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New Distribution Record of Eight Scleractinian Corals to Indian Water from Andaman and Nicobar Islands

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Abstract: Eight species of scleractinian corals such as *Anacropora forbesi* Ridley, 1884 and *Montipora samarensis* Nemenzo, 1967 of Acroporidae family *Caulastrea echinulata* (MED and H, 1849) and *Goniastrea palauensis* (Yabe and Sugiyama, 1936) under the family of Faviidae, *Seriatopora guttatus* Veron, 2000 under the family Pocilloporidae, *Euphyllia crispata* Chevalier, 1971 under the family Euphyllidae, *Hydnophora bonsai* Veron, 2000 of Merulinidae family and *Fungia puishani* Veron and DeVantier, 2000 of Fungiidae family were recorded as the new record from the marine environment of Andaman and Nicobar Islands as well as from Indian water for the first time. The present paper deals with the taxonomical features of newly recorded eight species of scleractinian corals with the distribution ranges.

Key words: Scleractinian Corals · New Record · Taxonomy · Andaman and Nicobar Islands

INTRODUCTION

Scleractinian corals are well known as reef building corals due to their solid, massive, encrusting etc. mode of structural conformation as well as development pattern on the shelf region of the seas in the form of barrier, fringing, atoll mode habituation. A maximum distribution of scleractinian founded mostly in Indo-Pacific region [1]. Andaman and Nicobar Islands have a coastline of 900 km with 572 islands surrounded by Coco-Channel, Andaman Sea, Great Channel and Bay of Bengal. The geographic advantageous location of this region provides a supportive atmosphere for a great deal of marine organisms. Physical parameters or constrains are most important administrator to make marine environment habitable for the scleractinians in distinctive distributed pattern [2]. Hermatypic corals are the representatives of substrate level which give the structural base for conjugating other associated faunal communities niche co-existence. Being a complex and diversified ecosystem, Coral reefs provide food, ecological services, livelihoods or several economical advantages towards the people of coastal communities and others [3, 4]. Diversification of stony corals is the indication of biologically enriched marine environment. This paper deals with the findings of eight species of scleractinian corals for the first time from Andaman and Nicobar Islands as well as from Indian water. Taxonomical analysis on morphological characters of those five with their distribution is described here.

MATERIALS AND METHODS

Several extensive undersea surveys were conducted at various sites Ritchie's Archipelago and Great Nicobar Island of Andaman and Nicobar Islands during January to December, 2011 to study faunal communities of these islands by employing Self Contained Underwater Breathing Apparatus (SCUBA) diving and snorkeling. The specimen was sampled to examine detailed morphological characters for taxonomic study. The sampled specimen was kept in fresh-water for few days and washed thoroughly with running water and dried. Taxonomic identification was made following the keys of Veron [5], Veron and Wallace [6], Veron and Pichon [7], Veron and Pichon [8] and Veron *et al.* [9] for identification. Corallites of the specimen were examined in detail to study the morphology for taxonomic analysis under stereo

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microscope (Leica, M 205 A). On completion of detailed structural study, the specimens were registered in National Zoological Collection of India and deposited at Zoological Survey of India, ANRC, Port Blair.

RESULTS

Morphological characters of the newly recorded corals species are described below.

Order: Scleractinia Bourne, 1900
Family: Acroporidae Verrill, 1902
Genus: *Anacropora* Ridley, 1884

Anacropora Forbesi Ridley, 1884, Fig. 1
Material Examined: Seven colonies were observed at North Passage Island (Lat. 12°17.410' N and Long. 092°55.603' E) during undersea survey on 11. 12. 2011 at the depth of 6 to 14 m. A portion of colony was collected for detailed taxonomic study (Reg. No.: ZSI/ANRC-6931).

Morphological Description: Colonies are arborescent, usually with dichotomous branching, branches being <10 mm diameter and only slightly tapered, with rounded tips. Branches may be short with frequent subdivisions giving colonies a lax appearance. The bases of the braches were buried in mud. Corallites are uniformly spaced and uniform within colonies. Calices are rounded and 0.6-1.0mm in diameter. Septa are usually in two complete cycles. Corallites have prominent lower tips. All septa consist of rows of straight spines. The coenosteum consists of compacted spinules which usually have elaborated tips.

Distribution
India: North Passage Island, Andaman and Nicobar Islands; *Elsewhere:* Australia, Cocos (Keeling) Islands, Fiji, Indonesia, Japan, Madagascar, Malaysia, Marshall Islands, Papua New Guinea, Philippines, Seychelles, Solomon Islands, Vanuatu and Viet Nam.

