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Research Article

Distribution and Attachment of Bryozoans in the Intertidal Region of South Andaman Island

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ABSTRACT

Aiming to collate the distribution and the attachment preference of intertidal bryozoan of Andaman waters, a study was carried out in three intertidal sites (Burmanallah, Kodiyaghat, and Chidiytapu) of southeastern coasts of the Andaman Islands between June and August 2016. The present study is the first exclusive report on bryozoans from the Andaman Islands after a long research gap of nine decades. During our investigation, a total of twelve genera were identified from both calcareous and non-calcareous substratum. Out of the twelve genera, eight genera were new records from the island. The present study showed that the attachment affinity of the Bryozoans is more towards natural substratum particularly on the rocks. The *Thalamoporella* sp. reported the most abundant species with maximum average colony length of 3.5 cm from the rock substratum.

Keywords: Bryozoa, colony length, intertidal, South Andaman, substratum

Introduction

Bryozoans (moss animals, sea mats or lace corals) are minute aquatic organisms which are grouped under phylum Ectoprocta. It forms colonies made up of box-like or tubular modules called zooids. These have various forms, but the fundamental unit, a feeding zooid (autozooid), comprises a body wall enclosing a polypide (lopophore and digestive tract) [1]. Bryozoan colonies are mostly encrusting on rocks, shells, seaweeds, and seagrasses. However, they can also be bushy (resembling hydroids or turfing algae) or large and foliaceous like some corals. Intertidal bryozoans are of concern for some reasons [2]. Bryozoans from intertidal zone contain not only inter-tidally restricted species but also those which extend into adjacent subtidal areas. Consequently, by collecting intertidal species, it is possible to take comparable samples of significant richness at numerous localities over broad geographic ranges which are quite useful from the perspective of zoogeography and biodiversity. Being filter feeders, Bryozoans control planktonic population and help in marine ecological balance. Bryozoans are potential in the production of promising novel anti-tumor natural products in the medical research [3]. Fouling behavior of bryozoans on pilings, pipes, and boats are a common threat in the harbors and related industries in maritime countries. This ecological and economic significance of bryozoans led to an extensive study on it throughout the world.

A systematic study of Bryozoan is primarily based on the highly calcified zooecia [1]. Circumscribed bryozoans include three classes, four orders, 187 families, 808 genera and about 6000 species [4]. A total of 257 marine species have been identified from Indian EEZ so far. However, the reports from Andaman and Nicobar, which covers 30% of Indian EEZ with rich repositories of biodiversity and endemicity, is below 18%, due to its remoteness and lack of research [5]. The available literature on Andaman bryozoans are scanty [6, 7, 8]. Till now no comprehensive attempt has been made to work out taxonomical and ecological aspects of intertidal bryozoans in detail. This paucity of information on bryozoans from the coastal wa-

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Figure 1. Map showing the three Study sites

ter of Andaman Island, especially from a typical tropical marine habitat of Indian EEZ leads to the present study.

Material and Methods

Three intertidal sites-Burmanallah (11°33’569 N and 92°43’781 E), Kodiyaghat (11°31’473 N and 92°43’546 E) and Chidiytapu (11°40'861 N and 92°43'546 E) on the southeastern coasts of the Andaman Islands were investigated between June and August 2016 (Figure 1). Beginning up to an hour before low tide and continuing for up to an hour after low tide, the sample collection was done through the intertidal zone and covered up to 250 m parallel to the sea by snorkeling and handpicking. Boulders, smaller rocks, shells, and artificial materials close to the water's edge at low tide were overturned and examined.

Specimens thus obtained were air-dried and wrapped with paper for transport. The lengths of the colonies were measured using Vernier Calipers. In the laboratory, colonies on stones and rock fragments were removed and treated with Sodium hypoclorite sollution (NaOCl) to remove the soft tissue and algal attachment. Then rinsed it in water, and air-dried. Some colonies became fragmented on the removal of specimens from large rocks. Then the specimens were examined by SMZ 1500 stereoscopic microscope. Bryozoan species was identified using standard identification keys [1]. Environmental parameters from the study sites including temperature, salinity, pH, dissolved oxygen were also estimated.

Results and Discussion

During the study period, the Maximum temperature of 30°C was recorded from Chidiyatapu in August. The monsoon rain might have resulted in the minimum temperature of 24°C in Burmanallah. Salinity varied from 26 – 32 (psu) and the month of August contributed the maximum salinity recording from all the three stations. pH was altered from 7.6 - 7.9. Dissolved Oxygen was ranged from 3.5 – 4.2 (mg/L). In all the stations, DO level was almost maintained during of June and (Table 1).

