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Murakami, Shiro
Amakusa Marine Biological Laboratory, Kyusyu Imperial University

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OPHIURANS FROM SOME GULFS AND BAYS OF NIPPON[1]

Shiro MURAKAMI

The Ophiuran material upon which the present paper was based had been collected by Professor Dr. D. MIYADI and Mr. T. MASUI of the Zoological Institute, Kyōto Imperial University, in the gulfs and bays of Ago, Gokasyo, Matoya, Ise, Mikawa, Beppu, Hakata (or Hukuoka) and Nanao, during their study of the marine benthic communities, and was submitted to me by them for identification. I could distinguish the following ten forms in it, among which two are described here for the first time. The list of the species is as follows:

Order Gnathophiurida
  Family Amphiuridae
    1. *Amphioplus diacritus* sp. nov.
    2. *Amphioplus miyadii* sp. nov.
    3. *Amphichilus trichoides* MATSUMOTO
    4. *Ophiophragmus japonicus* MATSUMOTO
    5. *Ophiophragmus japonicus* var. *parvus* MATSUMOTO
    6. *Amphiura aestuarii* MATSUMOTO
    7. *Amphiura sinicola* MATSUMOTO
  Family Ophiotrichidae
    8. *Ophiothrix koreana* DUNCAN
    9. *Ophiothrix marenzelleri* KOEHLER
Order Chilophiurida
  Family Ophiolepididae
    10. *Ophiura kinbergi* (LJUNGMAN).

The habitat in reference to the respective species is shown in Table 1.

It has been already known that all the described species, except *A. trichoides* whose locality was unknown, live in Nipponese

[1] Contributions from the Zoological Laboratory, Kyūsyū Imperial University, No. 166; Papers from the Amakusa Marine Biological Laboratory, No. 89.

bays. Thus, *Ophiophragmus japonicus* has been reported from Kagosima Bay and Mutu Bay, *O. japonicus* var. *parvus* from Mutu Bay, *Amphiura aestuarii* from Aburatubo Cove, *A. sinicola* from Mutu Bay, *Ophiothrix koreana* from Hakodate Bay, Gulf of Tokyo, Suruga Gulf and Kagosima Bay, *O. marenzelleri* from Gulf of Tokyo, Kagosima Bay, Asami Bay, Tusima, and Mutu Bay, and *Ophiura kinbergi* from Kagosima Bay and Mutu Bay. In the present paper more numerous localities are added to the foregoing ones. *Amphichilus trichoides* is represented by numerous specimens in the collection, and is thought to be also one of the common dwellers in our bays.

Table 1.

Bay \ Species	*A. diacritus*	*A. miyadii*	*A. trichoides*	*O. japonicus*	*O. japonicus* var. *parvus*	*A. aestuarii*	*A. sinicola*	*O. koreana*	*O. marenzelleri*	*O. kinbergi*
Ago		×	×	×		×				
Gokasyo	×	×	×			×	×			
Matoya	×		×	×	×	×			×	×
Ise				×						×
Mikawa										×
Beppu		×		×						×
Hakata		×								×
Nanao		×	×		×	×	×	×		

Among those Ophiurans, *O. kinbergi* is widely distributed in the Indo-Pacific region, and reaches as far as Otaru, which seems to be its known northern limit, *O. koreana* ranges from Malaysian waters to Nippon, and the rest are known only from vicinities of Honsyū.

Before proceeding further, I must express my sincere thanks to Professor Dr. H. OHSHIMA for his kindly guidance given to me during the work. I must also express my gratitude to Professor Dr. D. MIYADI and Mr. T. MASUI for their kindness in giving me the valuable material.

SYSTEMATICS

Family Amphiuridae

1. *Amphioplus diacritus* sp. nov.[1]

(Fig. 1)

Disk about 10 mm in diameter; arms all broken off at the base, but probably more than three times as long as the disk diameter in the intact state, as considered from the fragments. Breadth of arm 1.8 mm at the base.

