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Tasso Tayung

Scientist, ICAR-Central Inland
Fisheries Research Institute,
Barrackpore, Kolkata, West
Bengal, India

Pranab Gogoi

Scientist, ICAR-Central Inland
Fisheries Research Institute,
Barrackpore, Kolkata, West
Bengal, India

Mitesh H Ramteke

Scientist, ICAR-Central Inland
Fisheries Research Institute,
Barrackpore, Kolkata, West
Bengal, India

Dr. Archana Sinha

Principal Scientist, ICAR-
Central Inland Fisheries
Research Institute, Barrackpore,
Kolkata, West Bengal, India

Dr. Aparna Roy

Scientist, ICAR-Central Inland
Fisheries Research Institute,
Barrackpore, Kolkata, West
Bengal, India

Arunava Mitra

Technical Officer, ICAR-Central
Inland Fisheries Research
Institute, Barrackpore, Kolkata,
West Bengal, India

Dr. Basanta Kumar Das

Director, ICAR-Central Inland
Fisheries Research Institute
Barrackpore, Kolkata,
West Bengal, India

Corresponding Author:**Tasso Tayung**

Scientist, ICAR-Central Inland
Fisheries Research Institute,
Barrackpore, Kolkata, West
Bengal, India

Occurrence of freshwater sponge *Ephydatia fluviatilis* Linnaeus, 1759 (Porifera: Spongillidae) in the canal of Sundarbans eco-region, India

Tasso Tayung, Pranab Gogoi, Mitesh H Ramteke, Dr. Archana Sinha, Dr. Aparna Roy, Arunava Mitra and Dr. Basanta Kumar Das

Abstract

A field survey was carried out to the Bishalakhi canal (21°46'49.2"N 88°05'27.7"E) located in Sagar Island, Indian Sundarbans eco-region. The canal is a tide fed canal subjected to the brackish water influence as it is connected to the Hooghly River. A mass of freshwater sponge was found growing on submerged nylon net screen and bamboo poles structure, these structure were constructed for fish culture in the canal. Sponge specimens were carefully scraped out using a clean flat blade with the help of 'scalpel' and preserved it in 70% ethanol. Sponge samples were undergone an acid digestion process to obtain clean spicules. The spicules sample were examined under a compound light microscope for species-level identification. The sponge specimen was identified as *Ephydatia fluviatilis* Linnaeus, 1759 based on gemmule spicule morphology. The present study is the first report on the occurrence of *E. fluviatilis* from the Bishalakhi canal in Sagar Island, Indian Sundarbans eco-region, West Bengal. Studies on freshwater sponges can be useful for paleolimnological research, pharmaceutical industry, controlling of excess growth of sponge as biofouler, monitoring of water quality of the aquatic system.

Keywords: Freshwater sponge, *Ephydatia fluviatilis*, Canal, Indian Sundarbans, West Bengal

Introduction

Sponges are primitive, sessile and filter feeder organisms found in a wide variety of aquatic habitats such as marine, estuarine and freshwater ecosystems. These are the members of Phylum Porifera which characterized by pore bearers. They grow as masses on any submerged solid substrates such as logs, stones, boulders, rocks, roots or branches of tree, bamboo or wooden pole, macrophytes, shells of mollusk [1]. Many sponges can tolerate a wide range of environmental perturbations [2, 3]. Majority of the freshwater sponges belong to the family Spongillidae; commonly found in both lentic and lotic habitats such as lake, river, reservoir, lakes, pond, canal, tank, pool, caves, and derelict water bodies etc. with high quality of water and low level of pollution [1]. Freshwater sponges are consider an important component of the aquatic ecosystem as they play an essential role in the purification of water and recycling of organic matters [1]. They also act as good bioindicator to water pollution due to their early responsive nature to any alteration/ changes in the environment [4-6]. Sponge skeletal and reproductive structure can be a useful tools for the paleolimnological studies [7]. Nowadays, freshwater sponges have paramount importance in the pharmaceutical industry as they contain several bioactive compounds [8, 9]. They also serve as food for other organisms such as crayfish, caddisflies, midges, lacewings, and spongillaflies [10].

