Bull. Natn. Sci. Mus., Ser. A (Zool.), 2 (1), March 22, 1976

Halicarcinus orientalis SAKAI (Crustacea, Hymenosomatidae) Associated with *Ophiocoma brevipes* PETERS (Ophiuroidea, Ophiocomidae) from Hachijo Island[1)]

By

Masatsune TAKEDA

Department of Zoology, National Science Museum, Tokyo,

Makoto MIKI, Minoru ASAI

Hachijo Branch, Tokyo Fisheries Experimental Station, Tokyo

and

Katsumi SUZUKI

Marine Science Museum, Tokai University, Shizuoka

During the ecological survey on the abalone, *Sulculus diversicolor* (REEVE) [Jap. name: Fuku-tokobushi], in the summer of 1975, a small crab attached on the underside of the disc of a brittle star inhabiting under stone was unexpectedly found at the depth of 7 m in the protective area outside of Port Kaminato, Mitsune district, Hachijo Island. Subsequently on October 21 and 29, many crabs were also obtained from the same habitat with the brittle stars. On August 25, several specimens were also observed on the underside of the disc of brittle stars at the depth of 15 m off Ohne district, and on October 3 and 29, at the depth of about 20 m in Taredo Bay, Mitsune district. On close examination of the specimens and consulting the literature, we came to the conclusion that these small crabs with ca. 5.5 mm in carapace breadth represent a hymenosomatid, *Halicarcinus orientalis* SAKAI [Tôyô-yawara-gani], which is known from Tateyama Bay to Ise Bay as recorded only by the original author in 1932, 1938 and 1965. On the other hand, the brittle stars were seemingly distinguished into two species due to the different color patterns of the disc with or without reticulation, but they were decidedly identified with *Ophiocoma brevipes* PETERS [Gomafu-kumohitode] by Mr. Seiichi IRIMURA of Totsuka High School, to whom our cordial thanks are tendered. This brittle star species with ca. 2 cm in disc diameter and ca. 8 cm in arm length is widely distributed in the Indo-West Pacific waters, ranging northward to Sagami Bay.

Hachijo Island is a subtropical oceanic island situated at the outside of the Kuroshio Current and directly influenced by the Ogasawara warm current, the surface water temperature of yearly mean at the protective area in question being 21.1°C. In general the coastal zone around this volcanic island is steep with violent waves, and thus the

1) Contribution No. 31 from the Marine Science Museum, Tokai University.

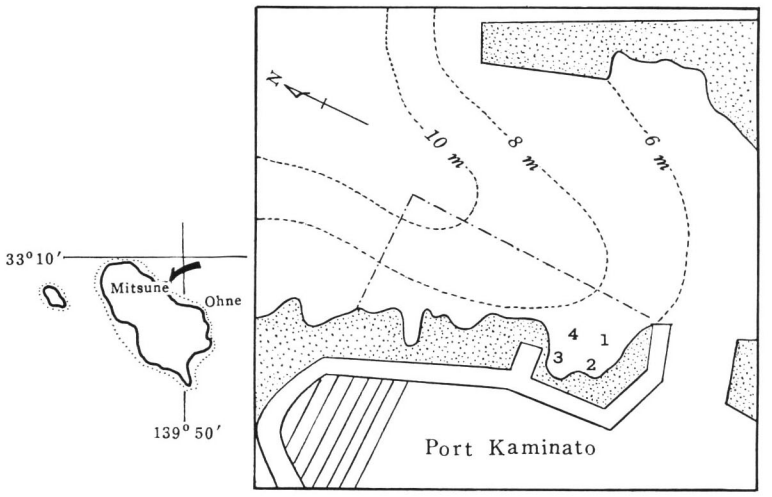


Fig. 1. Location of Hachijo Island, and details of protective area at Port Kaminato, Mitsune district. Protective area is indicated by chain line, and numbers 1–4 are stations of quadrats.

stones and rocks deviated from the land are widely distributed throughout the shallow water range. The rocky bottom shallower than 20 m is generally covered by the agar-agars, *Gelidium, Becherella* and *Pterochadia* [Tengusa], forming a desirable ground for the abalone culture mentioned above. Due to these topographical conditions it is reasonable that the corals and calcareous algae are rather ill-developed.

