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NEW RECORDS OF *SCLERACTINIANS* FROM ANDAMAN ISLANDS.

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INTRODUCTION

Andaman Nicobar Islands located between 6°-14° N and 91°-94° E, hosts fringing reefs encircling almost the entire coast. These reefs being touted as the less impacted, and could serve as reserves of Biodiversity in the Indian Ocean are the least investigated of the Indian Ocean, concerning Biodiversity. On zooxanthellate *scleractinians*, there have been very few extensive surveys, is apparent in the description of so far 177 species of hard corals under 57 genera, which is a mere 22.29% of the total reported species from the World. There was an international initiative, from UNDP-GEF, to confirm the global significance of biodiversity of the Andaman region. The report of which indicated a possible occurrence of 400 species of corals (Turner *et al.* 2001). The new records [111 Nos, later verified to be 94 Nos, which includes some non-scleractinians as well (Venkataraman *et al.* 2003)] of this study, however, have not been described. In spite of many organizations now working on coral reefs in India, no significant strides in taxonomic investigations of corals have been made since the last compilation by Pillai (1983). Venkataraman *et al*. (2003) were one exception : 42 species were added to the list of coral of the Andaman Nicobar islands and 13 to the Laskhadweep islands in the Arabian Sea—though, for the whole of Indian reefs the addition was a meager 9 Nos, since Pillai (1983). Raghuram & Venkataraman (2005) added two more species from Gulf of Mannar and Andaman waters.

Extensive surveys have been carried out since 2004 by the first author of this paper in South Andaman reefs for assessment scleractinian diversity in these reefs and changes with regard to climatic and local impacts; The list of new records the UNDP-GEF (Turner *et al.* 2001). report too needed to be verified for their occurrence or non-occurrence demanding description through taxonomic investigation of specimens. The present paper is the outcome of this effort. 7 new records to Andaman Nicobar waters are described, which include 4 species from the list of new records in the UNDP-GEF report (Turner *et al.* 2001). With the exception of one species which has previous records from Gulf of Mannar, all the described species are new records to Indian waters.

It may be noted that this is the first clear cut record of these species with descriptions of specimens from Indian waters. Earlier listings (other than Turner *et al.*, 2001) if available were ambiguous without the specimen descriptions, as the species described in this paper have closer affinities with many species and have many related species which makes their *in-situ* identification (definite) nearly impossible, and hence called for detailed taxonomic study of the specimens.

MATERIALS AND METHODS

Study area and sampling locations are shown in the map (Fig. I. a & b). Corals have been photographed *in-situ* with Sony cyber shot camera with underwater housing, and were tried to be identified at the first instance. Later, species which required detailed observations of skeletal structures were sampled, without causing un-due damage to the colony. SCUBA was employed for the observation and collection. The specimens were labeled and stored in freshwater for

rotting the tissue, while periodically replacing the water. They were then cleaned with a strong water jet to remove any sticking gelatinous tissue. The rotting procedure was continued if necessary.

Detailed skeletal structures were studied under Nikon SMZ 1500, trinocular, stereoscopic zoom microscope, and photographed with the affixed Nikon 8.0 megapixel ED camera. Whole corallum photographs were taken using Nikon D 300 using 60 mm macro lens provided with sufficient artificial lighting. The specimens after identification were submitted at the National Zoological Collections (NZC), Museum of Zoological Survey of India (ZSI), Andaman Nicobar Regional Centre (ANRC), Port Blair, and registered in the Named Register of ZSI, ANRC.

RESULTS

Family ACROPORIDAE Verrill, 1901

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

Montipora danae Edwards & Haime, 1851

Material examined : Corallum 10.5 × 10 cm, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 4 m, 6.VII.2009, coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4656–NZC–ANRC. (PLATE-I).

Description : Colonies are thin plates which are often found inwardly wounding, may give the appearance of inverted conical folds. The surface is covered with dome shaped, verrucae of 1.5-2.4 mm (thickness in perpendicular to the ridges). The verrucae are often fused and forming radiating ridges near the laminar edges. Verrucae are arranged in line to the radiating ridges in the laminar sheet. The spinules in the coenosteal valleys are very fine, however they are more finer in verrucae, both types have elaborate ends. Corallites are immersed and arranged between the verrucae and in the valleys between the ridges in the laminar plate. They are never present on the verrucae. The calices are 0.5-0.7 mm in diameter. Theca is distinguishable in some corallites. The primary septa <3/4 R, are complete and do not taper towards the center. The secondaries, <1/2 R are incomplete.

Colonies are 15-40 cm wide and are dirty cream or pale brown in color. Observed at reef slope of 4-6 m depth. Not very common.

Affinities : *Montipora dane* resembles *M. verruculosus* and *M. verrrucosa*. It is differentiated from *M. verruculosus* by (1) the finar reticula, whereas the latter has glabarous verrucae and coenosteum. (2) bigger sized verrucae; in *M. verrruculosus*, the size of the verrucae are small *i.e*. less than 1mm. (3) by the arrangement of verrucae in line to the radiating ridges in the laminar sheet. Differentiated from *M. verrucosa* by having smaller calices and irregular sized verrucae.

Distribution : Reported for the first time from Andaman Nicobar Islands and India. Widely reported from reefs World-wide.

Family FUNGIIDAE Dana, 1846

Genus ***Fungia*** Lamarck, 1801

Fungia granulosa Klunzinger, 1879

Material examined : 1. Corallum 10.2 cm in diameter, India Andaman Nicobar Islands, North Bay reef, stn. 3, 11° 42' 12.3" N; 092° 45' 06.4" E (Fig. I. a), Depth 6 m, 27.VIII.2008, Coll. Rajkumar Rajan & Murugeson, Reg. No. 4657–NZC–ANRC, (PLATE-II. a-d.).

2. Corallum 9.2 cm in diameter, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 5 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4658–NZC–ANRC (PLATE-II. e-h.).

Descriptions : Colonies are circular and in average 10 cm diameter. The disc is slightly convex. The area around the central fossa is slightly arched. The septa are distinctively wavy, more pronounced in the lower orders. The margins of the septa are comparatively thickened mostly due to the granular margins which gives a blunt appearance. Towards the periphery however small denticules in the margin are visible. At least the first two orders of septa are uniformly thickened, except near the fossa where tentacular lobes are formed of the higher orders. Coralla size in the present specimens ranged from 9.5-12.5 cm. The central fossa is narrow, elongate and columella spongy. The costae are clearly seen until the center, with the higher order vey distinct. They have fine papillae in the costal margins which give a granulose appearance and a thicker margin as that of the septa. Small sized and slit like perforations are observed more towards the outer margin of the corallum.

Observed at the depths of 6-10 m in reef slopes and beds of the protected bays. Not common.

Affinities : By studying the specimens, this species is easily differentiated by the granular nature of the blunt septal margin and the fine costal papillae which are numerous. Some affinities it may show at a first look with F. scabra, F. concinna and F. repanda are readily differentiable: In F. *scabra*, the septa of the higher order only was observed to be wavy, the waviness not extended till the periphery and not very pronounced; In F. concinna the higher orders of septa more excert and the margins are spinluose or lobate than granulose margins of *F. granulosa;* The coralla of *Fungia repanda* are comparatively bigger, and the septal margins have triangular dentations.

