

Article

New records of Actiniarian sea anemones in Andaman and Nicobar Islands, India

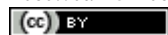
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Abstract

The present paper provides the descriptive features of three newly recorded Actiniarian sea anemones *Actinoporus elegans* Carlgren, 1900, *Heterodactyla hemprichii* Ehrenberg, 1834, *Thalassianthus aster* Rüppell & Leuckart, 1828 from Indian waters and two newly recorded species *Stichodactyla tapetum* (Hemprich & Ehrenberg in Ehrenberg, 1834), *Pelocoetes exul* (Annandale, 1907) from Andaman and Nicobar Islands. This paper also accounts two genera, namely *Heterodactyla* and *Thalassianthus* as new records to India waters.

Keywords sea anemone; new record; distribution; Andaman and Nicobar Islands; India.

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1 Introduction

The actiniarian sea anemones are convened under the class Anthozoa that comprises about 1107 described species occurring in all oceans (Fautin, 2008). These benthic anemones are biologically significant animals for their promising associations with other macrobenthos such as clown fishes, shrimps and hermit crabs (Gohar, 1934, 1948; Bach and Herrnkind, 1980; Fautin and Allen, 1992). Till now, waters around Andaman and Nicobar Islands are reported with 28 actiniarian sea anemone species by different scientists (Parulekar, 1990; Raghunathan et al., 2014; Choudhury et al., 2015; Raghunathan and Choudhury, 2017). The details related to diagnostic features, nematocysts and geographical distribution of this newly recorded species have been discussed.

2 Study Area and Methodology

Sea anemone specimens were collected by using SCUBA diving from Andaman and Nicobar Islands (Fig. 1). Photographs were taken *in situ* condition to comprehend about the colour pattern of tentacles and column, shape and habitat by the digital cameras with underwater housing. Soon after collection the specimens were relaxed by the addition of magnesium chloride crystals with seawater in the field. The family level taxonomic character was identified by observing the peculiarity of tentacular structures, the arrangement of tentacles in

sea anemones and special colour pattern of column and presence or absence of verrucae in the column. Measurements provided for pedal disc, column, oral disc and tentacles were obtained from living, relaxed and preserved specimens under stereozoom microscope (Leica M205A) in the laboratory. The specimen was identified to the species level according to Carlgren (1949), Fautin (1988), Ardelean (2003), Gonzalez-Munoz et al. (2013) and Fautin et al. (2015). Cnidocysts were extracted from various parts of organs of preserved specimen and examined using compound microscope Labovision AXR20 under oil immersion 100x. The length and width of all cnidae were measured by ocular scale. The terminology for cnidae were followed by Carlgren (1940, 1945), Mariscal (1974), Dunn (1981) and Ostman (2000). Histological cross and longitudinal sections were made at 8 μm thickness and stained with hematoxylin and eosin (Humason, 1967).

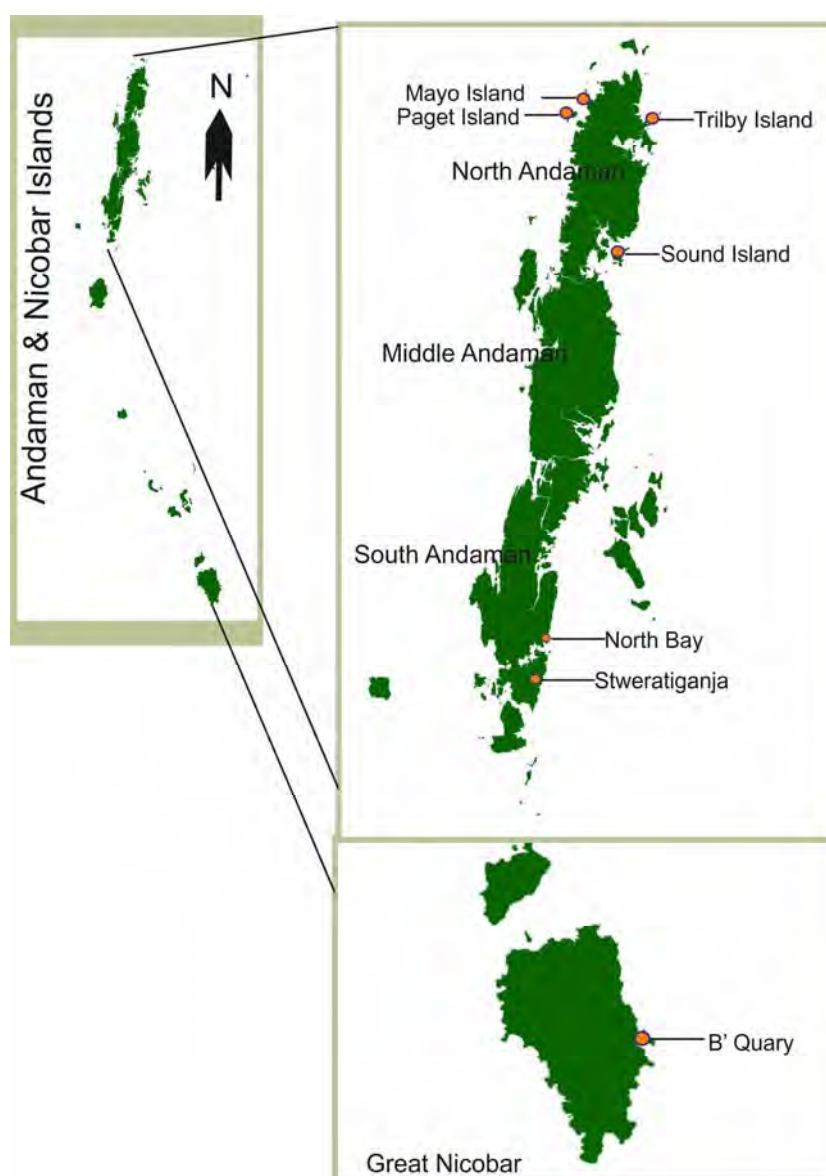


Fig. 1 Map showing area in which new record of sea anemone found in Andaman and Nicobar Islands.

3 Results and Discussion

Systematics

Phylum CNIDARIA

Class ANTHOZOA

Order ACTINIARIA

Family CAPNEIDAE Gosse, 1860

Genus *Actinoporus* Duchassaing, 1850

3.1 *Actinoporus elegans* Duchassaing, 1850 (Fig. 2)

Synonyms

1850. *Actinoporus elegans*: Duchassaing, p.10.

