



First record of symbiosis of the brittle star *Ophiocnemis marmorata* (Echinodermata: Ophiuroidea: Ophiotrichidae) on jellyfish of the genus *Rhopilema* (Cnidaria: Scyphozoa) in Vietnamese waters

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Abstract

First finding of brittle star *Ophiocnemis marmorata* in jellyfishes of genus *Rhopilema* in waters of Vietnam is described.

Symbiosis between scyphomedusae and epizoic invertebrates, in particular with hyperiid amphipods, has long been known (Thiel 1976). However, the association of echinoderms with jellyfish is unusual and has seldom been reported.

Russian investigators worked in the Nhatrang Bay near the Tam Island in 2011. Underwater they could meet enough greater number Scyphozoa jellyfishes *Rhopilema hispidum* (Vanhöffen, 1888).

Inside of a bell of many jellyfishes were visible brittle stars. One such jellyfish was placed in a bucket under water and delivered aboard a vessel together with all symbionts. Among symbionts there were 9 juvenile fishes, 7 swimming crabs *Charybdis feriata* (Linnaeus, 1758), 4 shrimps and 5 brittle star specimens *Ophiocnemis marmorata* (Lamarck, 1816).

Introduction

Symbiotic relationships of marine animals are most diverse in the tropics, where the most ancient ecosystems are located. The present study concerns a particularly interesting association that occurs between jellyfish and their symbionts. The first report regarding the symbiotic relationship between jellyfish and fish appeared in the late 19th century (Peach 1855). Since then, many symbionts of jellyfish, mainly crustaceans and fish (Thiel 1976), have been studied. All these animals are rather well adapted to the pelagic way of life. And suddenly brittle stars which are typical benthic animals were found in jellyfish *Rhopilema hispidum* (Panikkar and Prasad 1952). To date, there are several works devoted to this symbiosis (Fujita and Namikawa 2006; Kanagaraj *et al.* 2008; Hiruta *et al.* 2018). According to these authors, the brittle stars were found in four different jellyfishes: *Cephea cephea* Forskal, 1775, *Netrostoma sp.*, *Rhopilema hispidum* (Vanhöffen, 1888) and *R. esculentum* Kishinouye, 1891. Kanagaraj with colleagues have assumed, that *O. marmorata* is a filtration organism and is rather usual on soft bottom on shoals. The brittle stars probably find food, a refuge and protection borrowing niches in a body of jellyfishes (Kanagaraj *et al.* 2008).

In 2011 the authors encountered a large concentration of jellyfishes in the Nhatrang Bay near Tam Island. Some of them had symbiotic fishes, crabs, shrimps and brittle stars. Below we describe this symbiosis and discuss the relationship between host jellyfish and associated brittle stars.

Material and methods

Material was collected near the Tam Island (Hon Tam) in the Nhatrang Bay, South China Sea during the expedition of the Russian-Vietnamese Tropical research and technological center in May 14th, 2011. During collection of the material SCUBA was used to make observations on the distribution of jellyfish in the water column. One jellyfish with diameter of a bell about 20 cm, together with its symbionts, has been placed in a bucket that was brought aboard the research vessel. The symbionts were taken from under bell and fixed in 75% alcohol, and the jellyfish was released in the sea. Among the symbionts there were 9 juvenile fishes, 7 swimming crabs *Charybdis feriata* (Linnaeus, 1758), 4 shrimps and 5 brittle star specimens *Ophiocnemis marmorata* (Lamarck, 1816) (Smirnov *et al.* 2018). O.V. Savinkin made several photos of jellyfish and brittle star (Fig. 1–3). *Ophiocnemis marmorata* in Vietnamese waters has been noted by C. Dawydoff (1952).