Distribution : Though included in the list of corals identified by Turner et al. (2001), is described for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is usually uncommon. Other distributional records in Veron & Pichon (1980).

Genus ***Herpolitha*** Eschscholtz, 1825

Herpolitha weberi (van der Horst, 1921)

Material Examined : Corallum 14 × 4.5 cm, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 6 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C. R. Sreeraj, Reg. No. 4659–NZC–ANRC, (PLATE-III).

Description : Coralla are elongate with pointed tips. They are arched in the middle. The axial furrow reaches both the extremities. Septa are markedly alternating in height near the axial fossa. There are at least 3 groups of Septa. Fusion of septa across the axial furrow is observed with the first and 3rd orders of septa there by demarcating the linear series of centres. Lateral secondary centres are not observed. Columella in the axial furrow are elongate and papillate. The septal teeth present are small and cup shaped. The first group of septa numbering 49 + 49, on either side, originate from the axial fossa. They abruptly ends little short of the periphery (in aberration to the description of specimens by Veron & Pichon, 1980), except near the extremities where they reach the peripheries without interruption and may project outside the septal margin. The second group, equal in thickness and height to that of the first order, originate away by at least 4 mm away from the axial furrow, extend up to the periphery and projects outside the corallum margin. The 3rd group of septa (96 + 96 on either side) on the sides of the first order are very fine and markedly smaller in height that of the first order. This group of septa which also originate from the axial furrow encircles the first order a little short of periphery by forming loop. This loop formation of the 3rd order septa is observed where the first order does not extend to the periphery. The lower surface is perforate except in the central part. The spinulose spines arranged in rows are well defined towards the corallum perimeter.

Observed at depths of 3-4 m in gradually sloping reef slopes. Not very common.

Affnities : This species has resemblance to *H. limax*, but could be differentiated from the latter by the absence of secondary centres, and having higher length width ratio, usually > 4. Moreover, in *H. limax* the primary septa are heavily truncated and never reach the periphery.

Distribution : Recorded for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is uncommon. Other distributional records in Veron & Pichon (1980).

Family MERULINIDAE Verril, 1866

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

Hydnophora grandis Gardiner, 1904

Material examined : Coralla branching 7-16 cm tall, 6 pieces, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 4 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4660–NZC–ANRC, (PLATE-IV).

Descriptions : Colonies are ramose without an encrusting base. Branches are cylindrical along the whole coralla except near the tip where they may taper. They are 0.8 mm at the tip to 10-15 mm in the middle and up to 18 mm at the base. Monticules appear separated and individually projected. Fusion of monticules, thereby forming ridges, is observed only at branch tips, *i.e.* at branch thicknesses of 9 mm and below. However, matured specimens, even at the branch tips do not show fusion of monticules. There

are about 8-10 primary septa radiating from the monticules. They, on reaching the columella centers are slightly thickened and have small dentations. A row of secondary septa alternating the primaries are present but never reach the columella centers.

Colonies are up to 0.5 m across. Colouration is mostly brownish pink, tending to be bluish down the branches. At localities where this species is present, they form a reasonably good cover (an average of 12.7%). Not commonly observed.

Affinities : This species has resemblance only to *H. rigida*. Differentiated easily from it by the cylindrical branches, and by the presence of individual monticules. *H. rigida* on the other hand has finer branches and the monticules usually fused into ridges down the branch sides.

Distribution : Though included in the list of corals identified by Turner et al. (2001), is described for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is usually uncommon. Not widely reported.

Family PORITIDAE Gray, 1842

Genus ***Porites*** Link, 1807

Porites stephensoni Crossland, 1952

Material Examined : Corallum 5 × 3.7 cm, India, Andaman Nicobar Islands, North Bay reef, stn. 2, 11° 42.231' N; 092° 45.100' E, (Fig. I. a), Depth 3 m, 27.VIII.2008, Coll. Rajkumar Rajan & Murugeson, Reg. No. 4661–NZC–ANRC, (PLATE-V).

Description : Coralla are encrusting or massive. In the latter case are at the size range of 5-10 cm in diameter. The encrusting ones may grow up to 20 cm in diameter. The surface is humped at most instances. Calices are 0.9-1.1 mm in diameter. The walls are thin. Denticles over the wall, if present, are corresponding to the septa. The septa are thin and short (1/2 R). The septa bear a row of denticles near the theca. Both the septal and thecal denticles are fine and have an arrangement of small spines at the top. The triplet is not fused and the lateral pairs are larger than the dorsal and ventrals. Pali are prominent. 8 pali are present and the ones corresponding to the lateral pairs are bigger than the dorsal and the three ventrals. Columella is deeply seated and small. Three radii connecting the columella are distinctly noticed.

Colonies are observed in the colors of Pale brown, brown and grayish green. Usually the encrusting ones are brownish in color.

Affinities : From other species of *Porites*, this species is first distinguishable by it smaller sized colony. The closest resembling species in corallite structures is *P. murrayensis*, which also has smaller coralla. However, *P. stephensoni* has thin corallite wall and prominent pali, which differentiate from *P. murrayensis*'s thick walls and the relatively inconspicuous pali (may be absent in the dorsal directive and ventral triplet).

Distribution : Recorded for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is uncommon. Other distributional records in Veron & Pichon (1980).

Porites annae Crossland, 1952

Material Examined : Corallum 7 × 5.4 cm, India, Andaman Nicobar Islands, North Bay reef, stn. 3, 11° 42' 12.3" N; 092° 45' 06.4" E, (Fig. I. a), Depth 5 m, 27.VIII.2008, Coll. Rajkumar Rajan & Murugeson, Reg. No. 4663–NZC–ANRC, North (PLATE-VI).

Description : Colonies form nodular columns, rarely anastamosing, however, normally found to have fused column heads. The height of the columns usually does not exceed 8 cm. They have a thick encrusting base. The corallites appear little excavated. Calices are 1.2-1.6 mm in diameter. Paliform lobes are distinctly seen. Pali number is usually variable from corallite to corallite. As per Veron & Pichon (1982) matured corallites have an open triplet, therefore each septum having a small palus, in addition to the 5 big pali, thereby making the total number 8. It is usually 6 pali in other cases, where the triplet is fused, and the longer ventral directive has only one palus. At least two rows of denticles are present and one near the wall is slightly excert. Columella is present and is like a small pali.

Colonies form large stands of 0.5 to several meters across. Smaller colonies are observed at shallower depths and are extremely tolerant to sedimentation. Large stands are commonly occurring at depths of 4-8 m in protected bays. They may be pale brown to deep grey with white heads.

Affinities : This species is easily separated *in-situ* by its distinctive growth form. P. lichen, however has a similar growth form is distinguished from P. annae by the former's thicker walls, small sized calices and relatively less developed pali.

Distribution : Though included in the list of corals identified by Turner *et al.* (2001), is described for the first time from Andaman Nicobar Islands. Previous records in Indian waters are from Gulf of Mannar reefs, South East Coast of India (Raghuram & Venkataraman, 2005). Other distributional records in Veron & Smith (2000).

Porites monticulosa Dana, 1846

Material Examined : Corallum 12.5 × 12 cm, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 4 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4662–NZC–ANRC, (PLATE-VII).

