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Space competition studies between *Briareum violaceum* (Octocorallia; Alcyonacea) and scleractinian corals in shark Island, north Andaman, India

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Present study focused on growth competition between Scleractinia vs. Alcyonacea corals. Percentage of live scleractinian coral cover is 44.17% of which 11.67% Briareum violaceum (Alcyonacea) soft coral encrusted on scleractinian hard corals. Among them maximum 2.5% of Acropora and Porites species were causes by same species from the study site.

[Key words: Hexacoral – Octocoral competition, Overgrowth, *Briareum,* Invasive species, Andaman]

Introduction

The coral reefs are the most diverse and productive ecosystem, shaped by the laying down of calcium carbonate. Scleractinian corals are associated with *Zooxanthellae* a symbiotic algae and cannot survive without them. Scleractinian corals are slow growing organism and the complex reef structures declined due to numerous anthropogenic activities as well as ecological factors[1-7], among them, the interaction of space competition between coral and soft coral, coral - macroalgae, coral – sponges can reported to have negative impacts of coral reef ecosystem. The competitive growth reduces the space and light availability, which may affect the photosynthetic, growth and survival capacity of Scleractinian corals[8,9]. Notwithstanding the following reports, the studies on competitive growth between coral and sponge, coral and algae, coral and soft coral has not received much attention[10-13]. The competitive growth and impact were reported based on invasive species diversity beside the reef environment.

The invasive species such as crown-of-throns starfish (*Acanthaster planci*), orange-tube coral (*Tubastrea coccinia*), seaweed (*Kappaphycus alvarezii*) and soft coral (*Carriia ressis*) were reported from tropical regions around world and also in Indian reef environment (Lakshadweep, Andaman and Nicobar, Gulf of Mannar, Gulf of Kachchh)[14-24]. Based on available literature *Carijoa riisei* is the only one invasive species of soft coral (Alcyonacea) reported from Indian reef environment[20]. Apart from these reports, the information regarding the impact of soft coral (Alcyonacean) on Scleractinian corals in India is scanty. In this context, the present study focused on the competition between alcyonacea soft coral and scleractinian hard corals from the Shark Island, North Andaman.

Materials and Methods

The data on the occurrence of alcyonacean on hard coral colonies were collected during 2016 to 2017 with the help of Line Intercept Transect (LIT) method[25]. All observations and data collection in this study were performed at different depths, 5-10 m; 10-15 m; 15-20 m in Shark Island (Lat. $13^0$12.064 N Long. $92^0$45.255 E), North Andaman, Andaman and Nicobar Islands. The percentages of *B. violaceum* encrusted on corals were calculated as follows:

$$\frac{\text{Number of Alcyonacea encrusted on Scleractinian colonies}}{\text{Number of total surveyed colonies}} \text{ X } 100$$

The samples were collected during the survey by SCUBA and preserved in 70% ethanol following Breedy[26]. The sample was examined based on the morphological characteristics of the colony and microscopic sclerites structure. Sclerites were extracted by 5% sodium Hypochlorite[27] and sclerites rinsed many times with distilled water, then 100% ethanol, dried and mounted on stubs for Scanning Electron Microscope (SEM) and stereo microscope (Leica DFC 500). Underwater examination made with the help of a Canon G15 underwater camera. The

identified samples were deposited in the National Zoological Collection of ZSI, Andaman and Nicobar Regional Centre, Port Blair, Andaman and Nicobar Island. India.

Results

The transects were laid at three different depths with the help of SCUBA at Shark Island. Overall 44.17 ± 7.9 % of live corals (LC), 21.67±10.7% of soft corals (Alcyonacea), of which 11.67 ± 8.5 % *B. violaceum* Alcyonacea encrusted corals, 8.33 ± 5.16 % dead corals, 7.50 ± 2.24 % sponges, 6.67± 3.42% others were noted from the study site (Fig. 1). Maximum live coral cover was observed at 15 to 20 m depth (52.5%) and a minimum at 10 to 15m depth (35%). Maximum *B. violaceum* growth observed in 10 to 15 m depth (22.5%) and minimum at 15 to 20 m depth (5%) (Fig. 2). In specie vice effect on corals were reported as *Acropora* > *Porites* > *Montipora* > *Favia* > *Favites* > *Goniastrea* > *Galaxea* > *Hydnopora* > *Pocillopora* respectively (Fig. 3) and the growth of *B. violaceum* on different Scleractinian coral species were documented with the help of underwater camera canon G10 (Fig. 4).

