

RAYMOND B. MANNING

*Keys to the Species
of Oratosquilla
(Crustacea: Stomatopoda),
with Descriptions of
Two New Species*

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SMITHSONIAN CONTRIBUTIONS TO
ZOOLOGY

NUMBER 71

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SMITHSONIAN INSTITUTION PRESS
CITY OF WASHINGTON

1971

ABSTRACT

Manning, Raymond B. Keys to the Species of *Oratosquilla* (Crustacea: Stomatopoda), with Descriptions of Two New Species. *Smithsonian Contributions to Zoology*, 71:1-16. 1970. Eight species groups are recognized within the stomatopod crustacean genus *Oratosquilla*, which contains twenty-three species from the Indo-West Pacific area. Keys to species groups and to species within each group are presented. *Oratosquilla tweediei*, from Singapore, and *O. ornata*, from Hong Kong, are newly described.

Official publication date is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, Smithsonian Year.

UNITED STATES GOVERNMENT PRINTING OFFICE
WASHINGTON : 1971

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price 80 cents (paper cover)

Raymond B. Manning

Keys to the Species of *Oratosquilla* (Crustacea: Stomatopoda), with Descriptions of Two New Species

Introduction

The genus *Oratosquilla* comprises many of the large squillids from the Indo-West Pacific region that formerly were placed in *Squilla*; *Oratosquilla* was separated from *Squilla* by Manning (1968a). The notes presented here originally were compiled for a revision of the genus, but it has become apparent that much more material from localities throughout the Indo-West Pacific region will have to be studied before such a revision can be made. It is hoped that this preliminary paper will stimulate interest in the group, aid identification of the known species, and help to make more material available so that a definitive revision can be prepared. Planned studies of the *Albatross* collections from the Philippine Islands, as well as the collections made during the International Indian Ocean Expeditions, should help to clarify the status of several species of *Oratosquilla* not reported here.

Although the genus *Oratosquilla* as currently composed appears to be homogeneous, eight distinct groups of species can be recognized, based primarily on characters of the raptorial claw and the carapace. Most of the species have 6 teeth on the raptorial claw, but one, *O. indica* (Hansen, 1926), has 7 or 8, another, *O. investigatoris* (Lloyd, 1907), has 10 to 18, and three, *O. gonypetes* (Kemp, 1911) and allies, have but 5. The mandibular palp

is usually present; it is suppressed in *O. indica*. That species also differs from the other species in the genus in having but two epipods; the other species in the genus apparently have four epipods. The number of epipods could not be verified in the unique holotype of *O. imperialis* (Manning, 1965), in which two or three were visible; the remainder may have been damaged.

The median carina of the carapace affords good diagnostic features for distinguishing adults of most of the remainder of the species. The median carina, anterior to the cervical groove, usually terminates anteriorly in a well-marked anterior bifurcation (Figures 1a, 2a). In some species the branches of the bifurcation are present, but the median carina is interrupted at the base of the bifurcation (Figure 3a). In other species the branches of the bifurcation are completely suppressed (Figure 4a), although their position may be indicated by dark pigment, by a median depression, or by low tubercles or short, interrupted portions of the carina. The structure of the carina appears to be very stable in almost all species, so far as is known, between late juvenile stages and, perhaps, very old stages. In young specimens of species of *Oratosquilla*, especially postlarvae, the median carina and its bifurcation may not be distinct, as in the holotype of *O. calumnia*. In some species in which the anterior bifurcation is typically suppressed, as in *O. gonypetes*, it may be present at some later stage (Chopra, 1934; Manning, 1965, 1968b; Holthuis, 1967); *O. gonypetes* is the only species in

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which the structure of the median carina is variable, and the possibility exists that the specimens of that species reported from different areas actually represent distinct species.

By the recognition here of groups of species within *Oratosquilla*, I do not intend to imply that distinct subgenera should be recognized or that the complex relationships of species within the genus can be expressed adequately by the separation of the species into a series of arbitrary groups. The arrangement of species into these groups should facilitate their recognition. Nine of the twenty-three species of *Oratosquilla* have been described in the last fifty years, and it seems likely that several additional species will be recognized in the future. Familiarity with the species groups as outlined below and use of the key to species groups, as well as the keys to species within groups, should

aid recognition of undescribed species as well as established ones.

Terms used in the keys and in the text have been explained in detail in earlier papers (Manning, 1966; 1968b).

All of the specimens are in the Division of Crustacea, National Museum of Natural History, Smithsonian Institution, where they are listed under United States National Museum (USNM) numbers.

The references given in brackets after each specific name in the keys are to papers in which additional information on each species can be found.

Acknowledgments

I thank L. S. Kornicker and J. Rosewater for their comments on the manuscript. The illustrations were prepared by my wife Lilly.

Key to Species Groups in *Oratosquilla*

1. Mandibular palp absent; submedian, intermediate, and lateral carinae of anterior 3 abdominal somites unarmed (2 epipods present; dactylus of claw with 7-8 teeth) *Indica* Group
Mandibular palp present; some carinae of anterior 3 abdominal somites with posterior spines (usually 4 epipods present; dactylus of claw with 5, 6, or 10-18 teeth) 2
2. Anterior bifurcation of median carina of carapace opening posterior to dorsal pit; cornea small (corneal index 600 or more in adults), set transversely on stalk *Nepa* Group
Anterior bifurcation of median carina of carapace absent or opening anterior to dorsal pit; cornea large (corneal index less than 600 in adults), set obliquely on stalk 3
3. Lateral process of fifth thoracic somite composed of 2 slender, sharp spines directed laterally; lateral carinae of anterior 5 abdominal somites bicarinate *Mikado* Group
Lateral process of fifth thoracic somite not composed of 2 slender, sharp spines; lateral carinae of anterior 5 abdominal somites, simple, not bicarinate 4
4. Cornea expanded, very large, width about one-third carapace length; dactylus of claw with 10-18 teeth (rostral plate without median carina) *Investigatoris* Group
Cornea width less than one-third carapace length (if cornea equal to or greater than one third carapace length, then rostral plate with median carina); dactylus of claw with 5 or 6 teeth 5
5. Median carina of carapace entire, with well-formed anterior bifurcation (dactylus of claw with 6 teeth) *Oratoria* Group
Median carina of carapace interrupted at base of bifurcation or branches of bifurcation absent 6
6. Anterior branches of bifurcation of median carina of carapace present, well formed (dactylus of claw with 6 teeth) *Perpensa* Group
Anterior branches of bifurcation of median carina of carapace completely absent, area of bifurcation usually smooth, polished (occasionally arms of bifurcation represented by broken lines of tubercles or by lines of pigment; entire branches rarely present) 7
7. Anterior width of carapace greater than one-half median length; dactylus of claw with 6 teeth *Woodmasoni* Group
Anterior width of carapace less than one-half median length; dactylus of claw with 5 teeth *Gonypetes* Group

Indica Group

This group contains *O. indica* (Hansen, 1926), which differs from other species of *Oratosquilla* in lacking both the mandibular palp as well as spines on the carinae of the anterior three abdominal somites and in having the dactylus of the raptorial claw armed with 7-8 teeth, rather than 5 or 6. The species was described in detail by Hansen (1926), and Chopra (1934) provided additional information.

