

New Record of Colonial Ascidians from South West Coast off India

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Abstract: Though the south west coast of India is being dotted with more than 4 major and number of minor ports which are ideal places for settlement of ascidians, the ascidian fauna is poorly investigated with fewer than 50 species being known from that zone. The number is significantly less than in other regions. Hence the present study was carried with the aim of documenting the availability of ascidians along the south west coast off India. A total of 23 species of ascidians reported in the present study. Out of 23, seven species such as *Polyclinum tenuatum*, *Aplidiopsis confluata*, *Synoicum prunum*, *Didemnum fragile*, *D. tonga*, *Trididemum miniatum* and *T. spumosum* are reported for the first time in Indian waters. Taxonomical descriptions of these species are discussed.

Key words: Colonial ascidians · Didemniidae · Polycliniidae · New record · South west coast of India

INTRODUCTION

In India, a comprehensive treatments of the class Ascidiacea or Tunicata belongs to the Sub phylum Prochordata, commonly called as sea-squirts, are presented by earlier workers and examination of additional material is revealing further diversity in this class of the Tunicata which abounds around the south west coast of India. Though the south west coast of India is being dotted with more than 4 major and number of minor ports which are ideal places for settlement of ascidians, the ascidian fauna is poorly investigated with fewer than 50 species [1,2] being known from that zone. The number is significantly less than in other regions. With this in mind, an attempt has been made to study the occurrence of ascidians along the south west coast off India.

MATERIALS AND METHODS

Three stations were sampled along the south west coast of India during 2008-2009 covering Leepuram (Lat 8°07' N – Long 77° 33' E), China Muttom (Lat 8° 06'N - Long 77° 34'E) and Vizhinjam Bay (Lat 8°22'30"N – Long 76°56'15"E) (Fig. 1).

Collection, narcotization, preservation and identification are the important aspects of this present study. Intertidal sites were visited at low tides and

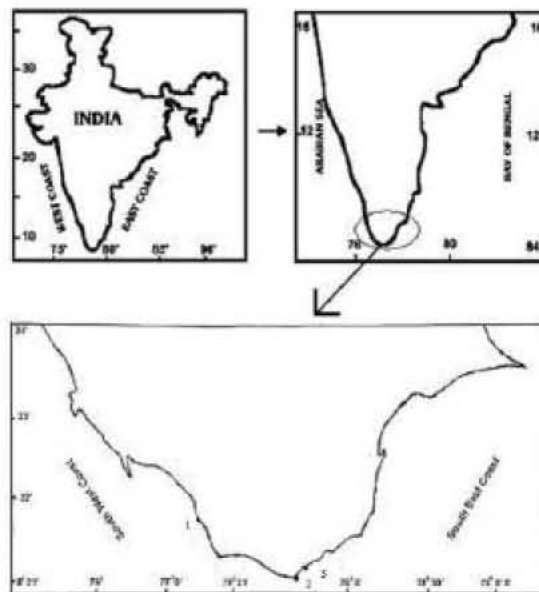


Fig. 1: Map showing the study areas (1. Vizhinjam Bay, 2. China muttom and 3. Leepuram)

a variety of collection methods were used to obtain the organisms. At the marina in Vizhinjam Bay, organisms were collected using hand tools to remove materials from bumper tires, docks and marina floats. SCUBA divers sampled the marina to the undersides of floating docks.

Specimens were carefully dislodged from their surfaces using a sharp fishing knife. Ascidians attached with sponges, coral pieces, sea grasses and molluscs which were accidentally caught during deep fishing were also collected from the fishing nets. All the specimens were narcotized with menthol crystals for up to 3 hours and were fixed quickly in 10% formalin. The specimens were sorted and identified with dissection, compound and/or digital binocular microscopes using various taxonomic keys and references.

RESULTS

The collections made in this present study are exclusively colonial species, which are invariably internally fertilized, brooding their embryos internally and with larvae free-swimming for particularly short periods. Further, these characteristics of colonial ascidians are particularly conspicuous in the Didemnidae, the most specious family in the tropical ascidian fauna and Polyclinidae.

