

## Report On The Ophiurans Of Palao, Caroline Islands

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## REPORT ON THE OPHIURANS OF PALAO, CAROLINE ISLANDS<sup>1)</sup>

Shiro MURAKAMI

### INTRODUCTION

The Palao, or Pelew, group of the South Sea Islands under Nipponese Mandate, lies  $134^{\circ} 10' - 134^{\circ} 43'$  E. Long.,  $6^{\circ} 50' - 8^{\circ} 05'$  N. Lat., or 500 miles north of New Guinea and about 500 miles east of Davao, Philippine Islands. It is composed of two atolls, several larger islands, and numerous limestone islets, arranged from south to north. Each of the islands is surrounded by coral reefs. On both the east and west sides of the group there are lagoons, one on each side, protected by a barrier reef. Further in Palao, between the islands Korōru and Oropusyakaru, there is a bay called Iwayama Bay, which is under no direct influence of the open sea, being called "lagoon in lagoon" or "inner lagoon". The physical, oceanographical and biological conditions of this lagoon differ from those of the others mentioned above. Accordingly great interest is foreseen in a study of the marine fauna of Palao not only faunistically but also ecologically.

The Ophiurans of Palao have already been dealt with by several authors, but our knowledge of them is not to be looked upon as satisfactory, for the species known so far from the region are only sixteen in number. I was fortunate enough to stay at Palao for the purpose of studying Ophiurans there, from Dec. 1937 to June 1938, enjoying the membership of the Palao Tropical

<sup>1)</sup> Contributions from the Zoological Laboratory, Kyūsyū Imperial University, No. 162; Papers from the Anakusa Marine Biological Laboratory, No. 86.

Biological Station. During my stay at Palao, I engaged in collection mainly on reef flats, and sometimes dredging was tried in the outer lagoon. As the result of these, I was able to make a good collection of Ophiurans and to add some interesting facts to our knowledge.

Before going further I must acknowledge my warmest thanks to Professor Dr. H. OHSHIMA for his kind guidance given to me during the study. I must also express my indebtedness to the Japan Society for the Promotion of Scientific Research for its financial aid; and to Dr. S. HATAI, the then Director of the Station, for the opportunity of studying at the station. My thanks are also due to Professor Dr. R. KÖKETSU of the Kyūsyū Imperial University who kindly recommended me as member of the station. Further I must express my gratitude to Messrs. Y. HANEDA, H. SIMAZU and I. KAWAKAMI, colleagues of mine during the stay at Palao, and Mr. R. WADA, for their kind assistance rendered me in collecting materials. The photographs are from the hands of Mr. K. YASUMOTO of the Zoological Laboratory of the Kyūsyū Imperial University.

### GENERAL

The first author to mention the Ophiurans from the Palao group was Th. LYMAN, who reported the following species from the district in 1874, based on C. SEMPER's collection.

1. *Ophiactis sexradia* (GRUBE)  
= *Ophiactis savignyi* (MÜLLER et TROSCHER)
2. *Ophiothrix elegans* LÜTKEN
3. *Ophiothrix longipeda* (LAMARCK)  
= *Macrophiothrix longipeda* (LAMARCK)
4. *Ophiolepis cincta* MÜLLER et TROSCHER
5. *Ophiarachna incrassata* (LAMARCK)
6. *Pectinura gorgonia* (MÜLLER et TROSCHER)  
= *Ophiarachnella gorgonia* (MÜLLER et TROSCHER)
7. *Pectinura infernalis* (MÜLLER et TROSCHER)  
= *Ophiarachnella infernalis* (MÜLLER et TROSCHER)
8. *Ophiocoma brevipes* PETERS
9. *Ophiocoma erinaceus* MÜLLER et TROSCHER
10. *Ophiocoma scolopendrina* (LAMARCK)

11. *Ophiomastix annulosa* (LAMARCK)
12. *Ophiomastix mixta* LÜTKEN
13. *Ophiarthrum elegans* PETERS
14. *Ophiarthrum pictum* (MÜLLER et TROSCHEL).

Further, LYMAN reported two species from Palao in 1882, L. DÖDERLEIN one species in 1888, and H. L. CLARK three species in 1909, but they added no new Ophiurans to those included in the foregoing list.

In 1915 CLARK reported thirteen species from Palao, among which one species was new to the fauna, namely :

*Ophiothrix trilineata* LÜTKEN.

Finally in 1921 CLARK added :

*Ophiocoma brevipes* var. *variegata* (SMITH).

In the present paper forty species and one variety are described, among which twelve species were already known from the district, fifteen species and one variety are new to the fauna, and thirteen species seem to be new to science, among which two belong to new genera. The complete list being :

1. *Ophiactis hemiteles* CLARK \*<sup>1)</sup>
2. *Ophiactis macrolepidota* MARKTANNER \*
3. *Ophiactis modesta* BROCK \*
4. *Ophiactis savignyi* (MÜLLER et TROSCHEL)
5. *Amphioplus iustus* sp. nov.
6. *Amphioplus platyacanthus* sp. nov.
7. *Amphipholis squamata* (DELLE CHIAJE) \*
8. *Amphiura crossola* sp. nov.
9. *Amphiura leptolepis* sp. nov.
10. *Amphiura macroscytalia* sp. nov.
11. *Ophiothrix armata* KÖHLER \*
12. *Ophiothrix scotiosa* sp. nov.
13. *Macrophiiothrix longipeda* (LAMARCK)
14. *Ophiothela danæ* VERRILL \*
15. *Ophiolepis annulosa* MÜLLER et TROSCHEL \*
16. *Ophiolepis cardioplax* sp. nov.
17. *Ophiolepis cincta* MÜLLER et TROSCHEL
18. *Ophioplocus imbricatus* (MÜLLER et TROSCHEL) \*

<sup>1)</sup> Those marked with an asterisk(\*) are the forms recorded as new to the fauna of Palao.

19. *Ophiotylos leucus* g. et sp. nov.
20. *Ophiurodon cinctum* (BROCK) \*
21. *Ophiurodon cupidum* (KOEHLER) \*
22. *Ophiopezella spinosa* (LJUNGMAN) \*
23. *Ophiarachnella gorgonia* (MÜLLER et TROSCHEL)
24. *Ophiarachnella infernalis* (MÜLLER et TROSCHEL)
25. *Ophiocryptus pacificus* sp. nov.
26. *Ophioclastus hataii* g. et sp. nov.
27. *Ophiocrasis thryptica* sp. nov.
28. *Ophiocoma brevipes* PETERS
29. *Ophiocoma erinaceus* MÜLLER et TROSCHEL
30. *Ophiocoma latilanxa* sp. nov.
31. *Ophiocoma scolopendrina* (LAMARCK)
32. *Ophiomastix annulosa* (LAMARCK)
33. *Ophiomastix asperula* LÜTKEN \*
34. *Ophiomastix bispinosa* CLARK \*
35. *Ophiomastix caryophyllata* LÜTKEN \*
36. *Ophiomastix mixta* LÜTKEN
37. *Ophiomastix palaoensis* sp. nov.
38. *Ophiomastix variabilis* KOEHLER \*
39. *Ophiarthrum elegans* PETERS
- 39'. *Ophiarthrum elegans* var. *unicolor* CLARK \*
40. *Ophiarthrum pictum* MÜLLER et TROSCHEL.

*Ophiothrix elegans*, *Ophiothrix trilineata*, *Ophiarachna incrassata* and *Ophiocoma brevipes* var. *variegata*, which were already reported from Palao, could not be collected by myself. Thus, all the known forms are referable to forty-three species and two varieties. Among them, *Ophiurodon cupidum*, *Ophiopezella spinosa*, *Ophiocoma latilanxa*, *Ophiomastix asperula*, *Ophiomastix caryophyllata* and *Ophiarthrum elegans* var. *unicolor* had not then been known to occur from Nipponese territory, but later they were found by me at Isigaki-sima and will be dealt with in the paper following this article. The forms known from Palao may be divided into four groups as follows, from the distributional standpoint:

I. Cosmopolitan species, which are widely distributed in both the Indo-Pacific and Atlantic, but not in the Arctic and Antarctic. The species to be referred to this group, and their known northern limits in the North Pacific are as follows:

<i>Ophiactis savignyi</i>	Misaki
<i>Amphipholis squamata</i>	Philippine Islands.
2 species.	

II. Indo-Pacific species, which range from the Indian Ocean to the Pacific Ocean. The species to be referred to here, and their known northern limits are as follows:

<i>Ophiothrix trilineata</i>	Isigaki-sima <sup>1)</sup>
<i>Macrophiothrix longipeda</i>	Kōminato
<i>Ophiolepis annulosa</i>	Okinawa
<i>Ophiolepis cincta</i>	Isigaki-sima
<i>Ophioplocus imbricatus</i>	Okinawa
<i>Ophiarachna incrassata</i>	Okinawa and Ogasawara (Bonin) Islands
<i>Ophiarachnella gorgonia</i>	Misaki districts
<i>Ophiarachnella infernalis</i>	Eno-ura
<i>Ophiocoma brevipes</i>	South Izu
<i>Ophiocoma brevipes</i> var. <i>variegata</i>	Hawaii
<i>Ophiocoma erinaceus</i>	Yaéyama
<i>Ophiocoma scolopendrina</i>	Kagosima Bay
<i>Ophiomastix annulosa</i>	Senkaku (Pinnacle) Islands
<i>Ophiarthrum elegans</i>	Okinawa.

13 species and 1 variety.

III. Pacific species, which occur in the Pacific Ocean, including the Malaysian waters. The species belonging here, and their known northern limits are as follows:

<i>Ophiactis hemiteles</i>	Palao
<i>Ophiactis macrolepidota</i>	Uruga Channel
<i>Ophiactis modesta</i>	Misaki districts
<i>Ophiothrix armata</i>	Banda
<i>Ophiothrix elegans</i>	China Sea
<i>Ophiothela danae</i>	Misaki districts
<i>Ophiurodon cinctum</i>	Sulu Archipelago
<i>Ophiurodon cupidum</i>	Isigaki-sima
<i>Ophiopezella spinosa</i>	Isigaki-sima
<i>Ophiocoma latilanxa</i>	Isigaki-sima

<sup>1)</sup> See the other paper following this article: Report on the Ophiurans of Yaéyama, Ryukyu. Vol. 7, no. 5.

<i>Ophiomastix asperula</i>	Isigaki-sima
<i>Ophiomastix bispinosa</i>	Palao
<i>Ophiomastix caryophyllata</i>	Isigaki-sima
<i>Ophiomastix mixta</i>	Misaki districts
<i>Ophiomastix variabilis</i>	East Indies
<i>Ophiarthrum elegans</i> var. <i>unicolor</i>	Isigaki-sima
<i>Ophiarthrum pictum</i>	Isigaki-sima.

16 species and 1 variety.

IV. Palao species, which are only known from the islands of Palao and its vicinity. The following species belong here:

<i>Amphioplus iustus</i>
<i>Amphioplus platyacanthus</i>
<i>Amphiura crossota</i>
<i>Amphiura leptolepis</i>
<i>Amphiura macroscytalia</i>
<i>Ophiothrix scotiosa</i>
<i>Ophiolepis cardioplax</i>
<i>Ophiotylos leucus</i>
<i>Ophiocryptus pacificus</i>
<i>Ophioclastus hataii</i>
<i>Ophiocraasis thryptica</i>
<i>Ophiomastix palaoensis</i> .

12 species.

While in Palao I made collecting excursions for Ophiurans at many localities, namely Garukoru, Garakakuraa, Gatomeru, Ogiwaru, Korōru-reef, Arumizu Passage, Iwayama Bay, Palao Harbour, Gadaraku-reef, Auguruperyū-reef, Kayangusu Island, Periryū (Peleliu) Island and west outer lagoon. These localities are in different ecological conditions, and thus, it is very interesting to treat them under separate headings.