The present study yielded one species (*B. violaceum)* as a new distribution record for India. The species is identified based on morphological character and with the help of Leica microscope analysis.

SYSTEMATIC ACCOUNTS

Phylum : Cnidaria
Class : Anthozoa
Sub Class : Octocorallia
Order : Alcyonacea
Sub Order : Scleraxonia

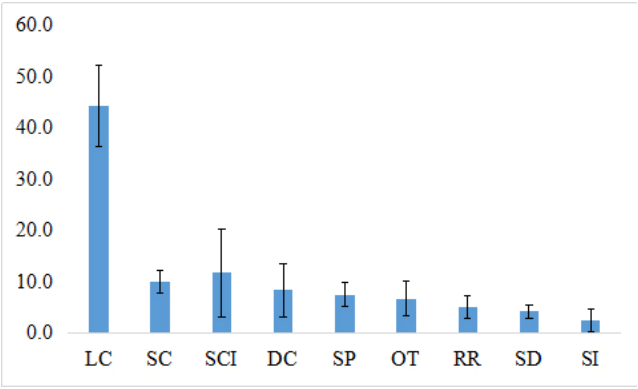

Fig. 1 — Percentage of Scleractinian corals and associated fauna at Shark Island, North Andaman. (LC Live Coral, SC Soft Coral, SCI Soft Coral Infection, DC Dead Coral, SP Sponges, OT Others, RR Rubbles, SD Sediment, SI Silt)

Family : Briareidae
Genus : *Briareum*
Briareum Blainville, 1830: 484
Asbestia Nardo, 1845
Pachyclavularia Roule, 1908: 165
Solenopodium Kukenthal, 1916a

Species : Briareum violaceum (Quoy & Gaimard, 1833)

Common Name: Star polyp coral

Material Examined: ZSI/ANRC 14651, 3 fragments of samples 5 to 8 cm in size; depth 5 – 20 meters depth; Shark Island (Lat. $13^0$12.064 N Long. $92^0$45.255 E), North Andaman, Andaman and Nicobar Islands.

Description: The collected samples are encrusting growth form, the growth extended on coral surface. Mostly the polyps are bright purple to brown membranous and cream coloured. Irregular lamellae are densely present on basal layer. Different length of

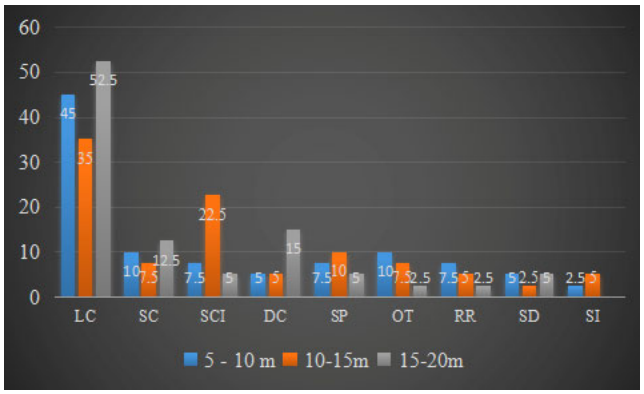

Fig. 2 — Depth vises status of Scleractinian corals (%) at Shark Island, North Andaman. (LC Live Coral, SC Soft Coral, SCI Soft Coral Impact, DC Dead Coral, SP Sponges, OT Others, RR Rubbles, SD Sediment, SI Silt)