According to the world Porifera database, there are 9,162 Porifera species are available, of this, 8,904 are marine and 270 are freshwater species [11]. In India, there are about 486 species of sponges and the majority of them are from marine origin [12]. Similarly, 451 species of marine sponges under 3 classes, 17 orders, 64 families and 168 genera from India [13]. 30 species of freshwater sponges belonging to 10 genera under the family Spongillidae [14]. There are around 10 endemic species of freshwater sponges in India [15].

The pioneering study on freshwater sponges in India can be traced back to 1849 and 1863 [16, 17]. Albeit, Annandale had documented detail information on taxonomy and biology of few Indian freshwater sponges, but these works were confined to only a part of Eastern India [18]. Later, studies were carried out on taxonomy, diversity, ecology and distribution pattern of Indian freshwater sponges by some researchers [13, 14, 19].

Total of 16 freshwater sponge species has been described from West Bengal [20]. The literature survey showed that no available report on the occurrence of freshwater sponge *Ephydatia fluviatilis* from the canal in Sagar Island, Indian Sundarbans eco-region, West Bengal. The aim of the present study is to report our observation on the occurrence of freshwater sponge *E. fluviatilis* in Bishalakhi canal of Sagar Island, Indian Sundarbans eco-region.

Materials and Methods

A field survey was carried out to the Bishalakhi canal (21°46'49.2"N 88°05'27.7"E) in Sagar Island on 30th September 2018. Bishalakhi canal is a tide-fed canal, which is located in the south-western part of Indian Sundarbans eco-region (Fig. 1). During the survey to the canal, sponge masses were encountered and found growing on the submerged nylon net screens and bamboo poles structure which was

constructed for fish culture practice in the canal. The sponge masses were scrapped out using a clean flat blade 'scalpel' from the submerged substrates. The sample was handled carefully to minimize the loss of shape of the sponge and preserved it in 70% ethanol for further taxonomic analysis. Photograph of specimens was taken in-situ by a digital camera (Nikkon D3500). The sponge specimen were identified based on gemmule spicule morphology i.e., gemmules and spicules (megascleres, microscleres, and gemmoscleres) with the help of standard taxonomic keys and descriptions described [18, 21]. In laboratory observation, firstly, spicule preparation/extraction was performed by acid digestion technique [14, 22]. The specimens were examined and the images of megascleres and gemoscleres were captured under compound light microscopy by employing a trinocular microscope (Nikkon SMZ 745T).

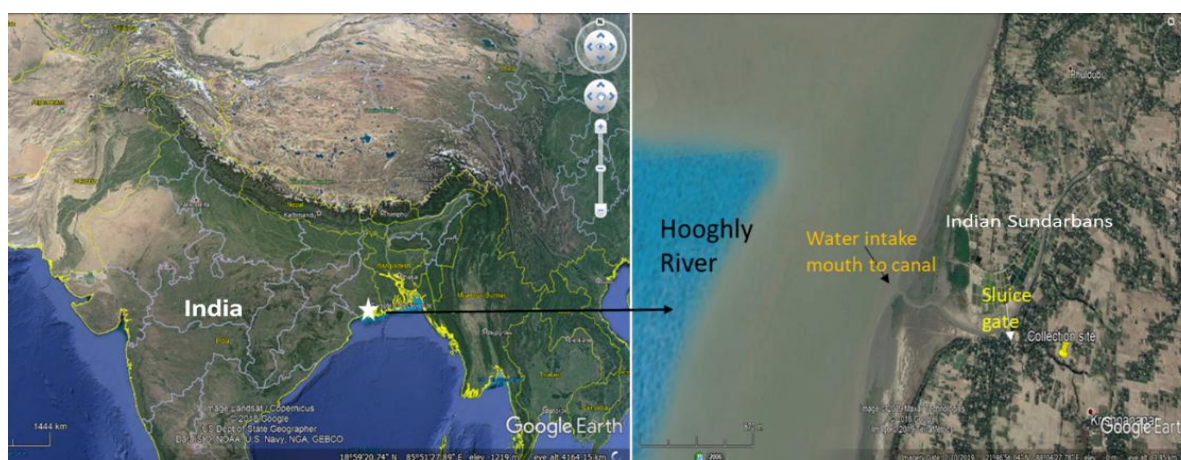


Fig 1: Google Earth image showing the sponge specimen collection site (21°46'56.04"N; 88°05'27.78"E)

Results and Discussions

The water in the Bishalakhi canal subjected to the brackish water influence as it is connected and located near the estuarine zone of Hooghly river. Natural base flow is existence in the canal but flow increases during the rainy season with a lower magnitude of salinity. The salient physico-chemical parameters of the canal recorded at the time of specimen collection are shown in Table 1.

