Handbook on Hard Corals of India



K. Venkataraman
Ch. Satyanarayana
J.R.B. Alfred
J. Wolstenholme

ZOOLOGICAL SURVEY OF INDIA

Handbook
on
Hard Corals of India

Handbook on Hard Corals of India

K. VENKATARAMAN
Zoological Survey of India, Marine Biological Station, Chennai
CH. SATYANARAYANA
J.R.B. ALFRED
Zoological Survey of India, M-Block, New Alipore, Kolkata
J. WOLSTENHOLME
Museum of Tropical Queensland, Australia

Zoological Survey of India
Kolkata

CITATION
Venkataraman, K.; Ch. Satyanarayan; Alfred, J.R.B. and Wolstenholme, J. 2003. *Handbook on Hard Corals of India*, 1-266. (Published by the Director, *Zoòl. Surv. India*, Kolkata)

Published : November, 2003

ISBN- 81-8171-20-7

PRICE
Indian : Rs. 2,300.00
Foreign : $ 150 £ 100

Published at the Publication Division by the Director, Zoological Survey of India, 234/4, AJC Bose Road, 2nd MSO Building (13th Floor), Nizam Palace, Kolkata-700020 and printed at Shiva Offset Press, Dehra Dun.

MUSEUM OF TROPICAL QUEENSLAND

78-102 Flinders SL
Townsville Old
Australia 4810
Ph: (07) 4726 0600
Fax: (07) 4721 2093
International: +617

FOREWORD

A country with marine borders is truly fortunate because of the marine resources that those borders enclose. India is doubly blessed by having extensive coral reefs adjacent to its shores and island chains. These reefs are the environmental future of India's coastal communities as well as a potential source of leisure and nourishment for future generations.

In the international community of coral reef scientists, India is held in high regard because of its role in commencing, in 1968, the great series of International Coral Reef Symposia, held every four years since then in some part of the tropical world. The name of Dr. C. S. Gopinatha Pillai, India's first coral taxonomist and a founder of the Zoological Survey of India's coral collection, is forever associated with that meeting.

The Government of India has acknowledged the importance of the coral reef environment by putting in place an accelerated programme to document and manage its reefs. It is as part of this programme that this handbook of the corals of India has been developed. It was my great fortune to be associated with Drs. Venkataraman and Satyanarayana as well as Dr. Alfred, all of the Zoological Survey of India, when the Museum of Tropical Queensland was responsible for the Taxonomic component of in the India Australia Capacity Building and Training Programme for Coral Reefs in 2000-2001.

Museum of Tropical Queensland has arguably the most completely documented collections of Indo-Pacific corals in the world, however our knowledge of the corals of India could only be fully developed in collaboration with these scientists. Our goal was firstly to inventory and document the corals known to be present on India's reefs, and then to develop a resource that would be of assistance to the young generation entrusted with the monitoring, management and care of India's reefs.

One first example of this process was the poster showing the corals of India. The second is this magnificent handbook. Drs. Venkataraman, Satyanarayana, Alfred and Wolstenholme have developed the descriptions of the corals in such a way that they are accessible to as broad an audience as possible. Whether as part of a training program for surveying corals on reefs, or as an individual wishing to extend your knowledge, you will find that this book offers a comprehensive, up-to-date summary of the species likely to be encountered and their distinctive characteristics. Behind this handbook is a great deal of scholarship and taxonomic expertise, but I am sure you will also appreciate the corals for what they are precious natural resources for the future.

28th November, 2002
Place : Australia

CARDEN WALLACE
Director

ACKNOWLEDGEMENTS

The Zoological Survey of India as a premier Institute owes special responsibility of promoting taxonomy and setting trends and standards for taxonomic research within the country. In this connection, Lt. Col. R.B.S. Sewell, (Former Director, ZSI, 1925-35) was the first person in India to conduct studies on Corals and coral reef formations in Andaman and Nicobar Islands and Maldives. He laid the foundation for coral reef and ocean research in India. In the past few decades many coral reef surveys have been conducted by Zoological Survey of India (especially by Dr. K. Reddiah) and the present book is the outcome of the National Zoological Collections. We thank all who have contributed to the coral reef studies in India.

We express our deep sense of gratitude to Dr. Carden C. Wallace, Director, Museum of Tropical Queensland, Townsville, Australia for writing the foreword for this book, her personal interest and inspirations we have received all the time and it is due to her constant support, two of us (KV and ChS) were able to undertake training on coral taxonomy in Museum of Tropical Queensland and to prepare this book.

We thank the coral taxonomists Drs. Carden Wallace, Museum of Tropical Queensland, Townsville, Dougles Fenner, Australian Institute of Marine Science, Townsville, Arjan Rajasuriya, NARA, Colombo, Bette Willis, James Cook Uuiversity, Townsville, Niphon Phongsuwan, Phuket Marine Station, Thailand and C. S. G. Pillai, (Senior Scientist, Rtd.), Central Marine Fisheries Research Institute, Cochin who helped us in the taxonomy of corals.

We thank Dr. M. Paul, Museum of Tropical Queensland, Townsille and Ms. Barbara Done, Museum of Tropical Queensland, Townsville for their encouragement and scientific support, Ms. R. Zoe, Marion Gaemers and Mr. James True, Museum of Tropical Queensland, Townsville, for their support in the preparation of the hand book in its initial stages.

We thank Drs. Hopley, James Cook University, Townsville and Tery Done, Australian Institute of Marine Sciences, Townsville and Clive Wilkinson, Global Coordinator, Global Coral Reef Monitoring Network, Townsville, Australia for their encouragement and support. We thank the GCRMN, National Coordinators Mr. Husain, Maldives, Mr. Arjan Rajasuriya, Srilanka for their support and encouragement.

We thank Global Coral Reef Monitoring Network, South Asia for coral taxonomy training, providing literature and books, Dr. Clive Wilkinson for funding SCUBA diving training at Australia.

We thank different organizations such as Museum of Tropical Queensland, Townsville, Forest departments of Tamil Nadu, Andaman and Nicobar Administration, Gulf of Kachchh, James Cook University, Townsville, Australian Institute of Marine Science, Townsville, ICMAM Project Directorate, Department of Ocean Development, Chennai.,GCRMN, South Asia, Colombo, Andaman and Nicobar Regional Station, ZSI, Port Blair, Project Directorate, UNDP-GEF PDF B, ANRS, Andaman who supported us in many ways to conduct studies on coral reefs and coral taxonomy.

We thank Dr A. K. Hazra, Scientist E, Mr. Satya Das, Sr. Zool Asst, Mr. Anand, Sr. Assit, and Mr. Sakthi, Junior Asst, Zoological Survey of India, Kolkata for their help in Scanning Electron Micrography.

We thank the Photographers Mr. Ponnusamy, Andaman and Nicobar Regional Station, Zoological Survey of India, Port Blair, Mr. E. Seshan, Marine Biological Station, ZSI, Chennai, and Mr. Z. Florian, Museum of Tropical Queensland, Townsville for their timely support in the coral photography. We also thank the Director, Museum of Tropical Queensland, Townsville for permission to compare the Indian coral collection and to photograph some of the coral specimens for use in this book.

We thank the artists Ms. Monica Bilande, Switzerland (Internship to Museum of Tropical Queensland, IATCB Programme, Australia) and Mr. Margabandu, Southern Regional Station, Zoological Survey of India, Chennai for the excellent coral diagrams.

We thank Mr. P. T. Rajan, Zool. Assistant, Andaman and Nicobar Regional Station, Zoological Survey of India, Port Blair, Dr. M.C. John Milton, Mr A. Gokul, Mr. M. Nithyanandam and Mr. B. Ashok Research staff of All India Coordinated Project on Marine Biodiversity, Marine Biological Station, Chennai for their help in the field as well as in the preparation of this book. We also thank the officers and technical staff of Marine Biological Station and Andaman and Nicobar Regional Station, ZSI for their help in the field as well as in the collection hall.

We thank Mr Rathiram, Publication and Production Officer, Publication Division, Zoological Survey of India for his support and excellent printing technologies used to print this book and bringing out this book within a short time.

Our sincere thanks are due to Dr E.V. Muley, Additional Director, Ministry of Environment and Forests, Coordinator, Indian Coral Reef Monitoring Network, National Coordinator, Global Coral Reef Monitoring Network, Coordinator, India Australia Training and Capacity Building Programme, without whose help we (KV and ChS) could not have undergone coral taxonomy training programmes as well as the preparation of this hand book.

Taxonomic sources used to identify and describe the species in this handbook are provided in the suggested reading list page 265. These references include several publications by Dr. Pillai and Dr. Scheer (Pillai, 1983; Pillai, 1986; Scheer and Pillai, 1983) for a range of texa and locations; the AIMS monograph series, Scleractinia of Eastern Australia (Vol. 1-6), a monograph of the mushroom corals of the Family Fungiidae (Hoksema, 1989) a revision of the staghorn coral genus *Acropora* (Wallace, 1999) and "Corals of the World" (Vol. 1-3) (Veron, 2000).

We (KV and ChS) thank the Aus Aid "India Australia Training and Capacity Building Programme" (IATCBP), Government of Australia and Australian Marine Science and Technology Limited (AMSAT), Mr. Jim Travers, Project Director, Mrs. Barbara Harriss, Project Assistant, Canberra, Australia for supporting the Coral Taxonomy Training in Australia, Financially.

We gratefully thank Mr. K.P. Raghuram, Project Staff of All India Coordinated Project on Marine Biodiversity, Marine Biological Station, Zoological Survey of India, Chennai for his extraordinary computer skills and designing the book with Photoshop techniques.

K. Venkataraman

CH. Satyanarayana

J.R.B. Alfred

J. Wolstenholme

CONTENTS

PHOTO CREDITS

1. Coral Ecosystem Photograph : Aerial Photographs of Agatti and Kavaratti, Lakshadweep by Rogan Arthur, Research Scholar, James Cook University, Australia.

2. Many underwater photographs of species of *Acropora* were provided by Dr. Carden C. Wallace, Director, Museum of Tropical Queensland, Townsville, Australia.

Page No. 48. Underwater coral reef ecosystem

Page No. 52. *Acropora humilis*

Page No. 52. *Acropora gemmifera*

Page No. 54. *Acropora samoensis*

Page No. 54. *Acropora digitifera*

Page No. 55. *Acropora multiacuta*

Page No. 55. *Acropora nasuta*

Page No. 56. *Acropora valida*

Page No. 56. *Acropora secale*

Page No. 57. *Acropora divaricata*

Page No. 58. *Acropora solitaryensis*

Page No. 58. *Acropora glauca*

Page No. 60. *Acropora grandis*

Page No. 60. *Acropora valenciennesi*

Page No. 60. *Acropora abrotanoides*

Page No. 62. *Acropora palmerae*

Page No. 62. *Acropora intermedia*

Page No. 63. *Acropora tenuis*

Page No. 66. *Acropora florida*

Page No. 68. *Acropora microclados*

Page No.68. *Acropora micropthalma*

Page No. 69. *Acropora loripes*

Page No. 69. *Acropora granulosa*

Page No. 70. *Acropora caroliniana*

Page No. 70. *Acropora echinata*

Page No. 71. *Acropora subglabra*

Page No. 71. *Acropora carduus*

Page No. 73. *Acropora brueggemanni*

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 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 (= hard or stony or hermatypic) corals 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 number of species 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 anywhere between half and 2 million, or perhaps even 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 (D.O.D. and S.A.C., 1997), which is less than one percent of all the coral reef areas in the world.

The most diverse region of 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. More than 208 species of hard corals have been recorded from 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 recent GCRMN Coral genera identification Training (December 1999) yielded 13 new records from Andaman (New Wandoor area: unpublished data) and the GOI/UNDP/GEF diving mission yielded 198 species of which 111 are new records to India (Turner *et al.*, 2001). More serious 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 and 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 at Gulf of Mannar region. Edgar Thurston collected several specimens from Rameswaram, (Gulf of Mannar) at a time as Foote (1888) aptly commented, when the place was "the most out of the way, and 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* were 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) mentioned the occurrence of *Montipora divaricata (= M. ramose)* and *M. foliosa* at Rameswaram. Bernard (1905) also described 14 specimens of *Porites* collected by Thurston from the living and subfossilised reefs of Rameswaram. Gardiner (1904, 1905) 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 (1924a) reported a species of *Culicia* from Chilka Lake, Orissa. In his catalogue of the "Meandroid Astraoidae" Matthai (1928) 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 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 to 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 few papers were published by Pillai after his cream publication on the Coral reefs of India, their conservation and management (Pillai, 1996). But for the taxonomic contributions by Pillai, the information base has not widened to any recognizeable extent.

It is important to mention here about the 1st International symposium on Corals, which was held in Mandapam, India. This symposium on Corals and Coral Reefs, organized by the Marine Biological Association of India, was held at the Central Marine Fisheries Institute, Mandapam Camp, India from 12th to 16th January 1969. The inaugural session was presided over by Dr. S. Jones, the then Director of the Institute and the President of the Association. Dr. P. S. B. R. James, the then Secretary of the Association welcomed the gathering. Dr. C. S. Gopinatha Pillai, Convener of the Symposium, introduced the participants. A total of 72 participants attended the symposium of which 25 were from abroad (United States of America 10; West Germany 4; France 5; Mexico, Singapore, United Kingdom, Indonesia, Australia and Brazil one each). Among the local participants 34 were from Central Marine Fisheries Research Institute and the rest from other institutes from India. There were 7 scientific sessions and 37 papers presented. Besides the scientific sessions, field trips to neighbouring coral reefs, variety of entertainments and film shows were also arranged. Dr. D. R. Stoddart, Chairman, Advisory Committee, spoke on behalf of the foreign participants.

In 1997, Global Coral Reef Monitoring Network (GCRMN) came to existence in South Asia mainly for capacity building in the region and new coral reef workers have started both in the biophysical studies as well as in the taxonomy. This resulted in a delegation of nine persons from India participating and presenting papers on the status of all the four major coral reefs of India in 9th International Coral Reef Symposium in Bali, 2000 after a gap of 30 years. A major break through was the signing of an agreement by governments of India and Australia in 2000 in the name of India-Australia Capacity Building and Training Project under which two scientists were trained on coral taxonomy in Museum of Tropical Queensland, Townsville (2001-2002) and the out come of this training is the publication of this hand book on corals of India.

The present *'Handbook on the hard corals of India'* is the maiden work on taxonomic and photographic guide for the identification of corals that inhabit Indian waters The aim of this guide is to document the biodiversity of Indian corals identified both during the Aus-Aid, India-Australia Training and Capacity Building Project, Coral Taxonomy Training (Museum of Tropical Queensland, Townsville: October 2001 – January 2002) (Appendix 2) as well as from other such earlier occasions. This guide is designed for students, snorkelers, divers, and in those interested in coral taxonomy.

GEOLOGIC HISTORY OF CORAL REEFS

The fossil record of coral enables us to understand the origin of coral reefs. The oldest

records indicate that reefs originated 2 billion years ago with the advent of filamentous algae. The first animal to be introduced into the reef building community appeared at the beginning of the Cambrian period - 600 million years ago. This was a stony sponge-like animal called an *archaeocyathid* (Greek for "ancient cup"). These animals were associated with stromatolites and contributed to the accumulation of reef material. Then, about 540 million years ago, the *archaeocyathids* became extinct.

In the middle of the Ordovician era, 480 million years ago, animals rejoined the reef-building process. These animals included the stony sponges called *stromatoporoid* and the stony coelenterates – the first corals. Then around 350 million years ago, reef building again diminished.

With the beginning of the Carboniferous period, the reef community re-established and began to flourish. The revitalized community contained the rugged stromatolites, along with bryozoans, brachipods and corals. For 115 million years, this new community flourished by radiating into thousands of new species that accumulated giant reefs still preserved in the fossil record. Then, 225 million years ago, reefs became extinct once more.

About 215 million years ago another reef community began to establish itself. Algae were the most important members of the community, but several new families of coral, the Scleractinians, became prominent. At this point, there was another

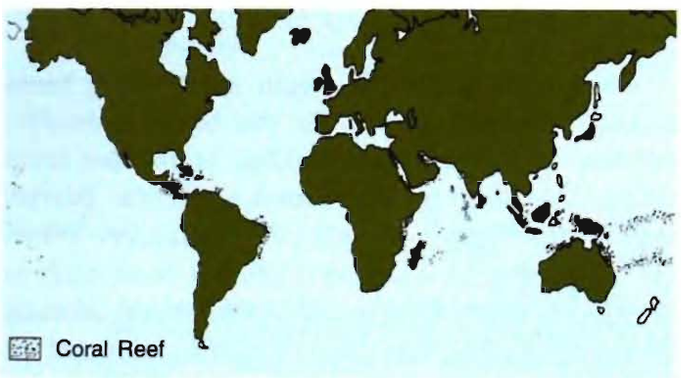


Fig. 1. Map showing the coral reef areas of the world

interval, about 20 million years, in which reefs were not present. This period was followed by an extensive period of reef expansion in which bivalve mollusks known as rudists dominated the reef ecosystem. For 60 million years, the rudists rivaled both the algae and coral as the dominant reef builder. Then, at the close of the cretaceous period, 62 million years ago, another great extinction occurred. Nearly a third of all animals known at that time did not survive. All 115 genera of dinosaurs became extinct and in the reef community, the rudists, along with two-thirds of the coral genera, perished.

A period of 10 million years passed before the reef community began to flourish once more. Since then, corals have become the most important members of the reef community. To date several periods of decline in reef building have been recorded, but no further great extinction events. Oddly enough, the last Ice Age, with its great swings in sea level, had little effect on reefs. Today reef communities occur throughout the tropical region, but are restricted to a relatively narrow sanctuary on either side of the equator where conditions still favour their growth (Fig. 1).

TYPES OF REEF

1. **Fringing Reefs** (Fig. 2 and 4)

Fringing reefs grow along the edges of continents around islands, close to shore but some times separated from it by a shallow lagoon. They are termed as shore reefs. They represent simplest reef type. They extend out from the coast for about a few meters to one kilometer as bench or platform with its surface more or less level with the water

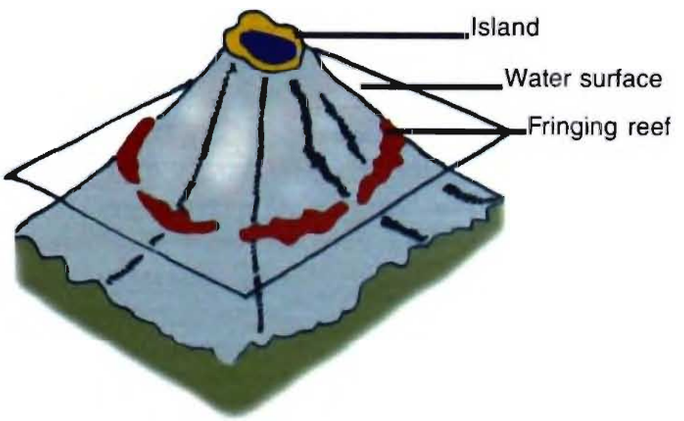


Fig. 2. Fringing Reef

surface. In fringing reefs the most active coral growth occurs at the reef edge or reef front. It is in fact narrow belt, 20 to 40 meters wide and subject to continuous surf. Beyond the outer edge

is a steep seaward slope to the sea bottom. Corals grow on this slope up to a depth of 40 – 100 meters. Between the reef-edge and the shore is a shallow and more or less flat surface, called the reef flat or seaward flat, composed largely of coral sand and mud, dead and living coral colonies, other animals and debris. The reef flat is ordinarily submerged at high tide, but at low tide the water seems to run rapidly exposing the whole surface of the flat almost simultaneously. This strongly contrasts with the gradual slopes of rocky surf beaches, which are exposed gradually, meter-by-meter as the tide falls. The flat is 50 to 100 meters broad and includes little or no loose material such as stones and rocks which may accumulate in a boulder zone, characterized by dead coral masses and reef fragments torn off by the breakers and carried across the flat by the surfs. Sometimes, between the boulder zone and the shore is found an inner flat, which may be several hundred meters wide. It is often hollowed out to form a shallow lake or channel serving as a convenient boat-channel to the locals, but suitable only for small boats at low tide. Fringing reefs are common in the Gulf of Mannar, Andaman and Nicobar Islands. Where there is murky water caused by soil run-off, fringing reefs rarely grow to a substantial depth.

2. **Barrier Reefs** (Fig. 3 and 4)

Barrier reefs develop along the edges of continental shelves or around islands that have become partially submerged, and are separated from mainland or island by a wide, deep lagoon. Fragile corals grow more on the lagoon side of the barrier than on the open side where they would have to withstand the force of larger and more violent waves. The stretch of water separating barrier reef from land may be many kilometers wide and is known as the lagoon. It may be 20 – 100 meters deep and suitable for navigation of the larger ships. A barrier reef, thus often encircles an island situated in the center of the lagoon. The barrier reefs may constitute a great danger to shipping. However, they form a breakwater off the shore but the sea on the outside is deep and often slopes to great depths. The barrier reef consists of the same parts as the fringing reef, that is reef edge, seaward flat and boulder zone. But the place of inner flat is taken by the lagoon flat.

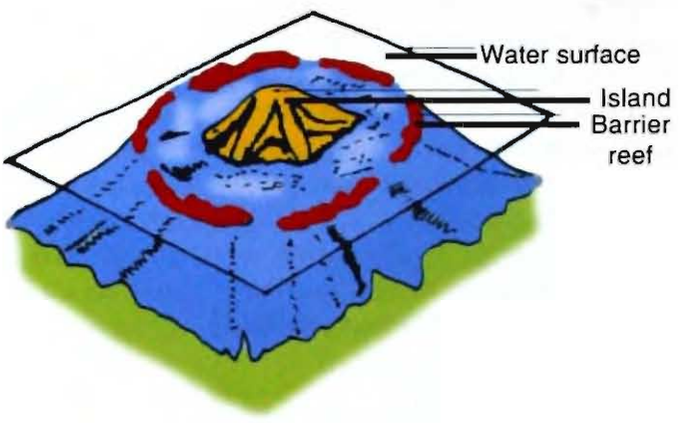


Fig. 3. Barrier Reef

The latter has a thin covering of sand and shows an extraordinary luxuriant coral growth. The lagoon may be so broad that, besides its distant barrier reef, the shore may posses a narrow fringing reef as well. There may be a fringing reef on one coast and a barrier reef on another and the two often merging into each other. This type of reefs can be found in Andaman and Nicobar Islands however the best-known example is the Great Barrier Reef, which extends nearly 2000 km along the east coast of Australia and represents the world's largest reef. It is an enormous coral structure extending along the northeastern coast of Australia for over 2000 km until it loses itself in the New Guinea reefs. Its distance from the main land varies from 15 – 250 km.

3. **Atoll Reefs** (Fig. 4 and 5)

Atoll reefs generally begin as fringing reefs around volcanic islands. As the island subsides, because of the sea floor sinking or the sea level rising, the fringing reef forms a circular barrier reef separated from the island by a lagoon. When the island finally disappears, the circle of reefs is left, sometimes capped with small coral islands, enclosing lagoon. The whole structure is called an atoll. It is also termed as a coral island or lagoon island. The lagoon varies from a few hundred meters to 70 or 90 km in diameter and 20 to 90 meters in depth. The rim of the ring is quite narrow, but a few hundred meters wide. It may be complete or broken by a number of gaps or channels of which only a few are navigable. The rim of reef often bears a linear series of the little

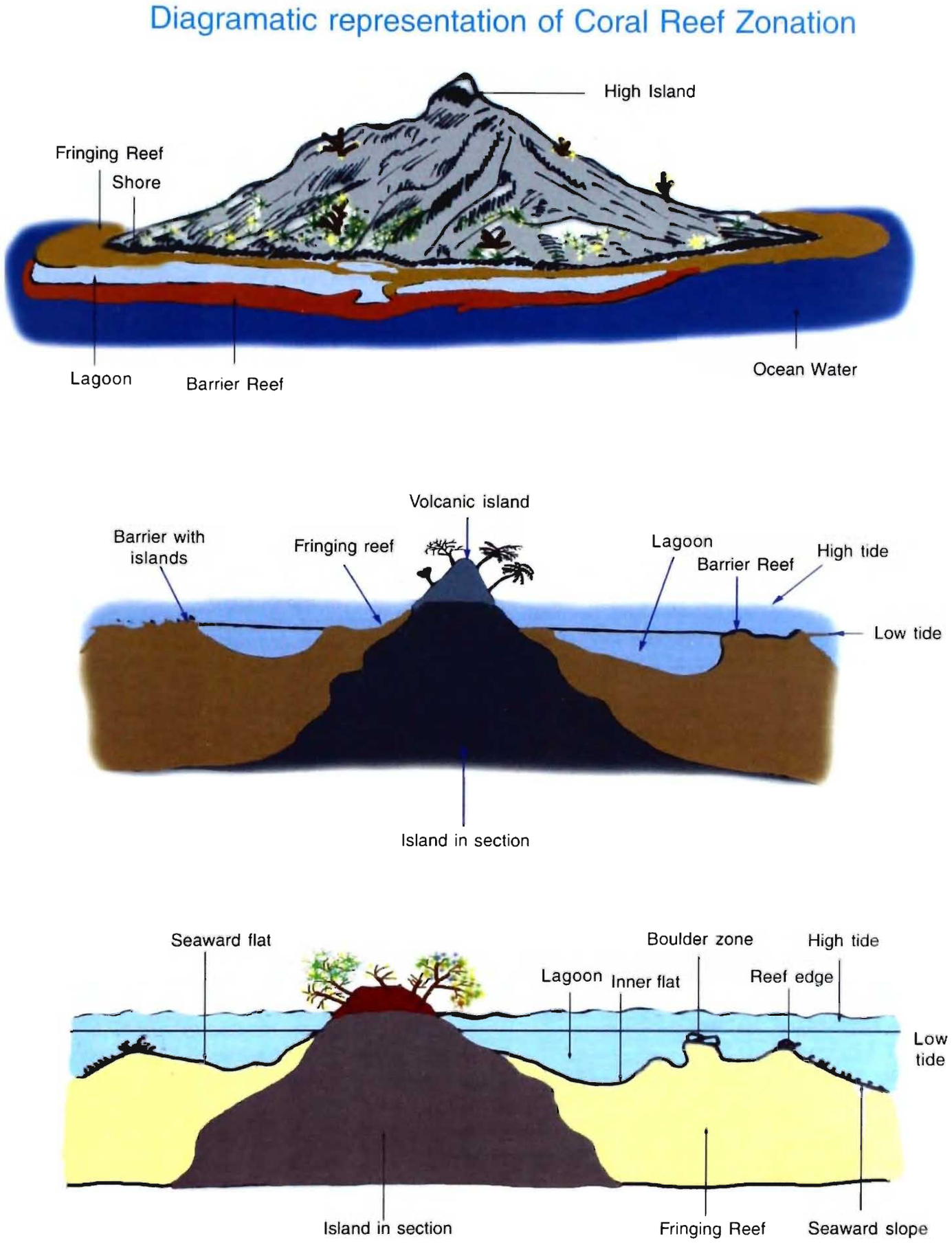


Fig. 4. Diagramatic representation of coral reef zonation.

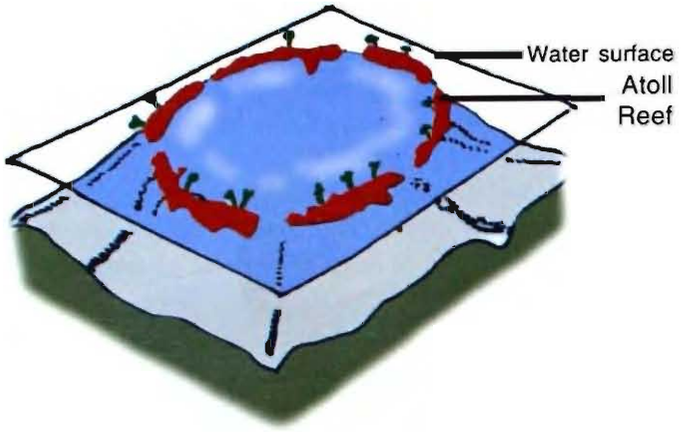


Fig. 5. Atoll Reef

islets. Thus a large atoll is a string of islets along a line of reef. The outer side of the atoll reef slopes off rather steeply into the depths of the ocean. Thousands of atolls dot the Indo-Pacific region forming nearly 90% of all coral formations of that region. The atolls are hundreds or thousands of kilometers away from the nearest land. The largest atoll of the world is the Suvadiva of the Maldives covering an area of 68 by 52 km with circumference of about 195 km and not less than 102 separate islets on its rim. The term atoll is derived from the language of Maldives, where a district is called an atolu and the governor the atoluveri. The king of Maldives bore the high-sounding title of "Ibrahim Sultan, king of the 13 Atollonas and 12,000 islets". Atoll varies in size from tiny Bitra, the smallest of just 0.10 sq km, to largest, Andrott, 4.84 sq km in Lakshadweep.

Fig. 6. Major coral reef areas in India

Apart from these, there are a few minor reef types as follows: Platform reef, Patch reef, Coral pinnacle, Reef flat, coralline shelf, Coral heads, and live coral platform.

CORAL REEFS IN INDIA

All the three major reef types occur in India (atoll, fringing and barrier) (Fig.6). 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 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 meters, 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

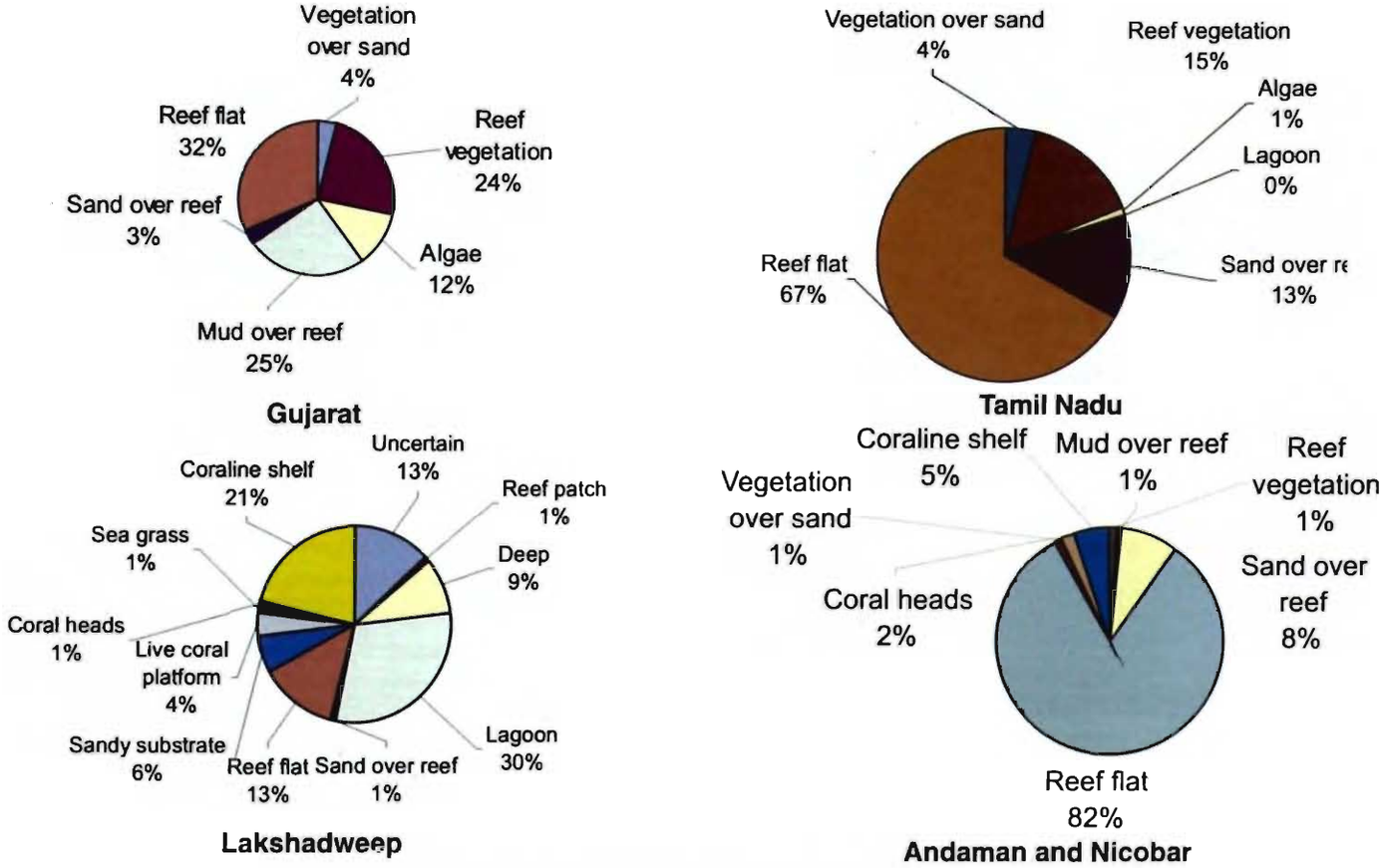


Fig.7. Area estimates of corai reefs in India (Adapted from D.O.D. and S.A.C., 1997)

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 noticeiably 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 (Fig. 8)

Coral reefs on Tamil Nadu coast (South East Coast) are located in Palk Bay near Rameswaram and in the Gulf of Mannar. Mandapam and Rameswaram Islands separate Palk Bay from the Gulf of Mannar. The reef is centred 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-west 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 of 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 extends up to Pamban Pass, is called Kathuvallimunai Reef, while

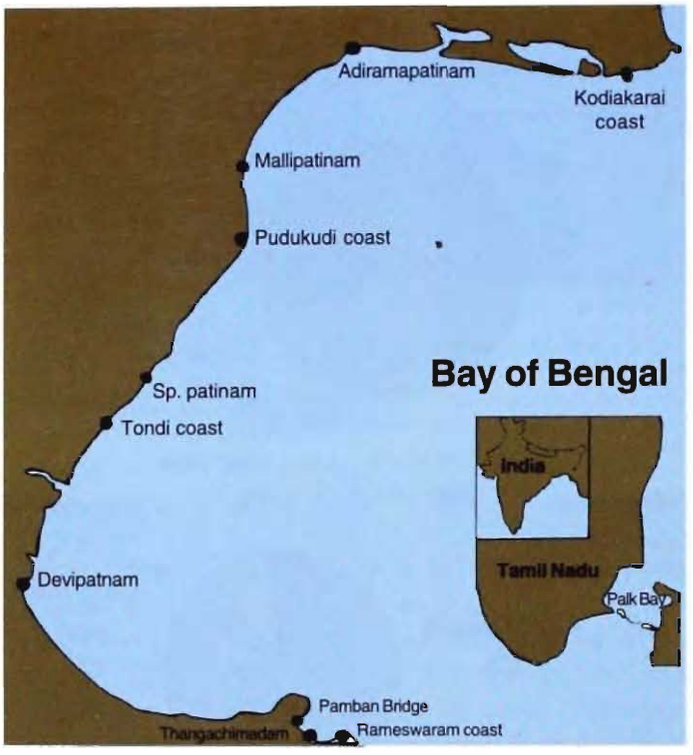


Fig. 8. Map of Palk Bay

the western half, which extends up to Thedai is called Vellaperthumunai Reef. The Kathuvallimunai reef is comparatively wider than the Vellperthumunai reef for most of its length. Visibility is poor due to siltation and 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.

Gulf of Mannar (Fig. 9)

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

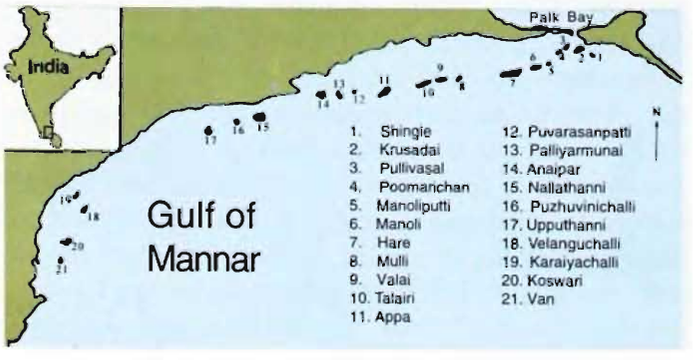


Fig. 9. Map of Gulf of Mannar showing 21 islands

latitude 8° 47′ N and 9° 15′N and longitude 78° 12′E and 79° 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 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 occupy 65 and 14 sq km, respectively (D.O.D and S.A.C., 1997). Usually monsoons, coral mining and high sedimentation load affect visibility. These reefs are more luxuriant and richer than the reefs of Palk Bay.

Pillai (1986) provided a comprehensive account of the coral fauna of this region. There are about 94 species of corals belonging to 37 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) 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 (Fig. 10)

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 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

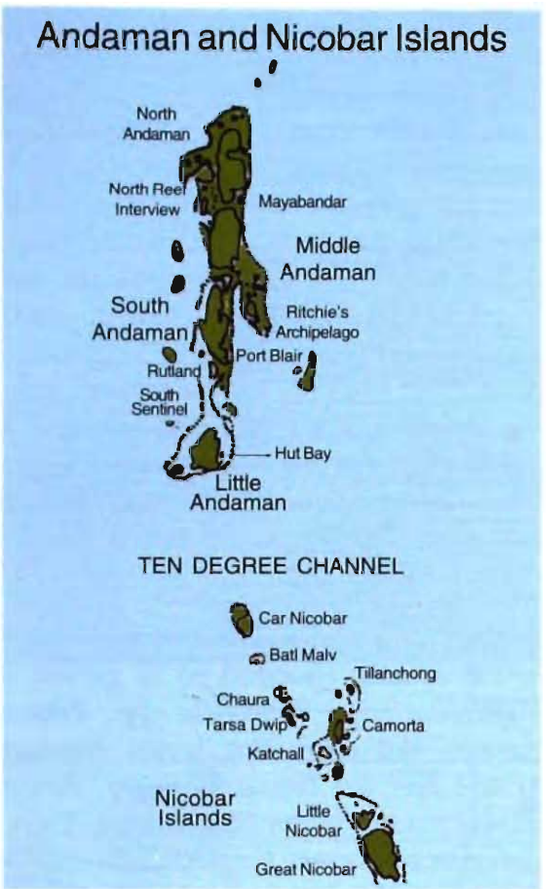


Fig. 10. Map of Andaman and Nicobar

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 unstudied. A deep oceanic ridge along 10° N separates the Andaman Group and the Nicobar Group islands. The orientaton 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.

WEST COAST OF INDIA

Malvan (Fig. 11)

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, Malvan and Rede, south of Bombay (Qasim and Wafar, 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 Vengura 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 northern 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 Malvan. Most of the marine flora and fauna from the intertidal area are 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.

Fig. 11. Map of Malvan

Lakshadweep Islands (Fig. 12)

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 Andrott, Amini, Agatti, Bangaram, Bita, Chetlat, Kadmat, Kalpeni, Kiltan, Minicoy and the headquaters 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.

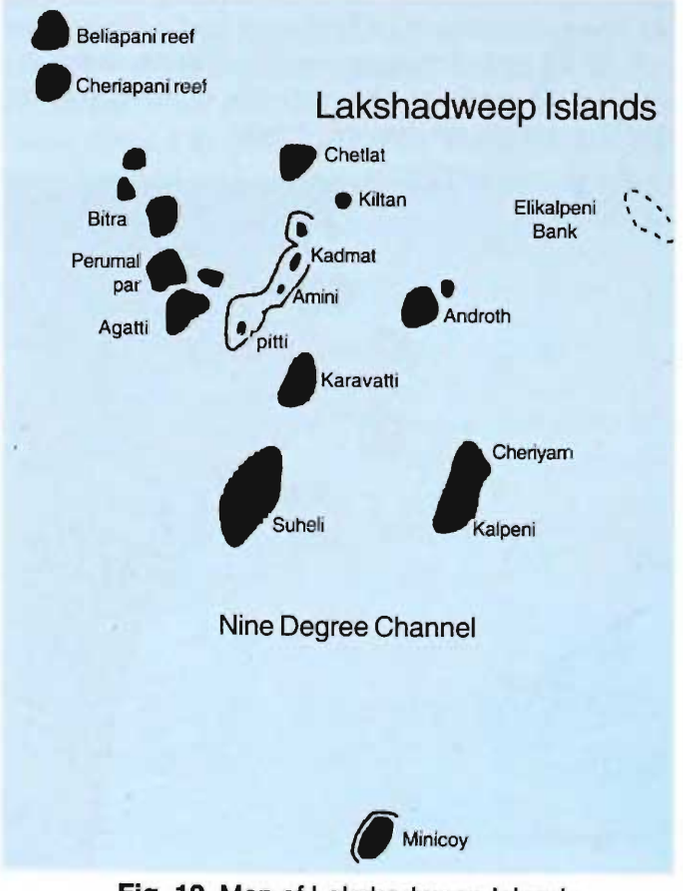


Fig. 12. Map of Lakshadweep Islands

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. Andrott 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-south, excepting Andrott that lies east-west. The distance between them varies from 11 km to 378 km.

The coral fauna of Lakshadweep is known to harbor 105 species allocated to 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.

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 (Fig. 13)

Gujarat state has 600 km long coastline is very rich in various edible fishes and varieties of algae. Veraval and Mongrol are fishing harbours Known for landings of 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 haven for their breeding. The Gulf of Kachchh is the richest source

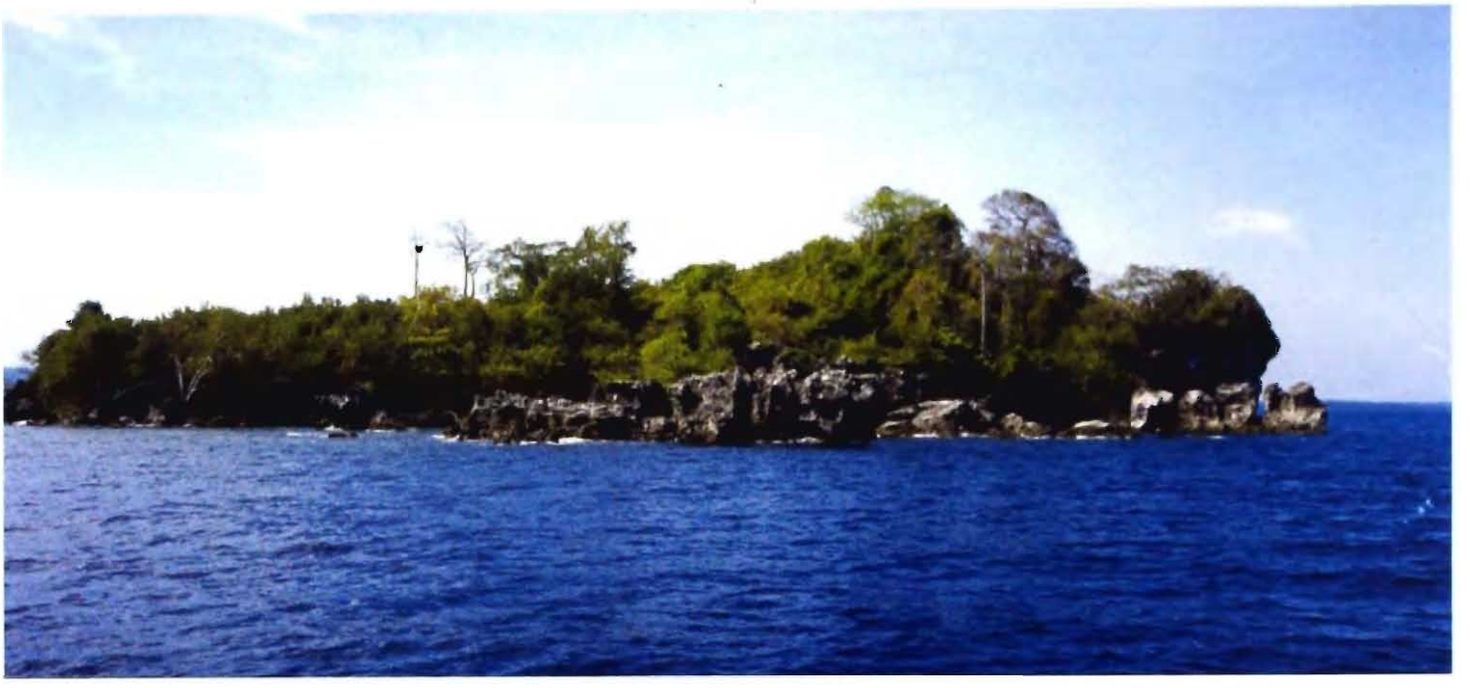
North Reef Sanctuary

View of Ross Island

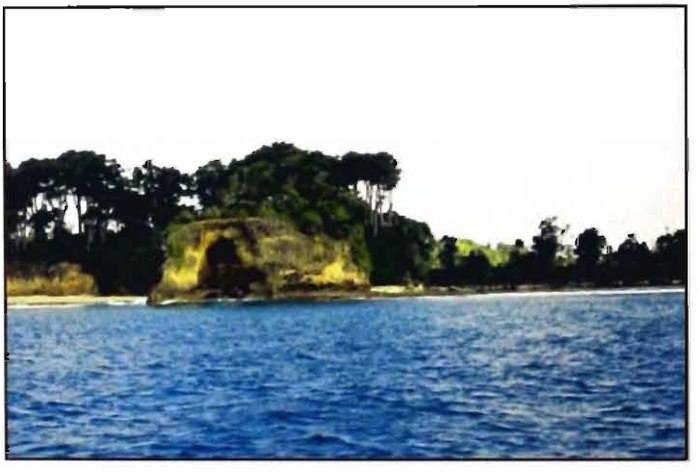
Barren Island volcano erruption in 1993

Tharmugli Island, Mahatma Gandhi Marine National Park

Mangroves of North Andaman creek



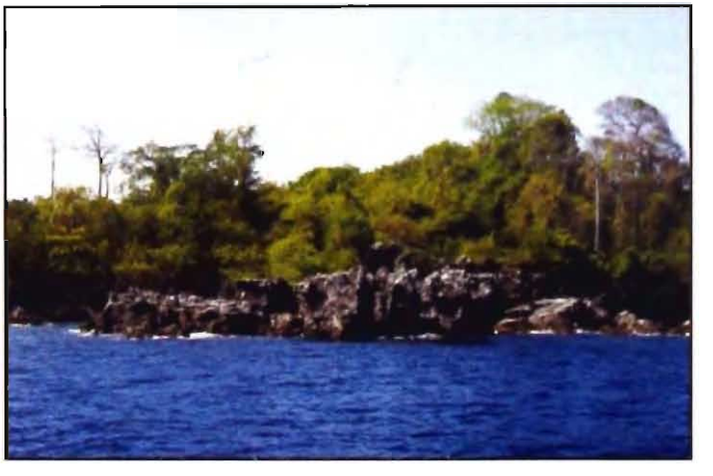
South Button Island, Rani Jhansi Marine National Park



Neil Island, Ritches Archipelago

Kachall Island, Nicobar group of Islands

Kachall Island, Nancowry Group



South Button Island, Rani Jhansi Marine National Park

Mandapam, Palk Bay

Fishing trawlers at Rameswaram Island

Krusadai Island, Gulf of Mannar Biosphere Reserve

Poomarichan Island, Gulf of Mannar

Bridge connecting Pamban & Rameswaram

Narara Reef, Kachchh Marine National Park

Narara Reef, Kachchh Marine National Park

Narara Reef, Kachchh Marine National Park

Kavaratti Atoll, Lakshadweep

Kavaratti Atoll, Lakshadweep

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).

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 low. 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 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, 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.

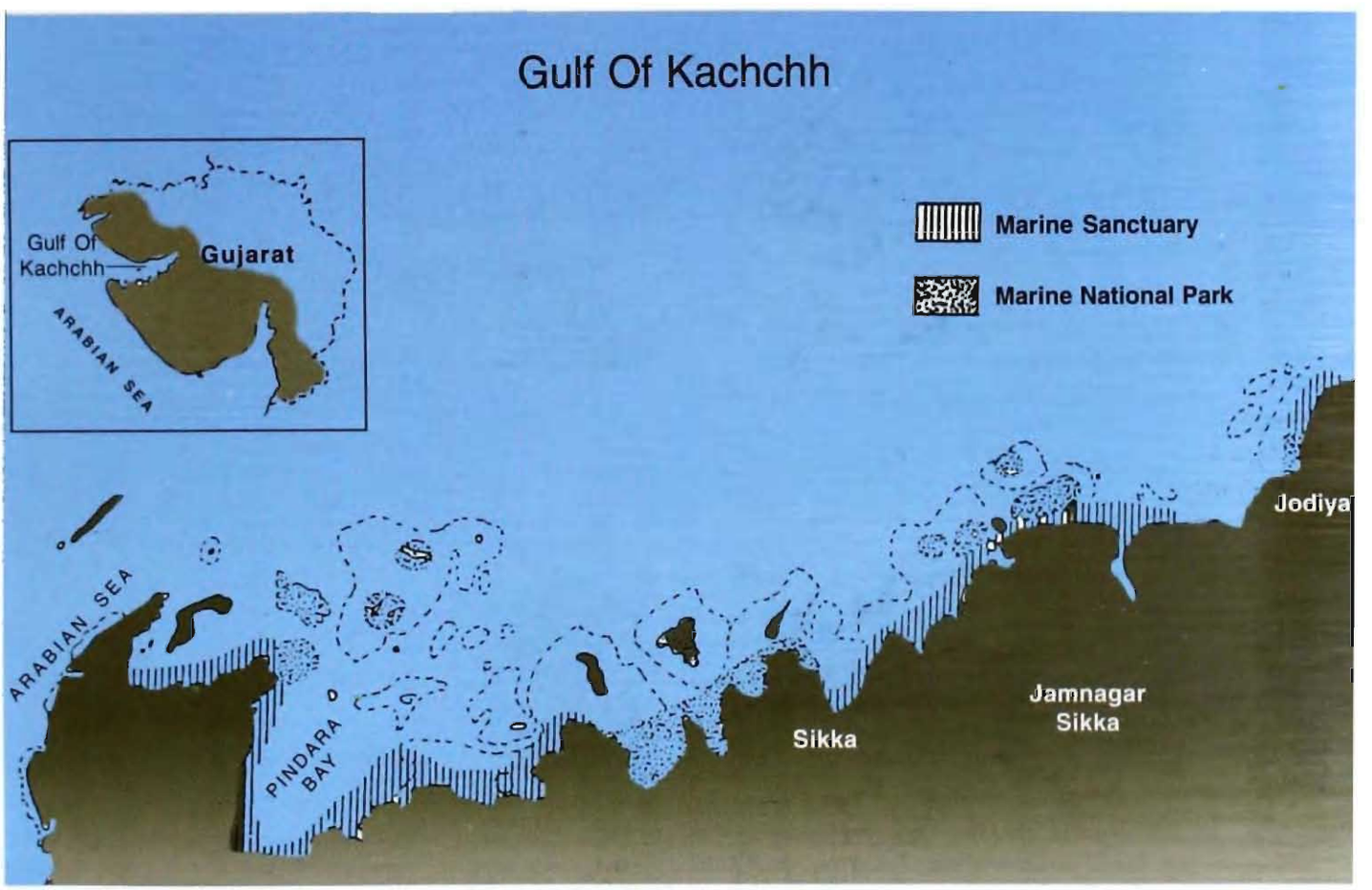


Fig. 13. Map of Gulf of kachchh

BIOLOGICAL DIVERSITY OF CORALS

If one opts for aproximate analysis, 32 of the 34 described phyla are found on coral reefs. Often compared with tropical ecosystem. In contrast, only 9 are found free-living in the tropical rain forest (Table 1). 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).

Table 1. The phyletic diversity of coral reefs vastly exceeds that of any other habitat on earth*

Phylum	Tropical Coral Reef	Tropical Fresh Water	Tropical rain forest
Placozoa	•		
Porifera	•	•	
Cnidaria	•	•	
Ctenophora	•		
Mesozoa	•		
Platyhelminthes	•	•	•
Nemertina	•	•	•
Gnathostomulida	•		
Gastrotricha	•	•	
Rotifera	•	•	
Kinorhyncha	•		
Loricifera	•		
Acanthocepahla	•	•	
Entoprocta	•	•	
Cycliophora	•	•	
Nematoda	•	•	•
Nematomorpha	•	•	
Entoprocta	•		
Phoronida	•		
Brachiopoda	•		
Mollusca	•	•	•
Priapulida	•		
Sipuncula	•		
Echiura	•		
Annelida	•	•	•
Tardigarda	•	•	•
Pentastoma	•	• **	
*Onychophora			•
Arthropoda	•	•	•
Pogonophora			
Echinodermata	•		
Chaetognatha	•		
Hemichordata	•		
Chordata	•	•	•
Total	**32**	**17**	**9**

* *Of the 34 animal phyla, 32 are found on coral reefs.Only the phylum Onychophora is found exclusively in moist forests; all other rain forest phyla are also found on coral reefs.The deep sea phylum Pogonophora is the only phylum found neither on coral reefs nor in topical rain forests. The phylum Pentastoma is found in terrestrial organisms as internal parasites.*

** *Found in terrestrial organisms as internal parasites.*

(adapted from 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 harbour rich biodiversity. Of the 1.86 million plant and animal species described, 2,74,000 are thought to be marine and more than half of these are tropical. Currently assumptions exist that 93,000 species of faunal and floral constituents are coral associated. Almost 66,000 of these are macroscopic invertebrates. Till date an effective inventorisation process has not materialised to census the multiple taxa coral agglomerates and when this is done, the total biodiversity would be extremely high.

Scleractinian 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. Until 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 198 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) (Appendix 1). 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 (36 species).

CORAL REEF ASSOCIATES

One of the most striking features of a coral reef is the immense concentration of different creatures that live on, around and within its complex three-dimensional frame. Immediately noticeable are the fish and, of course, the corals themselves, but many other animals including a seemingly infinite variety of invertebrates are largely hidden amongst the cracks and crevices of the reef. Only on close inspection are the secret lives of tiny crabs, worms and sea slugs revealed. In this crowded community, every vacant living space is strongly contested, and some species have gone to extraordinary distance to find a home.

ALGAE AND HIGHER PLANTS

Marine algae or seaweeds are marine plants,belonging to lower Cryptogams. These are the large and diversified groups with size ranging from single cell, such as *Chlamydomonas* to several meters in length i.e., *Macrocystis*. The four classes thus formed are Chlorophyta (green algae), Phaecophyta (brown algae), Rhodophyta (red algae) and Cyanophyta (blue-green algae). In India altogether there are 650 species (including blue-green algae) with maximum Rhodophyta (320), followed by Chlorophyta (165) and Pheaophyta (150). Out of these, maximum number have been recorded from Tamil Nadu (302), followed by 202 species in Gujarat, 159 species in Maharashtra, 89 species in Lakshadweep group of Islands and 82 in Goa (Table 2). A recent publication on the compilation of all the new records of marine algae of India shows that benthic marine algal flora of Indian coasts comprises of total 217 genera : 136 (62.67%) red; 43 (19.81%) green; 37 (17.05%) brown and 1 (0.46%) Xanthophyta. Out of 844 species including forma and varieties, 434 (51.42%) species belonged to Rhodophyta, 216 (25.595) species to Chlorophyta, 191 (22.63%) species to Phaeophyta, and 3 (0.35%) species to Xanthophyta (Oza and Zaidi, 2001).

In India, seaweeds are exploited and used as raw materials for the production of agar, alginates and seaweed liquid fertilizer. There are about 25 agar industries and 10 algin industries situated at different places in the maritime states of Tamil Nadu, Kerala, Karnataka, Andra Pradesh and

Table 2. Distribution of marine algal species along the Indian coast *(adapted from Seaweed weed Resources, The Indian Ocean Perspective 2. 2001).*

State	No. of Orders	No. of Families	No. of Genera	No. of species
Gujarat	15	42	105	202
Maharashtra	16	40	76	152*
Goa	13	29	48	75**
Karnataka	12	19	28	39
Kerala	8	10	14	20
Lakshadweep	13	29	51	89
Tamil Nadu	15	45	428	302
Andra Pradesh	14	29	51	79
Orissa	1	2	3	6
West Bengal	3	4	5	6
Andaman and Nicobar	8	15	23	34

*152 or 159 (see while up)
**In Goa 82 or 75 (see while up above)

Gujarat. Red algae such as *Gelidiella acerosa, Gracilaria edulis, G. crassa, G. foliifera* and *G. verrucosa* are being used for agar manufacture and brown algae *Sargassum* spp., *Turbinaria* spp. and *Cystoseira trinodis* for alginates and liquid seaweed fertilizer. The agar yielding seaweeds have been harvested since 1966 from the natural seaweed beds of Gulf of Mannar Islands, along the coastline from Rameswaram to Tuticorin in Gulf of Mannar area and Sethubava Chatram area in Palk Bay of Tamil Nadu. Data collected by the Central Marine Fisheries Research Institute (CMFRI) on seaweed landings in Tamil Nadu from 1978 to 2000 reveal that the quantity (dry wt) exploited in a year during this period varied from 102 – 541 t for *Gelidiella acerosa*, 108 – 982 t for *Grcilaria edulis*, 2-96 t from *G. crassa*, 3-110 t for *G. foliifera* and 129-830 t for *G. verrucosa* (Silas and Kalimuthu, 1997, Kalimuthu and Kaliaperumal, 1991 and 1996; Kaladharan and Kaliaperumal, 1999; Ramalingam *et al.*, 2000).

Sea grasses are the submerged marine angiosperms growing well in tidal and sub tidal areas of all seas except the Polar Regions. Sea grasses have a well-developed creeping rhizome, bearing branched or unbranched roots at each node and erect shoot bearing several foliage leaves. They do not actually belong to the family, Poaceae that has only terrestrial grown grasses but belong to two related families of monocots viz. Hydrocharitaceae and Potamogetonaceae and are successfully adapted to the saline environment. They act as sediment traps besides stabilizing the bottom sediments, thereby improving the water quality. Sea grasses are also involved in cycling of nutrients of their environment. They provide with food and shelter for diverse organisms and act as a nursery ground for many fishes of commercial importance and play a vital role in the fisheries production of the region. Indian coast embraces only 6 genera and 14 species of sea grasses (Table 3). Studies on sea grasses started only during 1980s and some of the first reports are available from the southern coast of India. Distribution of sea grasses along the Indian coast varied with varying species diversity.

Table 3. Distribution of sea grasses in five different regions of the Indian coast *viz.* 1. Coramandal Coast/East Coast. 2. Palk Bay and Gulf of Mannar, 3. West Coast, 4. Andaman and Nicobar Islands and 5. Lakshadweep.

Species	1	2	3	4	5
Enhalus acoroide(L.f.) Royle		•		•	•
Halophilia beccarii Asch.	•	•	•		
Halophilia decipiens Osten.f.		•			
Halophilia ovalis (R.Br.) Hook.f. subsp. *ovalis*	•	•	•	•	
Halophilia ovalis Hook. f.subsp. *ramamurthiana*	•				
Halophilia ovata Gaud	•	•	•	•	•
Halophilia stipulacea (Forsk.) Asch.		•			
Thalassia hemprichii (Ehrenb.) Asch.		•		•	•
Cymodocea rotundata Ehren. & Hempr. Ex Asch		•	•	•	•
Cymodocea serrulata (R. Br.) Asch. & Magnus		•	•	•	•
Holodule pinifolia (Miki) Hartog	•	•	•	•	
Halodule uninervis (Forsk.) Asch.	•	•	•	•	•
Holodule wrightii Asch.	•	•			
Syringodium isoetifolium (Asch.) Dandy		•		•	•

(•) denotes presence of species. (Adapted from Status of sea grasses of India, Kannan *et al.*, 1999)

All the 6 Indian genera of sea grasses with 11 species are recorded from the Palk bay region. Of the 11 species *C. serrulata, H. ovalis* sub sp. *ovalis, K. pinifolia* and *S. isoetifolium* are predominantly distributed. *H. wrightii* is present only in Akkalmadam of Rameswaram area. Thirteen species of seagrasses under six genera occur in the Gulf of Mannar Biosphere Reserve. Of these, *Halophila, Halodule, Enhalus* and *Cymodocea* are common. *Thalassia* and *Syringodium* are dominant in the areas of coral reefs and coral rubbles where as the others are distributed in muddy and fine sandy soils.

In general, west coast sea grasses have not been studied in detail as that of the east coast. Only *Halophila* and *Halodule* species are dominant and distributed throughout the coast. *Cymodocea* sp. and *Syringodium isoetifolium* occurs as very small patches at the southern most end of Thiruvananthapuram. Out of the 14 species of Indian sea grasses, nine species occur in the Andaman and Nicobar Islands. Of these *Thalassia hemprichii and Cymodocea rotundata* are found to be dominant. In Lakshadweep there are 7 species of sea grasses of which *Thalassia hemprichii* is the dominant one. *Enahalus acoroides* occurs only as small patches.

Mangrove is one of the most extraordinary ecological formations occurring almost exclusively in the tropics. Like the tropical rain forests, the mangroves have also played a very important role in the economics of our coastal population for thousands of years, providing a wide variety of goods and services including wood, support for commercial and subsistence fisheries, aquaculture, salt production and shoreline and coastal erosion control. Mangroves are salt-tolerant forest ecosystems of tropical and subtropical intertidal coastal regions near river mouths. Between latitudes 30°N and 30°S, the shoreline marsh vegetation is replaced by *'mangals'* (a community of mangroves is termed as mangal). They form highly productive ecosystems since the inorganic nutrients, brought in by the incoming freshwater from land run-off, are trapped to form the source of energy for many organisms. A mangrove ecosystem constitutes a reservoir, refuge, feeding ground and nursery for many useful and unique plants and animals confined to this region. Through the export of decomposable organic matter into adjacent coastal waters, the mangroves provide an important nutrient input and primary energy source for many tropical estuaries. The mangrove ecosystem also protects coastal areas from sea erosion and from the violent effects of cyclones and tropical storms. The warm, calm waterways of mangroves provide shelter and rich food for many juveniles and larvae of finfish and shellfish.

India has only 2.66% of the world's mangroves, covering an estimated area of 4827 sq km. The East Coast is endowed with the world's largest mangrove forest, the Gangetic Sundarban in West Bengal.The Sundarban mangroves are of the deltaic type. The 2109 km^2 area of Sundarban has 30 of the 50 species of the true mangroves in the world. The mangrove area in Orissa is nearly 200 km^2 in extent and its degradation is placed at 20 km^2 over ten years, as per recent estimates. Andhra Pradesh has about 582 km^2 of mangrove area. The area under mangrove ecosystem in Tamil Nadu is about 225 km^2. One of the largest and most unspoiled mangrove forests in Tamil Nadu is at Pitchavaram in Cuddalore District, extending over an area of 1100 ha. Out of India's total area under the mangroves, about 57% are found on the East Coast, 23% on the West Coast and remaining 20% on the Bay Islands (Andaman and Nicobar).

There are three types of mangroves in India viz., deltaic, backwater-estuarine and insular categories. The deltaic mangroves occur on the east coast (Bay of Bengal) where the mighty rivers make the deltas. The backwater-estuarine type of mangroves of the west coast exists along the typical funnel-shaped estuaries of major rivers (Indus, Narmada, Tapti) or backwaters, creeks, and neritic inlets. The insular mangroves are present in Andaman and Nicobar Islands, where many tidal estuaries, small rivers, neritic islets, and lagoons support a rich mangrove flora. The coastal zone, in general, and the mangroves in particular, are used for multiple purposes like recreation, tourism, forestry, agriculture, aquaculture, housing and commercial fishing. This zone is very highly productive and also thickly populated. The increasing use of this zone and its resources and coastal pollution by domestic industrial, municipal and agricultural wastes and of late due to oil exploration are causing a lot of concern. India is rich in marine biodiversity along the coastline of 7,500 km with exclusive economic zone of 2.02 million sq km supporting the most productive

ecosystems such as mangroves, coral reefs, estuaries, lagoons, and backwaters. Of these ecosystems, mangrove is significant in this country. However, mangrove ecosystem is little understood for its biodiversity. The knowledge on occurrence and distribution of mangrove species is inadequate. The mangroves of India comprise of 69 species excluding salt marshes and other associated species, under 42 genera and 27 families. The mangroves serve as a wild life sanctuary especially in Sundarban, Orissa and Andaman and Nicobar Islands. The wild life like tigers, crocodiles, snakes etc. save the mangroves in those places. Sometimes the wildlife may pose problems to the mangroves.

SPONGES

Sponges are asymmetrical benthic animals, and are strikingly coloured. They represent a major component of reef communities. Although they do not have true bodies with differentiated organs, most sponges grow into well-structured forms, with a network of internal canals through which seawater is passed, aided by the movement of flagella and microvillae. The majority of sponges are filter feeders processing considerable volumes of water every day, filtering out nutrients. Other sponges, including many of which live in the nutrient-poor waters of the reef, rely on associations with blue-green algae or zooxanthellae and are effectively autotrophic. A number of sponges are capable of chemically dissolving (etching) into corals in a process, which is a major part of bioerosion on coral reefs. This group has an evolutionary history of about 570 million years and is represented in the extant oceans by about 5000 species now reduced to 4562 species as per latest revision. So far, 451 species under 3 classes, 17 orders, 65 families and 169 genera have been described in India (Pattanayak, 2001). The sponge fauna of India is dominated by Desmospongia species followed by Hyalospongiae and Calciospongiae. Also 34 species of coral boring sponges, 20 species from Gulf of Mannar and Palk Bay, 5 species from Andaman and Nicobar Islands and 18 species from Lakshadweep reefs have been recorded. A total of 319 species has been recorded from Gulf of Mannar and Palk Bay. Other areas with numerical abundance are Gulf of Kachchh 25 species, Andaman and Nicobar Islands 95 species and Lakshadweep 82 species. Recent studies have revealed that sponges contain several peculiar chemical compounds that are not found in any other animals. Arabinose nucleosides isolated from *Tethya crypta* have proven cancer inhibiting properties and this discovery has triggered off a worldwide interest in the biochemistry of this group. In India too, several institutions have taken up the extraction and characterization of several pharmacologically active compounds from sponges. So far, no species of sponges are exploited commercially in India.

CRUSTACEANS

Global estimate of Crustacean species diversity is 150,000 of which 40,000 have been described so far. In India 2934+ species of Crustacea have so far been reported (Venkataraman and Krishnamoorthy, 1998). Marine crustaceans of India (94.85%), about which knowledge is far from complete, contribute maximum to this diversity. In India as many as, 121 species of stomatopods (4 families and 26 genera), 26 species of lobsters (4 families, 11 genera) 162 species of hermit crabs (3 families, 40 genera) 705 brachyuran crabs (28 families, 270 genera) 84 species of shrimps and prawns (7 families, 19 genera) and 159 species of caridea (15 families, 56 genera) have been recorded so far. Other than these, 540 species of copepods, 104 species of cirripeds, 120 species of ostrocods have also been recorded. The crustaceans rank second in the diversity of fauna in the coral reef ecosystem, and many of them are exploited for commercial purposes.

MOLLUSCA

The number of species of molluscs recorded from various parts of the world varies from 80,000 to 1,50,000 (Subba Rao, 1998). In India 5070 species of Mollusca have been recorded from freshwater (22 families, 53 genera 183 species), land (26 families, 140 genera and 1487 species) as well as from marine habitats (242 families 591 genera, 3370species). From the available data, it is possible to identify certain areas having rich molluscan diversity. Andaman and Nicobar Islands have a rich molluscan diversity, which include little over 1000 species from the marine region. Gulf of Mannar and Lakshadweep have 428

and 424 species of Mollusca respectively. 3,370 species of marine molluscs have been reported from India that includes those occurring in coral reef ecosystem as well as other areas. Though, the molluscan diversity is supposed to be the highest among all the invertebrates in the coral reef ecosystem, they are threatened by habitat alteration and indiscriminate exploitation by man. Eight species of Oysters, two species of mussels, 17 species of clams, six species of pearl oysters, four species of giant clams, one species of window-pane oyster and other gastropods such as Sacred chank, *Trochus*, *Turbo* as well as 15 species of cephalopods are exploited from the Indian coral reefs. In the Wildlife Protection Act 1972 amended recently (2002), 9 species of Mollusca have been included under Schedule I and 14 species under schedule IV.

BRYOZOANS

Bryozoa are aquatic, colonial, coelomate invertebrates with a recurved digestive tract bringing the anus near, but outside the mouth. Colonies may comprise of a single feeding zooid or hundreds or thousands or even a million. Although regarded traditionally as a minor phylum, the group contains as many as 20,000 described species actually occupying an intermediate position in the hierarchy of animal phylum in respect of species representation. Of these, approximately 4,000 species are living. At least 200 valid species occur in India. The bryozoa are grouped under three classes i.e. Phylactolaemata (freshwater species), Stenolaemata and Gynolaemata. A total of 126 families recognized – 100 from Gymnolaemata (15 form the order Ctenostomata and 85 from Cheilostomata), 21 from Stenolaemata and five from Phylactolaemata.

ECHINODERMS

The echinoderms comprises of over 6223 species of starfish, brittle stars, sea cucumbers, sea urchins and feather stars, world wide representing six classes. India has 765 species (Crinoidea : 13 families, 43 genera 95 species; Asteroidea : 20 families, 81 genera and 180 species; Ophiuroidea : 15 families, 67 genera 150 species; Echinoidea : 28 families, 79 genera 150 species; Holothuroidea 14

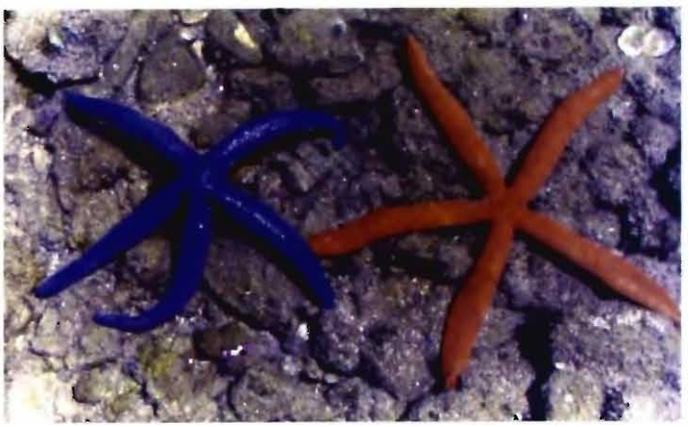


Fig. 14. *Linckia laevigata* from Andaman reefs

families, 62 genera 160 species) recorded until today and about 257 species are known from Andaman and Nicobar Islands (James, 1987). Lakhadweep has 77 species and in Gulf of Mannar it is 112. Sea urchins play a very important role in keping seaweed growth under control, but occurring in large numbers, they can damages reefs. Perhaps the most notorious echinoderm is the crown-of-thorns starfish that can devastate reefs in the course of its coral eating. Economically only holothuroidea are exploited on a commercial scale for export.Twelve species of Holothurians belonging to the genera *Actinopyga*, *Bohadschia*, *Holothuria*, *Stichopus* and *Thelenota* are known to be of commercial importance in India. However, only three species *Bohadschia marmorata*, *Holothuria scabra and H. spinifera* are being exploited to a large extent in the Gulf of Mannar. All holothurians are now Included under Schedule 1 of the Wildlife Protection Act, 1972.

TUNICATES

The term Urochordata (= Tunicata) means the presence of a notochord in the tail region of a group of Protochordates either in the adult form or during the life history stages of the developing larvae. All the tunicates are covered by a coat or tunic which is either leathery or gelatinous and opaque translucent or transparent. This subphylum Urochordata is divided into class Ascidiacea (sea squirts) that are sessile or benthos attached to substratum on the coral reef, Class Thaliacea (= salps) and Class Larvacea are planktonic. About 2000+ species of ascidians are reported from all over the world of which 47 are reported in India (9 families, 21 genera).

FISHES

Fishes comprise about half the total number of vertebrates. The number of estimated living fish species might be close to 28,000 in the world. Day (1889) has described 1418 species of fish under 342 genera from the British India. Talwar (1991) has described 2546 species of fish belonging to 969 genera, 254 families and 40 orders. The distribution of marine fishes is rather wide and some genera are common to the Indo-Pacific and the Atlantic regions. 57 percent of the Indian marine fish genera are common to the Indian Ocean and to the Atlantic and Mediterranean.

The exact number of species associated with coral reefs of India is still to be found, however the number of fishes in Indian Ocean is 1367 species. The Lakshadweep Islands have a total of 603+ species of fishes (Jones and Kumaran, 1980), over 1000+ species are found in the Andaman and Nicobar Islands and in Gulf of Mannar Biosphere Reserve it is 538+. The category of fishes occurring in coral reef ecosystem of India includes groups such as the damselfishes (52 species), butterfly fishes (32 species), sweatlips (16 species), angelfishes (16 species), parrotfishes (14 species), snappers (42 species) and most of the wrasses (53 species), groupers (43 species) and surgeon fishes (18 species). Another 20% are composed of cryptic and nocturnal species that are confined primarily to caverns and reef crevices during daylight periods. This assemblage includes families such as the cusk eels, some groupers and their relatives, most of the moray eels and some scorpion fishes, wrasses and nocturnal families including the squirrelfishes, cardinal fishes and sweet lips. Another 10% of fishes dwell primarily on reefs covered with sand and rubble including snake eels, worm eels, various rays, lizardfishes, grab fishes, flat fishes, and some wrasses and gobies. A relatively small percentage (about 5%) of the fauna is composed of transient mid water reef species that roam over large areas. This group includes most sharks, jacks, fusiliers, barracudas and a scattering of representatives of other families.

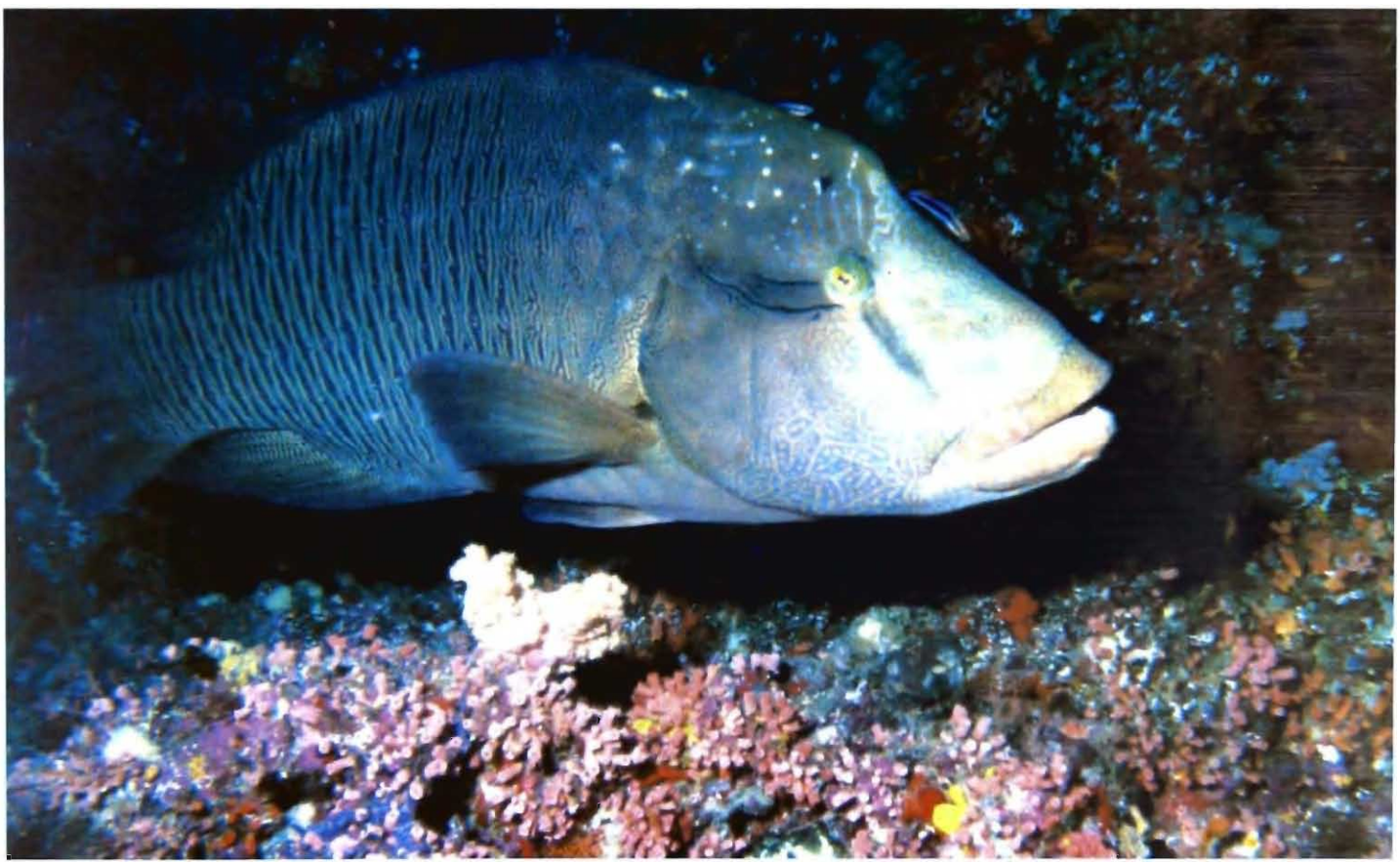


Fig. 15. One of the beautiful reef fish in its habitat

REPTILES

Among reptiles, sea snakes and turtles are important and are represented worldwide by 50 and seven species respectively. These are generally oceanic forms but majority of these often swim close to the shore and visit the shore at some part of their life. About 26 species of sea snakes belonging to the family, Hydrophiidae and five species of sea turtles have been reported from seas around India. Oceanic islands seem to harbor more reptiles in their marine environment. All the sea snakes and four species of turtles in their marine environment are known from islands of Andaman and Nicobar. Nesting sites of an amphibious snake were reported from the shores of North Andaman Islands (Whitaker, 1985). Turtles visit the shore during breeding time to lay their eggs. The shore visit of these turtles especially the Olive Ridley is a spectacular sight on the sandy beach at Gagirmatha near Bitharkanika in Orissa. The Andaman and Nicobar Islands have best nesting beaches for the leatherback, the hawksbill and the green turtle and also the Olive Ridley (Baskar, 1993).

Sea snakes are still common and are often encountered streaking over reefs, but most large marine vertebrates are now comparatively rare, their populations heavily reduced by human exploitation.

Seven species of sea turtles are found in the world's warm oceans of which five species are reported in India. Adult sea turtles are completely aquatic and spend most of their lifetime in water, but they start their lives on land, i.e. on sandy shores as hatchlings and then enter into the aquatic environment. Turtles are often seen on reefs. The hawksbill is most closely associated with coral reefs, and is found all around the reefs of India, nesting on small beaches and coral cays and feeding on sponges and invertebrates on nearby reefs. Other than this, green turtles, the loggerhead, olive ridley and leatherback turtle are also seen swimming and feeding in coral reef environments.

SEABIRDS

The coral reef offers a variable feeding and breeding ground for a number of birds. Although not exhibiting spectacular diversity, a number of seabirds are found regularly in coral reef environments. There are some special species, which are exclusively dependent on coral reef ecosystem, while a few are generalists without much dependence on it. Some of the pelagic seabirds notably boobies (Sulidae), shearwaters (Procellariidae) and terns (Sternidae) which were reported, rarely nest on Andaman and Nicobar Islands. These often breed in groups on small coral islands, especially where there is little human disturbance, and no predation from introduced species such as rats. Smaller numbers of waders and other seabirds are also found on or near reefs. These include sandpipers, oystercatchers, turnstones and plovers. Egrets and herons are also widespread, often feeding across the reef flat at low tide. Pelicans are quiet common on reefs in the Caribbean region, and in Gulf of Kachchh flamingos have been recorded on coral reefs. Birds of pray including ospreys and sea eagles are likewise occasional visitors of the reef. For example in Gulf of Kachchh Marine Park area 123 species of waterfowl and 85 species of terrestrial birds have been recorded in 2002. Waterfowl with moderately good population have been found in Kachchh are the Lesser Flamingo, Kentish Plover, Ruff, Crab Plover, Black tailed Godwit and Avocet. From Gulf of Mannar Marine National Park area in 1985-1988 a total of 187 species of birds were recorded of which 84 were aquatic and the remaining terrestrial. At Manali and Hare Islands 23 species of migratory birds were found to be over summer every year. The waders uncommon to India such as knot *Calidris canuta*, eastern knot *Calidris tenuirostris*, curlew *Numenius auquata*, Whimbrel *Numenius phaeopus and* bar tailed godwit *Limosa lapponica* were recorded as regular winter visitor to this area (Balachandran, 1995).

MARINE MAMMALS

Marine mammals belong to three orders, Sirenia, Cetacea and Carnivora. About 120 species are estimated to occur in World seas and of these 30 are reported from seas around India. But majority of these are oceanic forms and occasionally a few individuals may get stranded on the shore. Sea cow occurs near shore waters.Few marine mammals can be described as reef animals but several species are often spotted near reefs and many visit them to feed on fishes. The dugongs found in Gulf of Mannar, Gulf of Kachchh and

Fig. 16. Marine dolphins in Gulf of Mannar

Andaman and Nicobar Islands feed entirely on sea grass and other rich vegetation and are found near reefs, though rarely seen on them, as they prefer the better protection and more plentiful food offered by silt-laden waters. Dugongs are now endangered, they have been hunted extensively in the past, and are now threatened both by the disappearance of their shallow-water habitats and by the human activities. Dolphins and some of the whales that live or breed in tropical waters, such as humpbacks, are occasionally seen near reefs.

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 (Fig. 17). Some coral species exist as solitary polyps.

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

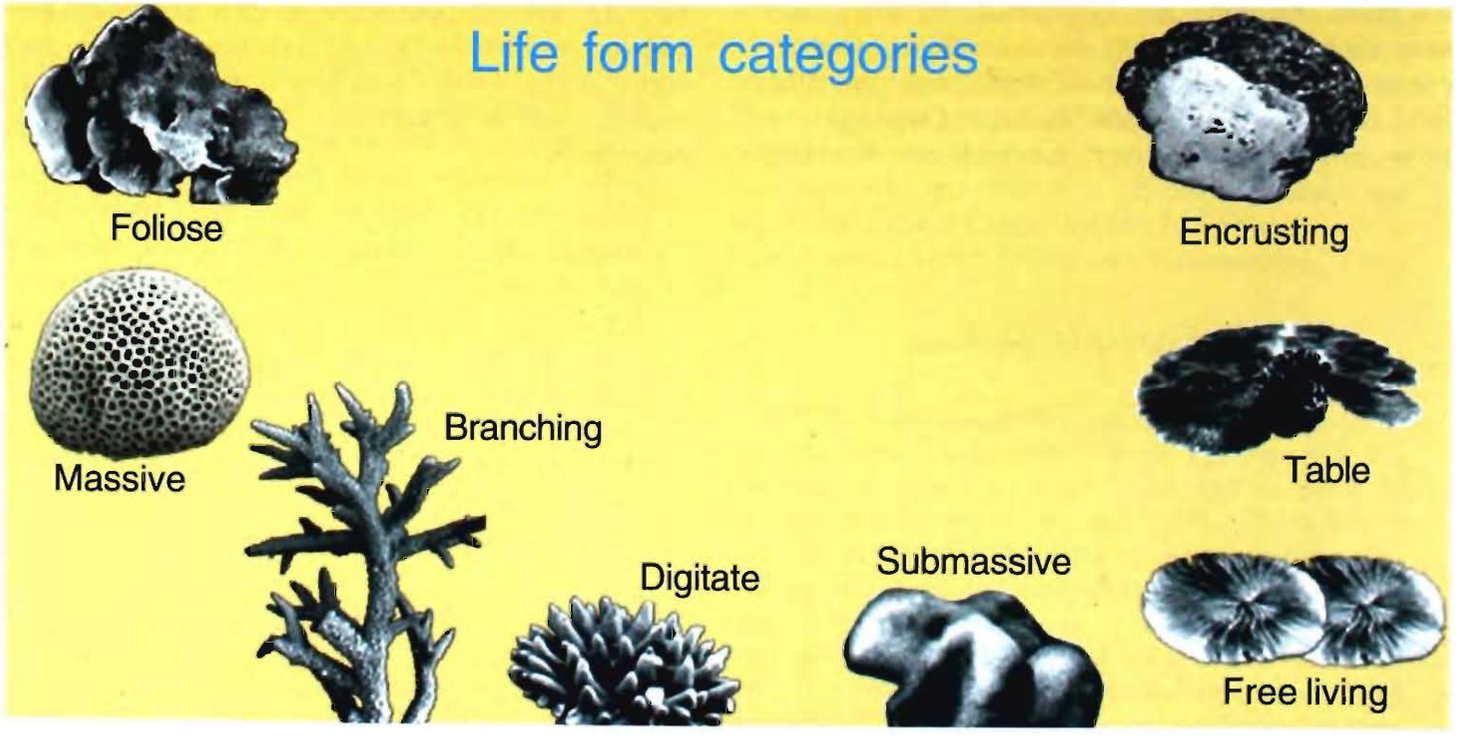


Fig. 17. Life form categories of different species of corals in India.

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 (Fig. 18) 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 (Fig. 19 21), which includes a free-living planktonic planula phase and

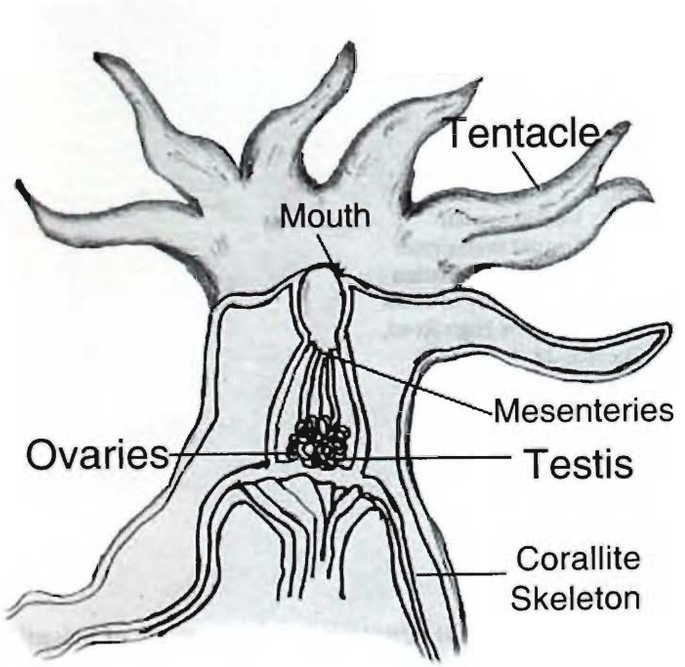


Fig. 18. Structure of a polyp.

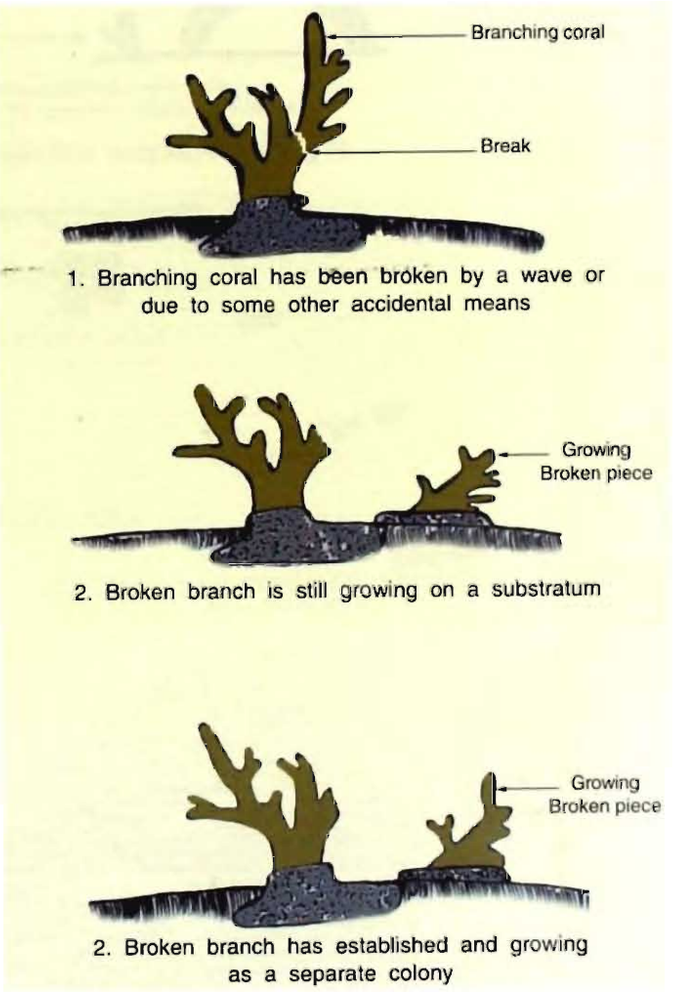


Fig. 19. Vegetative growth of some branching corals.

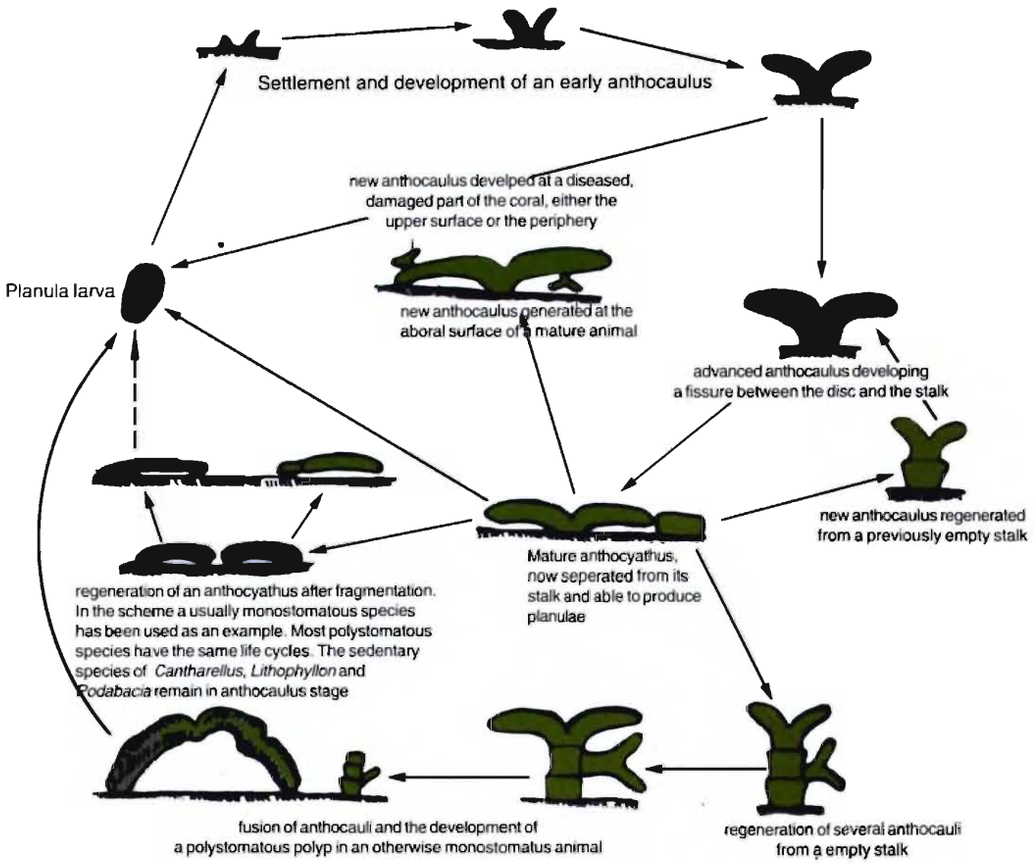
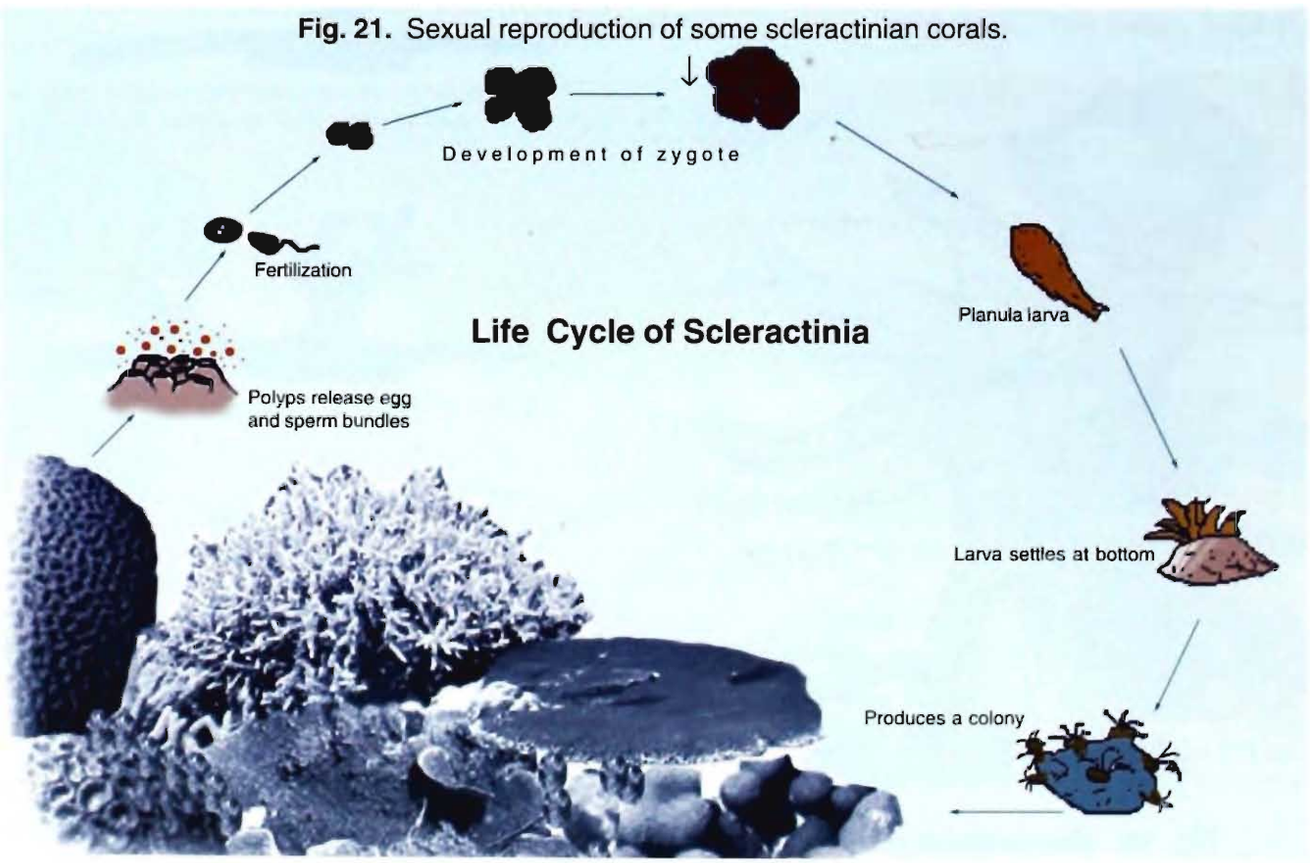


Fig. 20. Vegetative and sexual life cycle of species of Fugiidae.

