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On a collection of ascidians from the southern west coast of India with three new records from Indian waters

H. Abdul Jaffar Ali*, V. Sivakumar[1], M. Tamilselvi[2], A. Soban Akram and M. L. Kaleem Arshan
Department of Biotechnology, Islamiah College (Autonomous), Vaniyambadi - 635 752, India.
[1] Director of Research and Conservation, 4e India NGO (Reg 188/2010).
[2]Department of Zoology, V.V. Vanniaperumal College for Women, Virudhunagar - 626 001, India.

*Correspondence e-mail: jaffar.ascidian@gmail.com

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Original Article

Abstract

Diversity and distribution of 42 species of ascidians belonging to 7 families and 19 genera from six different stations along the southwest coast of India were documented. Most of the species were recorded for the first time from the southwest coast of India while three species appear to be new records from India. Previous records of these species in India were usually from Gulf of Mannar particularly in Thoothukudi water. The family Didemnidae was represented by 13 species of 4 genera followed by Styelidae (11 species of 7 genera), Polyclinidae (7 species of 2 genera), Pyuridae (6 species of 2 genera), Perophoridae (two species) and Polycitoridae and Ascidiidae (one species each). The present study showed that the diversity and distribution of ascidians have changed considerably when compared to a previous report. Recruitment of ascidians in Vizhinjam Bay region was more than in the other regions. As many as 28 species of ascidians were recorded in Vizhinjam Bay, 16 species in Colachel, six in Kadiapattanam, five in Chinna Muttom and four each in Muttom and Leepuram. The percentage composition of representatives of various genera was: *Didemnum* and *Polyclinum* each by 15%, *Microcosmus*-12%, *Botryllus*-8%,*Trididemnum*-10%, *Botrylloides*, *Symplegma*, *Eudistoma* and *Diplosoma* each by 5%; and *Phallusia*, *Herdmania*, *Styela*, *Monandrocarpa*, *Polycarpa*, *Cnemidocarpa*, *Aplidium*, *Lissoclinum, Perophora* and *Ecteinascidia* each by 2%. The results showed that distribution of colonial ascidians were more at majority of the stations whereas the simple ascidians were restricted to port area. Diversity, distribution and invasive status of ascidians are discussed in detail.

Keywords: *Ascidian, distribution, diversity, India, southwest coast, tunicate, new records.*

Introduction

The Class Ascidiacea of sub-phylum Tunicata constitutes a unique group of animals that serve as an essential source of a variety of studies in fields ranging from development and evolution to immunology and biotechnology. There are about 3000 species of ascidians reported worldwide so far. Ascidians have been proven for their potential to produce new lead molecules with significant pharmacological activities (Davidson, 1993; Rinehart, 2000; Haefner, 2003 and Jain *et al*., 2008). They are also used as food in the form of various preparations in many parts of the world including India (Nanri *et al*., 1992 and Tamilselvi *et al*., 2010).A few solitary ascidians serve as indicators to assess the quality of water (Abdul Jaffar Ali, 2004; Tamilselvi, 2008 and Abdul Jaffar Ali *et al*., 2011). On the other hand non-indigenous ascidians have significant effects on the natural fauna (Cohen *et al*., 2005) leading to significant economic problems since ascidians form an important group of fouling communities (Carver *et al*., 2003).

Although during the past two decades there has been considerable progress in the study of tunicates throughout the world, very little attention has been given to this group in India. The increasing evidence of multifarious potential of ascidians, highlights the need for additional research into the diversity and distribution of ascidians for sustainable utilization and conservation.

Though Indian subcontinent is blessed with diversified marine habitats dotted with 12 major and a number of minor ports, which are ideal for entry and settlement of ascidians, so far only 450 species of ascidians have been recorded (Oka, 1915; Das, 1945; Sebastian, 1956; Renganathan, 1981; Renganathan, 1984; Meenakshi and Senthamarai, 2013a; Abdul Jaffar Ali and Sivakumar, 2007; Abdul Jaffar Ali *et al.*, 2009; Tamilselvi *et al.*, 2011). A mere list of ascidian fauna along the Gulf of Mannar and other coasts of India were compiled by Meenakshi and Senthamarai (2013b).