1870. *Actinoporus Elegans* [sic]: Duchassaing, p. 21.

1883. *Aureliana elegans*: Andres, p. 289.

Material examined: Four specimens were collected from Trilby Island, North and Middle Andaman (Lat. 13°13.588'N & Long. 093°03.447'E) and Reg. No. ZSI/ANRC- 18235.

Description: The column is fully expanded, tube shaped with longitudinal lines through which mesenterial insertions can be noticeable in *in situ*. The column is 50 mm in height; the upper portion of column is wider than the base; about 30 mm diameter distally and proximal part of column is about 10 mm diameter. The distal part of column is with longitudinal rows of vesicles; about 4-6 vesicles per row are set in endocoelic and exocoelic spaces (Fig. 2a&b). In stress condition it is borrowed in the sandy bottom; only vesicles are exposed (Fig. 2c). The oral disc is rounded; covered with very small, globular tentacles which are arranged radially from mouth to margin of oral disc. The globular tentacles are about 0.8 -1mm in diameter; set in double rows on each endocoel and exocoel space. Mouth is well-developed with conchula and with single siphonglyph (Fig. 2b-e). The pedal disc is well developed, tapered about 14 mm in diameter.

Colour: The colour of column is off white in colour. The tentacles are white in colour with light brown spots. The conchula is yellowish cream in colour.

Internal anatomy: In the transverse section of the specimen, the retractor muscles are well developed, strong, large, restricted and appear like renniform (about 720 µm width) and the lamella of retractors are not compact, divided into two parts. Mesenteries are organised unevenly in three cycles; about 16 pairs observed in the specimen. Of which two pairs are directives, only one pair is attached to single siphonglyph. Only, first cycle is perfect. Basilar muscles are well developed (Fig. 2f&g).

Habitat: *A. elegans* inhabits in sandy bottom.

Depth ranges: Found in 12 m depth.

Distribution: *India:* A&N Islands: Trilby Island, North Andaman (Lat. 13°13.588'N & Long. 093°03.447'E).

Elsewhere: Western Atlantic, from the northern coast of Brazil to Guadeloupe, Jamaica, and Curaçao (Correa, 1973), Cape Verde Islands (Wirtz, 2009) and Mexico (Gonzalez-Munoz et al., 2013).

Remarks: *A. elegans* is new distributional record to India reported from Andaman and Nicobar Islands. The present specimen is comparatively smaller than those of the southern Gulf of Mexico. Moreover, it is observed that there is no difference in the colour patterns of tentacles and oral disc for this species as reported from Venezuela, whereas the specimen observed in Gulf of Mexico are multi-coloured (Gonzalez-Munoz et al. 2013). In present specimen, gametogenic tissue is not observed possibly due to immaturity of the specimen. From India, Menon (1927) identified *Actinoporus elonagatus* as *Actinoporus elegans* erroneously which lacks vesicles in the column.

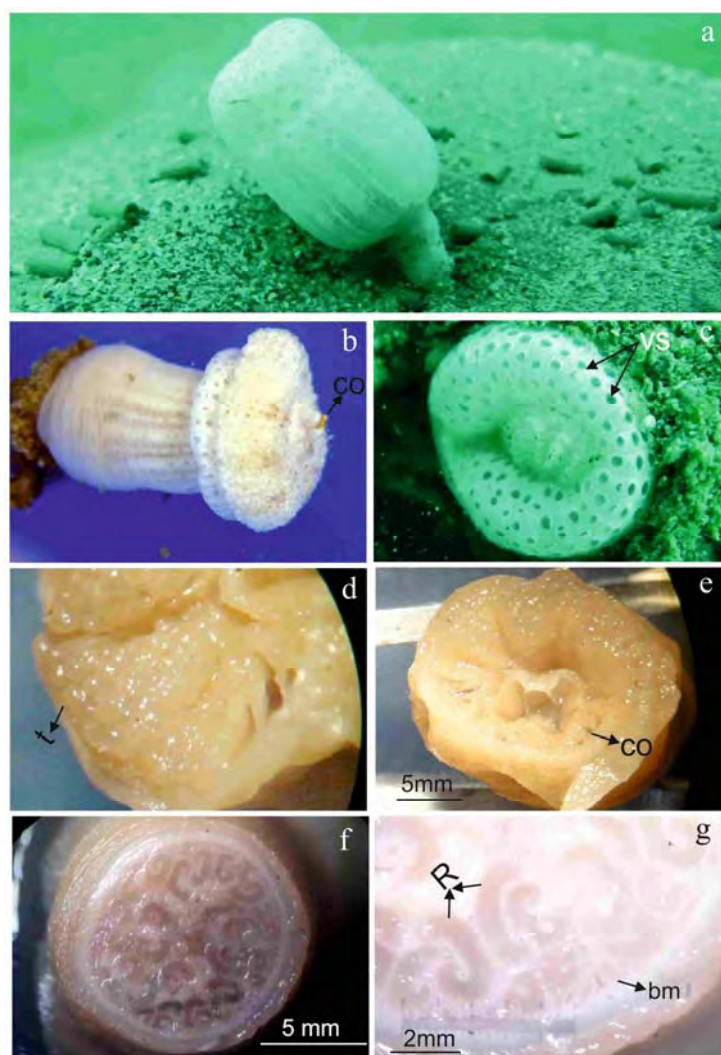


Fig. 2 External and internal morphology of *Actinoporus elegans*. [a. *In situ*; b. *Ex situ*; c. Vesicles; d. Tentacles; e. Oral disc in preserved condition; f. Transverse section; g. Retractor muscles. co: Conchula; R: Retractor muscles; vs: Vesicles.]

Family THALASSIANTHIDAE Milne Edwards, 1857

Genus *Thalassianthus* Leuckart, 1828

3.2 *Thalassianthus aster* Rüppell & Leuckart, 1828 (Fig. 3)

Synonyms

1828. *Thalassianthus aster*: Leuckart in Ruppel, p.5

1834. *Epicladia quadrangula*: Ehrenberg, p. 42

1877. *Thalassianthus aster*: Klunzinger, p. 89

1900. *Thalassianthus aster*: Carlgren, p. 87

Material examined: Two specimens were collected from Sound Island (Lat. 12°56.513'N & Long. 092°57.269'E) and Registration No. ZSI/ANRC-18196.