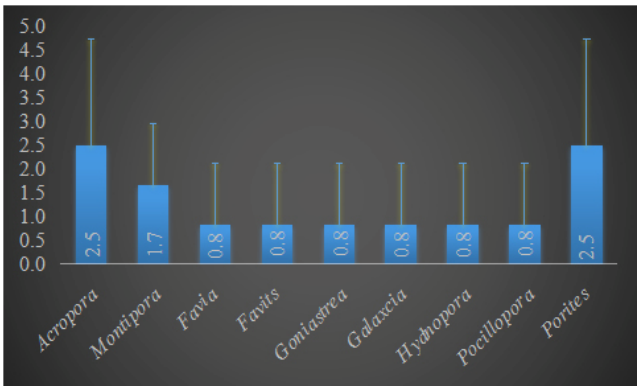

Fig. 3 — Competitive status of *Briareum violaceum* on different species of scleractinian corals in Shark Island, North Andaman.

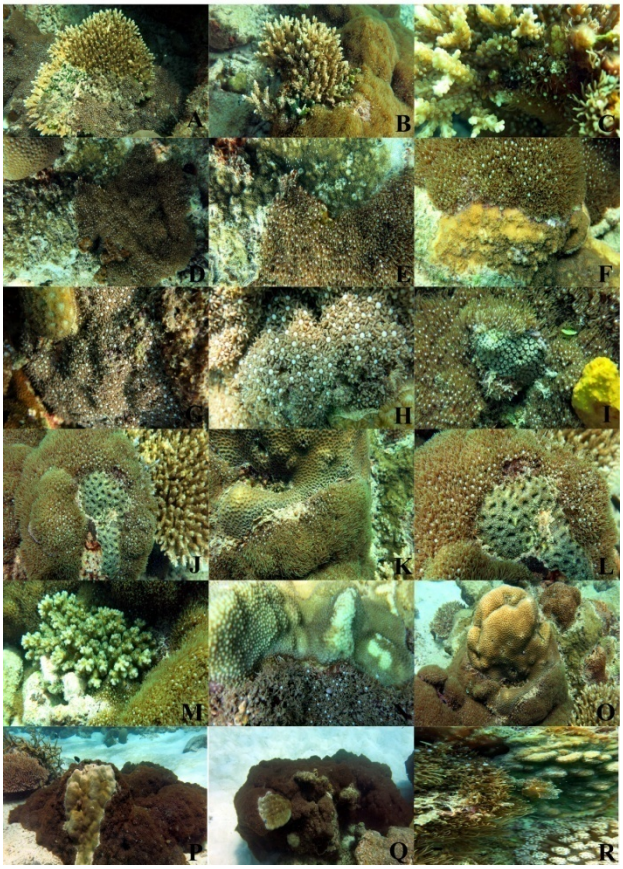

Fig. 4 — *Briareum violaceum* encrusted on different species of scleractinian corals from the study site (A-C *Acropora,* D-F *Montipora*, G & H *Favia*, I *Galaxcia*, J-L *Favites*, M *Pocillopora*, N *Hydnopora*, O *Goniastrea*, P&Q *Porites*, R *Acanthasrea*)

