounded rostral plate and a small uropod lobe (Figure 15*c*), and one with a flattened rostral plate and a small uropod lobe (Figure 15*d*). These features are shown in Figure 15*e* for the very similar *O. hindustanica* from India. In each of these forms the anterior lobe of the lateral process of the sixth thoracic somite is truncate and the spination of the abdominal carinae

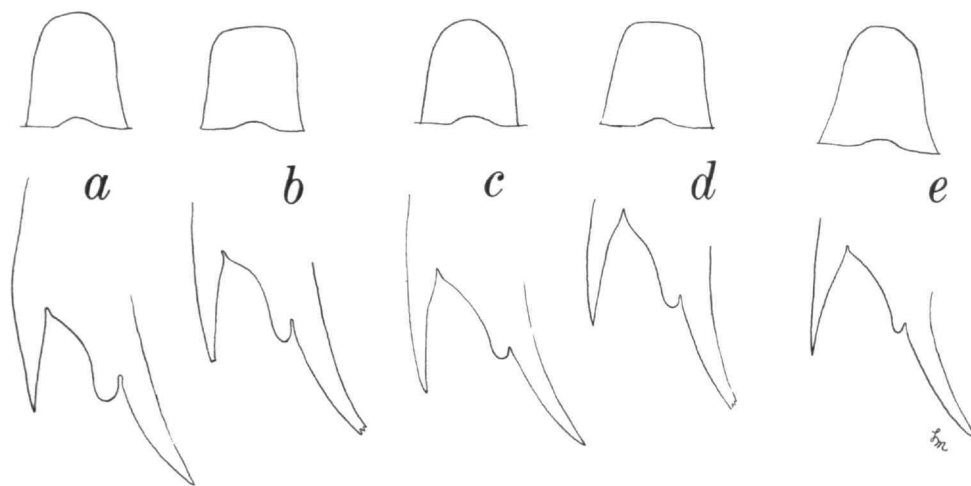


FIGURE 15.—Rostral plate (upper row) and basal prolongation of uropod (lower row) of *Oratosquilla sollicitans* (a-d) and *O. hindustanica* (e): a, form with rounded rostral plate and large lobe between spines of basal prolongation of uropod, female, TL 96 mm, Sabah; b, form with flattened rostral plate and large lobe between spines of basal prolongation of uropod, female holotype, TL 85 mm, Sabah; c, form with rounded rostral plate and small lobe between spines of basal prolongation of uropod, male, TL 68 mm, Thailand; d, form with flattened rostral plate and small lobe between spines of basal prolongation of uropod, female, TL 85 mm, Thailand; e, *O. hindustanica*, female paratype, TL 69 mm, India.

is similar: submedian 5-6, intermediate 4-6, lateral (1-2) 3-6, and marginal 1-5. Usually the intermediate carinae of the second abdominal somite are spined, and they are armed on the first somite in only one specimen. The intermediate carinae of the first and second somites are unarmed in the types of *O. sollicitans*, which represent the form with the flattened rostral plate and the large uropod lobe. (See Table 1, page 42.)

The available material is not extensive enough to reveal any differences in eye size which might be correlated with the observed variation in shape of rostral plates and uropod lobes, except that the three specimens from Anping have somewhat larger eyes than the other material available and they share a rounded rostral plate as well as a small uropod lobe. They probably represent a distinct species. Corneal indices for *O. sollicitans* and *O. hindustanica* are summarized below.

In view of the fact that the uropod lobe varies in size and shape in *O. woodmasoni* from different geographic localities between India and eastern Australia (see account of that species, below), it is possible that the relative size of the lobe in the material assigned here to *O. sollicitans* is unimpor-

tant, and that this feature can vary geographically in this species.

If this proves to be true, then it also is possible that most or all of the specimens with a flattened rostral plate represent *O. sollicitans* sensu stricto, a species not now known to range to India, and that the Indo-Malayan specimens with a rounded rostral plate are identifiable with *O. hindustanica*, now known to occur only off India. The possible exceptions to this are the three large-eyed specimens from Anping, Formosa, mentioned above, which may represent a distinct species.

Large series of *O. sollicitans* from throughout its range will have to be studied before this problem can be settled. It will be particularly important to study series from each of several localities in the Indo-Malayan area.

ETYMOLOGY.—The name is from the Latin for "vexing," alluding to the problems posed by the specimens assigned to this species.

DISTRIBUTION.—Western Pacific Ocean, primarily in the Indo-Malayan region, from Taiwan, the Gulf of Thailand, and localities in Malaysia and Indonesia.

### 11. *Oratosquilla stephensoni*, new species

FIGURE 16

*Squilla anomala*.—Stephenson. 1952:7; 1953:43.—Stephenson and McNeill, 1955:245, 246 [key].—Stephenson, Williams, and Cook, 1974:114 [listed] [not *Squilla anomala* Tweedie, 1935].

**MATERIAL.**—1.0–1.5 mi E of St. Helena Island, Moreton Bay [27°15'S, 153°15'E], Queensland, Australia; 4.5 fms (8 m); trawled; L. Wale, leg.; 15 Feb 1966; holotype: 1 ♂, TL 134 mm (USNM 125754). Data same; paratypes: 9 ♂, TL 108–142 mm; 8 ♀, TL 109.5–149 mm (USNM 156527; 1 ♂, 1 ♀ AM; 1 ♂, 1 ♀ QM W.5767). Data same; paratypes: 2 ♂, TL 141–144 mm; 5 ♀, TL 119–147.5 mm (USNM 125752). 2 mi N of the Pile Light, mouth of the Brisbane River, Moreton Bay, Queensland, Australia; 6 fms (11 m); muddy; trawl; W. Stephenson and May Rees, leg.; 29 Mar 1966; paratype: 1 ♂, TL 122 mm (USNM 125067). 2.5 mi E of Woody Point, Moreton Bay, Queensland, Australia; 6 fms (11 m); muddy; trawl; W. Stephenson and May Rees, leg.; 29 Mar 1966; paratype: 1 ♂, TL 93 mm (USNM 125753).

**DESCRIPTION.**—Size moderate, total length of adults 150 mm or less. Body roughened, dorsal surface coarsely pitted.

Eye (Figure 16*b*) very small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 502–579.

Antennular peduncle shorter than carapace. Dorsal processes of antennular somite produced into blunt lobes directed anterolaterally.

Rostral plate (Figure 16*a*) broader than long, tapering anteriorly, apex truncate. Median carina absent.

Anterior width of carapace less than half median length. Anterolateral spines (Figure 16*a*) strong, extending to base of rostral plate. Median carina lacking well marked anterior bifurcation, area of bifurcation indicated by depression medially. Intermediate carinae slightly turning toward laterals, falling well short of anterior margin, extending about to end of median carina.

Dactylus of claw with 6 teeth (7 on 1 side in 1 specimen), outer margin sinuous. Dorsal ridge of carpus (Figure 16*c*) undivided. Inferodistal angle on outer face of merus with sharp spine.

Exposed thoracic somites (Figure 16*d*) each with unarmed submedian and intermediate carinae, intermediates of fifth somite reduced. Lateral process of fifth somite bilobed, anterior lobe a slender, anterolaterally directed spine, posterior lobe broad,

rounded. Lateral process of sixth somite bilobed, anterior lobe a slender, rounded process, posterior lobe much larger, triangular, apex bluntly rounded, unarmed. Lateral process of seventh somite bilobed, anterior lobe smaller than that of sixth somite, triangular, apex blunt, posterior lobe much larger, triangular, apex rounded, unarmed.

Submedian carinae divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5–6, intermediate 4–6, lateral 3–6, marginal 1–5.