Description: The specimen is found attached to dead coral, fully expended in *in situ* with 40 mm in diameter. The upper part of column is with verrucae (Fig. 3a&b). The pedal disc is well developed. After preservation, the specimen is less folded; about 25 mm diameter (Fig. 3c&d). The oral disc has permanent tentacular lobes

which bear the grape like nematospheres at the aboral face and the branched tentacles on the oral face of the tentacular structure. The marginal tentacles are orally and aborally flattened and set at the margin not more than one exocoel (Fig. 3e&f). Mouth is round; siphonglyphs not connected with directives. The mesenteries at the distal region of column are not more than the mesenteries at proximal part (Fig. 3g).

Colour: The colour of column is off white with light pink verrucae. The tentacles are purplish brown in colour and the nematospheres are olive green. After preservation, the specimen is whitish in colour.

Habitat: *T. aster* inhabits in coral reef; the present specimen was attached to dead coral.

Depth ranges: Found in 10 m depth

Distribution: *India:* A&N Islands: Sound Island, North and Middle Andaman (Lat. 12°56.513'N & Long. 092°57.269'E). *Elsewhere:* The Red Sea, Zanzibar (Carlgren, 1949)

Remarks: *T. aster* is new distributional record to India reported from Andaman and Nicobar Islands.

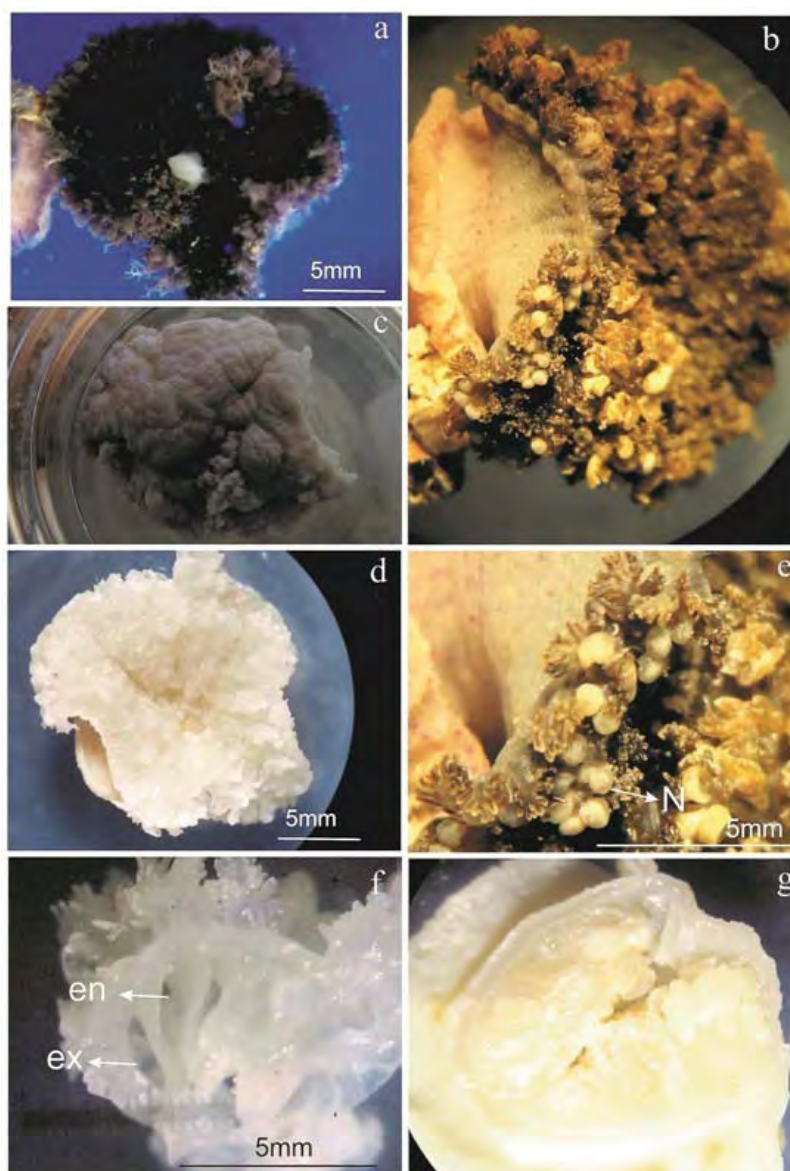


Fig. 3 External and internal morphology of *Thalassianthus aster*. [a. *Ex situ*; b. Microscopic view; c. Pedal disc; d. Preserved specimen; e. Nematospheres; f. Endocoel and exocoel; g. Transverse section. en: Endocoel; ex: exocoel; N: Nematospheres]

Family THALASSIANTHIDAE Milne Edwards, 1857

Genus *Heterodactyla* Hemprich & Ehrenberg in Ehrenberg, 1834

3.3 *Heterodactyla hemprichii* Ehrenberg, 1834 (Fig. 4)

Synonyms

1834. *Heterodactyla hemprichii*: Ehrenberg, p. 42

1877. *Heterodactyla hemprichii*: Klunzinger, p.90

1922. *Thalassianthus hemprichi*: Stephenson, p. 296

Material examined: Five specimens were collected from different regions of Andaman Islands: Duncan Bay (Lat. 13°27.860'N & Long. 092°52.229'E) and Reg. No. ZSI/ANRC-16953; Trilby Island (Lat. 13°24.577'N & Long. 093°04.266'E) and Reg. No. ZSI/ANRC-18195; Mayo Island (Lat. 13°27.900' N & Long. 092°51.945' E) and Reg. No. ZSI/ANRC-18199.

Description: The specimen is fully expanded *in situ* with 140 mm in diameter (Fig. 4a). The column is urn shaped and upper part of column is with verrucae. After preservation, the specimen is strongly folded; it is about 100 mm diameter. The whole oral disc is filled with tentacles which are closely arranged (Fig. 4b&c). Two siphonglyphs are present with well developed (Fig. 4d). The oral disc has permanent tentacular lobes which bear the cluster of nematospheres at the aboral face and the branched tentacles on the oral face of the tentacular structure. The exocoelic tentacles are orally and aborally flattened. The endocoelic tentacles are short, branched, radially arranged from the mouth to margin of oral disc (Fig. 4e&f). Two pairs of directives are present. Retractor muscles are well developed, strong, diffused and band like. Basilar muscles are well developed. The mesenteries present at distally are more than the proximal part (Fig. 4g&h).

Colour: The colour of column is light coloured with purplish verrucae. The tentacles are green in colour and the nematospheres are green with fluorescent yellow spots.

Habitat: *H. hemprichii* inhabits in coral reef; the present specimen was found attached to coral.

Depth ranges: Found in 12 m depth.