Order: Scleractinia Bourne, 1900
Family: Acroporidae Verrill, 1902
Genus: *Montipora* de Blainville, 1830

Montipora Samarensis Nemenzo, 1967, Fig. 2
Material Examined: Three colonies were observed at North Passage Island (Lat. 12°17.410' N and Long. 092°55.603' E) during undersea survey on 11.12.2011 at the depth of 7 to 12 m. A portion of colony was collected for detailed taxonomic study (Reg. No.: ZSI/ANRC-6915).

Morphological Description: Colonies are usually clumps of thin branches. The branches are 6mm in thickness. The branches are fused together in an irregular pattern giving the colony a compact conformation of thickets. Corallites are immersed in distinctive pits.

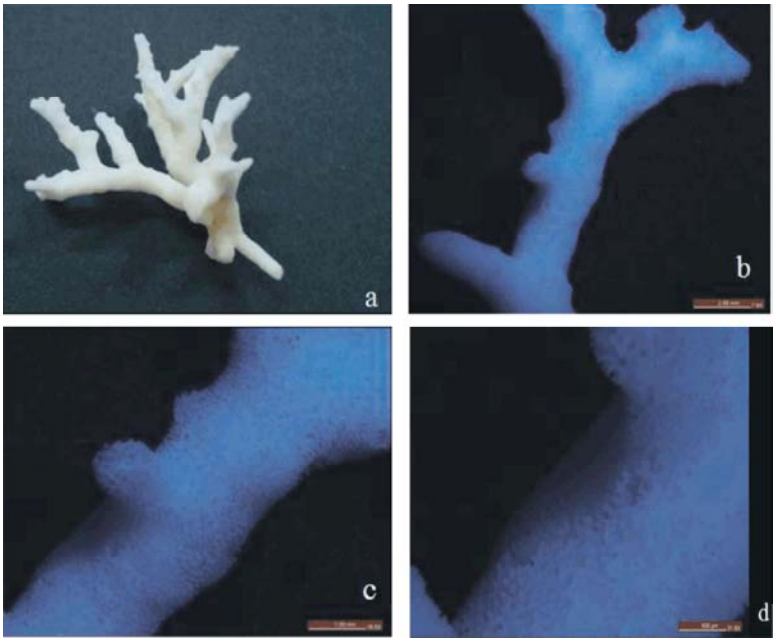

Fig. 1: *Anacropora forbesi* Ridley, 1884
a. Portion of Colony; b. Portion of Axial Corallites; c. Axial Corallites; d. Corallites

