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सत्यमेव जयते

ZOOLOGICAL SURVEY OF INDIA 1916

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Marine Biodiversity

Coral Identification Manual

K. Venkataraman
Ch Satyanarayana

ZOOLOGICAL SURVEY OF INDIA

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CORAL IDENTIFICATION MANUAL

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अध्यक्ष
Dr. Balakrishna Pisupati
Chairman

FOREWORD

Coral Reefs are home for a variety of flora , fauna and microbes and the wealth of ecological processes that support all of these, forming the most dynamic ecosystem on earth. In India, all the three major reef types (atoll, fringing and barrier) occur, and the region includes some of the most diverse, extensive and least disturbed reef areas of the Indian Ocean, many of which are among the least scientifically known. There are four major reef regions in India on all sides of its coastline. The Gulf of Kachchh in the northwest, Palk Bay and Gulf of Mannar in the southeast, the Andaman and Nicobar Islands on the east and Lakshadweep archipelago in the west. India has a combination of mainland reefs and near pristine continental and oceanic reefs.

The diversity of corals in India was estimated to be 199 species under 71 genera till the recent past. With the efforts of Zoological Survey of India by way of conducting faunistic surveys and International expeditions in the past decade, we currently have information on 345 species belonging to 87 genera.

The status of health of corals and coral reefs in the world is very alarming. Out of 845 known species of reef-building corals of the world, only 704 species have enough data to assess their status. Of these, 5 species are critically endangered, 25 are endangered and 201 are in the vulnerable category. Near threatened are 176 and remaining 297 are in the least concern category. Even though our country stands 10th in the world with a coral reef area of 5790 sq km, its status is rather poor with most of the reefs being in a degraded state primarily due to anthropogenic interference. The pressure on natural habitats associated with increasing population, climate change and economic growth will continue to lead to the loss of coral reef diversity. Therefore, the Zoological Survey of India has taken conservation and management measures of the corals to protect the reefs by conducting status surveys through national and international initiatives.

The present book is a very good attempt to develop capacity in better understanding of the diversity as well as taxonomy of coral reefs. I strongly believe that the information catered in this book will not only help in better management of our corals but also provide a base for science based policy making. In this decade of biodiversity, I whole heartedly appreciate and congratulate this attempt to develop the capacity in coral taxonomy which in turn will conserve and protect corals and coral reefs which are designated underwater paradises.

(Balakrishna Pisupati)
Chairman
National Biodiversity Authority

April 30, 2012

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PREFACE

"The corals constitute a chaotic collection of individuals and the uncertainty as to what may be considered a species is the first problem that must confront anyone who happens to study corals."— an opinion expressed by Wood Jones, a renowned British observational naturalist in the early twentieth century (1907) is still valid today because of the variety and variedness in the body and skeletal structure of corals.

Corals gained significance because of their ability to form the magnificent, wonderful and beautiful reef ecosystems in the shallow regions of marine environment, which in turn provide an array of benefits to the humankind.

Unfortunately, very little is known about the identity of these beautiful animals because of their occurrence in relatively less inaccessible media and difficulties faced while studying them. Many of them are disappearing very fast before their identity is known and it is predicted that this valuable group of animals along with their ecosystems, which appeared on this earth many millions of years ago may disappear in less than a century. Global warming is considered as a major destroyer in addition to many biotic and abiotic threats. There is a dire need to know about these animals, especially to conserve and protect them for the benefit of sustenance of life on earth.

This Training Manual, produced for building capacity in the taxonomy of true corals (Scleractinia), which are one of the few highly threatened groups due to human impacts and global warming, not only develops taxonomic skill in this neglected group but also inculcates a sense of belongingness, which ultimately and undoubtedly leads to its conservation. This book produces excellent results if it is used as a guide during Capacity Building Workshops on Coral Taxonomy. Information about the coral taxa recorded from India are dealt in this book and made simple for usage in neighbouring counties also. The primary aim in producing this book is to develop interest in coral identification, which is being considered as a difficult task to achieve, due to lack of simplified guides. With this aim, definitions used in coral identification were made as simple as possible and descriptions also made a bit elaborative where ever necessary. Considering the fragile and endangered nature of these organisms, developing the capacity in taxonomy helps in their discovery, inventorisation and conservation. Finally, it is expected that the field identification of corals prepares the enthusiasts on the long path of becoming a coral taxonomist. We take this opportunity to acknowledge the Ministry of Environment and Forests, Government of India and National Biodiversity Authority for their support in bringing out this publication.

May, 2012

Venkataraman, K.
Ch. Satyanarayana

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INTRODUCTION

Coral reefs are one of the most ancient and dynamic ecosystems of India. The coral reefs not only provide a sanctuary to a myriad of marine life but also play a key role in protecting the coastline from erosion. In addition, people living along the 8000 km long coastal stretch of India depend on coral reefs for their livelihood. India is centrally placed within the warm tropical region of the Indian Ocean and exhibits extensive coral reefs throughout its marine territories.

Reef-building corals (= true, hard, stony or hermatypic) are among the most important contributors to the reef structure. As per the recent global estimate, shallow coral reefs occupy 2,84,300 sq km, an area about half the size of Madagascar. This estimate is 1.2 % of the world's continental shelf area, and only 0.09 percent of the total area of the world's oceans. Coral reefs are scarce, but critically important resource. They provide shelter, food and protection for a diverse array of marine plants and animals. Efforts to quantify the total numbers of species, which are found on reefs, remain largely restricted to wild extrapolations and estimates. As many as 100,000 species may have been named and described world wide from reefs, but the total number inhabiting the world's reefs may be anything between half and 2 million, perhaps more. Large portions of the world's coral reefs occur within the Indian Ocean. The total area of coral reefs in India is estimated to be 2,379 sq km, which is less than one percent of all the coral reef areas in the world.

The most diverse region of the world for coral reefs is centered on the Philippines, Indonesia, Malaysia and Papua New Guinea, with between 500 and 600 species of coral in each of these countries. Unfortunately, these are also some of the most threatened coral reefs of the world. There are 345+ species of hard corals have been recorded within four major coral reefs of India *viz.* Gulf of Mannar, Gulf of Kachchh (= Kutch), Lakshadweep and Andaman and Nicobar Islands, and as research continues, many more are expected to be discovered in the coming years. For example a GCRMN Coral genera identification Training (December 1999) yielded 13 new records from Andaman (New Wandoor area: unpublished data by Zoological Survey of India) and the GOI/ UNDP/GEF diving mission yielded 234 species of which 110 are new records to India (Turner *et al.,* 2001). Still more studies are required to complete the inventorisation in the remote areas of the Andaman and Nicobar Islands as well as other reef areas of Indian main land. The coral assemblages of Indian reefs are of great interest to evolution and biogeography because they stem from a blend of widespread Indo-pacific species and species unique to the Indian Ocean as well as local waters.

The studies on taxonomy of Indian coral reef started in India as early as 1847 by Rink in Nicobar Islands and later in 1898 by Thurston in Gulf of Mannar region. Edgar Thurston collected several specimens from Rameswaram, (Gulf of Mannar) at a time as Foote (1888) has aptly commented when the place was "the most out of the way, an Un-get-able" one in India. Thurstons's collections were later studied by Brook (1893) and Bernard (1897, 1905). Brook (1893) recognized 8 species of *Acropora* from Rameswaram, out of which, *A. multicaulia, A. thurstoni* and *A. indica* have been described as new. Alcock (1893) published an account of some ahermatypic corals from the seas around India. Later Alcock (1898) described 25 species of "deep-sea Madreporaria" dredged by the Royal Indian Maine Survey ship "Investigator" from depth of more than hundred fathoms, around Andaman Islands, off Madras, Konkan Coast, off Kerala, Lakshadweep and Maldives.

Bernard (1897) has mentioned the occurrence of *Montipora divaricata (= M. ramose)* and *M. foliosa* in Rameswaram. Bernard (1905) has also described 14 specimens of *Porites* collected by Thurston from the living and subfossilised reefs of Rameswaram. Gardiner (1904, 1905) has recorded 27 species of corals assignable to 17 genera from Minicoy. Matthai's (1924) work on the coral collections of Indian Museum, Calcutta (=Kolkata) has already been alluded to. Matthai (1924 a) has reported a species of *Culicia* from Chilka Lake, Odisha (= Orisa). In his catalogue of the "Meandroid Astraoidae", Matthai (1928) has reported the occurrence of *Symphyllia recta*, *S. radians* and *Platygyra lamellina* around Mandapam. Gravely (1927) reported on the Scleractinia of the littoral waters of Krusadai Island and nearby places. This includes 22 genera and 30 species. He has only mentioned the occurrence of the genera *Goniopora* and *Porites*. Sewell (1935) during his geographic and oceanographic researches in Indian waters collected 13 species of corals belonging to 8 genera from

the raised reefs of Rameswaram and Mandapam. Gravely (1941) noted the presence of the remnants of *Pocillopora damicornis* at the Madras beach.

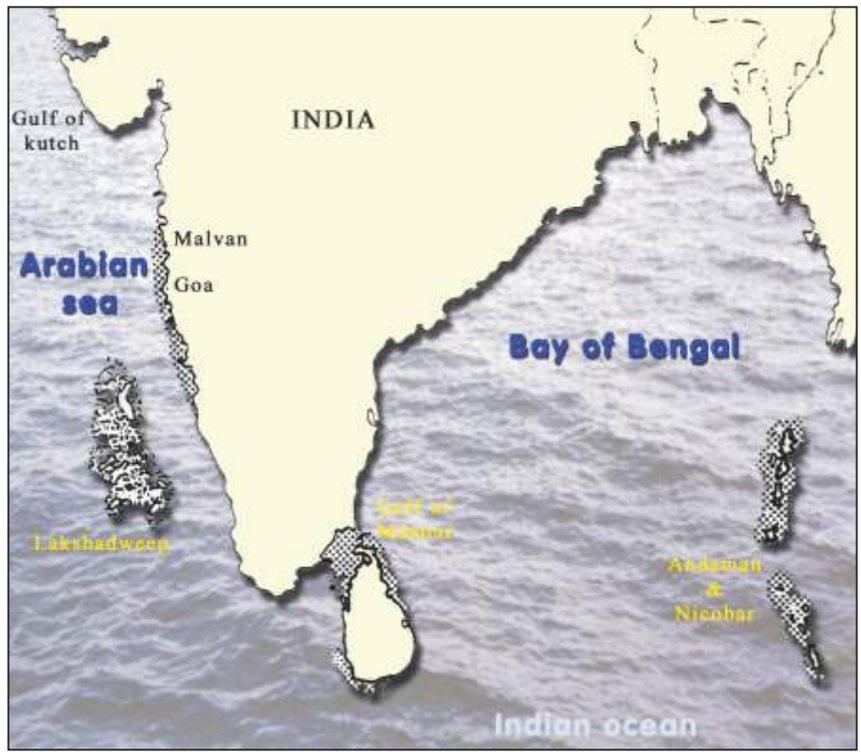
Pillai (1967) the first Indian worker on corals submitted his Ph D thesis on the "Studies on Corals" from Mandapam group of Islands of Gulf of Mannar and Chetlet and Minicoy group of islands from Lakshadweep. This thesis is considered to be first of its kind in India on corals, dealing with 125 species of corals belonging to 34 genera and one subgenus in detail.

During 1969, Pillai published a series of six papers (Pillai 1969 a, b, c, d, e, f) on the coral species of Gulf of Mannar followed by distribution of corals in Minicoy Atoll, Lakshadweep (Pillai 1971). Pillai (1971 a, b, c, 1972, 1973, 1974, 1975, 1977) contributed on composition, distribution, coral resources, and human effects on corals of Gulf of Mannar. Later Pillai (1977, 1977, 1978, 1983) also published a series of account on the corals of Andaman and Nicobar Islands with the impetus gained from the earlier works on the collection of Andaman and Nicobar Islands jointly with Scheer (Scheer and Pillai, 1974). His work with Patel in 1988 on the Scleractinian corals from the Gulf of Kachchh is the only work from that region. Only a very few stray papers were published by Pillai after his cream publication on the Coral reefs of India, their conservation and management (Pillai, 1996). Excepting the taxonomic studies of Pillai, there is no other contribution on corals till late nineties probably due to the risks involved in diving . After the massive and devastating bleaching event in 1998 Zoological Survey of India has responded positively to the conservation efforts of the world reef community. The outcome in the form of scientific output includes 1. The first authentic report of coral bleaching in the Indian waters (Gulf of Mannar) reported. 2. The myth of high mortality of coral reefs due to bleaching at Andamans was also broken by the International Expedition carried out by ZSI in Andaman waters. 3. Studies by ZSI on Lakshadweep reefs revealed the disastrous bleaching event which is responsible for a coral mortality amounting to more than 60% and its recovery in subsequent years. 4. Gulf of Kutch is the least affected due to bleaching because of its location in semiarid and industrial infested environment. 5.The elevated reefs of Gulf of Kutch and continental reefs of Andamans has the potential to seed the ravaged reefs in the Indian Ocean region especially reefs like Maldivian reefs which are much affected due to 1998 bleaching event. In addition to this, **Indian Coral Reef Monitoring Network** was started and major surveys and capacity building efforts were carried out through the well trained scientists from Zoological Survey of India and impetus was provided to other reef researchers in India. The training of about 150 Indian reef researchers by the scientists of Zoological Survey of India after their training in Australia under **India-Australia Training and Capacity Building Programme** and the discovery of the pristine and diverse condition of Andaman reefs by the scientists of ZSI and UNDP/GEF are some of the big leaps forward in Indian reef research. Couple of important publications in the form of hand books on taxonomy of hardcorals (Venkataraman *et al.,* 2003, Satyanarayana and Ramakrishna, 2009) were brought out with the description of some more new records to India. The present effort is also a follow up of that relentless initiative.

CORAL REEFS IN INDIA

All the three major reef types occur in India (atoll, fringing and barrier). Within these habitats are some of the most diverse, extensive and least disturbed reefs in the Indian Ocean. To this day, many of these reefs are largely unstudied. The mainland coast of India has two widely separated areas containing reefs: the Gulf of Kachchh in the northwest, which has some of the most northerly reefs in the world, and Palk Bay and Gulf of Mannar in the southeast. In addition to these, there are patches of reef growth on the West Coast, for example coral reefs at Malvan. The Andaman and Nicobar Islands have fringing reefs around many islands, and a long barrier reef (329 km) on the west coast. Little is known about these reefs, which may be the most diverse and pristine reefs in India. The Lakshadweep also has extensive reefs but these are also poorly explored.

The Indian landmass forms a major physical division between the Arabian Sea and the Bay of Bengal. Oceanographically, the Bay of Bengal differs from the Arabian Sea in maintaining clockwise circulation of major currents during both the northeast and southwest monsoons. The circulation in the Arabian Sea reverses, with surface water masses circulating counter clockwise during the northeast monsoon and clockwise during the southwest monsoon. There is also major difference in salinity. In the Arabian Sea, evaporation exceeds precipitation and runoff, leading to the formation



Major coral reef areas in India

of highly saline water masses that flow south. The Bay of Bengal has comparatively low salinity due to high runoff and precipitation; during the southwest monsoon, maximum salinity is found at depths of about 500 m as highly saline water moves into the Bay from the Indian Ocean.

Indian subcontinent with its coastline extending over 8,000 km and subtropical climatic condition has very few coral reef areas when compared to other regions of the world. In India, the reefs are distributed along the east and west coasts at restricted places. However, all the major reef types are represented. Fringing reefs are found in Gulf of Mannar and Palk Bay. Platform reefs are seen along the Gulf of Kachchh. Patchy reefs are present near Ratnagiri and Malvan coasts. Fringing and barrier reefs are found in Andaman and Nicobar Islands. Atoll reefs are found in Lakshadweep. The absence of reef in Bay of Bengal (North East Coast) is attributed to the immense quantity of freshwater and silt brought by the rivers such as Ganga, Krishna and Godavari. Satellite imagery (Space Application Centre, Ahmedabad) shows scattered patches of corals in the intertidal areas and occasionally at subtidal depths along the West Coast of India notably at Ratnagiri, Malvan and Rede Port.

The mainland coast of India has the Gulf of Kachchh in the Northwest (Gujarat State) and Palk Bay and the Gulf of Mannar in the southeast (Tamil Nadu State). Other than these important off shore island groups of India, the Andaman and Nicobar in the Bay of Bengal and Lakshadweep in the Arabian Sea also have extensive reef growth. The total area of coral reefs in India is estimated to be 2,375 sq km.

EAST COAST OF INDIA

PALK BAY

Coral reefs on the Tamil Nadu coast (South East Coast) are located in Palk Bay near Rameswaram and in the Gulf of Mannar. Mandapam peninsula and Rameswaram Islands separate Palk Bay from the Gulf of Mannar. The reef is centered at 9°17′ N and 79°15′ E. There is only one fringing reef in the Palk Bay, which lies along the mainland from the Pamban channel at the Pamban end of the bridge to Rameswaram Island. This reef is 25-30 km long, and generally less than 200 m wide; maximum depth is around 6 m. They are situated almost parallel to the shore in an east-westerly direction.

The lagoon is shallow and can be waded through at lowest tides. The width of the lagoon varies from 200 to 600 meters in different regions. A channel with two to three meters depth almost at the mid length of the reef, through which fishing boats enter the lagoon, divides the reef into the eastern and western halves.

The eastern half, which extend eastward up to Pamban Pass, is called Kathuvallimunai Reef, while the western half, which extends westward up to Thedai is called Vellaperthumunai Reef. The Kathuvallimunai reef is comparatively wider than the Vellaperthumunai reef for most of its length. Visibility is poor due to siltation and it is influenced by the northeast monsoon. The reef flat is relatively broad from Pamban channel to the southern end near Ramnad and narrow from Pamban to south of Rameswaram.

Map of Palk Bay

GULF OF MANNAR

The Gulf of Mannar reefs on the other hand are developed around a chain of 21 islands that lie along the 140 km stretch between Tuticorin and Rameswaram. These islands are located between latitude $8^0 47'$ N and $9^0 15'$N and longitude $78^0 12'$E and $79^0 14'$ E. The islands lie at an average distance of 8 km from the main land. They are a part of the Mannar Barrier reef, which are 140 km long and 25 km wide between Pamban and Tuticorin. Different types of reef forms such as shore, platform, patch and fringing type are also observed in the Gulf of Mannar. The islands have fringing coral reefs and patch reefs around them. Narrow fringing reefs are located mostly at a distance of 50 to 100 m from the islands. On the other hand, patch reefs rise from depths of 2 to 9 m and extend to 1 to 2 km in length with width as much as 50 meters. Reef flat is extensive in almost all the reefs in the Gulf of Mannar. Reef vegetation is richly distributed on these reefs. The total area occupied by reef and its associated features is 94 sq km. Reef flat and reef vegetation including algae occupies 65 and 14 sq km, respectively (D.O.D and S.A.C., 1997). Usually monsoons, coral mining and high sedimentation load affect the visibility. These reefs are more luxuriant and richer than the reefs of Palk Bay.

Map of Gulf of Mannar showing 21 islands

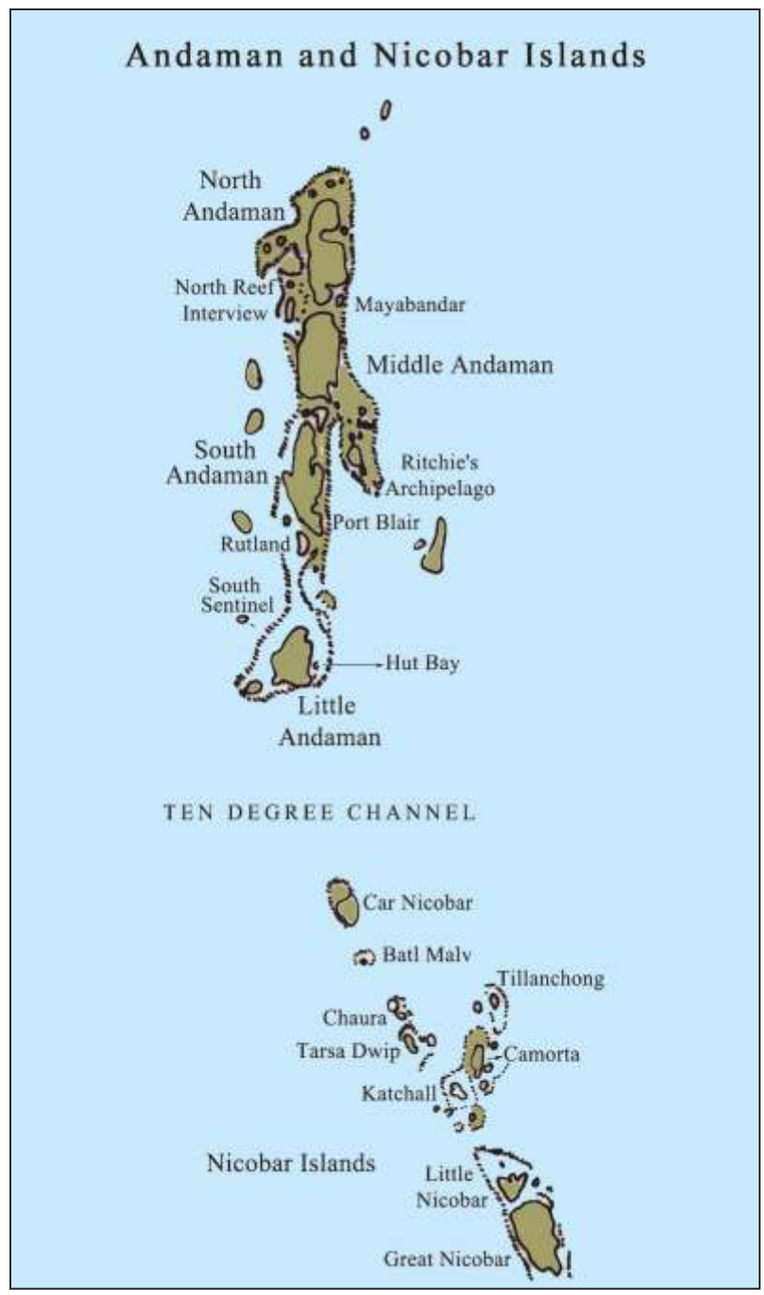
Pillai (1986) provided a comprehensive account of the coral fauna of this region. There are about 96 species of corals belonging to 38 genera in the Gulf of Mannar. The most commonly occurring genera of corals are *Acropora, Montipora* and *Porites*. Coral associates such as ornamental fishes belonging to the family Chaetodontidae, (butterfly fish); *Amphiprion* spp (clown fish), *Holocentrus* spp (squirrelfish), *Scarus* spp (parrotfish), *Lutjanus* spp (snapper fish) and *Abudefdul saxatilis* (sergeant Major) are found. Extensive sea grass beds are present; green turtles, olive ridley turtles and dugongs are dependent on the sea grasses.

ANDAMAN AND NICOBAR ISLANDS

The Andaman & Nicobar group of Islands is located in the SE of the Bay of Bengal, between 6°-14° N latitude and 91° – 94° E longitude. They are the emerged part of a mountain chain and lie on a ridge that extends southward from the Irrawaddy delta area of Burma, continuing the trend of the Arakan Yoma range.

The Andaman and Nicobar consist of 530 islands, of which only 38 are inhabited, along with a number of exposed islets and rocks. The principal of these is the North Andaman, Middle Andaman with Ritchies archipelago to the east, South Andaman, little Andaman, Baratang and Rutland Island. The coral reefs are of fringing type and except for a few investigation reports, the reefs of the area still largely remain unknown. A deep oceanic ridge along 10° N separates the Andaman Group and the Nicobar group islands.

The orientation of the chain of islands groups is north south. In these island groups there are two Marine National Parks *viz.*, Mahatma Gandhi and Rani Jhansi Marine National Parks. The coral fauna is diverse when compared to other parts of India.



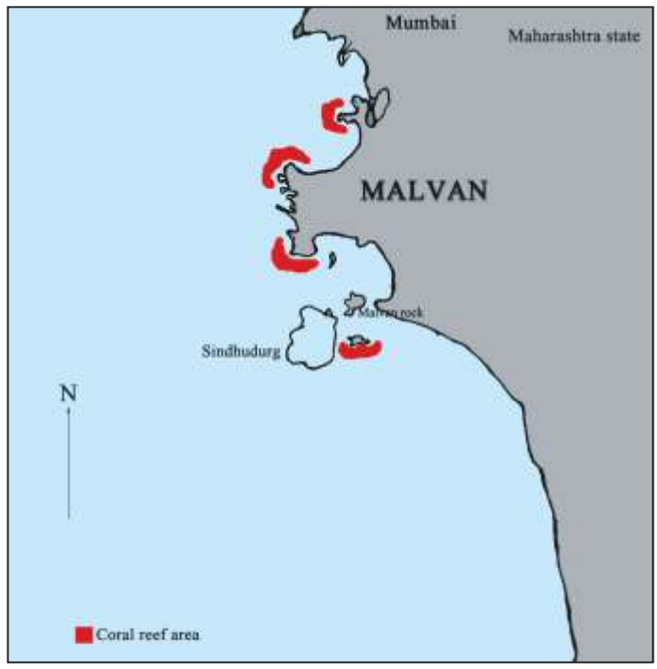
Map of Andaman and Nicobar

WEST COAST OF INDIA

MALVAN

The West Coast of India between Bombay and Goa is reported to have submerged banks with isolated coral formations (Nair and Qasim, 1978). Coral patches have been recorded in the intertidal regions of Ratnagiri, Malavan and Rede, south of Bombay (Qasim and Wafer, 1979) and at the Gaveshani bank, 100 km west to Mangalore (Nair and Qasim, 1978).

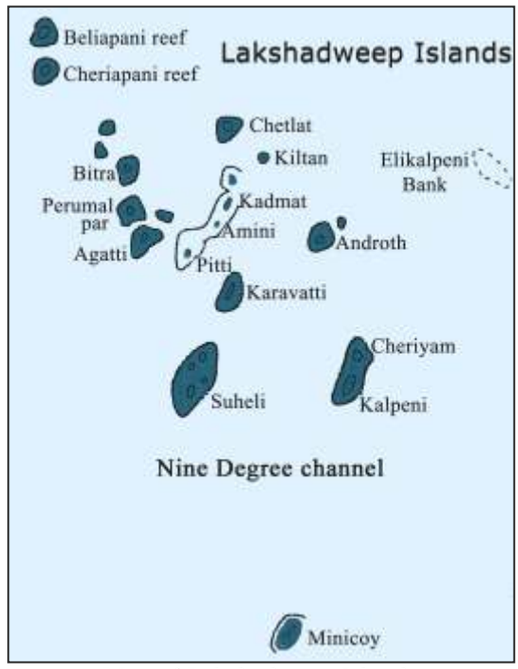
Malvan coast forms part of Western Ghats where Sahyadri ranges gradually meet the Arabian Sea. From Vengurla point, the coast trends towards north for about 22 km. From Malvan bay, a chain of submerged and exposed rocky islands extends straight towards south up to 15°53′ N and 73°27′ E. In this chain, several islands exist including Vengurla Rocks at the Southern tip and Sindhudurg Fort at the northern tip. Other small islets around Sindhudurg Fort are Mandel Rock, Malvan Rock etc. There are numerous exposed rocky outcrops in this area. Sindhudurg is a low fortified island on the coastal reef, which is connected to the mainland by a fringing reef. Kalarati and Kolamb rivers flank the Malvan coast in the north and Karli River in the south. The coast mainly consists of granites and genisses and in a few genissic interruptions the rocks are covered by laterite beds. Behind these marine coastal tertiaries, there are genisses up to 16°15′ N and further North Deccan lava starts. Sandy beaches and rocky cliffs interrupt the coastline near Malavan. Most of the marine flora and fauna from the intertidal area is exposed during any low tide. However, during lowest low tides (particularly minus tides), the coral reefs get exposed. *Porites, Coscinaraea, Turbinaria, Favia* and *Pseudosiderastrea* are some of genera reported from this coast. Siltation is of high rate and salinity may drop to 20 ppt during monsoon in some habitats, which may restrict the growth of ecologically sensitive forms of ramose corals.



Map of Malvan

LAKSHADWEEP ISLANDS

The Lakshadweep Islands lie scattered in the Arabian Sea at about 225 – 450 km from Kerala coast. Geographically, the islands lie between 8° N – 12° 3′ N latitude and 71° E – 74° E longitude. The islands consist of coral formations built up on the Laccadive-Chagos submarine ridge rising steeply from a depth of about 1500 m to 4000 m off the west coast of India. The Union Territory of Lakshadweep along with the Maldives and the Chagos Archipelagoes form an interrupted chain of coral atolls and reefs on a continuous submarine bank covering a distance of over 2000 km. This ridge is supposed to be a continuation of the Arravali Mountain, and the islands are believed to be remnants of the submerged mountain cliffs. There are six tiny islands, 12 atolls, 3 reefs and 5 submerged banks, covering an area of 32 km^2 with lagoons occupying about 4200 km^2. Only 11 of the 36 islands are inhabited. They are Androtт, Amini, Agatti, Bangaram, Bitra, Chetlat, Kadmat, Kalpeni, Kiltan, Minicoy and the headquarters at Kavaratti. The Minicoy Island is separated from the rest of the islands by a 180 km wide stretch of sea known as the nine-degree channel.



Map of Lakshadweep Islands

The islands are flat and scarcely rise more than two meters. They are made up of coral sand and boulders that have been compacted into sandstone. Coral reefs of

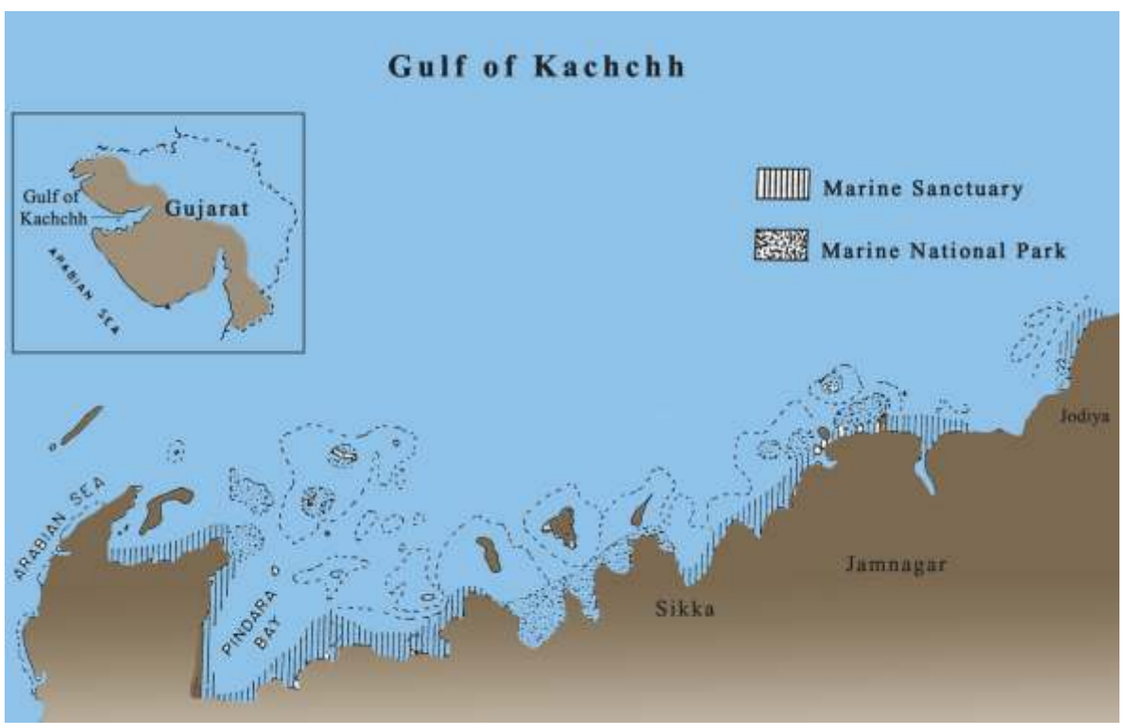
the islands are mainly atolls except one platform at Androt. The reef flat occupies 137 km area, sea grass occupies 11 sq km and lagoon occupies 309 sq km (Bahuguna and Nayak, 1994). The depth of the sea increases outside the coral reef and can reach up to 1500-3000 m. Androtт is the largest island with an area of 5 sq km and the only island that does not have a lagoon. Birta with an area of 0.10 sq km is the smallest in land area but perhaps has the most magnificent lagoon. All the islands lie north to south, excepting Androtт that lies east to west. The distance between them varies from 11 km to 378 km.

The coral fauna of Lakshadweep is known to harbor 105 species divided among 37 genera (Pillai, 1996). *Acropora* spp., *Pocillopora* spp., *Porites* spp. and massive and encrusting favids dominate the lagoon and reef flat faunal elements. *Psammocora spp.* is common in the northern islands. There is an abundance of blue coral *Helipora coerulea. Millepora* spp forms the dominant element in the lagoon. Minicoy has some elements such as *Lobophyllia* and *Diploastrea* that are common to the Maldives but rarely found in the northern islands. Similarly, the genera *Montipora* and *Echinopora* recorded from the northern group of atolls are not recorded in Minicoy. There are 86 species of macrophytes, 10 Anomuran crabs, 81 Brachyuran crabs, 155 Gastropods, 24 Bivalves, 13 Sea stars, 6 Brittle stars, 23 Sea cucumbers, 15 Sea urchins and 120 species of fish are found in the Lakshadweep. The green turtle and the hawksbill turtle are also found in all the islands.

GULF OF KACHCHH

Gujarat State has 600 km long coastline is very rich in various edible fishes and various types of algae. Veraval and Mongrol are fishing harbours as they produce large quantity of export quality fishes, crabs etc. Mangrol, Porbandar, Okha, Bedi and Dwarka have also got a great potential value for producing large quantity of such fishes for export as the Gulf of Kachchh is a heaven for their breeding. The Gulf of Kachchh is the richest source of floral, faunal, and marine wealth of India, as it gives favorable conditions for breeding and shelter to all marine life in the 42 islands.

Extensive mangroves are present in the Indus River Delta forming several islands. The tidal range in the Gulf is reported to be as great as 12 m, but may have seasonal changes with extreme low tides at certain times of the year (Brown, 1997). The corals in the Gulf of Kachchh survive through extreme environmental conditions such as high temperature, salinity changes and high-suspended particulate loads (Wafar *et al.,* 2000).



Map of Gulf of Kachchh

The annual rainfall in this area is less than 5 cm with maximum precipitation in July-August. As there are no major river openings, land runoff is minimal. Relative humidity is highest in August (82%) and lowest in December-January (60%). Atmospheric temperature varies from 10° C (January) to 35° C (May-June). Wind pattern is predominantly seasonal with rare cyclonic disturbances. Predominant wind direction in the Gulf of Kachchh is West southwesterly and north easterly during June to September and December to March respectively. July is the windiest month with wind speed exceeding 20 knots/h for the major part of the month (Srivasthava and John, 1977). Dominant direction of the wind is from west or west-southwest. Tides in the Gulf of Kachchh are mixed, predominantly semidiurnal type with a large diurnal inequality (Srivasthava and John, 1977).

The mean spring tidal influx extends from the mouth to the closed end of the Gulf and it has a range of 2.1 m to 6.2 m. A distinct correlation exists between the tidal range and the tidal current speed. The Gulf of Kachchh is elongated in the east west direction and has an average depth of 30 m. Its coastal configuration is very irregular with a number of islands, creeks and bays.

BIOLOGICAL DIVERSITY OF CORALS

At the phyletic level that more accurately tallies the diversity of evolved life forms in an ecosystem, 32 of the 34 described phyla are found on coral reefs. In contrast, only 9 are found free-living in the tropical rain forest. Even if freshwater and parasitic forms are included in the count, the rain forest total rises to 17 phyla, approximately half of the phyletic diversity of coral reefs (Porter and Tougas, 2001). Only tropical rainforests estimated by some to be home to a staggering 30 million insects, have a greater number of species, although due to the vast number of fish that inhabit them, reefs contain a larger number of vertebrates than rainforests. The diversity of coral reefs greatly exceeds that of any other marine environment. Reefs are home to more species than any other ecosystem in the sea. The total number of reef species in the world is still unknown, but up to 3,000 species can be found together on a single reef in South East Asia and over 1,000 on a single Caribbean reef. Coral reefs harbor rich biodiversity. Of the roughly 1.86 million plant and animal species described, 2,74,000 are thought to be marine and more than half of these are tropical. At present, there are thought to be 93,000 described species of coral reef plants and animals. Almost 66,000 of these are macroscopic invertebrates. At present, no fully comprehensive all-taxa biodiversity inventory has been conducted on a coral reef, but it is obvious that when this is done, the total biodiversity would be extremely high.

SCLERACTINIAN CORALS (Hard Corals)

The richest reefs, with the greatest diversity of plants and animals are in the region bound by Indonesia, Malaysia, the Philippines and southern Japan. Of the 793 or so reef corals that are known in the world, 600 are found in this region; over 400 are found in the Philippines and Japan, and about 350 in Indonesia, there are probably many more to be discovered here. Up to 200 corals may occur on a single reef in South East Asia. This high diversity extends equally to other reef associates and is partly because of the greatest area of reefs found here and partly because of its geological history. When the sea level was lower, the region comprised of three separate basins, within each of which numerous species evolved.

The coral reefs of India exhibit extraordinary biodiversity. Un till 1998 it was thought that the diversity of corals including hermatypic and ahermatypic corals amounts to 245 only. The Government of India and UNDP GEF field mission (2001 diving studies) reported a total of 234 species of scleractinian coral from Andaman group of Islands of which 111 are supposed to be new records to India (on verification with other studies only 94 species are found to be new records and this also includes some non-scleractinian corals) (Turner *et al.,* 2001). Also the underwater field mission revealed that the coral reefs of the Andaman Islands are globally significant in terms of coral reef diversity. The reefs around the islands were more diverse coral species than expected and less impacted than the other reefs of Indian Ocean region. The diversity is also comparable with numbers of coal reef species in the Philippines, Indonesia and Papua New Guinea, which are areas considered to be the world centers of coral diversity. The Andaman Islands have around 80% of the global maximum for coral diversity, suggesting a final count could reach 400 species of coral.

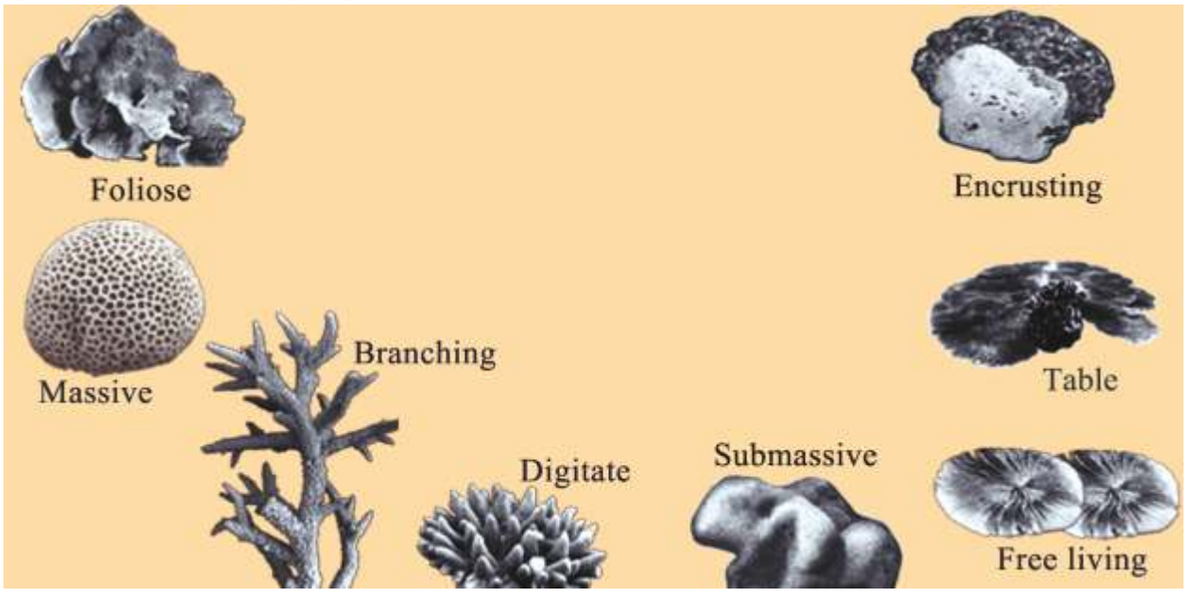
Other major coral reefs in India such as moderately rich diverse Lakshadweep and high diverse Gulf of Mannar have 100+ species each excepting Gulf of Kachchh where the diversity is minimum (49 species).

CORAL BIOLOGY

Corals are the most conspicuous inhabitants of reefs and provide the habitat amongst which fish and other reef animals exist. The term 'coral' has been used to describe a variety of different invertebrate animals from the Phylum Cnidaria including hard corals, soft corals, precious corals and hydrocorals. Most often the word coral refers to hard corals from the Order Scleractinia. Scleractinian corals are divided into reef-building corals (hermatypic corals), which form the primary structure of coral reefs, and non-reef building corals (ahermatypic corals), which do not contribute significantly to reef formation. Hermatypic corals usually contain millions of tiny algal cells, called zooxanthellae, within their tissues. These algae are a primary energy source for the reef-building activities of hermatypic corals.

The ability to recognize individual coral species is essential to decide on reef management and protection. However there are a number of characteristics that can make corals particularly elusive and difficult to identify. Corals are unique animals in that they have the ability to change their growth form to suit the habitat in which they live. Depending on the depth, light availability, temperature, water movement and quality, a single reef may contain an array of habitat types. Hence, the growth form of the same species of coral may look different from one type of habitat to the next. In addition, corals have the ability to hybridize, can reproduce from fragments, self fertilize and change their colouration so variability in growth form is abundant and can even occur within a single colony.

Most coral species have a colonial growth form. Each colony is composed of many living polyps that are interconnected to form various shapes, which are called as life form categories. Some coral species exist as solitary polyps.