Disk rounded, or five-lobed, notched at the interradial border, flat, covered with numerous thin, imbricating scales, among which

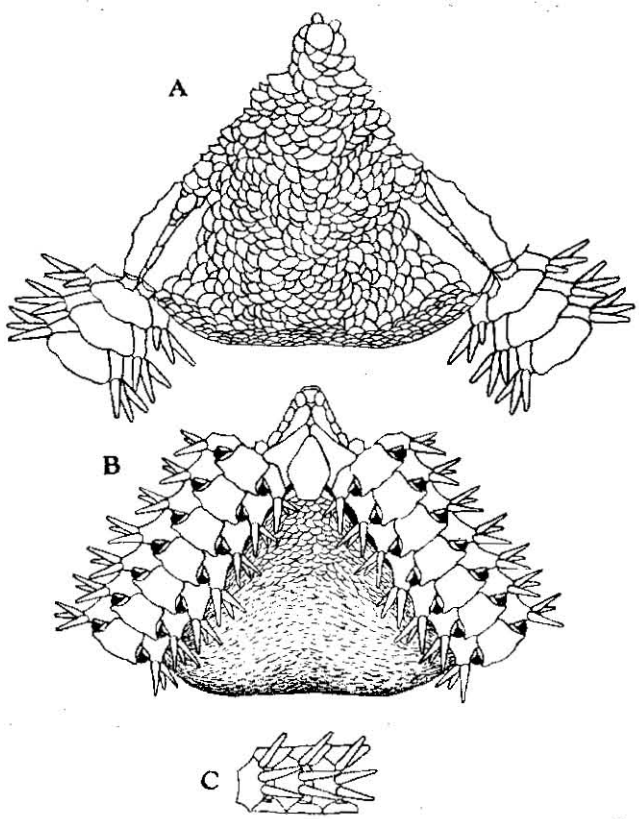

Fig. 1. *Amphioplus diacritus*. ×7.
A. From above. B. From below. C. Side view of three arm joints near disk.

1) Διάκριτος, signifying *separated*, in reference to the non-continuous adoral shields.

the peripheral ones are somewhat distinct. Primary plates not very large, but distinguishable. Radial shields of moderate size, a little less than one half of the disk radius in length, very narrow, more than four times as long as broad, bluntly pointed at the proximal end, somewhat enlarged distally, but the broadest part is at some distance from the distal end; they are diverging within and scarcely in contact without. Interbrachial spaces below covered with small imbricating scales.

Oral shields large, pentagonal, longer than broad, with rounded angles and gently curved margins. Madreporite largest of all, also pentagonal, broader than the remaining ones. Adoral shields also distinct, long and narrow, enlarged distally, tapering within where they are in contact with each other or otherwise, producing an outer lobe so as to separate the first side arm plate from the oral shield. Oral plates rather small, higher than broad. Oral papillae four in number on a side of an oral angle; the one at the apex of jaw largest, thick, stout, but blunt at the tip; following two rectangular, also stout; the distal one somewhat triangular, about as large as the foregoing.

Dorsal arm plates large, tetragonal, about two times as broad as long, with distal angles rounded; proximal border narrower than the distal one which is rather straight; lateral sides diverging distally; they are in contact with each other and are keeled at the centre longitudinally. First ventral arm plates small, hexagonal, slightly longer than broad. Following plates tetragonal or pentagonal, broader without than within, with lateral sides concave; at first they are broader than long and have a lobe at the middle of distal border, but distally they become longer than broad and the lobe becomes indistinct, or disappears. They are in contact with each other. Side arm plates somewhat prominent, not meeting both above and below. Arm spines three in number, stout, not sharply pointed at the tip, longer than a joint, among which the middle one is the largest. Tentacle pores large, protected by two elongate scales forming a right angle.

Colour (dried from alcohol): disk dirty gray; dorsal side of arm mineral gray; ventral side light gray.