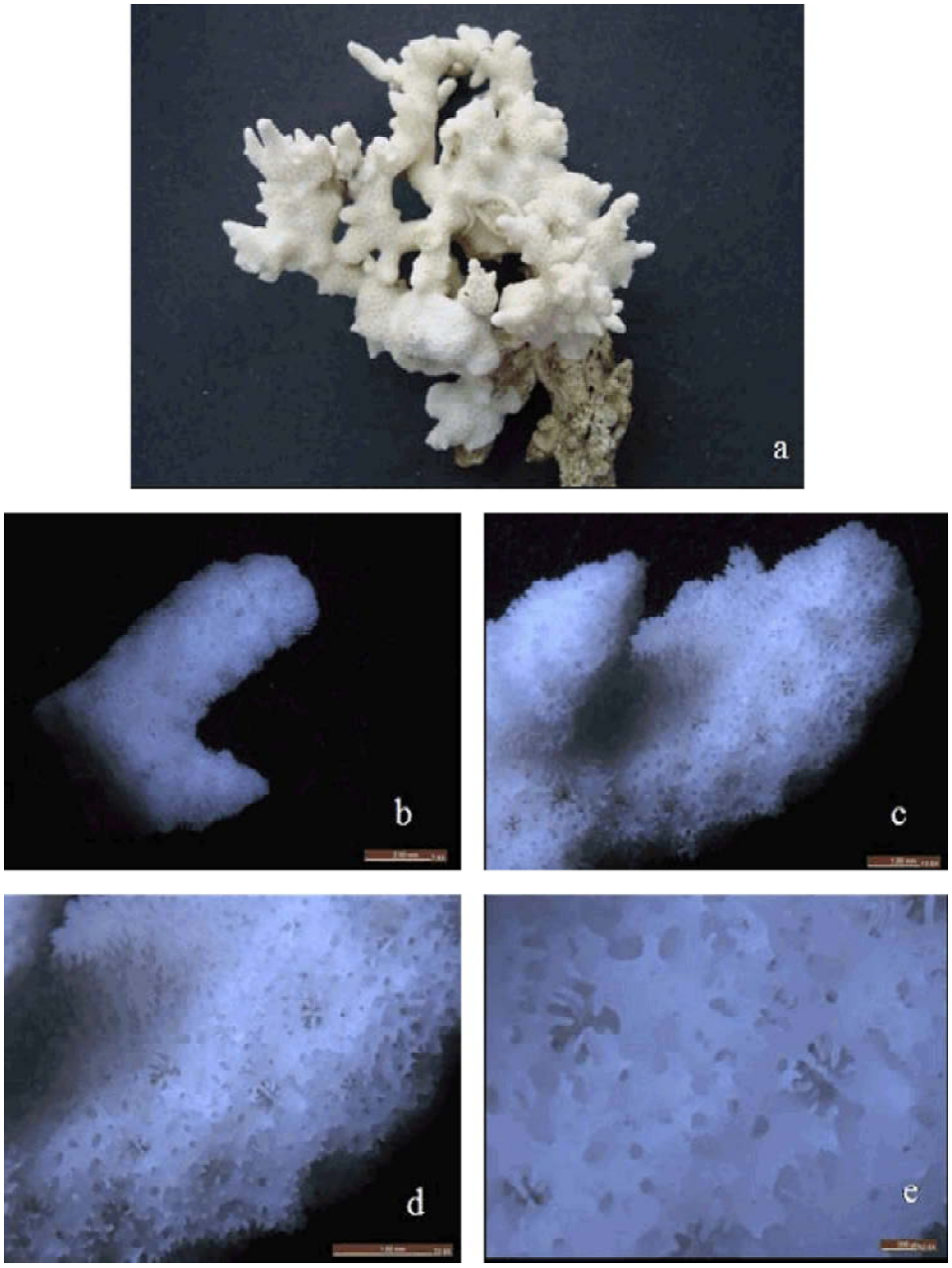

Fig. 2: *Montipora samarensis* Nemenzo, 1967
a. Portion of Colony; b. Portion of Axial Corallites; c. Axial Corallites; d. Corallites; e. corallites

IUCN Red List Category and Criteria: Vulnerable, 2010.

Distribution
India: North Passage Island, Andaman and Nicobar Islands; *Elsewhere:* Indonesia, Japan, Philippines, Vanuatu and Viet Nam.

Order: Scleractinia Bourne, 1900
Family: Faviidae Gregory, 1900
Genus: *Caulastrea* Dana 1846

Caulastrea echinulata **(MED and H, 1849), Fig. 3**
Material Examined: Two colonies were observed at Wall (Lat. 12°03.313' N and Long. 092°57.730' E), Havelock Island, Ritchie's Archipelago during undersea survey on 15.11.2011 at the depth of 16 m. A portion of colony was collected for detailed taxonomic study (Reg. No.: ZSI/ANRC-6810).

