Diversity of Coral Reef Associated Sponges in Andaman and Nicobar Islands

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Introduction

The phylum Porifera commonly known as sponges is the most primitive of the multicellular animals (more than 500 million years old) (Miiller, 1995), with a most ancient geological history. The sponges are unique group of organisms - although multi cellular they lack tissue grade of construction (Bergquist, 1978). Most of them are sedentary or immobile as adult but possess mobile larval forms. These invertebrates do not have nervous, digestive or circulatory system but they rely on constant water flow through their bodies to obtain food, oxygen and to remove waste. These filter-feeding metazoans utilize a single layer of flagellated cells (choanocytes) to pump unidirectional water current through their bodies.

Sponges form an important biotic component of the coral reef ecosystem (Reswig, 1973, Wulff, 2006) and one of the most abundant and diverse groups of marine benthic communities around the world. In fact they are more diverse than corals in many coral reef ecosystems around the world (Diaz and Rützler, 2001: Wulff, 2006). They play several ecologically important roles like binding live corals to the reef frame, facilitating regeneration of broken reefs and harbouring, nitrifying and photosynthesizing microbial symbionts, or intervening in erosion processes (Diaz and Rützler, 2001: Wulff, 2001, 2006).

Sponges have been the focus of much recent interest since they have been identified as a rich source of active secondary metabolites (Bergmann and Feeney, 1950). Sponges account as a source for around 37% of the biomedical compounds worldwide from the marine environment (Jha & Zi-rong, 2004). Most of the studies done on the marine sponges of India are from Gulf of Mannar, Kerala coast, Lakshadweep, Gulf of Kuchchh and Gulf of Cambay. Taxonomic information on the sponges of Andaman and Nicobar Islands is far from complete and detailed studies on these sedentary invertebrates are very scanty which describe 88 species of sponges.

Works on the diversity of sponges in Andaman date back to deep water scientific voyages in 1902, the studies since then have been very scanty and shallow water sponges have not been thoroughly studied from the Andaman and Nicobar Islands. The continental shelf of Andaman and Nicobar Islands plays host to large areas of coral reefs with in the area of 200 km, which harbour rich Poriferan diversity. This study aims at bridging this scientific gap by documenting the rich diversity of marine sponges in these islands especially in the coral reefs. Taxonomic studies on sponges of these Islands have been minimal, having ample scope for the present study.

Schulze (1902) provided the description of 11 new species of Hexactinellida collected by R.I.M.S. investigator from 1884 to 1900. Annandale (1915) described two species out of which one has been described as new species. Dendy and Burton (1926) described 13 species of Demospongiae and Hexactinellida, of which 5 are new species. Burton (1928) described 14 species of Demospongiae 8 included newly described species. Burton and Rao (1932) described 26 species of Demospongiae, 1 species of Calcarea, 3 species of Hexactinellida from Andaman and Nicobar region, with the inclusion of 2 new species. Thomas (1977, 1979) reported only 2 species of Demospongiae from this region. Later, Tikader (1986) listed seventy sponge species, Van Soest and Hooper (1993) described one species and Hooper (1996) also described one species from this region. Pattanayak (2006) had given detailed descriptions of 75 species of marine sponges from preserved specimens maintained by the Zoological Survey of India at Kolkata. Recently, Immanuel and Raghunathan (2011) recorded a sponge species from these Islands.The present listing records the distribution of **41 species of sponges from Andaman and Nicobar Islands.**

Material and methods

Detailed underwater survey using SCUBA was conducted in the coral reef areas of Andaman and Nicobar Islands from 2009 to August 2011 to study the Sponge diversity. In Andaman, surveys were made at 55 sites whereas, 23 in Nicobar group of Islands .

Before colleting the specimen, *in-situ* observation was made to collect the information on morphological characters such as form or shape, size, colour, surface characteristics, location and number of apertures on the sponge, depth at which the sponge was collected, microhabitat in which the sponge lives and abundance of the sponge in the particular area. Then, clear pictures were taken in *in-situ* condition by using Sony T-900 camera. Collection was done both in intertidal regions and also in depths of up to 30m. Sponge specimens were collected by using sharp underwater knife. Sponge tissues from near the osculum and the base were collected. Collected sponges were fixed in 90% ethanol. After a day thin slice of sponges were cut to made slides and also **spicules were extracted** from various parts of specimen by **using concentrated Nitric acid**. **Identification was done by analyzing the spicule extracts and sections of the sponges**. Then by using the keys from the book Systema Porifera by Hooper and Soest (2002) the sponges were identified. All available materials are deposited in the National Zoological Collections of Zoological Survey of India, Andaman and Nicobar Regional Centre.