Nepa Group

This group contains two species, *O. nepa* (Latreille, 1828) and *O. holoschista* (Kemp, 1911). The species can be recognized by: (1) the very small eyes, with corneal indices usually 600 or more in adults and the cornea set transversely on the stalk; (2) the shape of the anterior bifurcation of the carapace, which in both species opens posterior to the dorsal pit on the median carina; and (3) having 6 teeth on the claw. In all other

Key to Species of the Nepa Group

- Portion of median carina of carapace between cervical groove and anterior bifurcation simple, not bicarinate; submedian carinae of fourth abdominal somite armed posteriorly
O. nepa (Latreille, 1828)
 [Kemp, 1913]
- Portion of median carina of carapace between cervical groove and anterior bifurcation bicarinate; submedian carinae of fourth abdominal somite unarmed
O. holoschista (Kemp, 1911)
 [Kemp, 1913]

species of *Oratosquilla* the anterior bifurcation, when present, opens anteriorly to the dorsal pit.

Mikado Group

In the two species assigned here, *O. stridulans* (Wood-Mason in Alcock, 1894) and *O. mikado* (Kemp and Chopra, 1921), the two lobes of the lateral process of the fifth thoracic somite are pro-

duced into two sharp spines and the lateral carinae of the anterior five abdominal somites are bicarinate. Kemp and Chopra (1921) previously noted that these features will distinguish these two species from the remainder of the species in the genus. Both species have 6 teeth on the claw.

As I noted in 1965, *Squilla zanzibarica* Chopra, 1939, appears to be a synonym of the species now known as *O. mikado* (Kemp and Chopra, 1921).

Key to Species of the Mikado Group

- Rostral plate with median carina; undivided portion of median carina of carapace, anterior to dorsal pit, about one-half as long as bifurcated portion
O. mikado (Kemp and Chopra, 1921)
- Rostral plate without median carina; undivided portion of median carina of carapace, anterior to dorsal pit, about one-third as long as bifurcated portion
O. stridulans (Wood-Mason in Alcock, 1894)
 [Kemp, 1913]

Investigatoris Group

This group also contains one species, *O. investigatoris* (Lloyd, 1907), which can be distinguished by the large number of teeth on the dactylus of the claw, 10-18. The eyes of *O. investigatoris* are comparatively larger than in most other species of

Oratosquilla. Only in *O. quadraticauda* (Fukuda) are the eyes of comparable size, about one-third the carapace length; *O. quadraticauda*, however, has but 5 teeth on the claw as well as a median carina on the rostral plate. Kemp (1913) and Chopra (1939) have provided additional data on *O. investigatoris*.

Oratoria Group

This group contains the four species with 6 teeth on the claw, and in which the median carina of the carapace is well formed for all of its length anterior to the cervical groove; it is not interrupted at the bifurcation, and both branches of the bifurcation

are distinct. The species included in this group are *O. oratoria* (De Haan, 1844), *O. mauritiana* (Kemp, 1913), *O. kempfi* (Schmitt, 1929), and *O. calumnia* (Townsend, 1953). In all four species the carpus of the raptorial claw is ornamented with several tubercles. *Oratosquilla oratoria* and *O. calumnia* are diagnosed herein.

Key to Species of the *Oratoria* Group

1. Submedian carinae of fourth, fifth, and sixth abdominal somites with posterior spines. 2
Submedian carinae of fourth abdominal somite unarmed, those of fifth and sixth somites only with posterior spines 3
2. Intermediate carinae of first abdominal somite armed posteriorly; anterior lobe of lateral process of seventh thoracic somite sharp *O. calumnia* (Townsend, 1953)
Intermediate carinae of first abdominal somite unarmed; anterior lobe of lateral process of seventh somite rounded
O. mauritiana (Kemp, 1913) [= *Squilla juxtaoratoria* Ward, 1942] [Manning, 1968b]
3. Lateral process of seventh thoracic somite not markedly bilobed; second and fifth abdominal somites each with dark dorsal patch in preservative (merus of claw lacking inferodistal spine on outer face) *O. kempfi* (Schmitt, 1929) [Chopra, 1934]
Lateral process of seventh thoracic somite markedly bilobed; second and fifth abdominal somites lacking dark dorsal patch (merus of claw with inferodistal spine on outer face) *O. oratoria* (De Haan, 1844) [= *Squilla affinis* Berthold, 1845]

Oratosquilla calumnia* (Townsend, 1953)*FIGURE 1**

Squilla nepa.—Brooks, 1886, p. 25 [part, specimen from Hawaii only; not *S. nepa* Latreille].

Squilla calumnia Townsend, 1953, p. 410, figs. 8–9.—Manning, 1968a, p. 135 [listed].

Squilla oratoria.—Kemp, 1913, p. 68 [part, specimens from Hawaii only].—Edmondson, 1921, p. 287, fig. 1a.—Bigelow, 1931, p. 183.—Townsend, 1953, p. 404, figs. 2–3 [not *Squilla oratoria* De Haan].

MATERIAL.—1 ♂, 26 mm; Hilo Dock, Hilo, Hawaii; night light; Territory of Hawaii Division of Fish and Game; 24 August 1948; holotype; USNM 93097.—1 ♀, 89 mm; Hilo, Hawaii; *Albatross*; 1901; USNM 64909.—1 damaged ♀, CL 35.0 mm; Honolulu; *Albatross*; 1901; USNM 64908.—1 ♀, 175 mm; estuary, Oahu, Honolulu; R. A. Kinzie III; USNM 125051.

DIAGNOSIS.—Rostral plate as long as or slightly longer than broad, apex usually rounded; eye large, cornea set obliquely on stalk, corneal indices 391–500; anterior width of carapace about half median length; median carina of carapace entire, bifurcation opening anterior to dorsal pit, distance

from pit to bifurcation less than distance from bifurcation to anterior margin; raptorial claw with 6 teeth, dorsal ridge of carpus of claw bituberculate, inferodistal angle on outer face of merus with blunt tooth; mandibular palp and 4 epipods present; lateral process of fifth thoracic somite produced into an anterior spine and a slender posterior spine, directed laterally; lateral process of sixth thoracic somite bilobed, anterior lobe rounded; lateral process of seventh thoracic somite bilobed, anterior lobe angled, occasionally sharp; lateral carinae of abdomen not bicarinate; abdominal carinae spined as follows: submedian (3) 4–6, intermediate 1–6, lateral 1–6; telson lacking supplementary dorsal tubercles; telson denticles 3–4, 6–8, 1; proximal segment of uropodal exopod less than 1.5 times as long as distal segment; inner spine of basal prolongation of uropod with rounded lobe on outer margin, proximal margin of lobe concave.