Distribution: *India:* A&N Islands: Duncan Bay (Lat. 13°27.860'N & Long. 092°52.229'E), Trilby Island (Lat. 13°24.577'N & Long. 093°04.266'E), Mayo Island (Lat. 13°27.900' N & Long. 092°51.945' E), Paget Island (Lat. 13°26.608'N & Long. 092°50.738'E).

Elsewhere: The Red Sea, Zanzibar, Sumatra, Emma Bay, Australia (Carlgren, 1949).

Remark: *H. hemprichii* is new distributional record to India reported from Andaman and Nicobar Islands.



Fig. 4 External and internal morphology of *Heterodactyla hemprichii*. [a. *In situ*; b. Column; c. Preserved specimen and oral disc; d. Siphonglyphs; e. Exocoel; f. Nematospheres; g. Transverse section; h. Retractor muscles. Ex: exocoel; N: Nematospheres; R: Retractor muscle; Si: Siphonglyph.]

Family HALIACTINIDAE Carlgren, 1949

Genus *Pelocoetes* Annandale, 1915

3.4 *Pelocoetes exul* (Annandale, 1907) (Figs. 5, 6 & 7)

Synonyms

1907. *Metridium schillerianum* var. *exul*: Annandale, p. 48–73 (original description)

1915. *Pelocoetes exul*: Annandale, 69, 76; 86–88

Material examined: Four specimens collected from Stewartgunj (Lat. 11°43.961'N; Long: 092°42.546'E), at the depth of 1 m. Registration No. ZSI/ANRC-14911. Seventeen histological slides were prepared from two specimens.

Description: The pedal disc is well developed with 5.747 mm in diameter in contraction form (Fig. 5a&b). The column is 12.429 mm long which is divisible into scapus and capitulum. The scapus is 9.355 mm diameter and 8 mm long; the capitulum is 4.368 mm long (Fig. 5c). Oral disc flares abruptly at distal end of capitulum; proximal end may be bulbous. Scapus is with 48 longitudinal streaks. Every fourth line, at the distalmost end, a longitudinal row of 7 elevated warts or cinclides are present (Fig. 5c) that span endocoelic space. Thus 12 rows of cinclides are present in the body. The cinclides are prominent and large (about 0.635 mm diameter), lessening in size proximally (Fig. 5d). Acontia is emitted through cinclides. Very light longitudinal lines on capitulum, dark lines on scapus as well as horizontal lines are visible (Fig. 5c). Oral disc is unpatterned, rudimentary, with 12 unmarked tentacles. 6 single tentacles arise beside mouth, alternate with 6 compounds, branched and pedicellate ones at margin (Fig. 5e). Each compound tentacle has single pedicel bearing 5 branches. The length of pedicel is half of inner tentacle; tentacle beyond branch point is about same size as inner, unbranched tentacle. All tentacles are pointed. Outer tentacles arise at margin. The mouth is projected outside; oval in shape about 4 mm diameter with symmetrical deep siphonoglyphs (Fig. 5f).

Colour: The colour of scapus is yellow whereas, the capitulum is light cream colour. Central mouth and lips are dark in colour; actinopharynx is grey in colour. All tentacles are translucent, same grey as oral disc, darkening toward tip. The cinclides are cream in colour. After preservation, the specimen became colourless. Mouth region became darker than other body parts.

Internal anatomy: The transverse section of the specimen was done at the level of gametogenic tissue, just below actinopharynx. It is with five pairs of macrocnemes which are only complete mesenteries. Of which two pairs are directives. The 10 perfect mesenteries are present which are fertile (Fig. 6a&b). The retractor muscles are well developed, strong, and reniform (about 720 µm width) and the lamellae of retractors are compact (Fig. 6b). Parietobasilar and basilar muscles are weak. At the upper part of mesentery, ciliated tracts (streaks), the median band the cnido glandular tract are present (Fig. 6b). Male gonad showing well developed spermaries with visible mature gonadal packets about 0.127 mm diameter at the germinal mesentery (Fig. 6c). Mature gonadal packets are developed with abundant mature tailed sperms; spermatogonia at the periphery of mature gonadal packets, spermatozoa bundled with numerous pink coloured sperm tails in the lumen (Fig. 6d). No spinctor muscles.

Cnidae: Basitrichs and spirocysts were derived from various organs of *P. exul*. The basitrichs released from acontia are exceptionally greater in size and also numerous compared to those extracted from other body parts. And also, microbasic amastigophores are present in scapus. Capitulum contains numerous spirocysts. All the types and distribution of cnidae were given in Table 1 and all are illustrated in figure 7.

Habitat: The specimen reported here was found in mud flat area of shallow water occurring at depth of 1m. Found in Singapore in mangrove habitats at mid-intertidal level.

Distribution: *India:* A&N Islands: Stewartgunj, South Andaman (Lat. 11°43.961'N; Long: 092°42.546'E). Previously found only from east and west coasts of India (Annandale 1907 &1915; Panikkar, 1938; Parulekar, 1966, 1968 &1990).

Elsewhere: Singapore (Fautin et al., 2015).

Remarks: *P. exul* is new distributional record to Andaman and Nicobar Islands. Herein, 6 pedicellate tentacles bearing 5 branches are observed, but Fautin et al. (2015) found individuals that had 6-7 pedicellate tentacles and each single pedicel bearing 5-6 branches. It is observed that the mesenteries of the present specimen

contained male gonadal packets of uniform maturity. Recently, Raghunathan and Choudhury (2017) have erroneously identified this species as *Diadumene leucolena* (Verrill, 1866). Being of similar size in the field and the presence of cinclide, both the species were difficult to differentiate. But later, with the help of histological sections and studies of important identification characters such as the pattern of striping of column, arrangement of cinclides and presence of pedicellate tentacles revealed it as *P. exul*. Earlier, Annandale (1907) described this as a subspecies of *Metridium schillerianum* from Indian waters but in 1915, he described the genus *Pelocoetes* for it. Later, Panikkar (1938) recorded this species from Tamil Nadu.

