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STOMATOPODS OF PHUKET ISLAND, THAILAND

by

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STOMATOPODS OF PHUKET ISLAND, THAILAND

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ABSTRACT

Collections of stomatopods from Phuket include species from three families of stomatopods: Lysiosquillidae, Squillidae, and Gonodactylidae. Species of Gonodactylidae are distributed from the high intertidal to the subtidal zones. Keys and descriptions of families and species are given, including notes on color and distribution of the species.

I. INTRODUCTION

Several species of stomatopods (Crustacea: Stomatopoda) are common in the inshore waters of Thailand including the Andaman Sea in the vicinity of Phuket Island. During the periods August, 1973 and June—August, 1974, Dingle and Caldwell studied stomatopod ecology and behavior at the Phuket Marine Biological Center located at Laem Pan Wa on the southern tip of Phuket Island. Details of these studies will be published elsewhere in the appropriate journals (a preliminary discussion appears in Caldwell and Dingle, 1975), but we publish here keys and descriptions of the species we found at Phuket and some notes on their local distribution and ecology.

Most of our attention was concentrated on species in the family Gonodactylidae. As a result, species of Squillidae and Lysiosquillidae are underrepresented in our study. Many of these are, however, in the collection of the Department of Biology, Chulalongkorn University, Bangkok, under the care of Mr. Phaibul Naiyanetr. This collection also contains specimens from many other localities in Thailand, especially the Gulf of

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Thailand and Songkla. In this paper we include descriptions and brief notes on the species found during the course of studies at the Phuket Marine Biological Center.

The majority of our collecting was done at the beach on the west side of Laem Pan Wa just below the Marine Biological Center. At the south end, especially to the south of the Center pier, the shoreline consists of a large outcropping of shale, while at the north end there is an extensive sand beach extending past the coffee shops of the village. The tidal range can be as much as 3 meters, and at low tide extensive areas of rubble, sand, and, in the lower intertidal, living coral are exposed. At the outer boundary of the intertidal, at the edge of the living coral zone, there is a sharp drop-off where the water is 3–5 meters deep even at low tide. A profile of the intertidal zone is pictured in Fig. 1. A few collections also were made from areas bordering mangroves a few kilometers north of the Center, from islands west and south of the Center, and at Naiyang Beach at the north end of Phuket Island.

II. METHODS OF COLLECTION

Rock and coral dwelling stomatopods of the family Gonodactylidae (*Gonodactylus, Haplosquilla*) can be collected by breaking pieces of rock or coral with a heavy hammer. This exposes the cavities in which the animals live. The shale substrate at Phuket can be pried loose with hammer and chisel exposing burrows in the interstices between flat plates of shale. Species dwelling in soft substrates can be removed from the burrows simply by poking a finger down one burrow entrance and driving the animal out the other (Dingle and Caldwell, 1975). This does not work with lysiosquillids (except for *Acanthosquilla multifasciata* which lives in very soft mud) because they dig vertical burrows. These are best captured by attracting them to the surface with bait (fish or a squid tentacle) and inserting a trowel or other implement into the burrow behind the animal. *Gonodactylus affinis* was taken from rocks collected by scuba diving at depths of 10–40 meters.

![Fig. 1—Profile of intertidal zone at Phuket Marine Biological Center indicating distribution of stomatopod species.](image)
III. DISTRIBUTION AT LAEM PAN WA

During the course of studies at the Phuket Marine Biological Center many collections of animals were made during low tide at the Center beach both to the north and south of the pier. As a result of these collections we were able to plot the approximate distributions of the various species of stomatopods in the different habitats along the tidal gradient. These distributions are shown in Fig. 1 which indicates a profile of the beach. As can be seen, the different species of stomatopods succeed each other as one proceeds outward from the beach toward deeper water. In the highest shale habitat, exposed longest at low tide, one finds only Gonodactylus chiragra with G. viridis appearing as soon as one proceeds somewhat lower in the intertidal. Several species appear in intermediate areas until finally G. ternatensis is the last species to appear at the outer margin of the intertidal.

We also have data from a systematic sampling of the intertidal zone. Each of the four sampling sites whose locations are indicated by the Roman numerals in Fig. 1 were divided into 20 one-meter square quadrats evenly spaced over a 20 x 25 meter grid. All rock, rubble, and living and dead coral was removed from each of the quadrats and completely broken apart with hammers. In this way any animals living in cavities were removed, sexed, and measured. Any burrows in the substrate were dug up and any animals found were similarly removed and recorded. The numbers of animals of various species found in the four quadrat samples are indicated in Table 1.

What is immediately apparent from Table 1 is that only species of Gonodactylidae were taken by this sampling method. This indicates that these species predominate in hard substrates where they depend on cavities in rock and coral for shelter. The exception is Pseudosquilla ciliata which lives in burrows which it constructs in hard sand. We took only one individual of this species by sampling but it is quite common in the intertidal zone. Most individuals were seen swimming about in water a few centimeters deep where they could be trapped in the rubble and captured with a dip net. They were most common in the coral areas at the north end of the Laem Pan Wa beach where the coral comes quite close to the shore.