#### I. Intertidal zone.

1. The zone which is generally protected from direct influences of the open sea, and its bed is covered with dead coral fragments, living corals and seaweeds, under which the coral sand is concealed. Geruherugairu and Regio Passage of Iwayama Bay, and Korōru-reef near the Korōru Harbour belong to this zone. The Ophiurans found mainly in these areas are as follows:

*Amphioplus iustus*  
*Amphioplus platyacanthus*  
*Amphipholis squamata*  
*Amphiura crossota*  
*Amphiura leptolepis*  
*Ophiothrix scotiosa*  
*Ophiolepis cardioplax*  
*Ophiotylos leucus*  
*Ophiurodon cinctum*  
*Ophiurodon cupidum*  
*Ophiarachnella infernalis*  
*Ophioclastus hataii*  
*Ophiocrasis thryptica*  
*Ophiomastix asperula*  
*Ophiomastix caryophyllata*  
*Ophiomastix bispinosa*  
*Ophiomastix variabilis.*

2. The areas generally facing the open sea or outer lagoon, and the flats being covered with solid rock or coral sand. Garakakurao, Garukoru, Ogiwaru, Auguruperyū-reef, Gadaraku-reef and Periryū belong to this zone. The Ophiurans occurring in these areas are as follows:

*Macrophiothrix longipeda*  
*Ophiolepis annulosa*  
*Ophioplocus imbricatus*  
*Ophiopezella spinosa*  
*Ophiarachnella gorgonia*  
*Ophiocoma brevipes*  
*Ophiocoma scolopendrina*  
*Ophiomastix annulosa*  
*Ophiomastix mixta.*

II. Under the low water mark.

3. The zone where the water is several metres deep, and the bed is not exposed at low-tide. The greater part of Palao Harbour and the slope of the passage of Iwayama Bay belong to this zone. Eleven species are found in these areas, among which nine occur also at one or all of the foregoing zones. Therefore, only two are restricted to this zone.



<i>Ophiocoma latilanxa</i>	Palao Harbour
<i>Ophiactis modesta</i>	Iwayama Bay.

4. The west outer lagoon represents another zone. There the water is about 20 to 50 metres deep. The following are the members occurring in this zone.

<i>Ophiactis hemiteles</i>
<i>Ophiactis macrolepidota</i>
<i>Amphiura macroscytalia</i>
<i>Ophiothela danae</i> .

*Ophiactis savignyi* is found in each area, usually hiding itself in the sponge.

Further, I visited Tokobei Island for investigation of the Ophiuran fauna, and was able to collect seven species, which will also be reported in the present paper. Among them, *Ophiocoma pica* is recorded for the first time from the Nipponese territory. Recently I could find this species at Isigaki-sima also.<sup>1)</sup> The other species, *Ophiarachna incrassata*, is not to be found among my collection of Palao, though it has already been reported from there. The Ophiurans of the above named island are as follows.

1. *Ophiarachna incrassata* (LAMARCK)
2. *Ophiocoma erinaceus* MÜLLER et TROSCHEL
3. *Ophiocoma pica* MÜLLER et TROSCHEL
4. *Ophiocoma scolopendrina* (LAMARCK)
5. *Ophiomastix annulosa* (LAMARCK)
6. *Ophiarthrum elegans* PETERS
7. *Ophiarthrum pictum* (MÜLLER et TROSCHEL).

The materials are all preserved at the Amakusa Marine Biological Laboratory of Kyūsyū Imperial University.

## SYSTEMATICS

### Family Amphiuridae

#### Subfamily Ophiactinae

##### 1. *Ophiactis hemiteles* CLARK

CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 262, pl. X, figs. 7-8. —1921, Dept. Mar. Biol. Carnegie Inst., X, p. 108, pl. XVI, fig. 1.

<sup>1)</sup> See the other paper which follows this article: Report on the Ophiurans of Yaeyama, Ryūkyū. Vol. 7, no. 5.

Locality.—One specimen; off Gasupan, west lagoon, 50 metres, Feb. 21, 1938.

Distribution.—Torres Strait.

The specimen at hand is 2.5 mm across the disk, with arms measuring 23 mm in length. It is somewhat different from the type; the number of arm spines, five or six, is smaller than, and the squamation of the disk is coarser than, in the type. But these differences seem to be of no specific value, probably due to difference in age, for the type is said to be 5 mm across the disk.

### 2. *Ophiactis macrolepidota* MARKTANNER

MARKTANNER-TURNERETSCHER, 1887, *Ann. k. k. nat. Hofmus.*, II, p. 298, pl. XII, figs. 12-13. MATSUMOTO, 1917, *Journ. Coll. Sci., Imp. Univ. Tokyo*, XXXVIII, 2, p. 155, fig. 37. MURAKAMI, 1942, *Journ. Dept. Agric., Kyūsyū Imp. Univ.*, VII, 1, p. 8.

Locality.—Fourteen specimens; off Gasupan, west lagoon, 50 metres, Feb. 21, 1938.

Distribution.—Uraga Channel; South Izu; New South Wales; Amboina.

### 3. *Ophiactis modesta* BROCK

BROCK, 1888, *Zeit. f. wiss. Zool.*, XLVII, 3, p. 482. DÖDERLEIN, 1896, *Simon-Zool. Forschungen*, V, p. 285, pl. XIV, fig. 1, pl. XV, figs. 5-5b. MATSUMOTO, 1917, *Journ. Coll. Sci., Imp. Univ. Tokyo*, XXXVIII, 2, p. 156, fig. 38.

Localities.—Forty-nine specimens; Kaki Passage, Iwayama Bay, 3-4 metres, May 25, 1938. Forty-five specimens; B-division, Iwayama Bay, littoral, May 27, 1938.<sup>1)</sup>

Distribution.—Misaki; Amboina; Torres Strait.

### 4. *Ophiactis savignyi* (MÜLLER et TROSCHEL)

*Ophiolepis savignyi*: MÜLLER et TROSCHEL, 1842, *Sys. Ast.*, p. 95.

*Ophiactis sexradia*: LYMAN, 1874, *Bull. Mus. Comp. Zool.*, III, 10, p. 253.

*Ophiactis savignyi*: CLARK, 1915, *Mem. Mus. Comp. Zool.*, XXV, 4, p. 265. MATSUMOTO, 1917, *Journ. Coll. Sci., Imp. Univ. Tokyo*, XXXVIII, 2, p. 158, fig. 39. MURAKAMI, 1942, *Journ. Dept. Agric., Kyūsyū Imp. Univ.*, VII, 1, p. 8.

Localities.—Eight specimens; D-division, Iwayama Bay, littoral, Dec. 18, 1937. One specimen; K-division, Iwayama Bay, littoral, Dec. 19, 1937. Two specimens; same locality, littoral, Dec. 19, 1937. Thirty-one specimens; C-division, Iwayama Bay, littoral, Dec. 21, 1937. Four specimens; off Gasupan, west lagoon, 50 metres, Feb.

<sup>1)</sup> These divisions of Iwayama Bay are according to ARE, EGUCHI and HIRA.

21, 1938. Twenty-five specimens; Gatomeru, littoral, March 13, 1938. Five specimens; G-division, Iwayama Bay, littoral, March 22, 1938. Eight specimens; J-division, Iwayama Bay, littoral, March 24, 1938. One specimen; south coast of Garugoru Island, Palao Harbour, littoral, March 25, 1938. Nineteen specimens; Geruherugairu, Iwayama Bay, littoral, March 26, 1938. Four specimens; Korōru-reef near Korōru Harbour, littoral, March 29, 1938. Twenty-eight specimens; B-division, Iwayama Bay, littoral, April 3, 1938. One specimen; O-division, Iwayama Bay, littoral, April 20, 1938. One specimen; Gadaraku-reef, littoral, April 21, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Eight specimens; same locality, littoral, May 7, 1938. Six specimens; Kaki Passage, Iwayama Bay, littoral, May 20, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 30, 1938. One specimen; same locality, littoral, June 6, 1938. One specimen; north coast of Urukutāpuru, Palao Harbour, 2-3 metres, June 12, 1938.

Distribution.—Misaki; Izu; Malaysian waters; Australia; Sandwich Islands; Gulf of California; West Indies.

#### Subfamily Amphiurinae

#### 5. *Amphioplus iustus* sp. nov.<sup>1)</sup>

(Text-fig. 1)

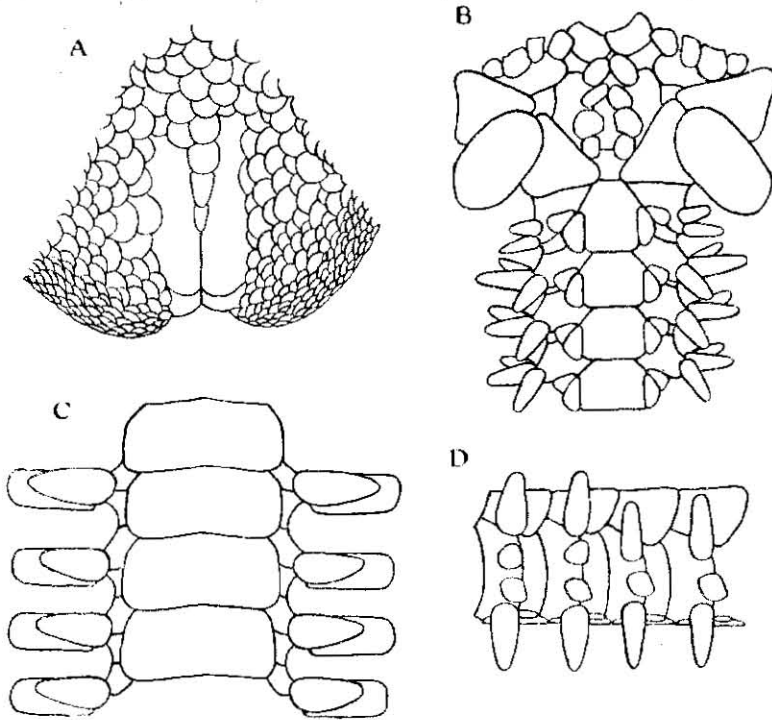
The specimens at hand are in good state of preservation, but their disk was shed after capture. Disk about 7 mm in diameter; arms about 80 mm long.

Disk five-lobed, concave at the interradial border, covered with numerous fine, imbricating scales. Primary plates indistinct. Radial shields small, about two-fifths of the disk radius in length, slender, much longer than broad, tapering within, broadening distally; each pair diverging proximad intervened by several scales. Interbranchial spaces below also covered with scaling similar to, but smaller than, that of the disk above.

Oral shields moderate, lens-shaped, about two times as long as wide. Madreporite large, pentagonal, much longer than broad. Adoral shields rather large, somewhat triangular, meeting within, producing an outer lobe, which separate the first side arm plate

<sup>1)</sup> *Iuxta*, signifying *near to*, in reference to the similarity of the species to *A. parviclypeus*.

from the oral shield. Oral plates higher than broad. Oral papillae four on a side of an oral angle; the distal one small; following



Text-fig. 1. *Amphioplus iustus*

A. From above. B. From below. C. Dorsal view of four arm joints near disk. D. Side view of four arm joints near disk.  $\times 21$ .

two large, tetragonal, thin; one at the apex of jaw very thick, but blunt at the tip. Teeth four in number on a jaw, tetragonal; the dorsal one longer than broad, but the undermost one broader than long and very thick.

Arms broader than high and broadest at some distance from the disk. Dorsal arm plates well developed, tetragonal, with rounded disto-lateral angles, about three times as broad as long, distal border somewhat concave, broadly in contact with each other. Those near the disk are not so broad as those at the middle of arm. First ventral arm plate very small, quadrangular, about as broad as long. Second one hexagonal, longer than broad. Following ones pentagonal or tetragonal, with rounded angles, in contact

with each other; at first longer than broad, but becoming broader than long distally. Side arm plates small, not meeting both above and below. Arm spines three to five on each side arm plate, subequal, somewhat longer than an arm segment, flat and blunt at the tip; the second from below rough on the surface and quadrangular in shape. Tentacle scales two to each pore, set at right angles to each other, very large; the adradial larger than the abradial.