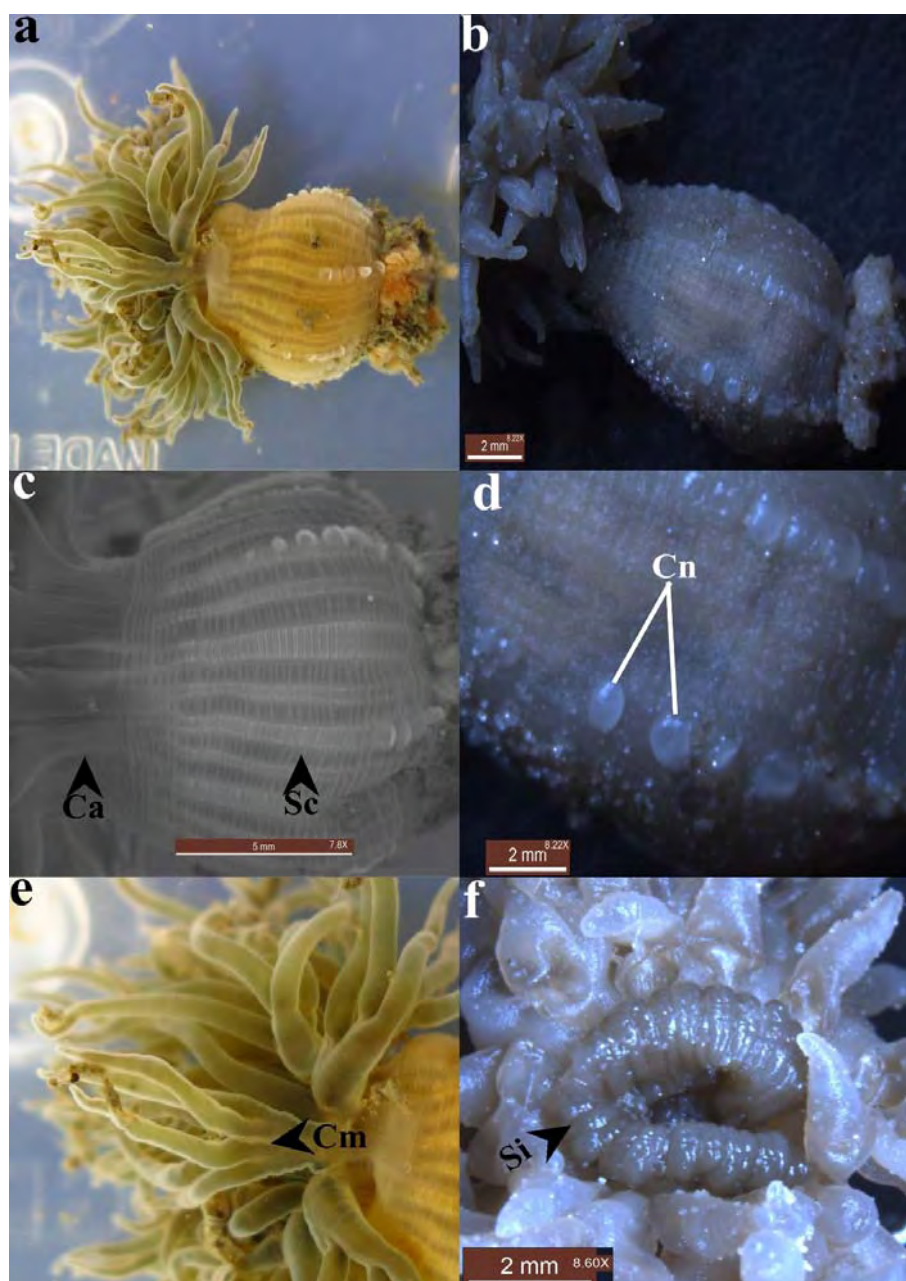


Fig. 5 External morphology of *Pelocoetes exul*. [a. *Ex situ*; b. Preserved; c. Column; d. Cinclides; e. Compound tentacles; f. Mouth. Ca: Capitulum; Sc: Scapus; Cn: Cinclides; Cm: Compound tentacle; Si: Siphonoglyph.]

