

RESEARCH ARTICLE

Occurrence of *Spongilla lacustris* and a case study on its associates from Madambakkam Lake, Kancheepuram district

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Abstract

This study was carried out to determine the floral and faunal components of Madambakkam Lake. Sponge occurrence was recorded and collections were made from eight different localities from the lake. They were identified as *Spongilla lacustris*, which was dominant during December 2011 in all the locations. The associated flora and fauna were identified and their abundance was enumerated and percentage composition was also estimated. Results showed that phytoplankton, nematodes, protozoans were recruited more when compared to the population of cladocerans and copepods. The species richness of phytoplankton was noticed to be higher.

Keywords: Madambakkam Lake, *Spongilla lacustris*, phytoplankton, nematodes, protozoans.

Introduction

Sponge is an immemorial species appeared on the earth in the early Cambrian period, it outspread vary widely in the Jurassic and the Cretaceous period from marine to freshwater (Djerassi and Lam, 1991). They are the most ancient multicellular animals, having existed for more than 580 million years (Müller, 1995). At least 15,000 species are classified into the phylum Porifera, divided into three classes, the Hexactinellida, the Demospongiae, and the Calcarea, based on the nature of their mineral skeleton. Sponges have colonized most aquatic habitats from polar seas to tropical waters and approximately 150 species (spongillids) have become adapted to freshwater (Manconi and Pronzato, 2002).

Freshwater sponges are crust like, branched or clumped. The texture is fragile and soft, and the colour is whitish or green. Freshwater sponges have irregularly scattered and barely visible water-exit holes. Freshwater sponges live in standing and running fresh waters and are filter feeders and have no known importance to people, are not threatened or endangered. Most of the sponges come under spongillidae and about 33 species of the genus *Spongilla* (class Demospongiae, siliceous sponges were reported from freshwaters of India (Pattanayak, 2011). Earlier studies conducted in Madambakkam Lake were related to the physico- chemical factors and the plankton community (Chitra and Prabakaran, 2011). During the study, the sponge samples were collected and identified as *Spongilla lacustris* from Madambakkam Lake which was reported for the first time. This study deals with the diagnostic characters, distribution and keys for identification of species hither to known from Madambakkam Lake. The faunal assemblage of the sponges was investigated in detail.

Materials and methods

The sponges were collected from eight different locations during December 2011 and were transported to the laboratory. They were rinsed thoroughly in fresh water and the water sieved through 50 µm plankton net and the collections were preserved in 5% formaldehyde. Few Specimens were stored in 95% ethyl alcohol for taxonomic studies. The microflora was identified following the manuals of Desikachary (1959); Anand, (1989; 1998) and microfauna by following Edmondson (1959); Victor and Fernando (1979); Michael and Sharma (1988); Battish (1992) and Dhanapathi (2000).

Results

Systematic account: The systemic account is given as:

Phylum Porifera
Class Demospongiae
Order Haplosclerina
Family Spongillidae Gray

Fig. 1. *Spongilla lacustris* at Madambakkam Lake.



Table 1. Microfloral and faunal assemblages in *Spongilla lacustris*.

Species	S1	S2	S3	S4	S5	S6	S7	S8
Protozoa								
<i>Arcella vulgaris</i>	+	+	+	+	+	-	-	+
<i>Centropyxis spinosa</i>	+	+	+	+	+	+	+	+
Rotifera								
<i>Lecane Monostyla bulla</i>	+	-	-	+	-	-	-	-
Cladocera								
<i>Chydorus barroisi</i>	+	+	-	+	-	-	+	-
<i>Alona davidi punctata</i> (Daday, 1898)	-	-	+	+	-	-	-	-
Copepoda								
<i>Cyclopoid nauplii</i>	-	-	+	-	-	+	-	-
Nematodes								
Annelida–Oligochaete	-	-	-	-	+	-	-	-
Phytoplankton								
<i>Closterium</i> sp.	+	+	+	+	+	+	+	+
<i>Gomphosphaeria aponina</i>	+	+	+	+	+	+	+	+
<i>Harmidium flaccidium</i>	-	-	+	-	-	+	-	+
<i>Navicula rhynchocephala</i>	-	+	+	+	+	+	-	+
<i>Navicula cuspidata</i>	+	+	+	+	+	+	+	-
<i>Oscillatoria subbrevis</i>	+	-	+	+	+	-	-	+
<i>Pediastrum duplex</i>	+	+	+	+	+	+	+	+

Diagnosis: Freshwater sponges, with a soft cavernous structure most noticeable just below the surface (Fig. 1). Spicules smooth or spined oxeas, or strongly or birotulates; organized into bundles or tracts and bound by sponging. Reproduction by gemmules, coated with pneumatic layer of loosely packed sponging; complex microscleres sometimes associated with the gemmule coat.