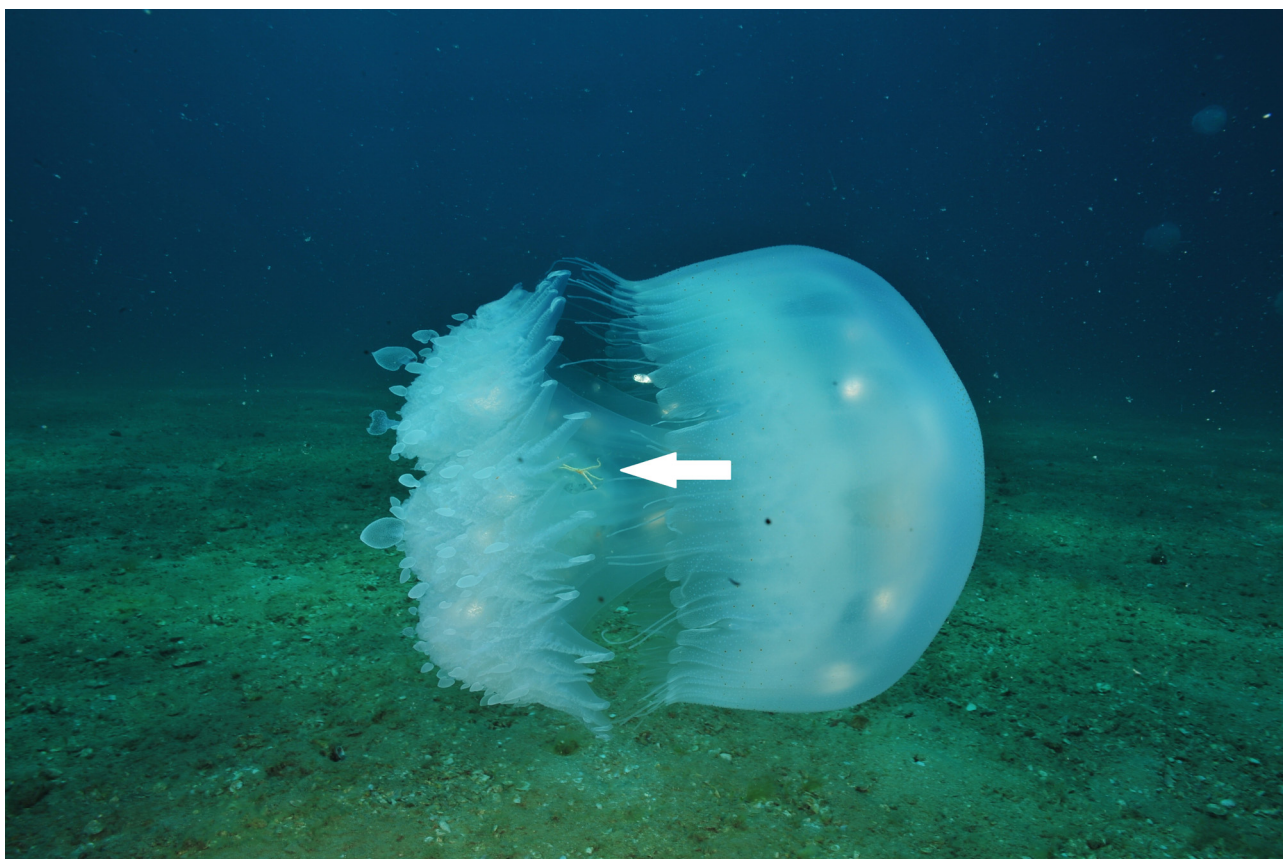


FIGURE 1. Jellyfish with symbionts. The ophiuroid *Ophiocnemis marmorata* indicated by an arrow. (Photo by O. Savinkin).

Results

The underwater observations revealed a more or less uniform distribution of jellyfishes in the water column with a slightly greater concentration near the surface than at the bottom at a depth of 12 m. Jellyfish observed *in situ* had a bell diameter of up to 25 cm. Inside the bell of many jellyfishes juvenile fishes and shrimps were visible, and in some especially large individuals there were also small crabs and brittle stars. Transparent walls of the body of the jellyfish allowed to determine the approximate number of brittle stars inside the bell. Inside some large jellyfish were more than 20 brittle stars of various sizes what is confirmed by some photos of Thomas P. Peschak (2019) in clear and warm waters of the Mozambique Channel.