Since ascidians can thrive on both stationary and mobile artificial structures (Shenkar, 2008), they have a high potential for introduction into new regimes. Moreover, diversity and distribution of ascidians have changed over the past two decades with the ongoing bio-geographical changes in marine ecosystem and the arrival as well as proliferation of non-indigenous ascidians in India. Earlier knowledge on the ascidian fauna needs updating to have a better understanding of the present status of ascidian diversity. The relatively low number of ascidians known from the southwest coast appears to be due to lack of intensive surveys. With this in view an intensive survey of different habitats was undertaken at six stations along the southwest coast of India.

Material and methods

The present study was conducted during November 2013 - September 2014 period covering all seasons at six stations (Table 1 and Fig.1) along the southwest coast of India. Samples were collected from various marine habitats such as intertidal flats, rocky intertidal zones, deep sea, sandy beach, muddy water, harbour/port water and shellfish reefs. Intertidal flats were visited during low tide. At shallow water regions, small boulders were overturned, examined and then attached ascidians were sampled. Snorkelers were engaged to collect ascidians from large submerged rocks, boulders, harbour installations, jetty etc. up to a depth of 4 m. Fish landings were examined for deep water forms. Both simple and colonial ascidians were collected from the undersides of floating docks and barges by engaging SCUBA divers at marinas.

The specimens were narcotized and then preserved in 8% seawater formalin. In the case of large colonial ascidians, a portion of the colony was collected after noting the structure and dimension of the whole colony. In the case of synacidians, a representative was collected. The specimens were identified with the help of Tokioka, 1967; Miller, 1975;

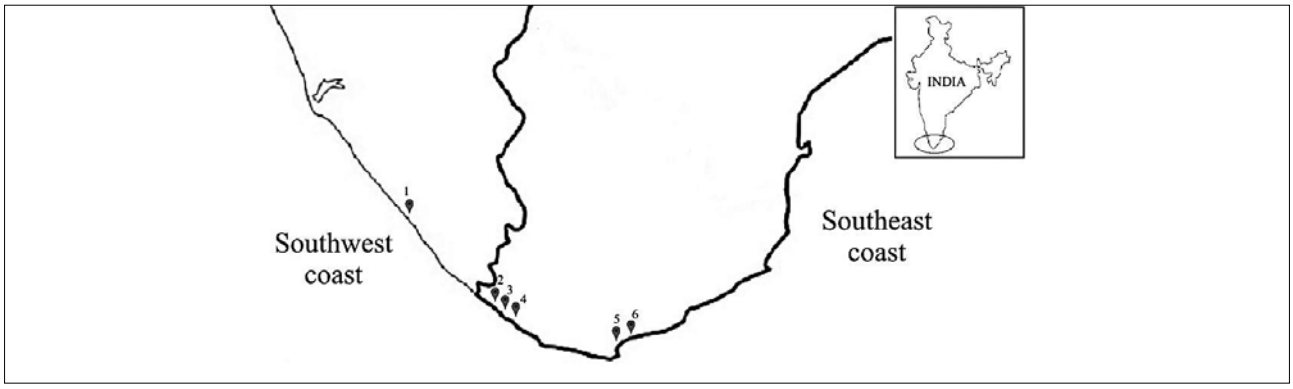

Fig.1. Map showing the study areas

Table 1. List of different stations and the available substratum

Sl No	Stations	Coordinates	Substrata
1	Vizhinjam Bay	8°22'30"N 76°56'15"E	Small stones, embedded rocks, pebbles, intertidal rocks, chank beds, barges, hulls of ships, oyster cages and other harbour installations
2	Colachel	8°8'17"N 77°18'12.7"E	Large boulders, cement blocks, hulls of boats
3	Kadiapattanam	8°8'4"N 77°18'31"E	Large boulders
4	Muttom	8°8'17"N 77°18'12.7"E	Large boulders, embedded rocks, small stones
5	China Muttom	8°5'47"N 77°33'50"E	Small stones, embedded rocks, pebbles Intertidal rocks, cement blocks
6	Leepuram	8°6'46"N 77°33'19"E	large boulders, embedded rocks, small stones