Telson flattened, longer than broad. Prelateral lobe shorter than margin of lateral tooth. Denticles (Figure 16*e*) subquadrate or rounded, 2–3, 6–11, 1, usually 3, 8–9, 1. Ventral surface with short postanal keel.

Uropod broad, proximal segment of exopod as long as, or slightly longer than, distal, with 7–9, usually 8, movable spines on outer margin, distal-most not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 16*f*) low, narrower than adjacent spine, margin usually slightly convex or straight, rarely inconspicuously concave, apex rounded.

**COLOR.**—Pattern not distinctive in preserved material. Anterior and posterior margins of carapace and posterior margins of thoracic and abdominal somites dark. Bases of teeth of telson dark. Uropod with dark spot at articulation of endopod segments, extending onto inner half of distal segment. Distal third of uropodal endopod dark.

**MEASUREMENTS.**—Males, TL 93–144 mm; females, TL 109.5–149 mm. Other measurements of male paratype, TL 93 mm: CL 20.3, anterior width 9.7; cornea width 3.9; antennular peduncle length 17.4; rostral plate length 2.8, width 3.2; telson length 19.4, width 17.6.

**REMARKS.**—This new species, a relatively large species of the *inornata* complex, *perpensa* group of *Oratosquilla*, resembles *O. anomala* and *O. perpensa* in having a short, quadrate rostral plate as well as in the spine formula of the abdomen. *Oratosquilla stephensoni*, a much larger species than either, can be distinguished easily by the convex or straight lobe between the spines of the basal prolongation of the uropod; in both *O. anomala* and *O. perpensa* that lobe is strongly concave. The lobe in *O. stephensoni* resembles that of *O. interrupta*, but the latter species always has a tuberculate rather than an undivided carpus on the claw

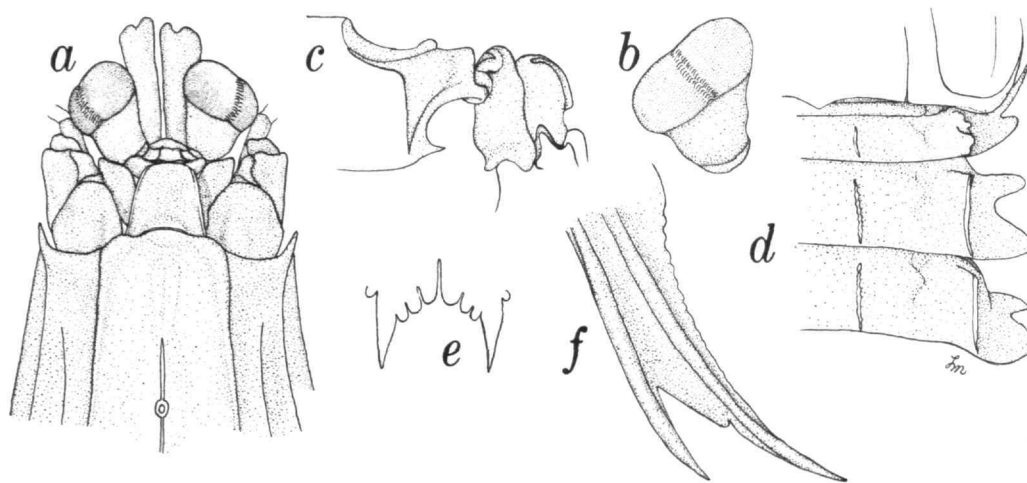


FIGURE 16.—*Oratosquilla stephensoni*, new species, male paratype, TL 93 mm, Queensland: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

as well as distinct branches on the bifurcation of the median carina of the carapace.

Stephenson's (1952:8) comment on the shape of the lobe on the basal prolongation of the uropod led me to the discovery that this species was undescribed.

*Oratosquilla stephensoni*, which appears to be common in the waters of Moreton Bay, Queensland, may occur together with *O. inornata* at localities off Queensland. *Oratosquilla stephensoni* is a smoother species, and that feature, as well as its short rostral plate and convex or straight lobe between the spines of the basal prolongation of the uropod, should simplify its recognition if the two species are taken together.

Some of the specimens from one of the lots (USNM 125752) have commensal bivalves attached to the body, usually under the carapace.

**ETYMOLOGY.**—It is a pleasure to name this species for W. Stephenson, University of Queensland, who first recorded it in the literature and who donated collections of the species to the National Museum of Natural History, Smithsonian Institution.

**DISTRIBUTION.**—Known only from localities in Queensland, including Townsville, Lindeman Island, and several localities in Moreton Bay, on

muddy bottom in depths between 5.5 and 13 meters.

## 12. *Oratosquilla striata*, new species

FIGURES 17–18

?*Squilla gonypetes*.—Chopra, 1939:140 [listed], 148, fig. 5 [part; not *Squilla gonypetes* Kemp, 1911].

?*Squilla simulans* Holthuis, 1967:7 [part; male paratype only].

**MATERIAL.**—Persian Gulf; no other data; paratype: 1 ♀, TL 34 mm (MNHN). Gulf of Oman, off Arabian coast; 25°37'N, 56°34'E to 25°39'N, 56°34'E; 79 m; green muddy sand; Anton Bruun Sta 262A; 1 Dec 1963; holotype: 1 ♂, TL 47 mm (USNM 168859).

**DESCRIPTION.**—Size small to moderate, total length of adults less than 60 mm. Body appearing smooth, actually minutely pitted under magnification.

Eye (Figure 17*b*) moderate to small, cornea bilobed, set slightly obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 386–407.

Antennular peduncle as long as, or slightly shorter than, carapace. Dorsal processes of antennular somite produced into triangular lobe, apices acute but not sharp, directed anterolaterally.

Rostral plate (Figure 17*a*) slightly longer than

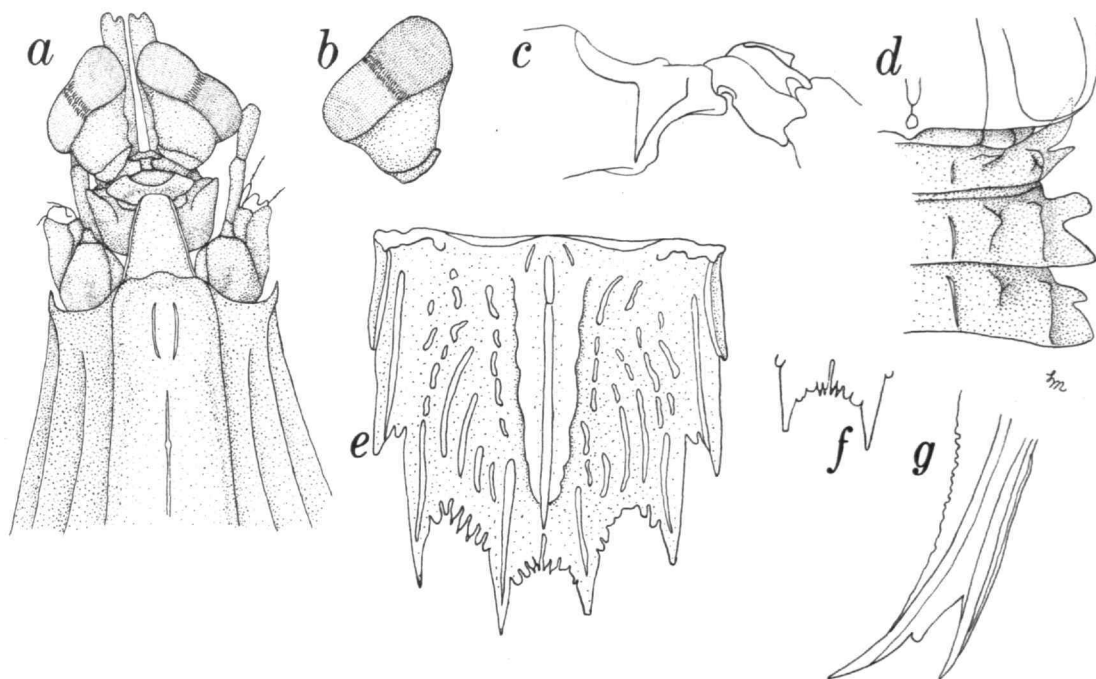


FIGURE 17.—*Oratosquilla striata*, new species, male holotype, TL 47 mm, Gulf of Oman: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, telson; *f*, submedian teeth and denticles of telson, ventral view; *g*, basal prolongation of uropod, ventral view.

broad, appearing elongate, lateral margins converging on rounded apex. Median carina absent.