We also failed to capture any specimens of Lysiosquilla tredecimdentata which is also common in the intertidal zone. This large yellow and black striped species constructs long U-shaped burrows in the substrate with entrance holes some 5 - 10 cm. in diameter and located up to 10 m. apart. These are scattered throughout the intertidal in areas where there is hard packed sand amidst the coral and rubble. The holes are usually partially covered by a soft lip made from fine sand or mud mixed with secretions produced by the animals from mandibular glands. The lining of the burrows is smooth and produced from

<table>
<thead>
<tr>
<th>Species</th>
<th>I Shale</th>
<th>II Pebble/Sand</th>
<th>III Rubble/Sand</th>
<th>IV Porites/Mixed Coral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonodactylus chiragra</td>
<td>36</td>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Haptosquilla glyptocercus</td>
<td>1</td>
<td>37</td>
<td>8</td>
<td></td>
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<tr>
<td>Gonodactylus viridis</td>
<td>33</td>
<td>79</td>
<td>50</td>
<td>10</td>
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<tr>
<td>Pseudosquilla ciliata</td>
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<tr>
<td>Gonodactylus smithii</td>
<td></td>
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<td>26</td>
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<tr>
<td>G. mutatus</td>
<td></td>
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<td></td>
<td>27</td>
</tr>
<tr>
<td>G. ternatensis</td>
<td></td>
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<td>2</td>
</tr>
</tbody>
</table>

3
similar material. Fishermen from Laem Pan Wa village frequently capture L. tredecimdentata for food by attracting the animals to the burrow entrance with bait and then spearing them.

As indicated in Table 1 the most abundant species in the intertidal zone is Gonodactylus viridis which was taken in every habitat. It is most common in Area II where it lives in cavities in the rock, but it also occurs commonly in shallow and in coral rubble and a few specimens were found in living coral. This species is also commonly seen swimming in shallow water at low tide where individuals can be captured with a net. These individuals are evidently foraging (some were carrying food items) although some of the males are probably searching for cavities containing receptive females. There seems to be no fixed breeding season, at least during the time of our studies, as we found females with eggs in all stages of development during all months of our stay. It would be interesting to know if breeding also occurs during other months of the year especially during the cooler months of December to February.

The next most abundant species as seen in Table 1 are Gonodactylus chiragra and Haptoquilla glyptocerus. G. chiragra predominates in the shallow habitat of the high intertidal where low tides expose the habitats for several hours each day. At this time, cavities occupied by animals can frequently be located by the pieces of broken shell, from the variety of pelecypods and gastropods on which this species feeds, deposited outside the cavity entrance. This is the species which occurs highest in the intertidal, and it was the only species occurring in the 10 one-meter square quadrats closest to the shore. Large individuals of G. chiragra are also frequently seen swimming about outside their cavities at low water and can then be netted. They are evidently foraging, or, in the case of males, seeking mates. When a pelecypod or gastropod food item is found, it is taken back to the cavity where it is broken up and eaten. A large animal can consume several snails and clams in a day. Breeding females of this species also were common.

Haptoquilla glyptocerus also occasionally occurs in shale, but it is much more common in the area of rock, pebble, and sand just below the shale as one proceeds outward from the shore. It is especially common in the area just to the south of the Center pier. H. glyptocerus was never seen outside cavities, unlike most other species of gonodactylids. An interesting aspect of the biology of this species is that the sex ratio of animals taken from caves is strongly biased in favor of females. Why this is so is not known. A few breeding females were collected. Studies of the aggressive behavior of this species can be found in Dingle et al., (1973) and Caldwell and Dingle (1977).

The three remaining species of the intertidal zone, Gonodactylus smithii, G. mutatus, and G. ternatensis, occurred only in the outermost series of quadrat samples in the living coral zone. G. smithii and G. mutatus were about evenly distributed in this habitat although separating somewhat according to species of coral occupied. G. smithii is most common in Porites lutea and occurs less often in species of Acropora and other corals; the reverse situation prevails with G. mutatus which is most abundant in the bases of various species of branching coral. A further difference between the species was that G. smithii was frequently seen out swimming about when we were collection at low tide while G. mutatus was never seen outside its cavities.

The last species, Gonodactylus ternatensis, is represented in our systematic sample by only two individuals although it is moderately common at the edge of the slope where we did not work quadrats (Fig. 1). The two individuals taken by sampling were found in two quadrats at the outer limit of the intertidal. The species occurs in the bases of living branching coral, and we never found it outside of its cavities. Most individuals that we collected during our stay at the Center were taken from water at least 30 centimeters deep even at the lowest tide. They are most common in one to two meters where they were removed from coral brought up from the bottom by snorkeling.
IV. DESCRIPTIONS OF FAMILIES AND SPECIES

Most terms used in the following descriptive accounts are shown in Figs. 2 and 3. These figures are based mainly on squillids with the carination of carapace, thorax, and abdomen characteristic of species in that family. The general features of carapace, claw (raptorial appendage), abdomen, telson, and uropod are, however, similar in all stomatopods. These figures can therefore be used for terms for all families and species described in this paper.