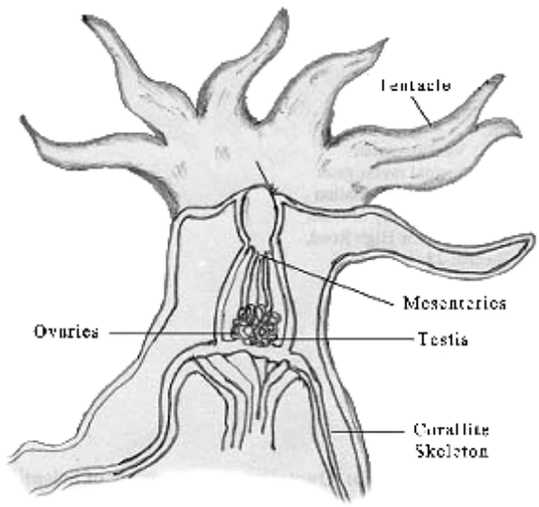


Life from categories of different species of corals in India

The structure of a coral is relatively simple. There is an outer layer of living tissue that secretes a lower layer of hard limestone skeleton. As the colony grows, additional polyps and more layers of skeleton are added. Over time, individual colonies of some corals such as *Porites* may grow to reach more than 10 m in diameter and may live for more than 1000 years. The living coral tissue has an outer epidermal layer, which secretes the skeleton, and an inner tissue layer termed the 'gastrodermis'. Between these tissues lies a thin, fibrous matrix termed the 'mesogloea'. The mesogloea is greatly expanded in other cnidarians, such as jellyfish, where it provides essential buoyancy and support, whereas in corals the mesogloea is a relatively thin layer because the hard skeleton provides support and protection for the tissue. The gastrodermal cells of most reef corals

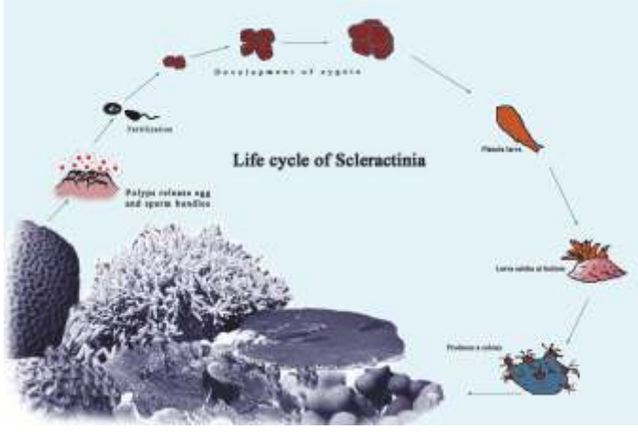
contain zooxanthellae, which use energy from sunlight for photosynthesis to produce complex energy-rich sugars, just as land plants do. Corals that contain zooxanthellae are termed 'zooxanthellate species'. The relationship between corals and zooxanthellae is termed as mutualistic symbiotic association since this benefits both. Zooxanthellae gain protection, access to sunlight and a stable environment by living in the coral tissue, and they obtain vital nutrients from the waste products of the coral. In return, the coral gains access to energy-rich compounds leaked from the zooxanthellae, and also the removal of wastes from its cells. The interaction of coral tissues and zooxanthellae also enhances the rate at which corals calcify and grow. In other words, the symbiosis of corals and algae is ultimately responsible for the development of coral reefs. Huge numbers of zooxanthellae live inside the gastrodermal cells of zooxanthellate corals, and give these corals their distinctive brown colouration. Zooxanthellae are also found in some other cnidarians, giant clams and other molluscs.

The coral polyp is a sac capped with an oral disc that is surrounded by a ring of tentacles. During daylight, the polyps are usually contracted within the protective coral skeleton to avoid predation. At night the polyps expand and extend a network of tentacles containing stinging cells, which allows corals to capture and feed upon small plankton and other creatures in the water column.

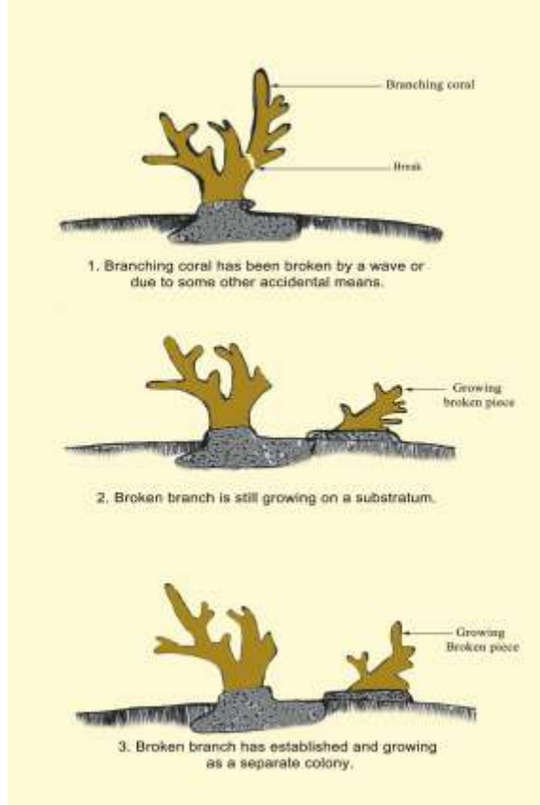


Corals have a life cycle, which includes a free-living planktonic planula phase and a sessile polyp phase, and various asexual and sexual modes of reproduction. As living polyps grow and enlarge, they can divide to form new polyps through the process of budding. Other forms of asexual reproduction leading to the development of new colonies are the survival of fragments broken in storms and the detachment polyps from the skeleton.

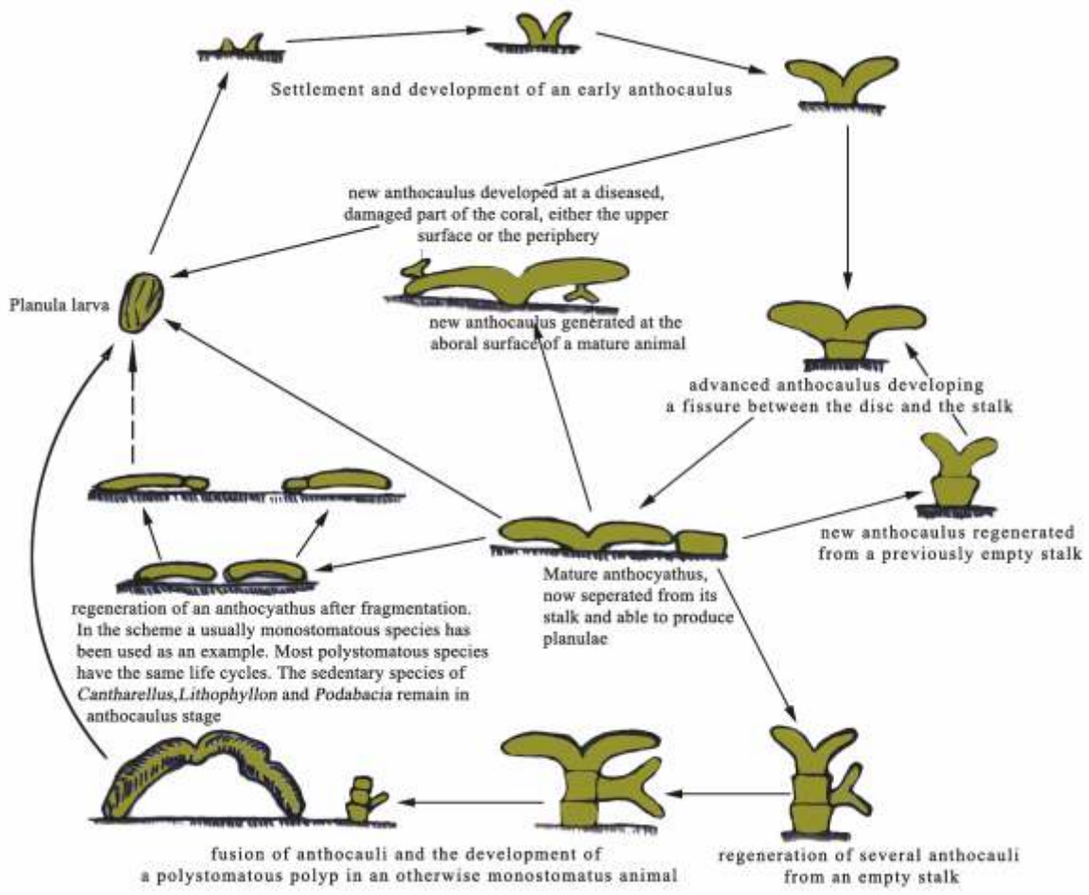
Corals reproduce sexually through the fertilization of eggs by sperm, which leads to the development of planula larvae. Sexually mature adult corals develop eggs and sperm within the polyp mesenteries during a 5-9 month period each year. Sexual reproduction and larval recruitment are critically important for the establishment and renewal of coral communities.



Sexual reproduction of scleractinian corals



Vegetative growth of branching corals



Vegetative and sexual life cycle of species of Fungiidae

CORAL TAXONOMY

Hard corals are belonging to the Order Scleractinia. There are 793 living species of scleractinian corals worldwide (Veron, 2000). While identifying corals, it is necessary to look in detail at the morphology of the skeleton. The skeletal structure of a single polyp is called a 'corallite'. This is a cylindrical cup that is divided into segments called 'septa'. The first six septa are called 'primary septa'; while later formed septa are called 'secondary septa', 'tertiary septa', etc., and are often described as cycles of septa. First and second cycles consist of six septa each, the third cycle 12, the fourth 24, the fifth cycle 48, etc. The earlier formed septa are usually larger than the later ones. The septa surround the central structure called the 'columella', which is situated below the mouth of the polyp. The inner parts of the septa may form a circle of vertical expansions around the columella, called the 'paliform lobes', easily distinguishable from both structures.

In colonial corals, individual corallites are joined together by skeletal elements termed 'coenosteum', which are secreted by coenosarc tissues between the polyps. The coenosteum forms a complex matrix, or grow as a fused plate, sometimes with elaborate structures. As colonies grow, the polyps expand until they reach a critical size; then the polyps and the associated corallites divide. Where the original polyp divides into two or more polyps, the process is known as 'intratentacular budding'. Where new polyps form on the outside of the parent polyp, the process is termed 'extratentacular' budding. This budding process produces a wide range of colony forms, which is the reason for the reef corals being ecologically adaptable and successful. The most common colony forms are plocoid where corallites have separate walls and are united by coenosteum (*Favia*), ceriod where adjacent corallites share common walls (*Favites*), meandroid where a series of corallites form valleys (*Platygyra*), and phaceloid where corallites have separate walls and form branched clumps (*Dendrophyllia*).

The growth form of the colony can be encrusting where the skeleton adheres closely to the substratum *Siderastrea*), massive (*Porites lutea*), column (*Goniopora*), branching (*Acropora, Stylophora*), foliaceous (*Turbinaria reniformis*) or plate-like (*Turbinaria peltata*). In some species, the growth form does not vary much among individuals in the population; whereas in most species, the growth form can change greatly depending upon the amount of light, wave action, water depth, sediment and other environmental factors. In most coral species, the corallites of each polyp are nearly identical; however, in branching *Acropora* species, two distinct types of corallites are developed. Relatively large axial polyps are present at the tip of each growing branch, while the main structure of the branch is formed by a series of smaller radial corallites.

THE SCLERACTINIAN FAUNA OF INDIA

Pillai (1983) recorded a total of 199 species, Venkataraman *et al* (2003) described 208 species and Satyanarayana and Ramakrishna added one genera and a couple of species to Indan diversity. The table given below and the subsequent check list given is an amalgamation of all the studies carried out till today. This account includes both hermatypic and ahermatypic corals recorded from the four major coral reefs of India. The following is the comprehensive list of genera and species of corals of India :

Area		Genera	Species
Lakshadweep	Hermatypes	42	105
	Ahermatypes	4	9
	Total	**46**	**114**
Gulf of Kutch	Hermatypes	23	45
	Ahermatypes	4	4
	Total	**27**	**49**
Southeast coast of India	Hermatypes	29	86
	Ahermatypes	9	10
	Total	**38**	**96**
Andaman and Nicobar Islands	Hermatypes	59	265
	Ahermatypes	12	35
	Total	**71**	**300**
The whole of India	Hermatypes	66	301
	Ahermatypes	21	44
	Total	**87**	**345**

The present account includes 18 families, 87 genera and 345 species of Scleractinia from four major reefs of India such as Gulf of Kachchh (49 species, 27 genera) Lakshadweep (114 species, 46 genera), Gulf of Mannar and Palk Bay (96 species 38 genera) Andaman and Nicobar Islands (300 species, 71 genera). The total number of species of Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Andaman and Nicobar Islands dealt in the present study is more than the previous report by Pillai (1996) due to discovery and inclusion of more new records in the coral reefs of India. The revision

of families and genera by the recent workers such as Hoeksema (1989) Carden Wallace (1999) and Veron (2000) has also made some of the earlier reported species as synonyms to the revised ones. Veron (2000) reported 18 families, 111 genera and 793 species of Scleractinia from the world in his three pictorial volumes on the "Corals of the World". Carden Wallace (1999) reported 114 species of the genus *Acropora* in her book on "Staghorn corals of the world" of which 47 species are reported in this account. Hoeksema (1989) in his book on the "Taxonomy, phylogeny and biogeography of Mushroom corals" revised 40 species of the family Fungiidae of which 22 are reported in this account.

From 1998 onwards, the coral reef studies in India gained a new direction due to many Training programmes by some of the international agencies. One such training was on the taxonomy of Indian Ocean Coral genera by the Global Coral Reef Monitoring Network (GCRMN) at Port Blair (December 1999), which yielded 13 new records of Scleractinian corals (unpublished) also included in this present account. Government of India and UNDP GEF field mission (Diving) in the Andaman Islands yielded 234 species of Scleractinian corals of which 197 are already reported and 111 are new record to Indian waters. Considerable number of deep water true corals (below 200 meters collected off Indian coast were not included/described in this book due to their rarity.

Collection of Corals

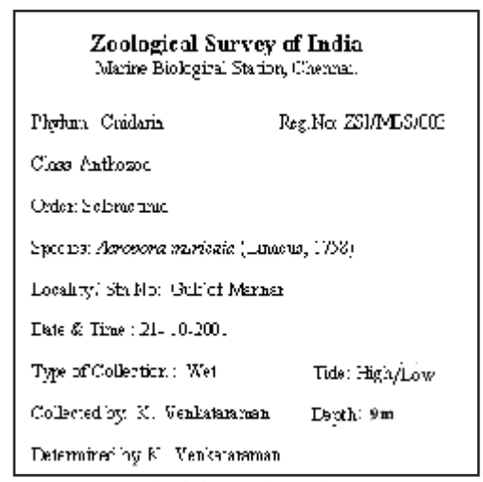
Collection of corals is important for identification for biodiversity studies and for the museums. Hammer, chisel and a sack are necessary equipments for coral collecting. Colour photographs should be taken before collecting or immediately before making the collection of the specimen. For shallow water collection, same procedure should be adopted. Underwater notes can be made on a slate, with surface scratched with fine flint paper. A soft pencil should be used. The pad may be cleaned with soap, water and a brush every time before going for collection. Small pieces of coral collection as well as the dead coral pieces found on the shore are not useful for identification purposes (e.g. *Acropora*). Collecting should be minimized for conservational reasons, and never be performed without proper authorization from the forest authorities since all the scleractinian corals are protected under wildlife Act. Dive number, locality, depth, colour and description of the immediate surroundings should be written with a waterproof marker on a solid plastic label attached to the specimen with a soft nylon line.

Cleaning of the skeleton

The labeled specimens should be rotted in fresh water for a week, and the water changed a few times during the process. Then the specimens should be cleaned with a strong water jet and gelatinous epidermis if any, be removed with a pair of forceps. The rotting procedure may be continued for another week, if necessary. The cleaned specimens should be dried in the sun for a fortnight. Rotting and bleaching with hypochlorite solution or bleaching powder should be avoided, as it makes the corals crisp.

Labeling

The cleaned specimens should be properly labeled. The label should indicate the locality (name of the reef, name of the island, name of the district, station number, latitude and longitude and depth of the reef and collection) date of collection, name of the collector, name of the boat/ survey and the cruise no etc. The information on the label may be made with printed/photocopied on an overhead projection sheet (transparent plastic sheet with nylon twain) and information may be written using a glass-marking pen


Zoological Survey of India
Marine Biological Station, Chennai.

Phylum Cnidaria Reg.No: ZSI/MBS/00

Class Anthozoa

Order: Scleractinia

Species: *Acropora nasuta* (Linnaeus, 1758)

Locality/ Stn No: Gulf of Mannar

Date & Time : 21-.10-200.

Type of Collection : Wet Tide: High/Low

Collected by: K. Venkataraman Depth: 9m

Determined by: K. Venkataraman

Label for registration

Underwater identification

A readymade species list may be prepared on an underwater paper with locality, station number, date, latitude, longitude, dive number, name of the person as

shown in the figure below. Along with this species list, information on the different features of the coral colony may be noted on an underwater slate or underwater paper. The information such as colour of the species, size of the colony, new recruits, other coral associates, fishes, topography drawing, bleaching, crown of thorn fish infestation can be noted before emerging from the water. It is always important to go to the field with a buddy and the name of the buddy should be written in the notes, the different pre dive preparations, list of precautions taken etc may also be included on the notes. The weather condition, season and the environmental conditions and sightings of anchor damage, ghost net etc will be valuable information about the reef.

LIST OF SCLERACTINIAN SPECIES RECORDED IN INDIA

FAMILY : ACROPORIDAE

1. *Montipora edwardsi* Bernard, 1897
2. *Montipora aequituberculata* Bernard, 1897
3. *Montipora angulata* (Lamarck, 1816)
4. *Montipora caliculata* (Dana, 1846)
5. *Montipora capitata* Dana, 1846
6. *Montipora cocosensis* Vaughan, 1918
7. *Montipora digitata* (Dana, 1846)
8. *Montipora explanata* Brueggeman,1879
9. *Montipora exserta* Quelch, 1886
10. *Montipora foliosa* (Pallas, 1766)
11. *Montipora foveolata* (Dana, 1846)
12. *Montipora hispida* (Dana, 1846)
13. *Montipora informis* Bernard, 1897
14. *Montipora jonesi* Pillai, 1969
15. *Montipora manauliensis* Pillai, 1969
16. *Montipora meandrina* (Ehrenberg, 1834)
17. *Montipora millepora* Crossland, 1952
18. *Montipora monasteriata* (Forskal, 1775)
19. *Montipora peltiformis* Bernard, 1897
20. *Montipora spongiosa* (Ehrenberg, 1834)
21. *Montipora spumosa* (Lamarck, 1816)
22. *Montipora tuberculosa* (Lamarck, 1816)
23. *Montipora turgescens* Bernard, 1897
24. *Montipora venosa* (Ehrenberg, 1834)
25. *Montipora verrilli* Vaughan, 1907
26. *Montipora verrucosa* (Lamarck, 1816)
27. *Acropora abrotanoides* (Lamarck, 1816)
28. *Acropora anthocercis* (Brook, 1893)
29. *Acropora aspera* (Dana, 1846)
30. *Acropora austera* (Dana, 1846)

31. *Acropora brueggemanni* (Brook, 1893)
32. *Acropora carduus* (Dana, 1846)
33. *Acropora caroliniana* Nemenzo, 1976
34. *Acropora cerealis* (Dana, 1846)
35. *Acropora chesterfieldensis* Veron Wallace, 1984
36. *Acropora clathrata* (Brook, 1891)
37. *Acropora cophodactyla* (Brook, 1892)
38. *Acropora cytherea* (Dana, 1846)
39. *Acropora digitifera* (Dana, 1846)
40. *Acropora divaricata* (Dana, 1846)
41. *Acropora donei* Veron Wallace, 1984
42. *Acropora echinata* (Dana, 1846)
43. *Acropora efflorescens* (Dana, 1846)
44. *Acropora florida* (Dana, 1846)
45. *Acropora gemmifera* (Brook, 1892)
46. *Acropora glauca* (Brook, 1893)
47. *Acropora globiceps* (Dana, 1846)
48. *Acropora grandis* (Brook, 1892)
49. *Acropora granulosa*(Milne Edwards & Haime, 1860)
50. *Acropora hemprichii* (Eherenberg, 1834)
51. *Acropora humilis* (Dana, 1846)
52. *Acropora hyacinthus* (Dana, 1846)
53. *Acropora intermedia* (Dana, 1846)
54. *Acropora kosurini* (Wallace, 1994)
55. *Acropora latistella* (Brook, 1891)
56. *Acropora longicyathus* (Milne Edwards & Haime, 1860)
57. *Acropora loripes* (Brook, 1892)
58. *Acropora lutkeni* Crossland, 1952
59. *Acropora microclados* (Ehrenberg, 1834)
60. *Acropora microphthalma* (Verrill, 1859)
61. *Acropora millepora* (Ehrenberg, 1834)
62. *Acropora monticulosa* (Bruggemann, 1879)
63. *Acropora multiacuta* Nemenzo, 1967
64. *Acropora formosa* (Linaeus, 1758)
65. *Acropora nasuta* (Dana, 1846)
66. *Acropora palifera* (Lamarck, 1816)
67. *Acropora palmerae* Wells, 1954
68. *Acropora paniculata* Verrill, 1902

69. *Acropora papillare* Latypov, 1992
70. *Acropora pinguis* Wells, 1950
71. *Acropora plana* Nemenzo, 1967
72. *Acropora plantaginea* (Lamarck, 1816)
73. *Acropora polystoma* (Brook, 1891)
74. *Acropora proximalis* Veron, 2000
75. *Acropora pulchra* (Brook, 1891)
76. *Acropora rambleri* (Bassett-Smith, 1890)
77. *Acropora robusta* (Dana, 1846)
78. *Acropora rudis* (Rehberg, 1892)
79. *Acropora samoensis* (Brook, 1891)
80. *Acropora schmitti* Wells, 1950
81. *Acropora secale* (Studer, 1878)
82. *Acropora selago* (Studer, 1878)
83. *Acropora solitaryensis* Veron Wallace, 1984
84. *Acropora spicifera* (Dana, 1846)
85. *Acropora squarrosa* (Ehrenberg, 1834)
86. *Acropora subglabra* (Brook, 1891)
87. *Acropora tenuis* (Dana, 1846)
88. *Acropora teres* (Verrill, 1866)
89. *Acropora valenciennesi* (Milne Edwards & Haime, 1860)
90. *Acropora valida* (Dana, 1846)
91. *Acropora vaughani* Wells, 1954
92. *Acropora verweyi* Veron Wallace, 1984
93. *Acropora yongei* Veron and Wallace, 1984
94. *Astreopora cucullata* Lamberts, 1980
95. *Astreopora gracilis* Bernard, 1896
96. *Astreopora listeri* Bernard, 1896
97. *Astreopora myriophthalma* (Lamarck, 1816)
98. *Astreopora randalli* Lamberts, 1980
99. *Astreopora scabra* Lamberts, 1982

FAMILY: AGARICIIDAE

100. *Pavona bipartita* Nemenzo, 1980
101. *Pavona cactus* (Forskal, 1775)
102. *Pavona danai* Milne Edwards and Haime, 1860
103. *Pavona clavus* (Dana, 1846)
104. *Pavona decussata* (Dana, 1846)
105. *Pavona duerdeni* Vaughan, 1907

106. *Pavona explanulata* (Lamarck, 1816)
107. *Pavona maldivensis* (Gardiner, 1905)
108. *Pavona minuta* Wells, 1954
109. *Pavona varians* Verrill, 1864
110. *Pavona venosa* (Ehrenberg, 1834)
111. *Leptoseris explanata* Yabe and Sugiyama, 1941
112. *Leptoseris foliosa* Dinesen, 1980
113. *Leptoseris gardineri* Horst, 1921
114. *Leptoseris hawaiiensis* Vaughan, 1907
115. *Leptoseris incrustans* (Quelch, 1886)
116. *Leptoseris mycetoseroides* Wells, 1954
117. *Leptoseris papyracea* (Dana, 1846)
118. *Leptoseris scabra* Vaughan, 1907
119. *Leptoseris yabei* (Pillai and Scheer, 1976)
120. *Coeloseris mayeri* Vaughan, 1918
121. *Gardineroseris planulata* (Dana, 1846)
122. *Pachyseris gemmae* Nemenzo, 1955
123. *Pachyseris rugosa* (Lamarck, 1801)
124. *Pachyseris speciosa* (Dana, 1846)

FAMILY: ASTROCOENIIDAE

125. *Stylocoeniella armata* (Eherenberg, 1834)
126. *Stylocoeniella guentheri* Bassett-Smith, 1890
127. *Palauastrea ramosa* Yabe and Sugiyama, 1941
128. *Madracis kirbyi* Veron & Pichon, 1976

FAMILY: CARYOPHYLLIIDAE

129. *Caryophyllia arcuata* (Milne Edwards and Haime, 1848)
130. *Caryophyllia grayi* Milne Edwards and Haime
131. *Caryophyllia smithii* Stokes and Broderip, 1828
132. *Deltocyathus andamanicus* Alcock, 1898
133. *Deltocyathus magnificus* Milne Edwards and Haime, 1848
134. *Heterocyathus aequicostatus* Moseley, I876
135. *Paracyathus indicus* Duncan, 1889
136. *Paracyathus profundus* Duncan, 1889
137. *Paracyathus stokesi* (Milne Edwards and Haime, 1848)
138. *Polycyathus andamanensis* Alcock, 1893
139. *Polycyathus verrilli* Duncan, 1889
140. *Stephanocyathus nobilis* (Mosley, 1873)

FAMILY: DENDROPHYLLIDAE

141. *Turbinaria frondens* (Dana, 1846)

142. *Turbinaria mesenterina* (Lamarck, 1816)
143. *Turbinaria patula* (Dana, 1846)
144. *Turbinaria peltata* (Esper, 1794)
145. *Turbinaria reniformis* Bernard, 1896
146. *Turbinaria stellulata* (Lamarck, 1816)
147. *Turbinaria undata* Bernard
148. *Balanophyllia affinis* (Semper, 1872)
149. *Balanophyllia imperiales* Kent, 1871
150. *Balanophyllia scabra* Alcock, 1893
151. *Dendrophyllia arbuscula* van der Horst, 1922
152. *Dendrophyllia coarctata* Duncan, 1889
153. *Dendrophyllia indica* Pillai, 1969
154. *Dendrophyllia minuscula* Bourne, 1905
155. *Enallopsammia amphelioides* (Alcock)
156. *Enallopsammia marenzelleri* Zibrowius
157. *Enallopsammia philippinensis* Milne Edwards and Haime, 1848
158. *Heteropsammia cochlea* (Spengler, 1781)
159. *Tubastrea aurea* (Quoy and Gaimard, 1833)
160. *Tubastrea coccinea* Lesson, 1829
161. *Tubastrea diaphana* (Dana, 1846)
162. *Tubastrea micranthus (*Ehrenberg, 1834)

FAMILY: EUPHYLLIDAE

163. *Euphyllia ancora* Veron and Pichon, 1980
164. *Euphyllia glabrescens* (Chamisso and Eysenhardt, 1821)
165. *Plerogyra sinuosa* (Dana, 1846)
166. *Physogyra lichtensteini* Milne Edwards and Haime, 1851

FAMILY: FAVIIDAE

167. *Caulastrea tumida* Matthai, 1928
168. *Favia favus* (Forskal, 1775)
169. *Favia helianthoides* Wells, 1954
170. *Favia lacuna* Veron, Turak, DeVantier, 2000
171. *Favia lizardensis* Veron and Pichon, 1977
172. *Favia matthaii* Vaughan, 1918
173. *Favia pallida* (Dana, 1846)
174. *Favia rotumana* (Gardiner, 1899)
175. *Favia rotundata* (Veron and Pichon, 1977)
176. *Favia speciosa* Dana, 1846
177. *Favia stelligera* (Dana, 1846)

178. *Barabattoia amicorum* (Milne Edwards and Haime, 1850)
179. *Favites abdita* (Ellis and Solander, 1786)
180. *Favites acuticollis* (Ortmann, 1889)
181. *Favites bestae* Veron, 2000
182. *Favites chinensis* (Verrill, 1866)
183. *Favites complanata* (Eherenberg, 1834)
184. *Favites flexuosa* (Dana, 1846)
185. *Favites halicora* (Eherenberg, 1834)
186. *Favites pentagona* (Esper, 1794)
187. *Goniastrea aspera* Verill, 1905
188. *Goniastrea australensis* (Milne Edwards and Haime, 1857)
189. *Goniastrea edwardsi* Chevalier, 1971
190. *Goniastrea minuta* Veron, 2000
191. *Goniastrea palauensis* Yabe and Sugiyama, 1936
192. *Goniastrea pectinata* (Eherenberg, 1834)
193. *Goniastrea retiformis* (Lamarck, 1816)
194. *Platygyra acuta* Veron, 2000
195. *Platygyra daedalea* (Ellis and Solander, 1786)
196. *Platygyra lamellina* (Eherenberg, 1834)
197. *Platygyra pini* Chevalier, 1975
198. *Platygyra sinensis* (Milne Edwards and Haime, 1849)
199. *Platygyra verweyi* Wijsman-Best, 1976
200. *Oulophyllia crispa* (Lamarck, 1816)
201. *Oulophyllia levis* (Nemenzo, 1959)
202. *Leptoria phrygia* (Ellis and Solander, 1786)
203. *Montastrea colemani* (Milne Edwards and Haime, 1849)
204. *Montastrea curta* Veron, 2000
205. *Montastrea magnistellata* (Dana, 1846)
206. *Montastrea valenciennesi* (Milne Edwards and Haime, 1848)
207. *Plesiastrea versipora* (Lamarck, 1816)
208. *Oulastrea crispata* (Lamarck, 1816)
209. *Diploastrea heliopora* (Lamarck, 1816)
210. *Leptastrea bottae* (Milne Edwards and Haime, 1849)
211. *Leptastrea purpurea* (Dana, 1846)
212. *Leptastrea transversa* Klunzinger, 1879
213. *Cyphastrea microphthalma*(Lamarck, 1816)
214. *Cyphastrea serailia* (Forskal, 1775)
215. *Echinopora gemmacea* Lamarck, 1816

216. *Echinopora hirsutissima* Milne Edwards and Haime, 1849
217. *Echinopora horrida* Dana, 1846
218. *Echinopora lamellose* (Esper, 1795)
219. *Moseleya latistellata* Quelch, 1884

FAMILY: FLABELLIDAE

220. *Flabellurn japonicum* Moseley, 1881
221. *Flabellum pavonium* Lesson, 1831
222. *Placotrochus laevis* Milne Edwards and Haime, 1848

FAMILY: FUNGIIDAE

223. *Cycloseris costulata* (Ortmann, 1889)
224. *Cycloseris cyclolites* (Lamarck, 1801)
225. *Cycloseris hexagonalis* Milne Edwards and Haime, 1848
226. *Cycloseris patelliformis* (Boschma, 1923)
227. *Cycloseris sinensis* Milne Edwards and Haime, 1851
228. *Cycloseris somervillei* (Gardiner, 1909)
229. *Diaseris distorta* (Michelin, 1843)
230. *Fungia concinna* Verrill, 1864
231. *Fungia corona* Doderlein, 1901
232. *Fungia danai* Milne Edwards and Haime, 1851
233. *Fungia fungites* (Linnaeus, 1758)
234. *Fungia granulosa* Klunzinger, 1879
235. *Fungia horrida* Dana, 1846
236. *Fungia klunzingeri* Doderlein, 1901
237. *Fungia moluccensis* Horst, 1919
238. *Fungia paumotensis* Stutchbury, 1833
239. *Fungia repanda* Dana, 1846
240. *Fungia scutaria* Lamarck, 1801
241. *Heliofungia actiniformis* (Quoy & Gaimard 1833)
242. *Ctenactis crassa* (Dana, 1846)
243. *Ctenactis echinata* (Pallas, 1766)
244. *Herpolitha limax* (Houttuyn, 1772)
245. *Polyphyllia talpina* (Lamarck, 1801)
246. *Sandalolitha dentata* Quelch, 1884
247. *Sandalolitha robusta* (Quelch, 1886)
248. *Zoopilus echinatus* Dana,1846
249. *Halomitra pileus* (Linnaeus, 1758)
250. *Lithophyllon undulatum* Rehberg, 1892
251. *Podabacia crustacea* (Pallas, 1766)

FAMILY: MERULINIDAE

252. *Hydnophora exesa* (Pallas, 1766)
253. *Hydnophora grandis* Gardiner, 1904
254. *Hydnophora microconos* (Lamarck, 1816)
255. *Hydnophora pilosa* Veron, 1985
256. *Hydnophora rigida* (Dana, 1846)
257. *Paraclavarina triangularis* (Veron and Pichon, 1980)
258. *Merulina ampliata* (Ellis and Solander, 1786)
259. *Merulina scabricula* Dana, 1846
260. *Scapophyllia cylindrica* Milne Edwards and Haime, 1848

FAMILY: MUSSIDAE

261. *Blastomussa merleti* Wells, 1961
262. *Acanthastrea echinata* (Dana, 1846)
263. *Acanthastrea hemprichii* (Eherenberg, 1834)
264. *Acanthastrea hillae* Wells, 1955
265. *Acanthastrea ishigakiensis* Veron, 1990
266. *Lobophyllia corymbosa* (Forskal, 1775)
267. *Lobophyllia diminuta* Veron, 1985
268. *Lobophyllia hemprichii* (Eherenberg, 1834)
269. *Lobophyllia hataii* Yabe and Sugiyama, 1936
270. *Symphyllia agaricia* Milne Edwards and Haime, 1849
271. *Symphyllia radians* Milne Edwards and Haime, 1849
272. *Symphyllia recta* (Dana, 1846)
273. *Scolymia vitiensis*Bruggemann, 1877
274. *Australomussa rowleyensis* Veron, 1985
275. *Cynarina lacrymalis* (Milne Edwards and Haime, 1848)

FAMILY: OCULINIDAE

276. *Galaxea acrhelia* Veron, 2000
277. *Galaxea astreata* (Lamarck, 1816)
278. *Galaxea fascicularis* (Linnaeus, 1767)

FAMILY: PECTINIIDAE

279. *Echinophyllia aspera* (Ellis and Solander, 1788)
280. *Echinophyllia echinata* (Saville-Kent, 1871)
281. *Echinophyllia echinoporoides* Veron and Pichon, 1980
282. *Echinophyllia patula* (Hodgson and Ross, 1981)
283. *Oxypora crassispinosa* Nemenzo, 1979
284. *Oxypora lacera* (Verrilll, 1864)
285. *Mycedium elephantotus* (Pallas, 1766)

286. *Pectinia alcicornis* (Saville-Kent, 1871)
287. *Pectinia lactuca* (Pallas, 1766)
288. *Pectinia paeonia* (Dana, 1846)
289. *Pectinia teres* Nemenzo and Montecillo, 1981

FAMILY: POCILLOPORIDAE

290. *Pocillopora ankeli* Scheer and Pillai, 1974
291. *Pocillopora damicornis* (Linnaeus, 1758)
292. *Pocillopora eydouxi* Milne Edwards and Haime, 1860
293. *Pocillopora ligulata* Dana, 1846
294. *Pocillopora meandrina* Dana, 1846
295. *Pocillopora verrucosa* (Ellis and Solander, 1786)
296. *Seriatopora caliendrum* Ehrenberg, 1834
297. *Seriatopora crassa* Quelch, 1886
298. *Seriatopora hystrix* Dana, 1846
299. *Seriatopora stellata* Quelch, 1886
300. *Stylophora pistillata* Esper, 1797

FAMILY: PORITIDAE

301. *Porites (synaraea) convexa* (Verilll 1864)
302. *Porites andrewsi* Vaughan 1918
303. *Porites annae* Crossland, 1952
304. *Porites compressa* Dana, 1846
305. *Porites cylindrica* Dana, 1846
306. *Porites eridani* Umbgrove, 1940
307. *Porites evermanni* Vaughan, 1907
308. *Porites exserta* Pillai
309. *Porites lichen* Dana, 1846
310. *Porites lobata* Dana, 1846
311. *Porites lutea* Milne Edwards and Haime, 1851
312. *Porites mannarensis* Pillai 1969
313. *Porites minicoensis* Pillai 1969
314. *Porites monticulosa* Dana, 1846
315. *Porites murrayensis*Vaughan, 1918
316. *Porites nigrescens* Dana, 1846
317. *Porites rus* (Forskal, 1775)
318. *Porites solida* (Forskal, 1775)
319. *Porites vaughani* Crossland, 1952
320. *Stylaraea punctata* (Linneaus, 1758)

321. *Goniopora columna* Dana, 1846
322. *Goniopora djiboutiensis* Vaughan, 1907
323. *Goniopora minor* Crossland, 1952
324. *Goniopora planulata* (Eherenberg, 1834)
325. *Goniopora stokesi* Milne Edwards and Haime, 1851
326. *Goniopora stutchburyi* Wells, 1955
327. *Goniopora tenuidens* (Quelch, 1886)
328. *Alveopora daedalea* (Forskal, 1775)
329. *Alveopora superficialis* (Pillai & Scheer, 1976)
330. *Alveopora verrilliana* Dana, 1846

FAMILY: RHIZANGIIDAE

331. *Astrangia* sp. Milne Edwards and Haime, 1848
332. *Cladangia exusta* Lutken, 1873
333. *Culicia rubeola* (Quoy and Gaimard, 1833)

FAMILY: SIDERASTREIDAE

334. *Pseudosiderastrea tayami* Yabe and Sugiyama, 1935
335. *Siderastrea savignyana* Milne Edwards and Haime, 1850
336. *Psammocora contigua* (Esper, 1797)
337. *Psammocora digitata* Milne Edwards and Haime, 1851
338. *Psammocora explanulata* Horst, 1922
339. *Psammocora haimeana* Milne Edwards and Haime, 1851
340. *Psammocora profundacella* Gardiner, 1898
341. *Psammocora superficialis* Gardiner, 1898
342. *Coscinaraea columna* (Dana, 1846)
343. *Coscinaraea crassa* Veron and Pichon, 1980
344. *Coscinaraea monile* (Forskal, 1775)

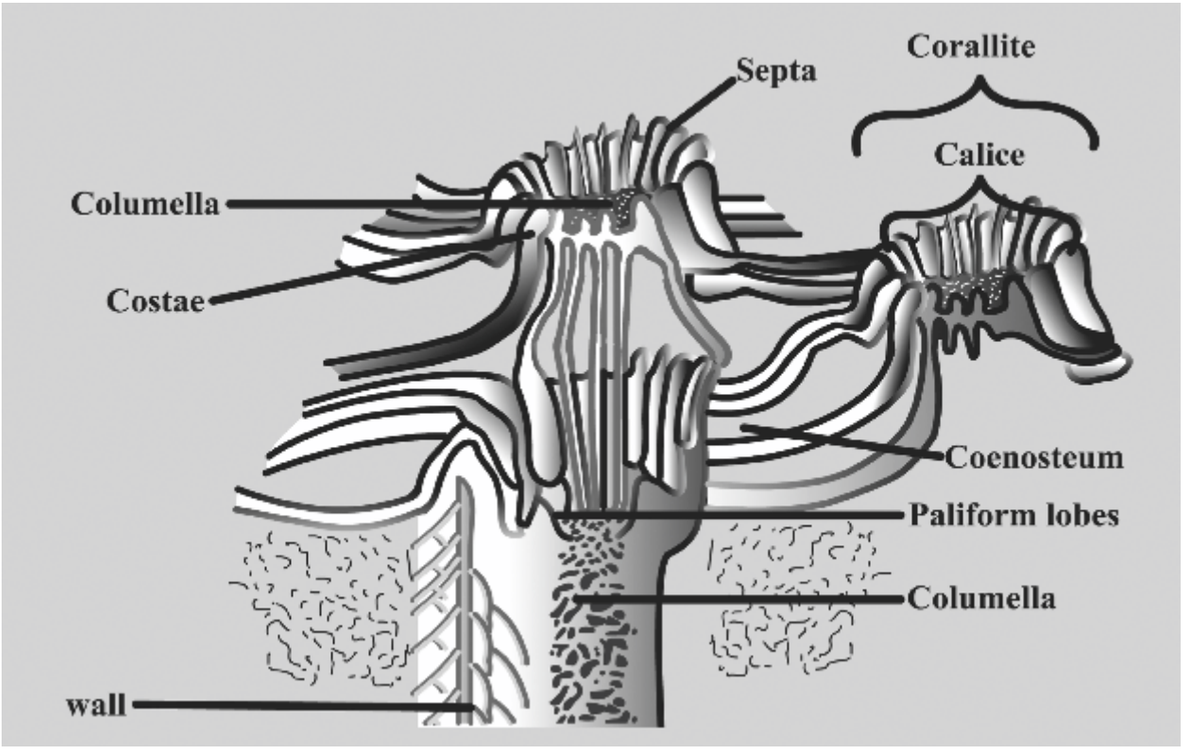
FAMILY: TRACHYPHYLLIIDAE

345. *Trachyphyllia geoffroyi* (Audouin, 1826)

IDENTIFYING A HARD CORAL

Identification of a hard coral underwater is effected by visual observation and touch. The crystalline and hard skeleton underneath its body tissue helps us in identifying it as hard coral and counting of the tentacles which are multiples of six helps us distinguishing it from its counterparts horny and soft corals. Corals are at present being identified upto species level with the help of its **skeletal morphology**. Hard coral species mostly spawn at once and there is always a chance for exchange of genetic material and interbreeding, making life miserable for the identification of a coral. This is one reason for selecting skeletal morphology for the identification of corals. Coral colour cannot be considered solely for identification, since the colour to the coral is mostly provided by symbiotic algae which live in their body tissues which change their colour and provide different hues within the same species in a genus, in the same locality. Coral colour is used for quick and temporary identification of corals underwater since the colour of a coral is affected by the

pigmentation in combination with the colour provided by the symbiotic algae, which is making the colour of a coral sometimes characteristic to a species. Coral skeleton is plastic in nature and change its shape, size and structure depending on the environmental conditions especially, depth and light availability. Inspire of this, identification of a hard coral using its skeletal morphology is more effective and reliable. It is not possible for a taxonomist to observe all the species in living condition, that too in its actual locality. Since the skeletogenesis takes place very quickly in corals, skeletal morphology is taken as the yardstick in identifying juvenile corals also. Identification of a coral using genetic material is a growing science and is proving to be challenging.