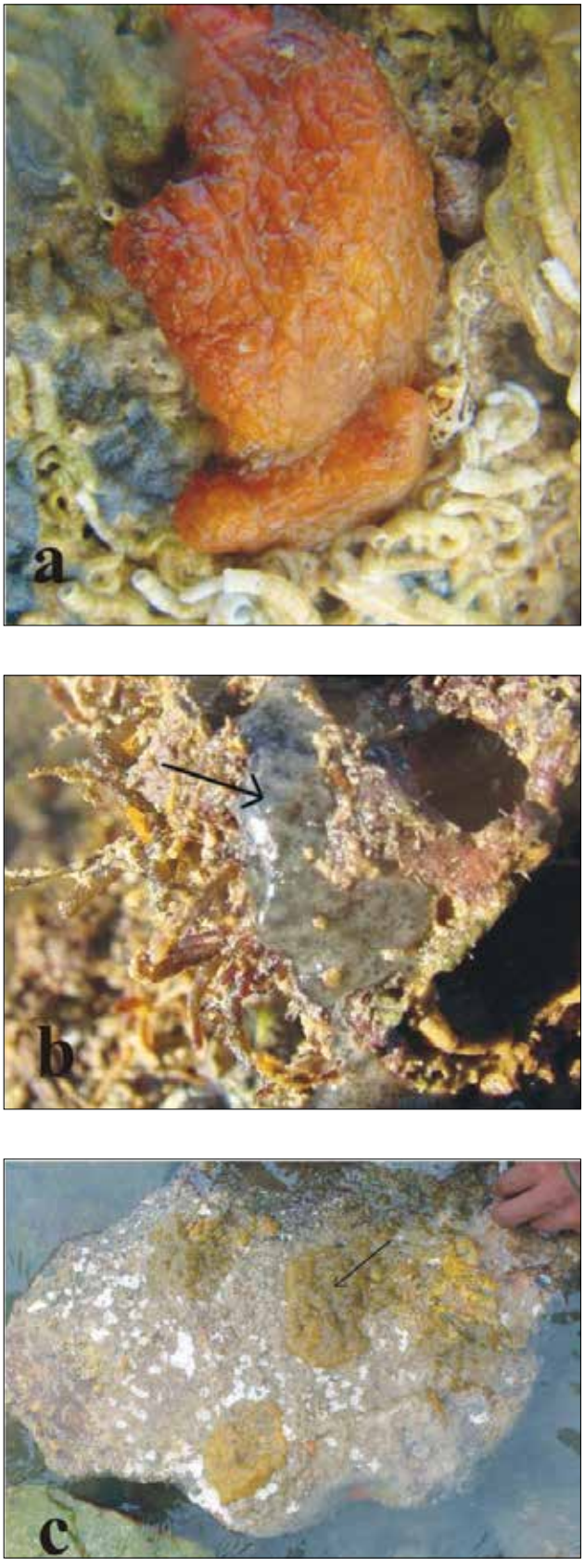

Fig.2. a. *Microcosmus sulcatus* b. *Botryllus Niger*, c. *Eudistoma sluiteri*

Kott, 1985, 2001; Renganathan, 1986; Monniot and Monniot, 1996. Voucher specimens were housed at Zoology Museum of Islamiah College (Autonomous), Vaniyambadi.