KEY TO STOMATOPOD FAMILIES FOUND AT PHUKET

1. Telson lacking sharp median carina or distinct longitudinal median swelling .... Lysiosquillidae
   Telson with sharp median carina or distinct longitudinal swelling .......................... 2

Fig. 2—Diagrammatic sketches of a, a typical squillid and b, a raptorial claw.
2. More than 4 intermediate denticles present on telson. ............... **Squillidae**
   No more than 2 intermediate denticles present on telson. ............... **Gonodactylidae**

(a) Family **LYSIOSQUILLIDAE** Giesbrecht, 1910

Our collections at Phuket yielded but two species of lysiosquilids, *Acanthosquilla multifasciata* and *Lysiosquilla tredecimdentata*. Another species of *Acanthosquilla*, *A. acanthocarpus* (Miers), and two other species of *Lysiosquilla, L. maculata* (Fabricius) and *L. sulcirostris* Kemp, can be expected to be found in adjacent waters. *A. acanthocarpus* is very similar to *A. multifasciata*, but the dactylus of the claw lacks the enlarged triangular lobe on its outer margin; that lobe is characteristic of *A. multifasciata*.

*Lysiosquilla sulcirostris*, like *L. tredecimdentata*, has a very slender scale, but its rostral plate is ornamented with deep longitudinal grooves flanking the median carina, and there are only 7 or 8 teeth on the dactylus of the claw. *L. maculata* thought to be the most common *Lysiosquilla* in the Indo-Pacific, differs from both of these species in having a very broad, ovate antennal scale (Fig. 4); the median carina on its rostral plate is not flanked by deep grooves.

**Key to genera of Lysiosquillidae found at Phuket**

1. Dorsal surface of telson with fan-shaped row of 5 spines. Rostral plate subquadrate. Uropodal endopod with strong proximal fold on outer margin. ............... *Acanthosquilla*
   Dorsal surface of telson unarmored. Rostral plate cordiform (heart-shaped). Uropodal endopod lacking strong proximal fold on outer margin. ............... *Lysiosquilla*

**Genus Acanthosquilla** Manning, 1963

*Acanthosquilla multifasciata* (Wood-Mason, 1895)

(Fig. 4)

*Kemp, 1913: 122 (as Lysiosquilla multifasciata).*

**Diagnosis:** Eyes small, cornea subglobular.
Rostral plate rectangular, with apical median projection. Dorsal surface of telson with fan-shaped row of 5 spines. Posterior margin of telson with 2 pairs of fixed marginal teeth, 1 pair of long, movable submedian teeth, and other smaller fixed denticles. Claw with 5–6 teeth on dactylus, penultimate much smaller than antepenultimate, outer lobe of dactylus with 2 projections, distal enlarged, triangular. Size of adults about 50 mm.

**Color of living animals:** Broad dark band on
Fig. 4—
a, Acanthosquilla multifasciata; arrow indicates triangular lobe on dactyl (absent in A. acanthocarpus);
b, telson of A. multifasciata; c, telson of Lysiosquilla tredecimdentata; d, head of L. tredecimdentata;
e, raptorial merus of L. tredecimdentata; f, merus of L. maculata; g, antennal scale of L. maculata;
h, ventral keel of eighth thoracic somite of L. tredecimdentata; i, same of L. maculata.

a-b from Wood-Mason (1895); c-i from Manning (1968).
the posterior fourth of the carapace (3 bands present on carapace of *A. acanthocarpus*). Thorax and abdomen lined with broad dark bands; gut and digestive gland bright orange and visible through the cuticle giving the animal a tiger-striped appearance.

**Distribution and Habitat:** Widely distributed in the Indo-Pacific, including the Red Sea. At Phuket we found it only in extremely soft mud in the outflows from mangrove streams. The similar species *A. acanthocarpus* apparently is confined to sandy beaches (it is common at Bang Saen on the Gulf of Thailand, for example) and probably occurs in the intertidal on sandy beaches on Phuket Island. We have seen an *Acanthosquilla* at Naiyang Beach which was probably *A. acanthocarpus*.

**Genus Lysiosquilla** Dana, 1852

*Lysiosquilla tredecimdentata* Holthuis, 1941

(Fig. 4)


**Diagnosis:** Eyes large, cornea bilobed. Rostral plate cordiform (heart-shaped), with blunt apical median projection. Dorsal surface of telson with at most low median boss, unarmed. Posterior margin of telson with 2–3 pairs of blunt, fixed teeth laterally, movable submedian teeth and other fixed denticles completely absent. Claw with 10–13 teeth on dactylus, fewer in large females, penultimate not markedly reduced; outer margin of dactylus lacking prominent triangular lobe. Size of adults to more than 250 mm.

**Color of Living Animals:** Banded with yellow and broad black bands the length of the body; antennal scale outlined in black.