Genus *Spongilla* Lamarck, 1816

Species *Spongilla lacustris* (Linnaeus, 1758)

1758. *Spongia lacustris*, Linnaeus, *Systema naturae*, 10th ed., 1. Animalia: 1348.

1968. *Spongilla lacustris*, Penney and Racek, *Bull. U.S. natn. Mus*, No. 272: 7.

1982. *Spongilla lacustris*, Soota and Pattanayak, *Rec. Zool. Surv. India*, 80: 223.

Description: Encrusting, branched, arborescent or massive sponges with a fragile, soft consistency and whitish or green colour, with irregularly scattered and inconspicuous oscula. Surface uneven and roughened by tiny spines. Gemmules subspherical to oval, occurring in dense clusters or irregularly scattered in the skeletal network. Sponge consisting of a flat or rounded thin basal portion with long free cylindrical branches; surface hispid; oscula small and star shaped; dermal membrane well developed; consistency soft and easily compressed. Megascleres—straight, sharply pointed, smooth amphioxea; length range: 225–410 μm, width range: 0.006–0.009 mm. Microscleres—abundant, straight, long slender, amphioxea with small spines of almost equal size and distribution; length range 0.075–0.090 mm, width range 0.0035–0.006 mm.

Gemmoscleres abundant, present throughout the body, large, spherical, pneumatic layer thick, granular in which the spicules tangentially arranged foramen not tubular, simple, bearing a shallow peripheral collar; diameter of gemmule: 0.50–0.60 mm.

Colour: Generally bright green due to presence of zoochlorellae, otherwise pale white to light grey in colour.

Distribution in India: West Bengal, Assam, Bihar, Himachal Pradesh, Jammu and Kashmir, Karnataka, Maharashtra, Orissa, Punjab, Rajasthan and Tamil Nadu. Elsewhere: Northern hemisphere, with its greatest expansion in cold-temperate regions.

Remarks: This species is widely distributed in India.

Microfloral and microfaunal assemblage with the sponges were investigated from eight different localities from this lake. Interestingly few species were encountered from the study and documented in Table 1. Six groups of microfauna viz., Protozoa, Rotifera, Nematoda, Annelida, Cladocera and Copepoda comprised 2 species of protozoa, 1 species of rotifera, 1 species belongs to copepoda, 2 species from cladocera, 1 species of nematoda and 1 species of oligochaete were noticed during the study. There was much variation noticed among locality wise (Table 1). Protozoans, copepods and nematodes were found in all the 8 localities. Rotifers were noticed from two localities. Oligochaete found very rare and was identified from S4 site. Among phytoplankton, diatoms were dominated from all the locations.

Seven species were identified viz., *Closterium* sp., *Gomphosphaeria aponina*, *Navicula rhynchocephala*, *Navicula cuspidata*, *Oscillatoria subbrevis*, *Pediastrum duplex* were occurred from all the localities. Surplus of sponge gemmules, spicules and scleres were also observed and due to rinsing process conducted for sorting the micro faunal and floral components. Overall, phytoplankton remarkably yields higher percentage composition followed by nematodes, protozoans, cladocerans, copepods, rotifers and oligochaete.

Discussion

Pattanayak (2011) reported 67 species of marine sponges from the existing collections of Zoological Survey of India mainly from the places viz., Andaman, Gulf of Mannar, Palk Bay, Ramnad, Cuddalore, Nagapattinam, Kancheepuram, Chennai, Kanyakumari etc., from Tamil Nadu. In Indian waters about 610 species have so far been recorded from both the east and west coasts. They are abundant in the regions of Gulf of Mannar, Palk Bay and Laccadive Archipelago from India (Palpandi *et al.*, 2004). Annandale (1906a; 1906b) reported on the fresh water sponge *Spongilla carteri* associated animals and also reported on the occurrence of *Spongilla lacustris* in varieties from lower Bengal. Four species of freshwater sponges namely *Spongilla lacustris*, *Eunapius carteri*, *Radiospongilla cerebellata* and *Ephydatia meyeri* were reported from Tamil Nadu (Pattanayak, 1999). Freshwater sponge *Spongilla lacustris* has been used as a traditional Chinese medicine for near upon 500 years in China for reinforcing the kidney and supporting yang (aphrodisiac), nevertheless the pharmacy research of this species is fewer (Zhongua, 1999). Mass culture of such species is required for further studies on their compounds. Studies on freshwater sponges from Tamil Nadu were limited compared to marine sponges. The overall antimicrobial activity assessed by Ravikumar *et al.* (2011) indicated the presence of active constituents in the extractions of sponges and associated macroorganisms which can be exploited for the production of lead molecules which are of use in pharmaceutical industry. Many novel and biologically active compounds have frequently been isolated from the marine sponges these years, while research reports about freshwater sponges were lesser (Li, 1975).