Fig. 21. Sexual reproduction of some scleractinian corals.



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 of polyps from the skeleton (Fig. 20). 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 (Fig. 21). Sexual reproduction and larval recruitment are critically important for the establishment and renewal of coral communities.

CORAL TAXONOMY

Hard corals belong 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*), cerioid 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 (*lobophyllia*) (Fig. 22). The growth form of the colony can be encrusting where the skeleton adheres closely to the substratum (*Siderastrea*), massive (*Porites*), column (*Goniopora*), branching (*Acropora, Stylophora*), foliaceous (*Turbinaria reniformis*) or plate-like (*Turbinaria peltata*) (Fig. 22). In some species, the growth form does not vary

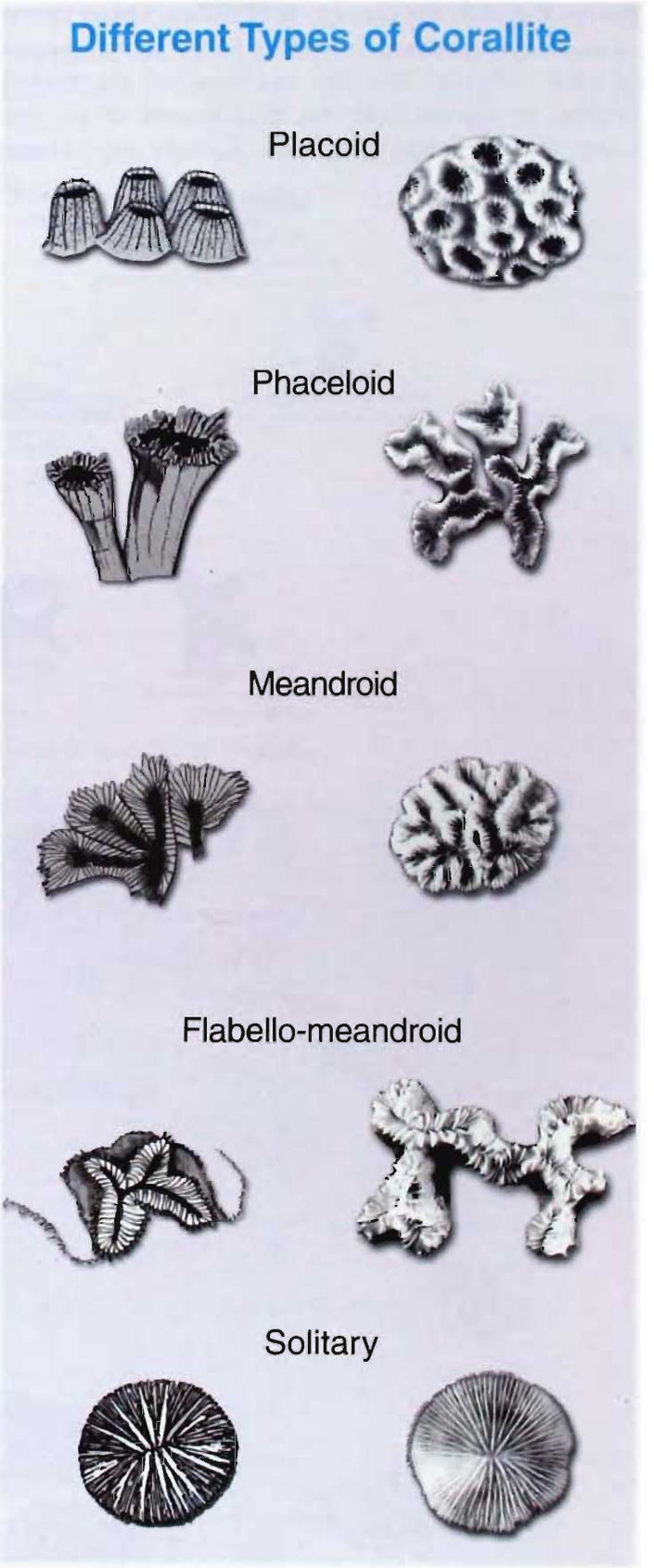


Fig. 22. Different types of corallite

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 divided among 71 genera, from India, which includes Lakshadweep (31 genera, 78 species), the Gulf of Kachchh (24 genera, 37 species) Palk Bay and the Gulf of Mannar (37 genera, 94 species) and Andaman and Nicobar Islands (59 genera, 135 species) (Table 4). This account includes both hermatypic and ahermatypic corals recorded from the four major coral reefs of India.

Table 4. The comprehensive list of genera and species of corals of India listed by Pillai (1983).

Area	Genera	Species
Lakshadweep		
Hermatypes	27	69
Ahermatypes	4	9
Total	**31**	**78**
Gulf of Kutch		
Hermatypes	20	34
Ahermatypes	4	3
Total	**24**	**37**
Southeast coast of India		
Hermatypes	28	84
Ahermatypes	9	10
Total	**37**	**94**
Andaman and Nicobar Islands		
Hermatypes	47	100
Ahermatypes	12	35
Total	**59**	**135**
The whole of India		
Hermatypes	50	155
Ahermatypes	21	44
Total	**71**	**199**

The present account includes 15 families, 60 genera and 208 species of Scleractinia from four major reefs of India such as Gulf of Kachchh (36 species, 20 genera) Lakshadweep (91 species, 34 genera), Gulf of Mannar and Palk Bay (82 species 27 genera) Andaman and Nicobar Islands (177 species, 57 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 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 (Table 6). Government of India and UNDP GEF field mission (Diving) in the Andaman Islands yielded 234 species of Scleractinian corals of which 198 are already reported and 111 are new record to Indian waters not included in this present study (Turner *et al.*, 2001) (Appendix 1).

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 collection. 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

Only 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 (Fig. 23).

Zoological Survey of India

Marine Biological Station, Chennai.
Phylum : Cnidaria Reg. No. : ZSI/MBS/003
Class : Anthozoa
Order : Scleractinia
Species : *Acropora muricata* (Linnaeus, 1758)
Locality/Stn. No. : Gulf of Mannar
Date & Time : 21-10-2001
Type of Collection : Wet Tide : HIgh/Low
Collected by. K. Venkataraman Depth : 9m
Determined by. K. Venkataraman

Fig. 23. Label used 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 (Fig. 24).

Andaman Coral Reefs

Station : **Date :**
Person : **am/pm**

aculeus	humilis	speciosa
acuminata	hyacinthus	striata
anthocercis	intermedia	subglabra
aspera	kirstyae	subulata
austera	latistella	tenuis
azurea	listeri	torihalimeda
brueggemanni	longicyathus	tortuosa
bushyensis	loripes	valenciennesi
cardenae	lovelli	valida
carduus	lutkeni	vaughani
caroliniana	microclados	verweyi
cerealis	microphthalma	williase
chesterfieldens.	millepora	yongei
clathrata	monticulota	
cuneata	multiacuta	
cytherea	muricata	
danai	nana	
dendrum	nasuta	
digitifera	palifera	
divaricata	palmerae	
donei	paniculata	
echinata	papillare	
elseyi	polystoma	
florida	pulchra	
gemmifera	robusta	
glauca	samoensis	
globiceps	sarmentosa	
grandis	secale	
granulosa	selago	
horrida	solitaryensis	

Fig. 24. Underwater data sheet.

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

Family ACROPORIDAE Verrill, 1902

Genus ***Montipora*** de Blainville, 1830

1. *M. foliosa* (Pallas, 1766)
2. *M. aequituberculata* Bernard, 1897
3. *M. monasteriata* (Forskal, 1775)
4. *M. tuberculosa* (Lamarck, 1816)
5. *M. peltiformis* Bernard, 1897
6. *M. informis* Bernard, 1897
7. *M. spumosa* (Lamarck, 1816)
8. *M. turgescens* Bernard, 1897
9. *M. venosa* (Ehrenberg, 1834)
10. *M. verrucosa* (Lamarck, 1816)
11. *M. hispida* (Dana, 1846)
12. *M. digitata* (Dana, 1846)
13. *M. angulata*(Lamarck, 1816)
14. *M. millepora* Crossland, 1952
15. *M. spongiosa* (Ehrenberg, 1834)
16. *M. jonesi* Pillai, 1969
17. *M. manauliensis* Pillai, 1967
18. *M. edwardsi* Bernard, 1897
19. *M. explanata* Brueggeman, 1879
20. *M. exserta* Quelch, 1886

Genus ***Acropora*** Oken, 1815

21. *A. rudis* (Rehberg, 1892)
22. *A. humilis* (Dana, 1846)
23. *A. gemmifera* (Brook, 1892)
24. *A. monticulosa* (Bruggemann, 1879)
25. *A. samoensis* (Brook, 1891)
26. *A. digitifera* (Dana, 1846)
27. *A. multiacuta* Nemenzo, 1967
28. *A. nasuta* (Dana, 1846)
29. *A. valida* (Dana, 1846)
30. *A. secale* (Studer, 1878)
31. *A. lutkeni* Crossland, 1952
32. *A. divaricata* (Dana, 1846)
33. *A. solitaryensis* Veron and Wallace, 1984
34. *A. clathrata* (Brook, 1891)
35. *A. glauca* (Brook, 1893)
36. *A. muricata* (Linaeus, 1758)
37. *A. grandis* (Brook, 1892)
38. *A. valenciennesi* (Milne Edwards and Haime, 1816)
39. *A. abrotanoides* (Lamarck, 1816)
40. *A. robusta* (Dana, 1846)
41. *A. palmerae* Wells, 1954
42. *A. intermedia* (Dana, 1846)
43. *A. tenuis* (Dana, 1846)
44. *A. aspera* (Dana, 1846)
45. *A. millepora* (Ehrenberg, 1834)
46. *A. spicifera* (Dana, 1846)
47. *A. papillare* Latypov, 1992
48. *A. florida* (Dana, 1846)
49. *A. hyacinthus* (Dana, 1846)
50. *A. cytherea* (Dana, 1846)
51. *A. microclados* (Ehrenberg, 1834)
52. *A. microphthalma* (Verrill, 1869)
53. *A. loripes* (Brook, 1892)
54. *A. granulosa* (Milne Edwards and Haime, 1860)
55. *A. caroliniana* Nemenzo, 1976
56. *A. echinata* (Dana, 1846)
57. *A. subglabra* (Brook, 1891)
58. *A. carduus* (Dana, 1846)
59. *A. longicyathus* (Milne Edwards and Haime, 1860)
60. *A. palifera* (Lamarck, 1816)
61. *A. brueggemanni* (Brook, 1893)
62. *A. austera* (Dana, 1846)
63. *A. pulchra* (Brook, 1891)
64. *A. anthocercis* (Brook, 1893)
65. *A. polystoma* (Brook, 1891)
66. *A. latistella* (Brook, 1892)
67. *A. hemprichi* (Ehrenberg, 1834)

Genus ***Astreopora*** de Blainville, 1830

68. *A. listeri* Bernard, 1896
69. *A. myriophthalma* (Lamarck, 1816)
70. *A. cucullata* Lamberts, 1980

Family ASTROCOENIIDAE Koby, 1890

Genus ***Stylocoeniella*** Yabe and Sugiyama, 1935

71. *S. guentheri* Bassett-Smith 1890

Genus ***Madracis*** Milne Edwards and Haime, 1849

72. *M. kirbyi* Veron and Pichon, 1976

Family POCILLOPORIDAE Gray, 1842

Genus ***Pocillopora*** Lamarck, 1816

73. *P. damicornis* Linnaeus, 1758
74. *P. verrucosa* (Ellis and Solander, 1786)
75. *P. eydouxi* MEdwards and Haime, 1860
76. *P. ligulata* Dana, 1846
77. *P. ankeli* Scheer and Pillai, 1974

Genus ***Seriatopora*** Lamarck, 1816

78. *S. hystrix* Dana, 1846
79. *S. stellata* Quelch, 1886
80. *S. crassa* Quelch, 1886

Genus ***Stylophora*** Schweigger, 1819

81. *S. pistillata* Esper, 1797

Family EUPHYLLIDAE Veron, 2000

Genus ***Euphyllia*** Dana, 1846

82. *E. glabrescens* (Chamisso and Eyscenhardt, 1821)

Genus : ***Plerogyra*** Milne Edwards and Haime, 1848

83. *P. sinuosa* (Dana, 1846)

Genus ***Physogyra*** Quelch, 1884

84. *P. lichtensteini* (Milne Edwards and Haime, 1851)

Family OCULINIDAE Gray, 1847

Genus ***Galaxea*** Oken, 1815

85. *G. astreata* (Lamarck, 1816)
86. *G. fascicularis* (Linnaeus, 1767)

Family SIDERASTREIDAE Vaughan and Wells, 1943

Genus ***Pseudosiderastrea*** Yabe and Sugiyama, 1935

87. *P. tayami* Yabe and Sugiyama, 1935

Genus ***Siderastrea*** de Blainville

88. *S. savignayana* Milne Edwards and Haime, 1850.

Genus ***Psammocora*** Dana, 1846

89. *P. contigua* (Esper, 1797)
90. *P. digitata* Milne Edwards and Haime, 1851
91. *P. profundacella* Gardiner, 1898
92. *P. haimeana* Milne Edwards and Haime, 1851

Genus ***Coscinaraea*** Milne Edwards andHaime, 1848

93. *C. monile* (Forskal, 1775)

Family AGARICIIDAE Gray, 1847

Genus ***Pavona*** Lamarck, 1801

94. *P. cactus* (Forskal, 1775)
95. *P. explanulata* (Lamarck, 1816)
96. *P. varians* Verrill, 1864
97. *P. maldivensis* (Gardiner, 1905)
98. *P. decussata* (Dana, 1846)
99. *P. venosa* (Ehrenberg, 1834)
100. *P. clavus* (Dana, 1846)
101. *P. duerdeni* Vaughan, 1907
102. *P. minuta* Wells, 1954

Genus ***Leptoseris*** Milne Edwards and Haime, 1849

103. *L. papyracea* (Dana, 1846)
104. *L. hawaiensis* Vaughan, 1907

Genus ***Coeloseris*** Vaughan, 1918

105. *C. mayeri* Vaughan, 1918

Genus ***Gardineroseris*** Scheer and Pillai, 1974.

106. *G. planulata* (Dana, 1846)

Genus ***Pachyseris*** Milne Edwards and Haime, 1849

107. *P. rugosa* (Lamarck, 1801)
108. *P. speciosa* (Dana, 1846)
109. *P. gemmae* Nemenzo, 1955

Family FUNGIIDAE Dana, 1846

Genus ***Cycloseris*** Milne Edwards and Haime, 1849

110. *C. cyclolites* (Lamarck, 1801)
111. *C. costulata* (Ortmann, 1889)
112. *C. hexagonalis* Milne Edwards and Haime, 1848
113. *C. patelliformis* (Boschma, 1923)
114. *C. sinensis* Milne Edwards and Haime, 1849
115. *C.somervillei* (Gardiner, 1909)

Genus ***Diaseris*** Milne Edwards and Haime, 1849

116. *D. distorta* (Michelin, 1843)

Genus ***Fungia*** Lamarck, 1801

117. *F. corona* Doderlein, 1901
118. *F. horrida* Dana, 1846
119. *F. danai* Milne Edwards and Haime, 1851
120. *F. fungites* (Linnaeus, 1758)
121. *F. repanda* Dana, 1846
122. *F. scutaria* Lamarck, 1801
123. *F. paumotensis* Stutchberry, 1833

Genus ***Ctenactis*** Verrill, 1864

124. *C. echinata* (Pallas, 1766)
125. *C. crassa* (Dana, 1846)

Genus ***Herpolitha*** Eschscholtz, 1825

126. *H. limax* (Houttuyn, 1772)

Genus ***Polyphyllia*** Quoy and Gaimard, 1833

127. *P. talpina* (Lamarck, 1801)

Genus ***Sandalolitha*** Quelch, 1884

128. *S. robusta* (Quelch, 1886)

Genus ***Halomitra*** Dana, 1846

129. *H. pileus* (Linnaeus, 1758)

Genus ***Lithophyllon*** Rehberg, 1892

130. *L. undulatum* Rehberg, 1892

Genus ***Podabacia*** Milne Edwards and Haime, 1849

131. *P. crustacea* (Pallas, 1766)

Family PECTINIIDAE Vaughan and Wells, 1943

Genus ***Echinophyllia*** Klunzinger, 1879

132. *E. aspera* (Ellis and Solander, 1786)

Genus ***Oxypora*** Saville-Kent, 1871

133. *O. lacera* (Verrill, 1864)

Genus ***Mycedium*** Oken, 1815

134. *M. elephantotus* (Pallas, 1766)

Genus ***Pectinia*** Oken, 1815

135. *P. lactuca* Pallas, 1766

136. *P. paeonia*, (Dana, 1846)

Family MERULINIDAE Verrill, 1866

Genus ***Hydnophora*** Fischer de Waldheim, 1807

137. *H. rigida* (Dana, 1846)

138. *H. exesa* (Pallas, 1766)

139. *H. microconos* (Lamarck, 1816)

Genus ***Merulina*** Ehrenberg, 1834

140. *M. ampliata* (Ellis and Solander, 1786)

Genus ***Scapophyllia*** Milne Edwards and Haime, 1848

141. *S. cylindrica* Milne Edwards and Haime, 1848

Family DENDROPHYLLIIDAE Gray, 1847

Genus ***Turbinaria*** Oken, 1815

142. *T. peltata* (Esper, 1794)

143. *T. reniformis* Bernard, 1896

144. *T. mesenterina* (Lamarck, 1816)

Family MUSSIDAE Ortmann, 1890

Genus ***Acanthastrea*** Milne Edwards and Haime, 1848

145. *A. echinata* (Dana, 1846)

146. *A. hillae* Wells 1955

Genus ***Lobophyllia*** de Blainville, 1830

147. *L. corymbosa* (Forskal, 1775)

148. *L. hemprichii* (Ehrenberg, 1834)

Genus ***Symphyllia*** Milne Edwards and Haime, 1848

149. *S. recta* (Dana, 1846)

150. *S. radians* Milne Edwards and Haime, 1849

151. *S. agaricia* Milne Edwards and Haime, 1849

Genus ***Cynarina*** Bruggemann, 1877

152. *Cynarina lacrymalis* (Milne Edwards and Haime, 1848)

Family FAVIIDAE Gregory, 1900

Genus ***Favia*** Oken, 1815

153. *F. stelligera* (Dana, 1846)

154. *F. matthaii* Vaughan, 1918

155. *F. pallida* (Dana, 1846)

156. *F. rotumana* (Gardiner, 1899)

157. *F. favus* (Forskal, 1775)

158. *F. speciosa* Dana, 1846

Genus ***Favites*** Link, 1807

159. *F. pentagona* (Esper, 1794)

160. *F. halicora* (Ehrenberg, 1834)

161. *F. abdita* (Ellis and Solander, 1786)

162. *F. complanata* (Ehrenberg, 1834)

163. *F. flexuosa* (Dana, 1846)

164. *F. bestae* (Veron, 2000)

Genus ***Goniastrea*** Milne Edwards and Haime, 1848

165. *G. edwardsi* Chevalier, 1971

166. *G. retiformis* (Lamarck, 1816)

167. *G. australensis* (Milne Edwards and Haime, 1857)

168. *G. aspera* Verrill, 1905

169. *G. pectinata* (Ehrenberg, 1834)

Genus ***Platygyra*** Ehrenberg, 1834

170. *P. pini* Chevalier, 1975

171. *P. lamellina* (Ehrenberg, 1834)

172. *P. daedalea* (Ellis and Solander, 1786)

173. *P. sinensis* (Milne Edwards and Haime, 1849)

Genus ***Oulophyllia*** Milne Edwards and Haime, 1848

174. *O. crispa* (Lamarck, 1816)

Genus ***Leptoria*** Milne Edwards and Haime, 1848

175. *L. phrygia* (Ellis and Solander, 1786)

Genus ***Montastrea*** de Blainville, 1830

176. *M. valenciennesi* (Milne Edwards and Haime, 1848)
177. *M. annuligera* (Milne Edwards and Haime, 1849)

Genus ***Plesiastrea*** Milne Edwards and Haime, 1848
178. *P. versipora* (Lamarck, 1816)

Genus ***Oulastrea*** Milne Edwards and Haime, 1848
179. *O. crispata* (Lamarck, 1816)

Genus ***Diploastrea*** Matthai, 1914
180. *D. heliopora* (Lamarck, 1816)

Genus ***Leptastrea*** Milne Edwards and Haime, 1848
181. *L. transversa* Klunzinger, 1879
182. *L. purpurea* (Dana, 1846)
183. *L. bottae* Milne Edwards and Haime, 1849

Genus ***Cyphastrea*** Milne Edwards and Haime, 1848
184. *C. serialia* (Forskal, 1775)
185. *C. microphthalma* (Lamarck, 1816)

Genus ***Echinopora*** Lamarck, 1816
186. *E. lamellosa* (Esper, 1795)
187. *E. gemmacea* Lamarck, 1816
188. *E. horrida* Dana, 1846

Family TRACHYPHYLLIIDAE

Genus ***Trachyphyllia*** Milne Edwards and Haime, 1848
189. *Trachyphyllia geoffroyi* (Audouin, 1826)

Family PORITIDAE Gray, 1842

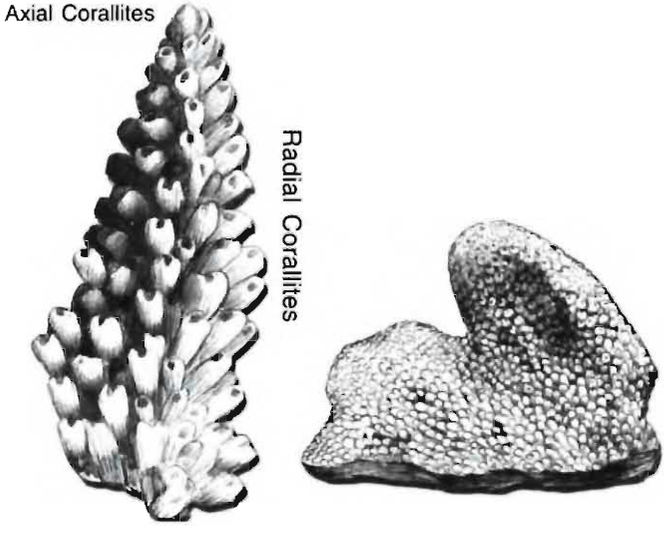
Genus ***Porites*** Link, 1807
190. *P. lutea* Milne Edwards and Haime, 1860
191. *P. lobata* Dana, 1846
192. *P. solida* (Forskal, 1775)
193. *P. lichen* Dana, 1846
194. *P. nigrescens* Dana, 1846
195. *P. compressa* Dana, 1846
196. *P. exserta* Pillai, 1969
197. *P. mannarensis* Pillai, 1969
198. *P. minicoensis* Pillai, 1969
199. *P. murrayensis* Vaughan, 1918
200. *P. rus* (Forskal, 1775)

Genus ***Goniopora*** de Blainville, 1830
201. *G. stokesi* Milne Edwards and Haime, 1851
202. *G. minor* Crossland, 1952
203. *G. tennuidens* (Quelch, 1886)
204. *G. stutchburyi* Wells, 1955
205. *G. columna* Dana, 1846
206. *G. planulata* (Ehrenberg, 1834)

Genus ***Alveopora*** de Blainville, 1830
207. *A. verrilliana* Dana, 1846
208. *A. superficialis* Pillai and Scheer, 1976

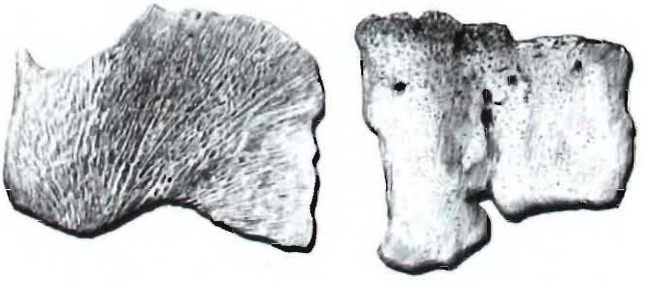
Family **ACROPORIDAE** Verrill, 1902

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. The genera included are *Montipora*, *Acropora*, *Astreopora* and *Anacropora* among which *Anacropora* is not recorded so far from Indian waters.



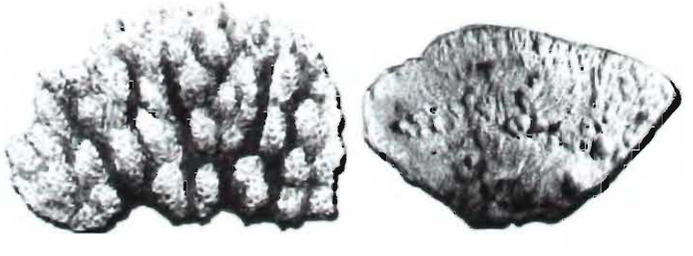
Sub genus *Acropora*
Acropora valida

Sub genus *Isopora*
Acropora palifera



Montipora foliosa

Montipora tuberculata



Acropora hyacinthus

Montipora spumosa

Genus ***Montipora*** de Blainville, 1830

A total of 72 species of *Montipora* are recorded in the world, making it the second largest coral genus in the Acroporidae family. In India 20 species have been recorded of which nineteen are from east coast (Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands) and thirteen are from west coast (Gulf of Kachchh and Lakshadweep Islands).

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*.

The coenosteal differences among species and shape of growth-forms are useful tools for identifying species of *Montipora*. Tuberculae and papillae are homologous structures differing in size only. Tuberculae refers to elaborations in the coenosteum, which are larger than the corallites. Papillae refer to elaborations in the coenosteum, which are smaller than the corallites.

1. ***Montipora foliosa*** (Pallas, 1766)

1766. *Madrepora foliosa* Pallas, *Elenchus zoophytoforum Den haad*, 451 pp.

1879. *Montipora foliosa* (Pallas) Bruggemann, Corals in Zoology of Rodriguez. *Philos. Trans. R. Soc. Lond. Biol. Sci., Ser. B*, **168**, 569-79.

1976. *Montipora foliosa* Pillai & Scheer, Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.)* **43** (126), 1-83, pl. 1-32.

Characters : Colonies are encrusting with broad laminar margins sometimes forming tiers or whorls. The development of papillae varies greatly reticulum form ridges which are conspicuous and usually lie perpendicular to the corallum margin. Corallites may be immersed or exert with the upper wall parathecate and the lower (submerged) wall absent or partly septothecate. Corallites are arranged in rows between reticulum edges. Calices < 1 mm in diameter. Coenosteum medium in size, coarse and spongy except for that of papillae, which is fine and has spinules with elaborted tips. Colour usually cream brown or pink.

Distribution : In India it is fairly common in Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed in the tropical Indo-Pacific from the Red Sea east to the New Hebrides and Fiji.

Remarks : Very common, especially on protected upper reef slopes. Closely resembles *M. aequituberculata* differs from it mainly because of the presence of reticulum ridges.

2. ***Montipora aequituberculata*** Bernard, 1897

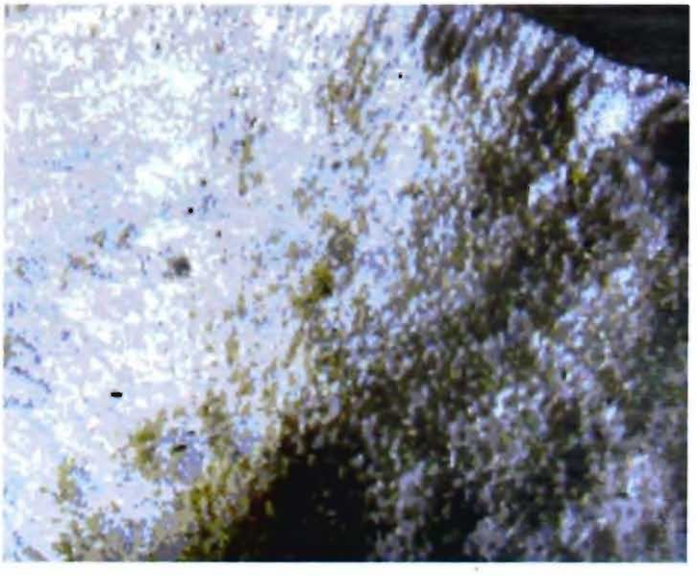
1897. *Montipora aequituberculata* Bernard, Catalogue of the Madreporarian corals *Br. Mus. (Nat. Hist.)* **3**, 1-192, pl.1-34

1907. *Montipora verrilli* Vaughan, Recent Madreporaria of the Hawaiian Islands and Layson.*U. S. Natl. Mus. Bull.* **59** (9), 1-427, pl. 1-96.

1952. *Montipora composita* Crossland, Sci. Rep. Great Barrier Reef Exped. 1928-29. *Br. Mus.(Nat. Hist.)*, **6** (3), 85-257, pl. 1-56.

Characters : Colonies are composed of thin laminae often arranged in oblique overlapping whorls. Corallites are immersed or exsert and are surrounded by thecal papillae. These are frequently fused into short ridges and may form hoods over the corallites. Reticulum papillae are thick and highly fused. Living colonies are usually uniform brown, cream or purple, sometimes with pale margin in colour.

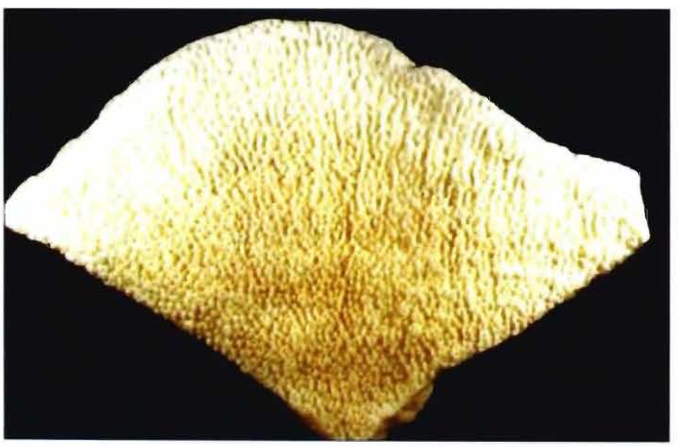
Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific from East Africa to Coral Sea.

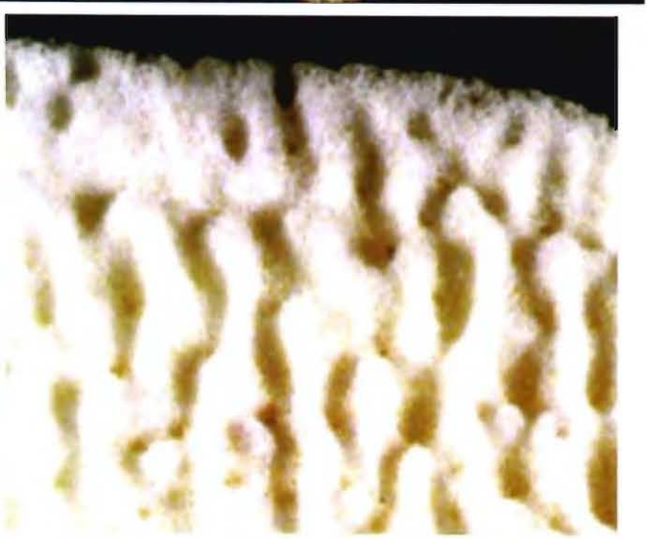


Remarks : This species is similar to *M. foliosa*. Usually occur in the shallow reef environments.

3. ***Montipora monasteriata*** (Forskal, 1775)

1775. *Madrepora monasteriata* Forskal, Vermium que inintinere orientali observavit Petrus Forskal. IV *Corallia. Hauniae.* 131-9.





Characters : Colonies are massive or thick plate which may be unifacial or bifacial. Corallites mostly immersed. Primary septa are complete. Reticulum is coarse and is uniformly covered with papillae or tuberculae or both papillae and tuberculae. All papillae and tuberculae are composed of fine reticulum with elaborated spines. Living colonies usually pale brown or pink in colour with pink or white margins.

Distribution : In India it is recorded from Gulf of Kachchh and Gulf of Mannar and Palk Bay. Worldwide it is distributed from the Red Sea east to Hawaii.

Remarks : Common on reef slopes and appears similar to *M. tuberculosa*. *M. monasteriata* has bigger corallites and papillae than *M. tuberculosa*. Colonies protected from strong wave action have small papillae and corallites have a relatively well-developed septation.

4. ***Montipora tuberculosa*** (Lamarck, 1816)

1816. *Porites tuberculosa* Lamarck, Histoire naturelle des animaux sans vertebres, Paris, **2** : 209-289.

1897. *Montipora tuberculosa* (Lamarck) Bernard, Catalogue of Madreporarian corals *Br. Mus. (Nat. Hist.)* **3**, 1-192, pl. 1-34.

Characters : Colonies are encrusting or plate like or sub-massive. Corallites are small, some exert and some immersed. Calice, 0.4 to 0.5 mm in diameter and upto 1 mm apart. One or two directives, branches than the rest of the primaries. Corallites are separated by papillae/tuberculae of about one corallite in diameter. On the crest, generally the tips of papillae remain free. Usually dull brown or blue in colour.

Distribution : In India it is recorded from Lakshadweep and Gulf of Mannar and Palk Bay. It is widely distributed from Red Sea, Maldives, China Sea, Marshall Islands and Samoa.

Remarks : Common over a wide ranges of habitats and resembles *M. monasteriata*. Mostly found on the upper reef slopes.

5. ***Montipora peltiformis*** Bernard, 1897

1897. *Montipora peltiformis* Bernard, Catalogue of the Madreporarian corals *Br. Mus. (Nat. Hist.)* **3**, 1-192, pl.1-34; Nemenzo (1967).

Characters : Colonies are sub-massive or flat, expalanate plates with or without nodular upward growths. Nodules usually irregular in size and shape but do not form columns. Thecal and reticulum papillae are slightly different especially on nodules where the thecal papillae form distinct circles. Corallites small and widely spaced. Two cycles of septa consists of rows of spines. Thecal and reticulum papillae sometimes form short ridges. Living colonies are pale brown in colour.

Distribution : In India this species has been recorded only from Andaman and Nicobar Islands. Globally, it is distributed from Madagascar, throughout the tropical Indian Ocean, east to the Philippines and eastern Australia.

Remarks : Mostly found on shallow reef slopes.

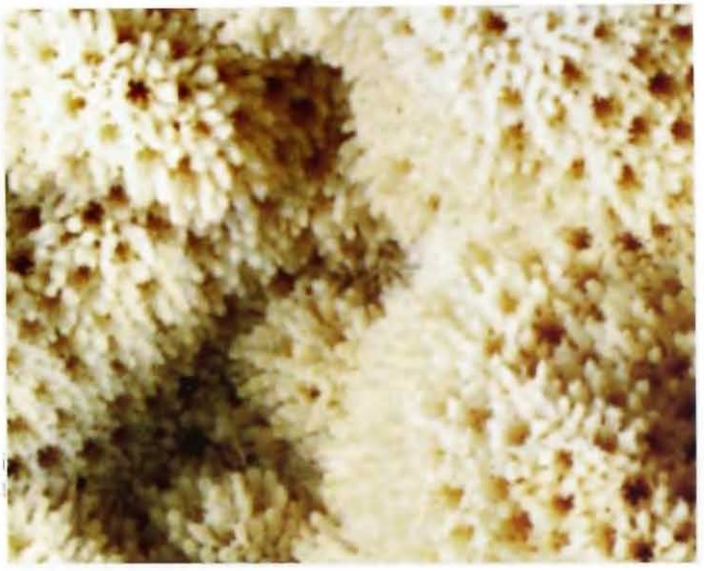
6. *Montipora informis* Bernard, 1897

1897. *Montipora informis* Bernard, Catalogue of the Madreporarian corals *Br. Mus. (Nat. Hist.)* **3**, 1-192, pl. 1-34.

1897. *Montipora granulata* Bernard, Catalogue of the Madreporarian corals *Br. Mus. (Nat. Hist.)* **3**, 1-192, pl. 1-34.

Characters : Colonies are massive to encrusting. Corallites are evenly distributed and immersed. The reticulum is densely covered with elongate papillae of uniform length. Living colonies are brown or mottled brown and white. Papillae may have white or purple tips. White polyps may be extended during the day.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide it is distributed in the tropical Indo-Pacific, Madagascar, New Caledonia and the Great Barrier Reef.



Remarks : Mostly found on the upper reef slopes.

7. *Montipora spumosa* (Lamarck, 1816)

1816. *Porites spumosa* Lamarck, Histoire naturelle des animaux sans vertebres, Paris 2, p.273.

1918. *Montipora spumosa* Vaughan, Some shoal-water corals from Murray Islands, Cocos-Keeling Islands and Fanning Island. *Pap. Dep. Mar. Biol. Carnegie Inst. Wash.* 9 (Publ. 213), 51-234. pl. 20-93.

1959. *Montipora guppyi* Ma, Effect of water temperature on growth rate of reef corals. Oceanogr. Sinica-2nd series of private research publication. Spec. vol. 1, 1-116, pl. 1-320.

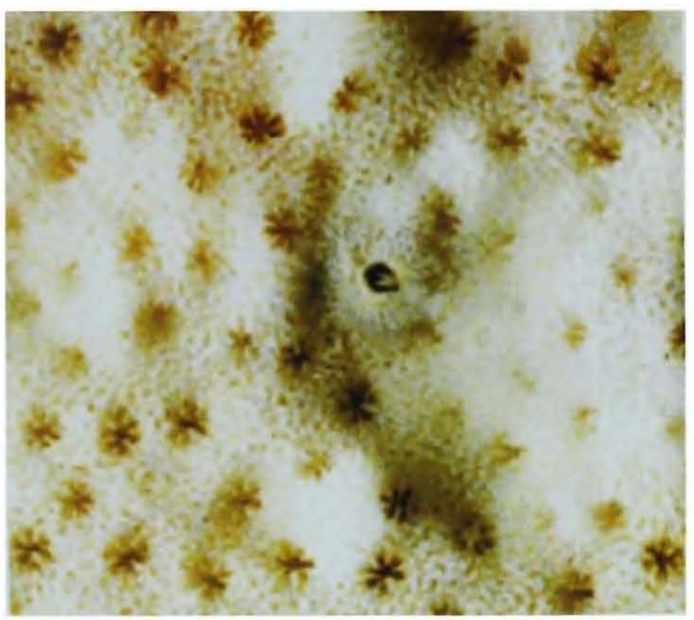
Characters : Colonies are encrusting, plate like

or columnar, the columns mostly being tubular. Encrusting colonies may usually develop rootlets. Corallites widely separated, immersed and without papillae. Primary septa complete. The reticulum is very coarse and uniform in structure. Coenosteum spinules are always highly elaborated. Tuberculae of irregular shapes may be formed but intergrade with larger mounds and ridges. Living corals yellowish brown in colour.

Distribution : In India it is recorded from the Lakshadweep and Gulf of Mannar and Palk Bay. Globally, it is distributed from the central Indo-Pacific to Fiji.

Remarks : It is very distinctive in appearance. This coral frequently overgrows on other corals and assumes their shape. Similar to *M. verrucosa* and *M. rus* insitu.

8. ***Montipora turgescens*** Bernard, 1897



1897. *Montipora turgescens* Bernard, Catalogue of the Madreporarian corals *Br. Mus. (Nat. Hist.)* **3**, p.53, pl. 6, fig. 2, pl. 32, fig. 11.

1974. *Montipora turgescens* Scheer & Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)* **42** (122), 1-75, pl. 1-33.

1975. *Montipora turgescens* Zou, Reef building corals in shallow water around Hainan Island. Scientific Publishing Society, *China Scientific Publishing House*, Peking. 1-66, pl. 1-15.

Characters : Colonies are massive, flat, hemispherical or columnar with the surface raised into subcircular mounds, 3 – 12 mm diameter. Mounds may be small enough to form the walls of single corallite. Corallites uniformly distributed on and between mounds and immersed with calices less than 1 mm in diameter. Septa are tapered and with two complete cycles. Reticulum uniform in structure, spongy with an outer covering of highly elaborated spinules. Living corals are usually brown, cream or purple in colour.

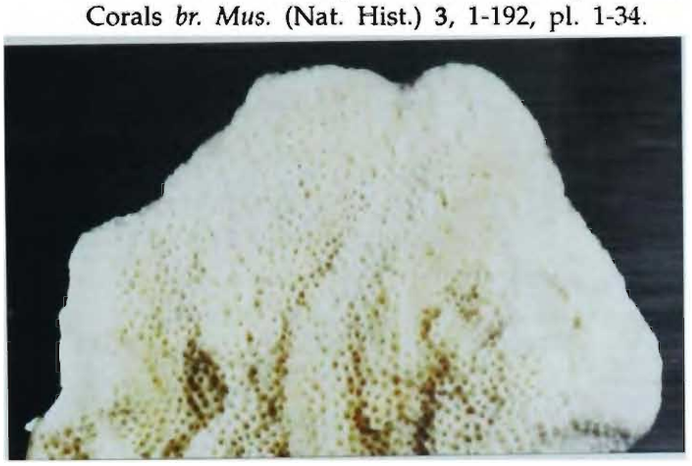
Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Globally, it is distributed from the western Indian Ocean, east to the Ellice Islands and Samoa.

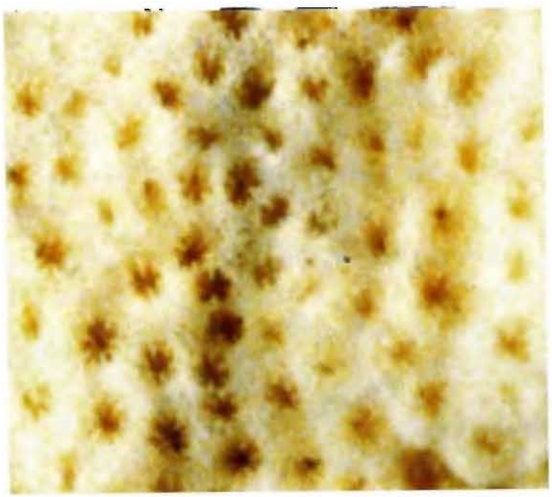
Remarks : Found in wide range of reef habitats. It is common in the islands of Gulf of Mannar.

9. ***Montipora venosa*** (Ehrenberg, 1834)

1834. *Porites venosa* Ehrenberg, Abl. Akad. Wiss. *DDR* 1832, 250-380

1897. *Montipora venosa* Bernard, The genus Montipora. The Genus Anacropora. Cat. Madreporarian Corals *br. Mus.* (Nat. Hist.) **3**, 1-192, pl. 1-34.





1982. *Montipora venosa* Veron, Hermatypic scleractinia of Hong Kong-an annotated list of species. In Morten, B.R. (Ed.) *Proceedings of the frist international workshop on the marine flora and fauna of Hong Kong.*

Characters : Colonies are massive or sub-massive. Corallites are a mixture some slightly exert, other funnel shaped. Both tuberculae and papillae are absent. Calices are less than 1.0 mm in diameter. Living colonies are pale brown in colour.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide it is distributed in the tropical Indo-Pacific from the Red Sea to the Marshall Islands.

Remarks : Mostly common in all reef environments of India.

10. ***Montipora verrucosa*** (Lamarck, 1816)

1816. *Porites verrucosa* Lamarck, Histoire naturelle des animaux sans vertebres, Paris, **2** : 209-287.

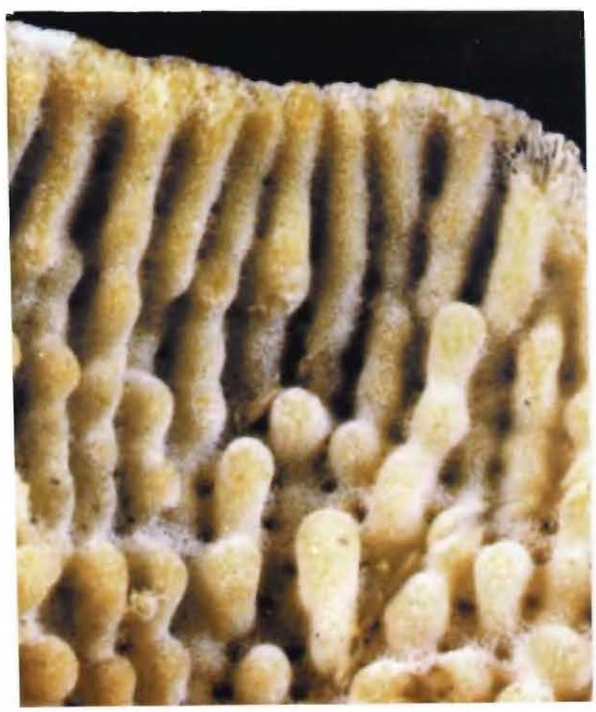
1833. *Montipora verrucosa* Quoy & Gaimard, Zoophytes. In Dumont d' Urville, J.S.C. 'Voyage de Decourvertes de l' Astrolabe, excute par ordre du Roi, pendant les annees 1826-29, sous le commandement de M.J. Dumont d' Urville'. *Zoologie* **4**, 175-254, pl. 14-20.

1968. *Montipora verrucosa* Chevalier, Geomorphologie de l'Ile Mare. Exped. Recifs corallines Nouvelle-Caledonie, Fond. Singer-Polignac, Paris, **3**, 5-50, pl. 1-12.

Characters : Colonies are encrusting, plate like or submassive. Surface with papillae with rounded and smooth surface, situated in radiating rows along the edge. Corallites situated between the papillae. Septa are tapered and characteristically plunge steeply within the corallites. Reticulum spongy, verrucae relatively fine covered with elaborated spinules. Living coral brown or blue in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. It is widely distributed from the tropical Indo-Pacific, from the Red Sea, east to the Marshall Islands.

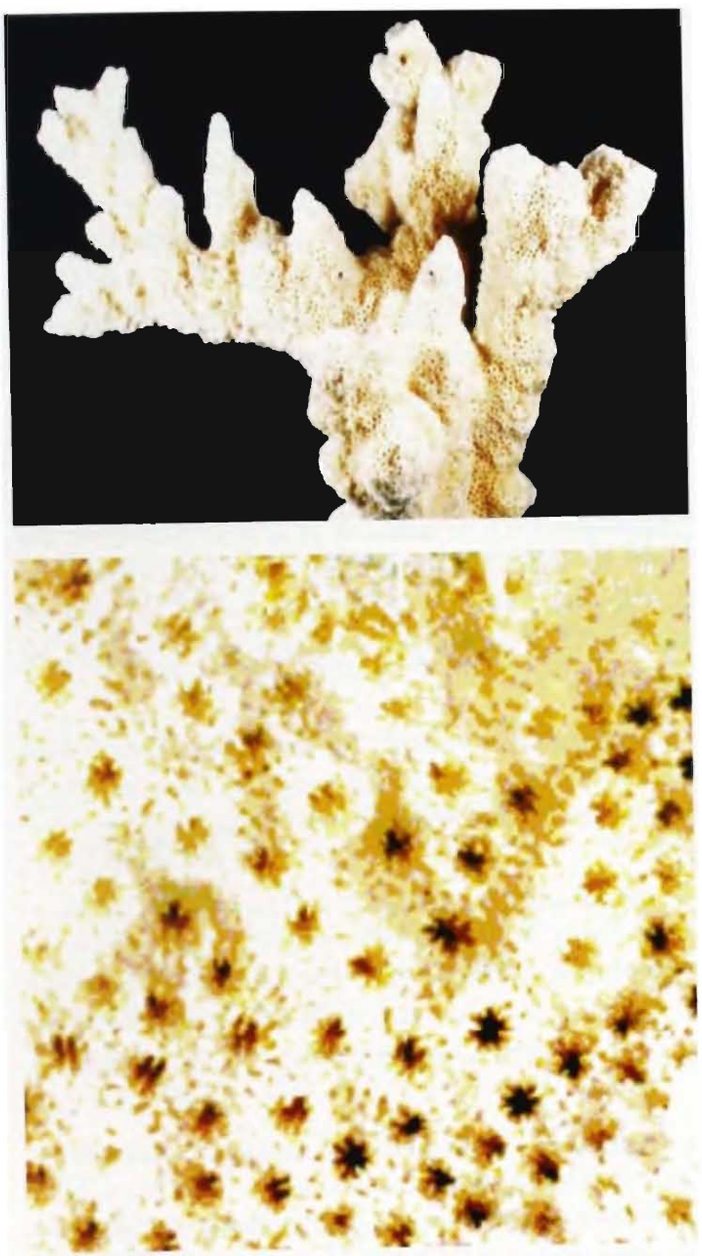
Remarks : Common in upper reef slopes and lagoons and closer in appearance to *M. danae.*



11. ***Montipora hispida*** (Dana, 1846)

1846. *Montipora hispida* Dana, U.S. Exploring Expedition 1838-1842, 7 : p. 496, pl. 46, fig. 5.

1880. *Montipora hispida* (Dana) Studer, Beitrage zur fauna der steinkorallen von Singapore. *Mitt. Naturforsch.Ges.*Bern 979, 15-53.



Characters : Colonies may be encrusting, columnar or digitate, submassive or a combination of these depending on the region of the reef. Most of the branches found to possess a central worm tube. Corallites both immersed and exert. The latter with thecal papillae; calices conspicuous, level or slightly projecting in appearance, septa in two cycles, over the branches the tubercles form ridges, particularly in older branches. Reticulum coarse with shorter papillae. Pale brown in colour.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the tropical Pacific, east to Hawaii and also the Indian Ocean, west to Sri Lanka.

Remarks : Commonly found in turbid waters. Common in Mandapam group of Islands, Gulf of Mannar.

12. ***Montipora digitata*** (Dana, 1846)

1846. *Montipora digitata* Dana, *U.S. Exploring Expedition* 1838-1842, 7 : p. 508, pl. 38, figs. 1c.

1846. *Montipora tortuosa* Dana, Zoophytes. *U. S. Exploring Exped.* 1838-1842. 7, 1-740, pl. 1-61.

Characters : Colonies are digitate or arborescent upright branches. Corallites are immersed and small (especially colonies from shallow waters), thecal wall present. Septa are in two cycles, primaries larger than secondaries, directive septa most conspicuous. Living colonies are dark brown in colour.

Distribution : In India it is recorded from

Lakshadweep, Palk Bay and Gulf of Mannar and Andaman and Nicobar Islands. Widely distributed throughout the tropical Indo-Pacific, from the western Indian Ocean, east to Fiji.

Remarks : Common, may be a dominant species on shallow reef flats. It is most common in the Mandapam group of Islands, Gulf of Mannar.

13. ***Montipora angulata*** (Lamarck, 1816)

1816. *Porites angulata* Lamarck, Histoire naturelle des animaux sans vertebres, Paris **2**, 1-88.

1897. *Montipora angulata* (Lamarck) Bernard, Catalogue of Madreporarian corals *Br. Mus. (Nat. Hist.)* **3**, 1-192, pl. 1-34.

1918. *Montipora cocosensis* Vaughan, Cocos-Keeling Islands and Fanning Island. *Pap. Dep. Mar. Biol. Carnegie Inst. Wash.* **9** (Publ. 213), 51-234. pl. 20-93.

Characters : Colonies have extensive encrusting bases with irregularly contorted branches. Corallites are immersed and evenly distributed. The reticulum is smooth. Living colonies are pale brown in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is widely distributed in the tropical Indo-Pacific and the Great Barrier Reef.

Remarks : Mostly found on the fringing reef flats.

14. ***Montipora millepora*** Crossland, 1952

1952. *Montipora millepora* Crossland, Sci. Rep. Great Barrier Reef Exped., 1928-29, *Br. Mus. (Nat. Hist.)*, **6** (3) : 85-257, pl. 1-56.

Characters : Colonies are massive with flattened encrusting margins or encrusting. Corallites are very small, immersed and are evenly distributed between and on the sides of tuberculae, but usually absent from the tips of tuberculae. The reticulum has low tuberculae. Living colonies are dark green or brown in colour.

Distribution : In India, it is is recorded from the Gulf of Mannar and Palk Bay. Globally, it is distributed throughout the Indo-Pacific, south East Asia and along the east and west coasts of Australia.

Remarks : *M. millepora* has the smallest corallites of all *Montipora*. Underwater, it also slightly resembles *Stylocoeniella guentheri*.

15. ***Montipora spongiosa*** (Ehemberg, 1834)

1834. *Madrepora hemprichii* Ehrenberg, Beitrage zur physiologischen Kenntniss der Corallenthiere im Allgemeinen und besanders des Rothen meeres. *Abh. Akad. Wiss. D.D.R.* 1832, 250-380.

Characters : Colonies are clumps of irregularly contorted or flattened branches, which may fuse. Corallites usually have a prominent lower lip and are deep and conspicuous. There is no development of papillae or other ornamentation.

Distribution : In India it is recorded only in Lakshadweep. Elsewhere it is reported only from Red Sea.

Remarks : Mostly found on the shallow reef environments.

16. ***Montipora jonesi*** Pillai, 1986

1986. *Montipora jonesi* Pillai, Recent corals from the South-East coast of India. *Today and Tomorrow's.* p. 141, pl. II, fig.4.

1969. *Montipora edwardsi* Pillai, Report on a species of *Montipora* (Acroporidae, Scleractinia), *J. mar. biol. Ass. India*, **9** (2) : 399-401.

Characters : Colonies composed of several tiers of inverted cones with a cylinderical peduncle. The top of the cones is 4 to 5 cm in spread with 1 to 1.5 cm thick peduncles. Primary septa larger than the secondaries. Directives often exert. Second cycle generally incomplete. Two to three papillae often to focus low ridge enclosing calices. Highly porous reticulum, living coral dull green in colour.

Distribution : Reported only from the Mandapam, Palk bay.

Remarks : Pillai (1986) synonymised *M. alveopora* (Pillai, 1969) and *M. edwardsi* (Pillai, 1969 and described the present species. *M. jonesi* is unique among the *Montipora* species reported in India. It is named after Dr. S. Jones, former director of CMFRI. The type specimen is deposited in the CMFRI, Mandapam (No. CMFRI C. 56).

17. ***Montipora manauliensis*** Pillai, 1967

1967. *Montipora manauliensis* Pillai, Studies on Indian corals-*I. J. Mar. boil. Ass. India*, **9**(2) p. 399, pl.1, fig. 1,2.

Characters : Colonies hillocky with small (<0.6 mm) corallites and foveolate coenchyme. Living coral is lilac in colour.

Distribution : Distributed along Gulf of Mannar and Palk Bay.

Remarks : This species belongs to foveolate group.

18. ***Montipora edwardsi*** Bernard, 1897

1897. *Montipora edwardsi* Bernard, Catalogue Madreporarian Corals *Brit. Mus.*, London, 3, 192 pp., 34 pl.

Characters : Colonies are ramose, narrow base, lower part dead. 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.

Distribution : In India it is recorded from Mandapam, Palk Bay. Worldwide it is distributed from Red Sea, Taiwan and Philippines.

Remarks : It is similar to *M. jonesi.* Pillai (1967) first recorded this speicies from Palk Bay, Mandapam and Pillai (1986) synonymised this species with *M. jonesi.* More studies are required to confirm the identity of this species.

19. ***Montipora explanata*** Brueggeman, 1879

1879. *Montepora explanata* Brueggeman, Corals in zoology of Rodriguez. *Philos. Trans. R. Soc. Lond. Biol. Sci Ser.* B, **168** : 569-579.

Characters : Colonies are 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. Coenchme reticulate with small spines and sometimes with round topped tubercles. It is characterised by the presence of scattered low tubercles though it is essentially a glabrous form.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep and Gulf of Mannar and Palk Bay. Worldwide it is distributed from Mauritius.

Remarks : Rare, it forms a connecting link between glabrous and tuberclate species of *Montipora.* Pillai (1967) reported this species from Palk Bay, Mandapam and it was not included in Veron and Wallace (1984) and Veron (2000). The identity and the taxonomic status of the present species is still not clear.

20. ***Montipora exserta*** Quelch, 1886

1886. *Montipora exserta* Quelch, *Rep. Sci. Res. Voyage, H.M.S. Challenger (Zool)* **16** : 1-2073, pls.1-12.

Characters : Colonies are 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. Living coral yellowish brown in colour.

Distribution : In India it is recorded only from Gulf of Mannar and Palk Bay. Worldwide it is distributed from Sri Lanka, Torres Strait, Wednesday Island and Samoa.

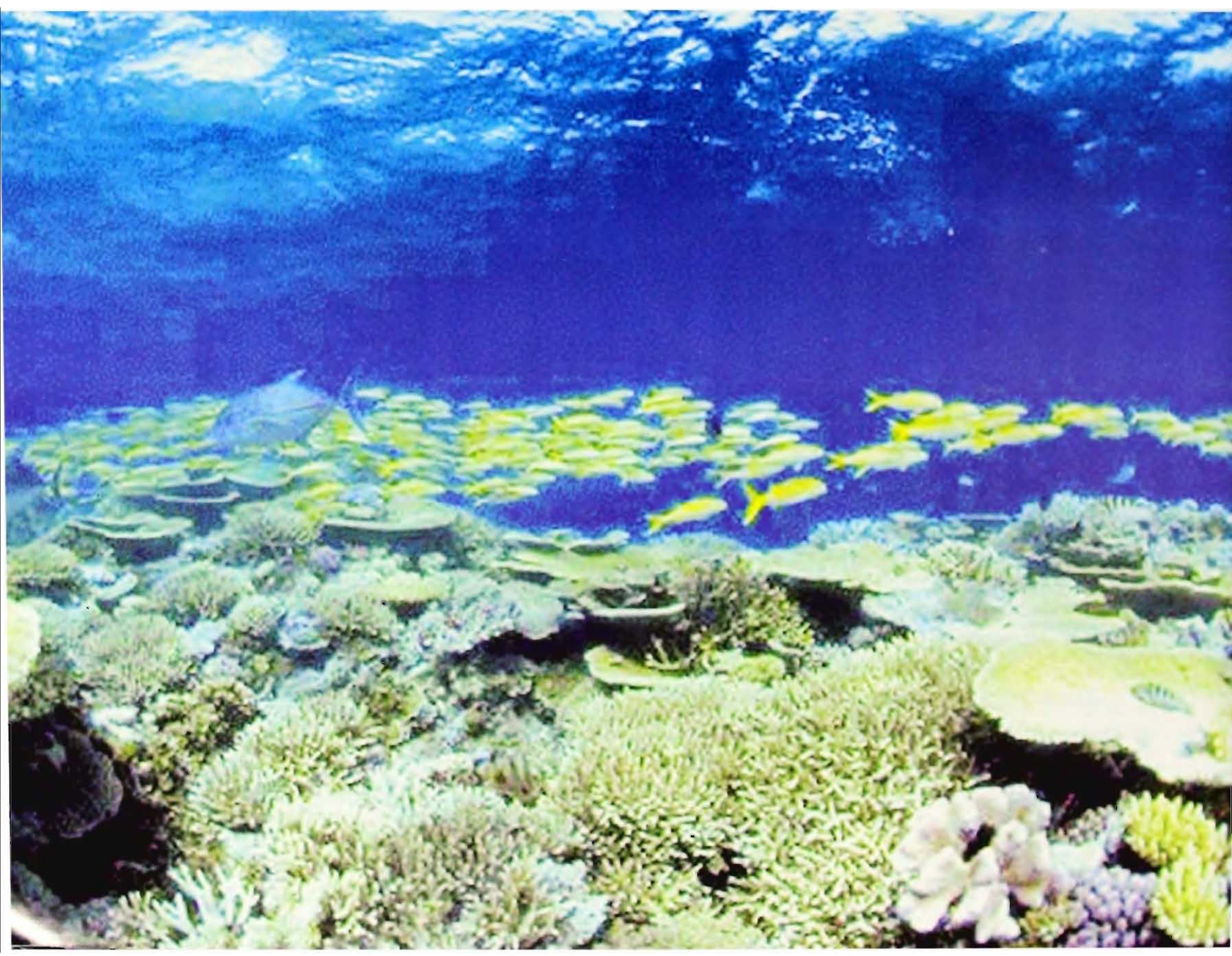
Remarks : Pillai (1967) reported this species from Palk Bay, Mandapam and it was not included in Corals of the world (Veron, 2000). The identity and the taxonomic status of the present species are still not clear.

Genus *Acropora* Oken, 1815

Acropora is the largest genus of reef-building corals with 170 species recorded around the world. Forty-seven species are so far recorded from Indian waters of which one species from Gulf of Kachchh, 14 species from Lakshadweep, 13 species from Gulf of Mannar and Palk Bay and 42 species from Andaman and Nicobar Islands.

Acropora have a much wider range of growth-forms useful to taxonomy than other characters (Fig. 25). 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 (Fig. 26). Septa are usually in two cycles. Columella are absent. Corallite walls and the coenosteum are porous. Polyps are usually extended only at night.

In Indian waters this genus is poorly represented around Gulf of Kachchh and very well represented in all the other major coral reef areas.



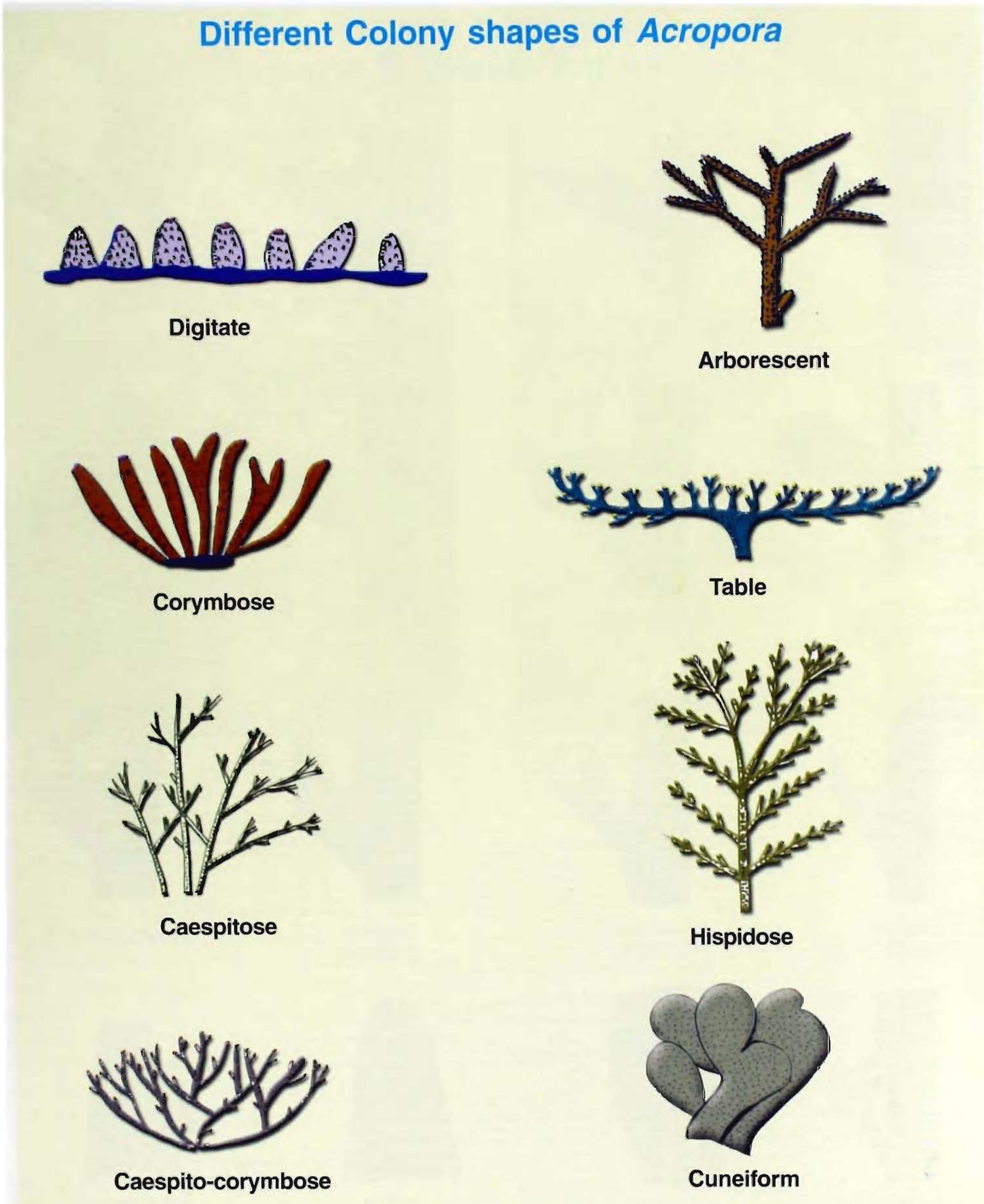


Fig. 25. Different colony shapes of the genus *Acropora*.

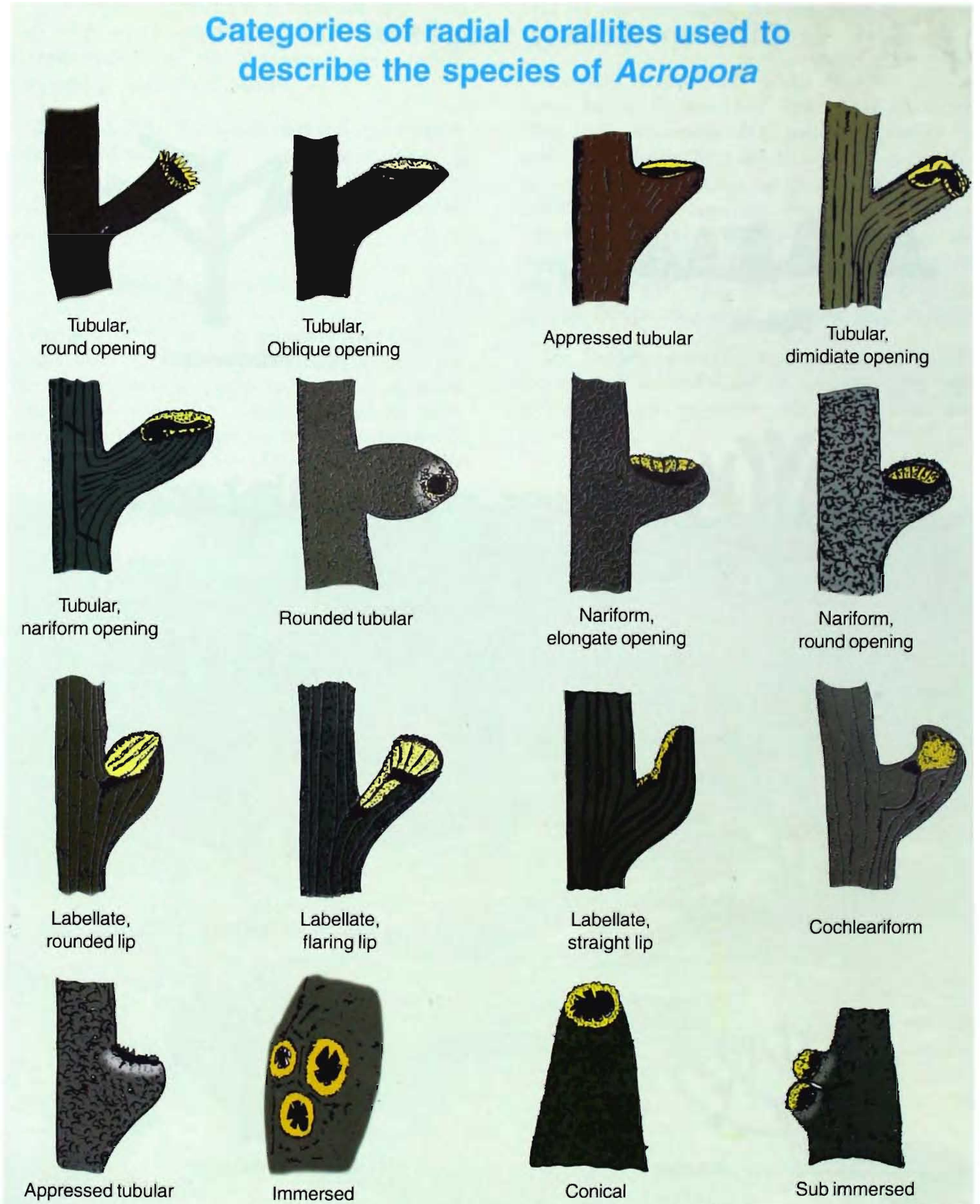


Fig. 26. Various categories of radial corallite shapes used to describe different species of *Acropora*.

21. ***Acropora rudis*** (Rehberg, 1892)

1892. *Madrepora rudis* Rehberg, *Abhandlingen Naturwissenschaften Vereinigung Hamburg* **12** : 1-50, pls 1-4.

Characters : Colonies are composed of large, tapered, prostrate branches. Axial corallites are dome-shaped with small openings. Radial corallites occur only on the upper surfaces of branches; lower surfaces are smooth. They are of mixed sizes, the smallest are immersed, the largest are bead-like, up to 4 millimetres diameter. The coenosteum is smooth and dense, composed of fine spinules without elaborated tips.

Distribution : It is recorded only from Gulf of Mannar and Palk Bay. It is a new record to India. It is also recorded from western side of Sri Lanka (type locality), Bangladesh, Western Thailand and Seychelles.

Remarks : This species is similar to *A. hemprichii*, which have smaller branches with corallites on all sides. The very large corallite size and rounded appearance of radial corallites, as well as the sturdy branches are distinctive features to identify this species in the field.

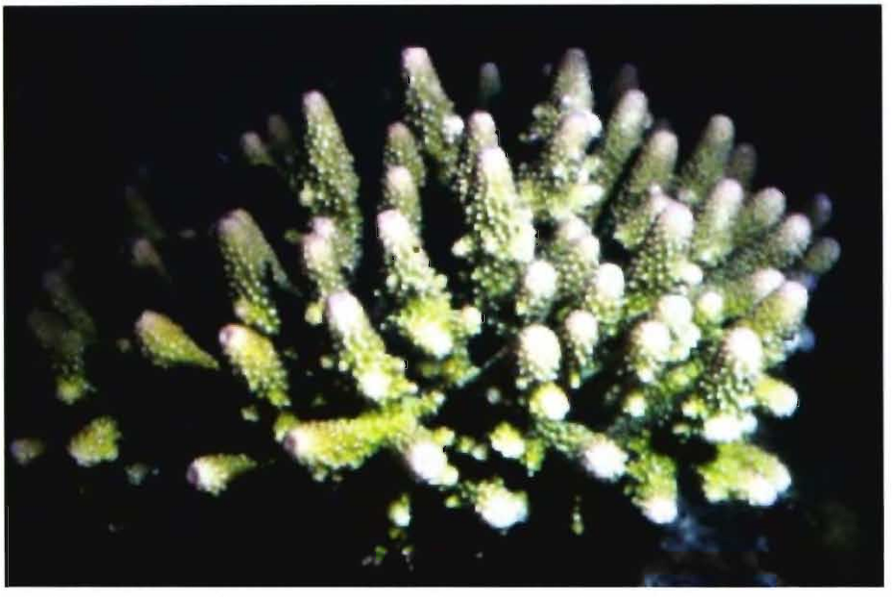
22. ***Acropora humilis*** (Dana, 1846)

1846. *Madrepora humilis Dana*, U.S. Exploring Expedition 1838-1842, **7** : 1-740, pl. 1-61.

1925. *Acropora fruticosa* Hoffmeister, *Pap. Dep. Mar. Biol. Carnegie Inst. Wash.* (Publ. 343) **22**, 1-90, pl. 1-23.

1952. *Acropora humilis* (Brook) Crossland, Rep. Great Barrier Reef Exped. 1928-29. *Br. Mus. (Nat. Hist.)*, **6** (3), 85-257, pl. 1-56

1974. *Acropora humilis* Scheer & Pillai, Report on Scleractinia from the Nicobar Islands, *Zoologica (Stugg.)*. **42** (122), 1-75, pl. 1-33.



Characters : A sturdy corymbose species with thick tapering branches, large and obvious axial corallites and thick-walled radial corallites. Axial corallites are up to 2 mm exert 3.0 – 8.0 mm in diameter with calices 1.2 – 1.6 mm in diameter. Radial corallites are usually of two sizes and in rows, evenly distributed, short tubular with dimidiate openings and thickened walls. This species may be cream, brown or blue, purple, yellow-green or blue with cream tips.

Distribution : This is the only species in genus *Acropora* found in all the four major coral reef areas in India. Globally, it is distributed throughout the tropical Indo-Pacific from the Red Sea in the west and to the Marshall Islands, Tamotu Archipelago and Hawaii in the east.

Remarks : The shape of radial corallites in this species is tubular, and the calice opening may also vary. Of all living *Acropora* species, *A. humilis* has the oldest fossil record (at least 25 million years). This may be the reason it occurs thoughout the Indo-Pacific and has many variations in form. This common species resembles *A. gemmifera* and *A. monticulosa*. Sturdy, digitate to corymbose colonies with large obvious axial corallites and mostly evenly sized redial corallites are the distinguishable features in the field.

23. *Acropora gemmifera* (Brook, 1892)

1892. *Madrepora gemmifera* Brook, Preliminary descriptions of new species of *Madrepora* in the collections of the British museum. Part II. *Ann. Mag. Nat. Hist.* (6) **10**, 451-65.

1918. *Acropora gemmifera* Vaughan, Some shoal-water corals from Murray Islands, Cocos-Keeling Islands and Fanning Island. *Pap. Dep. Mar. Biol. Carnegie Inst. Wash.* **9** (Publ. 213), 51-234. Pl. 20-93.

Characters : Colonies are digitate to corymbose; branches are thick, tapering to a small axial corallite. Radial corallites are of two sizes, usually in rows. Large–sized corallites increase in length towards branch bases, with dimidiate openings and thickened walls are the important characters of radial corallites. Colonies are usually blue, cream or brown, with blue or white branch tips in colour.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Worldwide it is distributed from Red Sea, New Caledonia, Fiji and the Great Barrier Reef.

Remarks : It is similar to *A. humilis*. The present species is distinguished from *A. humilis* by the consistant presence of immersed as well as longer radial corallites throughout the branch.

24. ***Acropora monticulosa*** (Bruggemann, 1879)

1879. *Madrepora monticulosa* Bruggmann, *Philos. Trans. R. Soc. Lond. Biol. Sci., ser.* B, **168**, 569-79.

Characters : A sturdy corymbose to digitate species with thick, low, conical and tapering branches. Axial calices are similar in size to radials. Radial coallites are uniform in size, usually arranged in rows with rounded and only very slightly dimidiate openings. Known colours include blue or cream, usually with pale branch tips.

Distribution : In India, it is recorded only from

the Andaman and Nicobar Islands. Globally it is distributed throughout the Indo-Pacific. Commonly occurs around low tide mark in exposed habitats.

Remarks : This species resembles *A. gemmifera* and *A. humilis* however the radial corallites are smaller and more uniform in size. This species is most common in habitats exposed to high water movement, either strong wave movement or strong currents.

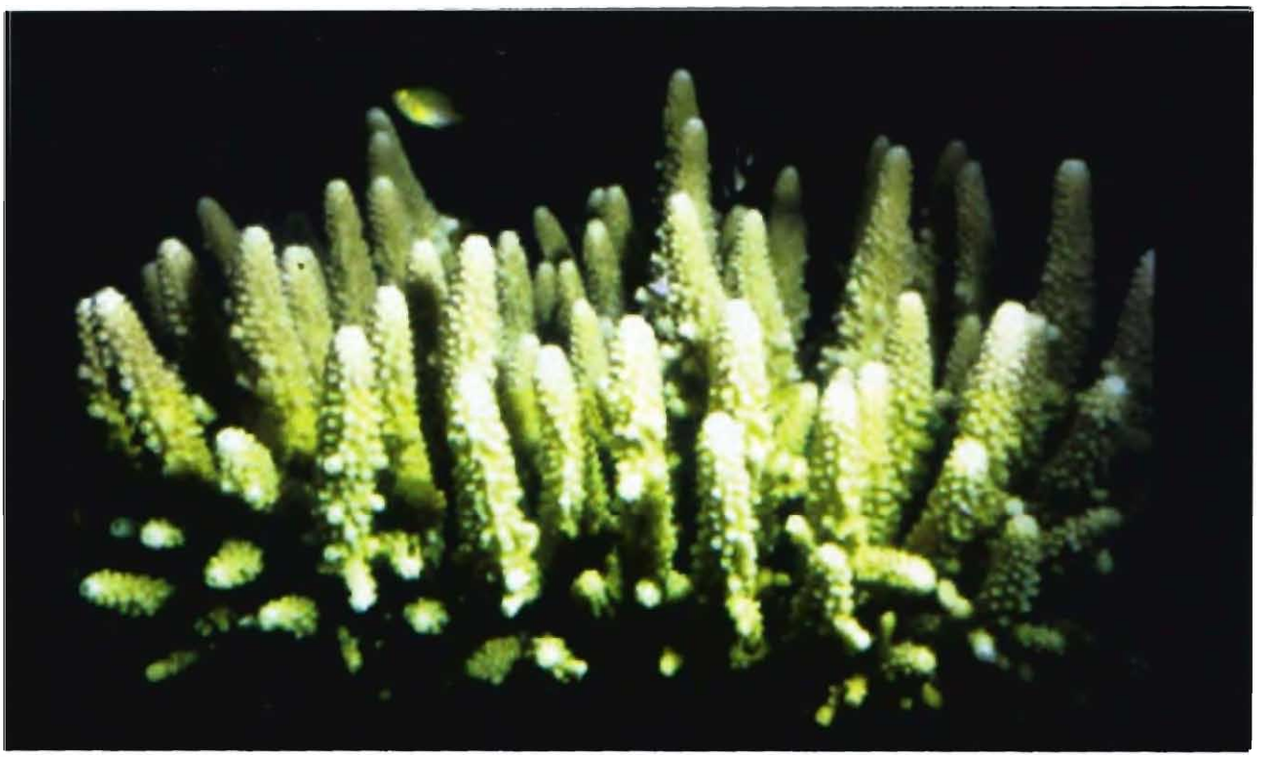
25. ***Acropora samoensis*** (Brook, 1891)

1891. *Madrepora samoensis* Brook, Descriptions of new species of Madrepora in the collections of the British Museum. *Ann. Mag. Nat. Hist.* (6) **8**, 458-71.

Characters : A moderately sturdy caespitose to caespito-corymbose species with a central to side attachment. Branches are non-tapering. Axial corallites are larger, with very thick walls. Radial corallites are tubular with round to dimidiate openings, interspersed with smaller immersed corallites. Colonies are usually purple or cream in colour.

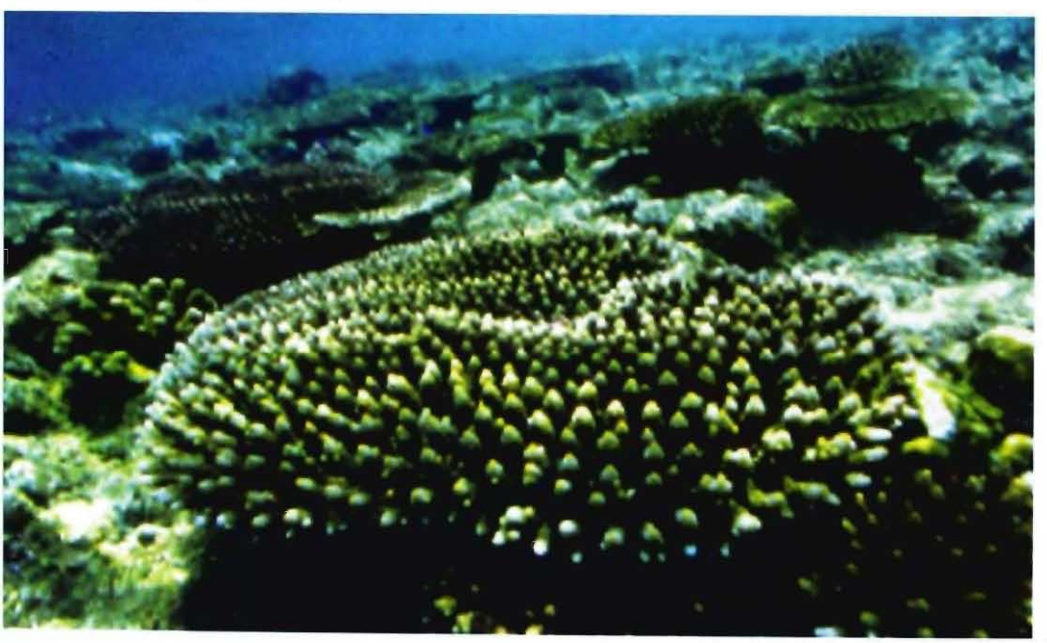
Distribution : It is recorded from the Andaman and Nicobar Islands. Globally it is distributed throughout the Indo-Pacific. *A.samoensis* occurs in a broader depth range than other species in the humilis group.

Remarks : This species occurs in most of the environments.Colonies located on the reef front commonly form side attachments while those growing in more protected environments have a bushy shape. This species occurs in a broader depth range than all other species in the *Acropora*



humilis group. On reef fronts colonies of *A. samoensis* form side-attached brachets that are more corymbose than caespitose.

26. *Acropora digitifera* (Dana, 1846)



1846. *Madrepora digitifera* Dana, *U.S. Exploring. Exped.* 1838-1842. 7, 1-740, pl. 1-56.

Characters : Colonies are corymbose or digitate with a central or side attachment. Radial corallites are tubular and crowded on branches. Radial corallites have thickened walls and little or no inner wall so that the lower wall looks like a lip. Radial corallites are dimidiate, evenly arranged close together, with thickened walls. Fine costae are sometimes developed. Living colonies are pale brown, cream or yellow with pale blue or cream branch tips.

Distribution : In India it is recorded from the Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Globally, it is distributed throughout Indo Pacific, Madagascar, Samoa and the Great Barrier Reef.

Remarks : This species resembles *A. humilis* however the branches are thinner. This species is often found growing with *A. pulchra* and *A. aspera* on rubble flats close to the shoreline.

27. ***Acropora multiacuta*** Nemenzo, 1967

1967. *Acropora multiacuta* Nemenzo, *Systematic studies on Philippine shallow-water Scleractinians; VI. Suborder Astrocoeniida* (*Montipora* and *Acropora*). *Nat. Appl. Sci. Bull. Univ. Philippines* **20** (1), 1-141 (text), (2), 11-223 (plates).

Characters : This species occurs as small colonies with irregular caespito-corymbose, tapering, extremely elongate branches. Axial corallites are tubular and prominent. Radial corallites are very few, nariform, tubo-nariform or partly appressed tubular, with circular or oval openings. Septa are absent or consist of a few spines. Living corals usually cream, sometimes pale blue or pink.

Distribution : In India it is recorded only from the Andaman and Nicobar Islands. Worlwide it is reported from Indonesia, Philippines, Papua New Guinea, Solomon Islands and the Great Barrier Reef.

Remarks : This species is extremely rare. Colonies are small, which may appear digitate because of the large size of the primary branches relative to the secondary branches. Colonies always group together. Sometimes located on wave-washed lagoon margins.

28. ***Acropora nasuta*** (Dana, 1846)

1846. *Madrepora nasuta* Dana, U.S. Exploring Expedition 1838-1842, **7** : 1-740, pl. 1-61.

1879. *Acropora canaliculata* Klunzinger, Die Korallenthiere des Rothen Meeres. Gautmann, Berlin. **2**, 1-88, pl. 1-10; 3, 1- 100, PL. 1-10.

1929. *Acropora nasuta* (Dana); Hoffmeister, Some reef corals from Tahiti. *J. Wash. Acad. Sci.* **19** (16), 357-65, pl.1-2.

Characters : Colonies are irregularly corymbose or forming small tables with tapering branches upto 12 mm wide. Radial corallites evenly sized are usually in neat rows and are nariform with rounded to slightly dimidiate openings. Cream or pale brown with blue branch tips, cream with brown corallites or greenish-brown with purple or blue corallites in colour.

Distribu tion : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely recorded from the tropical Indo-Pacific, west to the Red Sea and east to Tahiti.

Remarks : It is similar to *Acropora valida*. It is a common species occurring in most reef habitats. Because it can occur in a variety of colours, and because it is one of several species forming corymbose colonies with medium sized branches, it can be difficult to separate from other species in the field.

29. ***Acropora valida*** (Dana, 1846)

1846. *Madrepora valida* Dana, *U.S. Exploring Expedition* 1838-1842, **7** : 1-740, pl. 1-61.

Characters : Variable growth form encrusting over dense shrub to clearcut tables, depending on water

movement, mostly corymbose to caespito–corymbose or caespitose. Radial corallites usually a mixture of sizes, usually strongly appressed tubular or tubo-nariform with rounded to slightly elongate openings. Apices tapering to a large conical axial corallite. Cream brown or yellow sometimes brown with purple branch tips and cream corallites, a colour shared by *A. secale* and other species.

Distribution : In India it is recorded from Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed in the tropical and subtropical Indo-Pacific, west to the Red Sea and east to Hawaii.

Remarks : Occurs in a wide range of environments. It occurs as small rounded corymbose colonies or thick tables. Mostly found on the outer reef flat and subtidally on the reef edge and tops of submerged reefs.

30. *Acropora secale* (Studer, 1878)

1878. *Madrepora secale* Studer, Zweite Abtheilung der Anthosoa polyactinia, welche wahrend der Reise S.M.S. Corvette Gazelle un die Erde gesammelt wurde. Monatshr. *K. Akad. Wissensch.* Berlin 525-50, 5 pls.

Characters : Colonies are mostly corymbose with a side to central attachment. Branches are tapering, upto 25 mm in diameter. Corallites are of mixed sizes, sometimes alternating in vertical rows, and are large and conspicuous. Radial corallites are a mixture of long tubular with round to nariform openings and shorter nariform, the two types often arranged in separate rows along the branches. Colonies are colourful, usually mixtures of cream, blue, purple, brown and yellow in colour.

Distribution : In India it is recorded from Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed in the tropical Indo-Pacific, west to Mauritius and east to the Marshall Islands and the Taumotu Archipelago.

Remarks : *Acropora secale* can be confused with *Acropora gemmifera*. Mostly found on the outer reef flat, reef edge, slopes and walls.

31. *Acropora lutkeni* Crossland, 1952

1952. *Acropora lutkeni* Crossland, *Sci. Rep. Great Barrier Reef Exped.* 1928-29. *Br. Mus. (Nat. Hist.)*, **6** (3), 85-257, pl. 1-56.

Characters : Colonies are corymbose plates with thick tapering branches. Branches have incipient axial corallites and branchlets developing towards their base. Axial corallites are rounded and not much larger than radial corallites. Radial corallites are irregular and have a wide range of shapes and sizes but are characteristically thick walled with rounded margins, mostly tubular with rounded or slightly nariform openings.

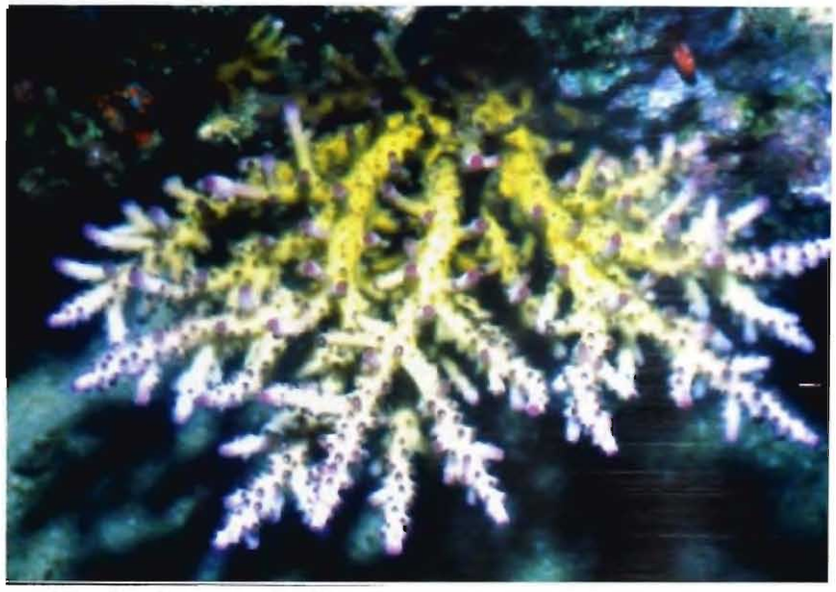
Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed throughout Indo-Pacific upto Coral Sea.

Remarks : This species is similar to *A. polystoma*, which has similar growth-forms and irregular corallites, but corallites are sharp edged, not rounded. Mostly occur in subtidal reef edge or upper slopes to about 5 m depth and submerged reefs.

32. *Acropora divaricata* (Dana, 1846)

1846. *Madrepora divaricata* Dana, *U. S. Exped.* 1838-1842. **7**, 1-740, pl. 1-61.

Characters : Colonies have an exceptionally wide range of growth-forms especially a distinctive divergent branching pattern within a bracket or rounded arborescent table shape. Branches may be flattened or tapered with open caespito-coymbose. Axial corallites are often devoid of radial corallites on their upper surface. Radial corallites are similar and are usually aligned along branches with nariform, large and open calices. Distal radial corallites are tubo-narifom and towards the base of the branches they may be appresssed tubular.



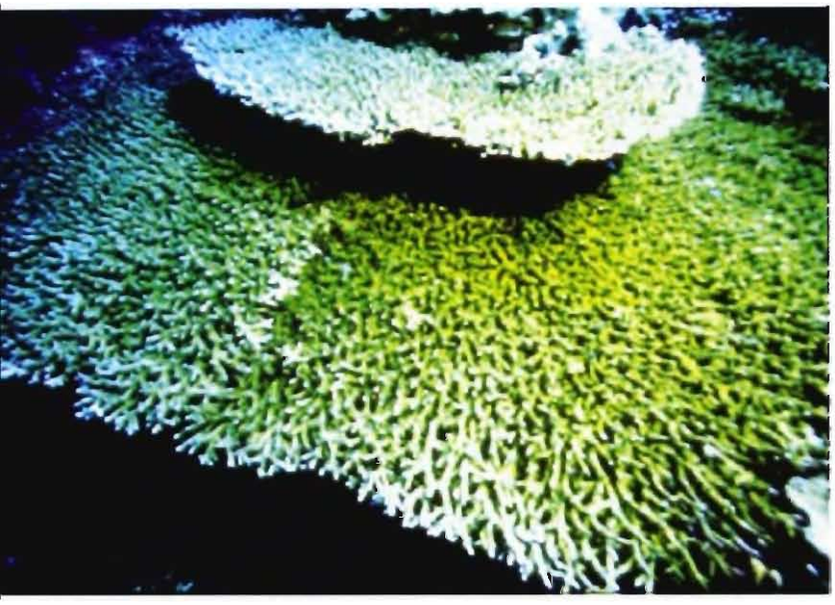
Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide it is reported throughout Indo-Pacific up to Coral Sea.

Remarks : This species is similar to *A. solitaryensis*, which has more highly fused basal branches. Mostly found on the reef slopes and submerged reefs.

33. *Acropora solitaryensis* Veron & Wallace, 1984

1984. *Acropora solitaryensis* Veron and Wallace, Scleractinia of Eastern Australia. Part V. Family Acroporidae. Australian institute of Marine Science *Monograph series* **6** : 485 pp.

Characters : Colonies consist of flat tables, highly fused, basal branches with irregular upright branchlets. Colonies may be over 2 meters across



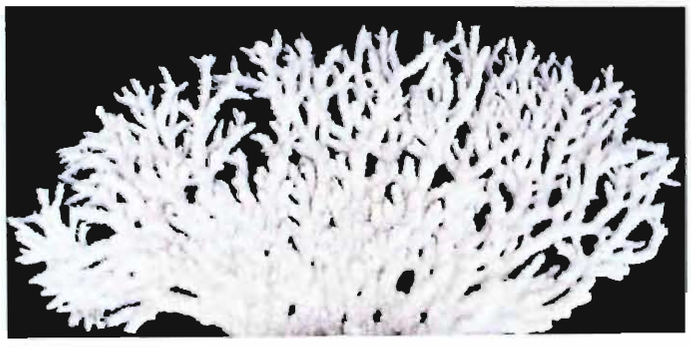
and can sometimes form a single solid plate. Axial corallites are tubular and distinct. Radial corallites are immersed on older parts of colonies, becoming tubular with nariform openings on peripheral parts.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed throughout Indo-Pacific to Coral Sea.

Remarks : This species may be confused with *A. divaricata* due to the formation of solid plates with anastomosing branches. It is a common species in Indian Ocean Islands. Mostly occurs on reef slopes and walls and submerged reefs.

34. *Acropora clathrata* (Brook, 1891)

1891. *Madrepora clathrata* Brook, Descriptions of new species of Madrepora in the collections of the British Museum *Ann. Mag. Nat. Hist.* (6) **8**, 458-71.