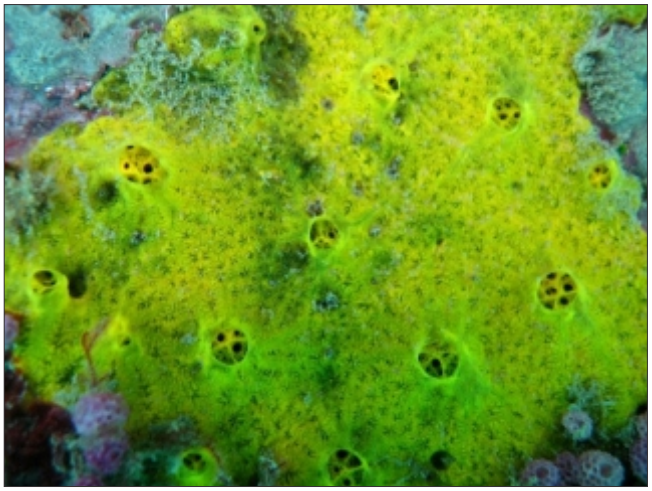
Result and discussion

The present study brings out a **total of 41 species** (Fig. 1, 2) under 33 genera, 27 families and 10 orders (Table 1). Remarkably, **all the 41 species recorded in Andaman Islands and 21 species from Nicobar Islands.** Among the 41 species, *Plakortis simplex, Paratetilla bacca, Stylissa massa, Oceanapia sagittaria, Hyrtios erectus* were recorded almost all the study sites. However, *Tethya diploderma, Damiria toxifera, Iotrochota baculifera* are rare species recorded during this study. *Xestospongia testudinaria* abundant in South Andaman and Ritchie's Archipelago. Taxonomy of spongesfor the past 3 decadesare scanty except for publications from Thomas, (1979)and Pattanayak, (2006). It is well known that sponges are difficult and often misidentification is possible (Pattanayak and Manna, 2001). This and the lack of access to previously published literature have probably caused many Indian taxonomists to totally ignore these invertebrates. Though through the years several collections of sponges have been made by the Zoological Survey of India most of them have laid in their repositories in need of identification. Most of the publications P.A. Thomas from Central Marine Fisheries Research Institute were of the sponges located in the Southern coast of India and the Lakshadweep Islands.

Pattanayak (2006) described 75 sponge species from the Andaman and Nicobar Islands with 18 new locational records and 4 newly described species. The sponges described were from collections made over a period of 100 years with major contributions from R.I.M.S. Investigators, and also some recent collections by scientists of ZSI that were present in ZSI, Calcutta. A total of 56 Demospongiae, 2 Calcarea and 17 Hexactinellida were described. Other major contributions to the sponges of these Islands were Schluze (1902), Dendy and Burton (1926), Burton (1928) and Burton and Rao (1932) (Table 1).

The Andaman and Nicobar Islands is known for its high biodiversity and affinities to the Indo-Malayan and Indo-Chinese regions (Smith, 1930). Studies on the zoogeographical patterns of distribution of sponges in Andaman and Nicobar region with reference to adjacent regions (Burma, Sumatra, Indonesia and Gulf of Mannar) reveals that these islands acting as a barrier between the Bay of Bengal and the Andaman Sea harbour sponge species from both the seas. The need for further investigation on the sponges of these islands is emphasised by the fact that they bear similarity of sponge species with by far the richest region the Indonesian Archipelago harbouring 786 species (Hooper *et al.*, 2000). The inventory of the sponges of these islands is by no means over and will keep on growing given that more taxonomic expertise is developed.

Ircinia strobilina (Lamark, 1816)



Iotrochota baculifera Dendy, 1887

Carteriospongia foliascens (Pallas, 1766)

Chalinula nematifera (de Laubenfels, 1954)

Axinella cannabina (Esper, 1794)

Neopetrosia exigua (Kirkpatrick, 1900)

Fig. 1: : Sponges of Andaman and Nicobar Islands

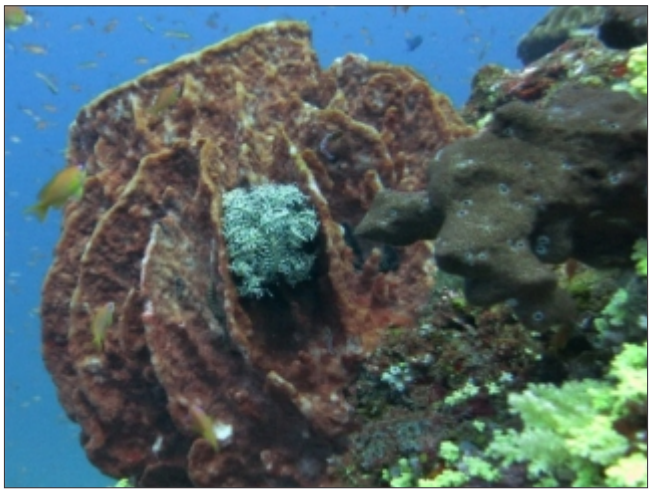
Tethya repens Schmidt, 1870

Damiria toxifera van Soest, & Kielman, 1994

Liosina paradoxa Thiele, 1899

Coelocarteria singaporensis (Carter, 1883)