Skeletal characters used for the Identification of a hard coral

Corallum : Skeleton of a whole colony.

Corallite : Skeletal structure of a single polyp.

Calice : Skeletal structure surrounded by corallite wall.

Wall : Outer boundary.

Septa : Radial skeletal elements project inwards from the corallite wall.

Costae : Radial skeletal elements outside the corallite wall.

Paliform lobe : Innermost dentation of septum (formed differently from palus) sometimes may form a crown. Pali is the pleural.

Columella : Skeletal structure at the centre of the corallite composed of single or multiple elements.

Coenosteum : The surface of the corallum in between the corallites.

Learning some technical terms related to the Coral skeleton is a prerequisite, as the coral taxonomy is based on the morphology of the skeleton.

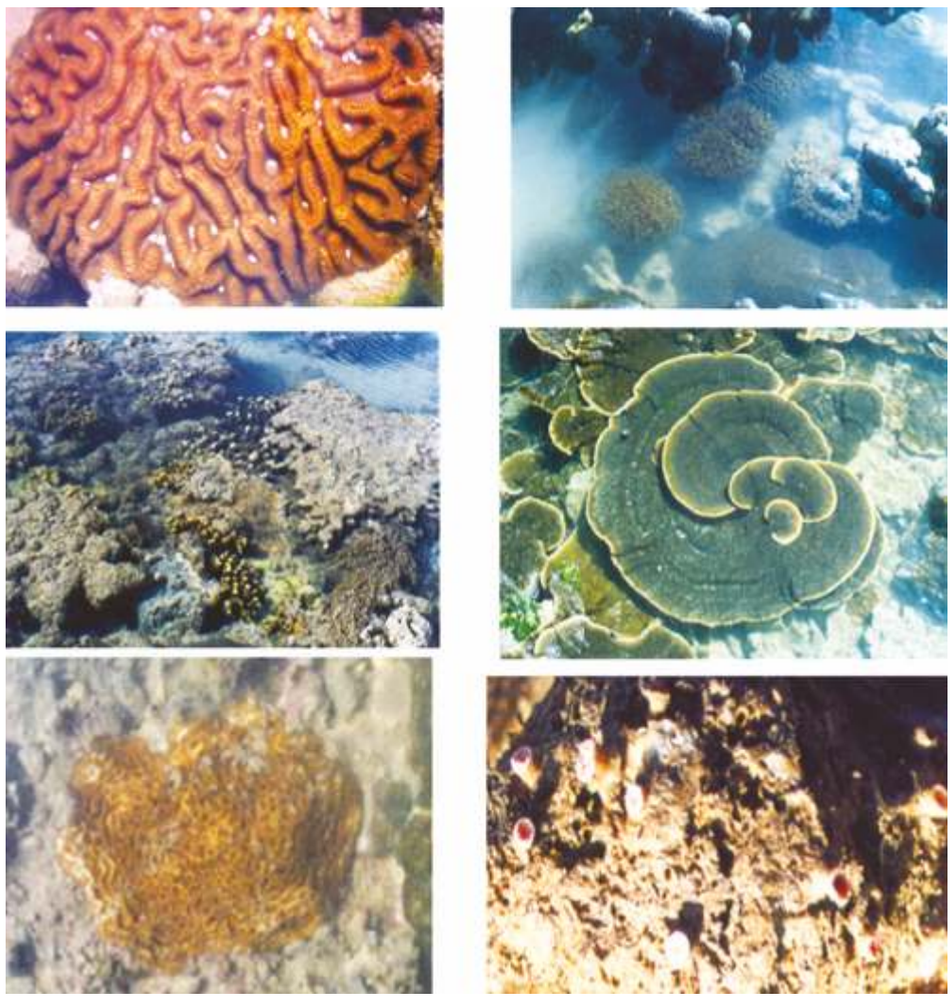
The skeletal structure of an individual polyp is called a **corallite.** The skeletal structure of the corallite surrounded by a corallite wall is called a **calice** and the same is called as a **center** if there is no wall formed. **Wall** is the outer boundary of the corallite. Radial skeletal elements projecting

inwards from the corallite wall are called as **septa** and those projecting outwards from the corallite wall are called as **costae**. When these two radial structures are united and continuous they are called as **septo-costae**. The wall and the radial structures (septa and coastae) are the supporting structures for the tentacles of the polyp. Septa are formed in between mesenteries. The innermost dentation of a septum is called as a **paliform lobe**. Paliform lobes sometimes forms a **crown** around **columella**, which is the skeletal structure located at the centre of the corallite. Columella is composed of single or multiple elements. Columella supports the oral disc and mouth of the polyp.

The skeleton of a coral as a whole is called the **corallum** and the surface of the corallum in between the corallites is called the **coenosteum**.

GROWTH FORM CATEGORIES

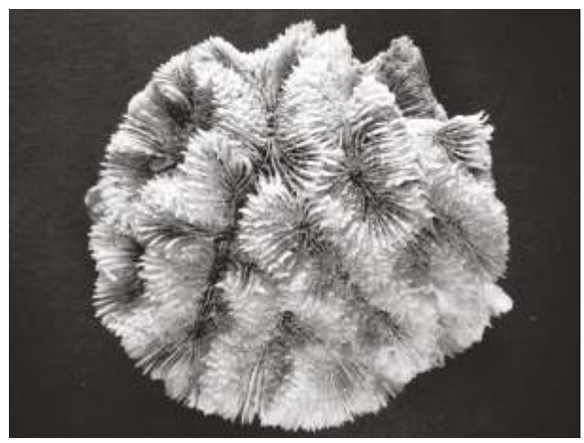
The coralla of hard corals are found in different growth forms and are used in the identification and description of corals. The following are the photographs and definition of some of the major **growth forms** found among Indian corals :



1. **Massive** = colonies which are solid and are typically hemispherical or otherwise have approximately similar dimensions in all directions.
2. **Sub massive** = Colonies which tend to form small columns, knobs or wedges.
3. **Branching** = a descriptive term for a branch with compact radial sub-branches.
4. **Foliose** = Coral colonies attached at one or more points, leaf-like, or plate-like in appearance.
5. **Encrusting** = Coral colonies which form a thin layer or crust over underlying substratum and
6. **Solitary** = corals composed of single individuals. Plates and Tables are the growth forms of Acropora.

CORALLITE ARRANGEMENT AND FORMATION

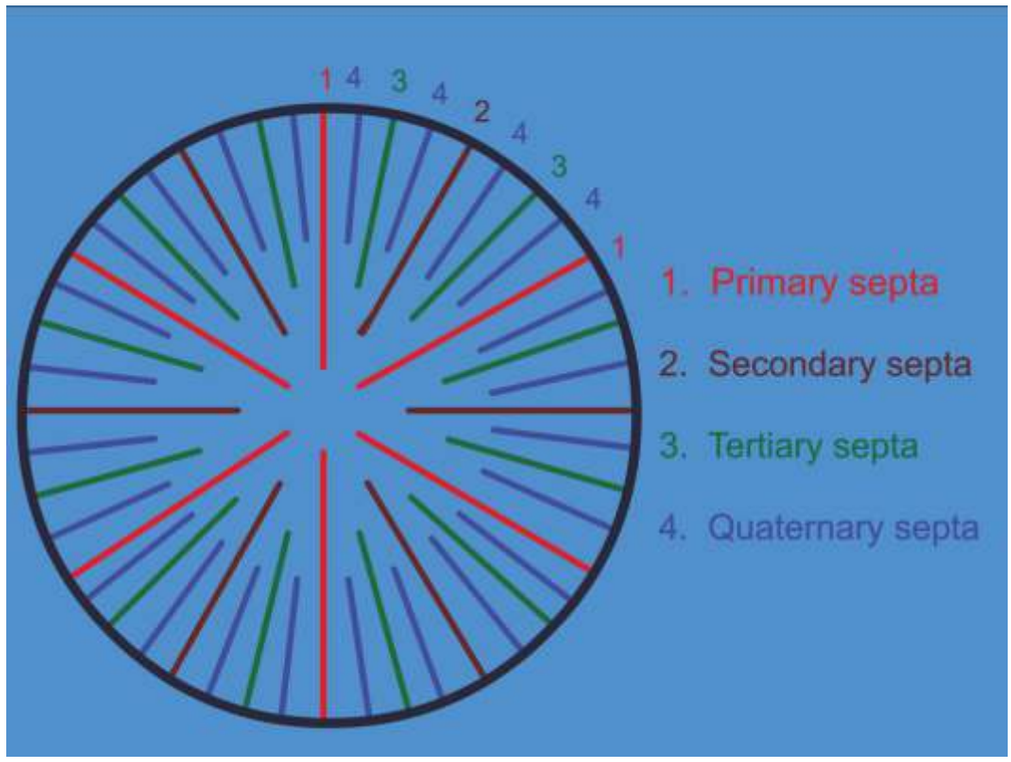
The arrangement or alignment of corallites in a corallum is a major character in the identification of a coral. The following are the photographs and definition of some of the **corallite arrangement** patterns found among Indian corals :



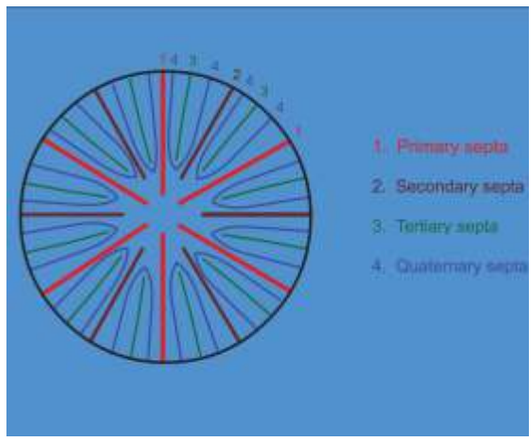
1. **Cerioid** = adjacent corallites share the same wall.
2. **Plocoid** = each corallite has its own separate wall.
3. **Phaceloid** = corals that have corallites of uniform height adjoined towards their base.
4. **Meandroid** = massive colonies that have corallite mouths aligned in valleys such that there are no individual polyps.
5. **Hydnophoroid =** septa fusing to form monticules or mould like structures

TYPES OF SEPTAL ARRANGEMENT

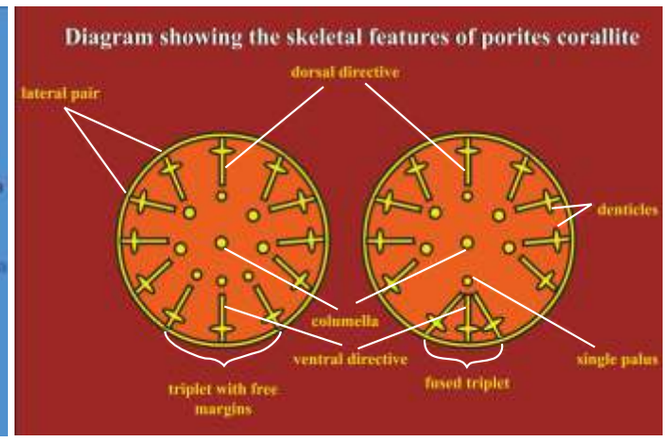
Septa are the major identifying characters formed after the settlement of the planula larvae of corals. They are the radial invaginations in the basal calcareous plate of young polyp. They are usually in multiples of six. The first **six** septa formed are called **primary septa** and are termed as the **first cycle**. The **second cycle** of septa which forms next to primary cycle also consists of **6** septa and these septa are called as **secondary septa**. Secondary septa are placed between the primary septa and are smaller in size when compared to primary septa. **Tertiary septa** which are further small in size are **12** in number and form the **third cycle**. They are placed equidistantly between primary and secondary septa. This pattern of number and septal size continues resulting in fourth cycle of 24, fifth cycle of 48 and so on.



1 Proto septa; 2 & 3 Substitute entosepta; 4 exosepta constituting fourth cycle greater development and curvature of fourth cycle exosepta is characteristic of the Pourtales plan



Pourtales plan in Dendrophyllid Corals



Patterns of fusion of the triplet in Porites

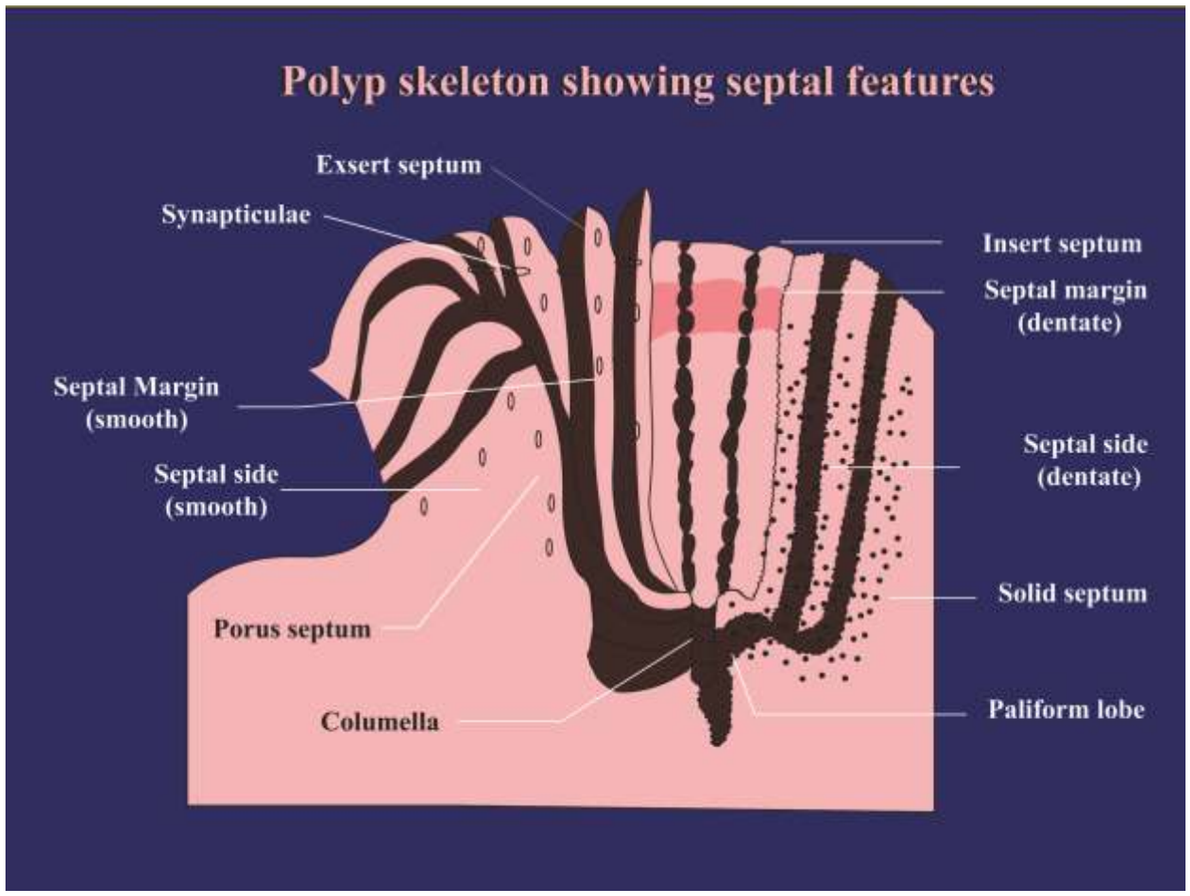
a) Triplet with free lateral septa and three pali; b) Triplet with lateral & ventral directive fused & one palus

If the cycles of septa are clearly equal in thickness and height, they are called **equal**. They are called as **subequal** when the differences are slight and **unequal** when the differences are striking.

The general pattern of septation is not found in genus *Porites* and dendrophyllid corals. In the case of *Porites* there is an inclination for fusion among three septa (two lateral septa with one ventral directive). This pattern of fusion is called as **triplet**. There are three kinds of triplet formation which play a major role in differentiating porites species.

In the case of Dendrophyllid corals the quarternary or the fourth cycle septa grows above and loop over the tertiary septa. This pattern of fusion of the two quarternary septa around the tertiary septa, which is characteristic of dendrophyllid corals, is called as **Pourtales plan.**

CATEGORISATION IN SEPTATION



Exsert septum

Insert septum

Septal Margin (dentate)

Septal margin (smooth)

Septal side (smooth)

Septal side (dentate)

Porous septum – Fenestrate plate

Solid septum – Solid plate

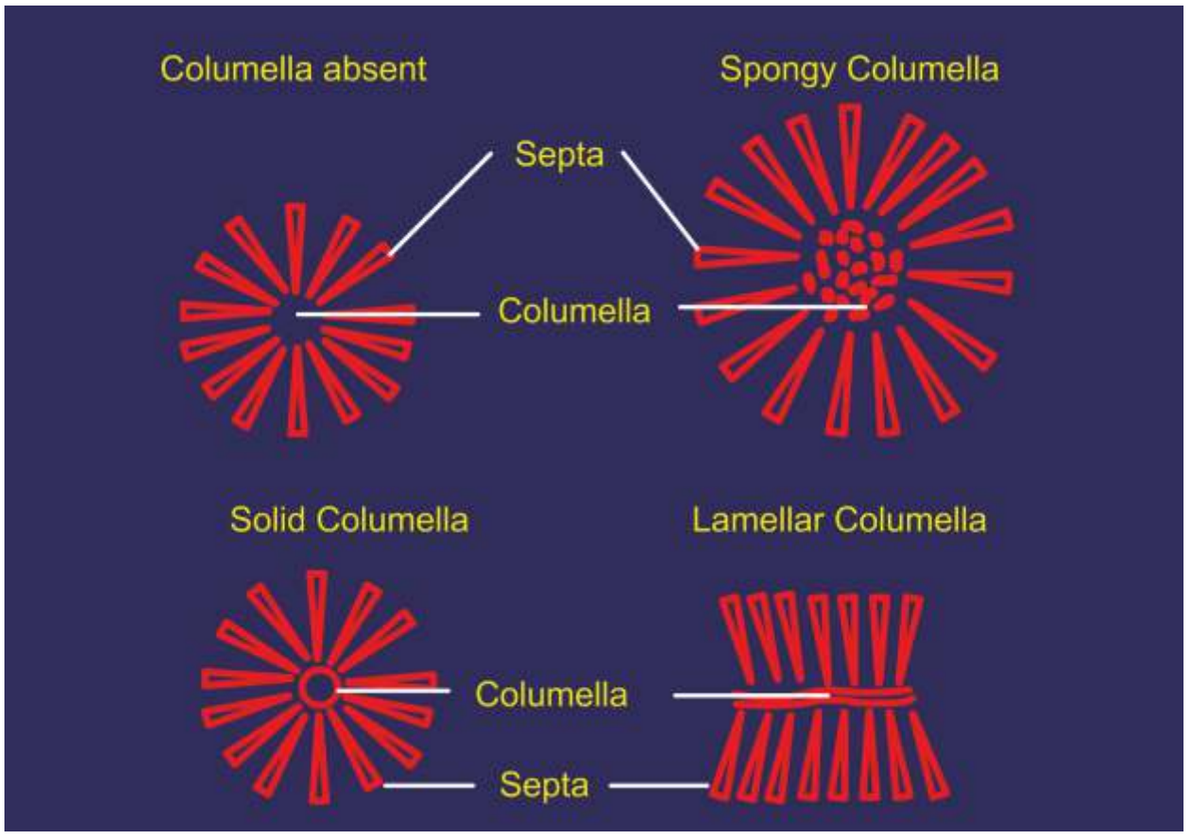
Vertical spines, Horizontal spines & Absent

Septa are of many kinds. A septum may form a **solid plate** or a porous (**fenestrate**) plate. In some species it may be reduced to rows of **vertical spines** or **horizontal spines** or may be **absent**. When a septum is well above the corallite wall it is called as an **exsert** septum and termed as **insert** septum when it is otherwise. Septal margin may be **dentate** or **smooth** and septal side is also termed **smooth** or **dentate** depending on its roughness.

COLUMELLA CATEGORISATION

Columella, the axial structure which is situated below the stomadaeum of the polyp may be broadly classified into the following categories based on its built:

A **spongy** or trabecular columella is formed by the intermingling irregularly twisted expansions from the inner septal margins and basal plate. If the expansions from the septa are vertical rods or ribbons, then it is called a **papillose** columella**.** When the papillose structures fuse to form a single rod it is called as **solid** or styliform columella. Lamellar columella is a plate like columella, usually arranged in a longitudinal series along the axis of elongated calices. It is recorded as **absent** when there are no projections at the corallite's base.



Absent : Spongy : Solid : Lamellar

DIFFICULTIES IN CORAL IDENTIFICATION
(Notes for would be Taxonomists)

"The corals constitute a chaotic collection of individuals and the uncertainty as to what may be considered a species is the first problem that must confront any one who happens to study corals" is the quotation pronounced by Wood Jones in 1907 and it is even to some extent true due to the difficulty Cnidarians pose difficulties to systematics due to their diverse form and simple morphology.

Before the advent of SCUBA diving coral taxonomists believed a coral with different morphology as a new species and many thousands of species were described. This is checked considerably after

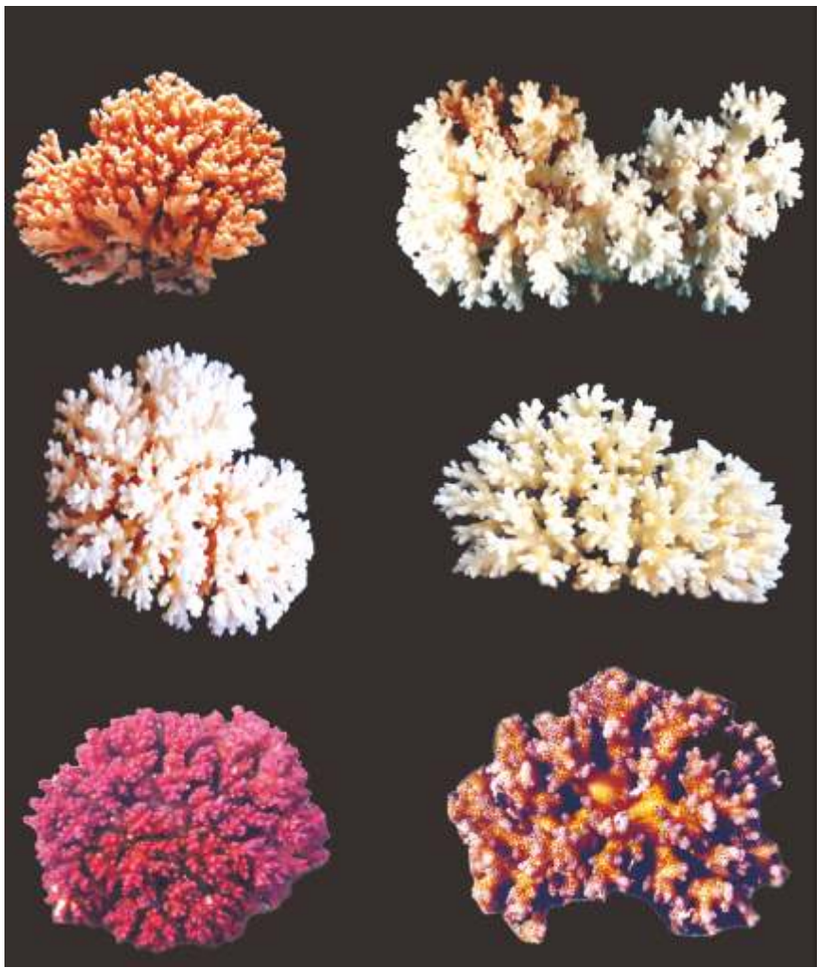
the increase in more diving taxonomists. Even today due to the problems in the identification of corals only the taxonomists in corals are few but conflicting identifications and difference of taxonomic opinion between the scientists are many.

Majority of the Coral researchers face problems in identifying corals primarily due to the following reasons:

Geographical variation: Geographic variation is very much pronounced in corals due to the variation in the climatic conditions and also due to genetic variations. Coral colonies in high latitudes are markedly different from their counterparts living in the tropical reefs. Calcification rates also vary. Coral species in Indonesia are comparatively small in size and appearance when compared to their counter parts in Australia.

Environmental Variation: Ecomorphs are Intraspecific variants, environmentally and/or genotypically determined in response to specific ecological conditions. The Morphological variations within a colony are both structural and colour based. Branching forms show lot of variation in their colony structure depending on the depth in which they dwell. *Pocillopora damicornis* is a great example for this variation in structure and even colour.

Variation of colour in the same species may be attributed to the symbiotic algae living in the tissues of the corals. The variation in the colour is very much pronounced in Favia favus and Hydnophora exesa as far as the Kutch corals are concerned. In general corals exhibit colour variation depending on their exposure to sun which is only temporary.

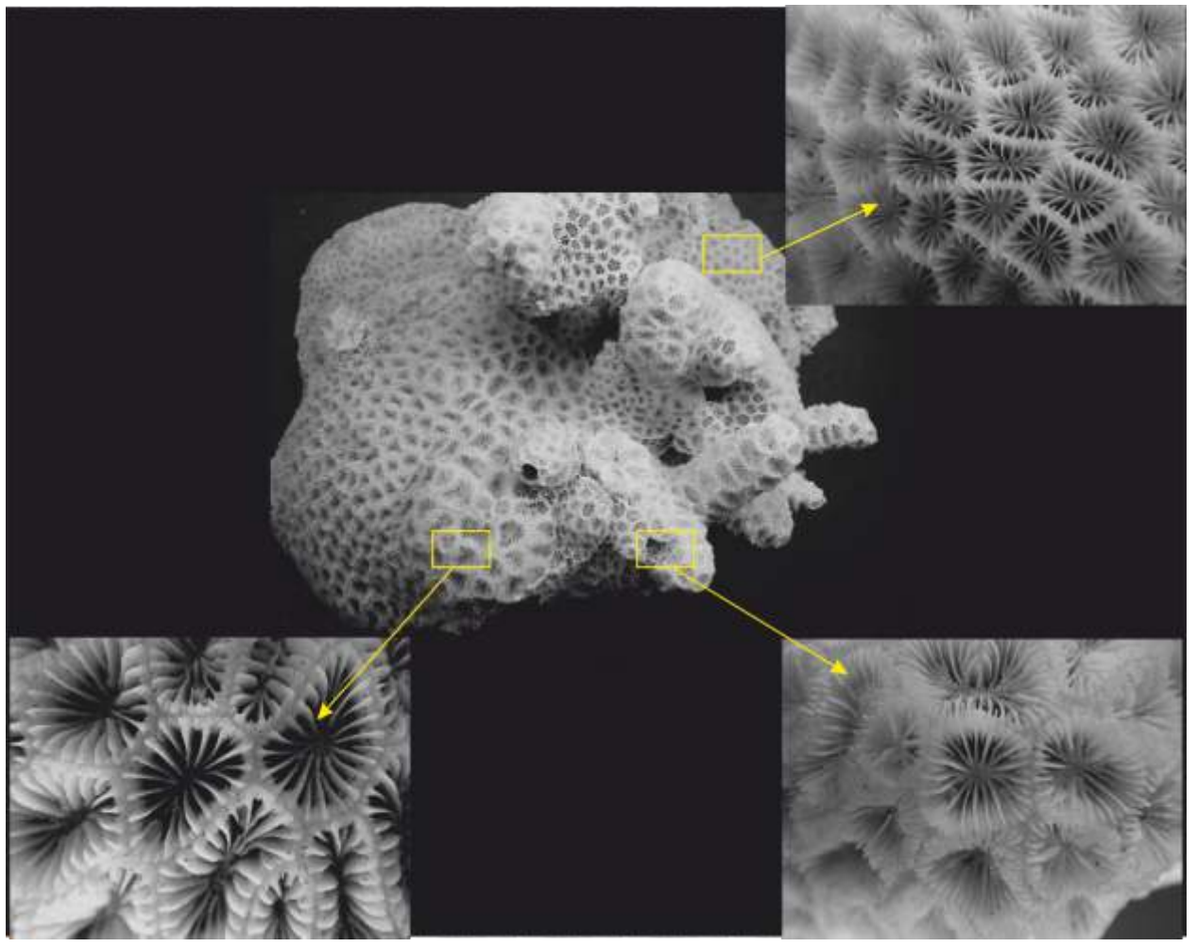


Skeletal and colour variation in *Pocillopora damicornis* due to their occurrence in different habitats and depths

The first challenge a novice in coral taxonomy faces is because of the **variation within a single colony**. This is in general more striking in the corallites of Porites. Leptastrea purpurea, Platygyra pini exhibit this difference in Kutch reefs. Some times a single colony exhibits the characters of two genera (especially between favia, favites and goniastrea) which surely might have driven many from taking up this group for study. Some researchers attributed this variation to intraspecific breeding might have resulted due to the synchronized spawning habit of corals.

"Identifying a coral by taking into account all these variations is really a pleasant and satisfying experience".

Skeletal variation in a single *Leptastrea* specimen



Polymorphism – Colour variation in *Favia favus*

CLEANING, LABELING AND PRESERVATION OF HARD CORALS

Specimen tied with waterproof label should be kept in fresh water until it gets rottened (1-5 days).

Clean the rottened specimen with a strong jet of freshwater.

Remove gelatinous epidermis which is present in some corals with forceps.

Keep the specimen away from dust and dry in sunlight.

Avoid bleaching solutions like hypochlorite. Especially for corals possessing minute characters like *Porites.*

Note: *For quick results in the field, mild washing detergents can be used for coral cleaning. In some cases hypochlorite can also be used.*

Permanent labels with all the required information should be tied firmly to the coral. (OHP sheets written with permanent marker pens make good labels for dry collections).

Always fix a water proof reference label (atleast with the registration No.) to the coral with waterproof resins for ready reference. It will be very useful in the event of permanent label detachment. Plaster of parrys written with Indian ink is also a good alternative in finished specimens.

ALWAYS KEEP THE SPECIMENS AWAY FROM DUST AND MOISTURE

Note: *Moisture attracts fungus and insects. These infestations not only spoil the specimen but also strictly avoided by foreign countries for transport due to fear of undesirable alien species dispersal.*

Never pack the specimens with cotton or any fibrous or sticky material. Specimens with dust and cotton strands are not good for photographing and identification. Keep the specimens in plastic trays in the case of dust free environments like Air Conditioned rooms, otherwise keep them in closed plastic or hardboard boxes.

A specimen lost is equal to lot of effort and money in addition to valuable information.

Labeling

Labeling is equally important as preservation. The main objective of collection is to know the exact locality of collection and the other particulars will help in reckoning the distribution, abundance and finally the status of the specimen collected in the conservation point of view. The whole effort of collection and preservation will go waste if the samples are not properly labeled. The labels attached to the unidentified specimens should contain the following:

Locality (site)
Date and Time of Collection
Area of collection (country or region)
Grid reference or latitude and longitude
Depth of collection
Collector
Type of gear/method used
Habitat details like substratum type
Reef zone: reef flat, edge, slope/exposed, sheltered etc.
Tide position
Growth form – size

Remarks with the notes about the activity around the site of collection will help in making some decision related to the actual location or state of the sample collected. A number must be given to the identified or unidentified specimens with an entry on the label and all the details entered along with that register number in separate register will be of immense use in locating the particulars about the specimen in case of mutilated or lost labels. The number glued to the specimen with permanent water proof glue, especially in the case of dried specimens will help in preparing a duplicate label in the case of snapped or lost labels.

In the field, labels can be written temporarily with pencil on a thick tracking paper. Tracing paper avoids absorption of water and stays stiff to preserve the data entered on them. Specimens where the identification is based on the hard skeletal parts (hard corals & Gorgonids), until the specimens are prepared for proper identification small acrylic sheets can be tied to the specimens with non-corrosive metal wires with the collection details scripted with pencil. The labels for the samples to be stored in alcohol must be written with Indian ink on paper suitable for alcohol storage. A field note book with all the details written on the label must be maintained to retrieve data lost during transportation or such activity.

In the case of identified samples attempt must be made to identify up to species level and taxonomic details starting from Phylum to species along with the authority must be entered. Determiner's name and the date determined also must be added. The date of identification helps in updating the taxonomy of the specimens as and when needed. Dry samples like hard corals, dried gorgonids etc., permanent labels made of non-degradable materials like transparent plastic sheets like OHP sheets written with permanent marking pens and tied with transparent nylon will last long and minimise the chances of missing data. Particulars like the ambiguity in identification, tips/ hints/doubts or similar notes must be attached with the label for accurate identification. All the labels including the temporary field labels must be retained with the specimen either laminated or put in small closed plastic covers. Conversion of data to electronic form is always recommended for better data preservation and retrieval.

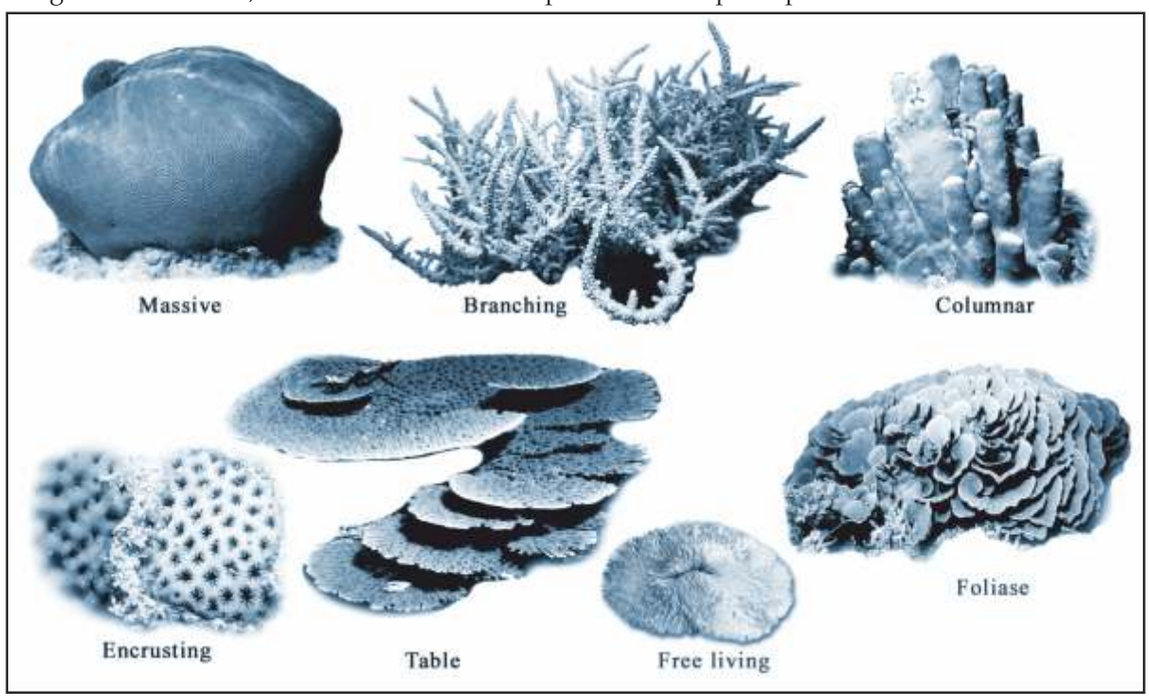
Tools useful for collection: Hammer, Chisel, Sack, and inflatable rubber bag.

TAXONOMIC INFORMATION OF SCLERACTINIAN CORALS

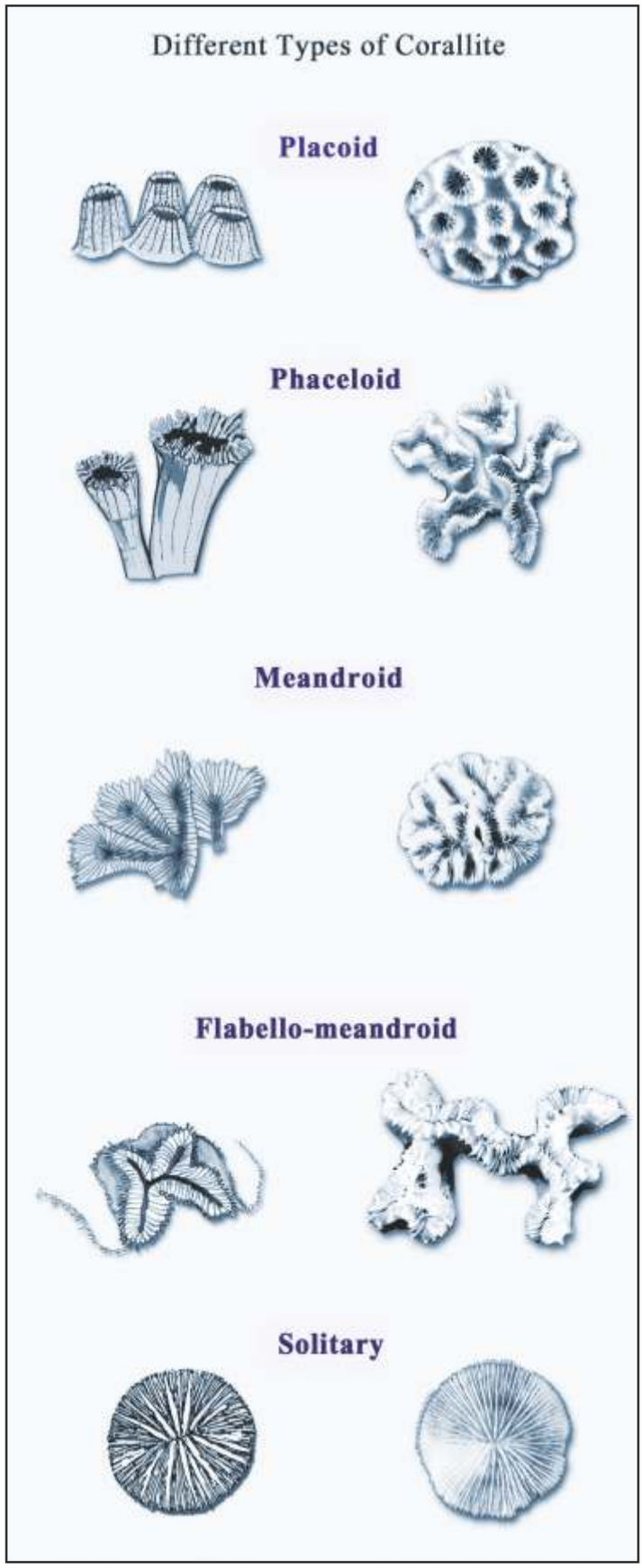
There are about 25 families of scleractinian corals comprising of about 1511 species (1490 species + 21 intraspecific species) in the world, of which 18 families, 87 genera and 345 species are recorded from India so far. The following is a capsuled information of scleractinian corals of India from family to species level, tailor made for training purposes and easy identification.

Order **SCLERACTINIA** Bourne, 1900

Within the Order Scleractinia, variation in the fundamental structure of the colony, corallite arrangement. Position, size and variation in septa forms the principal basis for the classification.



The growth forms of corals


Different Types of Corallite
Placoid
Phaceloid
Meandroid
Flabello-meandroid
Solitary

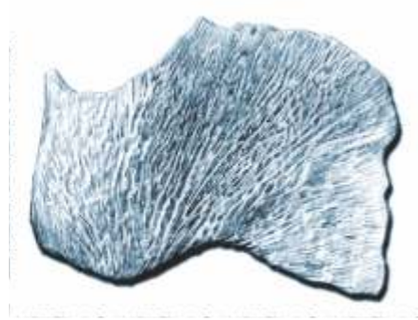
FAMILY **ACROPORIDAE** Verrill, 1902

Species of the family Acroporidae are colonial, hermatypic and are mostly living. Colonies have all growth forms known for hermatypic corals. Corallites (except *Astreopora*) are small with septa in two cycles or less, columellae are poorly developed. *Acroporidae* is related to families *Pocilloporidae* and *Astrocoeniidae.* There are about 5 genera included under this family. They are *Montipora, Acropora, Astreopora Enigmopora* and *Anacropora,* among which *Enigmopora* and *Anacropora* are not recorded so far from Indian waters. The total number of species recorded in the world are 242 and out of which only 99 species are reported from India.

Acropora valida

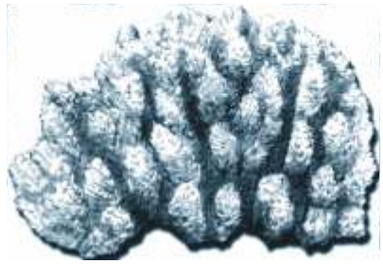
Subgenus : ***Isopora***

Acropora palifera



Montipora foliosa

Montipora tuberculata



Acropora hyacinthus

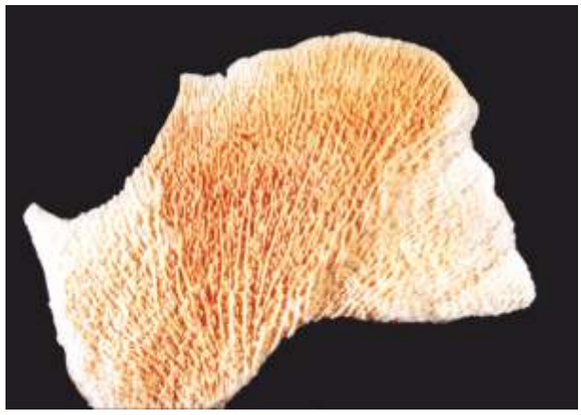
Montipora spumosa

Montipora and *Acropora* are the two largest scleractinian genera, *Anacropora* and *Astreopora* have substantially fewer species. *Montipora, Anacropora* and *Acropora* have similarly structured corallites primarily characterised by lack of columellae and dissepiments, small size, synapticulotheca (corallite walls are porous), simple septa which do not fuse, spinulose coenosteum. *Astreopora* fewer characters in common: corallites fairly large, septa fairly well developed and may form a columella tangle, superficially resemble corallites of *Turbinaria.*

GENUS

Montipora de Blainville, 1830

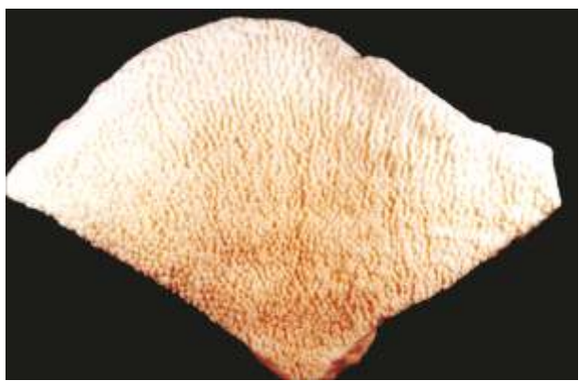
Characters : Colonies are sub-massive, laminar, encrusting, branching or foliaceous. Corallites are very small. Septa are in two cycles with inward-projecting teeth. Columellae are absent. Corallite walls and the coenosteum are porous and may be highly eloborate. Polyps are usually extended only at night. *Montipora* is often confused with *Porites*.