Characters : Colonies are table or platelike with horizontaly radiating, anastomosing branches which may form an almost solid plate. There is

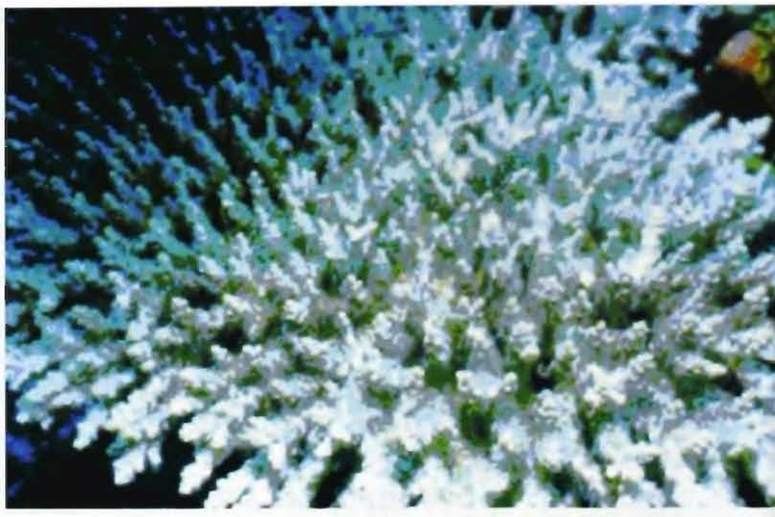
usually no development of vertical branches. Usually brown or green, often with pale margins in colour. Radial corallites evenly sized or mixed sizes, closely arranged on branches, nariform or appressed tubo-nariform, sometimes with rostrate developments in the form of single or double extension to the outer corallite wall.

Distribution : In India it is recorded in Andamans and Nicobar Islands. Worldwide it is distributed in the tropical Indo-Pacific, La Raunion, Taumotu Archipelago and the Great Barrier Reef.

Remarks : This species does not resemble any other species. Only *A. glauca* can be confused with *A. clathrata*. Mostly occur on reef tops, slopes and walls ro about 15 m depth.

35. *Acropora glauca* (Brook, 1893)

1893. *Madrepora glauca* Brook, The genus *Madrepora. Cat. Madreporarian corals Br. Mus. (Nat. Hist.)* **1**, 1-212, pl. 1-35.



Characters : Colonies consist of flat table or platelike, highly fused, basal branches with irregular upright branchlets. The young colony sometimes has upward branchlets. Axial corallites are indistinct from radial corallites. Radial corallites are evenly distributed, equal shapes and sizes, appressed rounded tubular with large round openings.

Distribution : In India it is reported from Andaman and Nicobar Islands. Elsewhere, it is also recorded from South East Asia and Great Barrier Reefs, Australia.

Remarks : Common in subtropical locations. Mostly occur on reef tops and upper slopes.

36. ***Acropora muricata*** (Linnaeus, 1758)

1758. *Millepora muricata* Linnaeus, *Systema naturae* (ed. 10) **1** : 1-824.

1846. *Madrepora formosa* Dana, U.S. Exploring. Exped. 1838-1842. **7**, 1-740, pl. 1-56.

Characters : Colonies are arborescent, usually

forming thickets. Radial corallites may be similar or varied in size, and uniformly or erratically distributed. Usually cream, brown or blue, usually with pale branch ends in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout Indo-Pacific west to Madagascar and east to the Marshall and Phoenix islands.

Remarks : Certain amount of confusion still exists in using the species name *A. muricata* resurrected by Carden (1999). Veron (2000) used the more familier name *A. formosa* to describe the present species. Mostly found on subtidal reef flats.

37. ***Acropora grandis*** (Brook, 1892)

1892. *Madrepora grandis* Brook, Preliminary descriptions of new species of Madrepora in the collections of the British Museum. Part II. *Ann. Mag. Nat. Hist.* (6) **10**, 451-65.

Characters : Colonies are arborescent, usually staghorn-like. Radial corallites are of mixed sizes and shapes. Those near branch tips are long and

tubular and outwardly projecting. Usually dark reddish-brown with very pale branch ends. Other colours include blue, purple and green, usually with pale at branch ends.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide it is distributed throughout Indo-Pacific, Philippines, Samoa and Great Barrier Reef.

Remarks : *A. grandis* is usually distinguished from *A. nobilis* by its radial corallites and also by its colour underwater. It is mostly found on the enclosed lagoons or sheltered slopes with sandy substrates.

38. ***Acropora valenciennesi***
(Milne Edwards & Haime, 1860)

1860. *Madrepora valenciennesi* Edwards, M & Haime, Histoire naturelle des Coralliaires. Paris. 1, 2 & 3, 1-326, 1-632, 1- 560.

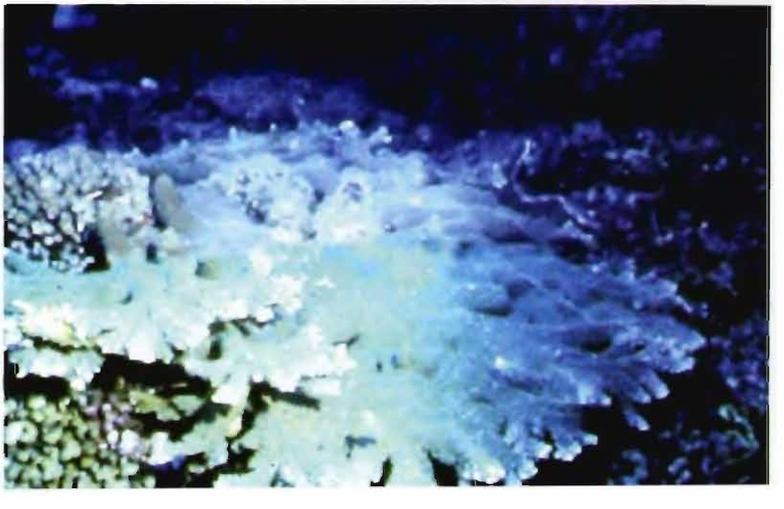
Characters : Colonies develop into open arboresscent corymbose tables composed of horizontal widely spaced branches and upturned branch ends. Mixture of brown, blue and green with pale branch ends in colour. Radial corallites evenly sized and evenly distributed, tubular withoval to nariform or dimidiate openings.

Distribution : In India it is recorded only from Rameswaram, Gulf of Mannar. Worlwide it is reported from Sri Lanka, Philippines, the Great Barrier Reef, Palau and Fiji.

Remarks : It can be easily identified in the field by the large open arborescent table and slightly curved branch ends. Mostly found on the reef slopes and submerged reefs.

39. ***Acropora abrotanoides*** (Lamarck, 1816)

1816. *Madrepora abrotanoides* Lamarck, Histoire naturelle des animaux sans vertebras. Paris. 2, 1-568.



Characters : Colonies are arborescent table or subarborescent shape, consist of sprawling prostrate branches with upwardly projecting pointed ends at the periphery. Radial corallites are evenly distributed, dimorphic : long tubular corallites with dimidiate openings are interspersed with sub-immersed forms; dimorphism most obvious towards edge of colony. Living colonies are deep pinkish-brown or greenish-grey in colour.

Distribution : In India it is recorded only from Lakshadweep. Worldwide it is distributed in the tropical Indo-Pacific, Chagos, Tahiti and the Great Barrier Reef.

Remarks : This species co-occurs with *Acropora robusta*. The two species are similar in all characters excepting the proliferation of small branches at the branch tips. Mostly occur on shallow reef tops and edges.

40. ***Acropora robusta*** (Dana, 1846)

1846. *Madrepora robusta* Dana, U.S. Exploring Exped. 1838-1842. 7, 1-740, pl. 1-56.

Characters : Colonies are subarborescent tables and irregular in shape with thick conical branches at the centre and with thinner prostrate branches with upturned ends at the periphery. Radial corallites are of mixed sizes and shapes but are generally rasp-like or tubular-dimidiate. They are evenly distributed, dimorphic, long tubular corallites with dimidiate openings are interpersed with subimmersed forms; dimorphism not obvious on digitate central branches, but distinctive towards branch tips. Colours of live colonies include bright green with deep-pink branch tips or pink brown, yellow-brown or cream in colour.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Worldwide it is distributed from the Red Sea to the tropical Indo-Pacific, Chagos, Tahiti and the Great Barrier Reef.

Remarks : There is much variation in this species. This species is similar to *A. abrotanoides*. Mosly occur on intertidal or subtidal shallow reef tops and edges.

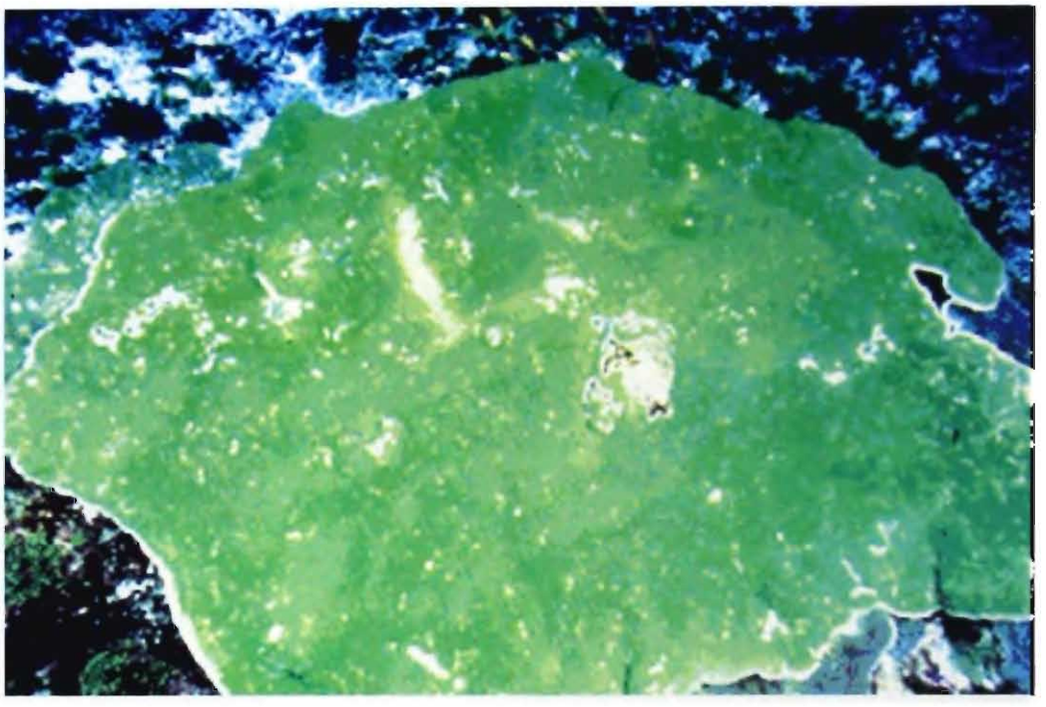
41. ***Acropora palmerae*** Wells, 1954

1954. *Acropora palmerae* Wells, *Prof. Pap. U.S. Geol. Surv.* 260-I, 385-486, pl. 94-187.

Characters : Colonies are encrusting with or without short irregularly shaped branches. Radial corallites are mostly rasp-like except that they face in different directions. They are sometimes dimorphic in some parts of the colony but mostly sub-immersed with nariform or just discernible dimidiate openings. Colonies are greenish or pinkish-brown in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from Marshall Islands, Great Barrier Reef and Coral Sea.

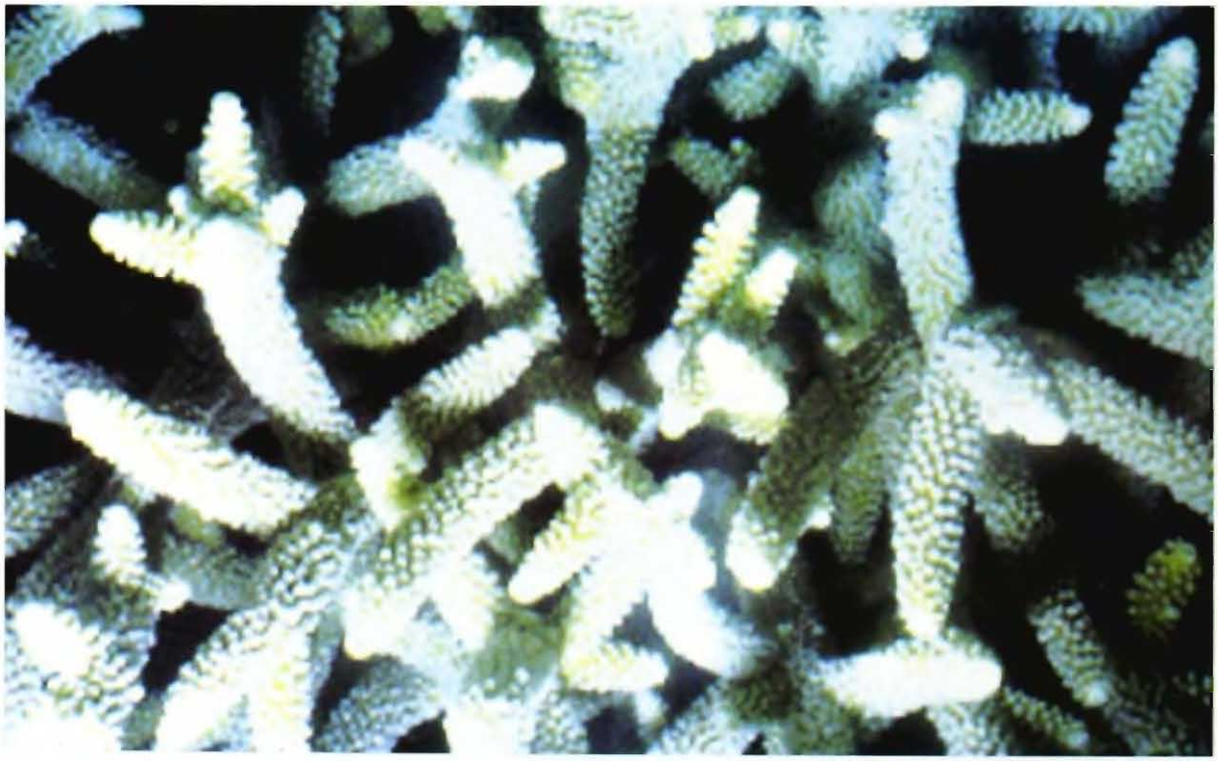
Remarks : Corallites of *A. robusta*, *A. danai*, *A. nobilis* and *A. palmerae* are hardly distinguishable, although these species are usually readily recognised by their very different growth forms. Mostly found on the shallow reef tips and edges, especially in regions of strong current.



42. ***Acropora intermedia*** (Dana, 1846)

1846. *Madrepora intermedia Dana*, U.S. Exploring. Exped. 1838-1842. 7, 1-740, pl. 1-56.

Characters : Colonies are arborescent, usually staghorn - like. Radial corallites are of mixed variety of shapes and sizes. They are evenly distributed, dimorphic : long tubular corallites with dimidiate or oblique openings interspersed with sub-immersed forms. Usually ranging from immersed to tubular, exsert with circular, nariform or dimidiate openings and thickened outer walls. Largest corallites usually dimidiate and evenly distributed. Axial corallites have better developed septa than those of radial corallites. All corallites are strongly costate. Live coral colour brown with white tips.



Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout Indo-Pacific to Coral Sea.

Remarks : Common in deep sandy lagoon and on upper reef slope. *A. muricata* and *A. grandis* may have similar growth forms but radial corallites are entirely different. This species has been stated as *A. nobilis* Veron (2000).

43. *Acropora tenuis* (Dana, 1846)

1846. *Madrepora tenuis* Dana, U.S. Exploring. Exped. 1838-1842. 7, 1-740, pl. 1-56.

Characters : Colonies are corymbose to casespito-corymbose plates with neat, evenly spaced branches. Radial corallites have wide lower lips giving them a neat rosette-like appearance when viewed from above. They are evenly sized, mostly touching, flaring broadly on radials towards the base of branches and extending upwards on distal radials. Colonies are cream or blue in colour. Colonies are distinctively bright coloured radial corallites lips.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Widely distributed throughout the tropical Indo-Pacific, Mauritius, Marshall Islands and the Great Barrier Reef.

Remarks : The compact, mostly pale grey colonies make this as one of the easiest *Acropora* species to identify in the field. Mostly found in shallow subtidal habitats, including outer reef flats and upper slopes.

44. *Acropora aspera* (Dana, 1846)

1846. *Madrepora aspera* Dana, U.S. Exploring. Exped. 1838-1842. 7, 1-740, pl. 1-56.

Characters : It is a polymorphic species. Colonies are corymbose or sometimes arborescent to apparently cespitose or corymbose with short thick branches. Crowded Radial corallites in two sizes. Larger more numeros radials with upper wall undeveloped and lower wall short and thickened or extended horizontally as rounded lip, smaller radials wub immersed or immersed. Mostly the radial corallites have prominent lower lips giving a scale like appearance. Commonly pale blue-grey, green or cream.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Recorded worldwide from the Cocos-Keeling Islands, the west Australian coast and the central Indo-Pacific Islands, east to Fiji.

Remarks : Abundant on reef flats and shallow slopes and deep water. *A. millepora* is readily distinguished from *A. aspera* by having all radial corallites of the same size. *A. pulchra* is similar, but corallites are much smaller. Mostly found on the shallow protected habitats, such as inter-reefal lagoons.

45. *Acropora millepora* (Ehrenberg, 1834)

1834. *Heteropora millepora* Ehrenberg, Beitrage zur Physiologischen Kenntniss der Rothen Meeres. *Abh. Akad. Wiss. D.D.R.* 1832, 250-380.

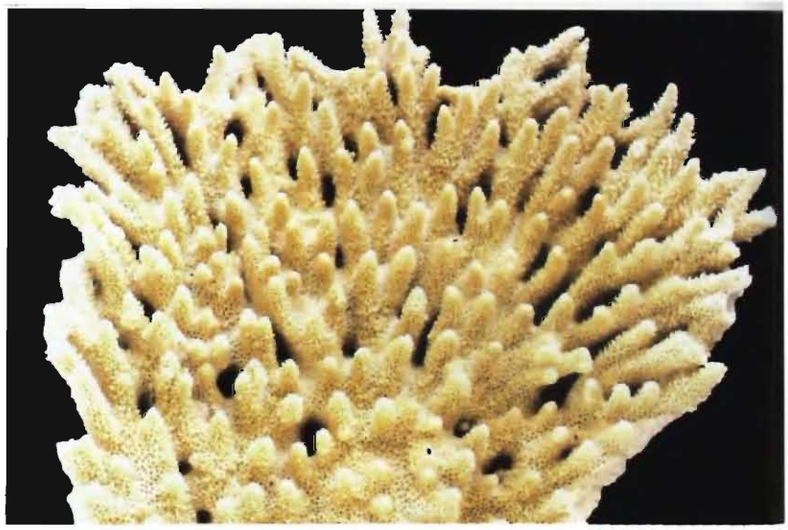
Characters : Colonies are corymbose to tabular, with short branches. Radial corallites are all the same size and have prominent lower lips giving a scale-like appearance. Commonly green with orange tips; also bright salmon-pink, bright or pale green, blue or pink.

Distribution : In India it is recorded from Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed in the tropical Indo-Pacific east to the Marshall Islands and Tonge and west to the west Australian coast, Great Barrier Reef, Thailand and Sri Lanka.

Remarks : Common in reef flats. *Acropora aspera* has similar radial corallites but they are of two intermixed sizes.

46. *Acropora spicifera* (Dana 1846)

1846. *Madrepora spicifera* Dana, *U. S. Exped.* 1838-1842. 7, 1-740, pl. 1-61.



Characters : Colonies are wide, flat, tiered plates or low corymbose from a central or sub-central base and tables, which commonly have lobed margins. Branches are outward projecting at the colony margins, but curved, tapered, and upward projecting elsewhere. Axial corallites are distinctive, radial corallites are labellate and have a rosette arrangement.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is also recorded from Singapore, Indonesia, Japan and Western Australia.

Remarks : This species is similar to *A. millepora;* from which is distinguished by its narrower and shorter branchlets and by it is less developed radial corallite lips. Mosly found on reef flats.

47. *Acropora papillare* Latypov, 1992

1992. *Acropora papillare* Latypov, Scleractinian corals of Vietnam. Part II. Acroporidae. *M. Science*. 133 pp.

1994. *Acropora Indiana* Wallace, *Invertebrate Taxonomy* 8 : 961- 988, p. 963 fig. 4.

Characters : Colonies are subarborescent clumps of irregular branches on thick encrusting bases. Axial corallites are small and thick walled. Radial corallites are of one size and have prominent lower

lips giving a scale-like appearance. Occasionally they are small immersed.

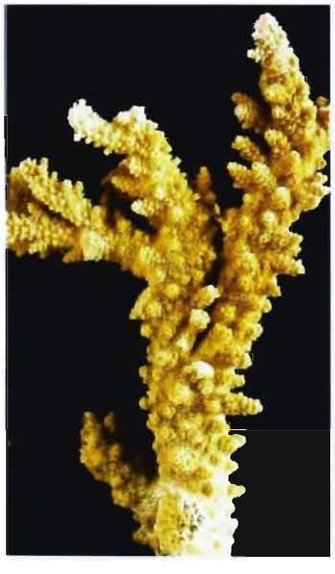
Distribution : In India it is recorded only from Andaman and Nicobar Islands. Also from West and Eastern Australia.

Remarks : This species is similar to *A. aspera*, which has similar corallites but lacks an encrusting base and *A. abrotanoides*, which has a similar growth-form but has rasp like radial corallites. Its general colony shape as well as its green colouration make it superficially similar to *A. robusta*, but the differences in radial corallite type are discernible even in the field. Mostly found on the intertidal reef flats.

48. *Acropora florida* (Dana, 1846)

1846. *Madrepora florida* Dana, U. S. Exped. 1838-1842. **7**, 1-740, pl. 1-61.

1978. *Acropora florida* Wallace, The coral genus *Acropora* (Scleractinia : Astrocoeniina : Acroporidae) in the central and southern Great Barrier Reef Province. *Mem. Qld. Mus.* **8** (2), 273-319, pl. 43-103.



Characters : Colonies are subarborescent; consist of thick upright or prostrate branches covered with short stubby branchlets. Corallites are even in size and distribution, labellate with thickened rounded lower lip, occasional small-immersed corallites. Living colonies are usually pinkish-brown, sometimes yellow-brown, occasionally green, bright green in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide it is distributed in the tropical Indo-Pacific, Maldive Islands, Marshall Islands and the Great Barrier Reef.

Remarks : This species is similar to *A. grandis*. *A. florida* occurs in most habitats and throughout a broad range from intertidal to about 20 m; it is also widespread throughout the Indo-Pacific.

49. *Acropora hyacinthus* (Dana, 1846)

1846. *Madrepora hyacinthus* Dana, U.S. Exploring. Exped. 1838-1842. **7**, 1-740, pl. 1-56.

Characters : Colonies are wide, flat tables to plate-like, which are thin and finely structured. Axial corallites are not exert. Radial corallites evenly sized, labellate, the lower wall developed as a rounded or square lip which extends outward from the branch; from above the radial corallites can be seen to be arranged in a neat rosette around the axial corallite. Colonies are uniform cream, brown or green, with or without blue or pink-growing margins in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific west to the Mascarene Archipelago and east to Tahiti.

Remarks : Colonies occur as large tables or plates with a flat top on which the short, regular, rosette-like branchlets can be seen. One of the most

abundant corals found on the upper reef slopes and outer reef flats of Andaman Islands. Often the dominant species on regenerating reefs. *Acropora cytherea* resembles this species.

50. ***Acropora cytherea*** (Dana, 1846)

1846. *Madrepora cytherea* Dana, U.S. Exploring. Exped. 1838-1842. 7, 1-740, pl. 1-56.

Characters : Colonies are wide flat tables which are thin and finely structured. Fine upward projecting branchlets have exsert axial corallites. Radial corallites evenly sized, with elongate upwardly pointing lips. Polyps are frequently extended during the day. Living colonies uniform pale cream, brown or blue in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide it is distributed in the tropical Indo-Pacific, west to the Mascarene Archipelago, Tahiti, Hawaii and the Great Barrier Reef.

Remarks : *A. cytherea* is similar to *Acropora hyacinthus* except that branchlets do not have exert axial corallites and have radial corallites arranged in a rosette. Mostly found on the subtidal reef slopes and submerged reefs.

51. ***Acropora microclados*** (Ehrenberg, 1834)

1834. *Heteropora microclados* Ehrenberg, Beitrage zur physiologischen Kenntniss der Corallenthiere im Allgemeinen und besanders des Rothen meeres. *Abh. Akad. Wiss. D.D.R.* 1832, 250-380.

Characters : Colonies are corymbose plates with branches up to 10 mm thick which are tapering, evenly spaced and curving upward to a uniform height. Always a distinctive pale pinky brown. Radial corallites are evenly sized, mostly not touching, narifom or tubular with nariform openings. Pale-grey tentacles are often extended during the day.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from Indonesia to Coral Sea.

Remarks : This species is similar to *A. cytherea*. Mostly found on the subtidal reef edges.

52. ***Acropora microphthalma*** (Verrill, 1869)

1869. *Madrepora microphthalma* verrill, Synopsis of the polyps and corals of the North pacific Exploring Expedition, 1853-1856, IV. *Communications of the Essex Institute* **6** : 51-178.

1978. *Acropora microphthalma* Wallace, *The oral genus Acropora (Scleractinia : Astrocoeniina : croporidae) in the central and southern Great Barrier Reef Province. Mem. Qld. Mus.* **8** (2), 273-319, pl. 43-103.

Characters : Colonies are arborescent to slightly hispidose with slender, straight, tapering branches. Branching may be open with branchlets widely spaced or compact with sub-branches forming at acute angles. Corallites are small and numerous. First cycle septa are well developed, second cycle septa are rudimentary. Radial corallites are evenly sized, tubular with round to oblique openings. Living colonies are uniform pale grey or sometimes pale brown or cream.

Distribution : In India it is recorded from Gulf of Manar and Palk Bay. Widely distributed throughout the tropical and subtropical Indo-Pacific from Madagascar in the west, east to the Marshall Islands and also north to the Ryukyu Islands.

Remarks : This species is close to *A. muricata*. Specimens of this species are sometimes difficult

to separate from fine-branched *A. muricata*. The usually whitish colouration of *A. microphthalma* is distinctive in the field.

53. ***Acropora loripes*** (Brook, 1892)

1892. *Madrepora loripes* Brook, Preliminary descriptions of new species of *Madrepora* in the collections of the British museum. Part II. *Ann. Mag. Nat. Hist.* (6) **10**, 451-65.

1978. *Acropora squarrosa* Wallace, The coral genus *Acropora* (Scleractinia : Astrocoeniina : Acroporidae) in the central and southern Great Barrier Reef Province. *Mem. Qld. Mus.* **8** (2), 273-319, pl. 43-103.

Characters : Colonies have many shapes and may be bottlebrush, caespitose or plate-like. Corallites may be tubular or have thickened walls becoming tubular. Tubular axial corallites may have no radial corallites on one side. Colonies are usually pale blue or brown in colour. Axial corallites are usually whitish in colour.

Distribution : In India it is recorded in Andaman and Nicobar Islands. Worldwide it is distributed from Indo-Pacific to Great Barrier Reef and Coral Sea.

Remarks : This species is highly variable and it is readily confused with several others, especially *A. granulosa* and *A. longicyathus*. The former is distinguished by its smaller, tapering corallites, which are not clearly divisible into axial radial. The latter species has thinner branches and shorter branchlets, giving an arborescent appearance. Hispidose or corymbose to cespito-corymbose colonies with large corallites and the naked upper branches are some of the characteristic features of this species. Mostly found on the reef flats, submerged reefs and upper slopes.

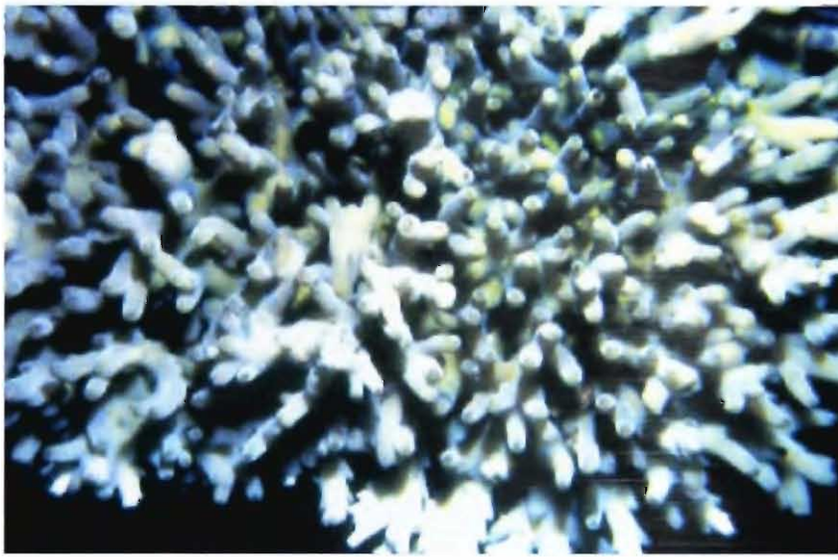
54. *Acropora granulosa* (Milne Edwards & Haime, 1860)

1860. *Madrepora granulosa* Edwards & Haime, *Histoire naturelle des Coralliaires*. Paris. **1**, *2&3*, 1-326, 1-632, 1-560.

1978. *Acropora granulosa* Wallace, The coral genus *Acropora* (Scleractinia : Astrocoeniina : Acroporidae) in the central and southern Great Barrier Reef Province. *Mem. Qld. Mus.* **8** (2), 273-319, pl. 43-103.

Characters : Colonies are semicircular horizontal plates less than 1 m across, composed of regularly spaced horizontal branches with short upright branchlets with tapering tubular corallites. Two types of radial corallites found on the branchlets, incipient axial corallites and tubular appressed tubular with round to slightly oval openings. Corallites of the main branches are mostly sub-immersed. Peritheca with small densely situated making the surface velvet like. Live corals are cream, grey or pale blue, but may be other colours.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Worldwide it is distributed in the tropical Indo-Pacific, west to La Reunion and east to Tahiti.



Remarks : Mostly found in shallow water but common on lower reef slopes. *A. loripes* and *A. caroliniana* look similar to this species. Side-attached plates with groups of short vertical branches with rounded axial corallites and few radial corallites are the characteristic features of this species.

55. *Acropora caroliniana* Nemenzo, 1976

1976. *Acropora caroliniana* Nemenzo, Some new Philippine Scleractinian reef corals. *Natur. Appl. Sci. Bull.* *28*, 229-76, pl. 1-5.

Characters : Colonies are corymbose to caespito-corymbose, thick horizontal plates composed of prostrate branches and short branchlets. Branchlets have large, usually tapering, axial and incipient axial corallites curving upwards or pointing in different directions. Radial corallites are mostly

scattered, not touching, appressed tubular with round to nariform openings.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Also reported from Indonesia, Philippines, Papua New Guinea and the Great Barrier Reef, Australia.

Remarks : This species is similar to *A. granulosa*, which forms thinner colonies with smaller corallites. Thick plates or corymbose tables with a whorl of bare incipient branches are characterstic features of this species. Mostly found on subtidal slopes and ledges.

56. ***Acropora echinata*** (Dana, 1846)

1846. *Madrepora echinata* Dana, U.S. Exploring Exped. 1838-1842. 7, 1-740, pl. 1-61.

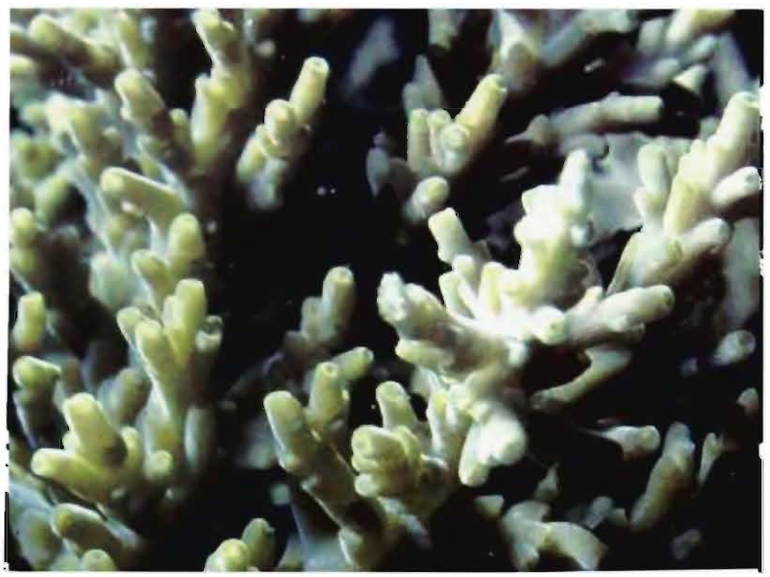
Characters : Colonies are hispidose, forming sprawling sometimes characteristic branches. Sometimes branchlets are fine and uniform. Elongate, tubular incipient axial corallites of variable lengths are found on branches, which are radiating perpendicularly from main branches. Radial corallites are evenly sized, scattered, not touching, appressed tubular with broad round, oval or nariform openings. Main branches also bear scattered immersed radial corallites. Septa are in two cycles. All tubular corallites have highly perforate walls, with costae and synapticulae forming an open lattice. Coenosteum perforate. Living colonies are cream with blue or purple branchlet tips. Occasionally they are blue.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar. Worldwide, it is recorded from Indo-Pacific west to the Maldive Islands and east to the Marshall Islands and Samoa.

Remarks : Resembles *A. subglabra*. This species occurs in the field as sprawling, fragile hispidose colonies usually not larger than 1.5 m in diameter. Mostly found on protected sandy slopes and lagoon floors.

57. *Acropora subglabra* (Brook, 1891)

1891. *Madrepora subglabra* Brook, Descriptions of new species of Madrepora in the collections of the British Museum *Ann. Mag. Nat. Hist.* (6) **8**, 458-71.



Characters : Colonies are hispidose, forming thickets of interwining branches, usually with the distal 10–20 cm only alive. Branches divide irregularly, usually at intervals of less than 5 cm, pale brown, usually with yellow branchlet tips. Radial corallites are arranged in rows down the branches, tubular with nariform openings curving away from the branchlet.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide, it is distributed in Western Pacific, Ryukyu Islands and the Great Barrier Reef.

Remarks : It is similar to *A. echinata* and *A. carduus*. This species usually occurs in protected sandy slopes and lagoon floors.

58. *Acropora carduus* (Dana, 1846)

1846. *Madrepora carduus Dana, U.S. Exploring Expedition* 1838-1842, **7** : 1-740, pl. 1-61.

1902. *Acropora prolixa* Verrill, *Notes on orals of the genus Acropora (Madrepora Lam.) with new descriptions and figures of types, and of several new species. Trans. Connecticut Acad. Arts Sci.* **11**, 207-66, 7 pl.

1927. *Acropora carduus* (Dana) Faustino, *Recent Madreporaria of the Philippine Islands. Bur. Sci., Manila, Monogr.* **22**, 1-310, pl. 1-100.

Characters : Colonies are hispidose, forming thickets with upright or prostrate main branches. Radial corallites are evenly sized, scattered on

branches, not touching, appressed tubular with round, oval or nariform openings. Branches are evenly spaced corallites are small and exsert. Uniform pale brown or cream, rarely blue.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Widely distributed in Western Pacific, Mauritius, Japan and the Great Barrier Reef.

Remarks : *A. subglabra* and *A. longicyathus* have smaller and larger corallites and branches respectively when compared with *A. carduus*. Hispidose colonies, sometimes forming thickets covering large areas of reef slope and protected sandy areas are the characteristic feature of this species.

59. ***Acropora longicyathus***
(Milne Edwards and Haime, 1860)

1860. *Madrepora longicyathus* Edwards & Haime, Histoire naturelle des Coralliaires. *Paris. 1, 2&3*, 1-326, 1-632, 1-560.

1978. *Acropora longicyathus* Wallace, The coral genus *Acropora* (Scleractinia : Astrocoeniina : Acroporidae) in the central and southern Great Barrier Reef Province. *Mem. Qld. Mus.* **8** (2), 273-319, pl. 43-103.

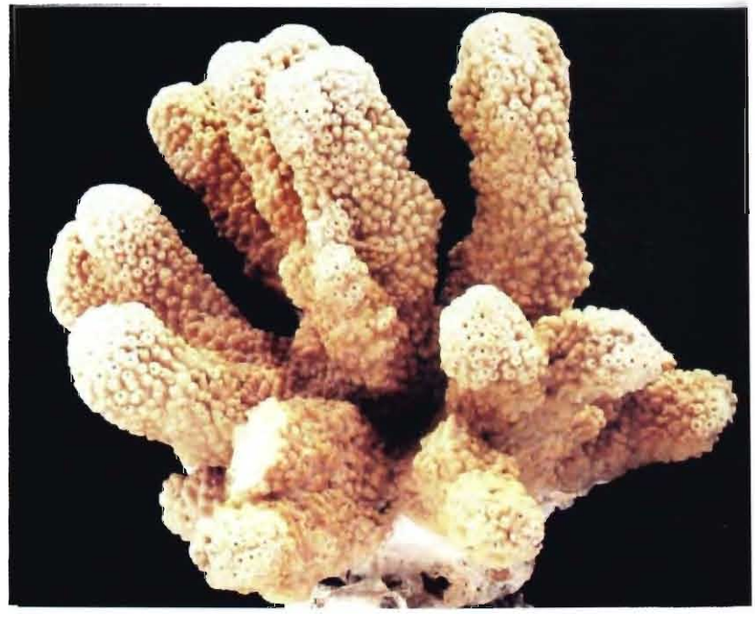
Characters : Colonies are sub-arborescent, hispidose, with upright main branches. Corallites are elongate tubes with round calices. Radial corallites are evenly sized, scattered on branches, mostly not touching, appressed or partly appressed tubular with round openings. Usually uniform pale to dark brown, occasionally blue in colour.

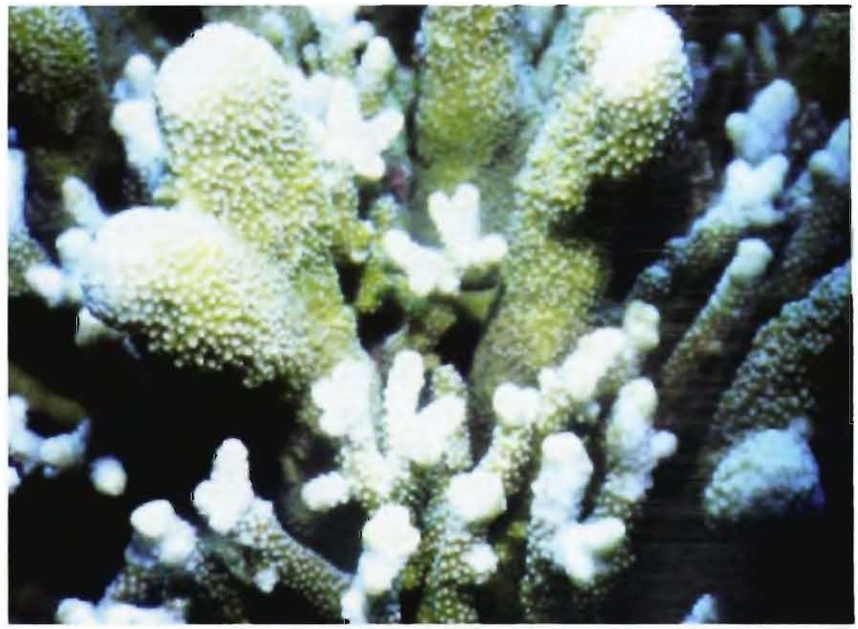
Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide, it is reported throughout Indo-Pacific to Coral Sea.

Remarks : This species is commonly encountered in mixed hispidose assemblages, occurring with *A. carduus* and *A. subglabra*. Mostly found on protected slopes, sandy slopes and lagoon floors.

60. ***Acropora (Isopora) palifera*** (Lamarck, 1816)

1816. *Astrea palifera* Lamarak, Histoire naturelle des animaux sans vertebres. Paris. **2**, 1-568.





Characters : Colonies are sturdy with wedge-shaped branches. Colonies may be encrusting in strong currents. Radial corallites are large, appressed tubular with 'horseshoe' shaped dimidiate openings and thick calicular walls. Two cycles of septa are usually complete and subequal. Septa are irregularly dentate. Coenosteum is densely covered with flattered spines with elaborate tips. Living corals are pale cream, green or brown in colour.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Globally, it is distributed throughout the tropical and subtropical Indo-Pacific, from the Madagascar and Diego Garcia in the west to the Marshall Islands and Samoa in the east.

Remarks : It is the common *Isopora* species. It is very broadly distributed and occurs in a variety of forms. This coral inhabits all reef environments including reef flat, edge, slope, wall and submerged reefs.

61. ***Acropora (Isopora) brueggemanni*** (Brook, 1893)

1893. *Madrepora brueggemanni*, The genus *Madrepora*. Catalogue of Madreporarian corals *Br. Mus. (Nat. Hist.* (6) **10**, 451-65.

Characters : Colonies are arborescent with cylindrical-shaped and tapering branches of varying length, with blunt ends and one or more immersed axial corallites. Radial corallites are evenly sized, mostly not touching, short conical or tubular appressed with round openings. Colonies can occur as isolated clumps or extensive thickets that sometimes dominate in reef edges. Green, white or pale brown in colour.

Distribution : In India it is recorded only from the Andaman and Nicobar Islands. Globally, it is distributed throughout the central Indo-Pacific to the Great Barrier Reef.

Remarks : Colonies occur as isolated clumps or extensive arborescent thickets with terete branching. Some branch tips have more than one axial corallite. This species reproduces by brooding its young and releasing fully developed planula larvae into the water. Mostly found on subtidal reef flats, reef edge and reef slope to about 15 m depth.

62. ***Acropora austera*** (Dana, 1846)

1846. *Madrepora austera* Dana, U.S. Exploring. Exped. 1838-1842. **7**, 1-740, pl. 1-56.

Characters : Colonies have wide range of growth forms, from open arborescent to caespitose. Corallites project outwards and have wide calices. Radial corallites are rounded tubular, with rounded to square calices. Many colours, commonly blue or cream. Axial corallites are often yellow.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Widely distributed throughout the tropical Indo-Pacific, Madagascar, Marshall Islands and the Great Barrier Reef.

Remarks : *A. austera* does not resemble closely with any other species but its wide range of growth forms sometimes makes it difficult to identify. Mostly found on all reef locations.

63. *Acropora pulchra* (Brook, 1891)

1891. *Madrepora pulchra* Brook, Descriptions of new species of *Madrepora* in the collections of the *British Museum. Ann. Mag. Nat. Hist.* (6) **8**, 458-71.

Characters : Colonies are arborescent with cylindrical branches but may be corymbose, with horizontally fused basal branches, which have upturned ends. They may form stands more than 5 meters across. Branches are smaller than those of the larger staghorn (*Acropora*) species. Radial corallites are of mixed sizes, with projecting lower lips.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it occurs thoughout Indo-Pacific, south East Asia, the Great Barrier Reef and Coral Sea.

Remarks : It superficially resembles *A. muricata*, but radial corallites are distinctive. *A. aspera* has similar radial corallites but these are much larger and more scale-like. Mostly found on reef flat and shallow habitats or inter-reefal lagoons.

64. *Acropora anthocercis* (Brook, 1893)

1893. *Madrepora anthocercis* Brook, The genus *Madrepora. Catalogue of Madreporarian corals Br. Mus. (Nat. Hist.)* **1**, 1- 212, pl. 1-35.

Characters : Colonies are thick corymbose to encrusting plates. Branchlets are short and thick and may be almost encrusting. There are usually several axial or incipient axial corallites are appressed, with thick flaring walls and are arranged in a rosette. Radial corallites evenly sized, labellate with thick outer wall and lip extended upwards.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is reported from south East Asia, the Great Barier Reef and Coral Sea.

Remarks : Colonies are mixture of colours grey being the most common Mostly found on exposed outer reef flats and patch reefs.

65. *Acropora polystoma* (Brook, 1891)

1891. *Madrepora polystoma* Brook, Descriptions of new species of *Madrepora* in the collections of the *British Museum. Ann. Mag. Nat. Hist.* (6) **8**, 458-71.

Characters : Colonies are tabulate or side-attached corymbose, with thick irregular branches. Long tubular radial corallites with dimidiate or oblique openings interspersed with sub-immersed forms. Colonies are cream or yellow in colour.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Widely distributed from westward to Mauritius and possibly the Red Sea and east to Samoa.

Remarks : This species appears to confined to reef-edge habitats with water current. Mostly found on shallow reef tops and edges.

66. *Acropora latistella* (Brook, 1892)

1892. *Madrepora latistella* Brook, Preliminary descriptions of new species of *Madrepora* in the collections of the British Museum. Part II. *Ann. Mag. Nat. Hist.* (6) **10**, 451-465.

Characters : Colonies form corymbose plates or clumps with side-attachment. Branchlets are thin and delicate, straight or uniformly curved. Axial corallites are usually distinctive. Radial corallites have rosette arrangement, are usually in rows and are appressed tubular with rounded or oval openings.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide, it is reported throughout Indo-Pacific, South East Asia, the Great Barrier Reef and Coral Sea.

Remarks : It occupies a wide range of habitats, from just below the low tide mark to about 20 m depth, and is encountered at most Andaman and Nicobar reefs.

67. ***Acropora hemprichii*** (Ehrenberg, 1834)

1834. *Madrepora hemprichii* Ehrenberg, Beitrage zur physiologischen Kenntniss der Corallenthiere im Allgemeinen und besanders des Rothen meeres. *Abh. Akad. Wiss. D.D.R.* 1832, 250-380.

Characters : Colonies are irregular arborescent or hispidose-arborescent, axial corallites conical, opening small rounded, about 1 mm in diameter. Primary septa well developed. Radial corallites are rounded tubular, uniform, rarely with smaller ones in between. Primary septa present, surface closely echinulate.

Distribution : In India it is recorded only in Lakshadweep. Worldwide, it is reported from the Red Sea, East coast of Africa, Maldive and Sri Lanka.

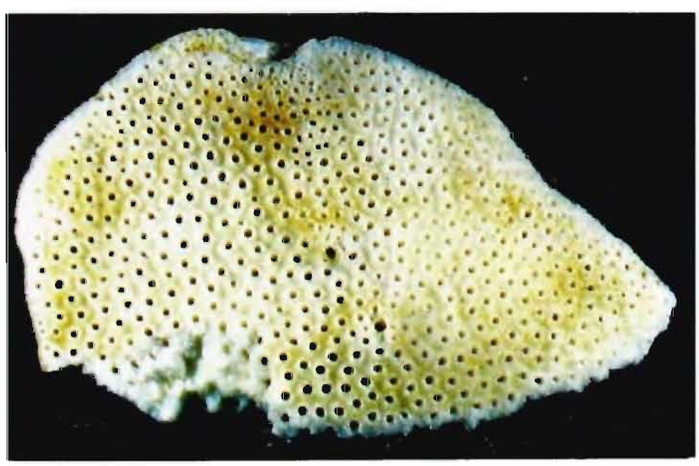
Remarks : In India it is rare and found mixed with other *Acropora* in Minicoy lagoon. Mostly found on submerged patch reef.

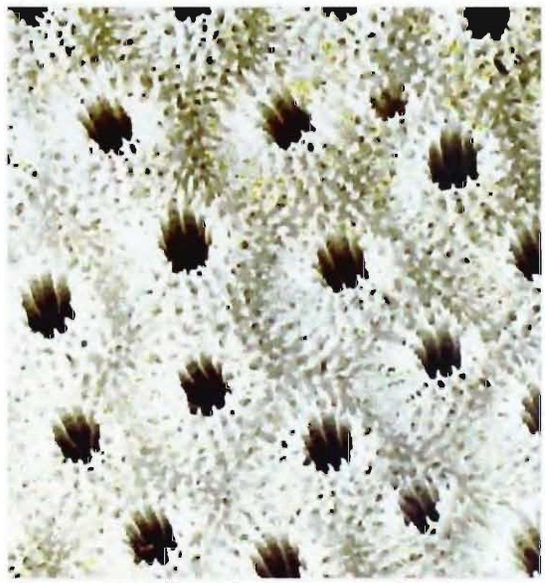
Genus ***Astreopora*** de Blainville, 1830

Worldwide, there are 12 species of *Astreopora* of which only three species are recorded from India.

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. Columelae are deeply set and compact. Corallite walls are slightly porous and the coenosteum and walls have few elaborations. Polyps are extended at night only.

68. ***Astreopora listeri*** Bernard, 1896





1896. *Astreopora listeri* Bernard, *Catalogue of the Madreporarian corals Br. Mus. (Nat. Hist.)* **2**, 1-166, pl. 1-33.

1974. *Astreopora listeri* Scheer & Pillai, *Report on Scleractinia from the Nicobar Islands. Zoologica (Stuttg.).* **42** (122), 1-75, pl. 1-33.

Characters : Colonies are massive, either hemispherical or flattened. Corallites are immersed evenly spaced, crowded, with rounded calices, surrounded by feathery spinules. Coenosteum is coarse. Colour is cream, grey or brown.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Globally, it is distributed in the tropical Indo-Pacific, the Great Barrier Reef and Coral Sea.

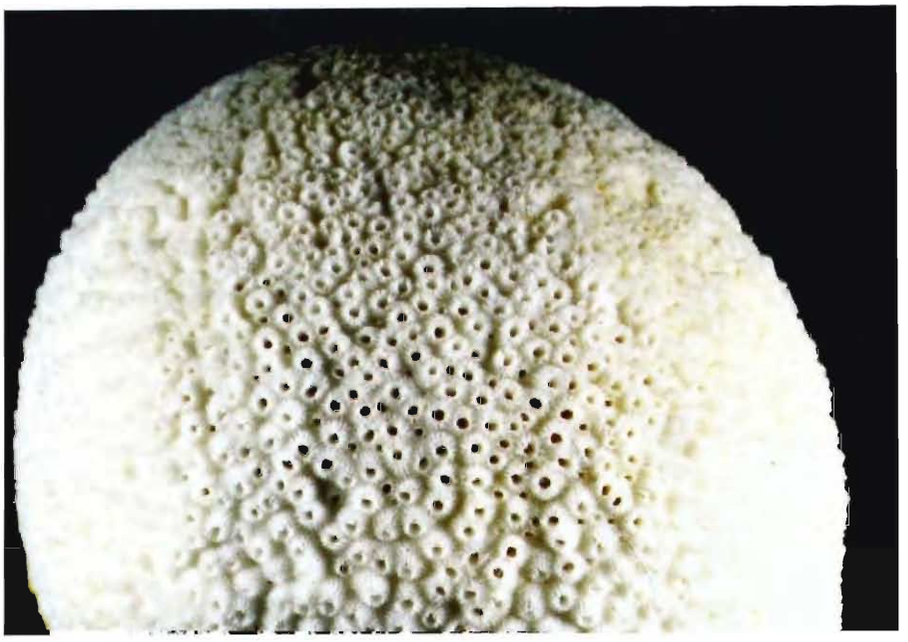
Remarks : Found in a wide range of environments but common especially in shallow turbid intertidal pools. Mostly resembles *Astreopora myriophthalma*.

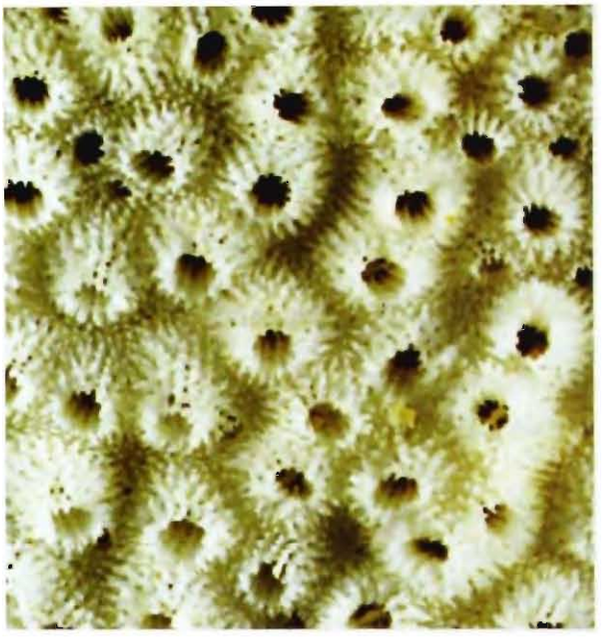
69. ***Astreopora myriophthalma*** (Lamarck, 1816)

1816. *Astrea myriophthalma* Lamarck, *Histoire naturelle des animaux sans vertebres*, Paris **2**, 1-568.

1860. *Astreopora myriophthalma* (Lamarck); Milne Edwards & Haime, *Histoire naturelle des Coralliaires*. Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

Characters : Colonies are massive, hemispherical with an even surface. Corallites are evenly spaced and slightly conical in shape. Calices usually round. The coenosteum is covered with short spinules with elobrated tips. Living colonies are cream, brown or yellow.





Distribution : In India it is recorded from Lakshadweep and Pamban, Gulf of Mannar. Globally, it is distributed in the tropical Indo-Pacific from the Red Sea to the south Pacific Islands.

Remarks : This species occurs in most reef habitats excluding very turbid water. Similar to *Astreopora listeri*.

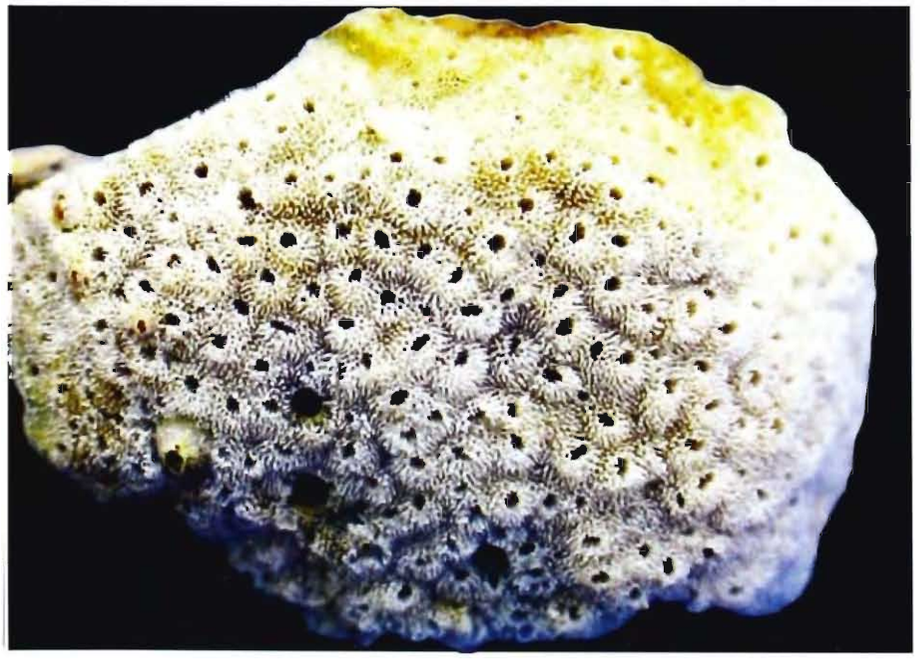
70. ***Astreopora cucullata*** Lamberts, 1980

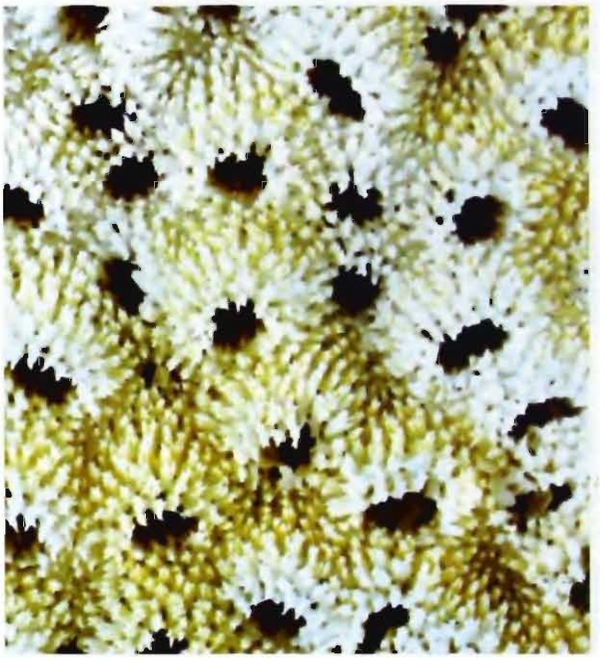
1980. *Astreopora cucullata*, Lamberts, *Pacific Sci.* **38** (1), 83-105, pl. 1-20.

Characters : Colonies are thick, sub-massive to encrusting plates, with a well-developed epitheca and sometimes with short rootlets. Corallites vary in size and shape from being immersed on concave surfaces to exsert on convex ones. The coenosteum is coarse and spongy with large, usually flattened spinules, which have highly elaborated tips.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Worlwide, it is reported from South East Asia to Coral Sea

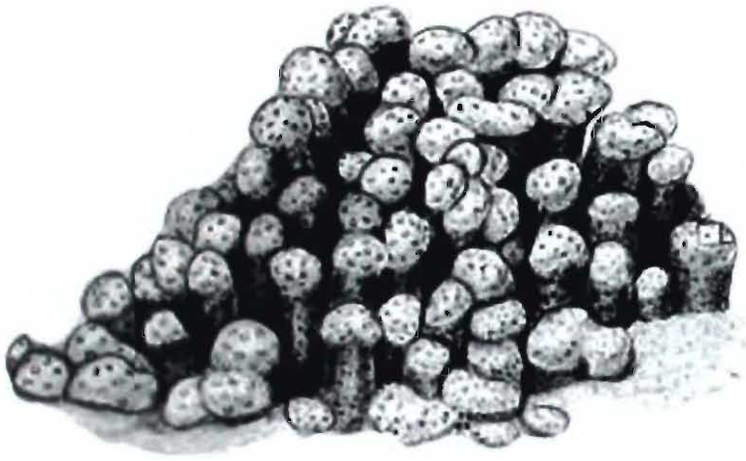
Remarks : Mostly found on the shallow reef environment.





Family **ASTROCOENIIDAE** Koby, 1890

Four genera, *Stylocoeniella*, *Stephanocoenia*, *Palauastrea* and *Madracis* are included in this family of which only two genera 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 (Veron, 2000).



Stylocoeniella guentheri

Madracis kirbyi

Genus ***Stylocoeniella*** Yabe and Sugiyama, 1935

Three species are reported from the world, of which only one species is reported from Andaman and Nicobar Islands.

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. Polyps have not been observed extended. *Stylocoeniella* resembles Pocilloporidae and *Porites sp.*in underwater. Both are distinguished by their lack of coenosteum styles. *Stylocoeniella* is uncommon in coral reefs of India and often forms small encrusting colonies in turbid environments.

71. ***Stylocoeniella guentheri*** Bassett-Smith, 1890

1890. *Stylocoeniella guentheri*, Bassett-Smith, *Ann. Mag. Nat. Hist. Ser.* **6, 6,** 353-374.

1966. *Stylocoeniella guentheri* Wells, Notes on Indo pacific Scleractinian corals. Pt. 4. a second species of Stylocoeniella. *Pac. Sci.* **20**, 203-205.

Characters : Colonies are encrusting. Calices are small. Septa are in two unequal cycles and may join between adjacent corallites. Corallites widely spaced. Coenosteum styles are small but distinctive.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Worlwide, it is reported throughout Indo-Pacific to Coral Sea.

Remarks : It resembles *S. armata*. Calices and septa may be difficult to distinguish in encrusting forms. Mostly found on reef slopes.

Genus ***Madracis*** Milne Edwards and Haime, 1849

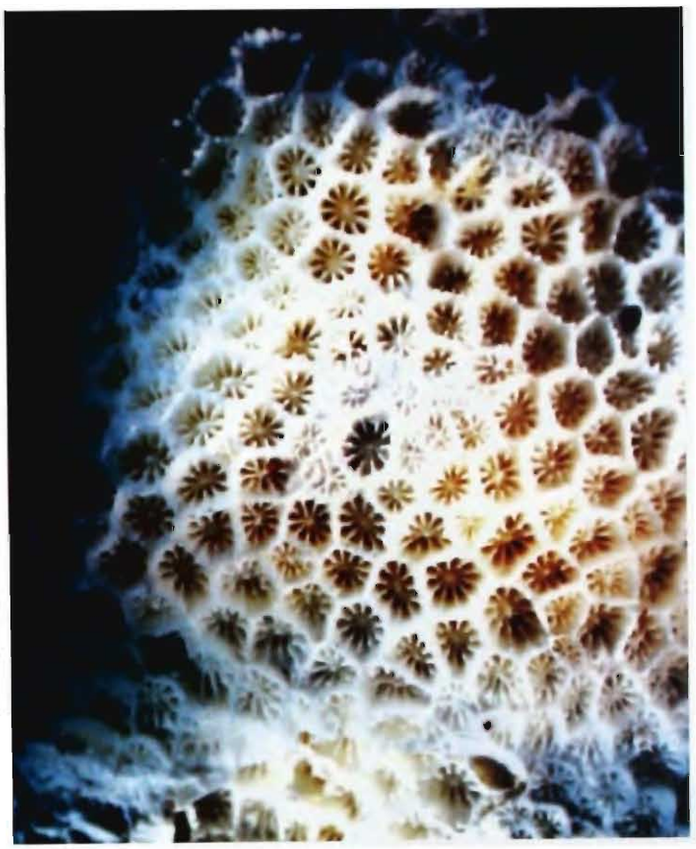
Madracis is primarily an azooxanthellate genus. Large angular corallites and lack of coenosteum styles characterize this genus however it has an encrusting and cryptic nature hence can easily be confused with *Stylocoeniella*. There are eight species reported form the world, of which one species is recorded in India.

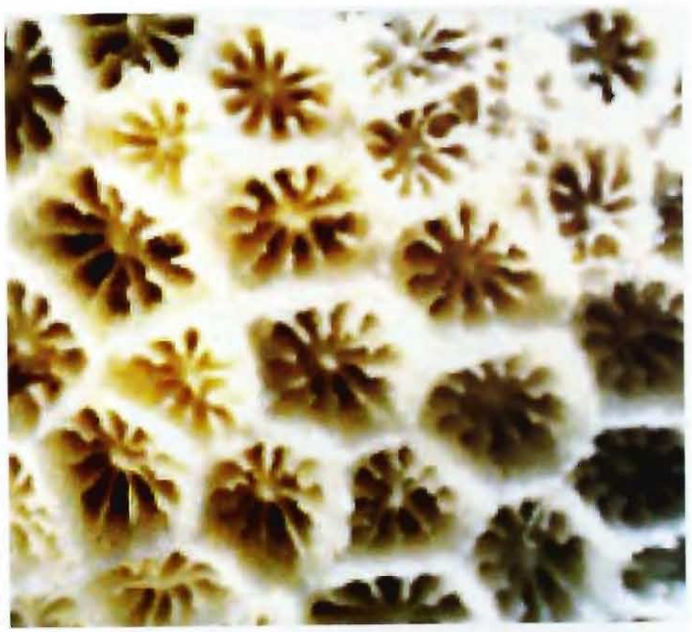
Characters : Colonies are massive, encrusting or columnar. Corallites are large and angular and there are no coenosteum styles. Corallites are closely packed and touching. Characters of the colonies (especially growth form and development of coenosteum) are variable, but the structure of the corallites, and in particular the non-hexameral disposition of the septa, remain conspicuous and typical of the genus.

72. ***Madracis kirbyi*** Veron and Pichon, 1976

1976. *Madracis kirbyi* Veron, *Aus. Inst. Mar. Sci. Mono. Ser.* Vol. I. 75-78.

Characters : Colonies are encrusting, nodular or columnar (club-shaped). Corallites are subcerioid, closely compacted and angular. 10 septa fuse with solid conical columellae. The coenosteum is covered by fine spinules.





Distribution : In India it is recorded from Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is reported from Indo-Pacific to Coral Sea.

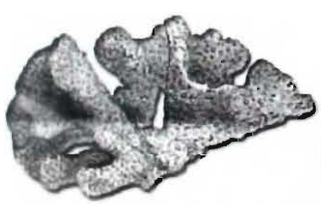
Remarks : Polyps extended only at night. Mostly found on turbid waters.

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. There are thirty species reported from the world, of which nine are recorded in India.

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. Skeletal characters vary greatly according to the position of corallites on branches. The coenosteum is covered with spinules. Superficially this family resembles Astrocoeniidae and Acroporidae.

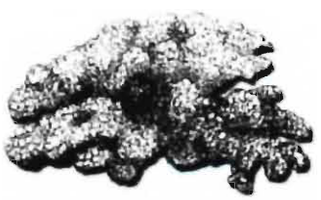
Pocillopora damicornis



Pocillopora eydouxi

Seriatopora hystrix

Stylophora pistillata



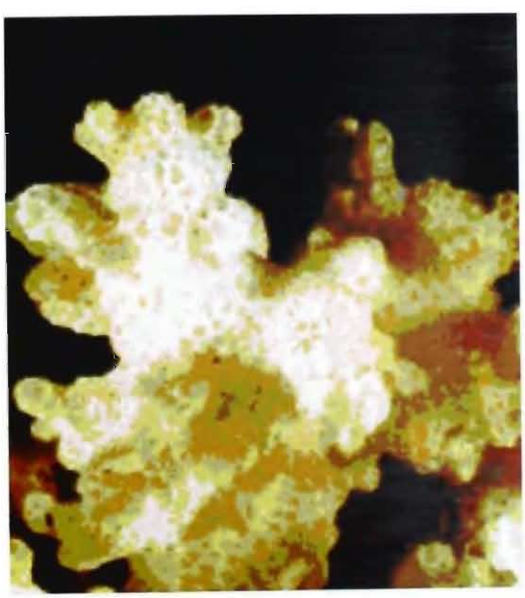
Pocillopora verrucosa

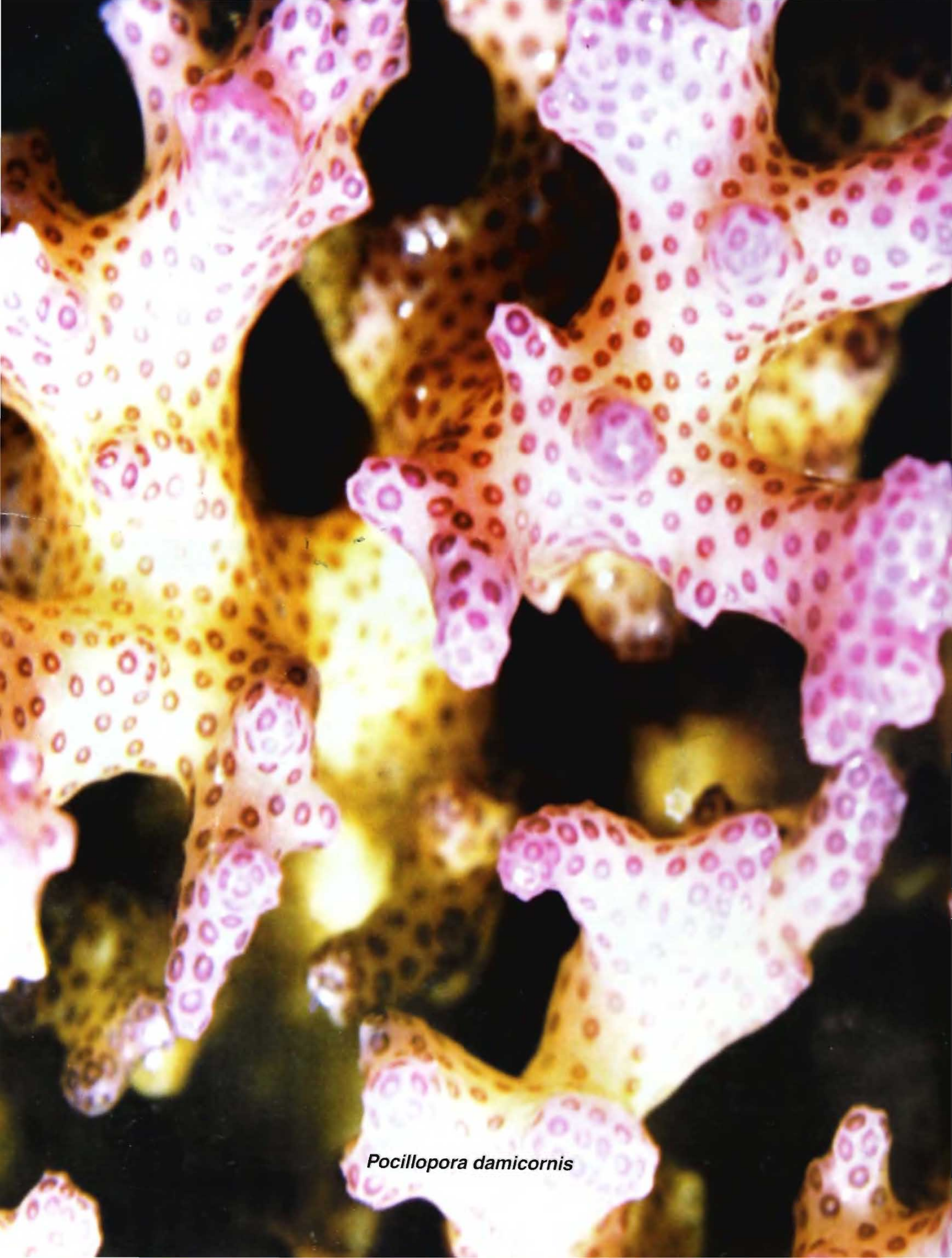
Genus ***Pocillopora*** Lamarck, 1816

Pocillopora is a well-defined genus readily distinguishable from other genus by the presence of verrucae. There are 17 species reported worldwide, of which five are recorded in India. It is represented in all major coral reef areas of India except the Gulf of Kachchh.

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.

73. ***Pocillopora damicornis*** (Linnaeus, 1758)





Pocillopora damicornis

1758. *Millipora damicornis* Linnaeus, *Systema naturae, I Regnum animale* Ed. X., p. 971.

1816. *Pocillopora acuta* Lamarck, *Histoire naturelle des Animaux sans vertebres.* Paris, **2**, 1-568.

1816. *Pocillopora brevicornis* Lamarck, *Histoire naturelle des Animaux sans vertebres.* Paris, **2**, 1-568.

1846. *Pocillopora caespitosa* Dana, U.S. Exploring Exped. 1838-1842, **7**, 1-740, pl. 1-61.

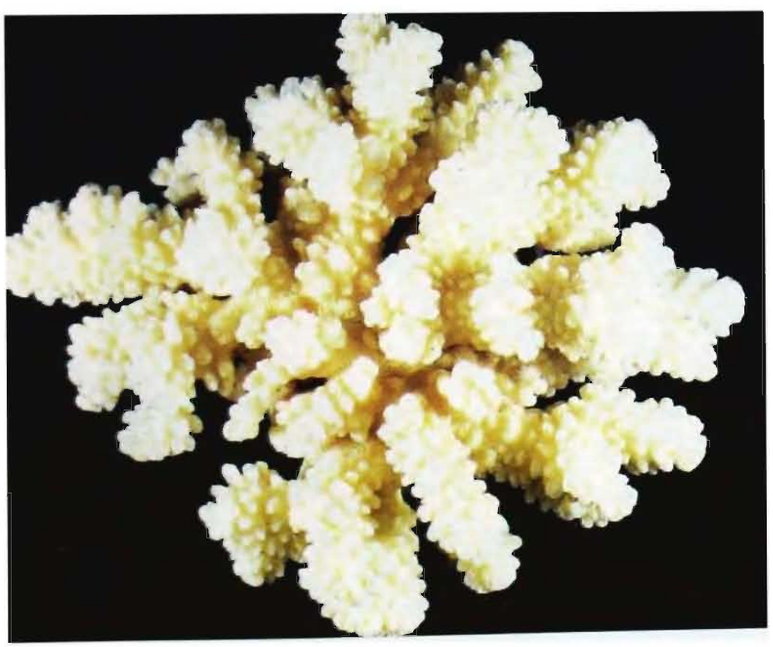
Characters : Colonies are compact slumps. Lacks true verrucae verrucae and branches intergrade. Branches may be fine and widely separated (in calm environments) to very compact (on upper reef slopes). Branches comprised of cerioid corallites and are highly compact and sturdy in habitats exposed to strong wave action and are thin and open in deep or protected habitats (Fig. 27). Colonies are pale brown, greenish or pink in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is reported throughout Indo-pacific to Coral Sea.

Remarks : It is similar to *P. verrucosa*. Peripheral branches are much thinner than other species in this genus.

74. ***Pocillopora verrucosa*** (Ellis and Solander, 1786)

1786. *Pocillopora verrucosa* Ellis & Solander *In* : The naturae history of many curios and uncommon zoophytes, London, **1** : 1-208, pl.1-63.



1864. *Pocillopora meandrina* var *nobilis* Verrill, List of the polyps and corals sent by the Museum of Comparative Zoology to other institutions in exchange, with annotations. *Bull. Mus. Comp. Zool. Harv.* **1**, 29-60.

Characters : Colonies are composed of uniform upright branches. Verrucae are prominent – large and irregular in size, giving the colony a rough/ ragged surface they have permanently coloured red-brown stalks. Branches are thick and compact in habitats exposed to wave action, becoming open and thinner in protected habitats. Colonies are usually cream, pink or blue in colour.

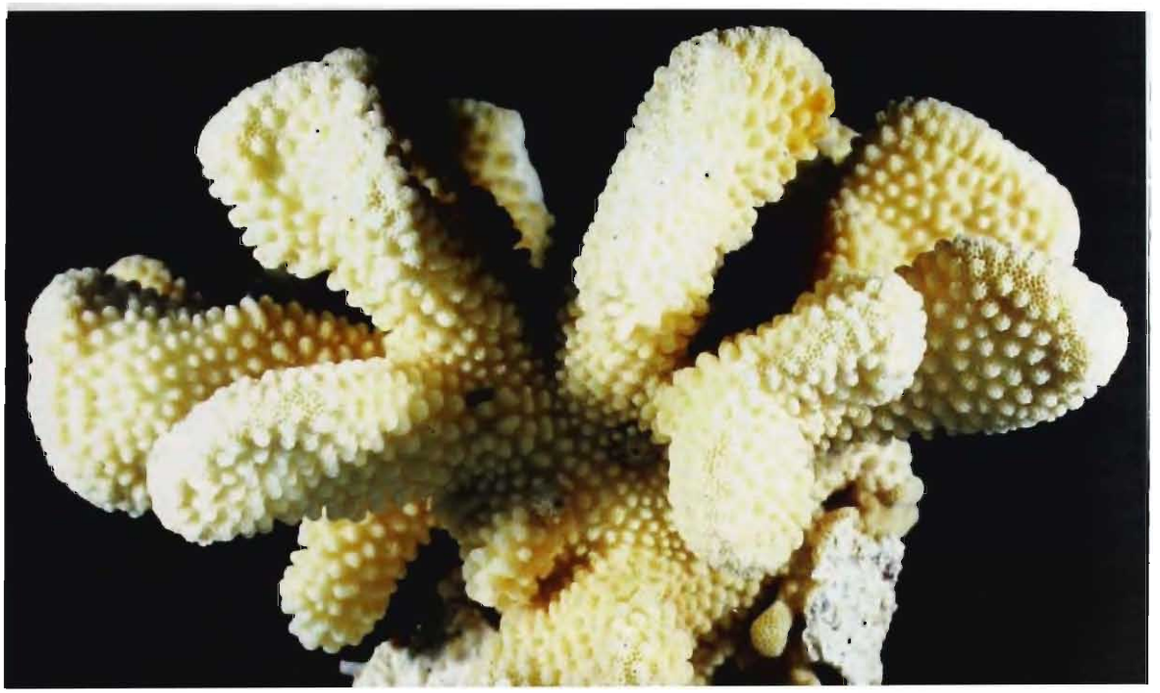
Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific to eastern Pacific.

Remarks : Resembles *Pocillopora damicornis* which has smaller branches. It is common only in exposed areas (outer reef fronts), therefore less variable than *P. damicornis*.

75. ***Pocillopora eydouxi***
Milne Edwards and Haime, 1860

1860. *Pocillopora eydouxi* Milne Edwards and Haime, Histoire naturelle des coralliaires, **2** : 633 pp.

Fig. 27. Morphological variation in the structure of colonies of *Pocillopora damicornis* from a wide range of habitats.



1932. *Pocillopora symmetrica* Thiel, Madreporaria. Zugleich ein Versuch Einer Vergleichenden Oekologie der gefundenen Formen. *Mem. Mus. R. Hist. Nat. Belg. Hors. Ser.* **2**, (12), 1-177.

Characters : Colonies are composed of stout, upright, flattened branches. Branches may be widely separated, or compact, especially where currents are strong. Colonies may be very large. Verrucae uniform. Colonies are pale to dark green or brown in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific, the Great Barrier Reef, Coral Sea and tropical East America.

Remarks : Similar to *P. verrucosa* but this species has more prominent veruccae. Mostly found on exposed reef fronts and where currents are strong.

76. ***Pocillopora ligulata*** Dana, 1846

1846. *Pocillopora ligulata* Dana, U.S. Exploring Expedition, 1838-1842, **7** : p. 531, pl. 50, figs. 2-2a.

Characters : Compact colonies with irregularly radiating branches with flattened ends. The calices are nearly 0.7 mm in diameter, close together, 2 cycles of septa are well developed in most of the calices with a styliform columella. The verucae are widely spaced and irregular. The growing tips of branchlets lack verrucae.

Distribution : In India it is recorded only from Lakshadweep. Worldwide, it is distributed from Coral Sea.

Remarks : Mostly found on shallow reefs exposed to strong wave action.

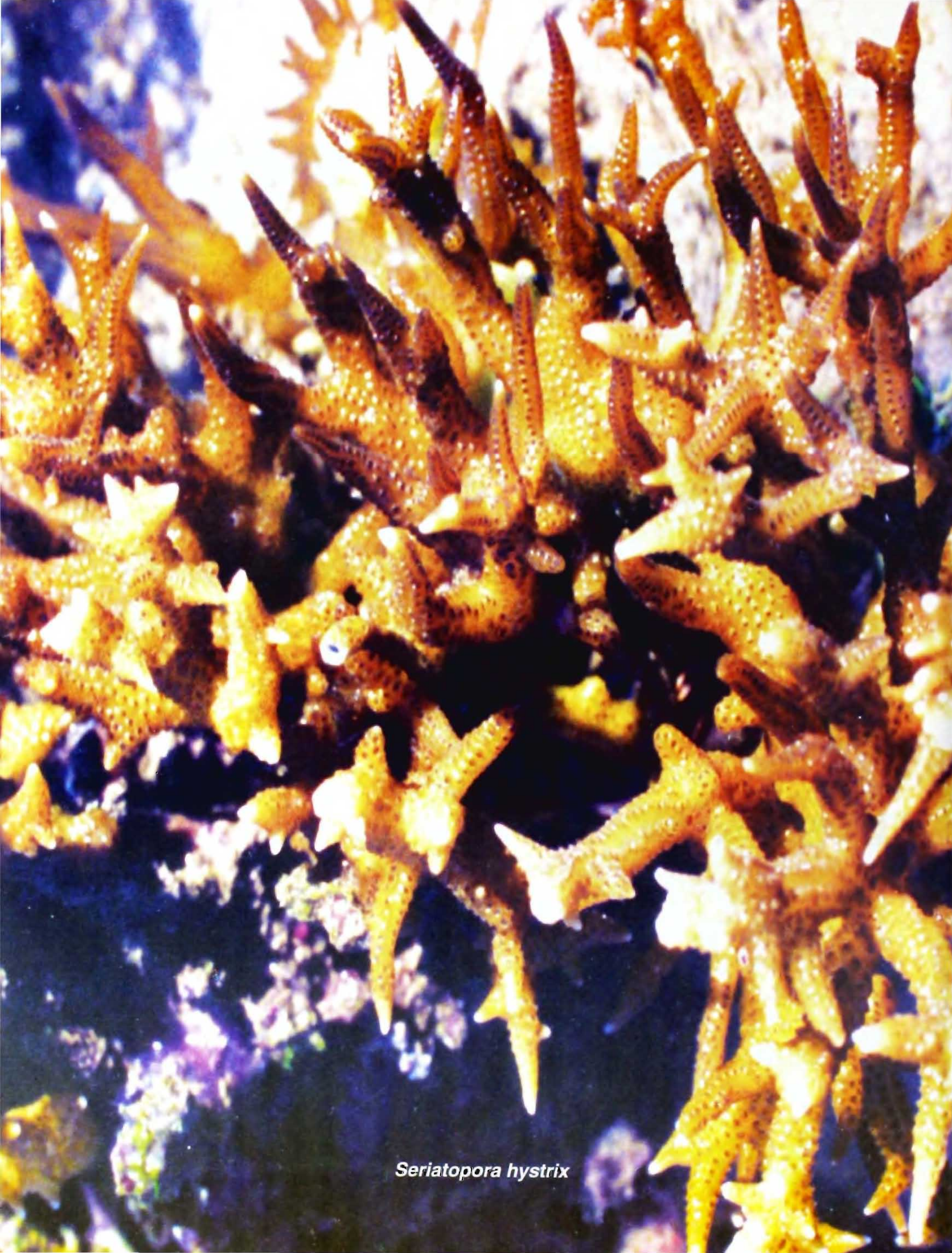
77. ***Pocillopora ankeli*** Scheer and Pillai, 1974

1974. *Pocillopora ankeli* Scheer & Pillai, *Zoologica.*, **122**, p. 15, pl. 3, figs. 1-4.

Characters : Colonies are small and compact with short knobby branches. Main branches with rounded base and compressed distal part. Repeatedly dividing branches. Branches are 6-7 cm long; branchlets with obtuse rounded or flattened apices and 3 cm in length. Verrucae present. Calices are 0.5 to 0.6 mm in diameter. At the junction of the septa and wall 12 spines are present. Well-developed septa and columella are present.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Also reported from Indonesia, Philippines and Malaysia.

Remarks : A rare species. Always found on the shallow areas of the reef.



Seriatopora hystrix

Genus ***Seriatopora*** Lamarck, 1816

Seriatopora is a well-defined genus. There are six species recorded from the world of which three are recorded in Andaman and Nicobar Islands.

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.

78. ***Seriatopora hystrix*** Dana, 1846

1846. *Seriatopora hystrix* Dana, U.S. Exploring Expedition 1838-1842, **7** : 1-740p, pl. 1-61.

1879. *Seriatopora angulata* Klunzinger; Die Korallenthiere des Rothen Meeres. **2**, 1-88, pl. 1-10; 3, 1-100, pl. 1-10, Gutmann, Berlin.

Characters : Colonies may form extensive stands. Thin tapering branches, size 1.5-4.5 mm, 1 cm below tip and 2.5-8 mm near colony base. Branches may be widely spaced or compact in more exposed habitats. Corallites are arranged in neat rows along branches. Colonies are cream, blue or pink in colour.

Distribution : In India it is recorded only from the Andaman and Nicobar Islands. It is widely distributed throughout the Indo-Pacific, the Great Barrier Reef and Coral Sea.

Remarks : *S. hystrix* is distinguished by its thinner branches, which taper at the end. Mostly found on shallow reef environments especially intertidal reef flats.

79. ***Seriatopora stellata*** Qulech, 1886

1886. *Seriatopora stellata* Quelch, *Rep. Sci. Results. Voyage HMS Challenger Zool.* **16** (3), p. 61, pl. 2, figs. 4-4b.

Characters : Thick, short and strongly tapered branches. Branches usually fused into clumps. Calices 0.6 mm in diameter and irregularly distributed. Corallites are alligned in rows which are raised into ridges down the sides of branches. The primary cycle of septa well developed.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is distributed from Maldives to Coral Sea except the Great Barrier Reef.

Remarks : It is rare in Indian waters. Similar to *S. hystrix*, which does not have raised ridges and usually has thin branches.

80. ***Seriatopora crassa*** Qulech, 1886

1886. *Seriatopora crassa* Quelch, *Rep. Sci. Results. Voyage HMS Challenger Zool.* **16** (3), p. 61, pl. 2, figs. 3-3d.

Characters : Colonies are 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.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is also reported from Philippines.

Remarks : It is rarely found in Indian waters. Using the material collected from Great Nicobar (Ganges Harbour) Scheer and Pillai (1974) described this species in their publication on the Report on the Scleractinia from the Nicobar Islands. However no mention has been made about this species in the recent revisions on the corals of Eastern Australia (Veron and Pichon, 1976), the Corals of Australia and the Indo-Pacific (Veron, 1986) and the Corals of the world (Veron, 2000).

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. In India it is recorded from Lakshadweep and Andaman and Nicobar Islands.

81. ***Stylophora pistillata*** Esper, 1797

1797. *Madrepora pistillaris* Esper, *Nurnberg*, 1-230.

1834. *Porites pistillata* Ehrenberg, *Abh. K. Akad.Wiss. Berlin. For* 1832, 250-380.

1846. *Sideropora mordax* Dana, *U.S. Exploring. Exped.* 1838-1842, **7**, 1-740, pl. 1-61.

1857. *Stylophora pistillata* Milne Edwards & Haime, Histoire naturelle des Coralliaires, Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

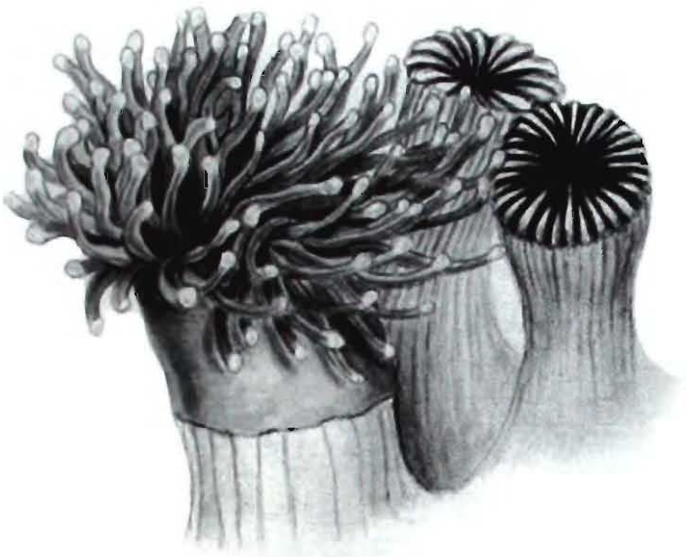
1918. *Stylophora mordax* Vaughan, *Pap. Dep. Mar. Biol. Carnegie Inst. Wash* **9**, (Publ. 213), 51-234, pl. 20-93.

Characters : Colonies are branching with blunt-ended branches becoming thick and submassive. Corallites are immersed, coral or hooded. They have a solid style-like columella. Six primary septa, which may be, short or fused with the columella, and sometimes six short secondary septa. The coenosteum is covered by fine spinules. Polyps are extended only at night. Uniform cream, pink, blue or green in colour.

Distribution : In India it is reported from Lakshadweep and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific, South East Asia, the Great Barrier Reef and Coral Sea.

Remarks : *Stylophora* is a well-defined genus closer to, but clearly distinct from, *Seriatopora*.

Family **EUPHYLLIDAE** Veron, 2000

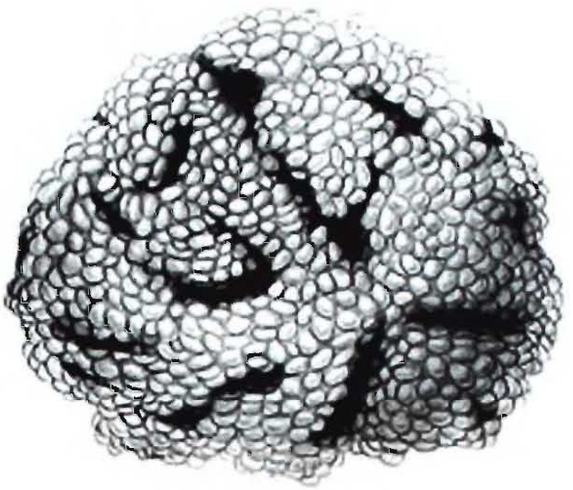


Euphyllia glabrescens

Physogyra lichtensteini

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.



Plerogyra sinuosa

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. Eight species are reported from the world of which only one species is recorded in India.

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. This genus is recorded from Lakshadweep and Andaman and Nicobar Islands.

82. ***Euphyllia glabrescens***
(Chamisso and Eyscenhardt, 1821)

1821. *Caryophyllia glabrescens* Chamisso & Eysenhardt, *Nova Acta Leopold* **10** (2), 343-74, pl. 24-33.

1824. *Caryophyllia angulosa* Quoy & Gaimard, Des polyps a polypiers 592-657.

Characters : Colonies are phaceloid and corallites are usually separated by 0.5-1 corallite diameters. Corallite walls are thin, with sharp edges. Septa are not strongly exert. Polyps have tubular tentacles. Colonies are usually grey-blue to grey-green with cream, green or white tips to the tentacles in colour.

Distribution : In India it is reported from Lakshadweep and Andaman and Nicobar Islands. Worldwide, it is distributed throughout the Indo-Pacific, Red sea, Marshall Islands, Samoa and the Great Barrier Reef.

Remarks : It can be easily identified by using tentacle shape. Easily differentiated from the other species of the genera *Plerogyra* and *Physogyra* by the presence of phaceloid colonies.

Genus ***Plerogyra*** Milne Edwards & Haime, 1848

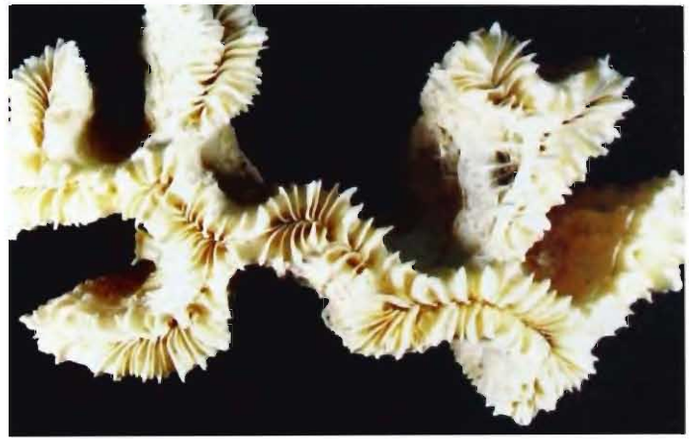
Plerogyra is one of the few corals sufficiently well armed to be able to sting a human. Of the three species recorded in the world only one species is reported from India.

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. These retract slowly, if at all, when disturbed. Living colonies of *Plerogyra* resemble those of *Physogyra*, except that the polyp vesicles of the latter are smaller and more retractable. Skeletons of *Physogyra* are meandroid, not meandro-phaceloid as with *Plerogyra*. *Plerogyra* skeletons may resemble *Euphyllia* as both have imperforate walls and septa are similar growth forms. *Euphyllia* has less exert, more numerous and more regular septa and there is little development of a blistery coenosteum. Living colonies are distinct, *Euphyllia* having tenctacles, *Plerogyra* having vesicles during the day. This genus is recorded only from Andaman and Nicobar Islands.

83. ***Plerogyra sinuosa*** (Dana, 1846)

1846. *Euphyllia sinuosa* Dana, U. S. Exploring Exped. 1838-1842. **7**, 1-740, pl. 1-61.

1846. *Euphyllia cultrifera* Dana, U. S. Exploring Exped. 1838-1842. **7**, 1-740, pl. 1-61.



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 exert and widely spaced. Collumellae are absent. Polyps are extended only at night. During the day, polyps extend clusters of grey vesicles, the size and shape of large grapes. These retract slowly, if at all, when distributed. Colonies are usually bluish-grey in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is distributed throughout the tropical Indo-pacific, Red sea, Marshall Islands and the Great Barrier Reef.

Remarks : Living colonies of *Plerogyra* resemble those of *Physogyra*, except that the polyp vesicles of the latter are smaller and more retractable. Skeletons of *Physogyra* are meandroid, not meandro-phaceloid as with *Plerogyra*. *Plerogyra* skeletons may resemble *Euphyllia* has less exert, more numerous and more regular septa and there is little development of a blistery coenosteum. Living colonies are distinct, *Euphyllia* having tentacles, *Plerogyra* extend vesicles during the day.

Genus ***Physogyra*** Quelch, 1884

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

Characters : Colonies are meandroid with short, widely separated valleys interconnected with a light blistery coenosteum. Septa are large, imperforate smooth-edged, exsert and widely spaced. Columellae are absent. Polyps are extended only at night. During the day the whole colony surface is covered with a mass of vesicles, which appears the size, and shape of small grapes. These vesicles retract when distributed.

84. ***Physogyra lichtensteini*** (Edwards and Haime, 1851)

1851. *Plerogyra lichtensteini* Edwards & Haime, *Arch. Mus. Natl. Hist. Nat. (Paris)* **5**, 1-505, pl. 1-20.

1884. *Physogyra aperta* Quelch, *Ann. Mag. Nat. Hist. Zool. Bot. Geol. Ser.* **5**, 13, 292-7.

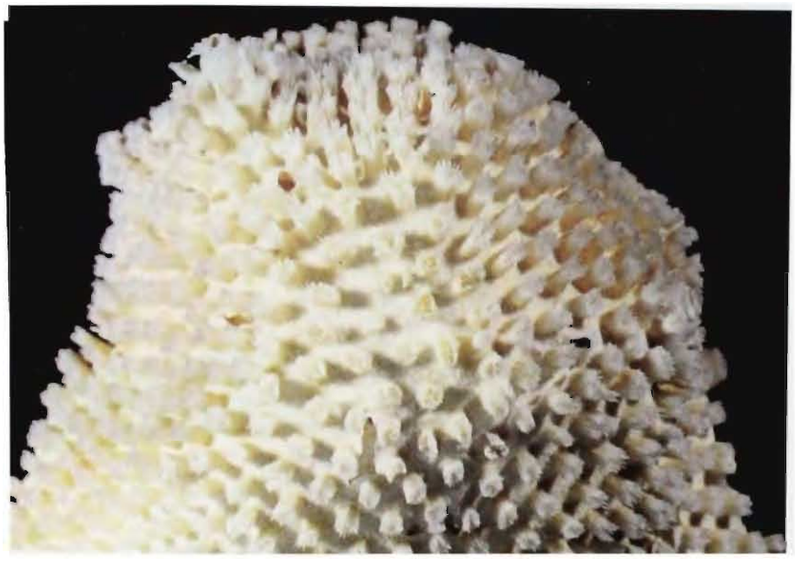
Characters : Colonies are meandroid with short, widely separated valleys interconnected with a light blistery coenosteum. Septa are large, imperforate, smooth-edged, exert and widely spaced. Walls are imperforate. Columellae are absent. Polyps are extended only at night. During the day the whole colony surface is covered with a mass of vesicles, which appears the size and shape of small grapes. It retracts when disturbed. Colonies are usually pale grey, sometimes dull green in colour.