Localities.—Station 22, Gokasyo Bay, Miê-ken, April 19–20, 1941; one specimen. Station 44b, the same bay, April 19–20, 1941; one specimen. Station 61, Matoya Bay, Miê-ken, April 15–17, 1941;

one specimen. Station 63, the same bay, April 15–17, 1941; one specimen. Station 88, the same bay, April 15–17, 1941; one specimen. Station 94, the same bay, April 15–17, 1941; one specimen. Station 95, the same bay, April 15–17, 1941; one specimen.

The present species is closely allied to *A. luctator* KOEHLER, the disk of which was not known, but differs from it in the close-set apical oral papillae, in the non-continuous adoral shields, in the hexagonal first ventral arm plates, in the shape of succeeding ventral arm plates, and in the elongate tentacle scales.

2. *Amphioplus miyadii* sp. nov.

(Fig. 2)

Disk 9 to 10 mm in diameter; arms torn away, but probably attain the length more than four times as long as the disk diameter. Breadth of arm 1.5 mm at the base.

Disk pentagonal or five-lobed, slightly notched at the base of arm, rather flat, covered with a smooth coating of coarse, thin, imbricating scales, among which those near the margin are smaller than the rest. Primary plates indistinct. Radial shields of moderate size, about two-fifths of disk radius in length, three times as long as broad, tapering proximally to a point, broadest at the middle part, somewhat rounded without, in contact with each other throughout the distal three-fifths of the length, but separated proximally by a few intervening scales. Interbrachial spaces below covered with numerous small, imbricating scales, which are smaller than those of the dorsal side of disk. Genital slits long.

Oral shields small, rhomboidal, with acute proximal, and rounded lateral and distal angles, much longer than broad; proximal borders are almost straight, but the distal ones are somewhat concave. Madreporite largest of all, also rhomboidal, with a very rounded distal angle. Adoral shields triangular, tapering within, where they are in contact with each other or not, enlarged distally. Oral plates small, higher than broad. Oral papillae four in number, thick and robust; the one at the apex of jaw longer than broad, but blunt at the tip, widely separated from the opposite one; the next one is about as large as the foregoing, tetragonal; the following two are triangular in shape, among which the penultimate is the largest, but not so sharply pointed

at the end as in the distal one. Teeth six or seven in number, tetragonal, thick and stout; the one situated ventrally is broader than long, while the upper ones are much longer than broad.

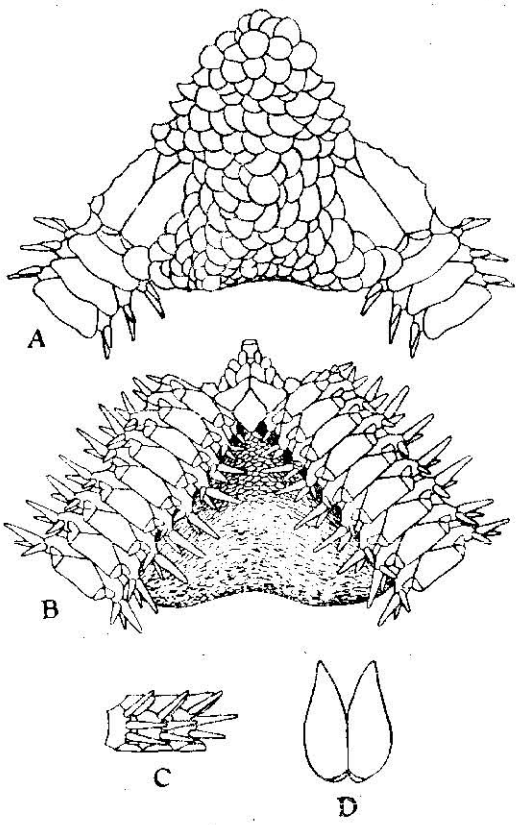

Fig. 2. *Ampioplus miyadii*. ×7.
A. From above. B. From below. C. Side view of three arm joints near disk. D. Radial shields of other specimen.