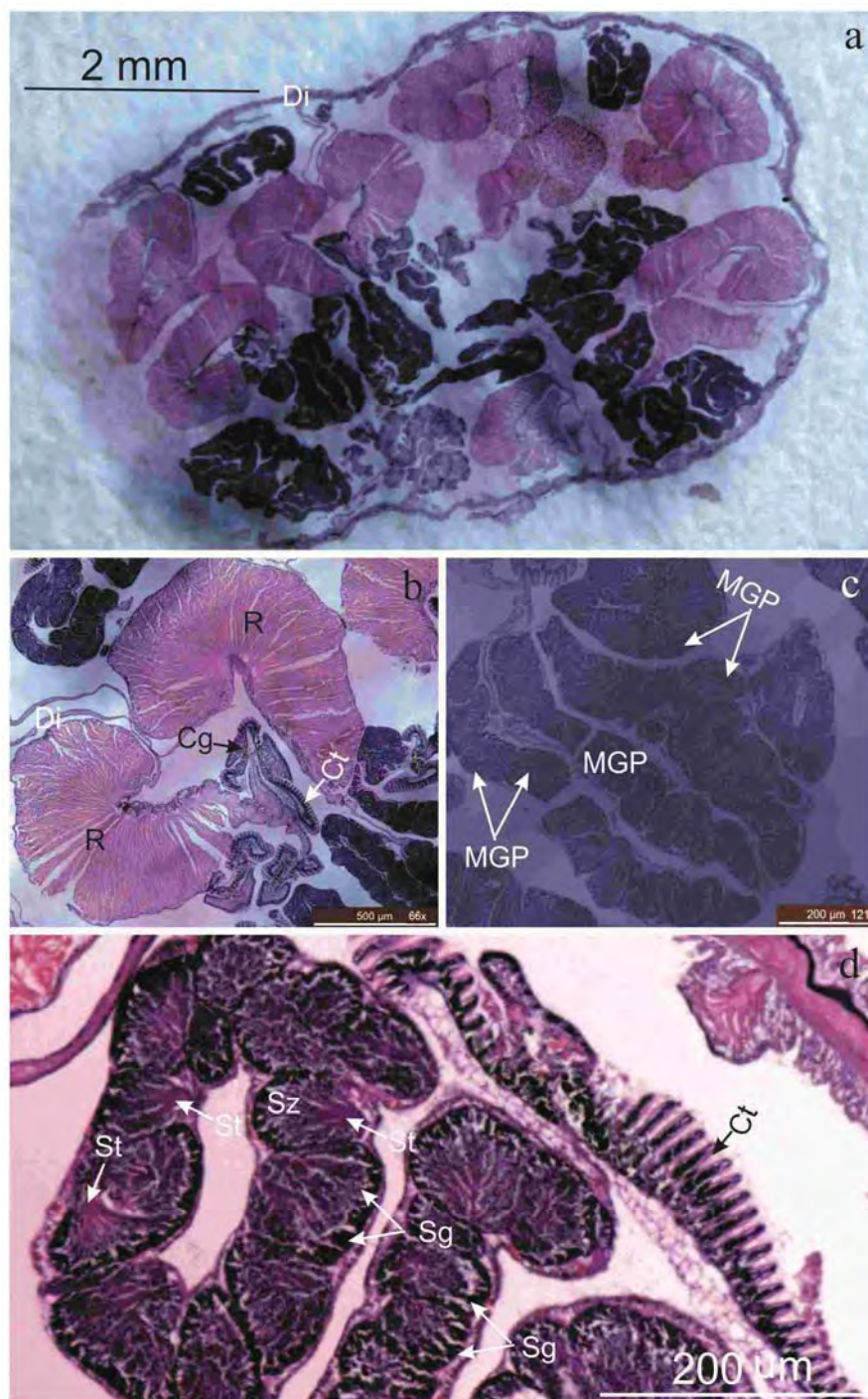


Fig. 6 Histological sections of *P. exul*. [a. Cross section through gametogenic portion of male anemone; b. Directive mesenteries with retractor muscles; c. Male gonad with numerous mature gonadal packets; d. Enlarged view of mature gonadal packets. Cg: Cnidoglandular tracts; Ct: Ciliated tracts; Di: Directive mesenteries; MGP: Mature gonadal packet; R: Retractor muscles; Sz: Spermatozoa; Sg: Spermatogonia; St: Sperm tails.]

Table 1 Morphometric measurement of cnidae in different body organs of *P. exul*. [n= Number of nematocyst measured; N= Number of individuals; F= Frequency; A= abundant; C= Common; R= rare; MPM= Microbasic *p*-mastigophores; MIA=Microbasic amastigophores; Spirocyst (G) = Gracile spirocyst]

Organs	Nematocyst Type	Length (µm)	Mean (µm)	Width (µm)	Mean (µm)	n	N	F	Status
Tentacle	Basitrich (Fig. 7a)	24.96 - 33.6	30.1	2.8-4.4	3.7	61	3	A	Unfired
	Spirocyst (Fig. 7b)	19.4- 27	25.6	1.9-3.6	2.99	70	3	A	Unfired
Actinopharynx	Spirocyst (Fig. 7c)	8.6-15.4	14.6	2.1-3.3	2.6	49	3	C	Unfired
	Basitrich (Fig. 7d)	23.04-26.9	24.7	2.4-3.84	3.1	40	3	C	Unfired
Mesenterial filament	Basitrich (Fig. 7e)	14.4-23.04	19.8	2.3-3.8	2.9	38	3	C	Unfired
	Basitrich (Fig. 7f)	3.8-5	4.1	1.7-1.9	1.8	14	3	R	Unfired
	Spirocyst (Fig. 7g)	9.7- 17.2	16.5	2.1-3.4	2.8	29	3	C	Unfired
	MPM (Fig. 7h)	6.6-8.7	7.6	1.9-2.2	2.1	7	3	R	Unfired
Acontia	Basitrich (Fig. 7i)	30.4-45.4	40.1	2.9-4.3	3.8	127	3	A	Unfired
	Spirocyst (Fig. 7j)	19.2-22.1	21.8	2.1-3.6	3.1	92	3	A	Unfired
Scapus	Basitrich (Fig. 7k)	9.3-13.5	12.5	1.8-2.3	2.2	12	3	R	Unfired
	MIA (Fig. 7l)	32.9-48.1	44.9	2.5-3.9	3.4	17	2	R	Unfired
	Spirocyst (Fig. 7m)	9.6-17.4	14.8	1.9-2.7	2.3	18	3	R	Unfired
Capitulum	Spirocyst (Fig. 7n)	14.4- 23.7	22.2	2.3-2.9	2.6	55	3	R	Unfired

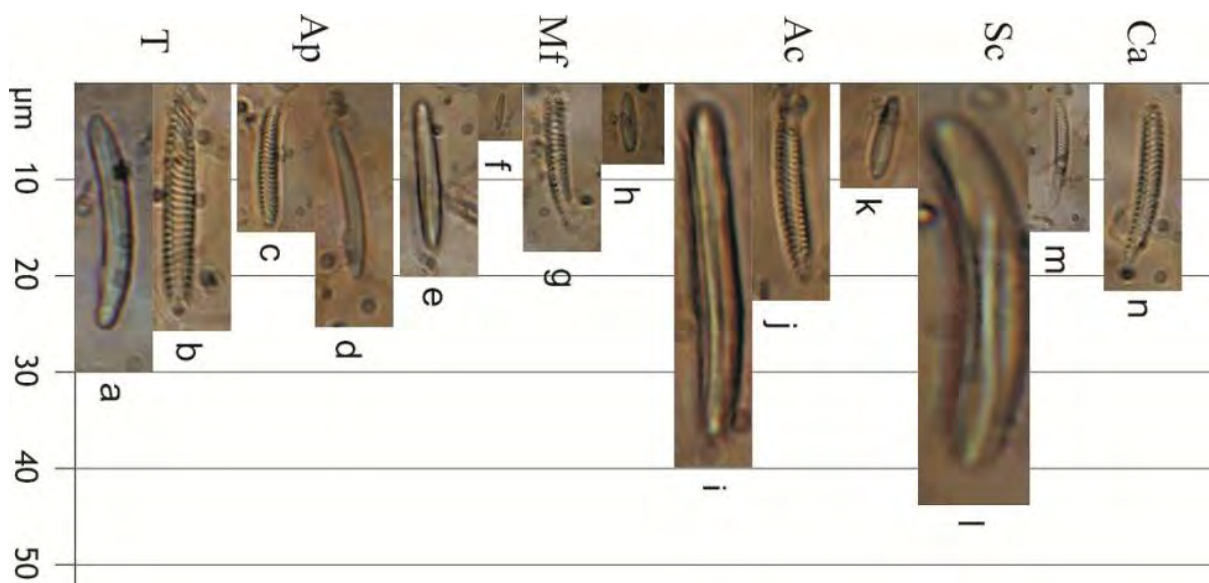


Fig. 7 Types of cnidae in different body organs of *P. exul*. [a-b from tentacles: a. Basitrich, b. Spirocyst; c-d from actinopharynx: c. Spirocyst, d. Basitrich; e-h from mesenterial filaments: e. Basitrich, f. Basitrich, g. Spirocyst, h. Microbasic *p*-mastigophore; i-j from acontia: i. Basitrich, j. Spirocyst; k-m from scapus: k. Basitrich, l. Microbasic amastigophore, m. Spirocyst; n from capitulum: n. Spirocyst. Ac: Acontia; Ap: Actinopharynx; Ca: Capitulum; MF: Mesenterial filaments; Sc: Scapus; T: Tentacles.]