Distribution : In India it is reported only in Andaman and Nicobar Islands. It is widely distributed throughout the Indo-Pacific, Madagascar, Marshall Islands and the Great Barrier Reef.

Remarks : *Physogyra* resembles only *Plerogyra*. Common in protected habitats such as crevices and overhangs, especially in turbid water with tidal currents.

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*. *Galaxea* is the only genus recorded in India.



Galaxea fascicularis

Genus ***Galaxea*** Oken, 1815

Of the seven species reported in the world only two are recorded from India.

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 exert. Polyps are sometimes extend during the day. *Galaxea* is close to *Acrhelia*, which differs in being arborescent or bushy. Expect Gulf of Kachchh it represents from all the other three major coral reef areas of India.

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.

85. ***Galaxea astreata*** (Lamarck, 1816)

1816. *Caryophyllia astreata* Lamarck, *Histoire naturelle des animaux sans vertebras*. Paris. **2**, 1-568.

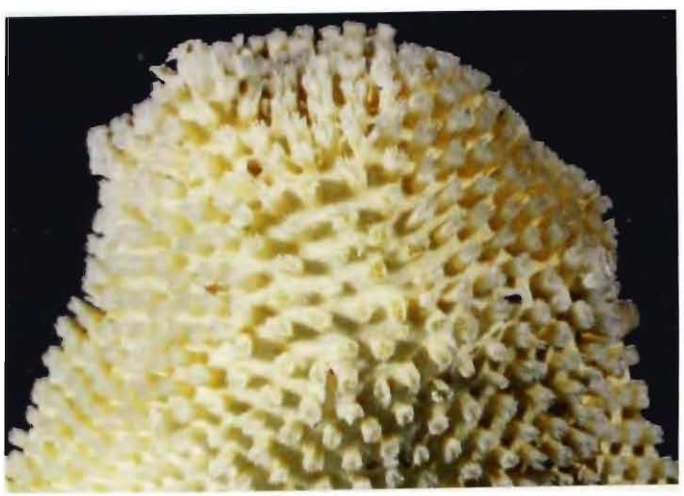
1971. *Galaxea astreata* (Lamarck); Chevalier, Lere Partie. Exped. Recifs Coralliens Nouvelle-Caledonie, Fond. Singer-Polignac, Paris. **3**, 5-50, pl. 1-4.

Characters : Colonies are submassive, columnar or encrusting, with uniform corallites 3-4.5 mm in diameter. Usually eight to 12 septa reach the corallite centre. Polyps are seldom extended during the day. Usually colonies are pink, green or brown in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is distributed from the Red sea to the Coral Sea.

Remarks : This species is similar to *G. fascicularis*. Usually found in reef environments protected from strong wave action.

86. ***Galaxea fascicularis*** (Linnaeus, 1767)



1767. *Madrepora fascicularis* Linnaeus, Systems naturae. I. Regnum animale. Ed. XII.

1974. *Galaxea fascicularis* Scheer & Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. 42 (122), 1-75, pl. 1-33.

Characters : Small colonies are cushion-shaped or low domes or irregular. Large colonies are

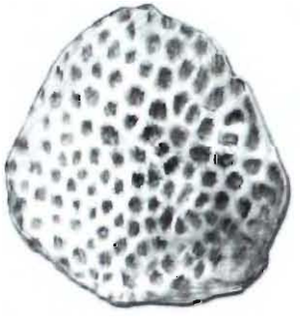
columnar or irregular short sub-branches. Corallites are of mixed sizes, commonly found up to 6 mm in diameter with numerous septa reaching the corallite centre. Colonies are usually green, red and brown in various mixtures. Polyps are frequently extended during the day and tentacles often have conspicuous white tips.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed from Red sea to the tropical Western Pacific including Fiji and Samoa, Abrolhos Islands and the Great Barrier Reef.

Remarks : Similar to *G. astreata*. Usually seen in reef environments protected from strong wave.

Family **SIDERASTREIDAE** Vaughan and Wells, 1943

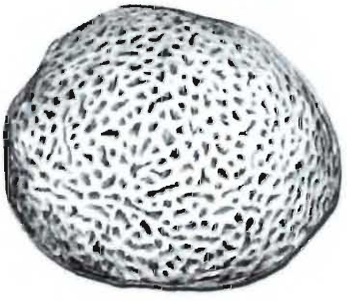
Siderastreidae is a family with mostly extant, colonial and hermatypic corals. Colonies are massive or columnar. Corallites are immersed with poorly defined walls formed by thickening of the septo-costae. Septa are usually fused along their inner margins to form fan-like groups; they have granulated upper margins and are closely compacted and evenly spaced.



Siderastrea savignyana

Psammocora digitata

Pseudosiderastrea tayami



Coscinaraea monile

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.

Genus ***Pseudosiderastrea*** Yabe and Sugiyama, 1935

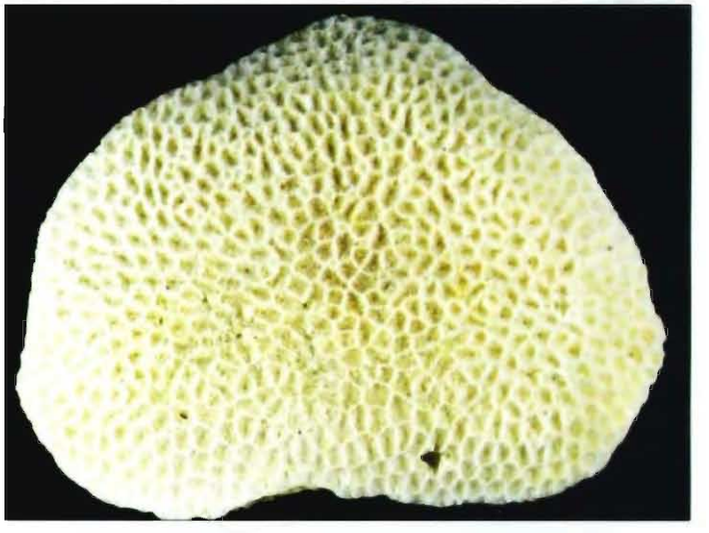
It is monospecific and closely resembles *Coscinaraea* and superficially resembles *Coeloseris* and *Leptastrea*. In India, it is reported in all reef areas except Lakshadweep Islands.

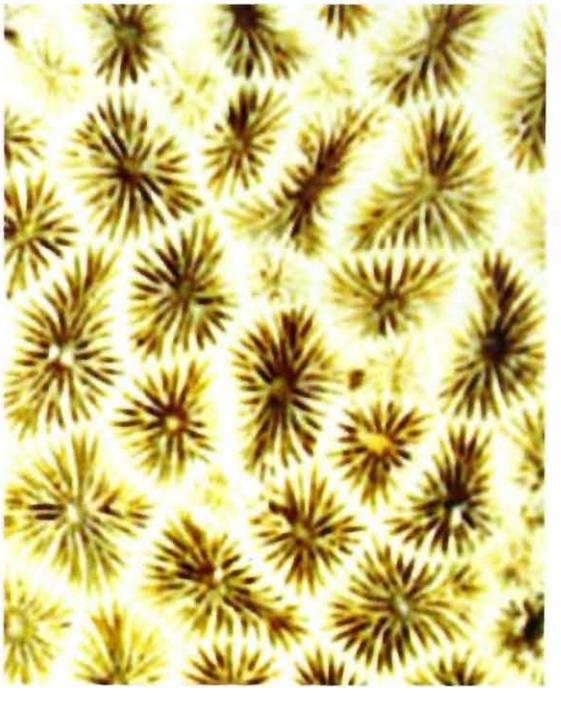
Characters : Colonies are encrusting to massive or dome-shaped. Corallites are cerioid, polygonal, 3-6 mm in diameter. Septa are evenly spaced and fuse with each other in fan-like groups. Septa have fine, saw-like teeth. Columellae consist of one to four pinnules.

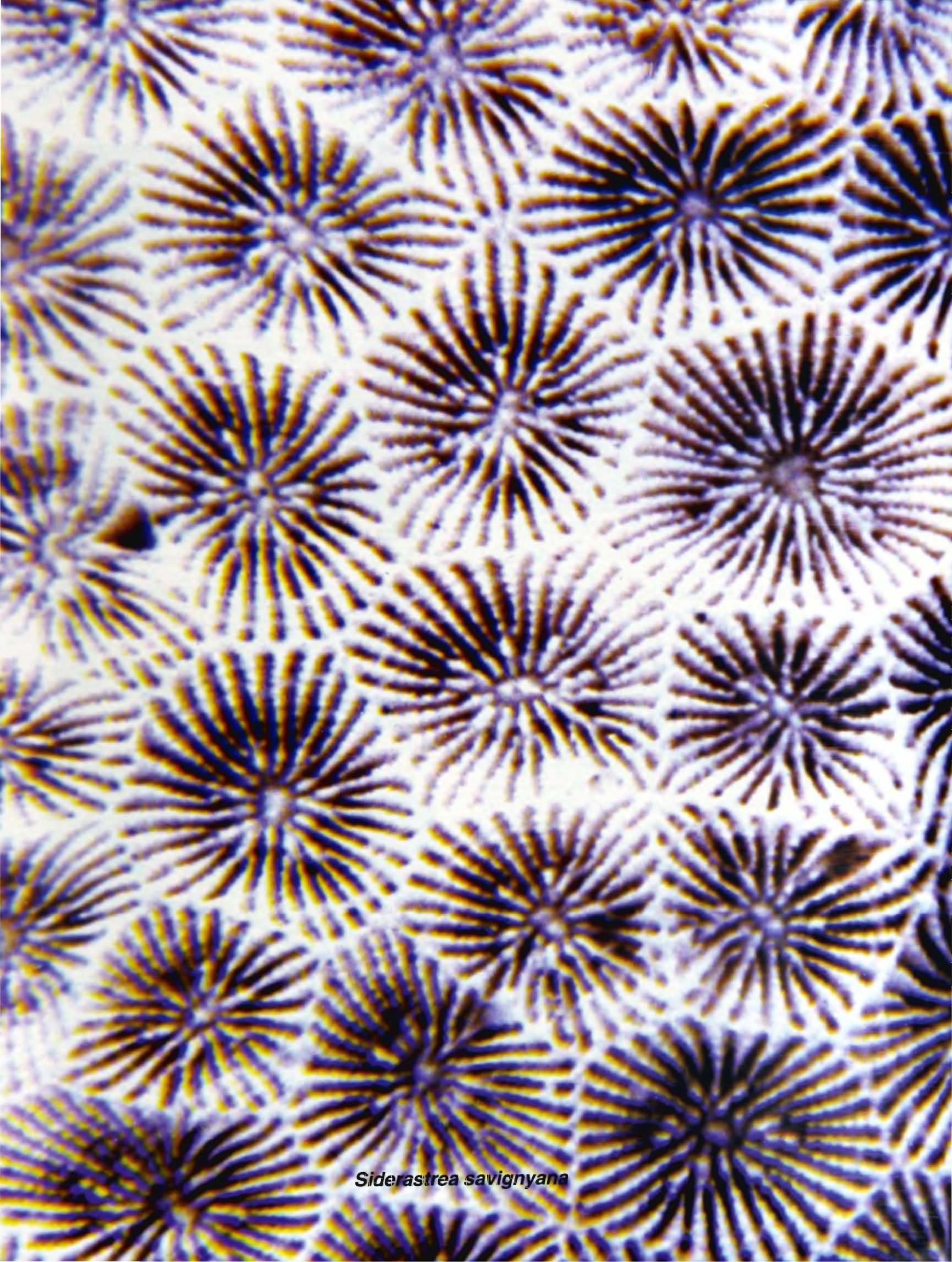
87. ***Pseudosiderastrea tayami*** Yabe and Sugiyama, 1935

1935. *Pseudosiderastrea tayami* Yabe and Sugiyama, *Proc. Jpn. Acad.*, **11** (9) : 378-8, 2 pls.

1956. *Anomastraea (Pseudosiderastrea) tayami* Wells, J.W. Scleractinia, in Moore, R. C. 'Treatise on Invertebrate Palaeontology.' *Coelenterata*. Univ. Kansas Press, F., F328-F440.





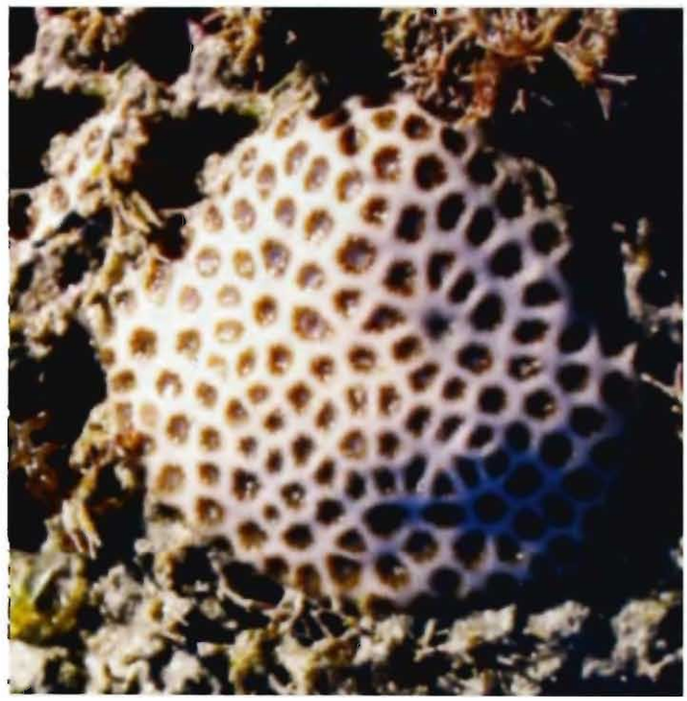


Siderastrea savignyana

Characters : Colonies are encrusting to dome shaped, up to 160 mm in diameter. Corallites are small and cerioid, 3-6 mm in diameter. Septa have fine saw-like teeth. Septa are evenly spaced and inner margins of septa are fused. Columellae consist of one to four pinnules. Colonies are pale grey with distinctive white corallite walls in colour.

Distribution : It is present in all three major reef areas in India except Lakshadweep Islands. Globally, it is distributed from Madagascar to Coral Sea.

Remarks : Similar to *Siderastrea savignyana* but it has smaller corallites and forms larger colonies. Also similar to *Coscinaraea* but corallites are not polygonal. There is not much tissue on this species hence, the skeletal characters are obvious in the field. Mostly found on shallow water, attached to bare rocks.



Genus ***Siderastrea*** de Blainville, 1830

Five recorded species in the world, of which one is reported from India.

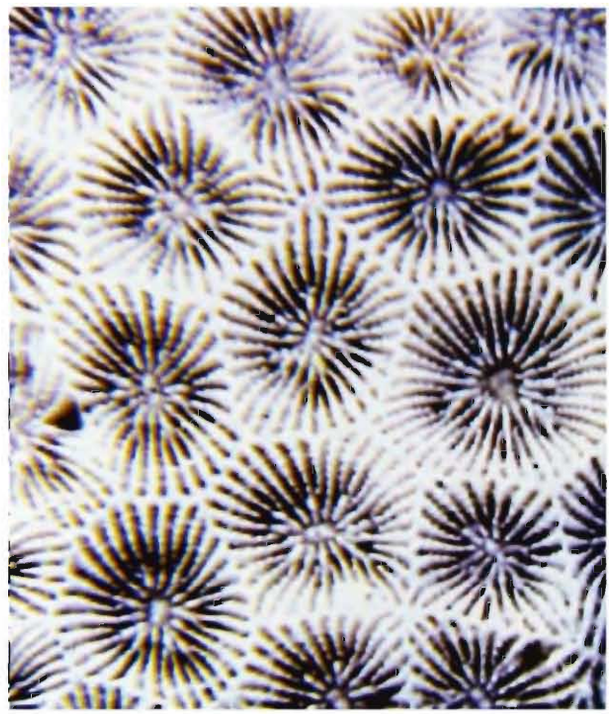
Characters : Colonies are encrusting to boulder shaped. Corallites are cerioid, polygonal, or rounded. Septa are evenly spaced and are in distinct orders. Columellae consist of few pinnules. Walls are composed of a network of septa with cross linkages. Closely resembles *Pseudosiderastrea*. In India it is recorded only from Gulf of Kachchh.

88. ***Siderastrea savignyana*** Edwards and Haime, 1850

1850. *Siderastrea savignyana* Edwards and Haime, Recherches sur les polypiers. Mem. 4 Monographie des Astreides. *Ann. Sci. Nat. zool. 3e. Ser.*, **13**, 63-110, pl. 3-4.

Characters : Colonies are encrusting or low mounds to one metre across. Corallites polygonal, 2-4mm diameter. Septa are neatly arranged. Fusing in neat fan-like groups. Walls have a fine ridge along the top.

Distribution : In India it is recorded only from Gulf of Kachchh. Worldwide, it is reported from Red Sea to Coral Sea.



Remarks : Similar to *Pseudosiderastrea tayami* which has a similar growth form but septa have saw-like teeth. Mostly found on shallow reef environments or sandy lagoons.

Genus ***Psammocora*** Dana, 1846

This genus was previously included under the family Thamnasteriidae is now believed to have

closer affinities with *Siderastreidae*, especially *Coscinaraea*. There are twelve species recorded worldwide, of which four species occur in Indian waters.

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. Septo-costae have finely granulated margins. Columellae consist of groups of pinnules. 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.

89. ***Psammocora contigua*** (Esper, 1797)

1797. *Madrepora contigua* Esper, *Numberg*, 81, pl. 66.

1846. *Psammocora contigua* (Esper) Dana, *U. S. Exploring Exped.* 1838-1842. 7, 1-740, pl. 1-61.

Characters : Colonies are mixture of flattened branches or columns or irregular nodules. Colonies have a smooth surface due to shallow corallites. Columella covered with granulations, or composed of loose trabeculae. Septa varies from about 5 to 25. Living colonies are pale to dark grey-brown.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Globally, it is reported throughout the tropical Indo-Pacific from eastern Africa and the Red Sea and east to Samoa.

Remarks : Despite its variety of growth forms, it is usually distinguished from other genus by having anastomosing branches. It clearly resembles *P. digitata*. Specimens from calm localities have a foliaceous growth form, where as specimens from exposed slopes and reef crests are stouter with rounded branches. Sometimes occur as free-living mobile balls.

90. ***Psammocora digitata*** Milne Edwards and Haime, 1851

1851. *Psammocora digitata* Milne Edwards & Haime, *Ann. Sci. Natur. Paris*, **16** : 21-70

1973. *Psammocora togianensis* Umbgrove; Pillai, Vine & Scheer, Bericht uber eine Korallensammlung von den Seychellen. (Notes on a collection of corals from the Seychelles.) Zool. Fahrb. Abt. Syst. **100**, S, 457-465, pl. 1-12.

Characters : Colonies are encrusting, plate-like or columnar. Corallites are small and shallow. Colony surface has a slightly rough appearance due to the irregularly arranged, slightly exsert, petaloid primary septa. The columella consists of few granulated trabecula or occassionally a single trabecula. Colour range from purple to medium purple-grey or grey-brown.

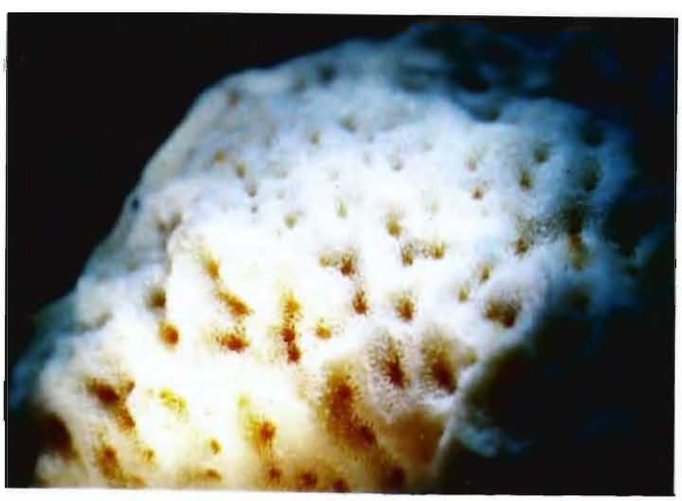
Distribution : In India it has been recorded from the Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. Globally, it is distributed throughout the tropical Indo-Pacific from the Bay Chelles Islands to the Fiji Islands.

Remarks : The growth form is unlike any other *Psammocora* species, but colonies of *Coscinaraea* may be similar in shape. Corallites are similar to those of *P. contigua* but larger. Mostly found on all reef environments.

91. ***Psammocora profundacella*** Gardiner, 1898

1896. *Psammocora profundacella* Gardiner, *J. S. Proc. zool. Soc. Lond.*, 525-539, pl. 43-45.

1955. *Psammocora profundacella* Nemenzo, Systematic studies on Philippine shallow-water Scleractinians. I Sub-order Fungiida. Nat. appl. Sci. Bull. **15**, 1, 3-84, pl. 1-14.



Characters : Colonies are submassive or plate-like. Corallites are arranged along valley floors. Primary septo-costae are not petaloid or only slightly so. Septa are not exert. Walls between corallites are rounded and may form a central ridge. Grey, brown or cream in colour.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Globally, it is distributed from South Africa, and the Western Indian Ocean, and East to the Line Islands.

Remarks : Resembles *P. haimeana*. The upper surface is usually irregular and often deformed by action of commensals or parasites. Mostly found on shallow reef environments.

92. ***Psammocora haimeana*** Milne Edwards and Haime, 1851

1851. *Psammocora haimeana* Milne Edwards & Haime, *Ann. Sci. Natur. Paris*, **16** : 21-70.

1964. *Psammocora haimeana* Scheer, *Korallen von Abd-el-Kuri. Zool. Fahrb. Abt. Syst.* **91**, S, 451-466.

Characters : Colonies are submassive. Corallites are situated at the bottom of shallow depressions or short non-meandering valleys. Walls have acute tops. Primary septo-costae are petaloid but not exert. Grey or brown in colour.

Distribution : In India, it is recorded only from Lakshadweep. Globally, it is distributed from South Africa, Madagascar, Red Sea, Maldives, Cocos Keeling Islands, Indonesia, Great Barrier Reef and Marshall Islands.

Remarks : *P. profundacella* is similar except that primay septa-costae are not petaloid. Mostly found on shallow reef environments.

Genus ***Coscinaraea*** Milne Edwards and Haime, 1848

Eight species have been reported from the world, of which only one is recorded from Gulf of Kachchh and Gulf of Mannar and Palk Bay in India. It closely resembles *Pseudosiderastrea* and is often confused with *Psammocora*.

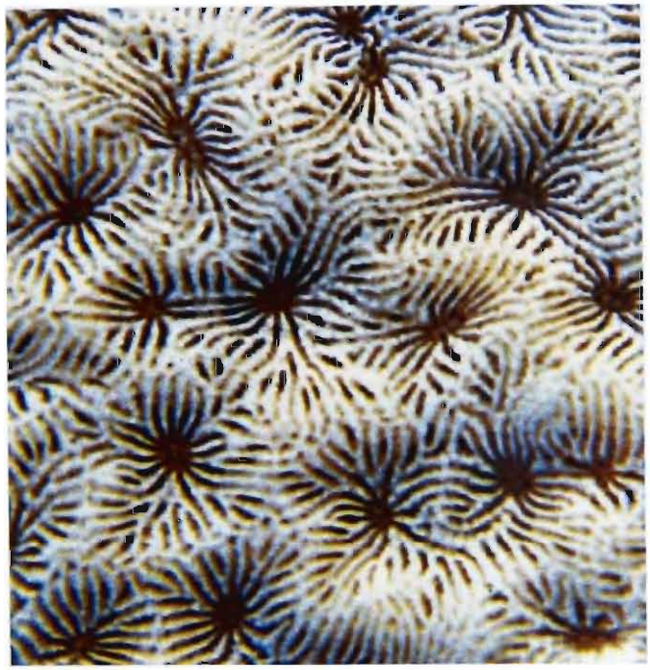
Characters : Colonies are massive, columnar,

encrusting or laminar. Corallites are large and in short valleys or irregularly scattered and shallow. Corallite walls developed. Columellae consist of groups of pinnules. Septo-costae are fused in distinsctive patterns and have finely serrated to heavily granulated margins. Compound trabeculae and true synapticulothecal wall distinguish *Coscinaraea* from *Psammocora*. Polyps are usually extended at night and sometimes during the day.

93. ***Coscinaraea monile*** (Forskal, 1775)

1775. *Madrepora monile* Forskal, *IV Corallia, hauniae*, p. 135.

1907. *Coscinaraea monile* Marenzeller Riffkorallen. Expeditionen S.M. Schiff *Pola* in das Rote Meer. Zool. Ergeb. XXV Tiefseekorallen, 13-27, pl. 1-2, Riffkorallen, 27-97, pl. 1-29. *Denkschr. Akad. Wiss. XXVI. Wien 80.*



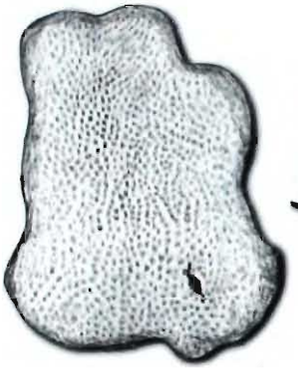
Characters : Colonies encrusting or dome-shaped, calices 6-8 mm in diameter, about 2 mm deep, often 2 to 3 calicinal centres run together to form short valleys. Intercorallite walls poorly developed. Septa are even and finely serrated giving colonies a smooth appearance. Axial fossa circular and with a papilliform columella.

Distribution : In India it is recorded from Gulf of Kachchh and Gulf of Mannar and Palk Bay. Widely distributed from Red Sea to Mergui Archipelago and Indian Ocean.

Remarks : It is a rare species. Mostly found on shallow reef environments.

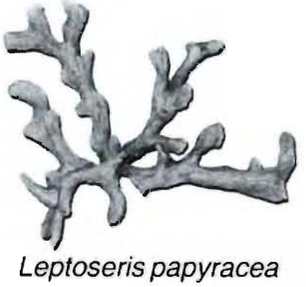
Family **AGARICIIDAE** Gray, 1847

The family Agariciidae includes six extant hermatypic genera, *Pavona*, *Leptoseris*, *Gardineroseris*, *Coeloseris*, *Pachyseris* and *Agaricia* of which except *Agaricia* all other five genera are reported from India.

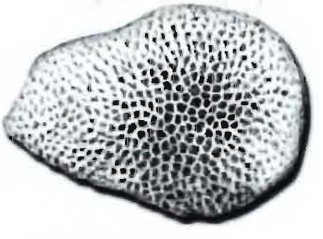


Pavona clavus

Pavona cactus



Leptoseris papyracea



Coeloseris mayeri

Pachyseris speciosa

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.

Genus ***Pavona*** Lamarck, 1801

There are 14 species reported in the genus *Pavona*, of which nine are recorded in India from all major reef areas except Gulf of Kachchh.

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 explanulata* is an exception.

Pavona closely resembles *Leptoseris*, which has similar corallites but fine septo-costae. Foliaceous colonies are unifacial in *Leptoseris* but the distinction between these genera may sometimes be unclear. For ease of identification, *Pavona* can be divided into two groups : leafy and non-leafy.

94. ***Pavona cactus*** (Forskal, 1775)

1775. *Madrepora cactus*, Forskal, *IV Corallia, Hauniae*, 131-9.

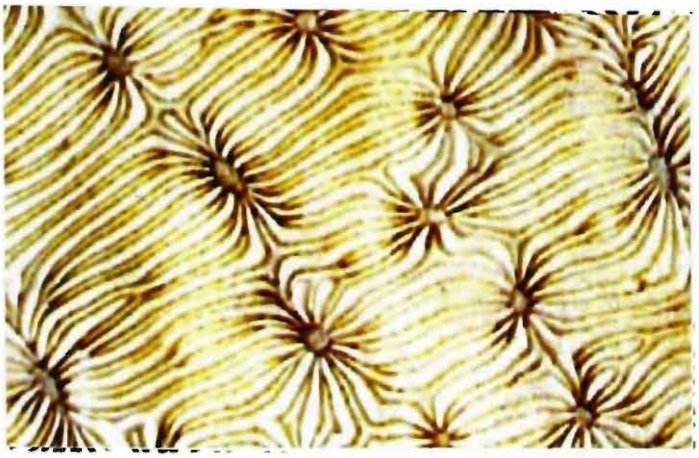
1879. *Pavona cactus* Klunzinger, Die Korallenthiere des Rothen Meeres. Gutmann, Berlin. **2**, 1-88, pl. 1-10; 3, 1-100, pl. 1-10.

Characters : Colonies are thin, contorted, bifacial upright fronds with or without thickened branching bases. Corallites are very small and shallow, and aligned in irregular rows parallel to the margins. Living colonies are pale brown or greenish-brown.

Distribution : In India it is recorded from the Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Globally, it is widely distributed from the Red Sea to Marshall Islands, the Great Barrier Reef in the east, Rowley Shoals and Scott on the west coast of Australia.

Remarks : It is very distinctive. Small size of corallites resembles *P. decussata*. Mostly found on upper reef slopes, especially those of fringing reefs, and in turbid water protected from wave action.

95. ***Pavona explanulata*** (Lamarck, 1816)



1816. *Agaricia explanulata* Lamarck, *Histoire naturelle des animaux sans vertebres*, Paris, 1-432 p.

1976. *Pavona explanulata* Pillai & Scheer, Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.)* **43** (126), 1-83, pl. 1-32.

Characters : Colonies are encrusting or thin unifical laminae, sometimes submassive or columnar. Corallites are fairly small (larger in this species than other *Pavona* species). Corallites widely spaced and circular and lack any form of a corallite wall. Corallites usually consists of a few fused, twisted tuberculae and alternating septo-costae. Living colonies may have a wide variety of colours, sometimes mottled.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is widely distributed from Madagascar, Cocos-Keeling Islands in the Indian Ocean and places like the Great Barrier Reef and Lord How Islands in the Pacific.

Remarks : Occur in a wide range of shallow habitats.

96. ***Pavona varians*** Verrill, 1864

1864. *Pavona varians* Verrill, *Bull. Mus. Comp. Zool. Harv. Univ.* **1**, 29-60.

1974. *Pavona varians* Scheer & Pillai, On a collection of Scleractinia from the Strait of Malacca. *In* 'Proceedings of the *Second International Symposium on coral Reefs. Great BarrierReef Comm., Brisbane*, **1**, 445-64.

Characters : Colonies are submassive, laminar or encrusting or various combination of these growth forms. Corallites are in short irregular valleys or are aligned between ridges perpendicular to margins or are irregularly distributed on flat surfaces. Calices are very small (maximum 1 mm in diameter). Septo-costae are arranged in two alternate orders, which are sometimes indistinct. The colour of individual colonies is frequently very variable, many having pale tops and dark sides. The most common colours are yellow, green and brown.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and the Andaman and Nicobar Islands. Globally, it is distributed throughout the tropical Pacific, from Madagascar in the west to the Marshall Islands in the east.

Remarks : It occurs in a wide range of habitats. *P. venosa* has similar corallites, but the walls between valleys are acute and septa are generally in three orders; columellae are less developed and septa are more widely spaced.

97. ***Pavona maldivensis*** (Gardiner, 1905)

1905. *Siderastrea maldivensis* Gardiner, In fauna and geography of the Maldivesand Laccadives Archipelagoes, *Cambridge*, **2**, 933-57, pl. 89-93.

1948. *Pavona maldivensis* (Gardiner); Matthai, *Philos. Trans. R. Soc. Lond. Biol. Sci. Ser.* B, **233**, (597), 177-96, pl. 3-14.

Characters : Colonies are laminar, encrusting and/or branching. Corallites are circular, plocoid, usually of irregular sizes with distinct thecae. Those near plate margins may be aligned in parallel rows. The colonies are pale or dark grey-brown or green, sometimes bright orange in colour.

Distribution : In India it is present in the Lakshadweep and Andaman and Nicobar Islands. Globally, it is distributed throughout the tropical Pacific, from Madagascar in the west to the Marshall Islands in the east.

Remarks : It is commonly available in all the reef areas especially those exposed to strong wave action, and also on vertical rock faces.

98. ***Pavona decussata*** (Dana, 1846)

1846. *Pavona decussata Dana*, U.S. Exploring Expedition 1838-1842, **7** : p. 327, pl. 22, figs. 4

1922. *Pavona decussata* Dana van der Horst, *Trans. Linn. Soc. Lond. Zool. Ser.* 2, *18*, 417-29, pl. 31-32.

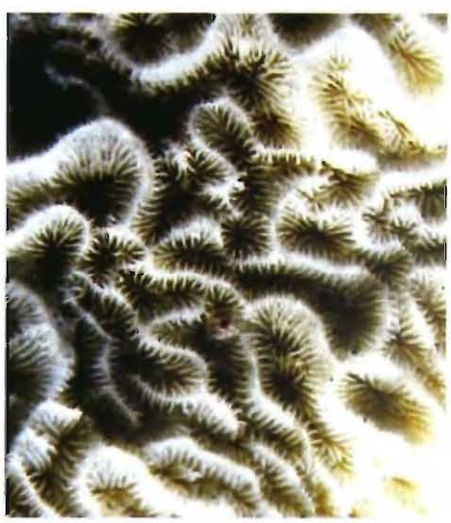
1973. *Pavona decussata* Pillai & Scheer, *Zool. Jahrb. Abt. Syst. Oekol. Georg. Tiere.* **100**, 466-76.

Characters : Colonies are thick, interconnecting, bifacial upright laminae, or submassive, with or without lobed horizontal margins and upright laminae. Corallites are irregular, deep-seated, sometimes aligned parallel margins or to radiating ridges. Colonies are usually brown, creamy yellow or greenish in colour.

Distribution : In India it is recorded from Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely reported from Red Sea east to Samoa, Great Barrier Reef, Elizabeth and Middleton Reefs in the east and south to Houtman Abrolhos on the west coast of Australia.

Remarks : It is very distinctive and common. It is present in most environments.

99. ***Pavona venosa*** (Ehrenberg, 1834)



1834. *Polyastra venosa* Ehrenberg, *Abl. Akad. Wiss. DDR* 1832, 250-380.

1936a. *Pavona (Polyastra) venosa* (Ehrenberg) Wells, *Ann. Mag. Nat. Hist. Ser.* 10, 18, 549-52, pl. 9-10.

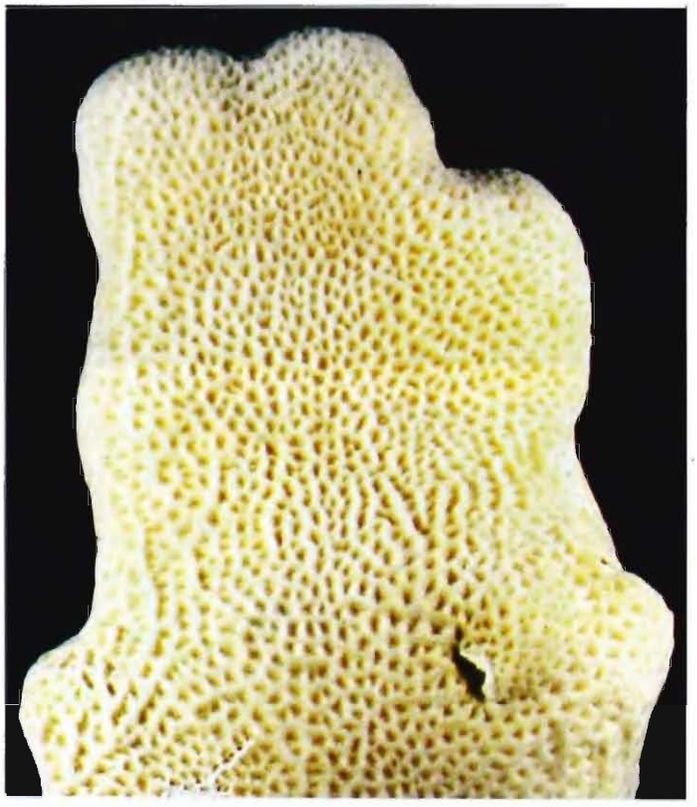
1936a. *Pavona (Polyastra) obtusata* (Quelch) Wells, *Ann. Mag. Nat. Hist. Ser.* 10, 18, 549-52, pl. 9-10.

Characters : Colonies are massive or columnar to encrusting. Corallites are nearly subcerioid or are in short valleys with acute walls (collines). Septo-costae are generally in three orders, widely spaced, and even in height. Columellae are poorly developed or absent. Colonies are yellow-brown or pinkish-brown in colour, sometimes mottled.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is widely distributed from Red Sea, Celebes, Indonesia, Marshall Islands and the Great Barrier Reef.

Remarks : Similar to *P. varians* which has less developed collines and usually 2 orders of septa. Mostly found on shallow reef environments.

100. ***Pavona clavus*** (Dana, 1846)



1846. *Agaricia clavus* Dana, *U.S. Exploring Expedition 1838-1842*, **7**.

1907. *Pavona duerdeni* Vaughan, *U. S. Natl. Mus. Bull.* **59** (9), 1-427, pl. 1-96.

1974. *Pavona clavus* Scheer & Pillai, On a collection of Scleractinia from the Strait of Malacca. *In*: Proceedings of the *Second International Symposium on coral Reefs. Great Barrier Reef Comm., Brisbane*, **1**, 445-64.

Characters : Colonies are mostly columnar, columns up to 10 cm thick. Columns divide but do not anastomose. Corallites small, 2.5-3.5 mm diameter – thick-walled and irregularly aligned or in short valleys. Columellae are short or absent. The colonies are uniform pale grey, cream or brown in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Globally, it is distributed throughout the tropical Pacific from the Red Sea and the Mascaren Archipelago in the west of Marshall Islands, Fiji and Hawaii in the east and the Great Barrier Reef.

Remarks : The corallites are similar to *Pavona minuta*. Occurs commonly in habitats exposed to currents.

101. ***Pavona duerdeni*** Vaughan, 1907

1907. *Pavona duerdeni* Vaughan, *U.S. National Mus. Bull.* **59** : 427 pp.

Characters : Massive colonies sometimes divided into irregular ridges. Very dense skeleton. Small corallites give the colony a smooth appearance. Septo-costae are strongly alternate.

Distribution : It is recorded only in Andaman

and Nicobar Islands. Worldwide, it is distributed from Madagascar to east of west of South America.

Remarks : Previously it is reported as *P. minuta* by Scheer and Pillai (1974). Corallites resemble *P. clavus* but are smaller with more exsert primary septo-costae. Occur in most reef environments and forms large colonies of horizontal shallow substrates.

102. ***Pavona minuta*** (Wells, 1954)

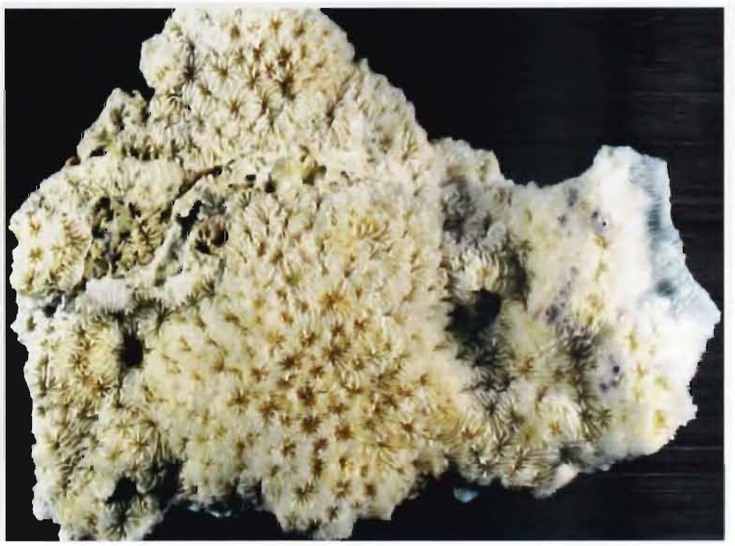
1954. *Pavona minuta* Wells, *U.S. Geol. Survey. Professional Papers* **260** : 384-486.

1974. *Pavona xarifae* Scheer & Pillai, On a collection of Scleractinia from the Strait of Malacca. *In* 'Proceedings of the Second International Symposium on coral Reefs.' Great Barrier Reef Comm., Brisbane, **1**, 445-64.

Characters : Colonies are submassive or encrusting with thin margins. Colony has a smooth surface due to the small, widely spaced corallites (2-3 mm diameter). Corallites walls are thick (because of wedge shaped septa). Colonies are dark green, brown or brownish-green.

Distribution : It is recorded in India only from Andaman and Nicobar Islands. Elsewhere, it is reported in the East Indian Ocean Sri Lanka, South East Asia, Great Barrier Reef and the Pacific.

Remarks : *P. minuta* has more regular calices with fewer, more regular and exsert septa and well developed columellae than *P. clavus*. Mostly available in shallow reef areas.



Genus ***Leptoseris*** Milne Edwards and Haime, 1849

There are 15 species of *Leptoseris*, of which two are recorded from the Andaman and Nicobar Islands.

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.

103. ***Leptoseris papyracea*** (Dana, 1846)

1846. *Pavona papyracea* Dana, *U.S. Exploring Expedition* 1838-1842, **7** : 1-740, pl. 1-61.

1864. *Leptoseris papyracea* (Dana) Verrill, *Bull. Mus. Comp. Zool. Harv. Univ.* **1**, 29-60.

1971. *Leptoseris zamboi* Nemenzo, *Nat. Appl. Sci. Bull.* **23** (3), 142-85, pl. 1-12.

Characters : Colonies are delicate, unifacial, contorted and with irregularly divided fronds, each frond with a few corallites. The colonies are pale-brown on upper surface and white undersurface.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Globally, it is distributed from Madagascar and the Amirante Islands, east to Hawaii and possibly the far eastern Pacific and the Great Barrier Reef.

Remarks : Mostly found on inter-reef areas on soft horizontal substrates where there is little sediment movement, but occasionally occurs in shallow habitats between the branches of other corals.

104. ***Leptoseris hawaiensis*** Vaughan, 1907

1907. *Leptoseris hawaiensis* Vaughan, *U.S. natl. Mus. Bull.* **59** (9), 1-427, pl. 1-96.

Characters : Colonies are encrusting laminae or funnel shaped. Corallites are small, deep and rounded, irregularly distributed and slightly inclined towards the perimeter. Septo-costae are even, giving the coenosteum a smooth appearance. Colonies are brown or green in colour, usually mottled.

Distribution : In India it is recorded from the Andaman and Nicobar Islands. Globally, it is distributed from the Mascarene Archipelago in the west, Indonesia, Palau, the Marshall Islands and Hawaii in the east.

Remarks : Usually found on vertical or overhanging walls.

Genus ***Coeloseris*** Vaughan, 1918

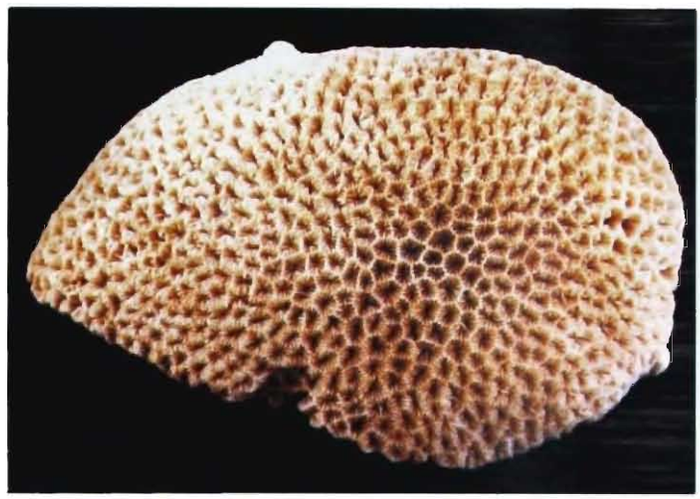
This is a monospecific and well-defined genus. Superficially it looks like a faviid, (especially *Goniastrea* and *Leptastrea),* and it is closely related to *Pavona.*

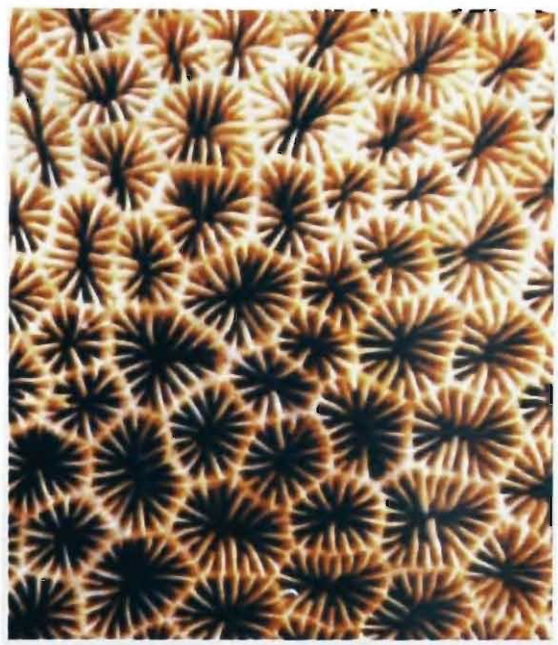
Characters : Colonies are massive either rounded or hillocky. Coralla are cerioid with colonies formed by monostomodaeal budding. Columellae are absent and the axial space is open. It has *Pavona* – like, neatly arranged septo-costae, which join, at the top of the walls. Polyps are extended only at night.

105. ***Coeloseris mayeri*** Vaughan, 1918

1918. *Coeloseris mayeri* Vaughan, *Pap. Dep. Mar. Biol. Carnegie Inst. Wash.* **9** (Publ. ZSI), 51-234, pl.20-93. 1975b *Xishasiderastrea granulata* Zou, *Stud. Mar. Sin.* 10, 61-4, pl. 1.

Characters : Colonies are massive either rounded or hillocky. Corallites are cerioid, without columellae and with *Pavona* like septo-costae. Polyps are extended only at night. Colonies are





usually pale green, yellow or brown with darker calices in colour.

Distribution : In India, it is recorded only from the Andaman and Nicobar Islands. Globally, it is distributed from the Great Barrier Reef and Elizabeth and Middleton Reefs in east, and Rowley Shoals and Scoot Reef on the west coast.

Remarks : *Coeloseris* is a well-defined genus closer to *Pavona*. Superficially it looks like a faviid, especially *Leptastrea*. Usually found on flat substrates.

Genus ***Gardineroseris*** Scheer and Pillai, 1974

It is a monospecific genus. In India it is reported from Lakshadweep and Andaman and Nicobar Islands.

Characters : 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.

106. ***Gardineroseris planulata*** (Dana, 1846)

1846. *Agaricia planulata* Dana, U.S. Exploring Expedition 1838-1842, 7, 1-740, pl. 1-61.

1905. *Agaricia ponderosa* Gardiner, In Fauna and geography of the Maldives and Laccadives Archipelagoes, *Cambridge*, 2, 756-90, pl. 89-93.

1974. *Gardineroseris ponderosa* (Gardiner) Scheer & Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. 42 (122), 1-75, pl. 1-33.

Characters : 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. Columella are present and septo-costae are fine and even. Polyps are rarely extended. Colonies are purple-grey, sometimes brown or yellow in colour.

Distribution : It is reported from Lakshadweep and Andaman and Nicobar Islands. Widely distributed from the Red Sea, throughout the tropical Indo-Pacific and east to the Marshall Islands.

Remarks : Usually uncommon, occurs on walls or under overhangs in clear water.

Genus ***Pachyseris*** Milne Edwards and Haime, 1849

Pachyseris is a well-defined genus. There are five species of *Pachyseris* reported from the world of which three are recorded from India.

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. Extended polyps have never been observed.

107. ***Pachyseris rugosa*** (Lamarck, 1801)

1816. *Agaricia rugosa* Lamarck, *Systema des animalae sars vertebres, Paris*, 2 : p. 240.

1974. *Pachyseris rugosa* Scheer & Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. 42 (122), 1-75, pl. 1-33.

Characters : Colonies consist of upright irregular, usually contorted, anastomosing bifacial plates. Columellae are wall-like lobes. Colonies are deep bluish-grey or brown in colour.

Distribution : In India, it is recorded from the Gulf of Mannar and Palk Bay and Andaman and

Nicobar Islands. Globally, it is distributed throughout the Indo-Pacific from the Red sea to the Caroline and Marshall Islands, Samoa and the Great Barrier Reef in the east, and south Houtman Abrolhos Islands on the west coast of Australia.

Remarks : It is similar to *P. speciosa*. Commonly occur as large mound-shaped colonies in shallow water but smaller colonies occur in a wide range of habitats including those exposed to strong wave action.

108. ***Pachyseris speciosa*** (Dana, 1846)

1846. *Agaricia speciosa* Dana, *U.S. Exploring Expedition* 1838-1842, **7**. 1-740, pl. 1-61

1951a. *Pachyseris speciosa* (Dana) Edwards & Haime, *Ann. Sci. Nat. Zool. 3e. Ser.*, **15**, 73-144.

1974. *Pachyseris speciosa* Scheer & Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. **42**(122), 1-75, pl. 1-33.

Characters : Colonies are unifacial laminae, usually horizontal, and may develop upright ridges or columns. More than one rows of corallites may occur between ridges. Columellae are absent. Colonies are pale brown to deep grey in colour.

Distribution : In India, it is recorded from Andaman and Nicobar Islands. Globally, it is distributed throughout the tropical Indo-Pacific from the Red Sea to the Marshall Islands, Samoa and Tahiti and the Great Barrier Reef, Coral Sea in the east, south to Houtman Abrolhos Islands on the west coast of Australia.

Remarks : It is similar to *P. rugosa*, readily distinguished by its growth and the presence of columellae. Also resembles *P. gemmae*. It occurs in all reef habitats but most common on lower reef slopes.

109. ***Pachyseris gemmae*** Nemenzo, 1955

1955. *Pachyseris gemmae* Nemenzo, *Nat Appl Sci Bull univ Philippines* **15** : 3-84.

Characters : 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. Colonies are wavy. Columellae are wall-like and clearly fused with the septo-costae.

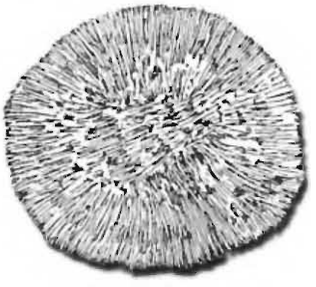
Distribution : It is recorded only from Andaman and Nicobar Islands. Elsewhere, it reported from South East Asia and Paupa New Guinea.

Remarks : May resemble tiered forms of *Pachyseris speciosa*. Occur in semiprotected reef area.

Family **FUNGIIDAE** Dana, 1846

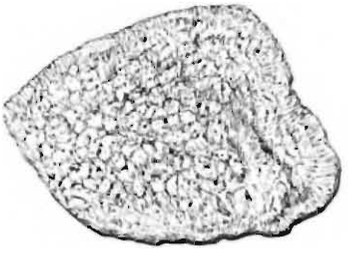
Solitary or colonial, free-living or attached, mostly hermatypic and extant. Colonial genera are derived from solitary genera and each has septo-costal structures corresponding to those of a solitary genus. These septo-costae radiate from the mouth on the upper surface as septa and from the centre of the undersurface as costae. The fungiidae includes 11 extant genera: *Cycloseris, Diaseris, Fungia, Ctenactis, Herpolitha, Polyphyllia, Halomitra, Sandalolitha, Lithophyllon, Podabacia* and *Zoophilus*. Except *Zoophilus* all the other ten genera are reported in India.

Cycloseris cyclolites



Halomitra pileus

Fungia paumotensis



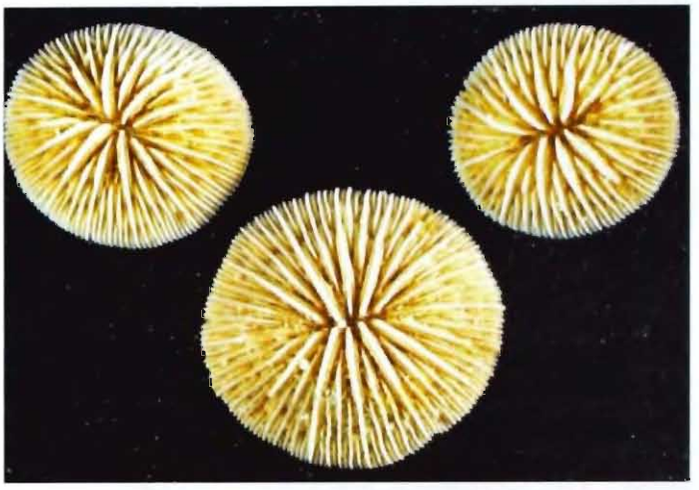
Podabacia crustacea

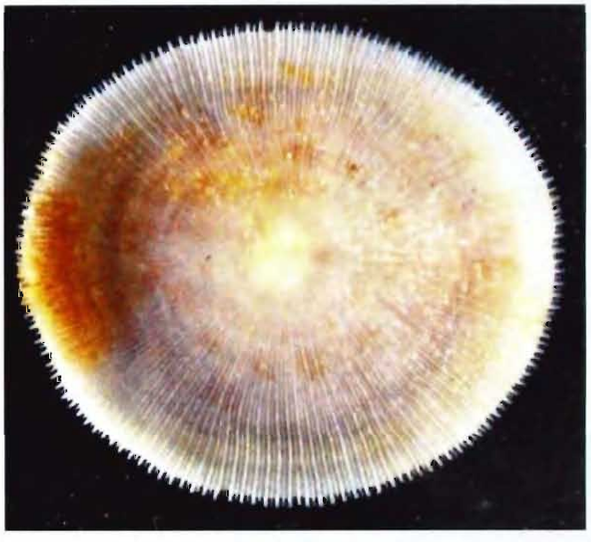
Genus ***Cycloseris*** Milne Edwards and Haime, 1849

Eleven species are reported from the world, of which six species are recorded in India.

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.

110. ***Cycloseris cyclolites*** (Lamarck, 1801)





1801. *Fungia cyclolites* Lamarck, *Systeme des animaux vertebras*. Paris. 1-432.

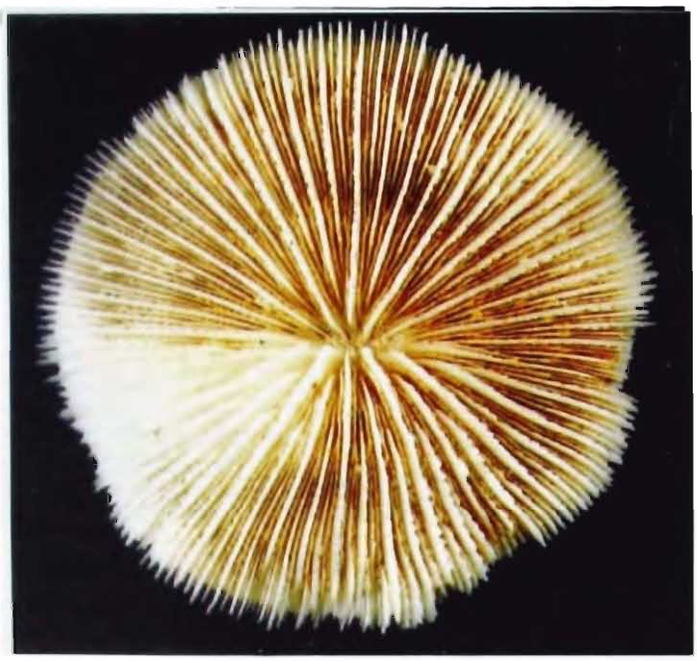
1974. *Cycloseris cyclolites* (Lamarck) Scheer and Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. **42** (122), 1-75, pl. 1-33.

Characters : Corals are circular domes up to 40 mm in diameter with a concave undersurface. Septa are straight and symmetrical. Primary septa are thick and exsert around the mouth. Usually it is pale cream or greenish in colour.

Distribution : In India it is reported in Gulf of Mannar and Palk bay and Andaman and Nicobar Islands. Elsewhere, it is distributed from the Red Sea, Sri Lanka, Indonesia, Philippines, the Great Barrier Reef, New Britain, Japan and Palau.

Remarks : It is similar to *C. costulata*, but *C. cyclolites* is very distinctive. Mostly occur in soft inter reef and sometimes on reef substrates.

111. ***Cycloseris Costulata*** (Ortmann, 1889)



1889. *Fungia costulata* Ortmann, Beobachtungen an Steinkorallen von der Surdkuste Ceylons. *Zool. Jahrb. Abt. Syst. Geogr. Biol. Tiere.* **4**, 493-590, pl. 11-18.

1976. *Cycloseris costulata* Pillai and Scheer, Report on the stony corals from the Maldive Archipelago. Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.)* **43** (126), 1-83, pl. 1-32.

Characters : Corals are circular, helmet shaped, up to 76 mm in diameter with a concave under surface. Primary septa are thick and exsert around the mouth. Usually it is pale cream or brown in colour.

Distributions : In India it is reported only from Andaman and Nicobar Islands. Worldwide, it is recorded from Maldives, Sri Lanka, the Great Barrier Reef, Bismarck Archipelago and Palau.

Remarks : This species similar to *C. cyclolites*. Usually occur in soft inter-reef and sometimes reef substrates.

112. ***Cycloseris hexagonalis*** Milne Edwards and haime, 1848

1848. *Fungia hexagonalis* Edwards and Haime, Recherches sur les polypiers. Mem. 1. Observations sur la structure et le development des polypiers en general. *Ann. Sci. Nat. Zooi. 3e Ser.* **9** : 37-89, pls. 4-6.

Characters : Polyps are flat, with a slight central dome around the mouth. Septa are not thickened or exsert around the mouth. Small corals have an angular outline that becomes irregular when fully grown. It reaches little over 90 millimetres in diameter. Septa are thick and unequal. Tentacular lobes are absent. Costae are fine and only developed towards the polyp perimeter.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide, it is reported from Sri Lanka to Coral Sea except the Great Barrier Reef.

Remarks : It is similar to *C. sinensis*, which has a longer mouth, less exsert primary septa and a more uniform shape. Occur in soft-inter reef substrates.

113. ***Cycloseris patelliformis*** (Boschma, 1923)

1923. *Fungia patelliformis* Boschma, Knospung und Verwandte Erscheinungen bei Fungia fungites and Fungia actiniformis. Treubia **3**, 149-79.

Characters : It is circular, or very lightly elongate, upto 7 cm maximum diameter. The undersurface is flat or slightly concave. The upper surface is flat, except around the axial fossa, where septa of the lower orders are strongly arched. It usually has very thin perimeters.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from the Indonesia, the Philippines, the Great Barrier Reef and Samoa.

Remarks : It has been found only on soft, sandy to muddy substrates. Usually occur in the soft-inter reef substrates.

114. *Cycloseris sinensis* Milne Edwards and Haime, 1849

1849. *Cycloseris sinensis* Edwards and haime, Memoire sur les polypiers apartment a la famille des oculinides, au groupe intermediaire des Pseudoastreides et a la famille des Fongides. *C.R. Hebd. Seances Acad. Sci.* **29** : 67-73.

Characters : Polyps are flat, circular or irregular in outline. There is little or no central dome. The central fossa is deep. Septa are thick, tightly packed and even, giving the oral disc a smooth appearance. Long and short septa clearly alternate.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Elsewhere, it is reported from Maldives, South Africa, Indonesia, Philippines, Great Barrier Reef and Coral Sea.

Remarks : Large *Cycloseris hexagonalis* are similar if the hexagonal pattern is not discernible. Septa are similar to those of *Diaseris distorta*. Usually occur in soft inter-reef substrates.

115. *Cycloseris somervillei* (Gardiner, 1909)

1909. *Fungia somervillei Gardiner, Trans. Linn. Soc. Lond. Zool. Ser* (2) **12** : 257-90, pl. 33-39.

1972. *Cycloseris somervillei* (Gardiner); Pillai, *Symp. Mar. Biol. Assoc. India. 5*, 191-216.

Characters : This single specimen of this species in the present collection is oval in shape. Septa are numerous and thin, except toward the centre, where those of the lower orders increase in thickness. Septal margins bear small, regular, triangular dentations, which correspond to vertical rows of small granules on the septal sides. The axial fossa is narrow and elongate. The columella is well developed and delicately spongiose. Costae are thin, slightly wavy towards the centre of the corallum and slightly alternate towards the perimeter where three orders can be recognised. On the rest of the under surface, they are equal or sub-equal.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely it is distributed from Seychelles, Amirante and Sulu Islands, the Great Barrier Reef and Fiji.

Remarks : It is similar to *F. horrida*. Mostly found on the soft inter-reef substrates and lower reef slopes protected from wave action.

Genus *Diaseris* Edwards and Haime, 1849

Out of two species reported from the world, only one is recorded in India.

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 resembles only *Cycloseris*. *Diaseris* is usually found in non-reef habitats. Like *Cycloseris*, *Diaseries* is found in non-reef habitats (usually inter-reef or seagrass) and thus distribution records are likely to be incomplete. The asexual reproductive capacity of *Diaseries* by autotomy is greater than that of any other coral, and can occur so frequently that individuals become small and so numerous that they cover the substrate in a living layer.

116. *Diaseris distorta* (Michelin, 1843)

1843. *Fungia distorta* Michelin, description d'une nouvelle espece de caryophyllie. *Rev. Mag. Zool. Ser.* 2, 3, 238-9, pl. 1.

Characters : Polyps consist of fan-shaped segments up to 40 mm wide. Thick beaded septa are of unequal in height. Polyps are commonly inflated by water to several times the volume of the skeleton.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Worldwide, it is reported from Madagascar to Hawaii Islands.

Remarks : Occur in soft substrates, especially where exposed to currents. Sometimes found in seagrass beds.

Genus ***Fungia*** Lamarck, 1801

Eighteen species recorded from the world, of which seven are reported from India.

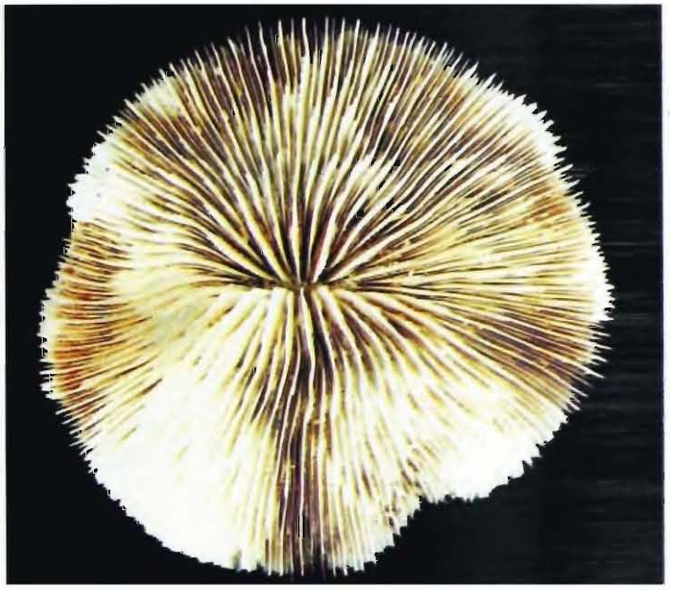
Characters : Corals are solitary, free-living (except for juveniles), flat or dome-shaped, circular or elongate in outline, with a central mouth. Septa have large or small, rounded or pointed teeth; costae consist mostly of rows of spines. The disc often has pits between the costae on the lower surface. Polyps are usually extended only at night and have short widely spaced tentacles. *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.

117. ***Fungia corona*** Doderlein, 1901

1901. *Fungia corona* Doderlin, Die Korallengattung *Fungia*. *Zool. Ans.* **24**, 351-60.

1924. *Fungia corona* Matthai, *Mem. Indian Mus.* **8**, 1-59, pl. 1-11.

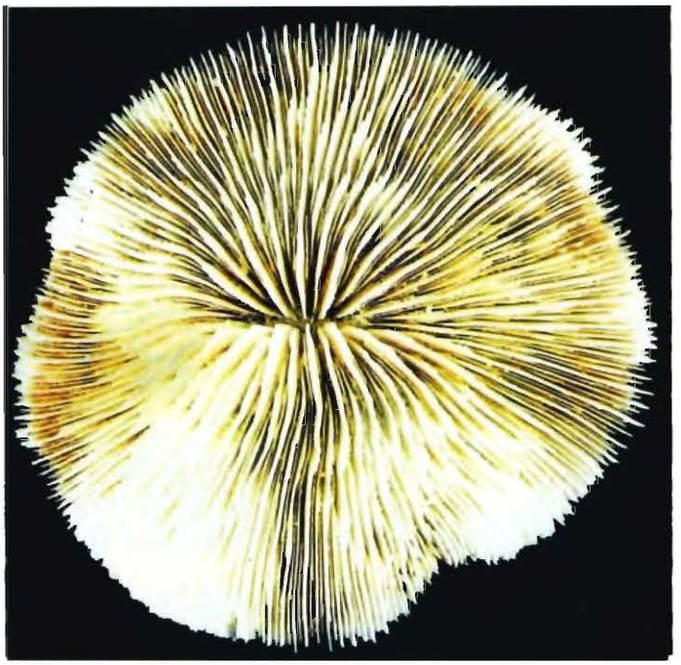
Characters : Polyps have an irregular outline, flat to strongly convex, thin and light. Septa are of different sizes and have large pointed teeth. Tentacular lobes are weakly developed. Costae are widely spaced, the larger having simple spines. The undersurface has pits between the costae.



Distribution : In India it is recorded only from Andaman and Nicobar Islands. Elsewhere, it is reported from Red Sea, Somalia coast, Maldives, Srilanka, Indonesia, Philippines and Great Barrier Reef.

Remarks : It is similar to *F. danai*. Commonly occur in reef slopes and lagoons of Andaman and Nicobar Islands.

118. *Fungia horrida* Dana, 1846



1846. *Fungia horrida* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 327, pl. 22, fig. 4.

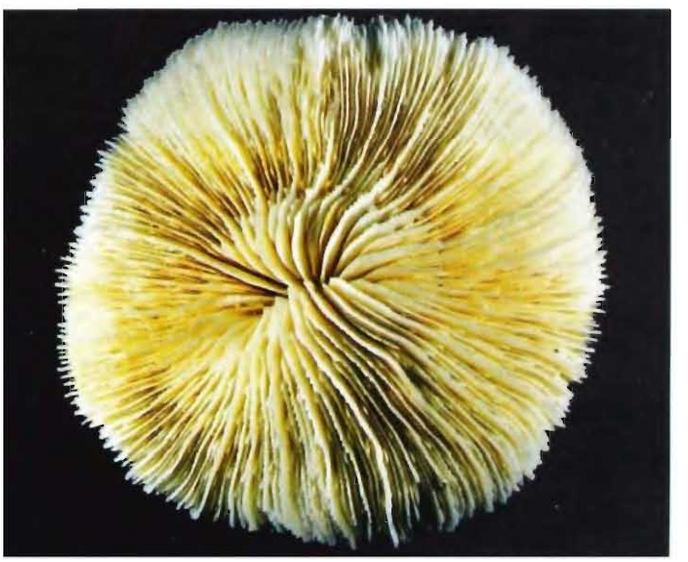
1964. *Fungia horrida* Pichon, *Mars. Fas. Hors Ser. Suppl.* **2**, 78-203.

Characters : Corals are circular, upto 200 mm in diameter, with a strong central arch. Septa have large irregular teeth. Costae are very unequal, with long spines. There are no pits between the costae. The living coral is brown in colour.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Widely distributed from the Red Sea, Zanzibar, Madagascar, Moluccas, Philippines and the Great Barrier Reef, Fiji and Tahiti.

Remarks : This species is similar to *F. corona*. Mostly occurs in reef slopes and lagoons of Andaman and Nicobar Islands.

119. ***Fungia danai*** Milne Edwards and Haime, 1851



1851. *Fungia danai* Milne Edwards and Haime, *Ann. Sci. Nat. Zool.* 3e Ser., **15** : 73-144.

1976. *Fungia danai* Pillai & Scheer, Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.).* **43** (126), 1-83, pl. 1-32.

Characters : Corals are circular, upto 300 mm in diameter, not heavily calicified. Septal teeth are very prominent. Costae are compact, with branching spines of different sizes on different orders. The undersurface has pits between the costae. The living corals are usually brown, sometimes mottles in colour.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely distributed from tropical Indo-Pacific from Madagascar to Tahiti and the Taumato Archipelago.

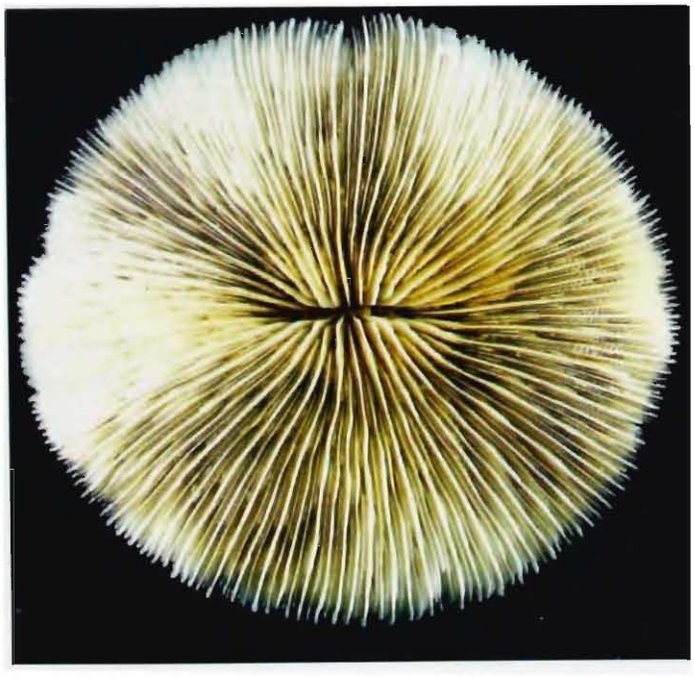
Remarks : This species is similar to *F. corona* and *F. fungites*. Usually occur in reef slopes and lagoons.

120. ***Fungia fungities*** (Linnaeus, 1758)

1758. *Madrepora fungites* Linnaeus, *Systema naturae I Regnum animale*, Ed. X.

1901. *Fungia fungities* (Linnaeus) Doderlein, *Abh. Senckenb. Naturforsch. Ges.* **27**, 1-162, pl. 1-25.

1976. *Fungia fungities* Pillai & Scheer, Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.).* **43** (126), 1-83, pl. 1-32.



Characters : Corals are circular or subcircular up to 280 mm in diameter. Septal teeth are triangular, pointed; costal spines are tall, smooth and conical. The living coral is brown, sometimes mottled in colour.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific.

Remarks : *F. danai is* sometimes confused with *F. fungites*. Usually occur in reef slopes and lagoon.

121. ***Fungia repanda*** Dana, 1846

1846. *Fungia repanda* Dana, U.S. Exploring Expedition 1838-1842, 7, p. 327, pl. 22, fig.4.

1966. *Fungia repanda* Wells, *Symp. Zool. Soc. Lond.* **16**, 223-46, 1 pl.

Characters : Corals are circular, up to 30 cm in diameter, thick, flat or strongly arched. Septal teeth are fine but clearly visible, coral spines are granular. The undersurface has pits between the costae. The living corals are brown in colour.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Widely distributed from the Indo-Pacific from the Red Sea and southwest Indian Ocean, to souteast Taumotu Archipelago and Great Barrier Reef.

Remarks : This species is similar to *F. fungites.* Commonly occur in reef slopes and lagoons of Andaman and Nicobar Islands.

122. ***Fungia scutaria*** Lamarck, 1801

1801. *Fungia scutaria* Lamarck, *Systema des animalae sars vertebres, Paris*, **2** : p. 1-568.

1976. *Fungia scutaria* Pillai & Scheer, *Results of the Xarifa Expedition* 1957/58. *Zoologica (Stuttg.).* **43** (126), 1-83, pl. 1-32.

Characters : Corals are oval, thick and heavy, up to 170 mm long, primary septa are inserted with a tall tentacular lobe and these are distributed at regular intervals from the mouth to the perimeter. The living corals are usually brown or yellow, often with bright green in tentacular lobes.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is widely distributed from western Indian Ocean (Red Sea to South Africa) and the Pacific, from Japan and the Great Barrier Reef, eastward to Hawaii and the Taumotu Archipelago.

Remarks : This species is similar to *F. paumotensis* but they differ in the presence of a strong central arch as in the case of *F. paumotensis.* Mostly found on the reef slopes exposed to strong wave action.

123. ***Fungia paumotensis*** Stutchbury, 1833

1833. *Fungia paumotensis* Stutchbury, *Fungia. Trans. Linn. Soc. Land.*, **16** : 493-7.

1974. *Fungia paumotensis* Scheer & Pillai, *Results of the Xarifa Expedition 1957/58. Zoologica (Stuttg.).* **43** (126), 1- 83, pl. 1-32.

Characters : Corals are elongate, upto 250 mm long with almost parallel sides, and thick and heavy, usually with a strong central arch. Most primary septa extend from the mouth to the perimeter. There are no attachment scars except on immature specimens. The living corals are brown in colour.

Distribution : In India it is recorded from Andaman and Nicobar Islands. It is widely distributed from Red Sea and Madagascar, east from the Clebes and japan to the Tauamotu Archipelago in the Pacific, also recorded by Quelch from Hawaii.

Remarks : It is similar to *F. scutaria*. Mostly occur in reef slopes and lagoons of Andaman and Nicobar Islands.

Genus ***Ctenactis*** Verrill, 1864

Three species are recorded in the world, of which only two are reported from India.

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*.

124. ***Ctenactis echinata*** (Pallas, 1766)

1766. *Madrepora echinata* Pallas, *Elenchus Zoophytorum Den Haag*. 1-451.

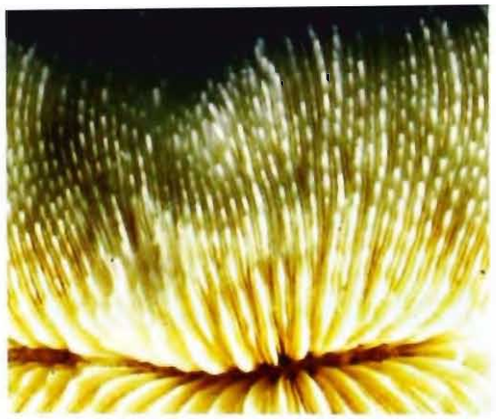
1974. *Fungia echinata* Scheer and Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.).* **42** (122), 1-75, pl. 1-33.

Characters : Adults are free-living. They are usually monostomatous. The coralla are thick and vary from flat to highly arched. Polyps are elongate. Septal teeth and costal spines are both strongly developed. The septal edges along the sides of the groove stand upright whereas those at its ends diverge away from it. The septa are densely packed and either straight or slightly bending. The septa of low order cycles are thick and solid, those of higher orders thin and usually perforated. The corallum wall is perforated and covered by granulations. Only a single mouth is present.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Elsewhere, it is recorded from Red Sea, Maldives, Western Australia, Indo Malayan region, Japan and New Caledonia.

Remarks : It is similar to *C. crassa*, which has a series of mouths along the axial furrow. The living animals are brown, sometimes with patches of lighter colour. It occurs in reef slopes and lagoons.

125. ***Ctenactis crassa*** (Gardiner, 1905)



1905. *Herpolitha simplex* Gardiner, In Fauna and geography of the Maldives and Laccadives Archipelagoes, *Cambridge*, **2**, 933-57, pl. 89-93.

1966. *Herpetoglossa simplex* (Gardiner) Wells, *Symp. Zool. Soc. Lond.* **16**, 223-46, 1 pl.

Characters : Adults are free living. Polyps are elongate, with an axial furrow extending almost to the polyp end. Several mouths are arranged along the axial furrow but do not occur outside the furrow. The septa are very densely packed and straight. The septa of lower orders are thick and solid, those of higher orders thin and perforated. Tentacular lobes are absent. The septal margins are coarsely ornamented with irregularly angular dentations. The corallum wall is perforated and covered with granulations. The coastae are almost equal in size; they are straight and distinct near the corallum margin, but less distinct near the center.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Elsewhere, it is reported from Red Sea, Maldives, Cocos-Keeling, Indo-Malayan, South Japan, Marshall Islands, Eastern Australia and New Calidonia.

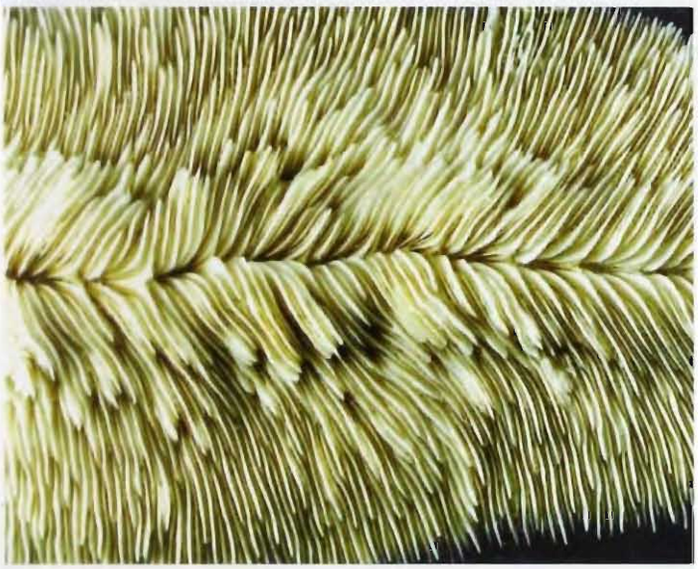
Remarks : It is similar to *C. echinata*, which has a single mouth. The colour of the living animal usually varies between brown and ochre. The juvenile specimens are usually ochre with a pink outline.

Genus ***Herpolitha*** Eschscholtz, 1825

Two species are reported from the world, of which one species is recorded from India.

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 septal and costal ornamentations are fine. 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. In India it is reported from the reefs of Andaman and Nicobar Islands.

126. ***Herpolitha limax*** (Houttuyn, 1772)



1772. *Madrepora limax* Houttuyn, *Trans. R. Soc. S. Aust.*, **33** : 242-52, pl. 16.

1825. *Herpolitha limax* Houttuyn, Escholtz, *Isis (Jena)* **6**, 734-47, pl. 5.

Characters : Colonies are elongated with rounded ends. Secondary centres are numerous. Few primary septa extend from the axial furrow to the perimeter. Some colonies develop forked axial furrows and become Y, T or X shaped. The septa are densely packed and straight. Interstomatous septa are situated in between the central axis and the newly formed lateral stomata. The septa of lower order cycles are thick and solid, those of higher orders thin and perforated. The septa are alternate in height, those of lower orders being more protruding than those of higher orders. Tentacular lobes are absent. The corallum wall is perforated. It is not covered with granulations. The costae are straight and almost equal in size. The living coral is pale or brown or greenish-brown in colour.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific, from northern Red Sea and Mozambique to Japan and eastern Taumotu Archipelago, and the Great Barrier Reef.

Remarks : The living animals are brown in colour. The small tentacles are translucent and colourless; less frequently, they are either white or green.

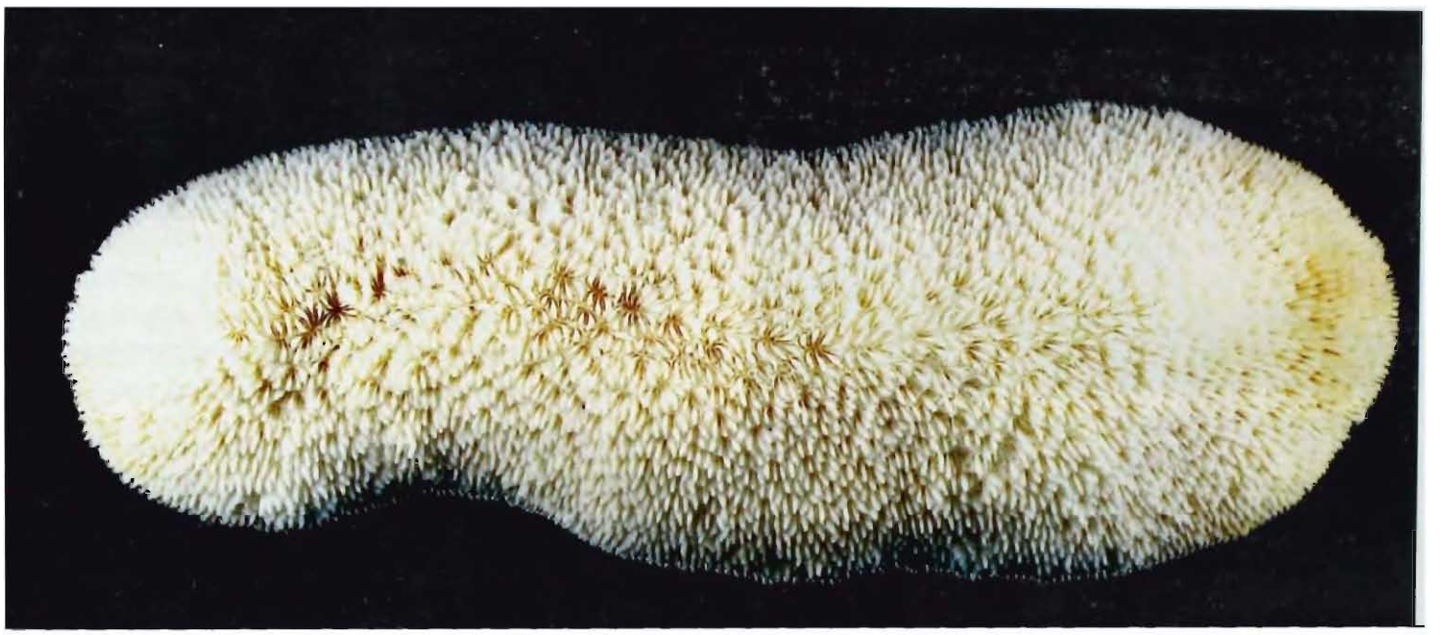
Genus ***Polyphyllia*** Quoy and Gaimard, 1833

Two species are recorded in the world, of which one species is reported from India.

Coralla are polystomatous, concavo-convex, 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. Polyps are usually extended during the day. Tentacles are long and numerous. In India it is reported from the reefs of Andaman and Nicobar Islands.

127. ***Polyphyllia talpina*** (Lamarck, 1801)

1801. *Fungia talpina* Lamarck, *Systema des animalae sars vertebres, Paris*, **2** : p. 1-568.



1909. *Polyphyllia talpina* (Lamarck); Gardiner, *Trans. Linn. Soc. Lond. Zool. Ser.* **2**, 12, 257-90, pl. 33-39.

Characters : Adults are free-living, elongated, with an axial furrow that may become indistinct. Centres are evenly distributed over the upper surface. The interstomatous septa are short because of the high density of the stomata. The septa are densely packed, straight and have unequal thickness and height. The septa of lower orders are thick and solid; those of higher orders are thin and usually perforated. The septa of lower orders are more exsert than those of higher orders. Tentacular lobes are absent. Primary septa are short, elliptical or petaloid, secondary septa usually fuse around the primaries to form a fused background matrix. The septal sides are thinly and irregularly covered by granulations. The lateral seconday stomata are usually indistinct compared to the stomata in the axial furrow. The columellae are poorly developed; they are either rudimentary or formed by some partly fused indistinct paliform lobes and trabeculae. Polyps are usually extended during the day. Tentacles are long and numerous. The living colonies are grey, greenish or cream in colour with white tentacle tips.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. It is widely distributed from Madagascar, Mauritius, Maldives, Indonesia, Philippines, Palau and the Great Barrier Reef, Fiji and Tonga.

Remarks : The living animals are usually grayish-

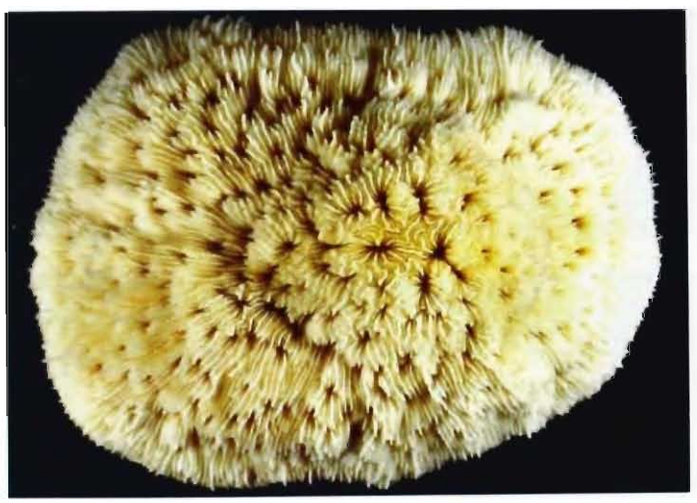
brown. It is densely covered by many tentacles, which usually extended both day and night. They are usually translucent and colourless, although their tips may be white.

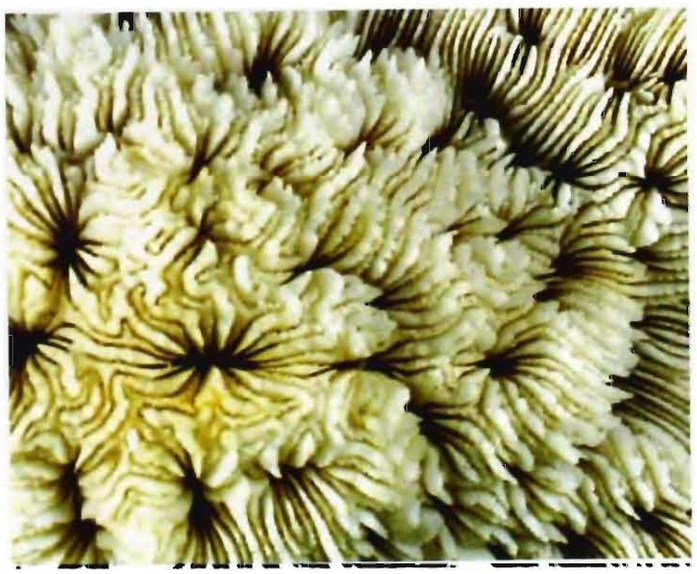
Genus ***Sandalolitha*** (Quelch, 1884)

Three species are recorded from the world, of which one species is reported from India.

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. *Halomitra*, which is of lighter construction with corallites further apart. Only one species is reported from Andaman and Nicobar Islands.

128. ***Sandalolitha robusta*** (Quelch, 1886)





1886. *Podabacia robusta* Quelch, *Rep. Sci. Results Vouyage H.M.S. Challenger Zool.* **16** (3), 1-203, pl. 1-12.

1974. *Sandalolitha robusta* (Quelch), Mergner & Scheer, *In proceedings of the second international symposium on coral reefs.* Great Barrier Reef Comm., Brisbane. **2**, 3-30.

Characters : Colonies are large, free-living, circular to oval, dome-shaped, heavily constructed and without an axial furrow. Corallites are compacted. The septa are densely packed and straight, except around the stomata, where they bend. The septa of lower orders are thicker and more protruding than those of higher orders. The septa are fenestrate; especially higher order septa, which are much perforated. Tentacular lobes are absent. The septal margins are coarsely ornamented with irregularly lobate dentations. The septal sides are thinly to densely granulated. Polyps are extended only at night. Colonies are pale or dark brown, sometimes with purple margins and white centres.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely reported from Maldives, Indonesia, Philippines, Palau, Caroline Islands, Great Barrier Reef, New Cladonia, Fiji, Marshall Islands and Tuamotu Archipelago.

Remarks : The living animal is usually brown, but may alternatively be green or ochre coloured. The small tentacles are usually colourless and translucent ; they are inconspicuous because of their small size.

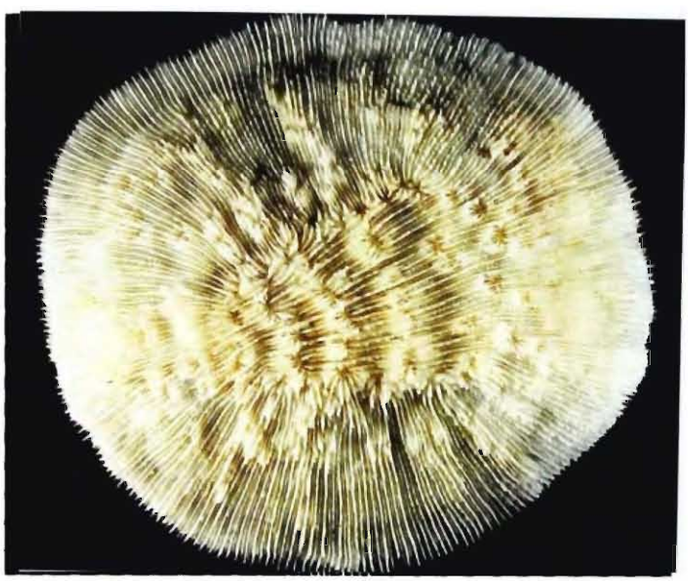
Genus ***Halomitra*** Dana, 1846

Three species are reported from the world, of which one species is recorded from India.

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 costal 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*. Polyps are

extended only at night. Tentacles are small and widely spaced. *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*. Only one species is reported from Andaman waters.

129. ***Halomitra pileus*** (Linnaeus, 1758)



1758. *Madrepora pileus* Linnaeus, *Systema naturae I Regnum animale*, Ed. X.

1846. *Halomitra pileus* (Linnaeus), Dana, *U. S. Exploring. Exped.* 1838-1842. **7**, 1-740, pl. 1-61.

1901. *Halomitra philippinensis* Studer, *Zool. Jahrb. Abt. Syst. Georg. Biol. Tiere.* **14** (5), 388-428, pl. 23-31.

Characters : Colonies are large and free-living, circular, dome or bell shaped, thin and delicate and without an axial furrow. The outline of the coralla varies from irregular circular to slightly oval. Corallites are widely spaced. The septa are loosely packed and straight. The septa of lower orders are thicker and more exert than those of higher orders. Septa of lower orders are solid, whereas those of higher orders may be perforated. All setpa are highest near a mouth, where they support a tentacle. The septal sides are thinly granulated. The granulations are fine. All stomata are distinct. They are unevenly distributed, some of them in pairs as a result of intrastomodeal budding. The primary stoma is usually located at the center, with the secondary stomata around it, but when a corallum regenerates from a fragment the primary stoma is usually lacking. Septo-costae are smililar to those of *Fungia fungites*. Polyps are extended only at night. Tentacles are small and widely spaced. Usually are pale brown, frequently with bright-pink or purple margins in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from Madagascar, Chagos, Maldives Islands, Indonesia, Philippines, Palau, Great Barrier Reef, Fiji and Samoa.

Remarks : *Halomitra* is similar to *Sandalolitha*. The later is of much heavier construction, Corallites are closer together, and septo-costae are more prominent and have the characters of *Fungia (Verrillo fungia)* and *Podabacia*. The animals are usually ochre-like brown with a violet margin. The mouths are white. The small tentacles are translucent and colourless.

Genus ***Lithophyllon*** Rehberg, 1892

Three species are reported from the world, of which one species is recorded from India.

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. The costae are simply granular, cylindrical-conical and granulated or arborescent.

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*. Only one species is reported from Andaman and Nicobar Islands.

130. ***Lithophyllon undulatum*** Rehberg, 1892

1892. *Lithophyllon undulatum* Rehberg, *Abh. Naturwiss. Ver. Hamburg* **12**, 1-50, pl. 1-4.

1971. *Lithophyllon elegans* (van der Horst); Utinomi, *Publ. Seto Mar. Biol. Lab.* **19** (4), 203-29, pl. 10-13.

Characters : Colonies are attached, encrusting or laminar, unifacial. A central corallite is usually distinguishable in small colonies. The septa are loosely packed and straight (except in lobed and folded margins). The septa of low order cycles are thick and solid, those of higher orders thin and perforated. The septa of low orders are more protruding than those of higher orders. Tentacular lobes are absent. The septal margins are finely ornamented with ravel-shaped dentations. The septal sides are thinly granulated. The granulations are irregularly distributed. Septo-costae are similar to *Diaseris*. The stomata are clearly visible. The primary stoma is the largest; the secondary stomata are evenly distributed around it. Polyps are extended only at night. Colonies are usually dull green, grey or brown in colour, sometimes with white margins or white centres.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Widely distributed from Indonesia, Philippines, Japan and the Western Australia.

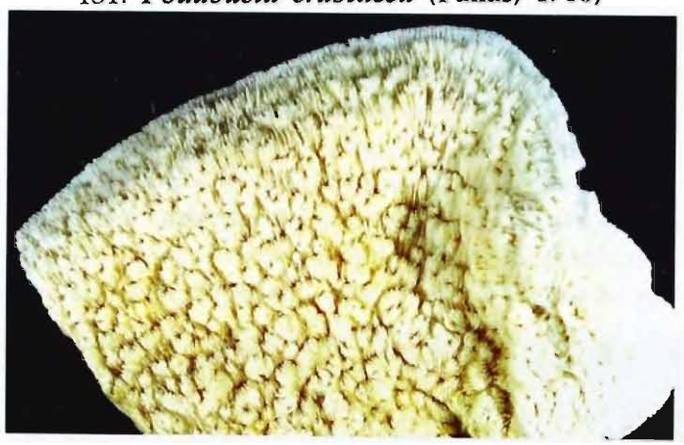
Remarks : *Lithophyllon* is most similar to *Podabacia*. The main colour of the living animal varies from ochre-like yellow to brown. The mouths are grey with white lips. The tentacles are small and transparent; they are either colourless or coloured like the rest of the animal.