Anterior width of carapace variable, slightly less than or slightly more than half of median length, shorter than carapace and rostral plate combined. Anterolateral spines of carapace (Figure 17*a*) strong but not overreaching base of rostral plate. Median carina interrupted at anterior bifurcation, branches of bifurcation usually poorly formed but distinct. Intermediate carinae not sloping toward laterals, not extending to anterior margin.

Dactylus of claw with 6 teeth, outer margin faintly sinuous, with obtuse projection basally. Dorsal ridge of carpus (Figure 17*c*) undivided. Inferodistal angle on outer face of merus unarmed.

Exposed thoracic somites (Figure 17*d*) each with unarmed submedian and intermediate carinae, submedians divergent, intermediates of fifth somite short. Lateral process of fifth somite bilobed, anterior lobe a slender, sharp, anteriorly directed spine, posterior lobe smaller, slender, triangular, directed anterolaterally. Lateral process of sixth

somite strongly bilobed, anterior lobe large, subrectangular, posterior lobe subtriangular, apex acute but rounded. Lateral process of seventh somite bilobed, anterior lobe smaller than that of sixth somite, subtriangular or trapezoidal, posterior lobe larger, triangular, apex unarmed.

Submedian carinae subparallel on fifth abdominal somite, slightly divergent anteriorly. Abdominal carinae spined as follows: submedian 5–6; intermediate 3–6; lateral 1–6; marginal 1–5.

Telson (Figures 17*e*, 18) flattened, slender, slightly longer than broad. Prelateral lobe slightly shorter than margin of lateral tooth. Dorsal surface with numerous longitudinal carinae, number, size, and arrangement variable. Denticles (Figures 17*e,f*, 18) 4, 7–8, 1, outer submedians and inner and outer intermediates enlarged, rounded, remainder spiniform. Ventral surface with short postanal keel.

Uropod slender, proximal segment of exopod slightly longer than distal, with 8–9 movable spines on outer margin, distalmost short, not extending to midlength of distal segment. Lobe on outer margin

of inner spine of basal prolongation (Figure 17g) small or moderate in size, narrower than adjacent spine, margin concave, apex rounded.

**COLOR.**—Eye with dark lateral patch on stalk. Carapace with 3 distinct pigmented areas: anterior, cardiac, and posterior; anteriormost area diffuse; cardiac patch on midline; posteriormost area U-shaped with chromatophores extending anteriorly along gastric grooves to cervical groove. Carinae and gastric grooves of carapace outlined with dark chromatophores. Claws with patches of dark chromatophores on basis, distolaterally on merus, and distally on propodus. Sixth and seventh thoracic somites with dark submedian carinae, pigment extending laterally onto posterior margin, and dark patches lateral to intermediate carinae. Abdomen with dark posterior line on each somite and with dark patches medially on second somite (middorsally) and fifth somite (on posterior margin, barely differentiated into 2 submedian spots). Intermediate carinae of abdomen lined with dark pigment, flanked laterally by dark patch between intermediate and lateral carina. Sixth somite dark posterolaterally. Telson pattern faded, but with traces of curved lines of dark chromatophores on surface, anterior and posterior dark patches on median carina, and bases of marginal teeth dark. Uropodal protopod with dark pigment on dorsal carina, exopod with trace of dark pigment at articulation

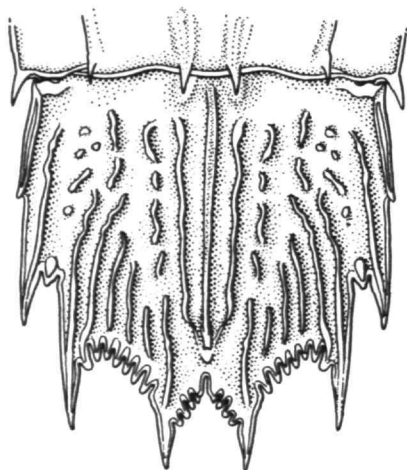


FIGURE 18.—*Oratosquilla striata*, new species, telson of female, TL 56 mm, Gulf of Oman (from Chopra, 1939, fig. 5).

extending onto proximal half of distal segment. Distal third or half of uropodal endopod dark.

**MEASUREMENTS.**—Only male examined, TL 47 mm; only female examined, TL 34 mm. Other measurements of female paratype, TL 34 mm: CL 8.1, anterior width 4.4; cornea width 2.1; antennular peduncle length 8.1; rostral plate length 1.4, width 1.3; telson length 6.9, width 6.6.

**REMARKS.**—*Oratosquilla striata* is the only member of the *imperialis* complex, *gonypetes* group, in which the dorsal surface of the telson is ornamented with numerous, well developed longitudinal carinae. This feature alone will distinguish the species from the other members of the *imperialis* complex.

Material of *O. striata* lacking claws might be difficult to distinguish from *O. gonypetes*, which occurs in the same area. In *O. striata* the dorsal carinae of the telson are stronger and more numerous than in *O. gonypetes* (in which carinae usually are absent). In *O. striata* the carinae flanking the median carina are stronger and the carina of the lateral tooth extends anteriorly beyond the mid-length of the prelateral lobe; in *O. gonypetes* the carina of the lateral tooth extends almost to the end of the prelateral lobe. Of the other differences between *O. striata* and *O. gonypetes* mentioned under the account of the latter species, the difference in color pattern on the fifth abdominal somite may be the most important; there is a single, dorsal patch of dark pigment, spreading anteriorly on the submedian carinae, in *O. striata*, and a pair of black squares on *O. gonypetes*.

It seems likely that at least part of the material from the Gulf of Oman identified with *O. gonypetes* by Chopra (1939), particularly the illustrated specimen, a female 56 mm long, is referable to *O. striata*. Chopra's figure is reproduced here (Figure 18); the dorsal carinae of the telson are well developed and the carinae of the lateral teeth are quite long. Only three of the original six specimens reported by Chopra remain in the collection of the British Museum (Natural History) and that female is not one of them. The three specimens that I could examine appear to be referable to *O. gonypetes*. The *John Murray* station at which Chopra's specimens were captured is situated very close to the type-locality of *O. striata*.

It seems likely also that the male paratype of *O. simulans* (Holthuis, 1967), from the Red Sea,

may be referable to *O. striata*. Holthuis pointed out several differences between his female holotype and the smaller male paratype, including the presence of dorsal carinae on the telson in the latter.

The anterior bifurcation of the median carina of the carapace does not appear to be interrupted in the female paratype from the Gulf of Oman. It is interrupted in the male holotype, on which the dark color of the carina also is interrupted. In both specimens the branches of the bifurcation are present and well developed.

**ETYMOLOGY.**—The name is from the Latin *stria* ("furrow"), alluding to the ornamentation of the telson.

**DISTRIBUTION.**—Known with certainty from the Persian Gulf and the Gulf of Oman in a depth of 79 m. It may also occur in the Red Sea.

### 13. *Oratosquilla subtilis*, new species

FIGURE 19

*Squilla gonypetes* Kemp, 1911:96 [part]; 1913:54 [part].—Kemp and Chopra, 1921:300 [part].  
*Squilla oratoria* var. *perpensa*.—Hansen, 1926:11 [part; not *Squilla oratoria* var. *perpensa* Kemp, 1911].