Family STICHODACTYLIDAE Andres, 1883

Genus *Stichodactyla* Brandt, 1835

3.5 *Stichodactyla tapetum* (Hemprich & Ehrenberg in Ehrenberg, 1834) (Figs. 8 & 9)

Synonyms

1834. *Actinia tapetum* Hemprich & Erhenberg, 1834: 256 (Original description)

1869. *Homactis rupicola* Verrill, 1869: 71-72 (Original description)

1877. *Discosoma tapetum* – Klunzinger, 1877: 83

1898. *Discosoma ambonensis* - Kwietniewski, 1898: 387, 410-412

1898. *Discosomoides tapetum*- Haddon, 1898: 469-470

1900. *Stoichactis tapetum* - Carlgren, 1900: 94-97

1911. *Stoichactis laevis* Lager, 1911: 240-241 (Original description)

1911. *Stoichactis australis* Lager, 1911: 241-243 (Original description)

1922. *Stoichactis ambonensis* – Stephenson, 1922: 299

1949. *Stoichactis rupicola* - Carlgren, 1949: 73

1981. *Stichodactyla tapetum* – Dunn, 1981: 5, 73-78, 90, 106, 108

Material examined: Two specimens collected from Andaman and Nicobar Islands: B' Quarry in Great Nicobar Islands (Lat. 07°00.419'N; Long. 93°56.528'E) and Registration No.: ZSI/ANRC-14380; Paget Island (Lat. 13°26.441'N; Long. 92°50.423'E) and Registration No.: ZSI/ANRC-15962.

Description: *Stichodactyla tapetum* is very small carpet anemone, usually flat; slightly undulated and the measured diameter of the oral disc in the current study was approximately 50-60 mm in *in situ* and *ex situ* condition (Fig. 8a), whereas in preserved condition its diameter is about 30 mm (Fig. 8b). Flat oral disc is broader than the pedal disc. The tentacles are similar in size, tightly packed, very short and globular in shape. They are arranged in radial endocoelic rows covering entire part of oral disc from mouth to margin of the oral disc. The mouth is oval in shape with two distinct siphonoglyphs (Fig. 8c). The preserved specimen is with four cycles of tentacles. Rows of tentacles communicating with first and second order endocoels approach near mouth; tentacles communicating in wedge shaped row are the shortest, highest order rows mostly hidden between adjoining lower order rows (Fig. 8d). All tentacles are similar, but the length may vary. The exocoelic tentacles are more robust than endocoelic one; marginal and tentacles up to 1.496 mm in length and endocoel tentacles are about 0.8 to 1 mm long (Fig. 8e). In preserved specimen, endocoelic tentacles are 0.59 mm long. Few tentacles are slightly larger in size. Tentacles may be polygonal in outline, like vesicles or kernels of maize (Fig. 8f). The column is without verrucae, but with prominent groove at entire part of column from margin to pedal disc (Fig. 8g) and its diameter is 20 mm.

Colour: The coloration of tentacles on oral disc are appearing in a rainbow colours, filled with mixture different colors of chocolate brown, cream with light brown tips and light green. Few tentacles are slightly larger in size with prominent white colour with brown tip and the margin of tentacles is white with light brown tips. The coloration of column is creamish orange and greenish grey; the basal disc is in white background with irregular red splotches.

Cnidae: Basitrichs, spirocysts and microbasic *p*-mastigophores were derived from various organs of *S. tapetum*. Large sized basitrichs are released from tentacles are exceptionally numerous compared to those extracted from other body parts. All the types and distribution of cnidae were given in Table 2 and all are illustrated in Plate 8.

Habitat: The current specimen was observed in coral reef. Earlier, it was found on rocks and it was reported before from sand flats and rock crevices (Fautin et al. 2009). It inhabits shallow waters as solitary, not firmly attached to rocky substrates (Fariman and Javid, 2015).

Depth ranges: Found between 10 and 15 m.

Distribution: *India:* Andaman Islands: Paget Island and North Bay; Nicobar Islands: B' Quarry; Gujrat.

Elsewhere: From Japan to Australia, Indian Ocean to New Caledonia and Red Sea (Dunn, 1981; Fautin and Allen, 1992; Fautin et al., 2008), and Singapore (Fautin et al., 2009); southeastern coast of Iran (Fariman and Javid, 2015); Taiwan and the Pescadore Islands (insular China) (Guo et al., 1996); Korea (Song and Cha, 2004).

Remarks: *Stichodactyla tapetum* is a new distributional record to Andaman and Nicobar Islands. In the present study, the size and distribution of cnidae are nearly similar to those reported by Dunn (1981). *S. tapetum* is mistaken for a small one of *S. haddoni* (Saville-Kent, 1893). Both the species are having short, bulbous tentacles. However, empty space is visible between wedge shaped groups of tentacles of *S. tapetum* whereas tentacles cover the entire oral disc of *S. haddoni* (except around the mouth). Secondly, *S. tapetum* is much smaller than a typical specimen of *S. haddoni*. Thirdly, the exocoelic tentacles of *S. haddoni* are commonly prominent, often projecting radially from the oral disc and be pigmented white whereas exocoelic tentacles of *S. tapetum* are less conspicuous. The present species host for no anemone fish. Earlier, it was described that *Stichodactyla tapetum* is not associated with anemonefish (Fautin et al., 2008). And also, Fariman and Javid (2015) observed no symbiotic life with *S. tapetum* in Iranian species. In contrast, adult specimens of anemone shrimps *Thor amboinensis* and *Periclimenes ornatus* are commonly found with *S. tapetum* in Taiwan and the Pescadore Islands (insular China) (Guo et al., 1996). Earlier, it was reported as new record from Gujarat. But, the information about the taxonomical key characters of this species was not provided in detail (Shah et al., 2017). Herein, the morphological features of this species were critically analysed in *in situ* and *ex situ* as well as nematocyst extraction of the preserved specimens.

