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First record of Five Species of Ascidiaceans (Tunicata: Ascidiaceae) from Okha, Gujarat

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ABSTRACT

Ascidiaceans are filter-feeding organisms that are sedentary and hermaphrodite in nature. In India we have 263 ascidian species coming under 41 genera, 12 families, 3 suborders, and 2 orders of the class Ascidiaceae. In this study, specimens of ascidiaceans were collected in the intertidal zones of Okha, Gujarat for the very first time. Five solitary ascidiaceans are recorded in this region, adding to the biodiversity of Gujarat. Also, a literature review on the distribution of ascidiaceans revealed that this is the first report of these ascidiaceans from Okha, Gujarat. A note on the taxonomic features of these specimens is discussed in the present study.

Key words: Ascidiaceae, Tunicata, Okha, Gujarat, India

Introduction

Ascidiaceans (Phylum: Chordata, Class: Ascidiaceae), or sea squirts, belong to Urochordata. They show chordate features at their larval stage, but after maturation, they lose their chordate characters.

Ascidiaceans belong to macrofouling marine ecosystems that attach to natural and artificial substrates in the intertidal and subtidal zones of coastal habitats around the world (Matin, 2016). They play a very important role because of their invasive nature.

Ascidiaceans are invertebrate chordates and prolific producers of a wide variety of biologically active secondary metabolites. Many of the compounds extracted from ascidiaceans have the potential to act as drugs in diseases like cancer and diabetes (Nishida, 2005). Ascidiaceans are a very good source of nutrition and are also used as food in many parts of the world, like Japan, Korea, France, and Chile and it can be used as food source in Gujarat as some ascidiaceans like *Herdmania momus* are found in ample amount throughout the year. Certain solitary ascid-

ians serve as indicators of water quality (Jaffarali *et al.*, 2016).

India has immense biodiversity, particularly marine biodiversity, with a coastline of 8100 km, while Gujarat has a total coastline of 1600 km. The total number of ascidiaceans we are getting in our study is five from Okha, Gujarat. Earlier records suggest the finding of one species of ascidian from Gujarat, which was done by Geeta Padate and her co-workers *et al.* while investigating macrobenthic fauna in and around Marine National Park and Sanctuary. The species identified was *Botrylloides digenesis* (Padate *et al.*, 2018). Okha is located in western Gujarat state, in west-central India. It is a port at the western tip of the Kathiawar Peninsula, between the Gulf of Kachchh and the Arabian Sea.

Compounds extracted from the dried tunic with methanol have been found to have cytotoxic, antibacterial, antipyretic, analgesic, and histamine-like activity (Matin, 2016). In the past two decades enormous progress has been achieved in the fields of evolution, development, natural products and ecol-

ogy of ascidians. Their small genome, small cell number and short life-cycle make them an attractive model system for developmental biologists (Nishida 2005). Investigating the phylogenetic position of the subphylum Tunicata in relation to the other subphyla in the phylum Chordata is crucial to the understanding of possible mechanisms of chordate evolution (Zeng, 2005). Ascidians found from Gujarat can add to the studies as a model organism.

Materials and Methods

Study area

Okha is a coastal town in the Devbhoomi Dwarka district of Gujarat state, India. It has a seaport. Whose coordinates are 22.4649° N and 69.0702° E. Okha is situated on a narrow strip of land that projects into the Arabian Sea. It is surrounded by sea on three sides and has a sandy beach on the Arabian Sea coast. It has a seaport on the east side. Bet Dwarka lies on the other side of a small creek from Okha Port. The total area is 5 km².

Data collection

For species identification of the intertidal ascidians, the samplings were carried out in one year (2020–2021). The specimens were collected by hand during the low tide. The specimens were preserved in a 10% formaldehyde-seawater solution with a pinch of menthol crystal for subsequent examination and transferred to the laboratory. Identification was done by Dr. V.K. Meenakshi, Associate Professor of Zoology (Retired), A.P.C. Mahalaxmi College for Women, Tuticorin, Tamilnadu, India.



Results and Discussions

The current study provides a list of five ascidians

species that are currently found along the Okha coast of Gujarat: *Diplosoma listerianum*, *Herdmania momus*, *Polyclinum madrasensis*, *Botrylloides magnicoecum*, and *Trididemnum cerebriforme*.

Diplosoma listerianum



Fig. 2. *Diplosoma listerianum*

General systematics

- Kingdom: Animalia
- Phylum: Chordata Haeckel, 1874
- Subphylum: Tunicata Lamarck, 1816
- Class: Ascidiacea Nielsen, 1995
- Order: Enterogona Perrier, 1898
- Family: Didemnidae Giard, 1872
- Genus: *Diplosoma* Macdonald, 1859
- Scientific name: *Diplosoma listerianum* (Milne-Edwards, 1841) (Fig. 2).

Description

The colony is very thin, encrusting the substrate as a transparent orange sheet. The test is delicate, transparent, and colourless in nature. Zooids crowded the text. Zooids are small, up to 0.8 to 1.2mm long. It is a cosmopolitan species. In India, it is found on the south coast. Internationally, it is distributed from South Africa, the North Sea, France, the Gulf of Mexico, Madagascar, the Netherlands, the North Atlantic Ocean, Tanzania, and the Central Atlantic Ocean to New Zealand Ali *et al.*, 2016.