In present study, a total of 23 species of ascidians including 7 new records are identified (Table 1). Out of 23, seven species including three species such as *Polyclinum tenuatum*, *Aplidiopsis confluata*, *Synoicum prunum* belong to the family Polyclinidae (Table 2) and four species such as *Didemnum fragile*, *D. tonga*, *Trididemnum miniatum* and *T. spumosum* belong to Didemnidae (Table 3) are reported for the first time in Indian waters. The taxonomical descriptions of these species are given below:

Table 1: The distribution of ascidian species in the three different stations

Species	Stations		
	1	2	3
Stolidobranchia			
Styelinae			
<i>Styela bicolor</i> Sluiter, 1887	x	--	--
<i>S. canopus</i> Savigny, 1816	x	--	--
Pyuridae			
<i>Microcosmus exasperatus</i> Heller, 1878	x	x	--
<i>M. helleri</i> Herdman, 1881	x	--	--
<i>M. squamiger</i> Micahelson, 1927	x	x	--
<i>Herdmania pallida</i> Savigny, 1816	x	x	x
Aplousobranchia			
Polycitoridae			
<i>Eudistoma laysani</i> (Sluiter, 1990)	x	--	--
Polyclinidae			
<i>Aplidium multiplicatum</i> Sluiter, 1909	x	--	--
<i>Synoicum prunum</i> (Herdman, 1899)	--	x	--
<i>Aplidiopsis confluata</i> Kott, 1992	x	--	--
<i>Polyclinum constellatum</i> Savigny, 1816	x	--	--
<i>P. incrustatum</i> Michaelsen, 1930	--	x	--
<i>P. tenuatum</i> Kott, 1992	--	x	x
Didemnidae			
<i>Didemnum candidum</i> Savigny, 1816	x	x	x
<i>D. fragile</i> Sluiter, 1909	x	x	--
<i>D. moseleyi</i> Herdman, 1866	x	--	--
<i>D. psammathodes</i> Sluiter, 1895	x	x	x
<i>D. nekozita</i> Tokioka, 1967*	x	--	--
<i>D. tonga</i> (Herdman, 1886)	x	x	--
<i>Trididemnum clinides</i> Kott, 1977	x	--	--
<i>T. miniatum</i> Kott, 1977	--	--	x
<i>T. spumosum</i> Kott, 1992	x	--	--
<i>Diplosoma similis</i> Sluiter, 1909	x	--	x
	19	10	6

Table 2: Summary of characters of Polyclinids of the South west coast of India

Colony	Test	Zooids						
		Shape	Size (mm)	Atrial languet	Stigmata row	No. stigmata/row	Branchial papilla	Gut loop
<i>Polyclinum tenuatum</i>	fleshy cushion with out sand	Gelatinous	3	R	13	12	5-6 minute	Twisted
<i>Aplidiopsis confluata</i>	Soft, cushion with some sand particles	soft and translucent	10	S	16	14	Absent	Large and Vertical
<i>Synoicum prunum</i>	large oval with sandy base	firm and gelatinous	8	R	16	9-11	Absent	Twisted

Note: R: from the rim of atrial siphon; S: separate from atrial siphon

Table 3: Summary of characters of Didemnids of the South west coast of India

Colony	Shape	Spicules	Zooids									
			Number of rays	Branchial lobes	Atrial aperture	Retractor muscle	Male Gut loop	Vas follicles	Vas deferens	Size (mm)	Endostyelar pigment cap	Stigmata
<i>Didemnum fragile</i>	Encrustated, thick sheet	Gb	Numerous	6	Wide	M	L	1	6	1.0	-	8 oval
<i>D. tonga</i>	Encrustated, thin sheet	St	7-9	6	Wide	M	M	1	81/2	1.3	-	9 long
<i>Trididemnum miniatum</i>	Encrustated, thin sheet	Gb	10-12	6	Transverse	M	M	1	51/2	0.6	-	7 oval
<i>T. spumosum</i>	Soft and cushion	Br/Gb	7-8	6	Transverse	S	M	1	-	0.3	-	8 oval