COLOR.—Posterior 3 thoracic and all abdominal somites each with dark posterior line; second abdominal somite with rectangular patch of dark chromatophores medially; distal half of proximal

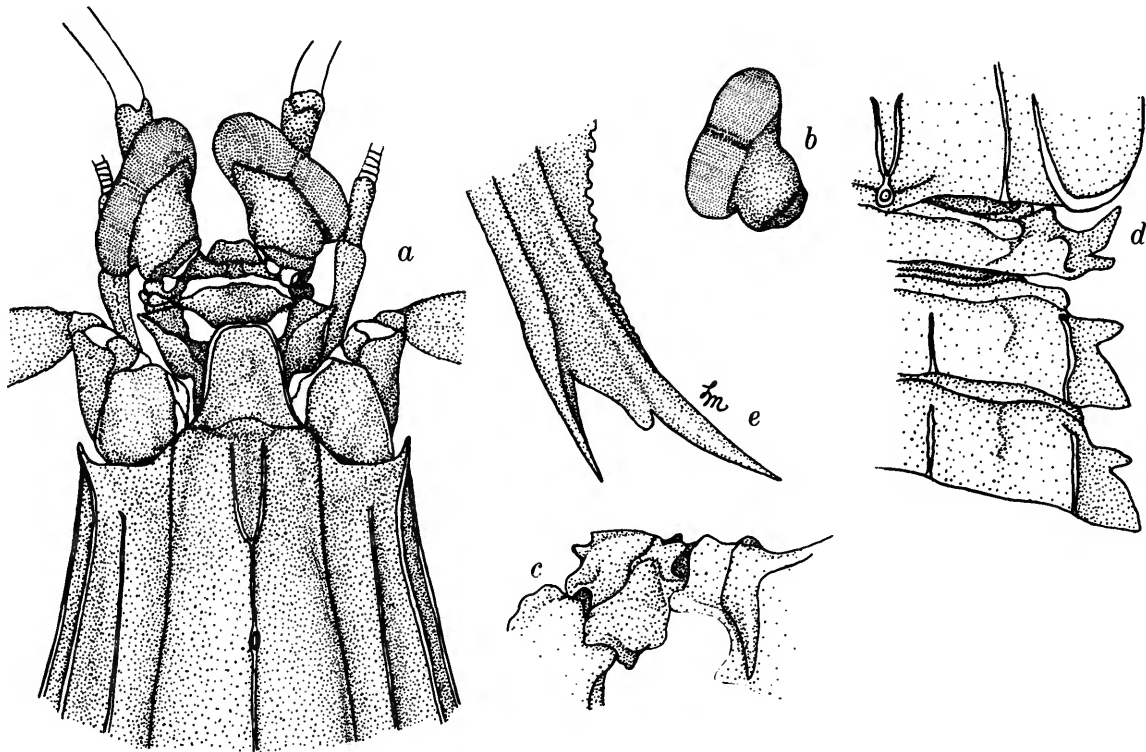


FIGURE 1.—*Oratosquilla calumnia* (Townsend), female, TL 89 mm, Hawaii: *a*, anterior portion of body; *b*, eye; *c*, carpus of raptorial claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, basal prolongation of uropod. (Setae omitted.)

segment and inner half of distal segment of uropodal exopod dark; distal half of endopod dark.

MEASUREMENTS.—Only male examined, TL 26 mm; females, TL 89–175 mm. Specimens ranging from 120–200 mm in length have been recorded in the literature. Other measurements of female, TL 175 mm: carapace length 36.5; anterior width of carapace 18.4; cornea width 7.7; rostral plate length 5.6, width 5.4; telson length 33.5, width 32.6.

REMARKS.—It is with some hesitation that I identify the adult specimens from Hawaii reported here with *O. calumnia*. The type of *O. calumnia* is a juvenile male that shows almost none of the diagnostic features of adults; the presence of six teeth on the claw, the mandibular palp, four epipods, and the faintly bilobed lateral processes of the exposed thoracic somites suggest that it can be identified as an *Oratosquilla*. The carinae of the

carapace are indistinct and the anterolateral spines of the carapace as well as most of the spines found on the abdominal carinae are not developed.

The only other species of *Oratosquilla* recorded from the Hawaiian Islands is *O. quadraticauda* (Fukuda) (see Townsend, 1953, under *Squilla boops*), which differs from the species reported here in having but five teeth on the dactylus of the claw. It seems likely that Townsend's juvenile holotype is conspecific with adults identified here as *O. calumnia*. The identity of that juvenile probably cannot be proved until similar specimens are related to an identifiable size.

Oratosquilla calumnia resembles *O. oratoria* in having an entire median carina on the carapace, but can be distinguished from *O. oratoria* by the spined submedian carinae of the fourth abdominal somite, which are never found in *O. oratoria*. *Oratosquilla calumnia* also differs from *O. oratoria* in

color pattern, for none of the specimens of the latter species examined by me has the well-formed rectangular patch of dark chromatophores on the second abdominal somite characteristic of *O. calumnia*.

Oratosquilla calumnia closely resembles *O. mauritiana* in almost all respects. The two species are so similar that they may prove to be terminal populations of a widely distributed species in the Indo-West Pacific region. Specimens have not been recorded from intermediate areas, however, and, until such are found, it seems better to recognize both as distinct species. *Oratosquilla mauritiana* appears to be a much smoother species, its dorsal surface presenting, when dried, an appearance similar to *O. woodmasoni* rather than *O. oratoria*. A good feature for distinguishing the two species is the shape of the lateral processes of the exposed thoracic somites. In *O. calumnia* the anterior lobe of the lateral process of the sixth somite is broader than that found in *O. mauritiana*; the anterior lobe of the lateral process of the seventh somite is sharp in *O. calumnia*, rounded in *O. mauritiana*. The intermediate carinae of the first abdominal somite are armed posteriorly in *O. calumnia*, unarmed in *O. mauritiana*.

DISTRIBUTION.—Pacific Ocean, where it has been recorded from the Hawaiian Islands and Guam.

Oratosquilla oratoria (De Haan, 1844)

FIGURE 2

Squilla oratoria De Haan, 1844, atlas, pl. 51: fig. 2; 1849, p. 223.—Kemp, 1913, p. 66, pl. 5: figs. 54–56 [part; older references].—Zaks, 1933, p. 73.—Holthuis, 1941, p. 247 [older references].—Shiino, 1942, pp. 77 et seq., pls. 4–14 [embryology].—Gurney, 1946, p. 160 [listed; larvae].—Anonymous, 1949, p. 842, fig. 2418.—Liu, 1949, p. 36, figs. 1a–b.—Dawydoff, 1952, p. 145.—Serène, 1953, p. 507 [listed].—Kobyakova, 1955, p. 199.—Utinomi, 1956, p. 91, pl. 46: fig. 1 [color].—Kubo and Asada, 1957, pp. 254, 257, 258, 259, 264, 265, 266, 268, 270, 272, 287, 289, tables 16–18, fig. 12 [ecology].—Kubo et al., 1959, pp. 1 et seq., figs. 1–16 [biology].—Utinomi, 1960, p. 114, pl. 57: fig. 8 [color].—Manning, 1965, p. 259.—Lee and Wu, 1966, p. 50.—Manning, 1968a, p. 135 [listed].

Oratosquilla oratoria.—Manning, 1968a, figs. 1c, 2d–f, 3b, 5e, 7c–d, 9e.

Not *Squilla oratoria*.—Edmondson, 1921, p. 287, fig. 1a.—Bigelow, 1931, p. 183.—Townsend, 1953, p. 404, figs. 2–3 [= *O. calumnia* (Townsend, 1953)].

MATERIAL.—53 ♂, 88–180 mm; 43 ♀, 54–183 mm, in twenty-nine lots from scattered localities

between southern Japan and Hong Kong, including localities off Korea and China.