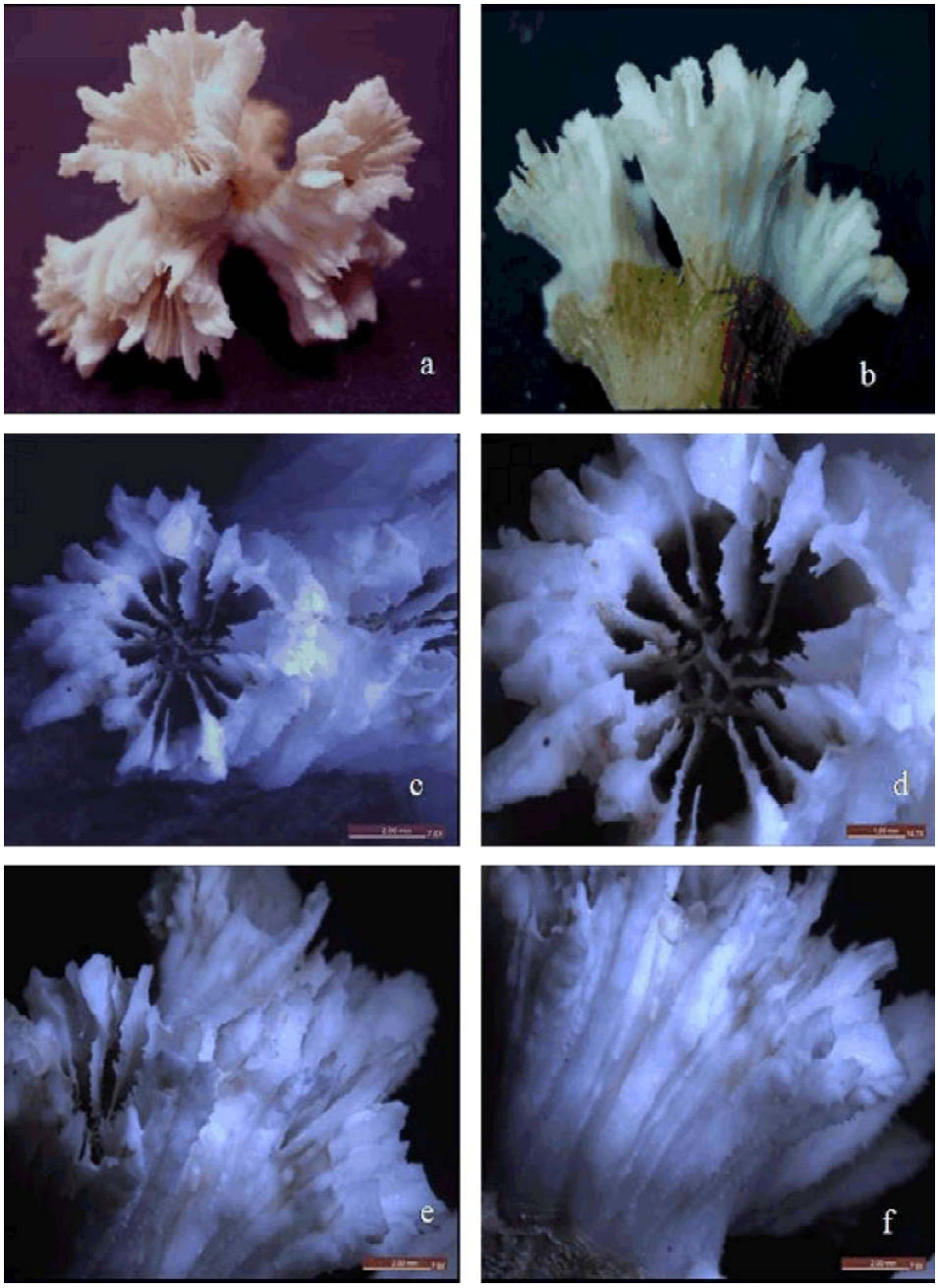

Fig. 3: *Caulastrea echinulata* (MED and H, 1849)
a. Portion of Colony; b. Costal view of colony; c. Corallites; Septal arrangement; e. Costal arrangement; f. Costal spines

Character Analysis: Colony is phaceloid with parallel branches in close association in a compact shape. The corallites are mostly mono-centric, generally oval in outline, with an average diameter of 10-12 mm. Some are laterally compressed with flattened side giving a triangular shape. The wall of corallites is thin. Number of septa ranges from 24-36, depending upon the size of the corallites. Septa are markedly exsert above the common wall. Up to 18 septa reach the columallae. The septal margin is irregularly takes the appearance of a paliform lobes. The sides of the septa bear scattered conical spines. The columellae are composed of a few flattened, twisted trabeculae. Uneven, irregular costae are present. The costae bear small, irregular spines.

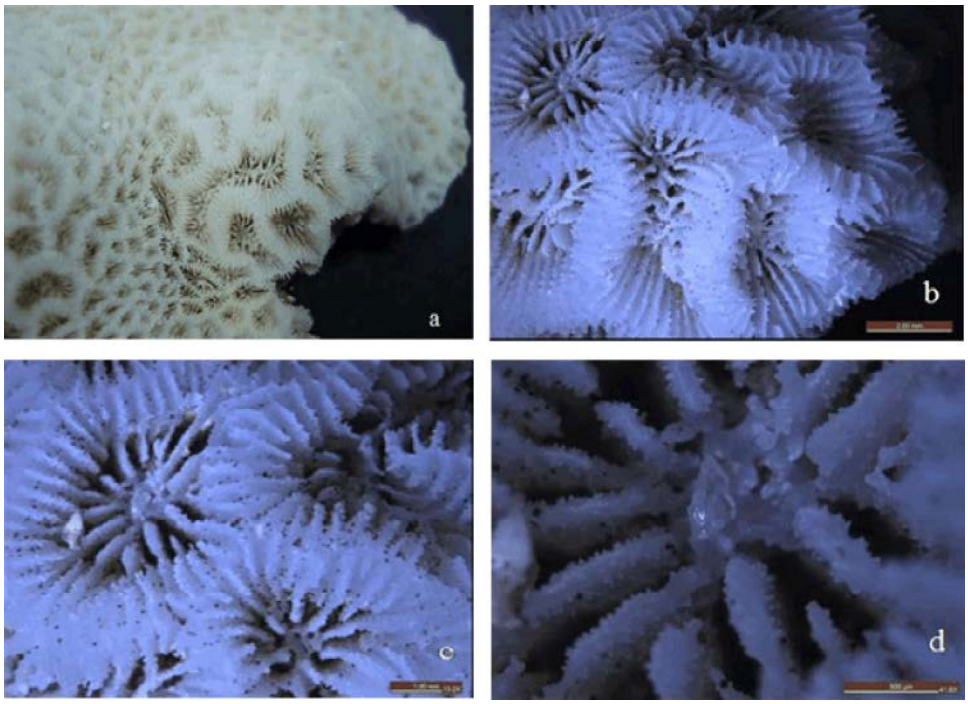

Fig. 4: *Goniastrea palauensis* (Yabe and Sugiyama, 1936)
a. Portion of Colony; b. Corallites; c. Septal arrangement; d. Paliform lobes

IUCN Red List Category and Criteria: Vulnerable, 2010.