Colour (dried from alcohol) gray.

Locality.—Three specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938.

The present species is very closely related to *A. parviclypeus* CLARK, but is easily distinguished from it by the disk shape being concave at the interradial border, and by the larger, but not completely separated, radial shields.

6. *Amphioplus platyacanthus* sp. nov.<sup>1)</sup>

(Text-fig. 2)

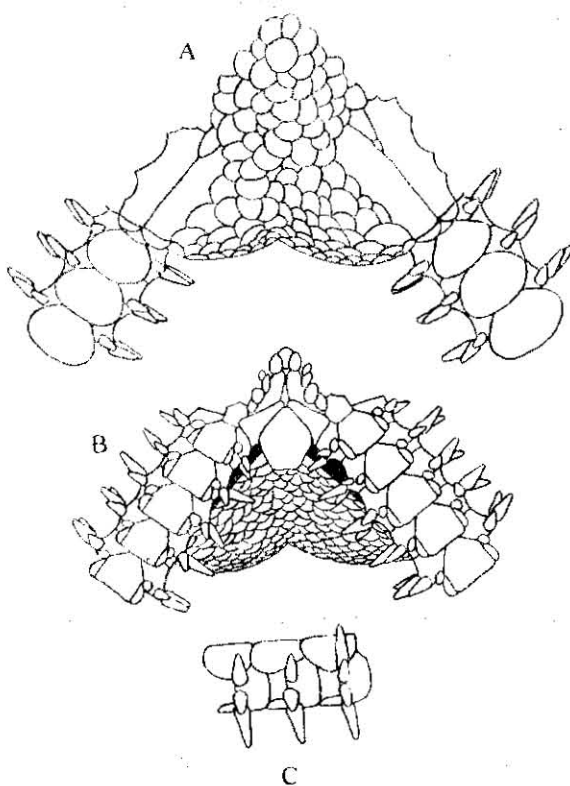
Disk small, not exceeding 3 mm in diameter; arms very long, 16 to 19 mm long. Disk pentagonal, somewhat excavated at the interradial border, covered with numerous coarse, rounded scales, which are more or less overlapping. Primary plates indistinguishable. Radial shields elongate, slightly less than one half of disk radius in length, about three times as long as wide, pointed within, rounded distally, in contact with each other along the distal two-thirds of their length, separated inwardly by a small triangular scale. Interbranchial spaces below covered with many imbricating scales.

Oral shields moderate, arrow-head shaped or pentagonal, longer than broad. Adoral shields somewhat triangular, about two times as long as broad, fully in contact within, separating the first side arm plate from the oral shield distally. Oral papillae four on a side of an oral angle; one at the apex of jaw thick and rounded; following two flat, with a rounded margin; distal one rudimentary, scale-like. Genital slits moderate.

Dorsal arm plates well developed, much broader than long, more or less triangular, each border gently curved and joined

<sup>1)</sup> *Plaxis*, signifying *flat*, and *axax*, signifying *spine*, in reference to the flat middle arm spine.

together by a wide rounded angle; they are in contact with each other till near the tip of arm. First ventral arm plate small, pentagonal, longer than wide. Following plates also pentagonal, longer than broad, with a wide proximal angle and a slightly convex distal margin, in contact with each other except those at the distal part of arm. Side arm plates small, not meeting both above and below. Arm spines three, but rarely four near the disk, small, subequal, about as long as a joint; the upper and under ones pointing, while the middle one flat, rough and blunt



Text-fig. 2. *Amphioplus platyacanthus*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 21$ .

at the tip. Tentacle scales two to each pore, set at right angles to each other; the adradial one larger than the abradial one.

Colour (dried from alcohol) white or yellowish gray.

Localities.—Four specimens; Geruherugairu, Iwayama Bay, littoral, March 21, 1938. Nine specimens; same locality, littoral, May 7, 1938. Ten specimens; same locality, littoral, June 11, 1938.

The present species is very near to *A. laevis* (LYMAN), but is distinguished from it by the coarse scaling of disk, by the longer under arm plates, by the scale-like distal oral papillae, by the slender arms and by the flat middle arm spines.

#### 7. *Amphipholis squamata* (DELLE CHIAJE)

*Asterias squamata*: DELLE CHIAJE, 1828, Mem. anim. Vert. Napoli, 3, p. 74.<sup>1)</sup>

*Amphipholis squamata*: CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 242.

MORTENSEN, 1927, Handbook Ech. British I., p. 221, fig. 125.

Localities.—One specimen; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Eight specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938, and Geruherugairu, Iwayama Bay, littoral, June 11, 1938. Six specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938.

Distribution.—Indo-Pacific and Atlantic Oceans.

This is a small, viviparous and cosmopolitan Ophiuran, which is replaced by *A. japonica* in the Nipponese waters.

#### 8. *Amphiura crossota* sp. nov.<sup>2)</sup>

(Text-fig. 3)

Disk contracted, but probably more than 4 mm in diameter; arms 30 to 35 mm long. Disk pentagonal, slightly concave at the interradiial border, naked at centre and in the interradii, but around the radial shields there are about five series of delicate, fine scales. Radial shields much longer than broad, about four times as long as wide, scarcely in contact without, slightly diverging proximally. Interbranchial spaces below naked.

Oral shields moderate, somewhat longer than broad, with proximal and distal angles rounded. Adoral shields rather large, triangular, with margins concave, not meeting within, separating the first side arm plate from the oral shield. Oral papillae two on each side; one at the apex of jaw rounded; the distal one

<sup>1)</sup> Not accessible to me.

<sup>2)</sup> Κροσσωτός, signifying *fringed*, in reference to the fringed radial shields.

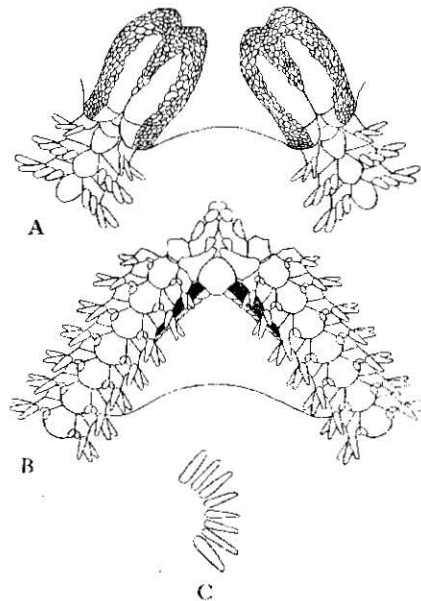
longer than broad, bluntly pointed. A sharply pointed additional one is visible high up on the oral jaw.

One or two basal dorsal arm plates broader than long; following four or five longer than broad, but soon becoming again broader than long distally; proximal border three-sided, distal one rounded; at first scarcely in contact with each other, but soon becoming broadly so distally. First ventral arm plate hexagonal, as broad as long. Following ones tetragonal, broader without than within, with a curved distal border; at first longer than broad, but gradually becoming broader than long without; broadly in contact with each other through the length. Side arm plates very narrow, not meeting both above and below; each carries six, seven or eight subequal, flat, blunt arm spines, among which the undermost one is slightly longer; third and fourth from below are usually pointed posteriorly. Tentacle scales two to each pore, very small.

Colour (dried from alcohol): disk blackish besides the radial shields and their margin which is white; arms whitish; spines tinged with purplish brown.

Locality.—Seven specimens; Geruherugairu, Iwayama Bay, littoral, May 30, 1938.

The present species is very near to *A. diacritica* CLARK, but is easily distinguished from it by the longer radial shields, by the large adoral shields, by a smaller amount of squamation of disk and by the rather thin distal oral papillae.



Text-fig. 3. *Amphiura crossota*

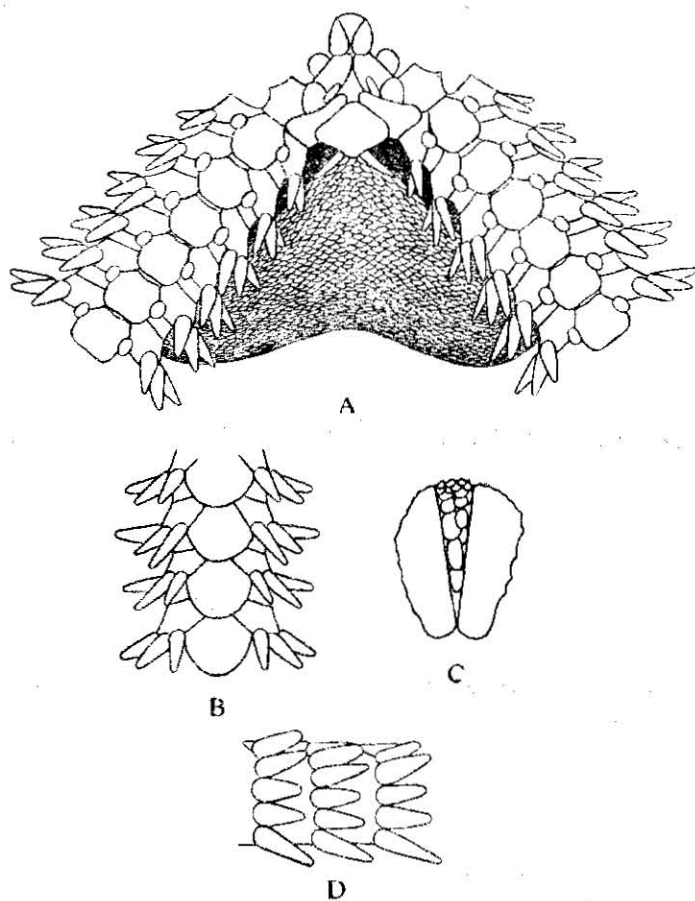
A. From above. B. From below. C. Arm spines of one side of an arm joint near disk.  $\times 10.5$ .



9. *Amphiura leptolepis* sp. nov.<sup>1)</sup>

(Text-fig. 4)

The single specimen at hand has its disk broken, but presumably it measured 3 mm in diameter; arms also broken at different distances from the disk, but the longest one measures 24 mm long.

Text-fig. 4. *Amphiura leptolepis*

A. From below. B. Dorsal view of four arm joints near disk.  
C. Radial shields. D. Side view of three arm joints near disk.  $\times 21$ .

<sup>1)</sup> Λεπτός, signifying *fine*, and λεπίς, signifying *scale*, in reference to the fine disk scales.

Disk five-lobed, concave at the interradiial border, covered with many small, imbricating scales. Radial shields rather large, about two-thirds as long as the disk radius, adradial border straight, abradial one very convex, proximal end pointed, distal one rounded, meeting distally, separated within. Interbrachial spaces below also covered with a scaling similar to that of the disk. Genital slits conspicuous. Genital scales indistinct.

Oral shields moderate, in the shape of a diamond with rounded angles, broader than long, but the madreporite as long as broad. Adoral shields long and narrow, broader without than within, not meeting proximally. Oral plates much higher than broad. Oral papillae two on a side; one at the apex of jaw thick and conical, rather pointed within; distal one inserted in the adoral shield, long and narrow, but blunt at the tip. Oral tentacle scales flat, about two times as broad as long, tightly closing the oral slits.