The stations for the investigation in the protective area outside of Port Kaminato were settled in the small inlet surrounded by the rocky reef and concrete wall (Fig. 1). The floor of this inlet is thickly covered with gravels of various size for its most part down to 7 m, and then the sandy mud bottom extends toward offshore. On August 12, we collected the animals found in four quadrats of a centiare settled in this inlet. Although all the species are still not identified, they are enumerated in Table 1. Besides the abalone which is outstandingly dominant a number of hermit crabs and chitons are found here and there on large rocks. During the survey some southern rare species such as the so-called zebra shrimp, *Gnathophyllum americanum* GUÉRIN [Yokoshima-ebi] and the tessellated anemone crab, *Lybia tessellata* (LATREILLE) [Kinchaku-gani], were found under stones. Raising up the stone of 30 to 40 cm in diameter, as usually observed and well known, one to three individuals of the brittle stars skillfully wriggle their arms, and hastily but quickly move under the adjacent stones or in sand. When a brittle star was turned over, we could find one or rarely two crabs clinging to the median part of ventral side of the disc. The crabs were collected from the brittle stars in the ratio of three to one at the station investigated in the protective area, but at the other two places already mentioned only in the ratio of ten to one. It must be otherwise mentioned that at the depths of 20 m or so in Taredo Bay the red brittle star, *Ophio-*

Table 1. Species found in four quadrats of a centiare settled in the inlet. Mollusks were identified by Mr. K. SASAO.

St. 1		St. 2	
Animals	Number of individuals	Animals	Number of individuals
Chitons	13	Chitons	2
Gastropods		Gastropods	
Sulculus diversicolor	7	*Sulculus divericolor*	18
Eurytrochus cognatus	1		
Trochus sacellus rota	6		
Tectus pyramis (young)	2		
Chelyconus catus	1		
Bivalve			
Cardita variegata	1		
Hermit crabs	19	Hermit crabs	23
Starfish		Starfish	
Coscinasterias acutispina	1	*Coscinasterias acutispina*	1
Brittle star		Brittle star	
Ophiocoma brevipes	5	*Ophiocoma brevipes*	1

St. 3		St. 4	
Chitons	24	Chitons	1
Gastropods		Gastropods	
Sulculus diversicolor	10	*Sulculcus diversicolor*	11
Pictodiloma suavis	1	*Trochus sacellus rota*	3
Omphalius nigerrimus	21	*Tectus pyramis*	1
Marmarostoma stenogyrum	1		
		Bivalve	
		Chlamys pelseneeri	1
Hermit crabs	12		
Sea urchin			
Tripneustes gratilla	1		
		Brittle star	
		Ophiocoma brevipes	1

mastix mixta LÜTKEN [Aka-kumohitode], is also rather common, but none of the crabs were found at all.

The crabs cling to the ventral side of the disc and are not carried away by the wave. When pulled apart from the host, they mimic death tightly folding the ambulatory legs. In the field they stay for some time in that posture at the sea bottom, and then slowly wander with no particular destination. In a petri dish at the laboratory, the crab awakened from the death mimicry began by clinging to the spines of the brittle star, and then turned to the ventral side of the arm. Then, it moved slowly toward the disc along the axis of the arm and finally arrived at the central part of the disc and settled down there. Due to the small size, the position usually settled down on the ventral side of the brittle star, the inactive movement and the sober color, this crab species seems to live safely with the reliable refuge at this oceanic island.

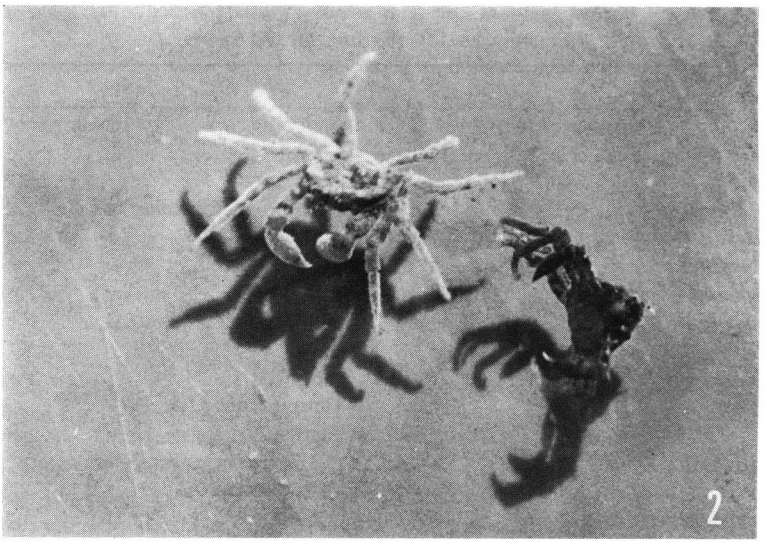


Fig. 2. *Halicarcinus orientalis* SAKAI. Individual of left side awakened from death mimicry.