Distribution
India: Wall, Havelock Island of Andaman and Nicobar Islands; *Elsewhere:* Australia, Fiji, Indonesia, Japan, Malaysia, New Caledonia, Papua New Guinea, Philippines, Singapore and Solomon Islands.

Order: Scleractinia Bourne, 1900
Family: Faviidae Gregory, 1900
Genus: *Goniastrea* Milne Edwards and Haime, 1848

***Goniastrea palauensis* (Yabe and Sugiyama, 1936), Fig. 4**
Material Examined: Three colonies were observed at off Laxman Beach (Lat. 7°01.454' N and Long. 093°55.267' E) in Great Nicobar Island during undersea survey on 02.08.2011 at the depth of 4 m. A portion (Length: 10.5 cm, Width: 8.9 and Height: 2.8cm) of the colony was collected for detailed taxonomic study (Reg. No.: ZSI/ ANRC- 6702).

Morphological Description: Colonies are massive and encrusting with flattened structure. Corallites are mono-centric and usually straight-sided with 3 to 6 angles. Colony is ceriod. The mean diameter of mature calices varies from 6 to 15 mm, depending on the thecal thickness. Two orders of septa can usually be distinguished, although their lengths vary greatly. Extremely crown shaped paliform lobes are the special features of this. The paliform lobes are always having vertical inner margins descending to the compact, deep seated columellae. They are usually thicker than the septa. Fine dentations are present at septa. Septa of the adjacent corallites are frequently adjoined over the theca. The thickness of the theca is most variable character of the species, varying from 2 to 8 mm in ceriod colonies.

IUCN Red List Category and Criteria: Near threatened, 2010.

Distribution
India: Great Nicobar Island in Andaman and Nicobar Islands; *Elsewhere*: American Samoa, Australia, Bangladesh, British Indian Ocean Territory, Djibouti, Indonesia, Japan, Madagascar, Malaysia, New Caledonia, Palau, Papua New Guinea, Philippines, Réunion, Seychelles, Singapore, Solomon Islands, Thailand and Vietnam.

Order: Scleractinia Bourne, 1900
Family: Pocilloporidae Lamarck, 1816
Genus: *Seriatopora* Lamarck, 1816