DIAGNOSIS.—Rostral plate broader than long, lacking median carina, anterior margin truncate; eye large, cornea set obliquely on stalk; anterior width of carapace subequal to or slightly larger than half of median length; median carina of carapace entire, bifurcation opening anterior to dorsal pit; raptorial claw with 6 teeth, dorsal ridge of carpus tuberculate, inferodistal angle on outer face of merus with blunt spine; mandibular palp and 4 epipods present; lateral process of fifth thoracic somite produced into an anterior spine and a posterior angled lobe; lateral processes of sixth and seventh thoracic somites bilobed, anterior lobes smaller than posterior; lateral carinae of abdomen not bicarinate; abdominal carinae spined as follows: submedian 5–6, intermediate 3–6, lateral 2–6; telson lacking supplementary dorsal tubercles; telson denticles 3–5, 6–10, 1; proximal segment of uropodal exopod subequal to distal segment in length; inner spine of basal prolongation of uropod with rounded lobe on outer margin, proximal margin of lobe concave.

COLOR.—Completely faded in the present material. Apparently the species lacks the dark dorsal patches on the second or on the second and fifth abdominal somites that may be found in several other species in the genus. Color illustrations have been given by Utinomi (1956, 1960).

MEASUREMENTS.—Males, TL 88–180 mm; females, TL 54–183 mm. Other measurements of a male, TL 153 mm: carapace length 31.3; anterior width of carapace 17.1; cornea width 6.9; rostral plate length 4.0, width 4.6; telson length 28.4, width 28.3.

REMARKS.—I have included a diagnosis and an illustration for this well-known and relatively well-illustrated species, for there has been some confusion in the past over its identity; the brief diagnosis given here should separate it from all known species of *Oratosquilla* and should allow its ready separation from similar species that may occur with it in the northwestern Pacific, including *O. interrupta* (Kemp), *O. perpensa* (Kemp), *O. kempi* (Schmitt), and *O. imperialis* (Manning).

Only three groups of species in *Oratosquilla* have an entire median carina on the carapace, with the anterior bifurcation not interrupted basally and the anterior branches of the bifurcation well-formed. The sharply spined, laterally directed

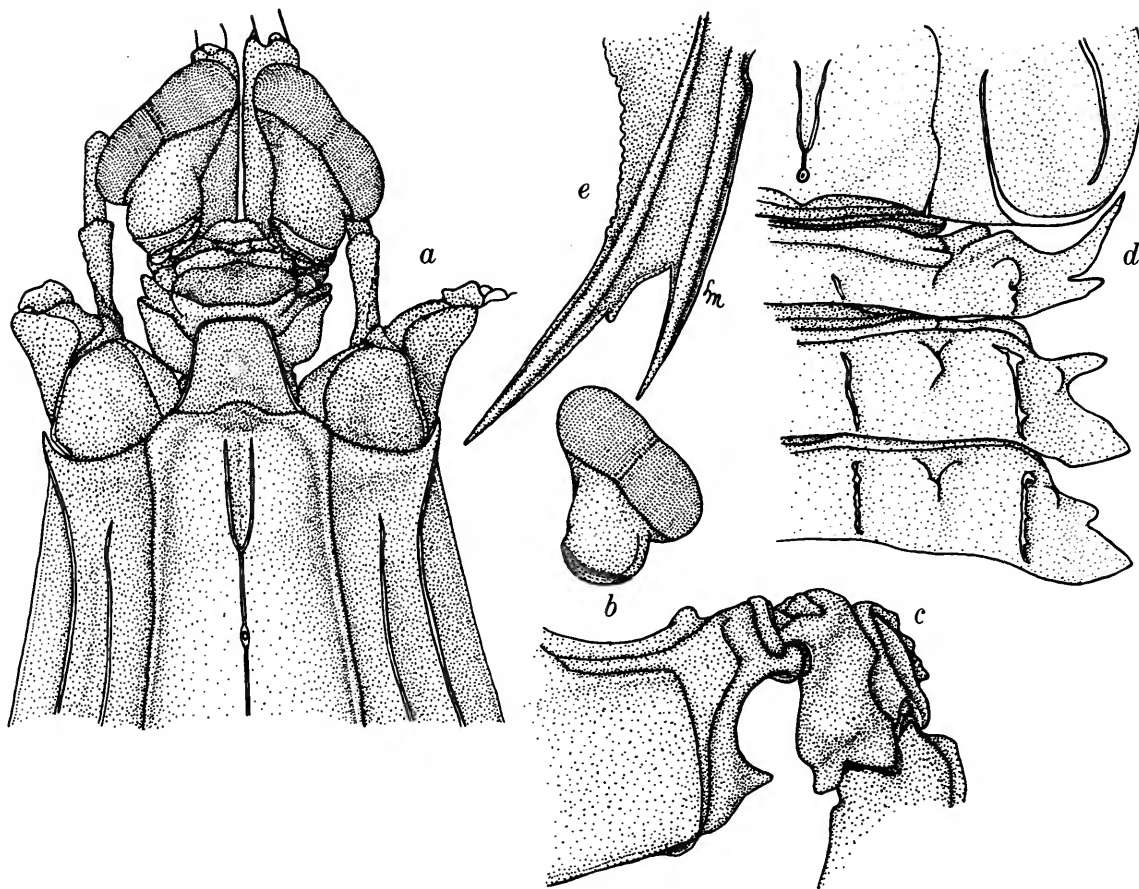


FIGURE 2.—*Oratosquilla oratoria* (De Haan), female, TL 99 mm, Amoy, China: a, anterior portion of body; b, eye; c, carpus of raptorial claw; d, lateral processes of fifth, sixth, and seventh thoracic somites; e, basal prolongation of uropod. (Setae omitted.)

processes of the fifth thoracic somite will distinguish the two species of the *Mikado* Group, *O. mikado* (Kemp and Chopra) and *O. stridulans* (Wood-Mason), from the species in the *Oratoria* Group. The two species of the *Nepa* Group, *O. nepa* (Latreille) and *O. holoschista* (Kemp), differ from the species of the *Oratoria* Group in having much smaller eyes and in having the bifurcation of the median carina of the carapace opening posteriorly to the dorsal pit on the carapace.

The four species of the *Oratoria* Group are very similar in basic facies. Both *O. calumnia* (Townsend), from Hawaii and Guam, and *O. mauritiana* (Kemp), from the western Indian Ocean, differ

from *O. oratoria* in having the submedian carinae of the fourth abdominal somite armed posteriorly. The fourth species in the group, *O. kempii* (Schmitt), which has approximately the same geographic range as *O. oratoria*, differs in having a sharp median carina on the rostral plate and dark dorsal patches on the second and fifth abdominal somites. In addition, *O. kempii* lacks the spine on the outer face of the merus of the claw and does not have a strongly bilobed lateral process on the seventh thoracic somite.

The corneal indices appear to be reliable characters in *Oratosquilla*; the following indices were found in specimens of *O. oratoria* reported here.

Carapace Length, in mm	Number of Specimens	Corneal Index	
		Range	Mean
10-15	1	-	349
16-20	10	383-456	413
21-25	10	394-486	426
26-30	9	435-482	456
31-35	9	453-530	490
36-40	6	486-521	502
41-45	1	-	510

I could detect no obvious differences in the corneal indices of males and females or in specimens from different areas.