In spite of the presence of some previous records from the Japanese mainland by the original author, we know nothing about the ecological behaviour mentioned above. In general this species is reputedly known to occur among calcareous algae or sea weed covering the rocks, or under stones or gravel, at the intertidal zone like the species such as *Rhynchoplax messor* STIMPSON [Yawara-gani] and *Elamena truncata* (STIMPSON) [Hime-sobagara-gani] of the same family. The members of this family may be the specialized forms with ill-calcified carapace, inhabiting chiefly the tidal and brackish zones, but partly the offshore or fresh waters. As rightly speculated by KEMP (1917) based on the number of the known species, this family may have originated in the New Zealand brackish waters, spreading the geographical distribution each toward Japan, India and South Africa and bathymetrically both to the fresh and offshore waters. In the Japanese waters altogether six species of four genera, *Halicarcinus*, *Rhynchoplax*, *Neorhynchoplax* and *Trigonoplax* are known to date. It is notable that the Japanese representative of *Neorhynchoplax*, *N. ariakensis* SAKAI, is a commensal with the sea cucumber, *Protankyra bidentata* (WOODWARD et BARRETT) [Toge-ikari-namako] from the Sea of Ariake.

As summarized by BALSS (1956), some groups of decapod crustaceans are in general closely concerned with echinoderms such as sea urchins, sea cucumbers and feather stars. It is well known that the pontoniid shrimps of *Stegopontonia* and other genera are associated with sea urchins, and *Palaemonella*, *Periclimenes* and others with feather stars. They are remarkably differentiated and the adaptation to the host is really surprising not only in morphological features but also in habit and color pattern. Some alpheid shrimps of *Athanas* are also commonly found among the spines of sea urchins, and some species of *Synalpheus* are associated with feather stars, though their

morphological adaptation to the hosts seems to be less developed than in the pontoniid shrimps. As for the crabs two major groups must be firstly mentioned. One is the pinnotherid crabs of *Pinnotheres* and allied genera found in the croacae of sea cucumbers, and the other is the parthenopid crabs of the subfamily Eumedoninae associated with sea urchins and feather stars. Recently, SUZUKI and TAKEDA (1974) concluded that *Zebrida adamsii* WHITE is parasitic on some species of sea urchins, and suggested the relation between *Echinoecus* and sea urchins as a similar case. *Harrovia* and *Ceratocarcinus* of the same subfamily are also well known as the associates of feather stars. The third group may be some portunid crabs of *Lissocarcinus* living on and in sea cucumbers somewhat like the case of the pinnotherid crabs. Finally, CHOPRA (1931) who dealt with the crabs obtained from the croacae of sea cucumbers from the Andamans mentioned two majid crabs, *Achaeus affinis* MIERS and *Menaethius monoceros* LATREILLE. They are, however, without doubt the happenings for protection or in search for food, though still decidedly unaccountable.

As briefly reviewed above, some groups of crabs are closely associated with sea urchins, sea cucumbers and feather stars, being usually parasitic rather than symbiotic. It may, however, be rather natural that the crabs bear no close association with starfishes and brittle stars, both of which are the major groups of echinoderms. HAYASHI (1975) mentioned three species of xanthid crabs found among the spines of the crown-of-thorns starfish, *Acanthaster planci* (LINNAEUS) [Oni-hitode]. Examining them, the senior author is now preparing a report on the collection, but considers that these crabs are not the usual associates of this monstrous starfish like the pontoniid shrimp, *Periclimenes soror* NOBILI [Hitode-yadori-ebi] also found among the spines. So far as we know, the association of crabs with the brittle stars has hitherto been unknown, so that the finding at Hachijo Island is of certain significance, though we could not confirm the evidence for parasitic or symbiotic relations between the crabs and brittle stars. This association is undoubtedly common and is observable everywhere at the shallow water bottom around this oceanic island, and it may be the outcome of peculiar adaptation to the circumstances without calcareous algae favourable for the crabs.

Literature

BALSS, H., 1956. Decapoda. VI. Ökologie. In BRONNS, H. G., *Klassen und Ordnungen des Tierreichs*, **5** (7): 1369–1476.

CHOPRA, B., 1931. Further notes on Crustacea Decapoda in the Indian Museum. II. On some decapod Crustacea found in the cloaca of holothurians. *Rec. Ind. Mus.*, **33**: 303–324, pl. 7.

HAYASHI, K., 1975. Occurrences of the crown-of-thorns starfish, *Acanthaster planci* (L.), along the southern coast of Kii Peninsula, Japan. *Bull. Mar. Park Res. St.*, **1**: 1–9.

KEMP, S., 1917. Notes on Crustacea Decapoda in the Indian Museum. X. Hymenosomatidae. *Rec. Ind. Mus.*, **13**: 243–279.

SAKAI, T., 1932. Notes on some rare materials of Japanese Oxyrhyncha. *Sci. Rep. Tokyo Bunrika Daigaku*, (B), **1**: 41–59, pls. 1–3.