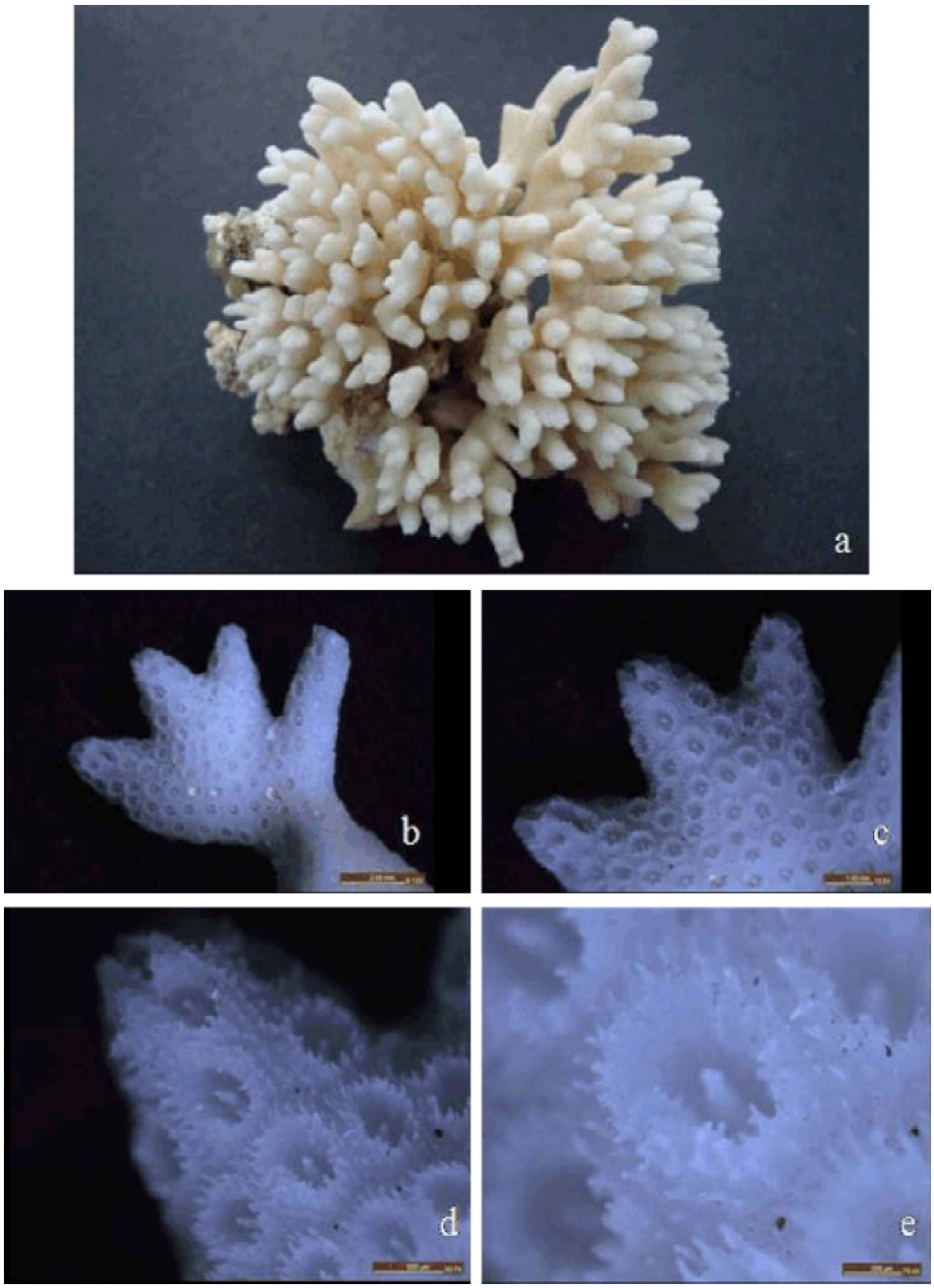

Fig. 5: *Seriatopora guttatus* Veron, 2000
b. Portion of Colony; b. Axial Corallites; c. Tip of Axial corallites; d. Arrangement of corallites; e. Structure of corallites

***Seriatopora guttatus* Veron, 2000, Fig. 5**

Material Examined: Five colonies were observed at off Laxman Beach (Lat. 7°01.454' N and Long. 093°55.267' E) in Great Nicobar Island during undersea survey on 02.08.2011 at the depth of 5 m. A portion (Length: 8.4 cm, Width: 6.2 and Height: 5.4 cm) of the colony was collected for detailed taxonomic study (Reg. No.: ZSI/ANRC-6935).

Morphological Description: Colonies are composed of masses of anastomosing branched and usually prostrate. Branches are irregularly fused. Usually upwardly directed branches are present in a colony and most of the branching can be seen on the upper region. Branches are very closely situated as the angle among the branches is very low, giving a corymbose type shape to the colony.