The biology of this species is reasonably well known. Komai (1924) reported on embryology, Komai and Tung (1929) gave an almost complete account of larval development. Kubo and Asada (1957) and Kubo et al. (1959) reported on the ecology of the species in Tokyo Bay.

DISTRIBUTION.—Northwestern Pacific Ocean, from Peter the Great Bay, Russia, and Japan southward to Hong Kong, including Korea, Taiwan, and China. Although it has been recorded from Viet Nam by Gravier (1930, 1937), Dawydoff (1953), and Serène (1937, as *Squilla affinis*; 1953), it was not listed from there by Serène (1954). Its occur-

rence in the Philippine Islands, as recorded by Roxas and Estampador (1930), requires verification. One specimen from the Philippines identified by Miers (1880) as *Squilla nepa* was reidentified by Kemp (1913) as *S. oratoria*; Kemp noted, however, that the specimen had an interrupted median carina on the carapace and armed submedian carinae on the fourth abdominal somite, so it may be referable to *O. fabricii* (Holthuis).

Hansen (1926) recorded a small specimen, 18 mm in length, taken by the *Siboga* in the Molo Strait, Indonesia; that record should be accepted with caution, for specimens that small generally do not exhibit many of the diagnostic features seen in adults, and the record is well south of the documented range of the species.

Perpensa Group

This group comprises those species in which the median carina of the carapace is interrupted at the base of the anterior bifurcation; the carina, posterior to the bifurcation, and the branches of the anterior bifurcation as well are well formed. Two

Key to Species of the *Perpensa* Group

1. Submedian carinae of fourth, fifth, and sixth abdominal somites armed posteriorly (dorsal ridge of carpus of claw tuberculate) *O. fabricii* (Holthuis, 1941)
Submedian carinae of fourth abdominal somite unarmed 2
2. Lobe between spines of basal prolongation of uropod convex (dorsal ridge of carpus of claw tuberculate) *O. interrupta* (Kemp, 1911)
[Kemp, 1913]
Lobe between spines of basal prolongation of uropod concave, distal margin rounded or acute (dorsal ridge of carpus of claw smooth, entire) 3
3. Slender spine present between spines of basal prolongation of uropod (proximal segment of uropodal exopod 1.5 times as long as distal) *O. ornata*, new species
At most a rounded lobe present between spines of basal prolongation of uropod (proximal segment of uropodal exopod subequal in length to distal) 4
4. Second and fifth abdominal somites with dark, median, rectangular patch of chromatophores (inferodistal angle on outer face of merus of claw rounded, unarmed)
O. imperialis (Manning, 1965) [= *O. simulans* (Holthuis, 1967)]
At most second abdominal somite with dark median patch of chromatophores (inferodistal angle on outer face of merus of claw with spine or blunt triangular prominence) 5
5. Rostral plate longer than broad; lateral carinae of second abdominal somite with posterior spine *O. inornata* (Tate, 1883)
[Manning, 1966]
Rostral plate broader than long; lateral carinae of second abdominal somite unarmed
O. perpensa (Kemp, 1911) [= *O. anomala* (Tweedie, 1935)]
[Kemp, 1913; Manning, 1966]

subgroups can be recognized in the group, one containing two species, characterized by a tuberculate ridge on the carpus on the raptorial claw, and the other with four species, characterized by an unbroken, smooth ridge on the carpus of the claw. The first subgroup contains *O. interrupta* (Kemp, 1911) and *O. fabricii* (Holthuis, 1941). The second subgroup contains *O. perpensa* (Kemp, 1911), *O. inornata* (Tate, 1883), *O. imperialis* (Manning, 1965), and *O. ornata*, new species, described below.

I can find no characters to separate *O. imperialis* (Manning, 1965), described from Japan, from *O. simulans* (Holthuis, 1967), based on material from the Red Sea. Although I have not been able to compare specimens of both species, comparison of their descriptions leaves me no alternative to synonymizing them. The two species are almost identical in morphology and color pattern. I reported that the type of *O. imperialis* had 2 or 3 epipods; Holthuis reported 4 epipods in *O. simulans*. It is possible that the epipods of the unique type of *O. imperialis* were damaged. The distribution of *O. imperialis*, known from localities in the Red Sea and from Japan but not from intermediate local-

ities, parallels that of *O. mikado*, which is known from Japan and Zanzibar. It seems likely that these distribution patterns, which are at best unusual in *Oratosquilla* in which most species have restricted ranges, reflect availability of collections or collecting effort rather than true discontinuous distribution patterns within the Indo-West Pacific region.

Oratosquilla ornata, new species

FIGURE 3

HOLOTYPE.—1 ♀, 43.5 mm; China Sea, off Hong Kong; 21°53'N, 115°51'E; 62 fathoms; sand, green mud; *Albatross* Station 5309; 4 November 1908; USNM 77939.

DIAGNOSIS.—Rostral plate as long as broad, appearing elongate, lacking median carina, apex rounded; eye large, cornea set obliquely on stalk; corneal index 426; anterior width of carapace less than half median length; median carina of carapace interrupted at base of bifurcation, bifurcation opening anterior to dorsal pit; raptorial claw with 6 teeth, dorsal ridge of carpus entire, inferodistal margin of outer face of merus at most angled; mandibular palp and 4 epipods present; lateral process

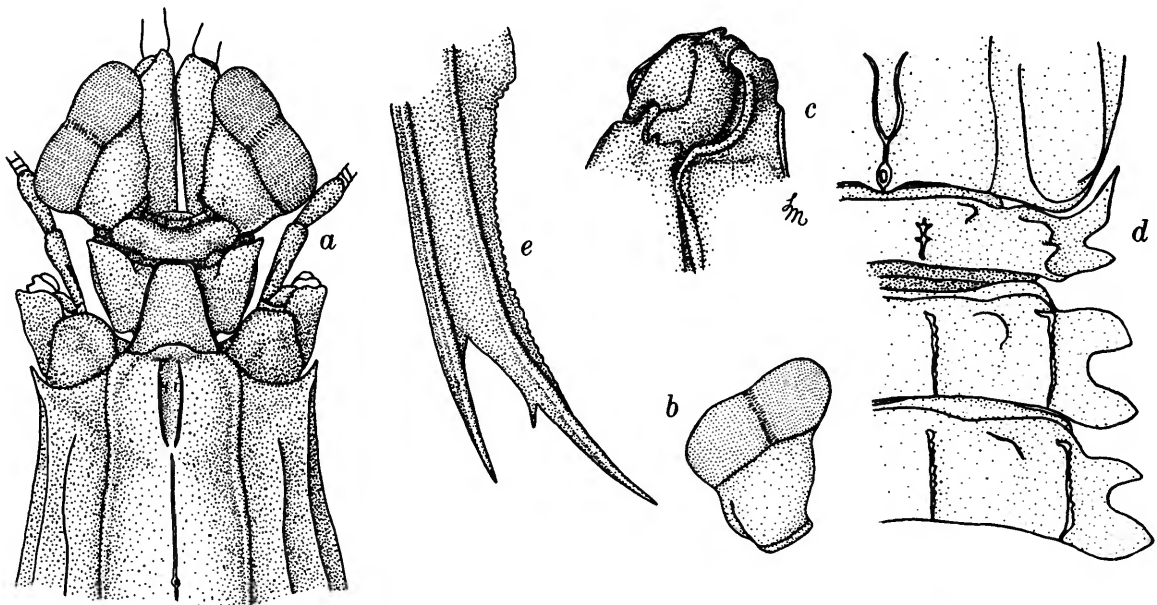


FIGURE 3.—*Oratosquilla ornata*, new species, female holotype, TL 43.5 mm, off Hong Kong: a, anterior portion of body; b, eye; c, carpus of raptorial claw; d, lateral processes of fifth, sixth, and seventh thoracic somites; e, basal prolongation of uropod. (Setae omitted.)