Table 1: Physico-chemical parameters of Bishalakhi canal, Indian Sundarbans

Water variables	Ranges
Water temperature (°C)	27.8-28.0
pH	7.3-7.5
Dissolved oxygen (mg ^l ⁻¹)	5.6-5.8
Salinity (ppt)	0.65-0.70
Total alkalinity (mg ^l ⁻¹)	220-225
Total hardness (mg ^l ⁻¹)	152-156
Total dissolved solids (mg ^l ⁻¹)	906-912
Specific conductivity (ms/cm)	1.20-1.29
Transparency (cm)	40-45
Water depth (feet)	7-8

The systematic account of *E. fluviatilis*

Kingdom: Animalia

Phylum: Porifera Grant, 1836

Class: Demospongiae Sollas, 1885

Subclass: Heteroscleromorpha Cárdenas, Perez & Boury-Esnault, 2012

Order: Spongillida Manconi & Pronzato, 2002

Family: Spongillidae Gray, 1867

Genus: *Ephydatia* Lamouroux, 1816

Species: *Ephydatia fluviatilis* Linnaeus, 1759

Morphological description: The collected specimen was flat to bulky encrustation, massive, irregular shaped, moderately firm, corrugated surface, very brittle when dry, oscula numerous and large, greenish to brown and covered with huge gemmules and surface hispid due to emerging minute spicules.

Diagnostic characters

Megasclere - slender, slightly curved, hardly straight oxeas, and completely smooth or covered with a varying number of micro spines (215–395 x 7–18 μm) (Fig. 2d).

Microsclere - absent.

Gemmosclere - typically birotule with spine or smooth shaft, rotules flat with equal diameter, and with incised irregular margins (25–30 x 19–22 μm) (Fig. 2e & f).

Gemmules - usually very numerous and scattered, subspherical to spherical, moderately large, and simple foramen (340–465 μm) (Fig. 2c).

From the above description of morphological features of sponge and diagnostic characters of sponge spicules and gemmule, the collected specimen identified as *E. fluviatilis* (Linnaeus, 1759); which conforms to the standard keys and descriptions given by Nelson Annandale and Penney & Racek [14, 22].