**MATERIAL.**—San Andreas Island, Philippine Islands; 13°38'N, 121°58'E; 50 fms (91.5 m); soft grey mud; *Albatross* sta 5220; 24 Apr 1908; paratype: 1 ♂, TL 52 mm (USNM 77990). Buton Strait, off Tikola Peninsula, S Celebes Island, Indonesia; 04°31'40"S, 122°49'42"E; 37 fms (68 m); green mud; *Albatross* sta 5642; 14 Dec 1909; paratype: 1 ♂, TL 40 mm (USNM 77989). Madura Strait; 07°25'S, 113°16'E; 56 m; grey mud with some Radiolariae; *Siboga* sta 2; 8 Mar 1900; paratype: 1 ♂, TL 30 mm (ZMA). Off Kabusa Island [Kabosa Island, 12°49'N, 97°53'E], Lower Burma; 25–35 fms (46–64 m); *Investigator*, leg.; paratypes: 1 ♂, TL 39 mm; 1 ♀, TL 43 mm (ZSI, ex C320/1). Off Vizagapatam [Visakhapatnam, 07°42'N, 83°18'E] coast, Madras, India; 20 fms (37 m); *Investigator*, leg.; holotype: 1 ♀, TL 47 mm (ZSI 7536/10).

**DESCRIPTION.**—Size small to moderate, total length of adults to 52 mm. Body appearing smooth, minutely pitted under magnification.

Eye (Figure 19b) small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 412–442.

Antennular peduncle longer than carapace. Dorsal processes of antennular somite produced into blunt lobes directed anterolaterally.

Rostral plate (Figure 19a) with shape variable, either broader than long or slightly longer than broad, lateral margins converging on rounded apex. Median carina absent.

Anterior width of carapace half or slightly less than half median length. Anterolateral spines (Figure 19a) strong, extending to or almost to base of rostral plate. Median carina interrupted at base of bifurcation, branches of bifurcation well developed in some specimens, scarcely visible in others. Intermediate carinae not sloping toward laterals, not extending to anterior margin.

Dactylus of claw with 5 teeth, outer margin evenly curved, with obtuse projection basally. Dorsal ridge of carpus (Figure 19c) undivided. Inferodistal angle on outer face of merus unarmed.

Exposed thoracic somites (Figure 19d) each with unarmed submedian and intermediate carinae, intermediates of fifth somite irregular, short. Lateral process of fifth somite bilobed, anterior lobe a sharp, anteriorly directed spine, posterior lobe smaller, broad, obtusely subtriangular, rounded, or subquadrate, directed laterally. Lateral process of sixth somite strongly bilobed, anterior lobe large, subrectangular, posterior lobe pentagonal or triangular, obtusely rounded. Lateral process of seventh somite distinctly bilobed, anterior lobe smaller than that of sixth somite, subtriangular, posterior lobe much larger, subtriangular, apex acute but rounded, unarmed.

Submedian carinae subparallel on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5–6, intermediate 4–6, lateral (3)4–6, marginal (2–3)4–5.

Telson flattened, slender, slightly longer than broad. Prelateral lobe subequal in length to margin of lateral tooth. Denticles (Figure 19e) subtriangular or rounded, usually unarmed, 3–5, 6–7, 1, outer submedian and outer intermediate larger than remainder, inner submedians occasionally spiniform. Ventral surface with short postanal keel.

Uropod (Figure 19f, g) slender, proximal segment longer than distal, with 9–10 movable spines on outer margin, distalmost not extending to mid-length of distal segment. Lobe on outer margin of inner spine of basal prolongation large, projecting, broader than adjacent spine, margin concave, apex angled or rounded.

**COLOR.**—Carinae and grooves of carapace lined

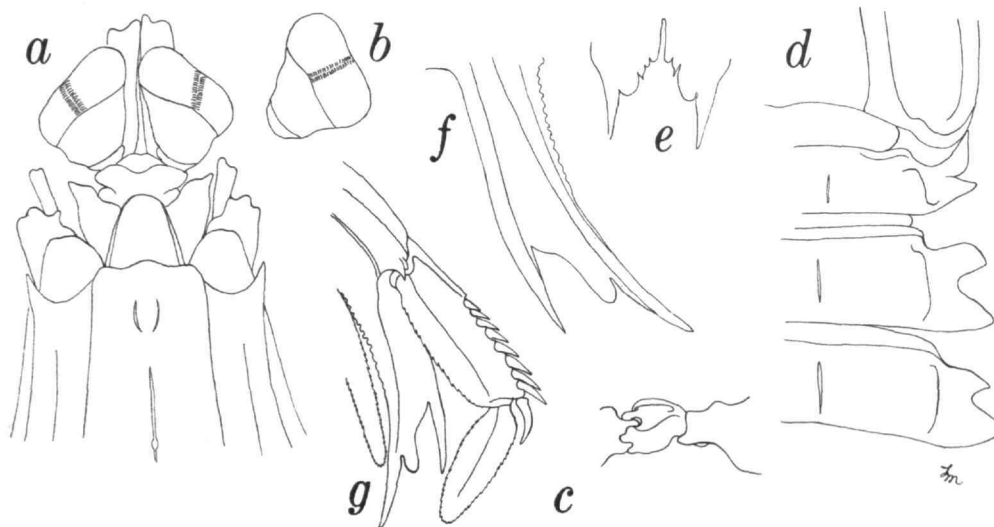


FIGURE 19.—*Oratosquilla subtilis*, new species, female holotype, TL 47 mm, India: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view. Male paratype, TL 52 mm, Philippine Islands: *g*, uropod.

with dark pigment. Posterior margins and submedian carinae of thoracic somites lined with dark pigment, sixth to eighth somites each with dark patch lateral to intermediate carinae. Second and fifth abdominal somites each with dark dorsal patch, that on second in middle of somite; that on fifth on posterior margin, often subdivided into 2 triangular patches. Posterior margin of each abdominal somite and submedian and intermediate carinae lined with dark pigment, area between submedian and intermediate carinae with dark longitudinal line. Sixth abdominal somite with triangular black spot below lateral carinae. Median carina of telson with 2 dark spots, anterior rectangular, posterior triangular, outer edges connected by faint dark line. Surface pits and carinae of marginal teeth of telson dark. Distal half of proximal segment and inner  $\frac{2}{3}$  of distal segment of uropod dark (most of distal segment in some specimens). Basal prolongation of uropod with dark line at about midlength of inner ventral surface.

MEASUREMENTS.—Males, TL 30–52 mm; females, TL 43–47 mm. Other measurements of male paratype, TL 39 mm: CL 8.8, anterior width 4.2; cornea width 2.1; antennular peduncle length 9.9; rostral

plate length 1.5, width 1.4; telson length 7.2, width 7.0.

REMARKS.—This species closely resembles *O. gonypetes*, and part of the material reported herein had been identified with that species by Kemp (1911, 1913), Kemp and Chopra (1921), and Hansen (1926). This species differs from *O. gonypetes* in numerous features: the lateral carinae of the abdomen anterior to the third somite and the marginal carinae of the first somite are unarmed, the proximal segment of the uropodal exopod is relatively longer, and the lobe on the basal prolongation of the uropod is comparatively much larger. The long, slender proximal segment of the uropodal exopod is a good recognition character.

The specimens from Kabosa Island, Burma, apparently were taken together with *O. gonypetes*. The small male from Siboga sta. 2 was identified with *O. perpensa* by Hansen (1926).

ETYMOLOGY.—The name is from the Latin *subtilis* ("thin"), alluding to the shape of the uropodal exopod.