of fifth thoracic somite produced into an anterior spine and a posterior angled lobe; lateral processes of sixth and seventh thoracic somites bilobed, anterior lobe of process of sixth somite truncate laterally, almost as large as posterior lobe; lateral carinae of abdomen not bicarinate; abdominal carinae spined as follows: submedian 5-6, intermediate 3-6, lateral 2-6; telson without supplementary dorsal tubercles; telson denticles 4, 8, 1; proximal segment of exopod longer than distal; inner spine of basal prolongation of uropod with sharp spine on outer margin, proximal margin of spine concave.

DESCRIPTION.—Dorsal surface of body pitted, rugose. Eye large, cornea bilobed, set very obliquely on stalk; eyes not extending to end of first segment of antennular peduncle; ocular scales truncate, inclined laterally, separate mesially; anterior margin of ophthalmic somite flattened; corneal index 426.

Antennular peduncle slightly shorter than carapace; dorsal processes of antennular somite flattened, directed anterolaterally.

Antennal scale slender, curved, elongate, more than half as long as carapace.

Rostral plate slender, length and width subequal, appearing elongate, upturned lateral margins converging on rounded apex; median carina absent.

Carapace narrowed anteriorly, anterior width less than half median length; anterolateral spines strong but not extending to base of rostral plate; median carina interrupted at base of anterior bifurcation, branches of bifurcation distinct; distance from dorsal pit to anterior bifurcation less than distance from bifurcation to anterior margin; portion of median carina posterior to cervical groove with anterior bifurcation; intermediate carinae not extending to anterior margin; posterolateral margin of carapace evenly curved, not angled anteriorly; median posterior margin of carapace with triangular projection.

Dactylus of raptorial claw with 6 teeth, outer margin of dactylus evenly curved; dorsal ridge of carpus undivided; inferodistal margin of outer face of merus with unarmed angular lobe.

Mandibular palp and 4 epipods present.

Exposed thoracic somites with irregular submedian and intermediate carinae; lateral process of fifth somite bilobed, anterior lobe a slender spine, outer margin convex, directed anteriorly,

posterior lobe short, bluntly triangular, directed laterally; lateral process of sixth somite bilobed, anterior lobe truncate, almost as large as posterior, apex acute but not spined; lateral process of seventh somite bilobed, anterior lobe triangular, posterior lobe larger, triangular; ventral keel of eighth somite erect, triangular, apex rounded.

Anterior 5 abdominal somites each with 8 carinae, submedians slightly divergent on each somite; sixth somite with 6 pairs of carinae; abdominal carinae spined as follows: submedian 5-6, intermediate 3-6, lateral 2-6, marginal 1-5; sixth somite with small ventrolateral spinule in front of articulation of each uropod and with median tubercle on posterior margin of sternum.

Telson flattened, longer than broad, with 6 elongate marginal teeth; prelateral lobes present, not markedly projecting laterally, shorter than lateral carina; dorsal surface of telson ornamented with median carina and carinae of marginal teeth, supplementary tubercles or carinae absent; median carina low, sharp, with obscure anterior notch and long distal spine; outer submedian denticle rounded, remainder sharp, 4, 8, 1; ventral surface of telson with short but prominent postanal keel.

Uropods slender, elongate, proximal segment of exopod longer than distal, with 9 graded spines on outer margin, distalmost not extending to mid-length of distal segment; endopod slender, inner margin concave; lobe on inner spine of basal prolongation of uropod a slender erect spine, margin concave.

COLOR.—Completely faded in holotype.

MEASUREMENTS.—Female holotype, TL 43.5 mm, only known specimen; other measurements, in mm: carapace length 9.8; anterior width of carapace 4.0; cornea width 2.3; rostral plate length 1.4, width 1.4; telson length 8.2, width 6.9.

REMARKS.—*Oratosquilla ornata* can be distinguished from the other species of the *Perpensa* Group, including *O. perpensa*, *O. inornata*, and *O. imperialis*, by the presence of a slender spine rather than a rounded lobe between the spines of the basal prolongation of the uropod; as in the case of most of the species assigned to this group, the dorsal ridge on the carpus of the claw in *O. ornata* is undivided. This new species also has a much slenderer uropod than any of the members of the group.

Tirmizi and Manning (1968) observed that a

slender spine replaced the rounded lobe between the spines of the basal prolongation of the uropod in *O. hesperia* from West Pakistan. In that species the spines were present in juveniles with a total length of approximately 50 mm or less, but in specimens larger than 100 mm the rounded lobe characteristic of adults was present. Alikunhi (1967) also noted that the spine was present in juveniles of *O. woodmasoni* from India. Thus the holotype of *O. ornata* may prove to be a juvenile. The basic facies of the unique holotype is adult, however, for the body carination and spination, usually poorly developed in specimens of this size, resemble that of larger specimens of other species.

NAME.—The name is from the Latin, *ornatus*, meaning decorate, alluding to the well-formed carinae of the abdomen and the elongate uropod.

DISTRIBUTION.—Known only from the type locality, off Hong Kong in the China Sea, at a depth of 62 fathoms.

Woodmasoni Group

Members of this group can be characterized by their broad, smooth carapace, with the anterior width of the carapace greater than one-half its median length and with the branches of the anterior bifurcation of the median carina of the carapace poorly developed or completely absent. The species assigned to this group include *O. woodmasoni* (Kemp, 1911), *O. massavensis* (Koss-

mann, 1880), *O. hesperia* (Manning, 1968), and *O. tweediei*, described below. Only two of the species, *O. massavensis* and *O. hesperia*, have the telson ornamented with dorsal tubercles on each side of the median carina of the telson. As in the species of the *Oratoria* Group, the carpus of the claw is tuberculate in members of the *Woodmasoni* Group.

In all four of the species placed in this group the body is relatively smooth, not so tuberculate as in *O. oratoria*, and the carapace is noticeably broader than in any of the other species in the genus. The carapace of *O. woodmasoni* is comparatively the broadest; in that species, the anterior width, at the base of the anterolateral spines, is usually greater than one-half the length of the carapace and rostral plate combined. In the other three species, the anterior length is greater than one-half the median length of the carapace, excluding the rostral plate.

Further investigation may show that there are several additional species in this complex; Chopra (1934), Holthuis (1941), and Manning (1966) all reported material from different localities that differs from Kemp's (1913) account of *O. woodmasoni* based primarily on material from India.