**Distribution and Habitat:** Indian Ocean, from the Gulf of Aden and southern Africa eastward to Thailand. The burrows of this species are common in hard sand exposed at low tides on the beach adjacent to the Phuket Marine Biological Center.

(b) Family SQUILLIDAE Latreille, 1803

Any of the 13 other squillids listed by Serèene (1954 : 6) from Viet Nam (and now assigned to several genera other than *Squilla*) might be expected to occur in other habitats around Phuket. Most of these species are differentiated in the only available monograph on Indo-Pacific stomatopods, that by Kemp (1913). Unfortunately the generic names used by both Kemp and Serèene are now outdated.

**Genus Oratosquilla** Manning, 1968

*Oratosquilla quinquedentata* (Brooks, 1886)

(Fig. 5)


**Diagnosis:** Anterior margin of opthalmic somite flattened or medially emarginate, unarmed. Rostal plate short, subquadrate, apex flattened. Carapace with broad punctations, narrow, anterior width less than half median length. Median carina of carapace lacking well developed anterior bifurcation, branches of bifurcation, if present, indistinct. Dactylus of claw with 5 teeth. Carpus of claw with undivided, smooth dorsal ridge. Merus of claw with sharp spine at inferodistal angle. Anterior lobe of lateral process of sixth thoracic somite slender, triangular. Abdomen lacking pair of submedian dark spots on fifth somite. Total length of adults to 140 mm

**Color of Living Animals:** Teeth of telson red distally, black proximally; outer spines of uropodal exopod red; terminal segment of uropodal exopod yellow, clear distally; intersegmental bands of thorax and abdomen red dorsally (between tergites), yellow laterally (between pleurites) giving red-striped appearance; two longitudinal red lines on carapace in gastric grooves; antennules striped; background color gray; conspicuous broad white band crossing median carina of telson (this latter feature is diagnostic for this species).
Fig. 5—a, *Orotosquilla quinquecostata* (arrow indicates 5 dactylar teeth); b, *O. woodmasoni*; c, claw of *O. woodmasoni* indicating 6 dactylar teeth; d, uropodal endopod of *O. woodmasoni*; e, lateral processes of fifth, sixth, and seventh thoracic somites of *O. inornata*; f, head of *O. inornata*; g, uropodal endopod of *O. inornata*.

a from Brooks (1886); b-d from Kemp (1913).
DISTRIBUTION AND HABITAT: Indo-Pacific, from the Philippines to Bombay, generally in shallow water but also to depths of 50 meters. Occurs on mudflats at Phuket and also frequently brought to Phuket pier by fishermen. (The similar, smaller, O. gonyptes (Kemp) also has 5 dactylar teeth and may occur at Phuket. It does not grow larger than 60 mm. and also differs in color pattern: there is a dark rectangle on the second and two dark squares on the fifth abdominal somites).

Oratosquilla inornata (Tate, 1883) (Fig. 5)

Manning, 1966 : 95 (diagnosis, Australia).

DIAGNOSIS: Anterior margin of ophthalmic somite flattened or medially emarginate, unarmed. Rostral plate appearing long, rectangular, apex rounded. Carapace minutely punctate, anterior width less than half median length. Median carina of carapace with well developed anterior bifurcation, carina distinctly interrupted at base of bifurcation. Dactylus of claw with 6 teeth. Carpus of claw with smooth, undivided dorsal ridge. Merus of claw with inferodistal angle produced into sharp spine. Anterior lobe of lateral process of sixth thoracic somite rectangular or trapezoidal. Abdomen without dark spots on fifth somite. Total length of adults less than 120 mm., usually less than 100 mm.

COLOR OF LIVING ANIMALS: Background color clear; teeth of telson red distally, black proximally; median carina of telson inconspicuously banded; terminal segment of uropodal exopod yellow laterally, black medially; antennal flagellum conspicuously white; intersegmental stripes of abdomen greenish black.

DISTRIBUTION AND HABITAT: Thought to be widespread in the Indo-Pacific. At Phuket we found it on mudflats associated with mangroves at several locations. It is also very common on mudflats in the Gulf of Thailand, especially at Ang Sila where it occurs in association with O. nepa (Latreille) and Cloridopsis scorpio (Latreille). (Recent examination by Manning of material from various localities identified as this species indicates that it may comprise as many as three distinct species. Specimens should be examined carefully with respect to exact details of habitat and color in life as well as morphologically for differences in rostrum shape (long or short, apex rounded or flattened), eye size, shape of lateral processes of thoracic somites, and size and shape of lobe between spines of basal prolongation of the uropod).

Oratosquilla woodmasoni (Kemp, 1911) (Fig. 6)

Kemp, 1913 : 74.—Manning, 1971 : 12 (as O. tweediei).