DISTRIBUTION.—Known from four localities in the Philippine Islands, Indonesia, off Burma, and off Madras, India, in depths between 37 and 91.5 m.



14. *Oratosquilla turbata*, new species

FIGURE 20

*Squilla gonypetes*.—Manning, 1968b:23, fig. 7 [not *Squilla gonypetes* Kemp, 1911].

*Oratosquilla gonypetes*.—Manning, 1970:1430 [not *Squilla gonypetes* Kemp, 1911].

**MATERIAL.**—Banc de Pracel [17°00'S, 43°30'E], W coast of Madagascar; 55 m; muddy sand; A. Crosnier, leg.; Jun 1959; holotype: 1 ♂, TL 53 mm (USNM 124672). Data same; paratype: 1 ♀, TL 45 mm (USNM 155310). Data same; paratypes: 1 ♂, TL 51 mm; 1 ♀, TL 39 mm (MNHN). Baie Moramba [14°55'N, 47°18'E], NW coast of Madagascar; 30 m; muddy sand; A. Crosnier, leg.; dredge; 1 Mar 1958: 1 ♂ postlarva, TL 15 mm (USNM 124671). Madagascar; 23°21'30"S, 43°37'57"E; 16 m; muddy sand; R. Derijard, leg., sta D-57; 28 Sep 1963; paratype: 1 ♂, TL 40 mm (MNHN).

**DESCRIPTION.**—Size small to moderate, total length of adults to 53 mm. Body appearing smooth, surface punctation scarcely visible under magnification.

Eye (Figure 20*b*) moderate to small, cornea bilobed, set obliquely on stalk. Eyes not extending to end of first segment of antennular peduncle. Corneal indices 396–457.

Antennular peduncle longer than carapace. Dorsal processes of antennular somite produced into blunt lobes directed anterolaterally.

Rostral plate (Figure 20*a*) slightly broader than long, appearing elongate, lateral margins converging on rounded apex. Median carina absent.

Anterior width of carapace slightly less than half median length. Anterolateral spines (Figure 20*a*) strong, extending to, but usually not overreaching, base of rostral plate. Median carina interrupted at anterior bifurcation, branches of bifurcation low but distinct. Intermediate carinae not turning toward laterals, not extending to anterior margin.

Dactylus of claw with 5 teeth (6 on 1 side in 1 specimen), outer margin evenly curved, with obtuse projection basally. Dorsal ridge of carpus (Figure 20*c*) undivided. Inferodistal angle on outer face of merus unarmed.

Exposed thoracic somites (Figure 20*d*) each with unarmed submedian and intermediate carinae, intermediates of fifth somite irregular. Lateral process of fifth somite bilobed, anterior lobe a sharp, anterolaterally directed spine, posterior lobe smaller, broad, quadrangular or trapezoidal, directed laterally. Lateral process of sixth somite strongly bi-

lobed, anterior lobe large, subrectangular, posterior lobe subtriangular, apex blunt, rounded. Lateral process of seventh somite distinctly bilobed, anterior lobe smaller than that of sixth somite, triangular, apex rounded.

Submedian carinae slightly divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian 5–6, intermediate 4–6, lateral 3–6, marginal 1–5.

Telson flattened, slender, appearing elongate, length and width subequal. Prelateral lobe subequal in length to margin of lateral tooth. Denticles (Figure 20*e*) 4, 7, 1, outer submedian and outer intermediate enlarged, rounded, inner submedian and some intermediates spine tipped. Ventral surface with short postanal keel.

Uropod broad, proximal segment as long as or slightly shorter than distal, with 8–10 movable spines on outer margin, distalmost short, not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figure 20*f*) small, not so broad as adjacent spine, margin concave, apex rounded.

**COLOR.**—Thoracic and abdominal somites with dark, irregular posterior line. Second abdominal somite with dark transverse patch. Fifth abdominal somite with pair of dark, triangular submedian patches. Sixth abdominal somite black posterolaterally. Telson with rectangular anterior and triangular posterior dark patches along median carina. Uropodal exopod with distal part of proximal segment, inner half of distal segment, and distal half of endopod dark (from Manning, 1968*b*).

**MEASUREMENTS.**—Males, TL 40–53 mm; females, TL 39–45 mm; postlarva, TL 15 mm. Other measurements of male holotype, TL 53 mm: CL 12.4, anterior width 4.6; cornea width 2.8; antennular peduncle length 12.8; rostral plate length 3.6, width 3.8; telson length 9.7, width 9.7.

**REMARKS.**—This species, the third representative of the *gonypetes* complex, *gonypetes* group, most closely resembles *O. gonypetes*, differing from it in several features, some of which I listed in 1968: the branches of the anterior bifurcation of the median carina of the carapace are more distinct; the posterior lobe of the lateral process of the fifth thoracic somite is much broader, and is quadrangular rather than triangular in shape; intermediate carinae anterior to the fourth abdominal somite and lateral carinae anterior to the third are un-



FIGURE 20.—*Oratosquilla turbata*, new species, male holotype, TL 53 mm, Madagascar: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

armed; and the dark squares on the fifth abdominal somite are represented by dark triangles. The lobe between the spines of the basal prolongation of the uropod is slender, as in *O. gonypetes*.

*Oratosquilla turbata* also resembles *O. subtilis* in having fewer abdominal carinae armed than *O. gonypetes*, but in *O. turbata* the posterior lobe of the lateral process of the fifth thoracic somite is much broader, the uropod is broader, with a shorter proximal segment on the exopod, and the lobe between the spines of the basal prolongation of the uropod is much smaller.

The male from the Derijard collection is unusual in that one claw is armed with 5 teeth, the other with 6. In all other respects it agrees with the remainder of the material. Whether such variation can be expected to occur throughout the *gonypetes* group remains to be determined. If so, it could drastically alter species concepts there.

**ETYMOLOGY.**—The name is from the Latin *turbatus* ("confused").

**DISTRIBUTION.**—Known only from localities off Madagascar, in depths between 16 and 55 m, on muddy sand.

### 15. *Oratosquilla woodmasoni* (Kemp, 1911)

FIGURES 21–22

*Squilla woodmasoni* Kemp, 1911:99; 1913:74, pl. 5: figs. 63–65.

*Squilla woodmasoni*.—Manning, 1966:100, fig. 5.

*Oratosquilla tweediei* Manning, 1971:12, fig. 4.

*Oratosquilla jakartensis* Moosa, 1975:13, fig. 1.

**MATERIAL.**—Hong Kong [Hong Kong Island, 22°15'N, 114°11'E]; syntype of *Squilla woodmasoni*: 1 ♀, TL 78.5 mm (ZMBS). Singapore [01°17'N, 103°51'E], Malaysia; M.W.F. Tweedie, leg.; 1934; holotype of *Oratosquilla tweediei*: 1 ♀, TL 107 mm (USNM 76026). Data same; paratype of *Oratosquilla tweediei*: 1 ♀, TL 96 mm (USNM 127449). Puri [19°48'N, 85°51'E], Orissa coast, India; F. H. Gravely, leg.; syntypes of *Squilla woodmasoni*: 1 ♂, TL 80 mm (USNM 125746). Data same; syntypes of *Squilla woodmasoni*: 1 ♂, TL 78 mm; 1 ♀, TL 73 mm (USNM 143581). Orissa State [21°00'N, 84°00'E], India; F. H. Gravely; 1886; syntypes of *Squilla woodmasoni*: 1 ♂, TL 81 mm; 1 ♀, TL 81 mm (MCSN). Madras [13°05'N, 80°17'E], India; syntypes of *Squilla woodmasoni*: 1 ♂, TL 88 mm; 1 ♀, TL 96 mm (BMNH 1910.11.14.11–12). Madras, India; syntype of *Squilla woodmasoni*: 1 ♂, TL 93 mm (ZSI 3098/5). Data same; syntype of *Squilla woodmasoni*: 1 ♂, TL 94 mm (USNM 143580).