Descriptions : Colonies are laminar or encrusting and in both the cases with nodular upward projections, which sometimes develop into slender columns of 3-4 cm height. Ridges are formed on the laminae as well as columns which seem to separate the corallites. Ridges are observed to be devoid of corallites over them. Corallites are 0.5-0.7 mm in dia. Triplet is fused by the inner margins, and makes a perfect cone. 6 pali are very distinct. The dorsal palus is smaller than the 4 lateral pali and that of the ventral. Columella is very small, deeply seated and is absent in some corallites. Only one row of denticles is arranged near the theca.

Colonies are dark brown. While encrusting colonies are 20-50 cm across, the laminar ones are comparatively smaller. Commonly occur at shallower depths (2-3 m) and in protected reef slopes.

Affinities : The growth forms may resemble those of *P. lichen* and *P. anne*, but differentiated from them by the smaller corallites and the columns usually remaining short.

Distriibution : Though included in the list of corals identified by Turner et al. (2001), is described for the first time from Andaman Nicobar Islands and India. Other distributional records in Veron & Smith (2000).

Porites latistella Quelch, 1886

Material Examined : Coralla laminar to encrusting base with short branches–3 pieces, 7.1 × 6.2 cm, 5.8 × 4.8 cm, 6.4 × 6 cm, India, Andaman Nicobar Islands, North Bay reef, stn. 2, 11° 42.231' N; 092° 45.100' E (Fig. I. a), Depth 3 m, 27.VIII.2008, Coll. Rajkumar Rajan & S. Murugeson, Reg. No. 4664–NZC–ANRC, (PLATE-VIII).

Description : Colonies are encrusting to thin basal laminae with upwardly arising, cylindrical, irregular sized branches of 4-5 cm height and 8-13 mm thick. The branches are flattened at their tips where they tend to divide. Corallites appear excavated. The walls are irregular in outline. Calices are 1.2-1.4 mm in diameter. 5 pali are usually present. The dorsal directive has no palus. Triplet is usually free; however it may be fused in some corallites. Columella is small and in some corallites it may be absent. One row of denticles is present in the septa.

Colonies are 5-13 cm across and occur in reef flats of protected bays. Normal colouration is pale brown. They are uncommon in reefs.

Affinities : Similar species are *P. sillimania*, *P. cylindrica* and *P. eridani*. *P. sillimania* has similar growth form, however, does not have excavated corallites. In *P. cylindrica*, the corallites are shallow, branches long, cylindrical and taper uniformly till the branch tips as against the flattened tips of *P. latistella*. *P. eridani* has large plates, branches contorted and tips un-flattened.

Distribution : Recorded for the first time from Andaman Nicobar Islands and India. Other distributional records in Veron & Smith (2000).

DISCUSSSION

The new records described are of the commonly occurring genera in Andaman Nicobar Islands. In *Montipora* there are so far 10 species described from Andaman Nicobar Islands (20 from the whole of India), and six more listed (with one doubtful identification) as new records (Turner *et al.*, 2001). Veron and Smith (2000) report 73 species of this genus world over. As observed by them, there are several groups of similar species in this genus. This may be one reason why many species have been overlooked and easily concluded as previously reported of this genera.

Though *Hydnophora* are easily distinguishable, the new record *H. grandis* described here could so far may

have been superficially identified as *H. rigida*, from these islands, because of the similarity in growth form. So far 3 species are described from Andaman Nicobar Islands; 2 listed as new records (Turner *et al.*, 2001). With the present description, the total described species will be 4, leaving only two species un-described from the World total. These species are inconspicuous in a reef explains them not being recorded in this reef area.

The family Fungiidae has 20 species, under 8 genera, described so far from Andaman Nicobar Islands (22 species under 10 genera for the whole of India) and 7 species listed as new records by Turner *et al*. (2001). Veron and Smith (2000) reports 57 species of this family, under 13 genera from World over. Though the species described in this study have uncommon occurrence, many species, including one genus of common occurrence (*Heliofungia)* are not recorded for this reef area, in addition to the remaining rare genera and species from the World list.

Of the 4 species of *Porites* described in the present study, 2 species (*Porites stephensoni* & *P. latistella*) have uncommon occurrence and remaining 2were commonly reported World over. So far 13 species of *Porites* have been described from India and only 7 from Andaman Nicobar Islands, excluding the 5 species listed as new records in the UNDP-GEF report. This number is very low as against the total 52 species reported from World reefs (Veron & Smith, 2000). The difficulties in identification of this species stem from little variation in corallite characters between species and the requirement of *in-situ* investigations of colony structure as well.

Overall, the new records described in this paper—all are not of uncommon occurrence, shows that reef areas in Andaman Nicobar Islands require extensive investigations for Scleractinian diversity. Moreover, the very low records so far of species of *Montipora*, *Porites* and Family *Fungiidae* indicate that these genus and family are under-represented in this area.

SUMMARY

Coral species described from Andaman Nicobar Islands remains a dismal 177 Nos (Venkataraman *et al.* 2003), despite the indication by Turner *et al*. (2001) that coral diversity in these islands could accrue to 80% of the global maximum. Though, Turner *et al.* (2001) by a rapid survey to investigate the coral diversity, listed 94 new records (out of the total 197 identified in the underwater survey), the new records were not described. A total of 8 species (1. *Montipora danae*, 2. *Fungia granulosa*, 3. *Herpolitha weberi*, 4. *Hydnophora grandis*, 5. *Porites stephensoni*, 6. *P. annae*, 7. *P. monticulosa*, and 8. *P. latistella*) have been described in the present study, which includes 4 species (Nos. 2, 4, 6 & 7) listed as new records in the report by Turner *et al.* (2001). Except for *Porites annae* which has one previous record from Gulf of Mannar (Raghuram & Venkataraman, 2005)—all species described in this paper are new records from Indian waters.

Key words : Scleractinia, new records, India, Andaman Nicobar Islands.

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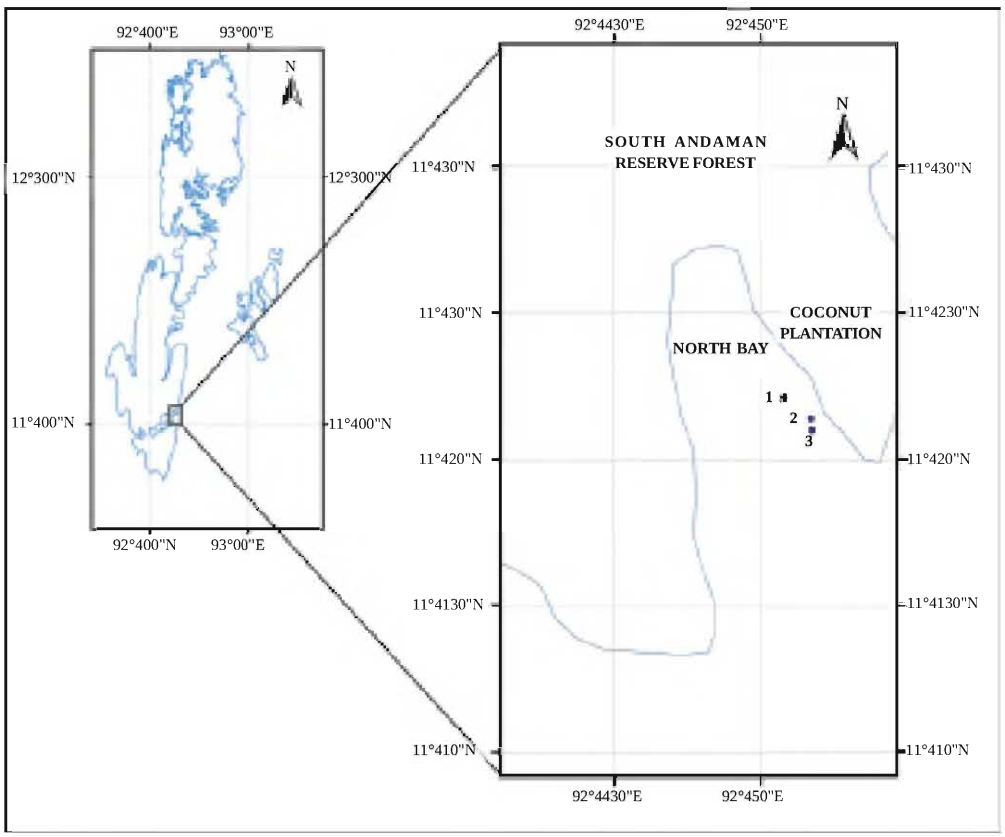