DIAGNOSIS: Anterior margin of ophthalmic somite evenly rounded, usually with median spinule. Rostral plate subquadrate, short, anterior margin flattened. Carapace smooth, broad, anterior width more than half median length. Median carina of carapace lacking well-developed anterior bifurcation. Dactylus of claw with 6 teeth. Carpus of claw with tubercles on dorsal ridge. Merus of claw with inferodistal angle produced into blunt spinule or tubercle. Anterior lobe of lateral process of sixth thoracic somite slender. Abdomen lacking dark patch or patches on fifth somite. Total length of adults to about 150 mm.

COLOR OF LIVING ANIMALS: Background color gray; teeth of telson dull red with yellow intermediate denticles; teeth of telson red; uropodal endopod and exopod bright blue; basal portions of antennules blue to red; antennular flagella bright red (antennules appear dark in preserved specimens). Can be distinguished readily from other species of Oratosquilla by the bright red antennular flagella and bright blue uropods.

HABITAT AND DISTRIBUTION: Indo-Pacific, from the western Pacific through the Indian Ocean. Occurs on mud bottoms usually in relatively clear water. Frequently taken by fishermen both at Phuket and in the Gulf of Thailand.
(c) Family GONODACTYLIDAE

Giesbrecht, 1910

Although 10 species of gonodactylids were encountered at Phuket during the course of our study, numerous other species might also be expected to occur there. Most of these were listed by Serène (1954: 6); as in the squillids, the generic names used by Serène are now out of date. Some of the other species which might be encountered are listed below.

A second species of Pseudosquilla, P. ornata Miers, is somewhat rarer than P. ciliata and may occur in different habitats. It is a much darker species with broader eyes and a pair of conspicuous dark circles on the carapace surrounded by a lighter ring. A second species of Odonto
dactylus, O. cultrifer (White), differs from the species we found, O. scyllarus, in having a very slender, elevated median carina on the telson and in being colored a light, pastel pink with pink antennal scales and uropods. O. cultrifer is common in the Indo-Malayan area. A second species of Haptosquilla, H. lenzi (Holthuis), is abundant in some areas; it differs from the species we found in having very smooth dorsal bosses on the telson.

The remaining species of gonodactylids listed by Serène are relatively rare.

Key to genera of Gonodactylidae found at Phuket

1. Claw inflated at articulation of prododus with dactylus. Ischiomeral articulation of claw subterminal, merus projecting posteriorly beyond articulation ........................................ 2
Claw slender, not inflated at articulation of propodus and dactylus. Ischiomer al articulation of claw terminal, merus not projecting posteriorly beyond articulation. (Dactylus of claw with 3 slender teeth) .......................................................... Pseudosquilla

2. Rostral plate bluntly triangular or broadly rounded anteriorly, lacking median spine. Dactylus of claw with teeth .......................................................... Odontodactylus
Rostral plate trilobed or with short basal portion and long median apical spine. Dactylus of claw unarmed.................................................................................................................. 3

3. Rostral plate sharply trisinuous. Anterolateral angles of carapace not extending anteriorly beyond base of rostral plate. Sixth abdominal somite appearing fused to telson ...... Hapitosquilla
Rostral plate with short basal portion and long median apical spine. Anterolateral angles of carapace extending anterior to base of rostral plate as rounded lobes. Sixth abdominal somite not appearing fused to telson .................................................. Gonodactylus

Genus Pseudosquilla Dana, 1852

Pseudosquilla ciliata (Fabricius, 1787)
(Fig. 6)
Kemp, 1913 : 96 (references).—Serène, 1951 : 11 (comparison with P. ornata).

DIAGNOSIS: Eyes subcylindrical, long, cornea rounded, not expanded laterally. Rostral plate oval, lacking anterior spine. Carapace lacking distinct paired dark spots resembling eyespots. Claw slender, dactylus armed with 3 teeth. Telson with sharp median carina and 3 pairs of dorsal carinae. Submedian teeth of telson long, movable, bases together, submedian denticles completely absent. Total length of adults less than 100 mm.

COLOR OF LIVING ANIMALS: Extremely color polymorphic; individuals may be dark green (almost black in some), brown, or sand colored and many appear mottled; many dark green or brown animals display a broad white or gray stripe running dorsally the length of the abdomen; antennular flagella and uropodal setae orange in some dark colored animals; males usually darker than females, but light males and dark females also are common.

HABITAT AND DISTRIBUTION: Common in shallow water and intertidally in tropical waters throughout the Indo-Pacific and the Atlantic as well. In Phuket common intertidally on the beach at the Marine Biological Center.

Two other species of Pseudosquilla may occur at Phuket. P. oculata (Brullee), a larger species, has two large “eye-spots” on the carapace, is usually mottled or spotted, and possesses four pairs of carinae on the telson in addition to the median carina. P. ornata also has eye spots on the carapace but lacks mottling or spotting and, like P. ciliata, possesses only 3 pairs of carinae on the telson in addition to the median carina.

Genus Odontodactylus Bigelow, 1893

Odontodactylus scyllarum (Linnaeus, 1758)
(Fig. 6)
Manning, 1967 : 10 (revision of genus).