Conclusion

Interestingly, present observations shown very clearly that microfaunal groups which coexists with sponge for their livelihood and also towards certain factors like predation, accidental clinging to the habitat. Roback (1968) and Pennak (1978) also suggested that sponges acts as a favourable substratum for a number of metazoans, such as insects, crustaceans, annelids, nematodes and mollusks. Further studies on freshwater sponges diversity, microbial and antibiotic to be enhanced in near future.

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References

- Anand, N. 1989. Handbook of Blue-green algae (of rice fields of south India). Bishen Singh Mahendrapal Singh, 23-A, Cannaught Place, Dehra Dun, pp.1-79.
- Anand, N. 1998. Indian Fresh water Microalgae. Bishen Singh Mahendrapal Singh, 23-A, Cannaught Place, Dehra Dun, p.94.
- Annandale, N. 1906a. Notes on freshwater fauna of India. Some animals found associated with *Spongilla carteri* in Calcutta. *J. Asiatic Soc. Bengal.* pp.187-190.
- Annandale, N. 1906b. Notes on the freshwater fauna of India. 1. A variety of *Spongilla lacustris* from brackish water of Bengal. *J. Asiatic Soc. Bengal.* 2: 55-58.
- Battish, S.K. 1992. Freshwater Zooplankton of India. Oxford and IBH Publishing Co., New Delhi.
- Chitra, J. and Prabakaran, K. 2011. Physico-chemical factors and plankton community of freshwater habitats in Madambakkam Town Panchayat, Tamil Nadu and its adjacent areas. *Environ. Ecol.* 29(2): 643-646.
- Desikachary, T.V. 1959. Cyanophyta. Pub., ICAR, New Delhi. p.686.
- Dhanapathi, M.V.S. S. S. 2000. Taxonomic notes on the Rotifers from India (from 1889-2000). *Ind. Assoc. Aquatic Biol.* 10: 169.
- Djerassi, C. and Lam, W. K. 1991. Sponge Phospholipids. *Acc. Chem. Res.* 24, 69.
- Edmondson, W.T. 1959. Freshwater biology, IInd edition, John Wiley and Sons Inc. New York. pp. 420-497.
- He, X.Y. and Xu, G.R. 1993. Paleontology tutorial. Geologic Press. p.49.
- Li, S.Z. 1975. Bencao Gangmu. People's sanitation express. p.2380.
- Manconi, R. and Pronzato, R. 2002. Suborder *Spongillina* subord. nov. fresh water sponges. In: J. N. A. Hooper and R.W.M. van Soest (Eds.) *Systema Porifera*. A guide to the Classification of sponges. 1: 921-1019.
- Michael, R.G. and Sharma, B.K. 1988. Indian Cladocera. Fauna of India. Zoological Survey of India. pp.1-262.
- Müller, W.E.G. 1995. Molecular phylogeny of Metazoa (animals): monophyletic origin. *Naturwiss.* 82: 321-329.
- Palpandi, C., Ananthan, G., Sampathkumar, P. and Kannan L. 2004. Sponges-store houses of valuable compounds. *Seshaiyana.* 12(2): 14-15.
- Pattanayak, J.G. 1999. Freshwater sponges. Fauna of West Bengal Ser. Zoological Survey of India. 11: 1-27.
- Pattanayak, J.G. 2011. Marine sponges. Fauna of Tamil Nadu. *State Fauna Series.* 17(2): 1-64.
- Pennak, R.W. 1978. Fresh-water invertebrates of the United States. 2nd Edn., John Wiley and Sons, New York. 15: 803.
- Ravikumar, S., Venkatesan, M., Ajmalkhan, M. and Dhinakarraj, M. 2011. Antimicrobial activity of sponge associated macroorganisms against fish pathogen. *World J. Fish Marine Sci.* 3(1): 67-70.
- Roback, S.S. 1968. Insects associated with the sponge *Spongilla fragilis* in the Savannah River. *Notulae Naturae.* 412: 1-10.
- Victor, R. and Fernando, C.H. 1979. On freshwater Ostracods (Crustacea: Ostracoda) of India. *Rec. Zool. Surv. India.* 74(2): 147-242.
- Zhonghua, B. 1999. State administration of traditional Chinese medicine of the people's republic of China. *Shanghai Sci. Tech. Publishers.* 9: 7930.