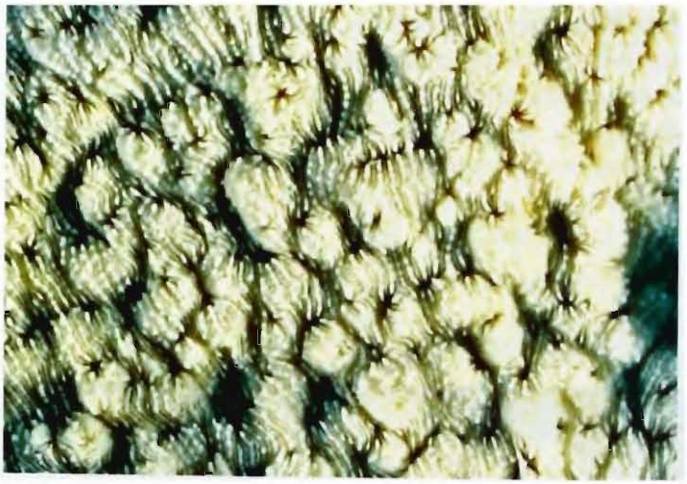
Genus ***Podabacia*** Milne Edwards and Haime, 1849

Four species are recorded from the world, of which one is reported from India.

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. Septo-costae structures are those of *Fungia* (*Verrilofungia*) and *Sandalolitha*. 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. Polyps may be extended day or night. *Podabacia* is most similar to *Lithophyllon*. One species is reported from Lakshadweep and Andaman and Nicobar Islands.

131. ***Podabacia crustacea*** (Pallas, 1766)





1766. *Madrepora crustacea* Pallas, *Elenchus Zoophytorum, Den. Hadd*, 1-451.

1851a. *Podabacia crustacea* Milne Edwards & Haime, *Ann. Sci. Nat. Zool. 3e. Ser.*, **16**, 21-70.

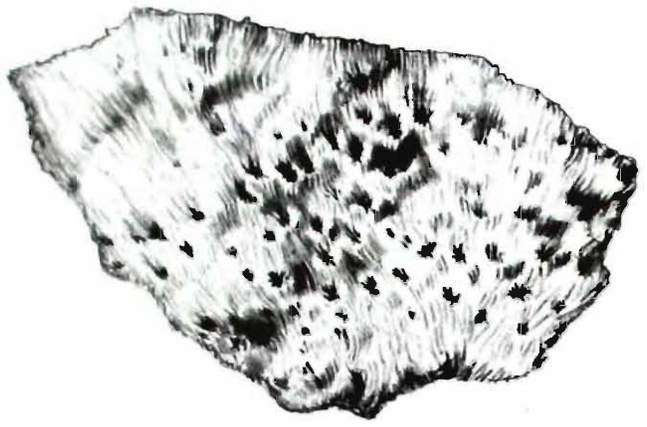
Characters : Colonies are attached, encrusting or laminar, unifacial, upto 1.5 m across. A central corallite is sometimes distinguishable. Septa are short, parallel and run perpendicular to the corallum periphery. The septa densely packed. They are straight between the stomata or may be slightly bent. The septa of lower order cycles are relatively thicker and more exert than those of higher orders. The septa of the lowest orders are either solid or fenestrate; those of highest orders are more perforated. The septal margins are finely ornamented with irregularly granular or slightly lobate dentations. The septal sides are densely granulated. The stomata are distinct despite their small size. The secondary stomata are almost evenly distributed around the larger primary stoma. The corallum wall is perforated and covered by granulations. The costae are more distinct in mature specimens than juvenile ones. They are ornamented with spines, which are either blunt and granular or elongate and echinose. Their extremities bend towards secondary centres, around which they radiate. Septa are spongiose, but never conspicuous. The live coral is dark-coloured, except for the septo-costae, which are cream in colour.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. It is widely distributed throughout the tropical Indo-Pacific, from the Red Sea and Madagascar to Japan, the Marshall Islands and the Taumato Archipelago.

Remarks : *Podabacia* is most similar to *Lithophyllon*. A small piece of corallum may be confused easily with *Sandalolitha robusta*. The living animals are usually light brown or slightly grayish brown. The small tentacles are translucent and colourless.

Family **PECTINIIDAE** Vaughan & Wells, 1943

There is one solitary fossil genus; the remainder is colonial and hermatypic. Colonies are basically laminar, composed of thin plates. Corallite walls



Mycedium elephantotus

Pectinia lactuca

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*. Among which *Echinophyllia*, *Oxypora*, *Mycedium* and *Pectinia* are recorded from India.

Genus ***Echinophyllia*** Klunzinger, 1879

Eight species are recorded in the world of which one species is reported in India.

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. Tentacles are extended only at night.

132. ***Echinophyllia aspera*** (Ellis & Solander, 1786)

1786. *Madrepora aspera* Ellis and Solander, *The natural history of many curious and uncommon zoophytes. London*. **1**, 1-208, pl. 1-63.

1857. *Echinopora aspera* (Ellis & Solander) Edwards & Haime, *Histoire naturelle des Coralliaires*. Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

Characters : Colonies are encrusting laminae. Central parts may be hillocky and submassive, peripheral parts may be contorted or form whorls and tiers. Corallites have toothed rather than beaded costae. There are no paliform lobes.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is reported from Indo-pacific to Coral Sea.

Remarks : It is similar to other laminate forms. This species may be confused with *Oxypora* and also resembles *Mycedium* and the faviid *Echinopora*.

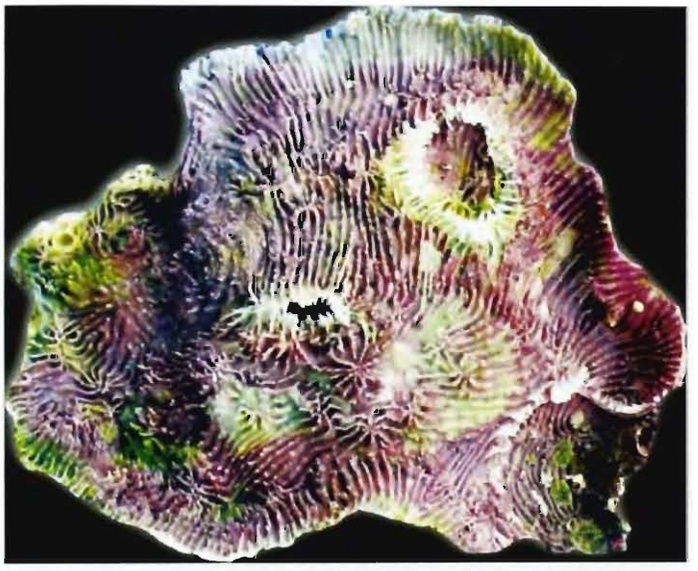
Genus ***Oxypora*** Saville-Kent, 1871

Five species recorded from the world, of which is one species is reported from India.

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. Polyps are extended only at night. *Oxypora* is readily confused with *Echinophyllia* especially when colonies become thickened. Sometimes confused with *Echinopora* and *Mycedium* also. This genus is recorded from Andamans and Nicobar Islands.

133. ***Oxypora lacera*** (Verrill, 1864)

1864. *Trachypora lacera* Verrill, List of the polyps and corals sent by the Museum of Comparative Zoology to other institutions in exchange, with annotations. *Bull. Mus. Comp. Zool. Harv. Univ.* **1**, 29-60.



1975. *Oxypora lacera* (Verrill) Chevalier, Les scleractiniaires de la melanesie francaise (Nouvelle-Caledonie, Iles Chesterfield, Iles Loyaure, Nouvelles-Hebrides). 2eme Partie. Exped. Recifs Coralliens Nouvelle-Caledonie, *Fond. Singer-Polignac,* Paris. 7, 5-407, pl. 1-42.

Characters : Colonies are thin, encrusting or laminar plates. They may become greatly thickened in turbulent environments. Corallites may be fine and delicate on thin laminae to grossly thickened on submassive parts of the same colony. Costae are always toothed.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is reported from Indo-pacific to Coral Sea.

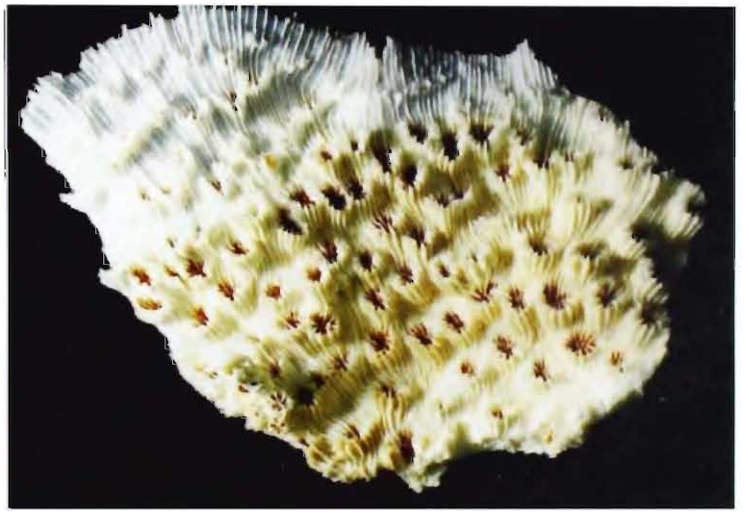
Remarks : This species may confused with *Echinophyllia,* especially when colonies develop thickened septal structures. Mostly found on the shallow protected reef slopes.

Genus *Mycedium* Oken, 1815

There are five species recorded from the world, of which one species is reported in India.

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. Except from Lakshadweep Islands it is reported in all the other three major coral reef areas in India.

134. *Mycedium elephantotus* (Pallas, 1766)



1766. *Madrepora elephantotus* Pallas, *Elenchus Zoophytorum*. Den Haag. 1-451.

1975. *Mycedium elephantotus* Chevalier, Les scleractiniaires de la melanesie francaise (Nouvelle-Caledonie, Iles Chesterfield, Iles Loyaure, Nouvelles-Hebrides). 2eme Partie. Exped. Recifs Coralliens Nouvelle-Caledonie, *Fond. Singer-Polignac*, Paris. 7, 5-407, pl. 1-42.

Character : Colonies are laminar or encrusting. Corallites are nose-shaped, facing outwards towards the corallum perimeter. Septa and columellae are well developed and costae form outwardly radiating ribs on the corallum surface, which may become highly elaborated on corallite walls. The coenosteum is never pitted at the insertion of new septo-costae. Polyps are extended only at night. Colonies are usually uniform brown, grey, green or pink but may have green or red oral discs and may have a coloured margin around the colony.

Distribution : In India it is reported in Gulf of Kachchh, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely recorded from tropical Indo-Pacific, Red sea, Tahiti and the Great Barrier Reef.

Remarks : It is a well-defined species. This species can be found in most reef environments protected from strong wave action.

Genus ***Pectinia*** Oken, 1815

Nine species are reported from the world, of which two species are recorded from India.

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* resembles only *Physophyllia*, which is not found in India. This genus is recorded only from the reefs of Andaman and Nicobar Islands.

135. ***Pectinia lactuca*** (Pallas, 1766)

1766. *Madrepora latuca* Pallas, *Elenchus Zoophytorum*. Den Haag. 1-451.

Characters : Colonies are submasive and have elongate valleys and walls, the latter or relatively uniform in height. Most valleys can be traced from the colony margins to the centre. Living colonies are mostly uniform colour, usually grey, brown or green.

Distribution : In India it is reported only in Andaman and Nicobar Islands. Worldwide, it is reported from Indo-Pacifc to Coral Sea.

Remarks : Mostly available in lower reef slopes and turbid water habitats.

136. ***Pectinia paeonia*** (Dana, 1846)

1846. *Tridacophyllia paeonia* Dana, *Zoophytes. U.S. Exploring Exped.* 1838-1842. 7, 1-740, pl. 1-61.

Characters : Colonies never have extended valleys. Instead they form irregular clusters of fluted thin laminae with exsert costae forming upwardly projecting spires and short walls. Columellae are weakly developed. Septa are smooth or have small teeth.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is reported from Maldives to Coral Sea.

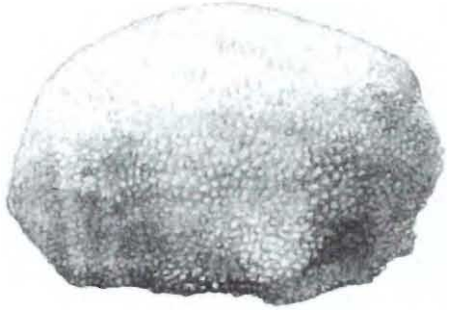
Remarks : It is mostly found in turbid water habitats, especially on fringing reefs and in crevices on the reef slopes.

Hydnophora exesa

Family **MERULINIDAE** Verrill, 1846

It is composed of five genera, *Hydnophora*, *Merulina*, *Paraclavarina*, *Scapophyllia* and *Boninastrea* of which *Hydnophora*, *Merulina* and *Scapophyllia* are reported from India.

Hydnophora rigida



Hydnophora microconos

Merulina ampliata

Scapophyllia cylindrica

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 Trachyphylliidae are related to Merulinidae

Genus *Hydnophora* Fisher de Waldheim, 1807

This genus has traditionally been included in the family Faviidae. However, the structural similarities between the branch tips of *Hydnophora* and *Merulina* and the similarities between the extended polyps of *H. pilosa* and *Scapophyllia cylindrica* leave very little doubt as to the former's real affinities. Six species are reported from the world, of which three species are recorded from India.

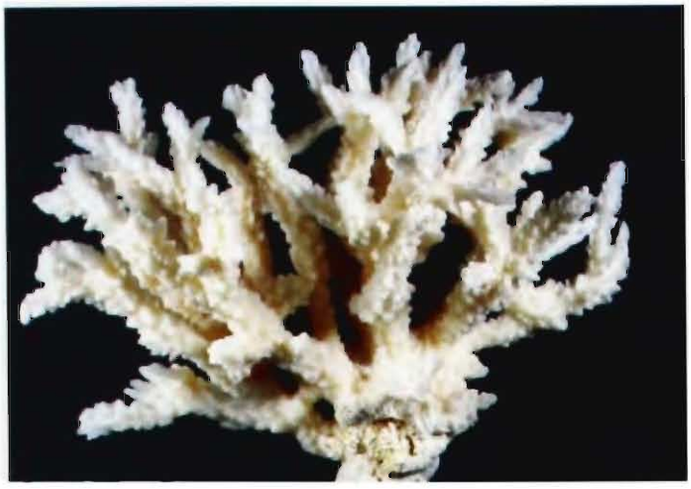
Characters : Colonies are massive, encrusting, or arborescent. The genus is characterized by the presence of hydnophores formed where sections of common wall between corallites intersect and develop into conical mounds. Hydnophores cover the colony surface and make this genus immediately reconisable. Polyps are usually extended only at night (except *H. exesa* and *H. pilosa*). Short tentacles surround the base of each hydnophore, one tentacle between each pair of septa. Fine branch tips of *Hydnophora* have sometimes been confused with *Merulina*. In India it is recorded from all the four major coral reef areas.

137. ***Hydnophora rigida*** (Dana, 1846)

1846. *Merulina laxa* Dana, *Zoophytes. U.S. Exploring Exped.* 1838-1842. 7, 1-740, pl. 1-61.

1857. *Hydnophora rigida* (Dana) Edwards & Haime, *Histoire naturelle des Coralliaires*. Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

Characters : Colonies are arborescent, without encrusting bases. Septa radiating around the monticules, columellar centers are well defined. Septal dentations are obsolute or minute, septal sides are spinose. Living colonies are cream or green in colour.



Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide, it is distributed in Singapore, Mollucca, Philippines, Yap, Palau, Taiwan, Ryukyu and the Great Barrier Reef.

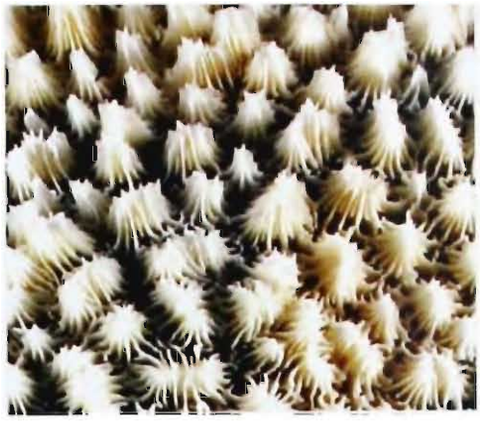
Remarks : It is found in shallow reef environments, especially lagoons and protected reef slopes.

138. ***Hydnophora exesa*** (Pallas, 1766)

1766. *Madrepora exesa* Pallas, *Elenchus Zoophytorum*. Den Haag. 1-451.

1974. *Hydnophora exesa* Scheer and Pillai, *Report on Scleractinia from the Nicobar Islands. Zoologica (Stuttg.).* **42** (122), 1-75, pl. 1-33.

Characters : Colonies are submasssive, encrusting or sub-arborescent. Monticules are evenly distributed over the corallum, in some parts



arranged in regular rows, 3-6 mm apart, separating continous valleys. In branching colonies, the monticule axis, which is normally perpendicular to the general surface of the corallum, tends to become increasingly inclined towards the tips of the branches. Ridges on colonies, which arise from the fusion of adjacent monticules, are well developed in some specimen. Septal dentations are obsolute on the monticules, but better developed on the lower part of the septa. The columellar structure is irregularly developed, absent in places. Living colonies are cream or dull cream in colour.

Distribution : In India it is reported in Gulf of Kachchh, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. It is widely distributed from the Indo-pacific, Red sea, Ellice Islands and Great Barrier Reef.

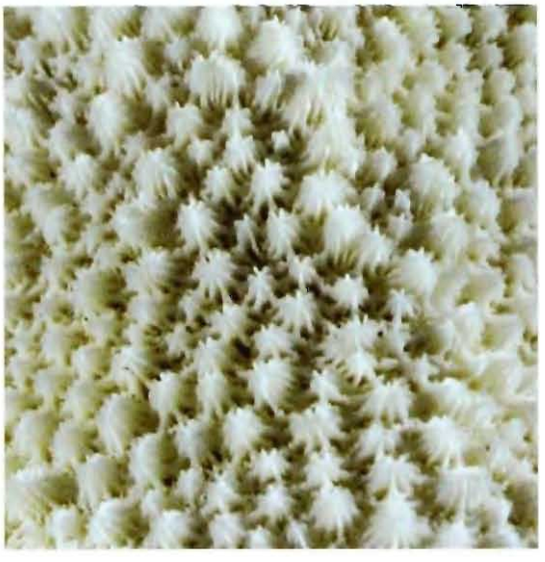
Remarks : It is similar to *H. microconus*, which is massive and rounded with smaller hydnophores. It is found in all reef environments, but especially lagoons and protected slopes.

139. ***Hydnophora microconos*** (Lamarck, 1816)

1816. *Monticularia microconos* Lamarck, Histoire naturelle des Animaux sans vertebrates. Paris, **2**, 1-568.

1974. *Hydnophora microconos* (Lamarck) Scheer and Pillai, Report on Scleractinia from the Nicobar Islands *Zoologica (Stuttg.).* **42** (122), 1-75, pl. 1-33.

Characters : Colonies are always massive, usually with a convex surface. Valleys are comparatively narrow with an average width of 2 to 3 mm. The monticules are regularly conical and elongated. The first order septa are horizontal at the top of the monticules. The septal dentations are obsolute



except on the lower part of the septa close to the columella, where a few fine dentations covered with scattered, small granules. The columellae are of a lamellar type, generally continuous, encircling the monticules. Living colonies have dull cream, brown, or green in colour.

Distribution : In India it is recorded in Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is distributed throughout Indian Ocean, Red sea, Cook Islands and Great Barrier Reef.

Remarks : It is similar to *H. exesa*. It is found in all reef environments, but especially lagoons and protected slopes.

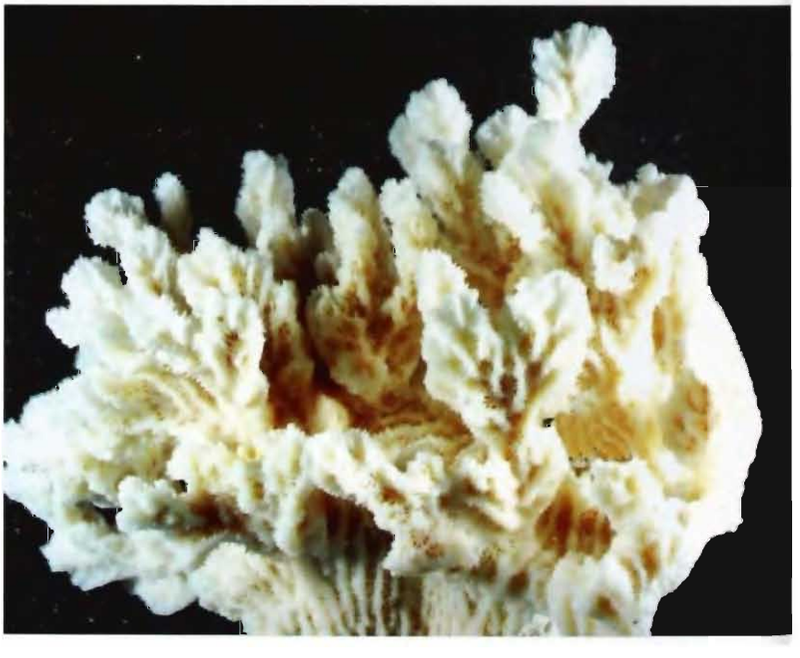
Genus ***Merulina*** Ehrenberg, 1834

Three species are reported from the world, of which one species is recorded from India.

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*. Laminar pieces have the same skeletal structure as *Scapophyllia* except that the valleys spreading fanwise. Only one species is recorded from the Lakshadweep and Andaman and Nicobar Islands.

140. ***Merulina ampliata*** (Ellis and Solander, 1786)

1786. *Madrepora ampliata* Ellis & Solander, *The natural history of many curious and uncommon zoophytes.* London. **1**, 1-208, pl. 1-63.



1974. *Merulina ampliata* Scheer and Pillai, *Report on Scleractinia from the Nicobar Islands. Zoologica (Stuttg.).* **42** (122), 1-75, pl. 1-33.

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. Living colonies are with variety of pale colours, usually pink or pale brown in colour.

Distribution : In India it is recorded in Lakshadweep and Andaman and Nicobar Islands. Worldwide, it is distributed from the Red sea, western Indian Ocean, Tonga, Samoa and the Great Barrier Reef.

Remarks : The branch tips may resemble *Hydnophora*. Laminar pieces have the same skeletal structure as *Scapophyllia* except that the latter do not have valleys spreading fanwise. It occurs in wide variety of reef environments, especially lagoons.

Genus *Scapophyllia*
Milne Edwards and Haime, 1848

It is a monospecific genus. In India it is recorded from Andaman and Nicobar Islands.

Characters : 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. Laminar pieces of *Scapophyllia* skeleton resemble *Merulina* but the latter have short valleys spreading fanwise, not sinuous valleys.

141. *Scapophyllia cylindrica*
Milne Edwards and Haime, 1848

1848. *Scapophyllia cylindrica* Edwards and Haime, Note sur la classification de la deuxieme tribude la famille des Astreides. *C. R. Hebd. Seances Acad. Sci.* 27 (20), 490-7.

Characters : 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 the few thick septal teeth that comprise each columella. Polyps are extended only at night and have long tapering tentacles of uniform length. Living colonies are usually cream or yellow-brown in colour.

Distribution : In India it is recoded only in Andaman and Nicobar Islands. It is widely distributed from tropical Indo-Pacific from Malaysia and Sumatra, Marshall Islands and Great Barrier Reef.

Remarks : Laminar pieces of *Scapophyllia* skeleton resemble *Merulina* but the latter have short valleys spreading fanwise, not sinuous valleys. It is usually found in partly turbid water such as around fringing reefs and in lagoons.

Turbinaria peltata

Family **DENDROPHYLLIIDAE** Gray, 1847

Turbinaria mesenterina

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.

Genus ***Turbinaria*** Oken, 1815

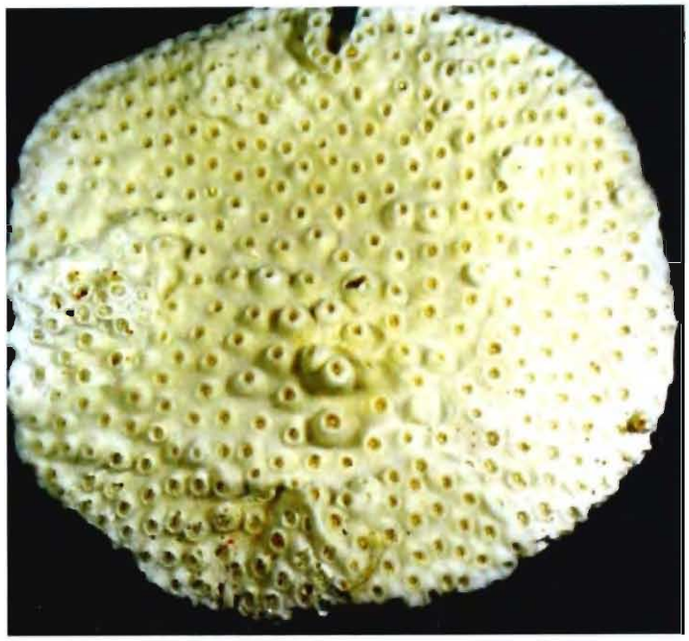
Turbinaria are particularly successful in higher latitudes, where they compete with kelp for space and light. Of the eleven species are reported in the world, three are recorded from India.

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*. This genus is represented from all the four major coral reef areas in India.

142. ***Turbinaria peltata*** (Esper, 1794)

1794. *Madrepora peltata* Esper, Die Pflanzenthiere 1-3, Fortsetzungen 1-2, Nurnberg.

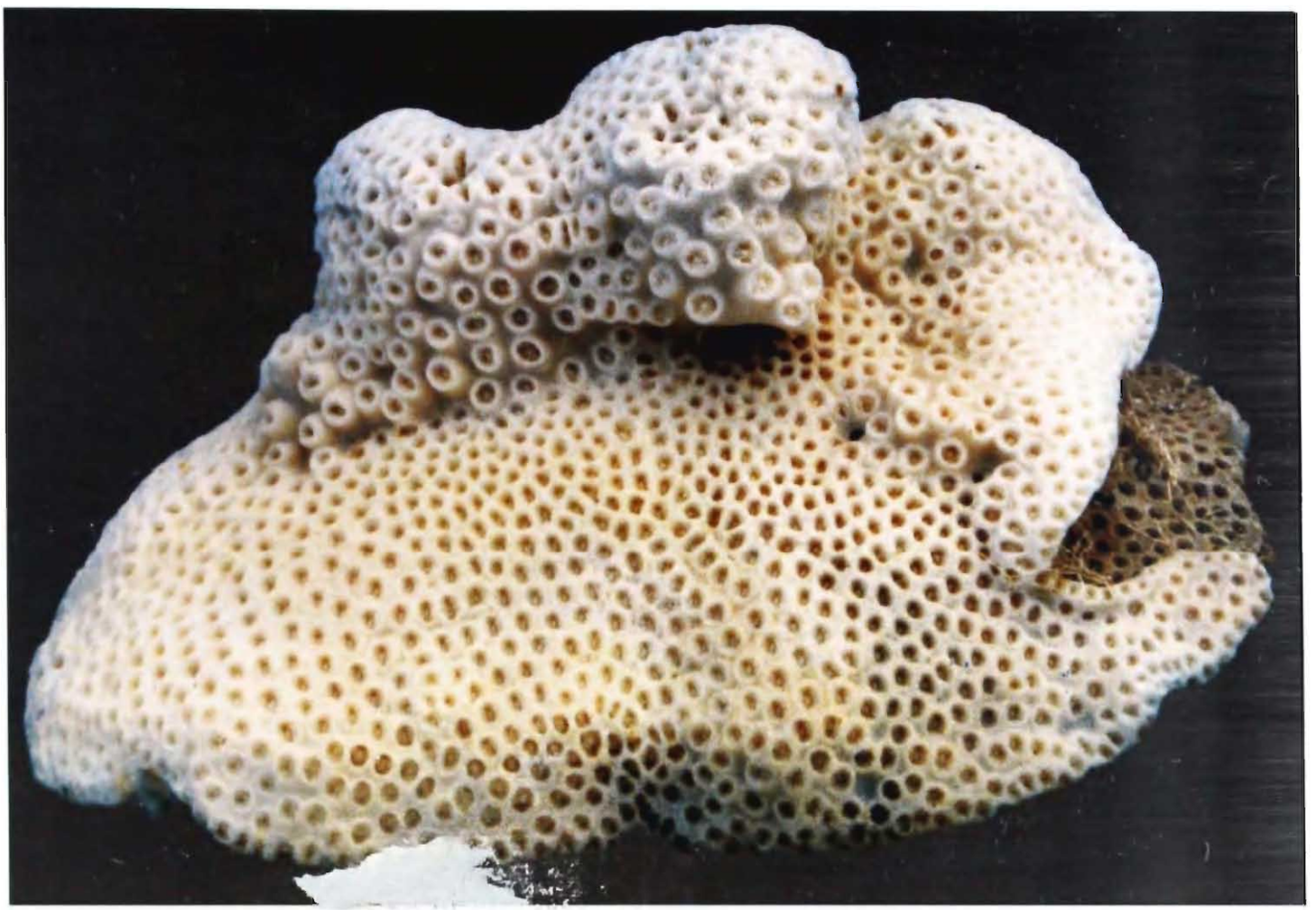
Characters : Colonies are with or without stalks, encrusting or tabular, thickened, unifacial or ridges with budding margins bifacial fronds or cylindrical columns. Corallites crowded or widely spaced, flush, or protrude 2.5 cm. Colony margins mostly composed of closely packed, outward projecting corallites; with subsequent growth of corallites become less inclined toward margins and more upward projecting and increasingly immersed and



decrease ... corallite density towards center. Calices circular, 3-5 mm diameter.

Distribution : In India it is recorded in Gulf of Kachchh, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is distributed in east Africa, Japan, Marshall Islands, Fiji and the Great Barrier Reef.

Remarks : It usually occurs in shallow rocky foreshores with turbid water. Also occurs on shallow reef slopes.



143. *Turbinaria reniformis* Bernard, 1896

1896. *Turbinaria reniformis* Bernard, The genus *Turbinaria*. The genus *Astraeopora*. Cat. Madreporarian Corals. *Br. Mus. (Nat. hist.)*. **2**, 1-666, pl. 1-33.

Characters : Growth forms are not usually as convoluted, unifacial laminae with plates horizontal at bottom becoming inclined and folded at top. Corallites are variable, widely spaced, thickwalled, crowded to almost touching, most conical, thick walls and small calices. Colonies sometimes form tiers, which are mostly horizontal.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is reported from Tonga and the Cook Islands, Marchall Islands and the Great Barrier Reef.

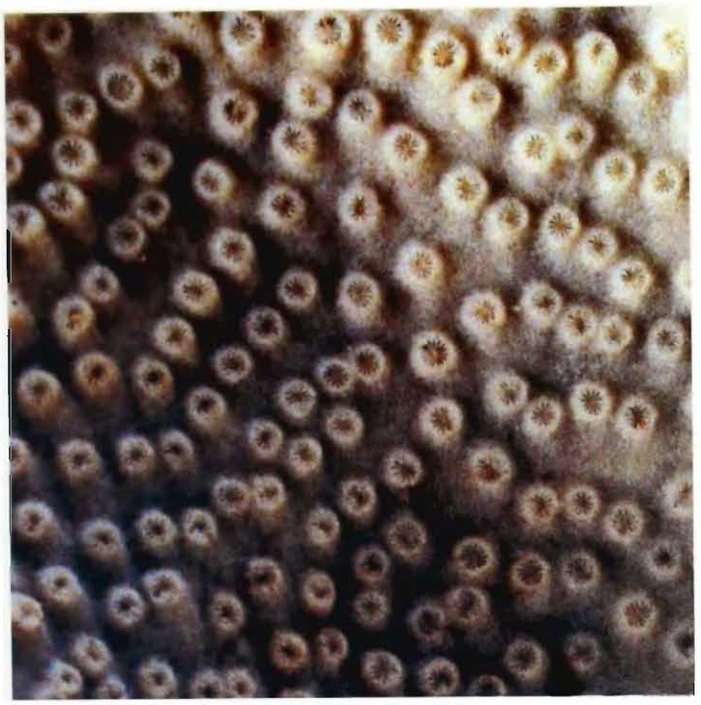
Remarks : Sometimes form large stands on fringing reefs where the water is turbid.

144. *Turbinaria mesenterina* (Lamarck, 1816)

1816. *Turbinaria mesenterina* Lamarck, Histoire naturelle des animaux sans vertebrates. Paris. **2**, 1-568.

1967. *Turbinaria mesenterina* Scheer, Korallen von den Sarso-inseln im Roten Meer. Senckenb. *Biol.* **48** (5-6), 421-36.

Characters : Colonies are composed of unifacial laminae, which are highly contorted. Fronds more vertical than horizontal, amount of folding vary greatly and can form dense mass of folds and tubes, less convoluted (and corallites more tubular



than conical) in deeper water or less light. Corallites are crowded, slightly exsert, 2.5-3.5 mm, tubular or conical, calices 1.3-2.0 mm, usually protuberant and strongly inclined ie vertical, older corallites deeply embedded to smooth.

Distribution : In India it is recorded in Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is recorded from tropical Indo-Pacific, Red sea, East African coast, Marshall Islands, Fiji and the Great Barrier Reef.

Remarks : It is similar to *T. reniformis*, which can usually be recognized in underwater by its colour, it is more horizontal than vertical fronds and it has more immersed corallites, which give a smooth appearance. It is dominant in shallow turbid environments.

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.

Acanthastrea echinata

Lobophyllia corymbosa

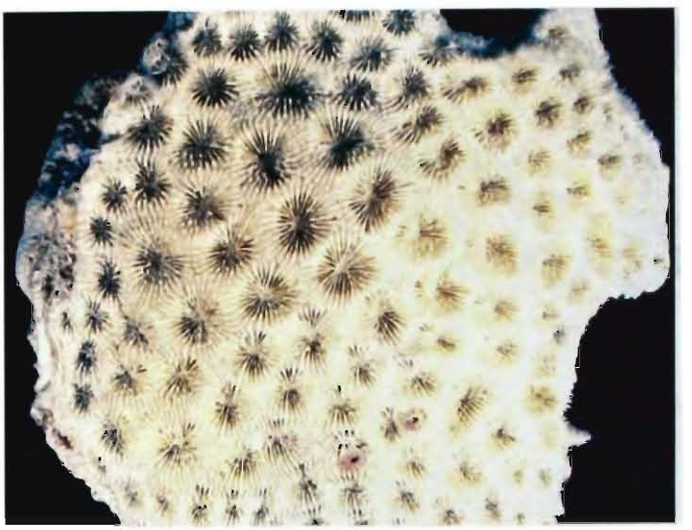
Mussidae includes the following genera, *Blastomussa, Cynarina, Scolymia, Australomussa, Acanthastrea, Lobophyllia, Symphyllia, Mussa, Isophyllia, Isophyllastrea, Mycetophyllia* and *Mussimillia*. The last five genera are restricted to the Atlantic. Only four genera *Acanthastrca, Lobophyllia, Symphyllia and Cynarina* are recorded in India of which *Cynarina* is reported only from Andaman and Nicobar Islands.

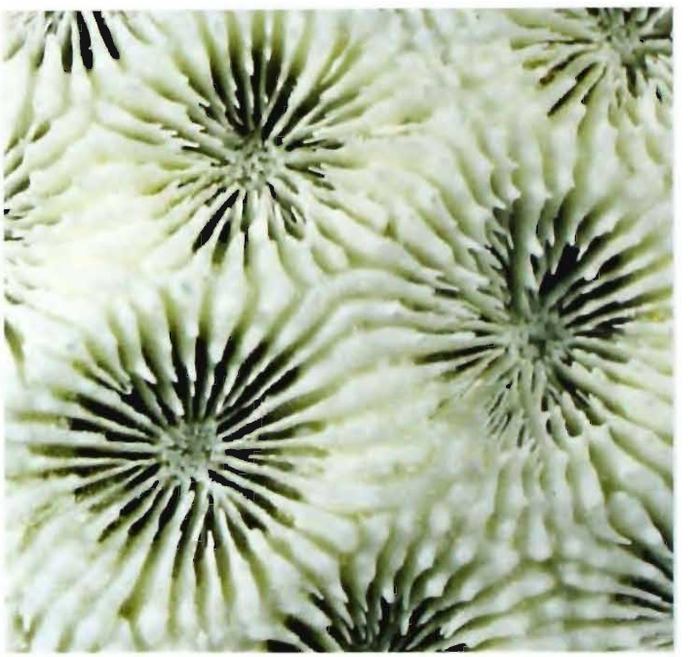
Genus ***Acanthastrea***
Milne Edwards and Haime, 1848

Twelve species are reported from the world, of which only two species are recorded from India.

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. This genus is recorded from Lakshadweep and Gulf of Kachchh.

145. ***Acanthastrea echinata*** (Dana, 1846)





1846. *Astrea echinata* Dana, U. S. Exploring. Exped. 1838-1842. **7**, 1-740, pl. 1-61.

1974. *Acanthastrea rotundoflora* Chevalier, Les scleractiniaires de la melanesie francaise (Nouvelle-Caledonie, *Iles Chesterfield, Iles Loyaute, Nouvelles-Hebrides). 2eme Partie. Exped. Recifs Coral-liens Nouvelle-Caledonie, Fond. Singer-Polig-nac, Paris.* **7**, 5-407, pl. 1-42.

Characters : Colonies are massive, either rounded or flattened. Corallites are cerioid or placoid, usually circular in outline and usually vary greatly in size within the corallum. Septa are

Lobophyllia sp.

characteristically mussid, with large, lobate or echinulate dentations and smooth or granulated on sides. Living colonies are uniform dull brown, grey or green in colour.

Distribution : In India it is recorded only in Lakshadweep. Worldwide, it is recorded in Red sea, Marshall, Ellice Islands, Tuamotu Archipelago and the Great Barrier Reef.

Remarks : *A. echinata* is different from *A. hillae* and *A. hillae* has cerioid with angular walls and larger corallites. The present species may be confused with the species of *Favites*, but not in underwater where the fleshy polyps of *A. echinata* are prominent.

146. *Acanthastrea hillae* Wells, 1955

1955. *Acanthastrea hillae* Wells, Recent and subfossil corals of Moreton Bay, Queensland. *Univ. Queensl. Pap. Dep. Geol.* 4 (10), 1-18, pl. 1-3.

Characters : Colonies are cerioid and usually small but sometimes over 1.5 metres across. Corallites have irregular shapes and may form short valleys with several centers. Colonies have moderately fleshy tissue over the skeleton.

Distribution : In India it is recorded only from Gulf of Kachchh. Worldwide, it is reported from Madagascar to Coral Sea.

Genus *Lobophyllia* de Blainville, 1830

Nine species are reported in the world, of which two are recorded in India.

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. Tentacles usually have white tips. *Symphyllia* has coarse skeletal structures comparable to *Lobophyllia*. In India this genus is reported from Lakshadweep and Andaman and Nicobar Islands.

147. *Lobophyllia corymbosa* (Forskal, 1775)

1775. *Madrepora corymbosa* Forskal, Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium que in intinere orientali observavit Petrus Forskal. IV Corallia. Hauniae. 131-9.

1974. *Lobophyllia corymbosa* Scheer and Pillai, Report on Scleractinia from the Nicobar Islands. Zoologica (Stuttg.). 42 (122), 1-75, pl. 1-33.

Characters : Colonies are flat to hemispherical and mostly phaceloid monocentric to tricentric.

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.

Distribution : In India it is recorded in Lakshadweep and Andaman and Nicobar Islands. Distributed widely throughout the Indo-Pacific, Red sea, Samoa, Tathiti, Tuamotu Archipelago and Great Barrier Reef.

Remarks : *L. corymbosa* differs from phaceloid *L. hemprichii* by the shape of the calices and septa. These species are distinct in underwater. Mostly found on upper reef slopes.

148. ***Lobophyllia hemprichii*** (Ehrenberg, 1834)

1834. *Manicina hemprichii* Ehrenberg, Beitrage zur physiologischen Kenntniss der Corallenthiereim Allgemeinen und besanders des Rothen Meeres, *Abh. Akad. Wiss. D.D.R.* 1832, 250-380.

1973. *Lobophyllia hemprichii* Pillai, Vine and Scheer, Bericht uber eine Korallensammlung von den Seychellen. *Zool. Jahrb. Abt. Syst. Oekol. Geogr. Tiere.* **100**, 451-65, pl. 1-3.

Characters : Colonies are flat to massive, may be large and phaceloid to flabello-meandroid. Septa taper from the wall to the columella with tall and sharp teeth. Similar in morphology with *Lobophyllia*

corymbosa, which has tall and blunt septal teeth decreasing in size towards the columella.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide, it is distributed from the Red sea, Tonga, Tahiti, Taumotu Archipelago to the Great Barrier Reef.

Remarks : *L. hemprichii* is polymorphic. Other *Lobophyllia* species shows little variation. Phaceloid *L. hemprichii* is similar to *L. corymbosa*. Underwater it is easily confused with *Symphyllia* as the thick fleshy polyps mask the underlying growth form.

Genus ***Symphyllia*** Milne Edwards and Haime, 1848

Seven species are reported in the world, of which three are recorded from India.

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*. It is represented from all the four major coral reef areas in India.

149. ***Symphyllia recta*** (Dana, 1846)

1846. *Symphyllia recta* Dana, *Zoophytes. U.S. Exploring Exped. 1838-1842*. 7, 1-740, pl. 1-61.

1974. *Symphyllia recta* Pillai and Scheer, On a collection of Scleractinia from the Strait of Malacca. In

'Proceedings of the Second International Symposium on Coral Reefs. *Great Barrier Reef Comm.*, Brisbane **1**, 445-464.

Characters : Colonies are massive to flat. Valleys are 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.

Distribution : In India it is recorded only in Andaman and Nicobar Islands. Worldwide, it is distributed from Maldives, Marshall Islands, Samoa and the Great Barrier Reef.

Remarks : This species is similar to *S. radians*. Mostly found on upper reef slopes and fringing reefs.

150. ***Symphyllia radians*** Milne Edwards & Haime, 1849

1849. *Symphyllia radians* Edwards & Haime, Recherches sur les polypiers. Mem. Mono graphie des Astreides. *Ann. Sci. Nat.* Zool. 3e. Ser., 11, 233-312.

1974. *Symphyllia radians* Scheer and Pillai, Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.).* **42** (122), 1-75, pl. 1-33.

Characters : Colonies are massive to flat. Valleys are fairly straight, especially if colonies have flat surfaces, otherwise irregularly sinuous. Valleys are in a radiating pattern. Septal dentations are intermediate between *S. recta* and *S. agaricia*. Valleys average 20-25 mm wide.

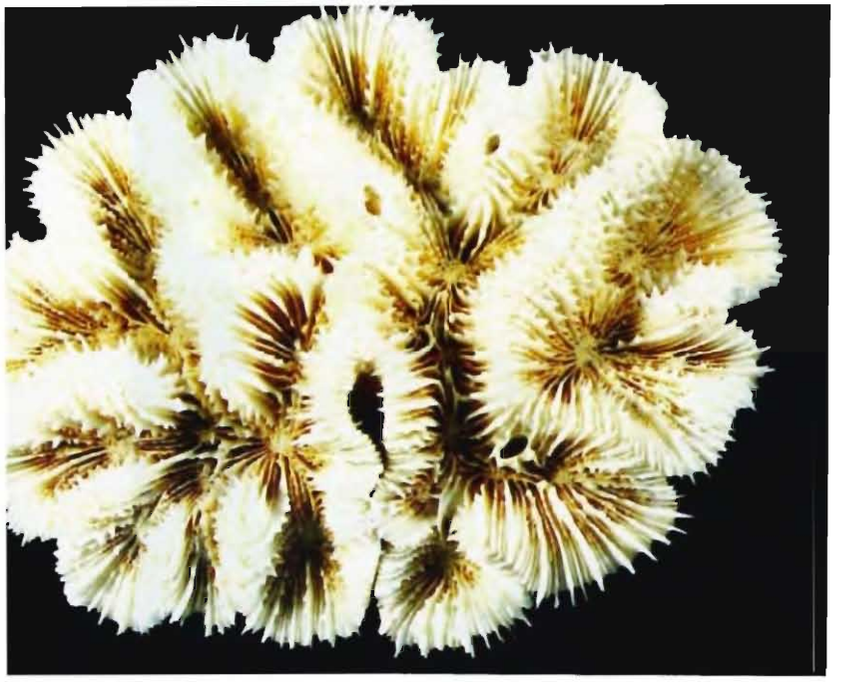
Distribution : In India it is recorded in Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is recorded from Maldives and the Great Barrier Reef.

Remarks : *S. radians* has valleys and septa intermediate in size between the small *S. recta and S. agaricia*. *S. recta* has more sinuous valleys, *S. agaricia* has a double row of columellae.

151. ***Symphyllia agaricia*** Milne Edwards & Haime, 1849

1849. *Symphyllia agaricia* Edwards & Haime, Recherches sur les polypiers. Mem. 4 Mono graphie des Astreides. *Ann. Sci. Nat.* Zool. 3e. Ser., **11**., 233-312.

1974. *Symphyllia agaricia* Report on Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.).* **42** (122), 1-75, pl. 1-33.



Characters : Colonies are hemispherical to flat. Valleys are sinuous or straight – 35 mm wide and

usually separated by a narrow groove. Septa are thick with large teeth. It is similar to *S. radians*, which has smaller, straighter valleys.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Elsewhere, it is reported throughout the Indo Pacific and up to Coral Sea.

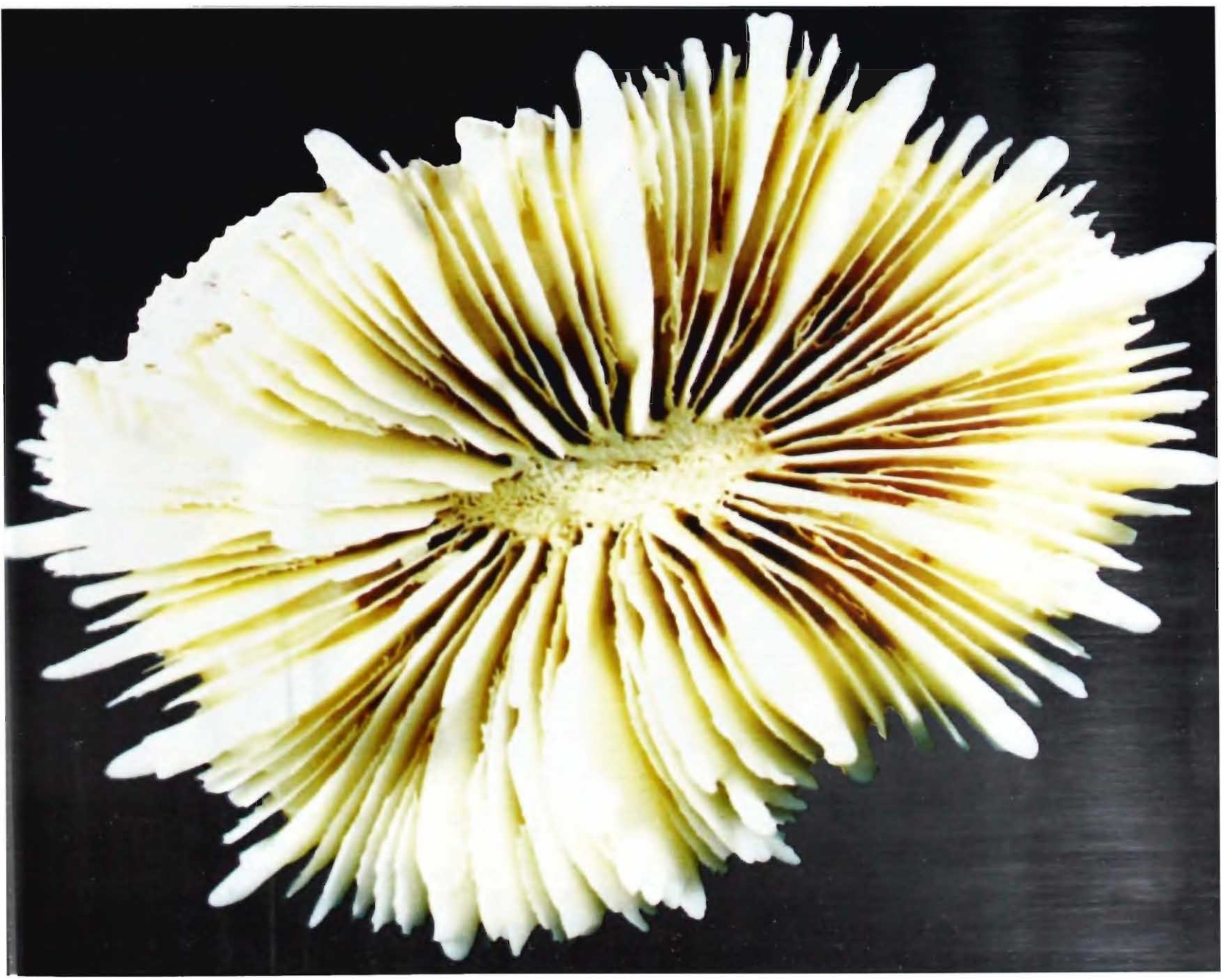
Remarks : It is similar to *Symphyllia radians*, which has smaller and straighter valley. Mostly found on exposed upper reef slopes.

Genus ***Cynarina*** Bruggemann, 1877

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 specimen. 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. Polyps are extended only at night and are transparent so that the toothed primary septa are seen clearly. *Cynarina* does not resemble any other genus. It is reported in India from Andaman and Nicobar Islands.

152. ***Cynarina lacrymalis***
(Milne Edwards and Haime, 1848)

1848. *Cynarina lacrymalis* Edwards and Haime, Recherches sur les polypiers. Mem. 3 Monographie des Eupsammides. *Ann. Sci. Nat. Zool.* 3e. Ser., **10**, 65-114, pl. 1.



Characters : Colonies are Monocentric, oval or circular with a base for attachment. It may have a pointed base when free-living. Primary septa are thick with large, rounded or lobed teeth. Paliform lobes are usually well developed. Columellae are broad and compact.

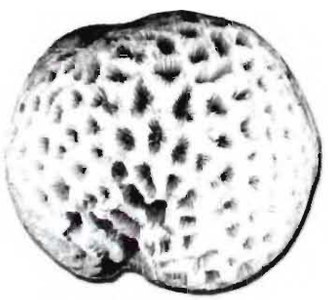
Distribution : In India it is recorded only from Andaman and Nicobar Islands. Elsewhere, it is reported throughout Indo-Pacific region up to Coral Sea.

Remarks : Mostly occur in protected reef environments and deep sandy substrates.


Favia favus

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 following 24 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*. 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, Favites, Goniastrea, Platygyra, Oulophyllia, Leptoria, Monastrea, Plesiastrea, Oulastrea, Diploastrea, Leptastrea, Cyphastrea* and *Echinopora* are the 13 genera available in India.

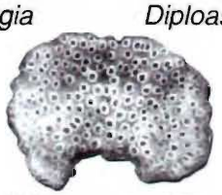


Favia favus

Goniastrea retiformis

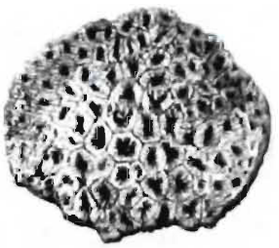
Leptoria phrygia

Diploastrea heliopora



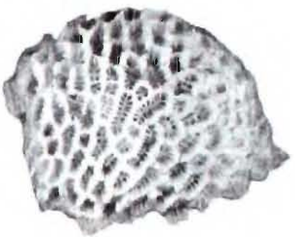
Echinopora lamellosa

Oulophyllia crispa



Montastrea valenciensis

Goniastrea australensis



Platygyra daedalea

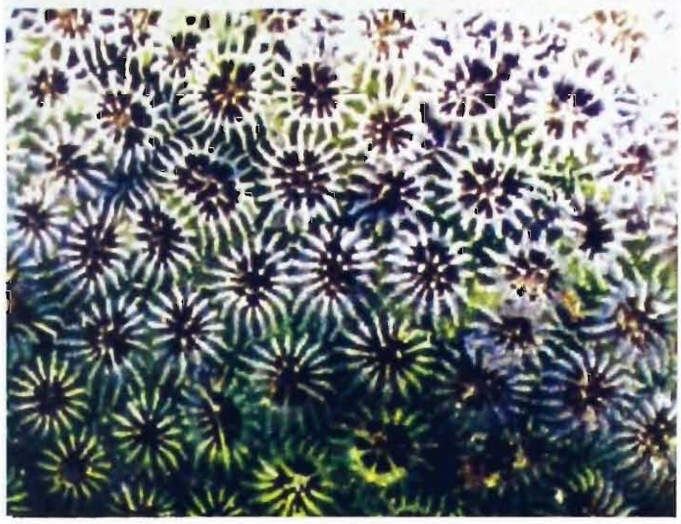
Cyphastrea serailia

Genus *Favia* Oken, 1815

The species of *Favia* are the most common coral found in shallow-water communities that are not dominated by *Acropora*. Twentytwo species are reported in the world, of which six are recorded from Indian waters.

Character : 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. This genus is reported from all four major coral reef areas in India.

153. ***Favia stelligera*** (Dana, 1846)



1846. *Orbicella stelligera* Dana, U.S. Exploring Expedition 1838-1842, 7, p. 1-740, pl. 61.

1857. *Favia hombroni* (Rossean), Edwards & Haime, Histoire naturelle des Coralliaires. Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

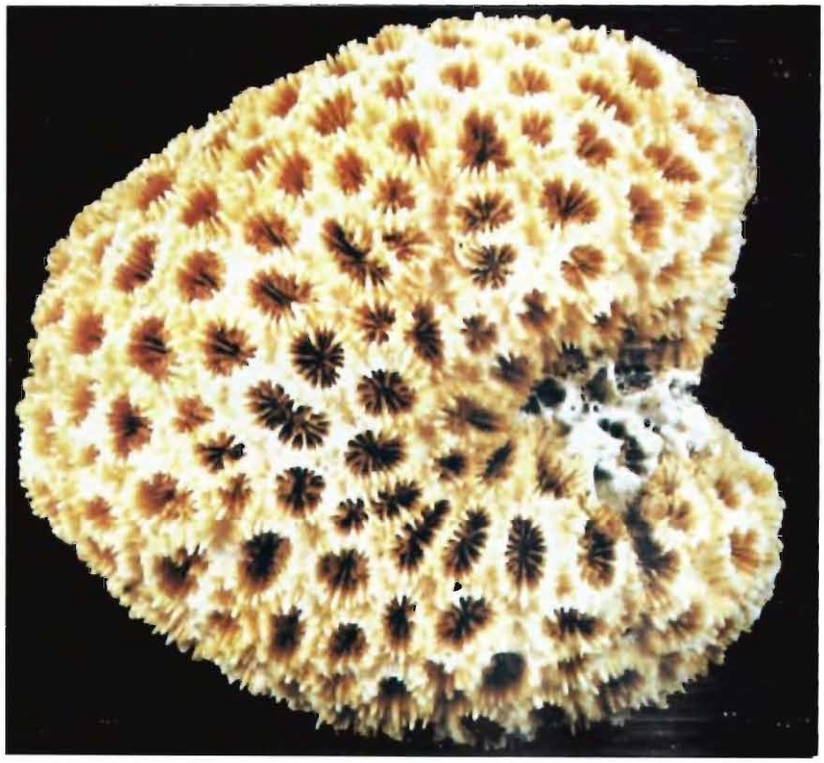
1974. *Favia stelligera* (Dana) Scheer & Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.).* **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are spherical, columnar, hillocky or flat. Corallites are evenly distributed, less than 8 mm diameter with small calices. A crown of paliform lobes is usually clearly visible. Colonies are uniform brown or green in colour.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is reported throughout Indo-Pacific up to Coral Sea.

Remarks : It resembles species of other genera with small corallites, especially *Plesiastrea versipora*.

154. ***Favia matthaii*** Vaughan, 1918



1918. *Favia matthaii* Vaughan, Some shoal-water corals from Murray Islands, Cocos Keeling Islands and Fanning islands. *Pap. Dep. Mar. Boil. Carnegie Inst.* Wash. **9** (Publ. 213), 51-234, pl. 20-93.

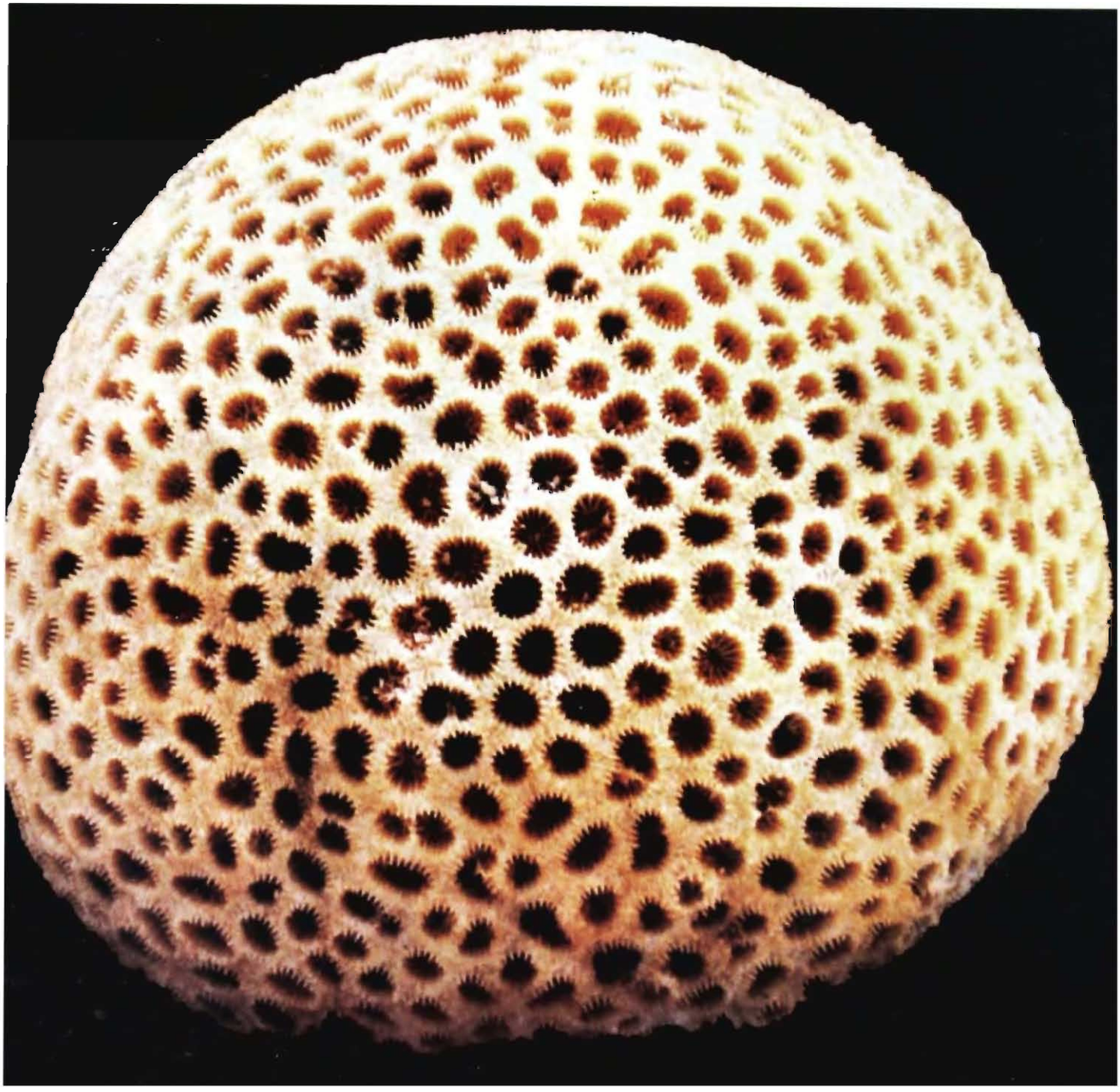
Characters : Colonies are massive and usually small. Corallites are crowded and circular. Septa are thickened, exsert or ragged, with large teeth near the wall and well developed paliform lobes forming a crown around the columella.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is found throughout the Indo-Pacific region up to Coral Sea.

Remarks : Usually found on the upper reef slopes. This species can be readily distinguished from *F. pallida and F. speciosa* by the exsert or ragged septa and paliform crown.

155. ***Favia pallida*** (Dana, 1846)

1846. *Astrea denticulata Dana, U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61

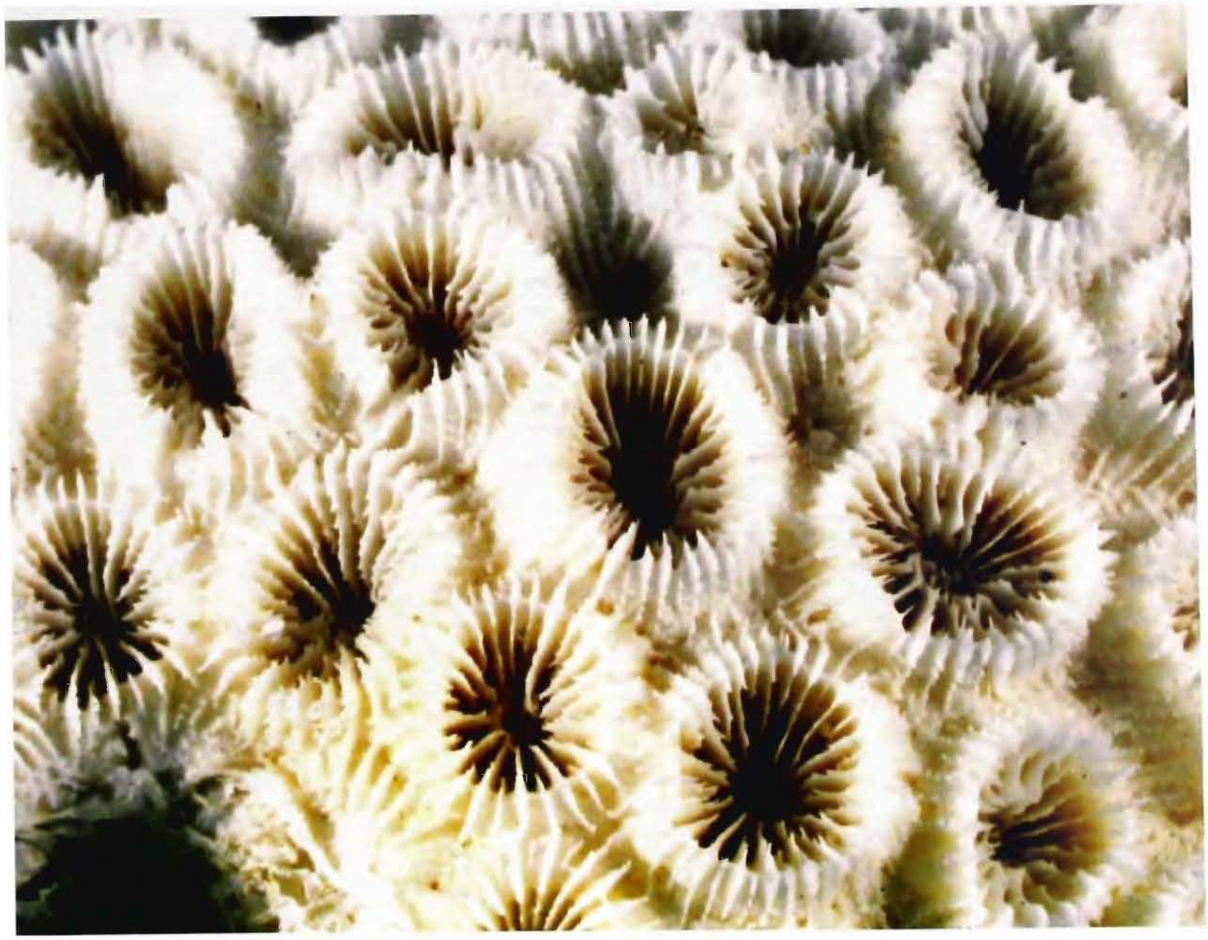


1901. *Faiva laccadivica* Gardiner, madreporaria, I Introduction, II Astraeidae in 'Fauna and Geography of *the Maldives and laccadives Archipelagoes' Cambridege*, 2, 756-790, pl. 59-64.

1918. *Favia pallida* (Dana) Vaughan, Some shoal-water corals from Murray Islands, Cocos Keeling Islands and Fanning Islands. *Pap. Dep. Mar. Biol. Carnegie Inst.* Wash. 9 (publ. 213), 51-234, pl. 20-93.

Characters : Colonies are massive. Corallites are circular, with calices 6-10 mm in diameter. Septa are widely spaced and irregular. Paliform lobes are poorly developed. Colonies are pale yellow, cream or green, always with dark-brown or green calices in colour.

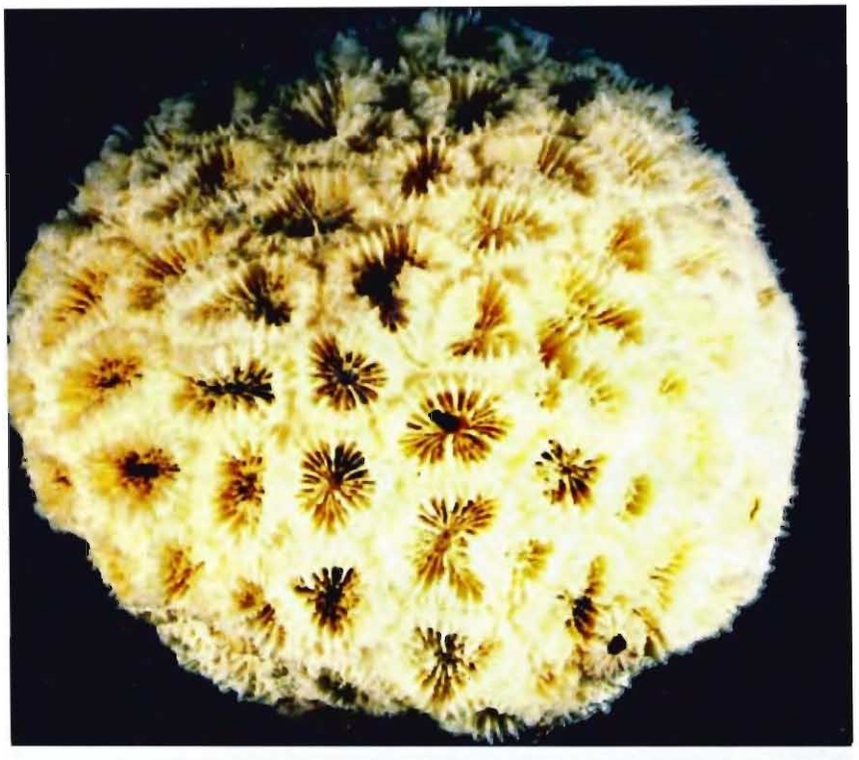
Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman



and Nicobar Islands. Worldwide, it is reported throughout the tropical Indo-Pacific, east Africa, Red Sea, Samoa, Tuamotu Archipelago and the Great Barrier Reef.

Remarks : It is similar to *F. speciosa*. One of the most common favids found in Gulf of Mannar reefs. Usually they are found as dominant species in the back reef margins.

156. *Favia rotumana* (Gardiner, 1899)



1899. *Astraea rotumana Gardiner*, On the astraeid corals collected by the author in the South Pacific. *Proc. Zool. Soc. Lond.*, 734-764.

1974. *Favia rotumana* (Gardiner), Scheer & Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. 42, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are usually flat and subplocoid. Corallites are large in size (more than 12 mm diameter). Corallites are crowded, irregular in shape and may have upto three centres. Septa are exsert, thin and very irregular, they plunge steeply inside the wall. Paliform lobes are poorly developed or absent. Living colonies are of wide range, usually with different-coloured corallite walls and oral discs.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is widely distributed throughout Indo-Pacific region and up to Coral Sea.

Remarks : This species is similar to *F. matthaii*. May also be confused with *Platygyra pini*. Usually they are found in upper reef slopes.

157. ***Favia favus*** (Forskal, 1775)

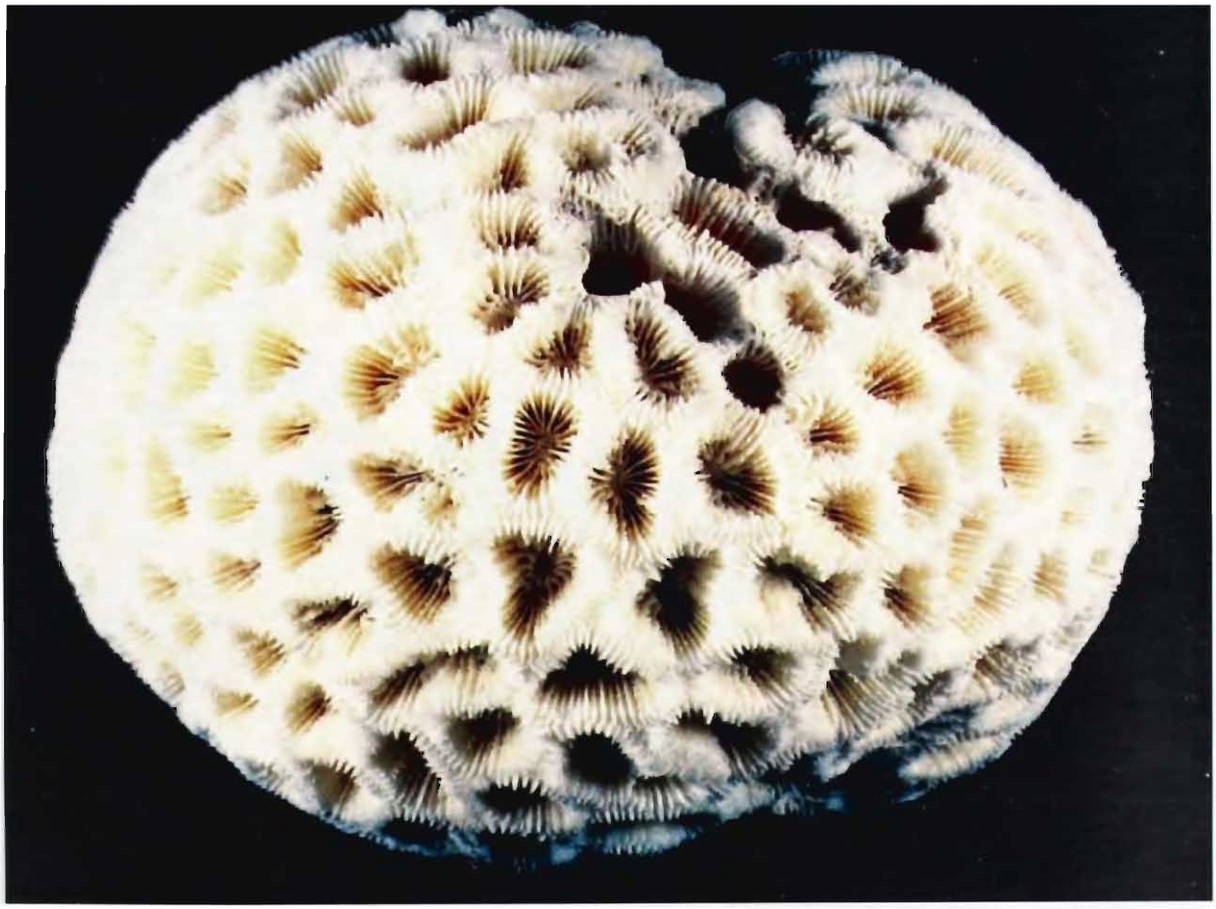
1775. *Madrepora favus* Forskal, Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum Vertmium que In intinere orientali observavit petrus Forskal. XVIII-XIX. 131-139. Hauniae.

1857. *Favia affinis* Milne Edwards & Haime Histoire naturelle des Coralliaires. Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

1974. *Favia favus* Forskal; Scheer & Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are massive, rounded or flat. Corallites are conical, with calices 12-20 mm in diameter. Septa have an irregular appearance. Paliform lobes are poorly developed. Colonies are dark green, brown or grey in colour. It is often mottled and may have pale calices.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is reported from Red Sea, Japan, Marshall Islands, Samoa, the Great Barrier Reef and the Coral Sea.



Remarks : It is similar to *F. pallida*. May be a dominant species on back reef margins.

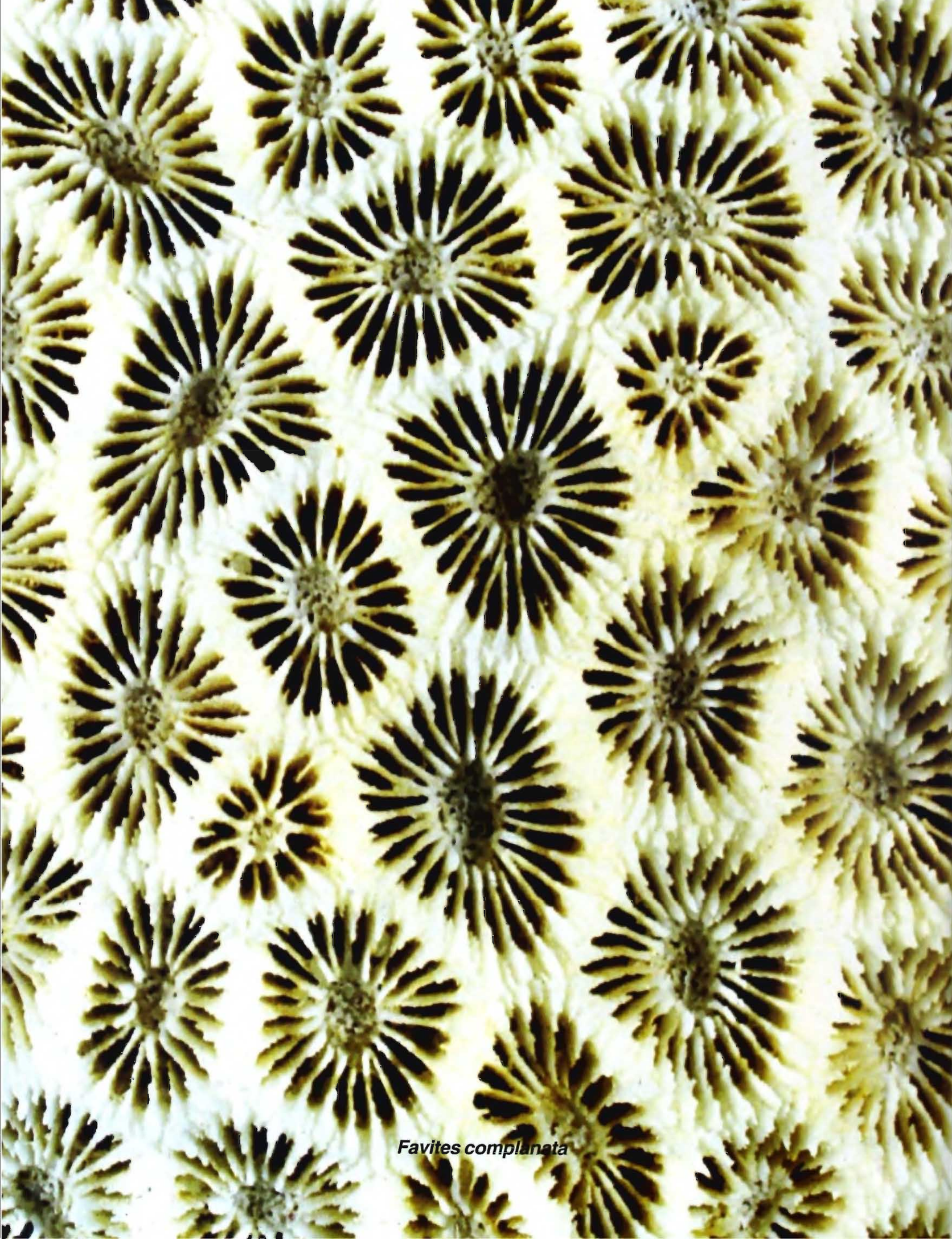
158. ***Favia speciosa*** Dana, 1846

1846. *Favia speciosa* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61.

Characters : Colonies are massive. Corallites are crowded together, subcircular, with calices upto 12 mm in diameter. Septa are fine, numerous and regular. Paliform lobes are poorly developed. Colonies are pale grey, green or brown in colour, usually with calices of contrasting colour.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide it is reported from Red Sea, east Africa, Tuamotu Archipelago, the Great Barrier Reef and the Coral Sea.

Remarks : This species is similar to *F. pallida*. Though this species is reported to be commonly found in high latitudes (Veron, 2000), in India it is reported from all the four major coral reefs of India.



Favites complanata

Genus ***Favites*** Link, 1807

Fourteen species are reported from the world, of which six are recorded from India.

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*, in this case it is distinguished by the presence of prominent paliform lobes, and by having a very regular pattern of septa with relatively fine teeth. It is recorded from all the major coral reef areas in India.

159. ***Favites pentagona*** (Esper, 1794)

1794. *Madrepora pentagona* Esper, *Die Pflanzenthiere*, 1, 97-192, 1789. *Fortsetzungen*, 1, 1-64, 1794. 1, 65-116. 1795. 1, 169-230, 1797, Nurnberg.

1971. *Favites pentagona* Chevalier, Les Scleractiniaires de la elanesie francaise recifs corallines Nouvelle *Caledonie, Edn. Found. Singer-Polignac*, Paris, **3**, 5-50.

Characters : Colonies are submassive to encrusting, sometimes forming irregular columns. Corallites are thin-walled and angular, with calices usually less than 6 mm in diameter. Septa are few in number, paliform lobes are well developed.

Living colonies are often brightly coloured, brown or red with green oral discs being common in colour.

Distribution : In India it is recorded from Lakshadweep and Gulf of Mannar and Palk Bay. Widely distributed throughout the Indo-Pacific region and upto Coral Sea.

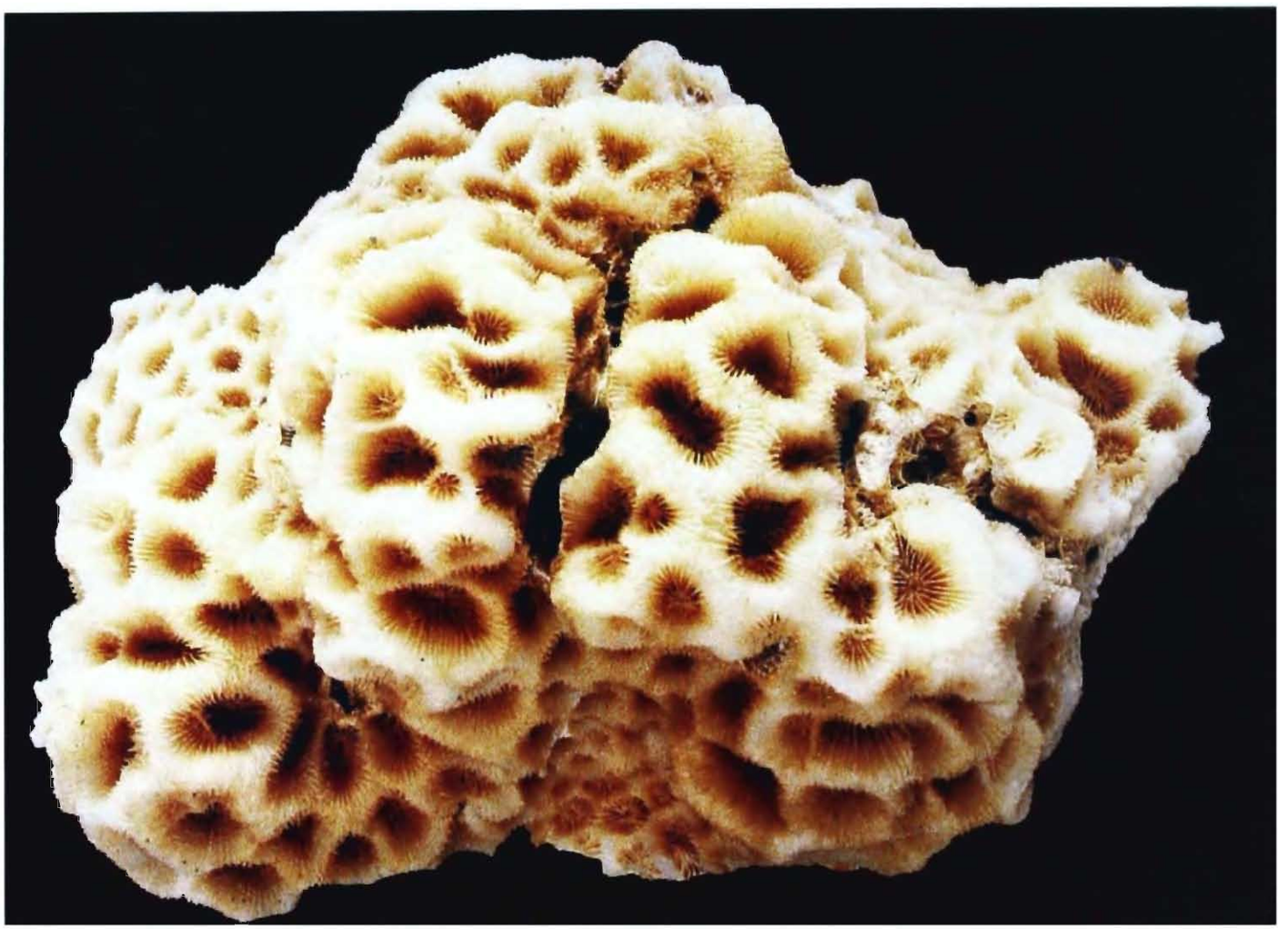
Remarks : The presence of paliform crown appears similar to the species of *Goniastrea*. Mostly found on the shallow reef environments.

160. ***Favites halicora*** (Ehrenberg, 1834)

1834. *Astrea halicora* Ehrenberg, Beitrage zur physiologischen Kenntniss der Corellenthiere im Allegemeinen und besanders des Rothen Meeres. *Abh. K. Akad. Wiss. Berl.* 1832, 250-380.

1974. *Favites halicora* (Ehrenberg) Scheer and Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*.42, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are massive, either rounded or hillocky. Corallites have very thick walls and



tend to become subplocoid. Calices average 10 – 13 mm in diameter. Budding is both intra and extratentacular. Paliform lobes may be developed. Living colonies are usually uniform pale yellowish or greenish-brown in colour.

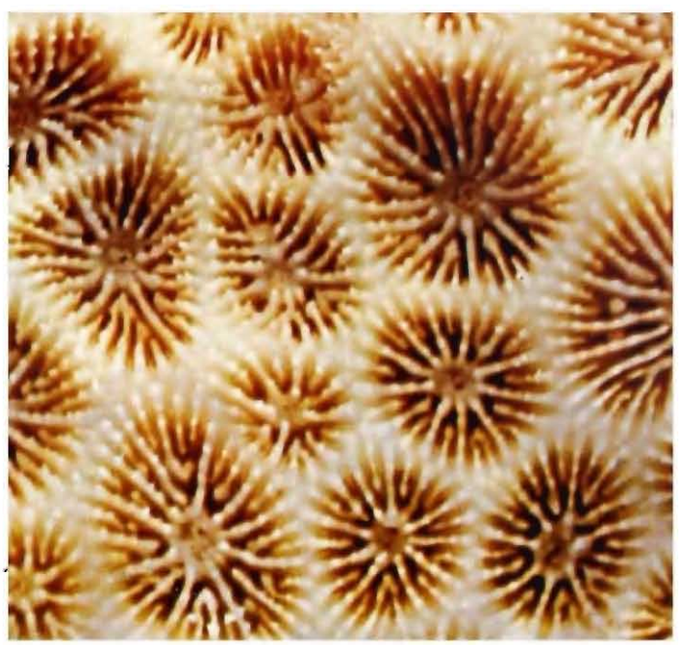
Distribution : In India it is reported from Gulf of Kachch, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is distributed throughout the Indo-Pacific, Red Sea, New Caledonia, Loyalty Islands, Samoa and the Great Barrier Reef.

Remarks : *F. abdita* has more angular corallites with thinner walls and no paliform lobes when compared to *F. halicora*. Mostly found on shallow reef environments.

161. ***Favites abdita*** (Ellis and Solander, 1786)

1786. *Madrepora abdita* Ellis and Solander, *Nat. Hist. of many curious and uncommon zoophytes, London*, **1** : 1-208, pl. 1-63

1914. *Favia abdita* (Ellis & Solander), Matthai, A revision of the recent colonial Astaeidae possessing



distinct corallites. *Trans. Linn. Soc. Lond.* 2nd Ser. Zool. **17**, 1-140, pl. 7-38.

1974. *Favites abdita* (Ellis& Solander), Pillai & Scheer, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.).* **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are massive, either rounded or hillocky. Walls are thick, calices are 1-12 mm in diameter, septa are straight, with prominent teeth. Living colonies are dark in turbid environments, otherwise pale brown with green oral discs.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. It is widely distributed throughout the Indo-Pacific, Red Sea, Samoa and the Great Barrier Reef.

Remarks : *F. halicora, F. flexuosa* as well as *Acanthastrea echinata* are similar to *F. abdita*. Mostly found on all reef environments.

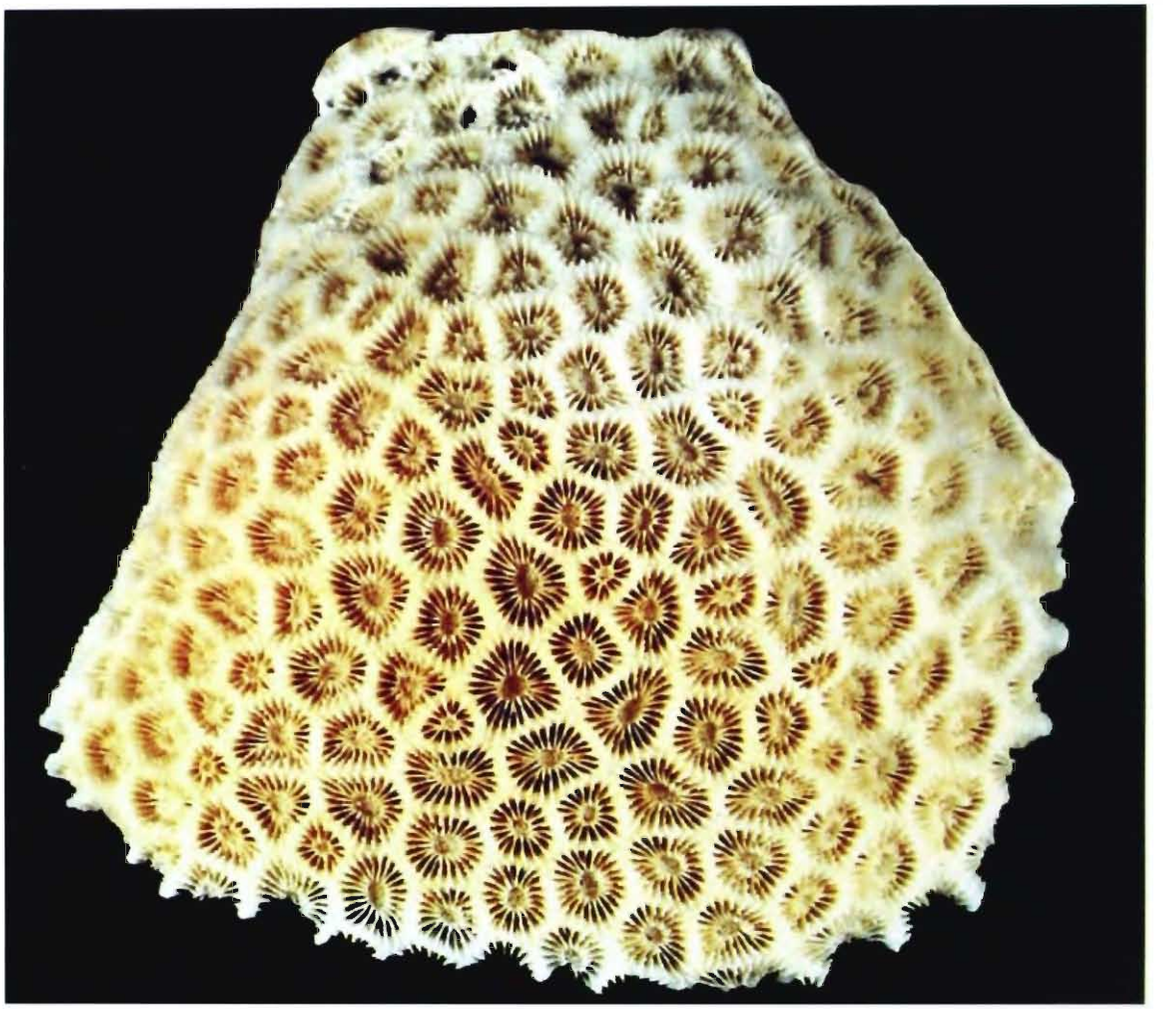
162. ***Favites complanata*** (Ehrenberg, 1834)

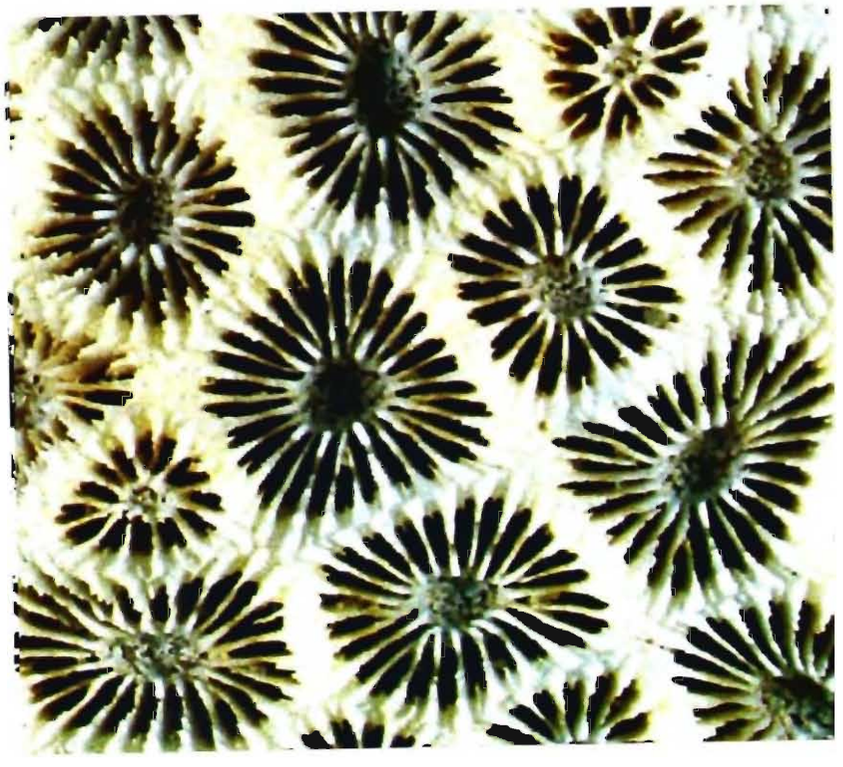
1834. *Favia complanata* Ehernberg, Beitrage zur physiologischen Kenntniss der Corellenthiere im Allegemeinen und besanders des Rothen Meeres. *Abh. K. Akad. Wiss. Berl.* 1832, 250-380.

1971. *Favites complanata* Chevalier, Les Scleractiniaires de la elanesie francaise recifs corallines Nouvelle Caledonie, *Edn. Found. Singer-Polignac*, Paris, **3**, 5-50.

Characters : Colonies are massive with slightly angular corallites. Calices are 8-12 mm in diameter with strongly alternating septa and weakly developed paliform lobes. Columellae are large. Living colonies are wide range but usually brown in colour, sometimes with green oral discs.

Distribution : In India it is reported from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands.





Worldwide it is distributed throughout the Indo-Pacific, Red Sea, Tahiti, Tuamotu Archipelago and the Great Barrier Reef.

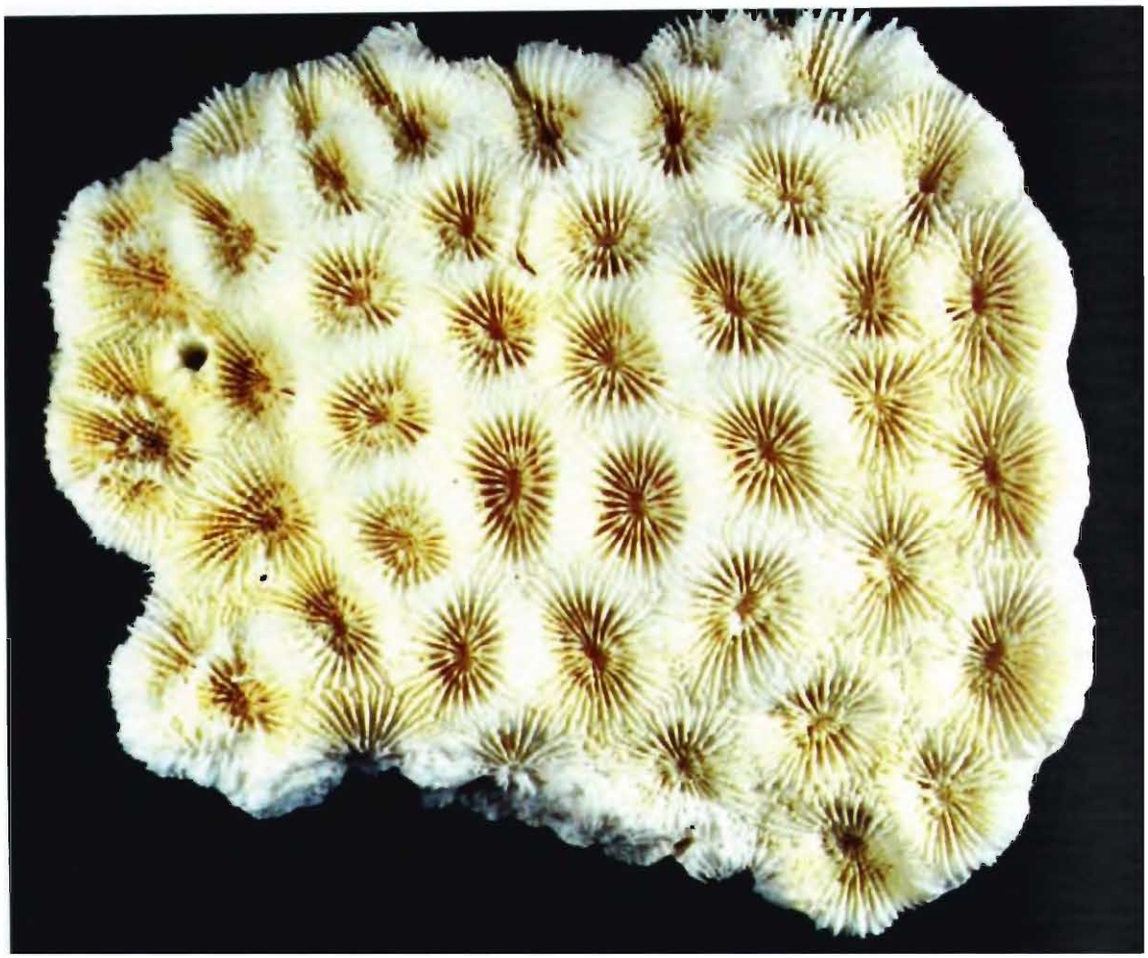
Remarks : It is similar to *F. abdita*, which has more angular corallites and lacks the star like costal pattern.