DIAGNOSIS: Eyes subglobular, stout, cornea rounded. Rostral plate subtriangular, apex flattened, often sulcate, unarmed anteriorly. Claw very stout, dactylus inflated basally, armed with 2-3 small teeth. Telson with median carina, carinae of marginal teeth, and 2 pairs of curved carinae next to median and converging under its apical spine. Submedian teeth of telson short, movable, bases separate, minute submedian denticles present. Total length of adults to more than 170 mm.

COLOR OF LIVING ANIMALS: Flagella of antennules and antennae red; antennal scales yellow, black distally with red setae; dactylus of claw red;
carapace with several large dark spots; thorax and abdomen with red intersegmental stripes; uropodal endopod and exopod black, bordered with bright blue, setae red. This is one of the most colorful stomatopods.

Habitat and distribution: Occurs throughout the Indo-Pacific associated with reefs in shallow water. Taken in channel between offshore islands near Phuket Marine Biological Center. (Odontodactylus cultrifer is frequently caught by fishermen in the Gulf of Thailand and seems to occur in deeper water. It is readily distinguished from O. scyllarus by its light pink color and by having a conspicuous elevated keel on the dorsal surface of the telson).

Genus Haptosquilla Manning, 1969

Haptosquilla glyptocercus (Wood-Mason, 1875) (Fig. 7)

Kemp, 1913: 186 (as Gonodactylus glyptocercus).—Serène, 1954: 10 (habitat), 51 (young stages).—Manning, 1969: 161 (key to genus).

Diagnosis: Eyes subcylindrical, cornea subglobular, not expanded laterally. Rostral plate sharply trispinous, median the longest. Dactylus of claw unarmed, outer margin inflated basally. Median part of fifth and sixth abdominal somites wrinkled dorsally. Telson with 4 pairs of marginal teeth, submedians with short movable apices, minute submedian denticles present. Telson surface with 3 dorsal elevations, surfaces deeply furrowed in symmetrical convoluted pattern. Total length of adults less than 50 mm., usually less than 35 mm. Largest Phuket individual 33 mm.

Key to species groups of Gonodactylus found at Phuket

1. Five carinae present mid-dorsally on telson. (Ocular scales small) .......... Falcatus Group
   Three carinae present mid-dorsally on telson ........................................ 2

2. Ocular scales very small, triangular or rounded. Adults not exceeding 55 mm. ... Affinis Group
   Ocular scales large, rectangular. Adults exceeding 70 or more mm. .......... Chiragra Group

Fig. 7—Haptosquilla glyptocercus; a, claw; b, telson.

Color of living animals: Body color varies from almost black to brown or gray, frequently mottled in appearance; a few animals covered with white flecks; females darker than males and all black animals were females; antennular flagella conspicuously long and striped.

Distribution and habitat: Occurs in intertidal and subtidal habitats throughout the western Pacific, from Japan and Micronesia to the African coast. Habitat is typically rubble derived from either rock or coral; often lives in tubes penetrating hard substrate. Common intertidally on the beach below the Phuket Marine Biological Center especially just to the south of the pier.
Genus *Gonodactylus* Berthold, 1827  
*Falceus* Group  
*Gonodactylus mutatus* Lanchester, 1903  
(Fig. 8)

Serène, 1954 : 10 (habitat), 80 (dimorphism; as *G. falceus var. ternatensis*).

**DIAGNOSIS:** Rostral plate as long as broad, median spine relatively short, anterior margins of plate straight or slightly concave, lateral margins divergent, anterolateral angles broadly rounded. Ocular scales very small, rounded, erect. Telson as broad as or broader than long, with 3 pairs of broad marginal teeth, laterals distinct, and with 5 primary mid-dorsal carinae. Median carina of telson usually inflated, usually with posterior spinule, long accessory.

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**Fig. 8**—**a** and **b,** telson and rostral plate (also showing ocular scales at apex of rostral spine) of *Gonodactylus ternatensis;*** c and **d,** telson and rostral plate of *G. mutatus.*
medians variously inflated, usually with posterior spinule. Anterior submedian carinæ usually inflated, unarmèd. Knob distinctly bilobed. Submedian teeth of telson each with ventral carina. Total length of adults not exceeding 60 mm., usually 40 mm. or less. Largest Phuket individual 41 mm.

COLOR OF LIVING ANIMALS : Generally dull olive brown or olive green; cuticle sometimes contains extremely fine wavy lines giving the animal a grainy appearance; depression on inner surface of merus of claw yellow or pale yellow.

HABITAT AND DISTRIBUTION : Apparently widely distributed throughout the western Indo-Pacific in coral in shallow water but often confused with G. falcatus (Forskal) and G. glabrous (Brooks) which it closely resembles. Common in living coral near the low tide line on the beach at the Phuket Marine Biological Center. It also occurs in coral at the north end of Naiyang Beach on the northern tip of Phuket Island.

Gonodactylus ternatensis De Man, 1902
(Fig. 8)
Serène, 1954:10 (habitat), 77 (dimorphism; as G. falcatus).