In accordance with a terminology adapted from Carlton (1996), identified ascidians were categorized into Cryptogenic (C), Non-indigenous (NI), Non-indigenous Established (NIE) and Non-indigenous Invasive (NII). The criteria of the WWF (2009) were also used to classify the species.

Results

A total of 42 species of ascidians belonging to 7 families and 19 genera were documented (Table 2), three of which; *Microcosmus sulcatus, Botryllus niger* and *Eudistoma sluiteri* (Fig. 2) appear to be new records for India. Description of these three species are given below:

1. *Botryllus niger* Michaelsen, (1921).

Colony is thinner and transparent. Zooids are black and grey coloured. They are moderately large and robust. Atrial languet is short. Number of tentacles is more than 14 in number. Thorax contains 16 rows of stigmata. The stomach has commonly 9 complete and one short incomplete glandular longitudinal folds, enlarged toward the blind distal end, and often only moderately curved. Presence of eggs posterior to the testes is the characteristic feature of this species; the other species has the eggs in front of the testes. A single large egg on each side of the body is usually present divided into lobules of uniform size and not numerous, often as few as five.

Remarks: *B. planus* appears to differ from *B. niger* in a number of minor characters. The former species shows different series of colour variations in living condition, but in preservation the zooids usually turn purple, blackish or brownish as in *B. niger*, the test remaining yellowish or nearly colorless. Apparently in *B. planus* the zooids average wider and shorter, the atrial languet longer, the rows of stigmata somewhat fewer, more than 8 tentacles. The stomach, on the other hand, furnishes an easy method of distinguishing these species from each other, although not necessarily from other species of other regions. In *B. planus* single egg is anterior to the testis and is a compact, convex mass divided into lobules by deep clefts.

2. *Eudistoma sluiteri* Hartmeyer, 1909

Colonies are smooth and rounded cushions about 1.0 to 2.0 cm in maximum extent. Brown colour in preservative. Zooids area arranged in a circular system. Sand and feacal pellets are embedded in test at the base of the colony. Zooids are large up to 5 mm long and robust. In preserved zooids the

Table 2. List of ascidians recorded from the different habitats of the study areas