Fig. 1. a) Study area and sampling location in North Bay reef, South Andaman

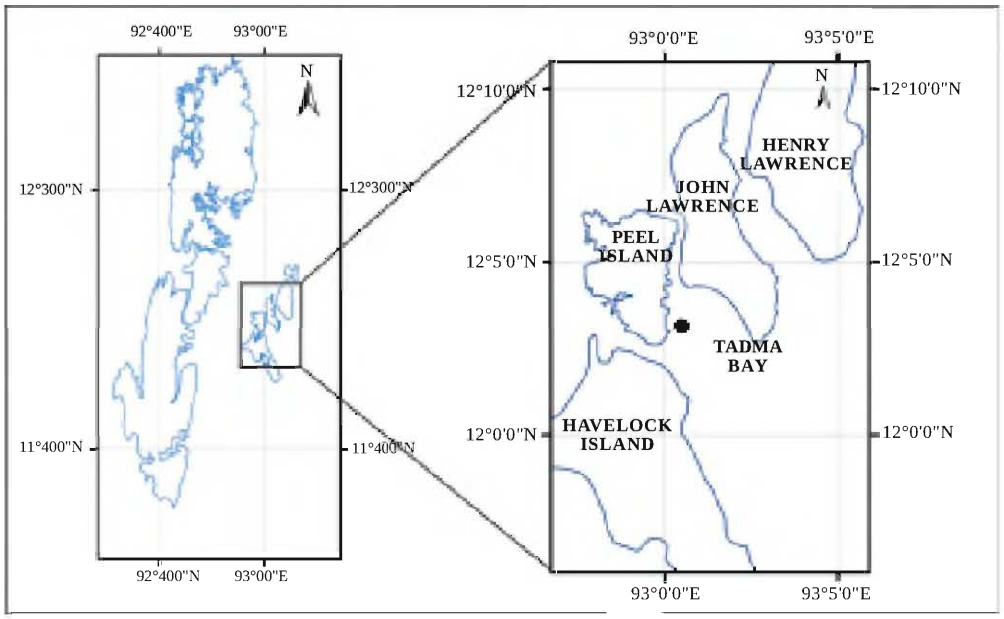
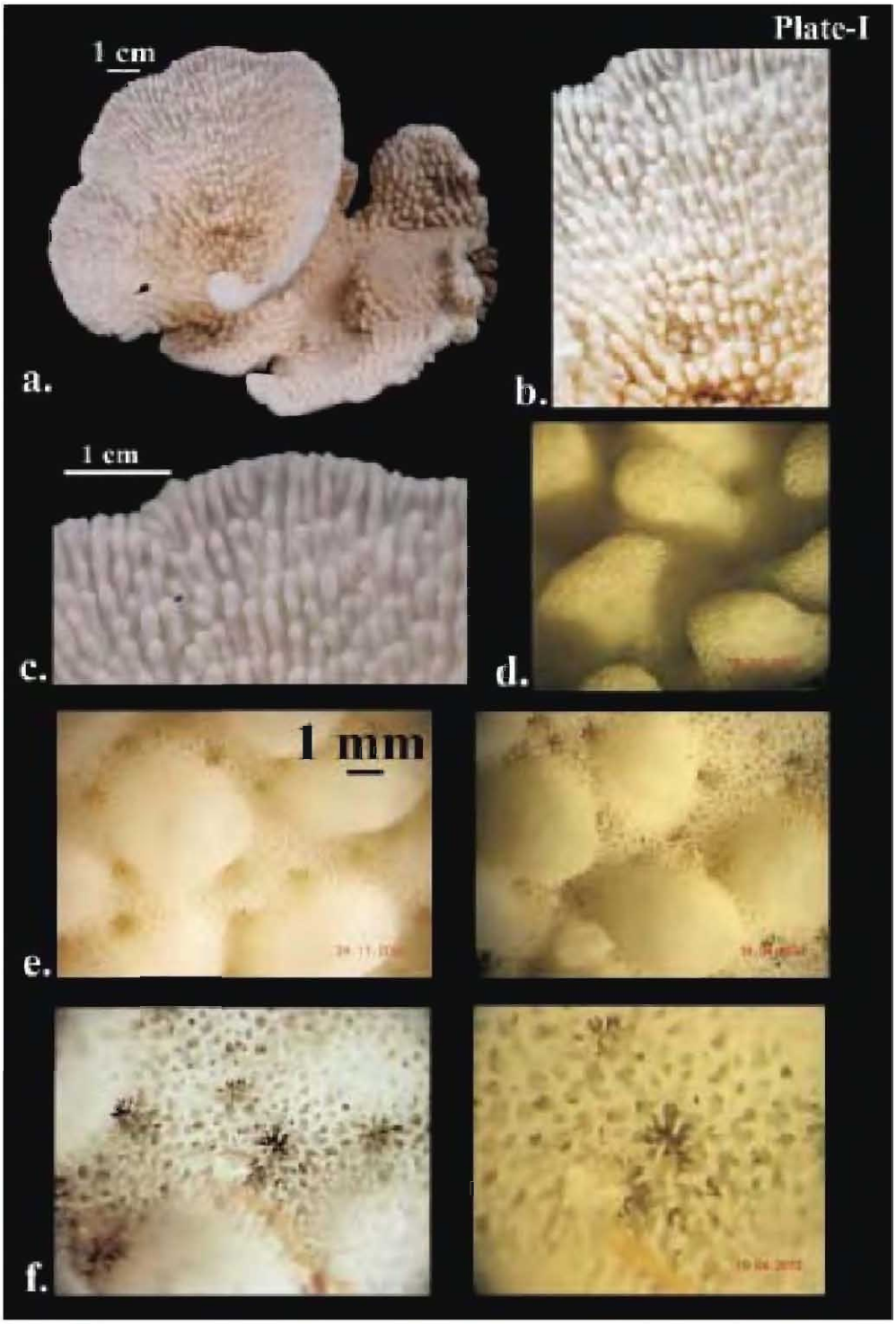