Arms slender. Dorsal arm plates well developed; those on the proximal part of arm somewhat elliptical, slightly broader than long, but those on the middle part of arm being much broader than long, biconvex, with lateral angles rounded; further distally they become as long as broad, having a proximal margin three-sided and a distal margin very convex or semicircular. They are all in contact with each other. First ventral arm plate small, hexagonal, longer than broad. Following ones tetragonal or pentagonal; at first they are somewhat longer than broad, but soon becoming as long as broad distally. Side arm plates slender, not meeting both above and below; each carries four or five short, stout, blunt arm spines, among which the undermost one is largest, and somewhat longer than a joint; two spines situated in the middle rather flat. Tentacle scale one to each pore, moderate, rounded.

Colour (dried from alcohol) light gray.

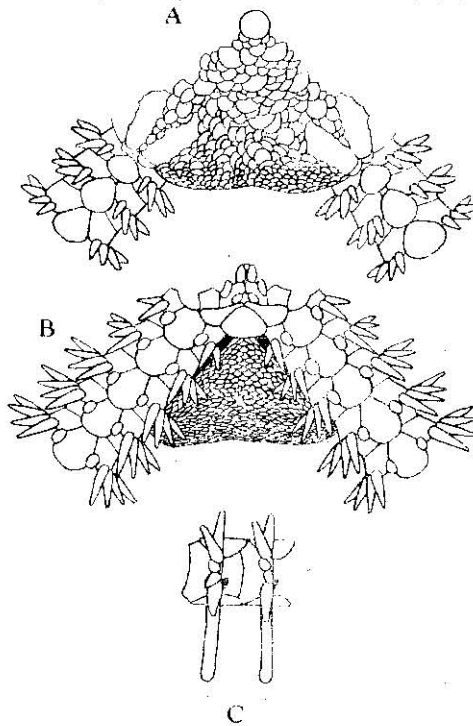
Locality.—One specimen; Korōru-reef, littoral, date unknown.

The present species is very similar to *A. ficta* KÖHLER and *A. velox* KÖHLER, but is easily distinguished from them by the diamond-shaped oral shields, by the broader radial shields, by the conical inner oral papillae and by the number of arm spines.

10. *Amphiura macroscytalia* sp. nov.<sup>1)</sup>

(Text-fig. 5)

Disk about 3 mm in diameter; arms broken, but the longest about 8 mm long. Disk pentagonal or rounded, covered with numerous small, imbricating scales, of which the primary and five interradial plates are distinguishable. Radial shields rather small, less than half the disk radius in length, separated from each other by intervening scales or sometimes meeting distally, about three

Text-fig. 5. *Amphiura macroscytalia*

A. From above. B. From below. C. Side view of two arm joints near disk.  $\times 21$ .

times as long as broad. Interbrachial spaces below covered with a smooth coat of small, imbricating scales.

<sup>1)</sup> *Μακρός*, signifying *long*, and *στυλίου*, signifying *stick*, in reference to the long undermost arm spine.

Oral shields moderate, rhomboidal or triangular, as long as broad or a little broader than long, with angles rounded. Adoral shields triangular, tapering proximally, not meeting within, but sometimes in contact without. Oral papillae two on a side; proximal one somewhat thick and conical; distal one small, flat, with a rounded margin. Oral tentacle scales flat and broad, in contact with each other so as to close the mouth slits. Genital slits inconspicuous.

Dorsal arm plates somewhat rhomboidal, with distal and lateral angles rounded, a little wider than long except basal one or two plates, in contact with each other till near the tip of arm. First ventral arm plate small, pentagonal, about as wide as long. Following plates tetragonal or pentagonal, longer than broad, with rounded disto-lateral angles; each plate has a special transparent mark on the proximal part. Side arm plates narrow, not meeting both above and below. Arm spines five or six, but there are only three near the tip of arm; from ninth to sixteenth joint, the undermost is very elongate, about two times as long as a joint, slightly curved, and has a blunt tip; the remaining ones are subequal and about as long as a joint. Tentacle scale one to each pore, oval.

Colour (dried from alcohol) whitish.

Locality.—Three specimens; off Gasupan, west lagoon, 20 metres, Feb. 21, 1938.

The present species is closely related to *A. spinipes* MORTENSEN, but differs from it in the larger radial shields and in the rounded distal oral papillae. Further *A. macroscytalia* is allied to *A. magellanica* LJUNGMAN, but is distinguished from it by the rhomboidal or triangular oral shields, by the larger radial shields, by the rhomboidal dorsal arm plates, and by not being viviparous.

#### Family Ophiotrichidae

##### 11. *Ophiothrix armata* KEHLER

KEHLER, 1905, Siboga-Exp., Oph. Litt., p. 103, pl. X, figs. 1-2. —1922, U. S. Nat. Mus., Bull. 100, V, p. 208, pl. LVII, figs. 3-6, pl. XCVII, fig. 2.

Localities.—Eleven specimens; A-division, Iwayama Bay, littoral, Dec. 17, 1937. Twenty-five specimens; D-division, Iwayama Bay, littoral, Dec. 18, 1937. Ten specimens; K-division, Iwayama Bay, littoral, Dec. 19, 1937. Three specimens; C-division, Iwayama Bay,

littoral, Dec. 21, 1937. Two specimens; O-division, Iwayama Bay, littoral, Dec. 22, 1937. Fifty-three specimens; E-division, Iwayama Bay, littoral, Jan. 18, 1938. Thirty-five specimens; H-division, Iwayama Bay, littoral, March 2, 1938. Nineteen specimens; B-division, Iwayama Bay, littoral, March 19, 1938. Forty-two specimens; G-division, Iwayama Bay, littoral, March 22, 1938. Twenty-six specimens; north coast of Urukutāpuru, Palao Harbour, 2-3 metres, March 23, 1938. Seventy-nine specimens; south coast of Garangoru, Palao Harbour, littoral, March 25, 1938. Fifteen specimens; Geruherugairu, Iwayama Bay, littoral, March 26, 1938. Twelve specimens; Korōru-reef, littoral, March 29, 1938. One specimen; A-division, Iwayama Bay, littoral, March 30, 1938. Twelve specimens; D-division, Iwayama Bay, littoral, April 1, 1938. Three specimens; B-division, Iwayama Bay, littoral, April 3, 1938. Fifteen specimens; Gadaraku-reef, littoral, April 21, 1938. Ten specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Two specimens; Palao Harbour, 2-3 metres, May 15, 1938. Eighteen specimens; Kaki Passage, Iwayama Bay, littoral, May 20, 1938. Four specimens; Geruherugairu, Iwayama Bay, littoral, May 27, 1938. Three specimens; same locality, littoral, May 30, 1938. One specimen; Regio Passage, Iwayama Bay, littoral, June 2, 1938.

Distribution.—East Indies.

12. *Ophiothrix scotiosa* sp. nov.<sup>1)</sup>

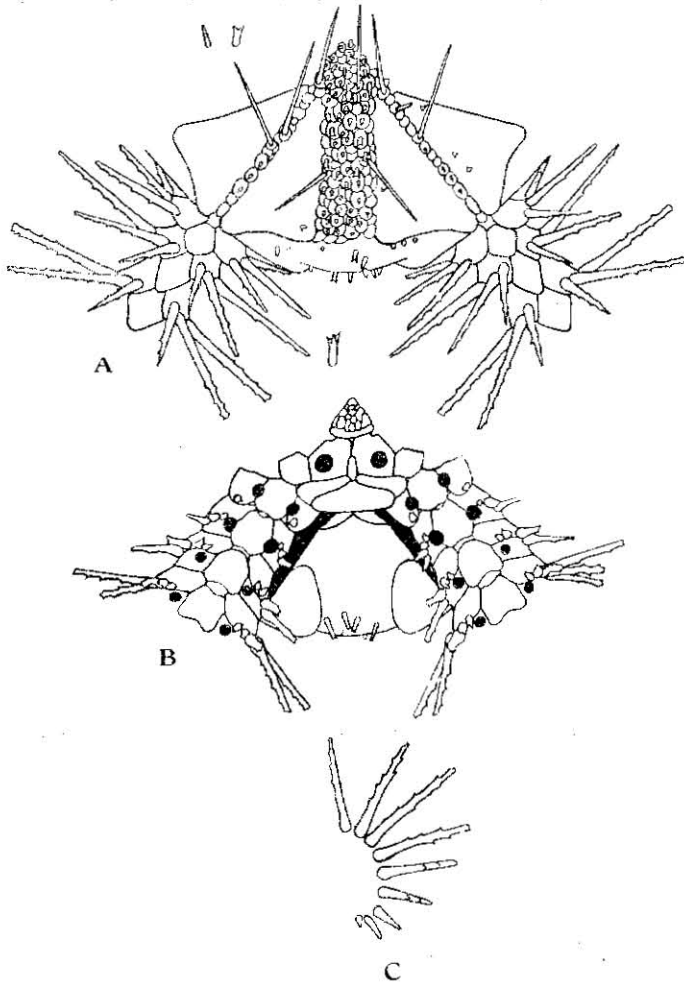
(Text-fig. 6)

Disk 4.5 mm in diameter; arms 25 to 30 mm long. Disk pentagonal or decagonal, covered with coarse elongate scales, each of which almost without exception bears a stump, terminating in two or three diverging, subequal spinelets; some of the scales have a true long spine. Radial shields large, about two-thirds as long as the disk radius, triangular, two times as long as broad, very close together, but perfectly separated from each other by a series of scales, bearing scattered stumps, as in the disk. Interbrachial spaces below naked, but having a number of cylindrical spines. Genital slits small; genital scales large, wide.

Oral shields rhombic, twice as wide as long, with lateral angles rounded. Adoral shields rather small, roughly triangular, not meeting within, lying more or less horizontally. Oral plates large,

<sup>1)</sup> σκοτός, signifying *dark*, in reference to the dark coloration.

stout. Dental papillae about twelve or thirteen in number, arranged in three series; lower papillae smaller.



Text-fig. 6. *Ophiothrix scotiosa*

A. From above. B. From below. C. Arm spines of one side of an arm joint near disk.  $\times 11$ .

Dorsal arm plates rhombic or pentagonal, longer than broad, in contact with each other throughout the length. First ventral arm plate small, hexagonal, broader than long. Following plates tetragonal, with rounded proximal and concave distal borders; first three broadly in contact with each other, but distally becoming

hardly touching, or separated by a narrow strip of naked skin, though the side arm plates are not meeting between the former. Side arm plates narrow, not meeting both above and below. Arm spines six or seven in number, falling to four distally; the upper ones longer, not always the uppermost one being the longest, about twice or more than twice as long as a joint, strongly thorny; the lowest one is hook-shaped, bearing four conspicuous spinelets. Tentacle pores large. Tentacle scale one to each pore, rudimentary, sometimes even absent.

Colour (dried from alcohol) black above; on the dorsal side of arm white bands or flecks are present; lighter below.

Locality.—Eighteen specimens; A-division, Iwayama Bay, littoral, Dec. 17, 1937.

The present species is so close to *O. armata* KÖHLER that one may place it within a range of variation of the latter. But for the present we may be justified to keep it separate from *O. armata* by its black coloration.

### 13. *Macrophiothrix longipeda* (LAMARCK)

*Ophiura longipeda*: LAMARCK, 1816, Anim. sans Vert., II, p. 544.

*Ophiothrix longipeda*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 113. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 227, fig. 65.

*Macrophiothrix longipeda*: CLARK, 1938, Mem. Mus. Comp. Zool., LV, pp. 282, 288.

Localities.—Nine specimens; Periryū, littoral, April 28, 1938. Five specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Kominato; Queensland; South Africa; Persian Gulf; Society Islands.

### 14. *Ophiothela danae* VERRILL

VERRILL, 1869, Proc. Boston Soc. Nat. Hist., XII, p. 391.<sup>1)</sup> DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 297, p. XVII, figs. 25–25b. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 230, fig. 67, pl. IV, fig. 8. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp., Univ., VII, 1, p. 20.

Locality.—Three specimens; off Gasupan, west lagoon, 20 metres, Feb. 21, 1938.