DIAGNOSIS : Rostral plate longer than broad, median spine long, anterior margins of plate sloping anteriorly, lateral margins divergent, anterolateral angles rounded. Ocular scales very small, rounded or flattened, erect. Telson longer, than broad, appearing elongate, with 3 pairs of sharp marginal teeth, laterals distinct, and with 5 primary mid-dorsal carinæ. Median carina of telson usually sharp, with posterior spine, long accessory medians slender, usually with posterior spinule. Anterior submedian carinæ slender, unarmèd. Knob present, not bilobed. Submedian teeth of telson each with ventral carina. Total length of adults to about 90 mm., usually greater than 50 mm. Largest Phuket individual 87 mm.

COLOR OF LIVING ANIMALS : Dark olive green with bright red intersegmental bands on thorax and abdomen; antennal scales, distal segments of walking legs, pleopods, and uropodal endopod and exopod yellow in females; in males these appendages are bright blue with elongate setæ clear proximally, bright red distally; dactylus of claw orange to pink, black spot on inner margin of carpus, depression on inner margin of merus orange, bordered with white; meral depressions often displayed in threat with orange spots conspicuous; four highly conspicuous black spots on sixth abdominal somite and telson, characteristic of Falcatus Group.

HABITAT AND DISTRIBUTION : Probably widely distributed in the Indo-Pacific, but so far specimens have been positively identified only from Samoa, the Moluccas, Viet Nam, and Phuket Island. It is a relatively common species intertidally and subtidally in living coral off the beach at the Phuket Marine Biological Center. Commonest in bases of Pocillopora spp.

Affinis Group

Gonodactylus affinis De Man, 1902
(Fig. 9)
Manning, 1968 : 51 (as G. segregatus).

DIAGNOSIS : Rostral plate as long as broad, median spine relatively short, anterior margins, of plate straight, lateral margins divergent, anterolateral angles acute, broadly rounded. Ocular scales small, squarish, erect. Telson as broad as or broader than long, with 2 pairs of sharp marginal teeth, laterals present but not separated from intermediates, and with 3 primary mid-dorsal carinæ. Median carina of telson usually inflated, usually with posterior spinule, flanked posteriorly by long accessory median carinæ, each usually with posterior spinule, converging toward and sometimes meeting under apical spine of median carina. Anterior submedian carinæ variously inflated, usually with posterior spinule. Knob absent, position often indicated by transverse swelling across posterior ends of dorsal carinæ. Subme-
dian teeth of telson lacking ventral carinae. Total length of adults less than 35 mm.

COLOR OF LIVING ANIMALS: Generally light brown or gray with an overall pinkish appearance, frequently mottled; telson often appears reddish brown; depression on inner surface of merus of claw white.

HABITAT AND DISTRIBUTION: Apparently widespread in the western Indo-Pacific but not often collected because it occurs mostly in deeper water (20 to 50 meters) than most species of Gonodactylus. Any small Gonodactylus taken at Phuket from water depths greater than 10 meters at low tide is most likely this species. Our specimens all came from depths of 10–40 meters.

Gonodactylus viridis Serène, 1954
(Fig. 9)
Serène, 1954: 10 (habitat), 75 (dimorphism, size).

DIAGNOSIS: Rostral plate as broad as or broader than long, median spine relatively short, anterior margins of plate straight or slightly concave, lateral margins divergent, anterolateral angles broadly rounded. Ocular scales very small, usually rounded, erect. Telson appearing broad, length and width subequal or width greater, with 2 pairs of blunt marginal teeth, laterals distinct but not separated from intermediates, and with 3 primary mid-dorsal carinae. Median carina variously inflated, usually unarmed posteriorly (with tubercles in juveniles), flanked posteriorly by short, unarmed accessory median carinae converging under apex. Anterior submedian carinae variously inflated, usually unarmed (each with posterior tubercles in some juveniles). Knob absent. Submedian teeth of telson lacking ventral carinae. Total length of adults usually less than 45 mm.; largest Phuket individual 55 mm.

COLOR OF LIVING ANIMALS: An extremely polymorphic species with individuals ranging from almost black to brown to green to grey to almost yellow; many individuals flecked or mottled with white; males usually darker and
females lighter but there is considerable overlap; depression on inner surface of merus of claw white.

**Habitat and Distribution**: Widespread in intertidal areas in the Indo-Malayan area. This is the most abundant species in the intertidal on the beach at the Phuket Marine Biological Center, and also occurs commonly in other rocky or coral rubble areas on Phuket Island.

**Chiragra Group**

*Gonodactylus chiragra* (Fabricius, 1781)

(Fig. 10)


**Diagnosis**: Rostral plate as long as broad, median spine relatively short, anterior margins of plate concave, lateral margins subparallel, anterolateral angles acute, narrow, but rounded. Ocular scales very large, broad, flattened. Telson as broad as or broader than long, with 2 pairs of marginal teeth, laterals present but not separated from intermediates, and with 3 primary mid-dorsal carinae. Median carina of telson variously inflated, unarmed posteriorly, flanked posteriorly by short, unarmed accessory median carinae converging under apex. Anterior submedian carinae variously inflated, unarmed. Knob absent. Submedian teeth of telson lacking ventral carinae. Ratio of abdominal width to carapace length .78 — .87; mean 82 ± .02 (N = 20). Total length of adults up to 100 mm., perhaps more; largest Phuket individual 99 mm.

