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Symbiotic relationship between sea pen and porcelain crab: Art of living in marine ecosystem

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ABSTRACT

Mutualistic symbiosis is a common phenomenon in nature. In this relationship, the porcelain crab is benefitting from the sea pen by being protected from potentially harmful predators (tiger shark, white tip reef shark, hammerhead shark, blacktip reef shark, green hump head parrotfish, napoleon wrasse and the cuttlefish) and it has a place to live. On the other hand, the sea pen is benefitting by getting nutrients from the Porcelain crab that it would not normally get by itself. Nutrients such as ammonia, sulphur and phosphorus are excreted by the porcelain crab are used by sea pen. The symbiotic relationship between Porcelain crabs and sea pens is a well-known example of mutualism in the sea. Among marine organisms, marine sessile invertebrates are rich sources for obtaining bioactive natural molecules. A majority of the last decade studies about sessile invertebrate *Pennatulacea* (Class- *Anthozoa*) focused on the potential of *Pennatulacea* derived bioactive molecules in treating neoplasm. Terpenoids are organic compounds extracted from *Octocoralina,* a subclass of *Anthozoa*, which demonstrate anti-cancer effects. Terpenoids are further classified to Hemiterpenes, Monoterpenes, Sesquiterpenoids, Diterpenoids, Sesterterpenes, Triterpenoids, Tetraterpenoids, and Polyterpenoid; Sarcophine ($C_{20}H_{28}O_3$), as a Diterpene with high anti-tumour activity.

Key words: Bioactive compounds, mutualistic symbiosis, porcelain crab, sea pen

INTRODUCTION

Mutualistic symbiosis (the interaction between species, where both partners derive benefits) is a common phenomenon in nature (Mebs, 2009). In this particular relationship, the Porcelain crab is benefitting from the sea pen by being protected from potentially harmful predators (tiger shark, white tip reef shark, hammerhead shark, blacktip reef shark, green hump head parrotfish, napoleon wrasse, and the cuttlefish) and porcelain has got a permanent shelter to live. On the other hand, the sea pen is benefitting by getting nutrients such as ammonia, sulphur and phosphorus from the excreta of porcelain crab (Mebs, 2009). The porcelain crab also assists in keeping the sea pens free from debris (Shedd Aquarium, 2001).

MATERIALS AND METHODS

During sampling, a living specimen of the sea pen, *Pteroeides esperi* Herklots 1858, Anthozoa: Octocorallia), was brought to the shore by shore seine gear at Jegadapattinum fishing harbour, Tehsil/Taluk: Arantangi near Pudukkottai district

of Tamil Nadu during August, 2013. Sea pens are colonial marine cnidarians belonging to the order Pennatulacea. There are 16 families within the order; they are thought to have a cosmopolitan distribution in tropical and temperate waters worldwide. Sea pens are grouped with the octocorals (soft corals), together with sea whips or gorgonians. Although named after their feather-like appearance reminiscent of antique quill pens, only sea pen species belonging to the sub-order Subselliflorae live up to the comparison. This species has been duly submitted to Zoological Survey of India, ZSI, MBRC, Museum, Chennai and got accession number: M-236 **(**File.No.4-49/2015) in 2015.

RESULTS AND DISCUSSION

A porcelain crab (*Porcellanella triloba*), the colour pattern of which resembled that of the host to a remarkable degree, was found sheltering between the pinnules of a sea pen. The camouflage was so perfect that it was difficult at a casual glance to spot the crab, the general colour of which was whitish as that often sea pen while the carapace and chelipeds had dark more or less symmetrically arranged spots, simulating to some extent the dark spots on the distal part and margin of the pinnules (Fig. 1). Attempts to dislodge the crab automatically disturbed the sea pen which reacted immediately by shrinking. This reduced further the interspace between the pinnacles, thereby affording greater protection to the porcelain crab.