Montipora foliosa

Montipora verrucosa

Montipora hispida



Montipora monasteriata

Montipora digitata

Some important definitions

Tuberculae (elaborations in the coenosteum which are larger than the corallites) and papillae (elaborations in the coenosteum which are smaller than the corallites) are homologous structures differing in size only.

Coenosteum reticulum is glabrous or papillae/tuberculae.

Reticulum doesn't include papillae/tuberculae.

Montipora species described below are arranged based on their growth form and the kind of coenosteal structures they have.

MASSIVE/THICK PLATES/ENCRUSTING

Tuberculae and Papillae

M. monasteriata

Massive or thick plates.

Tuberculae and papillae can fuse on flat surfaces into ridges perpendicular to the colony margin.

The reticulum is coarse and uniformly covered with papillae/tuberculae.

M. tuberculosa has smaller corallites and smaller tuberculae and papillae which are fused into thecal tubes. The tuberculae of *M. undata* are more fused than *M. tuberculosa*.

Papillae

M. tuberculosa

Submassive, encrusting or plate-like. The surface is usually raised into irregular mounds.

Tuberculae and papillae are of a similar size. The thecal papillae surrounding some corallites fuse as tubes. Corallites evenly distributed.

Similar to *M. undata* but it is much finer, submassive, encrusting or plate-like. Also resembles *M. corbettensis* however its papillae are more compacted, uniform in shape and size do not fuse around the corallites, and are not differentiated into thecal and reticulum papillae.

Tuberculae

M. millepora

Massive with flattened encrusting margins or encrusting.

Tuberculae are low encrusting and cover the entire colony surface. Corallites are evenly distributed between and on the sides of tuberculae, but usually absent from tips of tuberculae.

M. millepora has the smallest corallites of *Montiporas*.

No Puberculae or Papillae

M. foveolata

Massive or thick plates with foveolate corallites (adjacent corallites share a common reticulum wall).

Corallites are funnel-shaped. The funnel is formed of tuberculae which are fused to form a continuous or sub-continuous rim of reticulae, funnel not obvious if corallites are growing in different directions or if funnels are reduced and corallites separated by less than a calice diameter.

Resembles *M. incrassata, M. venosa, M. caliculata* if funnels not well developed. *M. incrassata* has smaller corallites which do not share a common reticulum wall. *M. venosa* has similar corallites but only slightly foveolate, the reticulum wall is slightly coarser. *M. caliculata* has smaller crowded corallites.

M. venosa

Massive or submassive.

Corallites slightly foveolate, immersed. The development of funnels is variable - can be tubular or funnel-shaped with or without common reticulum walls. The funnel is only slightly wider than the calice diameter.

Corallites with and without funnels are intergraded and usually intermixed.

Similar to *M. caliculata* but it has smaller corallites.

M. capitata

Encrusting bases with contorted well defined branches.

Verrucae present.

Irregularly spaced Verrucae generally get fused at branch tips.

Similar to *M. verrucosa* which does not form branched colonies.

M. meandrina

Colonies submassive.

Verrucae present.

Verrucae are large, contorted and irregular in shape.

Corallites are small.

Similar to *M. danae* which have less irregularly fused verrucae.

M. caliculata

Colonies are massive or sub-massive.

Corallites are slightly foveolate and immersed, tubular.

Similar to *M. venosa, M. incrassata, M. foveolata*.

MASSIVE/THICK PLATES/ENCRUSTING WITH COLUMNS/NODULES

Papillae

M. informis

Massive, plate-like or encrusting often over worm tubes, coral skeletons, etc.

Reticulum are medium-fine and uniformly covered with elongated papillae of uniform size. Papillae are never grouped around corallites therefore are no conspicuous thecal papillae. Plates are with or without nodules or columns. Similar to *M. efflorescens* and *M. corbettensis*.

No Tuberculae or Papillae

M. angulata

Extensive encrusting bases with very irregular, contorted branches.

Branches usually flattened in the plane of division and divide at irregular angles.

Similar to *M. digitata* which is arborescent with smaller superficial corallites.

M. spumosa

Encrusting with or without irregular upward plate-like (convoluted, bifacial or with epitheca or both) or columnar (often hollow with open or closed ends and usually with irregularly fused ridges), encrusting colonies usually have rootlets. Frequently overgrows other corals and assumes their shape.

The reticulum is very coarse and uniform, spinules are always highly elaborated.

Tuberculae of irregular shapes may be formed but intergrade with larger mounds and ridges.

Similar to *M. verrucosa* and *P. rus* in situ.

Papillae

M. foliosa

Encrusting with horizontal laminae around margins, may be several metres diameter, may be tiered and form whorls, rarely parts of colony may be submassive or develop columns.

Unifacial or bifacial but epitheca usually covers most of the undersurface overgrowing the minute and widely-spaced corallites.

Corallites are strongly inclined towards the colony perimeter on laminate corals. The upper wall may be well developed and lower wall absent or partly developed (walls consist partly of papillae).

Similar to *M. aequituberculata* but corallites are not inclined as strongly outwards, and the reticulum ridges are poorly developed.

M. aequituberculata

One of the most polymorphic and widespread *Montipora*.

Foliose, thin, expanding, flat to contorted laminae, usually with a side attachment, often arranged in oblique overlapping whorls.

Epitheca inconspicuous or absent, undersurface glabrous except for widely spaced tuberculae which may contain single minute corallites.

The thecal papillae which surround corallites are highly fused and frequently form long fine ridges perpendicular to the margins of thin laminae, ridges are often absent from thicker laminae. The ridges frequently form hoods over peripheral corallites which are strongly outwardly inclined.

Similar to *M. crassituberculata*, which has larger corallites and more papillae. Corallites also resemble *M. peltiformis*.

BRANCHING

No Tubuerculae or Papillae

M. digitata

Colonies branching

Branches tubular and twig like.

Branches mostly straight

Frond-like or spatulate tips.

Papillae

M. edwardsi

Ramose. Primary septa conspicuous,secondary cycle of septa spiny.

Lower down the branches the surface coenenchyme is mostly glabrous.

Papillae are well formed at the top of corallum.

M. confusa appears to be not far away from *M. edwardsi.*

RANGE OF GROWTH FORMS: MASSIVE/PLATES, WITH OR WITHOUT NODULES/COLUMNS

Papillae

M. peltiformis

Sub-massive or flat explanate plates with or without nodular upward growths. Nodules usually irregular in size and shape but do not form columns.

Bifacial with small widely spaced corallites or extensive epitheca almost to the colony margin.

Thecal and reticulum papillae are slightly different especially on nodules where the thecal papillae form distinct circles (cf *M. turtlensis* and *M. hispida*).

Similar to *M. mollis* but it has no thecal papillae.

M. verrilli

Thin encrusting colonies.

Papillae present.

Corallite papillae regularly placed.

Small corallites mostly submerged in the coenosteum.

M. hispida

Massive, submassive and columnar (usually well illuminated environments exposed to wave action), digitate and subarborescent (more protected envts), horizontal plates (turbid or deep water envts) or various combinations of these forms, wide range of growth forms may also occur in one environment with form influenced by space availability eg plates until space restricted and then develop branches.

All growth forms have thecal papillae which are clearly larger than reticulum papillae (cf. *M. turtlensis, M. peltiformis, M. efflorescens* and *M. grisea*).

Thecal papillae 4-8 surround corallites and may be connected by synapticular connections.

Reticulum papillae obvious, smaller and more widely spaced.

Distinguished from *M. efflorescens, M. nodosa* and *M. grisea* by growth form. Also the papillae of *M. efflorescens* are almost uniform in size.

Tuberculae

M. verrucosa

Sub-massive or plate-like.

Poorly developed epitheca in plate-like colonies.

Verrucae cover the colony surface, they have a uniform distribution, size and shape. Small verrucae along colony periphery join to form short ridges perpendicular to margin.

Corallites are uniformly interspersed in flat reticulum between but never on the verrucae.

Similar to *M. danae* but it has a wider range of growth forms, more irregular verrucae, and smaller corallites.

No Tuberculae Or Papillae

M. cococensis

Encrusting, submassive or columnar colonies.

Crowded, immersed and bigger corallites.

Coarse coenosteum.

Septa prominent.

Similar to *M. spumosa* which has a distinctive growthform.

M. turgescens

Massive, plate-like or columnar.

May have subcircular surface mounds 3-12 mm diameter, absence or degree of development varies greatly even in a single colony, mounds may be small enough to form the walls of single corallites.

Corallites uniformly distributed on and between mounds.

Coenosteum is uniform and resembles *M. nodosa* and *M. australiensis. M. mollis* has a different growth form and smaller corallites.

Other Species

M. explanata

Corallum explanate , encrusting and with small gibbosites on the surface.

Calices less than 1 mm in diameter. Irregular in outline and crowded.

Primary septa well develped.

Second cycle usually not seen.

M. exserta

Corallum explanate, less than 15 mm thick, surface with gibbosites. Calices less than 1 mm in diameter with a thecal wall.

Septa in two cycles.

Primary septa large and meet at the centre.

Second cycle almost complete.

Plate like spinules with secondary serrations on the surface.

Montipora jonesi

Colonies composed of several tiers of inverted cones with a cylinderical peduncle.

The top of the cones 4 to 5 cm in spread with 1 to 1.5 thick peduncles. Primary septa larger than the secondaries.

Directives often exsert.

Second cycle generally incomplete.

Two to three papillae often to focus low ridge enclosing calices.

Highly porous reticulum.

Montipora manauliensis

Corallum hillocky with small (<0.6 mm) corallites

Foveolate coenchyme.

Montipora spongiosa

Corallum with ramose, coalescent branches.

Calices conspicuous.

Septa are well developed.

Papillae are developed at the underside of the corallites, dried coral yellow in colour.

GENUS

Acropora Oken, 1815

Acropora is the largest genus of reef-building corals with about 170 species recorded around the world. *Acropora* have a much wider range of growth-forms useful to taxonomy than other characters. Colonies are usually ramose to arborscent, bushy or plate-like, rarely encrusting or submassive Corallites are two types, axial and radial. The radial corallites forms various shapes, which are of taxonomic importance. Septa are usually in two cycles. Columella are absent. Corallite walls and the coenosteum are porous. Polyps are usually extended only at night.

Acropora species are arranged into different groups named after a prominent species based on their identification characters. The kind of growth form, radial corallie structure and the structure if coenosteal structures also play a major role in their naming and identification. The figures with captions provided below are self explanatory and useful for identification of *Acropora* corals.

Different Colony shapes of *Acropora*

Digitate

Arborescent

Corymbose

Table

Caespitose

Hispidose

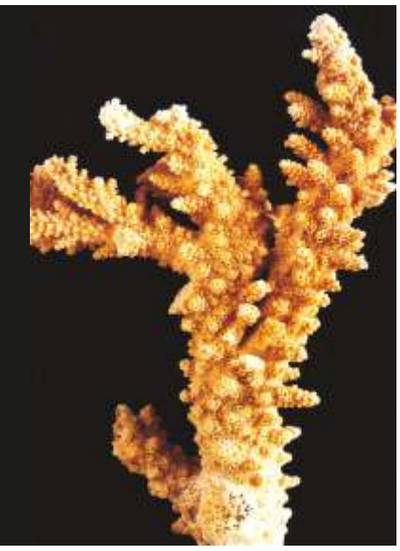
Caespito - corymbose

Cuneiform

Categories of radial corallites used to describe the species of *Acropora*

Acropora formosa

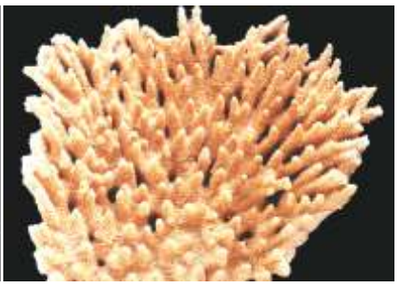
Acropora rudis



Acropora florida

Acropora robusta

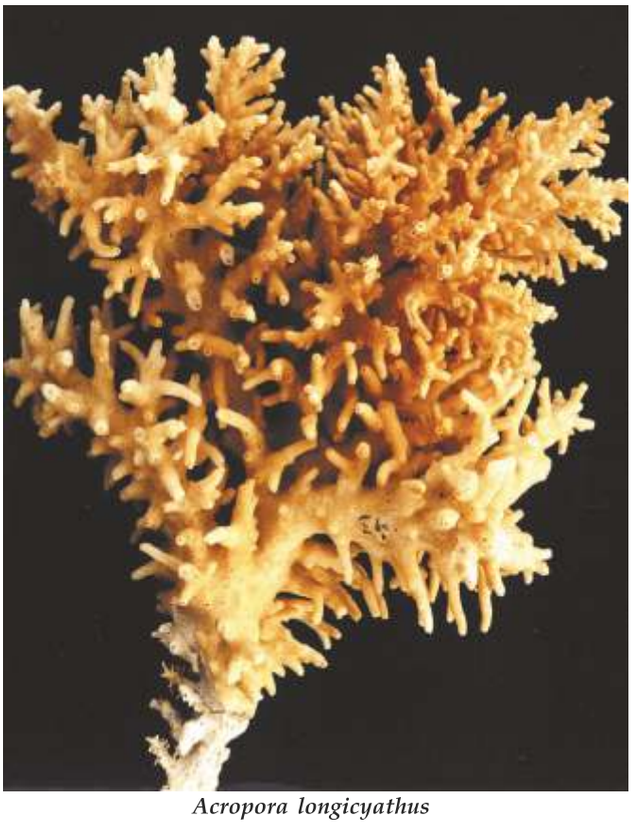
Acropora millepora



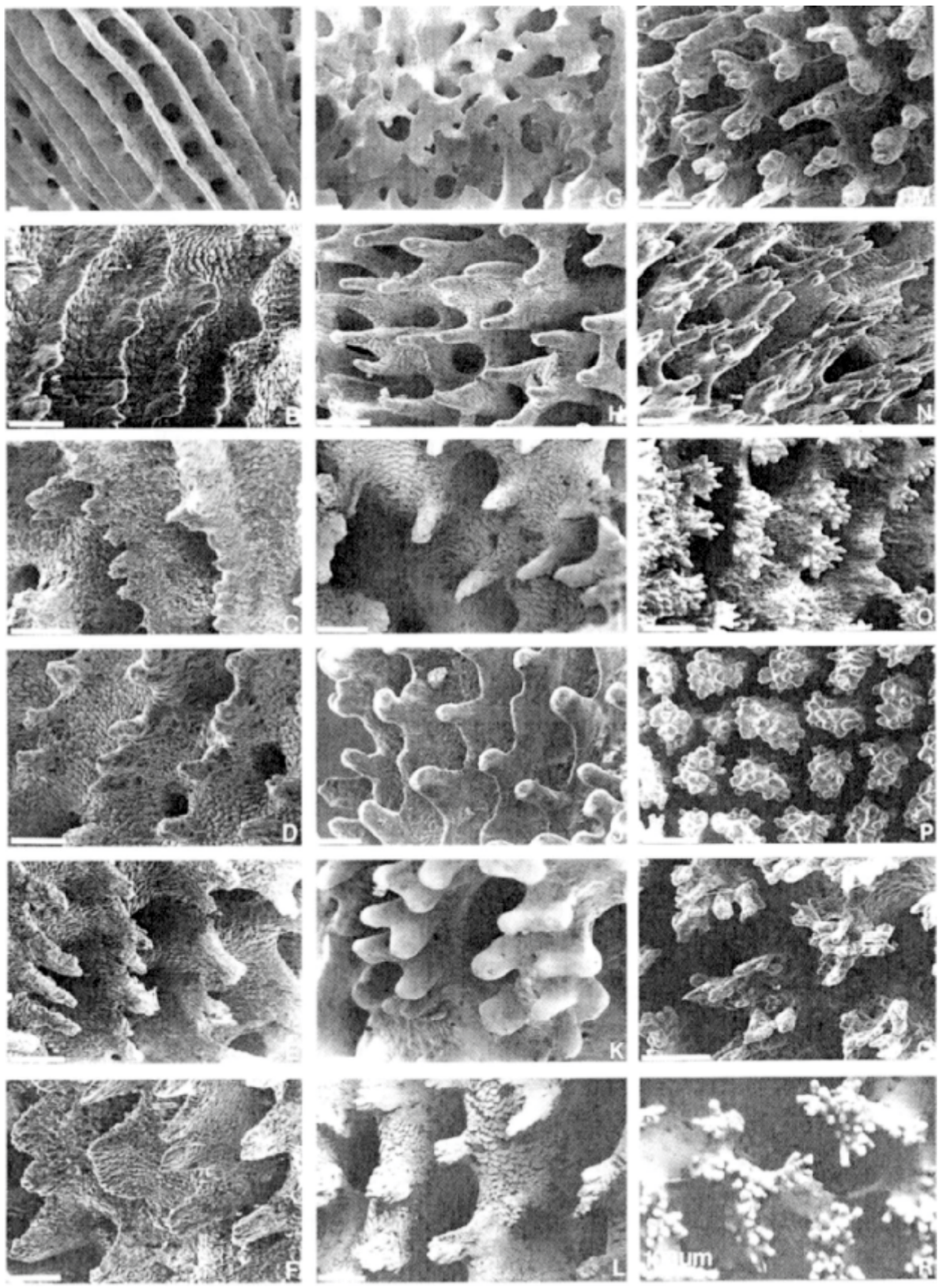
Acropora spiciffera

Acropora palifera

Acropora monticulosa



Acropora longicyathus



Examples of coenosteal structure

(A, B) costae; (C-F) costae, with increasing degree of spinule development; (G) reticulate (H-J) simple spinules; (K) forked spinules; (L-Q) increasingly elaborate spinules; (R) meandroid elaborate spinules.

RUDIS GROUP

Usually sturdy heavy structured species, irregular arborescent

Axial corallites large

Radial corallites tubular

A. rudis

Sturdy, irregular arborescent

Large, thick walled axial and radial corallites

Dense coenosteum

This species is not easily confused with any other

A. austera

Untidy branching

Radial corallites are large, crowded tubes with thick walled and calices have a distinctive shape

Most easily confused with: *A. verweyi, A. hemprichii*

A. hemprichii

Untidy branching

Radial corallites are large, crowded tubes with thick walls

Most easily confused with: *A. austera, A. variolosa*

HUMILIS GROUP

Sturdy heavy structured species, digitate to corymbose colonies with thick branches

Axial corallite large and forms much of the branch

Radial corallites short tubular and thick walled

A. humilis

Branches terete

Radial corallites are one size

Most easily confused with : *A. gemmifera, A. monticulosa, A. samoensis, A. digitifera*

A. globiceps

Branches terete

Axial corallites have a large calice and radial corallites are one size

Most easily confused with: *A. humilis, A. samoensis*

A. gemmifera

Branches taper

Two sizes of radial corallites

Most easily confused with: *A.humilis, A. monticulosa, A. digitifera*

A. monticulosa

Branches very conical

Radial corallites and opening of axial corallite are similar in size, radial corallites tubular with rounded to nariform openings

Most easily confused with: *A. gemmifera*

A. samoensis

More branching than any of the other species in this species group

Radial corallites quite widely spaced

Most easily confused with: *A. humilis*

A. digitifera

Branches thinner compared with other species in this species group

Inner wall of radial corallites is absent or barely developed, outer wall rounded and may form a flaring lip

Live colonies are always cream or pale brown with or without blue tips

Most easily confused with: *A. humilis, A. gemmifera*

A. multiacuta

Small colonies with simple branching

Axial corallites long and obvious

Radial corollites barely developed

This species is distinctive

Acropora cophodactyla

Digitate bushy type colonies. with ramose, coalescent branches.

Corallites are of mixed sizes and irregularly distributed.

Similar to *A. humilis* which has larger axial corallites and easily separable radial corallies.

Acropora schmitti

Colonies branching. Branches are irregular in shape.

Axial corallites intergrade with radial corallites.

Radial corallites are crowded.

Similar to *A. digitifera . It* appears like *A. chesterfieldensis* also.

NASUTA GROUP

Corymbose colonies, becoming more sturdy in the order that the species are listed: *A. kimbeensis, A. cerealis, A. nasuta, A. valida, A. arabensis, A. secale, A. lutkeni*

Radial corallites are nariform, appressed tubular with oval openings.

A. nasuta

Radial corallites nariform, crowded and evenly arranged

Most easily confused with: *A. cerealis, A. valida*

A. cerealis

Some anastomosis of branches, Radial corallites are nariform with elongate openings, outer edge of radial corallites may curve upwards.

Most easily confused with: *A. nasuta, A. divaricata*

A. valida

Corymbose colonies or large tables.

Radial corallites are tubular appressed with slightly oval openings.

Most easily confused with: *A. nasuta, A. secale*

A. secale

Radial corallites are thick walled, a mixture of long tubular corallites (often arranged in rows) with nariform corallites between them.

Most easily confused with: *A. valida, A. lutkeni*

A. lutkeni

Colonies may be irregularly corymbose.

Radial corallites are thick walled, tubular appressed with round or oval openings, may be variable in shape and size with some long tubular corallites.

A. plantiginea

Colonies small bushes, caespitose or corymbose.

Axial corallites dome shaped.

Radial corallites thick walled and some on the sides are elongated.

Similar to *A. secale* which is more robust in structure, appears like *A. squarrosa*

DIVARICATA GROUP

Colonies form tables with anastomosing branches.

Radial corallites are large appressed tubular with nariform openings.

A. divaricata

Colonies have a distinctive open pattern of branching with some branches anastomosing, Live colonies are usually brown with blue branch tips, Most easily confused with: *A. cerealis, A. solitaryensis*

A. solitaryensis

This species is similar to *A. divaricata*, differing in that the basal branches of the colony anastomose sometimes extensively to form a solid plate.

Live colonies may be brown with or without blue branch tips or green.

Most easily confused with: *A. divaricata*

A. kosurini

Colonies corymbose with evenly arranged and sized branches.

Radial corallites neat appearance.

Most easily confused with: *A. cerealis*

A. clathrata

Tables with a distinctive pattern of branching: regularly anastomosing horizontal branching with little or no vertical branching.

Radial corallites are tubular, openings are directed upwards and are variously shaped.

Most easily confused with: this species is not easily confused with any other.

LOVELLI GROUP

All uncommon except in very specific habitats of particular reefs.

Radial corallites large round openings, appressed tubular, equal shapes and sizes.

A. glauca

Corymbose plates.

Radial corallites nariform with obvious openings.

Most easily confused with: *A. solitaryensis*

VERWEYI GROUP

Only one species in this group.

A. verweyi

Small bushy colonies with thin branches.

Radial corallites thickened walls with obvious openings.

Most easily confused with: *A. austera, A. latistella*

FORMOSA GROUP

Open arborescent branching mode (no other distinctive features: this is probably not a monophyletic group).

A. formosa

Radial corallites crowded, tubular with small, usually oval shaped openings.

Most easily confused with: *A. intermedia, A. grandis, A. microphthalma*

A. grandis

Sprawling colonies.

Radial corallites tubular, widely spaced, directed outwards, vary in size and have round openings.

Most easily confused with: *A. intermedia, A. formosa*

A. valenciennesi

Large open arborescent table with upward curving branches.

Most easily confused with: *A. acuminata, A. hoeksemai*

A. teres

Colonies branching composed of twisted plain branches which divide irregularly.

Axial and Radial corallites are small.

Radial corallites with circular openings.

Coenosteum is coarse.

Similar to *A. formosa* which has larger more exsert radial and axial corallites. They appear like *A. abrolhosensis*

ROBUSTA GROUP

Radial corallites and coenosteum is very similar in all species in this group, main differences are in growth form

Radial corallites dimorphic: long tubular corallites with dimidiate openings interspersed with subimmersed corallites

Coenosteum structure dimorphic: costate on radials, reticulate between radials

A. robusta

Colonies arborescent tables, with digitate central branches and upwardly curving peripheral branches

Most easily confused with: *A. abrotanoides*

A. abrotanoides

Colonies have thick main branching units which proliferate distally

Most easily confused with: *A. robusta*

A. palmerae

Encrusting growth form, sometimes with irregular branching.

Most easily confused with: *A. robusta*

A. intermedia

Arborescent with straight branches.

Most easily confused with: *A. grandis, A. formosa*

A. polystoma

Thick plates or corymbose colonies.

Most easily confused with: *A. abrotanoides, A. listeri*

A. ***pinguis***

Colonies with short thick tapering branches.

Calices conspicuous.

Septa are well developed.

Similar *to A. robusta*

SELAGO GROUP

Radial corallites have variations of a cochleariform shape ie upper wall is short and weakly developed and the lower wall forms a flaring lip.

A. selago

Corymbose colonies, some anastomosing of branches.

Radial corallites appressed and cochleariform with "pointed" lips.

Most easily confused with: *A. tenuis*

A. tenuis

Corymbose colonies, well developed cochleariform corallites, lips of radial corallites rounded.
Most easily confused with: *A. selago*

A. donei

Large arborescent table.

Radial corallites cochleariform with a reduced lip.

Most easily confused with: *A. yongei*

A. yongei

Arborescent

Radial corallites cochleariform.

Most easily confused with: *A. donei*

ASPERA GROUP

All species have labellate radial corallites ie bottom/outer wall present and upper wall absent or very reduced

A. aspera

Arborescent

Larger rounded lipped radial corallites with smaller radial corallites between.

Most easily confused with: *A. pulchra*

A. pulchra

Arborescent.

Radial corallites have pointed (not rounded) lips and are a mixture of sizes.

Most easily confused with: *A. aspera*

A. millepora

Corymbose colonies with thin to medium sized branches.

Radial corallites are all of a similar size, evenly arranged with large rounded lips giving branches. a distinctive "scaly" appearance.

Most easily confused with: *A. spathulata*

A. spicifera

Tables or corymbose colonies with thin branches.

Radial corallites are all of a similar size, evenly arranged with rounded lips.

Most easily confused with: *A. millepora*

A. papillare

Sub-arborescent colonies with sturdy branches.

Radial corallites mostly one size with rounded, labellate lower walls.

Most easily confused with: *A. aspera, A.robusta*

FLORIDA GROUP

Sturdy hispidose branches ie short evenly sized and shaped secondary branches.

Radial corallites approach a labellate shape.

A. florida

Colonies may be quite large, branches are sturdy, hispidose with regularly spaced small branchlets.

Axial corallites are of similar size to the radial corallites.

Live colonies have a distinctive colouring: greenish brown, yellow or brown.

Most easily confused with: This species is quite distinct.

HYACINTHUS GROUP

Colonies are tables or plates.

Radial corallites labellate ie bottom/outer wall present and upper wall absent or very reduced.

A. hyacinthus

Radial corallites have neat rounded lips forming a "rosette" around the axial corallite.

Most easily confused with: *A. cytherea*

A. anthocercis

Thick plates or corymbose.

Axial corallites large, radial corallites labellate with thick walls.

Most easily confused with: *A.hyacinthus*

A. cytherea

Branchlets have groups of 2-3 axial corallites.

Radial corallites have elongate vertical lips.

Most easily confused with: *A. hyacinthus*

A. microclados

Corymbose colonies.

Radial corallites nariform to labellate.

Most easily confused with: *A.cerealis, A.selago*

A. paniculata

Tables often with fairly widely spaced branches.

Radial corallites nariform to labellate.

Most easily confused with: *A.cytherea*

Acropora plana

Tables formed by irregularly fused upright branches.

Axial corallites are tubular.

Radial corallites are appressed.

Simialr to *A. cytherea* which has smaller and even branches.

LATISTELLA GROUP

Corymbose colonies with slender branches.

Radial corallites are small, appressed tubular with round openings.

A. latistella

Radial corallites are fairly closely arranged, septa obvious in skeletal samples.

Most easily confused with: *A.aculeus*

HORRIDA GROUP

Growth form of all species in this group range from open arborescent to hispidose to irregular caespitose.

Radial corallites are tubular with round openings.

A. vaughani

Radial corallites are widely spaced, tubular, have thickened walls and are often directed outwards.

Most easily confused with: *A.horrida, A.variolosa*

A. microphthalma

Branches slender.

Radial corallites tubular and very neatly arranged.

Live colonies are white, cream or gery.

Most easily confused with: *A.formosa*

LORIPES GROUP

Appressed tubular (pocket-like) corallites with very thick walls.

Coenosteum is a very dense arrangement of elaborated spines on and between radial corallites giving branches and walls of corallites a smooth appearance.

A. loripes

Colonies form thick hispoidose branches, corymbose.

Radial corallites are large, thick walled with rounded openings, upper sides of branches may be devoid of radial corallites.

Most easily confused with: *A.longicyathus, A. granulose, A. squarrosa.*

A. squarrosa

Colonies are corymbose to cespito-corymbose.

Radial corallites appressed tubular to immersed with round openings, widely spaced.

Most easily confused with: *A. loripes*

A. chesterfieldensis

Colonies corymbose to caespito-corymbose.

Radial corallites appressed tubular with neat appearance.

Most easily confused with: *A. loripes*

A. granulosa

Small, thick plates with a large proportion of axial compared with radial corallites, branches terete.

Radial corallites are simple appressed pockets.

A. caroliniana

Small, thick plates, sturdy branchlets may approach a hispidose form.

Branchlets are composed of long tubular radial corallites or incipient axial corallites which often curve upwards, other radial corallites are simple tubular appressed or appressed pockets.

Most easily confused with: *A. granulosa*

ECHINATA GROUP

All species have a hispidose or bottlebrush growth form.

Radial corallites are few relative to axial corallites.

All species have tubular or tubular appressed (pocket-like) radial corallites with round openings.

Dimension of branches and degree of calcification increases in the order the species are listed.

A. echinata

Can develop long sprawling branches

Axial corallites of branchlets have round, open calices

Coenosteum on walls of corallites is costate

Live colonies are usually white purple or blue branch tips

Most easily confused with: *A. subglabra*

A. subglabra

Axial corallites of branchlets have round and slightly contracted calices

Coenosteum forms lines of spinules on walls of corallites

Most easily confused with: *A. echinata, A. carduus*

A. longicyathus

Radial corallites are crowded, large with fairly thick walls

Coenosteum is reticulate with elaborate spinules

Most easily confused with: *A. elseyi, A. carduus, A. loripes, A. awi*

A. carduus

Colonies are bottlebrush like.

Colonies form bushes with vertical or horizontal main branches.

Branches are evenly spaced.

Corallites are small and exsert.

Subgenus *Isopora*

Colonies can have more than I axial corallite per branch.

Very dense coenosteum and very elaborate spinules of similar appearance in all 3 species in this group.

A. palifera

Branches and corallites have a swollen appearance.

Radial corallites tubular appressed with dimidiate openings.

Most easily confused with: *A. cuneata*, *A. brueggemanni*

A. brueggemanni

Branches usually have one axial corallite, Radial corallites appressed.

Most easily confused with: *A. palifera*

Other Species

A. efflorescens

Corallum are flat plates.

Axial and radial corallites have sharp tips and are not only distinguishable.

Septa are well developed.

A. proximalis

Colonies with irregular branches forming thickets.

Branches may be upright or prostrate.

Corallites on the undersurface are mostly missing.

Small Axial corallites.

Elongated and strongly appressed radial corallites.

Papillae are developed at the underside of the corallites, dried coral yellow in colour.

A. ***rambleri***

Tables with horizontal and open branches.

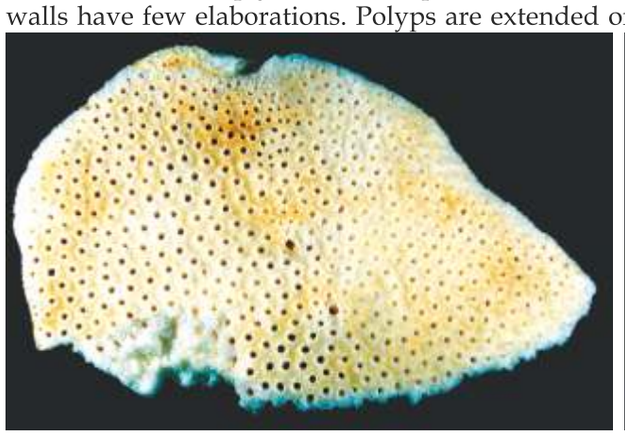
Axial corallites are long and tubular.

Radial corallites with nariform openings and are incipient on main branches.

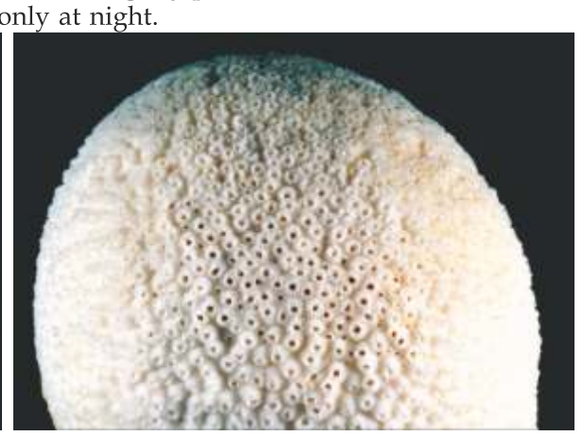
GENUS

Astreopora de Blainville, 1830

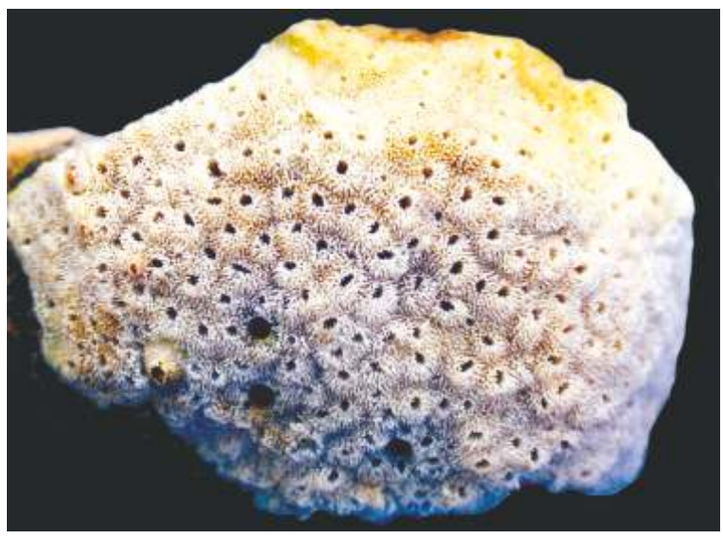
Characters: *Astreopora* is a well-defined genus. Colonies may be massive, laminar, encrusting or foliaceous. Corallites are immersed or conical with short, numerous, neatly spaced short septa. Columellae are deeply set and compact. Corallite walls are slightly porous and the coenosteum and walls have few elaborations. Polyps are extended only at night.



Astreopora listeri



Astreopora micropthalma



Astreopora cucullata

A. myriophthalma

Massive, hemispherical or flattened colonies.

The colony surface is usually even.

Corallites are slightly conical with smaller immersed corallites between.

Coenosteum is made of short spinules with elaborated tips.

Similar to *A. listeri* which is distinguished by its smooth coenostem and immersed corallites.

A. listeri

Massive, hemispherical or flattened colonies.

Corallites immersed.

Coenosteum covered with closely feathery spinules, giving a spiny appearance.

Similar to *A. myriophthalma* which has the same growth form but different corallites and coenosteum.

A. gracilis

Sub-massive.

Corallites of irregular sizes, some exsert corallites inclined in different directions.

Coenosteum is smooth and composed of compacted spinules.

Similar to *A. myriophthalma* but its corallites are arranged in an orderly fashion.

A. cucullata

Thick, sub-massive to encrusting plates with a well developed epitheca and sometimes short rootlets.

Corallites inclined on the corallum surface.

Coenosteum made up of elaborated spinules giving calice rims a feathery appearance.

Similar to *A. scabra*.

A. randalli

Colonies are encrusting or massive.

Immersed corallites with round openings.

Fine coenosteum papillae mostly form rows down the corallites giving a feathery appearance to the corallites.

A. scabra

Colonies massive.

Corallites are conical and conspicuous.

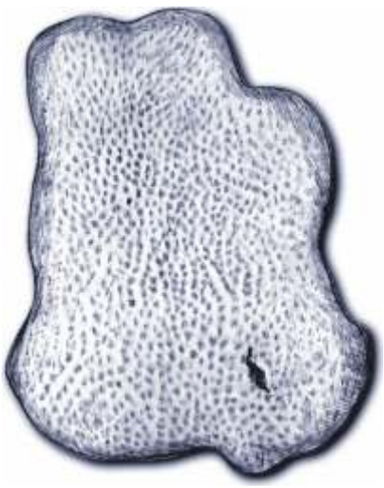
Septa are well developed.

Coenosteum is coarse with thick covering of papillae.

Coenosteum papillae are inclined.

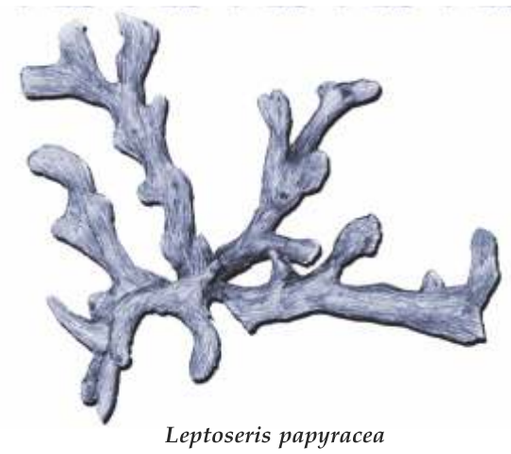
Family **AGARICIIDAE** Gray, 1847

Characters: Mostly colonial, hermatypic corals. Colonies are massive, laminar or foliaceous. Corallites are immersed with poorly defined walls formed by thickening of the septo-costae. Septa seldom fuse and are continuous between adjacent corallite centres. They have smooth or finely serrated margins and are closely packed. Corals of the Family Agariciidae are most similar to those of the Family Siderastreidae.

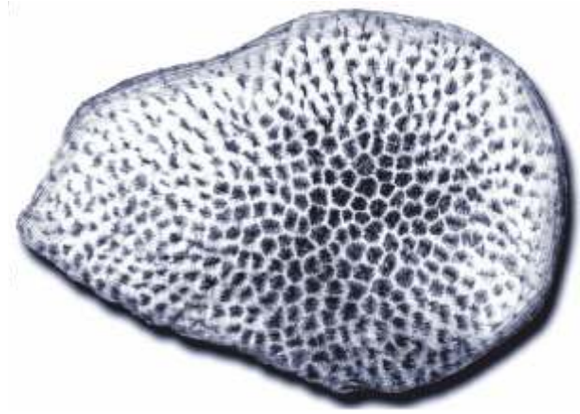


Pavona clavus

Pavona cactus



Leptoseris papyracea



Coeloseris mayeri

Pachyseris speciosa

There are about 7 genera included under this family out of which only 5 are reported from India. The total number of species recorded in the world are 47 and out of which 25 species are reported from India.

GENUS

Pavona Lamarck, 1801

Characters: Colonies are massive, laminar or foliaceous, the latter usually being bifacial. Corallites have poorly defined walls. They are small shallow depressions, usually with a central columella, sometimes separated by ridges. Corallites are interconnected by exsert septo-costae. Most *Pavona* species extend their polyps only at night.

Pavona cactus

Thin, contorted upright frond.

Corallites very small, Corallites aligned in irregular rows.

Small size of corallites resemble *P. decussata*

Pavona explanulata

Usually encrusting or laminar, larger colonies massive to columnar.

Corallites fairly small (larger in this species than other *Pavona* species), compact and lack any form of a corallite wall.

Corallites widely spaced and circular.

Generic affinity uncertain as this species is very similar to *Leptoseris*

Pavona clavus

Larger colonies mostly columnar, columns to 10 cm thick

Corallites very small, 2.5-3.5 mm diameter-irregularly aligned or in short valleys

Columellae rudimentary or absent

Corallite wall may be very thick or variable

Pavona venosa

Massive to encrusting

Corallites in short valleys with acute walls (collines)

3 orders of speta

Lack of columella development

Usually septa are more widely spaced and less even in height

Similar to *P. varians* which has less developed collines and usally 2 orders of septa

Povona varians

Submassive, plate-like or encrusting.

Corallites in short irregular valleys between ridges, perpendicular to margins

Septa in two (sometimes indistinct) alternate orders.

Pavona maldivensis

Laminar, encrusting &/or branching

Corallites circular and irregularly sized with distinct thecas

Pavona decussata

Thick, interconnecting upright plates.

Irregular deeply set corallites, sometimes aligned parallel to margins.

Similar to *P. danae* and *P. frondifera*

Pavona duerdeni (previously called *P. minuata* in Scheer and Pillai, 1974)

Massive or divided into irregular ridges.

Dense skeleton

Small corallites giving colony a smooth appearance

Strongly alternating septo-costae

Corallites resemble *P. clavus* but are smaller with more exsert primary septo-costae.

Pavona minuta (*P. xarifae* by Scheer and Pillai (1974), synonomysed in Veron, 2000)

Submassive or encrusting with thin margins.

Smooth surface due to the small, widely spaced corallites (2-3 mm diameter)

Corallites walls thick (because of wedge shaped septa)

P. minuta has more regular calices with fewer, more regular., more exsert septa and well formed columellae than *P. clavus.*

Pavona bipartita

Submassive or encrusting colonies.

Corallites uniformly distributed but collines are uneven in height and may form slightly raised ridges.

Septo costae are in two slightly alternating orders

Similar to *P. duerdeni*

Pavona danai

Colonies short, mostly leafy with short and laminar twisted fronds.