**DESCRIPTION.**—Size moderate, total length of

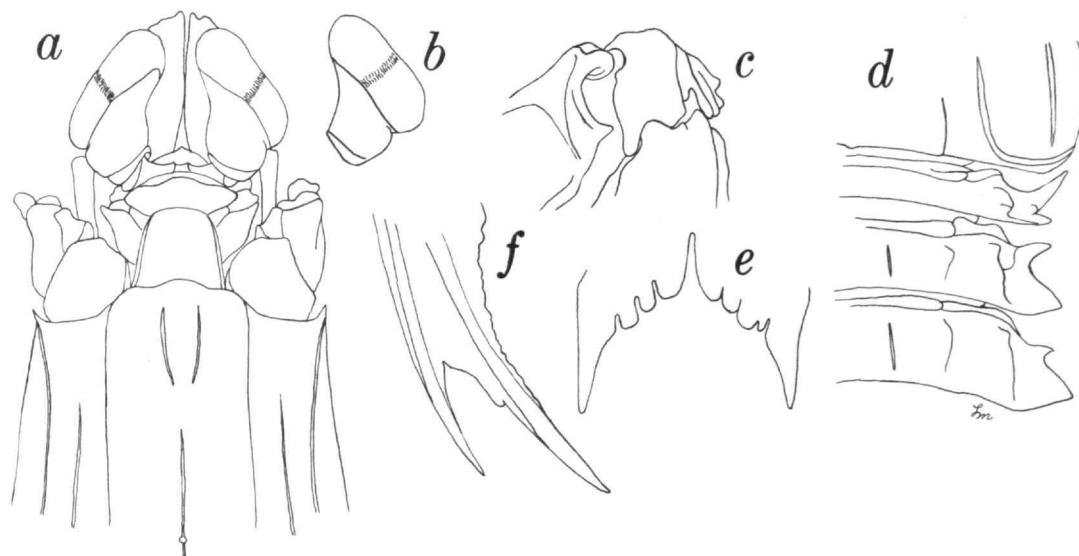


FIGURE 21.—*Oratosquilla woodmasoni* (Kemp, 1911), male syntype, TL 93 mm, Madras: *a*, anterior part of body; *b*, eye; *c*, carpus of claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, submedian teeth and denticles of telson, ventral view; *f*, basal prolongation of uropod, ventral view.

adults to about 110 mm. Surface of body smooth, highly polished.

Eye (Figure 21*b*) large to moderate, cornea bilobed, set very obliquely on stalk. Eyes extending almost to end of first segment of antennular peduncle. Anterior margin of ophthalmic somite rounded, usually with median spinule. Corneal indices 294–355.

Antennular peduncle as long as, or slightly longer than, carapace. Dorsal processes of antennular somite produced into triangular lobes, apices sharp but not spiniform, directed anterolaterally.

Rostral plate (Figure 21*a*) short, broader than long, trapezoidal or subquadrate, apex truncate or slightly rounded. Median carina absent.

Anterior width of carapace more than half median length. Anterolateral spines (Figure 21*a*) small, not extending to base of rostral plate. Median carina with at most low prominences indicating position of bifurcation, branches of bifurcation often indicated by pigment only, median depression usually present between branches. Intermediate carinae parallel to laterals, falling short of anterior margin.

Dactylus of claw with 6 teeth, outer margin

strongly sinuous. Dorsal ridge of carpus (Figure 21*f*) irregularly tuberculate, usually with 2 large tubercles. Inferodistal angle on outer face of merus produced into blunt spine.

Exposed thoracic somites (Figure 21*d*) with low, unarmed submedian and intermediate carinae, those of fifth somite scarcely if at all discernible. Lateral process of fifth somite bilobed, anterior lobe a short, blunt spine, directed anterolaterally; posterior lobe smaller, triangular, apex acute but rounded. Lateral process of sixth somite bilobed, anterior lobe small, slender, subtriangular, apex acute, posterior lobe much larger, triangular, apex acute, occasionally sharp. Lateral process of seventh somite bilobed, anterior lobe much smaller, slender than that of sixth somite, usually ovate or subtrapezoidal, posterior lobe much larger, apex acute, occasionally sharp but not spiniform.

Submedian carinae slightly divergent on fifth abdominal somite. Abdominal carinae spined as follows: submedian (4) 5–6, intermediate 3–6, lateral 2–6, marginal 1–5.

Telson flattened, broader than long. Prelateral lobe subequal in length to margin of lateral tooth. Denticles (Figure 21*e*) subquadrate or rounded,

2-4, 9-10, 1. Ventral surface with short postanal keel.

Uropod broad, proximal segment of exopod shorter than distal, with 8-9 movable spines on outer margin, proximal directed dorsally, distal not extending to midlength of distal segment. Lobe on outer margin of inner spine of basal prolongation (Figures 21f, 22) variable in size and shape, not so broad as adjacent spine, margin concave, apex rounded, angled, or spined.

COLOR.—Body appearing dusky, completely covered with minute dark chromatophores, concentration denser middorsally on abdomen. Posterior margins of thoracic and abdominal somites and bases of teeth of telson dark. Articulation of segments of uropodal exopod with prominent dark spot. Distal half of uropodal endopod dark. Uropod bright blue in life.

MEASUREMENTS.—Males, TL 78-93 mm; females TL 73-107 mm. Kemp (1911, 1913) mentioned specimens as large as 109 mm. Other measurements of male syntype, TL 78 mm: CL 15.9, anterior width 9.4; cornea width 5.1; antennular peduncle length 17.2; rostral plate length 2.4, width 3.1; telson length 14.6, width 15.0.

REMARKS.—Examination of the syntypes of *O. woodmasoni* has convinced me that *O. tweediei* Manning, 1971, must be considered as its synonym. The latter was based on specimens from Singapore in which the submedian carinae of the fourth ab-

dominal somite were armed and in which the lobe between the spines of the basal prolongation of the uropod was produced into sharp spines. Apparently these features vary geographically in *O. woodmasoni*. In Indian specimens the submedian carinae of the fourth abdominal somite are unarmed; they are usually armed in Indo-Malayan specimens, but some specimens from that region may have only one of the submedian carinae of the fourth somite terminating in a spine. The lobe between the spines of the basal prolongation is very low in Indian specimens (Figures 21a, 22a) (not so low as shown in Kemp, 1913, pl. 5: fig. 65), is produced into a spine in most Indo-Malayan specimens (Figure 22b, d), and is produced into an angled lobe in Australian specimens (Figure 22c). The anterior margin of the ophthalmic somite is always broadly rounded and usually has a median apical spinule, but that spinule is not always developed. Finally, dark antennules and blue uropods are characteristic of *O. woodmasoni* (H. Dingle, pers. comm.); the uropods of fresh specimens morphologically identifiable with *O. tweediei* clearly show blue pigment.