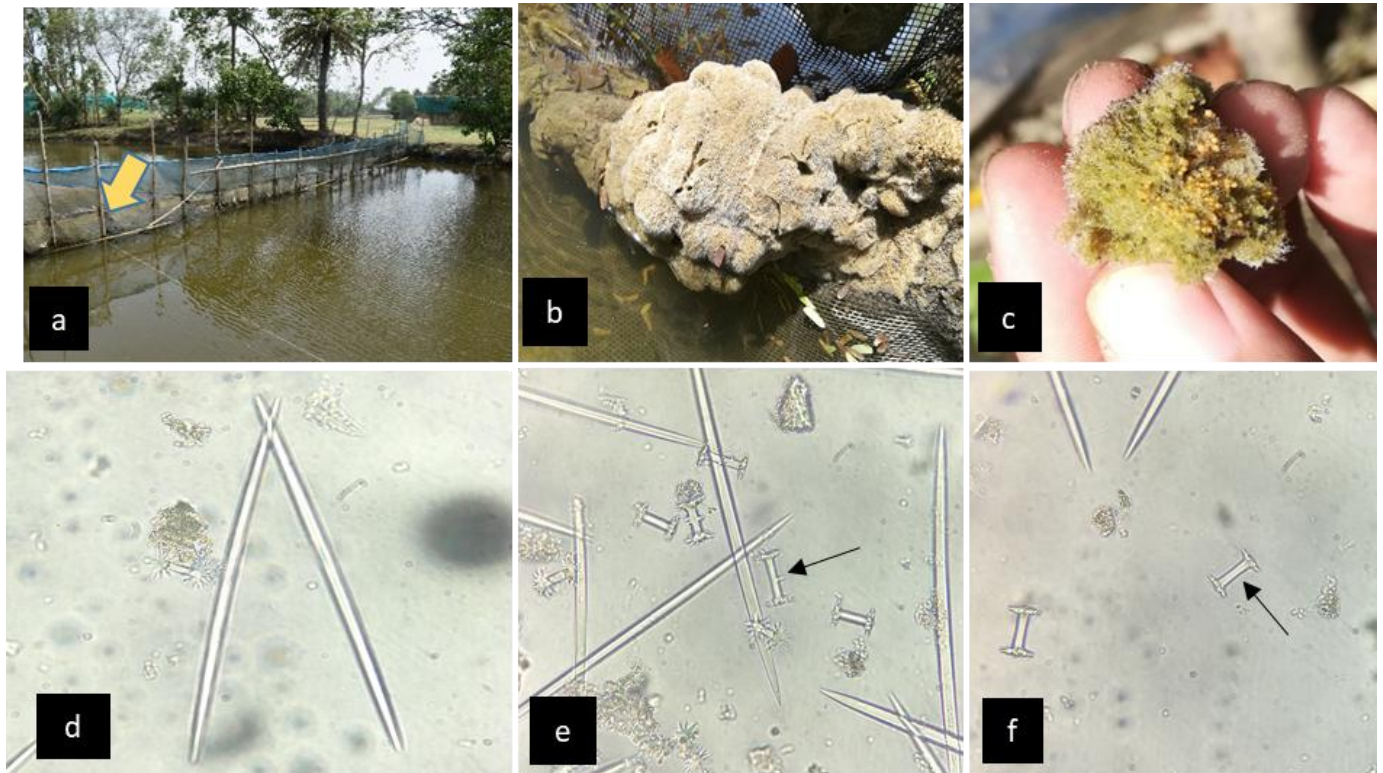


Fig 2a: Nylon net screen and bamboo pole structure in Bishalaxhi canal, b. The enormous growth of *Ephydatia fluviatilis* on net screen, c. A sponge filled with gemmules, d. Megascleres (smooth and pointed on both end), e. Gemmoscleres (birotule and spines on a shaft), and f. Gemmoscleres (birotule and smooth shaft)

E. fluviatilis is one of the most common and extensively distributed freshwater sponge species globally [23]. Generally they found in the lentic and lotic habitat of coastal brackish water to inland high altitude lakes [24]. Genus *Ephydatia* comprised of nine species worldwide but, in India, only four species (*E. fluviatilis*, *E. indica*, *E. crateriformis*, and *E. meyeri*) have been identified under this genus so far [24]. The occurrence of freshwater sponge *E. fluviatilis* had been reported for the first time from the Indian museum tank, Kolkata which was found growing on a brick wall along with other species *Spongilla alba*, *S. carteri*, *Trochospongilla phillottiana* and *T. latouchiana* [25]. Later, this species occurrence was also reported in lentic habitats from the western Himalayas range such as Kumaon, Naukuchiatal, Bhimtal, Sat Tal and Nanital [14] and in lentic as well as lotic habitats from the Satara region of Western ghat [26].

The majority of the freshwater sponges are stenohaline but *E. fluviatilis* can tolerate salinity up to a certain extent. *E. fluviatilis* was observed in a brackish water environment in Louisiana within the salinity ranges from 0.3–3.0 ppt [27, 28]. Similar observation also reported with a statement that *E. fluviatilis* can tolerate salinity gradient up to 5.0 ppt [29]. The present study also found a resemblance to the ecological parameters of the collection site as described [27, 28, 29]. There are few reports available on the existence of other freshwater sponges in the brackish water habitat from West Bengal. The occurrence of *Spongilla lacustris* in the brackish water environment was reported from the lower Bengal region [30]. Also, there is a documentation on two species of freshwater sponge under the genus *Spongilla* (*Spongilla lacustris* and *S. cerebellata*) from port canning near the Indian Sundarbans eco-region [31]. However, the literature review reveals no report of freshwater sponge *E. fluviatilis* from the canal in Sagar Island, Indian Sundarbans eco-region.

Conclusion

The present study represents the first report on the occurrence of freshwater sponge *E. fluviatilis* (Linnaeus, 1759) from Bishalaxhi canal in Sagar Island, Indian Sundarbans eco-region, West Bengal. Studies on the freshwater sponges can be useful for paleolimnological research, pharmaceutical industry, controlling of excess growth of sponge as biofouler, monitoring of water quality of the aquatic system.

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