Arms stout, broader than high, slowly tapering distally. Dorsal arm plates well developed, tetragonal, with disto-lateral angles rounded; proximal border narrower than the distal one, which is gently curved so as to give the plate a somewhat tri-lobed appearance; lateral sides are remarkably diverging distally; they are fully in contact with each other. First ventral arm plates small, pentagonal, somewhat broader than long, with a distal border convex. Succeeding plates pentagonal, with a wide proximal angle,

much broader than long, scarcely in contact with each other. Side arm plates narrow, broadly separated from each other on the dorsal side of arm, but less so below. Arm spines three in number, longer than a joint, stout and pointed at the tip: the middle one is the largest. Each tentacle pore furnished with two large, somewhat triangular scales which are set at right angles to each other.

Colour (dried from alcohol); dirty white.

Localities.—Station 46, Ago Bay, Mié-ken, Nov. 5–10, 1940; three specimens. Station 70, the same bay, Nov. 5–10, 1940; one specimen. Station 14, Gokasyo Bay, Mié-ken, April 19–20, 1941; one specimen. Station 16, the same bay, April 19–20, 1941; one specimen. Station 32, the same bay, April 19–20, 1941; two specimens. Station 35, the same bay, April 19–20, 1941; one specimen. Station 44b, the same bay, April 19–20, 1941; one specimen. Station 45, the same bay, April 19–20, 1941; one specimen. Station 38, Beppu Bay, Ōita-ken, Aug. 22–28, 1940; one specimen. Station 40, the same bay, Aug. 22–28, 1940; one specimen. Station 29, Hakata Bay, Hukuoka-ken, June 2–3, 1941; one specimen. Station 45, the same bay, June 2–3, 1941; one specimen. Station 47, the same bay, June 2–3, 1941; one specimen. Station 56, the same bay, June 2–3, 1941; one specimen. Station 78, the same bay, June 2–3, 1941; one specimen. Station 38, Nanao Bay, Isikawa-ken, Aug. 13–18, 1941; one specimen.

The present species is so closely related to *A. relictus* (KOEHLER) that I hesitated at first to make it separate from the latter. But, finding that our form has the narrow radial shields, different from *A. relictus*, and that being a constant character, I have come to convince me justified to establish a new species therefrom. The species is dedicated to Professor Dr. D. MIYADI of Kyōto Imperial University.

3. *Amphichilus trichoides* MATSUMOTO

MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 175, fig. 45.

Localities.—Station 54, Ago Bay, Mié-ken, Nov. 5–10, 1940; one specimen. Station 16, Gokasyo Bay, Mié-ken, April 19–20, 1941; one specimen. Station 19, the same bay, April 19–20, 1941; one specimen. Station 20, the same bay, April 19–20, 1941; one

specimen. Station 30, the same bay, April 19–20, 1941; one specimen. Station 38, the same bay, April 19–20, 1941; one specimen. Station 42, the same bay, April 19–20, 1941; one specimen. Station 44a, the same bay, April 19–20, 1941; one specimen. Station 48, the same bay, April 19–20, 1941; one specimen. Station 47, Matoya Bay, Mié-ken, April 15–17, 1941; one specimen. Station 56, the same bay, April 15–17, 1941; one specimen. Station 73, the same bay, April 15–17, 1941; one specimen. Station 74, the same bay, April 15–17, 1941; one specimen. Station 78, the same bay, April 15–17, 1941; one specimen. Station 86, the same bay, April 15–17, 1941; one specimen. Station 88, the same bay, April 15–17, 1941; one specimen. Station 89, the same bay, April 15–17, 1941; one specimen. Station 92, the same bay, April 15–17, 1941; one specimen. Station 12, Nanao Bay, Isikawa-ken, May 13–19, 1941; two specimens. Station 14, the same bay, May 13–19, 1941; one specimen. Station 20, the same bay, May 13–19, 1941; two specimens. Station 22, the same bay, May 13–19, 1941; one specimen. Station 31, the same bay, May 13–19, 1941; one specimen.