I believe that *O. jakartensis* Moosa, 1975, based on two juveniles, 40 to 54 mm long, also is identifiable with *O. woodmasoni*. In *O. jakartensis* the anterior margin of the ophthalmic somite is described as being notched, but it is shown as rounded, with an apical spinule in Moosa's fig. 1 (a lapsus similar to that which I made in the orig-

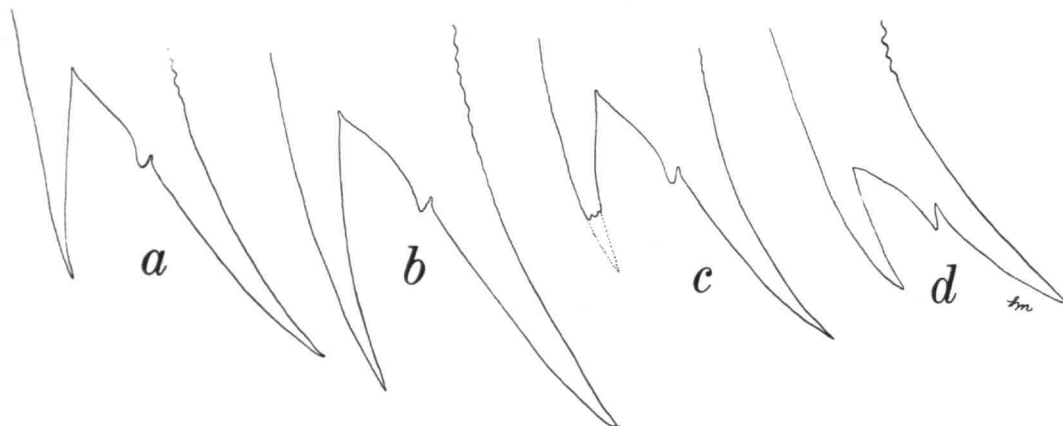


FIGURE 22.—*Oratosquilla woodmasoni* (Kemp, 1911), outline of basal prolongation of uropod: a, male syntype of *S. woodmasoni*, TL 78 mm, Puri; b, female holotype of *O. tweediei*, TL 107 mm, Singapore; c, male, TL 113 mm, Moreton Bay; d, female holotype of *O. jakartensis*, TL 54 mm, Indonesia (from Moosa, 1975, fig. 1d).

inal account of *O. tweedici*). Further, the submedian carinae of the fourth abdominal somite are unarmed and the lobe between the spines of the basal prolongation of the uropod is produced into a sharp spine (Figure 22d). Another feature by which Moosa distinguished *O. jakartensis* from *O. woodmasoni*, a more prominent anterior lobe on the lateral process of the sixth thoracic somite, is variable in the material reported here.

Apparently *O. woodmasoni* can exhibit considerable geographical variation, and this must be taken into account in identifying material of this species.

DISTRIBUTION.—Indo-West-Pacific region, from localities in the western Pacific through the Indian

Ocean to East Africa. Little is known of its depth range and habitat.

**Two New Genera for Species Previously Referred to *Oratosquilla***

***Kempina*, new genus**

DEFINITION.—Size moderate to large. Body very rugose, surface eroded and pitted, carinae strongly developed. Anterior margin of ophthalmic somite unarmed (Figure 23a, d). Eye small to very small, cornea bilobed, set almost transversely on stalk. Ocular scales subquadrate, separate. Carapace with

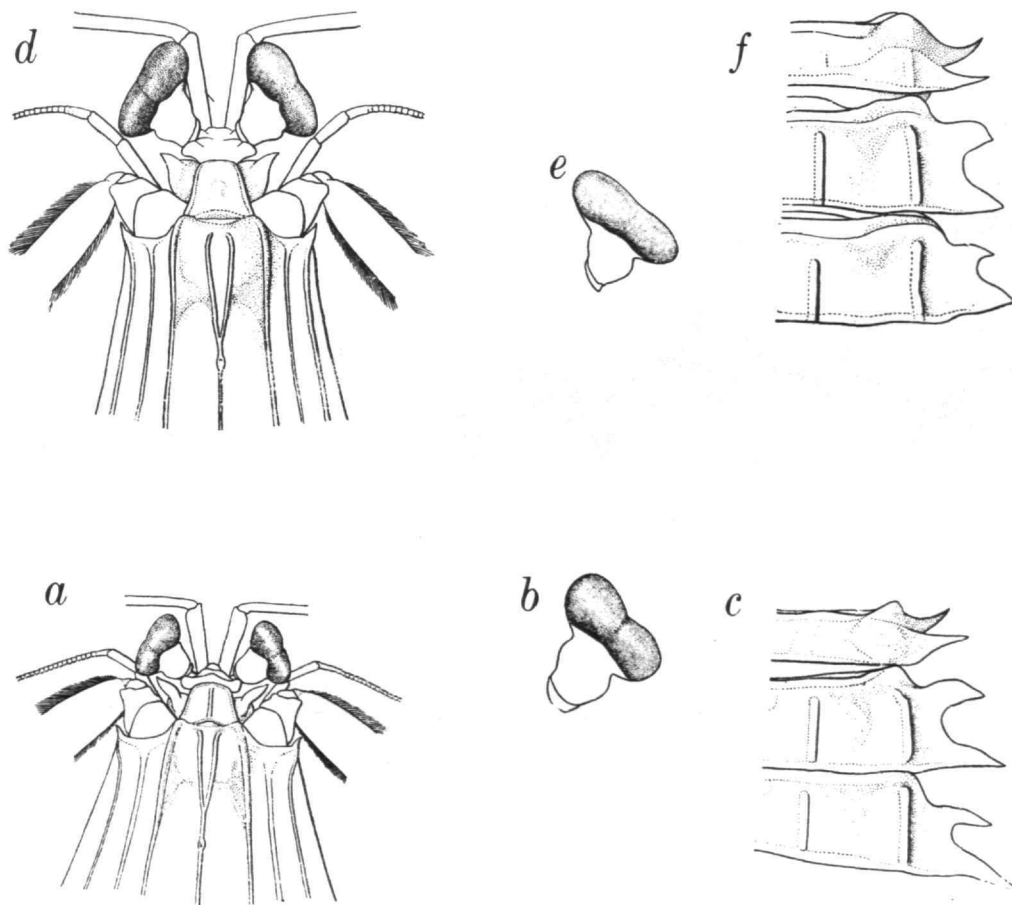


FIGURE 23.—Two species of *Kempina*, new genus: a-c, *K. mikado* (Kemp and Chopra, 1921, fig. 2); d-f, *K. stridulans* (Wood-Mason, 1894) (from Kemp and Chopra, 1921: fig. 1).

normal complement of carinae (median, intermediates, laterals, reflected marginals), median with well developed anterior bifurcation. Mandibular palp present. 4 epipods present. Dactylus of claw with 6 teeth. Lateral process of fifth thoracic somite (Figures 23*c, f*, 24) a single slender spine, directed laterally; slender ventral spine, directed anterolaterally, also present, visible in dorsal view. Lateral processes of sixth and seventh thoracic somites (Figures 23*c, f*, 24*a*) strongly bilobed. Abdomen with 8 carinae on anterior 5 somites. Telson flattened, with median carina and carinae of marginal teeth, lacking supplementary dorsal carinae; 3 pairs of marginal teeth present, submedians with fixed apices; prelateral lobes present. Basal prolongation of uropod produced into 2 strong spines, inner margin tuberculate or crenulate, unarmed.

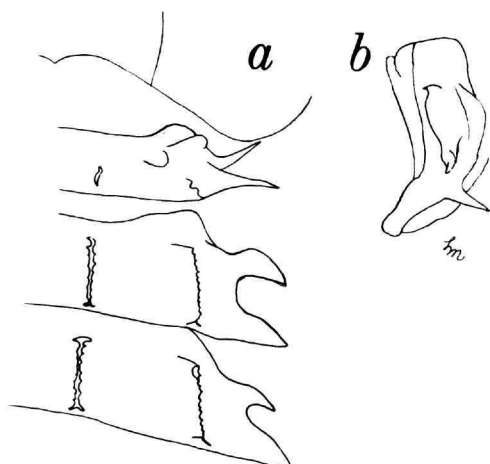


FIGURE 24.—*Kempina mikado* (Kemp and Chopra, 1921), female. TL 115.5 mm, Japan, lateral process of fifth thoracic somite: *a*, dorsal view; *b*, lateral view.