Note: St: Stellate, Gb: Globular, Br: Burr like, M: Medium, S: Small, L: Large

TAXONOMY

Family: Polyclinidae Milne Edwards, 1842 [3]: The family originally was established for genera with the gonads in a posterior abdomen. In the family Polyclinidae, the branchial aperture has a regularly lobed rim, but the atrial aperture is not lobed. The latter opens into the common cloaca guided by an anterior lip that either is a projection from the body wall anterior to the opening, or is produced from the anterior border of the opening. Minute branchial papillae that may be relicts of internal longitudinal vessels are present. Gonads are in the posterior abdomen. These consist of a small ovary and numerous male follicles. The larvae are small and have an otolith and ocellus, 3 small median adhesive organs, ectodermal ampullae and vesicles. The six genera of the family Polyclinidae are Polyclinum, Aplidiopsis, Synoicum, Sidneioides, Aplidium and Morchellium.

1. *Polyclinum tenuatum* Kott, 1992 [4] (Fig. 2)

Synoicum papilliferum Kott, 1963 [5]

Records

New Records: Chinna muttom and Lee purum along the Southwest coast of India.

Previous Records: New South Wales [4]

Description

Habitat: Attached on the small stones and piling. Also found attached with ropes used for sea weed culture at Leepuram. Distributed vertically up to 10 m along the ropes and low intertidal zones also.

Colony: The colonies are fleshy cushion sheets up to 6 cm in maximum extent with rounded border. The colonies are fixed to the substrate by the whole of the under surface. Dark green in color. The test is gelatinous.

Internal Structure: The thorax and abdomen are together about 3 mm long. The posterior abdomen is short and sac like. Long atrial languet is produced forwards from the upper rim of the atrial siphon. 5-6 minute pointed papillae form a fringe along the straight tip of the atrial lip. 13 rows of up to 12 relatively short oval stigmata with conspicuous conical branchial papilla. The gut loop is twisted and the distal part of the loop curves forward as is a characteristic for the genus.

Remarks: This species is first reported by Kott, 1992 in Australian waters. The present observation has similarities with *P. solum* but the later has a long thorax with more rows of fewer stigmata and lacks branchial

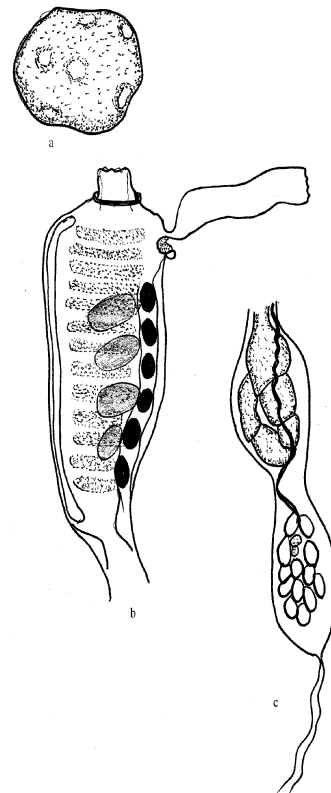


Fig. 2: *Polyclinum tenuatum* n. sp Kott, 1992
a. Colony; b. Thorax; c. Abdomen and Post abdomen Scales: a, 0.5 cm; b, c, 1.0 mm

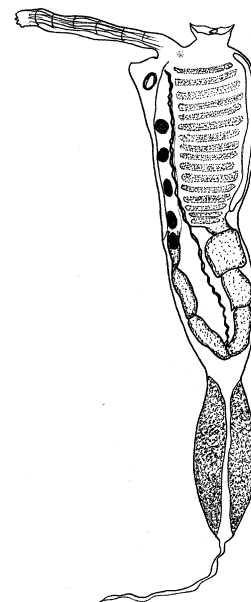


Fig. 3: *Aplidiopsis confluata* n. sp. Kott, 1992
Zooid Scale: 1 mm

papilla. This species is distinguished from *P. terranum* n. sp. by the smaller zooids. In *P. terranum* n.sp. the similar branchial papilla and atrial lip are present but its zooids are larger.