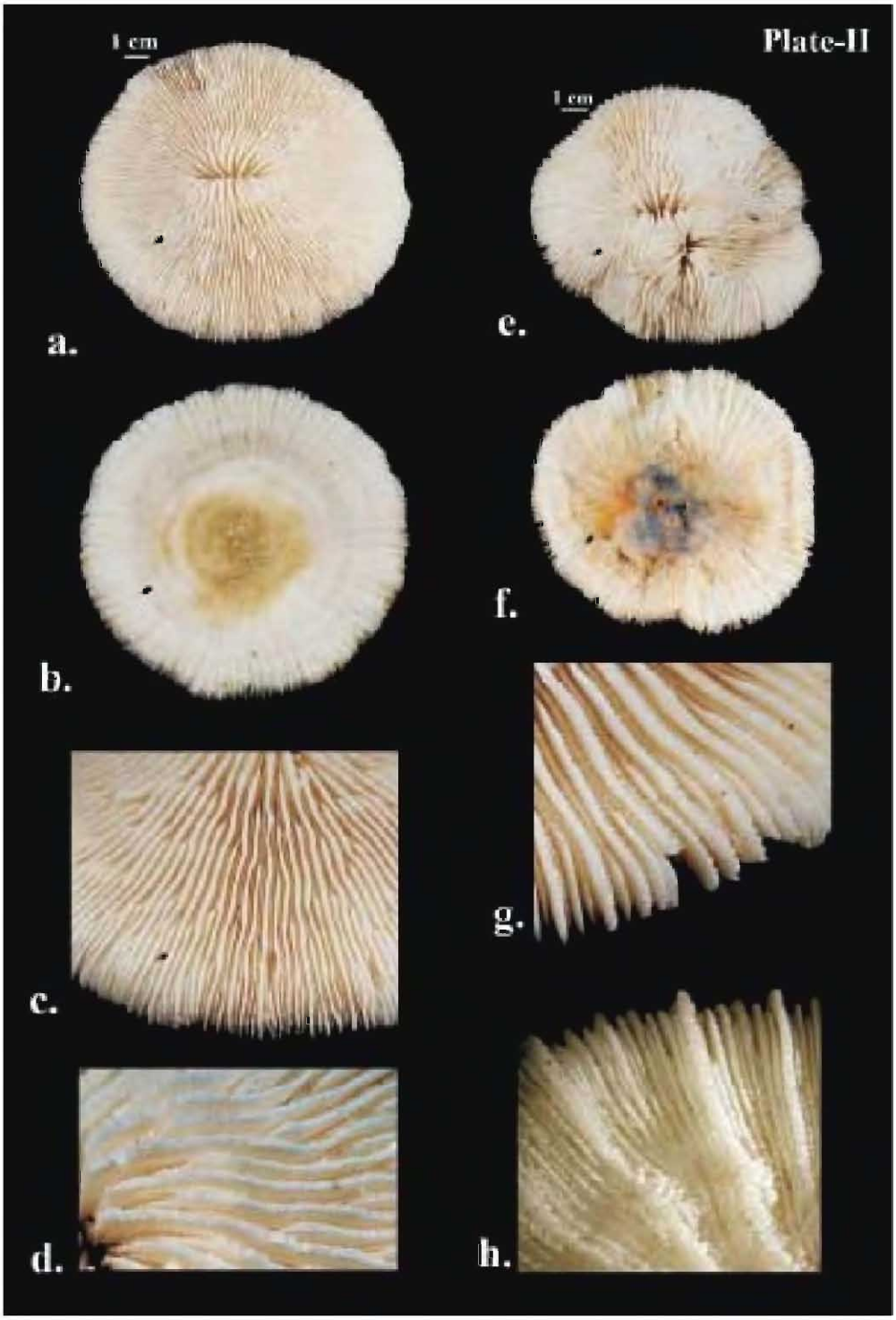
Fig. 1. b) Study area and sampling location in Ritchie's Archipelago, South Andaman

PLATE–I



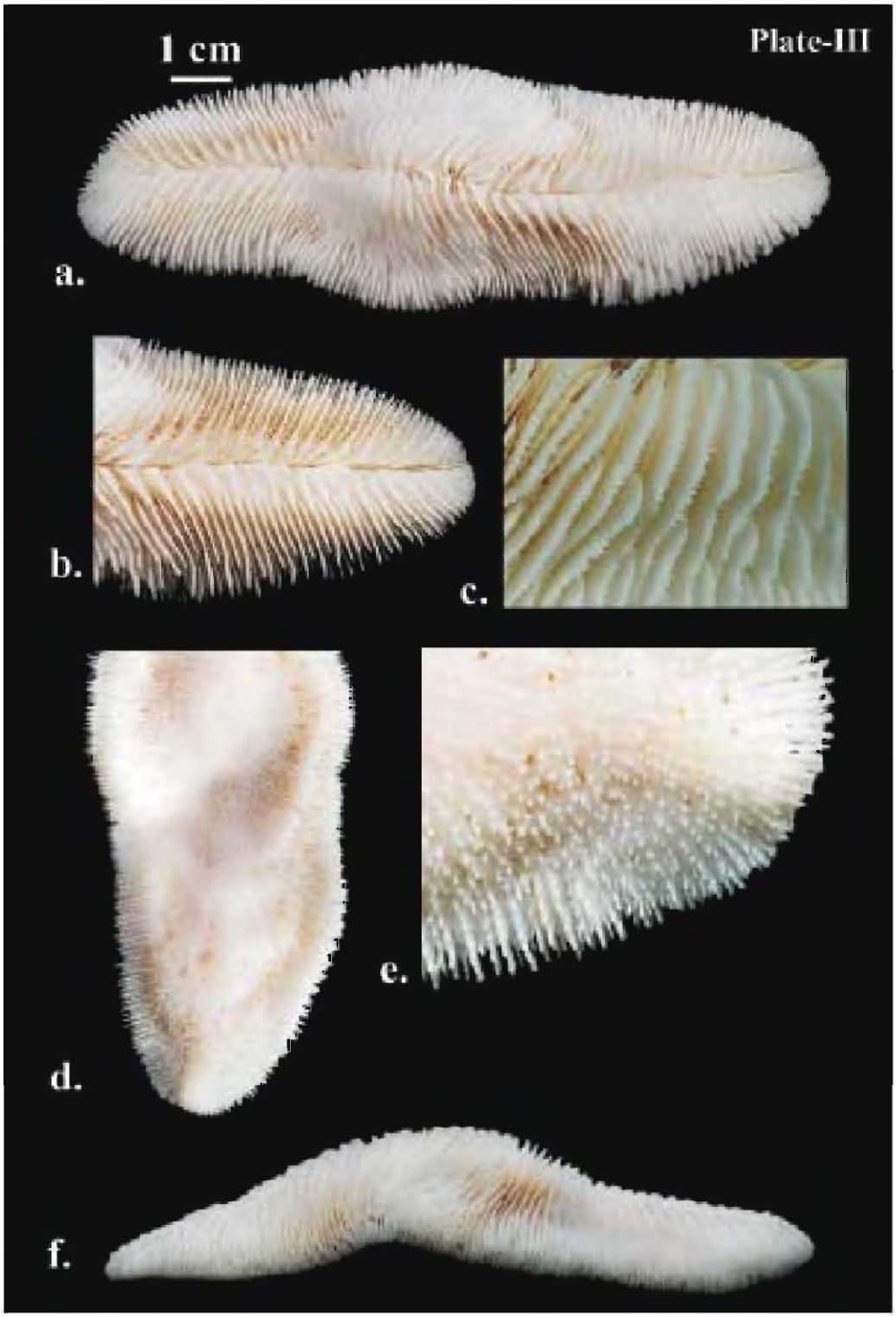
a. *Montipora danae*, material examined; **b.**Verrucae arranged in line to the peripheral radiating ridges; **c.** Radiating ridges at the periphery; **d.** Verrucae showing finer reticula; **e.** Arrangement of verrucae and corallites in the laminar sheet; **f.** Details of corallite structures