Oratosquilla massavensis is not known to occur in the Indian Ocean adjacent to the Red Sea, but it is apparently very abundant in the latter area (Holthuis, 1967). It has been recorded from Viet Nam by Serène (1953, 1954); but in view of its apparent occurrence only in the Red Sea, Serène's

Key to Species of the *Woodmasoni* Group

1. Dorsal surface of telson with longitudinal row of tubercles, converging distally, on each side of median carina 2
Dorsal surface of telson not ornamented with line of tubercles on each side of median carina 3
2. Lateral margins of rostral plate straight; submedian carinae of abdomen divergent on each somite, particularly on fourth and fifth somites; telson with 1 row of tubercles flanking median carina on each side *O. hesperia* (Manning, 1968)
[Tirmizi and Manning, 1968]
Lateral margins of rostral plate sinuous; submedian carinae of abdomen subparallel; telson with 2 rows of tubercles flanking median carina on each side *O. massavensis* (Kossmann, 1880)
[Ingle, 1963]
3. Submedian carinae of fourth, fifth, and sixth abdominal somites each with posterior spine; angular lobe present between apical spines of basal prolongation of uropod *O. tweediei*, new species
Submedian carinae of fifth and sixth somites only armed with spines; low, inconspicuous rounded lobe present between spines of basal prolongation of uropod *O. woodmasoni* (Kemp, 1911)
[Kemp, 1913]

records may be based on another undescribed species with a broad carapace, smooth body, and dorsal tubercles on the telson.

Oratosquilla tweediei, new species

FIGURE 4

HOLOTYPE.—1 ♀, 107 mm; Singapore; M. W. F. Tweedie, collector; 1934; USNM 76026.

PARATYPE.—1 ♀, 96 mm; data as in holotype; USNM.

DIAGNOSIS.—Rostral plate broader than long, lacking median carina, apex truncate; eye large, cornea set obliquely on stalk; corneal indices 332–337; anterior width of carapace more than half median length; anterior bifurcation of median carina of carapace absent; raptorial claw with 6

teeth, dorsal ridge of carpus tuberculate, infero-distal angle on outer face of merus bluntly angled; mandibular palp and 4 epipods present; lateral process of fifth thoracic somite produced into an anterior spine and a posterior angled lobe; lateral processes of sixth and seventh thoracic somites bilobed, anterior lobes sharper and smaller than posterior; lateral carinae of abdomen not bicarinate; abdominal carinae spined as follows: submedian 4–6, intermediate 3–6, lateral 2–6; telson lacking supplementary dorsal tubercles; telson denticles 3, 9, 1; distal segment of uropodal exopod longer than proximal; inner spine of basal prolongation of uropod with angled lobe on outer margin, proximal margin of lobe concave.

DESCRIPTION.—Dorsal surface of body smooth. Eye large, cornea bilobed, set very obliquely on stalk; eyes not extending beyond end of first seg-

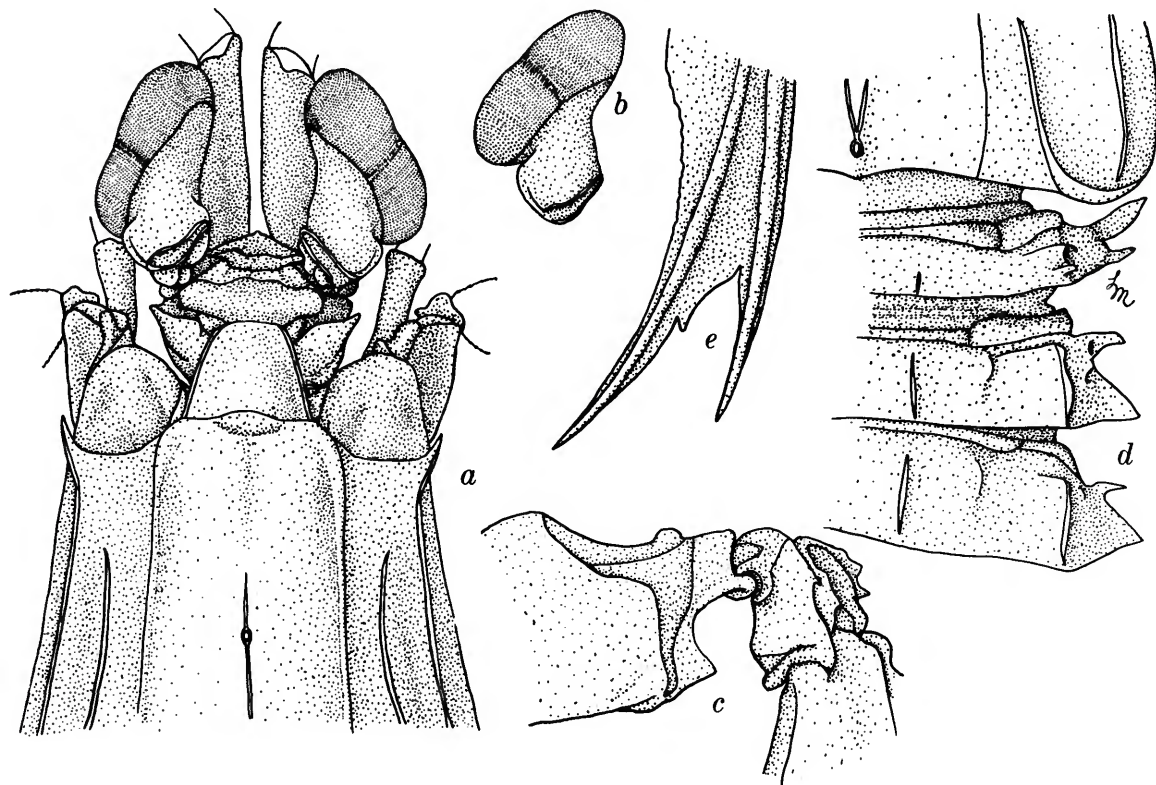


FIGURE 4.—*Oratosquilla tweediei*, new species, female holotype, TL 107 mm, Singapore: *a*, anterior portion of body; *b*, eye; *c*, carpus of raptorial claw; *d*, lateral processes of fifth, sixth, and seventh thoracic somites; *e*, basal prolongation of uropod. (Setae omitted.)

ment of antennular peduncle; ocular scales truncate, inclined laterally, separate mesially; anterior margin of ophthalmic somite rounded; corneal indices 332–337 in types.

Antennular peduncle subequal to carapace; dorsal processes of antennular somite blunt, truncate, anterior margin almost transverse.

Rostral plate broader than long, trapezoidal, upturned lateral margins converging on truncate apex; median carina absent.

Antennal scale slender, short, more than half as long as carapace.

Carapace broad, anterior width greater than one-half median length; anterolateral spines of moderate size, not extending to base of rostral plate; median carina of carapace obscure anteriorly, branches of anterior bifurcation only faintly indicated; portion of median carina posterior to cervical groove with anterior bifurcation; intermediate carinae not extending to anterior margin; posterolateral margin of carapace evenly curved, not angled anteriorly; posterior margin with median projection.

Dactylus of raptorial claw with 6 teeth; outer margin of dactylus sinuate; dorsal ridge of carpus irregularly tuberculate, with 2–3 rounded distal tubercles; inferodistal angle of outer face of merus with blunt, triangular tooth.