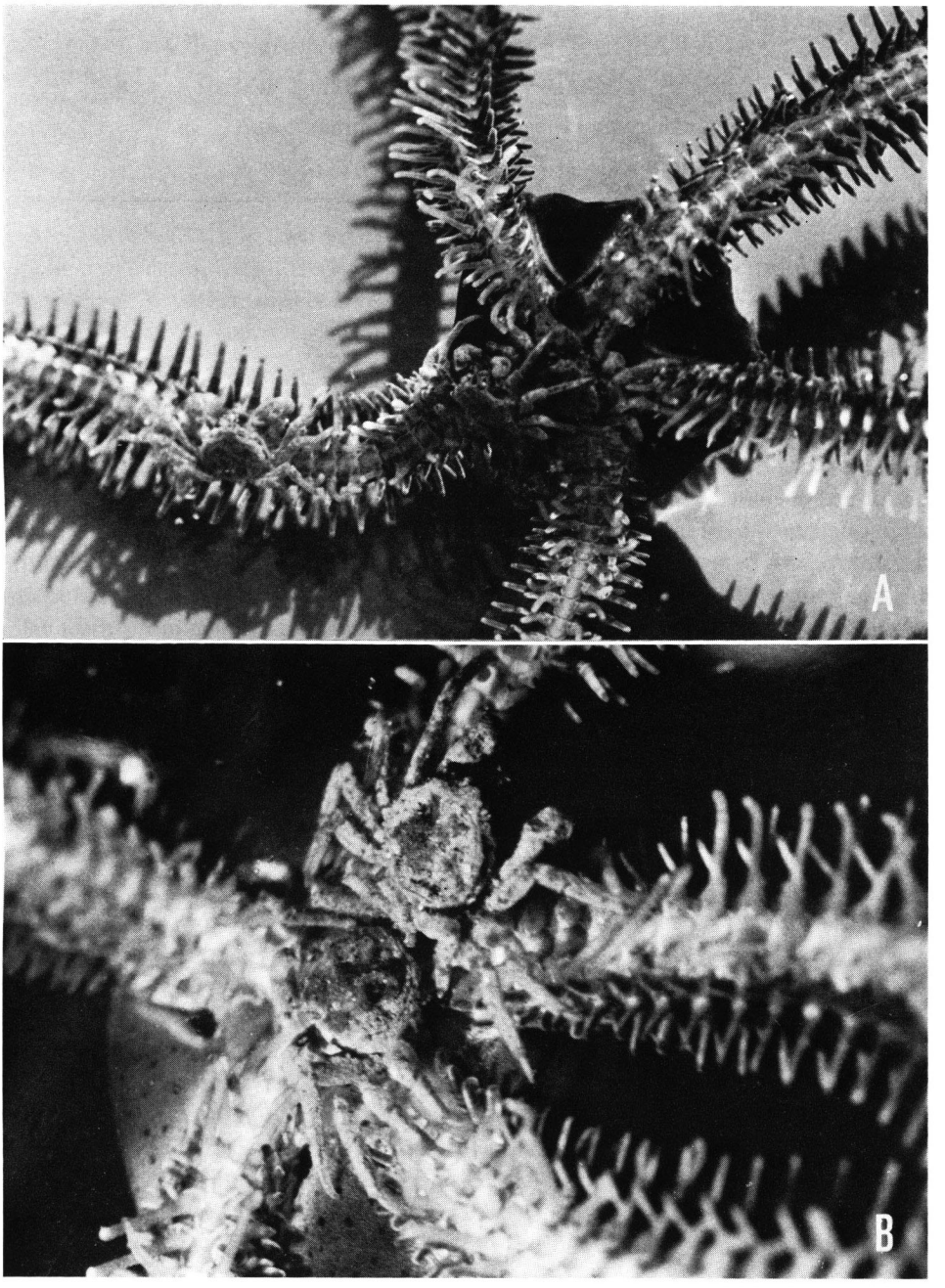
——— 1938. Studies on the crabs of Japan. III. Brachygnatha, Oxyrhyncha. 193–364 pp., pls. 20–41. Tokyo, Yokendo Co., Ltd.

SAKAI, T., 1965. The crabs of Sagami Bay collected by His Majesty the Emperor of Japan. xvi+206+92+32 pp., pls. 100. Tokyo, Maruzen Co., Ltd.

SUZUKI, K., and M. TAKEDA, 1974. On a parthenopid crab, *Zebrida adamsii* on the sea urchins from Suruga Bay, with a special reference to their parasitic relations. *Bull. Natn. Sci. Mus., Tokyo*, **17**: 287–296, pl. 1.

Explanation of Plate 1

Figs. A, B. *Halicarcinus orientalis* SAKAI clinging to the ventral side of the disc of brittle star. Behaviour of four crabs and one brittle star kept in a petri dish was observed, and then the brittle star was turned over for taking photographs.


A
B