The collected specimen of *Rhopilema hispidum* (Vanhöffen, 1888) contained 9 juvenile fishes, 4 shrimps, 7 swimming crabs *Charybdis feriata* (Linnaeus, 1758) and 5 brittle stars *Ophiocnemis marmorata* (Lamarck, 1816) of different size. Some of the brittle stars were under the bell together with juvenile fishes, shrimps and crabs and other part of brittle stars were on oral arms.

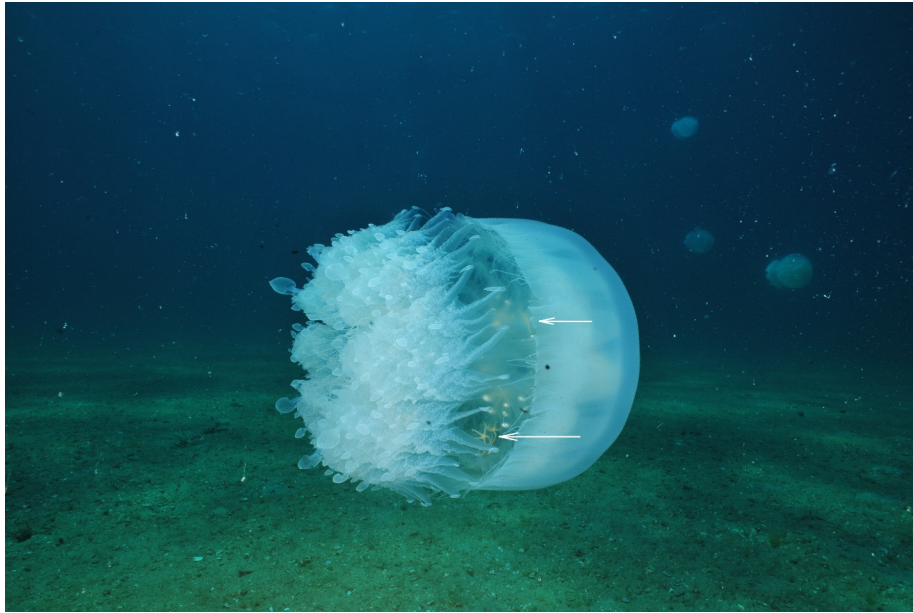


FIGURE 2. Jellyfish with symbionts. The ophiuroids *Ophiocnemis marmorata* indicated by arrows. (Photo by O. Savinkin).