2. *Aplidiopsis confluata* Kott, 1992 (Fig. 3)

Records

New Record: Vizhinjam Bay, South west coast of India.

Previous record: Tasmania, Ninepin Pint [6]

Description

Habitat: Colonies are attached to intertidal rocks, dead corals and over the bivalve shells. Distributed from 2 m to 15 m depths where they are found on hard substrata in protected embayment and harbour.

Colony: The colony is soft and cushion like about 3.0 cm in diameter attached by a thick, wrinkled stalk and some sand on it. The test is soft and translucent internally. Zooids are cross one another in the centre of the colony.

Internal Structure: Zooids are of about 1 cm long with maximum length of 3mm of thorax and the abdomen is about 1.5 mm. Posterior abdomen is wide and long crowded with gonads and pigments. Branchial aperture has 6 small pointed lobes. There is a long, flat wide tongue from the body near the anterior edge of the first row of stigmata. A sphincter muscle is present at the atrial opening. There are 16 rows of up to 14 stigmata. The gut loop is vertical. The duodenum expands in diameter to its junction with short proximal part of the intestine. The posterior abdomen is long extending into the center of the colony. Gonads are observed at the middle part of the posterior abdomen. The gonads are of various sizes randomly distributed in the cluster and they are not in regular series.

Remarks: The species is unique in its soft sand free test, crowded zooids and their long posterior abdomen each with long bunch of testis follicles. It resembles the other *Aplidiopsis mammillata* n. sp. in its long longitudinal muscles confined to the anterior part of the long delicate thorax and the absence of branchial papillae. This genus resembles those of *Polyclinum*. The zooids differ mainly in the absence of branchial papillae, the relatively large and vertical gut loop. The relatively large, vertical gut loop and the larger zooids of *Aplidiopsis* are very often, the only reliable characters to distinguish it from *Polyclinum*.

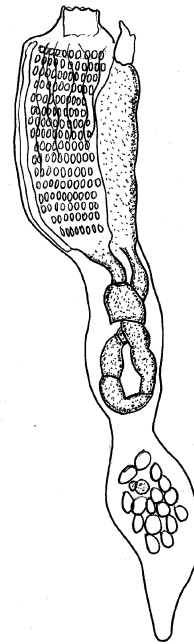


Fig. 4: *Synoicum prunum* (Herdman, 1899) Zooid
Scale: 0.3 mm

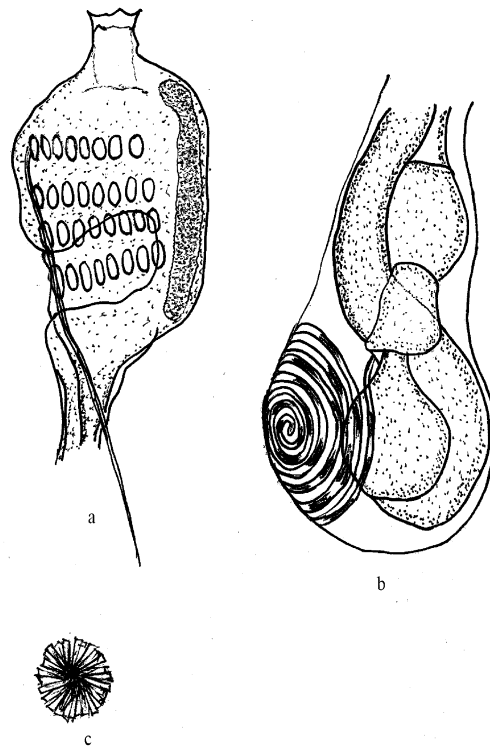


Fig. 5: *Didemnum fragile* Sluiter, 1909
a. Thorax; b. Abdomen; c. Spicule
Scales: a, b, 0.2 mm; c, 0.004 mm

3. *Synoicum prunum* (Herdman, 1899) (Fig. 4)

Psammaplidium prunum Herdman, 1899 [7]

Synoicum prunum: Kott, 1963 [6]

Records

New Records: Chinna muttom and Vizhinjam Bay along the Southwest coast of India.