Distribution.—Sagami Sea (?)

Some of the specimens at hand agree well with the type, which was described by MATSUMOTO based on a single specimen from unknown locality. But a number of specimens are different from the type in having the longer oral shields with an acute proximal angle and a much rounded distal border, and in having four oral papillae on a side. But these two distinct forms are perfectly connected with each other by intermediate specimens.

4. *Ophiophragmus japonicus* MATSUMOTO

MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 70. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 239. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 183, fig. 48, pl. IV, fig. 3.—1918, Annot. Zool. Japon., IX, 4, p. 478.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 333, fig. 2.

Localities.—Station 30, Ago Bay, Mié-ken, Nov. 5–10, 1940; one specimen. Station 4, Matoya Bay, Mié-ken, April 15–17, 1941; one specimen. Station 13, the same bay, April 15–17, 1941; one specimen. Station 55, the same bay, April 15–17, 1941; one specimen. Station 93, the same bay, April 15–17, 1941; one specimen. Station 16, Ise Bay, July 29–Aug. 3, 1940; two specimens. Station

47, the same bay, July 29–Aug. 3. 1940; one specimen. Station 93, Mikawa Bay, Aiti-ken, July 29–Aug. 3, 1940; one specimen. Station 20, Beppu Bay, Ōita-ken, Aug. 22–28, 1940; one specimen.

Distribution.—Off Namami, Kagosima Bay. Enoura, Suruga. Off Oginohama, Rikuzen. Mutu Bay. Bay of Thai (Siam). Amboina.

5. *Ophiophragmus japonicus* var. *parvus* MATSUMOTO

MATSUMOTO, 1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 334, figs. 3–4.

Localities.—Station 93, Matoya Bay, Mié-ken, April 15–17, 1941; one specimen. Station 22, Nanao Bay, Isikawa-ken, May 13–19, 1941; one specimen. Station 34, the same bay, May 13–19, 1941; one specimen. Station 51, the same bay, May 13–19, 1941; one specimen. Station 52, the same bay, May 13–19, 1941; one specimen. Station 59, the same bay, May 13–19, 1941; one specimen. Station 69, the same bay, May 13–19, 1941; one specimen. Station 96, the same bay, May 13–19, 1941; one specimen. Station 102, the same bay, May 13–19, 1941; one specimen. Station 105, the same bay, May 13–19, 1941; one specimen. Station 133, the same bay, May 13–19, 1941; two specimens. Station 145, the same bay, May 13–19, 1941; one specimen. Station 146, the same bay, May 13–19, 1941; one specimen.

Distribution.—Ōse, off Yunosima, Mutu Bay.

The present variety was recently described by MATSUMOTO based on the specimens from Mutu Bay. The full grown specimens in the collection are well accordant with the type, and are easily distinguished from the typical form of the species. The radial shields are longer than broad, and the marginal scales of disk are very indistinct, especially at the middle of the interradial border. Further, the scales of the dorsal side of disk are coarser than those of the typical form.

6. *Amphiura aestuarii* MATSUMOTO

MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 73.—1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 208, fig. 57.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 341.

Localities.—Station 40, Ago Bay, Mié-ken, Nov. 5–10, 1940; three specimens. Station 4, Gokasyo Bay, Mié-ken, April 19–20,

1941; one specimen. Station 82, Matoya Bay, Mié-ken, April 15–17, 1941; one specimen. Station 96, the same bay, April 15–17, 1941; one specimen. Station 104, the same bay, April 15–17, 1941; six specimens. Station 105, the same bay, April 15–17, 1941; three specimens. Station 95, Nanao Bay, Isikawa-ken, May 13–18, 1941; two specimens. Station 96, the same bay, May 13–18, 1941; three specimens. Station 97, the same bay, May 13–18, 1941; one specimen. Station 102, the same bay, May 13–18, 1941; one specimen. Station 103, the same bay, May 13–18, 1941; one specimen. Station 115, the same bay, May 13–18, 1941; one specimen.