PLATE–II



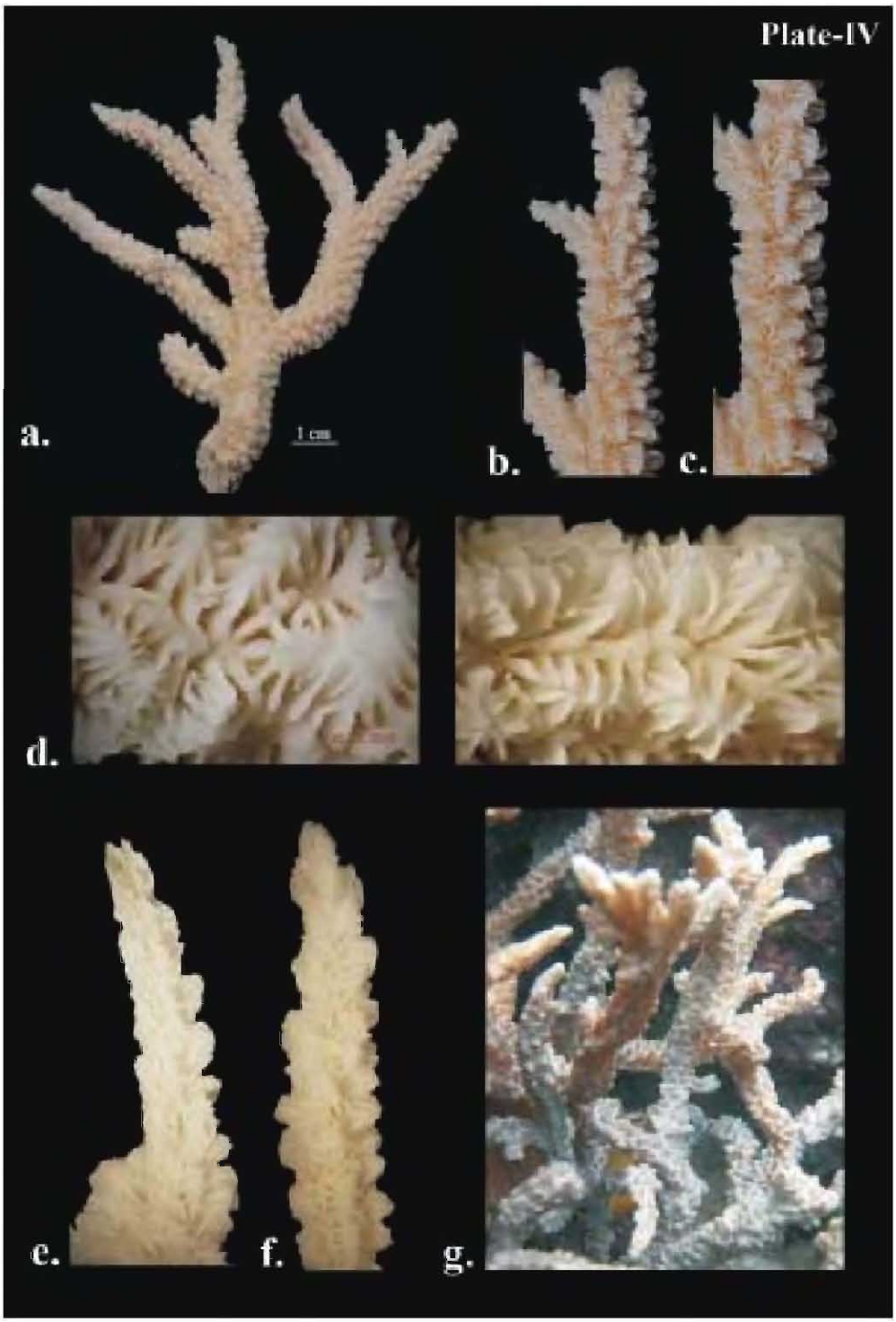
a. & e. *Fungia granulosa*, coralla showing dorsal view; **b. & f.** Ventral view of the coralla; **c.** Septa showing waviness, observed also in higher orders; **g.** Small denticules in the septa at the corallum periphery; **d.** Granular margins of the septa; **h.** Granular costae

PLATE–III



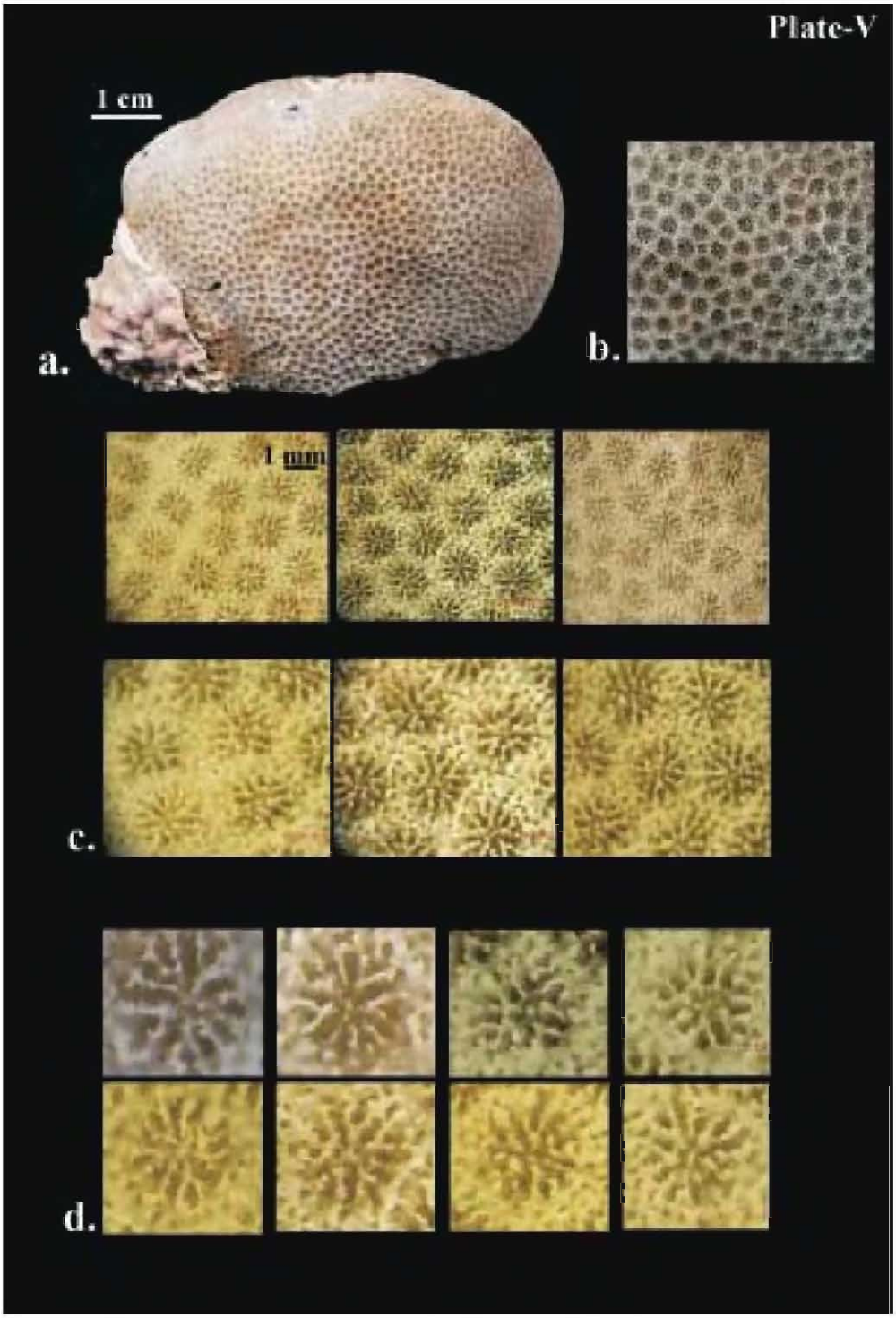
a. *Herpolitha weberi*, dorsal view of the corallum; **b.** Primary septa at the extremities reaching the peripheries, others encircled by a loop of the 3rd group of septa; **c.** Small cup shaped septal teeth; **d.** Arrangement of costae; **e.** Spinulose spines of the costa; **f.** Corallum showing arch