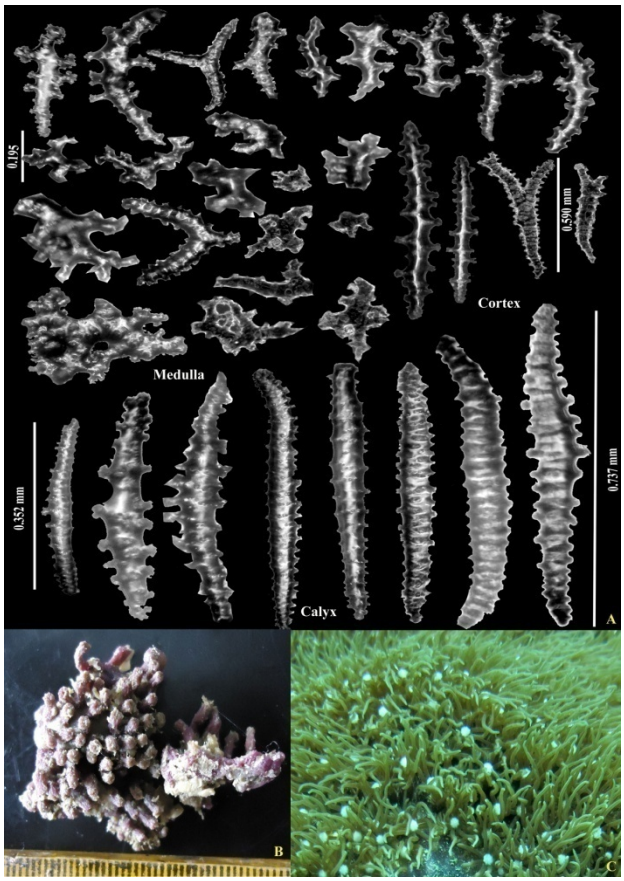

Fig. 5 — Taxonomical analysis and sclerites characters of *Briareum violaceum* (Quoy & Gaimard, 1833). A – Sclerites structures with scale, B – Voucher specimen (ZSI/ANRC 14651), C - Live colony with polyp..

polyps occurred around the entire colony surface and retractable, monomorphic growth.

Sclerites: The sclerites are magenta colour; 0.35 to 0.74 mm long rods are in calyces, straight and bent spindles (5.0 mm) in cortex and different shaped sclerites (0.19 to 0.59 mm) in medulla (Fig 5).

***Depth*: Shallow to 30 m depth.**

Distribution: Indo-Pacific coast, Solomon Island; Ambon; Indonesia; Great Barrier Reef; Ryukyu Archipelago, Sesoko Island, Okinawa, Japan; Bonin Island; South Taiwan, Taiwan; Marshell Islands; Bismarck Sea; Red Sea, Thailand, Australia, Papua New Guinea; Shark Island, North Andaman Island, Indian.

Remarks: Namin and Ofwegen[28] reviewed the genus *Briareum* and reported synonymized detail of the species *B violaceum* (*Clavularia violacea* in the Solomon Islands; *Pachyclavularia erecta* in the Ambon, Indonesia, Great Barrier Reef, Japan; *Briareum violacea* in the Ryukyu Archipelago, Japan, South Taiwan).

Discussion

The species *B violaceum* was encrusting soft coral and growing over the hard substratum (dead and live corals). The hard coral growth rate was lesser than alcyonacean growth rate[29,30] especially *B. violaceum* softcoral was a very fast growing alcyonacean. Reports show that optimum depth and climatic condition was required for the normal growth of *B. violaceum,* for instances, temperature (°C): 25.78 – 26.123, salinity (PPS): 34.47 – 34.54, dissolved oxygen (ml/l): 4.6 – 4.7, phosphate (µmol/l): 0.08-0.12, nitrate (µmol/l): 0.439-0.771, silicate (µmol/l): 3.5 – 3.7 and depth (meter): 6-14 [31]. Interestingly, the present study also reported the *B. violaceum* in optimum depth range between 10m to 15m.

The coral bleaching is an indicator of adverse coral reef health. The bleached corals get recover on suitable environment with sufficient sun light, but the encrusted soft corals are apparently resist penetration of light on the coral surface; it's leads to the

destruction of live corals. Competition is an important process determining the structure and status of Scleractinian corals on reef environment. The study was carried out over a limited time period; nevertheless, it does provide valuable baseline information for continuous monitoring and research on this line in the Andaman and Nicobar islands for better management of health of coral reefs.

Conclusions

The scleractinian corals of the world are already under pressure from various human activities and climate changes. While the competitive growth studies between the Scleractinian and Alcyonacean (*B. violaceum*) was reported first time in Indian coast. Maximum 22.5 % *B. violaceum* encrusted corals observed in 10 to 15m depth on different scleractinian corals beside the Shark Island, North Andaman. The baseline study clearly indicates that impact of *B. violaceum* on coral reef ecosystem in Shark Island. Consequently continuous monitoring and manual removal of encrusted alcyonacean species will go a long way in upholding sustainable of scleractinian along the coasts in Andaman and Nicobar Island.

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