Previous Records: New South Wales and Queensland [4]; New South Wales [7].

Description

Habitat: Attached on rocks, algae and sea weeds. Occurs from the low intertidal to 15 m depth.

Colony: Colony is large oval with sandy base. It is about 5 cm high and 3 cm in diameter. The test is firm and gelatinous. It is opaque in preservative. The outer test is embedded with sand. The long threads like zooids are found.

Internal Structure: Zooids are of about 8 mm long and thread like with long posterior abdomen. The thoraces are longer and narrower than the abdomen. About 10 long muscles are on the thorax. The atrial lip is fleshy with anterior rim of the atrial opening has a straight tip. There are 16 rows with up to 9 – 11 stigmata per row. Characteristically long oesophagous curves to enter smooth and small stomach. The long duodenum, inflated mid intestine and posterior stomach are distal to the stomach in the gut loop.

Remarks: This species resembles the *Polyclinum madrasensis* n.sp. [8] in Madras coast off India) in size and colour. Kott, 1992 observed 15 rows with up to 8 stigmata per row in this species but in the present observation it was 9-11 per row. *Synoicum citrum* differs from *S. prunum* by longer zooid, fewer rows of stigmata and more stigmata per row.

Key to the Genera of Polyclinidae Recorded from India:

- Constriction present between abdomen and Posterior abdomen 2
Constriction not present between abdomen and Posterior abdomen.....*Synoicum*
- Gut loop voluminous, not twisted and vertical. No branchial papillae...*Aplidiopsis*
Gut loop small, twisted and horizontal. Branchial papillae present.....*Polyclinum*

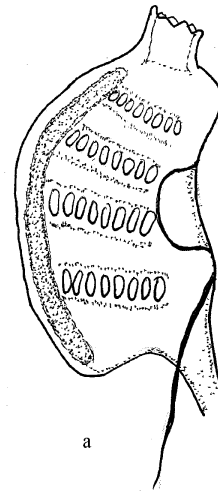


Fig. 6: *Didemnum tonga*
a. Thorax Scale: 0.1 mm

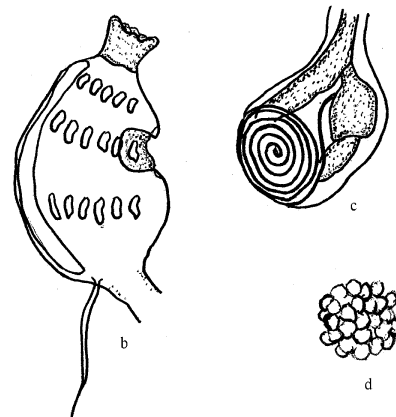
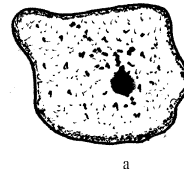


Fig. 7: *Trididemnum miniatum*
a. Colony; b. Thorax; c. Abdomen; d. Spicule
Scales: a, 1.0mm; b, c, 0.1 mm; d, 0.05mm

Family: Didemnidae (Giard, 1872) [9]: It is characterized by its small zooids divided into thorax and abdomen. The former consisting of a large pharynx perforated by 3 or 4 stigmata. Gonads in the abdomen respectively dorsal or posterior to the short, vertical or ventrally flexed gut loop consist of a small ovary with only one egg maturing at a fine and dome shaped to spherical or oval, entire, subdivide, with the vas deferens either straight or coiled around testis.