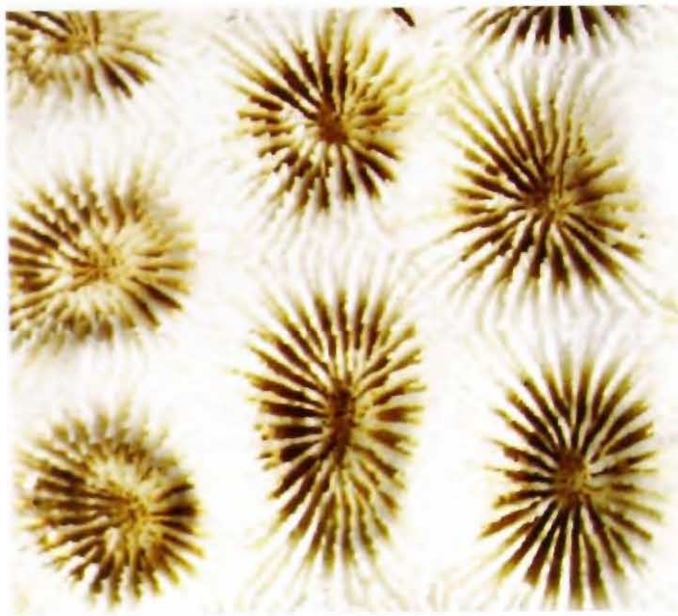
163. ***Favites flexuosa*** (Dana, 1846)

1846. *Astraea flexousa Dana, U.S. Exploring Expedition* 1838-1842, 7, p. 1-740, pl. 61.

1901. *Favites ellisiana* Verrill, Variations and nomenclature of Bermudian, West Indian and Brazilian reef Corals, with notes on various Indo-Pacific corals. *Trans. Conn. Acad. Arts Sci.* **XI**, 63-168, pl. 10-36.

1971. *Favites flexuosa* (Dana), Chevalier, Les Scleractiniaires de la elanesie francaise recifs corallines Nouvelle Caledonie, *Edn. Found. Singer-Polignac*, Paris, **3**, 5-50.





Characters : Colonies are hemispherical or flat. Corallites are angular with calices 15-20 mm in diameter. Septa have large teeth with a tendency to develop paliform lobes. Living colonies are green or brown in colour.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Worldwide, it is reported throughout the Indo-Pacific, Red Sea, Fiji the Great Barrier Reef and Coral Sea.

Remarks : It is similar to *F. abdita*, which has smaller and less angular corallites, as well as *Acanthastrea echinata*, which has larger septal teeth and thick flesh polyps.

164. ***Favites bestae*** Veron, 2000

1834. *Astrea melicerum Ehrenberg, Abh. K. Akad. Wiss. Berl.* 1832, **1** : p. 320.

Characters : Colonies are encrusting and the surface rising to hillocks. Corallites and calices are polygonal, penta or hexagonal, 5-6 mm long and 4-5 mm broad or 2-3 mm broad and 2-3 mm deep. Wall fused, thinner at the summit than at the base. Total number of septa are 20-24, alternating in size, very little exsert, continuous over the wall. Lower part of the septa broader than the upper two-

thirds. Septal edges dentate, sides granular. Eight to twelve septa reach the columella. Columella is trabecular and 1-2 mm in diameter.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, and Gulf of Mannar and Palk Bay. Worldwide, it is reported from Indonesia to Coral Sea.

Remarks : Veron (2000) was originally recorded *Favites bestae* as *F. melicerum* Eherenberg, 1834. *F. melicerum* was considered a synonym of *F. pentagona* by Matthai (1914) and a valid species by Vaughan (1918) and Wijsman-Best (1972). The same species has been again synonymised with *Favites chinensis* (Verrill, 1866) by Veron and Pichon (1977). Veron (2000) however, described this as a new species.

Genus ***Goniastrea*** Milne Edwards and Haime, 1848

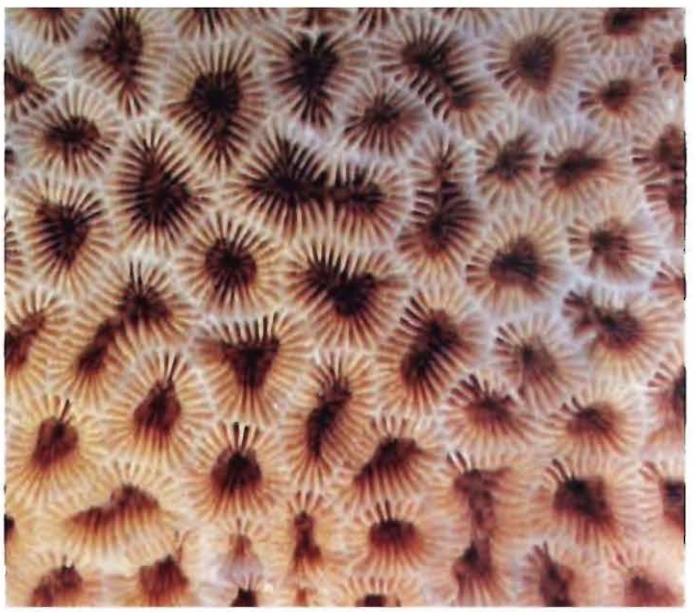
It is one of the toughest of all corals and can tolerate several hours of exposure to the tropical sun during the low tide and also muddy or low salinity conditions. Thirteen species are reported from the world, of which five species are recorded in India.

Charaters : 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 cerioid or meandroid but has no paliform lobes and columella centres and is seldom distinguishable. It is represented in all the major coral reef areas in India.

165. *Goniastrea edwardsi* Chevalier, 1971

1971. *Goniastrea edwardsi* Chevalier, Les Scleractiniaires de la Melanesie francaise (Nouvelle Caledonie, Iles Chesterfield, Iles Loyaure, Nouvelles Hebrides). Lere Partie. Exped. Francaise recifs corallines Nouvelle Caledonie, *Edn. Fond. Singer-Polignac*, Paris. **5**, 5-307, pl. 1-38.

Characters : Colonies are massive, hemispherical or columnar and often over one metre across. Corallites are slightly angular, with thick rounded walls. Septa are irregular in length and taper from the wall to the columellae, which are small. Paliform lobes are thick.

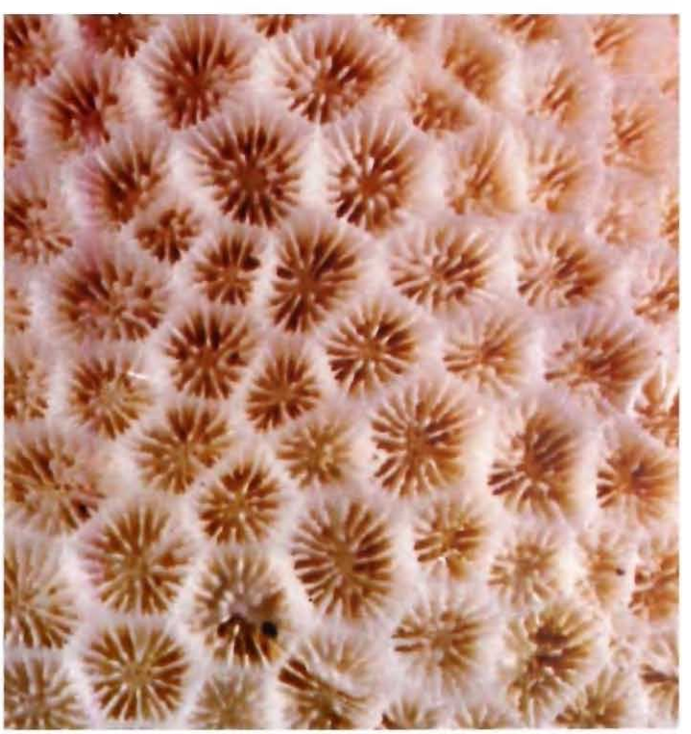


Distribution : In India it is recorded only from Andaman and Nicobar Islands. Worldwide, it is distributed throughout Indo-Pacific regions and up to Coral Sea.

Remarks : It is similar to *G. retiformis*. Mostly found on shallow subtidal regions.

166. ***Goniastrea retiformis*** (Lamarck, 1816)

1816. *Astrea retiformis* Lamarck, *Histoire naturelle des Animaux sans vertebras*. Paris, **2**, 1-568.



1974. *Goniastrea retiformis* Scheer & Pillai, *Report on the Scleractinia from the Nicobar Islands. Zoologica (Stuttg.).* **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are massive or columnar. Calices are 3.5 mm in diameter and four to six sided. Septa clearly alternate and are thin and straight with well-developed thin paliform lobes. Living colonies are cream or pale brown, occasionally brown, pink or green in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. It is widely distributed throughout the Indo-Pacific, Red Sea, Samoa, the Great Barrier Reef and the Coral Sea.

Remarks : It is similar to *G. edwardsi*, which has thicker walls and septa and irregular corallites. Sometimes forms a dominant species of intertidal habitats.

167. ***Goniastrea australensis***
(Milne Edwards and Haime, 1857)

1857. *Prionastrea australensis* Edwards and Haime, Histoire naturelle des *Coralliaires. Paris.* 1, 2 & 3, 1- 326, 1-632, 1-560.

1972. *Goniastrea australensis* Wijsman-Best, Systematics and ecology of New Caledonian Faviine (Coelentrata,Scleractinia). *Bijdr/ Dierkd.* **42** (1), 1-76, pl. 1-14.

Characters : Colonies are submassive or encrusting and meandroid with sinuous valleys. Columella centres and paliform lobes are well developed. Colour variable but commonly a uniform dull green or brown or with walls and valley floors of different dull or bright colours.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific,

New Caledonia, Philippines, Japan, the Great Barrier Reef and the Coral Sea.

Remarks : This is the only species with fully meandroid corallites and thus is readily distinguishable from other species of the genus. Mostly found on shallow or clear water.

168. ***Goniastrea aspera*** Verrill, 1905

1865. *Goniastrea aspera* Verrill, Corals and polyps of the North Pacific exploring Expedition. *Proc. Essex Inst. Salem*, **4**, 32.

1935. *Goniastrea aspera* Yabe & Sugiyama, Revised lists of the reef corals from the Japanese seas and of the fossil reef corals of the raised reefs and the Ryukyu limestone of Japan. *J. Geol. Soc. Jpn.* **42**, 379-403.

Characters : Colonies are massive to encrusting. Calices are 7 – 10 mm in diameter and are angular. Septa generally alternate; paliform lobes are well developed in coralla from turbid water and absent in coralla from exposed habitats. Colonies are usually pale brown; corallite centres are often cream in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from Palau, Mergui Archipelago, Indonesia, Philippines, New Caledonia, the Great Barrier Reef and the Coral Sea.

Remarks : This species similar to *G. edwardsi*, which has skeletal structures but it is much small. Mostly found on intertidal habitats, where different colonies may adjoin to form flat expanses.

169. ***Goniastrea pectinata*** (Ehrenberg, 1834)

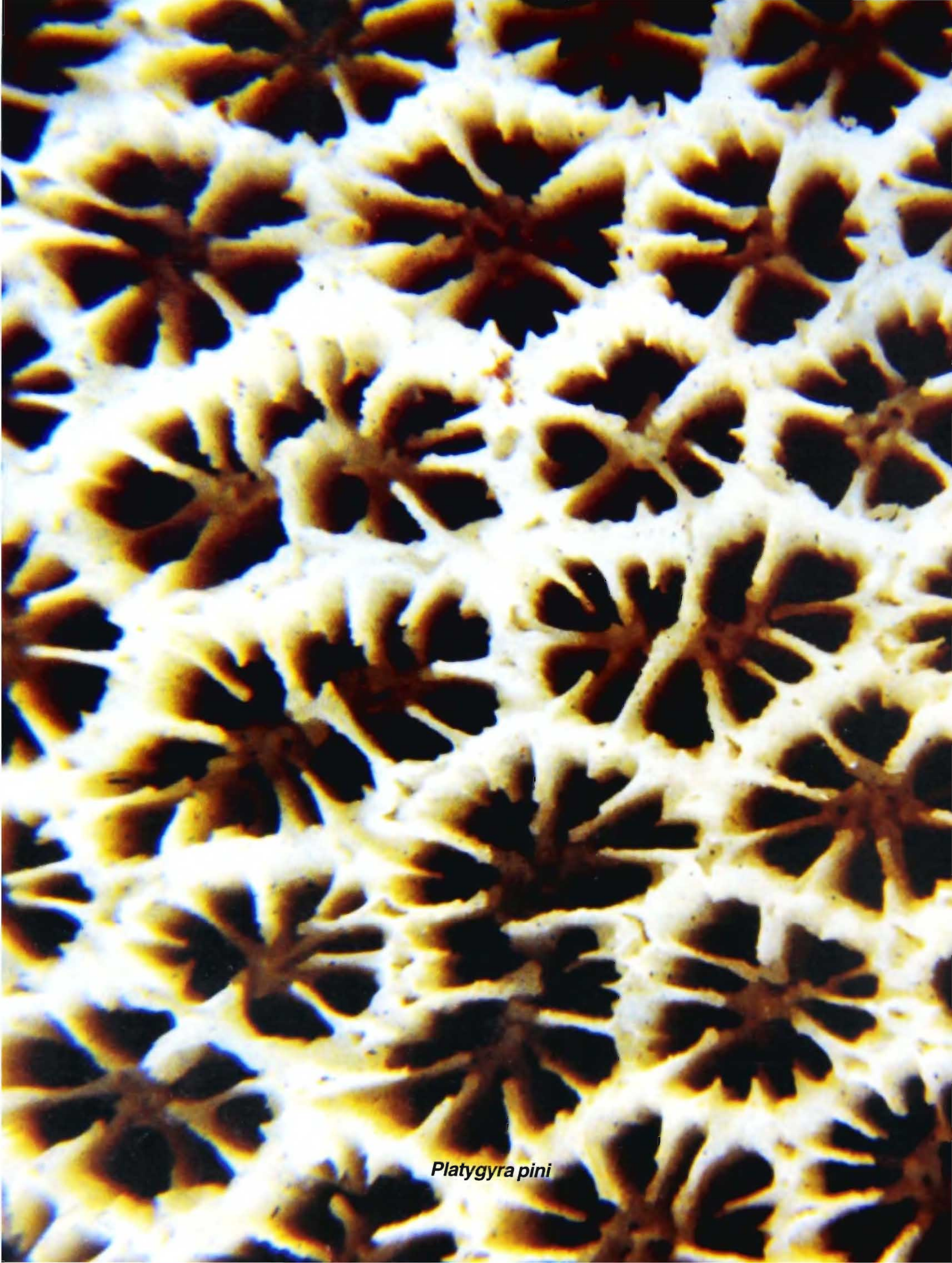
1833. *Astrea pectinata* Ehernberg, *Beitrage zur physiologischen Kenntniss der Corellenthiere im Allegemeinen und besanders des Rothen Meeres. Abh. K. Akad. Wiss. Berl.* 1832, 250-380.

1974. *Goniastrea pectinata* Scheer & Pillai, *Report on the Scleractinia from the Nicobar Islands. Zoologica (Stuttg.).* **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are submassive or encrusting. Corallites are cerioid to submeandroid usually with less than four centres. Walls are thick and paliform lobes are well developed. Living colonies are pale brown or pink, dark brown in deep or turbid water.

Distribution : In India it is reported from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely reported throughout the Indo-Pacific, Red Sea, Samoa, the Great Barrier Reef and the Coral Sea.

Remarks : It is similar to *G. edwardsi* but has distinctly smaller corallites. Mostly found on the shallow water environments.



Platygyra pini

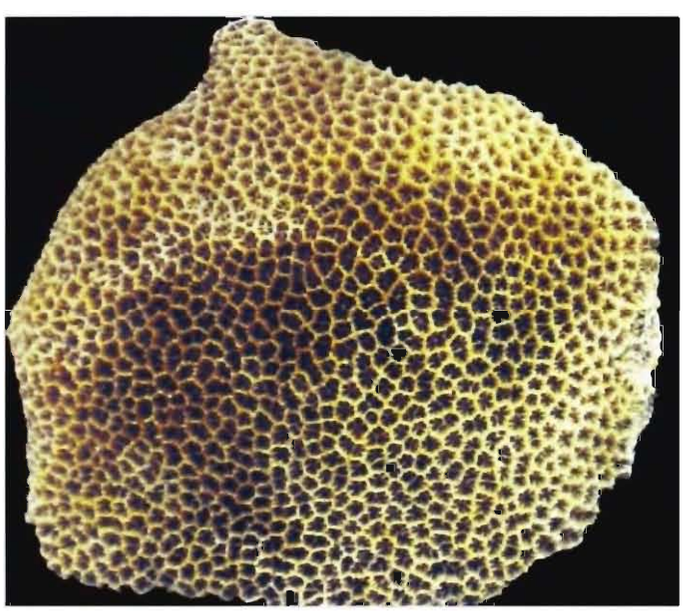
Genus ***Platygyra*** Ehrenberg, 1834

Ten species are reported from the world, of which four are recorded from India.

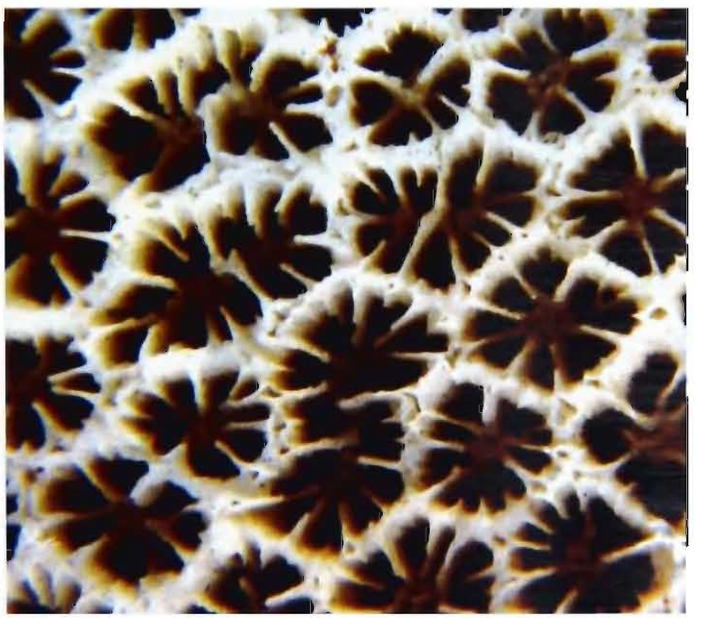
Charaters : Colonies are massive, either flat or dome-shaped. Corallites are rarely cerioid, commonly meandroid. Paliform lobes are not developed; columellae seldom form centres and are continuous tangle of species. Polyps are extended only at night. *Platygyra* is similar to *Goniastrea* and *Leptoria*. *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. It is represented in all the four major coral reef areas in India.

170. ***Platygyra pini*** Chevalier, 1975

1974. *Platygyra pini* Chevalier, Les Scleractiniares de la Melanesie francaise (Nouvelle Caledonie, Iles Chesterfield, Ildes Loyaute, Noulles Herbrides). 2eme Partie. Exped. Francaise recifs corallines Nouvelle Caledonie, *Edn. Fond. Singer-Polignac*, Paris. 7, 5-407, pl. 42.



Characters : Colonies are massive to encrusting, subcerioid to submeandroid with thick walls. Septa are thin and widely spaced. There may be some development of columella and/or paliform lobes.



Living colonies are gray or yellow-brown in colour with green or cream centers.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is widely distributed from Caledonia, Indonesia, Chesterfield Islands, the Great Barrier Reef and the Coral Sea.

Remarks : Submeandroid *P. sinensis* is distinguished from *P. pini* by its thinner walls and more compact septa. Submeandorid *P. daedalea* is usually distinguished from *P. pini* by exsert septa and the occassional presence of elongate valleys. Usually found on the shallow reef environments.

171. ***Platygyra lamellina*** (Ehrenberg, 1834)

1834. *Maendra lamellina* Ehrenberg, Beitrage zur physiologischen Kenntniss der Corellenthiere im Allegemeinen und besanders des Rothen Meeres. *Abh. K. Akad. Wiss. Berl.* 1832, 250-380.

1973. *Platygyra lamellina* (Ehrenber) Pillai, Vine & Scheer, Bericht uber eine Korallensammlung von den Seychellen. (Notes on a collection of corals from the Seychelles). *Zool. Jahrb. Abt. Syst. Oekol. Geogr. Tiere.* 100, S, 457- 465, pl. 1-3.

Characters : Colonies are massive, meandroid, with thick walls. Septa are uniformly exsert and are rounded. Columella may be well developed, but do not form distinct centers. Colonies are brown or with brown walls and grey or green valleys.

Distribution : In India it is recorded only from

Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific, from the Red Sea to Polynesia and Coral Sea.

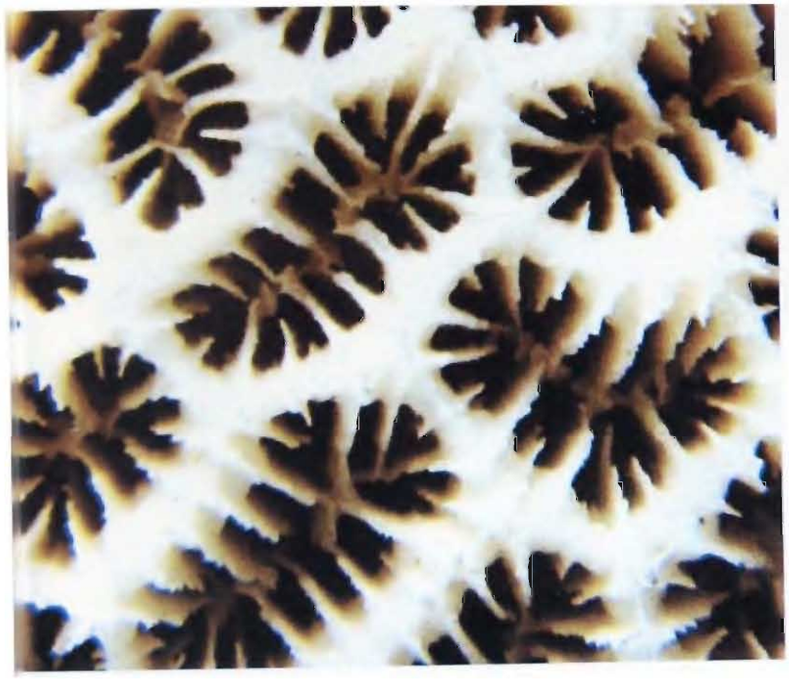
Remarks : *P. lamellina* is usually distinguished from the common *P. daedalea* by the presence of a much thicker wall and rounded, less exsert septa. Usually found on the back reef margins.

172. ***Platygyra daedalea*** (Ellis and Solander, 1786)

1786. *Madrepora daedalea* Ellis and Solander, *Nat. Hist. of many curious and uncommon zoophytes, London,* **1** : 1-208, pl. 1-63.

1864. *Coeloria daedalea* (Ellis & Solander) Verrill, *List of the polyps and corals sent by the Museum of Comparative Zoology to tother institutions in exchange, with annotations. Bull. Mus. Comp. Zool. Harv. Coll.* **1**, 29-60.

Characters : Colonies are massive to encrusting, meandroid or submeandroid, with thick walls. Septa are exsert and have a characteristically ragged appearance. Colonies are brightly coloured, most commonly with brown walls and grey or green valleys in colour.



Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. It is widely distributed throughout the Indo-Pacific, Marshall Islands, the Great Barrier Reef and the Coral Sea.

Remarks : *P. lamellina* is distinguished from *P. daedalea* by its neat rounded septa.

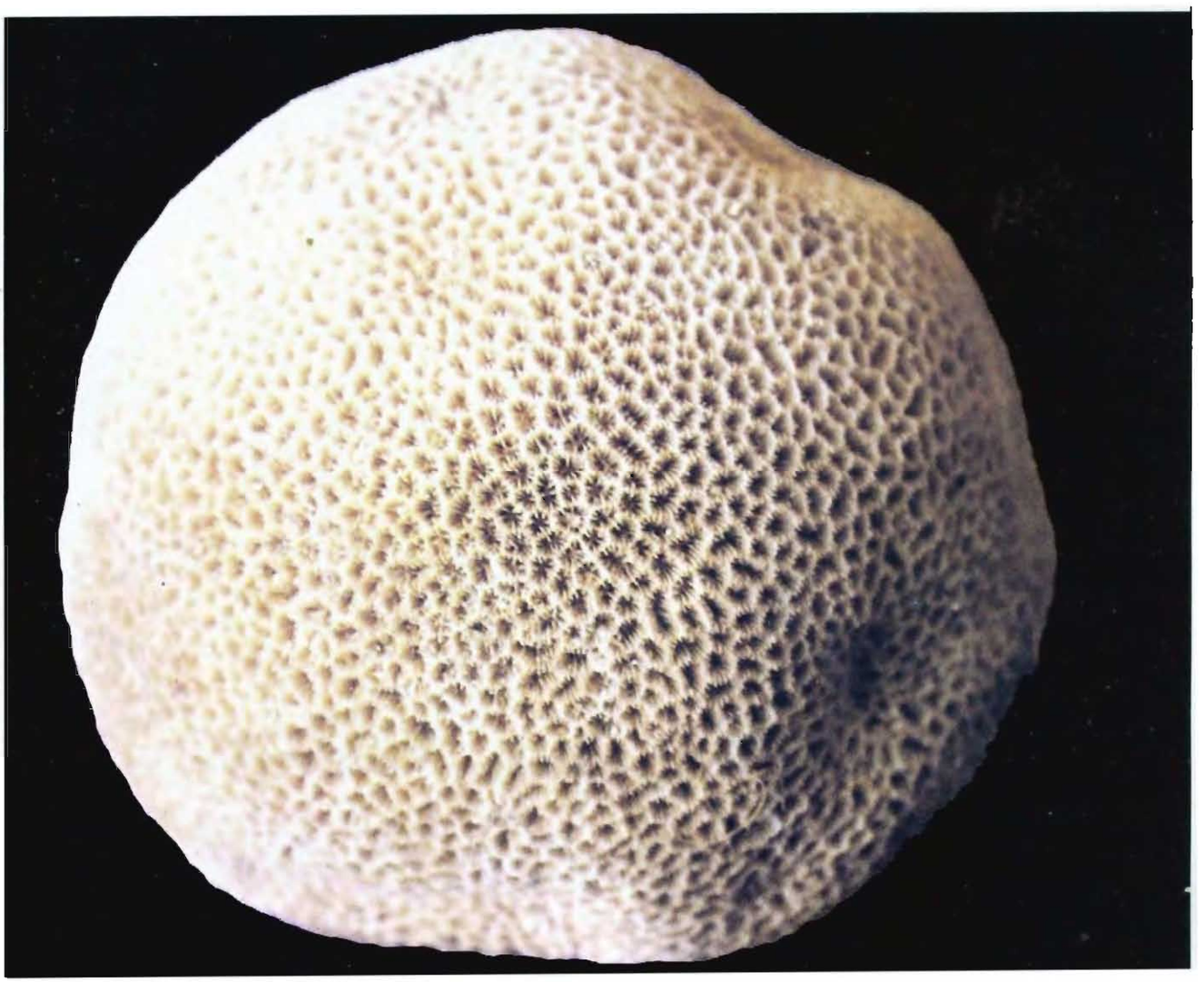
173. ***Platygyra sinensis***
(Milne Edwards and Haime, 1849)

1849. *Astoria sinensis* Edwards & Haime, *Memoire les polypiers appartenant a la famille des Oculinides, au groupe intermediaire des Pseudastreides er a la familie des Fongides. C.R. Hebd. Seances Acad. Sci.* **29**, 67-73.

1976. *Platygyra sinensis* Wijsman-Best, *Systematics and ecology of New Caledonian Faviinae (Coelentrata, Scleractinia). Bijdr. Dierkd.* **2** (1), 1-76, pl. 1-14.

Characters : Colonies are massive or flat, subcerioid to meandroid, with thin walls. Septa are thin, slightly exsert. There are no paliform lobes, although larger septal dentations may occur where the septa descent vertically. Columellae are narrow and largely composed of loosely interwined trabeculae. Living colonies have a wide variety of colours, often bright, as in the case of other *Platygyra* species.

Distribution : In India it is recorded from Gulf



of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the tropical Indo-Pacific, Red Sea, Samoa, the Great Barrier Reef and the Coral Sea.

Remarks : It is similar to *P. pini*. It is found on most reef environments, especially back reef margins.

Genus ***Oulophyllia*** Milne Edwards and Haime, 1848

Three species are reported from the world, of which only one species is recorded in India.

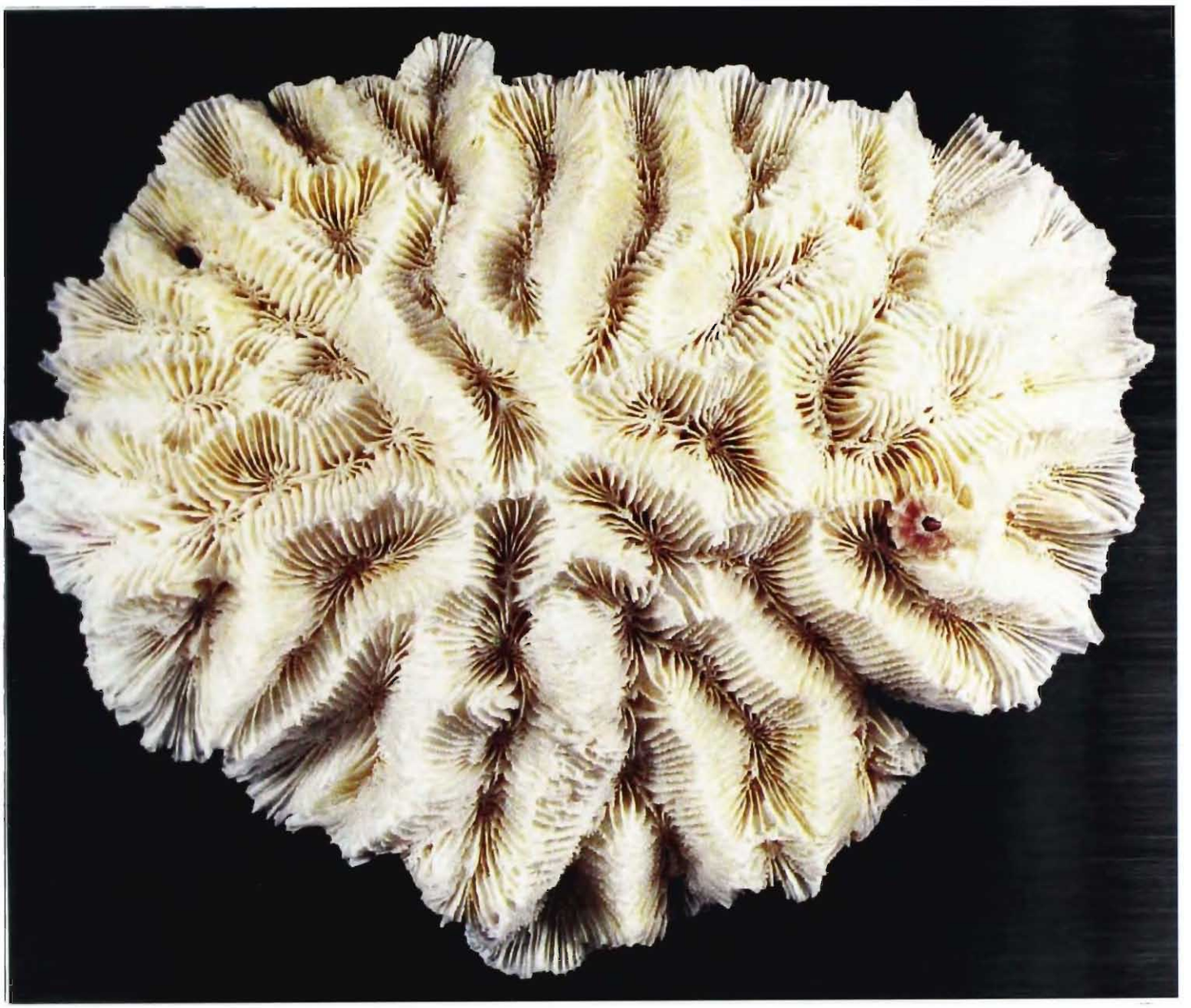
Characters : Colonies are massive, monocentric to meandroid, composed of large valleys with widely spaced, ragged septa and acute thin walls. Paliform lobes are usually present. Polyps are extended only at night. This genus is similar to *Platygyra*. Only one species is recorded from the Andaman and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

174. ***Oulophyllia crispa*** (Lamarck, 1816)

1816. *Meandrina crispa* Lamarck, Histoire naturelle des Animaux sans vertebras. Paris, **2**, 1-568.

1974. *Oulophyllia crispa* Wijsman-Best, *Faviidae collected by the Snellius Exped. II* The genera *Favites, Goniastrea, Platygyra, Oulophyllia, Leptoria, Hydnophora and Caulastrea*. Snellius Exped. *27, Zool. Meded. Rijksmus. Nat. Hist.* Leiden. **50** (4), 45-63, pl. 1-8.

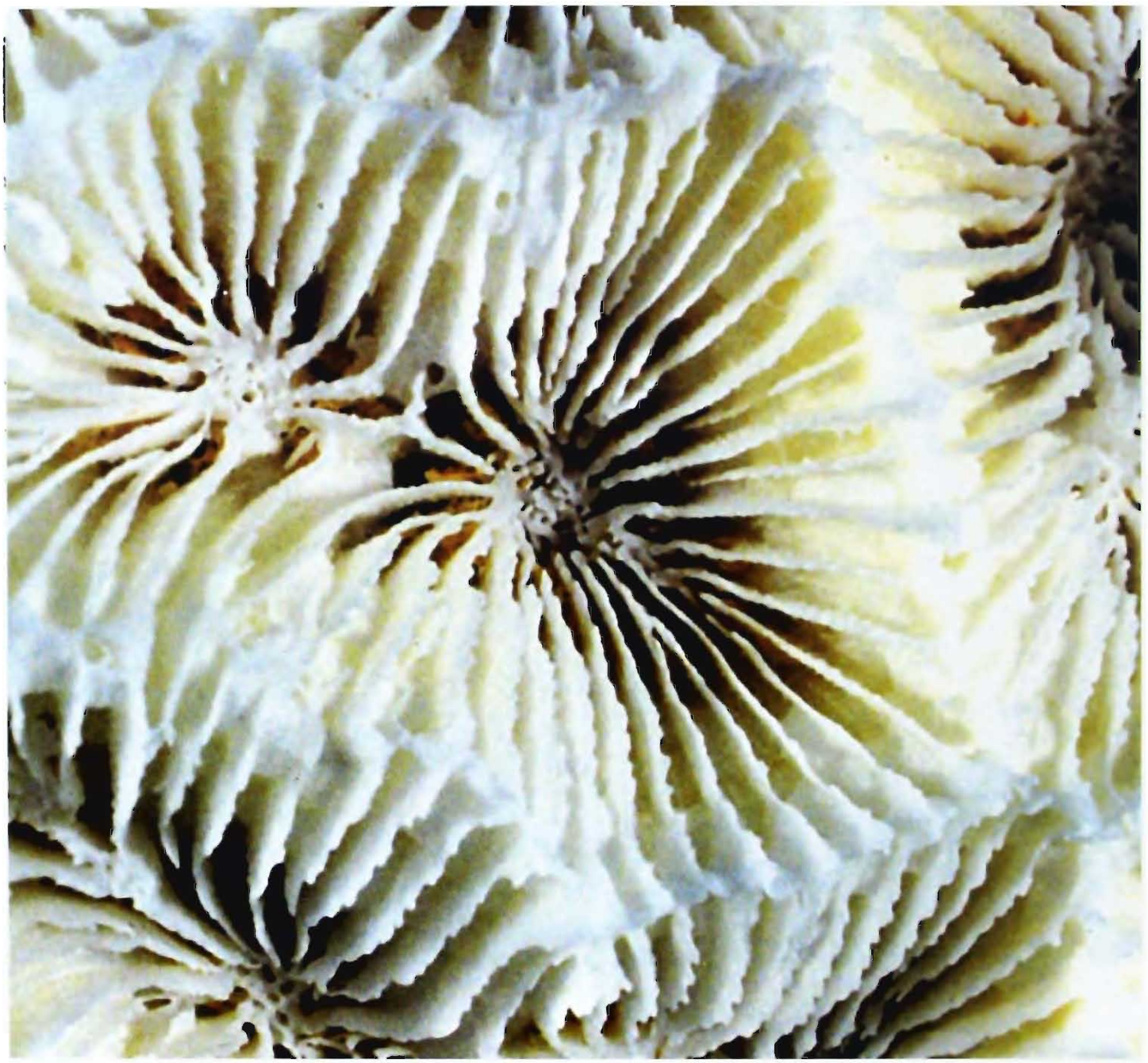
Characters : Colonies are usually massive and frequently exceed 1 m in diameter. Valleys are broad (up to 20 mm) and V-shaped. Septa are



usually thin and slope uniformly to the columellae, which usually form well-defined centres. Paliform lobes may be present. Valley walls have acute upper margins. Polyps are extended only at night and are large and fleshy with conspicuous white tips to the tentacles. When retracted polyps have a coarse reptilian texture, mouths are conspicuous. Living colonies have brown walls with pale-cream or pink in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. It is widely distributed from Red Sea, east Africa, Madagascar, Chagos, Maldives, Singapore, Molluccas, Duke of York Islands, Great Barrier Reef, New Caledonia, Philippines, Taiwan and Japan.

Remarks : It is similar to *Platygyra*, which has smaller skeletal structures. Mostly found on lagoons.



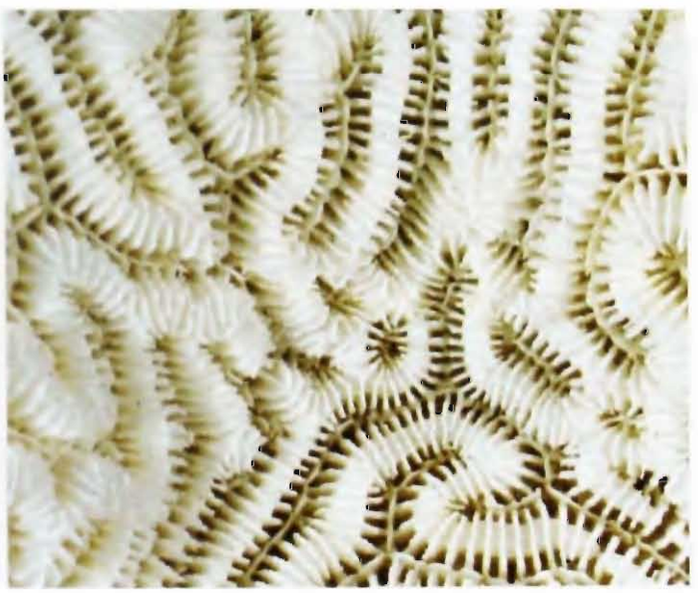
Genus ***Leptoria*** Milne Edwards and Haime, 1848

Of the two species reported from the world, of which one is recorded in India.

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. In India except from the reefs of Gulf of Kachchh, it is reported from all the other major coral reef areas.

175. ***Leptoria phrygia*** (Ellis and Solander, 1786)

1786. *Madrepora phrygia* Ellis and Solander, Nat. Hist. of many curious and uncommon zoophytes, *London*, **1** : 1-208, pl. 1-63.



1974. *Leptoria phrygia* (Ellis and Solander) Scheer and Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.).* **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are massive with an even surface and dense skeleton. Corallite 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. Living colonies are cream, brown or green in colour, with walls and valleys of different colours.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. It is widely distributed throughout the Indo-Pacific, Red Sea, Fiji Islands, Japan, the Great Barrier Reef and the Coral Sea.

Remarks : *Leptoria* is similar to *Platygyra* and also *Goniastrea*. *Goniastrea* is less meandroid than distinct centres and well developed paliform lobes. Commonly found on the upper reef slopes.

Genus *Montastrea* Blainville, 1830

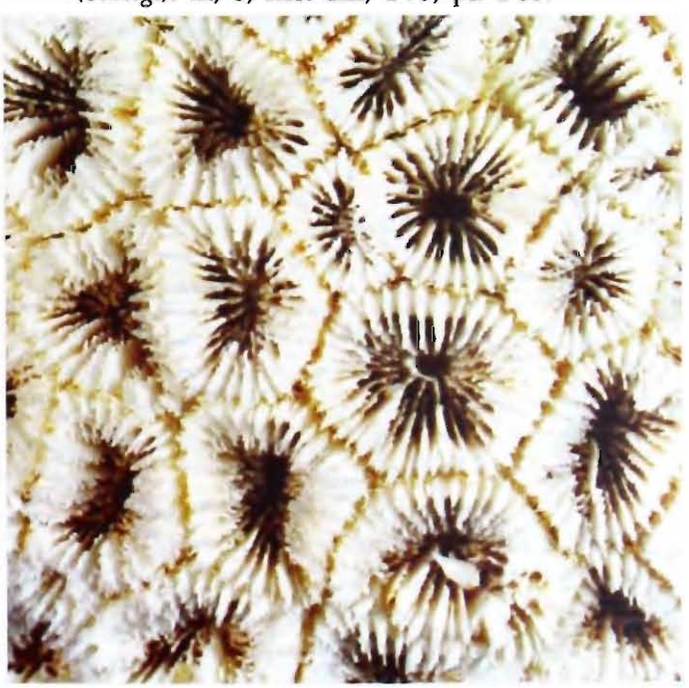
Ten species are reported from the world, of which two species are recorded from India.

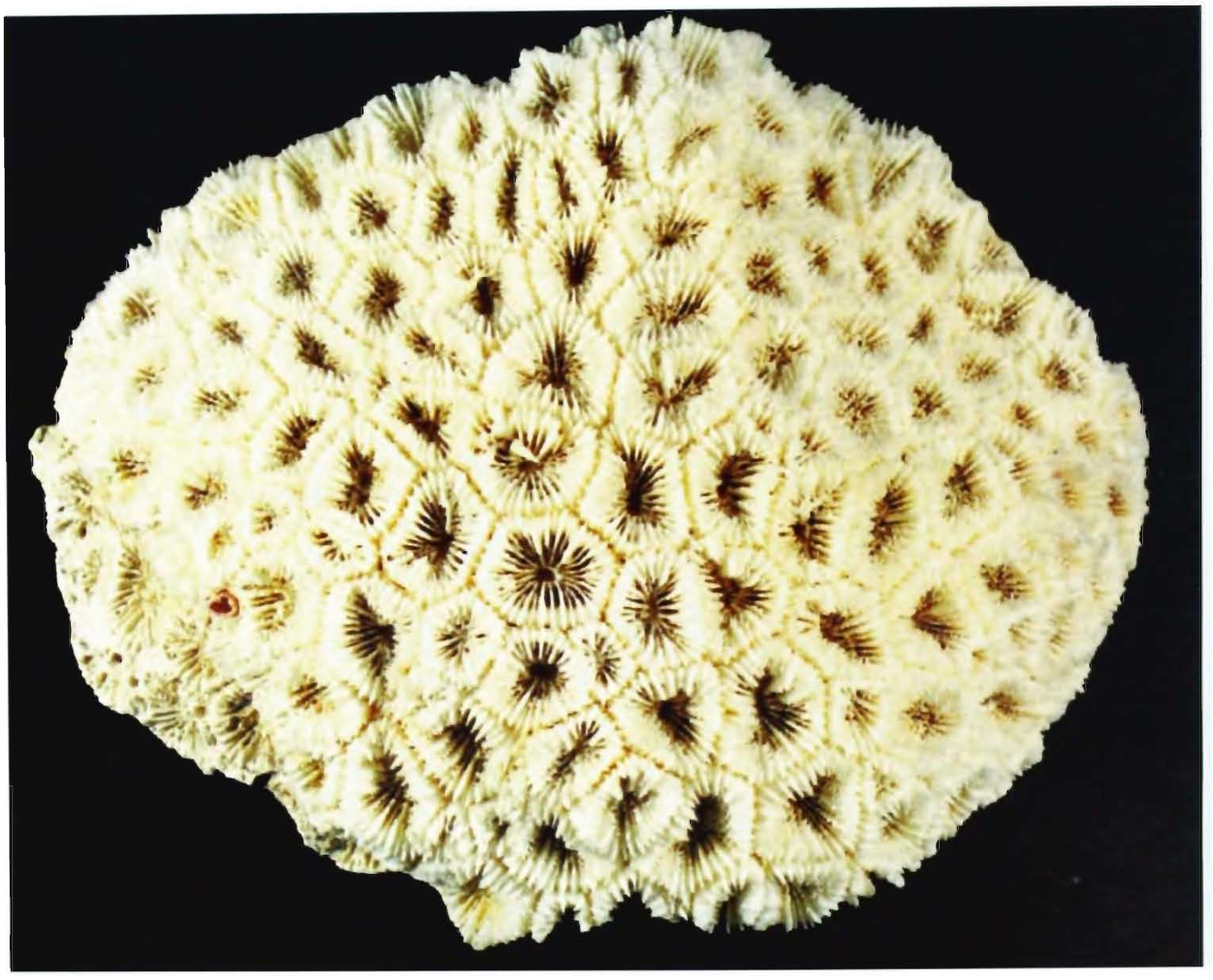
Characters : Colonies are massive, either flat or dome-shaped. Corallites are monocentric and plocoid. Daughter corallites are predominantly formed by extratentacular budding, which is, budding from the wall of parent corallites. Some intratentacular budding may also occur. This genus can be separated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

176. *Montastrea valenciennesi* (Milne Edwards and Haime, 1848)

1848. *Phymastraea valenciennesi* Edwards & Haime, Note sur la dassification de la deuxieme tribu de la famille des Astreides. *C.R. Hebd. Seances Acad. Sci.* **27** (20), 490-497.

1974. *Favia valencienessi* Scheer & Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.).* **42**, 3, heft 122, 1-75, pl. 1-33.





Characters : Colonies are massive, rounded or flattened, sometimes encrusting. Corallites are distinctly polygonal, usually hexagonal, 9-15 mm in diameter. Three order of septa are usually present; sometimes six exert primary septa can be distinguished from the others of the first order and occasionally a fourth order is present. All septa are dentate, the dentations being large and conspicuous. The dentations and septa are always granulated. The columellae are usually small, compact and spongy, sometimes loosely trabecular. Costae are prominently beaded and are well developed in calices with well-developed exotheca. Colours are variable, most frequently green and yellow with the coenosarc and oral disc always being different.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Elsewhere, it is recorded from Madagascar, Seychelies Islands, Marshall Islands and the Great Barrier Reefs.

Remarks : It is a well-defined species and abundant in the reef flat areas.

177. ***Montastrea annuligera***
(Milne Edwards and Haime, 1849)

1849. *Orbicella annuligera* Edwards & Haime, Memoire sur les polypiers appartenant a la famille des Oculinides, au groupe intermediaire des Pseudastreides et a la famille des Fongides. *C.R. Hebd. Seances. Acad. Sci.* **29** : 67-73.

Characters : Colonies are irregular or encrusting.

Corallites are circular with calices 3-4 mm in diameter. Septa taper from the wall to the columella and are in three cycles, those of the primary cycle being widely spaced with well-developed paliform lobes. Most colonies have atleast some development of a groove and tubercle system. Colonies are mottled or uniform green and brown, with darker calices.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely distributed from the Red Sea to the western Pacific, including Indonesia, the Philippines and New Caledonia.

Remarks : Usually found on the back reefs and lagoons.

Genus ***Plesiastrea*** Milne Edwards and Haime, 1848

Two species are reported from the world, of which one is recorded in India.

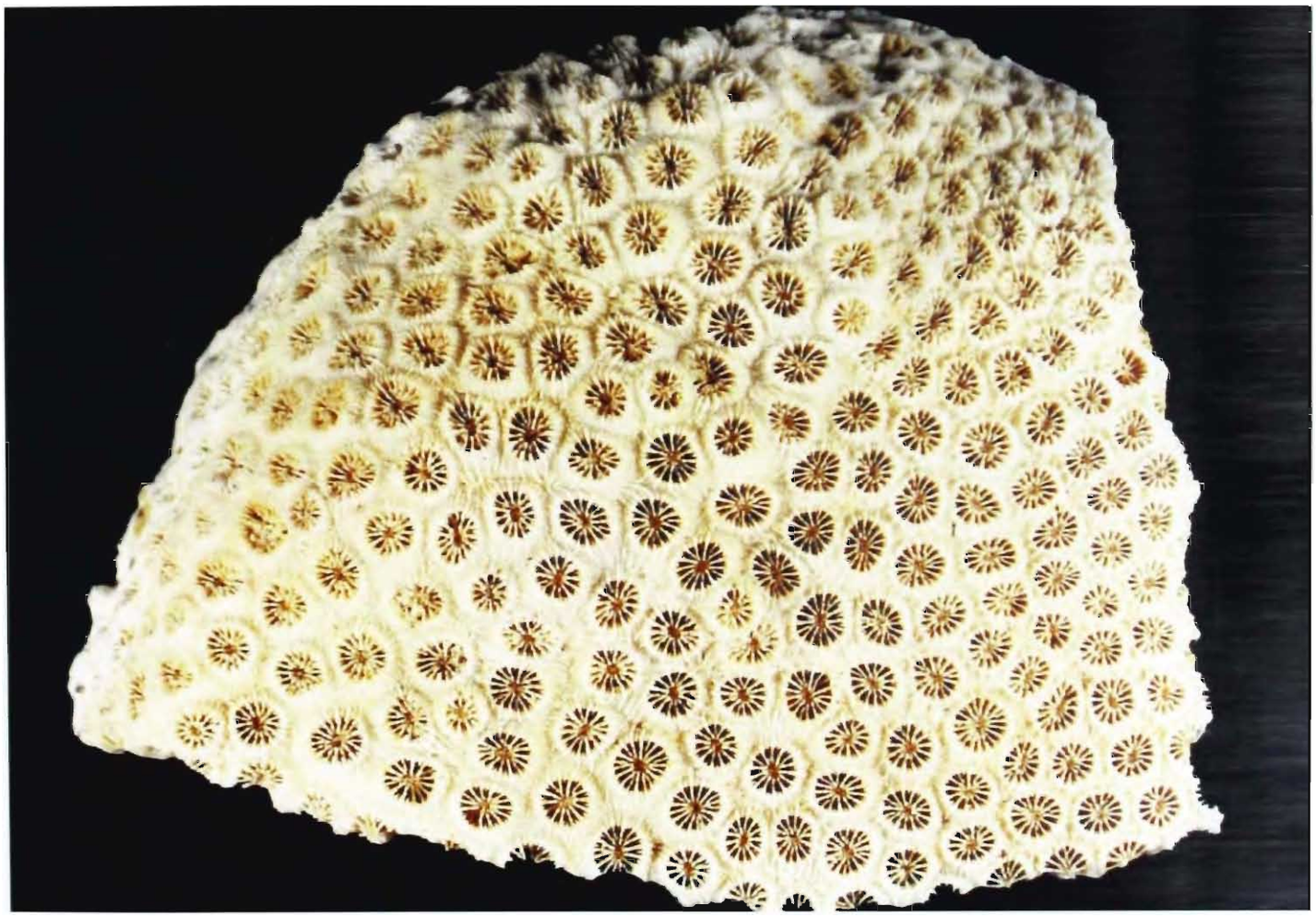
Characters : Colonies are massive, rounded or flattened. Coralla are sub-cerioid to plocoid with round corallites produced by extra-tentacular budding. Like *Montastrea*, but corallites are smaller, with a well developed paliform crown composed of true Pali. Polyps are usually extended only at night. *Plesiastrea* is close to *Montastrea* but has smaller corallites with well-developed paliform lobes. In India, except Gulf of Mannar it is recorded in all the other major coral reef areas.

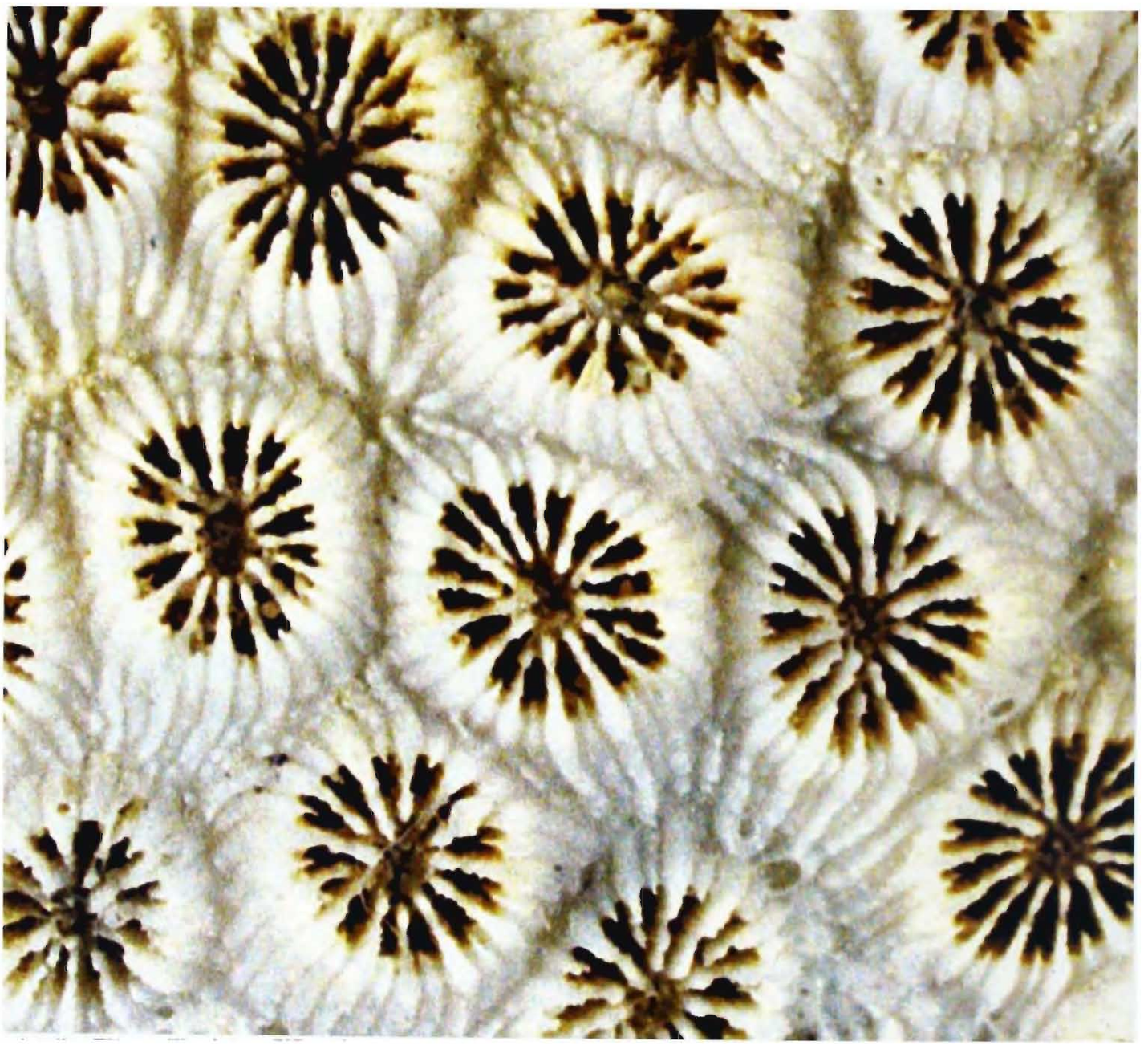
178. ***Plesiastrea versipora*** (Lamarck, 1816)

1816. *Astrea versipora* Lamarck, Hisotoire naturelle des Animaux sans vertebras. Paris, **2**, 1-568.

1974. *Plesiastrea versipora* Scheer and Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are flat and are frequently lobed. Corallites are monocentric and plocoid.





Extratentacular budding produces daughter corallites. Corallites have calices approximately 2.5 mm in diameter. Paliform lobes form a neat circle around small columellae. Polyps are usually extended only at night. Tentacles are short and are of two alternating sizes. Living colonies are yellow, cream, green or brown, usually pale-coloured.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. It is widely distributed from St. Vincent's Gulf to South Australia.

Remarks : *P. versipora* is close to *Montastrea* but has smaller corallites with well-developed paliform lobes. It is readily confused with other faviid species with corallites of similar size and shape, notably *Favia stelligera* and *Cyphastrea* species. Mostly occur in shaded places such as under overhangs.

Genus ***Oulastrea*** Milne Edwards and Haime, 1848

Monospecific and it is recorded in India.

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. Defined genus. In India it is recorded only from Andaman and Nicobar waters.

179. ***Oulastrea crispata*** (Lamarck, 1816)

1816. *Astrea helipora* Lamarck, *Histoire naturelle des Rothen Meeres*, **2** : p. 1-568.

Characters : 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.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Elsewhere, it found east of India to East of Australia including Great Barrier Reef.

Remarks : Found only in subtidal turbid water mostly attached to rocks.

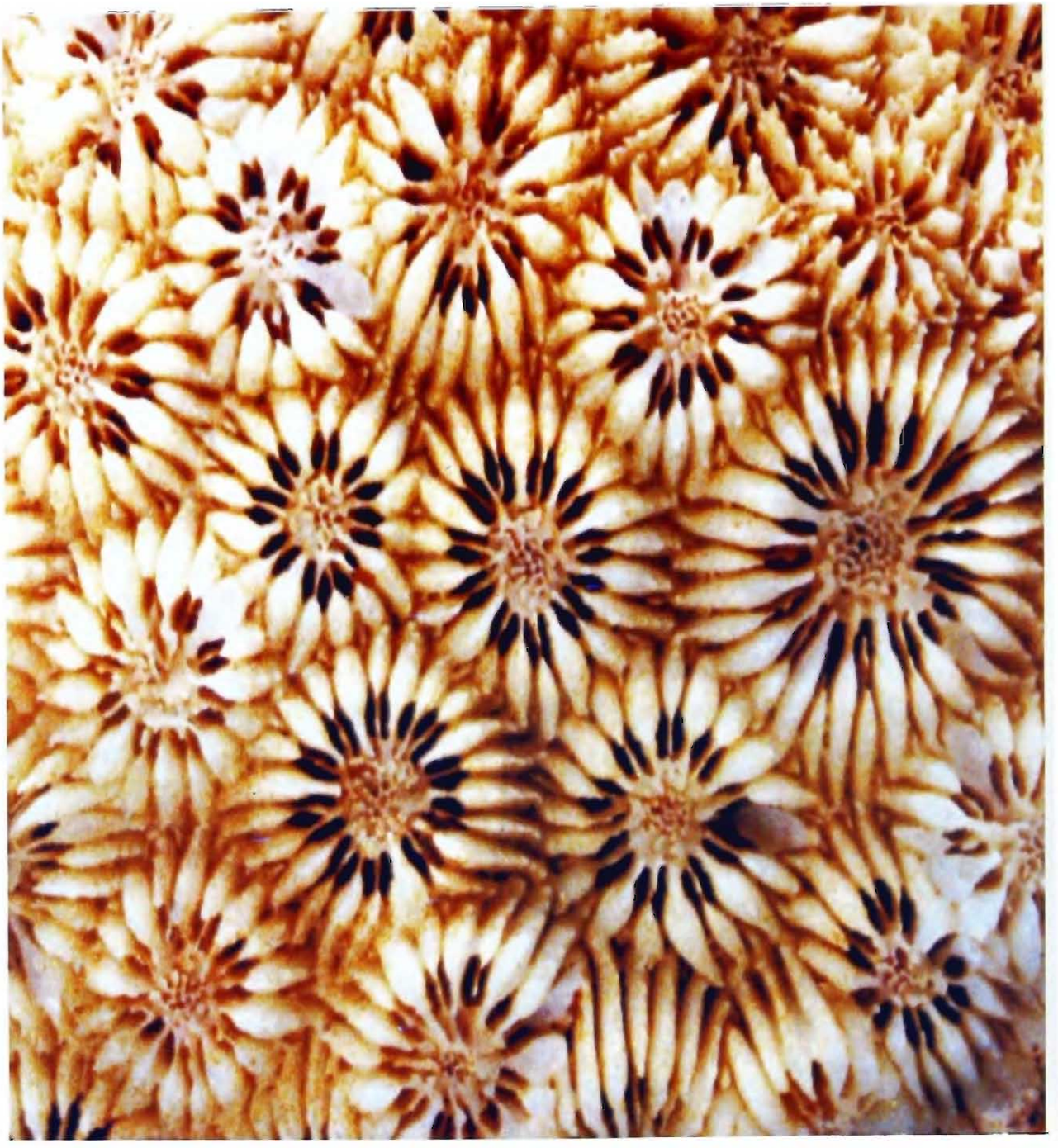
Genus ***Diploastrea*** Matthai, 1914

Monospecific. *Diploastrea heliopora* has a dense skeleton, which is seldom penetrated by boring organisms and fish also seldom grazes it. Even the crown-of-thorns starfish is reluctant to attack it, which is probably why colonies may attain very large sizes, larger than any other faviid.

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. In India it is recorded from Lakshadweep and Andaman and Nicobar Islands.

180. ***Diploastrea heliopora*** (Lamarck, 1816)



1816. *Astrea helipora* Lamarck, *Histoire naturelle des Rothen Meeres*, **2** : p. 1-568.

1974. *Diploastrea helipora* (Lamarck) Scheer and Pillai, *Report on the Scleractinia from the Nicobar Islands. Zoologica (Stuttg.)*. **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are dome-shaped with a very even surface and may be up to 2 m high and 5 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. Usually uniform cream or grey in colour, sometimes greenish.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely it is distributed throughout the Indo-Pacific, Red Sea, Madagascar, Samoa and the Great Barrier Reef.

Remarks : This is one of the easily recognised species of all corals. Mostly found in exposed and protected reef environments.

Genus ***Leptastrea*** Milne Edwards and Haime, 1848

Seven species are reported from the world, of which three are recorded from India.

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. It is represented from all the major coral reef areas in India.

181. ***Leptastrea transversa*** Klunzinger, 1879

1879. *Leptastrea transversa* Klunzinger, Die Korallenthiere des rothern Meeres. **2**, 1-88, pl. 1-10; 3, 1-100, pl. 1-10, Gutmann, Berlin.

1974. *Leptastrea transversa* Scheer and pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are either massive or encrusting. Calices are polygonal, 2-9 mm in diameter. The septa are strongly dentate near the base of the calices. The paliform dentations become vertical towards the calice centre where they fuse with each other to form a compact, elongated base, supporting a series of papillae. The columellae sometimes have a more spongy, trabecular in nature; both the septa and columellae are granulated. Living colonies are usually pale cream, green or yellow with grey calices.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is reported throughout the Indo-Pacific, Red Sea, Tahiti and the Great Barrier Reef.

Remarks : This species is similar to *L. purpurea*. Mostly found on a wide range of reef environments.

182. ***Leptastrea purpurea*** (Dana, 1846)

1846. *Astraea purpurea* Dana, Zoophytes. *U.S. Exploring Exped.* 1838-1842, 7, 1-740, pl. 1-61.

1975. *Leptastrea purpurea* Chevalier, Les Scleractiniaires de la Melanesie francaise (Nouvelle caledinie, Iles Chesterfield, Iles Loyaure, Nouvelles Hebrides). 2eme Partie. Exped. Francaise recifs corallines Nouvelle Caledonie, *Edn. Fond. Singer-Polignac*, Paris 7, 5-407, pl. 42.

Characters : Colonies are irregular. Encrusting or massive and range in size up to 1 mm in diameter. Colonies are sub-cerioid. Corallites are always discrete and polygonal and are characteristically variable in size (2 11 mm in diameter). The septa are seldom thickened above the thecae. Costae are poorly developed, the coenosteum between adjacent corallites is usually a narrow, smooth strip overshadowed by the exert septa. Living colonies are pale yellow or cream on their upper surface with dark calices.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and

Palk Bay and Andaman and Nicobar Islands. Worldwide it is reported throughout the Indo-Pacific, Red Sea, Hawaii and the Great Barrier Reef.

Remarks : *L. transversa* is similar to *L. purpurea* but has uniformly sized corallites and septa have steeply plunging inner margins. Mostly found on a wide range of reef environments.

183. ***Leptastrea bottae***
(Milne Edwards and Haime, 1849)

1849. *Cyphastrea bottae* Milne Edwards and Haime, C.R. *Hebd. Scances Acad. Sci.*, **29** : 67-73.

1914. *Leptastrea solida* Matthai, A revision of the recent colonial Astraeidae possessing distinct corallites. *Trans. Linn. Soc. Lond.* 2nd Ser. Zool. 17, 1-140, pl. 7-38.

Characters : Coralla are massive and plocoid. Calices on flat surfaces are mostly of uniform diameter (about 3 mm), while those at the base of depressions are usually much smaller. Occasionally giant calices are present. The septa of an average sized calice are in three distinct cycles. All septa greatly thickened above the thecae. Costae are usually absent, the coenosteum usually being smooth or finely granulated. Living colonies are pale cream or yellow with black centres.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific, Red Sea, Hawaii and the Great Barrier Reef.

Remarks : This species is readily recognisable in underwater. This species also occurs in a wide variety of biotopes ranging from the front of Barrier Reefs to protected fringing reefs.

Genus *Cyphastrea*
Milne Edwards and Haime, 1848

Eight species are reported from the world, of which two species are recorded from India.

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. In India it is reported from all the major coral reef areas.

184. *Cyphastrea serailia* (Forskal, 1775)

1775. *Madrepora serailia* Forskal, *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum Vermium que in intinere orientali onservait Petrus* Forskal, *XIV, Corallia Havniae*, 131-9.

1975. *Cyphastrea serailia* (Forskal) Chevalier, *Les scleractiniaires de la Melanesie francaise (Nouvelle Caledonie, Iles Chesterfield, Iles Loyaure, Nouvelles Hebrides). 2eme Partie. Exped. Francaise recifs corallines Nouvelle Caledonie, Edn. Fond. Singer-Polignac*, Paris. 7, 5-407, pl. 42.

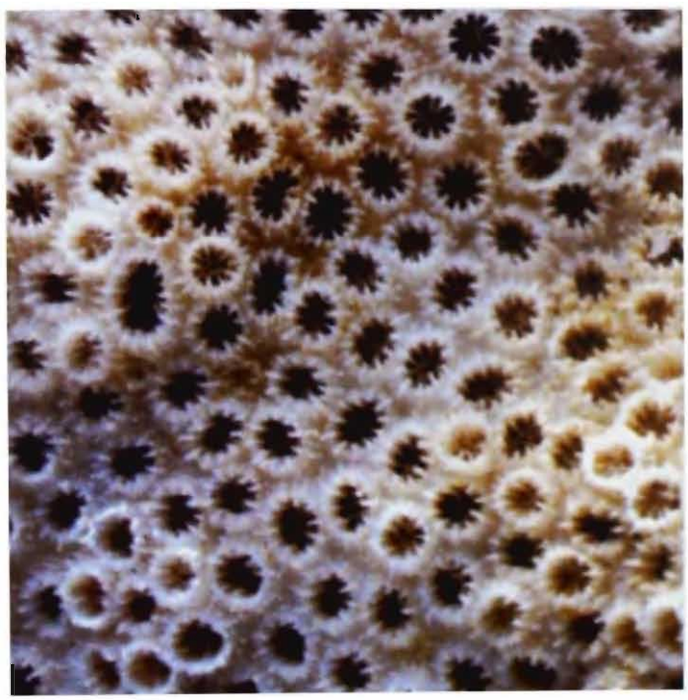
Characters : Colonies are usually massive or sub-massive, sometimes encrusting. Corallites are round and variable exsert. Calices of mature corallites are 1.5 to 2.8 mm in diameter. The corallites have 12 septa. The columella are usually inconspicuous and trabecular. The costae are equal or subequal and are poorly developed. Thecae vary greatly in height and thickness. The coenosteum is often largely composed of dissepimental blisters and is always covered with granulated exothecal spines. Living colonies are usually gray, brown or cream in colour.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide it is reported throughout the Indo-Pacific from the Red Sea to the Marshall Islands and Philippines and the Great Barrier Reef.

Remarks : *C. serailia* corallites have a very wide range of variation so that colonies from different habitats may appear to be different species. Nevertheless, it is readily distinguished from *C. chalcidicum* by the costae and from *C. microphthalma* by the number of septa.

185. *Cyphastrea microphthalma* (Lamarck, 1816)

1816. *Astrea microphthamla* Lamarck, *Histoire naturelle des Rothen Meeres*, 2 : p. 1-568.



1974. *Cyphastrea microphthalma* (Lamarck) Scheer and Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies are usually encrusting, rarely sub-massive or massive. Calices are 1- 2 mm in diameter and contain two orders of septa arranged systematically. Occasionally eleven septa are found. Costae are usually equal and support elongated, granulated perithecal spines, which extend across the coenosteum, elaborate ornamentation. Living colonies are pale, uniform colours; those from turbid biotopes or from shaded regions are usually dark brown or dark green.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar, Palk Bay and Andaman and Nicobar Islands. Widely it is distributed throughout the Indo-Pacific, Red Sea, to the New Hebrides, Samoa, Tahiti and the Great Barrier Reef.

Remarks : *C. microphthalma* is readily identified by its 10 primary septa (which can be easily counted in underwater).

Genus *Echinopora* Lamarck, 1816

More than any other genus of corals (except perhaps *Merulina*), *Echinopora* colonies have widely varying growth forms. Twelve species are reported from the world, of which three species are recorded from India.

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 exert 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* has a superficial resemblance to *Echinophyllia*. In India it is recorded from the Gulf of Mannar and Palk Bay, Lakshadweep and Andaman and Nicobar Islands.

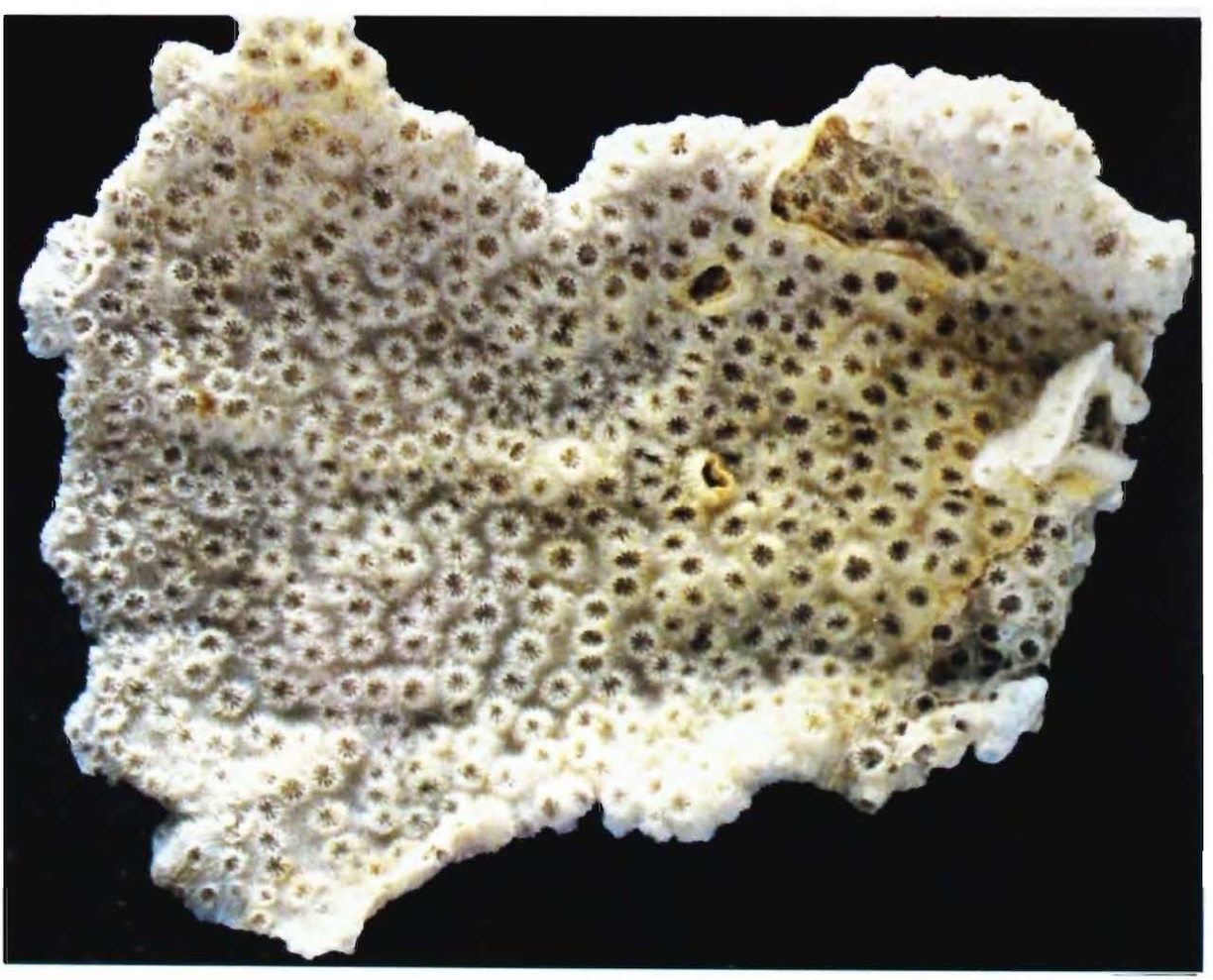
186. *Echinopora lamellosa* (Esper, 1795)

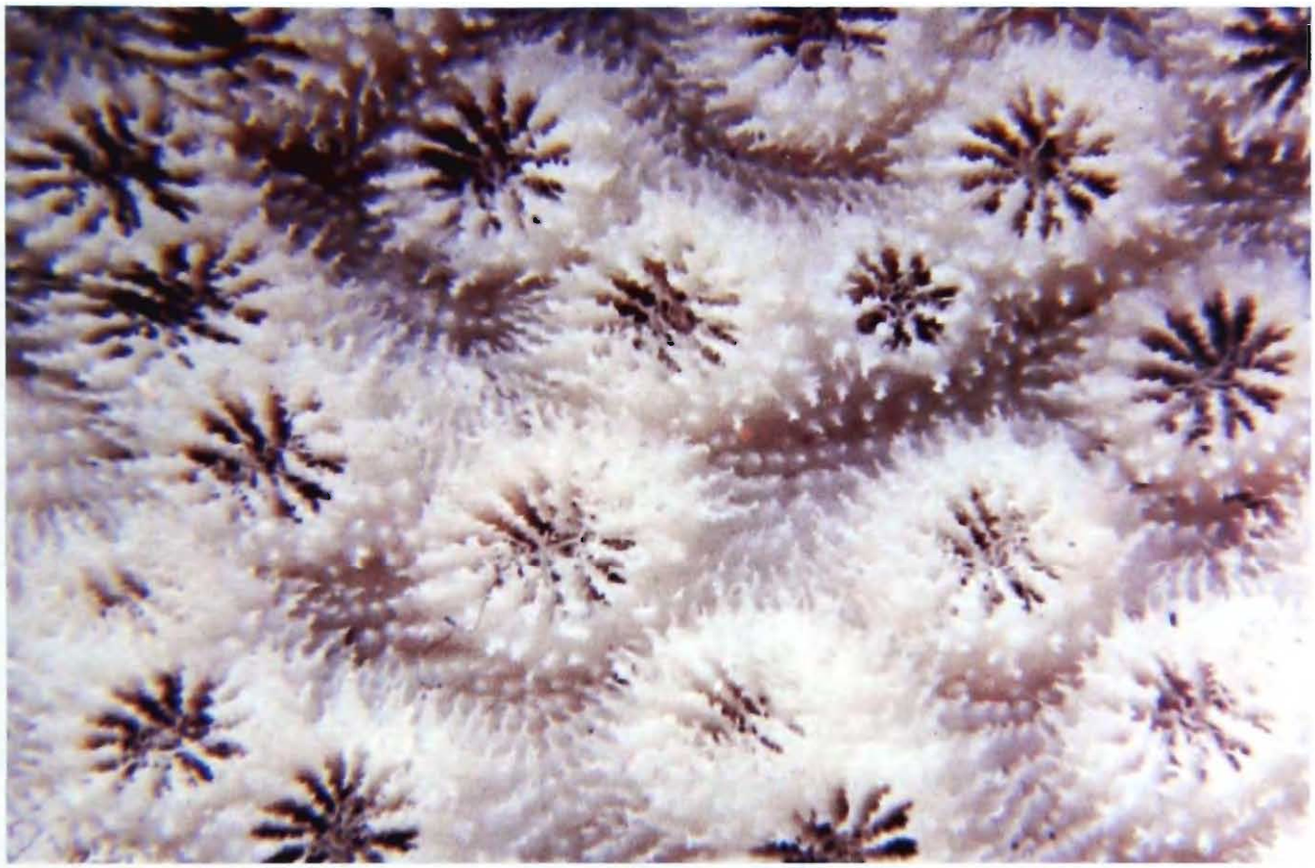
1794. *Madrepora lamellosa* Esper, *Die Pflanzenthiere*, **1** : 65-116.

1974. *Echinopora lamellosa* (Esper) Scheer and Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*. **42**, 3, heft 122, 1-75, pl. 1-33.

Characters : Colonies consist of thin laminae arranged in whorls or tiers or, rarely, forming tubes. Corallites are relatively thin-walled and have calices 2.5 to 4.0 mm in diameter. Columellae are small and compact, and paliform lobes are well developed. Living colonies are amber, pale to dark brown or greenish, often with darker brown or green calices in colour.

Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the Indo-Pacific, from the Red Sea, Japan, Bonin Island, Marshall Island, Samoa and the Great Barrier Reef.





Remarks : This species is similar to *E. gemmacea*. Sometimes a dominant species in the shallow water habitats with flat substrates as in the case of Gulf of Mannar Islands.

187. ***Echinopora gemmacea*** (Lamarck, 1816)

1816. *Explanaria gemmacea* Lamarck, *Histoire naturelle des Animaux sans vertebres*. Paris, **2**, 1-568.

Characters : Colonies are laminar, bifacial, sometimes forming contorted branches. Corallites have calices 0.5-4.5 mm in diameter.

Columellae are large, and paliform lobes are not well developed. Primary septa may be thick and are always exert.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Worldwide, it is found throughout the Indo-Pacific region, the Great Barrier Reef and the Coral Sea.

Remarks : It is similar to *E. lamellosa* but forms inclined corallites. Mostly found on the protected reef environments.

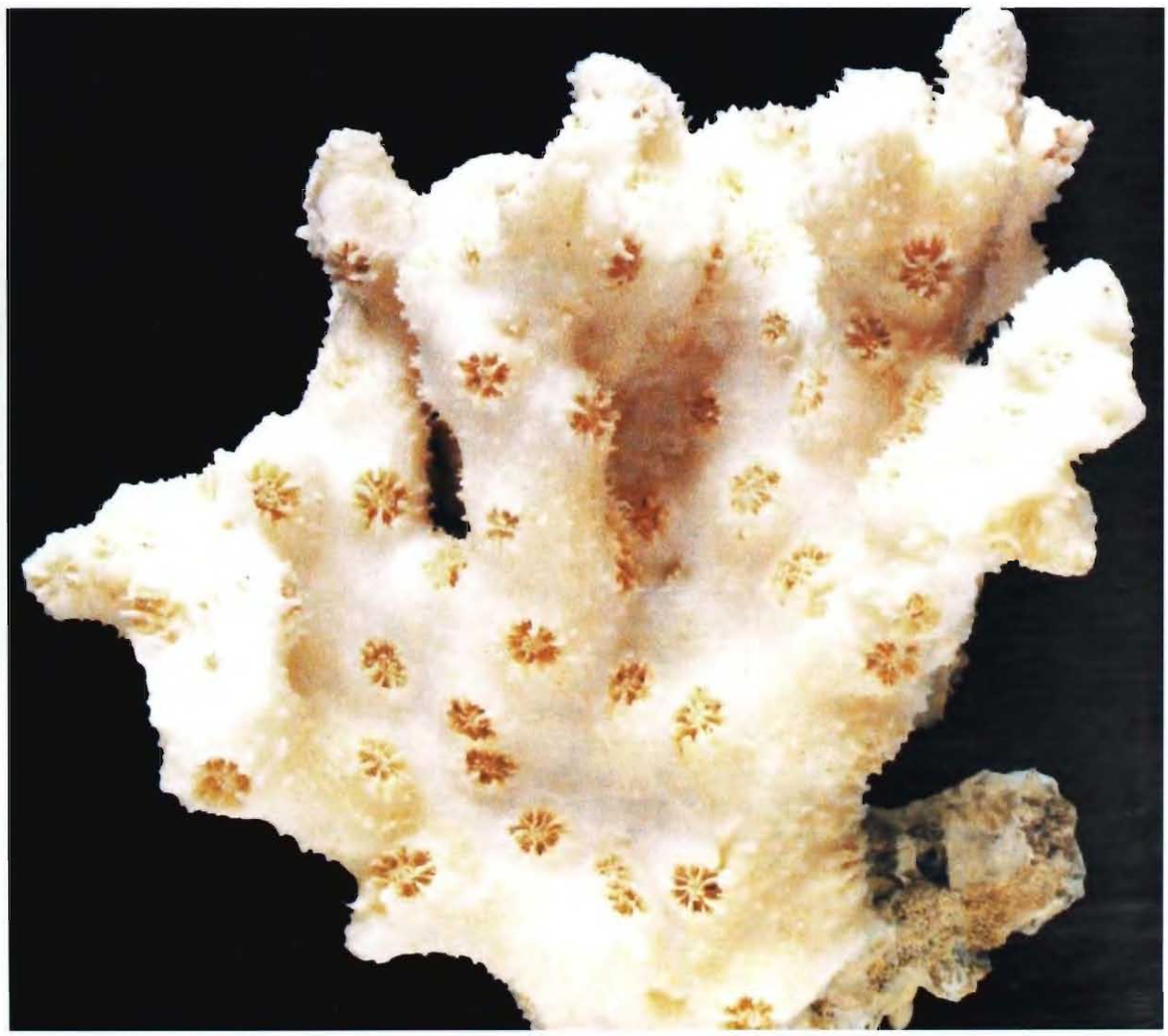
188. ***Echinopora horrida*** Dana, 1846

1846. *Echinopora horrida Dana, U.S. Exploring Expedition* 1838-1842, **7,** p. 1-740, pl. 61.

Characters : Colonies are composed of contorted branches with flat laminar bases. Corallites are circular, up to 4 mm in diameter, cylindrical or with the shape of a truncated cone more or less protruding from the branches. Septa are generally in three cycles. The living colonies are dark brown, cream or green in colour.

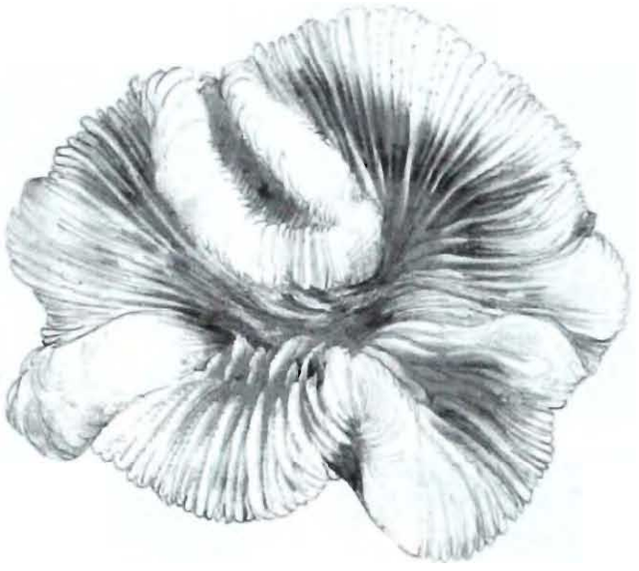
Distribution : In India it is recorded from Andaman and Nicobar Islands. Worldwide, it is reported from Singapore, Indonesia, New Guinea, Philippines, New Caledonia, Fiji and the Great Barrier Reef.

Remarks : It is similar to *E. gemmacea*. Sometimes form large stands on protected horizontal substrates including shallow reefs and lagoons.



Family **TRACHYPHYLLIIDAE** Verrill, 1901

Characters : Solitary to colonial and zooxanthellate. The family is separated from Faviidae by growth-form, the presence of large paliform lobes and fine teeth on the septa. This family has only one genus *Trachyphyllia*.



Trachyphyllia geoffroyi

Genus ***Trachyphyllia*** Milne Edwards and Haime, 1848

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.

189. ***Trachyphyllia geoffroyi*** (Audouin, 1826)

1826. *Turbinolia geoffroyi* Audouin, Explication sommaire des planches de Polypes in Savigny, J.C. : 'Description de l' Egypte', 1 (4).

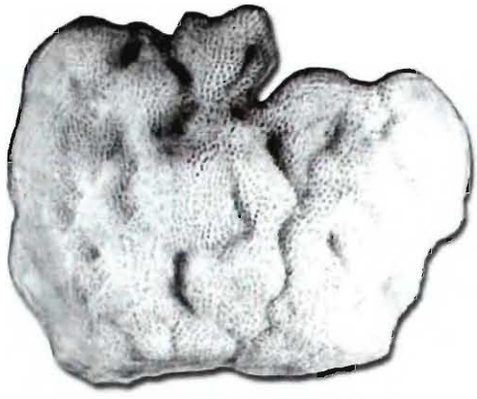
Characters : Living colonies are always brightly coloured, various mixtures of red, blue and green being the most common. The upper surface consists of a large oral disc surrounded by a single circle of tentacles, which are extended only at night.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from the Red sea to the Philippine Islands and Eastern Australia.

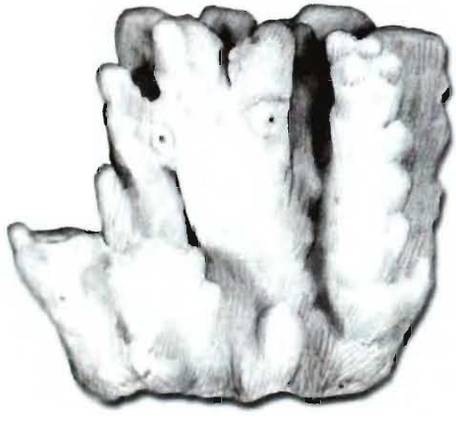
Remarks : Mostly found on inner reef environments and on soft substrates.

Family **PORITIDAE** Gray, 1842

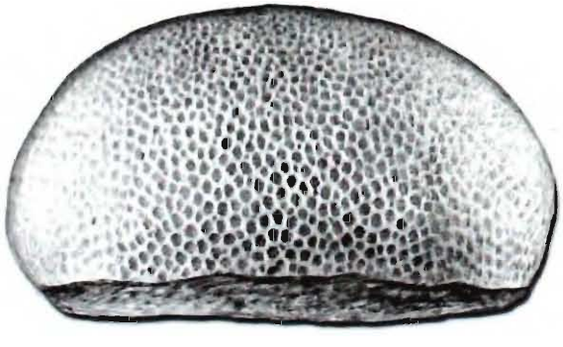
Family Poritidae is a heterogenous assemblage of distantly related genera. It is Colonial, hermatypic and mostly extant. Colonies are usually massive, laminar or ramose. Corallites have a wide size range but are usually compact with little or no coenosteum. Walls and septa are porous.



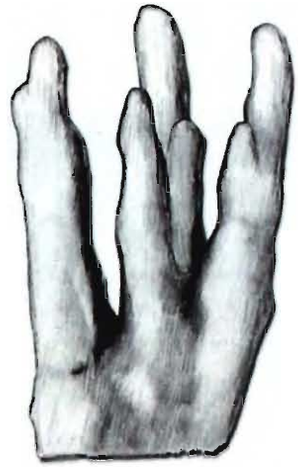
Porites lobata



Porites lichen



Goniopora minor



Porites nigrescens

The Poritidae includes five extant hermatypic genera, *Porites, Stylaraea, Poritipora, Goniopora* and *Alveopora. Poritipora* is a very recently erected genus. *Stylaraea* and *Poritipora* are very rare, monospecific and are not found in India. All the other genera are reported in India.

Genus ***Porites*** Link, 1807

Fifty-two species are reported from the world, of which eleven are recorded in India.

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. It is widely represented in all the major coral reef areas in India.

190. ***Porites lutea*** Milne Edwards and Haime, 1860

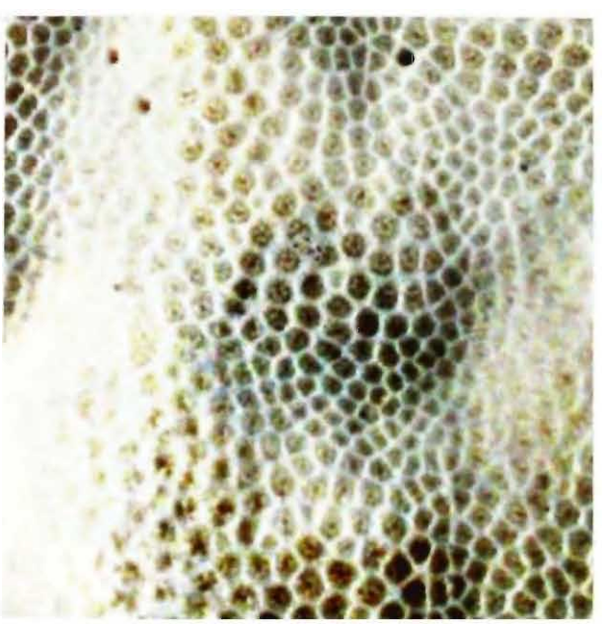
1860. *Porites lutea* Edwards and Haime, *Histoire naturelle des Coralliaires*. Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

Remarks : *P. lobata* is similar but the five tall pali with radii are easily recognisable even in underwater. Mostly occur on back reef margins.

1976. *Porites lutea* Pillai and Scheer, Report on the stony corals from the Maldive Archipelago. Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.)*. **43** (126), 1-83, pl. 1-32.

Characters : Colonies are hemispherical or helmet-shaped and may be very large. The surface is usually smooth. Usually cream or yellow but may be bright coloured in shallow waters.

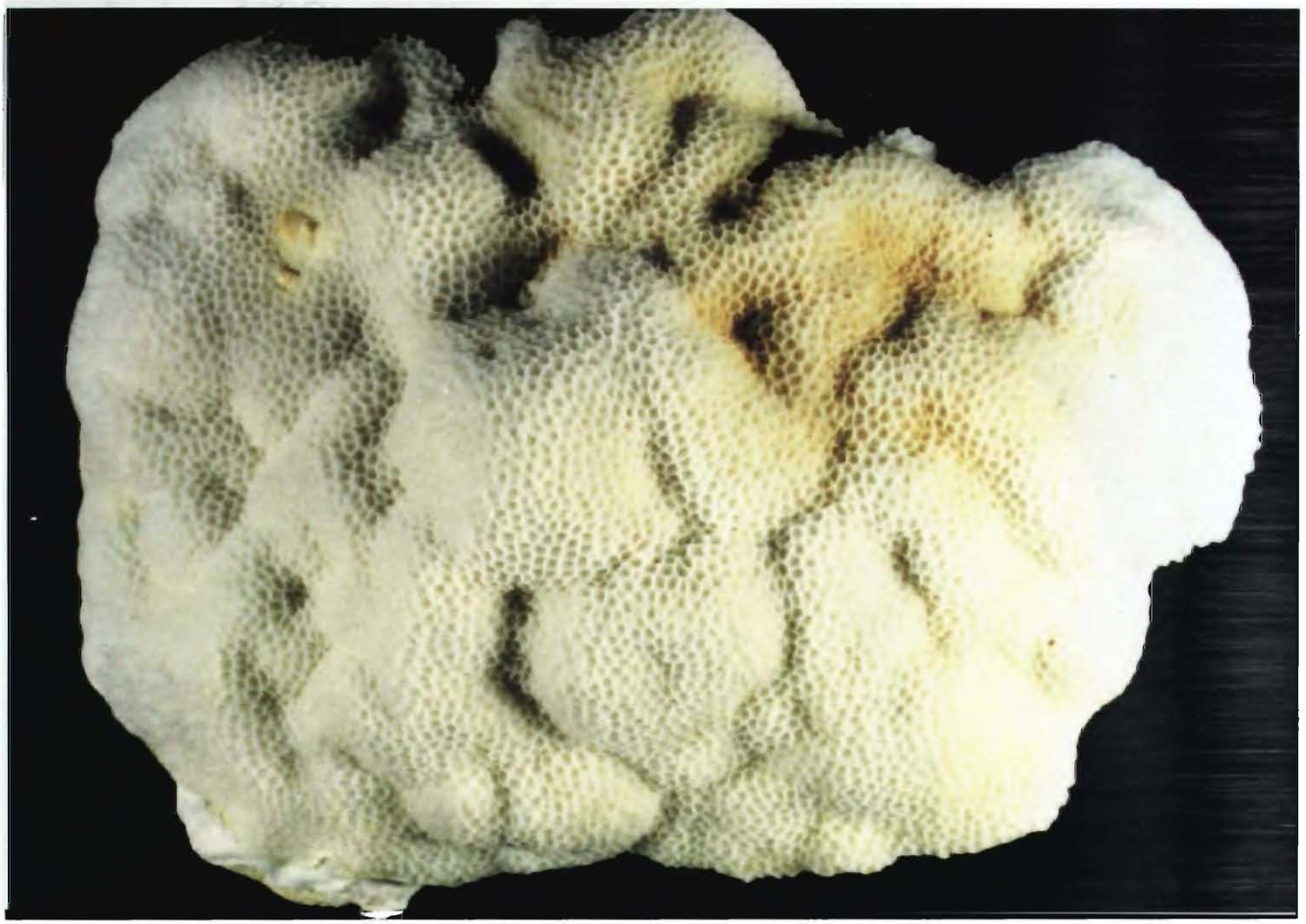
Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed from Red Sea east to the Tuamotu Archipelago and the Great Barrier Reef.