Distribution.—Off Misaki; South Izu; Philippine Islands; East Indies; off Syōnan-tō (Singapore); Fiji Islands.

<sup>1)</sup> Not accessible to me.

## Family Ophiolepididae

## Subfamily Ophiolepidinae

15. *Ophiolepis annulosa* MÜLLER et TROSCHEL

*Ophiura annulosa*: BLAINVILLE, 1843, Manu, Act., p. 244, pl. XXIV, figs. 1-4.<sup>1)</sup>

*Ophiolepis annulosa*: MÜLLER et TROSCHEL, 1840, Arch. Naturg., VI, p. 328. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 300, fig. 82.

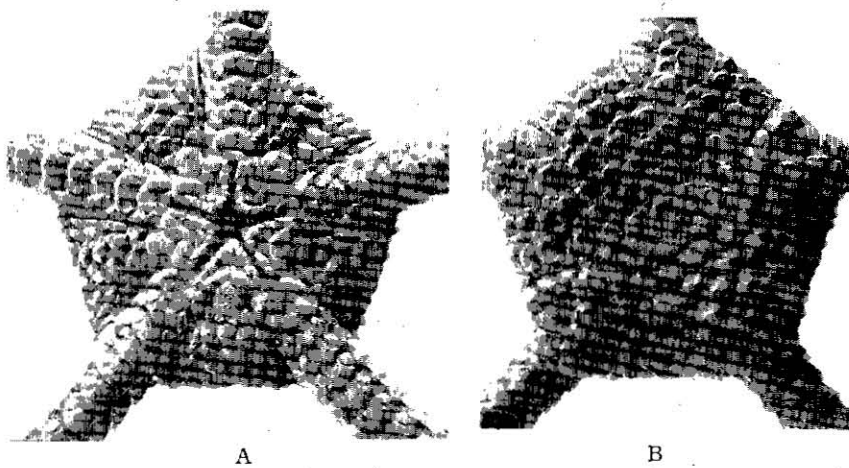
Locality.—One specimen; Periryū, littoral, April 28, 1938.

Distribution.—Ryukyu Islands; West Australia; Zanzibar; Marshall Islands.

16. *Ophiolepis cardioplax* sp. nov.<sup>2)</sup>

(Text-fig. 7)

Disk 7 mm in diameter; arms 33 to 42 mm long. Breadth of arm 1.5 mm at base.



Text-fig. 7. *Ophiolepis cardioplax*

A. From below. B. From above.  $\times 6.7$ .

Disk pentagonal, with almost straight interradiial borders, flat, covered with one hundred and forty-one large, thick, flat plates which are somewhat concave at the centre, and surrounded by small scales. The arrangement of the plates is quite regular and radially symmetrical. Dorsocentral somewhat large, circular. At

<sup>1)</sup> Not accessible to me.

<sup>2)</sup> Καρδιά, signifying heart, and πλάξ, signifying plate, in reference to the heart-shaped oral shields.



the interradial area, they arrange themselves in three series, among which those of the middle one are somewhat larger than the others. Radial shields comparatively small, triangular, flat, sunken, longer than broad, with slightly convex margins and rounded angles, separated from each other by three plates, among which the abcentral one forms with those bordered outside of radial shields a band separating the arm from the disk. Interbrachial spaces below also covered with regularly arranged plates like those of the dorsal side of disk, not surrounded by small ones, which are only present between larger plates. Genital slits long. Genital scales distinct.

Oral shields moderate, pentagonal or somewhat heart-shaped, as long as broad. Adoral shields rather large, slightly tapering inwards, completely in contact with each other at the interradial line, producing a small outer lobe so as to separate the first side arm plate from the oral shield. Oral papillae five on a side of an oral angle, thick, squarish; the distal one is large and pointed, overlapping the next, which is the broadest; remaining three longer than broad, with an obtuse end. Teeth four or five in number, tetragonal, with a slightly rounded margin; undermost one is smallest.

Arms robust, tapering slowly. Dorsal arm plates thick, tetragonal, broader without than within, wider than long, distal margin very convex, broadly in contact with each other. First ventral arm plate small, much broader than long, with convex distal and concave lateral borders. Following ones tetragonal, broader than long, wider without than within, lateral side reentering, distal one convex, broadly in contact with each other; towards the extremity of arm they become gradually longer than broad, pentagonal, and separated from each other by the side arm plate. Side arm plates well developed, but not so high as the arm joint; each carries four arm spines, which are small, subequal, about one-fourth of the corresponding joint in length; the undermost spine is largest. Two tentacle scales to each pore, thick, subequal, jointed together to form an elliptical appearance.

Colour (dried from alcohol): disk brown, arms dirty gray, banded with white; ventral side whitish.

Localities.—Forty-four specimens; Geruherugairu, Iwayama Bay, littoral, May 29, and June 6, 1938. Two specimens; same locality,

littoral, May 2, 1938.

The present species is closely related to *O. irregularis* KÖHLER, but differs from it in the regular squamation of disk, in the broader oral shields, and in having five oral papillae.

#### 17. *Ophiolepis cincta* MÜLLER et TROSCHEL

MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 90. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 299, fig. 81.

Localities.—Two specimens; Korōru-reef, littoral, Jan. 28, 1938. One specimen; Kayangusu, Yō Passage, littoral, March 7, 1938. One specimen; Auguruperyū-reef, littoral, May 3, 1938. One specimen; Urukutāpuru, littoral, June 12, 1938.

Distribution.—Yaéyama; New South Wales; Mozambique; Red Sea; Society Islands.

#### 18. *Ophioplocus imbricatus* MÜLLER et TROSCHEL

*Ophiolepis imbricata*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 93.

*Ophioplocus imbricatus*: LYMAN, 1865, Ill. Cat. Mus. Comp. Zool., I, p. 69. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 344. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 301, fig. 83.

Locality.—One specimen; Periryū, littoral, April 28, 1938.

Distribution.—Ryukyu Islands; West Australia; Murray Islands; Gilbert Islands; Zanzibar; Madagascar; Mauritius; Philippine Islands; Java; Amboina; Torres Strait.

#### *Ophiotylos leucus* g. et sp. nov.

##### *Ophiotylos* g. nov.<sup>1)</sup>

Disk swollen, covered with stout plates encircled by a series of small scales. Radial shields somewhat distinct, separated from each other. Trio of plates present just outside and between each pair of radial shields. Oral and adoral shields stout. Teeth indistinct. Oral papillae four or five, thick and close-set. Genital slits inconspicuous. Arms short, rather stout, knobbed, tapering gradually. Dorsal and ventral arm plates small. Side arm plates well developed. Arm spines few, rudimentary. Tentacle scales large, single.

<sup>1)</sup> *ὄφιος*, signifying *snake*, and *τύλος*, signifying *knob*, in reference to the knobbed arms.

Type species.—*Ophiotylos leucus*.

The new genus is very peculiar in several features. The squamation of disk reminds us of that of *Ophiolepis*, but *Ophiotylos* differs from it in want of supplementary dorsal arm plates. It is also similar to *Ophiomusium* in having the well developed side arm plates, but in the latter genus ventral arm plates and tentacle pores are lacking except in the proximal ones.

19. *Ophiotylos leucus* sp. nov.<sup>1)</sup>

(Text-fig. 8)

Disk 3.8 mm in diameter; arms 5 mm long. Breadth of arm 0.9 mm near the disk.

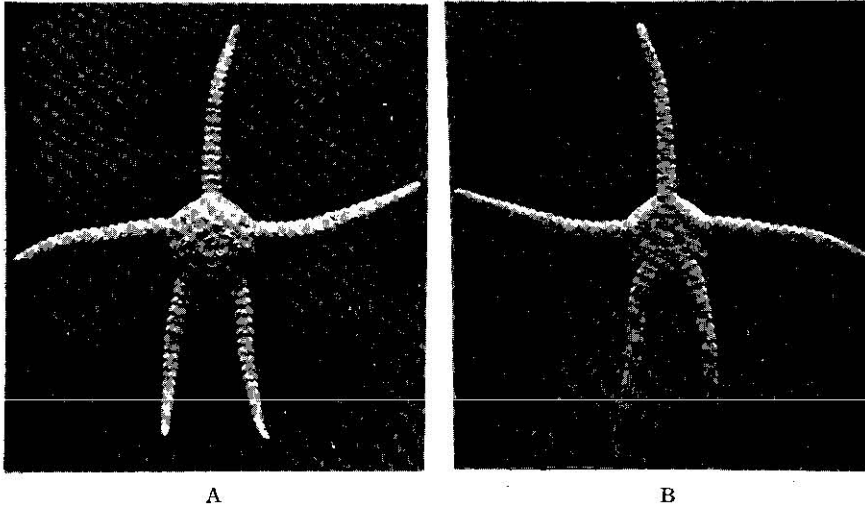
Disk pentagonal, with slightly convex or straight interr radial borders, swollen on the dorsal side and flat on the ventral side, covered with forty-six large, subequal plates, which are surrounded by small scales. Dorsocentral, first and second radials rounded; interr radials arranged in one series, tetragonal, thick, but concave at the centre. Radial shields small, but larger than the other plates, triangular, much broader than long, completely separated from each other. Those adjoining abaxial to the radial shields make a band with the distal scale of those lying along the radial line. Interbrachial spaces below covered with three large plates surrounded by small scales which are coarser than the corresponding ones of the dorsal side of disk. Genital slits long, more than two arm joints in length, bounded by elongate genital scales.

Oral shields, of moderate size, about as long as broad or a little broader than long, distal border semicircular, proximal borders slightly concave, and make a rather sharp inner angle. Adoral shields comparatively large, broader without, slightly tapering within, broadly in contact with each other on the interr radial line, producing a small outer lobe so as to separate the first side arm plate from the oral shield. Oral plates small, triangular, higher than broad. Oral papillae four or five on each side of an oral angle, truncated; the penultimate largest. Teeth two, thick, somewhat triangular, with a blunt tip.

Arms stout, slowly tapering, broader than high. First dorsal arm plate tetragonal, broader than long, broader without than

<sup>1)</sup> Λευκός, signifying *white*, in reference to the white coloration.

within, with a convex distal border and sharply pointed distolateral angles. Next one fan-shaped, as long as broad, with a very narrow proximal border, scarcely in contact with the first one.



Text-fig. 8. *Ophiotylos leucus*  
A. From above. B. From below.  $\times 3.4$ .

Beyond it they become triangular and smaller in size; near the end of arm they are broadly separated from each other by the side arm plate. At the basal half of arm the dorsal arm plates have a conspicuous boss near the middle of distal border. First ventral arm plate somewhat triangular, with a broad median lobe on the distal border, much broader than long. Following ones pentagonal, longer than broad, broader without than within, distal border slightly convex, lateral border concave, proximal and distolateral angles acute. At first they are in contact with each other, but soon becoming separated from each other distally. Side arm plates large, well developed, thick at the distal border, fully in contact both above and below except a few basal joints. Two arm spines on each side arm plate, rudimentary. Tentacle scale one on each pore, large, oval.

Colour in life white.

Locality.—Fifty-four specimens; Geruherugairu, Iwayama Bay, littoral, March 21, 22 and June 6, 11, 1938.

## Family Ophiidermatidae

## Subfamily Ophiarachninae

20. *Ophiurodon cinctum* (BROCK)

*Ophioconis cincta*: BROCK, 1888, Zeit. f. wiss. Zool., XLVII, 3, p. 480. KEHLER, 1905, Siboga-Exp., Oph. litt., p. 14, pl. II, fig. 2-3.

*Ophiurodon cinctum*: MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 84. KEHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 351, pl. LXXXI, fig. 5.—1930, Vidensk. Medd. fra Dansk Naturh. Foren., LXXXIX, p. 277.

Localities.—Two specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. One specimen; same locality, littoral, May 18, 1938. Fourteen specimens; same locality, littoral, June 11, 1938.