**Color of Living Animals**: Males dark olive green, almost black in some large specimens, to mottled olive or brownish gray; females and smaller animals (50 mm. or less) mostly pearl gray and mottled; antennular flagella, extremities of walking legs, setae on pleopods, and distal portions of uropodal exopod and endopod pink to dark pink in females and orange to dark red orange in males; antennal scales yellow to yellow orange in males and pink in females; depression on inner surface of merus of claw white with black spot anteriorly. A color polymorphic species, but males usually darker.

**Habitat and Distribution**: Widely distributed intertidally throughout Indo-Pacific and usually common where found. It seems to be more common on continental margins and high islands than on atolls where it is largely replaced by *G. platysoma*. Abundant on the beach below the Phuket Marine Biological Center especially in shale outcroppings in the high intertidal. We have also seen it at Satthip in the Gulf of Thailand.

*Gonodactylus platysoma* Wood-Mason, 1895

(Fig. 10)


**Diagnosis**: Rostral plate as broad as or broader than long, median spine relatively short, anterior margins of plate concave, lateral margins subparallel or slightly divergent, anterolateral angles acute but rounded. Ocular scales very large, broad, flattened. Telson usually broader than long, with 2 pairs of marginal teeth, laterals completely absent, and with 3 primary mid-dorsal carinae. Median carina of telson usually slender, unarmed posteriorly, flanked posteriorly by very short, unarmed accessory median carinae converging under apex. Anterior submedian carinae usually slender, unarmed. Knob absent. Ratio of abdominal width to carapace length .86 — .99; mean .91 ± .05 (N = 6). Submedian teeth of telson lacking ventral carinae. Total length of adults to at least 90 mm.

**Color of Living Animals**: Generally greyish or brownish but quite mottled in appearance; much green mottling on telson; antennular and antennal flagella pink; dactylius of claw pale blue, propodus bluish pink; depression on inner surface of merus of claw white; outer margin of tergite of last thoracic somite orange bound-
ed mesially by blue; posterior outer margin of penultimate abdominal tergite also possesses orange spot bounded by blue; the two pairs of orange and blue spots are diagnostic for *G. platysoma*. The abdomen appears broader than in any other species of *Gonodactylus*.

Males darker than females, but otherwise not polymorphic for color or pattern.

**Habitat and Distribution**: Widely distributed intertidally in the Indo-Pacific mostly on islands and atolls. Like *G. smithii* often...
associated with *Porites* “wheels”. The only specimen we collected on Phuket Island was taken intertidally from living coral at the north end of Naiyang Beach. It apparently is not common at Phuket because we failed to find more specimens in spite of intensive searching.

Gonodactylus smithii Pocock, 1893

(Fig. 11)


**Diagnosis:** Rostral plate as broad as or broader than long, median spine relatively short, anterior margins of plate concave, lateral margins divergent, anterolateral angles pointed but not sharply spinous. Ocular scales very large, broad, flattened. Telson proportions variable, often appearing elongate, with 2 pairs of marginal teeth, laterals present but not separate from intermediates, and with 3 primary mid-dorsal carinae. Median carina of telson usually sharp, with posterior spine, flanked posteriorly by very short, unarmed accessory median carinae converging under apex. Anterior submedian carinae usually slender, unarmed. Knob absent. Submedian teeth of telson lacking ventral carinae. Total length of adults to more than 70 mm.; largest Phuket individual 69 mm.

**Color of living animals:** Generally very dark green although a few animals (less than 5 percent) were a pale bluish green; some animals flecked with white, others displaying pairs of white dots on one or more thoracic or abdominal segments; outer distal margin of propodus and distal portion of dactylus of claw dark blue making distinct blue spot visible when these folded beneath merus; depression on inner margin of merus of claw purple with white margin and very conspicuous; meral depressions particularly obvious in threat display which is performed frequently by individuals of this species.

**Habitat and distribution:** Widely distributed intertidally throughout the Indo-Pacific. It is particularly likely to be associated with coral “mushrooms” or “wheels” formed by living *Porites*. In Phuket found in association with *Porites lutea* and other living coral on the beach at the Marine Biological Center.

**V. SUMMARY**

1. Several species of stomatopod were collected from the waters around Phuket Island. These included species from the families Lysiosquillidae, Squillidae, and Gonodactylidae.

2. The distribution of Gonodactylidae was studied in the intertidal zone at Laem Pan Wa near the Phuket Marine Biological Center. Seven species were found and were distributed from the high intertidal to the subtidal. The burrows of the large lysiosquillid, *L. tredecimdentata*, also were found here.

3. All families and species found on Phuket Island are described and keys are provided. Descriptions of species include notes on distribution and on the color of living animals.
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