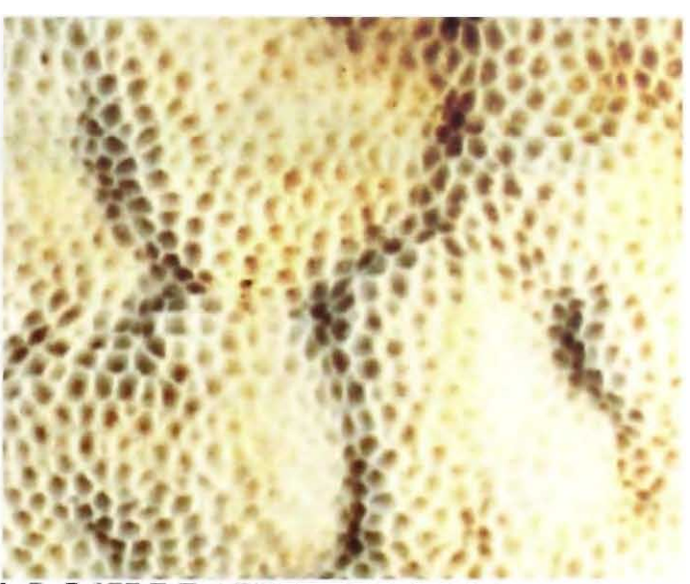
191. ***Porites lobata*** Dana, 1846

1846. *Porites lobata* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61.

Distribution : In India it is recorded from Lakshadweep and Andaman and Nicobar Islands. Widely distributed from the tropical Indo-Pacific, Tuamotu Islands, Hawaii, Bonin Islands and possibly the Galapagos Islands.



Characters : Colonies are massive, usually hemispherical or helmet-shaped and may be several m in diameter and height. Larger colonies have thick ledges, or a series of thick ledges, around their base, smooth surface, sometimes with humps or columnar expansions. Calices average 1.5 mm in diameter. The upper surface of thick walls is composed of three rows of denticles, the two outer rows following along the rim of their respective calices leaving a central row along the wall summit. Septa usually have two denticals between the pali and the wall. Columella is present. Living colonies have uniform colours, usually cream or pale brown but may be bright blue, purple or green, especially in shallow water.



Remarks : It is similar to *P. solida*, which is distinguished by having taller pali, especially on the lateral pairs of septa.

192. ***Porites solida*** (Forskal, 1775)

1775. *Madrepora solida* Forskal, Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium que in intinere orientali observavit Petrus Forskal. *IV Corallia, hauniae*, p. 131-9.

1976. *Porites solida* (Forskal) Pillai & Scheer, Report on the stony corals from the Maldive Archipelago. *Results of the Xarifa Expedition 1957/58. Zoologica (Stuttg.).* **43** (126), 1-83, pl. 1-32.

Characters : Colonies are massive, hemispherical, and may be several meters in diameter. Calices are 1.5 –2.0 mm in diameter and corallites have thin walls with approximately 24 denticles on them. Septa do not reach the upper wall margin but slope gently towards the columellae. They are usually wedge-shaped and sometimes divide near the wall. Columellae are present, but are sometimes weakly developed and laterally compressed in the direction of the directive septa.

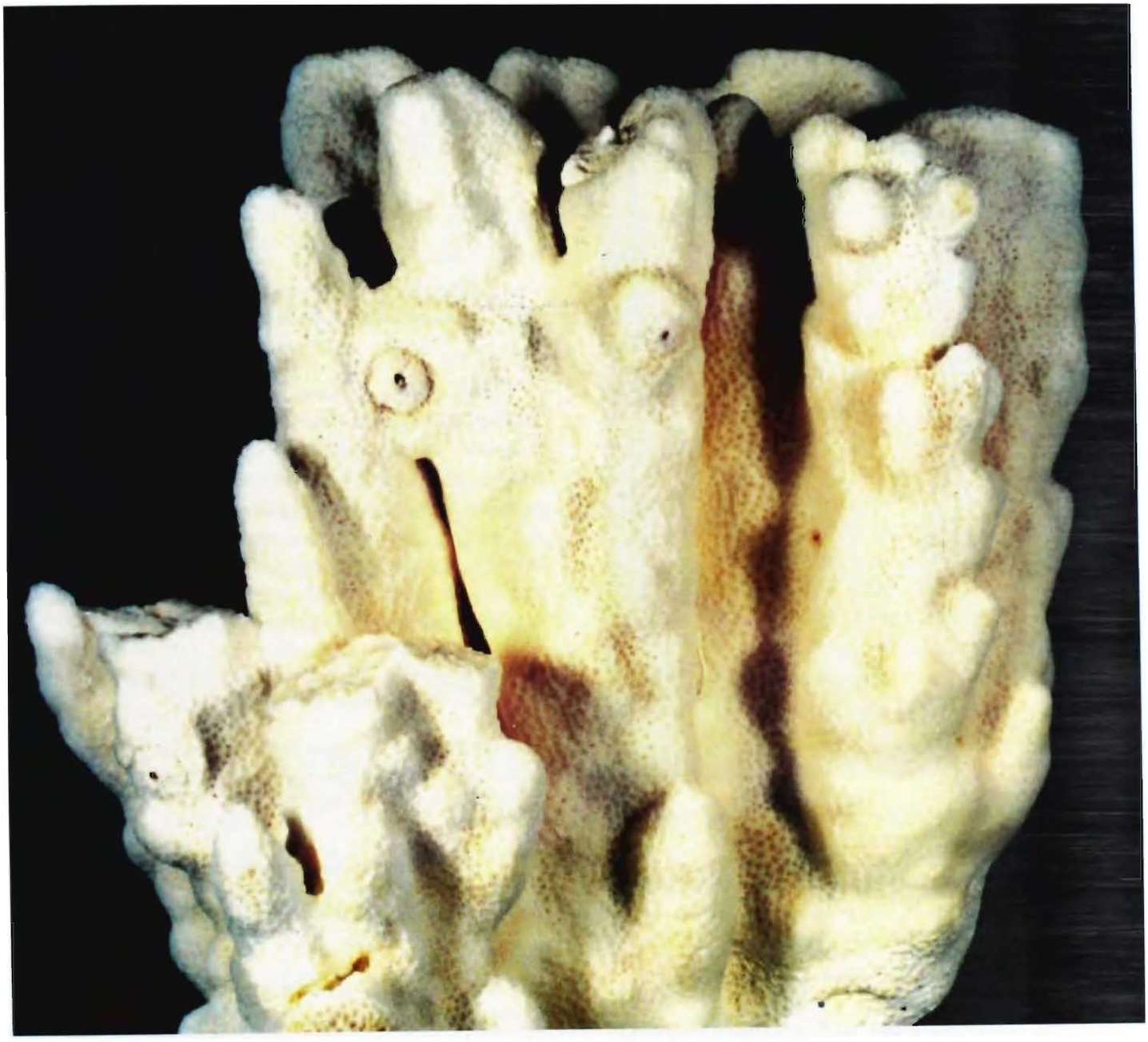
Distribution : In India it is recorded from Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed throughout the tropical Indo-Pacific from the Red Sea to Hawaii and the Great Barrier Reef.

Remarks : *P. lobata*, which has weakly developed pali. *P. solida* is easily recognized in underwater.

193. ***Porites lichen*** Dana, 1846

1846. *Porites lichen* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61.

Characters : Colonies form flat laminae or plates, or fused nodules and columns. Corallites are usually aligned in irregular rows separated by low ridges. Septal structures are variable and irregular. Colonies are bright yellowish-green, sometimes brown in colour.



Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed from the tropical Indo-Pacific, Red Sea to the Ellice and Marshall Islands, Fiji and Samoa and Great Barrier Reef.

Remarks : Usually a dominant species of lagoons and reef slopes.

194. ***Porites nigrescens*** Dana, 1846

1846. *Porites nigrescens* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61.

1974. *Porites nigrescens* Faure, Annotated check list of corals in the Mascarene Archipelago, Indian Ocean. Atoll. Res. Bull., 203, 26 pp.

Characters : Colonies are branching, sometimes with an encrusting base. Concave calices give the surface a pitted appearance. Polyps are frequently extended during the day. Living colonies are brown or cream in colour.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from the tropical Indo-Pacific, Madagascar, Mascare

Archipelago, South China Sea, Fiji, Tonga and the Great Barrier Reef.

Remarks : Usually found on the lower reef slopes and lagoons protected from wave action.

195. ***Porites compressa*** Dana, 1846

1846. *Porites compressa* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61.

Characters : Colonies composed of vertical flabellate thick plate arising from a solid base. Calices polygonal excavated 1.5 mm long. Walls thin, with twisted mural denticles. A single septal denticle is present between the palus and the wall. Ventral triplets do not form a trident. Two rings of synapteculae. Pali poorly developed, one each on the lateral pairs of septa and the fifth on the ventral directive. Columella thin, compressed style joined to the fused ends of septa by radii.

Distribution : In India it is recorded from Gulf of Kachchh and Gulf of Mannar and Palk Bay. Worldwide, it is reported from St. Malacca, Palau Islands and Hawaii.

Remarks : Rare species. Mostly found on the protected reef and lagoon environments.

196. ***Porites exserta*** Pillai, 1969

1969. *Porites exserta* Pillai, Studies on Indian corals 2. Report on a new species of *Goniopora* and three new species of *porites* (Scleractinia, Poritidae). – *J. mar. biol. Ass. India* **9**, 402-406.b

Characters : Colonies are encrusting, calices shallow, polygonal or circular, generally 12 septa present, sometimes two or three of the second cycles missing. A prominent septal denticle is present between the exert part of the septa and the palus. Two rings of synapticulae. Pali is five, one on the ventral directive and four-one each on the fused ends of the lateral pairs. Columella is usually absent. Living coral greenish brown.

Distribution : In India it is recorded only from the Gulf of Mannar and Palk Bay.

Remarks : This species is closely related to *P. lichen* except for the nature of the wall and the exert free ends of the septa.

197. ***Porites mannarensis*** Pillai, 1969

1967. *Porites mannarensis* Pillai, Studies on Indian corals. *J. mar. biol. Ass. India*, **9** (2); 402-406.

Characters : 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.

Distribution : In India it is recorded from the Manauli, Pullivasal and Hare Islands in the Gulf of Mannar.

Remarks : The species is fairly common in the Mandapam group of Islands, Gulf of Mannar.

198. ***Porites minicoensis*** Pillai, 1969

1967. *Porites mannarensis* Pillai, Studies on Indian corals. *J. mar. biol. Ass. India*, **9** (2); 402-406.

Characters : Corallum 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.

Distribution : In India it is recorded in Minicoy, Lakshadweep and Gulf of Mannar and Palk Bay.

Remarks : This species is fairly common at Minicoy where colonies often lie in sandy bottom in shallow waters.

199. ***Porites murrayensis*** Vaughan, 1918

1918. *Porites murrayensis* Vaughan, Some shoal-water corals from Murray Islands, Cocos-Keling Islands and Fanning Island. *Pap. Dep. Mar. Biol. Carnegie Inst.* Wash. **9** (Publ. 213), 51-234, pl. 20-93.

Characters : Colonies are hemispherical or spherical, up to 200 mm in diameter and are usually cream or brown, but may be bright colours in shallow water.

Distribution : In India it is recorded only from Andaman and Nicobar Islands. Widely distributed from Maldives, Great Barrier Reef, Samoa Marshall Islands, Palau, Philippines and the Mariana Islands.

Remarks : This species is slightly similar to *P. lobata*.

200. ***Porites rus*** (Forskal, 1775)

1775. *Madrepora rus* Forskal, Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium que in intinere orientali observavit Petrus *Forskal. IV Corallia, hauniae*, p. 131-9.

Characters : Colonies are laminar or contorted anastomosing branches and columns. Corallites are very small. They are separated into groups by ridges, which characteristically converge towards each other forming flame-shaped patterns. Pale cream or yellow, or dark bluish-brown, often with pale branch tips.

Distribution : In India it is recorded only from Lakshadweep. Widely distributed throughout the tropical and subtropical Indo-Pacific, from the Red Sea to Hawaii and the Society islands.

Remarks : *P. rus* has distinctive pattern of corallites than any other *Porites* species.

Genus ***Goniopora*** de Blainville, 1830

Twenty-four species are reported from the world, of which six species are recorded from India.

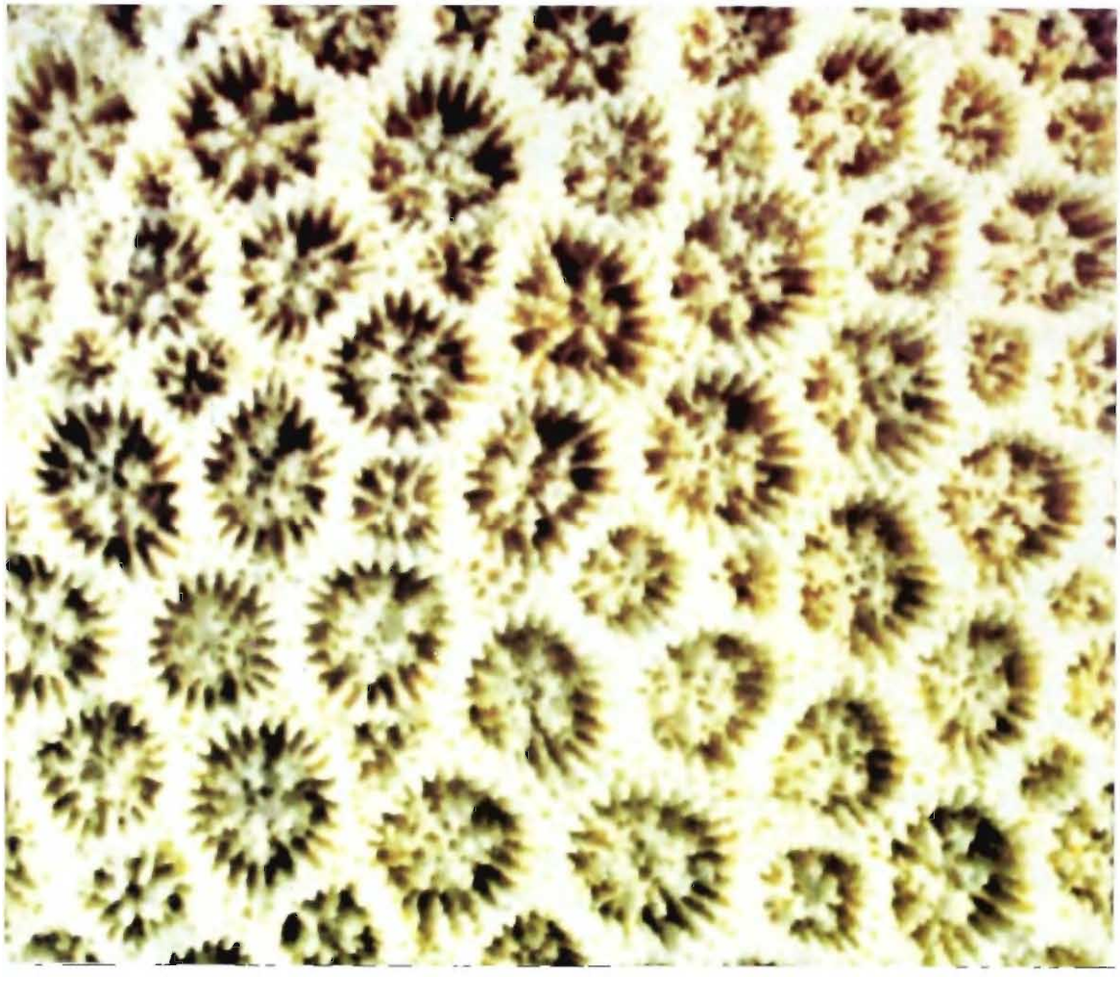
Characters : Colonies are usually columnar or massive but may be encrusting. Corallites are usually thick but porous walls and calices are filled with compact septa and columella. Polyps are long and fleshy, extended day and night. *Goniopora* are usually easier to identify in underwater than they are 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. This genus is reported in all the four major coral reef areas in India.

201. ***Goniopora stokesi*** Milne Edwards and Haime, 1851

1851. *Goniopora stokesi* Edwards and Haime, Recherches sur les Polypiers. *Mem. 7 Monographie des Poritides. Ann. Sci. Nat. Zool.* 3e Ser., **16**, 21-70.

Characters : Colonies are free-living or attached, hemispherical or short thick columns. Calices are 3-6 mm in diameter with high walls, which have a ragged appearance. Columella is broad and irregular. Small daughter colonies often occur imbedded in the living tissue of parent colonies. Polyps are of mixed sizes, the larger being very elongate. The living coral usually uniform brown or green in colour.

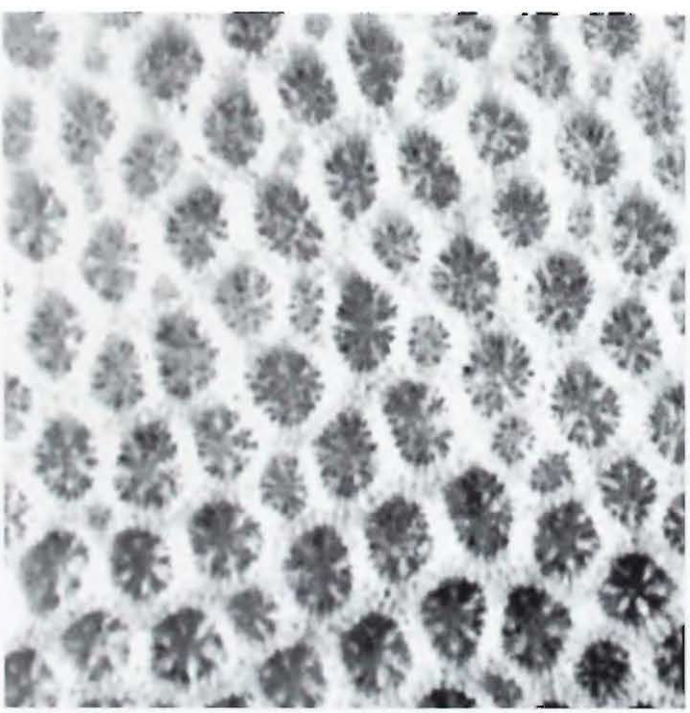
Distribution : In India this species recorded from Lakshadweep, Gulf of Mannar and Palk Bay and



Andaman and Nicobar Islands. Widely distributed from tropical Indo-Pacific, east Africa, Philippines, Indonesia and to the Great Barrier Reef.

Remarks : Usually found on soft substrates. Most common in the shallow regions of Gulf of Mannar reefs.

202. ***Goniopora minor*** Crossland, 1952



1952. *Goniopora minor* Crossland, *Madreporaria, Hydro corallinae, Helliopora and Tubipora.* Sci. Rep. Great Barrier reef Exped. 1928-29. *Br. Mus. (Nat. Hist.),* **6** (3), 85-257, pl. 1-56.

Characters : Colonies are hemispherical or encrusting. Calices are 2.5 – 4 mm in diameter, circular in outline, with thick walls. There are usually six thick pali, which are in contact forming a crown. All septal structures are heavily granulated. The live coral is brown or green, usually with distinguished coloured oral discs and pale tips to the tentacles.

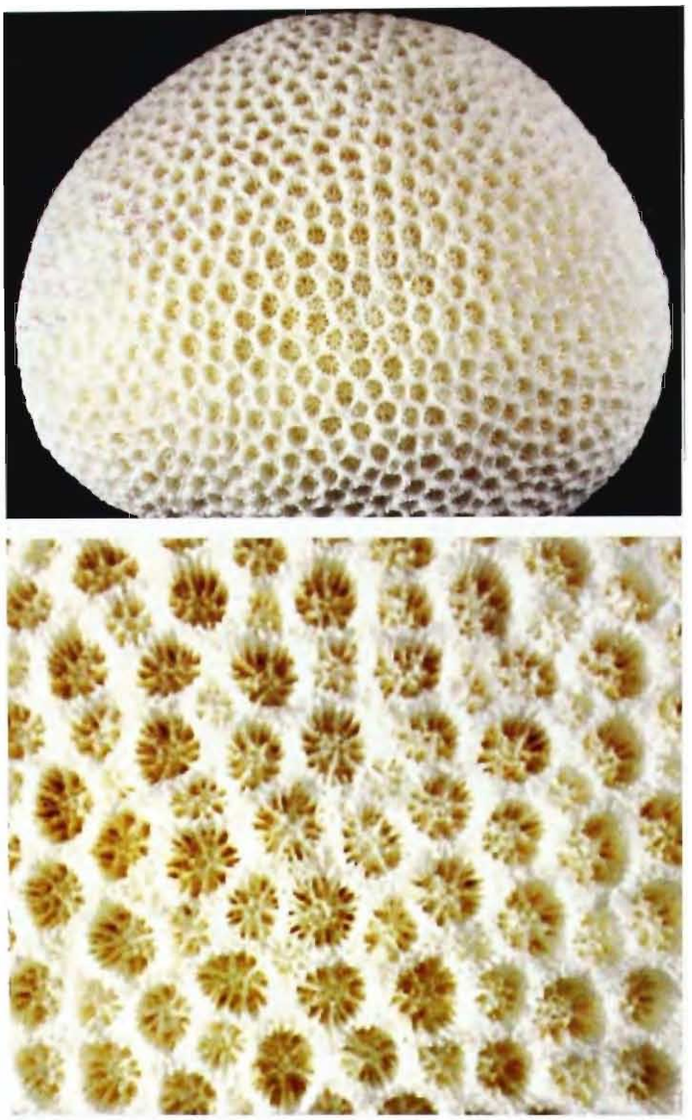
Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. It is widely distributed throughout Indo-Pacific and East Pacific regions.

Remarks : This species is similar to *G. tenuidens*, which has blunt tentacles of uniform length. Mostly found in subtidal reef environments, especially lagoons.

203. ***Goniopora tenuidens*** (Quelch, 1886)

1886. *Rhodaraea tenuidens* Quelch, Report on the reef-corals collected by H.M.S. Challenger during the years 1873-76. *Rep. Sci. Results Voyage H.M.S. Challenger Zool.* **16** (3), 1-203, pl. 1-12.

Characters : Colonies are massive, hemispherical or irregular. Calices are 3-5 mm in diameter. They have six prominent pali. Polyps are elongate with tentacles of even length. The live coral is uniform



blue, green or brown in colour, sometimes with white tips on the tentacles.

Distribution : In India this species recorded from Andaman and Nicobar Islands. Widely distributed from western Pacific from the South China Sea, Philippines, Indonesia, and New Caledonia to the Great Barrier Reef and west to the Nicobar Islands.

Remarks : *C. minor* has thick pali forming a crown. Mostly found on subtidal reef environments, especially lagoons.

204. ***Goniopora stutchburyi*** Wells, 1955

1955. *Goniopora stuchburyi* Wells, Recent and subfossil corals of Moreton Bay, Queensland. Univ. Queenl. *Pap. Dep. Geol.* **4** (10), 1-18, pl. 1-3.

Characters : Colonies are submassive to encrusting. Calices are small, (less than 3 mm in diameter) and shallow, giving colonies a smooth surface. Polyps have short, tapering tentacles, which may not be extended during the day. Colonies are usually pale brown or cream, sometimes with pale blue mouths.

Distribution : In India this species recorded from Gulf of Kachchh and Gulf of Mannar and Palk Bay. Widely distributed from Sri Lanka, South China Sea, Malaysia and east and west coasts of Australia.

Remarks : This species could be confused with *G. planulata*, which has larger polyps. Mostly found on the shallow reef environments.

205. ***Goniopora columna*** Dana, 1846

1846. *Goniopora columna* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61.

Characters : Colonies are rounded, corallites are uniform, and calices are over 5 mm in diameter. Septa are very fine and highly perforate and irregular. Living colonies are uniform in colour, usually brown, green or yellow. Polyps are of mixed sizes, the larger being very elongate.

Distribution : In India this species recorded only from Andaman and Nicobar Islands. Widely distributed throughout the tropical Indo-Pacific from the Red Sea to Fiji.

Remarks : This species is very close to *G. stokesi* and also similar to *G. lobata*. Colonies are short columns, oval in transverse section. Mostly form large single species stands, especially in turbid waters.

206. ***Goniopora planulata*** (Ehrenberg, 1834)

1834. *Goniopora planulata* Ehrenberg, Beitrage zur physiologischen Kenntnis der Corallenthiere im allgemeinen, und besonders des rothen Meeres, nebst einem Versuche zur physiologischen Systematik derselben. – *Phys. Abh. Konigl. Akad. Wiss. Berlin a.d. jahre* 1832, 1. Teil, 225-380.

Characters : Colonies are columnar, corallites polygonal and calices oval or rounded. Diameter of the calices is 3 to 5 mm. Septa 24, mostly regular, the tertiaries fuse to the secondaries. Septa are descending vertically at the wall, edges with 4 to

5 teeth. 6 to 12 pali present of which those of the primaries are very prominent and frosted. They stand high above the columella. Columella are loose trabecular or sometimes solid. Polyps extend during the daytime.

Distribution : In India it is reported from Gulf of Kachchh, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is reported from Red Sea, Madagascar and from Srilanka to tip of Western Australia.

Remarks : It is often confused with *G. columna*, which forms thicker columns and has larger corallites. Mostly found on the shallow reef environments.

Genus ***Alveopora*** de Blainville, 1830

Fourteen species are reported from the world, of which only two species is recorded in India.

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. Polyps are large and fleshy and are extended day and night. It has 12 tentacles, often with swollen knob-like tips. *Alveopora* is similar to *Goniopora*. In India it is reported from Lakshadweep and Andaman and Nicobar Islands.

207. ***Alveopora verrilliana*** Dana, 1846

1846. *Alveopora verriliana* Dana, *U.S. Exploring Expedition* 1838-1842, **7**, p. 1-740, pl. 61.

Characters : Colonies have short irregularly dividing, knob-like branches. Corallites are polygonal 1.7 – 2.0 mm in diameter. Their walls are irregularly perforated and consist of 30-50 percent pores. Septa are very irregular. Living colonies have polyps extended during the day. It is relatively long for the small sized calices and is dark greenish-brown in colour.

Distribution : In India it is recorded from Andaman and Nicobar Islands. Worldwide, it is reported from Indonesia to Great Barrier Reef and Coral Sea.

Remarks : Mostly found on shallow reef environments.

208. ***Alveopora superficialis*** Pillai and Scheer, 1976

1976. *Alveopora superficialis* Pillai and Scheer, Report on the stony corals from the Maldive Archipelago, Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.)* **43** (126), 1-83, pl. 1-32.

Characters : 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.

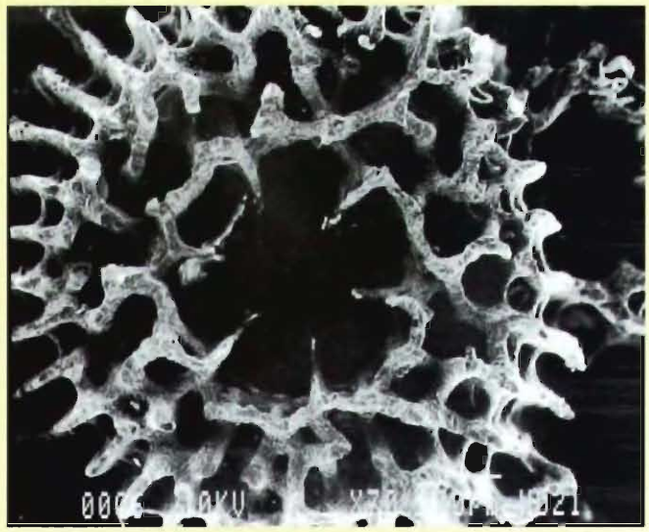
Distribution : In India it is recorded only from Lakshadweep. Also reported from western Indian Ocean eastward to Samoa.

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.

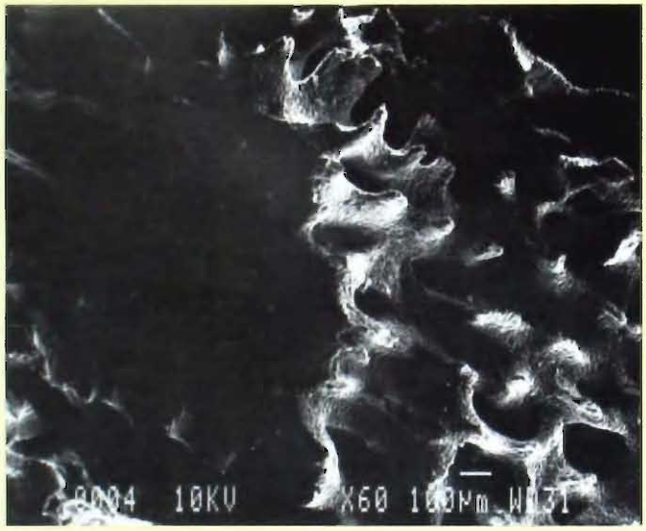
Acanthastrea and *Coscinaraea* have been reported in the recent studies (Appendix 1). Hence, *Siderastrea* is the only genus not found in Andaman and Nicobar Islands. Eighty five species are reported in the present account, which are not found in other reefs of India (Table 6).

There are 20 species common to all the four major coral reefs of India (Table 6). They are *Montipora foliosa, M. turgescens, M. venosa, M. hispida, Acropora humilis, Turbinaria mesenterina, Symphyllia radians, Favia stelligera, F. pallida, F. favus, F. speciosa, Favites halicora, F. complanata, Goniastrea pectinata, Platygyra daedalea, P. sinensis, Leptastrea purpurea, Cyphastrea microphthalma, Porites lutea and Porites lichen.*

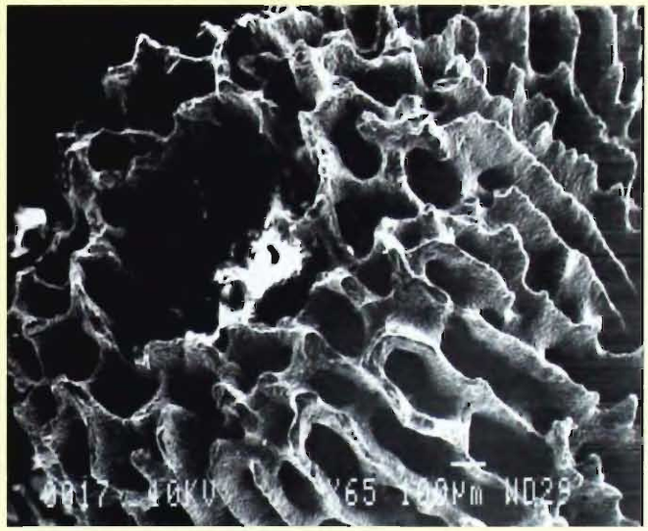
Acropora muricata



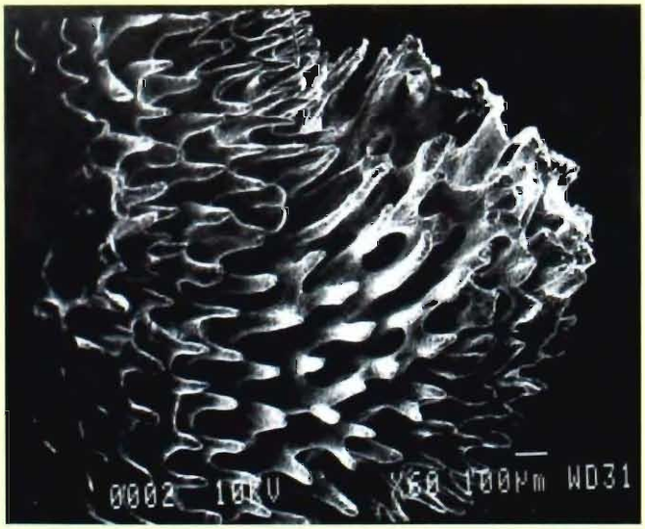
Acropora hyacinthus



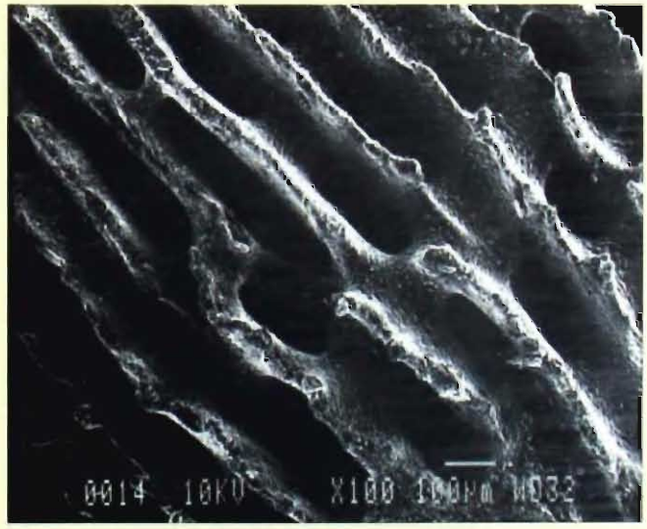
Acropora intermedia



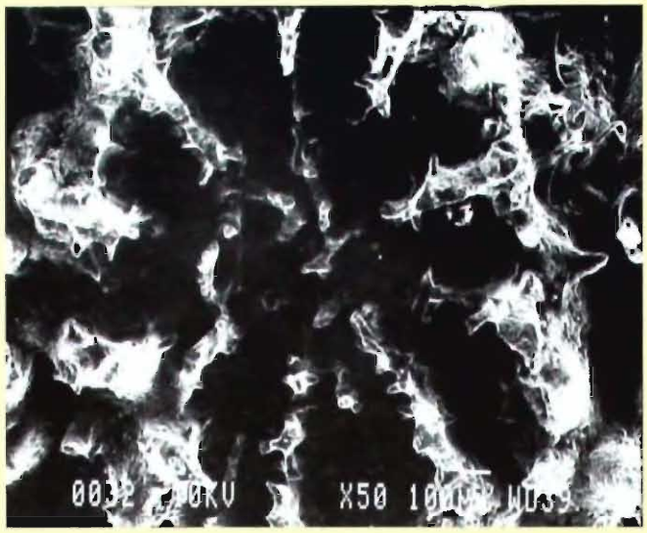
Acropora hyacinthus



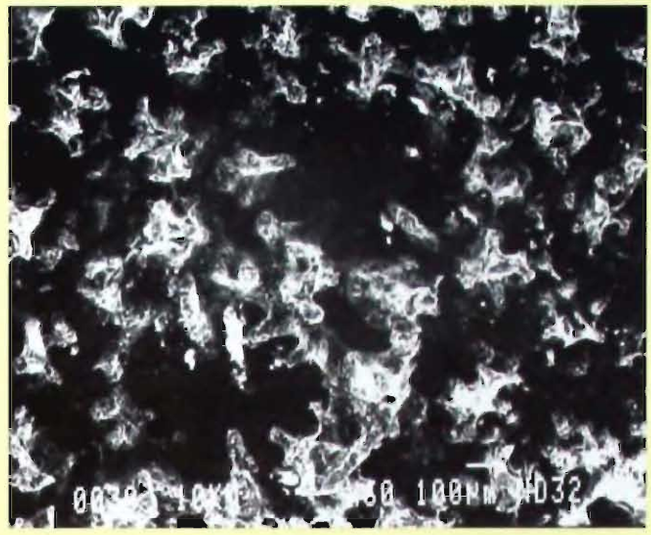
Acropora divaricata



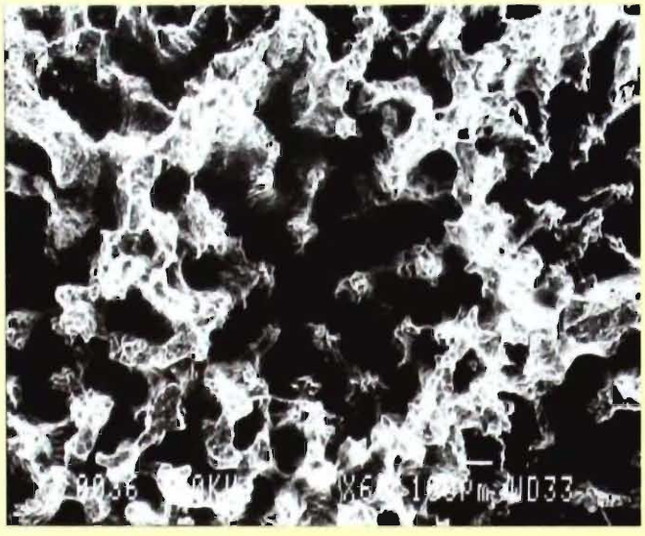
Acropora valida



Echinopora lamellosa

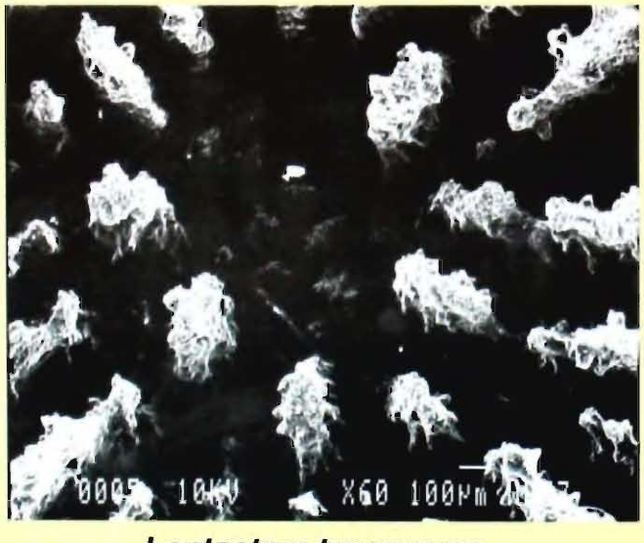


Montipora subtilis

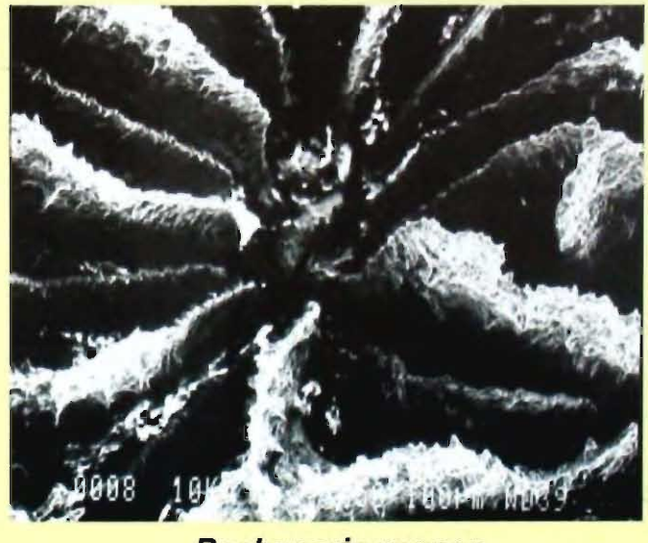


Porites lichen

Galaxea astreata

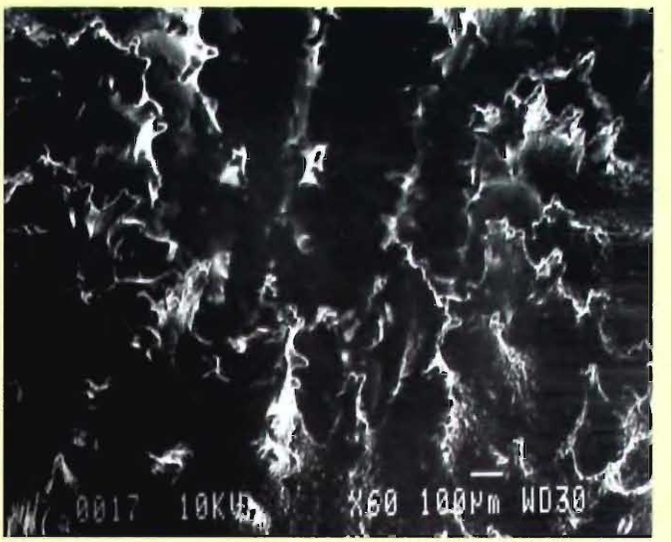


Leptastrea transversa



Pachyseris rugosa

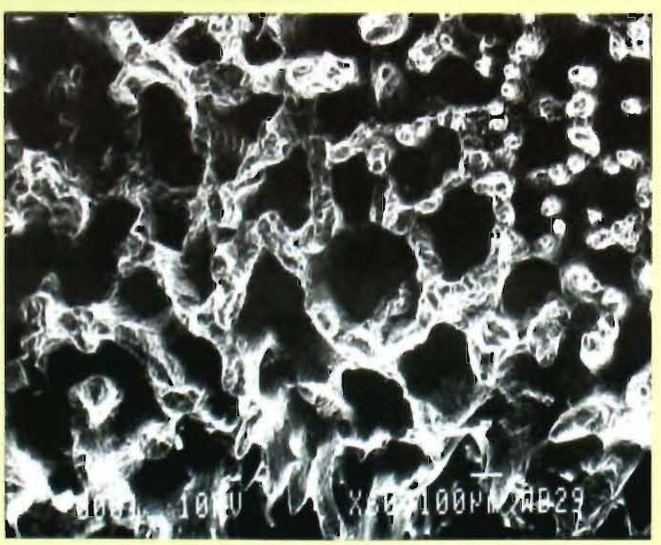
Turbinaria peltata



Cyphastrea serialia

Montipora spumosa

Pavona duerdeni



Echinopora horrida

Pavona varians

NON-SCLERACTINIAN CORALS

Subclass Octocorollia Haeckel, 1866

Order Stolonifera Hickson, 1883

Family TUBIPORIDAE Ehrenberg, 1828

Colonies are massive, formed by parallel tubes connected by horizontal platforms. The tubes contain the polyps, each of which has eight feather-like tentacles. The skeleton is permanent dark red in colour. One species *Tubipora musica* is reported in the world. This is a new record to India and it is recorded from Andaman and Nicobar Islands.

Genus ***Tubipora*** Linnaeus, 1758

Characters : Colonies are long, rigid, vertical tubes interconnected by irregular thin vertical folia. Skeleton appears dark red in colour. Only the uppermost tubes in the colony are occupied by polyps.

Tubipora musica Linnaeus, 1758

Order Coenothecalia Bourne, 1895

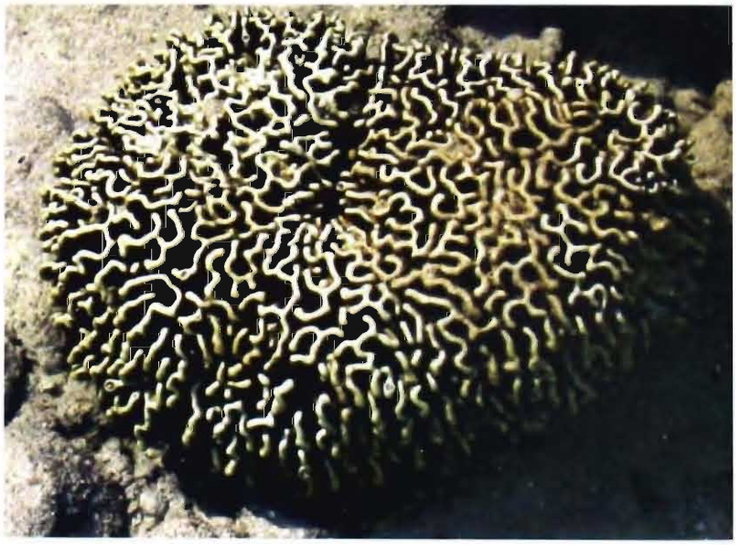
Family HELIOPORIDAE Mosley, 1876

Characters : Colonies are hermatypic and arborescent, plate-like or columnar. The skeleton is composed of a matrix of fibrocrystalline aragonite penetrated by closely compacted circular tubes containing the polyps as well as finer tubes of a canal system. The skeleton is permanent blue in colour. *Heliopora coerulea* is a new record to India and it is reported from Andaman and Nicobar Islands.

Genus ***Heliopora*** de Blainveille, 1830

Characters : Colonies are blue in colour and massive with vertical, more or less flattened, lobate plates or columns. Calices are plocoid with 10-16 pseudosepta. Peritheca are with fine dentation. One species is reported in the world.

Heliopora coerulea (Pallas, 1766)



Class HYDROZOA

Order Milleporina Hickson, 1901

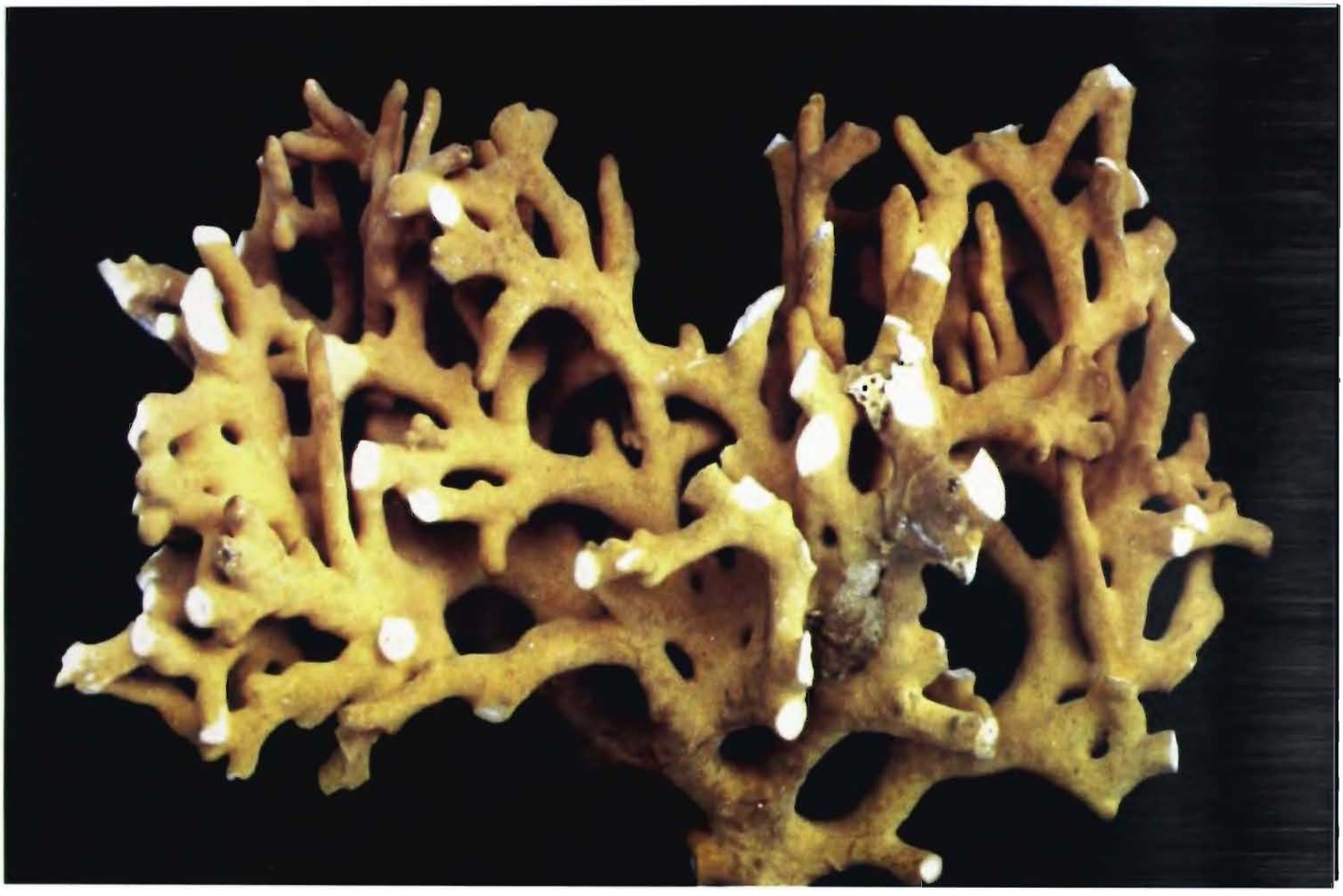
Family MILLEPORIDAE Flemming, 1828

Genus *Millepora* Linnaeus, 1758

Colonies are encrusting, solid and columniform or ramose. Two sizes of small pores are scattered over the surface. Septa are absent. Larger pores are corresponding to gastrozooids. The smaller pores correspond to dactylozooids and are often set in irregular circles around the larger pores. Sexual reproduction is by free-swimming medusae. Colonies are dark to pale yellowish brown in

colour, often with white tips. Seven species are known the worldover. In India studies are scanty. At least three different species occurr in Andaman and Nicobar Islands.

Millepora sp.



AHERMATYPIC CORALS

These corals are not responsible for reef building. Ahermatypic (=azooxanthellate) Scleractinia, amounting to 117 extant genera, mostly inhabiting the deep ocean, although some are commonly found on reefs and other shallow water habitats of the world as well as in India. 27 species under 16 genera and 4 families are known from Indian reefs.

Table 5. List of ahermatypic corals recorded from the four major coral reefs in India

Sl. No.	Species	Lakshadweep	Gulf of Kutch	Gulf of Mannar & Palk Bay	Andaman and Nicobar
Family CARYOPHYLLIDAE Grey, 1847 Genus *Caryophyllia* Lamark, 1801					
1.	*C. clavus* Scacchi	•			•
2.	*C. arcuata* M. Edwards & Haime	•			•
3.	*C. acanthocyathus grayi* M. Edwards & Haime				•
Genus *Deltocyathus* M. Edwards and Haime, 1848					
4.	*D. andamanensis* Alcock				•
Genus *Paracyathus* M. Edwards & Haime					
5.	*P. indicus* Duncan				•
6.	*P. profundus* Duncan			•	
7.	*P. stokesi* M. Edwards & Haime		•	•	•
Genus *Polycyathus* Duncan, 1889					
8.	*P. verrilli* Duncan		•	•	•
9.	*P. andamanensis* Alcock				•
Genus *Heterocyathus* M. Edwards and Haime, 1848					
10.	*H. aequicostatus* M. Edwards & Haime			•	•
Genus *Stephanocyathus* Seguenza, 1864					
11.	*S. nobilis* (Moseley)	•			
Family FLABELLIDAE Bourne, 1905 Genus *Flabellum* Lesson, 1831					
12.	*F. pavonium* Alcock	•			
Genus *Placotrochus* M. Edwards and Haime, 1848					
13.	*P. laevis* M. Edwards and Haime				•

Sl. No.	Species	Lakshadweep	Gulf of Kutch	Gulf of Mannar & Palk Bay	Andaman and Nicobar
Family RHIZANGIIDAE Orbingny, 1851 Genus *Culicia* Dana, 1846					
14.	*C. rubeola* (Quoy and Gaimard, 1833)			•	•
Genus *Cladangia* M. Edwards and Haime, 1851					
15.	*C. exusta* Luetken, 1872			•	
Family DENDROPHYLLIDAE Gray, 1847 Genus *Balanophyllia* S. Wood, 1844					
16.	*B. affinis* (Semper)			•	
17.	*B. imperialis* Kent				•
18.	*B. scabra* Alcock				•
Genus *Endopsammia* M. Edwards and Haime, 1848					
19.	*E. philippinensis* M. Edwards and Haime			•	•
Genus *Heteropsammia* M. Edwards and Haime, 1848					
20.	*H. michelini* M. Edwards and Haime			•	•
Genus *Tubastrea* Lesson, 1829					
21.	*T. aurea* (Quoy and Gaimars)		•	•	•
Genus *Dendrophyllia* de Blainville, 1830					
22.	*D. coarctata* Duncan			•	
23.	*D. arbuscula* V. der Horst				•
24.	*D. micranthus* (Ehrenberg)			•	
25.	*D. indica* Pillai			•	
Genus *Enallopsammia* Micheloti					
26.	*E. amphelioides* (Alcock)				•
27.	*E. marenzelleri* Zibrowius				•
	Total	**4**	**3**	**13**	**18**

Suborder CARYOPHYLLIINA Vaughan and Wells, 1943

Family CARYOPHYLLIIDAE Gray, 1847

Genus ***Caryophyllia*** Lamarck, 1801

Characters : Solitary, attached or free-living, mostly cylindrical or horn-shaped. Septa are thin and straight with smooth margins. Pali and columella are present. Three species have been recorded in India; all the three species occur in Andaman and Nicobar Islands. They are *Caryophyllia clavus* Scacchi, *Caryophyllia arcuata* Milne Edwards and Haime and *Caryophyllia acanthocyathus* Milne Edwards and Haime.

Genus ***Deltocyathus*** Milne Edwards and Haime, 1848

Characters : Solitary, free-living and disc-shaped. Pali forms deltas. In India *Deltocyathus andamanensis* Alcock, 1902 is Known from Andaman and Nicobar Islands.

Genus ***Paracyathus*** Edwards and Haime, 1848

Characters : Solitary, attached, and tapering to a pointed base. Pali merges with the columella. In India three species have been recorded. They are *Paracyathus indicus, Paracyathus profundus* and *Paracyathus stokesi.*

Genus ***Polycyathus*** Duncan, 1876

Characters : Solitary, attached, forming small colonies by budding from the sides of parent polyps. *Polycyathus verrilli* Duncan, 1876 and *Polycyathus andamanensis* Alcock are recorded in India.

Genus ***Heterocyathus*** Milne Edwards and Haime, 1848

Characters : Solitary, young stage attached to a small gastropod shell, which later is completely covered by the base of the coral, except on 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.

Genus ***Stephanocyathus*** Seguenza, 1864

Characters : 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.

Family FLABELLIDAE Bourne, 1905

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

Genus ***Flabellum*** Lesson, 1831

Characters : 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.

Genus ***Placotrochus*** Milne Edwards and Haime, 1848

Characters : Solitary, free-living and purse-shaped. A thin, plate-like columella is present. In India *Placotrochus laevis* Milne Edwards and Haime, 1848 is recorded in Andaman and Nicobar Islands.

Suborder DENDROPHYLLIINA Vaughan and Wells 1943

Family DENDROPHYLLIIDAE Gray, 1847

Colonies are solitary or colonial, mostly ahermatypic. Corallite walls are porous, usually composed of coenosteum. Septa are fused in a distinctive pattern *'Pourtales plan'*, at least in immature corallites. This family consists of three hermatypic genera and more than eight genera are ahermatypic of which *Balanophyllia, Endopsammia, Heteropsammia, Tubastrea, Dendrophyllia* and *Enallopsammia* are recorded in India.

Genus ***Dendrophyllia*** de Blainville, 1830

Five species are reported from India.

Characters : Colonies are dendroid becoming bushy by extra-tentacular budding. Corallites are tubular with septa fused according to *'Pourtales Plan'*. Polyps are extended mostly at night and are

large and fleshy. *Dendrophyllia* resembles *Tubastrea* and can be distinguished by the latter's mature corallites not having septa clearly arranged according to *'Pourtales Plan'* Except from Lakshadweep, it is reported from all the three major coral reef areas in India. The following species are recorded in India : *Dendrophyllia coarctata* Duncan, 1889; *Dendrophyllia arbuscula* Horst, 1992; *Dendrophyllia minusculla* Bourne, 1905; *Dendrophyllia micranthus* (Ehrenberg, 1834) and *Dendrophyllia indica* Pillai, 1967.

Genus ***Tubastrea*** Lesson, 1829

One species is recorded in India.

Characters : Colonies are dendroid, up to 1.0 m tall. Corallites are tubular with septa of immature corallites only following *'Pourtales Plan'* Polyps are extended mostly at night and are large and fleshy. It is reported from all the three major coral reef areas in India except Lakshadweep. *Tubastrea aurea* (Quoy and Gaimard, 1833) is the only species recorded in India.

Genus ***Balanophyllia*** Wood, 1844

Three species are recorded in India.

Characters : Solitary or corallites in small-attached clumps. Corallites are elongate, tapering towards their base, elliptical in cross-section. Walls are thick, composed of coenosteum with costae. Septa are fused according to *'Pourtales Plan'* Polyps are usually extended during the day. *Dendrophyllia* and *Tubastrea* are similar to *Balanophyllia*. However the former have thinner and less porous walls. Living colonies of these genera are usually difficult to distinguish as all may have similar black, bright-orange or yellow polyps. In India it is reported from Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. The following species are recorded in India: *Balanophyllia imperialis* Kent; *Balanophyllia scabra* Alcock and *Balanophyllia affinis* (Semper, 1872)

Genus ***Endopsammia*** Milne Edwards and Haime, 1848

One species is recorded from India.

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

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.

Characters : 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. This genus is reported from Gulf of Mannar and Andaman and Nicobar Islands. *Heterpsammia michelini* Milne Edwards and Haime, 1848 is the only species recorded in India.

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.

DIVERSITY OF CORALS IN THE FOUR MAJOR CORAL REEFS OF INDIA

The scleractinia corals of India have a richer diversity when compared to the other reefs of the tropical world. A total of 208 species have been dealt in this book, which includes 15 families and 60 genera (Table 6 and Table 11).

Among the four major reef areas of India, Andaman and Nicobar Islands are found to be very rich and Gulf of Kachchh the poorest in species diversity. Lakshadweep Islands have more number of species than the Gulf of Mannar (Table 7).

Table 7. Distribution of total number of families, genera and species of Scleractinian corals in the four major coral reefs of India.

	Gulf of Kachchh	Lakshadweep	Palk Bay and Gulf of Mannar	Andaman and Nicobar Islands	Total
Families	8	12	13	15	15
Genera	20	34	27	57	60
Species	36	91	82	177	208

Gulf of Kachchh : The diversity of scleractinian corals in this region is very poor when compared to all the other three major regions of India. Families such as Astrocoeniidae, Pocilloporidae, Euphyllidae, Oculinidae, Agariciidae, Fungiidae and Trachyphylliidae are totally absent. Among the 60 genera recorded in India only 20 are reported so far. *Acropora humils* reported earlier is not found in the recent studies. *Montipora venosa, Cosinaria monile, Hydnophora exesa, Turbinaria peltata, Goniastrea pectinata, Platygyra sinensis, Cyphastrea serialia, Porites compressa* and *Goniopora stutchburyi* are some of the common species found in all the islands of Gulf of Kachchh. Species such as *Siderastrea savignayana* and *Acanthastrea hillae* are reported only from Gulf of Kachchh.

Lakshadweep Islands : Twelve families, 34 genera and 91 species are reported from these islands (Table 11). Families such as Astrocoeniidae, Pectiniidae and Trachyphylliidae are absent. Among the 60 genera recorded in India only 34 are reported so far. Species such as *Acropora humilis, A. muricata (= A. Formosa), A. intermedia, A. hyacinthus, Pocillopora verrucosa, Euphyllia glabrescens, Galaxea fascicularis, Psammocora contigua, P. haimeana, Pavona maldivensis, P. clavus, Fungia danai, Podobacia crustacea, Hydnophora microconos, Favites abdita, Goniastrea retiformis, Platygyra daedalea, P. sinensis, Leptastrea bottae, Porites solida, P. lichen* and *P. minicoensis* are common in these islands. Species such as *Montipora spongiosa, Acropora abrotanoides, A. hemprichii, Psammocora haimeana, Acanthastrea echinata, Porites rus* and *Alveopora superficialis* are reported only from Lakshadweep.

Gulf of Mannar and Palk Bay : Thirteen families 27 genera and 82 species are reported from this area (Table 11). Families such as Euphyllidae and Trachyphylliidae are absent. Among the 60 genera recorded in India, only 28 are reported so far. Species such as *Montipora monasteriata, M. informis, M. spumosa, M. turgescens, M. venosa, M. verrucosa, M. digitata, M. millepora, M. manauliensis, Acropora digitifera, A. secale, A. intermedia, Pocillopora verrucosa, Porites mannarensis, P. exserta* and *Goniopora stutchburyi* are common in these islands. Species such as *Montipora millepora, M. jonesi, M. manauliensis, M. edwardsi, M. exserta, Acropora rudis, A. valenciennesi, A. microphthalma, Porites exserta and Porites mannarensis* are reported only form Gulf of Mannar and Palk Bay.

Andaman and Nicobar Islands : Fifteen families, 57 genera 177 species are reported from these islands (Table 10). All the fifteen families are represented. Out of 60 genera reported from India *Siderastrea, Coscinaraea* and *Acanthastrea* are not reported in the present account. However,

Acanthastrea and *Coscinaraea* have been reported in the recent studies (Appendix 1). Hence, *Siderastrea* is the only genus not found in Andaman and Nicobar Islands. Eighty five species are reported in the present account, which are not found in other reefs of India (Table 6).

There are 20 species common to all the four major coral reefs of India (Table 6). They are *Montipora foliosa, M. turgescens, M. venosa, M. hispida, Acropora humilis, Turbinaria mesenterina, Symphyllia radians, Favia stelligera, F. pallida, F. favus, F. speciosa, Favites halicora, F. complanata, Goniastrea pectinata, Platygyra daedalea, P. sinensis, Leptastrea purpurea, Cyphastrea microphthalma, Porites lutea and Porites lichen.*

MONOSPECIFIC GENERA OF SCLERACTINIAN CORALS

Monospecific genera are very important both taxonomically as well as from the diversity point of view. The total monospecific genera in the sclerectinian corals are forty-two (8% of the 111 genera and 5% of the 793 species in the world), of which India has eight genera (19% of the 42 monospecific genera of the world) (Tab.8).

Table 8. Comparison of monospecific genera of the world* and India (*genera only occurring in India are included in this work).

Family	Number of Monospecific genera of the world	Number of Monospecific genera of India	Species of Monospecific genera of India	Percentage
Mussidae	4	1	*Cynarina lacrymalis* (ME and Haime, 1848).	25
Faviidae	8	2	*Oulastrea crispata* (Lamark, 1816). *Diploastrea heliopora* (Lamark, 1816).	25
Trachyphylliidae	1	1	*Trachyphyllia geoffroyi* Audouin, 1826.	100
Euphillidae	3	1	*Physogyra lichtensteini* (ME and Haime, 1851).	34
Agariciidae	2	2	*Coeloseris mayeri* Vaughan, 1918. *Gardineroseris planulata* (Dana, 1846).	100
Merulinidae	2	1	*Scapophyllia cylindrica* ME and Haime, 1848.	50

Table 6. Scleractinian species recorded from the four major coral reefs of India (The numbers below each reef area are the records of species. The references for which are given below the table).

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Family ACROPORIDAE Verrill, 1902 Genus ***Montipora*** de Blainville, 1830																	
1.	*M. foliosa* (Pallas, 1766)		•	•		•			•		•		•	•	•	•	•	
2.	*M. aequituberculata* Bernard, 1897				•			•			•		•					
3.	*M. monasteriata* (Forskal, 1775)		•	•				•	•									
4.	*M. tuberculosa* (Lamarck, 1816)					•	•		•									
5.	*M. peltiformis* Bernard, 1897										•			•	•	•	•	
6.	*M. informis* Bernard, 1897				•			•	•		•						•	
7.	*M. spumosa* (Lamarck, 1816)				•			•	•									
8.	*M. turgescens* Bernard, 1897		•	•		•		•	•		•			•	•	•	•	
9.	*M. venosa* (Ehrenberg, 1834)	•	•	•		•		•	•	•							•	
10.	*M. verrucosa* (Lamarck, 1816)				•			•	•								•	
11.	*M. hispida* (Dana, 1846)		•	•	•				•				•		•		•	
12.	*M. digitata* (Dana, 1846)				•			•	•		•		•	•	•	•	•	
13.	*M. angulata*(Lamarck, 1816)										•			•	•		•	
14.	*M. millepora* Crossland, 1952							•	•									
15.	*M. spongiosa* (Ehrenberg, 1834)				•													
16.	*M. jonesi* Pillai, 1969								•									
17.	*M. manauliensis* Pillai, 1967							•	•									
18.	*M. edwardsi* Bernard, 1897							•										
19.	*M. explanata* Brueggeman, 1879		•	•		•			•									
20.	*M. exserta* Quelch, 1886								•									

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Genus *Acropora* Oken, 1815																	
21.	*A. rudis* (Rehberg, 1892)								•									
22.	*A. humilis* (Dana, 1846)		•	•	•	•	•		•		•	•	•	•	•	•	•	
23.	*A. gemmifera* (Brook, 1892)																	•
24.	*A. monticulosa* (Bruggemann, 1879)											•	•		•		•	
25.	*A. samoensis* (Brook, 1891)																	
26.	*A. digitifera* (Dana, 1846)				•			•	•			•	•		•	•		
27.	*A. multiacuta* Nemenzo, 1967										•			•	•	•	•	
28.	*A. nasuta* (Dana, 1846)					•	•					•			•		•	
29.	*A. valida* (Dana, 1846)								•		•	•	•	•	•	•	•	
30.	*A. secale* (Studer, 1878)							•	•		•	•	•	•	•	•	•	
31.	*A. lutkeni* Crossland, 1952																	•
32.	*A. divaricata* (Dana, 1846)																	•
33.	*A. solitaryensis* Veron and Wallace, 1984																	•
34.	*A. clathrata* (Brook, 1891)												•		•		•	
35.	*A. glauca* (Brook, 1893)																	•
36.	*A. muricata* (Linaeus, 1758)				•	•	•		•		•	•	•	•	•	•	•	
37.	*A. grandis* (Brook, 1892)											•	•		•			
38.	*A. valenciennesi* (MED & H, 1816)								•									
39.	*A. abrotanoides* (Lamarck, 1816)					•	•											
40.	*A. robusta* (Dana, 1846)					•	•				•	•	•	•	•	•	•	
41.	*A. palmerae* Wells, 1954											•	•		•		•	
42.	*A. intermedia* (Dana, 1846)				•	•	•	•	•			•	•	•	•	•	•	
43.	*A. tenuis* (Dana, 1846)																•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
44.	*A. aspera* (Dana, 1846)					•	•										•	
45.	*A. millepora* (Ehrenberg, 1834)								•					•	•	•	•	
46.	*A. spicifera* (Dana, 1846)																	•
47.	*A. papillare* Latypov, 1992																	•
48.	*A. florida* (Dana, 1846)										•			•	•	•	•	
49.	*A. hyacinthus* (Dana, 1846)				•	•	•		•		•	•	•	•	•	•	•	
50.	*A. cytherea* (Dana, 1846)					•	•		•		•	•	•	•	•	•	•	
51.	*A. microclados* (Ehrenberg, 1834)										•							
52.	*A. microphthalma* (Verrill, 1869)							•										
53.	*A. loripes* (Brook, 1892)																	•
54.	*A. granulosa* (MED & H, 1860)					•	•					•	•		•		•	
55.	*A. caroliniana* Nemenzo, 1976																	•
56.	*A. echinata* (Dana, 1846)					•	•	•					•		•	•	•	
57.	*A. subglabra* (Brook, 1891)																•	
58.	*A. carduus* (Dana, 1846)																•	
59.	*A. longicyathus* (MED & H, 1860)																•	
60.	*A. palifera* (Lamarck, 1816)					•	•				•	•	•	•	•	•	•	
61.	*A. brueggemanni* (Brook, 1893)											•	•		•		•	
62.	*A. austera* (Dana, 1846)																•	
63.	*A. pulchra* (Brook, 1891)											•	•		•		•	
64.	*A. anthocercis* (Brook, 1893)																	•
65.	*A. polystoma* (Brook, 1891)																•	
66.	*A. latistella* (Brook, 1892)																	•
67.	*A. hemprichii* (Ehrenberg, 1834)					•	•											

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Genus *Astreopora* de Blainville, 1830																	
68.	*A. listeri* Bernard, 1896					•					•			•	•	•	•	
69.	*A. myriophthalma* (Lamarck, 1816)					•	•		•									
70.	*A. cucullata* Lamberts, 1980																	•
	Family ASTROCOENIIDAE Koby, 1890 Genus ***Stylocoeniella*** Yabe & Sugiyama, 1935																	
71.	*S. guentheri* Bassett Smith 1890																•	
	Genus ***Madracis*** MED & H, 1849																	
72.	*M. kirbyi* Veron & Pichon, 1976								•							•	•	
	Family POCILLOPORIDAE Gray, 1842 Genus ***Pocillopora*** Lamarck, 1816																	
73.	*P. damicornis* Linnaeus, 1758					•	•		•		•	•	•	•	•	•	•	
74.	*P. verrucosa* (Ellis & Solander, 1786)				•	•	•	•	•		•			•	•	•	•	
75.	*P. eydouxi* MED & H, 1860					•	•		•		•			•	•	•	•	
76.	*P. ligulata* Dana, 1846					•	•											
77.	*P. ankeli* Scheer & Pillai, 1974										•			•	•	•	•	
	Genus ***Seriatopora*** Lamarck, 1816																	
78.	*S. hystrix* Dana, 1846										•			•	•	•	•	
79.	*S. stellata* Quelch, 1886										•			•	•	•	•	
80.	*S. crassa* Quelch, 1886										•			•	•	•	•	
	Genus ***Stylophora*** Schweigger, 1819																	
81.	*S. pistillata* Esper, 1797					•	•				•	•	•	•	•	•	•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Family EUPHYLLIDAE Veron, 2000 Genus ***Euphyllia*** Dana, 1846																	
82.	*E. glabrescens* (Chamisso & Eyscenhardt, 1821)				•	•	•				•		•	•	•	•	•	
	Genus ***Plerogyra*** MED & H, 1848																	
83.	*P. sinuosa* (Dana, 1846)										•			•	•	•	•	
	Genus ***Physogyra*** Quelch, 1884																	
84.	*P. lichtensteini* (MED & H, 1851)													•	•	•	•	
	Family OCULINIDAE Gray, 1847 Genus ***Galaxea*** Oken, 1815																	
85.	*G. astreata* (Lamarck, 1816)				•				•		•			•	•	•	•	
86.	*G. fascicularis* (Linnaeus, 1767)				•	•	•		•	•	•	•	•	•	•	•	•	
	Family SIDERASTREIDAE Vaughan &Wells, 1943 Genus ***Pseudosiderastrea*** Yabe & Sugiyama, 1935																	
87.	*P. tayami* Yabe & Sugiyama, 1935		•	•					•					•	•	•	•	
	Genus ***Siderastrea*** de Blainville																	
88.	*S. savignyana* Milne Edwards & Haime, 1850	•																
	Genus ***Psammocora*** Dana, 1846																	
89.	*P. contigua* (Esper, 1797)				•	•	•		•				•	•	•	•	•	
90.	*P. digitata* MED & H, 1851		•	•		•	•										•	
91.	*P. profundacella* Gardiner, 1898					•	•			•				•	•	•	•	
92.	*P. haimeana* MED & H, 1851				•	•	•											

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Genus ***Coscinaraea*** MED & H, 1848																	
93.	*C. monile* (Forskal, 1775)	•	•	•					•									
	Family **AGARICIIDAE** Gray, 1847 Genus ***Pavona*** Lamarck, 1801																	
94.	*P. cactus* (Forskal, 1775)								•	•				•	•		•	
95.	*P. explanulata* (Lamarck, 1816)													•	•	•	•	
96.	*P. varians* Verrill, 1864					•	•		•		•			•	•	•	•	
97.	*P. maldivensis* (Gardiner, 1905)				•	•	•				•						•	
98.	*P. decussata* (Dana, 1846)								•	•				•	•	•	•	
99.	*P. venosa* (Ehrenberg, 1834)												•		•		•	
100.	*P. clavus* (Dana, 1846)				•	•	•		•		•			•	•	•	•	
101.	*P. duerdeni* Vaughan, 1907																	•
102.	*P. minuta* Wells, 1954										•			•	•	•	•	
	Genus ***Leptoseris*** MED & H, 1849																	
103.	*L. papyracea* (Dana, 1846)												•	•	•	•	•	
104.	*L. hawaiensis* Vaughan, 1907									•								
	Genus ***Coeloseris*** Vaughan, 1918																	
105.	*C. mayeri* Vaughan, 1918													•	•	•	•	
	Genus **Gardineroseris** Scheer & Pillai, 1974																	
106.	*G. planulata* (Dana, 1846)					•	•									•	•	
	Genus ***Pachyseris*** MED & H, 1849																	
107.	*P. rugosa* (Lamarck, 1801)								•		•		•	•	•	•	•	
108.	*P. speciosa* (Dana, 1846)										•			•	•	•	•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
109.	*P. gemmae* Nemenzo, 1955																	•
	Family FUNGIIDAE Dana, 1846 Genus ***Cycloseris*** MED & H, 1849																	
110.	*C. cyclolites* (Lamarck, 1801)								•		•			•	•		•	
111.	*C. costulata* (Ortmann, 1889)													•	•	•	•	
112.	*C. hexagonalis* MED & H, 1848													•	•	•	•	
113.	*C. patelliformis* (Boschma, 1923)									•	•						•	
114.	*C. sinensis* MED & H, 1849													•	•	•	•	
115.	*C.somervillei* (Gardiner, 1909)					•	•			•	•			•	•	•		
	Genus ***Diaseris*** MED & H, 1849																	
116.	*D. distorta* (Michelin, 1843)													•	•	•	•	
	Genus ***Fungia*** Lamarck, 1801																	
117.	*F. corona* Doderlein, 1901									•								
118.	*F. horrida* Dana, 1846									•			•	•	•	•		
119.	*F. danai* MED & H, 1851				•	•	•			•				•	•	•	•	
120.	*F. fungites* (Linnaeus, 1758)					•	•			•	•	•	•	•	•	•	•	
121.	*F. repanda* Dana, 1846													•	•	•	•	
122.	*F. scutaria* Lamarck, 1801					•	•				•			•	•	•	•	
123.	*F. paumotensis* Stutchberry, 1833									•	•			•	•	•	•	
	Genus ***Ctenactis*** Verrill, 1864																	
124.	*C. echinata* (Pallas, 1766)									•	•	•	•	•	•		•	
125.	*C. crassa* (Dana, 1846)													•	•		•	
	Genus ***Herpolitha*** Eschscholtz, 1825																	
126.	*H. limax* (Houttuyn, 1772)									•	•		•	•	•	•	•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Genus ***Polyphyllia*** Quoy & Gaimard, 1833																	
127.	*P. talpina* (Lamarck, 1801)					•					•			•	•	•	•	
	Genus ***Sandalolitha*** Quelch, 1884																	
128.	*S. robusta* (Quelch, 1886)																•	
	Genus ***Halomitra*** Dana, 1846																	
129.	*H. pileus* (Linnaeus, 1758)																•	
	Genus ***Lithophyllon*** Rehberg, 1892																	
130.	*L. undulatum* Rehberg, 1892								•									
	Genus ***Podabacia*** MED & H, 1849																	
131.	*P. crustacea* (Pallas, 1766)				•	•	•	•										
	Family PECTINIIDAE Vaughan & Wells, 1943 Genus ***Echinophyllia*** Klunzinger, 1879																	
132.	*E. aspera* (Ellis & Solander, 1786)						•		•									
	Genus ***Oxypora*** Saville Kent, 1871																	
133.	*O. lacera* (Verrill, 1864)								•									
	Genus ***Mycedium*** Oken, 1815																	
134.	*M. elephantotus* (Pallas, 1766)		•	•	•		•	•	•									
	Genus ***Pectinia*** Oken, 1815																	
135.	*P. lactuca* Pallas, 1766		•		•	•	•	•										
136.	*P. paeonia,* (Dana, 1846)																	•
	Family MERULINIDAE Verrill, 1866 Genus ***Hydnophora*** Fischer de Waldheim, 1807																	
137.	*H. rigida* (Dana, 1846)									•	•	•	•	•	•	•	•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
138.	*H. exesa* (Pallas, 1766)	•	•	•					•		•			•	•	•	•	
139.	*H. microconos* (Lamarck, 1816)				•	•	•		•		•			•	•	•	•	
	Genus ***Merulina*** Ehrenberg, 1834																	
140.	*M. ampliata* (Ellis & Solander, 1786)					•	•			•			•	•	•	•	•	
	Genus ***Scapophyllia*** MED & H, 1848																	
141.	*S. cylindrica* MED & H, 1848										•			•	•	•	•	
	Family DENDROPHYLLIIDAE Gray, 1847 Genus ***Turbinaria*** Oken, 1815																	
142.	*T. peltata* (Esper, 1794)	•	•	•					•		•			•	•	•	•	
143.	*T. reniformis* Bernard, 1896										•			•	•	•	•	
144.	*T. mesenterina* (Lamarck, 1816)		•	•		•	•		•		•			•	•	•	•	
	Family MUSSIDAE Ortmann, 1890 Genus ***Acanthastrea*** MED & H, 1848																	
145.	*A. echinata* (Dana, 1846)				•		•											
146.	*A. hillae* Wells 1955		•	•														
	Genus ***Lobophyllia*** de Blainville, 1830																	
147.	*L. corymbosa* (Forskal, 1775)					•	•				•			•	•	•	•	
148.	*L. hemprichii* (Ehrenberg, 1834)												•		•		•	
	Genus ***Symphyllia*** MED & H, 1848																	
149.	*S. recta* (Dana, 1846)										•	•			•		•	
150.	*S. radians* MED & H, 1849		•	•		•	•		•		•			•	•	•	•	
151.	*S. agaricia* MED & H, 1849										•						•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Genus *Cynarina* Bruggemann, 1877																	
152.	*Cynarina lacrymalis* (MED & H, 1848)																•	
	Family FAVIIDAE Gregory, 1900 Genus *Favia* Oken, 1815																	
153.	*F. stelligera* (Dana, 1846)			•		•	•		•		•			•	•	•	•	
154.	*F. matthaii* Vaughan, 1918																	•
155.	*F. pallida* (Dana, 1846)	•					•		•		•		•	•	•	•	•	
156.	*F. rotumana* (Gardiner, 1899)										•			•	•	•	•	
157.	*F. favus* (Forskal, 1775)		•	•		•	•		•		•			•	•	•	•	
158.	*F. speciosa* Dana, 1846		•	•		•	•		•		•	•		•	•	•	•	
	Genus *Favites* Link, 1807																	
159.	*F. pentagona* (Esper, 1794)					•	•		•									
160.	*F. halicora* (Ehrenberg, 1834)	•			•		•		•	•	•	•			•	•		
161.	*F. abdita* (Ellis & Solander, 1786)				•	•	•		•	•	•	•		•	•	•	•	
162.	*F. complanata* (Ehrenberg, 1834)		•	•		•	•		•					•	•	•	•	
163.	*F. flexuosa* (Dana, 1846)					•					•			•	•	•	•	
164.	*F. bestae* (Veron, 2000)		•	•		•	•		•									
	Genus *Goniastrea* MED & H, 1848																	
165.	*G. edwardsi* Chevalier, 1971																	•
166.	*G. retiformis* (Lamarck, 1816)				•	•	•		•		•		•	•	•	•	•	
167.	*G. australensis* (MED & H, 1857)					•							•		•		•	
168.	*G. aspera* Verrill, 1905										•							
169.	*G. pectinata* (Ehrenberg, 1834)	•	•	•		•	•		•		•	•	•	•	•	•	•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Genus ***Platygyra*** Ehrenberg, 1834																	
170.	*P. pini* Chevalier, 1975																•	
171.	*P. lamellina* (Ehrenberg, 1834)										•			•	•		•	
172.	*P. daedalea* (Ellis & Solander, 1786)	•			•	•	•		•	•		•			•	•		
173.	*P. sinensis* (MED & H, 1849)	•	•	•	•	•	•		•	•		•			•	•	•	
	Genus ***Oulophyllia*** MED & H, 1848																	
174.	*O. crispa* (Lamarck, 1816)															•		
	Genus ***Leptoria*** MED & H, 1848																	
175.	*L. phrygia* (Ellis & Solander, 1786)					•	•		•		•			•	•	•	•	
	Genus ***Montastrea*** de Blainville, 1830																	
176.	*M. valenciennesi* (MED & H, 1848)					•			•		•			•	•	•	•	
177.	*M. annuligera* (MED & H, 1849)				•												•	
	Genus ***Plesiastrea*** MED & H, 1848																	
178.	*P. versipora* (Lamarck, 1816)		•	•		•	•				•			•	•	•	•	
	Genus ***Oulastrea*** MED & H, 1848																	
179.	*O. crispata* (Lamarck, 1816)													•	•	•	•	
	Genus ***Diploastrea*** Matthai, 1914																	
180.	*D. heliopora* (Lamarck, 1816)					•	•				•		•	•	•	•	•	
	Genus ***Leptastrea*** MED & H, 1848																	
181.	*L. transversa* Klunzinger, 1879					•	•		•		•						•	
182.	*L. purpurea* (Dana, 1846)		•	•		•	•		•					•	•	•	•	
183.	*L. bottae* MED &H, 1849				•	•	•										•	
	Genus ***Cyphastrea*** MED & H, 1848																	
184.	*C. serailia* (Forskal, 1775)	•	•	•		•			•								•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
185.	*C. microphthalma* (Lamarck, 1816)				•	•			•		•			•	•	•	•	
	Genus ***Echinopora*** Lamarck, 1816																	
186.	*E. lamellosa* (Esper, 1795)					•			•	•	•			•	•	•	•	
187.	*E. gemmacea* Lamarck, 1816																	•
188.	*E. horrida* Dana, 1846													•	•	•	•	
	Family TRACHYPHYLLIIDAE Genus ***Trachyphyllia*** MED & H, 1848																	
189.	*Trachyphyllia geoffroyi* (Audouin, 1826)										•				•			
	Family PORITIDAE Gray, 1842 Genus ***Porites*** Link, 1807																	
190.	*P. lutea* MED & H, 1860		•	•		•	•		•		•			•	•	•	•	
191.	*P. lobata* Dana, 1846					•					•			•	•	•	•	
192.	*P. solida* (Forskal, 1775)				•	•	•		•		•			•	•	•	•	
193.	*P. lichen* Dana, 1846		•	•	•	•	•		•					•	•	•		
194.	*P. nigrescens* Dana, 1846										•	•	•		•		•	
195.	*P. compressa* Dana, 1846	•	•	•					•									
196.	*P. exserta* Pillai, 1969							•	•									
197.	*P. mannarensis* Pillai, 1969							•	•									
198.	*P. minicoensis* Pillai, 1969				•	•	•	•										
199.	*P. murrayensis* Vaughan, 1918										•						•	
200.	*P. rus* (Forskal, 1775)					•												
	Genus ***Goniopora*** de Blainville, 1830																	
201.	*G. stokesi* MED & H, 1851					•	•		•		•	•		•	•	•	•	
202.	*G. minor* Crossland, 1952		.	.		.	.										•	

S.No.	Species	Gulf of Kutch			Lakshadweep			Gulf of Mannar and Palk Bay		Andaman and Nicobar Islands								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
203.	*G. tenuidens* (Quelch, 1886)										•	•		•	•	•	•	
204.	*G. stutchburyi* Wells, 1955	•	•	•				•	•									
205.	*G. columna* Dana, 1846										•	•			•			
206.	*G. planulata* (Ehrenberg, 1834)		•	•					•					•	•	•	•	
	Genus ***Alveopora*** de Blainville, 1830																	
207.	*A. verrilliana* Dana, 1846																	•
208.	*A. superficialis* Pillai & Scheer, 1976					•												

1. Pillai, C. S. G., M. S. Rajagopalan and Varghese, M. A.1979. *Mar. Infor. Ser. T* and *E Ser.*, **14** : 16-20;

2. Pillai, C. S. G. and Patel, M. I. 1988. *J. mar. biol. Assoc. India*, **30**(1&2): 54-74; **3,6,8 & 15**. Pillai, C.S.G.*J. mar. biol. Assoc. India*, 1983. **25** (1&2) : 78-90;

4. Nagabushanam, A. K. and Rao,G.C.1972. *Mitt. Zool. Mus. Bechin Bad.*, **48**(2) : 270-273p.; **5**. Pillai,C. S. G., Jasmine, S. 1989. *Bull. Cent. Mar. Fish. Res. Inst.*, **43** : pl. 79-194; **7**. Pillai, C. S. G. 1969. Today and Tomorrow publications; **9**. Mathai, G. 1924. *Mem. Indian Mus.*, **8** : 1-59;

10. Scheer, G and Pillai,C. S. G. 1974. *Zoologica*, **122** : 1-75; **11 & 12**. Reddiah, K. 1977. *Rec. Zool. Surv. India*, **72** : 315-324; **13**. Pillai, C. S. G. 1983. *Bull. Cent. Mar. Fish. Res. Inst.*, **34** : 36-43; **14**. Tikader, B. K., A. Daniel & Subba Rao, N.V. 1986. *In* : Seashore animals of Andaman and Nicobar Islands, *Publi.* 84, *ZSI*, Calcutta, 188pp ; **16**. Collection made during GCRMN Coral Taxonomy Workshop at Andamans during December 1998; **17**. Species identified from the collections of Marine Biological Station, Zoological Survey of India, Chennai.

ENDEMICITY OF CORAL SPECIES IN INDIA

Unlike terrestrial animals, fewer marine animals are endemic or restricted to a small area – the result of their larvae floating freely in the oceans. The exceptions are species that do not have floating larvae or have larvae that float in the currents for a very short time around isolated reefs or in semi-enclosed seas. Although most coral species are very wide – ranging, thirty one corals are endemic to Indonesian-Philippines center of diversity which is supposed to be the first in the endemism (5% of the total number of species of corals *i.e.* 581), twenty one species in the Caribbean and Gulf of Mexico (37% of the total number of species) 18 species in Red Sea (6% of the total number of species) and at least six are endemic to India (3% of the total number of species *i.e.*208) (*Montipora jonesi* Pillai 1969; *Montipora manauliensis* Pillai 1969; *Porites exserta* Pillai 1969; *Porites mannarensis* Pillai 1969; *Porites minicoensis* Pillai, 1969; *Alveopora superficialis* Pillai and Scheer, 1976) and probably many more remain to be discovered. Recently Zoological Survey of India and a few other organizations including some non-governmental organisations initiated studies on the coral reefs combined with specialisation on underwater survey. Probably during the coming years many more new discoveries on the fauna of the coral reefs of India may emerge.

DIVERSITY CHARACTERISTICS OF THE SCLERACTINIAN FAUNA OF INDIA

Eighteen families have been reported from the world out of which 15 are represented in India. This diversity is almost same when compared biogeographically to all reefs in the world. However, of the 111 genera reported from the world (Veron, 2000) India has only 60, which is slightly less when compared to Indo-Pacific centre of diversity (82 genera) (Indonesia, Malaysia and Philippines). Of the 793 species reported from the world, India has 208+ species (it is expected to increase up to 400 when intensive studies are carried out), which is still less when compared to 581 species reported from the neighbouring Indo-Pacific centre of diversity. This emphasizes the importance of more intensive studies on the inventorization of scleractinian fauna of India.

Among the 208 species reported in the present account, the family Acroporidae has the maximum number of species (74 species, which is 34% of scleractinian fauna of India) (Table 9). Next to Acroporidae the family with maximum number of species are Faviidae with 36 species and 17% of the total coral fauna and Fungiidae with 22 species and 11% of total coral species of India followed by Porites 19 species and Agariciidae 16 species. Families such as Astrocoeniidae, Euphyllidae, Oculinidae, Pectiniidae, Merulinidae, Dendrophylliidae, and Trachyphylliidae have less number of species recorded when compared to other families.

The number of species and genera of each family is compared with the world fauna in Table 10. The

Table 9. Percentage occurrence of species of corals of the families of India.

S. No.	Family	No. of Species	Percentage
1.	ACROPORIDAE	70	34
2.	ASTROCOENIIDAE	2	1
3.	POCILLOPORIDAE	9	4
4.	EUPHYLLIDAE	3	1.5
5.	OCULINIDAE	2	1
6.	SIDERASTREIDAE	7	3
7.	AGARICIIDAE	16	8
8.	FUNGIIDAE	22	11
9.	PECTINIIDAE	5	2
10.	MERULINIDAE	5	2
11.	DENDROPHYLLIIDAE	3	1.5
12.	MUSSIDAE	8	4
13.	FAVIIDAE	36	17
14.	TRACHYPHYLLIIDAE	1	0.5
15.	PORITIDAE	19	10

diversity of scleractinian fauna of India is only 30% when compared to the total coral species of the world (700 in the case of present study; Table 10). However, when individual families are compared to world, India has unique species in the family Trachyphylliidae due to monospecific genera *Trachyphyllia*. Other monospecific genera represented are *Physogyra, Pseudosiderastrea, Gardineroseris, Coeloseris, Scapophyllia, Cynarina, Oulastrea and Diploastrea* (Table 10).

Table 10. Comparison of number of species in the world and India in relation to genera occurring in India. (* Family and genera only occurring in India are included in this work).

Family and Genera*	Numbers of species		Percentage
	India	World	
1. ACROPORIDAE			
Montipora	20	72	28
Acropora	47	170	28
Astreopora	3	12	25
Total	**70**	**254**	**28**
2. ASTROCOENIIDAE			
Stylocoeniella	1	3	33
Madracis	1	8	13
Total	**2**	**11**	**19**
3. POCILLOPORIDAE			
Pocillopora	5	17	29
Seriatopora	3	6	50
Stylophora	1	7	14
Total	**9**	**30**	**30**
4. EUPHYLLIDAE			
Euphyllia	1	7	14
Plerogyra	1	3	33
Physogyra	1	1	100
Total	**3**	**11**	**27**
5. OCULINIDAE			
Galaxea	2	7	29
Total	**2**	**7**	**29**
6. SIDERASTREIDAE			
Pseudosiderastrea	1	1	100
Siderastrea	1	5	20
Psammocora	4	12	33
Coscinaraea	1	8	13
Total	**7**	**26**	**27**
7. AGARICIIDAE			
Pavona	9	14	64
Leptoseris	2	15	13
Gardineroseris	1	1	100

Family and Genera*	Number of species		Percentage
	India	World	
Coeloseris	1	1	100
Pachyseris	3	5	60
Total	**16**	**36**	**44**
8. FUNGIIDAE			
Cycloseris	6	11	54
Diaseris	1	2	50
Fungia	7	18	39
Ctenactis	2	3	67
Herpolitha	1	2	50
Polyphyllia	1	2	50
Sandalolitha	1	3	33
Halomitra	1	3	33
Lithophyllon	1	3	33
Podabacia	1	4	25
Total	**22**	**51**	**43**
9. PECTINIIDAE			
Echinophyllia	1	8	13
Oxypora	1	5	20
Mycedium	1	5	20
Pectinia	2	9	22
Total	**5**	**27**	**19**
10. MERULINIDAE			
Hydnophora	3	6	50
Merulina	1	3	33
Scapophyllia	1	1	100
Total	**5**	**10**	**50**
11. DENDROPHYLLIIDAE			
Turbinaria	3	11	27
Total	**3**	**29**	**28**
12. MUSSIDAE			
Acanthastrea	2	12	17
Lobophyllia	1	9	11
Symphyllia	3	7	43
Cynarina	1	1	100
Total	**8**	**29**	**28**

Family and Genera*	Numbers of species		Percentage
	India	World	
13. FAVIIDAE			
Favia	6	22	27
Favites	6	14	43
Goniastrea	5	13	39
Platygyra	4	10	40
Oulophyllia	1	3	33
Leptoria	1	2	50
Montastrea	2	10	20
Plesiastrea	1	2	50
Oulastrea	1	1	100
Diploastrea	1	1	100
Leptastrea	3	7	43
Cyphastrea	2	8	25
Echinopora	3	12	25
Total	**36**	**105**	**34**
14. TRACHYPHYLLIIDAE			
Trachyphyllia	1	1	100
Total	**1**	**1**	**100**
15. PORITIDAE			
Porites	11	52	21
Goniopora	6	24	26
Alveopora	2	14	14
Total	**19**	**89**	**21**
Total : 15 Families, 60 Genera	**208**	**700**	**30**

Table 11. Comparison of number of species occurring in four major coral reefs of India in relation to genera and total number of species recorded in India. (This list of species does not include non-hermatypic corals recorded earlier by Pillai, 1967-1996).