Distribution.—Amboina; Mindoro; Banda; Sulu Archipelago.

21. *Ophiurodon cupidum* (KEHLER)

*Ophioconis cupida*: KEHLER, 1905, Siboga-Exp., Oph. litt., p. 15, pl. I, figs. 19-20.

*Ophiurodon cupidum*: MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 84. KEHLER, 1930, Vidensk. Medd. fra Dansk Naturh. Foren., LXXXIX, p. 278. CLARK, 1932, Sci. Rep. Gt. Barrier Reef Exp., IV, 7, p. 203.

Locality.—Thirteen specimens; Geruherugairu, Iwayama Bay, littoral, June 6-11, 1938.

Distribution.—Isigaki-sima; Moluccas; Sulu; East Indies; Mindanao; Kei Islands; Queensland.

22. *Ophiarachna incrassata* (LAMARCK)

*Ophiura incrassata*: LAMARCK, 1816, Anim. sans Vert., II, p. 542.

*Ophiarachna incrassata*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 104. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 299. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 318, fig. 88, pl. VI, fig. 4.

Locality.—Four specimens; Tokobei, littoral, April 6-16, 1938.

Distribution.—Ryukyu Islands; Ogasawara (Bonin) Islands; Zanzibar; Ceylon; Darros Islands; Amboina; Fiji Islands; Queensland.

## Subfamily Ophiidermatinae

23. *Ophiopezella spinosa* (LJUNGMAN)

*Ophiarachna spinosa*: LJUNGMAN, 1867, Öfv. Kongl. Vet.-Akad. Föhr., XXIII, p. 305.<sup>1)</sup>

*Pectinura spinosa*: LYMAN, 1874, Bull. Mus. Comp. Zoöl., III, 10, p. 221.

<sup>1)</sup> Not accessible to me.

*Ophiopezella spinosa*: LYMAN, 1882, Challenger Oph., p. 17. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 304.

*Ophiopezella lütkeni*: de LERIOU, 1893, Rev. Suisse de Zool., I., p. 392, pl. XIII, figs. 1-1e.

Localities.—One specimen; Periryū, littoral, April 28, 1938. Three specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Isigaki-sima; Philippine Islands; Society Islands; Torres Strait.

#### 24. *Ophiarachnella gorgonia* (MÜLLER et TROSCHER)

(Text-fig. 9)

*Ophiarachna gorgonia*: MÜLLER et TROSCHER, 1842, Sys. Ast., p. 105.

*Pectinura gorgonia*: LÜTKEN, 1869, Add. Hist. Oph., III, p. 33.

*Ophiarachnella gorgonia*: CLARK, 1909, Bull. Mus. Comp. Zoöl., LII, 7, p. 117.—1915,

Mem. Mus. Comp. Zoöl., XXV, 4,

p. 305. MATSUMOTO, 1917, Journ.

Coll. Sci., Imp. Univ. Tokyo,

XXXVIII, 2, p. 323, pl. VI, fig. 7.

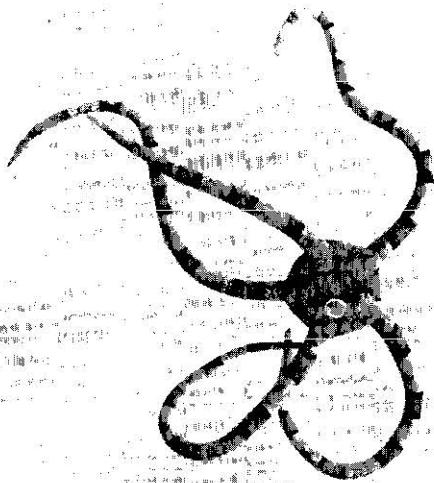
MURAKAMI, 1942, Journ. Dept.

Agric., Kyūsyū Imp. Univ., VII,

1, p. 33.

Localities. — Two specimens; Kayangusu, Yō Passage, littoral, March 7, 1938. Five specimens; Periryū, littoral, April 28, 1938. Four specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution. — Misaki; South Izu; Africa; Zanzibar; Palao Islands; Fiji Islands; Samoa; New Guinea; Torres Strait; Queensland; Gilbert Islands.



Text-fig. 9. *Ophiarachnella gorgonia*.

From above.  $\times 1$ .

#### 25. *Ophiarachnella infernalis* (MÜLLER et TROSCHER)

*Ophiarachna infernalis*: MÜLLER et TROSCHER, 1842, Sys. Ast., p. 105.

*Pectinura infernalis*: LÜTKEN, 1869, Add. Hist. Oph., III, p. 33.

*Ophiarachnella infernalis*: CLARK, 1909, Bull. Mus. Comp. Zoöl., LII, 7, p. 124.—1915,

Mem. Mus. Comp. Zoöl., XXV, 4, p. 305. MATSUMOTO, 1917, Journ. Coll. Sci.,

Imp. Univ. Tokyo, XXXVIII, 2, p. 324, fig. 90.

Localities.—Nine specimens; G-division, Iwayama Bay, littoral, March 22, 1938. One specimen; J-division, Iwayama Bay, littoral, March 24, 1938. Two specimens; G-division, Iwayama Bay, littoral, March 26, 1938. One specimen; B-division, Iwayama Bay, littoral, April 3, 1938. Thirty-seven specimens; A'-division, Iwayama Bay, littoral, May 1, 1938. Twelve specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Fifteen specimens; B-division, Iwayama Bay, littoral, May 5, 1938. Sixteen specimens; Geruherugairu, Iwayama Bay, littoral, May 7, 1938. Thirteen specimens: A'-division, Iwayama Bay, littoral, May 11, 1938. Two specimens; Marakaru, Palao Harbour, littoral, May 17, 1938. One specimen; Kaki Passage, Iwayama Bay, littoral, May 20, 1938. Five specimens; Korōru-reef, littoral, May 26, 1938. Four specimens; Geruherugairu, Iwayama Bay, littoral, May 30, 1938. One specimen; Urukutāpuru, littoral, June 12, 1938.

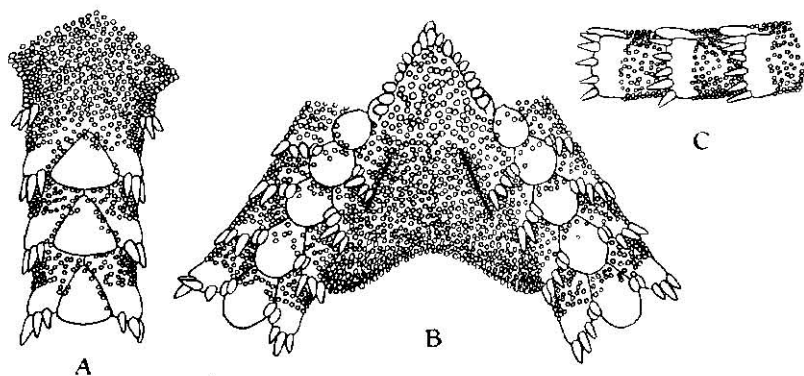
Distribution.—Suruga Gulf; Philippine Islands; Palao Islands; Zanzibar; Torres Strait; New Guinea.

26. *Ophiocryptus pacificus* sp. nov.

(Text-fig. 10)

Disk 4 mm in diameter; arms all broken at different distances from the disk, the longest among them being 9 mm in length.

Disk flat, pentagonal, covered with numerous small granules. Radial shields invisible. Interbrachial spaces below, oral shields,



Text-fig. 10. *Ophiocryptus pacificus*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 21$ .

adoral shields and oral plates also covered with granulation similar to that of the disk. Arms also granulated, especially the side arm plates being so, but the granules are limited to the proximal half of each plate and diminishing in number distally. Oral papillae nine, rarely eight or ten, on a side, small, subequal; proximal ones conical; distal ones flat and blunt, except the outermost one which is pointed and overlapping the penultimate.

Dorsal arm plates triangular, a little longer than broad, distal margin slightly convex, proximal angle acute; only proximal two or three scarcely in contact with each other. First ventral arm plate distinct, somewhat circular, longer than broad. Following plates tetragonal or pentagonal, with a very convex distal border; at first they are as wide as long, but soon becoming longer than broad distally. Side arm plates well developed, meeting both above and below except those near the disk; each carries five or six small, subequal, conical arm spines, which are about one-third as long as a joint. Tentacle scales two near the disk, but falling to one at the distal part of arm, small, elongate.

Colour (dried from alcohol): dorsal side of disk dirty gray; arms light gray, annulated with light brownish olive; ventral side light gray.

Localities.—One specimen; north coast of Marakaru, Palao Harbour, littoral, May 19, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 29, 1938.

The new species differs from *O. maculosus* CLARK in the flat pentagonal disk not bulging in each interradius, in the small number of oral papillae and in the longer arms. It is also different from *O. hexacanthus* CLARK by the concealed radial shields. Further, the present species is distinguished from *O. dubius* CLARK by the arms incompletely covered with the granules, by the number of arm spines and by two genital slits in each interradius. KOEHLER and CLARK thought that the Ophiurans belonging to the present genus were nothing but young of *Ophioderma*, but I cannot accept their opinion, for not a single individual of adult *Ophioderma* was found in Palao.



*Ophioclastus hataii* g. et sp. nov.*Ophioclastus* g. nov.<sup>1)</sup>

Disk flat, covered with numerous fine granules. Radial shields invisible. Interbrachial spaces below and oral plates also covered with granulation quite as on the disk, but oral and adoral shields being bare. Oral papillae numerous. Teeth rather slender. Arm plates well developed. One supplementary dorsal arm plate present on each side of the dorsal arm plate. Arm spines numerous, rather small. Tentacle scales two.

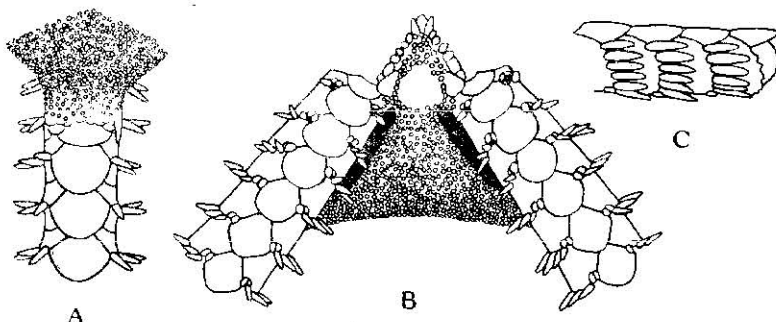
Type species.—*Ophioclastus hataii*.

The present genus is easily distinguished from the other genera of Ophiidermatidae by the possession of supplementary dorsal arm plates.

27. *Ophioclastus hataii* sp. nov.<sup>2)</sup>

(Text-fig. 11)

Disk 6.5 mm in diameter; arms six in number, about 26 mm long, tapering slowly. Disk hexagonal, covered with numerous fine granules, under which small, rounded scales are concealed. Radial shields invisible. Interbrachial spaces below covered with granulation like that of the dorsal surface of disk.



Text-fig. 11. *Ophioclastus hataii*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 8.7$ .

<sup>1)</sup> *Ophis*, signifying *snake*, and *κλαστός*, signifying *broken in pieces*, in reference to having the supplementary dorsal arm plates.

<sup>2)</sup> The species is dedicated to Dr. S. Hatai, the Director of the Palao Tropical Biological Station.

Oral shields naked, triangular, with angles rounded, about as broad as long, surrounded by granules. Adoral shields also naked, small, triangular. Oral plates covered with granules, which are coarser than those of the disk. Oral papillae seven in number on each side; the distal one small, pointed at the tip, overlapping the next, which is the broadest of all; proximal four conical, among which the one at the apex of jaw is large and stout. Teeth three in number on each jaw, slender, elongate, pointed at the tip.