Table 2 Morphometric measurement of cnidae in different body organs of *S. tapetum*. [n= Number of cnidae measured; N = Number of individuals; F = Frequency; A = Abundant; C = Common; R = Rare; S = Sporadic; MPM= Microbasic p-mastigophores; Spirocyst (G) = Gracile spirocyst]

Organs	Type of cnidae	Range of Length (µm)	Mean (µm)	Range of Width (µm)	Mean (µm)	n	N	F
Tentacles	Spirocyst (G) (Fig. 9a)	9.1- 25.5	18.6	1.4-2.7	2.5	80	2	A
	Basitrich (Fig. 9b)	11.4-20.0	17.5	1.4-2.3	1.9	21	2	C
	Basitrich (Fig. 9c)	23.6-32.8	28.9	1.8-3.2	3	83	2	A
Actinopharynx	MPM (Fig. 9d)	25.3- 37.2	32.7	4.6-6.9	5.4	17	2	C
	Basitrich (Fig. 9e)	10.6- 20.1	17.8	2.1-2.7	2.3	21	2	C
	Basitrich (Fig. 9f)	21.8- 33	29.6	2.3-3.5	2.8	43	2	C
Mesenterial filaments	Spirocyst (Fig. 9g)	14.9-30.2	28.8	1.9-2.8	2.2	12	2	S
	Basitrich (Fig. 9h)	23.2-42.0	34.5	2.6-3.1	2.8	68	2	C
	MPM (Fig. 9i)	22 - 43.6	39.9	5.3-6.9	6.5	37	2	C
Column	Spirocyst (Fig. 9j)	13.7- 24.9	21.6	1.8-3.1	2.7	7	2	R
	MPM (Fig. 9k)	20.2- 30.4	28.8	4.3- 6.6	5.1	4	2	R
	Basitrich (Fig. 9l)	14.2-26.7	23.4	2.3-3.2	3.1	72	2	A
	Holotrich (Fig. 9m)	23.7-38.7	35.6	4.1-4.8	4.6	12	2	R

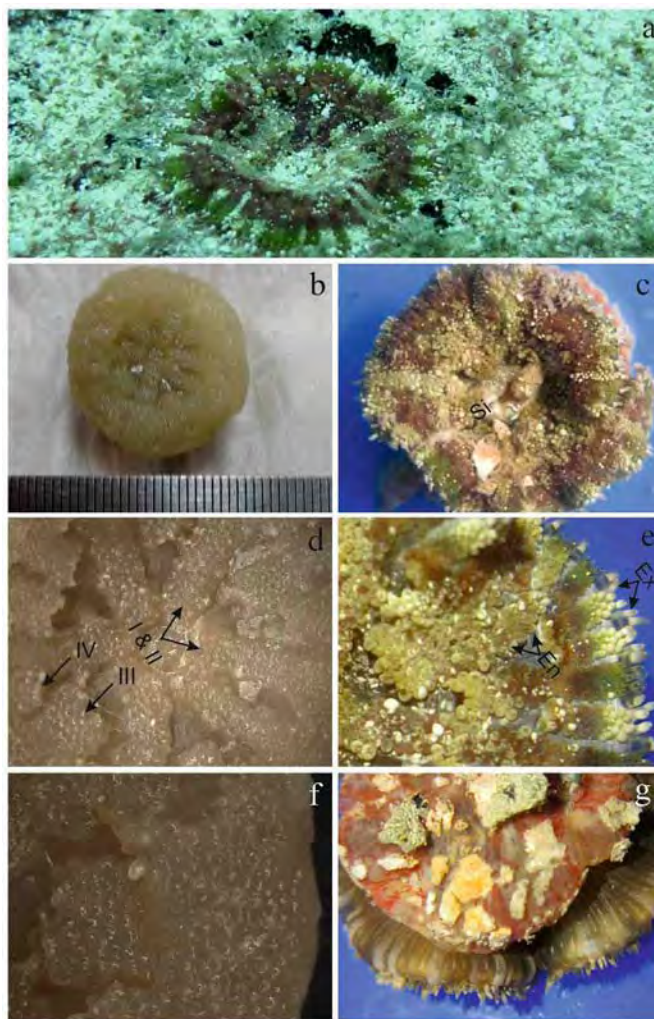


Fig. 8 External morphology of *Stichodactyla tapetum*. [a. *In situ*; b. Preserved specimen; c. Oral disc and mouth; d. Arrangement of tentacles; e. Types of tentacles; f. Microscopic view of tentacles; g. Column and pedal disc. En: Endocoel; Ex: Exocoel; I: First order cycle; II: Second order cycle; III: Third order cycle; IV: Fourth order cycle; Si: Siphonoglyph.]

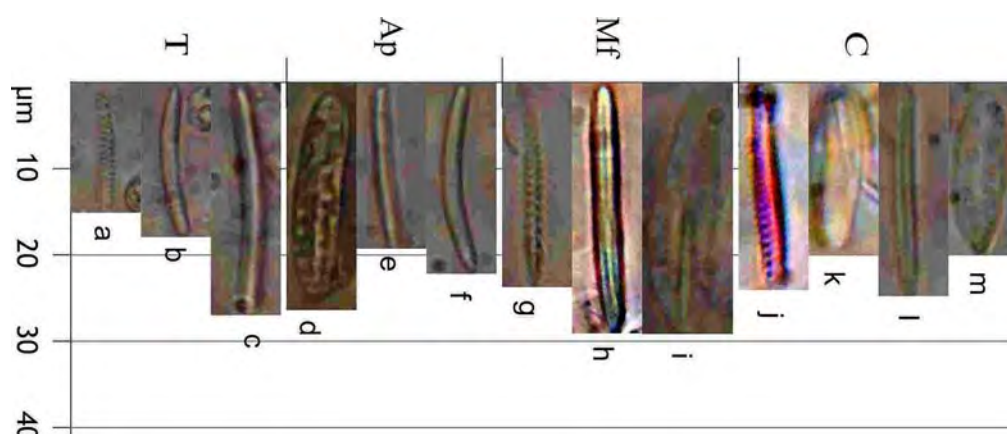


Fig. 9 Types of cnidae in different body organs of *S. tapetum*. [a-c from tentacles: a. Spirocyst, b. Basitrich, c. Basitrich; d-f from actinopharynx: d. Microbasic *p*-mastigophore, e. Basitrich, f. Basitrich; g-i from mesenterial filaments: g. Spirocyst, h. Basitrich, i. Microbasic *p*-mastigophore; j-m from column: j. Spirocyst, k. Microbasic *p*-mastigophore, l. Basitrich, m. Holo-trich. Ap: Actinopharynx; C: Column; Mf: Mesenterial filaments; T: Tentacles.]

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