S. No.	Genus	Number of Species				TOTAL
		Gulf of Kutch	Lakshadweep	Palk Bay & Gulf of Mannar	Andaman & Nicobar	
1. ACROPORIDAE						
1.	*Montipora*	6	12	17	10	20
2.	*Acropora*	1	14	13	42	47
3.	*Astreopora*	-	2	1	2	3
2. ASTROCOENIIDAE						
4.	*Stylocoeniella*	-	-	-	1	1
5.	*Madracis*	-	-	1	1	1
3. POCILLOPORIDAE						
6.	*Pocillopora*	-	4	3	4	5
7.	*Seriatopora*	-	-	-	3	3
8.	*Stylophora*	-	1	-	1	1
4. EUPHYLLIDAE						
9.	*Euphyllia*	-	1	-	1	1
10.	*Plerogyra*	-	-	-	1	1
11.	*Physogyra*	-	-	-	1	1
5. OCULINIDAE						
12.	*Galaxea*	-	2	2	2	2
6. SIDERASTREIDAE						
13.	*Pseudosiderastrea*	1	-	1	1	1
14.	*Siderastrea*	1	-	-	-	1
15.	*Psammocora*	1	4	1	3	4
16.	*Coscinaraea*	1	-	1	-	1
7. AGARICIIDAE						
17.	*Pavona*	-	3	4	9	9
18.	*Leptoseris*	-	-	-	2	2
19.	*Gardineroseris*	-	1	-	1	1
20.	*Coeloseris*	-	-	-	1	1
21.	*Pachyseris*	-	-	1	3	3
8. FUNGIIDAE						
22.	*Cycloseris*	-	1	1	6	6
23.	*Diaseris*	-	-	-	1	1
24.	*Fungia*	-	3	-	7	7
25.	*Ctenactis*	-	-	-	2	2
26.	*Herpolitha*	-	-	-	1	1
27.	*Polyphyllia*	-	1	-	1	1
28.	*Sandalolitha*	-	-	-	1	1

S. No.	Genus	Number of Species				TOTAL
		Gulf of Kutch	Lakshadweep	Palk Bay & Gulf of Mannar	Andaman & Nicobar	
29.	*Halomitra*	-	-	-	1	1
30.	*Lithophyllon*	-	-	-	1	1
31.	*Podabacia*	-	1	-	1	1
9. PECTINIIDAE						
32.	*Echinophyllia*	-	-	-	1	1
33.	*Oxypora*	-	-	-	1	1
34.	*Mycedium*	1	-	1	1	1
35.	*Pectinia*	-	-	-	2	2
10. MERULINIDAE						
36.	*Hydnophora*	1	1	2	3	3
37.	*Merulina*	-	1	-	1	1
38.	*Scapophyllia*	-	-	-	1	1
11. DENDROPHYLLIIDAE						
39.	*Turbinaria*	2	1	2	3	3
12. MUSSIDAE						
40.	*Acanthastrea*	1	1	-	-	2
41.	*Lobophyllia*	-	1	-	2	2
42.	*Symphyllia*	1	1	1	3	3
43.	*Cynarina*	-	-	-	1	1
13. FAVIIDAE						
44.	*Favia*	4	4	4	6	6
45.	*Favites*	3	6	5	4	6
46.	*Goniastrea*	1	3	2	5	5
47.	*Platygyra*	2	2	2	4	4
48.	*Oulophyllia*	-	-	-	1	1
49.	*Leptoria*	-	1	1	1	1
50.	*Montastrea*	-	2	1	2	2
51.	*Plesiastrea*	1	1	-	1	1
52.	*Oulastrea*	-	-	-	1	1
53.	*Diploastrea*	-	1	-	1	1
54.	*Leptastrea*	1	3	2	3	3
55.	*Cyphastrea*	1	2	2	2	2
56.	*Echinopora*	-	1	1	3	3
14. TRACHYPHYLLIIDAE						
57.	*Trachyphyllia*	-	-	-	1	1
15. PORITIDAE						
58.	*Porites*	3	6	7	6	11
59.	*Goniopora*	3	2	3	5	6
60.	*Alveopora*	-	1	-	1	2
	Total	**36**	**91**	**82**	**177**	**208**

VALUES OF CORAL REEFS

The Indian subcontinent being surrounded by the Indian Ocean, Arabian Sea and Bay of Bengal, has traditionally had a close relationship with the sea. This has resulted in strong cultural and economic links with maritime activities such as fishing, pearl diving, shipbuilding and international maritime trading. India's coral reefs provide habitats for many commercially important fish species. These reefs and some of the associated islands are becoming increasingly popular sites for recreation and are strategically important for India. It would also provide the further potential for numerous pharmaceutical compounds, which are yet to be discovered.

The coral reefs have a large variety of direct and indirect uses that benefit man and society. Among the dominant and most valued uses are the large yield obtained from marine fisheries supported by the reef system. Reefs provide up to 25% of the total fish catch in India and up to 75% of the animal protein consumed. This yield includes a large variety and quantity of organisms caught elsewhere but whose existence is dependent upon the reef.

There has been a long tradition of removing materials from coral reefs and nearby lagoons particularly for building purposes. Some of the ancient temples in south India have been built using corals only. The use of coral rock in the construction of stone buildings also goes back to many centuries, notably in houses along the Gulf of Mannar and Gulf of Kachchh. In Lakshadweep the only material available for building purposes is the coral shingle, which is being collected regularly by locals for building new houses even today. Similarly, sand is often dredged from reef flats and lagoons for the construction industry in Andaman Islands, despite the immediate catastrophies that such actions trigger on the reefs and nearby beaches. Apart from high levels of siltation, which often smother and kill the adjacent reefs, the extraction of sand frequently leads to coastal erosion. Such activities frequently lead to the partial or complete loss of live corals on the adjacent fringing reef as in the case of Gulf of Mannar corals especially the Tuticorin group of seven islands, most of the reefs surrounding Jamnagar in Gulf of Kachchh and the reefs surrounding Port Blair in Andaman. Once the coral reefs were the major visual treat on the coastline, but now one has to travel a long distance inside the sea to enjoy seeing the corals. As a source of lime production, mining of the living reef and back-reef areas is still common in many parts of the world. However in India it has become history. Before the formation of National Parks (first national park was formed in India in the early 1980's) reefs were quarried for cement production. Most of reefs can be seen still suffering from the aftermath of coral mining such as Gulf of Kachchh and Gulf of Mannar. It takes many decades for these reefs to restore its original glory.

As coral reefs tend to be positioned perpendicularly to the direction of wind generated by the swell currents flowing over the reef, they can serve to weaken incoming waves, thereby minimising erosion and coastal hazards on the reef. In fact the reefs not only protect coastlines from the worst excesses of severe cyclone damage, but are also the source of sand, which builds up or replenishes the beaches. During the biggest cyclone such as the one which happened in 1969 in Gulf of Mannar, and in 1988 in Andaman and Nicobar Islands, many corals might have broken up, but the coral rubble and sand are often forced up during these same cyclone on to islands or on to beaches, creating new land as in the case of Manoli Putti in Mandapam, Gulf of Mannar.

Besides reefs provide homes for many organisms, including those we rely on for food and trade. The reef resources are being harvested for their food value and also for other purposes like aquaculture for pearl production. Two species of pearl oysters are harvested from the reefs of Gulf of Mannar, Gulf of Kachchh and Andaman and Nicobar Islands. The development of aquaculture techniques has greatly influenced the value and geographic spread of pearl culture. In some parts of India, small-scale natural pearl industry is still continuing. Sacred chank (*Turbinella pyrum*), Top shell (*Trochus nilolticus*), Turban shell (*Turbo marmoratus*) and many other shells (more than 100 species) are collected for the shell industry, which is thriving well in Gulf of Mannar and Andaman and Nicobar Islands. Large-scale outlets

for domestic sale and as well for international export are mainly Rameswaram, Gulf of Mannar and from Port Blair in Andaman and Nicobar Islands. Many retail shops for shell products and shell jewelry can be seen in Port Blair, Kanyakumari, Marina beach, Mamallapuram, Pondicherry, Velankanni, Thiruchendur and Rameswaram. The usage of cowrie shells as currency was another ancient and wide spread practice, and at least some of them would have come from reefs. Examples of shell currency have been found across Africa and South Asia to China. There is also evidence of a trade in these shells from India to China from records dating back to 400 AD.

Though the tourism in coral reef areas in other parts of the world started in the middle of the last century, and is one of the major income generating industry, India is yet to pick up the benefit in this sector. Bangaram and Agatti are the only two islands where the reef related tourism activity takes place in Lakshadweep. The dive tourism was opened in Lakshadweep in 1989. There are 9 main dive sites, 4 to the north and 5 to the south of Bangaram Island. The number of tourists and the amount of economy generated out of tourism are not much advantageous to the locals. The aesthetic beauty of Andaman Islands is attracting large number of tourists from within India and from abroad. During 1988-89, 37,500 tourists including 2438 foreigners visited these islands. It is estimated that about 99% of tourists coming from abroad and 75% of the domestic tourists get into the sea to have a glimpse of tropical fishes and the coral formations. Such unescorted and unguided groups of reef gleaners, most of them learning to snorkel, are responsible for large scale destruction of corals in shallow near shore waters due to trampling, walking and breaking of corals for fun. Even the SCUBA and skin divers are seen disturbing and damaging the reef inhabitants. The illegal collection and export of decorative corals and shells continue to be a major problem. Only in the Andaman group of islands tourism is permitted, while the Nicobar Islands are not open for tourists. The dive tourism thrives only in Port Blair and a nearby island called Havelock. There are two to three dive shops in Port Blair and the same number in Havelock. The Port Blair dive shops take the tourists to some five to ten dive sites (around labyrinth groups of islands) including a shipwreck, the Havelock dive shops take the tourists to some of the real natural dive sites in different islands of Ritches Archipelago. The number of tourists is expected to increase many fold after the opening of the international airport in Port Blair.

THREATS TO CORAL REEFS OF INDIA

ISSUES RELATED TO CORAL REEFS OF INDIA

Corals are ancient animals that date back to 400 million years. Over the past 25 million years they have evolved into modern reef-building forms. Corals reefs are one of the most diverse habitats in the world and are considered the largest structures on Earth of biological origin, rivaling old-growth forests in their longevity. Reef's resources have traditionally been a major source of food for local inhabitants and of major economic value in terms of commercial exploitation. The human exploitation of coral reefs has increased dramatically in the last few decades for reasons, both commerce and subsistence living. Coral reefs of India have been exploited since time immemorial but it is only in the last century that the rate of exploitation has increased dramatically, due to increase in the human population. Except for some of the Andaman-Nicobar Islands, no pristine coral reefs exist today. Alarm over the decline of many coral reefs of India goes back at least as early as 1936, when Gardiner expressed concern about the degree of degradation where the habitation occurs near reef areas. At the end of the last century or in the beginning of this century, very few coral reefs of India remained unaffected, wherein most were partially damaged while a few have been severely affected. Some reefs have been completely removed, either inadvertently or by intentional activity such as coral mining.

Two generalizations can be made in connection with the degradation of coral reefs of India. Firstly, the degree of reef degradation in proportion to thickly populated area of the major coral reef area of India is alarming, and indeed, may be surprising to anyone who have been involved with reefs. Prof. T. N. Ananthakrishnan (former Director, Zoological Survey of India) who had visited the coral reef areas of Gulf of Mannar regularly for scientific collections during 1940's till 1960's (25 years) observed a dramatic decline in the total coral reef biodiversity in the area (Personal communication). The richness of fauna of Gulf of Mannar during 1940–1970 was mentioned in his book "General Animal Ecology of India" (Ananthakrishnan and Viswanathan, 1976). Conventional literature does not yet contain much reference to the worst affected areas. The second is that the degradation of coral reefs is only one manifestation of a much wider and more intractable problem that currently afflicts Indian coral reefs as a consequence of agricultural malpractices and terrestrial runoff. The extent of terrestrial runoff two decades ago was 250 t of topsoil per hectare in a year and the total terrigenous load reaching the western Indian Ocean alone was 500 million m^3/y. Apart from the obvious impact on agricultural productivity, this has severe consequences on the estuarine and coastal fisheries and habitats, and has caused the obliteration of substantial tracts of fringing reefs. Coral remains a cheap and easily available raw material for constructing houses, roads and walls. Coral mining has been banned in National Parks since their creation in the 1980's but large-scale illegal mining is still prevalent in parts of the Lakshadweep and Nicobar Islands and Gulf of Mannar despite legal protection. Legal harvesting, in the Lakshadweep Islands where there are no parks, is presently restricted to dead coral shingles. In Gulf of Kachchh the whole area of Narara reef was mined for cement production before the formation of National Park. Coral mining has, however left scars that will take decades to repair in Gulf of Kachchh and Gulf of Mannar.

The terms "stress" and "disturbance" have been applied to coral reefs with a variety of interpretations. Stress is a physiological condition that results from adverse or excessive environmental factors and in corals this can be measured by decreased growth rates, metabolic differences, and biochemical changes. Disturbance is an ecological phenomenon, which includes departure from a routine set of conditions. Both these factors lead to coral degradation.

There are varying levels of degradation which can be observed on coral reefs, from the extreme and obvious (mortality) to more sublime changes in characteristics including competitive dominance among organisms, decreased growth rates, breakdown of species association, reduced fecundity, reproductive failure and declining recruitment of larvae. Essentially, whether a coral reef is killed in a week, due to sediment burial, or over a ten-year period, due to attrition and lack

of recruitment, the result is the same. The loss of the coral reef community results in the loss of all the benefits that it offers.

Recent reports indicate that coral reefs are under considerable stress and are experiencing considerable damage. Coral reefs have been resilient ecosystems since the Mesozoic era (about 200 million years ago), surviving major environmental events such as ice ages, meteor strikes, and large changes in solar activity. Notwithstanding these events, coral reefs have recovered to form the extensive reefs we see today, although recovery may have taken thousands to hundreds – of thousands of years. Coral reefs also have the capacity to regenerate rapidly after catastrophic tropical storms, plagues of the coral-eating Crown-of thorn starfish, and severe bleaching. Recovery often takes 15 to 20 years. However over the past 50 years, there has been major increase in stresses on coral reefs due to direct and indirect human interference. These stresses are threatening the very existence of reefs in some areas, and will diminish the extent of reefs in other areas.

NATURAL STRESSES TO CORAL REEFS

The major stresses on reefs are storms and waves, particularly tropical storms and cyclones. These cause major intermittent damage to reefs, particularly to those reefs that rarely experience these storms. Cyclonic disturbances develop during certain months (October-November) along the Indian Seacoast and elsewhere in the tropical region. These cyclones have sustained winds with speed ranging from 65 to 120 km per hour. High-speed winds cause extreme wave action that break coral into rubbles and sometimes-large amounts of sand and other materials may be dumped onto the coral reef. Due to 1969 cyclone a large area of coral was buried under the sand in Rameswaram area of Gulf of Mannar. Likewise the cyclone of December 1987 in Bay of Bengal devastated the coral reefs of the Mahatma Gandhi Marine National Park of Port Blair, Andaman that resulted in heaps of broken coral colonies scattered near the shore.

Freshwater runoff damages reefs in semi-enclosed bays and lagoons (a channel near the Mahatma Gandhi Marine National Park entrance) by lowering salinity and depositing large amounts of sediments and nutrients. Reefs are also damaged by volcanic activity (earthquakes, volcanic lava flows, severe uplifting) in the Andaman Islands, for example in Barren Island. The major biological stress on reefs is predation by crown-of-thorns starfish in Andaman and Nicobar reefs (Mahatma Gandhi Marine National Park, 1989) and coral diseases have been particularly devastating in Lakshadweep. There is now considerable speculation that the incidences of both these stresses have been exacerbated by human activities.

HUMAN IMPACTS ON CORAL REEFS

Varied human activities which are, a cause for concern over and above the natural disturbances, include runoff and sedimentation from development activities (projects), eutrophication from sewage and agriculture, physical impact of maritime activities, dredging, collecting, and destructive fishing practices, pollution from industrial sources, golf courses and oil refineries and the synergistic impacts of anthropogenic disturbance.

a. Sedimentation

Sedimentation, may affect corals in three different ways: photosynthetically, physically and chemically. As most reef-building corals obtain the majority of their nutritional requirements through translocation of metabolites from their photosynthetic partners (Zooxanthellae), any reduction in the availability of light will affect coral nutrition, growth, reproduction and depth distribution.

Physically, sediments also interfere with coral nutrition by coating the feeding surfaces responsible for catching prey items needed to supplement the energy provided by zooxanthellae. While corals do have the ability to clean themselves using a combination of mucus secretion and ciliary action, chronic sedimentation may end up in a high energetic cost, adding to the overall impact on the colony. Sedimentation can alter species composition of reefs through photosynthetic and physical effects. Change in relative abundance of morphological types as well as individual species are an important illustration of how sedimentation affects community structure. The standing examples are the coral reefs of Gulf of Mannar islands and the reefs of Little Andaman. So far, the presence of sediment load in the coral reef areas has been confirmed in Gulf of Mannar and Andaman and Nicobar Islands though not reported quantitatively. Venkataraman and Rajan (1994) reported the amount of silt carried by the rainwater from Port Blair City into the sea. Only a few studies have been focused on the quantitative effect of sedimentation and siltation on reefs.

Sedimentation can also physically interfere with recruitment of coral larvae, which require a solid substratum upon which to settle and metamorphose. Dredging projects have been particularly damaging to reefs, (Sethu Samudram Project, Gulf of Mannar region) primarily through the initial physical disturbance, habitat alteration and the subsequent problems associated with sedimentation. Illegal sand mining in Andaman Islands and coral quarrying in Gulf of Mannar (Tuticorin group of Islands) and some islands of Gulf of Kachchh have caused a lot of sedimentation and siltation on coral reefs. In fact recently two islands in Gulf of Mannar have gone under water viz. Vilanguchalli in Tuticorin group and Poovarasan Patti Island in Keelakarai group probably due to coral mining.

Very few studies have focused on the chemical effects of sediment on corals. Dumping of fly ash near Pandian Island at Tuticorin may contain a variety of heavy metals particularly detrimental to coral reefs.

b. Runoff/Chemical Pollution/ Water Quality

A general rule for coastal zone is: whatever is used on land today ends up in the aquifer or coastal zone tomorrow. Salinity changes alone have been proven to affect corals, especially on shallow water reef flats, which are most likely to be affected by freshwater runoff. The amount of sediments and chemicals the runoff water carries to the sea has profound effects on fertilization of eggs of coral species. Likewise, the quality of runoff water can affect the metamorphosis of the larvae of corals. Many experiments have demonstrated that the actual coastal surface water quality above reefs during coral spawning events has reduced reproductive capacity to a great extend. Many areas in Andaman and Nicobar Islands and Gulf of Mannar area have large quantities of sediment laden freshwater runoff impinging on coastal reefs, causing high levels of coral mortality, rapid growth of fleshy algae species, and large areas of reduced salinity/quality seawater. Local fishermen of Gulf of Mannar have complained of decreased fisheries and reef vitality not only on these coastal reefs, but also on off shore islands and reefs not directly affected by sediment. Inspection of these reefs by

the Zoological Survey of India have revealed live adult coral colonies, but no signs of larval recruits, with increased levels of sedimentation.

Oil pollution is an example of how chemicals, in this case hydrocarbons, can affect reefs. Research performed in many areas have documented coral mortality, decreased fecundity and recruitment failure as a consequence of chronic oil pollution.

The aquaculture farms and seafood processing industries occupy most of the coastal belt in India. Other industries like fertilizer, refinery, pesticides, textiles, power plants, petro and agrochemicals and chemicals are also located along the coast of Gulf of Kachchh and Gulf of Mannar. Besides industrial and municipal wastes, port operation with busy traffic of marine vessels at Gulf of Kachchh and Tuticorin Port including oil transport as also the wastes of aquaculture farms are increasingly posing threats to the water quality of coral reef area. Industrial waste discharged in to the sea near Tuticorin islands, Chattam Saw mill wastes in Port Blair are the standing example of how pollution deteriorates the reef ecosystem. All the near shore reefs and island reefs of Tuticorin, Gulf of Mannar and Port Blair area (on the way to Ross Island) Andaman and Nicobar area have become barren rocks.

c. Sewage

The overall impact of sewage on a coral reef community depends on its quality and quantity, level of treatment, presence of toxic materials and receiving water characteristics. The effects of sewage-related nutrient enrichment on coral reef communities have been documented and include alteration of competitive interactions, reduction of coral calcification rates from decreased light levels and increased phosphate concentrations and increased mortality due to bacterial infection. Corals are adapted to live in nutrient poor environments and are relatively slow growing compared to algae, sponges, tunicates and other groups of sessile benthic organisms. Nutrients not only increase the bio-mass of phytoplankton, affecting light transmission and increasing the biological oxygen demand (B.O.D.) which may have some impact on the corals but also give a competitive advantage to faster growing benthic species. The large green algae mats formed due to the sewage pollution from the town have covered and killed coral in Keelakarai coast, Gulf of Mannar

Fig. 28. Sewage pollution near Keelakarai

(Fig. 28). The nutrient enrichment via sewage reduces the photosynthetic efficiency of corals, as algal cells increase in density to the point of becoming self-shading as in the case of blooming of seaweeds in the Narara Reef, Jamnagar, Gulf of Kachchh National Park area. Since the coral-zooxanthellae symbiosis evolved under nutrient limited conditions, it is reasonable to assume that the relationship will become altered in response to changes in the level of nutrients available. Further studies of the physiological effects of such changes are needed to determine the sub lethal or long-term effects of sewage and nutrient enrichment on coral reefs of Gulf of Mannar Islands and Andaman and Nicobar.

While the effects of suspended solids from sewer out falls have been compared to those from terrigenous runoff and sedimentation, the two types of sediments differ in physical, chemical and toxicological characteristics, which must be considered when assessing impacts. Sewage suspended solids, primarily organic, can contain absorbed toxins, and increase Biological Oxygen

Demand (B.O.D) more than inorganic sediment associated with runoff. The toxic component of sewage depends on the sources of input and is primarily a concern in industrial or agricultural areas where industrial wastes and pesticides are included in the effluent.

d. Temperature Stress and Bleaching

The negative impacts of increased temperature on corals have been documented from both anthropogenic and natural sources. There are many documented evidences for coral mortality associated with the hot water discharge from a cooling system for a power plant and widespread mortality with increased temperatures accompanying the *ElNino* event. In both cases, the cause of mortality appeared to be the breakdown of the symbiotic association between the zooxanthellae and the coral host (bleaching).

There has been unprecedented bleaching of hard and soft corals throughout the coral reefs of the world from mid-1997 to late-1998. Much of the bleaching coincided with a large *ElNino* event followed by a strong La Nina but bleaching in all the coral reefs are uncorrelated (Wilkinson, 1998, 2000). During this event bleaching and mortality were most pronounced in shallow water (less than 15 m) and particularly affected staghorn and plate *Acropora* and other fast growing corals. Many of the massive, slow-growing species bleached, but many recovered within one or two months. This bleaching event has resulted in poor coral cover in all four major coral reefs of India and possibly fewer new coral recruits on many reefs in India for the next 10 years until recovery gains speed. In the short term, this will affect adversely the economy of India, particularly fisheries. There will be a shift in the composition of coral communities; some will have greater dominance of slow growing massive corals, whereas other reefs will lose century-old colonies. Nevertheless, such shifts have occurred in the past and are part of the normal variability of many coral reefs. If however, the recent bleaching event is linked to global climate change, and repeats regularly in the immediate future, the consequences would be serious for many coral reefs if sea temperatures show a continuing upward trend.

Most of the corals in the coral reefs of India had been adversely affected during the bleaching in 1998, which destroyed most shallow water corals. This event has left only very less live coral cover in the reef. Study conducted after or during the bleaching event reported a very less live cover of corals in Gulf of Kachchh (20-40%), Gulf of Mannar (20-40%), Lakshadweep (20-30%) and Andaman and Nicobar Islands (to the least cover; 10%). Recent surveys conducted in Andaman and Nicobar Islands reported about the near pristine and high diversity of corals and also reported that there is no evidence of crown of thorns star fish and bleaching. The live coral cover in these islands is between 50-75%, which is expected to be a very high level compared to other reefs in the Indo-Pacific region.

e. Coral diseases

In recent times, degradation of coral reefs is common and there are several abiotic and biotic factors, which are responsible for this. In addition to natural and human induced coral degradation, coral diseases are considered to be one of the major problems faced by the coral reefs in recent years. Diseases in corals and other organisms have significant, negative impacts on the structure and appearance of coral reefs. On some reefs, the effects of diseases have been of a similar magnitude to more familiar disturbances, such as outbreaks of the crown-of-thorns starfish and coral bleaching associated with elevated sea temperatures. Because of widespread mortality of coral reefs, documenting coral diseases has assumed importance in recent years and the spread of several old and new diseases has been reported from various parts of the world. Bacteria, fungi and cyanobacteria (blue-green algae) are known to cause diseases in corals. Fungi are well known as plant and animal pathogens on land, and several fungal diseases have also been reported from the marine environment. Among diseases, especially the microbial diseases, White band, Pink line, Red band and Black band diseases caused by cyanobacterial infections are considered to be the main cause in coral reef degradation. Necrotic lesions, fleshy algal over-growth, Black band disease and White band disease have been reported from Andaman and Nicobar and Lakshadweep Islands. In addition, a new disease called Pink line disease has also been reported recently from Lakshadweep. Worldwide observation on Black band and White band diseases

on corals includes studies on the reefs of Belize and the Florida keys, Caribbean basin, Indo-Pacific, Philippines and Australia. As far as the Indian reefs are concerned, not much attempt has been made so far to identify these problems at a larger scale though many cyanobacterial species are present, especially in the Gulf of Mannar region. Apart from cyanobacteria, fungi cause coral diseases as secondary invaders. While there is a degree of uncertainty over the causes responsible for each disease, since they all appear to be stress-related. Many marine scientists suspect that human activities, such as pollution and changing patterns of land use, have caused the spread of disease in coral reefs. Eutrophication, the enhanced input of nutrients by human, may be an important source of stress to reef organisms. Eutrophication may compromise disease resistance, allowing opportunistic infections to take hold and new diseases to emerge. Synergism is believed to play an important role, as stressed coral seems to be the most susceptible to the above diseases. Because corals grow slowly, live for decades to centuries and reproduce sporadically, today's epizootics will probably have far reaching consequences. Multidisciplinary efforts, combining microbiology, coral physiology and pathology, ecological monitoring and palaeontology will be necessary if we are to understand what is happening and device management strategies accordingly.

f. Destructive fishing practices

Fishing is one of the oldest human activities, and it developed gradually, when our ancestors moved from the collection of plants and animals to hunting by using tools and weapons. The oldest fishing implements so far identified are harpoons, found in the territory of Congo, and dated about 90,000 years (Stinger and McKie, 1996). In India too, it is believed that the development of fishing must have been parallel. There are reports that fishes were grown in reservoirs as early as 320 BC. At present, in the 3651 fishing villages situated along the 8129 km coastline, about one million are occupied, full time in marine capture fisheries. The value of the annual marine fish production of 2.7 million tones during the year 2000 was Rs. 10,000 crores and the value of marine products export was Rs. 6,300 crores. This is mainly due to the introduction of bottom trawlers, which was introduced in the Indian water in the early 1960s. Since then trawling has emerged as the most important method for exploiting the demersal fisheries resources. In 1988, there were 30, 979 trawlers ranging from 9 to 17 m overall length with engine horsepower of 40 to 150. The annual average landings by the trawlers increased from 3,02,952 t (1980-1981) to 12,94,822 t (1999-2000). The contribution of the trawlers to the total marine production also increased from 29 % to 49 %. The disturbing aspect of trawling is the usage of very small mesh size in the cod end of the net. The mesh size used at present is only 8 – 10 mm, which prevents escape of juvenile fishes. This has resulted in exploitation of a very large quantity of juveniles of economically important fishes, exploitation of a large quantity of small sized adult fin fishes and crustaceans, which fetch very low price and discard of trash fish in the sea due to inadequate storage space and processing facilities on board. Another concern often expressed about trawling is the damage it is alleged to cause to the seabed. The weight of the sinkers used for shrimp trawling has been increased to touch the sea bottom and hence, the seabed gets disturbed while dragging the net. Along with the seabed, the plants and animals associated with the seabed especially the reef building corals are disturbed. A total of 1006 purse seines in India on different coast may have the same effect on the seabed as found in the trawl netting. The Ministry of Agriculture, Government of India (1991) has estimated the annual catchable potential of the Indian waters as 3.9 m t. Of this 2.2 m t could be exploited from the inshore waters and 1.7 m t from the offshore waters. The marine fish landings in India increased from 0.5 m t in 1950 to 2.7 m t in 2000. Most of this increase came only from the exploitation of inshore waters and hence the whole area is over exploited.

This same problem has lead to another anthropogenic disturbance on reefs **'over fishing'**. Several types of net fishing have also been responsible for over-exploitation of reefs. As in the case of all biological communities, in a coral reef, also each species plays an important role in the dynamics of balance. The depletion of grazers, for example, may eventually lead to an overgrowth of algae as in the case of Gulf of Mannar reefs. The use of fish traps made of long-lasting materials with small mesh sizes results in the capture of pre-reproductive juveniles affecting future populations

and the death of fish when traps become dislodged during storms, continue to capture fish, which eventually starve. The use of destructive fishing practices has been responsible for the destruction of coral reefs throughout the world. Destructive fishing practices have seriously damaged many of the Gulf of Mannar's richest and most diverse coral reefs, necessitating an urgent, far-reaching action. The Gulf of Mannar stands out as one of the hardest hit areas, with 60% of its reef in varying stages of deterioration. Because of the large size of the areas concerned (Gulf of Mannar and Andaman and Nicobar Islands or other areas in India), and the general lack of resources for enforcement, education appears to be more successful than legislation in controlling these practices. Poverty reduces the alternatives for fishermen who must feed their families and rely on fishing as a source of protein and income.

Fig. 29. Fertilizer bomb

g. Blast Fishing

Although it is now illegal, blast fishing has been a widespread and accepted fishing technique in some of the developing countries such as India. Schooling reef fishes are located visually, after which the capture boat moves within close range and a lighted bomb is thrown into the middle of the school. After the bomb explodes, fishermen enter the water to collect the fish that have been killed or stunned by the resulting shock wave. Due to blasting, branching, tabulate and foliose hard corals get shattered while massive and columnar corals are often fractured. Although this effect of blasting is quite localized, reefs subject to repeated blasting are often reduced to not more than shifting rubble fields, broken by the occasional massive coral head. In addition to damaging the reef framework, blast fishing results in side-kills of non-target and juvenile fish and invertebrates. Bombs made of chemical fertilizers such as ammonium/potassium nitrate were confiscated from the foreign poachers apprehended in Andaman and Nicobar Islands (Fig. 29). Gelatin sticks were observed to be used to blast fish by the fishermen around Gulf of Mannar reefs. The methodology of blast fishing in Gulf of Mannar is unique. This consists of using large trees of *Prosobis juliflora*, which are cut and towed inside the sea where the blast fishing is to be operated. The tree is left for a few days to decay. Then the gelatin sticks are used to blast and the fishes, which had congregated under or near the decaying *Prosobis* trees get killed. The dead floating fishes are hand picked. After the bomb blast most fishes that congregate under the decaying tree get attached to the thorns of the *Prosobis* tree and the tree is towed back again to the shore and the fishes separated.

h. Trap Fishing *(=Koodu)*

The use of bamboo mesh traps, locally known as 'koodu', is widespread throughout the Gulf of Mannar Islands (Fig. 30). In Ramanathapuram alone 3,312 traps (37% of the total trap in the Tamil Nadu State) are found. About 10-15 traps are taken by boat and it is placed near or on the coral reefs once in two days. Per trip each fisherman catches 25 to 30 kg of fish. Although this gear is not intrinsically destructive, the process of setting and retrieving the trap is largely responsible for the destruction wrought on the reef. These traps set by simply lowering them from boat-side via a buoyed rope are responsible for most reef damage. The traps are often heavy with wooden runners or stones and can destroy entire stands of branching and foliose corals on the reef during their installation and especially removal (by pulling on the rope). If the current trend continues, Koodu

Fig. 30. Fish Traps of Gulf of Mannar

trap activities will become an increasingly important cause of reef damage in Gulf of Mannar. Over 40,000 fish traps are putting American coral reefs off West Florida, Puerto Rico and the U.S. Virgin islands at daily risk of serious damage. As found in the reefs of Gulf of Mannar area the fish traps set in U. S. coral reef areas were also directly on coral reefs. The two scientific studies conducted on the destruction of placing fish traps in the coral reef area also found that fish traps are damaging large amounts of coral. One study calculated the damage at 10 sq cm / week for every trap on coral at the coral reefs of La Parguera. The other study calculated weekly damage per trap at 70 sq cm of complete removal of coral tissue. When the average of these numbers is calculated and then multiplied by the 8,000 traps per week landing on U. S. Caribbean coral, the result is 1,60,000 sq m (40 acres) of coral damaged each and every year. More such studies have to be carried out in Gulf of Mannar coral reefs and the damage to the coral reefs should be assessed.

i. Ola valai and Shore Seine

'Ola valai' is a type of drive-in net fishing technique whereby a row of fishermen in the water use scare-lines, lines with palm leaves tied off at regular intervals to drive fish down a bag net (Fig. 31). The scare lines are rhythmically lifted and dropped into the shore areas, often breaking live corals while the fish are driven ahead. Next to this the shore seines form the major gear of Gulf of Mannar. A funnel shaped net with a mesh size of 2 to 3 cm, forms the mouth and central portion of the net. A rectangular bag of 18 m length and 1 m width with a mesh size of 1 cm is attached to the tapering side of the funnel shaped net. Two wings of coir rope each 4500 m, in length are attached to either side of the mouth. Outer rope of 600 to 800 m in length is tied to each wing at the time of operation of the net. Wooden floats are tied to the head rope and stones to the footrope to get vertical spread of the net. The net is shot near the surf beaten shore from the boat and fish shoal is covered by rowing the boat in a circle and trapped. The net is dragged towards the shore by two groups of fishermen. These nets are operated

Fig. 31. Olavali operation in Mandapam, Gulf of Manna

throughout the east coast and Andaman and Nicobar Islands. There are about 1,523 numbers of shore seines found in Ramanathapuram district alone (Gulf of Mannar area), forming about 33% of the total shore seines in the Tamil Nadu state. Although this gear is not intrinsically destructive, the process of shore seine operation is largely responsible for the destruction of new colonies emerging near lagoon.

While it is simple to prove how damaging destructive fishing practices are to the productivity of fisheries, the economic realities of day-to-day life in Gulf of Mannar and Andaman and Nicobar Islands makes it difficult to arrive at a solution.

j. Crown-of-thorns starfish

The coral eating starfish, *Acanthaster planci* (Fig. 32) has been the focus of a debate on the fate of coral reefs since outbreaks were observed in the late 1980's and early 1990's at Andaman and Nicobar Islands (Mahatma Gandhi Marine National Park) as well as in other coral reefs areas of the world. It is also reported from the reefs of Lakshadweep Islands. It was first discovered by a biologist called Rumphium in 1705. Over the years since this starfish was first recorded, it has been reported in a variety of places in India. Field studies show that these starfish prefer to live in sheltered environments where it is not so likely to be injured by strong waves or forced off corals by strong currents. This is a predator of the stony corals, which form reefs. It attaches itself to a coral using its suckered 'tube feet' and protrudes its yellow stomach from its mouth, covering an area of its prey. Digestive juices from the stomach break down the coral tissues, which are then absorbed, leaving the coral skeleton. While damage from a low density of the starfish is slight as in the case of Andaman Islands in 1989-90, outbreaks have occurred in many parts of the Indian and Pacific Oceans including the Great Barrier Reef, causing great damage to corals. Till today it is not reported in alarming numbers in any of the reefs in India. While it has been documented that hundreds of km^2 of coral reefs of Australia and other areas have been devastated by population blooms of starfish, the debate centers on the out breaks of natural events, whether occurring repeatedly over geologic time or whether the situation has arisen as a result of man's activities. Although sediment core data have indicated *Acanthaster* out breaks that occurred 10,000 years ago, recent studies have shown a relationship between nutrient input and recruitment success of the larvae. Studies of echinoderm reproduction have demonstrated that the success of recruitment of their planktonic larvae depends on phytoplankton availability following spawning. Events that increase nutrient availability on coral reefs can affect reproduction and recruitment in *Acanthaster*, while outbreaks may be considered natural, an increasing number and /or the persistence of these events may be linked to anthropogenic nutrient input.

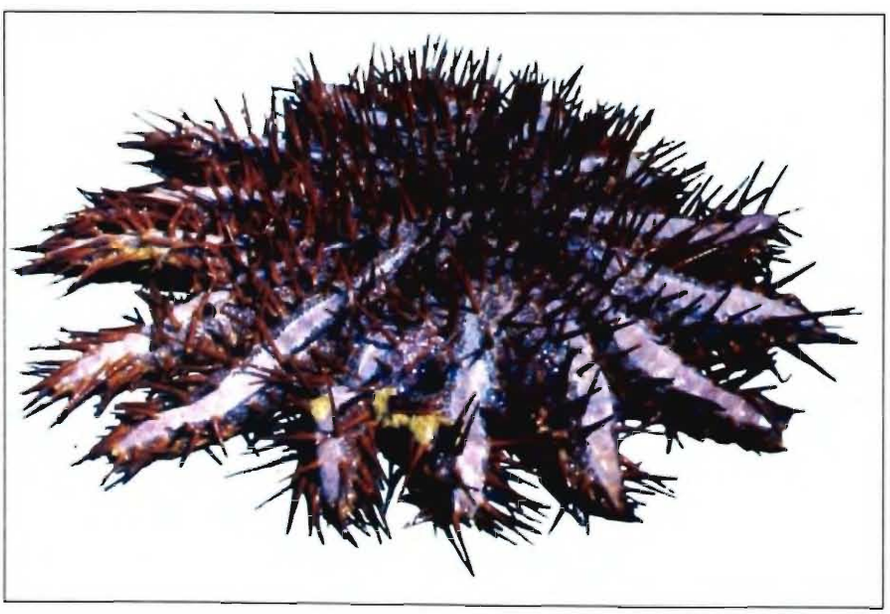


Fig. 32. *Acanthaster planci* in Andaman reefs

PALK BAY AND GULF OF MANNAR

The threats to the Palk Bay and Gulf of Mannar are through indiscriminate exploitation of natural resources by poachers for commercial purposes. There are about thirty-eight fishing villages on the coastal stretch of Ramnathapuram district with a population of little over 32,000, entirely depending on fishing. Extensive areas of sea grass beds with species such as *Cymodocea sp., Thalassia sp.* and *Enhalus sp.* are being disturbed by stake net fishing and intensive trawling operation around the islands. Large-scale collection of *Ptychodera flava* (*Balanoglossus*) as biological specimen has virtually annihilated the population density. This is another unique species occurring in the sandy flats of northern islands of Gulf of Mannar. Exploitation of fishery resources in the inshore waters has been the sole occupation of hundreds of fishing families along the coast for centuries. Reef exploitation includes reef fishery, shell (=chanks) and pearl fishery, ornamental shell trade and illegal mining of corals. Over exploitation of commercially important species such as *Turbinella pyrum, Pinctada fucata, Cypraea talpa, Cypraea serpentis, Chicoreus ramosus, Chicoreus virgineus, Conus amadis, Conus textile,*

Strombus canarium, Murex adustus, Veluta lapponica and *Murex haustellum* may ultimately threaten the very existence of these species in Gulf of Mannar reefs. Villagers around Palk Bay harvest holothurians, seahorses and pipefishes.

The destruction of reefs and reef associated organisms in the Gulf of Mannar and Palk Bay is perhaps unparalleled in the history of environmental damage to nature and natural resources in the recent past (Pillai, 1996). The coral reefs of Palk Bay and Gulf of Mannar have been quarried for industrial purposes from the early sixties from Mandapam to Tuticorin before the declaration of the Marine Biosphere Reserve and National Park. The estimate of coral quarried varies. Pillai (1973) estimated the exploitation of corals for extraction of lime and for manufacture of cement from Mandapam area alone during the sixties and early seventies to be to the tone of 250 m^3 per day. Some of the islands (Vilanguchalli in Tuticorin group and Poovarasanpatti Island in Keelakari group) are totally submerged 3-5 m below water level probably due to quarrying (Venkataraman, 2000). At Tuticorin alone one estimate was 80,000 t per year (Pillai, 1986) and another estimated to an annual removal of 15,0000 t of boulders and 10,000 t of coral debris (Venkataramanujam *et al.*, 1981). Huge colonies of massive corals that occupied large areas in the lagoons of many islands are no longer found due to over exploitation of algae and shells for commercial purposes.

The corals in Gulf of Mannar are fast deteriorating, particularly due to human interference. Island based stake-net operations have entailed heavy destruction by fisher folk of the marine turtle eggs which are laid seasonally by the olive ridley on the seaward sandy beaches of almost all the islands (Lal Mohan, 1983). Drift netting in the zone of the arrival of turtles, traps the breeders coming in for nesting. Besides, this area also has been identified as an important feeding ground for green turtle and hawks-bill turtle. The seabed of the shallow stretch of water between the island and mainland are intensively trawled for prawns thus adding another new dimension to the disturbance of the habitat. Sand quarrying, fly ash discharge from thermal power stations and installation of chemical industries in the Gulf of Mannar area are the main causes of destruction of the pearl oyster fishing, live corals and the freshwater aquifers. The export of live crabs and lobsters from this area in recent years is also causing damage to live corals. Fish traps (=Koodu) used to collect live crabs for export damage coral reefs in these areas. The boring sponges cause considerable destruction to corals and about 20 species of boring sponges are recorded from this region. Other than these disturbances, siltation, agricultural runoff and sewage discharge are major problems in these areas.

ANDAMAN AND NICOBAR ISLANDS

According to the 1991 census, the human population of these islands was 279 thousand and the estimated population by the new millennium is 405 thousand, out of which, the tribal population is only 23 thousand. Very little documented information exists on the relationship between the original tribal population and the coral reefs. The population mainly consists of settlers from the mainland who came after the establishment of penal settlements in 1857. Clearly the greatest impact of human activities on reef resources is due to the demands of the settlement populations, government servants, business opportunists and tourists who visit the island.

Today, among the reefs in India, many areas in Andaman and Nicobar remain in pristine condition. However, during a recent survey of the Mahatma Gandhi Marine National Park area in South Andaman, it was observed that siltation has caused mass mortality of corals at Tarmuguli and Hobday Island. The corals near Old Wandoor area and Chiriatapu of South Andaman and Dugong creek and Hut Bay area of Little Andaman were found dead mainly due to siltation. The plantation of oil palm trees at Little Andaman is reported to be the cause for the death of many coral reefs in this island. Mass mortality of corals was also observed in and around Port Blair probably due to siltation. It is reported that Chattam saw mill effluents might be the reason for the destruction of coral reefs in this area. During a recent survey at Neil Island near the Ritche's archipelago (Zoological Survey of India) most of the coral reefs were found dead. This is probably due to agricultural runoff from this island where a lot of vegetables are grown and also due to the application of pesticides to get a good yield of vegetables. So far, no studies on the effect of cultivation on coral reef have been

done on this island. In recent days, a lot of construction and developmental activities are going on in many areas of Andaman and Nicobar Islands. Construction of jetty, road and buildings need a lot of sand material. Sand mining is the major activity that leads to destruction of coral reefs in many islands in Andaman and Nicobar Islands. Collection of coral reef associates such as *Trochus* and other shells as well as other reef resources are also causing damage. Invasion of crown of thorn starfish (*Acanthaster planci*) and White band disease are reported in many reefs in Andaman and Nicobar Islands. In recent years number of foreign poachers visiting Andaman and Nicobar Islands are on the increase. Such poachers with vessels of around 10-15 meters with a crew of 10-15 members fishing on fringing reefs of uninhabited and remote islands are quiet common. Andaman and Nicobar Islands share maritime boundaries with Myanmar, Thailand and Indonesia. Usually poachers come from these countries to exploit the extensive wealth of sea resources especially of coral reef associated fauna such as shells, sea cucumber and fishes. The perceptible increase upto 1998 and a slow decline in incursion of poachers in these islands is shown in Tables 12 and 13.

Table 12. Total number of foreign vessels seized and foreigners apprehended by Andaman and Nicobar Administration from 1995- 2000.

Craft	1995	1996	1997	1998	1999	2000(up to May)
Boats	7	9	23	19	2	6
Dinghies	4	10	4	12	9	6
Total	**11**	**19**	**27**	**31**	**11**	**12**

(adapted from Rajan, 9ICRS Poster)

Table 13. Total number of poachers apprehended by Andaman Administration from various maritime countries around Andaman and Nicobar Islands from 1994 – 2000.

Nationality	1994	1995	1996	1997	1998	1999	2000
Myanmer	138	39	146	134	200	233	225
Thailand	38	12	7	10	60	-	10
Srilanka	-	9	18	25	32	15	-
Indonesia	18	8	3	42	6	-	4
China	55	-	-	-	-	-	-
Philippines	-	-	5	-	-	-	-
Taiwan	-	-	1	-	-	-	-
Total	**249**	**68**	**180**	**211**	**298**	**248**	**239**

(adapted from Rajan, 9ICRS, Poster)

Recent underwater studies on the Andaman Islands by the UNDP and Indian experts revealed that the coral reefs are globally significant in terms of species diversity. The reefs around the islands were more diverse than expected and less impacted than the other reefs in the Indian Ocean. The study also revealed that there was no evidence of mortality due to the 1998 bleaching event and no crown of thorn infestation in the reef of Andaman Islands. Further it is stated that the reefs around Andaman and Nicobar may prove to be an important stronghold of healthy coral within Indian Ocean and could provide a reliable source for natural seeding and rehabilitation of other impacted coral reefs within the region (Turner *et al.*, 2001).

LAKSHADWEEP

Population growth coupled with modernization of the society and popularity of the nuclear family has put great pressure on the limited land, freshwater, and lagoon reef resources in most of the Lakshadweep Islands. In Agatti Island alone the population has increased from 2000 (in 1949) to 7072 (in 2001). Coral boulders are the only material available for construction purposes. Boulders are collected both during monsoon and fair seasons. Boulder collection in Lakshadweep Islands appears to be indiscriminate and no part of the reef is considered sacred. A total of 197 loads of boulder were collected in the months of July – August in a single year. Each load is equal to approximately 500 kg. It is calculated that 98 t of boulder where collected during 2002 alone (Vineeta, 2002). Other than this boulder, sand and shingle collections are some of the other threats to the island as well as the coral reefs. Sivadas first noticed the crown of thorns starfish at Agatti Island in 1977, it is reported from all the islands and reefs. Black and white band diseases have also been observed in shallow coral areas and there are reports of pink band disease (Raghukumar and Raghukumar, 1991). Other than bleaching, the main causes for the loss of reef biodiversity are coral mining, dredging of navigational channels, unsustainable fishing practices, coastal development activities, souvenir collection and other population associated pressures (Koya and Muley, 2000). Routine monitoring of nutrients has not indicated any sewage or oil pollution in the reef lagoons.

Although the blasting of corals to create navigational channels has been stopped, the construction of breakwaters on some of the islands is a cause for concern with regard to coastal erosion related problems (Koya and Muley, 2000).

In recent times people have noticed a drop in fish catch within the reef lagoons, which could be due to the loss of live corals due to bleaching, or to increased harvesting due to population increase on the islands. The population in most islands has tripled during the last two decades (Koya and Muley, 2000). Methods of catching live bait for the tuna fishery causes damage to the reefs and the reduction of live bait for the tuna fishery has an adverse impact on the local economy since the tuna fishery is the mainstay of the local people.

GULF OF KACHCHH

The local population depends on the reef resources only for subsistence. There are six talukas in the Marine National Park, Jamnagar. There are 53 coastal villages having a total population of 1,67,636 individuals. The population density is 526 persons/sq km. Gulf of Kachchh Marine National Park is one of the richest fishing areas in the country. Fishes such as pomfrets, hilsa, goldhara, perches, sharks, catfish, tuna and crustaceans like prawns, shrimps, crabs and lobsters are plentiful. There are about 2000 mechanised and 350 traditional boats operating for this activity in the area. The local fishermen also use insecticides for fishing, which is posing a threat to the coral reef ecosystem in this area. The major impacts on the coral reef ecosystem come from industrial development, including cutting of mangroves, development of ports and offshore moorings and pollution from large cities. There are 21 salt industries working in an area of 24, 780 ha adjoining the Marine National Park area and produce a total of 2.9 million tones of salt. These industries release about 2,740 million liters of bittern annually, which cause a negative impact on marine life. A cement industry was mining on six islands of the Marine National Park till 1983 – 84 and this was stopped after a legal battle in the court. There are eleven intermediate/minor ports and jetties in the Marine National Park area. Expansion, improvement and dredging of these units are constant threat to the coral reef habitats. Sachana Ship Breaking Yard causes considerable damage to mangrove and coral reefs in neighbouring areas. Petroleum industries have very high stake. At present four SBMs handle crude oil and other two are under consideration. These six SBMs would import up to 80 million tonnes of crude oil annually in future. Minor spills have been observed in the area and some cases have been recorded, although many spills remain unrecorded. Petroleum industries and refineries are potential threat to the Marine National Park. Chemical industries, thermal power plants, tourism industry, mining of coastal area and discharge of sewage in the Gulf of Kachchh in Jamnagar increase pollution to a high level in the coral reef area. Cleaning of vessels in the Gulf is another environmental burden. According to Wafar *et al.* (2000) impacts from human activities have degraded the coral reef habitats and reduced the coral cover by less than 50% on most reefs in Gulf of Kachchh.

CONSERVATION

India has 36 marine protected areas of which 20 comprise exclusively in intertidal/subtidal or seawater-mangroves, coral reefs, lagoons, estuaries, beaches etc., and rest of the 13 include major parts of the marine ecosystem and some parts of terrestrial ecosystem (Table 14, 15 and 16). The list includes three Marine Biosphere Reserves. There are 5 Marine Protected Areas (MPAs) in India. They are Gulf of Mannar Biosphere Reserve-10,500 km^2 (includes Gulf of Mannar Marine National Park from Ramathapuram to Tuticorin, 1980, 6.23 km^2), Gulf of Kachchh Marine National Park – 400 km^2 (includes Marine Sanctuary, Gulf of Kachchh, 1980, 295 km^2), Mahatma Gandhi Marine National Park in Andamans – 282 km^2, Great Nicobar Biosphere Reserve – 885 km^2 and Rani Jhansi Marine National Park 256 km^2 (Richies Archipelogo). In Andaman and Nicobar Islands four MPAs are exclusively for coral reef conservation and Great Nicobar Biosphere Reserve is mainly to conserve the terrestrial region and has some areas around the island protected for marine region, which contains extensive coral reefs.

Table 14. Category-I. Marine Protected Areas (National Parks and Sanctuaries) *(MPAs having entire areas in intertidal/subtidal or sea water-mangroves, coral reefs, lagoons, estuaries, beaches etc.,)* (Singh, 2002)

Sl. No.	Name of the MPA (District) State/UT	Declaration	Area (sq km)	Ecosystem
1.	Mahathma Gandhi Marine NP, Wandoor (South Andaman) Andaman.	1983	281.50	Tropical evergreen forest, mangroves, Coral reefs, creeks and seawater.
2.	Rani Jhansi Marine NP (Ritchies1996 Archipelago) Andaman.	1996	256.14	Evergreen forest, mangroves and Coral reefs.
3.	Lahabarrack (Salt water crocodile) Sanctuary (South Andaman) Andaman.	1987	100.00	Dense mangroves (tidal forest), littoral forest, creeks, marine water and tropical evergreen forest.
4.	Gulf of Kachchh Marine NP (Jamnagar) Gujarat.	1982	162.89	Mangroves, coral reefs, mudflats, creeks, beaches and scrub forest.
5.	Marine Sanctuary Gulf of Kutchchh (Jamnagar) Gujarat.	1980	295.03	Mangroves, intertidal mudflats, beaches and coral reefs.
6.	Malvan Marine Sanctuary (Sindhudurg) Maharashtra.	1987	29.12	Inter tidal area, marine water, coral patches and sandy beach.
7.	Bhitar Kanika NP (Cuttak) Orissa.	1988	145.00	Estuary, delta and mangroves.
8.	Bhitar Kanika Sanctuary (Kendrapara) Orissa.	1975	672.00	Estuary, mangroces, terrestrial forest and ecotone with marine environment.
9.	Gahirmatha Marine sanctuary (Kendrapara) Orissa.	1997	1,435.00	Sea water, sandy beach, estuary mangroves and ecotone with marine environment.
10.	Chilka (Nalabund) WLS (Khundra, Puri, Ganjam) Orissa.	1987	15.50	Island, Lagoon and brackish water.
11.	Gulf of Mannar NP (Ramanathapuram /Tuticorin) Tamil Nadu.	1980	6.23	21 islands, coral reefs, mangroves, sea grass beds and beaches.

Sl. No.	Name of the MPA (District) State/UT	Declaration	Area (sq km)	Ecosystem
12.	Pulicat Lake (Bird) Sanctuary Tiruvellore, Tamil Nadu.	1980	153.67	Lake of brackish water of rain and seawater, mangrove and estuarine environment.
13.	Point Calimere Sanctuary (Nagapattinam), Tamil Nadu.	1967	17.26	Tidal swamp, mangroves, creek and evergreen forests.
14.	Coringa Wildlife Sanctuary (East Godavary), Andhra Pradesh.	1978	235.70	Mangroves, estuary, back water, creek and mud flats.
15.	Krishna Wildlife Sanctuary (Krishna/ Guntur), Andhra Pradesh.	1999	194.81	Mangroves, back water, creeks and mud flats.
16.	Pulicat Lake Bird Sanctuary (Nellore), Andhra Pradesh.	1976	500.00	Brackish water of rain and seawater, mangroves, estuarine and algal beds.
17.	Sundarbans National Park-Tiger Reserve (North and South 24-Pargana), West Bengal.	1973/ 1984	1,330.10	Mangroves, estuarine, creeks, swampy islands and mud flats.
18.	Halliday Sanctuary (South 24-Pargana) West Bengal.	1976	5.95	Mangroves, estuaries, swampy islands and mudflats.
19.	Lothian Island Sanctuary (South 24-Pargana) West Bengal.	1998	38.00	Mangroves, estuaries, creeks, swampy islands and mudflats.
20.	Sajnakhali Sanctuary (South 24-Pargana) West Bengal.	1976	362.4	Mangroves, estuaries, creeks, swampy islands and mudflats.

Table 15. Category-II. Marine Protected Areas *(MPAs in Andaman and Nicobar and Lakshdweep Islands, which have major parts in marine ecosystem and some part in terrestrial ecosystem).*

Sl. No.	Name of the MPA (District) State/UT	Year of Declaration	Area (sq km)	Ecosystem
1.	North Buttan NP (Middle Andaman), Andaman.	1987	0.44	Evergreen forest, littoral forest, mangroves, beach and coral reefs.
2.	South Buttan NP (Middle Andaman), Andaman.	1987	0.03	Evergreen forest, littoral forest, mangroves and beach.
3.	North Reef Island Sanctuary (North Andaman), Andaman.	1987	3.48	Evergreen forest, littoral forest, mangroves and beach.
4.	South Reef Island Sanctuary (Middle Andaman), Andaman.	1987	1.17	Beach and Coral reefs.
5.	Cuthbert Bay Sanctuary, (Middle Andaman), Andaman.	1987	5.82	Splendid beach and creek.
6.	Cinque Sanctuary (South Andaman), Andaman.	1987	9.51	Evergreen forest, coral reef and beach.
7.	Galathea Bay sanctuary, Great Nicobar.	1997	11.44	Evergreen forest and mangroves.

Sl. No.	Name of the MPA (District) State/UT	Year of Declaration	Area (sq km)	Ecosystem
8.	Parkinson Island Sanctuary, Middle Andaman.	1987	0.34	Evergreen and littoral forest and mangroves.
9.	Mangrove Island Sanctuary, Middle Andaman.	1987	0.39	Mangroves and marine life.
10.	Blister Island Sanctuary, North Andaman.	1987	0.26	Mangroves and beach.
11.	Sandy Island Sanctuary, South Andaman.	1987	1.58	Sandy islands.
12.	Pitti wildlife Sanctuary, Lakshadweep.	2000	0.01	A small sandy island surrounded by sea.

Table 16. Biosphere Reserves in Marine Areas of India (* coral reefs are present).

Name	State	Year of notification	Area (sq km)
Sundarbans.	West Bengal	1989	9630
Gulf of Mannar*.	Tamil Nadu	1989	10500
Great Nicobar*.	Andaman and Nicobar	1989	885

Wildlife Protection Act 1972 provides protection for protected areas and certain marine species. Corals are also protected under this act. The Federal government *Coastal Regulation Zone Notification 1991* regulates onshore development activities, which affect coastal environments, and strictly prohibits the collection and trade of corals. Coral reef conservation is also included in the *Environmental Protection Act* (1986), *the National Conservation Strategy and Policy Statement on Environmental Development (1992)* and the Action Plan of the Ministry of Environment and Forests. The conservation and management of coral reef resources is within the mandate of the Ministry of Environment and Forests, the focal point for the Indian Coral Reef Monitoring Network (ICRMN) and the National focal point of International Coral Reef Initiative (ICRI).

India had no coral reef monitoring prior to 1998 due to a major lack of equipments and trained scuba divers. Since then Coral Reef Monitoring Action Plans (CRMAPs) have been prepared for all four major coral reef areas and programs are in progress to train people and to monitor the reefs. The government of India has laws to protect coral reefs and other coastal environments and prohibits the collection of corals. To effect this all the scleractinian corals and gorgonids are included in the Schedule list of *Wild Life Act* 1972 from July 2001. To protect the coral reef associated organisms such as the sponges, molluscs, sharks and skates, these are banned from collecting and is a punishable offence under the wild life act 1972. It is only since the late 90s, with the formation of the Indian Coral Reef Monitoring Network (ICRMN) that there is a cross-sectoral approach to improve coral reef management. Under this banner, the Government of India, Ministry of Environment and Forest has funded monitoring training programmes in all the four major coral reef areas and for conservation and management programmes to the state government where the coral reef areas are situated.

Coral reefs in India are under increasing pressure. In many cases, the sources of stress due to human pressure are known. However, the etiology of a growing number of diseases and pathologies now being reported in corals is not widely understood, highlighting the need for more research to unravel the complex interactive effects between natural and anthropogenic forms of stress and their effects on coral reefs. The inability of scientists to predict with any certainty where the critical thresholds of resilience to stress lie along

the continuum of human-induced and natural disturbances, make it inherently difficult to manage sustainable reefs. Solutions to these conservation and management problems will have to incorporate effective science, robust economic analysis and sound policies and laws. Participatory actions grounded in the cultural and social reality of local people who depend on and benefit directly from coral reefs must be part of the solution. Creating political will, through communication and environmental education, will be essential in mobilising and sustaining conservation efforts.

Studies such as qualitative and quantitative estimation of biodiversity, percentage cover of live and dead coral estimation by standard methods, estimation of standing crops of reef resources, their recruitment, growth, mortality, standing stock, and level of exploitation, to suggest norms for judicious exploitation. These aspects need intense and long-term study in the coral reefs of India. In general, the percentage cover of live coral estimation is not the only criteria for the health of reefs but also the ratio of dead and live coverage.

Presence or absence of indicator species may be an index of environmental stress or pressure on reefs. The taxonomically extended surveys on sessile organisms such as sponges, alcyonarians, crustaceans, mollusks, echinoderms, fishes and polychaetes can give clue to the state of art of environmental conditions. Assessment of heterotrophic macro invertebrates such as sponges, barnacles, hydroides, tunicates, echinoderms etc. may yield clues to stress conditions due to pollution. Such studies are very important for management of coral reefs.

We cannot control nature, but with adequate and accurate data, can make decisions, which control the impacts of human activities on coral reef communities.

HELP THE CONSERVATION OF CORAL REEFS IN THE MARINE PROTECTED AREA

FOR PUBLIC

- Do not disturb other tourists using the Marine National Park.
- Don't involve in any activity, which creates threat to the environment.
- Enjoy the beauty of animals in Marine National Park and learn more about them and how to protect them with least disturbance.

FOR STUDENTS AND SCIENTISTS

Understanding how the marine ecosystem works and the effect of human interactions with the environment is fundamental to the successful management of the Marine National Park. Data collected on the inventory, status, impact and other effects of fauna and flora will be very important for management. Research activities, do however, have the potential to have a significant impact on the environment. Please help to ensure the effects of research activities are minimised.

- Necessary permission can be obtained from the Chief wildlife warden/Wildlife warden of the respective Forest Department to conduct a research program in the Marine National Park.

Gulf of Mannar
Chief wildlife warden
Panagal Building
Saidapet
Chennai 600 015

Andaman and Nicobar Islands
Chief wildlife warden
Haddo Post
Port Blair 744 102
Andaman

Gulf of Kachchh
Chief wildlife warden
Block 14, Old Sachivalai
Dr Jivaraj Mehta Bhavan
Gandhi Nagar, 382 009
Gujarat

Lakshdweep
To the Secretary
Administration
U.T. of Lakshadweep
Kavaratti 682555

- Ensure research program in the Marine National Park area is having minimal impact on the physical environment and the visual aesthetics of frequently visited areas.
- Understand the effect of research on the animals being researched and do not harm/disturb animals at all times.
- The research programme should not affect others in the National Park area.
- Explain the purpose of the research program to interested reef users and where ever appropriate provide opportunity for community involvement.
- Provide updates on the progress of the study and feedback of research results to Wildlife Department/Forest Department and Ministry of Environment and Forests, New Delhi.

DISPOSAL OF WASTE MATERIALS

Increasing nutrients in reef waters and marine pollution pose major threats to the Marine Protected Area. Ministry of Environment is actively encouraging the adoption of standards similar to that followed in mainland.

- The disposal of garbage (including plastics, fishing nets and lines) and oil products within the Marine Park is totally prohibited.
- Sewage may not be discharged, from vessels with a holding tank, less than 500 m from the edge of the nearest reef.
- Visitors should not abuse the reefs or in enclosed bays especially through defaecation.
- Use biodegradable toilet paper and phosphate-free cleaning products and make sure they don't end up in the water. No Plastic material should be used in the Park area.
- All litters should be brought back to mainland and disposed of at a suitable waste disposal site.

ANCHORING

Anchors and chains wreck fragile coral environments. Frequent anchoring at popular sites can destroy the coral reefs in that area. Familiarity of the anchoring area is necessary to avoid damage to the corals. Anchor with care.

- Carry enough chain or chain and line for the depth.
- Check out the area before anchoring.
- Anchor in sand or mud away from corals.
- Motor towards the anchor when hauling in.

BOATING

Being alert and careful while boating in the Marine Park area can minimise accidents to marine organisms and tourists, and reduce the risks of damaging shorelines.

- To avoid collisions with large marine creatures, stay alert for the following species at these times of the year :
  - o Dugongs are mostly found in shallow inshore areas where the sea grass are plenty.
  - o Turtles are mostly found along the Indian coast, and particularly during October to March.
- Take care when approaching shorelines, beaches and reef edges. Proceed slowly, and carefully choose where to come ashore or leave your vessel.
- Take care when transferring fuel. Refuel on land to minimise the risk of fuel and oil spillages.

DIVING AND SNORKELING

Scuba diving and snorkeling are the most popular ways to experience the unique and beautiful underwater world of the Marine National Parks. Results from recent studies on the impact of diving activities on the reef, indicate that the majority of divers cause little detectable damage to corals. Where damage to coral was detected in studies, it was most commonly in the form of fin damage, suggesting buoyancy control is a critical factor in minimizing the impacts of divers on corals. Help to keep the impacts of diving to a minimum.

All divers and snorkelers should be aware that it is an offence to damage or remove coral in the Marine Park.

- Check your weight correctly before diving and practice buoyancy control away from coral.
- Beginner's, practice snorkeling techniques away from coral, and dive over sand until you have mastered buoyancy control.
- Secure dragging diving equipment such as gauges.
- Do not rest or stand on coral. Take extra care when taking underwater photographs.
- Avoid touching anything with your fins and try not to disturb sediment or coral.
- Observe animals rather than handle them. Handling some animals may be dangerous.
- Do not chase or attempt to ride or grab free-swimming animals and avoid blocking their path.
- Do not prod any plants or animals.
- Do not pick up anything under water- Live or dead, always return it to exactly the same position.
- Learn about the underwater environment.

VISITING ISLANDS

Islands within the National Park Area are a popular destination for tourists and locals alike. Please help to ensure that the natural setting that people come to enjoy is not degraded by human activities.

- Before visiting islands, check for special requirements and obtain national park camping permits from the Wildlife warden.
- Remove plants/seeds from your clothing or shoes before landing and before departure.
- Take any litter or rubbish back to the mainland.
- Take note of the following Instructions when washing :
  - ☞ Do not use detergents, toothpaste or soap in creeks, streams or closed waterways.
  - ☞ Wash at least 50 m away from water courses and use only biodegradable products;
  - ☞ Use sand as a scourer to remove waste when cleaning dishes.
- Use gas stoves for cooking. Campfires are not permitted on most islands.
- Always use toilets where provided. Where there are no toilets, use a spot at least 100 m from campsites and watercourses and bury all faecal matters at least 15 m depth.

- Do not disturb vegetation or break off branches from trees and shrubs.
- Do not disturb nesting seabirds or turtles. Avoid making loud noises, using strong lights, or making sudden movements near their nests.
- Do not take animals or plants to islands or feed the active animals.
- Do not write or place graffiti anywhere.
- Do not use generators or compressors unless you have permission from the Wildlife warden. Do not play amplified music on island national parks.
- Learn about the natural and cultural values of the island you are visiting.

REEF WALKING

Reef walking is a popular way of exploring the intertidal area or reef flat, especially for those who cannot swim. However, reef walking needs to be conducted carefully to avoid serious damage to the environment.

All reef walkers should be aware that it is a legal Offence in the Marine National Park to damage or remove coral,

- Be careful not to step on coral or living matter.
- Avoid straying.
- If there is no marked trail, locate regularly used routes or follow sand channels.
- Use a pole or a stick for balance, not to poke animals.
- If you pick up anything, live or dead, always return it to the exact position where you found it.
- Do not pick up species, which are attached to the reef flat.
- Be aware of restrictions on collecting in the Marine National Park.

YOU CAN HELP TO MANAGE THE MARINE NATIONAL PARKS BY REPORTING ANY OF THE FOLLOWING ACTIVITIES OR INCIDENTS

- Any suspected breaches in land including illegal fishing, sand collection may be reported to the nearest Forest office, (Chief Wildlife Warden of that area).
- Oil spills or any form of marine pollution.
- Marine mammal sightings or stranding.
- Crown-of-thorns starfish sightings.
- Natural history observations such as fish spawning, coral bleaching or algal blooms.

APPENDIX 1

List of coral species identified during underwater field mission conducted in Andaman Islands during 2001 (Turner *et al.*, 2001)

Family ASTROCOENIIDAE

1. **Stylocoeniella armata* (Ehrenberg, 1834)
2. *Stylocoeniella guentheri* Bassett-Smith, 1890

Family POCILLOPORIDAE

3. *Pocillopora damicornis* (Linnaeus, 1758)
4. *Pocillopora eydouxi* Milne Edwards & Haime, 1860
5. **Pocillopora meandrina* Dana, 1846
6. *Pocillopora verrucosa* (Ellis & Solander, 1786)
7. **Seriatopora caliendrum* Ehrenberg, 1834
8. *Seriatopora hystrix* Dana, 1846
9. *Stylophora pistillata*

Family ACROPORIDAE

10. *Acropora aspera*
11. **Acropora sp. 1 "brown digitate"*
12. *Acropora austera* (Dana, 1846)
13. *Acropora brueggemanni* (Brook, 1893)
14. *Acropora carduus* (Dana, 1846)
15. **Acropora cerealis* (Dana, 1846)
16. **Acropora chesterfieldensis*
17. *Acropora clathrata* (Brook, 1891)
18. **Acropora cophodactyla* (Brook, 1842)
19. *Acropora cytherea* (Dana, 1846)
20. **Acropora sp. 1 "danai-like"*
21. *Acorpora digitifera* (Dana, 1846)
22. *Acropora divaricata* (Dana, 1846)
23. *Acropora echinata* (Dana, 1846)
24. **Acropora efflorescens*
25. *Acropora florida* (Dana, 1846)
26. *Acropora formosa* (Dana, 1846)
27. *Acropora gemmifera* (Brook, 1892)
28. **Acropora globiceps* (Dana, 1846)(?)
29. *Acropora grandis* (Brook, 1892)
30. *Acropora granulosa* (Milne Edwards & Haime, 1860)
31. **Acropora hemprichii*
32. *Acropora humilis* (Dana, 1846)
33. *Acropora hyacinthus* (Dana, 1846)
34. **Acropora kosurini* Wallace
35. **Acropora loisettae?* Wallace, 1994
36. *Acropora longicyathus* (Milne Edwards & Haime, 1860)
37. **Acropora loripes* (Brook, 1892)
38. **Acropora lutkeni* Crossland, 1952(?)
39. *Acropora monticulosa* (Bruggemann, 1879)
40. *Acropora nasuta* (Dana, 1846)
41. *Acropora nobilis* (Dana, 1846)
42. *Acropora palifera* (Lamarck, 1816)
43. *Acropora palmerae*
44. **Acropora paniculata* Verrill, 1902
45. *Acropora proximalis*
46. *Acropora pulchra* (Brook, 1891)
47. *Acropora robusta* (Dana, 1846)
48. **Acropora rudis*
49. *Acropora samoensis* Brook, 1891)
50. **Acropora selago* (Studer, 1878)
51. **cropora solitaryensis* Veron & Wallace, 1984
52. **Acropora spicifera* as in Wallace 1999
53. *Acropora tenuis* (Dana, 1846)
54. **Acropora valenciennesi* (Milne Edwards & Haime, 1860)
55. **Acropora vaughani* Wells, 1954
56. **Astreopora gracilis* Bernard, 1896
57. *Astreopora listeri* Bernard, 1896
58. *Astreopora myriophthalma* (Lamarck, 1816)
59. **Astreopora randalli* Lamberts, 1980
60. **Astreopora suggesta* Wells, 1954
61. *Montipora aequituberculata* Bernard, 1897
62. **Montipora caliculata* (Dana, 1846)
63. **Montipora capitata* Dana, 1846
64. *Montipora digitata*
65. **Montipora foveolata* (Dana, 1846)
66. **Montipora meandrina*
67. **Montipora tuberculosa* Lamarck, 1816)
68. *Montipora turgescens*
69. *Montipora venosa* (Ehrenberg, 1834)
70. *Montipora verrucosa* (Lamarck, 1816)
71. **Montipora vietnamensis* Veron, 2000 (or *M. porites* ?)

Family PORITIDAE

72. **Porites annae* Crossland, 1952
73. **Porites cylindrica* Dana, 1846
74. **Porites evermanni* Vaughan, 1907
75. **Porites monticulosa* Dana, 1846
76. *Porites rus* (Forskal, 1775)
77. **Porites vaughani* Crossland, 1952

Family SIDERASTERIDAE

78. **Coscinaraea columna* (Dana, 1846)
79. **Coscinaraea crassa*
80. *Psammocora contigua* (Esper, 1797)

81. *Psammocora digitata* Milne Edwards & Haime, 1851
82. **Psammocora explanulata* van der Horst, 1922
83. *Psammocora haimeana* Milne Edwards & Haime, 1851
84. *Psammocora profundacella* Gardiner, 1898
85. **Psammocora superficialis* Gardiner, 1898

Family AGARICIIDAE

86. *Coeloseris mayeri* Vaughan, 1918
87. *Gardineroseris planulata* Dana, 1846
88. **Leptoseris explanata* Yabe & Sugiyama, 1941
89. *Leptoseris hawaiiensis* Vaughan, 1907
90. **Leptoseris incrustans*
91. **Leptoseris mycetoseroides* Wells, 1954
92. **Leptoseris scabra* Vaughan, 1907
93. **Leptoseris yabei* (Pillai & Scheer, 1976)
94. **Pachyseris gemmae* Nemenzo, 1955
95. *Pachyseris rugosa* (Lamarck, 1801)
96. *Pachyseris speciosa* (Dana, 1846)
97. **Pavona bipartita* Nemenzo, 1980
98. *Pavona cactus* (Forskal, 1775)
99. *Pavona clavus* (Dana, 1846)
100. *Pavona decussata* (Dana, 1846)
101. **Pavona duerdeni* Vaughan, 1907
102. **Pavona sp "duerdeni-like"*
103. *Pavona explanulata* (Lamarck, 1816)
104. *Pavona maldivensis*
105. *Pavona varians* Verrill, 1864
106. *Pavona venosa* (Ehrenberg, 1834)

Family FUNGIIDAE

107. *Ctenactis crassa* (Dana, 1846)
108. *Ctenactis echinata* (Pallas, 1766)
109. **Fungia concinna* Verrill, 1864
110. *Fungia fungites* (Linneaus, 1758)
111. **Fungia granulosa* Klunzinger, 1879
112. *Fungia horrida* Dana, 1846
113. **Fungia klunzingeri* Doderlein, 1901
114. **Fungia moluccensis* Horst, 1919
115. **Fungia paumotensis* Stutchbury, 1833
116. *Fungia repanda* Dana, 1846
117. *Fungia scutaria* Lamarck, 1816
118. *Herpolitha limax* (Houttuyn, 1772)
119. *Lithophyllon undulatum*
120. **Podabacia lanakensis*? Veron, 2000
121. *Polyphyllia talpina* Lamarck, 1801
122. **Sandalolitha dentata* Quelch, 1884

Family OCULINIDAE

123. **Galaxea acrhelia*
124. *Galaxea astreata* (Lamarck,. 1816)
125. *Galaxea fascicularis* (Linnaeus, 1767)

Family PECTINIDAE

126. *Echinophyllia aspera* (Ellis & Solander, 1788)
127. **Echinophyllia echinata* (Saville-Kent, 1871)
128. **Echinophyllia echinoporoides* Veron & Pichon, 1979
129. *Mycedium elephantotus* (Pallas, 1766)
130. **Oxypora crassispinosa* Nemenzo, 1979
131. *Oxypora lacera* Verrill, 1864
132. **Pectinia alcicornis*
133. **Pectinia paeonia* (Dana, 1846)

Family MUSSIDAE

134. *Acanthastrea echinata* (Dana, 1846)
135. **Acanthastrea hemprichii* (Ehrenberg, 1834)
136. **Acanthastrea ishigakiensis* Veron, 1990
137. **Australomussa rowleyensis* Veron, 1985
138. *Cynarina lacrymalis* (Milne Edwards & Haime, 1848)
139. *Lobophyllia hemprichii* (Ehrenberg, 1834)
140. *Symphyllia agaricia* Milne Edwards & Haime, 1849
141. *Symphyllia radians* Milne Edwards & Haime, 1849
142. *Symphyllia recta* (Dana, 1846)

Family MERULINIDAE

143. *Hydnophora exesa* (Pallas, 1766)
144. **Hydnophora grandis Gardiner, 1904*
145. *Hydnophora microconos (Lamarck, 1816)*
146. **Hydnophora pilosa* (Veron, 1985)
147. *Hydnophora rigida* (Dana, 1846)
148. *Merulina ampliata* (Ellis & Solander, 1786)
149. **Merulina scabricula* Dana, 1846
150. *Scapophyllia cylindrica* Milne Edwards & Haime, 1848

Family FAVIIDAE

151. *Diploastrea heliopora* (Lamarck, 1816)
152. **Echinopora gemmacea* Lamarck, 1816
153. **Echinopora hirsuitissima* Milne Edwards & Haime, 1849
154. *Favia pallida* (Dana, 1846)
155. **Favia rotundata* Veron & Pichon, 1977
156. *Favia stelligera* (Dana, 1846)
157. **Favia truncatus* Veron, 2000
158. *Favites abdita* (Ellis & Solander, 1786)
159. **Favites acuticollis*
160. *Favites halicora* (Ehrenberg, 1834)

161. *Favites pentagona* (Esper, 1794)
162. **Goniastrea edwardsi* Chevalier, 1971
163. **Goniastrea minuta*
164. *Goniastrea pectinata* (Ehrenberg, 1834)
165. *Goniastrea retiformis* (Lamarck, 1816)
166. *Leptastrea purpurea* (Dana, 1846)
167. *Leptastrea transversa* Klunzinger, 1879
168. *Leptoria phrygia* (Ellis & Solander)
169. **Montastrea colemani*
170. **Montastrea curta* (Dana, 1846)
171. *Oulastrea crispata* (Lamarck, 1816)
172. **Oulophyllia laevis*
173. **Platygyra acuta* Veron, 2000
174. *Platygyra daedalea* (Ellis & Solander, 1786)
175. **Platygyra sp "green"*
176. *Platygyra lamellina* (Ehrenberg, 1834)
177. **Platygyra verweyi* Wijsman-Best, 1976
178. *Plesiastrea versipora* (Lamarck, 1816)

Family EUPHYLLIDAE

179. **Euphyllia ancora* Veron & Pichon, 1979
180. **Euphyllia divisa* Veron & Pichon, 1979
181. *Euphyllia glabrescens* (Chamisso & Eysenhardt, 1821)
182. **Euphyllia yaeyamaenisis* (Shirai, 1980)
183. *Physogyra lichtensteini* Milne Edwards & Haime, 1786
184. *Plerogyra sinuosa* (Dana, 1846)

Family DENDROPHYLLIIDAE

185. *Tubastraea coccinea* Lesson, 1829
186. **Tubastraea diaphana*
187. *Tubastraea micranthus* Ehrenberg, 1834
188. *Turbinaria mesenterina* (Lamarck, 1816)
189. **Turbinaria stellulata* (Lamarck, 1816)

Family HELIPORIDAE

190. **Heliopora* sp 1 "short"

Family CLAVULARIIDAE

191. *Tubipora musica* Linnaeus, 1758

Family MILLEPORIDAE

192. **Millepora dichotoma*
193. **Millepora exaesa*
194. **Millepora intricata*
195. **Millepora murrayensis*
196. **Millepora platyphylla*

Family STYLASTERIDAE

197. **Stylaster* sp. 1 orange or pink
198. **Distichopora violacea* (Ellis & Solander, 1788)

*** = new records during the underwater survey.**

APPENDIX 2

The National Zoological Collection of Corals identified by Dr. Carden Wallace and Jacqueline Wolstenholme at Museum of Tropical Queensland, Australia during the India Australia Training and Capacity Buiiiding Programme : Coral Taxonomy Training at Museum of Tropical Queensland, Townsville during 2001-2002.

ZSI Reg. No.	Species Identified
2	*Pocillopora damicornis*
84	*Montipora verrucosa*
85	*Montipora efflorescens*
86	*Montipora peltiformis*
87	*Montipora angulata*
88	*Porites monticulosa*
89	*Montipora aequituberculata*
90	*Montipora tortuosa*
92	*Montipora aequituberculata*
94	*Montipora aequituberculata*
95	*Montipora aequituberculata*
96	*Montipora spumosa*
97	*Pavona venosa*
98	*Pavona duerdeni*
99	*Pavona minuta*
100	*Pavona varians*
106	*Psammocora digitata*
108	*Siderastrea savignyana*
124	*Porites lutea*
128	*Porites vaughani*
130	*Porites lobata*
131	*Porites lichen*
135	*Goniopora sp.*
136	*Goniopora tenuidens*
137	*Goniopora sp*
138	*Porites lobata*
140	*Goniopora minor*
161	*Leptastrea transversa*
162	*Leptastrea transversa*
165	*Goniastrea edwardsi*
166	*Goniastrea pectinata*
169	*Platygyra sinensis*
170	*Platygyra ryukyensis?*
172	*Platygyra lamellina*
173	*Platygyra daedalea*
181	*Cyphastrea microphthalma*
182	*Echinopora gemmaceae*
Photo	*Acropora robusta*
Photo	*Acropora monticulosa*
Photo	*Acropora papillare*
Photo	*Acropora anthocercis*
Photo	*Acropora millepora*
Photo	*Acropora florida*
Photo	*Acropora grandis ?*
Photo	*Acropora cerealis ?*
Photo	*Acropora intermedia*
Photo	*Acropora palifera*
Photo	*Acropora aspera*
Photo	*Acropora hyacinthus*
Photo	*Acropora longicyathus*
Photo	*Acropora cytherea*
Photo	*Acropora lutkeni*
Photo	*Acropora muricata*
Photo	*Acropora vaughani*
Photo	*Acropora valida*
Photo	*Acropora glauca ?*
Photo	*Acropora spicifera*
Photo	*Acropora nasuta*

APPENDIX 3

Common Names of Corals

Antler coral : *Pocillopora eydouxi*
Birds nest coral : *Seriatopora*
Bladder coral : *Plerogyra sinuosa*
Blue coral : *Heliopora coerulea*
Blue tip coral : *Acropora loripes*
Boulder coral : *Porites*
Boulder star coral : *Montastrea annularis*
Boul coral : *Turbinaria peltata*
Brain coral : *Symphyllia, Platygyra, Leptoria*
Brush coral : *Seriatopora*
Bubble coral : *Physogyra, Plerogyra*
Bush coral : *Stylophora*
Cactus coral : *Pavona decussata*
Cabbage coral : *Merulina*
Carnation coral : *Pectinia*
Castle coral : *Pachyseris rugosa*
Cauliflower coral : *Pocillopora damicornis*
Chalice coral : *Oxypora*
Club finger coral : *Stylophora*
Cluster coral : *Stylophora pistillata*
Corduroy coral : *Pachyseris*
Crater coral : *Trachyphyllia geoffroyi*
Crystal coral : *Turbinaria*
Daisy coral : *Alveopora, Goniopora*
Dome coral : *Halomitra pileus*
Elephant skin coral : *Pachyseris*
Elephant nose coral : *Mycedium*
Elkhorn coral : *Acropora palmata*
Fire coral : *Millepora*
Flowerport coral : *Alveopora, Goniopora*
Folded coral : *Trachyphyllia geoffroyi*
Frilly lettuce coral : *Pectinia lactuca*
Galaxy coral : *Galaxea*
Helmet coral : *Halomitra pileus*
Hibiscus coral : *Pectinia*
Horn coral : *Hydnophora*
Knob coral : *Cyphastrea*
Leaf coral : *Pavona cactus*
Lettuce coral : *Pectinia, Agaricia*
Maze coral : *Platygyra, Leptoria*
Mole coral : *Herpolitha, Polyphyllia*
Moon coral : *Favia, Astreopora*
Mushroom coral : *Fungia*
Needle coral : *Seriatopora hystrix*
Neptune's cup coral : *Halomitra pileus*
Organ pipe coral : *Tubipora musica*
Pacific rose coral : *Cynarina lacrymalis*
Pagoda coral : *Turbinaria mesenterina*
Palm lettuce coral : *Pectinia paeonia*
Pearl bubble coral : *Physogyra lichtensteini*
Phonograph coral : *Pachyseris speciosa*
Pinnapple coral : *Favites*
Pore coral : *Porites*
Potato chip coral : *Pavona*
Puffed coral : *Trachyphyllia geoffroyi*
Ruffled coral : *Merulina ampliata*
Scroll coral : *Turbinaria*
Sea mole coral : *Polyphyllia talpina*
Slipper coral : *Polyphyllia talpina*
Small bubble coral : *Physogrya lichtensteini*
Staghorn coral : *Acropora*
Starburst coral : *Galaxea*
Starlet coral : *Siderastrea*
Star column coral : *Pavona clavus*
Sun coral : *Tubastrea*
Table coral : *Acropora*
Thorn coral : *Stylocoeniella*
Tongue coral : *Herpolitha limax*
Tooth coral : *Galaxea, Lobophyllia*
Turban coral : *Turbinaria*
Vase coral : *Turbinaria*
Velvet coral : *Monitpora*
Velvet branch coral : *Montipora*
Yellow scroll coral : *Turbinaria reniformis*
Zebra coral : *Oulastrea crispata*

EXPLANATION OF TERMS USED IN THE IDENTIFICATION OF CORAL SPECIES

Anastomose : Fusion by growth of branches etc.

Appressed : Corallite closely connected to coenosteum.

Arborescent : Colony composed of elongate, tree-like branches.

Axial corallite : Corallite at the tip of a branch, which runs through the branch axis, characteristic of *Acropora*.

Bifacial : Corallites occur on both sides of a plate or folia.

Bleaching : When corals are severally stressed they become white.

Branching colonies : Any growth form where branches are formed.

Budding : Coral polyp splits in two and produces two new "daughter" polyps.

Caespitose : Growing as a clump or compact bush.

Calice : The inside area of the corallite, not including the walls.

Cerioid : Adjacent corallites share the same wall.

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

Colony : Corals are made up of numerous individual coral polyps which are inter connected to form a colony.

Colline : A ridge.

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

Continuous septa : The septa in one corallite meet the septa in an adjacent corallite along the same axis.

Coralline algae : Algae that form solid calcium carbonate accretions.

Corallum (plural-coralla) : Coral skeleton.

Corallite : Individual cup in the skeleton, which holds a polyp.

Corymbose : Forming a thick table-shaped colony supported by a central or marginal stalk. costae. Thin skeletal ridges on the coenosteum, that are continuations of septa and septocostae.

Costae : Radial skeletal elements outside the corallite wall.

Cycles of septa/septo-costae : Where radial elements occur in a set sequence of size.

Dendroid : Branching like a tree.

Denticles : Small teeth.

Dichotomous : In two parts.

Digitate : A colony with short branches shaped like the upturned fingers of a hand.

Dimidiate : Shape of radial corallites that resembles a scoop.

Dissepiment : Horizontal sheet of skeleton that forms the floor of the corallite, echinate, spiny.

Encrusting : Growth form of a coral in which the animal forms a thin layer or crust over rocks.

Endemic : A species restricted to a specific region.

Epitheca : The unattached area on the underside of a corallum, only found on corals that do not have living undersurfaces.

Exotheca : Entire inner surface of the coral outside the corallite.

Extant : Now living.

Extinct : No longer living.

Explanate : Plate growth form.

Exsert : Protrude above the surface.

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.

Fenestrate : Having small openings.

Flabello-meandroid corals : Corals, which have valleys with walls that are separate from the walls of adjacent valleys.

Foliaceous : Formed of leaves or folia.

Fossa : Depression formed where septa do not reach the corallite centre; if present, the columella is at the centre of the fossa.

Foveolate corallites : Corallites of some species of *Montipora*, which are situated at the base of funnel shaped depressions.

Freeliving coral : Corals that are not attached to the substrate.

Genus : Taxonomic ranking comprising a groups of related species exhibiting unusual characters.

Granulate : Covered with tiny protruding granules of skeleton, usually the ends of trabeculae.

Growth form : Overall shape of the entire coral skeleton.

Hermaphrodite : Possessing both male and female reproductive organs.

Hermatypic : Marine invertebrates that have photosynthetic plants living symbiotically within their tissues.

Holotype : The principal specimen on which a species name is based.

Hydnophores : small mounds that cover the surface of *Hydnophora* and carry septa.

Intratentacular budding : Method of polyp reproduction in which a new polyp originates inside the ring of tentacles of another polyp, which results in one polyp dividing into two or more polyps.

Isopora : Group of four of the *Acropora* corals, which have more than one axial corallite.

Labellate : Shaped like a lip.

Larva : Young stage which looks quiet different to the adult stage.

Lamellar : Flat, plate-like.

Margin : Edge.

Meandroid : Corallite arrangement in which corallites form a series to create valleys or meanders.

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.

Mesoglea : An initially non-cellular layer between the ectodermis and gastrodermis.

Morphotype : A different form of a polymorphic species.

Mural : on the wall.

Nariform : Shape of a radial corallites that resemble an inverted nose.

Nematocysts : Microscopic stinging cells occurring individually in the ectodermis or grouped into wart like clumps on tentacles.

Nominal species : Species that exist in name only.

Oral disc : The soft tissue between the mouth and the surrounding tentacles.

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 : Projection of coenosteum on the surface of many species of *Montipora* that are less than a corallite in width.

Perforate : Having many holes.

Peritheca : Area outside the corallite, also called coenosteum and exotheca.

Phaceloid corals : Corals that have corllites of uniform height adjoined towards their base.

Phylum : The taxon level representing a group of related families.

Planktonic : Microscopic animals and plants, which live suspended in the water.

Planula : The larval, swimming stage of corals.

Platform reefs : General term for reefs which are not clearly derived from sea level change or the proximity of land.

Plocoid : Each corallite has its own separate wall.

Polymorphic : Species having more than one growth form or shape.

Polyp : Small, tube shaped animal with a ring of tentacles.

Pourtales plan : Distinctive arrangement of septa found in some corals.

Proximal : Towards the columella.

Radial corallites : Corallites on the sides of branches of *Acropora*.

Ramose : Colony composed of branches.

Reefs : Limestone flatforms of shallow tropical seas built by corals, coralline algae and other photosynthetic organisms or symbionts.

Reef-Building corals : Zooxanthellate or hermatypic corals.

Reef-flat : The flat intertidal parts of reef that are exposed to wave action.

Reef-slope : The sloping parts of reefs below the reef flat.

Reptoid : Creeping, corallites attached to each other by a thin sheet at corallite bases.

Reticulate : Net-like pattern.

Rudists : A large group of Mesozoic bivalves that dominated reefs throughout much of the cretaceous and which became extinct at the close of the cretaceous.

Scleractinia : Belonging to the Order Scleractinia, commonly known as hard corals.

Septocostae : Ridges on the outside of the corallite walls that are continuations of the septa; they are called costae after they reach the end of the wall and continue out onto the coenosteum.

Septum (plural septa) : the blade-shaped skeletal element that radiates from the corallite center.

Solitary corals : Corals composed of single individuals. There may be clear distinction between single individuals with may mouths and colonies with individuals which have single mouths.

Spat : Pinhead sized single corallites that form immediately after metamorphosis of planula larvae.

Spawning : The release of gametes into the water column.

Species : Comprises all the individual animals that look alike and are capable of interbreeding with one another.

Spongy : Tightly reticulate.

Spinule : Small spines that occur between the corallites of a coral skeleton.

Staghorn corals : Common name for arborescent *Acropora.*

Striated : Ridged.

Stromatoporoids : Sponge like organisms that were major builders of Paleozoic reefs.

Styliform : A single needle.

Symbiosis : The close association between two organisms where there is substantial mutual benefit.

Synapticulae : Skeletal rods that join adjacent septa; orientated parallel to the wall, and may form inner rings.

Synonymy : A list of names considered by a taxonomist to apply to a given taxon other than name by which the taxon should be known.

Systematics : Study of the genetic relationship between taxa.

Tabulate corals : A major group of non-scleractinian corals that became extinct at the close of the Paleozoic era.

Taxon : A taxonomic unit

Taxonomy : The process of recognizing, describing and ordering species.

Tentacle : Projection around the mouth of a coral polyp.

Thamnasteroid : a corallite arrangement characteristic of the Family Thamnasteriidae in which there are no walls between corallites; septa and septocostae flow uninterrupted between corallites.

Trabeculae : radiating skeletal fibres that grow together to form septa and other skeletal elements; the endpoints are visible as granulations.

Tubular : Simplest type of corallite shape.

Unifacial : Describes plates, which have corallites on one side only.

Vesiculate : covered with thin bubble-like structures.

Zooxanthellae : Photosynthetic algae that can occur symbiotically in animal tissue.

SUGGESTED READINGS

Alfred, J. R. B., Das, A.K. and Sanyal, A.K. 1998. Faunal Diversity in India. 499 pp.

Hodson, G. and Carpenter, K. 1995. Scleractinian corals of Kuwait. Pacific Sci. **49 (3)** : 246 pp.

Hoeksema, B. W. 1989. Systematics and ecology of mushroom corals (Scleractinia:Fungiidae). *Zool Verhandelingen* **254** : 471 pp.

Pillai, C. S. G. 1973. A review of the genus *Anacropora* Ridley, (Scleractinia, Acroporidae) with the description of a new species. *J. mar. biol. Assoc. India* **15** : 296-301.

Pillai, C. S. G. and Scheer, G. 1976. Report on the stony corals from the Maldive Archipelago. *Zoologica (Stuttgart)* **43** : 83 pp.

Pillai. C. S. G. 1996. Coral reefs of India, their Conservation and Management. *In* : Marine Biodiversity conservation and Management (Ed.) N.G. Menon and C.S.G. Pillai. 16-31.

Scheer, G. and Pillai, C. S. G. 1974. Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttgart)* **42** : 75 pp.

Scheer, G. and Pillai, C. S. G. 1983. Report on the Stony Corals from the Red Sea. *Zoologica (Stuttgart)* **45** : 197 pp.

Venkataraman, K. and Alfred, J. R. B. 2002. Coral reefs *In*: Ecosystems of India, (Ed.) Alfred, J. R. B., Das, A. K. and Sanyal, A. K., *ENVIS, Zool. Surv. India*, 261-290.

Veron, J. E. N. 2000. Corals of the World **1** : 463 pp; **2**: 429 pp; **3** : 490 pp.

Veron, J. E. N. and Pichon, M. 1976. Scleractinia of Eastern Australia. Part 1, Families Thamnasteriidae, Astrocoeniidae, Pocilloporidae. *Australian Inst. Mar. Sci. Monogr. Ser.* **I** : 86 pp.

Veron, J. E. N. and Pichon, M. 1980. Scleractinia of Eastern Australia. Part 3. Families Agaraciidae, Siderastreidae, Fungiidae, Oculinidae, Merulinidae, Mussidae, Pectiniidae, Cargophyllidae, Dendrophylliidae. *Australian Institute of Marine Science Monograph Series* **IV** : 471 pp.

Veron, J. E. N. and Pichon, M. 1982. Scleractinia of Eastern Australia. Part 4. Family Poritidae. *Australian Insisitue of Marine Science Monograph Series* **V** : 210 pp.

Veron, J. E. N., Pichon, M. and Wijsman-Best, M. 1977. Scleractinia of Eastern Australia. Part 2. Families Faviidae, Trachyphylliidae. *Australian Institute of Marine Science Monograph Series* **III** : 233 pp.

Veron, J. E. N. and Wallace, C. C. 1984. Scleractinia of Eastern Australia. Part 5. Family Acroporidae. *Australian Institute of Marine Science Monograph Series* **6** : 485 pp.

Veron, J. E. N. 1986. Corals of Australia and Indo-Pacific. Angus and Robertson, Sydney. 644 pp.

Veron, J. E. N. 1995. Corals in space and time; the biogeography and evolution of the Scleractinia. UNSW Press, Sydney. 321 pp.

Wallace, C. C. 1999. Staghorn corals of the world. CSIRO Publ, Melbourne. 422 pp.

Wallace, C. C. and Wolestenholme, J. 1998. Revision of the coral genus *Acropora* (Scleractinia:Astrocoeniina:Acroporidae) from Indonesia. *Zool. J. Linnean Soc.* **123** : 199-384.

Wallace, C. C. Acropora, Staghorn corals, A getting to know you and identification guide, Indian Ocean, South East Asia, Pacific Ocean. Ocean Environment Ltd., Australia, 126 pp.

Wilkinson, C. R., 1998. Status of Coral Reefs of the World : 1998. Global coral Reef Monitoring Network and Australian Institute of Marine Science, Townsville, Australia. 184 pp.

Wilkinson, C. R. 2000. Status of Coral reefs of the World : 2000. Australian Institute of Marine Science, 363 pp.

ISBN 81-8171-020-7

Indian: Rs. 2,300.00
Foreign: $ 150 £ 100