Dorsal arm plates well developed, tetragonal, wider without than within, distal border convex, broadly in contact with each other; at first they are broader than long, but soon becoming longer than broad distally. Supplementary dorsal arm plates conspicuous, one on each side. First ventral arm plate large, much broader than long, with an obtuse proximal angle and a very rounded distal border. Following plates at first broader than long, but immediately becoming longer than broad distally; proximal two or three octagonal or heptagonal, and broadly in contact with each other, but distally they become rhomboidal, and separated from each other. Side arm plates not meeting above and below near the disk; each carries five or six, subequal, blunt arm spines, which are a little less than the corresponding joint in length. Tentacle pores indistinct, protected by two scales, among which the abradial one is larger, rounded, and overlapping the base of undermost arm spine. The first arm tentacle pore is sometimes provided with three scales. Genital slits broad, beginning close to the oral shield and reaching the fourth joint.

Colour (dried from alcohol): disk dirty gray; arms also dirty gray, banded with deep gray; ventral side lighter.

Localities.—Fifteen specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Thirty-nine specimens; A'-division, Iwayama Bay, littoral, May 11, 1938, Geruherugairu, Iwayama Bay, littoral, June 11, 1938, and Regio Passage, Iwayama Bay, littoral, June 2, 1938. Two specimens; Arakabesan Passage, littoral, June 5, 1938. Thirteen specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938.

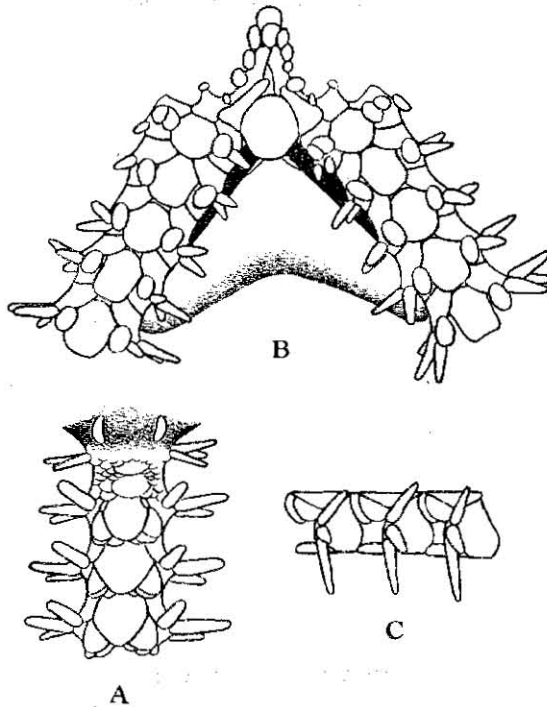
## Family Ophiochitonidae

## Subfamily Ophionereidinae

28. *Ophiocrasis thryptica* sp. nov.<sup>1)</sup>

(Text-fig. 12)

Disk 3 mm in diameter; arms six in number, 20 mm long. Disk hexagonal, covered with many small delicate scales. Radial shields small, triangular or wedge-shaped, tapering within, twice as long as broad, widely separated from each other. Interbrachial spaces below entirely naked, except for marginal area.



Text-fig. 12. *Ophiocrasis thryptica*  
 A. From above. B. From below. C. Side view of  
 three arm joints near disk.  $\times 21$ .

Oral shields moderate, somewhat lens-shaped, longer than broad. Adoral shields long and narrow, slightly broader without than within,

<sup>1)</sup> *θρυπτός*, signifying *delicate*, in reference to the delicate disk scales.

usually in contact with each other on the interradial line, but sometimes separated from each other. Oral papillae four on a side of an oral angle, small, flat with a rounded margin. Teeth three in number on a jaw, oblong. One small dental papilla present. Genital slits conspicuous.

Arms slender. Dorsal arm plates longer than broad, proximal margin three-sided, distal margin convex, but distally they become pentagonal, with a sharp proximal angle and a rounded distal margin. They are in contact with each other near the disk, but gradually becoming separated from each other as it proceeds distally. Supplementary plates large; each furnished with two secondary scales just distal to it. First ventral arm plate small, tetragonal, nearly as broad as long. Following plates pentagonal, longer than broad, in contact with each other at first, but becoming less so distally, and finally near the end they are separated from each other. Side arm plates narrow, not meeting above and below, except those of the terminal part of arm; each carries three, subequal, slender arm spines, which are slightly less than a joint in length. Tentacle scale single, large, oval.

Colour (dried from alcohol): disk gray, having a marking of brownish purple at the base of arm. Arms grayish, with brownish purple bands.

Localities.—Three specimens; A'-division, Iwayama Bay, littoral, May 19, 1938. Two specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938. Five specimens; same locality, littoral, June 11, 1938.

The present species is closely related to *O. dictydisca* CLARK, but is easily distinguished from it by the lens-shaped oral shields, by the longer dorsal arm plates and by the sharply pointed radial shields.

### Family Ophiocomidae

#### Subfamily Ophiocominae

#### 29. *Ophiocoma brevipes* PETERS

PETERS, 1852, Arch. Naturg., p. 85.<sup>1)</sup> CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 291. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 343, fig. 85. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 34.

<sup>1)</sup> Not accessible to me.

Localities.—One specimen; Kayangusu, Yō Passage, littoral, March 7, 1938. One specimen; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Hyūga; South Izu; Zanzibar; Mauritius; Philippine Islands; Caroline Islands; Gilbert Islands; Amboina; New Guinea; Torres Strait; Queensland; Lord Howe Island; Fiji Islands; Hawaii.

### 30. *Ophiocoma erinaceus* MÜLLER et TROSCHEL

MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 98. CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 257.—1915, Mem. Mus. Comp. Zool., XXV, 4, p. 291.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 127.

*Ophiocoma scolopendrina* var. *erinaceus*: MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 345, fig. 96.

Localities.—Seven specimens; Tokobei, littoral, April 6–16, 1938. One specimen; A'-division, Iwayama Bay, littoral, May 1, 1938. Seven specimens; same locality, littoral, May 11, 1938. One specimen; Marakaru, Palao Harbour, littoral, May 17, 1938. One specimen; Korōru-reef, littoral, May 26, 1938.

Distribution.—Yaéyama; Zanzibar; Torres Strait; Lord Howe Island; Society Islands; Hawaiian Islands.

### 31. *Ophiocoma latilanxa* sp. nov.<sup>1)</sup>

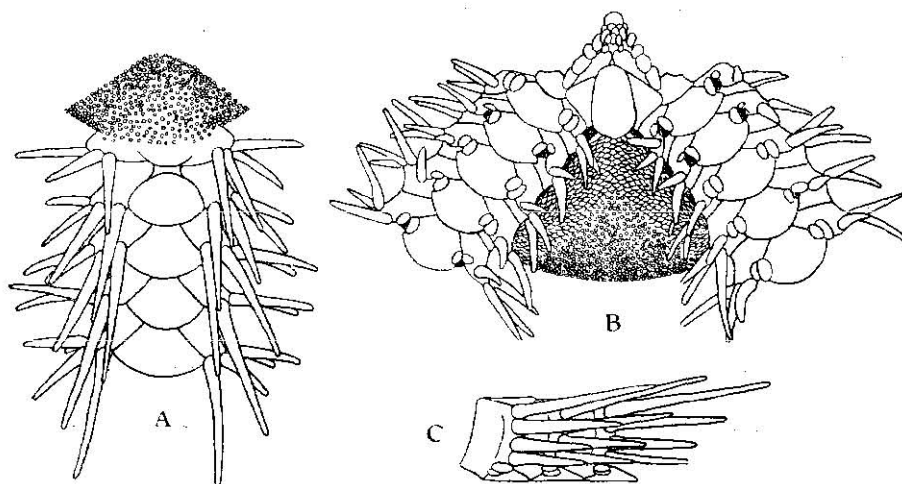
(Text-fig. 13)

Disk 6.5 mm in diameter; arms 20 mm long. Disk pentagonal, covered with fine, dense granules, under which small delicate scales are concealed. Interbrachial spaces below also covered with fine scaling, but the granulation not reaching the oral shield and genital slit. Genital slits moderate; genital scales inconspicuous.

Oral shields moderate, pentagonal, with rounded angles, longer than broad, broader without than within, proximal border rounded. Adoral shields large, triangular, longer than broad, standing on the lateral side of oral shield, not meeting within. Oral plates small. Oral papillae four on a side; distal one large, pointed within; the penultimate broadest, flat, with a somewhat rounded margin; proximal two small, also flat, blunt at the tip. Dental papillae about

<sup>1)</sup> *Latus*, signifying *broad*, and *lanxa*, signifying *plate*, in reference to the broad ventral arm plates.

fifteen in number, arranged in three series, small, conical; some of them being borne on the oral plate.



Text-fig. 13. *Ophiocoma latilanxa*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 11$ .

Dorsal arm plates fan-shaped, broader without than within, with a convex distal border; at first they are broader than long and in contact with each other, but becoming longer than broad and separated from each other as it goes distally. First ventral arm plate small, slightly broader than long, broader without than within. Succeeding plates tetragonal or pentagonal, with a very convex distal margin; they are broader than long and in contact with each other near the disk, but becoming longer than broad and separated from each other near the tip of arm. Side arm plates slender, not meeting above and below at the proximal part of arm. Arm spines four, but rarely five, in number proximally, falling to three near the tip of arm, very slender; the uppermost one or two very long, more than twice the corresponding arm joint in length; the length of spines diminishing downwards, but even the undermost one is still much longer than an arm segment. Tentacle scales two to each pore, rather large; abradial one larger than the adradial.

Colour (dried from alcohol): disk light gray in the background, variegated with brown; arms annulated with brown; ventral side lighter.

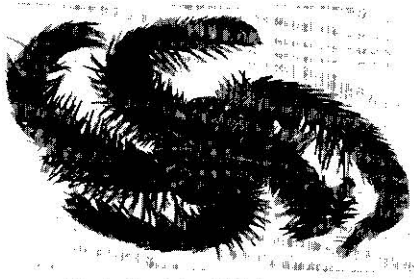
Locality.—Two specimens; north coast of Urukutāpuru, Palao Harbour, 2-3 metres, March 23, 1938.

The present species is very near to *O. lubrica* KÖHLER, but is easily distinguished from it by the broad pentagonal ventral arm plate, by the more numerous dental papillae and by the pentagonal oral shields.

### 32. *Ophiocoma pica* MÜLLER et TROSCHEL

(Text-fig. 14)

*Ophiocoma pica*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 101. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 293.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 127, pl. XIII, fig. 8.



Text-fig. 14. *Ophiocoma pica*  
From above.  $\times 1$ .

*Ophiocoma lineolata*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 102. KÖHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 324, pl. LXXIII, figs. 1-4.

Locality. — Three specimens; Tokobei, littoral, April 6-16, 1938.

Distribution.—Isigaki-sima; Zanzibar; Red Sea; Torres Strait; Paumotus; Gilbert Islands; Society Islands; Hawaiian Islands.

### 33. *Ophiocoma scolopendrina* (LAMARCK)

*Ophiura scolopendrina*: LAMARCK, 1816, Anim. sans Vert., II, p. 544.

*Ophiocoma scolopendrina*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 101. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 293.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 125, pl. XIII, fig. 9.

*Ophiocoma scolopendrina* typical: MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 345, pl. VII, figs. 4-5.

Localities.—Twelve specimens; Periryū, littoral, Jan. 22, 1938. Eight specimens; Ogiwaru, littoral, Feb. 5, 1938. Thirteen specimens; Kayangusu, Yō Passage, littoral, March 7, 1938. Eight specimens; Garakakurao, littoral, March 14, 1938. Six specimens; Tokobei, littoral, April 6-16, 1938. One specimen; Periryū, littoral, April 28, 1938. Seven specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Kagosima Gulf; Cape of Good Hope; Arabian Gulf; Australia; Paumotus; Hawaiian Islands.