Mandibular palp and 4 epipods present.

Posterior 3 thoracic somites with well marked, smooth submedian and intermediate carinae; fifth somite with faint indications of submedian carinae and with irregular tubercles at level of intermediate carinae of sixth somite; lateral process of fifth somite bilobed, anterior lobe a blunt spine directed anterolaterally, posterior lobe slender, sharp, directed laterally; lateral process of sixth somite bilobed, anterior lobe slender, sharp, recurved posteriorly, posterior lobe much larger, triangular, apex acute; lateral process of seventh somite bilobed, anterior lobe small, spiniform, posterior lobe much larger, apex acute; ventral keel of eighth somite low, rounded.

Anterior 5 abdominal somites each with 8 carinae, submedians subparallel on anterior somites, slightly divergent on fifth somite; sixth somite with 6 pairs of carinae; abdominal carinae spined as follows: submedian 4–6, intermediate 3–6, lateral 2–6, marginal 1–5; sixth somite with small ventrolateral spinule in front of articulation of each

uropod and with low median carina on posterior half of sternum.

Telson flattened, slightly broader than long, with 6 slender marginal spines; prelateral lobes present, slightly projecting laterally, shorter than carina of lateral tooth; dorsal surface of telson ornamented with median carina and carinae of marginal teeth only, supplementary dorsal tubercles or carinae absent; median carina sharp, with anterior notch and long posterior spine flanked distally with 1 or 2 irregular tubercles; denticles rounded, 3, 9, 1; ventral surface with uninterrupted postanal keel.

Uropods stout, exopod with 7–9 short spines on outer margin of proximal segment; distal segment of exopod longer than proximal; endopod slender, curved; basal prolongation with triangular projection on outer margin of inner spine, inner margin of projecting lobe concave.

COLOR.—Almost completely faded in the types; dark pigment present on distal half of proximal segment and inner half of distal segment of uropodal exopod; distal two-thirds of uropodal endopod dark.

MEASUREMENTS.—Females only known, TL 96–107 mm. Other measurements, in mm, of holotype, TL 107 mm: carapace length 20.8; anterior width of carapace 12.9; cornea width 6.2; rostral plate length 3.1, width 4.8; telson length 18.8, width 19.2.

REMARKS.—*Oratosquilla tweediei* belongs to the *Woodmasoni* Group of species in the genus, all of which are characterized by the broad, smooth carapace on which the anterior bifurcation of the median carina is absent or nearly so. *Oratosquilla tweediei* agrees with *O. woodmasoni* (Kemp) and differs from both *O. massavensis* (Kossman) and *O. hesperia* (Manning) in lacking supplementary dorsal tubercles on the telson; in both *O. massavensis* and *O. hesperia* the median carina of the telson is flanked laterally by a line of tubercles that converge distally under the apical spine.

Oratosquilla tweediei closely resembles *O. woodmasoni* but can be distinguished from it by the following features: (1) the anterior width of the carapace is greater than one-half the median length, excluding the rostral plate; (2) the anterior lobes of the lateral processes of both sixth and seventh thoracic somites are sharper and more prominent; (3) the lateral process of the eighth somite is sharper (compare Figure 4d with Figure 63 in Kemp, 1913); (4) the submedian carinae of

the fourth abdominal somite are armed posteriorly; and (5) the lobe on the inner spine of the basal prolongation of the uropod is much more prominent in *O. tweediei* than in *O. woodmasoni* (compare Figure 4e with Figure 65 in Kemp, 1913).

Oratosquilla woodmasoni and *O. tweediei* are the eastern counterparts of *O. hesperia* and *O. massavensis* in the Indo-West Pacific region; *O. hesperia* is known from the northwestern Arabian Sea, south to Madagascar, and *O. massavensis* apparently occurs only in the Red Sea (Tirmizi and Manning, 1968). *Oratosquilla woodmasoni* is known from localities between Hong Kong and western India (Kemp, 1913) and *O. tweediei* is known only from off Singapore.

This new species agrees with the specimen I reported in 1966 from off Bowen, Queensland, and differs from previous accounts of *O. woodmasoni* in having a well-developed lobe on the outer margin of the inner spine of the basal prolongation of the uropod. The Australian specimen, however, differs in having the anterior branches of the bifurcation of the median carinae; these carinae are completely lacking in both *O. woodmasoni* sensu stricto and in *O. tweediei*. It seems likely that the Australian specimen represents a distinct species.

The only other species in the genus with the submedian carinae of the fourth abdominal somite armed are: (1) *O. nepa* (Latreille), which differs in having very small eyes and in having the anterior bifurcation of the median carina of the carapace open posterior to the dorsal pit; (2, 3) *O. mauritiana* (Kemp) and *O. calumnia* (Townsend), both of which differ in having an entire median carina on the carapace with a well-developed anterior bifurcation; (4) *O. fabricii* (Holthuis), in which

the median carina is interrupted but the anterior bifurcation is well formed; and (5, 6) *O. massavensis* (Kossmann) and *O. hesperia* (Manning), both of which have supplementary dorsal tubercles on the telson. All of these species differ from *O. tweediei* in other features as well, but these are the most important differences.

NAME.—The species is named for M. W. F. Tweedie, who collected the specimens and donated them to the United States National Museum.

DISTRIBUTION.—Known only from the type locality, Singapore.

Gonypetes Group

This group contains three species, which have but 5 teeth on the dactylus of the claw, *O. quadraticauda* (Fukuda, 1911), *O. quinquedentata* (Brooks, 1886), and *O. gonypetes* (Kemp, 1911). In other respects the species in the *Gonypetes* Group resemble those in other groups with 6 teeth on the claw, especially the species of the *Woodmasoni* Group, which lack a well-formed anterior bifurcation on the median carina of the carapace. As Holthuis (1967) commented, these species are extremely difficult to identify when their raptorial claws are missing.

In 1965, I pointed out that *Squilla boops* Kemp was a synonym of *S. quadraticauda* Fukuda.

On the basis of his studies of stomatopod larvae and juvenile stages, Alikunhi (1967) suggested that *O. gonypetes* and its allies [*O. quadraticauda* and *O. quinquedentata*] are more closely related to the "*Chloridella*" [now *Clorida*] and "*raphidea*" [now *Harpiosquilla*] groups of species than are species of the "*nepa*" [*Nepa*, *Perpensa*, and *Woodmasoni*] groups.

Key to Species of the *Gonypetes* Group

1. Rostral plate with median carina; lateral process of seventh thoracic somite not bilobed (eyes very large, cornea width about one-third carapace length)
 - O. quadraticauda* (Fukuda, 1911) [= *Squilla boops* Kemp, 1911] [Kemp, 1913]
- Rostral plate without median carina; lateral process of seventh thoracic somite bilobed (eyes of moderate size, cornea width less than one-fourth carapace length) 2
2. Outer face of merus of claw with tooth at inferodistal angle; anterior lobe of lateral process of seventh thoracic somite short, not exceeding half of length of posterior lobe *O. quinquedentata* (Brooks, 1886)
- Outer face of merus of claw unarmed inferodistally; anterior lobe of lateral process of seventh thoracic somite more than half as long as posterior lobe. *O. gonypetes* (Kemp, 1911) [Kemp, 1913]

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