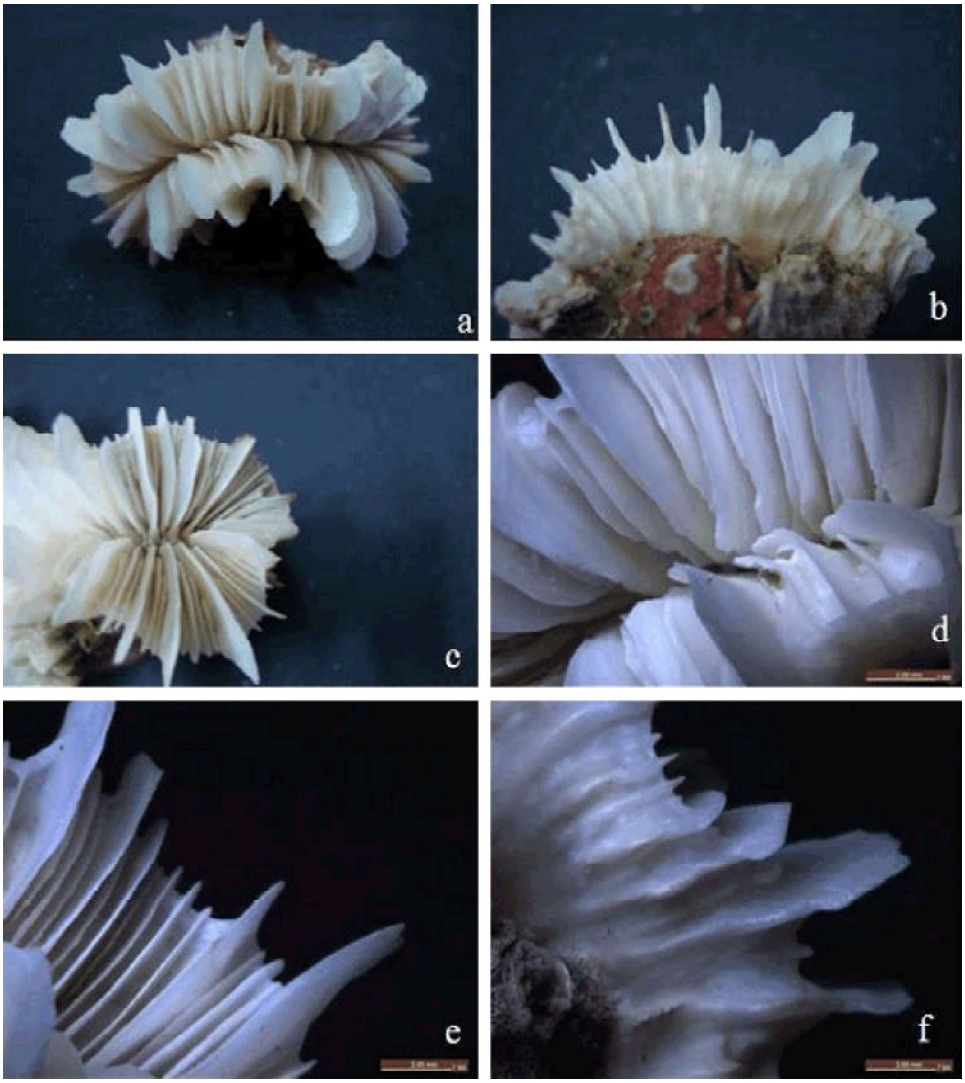

Fig. 6: *Euphyllia crispata* Chevalier, 1971
a. Portion of Corolla; b. Costae of coralla; c. Septa; d. Septal arrangement; e. Septal order; f. Costal arrangement

They are not tapered and do not have sharp points. Corallites are arranged irregularly or in indistinct rows. They have a well defined rim, but do not have hoods.

IUCN Red List Category and Criteria: Least Concern, 2010.

Distribution

India: Great Nicobar Island in Andaman and Nicobar Islands; *Elsewhere:* Indonesia, Madagascar, Papua New Guinea, Solomon Islands and Vietnam.

Order: Scleractinia Bourne, 1900
Family: Euphyllidae Veron, 2000
Genus: *Euphyllia* Dana, 1846

***Euphyllia crispata* Chevalier, 1971, Fig. 6**

Material Examined: Two coralla were observed at Wall (Lat. 12°03.313' N and Long. 092°57.730' E), Havelock Island of Ritchie's Archipelago during undersea survey on 15.11.2011 at the depth of 23 m. A solitary (Length: 5 cm, Width: 2.7 and Height: 4.4 cm) coralla was collected for detailed taxonomic study (Reg. No.: ZSI/ANRC- 6802).

Morphological Description: Small solitary polyps are common. Colonies are phaceloid, dome shaped and <12 cm in diameter, with compact branches with a uniform distance of 4-8 mm on the basis of coralla. 1-3 centers can be seen in branches in a frequent interval by the formation of constriction which usually becomes traversed by septa. 5 order septa usually distinguishable.

Fig. 7: *Hydnophora bonsai* Veron, 2000
b. Portion of Colony; b. Distribution of monticule; c. Monticule; d. Monticule Arrangement arrangement; e. Monticile structure

First order septa are up to 4 mm exsert and extend outwards above and beyond the thecae. The margins of the first order septa are usually strongly curved with septa extending almost to the calice centers. Septa of higher orders become progressively reduced until those of the fifth order. First and second order septa plunge steeply near the centre of the corallite. The sides of the septa are glabrous or very finely granulated and their margins are finely serrated. There are no columellae. Costae of at least three orders are present and are mostly well developed, especially those of the first order which may develop lobes or spines which sometimes prominent. The walls are thin, especially towards their upper margins.

Distribution

India: Wall, Havelock Island of Andaman and Nicobar Islands; *Elsewhere:* American Samoa, Australia, Fiji, Indonesia, Japan, New Caledonia, Papua New Guinea, Philippines, Solomon Islands, Taiwan, Province of China, Vanuatu and Vietnam.

Order: Scleractinia Bourne, 1900
Family: Merulinidae Verrill, 1866
Genus: *Hydnophora* Fischer de Waldheim 1807

***Hydnophora bonsai* Veron, 2000, Fig. 7**

Material Examined: Three colonies were observed at Wall (Lat. 12°03.313' N and Long. 092°57.730' E), Havelock Island, Ritchie's Archipelago during undersea survey on 15.11.2011 at the depth of 19 m. A portion (Diameter: 8.6 cm and Height: 2.2 cm) of colony was collected for detailed taxonomic study (Reg. No.: ZSI/ANRC- 6806).

Morphological Description: Colony was encrusting and strongly attached to the substratum. The upper surface of the colony is irregular in appearance. Monticules are fine and fused into irregular ridges. Skeletal structures are fine.

IUCN Red List Category and Criteria: Endangered, 2010.