PLATE–IV



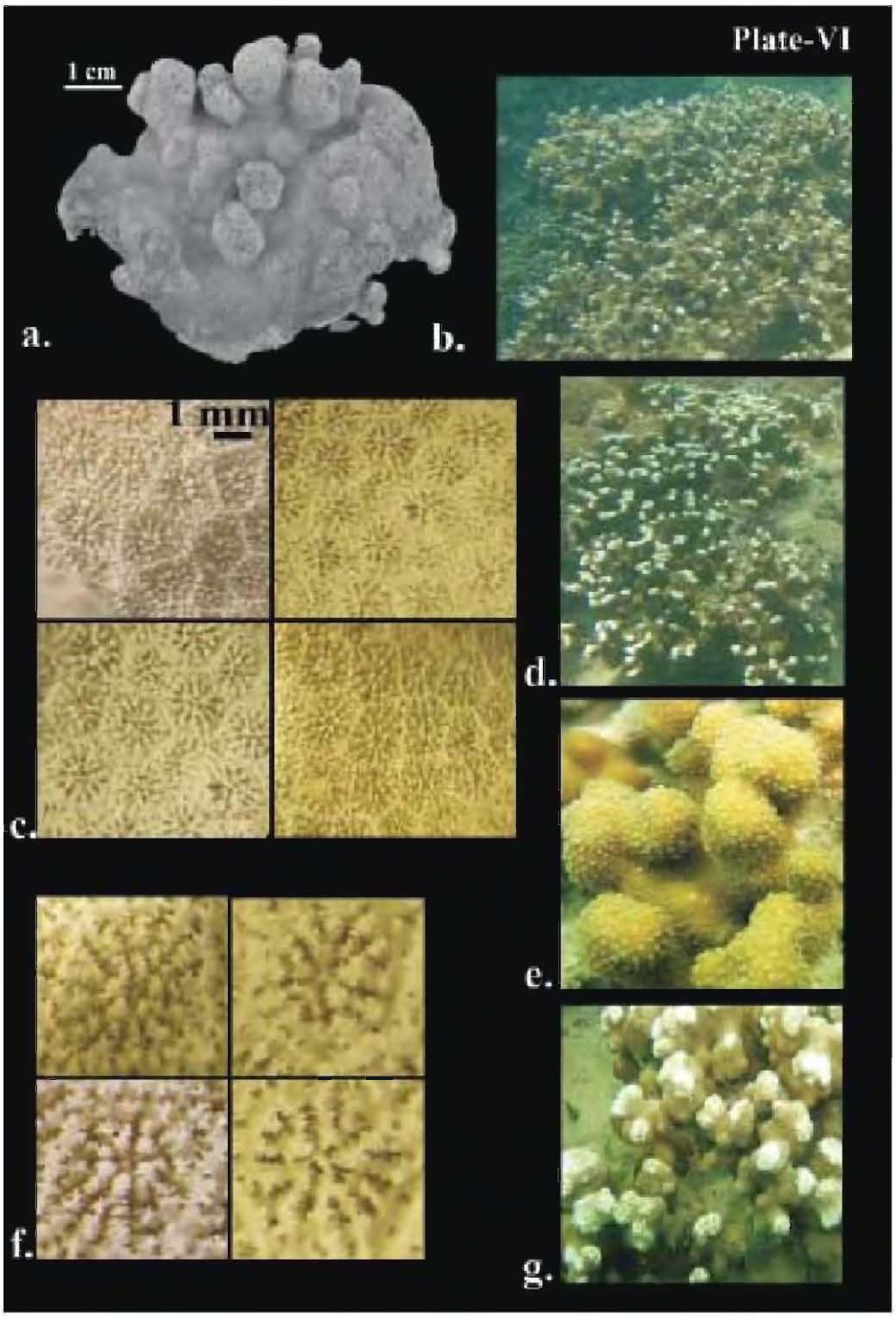
a. *Hydnophora grandis*, corallum; **b. & c.** Branches showing individually projected monticules; **d.** Arrangement of septa; **e.** Monticules appear fused at younger branch tips; **f.** Matured branch tips showing individual monticules; **g.** *In-situ* photograph of a ramose colony.