Rhabdastrella globostellata (Carter, 1883)



Xestospongia testudinaria (Lamarck, 1815)

Fig. 2: Sponges of Andaman & Nicobar Islands

Table 1: List of sponges recorded from Andaman and Nicobar Islands

	Species	Andaman	Nicobar
	Order: Homosclerophorida Dendy, 1905		
	Family: Plakinidae Schulze, 1880		
	Genus: *Plakortis* Schulze, 1880		
1.	***Plakortis simplex* Schulze, 1880**	+	+
	Order: Spirophorida Bergquist & Hogg, 1969		
	Family: Tetillidae Sollas, 1886		
	Genus: *Paratetilla* Dendy, 1905		
2.	**Paratetilla bacca (Selenka, 1867)**	+	+
	Order: Astrophorida Sollas, 1888		
	Family: Ancorinidae Schmidt, 1870		
	Genus: *Rhabdastrella* Thiele, 1903		
3.	***Rhabdastrella globostellata* (Carter, 1883)**	+	
	Genus: *Ecionemia* Bowerbank, 1864		
4.	***Ecionemia acervus* Bowerbank, 1864**	+	+
	Order: Hadromerida Topsent, 1894		
	Family: Clionaidae D'Orbigny, 1851		
	Genus: *Cliona* Grant, 1826		
5.	***Cliona varians* (Duchassaing & Michelotti, 1864)**	+	+
6.	**Cliona ensifera Sollas, 1878**	+	
	Genus: *Spheciospongia* Marshall, 1892		
7.	***Spheciospongia vagabunda* (Ridley, 1884)**	+	+
	Family: Spirastrellidae Ridley & Dendy, 1886		
	Genus: *Spirastrella* Schmidt, 1868		
8.	***Spirastrella cunctatrix* Schmidt, 1868**	+	+
	Family: Tethyidae Gray, 1848		
	Genus: *Tethya* Lamark, 1815		
9.	***Tethya diploderma* (Schmidt, 1870)**	+	
	Order: Poecilosclerida Topsent, 1928		
	Suborder: Microcionina Hajdu, Van Soest & Hooper, 1994		
	Family: Acarnidae Dendy, 1922		
	Genus: *Damiria* Keller, 1891		
10.	***Damiria toxifera* van Soest, Zea & Kielman, 1994**	+	
	Family: Microcionidae Carter, 1875		
	Subfamily: Microcioninae Carter, 1875		
	Genus: *Clathria* Schmidt, 1862		
	Subgenus: *Thalysias* Duchassaing & Michelotti, 1864		
11.	***Clathria* (Thalysias) *vulpina* (Lamark, 1814)**	+	
12.	***Clathria* (Thalysias) *cervicornis* (Thiele, 1903)**	+	
	Suborder: Myxillina Hajdu, Van Soest & Hooper, 1994		
	Family: Crambeidae Levi, 1963		
	Genus: *Monanchora* Carter, 1883		