Corallites are aligned vertically in short shallow valleys.

GENUS

Leptoseris Milne Edwards and Haime, 1849

Characters: Colonies are foliaceous and have a delicate leafy appearance. On occassions, colonies may be laminar or encrusting. They frequently have a distinctive central corallite. Corallites have poorly defined walls. There are small shallow depressions with a central columella, usually separated by ridges and interconnected by fine septo-costae. *Leptoseris* is similar to *Pavona.* Even though they are widespread, most species show considerable geographic – as well as environmental variations.

L. papyracea

Delicate, irregularly dividing fronds.

Each frond has only a few corallites

Similar to *L. gardineri* which is larger and coarser and hasfronds containing many corallites.

L. gardineri

Colonies are horizontal, unifacial with subdividing fronds.

Corallites are aligned near the centre of fronds.

May form dense thickets.

Fronds are larger and coarser than *L. papyracea.*

L. explanata

Laminar plates which may be horizontal with entire or lobed margins and contorted branches.

Calices elongate to circular, <6 mm max dimension, usually inclined toward margins.

Septo-costae very unequal-first order larger, thicker, more exsert

Similar to *L. gardineri* but *L. explanulata* has larger corallites which are more prominent, wider branches, more septa and markedly unequal septo-costae.

L. scabra

Laminar, encrusting, may be highly contorted forming hollow columns, tubes, fronds

Corallites large, sometimes indistinct in highly contorted colonies

Corallites may be more spaced towards the colony perimeter and outwardly inclined.

2 cycles of septa alternate strongly

Thecae usually thick

Similar to *L. hawaiiensis* which has deep, rounded corallites and a smooth coenosteum. Aslo resembles *L. solida* and *L. striata* but they do not have strongly inclined corallites.

L. mycetoseroides

Primarily encrusting with free laminar margins, up to 2m diameter and sometimes several tiers

Plates have short irregular folds on the surface

Corallites are crowded between folds except to wards the periphery where they are aligned in rows parallel to the margins.

Corallites outwardly inclined, thecae not well defined

Septo-costae usually in 2 alternating orders

Similar to *L. tenuis* which has identical septo-costae

L. yabei

Laminar vertical to horizontal & or overlapping tiers frequently with upturned margins, unifacial unless fronds fuse, sometimes fluted tubes.

Corallites in rectangular pockets formed between radiating ridges.

Calices frequently inclined to colony margin

Septo-costae 2 alternating orders, undersurface of colonies are finely costate and folded, folds correspond to collines.

L. incrustans

Primarily encrusting, also plate-like. Plate often have radiating ridges.

Corallites are small and closely compacted.

The coenosteum has numerous hydnophoroid projections.

Similar to *L hawaiiensis* which has larger corallites and no hydnophora-like projections.

L. mycetoseroides is similar also but is has more well developed radiating ridges.

L. foliosa (*L. tenuis* in AIMS Monograph)

Encrusting, submassive or unifacial laminae with free margins.

Radiating folds may be present.

Outwardly inclined, small and shallow corallites in irregular rows parallel to colony margin.

Little or no development of thecae.

Costae fine, equal or slightly alternate, closely spaced and heavily granulated giving colonies a smooth appearance.

Similar to *L. yabei* but lacks radiating ridges and the alternate wider spaced septa/ Resembles *L. explanata* but lacks alternating septo-costae.

Leptoseries hawaiiensis

Colonies are encrusting laminae.

Corallites are deep and rounded, irregularly distributed and slightly inclined towards the perimeter.

Septo-costae are very even, giving the coenosteum a smooth appearance.

Brown or green in colour, usually mottled.

GENUS

Coeloseris Vaughan, 1918

Characters: Monospecific and well defined genus. Colonies are massive either rounded or hillocky. Coralla are cerioid with colonies formed by monostomodaeal budding. Columellae are absent and the axial space is open. It has *Pavona* – like, neatly arranged septo-costae, which join, at the top of the walls. Polyps are extended only at night. Superficially it looks like a faviid, and it is closely related to *Pavona.*

Coeloseris mayeri

Colonies massive or rounded.

Corallites are ceriod without columellae and neatly arranged septo-costae.

Septo-costae join at the top of the walls.

GENUS

Gardineroseris Scheer and Pillai, 1974

Characters: It is a monospecific genus, colonies are massive to encrusting, sometimes with laminar margins. Corallites have poorly defined walls but are separated by acute ridges so that each corallite is at the bottom of a neat excavation. Columellae are present and septo-costae are fine and even. Polyps are extended only at night.

Gardineroseris planulata

Massive or encrusting, sometimes with laminar margins.

Corallites have poorly defined walls but are separated by acute ridges.

Columellae present, septo-costae are fine and even.

May resemble *Pavona varians* and *Pavoana vensoa*.

GENUS

Pachyseris Milne Edwards and Haime, 1849

Characters: Colonies are laminar (upright fronds) and unifacial, to branching and bifacial. Branches are usually highly contorted. The surface is a series of concentric ridges parallel with the margins. Corallite centres are not discernible. Valleys are concentric and parallel to the corallum edge. Columellae are wall–like with lobed upper margins or absent. Septo-costae are fine, even and tightly compacted.

P. gemmae

Colonies have both horizontal and upright irregularly folded fronds.

Valleys are parallel to frond margins except towards the base of fronds where they become irregular.

Colines are wavy.

Columellae are wall-like and clearly fused with septo-costae.

May resemble tiered forms of *Pachyseris speciosa*

P. speciosa

Colonies are unifacial laminae-usually horizontal, but may have upright ridges or columns.

Columella absent or rudimentary.

More than one row of corallites may occur between ridges

Similar to *P. gemmae*

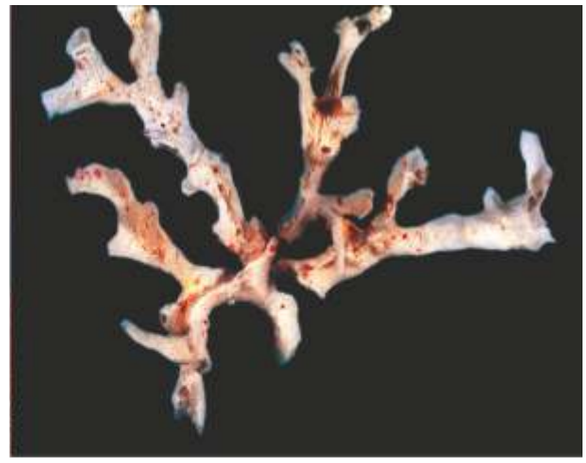
P. rugosa

Wide range of growth forms with irregular vertical plates, ridges, columns which branch and anastomose.

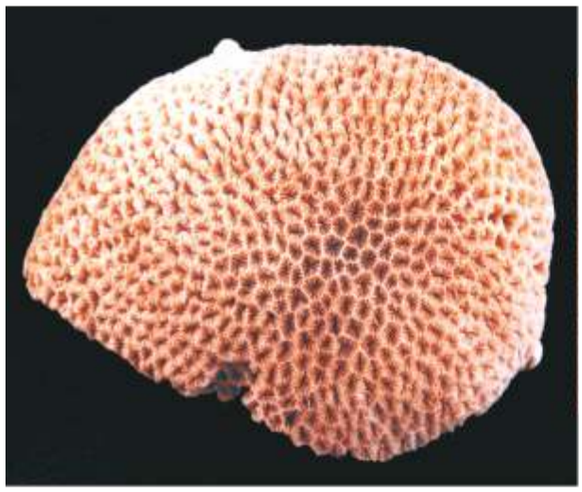
Columella always well formed, continuous or discontinuous plates.

Similar to *Pachyseris gemmae*

Pavona decussata



Leptoseris papyracea



Coeloseris mayeri

Pachyseris rugosa

Gardineroseris planulata

Pavona cactus

FAMILY : **ASTROCOENIIDAE** Koby, 1890

There are about 6 genera included in the world out of which three genera, *Stylocoeniella, Palauastrea* and *Madracis* are reported from India. All the genera have close affinities with Pocilloporidae. Style-like columellae and neatly arranged solid septa are important characters to this family. *Palauastrea* and *Madracis*, previously placed in family Pocilloporidae, have been moved to the Astrocoeniidae. A total of 6 species are reported and out of which 4 are reported from India.

Stylocoeniella guentheri

Madracis kirbyi

GENUS

Stylocoeniella Yabe and Sugiyama, 1935

Characters: Colonies are massive, columnar or encrusting. Corallites are immersed, circular, with two unequal cycles of septa and a style–like columella (like a pencil). The coenosteum is covered with fine spinules and also by larger pointed styles, which are almost as numerous as the corallites. *Stylocoeniella* resembles Pocilloporidae and *Porites sp.*in underwater. Both are distinguished by their lack of coenosteum styles.

Stylocoeniella guentheri

Small calices, Septa in two very unequal cycles.

Corallites widely spaced

Septa of adjacent corallites join in some specimens

Calices and septa may be difficult to distinguish in encrusting forms.

Stylocoeniella armata

Larger corallites and more prominent styles than *guentheri*

Encrusting

Corallites widely spaced

Secondary cycle of septa appear longer than *guentheri*

GENUS

Palauastrea Milne Edwards and Haime, 1849

Characters: Colonies are branching, encrusting or submassive Corallites are plocoid or plococerioid. Septa 8 or more frequently 10 larger septa present in corallites, higher septal cycles reduced to spines. Columellae styliform and prominent. The growth form and coenosteum are variable but the structure of the corallites and especially the non-hexameral septa are conspicuous and typical of this genus

Palauastrea ramosa

Star-like corallites

Blunt-ended branches

Corallites immersed, round, and not touching (resemble Pocilliporid)

Small blunt style-like columella

GENUS

Madracis Milne Edwards and Haime, 1849

Characters: *Madracis* is primarily an azooxanthellate genus. Colonies are massive, encrusting or columnar. Corallites are large and angular and there are no coenosteum styles. Corallites are closely packed and touching.

Madracis kirbyi

Encrusting, nodular or columnar (club-shaped)

Corallites are subceroid, closely compacted and angular.

10 septa fused with the columellae

Solid conical columellae

Coenosteum is covered by fine spinules.

Madracis kirbyi

FAMILY : **CARYOPHYLLIIDAE** Gray, 1847

This is the biggest of all the scleractinian families comprising of 301 species (including 6 infraspecific species) belonging to 43 genera out of which only 12 species belonging to 6 genera are reported from India. Most of the species belonging to this family are azooxanthellate and found in deeper waters. Heterocyathus aequicostatus which is found in abundance all along the coasts and is a zooxanthellate species is described here upto species level along with few commonly occurring species, all others are given only upto genus and also in the form of lists since their availability itself is in question.

GENUS

Caryophyllia Lamarck, 1801

Solitary, attached or free-living, mostly cylindrical or horn-shaped.

Septa are thin and straight with smooth margins.

Pali and columella are present.

Caryophyllia smithii

Corallum solitary, subcylindrical and with a broad attachment base.

Calyx elliptical.

Septa exsert, with granulate surface arranged in four or five cycles.

Pali forms a series of atleast 17 opposite septa of 3rd cycle.

Columella a series of twisted ribbons.

Once described as *Caryophyllia clavus* in Indian waters and elsewhere..

Caryophyllia arcuata

Corallum solitary, cornuate.

Calice slightly elliptical.

Septa in four cycles.

Edges of septa entire, sides granular.

Columella a series of twisted ribbon like trabeculae

Pali poorly developed and scarcely distinct.

Now it is considered as a fossil species in Indian waters and elsewhere.

Caryophyllia grayi

Corallum solitary, cornuate.

Calice broadly elliptical cup shaped.

Thin epitheca present.

Septa in four complete cycles.

Columella not deep seated, a number of large curled leaf-like processes.

GENUS

Deltocyathus Milne Edwards and Haime, 1848

Solitary, free-living and disc-shaped.

Pali forms deltas.

Deltocyathus andamanicus

Corallum discoid, free living.

Septa and Pali are granulated.

Septa with four complete cycles.

Septa of the first cycle large and exsert and with pali, where as the last cycle

Columella spongy and papillose.

Deltocyathus magnificus Moseley, 1876 is another valid species reported from India.

GENUS

Paracyathus Edwards and Haime, 1848

Solitary, attached, and tapering to a pointed base.

Pali merges with the columella.

Paracyathus profundus

Solitary with a broad attachment base.

No epitheca, septa ranges from 60 to 80 in adult calices.

The first three cycles of septa equally exsert and reach the columella.

The fourth and fifth cycles of septa unite to the third.

Edges of septa entire sides granular.

Pali prominent, costs extend to the base of corallite.

Living coral with a dark or purple calyx.

Young corallites white, outer wall dull white.

Paracyathus indicus

Solitary with a expanded attachment base.

Calice elliptical, deep, margin curved upwards with a slight downward curve at the ends.

Septa exsert, numerous and unequal in five cycles.

Pali small and resemble pinnacles of the columella.

Columella deep, elongate concave and consists of papillose structures.

Edges of septa are spinulose.

Paracyathus stokesi

Azooxanthellate. Solitary and tapering to a pointed base.

Without epitheca, 5 to 11mm in height.

Calice diameter varies with the size of the corallum, usally 5-11mm.

Septa exsert, entire with granular sides.

Padi prominent and merges with the columella.

GENUS

Polycyathus Duncan, 1876

Solitary, attached, forming small colonies by budding from the sides of parent polyps.

Polycyathus verrilli

Colonial, corallites formed of extratentacular budding.

An epitheca present which may reach upto the thecal tip.

Septa 30 to 36, all septa exsert, primaries the maximum, exsert parts vertical, edges entire, side granular.

First two cycles of septa reach the columella.

Pali in front of the first three cycles of the septa, total Pali upto 20.

Columella with 10 to 12 vertical papillae standing below the level of the pali, concave.

Costae recognisable at the distal part of the corallites with a row of granules.

Polycyathus andamanensis Alcock is another species reported from India.

GENUS

Heterocyathus Milne Edwards and Haime, 1848

Solitary, young stage attached to a small gastropod shell, which later is completely covered by the base of the coral, except an aboral hole and small lateral respiratory openings which leads to a spiraling tube inhabited by a commensal sipunculid.

Heterocyathus aequicostatus Mile Edwards and Haime 1848 is the only species recorded in India.

Heterocyathus aequicostatus

Corals are solitary, free-living, and have a flat base.

They have a commensal relationship with a spiunculid worm.

The spiunculid moves the coral about on soft substrates and prevents it from becoming buried.

Polyps are extended only at night.

Polyp larvae settle initially on dead micro-molluscs which become embedded in the corallum.

Living colonies are pale brown, often with a greenish oral disc.

Costae are prominent.

Similar to *Hateropsammia.*

Heteropsammia lacks the prominent costae of *Hetrocyathus*.

GENUS

Stephanocyathus Seguenza, 1864

Solitary, patellate, free, with strong coastae.

Pali is opposite one or two cycles or absent.

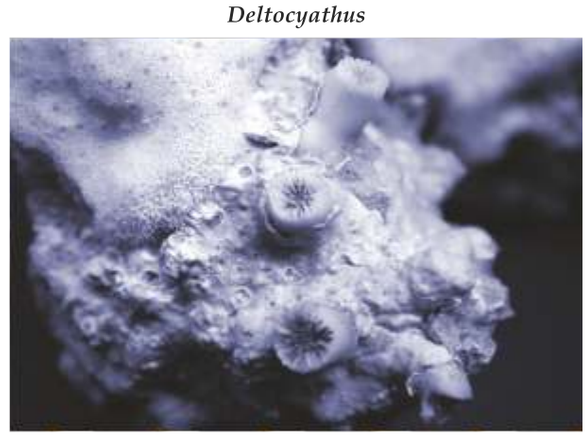
Columella is trabecular and papillose on surface.

Stephanocyathus nobilis (Moseley) is recorded in Lakshadweep.

Caryophyllia

Deltocyathus

Paracyathus stokesi



Polycyathus verilli

Heterocyathus aequicostatus

FAMILY : **DENDROPHYLLIIDAE** Gray, 1847

Characters: Solitary or colonial, mostly ahermatypic. Corallite walls are porous, usually composed of coenosteum. Septa are fused in a distinctive pattern (*Pourtales Plan* = inner margins of higher order septa curve to adjacent septa and fuse), atleast in immature corallites. Not related to any other family. This family contains only three hermatypic genera, *Turbinaria*, *Duncanopsammia* and *Heteropsammia*. Superficially they are completely different. *Turbinaria* and *Heteropsammia* are reported from India. More than eight genera are ahermatypic. *Balanophyllia*, *Endopsammia*, *Tubastrea*, *Dendrophyllia*, *Enallopsammia* are the ahermatypic genera recorded in India.

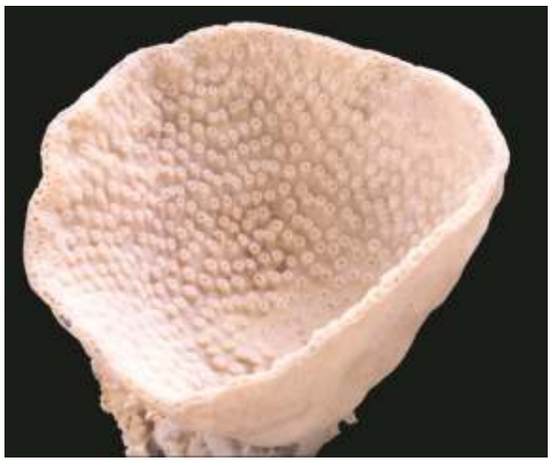
There are about 20 genera included under this family out of which 6 genera are reported from India. The total number of species recorded in the world are a woofing 169 and out of which only 22 species are reported from India.

GENUS

Turbinaria Oken, 1815

Characters: Colonies are massive, columnar, laminar or foliaceous with laminae frequently contorted. Corallites are round, immersed to tubular and have porous walls with the same structure as the surrounding coenosteum. Septa are short and neat, columellae are broad and compact. Polyps, except for those of *T. peltata*, are usually extended only at night. *Turbinaria* is a well-defined genus, which does not resembles any other, except occasionally *Astreopora*.

Turbinaria peltata



Turbinaria mesenterina

T. peltata

With or without stalks, encrusting or tabular, thickened, unifacial or ridges with budding margins bifacial fronds or cylindrical columns.

Corallites crowded or widely spaced, flush or protrude 2.5 cm.

Colony margins mostly composed of closely packed, outward projecting corallites; with subsequent growth corallites become less inclined toward margins and more upward projecting and increasingly immersed and decrease in corallite density towards centre.

Calices circular, 3-5 mm diameter.

T. mesenterina

Fronds more vertical than horizontal, amount of folding varies greatly, can form a dense mass of folds and tubes, less convoluted (and corallites more tubular than conical) in deeper water/ less light.

Corallites 2.5 - 3.5 mm, tubular or conical, calices 1.3 - 2 mm, usually protuberant and strongly inclined i.e., vertical, older corallites deeply embedded to smooth.

Similar to *T. reniformis* but *T. mesenterina* has thinner more tubular corallites.

T. reniformis

Growth form similar to *T. mesenterina* but not usually as convoluted, plates horizontal at bottom becoming inclined and folded at top.

Corallites vary variable, crowded to almost touching, most conical, thick walls and small calices.

Similar to *T. stellulata* if growth form overlaps, *T. reniformis* has thicker walls, conical corallites with broad base and fairly narrow apertures.

T. patula

Plates stalked, plate edges upturned, irregularly folded sub-vertical fronds.

Corallites strongly inclined, conical to tubular, 4-6 mm diameter at rim, protrude to 1.8 cm.

Elliptical calices 3.5 mm max. diameter.

Similar to *T. peltata* which has larger, less tubular corallites. *T. frondens* has smaller corallites and *T. heronensis* has very elongate corallites.

T. frondens

Usually crateriform or regular fronds, also other growth forms eg. bare with no corallites.

Corallites with circular apertures 1.5 - 2.5 mm, regularly spaced and inclined, regularly protuberant.

Similar to *T. mesenterina* which has smaller corallites and more highly anastomosed fronds.

T. stellulata

Massive, dome-like colonies formed by repeated overgrowths of plate-like or subspherical expansions.

Mature corallites well defined thecae, conical, protrude to 2 cm, 3 4 mm diameter, calices wide approx. 2mm giving corallites an open appearance.

Similar to *T. radicalis* which is also encrusting but has rootlets and has smaller usually less protuberant corallites.

T. undata

Colony surfaces are unifacial, bifacial, or form fused tubes or columns with corallites on the outer surface.

Corallites are round, range from immersed to tubular, usually widely spaced.

Development of septa following Pourtales plan only evident in immature corallites.

Paliform lobes and costae are absent.

GENUS

Tubastrea Lesson, 1829

Characters: Colonies form small clumps. Corallites plocoid. Septa thin, following Pourtales plan only in early stages. Columellae small. Corallite walls are thin, coenosteum as described for this family.

Tubastrea aurea

Corallum with an encrusting base sending up plocoid corallites.

Septa in three cycles with few of the fourth cycle.

Primary septa broadest, but little exsert.

Septa deeply descending of uniform width throughout the length.

Twelve septa reach the columella, others unite to the lower cycles in a dendrophylliid pattern.

Columella rudimentary.

Costae sinuous reach the base of the corallites, united by transverse connections.

It resembles *T. coccinea.*

Tubastrea micranthus

Colonies are dendroid and arborescent.

Several branchlets radiate in all directions.

Branchlets flattened or rounded.

Corallites 6 to 8 mm in diameter.

Corallites are usually broader at the top than at the basal part.

Septa in three cycles, the third very narrow and often obsolete.

Primary cycles of septa unite.

Corallite wall thin and porous.

The following species belonging to this genus are also reported from the Indian waters and fall under azooxanthellate group of corals.

Tubastrea coccinea

Colonies spherical to mound shaped upto 13 cm in diameter.

Corallites cylindrical.

Septa in four cycles.

Columella small and spongy.

T. diaphana is another species reported from Indian waters.

GENUS

Dendrophyllia (Blainville, 1830)

Azooxanthellate and colonial corals. Colonies may be small and bushy or dendroid with sympodial branching. Branching is extratentacular. Septa develop according to Pourtales plan. Columella prominent: spongy or papillose. Corallite walls are thin.

Dendrophyllia resembles *Tubastrea* and can be distinguished by the latter's mature corallites not having septa clearly arranged according to '*Pourtales Plan'*.

Dendrophyllia arbuscula

Colonies dendroid with branches radiating from a central stem.

Larger corallites have two to four smaller buds.

Adult calices 6 to 8 mm in diameter and 4 to 5 mm in deep.

Septa in four cycles with a few of the fifth.

The primaries are the broadest.

It is a little discovered species.

Dendrophyllia coarctata

Colonies dendroid and branching.

Corallites 10 to 15 mm in diameter and 10 mm deep.

Septa in four full cycles with a few of the fifth. The first two cycles are larger than others.

Septa not exsert.

Costae correspond to septa, extend to the base of the corallite, connected by transverse ridges, wall porous Columella spongy, convex, circular or elongated in outline.

It resembles *Lobophyllia robusta*.

Dendrophyllia indica

Corallum branching.

Corallites arrange all around the main stem and the branches.

Calices rounded, generally 10 mm in diameter.

Septa in four complete cycles.

The first three cycles always reach the columella; distinction between primaries and secondaries clear.

Columella formed of loose trabeculae.

Costate wavy.

Spinulations on the costae small, rounded and scattered.

Dendrophyllia minuscula Bourne, 1905

Colonies are branchlets and slender.

Corallites are upto 8 mm long.

The costae of the corallites and branchlets are irregular.

Calices are slightly oval.

Septa taper from the wall to the columella and first three cycles are complete, the fourth and fifth cycles are incomplete.

GENUS

Balanophyllia Wood, 1844

Characters: Common only on the roofs of caves. This genus is solitary or forms small attached clumps, solitary colonies taper towards their base. Corallites are elliptical in cross-section. Septa develop according to Pourtales plan. Columellae well developed, spongy. Corallite walls are thick, costae are developed.

The following species belonging to this genus are reported from the Indian waters and fall under azooxanthellate group of corals.

1. *Balanophyllia imperialis* Kent;

2. *Balanophyllia scabra* Alcock

3. *Balanophyllia affinis* (Semper, 1872)

GENUS

Endopsammia Milne Edwards and Haime, 1848

Characters: Solitary, free-living or attached and cylindrical. Septa are thin and columellae are weakly developed. No similar genus. *Endopsammia philippinensis* Milne Edwards and Haime, 1848 is the only reported species in India.

Endopsammia philippinensis

Solitary and fixed coralla.

Epitheca present.

Calices circular or oval, shallow.

Septal edges entire, sides granular.

Costae with single row of granules.

Columella well developed.

Two to three papilliform projections from columella.

Wall porous.

GENUS

Heteropsammia Milne Edwards and Haime, 1848

Heteropsammia is well adapted on soft substrates. It always has worms and thus appears to be dependent on them. Nine nominal species are reported from the world. One species is recorded from India. Solitary or colonial with up to 7 calices resulting from mono or distomodaeal intratentacular budding, free, base enclosing tube of commensal sipunculid. Wall thick and spongy; costae reduced to multiple rows of crispate granulations, becoming labyrinthine over base. Septa following '*Pourtales plan*', lower cycles thick and spongy. Columella well developed. *Heteropsammia* and *Heterocyathus* are structural and ecological equivalents; *Psammoseris* is at least a structural equivalent.

Heterpsammia cochlea (Spengler, 1781) is the only species recorded in India.

Heteropsammia cochlea

Corals are solitary.

Contains a hole at the bottom harbouring commensal sipunculid worm, which helps the coral to move.

Corallum hourglass shaped with one or two corallites some even more.

Well developed septa with pourtales plan.

Porous coenosteum.

Columellae present.

Heteropsammia resembles caryophyllid *Heterocyathus*

GENUS

Enallopsammia Micheloti, 1871

Characters: Dendroid colonies formed by extra-tentacular budding, the calices generally on one side of branches which tend to anastomose in one plane.

Septa following *Pourtales plan* only in early stages and the columella are weakly developed.

The following species belonging to this genus are reported from the Indian waters and their validity is at stake.

1. *Enallopsammia amphelioides* (Alcock)
2. *Enallopsammia marenzelleri* Zibrowius

Tubastrea aurea

Dendrophyllia indica

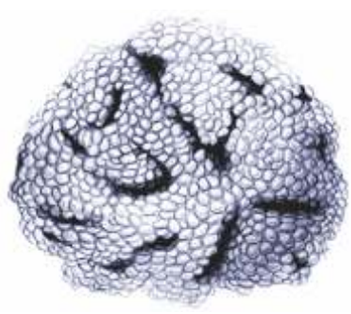
Balanophyllia affinis

FAMILY : **EUPHYLLIDAE** Veron, 2000

Species of this family are commonly called as bubble corals. The shape of the extended tentacles in underwater is used to identify the species. The museum specimens are difficult to identify. There are five reported genera from the world of which three are recorded in India. The Family Euphyllidae was recently (Veron, 2000) erected by moving five genera *viz*., *Euphyllia, Catalaphyllia, Nemansophyllia, Pleurogyra and Physogyra* from the Family Caryophylliidae due to the presence or absence of *zooxanthellae.*

Characters: Colonies are phaceloid, meandroid or flabello-meandroid, with large, solid and widely spaced septo-costae, which have little or no ornamentation. Corallite walls have a similar structure. All species are zooxanthellate.

Euphyllia glabrescens



Plerogyra sinuosa

Physogyra lichtensteini

GENUS

Euphyllia Dana, 1846

For two centuries, corals have been identified entirely by their skeletons, but only in *Euphyllia* the appearance of living polyp is being used to identify different species.

Characters: Colonies are flabelloid, phaceloid or meandro-phaceloid, the latter usually dome-shaped. Walls are thin and imperforate. Columellae are mostly absent. Septa are prominent, smooth-edged and imperforate. Polyps are extended day and night, are large and fleshy and have tentacles, which vary in shape or each species. *Euphyllia* and *Plerogyra* coralla may be similar, but living polyps are completely different.

Euphyllia ancora

Colonies flabello-meandroid.

Polyps with distinctive anchor-shaped tentacle ends.

Tentacles may sometimes have branchlets.

Rarely seen in Indian waters.

Euphyllia glabrescens

Colonies are phaceloid.

Corallites are usually separated by 0.5-1 corallite diameters.

Septa are not strongly exert. Polyps have tubular tentacles.

Usually grey-blue to grey-green with cream, green or white tips to the tentacles in colour.

GENUS

Plerogyra Milne Edwards and Haime, 1848

Plerogyra is one of the few corals sufficiently well armed to be able to sting a human.

Characters: Colonies are phaceloid to flabello-meandroid with valleys more or less connected by a light blistery coenosteum. Septa are large, imperforate, smooth-edged, very exsert and widely spaced. Columellae are absent. Polyps are extended only at night. During the day, polyps extend clusters of grey vesicles, the size and shape of large grapes.

Plerogyra sinuosa

Colonies are flabello-meandroid.

Septa are large, imperforate, smooth-edged, very exsert

Walls are imperforate.

Columella are absent.

These retract slowly, if at all, when distributed.

Usually bluish-grey in colour.

GENUS

Physogyra Quelch, 1884

Like *Plerogyra, Physogyra* is capable of stinging humans. It is a monospecific genus.

Physogyra lichtensteini

Colonies are meandroid with short, widely separated valleys and massive .

Valleys interconnected with blistery coenosteum.

Septa are large, imperforate, smooth-edged, exsert and widely spaced.

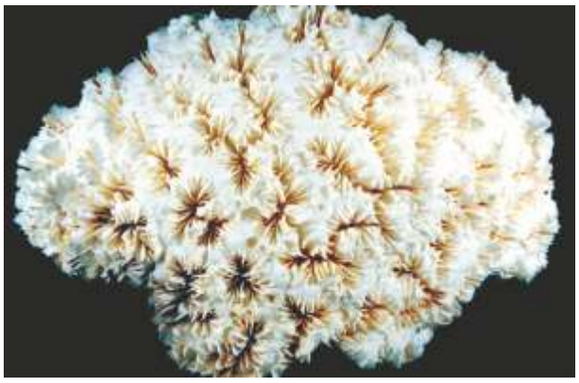
Walls are imperforate.

Columellae are absent

Physogyra resembles only *Plerogyra.*

Euphyllia glabrescens

Plerogyra sinuosa



Physogyra lichtensteini

FAMILY : **FAVIIDAE** Gregory, 1900

The Faviidae is one of the most important families of scleractinian corals. It is the biggest in terms of number of genera. All extant species are hermatypic and colonial. Septa, paliform lobes, columellae and wall structures, when present, all appear to be structurally similar. Septal structures are simple, columellae are a simple tangle of elongate septal teeth, walls are composed of thickened septa and cross-linkages. Families Merulinidae and Trachyphyllidae and Mussidae are related to familily Faviidae. Family Faviidae is composed of the 26 genera; (*Diploria, Calpophyllia, Manicinia, Solenastrea, Cladocora, Astreosmilia, Erythrastrea, Caulastrea, Favia, Barabattoia, Favites, Goniastrea, Platygyra, Australogyra, Leptoria, Oulophyllia, Oulastrea, Montastrea, Plesiastrea, Diploastrea, Leptastrea, Cyphastrea, Echinopora* and *Moseleya)* composed of 126 species out of which 53 species belonging to 126 species are reported from India. The majority of faviid genera are easily recognised because they are composed of a small number of species all of which have a number of distinctive characters in common. However, four genera, *Favia, Barabattoia, Favites* and *Monastrea,* may be confused.

Favia favus

Goniastrea retiformis

Leptoria phrygia

Diploastrea heliopora

Echinopora lamellosa

Oulophyllia crispa

GENUS

Caulastrea Dana, 1846

Characters: *Colonies* phaceloid with divergent branching. Septa finely dentate. Costae have fine costal spines. Edge zone developed

Caulastrea tumida

Branches short, thick

Corallites small (10-12 mm diameter) and circular or large (12-15 mm diameter) and oval to triangular, corallite walls thick ie. 1.5-2 mm

Septa slightly exsert to 2 mm, markedly thickened close to wall, dentations well developed especially on inner half of septal margin, columella trabecular and well developed

Edge zone 10-35 mm, max length unknown because all specimens (only four) in monograph series have short branches

Costae more developed toward branch extremities, smooth or finely dentate

Similar to *Caulastrea connata*.

GENUS

Favia Oken, 1815

Characters: Colonies are usually massive, either flat or dome-shaped. Corallites are monocentric and plocoid, each corallites projects slightly above the colony surface and have their own wall. Intratentacular division forms daughter corallites. Polyps are extended only at night and have a simple circle of tapering tentacles, often with a pigmented tip. *Favia* is similar to *Favites* but the latter has cerioid corallites. This distinction is sometimes arbitrary, because corallites of *Favia* are further characterised by subdividing equally, whereas, corallites of *Favites* usually subdivide unequally, producing daughter corallites of different sizes.

Species with small Corallites (averaging less than 8 mm diameter)

Favia stelligera

Colonies massive, columnar, hillocky or flat.

Corallites plocoid, very small (2.5-3.5 mm diameter), evenly distributed with thick walls.

Septa moderately exsert.

Paliform lobes large.

Theca usually thick, coenosteum smooth and frequently blistered

Budding is predominantly extratentacular, at least in colonies from exposed biotopes.

Growth form makes this species distinctive. Resembles *Montastrea* species but they have larger corallites.

Species with middle sized Corallites (averaging 8-12 mm diameter)

Favia pallida

Colonies massive and rounded

Corallites plocoid or ploco-cerioid, 6-10 mm diameter, usually less than or equal to 2 mm exsert,

Calices circular, irregularly squashed together or elliptical.

Corallites closely compacted in shallow water, more widely spaced in deeper water.

Septa are widely spaced, thickened over thecae and tapered towards centre, descend abruptly into corallite centre.

Paliform lobes range from being inconspicuous or absent to forming a crown. Septa have short dentations. Costae when present are regularly dentate and usually equal.

Coenosteum is smooth or slightly blistered. Ploco-cerioid colonies usually have thin walls and thin septa.

Similar to *F. favus* and *F. matthai*.

Favia speciosa

Colonies massive.

Corallites circular and closely compacted in shallow water, more widely spaced in deeper water.

Calices crowded with fine, numerous and regular septa.

Paliform lobes are often underdeveloped.

Similar to *F. pallida* but it has circular or elliptical calices which are less crowded and shallower.

Favia matthai

Colonies are massive and rounded, occasionally flat or encrusting.

Corallites are crowded, plocoid, circular, 9-15 mm diameter, shallow open calices.

Septa are thickened and exsert with large teeth near the wall.

A well developed paliform crown is present. Sometimes 3 cycles of septa appear as a series of crowns in concentric circles.

Costae beaded and not usually joined with costae of adjacent corallites

Coenosteum usually blistered

Budding is entirely intratentacular

Similar to *F. pallida* but *F. matthai* has shallower, more open calices with more exsert septa and a more prominent paliform crown or series of crowns, concentric circles of elongated septo-costal dentations are readily recognisable underwater. *F. favus* has markedly larger, more protruding corallites than *F. matthai* and substantially different calicular structures.

Favia helianthoides

Submassive.

Corallites plocoid and uniform in shape. Project 1-2 mm, 1.5-2 mm apart, calices 3-3.5 mm diameter.

Paliform lobes are well developed.

Septa neatly arranged and thickened over the walls.

Costae even and those of adjacent corallites join.

Intra and extratentacular budding is present.

Similar to *F. laxa* which has smaller more widely spaced corallites. *F. speciosa* has less conical corallites.

Diploastrea heliopora is also similar but it has larger corallites with much thicker septo-costae.

Favia lacuna

Colonies massive or submsassive.

Subplocoid corallies crowded and irregular in shape.

Septa thin, subequal and regular in height.

Subequal and thin costae.

Costae of adjacent corallites rarely meet.

Meandroid appearance with valleys.

Indistinct paliform lobes and

Columellae are small and compact.

Species with large Corallites (averaging more than 12 mm diameter)

Favia favus

Colonies are massive and rounded, sometimes flattened

Corallites plocoid, 12-20 mm diameter, up to 5 mm exsert with broad bases, ie conical corallites which are quite protruding. Corallites are usually circular but may be irregular in shape, endotheca almost always cylindrical, calices deep (in corallites where the theca is not exsert) or shallow.

Septa not usually in distinct orders, usually regularly exsert. Septal dentations present and slope inwards. Paliform lobes usually present but vary from barely recognisable to forming a distinct crown.

Costae are equal and frequently aligned between adjacent corallites.

Coenosteum usually blistered.

This is one of the most abundant and variable *Favia* species. It closely resembles the *F. amicorum* complex which has smaller more exsert corallites with thinner thecae. Similar to *F. pallida* however the corallites of this coral are plocoid to ploco-cerioid, 6-10 mm to 2 mm exsert, septa descend abruptly, and it has short dentations.

Favia rotumana

Colonies are massive and usually rounded.

Corallites crowded and fairly large. Cerioid to sub-plocoid, irregular shape sometimes forming short valleys with up to 3 centres.

Septa thin, and irregularly exsert, all descend steeply into corallite centre.

Paliform lobes are poorly developed. Dentations prominent and irregular giving a ragged appearance.

Septa not usually joined with adjacent corallites.

Coenosteum often blistered.

Favia rotundata

Colonies dome shaped or flat.

Corallites are thick walled and circular tending to be cerioid (9-22 mm in diameter).

Larger septa which reach the columella develop paliform lobes.

Septa and costae have regular dentations, equally exsert except septa of the third order which are reduced, septo-costae of adjacent corallites regularly adjoined although delineation between corallites is distinct.

Similar to *F. maxima* and *F. veroni* which have corallites of a similar size, but are generally more exsert.

Probably included in *F. flexuosa* by previous authors. *F. rotundata* differs because it has rounded, sub-plocoid corallites.

Favia lizardensis

Colonies are massive usually with a rounded surface.

Corallites plocoid, circular or oval, 10-13 mm diameter and regularly spaced.

All septa thin, fine, evenly exsert, usually thickened above thecae.

Paliform lobes weakly developed.

Small dentations present along septa.

Costae even, conspicuous.

Endothecae usually thin, walls of calices near vertical, coenosteum usually blistered.

Budding is intratentacular, mono- to tristomodaeal

Similar to *F. favus* but *F. lizardensis* has more regular, shallower corallites with thinner septa and usually much thinner thecae. Also resembles *F. pallida* as both species can have thin walls, but *F. lizardensis* has larger corallites and septa which are more exsert and which have more elongated dentations.

GENUS

Barabattoia Yabe and Sugiyama, 1941

Characters: Colonies submassive or encrusting. Corallites plocoid, exsert to very exsert, sometimes ramose and anastomosing (probably over depositing sediment). Columella small, paliform lobes absent or feebly developed. Costae prominent, equal, strongly dentate or beaded. Budding intratentacular, daughter corallites at a sharp angle.

Barabattoia amicorum

Colonies are submassive or encrusting

Corallites plocoid, exsert, sometimes ramose and anastomosing (probably over depositing sediment)

Columella small, paliform lobes vary from absent to forming a paliform crown

Costae always prominent, equal, strongly dentate or beaded

Budding - intratentacular, mono- to tristomodaeal budding, daughter corallites at a sharp angle

Patchy distribution, usually in turbid environments

Similar to *F. favus* but *F. amicorum* has more exsert corallites with smaller and thinner walls

GENUS

Favites Link, 1807

Characters: Colonies are usually massive, either flat or dome-shaped. Corallites are monocentric and cerioid, occasionally subplocoid. Corallites are usually reported with 6 - 14 mm in size. Adjacent corallites mostly share common walls. Paliform lobes are often poorly developed. Polyps are extended only at night and have a single circle of tapering tentacles like *Favia*. *Favites* is similar to *Favia* and also to *Goniastrea*. *Goniastrea* may be cerioid like *Favites*, inwhich case it is distinguished by the presence of prominent paliform lobes, and by having a very regular pattern of septa with relatively fine teeth.

Species with small Corallites (6-10 mm diameter)

Favites pentagona

Submassive to encrusting colonies sometimes forming irregular columns.

Corallites cerioid, less than 6 mm - thin walled and angular.

Septa usually two cycles, septa dentate, septa reaching columella have well developed paliform lobes forming a distinctive crown.

Septa variably exsert over thecae, frequently adjoined with those of adjacent corallites.

Budding intratentacular and extratentacular.

The paliform crown makes this species *Goniastrea*-like

Resembles *F. micropentagona* but corallites are larger.

Favites bestae

Colonies submassive to encrusting.

Corallites are thick walled and rounded, becoming subplocoid.

Few septa, uniform in height and usually in two alternating orders.

Paliform lobes and columellae are well developed.

Similar to *F. pentagona* which has angular corallites and irregular septa.

Also similar to *F. chinensis* which has no paliform lobes.

New species in Veron, 2000.

Favites acuticollis

Colonies submassive to encrusting.

Corallites are deep with very thin angular walls.

Corallites are usually less than 7 mm in diameter.

Few widely spaced septa.

No paliform lobes.

Similar to *F. pentagona* which has thicker walls, slightly larger corallites and well developed paliform lobes.

Favites chinensis

Massive, rounded colonies

Corallites 10-13 mm diameter, angular or irregular shape, sometimes ploco-cerioid.

Septa usually spaced irregularly and widely, aligned with septa of adjacent corallites.

Characteristically elongated septal dentations.

Thecae thin and angular, sometimes deep intercalicular groove in ploco-cerioid colonies

Similar to *F. abdita* - but *F. chinensis* has larger corallites, usually angular, fewer septa and (less reliably) fewer but more elongated dentations.

Species with middle sized Corallites (10-13 mm diameter)

F. abdita

Massive, rounded, flattened, hillocky

Corallites cerioid, 7-12 mm, rounded rather than angular becoming more angular when walls are thin/calices are larger.

Septa usually uniform in thickness, regular spacing, teeth along septa.

No paliform lobes.

Thecae variable within a single colony: thin and irregular on hillocky parts and broad on flat sides where calices are shallow.

Budding always intratentacular and usually very unequal

Most widespread species of *Favites*, found in all biotopes of hermatypic corals.

Similar to *F. halicora* and *F. flexuosa*.