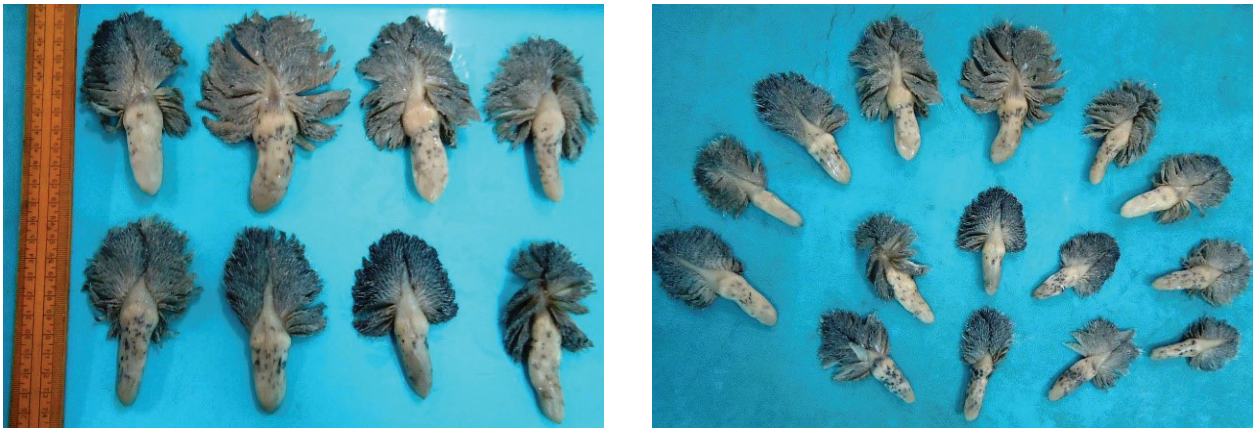

Fig. 1. Sea pens, *Pteroeides esperi* collected from fish landing centre of Jegadapattinum, Pudupettai district of Tamil Nadu

Fig. 2. Sea pens, *P. esperi* showing the one pair of Porcelain crab, *P. triloba* from fish landing centre of Jegadapattinum, Pudupettai district of Tamil Nadu

The crab in turn clasped firmly on to the body of the sea pen and only with considerable difficulty could it be separated without inflicting any damage. The porcelain crab belongs to the genus *Porcellanella* White (Family Porcellanidae: Section Anomura) and does not come under the category of true crabs. There are three species of the above have hitherto been recorded from Indian waters, *P. quadrilobata* Miers and *P. gakwari* Hornell from Alcyonarians and *P. triloba* White from Pennatula. (Fig. 2). A number of sea pens were collected subsequently, each with one to four crabs, two being the general rule as a pair. The crabs are characterized by long antennae which are constantly kept in motion and quite often the chelipeds are waved to and fro movement. The association of mutual benefits of both animals as the row of setaceous hair present in the form of a comb on the inner margin of each cheliped may help to brush off and thus keep clean the body of the sea pen from organic matter and dirt that might get entangled in its body.

The symbiosis refers to the biological interaction between two organisms living in close association. It is a widespread phenomenon in tropical marine communities and the association between sea pens and porcelain crabs belongs to the most common cases. It is a familiar example of mutualism. The symbiotic relationship between porcelain crab and sea pen is a classic example of mutualism relationship in the sea. Among marine organisms, marine sessile invertebrates are a rich source for obtaining bioactive natural molecules. A majority of the last decade studies about sessile invertebrate *Pennatulacea* (Class *Anthozoa*) focused on the potential of *Pennatulacea* derived bioactive molecules in treating neoplasm (Rocha et al., 2011). The order of *Pennatulacea* contains sea pens, which are colonial marine invertebrates including 300 species. The sea pens have feather-like appearance available at intertidal zones (15 meter) up to 600 meters depths (Sharifi and Safaeian, 2015). Terpenoids are organic compounds extracted from *Octocoralina* (a subclass of *Anthozoa*) which demonstrate anti-cancer effects (Rocha et al., 2011).

Terpenoids are classified to Hemiterpenes, Monoterpenes, Sesquiterpenoids, Diterpenoids, Sesterterpenes, Triterpenoids, Tetraterpenoids, and Polyterpenoid (Abandansari et al., 2013), Sarcophine ($C_{20}H_{28}O_3$), as a Diterpene with high anti-tumour activity (Sharifi and Safaeian, 2015), has the capability to induce apoptosis in cancer cells both *in-vitro* and *in-vivo*, as well as showing anti-inflammatory effects (Zhang et al., 2009). This species is available as bycatch by gillnet, shore seine, no body uses specifically, but it is used as trash fish as fish meal in poultry and fish feed industry.

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