A total of twelve genera were identified that included *Smittipora* sp., *Hippopodina* sp., *Cupuladria* sp., *Hippaliosina* sp., *Membranipora* sp., *Schizoporella* sp., *Thalamoporella* sp., *Parasmittina* sp., *Caleschara* sp., *Antropora* sp., *Thalamoporella* sp., and *Tremogasterina* sp. (Table 2). In the entire three stations, *Thalamoporella* sp. was the most abundant among the total collections. *Smittipora* sp., *Hippaliosina* sp., *Membranipora* sp., *Schizoporella* sp., *Caleschara* sp., *Thalamoporella rozarii* were got from two sites Burmanalla and Chidiyatapu. *Antropora* sp., *Tremogasterina* sp., *Hippopodina* sp. were reported only from Burmanallah, and *Cupuladria* sp. was reported only from Chidiyatapu. Burmanallah contributed the maximum number of species (nine) recorded from the study area followed by Chidiyatapu (eight), and Kodiyaghat was the least recorded area (three). The length of the colonial attachment on each substratum was also recorded using Vernier Calipers. The *Thalamoporella* sp. colony was the lengthiest colony (3.5 cm) with a broad spread of colonial growth throughout the rocks and giant clam shells. Whereas *Parasmittina* sp. and *Cupuladria* sp. were recorded with moderate length (1.3 cm and 0.9 cm respectively). The lowest colony length was noticed for *Hippopodina* sp. and *Hippaliosina* sp. (0.5 cm) (Table 2).

In all the three stations the attachment on the rocks was most abundant. About 40% of the total colony collected was from the underneath of the rocks followed by the shell of Tridacna (Figure 2). Dead corals, bivalve shells were also provided substratum for the moderate attachment. No colo-

Table 1. Environmental Parameters recorded during the study period for the three stations (BR – Burmanalla, KD – Kodiyaghat, CD – Chidiyatapu)

	Temperature-Salinity (°C)			pH (psu)			Dissolved Oxygen (mg/L)					
	BR	KD	CD	BR	KD	CD	BR	KD	CD	BR	KD	CD
June	27	27	28	27	26	27	7.6	7.8	7.8	3.9	3.7	3.5
July	24	26	25	29	29	30	7.9	7.7	7.7	3.8	3.6	3.7
August	28	29	30	31	32	32	7.4	7.6	7.6	4	4.2	3.9

Table 2. Bryozoan species list with Number of colonies, colony length range (minimum to maximum), mean length, Standard deviation (±SD)

Bryozoan Species	Burmanallah				Kodiyaghat				Chidiyatapu			
	NoC	Range	ML	SD	NoC	Range	ML	SD	NoC	Range	ML	SD
Smittipora sp.	2	0.3-0.7	0.5	0.2					1	0.4	0.4	0
Hippopodina sp.	1	0.5	0.5	0								
Cupuladria sp.									1	0.9	0.9	0
Hippaliosina sp.	1	0.5	0.5	0	2	0.4-0.5	0.45	0.05				
Membranipora sp.					2	0.3-0.8	0.55	0.25	1	0.5	0.5	0
Schizoporella sp.	1	0.7	0.7	0								
Thalamoporella sp.	4	1.1-3.5	2.3	0.89	2	0.7-2.5	1.6	0.9	1	1.6	1.6	0
Parasmittina sp.									1	1.3	1.3	0
Caleschara sp.	1	0.6	0.6	0					2	0.4-0.6	0.5	0.1
Antropora sp.	1	0.5	0.5	0								
T. rozierii	3	1.5-2.1	1.86	0.26					2	1.9-1.3	1.6	0.3
Tremogasterina sp.	1	0.7	0.7	0								

ny was recorded from the substratum of anthropogenic origins such as chappals, bottles, and fragments of constructions.

The suborder Anasca (order Cheilostomata) was by far the most significant component of the intertidal bryozoan fauna found in the study. The six genera were included under *Anascan cheilostomes*, and the remaining five belongs to *Ascophoran cheilostomes*. No species from the orders Ctenostomes and Cyclostomes were found in any of the three stations. All species were encrusting forms and no erect forms, either flexible or rigid, were found. In Chidiyatapu some of the colonies were found attached directly to the coral substratum. Moreover, many of these species were also found on calcareous shells upon the rock surface. The small colonies of *Hippaliosina* sp. and *Cupuladria* sp. were found encrusting on the shells of Lambis. *Thalamoporella* sp. were much more abundant on rocks, though colonies were also observed on other substrata. *Chaleschara* sp. was solely noticed in small cavities of rocks, *Membrinopora* sp. was found primarily encrusting on rocks and also, on some bivalve shells. The upper surfaces of rocks where bryozoans were encrusted and exposed to light were heavily coated with flexible macroalgae. Due to its thinness, not all colonies could be removed. In Chidiyatapu beach, several dead colonies of bryozoans were scraped out, of which few remained unidentified.