**TYPE-SPECIES.**—*Squilla mikado* Kemp and Chopra, 1921.

**OTHER SPECIES.**—*Squilla stridulans* Wood-Mason in Alcock, 1894, and *Squilla zanzibarica* Chopra, 1939; the latter probably is a synonym of *S. mikado* but perhaps should be considered distinct until material of the two can be compared directly.

**ETYMOLOGY.**—The genus is named for Stanley W. Kemp, whose basic studies on Indo-West-Pacific stomatopods laid the foundation for subsequent work on the group. The gender is feminine.

**AFFINITIES.**—*Kempina* shows strong affinities with the Atlantic–East Pacific genus *Squilla* Fabricius, 1787, with which it shares numerous features: eye size and shape, normal complement of carinae on the body, single lateral process on the fifth thoracic somite, mandibular palp, and six teeth on the dactylus of the claw. It differs from *Squilla* in having the surface of the body much more rugose, the carinae of the body better developed, and in the strongly bilobed lateral processes of the six and seventh thoracic somites. Only in the western Atlantic *Squilla heptacantha* (Chace, 1939) is the anterior lobe of the lateral processes of the sixth thoracic somite as comparably well developed as in the species of *Kempina*, and *S. heptacantha*, like *Kempina*, has only four epipods. Of the other genera of squillids, only the dissimilar *Pterygosquilla* Hilgendorf, 1890, has such a slender, laterally directed lateral process on the fifth thoracic somite.

#### *Natosquilla*, new genus

**DEFINITION.**—Size moderate. Body very smooth, not strongly carinate. Anterior margin of ophthalmic somite (Figure 25*a*), usually with 3 points. Eye large (Figure 25*a*), cornea indistinctly bilobed, set obliquely on stalk. Ocular scales small, angled or rounded, separate. Carapace with normal complement of carinae (median, intermediates, laterals, reflected marginals), median suppressed anterior to dorsal pit, lacking distinct anterior bifurcation. Mandibular palp present. 4 epipods present. Dactylus of claw with 10–18 teeth (Figure 25*b*). Lateral process of fifth thoracic somite (Figure 25*c, d*) appearing bilobed (in dorsal view), lobes separate, anterior lobe directed anterolaterally, posterior lobe (Figure 25*d*) in higher plane, directed laterally. Lateral process of sixth somite distinctly bilobed, that of seventh obscurely so. Abdomen with 8 carinae on anterior 5 somites. Telson flattened, with median carina and carinae of marginal teeth, lacking supplementary dorsal carinae; 3 pairs of marginal teeth present, submedians with fixed apices; prelateral lobes present. Basal prolongation of uropod produced into 2 strong spines, inner margin tuberculate or crenulate, unarmed.

**TYPE-SPECIES.**—*Squilla investigatoris* Lloyd, 1907.

**OTHER SPECIES.**—None.

**ETYMOLOGY.**—The name is derived from the

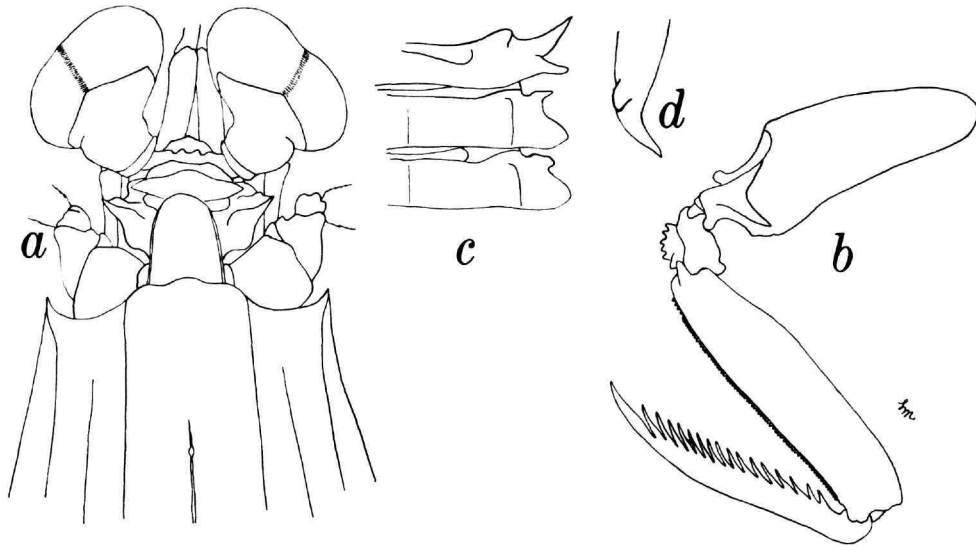


FIGURE 25.—*Natosquilla investigatoris* (Lloyd, 1907), male, TL 89 mm, Zanzibar: *a*, anterior part of body; *b*, claw; *c*, lateral processes of fifth, sixth, and seventh thoracic somites; *d*, lateral process of fifth thoracic somite, lateral view.

Latin *natus* ("swim"), in combination with the generic name *Squilla*, alluding to the swarming behavior of the type-species.

**AFFINITIES.**—*Natosquilla* shares several features with *Busquilla* Manning, 1978, especially the enlarged eyes, the suppression of the anterior bifurcation of the median carina of the carapace, and the shape of the lateral process of the fifth thoracic somite. However, in *Natosquilla* the anterior margin of the ophthalmic somite has three points or denticles rather than a single median spinule, the ocular scales are much smaller, there are 10–18 rather than five teeth on the claw, and the anterior lobes of the lateral processes of the sixth and seventh thoracic somites are greatly reduced; the lateral process of the seventh somite is obscurely

bilobed in *N. investigatoris*, distinctly bilobed in species of *Busquilla*.

The morphological differences in representatives of the two genera suggest that they are not closely related and that they independently acquired the enlarged eyes. In *Natosquilla* the eye size may be an adaptation for their observed schooling and swarming behavior at the surface in very deep water (Losse & Merrett, 1971). So far as is known, however, the two species of *Busquilla* are bottom dwellers, like most stomatopods; swarming or schooling behavior has not been reported for either species.

The enlarged eyes and the large number, 10–18, of teeth on the claw will serve to distinguish *Natosquilla* from all other stomatopod genera.

TABLE 1.—Range of variation of corneal indices by size in *O. sollicitans* and *O. hindustanica*  
(numbers in parentheses = the mean and the number of specimens)

| Carapace length (mm) | <i>O. sollicitans</i>                               |   |  |   |  | <i>O. hindustanica</i>                              |
|----------------------|---|---|--|---|--|---|
|                      | Round rostral plate, large uropod lobe (Figure 15a) | Round rostral plate, small uropod lobe (Anping) | Flat rostral plate, large uropod lobe (Figure 15b) | Round rostral plate, small uropod lobe (Figure 15c) | Flat rostral plate, small uropod lobe (Figure 15d) | Round rostral plate, small uropod lobe (Figure 15e) |
| 11.....              | -   | -   | -  | -   | -  | 309-326<br>(320;6)                                  |
| 12.....              | -   | 290   | -  | -   | -  | 335-365<br>(337;4)                                  |
| 13.....              | -   | -   | -  | -   | -  | 332-358<br>(344;4)                                  |
| 14.....              | -   | 313   | 340-355<br>(346;4)                                 | 349   | 368-384<br>(376;2)                                 | 338-353<br>(349;6)                                  |
| 15.....              | -   | 304   | 339  | 350   | -  | 354-373<br>(360;7)                                  |
| 16.....              | -   | -   | 369  | -   | -  | -   |
| 17.....              | -   | -   | -  | -   | -  | -   |
| 18.....              | 400   | -   | -  | 368   | 366  | -   |
| 19.....              | -   | -   | 370  | -   | 388  | -   |
| 20.....              | -   | -   | -  | -   | 383  | 375   |
| 21.....              | 380   | -   | -  | -   | -  | 412   |



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