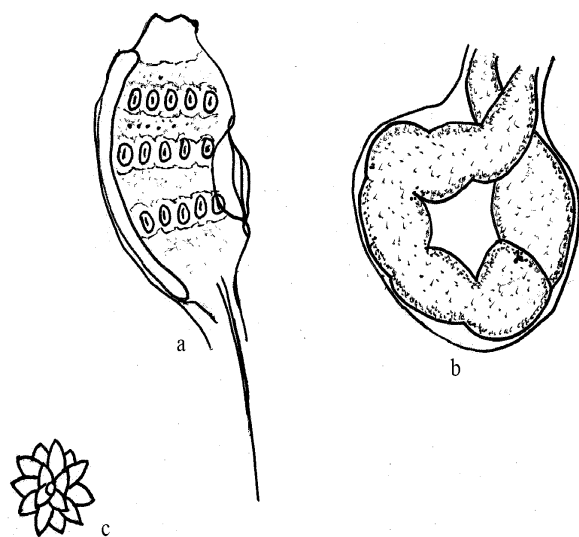


Fig. 8: *Trididemnum spumosum* sp nov. Kott, 1992
 a. Thorax; b. Abdomen; c. Spicule
 Scales: a, b, 0.1mm; c, 0.04 mm

The Following Genera Are Belonging to this Family: *Trididemnum*, *Atriolum*, *Leptoclinides*, *Polysyncarton*, *Didemnum*, *Diplosoma*, *Lissoclinum* and *Clitella*

4. *Didemnum fragile* Sluiter, 1909 (Fig. 5)

Didemnum fragile Sluiter, 1909: 56 [10]
 Monniot and Monniot, 1987: 30 [11]
Didemnum proliferum Kott, 1981:171 [12]
Didemnum candidum Hastings, 1931:94 [13]

Records

New Record: Chinna muttom and Vizhinjam Bay along the south west coast of India

Previous Records: Western Australia, Queensland and Timor Sea[6]; Queensland[13]; Western Pacific – Indonesia [10]; French Polynesia [11]; Fiji [14].

Description

Habitat: Colonies are found attached to small rocks, sea grass and some molluscan shells. Distributed low and high intertidal zones and up to 15 m depth.

Colony: Colony is encrusted sheet like up to 2 cm in diameter. Spicules are crowded throughout the test. Branchial aperture is surrounded by crowded spicules. Spicules are globular with narrow, radially arranged with numerous rays.

Internal Structure: Zooids are small. Retractor muscle extends free of the zooid from a short distance down the oesophageal neck. Atrial aperture is wide, exposing most of the dorsal part of the pharynx. Atrial lip is not present. Branchial sac has 8 stigmata. 6 coils of vas deferens are around its outer half only.

Remarks: *Didemnum proliferum* Kott, 1981 from Fiji has the spicules of the same size and shape, 8 stigmata per row and vas deferens. *D. paran* Monniot and Monniot, 1987 also resembles the present species. It has similar spicules and 7 coils of vas deferens.

5. *Didemnum tonga* (Fig. 6)

Didemnum tonga (Herdman, 1886) [15]
Leptoclinum tonga Herdman, 1886:269 [15]
 Not *Didemnum tonga*: Kott and Good body, 1982:520 [16]
Didemnum productum Monniot, 1995: 323 [17]

Records

New Record: Chinna muttom, South west coast of India.

Previous Record: Western Pacific[15]; Marion Reef, Coral Sea[17]; Queensland [6]

Description

Habitat: Colonies are found attached to small rocks, sea grass and some molluscan shells. Distributed low and high intertidal zones.

Colony: Colony is thin encrustating and brittle. The test is very soft and easily torn. Bladder cell layer is clear. No hypozoooidal lacuna is present. Spicules are stellate and uniformly distributed. Spicules are easily broken with 7-9 rays and 0.05 mm diameter.

Internal Structure: Zooids are light yellowish brown in colour. The retractor muscle separates from the lower part of the relatively long oesophageal neck. The branchial siphon is long and cylindrical and the branchial sac is with 9 stigmata per row. The testis is having 8 ½ coils of vas deferens.

Remarks: *Didemnum elongatum* has a same size of spicules as in the present species. Spicules resemble same in *Didemnum scopi*, having 9-11 long rods – like rays.