	Species	Andaman	Nicobar
13.	***Monanchora unguiculata*** **(Dendy, 1922)** Family: Crellidae Dendy, 1922 Genus: *Crella* Gray, 1867 Subgenus: *Greyella* Carter, 1869	+	+
14.	***Crella (Grayella) cyathophora*** **Carter, 1869** Family: Iotrochotidae Genus: *Iotrochota* Ridley, 1884	+	
15.	***Iotrochota baculifera*** **Ridley, 1884** Family: Tedanidae Ridley & Dendy, 1886 Genus: *Tedania* Gray, 1867 Subgenus: *Tedania* Gray, 1867	+	
16.	***Tedania (Tedania) anhelans*** **(Lieberkühn, 1859)** Suborder: Mycalina Hajdu, Van Soest & Hooper, 1994 Family: *Mycalidae* Lundbeck, 1905 Genus: *Mycale* Gray, 1867 Subgenus: Aegogropila Gray, 1867	+	
17.	***Mycale (Aegogropila) crassissima*** **(Dendy, 1905)** Family: Isodictyidae Dendy, 1924 Genus: *Coelocarteria* Burton, 1934	+	+
18.	***Coelocarteria singaporensis*** **(Carter, 1883)** Family: Podospongiidae de Laubenfels, 1936 Genus: *Diacarnus* Burton, 1934	+	
19.	***Diacarnus megaspinorhabdosa*** **Kelly-Borges & Vacelet, 1995** Order: Halichondrida Gray, 1867 Family: Axinellidae Carter, 1867 Genus: *Axinella* Schmidt, 1862	+	
20.	***Axinella acanthelloides*** **Pattanayak, 2006**	+	
21.	***Axinella cannabina*** **(Esper, 1794)** Family: Dictyonellidae Van Soest, Diaz & Pomponi, 1990 Genus: *Acanthella* Schmidt, 1862	+	
22.	**Acanthella cavernosa Dendy, 1922** Genus: Liosina Theile, 1899	+	
23.	**Liosina paradoxa Thiele, 1899** Genus: *Stylissa* Hallmann, 1914	+	+
24.	**Stylissa carteri (Dendy, 1889)**	+	+
25.	**Stylissa massa (Carter, 1887)** Order: Haplosclerida Topsent, 1928 Suborder: Haplosclerina Topsent, 1928 Family: Callyspongidae de Laubenfels, 1936 Genus: *Callyspongia* Duchassaing & Michelotti, 1864 Subgenus: Toxochalina Ridley, 1884	+	+

	Species	Andaman	Nicobar
26.	***Callyspongia (Toxochalina) multiformis*** **(Pulitzer-Finali, 1986)** Subgenus: Euplacella Lendenfeld, 1887	+	
27.	***Callyspongia (Euplacella) australis*** **(Lendenfeld, 1887)** Family: Chalinidae Gray, 1867 Genus: *Chalinula* Schmidt, 1868	+	
28.	***Chalinula nematifera*** **(de Laubenfels, 1954)** Genus: *Haliclona* Grant, 1836 Subgenus: *Gellius* Gray, 1867	+	
29.	**Haliclona (Gellius) cymaeformis (Esper, 1794)** Subgenus: *Reniera* Schmidt, 1862	+	+
30.	**Haliclona (Reniera) fascigera (Hentschel, 1912)** Family: Niphatidae Van Soest, 1980 Genus: *Gelliodes* Ridley, 1884	+	
31.	**Gelliodes fibulata (Carter, 1881)** Suborder: Petrosina Boury-Esnault & Van Beveren, 1982 Family: Phloeodictyidae Carter, 1882 Genus: *Oceanapia* Norman, 1869	+	+
32.	***Oceanapia sagittaria*** **(Sollas, 1902)** Family: Petrosiidae Van Soest, 1980 Genus: *Xestospongia* de Laubenfels, 1932	+	+
33.	***Xestospongia testudinaria*** **(Lamarck, 1815)** Genus: Petrosia Vosmaer, 1885 Subgenus: *Strongylophora* Dendy, 1905	+	+
34.	**Petrosia (Strongylophora) strongylata Thiele, 1903** Genus: *Neopetrosia* de Laubenfels, 1949	+	
35.	**Neopetrosia exigua (Kirkpatrick, 1900)** Order: Dictyoceratida Minchin, 1900 Family: Ircinidae Gray, 1867 Genus: *Ircinia* Nardo, 1833	+	+
36.	**Ircinia strobilina (Lamarck, 1816)** Family: Thorectidae Bergquist, 1978 Subfamily: Thorectinae Bergquist, 1978 Genus: *Hyrtios* Duchassaing & Michelotti, 1864	+	+
37.	**Hyrtios erectus (Keller, 1889)** Subfamily: Phyllospongiinae Keller, 1889 Genus: *Carteriospongia* Hyatt, 1877	+	+
38.	**Carteriospongia foliascens (Pallas, 1766)** Family: Dysideidae Gray, 1867 Genus: *Lamellodysidea* Hooper, Van Soest, 2002	+	+
39.	**Lamellodysidea herbacea (Keller, 1889)** Order: Dendroceratida Minchin, 1900 Family: Darwinellidae Merejkowsky, 1879 Genus: *Aplysilla* Schulze, 1878	+	+

	Species	Andaman	Nicobar
40.	***Aplysilla rosea* (Barrois, 1876)**	+	
	Order: Verongida Bergquist, 1978		
	Family: Pseudoceratinidae Carter, 1885		
	Genus: *Pseudoceratina* Carter, 1885		
41.	***Pseudoceratina purpurea* (Carter, 1880)**	+	+
	Total	41	21

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