Sl No	Species	Status	Station 1 (28)					Station 2 (16)		Station 3 (6)			Station 4 (5)			Station 5 (4)		Station 6 (4)
			IF	SW	HB	POC	MB	SW	HB	IF	SW	DS	IF	SW	DS	IF	SW	IF
	PEROPHORIDAE																	
1	*Ecteinascidia garstangi* Sluiter, 1898	I	-	-	-	-	-	-	-	-	-	-	-	-	-	a	a	-
2	*Perophora formosana* (Oka, 1931)	C	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ASCIDIIDAE																	
3	*Phallusia nigra* Savigny,1816	EI	-	x	a	a	-	-	-	-	-	-	-	-	-	-	-	-
	STYELIDAE																	
4	*Botryllus chevalense* (Herdman, 1906)	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
5	**B. niger* (Herdman, 1886)	C	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-
6	*B. schlosseri* (Pallas, 1766)	I	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
7	*Botrylloides leachii* (Savigny, 1816)	I	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
8	*B. magnicoecum* (Hartmeyer, 1912)	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
9	*Symplegma oceania* Tokioka, 1961	C	-	-	a	a	x	-	x	-	-	-	-	-	-	a	x	x
10	*S. repten* (Oka, 1927)	C	-	x	a	a	-	-	-	-	-	-	-	-	-	-	-	-
11	*Monandrocarpa* sp.	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
12	*Polycarpa* sp.	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
13	*Styela canopus* (Savigny, 1816)	I	-	x	x	x	x	-	x	-	-	-	-	-	-	x	x	-
14	*Cnemidocarpa* sp.	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
	PYURIDAE																	
15	*Microcosmus exasperates* Heller, 1878	I	-	x	a	a	-	-	-	-	x	x	-	r	r	-	-	-
16	*M. helleri* Herdman, 1881	C	-	-	-	r	-	-	-	-	-	x	-	-	-	-	-	-
17	*M. propinquus* Herdman, 1881	C	-	-	-	r	-	-	-	-	-	x	-	-	-	-	-	-
18	*M. squamiger* Michaelsen, 1927	I	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-
19	**M. sulcatus* (Coquebert, 1797)	C	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
20	*Herdmania momus* (Savigny, 1816)	EI	-	x	x	x	-	-	-	-	x	x	-	-		-	-	-
	POLYCITORIDAE																	
21	*Eudistoma microlarvum* Kott, 1990	C	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	**E. sluiteri* Hartmeyer, 1909	C	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	POLYCLINIDAE																	
23	*Aplidium multiplicatum* Sluiter, 1909	C	x	-	a	-	-	-	-	-	-	-	-	-	-	-	-	-
24	*Polyclinum fungosum* Herdman, 1886	C	x	x	a	a	-	-	-	-	-	-	-	-	-	-	-	-
25	*P. glabrum* (Sluiter, 1895)	I	-	-	x		-	-	-	-	-	-	-	-	-	-	-	-
26	*P. indicum* Sebastian, 1954	N	x	x	a	a	-	-	-	-	-	-	-	-	-	-	-	-
27	*P. nudum* Kott, 1992	C	-	-	a	a	-	-	-	-	-	-	-	-	-	-	-	-
28	*P. saturnium* Savigny,1816	C	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
29	*P. vasculosum* Pizon, 1908	C	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
	DIDEMNIDAE																	
30	*Tridemnum cyclops* Michaelsen, 1921	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
31	*T. miniatum* Kott, 1977	C	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	*T. paracyclops* Kott, 1980	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
33	*T. savignii* (Herdman,1886)	C	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
34	*Didemnum candidum* Savigny,1816	EI	x	a	a	x	a	-	-	-	-	-	x	x	x	x	x	x
35	*D. fragile* Sluiter, 1909	I	-	x	x	-	x	-	-	-	-	-	-	-	-	-	-	-
36	*D. granulatum* Tokioka, 1954	C	-	x	x	-	x	-	-	-	-	-	-	-		-	-	-
37	*D. nekozita* (Tokiota, 1967)	C	x	x	x	x	a	-	-	-	-	-	-	x	x	-	-	-
38	*D. psammathodes* (Sluiter,1895)	EC	a	a	a	x	a	x	x	x	x	x	x	x	x	-	-	x
39	*Didemnum* sp.	C	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-
40	*Diplosoma listerianum* (Milne-Edwards, 1841)	I	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-
41	*D. simileguwa* Oka, Suetsegu & Hirose, 2005	C	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-
42	*Lissoclinum fragile* (Van Name,1902)	EI	a	a	a	x	a	-	-	x	x	x	-	-	x	-	-	x
	Total		11	16	22	16	8	1	16	2	4	6	2	4	4	4	4	4

Note: * New report to Indian waters
x – Present, a – Abundant; r – Rare;- – Absent IF – Intertidal flats; SW – Shallow water; HB – Hull of boat; POC– Pearl oyster cage; MB – Mussel Bed; DS – Deep Sea C – Cryptogenic; I – Invasive; EC – Established cryptogenic; EI – Established invasive; N – Native

endostyle, gut and gonads become dark brown in colour. Dark capsular pigment present in between the branchial and atrial siphons. The esophageal neck is relatively thicker than other *Eudistoma* species. The atrial siphon is three folds longer than branchial siphon. Sphincter muscles surround the siphons. There are numerous thoracic longitudinal and circular muscles. About 20 stigmata in each row. Longitudinal bands extend up to the abdomen. One or two embryos are observed in the atrial cavity.

Remarks: Living specimens are distinguished by their dark green colour. Presence of single capsular pigment is the characteristic feature of this species when compared to *Eudistoma viride* where two endostylar pigments present.