Key to the Species of *Didemnum* Recorded from India:

- Colony sheet like. Spicules < 0.04 mm. Vas deferens coils 6 times..... *D. fragile*

- Colony not sheet like. Spicules > 0.04 mm. Vas deferens coils 8 times.....*D. tonga*

6. *Trididemnum miniatum* (Fig. 7)

Trididemnum miniatum Kott, [18, 22, 23, 24, 21]

Trididemnum viride [20]

Didemnum dealbatum [10]

Records

New Records: Lee puram, Southwest coast of India.

Previous Report: Queensland [6]; Queensland [18,19]; Philipines [20]; New Caledonia [21]

Description

Colony: Colony is thin encrustating light green in color. Spicules are uniformly distributed throughout the test. They are small with broad base and are having crowded flat tipped cylindrical rays. The symbiotic cells are *Prochloron*. Bladder cell layer is distinct. Green cells are sparse at the base of the colony. Spicules are small and globular with cylindrical rays.

Internal Structure: Zooids are colorless in preservative. Branchial siphon is short with pointed lobes. A lateral organ is present on the thorax. 6-7 stigmata are in each of the 3 rows. A retractor muscle projects from the anterior of thorax. Vas deferens coils around 7 1/2. Larvae are not observed.

Remarks: The small, green colonies with embedded *Prochloron* are distinctive. This species is similar to that of *Trididemnum cyclops* and but the latter species is distinguished by its endostylar pigment cap and absence of embedded *Prochloron*. This species is reported for the first in Indian water. It varies from *T. clinids* by the presence of *Prochloron* cells. The small globular spicules are unique amongst plant-bearing *Trididemnum* spp.

7. *Trididemnum spumosum* Kott, 1992 (Fig. 8)

Records

New Records: Vizhinjam Bay, Southwest coast of India.

Previous records: South Australia [6]

Description

Habitat: Colonies are attached to intertidal rocks, dead corals and over the bivalve shells. Distributed from 2 to 15 m depths where they are found on hard substrata in protected embayment and harbour.

Colony: The very soft and cushion like up to 3 cm long, with upper surface raised into a long ridge, translucent in preservative. Spicules are sparse and evenly distributed. Spicules are also observed in the siphonal lining of branchial apertures. Spicules are diverse being either burr like or globular. Both types have 7-8 straight rods like rays.

Internal Structure: Zooids are small with 9 short wide brachial siphon and posteriorly oriented atrial siphon. A short retractor muscles projects from the anterior part of the oesophageal neck. 7 stigmata in each of 3 rows. Dark squamous epithelium, a characteristic feature of this species is present.

Remarks: Posteriorly oriented atrial siphon together with 3 rows of stigmata confirm the generic classification of this unusual *Trididemnum* species. Sparsely distributed spicules resemble certain specimens of *T. nobile*. The species most closely resembles *T. pseudocliposoma* having similar burr-like and globular spicules and this clearly suggest a close relationship with that species.

Key to the Species of *Trididemnum* Recorded from India:

- Spicules small and globular with broad based cylindrical rays uniformly distributed throughout the test. *Prochloron* cells present. Stigmata < 7 in each of the 3 rows. Dark squamous epithelium not present *T. miniatum*
- Spicules sparse and evenly distributed either burr like or globular with rod like rays. *Prochloron* cells absent. Stigmata > 7 in each of the 3 rows. Dark squamous epithelium present *T. spumosum*

DISCUSSION

The present study reports a total of 7 new records of ascidians from south west coastal waters and suggesting that the diversity of south west coasts is increased than has been previously reported. Previously, out of the total 33 species, there has been 15 species including two genera Polysyncraton and Leptoclinides, were reported for the first time in India from Vizhinjam Bay [2]. Research on the biodiversity and ecology of ascidians is still limited due to a lack of ascidian taxonomist and number of other difficulties, such as obtaining adequate sample sizes, scattered sample locations. As even preliminary survey of ascidians with limited stations could give as many as 7 new records, a detailed survey on the south west coast

along with seasonal availability, factor affecting colonization, succession at different depths etc. is sure to yield a rich haul of ascidians in the future.

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