PLATE–V



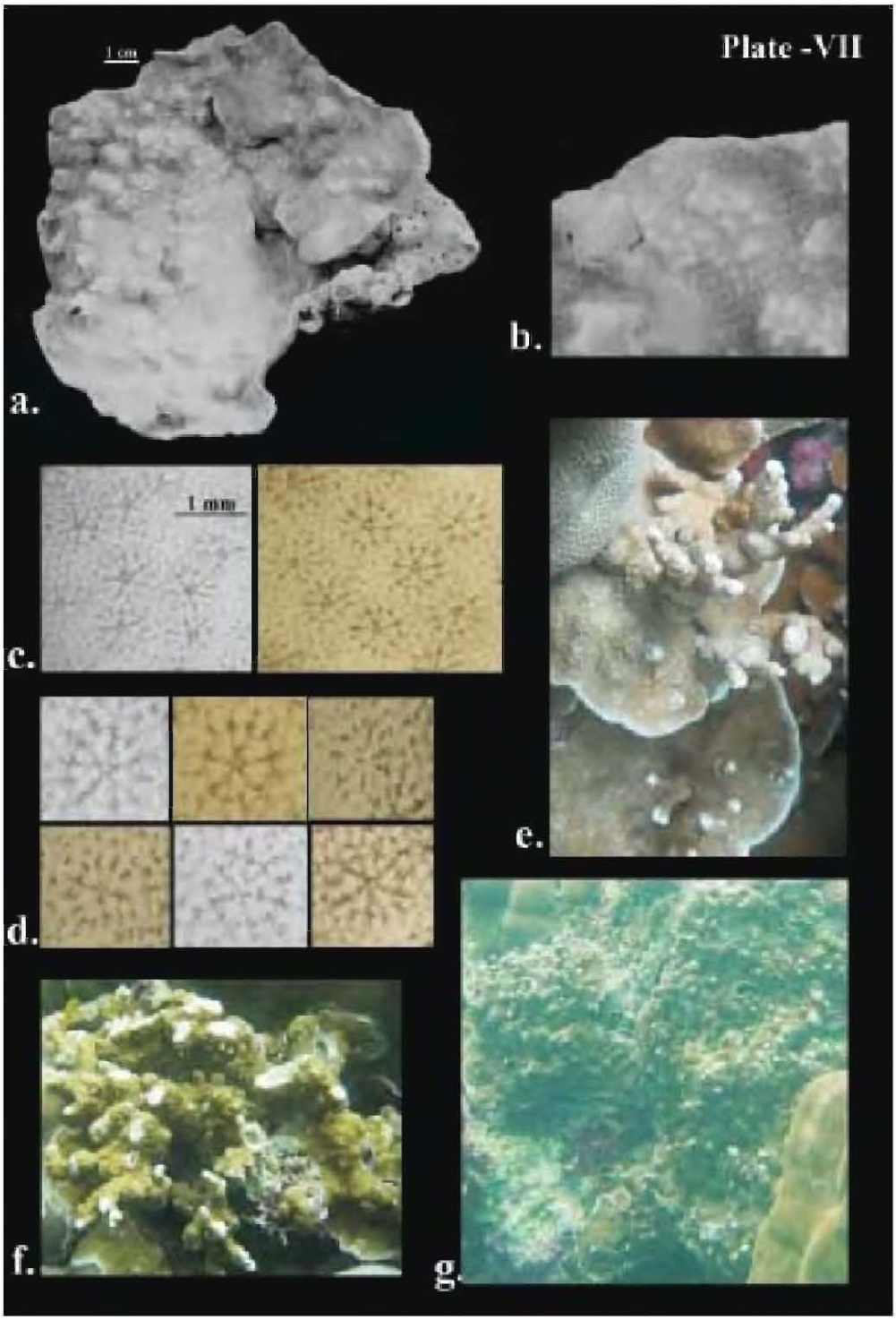
a. *Porites stephensoni*, material examined; **b.** Arrangement of corallites; **c. & d.** Details of corallite structures

PLATE–VI



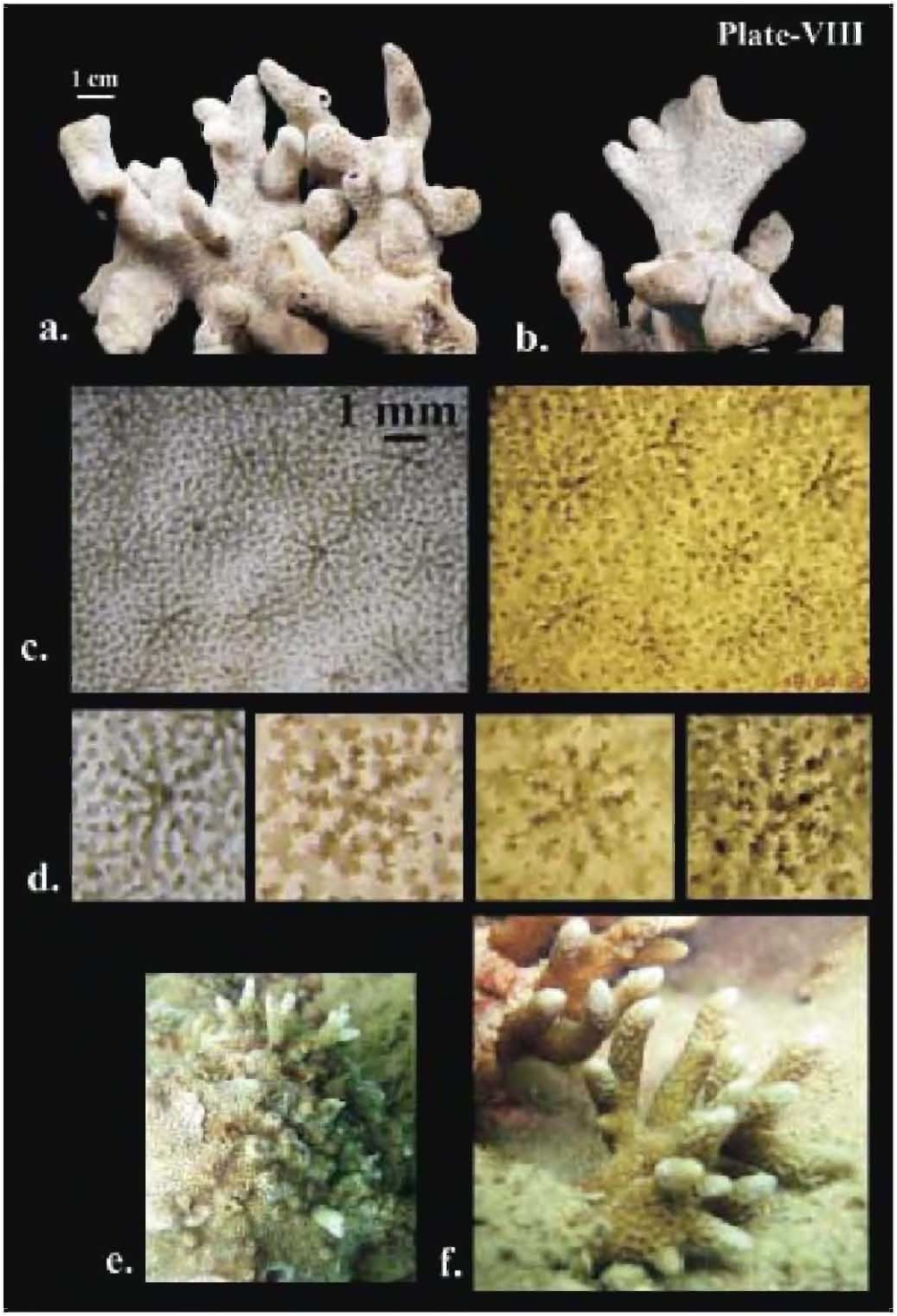
a. *Porites annae*,corallum showing nodular growth; **b.** A large colony at 6 m depth; **d.** Colony at a very shallow depth; **e. & g.** Colonies at shallower depths with polyps extended; **c.** Arrangement of corallites; **f.** Details of corallite structures

PLATE–VII



a. *Porites monticulosa*, laminar corallum; **b.** Laminar sheet showing ridges; **c.** Arrangement of corallites; **d.** Details of corallite structures; **e.** A laminar colony with upward projections developing into a slender coloumn; **f.** Encrusting colony with slender columns; **g.** Encrusting colony with nodular projections

PLATE–VIII



a. *Porites latistella*, corallum showing excavated corallites; **b.** Branches with flattened tips; **c.** Arrangement of corallites; **d.** Details of corallite structures; **e. & f.** Smaller colonies at shallower depths