Herdmania momus

General systematics

- Kingdom: Animalia
- Kingdom: Animalia

- Phylum: Chordata Haeckel, 1874
- Subphylum: Tunicata Lamarck, 1816
- Class: Ascidiacea Nielsen, 1995
- Order: Pleurogona Perrier, 1898
- Suborder: Stolidobranchia Lahille, 1887
- Family: Pyuridae Hartmeyer, 1908
- Genus: Herdmania Lahille, 1818
- Scientific name: *Herdmania momus* (Herdman, 1816) (Fig. 3).



Fig. 3. *Herdmania momus*

Description

The solitary ascidian *Herdmania momus* is one of the most commonly encountered species of ascidians. Red in colour and with a leathery texture. This genus was first described in India by Das (1936, 1945) and on the Madras coast by Sebastian and Kurian (1981). Recently, Kartikeyan *et al.* (2009) visited Palk Bay, on the southeast coast of India. In India, it is found in the Gulf of Mannar, on the southwest Queensland coast. Internationally, it is distributed from Japan, Taiwan, the Philippines, Indonesia, Palau, Hawaii, Fiji, South Africa, Queensland (Northeast Coast), Western Australia (Central West Coast, Lower West Coast, Northeast Coast, Northwest Coast) to the Indian Ocean, South China Sea, Tahiti, and the Arafura Sea Ali *et al.*, 2016.

Polyclinum madrasensis

General systematics

- Kingdom: Animalia
- Phylum: Chordata Haeckel, 1874
- Subphylum: Tunicata Lamarck, 1816
- Class: Ascidiacea Nielsen, 1995
- Order: Enterogona Perrier, 1898
- Suborder: Aplousobranchia Lahille, 1887

- Family: Polyclinidae Milne-Edwards, 1841
- Genus: *Polyclinum* Savigny, 1816
- Scientific name: *Polyclinum madrasensis* Sebastian, 1952 (Fig. 4).

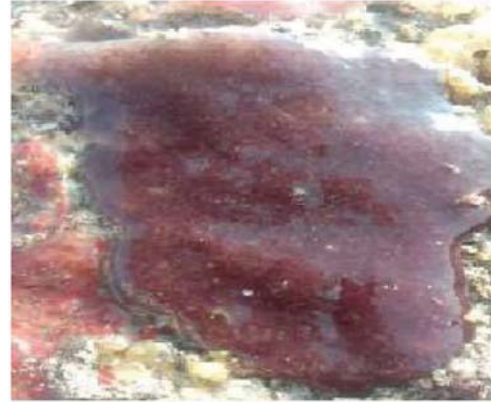


Fig. 4. *Polyclinum madrasensis*

Description

The colonies are hard cushions up to 3 cm long, usually sand-free. The test is gelatinous, translucent internally, and red in colour. *P. madrasensis* was reported on the Madras coast by Sebastian in 1952. Native to India. This species is characterised by the presence of six branchial lobes. Found in the Gulf of Mannar, on the southeast coast of India Ali *et al.*, 2016.

Botrylloides magnicoecum



Fig. 5. *Botrylloides magnicoecum*

General systematics

- Kingdom: Animalia
- Phylum: Chordata Haeckel, 1874
- Subphylum: Tunicata Lamarck, 1816
- Class: Ascidiacea Nielsen, 1995
- Order: Pleurogona Perrier, 1898
- Suborder: Stolidobranchia Lahille, 1887

- Family: Styelidae Sluiter, 1895
- Subfamily: Botryllinae Adams & Adams, 1858
- Genus: Botrylloides Milne-Edwards, 1841
- Scientific name: Botrylloides magnicoecum Hartmeyer, 1912 (Fig.5).

Description

Colonies are thin sheets up to 2 to 3 cm wide, fouling the substrata. The text is thin and transparent. Reported from the Thoothukudi coast, Bombay, Gulf of Mannar, Southeast coast, India. Internationally, it is reported from South Africa and New Zealand Ali J. *et al.*, 2016.

Trididemnum cerebriforme



Fig. 6. *Trididemnum cerebriforme*

General systematics

- Kingdom: Animalia
- Phylum: Chordata Haeckel, 1874
- Subphylum: Tunicata Lamarck, 1816
- Class: Ascidiacea Nielsen, 1995
- Order: Enterogona Perrier, 1898
- Suborder: Aplousobranchia Lahille, 1887
- Family; Didemnidae Giard, 1872
- Genus: Trididemnum Della Valle, 1881 Khaleghi, 2016
- Scientific name: Trididemnum cerebriforme (Fig.6)

Description

It is colonial ascidian reported by Meenakshi, 1996, 1997, 2000b, 2003, 2004 and Meenakshi and Senthamarai, 2013 in India (Meenakshi *et al.*, 2018). The distribution of this highly variable species includes South Africa (where it is very common), the Western Indian Ocean, Australia, the western tropical Pacific Ocean, and Japan

Discussion

It is colonial, as reported by Meenakshi, 1996, 1997, 2000b, 2003, 2004, and Meenakshi and Senthamarai, 2013a, in India (Meenakshi *et al.*, 2018). The distribution of this highly variable species includes South Africa (where it is very common), the western Indian Ocean, Australia, the western tropical Pacific Ocean, and Japan Ali *et al.*, 2016.

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Conflict of Interest

The authors declare that they have no competing interests related to this research. They have received no financial support or funding that could have influenced the findings or interpretations presented in this article. Additionally, the authors have no personal or professional relationships with any organizations or individuals that might have a direct or indirect interest in the research results. This research was conducted in an unbiased and objective manner, and the findings represent the authors' best efforts to report accurate and relevant results.

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