F. halicora

Massive, rounded or hillocky.

Corallites cerioid becoming sub-plocoid with thick walls, calices approx 1 cm diameter.

Septa usually equal, sometimes two alternating cycles, fine, dentate, dentations larger at calice centre forming 1 or more paliform lobes and a distinct *Goniastrea*-like paliform crown.

Thecae characteristically thick, septa do not form ridges over thecae.

Budding mostly intratentacular, some extratentacular

Similar to *F. abdita* - *F. halicora* has more rounded corallites, thicker thecae, paliform crown

F. complanata

Usually massive with an uneven surface.

Corallites approx 12 mm diameter, cerioid or slightly sub-plocoid, usually slightly angular in outline.

Septa in two alternating cycles.

First cycle septa thick, especially near thecae, 4 or 5 prominent dentations and a distinct paliform lobe, Secondary septa very reduced.

Septa of adjacent corallites usually adjoined, sometimes an intercorallite groove present.

Columellae usually large and compact.

Similar to *F.abdita* which has more angular corallites.

Species with large Corallites (over 14 mm diameter)

F. flexuosa

Massive or encrusting, usually flat or spherical ie surface mostly even/Not hillocky.

Corallites always cerioid, usually angular, 1.5-2 cm diameter.

Septa usually two alternating orders, primary septa strongly dentate, especially towards centre where dentations form one or more irregular paliform lobes, secondary septa are usually much reduced, much thinner and usually slightly less exsert.

All septa usually regularly adjoined above thecae.

Budding intratentacular

Similar to *F. abdita* which has smaller and less angular corallites. Also similar to *Acanthastrea echinata* which has larger septal teeth and thick fleshy polyps.

GENUS

Goniastrea Milne Edwards and Haime, 1848

It is one of the toughest of all corals and can tolerate several hours of exposure to the tropical sun during the low tide and also muddy or low salinity conditions.

Characters: Colonies are massive, usually spherical or elongate. Corallites are monocentric and cerioid to polycentric and meandroid. Paliform lobes are well developed. Meandroid colonies have well-defined columella centres. Polyps are extended only at night. *Goniastrea* has similaraties with *Favites, Leptoria* and also *Platygyra*. *Platygyra*, like *Goniastrea* can be cereoid or meandroid but has no paliform lobes and columella centres and is seldom distinguishable.

Monocentric species with Corallite diameter mostly less than 5 mm

Goniastrea retiformis

Colonies usually massive tending towards spherical or columnar, common in intertidal zones.

Corallites have a neat cellular appearance, cerioid, 4-6 sided, uniform in size (3-5 mm diameter).

Long and short septa alternate and septa plunge steeply to columella.

Paliform lobes are large and form a distinct crown.

Columellae are small.

Septa are not continuous over thecae.

Similar to *Goniastrea edwardsi* which has thicker walls and septa and more irregular corallites.

Goniastrea edwardsi

Colonies usually massive tending towards spherical or columnar, common in intertidal zones.

Corallites are 2.5-7 mm diameter, slightly angular with thick rounded walls.

Septa plunge steeply inside thecae then project inwards forming large paliform lobes.

Columellae are small.

Septa of adjacent corallites are often separated by a thin ridge along the top of the relatively thick thecae

Similar to *G. retiformis*. *G. aspera* has larger corallites.

Goniastrea minuta

Colonies usually encrusting, becoming submassive corallites are angular, ceroid with a uniform appearance.

Corallite walls are thin.

Long and short septa alternate.

Paliform lobes well developed forming a crown.

Similar to *G.retiformis* the corallites of this species are larger. Very similar to *Porities*.

New species described in Verson, 2000.

Predominantly Monocentric species with a Corallite diameter over 5 mm

Goniastrea palauensis

Massive colonies sometimes flattened or hillocky.

Corallites monocentric, usually 3-6 straight and thick walls, cerioid or (rarely) sub-plocoid, calices usually 6-15 mm diameter

Columellae are small and surrounded by a crown of tall paliform lobes.

Septa are straight and neat in appearance and frequently adjoined over the theca.

Thickness of the thecae is the most variable character of this species, from 2-8 mm in cerioid colonies, sub-plocoid colonies have weakly developed costae.

Similar to *G. aspera* and *G. peresi* which have smaller corallites.

Goniastrea aspera

Colonies rounded, massive or encrusting.

Corallites cellular in appearance, cerioid, deep with straight sided walls, 7-10 mm diameter.

Septa evenly spaced, descend abruptly, paliform crowns usually very conspicuous.

Columellae small

Thecae usually thin

Budding usually monostomodaeal but may be tristomodaeal in areas of rapid division

Probably restricted to shallow water inside barrier reefs

Similar to *G. edwardsi* which has similar skeletal structures but is much smaller. Also *G. favulus*.

Predominantly Meandroid species

Goniastrea australensis

Massive, submassive or encrusting

Meandroid or submeandroid with valleys of 1, 2 or 3 centres, or combinations of both

Corallite centres usually distinct with large, conspicuous columellae linked by trabecular-like septal processes.

Septa regularly spaced, usually equal and evenly exsert, usually have paliform lobes.

Valleys of most colonies are deep and steep sided, septa adjoined over theca with septa of adjacent valleys.

Thecae may show great variation in thickness, valleys in colonies with very wide thecae may be separated by a groove and may become sub-plocoid.

Similar to *Platygyra lamellina* but this species has no paliform lobes.

Colonies of *G. australensis* with sub-meandroid or monocentric corallites have valleys of more regular width and more regularly spaced septa than *G. pectinata*.

Goniastrea pectinata

Colonies mostly submassive or encrusting

Corallites monocentric or submeandroid with seldom more than three centres

Septa have well developed paliform lobes

Thecae are variable in thickness but do not show the extremes of variation found in *G. australiensis*

Similar to *G. edwardsi*, which has smaller corallites. *G. australiensis* has valleys of a similar width but is usually fully meandroid. Also resembles *Merulina scheeri*.

GENUS

Platygyra Ehrenberg, 1834

Characters: Colonies are massive, either flat or dome-shaped. Corallites are rarely cerioid, commonly meandroid. Paliform lobes are not developed; columellae seldom form centres and are continuous tangle of species. Polyps are extended only at night. *Platygyra* is similar to *Goniastrea* and *Leptoria*. *Leptoria* is more meandroid than *Platygyra,* has distinctive wall-like columellae and has uniformly spaced septa of equal size. All species of *Platygyra* shows similar skeletal modifications along environmental gradients and some, especially *P. daedalea and P. lamellina*, may sometimes be difficult to distinguish unless they occur together.

Species which are Monocentric or form only short valleys

Platygyra pini

Massive and rounded or flat, sometimes encrusting

Valleys short, usually with one or two recognisable centres

Walls are usually fairly thick, but this is variable.

Septa are usually thin but may be very thick if walls also very thick, septa dentate

Septa form distinctive paliform lobes

Columellae trabecular, usually well developed with centres tending to form at the ends of valleys

Resembles *P. sinensis* because of short valleys, however *P. pini* has thick walls, paliform lobes and much greater development of the columella.

Platygyra verweyi

Colonies massive

Valleys short forming subcerioid to submeandroid with thin acute walls, sometimes walls perforated at the top, valleys or calices deep.

Goniastrea - like neat skeletal structure, septa are thin, uniformly spaced and not exsert, septal cycles not distinguishable, columellae are weakly developed or absent.

Similar *P. sinensis* which is more meandroid with shallower calices. *P. pini* has more widely spaced, more irregular septa.

Species which are primarily Meandroid

Platygyra sinensis

Massive and rounded, occasionally flat

Valleys usually very short, mostly monocentric but some colonies do have long meandering valleys

Septa thin, only slightly exsert, evenly spaced, dentate

Columella are narrow and largely composed of loosely intertwined trabeculae. No columellae centres.

Similar to *P. ryukyuensis*.

Platygyra daedalea

Polymorphic species

Massive, either rounded or flattened, or sometimes encrusting

Valleys usually long, but sometimes short or mixtures of both, walls usually narrow and often perforated

Septa very exsert, usually with pointed or ragged tips and frequently adjoined by fine trabecular linkages above the wall.

Columellae of various widths but are usually conspicuous, spongy, trabecular, centres not formed or only formed where valleys join

Colour variable, often brightly coloured, frequently with brown walls and green valleys, darker colours on shaded sides of colony.

Platygyra lamellina

Massive and rounded, occasionally flat

Valleys usually elongated except on concave surfaces where they may become short or monocentric

Walls are characteristically thick ie 1-1.5 times the valley width.

Septa are continuous across walls, only slightly exsert, evenly spaced, dentate.

Columellae are usually narrow and not significantly different from *P. daedalea*, little tendency to form a recognisable centre

Similar to *P. daedalea* which is much more common, but *P. lamellina* has a much thicker wall and more rounded, less exsert septa.

Colonies of *P. sinensis* with short valleys resemble *P. lamellina* but this species has a much thicker wall and different septal structures.

Similar to *P. pini* but *P. lamellina* has no paliform lobes and a different columella structure.

Platygyra acuta

Massive and meandroid with walls forming an acute or sharp edge.

Septa are uniformly exsert and have ragged margins.

Columella are well developed but do not form centres.

Similar to *P. daedalea* which has weakly developed columellae but does not have walls with acute edges.

Also resembles *P. sinensis* but this species has more meandroid valleys and walls of uniform thickness.

GENUS

Oulophyllia Milne Edwards and Haime, 1848

Characters: Colonies are massive, monocentric to meandroid, composed of large valleys with widely spaced, ragged septa and acute thin walls. Paliform lobes are usually present. Polyps are extended only at night. This genus is similar to *Platygyra.*

Oulophyllia crispa

Valleys are usually fairly short, sometimes monocentric. Valleys are 9 20 mm wide

Septa usually compact, in 2 to 3 orders and are continuous between valleys.

Paliform lobes may be developed.

Thecae are variable in width, acute angle of valley walls is emphasised by slope of septa.

Oulophyllia levis

Colonies dome shaped.

Meandroid appearance with valleys.

Valleys are perpendicular at the margins and sinuous in the center of the colony.

Valleys with atleast three centers, shallow and V shaped and with sharp upper margins.

Columellae weakly developed.

Similar to *O. crispa* which is with deep and large valleys.

GENUS

Leptoria Milne Edwards and Haime, 1848

Characters: Colonies are massive with an even surface and dense skeleton. Corallites valleys are highly meandroid and uniform. Septa are uniformly spaced and are of equal size. Columellae are wall-like with a lobed upper margin and do not form centres. Paliform lobes are absent. Polyps are extended only at night. *Leptoria* is similar to *Platygyra* and *Goniastrea*. *Goniastrea* is less meandroid than *Leptoria*, has columella forming distinct centres and well-developed paliform lobes.

Leptoria phrygia

Massive colonies can be submassive or ridges with an even surface and dense skeleton.

Corallites meandroid with valleys of indefinite length, valleys have a very neat appearance being of constant width, thecae are always thick and dense.

Septa are all even in size and spacing and regularly adjoined with those of the adjacent valley, columellae are a series of vertical plates.

GENUS

Montastrea Blainville, 1830

Characters: Colonies are massive, either flat or dome-shaped. Corallites are monocentric and plocoid. Daughter corallites are predominantly formed by extratentacular budding, which is, budding from the wall of parent corallites. Some intratentacular budding may also occur. This genus can be separated readily from the other massive faviid genera with extratentacular budding (*Plesiastrea, Diploastrea, Leptastrea, Cyphastrea*) because each of these has well defined characters.

Species with small Corallites (less than 7 mm diameter) and no groove and tubecule formation

Montastrea curta

Colonies massive to encrusting with round or flat surfaces.

Corallites moderately exsert, usually circular or sometimes squeezed into irregular shapes, calices 2.5 - 7.5 mm diameter.

Septa descend vertically just inside theca then curve inwards deep within the calice

Paliform crown deep within the calice

Costae not adjoined with those of adjacent corallites, beaded forming concentric circles with beads on adjacent costae

Budding is always extratentacular.

Species with middle sized Corallites and groove and tubercle formations

Montastrea colemani

Colonies encrusting and becomes submassive.

Round and compact plocoid corallites.

Groove and tubercle (barnacle) formations distinctive.

Two cycles of prominent alternating septa.

Paliform lobes well developed.

Similar to *M. valenciennesi*, and are distinguished with larger and more angular corallites.

Species with large Corallites (over 9 mm diameter)

M. valenciennesi

Colonies are massive with rounded or flattened surfaces, sometimes encrusting

Corallites distinctly polygonal, usually hexagonal, 8-15 mm diameter

Septal dentations present along the upper margins of septa

Paliform lobes form a distinct crown

Costae are prominently beaded

This species is usually characterised by the presence of 'groove and tubercle' structures intersperse between most calices. These structures consist of very thin walled tubes up to 0.5 mm diameter which have circular or elongated openings at irregular intervals on their upper surfaces. They have calcareous walls identical to, and continuous with the epitheca (a fine skeletal layer) which is normally visible as a fine laminar the periphery of most colonies. Polychaetes live within these tubes.

Extratentacular and intratentacular budding, with extratentacular being dominant.

M. magnistellata

Colonies are massive or encrusting with flattened or irregular shapes

Corallites usually slightly exsert, circular, 7-15 mm diameter

Septa in 2 alternate orders, sloping gradually or sharply to calice centre, septal dentations present along the upper margin of septa.

Paliform lobes can usually be distinguished.

Costae are usually unequal, not adjoined with those of adjacent corallites and may be separated by a small ridge

Similar to *M. valenciennesi* which has less compact, irregular septa.

GENUS

Plesiastrea Milne Edwards and Haime, 1848

Characters: Colonies are massive, rounded or flattened. Coralla are sub-cerioid to plocoid with round corallites produced by extra-tentacular budding. Like *Montastrea,* but corallites are smaller, with a well developed paliform crown composed of true Pali. Polyps are usually extended only at night. *Plesiastrea* is close to *Montastrea* but has smaller corallites with well-developed paliform lobes.

Plesiastrea versipora

Massive or encrusting

Corallites average 3 mm diameter, range from 2.5-5 mm diameter.

Pali form a defined paliform crown varying from thick wedges to fine pinnacles.

Columella are small, usually consisting only of a few pinnacles.

First order costae are always present and those of other orders may be equal or absent

Coenosteum smooth, blistered or ornamented with granules.

Sometimes confused with other faviids with corallites of a similar size notably *Favia stelligera* and some *Montastrea* and *Cyphastrea* species.

GENUS

Oulastrea Milne Edwards and Haime, 1848

Characters: Colonies are encrusting and grow to only a few centimeters in diameter. Corallites are like a small *Montastrea.* The skeleton remains black with septa when dries. Well defined genus.

Oulastrea crispata

Colonies are encrusting and grow to only a few centimeters across.

Corallites are like a small *Montastrea* species, are of uniform size and are closely compact.

Long and short septa are alternate.

Paliform lobes are well developed.

Tentacles are sometimes extended during the day.

GENUS

Diploastrea Matthai, 1914

Characters: Colonies are dome-shaped with a very even surface and may be up to 2 m high and 7 m in diameter. The skeleton is very dense. Corallites are plocoid. Columellae are large. Septa are equal and are thick at the wall and thin where they join the columellae.

Polyps are extended only at night. Well-defined genus. This is one of the most easily recognised of all corals.

Diploastrea heliopora

Colonies large, dome shaped with a very uniform surface

Skeleton is dense

Corallites form low cones with small openings and very thick walls.

Columellae are large

Septa are equal and are thick at the wall and thin where joining the columellae.

GENUS

Leptastrea Milne Edwards and Haime, 1848

Characters : Colonies are massive, usually flat or dome-shaped. Corallites are subcerioid to plocoid. Costae are poorly developed or absent. Columellae consist of vertical pinnules. Septa have inward-projecting teeth. Polyps are extended only at night. *Leptastrea* is a well-defined genus closest to *Cyphastrea,* which is plocoid with widely separated corallites.

Leptastrea bottae

Massive to encrusting

Corallites are cylindrical, separated only by a fine groove.

Septa are in 3 cycles, the longest being distinctive and exsert

Groove and tubercle formulations are sometimes well developed.

Similar to *Leptastrea inaequalis* which has corallites of a similar size, but these are barrel-shaped, more exsert, usually have extensive groove and tubercle formations and have few, if any, third cycle septa.

Leptastrea purpurea

Colonies are irregular, encrusting or massive and to 1 metre diameter.

Sub-cerioid, polygonal and characteristically variable in size (2-11 mm diameter) with smaller calices in depressions or around worm or gastropod holes etc.

Smaller septa may fuse with larger septa

Septal dentations around the columella may form paliform lobes

Septa usually slope gently towards the columellae

Columellae consist of one or a few pinnules, larger calices frequently have prominent columellae of many pinnacles

Costae are usually poorly developed

Coenosteum between adjacent corallites is usually a narrow, smooth strip

Thickness of thecae are very variable

All budding is extratentacular.

Similar to *L. transversa* which has characteristically deeply plunging septa.

Leptatrea transversa

Massive or encrusting

Calices or polygonal, 2-9 mm diameter and show much less size variation

Septa are characteristically deeply plunging, usually they extend inwards approx 2/3 of the calice radius before descending vertically or near vertically.

Paliform dentations become vertical towards the calice centre where they fuse with each other to form a series of papillae

The columellae sometimes have a spongy, trabecular nature

Intracalicular groove may be absent in some colonies or parts of colonies, in such cases septa are adjoined or alternate.

Resembles *L. purpurea* in that the wall, peritheca, costae and intercalicular groove are mostly similar in both species, septa usually slope gently towards the columellae in *L. purpurea*

All budding is extratentacular.

GENUS

Cyphastrea Milne Edwards and Haime, 1848

Characters: Species are massive to columnar with a smooth or hillocky as in the case of *C. serailia* and massive or encrusting as in the case of *C. microphthalma*. Corallites are plocoid, with calices less than 3 mm in diameter. Costae are generally restricted to the corallite wall; the coenosteum is granulated. Polyps are extended only at night. *Cyphastrea* is a well-defined genus. It resembles *Echinopora* and *Plesiastrea versipora,* which is distinguished by having larger corallites with well-developed paliform lobes and by having costae of adjacent corallites in contact, with no coenosteum granules. It also resembles some *Montastrea* with small corallites.

Cyphastrea serailia

Massive to columnar or encrusting

Corallites round, variably exsert from sub-cerioid to ~3 mm, calices 1.5 - 2.8 mm diameter

Septa 2 very unequal orders of 12 septa each, second order is usually less than half the calice radius.

Columellae usually inconspicuous.

Costae are equal or subequal, frequently poorly developed, heavily ornamented with granulated perithecal spines. Costae don't alternate strongly

Thecae very greatly in height and thickness, they may be abruptly delineated from the coenosteum or be completely confluent, coenosteum often blistered and is always covered with granulated exothecal spines

This is the most abundant species in this genus - therefore the greatest diversity of growth forms and range of calicular structures.

Similar to *Cyphastrea chalcidicum* which has well developed alternating costae. *Cyphastrea microphthalma* has 10 primary septa.

Cyphastrea microphthalma

Usually encrusting, sometimes massive, colonies are often infested with borers esp. *Lithophaga* and polychaetes

Usually plocoid with a tendency to become cerioid in many specimens, calicular structures very granulated

Calices 1-2 mm diameter, 2 orders of septa, primarily characterised by 10 (sometimes 11) first order septa, first order septa exsert, second order septa are less exsert and never reach the columellae

Columellae consist of a few twisted trabeculae

Costae usually equal and support elongated, granulated perithecal spines which extend across the coenosteum, giving an elaborate ornamentation

Colonies usually pale and uniform in colour, except in turbid or shaded habitats where colonies are usually dark brown or dark green.

GENUS

Echinopora Lamarck, 1816

Characters: Colonies are massive, arborescent or foliaceous or mixtures of these forms. Corallites are plocoid with calices up to 5 mm in diameter. Septa are exsert and irregular. Columellae are usually prominent. Costae are usually restricted to the corallite wall. The coenosteum is granulated. Polyps are extended only at night. *Echinopora* is a well-defined genus. It is closer to *Cyphastrea*, which is distinguished by its massive, or encrusting growth form. The corallites of these genera are similar; those of *Echinopora* are usually larger, with thicker walls and more prominent columellae and septa.

Echinopora lamellosa

Laminar sometimes with hollow tubes to 30 cm high developing from the central part of some colonies

Corallites 2.5-4 mm diameter, circular, cylindrical or markedly conical, equal or subequal in height

Septa of the first and sometimes second cycle are exsert

A ring of paliform lobes is usually present and may be as tall as the septal spines

Spines on and between corallites are uniformly distributed and quite close together - this is characteristic of this species, giving colonies of this species a "furry" rather than spiky appearance

Similar to *E. ashmorensis, E. pacificus* and *E. gemmacea*.

Echinopora horrida

Always branching, branches vary in extent of anastomosis, sometimes with a flat expanded laminar base, branches upto 40 mm diameter (growth form overlap with *E. mammiformis*)

Corallites to 4 mm in diameter, circular, cylindrical or with the shape of a truncated cone, superficial or protuberant.

Primary septa exsert and thick at the periphery of the calice with tall prominent spines

Paliform dentations present

Costae increase in size towards the base of the corallites, costae on and between corallites bear well developed, irregularly spaced spines often have an inflated base

Septal and costal spines give colonies a spiky appearance

Similar to *Echinopora gemmacea* which does not form extensive branches.

Echinopora gemmacea

Laminar, rarely thick or encrusting, sometimes with solid (not hollow) irregular proliferations (never the characteristic dendroid growth form of *E. horrida*)

Corallites upto 5 mm diameter, circular or slightly elongated, cylindrical and superficial or conical and protruding, conical corallites are sometimes inclined, marginal corallites slightly smaller and inclined towards periphery.

Prominent upper lobe or spines on first cycle septa

Paliform lobes not well developed (in contrast with *E. lamellosa*).

Costae on and between corallites are well developed and bear well developed, irregularly spaced spines

Septal and costal spines give colonies a spiky appearance

Echinopora hirrutissima

Colonies laminar explanate or contorted in vertically rising, hollow projections without apertures at the top

Corallites superficial/slightly protruding, sometimes inclined

Septa larger septa are fairly thick, very exsert, hirsute, reach the columellae, have two or three very prominent lobes, outer septal lobe often flattened or divided sometimes appearing to replace the first costal spine

Costae well developed, equal or subequal have numerous tall spines well developed ornamented with abundant granulations and echinulations.

Similar to *E. horrida* and *E. gemmacea* which have less coarse corallite structures and smaller corallites.

GENUS

Moseleya Quelch, 1884

Characters: Monospecific genus. Colonies always small (maximum colony size approx 25 cm). Large central calice often present, calices are angular and cerioid. Septa are numerous, different cycles are evident, small dentations are present along the length of the septa, paliform lobes developed. This species has only been recorded in areas which are turbid or with muddy substrates. Corallites produced by extratentacular budding at the colony perimeter.

Moseleya latistellata

This species occurs as very small colonies, with a maximum colony size of approx 25 cm.

Large central calice often present, calices are angular and cerioid

Corallites produced by extratentacular budding at the colony perimeter

Septa are numerous, different cycles ae evident, small dentations are present along the length of the septa, paliform lobes are developed.

This species has only been recorded in areas which are turbid or with muddy substrates

May resemble *Acanthastrea* species which can have the same colony and corallite shapes

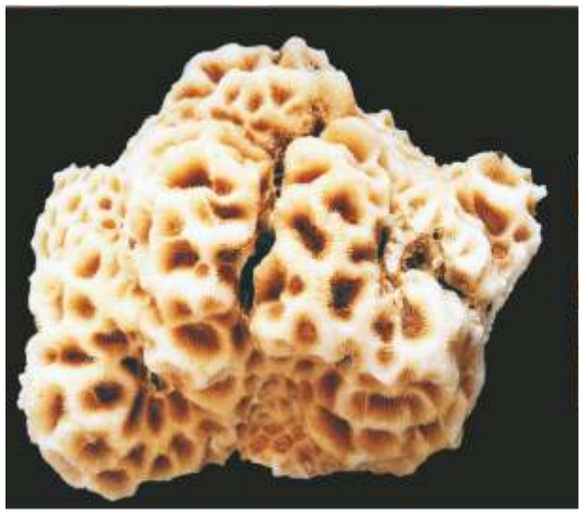
FAMILY : **FLABELLIDAE** Bourne, 1905

This family consists of about 104 species (including 5 infraspecific species) belonging to 10 genera, which are all azooxanthellate, out of which only 3 species belonging to 2 genra are reported from India, living lot of scope for research. They are found in deeper waters (usually bellow 25 meter depths).

Solitary, free-living corals with non-exsert septa, no paliform lobes and thin walls primarily composed of epitheca.

Favia favus

Favites fleuxuosa



Favites halicora

Goniastrea edwardsii

Platygyra lamellina

Platygyra daedalea

Oulophyllia crispa

Leptoria phyrgia

Echinophora lamellosa

Cyphastrea micropthalma

Leptastrea transversa

Diploastrea heliopora

Barabattoia amicorum

GENUS

Flabellum Lesson, 1831

Solitary, free-living corals that are purse-shaped with or without rootlets. Septa are very fine and numerous. Columellae are absent or nearly so. Polyps are extended day and night and are large, like *Tubastrea*. In India it is recorded only in Lakshadweep. *Flabellum pavonium* Lesson, 1831 is the only species reported in India.

Flabellum japonicum

Solitary, free ling.

Calice 24 -26 mm long by 26 -28 mm high.

Very low arch to calicular margin, fairly compressed slight wings on lower part, rather constricted just below calicular opening,

Septal edges are pleated and sides spiny.

Septa in five cycles, four complete and the fifth incomplete.

Flabellum pavonium

Solitary, free ling.

Corallum wedge-shaped.

Externally have 12 marked ridges.

Septa in four cycles.

Septal edges are toothed, especially in the region of conjunction with columella.

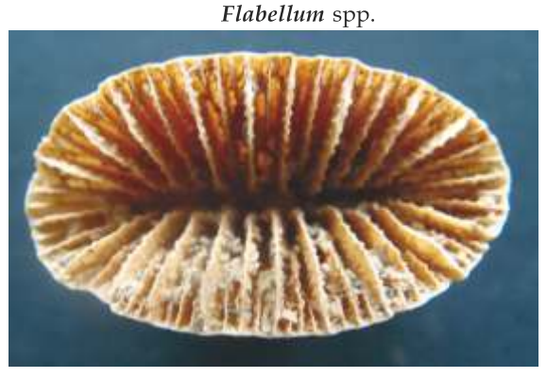
Placotrochus Milne Edwards and Haime, 1848

Solitary, free-living and purse-shaped.

A thin, plate-like columella is present.

Placotrochus laevis Milne Edwards and Haime, 1848 is the only species reported from India.

Flabellum spp.



Flabellum pavonium

FAMILY : **FUNGIIDAE** Dana, 1846

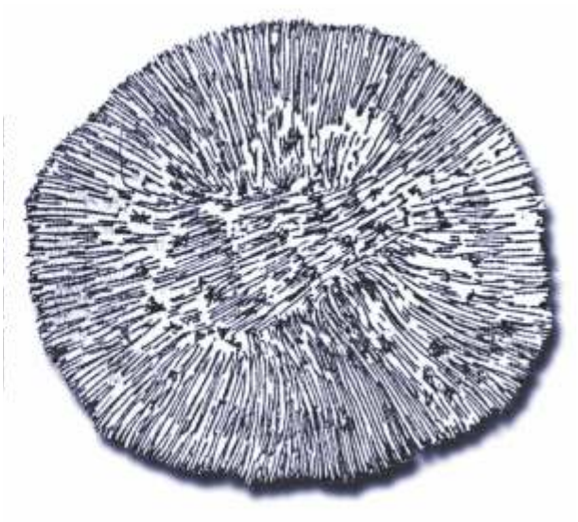
Characters: Solitary or colonial, free-living or attached, mostly hermatypic and extant. Colonial genera are derived from solitary genera and each has septo-costal structures corresponding to those of a solitary genus. These septo-costae radiate from the mouth on the upper surface as septa and from the centre of the undersurface as costae.

Anthocaulus - the early attached stage of development

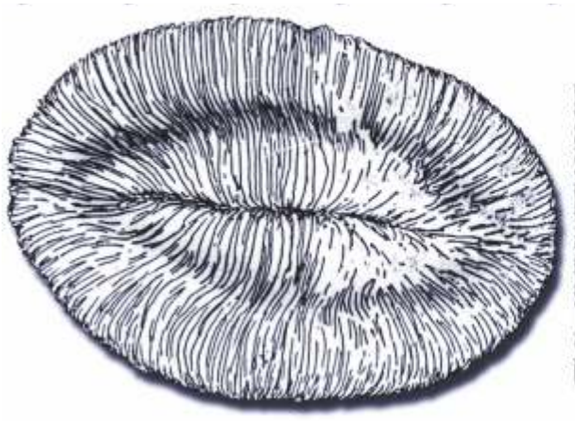
Anthocyathus - the later free-living stage of development

There are about 14 genera included under this family out of which 12 genera are reported from India. The total number of species recorded in the world are 51 and out of which only 29 species are reported from India.

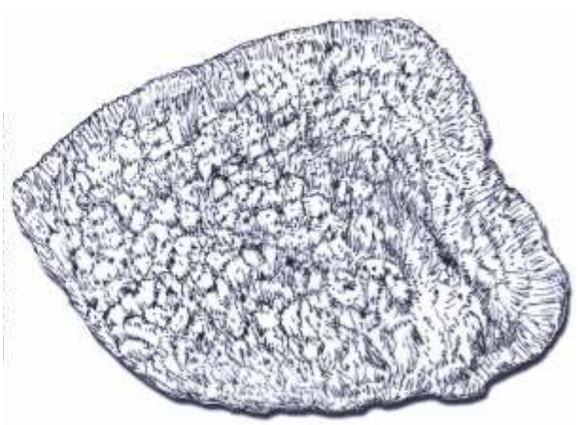
Cycloseris cyclolites



Halomitra pileus



Fungia paumotensis



Podabacia crustacea

GENUS

Cycloseris Milne Edwards and Haime, 1849

Characters: Solitary, free-living, flat or dome-shaped, circular or slightly oval in outline, with a central mouth. Septa have fine teeth; costae are fine, without undersurface pits. Polyps are usually extended only at night. Fine tentacles cover the upper surface of the disc. *Cycloseris* is close to *Fungia* and resembles *Diaseris*. *Fungia* grows larger than *Cycloseris*, may be elongate, and has septa with larger teeth and costae composed of rows of spines. *Diaseris* is composed of wedge-shaped segments giving an irregular shape; septa are thick with blunt teeth.

Cycloseris cyclolites

Circular or slightly oval domes up to 40 mm wide with a concave undersurface.

Septa are straight and symmetrical.

Primary septa thick and exsert around the mouth.

Similar to *C. curvata*

Cycloseris sinensis

Polyps flat, circular or irregular in outline.

Little or no central dome. Central fossa is deep.

Oral disc is smooth due to thick, tightly packed and even septa.

Costae are fine and developed near colony perimeter.

Cycloseris hexagonalis

Polyps flat, with a slight central dome around the mouth.

Septa are not thickened or exsert around the mouth.

Juvenile corals have an angular outline.

Costae are fine and developed near the colony perimeter.

Cycloseris costulata

Polyps circular, helmet-shaped with a concave undersurface.

Primary septa are thick and exsert around the mouth.

Similar to *C.cyclolites* which is more dome-shaped and septa around the mouth less exsert.

Cycloseris patelliformis

Polyps circular to slightly oval, with a large central dome and flat undersurface. Costae and septa do not alternate at colony margin.

Cycloseris somervillei

Polyps are oval and flat, with an arched central dome and a flat undersurface.

Elongate axial furrow.

Primary septa exert on the central dome.

Similar to *C. patelliformis* which is not distinctly oval.

GENUS

Diaseris Edwards and Haime, 1849

Characters: Corals are flat, solitary, free-living polyps, which are composed of several fan-shaped segments with a mouth situated at the point of divergence of the segments. Septa are thick with blunt teeth resembling rows of granules. Corals are commonly inflated with water. The increased surface area may help to prevent burial in soft substrates and may also facilitate movement across the substrate.

Diaseris distorta

Polyps consist of fan-shaped segments up to 40 mm wide.

Thick beaded septa of unequal height.

Polyps can inflate with water to several times their size.

D. fragilis is larger with thinner margins and has septa of uniform height.

GENUS

Fungia Lamarck, 1801

Characters: Corals are solitary, free-living (except for juveniles), flat or dome-shaped, circular or elongate in outline, with a central mouth. Septa have large or small, rounded or pointed teeth; costae consist mostly of rows of spines. The disc often has pits between the costae on the lower surface. *Fungia* is distinguished from *Cycloseris* by growing much larger, frequently being elongate, often having septa with larger teeth and costae with large spines and sometimes having pits on the lower surface.

1. Species with large septal teeth

F. corona

Polyps have an irregular outline, flat to strongly convex, light polyps.

Septa are of different sizes and have large pointed teeth.

Costae are widely spaced with simple spines.

The undersurface has pits between costae.

Similar to *F. danai* and *F. scruposa*

F. danai

Polyps circular, arched around the mouth and lightly calcified.

Septa are straight with large teeth and a prominent tentacular lobe.

Costae are compact with large branching spines.

The undersurface has pits between costae.

Similar to *F. horrida* which does not have prominent tentacular lobes. *F. corona* does not have a strong central arch and has a thinner, more irregular polyp disc with many perforations.

F. horrida

Polyps circular and thick. Strongly arched around the mouth.

Septa are straight with very large irregular teeth.

Tentacular lobes are weakly developed.

Costae unequal with very long spines.

No pits between costae.

Similar to *F. danai* and *F. corona* which does not have a central arch and has simple costal spines.

F. klunzingeri

Circular polyps, flat or with a central arch.

Septa of different sizes with large triangular septal teeth which have a central rib and form a regular pattern.

Tentacular lobes are usually not developed.

Costae are widely spaced and have simple spines. The undersurface has pits between costae.

Similar to *F. horrida* which does not have regular triangular septal teeth.

2. Species with Saw-like teeth and usually a central rib

F. fungites

Polyps circular.

Septa triangular, pointed and usually have a well defined central rib.

Costal spines tall, conical and smooth.

Similar to *F. repanda* which has finer septal teeth.

3. Species with middle sized, rounded teeth

F. concinna

Circular, flat.

Septa densely packed.

Septa are smooth due to small septal teeth and costal spines.

No pits on the undersurface.

Similar to *F. repanda* which has coarser septal teeth, pits between the costae and is usually more arched.

F. repanda

Circular polyp - thick and arched or flat

Septa are almost equal at the polyp perimeter.

Fine septal teeth.

Pits between costae.

Costal spines granular.

Similar to *F. scabra* which has finer septal teeth.

F. granulosa

Polyps circular and flat or with a central arch.

Thick wavy septa with finely granulated margins.

Wavy shape caused by wide tentacular lobes (where septa commence).

Costae fine with pits between. Similar to *F. scabra.*

4. Species with distinctly Non-circular polyps

F. scutaria

Oval, thick and heavy up to 17 cm long.

Primary septa commense with a tall tentacular lobe.

Lobes distributed at regular intervals from the mouth to perimeter.

Similar to *Fungia seychellensis.*

F. paumotensis

Elongate polyps up to 25 cm long with almost parallel sides.

Strong central arch.

Straight and uniform costae.

Most primary septa reach from mouth to the perimeter.

Similar to *F. moluccensis.*

F. moluccensis

Polyps attach or encrust to the substrate.

Central arch - shape of polyp often contorted.

Secondary mouth sometimes present.

Irregular costae.

Attachment scar is usually prominent.

Similar to *F. paumotensis* which is heavier, less irregular and has thicker septa and costae which are straight and uniform.

GENUS

Ctenactis Verrill, 1864

Characters: Polyps are elongated with a prominent central furrow, which may have one to several mouths. Adults are free-living and either mono- or poly stomatous. Septa are neatly spaced and have large triangular evenly spaced teeth. Septal dentations are coarse and either angular or rounded-lobate. The coastal spines are relatively large and echinose. It is similar to Fungia and Herpolitha.

Ctenactis echinata

Elongate polyp - single mouth.

Well developed septal dentations and costal spines.

Similar to *Ctenactis crassa* which has a series of mouths.

Ctenactis crassa

Elongate polyp, axial furrow extends almost to the polyp ends - several mouths.

Similar to *Ctenactis echinata* which only has a single mouth.

GENUS

Heliofungia Wells, 1966

Characters: Monospecific genus. Coralla solitary, circular to slightly oval, flat to slightly arched around the central mouth, free-living, skeletons usually imperforate (some pits may be seen at the margins). Septa are solid, vertical plates radiating in straight lines, unequal in size with larger septa forming thick, exsert plates. Septal dentations large (compared with *Fungia*), lobulate, rounded to triangular. Costae numerous, all of similar thickness, virtually continuous from the centre to the corallum margin. Costae are not elaborate, possessing only microscopic costal spines. Polyp large with long, continually extended tentacles

Heliofungia actiniformis

Polyps solitary, free-living and flat with a central mouth up to 30 mm wide

Septa have large lobed teeth

Polyps very large

Long tentacles extend during the day and night.

GENUS

Herpolitha Eschscholtz, 1825

Characters: Adults are free-living, elongate, with an axial furrow that may extend to the corallum ends. Several centres, corresponding with mouths, are arranged along the furrow and secondary centres are distributed over the rest of the upper surface. The corallum wall is perforated and not covered by granulations. The granulations on the septal sides are arranged in rows perpendicular to the septal margins. Septa are similar in structure to those of *Fungia* (*Pleuractis).* Polyps are extended only at night. Tentacles are short and widely spaced, like *Fungia*. Secondary centres have single tentacles. *Herpolitha* has similar shape to *Fungia (Ctenactis).* It also has similarities with *Polyphyllia*, although the latter has very distinct septa and more numerous centres.

Herpolitha limax

Polyps can have many shapes, usually elongate with rounded ends but may be X or Y shaped.

Mouths occur within the axial furrow which can extend most of the length of the colony.

Secondary mouths outside the axial furrow are numerous.

Similar to *Herpolitha weberi.*

GENUS

Polyphyllia Quoy and Gaimard, 1833

Characters: Coralla are polystomatous, mostly elliptical or elongate in outline. Colony formation is by linear polystomodeal budding in early stages, followed by abundant circumoral budding. Secondary centres are numerous and equal to nearly equal in size to those of the axial furrow, which may become obscure. Septal and costal characters are those of *Fungia* (*Pleuractis*) *paumotensis* and *Herpolitha*. Corallum wall is perforated. It is not covered by granulations. The coralla vary from flat to arched. The septal dentations are fine, they are covered by irregular rows of granulations perpendicular to the septal margins. *Herpolitha* and *Podabacia* are similar to this genus.

Polyphyllia talpina

Free-living and elongate colonies.

Axial furrow may be indistinct.

High arch underneath.

Colonies may be X, Y or T shaped.

Primary septa are petaloid.

GENUS

Sandalolitha (Quelch, 1884)

Characters : Adult animals are free-living. Colonies are with heavy construction and without an axial furrow. Corallites are exsert, outward facing and numerous. The polyps become polystomatous by circumstomadaeal budding. The corallum wall is perforate. The septal and coastal ornamentations are coarse. The granulations on the septal sides are irregularly dispersed. Polyps are extended only at night.

Sandalolitha robusta

Large, dome-shaped and heavy colonies.

No axial furrow.

Corallites are compact.

Septa are even in height.

Similar to *Sandalolitha dentata* which is irregular in shape and less domed, with widely spaced corallites.

Sandalolitha dentata

Flat and irregular in shape.

Corallites mostly clustered in centre of colony.

Septa have variable heights.

GENUS

Halomitra Dana, 1846

Characters: Adults are free-living. Colonies are thin walled and delicate, with outward facing corallites. Coralla are polycentric, free, subcircular, gently convex or strongly arched (bell-shaped), without, an axial furrow. The corallum wall is perforated and its lower surface is granulated. The septal and coastal ornamentations are coarse. The granulations on the septal sides are either arranged in rows or in ridges perpendicular to the septal margin. Colony formation is by circumoral, polycyclic polystomodeal budding. Septo-costal characters are those of *Fungia (Fungia) fungites*. *Halomitra* is similar to *Sandalolitha*. The latter is of much heavier construction, corallites are closer together, and septo-costae are more prominent and have the characters of *Fungia (Verrillofungia)* and *Podabacia*.

Halomitra pileus

Large, free-living delicate, circular, dome or bell-shaped colonies.

No axial furrow.

Corallites are widely spaced and increase in size as the colony grows.

Strong demarcation where groups of septa meet.

Saw-like teeth.

GENUS

Zoopilus Dana, 1846

Colonial, free-living, rounded or slightly elongate and strongly domed in shape, light in weight. Tentacles are not extended during the day. Central calice with few irregularly placed lateral centers. Septa are neatly arranged in a distinctive pattern on the coral.

Zoopilus echinatus

Colonies large, dome shaped and free living.

Septocostae are mostly perpendicular to the colony margin.

Prominent and tall septal teeth.

Distinctive line of demarcation can be noticed in the places where groups of septa meet.

Not so common in occurrence.

GENUS

Lithophyllon Rehberg, 1892

Characters : The animals remain in anthocaulus stage (they do not become detached). The polyps are polystomatous by circumstomadeal budding. The corallum wall is solid and does not form fragmentation clefts. The septal dentations are ravel-shaped. Coralla are polycentric, explanate, foliaceous, unifacial and remain attached to the substratum in the adult stage. Colony formation is by marginal budding. Septo-costae structures are those of *Cycloseris.* Polyps are usually extended only at night. *Lithophyllon* is most similar to *Podabacia*.

Lithophyllon undulatum

Encrusting or may form flat laminae with lobed margins.

Usually no central corallite.

Septo-costae thin and exsert.

GENUS

Podabacia Milne Edwards and Haime, 1849

Characters: The animals are free-living. The corals are either cup shaped or foliaceous. Coralla are polycentric, explanate or foliaceous, remaining attached to the substratum in the adult stage. Corallites are well defined, usually inclined towards the plate margins. The corallum wall is perforated and covered by granulations. The septal dentations are fine and lobate with granulations irregularly distributed over their sides. The coastal spines are small and slightly echinose.