3. *Microcosmus sulcatus* (Coquebert, 1797)

The globular body is enclosed within a leathery tunic. The tunic is orange in live condition and flesh colour in preservative, and encrusting organisms on the surface. Mantle body is orange yellow in colour. Both siphons are lobed with four triangular lobes and pale pink in live condition. There are 14 large and 20 smaller branched oral tentacles arranged on a muscular ring. The neural gland opening U-shaped with rolled horns. The pharynx has 8 folds on each side. One gonad on each side of the body is formed by 3 masses of testis follicles.

Remarks: *Microcosmus helleri* differs from *M. sulcatus* by the smaller number of branchial folds, the gut loop is less bent upwards at the anterior end and there is a more compacted gonad, not divided into segments (Van Name, 1945). *M. squamiger* has the gonads also divided into three lobes but the siphonal spines with roof-tile shape and spiny rims (Monniot *et al.* 2001). *M. sulcatus* is widely distributed in all oceans. But in the present study *M. sulcatus* is reported for the first time from Indian waters.

Species composition

Most of the species observed are recorded for the first time from the southwest coast of India. The family Didemnidae was represented by a maximum of 13 species belonging to 4 genera, followed by Styelidae by 11 species of 7 genera and Polyclinidae by 7 species of 2 genera. Pyuridae and Perophoridae were represented by 6 and 2 species respectively of 2 genera each whereas, only one genus each was recorded from the families Polycitoridae and Ascididae (Fig.3). The two genera *Polyclinum* and *Didemnum* contributed a maximum number of six species each.

The percentage composition observed among the various genera were *Didemnum* and *Polyclinum* - 15%; *Microcosmus*

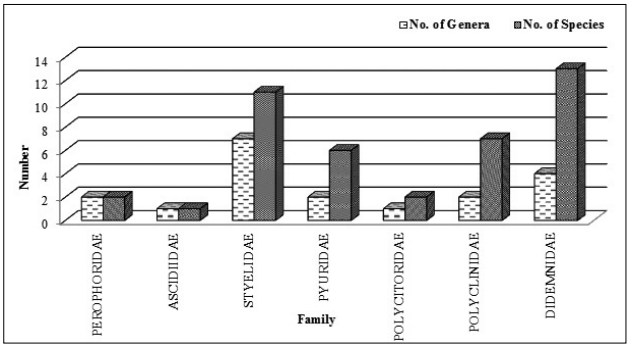

Fig. 3. Number of ascidian genera and species belonging to different families

- 12%; *Botryllus* - 8%; *Tridemnum* -10%; *Botrylloides*, *Symplegma*, *Eudistoma*, *Diplosoma* - 5%; and *Phallusia*, *Herdmania*, *Styela*, *Monandrocarpa*, *Polycarpa*, *Cnemidocarpa*, *Aplidium*, *Lissoclinum*, *Perophora* and *Ecteinascidia* by 2 %. Simple ascidians were represented by 29% and colonial ones by 71%.

Distribution of ascidians

Diversity of ascidians in Vizhinjam Bay was more than that in other regions. As many as 28 species of ascidians were recorded at Vizhinjam Bay, 16 species at Colachel, 6 at Kadiapattanam, 5 at Chinna Muttom and 4 each at Muttom and Leepuram.

The species recorded at Colachel station were solely collected from hulls of boats and not encountered at any stationary substrates available in that station. These species may be considered as floating species (visitors) because of the fact that the movements of the boats under consideration are restricted to Indian waters, licensed to operate within the boundaries on Indian EEZ and they are regularly used for fishing by local fisherman of that station. Though the source of attachment to the hulls of boats at this station is not known, these ascidians may be considered as floating species. Another point of interest is that, *Monandrocarpa* sp which may also be considered as a floating or visitor species, since they are collected only from the hulls of fishing boats with fishing activity around Indian waters, but this species has not been reported elsewhere in India except at this station. So this species may be considered as a species appearing for the first time in India.