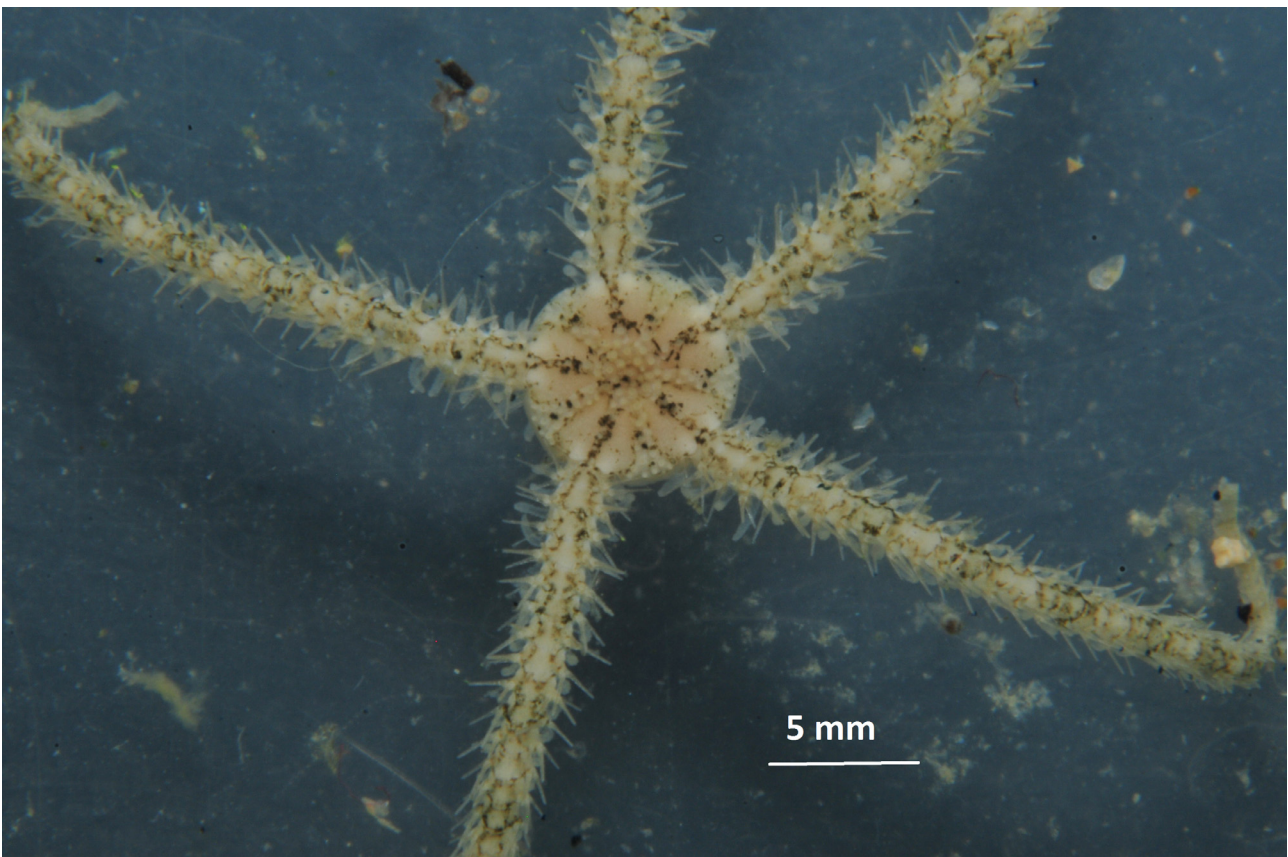


FIGURE 3. Brittle star *Ophiocnemis marmorata* from jellyfish (Photo by O. Savinkin).

Discussion

Judging by the variety of jellyfishes (four species) on which brittle stars were met their symbiotic relationship is not obligate but facultative. It is rather an indication of the youth of these symbiotic relationships.

What are the adaptive advantages to *Ophiocnemis* of this relationship with jellyfish? Apparently, three main hypotheses can be considered here: the desire for spread, the search for food and protection from predators (Doyle 2014).

The first presumed reason is related to the need of every living organism to disperse. This reason was discussed by Fujita and Namikawa 2006 and Kanagaraj *et al.* 2008. There is well name for such symbiotic species as hitchhikers including brittle stars (Marsh 1998; Hiruta *et al.* 2018).

The second possible reason related to the search for food can also take place. Although brittle star *O. marmorata* is supposed to be a suspension feeder (Warner 1982), it can be assumed that it also feeds on the mucus produced by the jellyfish, as well as the body of the jellyfish.

However, B. Ingram and colleagues based on the study of stable isotopes include the species *Ophiocnemis marmorata* to kleptoparasites (Ingram *et al.* 2017).

The third reason associated with defense against predators, apparently, also plays a role in this symbiosis, although not very significant, judging by the location of some of the brittle stars on the outer surface of the bell, see photographs of Peschak (2019).

In conclusion, we suggest that the potential advantages for *O. marmorata*, of its symbiosis with jellyfish, are dispersal, food, and protection from benthic predators.

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