Among the three study sites, Burmanallah was the most diversified sites for the marine bryozoan species. The Chidiyatapu gave habitat for many coral reef-associated Bryozoan. The twelve species identified from three sites out of which four genera were reported during the previous studies [6, 7, 8] and the remaining eight genera are a new record to this island. From all the three stations, the big rocks were the most preferred substratum for the bryozoans than entire calcareous platforms. This may be due to exceptional diversity and assemblage heterogeneity generally found in marine hard bottom habitats contribute significantly to species richness, abundance, and biomass [9]. In substratum rich environments, such as rocky shores, many Bryozoans display a high degree of

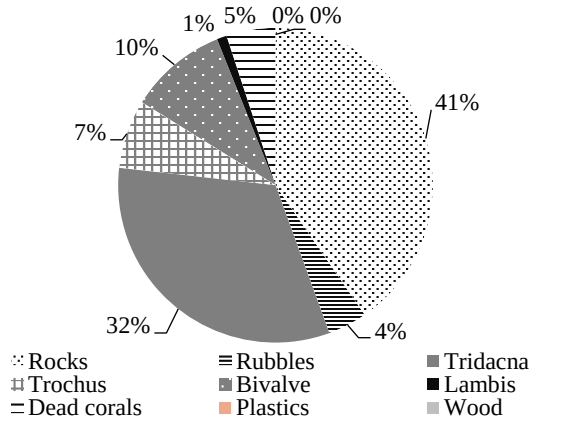

Figure 2. Showing the percentage of bryozoan attachment on the substratum

specificity in their habitat preferences. The dead shells of tridacna host most number of colony among the calcareous substrata. It should be due to the immense surface area of the giant clam shells for colonization compared to other mollusk shells [10]. There were very few attachments from small invertebrate shells, which may be due to its lack of sufficient attachment surface along with disturbance and replacement that could occur during the tidal activity [11]. Moreover, based on the study on epizoic bryozoan on cephalopod shells, Wyse Jackson and Key [12] analyzed that the rate at which these shells become available is very slow and directly dependent on the life cycle and abundance of the host organism, especially on their reproduction and mortality rates. In some rather inhospitable situations, Bryozoans appear to settle on whatever substrate is available [13]. However, no attachment was reported from the substratum with anthropogenic origin.

Bryozoans are one of the six group of invertebrates documented in a catalog of the central marine fouling organism [1]. *Thalamoporella* sp. which is one of the most biofouling species [14] reported is available in plenty throughout the three study sites. Two different species of genus *Thalamoporella* were reported in our study. The substratum selection mechanism of the Bryozoan is significant in ecological aspect since it is providing shelter for many invertebrate species, including other bryozoans [15] and thus they show their crucial role in the marine ecological balance. The intertidal bryozoans were also found to be food organisms for echinoids, starfish, brittle-stars, chitons, and opisthobranches [16]. A total of thirty species of coral associated bryozoans have recorded from the Indian coral reef, of which five species *Tremogasterina* sp., *Parasmittina* sp., *Membranipora* sp., *Smittipora* sp., and *Thalamoporella* sp. were reported in the present study. Our studies also revealed that the rocky platform is the most preferable substratum for the Bryozoans attachment in the intertidal waters of Andman Is land. A similar pattern of attachment abundance on the rocks is also reported from some temperate fjords [17].

The genera like *Thalamoporella* sp., *Parasmittina* sp., and *Membranipora* sp. reported from the Chidiyatapu were also included in a previously reported list from the Great Barrier Reef (GBR) and from Indo-Pacific reef [11]. However, many species, which belong to the common genera and are reported from other parts of the world such as, *Stylopoma*, *Crassimarginatella*, *Micropora*, *Puellina*, *Hippothoa*, *Celloporaria*, etc., have not been recorded from this Island territory of India.

Conclusion

Intertidal bryozoan fauna is a very diverse one, probably consisting of several species. However, Andaman bryozoan fauna of intertidal and coral reefs ecosystem is poorly understood. Our results suggested that the species of the most abundant bryozoans is that of *Thalamoporella*. Moreover, the majority of the genera recorded in the present study have a worldwide distribution along the shallow waters of the tropical and temperate seas. The most heavily colonized substrate was rocks, followed by the calcareous shells. This might be due to physical damages caused in the light shells owing to high wave actions and get easily turned over. A difference between epibiont species of tridacna shells and other dead shells were recorded. Tridacna shells seem to be more attractive and ease for the big colonies than small bivalves and mollusk shells. Our findings further emphasize the importance of rocky shores as a comfort station for the sessile invertebrates like bryozoan. To explore the diversity and ecological activities of bryozoans, a detailed study is most vital. Our results demonstrate that these Andaman Islands and surrounding regions deserve essential baseline surveys which are still lacking for even some of the better-studied taxa in the world, such as bryozoans.

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