Abundant and dominant species in the study areas were *Phallusia nigra*, *Microcosmus exasperates*, *Symplegma oceania, Aplidium multiplicatum*, *Polyclinum nudum, P. fungosum, P. indicum, Didemnum candidum, D. psammathodes* and *Lissoclinum fragile* at Vizhinjam Bay;

Botryllus schlosseri, *B. chevalense, Botrylloides magnicoecum, B. leachii, Monandrocarpa* sp*, Polycarpa* sp*., Cnemidocarpa* sp*., Tridemnum cyclops, T. paracyclops, T. savignii* and *Diplosoma listerianum,* at Colachel; and *Symplegma oceania* and *Ecteinascidia garstangi* at Chinna Muttom .

At Colachel *Botyllus* and *Botrylloides* species were found occupying the siphons of *Monandrocarpa* sp. collected from hull of boats whereas, the solitary ascidians *Cnemidocarpa* sp. and *Polycarpa* sp. were found embedded in the tunic of the compound ascidians *Tridemnids* and *Botrylloides* (Fig. 4). The tunic had wrapped around the cnemidocarps and formed a cavity. The few unidentified molluscans and bryozoans were found in the crevices among compound and solitary ascidians.

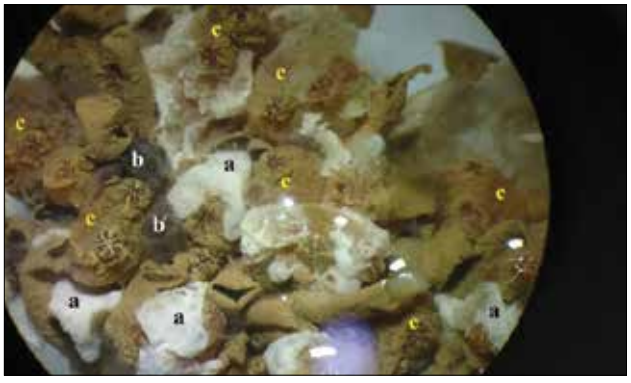

Fig. 4. Fouling ascidian communities a) *Botryllus niger*, b) *Monandrocarpa* sp., c) *Cnemidocarpa* sp.

Non-Indigenous ascidians

In relation to the bioinvasion status, only one native species, *Polyclinum indicum*, was identified. Of the 28 species identified as cryptogenic species, 22 are colonial and 6 are solitary. Only one species, *Didemnum psammathodes*, was listed as established cryptogenic ascidian. The remaining species were classified as invasive ascidians, of which 4 species, namely *Phallusia nigra, Herdmania momus, Didemnum candidum* and *Lissoclinum fragile* were established invasive.

Diversity of ascidians in marine habitats

Ascidians were found distributed in a variety of marine habitats such as intertidal flats, shallow water (1-2 m depth), hull of boats, pearl oyster cages (3-5 m depth), mussel beds (10-15 m depth) and deeper waters (20-30 m depth). Four colonial ascidians, namely *Didemnum candidum*, *D. nekozita*, *D. psammathodes* and *Lissoclinum fragile* inhabited all the habitats examined whereas *Symplegma oceania* and *Styela canopus* were found only in five habitats. Maximum of 35 species were found attached to hull of boats, followed by shallow water with maximum of 18, pearl oyster cages (12), intertidal flats (14), Deep Sea (8) and mussel beds (7) in that order (Table 2).

Discussion

In the present study, maximum numbers of ascidians were recorded from Vizhinjam coast. It could be correlated with availability of diverse substrata including natural (pebbles, intertidal rocks, mussel bed etc.) as well as manmade structures (barges, hulls of ship, oyster cages, etc.). This could be justified with the new entry of eight species to this station. Kott (2002), Abdul Jaffar Ali (2004) and Tamilselvi *et al.* (2011) reported that the provisions of maritime and other installations associated with commercial harbour could have facilitated the settlement of ascidians species. The presence of the simple ascidian, *Phallusia nigra* and the colonial ascidian *Didemnum psammathodes* found throughout the year in dominant numbers at the port area of Vizhinjam may be attributed to their adaptation to various changing physical parameters especially the sedimentary dynamics, availability of food, current intensity, wave exposure etc. as reported by Rocha *et al.* (2010 a, b).