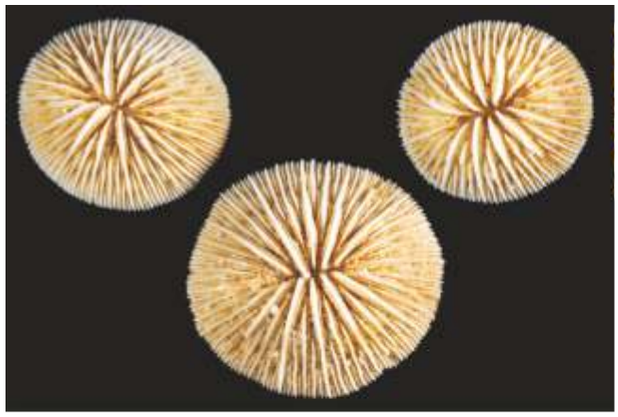
Podabacia crustacea

Colonies attached, encrusting or laminar.

Central corallite sometimes distinguishable.

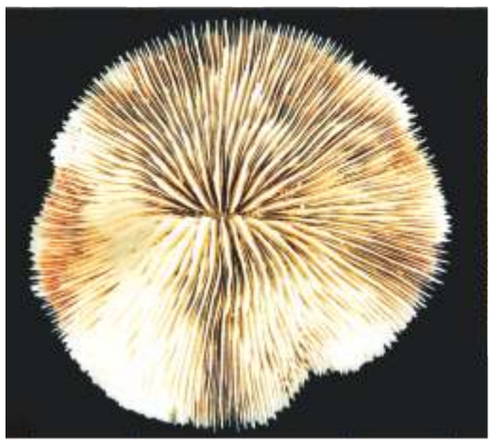
Peripheral corallites are exsert and inclined towards the colony margin.

Similar to a lightly calcified *Sandalolitha robusta* but this species is not attached.



Cycloseris cyclolites

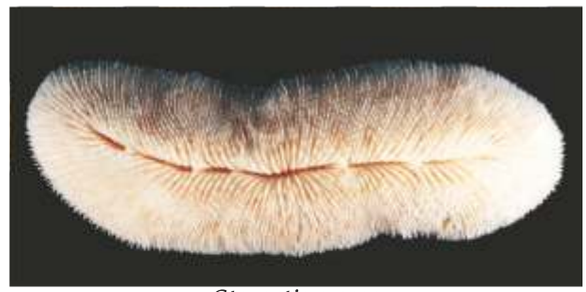
Diaseris distorta



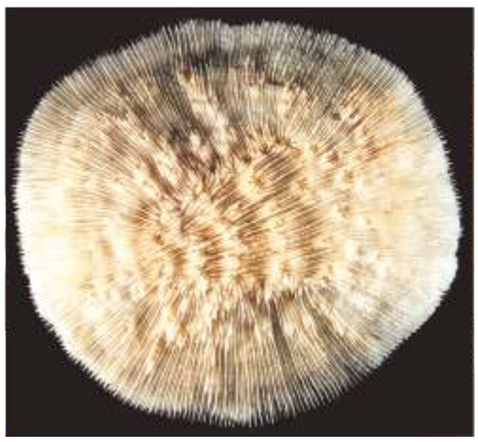
Fungia danai

Fungia paumotensis

Herpolitha limax

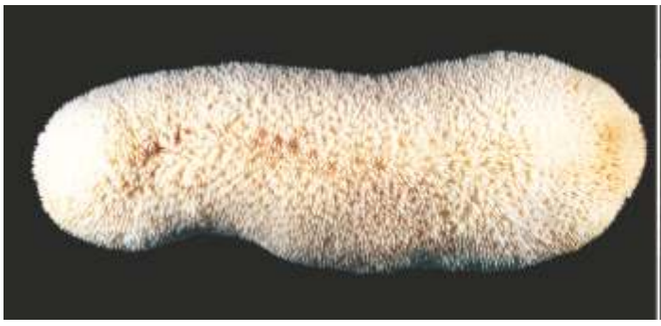


Ctenactis crassa



Halomitra pileus

Podabacia crustacea



Polyphyllia talpina

Lithophyllon undulatum

FAMILY : **MERULINIDAE** Verrill, 1846

It is composed of 12 species belonging to five genera, *Hydnophora, Merulina, Paraclavarina*, *Scapophyllia* and *Boninastrea,* out of which 9 species belonging to 4 genra are reported from India. All genera are extant, hermatypic and colonial. Skeletal structures are faviid-like but are highly fused, without paliform lobes. Valleys are superficial or may become obscured because of fanwise spreading or contortions. Faviidae and Trachyphyllidae are related to Merulinidae

GENUS

Hydnophora Fisher de Waldheim, 1807

Characters: Colonies are massive, encrusting, or arborescent. The genus is characterized by the presence of hydnophores formed where sections of common wall between corallites intersect and develop into conical mounds. Hydnophores cover the colony surface and make this genus immediately reconisable. Short tentacles surround the base of each hydnophore, one tentacle between each pair of septa.

Hydnophora rigida

Colonies composed or irregular, flattened branches with or without encrusting bases.

Monticules are usually fused into ridges down the sides of branches.

Hydnophora exesa

Colonies commonly have encrusting bases and an upper surface of irregular branches.

Hydnophores are 5-8 mm in diameter - give the colony a rough appearance.

Similar to *H. microconos* which is massive, rounded with smaller monticules.

Hydnophora microconos

Massive and rounded colonies.

Small uniform monticules 2-3 mm in diameter.

Hydnophora grandis

Colonies of irregular branches, circular in section - rarely with encrusting bases.

Little fusion of monticules.

Similar to *Hydnophora rigida* which has finer and flattened branches with fused monticules.

Hydnophora pilosa

Small colonies with encrusting, laminar or submassive bases with short branches.

Branches may be flattened.

Monticules (short sections of wall) are low and rounded.

Similar to *Hydnophora exesa* which may have more developed branches and more exsert monticules.

GENUS

Paraclavarina Veron, 1985

Monospecific easily distinguishable genus

Paraclavarina triangularis

Colonies branching.

Branches intergrade with each other.

Massive with flattened encrusting margins or encrusting.

Branches are triangular in horizontal section.

Valleys in the branches with thick columellae and septa.

Similar to Hydnophora and are readily distinguished with the presence or absence of triangular branches.

GENUS

Merulina Ehrenberg, 1834

Characters: Colonies are laminar and foliaceous or sub-arborescent with different growth forms characteristically occurring in one colony. Valleys are short, straight and spread fanwise, then divide. They radiate from the colony centre on flat surfaces but are highly contorted on branches. Flat surfaces often have concentric growth lines. Polyps are extended only at night. Branch tips may resemble *Hydnophora*.

Merulina ampliata

Laminar or subarborescent colonies (plates in deep water, branches in shallow water).

Valleys short and straight and spread like a fan.

Flat surfaces often have cocentric growth lines.

Merulina scrabricula

Colonies laminar or subarborescent with different growth forms occurring in the same colony.

Valleys are short and straight and spread in a fan before dividing.

Valleys radiate from the colony centre on flat surfaces but are highly contorted on branches.

Flat surfaces have concentric growth lines

Similar to *Merulina ampliata* which has thicker and coarser skeletal structures.

GENUS

Scapophyllia Milne Edwards and Haime, 1848

Characters: It is a monospecific genus. Colonies are composed of blunt-ended columns, which may divide and with thick laminar bases. Valleys are meandroid and sinuous. Septa are thick in the valleys and fuse irregularly with each other and with a few thick septal teeth that comprise each columella. Polyps are extended only at night and have long tapering tentacles of uniform length.

Scapophyllia cylindrica

Colonies have thick laminar bases and blunt-ended columns which occasionally branch.

Valleys are meandroid and sinuous.

Septa are thick and fuse irregularly with each other and with the columellae.

Columellae are composed of a few thick septal teeth.

Laminar *Scapophyllia* resemble *Merulina* but parallel, not spreading vallyes.

Hydnophora rigida

Hydnophora microconos

Merulina ampliata

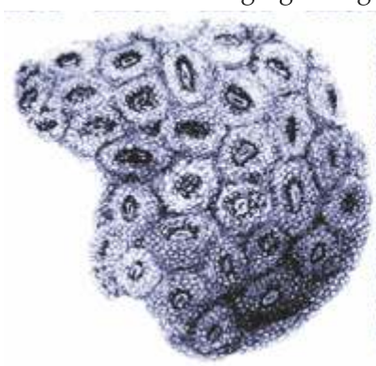
Hydnophora exesa

Scapophyllia cylindrica

FAMILY : **MUSSIDAE** Ortmann, 1890

All genera are hermatypic, solitary or colonial, extant or fossil. Skeletal structures are solid. Corallites and valleys are large. Septa have large teeth or lobes. Columellae and walls are thick and well developed. Family Pectiniidae is related to Mussidae.

Mussidae includes the following 14 genera, *Blastomussa, Cynarina, Scolymia, Australomussa, Acanthastrea, Lobophyllia, Symphyllia, Mussa, Isophyllia, Isophyllastrea, Mycetophyllia* and *Mussimillia.* The last five genera are restricted to the Atlantic. There are about 54 species in the world and 15 are reported from india belonging to 7 genera.



Acanthastrea echinata

Lobophyllia corymbosa

GENUS

Blastomussa Wells, 1961

Characters: Colonies phaceloid with erect cylindrical corallites. Corallites costate with narrow edge-zone and a delicate epitheca. Septal dentations low, rounded and lobate. Columellae coarsely trabecular, small. Polyps as described for this family but do not form concentric rings.

B. merleti

Colonies phaceloid to plocoid.

Corallites to 7 mm diameter.

Septa in 2 orders - Primary septa may be exsert.

Columellae is poorly developed.

Similar to *B. wellsi* which has much larger corallites with more numerous septa.

GENUS

Scolymia Haime, 1852

Characters: Usually monocentric, sometimes polycentric. Septa are numerous with five or six cycles developed. Septa have large, regular, blunt dentations. Columellae large. Polyps as described for this family but do not form concentric rings

S. vitiensis

Sturdy with large blunt teeth

Indo-Pacific distribution

GENUS

Australomussa Veron, 1985

Monospecific genus

Australomussa rowleyensis

Colonies dome shaped.

Colonies subcerioid, placed in shallow valleys.

Septa and costae thick and with blunt teeth.

Similar to *Scolymia vitiensis* which is non-colonial in nature

GENUS

Acanthastrea Milne Edwards and Haime, 1848

Characters: Colonies are massive, usually flat. Corallites are cerioid or subplacoid, monocentric, either circular or angular in shape. Septo-costae are thick near the corallite wall, becoming thin near the columella and have tall mussid teeth. Polyps are thick-walled and are extended only at night. *Acanthastrea* does not resemble any other mussid genus, with the exception of *A. hillae,* which is sometimes *Symphyllia*-like. However, *Acanthastrea* species are readily confused with Faviidae, especially *Favites* (in the case of *A. echinata*). They are identified much more easily in underwater, where thick fleshy polyps obscure underlying skeletal structures, just as they do with most other mussids.

1. Species with small Corallites (less than 15 mm diameter)

Acanthastrea echinata

Colonies massive or encrusting.

Corallites cerioid or plocoid, usually circular, wide range of sizes within a colony.

Septa have long pointed teeth.

A. hemprichii

Colonies encrusting to massive.

Corallites cerioid.

Septa have exsert teeth.

Similar to *A. echinata* which has more widely spaced, fleshy, less cerioid corallites.

2. Species with large corallites (over 15 mm diameter)

A. hillae

Colonies are cerioid.

Corallites have irregular shapes and sometimes form short valleys with several centres.

A. ishigakiensis

Massive are submassive

Corallites ceioid up to 25mm diameter- becoming plocoid on the sides of the colony

Septa uniform with large teeth.

Similar to *A. hillae* which has smaller corallites and forms valleys.

GENUS

Lobophyllia de Blainville, 1830

Characters: Colonies are phaceloid to flabello-meandroid either flat-topped or dome-shaped. Corallites and /or valleys are large. Septa are large with very long teeth. Columella centers are broad and compact. Polyps are extended only at night. *Symphyllia* has coarse skeletal structures comparable to *Lobophyllia*.

L. hemprichii

Colonies flat to massive and may be very large.

Phaceloid to flabello-meandroid.

Septa taper from the wall to the columella. Tall sharp teeth.

Similar to *Lobophyllia dentatus* which has more exsert septa and prominent teeth.

L. corymbosa

Colonies flat to hemispherical and mostly phaceloid - monocentric to tricentric.

Does not have a large growth form variation.

Calices are deep with well defined walls.

Septa thick near walls and thin within the calice.

Septal teeth tall and decrease in size towards the calice centre.

Similar to *Lobophyllia dentatus* which has different calices and septa.

L. diminuta

Small, flat or dome-shaped colonies.

Corallites are phaceloid up to 35 mm diameter.

L. hemprichii has larger and more uniformly spaced corallites.

Tall septal dentations make corallites irregular and spiny.

L. hattai

Colonies partly flabellate, partly meandroid.

Valleys wide and shallow.

Columellae are in two rows.

Small colonies can be confused with *L. hemprichii*.

S. agaricia also has two rows of columellae but this *S. agaricia* has coarser septa, septal ornamentation, and much deeper valleys.

GENUS

Symphyllia Milne Edwards and Haime, 1848

Characters: Colonies are meandroid, either flat-topped or dome shaped. Valleys are wide. A groove usually runs along the top of the walls. Septa are large with long teeth. Columella centers are broad and compact. Polyps are extended only at night. *Lobophyllia* alone has coarse skeletal structures comparable to *Symphyllia.*

S. recta

Colonies massive to flat.

Valleys highly sinuous and narrow - up to 15 mm wide.

Walls have a groove along the top.

Septal dentations are fine.

Similar to *S. radians* which has larger and less sinuous valleys.

S. radians

Colonies massive to flat.

Valleys fairly straight, especially if colonies have flat surfaces, otherwise irregularly sinuous vallyes in a radiating pattern.

Septal dentations intermediate between *S. recta* and *S. agaricia*.

Valleys average 20-25 mm wide.

S. agaricia

Colonies hemispherical to flat.

Valleys sinuous or straight - 35 mm wide. Usually separated by a narrow groove.

Septa thick with large teeth.

Similar to *S. radians* which has smaller, straighter valleys.

GENUS

Cynarina Bruggemann, 1877

Characters: One of the most delicately beautiful of all corals. Despite their delicate appearance *Cynarina,* alone among the mussids, are tolerant of a wide range of environmental conditions and make a good aquarium speciemen. It is a monospecific genus. Corals are monocentric (oval or circular or cylindrical) with a base firmly attached or with a pointed base and free living. Primary septa are thick and have very large teeth. Paliform lobes are usually well developed. Columellae are broad and compact.

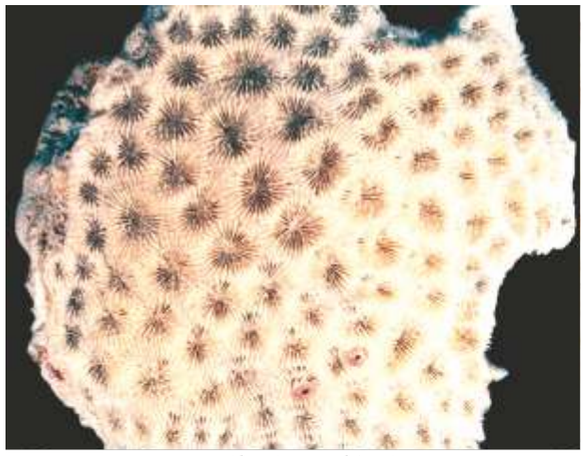
Cynaria lacrymalis

Monocentric, oval or circular with a base for attachment. May have a pointed base when free-living.

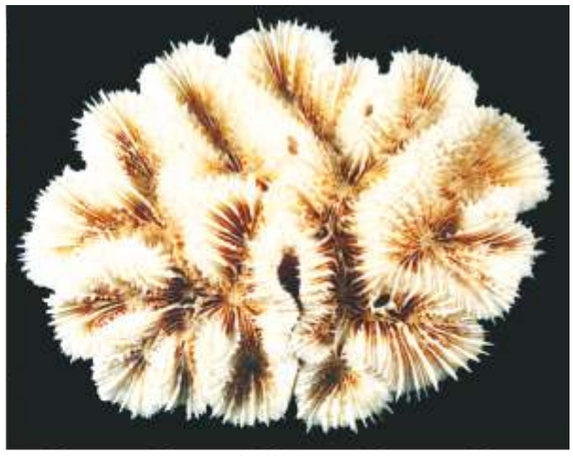
Primary septa thick with large, rounded or lobed teeth.

Paliform lobes usually well developed.

Columellae broad and compact.

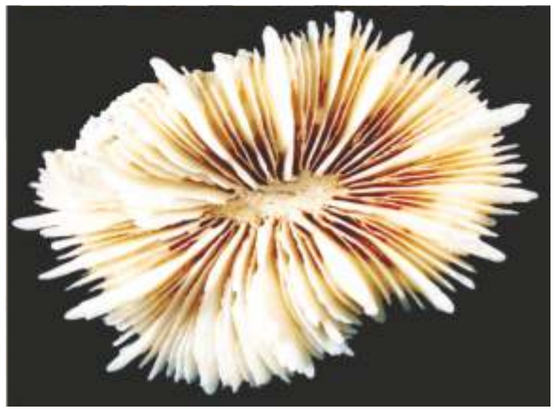


Acanthastrea echinata



Symphyllia agaricia

Lobophyllia corymbosa



Cynarina lacrymalis

FAMILY : **OCULINIDAE** Gray, 1847

Colonial, hermatypic and ahermatypic, extant and fossil. Corallites are thickened and linked by a smooth coenosteum. Septa are very exsert. Related to the family Rhizangiidae. The Oculinidae are generally ahermatypic except two genera *viz*. *Galaxea* and *Archelia*.

There are bout 29 species belonging to 10 genera out of which only 3 species belonging to only 1 genera are reported from India.

GENUS

Galaxea Oken, 1815

Characters: Colonies are massive, columnar, encrusting or irregular. Corallites are cylindrical, thin-walled and separated by a blistery coenosteum. Columellae are weak or absent. Septa are very exsert. It is very distinctive, although the species within the genus are very similar, with the main difference being only in the size of the corallites. *G. astreata* corallites are smaller in diameter and round comparable to *G. fascicularis,* which is larger in diameter and may be irregular.

Galaxea astreata

Galaxea acrhelia

Colonies branching.

Branches short, truncated and irregular.

Corallites tubular, delicate and with open rims.

Coralllites branch off from older corallites.

Septa are very exsert and are irregular in length.

Blistery coenosteum and

Colummellae absent.

Similar to *G. fascicularis* which does not branch.

Galaxea fascicularis

Massive colonies frequently over 5 m across.

Corallites of mixed sizes, usually less than 10 mm in diameter.

Some septa reach the centre of the corallite.

Galaxea astreata

Colonies submassive, columnar and encrusting.

Corallites may vary greatly in size depending upon where in the colony they appear.

Usually 8-12 septa reach the colony centre.

FAMILY : **PECTINIIDAE** Vaughan and Wells, 1943

Characters : There is one solitary fossil genus; the remainder is colonial and hermatypic. Colonies are basically laminar, composed of thin plates. Corallite walls are absent or formed by the non-porous costate coenosteum of the laminae. Family Mussidae is similar to Pectinidae. The Pectiniidae is a small distinct family with only five extant genera, all hermatypic, comprised of *Echinophyllia*, *Echinomorpha, Oxypora*, *Mycedium* and *Pectinia*.

There are bout 31 species belonging to 6 genera out of which only 11 species belonging to only 4 genera are reported from India.

GENUS

Echinophyllia Klunzinger, 1879

Characters: Colonies are encrusting or laminar. Calices are round or oval, immersed to tubular and not strongly inclined on the colony surface. Septa are usually numerous. Columellae are usually well developed. The coenosteum is pitted at the commencement of new septo-costae.

Echinophyllia aspera

Plates with irregular, hillocky or submassive central areas and thin at edges.

Smaller colonies usually have a central corallite.

Corallites have toothed costae.

No paliform lobes.

Echinophyllia echinoporoides

Explanate plates with thin edges and central area (frequently formed by central overgrowths) to 3 cm thick.

Corallites mostly plocoid or subplocoid, small and are slightly inclined towards the colony margin.

Similar to *Echinopora lamellosa* which has a similar growth form, corallites of a similar size, shape, density but has exsert costae.

Echinophyllia patula

Thin plates with widely spaced corallites.

Corallites immersed with broad columellae.

A large central corallite may be distinguishable.

Costae are well developed with exsert triangular granulations.

Deep pits where costae commence.

Similar to *Echinophyllia aspera* which has smaller, more exsert and more crowded corallites.

Echinophyllia echinata has more irregular costae and a more prominent central corallite.

Echinophyllia echinata

Thin plates, do not form thick plates or submassive forms

Large central corallite

Very prominent first and second order sept-costae

GENUS

Oxypora Saville-Kent, 1871

Characters: Colonies are foliaceous, usually with very thin laminae. Calices are round or oval in shape, irregular, shallow, not strongly inclined on the corallum surface. Septa are few, columellae are poorly developed. The coenosteum is pitted at the insertion of new septo-coastae. *Oxypora* is readily confused with *Echinophyllia* especially when colonies become thickened. Sometimes confused with *Echinopora* and *Mycedium* also.

Oxypora crassispinosa

Colonies foliose.

Laminar or thin, convoluted, horizontal or upright.

Laminar with prominent coastal ridges

Corallites are small with few costae (mostly one or two per corallite)

Similar to *Mycedium* but easily recognizable due to coastal ridges..

O. lacera

Thin, encrusting or laminar plates.

Intercostal slits usually absent from central parts of colony.

Costae are very toothed.

Similar to *Echinophyllia aspera* which usually has corallites slightly inclined near the periphery and is radially symmetrical near the colony centre (reverse occurs in *O. lacera*).

O. lacera usually has less than 12 primary septa, *E. aspera* usually has over 12 primary septa.

GENUS

Mycedium Oken, 1815

Characters : Colonies are laminar or foliaceous. Corallites are nose-shaped, facing outward towards the corallum perimeter. Septa and columellae are well developed and costae form outwardly walls. The coenosteum is never pitted at the insertion of new septo-costae. Polyps are extended only at night.

Mycedium elephantotus

Colonies laminar or encrusting.

Corallites nariform, up to 15 mm diameter, inclined towards the colony perimeter. Septa and columellae are well developed and costae form outwardly radiating ribs. Coenosteum has no pits.

Similar to *Mycedium robokaki* which has smaller corallites and irregularly shaped fronds.

GENUS

Pectinia Oken, 1815

Characters: Colonies are laminar to sub-arborescent, covered with high, thin, acute irregular walls usually arranged as wide valleys. Valleys may be as short as they are wide and the walls may form tall spires, becoming sub-arborescent. Corallite centers occur in any position. Septo-costae are well developed and may form the start of walls or spires. Polyps are extended only at night.

Pectinia lactuca

Colonies are submassive or form thick plates.

Radiating valleys can be traced from colony centre to periphery.

Collines continuous and plate-like.

Pectinia paeonia

Colonies never have extended valleys. Instead colonies form clusters of fluted thin laminae with exsert costae forming upwardly projecting spires and short walls.

Collines bisected and irregular, surround only 1 or a few centres.

Septa have small teeth.

Columellae are weakly developed.

Similar to *Pectinia alcicornis* which has more solid skeletal structures, tall spires, a well developed columellae and highly toothed costae.

Pectinia alcicornis

Colonies irregular clusters of fluted flat laminae with exsert costae forming upwardly projecting spires and short walls.

Tall upwardly projecting spires dominate the colony.

Strong septal/ costal dentations.

Relatively large columellae.

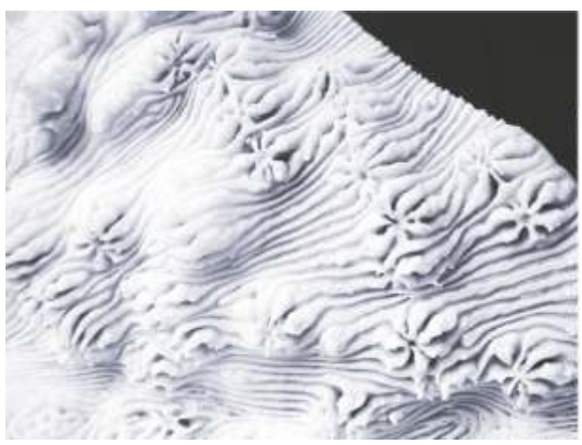
Similar to *P. paeonia,* which is less calcified and has thinner skeletal structures.

Pectinia teres

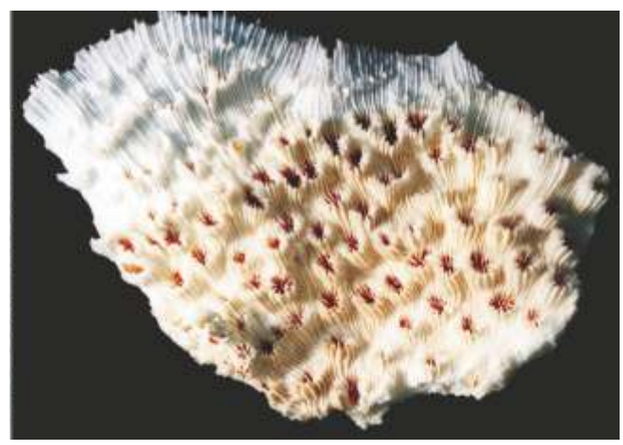
Small clumps of pointed branch-like spires.

Conspicuous corallites.

Exsert costae.

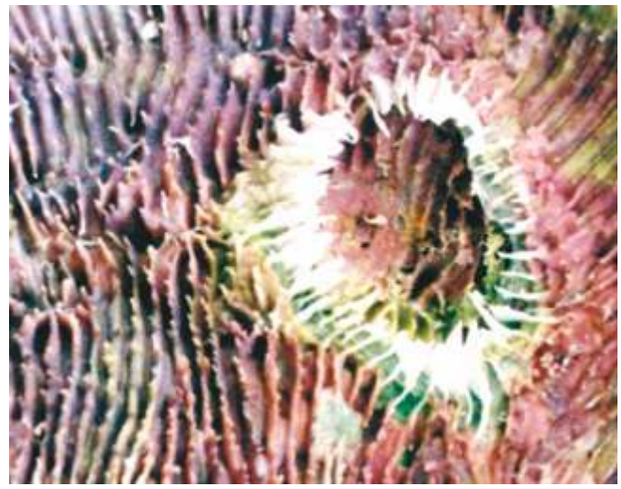


Echinophyllia aspera



Mycedium elephantotus

Pectinia paeonia



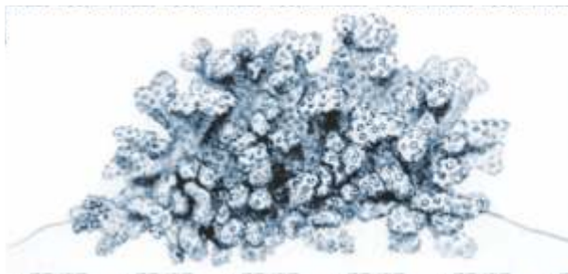
Oxypora lacera

FAMILY : **POCILLOPORIDAE** Gray, 1842

It is colonial and mostly hermatypic corals, contains three common genera, *Pocillopora, Seriatopora* and *Stylophora,* which have very similar biological characters. Representative of all these genera are recorded in Indian waters.

Characters : Colonies are submassive, ramose or arborescent. Branches are often flattened or fine and irregular. Colonies are covered in verrucae (large mounds). Corallites are small and immersed. Septa and columella are usually poorly developed. The coenosteum is covered with spinules. Superficially this family resembles *Astrocoeniidae* and *Acroporidae.*

There are bout 39 species belonging to 4 genera out of which only11 species belonging to only 3 genera are reported from India.



Pocillopora damicornis

Pocillopora eydouxi

Seriatopora hystrix

Stylophora pistillata

Pocillopora verrucosa

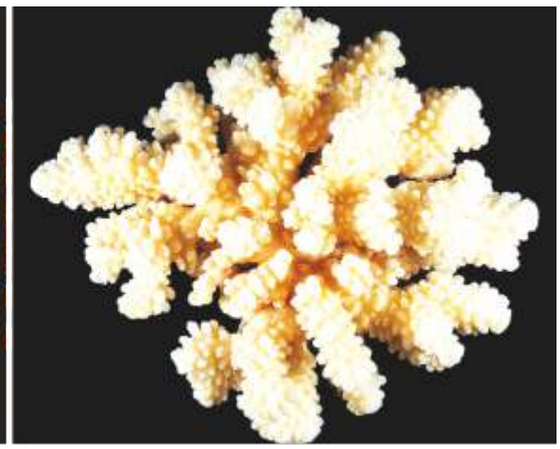
GENUS

Pocillopora Lamarck, 1816

Pocillopora is a well-deined genus readily distinguishable from other genus by the presence of verrucae.

Characters: Colonies are sub-massive to ramose with branches tending to be blade-like or else fine and irregular. Colonies are covered with verrucae. Corallites are immersed. They may be devoid of internal structures or have a low solid columella and two unequal cycles of septa. The coenosteum is usually covered by granules. Polyps are usually extended only at night.

Pocillopora damicornis



Pocillopora verrucosa

Pocillopora eydouxi

P. damicornis

Lacks true verrucae-no clear distinction between verrucae and branches

Branches comprised of cerioid corallites

Peripheral branches much thinner than other species in this genus

P. meandrina

Colonies compact and upright.

Branches short, flat and radiate from the center.

Verrucae neat, uniform rounded and medium sized.

Verrucae not longer than wide

Similar to *P. verrucosa* which has relatively prominent verrucae which are longer than wide.

P. verrucosa

Uniform upright distinct branches.

Prominent verrucae-large and irregular in size, giving the colony a rough/ragged surface

Larger branches than *P. damicornis*

Synonymised with *P. meandrina* in monograph. There is some overlap in calicular characters (The calices of *P. meandrina* are slightly larger and there is slightly less septal development).

Only common in exposed areas (outer reef fronts), therefore less variable than *P.damicornis.*

P. eydouxi

Large upright club shaped branches, branching may be infrequent.

Can form large colonies.

Veruccae uniform.

P. ankeli

Colonies short and compact with short knobby branches.

Verrucae small and crowded.

Corallites crowded on verrucae.

Similar to *P. verrucosa* which has less crowded corallites and more upright branches.

P. linguata

Compact colonies with irregularly radiating branches with flattended ends.

Verrucae widely spaced and irregular.

GENUS

Seriatopora Lamarck, 1816

Characters: Colonies form compact bushes with thin anastomosing (fused) branches. Corallites are arranged in neat rows along the branches. They are mostly immersed and have poorly developed internal structures except for solid-like columella. Usually one, sometimes two cycles of septa are developed and are fused to the columella. The coenosteum is covered by fine spinules. Polyps are extended only at night.

Seriatopora crassa

Colony branching.

Main branches about 1 cm thick and branchlets either narrow or broad, when narrow 3 to 4 mm, broader ones 7 to 8 mm.

Calices subcircular 0.6 mm in diameter.

Upper wall raised up forming hoods.

First cycle of septa prominent, surface coenchyme echinulate.

S. hystrix

Thin tapering branches - 1.5-4.5 mm 1 cm below tip and 2.5-8 mm near colony base.

S. stellata

Thick, short and strongly tapered branches.

Branches usually fused into clumps.

Corallites are aligned in rows which are raised into ridges down the sides of branches.

Similar to *S. hystrix* which does not have raised ridges and usually has thin branches.

S. caliendrum

Branches usually thick (3-8 mm) and non-tapering (rounded tips).

Corallites are in rows but not as obvious as *S.hystrix*.

Corallites have *Stylophora*-like hoods.

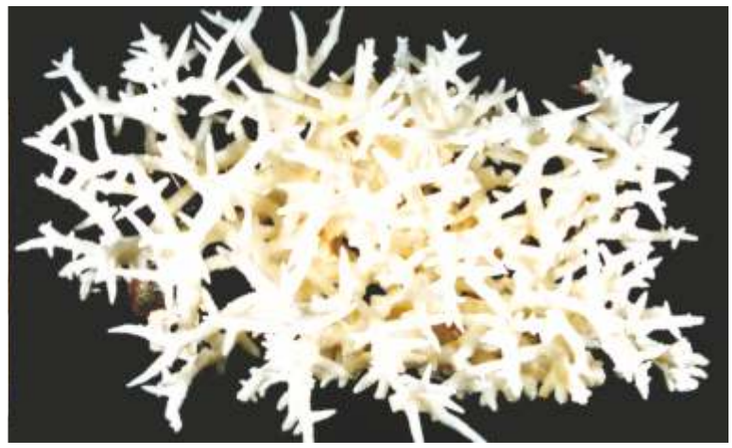
GENUS

Stylophora Schweigger, 1819

Seven species are reported worldwide, of which only one species is recorded from India.

Characters: Colonies are ramose to submassive with short, seldom fusing branches, which are expanded at the tips. Colonies lack true verrucae. Upper wall of corallites is developed as a *spiny hood*. Six primary septa may be fused to a style-like columella. Corallites are in rows down branches.

Stylophora pistillata



Seriatopora hystrix

Stylophora pistillata

Thick, blunt-ended branches.

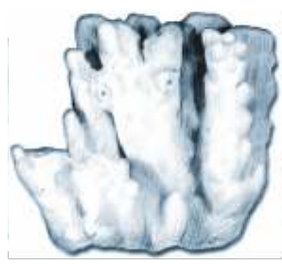
Corallites immersed, conical or hooded.

FAMILY : **PORITIDAE** Gray, 1842

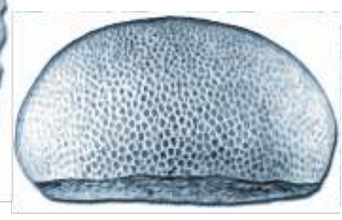
Family Poritidae is a heterogenous assemblage of distantly related genera. It is Colonial, hermatypic and mostly extant. Colonies are usually massive, laminar or ramose. Corallites have a wide size range but are usually compact with little or no coenosteum. Walls and septa are porous. The Poritidae includes five extant hermatypic genera, *Porites, Stylaraea, Poritipora, Goniopora* and *Alveopora. Poritipora* is a very recently erected genus.

There are bout 89 species belonging to 6 genera out of which only 20 species belonging to only 4 genera are reported from India.

Porites lobata



Porites lichen



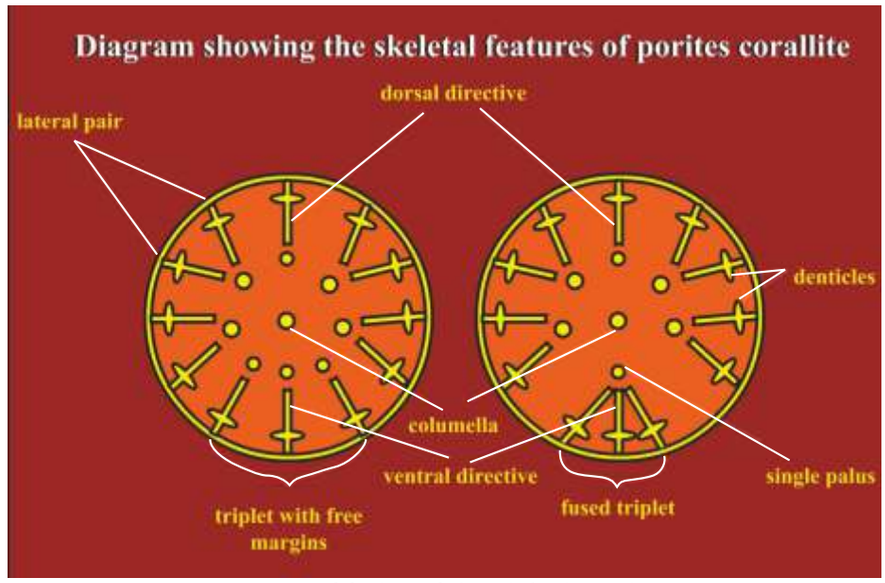
Goniopora minor

Porites nigresences

GENUS

Porites Link, 1807

Characters: Colonies are flat (foliaceous or encrusting), massive or branching. Massive colonies are spherical or hemispherical when small and helmet or dome-shaped when large, and are commonly over 5 m in diameter. Corallites are small, immersed, with calices less than 2 mm in diameter and filled with septa. Polyps usually extend only at night. *Porites* resembles *Montipora*. *Porites* differs from *Montipora* by different growth forms. Corallites are usually larger and more compacted and lack the elaborate thecal and reticulum papillae and tuberculae, which characterise *Montipora. Porites* also have corallites filled with septa, whereas those of *Montipora* contain only inward projecting septal teeth. *Porites* species are the most difficult of all the major genera to identify because of variable and small corallites.



Patterns of fusion of the triplet in Porites
a) Triplet with free lateral septa and three pali
b) Triplet with lateral & ventral directive fused & one palus

Skeletal structures used in *porites* species identification:

Dorsal directive septum

Four pairs of lateral septa with each pair fused at their inner margin (these septa are usually larger than the lateral septa in the ventral triplet)

Ventral triplet composed of ventral directive septum (centre) and two lateral septum, inner margins of septa in triplet are free or fused

Pali vary in height, absent only in *P. solida*

Denticles are on upper septal margins

1. Species forming large massive colonies

P. lutea

Large hemispherical or helmet shaped colonies.

Usually form microatolls in intertidal habitats.

Tightly packed corallites are 'filled' with skeletal structures. Similar to *P. australiensis* which has thicker walls and five tall and three short pali.

Corallites of *P.lobata* appear to have fewer skeletal elements.

Widely distributed throughout reefs of the world (excluding Caribbean).

P. lobata

Large hemispherical or helmet shaped colonies with a lobed upper surface. Commonly form microatolls in intertidal habitats.

Corallites are open with relatively few skeletal elements.

Similar to *P. solida* and *P. australiensis.* Widely distributed throughout reefs of the world.

P. solida

Large massive colonies, usually hemispherical.

Surface is smooth to undulating.

Corallites are large with no pali.

Similar to *P. lobata* which has weakly developed pali.

2. Species forming small massive colonies

P. murrayensis

Colonies hemispherical or spherical.

Colony surface is smooth and corallites are evenly spaced.

Similar to *P. lobata* which has larger corallites and longer septa. *P. stephensoni* has similar corallite characters.

3. Species forming columns, laminae and branches

P. lichen

Encrusting laminae, thick plates or sub-massive with columns or branches. Corallites in rows-thin wall within rows and thick walls between rows.

Thick and thin walls means that *P. lichen* forms a transition between other *Porites* species esp *P. annae* and *P. vaughani*. Widely distributed throughout Indian and Pacific Oceans, SE Asia and the GBR.

P. annae

Branching, usually with horizontal basal plates.

Nodular branches usually anastomose or columnar.

Abundant on intertidal flats and may form micro-atolls.

P. vaughani

Colonis encrusting, laminar or form columns. Corallites widely spaced and separated by ridges.

Similar to *P. annae.* Corallites resemble *P.lichen.*

4. Species forming laminae and branches

P. nigrescens

Branching, sometimes with an encrusting base. Concave calices.

Similar to *P. cylindrica,* but it has shallow corallites and thicker branchers.

Also resembles *P. negrosensis.*

P. eridani

Encrusting plates with short simple branches/columns.

Corallites irregularly distributed on both laminae and branches.

Five pali sometimes united, fossa deep, columella absent, septa short and thick, corallite walls thick Similar to *P. flavus* but it does not have basal laminae. Growth from resembles *P. latistella.*

P. compressa

Cylindrical branches with fuse.

Growth form and corallite characters extremely variable.

Similar to *P. cylindrica*

Endemic species of Hawaii.

P. cylindrica

Branching, sometimes with an encrusting base.

Colonies have a smooth surface due to shallow corallites.

Similar to *P. compressa* and *P. attenuata*. Often confused with *Paulastrea ramosa* under water.

P. monticulosa

Colonies massive or plate like sometimes branching and encrusting, or a combination of growth forms.

Corallites are separated into groups by ridges.

Similar to *P. rus* but this species is more branching.

P. rus

Large colonies, submassive, laminar or branching.

Coenosteum commonly raised in ridges which characteristically converge towards each other forming flame-shaped patterns.

Corallites small, superficial and widely separated by an extensive, finely reticulated coenosteum.

Similar to *Montipora*. Resembles *P. monticulosa*.

Porites andrewsi

Colonies are branching, sometimes with an encrusting or massive base and may be very large.

Branches are usually <30 cm long and <40 mm in diameter near their base. Corallites are very superficial, flush with the corallum surface.

The maximum diameter of calices is 1.5 mm and the distance between corallites is upto 7 calice diameters but is usually less.

Living colonies have a very vide range of colours, especially those occurring in shallow water.

Porites evermanni

Colonies submassive to massive.

Triplet has free margins.

Septa thick.

8 large pali and a

Large columella

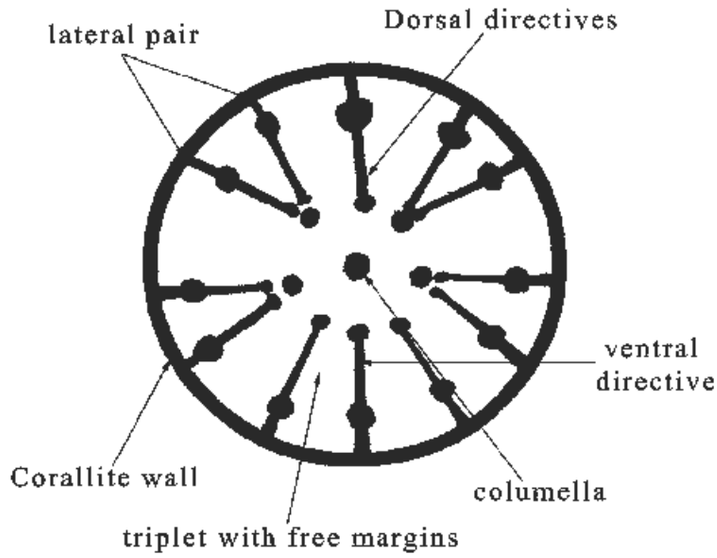
Septa are thick.