Distribution.—Aburatubo, Misaki.

A close examination of the specimens at hand makes me believe that they belong to *A. aestuarii*, especially in having the large radial shields, in the size and arrangement of the scales around them, and in having the dorsal arm plates being large and wide even at the base of arm. It has been known only from Misaki so far. But it seems to me that the range of this species is not limited, as MATSUMOTO has said. In addition to the foregoing localities, I was able to find it at Tomioka, Amakusa.

7. *Amphiura sinicola* MATSUMOTO

MATSUMOTO, 1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 339, fig. 7.

Localities.—Station 8, Gokasyo Bay, Mié-ken, April 19–20, 1941; two specimens. Station 29, Nanao Bay, Isikawa-ken, May 13–18, 1941; one specimen.

Distribution.—Mutu Bay.

The specimens before me are rather of small size, but I am convinced that they belong to *A. sinicola*. Though the distal oral papillae are somewhat large, and about of the same size as the inner oral papillae, they agree with the type in having the small, narrow radial shields, in having the basal dorsal arm plates being not rudimentary and in having the first ventral arm plates longer than wide.

Family Ophiotrichidae

8. *Ophiothrix koreana* DUNCAN

DUNCAN, 1879, Journ. Linn. Soc. London, XIV, p. 473, pl. XI, figs. 28–32. CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 257, figs. 127–128.—1915, Mem. Mus. Comp. Zoöl.,

XXV, 4, p. 273. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 220, pl. IV, fig. 7. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 20.

Localities.—Station 87, Nanao Bay, Isikawa-ken, May 13–18, 1941; one specimen. Station 105, the same bay, May 13–18, 1941; one specimen. Station 107, the same bay, May 13–18, 1941; one specimen. Station 133, the same bay, May 13–18, 1941; one specimen.

Distribution.—Hakodate. Gulf of Tokyo. Uraga Channel. Sagami Sea. Suruga Gulf. Sea of Nippon. Tyōsen (Korea) Strait. Kagosima. Off Satuma. Moluccas. Philippine Islands. Banda. Amboina. Kei Islands.

9. *Ophiothrix marenzelleri* KOEHLER

Ophiothrix marenzelleri: KOEHLER, 1904, Mém. Soc. Zool. Fr., XVII, p. 103, figs. 76–78. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 281. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 220.—1918, Annot. Zool. Japon., IX, 4, p. 478.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 342, fig. 8.

Ophiothrix hylodes: CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 126, fig. 130.

Locality.—Station 99, Matoya Bay, Miė-ken, April 15–17, 1941; one specimen.

Distribution.—Tomo, Bingo. Toba, Sima. Misaki. Entrance to the Gulf of Tokyo. Kagosima Gulf. Tusima. Off Jōgasima. Kominato.

Family Ophiolepididae

10. *Ophiura kinbergi* (LJUNGMAN)

CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 37, fig. 9.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 321. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 271, fig. 73.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 343, fig. 9. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp., Univ., VII, 1, p. 28.

Localities.—Station 16, Matoya Bay, Miė-ken, April 15–17, 1941; one specimen. Stations 31 and 32, the same bay, April 15–17, 1941; three specimens. Station 3, Ise Bay, July. 29–Aug. 3, 1940; one specimen. Station 15a, the same bay, July 29–Aug. 3, 1940; two specimens. Station 16, the same bay, July 29–Aug. 3, 1940; one specimen. Station 85, Mikawa Bay, Aiti-ken, July 29–Aug. 3, 1940: one specimen. Stations 87 and 88, the same bay, July 29–Aug. 3, 1940; ten specimens. Station 10, Beppu Bay, Ōita-ken,

Aug. 22–28, 1940; one specimen. Station 46, Hakata Bay, Hukuoka-ken, June 2–3, 1941; one specimen. Station 54, the same bay, June 2–3, 1941; one specimen.

Distribution.—Indo-Pacific.

(*Amakusa Marine Biological Laboratory, Kumamoto-ken*)

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