The results showed that abundance of colonial ascidians was found to be more in majority of the stations. Colonial ascidians always colonized nearby the parent colony as they exhibit a kind of asexual reproduction (budding) and shelter the larvae in a brood pouch. The short life of the larvae facilitates dispersal only over short distances (Yund and Stires, 2002; Tamilselvi *et al*., 2011). Some ascidians undergo frequent fission, but the resulting colonies remain close to the parent colonies (Bak *et al*., 1981; Ryland *et al*., 1984; Stocker 1991).

Majority of the species belonging to Didemnidae showed wide distribution and inhabited all the habitats observed and this might be due to their reproductive nature, tolerance to wide range of environmental parameters and settling behavior of mobile larva. Rinkevich *et al.* (1993) reported that the life history traits such as longevity and reproduction are subject to adaptation to environmental and biotic conditions and different velocity of water currents and the quality of food.

Entry of exotic species in marine environment results from changing current patterns, environmental parameters etc. which lead to successful establishment in a new area. Generally nonindigenous species (NIS) are abundant in harbour areas (Johnston *et al*., 2009). An alternative factor that may enhance invasion of harbours and other marine areas is environmental degradation commonly found in these habitats that favours the establishment of NIS, as

native species are poorly adapted to these altered conditions (Preisler *et al*., 2009). Introduced organisms may also be favoured by a change in resource available, such as space for colonization when pollution intolerant species die (Herbert, 1999). Report of 28 cryptogenic species, 13 invasive species and only one native species in the present study might be due to the connectivity between ports from the southeast coast of India particularly from Thoothukudi harbour. This could also be due to the present intensive survey of all available habitats including submerged habitats. The large numbers of boats with fouled hulls undoubtedly provide new breeding stock to recolonize denuded surfaces and also enhance gene flow between harbours. Maximum number of species reported at Vizhinjam port might be due to the visit of a large number of ships from North East countries and from other ports of India.

Based on ecological and economic importance, ascidians recorded in the present study are grouped as below:

Species of aquaculture importance: Though the species diversity of the ascidian is rich, only a few species are at present utilized in aquaculture in Japan, Korea, France, Italy and Chile (Nanri *et al*., 1992; Davis, 1995). The species of importance include: *Herdmania momus, Microcosmus sulcatus* and *Styela canopus*.

Species of pharmacological importance: Most of the members of *Phallusia, Ecteinas cidia, Polyclinum, Didemnum, Tridemnum, Lissoclinum, Microcosmus, Aplidium* and *Botryllus* reported in the present study are potential producers of novel lead molecules with anti-carcinoma, anti-tumour, anti-viral, anti-microbial, anti-oxidant, anti-fouling and anti-mitotic activities.

Species of fouling: In the present study 35 species were found to foul on the hull of boats.

Species of invasiveness: By virtue of their sedentary nature and brief planktonic larval period they are mostly transported through hulls of ships and ballast water and invade or colonize new localities. Out of 42 species, 28 were cryptogenic, 13 were invasive and remaining one was native species.

Species of food value: A value added product, ascidian pickle, was prepared from alien ascidian *Herdmania momus* (Tamilselvi *et al*., 2010). Besides, recent study reveals pellet feed prepared using *H. momus* showed better performance on growth, survival and reproduction during culturing periods of black molly (Tamilselvi, 2013). In the present study, it is noteworthy to report new entry of *Microcosmus sulcatus* and species of *Microcosmus*, in addition to *Herdmania momus* into Indian waters.

The findings of the present study of the current status of diversity and distribution of ascidians might help in their sustainable utilization for the welfare of mankind.

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