Porites exserta

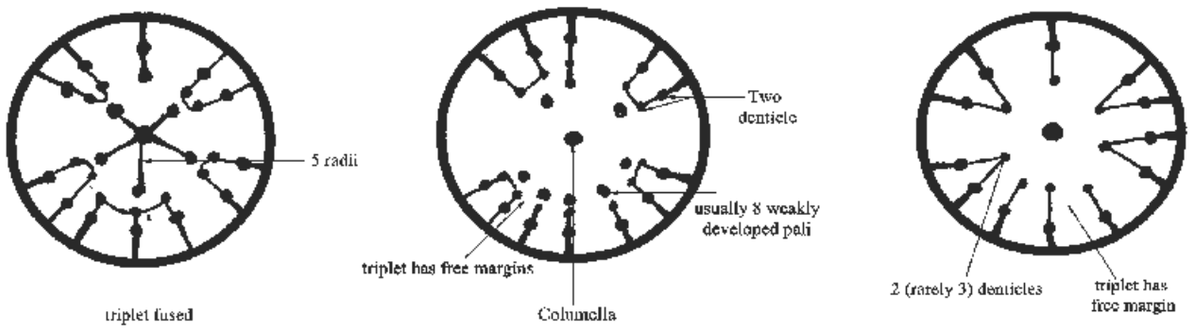
Corallum encrusting.

Calices shallow, polygonal or circular, generally 12 septa present.

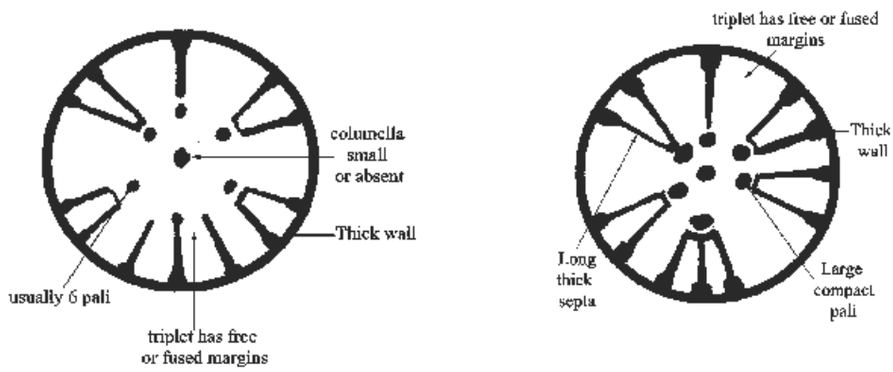
A prominent septal denticle present between the exsert part of the septa and the palus. Two rings of synapticulae.



Diagramatic representation of a Porities corallite, showing septal structures commonly used in species identification.



Porites lutea ***Porites lobata*** ***Porites solida***



Porites lichen ***Porites nigrescens***

Pali, five, one on the ventral directive and four-one each on the fused ends of the lateral pairs.

Columella usually absent

This species is closely related to *P. lichen* except for the nature of the wall and the exsert free ends of the septa.

Porites mannarensis

Colonies are globular or subhemispherical, occur as free living.

Surface lobulated.

In globular specimens invariably the remains of *Acropora* on which the colony initially starts its growth is retained. In others the basal part is expanded.

Porites minicoensis

Colonies unattached, free, ramose, with a crowded cluster of small branches radiating from a central elongated body.

Largest size recorded is 7 cm. Branches 1.5 to 2.5 cm. long, up to 10 mm.

Thick at the base.

Tip of the branches expanded with small nodules.

SUB GENUS

Synaraea VERRILL, 1864

Porites (Synaraea) convexa

Colonies encrusting to submassive.

Calices round, superficial and arranged in valleys formed by coenchymal foveolations.

Triplet often forms trident.

Pali 5 to 6.

Columella style may or may not present.

Similar to *P. monticulosa* and may be a synonym of it.

GENUS

Stylaraea Mile Edwards and Haime, 1851

Monospecific genus

Stylaraea punctata

Colonies encrusting and usually round in shape.

Corallies are with flaring openings and are neatly arranged.

Pinnule like distinctive columella.

Two cycles of septa.

Resembles Porites but easily distinguishable with the prominent pinnule like distinctive columella.

GENUS

Goniopora de Blainville, 1830

Characters: Colonies are usually columnar or massive but may be encrusting. Corallites are usually thick but porous walls and calices are filled with compact septa and columella. Polyps are long and fleshy, extended day and night. *Goniopora* are usually easier to identify in underwater than they are from skeletons. They have 24 tentacles. Different species have polyps of different shapes and colours, which allow them easy to identify in underwater. *Goniopora* is similar to *Alveopora*. Polyps of this genus are similar to *Goniopora*, which has 24 tentacles, while *Alveopora* has only 12.

Massive species with large (over 5 mm) Corallites

Goniopora djiboutiensis

Submassive or columnar usually with an encrusting margin.

Cirallites rounded or polygonal.

Columellae prominent, dome-shaped and usually divided into 6 fused parts.

Polyps have large oral cones.

Similar to *G. pendulus* and *G. columna* which also have large oral cones.

G. pendulus has bigger polyps with much longer tentacles. *G. columna* has a more columnar growth-form.

Goniopora stokesi

Shape of colonies varies greatly from free-living and massive to attached and columnar.

Calices have high walls giving the colony a ragged appearance.

Columellae are broad and irregular.

Similar to *G. pendulus* which forms larger colonies with polyps of equal size.

Branching or columnar species with large (over 5 mm) corallites

Goniopora columna

Short columns, oval in traverse section.

Corallites near the tops of columns have fine irregular septa and diffuse columellae. Those on the sides of columns have broad compact columellae and short septa.

Large polyps with large oral discs.

Similar to *G. stokesi,* which has larger polyps and a ragged wall structure.

Massive species with medium (3-5 mm) Corallites

Goniopora tenuidens

Colonies massive, hemispherical or irregular.

Corallites rounded with thin walls and 6 prominent paliform lobes.

Polyps to *G. minor* which has thick pali forming a crown.

Gonipora minor

Colonies hemispherical or encrusting.

Calices are circular with thick walls.

Usually 6 thick pali which are in contact and form a crown.

Septal structures are heavily granulated.

Similar to *G. tenuidens* which has blunt tentacles of uniform length.

Branching or columnar species with medium (3-5 mm) Corallites

Goniopora planulata

Colonies submassive with small compacted columns or mounds.

Corallites have thin walls.

Septa are thin and irregular.

Paliform lobes form a diffuse crown.

Similar to *G. columna* which forms thicker columns and has larger corallites.

Species with small (less than 3 mm) Corallites

Goniopora stutchburyi

Colonies submassive to encrusting.

Calices are small and shallow giving colonies a smooth surface.

Resembles *Porities.*

GENUS

Alveopora de Blainville, 1830

Characters: Colonies are massive or branching, often with irregular shapes. The skeletal structure is very light, consisting of interconnecting rods and spines. Corallites have walls that are perforated and septa that are mostly composed of fine spines, which may meet in the centre forming a columella tangle. It has 12 tentacles, often with swollen knob-like tips. *Alveopora* is similar to *Goniopora.*

Medium sized Corallites

A. verrilliana

Short irregularly dividing knob branches are distinctive

Corallites 1.7-2.0 mm with short blunt skeletal spines.

No columellae.

Similar to *A. fenestrata* which has a hemispherical growth form and larger corallites.

Small Corallites and short polyps

A. daedalea

Colonies encrsting, thick plates or columnar.

Smooth surface.

Tips of polyp tentacles are truncated giving a squared appearance.

Sometimes 6 large tentacles alternate with 6 small tentacles.

Similar to *A. spongiosa* which is less columnar, and does not have trauncated tentacles.

Other species

Alveopora superficialis

Colonies are explanate, thick; calices neatly rounded, close together, intercorallite wall very thin.

Calices neatly rounded, close together, intercorallite wall 0.1 to 0.2 mm, adjacent ones almost used.

Septa 12 in number subequal in thickness, horizontally extending, hair-like.

The inter-septal spaces are oval in outline and the calyx, spear like a wheel when observed from above.

The colonies are light and fragile.

Remarks: Though Veron and Pichon (1982) reported this species as nominal, Veron (2000) did not include this species in the world species list. Mostly found on shallow reef environments.

Goniopora tenuidens

Porites solida

Goniopora stokesi

FAMILY : **RHIZANGIIDAE** d'Orbigny, 1851

Characters : Colonies usually encrusting with scattered corallites. Sometimes solitary. Corallites tubular and small. Budding extratentacular. Mostlycomposed of azooxanthellate species.

There are bout 33 species belonging to 4 genera out of which only 3 species belonging to only 3 genera are reported from India.

GENUS

Astrangia sp. Milne Edwards and Haime, 1848

Encrusting and submassive.

Compacted and deep corallites.

Corallites mostly circular in shape.

Septal margins beaded.

Columellae well developed.

Cladangia exusta

Corallum encrusting and thin.

Corallites 1-3mm in height and shallow.

Distance between corallites vary from 2 to 6 mm.

Calices mostly round in shape.

Coenosteum dense.

Epitherca absent.

Septa in three complete cycles.

Columella distinct, usually trabecular , have papillary projects merging with septal dentition.

GENUS

Culicia Dana, 1846

Corallum solitary and in groups. Cylindrical corallites. Mostly less than 5 mm in height and width. Granular septa. Columella present.

Culicia rubeola

Corallum reptoid, corallites circular, 2-4 mm in diameter.

Epitheca well developed. 20 to 24 septa, first two cycles well developed.

Edges with weak dentition, sides granular.

Twelve septa reach the columella.

Columella trabecular with a few vertical papillae.

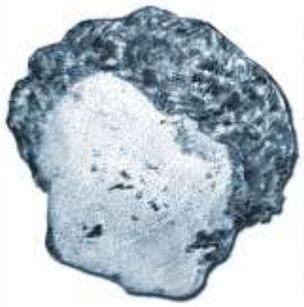
Generally the colonies are found under dead parts of the massive corals.

The total number of septa may range upto 36 depending on the size of the corallites.

FAMILY: **SIDERASTREIDAE** Vaughan and Wells, 1943

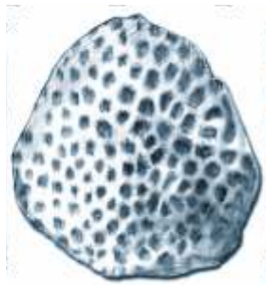
Siderastreidae is a family with mostly extant, colonial and hermatypic corals. Colonies are massive or columnar. Corallites are immersed with poorly defined walls formed by thickening of the septo-costae. Septa are usually fused along their inner margins to form fan-like groups; they have granulated upper margins and are closely compacted and evenly spaced.

It is closely related to family Agariciidae. There are six extant hermatypic genera, four of which, *Siderastrea*, *Pseudosiderastrea, Psammocora* and *Coscinaraea* are found in Indian waters. The *Psammocora* and *Coscinaraea* are common with clear affinities. Other genera within the family have a few species with uncertain relationships and unusual distributions and habitat preferences. A total of 28 species are reported in the world out of which only 11 species are reported from India.

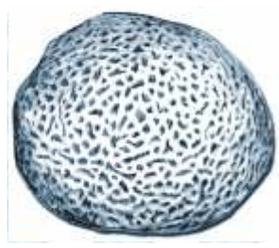


Pseudosiderastrea tayami

Psammocora digitata



Siderastrea savignyana



Coscinaraea monile

GENUS

Pseudosiderastrea Yabe and Sugiyama, 1935

It is monospecific and closely resembles *Coscinaraea* and superficially resembles *Coeloseris* and *Leptastrea*.

Characters: Colonies are encrusting to massive or dome-shaped. Corallites are cereoid, polygonal, 3-6 mm in diameter. Septa are evenly spaced and fuse with each other in fan-like groups. Septa have fine, saw-like teeth. Columellae consist of one to four pinnules.

Pseudosiderasterea tayami

Encrusting to dome shaped.

Corallites polygonal, 2-4 mm diameter.

Septa are neatly arranged. Fusing in neat fan-like groups.

Walls have a fine ridge along the top.

Similar to *Pseudosiderastrea tayami* which has a similar growth form but septa have saw-like teeth.

GENUS

Siderastrea Yabe and Sugiyama, 1935

Characters : Colonies are Boulder shaped to encrusting. Corallites cerioid, rounded or polygonal. Septa evenly spaced with fine saw-like teeth.

Siderastrea savignayana

Encrusting or low mounds to one metre across.

Corallites polygonal, 2-4 mm diameter.

Septa are neatly arranged. Fusing in neat fan-like groups.

Walls have a fine ridge along the top.

Similar to *Pseudosiderastrea tayami* which has a similar growth form but septa have saw like teeth.

GENUS

Psammocora Dana, 1846

Characters : Colonies are massive, columnar, laminar, foliaceous or encrusting. Corallites are very small and shallow, sometimes forming shallow valleys. Walls are indistinct. A small number of primary septo-costae are imbedded in secondary septo-costae, forming distinctive species-specific patterns. Polyps are usually extended only at night. *Psammocora* is readily confused with *Coscinaraea,* which is initially distinguished by having larger corallites with much larger calices.

Psammocora digitata

Plate-like or columnar.

Small shallow corallites.

Slightly exsert petaloid primary septa.

Psammocora contigua

Colonies mixtures of flattened branches.

Colonies have a smooth surface due to shallow corallites.

Corallite structures are fine.

Sometimes occur as free-living mobile balls.

Psammocora profundacella

Colonies submassive or plate-like

Corallites arranged along valley floors

Walls between corallites are rounded and may form a central ridge. Septa not exsert.

Psammocora haimeana

Corallites situated at the bottom of depressions

Walls have acute tops

Primary septo-costae are petaloid but not exsert.

Psammocora superficialis

Encrusting with low irregular ridges.

Corallites small, shallow and irregularly distributed.

Similar to *P. niertraszi* which has similar corallites but has well defined ridges between them.

Psammocora explanulata

Thin plates with large corallites which are evenly distributed.

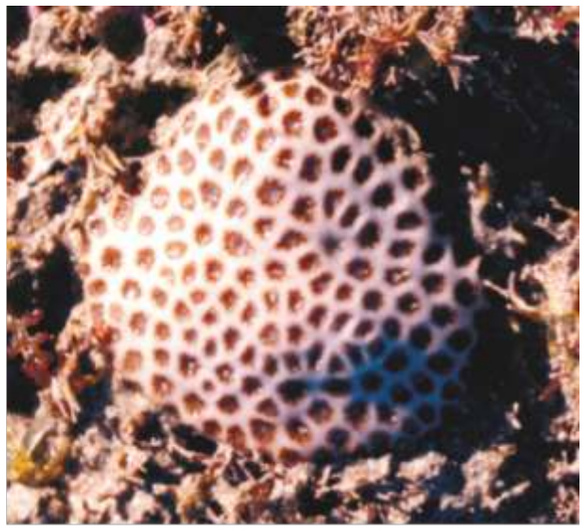
Distinctive exsert septa which may be petaloid or meandering.

GENUS

Coscinaraea Milne Edwards and Haime, 1848

Characters: Colonies are massive, columnar, encrusting or laminar. Corallites are large and in short valleys or irregularly scattered and shallow. Septo-costae are fused in distinctive patterns and have finely serrated to heavily granulated margins. Compound trabeculae and true synapticulothecal wall distinguish *Coscinaraea* from *Psammocora*.

Psammocora contigua



Siderastrea sayignyana

Coscinaraea monile

Colonies encrusting or dome-shaped.

Calices monocentric - up to 7 mm - or form short valleys.

Septa are even and finely serrated giving colonies a smooth appearance.

Coscinaraea columna

Encrusting or massive

Septo-costae are not heavily granulated.

Pinnules present on top of corallite walls.

Similar to *C. exesa*, which has columnar growth-form and more larger and shallower corallites with granulated septo-costae.

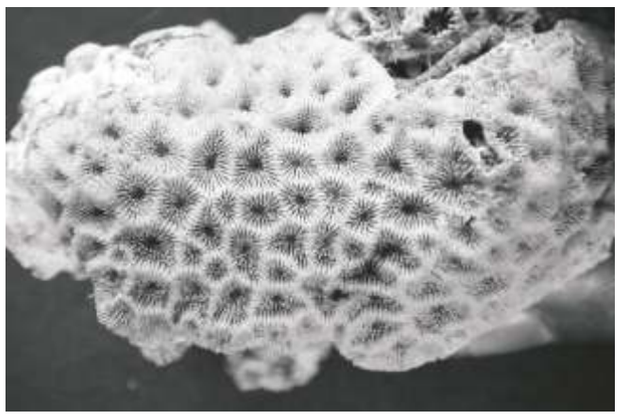
Coscinaraea crassa

Large heavily calcified unifacial plate with large compact corallites.

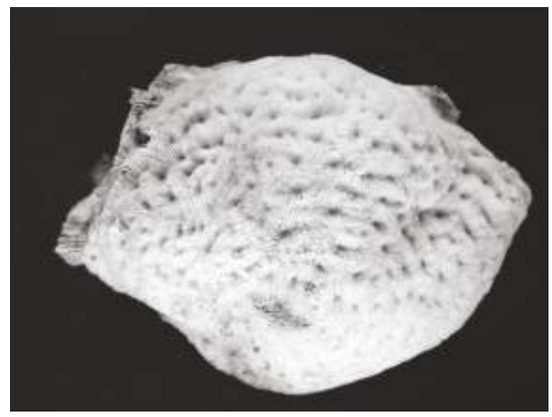
Long and short septo-costae are slightly alternate.

Columellae are single fused septal margins deep within the corallite.

Superficially a greatly enlarged coarser and thicker version of *C. mcneilli*.



Pseudosiderastrea tayami



Coscinaraea monile

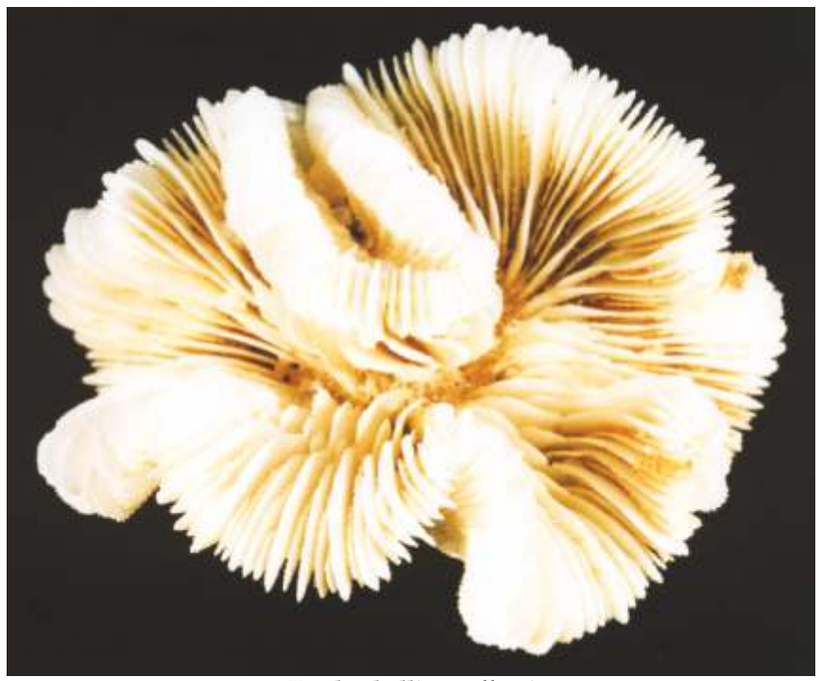
FAMILY : **TRACHYPHYLLIDAE** Verrill, 1901

Characters: Solitary to colonial and zooxanthellate. The family is separated fromFaviidae by growth-form, the presence of large paliform lobes and fine teeth on the septa. This family has only one genus *Trachyphyllia*, which itself is a monospecific genus.

GENUS

Trachyphyllia Milne Edwards and Haime, 1848

Characters: It is a monospecific genus. Colonies are usually free-living, colonial and flabello-meandroid, resulting from intramural budding. Corallite wall appears to be primarily parathecal and primarily septothecal. The columella is trabecular centers are linked.



Trachyphyllia geoffroyi

Trachyphyllia geoffroyi

Colonies flabello-meandroid and free-living.

Usually hourglass shaped up to 80mm in length with one to three mouths.

Valleys have large regular septa, paliform lobes and a large columellae of tangles spines.

GLOSSARY

Anastomose : descriptive term for branches which re-fuse after having initially divided.

Appressed corallites : corallites which are fused (partly or completely) with the coenosteum on one side so that their axis is approximately parallel with the coenosteum.

Arborescent colonies : colonies with a tree-like growth from.

Axial corallite : a corallite which forms the tip of a branch. Most acropora have axial corallites whereas they only occur sporadically in other corals.

Axial furrow : a groove along the axis of the upper surface of some fungiids

Azooxanthellate corals : corals that do not have zooxanthellae. Most of them are deep water dwelling where, light rarely penetrates.

Bifacial : corallites occur on both sides of a plate or folia

Bottle brush branching : a descriptive term for a branch with compact radial radial sub-branches, usually used for some acropora species.

Branching colonies : a descriptive term for a branch with compact radial sub-branches, usually used for some acropora species.

Budding : coral polyp splits in two and produces two new "daughter" polyps.

Caespitose : a descriptive term for branches which interlock similarly in three dimensions, usually used for some acropora species.

Calice : the inside area of the corallite, not including the walls

Central arch : a raised area surrounding the mouth of some solitary fungiids

Cerioid : adjacent corallites share the same wall

Coenosteum pit : the point of insertion, or commencement of septa. Mostly found in pectiniidae and fungiida

Coenosteum style : prominent projections from the coenosteum usually associated with a single corallite.

Coenosteum : the surface of the corallum in between the corallites

Collines : skeletal ridges composed of coenosteum which separate corallites

Colony : corals are made up of numerous individual coral polyps which are inter connected to form a colony.

Columella : skeletal structure at the centre of the corallite composed of single or multiple elements.

Columnar colonies : colonies forming into one or more columns.

Commensal : a partner in a mutually beneficial relationship between two different types of organisms

Compact branching : where branches of a colony are close together.

Corallite : individual cup in the skeleton, which holds a polyp.

Corallum : coral skeleton pleural: coralla

Corymbose : a descriptive term for colonies which have horizontal interlocking branches and have short upright branchlets, usually used for some acropora species.

Costae : radial skeletal elements outside the corallite wall.

Cycles of septa/septo-costae : where radial elements occur in a set sequence of size (6 primary, 6 secondary, 12 tertiary and so on)

Deltas of septa : fusion of septa into a hexamerous pattern of spongy columella. Common in goniopora.

Dentation : teeth which form along the upper margins of the septa

Digitate : a colony with short branches shaped like the upturned fingers of a hand.

Dissepiments : partitions which cut off the lower part of the colony which the polyp no longer occupies (as the polyp grows upward)

Distal : remote from the centre, eg., the end of a branch.

Diversity : the number of taxa in a group or place.

Ectodermis : the outer cell layer of a polyp.

Edge zone : zone between the calice or top of branch and the start of the **epitheca,** where live coral tissue comes down to meet the epitheca

Encrusting colonies : thin colonies which adhere closely, and are attached to the substrate.

Encrusting : growth form of a coral in which the animal forms a think layer or crust over rocks.

Endemic : a species restricted to a specific region.

Entire : without substantial irregularities.

Epitheca : a tissue-like layer of calcium carbonate that grows outside corallite walls. Originally derived from the basal plate.

Explanate corals : colonies which spread horizontally as branches fuse into a solid or near solid plate.

Explanate : plate growth form.

Exsert corallite : corallite which protrudes above the level of the coenosteum

Exsert septa : septa which project above the corallite wall

Extant : now living

Extinct : no longer living

Extratentacular budding : method of polyp reproduction in which the new polyp originates outside the ring of tentacles.

Family : taxonomic ranking comprising a group of related genera

Flabello-meandroid : corals, which have valleys with walls that are separate from the walls of adjacent valleys.

Flaring corallites : with expanding (trumpet-like) curves to the outer corallite wall.

Foliaceous : growth form in which colonies form thin sheets which may be inclined upwards and sometimes develop into branches.

Fossa : a cavity or hole in the skeleton.

Foveolate corallites : corallites of some species of montipora which are situated at the base of funnel-shaped depressions.

Foveolate : funnel shaped corallites with deep depressions at the base

Free-living coral : corals that are not attached to the substrate.

Genus : taxonomic ranking comprising a group of related species exhibiting unusual characters.

Glabrous : devoid of attached structures.

Granulate : covered with tiny protruding granules of skeleton, usually the ends of trabeculae.

Granulated : covered with sand-like particles.

Groove-and-tubercle structures : fine epithecal structures, the development of which is controlled by polychaete worms.

Growth form : overall shape of the entire coral skeleton.

Hermatypic : literally means reef building

Holotype : the principal specimen on which a species name is based.

Immersed corallites : corallites which are embedded in development between radial and axial corallites of acropora.

Incipient axial corallites : corallites intermediate in development between radial and axial corallites of acropora.

Intertentacular budding : growth of polyps from the inside wall of parent corallites, usually by division of the parent corallites.

Lamellar : flat, plate-like

Latitudinal attenuation : the progressive decrease in diversity along continental coastlines with increasing distance from the equator.

Massive colonies : colonies which are solid and which are typically hemispherical or otherwise have approximately similar dimensions in all directions.

Meandroid colonies : massive colonies that have corallite mouths aligned in valleys such that there are no individual polyps.

Monocentric corallites : corallites have one columella centre per corallite.

Monospecific : describes a genus with one species only, or a coral community with one species only.

Monticules : conical sections of common wall between corallites which have a secondary radial symmetry.

Mucous : gelatinous substance secreted by the ectodermis for protection, to aid the capture of food, or to remove sediment. Mucous is usually moved by cilia.

Nariform : a radial corallite shaped like upside down nose. Usually found in acropora.

Nominal species : species that exists in name only.

Oral cone : a mound of soft tissue surrounding the mouth.

Oral disc : the soft tissue between the mouth and the surrounding tentacles.

Orders of septa/septo-costae : where radial elements occur in different sizes, but not as cycles.

Pali : upright skeletal rods or plates at the inner margin of septa formed by upward growth of the septum.

Paliform crown : a circle of paliform lobes surrounding the columella.

Paliform lobe : innermost dentation of septum (formed differently from palus) may form a crown.

Palus : (plural - pali) : innermost dentation of septum (formed differently from paliform lobe) may form a crown.

Papillae : projections on the surface

Peritheca : area outside the corallite, also called coenosteum and exotheca.

Phaceloid corals : corals that have corallites of uniform height adjoined towards their base.

Phylum : the taxon level representing a group of related families.

Pinnule : small upright structures, usually columellae, which are cylindrical in shape.

Plocoid : each corallite has its own separate wall

Polyp : small, tube shaped animal with a ring of tentacles.

Pourtales plan: a cyclical arrangement of septa created by a specific pattern of fusion.

Propagule : a sexually or asexually produced reproductive body capable of developing into an adult organism.

Prostrate : a descriptive term for a colony which sprawls horizontally over the substrate.

Proximal : close to the centrel, eg., the base of a branch.

Radial corallite : corallites on the sides of branches as opposed to axial corallites on the tips of branches. The term is usually used with acropora and anacropora.

Radii : inconspicuous septal elements connecting septa with the columella. Used in the taxonomy of porites.

Rasp like corallites : regularly arranged corallites with sharp edges reminiscent of a wood rasp.

Reef flat : the flat intertidal parts of reef that are exposed to wave action.

Reefs : limestone platforms of shallow tropical seas built by corals, coralline algae and other photosynthetic organisms or symbionts.

Reef-slope : the sloping parts of reefs below the reef flat.

Scale like corallites : corallites forming a pattern reminiscent of the pattern of fish scales.

Scleractinian corals : hard corals which have skeleton made up of limestone and grouped under order scleractinia.

Septa : radial skeletal elements project inwards from the corallite wall.

Septal teeth : sharp tooth-like or lobed structures along the margins of septa.

Septo-costae : radial skeletal elements crossing the corallite wall, composed of both septa and costae.

Solitary corals : corals composed of single individuals. There may be no clear distinction between single individuals with many mouths and colonies with individuals which have single mouths.

Species : comprises all the individual animals that look alike and are capable of interbreeding with one another.

Spinnule : a soluble if bear microscopic size.

Spinule : small spines that occur between the corallites of a coral skeleton.

Spongy : tightly reticulate

Staghorn : common name for branching acropora species.

Sterome : skeletal infilling derived from the thickening of septa to provide most of the content of corallite walls in some coral families.

Stolons : horizontal polyp outgrowths from which daughter polyps are budded.

Striae : a string-like arrangement of skeletal elements or soft tissue.

Styliform : needle like

Sub- : a prefix meaning less than or not quite

Synapticulae : rods linking septa, either forming a network or in some coral families, contributing to the content of corallite walls.

Synonymy : a list of names considered by a taxonomist to apply to a given taxon other than the name by which the taxon should be known.

Systematics : study of the genetic relationship between taxa.

Taxon : a taxonomic unit

Taxonomy : study of the morphological relationship between taxa and the naming of taxa.

Tentacle : projection around the mouth of a coral polyp

Tentacles : tubular extensions of the polyp. The interior of the tentacles is continuous with the coelenteron.

Tentacular lobe : a lobe at the beginning (point of insertion) of a septum. Commonly found in fungia where each lobe supports a single tentacle.

Thicket : a descriptive term for colonies composed of closely compacted upright branches.

Trabeculae : radiating skeletal fibres that grow together to form septa and other skeletal elements; the endpoints are visible as granulations.

Trident : pattern of fusion of the ventral septa of some porites where the septa are linked by a cross-bar.

Triplet of septa : the three ventral septa of porites corallites.

Tuberculae : projections of coenosteum on the surface of many species of montipora that are more than a corallite wide.

Type locality : the place where a species was originally described from.

Type species : the species that a genus is primarily based on.

Type specimens : the specimens that a species was originally described from. A single or principle specimen is the holotype.

Unifacial : describes plates which have corallites on one side only.

Verrucae : mounds of coenosteum on the surface of many species of montipora and pocillopora, that are wider than a corallite.

Zooxanthellae : photosynthetic algae (dinoflagellates) that can occur symbiotically in animal tissue.

Zooxanthellate corals : corals that have zooxanthellae

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CORALS OF INDIA

Pocillopora damicornis
CAULIFLOWER CORAL

Montipora verrucosa
VELVET CORAL

Montipora aequituberculata
VELVET CORAL

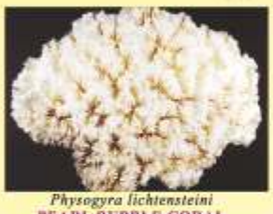
Montipora digitata
VELVET BRANCH CORAL

Astreopora listeri
MOON CORAL

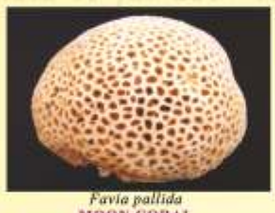
Seriatopora hystrix
BIRDS NEST CORAL

Euphyllia glabrescens
HAMMER CORAL

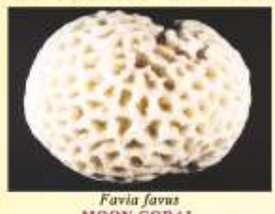
Favia matthai
MOON CORAL



Physogyra lichtensteini
PEARL BUBBLE CORAL



Favia pallida
MOON CORAL



Favia favus
MOON CORAL

Goniastrea edwardsi
MOON CORAL

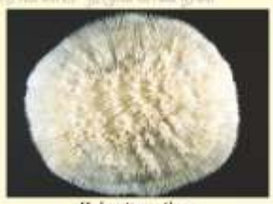
Platygyra lamellina
MAZE CORAL

Leptoria phrygia
BRAIN CORAL

Oulophyllia crispa
BRAIN CORAL

Echinopora lamellosa
STAR CORAL

Fungia scutaria
MUSHROOM CORAL



Halomitra pileus
HELMET CORAL

Galaxea astreata
TOOTH CORAL

Lobophyllia hemprichii
TOOTH CORAL

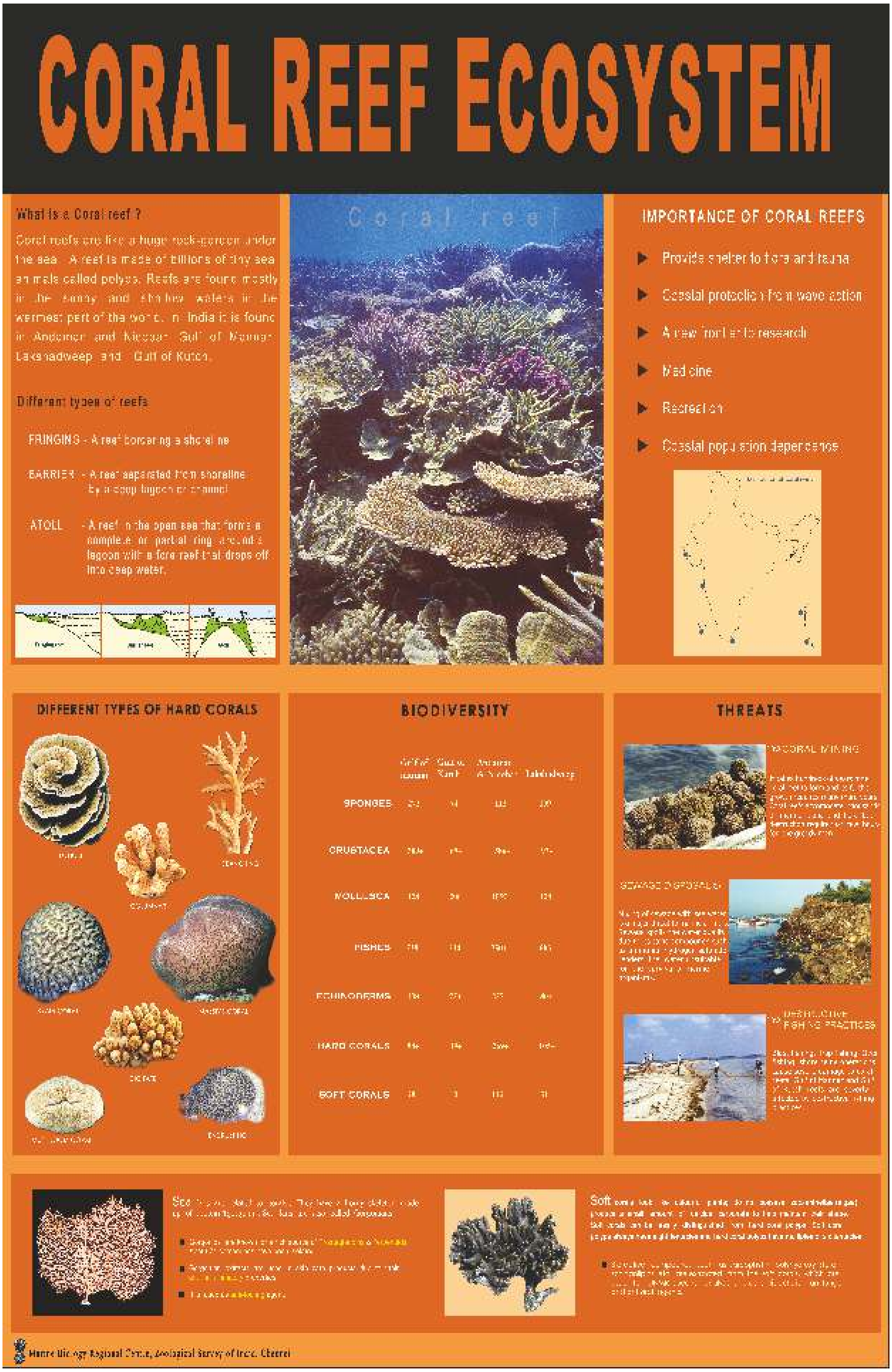
Pectinia paeonia
PALM LETTUCE CORAL

Turbinaria mesenterina
TURBAN CORAL

Acropora robusta
STAGHORN CORAL

Heliopora sp.
BLUE CORAL

CORALS ARE PROTECTED UNDER SCHEDULE I OF WILDLIFE PROTECTION ACT, 1972


CORAL REEF ECOSYSTEM
What is a Coral reef ?
Coral reefs are like a huge rock-garden under the sea. A reef is made of billions of tiny sea animals called polyps. Reefs are found mostly in the sunny and shallow waters in the warmest part of the world. In India it is found in Andaman and Nicobar, Gulf of Mannar, Lakshadweep and Gulf of Kutch.
Different types of reefs
FRINGING - A reef bordering a shoreline
BARRIER - A reef separated from shoreline by a deep lagoon or channel
ATOLL - A reef in the open sea that forms a complete or partial ring around a lagoon with a fore reef that drops off into deep water.
Coral reef
IMPORTANCE OF CORAL REEFS
Provide shelter to flora and fauna
Coastal protection from wave action
A new frontier to research
Medicine
Recreation
Coastal population dependence
DIFFERENT TYPES OF HARD CORALS
BIODIVERSITY
SPONGES
CRUSTACEA
MOLLUSCA
FISHES
ECHINODERMS
HARD CORALS
SOFT CORALS
THREATS
CORAL MINING
SEWAGE DISPOSAL
DESTRUCTIVE FISHING PRACTICES
Sea
Soft
Marine Biology Regional Centre, Zoological Survey of India, Chennai

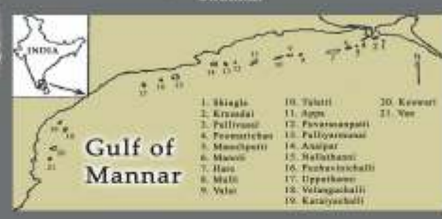
Scleractinian Fauna of Gulf of Mannar Biosphere Reserve

The Gulf of Mannar Marine Biosphere Reserve is the first marine Biosphere not only in India but in the entire south and south East Asia. It was established jointly by the Government of India and the Government of Tamil Nadu with effect from 18.2.1989. There are 21 islands lying off the coast in Ramanathapuram and Tuticorin districts. Most of the islands are of coral origin.

The Islands lie at an average of about 8 km from the main land. They are a part of the manner Barrier reef, which is about 140km long and 25km wide between Pamban and Tuticorin.

A total of 199+ species divided among 71+ genera are hither to recorded from India, out of these the Gulf of Mannar bearing 91+ species among 35+ genera.

Marine Biology Regional Centre
Zoological Survey of India
Chennai



There are about 47 fishing villages along the coast of which 38 are in the Ramanathapuram district and nine in V.O. Chidambaranar district bordering the Gulf of Mannar park area. Exploitation of fishery resources in the inshore waters has been the sole occupation of hundreds of fishing families along the coast for centuries. The reefs are used to carry out reef fishery, chanks and pearl fishery and Ornamental shell trade. Turtles & Dugongs are also present.


Montipora hispida


Montipora verrucosa


Montipora digitata


Stylophora pistillata


Pocillopora damicornis


Pocillopora eydouxi


Pocillopora verrucosa


Favites abdita


Favites halicora


Favites pentagona


Favia pallida


Goniastrea retiformis


Platygyra lamellina


Platygyra daedalea


Platygyra sinensis


Leptoria phrygia


Cyphastrea microphthalma


Lepastrea purpurea


Leptastrea transversa


Cycloseris cyclolites


Galaxea astreata


Turbinaria peltata


Symphyllia radians


Goniopora stokesi


Porana decussata

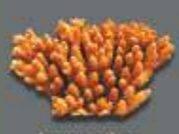

Pachyseris rugosa


Psammocora contigua


Acropora muricata


Acropora hyacinthus


Acropora robusta


Acropora cytherea


Acropora millepora


Astreopora myriophthalma


Hydnophora exesa


Hydnophora microconos


Mycedium elephantotus

Values of Coral Reefs

- Home to 1/3 of all Marine fish
- Support Tourist Economies
- A new frontier for Medical research
- A food source for 100s of millions of people
- Coastal protection from wave action
- Great Beauty and Spiritual value

Threats to Coral Reefs

- Sediments from Dredging or land clearing
- Nutrient influx from sewage
- Agricultural runoff (Pesticides, Nutrients)
- Boat groundings and anchors
- Physical damage from SCUBA, Snorkeling & Swimming
- Shoreline development
- Industrial pollution
- Over-fishing
- Collecting for aquariums
- Oil spills
- Storms
- Disease
- Thermal stress
- Urban runoff

Corals are one of the few difficult groups in Animal Kingdom as far as Taxonomy is concerned. Identification of corals is difficult not only through traditional morphological taxonomy but also with the help of upcoming molecular taxonomy. The major projected reasons for this difficulty are the fast evolving nature of these animals and the identification of corals traditionally by studying the morphology and structure of the coral colony as a whole and individual corallite in detail. The practical reasons for the intricacies in identification, is the synchronized spawning of all corals at only one time of a year and the plastic nature of its skeleton. There is every possibility of interbreeding during spawning and the plastic nature of skeleton changes the shape of the corallite in general and coral colony in particular. The morphology of the coral colony varies according to the physical environment such as wave action, current or the depth in which they grow.

In fact, close and patient observation is very much required to identify the changes. This habit gets evolved only under proper supervision and at the availability of sufficient easily understandable literature. Literature on coral taxonomy is very much lacking because of the availability of few diving researchers, their interest to work on this group and most importantly the interest of the experienced taxonomists to develop further capacity by sharing the expertise they gained. With a view to break this barrier, the present book is prepared as simple as possible with proper and simple explanation of the characters used for identification with pictures, projection of only the important characters of the species listed supported by a glossary. The major objective of this book is not just to inculcate interest among the readers but also to create thoughtful capacity in coral taxonomy. There are chapters on the diversity, variety and distribution of corals and coral reefs for enthusiastic readers as well.

Corals are highly threatened group of animals which are predicted to vanish by the end of this century primarily due to global warming. Coral identification is selected by a very few who are adventurous and have a lion heart to do something recognisable to the society. Since this book is in your hand and if we can presume that you are of such kind, please act as a crusader to save and protect these very sensitive animals which grow very slow (on an average only 1.5 cm in a year) and disappearing very fast.