#### 34. *Ophiomastix annulosa* (LAMARCK)

*Ophiura annulosa*: LAMARCK, 1816, Anim. sans Vert., II, p. 543.

*Ophiomastix annulosa*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 107. DÖDERLEIN, 1896, SEMON-Zool. Forschungr., V, p. 289, pl. XVI, fig. 11. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 350, fig. 99, pl. VII, fig. 6.

Localities.—Three specimens; Tokobei, littoral, April 6-16, 1938. One specimen; Periryū, littoral, April 28, 1938.

Distribution.—Senkaku (Pinnacle) Islands; Philippine Islands; Minikoi; Ceylon; East Indies; Solomon Islands; Loyalty Islands; Torres Strait.

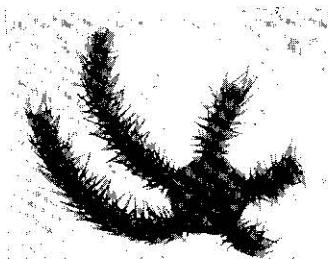
#### 35. *Ophiomastix asperula* LÜTKEN

(Text-fig. 15)

LÜTKEN, 1869, Add. Hist. Oph., III, p. 45. DÖDERLEIN, 1896, SEMON-Zool. Forschungr., V, p. 290, pl. XV, fig. 9. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 134, pl. XIV, fig. 1.

Locality.—Two specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938.

Distribution.—Isigaki-sima; Zanzibar; Amboina; East coast of Borneo; Torres Strait; Fiji Islands.



Text-fig. 15.  
*Ophiomastix asperula*  
From above.  $\times 1$ .

#### 36. *Ophiomastix bispinosa* CLARK

CLARK, 1917, Bull. Mus. Comp. Zoöl., LXI, 12, p. 442, pl. II, figs. 1-2.—1932, Gt. Barrier Reef Exp., IV, 7, p. 207.

Locality.—One specimen; A'-division, Iwayama Bay, littoral, May 11, 1938.

Distribution.—Paumotus; Australia.

It was fortunate to encounter with such a rare species. The specimen at hand agrees very well with CLARK's original description and figures. The description runs as follows:



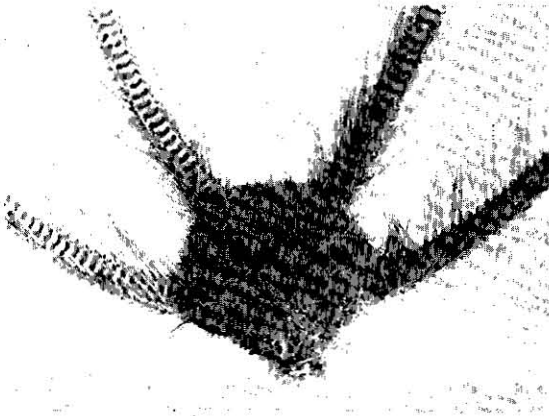
Disk 6.5 mm in diameter; arms broken, but the longest about 40 mm long. Disk five-lobed, deeply excavated at the interradial margin, closely covered with numerous small, thin, imbricating scales, which are perfectly concealed by the skin bearing many spinelets. Radial shields invisible. Interbranchial spaces below also covered with the covering similar to that of the disk. Genital slits moderate.

Oral shields transversely oval, broader than long. Adoral shields small, triangular, not meeting within, slightly enlarged without. Oral plates inconspicuous. Oral papillae three on a side, thick and blunt. Dental papillae about ten in number, stout.

Arms long, very slowly tapering, covered with skin at the base. Dorsal arm plates transversely oval, wider than long, broadly in contact with each other proximally. First ventral arm plate very small, longer than broad. Following plates tetragonal, as broad as long, wider without than within with rounded angles, scarcely in contact at the base of arm. Side arm plates rather small, narrow, not meeting above and below at least near the disk. Arm spines three or four, stout and blunt, a little longer than a joint; some of the uppermost ones enlarged, about twice as long as a joint, forming a club-spine. Tentacle pores small, protected by a single oval scale.

Colour (dried from alcohol): chocolate in general; arms have obscure white bands at irregular intervals. Arm spines annulated by white and chocolate. Disk spines sometimes white.

37. *Ophiomastix caryophyllata* LÜTKEN (Text-fig. 16)



Text-fig. 16.

*Ophiomastix caryophyllata*

From above.  $\times 1$ .

LÜTKEN, 1869, Add. Hist. Oph., III, p. 43. DÜDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 290, pl. XV, figs. 10-10a. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 294.

One specimen; locality unknown.

Distribution.—East coast of Borneo; Amboina; Torres Strait; Saleyer; Sulu Archipelago; New Guinea; Fiji Islands.

### 38. *Ophiomastix mixta* LÜTKEN

LÜTKEN, 1869, Add. Hist. Oph., III, p. 44. CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 256, fig. 126.—1915, Mem. Mus. Comp. Zool., XXV, 4, p. 296. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 348, fig. 97. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 34.

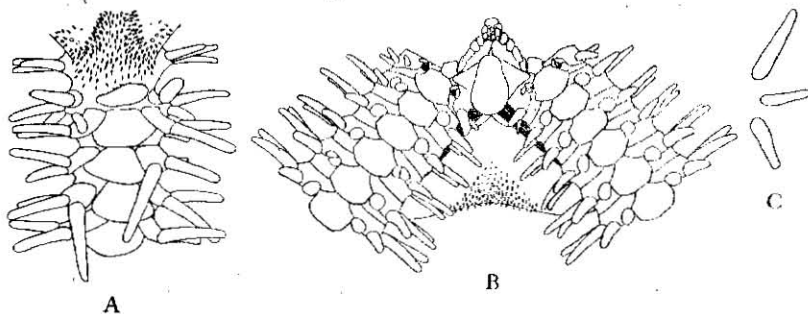
Locality.—Four specimens; Periryū, littoral, April 28, 1938.

Distribution.—Misaki; Izu; Isigaki-sima; Amboina; Timor; Torres Strait; Samoa; Loyalty Islands; Fiji Islands.

### 39. *Ophiomastix palaoensis* sp. nov.

(Text-fig. 17)

Disk 16 mm in diameter; arms (broken in all the specimens at hand, but) more than 65 mm long. Disk pentagonal, slightly excavated at the interradial border, covered with thick skin, which carries numerous fine spines. Those spines are only recognizable under a magnifying lens. Interbrachial spaces below covered with skin which is exactly like that of the disk, but no spines are borne near the genital slits and oral shield.



Text-fig. 17. *Ophiomastix palaoensis*

A. From above. B. From below. C. Arm spines of one side of an arm joint near disk.  $\times 3.5$ .

Oral shields large, much longer than broad, broader without than within, proximal and distal margins rounded, lateral side

slightly concave. Adoral shields moderate, triangular, with rather sharp angles, longer than broad, not meeting on the interradiial line. Oral plates inconspicuous. Oral papillae four on a side, thick and robust; the penultimate largest, twice as broad as long; proximal two longer than broad, with a rounded free end. Dental papillae thirteen to fifteen in number, thick and stout, but the undermost ones are rather small and feeble. Genital slits large, but genital scales inconspicuous.

The base of arm covered with extension of disk skin. Dorsal arm plates large, fan-shaped, wider than long, in contact with each other. First ventral arm plate small, pentagonal, about as long as broad. Following plates well developed, wider than long, distal margin convex, proximal border three-sided, lateral side concave, fully in contact with each other till near the tip of arm. Side arm plates narrow, not meeting above and below; each carries three or four arm spines, which are about twice or more than twice as long as a joint, thick, cylindrical, and blunt at the tip; the uppermost spine of every two or three joints is exceedingly large, about three times as long as a joint, or even longer than that, forming a club-spine. Tentacle scales generally single, but sometimes two, large, rounded.

Colour (dried from alcohol): deep chocolate in general; ventral side lighter; distal part of arm annulated with white lines.

Localities.—One specimen; K-division, Iwayama Bay, littoral, Dec. 19, 1937. Three specimens; Arumizu Passage, littoral, Jan. 22, 1938. Five specimens; A'-division, Iwayama Bay, littoral, March 11, 1938. One specimen; south coast of Garangoru, Palao Harbour, littoral, March 25, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 7, 1938. Three specimens; Regio Passage, Iwayama Bay, littoral, May 24, 1938. Four specimens; same locality, littoral, June 2, 1938.

The present species is very near to *O. variabilis* KOEHLER, only differing from it in larger number of disk spines, in the uniform coloration of disk without peripheral white markings, in the arm striation which is limited to the distal part of arm, and in larger size of body.

40. *Ophiomastix variabilis* KOEHLER

KOEHLER, 1905, Siboga-Exp., Oph. litt., II, p. 69, pl. VI, fig. 16, pl. XVI, figs. 3-4. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 138.

Localities.—One specimen; Korōru-reef, littoral, March 29, 1938. Four specimens; A'-division, Iwayama Bay, littoral, May 11, 1938. One specimen; Korōru-reef, littoral, May 26, 1938. One specimen; Regio Passage, Iwayama Bay, littoral, June 2, 1938.

Distribution.—East Indies; Kei Island.

41. *Ophiarthrum elegans* PETERS

PETERS, 1851, Monatsb. K.-Preuss. Akad. Wiss., p. 463. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 296. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 351, fig. 100, pl. VII, fig. 7. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 139, pl. XIII, fig. 1.

Localities.—Two specimens; Kayangusu, Yō Passage, littoral, March 7, 1938. Two specimens; Tokobei, littoral, April 6-16, 1938. Six specimens; Periryū, littoral, April 28, 1938. Two specimens; A'-division, Iwayama Bay, littoral, May 1, 1938. Ten specimens; Auguruperyū-reef, littoral, May 3, 1938. Two specimens; A'-division, Iwayama Bay, littoral, May 11, 1938. Three specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938. One specimen; north coast of Urukutāpuru, Palao Harbour, littoral, June 12, 1938.

Distribution.—Ryukyu; Zamboanga; Philippine Islands; Mozambique; Zanzibar; Palao Islands; Caroline Islands; New Guinea; Torres Strait; Society Islands; Queensland.

41'. *Ophiarthrum elegans* var. *unicolor* CLARK

CLARK, 1932, Gt. Barrier Reef Exp., IV, 7, p. 208.

Localities.—Two specimens; A'-division, Iwayama Bay, littoral, May 1, 1938. One specimen; same locality, littoral, May 11, 1938. Five specimens; same locality, littoral, May 20, 1938. Two specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938. Two specimens; Arakabesan Passage, littoral, June 5, 1938.

Distribution.—Australia.

The living animals have a number of red speckles on the dorsal side of arm, which are very fugitive in alcohol.

42. *Ophiarthrum pictum* (MÜLLER et TROSCHEL)

*Ophiocoma picta*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 102.

*Ophiarthrum pictum*: LYMAN, 1874, Bull. Mus. Comp. Zool., III, 10, p. 225, pl. VII, figs. 2-4. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 297.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 140, pl. XII, fig. 1. OSHIMA, 1935, Bot. Zool., III, 3, p. 62, fig. 28, b-c.

Localities.—One specimen; Kayangusu, Yō Passage, littoral, March 7, 1938. One specimen; B-division, Iwayama Bay, littoral, May 19, 1938. Five specimens; Tokobei, littoral, April 6-16, 1938. One specimen; Periryū, littoral, April 28, 1938. One specimen; A'-division, Iwayama Bay, littoral, May 1, 1938. Three specimens; same locality, littoral, May 11, 1938. One specimen; north coast of Marakaru, Palao Harbour, littoral, May 17, 1938. One specimen; Regio Passage, Iwayama Bay, littoral, June 7, 1938.

Distribution.—Yaéyama; East Indies; Philippine Islands; Amboina; Timor; New Guinea; Torres Strait.

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