Distribution

India: Wall, Havelock Island, Andaman and Nicobar Islands; *Elsewhere:* Indonesia, Japan, Philippines, Taiwan and Province of China.

Order: Scleractinia Bourne, 1900
Family: Fungiidae Dana, 1846
Genus: *Fungia* Lamarck, 1801

***Fungia puishani* Veron and DeVantier, 2000, Fig. 8**

Material Examined: Nine coralla were observed at Guiter Island (Lat. 12 º 21.136'N and Long. 092 º 55.218'E), Havelock Island during undersea survey on 22.01.2011 at the depth of 6 to 16 m. A solitary (Length-5 cm, Width- 2.7 and Height- 4.4 cm) coralla was collected for detailed taxonomic study (Reg. No.: ZSI/ANRC- 5536).

Character Analysis: The coralla is circular or oval in shape, sometime strong arched can be seen. Septa are densely packed. The septa are straight and have small blunt teeth. The axial mouth is well defined and the outer surface is covered is covered with small peripheral mouths. The peripheral mouths are well separated from each other by septa with variable length.

Distribution

India: Wall, Havelock Island, Andaman and Nicobar Islands; *Elsewhere:* Seychelles.

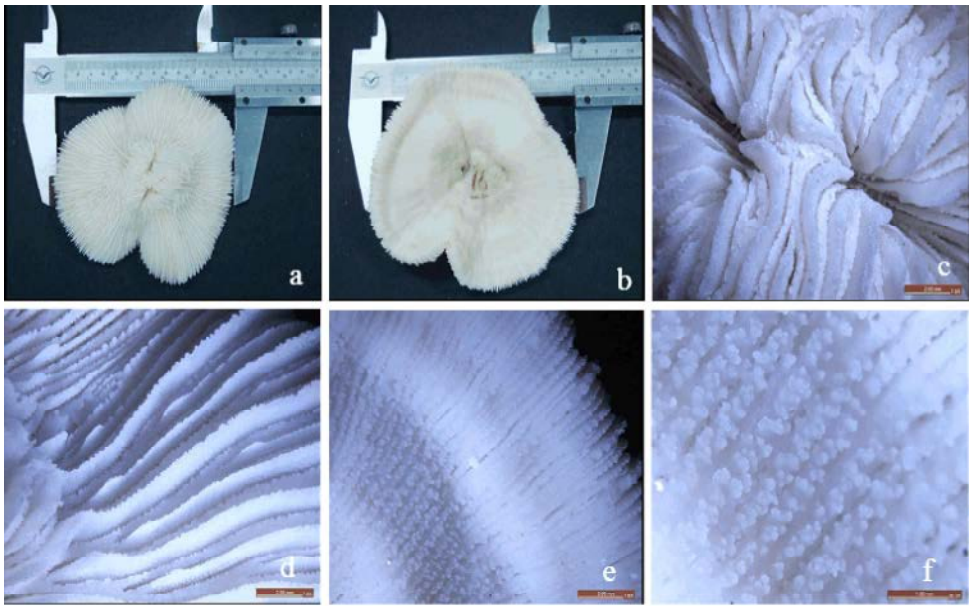

Fig. 7: *Fungia puishani* Veron and DeVantier, 2000
c. Coralla dorsal view; b. Coralla ventral view; c. Mouths; d. Septal arrangement e. Costal arrangement; f. Costal spines

DISCUSSION

Pillai is the pioneer worker of scleractinian taxonomy for Indian corals. In 1983, he recorded a total of 135 coral species from Andaman and Nicobar, among them 82 species under 31 genera from Andaman Islands and 103 species under 43 genera from Nicobar Islands [10]. As the conclusive remark of his study, it can be said that Andaman Islands are less diverse in coral composition than the islands of Nicobar. Description of 228 species of corals under 58 genera and 15 families were made by Venkataraman *et al.* in [11]. A consolidated list of 418 species of scleractinian corals was reported by Ramakrishna *et al.* [12]. In 2010-11, Tamal *et al.* recorded 73 species of Scleractinian corals from different areas of Andaman and Nicobar Islands as new record to this group of islands as well as to Indian water [13-22]. The previous descriptions of the stony corals have been showing the enriched biogenic habitat of the scleractinian in this present circumstance. In 2011, Tamal *et al.* also described the diversity and distribution of a total of 244 species of scleractinian corals with a high comparative value of ecological status to denote the progressive status of scleractinians with the presence of favorable habitat at several areas of North and Middle Andaman [23]. This paper depicts taxonomical attributes of eight species of scleractinian corals as well as inclusion of new distribution area in global scenario. These species will increase the database of Indian Scleractinian as an addition of earlier report. Further extensive surveys are required in near future to get more apprehensive data on diversified species.

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